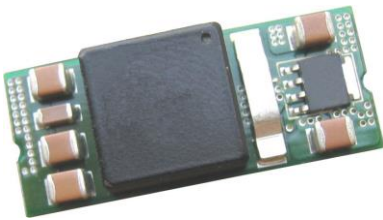


# SRBC-16A2A

## Non-Isolated DC-DC Converter

The Bel SRBC-16A2A modules are a series of non-isolated dc/dc converters that deliver up to 16 A of output current with full load efficiency of 92% at 3.3 VDC output. These modules provide precisely regulated voltage programmable via external resistor from 0.75 to 5.0 VDC over a wide range of input voltage (8.3 - 14 VDC).

These modules have a sequencing feature that enables designers to implement various types of output voltage sequencing when powering multiple voltages on a board. The open-frame construction and small footprint enable designers to develop cost and space-efficient solutions. Standard features include remote on/off, remote sense, over current protection, short current protection, wide input, and programmable output voltage.



### Key Features & Benefits

- Non-Isolated
- High Efficiency
- High Power Density
- Excellent Thermal Performance
- Low Cost
- Flexible Output Voltage Sequencing
- Remote Sense
- Able to Sink/Source Current
- Vout Pre-bias
- Under-voltage Lockout (UVLO)
- Over Temperature Protection
- OCP/SCP
- Wide Input
- Wide Trim
- Remote On/Off
- Active Low/High (option)
- Industrial Temperature Range
- Approved to IEC/EN 62368-1
- Approved to CSA/UL 62368-1



### Applications

- Networking
- Computers and Peripherals
- Telecommunications

## 1. MODEL SELECTION

MODEL NUMBER ACTIVE LOW	MODEL NUMBER ACTIVE HIGH	OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY
SRBC-16A2ALG	SRBC-16A2A0G					
SRBC-16A2ALH	SRBC-16A2A0H	0.75 - 5.0 V	8.3 - 14 V	16 A	80 W	94%
SRBC-16A2ALR	SRBC-16A2A0R					

### PART NUMBER EXPLANATION

S	R	BC	-	16	A	2A	x	y
Mounting Type	RoHS Status	Series Name		Output Current	Input Range	Output Voltage	Active Logic	Package Type
Surface Mount	RoHS	Bobcat		16 A	8.3 - 14 V	0.75 - 5.0 V	L – Active Low 0 – Active High	G - Tray Package H - Tray Package <sup>1</sup> R - Tape & Reel Package

**NOTE:** <sup>1</sup> Add “H” suffix at the end of the model number to indicate Tray packaging and RoHS compliant without requiring exemption 7c-III.

## 2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Input Voltage (Continuous)		-0.3	-	15	V
Output Enable Terminal Voltage		-0.3	-	15	V
Sequencing Voltage <sup>1</sup>		-0.3		V <sub>in</sub>	V
Ambient Temperature		-40	-	85	°C
Storage Temperature		-55	-	125	°C
Altitude		-	-	2000	m

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

<sup>1</sup> SRBC-16A2A series of modules include a sequencing feature that enables users to implement various types of output voltage sequencing in their applications. This is accomplished via an additional sequencing pin. When the sequencing feature is not used, tie the SEQ pin to V<sub>in</sub> or leave it unconnected.

## 3. INPUT SPECIFICATIONS

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Input Voltage	V <sub>o</sub> , set ≤ 3.63 V	8.3	12	14	V
	V <sub>o</sub> , set > 3.63 V	8.3	12	13.2	V
Input Current (full load)		-	-	11	A
Input Current (no load)		-	100	-	mA
Remote Off Input Current		-	2	-	mA
Input Reflected Ripple Current (pk-pk)	Tested with one 1000 μF/25 V AL input capacitor with ESR = 0.03 Ω max and 6 × 47 μF/16 V tantalum capacitors with ESR = 0.013 Ω max at 100 kHz, & simulated source impedance of 1000 nH, 5 Hz to 20 MHz.	-	70	200	mA
Input Reflected Ripple Current (rms)		-	-	150	mA
I <sup>2</sup> t Inrush Current Transient		-	0.2	0.4	A <sup>2</sup> s
Turn-on Voltage Threshold		-	8.0	-	V
Turn-off Voltage Threshold		-	7.5	-	V

#### 4. OUTPUT SPECIFICATIONS

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

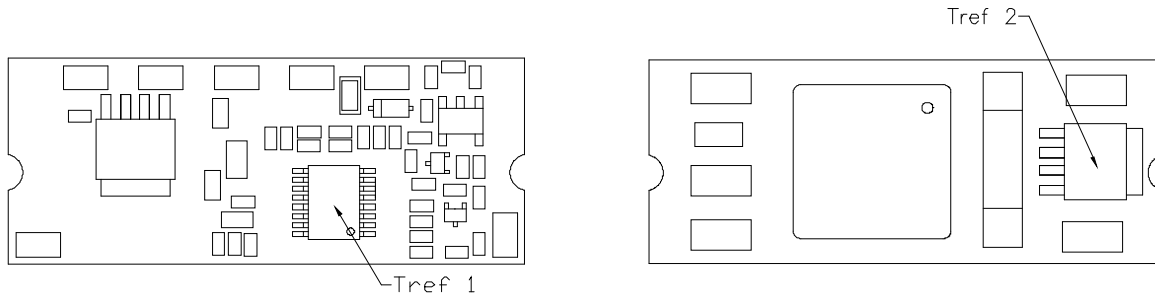
PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Output Voltage Set Point	V <sub>in</sub> =12 V, full load.	-2%	-	2%	V <sub>o,set</sub>
Load Regulation	I <sub>o</sub> = I <sub>o</sub> , min to I <sub>o</sub> , max	-	0.1%	-	V <sub>o,set</sub>
Line Regulation	V <sub>in</sub> = V <sub>in</sub> , min to V <sub>in</sub> , max	-	0.1%	-	V <sub>o,set</sub>
Regulation Over Temperature (-40 °C to +85 °C)	T <sub>ref</sub> =T <sub>a,min</sub> to T <sub>a,max</sub>	-	0.3%	-	V <sub>o,set</sub>
Output Current Range		0	-	16	A
Current Limit Threshold		-	180% I <sub>o</sub>	-	A
Short Circuit Surge Transient		-	1	3	A <sup>2</sup> s
Ripple and Noise (Pk-Pk)	Tested with 0-20 MHz, 10 µF tantalum capacitor & 1 µF TDK ceramic capacitor at the output	-	75	100	mV
Ripple and Noise (RMS)		-	30	45	mV
Turn on Time		-	6	10	ms
Overshoot at Turn on		-	-	1%	V <sub>o,set</sub>
Output Capacitance		0	-	5000	µF
<b>Transient Response</b>					
ΔV 50%~100% of Max Load		-	100	-	mV
Settling Time	V <sub>o</sub> = 0.75 - 5 V		50	-	µs
ΔV 100%~50% of Max Load			100	-	mV
Settling Time		-	50	-	µs

## 5. GENERAL SPECIFICATIONS

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

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	Vo = 5.0 V	-	94%	-	
	Vo = 3.3 V	-	92%	-	
	Vo = 2.5 V	-	90%	-	
	Vo = 1.8 V	-	88%	-	-
	Vo = 1.5 V	-	87%	-	
	Vo = 1.2 V	-	85%	-	
	Vo = 0.75 V	-	79%	-	
Switching Frequency		265	300	335	kHz
Over Temperature Shutdown <sup>1</sup>		-	130	-	°C
Output Trim Range (Wide Trim)		0.7525	-	5.0	V
Remote Sense Compensation		-	-	0.5	V
MTBF	Calculated Per Bell Core SR-332 (Io =80% Io,max; Vo = 5 V; Vin = 12 V; Ta = 25°C)	-	2,666,488	-	hour
Weight		-	8	-	g
Dimensions (L x W x H)		1.30 x 0.53 x 0.315			inch
		33.02 x 13.46 x 8.00			mm

**NOTE:** <sup>1</sup> The Tref temperature measurement location. For reliable operation the Tref 1 and Tref 2 must not exceed 130°C.



## 6. CONTROL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
<b>Remote on/off</b>					
Signal Low (Unit Off)	SRBC-16A2A0; Remote On/Off pin open, Unit on.	-0.2	-	0.3	V
Signal High (Unit On)		1.0	-	Vin, max	V
Signal Low (Unit On)	SRBC-16A2AL; Remote On/Off pin open, Unit on.	-0.2	-	0.3	V
Signal High (Unit Off)		2.5	-	Vin, max	V
<b>Voltage Sequencing</b>					
Sequencing Delay Time	Delay from Vin, min to application of voltage on SEQ pin	10	-	-	ms
Sequencing Slew Rate Capability		-	-	2	V/ms
Tracking Accuracy	Power-Up	-	100	200	mV
	Power-Down	-	300	500	mV

## 7. EFFICIENCY DATA

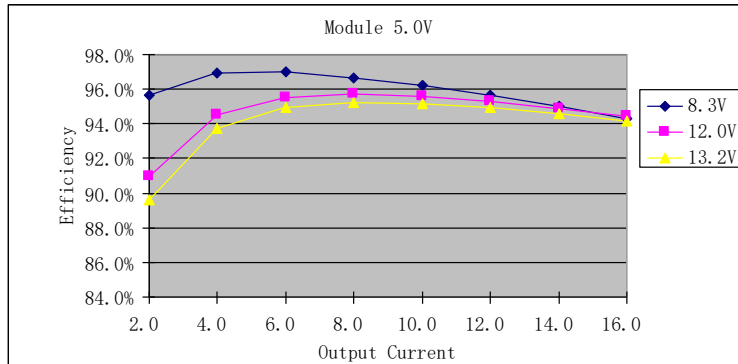


Figure 1.  $V_o = 5.0\text{ V}$

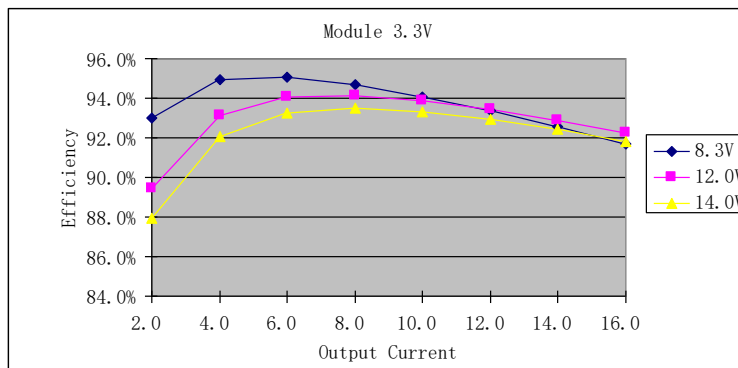


Figure 2.  $V_o = 3.3\text{ V}$

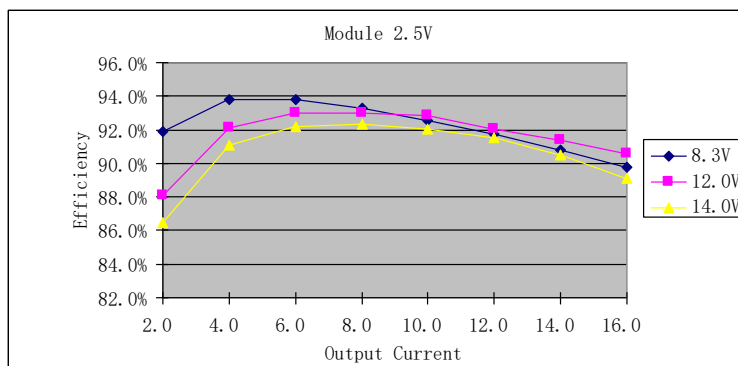
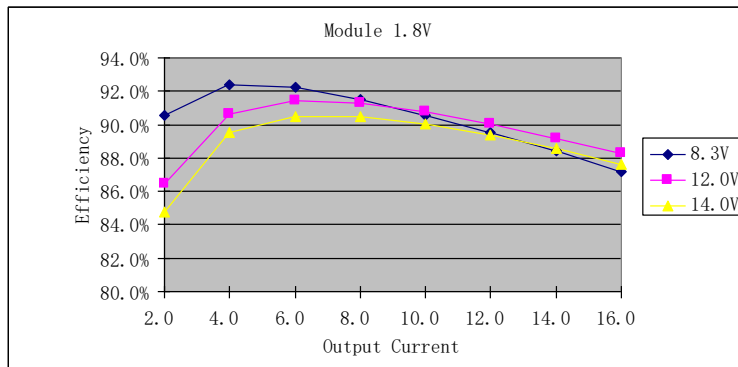
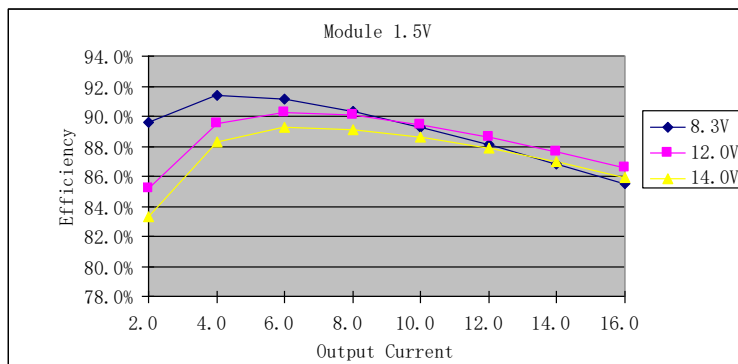
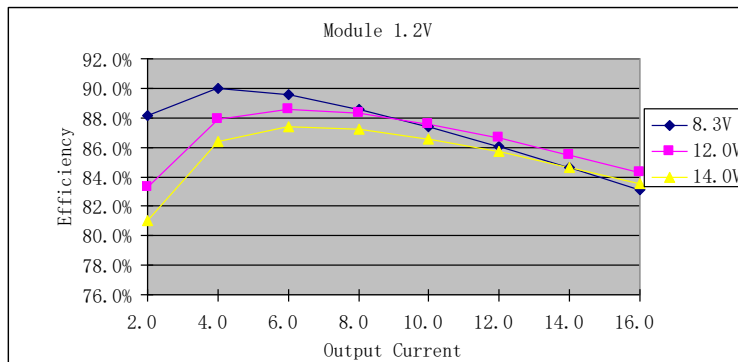


Figure 3.  $V_o = 2.5\text{ V}$

Figure 4.  $V_o = 1.8 V$ Figure 5.  $V_o = 1.5 V$ Figure 6.  $V_o = 1.2 V$

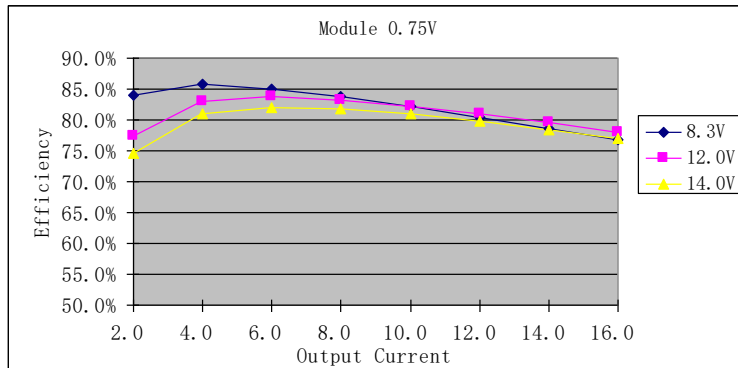


Figure 7. Vo = 0.75 V

## 8. OUTPUT TRIM EQUATIONS

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

$$R_{trimup} = \frac{10500}{V_{adj} - 0.7525} - 1000$$

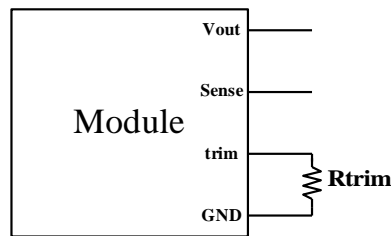


Figure 8. Trim up circuit-1

Equation for calculating the trim voltage (in V) given the desired adjusted voltage (Vadj) is shown below. The Trim Up voltage should be connected between the Trim pin and Ground.

$$V_{trimup} = 0.7 - 0.0667 \times (V_{adj} - 0.7525)$$

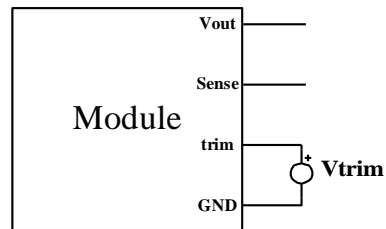


Figure 9. Trim up circuit-2

## 9. RIPPLE AND NOISE WAVEFORMS

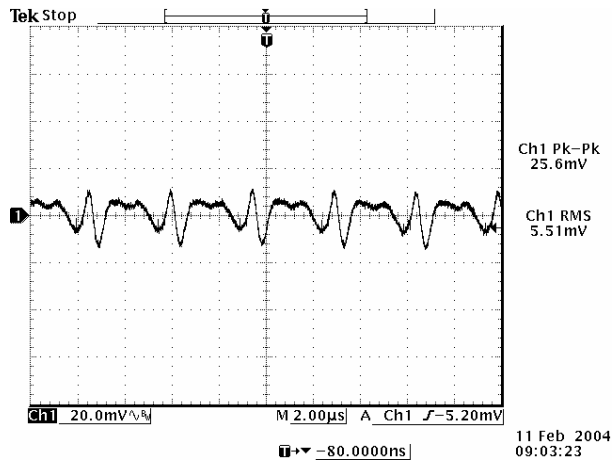


Figure 10. Ripple and noise at max load 0.75 VDC output

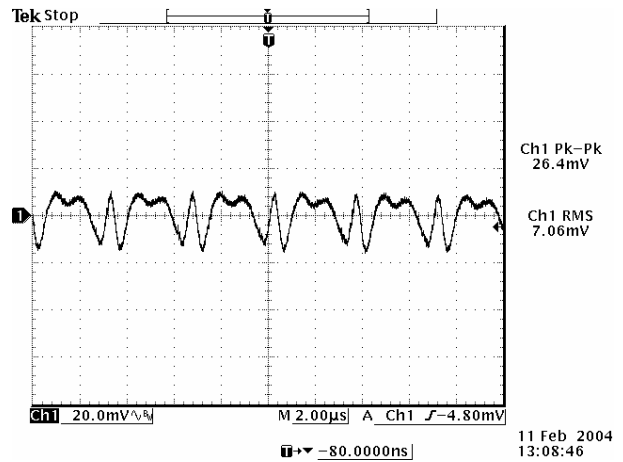


Figure 11. Ripple and noise at max load 1.2 VDC output

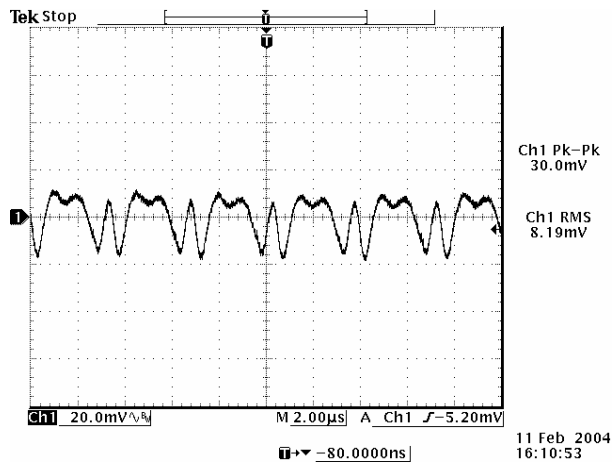


Figure 12. Ripple and noise at max load 1.5 VDC output

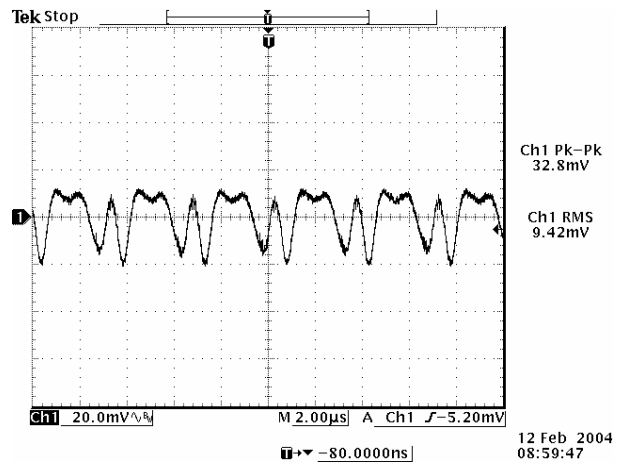


Figure 13. Ripple and noise at max load 1.8 VDC output



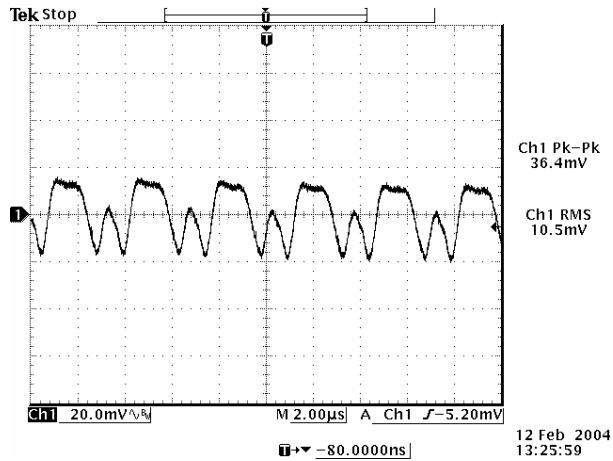


Figure 14. Ripple and noise at max load 2.5 VDC output

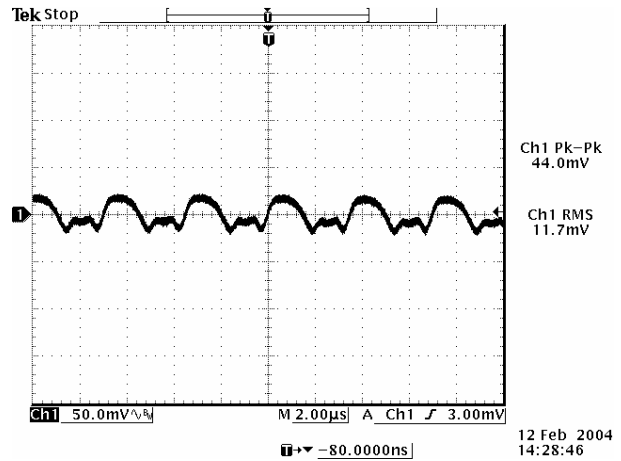


Figure 15. Ripple and noise at max load 3.3 VDC output

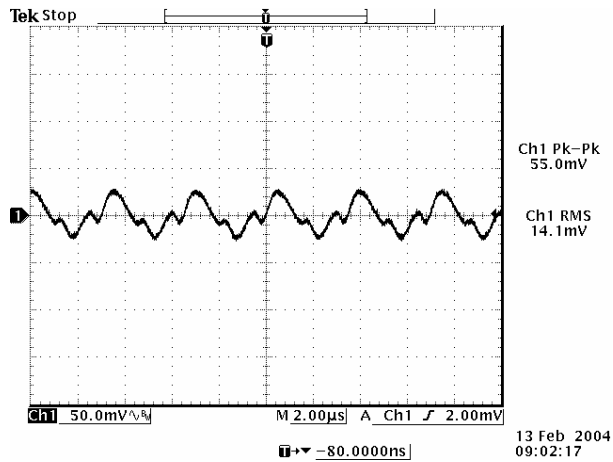


Figure 16. Ripple and noise at max load 5.0 VDC output

**Note:** Ripple and Noise at 12 V input, with 10  $\mu$ F tantalum capacitor and 1  $\mu$ F ceramic capacitor at the output, and  $T_a = 25^\circ\text{C}$ .

10. TRANSIENT RESPONSE WAVEFORMS

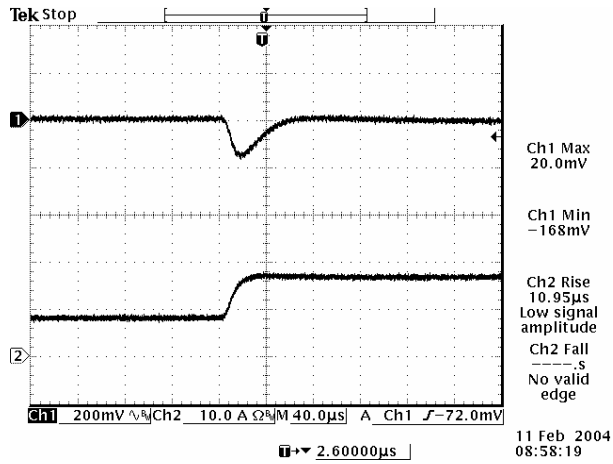


Figure 17. Transients 50% to 100% load, 0.75 VDC output

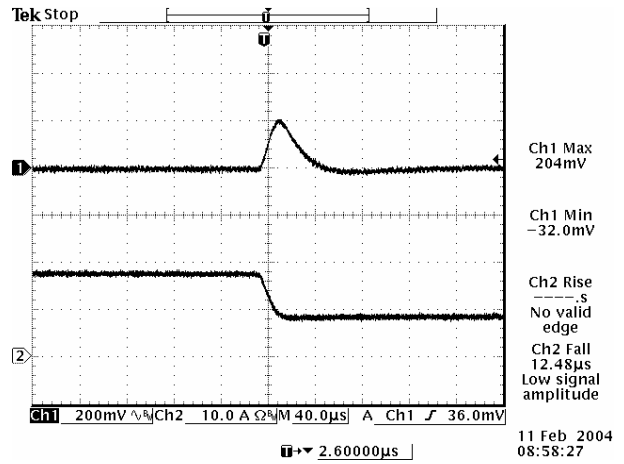


Figure 18. Transients 100% to 50% load, 0.75 VDC output

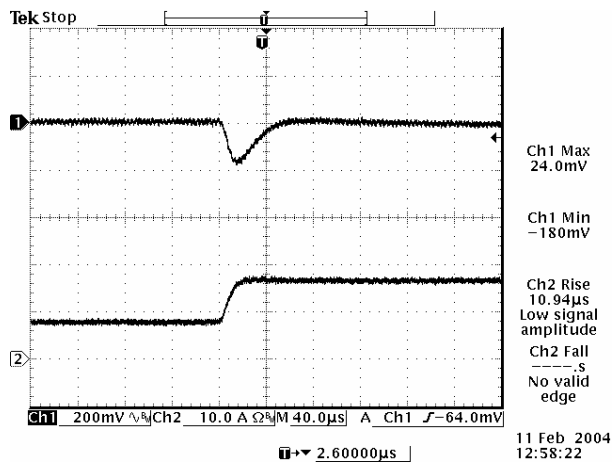


Figure 19. Transients 50% to 100% load, 1.2 VDC output

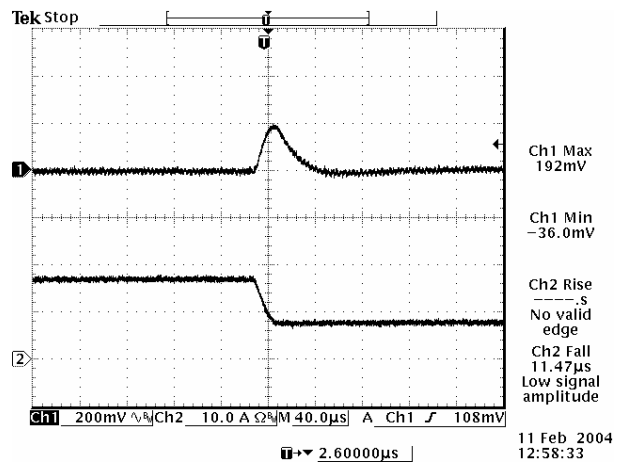


Figure 20. Transients 100% to 50% load, 1.2 VDC output

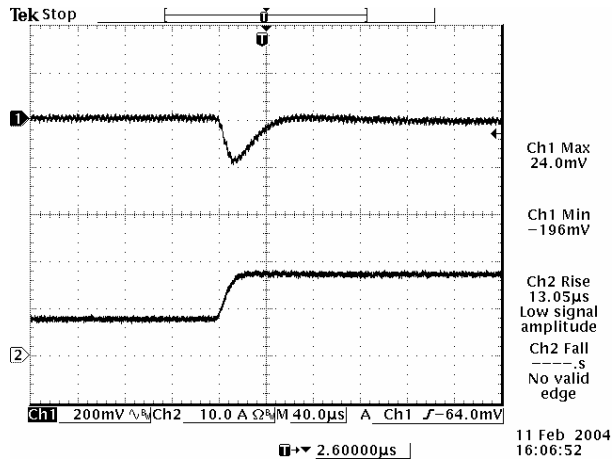


Figure 21. Transients 50% to 100% load, 1.5 VDC output

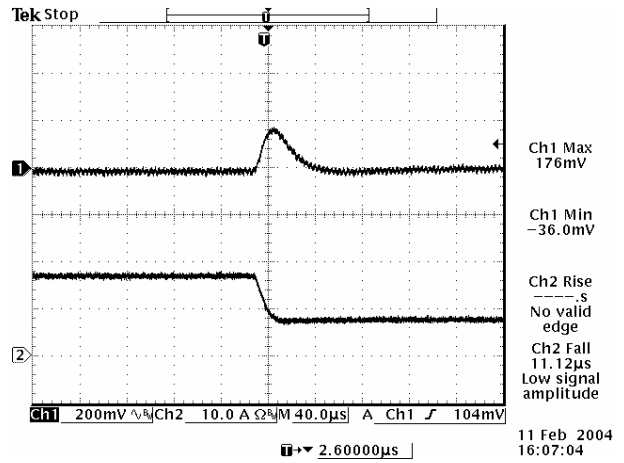


Figure 22. Transients 100% to 50% load, 1.5 VDC output

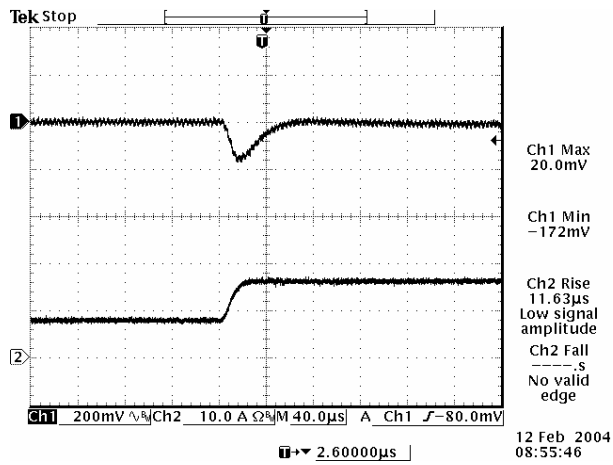


Figure 23. Transients 50% to 100% load, 1.8 VDC output

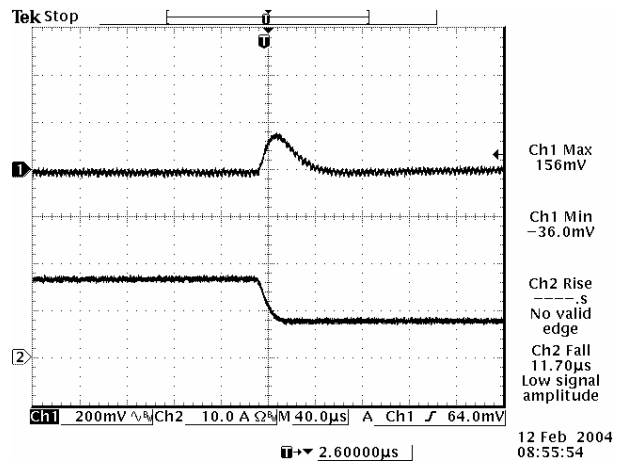


Figure 24. Transients 100% to 50% load, 1.8 VDC output

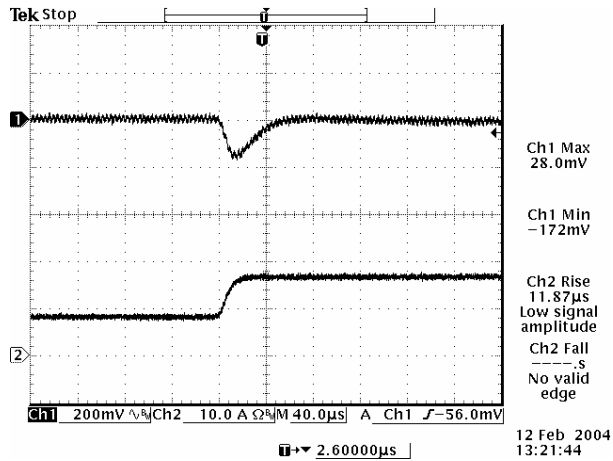


Figure 25. Transients 50% to 100% load, 2.5 VDC output

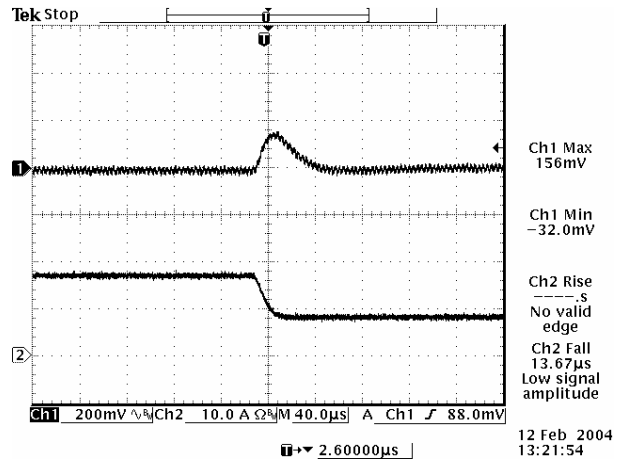


Figure 26. Transients 100% to 50% load, 2.5 VDC output

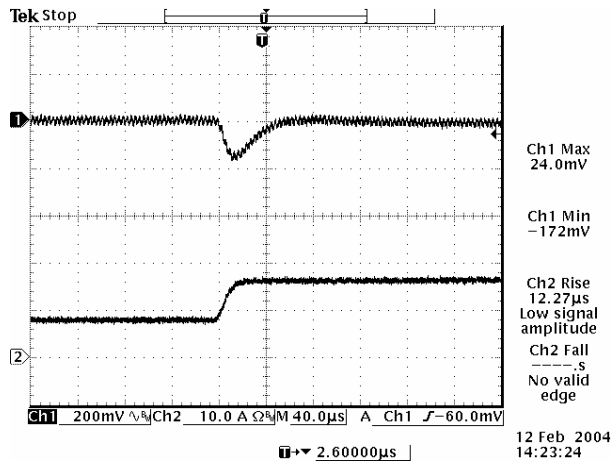


Figure 27. Transients 50% to 100% load, 3.3 VDC output

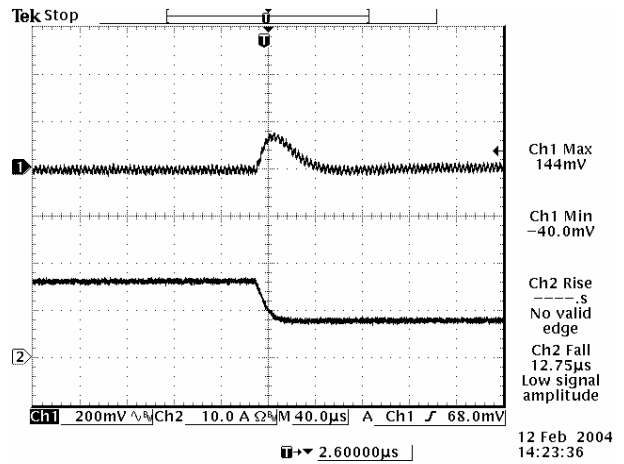


Figure 28. Transients 100% to 50% load, 3.3 VDC output

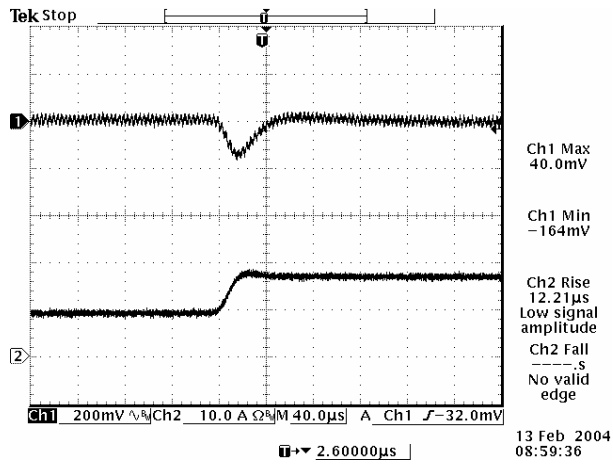


Figure 29. Transients 50% to 100% load, 5.0 VDC output

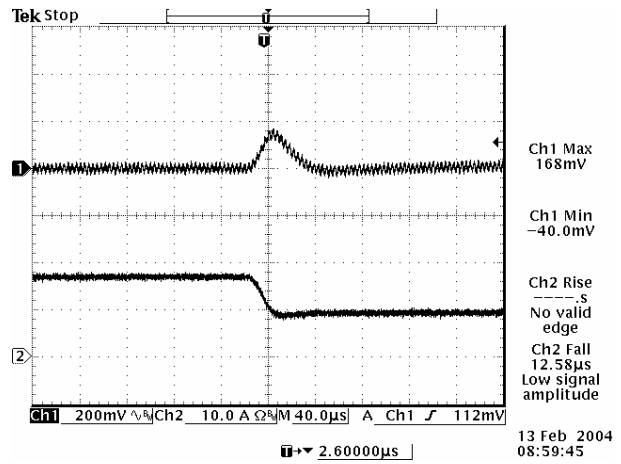


Figure 30. Transients 100% to 50% load, 5.0 VDC output

**Note:** Transient response at 12 V input,  $di/dt = 2.5 \text{ A}/\mu\text{s}$ , with external  $2 \times 150 \mu\text{F}$  polymer capacitor at the output,  $T_a = 25^\circ\text{C}$ .

11. THERMAL DERATING CURVE

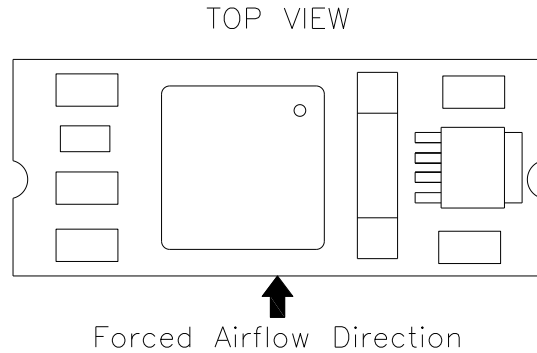


Figure 31. Airflow direction

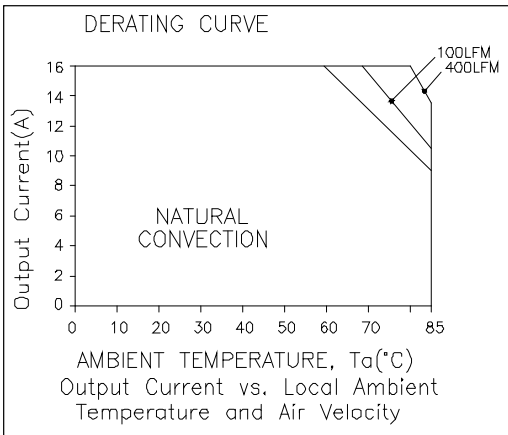


Figure 32. Vo = 0.75 V

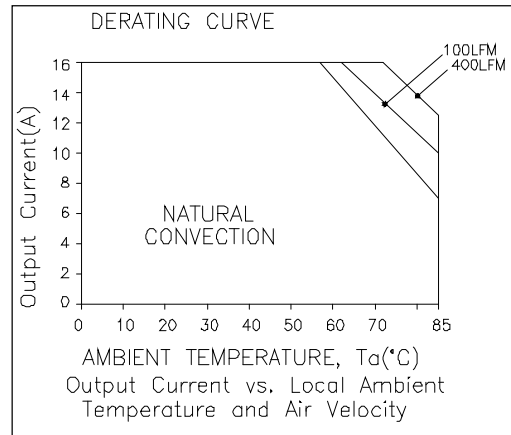


Figure 33. Vo = 1.8 V

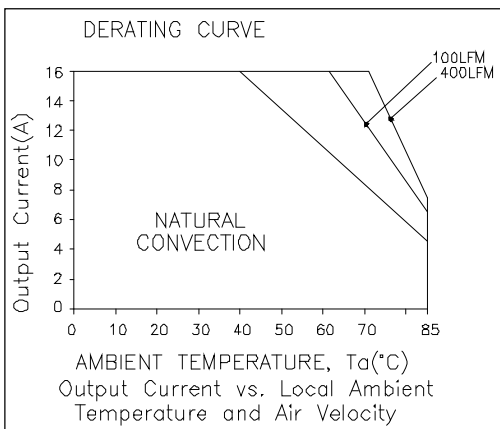


Figure 34. Vo = 3.3 V

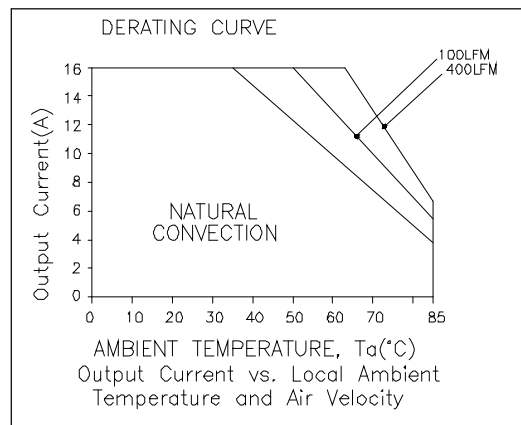


Figure 35. Vo = 5.0 V

## 12. MECHANICAL DIMENSIONS

### OUTLINE

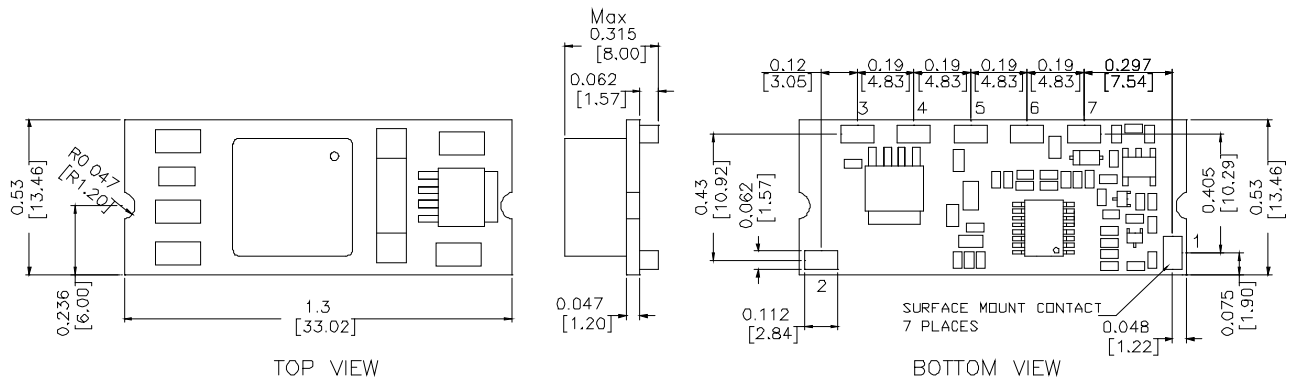


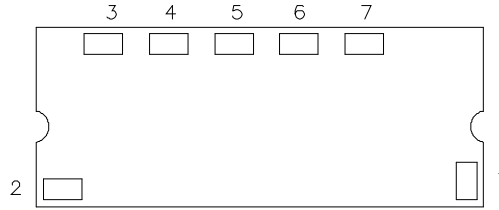
Figure 36. Outline

**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**

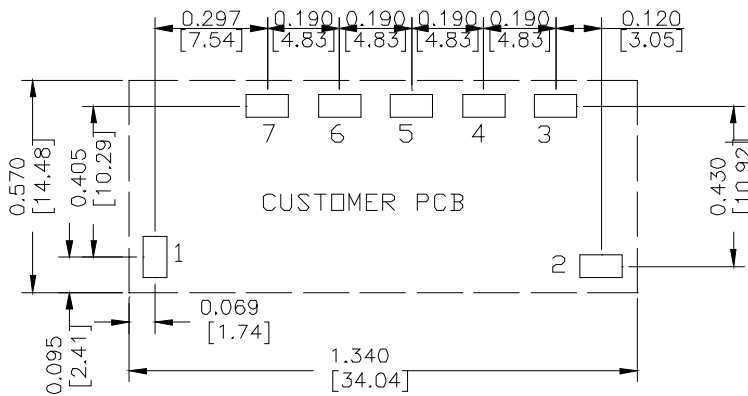


**BOTTOM VIEW**

*Figure 37. Pins*

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

**RECOMMENDED PAD LAYOUT**



**PAD SIZE:**

MIN: 0.14" \* 0.095" (3.56mm \* 2.41mm)

MAX: 0.165" \* 0.11" (4.19mm \* 2.79mm)

*Figure 38. Recommended pad layout*



### 13. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2007-01-15	A	First release.	Lynn
2011-08-25	B	Update the reflow solder temperature.	HL.Lu
2012-07-04	C	Adding the 7C-III compliance suffix statement.	HL.Lu
2013-01-25	D	Update UL.	HL.Lu
2021-08-02	AE	Add object ID, altitude, thermal test airflow direction and tape & reel package. Update to new form. Update safety certificate.	XF.Jiang

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.



Asia-Pacific  
+86 755 298 85888

Europe, Middle East  
+353 61 49 8941

North America  
+1 866 513 2839