NON-ISOLATED DC/DC CONVERTERS

5.5 Vdc - 13.2 Vdc Input **0.6 Vdc - 5.5 Vdc / 1.5 A Output**

May. 12, 2016

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

SRPE-02E1A0 RoHS Compliant Rev.I

Features

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

Applications

- Networking
- Computers and peripherals
- Telecommunications

Description

The Bel SRPE-02E1A0 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 (VIN = 5.5 Vdc - 13.2 Vdc).The efficiency is typically 83.7% at 3.3 Vout (Vin=12 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	1.5 A	8 W	83.7%	SRPE-02E1A0

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

Ordering Part Number

S	R	PE	–	02	E	1A	0	x
1	2	3		4	5	6	7	8

1---Mounting type, **S –Surface mount**
2---RoHS Status, **R – RoHS 6**
3---Series name, **PE –SMD Series name**
4---Output power, **02 – 8W output**
5---Input range, **E – 5.5-13.2V input**
6---Output voltage, **1A – 0.6-5.5V output**
7---Active logic and HSK feature, **0 – active high, without HSK**
8---Package type, **G – Tray packaging**

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)	-	-	1.4	A	This power module is not internally fused. An input line fuse must always be used
Input Current (no load)	-	40	150	mA	
Remote Off Input Current	-	10	25	mA	
Input Reflected Ripple Current (pk-pk)	-	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 withESR=0.013 ohm max, at 100KHz@25°C.
Input Reflected Ripple Current (rms)	-	20	50	mA	
I^2t Inrush Current Transient	-	-	1	A^2s	
Turn-on Voltage Threshold	4.09	4.3	4.45	V	
Turn-off Voltage Threshold	3.7	3.9	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		-2	-	2	%Vo,set	Setpoint test condition: Vin=5V and 12V, Iout=full load, Ta=25°C
Load regulation		-	±0.2	±0.5	%Vo,set	
Line Regulation		-	±0.2	±0.5	%Vo,set	
Regulation Over Temperature		-	0.5	-	%Vo,set	
Output Ripple and Noise (pk-pk)		-	10	25	mV	0-20MHz BW, with a 1μF ceramic capacitor and a 100uF Tantalum cap at output.
Output Ripple and Noise (rms)		-	3	10	mV	
Output Current Range		0	-	1.5	A	
Output DC Current Limit		2.4	3.2	3.94	A	
Output Short-Circuit Current (Vo≤20mV)(Hiccup Mode)		-	-	1	Adc	
Rise time		-	2	2.5	ms	
Turn On Time		-	5.8	7	ms	
Overshoot at Turn on		-	0	3	%	
Output Capacitance		0	-	500	uF	
Transient Response						
△V50%~100% of Max Load	Overshoot	-	80	130	mV	di/dt=0.25A/us, Vin=12Vdc, Ta=25°C, with a 1μF ceramic capacitor and a 100uF Tantalum cap at output.
	Settling Time	-	80	180	us	
△V100%~50% of Max Load	Overshoot	-	80	130	mV	
	Settling Time	-	80	180	us	

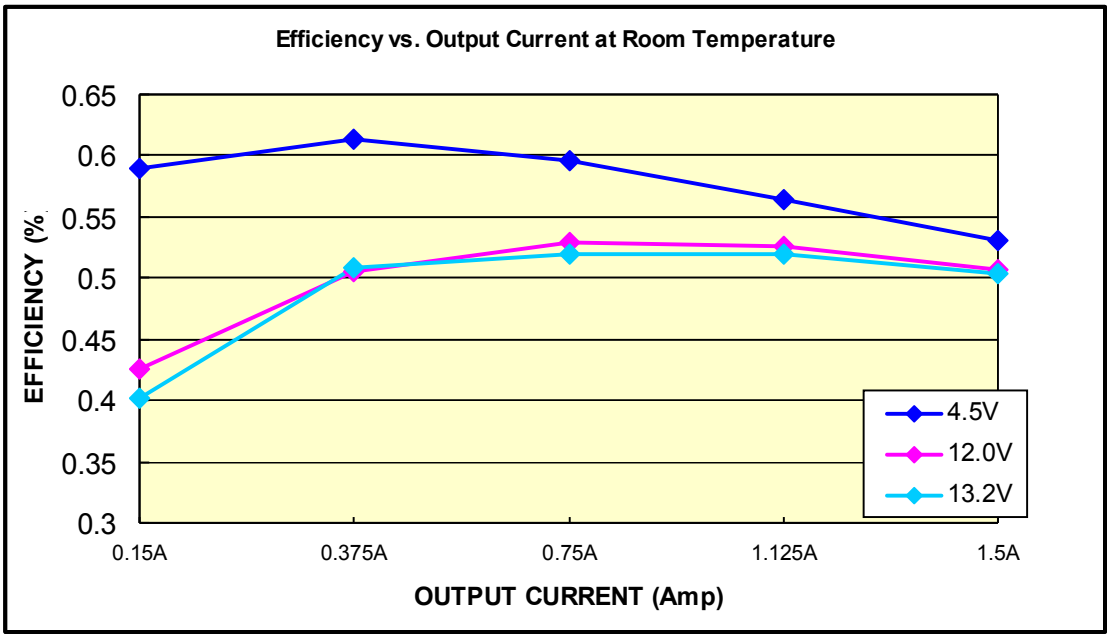
Note: All specifications are typical at 25 °C unless otherwise stated.

General Specifications

Parameter	Min	Typ	Max	Unit	Notes
Efficiency 5.5V 3.3V 0.6V	 85 81 45	 88 83 50		%	The efficiency is measured at Vin=12V, full load and Ta=25°C.
Switching Frequency	-	500	-	kHz	
Output Voltage Trim Range(Wide Trim)	0.6	-	5.5	V	This voltage is achieved by trimming up output slowly.
Weight	-	1.5	-	g	
FIT		75.7		-	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 x0.50x 0.38 10.41 x 12.70 x 6.27		-	

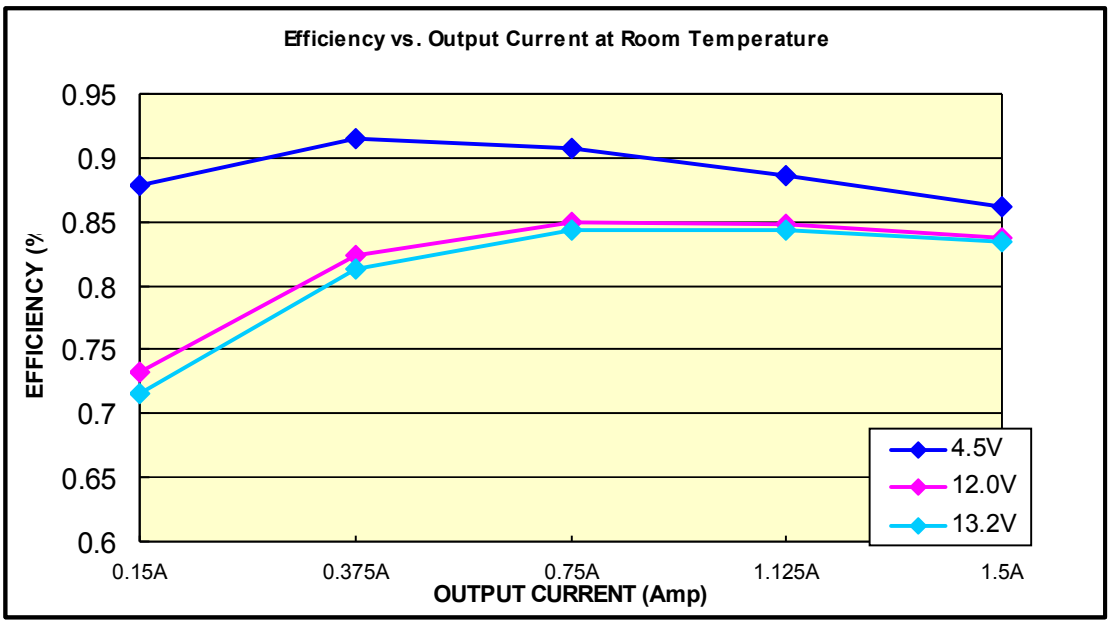
Note: All specifications are typical at 25 °C unless otherwise stated.

Efficiency Data

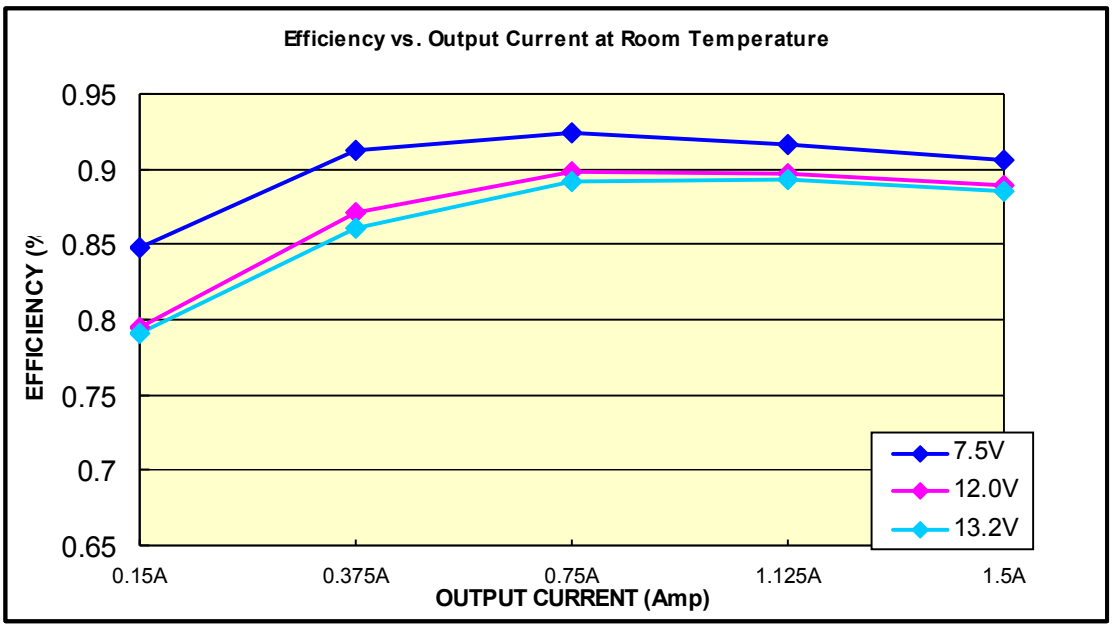


Vout: 0.6V

Efficiency Data（continued）

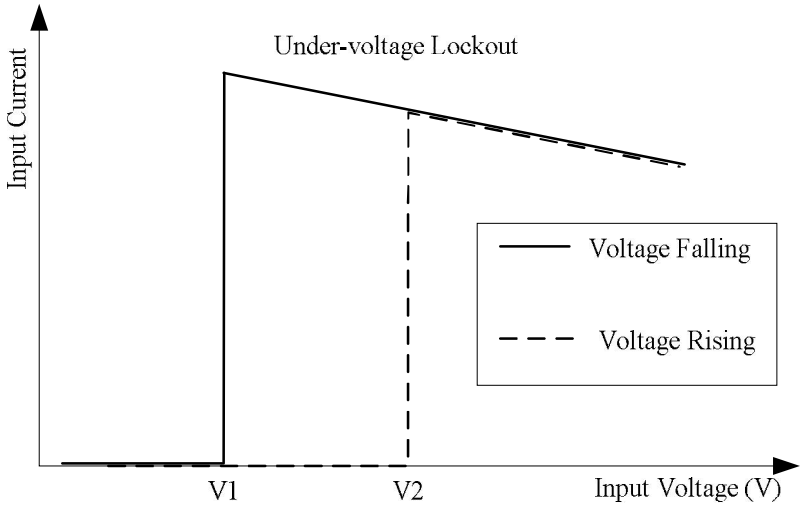


Vout: 3.3V



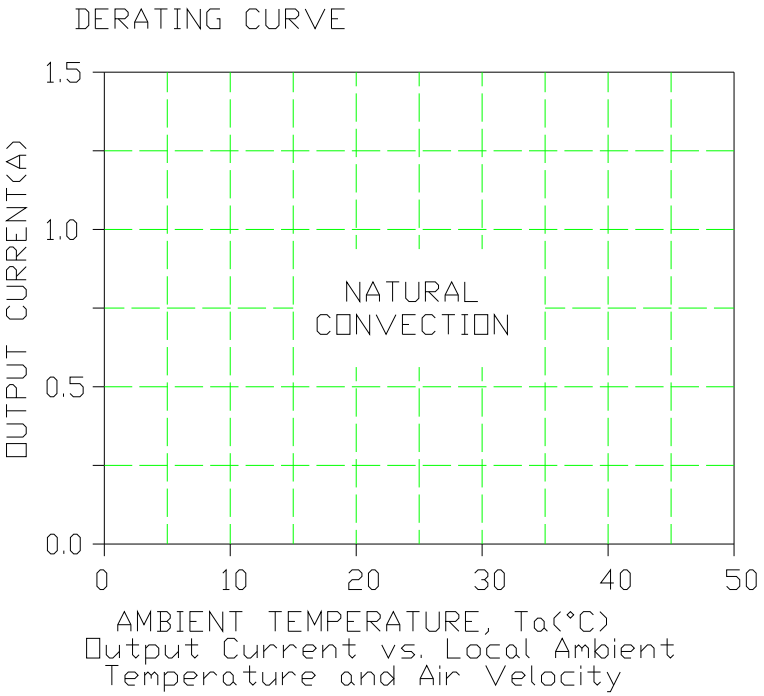
Vout: 5.5V

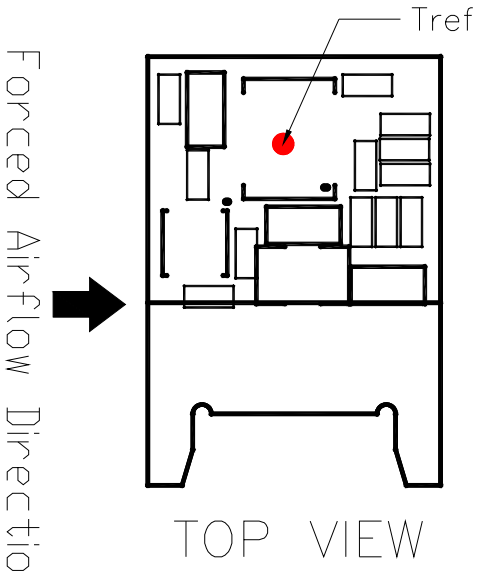
Input under-voltage lockout



V1=4V
V2=4.3V

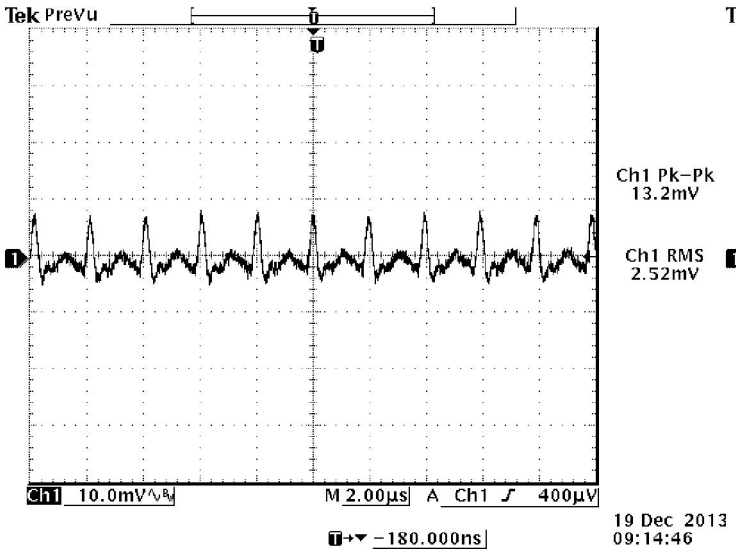
Thermal Derating Curves



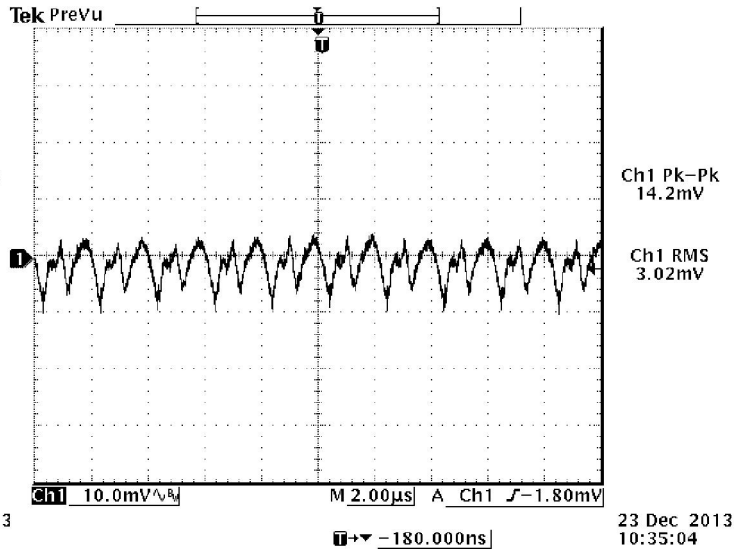


Vin=12V, with maximum junction temperature of semiconductors derated to 115C

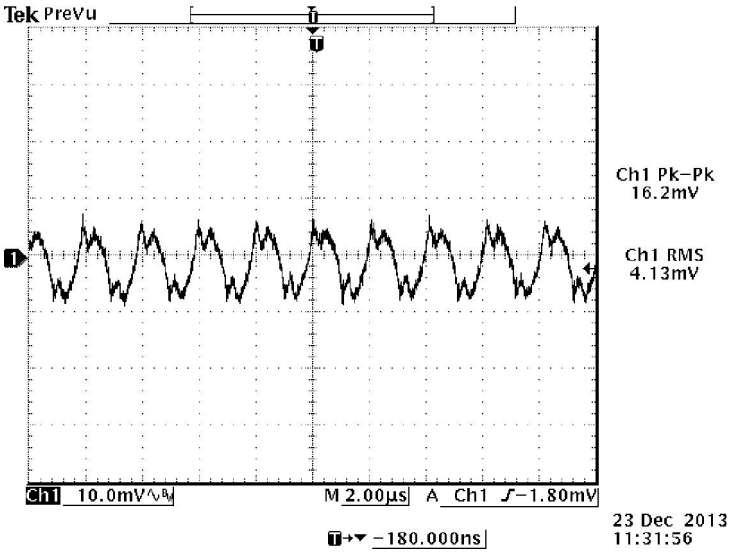
Ripple and Noise Waveform



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



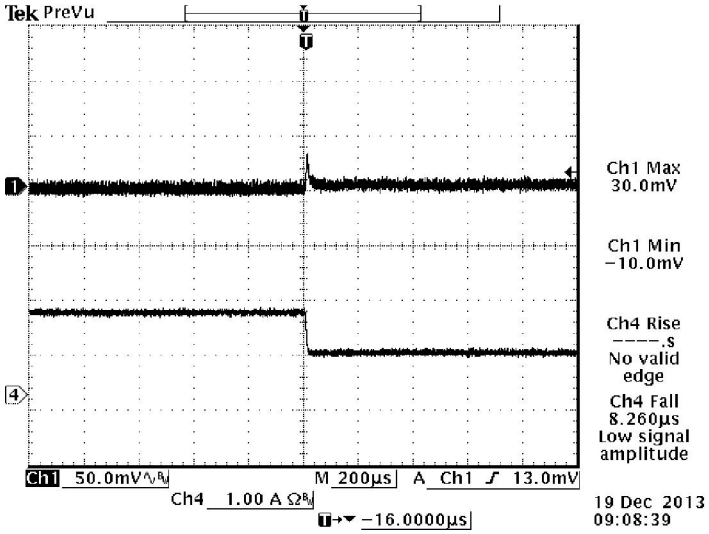
Ripple and noise at full load, 12V input,
3.3V output and Ta=25 degC



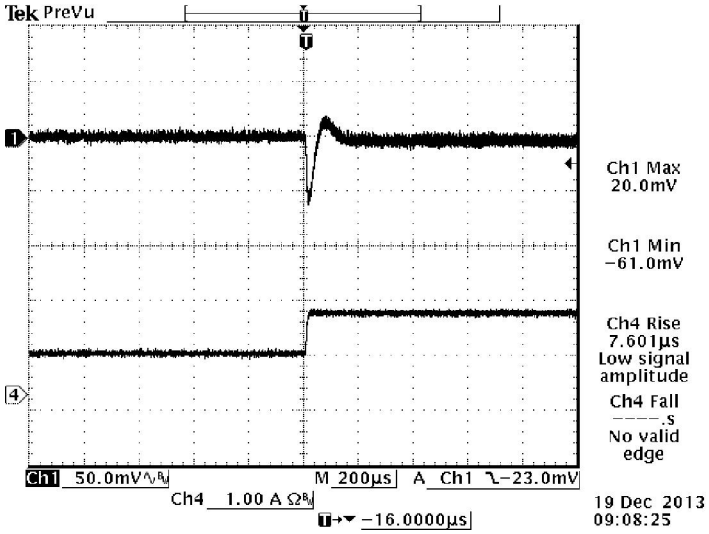
Ripple and noise at full load, 12V input,5.5V output and Ta=25 degC

Note: Test condition of the output ripple and noise: 0-20MHz BW,with a 1uF ceramic cap and a 100uF Tantalum cap at output

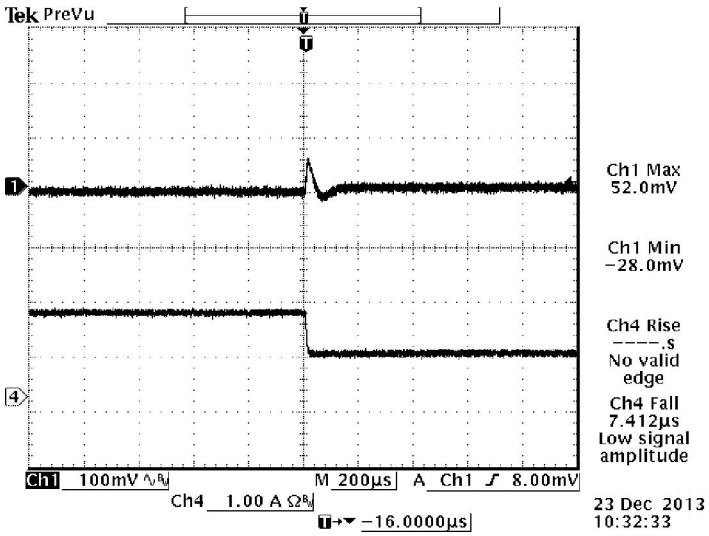
Transient Response Waveforms



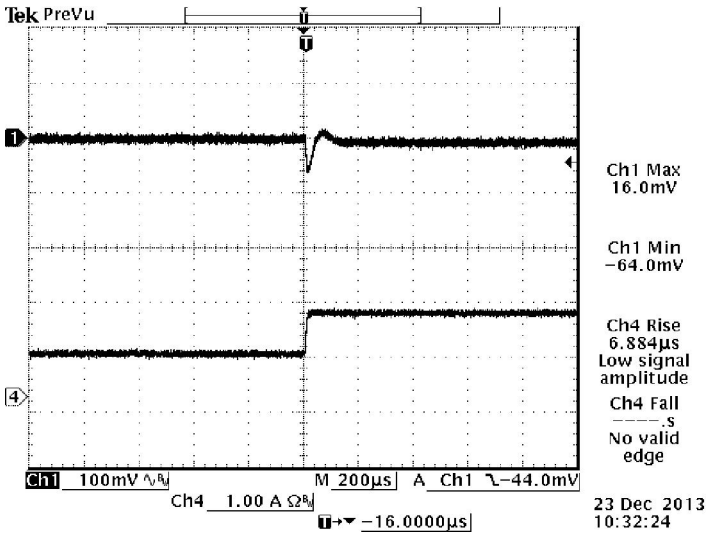
100%-50% Load Transients at Vin=12V,Vout=0.6V@Ta=25℃



50%-100% Load Transients at Vin=12V,Vout=0.6V@Ta=25℃

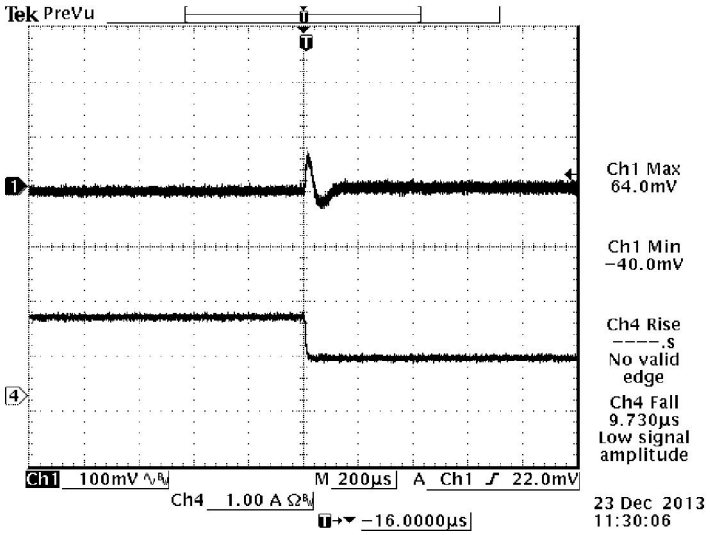


100%-50% Load Transients at Vin=12V,Vout=3.3V@Ta=25℃

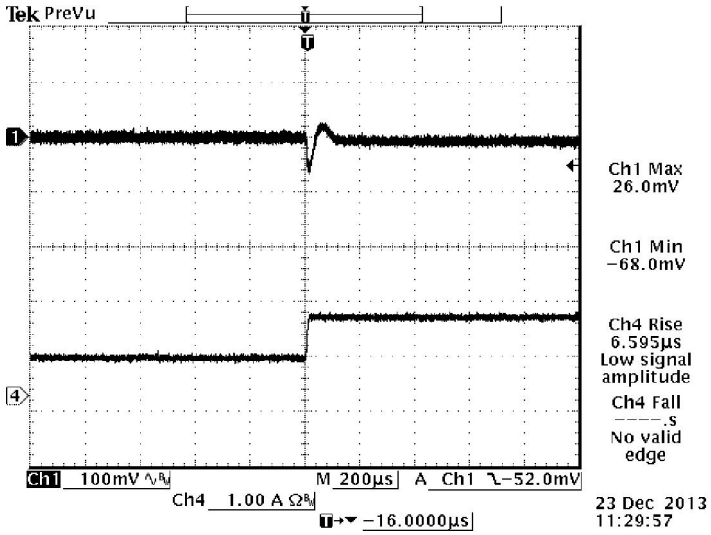


50%-100% Load Transients at Vin=12V,Vout=3.3V@Ta=25℃

Transient Response Waveforms（continued）



100%-50% Load Transients at Vin=12V,Vout=5.5V@Ta=25℃

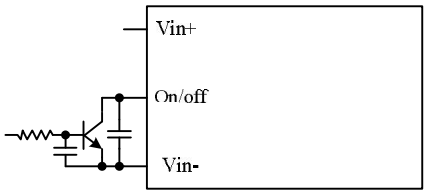


50%-100% Load Transients at Vin=12V,Vout=5.5V@Ta=25℃

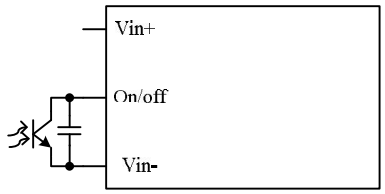
Note: Test condition of the transient response: di/dt=0.25A/uS, with a 1uF ceramic cap and a 100uF Tantalum cap at output

Remote On/Off

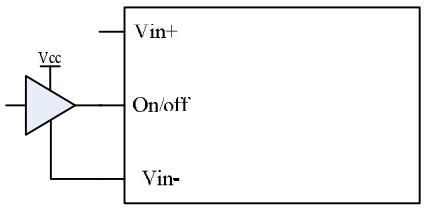
Parameter		Min	Typ	Max	Notes
Signal Low (Unit Off)	Active High	-0.3 V	-	0.8V	Remote On/Off pin is open, the module is off.
Signal High (Unit On)		2.4 V	-	18 V	



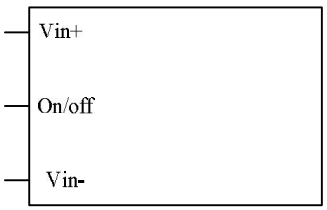
Control with open collector/drain circuit



Control with photocoupler circuit



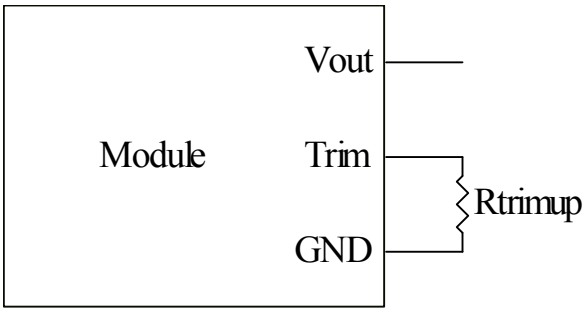
Control with logic circuit



Permanently off

Trim

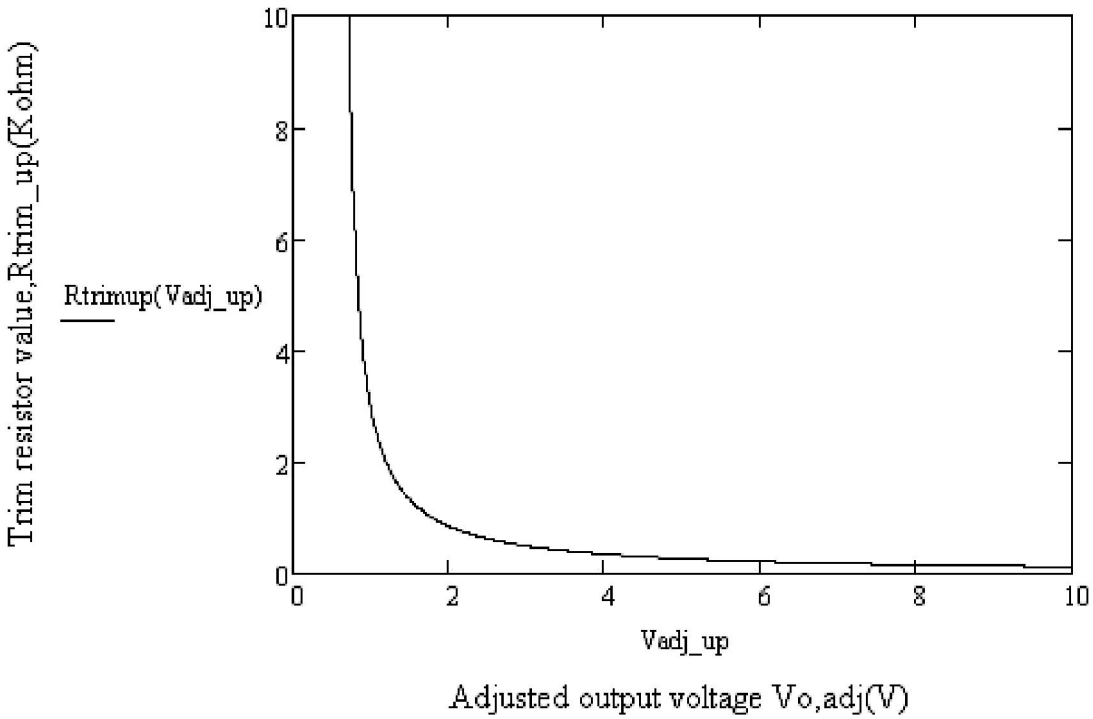
Trim up circuit (using an external resistor)



$$Rtrim = \frac{1.2}{Vo - 0.6} k\Omega$$

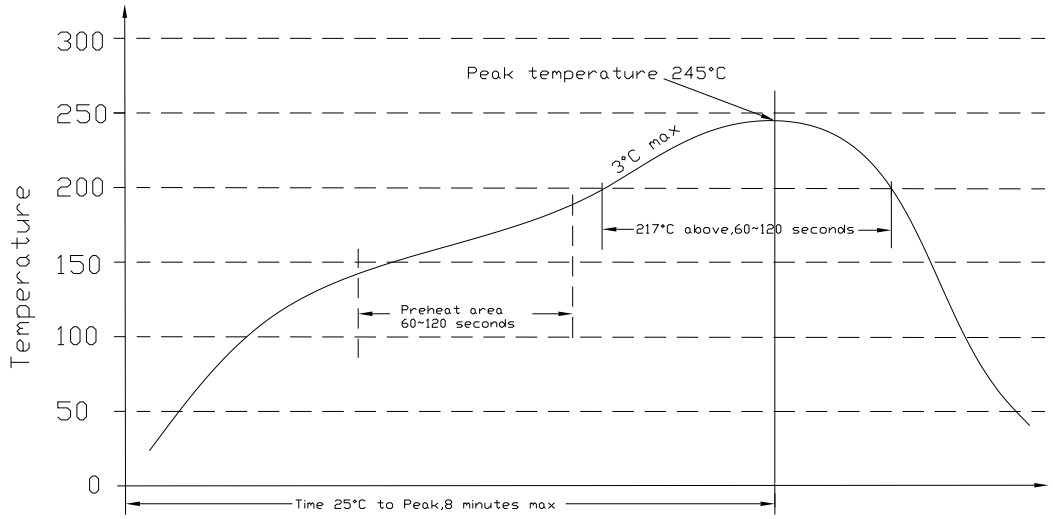
Vo is the desired output voltage
Rtrim is the required resistance between TRIM and GND

SRPE-02E1A0 Trim up Resistor Calculate



Soldering Information

The SRPE-02E1A0G 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℃ while the part can withstand peak temperature of 260℃ 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-02E1A0G modules have a MSL rating of 3.

Storage and Handling

The SRPE-02E1A0G 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℃ for a minimum of 4 hours (preferably 24 hours) before reflow soldering.

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5.5 Vdc - 13.2 Vdc Input **0.6 Vdc - 5.5 Vdc / 1.5 A Output**

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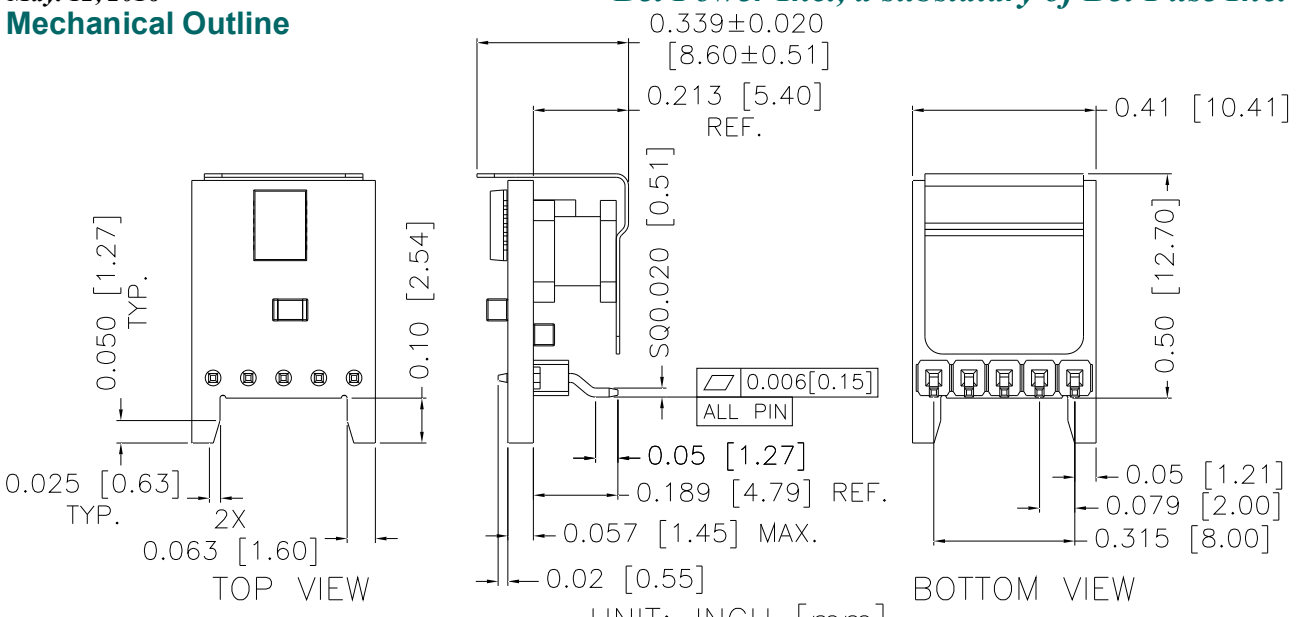
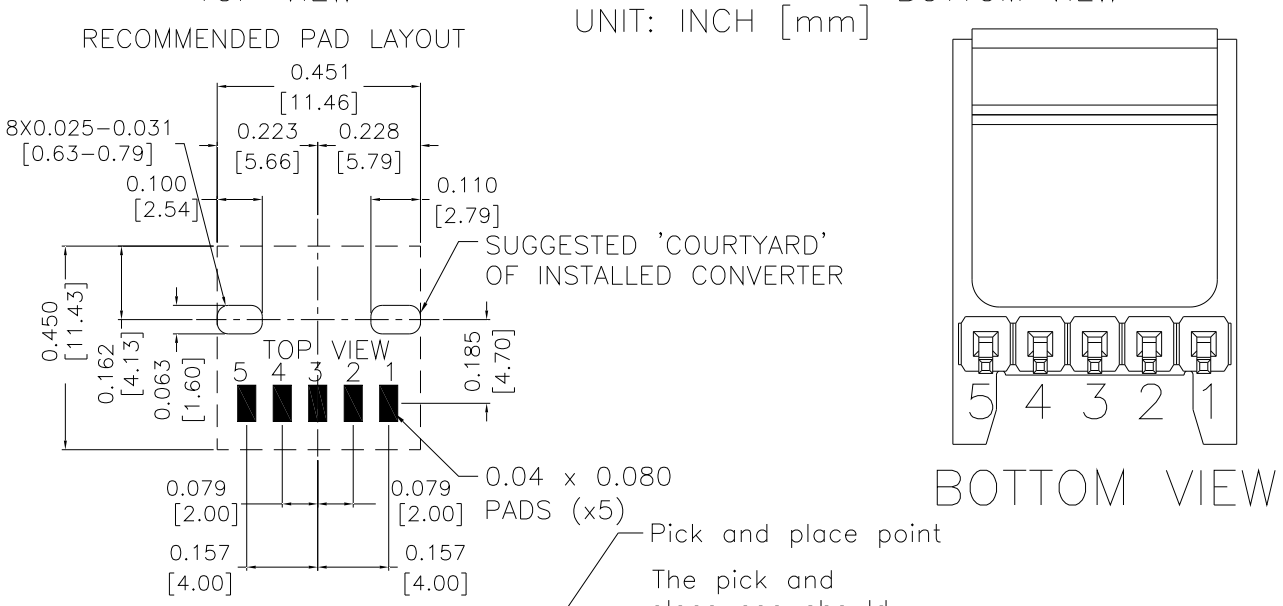
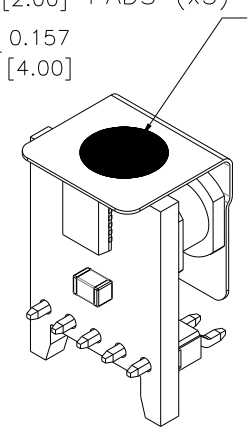
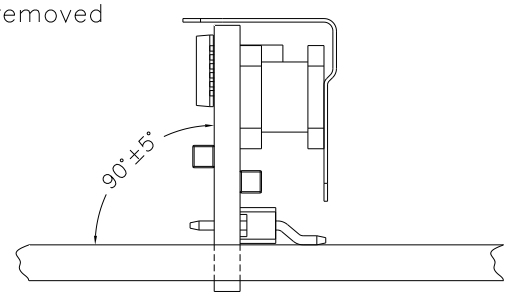
Mechanical Outline









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].

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
2014-11-5	F	Update MD.	XF JIANG
2014-11-18	G	Update General Specifications, TD, MD.	XF JIANG
2015-11-18	H	Update MD.	XF JIANG
2016-05-12	I	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.

CORPORATE

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