

NON-ISOLATED DC/DC CONVERTERS

5.5 Vdc - 13.2 Vdc Input

0.6 Vdc - 5.5 Vdc / 3 A Output

May. 12, 2016

Bel Power Inc., a subsidiary of Bel Fuse Inc.

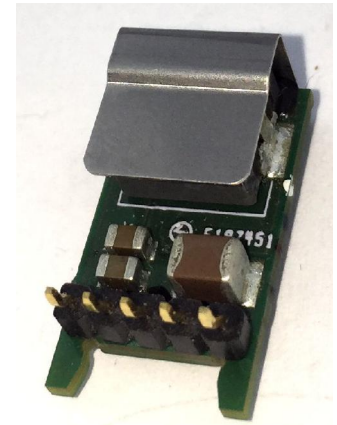
SRPE-03E1A0

RoHS Compliant

Rev.J

Features

- Non-Isolated
- High Efficiency
- Fixed Frequency
- Low Cost
- Wide Input
- Class 2, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592B)
- Under-Voltage Lockout
- Wide Trim
- OCP/SCP
- Remote On/Off



Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel SRPE-03E1A0 is part of the non-isolated dc/dc converter Power Module series. The modules use a SMD package. These converters are available in a range of output voltages from 0.6 Vdc to 5.5 Vdc over a wide range of input voltage ($V_{IN} = 5.5 \text{ Vdc} - 13.2 \text{ Vdc}$). The efficiency is typically 92% at 3.3 Vout ($V_{in}=12 \text{ Vdc}$) at full load.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number
0.6 V - 5.5 V	5.5 V - 13.2 V	3A	16.5 W	92%	SRPE-03E1A0

Notes: 1. Add "G" suffix at the end of the model numbers listed above to indicate "Tray Packaging".

Ordering Part Number

S R PE - 03 E 1A 0 x
1 2 3 4 5 6 7 8

- 1---Mounting type,
- 2---RoHS Status,
- 3---Series name,
- 4---Output power,
- 5---Input range,
- 6---Output voltage,
- 7---Active logic and HSK feature,
- 8---Package type,

- S** –Surface mount
- R** – RoHS 6
- PE** –SMD Series name
- 03** – 16.5W output
- E** – 5.5-13.2V input
- 1A** – 0.6-5.5V output
- 0** – active high, without HSK
- G** – Tray packaging

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Absolute Maximum Ratings

Parameter	Min	Typ	Max	Unit	Notes
Continuous non-operating Input Voltage	-0.3	-	15	V	All specification are typical at 25°C unless otherwise stated.
Remote On/Off	-0.3	-	15	V	
Ambient Temperature	0	-	50	°C	
Storage Temperature	-55	-	125	°C	
Altitude	-	-	2000	m	

Note: Use beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

Input Specifications

Parameter	Min	Typ	Max	Unit	Notes
Input Voltage	5.5	-	13.2	V	
Input Current (full load)	-	-	2.6	A	This power module is not internally fused. An input line fuse must always be used
Input Current (no load)	-	10	150	mA	
Remote Off Input Current	-	1	5	mA	
Input Reflected Ripple Current (rms)	-	5	15	mA	With simulated source impedance of 1000nH, 5Hz to 20MHz. Use a 1000uF/25V AL-Cap with ESR=0.03 ohm max and 2*100uF/25V Tan cap with ESR=0.013 ohm max, at 100KHz@25°C.
Input Reflected Ripple Current (pk-pk)	-	15	30	mA	
I ² t Inrush Current Transient	-	-	1	A ² s	
Turn-on Voltage Threshold	4.15	4.2	4.45	V	
Turn-off Voltage Threshold	3.7	4	4.2	V	

Note: All specifications are typical at 25 °C unless otherwise stated.

Output Specifications

Parameter	Min	Typ	Max	Unit	Notes	
Output Voltage Set Point	Vo, set ≥ 0.9Vdc	-2	-	2	%Vo,set	Setpoint test condition: Vin=12V, Iout=half load, Ta=25°C
	Vo, set < 0.9Vdc	-3	-	3	%Vo,set	
Load regulation	Vo ≥ 3.3 Vdc	-1.5	-	1.5	%Vo,set	Vin=12V, Io=0-3A, Ta=25°C .
	Vo < 3.3Vdc	-20	-	20	mV	
Line Regulation	Vo ≥ 3.3 Vdc	-1.5	-	1.5	%Vo,set	Vin=8-13.2V, Io=1.5A, Ta=25°C . Vin=5.5-13.2V, Io=1.5A, Ta=25°C .
	Vo < 3.3Vdc	-15	-	15	mV	
Regulation Over Temperature	-	0.8	-	%Vo,set		
Output Ripple and Noise (pk-pk)	-	20	50	mV	0-20MHz BW, with 360µF ceramic capacitor at output.	
Output Ripple and Noise (rms)	-	5	20	mV		
Output Current Range	0	-	3	A		
Output DC Current Limit	3.5	4	6	A		
Output Short-Circuit Current (Vo ≤ 20mV)(Hiccup Mode)	-	-	2	Adc		
Rise time	-	2	2.5	ms		
Turn On Time	-	3	5	ms		
Overshoot at Turn on	-	0	3.5	%		
Output Capacitance	200	-	1000	uF		

Transient Response

ΔV50%~100% of Max Load	Overshoot	-	30	60	mV	di/dt=0.25A/us, Vin=12Vdc, Ta=25°C, with 360µF ceramic capacitor at output.
	Settling Time	-	20	50	us	
ΔV100%~50% of Max Load	Overshoot	-	30	60	mV	
	Settling Time	-	20	50	us	

Note: All specifications are typical at 25 °C unless otherwise stated.

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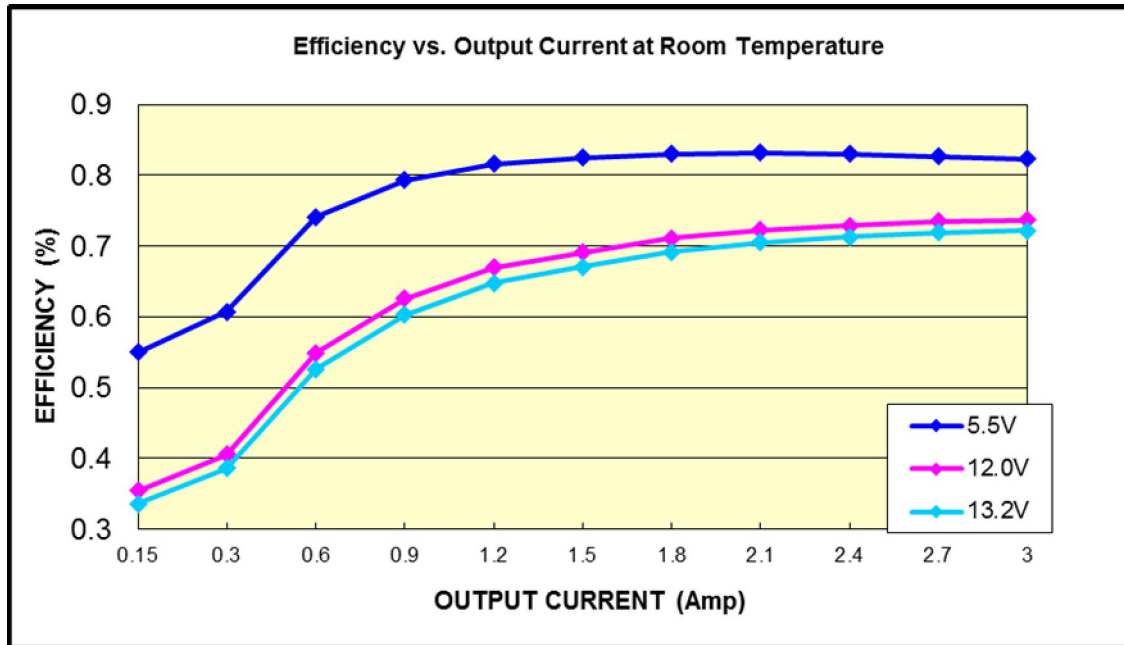
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General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Efficiency 5.5V 3.3V 0.6V	92 90 72	94 92 74		%	The efficiency is measured at Vin=12V, full load and Ta=25°C.
Switching Frequency	-	650	-	kHz	
Output Voltage Trim Range(Wide Trim)	0.6	-	5.5	V	This voltage is achieved by trimming up output slowly.
Weight	-	2.5	-	g	
FIT	16.8			-	Calculated Telcordia SR-332, Issue 2 (Vin=12 V, Vo=5.5V, Io=12A, Ta = 40C, no forced air, 90% confidence Level FIT=10 ⁹ /MTBF)
Dimensions Inches (L × W × H) Millimeters (L × W × H)	0.41 x 0.65 x 0.339 10.41 x 16.51 x 8.60			-	

Note: All specifications are typical at 25 °C unless otherwise stated.

Efficiency Data



Vout: 0.6V

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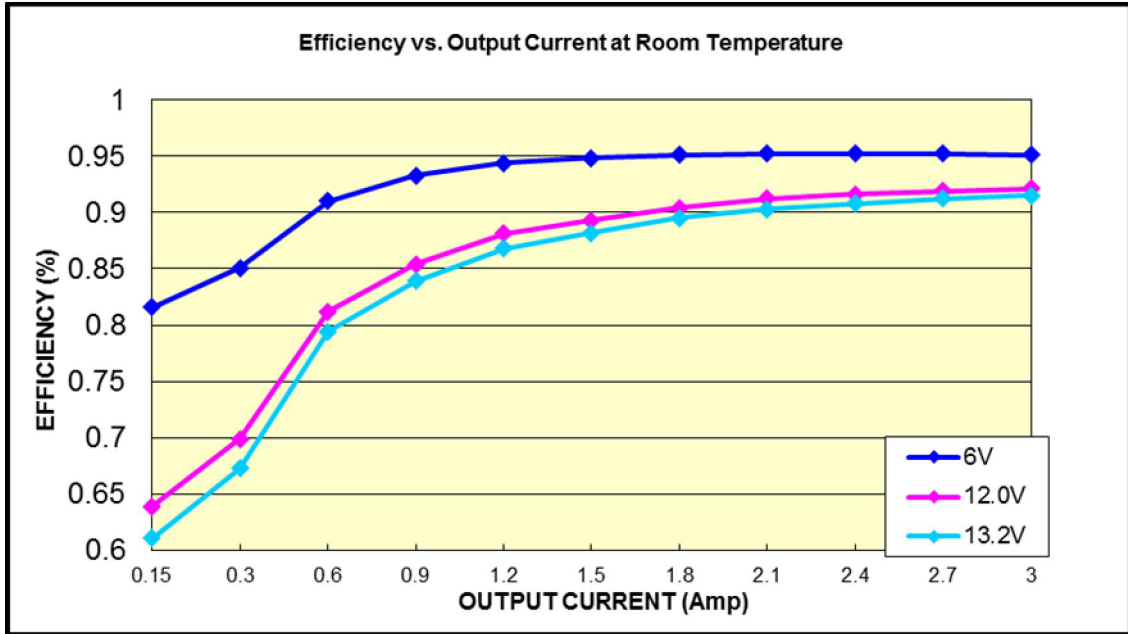
0.6 Vdc - 5.5 Vdc / 3 A Output



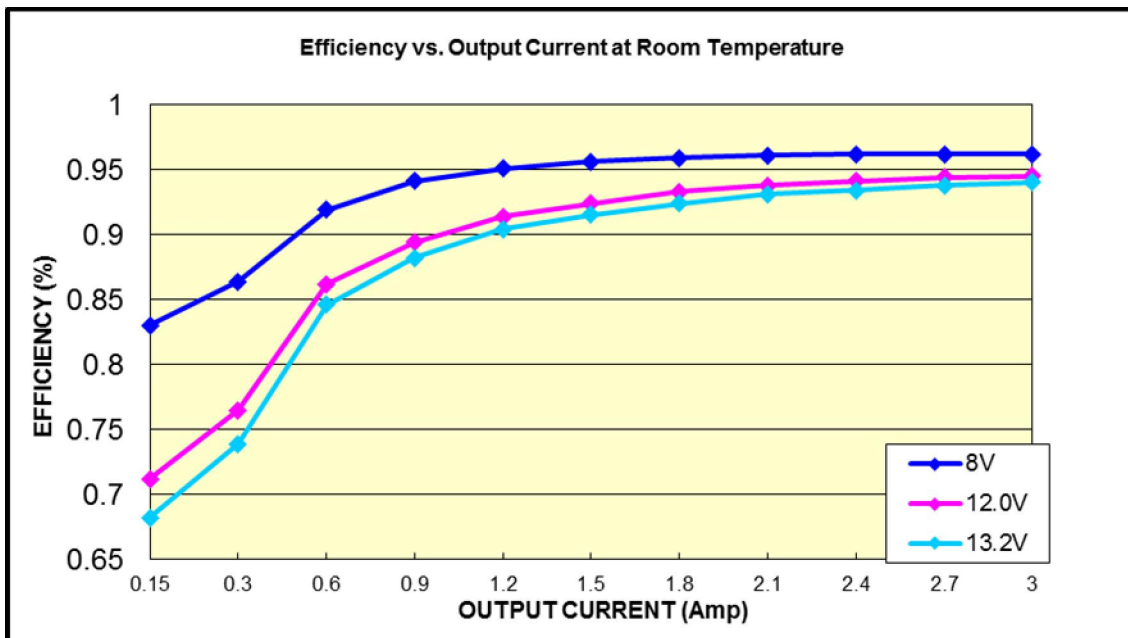
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Efficiency Data (continued)



Vout: 3.3V



Vout: 5.5V

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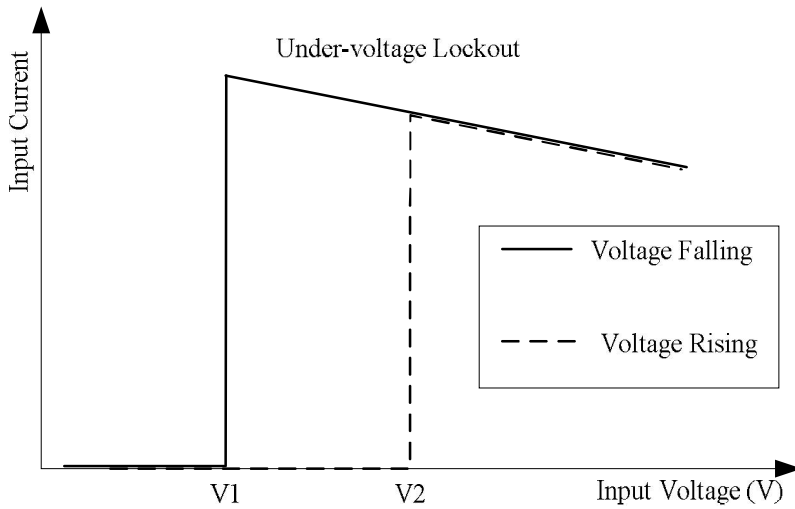
0.6 Vdc - 5.5 Vdc / 3 A Output



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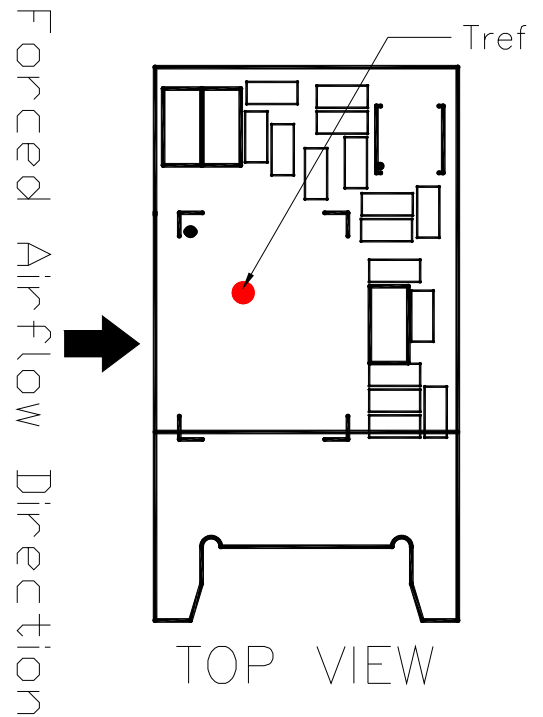
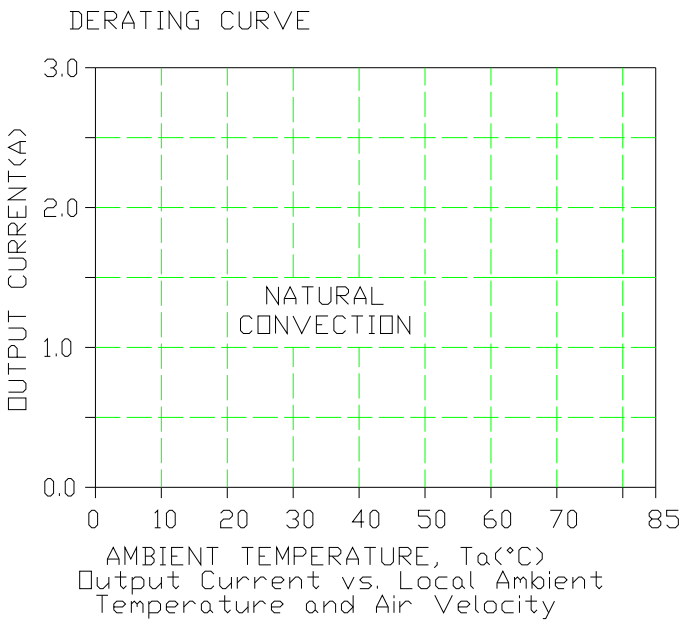
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Input under-voltage lockout



V1=4V
V2=4.15V

Thermal Derating Curves



Vin=12V, with maximum junction temperature of semiconductors derated to 115C

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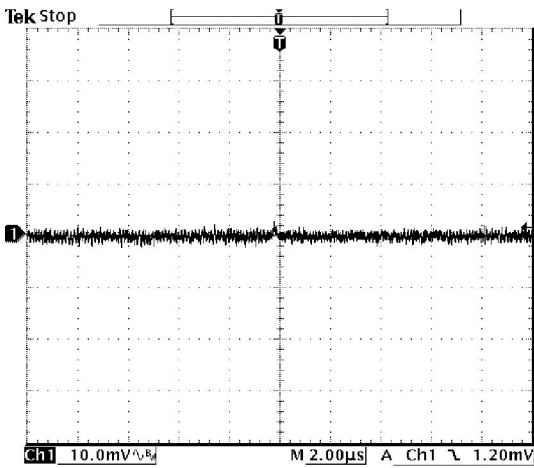
0.6 Vdc - 5.5 Vdc / 3 A Output



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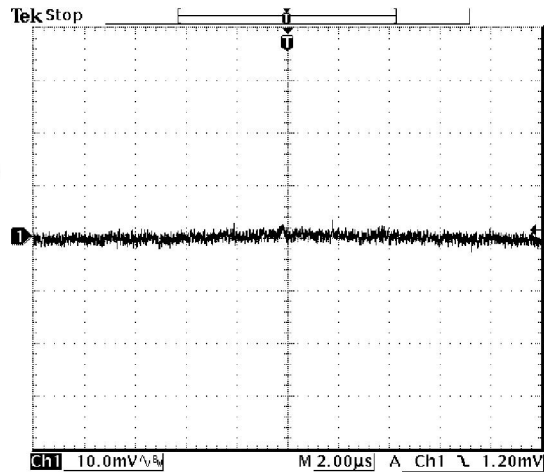
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Ripple and Noise Waveform



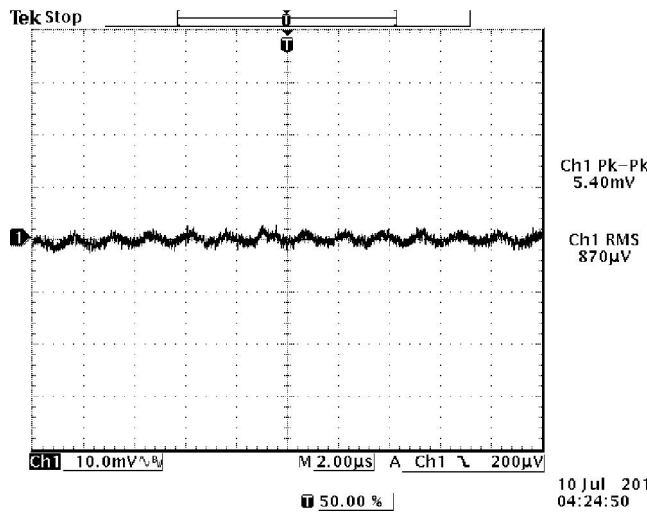
Ripple and noise at full load, 12V input, 0.6V output and Ta=25 degC

10 Jul 2015 13:09:54



Ripple and noise at full load, 12V input, 3.3V output and Ta=25 degC

10 Jul 2015 08:29:09



Ripple and noise at full load, 12V input, 5.5V output and Ta=25 degC

10 Jul 2015 04:24:50

Note: Test condition of the output ripple and noise: 0-20MHz BW, with 360uF ceramic cap at output

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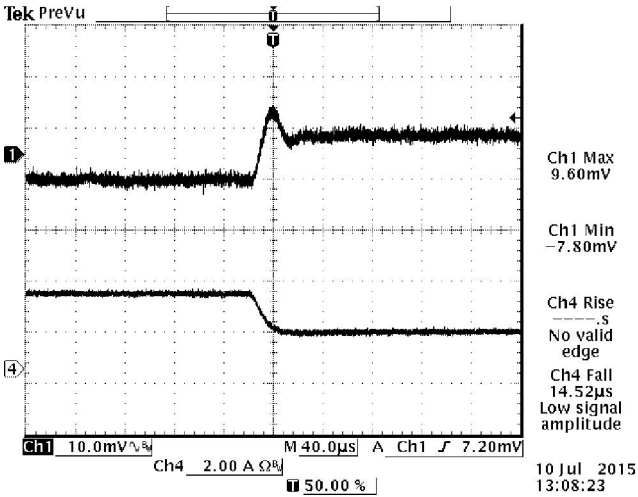
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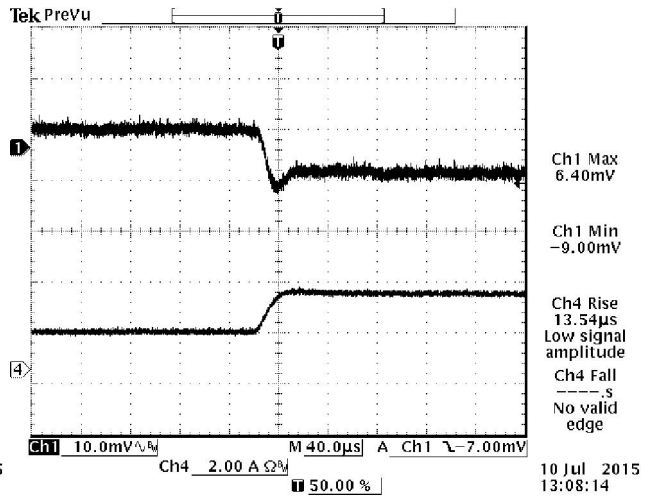
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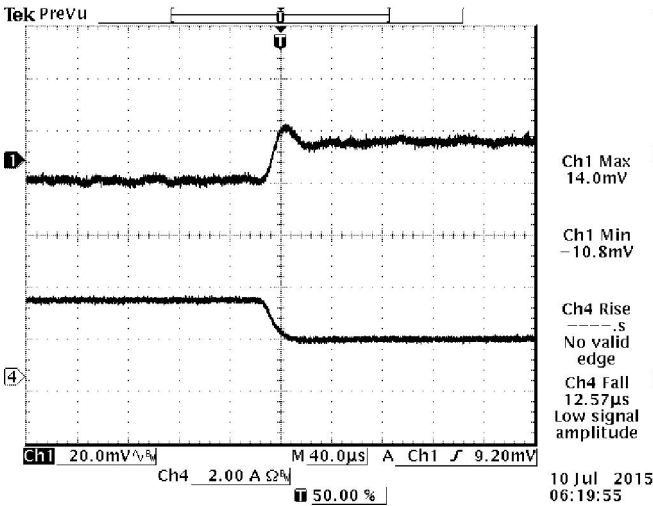
Transient Response Waveforms



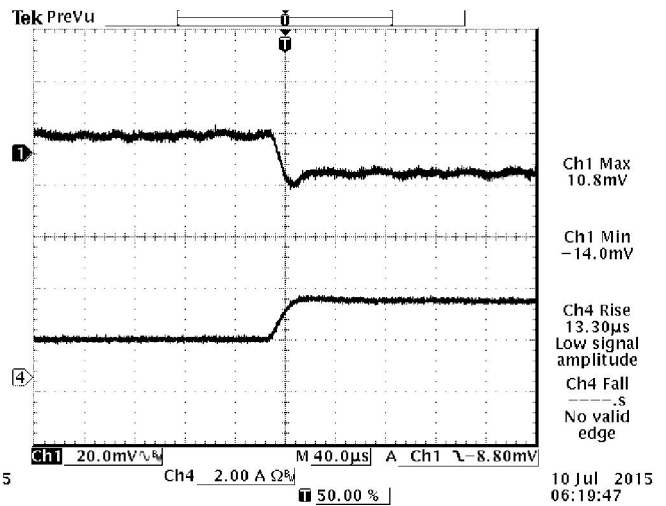
100%-50% Load Transients at $V_{in}=12V$, $V_{out}=0.6V@T_a=25^\circ C$



50%-100% Load Transients at $V_{in}=12V$, $V_{out}=0.6V@T_a=25^\circ C$



100%-50% Load Transients at $V_{in}=12V$, $V_{out}=3.3V@T_a=25^\circ C$



50%-100% Load Transients at $V_{in}=12V$, $V_{out}=3.3V@T_a=25^\circ C$

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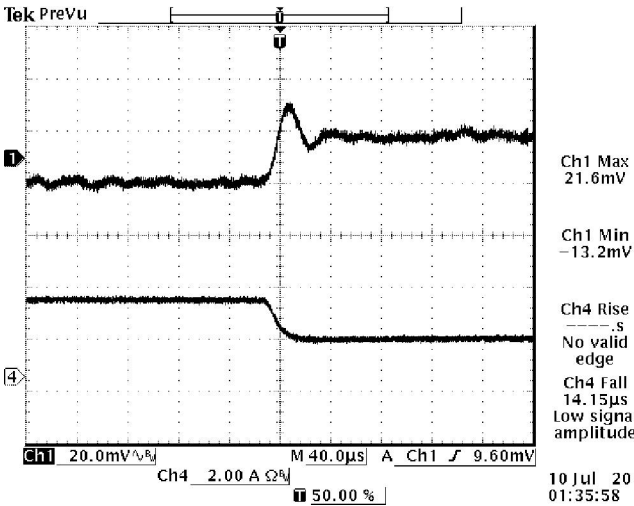
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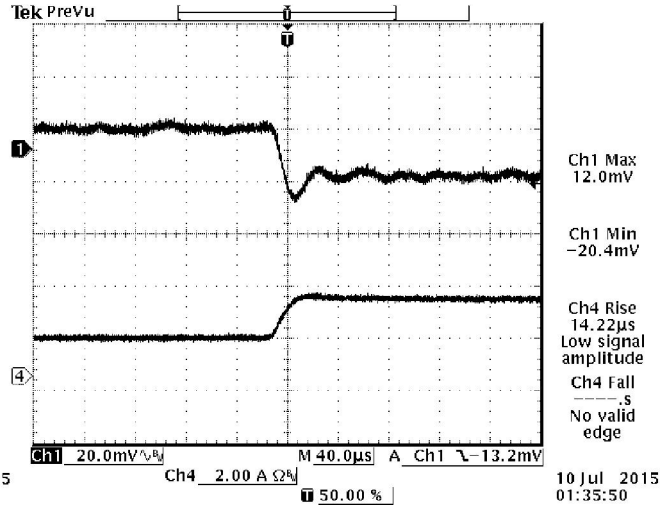
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Transient Response Waveforms (continued)



100%-50% Load Transients at $V_{in}=12V$,
 $V_{out}=5.5V@T_a=25^\circ C$



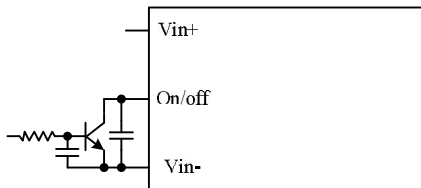
50%-100% Load Transients at $V_{in}=12V$,
 $V_{out}=5.5V@T_a=25^\circ C$

Note: Test condition of the transient response: $di/dt=0.25A/\mu S$, with 360uF ceramic cap at output

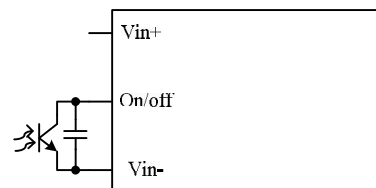
Remote On/Off

Parameter		Min	Typ	Max	Notes
Signal Low (Unit Off)	Active High	-0.3 V	-	0.8V	Remote On/Off pin is open, the module is off.
Signal High (Unit On)		2.4 V	-	18 V	

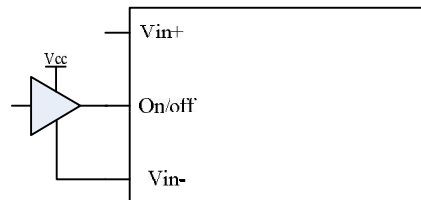
Recommended remote on/off circuit for active high



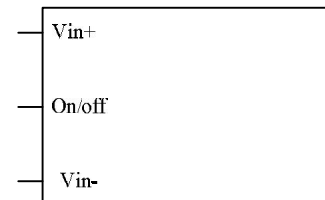
Control with open collector/drain circuit



Control with photocoupler circuit



Control with logic circuit



Permanently off

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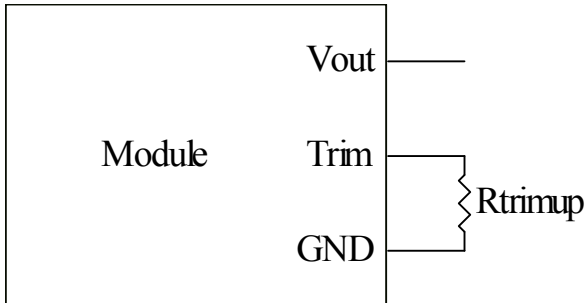


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Trim

Trim up circuit (using an external resistor)

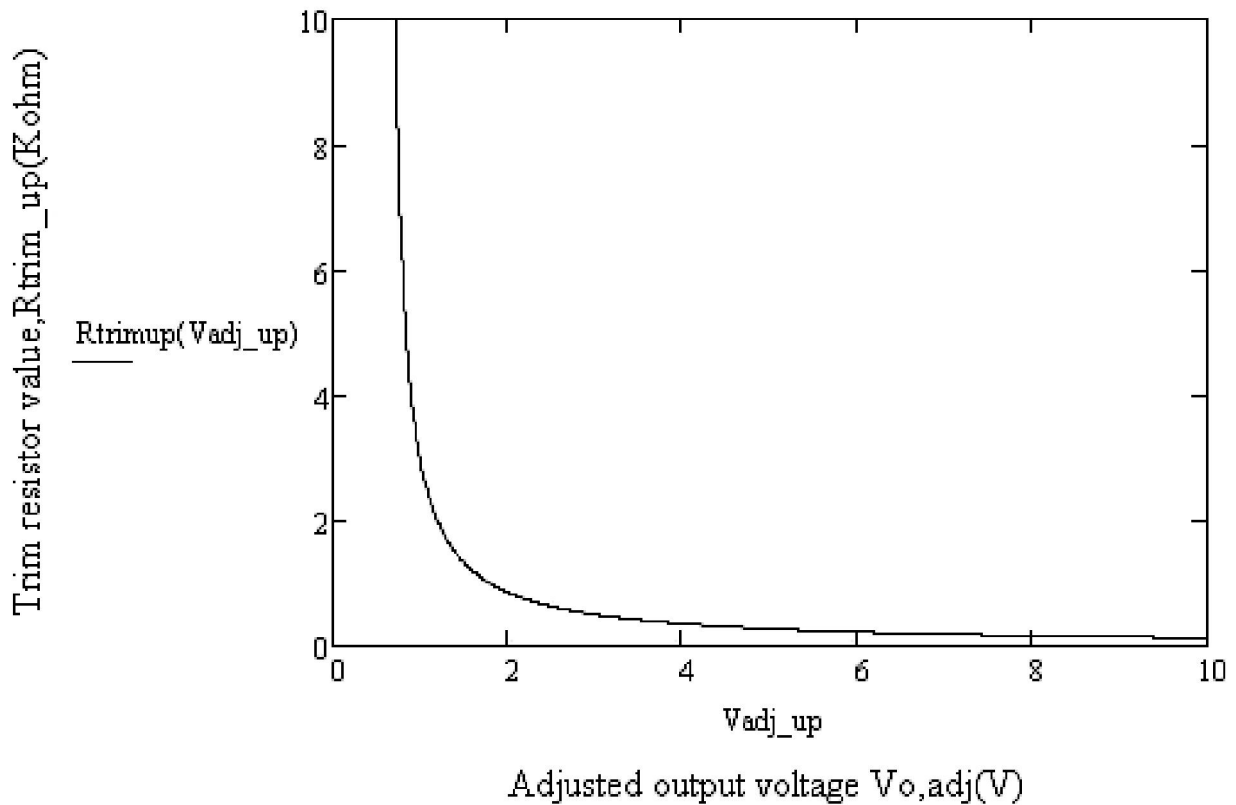


$$R_{trim} = \frac{1.2}{V_o - 0.6} k\Omega$$

V_o is the desired output voltage

R_{trim} is the required resistance between TRIM and GND

SRPE-03E1A0 Trim up Resistor Calculate



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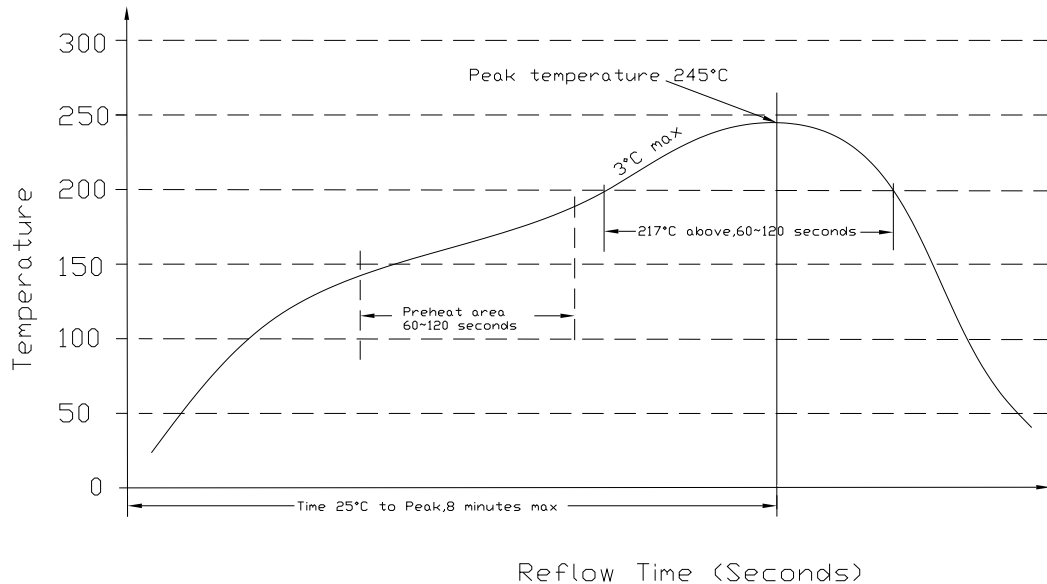


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Soldering Information

The SRPE-03E1A0G modules are designed to be compatible with a Paste-In-Hole assembly process. The suggested Pb-free solder paste is Sn/Ag/Cu(SAC). The recommended reflow profile using Sn/Ag/Cu solder is shown in the following. Recommended reflow peak temperature is 245°C while the part can withstand peak temperature of 260°C maximum for 10seconds. This profile should be used only as a guideline. Many other factors influence the success of SMT reflow soldering. Since your production environment may differ, please thoroughly review these guidelines with your process engineers.



MSL Rating

The SRPE-03E1A0G modules have a MSL rating of 3.

Storage and Handling

The SRPE-03E1A0G modules are designed to be compatible with J-STD-033 Rev:A (Handling, Packing, Shipping and Use of Moisture /Reflow Sensitive surface Mount devices). Moisture barrier bags (MBB) with desiccant are applied. The recommended storage environment and handling procedure is detailed in J-STD-033.

Pre-baking

This component has been designed, handled, and packaged ready for pb-free reflow soldering. If the assembly shop follows J-STD-033 guidelines, no pre-bake of this component is required before being reflowed to a PCB. However, if the J-STD-033 guidelines are not followed by the assembler, Bel recommends that the modules should be pre-baked @ 120~125°C for a minimum of 4 hours (preferably 24 hours) before reflow soldering.

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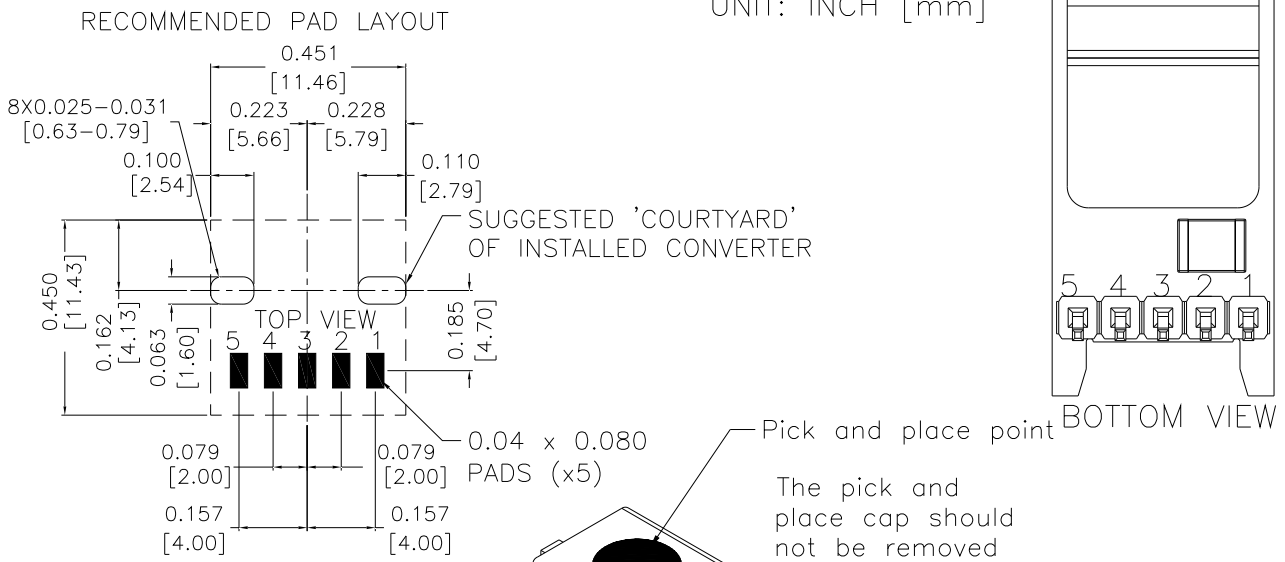
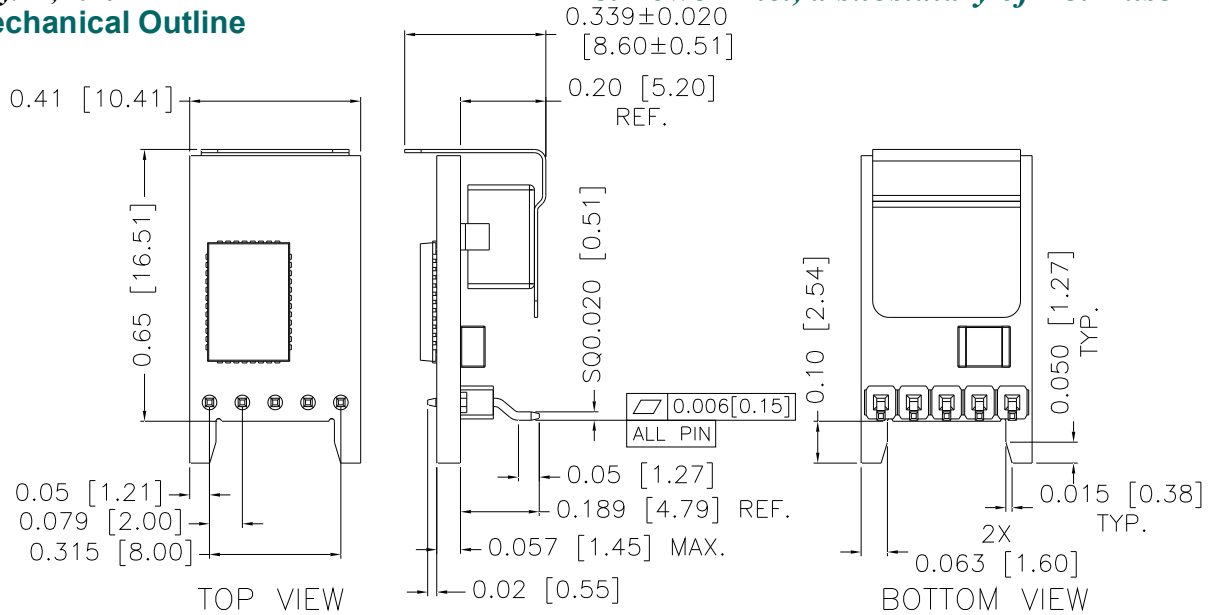
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Mechanical Outline



Pin Connections

Pin	Function
1	Enable
2	Vin
3	GND
4	Vout
5	Trim

Note:

- 1) All Pins: Material - Copper Alloy;
Finish - 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.
- 2) Undimensioned components are shown for visual reference only.
- 3) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in[0.5mm] x.xxx +/-0.010 in[0.25mm].

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Datasheet Revision History

Date	Revision	Changes Detail	Approval
2013-8-20	A	First Release	XF JIANG
2014-1-14	B	1.Mechanical drawing; 2. Output ripple and noise; 3.Output DC Current Limit; 4.Transient Response; 5.add ROHS logo; 6.Output Voltage Set Point; 7.Load Regulation; 8.Line Regulation; 9.Output DC Current Limit; 10.Efficiency; 11.Turn on/off Voltage Threshold; 11.Update on/off discription, add a note for UVLO.	XF JIANG
2014-4-8	C	Update MD.	XF JIANG
2014-6-24	D	Update MD.	XF JIANG
2014-7-3	E	Update part number explanation, RoHS compliance, Add MD Note.	XF JIANG
2014-11-05	F	Update MD.	XF JIANG
2014-11-18	G	Update General Specifications, TD, MD.	XF JIANG
2015-11-17	H	Update Input Specs, Output Specs, General, Efficiency Data, NR, TR, MD.	XF JIANG
2015-12-22	I	Update Output Specs.	XF JIANG
2016-05-12	J	Update Thermal Derating Curves.	XF JIANG

RoHS Compliance

Complies with the European Directive 2011/65/EU, calling for the elimination of lead and other hazardous substances from electronic products.



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