SRPE-12E1A0

Non-Isolated DC-DC Converter

The Bel SRPE-12E1A0 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 - 13.2 VDC). The efficiency is typically 93% at 3.3 Vout (Vin = 12 Vdc) at full load.

Key Features & Benefits

- 5.5 – 13.2 VDC Input
- 0.6 – 5.5 VDC / 12 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)

RoHS Compliant

Applications

- Networking
- Computers and Peripherals
- Telecommunications

1. MODEL SELECTION

MODEL NUMBER	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
SRPE-12E1A0G SRPE-12E1A0R	0.6 V - 5.5 V	5.5 V - 13.2 V	12 A	66 W	93%

PART NUMBER EXPLANATION

S	R	PE	-	12	E	1A	0	x
Mounting Type	RoHS Status	Series Name		Output Current	Input Range	Output Voltage	Active Logic	Package
Surface Mount	RoHS	SMD SIP		12 A	5.5 - 13.2 V	0.6 - 5.5 V	Active High	G – Tray Package R – Tape & 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	-	-	8.5	A
Input Current (no load)		-	40	100	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.	-	10	20	mA
Input Reflected Ripple Current (pk-pk)		-	35	70	mA
I^2t Inrush Current Transient		-	-	1	A^2s
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	Vo, set ≥ 0.9 VDC	Setpoint test condition: Vin = 12 V, Iout = half load, Ta = 25°C	-2	-	2	%Vo,set
	Vo, set < 0.9 VDC		-3	-	3	
Load Regulation	Vo ≥ 3.3 VDC	Vin = 12 V, Io = 0 - 12 A, Ta = 25°C	-2	-	2	%Vo,set
	Vo < 3.3 VDC		-70	-	70	mV
Line Regulation	Vo ≥ 3.3 VDC	Vin = 8 - 13.2 V, Io = 6 A, Ta = 25°C Vin = 5.5 - 13.2 V, Io = 6 A, Ta = 25°C	-2	-	2	%Vo,set
	Vo < 3.3 VDC		-15	-	15	mV
Regulation Over Temperature			-	0.7	-	%Vo,set
Output Ripple and Noise (pk-pk)		0-20 MHz BW, with 300 µF ceramic capacitor at output.	-	-	50	mV
Output Ripple and Noise (rms)			-	-	10	mV
Output Current Range			0	-	12	A
Output DC Current Limit			14	-	25	A
Output Short-Circuit Current (Vo ≤ 20 mV) (Hiccup Mode)			-	-	6	Adc
Rise Time			-	2	2.9	ms
Turn On Time			-	3	5	ms
Overshoot at Turn on			-	0	4.5	%
Output Capacitance			300	-	3300	µF
TRANSIENT RESPONSE						
△V 50% ~ 100% Max Load	Overshoot	di/dt = 0.25 A/µs, Vin = 12 VDC, Ta = 25°C, with 300 µF ceramic capacitor at output.	-	50	120	mV
	Settling Time		-	50	150	µs
△V 100% ~ 50% Max Load	Overshoot		-	50	120	mV
	Settling Time		-	80	150	µs

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	Vo = 5.5 V		93.2	95.2	-	%
	Vo = 3.3 V		91	93	-	
	Vo = 0.6 V		74.5	76.5	-	
Output Voltage Trim Range (Wide Trim)		This voltage is achieved by trimming up output slowly.	0.6	-	5.5	V
FIT		Calculated Telcordia SR-332, Issue 2 (Vin = 12 V, Vo = 5.5 V, Io = 12 A, Ta = 40°C, no forced air, 90% confidence Level, FIT = 10^9/MTBF)	-	17.8	-	-
Weight			-	2.5	-	g
Dimensions (L × W × H)				0.41 x 0.339 x 0.65		inch
				10.41 x 8.60 x 16.51		mm

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

6. EFFICIENCY DATA

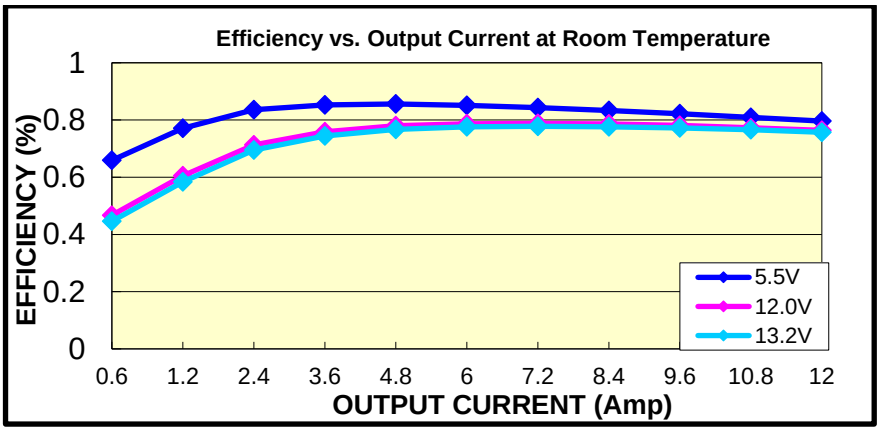

Figure 1. Vout = 0.6 V

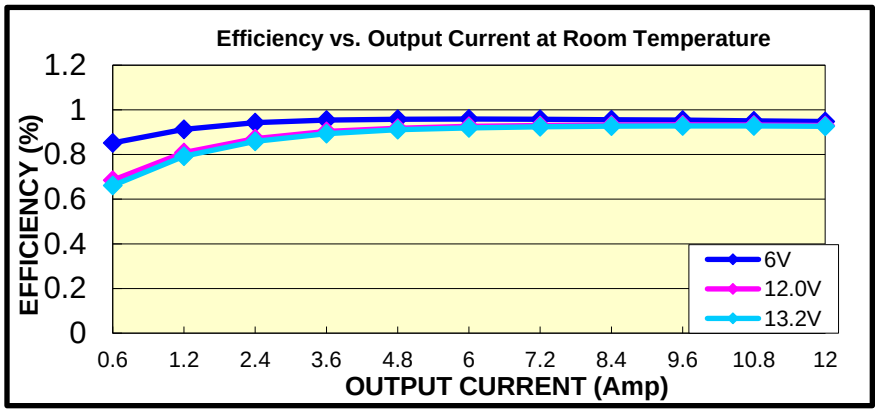

Figure 2. Vout = 3.3 V

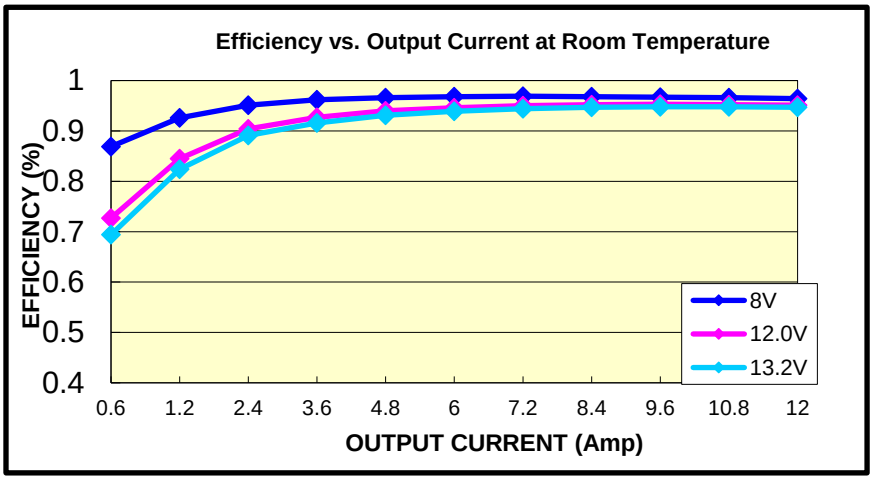

Figure 3. Vout = 5.5 V

7. 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	-	15	V

Recommended remote on/off circuit for active high

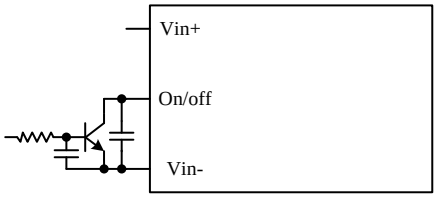

Figure 4. Control with open collector/drain circuit

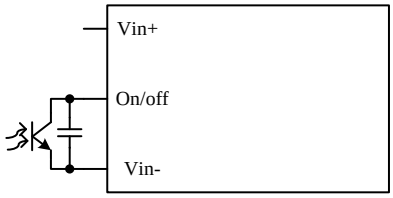

Figure 5. Control with photocoupler circuit

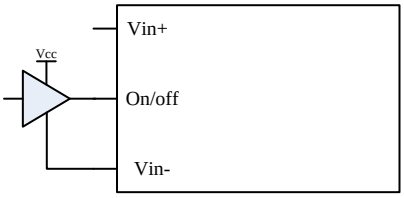

Figure 6. Control with logic circuit

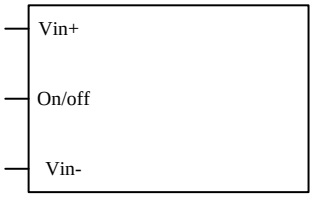

Figure 7. Permanently on

8. TRIM

Trim up circuit (using an external resistor)

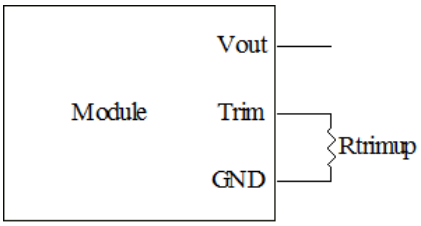

Figure 8. Trim up circuit

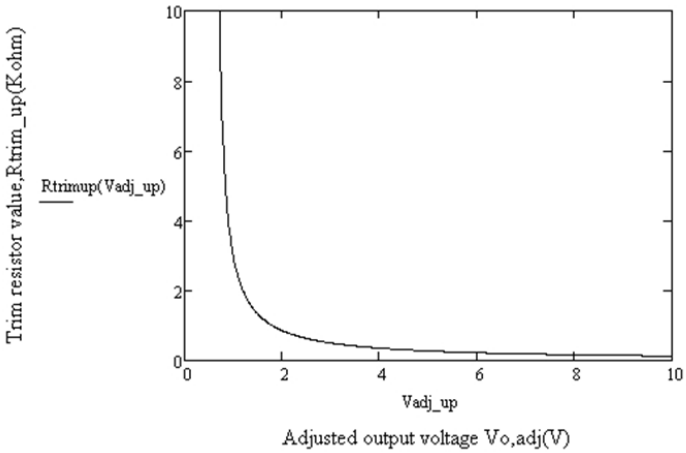

Figure 9. Trim up circuit

SRPE-12E1A0 Trim up Resistor Calculate:

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

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

9. THERMAL DERATING CURVES

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

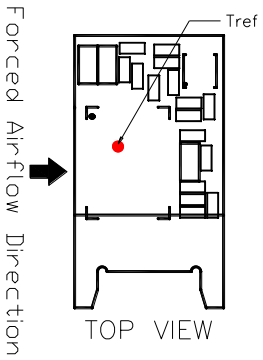

Figure 10. Forced airflow direction

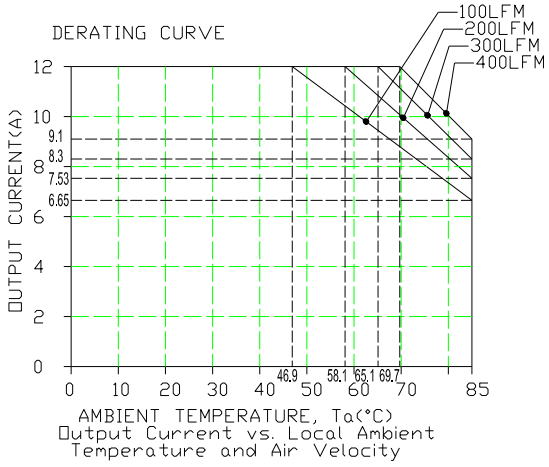

Figure 11. Vout = 0.6 V

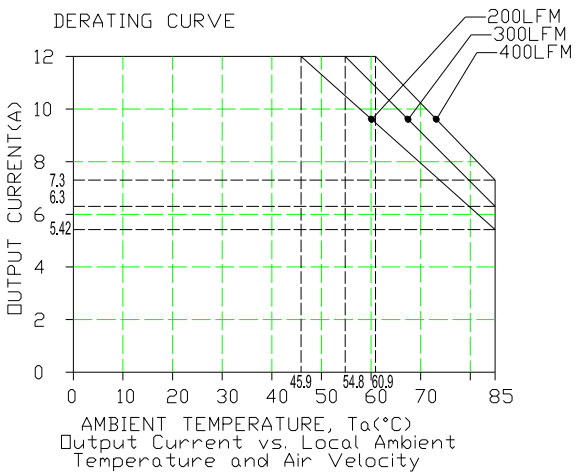

Figure 12. Vout = 1.8 V

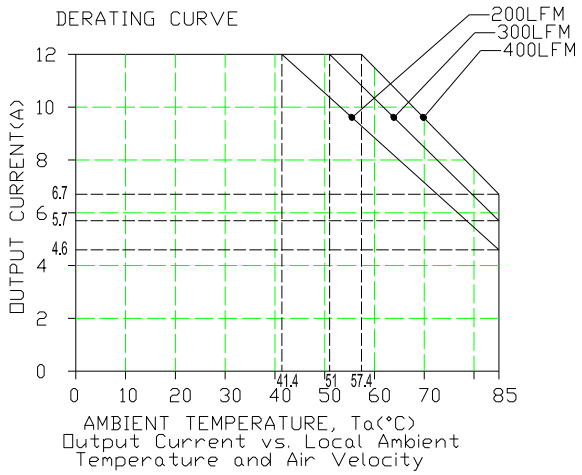

Figure 13. Vout = 3.3 V

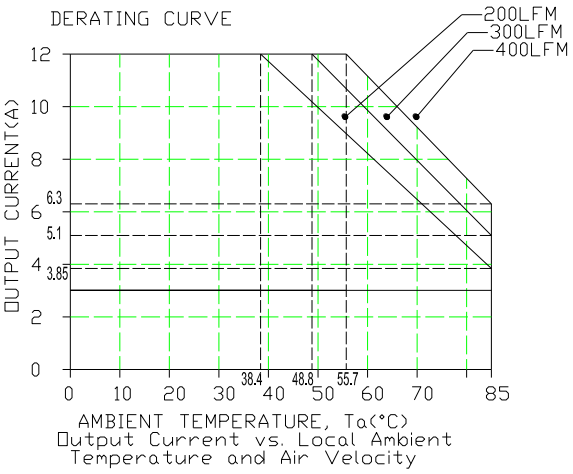

Figure 14. Vout = 5.5 V

10. RIPPLE AND NOISE WAVEFORM

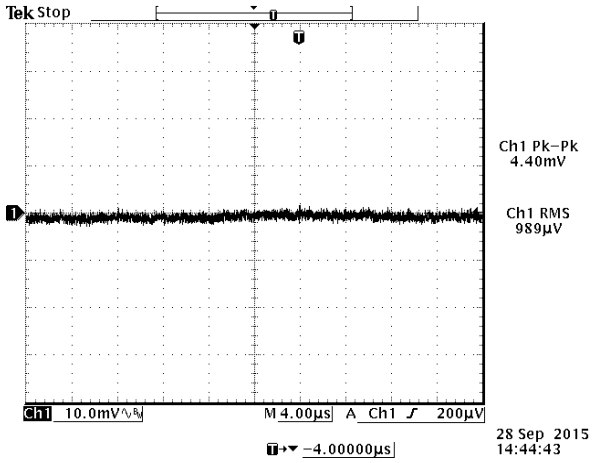

Figure 15. Ripple and noise at full load, 12 V input, 0.6 V output and Ta=25℃

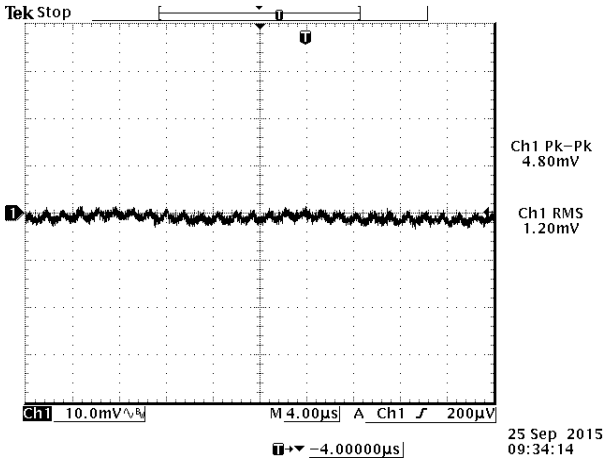

Figure 16. Ripple and noise at full load, 12 V input, 3.3 V output and Ta = 25℃

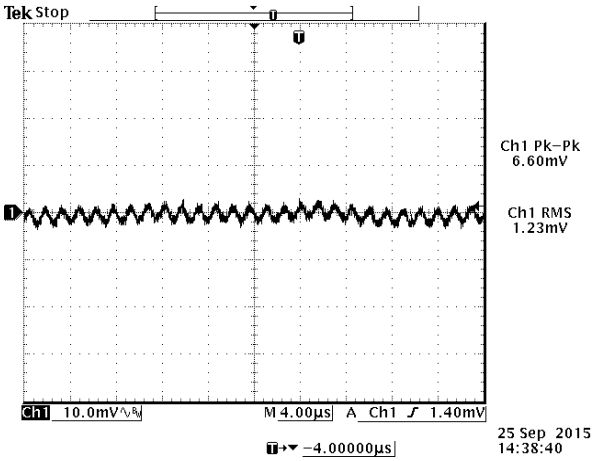

Figure 17. Ripple and noise at full load, 12 V input, 5.5 V output and Ta = 25℃

NOTE: Test condition of the output ripple and noise: 0-20 MHz BW, with 300 µF ceramic cap at output.

11. TRANSIENT RESPONSE WAVEFORMS

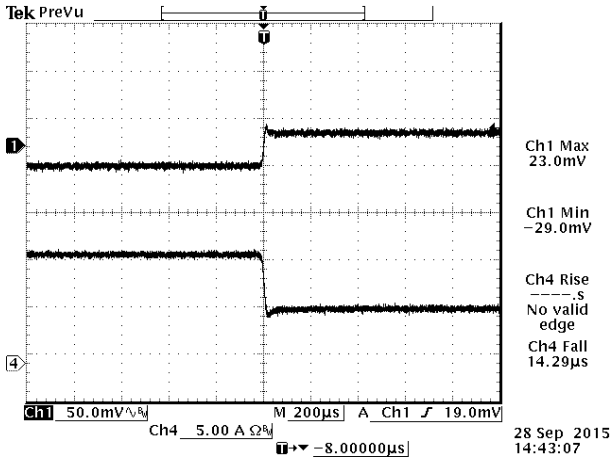

Figure 18. 100%-50% Load Transients at Vin = 12 V, Vout = 0.6 V @ Ta = 25 ℃

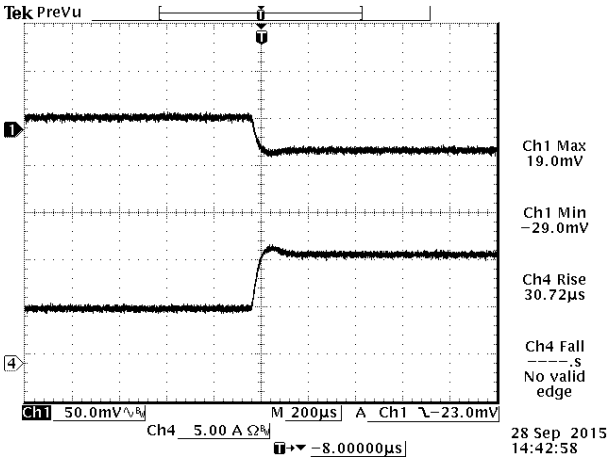

Figure 19. 50%-100% Load Transients at Vin = 12 V, Vout = 0.6 V @ Ta = 25℃

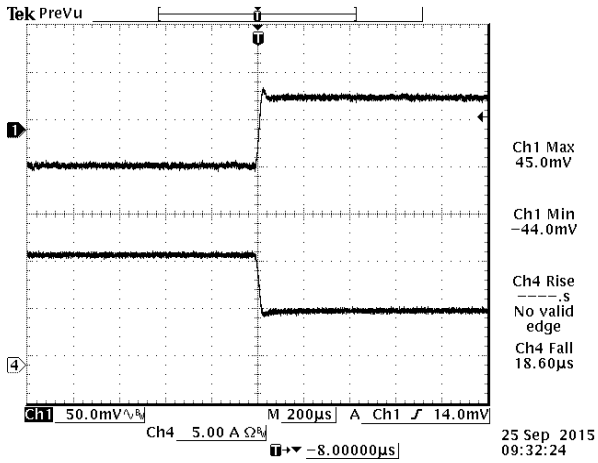

Figure 20. 100%-50% Load Transients at Vin = 12 V, Vout = 3.3 V @ Ta = 25℃

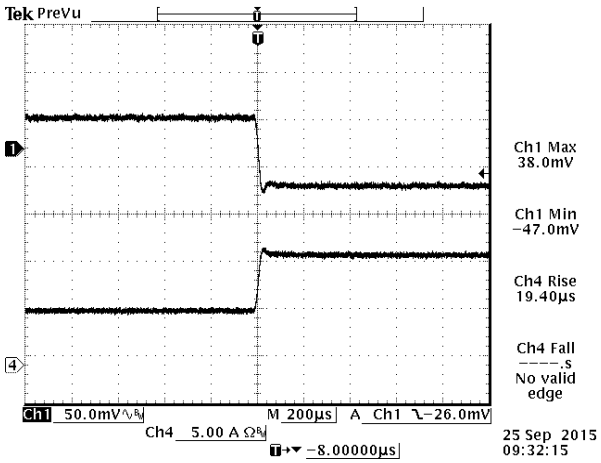

Figure 21. 50%-100% Load Transients at Vin = 12 V, Vout = 3.3 V @ Ta = 25℃

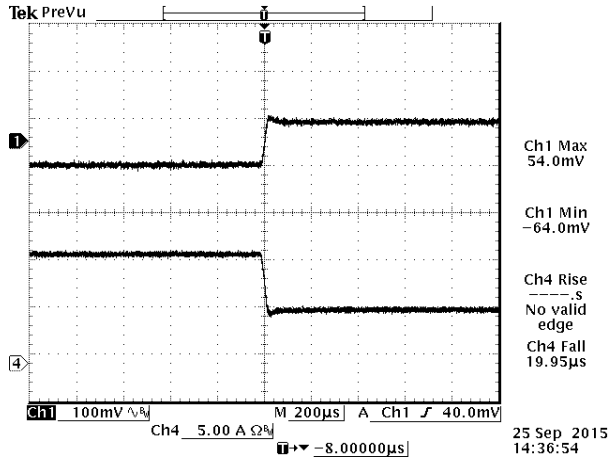

Figure 22. 100%-50% Load Transients at Vin = 12 V, Vout = 5.5 V @Ta = 25℃

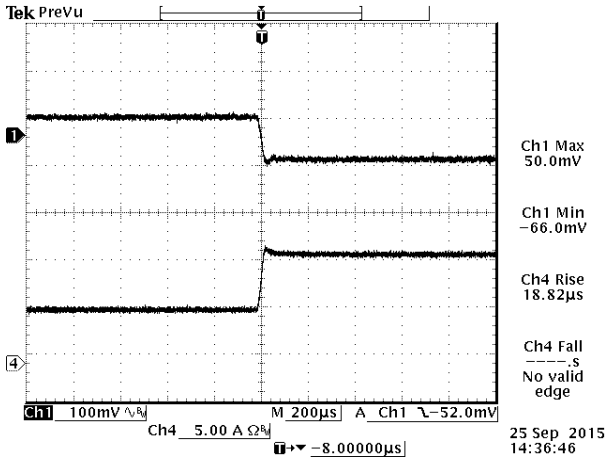

Figure 23. 50%-100% Load Transients at Vin = 12 V, Vout = 5.5V @ Ta = 25℃

NOTE: Test condition of the transient response: di/dt = 0.25 A/µs, with 360 µF ceramic cap at output.

12. INPUT UNDER-VOLTAGE LOCKOUT

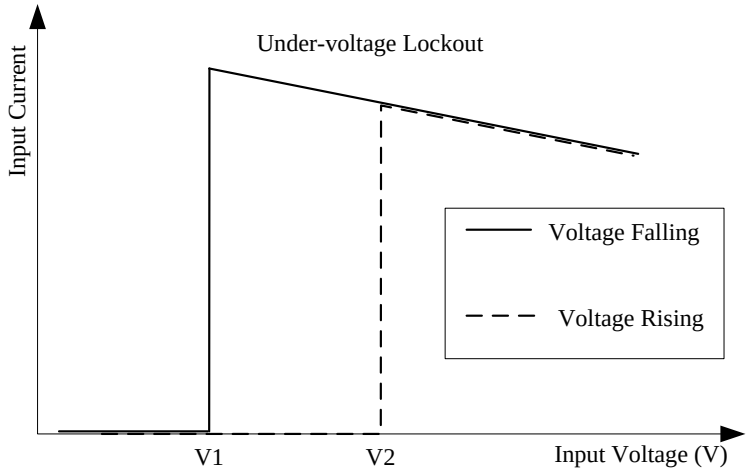

Figure 24. Input under-voltage lockout
V1 = 4 V
V2 = 4.2 V

13. SOLDERING INFORMATION

The SRPE-12E1A0 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 10 seconds. 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.

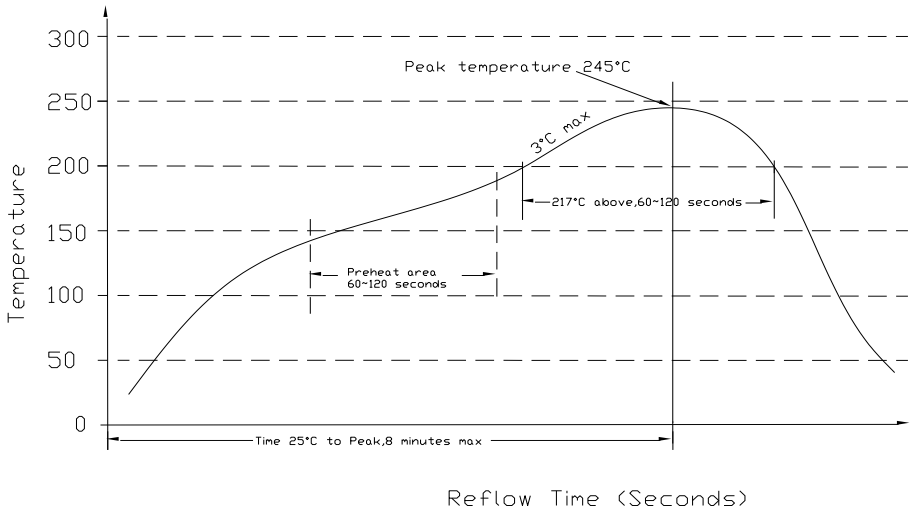

Figure 25. Soldering information

14. MSL RATING

The SRPE-12E1A0 modules have a MSL rating of 3.

15. STORAGE AND HANDLING

The SRPE-12E1A0 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.

17. MECHANICAL OUTLINE

OUTLINE

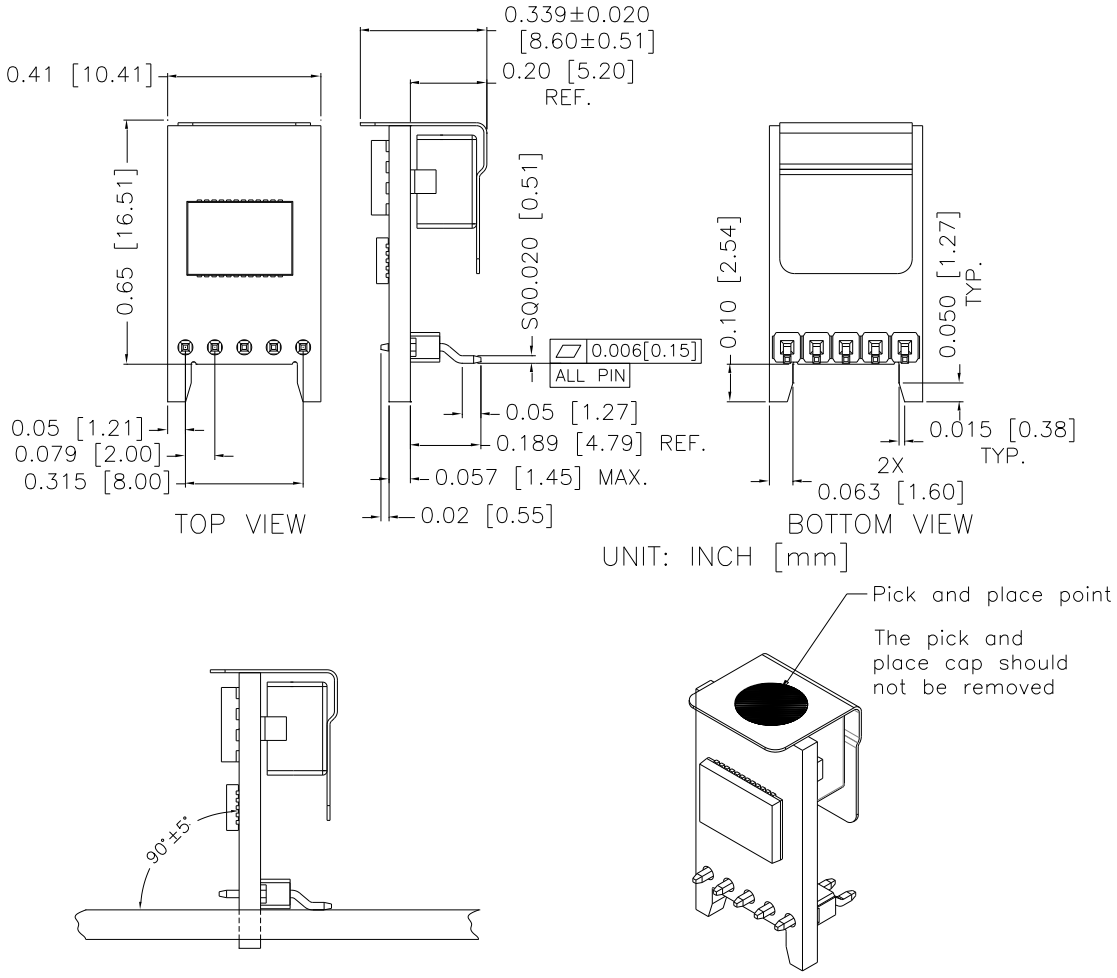

Figure 26. Outline

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

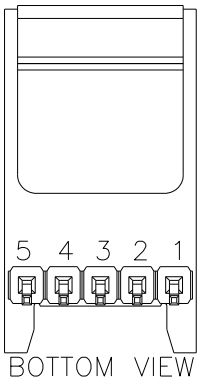

Figure 27. Pins

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

RECOMMENDED PAD LAYOUT

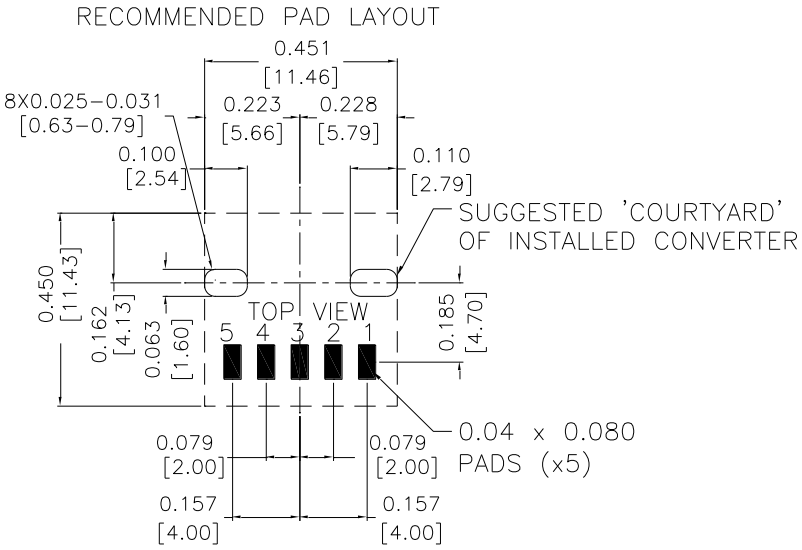

Figure 28. Recommended pad layout

18. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2014-01-25	VP1	First Release	XF.Jiang
2014-02-10	A	1.Ambient Temperature; 2. Add thermal derating curve;3. Output DC Current Limit; 4. Transient Response; 5.di/dt	XF.Jiang
2014-02-20	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 description, add a note for UVLO.	XF.Jiang
2014-04-09	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
2015-11-13	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
2018-02-12	AK	Update the form.	XF.Jiang
2021-06-29	AL	Add object ID.	XF.Jiang

For more information on these products consult: tech.support@psbel.com

NUCLEAR AND MEDICAL APPLICATIONS - Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.
TECHNICAL REVISIONS - The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.

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