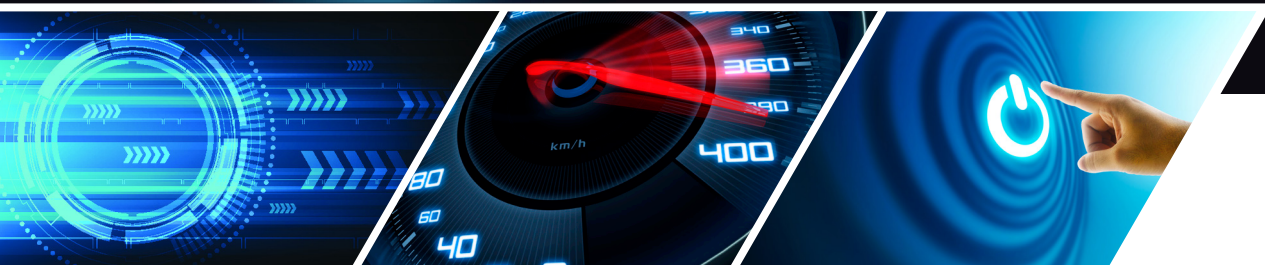
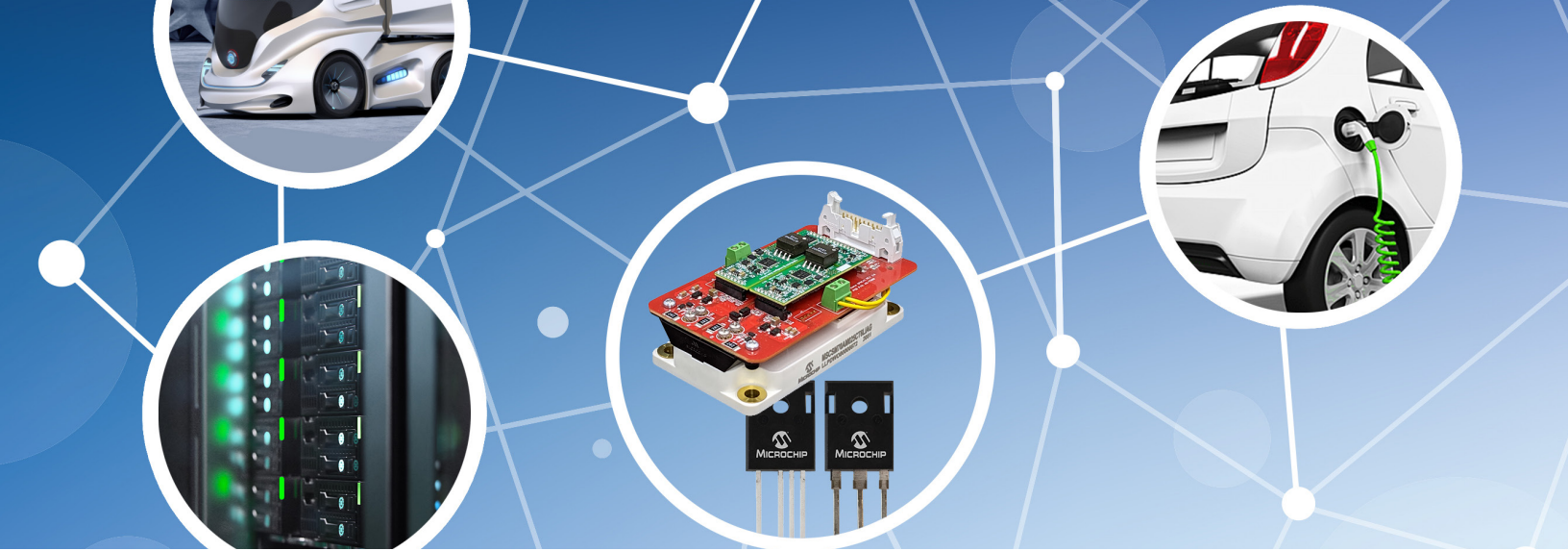


# High-Voltage Power Discretes and Modules



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## Silicon Carbide (SiC) MOSFETs

Silicon Carbide (SiC) is the ideal technology for higher switching frequency, higher efficiency, and higher power (>650V) applications. Target markets and applications include:

- Transportation/automotive: Electric Vehicle (EV): battery charger, Hybrid Electric Vehicle (HEV) powertrain, DC-DC converter, energy recovery
- Data center: UPS, PDU, PSU (PFC/LLC) power supplies
- Commercial aviation: actuation, air conditioning, power distribution
- Industrial: induction heating, motor drives, SMPS, Uninterruptible Power Supply (UPS), welding
- Smart energy: energy storage, PhotoVoltaic (PV) inverter, wind (turbine)
- Medical: MRI power supply, X-ray power supply
- Defense: motor drives, power supplies

SiC MOSFET and SiC Schottky barrier diode product lines from Microchip increase your system efficiency over silicon MOSFET and IGBT solutions while lowering your cost of ownership by enabling downsized systems and smaller/lower cost cooling.

## SiC MOSFET Features and Benefits

| Characteristics                  | Results                     | Benefits                    |
|----------------------------------|-----------------------------|-----------------------------|
| Breakdown field (MV/cm)          | Lower on-resistance         | Higher efficiency           |
| Electron sat. velocity (cm/s)    | Faster switching            | Size reduction              |
| Bandgap energy (eV)              | Higher junction temperature | Improved cooling            |
| Thermal conductivity (W/m.K)     | Higher power density        | Higher current capabilities |
| Positive temperature coefficient | Self regulation             | Easy paralleling            |

## Advantages Versus Competition: Quality, Supply, Support (QSS)

### Quality

- RDSon stability over temperature
- High avalanche performance – UIS and repetitive UIS
- Long short circuit withstand time
- No lifetime degradation of the internal body diode


### Supply

- Multiple qualified sources of substrate and epitaxy material
- Dual fabrication capability
- No EOL policy
- Competitive lead times

### Support

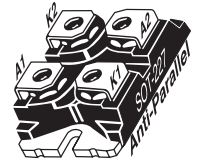
- Broad power switching portfolio – Discretes, die and modules
- Microchip's Total System Solution (TSS) – Power stage, gate driver and control solutions
- Expertise and support infrastructure in Aerospace, Defense, Industrial and Automotive

## SiC MOSFET Devices

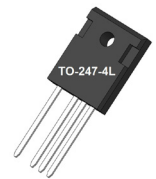
| Part Number   | Voltage (V) | $R_{DS(on)}$ (m $\Omega$ ) | Package   |           |
|---|-------------|----------------------------|-----------|-----------|
| MSC090SMA070B   | 700         | 90                         | TO-247    |           |
| MSC090SMA070S   |             |                            | D3PAK     |           |
| MSC060SMA070B   |             | 60                         | TO-247    |           |
| MSC060SMA070B4  |             |                            | TO-247-4L |           |
| MSC060SMA070S   |             |                            | D3PAK     |           |
| MSC035SMA070B  |             |                            | TO-247    |           |
| MSC035SMA070B4  |             | 35                         | TO-247-4L |           |
| MSC035SMA070S   |             |                            | D3PAK     |           |
| MSC035SMA070J   |             | 15                         | SOT-227   |           |
| MSC015SMA070B   |             |                            | TO-247    |           |
| MSC015SMA070B4  |             |                            | TO-247-4L |           |
| MSC015SMA070S   |             |                            | D3PAK     |           |
| MSC015SMA070J   |             |                            | SOT-227   |           |
| MSC360SMA120B   |             | 1200                       | 360       | TO-247    |
| MSC360SMA120S   | D3PAK       |                            |           |           |
| MSC180SMA120B   | 180         |                            | TO-247    |           |
| MSC180SMA120S   |             |                            | D3PAK     |           |
| MSC080SMA120B   | 80          |                            | TO-247    |           |
| MSC080SMA120B4  |             |                            | TO-247-4L |           |
| MSC080SMA120S   |             |                            | D3PAK     |           |
| MSC080SMA120J   |             |                            | SOT-227   |           |
| MSC040SMA120B   | 40          |                            | TO-247    |           |
| MSC040SMA120B4  |             |                            | TO-247-4L |           |
| MSC040SMA120S   |             |                            | D3PAK     |           |
| MSC040SMA120J   |             |                            | SOT-227   |           |
| MSC025SMA120B   | 25          |                            | TO-247    |           |
| MSC025SMA120B4  |             |                            | TO-247-4L |           |
| MSC025SMA120S   |             |                            | D3PAK     |           |
| MSC025SMA120J   |             |                            | SOT-227   |           |
| MSC017SMA120B   | 17          |                            | TO-247    |           |
| MSC017SMA120B4  |             |                            | TO-247-4L |           |
| MSC017SMA120J   |             |                            | SOT-227   |           |
| MSC017SMA120S   |             |                            | D3PAK     |           |
| MSC750SMA170B   | 1700        |                            | 750       | TO-247    |
| MSC750SMA170B4  |             |                            |           | TO-247-4L |
| MSC750SMA170S   |             |                            |           | D3PAK     |
| MSC035SMA170B   |             |                            | 35        | TO-247    |
| MSC035SMA170B4  |             |                            |           | TO-247-4L |
| MSC035SMA170S   |             |                            |           | D3PAK     |
| MSC400SMA330B4  | 3300        |                            | 400       | TO-247-4L |
| MSC080SMA330B4  |             |                            | 80        | TO-247-4L |
| MSC025SMA330B4  |             | 25                         | TO-247-4L |           |



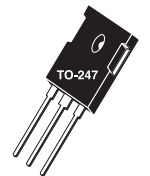
D3PAK[S]



SOT-227[J]  
Antiparallel  
Configuration  
(Isolated Base)



TO-247-4L

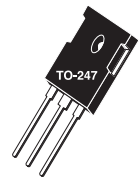


TO-247[B]

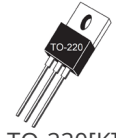
## Power MOS 8™ MOSFETs/FREDFETs

| BV <sub>DSS</sub> (V) | R <sub>DS(on)</sub> Max (Ω) | I <sub>D</sub> (A) | MOSFET Part Number | I <sub>D</sub> (A) | FREDFET Part Number | Package Style    |
|-----------------------|-----------------------------|--------------------|--------------------|--------------------|---------------------|------------------|
| 1200                  | 4.20                        |                    |                    | 4                  | APT4F120K           | TO-220           |
|                       | 4.20                        |                    |                    | 4                  | APT4F120S           | D3PAK            |
|                       | 3.80                        | 5                  | APT4M120K          |                    |                     | TO-220           |
|                       | 2.40                        |                    |                    | 7                  | APT7F120B           | TO-247 or D3PAK  |
|                       | 2.10                        | 8                  | APT7M120B          |                    |                     | TO-247           |
|                       | 1.20                        |                    |                    | 14                 | APT13F120B          | TO-247 or D3PAK  |
|                       | 1.10                        | 14                 | APT14M120B         |                    |                     | TO-247           |
|                       | 0.70                        |                    |                    | 23                 | APT22F120B2         | T-MAX® or TO-264 |
|                       | 0.63                        | 24                 | APT24M120B2        |                    |                     | T-MAX or TO-264  |
|                       | 0.58                        |                    |                    | 27                 | APT26F120B2         | T-MAX or TO-264  |
|                       | 0.58                        |                    |                    | 18                 | APT17F120J          | SOT-227          |
|                       | 0.53                        | 29                 | APT28M120B2        |                    |                     | T-MAX or TO-264  |
|                       | 0.53                        | 19                 | APT19M120J         |                    |                     | SOT-227          |
|                       | 0.32                        |                    |                    | 33                 | APT32F120J          | SOT-227          |
| 0.29                  | 35                          | APT34M120J         |                    |                    | SOT-227             |                  |
| 1000                  | 2.00                        |                    |                    | 7                  | APT7F100B           | TO-247           |
|                       | 1.80                        | 8                  | APT8M100B          |                    |                     | TO-247           |
|                       | 1.60                        |                    |                    | 9                  | APT9F100B           | TO-247 or D3PAK  |
|                       | 1.40                        | 9                  | APT9M100B          |                    |                     | TO-247           |
|                       | 0.98                        |                    |                    | 14                 | APT14F100B          | TO-247 or D3PAK  |
|                       | 0.88                        | 14                 | APT14M100B         |                    |                     | TO-247 or D3PAK  |
|                       | 0.78                        |                    |                    | 17                 | APT17F100B          | TO-247 or D3PAK  |
|                       | 0.70                        | 18                 | APT18M100B         |                    |                     | TO-247           |
|                       | 0.44                        |                    |                    | 30                 | APT29F100B2         | T-MAX or TO-264  |
|                       | 0.44                        |                    |                    | 20                 | APT19F100J          | SOT-227          |
|                       | 0.38                        | 32                 | APT31M100B2        |                    |                     | T-MAX or TO-264  |
|                       | 0.38                        | 21                 | APT21M100J         |                    |                     | SOT-227          |
|                       | 0.38                        |                    |                    | 35                 | APT34F100B2         | T-MAX or TO-264  |
|                       | 0.38                        |                    |                    | 23                 | APT22F100J          | SOT-227          |
|                       | 0.33                        | 37                 | APT37M100B2        |                    |                     | T-MAX or TO-264  |
|                       | 0.33                        | 25                 | APT25M100J         |                    |                     | SOT-227          |
| 0.20                  |                             |                    | 42                 | APT41F100J         | SOT-227             |                  |
| 0.18                  | 45                          | APT45M100J         |                    |                    | SOT-227             |                  |
| 800                   | 0.90                        |                    |                    | 12                 | APT11F80B           | TO-247 or D3PAK  |
|                       | 0.80                        | 13                 | APT12M80B          |                    |                     | TO-247           |
|                       | 0.58                        |                    |                    | 18                 | APT17F80B           | TO-247 or D3PAK  |
|                       | 0.53                        | 19                 | APT18M80B          |                    |                     | TO-247 or D3PAK  |
|                       | 0.43                        |                    |                    | 23                 | APT22F80B           | TO-247 or D3PAK  |
|                       | 0.39                        | 25                 | APT24M80B          |                    |                     | TO-247 or D3PAK  |
|                       | 0.24                        |                    |                    | 41                 | APT38F80B2          | T-MAX or TO-264  |
|                       | 0.21                        | 43                 | APT41M80B2         |                    |                     | T-MAX or TO-264  |
|                       | 0.21                        |                    |                    | 47                 | APT44F80B2          | T-MAX or TO-264  |
|                       | 0.21                        |                    |                    | 31                 | APT29F80J           | SOT-227          |
|                       | 0.19                        | 49                 | APT48M80B2         |                    |                     | T-MAX or TO-264  |
|                       | 0.19                        | 33                 | APT32M80J          |                    |                     | SOT-227          |
|                       | 0.11                        |                    |                    | 57                 | APT53F80J           | SOT-227          |
|                       | 0.10                        | 60                 | APT58M80J          |                    |                     | SOT-227          |

Part numbers for D3PAK packages—replace “B” with “S” in part number.  
 Part numbers for TO-264 packages—replace “B2” with “L” in part number.



TO-247[B]



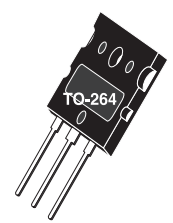
TO-220[K]



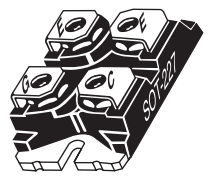
D3PAK[S]



T-MAX®[B2]



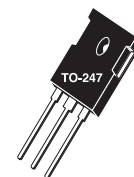
TO-264[L]



SOT-227[J]  
(Isolated Base)

| BV <sub>DSS</sub> (V) | R <sub>DS(ON)</sub> Max (Ω) | I <sub>D</sub> (A) | MOSFET Part Number | I <sub>D</sub> (A) | FREDFET Part Number | Package Style    |
|-----------------------|-----------------------------|--------------------|--------------------|--------------------|---------------------|------------------|
| 600                   | 0.37                        |                    |                    | 19                 | APT18F60B           | TO-247 or D3PAK  |
|                       | 0.29                        |                    |                    | 24                 | APT23F60B           | TO-247 or D3PAK  |
|                       | 0.19                        | 36                 | APT34M60B          | 36                 | APT34F60B           | TO-247           |
|                       | 0.15                        | 45                 | APT43M60B2         | 45                 | APT43F60B2          | T-MAX® or TO-264 |
|                       | 0.15                        | 31                 | APT30M60J          | 31                 | APT30F60J           | SOT-227          |
|                       | 0.11                        | 60                 | APT56M60B2         | 60                 | APT56F60B2          | T-MAX or TO-264  |
|                       | 0.11                        | 42                 | APT39M60J          | 42                 | APT39F60J           | SOT-227          |
|                       | 0.09                        | 70                 | APT66M60B2         | 70                 | APT66F60B2          | T-MAX or TO-264  |
|                       | 0.09                        | 49                 | APT47M60J          | 49                 | APT47F60J           | SOT-227          |
|                       | 0.055                       | 84                 | APT80M60J          | 84                 | APT80F60J           | SOT-227          |
| 500                   | 0.24                        |                    |                    | 24                 | APT24F50B           | TO-247 or D3PAK  |
|                       | 0.19                        |                    |                    | 30                 | APT30F50B           | TO-247 or D3PAK  |
|                       | 0.15                        |                    |                    | 37                 | APT37F50B           | TO-247 or D3PAK  |
|                       | 0.13                        |                    |                    | 43                 | APT42F50B           | TO-247 or D3PAK  |
|                       | 0.10                        | 56                 | APT56M50B2         | 56                 | APT56F50B2          | T-MAX or TO-264  |
|                       | 0.10                        | 38                 | APT38M50J          | 38                 | APT38F50J           | SOT-227          |
|                       | 0.075                       | 75                 | APT75M50B2         | 75                 | APT75F50B2          | T-MAX or TO-264  |
|                       | 0.075                       | 51                 | APT51M50J          | 51                 | APT51F50J           | SOT-227          |
|                       | 0.062                       | 84                 | APT84M50B2         | 84                 | APT84F50B2          | T-MAX or TO-264  |
|                       | 0.062                       | 58                 | APT58M50J          | 58                 | APT58F50J           | SOT-227          |
|                       |                             | 0.036              | 103                | APT100M50J         | 103                 | APT100F50J       |

Part numbers for D3PAK packages—replace “B” with “S” in part number.  
Part numbers for TO-264 packages—replace “B2” with “L” in part number.



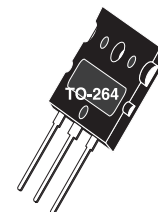
TO-247[B]



D3PAK[S]



T-MAX [B2]

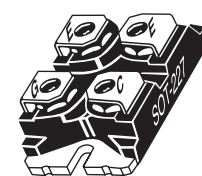


TO-264[L]

## Low-Voltage Power MOS V<sup>®</sup> MOSFETs/FREDFETs

| BV <sub>DSS</sub> (V) | R <sub>DS(ON)</sub> Max (Ω) | I <sub>D</sub> (A) | MOSFET Part Number | I <sub>D</sub> (A) | FREDFET Part Number | Package Style   |
|-----------------------|-----------------------------|--------------------|--------------------|--------------------|---------------------|-----------------|
| 300                   | 0.085                       | 40                 | APT30M85BVRG       |                    |                     | TO-247          |
|                       | 0.070                       | 48                 | APT30M70BVRG       | 48                 | APT30M70BVFRG       | TO-247 or D3PAK |
|                       | 0.040                       | 70                 | APT30M40JVR        | 70                 | APT30M40JVFR        | SOT-227         |
|                       | 0.019                       | 130                | APT30M19JVR        | 130                | APT30M19JVFR        | SOT-227         |
| 200                   | 0.045                       | 56                 | APT20M45BVRG       | 56                 | APT20M45BVFRG       | TO-247          |
|                       | 0.038                       | 67                 | APT20M38BVRG       |                    |                     | TO-247 or D3PAK |
|                       | 0.022                       |                    |                    | 100                | APT20M22LVFRG       | TO-264          |
|                       | 0.018                       | 100                | APT20M18B2VRG      | 100                | APT20M18B2VFRG      | T-MAX or TO-264 |
|                       | 0.011                       | 175                | APT20M11JVR        | 175                | APT20M11JVFR        | SOT-227         |

Part numbers for D3PAK packages—replace “B” with “S” in part number.  
Part numbers for TO-264 packages—replace “B2” with “L” in part number.



SOT-227[J]  
(Isolated Base)

# Ultra-Fast, Low Gate Charge MOSFETs



## For 250 kHz–2 MHz Switching Applications

The ultra-fast, low gate charge MOSFET family combines the lowest gate charge available in the industry with Microchip's proprietary self-aligned aluminum metal gate structure. The result is a MOSFET capable of extremely fast switching speeds and very-low switching losses. The metal gate structure and the layout of these chips provide an internal Series Gate Resistance (EGR) an order of magnitude lower than competitive devices built with a polysilicon gate.

These devices are ideally suited for high-frequency and pulsed high-voltage applications.

### Typical Applications

- Class D amplifiers up to 2 MHz
- High-voltage pulsed DC
- AM transmitters
- Plasma deposition/etch

### Features

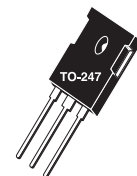
- Series gate resistance ( $R_g$ )  $< 0.1 \Omega$
- $T_R$  and  $T_F$  times of  $< 10$  ns
- Industry's lowest gate charge

### Benefits

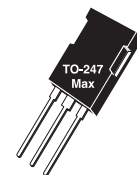
- Fast switching, uniform signal propagation
- Pulse power applications
- Fast switching, reduced gate drive power

| $V_{DSS}$ (V) | $R_{DS(on)}$ Max ( $\Omega$ ) | $I_D$ (A) | MOSFET Part Number | FREDFET Part Number | Package Style    |
|---------------|-------------------------------|-----------|--------------------|---------------------|------------------|
| 1200          | 4.700                         | 3.5       |                    | APT1204R7BFLLG      | TO-247 or D3PAK  |
|               | 1.400                         | 9         |                    | APT1201R4BFLLG      | TO-247           |
|               | 0.570                         | 22        | APT12057B2LLG      |                     | T-MAX®           |
| 1000          | 0.900                         | 12        | APT10090BLLG       |                     | TO-247           |
|               | 0.780                         | 14        | APT10078BLLG       |                     | TO-247 or D3PAK  |
|               | 0.450                         | 23        | APT10045B2LLG      |                     | T-MAX or TO-264  |
|               | 0.450                         | 21        | APT10045JLL        |                     | SOT-227          |
|               | 0.370                         | 25        |                    | APT10035JFLL        | SOT-227          |
|               | 0.370                         | 28        |                    | APT10035B2FLLG      | T-MAX            |
|               | 0.350                         | 28        | APT10035LLLG       |                     | TO-264           |
|               | 0.350                         | 25        | APT10035JLL        |                     | SOT-227          |
|               | 0.260                         | 38        |                    | APT10026L2FLLG      | 264-MAX™         |
|               | 0.260                         | 30        | APT10026JLL        | APT10026JFLL        | SOT-227          |
|               | 0.210                         | 37        | APT10021JLL        | APT10021JFLL        | SOT-227          |
| 800           | 0.260                         | 29        |                    | APT8024JFLL         | SOT-227          |
|               | 0.240                         | 29        | APT8024JLL         |                     | SOT-227          |
|               | 0.200                         | 38        | APT8020B2LLG       | APT8020B2FLLG       | T-MAX            |
|               | 0.200                         | 33        | APT8020JLL         |                     | SOT-227 or D3PAK |
|               | 0.160                         | 42        |                    | APT8014JFLL         | SOT-227          |
|               | 0.140                         | 52        | APT8014L2LLG       | APT8014L2FLLG       | 264-MAX          |
|               | 0.140                         | 42        | APT8014JLL         |                     | SOT-227          |
|               | 0.110                         | 51        | APT8011JLL         | APT8011JFLL         | T-MAX or TO-264  |
| 500           | 0.140                         | 35        | APT5014BLLG        |                     | TO-247           |
|               | 0.100                         | 46        | APT5010B2LLG       | APT5010B2FLLG       | T-MAX or TO-264  |
|               | 0.075                         | 51        | APT50M75JLL        | APT50M75JFLL        | SOT-227          |
|               | 0.075                         | 57        | APT50M75B2LLG      |                     | T-MAX or TO-264  |
|               | 0.065                         | 67        | APT50M65LLLG       | APT50M65B2FLLG      | TO-264           |
|               | 0.065                         | 58        | APT50M65JLL        | APT50M65JFLL        | SOT-227          |
|               | 0.050                         | 71        | APT50M50JLL        | APT50M50JFLL        | SOT-227          |
|               | 0.038                         | 88        | APT50M38JLL        | APT50M38JFLL        | SOT-227          |

Part numbers for D3PAK packages—replace “B” with “S” in part number.  
Part numbers for TO-264 packages—replace “B2” with “L” in part number.



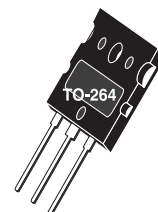
TO-247[B]



T-MAX®[B2]



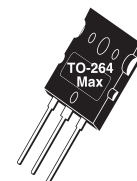
SOT-227[J]  
(Isolated Base)



TO-264[L]



D3PAK[S]



264-MAX™[L2]

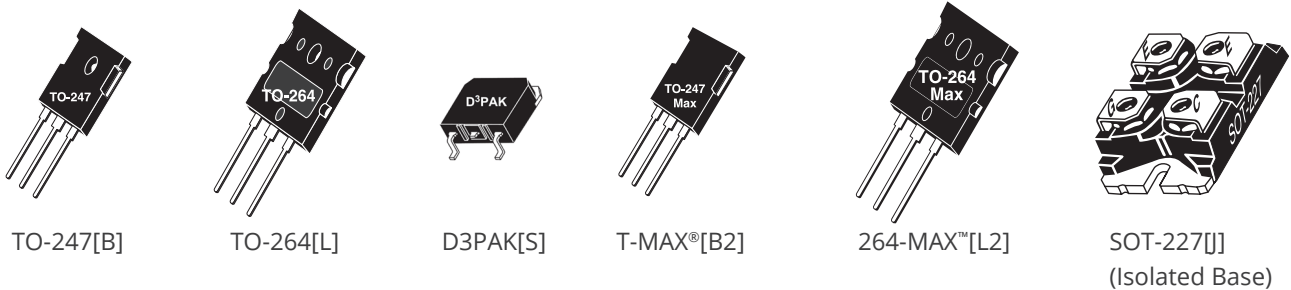


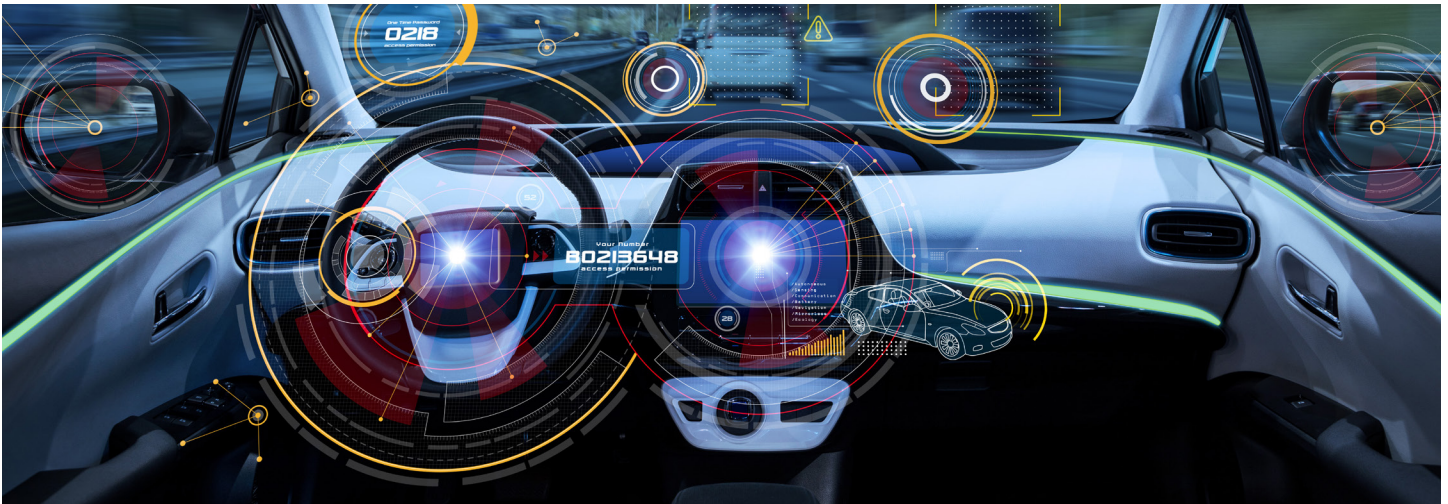


## Super Junction MOSFETs

| $V_{DS}$ (V)         | $R_{DS(ON)}$ ( $\Omega$ ) | $I_{D(CONT)}$ (A) | Part Number     | Package Style    |  |
|----------------------|---------------------------|-------------------|-----------------|------------------|--|
| <b>C3 Technology</b> |                           |                   |                 |                  |  |
| 800                  | 0.450                     | 11                | APT11N80BC3G    | TO-247           |  |
|                      | 0.145                     | 34                | APT34N80B2C3G   | T-MAX® or TO-264 |  |
|                      | 0.145                     | 34                | APT34N80LC3G    | TO-264           |  |
| 600                  | 0.070                     | 47                | APT47N60BC3G    | TO-247 or D3PAK  |  |
|                      | 0.035                     | 77                | APT77N60JC3     | SOT-227          |  |
|                      | 0.042                     | 94                | APT94N60L2C3G   | 264-MAX™         |  |
| <b>Server Series</b> |                           |                   |                 |                  |  |
| 600                  | 0.045                     | 60                | APT60N60BCSG    | TO-247 or D3PAK  |  |
|                      | <b>C6 Technology</b>      |                   |                 |                  |  |
|                      | 0.041                     | 77                | APT77N60BC6     | TO-247 or D3PAK  |  |
|                      | 0.070                     | 53                | APT53N60BC6     | TO-247 or D3PAK  |  |
|                      | 0.099                     | 38                | APT38N60BC6     | TO-247 or D3PAK  |  |
| 0.125                | 30                        | APT30N60BC6       | TO-247 or D3PAK |                  |  |
| 0.035                | 106                       | APT106N60B2C6     | T-MAX or TO-264 |                  |  |

Part numbers for D3PAK packages—replace “B” with “S” in part number.  
 Part numbers for TO-264 packages—replace “B2” with “L” in part number.





## Linear MOSFETs

### What is a Linear MOSFET?

A MOSFET specifically designed to be more robust than a standard MOSFET when operated with both high voltage and high current near DC conditions (>100 ms).

### The Problem with SMPS MOSFETs

MOSFETs optimized for high-frequency SMPS applications have poor high voltage DC SOA. Most SMPS-type MOSFETs overstate SOA capability at high voltage on the datasheets. Above ~30V and DC conditions, SOA drops faster than is indicated by Power Dissipation (PD) limited operation. For pulsed loads ( $t < 10$  ms), there is generally no problem using a standard MOSFET.

### Technology Innovation

Introduced in 1999, Microchip modified its proprietary patented self-aligned metal gate MOSFET technology for enhanced performance in high voltage, linear applications. These linear MOSFETs typically provide 1.5–2.0 times the DC SOA capability at high voltage compared to other MOSFET technologies optimized for switching applications.

| BV <sub>DSS</sub> (V) | R <sub>DS(on)</sub> (Ω) | I <sub>D(Cont)</sub> (A) | SOA (W) | Part Number |
|-----------------------|-------------------------|--------------------------|---------|-------------|
| 600                   | 0.125                   | 49                       | 325     | APL602B2G   |
|                       | 0.125                   | 43                       | 325     | APL602J     |
| 500                   | 0.090                   | 58                       | 325     | APL502B2G   |
|                       | 0.090                   | 52                       | 325     | APL502J     |

Part numbers for TO-264 packages—replace “B2” with “L” in part number.

### A Design Will Need Linear MOSFETs in the Following Situations

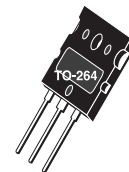
- High current and less than 200 volts at less than 100 milliseconds
- Used as a variable power resistor
- Soft start application (limit surge currents)
- Linear amplifier circuit

### Typical Applications

- Active loads above 200 volts, such as DC dynamic loads for testing power supplies, batteries, fuel cells, etc.
- High voltage, high current, constant current sources



SOT-227[J]  
(Isolated Base)



TO-264[L]



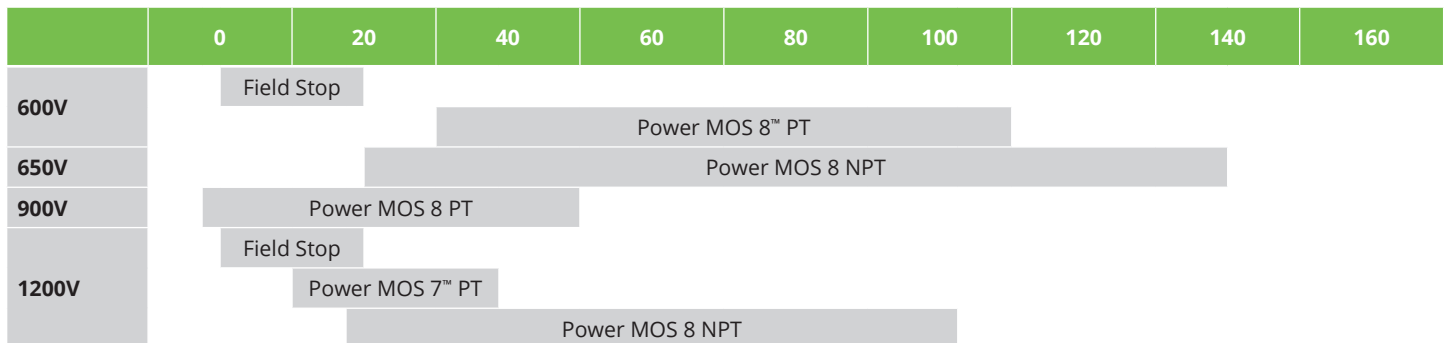
T-MAX® [B2]



## IGBTs From Microchip

IGBT products from Microchip provide high-quality solutions for a wide range of high-voltage and high-power applications. The switching frequency range spans from DC for minimal conduction loss to 150 kHz for very-high-power-density Switch Mode Power Supply (SMPS) applications. The frequency range for each product type is shown in the following graph. Each IGBT product represents the latest in IGBT technology, providing the best possible performance/cost combination for the targeted application. There are six product series that utilize three different IGBT technologies: Non-Punch-Through (NPT), Punch-Through (PT) and field stop.

### IGBT Switching Frequency Ranges (kHz, Hard Switched)





**Note: Frequency ranges shown are typical for a 50 A IGBT. Refer to product datasheet maximum frequency versus current graph for more information.**

| Standard Series               | Voltage Ratings (V) | Technology | Easy to Parallel | Short Circuit Safe Operating Area (SOA) | Parameter              |
|-------------------------------|---------------------|------------|------------------|---|------------------------|
| <b>MOS 7™</b>                 | 600, 900, 1200      | PT         |                  |   | Ultra-low gate charge  |
| <b>MOS 8™</b>                 | 600, 650, 900, 1200 | PT, NPT    |                  |   | Highest efficiency     |
| <b>Field Stop Trench Gate</b> | 600, 1200           | Field Stop | •                | •                                       | Lowest conduction loss |

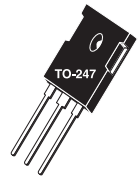
## Product Options

All standard IGBT products are available as a single IGBT or as a Combi product packaged with an anti-parallel DQ series diode. Package options include TO-220, TO-247, T-MAX®, TO-264 and SOT-227. Customized products are available; contact the factory for details.

## IGBTs—Punch-Through

|   | $V_{(BR)CES}$ (V)                       | $V_{CE(ON)}$ (V)<br>Typ 25°C | $I_{c2}$ (A)<br>100°C | Maximum $I_c$ (A)<br>at Frequency |         | Part<br>Number | Package<br>Style |                 |                 |                 |               |                 |        |
|---|---|------------------------------|-----------------------|-----------------------------------|---------|----------------|------------------|-----------------|-----------------|-----------------|---------------|-----------------|--------|
|   |   |                              |                       | 100 kHz                           | 200 kHz |                |                  |                 |                 |                 |               |                 |        |
| <b>POWER MOS 7™</b><br><br><br><br><ul style="list-style-type: none"> <li>• Ultra-low gate charge</li> <li>• Combi with high-speed DQ diode</li> </ul>                         | Single                                  | 600                          | 2.2                   | 27                                | 19      | 12             | APT15GP60BG      | TO-247          |                 |                 |               |                 |        |
|   |   |                              | 2.2                   | 49                                | 37      | 24             | APT30GP60BG      | TO-247          |                 |                 |               |                 |        |
|   |   |                              | 2.2                   | 62                                | 41      | 26             | APT40GP60BG      | TO-247          |                 |                 |               |                 |        |
|   |   |                              | 2.2                   | 40                                | 25      | 16             | APT40GP60J       | SOT-227         |                 |                 |               |                 |        |
|   |   |                              | 2.2                   | 72                                | 41      | 26             | APT50GP60BG      | TO-247          |                 |                 |               |                 |        |
|   |   |                              | 2.2                   | 46                                | 26      | 19             | APT50GP60J       | SOT-227         |                 |                 |               |                 |        |
|   |   |                              | 2.2                   | 100                               | 72      | 45             | APT80GP60B2G     | T-MAX®          |                 |                 |               |                 |        |
|   |   | 900                          | 50 kHz                | 600                               | 2.2     | 96             | 76               | 54              | APT65GP60B2G    | T-MAX           |               |                 |        |
|   |   |                              |                       |                                   | 2.2     | 60             | 47               | 33              | APT65GP60J      | SOT-227         |               |                 |        |
|   |   |                              |                       |                                   | 2.2     | 68             | 59               | 39              | APT80GP60J      | SOT-227         |               |                 |        |
|   |   |                              | 1200                  | 40 kHz                            | 600     | 3.2            | 36               | 33              | 21              | APT25GP90BG     | TO-247        |                 |        |
|   |   |                              |                       |                                   |         | 3.2            | 50               | N/A             | N/A             | APT40GP90BG     | TO-247        |                 |        |
|   |   |                              |                       |                                   |         | 3.2            | 32               | N/A             | N/A             | APT40GP90J      | SOT-227       |                 |        |
|   |   |                              |                       |                                   |         | 3.3            | 33               | 19              | 12              | APT25GP120BG    | TO-247        |                 |        |
|   | <b>Combi (IGBT<br/>&amp; "DQ" FRED)</b> | 600                          | 50 kHz                | 900                               | 2.2     | 60             | 47               | 33              | APT65GP60JDQ2   | SOT-227         |               |                 |        |
|   |   |                              |                       |                                   | 2.2     | 96             | 76               | 54              | APT65GP60L2DQ2G | 264-MAX®        |               |                 |        |
|   |   |                              |                       |                                   | 2.2     | 68             | 59               | 39              | APT80GP60JDQ3   | SOT-227         |               |                 |        |
|   |   |                              |                       |                                   | 2.2     | 68             | 59               | 39              | APT80GP60JDQ3   | SOT-227         |               |                 |        |
|   |   |                              |                       |                                   | 1200    | 100 kHz        | 900              | 2.2             | 27              | 19              | 12            | APT15GP60BDQ1G  | TO-247 |
|   |   |                              |                       |                                   |         |                |                  | 2.2             | 49              | 37              | 24            | APT30GP60BDQ1G  | TO-247 |
|   |   |                              |                       |                                   |         |                |                  | 2.2             | 62              | 41              | 26            | APT40GP60B2DQ2G | TO-247 |
|   |   | 900                          | 40 kHz                | 600                               | 2.2     | 40             | 25               | 16              | APT40GP60JDQ2   | SOT-227         |               |                 |        |
|   |   |                              |                       |                                   | 2.2     | 72             | N/A              | N/A             | APT50GP60B2DQ2G | TO-247          |               |                 |        |
|   |   |                              |                       |                                   | 2.2     | 46             | N/A              | N/A             | APT50GP60JDQ2   | SOT-227         |               |                 |        |
|   |   |                              |                       |                                   | 3.2     | 21             | 27               | 20              | APT15GP90BDQ1G  | TO-247          |               |                 |        |
|   |   |                              |                       |                                   | 3.2     | 36             | 53               | 34              | APT25GP90BDQ1G  | TO-247          |               |                 |        |
|   |   |                              |                       |                                   | 3.2     | 50             | 56               | 40              | APT40GP90B2DQ2G | T-MAX           |               |                 |        |
|   |   |                              |                       |                                   | 3.2     | 27             | 33               | 24              | APT40GP90JDQ2   | SOT-227         |               |                 |        |
| 1200  | 20 kHz                                  | 900                          | 3.3                   | 33                                | 19      | 12             | APT25GP120BDQ1G  | TO-247          |                 |                 |               |                 |        |
|   |   |                              | 3.3                   | 46                                | 24      | 15             | APT35GP120B2DQ2G | T-MAX           |                 |                 |               |                 |        |
|   |   |                              | 3.3                   | 54                                | 29      | 18             | APT45GP120B2DQ2G | T-MAX           |                 |                 |               |                 |        |
|   |   |                              | 3.3                   | 34                                | 28      | 18             | APT45GP120JDQ2   | SOT-227         |                 |                 |               |                 |        |
| 3.3   | 57                                      | 40                           | 23                    | APT75GP120JDQ3                    | SOT-227 |                |                  |                 |                 |                 |               |                 |        |
| <b>POWER MOS 8™</b><br><br><br><br><ul style="list-style-type: none"> <li>• Fast switching</li> <li>• Highest efficiency</li> <li>• Combi with high-speed DQ diode</li> </ul> | Single                                  | 600                          | 2                     | 36                                | 21      | 17             | APT36GA60B       | TO-247 or D3PAK |                 |                 |               |                 |        |
|   |   |                              | 2                     | 44                                | 26      | 20             | APT44GA60B       | TO-247 or D3PAK |                 |                 |               |                 |        |
|   |   |                              | 2                     | 47                                | N/A     | N/A            | APT47GA60JD40    | SOT-227         |                 |                 |               |                 |        |
|   |   |                              | 2                     | 54                                | 30      | 23             | APT54GA60B       | TO-247 or D3PAK |                 |                 |               |                 |        |
|   |   |                              | 2                     | 68                                | 35      | 27             | APT68GA60B       | TO-247 or D3PAK |                 |                 |               |                 |        |
|   |   |                              | 2                     | 80                                | 40      | 31             | APT80GA60B       | TO-247 or D3PAK |                 |                 |               |                 |        |
|   |   |                              | 2                     | 102                               | 51      | 39             | APT102GA60B2     | T-MAX or TO-264 |                 |                 |               |                 |        |
|   |   | 900                          | 25 kHz                | 600                               | 2.5     | 35             | 17               | 10              | APT35GA90B      | TO-247 or D3PAK |               |                 |        |
|   |   |                              |                       |                                   | 2.5     | 43             | 21               | 13              | APT43GA90B      | TO-247 or D3PAK |               |                 |        |
|   |   |                              |                       |                                   | 2.5     | 64             | 29               | 19              | APT64GA90B      | TO-247 or D3PAK |               |                 |        |
|   |   |                              | 50 kHz                | 900                               | 2.5     | 80             | 34               | 23              | APT80GA90B      | TO-247 or D3PAK |               |                 |        |
|   |   |                              |                       |                                   | 600     | 50 kHz         | 2                | 36              | 21              | 17              | APT36GA60BD15 | TO-247 or D3PAK |        |
|   |   |                              |                       |                                   |         |                | 2                | 44              | 26              | 20              | APT44GA60BD30 | TO-247 or D3PAK |        |
|   |   |                              |                       |                                   |         |                | 2                | 54              | 30              | 23              | APT54GA60BD30 | TO-247 or D3PAK |        |
|   | 2                                       | 60                           | 48                    | 36                                |         |                | APT60GA60JD60    | SOT-227         |                 |                 |               |                 |        |
|   | 2                                       | 68                           | 35                    | 27                                |         |                | APT68GA60B2D40   | T-MAX or TO-264 |                 |                 |               |                 |        |
|   | 2                                       | 80                           | 40                    | 31                                |         |                | APT80GA60LD40    | TO-264          |                 |                 |               |                 |        |
|   | 900                                     | 25 kHz                       | 600                   | 2.5                               | 27      | 14             | 8                | APT27GA90BD15   | TO-247 or D3PAK |                 |               |                 |        |
|   |   |                              |                       | 2.5                               | 35      | 17             | 10               | APT35GA90BD15   | TO-247 or D3PAK |                 |               |                 |        |
|   |   |                              |                       | 2.5                               | 43      | 21             | 13               | APT43GA90BD30   | TO-247 or D3PAK |                 |               |                 |        |
|   |   | 50 kHz                       | 900                   | 2.5                               | 46      | 33             | 21               | APT46GA90JD40   | SOT-227         |                 |               |                 |        |
|   |   |                              |                       | 2.5                               | 64      | 29             | 19               | APT64GA90B2D30  | T-MAX or TO-264 |                 |               |                 |        |
|   |   |                              |                       | 2.5                               | 80      | 34             | 23               | APT80GA90LD40   | TO-264          |                 |               |                 |        |
|   |   |                              |                       | 2.5                               | 80      | 34             | 23               | APT80GA90LD40   | TO-264          |                 |               |                 |        |

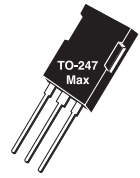
Part numbers for D3PAK packages—replace "B" with "S" in part number.  
 Part numbers for TO-264 packages—replace "B2" with "L" in part number.



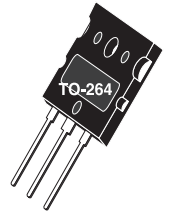
TO-247[B]



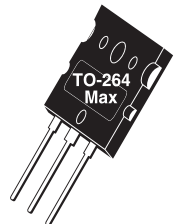
D3PAK[S]



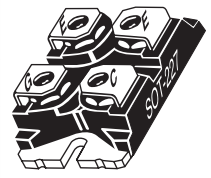
T-MAX®[B2]



TO-264[L]




264-MAX™[L2]

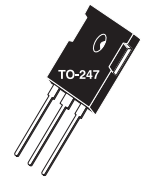


SOT-227[J]

# IGBTs—Non-Punch-Thru

## POWER MOS 8™

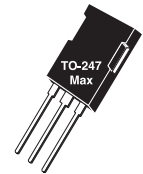
|  | $V_{(BR)CES}$ (V) | $V_{CE(ON)}$ (V)<br>Typ 25°C | $I_{c2}$ (A)<br>100°C | Maximum $I_c$ (A)<br>at Frequency |                | Part<br>Number | Package<br>Style |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|--|-------------------|------------------------------|-----------------------|-----------------------------------|----------------|----------------|------------------|----------------|----|--------|-------------|--------|--|--|--|-------------|--------|--|--|--|-------------|-------|--|--|--|--------------|-------|--|--|--|-------------|--------|--|--|--|---------------|---------------|--|--|--------------|-------|--|--|--|-------------|--------|--|--|--|-------------|---------|--|--|--|--------------|-------|
|  |                   |                              |                       | 100 kHz                           | 200 kHz        |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  <ul style="list-style-type: none"> <li>• High-speed switching</li> <li>• Low switching losses</li> <li>• Easy to parallel</li> </ul> | <b>Single</b>     |                              |                       | <b>100 kHz</b>                    | <b>200 kHz</b> |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       | 650                               | 1.9            |                |                  | 45             | 31 | 25     | APT45GR65B  | TO-247 |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              | <b>100 kHz</b>        |                                   |                | <b>150 kHz</b> |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              | 1.9                   | 70                                | 52             | 39             |                  | APT70GR65B     |    | TO-247 |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                | <b>50 kHz</b>    | <b>100 kHz</b> |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              | 1.9                   | 95                                | 69             | 41             | APT95GR65B2      | T-MAX®         |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                | <b>50 kHz</b>    | <b>80 kHz</b>  |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              | 1200                  | 2.5                               | 25             | 25             | 21               | APT25GR120B    |    |        | TO-247      |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        | APT25GR120S | D3PAK  |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  | APT40GR120B | TO-247 |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  | APT40GR120S | D3PAK |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  | APT50GR120B2 | T-MAX |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  | APT50GR120L | TO-264 |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  | <b>25 kHz</b> | <b>50 kHz</b> |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  | APT70GR120B2 | T-MAX |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  | APT70GR120L | TO-264 |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  | APT70GR120J | SOT-227 |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  | APT85GR120B2 | T-MAX |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |
|  |                   |                              |                       |                                   |                |                |                  |                |    |        |             |        |  |  |  |             |        |  |  |  |             |       |  |  |  |              |       |  |  |  |             |        |  |  |  |               |               |  |  |              |       |  |  |  |             |        |  |  |  |             |         |  |  |  |              |       |



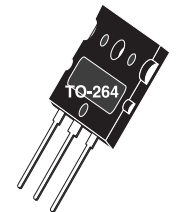
TO-247[B]



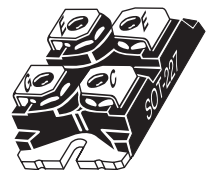
D3PAK[S]



T-MAX®[B2]



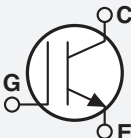
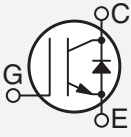
TO-264[L]

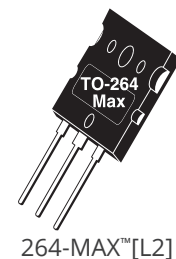
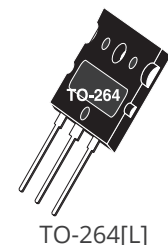
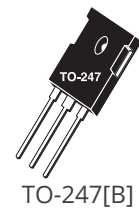


SOT-227[J]

Current at frequency test conditions:  $T_j = 125^\circ\text{C}$ ,  $T_c = 100^\circ\text{C}$  except SOT-227 where  $T_c = 80^\circ\text{C}$ ,  $V_{cc} = 67\%$  rated voltage hard switch.

## IGBTs—Field Stop

| Field Stop   | Single | $V_{(BR)CES}$ (V)                   | $V_{CE(ON)}$ (V)<br>Typ 25°C | $I_{c2}$ (A) |                                   | Part Number      | Package Style    |                 |  |
|--|--------|-------------------------------------|------------------------------|--------------|-----------------------------------|------------------|------------------|-----------------|--|
|  |        |                                     |                              | 100°C        | Maximum $I_c$ (A)<br>at Frequency |                  |                  |                 |  |
|  <ul style="list-style-type: none"> <li>Trench technology</li> <li>Short circuit rated</li> <li>Lowest conduction loss</li> <li>Easy paralleling</li> <li>Combi with high-speed DQ diode</li> </ul>  | 600    | 1.5                                 | 24                           | 15           | 10                                | APT20GN60BG      | TO-247           |                 |  |
|  |        | 1.5                                 | 37                           | 20           | 14                                | APT30GN60BG      | TO-247           |                 |  |
|  |        | 1.5                                 | 64                           | 30           | 21                                | APT50GN60BG      | TO-247           |                 |  |
|  |        | 1.5                                 | 93                           | 42           | 30                                | APT75GN60BG      | TO-247           |                 |  |
|  |        | 1.5                                 | 123                          | 75           | 47                                | APT150GN60J      | SOT-227          |                 |  |
|  |        | 1.5                                 | 135                          | 54           | 39                                | APT100GN60B2G    | T-MAX®           |                 |  |
|  |        | 1.5                                 | 190                          | 79           | 57                                | APT150GN60B2G    | T-MAX            |                 |  |
|  |        | 1.5                                 | 230                          | 103          | 75                                | APT200GN60B2G    | T-MAX            |                 |  |
|  | 1200   |                                     |                              |              | 10 kHz                            | 20 kHz           |                  |                 |  |
|  |        | 1.7                                 | 33                           | 19           | 13                                | APT25GN120BG     | TO-247 or D3PAK  |                 |  |
|  |        | 1.7                                 | 46                           | 24           | 17                                | APT35GN120BG     | TO-247           |                 |  |
|  |        | 1.7                                 | 66                           | 32           | 22                                | APT50GN120B2G    | T-MAX            |                 |  |
|  |        | 1.7                                 | 70                           | 44           | 27                                | APT100GN120J     | SOT-227          |                 |  |
|  |        | 1.7                                 | 99                           | 45           | 30                                | APT75GN120B2G    | T-MAX or TO-264  |                 |  |
|  |        | 1.7                                 | 120                          | 58           | 38                                | APT100GN120B2G   | T-MAX            |                 |  |
|  |        | 1.7                                 | 99                           | 60           | 36                                | APT150GN120J     | SOT-227          |                 |  |
|  | 600    | <b>Combi (IGBT &amp; "DQ" FRED)</b> |                              |              | 15 kHz                            | 30 kHz           |                  |                 |  |
|  |        | 1.5                                 | 24                           | 15           | 10                                | APT20GN60BDQ1G   | TO-247           |                 |  |
|  |        | 1.5                                 | 37                           | 20           | 14                                | APT30GN60BDQ2G   | TO-247           |                 |  |
|  |        | 1.5                                 | 64                           | 30           | 21                                | APT50GN60BDQ2G   | TO-247           |                 |  |
|  |        | 1.5                                 | 93                           | 42           | 30                                | APT75GN60LDQ3G   | TO-264           |                 |  |
|  |        | 1.5                                 | 123                          | 75           | 47                                | APT150GN60JDQ4   | SOT-227          |                 |  |
|  |        | 1.5                                 | 135                          | 54           | 39                                | APT100GN60LDQ4G  | TO-264           |                 |  |
|  |        | 1.5                                 | 190                          | 79           | 57                                | APT150GN60LDQ4G  | TO-264           |                 |  |
|  |        | 1.5                                 | 158                          | 100          | 66                                | APT200GN60JDQ4   | SOT-227          |                 |  |
|  |        | 1200                                |                              |              |                                   | 10 kHz           | 20 kHz           |                 |  |
|  |        |                                     | 1.7                          | 22           | 14                                | 10               | APT15GN120BDQ1G  | TO-247 or D3PAK |  |
|  |        |                                     | 1.7                          | 33           | 19                                | 13               | APT25GN120B2DQ2G | T-MAX           |  |
| 1.7  |        |                                     | 46                           | 24           | 17                                | APT35GN120L2DQ2G | 264-MAX™         |                 |  |
| 1.7  |        |                                     | 57                           | 36           | 22                                | APT75GN120JDQ3   | SOT-227          |                 |  |
| 1.7  |        |                                     | 66                           | 32           | 22                                | APT50GN120L2DQ2G | 264-MAX          |                 |  |
| 1.7  |        |                                     | 70                           | 44           | 27                                | APT100GN120JDQ4  | SOT-227          |                 |  |
| 1.7  | 99     |                                     | 60                           | 36           | APT150GN120JDQ4                   | SOT-227          |                  |                 |  |



Part numbers for D3PAK packages—replace "B" with "S" in part number.  
Part numbers for TO-264 packages—replace "B2" with "L" in part number.

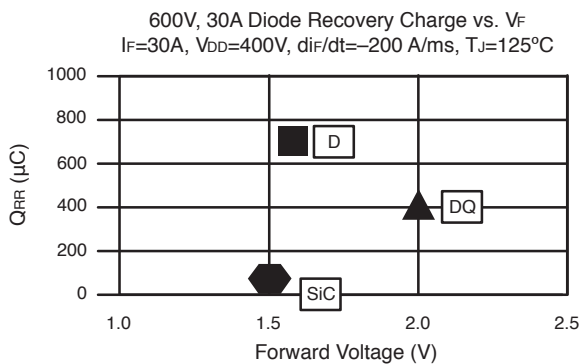
Current at frequency test conditions:  $T_j = 125^\circ\text{C}$ ,  $T_c = 100^\circ\text{C}$  except SOT-227 where  $T_c = 80^\circ\text{C}$ ,  $V_{cc} = 67\%$  rated voltage hard switch.



## Schottky Barrier Diodes, Fast and Ultra-Fast Recovery Diodes

Microchip offers four series of discrete diode products: the medium-speed medium  $V_f$  D series, the high-speed DQ series, the silicon Schottky S series and the SiC Schottky Barrier Diode series. These series of diodes are designed to provide high-quality solutions to a wide range of high-voltage, high-power application requirements, ranging from fast recovery for continuous conduction mode power factor correction to low conduction loss for output rectification. The following table summarizes each product family's distinguishing features and potential applications.

The following graph shows the relative recovery speed and forward voltage positions of D, DQ, and SiC series diodes.




















## Fast, Ultra-Fast and Schottky Diodes

| Series              | Voltage Ratings                | Features                      | Applications  | Comment   |
|---------------------|--------------------------------|-------------------------------|---|---|
| <b>D</b>            | 200, 300, 400, 600, 1000, 1200 | Medium $V_f$<br>Medium speed  | Freewheeling diode<br>Output rectifier<br>DC-DC converter | Proprietary platinum process  |
| <b>DQ</b>           | 600, 1000, 1200                | High speed<br>Avalanche rated | PFC<br>Freewheeling diode<br>DC-DC converter              | Stepped EPI improves softness<br>Proprietary platinum process           |
| <b>Schottky</b>     | 200                            | Low $V_f$<br>Avalanche rated  | Output rectifier<br>Freewheeling diode<br>DC-DC converter |   |
| <b>SiC Schottky</b> | 700, 1200, 1700, 3300          | Zero reverse recovery         | PFC<br>Freewheeling diode<br>DC-DC converter              | Low switching losses, high power density and high-temperature operation |

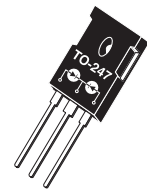


## SiC Schottky Barrier Diode (SBD) Devices

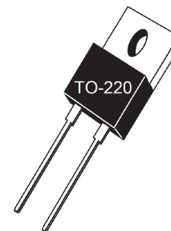
| Part Number   | Voltage (V)                                    | I <sub>F</sub> (A) | Package |
|---|--|--------------------|---------|
| MSC010SDA070B    | 700  | 10                 | TO-247  |
| MSC010SDA070K    |  | 10                 | TO-220  |
| MSC030SDA070B    |  | 30                 | TO-247  |
| MSC030SDA070K    |  | 30                 | TO-220  |
| MSC050SDA070B    |  | 50                 | TO-247  |
| MSC010SDA120B    | 1200   | 10                 | TO-247  |
| MSC010SDA120K   |  | 10                 | TO-220  |
| MSC015SDA120B  |  | 15                 | TO-247  |
| MSC015SDA120K  |  | 15                 | TO-220  |
| MSC020SDA120B  |  | 20                 | TO-247  |
| MSC020SDA120K  |  | 20                 | TO-220  |
| MSC020SDA120S  |  | 20                 | D3PAK   |
| MSC030SDA120B  |  | 30                 | TO-247  |
| MSC030SDA120K  |  | 30                 | TO-220  |
| MSC030SDA120S  |  | 30                 | D3PAK   |
| MSC050SDA120B  | 1700   | 50                 | TO-247  |
| MSC050SDA120S  |  | 50                 | D3PAK   |
| MSC010SDA170B   |  | 10                 | TO-247  |
| MSC030SDA170B   | 3300   | 30                 | TO-247  |
| MSC050SDA170B   |  | 50                 | TO-247  |
| MSC030SDA330B   | 700<br>Dual Diode<br>(Common Cathode)          | 30                 | TO-247  |
| MSC090SDA330B2  |  | 90                 | T-MAX®  |
| MSC030SDA070BCT   | 1200<br>Dual Diode<br>(Common Cathode)         | 2 × 30             | TO-247  |
| MSC050SDA070BCT   |  | 2 × 50             | TO-247  |
| MSC030SDA120BCT   | 700<br>Dual Diode<br>(Anti-parallel/parallel)  | 2 × 30             | TO-247  |
| MSC050SDA120BCT   |  | 2 × 50             | TO-247  |
| MSC2X30/31SDA070J   | 700<br>Dual Diode<br>(Anti-parallel/parallel)  | 2 × 30             | SOT-227 |
| MSC2X50/51SDA070J   |  | 2 × 50             | SOT-227 |
| MSC2X100/101SDA070J   |  | 2 × 100            | SOT-227 |
| MSC2X30/31SDA120J   | 1200<br>Dual Diode<br>(Anti-parallel/parallel) | 2 × 30             | SOT-227 |
| MSC2X50/51SDA120J   |  | 2 × 50             | SOT-227 |
| MSC2X100/101SDA120J   |  | 2 × 100            | SOT-227 |



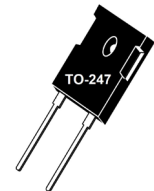
D3PAK[S]



TO-247[BCT]  
Common cathode



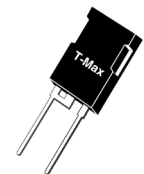
TO-220[K]




TO-247-2L[B]



SOT-227[J]  
Antiparallel  
Configuration  
(Isolated Base)



T-MAX®[B2]

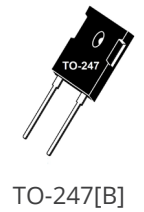
 Auto-Qualified Part



## Si Schottky Barrier Diodes, Fast and Ultra-Fast Recovery Diodes

| Volts         | I (A) | Forward Voltage Typ 25°C | t(ns) Typ 25°C | Qrr (nC) Typ 125°C at I <sub>F</sub> = I <sub>F</sub> (avg) | Diode Series | Part Number  | Package         |
|---------------|-------|--------------------------|----------------|---|--------------|--------------|-----------------|
| <b>Single</b> |       |                          |                |   |              |              |                 |
| <b>1200</b>   | 15    | 2.8                      | 21             | 960   | DQ           | APT15DQ120BG | TO-247          |
|               | 15    | 2.8                      | 21             | 960   | DQ           | APT15DQ120KG | TO-220          |
|               | 15    | 2.0                      | 32             | 1300  | D            | APT15D120BG  | TO-247          |
|               | 15    | 2.0                      | 32             | 1300  | D            | APT15D120KG  | TO-220          |
|               | 30    | 2.8                      | 24             | 1800  | DQ           | APT30DQ120BG | TO-247          |
|               | 30    | 2.8                      | 24             | 1800  | DQ           | APT30DQ120KG | TO-220          |
|               | 30    | 2.0                      | 31             | 3450  | D            | APT30D120BG  | TO-247          |
|               | 40    | 2.8                      | 26             | 2200  | DQ           | APT40DQ120BG | TO-247          |
|               | 60    | 2.8                      | 30             | 2800  | DQ           | APT60DQ120BG | TO-247          |
|               | 60    | 2.0                      | 38             | 4000  | D            | APT60D120BG  | TO-247 or D3PAK |
| 75            | 2.8   | 32                       | 3340           | DQ  | APT75DQ120BG | TO-247       |                 |
| <b>1000</b>   | 15    | 2.5                      | 20             | 810   | DQ           | APT15DQ100BG | TO-247          |
|               | 15    | 2.5                      | 20             | 810   | DQ           | APT15DQ100KG | TO-220          |
|               | 15    | 1.9                      | 28             | 1550  | D            | APT15D100BG  | TO-247          |
|               | 15    | 1.9                      | 28             | 1550  | D            | APT15D100KG  | TO-220          |
|               | 30    | 2.5                      | 22             | 1250  | DQ           | APT30DQ100BG | TO-247          |
|               | 30    | 2.5                      | 22             | 1250  | DQ           | APT30DQ100KG | TO-247          |
|               | 30    | 1.9                      | 29             | 2350  | D            | APT30D100BG  | TO-247          |
|               | 40    | 2.5                      | 24             | 1430  | DQ           | APT40DQ100BG | TO-247          |
|               | 60    | 2.5                      | 29             | 2325  | DQ           | APT60DQ100BG | TO-247          |
|               | 60    | 1.9                      | 34             | 3600  | D            | APT60D100BG  | TO-247 or D3PAK |
| 75            | 2.5   | 33                       | 2660           | DQ  | APT75DQ100BG | TO-247       |                 |
| <b>600</b>    | 15    | 2.0                      | 16             | 250   | DQ           | APT15DQ60BG  | TO-247          |
|               | 15    | 2.0                      | 16             | 250   | DQ           | APT15DQ60KG  | TO-220          |
|               | 15    | 1.6                      | 21             | 520   | D            | APT15D60BG   | TO-247          |
|               | 15    | 1.6                      | 21             | 520   | D            | APT15D60KG   | TO-220          |
|               | 30    | 2.0                      | 19             | 400   | DQ           | APT30DQ60BG  | TO-247          |
|               | 30    | 2.0                      | 19             | 400   | DQ           | APT30DQ60KG  | TO-220          |
|               | 30    | 1.6                      | 23             | 700   | D            | APT30D60BG   | TO-247          |
|               | 40    | 2.0                      | 22             | 480   | DQ           | APT40DQ60BG  | TO-247          |
|               | 60    | 2.0                      | 26             | 640   | DQ           | APT60DQ60BG  | TO-247          |
|               | 60    | 1.6                      | 40             | 920   | D            | APT60D60BG   | TO-247 or D3PAK |
| 75            | 2.0   | 29                       | 650            | DQ  | APT75DQ60BG  | TO-247       |                 |
| <b>400</b>    | 15    | 1.3                      | 19             | 300   | D            | APT15D40KG   | TO-220          |
|               | 30    | 1.3                      | 22             | 360   | D            | APT30D40BG   | TO-247          |
|               | 60    | 1.3                      | 30             | 540   | D            | APT60D40BG   | TO-247          |
| <b>200</b>    | 30    | 1.1                      | 21             | 150   | D            | APT30D20BG   | TO-247          |
|               | 30    | 0.83                     | 25             | 448   | Schottky     | APT30S20BG   | TO-247 or D3PAK |
|               | 60    | 1.1                      | 30             | 250   | D            | APT60D20BG   | TO-247          |
|               | 60    | 0.83                     | 35             | 490   | Schottky     | APT60S20BG   | TO-247 or D3PAK |
|               | 100   | 0.89                     | 40             | 690   | Schottky     | APT100S20BG  | TO-247          |

Part numbers for D3PAK—replace “B” with “S” in part number.



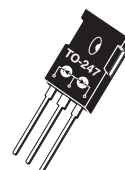
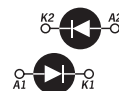
## Si Schottky Barrier Diodes, Fast and Ultra-Fast Recovery Diodes

| Volts       | I (A) | Forward Voltage Typ 25°C | t(ns) Typ 25°C | Qrr (nC) Typ 125°C at I <sub>r</sub> = I <sub>f</sub> (avg) | Diode Series | Part Number    | Package       |
|-------------|-------|--------------------------|----------------|---|--------------|----------------|---------------|
| <b>Dual</b> |       |                          |                |   |              |                |               |
| 1200        | 2x27  | 2                        | 31             | 3450  | D            | APT2X30D120J   | SOT-227       |
|             | 2x30  | 2.6                      | 25             | 1800  | DQ           | APT2X30DQ120J  | SOT-227       |
|             | 2x53  | 2.0                      | 38             | 4000  | D            | APT2X60D120J   | SOT-227       |
|             | 2x60  | 2.5                      | 30             | 2890  | DQ           | APT2X60DQ120J  | SOT-227       |
|             | 2x93  | 2.0                      | 47             | 5350  | D            | APT2X100D120J  | SOT-227       |
| 1000        | 2x100 | 2.4                      | 45             | 5240  | DQ           | APT2X100DQ120J | SOT-227       |
|             | 2x28  | 1.9                      | 29             | 2350  | D            | APT2X30D100J   | SOT-227       |
|             | 2x55  | 1.9                      | 34             | 3600  | D            | APT2X60D100J   | SOT-227       |
|             | 2x60  | 2.2                      | 30             | 2350  | DQ           | APT2X60DQ100J  | SOT-227       |
|             | 2x95  | 1.9                      | 43             | 4050  | D            | APT2X100D100J  | SOT-227       |
| 600         | 2x100 | 2.1                      | 45             | 3645  | DQ           | APT2X100DQ100J | SOT-227       |
|             | 2x30  | 1.8                      | 20             | 400   | DQ           | APT2X30DQ60J   | SOT-227       |
|             | 2x30  | 1.6                      | 23             | 700   | D            | APT2X30D60J    | SOT-227       |
|             | 2x60  | 1.7                      | 27             | 650   | DQ           | APT2X60DQ60J   | SOT-227       |
|             | 2x60  | 1.6                      | 40             | 920   | D            | APT2X60D60J    | SOT-227       |
| 400         | 2x100 | 1.6                      | 30             | 980   | DQ           | APT2X100DQ60J  | SOT-227       |
|             | 2x100 | 1.6                      | 34             | 1450  | D            | APT2X100D60J   | SOT-227       |
|             | 2x30  | 1.3                      | 22             | 360   | D            | APT2X30D40J    | SOT-227       |
|             | 2x60  | 1.3                      | 30             | 540   | D            | APT2X60D40J    | SOT-227       |
|             | 2x100 | 1.3                      | 37             | 1050  | D            | APT2X100D40J   | SOT-227       |
| 300         | 2x30  | 1.2                      | 20             | 150   | D            | APT2X30D30J    | SOT-227       |
|             | 2x60  | 1.2                      | 29             | 370   | D            | APT2X61D30J    | SOT-227       |
|             | 2x100 | 1.2                      | 36             | 650   | D            | APT2X101D30J   | SOT-227       |
| 200         | 2x30  | 1.1                      | 21             | 150   | D            | APT2X30D20J    | SOT-227       |
|             | 2x60  | 1.1                      | 30             | 250   | D            | APT2X61D20J    | SOT-227       |
|             | 2x30  | 0.80                     | 25             | 448   | Schottky     | APT2X31S20J    | SOT-227       |
|             | 2x60  | 0.83                     | 35             | 490   | Schottky     | APT2X61S20J    | SOT-227       |
|             | 2x100 | 1.1                      | 39             | 840   | D            | APT2X100D20J   | SOT-227       |
| 1200        | 2x100 | 0.89                     | 40             | 690   | Schottky     | APT2X101S20J   | SOT-227       |
|             | 2x30  | 2.8                      | 26             | 2100  | DQ           | APT30DQ120BCTG | TO-247 [BCT]  |
|             | 2x15  | 2.5                      | 20             | 810   | DQ           | APT15DQ100BCTG | TO-247 [BCT]  |
|             | 2x15  | 1.9                      | 28             | 1550  | D            | APT15D100BCTG  | TO-247 [BCT]  |
|             | 2x15  | 1.9                      | 28             | 1550  | D            | APT15D100BHBG  | TO-247 [BHB]  |
| 1000        | 2x18  | 1.9                      | 29             | 2350  | D            | APT30D100BCAG  | TO-247 [BCA]  |
|             | 2x30  | 1.9                      | 29             | 2360  | D            | APT30D100BCTG  | TO-247 [BCT]  |
|             | 2x30  | 1.9                      | 30             | 2350  | D            | APT30D100BHBG  | TO-247 [BHB]  |
|             | 2x40  | 2.5                      | 25             | 1650  | DQ           | APT40DQ100BCTG | TO-247 [BCT]  |
|             | 2x60  | 2.5                      | 29             | 2325  | DQ           | APT60DQ100LCTG | TO-264 [LCT]  |
| 600         | 2x60  | 1.9                      | 35             | 3600  | D            | APT60D100LCTG  | TO-264 [LCT]  |
|             | 2x15  | 1.6                      | 21             | 520   | D            | APT15D60BCTG   | TO-247 [BCT]  |
|             | 2x15  | 2.0                      | 15             | 250   | DQ           | APT15DQ60BCTG  | TO-247 [BCT]  |
|             | 2x15  | 1.6                      | 20             | 520   | D            | APT15D60BCAG   | TO-247 [BCA]  |
|             | 2x30  | 2.0                      | 22             | 480   | DQ           | APT30DQ60BHBG  | TO-247 [BHB]  |
|             | 2x30  | 2.0                      | 19             | 400   | DQ           | APT30DQ60BCTG  | TO-247 [BCT]  |
|             | 2x30  | 1.6                      | 23             | 700   | D            | APT30D60BCTG   | TO-247 [BCT]  |
|             | 2x30  | 1.6                      | 25             | 700   | D            | APT30D60BHBG   | TO-247 [BHB]  |
|             | 2x30  | 1.6                      | 25             | 700   | D            | APT30D60BCAG   | TO-247 [BCA]  |
|             | 2x40  | 2.0                      | 22             | 480   | DQ           | APT40DQ60BCTG  | TO-247 [BCT]  |
| 400         | 2x60  | 2.0                      | 26             | 640   | DQ           | APT60DQ60BCTG  | TO-247 [BCT]  |
|             | 2x60  | 1.6                      | 30             | 920   | D            | APT60D60LCTG   | TO-264 [LCT]  |
|             | 2x15  | 1.3                      | 19             | 300   | D            | APT15D40BCTG   | TO-247 [BCT]  |
|             | 2x30  | 1.3                      | 22             | 360   | D            | APT30D40BCTG   | TO-247 [BCT]  |
|             | 2x60  | 1.3                      | 30             | 540   | D            | APT60D40LCTG   | TO-264 [LCT]  |
| 300         | 2x30  | 1.2                      | 25             | 1300  | D            | APT30D30BCTG   | TO-247 [BCT]  |
|             | 2x30  | 1.1                      | 21             | 150   | D            | APT30D20BCTG   | TO-247 [BCT]  |
|             | 2x30  | 1.1                      | 21             | 150   | D            | APT30D20BCAG   | TO-247 [BCA]  |
| 200         | 2x30  | 0.80                     | 25             | 448   | Schottky     | APT30S20BCTG   | TO-247 [BCT]  |
|             | 2x60  | 0.83                     | 35             | 490   | Schottky     | APT60S20B2CTG  | T-MAX® [B2CT] |
|             | 2x100 | 0.89                     | 40             | 690   | Schottky     | APT100S20LCTG  | TO-264 [LCT]  |

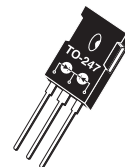
Part numbers for parallel configuration: replace 30, 60, or 100 with 31, 61, or 101, unless Schottky.  
Example: 2X30D120J becomes 2X31D120J.



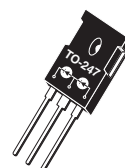
SOT-227[J]  
Antiparallel  
Configuration  
(Isolated Base)



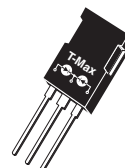
TO-247[BCA]  
Common anode



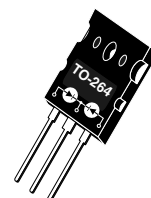
TO-247[BCT]  
Common cathode



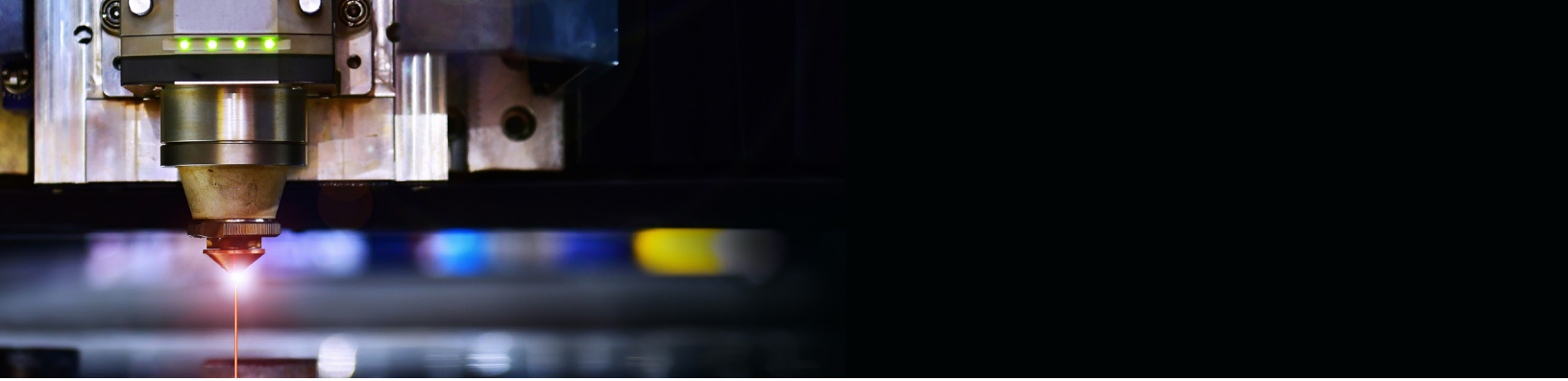
TO-247[BHB]  
Half-bridge



T-MAX® [B2CT]  
Common cathode



TO-264[LCT]  
Common cathode



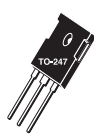
## High-Voltage RF MOSFETs

The ARF family of RF power MOSFETs is optimized for applications requiring frequencies as high as 150 MHz and operating voltages as high as 400V. Historically, RF power MOSFETs were limited to applications of 50V or less. This limitation has been removed by combining Microchip's high-voltage MOSFET technology with RF-specific die geometries.

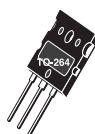
Higher  $V_{DD}$  means higher load impedance. For 150W output from a 50V supply, the load impedance is only 8 $\Omega$ . At 125V,

the load impedance is 50 $\Omega$ . The higher impedance allows simpler transformers and combiners. Paralleled devices can still operate into reasonable and convenient impedances. The increased operating voltage also lowers the DC current required for any given power output, increasing efficiency and reducing the size, weight and cost of other system components. High breakdown voltage is a necessity in high-efficiency switchmode amplifiers, such as class C-E, which can see peak drain voltages of over 4x the applied  $V_{DD}$ .

| Part Number     | P <sub>out</sub> (W) | Freq. (MHz) | V <sub>DD</sub> /B <sub>V</sub> DSS (V) | R <sub>thjc</sub> (°C/W) | Package Style | Class of Operation |
|-----------------|----------------------|-------------|---|--------------------------|---------------|--------------------|
| ARF449AG/BG     | 90                   | 120         | 150/450                                 | 0.76                     | TO-247        | A-E                |
| ARF463AG/BG     | 100                  | 100         | 125/500                                 | 0.7                      | TO-247        | A-E                |
| ARF463AP1G/BP1G | 100                  | 100         | 125/500                                 | 0.7                      | TO-247        | A-E                |
| ARF460AG/BG     | 150                  | 65          | 125/500                                 | 0.5                      | TO-247        | A-E                |
| ARF461AG/BG     | 150                  | 65          | 250/1000                                | 0.5                      | TO-247        | A-E                |
| ARF465AG/BG     | 150                  | 60          | 300/1200                                | 0.5                      | TO-247        | A-E                |
| ARF468AG/BG     | 300                  | 45          | 150/500                                 | 0.35                     | TO-264        | A-E                |
| ARF475FL        | 450                  | 150         | 165/500                                 | 0.17                     | T3A           | A-E                |
| ARF476FL        | 300                  | 150         | 165/500                                 | 0.31                     | T3            | A-E                |
| ARF466AG/BG     | 300                  | 45          | 200/1000                                | 0.35                     | TO-264        | A-E                |
| ARF466FL        | 300                  | 45          | 200/1000                                | 0.13                     | T3A           | A-E                |
| ARF469AG/BG     | 350                  | 45          | 165/500                                 | 0.28                     | TO-264        | A-E                |
| ARF477FL        | 400                  | 100         | 165/500                                 | 0.20                     | T3A           | A-E                |
| ARF1500         | 750                  | 40          | 125/500                                 | 0.10                     | T1            | A-E                |
| ARF1501         | 750                  | 40          | 250/1000                                | 0.10                     | T1            | A-E                |
| ARF1510         | 750                  | 40          | 400/1000                                | 0.10                     | T1            | D                  |
| ARF1511         | 750                  | 40          | 380/500                                 | 0.10                     | T1            | D                  |
| ARF1519         | 750                  | 25          | 250/1000                                | 0.13                     | T2            | A-E                |



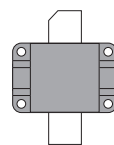
TO-247



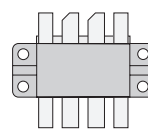
TO-264



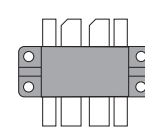
T1



T2



T3



T3A

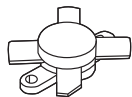


## High-Frequency RF MOSFETs

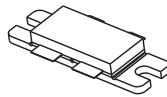
The VRF family of RF MOSFETs includes improved replacements for industry-standard RF transistors. They provide improved ruggedness by increasing the  $B_{VDS}$  over 30 percent from the industry-standard 125V to 170V minimum. Low-cost flangeless packages are another improvement that shows

Microchip's dedication to optimizing performance, reducing cost and improving reliability. We will continue to offer more products with the new reduced-cost flangeless packages.

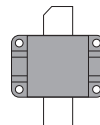
| Part Number | $P_{OUT}$ (W) | Freq. (MHz) | Gain Typ (dB) | Eff. Typ (%) | $V_{DD}/B_{VDS}$ (V) | $R_{thJC}$ ( $^{\circ}C/W$ ) | Package Style |
|-------------|---------------|-------------|---------------|--------------|----------------------|------------------------------|---------------|
| VRF141      | 150           | 175         | 13            | 45           | 28/80                | 0.60                         | M174          |
| VRF151      | 150           | 175         | 14            | 50           | 20/170               | 0.60                         | M174          |
| VRF152      | 150           | 175         | 14            | 50           | 50/130               | 0.60                         | M174          |
| VRF150      | 150           | 150         | 11            | 50           | 50/170               | 0.60                         | M174          |
| VRF161      | 200           | 150         | 14            | 50           | 50/170               | 0.50                         | M177          |
| VRF141G     | 300           | 175         | 14            | 55           | 28/80                | 0.35                         | M208          |
| VRF151G     | 300           | 175         | 16            | 55           | 50/170               | 0.35                         | M208          |
| VRF2933     | 300           | 150         | 22            | 50           | 50/170               | 0.27                         | M177          |
| VRF2944     | 400           | 150         | 25            | 50           | 65/170               | 0.22                         | M177          |
| VRF154FL    | 600           | 30          | 17            | 45           | 50/170               | 0.13                         | T2            |
| VRF157FL    | 600           | 30          | 21            | 45           | 50/170               | 0.13                         | T2            |
| VRF164FL    | 600           | 30          | 21            | 45           | 65/170               | 0.10                         | T2            |



M113/M174/  
M177



M208



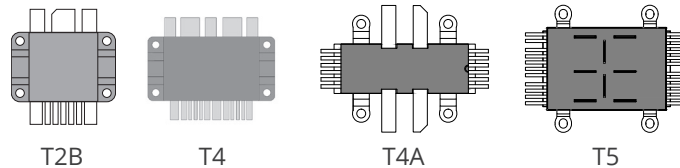
T2

## Drivers and Driver-RF MOSFET Hybrids

The DRF1200/01 hybrids integrate drivers, bypass capacitors and RF MOSFETs into a single package. Integration maximizes amplifier performance by minimizing transmission line parasitics between the driver and the MOSFET. The DRF1300 and DRF1301 have two independent channels, each containing a driver and RF MOSFET in a push-pull configuration. The DRF1400 is a half-bridge hybrid with symmetrically oriented

leads that can be easily configured into a full-bridge converter. The DRF1510 is a full bridge product optimized for maximum efficiency in class D amplifiers. All DRF parts feature a proprietary anti-ring function to eliminate cross conduction in bridge or push-pull topologies. All DRF parts can be externally selected in either an inverting or non-inverting configuration.

| Part Number    | P <sub>out</sub> (W) | Freq. (MHz) | V <sub>DD</sub> /B <sub>VDDSS</sub> (V) | Package Style | Class of Operation |
|----------------|----------------------|-------------|---|---------------|--------------------|
| <b>DRF1200</b> | 600                  | 30          | 15/1000                                 | T2B           | D-E                |
| <b>DRF1201</b> | 1000                 | 30          | 15/1000                                 | T2B           | D-E                |
| <b>DRF1300</b> | 1000                 | 30          | 15/500                                  | T4            | D-E                |
| <b>DRF1301</b> | 1000                 | 30          | 15/1000                                 | T4            | D-E                |
| <b>DRF1400</b> | 1000                 | 30          | 15/500                                  | T4            | D-E                |
| <b>DRF1211</b> | 1000                 | 30          | 15/1000                                 | T2B           | D-E                |
| <b>DRF1311</b> | 1000                 | 30          | 15/1000                                 | T4            | D-E                |
| <b>DRF1410</b> | 1000                 | 30          | 15/500                                  | T4A           | D-E                |
| <b>DRF1510</b> | 2000                 | 30          | 15/500                                  | T5            | D-E                |



## RF Reference Designs

### [DRF1200/CLASS-E, 13.56 MHz](#) [DRF1200/CLASS-E, 27.12 MHz](#)

The DRF1200/Class-E single-ended RF generator is a reference design that allows the designer to evaluate an 85 percent efficient 1000W Class-E RF generator.

### [DRF1300/CLASS-D, 13.56 MHz](#)

The DRF1300/Class-D push-pull RF generator is a reference design that allows the designer to evaluate an 80-percent efficient 2000W Class-D RF generator.

### [DRF1400/Class-D, 13.56 MHz](#)

The DRF1400/Class-D half-bridge RF generator is a reference design that allows the designer to evaluate an 85-percent efficient 2500W Class-D RF generator.

## Reference Design Kits

All kits include a fully populated board attached to an aluminum heat sink, an extensive application note explaining the theory of operation with designer's recommendations for evaluation and board layout, and all key waveforms illustrated and described. A complete parts list with recommended vendor part numbers and the board's Gerber file are provided for an easy transition into an end application.

### [DRF1200/CLASS-E, 13.56 MHz and DRF1200/CLASS-E, 27.12 MHz](#)

The DRF1200/Class-E single-ended RF generator is a reference design that allows the designer to evaluate an 85 percent efficient 1000W Class-E RF generator.

### [DRF1300/CLASS-D, 13.56 MHz](#)

The DRF1300/Class-D push-pull RF generator is a reference design that allows the designer to evaluate an 80-percent efficient 2000W Class-D RF generator.

### [DRF1400/Class-D, 13.56 MHz](#)

The DRF1400/Class-D half-bridge RF generator is a reference design that allows the designer to evaluate an 85-percent efficient 2500W Class-D RF generator.

# Power Modules Contents



Microchip combines a formidable array of technologies in semiconductors, packaging and automated manufacturing to produce a wide range of high-quality modules optimized for the following traits:

- Reliability
- Efficiency and electrical performance
- Low cost
- Space savings
- Reduced assembly time

The readily available standard module product line spans a wide selection of semiconductor (including Silicon Carbide) circuit topologies, voltage and current ratings, and packages. If you need even more flexibility or intellectual property protection, we can customize a standard module with a low setup cost and short lead time. Unique requirements can be met with Application Specific Power Modules (ASPM).

Microchip serves a broad spectrum of industrial applications for welding, solar, induction heating, medical, UPS, motor control and SMPS markets as well as high-reliability applications for semicap, defense and aerospace markets. A wide selection of construction materials enables Microchip to manufacture modules with the following features:

- Extended temperature range:  $-60^{\circ}\text{C}$  to  $200^{\circ}\text{C}$
- High-reliability
- Reduced size and weight
- High-reliability testing and screening options
- Short lead times

Microchip's experience and expertise in power electronic conversion brings the most effective technical support for your new development.

- Isolated gate driver
- Snubbers
- Mix-and-match semiconductors
- Short-circuit protection
- Temperature and current sensing
- Parameter binning

## Standard Electrical Configurations

Microchip offers a wide range of standard electrical configurations housed in a variety of packages to match your specific needs for high power-density and performance. Various semiconductor types are offered in the same topology.

| Electrical Topology                              | IGBT<br>600V-1700V | MOSFET<br>75V-1200V   | Diode<br>200V-1700V | Mix Si-SiC<br>600V-1200V | Full SiC<br>600V-1700V | Digital Gate Driver  |
|--|--------------------|-----------------------|---------------------|--------------------------|------------------------|----------------------|
| Asymmetrical bridge                              | •                  | •                     |                     |                          |                        |                      |
| Boost buck                                       | •                  | •                     |                     |                          |                        |                      |
| Boost and buck chopper                           | •                  | •                     |                     | •                        | •                      | •                    |
| Common anode                                     |                    |                       | •                   |                          |                        |                      |
| Common cathode                                   |                    |                       | •                   |                          |                        |                      |
| Dual boost and buck chopper                      | •                  | •                     |                     | •                        |                        |                      |
| Dual common source                               | •                  | •                     |                     |                          |                        |                      |
| Dual diode                                       |                    |                       |                     |                          | •                      |                      |
| Full bridge                                      | •                  | •                     | •                   |                          | •                      | •                    |
| Full bridge with PFC                             | •                  | •                     |                     | •                        |                        |                      |
| Full bridge with secondary fast rectifier bridge | •                  | •                     |                     | •                        |                        |                      |
| Full bridge with series and parallel diodes      |                    | •                     |                     | •                        |                        |                      |
| Interleaved PFC                                  | •                  | •                     |                     |                          |                        |                      |
| Linear single and dual switch                    |                    | •                     |                     |                          |                        |                      |
| Phase leg  | •                  | •                     | •                   |                          | •                      | •                    |
| Phase leg intelligent                            | •                  |                       |                     |                          |                        |                      |
| Phase leg with PFC                               |                    | •                     |                     | •                        |                        |                      |
| Phase leg with series and parallel diodes        |                    | •                     |                     | •                        |                        |                      |
| Single switch                                    | •                  | •                     | •                   |                          |                        |                      |
| Single switch with series and parallel diodes    |                    | •                     |                     | •                        |                        |                      |
| Single switch with series diodes                 | •                  | •                     |                     |                          |                        |                      |
| 3-Level NPC inverter                             | •                  |                       |                     |                          | •                      | •                    |
| 3-Level T-Type inverter                          | •                  |                       |                     | •                        | •                      | •                    |
| 3-Phase bridge                                   | •                  |                       | •                   |                          |                        |                      |
| Triple dual common source                        | •                  | •                     |                     |                          |                        |                      |
| Triple phase leg                                 | •                  | •                     |                     | •                        | •                      | •                    |
|  | Trench3            | MOSFET                | FRED                | IGBT                     | Diode                  | Gate Driver Core     |
|  | Trench4            | FREDFET               | Std Rectifier       | MOSFET                   | MOSFET                 | Module Adapter Board |
|  | Trench4 Fast       | Super Junction MOSFET |                     | Diode                    |                        | Plug and Play Driver |
|  | Trench5            |                       |                     |                          |                        | Developer Kit        |

## Package Advantages

### SP1 package

- Replaces two SOT-227 parts
- Improved assembly time and cost
- Height compatible with SOT-227
- Copper base plate

### SP3F package

- Replaces up to four SOT-227 parts
- Reduced assembly time and cost
- Height compatible with SOT-227
- Copper base plate

### SP6 package

- Offers the same footprint and the same pinout location as the popular 62 mm package but with lower height, giving it the following advantages:
  - Reduced stray inductance
  - Reduced parasitic resistance
  - Higher efficiency at high frequency

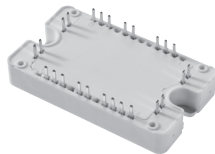
### SP6-P package

- Replaces up to six SOT-227 parts
- Height compatible with SOT-227
- Low-inductance solder pins
- High current capability

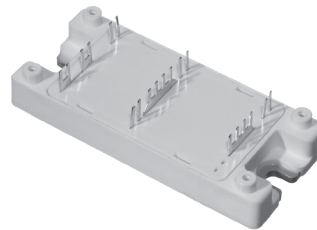
## Improved Low-Profile Packages



SP1 (12 mm)



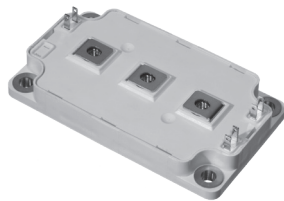
SP3F (12 mm)



SP4 (17 mm)



D1P (17 mm)



SP6 (17 mm)



SP6-P (12 mm)



SP6LI (17 mm)

## Industry-Standard Packages



SOT-227



D3 (62 mm wide)



D4 (62 mm wide)



## High Reliability Baseless Packages



BL1 (9.3 mm)



BL2 (9.3 mm)



BL3 (9.3 mm)

## Custom Power Modules

Microchip created the Active-state power management (ASPM) concept, and has been offering customized power modules since 1983. We offer a complete engineered solution with mix-and-match capabilities in term of package, configuration, performance and cost.

### Internal Printed Circuit Board

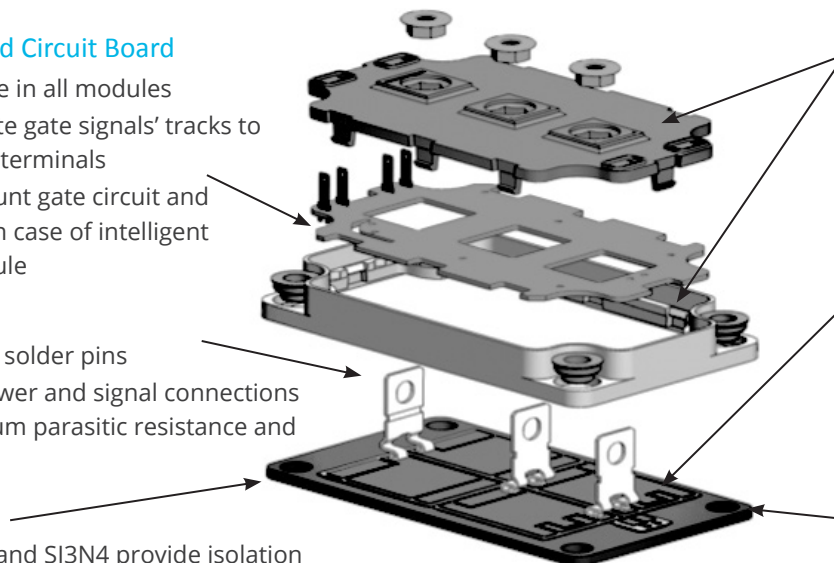
- Not available in all modules
- Used to route gate signals' tracks to small signal terminals
- Used to mount gate circuit and protection in case of intelligent power module

### Terminals

- Screw-on or solder pins
- Provides power and signal connections with minimum parasitic resistance and inductance

### Substrates

- Al<sub>2</sub>O<sub>3</sub>, AlN, and Si<sub>3</sub>N<sub>4</sub> provide isolation and good heat transfer to the base plate



### Package

- Standard or custom
- Ensures environmental protection and mechanical robustness

### Power Semiconductor Die

- IGBT, MOSFET, diode, SiC, thyristor and switching devices soldered to the substrates and connected by ultrasonic aluminum wire bonds

### Base Plate

- Improves the heat transfer to the heat sink
- Copper for good thermal transfer
- AlSiC, CuW and CuMoCu for improved reliability

## Rugged Custom Versions (Available on Demand):

The standard power module products listed in this catalog are dedicated to industrial applications.

For more severe environmental conditions/requirements, we can propose rugged custom versions (derived from the existing standard products) using specific materials, including Aerospace-grade versions managed under AS9100 Quality Standards, with:

- AlSiC baseplate (instead of copper) for about (6x) higher power cycling capabilities
- Si<sub>3</sub>N<sub>4</sub> AMB substrates or AlN DBC substrates (instead of Al<sub>2</sub>O<sub>3</sub>) for (20%) improved thermal conductivity
- Extended temperature raw materials to address wider temperature range applications (from -60°C Storage ; -55°C to +125°C Operating)

## Easy Mounting Solutions With Press-Fit Versions (Available on Demand):

To facilitate the design, the assembly, and repair of your systems, our SP1F and SP3F package type products can be available with Press-Fit terminals.

## SiC MOSFET Modules Without Parallel SiC Diodes (Available on Demand):

If applicable with your application (for cost saving), the SiC MOSFET products featuring a parallel SiC diode, listed in this catalog, can be available without.

## Custom Power Modules

The following table shows the three customization levels

| Change Options:  | Die     | Substrate           | Base Plate         | Plastic Lid        | Terminals | NRE Level      | MOQ            |
|--|---------|---------------------|--------------------|--------------------|-----------|----------------|----------------|
| Electrical/thermal performance   | Die P/N | Material            | Material           |                    |           | None to low    | 5 to 10 pieces |
| Electrical/thermal performance and electrical configuration                      | Die P/N | Material and layout | Material           |                    |           | Low to medium  |                |
| Electrical/thermal performance, and electrical configuration, and module housing | Die P/N | Material and layout | Material and shape | Material and shape | Shape     | Medium to high |                |

Microchip power modules are made of different sub-elements. Most of them are standard and can be reused to build infinite solutions for the end user. Microchip offers optimum development cost and cycle time thanks to long-term experience and a wide range of available technologies.

### Power Modules Features

- High power density
- Isolated and highly thermally-conductive substrate
- Internal wiring
- Minimum parasitics
- Minimum output terminals
- Mix-and-match components
- Fully engineered solutions

### Customer Benefits

- Size and cost reduction
- Excellent thermal management
- Reduced external hardware
- Improved performance
- Reduced assembly time
- Optimizes losses
- Easy to upgrade, lower part count, shorter time to market and IP protection

### Rugged Custom Power Modules

Various proposed solutions offer different costs and low volume of entry

|                          | Industrial Application | Extended Temp. Application | Harsh Environment Application |  |
|--------------------------|------------------------|----------------------------|-------------------------------|--|
| Standard module          | •                      |                            |                               | No NRE<br>Low-volume entry             |
| Modified standard module | •                      | •                          |                               | Low NRE<br>Low-volume entry            |
| Custom module            | •                      | •                          | •                             | Medium to high NRE<br>Low-volume entry |

### Flexibility

- Great level of integration
- Mix of silicon within the same package
- No quantity limitation

### Technology

- Application oriented

### Packaging Capability

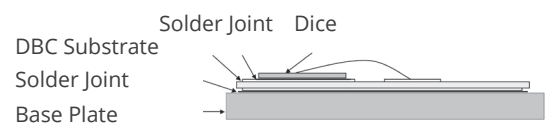
- Standard and custom packages
- Standard and custom terminals
- Various substrate technologies

### Reliability

- Coefficient of thermal expansion matching

### Applications

- Solar, welding, plasma cutting, semicap, MRI and X-ray, EV/HEV, induction heating, UPS, motor control, data communication





## Rugged Custom Power Modules

Microchip has acquired much experience and know-how in module customization that addresses rugged and wide temperature range applications, offering solutions to meet the expectations of next-generation integrated power systems for the following attributes:

- Improved reliability
- Wider operating temperatures
- Higher power
- Higher efficiency
- Lower weight and size
- Lower cost

## Applications

- Avionics actuation system
- Avionics lift and pump
- Military ground vehicle
- Power supply and motor control
- Navy ship auxiliary power supply
- Down hole drilling

## Test Capabilities

- X-Ray inspection
- Dielectric test (up to 6 kV)
- Electrical testing at specified temperature
- Burn-in
- Acoustic imaging

## Reliability Testing Capabilities

- Power cycling
- Hermetic sealing
- Moisture
- Salt atmosphere
- HTGB
- Temperature shock
- HAST
- H3TRB
- Altitude
- Mechanical shock, vibration

## Expertise Capabilities

- Cross-sectioning
- Structural analysis

All tests can be conducted upon demand by sampling or at 100 percent. Tests can be performed in-house or in an external lab.

## Our Core Competencies

- Extensive experience with rugged solutions for harsh environments
- Wide range of silicon technologies
- Wafer fab capabilities
- Mix of assembly technologies
- Hermetic and robust plastic packages
- Custom test and burn-in solutions
- ISO9001-certified
- End-of-life (obsolescence) management
- Thermal management
- Material expertise
- Product life management and risk analysis



### Module performance and reliability depends on the choice of assembly materials

Temperature Coefficients of Expansion (TCEs) with more closely matched materials increase the module's lifetime by reducing the stress at both the interface and interior of the materials.

The higher the thermal conductivity, the lower the junction-to-case thermal resistance and the lower the delta of junction temperature of the device during operation. This will minimize the effect of power cycling on the dice.

Another important feature is the material density, particularly for the baseplate. Taking copper as the reference, AlSiC has a density of 1/3, while CuW has twice the density. Therefore, AlSiC will provide substantial weight reduction while increasing reliability.

|                                      | CTE (ppm/K) | Thermal Conductivity (W/m.K) | R <sub>θjC</sub> or R <sub>θjC</sub> (K/W) |
|--------------------------------------|-------------|------------------------------|--|
| Silicon die (120 mm <sup>2</sup> )   | 4           | 136                          |  |
| Cu/Al <sub>2</sub> O <sub>3</sub>    | 17/7        | 390/25                       | 0.35                                       |
| AlSiC/Al <sub>2</sub> O <sub>3</sub> | 7/7         | 170/25                       | 0.38                                       |
| Cu/AlN                               | 17/5        | 390/170                      | 0.28                                       |
| AlSiC/AlN                            | 7/5         | 170/170                      | 0.31                                       |
| AlSiC/Si <sub>3</sub> N <sub>4</sub> | 7/3         | 170/60                       | 0.31                                       |

|            | Material                       | CTE (ppm/K) (W/m.K) | Thermal Conductivity | Density (g/cc) |
|------------|--------------------------------|---------------------|----------------------|----------------|
| Base plate | CuW                            | 6.5                 | 190                  | 17             |
|            | AlSiC                          | 7                   | 170                  | 2.9            |
|            | Cu                             | 17                  | 390                  | 8.9            |
| Substrate  | Al <sub>2</sub> O <sub>3</sub> | 7                   | 25                   |                |
|            | AlN                            | 5                   | 170                  |                |
|            | Si <sub>3</sub> N <sub>4</sub> | 3                   | 60                   |                |
| Die        | Si                             | 4                   | 136                  |                |
|            | SiC                            | 2.6                 | 270                  |                |

# Power Module Part Numbering System

## IGBT Modules

| APT MSC | GL | 475 | A  | 120 | T  | D3  | G    |
|---------|----|-----|----|-----|----|-----|------|
| I       | II | III | IV | V   | VI | VII | VIII |

|      |   |
|------|---|
| I    | TradeMark   |
| II   | IGBT Type:<br>GL = TRENCH 4<br>GLQ = High-speed TRENCH 4<br>GT = TRENCH 3<br>GTQ = TRENCH 5<br>GV = Mix NPT/TRENCH<br>CV = Mix TRENCH/Super Junction MOSFET   |
| III  | Current:<br>$I_c$ at $T_c = 80^\circ\text{C}$   |
| IV   | Topology:<br>A = Phase Leg<br>BB = Boost Buck<br>DA = Boost Chopper<br>DDA = Double Boost Chopper<br>DH = Asymmetrical Bridge<br>DSK = Double Buck Chopper<br>DU = Dual Common Source<br>H = Full Bridge<br>HR = T-Type 3-Level<br>SDA = Double Boost + Bypass Diode<br>SK = Buck Chopper<br>TA = Triple Phase Leg<br>TDU = Triple Dual Common Source<br>TL = Three Level<br>U = Single Switch<br>VDA = Interleaved PFC<br>X = Three Phase Bridge |
| V    | Blocking Voltage:<br>60 = 600V<br>120 = 1200V<br>170 = 1700V  |
| VI   | Option:<br>A = AlN Substrate<br>C = SiC Diode<br>D = Series Diode<br>E = PressFit<br>T = Temperature Sensor<br>W = Clamping Parallel Diode  |
| VII  | Package:<br>1 = SP1, SP1F<br>3 = SP3F<br>P = SP6-P<br>D3 = D3 (62 mm)<br>D4 = D4 (62 mm)<br>BL1, BL2, BL3 (Baseless)  |
| VIII | G = RoHS-compliant  |

## MOSFET Modules

| APT MSC | C  | 60  | DA | M24 | T  | 1   | G    |
|---------|----|-----|----|-----|----|-----|------|
| I       | II | III | IV | V   | VI | VII | VIII |

|      |   |
|------|---|
| I    | TradeMark   |
| II   | MOSFET Type:<br>SM = SiC MOSFET<br>M = MOSFET<br>C = Super Junction MOSFET  |
| III  | Blocking Voltage:<br>08 = 75V<br>10 = 100V<br>20 = 200V<br>50 = 500V<br>60 = 600V<br>70 = 700V<br>80 = 800V<br>100 = 1000V<br>120 = 1200V<br>170 = 1700V  |
| IV   | Topology:<br>A = Phase Leg<br>BB = Boost Buck<br>DA = Boost Chopper<br>DDA = Double Boost Chopper<br>DH = Asymmetrical Bridge<br>DSK = Double Buck Chopper<br>DU = Dual Common Source<br>H = Full Bridge<br>HR = T-Type 3-Level<br>SDA = Double Boost and Bypass Diode<br>SK = Buck Chopper<br>TA = Triple Phase Leg<br>TDU = Triple Dual Common Source<br>TL = Three Level NPC<br>U = Single Switch<br>VDA = Interleaved PFC |
| V    | $R_{DS(on)}$ at $T_c = 25^\circ\text{C}$<br>240 = 2400 mΩ<br>24 = 240 mΩ<br>M24 = 24 mΩ   |
| VI   | Option:<br>A = AlN Substrate<br>C = SiC Diode<br>D = Series Diode<br>E = PressFit<br>F = FREDFET<br>S = Series and Parallel Diodes<br>T = Temperature Sensor<br>U = Ultra-fast FREDFET  |
| VII  | Package:<br>1 = SP1, SP1F<br>3 = SP3F<br>P = SP6-P<br>LI = SP6LI<br>BL1, BL2, BL3 (Baseless)  |
| VIII | G = RoHS-compliant  |

## Diode Modules

| APT MSC | DR | 90  | X  | 160 | 1  | G   |
|---------|----|-----|----|-----|----|-----|
| I       | II | III | IV | V   | VI | VII |

|     |  |
|-----|--|
| I   | TradeMark  |
| II  | Diode Type:<br>DF = FRED<br>DR = Standard Rectifier<br>DC = SiC<br>DSK = Schottky  |
| III | Current:<br>$I_f$ at $T_c = 80^\circ\text{C}$  |
| IV  | Topology:<br>AA = Dual Common Anode<br>BB = Boost Buck<br>AK = Dual Series<br>KK = Dual Common Cathode<br>H = Single Phase Bridge<br>U = Single Switch<br>X = Three Phase Bridge |
| V   | Blocking Voltage:<br>20 = 200V<br>40 = 400V<br>60 = 600V<br>70 = 700V<br>100 = 1000V<br>120 = 1200V<br>160 = 1600V<br>170 = 1700V  |
| VI  | Option:<br>E = PressFit<br><br>Package:<br>1 = SP1, SP1F<br>3 = SP3F<br>D1P = D1P<br>BL1, BL2, BL3 (Baseless)  |
| VII | G = RoHS-compliant   |

## Optional Materials

Optional materials are available upon demand for most of the listed standard power modules. Options are indicated with a letter in the suffix of the module part number. The temperature sensor option is listed as "YES" or "OPTION" when available for a standard part or on-demand.

The following tables list the options available for our product categories.

|   |   |
|---|---|
| A | AlN substrate for higher thermal conductivity                           |
| M | AlSiC base plate material for improved temperature cycling capabilities |
| T | Temperature sensor (NTC or PTC) for case temperature information        |
| C | SiC diode for higher efficiency   |
| N | Si <sub>3</sub> N <sub>4</sub> substrate                                |
| E | Press fit terminals (for SP1F and SP3F package only)                    |
| X | Gold pin terminals (SP1 only)   |
| L | Phase change material option  |

# SiC MOSFET Power Module

| Part Number          | Electrical Topology | Voltage (V) | $R_{DS(on)}$ (m $\Omega$ ) | Current (A)<br>Tc = 80°C | Package<br>(see page 23) | Gate Driver Core | Module Adapter Board | Plug and Play Driver | Developer Kit        |                      |
|----------------------|---------------------|-------------|----------------------------|--------------------------|--------------------------|------------------|----------------------|----------------------|----------------------|----------------------|
| MSC100SM70JCU2       | Boost chopper       | 700         | 15                         | 97                       | SOT-227                  |                  |                      |                      |                      |                      |
| MSC40SM120JCU2       |                     | 1200        | 40                         | 44                       | SOT-227                  |                  |                      |                      |                      |                      |
| MSC70SM120JCU2       |                     |             | 25                         | 71                       | SOT-227                  |                  |                      |                      |                      |                      |
| MSC130SM120JCU2      |                     |             | 12.5                       | 138                      | SOT-227                  |                  |                      |                      |                      |                      |
| MSCSM120DAM11CT3AG   |                     |             | 11                         | 202                      | SP3F                     |                  |                      |                      |                      |                      |
| MSC100SM70JCU3       | 700                 |             | 15                         | 97                       | SOT-227                  |                  |                      |                      |                      |                      |
| MSC40SM120JCU3       | Buck chopper        | 1200        | 40                         | 44                       | SOT-227                  |                  |                      |                      |                      |                      |
| MSC70SM120JCU3       |                     |             | 25                         | 71                       | SOT-227                  |                  |                      |                      |                      |                      |
| MSC130SM120JCU3      |                     |             | 12.5                       | 138                      | SOT-227                  |                  |                      |                      |                      |                      |
| MSCSM120SKM11CT3AG   |                     |             | 11                         | 202                      | SP3F                     |                  |                      |                      |                      |                      |
| MSCSM70HM19CT3AG     |                     |             | 700                        | 15                       | 97                       | SP3F             |                      |                      |                      |                      |
| MSCSM120HM31CT3AG    | Full bridge         | 1200        | 25                         | 71                       | SP3F                     |                  |                      |                      |                      |                      |
| MSCSM120HM16CT3AG    |                     |             | 12.5                       | 138                      | SP3F                     |                  |                      |                      |                      |                      |
| MSCSM120HM50CT3AG    |                     |             | 40                         | 44                       | SP3F                     |                  |                      |                      |                      |                      |
| MSCSM120HM063CAG     |                     |             | 6.3                        | 265                      | SP6C                     |                  |                      |                      |                      |                      |
| MSCSM120HM083CAG     |                     |             | 8.3                        | 200                      | SP6C                     |                  |                      |                      |                      |                      |
| MSCSM170HM45CT3AG    |                     |             | 1700                       | 35                       | 50                       | SP3F             |                      |                      |                      |                      |
| MSCSM170HM23CT3AG    |                     |             |                            | 17.5                     | 97                       | SP3F             |                      |                      |                      |                      |
| MSCSM70AM19CT1AG     | Phase leg           | 700         | 15                         | 97                       | SP1F                     |                  |                      |                      |                      |                      |
| MSCSM70AM07CT3AG     |                     |             | 5                          | 276                      | SP3F                     | 2ASC-12A2HP      |                      |                      |                      |                      |
| MSCSM70AM10CT3AG     |                     |             | 7.5                        | 188                      | SP3F                     | 2ASC-12A2HP      |                      |                      |                      |                      |
| MSCSM70AM025CD3AG    |                     |             | 2.5                        | 538                      | D3                       | 2ASC-12A2HP      | 62CA1                | 62EM1-00001          | ASDAK-2ASC-12A1HP-62 |                      |
| MSCSM70AM025CT6AG    |                     |             | 2.5                        | 538                      | SP6C                     | 2ASC-12A2HP      | 62CA1                | 62EM1-00001          | ASDAK-2ASC-12A1HP-62 |                      |
| MSCSM120AM16CT1AG    |                     |             | 1200                       | 12.5                     | 138                      | SP1F             |                      |                      |                      |                      |
| MSCSM120AM31CT1AG    |                     | 25          |                            | 71                       | SP1F                     |                  |                      |                      |                      |                      |
| MSCSM120AM50CT1AG    |                     | 40          |                            | 44                       | SP1F                     |                  |                      |                      |                      |                      |
| MSCSM120AM08CT3AG    |                     | 6.25        |                            | 268                      | SP3F                     | 2ASC-12A2HP      |                      |                      |                      |                      |
| MSCSM120AM11CT3AG    |                     | 8.33        |                            | 202                      | SP3F                     | 2ASC-12A1HP      | 62CA1                | 62EM1-00001          |                      |                      |
| MSCSM120AM042CD3AG   |                     | 4.2         |                            | 394                      | D3                       | 2ASC-12A2HP      | 62CA1                | 62EM1-00001          | ASDAK-2ASC-12A1HP-62 |                      |
| MSCSM120AM027CD3AG   |                     | 2.7         |                            | 584                      | D3                       | 2ASC-12A2HP      | 62CA1                | 62EM1-00001          | ASDAK-2ASC-12A1HP-62 |                      |
| MSCSM120AM042CT6AG   |                     | 4.2         |                            | 394                      | SP6C                     | 2ASC-12A2HP      | 62CA1                | 62EM1-00001          | ASDAK-2ASC-12A1HP-62 |                      |
| MSCSM120AM027CT6AG   |                     | 2.7         |                            | 584                      | SP6C                     | 2ASC-12A2HP      | 62CA1                | 62EM1-00001          | ASDAK-2ASC-12A1HP-62 |                      |
| MSCSM170AM23CT1AG    |                     | 1700        |                            | 17.5                     | 97                       | SP1F             |                      |                      |                      |                      |
| MSCSM170AM45CT1AG    |                     |             |                            | 35                       | 50                       | SP1F             |                      |                      |                      |                      |
| MSCSM170AM11CT3AG    |                     |             |                            | 8.75                     | 188                      | SP3F             | 2ASC-17A1HP          |                      |                      |                      |
| MSCSM170AM15CT3AG    |                     |             |                            | 11.7                     | 142                      | SP3F             | 2ASC-17A1HP          |                      |                      |                      |
| MSCSM170AM058CD3AG   |                     |             |                            | 5.8                      | 277                      | D3               | 2ASC-17A1HP          | 62CA4                | 62EM1-00001          | ASDAK-2ASC-17A1HP-62 |
| MSCSM170AM039CD3AG   |                     |             |                            | 3.9                      | 410                      | D3               | 2ASC-17A1HP          | 62CA4                | 62EM1-00001          | ASDAK-2ASC-17A1HP-62 |
| MSCSM170AM058CT6AG   |                     |             |                            | 5.8                      | 277                      | SP6C             | 2ASC-17A1HP          | 62CA4                | 62EM1-00001          | ASDAK-2ASC-17A1HP-62 |
| MSCSM170AM039CT6AG   |                     |             |                            | 3.9                      | 410                      | SP6C             | 2ASC-17A1HP          | 62CA4                | 62EM1-00001          | ASDAK-2ASC-17A1HP-62 |
| MSCSM170AM029CT6LIAG |                     |             |                            | 2.9                      | 530                      | SP6LI            | 2ASC-17A1HP          | SP6CA3               |                      |                      |
| MSCSM170AM058CT6LIAG |                     |             | 5.8                        | 277                      | SP6LI                    | 2ASC-17A1HP      | SP6CA3               |                      |                      |                      |

## SiC MOSFET Power Modules (continued)

| Part Number          | Electrical Topology | Voltage (V) | $R_{DS(on)}$ (mΩ) | Current (A)<br>$T_c = 80^\circ\text{C}$ | Package<br>(see page 23) | Gate Driver Core | Module Adapter Board | Plug and Play Driver | Developer Kit           |
|----------------------|---------------------|-------------|-------------------|---|--------------------------|------------------|----------------------|----------------------|-------------------------|
| MSCSM70VM19C3AG      | Vienna phase leg    | 700         | 15                | 97                                      | SP3F                     |                  |                      |                      |                         |
| MSCSM70VM10C4AG      |                     |             | 7.5               | 97                                      | SP4                      |                  |                      |                      |                         |
| MSCSM70TAM19CT3AG    | Three phase bridge  |             | 15                | 97                                      | SP3F                     |                  |                      |                      |                         |
| MSCSM70TAM10CTPAG    |                     |             | 7.5               | 186                                     | SP6P                     |                  |                      |                      |                         |
| MSCSM70TAM05TPAG     |                     |             | 5                 | 273                                     | SP6P                     |                  |                      |                      |                         |
| MSCSM120TAM31CT3AG   | Triple phase leg    |             | 1200              | 25                                      | 71                       | SP3F             |                      |                      |                         |
| MSCSM120TAM16CTPAG   |                     | 12.5        |                   | 136                                     | SP6P                     |                  |                      |                      |                         |
| MSCSM120TAM11CTPAG   |                     | 8.33        |                   | 200                                     | SP6P                     |                  |                      |                      |                         |
| MSCSM170HM087CAG     | Full Bridge         | 1700        | 8.7               | 189                                     | SP6C                     |                  |                      |                      |                         |
| MSCSM170HM12CAG      |                     |             | 11.7              | 142                                     | SP6C                     |                  |                      |                      |                         |
| MSCSM170TAM45CT3AG   |                     |             | 35                | 50                                      | SP3F                     |                  |                      |                      |                         |
| MSCSM70AM025CT6LIAG  | Phase leg           | 700         | 2.5               | 538                                     | SP6C LI                  | 2ASC-12A2HP      | SP6CA1               |                      | ASDAK-2ASC-12A1HP-SP6LI |
| MSCSM120AM042CT6LIAG |                     | 1200        | 4.2               | 394                                     | SP6C LI                  | 2ASC-12A2HP      | SP6CA1               |                      | ASDAK-2ASC-12A1HP-SP6LI |
| MSCSM120AM03CT6LIAG  |                     |             | 2.5               | 641                                     | SP6C LI                  | 2ASC-12A2HP      | SP6CA1               |                      | ASDAK-2ASC-12A1HP-SP6LI |
| MSCSM120AM02CT6LIAG  |                     |             | 2.1               | 754                                     | SP6C LI                  | 2ASC-12A2HP      | SP6CA1               |                      | ASDAK-2ASC-12A1HP-SP6LI |
| MSCSM170AM029CT6LIAG |                     | 1700        | 2.9               | 530                                     | SP6C LI                  | 2ASC-17A1HP      | SP6CA3               |                      |                         |
| MSCSM170AM058CT6LIAG |                     |             | 5.8               | 277                                     | SP6C LI                  | 2ASC-17A1HP      | SP6CA3               |                      |                         |

## Baseless Power Modules

| Part Number           | Silicon type | Configuration           | VDS (V) | $R_{DS(on)}$ type (mΩ) | Current (A)<br>$T_c=80\text{ C}$ | Package |
|-----------------------|--------------|-------------------------|---------|------------------------|----------------------------------|---------|
| MSCSM120DHM31CTBL2NG  | SiC MOSFET   | Asymmetrical bridge     | 1200    | 25                     | 60                               | BL2     |
| MSCSM120DAM31CTBL1NG  | SiC MOSFET   | Boost chopper           |         | 25                     | 60                               | BL1     |
| MSCSM120SKM31CTBL1NG  | SiC MOSFET   | Buck chopper            |         | 25                     | 60                               | BL1     |
| MSCSM120DUM31CTBL1NG  | SiC MOSFET   | Dual common source      |         | 25                     | 60                               | BL1     |
| MSCSM120DDUM31CTBL2NG | SiC MOSFET   | Dual dual common source |         | 25                     | 60                               | BL2     |
| MSCSM120DDUM16CTBL3NG | SiC MOSFET   | Dual dual common source |         | 12.5                   | 120                              | BL3     |
| MSCSM120HM31CTBL2NG   | SiC MOSFET   | Full bridge             |         | 25                     | 60                               | BL2     |
| MSCSM120HM16CTBL3NG   | SiC MOSFET   | Full bridge             |         | 12.5                   | 120                              | BL3     |
| MSCSM120AM31CTBL1NG   | SiC MOSFET   | Phase leg               |         | 25                     | 60                               | BL1     |

| Part Number           | Silicon type  | Configuration           | VCE (V) | VCEsat (V) | Current (A)<br>$T_c=80\text{ C}$ | Package |
|-----------------------|---------------|-------------------------|---------|------------|----------------------------------|---------|
| MSCGLQ50DH120CTBL2NG  | TRENCH 4 FAST | Asymmetrical bridge     | 1200    | 2.05       | 50                               | BL2     |
| MSCGLQ50DU120CTBL1NG  | TRENCH 4 FAST | Dual common source      |         | 2.05       | 50                               | BL1     |
| MSCGLQ50DDU120CTBL2NG | TRENCH 4 FAST | Dual dual common source |         | 2.05       | 50                               | BL2     |
| MSCGLQ75DDU120CTBL3NG | TRENCH 4 FAST | Dual dual common source |         | 2.05       | 75                               | BL3     |
| MSCGLQ50H120CTBL2NG   | TRENCH 4 FAST | Full bridge             |         | 2.05       | 50                               | BL2     |
| MSCGLQ75H120CTBL3NG   | TRENCH 4 FAST | Full bridge             |         | 2.05       | 75                               | BL3     |
| MSCGLQ50A120CTBL1NG   | TRENCH 4 FAST | Phase leg               |         | 2.05       | 50                               | BL1     |

| Part Number      | Silicon type    | Configuration | VRRM (V) | VF (V) | Current (A)<br>$T_c=80\text{ C}$ | Package |
|------------------|-----------------|---------------|----------|--------|----------------------------------|---------|
| MSCDR90A160BL1NG | Rectifier diode | Phase leg     | 1600     | 1.3    | 90                               | BL1     |

# SiC Diode Power Module

## Power Module Advantages

- High-speed switching
- Low switching losses
- Low-input capacitance
- High-power density
- Low-profile packages
- Minimum parasitic inductance
- Lower system cost
- Standard and custom modules
- 30+ years design experience

## SiC Diode Power Modules

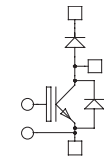
| Part Number        | Electrical Topology | Voltage (V) | Current (A)<br>Tc = 80°C | Package<br>(see page 19) |
|--------------------|---------------------|-------------|--------------------------|--------------------------|
| MSCDC50H701AG      | Full bridge         | 700         | 50                       | SP1                      |
| MSC50DC70HJ        |                     |             | 50                       | SOT-227                  |
| MSCDC100H70AG      |                     |             | 100                      | SP6                      |
| MSCDC200H70AG      |                     |             | 200                      | SP6                      |
| MSCDC50H1201AG     |                     | 1200        | 50                       | SP1                      |
| MSC50DC120HJ       |                     |             | 50                       | SOT-227                  |
| MSCDC100H120AG     |                     |             | 100                      | SP6                      |
| MSCDC200H120AG     |                     |             | 200                      | SP6                      |
| MSCDC100H170AG     |                     | 1700        | 100                      | SP6C                     |
| MSCDC200H170AG     |                     |             | 200                      | SP6C                     |
| MSCDC50H1701AG     |                     |             | 50                       | SP1                      |
| MSC50DC170HJ       |                     |             | 50                       | SOT-227                  |
| MSCDC100A70D1PAG   | Phase leg           | 700         | 100                      | D1P                      |
| MSCDC150A70D1PAG   |                     |             | 150                      | D1P                      |
| MSCDC200A70D1PAG   |                     |             | 200                      | D1P                      |
| MSCDC300A70AG      |                     |             | 300                      | SP6                      |
| MSCDC450A70AG      |                     |             | 450                      | SP6                      |
| MSCDC600A70AG      |                     |             | 600                      | SP6                      |
| MSCDC100A120D1PAG  | 1200                | 100         | D1P                      |                          |
| MSCDC150A120D1PAG  |                     | 150         | D1P                      |                          |
| MSCDC200A120D1PAG  |                     | 200         | D1P                      |                          |
| MSCDC300A120AG     |                     | 300         | SP6                      |                          |
| MSCDC450A120AG     |                     | 450         | SP6                      |                          |
| MSCDC600A120AG     |                     | 600         | SP6                      |                          |
| MSCDC300A170AG     | 1700                | 300         | SP6C                     |                          |
| MSCDC450A170AG     |                     | 450         | SP6C                     |                          |
| MSCDC600A170AG     |                     | 600         | SP6C                     |                          |
| MSCDC100A170D1PAG  |                     | 100         | D1P                      |                          |
| MSCDC150A170D1PAG  |                     | 150         | D1P                      |                          |
| MSCDC200A170D1PAG  |                     | 200         | D1P                      |                          |
| MSCDC100KK70D1PAG  | Dual common cathode | 700         | 100                      | D1P                      |
| MSCDC150KK70D1PAG  |                     |             | 150                      | D1P                      |
| MSCDC200KK70D1PAG  |                     |             | 200                      | D1P                      |
| MSCDC100KK120D1PAG |                     | 1200        | 100                      | D1P                      |
| MSCDC150KK120D1PAG |                     |             | 150                      | D1P                      |
| MSCDC200KK120D1PAG |                     |             | 200                      | D1P                      |
| MSCDC100KK170D1PAG |                     | 1700        | 100                      | D1P                      |
| MSCDC150KK170D1PAG |                     |             | 150                      | D1P                      |
| MSCDC200KK170D1PAG |                     |             | 200                      | D1P                      |
| MSCDC50X701AG      | Three phase bridge  | 1200        | 50                       | SP1                      |
| MSCDC50X1201AG     |                     |             | 50                       | SP1                      |
| MSCDC50X1701AG     |                     |             | 50                       | SP1                      |



# IGBT & Si MOSFET Power Modules with SiC Diodes

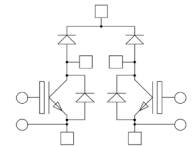
## Boost Chopper

| $V_{RRM}$ (V) | IGBT Type     | $I_D$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V)<br>at Rated $I_c$ | Package<br>(see page 20) | NTC | Part Number     |
|---------------|---------------|---------------------------------------|------------------------------------|--------------------------|-----|-----------------|
| 1200          | Trench 4 Fast | 25                                    | 2.05                               | SOT-227                  | No  | APT25GLQ120JCU2 |
|               |               | 40                                    | 2.05                               | SOT-227                  | No  | APT40GLQ120JCU2 |



## Dual Chopper

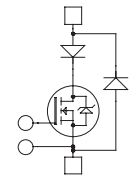
| $V_{RRM}$ (V) | IGBT Type     | $I_D$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V)<br>at Rated $I_c$ | Package<br>(see page 20) | NTC | Part Number        |
|---------------|---------------|---------------------------------------|------------------------------------|--------------------------|-----|--------------------|
| 1200          | Trench 4 Fast | 40                                    | 2.05                               | SP3F                     | Yes | APTGLQ40DDA120CT3G |



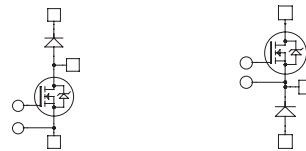
## MOSFETs and Super Junction MOSFET Power Modules With SiC Diodes

### Single Switch + Series FRED and SiC Parallel Diodes

| $V_{DSS}$ (V) | MOSFET Type | $R_{DS(ON)}$ (m $\Omega$ ) | $I_D$ (A)<br>$T_c = 80^\circ\text{C}$ | Package<br>(see page 20) | NTC    | Part Number      |
|---------------|-------------|----------------------------|---------------------------------------|--------------------------|--------|------------------|
| 1000          | MOS 7       | 65                         | 110                                   | SP6                      | Option | APTM100UM65SCAVG |
| 1200          | MOS 7       | 100                        | 86                                    | SP6                      | Option | APTM120U10SCAVG  |



### Power Modules With SiC Schottky Diodes

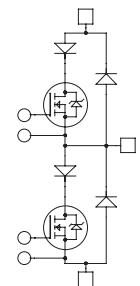


## Chopper

| $V_{DSS}$ (V) | MOSFET Type           | $R_{DS(ON)}$ (m $\Omega$ ) | $I_D$ (A)<br>$T_c = 80^\circ\text{C}$ | Package<br>(see page 20) | NTC | ...DA... or U2  | ...SK... or U3  |
|---------------|-----------------------|----------------------------|---------------------------------------|--------------------------|-----|-----------------|-----------------|
| 500           | MOS 8                 | 65                         | 43                                    | SOT-227                  | No  | APT58M50JCU2    |                 |
|               |                       | 45                         | 38                                    | SOT-227                  | No  | APT50N60JCCU2   |                 |
| 600           | Super Junction MOSFET | 24                         | 70                                    | SP1                      | Yes |                 | APTC60SKM24CT1G |
|               |                       | 18                         | 107                                   | SP4                      | Yes | APTC60DAM18CTG  |                 |
| 1000          | MOS 8                 | 330                        | 20                                    | SOT-227                  | No  | APT26M100JCU2   | APT26M100JCU3   |
| 1200          | MOS 8                 | 560                        | 15                                    | SOT-227                  | No  | APT20M120JCU2   | APT20M120JCU3   |
|               |                       | 300                        | 23                                    | SP1                      | Yes | APTM120DA30CT1G |                 |

## Phase Leg + Series FRED and SiC Parallel Diodes

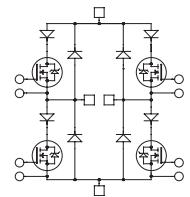
| $V_{DSS}$ (V) | MOSFET Type           | $R_{DS(ON)}$ (m $\Omega$ ) | $I_D$ (A)<br>$T_c = 80^\circ\text{C}$ | Package<br>(see page 20) | NTC | Part Number    |
|---------------|-----------------------|----------------------------|---------------------------------------|--------------------------|-----|----------------|
| 500           | MOS 7                 | 38                         | 67                                    | SP4                      | Yes | APTM50AM38SCTG |
|               |                       | 24                         | 110                                   | SP6                      | No  | APTM50AM24SCG  |
| 600           | Super Junction MOSFET | 35                         | 54                                    | SP4                      | Yes | APTC60AM35SCTG |
|               |                       | 24                         | 70                                    | SP4                      | Yes | APTC60AM24SCTG |
|               |                       | 18                         | 107                                   | SP6                      | No  | APTC60AM18SCG  |
| 800           | Super Junction MOSFET | 150                        | 21                                    | SP4                      | Yes | APTC80A15SCTG  |
|               |                       | 100                        | 32                                    | SP4                      | Yes | APTC80A10SCTG  |
|               |                       | 75                         | 43                                    | SP6                      | No  | APTC80AM75SCG  |
| 1000          | MOS 7                 | 130                        | 49                                    | SP6                      | No  | APTM100A13SCG  |





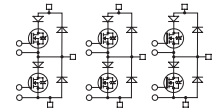
## Full Bridge + Series FRED and SiC Parallel Diodes

| $V_{DSS}$ (V) | MOSFET Type           | $R_{DS(on)}$ (m $\Omega$ ) | $I_D$ (A)<br>$T_C = 80^\circ\text{C}$ | Package<br>(see page 20) | NTC | Part Number    |
|---------------|-----------------------|----------------------------|---------------------------------------|--------------------------|-----|----------------|
| 500           | MOS 7                 | 75                         | 34                                    | SP4                      | Yes | APTM50HM75SCTG |
| 600           | Super Junction MOSFET | 70                         | 29                                    | SP4                      | Yes | APTC60HM70SCTG |
|               |                       | 45                         | 38                                    | SP4                      | Yes | APTC60HM45SCTG |
| 800           |                       | 290                        | 11                                    | SP4                      | Yes | APTC80H29SCTG  |
| 1000          | MOS 7                 | 450                        | 14                                    | SP4                      | Yes | APTM100H45SCTG |

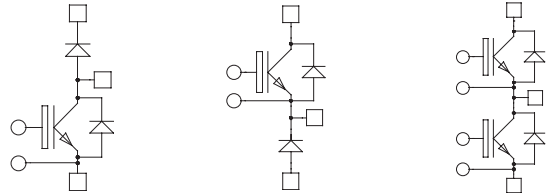


## Triple Phase Leg

| $V_{DSS}$ (V) | MOSFET Type           | $R_{DS(on)}$ (m $\Omega$ ) | $I_D$ (A)<br>$T_C = 80^\circ\text{C}$ | Package<br>(see page 20) | NTC | Part Number       |
|---------------|-----------------------|----------------------------|---------------------------------------|--------------------------|-----|-------------------|
| 600           | Super Junction MOSFET | 24                         | 87                                    | SP6-P                    | Yes | APTC60TAM21SCTPAG |
| 1000          | MOS 7                 | 350                        | 50                                    | SP6-P                    | Yes | APTM100TA35SCTPG  |



# IGBT Power Modules

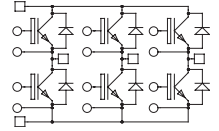


## Chopper and Phase Leg

| $V_{(BR)CES}$ (V) | IGBT Type     | $I_c$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$ (V)<br>at Rated $I_c$ | Package<br>(see page 19) | NTC             | ...DA... or ...U2 | ...SK... or ...U3 | ...A...           |
|-------------------|---------------|---------------------------------------|------------------------------------|--------------------------|-----------------|-------------------|-------------------|-------------------|
| 600               | TRENCH 3      | 75                                    | 1.5                                | SP1                      | YES             | APTGT75DA60T1G    |                   | APTGT75A60T1G     |
|                   |               | 100                                   | 1.5                                | SP1                      | YES             | APTGT100DA60T1G   |                   | APTGT100A60T1G    |
|                   |               | 150                                   | 1.5                                | SP1                      | YES             | APTGT150DA60T1G   | APTGT150SK60T1G   | APTGT150A60T1G    |
|                   |               | 150                                   | 1.5                                | SP3F                     | YES             |                   |                   | APTGT150A60T3AG   |
|                   |               | 200                                   | 1.5                                | SP3F                     | YES             | APTGT200DA60T3AG  | APTGT200SK60T3AG  | APTGT200A60T3AG   |
|                   |               | 300                                   | 1.5                                | SP4                      | YES             |                   |                   | APTGT300A60TG     |
|                   |               | 300                                   | 1.5                                | SP6                      | OPTION          | APTGT300DA60G     | APTGT300SK60G     | APTGT300A60G      |
|                   |               | 300                                   | 1.5                                | D3                       | OPTION          | APTGT300DA60D3G   | APTGT300SK60D3G   | APTGT300A60D3G    |
|                   |               | 400                                   | 1.5                                | D3                       | OPTION          | APTGT400DA60D3G   |                   | APTGT400A60D3G    |
|                   |               | 450                                   | 1.5                                | SP6                      | OPTION          | APTGT450DA60G     | APTGT450SK60G     | APTGT450A60G      |
| 600               | 1.5           | SP6                                   | OPTION                             | APTGT600DA60G            | APTGT600SK60G   | APTGT600A60G      |                   |                   |
| 650               | TRENCH 4 FAST | 50                                    | 1.85                               | SOT227                   |                 | APT50GLQ65JU2     |                   |                   |
|                   |               | 50                                    | 1.85                               | SOT227                   |                 | APT100GLQ65JU2    | APT100GLQ65JU3    |                   |
|                   |               | 100                                   | 1.85                               | SP1                      | YES             |                   |                   | APTGLQ100A65T1G   |
| 650               | TRENCH 5      | 60                                    | 1.65                               | SP1                      | YES             | APTGTQ100DA65T1G  | APTGTQ100SK65T1G  | APTGTQ100A65T1G   |
|                   |               | 120                                   | 1.65                               | SP3F                     | YES             | APTGTQ200DA65T3G  | APTGTQ200SK65T3G  | APTGTQ200A65T3G   |
| 1200              | TRENCH 3      | 35                                    | 1.7                                | SP1                      | YES             |                   |                   | APTGT35A120T1G    |
|                   |               | 35                                    | 1.7                                | SOT227                   | -               | APT35GT120JU2     | APT35GT120JU3     |                   |
|                   |               | 50                                    | 1.7                                | SOT227                   | -               | APT50GT120JU2     | APT50GT120JU3     |                   |
|                   |               | 50                                    | 1.7                                | SP1                      | YES             |                   |                   | APTGT50A120T1G    |
|                   |               | 50                                    | 1.7                                | SP4                      | YES             | APTGT50DA120TG    | APTGT50SK120TG    |                   |
|                   |               | 75                                    | 1.7                                | SOT227                   | -               | APT75GT120JU2     | APT75GT120JU3     |                   |
|                   |               | 75                                    | 1.7                                | SP1                      | YES             |                   |                   | APTGT75A120T1G    |
|                   |               | 75                                    | 1.7                                | SP4                      | YES             | APTGT75DA120TG    | APTGT75SK120TG    |                   |
|                   |               | 100                                   | 1.7                                | SP1                      | YES             | APTGT100DA120T1G  |                   |                   |
|                   |               | 100                                   | 1.7                                | SOT227                   | -               | APT100GT120JU2    | APT100GT120JU3    |                   |
|                   |               | 100                                   | 1.7                                | SP3F                     | YES             |                   |                   | APTGT100A120T3AG  |
|                   |               | 100                                   | 1.7                                | SP4                      | YES             |                   |                   | APTGT100A120TG    |
|                   |               | 150                                   | 1.7                                | SP6                      | OPTION          | APTGT150DA120G    | APTGT150SK120G    | APTGT150A120G     |
|                   |               | 150                                   | 1.7                                | SP3F                     | YES             |                   |                   | APTGT150A120T3AG  |
|                   |               | 150                                   | 1.7                                | SP4                      | YES             |                   |                   | APTGT150A120TG    |
|                   |               | 200                                   | 1.7                                | SP6                      | OPTION          | APTGT200DA120G    | APTGT200SK120G    | APTGT200A120G     |
|                   |               | 200                                   | 1.7                                | D3                       | OPTION          | APTGT200DA120D3G  |                   | APTGT200A120D3G   |
|                   |               | 300                                   | 1.7                                | SP6                      | OPTION          | APTGT300DA120G    | APTGT300SK120G    | APTGT300A120G     |
|                   |               | 300                                   | 1.7                                | D3                       | OPTION          |                   |                   | APTGT300A120D3G   |
|                   |               | 400                                   | 1.7                                | SP6                      | OPTION          | APTGT400DA120G    | APTGT400SK120G    | APTGT400A120G     |
| 400               | 1.7           | D3                                    | OPTION                             |                          |                 | APTGT400A120D3G   |                   |                   |
| 1200              | TRENCH 4      | 40                                    | 1.85                               | SOT227                   | -               | APT40GL120JU2     | APT40GL120JU3     |                   |
|                   |               | 90                                    | 1.85                               | SP1                      | YES             | APTGL90DA120T1G   |                   | APTGL90A120T1G    |
|                   |               | 180                                   | 1.85                               | SP3F                     | YES             |                   |                   | APTGL180A120T3AG  |
|                   |               | 325                                   | 1.85                               | D3                       | OPTION          |                   |                   | APTGL325A120D3G   |
|                   |               | 475                                   | 1.85                               | D3                       | OPTION          | APTGL475DA120D3G  | APTGL475SK120D3G  | APTGL475A120D3G   |
|                   | TRENCH 4 FAST | 700                                   | 1.85                               | D3                       | OPTION          | APTGL700DA120D3G  | APTGL700SK120D3G  |                   |
|                   |               | 100                                   | 2.05                               | SP3F                     | YES             |                   |                   | APTGLQ100A120T3AG |
|                   |               | 100                                   | 2.05                               | SP1                      | YES             | APTGLQ100DA120T1G |                   |                   |
|                   |               | 100                                   | 2.05                               | SP4                      | YES             |                   |                   | APTGLQ100A120TG   |
|                   |               | 150                                   | 2.05                               | SP4                      | YES             |                   |                   | APTGLQ150A120TG   |
| 200               | 2.05          | SP3F                                  | YES                                |                          |                 | APTGLQ200A120T3AG |                   |                   |
| 300               | 2.05          | SP6C                                  |                                    |                          | APTGLQ300SK120G | APTGLQ300A120G    |                   |                   |
| 400               | 2.05          | SP6                                   | YES                                |                          |                 | APTGLQ400A120T6G  |                   |                   |
| 1700              | TRENCH 3      | 30                                    | 2                                  | SP1                      | YES             |                   |                   | APTGT30A170T1G    |
|                   |               | 50                                    | 2                                  | SP1                      | YES             |                   | APTGT50SK170T1G   | APTGT50A170T1G    |
|                   |               | 50                                    | 2                                  | SP4                      | YES             |                   | APTGT50SK170TG    | APTGT50A170TG     |
|                   |               | 100                                   | 2                                  | SP4                      | YES             |                   | APTGT100SK170TG   | APTGT100A170TG    |
|                   |               | 150                                   | 2                                  | SP6                      | OPTION          |                   | APTGT150SK170G    |                   |
|                   |               | 200                                   | 2                                  | D3                       | OPTION          |                   |                   | APTGT200A170D3G   |
|                   |               | 225                                   | 2                                  | SP6                      | OPTION          |                   | APTGT225SK170G    | APTGT225A170G     |
|                   |               | 300                                   | 2                                  | SP6                      | OPTION          | APTGT300DA170G    | APTGT300SK170G    | APTGT300A170G     |
|                   |               | 300                                   | 2                                  | D3                       | OPTION          | APTGT300DA170D3G  |                   | APTGT300A170D3G   |

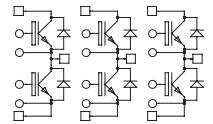
## Three-Phase Bridge

| $V_{(BR)CES}$ (V) | IGBT Type | $I_c$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$<br>(V) at Rated $I_c$ | Package<br>(see page 20) | NTC | Part Number     |
|-------------------|-----------|---------------------------------------|------------------------------------|--------------------------|-----|-----------------|
| 600               | TRENCH 3  | 30                                    | 1.5                                | SP3F                     | Yes | APTGT30X60T3G   |
|                   |           | 50                                    | 1.5                                | SP3F                     | Yes | APTGT50X60T3G   |
|                   |           | 75                                    | 1.5                                | SP3F                     | Yes | APTGT75X60T3G   |
| 1200              | TRENCH 3  | 25                                    | 1.7                                | SP3F                     | Yes | APTGT25X120T3G  |
|                   |           | 35                                    | 1.7                                | SP3F                     | Yes | APTGT35X120T3G  |
|                   | TRENCH 4  | 40                                    | 1.85                               | SP3F                     | Yes | MSCGL40X120T3AG |
|                   |           | 40                                    | 1.85                               | SP3F                     | Yes | APTGL40X120T3G  |



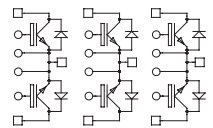
## Three-Phase Leg

| $V_{(BR)CES}$ (V) | IGBT Type | $I_c$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$<br>(V) at Rated $I_c$ | Package<br>(see page 20) | NTC    | Part Number      |
|-------------------|-----------|---------------------------------------|------------------------------------|--------------------------|--------|------------------|
| 600               | TRENCH 3  | 50                                    | 1.5                                | SP6-P                    | Option | APTGT50TA60PG    |
|                   |           | 150                                   | 1.5                                | SP6-P                    | Option | APTGT150TA60PG   |
| 650               | TRENCH 5  | 30                                    | 1.65                               | SP3F                     | Yes    | APTGTQ50TA65T3G  |
|                   |           | 90                                    | 1.65                               | SP6-P                    | Yes    | APTGTQ150TA65TPG |
| 1200              | TRENCH 3  | 75                                    | 1.7                                | SP6-P                    | Option | APTGT75TA120PG   |
|                   |           | 100                                   | 1.7                                | SP6-P                    | Yes    | APTGT100TA120TPG |
|                   | TRENCH 4  | 120                                   | 1.85                               | SP6-P                    | Yes    | APTGL120TA120TPG |



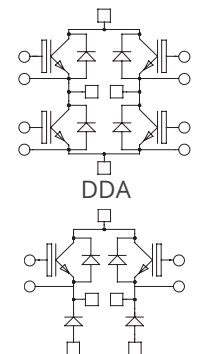
## Triple Dual Common Source

| $V_{(BR)CES}$ (V) | IGBT Type | $I_c$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$<br>(V) at Rated $I_c$ | Package<br>(see page 20) | NTC    | Part Number       |
|-------------------|-----------|---------------------------------------|------------------------------------|--------------------------|--------|-------------------|
| 600               | TRENCH 3  | 50                                    | 1.5                                | SP6-P                    | Option | APTGT50TDU60PG    |
|                   |           | 75                                    | 1.5                                | SP6-P                    | Option | APTGT75TDU60PG    |
|                   |           | 100                                   | 1.5                                | SP6-P                    | Option | APTGT100TDU60PG   |
|                   |           | 150                                   | 1.5                                | SP6-P                    | Option | APTGT150TDU60PG   |
| 1200              | TRENCH 3  | 75                                    | 1.7                                | SP6-P                    | Option | APTGT75TDU120PG   |
|                   | TRENCH 4  | 120                                   | 1.85                               | SP6-P                    | Yes    | APTGL120TDU120TPG |
| 1700              | TRENCH 3  | 50                                    | 2                                  | SP6-P                    | Option | APTGT50TDU170PG   |

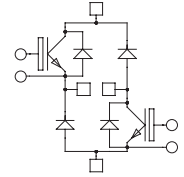
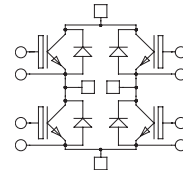


## Dual Chopper

| $V_{(BR)CES}$ (V) | IGBT Type     | $I_c$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(ON)}$<br>(V) at Rated $I_c$ | Package | NTC | ...DDA...         | ...DSK...        |
|-------------------|---------------|---------------------------------------|------------------------------------|---------|-----|-------------------|------------------|
| 600               | TRENCH 3      | 50                                    | 1.5                                | SP3F    | Yes | APTGT50DDA60T3G   |                  |
|                   |               | 75                                    | 1.5                                | SP3F    | Yes | APTGT75DDA60T3G   |                  |
| 650               | TRENCH 5      | 60                                    | 1.65                               | SP3F    | Yes | APTGTQ100DDA65T3G |                  |
|                   | TRENCH 4 FAST | 50                                    | 1.85                               | SP3F    | Yes | APTGLQ50DDA65T3G  |                  |
|                   | TRENCH 4 FAST | 50                                    | 1.85                               | SP3F    | Yes | APTGLQ50VDA65T3G  |                  |
| 1200              | TRENCH 3      | 50                                    | 1.7                                | SP3F    | Yes | APTGT50DDA120T3G  |                  |
|                   | TRENCH 4      | 60                                    | 1.85                               | SP3F    | Yes | APTGL60DDA120T3G  |                  |
|                   |               | 90                                    | 1.85                               | SP3F    | Yes | APTGL90DDA120T3G  | APTGL90DSK120T3G |



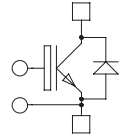
## Full and Asymmetrical



| $V_{(BR)CES}$ (V) | IGBT Type     | $I_c$ (A)<br>$T_c = 80^\circ\text{C}$ | $V_{CE(on)}$<br>(V) at Rated $I_c$ | Package<br>(see page 20) | NTC             | ...H...         | ...DH...        |
|-------------------|---------------|---------------------------------------|------------------------------------|--------------------------|-----------------|-----------------|-----------------|
| 600               | TRENCH 3      | 20                                    | 1.5                                | SP1                      | YES             | APTGT20H60T1G   |                 |
|                   |               | 30                                    | 1.5                                | SP1                      | YES             | APTGT30H60T1G   |                 |
|                   |               | 50                                    | 1.5                                | SP1                      | YES             | APTGT50H60T1G   | APTGT50DH60T1G  |
|                   |               | 50                                    | 1.5                                | SP3F                     | YES             | APTGT50H60T3G   |                 |
|                   |               | 75                                    | 1.5                                | SP1                      | YES             | APTGT75H60T1G   |                 |
|                   |               | 75                                    | 1.5                                | SP3F                     | YES             | APTGT75H60T3G   |                 |
|                   |               | 100                                   | 1.5                                | SP4                      | YES             | APTGT100H60TG   | APTGT100DH60TG  |
|                   |               | 100                                   | 1.5                                | SP3F                     | YES             | APTGT100H60T3G  |                 |
|                   |               | 150                                   | 1.5                                | SP4                      | YES             | APTGT150H60TG   | APTGT150DH60TG  |
| 650               | TRENCH 4 FAST | 30                                    | 1.95                               | SP3F                     | YES             | APTGLQ30H65T3G  |                 |
|                   |               | 50                                    | 1.85                               | SP1                      | YES             | APTGLQ50H65T1G  |                 |
|                   |               | 50                                    | 1.85                               | SP3F                     | YES             | APTGLQ50H65T3G  |                 |
|                   |               | 75                                    | 1.85                               | SP1                      | YES             | APTGLQ75H65T1G  |                 |
|                   |               | 100                                   | 1.85                               | SP3F                     | YES             | APTGLQ100H65T3G |                 |
|                   |               | 200                                   | 1.85                               | SP6C                     |                 | APTGLQ200H65G   |                 |
| 650               | TRENCH 5      | 300                                   | 1.85                               | SP6                      | OPTION          | APTGLQ300H65G   | APTGT300DH60G   |
| 1200              | TRENCH 3      | 60                                    | 1.65                               | SP3F                     | YES             | APTGTQ100H65T3G |                 |
|                   |               | 35                                    | 1.7                                | SP3F                     | YES             | APTGT35H120T3G  |                 |
|                   |               | 50                                    | 1.7                                | SP3F                     | YES             | APTGT50H120T3G  |                 |
|                   |               | 50                                    | 1.7                                | SP4                      | YES             |                 | APTGT50DH120TG  |
|                   |               | 75                                    | 1.7                                | SP3F                     | YES             |                 | APTGT75DH120T3G |
|                   |               | 75                                    | 1.7                                | SP4                      | YES             | APTGT75H120TG   |                 |
|                   |               | 100                                   | 1.7                                | SP4                      | YES             |                 | APTGT100DH120TG |
|                   |               | 100                                   | 1.7                                | SP6                      |                 | APTGT100H120G   |                 |
|                   | 150           | 1.7                                   | SP6                                |                          | APTGT150H120G   | APTGT150DH120G  |                 |
|                   | 200           | 1.7                                   | SP6                                |                          | APTGT200H120G   | APTGT200DH120G  |                 |
|                   | TRENCH 4      | 40                                    | 1.85                               | SP1                      | YES             | APTGL40H120T1G  |                 |
|                   |               | 60                                    | 1.85                               | SP3F                     | YES             | APTGL60H120T3G  |                 |
|                   |               | 90                                    | 1.85                               | SP3F                     | YES             | APTGL90H120T3G  |                 |
|                   | TRENCH 4 FAST | 25                                    | 2.05                               | SP1                      | YES             | APTGLQ25H120T1G |                 |
|                   |               | 40                                    | 2.05                               | SP1                      | YES             | APTGLQ40H120T1G |                 |
| 75                |               | 2.05                                  | SP3F                               | YES                      | APTGLQ75H120T3G |                 |                 |
| 75                |               | 2.05                                  | SP4                                | YES                      | APTGLQ75H120TG  |                 |                 |
| 150               |               | 2.05                                  | SP6C                               |                          | APTGLQ150H120G  |                 |                 |
| 200               | 2.05          | SP6                                   | OPTION                             | APTGLQ200H120G           |                 |                 |                 |
| 1700              | TRENCH 3      | 30                                    | 2                                  | SP3F                     | YES             | APTGT30H170T3G  |                 |
|                   |               | 50                                    | 2                                  | SP4                      | YES             | APTGT50H170TG   | APTGT50DH170TG  |
|                   |               | 100                                   | 2                                  | SP6                      |                 | APTGT100H170G   |                 |
|                   |               | 150                                   | 2                                  | SP6                      |                 |                 | APTGT150DH170G  |

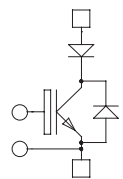
## Single Switch

| V <sub>CES</sub> (V) | IGBT Type | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE (ON)</sub> (V) at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Part Number     |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 600                  | TRENCH 3  | 750   | 1.5  | D4                       | No  | APTGT750U60D4G  |
| 1200                 | TRENCH 3  | 400   | 1.7  | D4                       | No  | APTGT400U120D4G |
|                      |           | 600   | 1.7  | D4                       | No  | APTGT600U120D4G |
|                      | TRENCH 4  | 475   | 1.85   | D4                       | No  | APTGL475U120D4G |
|                      |           | 700   | 1.85   | D4                       | No  | APTGL700U120D4G |
| 1700                 | TRENCH 3  | 400   | 2  | D4                       | No  | APTGT400U170D4G |
|                      |           | 600   | 2  | D4                       | No  | APTGT600U170D4G |



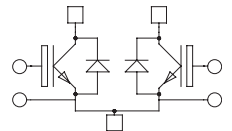
## Single Switch + Series Diode

| V <sub>CES</sub> (V) | IGBT Type | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE (ON)</sub> (V) at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Part Number     |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 1200                 | TRENCH 4  | 475   | 1.85   | SP6                      | No  | APTGL475U120DAG |



## Dual Common Source

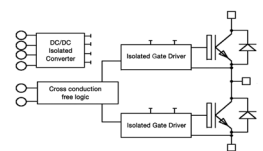
| V <sub>CES</sub> (V) | IGBT Type | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE (ON)</sub> (V) at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Part Number     |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 600                  | TRENCH 3  | 100   | 1.5  | SP4                      | Yes | APTGT100DU60TG  |
|                      |           | 200   | 1.5  | SP4                      | Yes | APTGT200DU60TG  |
|                      |           | 300   | 1.4  | SP6                      | No  | APTGT300DU60G   |
|                      |           | 600   | 1.4  | SP6                      | No  | APTGT600DU60G   |
| 1200                 | TRENCH 3  | 50  | 1.7  | SP4                      | Yes | APTGT50DU120TG  |
|                      |           | 75  | 1.7  | SP4                      | Yes | APTGT75DU120TG  |
|                      |           | 100   | 1.7  | SP4                      | Yes | APTGT100DU120TG |
|                      |           | 150   | 1.7  | SP6                      | No  | APTGT150DU120G  |
|                      |           | 150   | 1.7  | SP4                      | Yes | APTGT150DU120TG |
|                      |           | 200   | 1.7  | SP6                      | No  | APTGT200DU120G  |
|                      |           | 300   | 1.7  | SP6                      | No  | APTGT300DU120G  |
|                      |           | 400   | 1.7  | SP6                      | No  | APTGT400DU120G  |
| 1700                 | TRENCH 3  | 100   | 2  | SP4                      | Yes | APTGT100DU170TG |
|                      |           | 225   | 2  | SP6                      | No  | APTGT225DU170G  |
|                      |           | 300   | 2  | SP6                      | No  | APTGT300DU170G  |



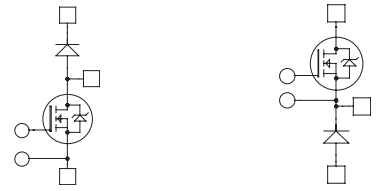
## Intelligent Power Modules

### Phase Leg

| V <sub>CES</sub> (V) | IGBT Type | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE (ON)</sub> (V) at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Part Number     |
|----------------------|-----------|---|--|--------------------------|-----|-----------------|
| 600                  | TRENCH 3  | 400   | 1.5  | LP8                      | No  | APTLGT400A608G  |
| 1200                 | TRENCH 3  | 300   | 1.7  | LP8                      | No  | APTLGT300A1208G |
|                      | TRENCH 4  | 325   | 1.8  | LP8                      | No  | APTLGL325A1208G |

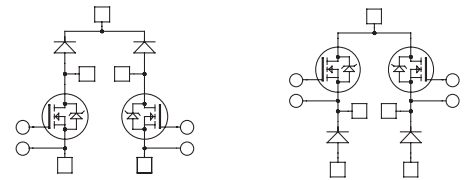


# MOSFET Power Module



## Chopper

| V <sub>DSS</sub> (V) | MOSFET Type           | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package<br>(see page 20) | NTC         | DA...or...U2   | SK...or...U3   |
|----------------------|-----------------------|--------------------------|---|--------------------------|-------------|----------------|----------------|
| 100                  | MOS 5                 | 11                       | 100   | SOT-227                  | No          | APT10M11JVU2   | APT10M11JVU3   |
|                      |                       | 4.5                      | 207   | SP4                      | Yes         | APTM10DAM05TG  | APTM10SKM05TG  |
|                      |                       | 2.25                     | 370   | SP6                      | No          | APTM10DAM02G   | APTM10SKM02G   |
| 200                  | MOS 5                 | 22                       | 71  | SOT-227                  | No          | APT20M22JVU2   | APT20M22JVU3   |
|                      | MOS 7™                | 8                        | 147   | SP4                      | Yes         | APTM20DAM08TG  | APTM20SKM08TG  |
|                      |                       | 5                        | 250   | SP6                      | Option      | APTM20DAM05G   |                |
|                      |                       | 4                        | 300   | SP6                      | Option      | APTM20DAM04G   | APTM20SKM04G   |
| 500                  | MOS 5                 | 100                      | 30  | SOT-227                  | No          | APT5010JVU2    | APT5010JVU3    |
|                      | MOS 7                 | 100                      | 30  | SOT-227                  | No          | APT5010JLLU2   | APT5010JLLU3   |
|                      |                       | 75                       | 32  | SOT-227                  | No          | APT50M75JLLU2  | APT50M75JLLU3  |
|                      |                       | 19                       | 125   | SP6                      | Option      | APTM50DAM19G   | APTM50SKM19G   |
|                      |                       | 17                       | 140   | SP6                      | Option      | APTM50DAM17G   | APTM50SKM17G   |
| MOS 8™               | 65                    | 43                       | SOT-227                                     | No                       | APT58M50JU2 | APT58M50JU3    |                |
| 600                  | Super Junction MOSFET | 70                       | 40  | SOT-227                  | No          | APT40N60JCU2   | APT40N60JCU3   |
|                      |                       | 24                       | 70  | SP1                      | Yes         |                | APTC60SKM24T1G |
| 1000                 | MOS 7                 | 180                      | 33  | SP4                      | Yes         | APTM100DA18TG  |                |
|                      |                       | 90                       | 59  | SP6                      | Option      | APTM100DAM90G  |                |
|                      | MOS 8                 | 330                      | 17  | SP1                      | Yes         |                | APTM100SK33T1G |
| 1200                 | MOS 8                 | 300                      | 23  | SP1                      | Yes         | APTM120DA30T1G |                |

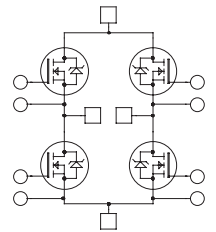


## Dual Chopper

| V <sub>DSS</sub> (V) | MOSFET Type           | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package<br>(see page 20) | NTC | ...DDA...       | ...DSK...       |
|----------------------|-----------------------|--------------------------|---|--------------------------|-----|-----------------|-----------------|
| 100                  | MOS 5                 | 19                       | 50  | SP3F                     | Yes |                 | APTM10DSKM19T3G |
|                      |                       | 9                        | 100   | SP3F                     | Yes |                 | APTM10DSKM09T3G |
| 500                  | MOS 7™                | 100                      | 24  | SP3F                     | Yes | APTM50DDA10T3G  |                 |
|                      |                       | 65                       | 37  | SP3F                     | Yes | APTM50DDAM65T3G |                 |
| 600                  | Super Junction MOSFET | 45                       | 38  | SP1                      | Yes | APTC60DDAM45T1G |                 |
|                      |                       | 70                       | 29  | SP1                      | Yes | APTC60DDAM70T1G |                 |
|                      |                       | 35                       | 54  | SP3F                     | Yes | APTC60DDAM35T3G |                 |
|                      |                       | 24                       | 70  | SP3F                     | Yes | APTC60DDAM24T3G | APTC60DSKM24T3G |
| 800                  |                       | 150                      | 21  | SP3F                     | Yes | APTC80DDA15T3G  |                 |
| 1000                 | MOS 7                 | 350                      | 17  | SP3F                     | Yes |                 | APTM100DSK35T3G |

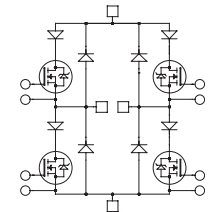
## Full Bridge

| V <sub>DSS</sub> (V) | MOSFET Type           | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package | NTC          | Part Number     |
|----------------------|-----------------------|--------------------------|---|---------|--------------|-----------------|
| 100                  | FREDFET 5             | 4.5                      | 207   | SP6     | No           | APTM10HM05FG    |
|                      |                       | 19                       | 50  | SP3F    | Yes          | APTM10HM19FT3G  |
|                      |                       | 9                        | 100   | SP3F    | Yes          | APTM10HM09FT3G  |
| 200                  | FREDFET 7             | 20                       | 62  | SP4     | Yes          | APTM20HM20FTG   |
|                      |                       | 16                       | 74  | SP4     | Yes          | APTM20HM16FTG   |
|                      |                       | 10                       | 125   | SP6     | No           | APTM20HM10FG    |
|                      |                       | 8                        | 147   | SP6     | No           | APTM20HM08FG    |
| 500                  | FREDFET 7             | 140                      | 18  | SP3F    | Yes          | APTM50H14FT3G   |
|                      |                       | 100                      | 24  | SP3F    | Yes          | APTM50H10FT3G   |
|                      |                       | 75                       | 32  | SP4     | Yes          | APTM50HM75FTG   |
|                      |                       | 75                       | 32  | SP3F    | Yes          | APTM50HM75FT3G  |
|                      |                       | 65                       | 37  | SP4     | Yes          | APTM50HM65FTG   |
|                      |                       | 65                       | 37  | SP3F    | Yes          | APTM50HM65FT3G  |
|                      |                       | 38                       | 64  | SP6     | No           | APTM50HM38FG    |
|                      | 35                    | 70                       | SP6   | No      | APTM50HM35FG |                 |
| 600                  | Super Junction MOSFET | 150                      | 19  | SP1     | Yes          | APTM50H15FT1G   |
|                      |                       | 70                       | 29  | SP1     | Yes          | APTC60HM70T1G   |
|                      |                       | 45                       | 38  | SP1     | Yes          | APTC60HM45T1G   |
|                      |                       | 70                       | 29  | SP3F    | Yes          | APTC60HM70T3G   |
|                      |                       | 35                       | 54  | SP3F    | Yes          | APTC60HM35T3G   |
|                      |                       | 24                       | 70  | SP3F    | Yes          | APTC60HM24T3G   |
|                      | FREDFET 8             | 230                      | 15  | SP1     | Yes          | APTM60H23FT1G   |
| 800                  | Super Junction MOSFET | 150                      | 21  | SP1     | Yes          | APTC80H15T1G    |
|                      |                       | 290                      | 11  | SP3F    | Yes          | APTC80H29T3G    |
|                      |                       | 150                      | 21  | SP3F    | Yes          | APTC80H15T3G    |
| 1000                 | FREDFET 7             | 450                      | 14  | SP3F    | Yes          | APTM100H45FT3G  |
|                      |                       | 350                      | 17  | SP4     | Yes          | APTM100H35FTG   |
|                      |                       | 350                      | 17  | SP3F    | Yes          | APTM100H35FT3G  |
|                      | FREDFET 8             | 180                      | 33  | SP6     | No           | APTM100H18FG    |
|                      | FREDFET 8             | 460                      | 14  | SP3F    | Yes          | APTM100H46FT3G  |
| 1200                 | FREDFET 7             | 290                      | 25  | SP6     | No           | APTM120H29FG    |
|                      | FREDFET 8             | 1400                     | 6   | SP1     | Yes          | APTM120H140FT1G |



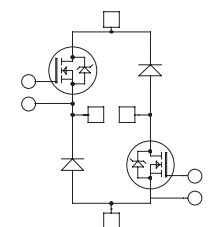
## Full Bridge + Series and Parallel

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package | NTC | Part Number   |
|----------------------|-------------|--------------------------|---|---------|-----|---------------|
| 200                  | MOS 7™      | 20                       | 62  | SP4     | Yes | APTM20HM20STG |
| 500                  | MOS 7       | 75                       | 32  | SP4     | Yes | APTM50HM75STG |
| 1000                 | MOS 7       | 450                      | 13  | SP4     | Yes | APTM100H45STG |



## Asymmetrical Bridge

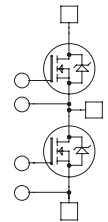
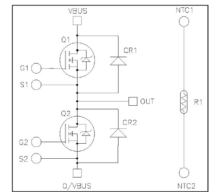
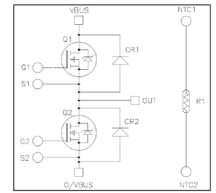
| V <sub>DSS</sub> (V) | MOSFET Type           | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package | NTC | Part Number    |
|----------------------|-----------------------|--------------------------|---|---------|-----|----------------|
| 100                  | MOS 5                 | 4.5                      | 207   | SP6     | No  | APTM10DHM05G   |
| 500                  | MOS 7™                | 38                       | 64  | SP6     | No  | APTM50DHM38G   |
| 600                  | Super Junction MOSFET | 24                       | 70  | SP3F    | Yes | APTC60DHM24T3G |





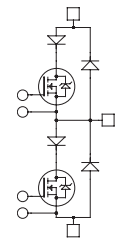
## Phase Leg

| V <sub>DSS</sub> (V) | MOSFET Type           | R <sub>Ds(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package<br>(see page 20) | NTC    | Part Number   |
|----------------------|-----------------------|--------------------------|---|--------------------------|--------|---------------|
| 100                  | FREDFET 5             | 4.5                      | 207   | SP4                      | Yes    | APTM10AM05FTG |
|                      |                       | 2.25                     | 370   | SP6                      | Option | APTM10AM02FG  |
| 200                  | FREDFET 7             | 10                       | 125   | SP4                      | Yes    | APTM20AM10FTG |
|                      |                       | 8                        | 147   | SP4                      | Yes    | APTM20AM08FTG |
|                      |                       | 5                        | 250   | SP6                      | Option | APTM20AM05FG  |
|                      |                       | 5                        | 280   | LP8                      |        | MSCM20AM058G  |
|                      |                       | 4                        | 300   | SP6                      | Option | APTM20AM04FG  |
| 500                  | FREDFET 7             | 38                       | 64  | SP4                      | Yes    | APTM50AM38FTG |
|                      |                       | 35                       | 70  | SP4                      | Yes    | APTM50AM35FTG |
|                      |                       | 19                       | 125   | SP6                      | Option | APTM50AM19FG  |
|                      |                       | 17                       | 140   | SP6                      | Option | APTM50AM17FG  |
| 600                  | Super Junction MOSFET | 45                       | 38  | SP1                      | Yes    | APTC60AM45T1G |
|                      |                       | 35                       | 54  | SP1                      | Yes    | APTC60AM35T1G |
|                      |                       | 24                       | 70  | SP1                      | Yes    | APTC60AM24T1G |
|                      | FREDFET 8             | 110                      | 30  | SP1                      | Yes    | APTM60A11FT1G |
| 1000                 | FREDFET 7             | 180                      | 33  | SP4                      | Yes    | APTM100A18FTG |
|                      |                       | 90                       | 59  | SP6                      | Option | APTM100AM90FG |
| 1200                 | FREDFET 7             | 290                      | 25  | SP4                      | Yes    | APTM120A29FTG |
|                      |                       | 150                      | 45  | SP6                      | Option | APTM120A15FG  |



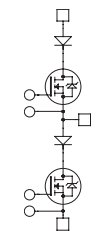
## Phase Leg + Series and Parallel

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>Ds(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package<br>(see page 20) | NTC | Part Number   |
|----------------------|-------------|--------------------------|---|--------------------------|-----|---------------|
| 200                  | MOS 7™      | 10                       | 125   | SP4                      | Yes | APTM20AM10STG |
|                      |             | 6                        | 225   | SP6                      | No  | APTM20AM06SG  |
| 500                  | MOS 7       | 38                       | 64  | SP4                      | Yes | APTM50AM38STG |
|                      |             | 24                       | 110   | SP6                      | No  | APTM50AM24SG  |
| 1000                 | MOS 7       | 230                      | 26  | SP4                      | Yes | APTM100A23STG |
|                      |             | 130                      | 49  | SP6                      | No  | APTM100A13SG  |
| 1200                 | MOS 7       | 200                      | 37  | SP6                      | No  | APTM120A20SG  |



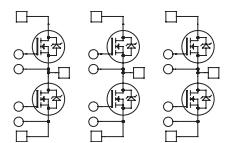
## Phase Leg + Series Diodes

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>Ds(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package<br>(see page 20) | NTC | Part Number  |
|----------------------|-------------|--------------------------|---|--------------------------|-----|--------------|
| 1000                 | MOS 7       | 130                      | 49  | SP6                      | No  | APTM100A13DG |
| 1200                 | MOS 7       | 200                      | 37  | SP6                      | No  | APTM120A20DG |



## Triple Phase Leg

| V <sub>DSS</sub> (V) | MOSFET Type           | R <sub>Ds(on)</sub> (mΩ) | I <sub>D</sub> (A)<br>T <sub>C</sub> = 80°C | Package<br>(see page 20) | NTC    | Part Number    |
|----------------------|-----------------------|--------------------------|---|--------------------------|--------|----------------|
| 75                   | MOSFET                | 4.2                      | 90  | SP6-P                    | Option | APTM08TAM04PG  |
| 100                  | FREDFET 5             | 19                       | 50  | SP6-P                    | Option | APTM10TAM19FPG |
|                      |                       | 9                        | 100   | SP6-P                    | Option | APTM10TAM09FPG |
| 200                  | FREDFET 7             | 16                       | 74  | SP6-P                    | Option | APTM20TAM16FPG |
| 500                  | FREDFET 7             | 65                       | 37  | SP6-P                    | Option | APTM50TAM65FPG |
| 600                  | Super Junction MOSFET | 35                       | 54  | SP6-P                    | Option | APTC60TAM35PG  |
|                      |                       | 24                       | 70  | SP6-P                    | Yes    | APTC60TAM24TPG |
| 1000                 | FREDFET 7             | 350                      | 17  | SP6-P                    | Option | APTM100TA35FPG |

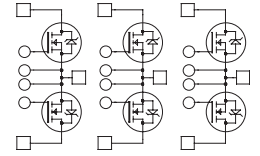


## Three-Phase Bridge

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A) T <sub>C</sub> = 80°C | Package | NTC | Part Number    |
|----------------------|-------------|--------------------------|--|---------|-----|----------------|
| 200                  | FREDFET 5   | 16                       | 77                                       | SP4     |     | MSCM20XM16F4G  |
|                      | FREDFET 5   | 10                       | 84                                       | SP3X    |     | MSCM20XM10T3XG |

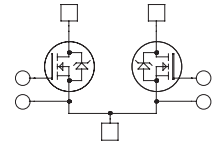
## Triple Dual Common Source

| V <sub>DSS</sub> (V) | MOSFET Type    | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A) T <sub>C</sub> = 80°C | Package (see page 20) | NTC    | Part Number    |
|----------------------|----------------|--------------------------|--|-----------------------|--------|----------------|
| 600                  | Super Junction | 35                       | 54                                       | SP6-P                 | Option | APTC60TDUM35PG |
| 800                  | MOSFET         | 150                      | 21                                       | SP6-P                 | Option | APTC80TDU15PG  |



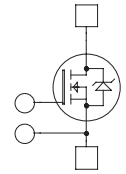
## Dual Common Source

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A) T <sub>C</sub> = 80°C | Package (see page 20) | NTC | Part Number   |
|----------------------|-------------|--------------------------|--|-----------------------|-----|---------------|
| 100                  | MOS 5       | 2.25                     | 370                                      | SP6                   | No  | APTM10DUM02G  |
| 200                  | MOS 7™      | 8                        | 147                                      | SP4                   | Yes | APTM20DUM08TG |
|                      |             | 5                        | 250                                      | SP6                   | No  | APTM20DUM05G  |
|                      |             | 4                        | 300                                      | SP6                   | No  | APTM20DUM04G  |
| 1200                 | MOS 7       | 150                      | 45                                       | SP6                   | No  | APTM120DU15G  |



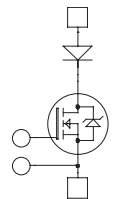
## Single Switch

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A) T <sub>C</sub> = 80°C | Package (see page 20) | NTC    | Part Number    |
|----------------------|-------------|--------------------------|--|-----------------------|--------|----------------|
| 100                  | FREDFET 5   | 2.25                     | 430                                      | SP6                   | Option | APTM10UM02FAG  |
|                      |             | 1.5                      | 640                                      | SP6                   | Option | APTM10UM01FAG  |
| 200                  | FREDFET 7   | 3                        | 434                                      | SP6                   | Option | APTM20UM03FAG  |
| 500                  | FREDFET 7   | 9                        | 371                                      | SP6                   | Option | APTM50UM09FAG  |
| 1000                 | FREDFET 7   | 60                       | 97                                       | SP6                   | Option | APTM100UM60FAG |
|                      |             | 45                       | 160                                      | SP6                   | Option | APTM100UM45FAG |
| 1200                 | FREDFET 7   | 70                       | 126                                      | SP6                   | Option | APTM120UM70FAG |



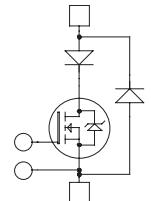
## Single Switch + Series Diode

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A) T <sub>C</sub> = 80°C | Package (see page 20) | NTC | Part Number    |
|----------------------|-------------|--------------------------|--|-----------------------|-----|----------------|
| 1000                 | MOS 7™      | 65                       | 110                                      | SP6                   | No  | APTM100UM65DAG |
|                      |             | 45                       | 160                                      | SP6                   | No  | APTM100UM45DAG |
| 1200                 | MOS 7       | 70                       | 126                                      | SP6                   | No  | APTM120UM70DAG |



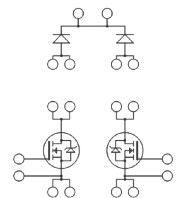
## Single Switch + Series and Parallel

| V <sub>DSS</sub> (V) | MOSFET Type | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A) T <sub>C</sub> = 80°C | Package (see page 20) | NTC    | Part Number    |
|----------------------|-------------|--------------------------|--|-----------------------|--------|----------------|
| 200                  | MOS 7™      | 4                        | 310                                      | SP6                   | Option | APTM20UM04SAG  |
| 500                  | MOS 7       | 13                       | 250                                      | SP6                   | Option | APTM50UM13SAG  |
| 1000                 | MOS 7       | 65                       | 110                                      | SP6                   | Option | APTM100UM65SAG |
| 1200                 | MOS 7       | 100                      | 86                                       | SP6                   | Option | APTM120U10SAG  |



## Interleaved PFC

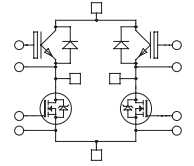
| V <sub>DSS</sub> (V) | MOSFET Type    | R <sub>DS(on)</sub> (mΩ) | I <sub>D</sub> (A) T <sub>C</sub> = 80°C | Package (see page 20) | NTC | Part Number     |
|----------------------|----------------|--------------------------|--|-----------------------|-----|-----------------|
| 600                  | Super Junction | 45                       | 38                                       | SP1                   | Yes | APTC60VDAM45T1G |
|                      | MOSFET         | 24                       | 70                                       | SP3F                  | Yes | APTC60VDAM24T3G |



# Renewable Energy Power Module

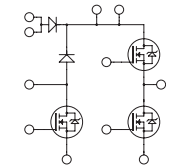
## Full Bridge

| V <sub>CE(S)</sub> (V) | Technology                                    | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE(ON)</sub> (V)<br>at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Part Number    |
|------------------------|---|---|--|--------------------------|-----|----------------|
| 600                    | Mix Trench IGBT<br>& Super Junction<br>MOSFET | 50  | 83 mΩ/1.5  | SP1                      | Yes | APTCV40H60CT1G |
|                        |   | 50  | 45 mΩ/1.5  | SP3F                     | Yes | APTCV50H60T3G  |



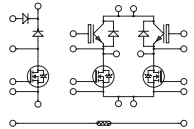
## PFC + Bypass Diode + Phase Leg

| V <sub>CE(S)</sub> (V) | Technology               | I <sub>D</sub> (A)<br>T <sub>c</sub> = 80°C | R <sub>DS(on)</sub> (V)<br>at Rated I <sub>D</sub> | Package<br>(see page 20) | NTC | Special              | Part Number    |
|------------------------|--------------------------|---|--|--------------------------|-----|----------------------|----------------|
| 600                    | Super Junction<br>MOSFET | 38  | 45 mΩ  | SP1                      | N/A | 10A PFC SiC<br>Diode | APTC60AM45BC1G |
|                        |                          | 38  | 45 mΩ  | SP1                      | N/A |                      | APTC60AM45B1G  |



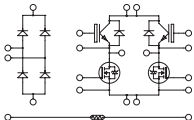
## PFC + Bypass Diode + Full Bridge

| V <sub>CE(S)</sub> (V) | Technology                                    | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE(ON)</sub> (V)<br>at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Special               | Part Number        |
|------------------------|---|---|--|--------------------------|-----|-----------------------|--------------------|
| 600                    | Mix Trench IGBT<br>& Super Junction<br>MOSFET | 38  | 1.5/45 mΩ  | SP3F                     | Yes | 20 A PFC SiC<br>Diode | APTCV60HM45BC20T3G |
|                        |   | 38  | 1.5/45 mΩ  | SP3F                     | Yes |                       | APTCV60HM45BT3G    |
|                        | Super Junction<br>MOSFET                      | 29  | 70 mΩ  | SP3F                     | Yes |                       | APTC60HM70BT3G     |



## Secondary Fast Rectifier + Full Bridge

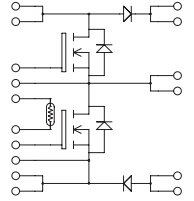
| V <sub>CE(S)</sub> (V) | Technology                                    | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE(ON)</sub> (V)<br>at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Special                       | Part Number      |
|------------------------|---|---|--|--------------------------|-----|-------------------------------|------------------|
| 600                    | Mix Trench IGBT<br>& Super Junction<br>MOSFET | 38  | 1.5/45 mΩ  | SP3F                     | Yes | 20A SiC<br>Antiparallel Diode | APTCV60HM45RCT3G |
|                        |   | 38  | 1.5/45 mΩ  | SP3F                     | Yes |                               | APTCV60HM45RT3G  |
|                        | Super Junction<br>MOSFET                      | 29  | 70 mΩ  | SP3F                     | Yes |                               | APTC60HM70RT3G   |
|                        | Trench 3                                      | 50  | 1.5  | SP3F                     | Yes |                               | APTGT50H60RT3G   |



R<sub>DS(on)</sub> value for the MOSFETs in mΩ and V<sub>ce(on)</sub> value for the IGBTs in Volts

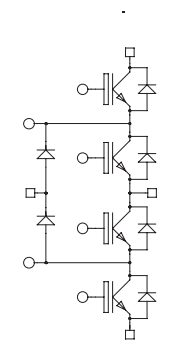
## Boost Buck

| V <sub>CE(S)</sub> (V) | Technology            | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE(ON)</sub> (V)<br>at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Part Number     |
|------------------------|-----------------------|---|--|--------------------------|-----|-----------------|
| 600                    | Super Junction MOSFET | 70  | 24 mΩ  | SP3F                     | Yes | APTC60BBM24T3G  |
|                        | Trench 3              | 100   | 1.5  | SP3F                     | Yes | APTGT100BB60T3G |

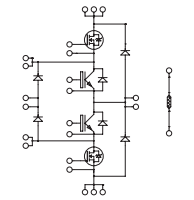


## Three-Level NPC Inverter

| V <sub>CE(S)</sub> (V) | Technology    | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE(ON)</sub> (V)<br>at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Part Number     |
|------------------------|---------------|---|--|--------------------------|-----|-----------------|
| 600                    | Trench 3      | 20  | 1.5  | SP1                      | No  | APTGT20TL601G   |
|                        |               | 30  | 1.5  | SP1                      | No  | APTGT30TL601G   |
|                        |               | 50  | 1.5  | SP3F                     | Yes | APTGT50TL60T3G  |
|                        |               | 50  | 1.5  | SP1                      | No  | APTGT50TL601G   |
|                        |               | 75  | 1.5  | SP3F                     | Yes | APTGT75TL60T3G  |
|                        |               | 100   | 1.5  | SP3F                     | Yes | APTGT100TL60T3G |
|                        |               | 150   | 1.5  | SP6                      | No  | APTGT150TL60G   |
|                        |               | 200   | 1.5  | SP6                      | No  | APTGT200TL60G   |
| 650                    | Trench 3      | 300   | 1.5  | SP6                      | No  | APTGT300TL65G   |
|                        |               | 400   | 1.5  | SP6                      | No  | APTGT400TL65G   |
|                        | Trench 4 Fast | 50  | 1.85   | SP3F                     | Yes | APTGLQ50TL65T3G |
| 1200                   | Trench 4      | 60  | 1.85   | SP3F                     | Yes | APTGL60TL120T3G |
|                        |               | 240   | 1.8  | SP6                      | No  | APTGL240TL120G  |
| 1700                   | Trench 3      | 100   | 2  | SP6                      | No  | APTGT100TL170G  |

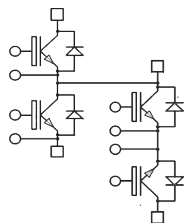


| V <sub>CE(S)</sub> (V) | Technology                                | R <sub>DS(ON)</sub><br>Super Junction<br>MOSFET (mΩ) | V <sub>CE(ON)</sub> IGBT (V)/<br>I <sub>c</sub> (A) | Package<br>(see page 20) | NTC | Part Number     |
|------------------------|---|--|---|--------------------------|-----|-----------------|
| 600                    | Mix Trench IGBT and Super Junction MOSFET | 24   | 1.5/75  | SP3F                     | Yes | APTCV60TLM24T3G |
|                        |   | 45   | 1.5/75  | SP3F                     | Yes | APTCV60TLM45T3G |
|                        |   | 70   | 1.5/50  | SP3F                     | Yes | APTCV60TLM70T3G |
|                        |   | 99   | 1.5/30  | SP3F                     | Yes | APTCV60TLM99T3G |



## T-Type 3-Level Inverter

| V <sub>CE(S)</sub> (V) | Technology    | I <sub>c</sub> (A)<br>T <sub>c</sub> = 80°C | V <sub>CE(ON)</sub> (V)<br>at Rated I <sub>c</sub> | Package<br>(see page 20) | NTC | Special       | Part Number       |
|------------------------|---------------|---|--|--------------------------|-----|---------------|-------------------|
| 600/1200               | Trench 4 Fast | 40  | 2.05   | SP3F                     | Yes | 10A/600 V SiC | APTGLQ40HR120CT3G |
|                        |               | 80  | 2.05   | SP3F                     | Yes | 30A/600 V SiC | APTGLQ80HR120CT3G |
|                        |               | 200   | 2.05   | SP6                      | No  |               | APTGLQ200HR120G   |

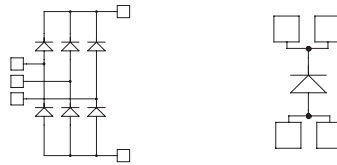


## Vienna Rectifier

| V <sub>CE(S)</sub> (V) | IGBT Type             | I <sub>c</sub> (A) TC = 80°C | V <sub>CE(ON)</sub> (V) at<br>Rated I <sub>c</sub> | Package<br>(see page 19) | NTC | Part Number       |
|------------------------|-----------------------|------------------------------|--|--------------------------|-----|-------------------|
| 600                    | Super Junction MOSFET | 19                           | 99 mΩ  | SP3F                     | YES | MSCC60VRM99CT3AG  |
|                        |                       | 40                           | 45 mΩ  | SP6-P                    | YES | MSCC60VRM45TAPG   |
|                        |                       | 81                           | 23 mΩ  | SP4                      |     | MSCC60AM23C4AG    |
| 650                    | TRENCH 5              | 80                           | 1.65   | SP1                      |     | MSCGTQ100HD65C1AG |

R<sub>DS(on)</sub> value for the MOSFETs in mΩ and V<sub>CE(on)</sub> value for the IGBTs in Volts

# Diode Power Modules

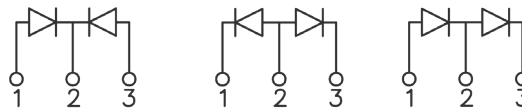


| $V_{RRM}$ (V) | Diode Type | $I_F$ (A) $T_c = 80^\circ\text{C}$ | $V_F$ (V) $T_c = 80^\circ\text{C}$ | Package (see page 20) | Part Number   |
|---------------|------------|------------------------------------|------------------------------------|-----------------------|---------------|
| 200           | FRED       | 500                                | 1.1                                | LP4                   | APTDF500U20G  |
| 400           |            | 500                                | 1.5                                |                       | APTDF500U40G  |
| 600           |            | 450                                | 1.8                                |                       | APTDF450U60G  |
| 1000          |            | 430                                | 2.3                                |                       | APTDF430U100G |
| 1200          |            | 400                                | 2.5                                |                       | APTDF400U120G |

## Single Diode

| $V_{RRM}$ (V) | Diode Type | $I_F$ (A) $T_c = 80^\circ\text{C}$ | $V_F$ (V) $T_J = 25^\circ\text{C}$ | Package (see page 20) | Part Number   |
|---------------|------------|------------------------------------|------------------------------------|-----------------------|---------------|
| 1600          | Rectifier  | 40                                 | 1.3                                | SP1                   | APTDR40X1601G |
|               |            | 90                                 | 1.3                                | SP1                   | APTDR90X1601G |

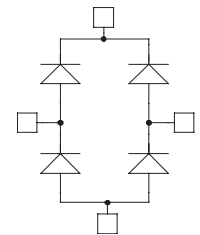
## Common Cathode– Common Anode–Doubler



| $V_{RRM}$ (V) | Diode Type | $I_F$ (A) per Diode | $V_F$ (V) $T_J = 25^\circ\text{C}$ | Package (see page 20) | Common Cathode | Common Anode   | Doubler        |
|---------------|------------|---------------------|------------------------------------|-----------------------|----------------|----------------|----------------|
| 200           | FRED       | 400                 | 1                                  | SP6                   | APTDF400KK20G  | APTDF400AA20G  | APTDF400AK20G  |
| 600           |            |                     | 1.6                                |                       | APTDF400KK60G  | APTDF400AA60G  | APTDF400AK60G  |
| 1000          |            |                     | 2.1                                |                       | APTDF400KK100G | APTDF400AA100G | APTDF400AK100G |
| 1200          |            |                     | 2.4                                |                       | APTDF400KK120G | APTDF400AA120G | APTDF400AK120G |
| 1700          |            |                     | 2.2                                |                       | APTDF400KK170G | APTDF400AA170G | APTDF400AK170G |

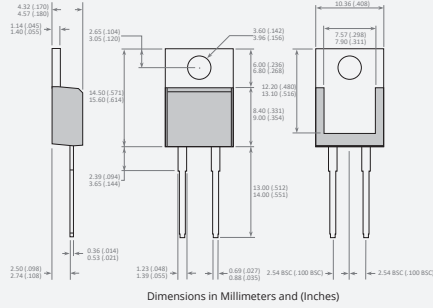
## Full Bridge

| $V_{RRM}$ (V) | Diode Type | $I_F$ (A) $T_c = 80^\circ\text{C}$ | $V_F$ (V) $T_c = 80^\circ\text{C}$ | Package (see page 20) | Part Number   |
|---------------|------------|------------------------------------|------------------------------------|-----------------------|---------------|
| 200           | FRED       | 30                                 | 1                                  | SOT-227               | APT30DF20HJ   |
|               |            | 60                                 | 1                                  | SOT-227               | APT60DF20HJ   |
|               |            | 100                                | 1                                  | SP4                   | APTDF100H20G  |
| 600           |            | 30                                 | 1.8                                | SP1                   | APTDF30H601G  |
|               |            | 30                                 | 1.8                                | SOT-227               | APT30DF60HJ   |
|               |            | 60                                 | 1.8                                | SOT-227               | APT60DF60HJ   |
|               |            | 60                                 | 1.8                                | SP1                   | APTDF60H601G  |
|               |            | 100                                | 1.6                                | SOT-227               | APT100DL60HJ  |
|               |            | 100                                | 1.6                                | SP1                   | APTDF100H601G |
| 1000          |            | 200                                | 1.6                                | SP6                   | APTDF200H60G  |
|               |            | 30                                 | 2.1                                | SOT-227               | APT30DF100HJ  |
|               |            | 100                                | 2.1                                | SP4                   | APTDF100H100G |
| 1200          |            | 200                                | 2.1                                | SP6                   | APTDF200H100G |
|               |            | 30                                 | 2.6                                | SP1                   | APTDF30H1201G |
|               |            | 60                                 | 2.6                                | SP1                   | APTDF60H1201G |
|               | 75         | 1.6                                | SOT-227                            | APT75DL120HJ          |               |
| 1700          | 200        | 2.4                                | SP6                                | APTDF200H120G         |               |
|               | 50         | 1.8                                | SOT-227                            | APT50DF170HJ          |               |
| 1600          | RECTIFIER  | 75                                 | 1.8                                | SOT-227               | APT75DF170HJ  |
|               |            | 40                                 | 1.3                                | SOT-227               | APT40DR160HJ  |
|               |            | 90                                 | 1.3                                | SOT-227               | APT90DR160HJ  |

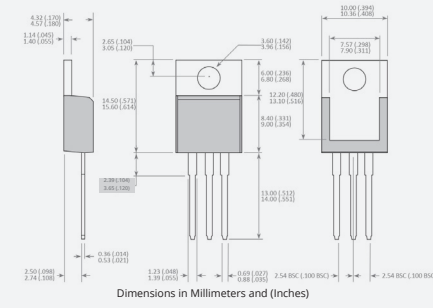


# Power Discrete and Module Outlines

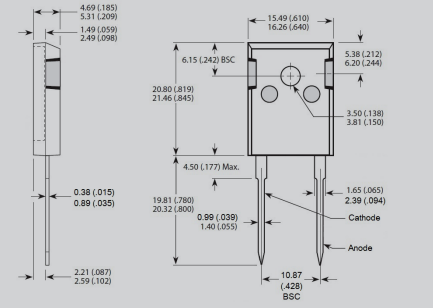
TO-220 2-Lead



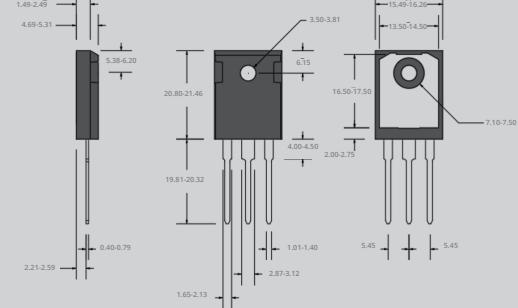
TO-220 3-Lead



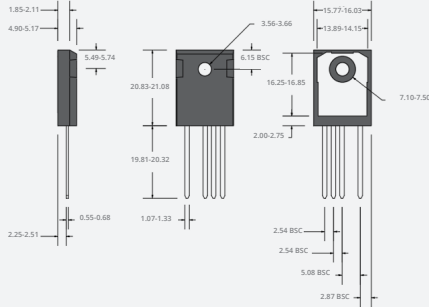
TO-247 2Lead



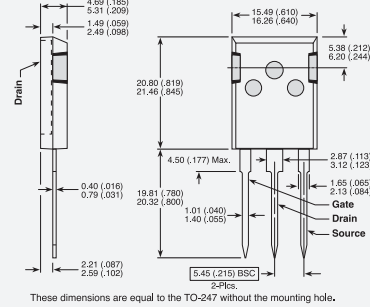
TO-247-3Lead



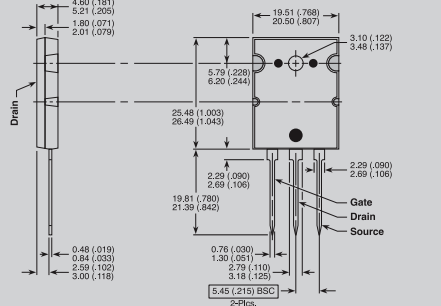
TO-247-4Lead



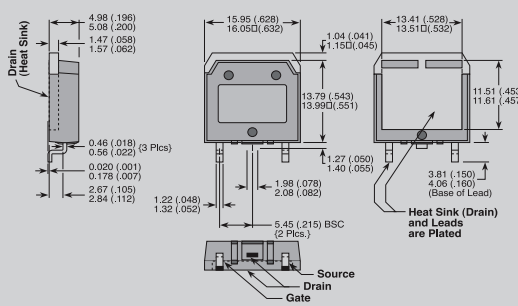
T-MAX®



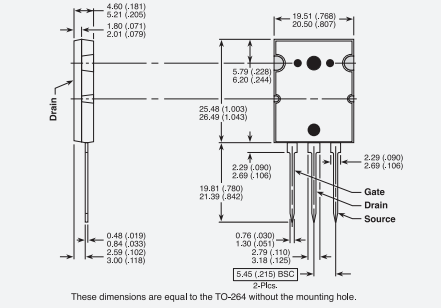
TO-264



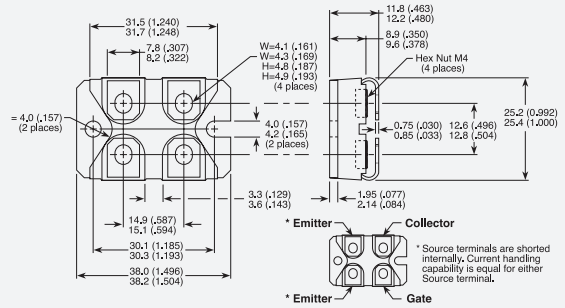
D3PAK or TO-268



264 MAX™

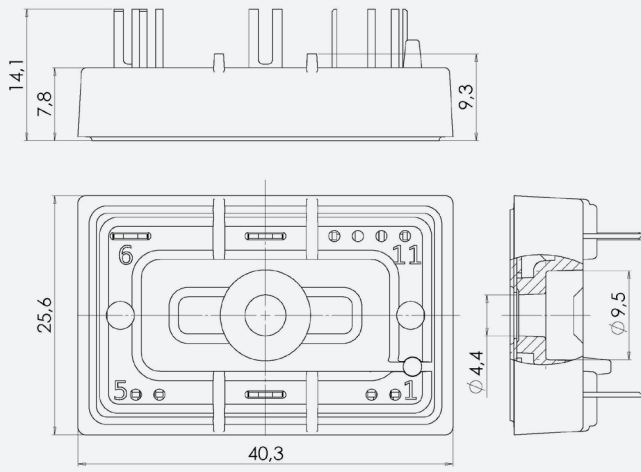


SOT-227

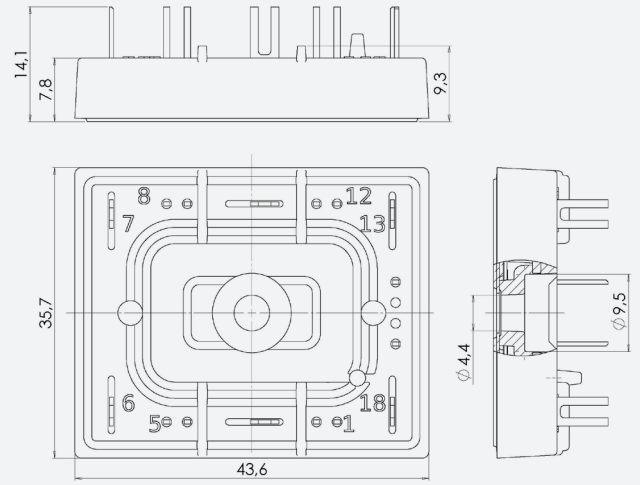


Pinout location depends on the module configuration. Please refer to the product datasheet for pin assignments. All dimensions in millimeters and (inches).

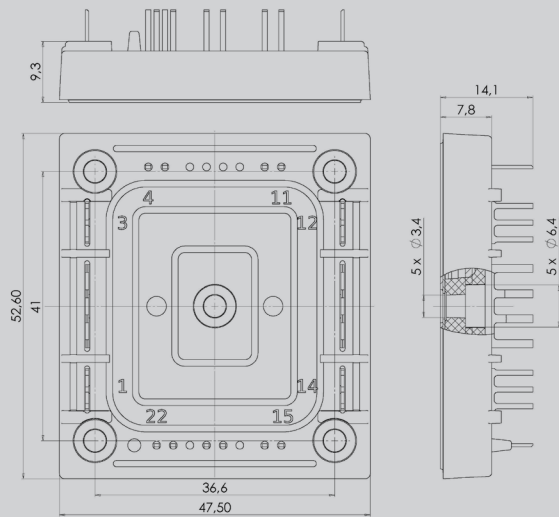
BL1



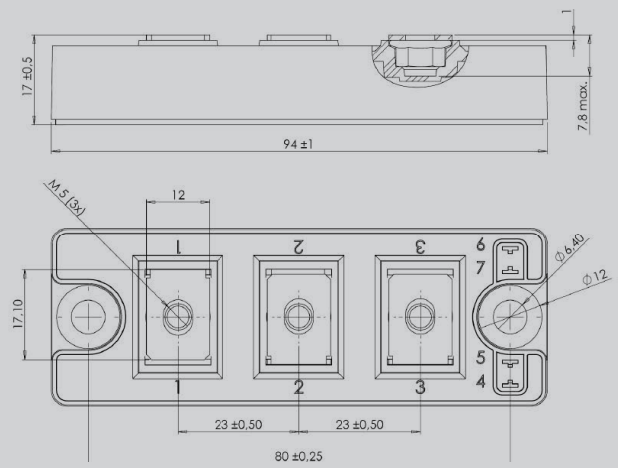
BL2



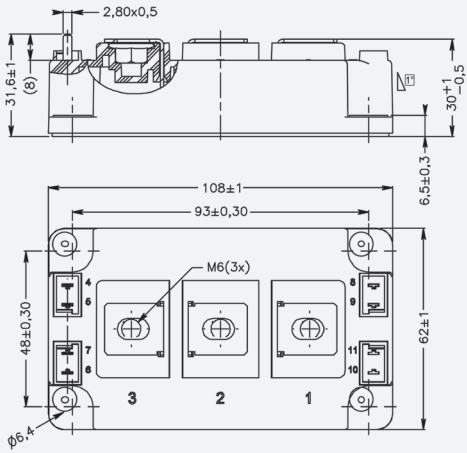
BL3



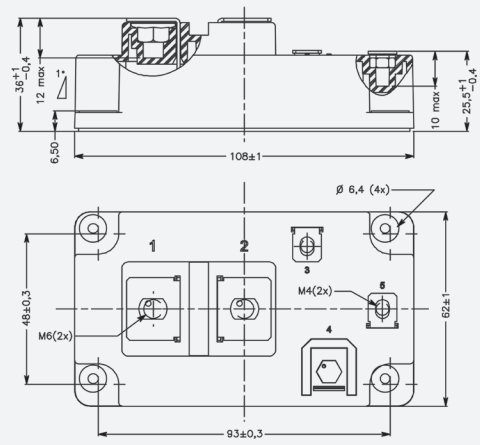
D1P



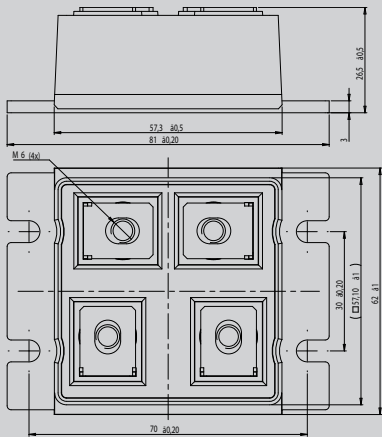
D3



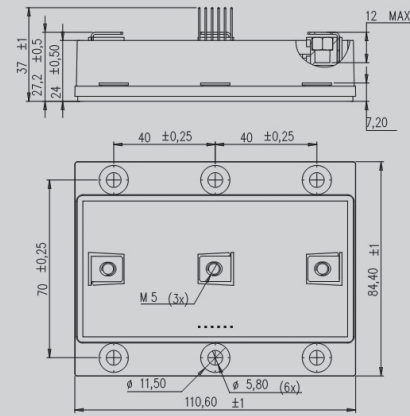
D4



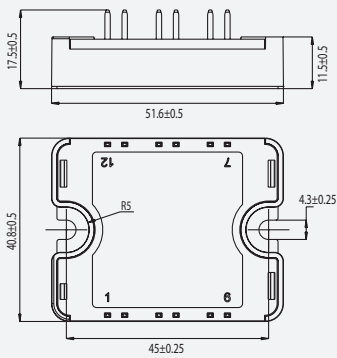
LP4



LP8



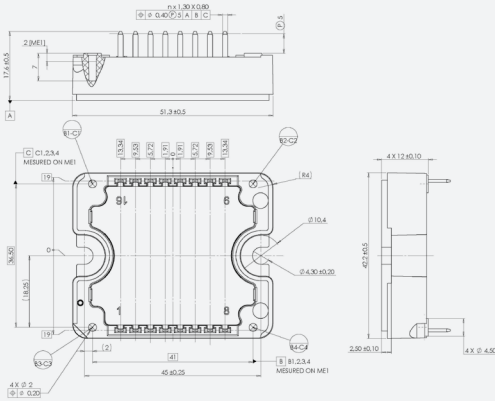
SP1



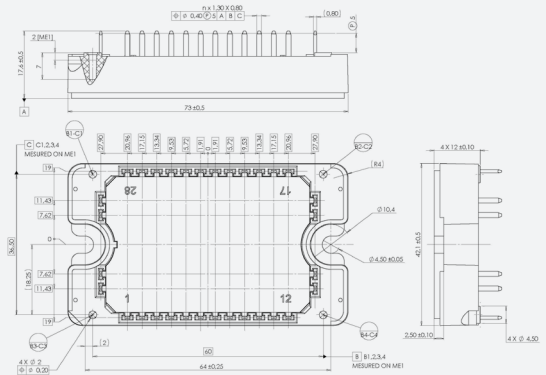
Pinout location depends on the module configuration. Please refer to the product datasheet for pin assignments. All dimensions in millimeters.



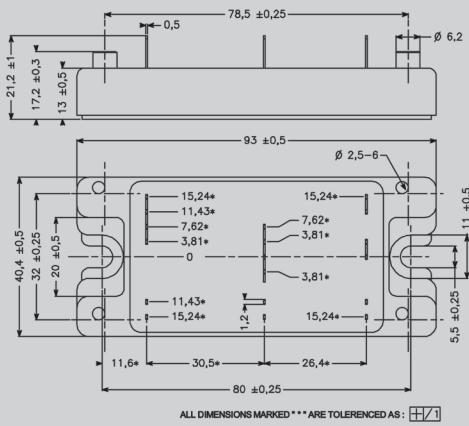
SP1F



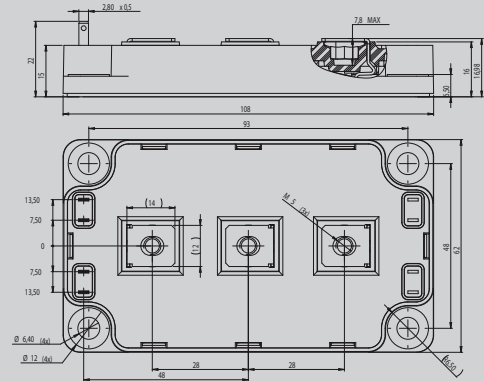
SP3F



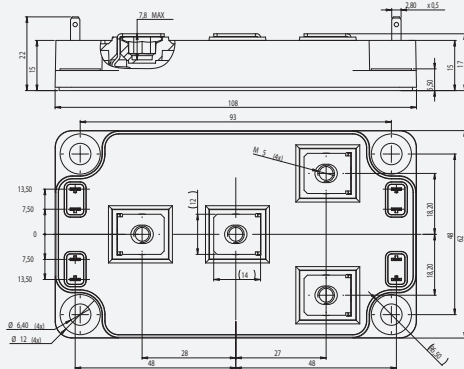
SP4



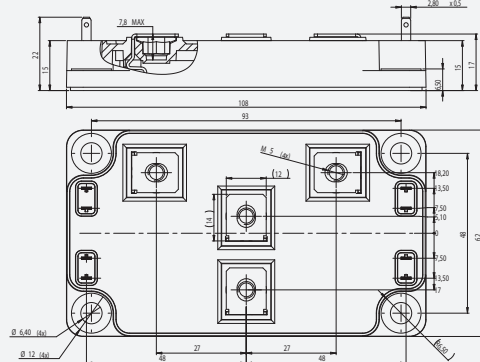
SP6-Three Outputs



SP6-Four Outputs, Version 1



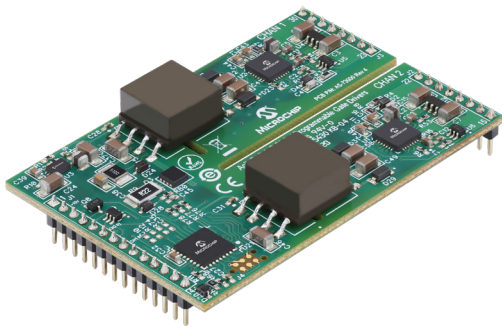
SP6-Four Outputs, Version 2



Pinout location depends on the module configuration. Please refer to the product datasheet for pin assignments. All dimensions in millimeters.

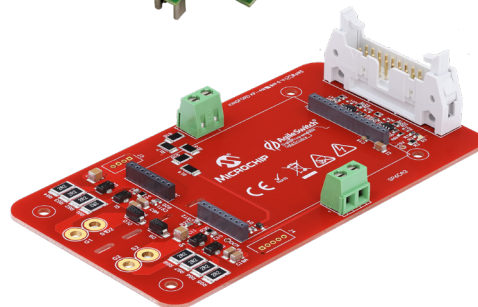


# AgileSwitch™ Configurable Digital Gate Driver Solutions



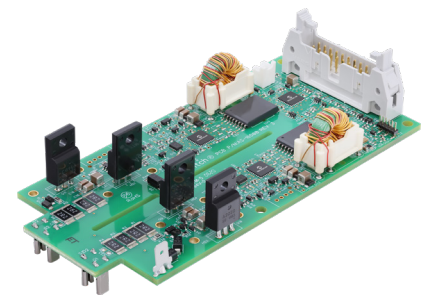
## 2ASC Configurable Digital Gate Driver Cores

Providing higher performance, lower system cost and faster time to market for your SiC based power systems. Our AgileSwitch 2ASC dual-channel high performance digital gate driver cores incorporate patented Augmented Switching technology to reduce EMI Noise in the system, catch short circuit conditions before they become a hazard, reduce thermal losses, control voltage overshoots and control ringing.



## Module Adapter Boards

Coupled with our AgileSwitch 2ASC Gate Driver Cores, our Module Adapter Board series provides a platform to rapidly evaluate and optimize new SiC power designs and systems. Standard offerings include a reference design for 1200V/1700 SP6LI (SP6CA1/SP6CA3) and 1200V/1700 D3 (62CA1/62CA4) Micro-chip SiC Power Modules. Shown are the 62CA1 board coupled with an ASC-12A1HP core and the SP6CA1 board.



## Plug and Play Configurable Digital Gate Driver Boards

Control, monitor and protect the latest 62 mm SiC modules using our Plug and Play 62EM Configurable Digital Gate Driver Boards. Designed for traction applications, the 62EM can drive up to 1.7 kV devices at 100 kHz with configurable fault settings and patented Augmented Switching technology.

## Configurable SiC Digital Gate Driver Cores

| Part Number | Voltage (V) | Driver Type  | Programming Tool | Augmented Switching | Turn On Voltage Range | Turn Off Voltage Range |
|-------------|-------------|--------------|------------------|---------------------|-----------------------|------------------------|
| 2ASC-12A1HP | 1200        | Dual Channel | ASBK-014         | Turn On             | +15V to +20V          | -5V to 0V              |
| 2ASC-12A2HP | 1200        | Dual Channel | ASBK-014         | Turn On & Turn Off  | +15V to +20V          | -5V to 0V              |
| 2ASC-17A1HP | 1700        | Dual Channel | ASBK-014         | Turn On             | +15V to +20V          | -5V to 0V              |

## Module Adapter Boards

| Part Number | Voltage (V) | For Module Type | Compatible With Gate Driver Core |
|-------------|-------------|-----------------|----------------------------------|
| 62CA1       | 1200        | 62 mm, D3, SP6  | 2ASC-12A2HP / 2ASC-12A1HP        |
| EDCA1       | 1200        | Rohm E/G Type   | 2ASC-12A2HP / 2ASC-12A1HP        |
| SP6CA1      | 1200        | SP6LI           | 2ASC-12A2HP / 2ASC-12A1HP        |
| XMCA1       | 1200        | Wolfspeed XM3   | 2ASC-12A2HP / 2ASC-12A1HP        |
| 62CA4       | 1700        | 62 mm, D3, SP6  | 2ASC-17A1HP                      |
| SP6CA3      | 1700        | SP6LI           | 2ASC-17A1HP                      |

## Plug and Play Configurable SiC Digital Gate Driver Core

| Part Number | Voltage (V) | Driver Type  | Programming Tool | Augmented Switching | Turn On Voltage Range | Turn Off Voltage Range |
|-------------|-------------|--------------|------------------|---------------------|-----------------------|------------------------|
| 62EM1-00001 | 1700        | Dual Channel | ASBK-014         | Turn On             | Fixed (+20V)          | Fixed (-5V)            |

## Digital Gate Driver Developer Kits

| Part Number                   | Voltage (V) | Module Adapter Board | Gate Driver Core | Included SiC MOSFET Power Module |
|-------------------------------|-------------|----------------------|------------------|----------------------------------|
| ASDAK-MSCSM70AM025CT6LIAG-01  | 700         | 1 x SPCA1            | 1 x 2ASC-12A1HP  | 1 x MSCSM70AM025CT6LIAG          |
| ASDAK-2ASC-12A1HP-62          | 1200        | 1 x 62CA1            | 3 x 2ASC-12A1HP  |                                  |
| ASDAK-2ASC-12A1HP-SP6LI       | 1200        | 1 x 62CA1            | 3 x 2ASC-12A1HP  |                                  |
| ASDAK-MSCSM120AM02CT6LIAG-01  | 1200        | 1 x SPCA1            | 1 x 2ASC-12A1HP  | 1 x MSCSM120AM02CT6LIAG          |
| ASDAK-MSCSM120AM03CT6LIAG-01  | 1200        | 1 x SPCA1            | 1 x 2ASC-12A1HP  | 1 x MSCSM120AM03CT6LIAG          |
| ASDAK-MSCSM120AM042CT6LIAG-01 | 1200        | 1 x SPCA1            | 1 x 2ASC-12A1HP  | 1 x MSCSM120AM042CT6LIAG         |
| ASDAK-2ASC-17A1HP-62          | 1700        | 1 x 62CA4            | 3 x 2ASC-17A1HP  |                                  |

Each Developer Kit Also Includes, PICKit™ Device Programming Kit (ASBK-014), Intelligent Configuration Tool (ICT) Software and Cables

## User-Friendly Reference Designs

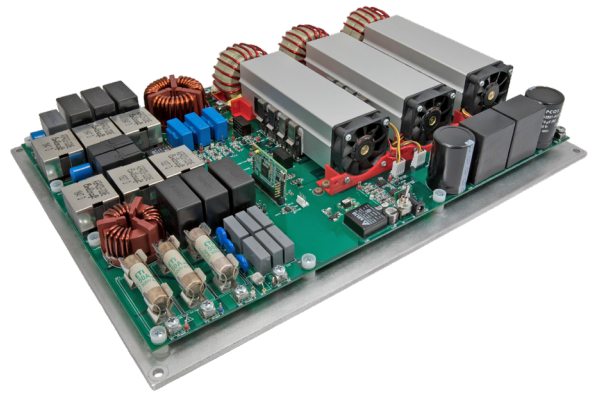
Microchip and our partner ecosystem provide open-source, user friendly SiC MOSFET reference design solutions that enable faster time to market for customers using our SiC MOSFETs and power modules. You can use isolated dual-gate driver reference designs with our SiC MOSFETs in a number of SiC topologies.

## SiC Solutions

| Part Number    | Gate Drive or Line Voltage | kHz, max | Per Side Drive Power (W) | Description                                  |
|----------------|----------------------------|----------|--------------------------|--|
| MSCSICPFC/REF5 | In: 400 Vrms, Out: 700 Vdc | 140      | 30 kW                    | 30 kW 3-phase Vienna PFC (design files only) |

The MSCSICPFC/REF5 is a Vienna 3-Phase PFC reference design for Hybrid Electric Vehicle/Electric Vehicle (HEV/EV) charger and high-power switch mode power supply applications.

- 30 kW Vienna rectifier topology at 98.6 % peak efficiency
- 380/400 VAC, 50 Hz/60 Hz input voltage with 700V DC output voltage
- 140 kHz pulse-width modulation switching frequency
- < 5% current THD at half and full loads
- 700V SiC MOSFETs and 1200V SiC diodes
- dsPIC33CH using 3-level modulation for digital control
- Includes Microchip linear op amps, voltage regulators and CAN FD-ready transceiver

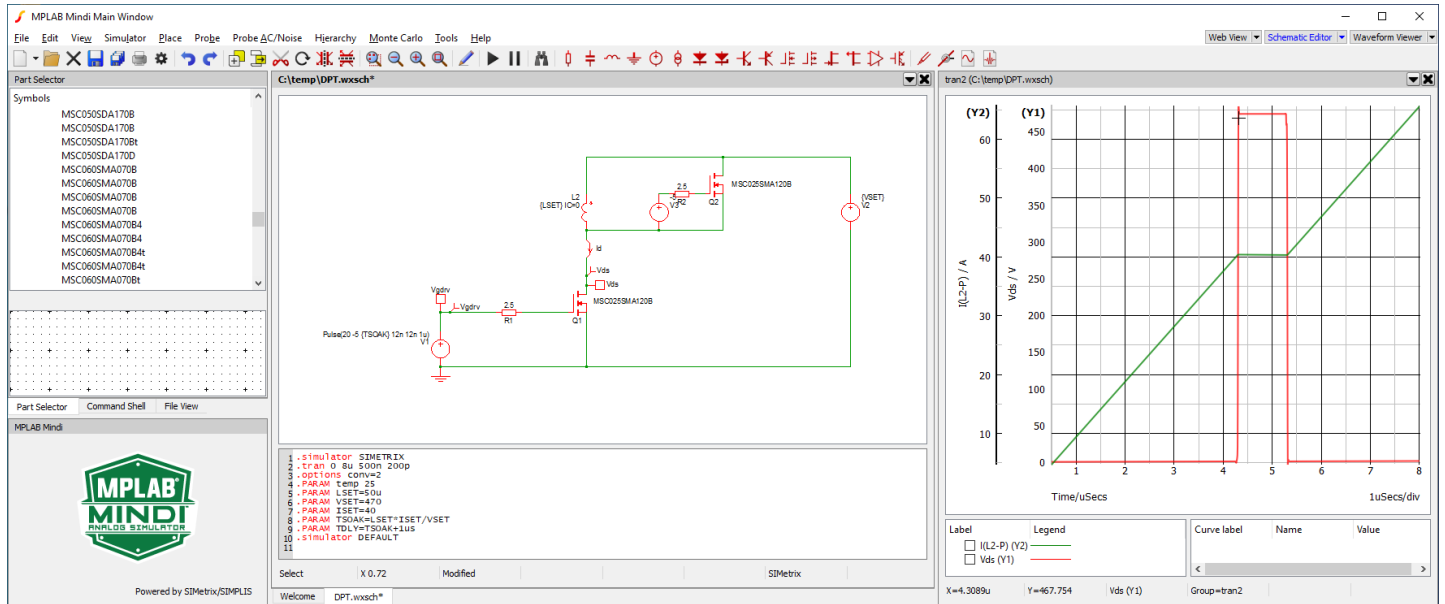


## Simulation Models

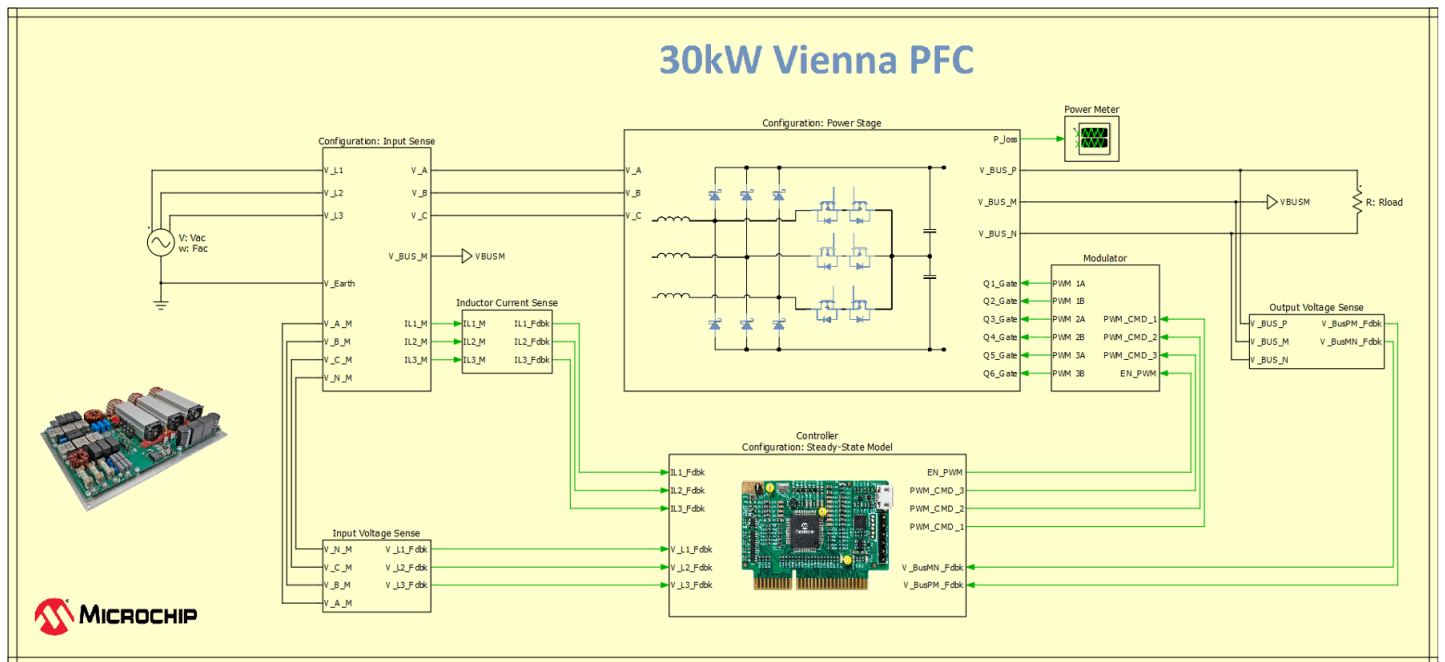
Microchip offers a variety of simulation tools that help designers lower design complexities and shorten design cycle times. Both device and system level tools are available for use in device evaluation, system development and scaling of existing system level models.

- **MPLAB® Mindi™ Analog Simulator**
  - Brief Description: Free SPICE circuit simulation tool that uses a SIMetrix/SIMPLIS simulation environment.
  - What's available: Free MPLAB Mindi Analog Simulator download. SiC Models are available for the 700V, 1200V and 1700V SiC MOSFETs and Schottky Barrier Diodes
  - Relevant links: Simulation tool download at [microchip.com/mplab/mplab-mindi](http://microchip.com/mplab/mplab-mindi) and SiC models at [microchip.com](http://microchip.com)
- **SPICE**
  - Brief Description: SPICE is a widely used circuit simulator that provides the ability to evaluate a device within a circuit design. SPICE models support this simulation work by designers.
  - What's available: Microchip provides SPICE models for all of its newest SiC Schottky Barrier Diodes and SiC MOSFETs in 700V, 1200V, and 1700V
  - Relevant links: [microchip.com](http://microchip.com)
- **PLECS**
  - Brief Description: PLECS models provide device switching and conduction losses as well as thermal characterization for use in PLECS multi-domain simulations.
  - What's available: Vienna 3-Phase Power Factor Correction (PFC) Reference Design PLECS simulation model
  - Relevant links: [microchip.com](http://microchip.com)
  - [microchip.com/plecs](http://microchip.com/plecs)

# MPLAB® Mindi™ SPICE Circuit Simulation Model



# PLECS Simulation Model for 30 kW Vienna PFC





## Support

Microchip is committed to supporting its customers in developing products faster and more efficiently. We maintain a worldwide network of field applications engineers and technical support ready to provide product and system assistance. For more information, please visit [www.microchip.com](http://www.microchip.com):

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- Knowledge base and peer help: [www.microchip.com/forums](http://www.microchip.com/forums)
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## Training

If additional training interests you, Microchip offers several resources including in-depth technical training and reference material, self-paced tutorials and significant online resources.

- Overview of Technical Training Resources: [www.microchip.com/training](http://www.microchip.com/training)
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- Developer Help Website: [www.microchip.com/developerhelp](http://www.microchip.com/developerhelp)
- Technical Training Centers: [www.microchip.com/seminars](http://www.microchip.com/seminars)



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