

# xRSB-80T03x Series

## Isolated DC-DC Converter

The xRSB-80T03x is isolated DC/DC converter that operates from a nominal 48 VDC source. This secondary side control unit will provide up to 82.5 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. This converter is provided in an industry standard sixteenth brick package.



### Key Features & Benefits

- 36 VDC – 75 VDC Input
- 3.3 VDC / 25 A Output / 16<sup>th</sup> Brick Converter
- Isolated
- Input Under Voltage Lockout
- Fixed Frequency (500 kHz)
- Start-up into pre-biased load
- High Efficiency
- OCP/SCP
- High Power Density
- Over Temperature Protection
- Low Cost
- Remote On/Off
- Output Voltage Trim
- Positive/Negative Remote Sense
- Basic Insulation
- Approved to UL/CSA/IEC60950-1, 2nd +A2 version
- Output overvoltage protection with autorecovery
- Secondary side control for fast transient response and high reliability
- Class II, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592B)



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## 1. MODEL SELECTION

OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY	MODEL NUMBER ACTIVE HIGH	MODEL NUMBER ACTIVE LOW
3.3 VDC	36 VDC - 75 VDC	25 A	82.5 W	92.5%	xRSB-80T030	xRSB-80T03L

**NOTE :** 1.Add “G” or “R” suffix at the end of the model number to indicate packaging.

### PART NUMBER EXPLANATION

x	R	SB	-	80	T	03	x	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 6	1/16 <sup>th</sup> Brick		82.5 W	36-75V	3.3V	0 - Active high L - Active low	G - Tray package R - Tape and Reel package

## 2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	75	V
Input Transient Voltage	100 ms maximum	-	-	100	V
Remote On/Off		-0.3	-	18	V
I/O Isolation Voltage		1500	-	-	V
Ambient Temperature		-40	-	85	°C
Storage Temperature		-55	-	125	°C
Altitude		-	-	2000	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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		36	48	75	V
Input Current (full load)		-	-	3	A
Input Current (no load)		-	40	70	mA
Remote Off Input Current		-	2	5	mA
Input Reflected Ripple Current (pk-pk)	With simulated source impedance of 10 $\mu$ H, 5Hz to 20MHz. Use a 100 $\mu$ F/100V electrolytic capacitor with ESR=1 ohm max, at 200KHz@25°C.	-	20	30	mA
Input Reflected Ripple Current (rms)		-	5	10	mA
I <sup>2</sup> t Inrush Current Transient		-	-	1	A <sup>2</sup> s
Turn on Voltage Threshold		-	-	1	V
Turn off Voltage Threshold		32.5	-	35.5	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 5A on system board. Refer to the fuse manufacture’s datasheet for further information.

**NOTES:** This converter has internal L-C (0.47 $\mu$ F-0.33  $\mu$ H-2.35  $\mu$ F) filter.

## 4. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	V <sub>in</sub> =12 V, half load	3.230	3.300	3.370	V
Load Regulation		-	±4	±9	mV
Line Regulation		-	±4	±9	mV
Regulation Over Temperature		-	±8	±15	mV
Output Ripple and Noise (pk-pk)	0-20 MHz BW, with a 22 µF ceramic capacitor and a 150 µF tantalum capacitor at the output.	-	50	80	mV
Output Ripple and Noise (rms)		-	20	30	mV
Output Ripple and Noise (pk-pk) under worst case		-	-	120	mV
Output Current Range		0	-	25	A
Output DC Current Limit		26	30	34	A
Short Circuit Surge Transient		-	-	3	A <sup>2</sup> s
Rise Time		5	-	10	ms
Turn on Time	Enable form V <sub>in</sub>	-	30	50	ms
	Enable form ON/OFF	-	30	50	ms
Overshoot at Turn on		-	0	3	%
Output Capacitance		0	-	10000	µF
TRANSIENT RESPONSE					
ΔV 50% ~ 75% of Max Load		-	80	150	mV
Setting Time	di/dt=1A/µs, V <sub>in</sub> =48VDC, T <sub>a</sub> =25°C, with 270µF Tantalum cap at output..	-	50	100	µS
ΔV 75% ~ 50% of Max Load		-	80	150	mV
Setting Time		-	50	100	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
Efficiency	The efficiency is measured at V <sub>in</sub> =48V, full load and T <sub>a</sub> =25°C.	90.5	92.5	-	%
Switching Frequency		-	500	-	kHz
Over Temperature Protection		-	125	-	°C
Over Voltage Protection (Static)	This voltage is achieved by trimming up output slowly.	-	4.2	-	V
FIT					
MTBF	Calculated Per Telcordia SR-332, Issue 2 (V <sub>in</sub> =48 V, V <sub>o</sub> =3.3 V, I <sub>o</sub> =25A, T <sub>a</sub> = 25 °C, 100LFM, FIT=10 <sup>9</sup> /MTBF)		5.7		M hrs
Dimensions (L x W x H)			1.30 x 0.9 x 0.453		inch
			33.02 x 22.86 x 11.50		mm
Weight		-	15.5	-	g
ISOLATION CHARACTERISTICS					
Input to Output		-	-	1500	V
Isolation Resistance		10M	-	-	Ohm
Isolation Capacitance		-	1000	-	pF

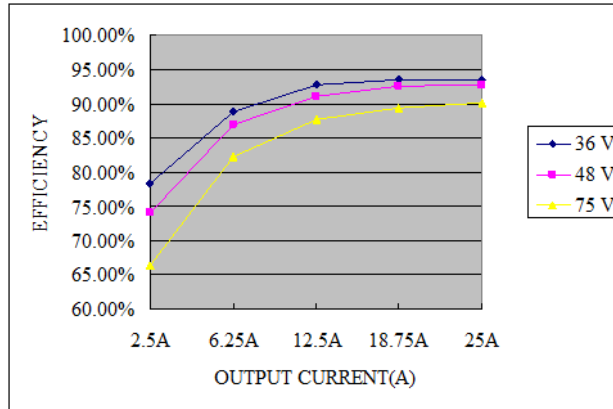


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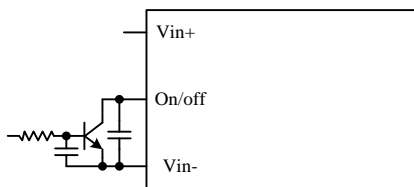
## 6. EFFICIENCY DATA



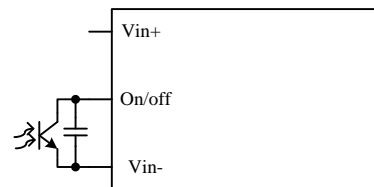
## 7. CONTROL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
<b>REMOTE ON/OFF</b>					
Signal Low (Unit On)	Active Low	-0.3	-	0.8	V
Signal High (Unit Off)		2.4	-	18	V
Signal Low (Unit Off)	Active High	-0.3	-	0.8	V
Signal High (Unit On)		2.4	-	18	V
Current Sink		0	-	1	mA

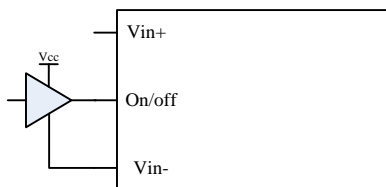
### Recommended remote on/off circuit for active low



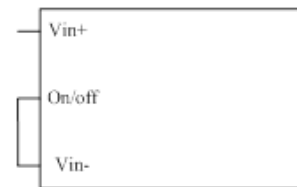
Control with open collector/drain circuit



Control with photocoupler circuit

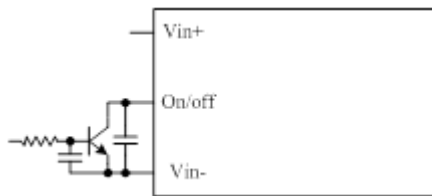


Control with logic circuit

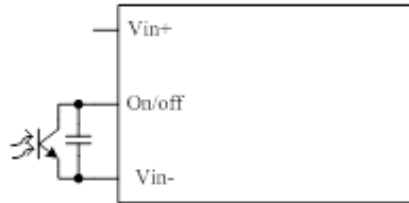


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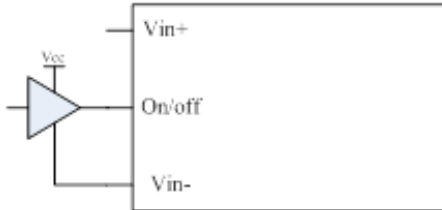
## Recommended remote on/off circuit for active high



Control with open collector/drain circuit



Control with photocoupler circuit



Control with logic circuit

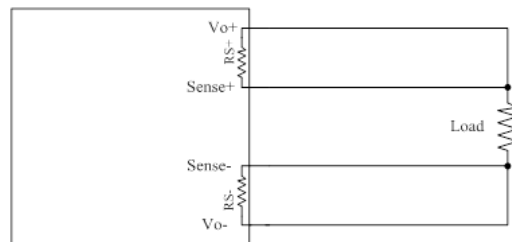


Permanently on

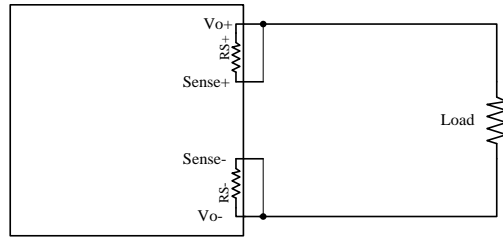
## 8. REMOTE SENSE

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

1. The remote sense lines carry very little current and hence do not require a large cross-sectional area.
2. This module compensates for a maximum drop of 10% 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 10% 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. This can have an effect on the module's compensation, affecting the stability and dynamic response. A 0.1µF 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- (51 ohm) from Vo- to Sense- inside of this module.



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.



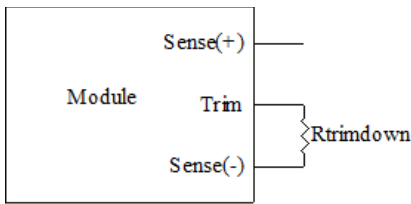
### 9. OUTPUT TRIM EQUATIONS

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.

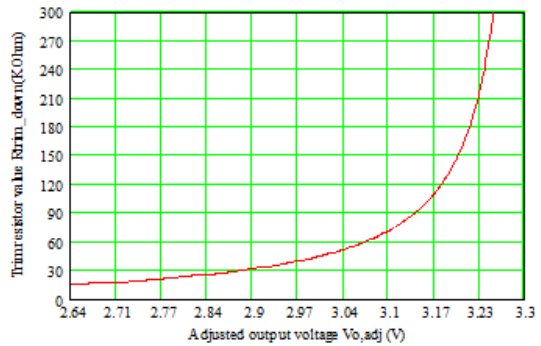
Minimum trim down voltage is 2.64V  
 Maximum trim up voltage is 3.63V.

The total voltage increased by trim and remote sense should not exceed 10% of the nominal output voltage.

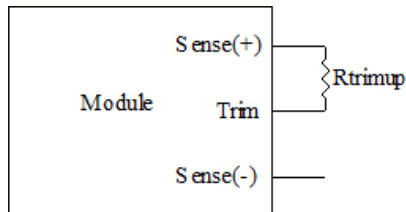
#### Trim down test circuit



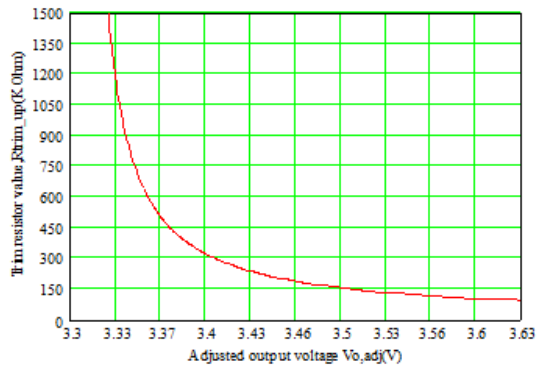
$$R_{trimdown} = \frac{511}{\Delta} - 10.22 [k\Omega]$$



#### Trim up test circuit



$$R_{trimup} = \frac{(100 + \Delta) \cdot V_o \cdot 5.11 - 626}{1.225 \cdot \Delta} - 10.22 [k\Omega]$$



**NOTE:** Vo\_req=Desired(trimmed) output voltage[V]  
 Output voltage Vo=3.3V

10. RIPPLE AND NOISE WAVEFORM

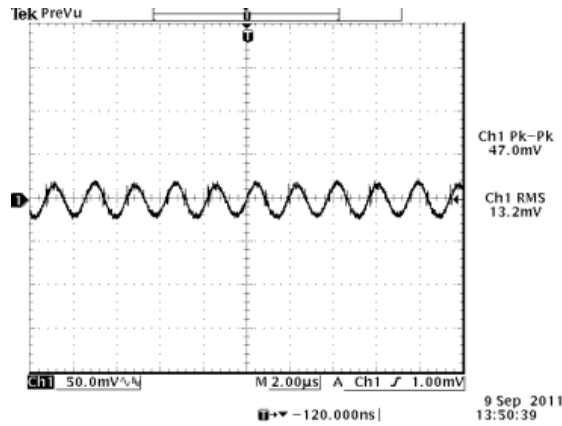


Figure 1. 48 VDC input, 3.3 V output

NOTE: Ripple and noise at full load, 48VDC input, 3.3VDC/25A output and Ta=25 ° C, and with a 10µF ceramic cap at output.

11. TRANSIENT RESPONSE WAVEFORMS

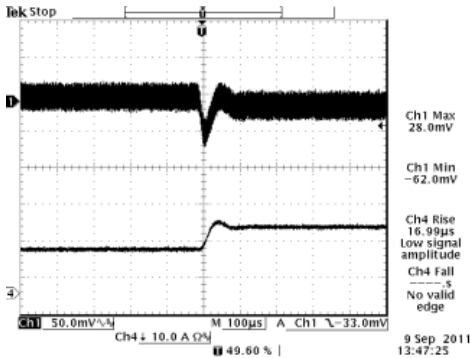


Figure 2. Vo= 3.3 V 50%-75% Load Transients

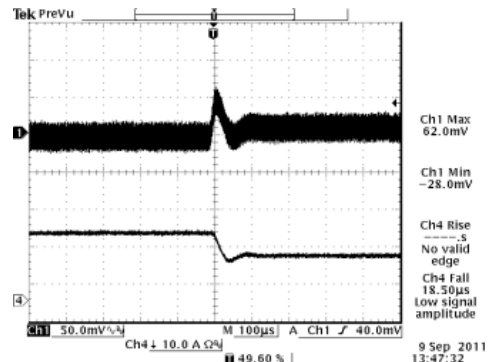
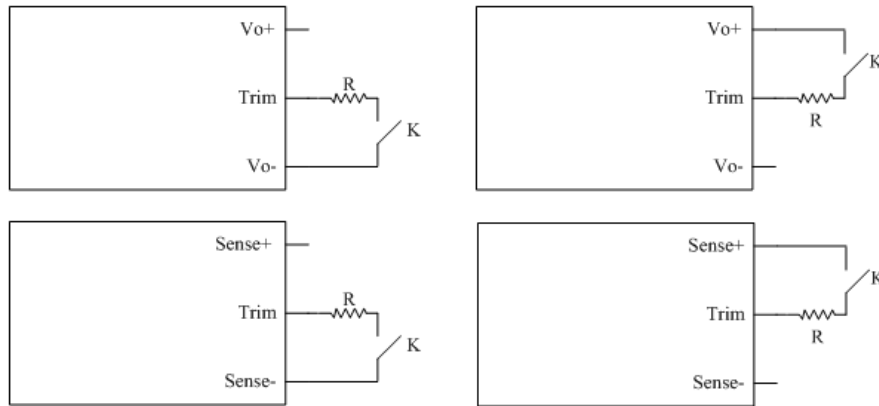


Figure 3. Vout= 3.3 V 75%-50% Load Transients

NOTE: Transients Response at Vin=48V, di/dt=1A/µS, 270µF aluminum cap at output, Ta=25 ° C.

## 12. 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 shutdown into hiccup mode and restart once every 400mS. The module operates normally when the fault is cleared.





### 13. STARTUP & SHUTDOWN

#### RISE TIME

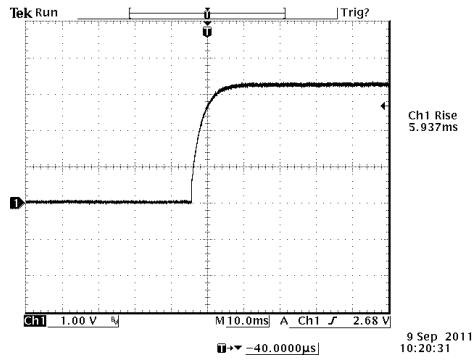


Figure 4.  $V_{in}=48, V_o=3.3V, I_o=25A$

#### STARTUP TIME

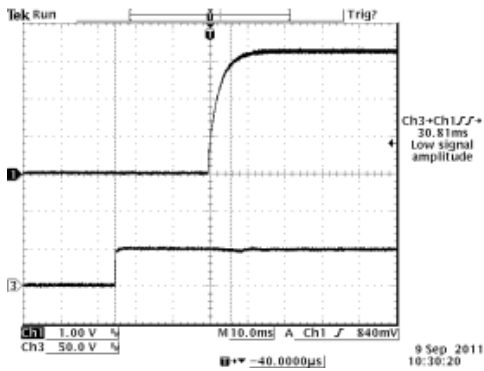


Figure 5. Startup from  $V_{in}$   
 Ch1:  $V_o$   
 Ch3:  $V_{in}$   
 Test Condition:  $V_{in}=48, V_o=3.3V, I_o=25A$

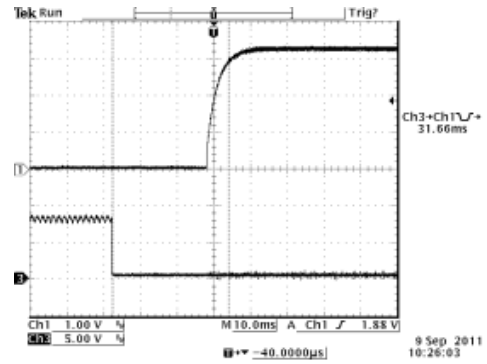


Figure 6. Startup from on/off  
 Ch1:  $V_o$   
 Ch3: on/off  
 Test Condition:  $V_{in}=48, V_o=3.3V, I_o=25A$

#### SHUTDOWN

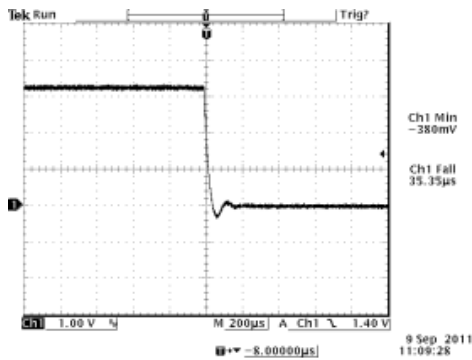
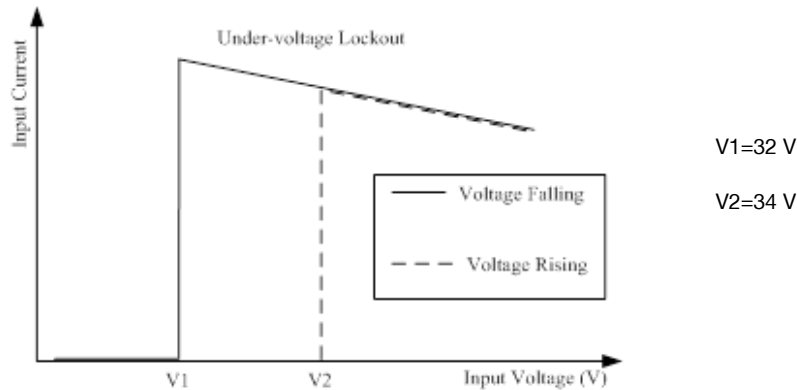


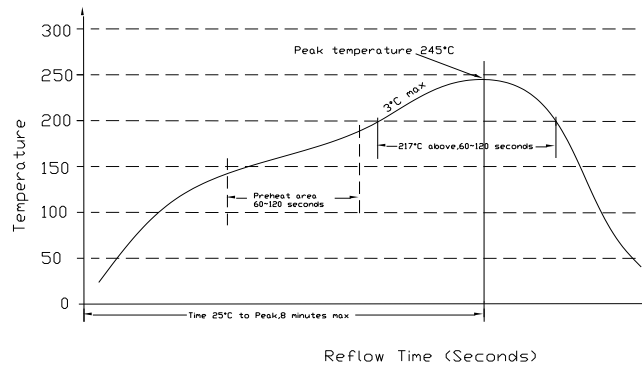
Figure 7.  $V_{in}=48, V_o=3.3V, I_o=25A$

## 14. INPUT UNDER-VOLTAGE LOCKOUT



## 15. SOLDERING INFORMATION

The SRSB-80T03x 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.



## 16. MSL RATING

The SRSB-80T03x modules have a MSL rating of 3.

## 17. STORAGE AND HANDLING

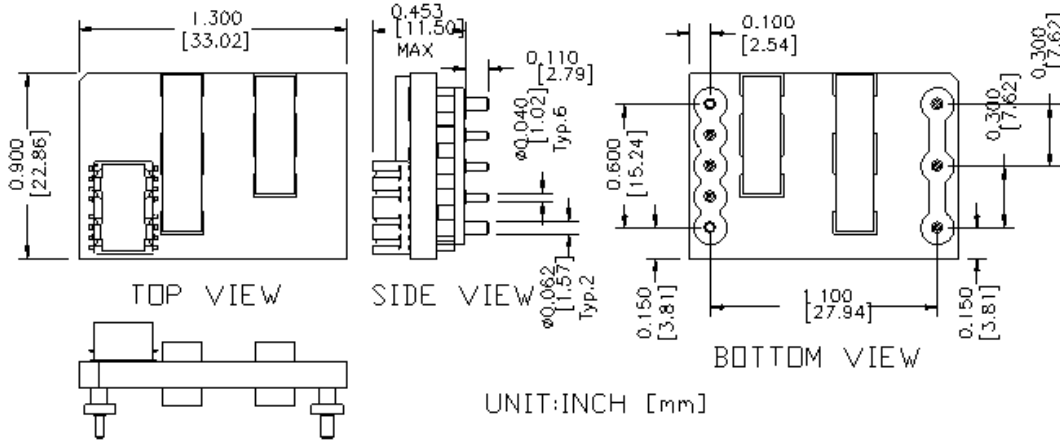
The SRSB-80T05CG modules are designed to be compatible with J-STD-033 Rev:A (Handling, Packing, Shipping and Use of Moisture /Reflow Sensitive surface Mount devices). Moisture barrier bags (MBB) with desiccant are applied. The recommended storage environment and handling procedure is detailed in J-STD-033.

## 18. PRE-BAKING

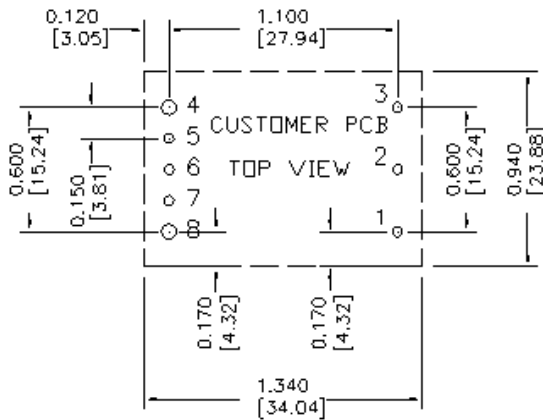
This component has been designed, handled, and packaged ready for pb-free reflow soldering. If the assembly shop follows J-STD-033 guidelines, no pre-bake of this component is required before being reflowed to a PCB. However, if the J-STD-033 guidelines are not followed by the assembler, Bel recommends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

## 19. MECHANICAL OUTLINE

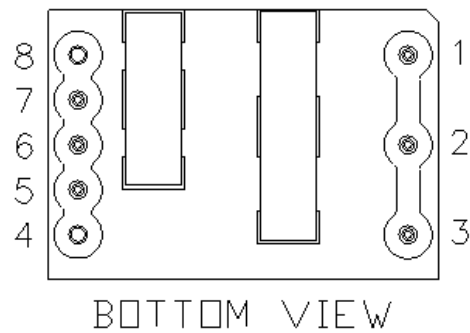
### ORSB-80T03x



### RECOMMENDED PCB PAD LAYOUT



HOLE SIZE: 1-3, 5-7  $\varnothing 0.047$  [1.19],  
 4,8  $\varnothing 0.07$  [1.78]  
 PAD SIZE: 1-3, 5-7  $\varnothing 0.08$  [2.03]  
 4,8  $\varnothing 0.10$  [2.54]



### PIN CONNECTIONS

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

**NOTE:** This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.

**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. (x.x +/-0.5mm) x.xxx +/-0.010 in. (x.xx +/-0.25mm).

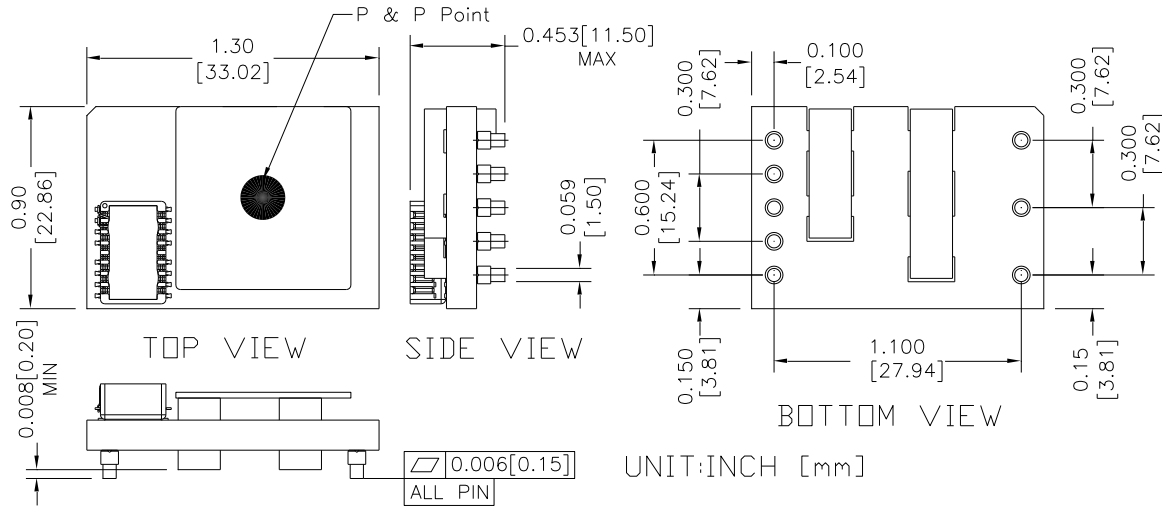


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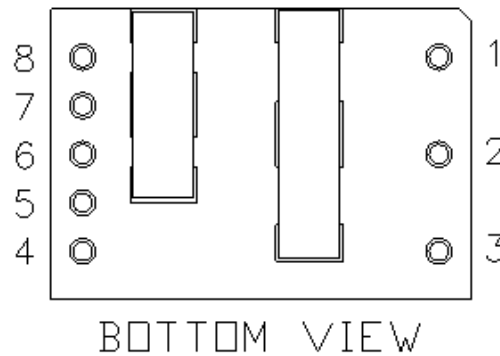
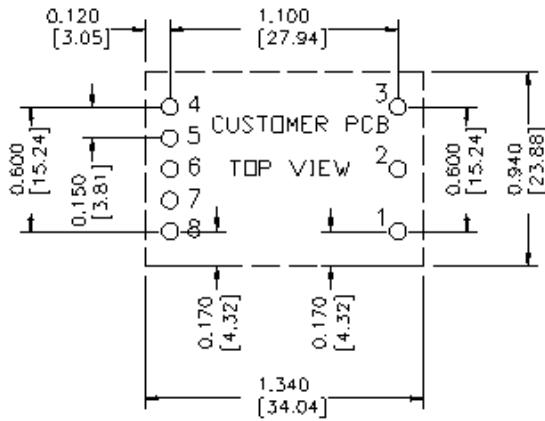
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**SRSB-80T03x**



**RECOMMENDED PCB PAD LAYOUT**



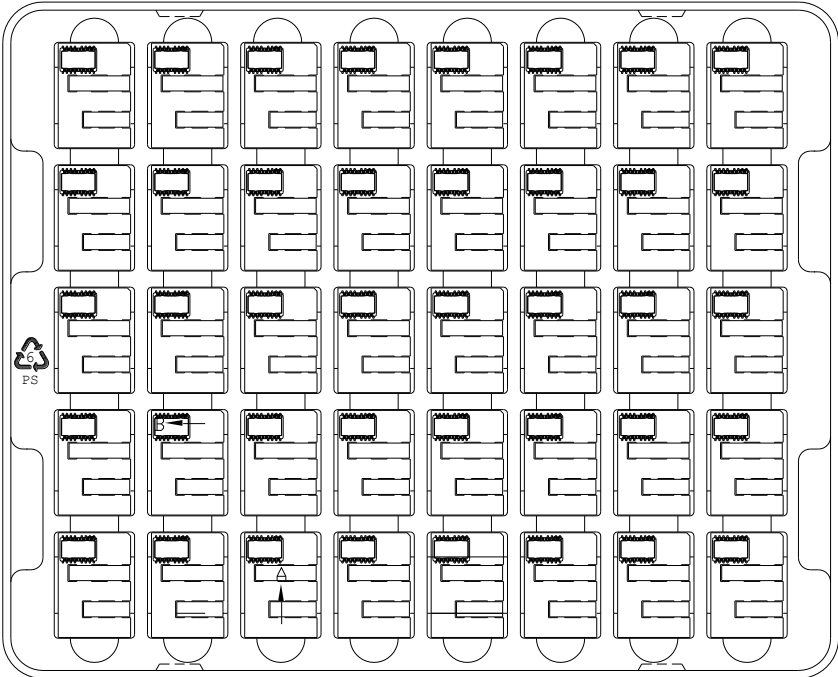
**PIN CONNECTIONS**

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

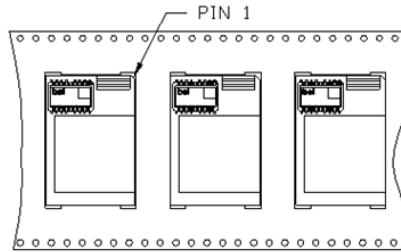
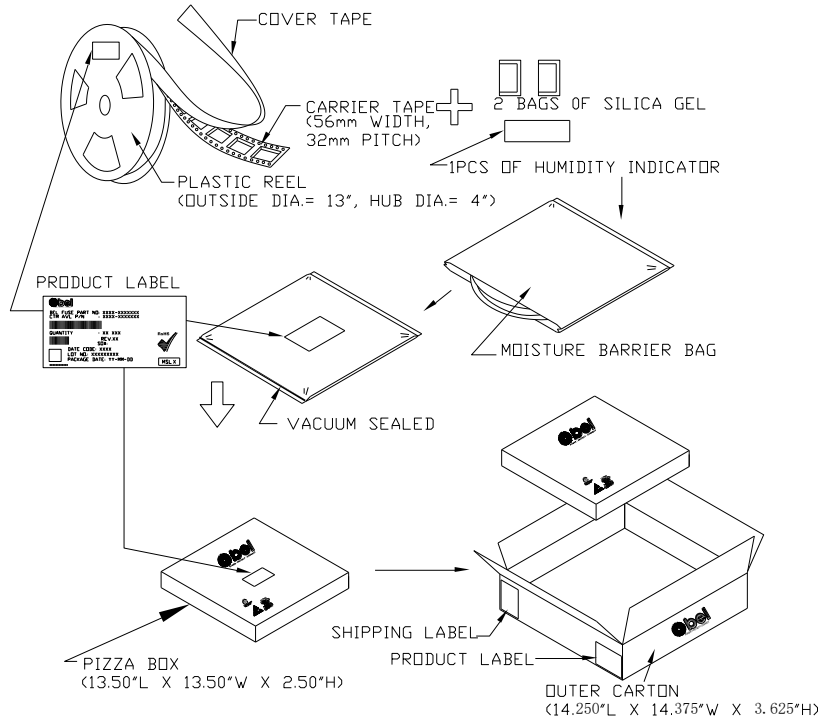
- NOTE:**
- 1) All Pins: Material - Copper Alloy; Finish - 3 micro inches minimum Gold over 50 micro inches minimum Nickel plate
  - 2) Undimensioned components are shown for visual reference only.
  - 3) All dimensions in inches (mm); Tolerances: x.xx +/-0.02 in. x.xxx +/-0.010 in. unless otherwise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

20. PACKAGING INFORMATION

xRSB-80T03xG



**SRSB-80T03xR**



ORIENTATION OF COMPONENT INSIDE POCKET

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	

## 21. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2012-6-1	A	First release	JZ Wang
2014-9-26	B	Update output specs, general specs	J Yan
2017-08-30	C	Update TD, add soldering information and package drawing	J Yan

For more information on these products consult: [tech.support@psbel.com](mailto: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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