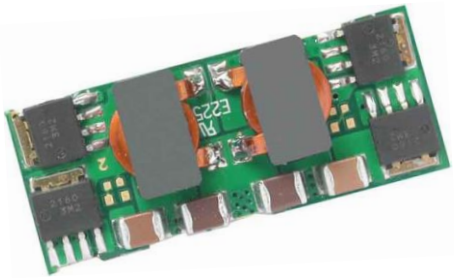
SRBC-30ExAL

Non-Isolated DC-DC Converter

The Bel SRBC-30ExAL is part of the non-isolated dc/dc converter power module series. The modules use a SMT package. These converters are available in a range of output voltages from 0.8 VDC to 3.63 VDC or 1.4 VDC over a wide range of input voltage (Vin = 6 - 14 VDC).

The Bel SRBC-30ExAL has a sequencing feature that enables designers to implement various types of output voltage sequencing when powering.



RoHS Compliant

Key Features & Benefits

- 6 - 14 VDC Input
- 0.8 - 3.63 VDC or 1.4 VDC @ 25 A or 30 A Output
- SMD POL
- Fixed Frequency
- Non-Isolated
- High Efficiency
- Wide Trim
- Low Cost
- Flexible Output Voltage Sequencing
- Under-Voltage Lockout (UVLO)
- OCP/SCP
- Over Temperature Shutdown
- Parallel Operation with Active Current Sharing (Option)
- Remote On/Off
- Remote Sense
- Industrial Temperature Range
- Approved to UL/CSA 62368-1
- Approved to IEC/EN 62368-1
- Class II, Category 2, 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
SRBC-30E2AL	0.8 < Vo⩽ 2.5 V	6 – 14 V	30 A	75 W	87%
SRBC-30E3AL SRBC-30E5AL	2.5 < Vo ⩽ 3.63 V		25 A	90 W	92%
SRBC-30E6AL	0.8 – 1.4 V	6 – 14 V	30 A	42 W	86%

NOTE: Add “G” suffix at the end of the model number to indicate tray packaging
And “H” suffix at the end of the model number to indicate Tray packaging and RoHS compliant without requiring exemption 7c-III.
Add “S” suffix at the end of the model number to indicate Tape and Reel packaging and RoHS compliant without requiring exemption 7c-III.

PART NUMBER EXPLANATION

S	R	BC	-	30	E	xA	L	y
Mounting Type	RoHS Status	Series Name		Output Current	Input Range	Output Voltage	Active Logic	Package Type
Surface Mount	RoHS	Bobcat Series		30 A	6 – 14 V	2/3/5A: 0.8 - 3.63 V 6A: 0.8 - 1.4 V	Active Low	G – Tray package S – Tape and Reel package and RoHS compliant without requiring exemption 7c-III H – Tray package and RoHS compliant without requiring exemption 7c-III

NOTE: SRBC-30E3AL without share and H GND pins. SRBC-30E5AL without share pin.

2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Input Voltage		-0.3	-	15	V
Output Enable Terminal Voltage		-0.3	-	15	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

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Input Voltage		6	12	14	V
Input Current (full load)	Except SRBC-30E6AL	-	-	26	A
Input Current (full load)	For SRBC-30E6AL	-	-	8.3	A
Input Current (no load)		-	150	300	mA
Remote Off Input Current		-	2	-	mA
Input Reflected Ripple Current (pk-pk)	With simulated source impedance of 1000 nH, 5 Hz to 20 MHz, and use a 220 µF/25 V AL-Cap, 270 µF/16 V Osc-Cap and 2 x 22 µF/ 25 V ceramic	-	100	-	mA
Input Reflected Ripple Current (rms)		-	40	-	mA
I^2t Inrush Current Transient		-	-	1	A^2s
Turn-on Voltage Threshold		-	5.0	-	V
Turn-off Voltage Threshold		-	4.6	-	V

CAUTION: 1 This power module is not internally fused. An input line fuse must always be used.
2. All specifications are typical at nominal input, full load at 25 °C unless otherwise stated.

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 = 12 V, Io = half load		-1.5	-	1.5	%Vo,set
Load Regulation			-	-	0.4	%Vo,set
Line Regulation			-	-	0.3	%Vo,set
Regulation Over Temperature (-40 °C to +85 °C)			-	-	0.8	%Vo,set
Output Current	Except SRBC-30E6AL	0.8 < Vo≤ 2.5 V	0	-	30	A
		2.5 < Vo ≤ 3.63 V	0	-	25	A
Output Current	For SRBC-30E6AL		0	-	30	A
Current Limit Threshold			105	140	-	% Io
Short Circuit Surge Transient			-	1	3	A^2s
Output Ripple and Noise (pk-pk)	0-20 MHz BW		-	50	100	mV
Output Ripple and Noise (rms)			-	30	60	mV
Turn on Time			-	10	20	ms
Overshoot at Turn on			-	-	3	%Vo,set
Output Capacitance	ESR ＞ 0.01 ohm max		242	-	10000	µF
Transient Response						
△V 50%~100% of Max Load	Vo = 3.3 V or Vo = 1.4 V for SRBC-60E1AL	di/dt = 1 A/µs; Vin = 12 V	-	150	-	mV
Settling Time			-	25	-	µs
△V 100%~50% of Max Load			-	150	-	mV
Settling Time			-	25	-	µs

5. GENERAL SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Vo = 3.3 V	Measured at Vin = 12 V, full load, except SRBC-30E6AL	-	92	-	%
	Vo = 1.8 V		-	87	-	%
	Vo = 0.8 V		-	77	-	%
Efficiency	Vo = 1.4 V	Measured at Vin = 12 V, full load, for SRBC-30E6AL	-	86	-	%
	Vo = 0.8 V		-	80	-	%
Switching Frequency			-	300	-	kHz
MTBF			-	3,289,732	-	hours
Remote Sense Compensation			-	-	0.5	V
Over Temperature Protection			-	125	-	°C
Output Trim Range (Wide Trim)		Except SRBC-30E6AL	0.8	-	3.63	V
Output Trim Range (Wide Trim)		For SRBC-30E6AL	0.8	-	1.4	V
Weight			-	6.5	-	g
Dimensions (L × W × H)				1.30 x 0.53 x 0.358		inch
				33.02 x 13.46 x 9.10		mm

6. CONTROL SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Remote On/Off						
Signal Low (Unit On)			-0.3	-	1.2	V
Signal High (Unit Off)			3	-	Vin, max	V
Voltage Sequencing						
Sequencing Delay Time		Delay from Vin min to application of voltage on SEQ pin	10	-	-	ms
Sequencing Slew Rate Capability			-	-	2	V/ms
Forced Load Share Accuracy			-	10	-	%Io
Number of Units in Parallel			-	-	5	
Tracking Accuracy	Power-Up	Vin min to Vin max; Io min to Io max; Vseq < Vo	-	100	200	mV
	Power-Down		-	200	400	mV

7. EFFICIENCY DATA

Except SRBC-30E6AL

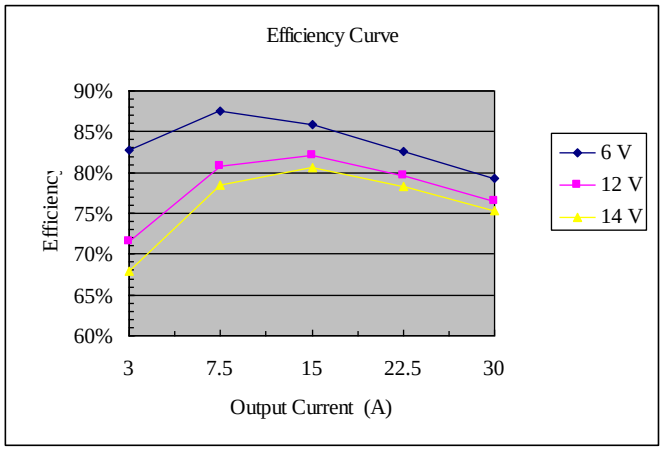


Figure 1. Efficiency data@ Vo = 0.8 V

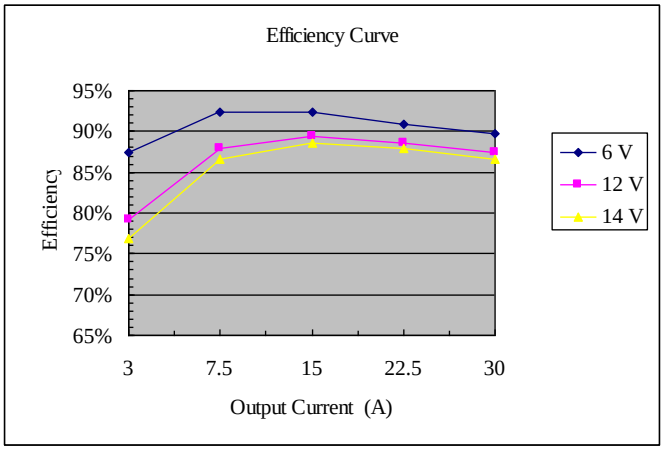


Figure 2. Efficiency data@ Vo = 1.8 V

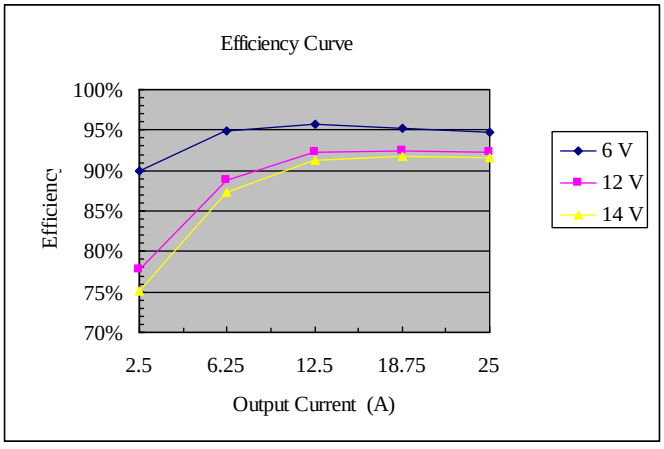


Figure 3. Efficiency data@ Vo = 3.3 V

For SRBC-30E6AL

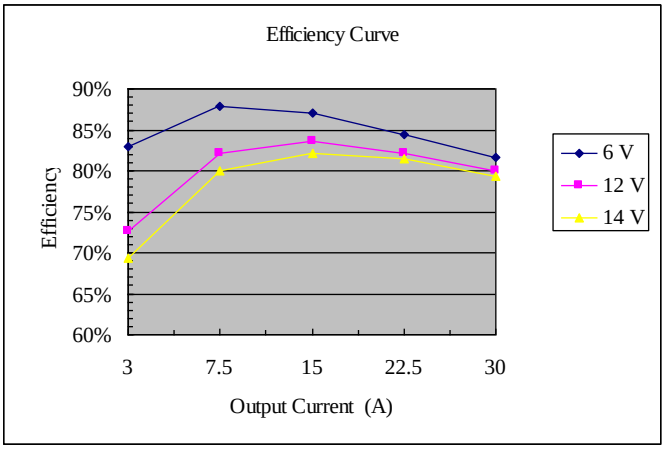


Figure 4. Efficiency data@ Vo = 0.8 V

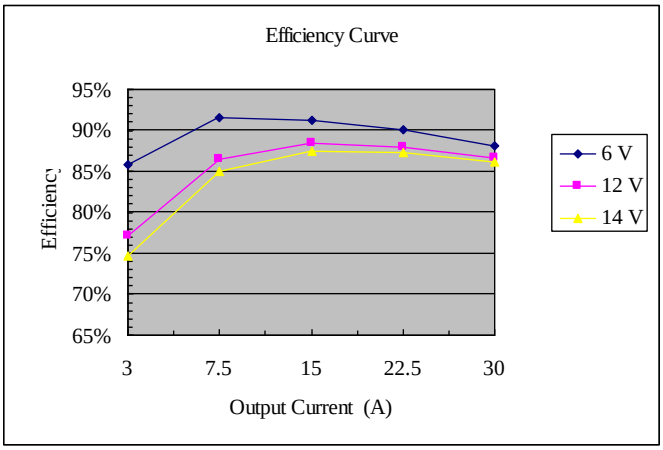


Figure 5. Efficiency data@ Vo = 1.4 V

8. OUTPUT TRIM EQUATIONS

Trim Resistor Calculate

Equation for calculating the trim resistor (in Ω) given the desired output voltage (Vo) is shown below. The Trim Up resistor should be connected between the Trim pin and Ground.

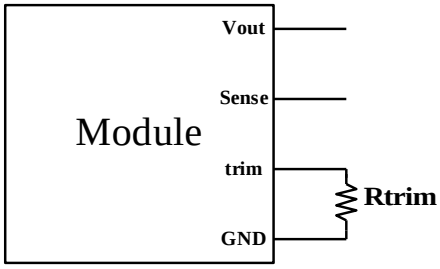


Figure 6. Trim circuit-1

$$R\,trim = \left[\frac{1200}{Vo - 0.8} - 100 \right]$$

Note: *Vo is the desired output voltage*
Rtrim is the required resistance between TRIM and GND

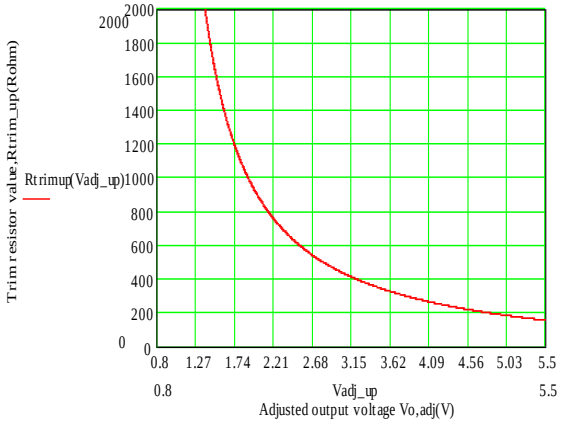


Figure 7. Trim curve-1

Trim Voltage Calculate

Equation for calculating the trim voltage given the desired output voltage (Vo) is shown below.

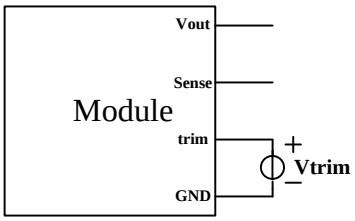


Figure 8. Trim circuit-2

$$Vtrim=0.853-0.067*Vo\ [V]$$

Note: *Vo is the desired output voltage*
Vtrim is the required resistance between TRIM and GND

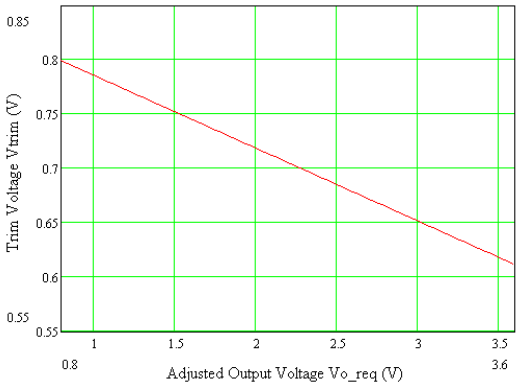


Figure 9. Trim curve-2

9. RIPPLE AND NOISE WAVEFORMS

Except SRBC-30E6AL

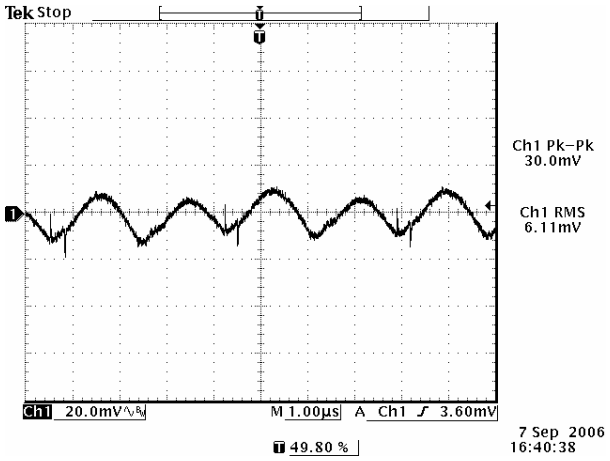


Figure 10. Ripple and noise at 0.8 VDC/30 A output

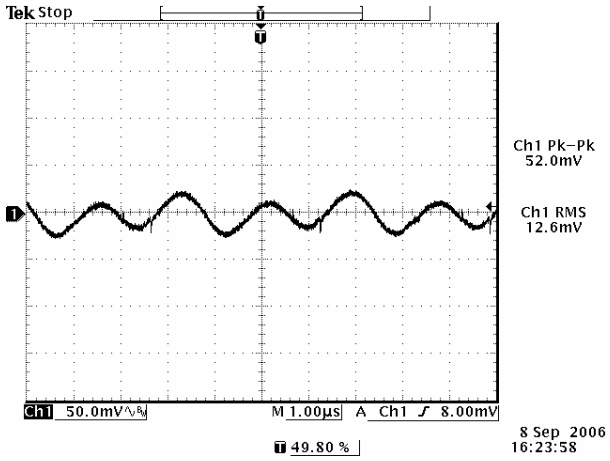


Figure 11. Ripple and noise at 1.8 VDC/30 A output

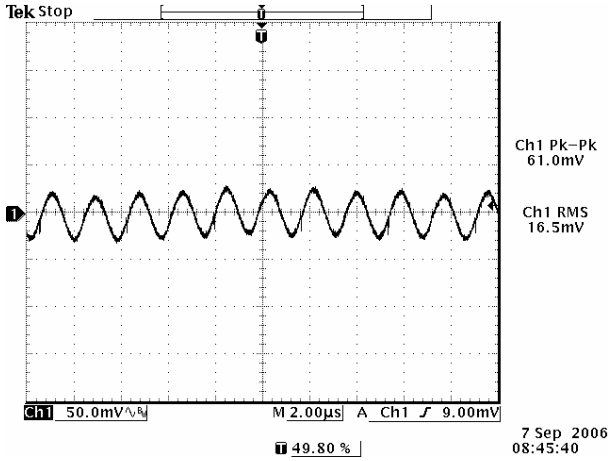


Figure 12. Ripple and noise at 3.3 VDC/25 A output

Note: Ripple and noise at full load, 12 VDC input, with a 22 µF ceramic cap and a 220 µF Tantalum cap at the output, and Ta = 25 °C.

For SRBC-30E6AL

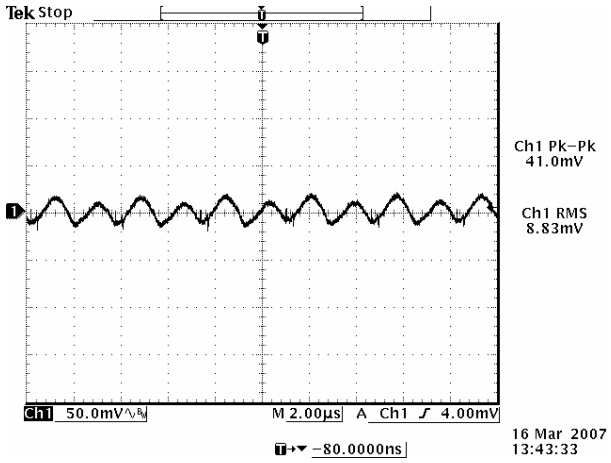


Figure 13. Ripple and noise at 0.8 VDC/30 A output

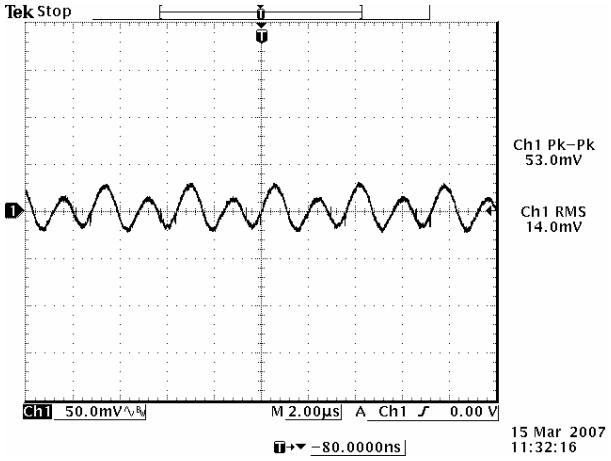


Figure 14. Ripple and noise at 1.4 VDC/30 A output

Note: Ripple and noise at full load, 12 VDC input, with a 22 µF ceramic cap and a 220 µF Tantalum cap at the output, and Ta = 25°C.

10. TRANSIENT RESPONSE WAVEFORMS

Except SRBC-30E6AL

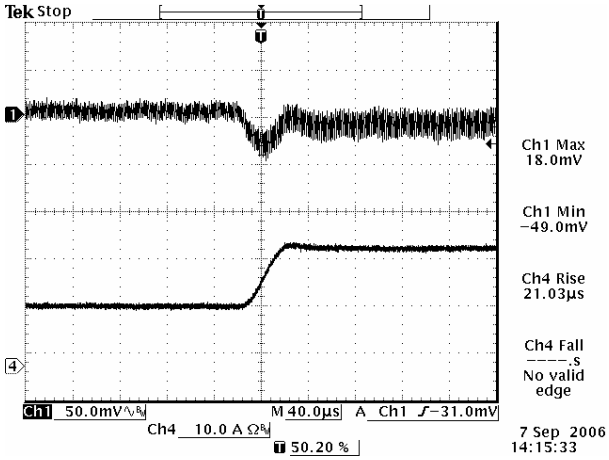


Figure 15. Vout = 0.8 V, 50%-100% Load Transients

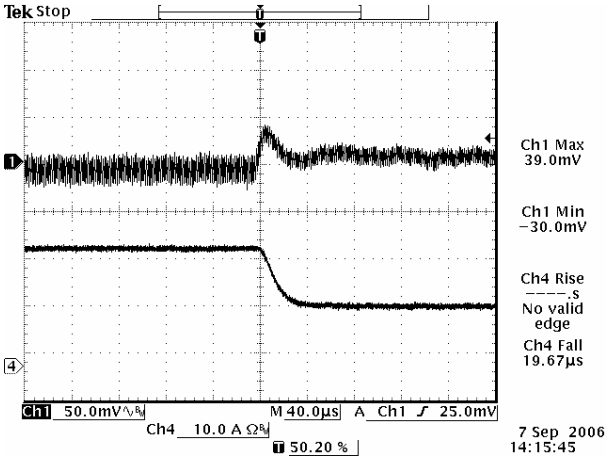


Figure 16. Vout = 0.8 V, 100%-50% Load Transients

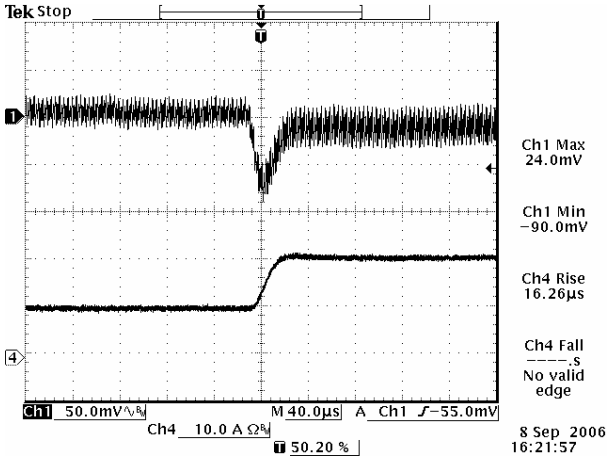


Figure 17. Vout = 1.8 V, 50%-100% Load Transients

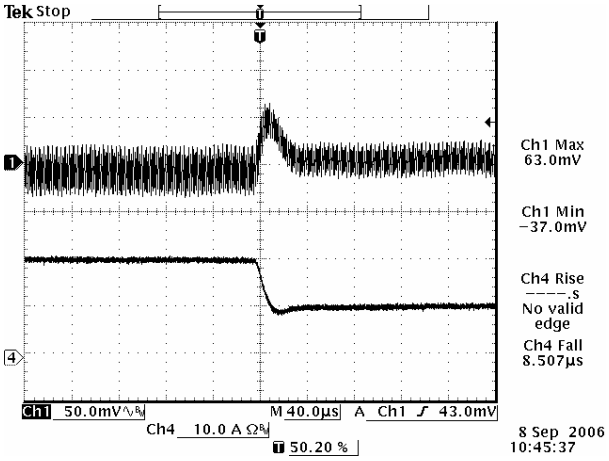


Figure 18. Vout = 1.8 V, 100%-50% Load Transients

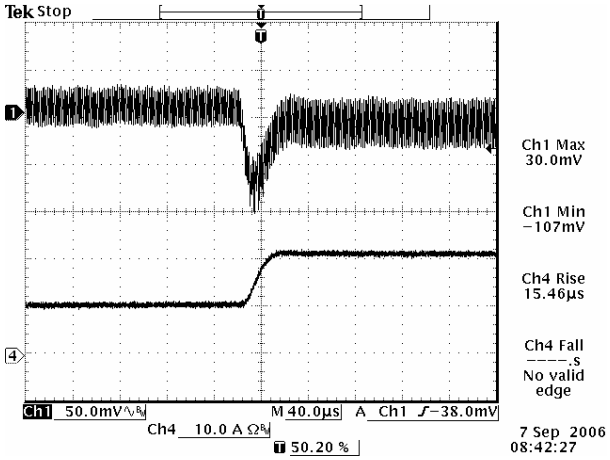


Figure 19. Vout = 3.3 V, 50%-100% Load Transients

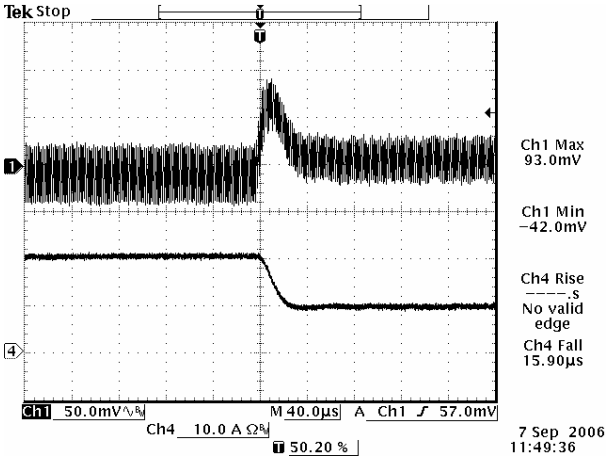


Figure 20. Vout = 3.3 V, 100%-50% Load Transients

For SRBC-30E6AL

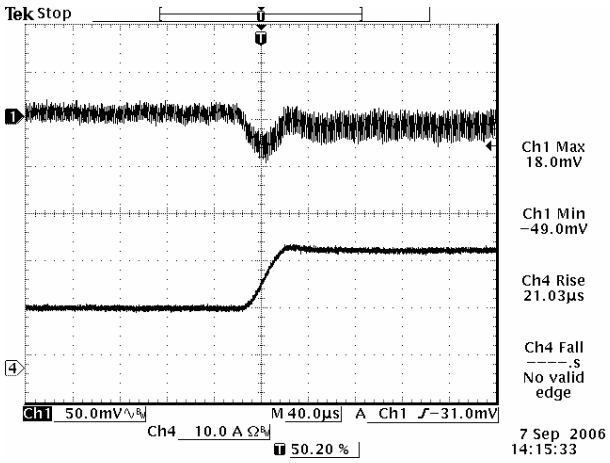


Figure 21. Vout = 0.8 V, 50%-100% Load Transients

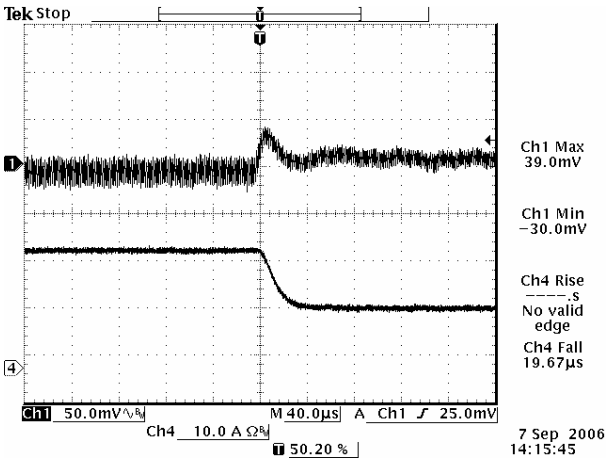


Figure 22. Vout = 0.8 V, 100%-50% Load Transients

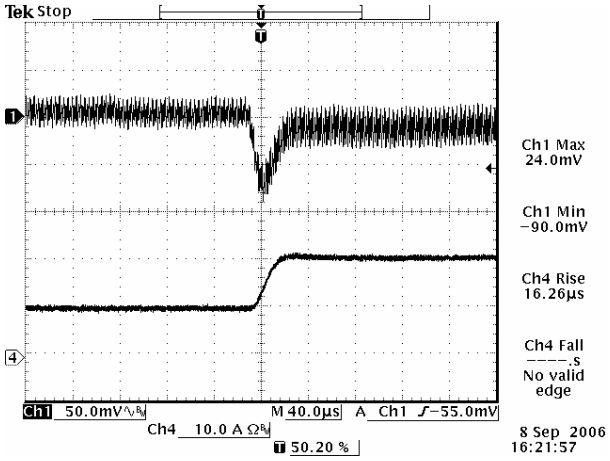


Figure 23. Vout = 1.4 V, 50%-100% Load Transients

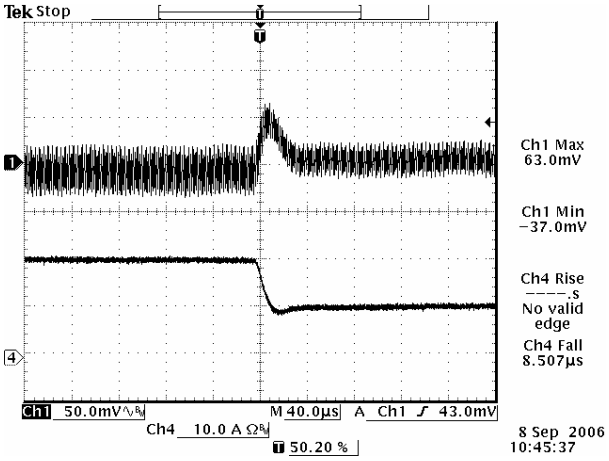


Figure 24. Vout = 1.4 V, 100%-50% Load Transients

11. THERMAL DERATING CURVES

Except SRBC-30E6AL

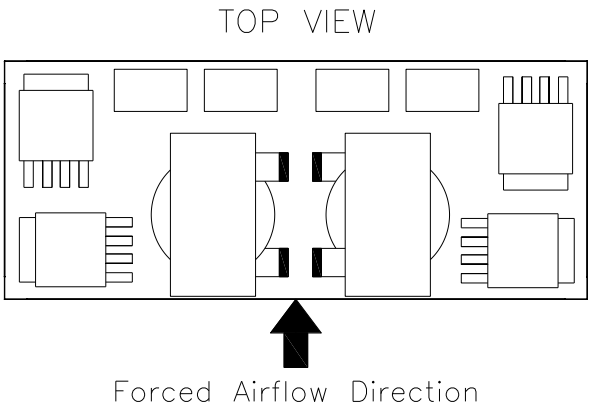


Figure 25. Airflow direction

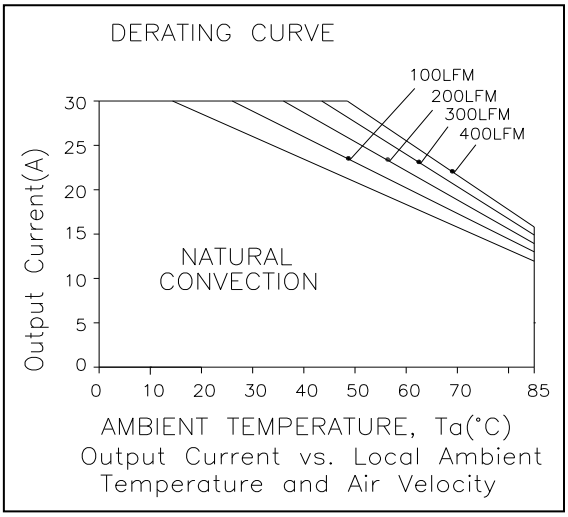


Figure 26. Thermal derating curve
Vin = 12 V, Vo = 0.8 V

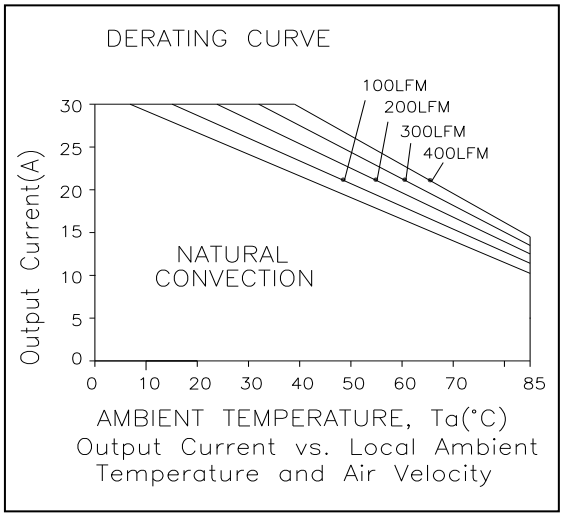


Figure 27. Thermal derating curve
Vin = 12 V, Vo = 1.8 V

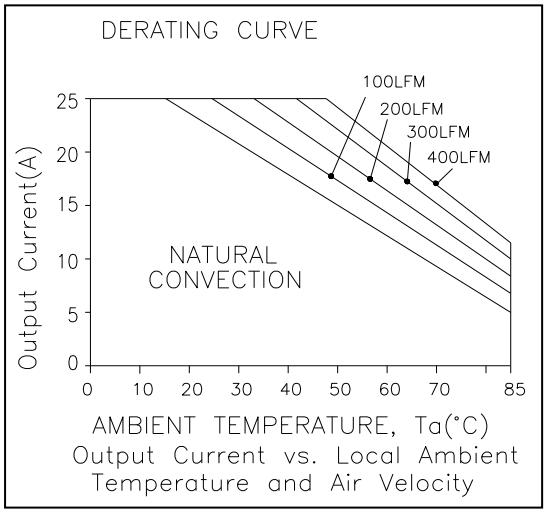


Figure 28. Thermal derating curve
Vin = 12 V, Vo = 3.3 V

Note: Maximum junction temperature of semiconductors derated to 120°C.

For SRBC-30E6AL

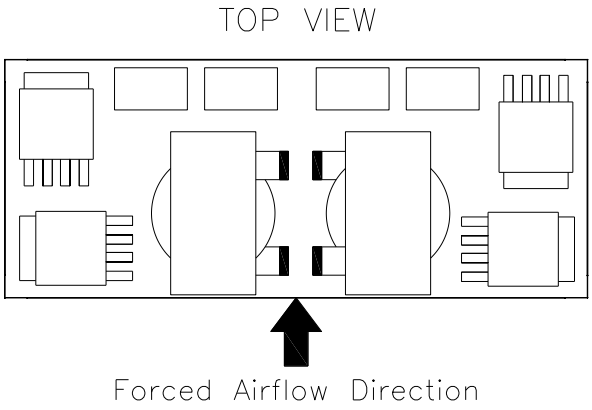


Figure 29. Airflow direction

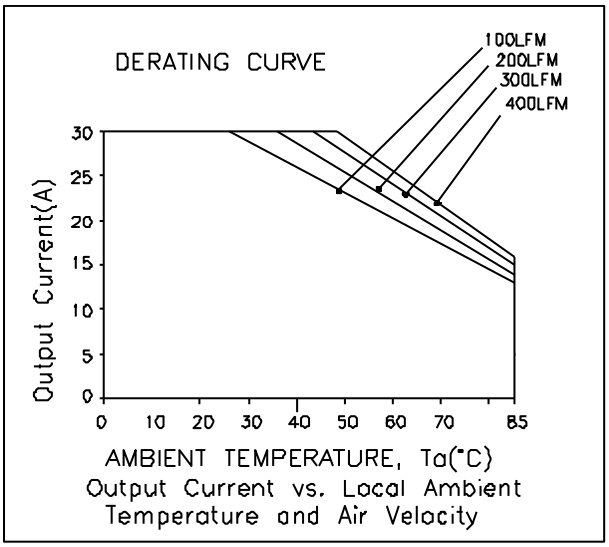


Figure 30. Thermal derating curve
Vin = 12 V, Vo = 0.8 V

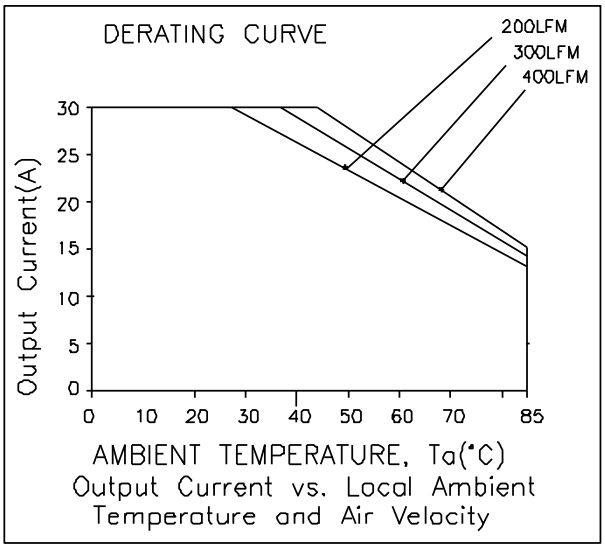


Figure 31. Thermal derating curve
Vin = 12 V, Vo = 1.4 V

Note: Maximum junction temperature of semiconductors derated to 120°C.

12. SOLDERING INFORMATION

The 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 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.

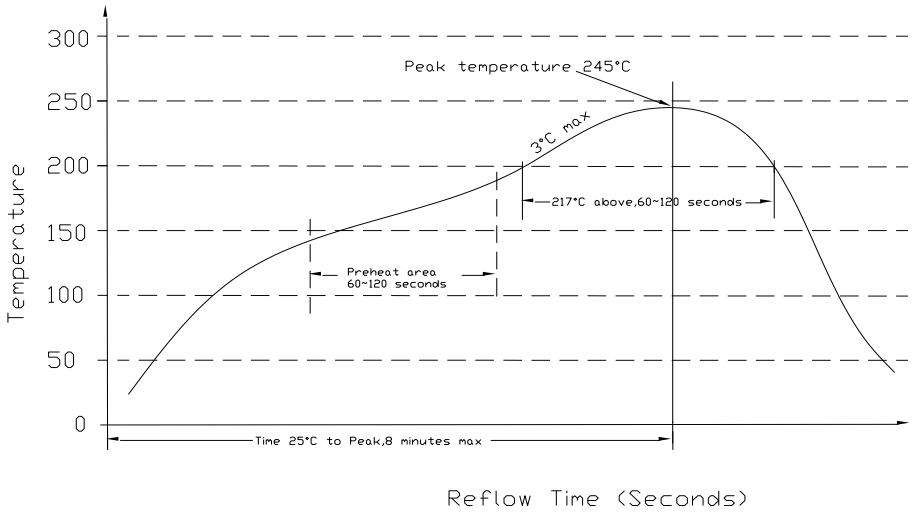


Figure 32. Solder information

13. MSL RATING

The SRBC-30ExAL modules have a MSL rating of 2.

14. STORAGE AND HANDLING

The SRBC-30ExAL 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.

15. 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.

16. MECHANICAL DIMENSIONS

SRBC-30E2AL & SRBC-30E6AL

OUTLINE

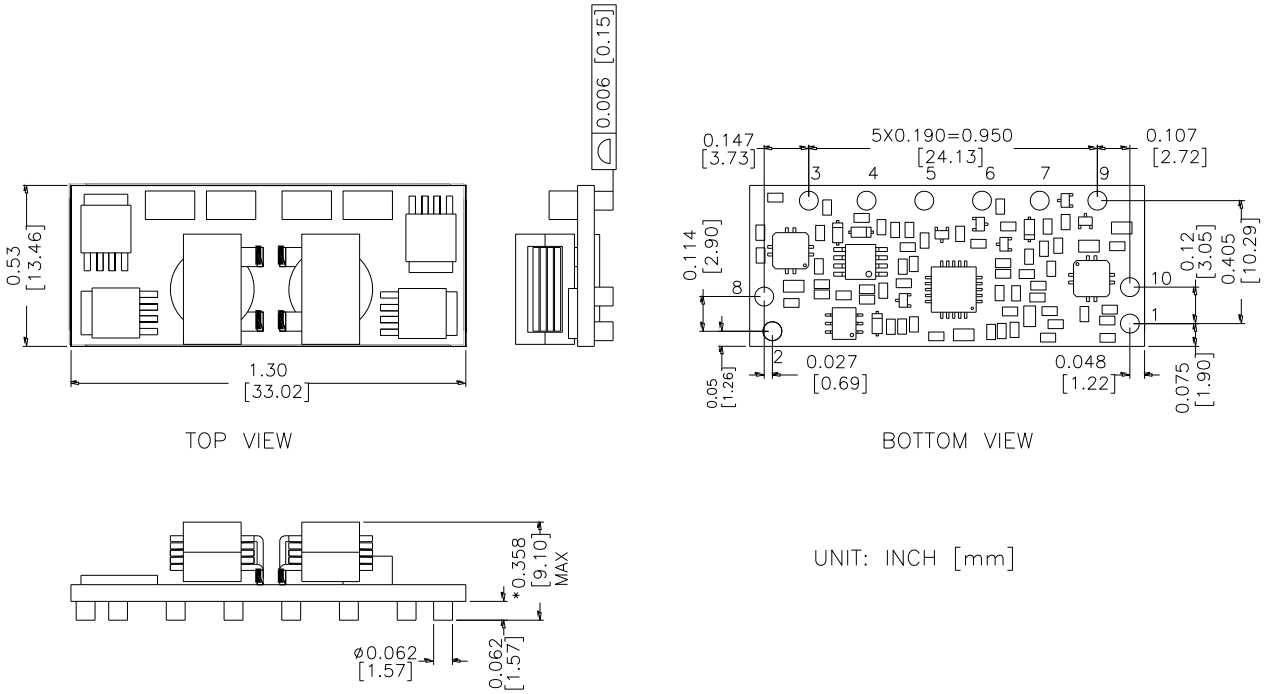


Figure 33. SRBC-30E2AL & SRBC-30E6AL Outline

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 –Gold plated.
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

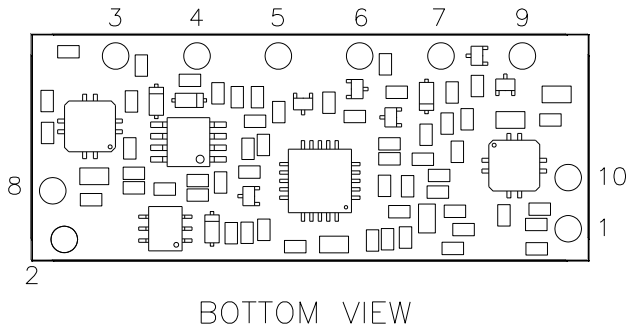


Figure 34. SRBC-30E2AL & SRBC-30E6AL Pins

PIN	FUNCTION	PIN	FUNCTION
1	On/Off	6	Trim
2	Vin	7	Sense
3	SEQ	8	GND(-H)
4	GND	9	Share
5	Vout	10	GND(-H)

RECOMMENDED PAD LAYOUT

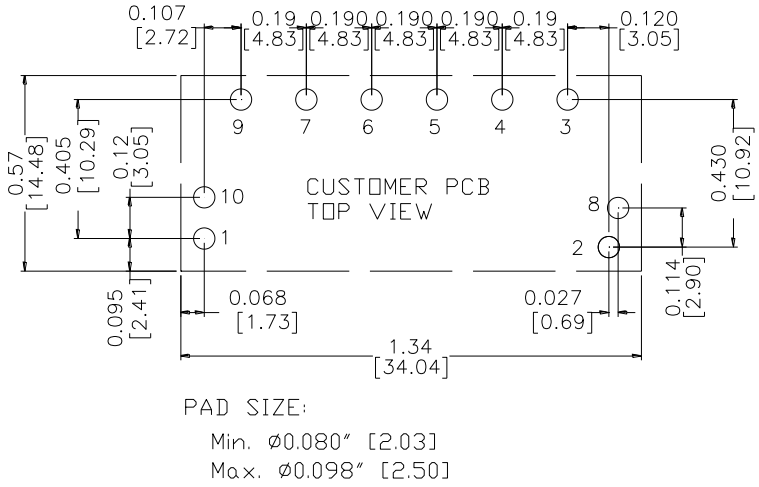


Figure 35. SRBC-30E2AL & SRBC-30E6AL Recommended pad layout

SRBC-30E3AL

OUTLINE

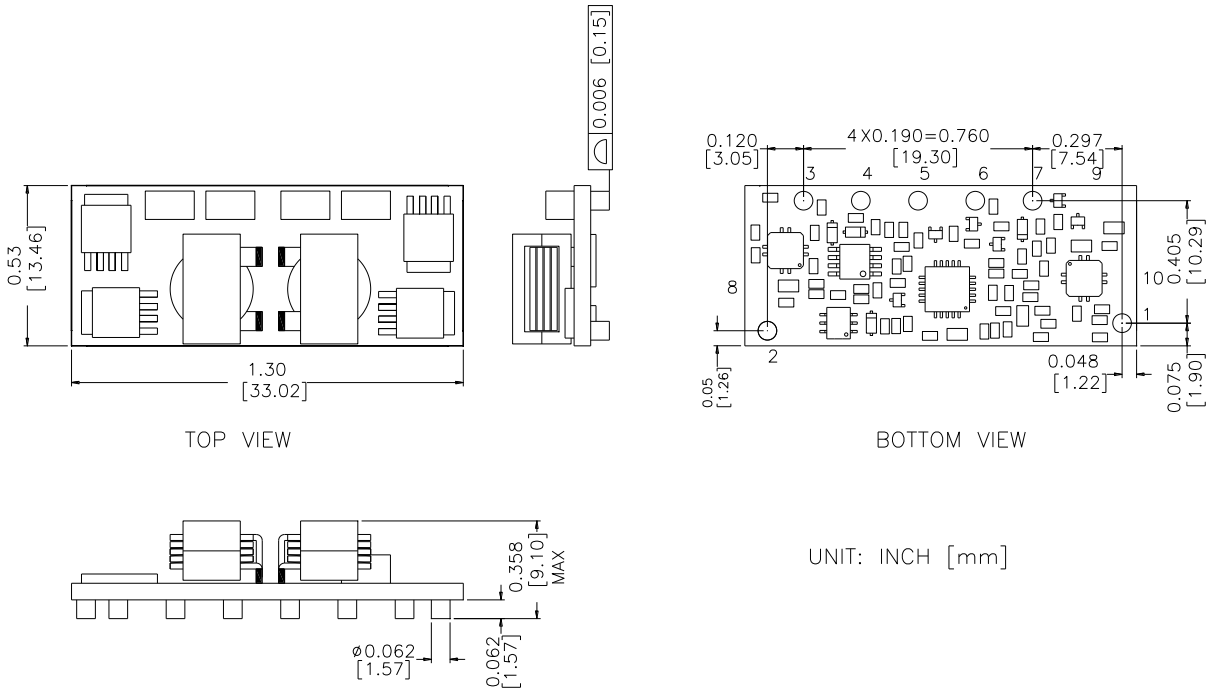


Figure 36. SRBC-30E3AL Outline

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:

4) All Pins: Material - Copper Alloy;
   Finish – Gold plated.
5) Un-dimensioned components are shown for visual reference only.
6) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.51 mm]; x.xxx +/-0.010 inch [0.25 mm].

PIN DEFINITIONS

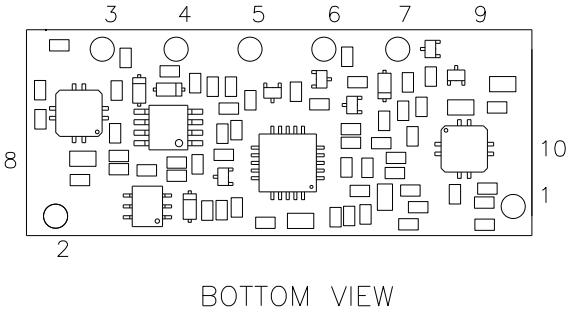


Figure 37. SRBC-30E3AL Pins

PIN	FUNCTION	PIN	FUNCTION
1	On/Off	6	Trim
2	Vin	7	Sense
3	SEQ	8	NILL
4	GND	9	NILL
5	Vout	10	NILL

RECOMMENDED PAD LAYOUT

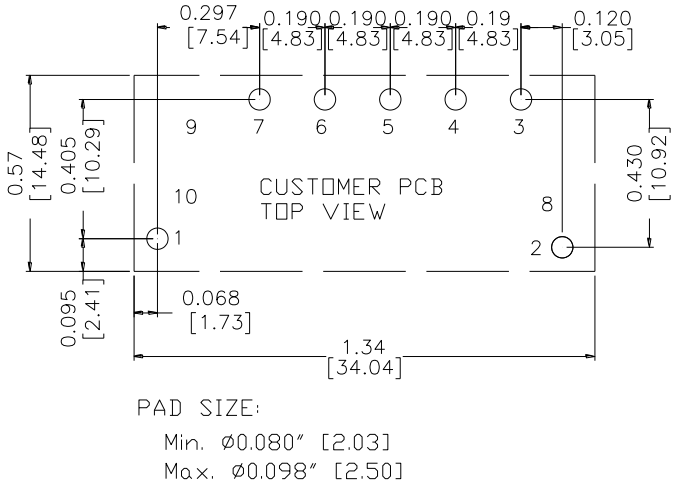


Figure 38. SRBC-30E3AL Recommended pad layout

SRBC-30E5AL

OUTLINE

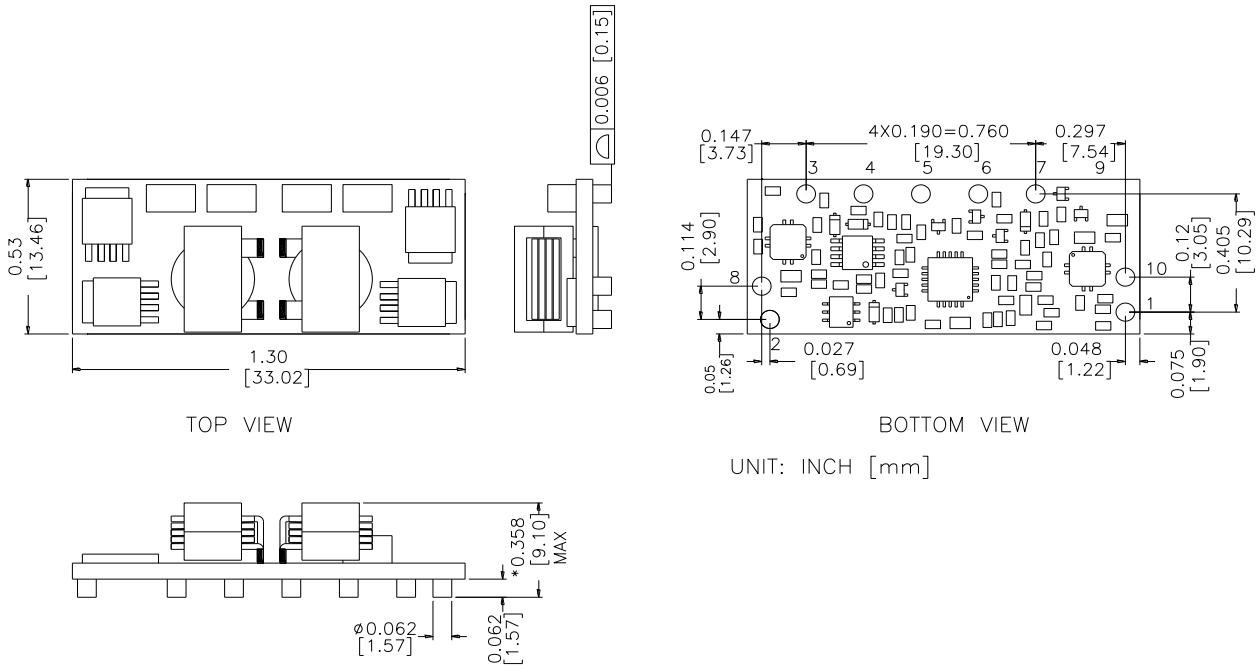


Figure 39. SRBC-30E5AL Outline

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

Note:

7) All Pins: Material - Copper Alloy;
   Finish – Gold plated.
8) Un-dimensioned components are shown for visual reference only.
9) All dimensions in inch [mm]; Tolerances: x.xx +/-0.02 inch [0.51 mm]; x.xxx +/-0.010 inch [0.25 mm].

PIN DEFINITIONS

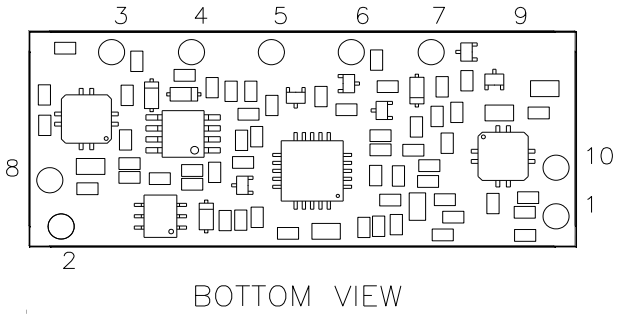


Figure 40. SRBC-30E5AL Pins

PIN	FUNCTION	PIN	FUNCTION
1	On/Off	6	Trim
2	Vin	7	Sense
3	SEQ	8	GND(-H)
4	GND	9	NILL
5	Vout	10	GND(-H)

RECOMMENDED PAD LAYOUT

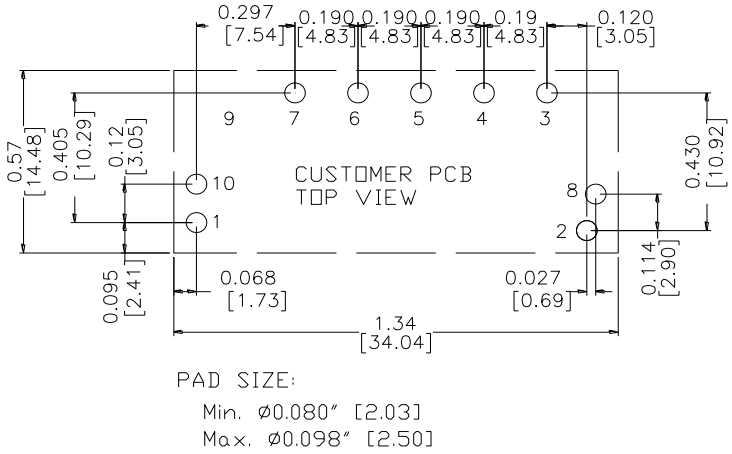


Figure 41. SRBC-30E5AL Recommended pad layout

17. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2020-07-09	AA	Make SRBC-30E2/3/5/6AL to one document.	XF.Jiang
2021-07-06	AB	Add object ID and thermal test airflow direction. Update safety certificate and mechanical outline tolerance.	XF.Jiang