

## NON-ISOLATED DC/DC CONVERTERS

4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output

**bel**  
POWER PRODUCTS

**SRDB-30B1AH**

**RoHS Compliant**

- Non-Isolated
- Under-Voltage lockout (UVLO)
- Wide Output
- Over voltage protection
- Remote Sense
- OCP/SCP
- Low profile package
- Remote On/Off (Active High)



### Description

The Bel SRDB-30B1AH is part of the non-isolated dc/dc converter Power Module series. The modules use a DIP package for ease of layout and space savings. The output can be trimmed from 0.9 V to 2.75 V and the efficiency of 2.5 V output module is typically 93% at full load. Typical features include remote on/off, over current protection and short circuit protection.

### Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Active High
0.9 V - 2.75 V	4.5 V - 5.5 V	30 A	82.5 W	93%	SRDB-30B1AH

**Note:** Add "R" suffix at the end of the model number to indicate "Reel Packaging", and "G" for "Tray Packaging".

### Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	7 V	
Output Enable Terminal Voltage	-0.5 V	-	7 V	
Ambient Temperature	-40 °C	-	85 °C	
Storage Temperature	-40 °C	-	125 °C	

### Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	4.5 V	-	5.5 V	
Input Current (full load)				
Vo=2.5 V	-	-	20.4 A	
Vo=1.8 V	-	-	15.0 A	
Vo=1.5 V	-	-	12.9 A	
Vo=1.2 V	-	-	10.6 A	
Vo=1.0 V	-	-	9.05 A	
Input Current (no load)				
Vo=2.5 V	-	220 mA	-	
Vo=1.8 V	-	200 mA	-	
Vo=1.5 V	-	180 mA	-	
Vo=1.2 V	-	160 mA	-	
Vo=1.0 V	-	140 mA	-	

## NON-ISOLATED DC/DC CONVERTERS

4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



### Input Specifications (continued)

Parameter	Min	Typ	Max	Notes
Input Reflected Ripple Current (pk-pk)	-	120 mA	160 mA	With simulated source impedance of 500 nH, 5 Hz to 20 MHz. Use two 270 uF/16 V capacitors with ESR=0.018 ohm max. at 100 kHz.
Input Reflected Ripple Current (rms)				
Vo=2.5 V	-	12 mA	25 mA	
Vo=1.8 V	-	25 mA	50 mA	
Vo=1.5 V	-	29 mA	58 mA	
Vo=1.2 V	-	32 mA	64 mA	
Vo=1.0 V	-	36 mA	72 mA	
I <sup>2</sup> t Inrush Current Transient	-	0.1 A <sup>2</sup> s	0.2 A <sup>2</sup> s	
Turn-on Voltage Threshold	4.3 V	4.4 V	4.5 V	
Turn-off Voltage Threshold	3.4 V	3.7 V	4.3 V	

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

### Output Specifications

Parameter	Min	Typ	Max	Notes
Output Voltage Set Point				Vin=5 V, Iout=half load.
Vo=2.5 V	2.450 V	2.5 V	2.550 V	
Vo=1.8 V	1.764 V	1.8 V	1.836 V	
Vo=1.5 V	1.470 V	1.5 V	1.530 V	
Vo=1.2 V	1.176 V	1.2 V	1.224 V	
Vo=1.0 V	0.980 V	1.0 V	1.020 V	
Line Regulation				
Vo=2.5 V	-	±2 mV	±5 mV	
Vo=1.8 V	-	±2 mV	±4 mV	
Vo=1.5 V	-	±1 mV	±3 mV	
Vo=1.2 V	-	±1 mV	±2 mV	
Vo=1.0 V	-	±1 mV	±2 mV	
Load Regulation				
Vo=2.5 V	-	±5 mV	±10 mV	
Vo=1.8 V	-	±4 mV	±8 mV	
Vo=1.5 V	-	±4 mV	±7 mV	
Vo=1.2 V	-	±3 mV	±6 mV	
Vo=1.0 V	-	±3 mV	±5 mV	
Regulation Over Temperature				
Vo=2.5 V	-	±15 mV	±30 mV	
Vo=1.8 V	-	±12 mV	±24 mV	
Vo=1.5 V	-	±8 mV	±16 mV	
Vo=1.2 V	-	±6 mV	±12 mV	
Vo=1.0 V	-	±6 mV	±12 mV	
Output Current	0 A	-	30 A	
Current Limit Threshold	36 A	-	55 A	Input Voltage Range:4.75 V-5.5 V

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

# NON-ISOLATED DC/DC CONVERTERS

4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



## Output Specifications (continued)

Parameter		Min	Typ	Max	Notes	
<b>Transient Response</b>						
Ripple and Noise (rms)					Test conditions: two 270 uF/16 V capacitors with ESR=0.018 ohm max at the input; Vin=5 V, Io=30 A, 0-20 MHz BW.	
	Vo=2.5 V	-	3 mV	6 mV		
	Vo=1.8 V	-	5 mV	10 mV		
	Vo=1.5 V	-	7 mV	14 mV		
	Vo=1.2 V	-	7 mV	14 mV		
	Vo=1.0 V	-	7 mV	14 mV		
Ripple and Noise (pk-pk)						
	Vo=2.5 V	-	15 mV	30 mV		
	Vo=1.8 V	-	20 mV	40 mV		
	Vo=1.5 V	-	25 mV	50 mV		
	Vo=1.2 V	-	25 mV	50 mV		
	Vo=1.0 V	-	25 mV	50 mV		
Short Circuit Surge Transient		-	0.1 A <sup>2</sup> s	0.2 A <sup>2</sup> s		
Turn on Time		-	6 mS	10 mS		
Overshoot at Turn on		-	0%	3%		
Output Capacitance		680 uF		12000 uF		
<b>Transient Response</b>						
50% ~ 100% Max Load	Overshoot	Vo=2.5 V	-	100 mV	150 mV	Test conditions: di/dt=0.5 A/uS, Vin=5 V, Ta=25 °C with external 680 uF tantalum capacitance.
	Settling Time		-	60 uS	100 uS	
100% ~ 50% Max Load	Overshoot	Vo=2.5 V	-	100 mV	150 mV	
	Settling Time		-	60 uS	100 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.8 V	-	100 mV	150 mV	
	Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load	Overshoot	Vo=1.8 V	-	100 mV	150 mV	
	Settling Time		-	50 uS	100 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.5 V	-	90 mV	140 mV	
	Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load	Overshoot	Vo=1.5 V	-	90 mV	140 mV	
	Settling Time		-	50 uS	100 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.2 V	-	90 mV	140 mV	
	Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load	Overshoot	Vo=1.2 V	-	90 mV	140 mV	
	Settling Time		-	50 uS	100 uS	
50% ~ 100% Max Load	Overshoot	Vo=1.0 V	-	80 mV	130 mV	
	Settling Time		-	50 uS	100 uS	
100% ~ 50% Max Load	Overshoot	Vo=1.0 V	-	80 mV	130 mV	
	Settling Time		-	50 uS	100 uS	

**Note:** All specifications are typical at full load, 25 °C unless otherwise stated.

# NON-ISOLATED DC/DC CONVERTERS

4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



## General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				
Vo=2.5 V	90%	93%	-	Vin=5 V, full load.
Vo=1.8 V	88%	91%	-	
Vo=1.5 V	86%	89%	-	
Vo=1.2 V	85%	88%	-	
Vo=1.0 V	82%	85%	-	
Switching Frequency	480 kHz	600 kHz	720 kHz	
Over Voltage Protection (Latch)	108.5%	115%	120%	
Output Voltage Trim Range	0.9 V	-	2.75 V	Vo=1.2 V when trim pin is open.
Remote Sense Compensation <sup>1</sup>	-	-	10%	
MTBF	3,078,055 hours			Calculated Per Bell Core SR-332 (Vin=5 V; Io = 24 A, Vo=1.2 V; Ta = 25 °C)
Dimensions	Inches millimeters	1.22 x 0.67 x 0.345 31.0 x 17.0 x 8.75		Body outline
Weight	-	11 g	-	

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

- The OVP latch can be reset by cycling the input supply voltage or remote on/off.

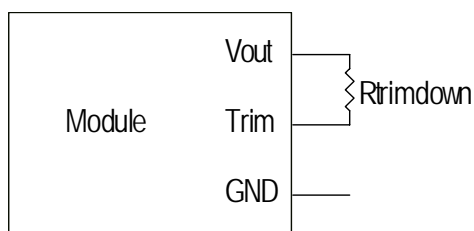
## Control Specifications

Parameter	Min	Typ	Max	Notes	
<b>Remote On/Off</b>					
Signal Low (Unit Off)	Vin=4.5 V	-0.3 V	-	Remote on/off pin open, unit on.	
Signal High (Unit On)		3.15 V	-		5.5 V
Signal Low (Unit Off)	Vin=5.5 V	-0.3 V	-		1.65 V
Signal High (Unit On)		3.85 V	-		5.5 V

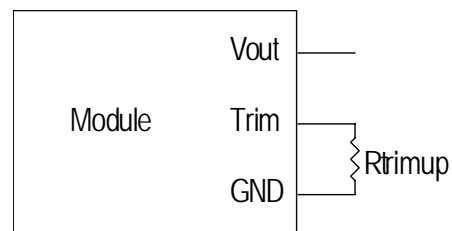
## Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (Vadj) 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.

$$R_{TrimDown} = \frac{0.774}{V_o - V_{adj}} - 2.075$$



$$R_{TrimUp} = \frac{1.533}{V_{adj} - V_o} - 0.158$$



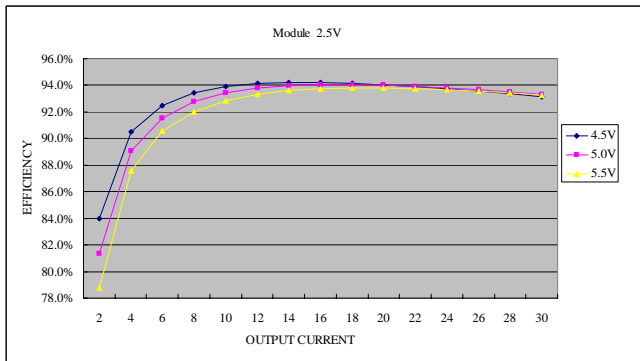
**Note:** Vo is the nominal output voltage set point when trim pin is open, Vo=1.204 V.

# NON-ISOLATED DC/DC CONVERTERS

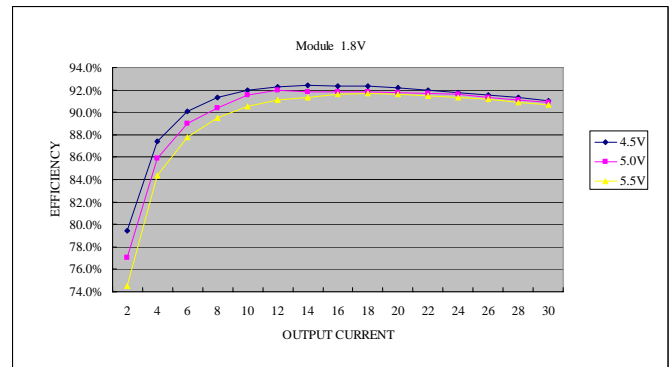
4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



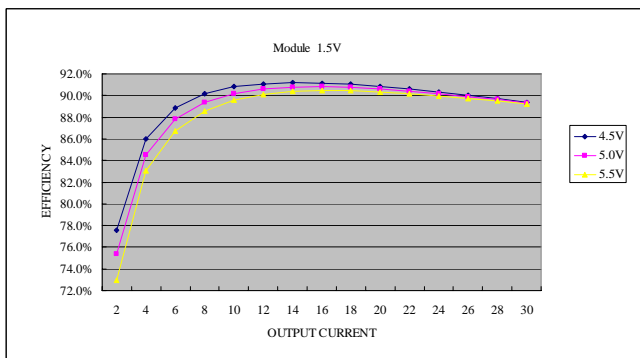
## Efficiency Data



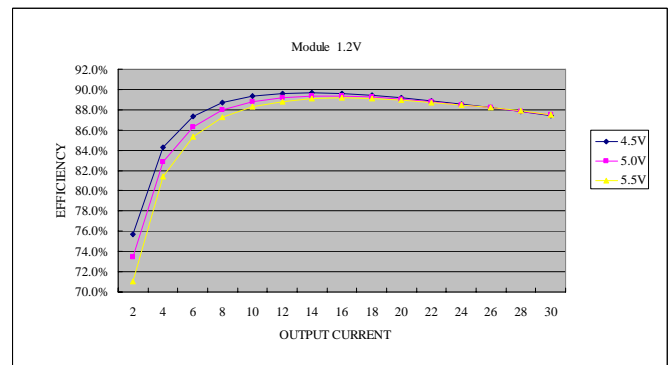
Vo=2.5 V



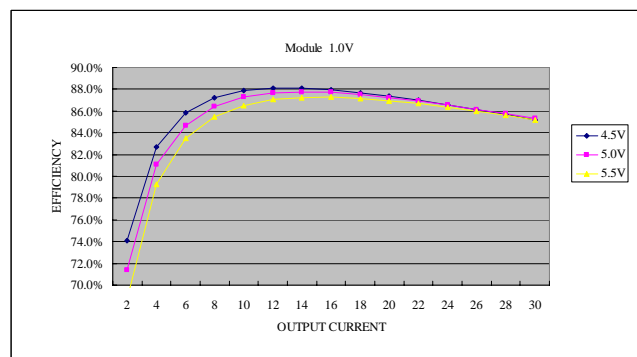
Vo=1.8 V



Vo=1.5 V



Vo=1.2 V



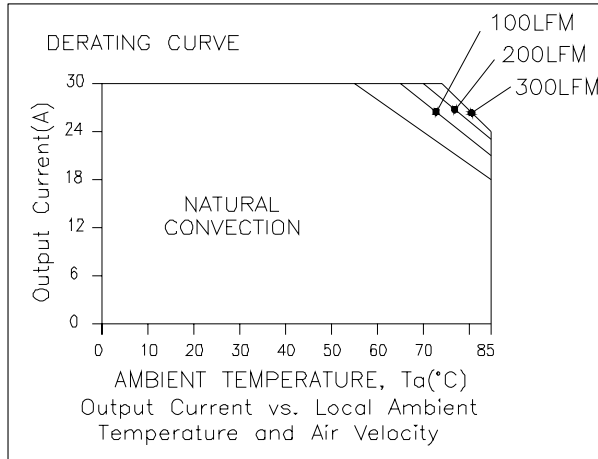
Vo=1.0 V

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4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output

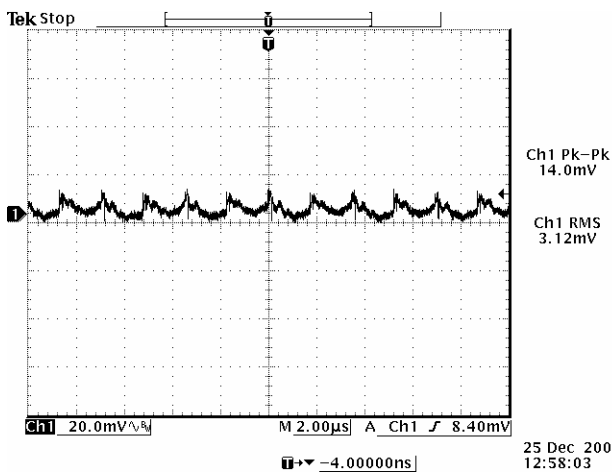


## Thermal Derating Curve

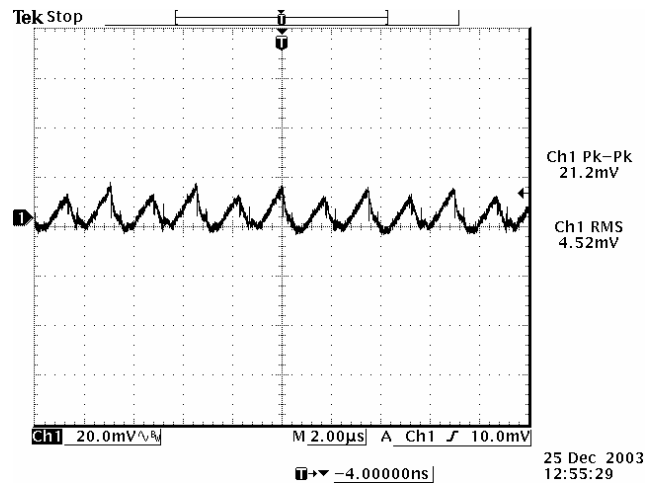


**Note:** Derating curve is for 2.5 V output and tested at nominal input voltage.

## Ripple and Noise Waveforms



$V_o=2.5\text{ V}$



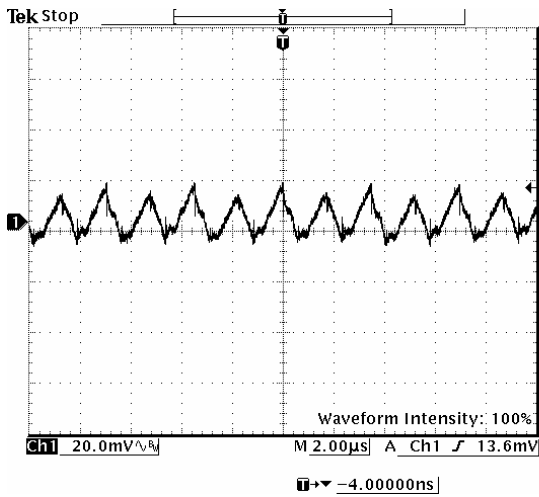
$V_o=1.8\text{ V}$

# NON-ISOLATED DC/DC CONVERTERS

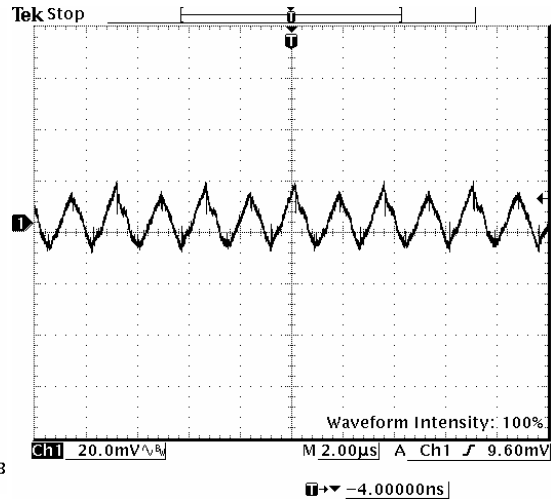
4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



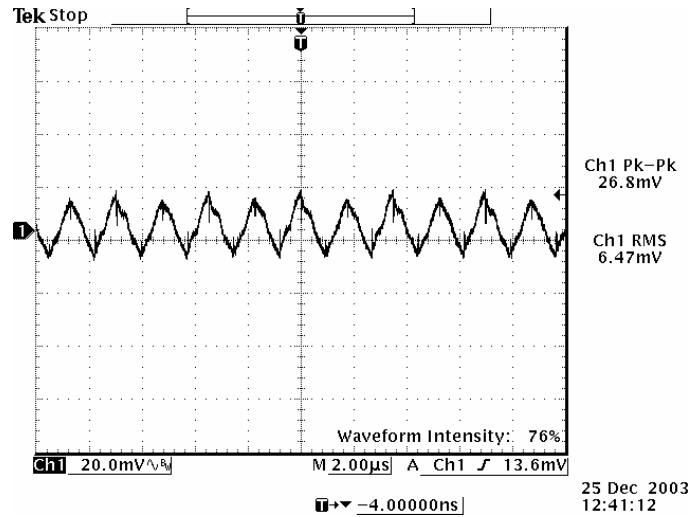
## Ripple and Noise Waveforms (continued)



$V_o=1.5\text{ V}$



$V_o=1.2\text{ V}$



$V_o=1.0\text{ V}$

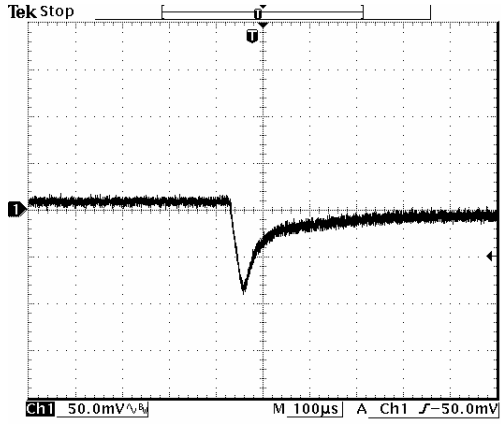
**Note:** Ripple and Noise at full load,  $V_{in}=5\text{ V}$ ,  $I_o=30\text{ A}$ ,  $T_a=25^\circ\text{C}$  with external 680  $\mu\text{F}$  tantalum capacitor.

# NON-ISOLATED DC/DC CONVERTERS

4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



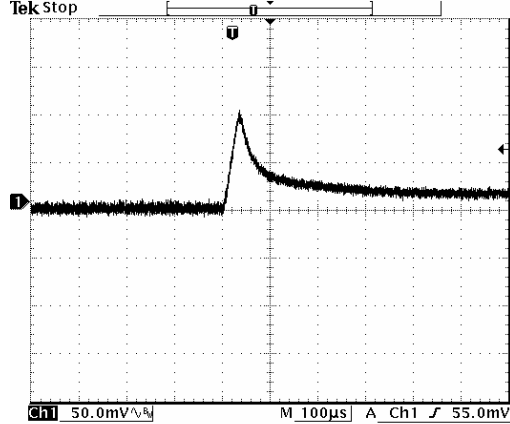
## Transient Response Waveforms



Ch1 Min  
-91.0mV

25 Dec 2003  
13:00:11

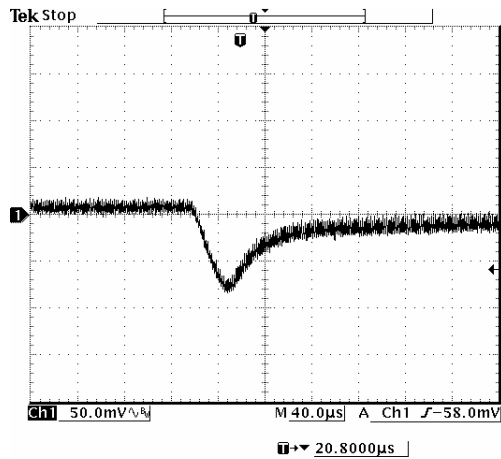
Transients 50% to 100% load 2.5 V Output



Ch1 Max  
96.0mV

25 Dec 2003  
12:58:58

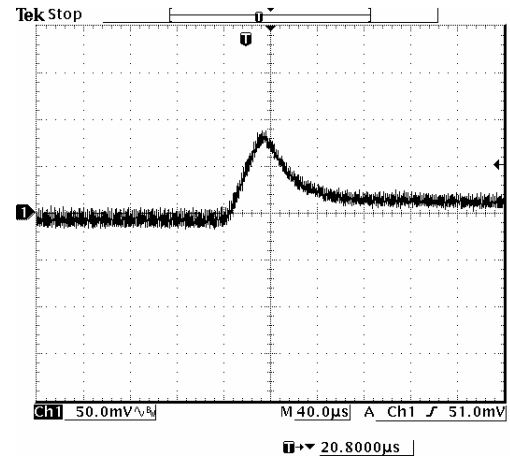
Transients 100% to 50% load 2.5 V Output



Ch1 Min  
-83.0mV

25 Dec 2003  
12:56:25

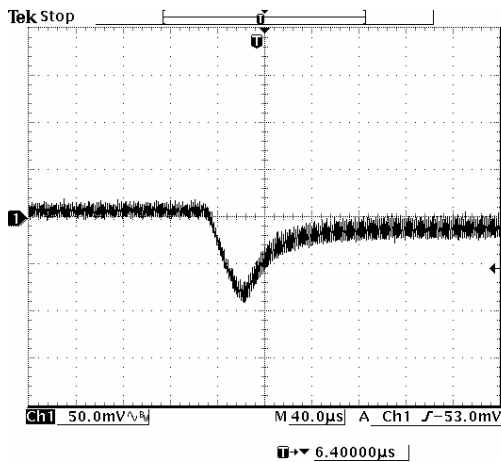
Transients 50% to 100% load 1.8 V Output



Ch1 Max  
87.0mV

25 Dec 2003  
12:55:54

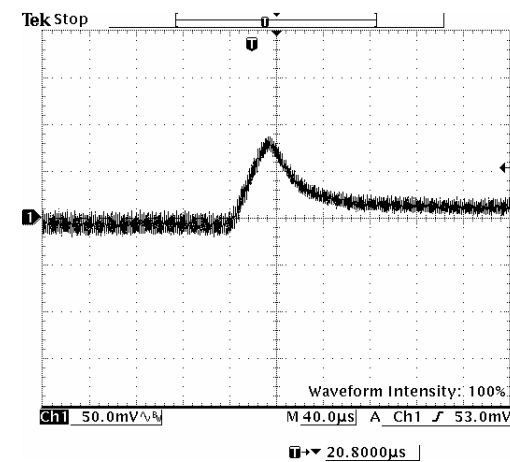
Transients 100% to 50% load 1.8 V Output



Ch1 Min  
-89.0mV

25 Dec 2003  
12:54:17

Transients 50% to 100% load 1.5 V Output



Ch1 Max  
86.0mV

25 Dec 2003  
12:53:43

Transients 100% to 50% load 1.5 V Output

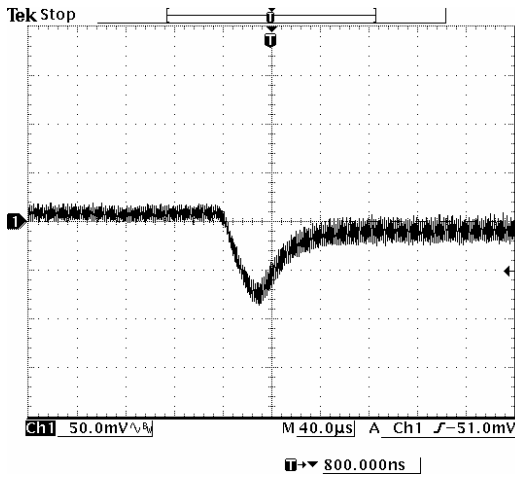


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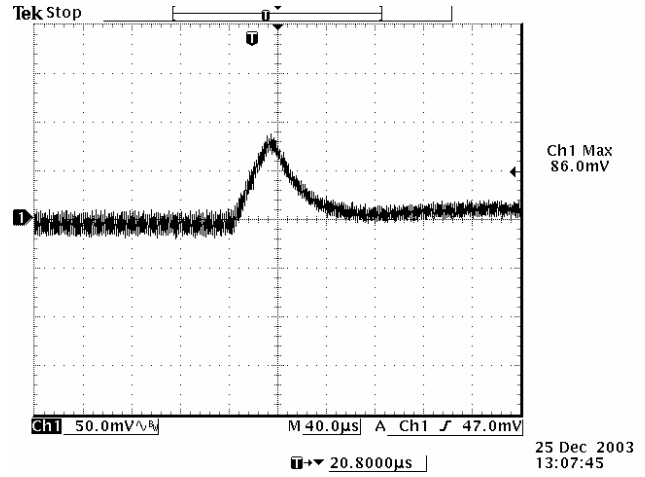
4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



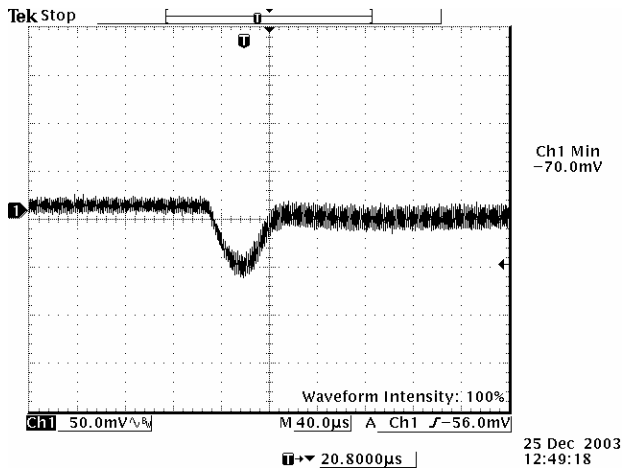
## Transient Response Waveforms (continued)



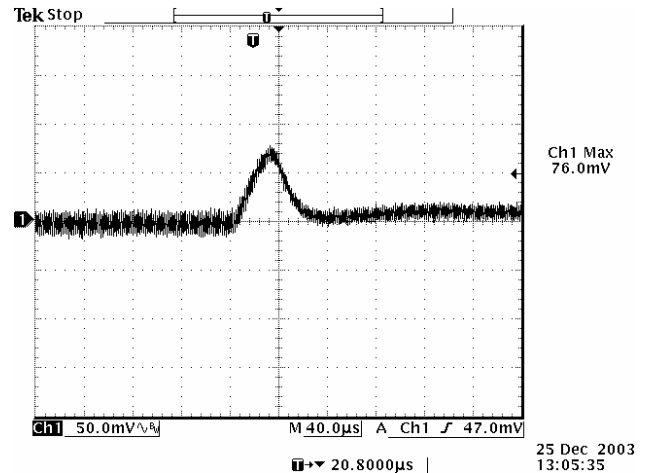
Transients 50% to 100% load 1.2 V Output



Transients 100% to 50% load 1.2 V Output



Transients 50% to 100% load 1.0 V Output



Transients 100% to 50% load 1.0 V Output

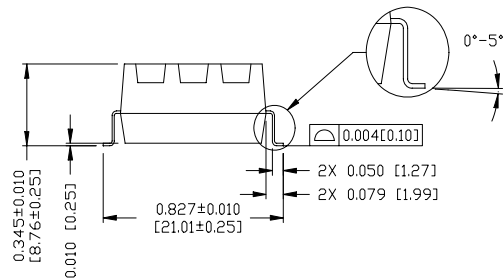
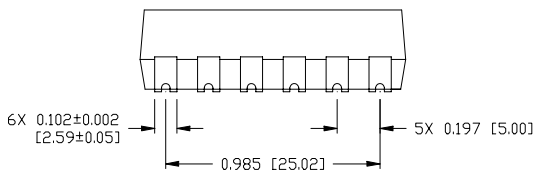
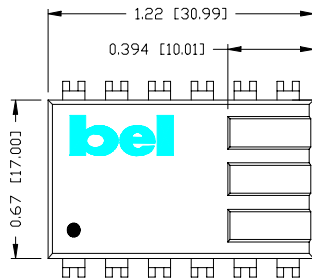
**Note:**  $V_{in}=5\text{ V}$ ,  $T_a=25^\circ\text{C}$ , with external 680  $\mu\text{F}$  tantalum capacitor.

# NON-ISOLATED DC/DC CONVERTERS

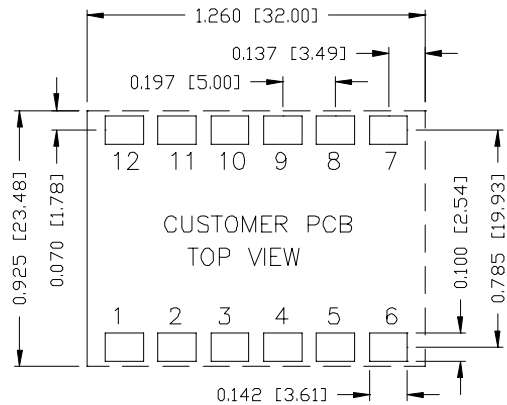
4.5 V - 5.5 V Input    0.9 V - 2.75 V/30 A Output



## Mechanical Outline

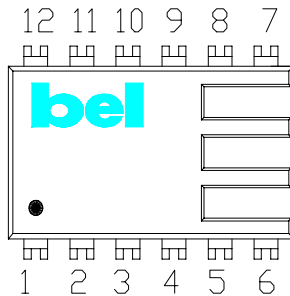


### RECOMMENDED PAD LAYOUT



DON'T PLACE OTHER COMPONENTS IN THIS DASHED AREA

### Pin Connections



Pin	Function
1	+Vo
2	+Vo
3	Ground
4	Ground
5	Ground
6	+Vin
7	+Vin
8	Ground
9	Ground
10	Remote On/Off
11	Trim
12	Remote Sense (+)

**Note:** Though there are 5 GND pins (3,4,5,8,9), it is highly recommended that all of them should be used in the system application, because of the current and the thermal conduction.

### RoHS Compliance

Complies with the European Directive 2002/95/EC, calling for the elimination of lead and other hazardous substances from electronic products. 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 240°C.



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