

# SRPE-06E1A0

## Non-Isolated DC-DC Converter

The Bel SRPE-06E1A0 is part of the non-isolated DC/DC converter power module series. The modules use a SIP 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 ( $V_{in} = 5.5 - 13.2$  VDC). The efficiency is typically 91% at 3.3 Vout ( $V_{in} = 12$  VDC) at full load.



### Key Features & Benefits

- 5.5 – 13.2 VDC Input
- 0.6 – 5.5 VDC / 6 A Output
- Non-Isolated
- Under-Voltage Lockout
- High Efficiency
- Wide Trim
- Fixed Frequency
- OCP/SCP
- Low Cost
- Remote On/Off
- Wide Input
- Class II, Category 2, Non-Isolated DC-DC Converter (refer to IPC-9592B)

### Applications

- Networking
- Computers and Peripherals
- Telecommunications

## 1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
SRPE-06E1A0G SRPE-06E1A0R	0.6 - 5.5 V	5.5 - 13.2 V	6 A	33 W	91%

### PART NUMBER EXPLANATION

S	R	PE	-	06	E	1A	0	x
Mounting Type	RoHS Status	Series Name		Output Current	Input Range	Output Voltage	Active Logic	Package
Surface Mount	RoHS	SMD SIP		6 A	5.5 - 13.2 V	0.6 - 5.5 V	Active High	G – Tray Package R – Tape and Reel Package

## 2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Input Supply Voltage		-0.3	-	15	V
Remote On/Off		-0.3	-	15	V
Ambient Temperature		0	-	50	°C
Storage Temperature		-55	-	125	°C
Altitude		-	-	2000	m

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

## 3. INPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Input Voltage		5.5	-	13.2	V
Input Current (full load)	This power module is not internally fused. An input line fuse must always be used	-	-	4.9	A
Input Current (no load)		-	50	150	mA
Remote Off Input Current		-	1	5	mA
Input Reflected Ripple Current (rms)	With simulated source impedance of 1000 nH, 5 Hz to 20 MHz. Use a 1000 µF/25 V AL-Cap with ESR = 0.03 ohm max and 2*100 µF/25 V Tan cap with ESR = 0.013 ohm max, at 100 kHz @ 25°C.	-	7	20	mA
Input Reflected Ripple Current (pk-pk)		-	22	40	mA
I <sup>2</sup> t Inrush Current Transient		-	-	1	A <sup>2</sup> 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.

#### 4. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	$V_o, \text{set} \geq 0.9 \text{ VDC}$	-2	-	2	% $V_{o,\text{set}}$
	$V_o, \text{set} < 0.9 \text{ VDC}$	-3	-	3	
Load Regulation	$V_o \geq 3.3 \text{ VDC}$	-2	-	2	% $V_{o,\text{set}}$
	$V_o < 3.3 \text{ VDC}$	-40	-	40	mV
Line Regulation	$V_o \geq 3.3 \text{ VDC}$	-1.5	-	1.5	% $V_{o,\text{set}}$
	$V_o < 3.3 \text{ VDC}$	-15	-	15	mV
Regulation Over Temperature		-	0.8	-	% $V_{o,\text{set}}$
Output Ripple and Noise (pk-pk)		-	60	200	mV
Output Ripple and Noise (rms)		-	15	80	mV
Output Current Range		0	-	6	A
Output DC Current Limit		7	-	10	A
Output Short-Circuit Current ( $V_o \leq 20 \text{ mV}$ ) (Hiccup Mode)		-	-	4	Adc
Rise Time		-	2	2.5	ms
Turn On Time		-	2.9	5	ms
Overshoot at Turn on		-	0	4.5	%
Output Capacitance		200	-	2000	$\mu\text{F}$
<b>TRANSIENT RESPONSE</b>					
$\Delta V$ 50% ~ 100% Max Load	Overshoot	-	40	80	mV
	Settling Time	-	80	200	$\mu\text{s}$
$\Delta V$ 100% ~ 50% Max Load	Overshoot	-	40	80	mV
	Settling Time	-	80	200	$\mu\text{s}$

**NOTE:** All specifications are typical at nominal input, full load at 25°C unless otherwise stated.

#### 5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Switching Frequency		-	650	-	kHz
Efficiency	$V_o = 5.5 \text{ V}$	92.2	94.2	-	%
	$V_o = 3.3 \text{ V}$	9.	91.6	-	
	$V_o = 0.6 \text{ V}$	69	71	-	
Output Voltage Trim Range (Wide Trim)		0.6	-	5.5	V
FIT		-	17	-	-
Weight		-	2.5	-	g
Dimensions (L x W x H)		0.41 x 0.315 x 0.65			inch
		10.41 x 8.00 x 16.51			mm

**NOTE:** All specifications are typical at nominal input, full load at 25°C unless otherwise stated.



Asia-Pacific  
+86 755 298 85888

Europe, Middle East  
+353 61 225 977

North America  
+1 408 785 5200

## 6. REMOTE ON/OFF

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT	
Signal Low (Unit Off)	Active High	The remote on/off pin open, Unit off.	-0.3	-	0.8	V
Signal High (Unit On)			2.4	-	18	V

Recommended remote on/off circuit for active high

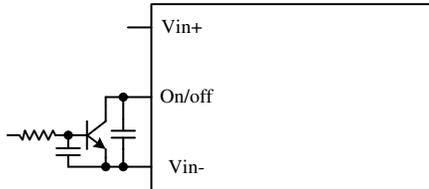


Figure 1. Control with open collector/drain circuit

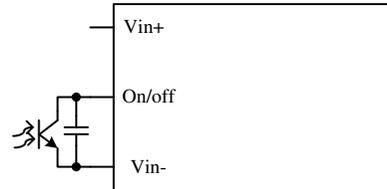


Figure 2. Control with photocoupler circuit

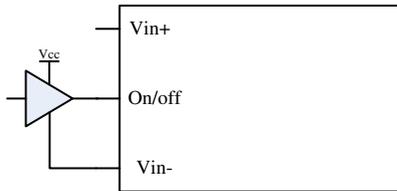


Figure 3. Control with logic circuit

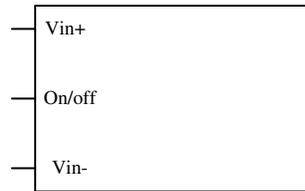


Figure 4. Permanently on

7. EFFICIENCY DATA

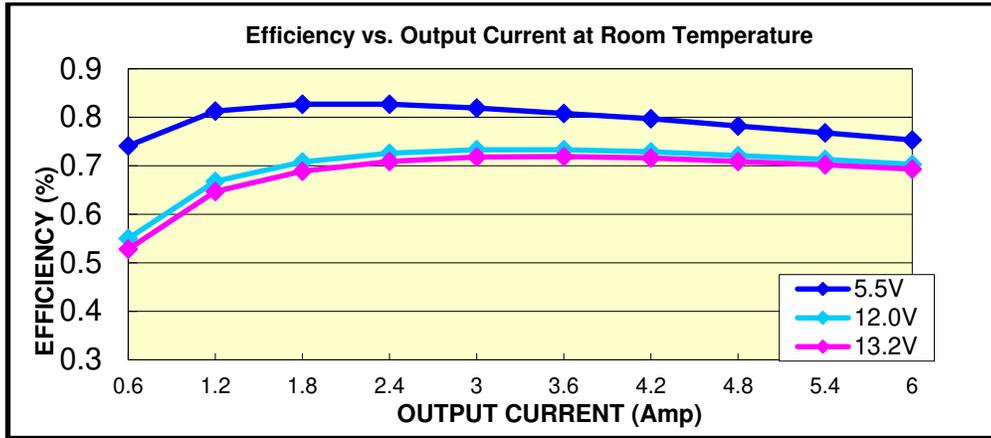


Figure 5. Vout = 0.6 V

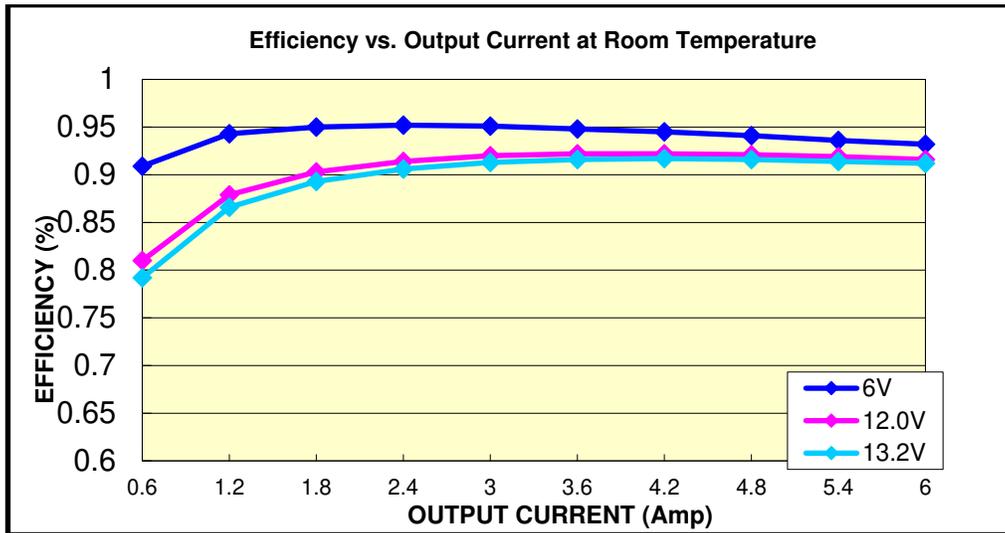


Figure 6. Vout = 3.3 V

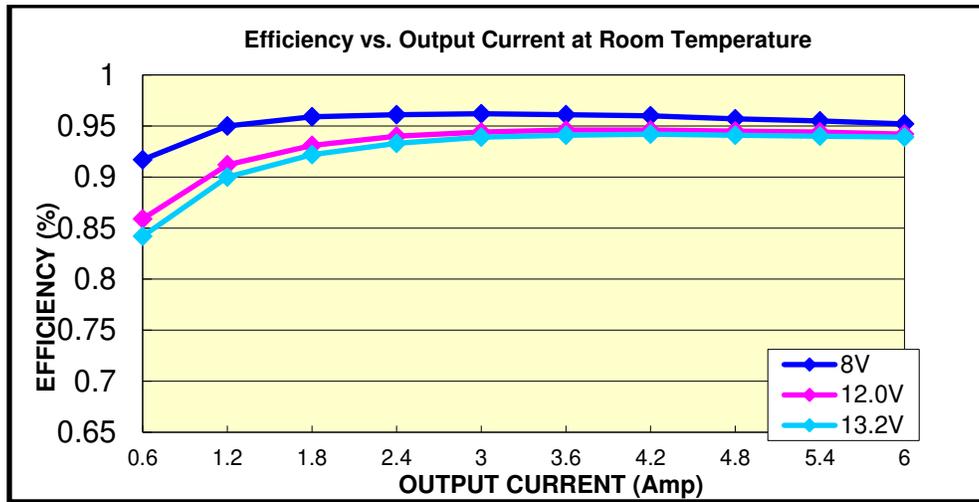


Figure 7.  $V_{out} = 5.5 V$

### 8. TRIM

Trim up circuit (using an external resistor)

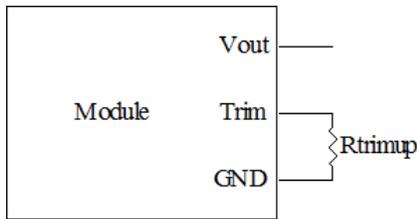


Figure 8. Trim up circuit

SRPE-06E1A0 Trim up Resistor Calculate:

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

$V_o$  is the desired output voltage.

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

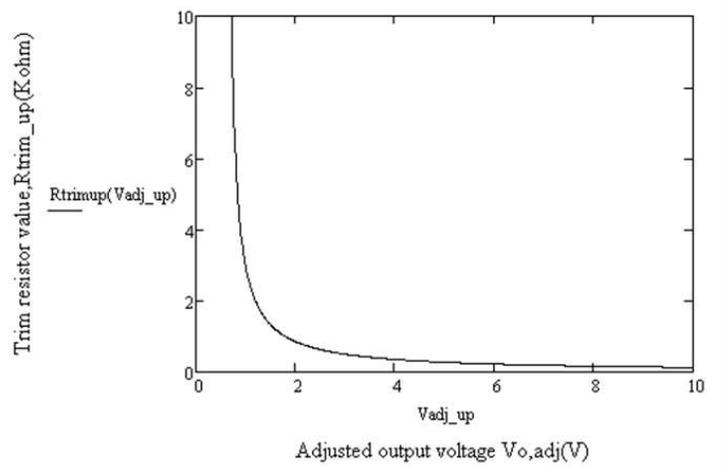


Figure 9. Trim curve

9. THERMAL DERATING CURVES

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

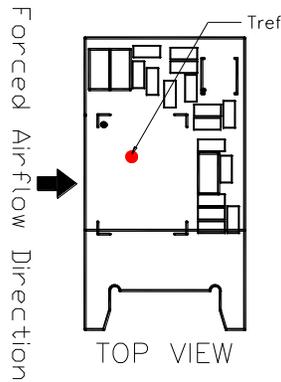


Figure 10. Airflow direction and hot spot

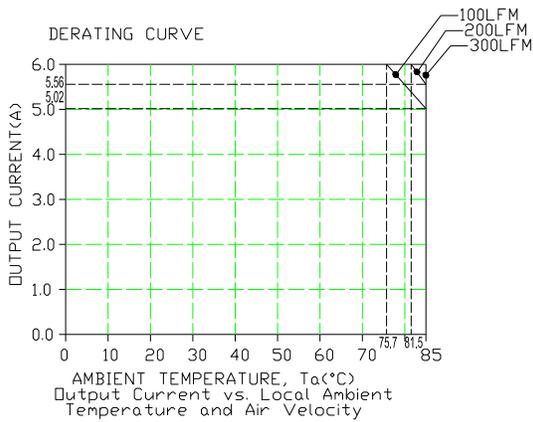


Figure 11. Vout = 0.6 V

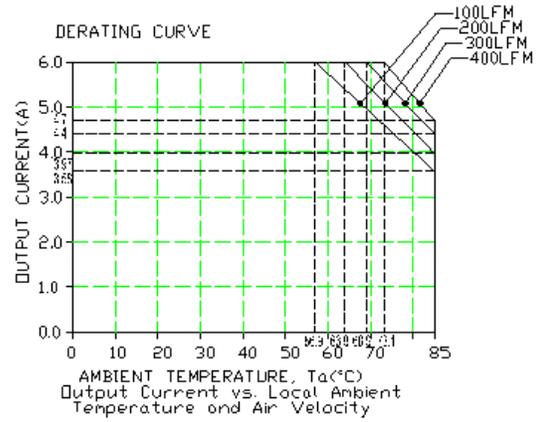


Figure 12. Vout = 1.8 V

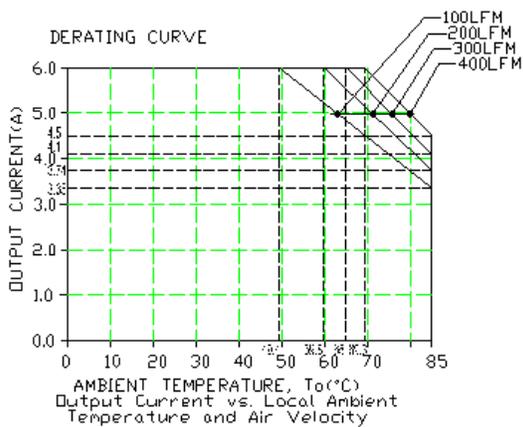


Figure 13. Vout = 3.3 V

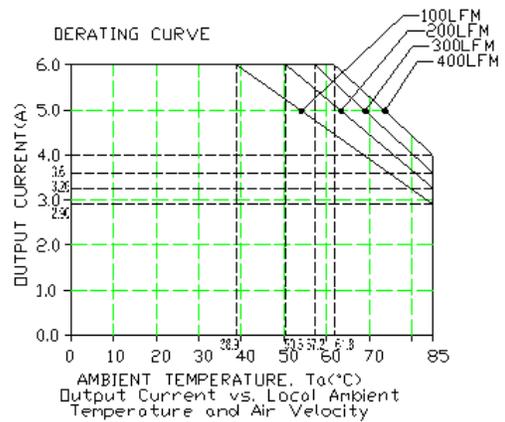


Figure 14. Vout = 5.5 V

10. RIPPLE AND NOISE WAVEFORM

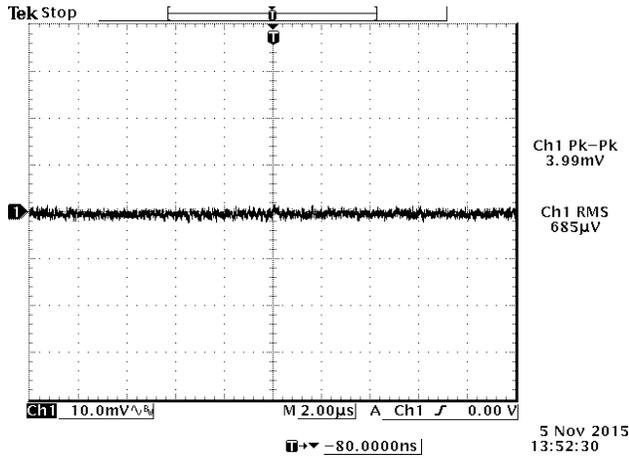


Figure 15. Ripple and noise at full load, 12 V input, 0.6 V output and  $T_a = 25^\circ\text{C}$

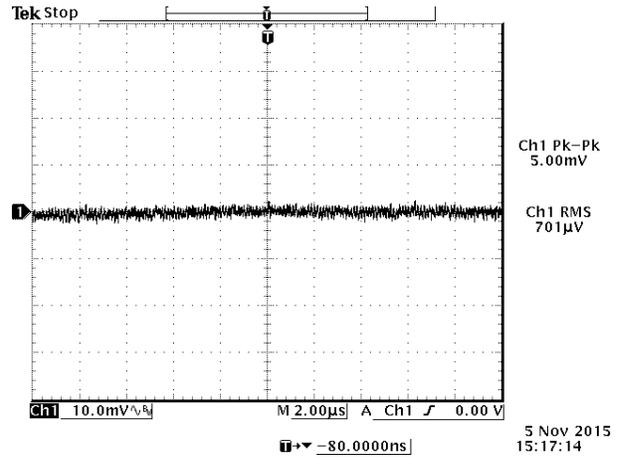


Figure 16. Ripple and noise at full load, 12 V input, 3.3 V output and  $T_a = 25^\circ\text{C}$

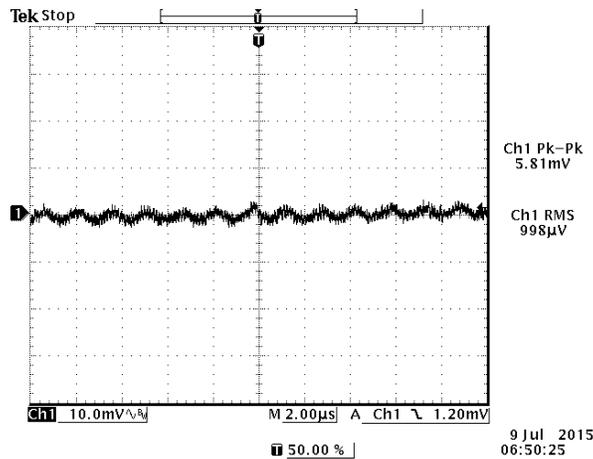


Figure 17. Ripple and noise at full load, 12 V input, 5.5 V output and  $T_a = 25^\circ\text{C}$

**NOTE:** Test condition of the output ripple and noise: 0 – 20 MHz BW, with 360 µF ceramic cap at output.

11. TRANSIENT RESPONSE WAVEFORMS

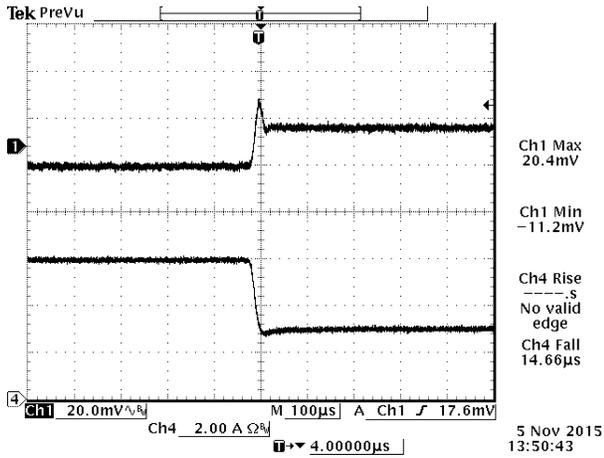


Figure 18. 100%-50% Load Transients at  $V_{in} = 12 V$ ,  $V_{out} = 0.6 V @ T_a = 25^{\circ}C$

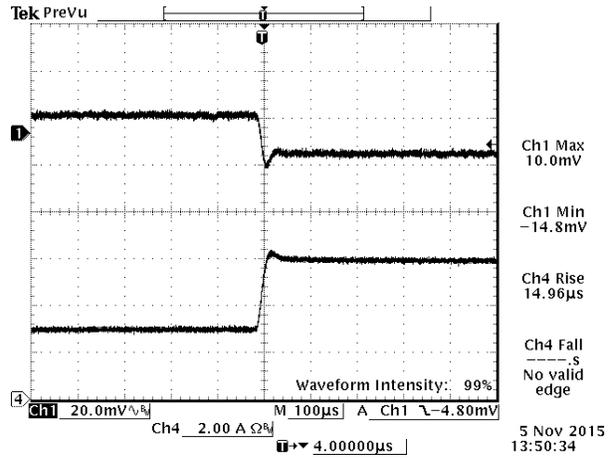


Figure 19. 50%-100% Load Transients at  $V_{in} = 12 V$ ,  $V_{out} = 0.6 V @ T_a = 25^{\circ}C$

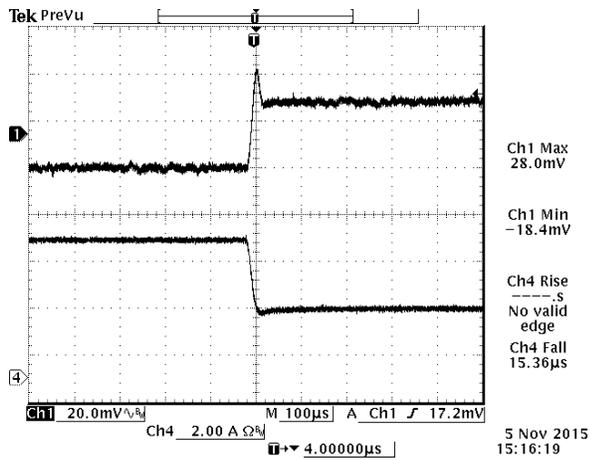


Figure 20. 100%-50% Load Transients at  $V_{in} = 12 V$ ,  $V_{out} = 3.3 V @ T_a = 25^{\circ}C$

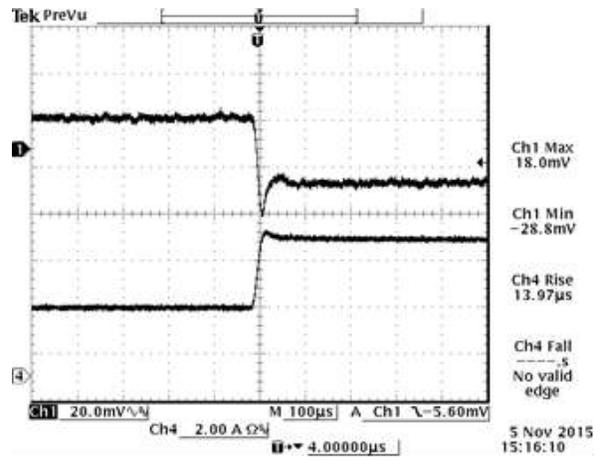


Figure 21. 50%-100% Load Transients at  $V_{in} = 12 V$ ,  $V_{out} = 3.3 V @ T_a = 25^{\circ}C$

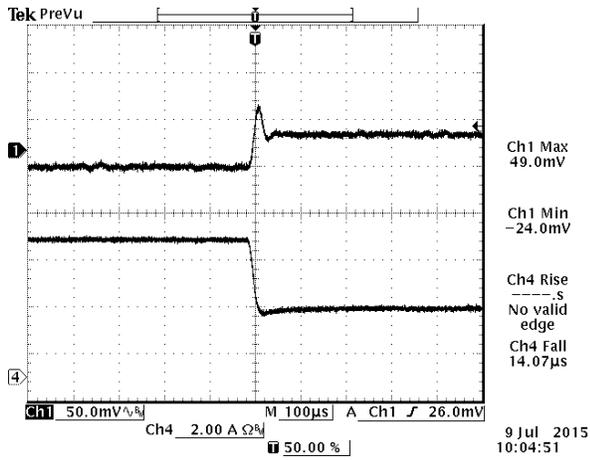


Figure 22. 100%-50% Load Transients at  $V_{in} = 12 V$ ,  $V_{out} = 5.5 V @ T_a = 25^\circ C$

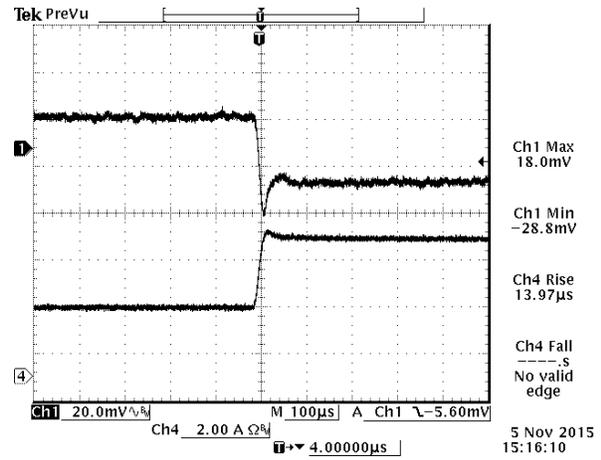


Figure 23. 50%-100% Load Transients at  $V_{in} = 12 V$ ,  $V_{out} = 5.5 V @ T_a = 25^\circ C$

**NOTE:** Test condition of the transient response:  $di/dt = 0.25 A/\mu s$ , with 360  $\mu F$  ceramic cap at output.

## 12. INPUT UNDER-VOLTAGE LOCKOUT

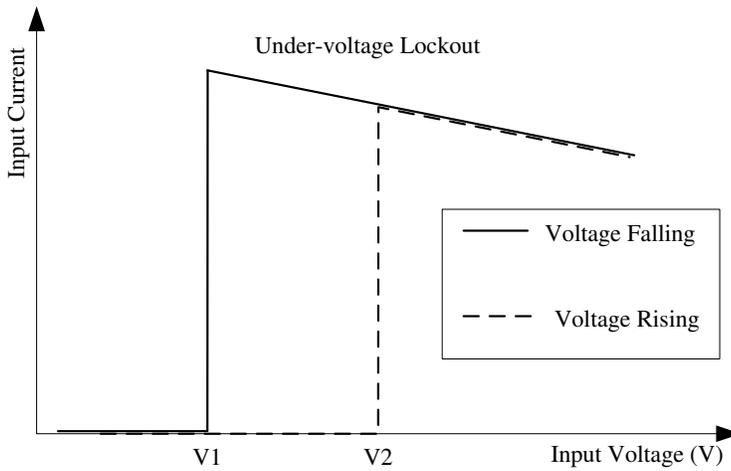


Figure 24. Input under-voltage lockout  
 $V1 = 4 V$   
 $V2 = 4.15 V$

### 13. SOLDERING INFORMATION

The SRPE-06E1A0 modules are designed to be compatible with a reflow soldering 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.

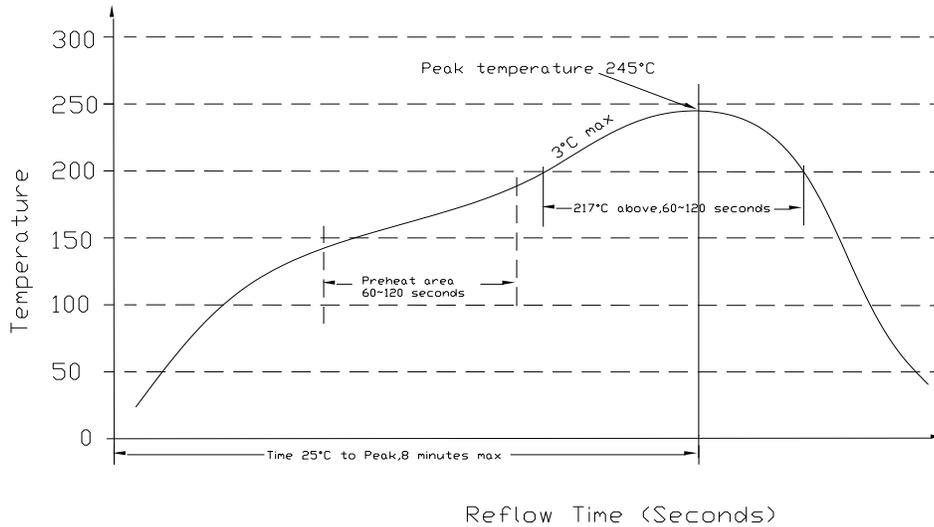


Figure 25. Solder information

### 14. MSL RATING

The SRPE-06E1A0 modules have a MSL rating of 3.

### 15. STORAGE AND HANDLING

The SRPE-06E1A0 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.

### 16. 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.



Asia-Pacific  
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**17. MECHANICAL DIMENSIONS**  
**OUTLINE**

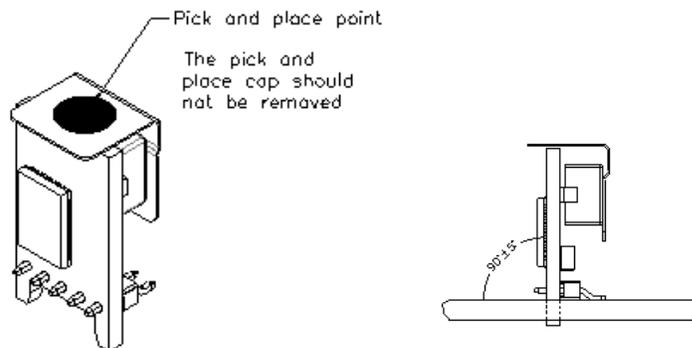
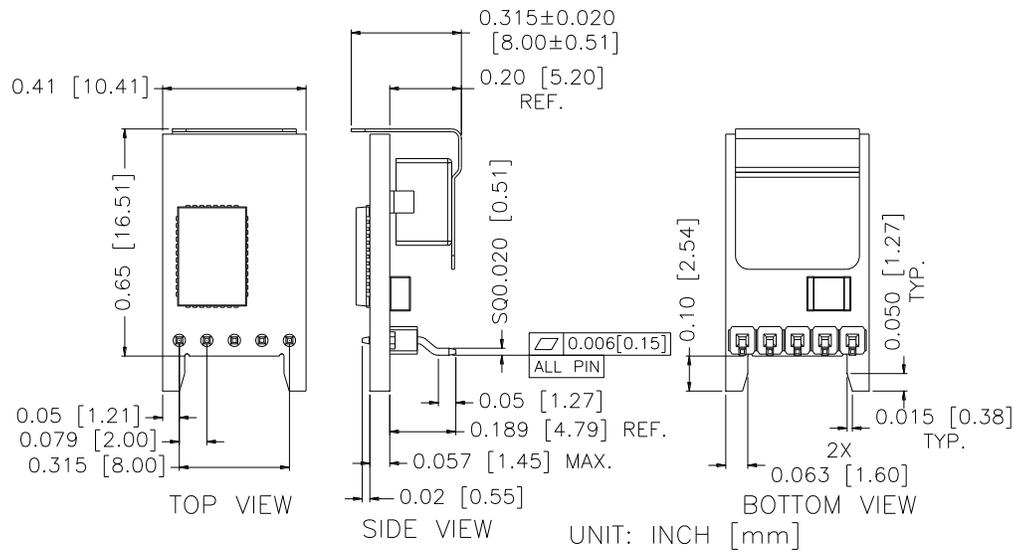


Figure 26. Outline

- NOTE:** 1) All Pins: Material - Copper Alloy;  
Finish – 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate.  
2) Un-dimensioned components are shown for visual reference only.  
3) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.51 mm]; x.xxx +/-0.010 inch [0.25 mm].

## PIN DEFINITIONS

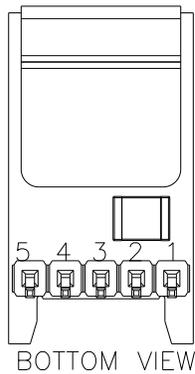


Figure 27. Pins

PIN	FUNCTION
1	Enable
2	Vin
3	GND
4	Vout
5	Trim

## RECOMMENDED PAD LAYOUT

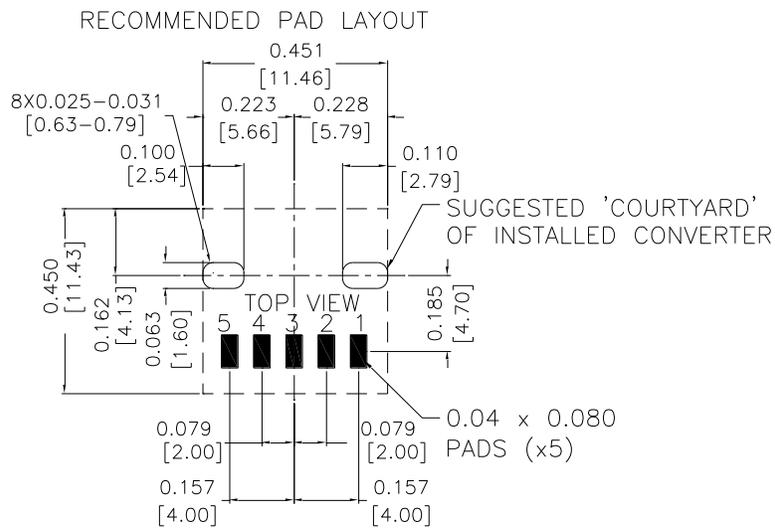


Figure 28. Recommended pad layout

## 18. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2013-08-20	A	First Release	XF.Jiang
2014-01-23	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; 12.Update on/off description, add a note for UVLO.	XF.Jiang
2014-04-08	C	Update MD.	XF.Jiang
2014-06-24	D	Update MD.	XF.Jiang
2014-07-03	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
2015-11-12	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
2020-06-09	AK	Update mechanical outline	XF.Jiang
2021-06-28	AL	Add object ID.	XF.Jiang

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