xRSB-80T12L

Isolated DC-DC Converter

The xRSB-80T12L are isolated DC/DC converters that operate from a nominal 48 VDC source. These secondary side control units will provide up to 100 W of output power from a nominal 48 VDC input.

Features include start-up into pre-biased load, remote on/off, over current protection and under-voltage lockout.

These converters are provided in an industry standard sixteenth brick package.

Key Features & Benefits

- 48 VDC Input
- 12 VDC @ 8 A Output
- 1/16th Brick Converter
- Isolated
- Fixed Frequency (400 kHz)
- High Efficiency
- High Power Density
- Low Cost
- Basic Insulation
- Input Under-Voltage Lockout
- Start-up into Pre-biased Load
- OCP/SCP
- Over Temperature Protection
- Remote On/Off
- Output Over-Voltage Protection with Auto-Recovery
- Secondary Side Control for Fast Transient Response and High Reliability
- Approved to UL/CSA 62368-1
- Approved to IEC/EN 62368-1
- Class II, Category 2, 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
0RSB-80T12LG SRSB-80T12LG SRSB-80T12LR	12 VDC	36 - 75 VDC	8.3 A	100 W	93%

PART NUMBER EXPLANATION

x	R	SB	-	80	T	12	L	y
Mounting Type	RoHS Status	Series Name		Output Power	Input Range	Output Voltage	Active Logic	Package Type
0 - Through Hole Mount S - Surface Mount	RoHS	1/16th Brick		100 W	36 - 75 V	12 V	Active Low, with HSK & Fins	G - Tray Package R - Tape & Reel Package

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	80	V
Input Transient Voltage	100 ms maximum, Cin = 330 µF	-	-	100	V
I/O Isolation Voltage		1500	-	-	V
Ambient Temperature		-40	-	85	°C
Storage Temperature		-55	-	125	°C
Altitude	Ta = 45°C	-	-	3000	m

NOTE: Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

3. INPUT SPECIFICATIONS

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		36	48	75	V
Input Current (full load)		-	-	3.5	A
Input Current (no load)		-	40	70	mA
Remote Off Input Current		-	2	5	mA
Input Reflected Ripple Current (pk-pk)	Cin = 330 µF, ESR < 0.1 Ω @ 100 kHz, 20˚C	-	-	20	mA
I^2t Inrush Current Transient		-	-	1	A^2s
Turn-on Voltage Threshold		32.5	-	35.5	V
Turn-off Voltage Threshold		31	-	34	V
Lockout Hysteresis Voltage		2	-	-	V

CAUTION: This converter is not internally fused. An input line fuse must be used in application.
Recommend a fast-acting fuse with maximum rating of 5 A on system board. Refer to the fuse manufacture's datasheet for further information.

4. OUTPUT SPECIFICATIONS

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	Vin = 48 V, Io = 50% load	11.76	12.00	12.24	V
Load Regulation		-	±12	±24	mV
Line Regulation		-	±12	±24	mV
Regulation Over Temperature		-	±60	±100	mV
Ripple and Noise (pk-pk)	0-20 MHz BW, with a 1 μF ceramic and a 10 μF Tan capacitor at output.	-	100	200	mV
Ripple and Noise (rms)		-	30	35	mV
Output Current Range		0	-	8.3	A
Output DC Current Limit		9.2	10.4	11.6	A
Short Circuit Surge Transient		-	-	3	A^2s
Rise Time (from ON/OFF or Vin)	From 10% to 90% of Vo	-	25	28	ms
Turn on Delay Time	Enable from Vin . Turn on time from Vin to 90% of Vo	-	27	32	ms
	Enable from ON/OFF . Turn on time from ON/OFF to 90% of Vo	-	27	32	ms
Overshoot at Turn on		-	0	3	%
Output Capacitance	Typically the ceramic capacitance is lower than 600 μF.	0	-	3300	μF
Transient Response					
△V 50%~75% of Max Load	di/dt = 0.1 A/μs, Vin = 48 VDC, Ta = 25°C Load capacitor = 10 μF tantalum + 1 μF ceramic.	-	150	250	mV
Settling Time		-	50	100	μs
△V 75%~50% of Max Load		-	150	250	mV
Settling Time		-	50	100	μs

5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	The efficiency is measured at Vin = 48 V, full load and Ta = 25°C.	91	93	-	%
Switching Frequency		-	400	-	kHz
MTBF	Calculated Per Telcordia SR-332, Issue 2 (Vin = 48 V, Vo = 12 V, Io = 8.3 A, Ta = 25 °C, 100 LFM, FIT = 10^9/MTBF)	-	5.28	-	M hrs
FIT		-	189	-	-
Over Temperature Protection		125	-	135	°C
Over Voltage Protection (Static)	This voltage is achieved by trimming up output slowly.	13.8	-	15.8	V
Weight		-	15.5	-	g
Dimensions (L × W × H)	For SRSB-80T12L		1.30 x 0.90 x 0.422 33.02 x 22.86 x 10.72		inch mm
	For 0RSB-80T12L		1.30 × 0.90 × 0.453 33.02 × 22.86 × 11.50		inch mm
ISOLATION CHARACTERISTICS					
Input to Output		-	-	1500	V
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

6. EFFICIENCY DATA

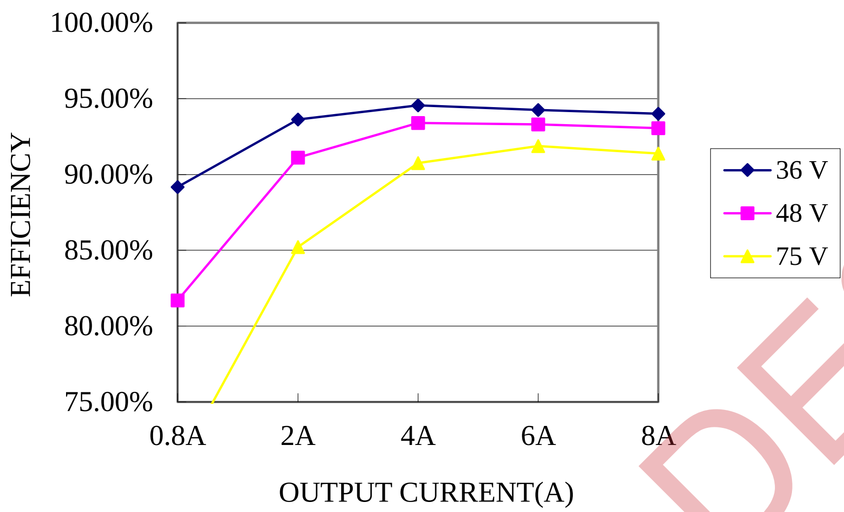


Figure 1. Efficiency data

7. REMOTE ON/OFF

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Signal Low (Unit Off)	Active Low	Remote On/Off pin is open, the module is off.	-0.3	-	0.8	V
Signal High (Unit On)			2.4	-	18	V
Current Sink			0	-	1	mA

Recommended remote on/off circuit for active low

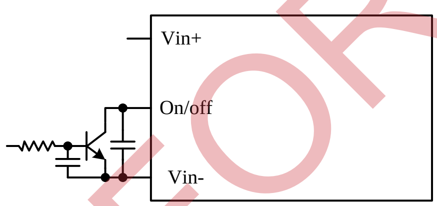


Figure 2. Control with open collector/drain circuit

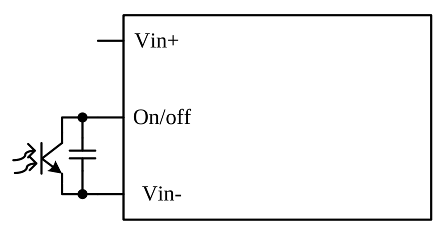


Figure 3. Control with photocoupler circuit

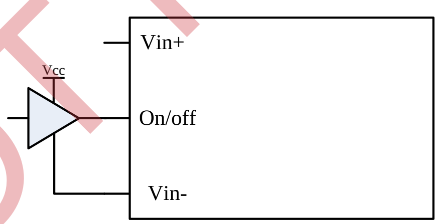


Figure 4. Control with logic circuit

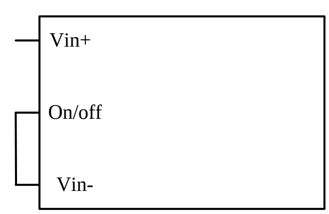


Figure 5. Permanently on

8. REMOTE SENSE

This module has remote sense compensation feature. It can minimize the effects of resistance between output and load in system layout and facilitate accurate voltage regulation at load terminals or other selected point.

1. The remote sense lines carries very little current and hence do not require a large cross-sectional area.

2. This module compensates for a maximum drop of 5% of the nominal output voltage.

3. If the unit is already trimmed up, the available remote sense compensation range should be correspondingly reduced. The total voltage increased by trim and remote sense should not exceed 5% of the nominal output voltage.

4. When using remote sense compensation, all the resistance, parasitic inductance and capacitance of the system are incorporated within the feedback loop of this module which can make an effect on the module's compensation, affecting the stability and dynamic response. A 0.1 μF ceramic capacitor can be connected at the point of load to de-couple noise on the sense wires.

5. Recommend the connection of remote sense compensation as below figure. There are a resistor RS+ (100 ohm) from Vo+ to Sense+ and a resistor RS- (11.3 ohm)) from Vo- to Sense- inside of this module.

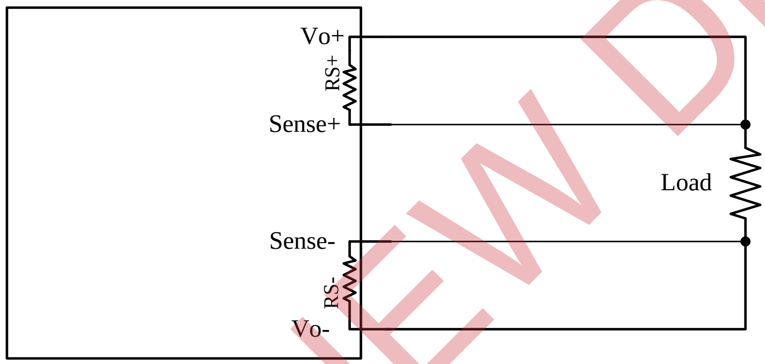


Figure 6.

6. If not using remote sense compensation, please connect sense directly to output at module's pin, that is, connect sense+ to Vo+ and sense- to Vo- at module's pin, the shorter the better. see below figure.

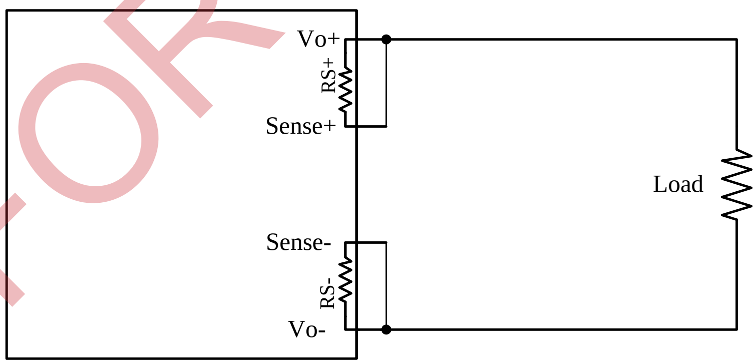


Figure 7.

9. INPUT NOISE

Input Reflected Ripple Current

Testing setup

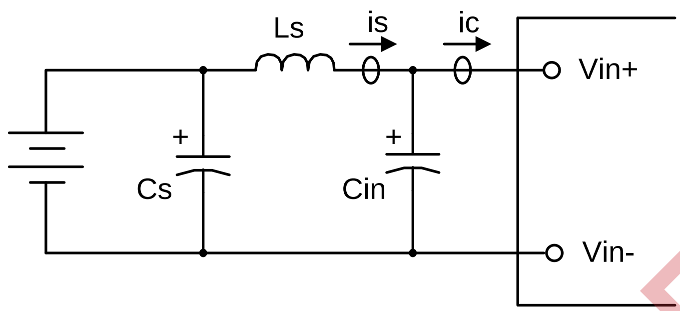


Figure 8.

Notes and values in testing:

- is: Input Reflected Ripple Current
- ic: Input Terminal Ripple Current
- Ls: Simulated Source Impedance (12 µH)
- Cs: Offset possible source Impedance (330 µF, ESR < 0.1 Ω @ 100 kHz, 20˚C)
- Cin: Electrolytic capacitor, should be as close as possible to the power module to damp ic ripple current and enhance stability. Recommendation:330 µF, ESR < 0.1 Ω @ 100kHz, 20˚C.

Below measured waveforms are based on above simulated and recommended inductance and capacitance.

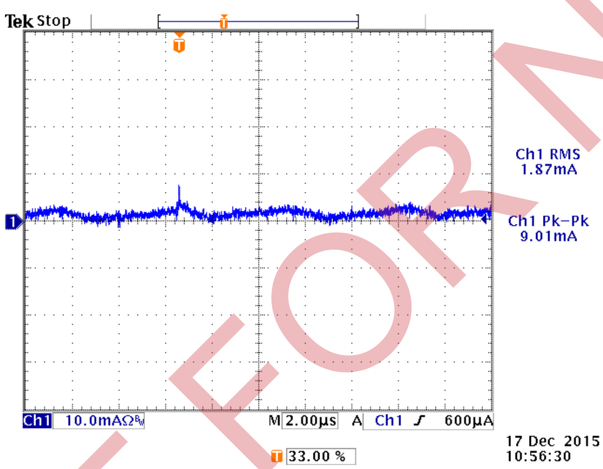


Figure 9. is (input reflected ripple current), AC component

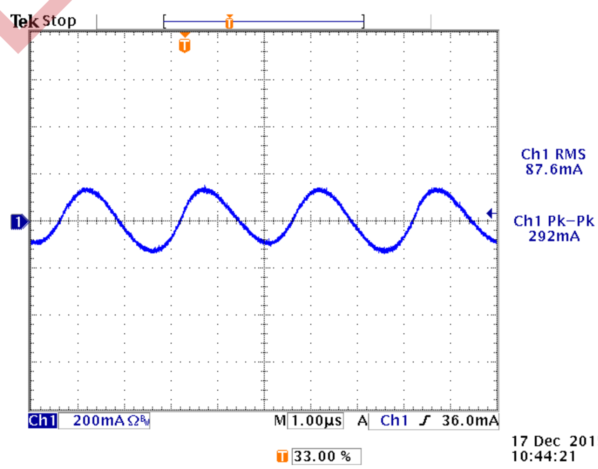


Figure 10. ic (input terminal ripple current), AC component

Test condition: 48 VDC input, 12 VDC / 8.3 A output and Ta = 25˚C, with a 1 µF ceramic and 10 µF Tan. Cap at output.

10. OUTPUT TRIM EQUATIONS

Equations for calculating the trim resistor are shown below. The Trim Down resistor should be connected between the Trim pin and Sense (-) pin. The Trim Up resistor should be connected between the Trim pin and the Sense (+). Only one of the resistors should be used for any given application.

Minimum trim down voltage is 9.6 V

Maximum trim up voltage is 12.6 V.

The total voltage increased by trim and remote sense should not exceed 5% of the nominal output voltage.

Trim Down Test Circuit

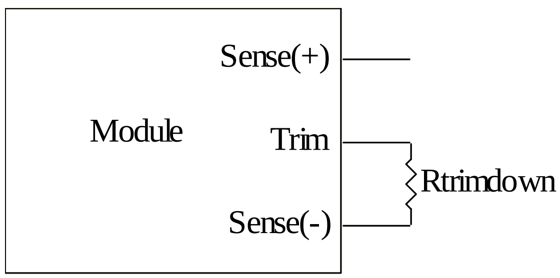


Figure 11. Trim down test circuit

$$Rtrimdown = \frac{511}{|delta|} - 10.22[k\Omega]$$

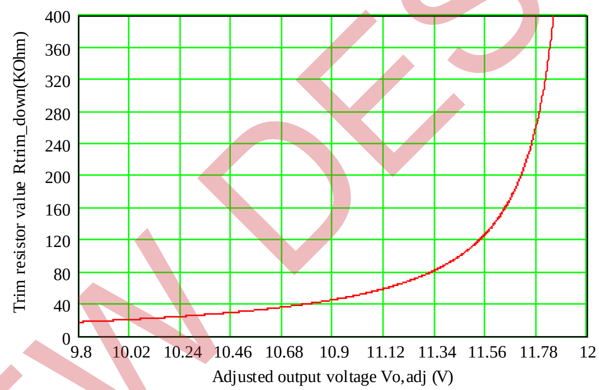


Figure 12. Trim down curve

Trim Up Test Circuit

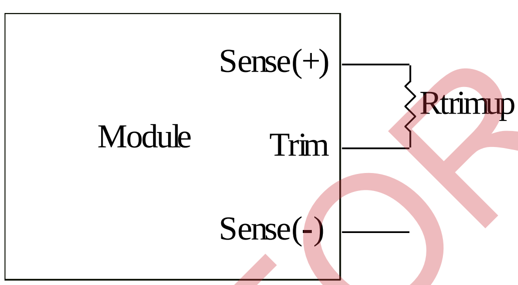


Figure 13. Trim up test circuit

$$Rtrimup = \frac{(100 + delta) \cdot Vo \cdot 5.11 - 626}{1.225 \cdot delta} - 10.22[k\Omega]$$

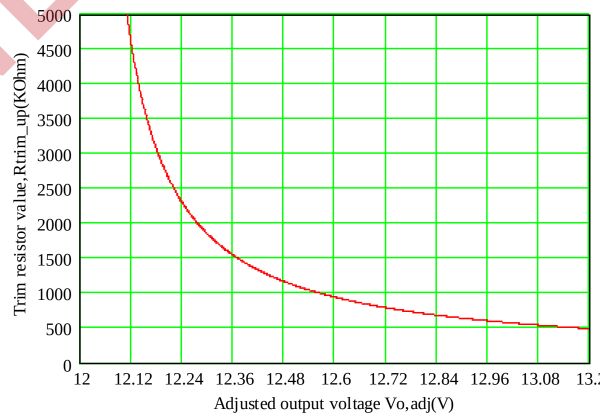


Figure 14. Trim up curve

NOTE:

$$delta = \frac{(Vo\_req - Vo)}{Vo} \times 100[\%]$$

Vo_req = Desired(trimmed) output voltage [V]
Output voltage Vo = 12 V

11. RIPPLE AND NOISE WAVEFORM

Testing setup

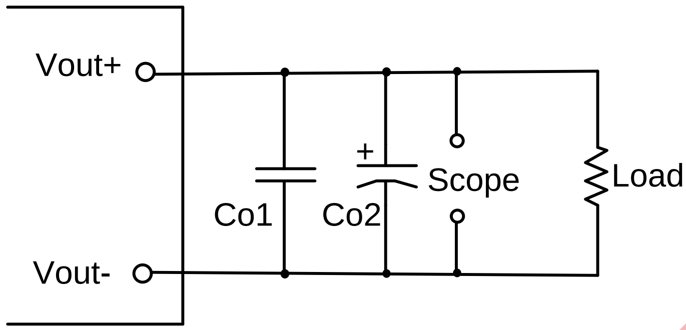


Figure 15.

Notes and values in testing:

Co1: 1 μF ceramic capacitor

Co2: 10 μF tantalum capacitor

The capacitor should be as close as possible to the power module to damp ripple current and enhance stability.

Below measured waveforms are based on above capacitance.

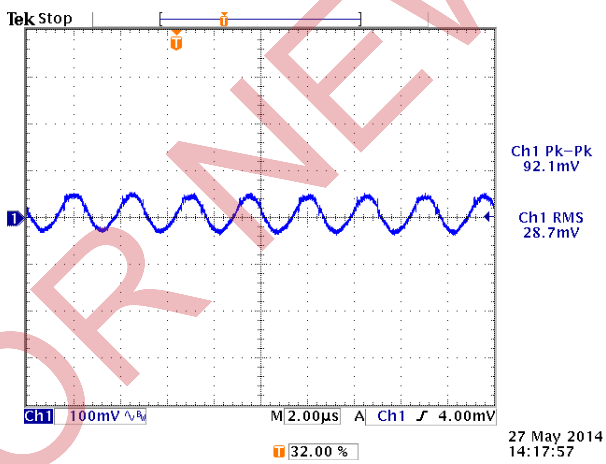


Figure 16. Ripple and noise waveform

NOTE: Ripple and noise at full load, 48 VDC input, 12 VDC / 8.3 A output and Ta = 25°C, with a 1 μF ceramic and 10 μF Tan. cap at output.

12. TRANSIENT RESPONSE WAVEFORMS

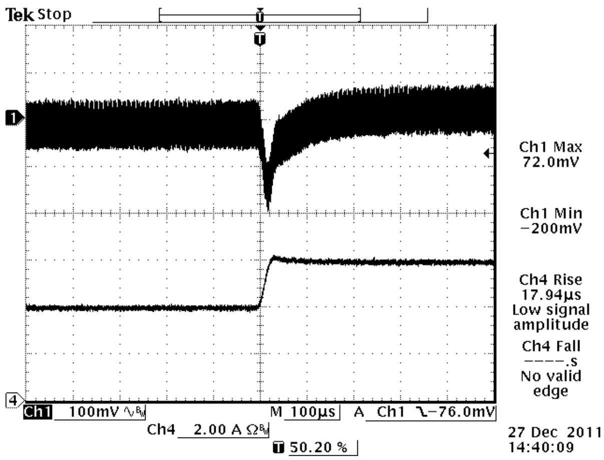


Figure 17. Vo=12 V, 50% to 75% Load Transients

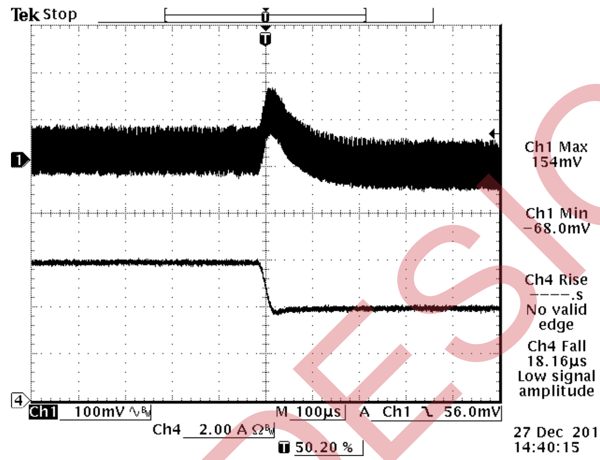


Figure 18. Vo=12 V, 75% to 50% Load Transients

NOTE: Transients Response at Vin = 48 V, di/dt = 0.1 A/µs, Ta = 25°C.

13. OVER VOLTAGE PROTECTION

The output overvoltage protection consists of circuitry that monitors the voltage on the output terminals. If the voltage on the output terminals exceeds the over voltage protection threshold, the module will shut down into hiccup mode and restart once every 400 ms. The module operates normally when the fault is cleared.

TEST SETUP:

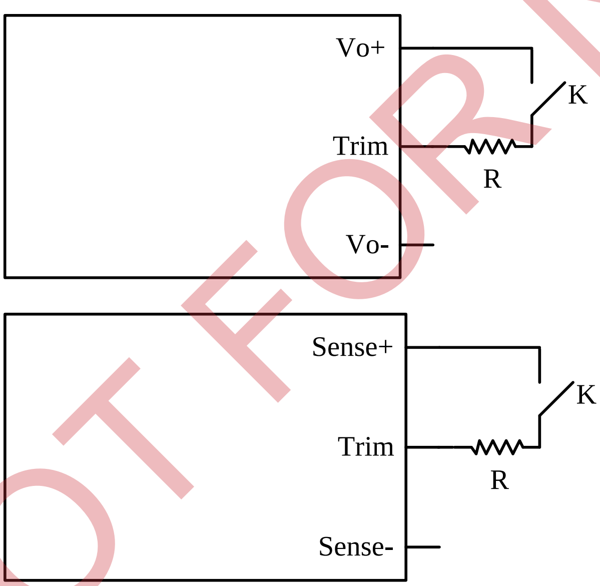


Figure 19. R = 10 kΩ

WAVEFORM:

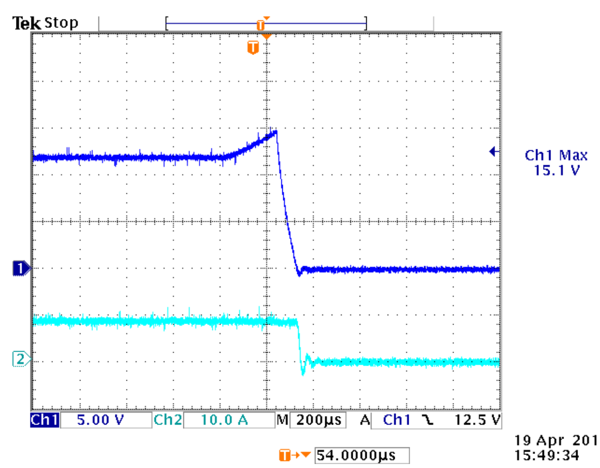


Figure 20.
CH1: Output voltage waveform
CH2: Output Current waveform
Test condition: 48 Vin, 8.3 A, Rload = 10 kΩ

14. OVER TEMPERATURE PROTECTION

The OTP is achieved by thermistor R25 and the threshold is set at 125°C in non-latch mode; the hottest component Q13 reaches 130°C with 100 LFM air flow correspondingly. It will restart automatically when the temperature falls to 118°C. The protecting point will be varied a little under different conditions (air flow, ambient temperature, input voltage, load...).

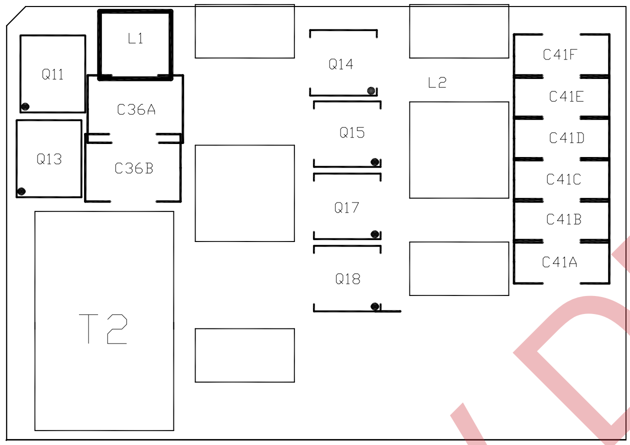
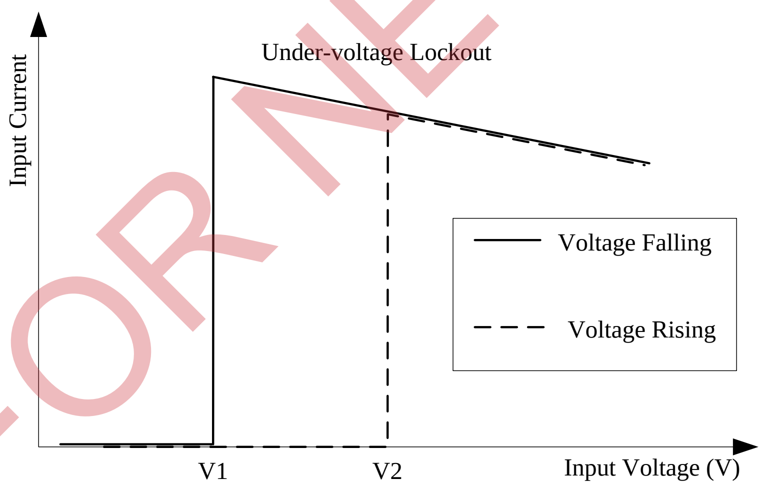


Figure 21.

15. UNDER VOLTAGE LOCKOUT



V1 = 32.5 V

V2 = 34 V

Figure 22. Under-voltage lockout

16. THERMAL DERATING CURVE

The airflow is in either the transverse or longitudinal direction.

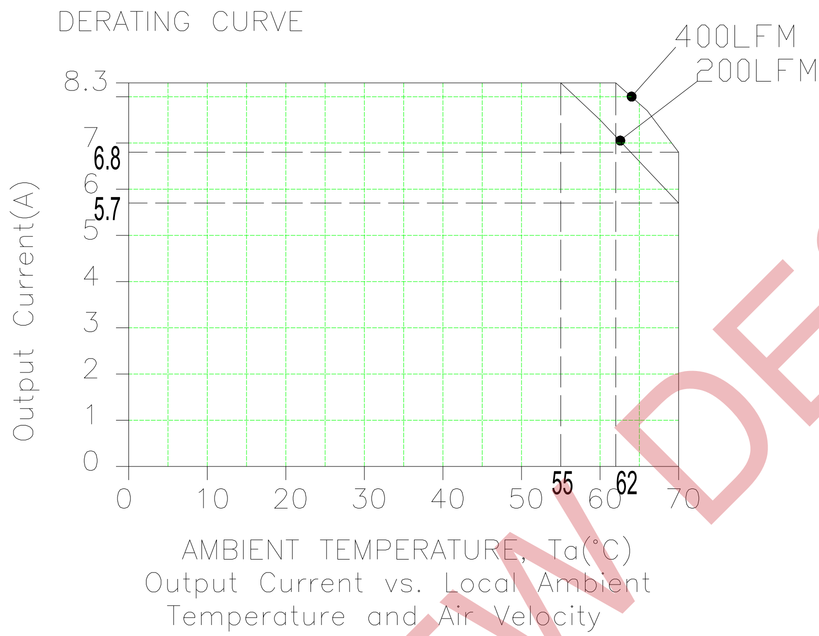


Figure 23. Vo = 12 V, Vin = 48 V

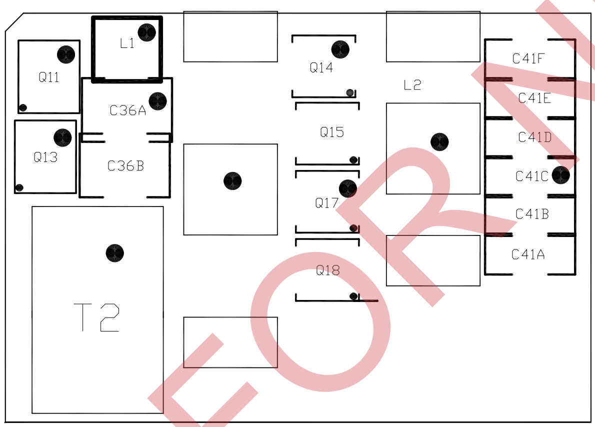


Figure 24. Temperature reference points on top side

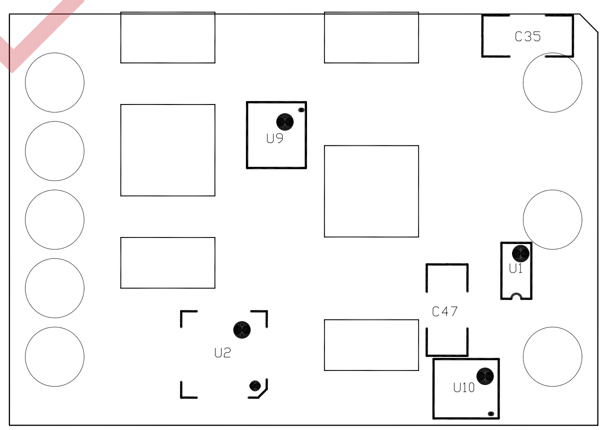


Figure 25. Temperature reference points on bottom side

17. SAFETY&EMC

SAFETY:

Material flammability: UL94V-0

Compliance to IEC/EN 62368-1

Compliance to UL/CSA 62368-1

EMC:

1. Surge: IEC61000-4-5
2. DC-DIP: IEC61000-4-29
3. Conductive EMI: EN 55032 class A

Compliance to EN 55032 class A (both peak and average) with the following inductive and capacitive filter.

Test Setup:

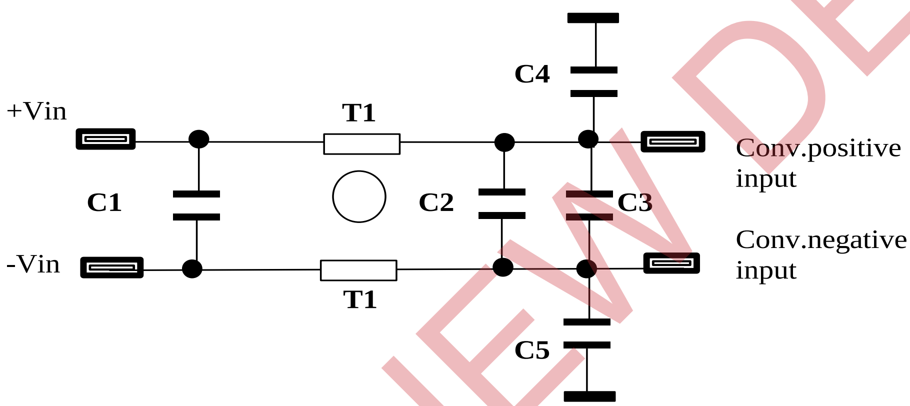


Figure 26.

Item	Designator	Parameter	Vendor	Vendor P/N
1	C1	1µF		
2	C2	1µF		
3	C3	220µF		
4	C4	0.11µF		
5	C5	0.11µF		
6	T1	1mH		

POSITIVE:

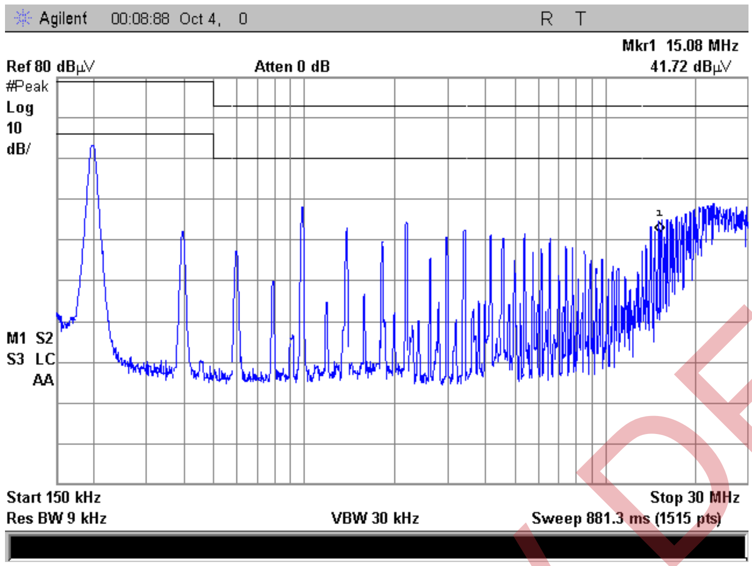


Figure 27.

NEGATIVE:

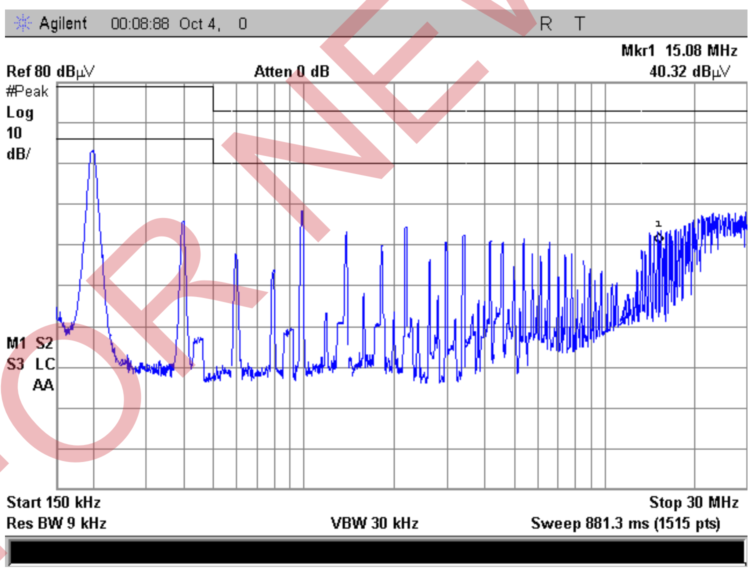


Figure 28.

18. SOLDERING INFORMATION

The SRSB-80T12Lx modules are designed to be compatible with 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.

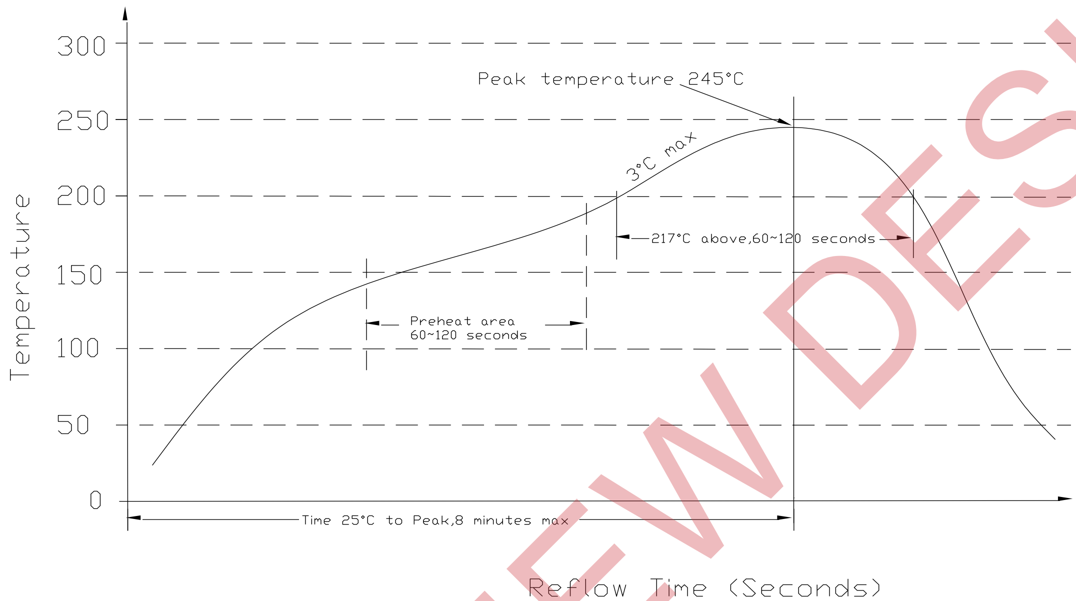


Figure 29. Soldering information

19. MSL RATING

The SRSB-80T12Lx modules have a MSL rating of 3.

20. STORAGE AND HANDLING

The SRSB-80T12Lx 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.

21. 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.

22. MECHANICAL DIMENSIONS

0RSB-80T12L OUTLINE

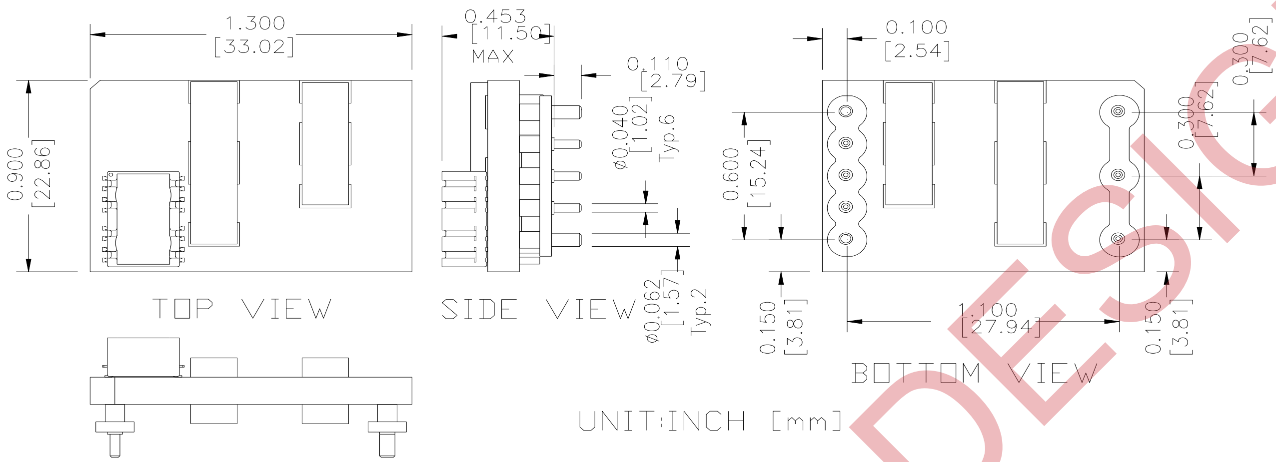


Figure 30. 0RSB-80T12L Outline

NOTE: These parts are not however compatible with the higher temperatures associated with lead free solder processes and must be soldered using a reflow profile with a peak temperature of no more than 245 °C.

NOTES*:*

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 inches; Tolerances: x.xx +/-0.02 inch [0.51 mm].
   x.xxx +/-0.010 inch [0.25 mm]. Unless otherwise stated

0RSB-80T12L PIN DEFINITIONS

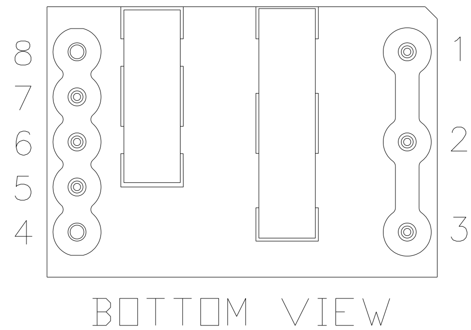


Figure 31. 0RSB-80T12L Pins

PIN	FUNCTION
1	Vin (+)
2	Remote On/Off
3	Vin (-)
4	Vout (-)
5	SENSE (-)
6	TRIM
7	SENSE (+)
8	Vout (+)

0RSB-80T12L RECOMMENDED PAD LAYOUT

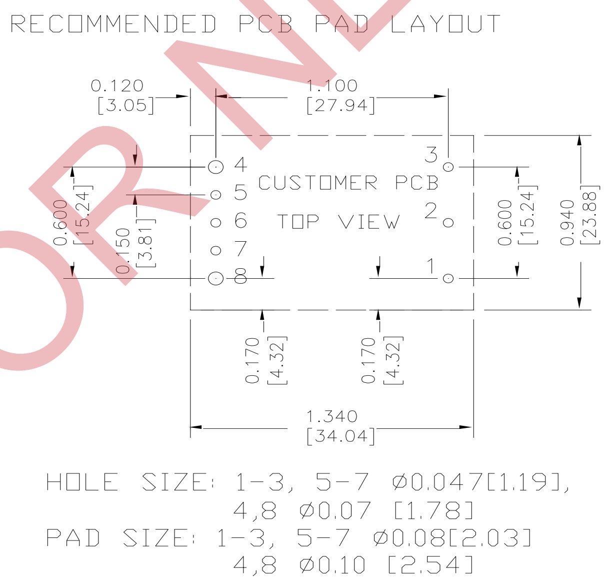


Figure 32. 0RSB-80T12L Recommended pad layout

SRSB-80T12L OUTLINE

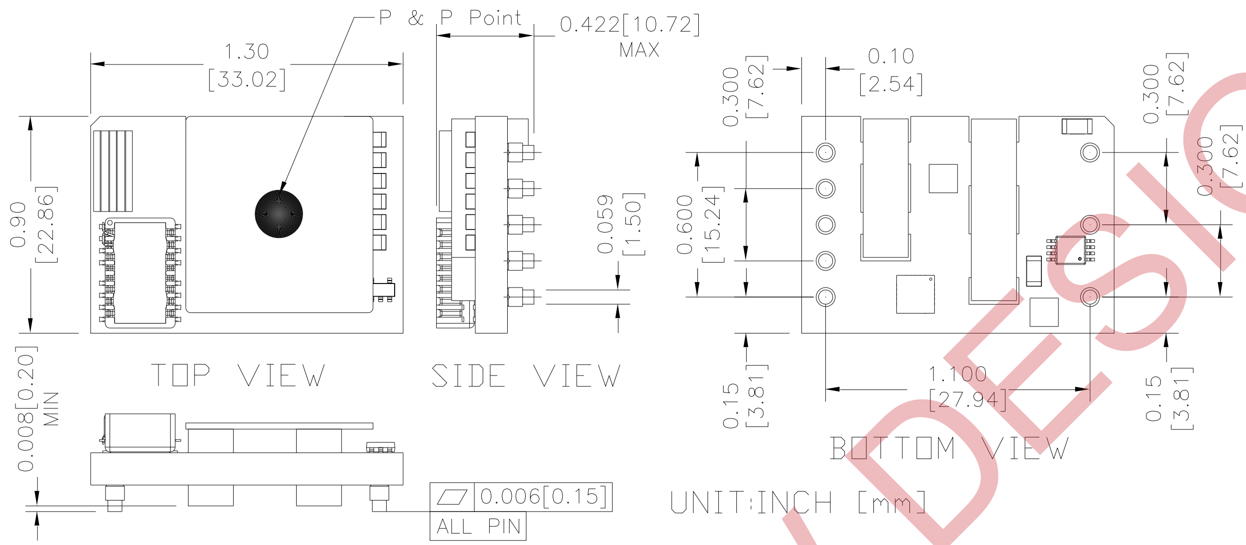


Figure 33. SRSB-80T12L Outline

NOTES*:*

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 inches; Tolerances: x.xx +/-0.02 inch [0.51 mm].
   x.xxx +/-0.010 inch [0.25 mm]. Unless otherwise stated

SRSB-80T12L PIN DEFINITIONS

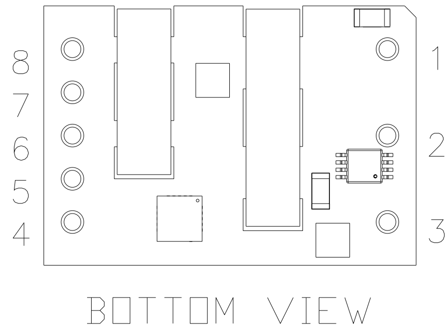


Figure 34. SRSB-80T12L Pins

PIN	FUNCTION
1	Vin (+)
2	Remote On/Off
3	Vin (-)
4	Vout (-)
5	SENSE (-)
6	TRIM
7	SENSE (+)
8	Vout (+)

SRSB-80T12L RECOMMENDED PAD LAYOUT

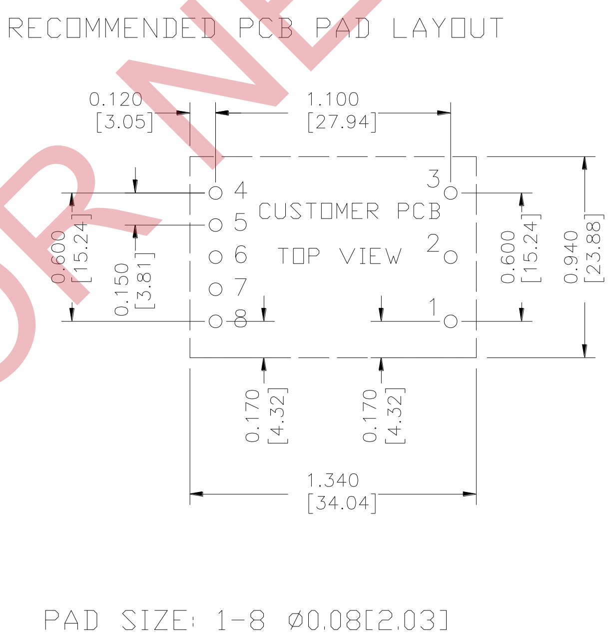
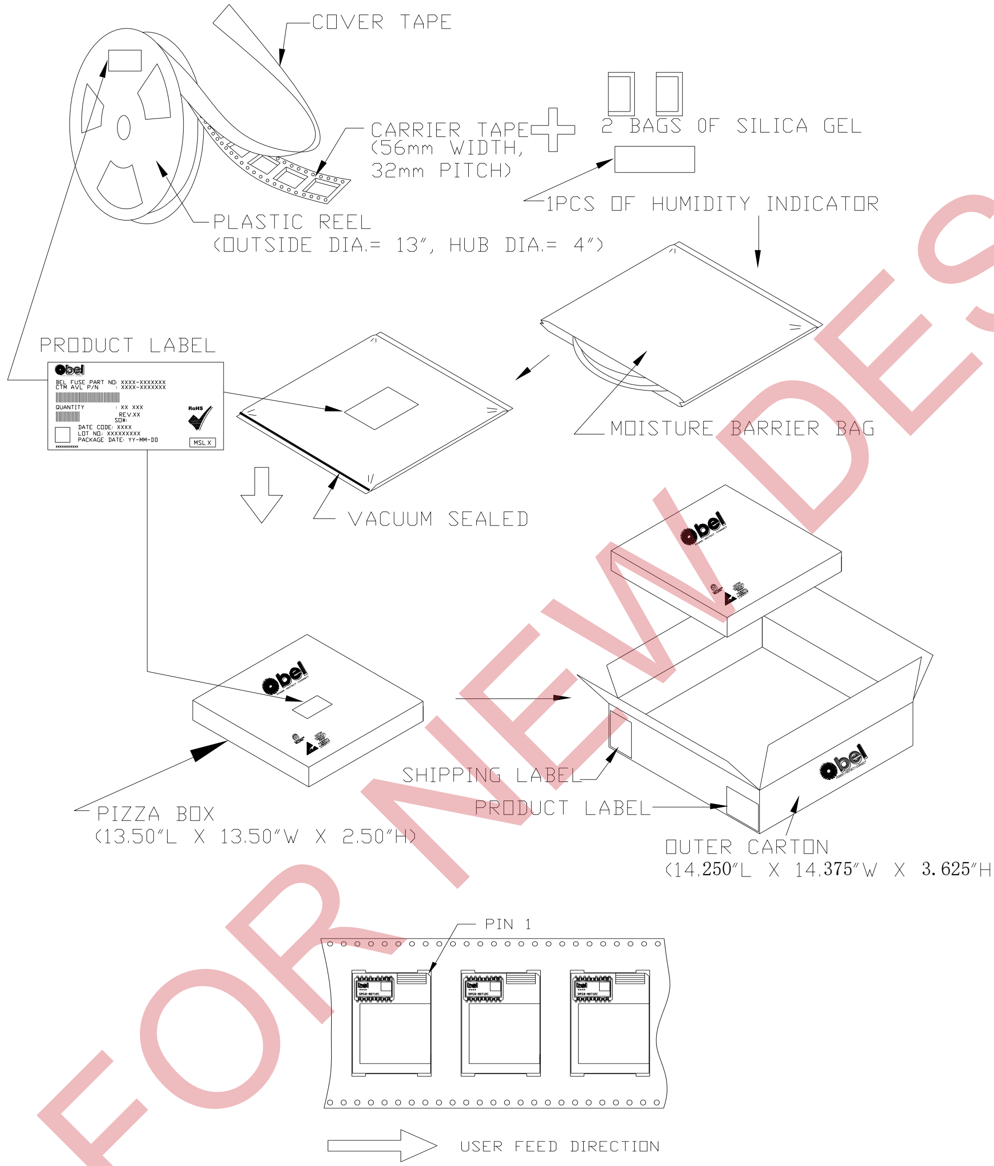


Figure 35. SRSB-80T12L Recommended pad layout

23. PACKAGING INFORMATION

SRSB-80T12LR



TAPE WIDTH	56mm
POCKET PITCH	32mm
QUANTITY OF COMPONENTS PER REEL	160
PLASTIC REEL OUTER DIAMETER	13 INCHES
PLASTIC REEL HUB DIAMETER	4 INCHES
COMPLY WITH EIA 481-2-A	

Figure 36. SRSB-80T12LR package information

xRSB-80T12LG

Figure 37. xRSB-80T12LG package information

24. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2013-07-10	A	First release.	J.Yan
2015-02-09	B	Update Output Specs, TR, Startup & shut down, Trim and MD.	J.Yan
2017-02-20	AC	Update Absolute max, Input spec, Output.	J.Yan
2017-07-04	AC	Update Cin.	J.Yan
2017-08-30	AD	Update MD, Add package drawing.	J.Yan
2017-10-31	AE	Update General specification.	J.Yan
2021-07-05	AF	Add object ID. Update safety certificate.	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.

