Industrial and general purpose gate driver ICs
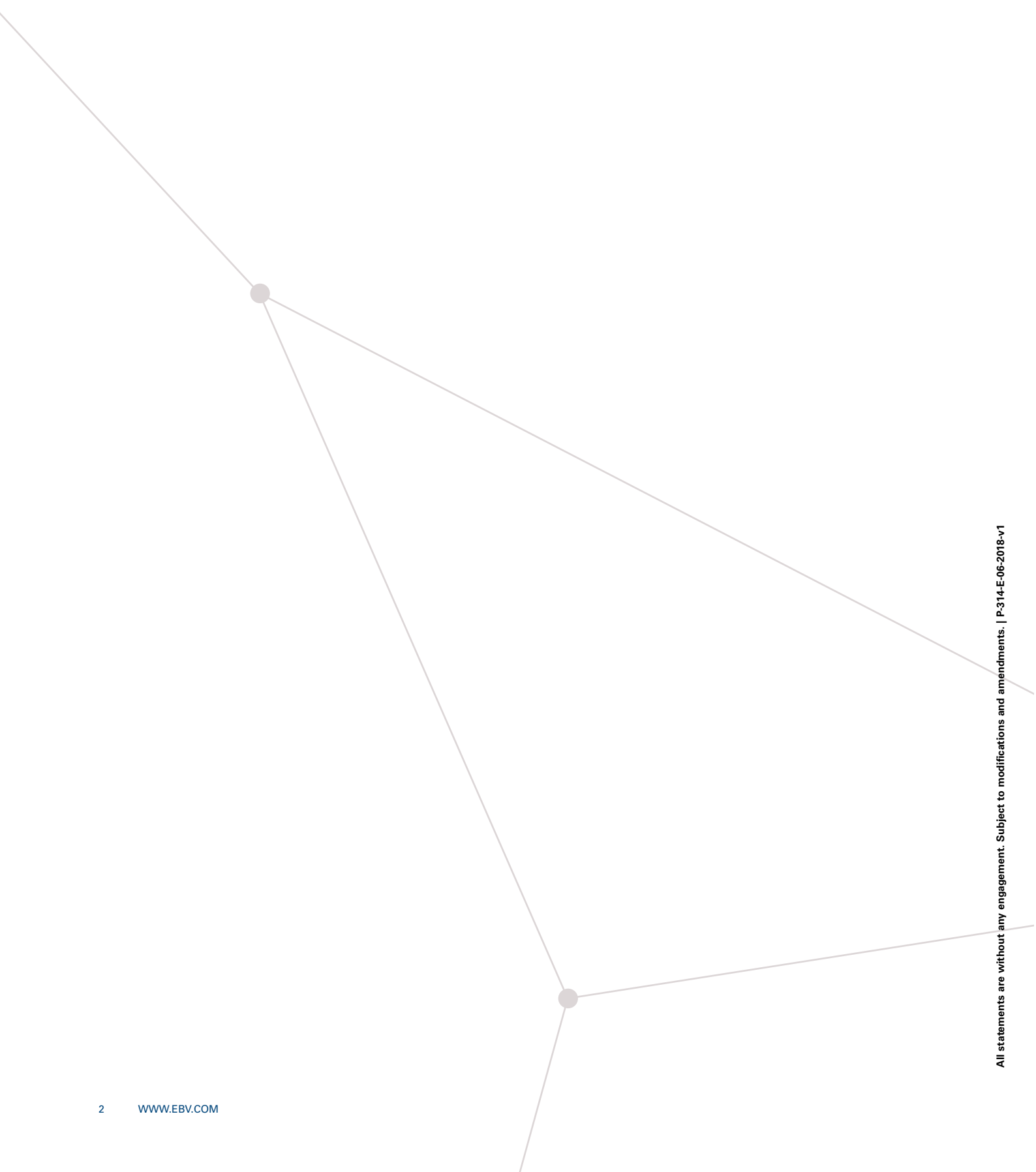
Selection guide 2017

www.infineon.com/gatedriver
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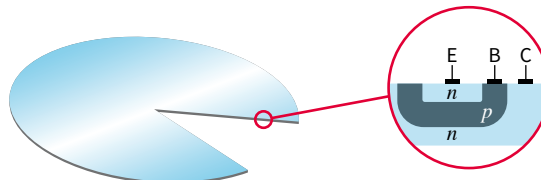
Infineon gate driver IC technologies

Leveraging the application expertise and advanced technologies of Infineon and International Rectifier, the industrial and general purpose gate driver ICs are well suited for many application such as major home appliances, industrial motor drives, solar inverters, UPS, switched-mode power supplies, and high-voltage lighting. Infineon offers a comprehensive portfolio with a variety of configurations, voltage classes, isolation levels, protection features, and package options. These flexible gate driver ICs are complementary to Infineon IGBTs, silicon and silicon carbide MOSFETs (CoolMOS™ and CoolSiC™), or as part of integrated power modules. Every switch needs a driver.

Level-shifting p-n junction isolation (LS-JI) technology is a mature, proven industry standard MOS/CMOS fabrication technique. Infineon's proprietary HVIC and latch-immune CMOS technologies enable ruggedized monolithic construction. The advanced process allows monolithic high-voltage and low-voltage circuitry construction with the best price per performance.
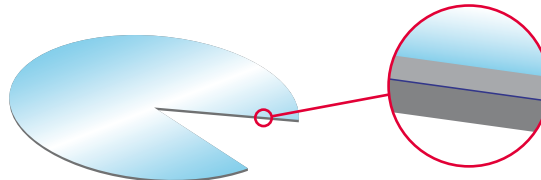
Main benefits of JI technology:
› High current capability
› Precision analog circuitry (tight timing/propagation delay)
› Most comprehensive portfolio with industry-standard gate drivers
   – **Voltage classes:** 1200 V, 700 V, 600 V, 200 V, and 100 V
   – **Configurations:** three-phase, half-bridge, single channel, and more
› Drivers tailored towards the best price per performance

Level-shifting silicon-on-insulator (LS-SOI) technology is an advanced fabrication technique used for Infineon EiceDRIVER™ SOI products. The silicon is separated from the substrate by a buried oxide layer. The top layer, which is the silicon film, is used to produce the transistor. The bottom layer is used as the silicon substrate. The buried silicon dioxide provides an insulation barrier between the active layer and silicon substrate. The advanced process allows monolithic high-voltage and low-voltage circuitry construction with additional technology-enhanced features.

Main benefits of Infineon SOI technology:
› Best-in-class immunity to negative transients prevents erratic operation and latch-up while improving reliability
› Low-ohmic integrated bootstrap diode has the lowest reverse recovery losses resulting in reduced power losses
› Minimum level-shift losses improve driver efficiency and allows flexible housing designs
› 600 V and higher withstand voltages for operating margin
› Integrated filters

Coreless transformer (CT) technology is an isolated technology which uses semiconductor manu-facturing processes to integrate an on-chip transformer consisting of metal spirals and silicon oxide insulation. These coreless transformers are used for transmitting switching information between input chip and output chip. Two isolated chips ensure galvanic isolation.

Main benefits of CT technology:
› Galvanic isolation
› Allows very large voltage swings of ±1200 V or larger
› Immunity against negative and positive transients
› Increases reliability of the end product
› Low losses and low power dissipation

Non-isolated (NI) technology refers to gate drivers utilizing low-voltage circuitry. Infineon's world-class fabrication techniques enable high-current gate drivers for high-power-density applications in industry standard DSO-8 and small form-factor SOT23 and WSON packages.

Typical applications

**Level-shifting technology
(LS-SOI) & (LS-JI)**

Aircon	Major home appliance	Fridge
Dishwasher	Laundry dryer	Vacuum cleaner
Power tools	Multicopter	LEV
SMPS	Induction	Home & garden
Consumer	Electric toys	PFC

Motor control	Fans
Pumps	Welding
Server	Telecom

**Coreless transformer
(CT) technology**

UPS	Drives	Solar
LV-drives	Automation	EV-Charging

Junctional isolation technology

Pioneered by International Rectifier since 1984 with the introduction of the first monolithic product, the high-voltage integrated circuit (HVIC) technology uses patented and proprietary monolithic structures integrating bipolar, CMOS, and lateral DMOS devices with breakdown voltages above 700 V and 1400 V for operating offset voltages of 600 V and 1200 V. Using this mixed signal HVIC technology, both high-voltage level-shifting circuits and low-voltage analog and digital circuits can be implemented. With the ability to place high-voltage circuitry (in a 'well' formed by polysilicon rings) that can 'float' 600 V or 1200 V on the same silicon away from the rest of the low-voltage circuitry, high-side power MOSFETs or IGBTs that exist in many popular off-line circuit topologies such as buck, synchronous boost, half-bridge, full-bridge and three-phase.
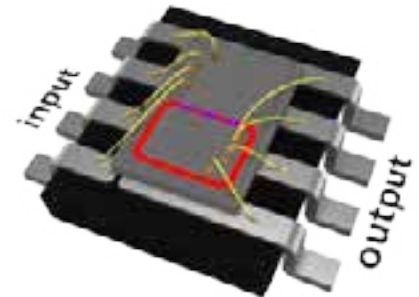
These HVIC gate drivers with floating switches are well suited for topologies requiring high-side and bridge configurations.
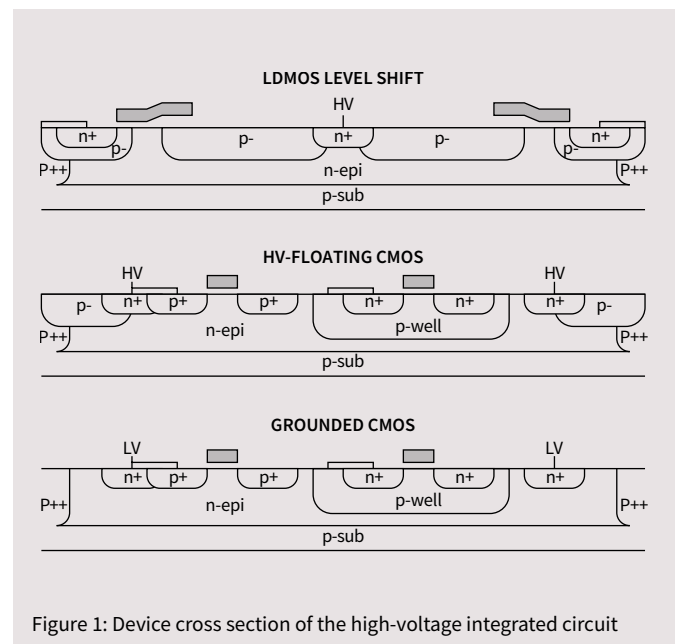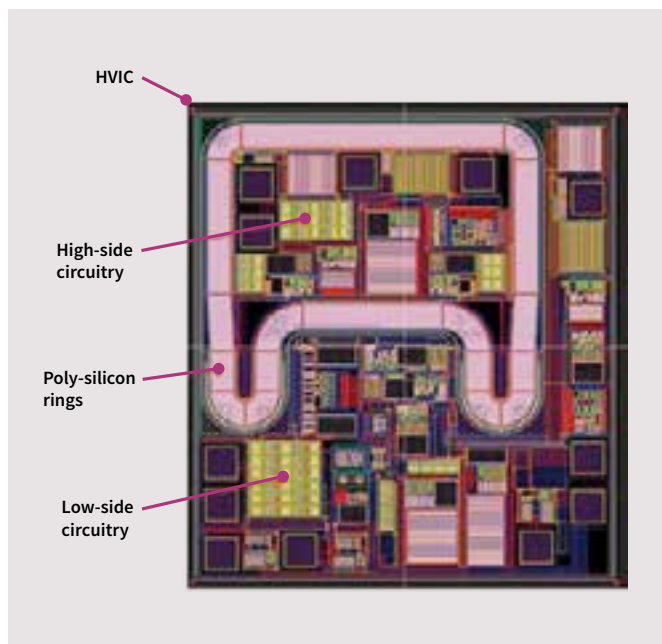
Figure 1: Device cross section of the high-voltage integrated circuit

Infineon SOI technology

EiceDRIVER™ products with Infineon SOI technology provide unique, measurable, best-in-class advantages.

Negative V_S transient (-V_S) operation robustness

Today's high-power switching converters carry a large load current. The V_S voltage swing does not stop at the level of the negative DC bus. It swings below the level of the negative DC bus due to the parasitic inductances in the power circuit and from the die bonding to the PCB tracks. This undershoot voltage is called "negative V_S transient".

High-voltage EiceDRIVER™ products using Infineon SOI have the best-in-the-industry operational robustness. In Figure 3, the safe operating line is shown at V_{BS} = 15 V for pulse widths up to 1000 ns. Above this line, the products do not show unwanted functional anomalies or permanent damage to the IC.
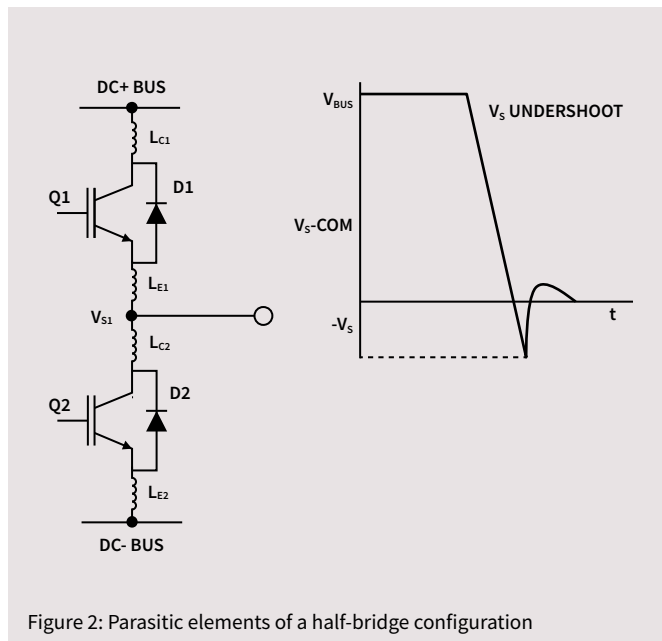
Figure 2: Parasitic elements of a half-bridge configuration
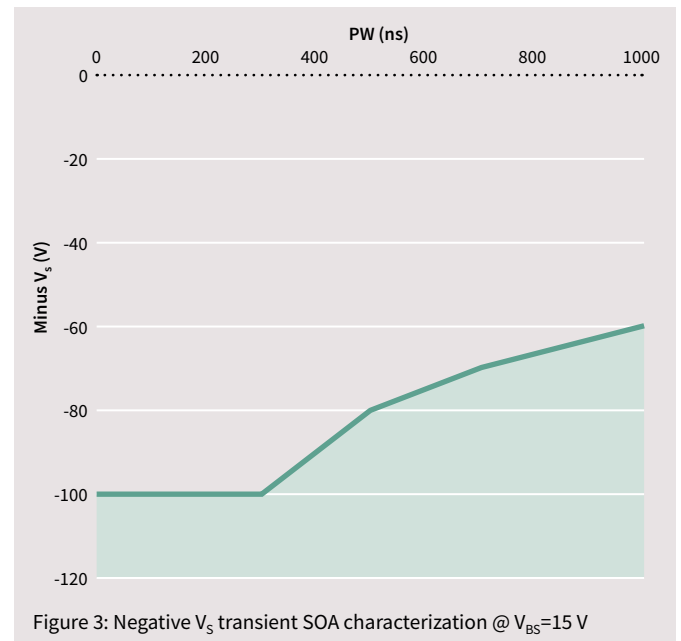
Figure 3: Negative V_S transient SOA characterization @ V_{BS}=15 V

Integrated bootstrap diode

The bootstrap power supply is one of the most common techniques for suppling power to the high-side driver circuitry due to its simplicity and low cost. As shown in Figure 4, the bootstrap power supply consists of a bootstrap diode and capacitor. The floating channel of JI drivers is typically designed for bootstrap operation. Infineon SOI drivers features excellent ultra-fast bootstrap diodes. The low diode resistance of $R_{BS} \leq 40\ \Omega$ enables a wide control range. The Infineon SOI drivers with this feature can drive larger IGBTs without the risk of self-heating, minimize BOM count, and reduce system cost.
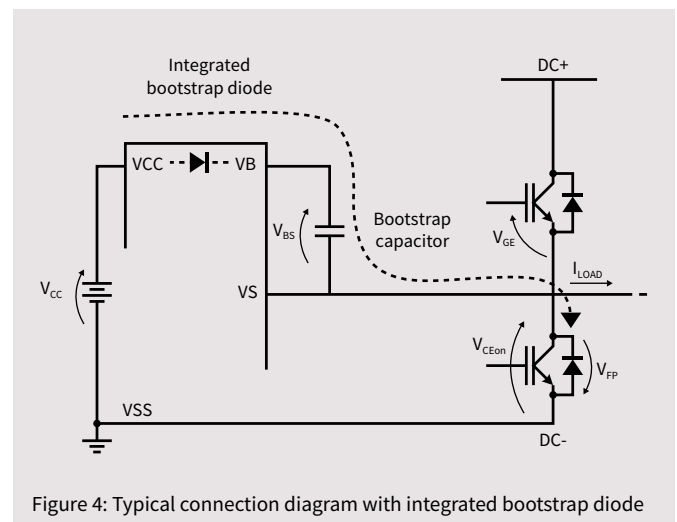
Figure 4: Typical connection diagram with integrated bootstrap diode

Level shift losses

Level-shift losses can be a very significant part as the operating frequency increases. A level-shift circuit is used to transmit the switching information from the low-side to the high-side. The necessary charge of the transmission determines the level-shift losses. EiceDRIVER™ high-voltage products using the Infineon SOI technology requires a very low charge to transmit the information. Minimizing level-shifting power consumption allows design flexibility of higher frequency operations, as well as longer lifetime, improved system efficiency and application reliability.

Infineon CT Isolation Technology

Infineon EiceDRIVER™ galvanically isolated products use the magnetically-coupled coreless transformer (CT) technology to provide signal transfer across the galvanic isolation. The technology provides short propagation delay, excellent delay matching, and strong robustness. The isolation allows very large voltage swings (e.g. ±1200 V).

Robustness

› Extremely robust signal transfer independent of common mode noise
› Stability against common mode noise up to 100 V/ns
› Tight propagation delay matching: Tolerance improves application robustness without variations due to age, current, and temperature
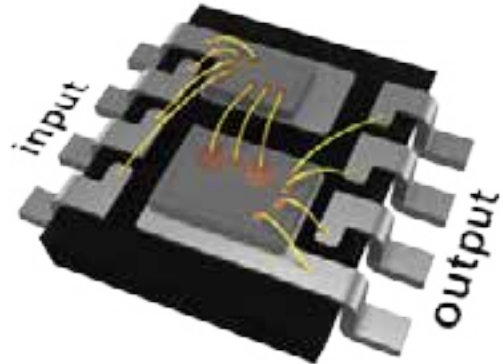
Design flexibility

› Wide range of gate voltages including negative gate voltage
› CT technology is ready for use with silicon carbide MOSFETs

› Closed-loop gate current control option

Precise timing control

› Precise integrated filters reduce the propagation delay and propagation delay variation over a wide range of operating conditions
› Integrated filters reduce the effort for external filters
› Tight propagation delay allows minimum deadtime and improved system efficiency

Integrated ramp-based filter
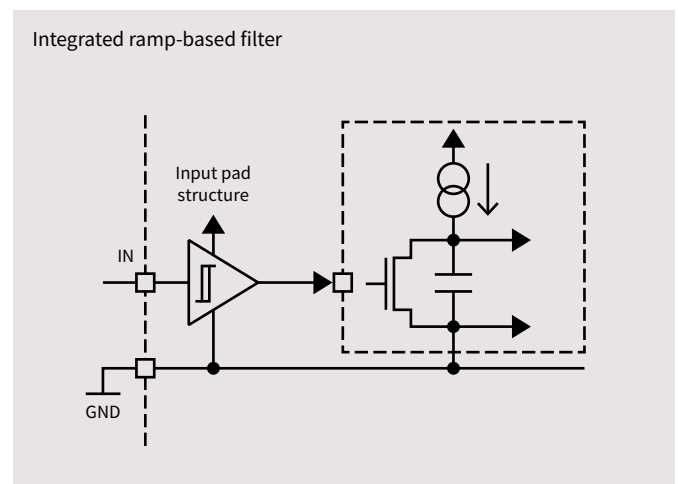
Protection

› Short dead times with tight propagation delay
matching and precise integrated filters over a wide
range of operating conditions
› Fast short-circuit shut down using optional fast DESAT
detection and two-level turn-off for short-circuit current
protection
› Reliable short-circuit detection via a fast and accurate
desaturation (DESAT) detection circuit protects the power
switches from damage during short-circuit condition
› Active miller clamping option protects against parasitic
turn-on due to high dV/dt
› Built in short-circuit clamping limits the gate drive
voltage during short circuit and lowers collecter voltage
overshoot
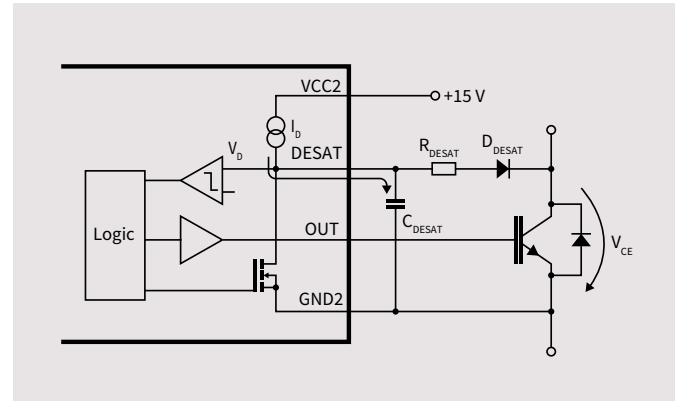
Coupling method	Tolerance I_D	Tolerance V_D
Coreless transformer	±10%	-8/+6%
Capacitive	±18%	-8/+6%
Optical	-48/+32%	±11%

Safety certification

› Safety certification available for VDE0884 and UL1577

For SiC MOSFET switching

› Ideal for ultra-fast switching 1200 V silicon carbide power
transistors such as CoolSiC™ MOSFETs
› The drivers incorporate most important key features and
parameters for SiC driving:
 – Tight propagation delay matching
 – Precise input filters

 – Wide output side supply range
 – Negative gate voltage capability
 – Extended common mode transient immunity (CMTI)
  capability

Silicon carbide drive requirements
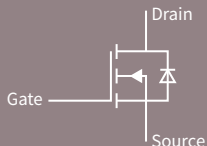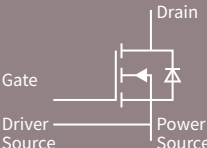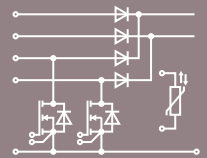
CoolSiC™ MOSFETs and modules

Infineon's CoolSiC™ silicon carbide (SiC) MOSFETs open new degrees of freedom for designers to improve efficiency and system flexibility.

The CoolSiC™ MOSFET offers advantages of the lowest gate charge and device capacitance levels in 1200 V switches, no reverse recovery losses of the internal body diode, temperature-independent low switching losses, and threshold-free on-state characteristics. Infineon's unique 1200 V SiC MOSFET adds additional advantages of superior gate-oxide reliability enabled by state-of-the-art trench

design, best in class switching and conduction losses, highest transconductance (gain), full turn-on capability with gate voltage of only +15 V and short-circuit robustness.

The result is a robust SiC MOSFET which is ideal for hard- and resonant-switching topologies. It can be driven like an IGBT using standard drivers delivering the highest level efficiency at switching frequencies unreachable by Si based switches allowing for system size reduction, higher power density and improved lifetime reliability.

Lead products

Schematic	Type	R_{DSON}	V_{DS}	Package
Single switch	IMW120R045M1	45 mΩ	1200 V	TO-247-3pin
Single switch	IMZ120R045M1	45 mΩ	1200 V	TO-247-4pin
Booster with NTC	DF11mR12W1M1_B11	11 mΩ	1200 V	Easy 1B
	DF23mR12W1M1_B11	23 mΩ	1200 V	
Half bridge with NTC	FF11mR12W1M1_B11	11 mΩ	1200 V	
	FF23mR12W1M1_B11	23 mΩ	1200 V	

Sampling on request

Recommended gate drivers

Ultra-fast switching 1200 V power transistors such as CoolSiC™ MOSFETs can be easier handled by means of isolated gate output sections. Therefore, the following galvanically isolated EiceDRIVER™ ICs based on Infineon's coreless transformer technology are recommended as most suitable. For a larger selection of isolated gate drivers, please refer to the product portfolio overview section of the selection guide. The drivers incorporate most important key features and parameters for SiC driving such as tight propagation delay matching, precise input filters, wide output-side supply range, negative gate voltage capability, and extended CMTI capability.

Recommended gate drivers

| Product | Part number | Typ. peak drive current | VCC2-VEE2 | Typ. prop. delay | Typ. UVLO | | Miller clamp | Other key features | Package |
					ON	OFF			
1EDI compact isolated high-side driver family	1EDI20N12AF	3.5 A	40.0 V	≤ 120 ns	9.1 V	8.5 V	No	Functional isolation	DSO-8 150 mil
	1EDI60N12AF	9.4 A	40.0 V	≤ 120 ns	9.1 V	8.5 V	No		
	1EDI20I12MF	3.5 A	20.0 V	≤ 300 ns	11.9 V	11.0 V	Yes		
	1EDI20H12AH	3.5 A	40.0 V	≤ 125 ns	12.0 V	11.1 V	No	8 mm creepage clearance	DSO-8 300 mil
	1EDI60H12AH	9.4 A	40.0 V	≤ 125 ns	12.0 V	11.1 V	No		
	1EDI20I12MH	3.5 A	20.0 V	≤ 300 ns	11.9 V	11.0 V	Yes		
1ED-F2 isolated high-side driver with integrated protection	1ED020I12-F2	2.0 A	28.0 V	≤ 170 ns	12.0 V	11.0 V	Yes	Short circuit clamping; DESAT protection; active shutdown	DSO-16
2ED-F2 isolated dual high-side driver with integrated protection	2ED020I12-F2	2.0 A	28.0 V	≤ 170 ns	12.0 V	11.0 V	Yes	Short circuit clamping; DESAT protection; active shutdown	DSO-36
1ED slew rate control (SRC) isolated high-side driver	1EDI20I12SV	2.0 A	28.0 V	≤ 485 ns	11.9 V	11.0 V	Yes	Real-time adjustable gate current control; over-current protection, soft turn-off shut down, two-level turn-off	DSO-36

Product portfolio overview

Infineon's gate driver IC solutions are the expert's choice. With more than 200 reliable and efficient gate driver solutions, we provide a comprehensive portfolio for virtually any application. To ease the selection process, this overview is structured along the configurations of the gate driver ICs, as opposed to by application topology.

Half-bridge gate driver ICs

Typical connection

Typical connection diagram: V_{CC} — VCC/VB, IN — IN/HO, $\overline{SD}$ — $\overline{SD}$/VS, COM/LO. Up to 1200 V. To load.

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Comparator	Current amplifier	Desaturation protection	Enable	Fault reporting	Integrated bootstrap diode	Over-current protection	Programmable dead time	Programmable shutdown	Self-oscillating	Separate pin for logic ground	Shoot-through protection	Shutdown	Soft over-current shutdown	Under-voltage lockout	DSO-8	DSO-14	DSO-18	DIP-8	DIP-14	SSOP-24	VQFN-14	CHIP
1200	1500/2500	85/85	2ED020I12-FI	CT	✓	✓										✓	✓		✓			✓					
	2000/3000	440/440	IR2214	JI			✓		✓						✓	✓		✓	✓						✓		
700	78/169	220/220	IR7304	JI												✓		✓	✓	✓							
	1900/2300	270/680	IR7184	JI												✓	✓	✓	✓	✓							
650	1500/2500	85/85	2ED020I06-FI	CT												✓	✓		✓			✓					
600	78/169	220/220	IR2304	JI												✓			✓	✓						✓	
			IR25601	JI												✓			✓	✓							
	180/260	na	IR21531	JI							✓	✓				✓	✓		✓	✓						✓	✓
			IR21531D	JI							✓	✓	✓			✓	✓		✓							✓	
			IR25603	JI							✓	✓				✓	✓		✓	✓						✓	
			IRS2153(1)D	JI							✓	✓		✓		✓	✓		✓	✓						✓	✓
	200/350	200/220	IR2108	JI												✓			✓	✓					✓		
			IR21084	JI							✓				✓	✓			✓		✓				✓		
			IR2308	JI												✓			✓	✓					✓		
			IR25606	JI												✓			✓	✓							
		200/750	IR2109	JI												✓	✓		✓	✓					✓		
			IR21091	JI							✓					✓	✓		✓	✓					✓		
			IR21094	JI							✓				✓	✓			✓		✓					✓	
			IR2302	JI												✓	✓		✓	✓					✓		
	210/360	150/680	IR2103	JI												✓			✓	✓					✓		
			IR2104	JI												✓	✓		✓	✓					✓		
			IR25602	JI												✓	✓		✓	✓							
	220/480	500/500	IRS2890D*	JI				✓	✓	✓						✓			✓				✓				
	250/500	150/750	IR2111	JI												✓			✓	✓					✓		
	290/600	150/150	IRS2304	JI												✓			✓	✓					✓		✓
		150/680	IRS2103	JI												✓			✓	✓					✓		✓
			IRS2104	JI												✓	✓		✓	✓					✓		✓
		150/750	IRS2111	JI												✓			✓	✓					✓		✓
		200/220	IRS2108	JI												✓			✓	✓					✓		✓
			IRS2308	JI												✓			✓	✓					✓		✓
			IRS21084	JI							✓				✓	✓			✓		✓				✓		
		200/750	IRS2109	JI												✓	✓		✓	✓					✓		✓

*New

Half-bridge gate driver ICs

Typical connection

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Comparator	Current amplifier	Desaturation protection	Enable	Fault reporting	Integrated bootstrap diode	Over-current protection	Programmable dead time	Programmable shutdown	Self-oscillating	Separate pin for logic ground	Shoot-through protection	Shutdown	Soft over-current shutdown	Under-voltage lockout	DSO-8	DSO-14	DSO-18	DIP-8	DIP-14	SSOP-24	VQFN-14	CHIP
	360/700	300/310	2EDL05N06P	SOI						✓						✓			✓	✓	✓						
	360/700	400/420	2EDL05I06P	SOI						✓						✓			✓	✓	✓						
600	1900/2300	220/180	IRS2183	JI												✓			✓	✓			✓				✓
600	1900/2300	220/180	IR2183	JI												✓			✓	✓			✓				
600	1900/2300	220/180	IR(S)21834	JI							✓				✓	✓			✓		✓				✓		
600	1900/2300	270/680	IRS2184	JI												✓	✓		✓	✓			✓				✓
600	1900/2300	270/680	IR2184	JI												✓	✓		✓	✓			✓				
600	1900/2300	270/680	IR21844	JI							✓				✓	✓	✓		✓		✓					✓	
600	1900/2300	270/680	IRS21844	JI							✓				✓	✓	✓		✓		✓					✓	✓
600	2000/3000	440/440	IR2114	JI			✓		✓						✓	✓		✓	✓							✓	
600	2300/2800	300/310	2EDL23N06P	SOI			✓	✓	✓	✓						✓			✓					✓			
600	2300/2800	400/420	2EDL23I06P	SOI			✓	✓	✓	✓						✓			✓					✓			
200	290/600	150/680	IRS2003	JI												✓			✓	✓			✓			
200	290/600	150/680	IRS2008*	JI												✓		✓									
200	290/600	150/680	IRS2004	JI												✓	✓			✓			✓			✓

*New

Three-phase gate driver ICs

Typical connection

Pins: VCC, HIN, LIN, EN, FAULT, RCIN, ITRIP, VSS, VB (x3), HO (x3), VS (x3), LO (x3), COM. Connections: DC+ bus, DC- bus, To load.

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Current amplifier	Desaturation protection	Enable	Fault reporting	Integrated bootstrap diode	Output for brake chopper	Over-current protection	Separate pin for logic ground	Shutdown	Under-voltage lockout	DSO-20 WB	DSO-28 WB	DIP-28	LCC-32	MQFP-64	TSSOP-28	VQFN-28	VQFN-34	CHIP
								Features (see page 24)										Package (see page 25)					
1200	250/500	700/750	IR2233	JI	✓			✓			✓	✓	✓	✓		✓	✓	✓					✓
	250/500	700/750	IR2235	JI	✓			✓			✓	✓	✓	✓		✓	✓	✓					
	350/450	550/550	IR2238	JI		✓		✓		✓	✓	✓	✓	✓					✓				
600	165/375	490/530	6ED003L06-F2	SOI			✓	✓			✓	✓		✓		✓							✓
	165/375	490/530	6EDL04I06(N,P)	SOI			✓	✓	✓		✓	✓		✓		✓							✓
	165/375	530/530	6EDL04N06P	SOI			✓	✓	✓		✓	✓		✓		✓							✓
	200/350	400/425	IR2136	JI			✓	✓			✓	✓		✓		✓	✓	✓					✓
	200/350	400/425	IR21363	JI			✓	✓			✓	✓		✓		✓		✓					✓
	200/350	400/425	IR21365	JI			✓	✓			✓	✓		✓		✓							
	200/350	400/425	IR21368	JI			✓	✓			✓	✓		✓		✓							✓
	200/350	530/500	IR21364	JI			✓	✓			✓	✓		✓		✓							✓
	200/350	530/530	IRS2334	JI									✓	✓	✓						✓		
	200/350	530/530	IRS2336	JI			✓	✓			✓	✓		✓		✓		✓					
	200/350	530/530	IRS2336D	JI			✓	✓	✓		✓	✓		✓		✓		✓			✓		✓
	200/350	530/530	IRS23364D	JI			✓	✓	✓		✓	✓		✓		✓		✓					✓
	200/350	530/530	IRS23365D	JI			✓	✓	✓		✓	✓		✓								✓	
	250/500	425/675	IR213(0,2)	JI	✓			✓			✓	✓		✓		✓	✓	✓					✓
	250/500	300/1300	IR2131	JI				✓			✓	✓	✓	✓		✓	✓	✓					
	250/500	700/750	IR2133	JI	✓			✓			✓	✓	✓	✓		✓	✓	✓					
	250/500	700/750	IR2135	JI	✓			✓			✓	✓	✓	✓		✓		✓					✓
200	165/375	490/530	6ED003L02-F2	SOI			✓	✓			✓	✓		✓						✓			
	165/375	530/530	6EDL04N02P	SOI			✓	✓	✓		✓	✓		✓						✓			

Single high-side gate driver ICs

Typical connection

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Active Miller clamp	Current sense	Dedicated control for JFET	Desaturation protection	Enable	Error reporting with shutdown	Fault reporting	Fault reset	Over-current protection	Separate pin for logic ground	Separate sink/source outputs	Soft over-current shutdown	Two-level turn-off	Under-voltage lockout	DSO-8	DSO-8 300mil	DSO-16 WB	DSO-19	DSO-36	DIP-8	SOT23-6	Chip
1200	1300/900	300/300	1EDI05I12A	CT									✓	✓				✓	✓	✓						
	2000/2000	165/170	1ED020I12-(B,F)2	CT	✓			✓			✓	✓		✓				✓				✓				
		1750/1750	1ED020I12-(B,F)T	CT	✓			✓			✓	✓		✓			✓	✓				✓				
	2200/2300	300/300	1EDI10I12M	CT	✓									✓				✓	✓	✓						
	4000/3500	120/115	1EDI20N12A	CT									✓	✓				✓	✓							
		125/120	1EDI20H12A	CT									✓	✓				✓		✓						
		300/300	1EDI20I12A	CT									✓	✓				✓	✓	✓						
			1EDI20I12M	CT	✓									✓				✓	✓	✓						
	4000/4000	80/80	1EDI30J12C	CT			✓		✓									✓				✓				
	5900/6200	300/300	1EDI30I12M	CT	✓									✓				✓	✓	✓						
	7500/6800	300/300	1EDI40I12A	CT									✓	✓				✓	✓	✓						
	SRC/2000	460/460	1EDI20I12SV*	CT				✓	✓				✓	✓		✓	✓	✓							✓	
	10000/9400	125/120	1EDI60H12A	CT									✓	✓				✓	✓	✓						
		300/300	1EDI60I12A	CT									✓	✓				✓	✓	✓						
600	160/240	215/140	IRS25752	JI														✓							✓	
	250/500	105/125	IR2117	JI														✓	✓						✓	✓
			IR2118	JI														✓	✓						✓	
		150/200	IR2127	JI		✓					✓		✓					✓	✓						✓	✓
			IR21271	JI		✓					✓		✓					✓	✓						✓	
			IR2128	JI		✓					✓		✓					✓	✓						✓	✓
	290/600	105/125	IRS211(7,8)	JI														✓	✓						✓	✓
		150/150	IRS2127	JI		✓					✓		✓					✓	✓						✓	✓
			IRS21271	JI		✓		✓			✓		✓					✓	✓						✓	
500	1600/3300	200/170	IR2125	JI		✓				✓	✓		✓					✓			✓			✓	
200	160/240	215/140	IRS20752	JI														✓							✓	
100	160/240	215/140	IRS10752	JI														✓							✓	

SRC = Turn on slew rate control   *New

Dual high-side gate driver IC

Typical connection

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Desaturation protection	Fault reporting	Fault reset	Separate pin for logic ground	Under-voltage lockout	DSO-36
1200	2000/2000	165/170	2ED020I12-F2	CT	✓	✓	✓	✓	✓	✓

High-side and low-side gate driver ICs

Typical connection

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Integrated bootstrap diode	Separate pin for logic ground	Shutdown	Under-voltage lockout	DSO-8	DSO-14	DSO-16 WB	DIP-8	DIP-14	VQFN-14	CHIP
					Features (see page 24)				Package (see page 25)						
1200	2000/2500	225/280	IR2213	JI		✓	✓	✓			✓		✓		✓
700	220/350	200/220	IR7106	JI				✓	✓						
600	200/350	200/220	IR2106	JI				✓	✓			✓			
			IR21064	JI		✓		✓		✓			✓		
			IR2301	JI				✓	✓			✓			
			IR25604	JI				✓	✓						
			IRS2301	JI				✓	✓						
	210/360	150/160	IR2101	JI				✓	✓			✓			✓
			IR2102	JI				✓	✓			✓			
	250/500	105/125	IR2112	JI			✓	✓			✓		✓		
	290/600	130/135	IRS2112	JI		✓	✓	✓			✓		✓		✓
		150/160	IRS2101	JI				✓	✓			✓			✓
		200/220	IRS2106	JI				✓	✓			✓			✓
			IRS21064	JI		✓		✓		✓			✓		
	360/700	400/420	2EDL05I06BF	SOI	✓			✓	✓						
	1900/2300	220/180	IRS2181	JI				✓	✓			✓			✓
			IR2181	JI				✓	✓			✓			
			IR21814	JI		✓		✓		✓			✓		
			IRS21814	JI		✓		✓		✓			✓	✓	
	2500/2500	94/120	IR2113	JI		✓	✓	✓		✓			✓		✓
		94/120	IR25607	JI		✓	✓	✓		✓					
		120/130	IRS2113	JI		✓	✓	✓		✓			✓	✓	✓
	4000/4000	170/170	IRS2186	JI				✓	✓			✓			✓
			IRS21864	JI		✓		✓		✓			✓		
			IRS21867	JI				✓	✓						
500	2500/2500	94/120	IR2110	JI		✓	✓	✓		✓			✓		
		120/130	IRS2110	JI		✓	✓	✓		✓			✓		✓
200	290/600	150/160	IRS2005	JI				✓	✓					✓	
	1000/1000	60/60	IRS2011	JI				✓	✓			✓			✓
		75/80	IR2011	JI				✓	✓			✓			
	3000/3000	65/95	IR2010	JI		✓	✓	✓		✓			✓		

Single low-side gate driver ICs

Typical connection

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Current sense	Enable	Error reporting with shutdown	Fault reporting	Over-current protection	Separate sink/source outputs	Under-voltage lockout	DIP-8	SOT23-5	SOT23-6	WSON-6
					Features (see page 24)							Package (see page 25)			
25	300/550	50/50	IR44252	NI							✓		✓		
	1500/1500	50/50	IRS44273	NI							✓		✓		
	1700/1500	50/50	IR44272	NI	✓						✓		✓		
			IR44273	NI							✓		✓		
20	4000/8000	19/19	1EDN(7,8)511B**	NI		✓				✓	✓			✓	
			1EDN7512*	NI		✓					✓			✓	✓
5	1600/3300	200/150	IR2121	NI	✓		✓	✓	✓		✓	✓			

*New   **Coming soon

Dual low-side gate driver ICs

Typical connection

Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Enable	Under-voltage lockout	DSO-8	DIP-8	WSON-8	TSSOP-8
					Features (see page 24)		Package (see page 25)			
25	2300/3300	50/50	IRS4426	NI			✓			
			IRS44262	NI		✓	✓			
			IRS4427	NI			✓	✓		
		65/85	IR25600	NI			✓	✓		
			IR442(6,7)	NI			✓	✓		
20	5000/5000	19/19	2EDN752(3,4)	NI	✓	✓	✓		✓	✓
			2EDN852(3,4)	NI	✓	✓	✓		✓	✓

Complementary: Current sense ICs

Typical connection
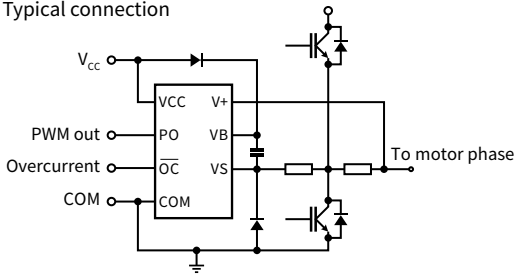
Voltage class [V]	Base PN	Technology	Features (see page 24)			Package (see page 25)			
			Current sense	Over-current protection	Separate pin for logic ground	DSO-8	DSO-16 WB	DIP-8	SOT23-5
1200	IR2277(1)	JI	✓	✓	✓		✓		
600	IR2172	JI		✓		✓		✓	
	IR2175	JI	✓	✓		✓		✓	
	IR2177(1)	JI	✓	✓	✓		✓		
	IR25750	JI		✓					✓

Complementary: High-voltage start-up IC

Typical connection
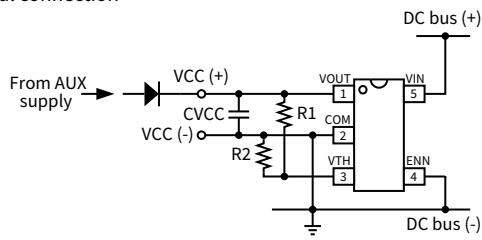
Voltage class [V]	Base PN	Technology	Features (see page 24)			Package (see page 25)
			Enable	High-voltage start-up	Over temperature shutdown	SOT23-5
480	IRS25751	JI	✓	✓	✓	✓

Complementary: Opto-isolated solid state relays

Typical connection

AC or DC

LOAD
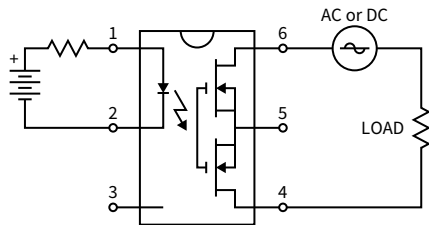
Microelectronic relays (MER) are power MOSFET or IGBT output photovoltaic relays where the output switch is controlled by radiation from a GaAlAs light emitting diode (LED) optically isolated from the output. MERs are a good choice to replace mechanical relays.

Load voltage [V]	Load current [mA]	$R_{DS(on)}$ [Ω]	Isolation voltage [V_{RMS}]	Base PN	Package (see page 25)							
					DIP-4-902	DIP-6	SM PDIP-6	DIP-8	SM DIP-8	DIP - 4	SM DIP-4	DIP-10
400	1000 AC/DC	---	3750	PVX6012	✓							
	140 AC/DC	27/7	4000	PVU414		✓	✓					
	120 AC/DC	35/9	4000	PVT412L	✓	✓						
	240 AC/DC	6/2	4000	PVT412A		✓	✓					
	140 AC/DC	27/7	4000	PVT412		✓	✓					
	120 AC/DC	35	4000	PVT422				✓	✓			
300	150 AC/DC	24	4000	PVA3354N						✓	✓	
				PVA3324N						✓	✓	
	50 AC/DC	160	4000	PVA3055N						✓	✓	
				PVA3054N						✓	✓	
250	170 AC/DC	15/4.25	4000	PVT312L		✓	✓					
	190 AC/DC	10/3	4000	PVT312		✓	✓					
	170 AC/DC	8	4000	PVT322A				✓	✓			
	170 AC/DC	10	4000	PVT322				✓	✓			
200	150 AC/DC	24	4000	PVA2352N						✓	✓	
150	550 AC/DC	0.7/0.25	4000	PVT212		✓	✓					
100	360 AC	5	1500	PVR130(0,1)								✓
	550 DC	1.5	4000	PVD1354N						✓	✓	
				PVD1352N						✓	✓	
	375 AC/DC	5	4000	PVA1354N						✓	✓	
				PVA1352N						✓	✓	
60	1500 DC	0.25	4000	PVDZ172N						✓	✓	
	1000 AC	0.5	4000	PVAZ172N						✓	✓	
	1000 AC/2000 DC	0.5/0.15	4000	PVG613*		✓	✓					
	2000 AC/4000 DC	0.1/0.035	4000	PVG612A		✓	✓					
	1000 AC/2000 DC	0.5/0.15	4000	PVG612		✓	✓					
20	2500 AC/4500 DC	0.1/0.04	4000	PVN013*		✓	✓					
	4000 AC/6000 DC	0.05/0.015	4000	PVN012A		✓	✓					
	2500 AC/4500 DC	0.1/0.04	4000	PVN012		✓	✓					

*10 nA leakage current

Complementary: Opto-isolated gate drivers/voltage sources

Typical connection

Anode (+) 2
Cathode (-) 3

(-) 8
DC
(+) 5
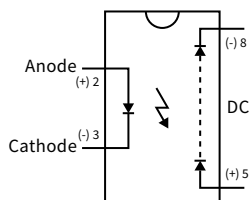
Photovoltaic isolators generate an electrically isolated DC voltage upon receipt of a DC input signal and are capable of directly driving MOSFET or IGBT gates. The output is controlled by radiation from a GaAlAs light emitting diode (LED) optically isolated from the output

Output voltage DC [V]	Short current [µA]	Nominal control current (DC) [mA]	Isolation voltage [V_{RMS}]	Base PN	Package (see page 25)			
					DIP-8	SM DIP-8	DIP - 4	SM DIP-4
5/10	10/5	5	5	PVI5033R	✓	✓		
3/6	2/1	5	5	PVI5013R	✓	✓		
5/10	10/5	10	10	PVI1050N	✓	✓		
5	8	10	10	PVI5080N			✓	✓
5	5	10	10	PVI5050N			✓	✓

Features

Addressing various application requirements, Infineon delivers solutions with an assortment of features intended to optimize performance, minimize size and reduce cost. Below is a table of additional gate driver IC features available in the current portfolio.

Feature	Benefits
Active Miller clamp	Protection against inadvertent dynamic turn-on because of parasitic effects
Brake chopper	Integrated brake IGBT driver with protection
Comparator	General purpose comparator included
Current amplifier	An independent opamp for current measurement or over-current detection
Current sense	Dedicated input detects over-current events
Dedicated JFET control	Optimized to drive SiC JFET
Desaturation protection	Protects the switch (IGBT) at short circuit
Enable	Dedicated pin terminates all outputs
Error reporting with shutdown	Pin indicates fault conditions and programs shutdown time
Fault reporting	Indicates an over-current or under-voltage shutdown has occurred
Fault reset	Dedicated pin resets the DESAT-FAULT-state of the chip
High-voltage start-up	Provides easy and fast circuit start-up while enabling low circuit standby losses
Integrated bootstrap diode	Integrated bootstrap reduces BOM
Over temperature shutdown	Internal over temperature protection circuit protects the IC against excessive power loss and overheating
Over-current protection	Ensures safe application operation in case of over-current
Programmable sead time	Dead time is programmable with external resistor for flexible design
Programmable shutdown	A shutdown feature has been designed into a pin
Self-oscillating	Integrated front end oscillator
Separate pin for logic ground	Dedicated pin or logic ground for improved noise immunity
Separate sink/source outputs	Simplifies gate resistor selection, reduces BOM, and improves dV/dt control
Shoot-through protection	Functionality such as deadtime and interlock
Shutdown	Dedicated pin disables the IC outputs
Soft over-current shutdown	Dedicated pin turns off the desaturated transistor, preventing over-voltages
Two-level turn-off	Lowers VCE overshoots at turn off during short circuits or over current events
Under-voltage lockout	Ensures safe application operation by avoiding unexpected driver behavior

Package options

Infineon offers a multitude of packages. Below is a list of gate driver IC package options which are currently available.

DSO-8	DSO-8 (300-mil)	DSO-14	DSO-16 (WB)	DSO-18	DSO-19
DSO-20	DSO-28	DSO-36	SOT23-5	SOT23-6	SSOP-24
TSSOP-8	TSSOP-28	WSON-6	WSON-8	VQFN-14	VQFN-28
VQFN-34	LCC-32	MQFP-64	DIP-4	SM DIP-4	DIP-6
SM DIP-6	DIP-8	SM DIP-8	DIP-14	DIP-4-902	DIP-10
CHIP					

New product highlights

The following segment features Infineon's latest gate driver IC families at a glance. Visit the family pages for more information.

IRS2890DS 600-V gate driver IC

600-V half-bridge driver IC with overcurrent protection
The new 600-V half-bridge driver IC is optimized for high-voltage motor drive applications in major home appliance applications requiring rigorous standards for reliability and quality.

Designers are constantly challenged with developing compact, energy-efficient solutions while maintaining a high level of reliability and ruggedness. The IRS2980DS is tailored for motor drive applications requiring over current protection and best-in-class default reporting accuracy in a small form-factor with high-voltage IC process to realize a compact, efficient and robust monolithic construction while integrating several features.

The IRS890DS achieves high-power density by integrating the bootstrap FET, under-voltage (UVLO) protection, shoot-through protection, overcurrent protection, fault reporting, and fault clear function. The overcurrent protection feature has an internal threshold of ±5 % for accurate reporting. Additionally, the IRS2890DS has V_s operational logic of -8 V and is tolerant to negative transient voltages. The IRS28990DS is offered in fourteen-pin SOIC and requires the use of less pins then comparable parts on the market.
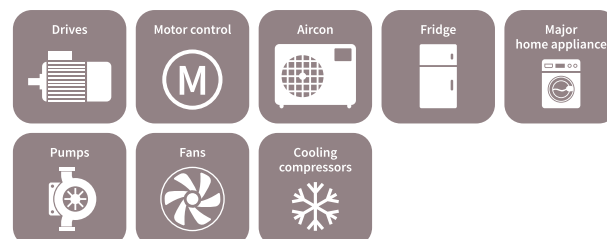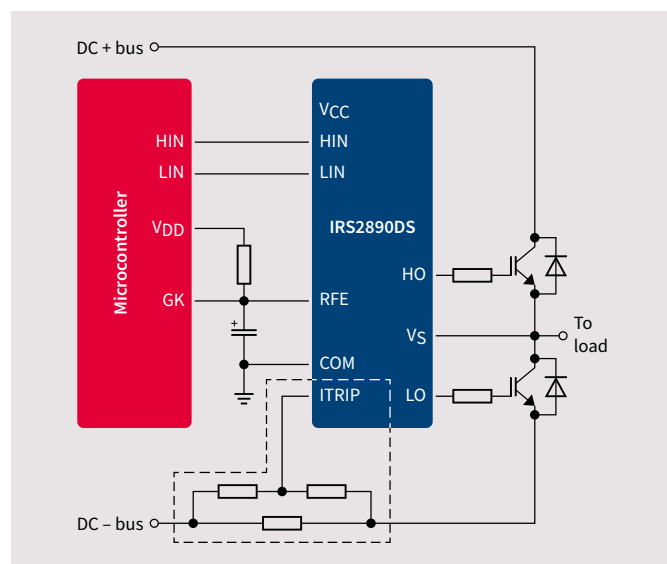
For more information visit www.infineon.com/IRS2890DS

IRS200x 200-V gate driver family

Now including IRS2008

Infineon offers 200-V half-bridge and high- and low-side driver ICs tailored for low-voltage (24 V, 36 V, and 48 V) and mid-voltage (60 V, 80 V, and 100 V) motor drive applications.

The IRS200x family utilizes our advanced high-voltage IC process to realize a compact, efficient, and robust monolithic construction.

The IRS200x family consists of seven devices with a typical output sink current of 600 mA and typical output source current of 290 mA. The 200 V devices are 3.3, 5 and 15 V logic compatible. V_{CC} under-voltage lockout (UVLO) protection is a standard feature provided across the family while IRS2008 and IRS2005 also include V_{BS} UVLO

protection. Additionally, the IRS2008 has V_s operational logic of -8 V. The IRS2008, IRS2004, and IRS2003 include integrated deadtime and shoot-through protection. The 200 V devices feature low quiescent currents. IRS2008 and IRS2004 also features a shutdown input pin.

The 200 V devices are offered in eight-pin SOIC, eight-pin DIP or fourteen-pin 4 x 4 mm MLPQ packages with various logic input options and standard pin-out configurations for high design flexibility and fast time-to-market.
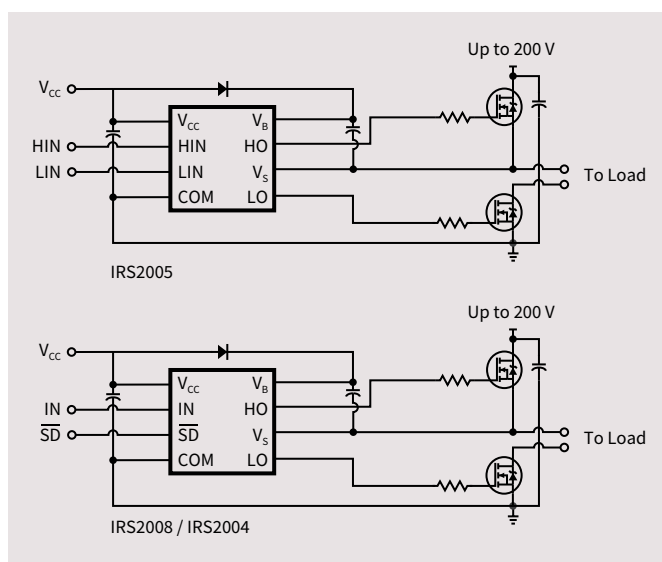
For more information visit www.infineon.com/200VHVIC

2EDL EiceDRIVER™ compact

600-V half-bridge gate driver ICs with integrated bootstrap diode
The new 2EDL EiceDRIVER™ Compact high-voltage gate driver family meets the ever-growing need for higher application efficiency and smaller form factors in consumer electronics and home appliances. It is optimized for the switching behavior and power losses of today's power supplies using IGBT and MOSFETs with dramatically reduced gate charges such as the latest generation of Infineon's CoolMOS™. With a monolithically integrated ultrafast low-ohmic bootstrap diode, the 2EDL Compact sets the benchmark for driver ICs needed in applications with more than 2 A output currents.

The 2EDL Compact family comprises seven 600 V drivers with output currents of 0.5 A and 2.3 A in DSO-8 and DSO-14 150 mil packages for applications based on IGBT or MOSFET switches:

› The 2EDL05I06BF in DSO-8, optimized for IGBTs, comes without interlock or dead time. It is ideal for switched reluctance motor drives and two-transistor forward switched-mode power supply topologies.
› The 2EDL05I06PF in DSO-8 and the 2EDL05I06PJ in DSO-14 are optimized for IGBTs and include interlock and dead time. They are recommended for applications such as fans, pumps, major home appliances, power tools, and general purpose inverters. The DSO-14 version is recommended for industrial applications with higher creepage distance requirements.

› The 2EDL05N06PF in DSO-8 and the 2EDL05N06PJ in DSO-14 boast the same features as the IGBT driver versions and an under-voltage lockout adapted for MOSFETs. They are recommended for servers and telecommunications equipment, low-voltage drives, e-bikes, battery chargers, and half-bridge-based switched-mode power supply applications.
› The 2EDL23I06PJ and 2EDL23N06PJ are 2.3 A half-bridge driver ICs in DSO-14 with interlock, dead time, fault enable, and overcurrent protection. The 2EDL23I06PJ for IGBTs is ideal for applications such as multi-oven IH cookers, fans, pumps, and drives. The 2EDL23N06PJ for MOSFETs is best suited for switched-mode power supplies, servers and telecommunications equipment, e-scooters, forklifts, and battery chargers.
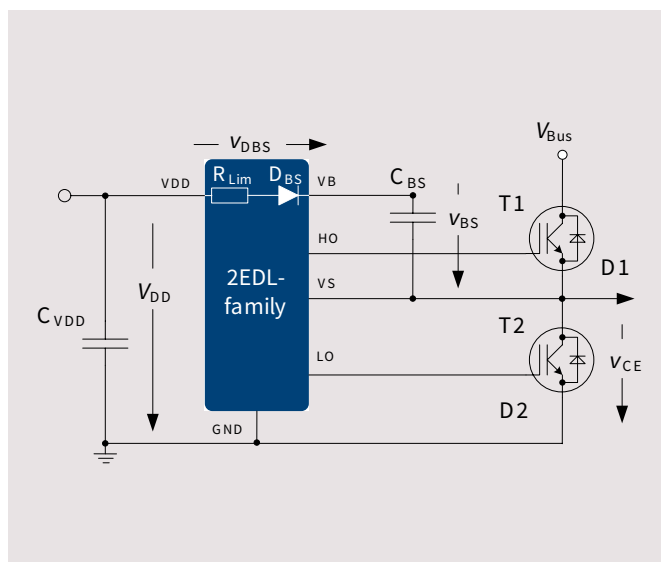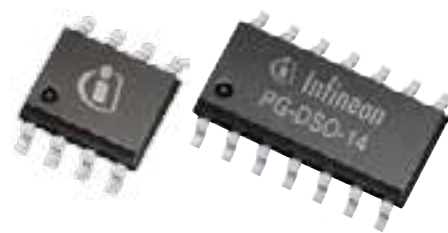
For more information visit www.infineon.com/eicedriver-compact

1EDI20I12SV EiceDRIVER™

1200-V single-channel driver IC with dynamic slew-rate control

The new 1EDI20I12SV EiceDRIVER™ serves the latest generation of highly efficient low-EMI electric drive systems with a variety of advanced features. It is the first driver on the market with dynamic slew-rate control (SRC) that allows on-the-fly dV/dT control of electric drives through precise gate current control, providing for the best tradeoff between minimum power dissipation and minimum EMI depending on operating conditions such as high and low load.

The driver also includes desaturation protection for IGBTs and overcurrent protection for sense IGBTs via the fault status output pin. Two ready-state output pins indicate proper driver power supply and normal operation. Two-level turn-off with adjustable timing and voltage protects against excessive overvoltage in case of the IGBT operating at overcurrent or a short circuit. To turn on the IGBT, the driver works as an adjustable current source in conjunction with an external PMOS transistors and a sense resistor. To turn off the IGBT, the driver uses a 2 A MOSFET output stage.

The 1EDI20I12SV is tailored for industrial drive applications using 1200 V power modules for currents up to 900 A, such as the EconoDUAL™ 3 (up to 600 A). It is a single-channel IGBT driver IC based on Infineon's coreless transformer technology.

The driver meets today's long-term stability requirements for industrial applications. It is offered in a DSO-36 package with a package width of 300 mil. It is RoHS compliant, green, and halogen-free.

Features

› 1200- V single-channel IGBT driver IC
› Unique: precise dynamic gate current control
› Unique: selective short circuit protection for 3-level inverters
› Overcurrent protection for sense IGBTs and conventional IGBTs
› Protection: DESAT, soft turn-off or two-level turn-off

Benefits

› Low EMI during low load conditions and high efficiency during high load conditions
› Reduction or elimination of dV/dT filter
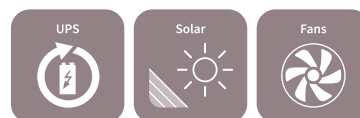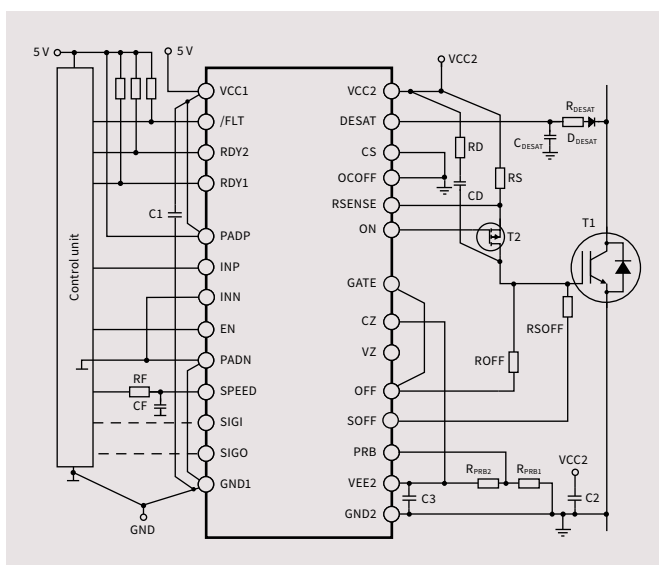
1EDI EiceDRIVER™ compact 150-mil and 300-mil

1200-V galvanically isolated single-channel wide body gate driver IC family
Our new 1EDI EiceDRIVER™ Compact family complements our extensive range of high-voltage driver ICs for a market that demands easy-to-use drivers with a small footprint for quick design-in cycles. The driver family is based on Infineon's coreless transformer technology, enabling a benchmark-setting minimum common mode transient immunity (CMTI) of 100 kV/µs with drive strengths of up to 6 A. They are ideal for IGBT-based applications such as photovoltaic string inverters, charge stations for electric vehicles, industrial drives, welding equipment, induction heating appliances and power supplies for servers and telecommunication systems

Features
› Single-channel isolated high-voltage gate driver IC
› 12 V input-to-output isolation voltage
› Drives high-voltage power MOSFETs and IGBTs
› Up to 6 A minimum peak rail-to-rail output
› Separate source and sink outputs or active Miller clamp
› DSO-8 300-mil-wide body package option with 8-mm creepage distance

Benefits
› Best-in-class common mode transient immunity (CMTI): 100 kV/µs
› Wide input operating range (3…17 V)
› No voltage/signal adaptation between µC and driver necessary
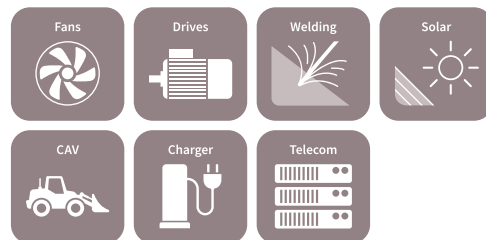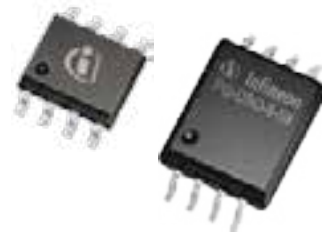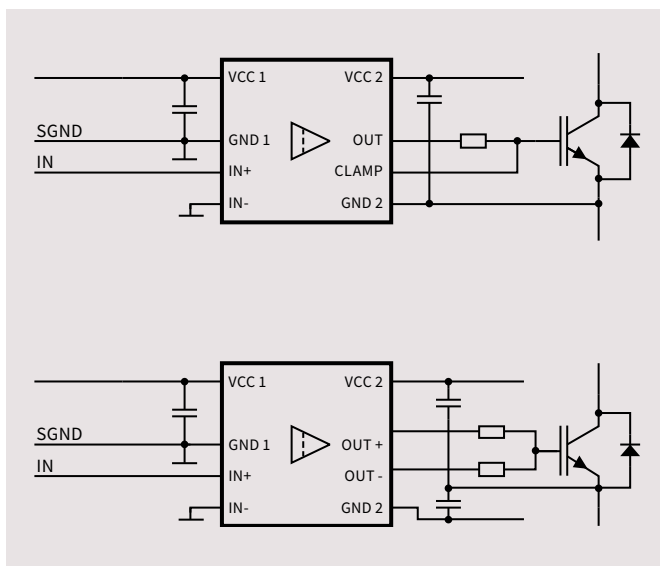
For more information visit www.infineon.com/300mill and www.infineon.com/eicedriver-compact

1EDN and 2EDN EiceDRIVER™ families

## Rugged, cool and fast, 1-channel low-side 4/8 A gate driver ICs

1-channel (1EDN) and 2-channel (2EDN) MOSFET gate driver ICs are the crucial link between control ICs and powerful MOSFET and GaN switching devices. Gate driver ICs enable high system level efficiencies, excellent power density and consistent system robustness.

Fast, precise, strong and compatible

› Highly efficient SMPS enabled by 5 ns short slew rates and ±5 ns propagation delay precision for fast MOSFET and GaN switching

› Separate source and sink outputs simplify the application design

› Industry standard packages and pin-out ease system design upgrades

The new reference in ruggedness and low power dissipation

› -10 V robustness of control and enable inputs provides crucial safety margin when driving pulse transformers

› 5 A reverse output current robustness eliminates the need for Schottky switching diodes when driving MOSFETs in T0-220 and T0-247 packages

› Cool driver ICs from true rail-to-rail low impedance output stages

› 4 V and 8 V UVLO (under-voltage lockout) options for instant MOSFET protection during start-up and under abnormal conditions
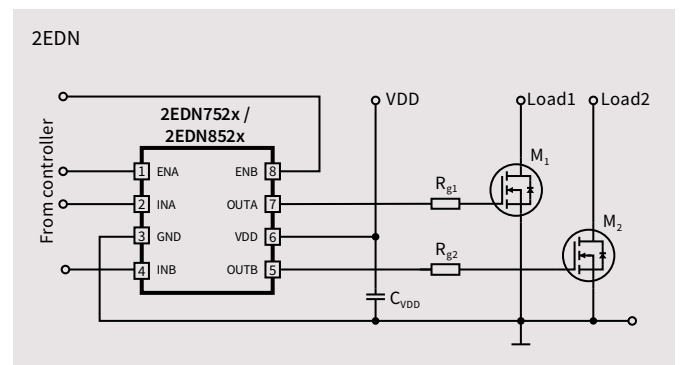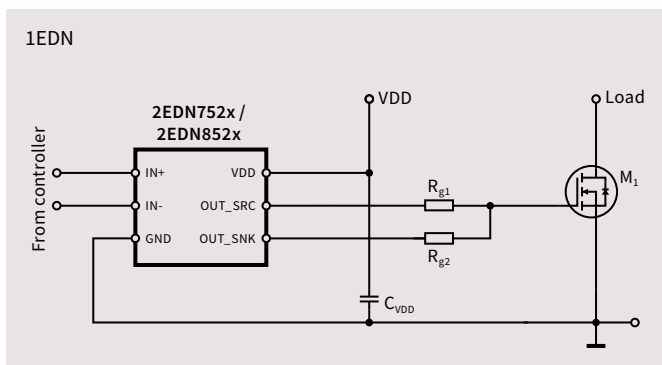
For more information visit www.infineon.com/1edn

For more information visit www.infineon.com/2edn
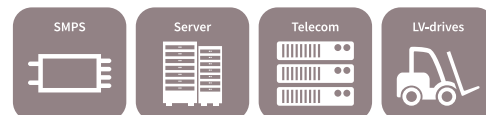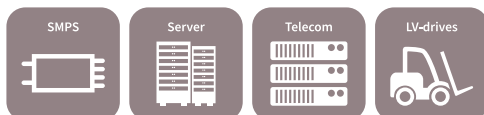
Infineon's powerful gate driver IC support
Useful links and helpful tools

Gate driver IC selection tool

To simplify the gate driver selection process, Infineon offers an online easy-to-use gate driver selection tool.
By selecting a few key parameters, the tool quickly guides you in finding the right driver for your application.

Gate driver selection criteria	or	Driver selection based on switch criteria
1 Driver current		1 Switch type
2 Voltage class		2 Voltage class
3 Switchiny frequency		3 Gate resistance
4 Driver configuration		
5 Isolation requirement		
6 Qualification level		
7 Package		

Start exploring today!
Visit: www.infineon.com/driver-finder

Infineon Designer

Select gate driver prototypes are available on **www.infineon.com/ifxdesigner**. Infineon Designer is an online prototyping engine combining analog and digital simulation functionalities in an Internet application. Requiring a web browser only, it is a perfect match for supporting customers in selecting the right product for a defined application.

Gate driver IC evaluation boards

EiceDRIVER™ evaluation boards are available on **www.infineon.com/tool**. The boards enable fast evaluation, prototyping and system design by demonstrating key characteristics and benefits of Infineon gate driver ICs.

Evaluation board

EVAL-6EDL04I06PT
Single EiceDRIVER™ with six 600 V Trenchstop™ Infineon IGBTs in full-bridge configuration

EVAL-6EDL04N02PR
Single EiceDRIVER™ with six 80 V OptiMOS™ Infineon MOSFETs in full-bridge configuration

EVAL-2EDL23I06PJ
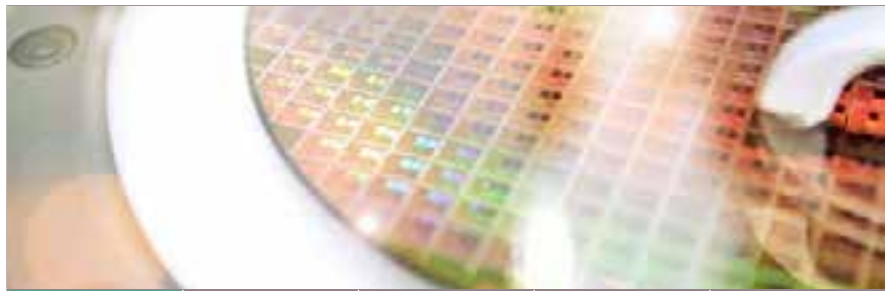Single EiceDRIVER™ with two 600 V Infineon IGBTs in half-bridge configuration

EVAL-2EDL23N06PJ
Single EiceDRIVER™ with two 600 V Infineon COOLMOS™ MOSFETs in half-bridge configuration

Featured gate driver

ED-C Compact

6EDL04I06PT
LS-SOI 600 V three-phase gate driver IC with ultra-fast bootstrap diode and integrated protective features (interlock, over-current protection, fault reporting, and under-voltage lock out)

ED-C Compact

6EDL04N02PR
LS-SOI 200 V three-phase gate driver IC with ultra-fast bootstrap diode and integrated protective features (interlock, over-current protection, fault reporting, and under-voltage lock out)

ED-C Compact

2EDL23I06PJ
LS-SOI 600 V half-bridge gate driver IC with ultra-fast bootstrap diode and integrated protective features (interlock, over-current protection, fault reporting, and under-voltage lockout)

ED-C Compact

2EDL23N06PJ
LS-SOI 600 V half-bridge gate driver IC with ultra-fast bootstrap diode and integrated protective features (interlock, over-current protection, fault reporting, and under-voltage lockout)

Evaluation board

EVAL-1EDI60I12AF
Two EiceDRIVER™s with two 600 V TRENCHSTOP™ Infineon IGBTs in half-bridge configuration

EVAL-1ED020I12-BT
Two EiceDRIVER™s with two 1200 V Infineon IGBTs in half-bridge configuration

EVAL-1ED020I12-B2
Two EiceDRIVER™s with two 1200 V Infineon IGBT modules

Featured gate driver

ED-C Compact

1EDI60I12AF
Galvanically isolated CT 1200 V single-channel gate driver IC for high-voltage power IGBTs

ED-E Enhanced

1ED020I12-BT
Galvanically isolated CT 1200 V single-channel gate driver IC for high-voltage power IGBTs with integrated protective features (desaturation detection, two-level turn-off, active Miller clamping)

ED-E Enhanced

1ED020I12-B2
Galvanically isolated CT 1200 V single-channel gate driver IC for high-voltage power IGBTs with integrated protective features (desaturation detection, two-level turn-off, active Miller clamping)

Contact your local Infineon sales team for evaluation board availability information.

Gate driver IC chips for multi-chip packages

Infineon offers gate driver IC chips to address the on-going trend of integrating the driver, power stages, controllers and other components into a smaller, more efficient single package.

Driver configuration	Voltage class [V]	I_{O+}/I_{O-} typ [mA]	Typ. prop. delay: off/on [ns]	Base PN	Technology	Current amplifier	Current sense	Enable	Fault reporting	Integrated bootstrap diode	Over-current protection	Programmable shutdown	Self-oscillating	Separate pin for logic ground	Shoot-through protection	Shutdown	Under-voltage lockout	Chip
Single high-side	600	250/500	105/250	IR2117	JI												✓	✓
		250/500	150/200	IR2127	JI		✓		✓		✓					✓	✓	✓
			150/200	IR2128	JI		✓		✓		✓						✓	✓
		290/600	105/125	IRS211(7,8)	JI											✓	✓	✓
			150/150	IRS2127	JI		✓		✓		✓						✓	✓
High-side and low-side	1200	2000/2500	225/280	IR2213	JI									✓			✓	✓
	600	210/360	150/160	IR2101	JI												✓	✓
		290/600	130/135	IRS2112	JI									✓		✓	✓	✓
			150/160	IRS2101	JI											✓	✓	✓
			200/220	IRS2106	JI												✓	✓
		1900/2300	220/180	IRS2181	JI											✓	✓	✓
		2500/2500	94/120	IR2113	JI									✓			✓	✓
			120/130	IRS2113	JI									✓		✓	✓	✓
		4000/4000	170/170	IRS2186	JI												✓	✓
	500	2500/2500	120/130	IRS2110	JI									✓			✓	✓
	200	1000/1000	60/60	IRS2011	JI												✓	✓
		3000/3000	65/95	IR2010	JI									✓			✓	✓
Half-bridge	600	180/260	na	IR21531	JI							✓	✓		✓	✓	✓	✓
		180/260	na	IRS2153(1)D	JI							✓	✓		✓	✓	✓	✓
		290/600	150/150	IRS2304	JI									✓			✓	✓
			150/680	IRS2103	JI									✓			✓	✓
			150/680	IRS2104	JI									✓	✓		✓	✓
			150/750	IRS2111	JI									✓			✓	✓
			200/220	IRS2108	JI									✓			✓	✓
			200/220	IRS2308	JI									✓			✓	✓
			200/750	IRS2109	JI									✓	✓		✓	✓
		1900/2300	220/180	IRS2183	JI									✓			✓	✓
			270/680	IRS2184	JI									✓	✓		✓	✓
Three-phase	1200	250/500	700/750	IR2233	JI	✓			✓		✓				✓		✓	✓
	600	165/375	490/530	6ED003L06-F2	SOI		✓	✓			✓				✓		✓	✓
			490/530	6EDL04I06(N,P)	SOI		✓	✓	✓		✓				✓		✓	✓
			530/530	6EDL04N06P	SOI		✓	✓	✓		✓				✓		✓	✓
		200/350	400/425	IR2136	JI			✓	✓		✓				✓		✓	✓
			400/425	IR21363	JI			✓	✓		✓				✓		✓	✓
			400/425	IR21368	JI			✓	✓		✓				✓		✓	✓
			530/500	IR21364	JI			✓	✓		✓				✓		✓	✓
			530/530	IRS2336D	JI			✓	✓	✓	✓				✓		✓	✓
			530/530	IRS23364D	JI			✓	✓	✓	✓				✓		✓	✓
		250/500	425/675	IR213(0,2)	JI	✓			✓		✓				✓		✓	✓
			700/750	IR2135	JI	✓			✓		✓				✓	✓	✓	✓

Features (see page 24)

Notes

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