xRBH-03Hxx0 Series

Non-Isolated DC-DC Converter

The Bel xRBH-03Hxx0 is a part of the low cost non-isolated DC/DC power converter series providing up to 3 A output current. Optional lead forming provides a vertical mount product for minimal footprint or a surface mount option for a very low profile. The output is closely regulated and the efficiency of 3.3 VDC output is typically 88% at full load. Typical features include remote on/off, input under voltage lockout, over current protection and short circuit protection.

Key Features & Benefits

- 9 VDC – 36 VDC Input
- 1.2 VDC – 5.0 VDC /3 A Output
- Non-Isolated
- Remote On/Off
- High Efficiency
- Input Under Voltage Lockout
- High Power Density
- OCP/SCP
- Excellent Thermal Performance
- Low Cost
- Class II, Category 2, Isolated DC/DC Converter (refer to IPC-9592B)

RoHS Compliant

Applications

- Networking
- Computers and Peripherals
- Telecommunications

1. MODEL SELECTION

OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY	PART NUMBER SURFACE MOUNT	PART NUMBER VERTICAL MOUNT
5.0 V	9.0 V - 36 V	3 A	15 W	89%	SRBH-03H500	VRBH-03H500
3.3 V	9.0 V - 36 V	3 A	10 W	87%	SRBH-03H330	VRBH-03H330
2.5 V	9.0 V - 36 V	3 A	7.5 W	84%	SRBH-03H250	VRBH-03H250
1.8 V	9.0 V - 36 V	3 A	5.4 W	82%	SRBH-03H180	VRBH-03H180
1.5 V	9.0 V - 28 V	3 A	4.5 W	80%	SRBH-03H150	VRBH-03H150
1.2 V	9.0 V - 28 V	3 A	3.6 W	78%	SRBH-03H120	VRBH-03H120

NOTE: 1. Add “0” suffix at the end of the model number to indicate “Tube Packaging”, and “R” for “Reel Packaging”, and “G” for “Tray Packaging”.

PART NUMBER EXPLANATION

x	R	BH	-	03	H	xx	0	x
Mouting type	RoHS status	Series name		Output current	Input range	Output voltage	Option	Package
V – Vertical type S – Surface mount	RoHS 6	Arrow head		3A	9-36 V	1.2-5.0 V		G – Tray R – Tape and Reel

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	38	V
Remove On/Off		-0.3	-	12	V
Ambient Temperature		-40	-	85	°C
Storage Temperature		-40	-	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
Input Voltage		9	-	36	V
Input Current (full load)		-	-	2.2	A
Input Current (no load)		-	-	15	mA
Remote Off Input Current		-	3	-	mA
Input Reflected Ripple Current (rms)	Tested with simulated source impedance of 500 nH, 5 Hz to 20 MHz and two 100 µF/50 V electrolytic capacitors and a 3.3 µF/50 V ceramic capacitor at the input.	-	35	70	mA
Input Reflected Ripple Current (pk-pk)		-	45	70	mA
Turn-on Voltage Threshold		5.8	-	8.5	V
Turn-off Voltage Threshold		5.7	-	8.5	V
I^2t Inrush Current Transient		-	0.02	0.1	A^2s

4. OUTPUT SPECIFICATIONS

PARAMETER		DESCRIPTION		MIN	TYP	MAX	UNIT
Output Voltage Set Point	Vo = 5.0V	Test conditions: Vin=12 V, Io=50% full load		4.900	5.0	5.100	V
	Vo = 3.3V			3.234	3.3	3.366	
	Vo = 2.5V			2.450	2.5	2.550	
	Vo = 1.8V			1.764	1.8	1.836	
	Vo = 1.5V			1.470	1.5	1.530	
	Vo = 1.2V			1.176	1.2	1.224	
Load regulation	Vo = 5.0V	Vin=38-55V, Io=100% load		-	±10	±20	mV
	Vo=1.2 V-3.3 V			-	±5	±15	
Line Regulation	Vo = 5.0V			-	±10	±25	mV
	Vo=1.2 V-3.3 V			-	±5	±20	
Regulation Over Temperature				-	30	50	mV
Output Ripple and Noise (pk-pk)		Tested with 0-20 MHz BW, with a 220 µF tantalum capacitor at the output.	Vo =1.2 V-5.0 V	-	60	100	mV
Output Ripple and Noise (rms)			Vo =1.2 V-5.0 V	-	25	50	mV
Output Current				0	-	3	A
Current Limit Threshold				3.2	3.6	5	A
Turn On Time				-	6	10	ms
Overshoot at Turn on		.		-	2	5	%
Output Capacitance				220	-	1200	µF
TRANSIENT RESPONSE							
50% ~ 100% of Max Load	Overshoot	Test conditions: di/dt = 0.5 A/µS; Vin = 12 V; with a 220 µF Tantalum capacitor at the output.	Vo = 5.0 V	-	80	150	mV
	Settling Time			-	260	300	µs
100% ~ 50% of Max Load	Overshoot			-	80	150	mV
	Settling Time			-	260	300	µs
50% ~ 100% of Max Load	Overshoot		Vo = 3.3 V	-	80	150	mV
	Settling Time			-	260	300	µs
100% ~ 50% of Max Load	Overshoot			-	80	150	mV
	Settling Time			-	260	300	µs
50% ~ 100% of Max Load	Overshoot		Vo = 1.8 V - 2.5 V	-	100	150	mV
	Settling Time			-	250	300	µs
100% ~ 50% of Max Load	Overshoot			-	100	150	mV
	Settling Time			-	250	300	µs
50% ~ 100% of Max Load	Overshoot		Vo = 1.2 V -1.5 V	-	100	150	mV
	Settling Time			-	250	300	µs
100% ~ 50% of Max Load	Overshoot			-	100	150	mV
	Settling Time			-	250	300	µs

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

5. REMOVE ON/OFF

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
REMOTE ON/OFF					
Signal Low (Unit On)	Remote On/Off pin is open, the module is off.	-0.3	-	1	V
Signal High (Unit Off)		2.6	-	12	

6. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION		MIN	TYP	MAX	UNIT
Efficiency	Measured at Vin=12 V, full load and Ta=25 °C	Vo = 5.0V	87	89	-	%
		Vo = 3.3V	85	87	-	
		Vo = 2.5V	82	84	-	
		Vo = 1.8V	70	82	-	
		Vo = 1.5V	78	80	-	
		Vo = 1.2V	76	78	-	
Switching Frequency			-	300	-	kHz
Output Voltage Trim Range	Wide Trim		90	-	110	%Vo
Weight			-	3.7	-	g
Weight (vertical)			-	3.4	-	g
FIT	Calculated Per Bell Core SR-332 (Vin=12 V, Vo=5 V, Io=3A, Ta = 25C, FIT=10^9/MTBF)			20.248		
Dimensions (L × W ×H)	Surface mount			0.885 x 0.512 x 0.32 22.48 x 13.00 x 8.13		inch mm
Dimensions (L × W ×H)	Vertical			0.70 x 0.60 x 0.308 17.78 x 15.24 x 7.82		inch mm

7. EFFICIENCY DATA

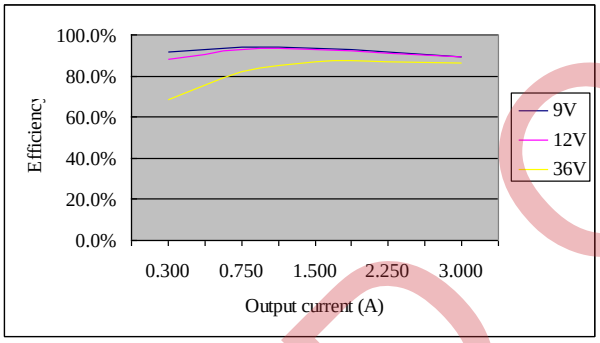


Figure 1. xRBH-03H500

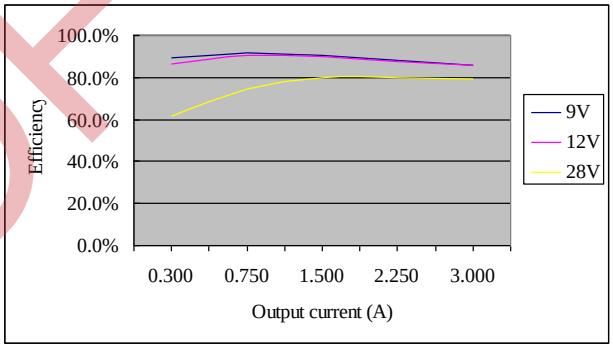


Figure 2. xRBH-03H330

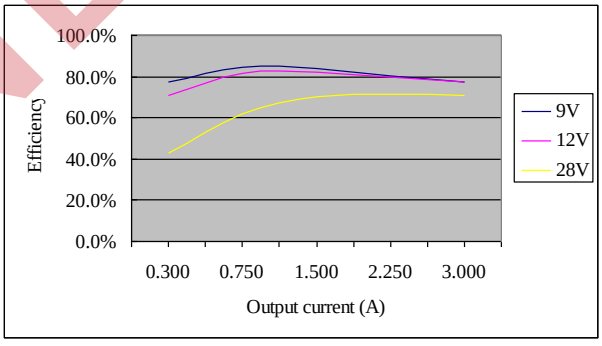
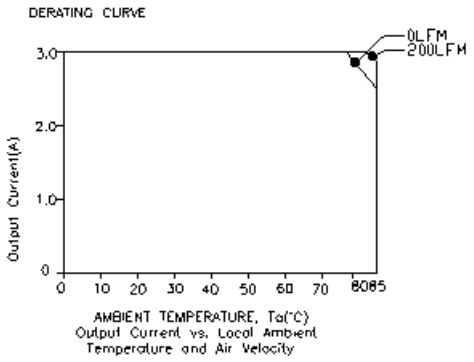
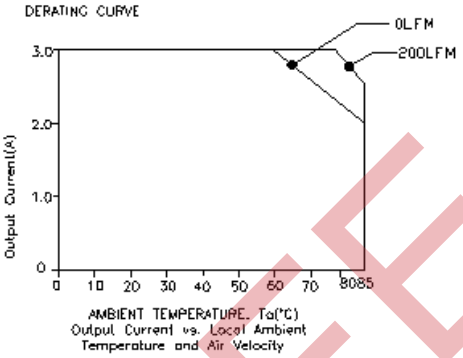


Figure 3. xRBH-03H120

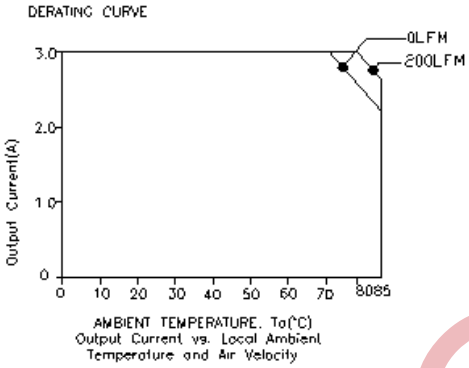
8. THERMAL DERATING CURVES



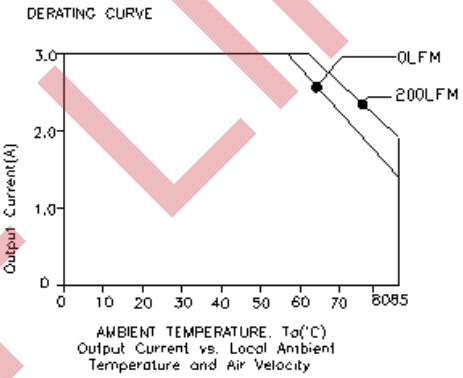
1.SRBH-03H500. Vin=24.0V Vout=5.0V



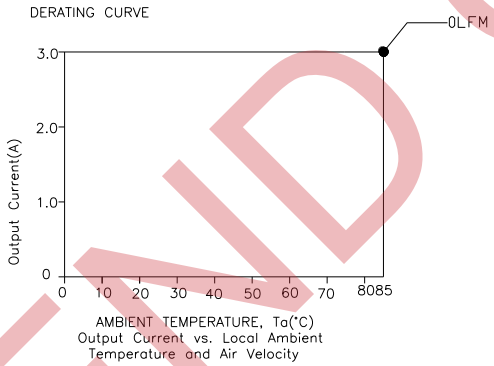
4.VRBH-03H500. Vin=24.0V Vout=5.0V



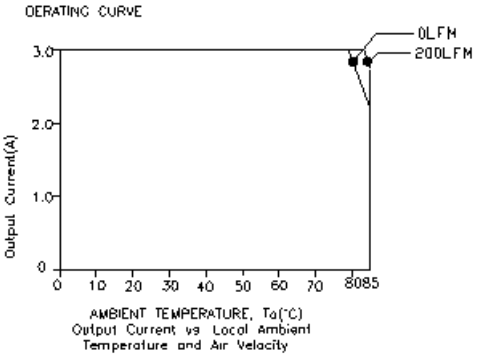
2.SRBH-03H330. Vin=24.0V Vout=3.3V



5.VRBH-03H330. Vin=24.0V Vout=3.3V



3.SRBH-03H120. Vin=24.0V Vout=1.2V



6.VRBH-03H120. Vin=24.0V Vout=1.2V

9. RIPPLE AND NOISE WAVEFORMS

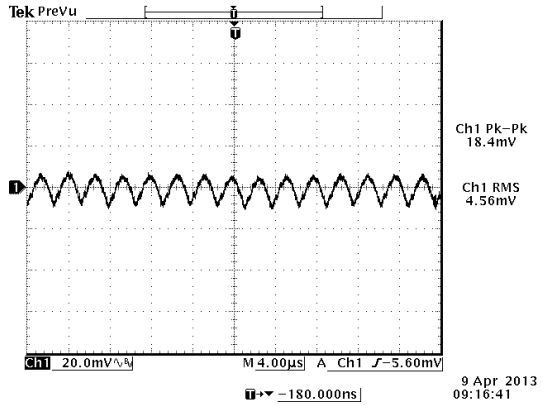


Figure 4. Ripple and noise at no load, 5VDC output

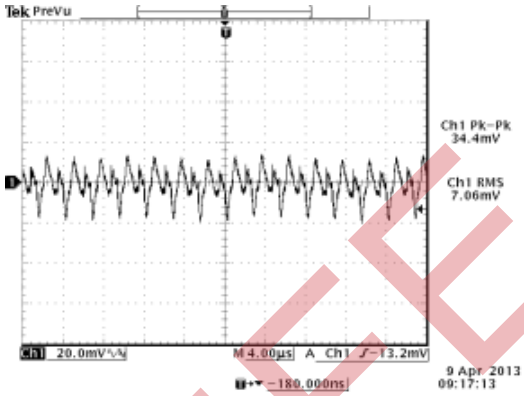


Figure 5. Ripple and noise at full load, 5VDC output

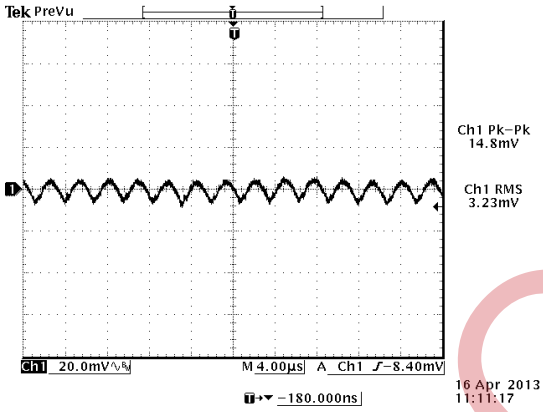


Figure 6. Ripple and noise at no load, 3.3VDC output

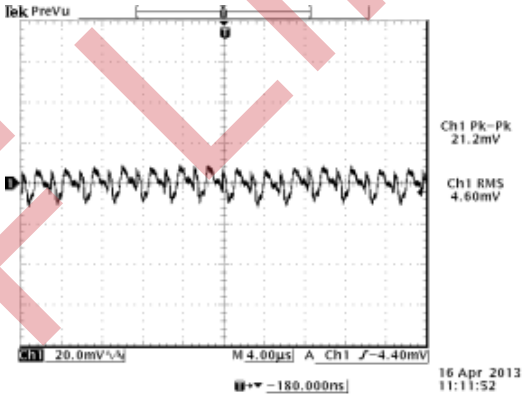


Figure 7. Ripple and noise at full load, 3.3VDC output

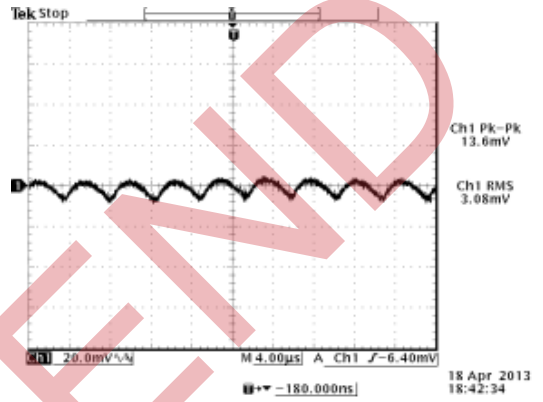


Figure 8. Ripple and noise at no load, 1.2VDC output

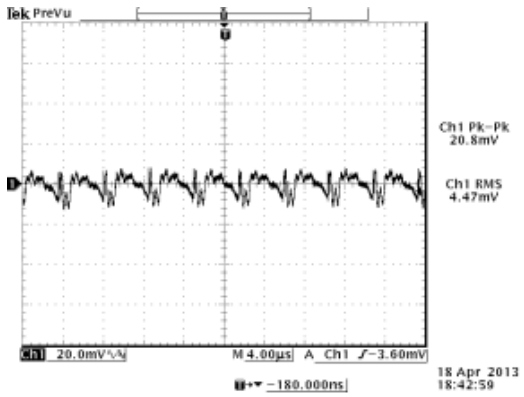


Figure 9. Ripple and noise at full load, 1.2VDC output

NOTE: Ripple and Noise at 24VDC input, with a 220 µF tantalum cap at the output, Ta=25 ° C**.**

10. TRANSIENT RESPONSE WAVEFORMS

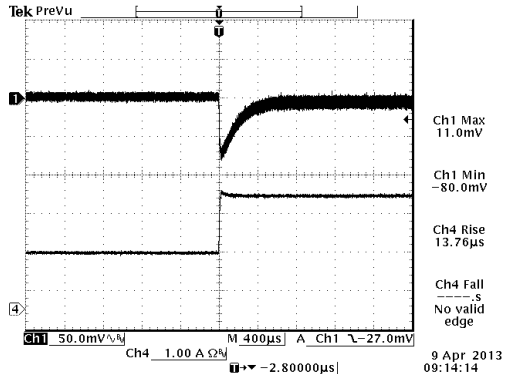


Figure 10. Vin= 50%-100% Load Transient at Vin = 24 VDC input, 5VDC output and Ta = 25 ℃

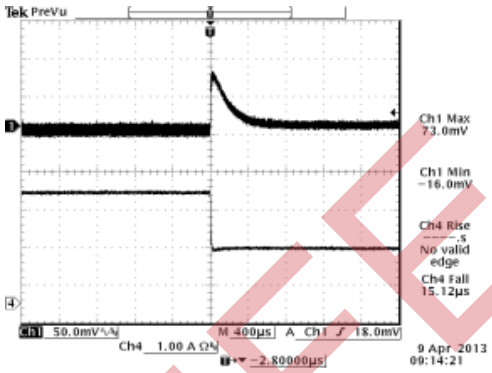


Figure 11. Vin= 100% - 50% Load Transient at Vin = 24 VDC input, 5VDC output and Ta = 25 ℃

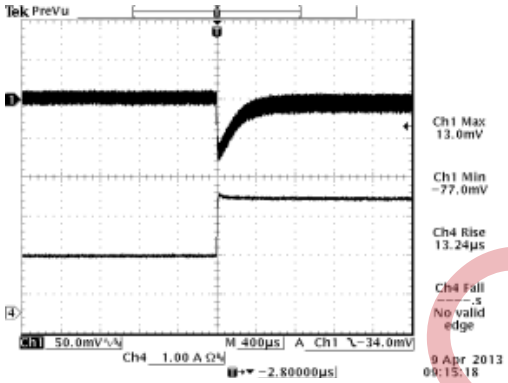


Figure 12. Vin= 50%-100% Load Transient at Vin = 24 VDC input, 3.3VDC output and Ta = 25 ℃

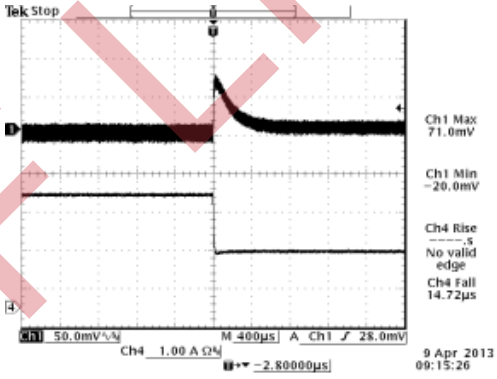


Figure 13. Vin= 100% - 50% Load Transient at Vin = 24 VDC input, 3.3VDC output and Ta = 25 ℃

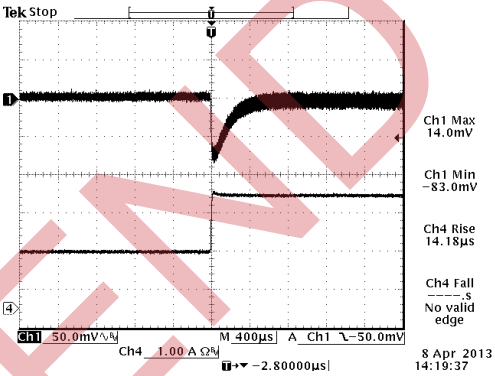


Figure 14. Vin= 50%-100% Load Transient at Vin = 24 VDC input, 1.2VDC output and Ta = 25 ℃

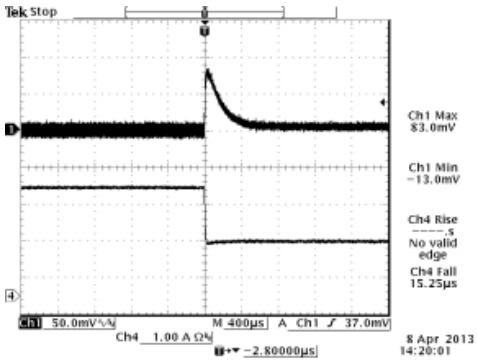


Figure 15. Vin= 100% - 50% Load Transient at Vin = 24 VDC input, 1.2VDC output and Ta = 25 ℃

NOTE: Test Condition: di/dt=0.5A/µS, Vin=24V, with a 220µF tantalum 7capacitor at the output.

11. STARTUP & SHUTDOWN

STARTUP

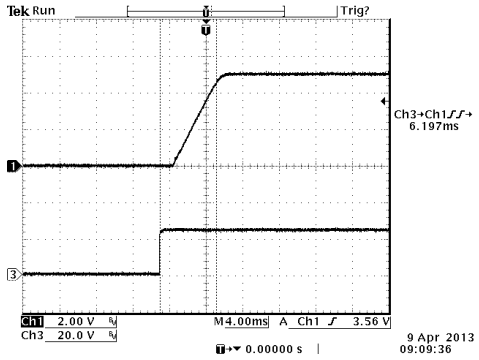


Figure 16. Start up at full load, 24VDC input 5VDC output and Ta=25 ˚C

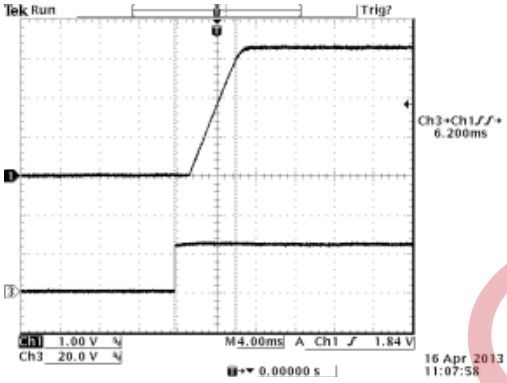


Figure 16. Start up at full load, 24VDC input 3.3VDC output and Ta=25 ˚C

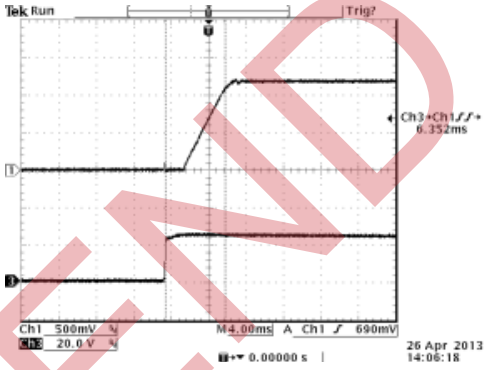


Figure 18. Start up at full load, 24VDC input 1.2VDC output and Ta=25 ˚C

SHUT DOWN

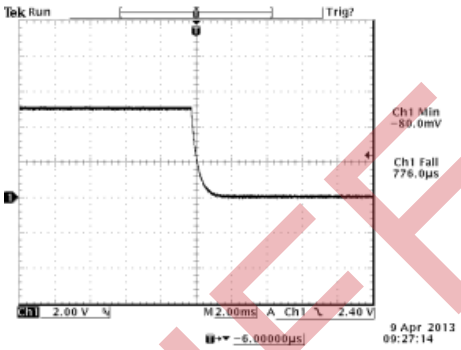


Figure 17. Shut down at full load, 24VDC input 5VDC output and Ta=25 ˚C

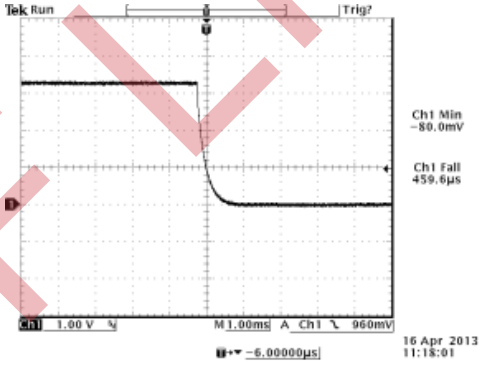


Figure 17. Shut down at full load, 24VDC input 3.3VDC output and Ta=25 ˚C

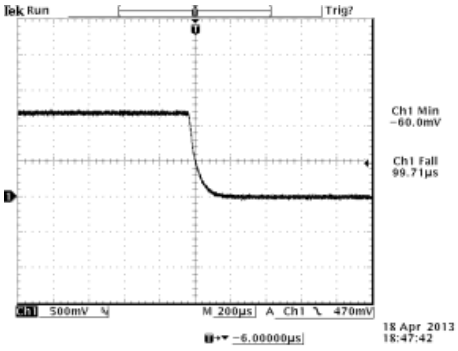


Figure 19. Shut down at full load, 24VDC input 1.2VDC output and Ta=25 ˚C

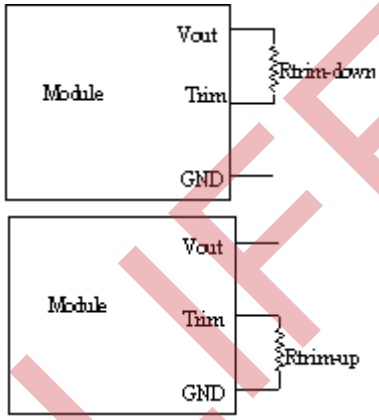
NOTE: Test Condition: Vin=24V, Iout=3A, with a 220µF tantalum capacitor at the output.

12. OUTPUT TRIM EQUATIONS

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) and the nominal output voltage of the converter (Vnom) are shown below. The Trim Down resistor should be connected between the Trim pin and Vout. The Trim Up resistor should be connected between the Trim pin and Ground. Only one of the resistors should be used for any given application.

$$R_{trimdown} = \frac{A}{V_{nom} - V_{adj}} - B$$

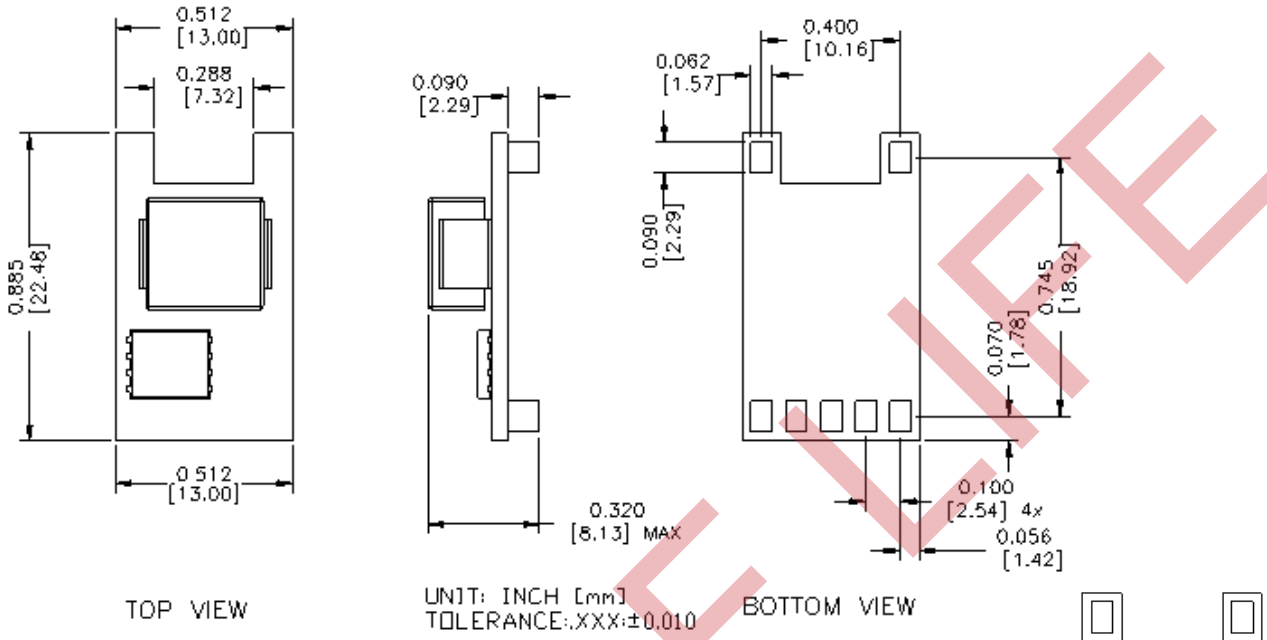
$$R_{trimup} = \frac{C}{V_{adj} - V_{nom}} - D$$

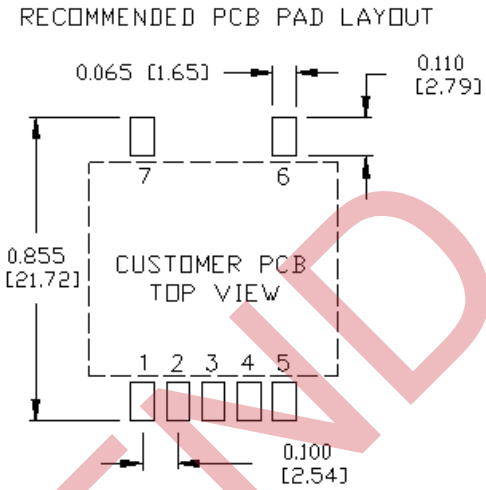


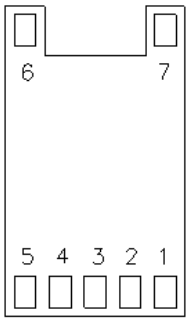
Vnom	A	B	C	D
5	995.39	474	189.6	237
3.3	592.5	474	189.6	237
2.5	402.9	474	189.6	237
1.8	237	474	189.6	237
1.5	165.9	474	189.6	237
1.2	94.8	474	189.6	237

13. MECHANICAL OUTLINE

SRBH-03Hxx0







PIN CONNECTIONS

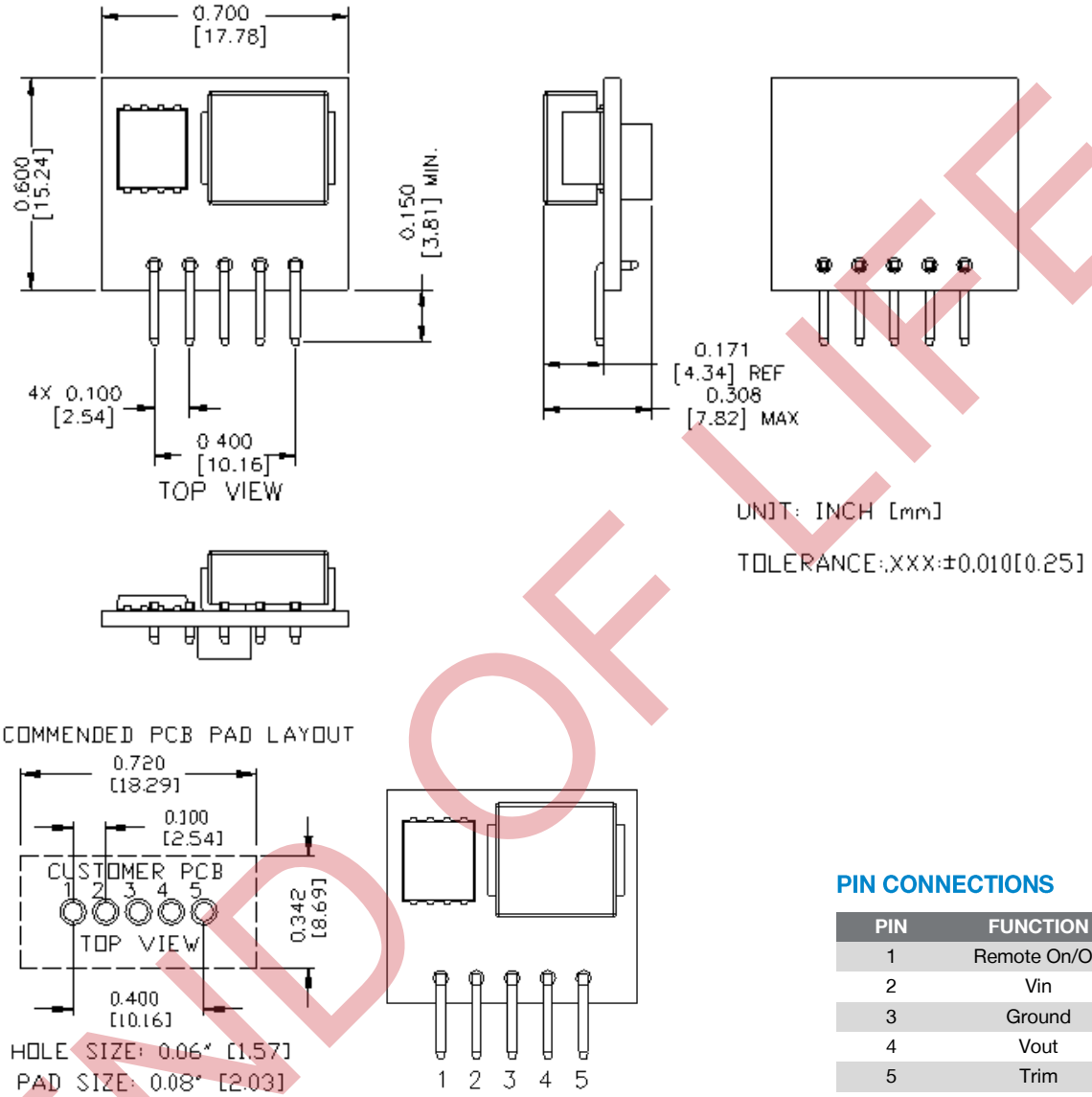
PIN	FUNCTION
1	Remote On/Off
2	Vin
3	Ground
4	Vout
5	Trim
6	N/A
7	N/A

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.

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).

VRBH-03Hxx0



PIN CONNECTIONS

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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).

14. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2012-01-20	PA	First release	YF Sun
2012-7-31	PB	1. Update Input spec; 2. Updated Current Limit Threshold in Output spec; 3. Update Efficiency in General; 4. Update Thermal Derating Curve; 5. Add trim equations	Summer Wang
2012-9-25	PC	1.Update trim equations; 2.Update the MD of SMD narrow version; 3.Update Input spec; 4.Update Output spec 5.Add Efficiency Data; 6.Add NR; 7.Add TR; 8.Add Startup&Shutdown	Summer Wang
2012-10-29	PD	1.Update Continuous Input Voltage in Abs Max; 2.Update Input Voltage in Input Specs; 3. Update Efficiency Data; 4.Update the description in NR;	Summer Wang
2013-8-12	PE	1.Update Cover; 2.Update Turn on Voltage Threshold; 3.Update Turn off Voltage Threshold; 4.Input Reflected Ripple Current; 5.Update Turn on Time; 6.Update Transient Response; 7.Update Weight; 8.Update Efficiency Data; 9. Update Thermal Derating Curve; 10.Update Output Ripple and Noise Waveforms; 11.Update Mechanical Outline; 12.Update Transient Response Waveforms; 13.Update Start up & Shut down Waveforms.	Summer Wang
2014-6-23	F	1.Update Input Reflected Ripple Current; 2.Update Turn on Voltage Threshold; 3.Update Turn off Voltage Threshold; 4.Update Load Regulation; 5.Update FIT2; 6.Update Mechanical Outline; 7.Update Line Regulation; 8.Update Current Limit Threshold ; 9.Update Input Current (no load); 10.Add Weight (vertical)	Summer Wang

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

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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.