

## NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output

**bel**  
POWER PRODUCTS

VRP4-80A1Ax

RoHS Compliant

Rev.B

- Non-Isolated
- High Efficiency
- Fixed Switching Frequency
- Low Cost
- Excellent Thermal Performance
- Output Voltage Trim
- Current Share
- Output Over-Voltage Shutdown
- OCP/SCP
- Low Output Ripple
- Power Good Signal
- Remote On/Off
- Over Temperature Protection

### Description

The VRP4-80A1Ax is a non-isolated dc/dc converter that operates from a nominal 12 Vdc source. This unit can provide a precisely regulated output voltage from 0.6 Vdc to 5.0 Vdc and can deliver up to 80 A of output current. This unit is designed to be highly efficient and low cost. The converter is provided in an industry standard package.

### Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency (Vo=3.3 Vdc)	Model Number Active High	Model Number Active High
0.6 V - 5.0 V	10.8 V - 13.2 V	80 A	400 W	93%	VRP4-80A1A0	VRP4-80A1AB <sup>1</sup>

**Notes:** 1. VRP4-80A1A0 and VRP4-80A1AB are with different heatsink.

2. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.

3. Add "G" suffix at the end of the model numbers listed above to indicate "Tray Packaging".

### Absolute Maximum Ratings

Parameter	Min	Typ	Max	Notes
Input Voltage (continuous)	-0.3 V	-	15 V	
Output Enable Terminal Voltage	-0.3 V	-	15 V	
Ambient Temperature	0 °C	-	70 °C	
Storage Temperature	-55 °C	-	125 °C	

### Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	10.8 V	12 V	13.2 V	
Input Current (full load)	-	-	40 A	
Input Reflected Ripple Current (pk-pk)	-	20	35	With simulated source impedance of 1 uH, 5 Hz to 20 MHz. Use a 1000 uF/16 V electrolytic capacitor with ESR=0.1 ohm max, at 100 kHz at 25°C.
Input Reflected Ripple Current (rms)	-	5	10	
I <sup>2</sup> t Inrush Current Transient	-	-	1 A <sup>2</sup> s	
Turn-on Voltage Threshold	-	10.2 V	10.6 V	
Under Voltage Threshold	-	9.5 V	10 V	

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

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## Output Specifications

Parameter	Min	Typ	Max	Notes	
Output Voltage Set Point Vo ≥ 1 V Vo < 1 V	-1.5 % Vo -10 mV	- -	+1.5 % Vo +10 mV	Vin=Vinmin, Io=Iomax	
Load Regulation Vo ≥ 2.5 V Vo < 2.5 V	- -	- -	0.6% Vo 12 mV		
Line Regulation Vo ≥ 2.5 V Vo < 2.5 V	- -	- -	0.3% Vo 9 mV		
Regulation Over Temperature (0 °C to +70 °C)	-	-	0.02% Vo/C		
Output Current	0 A	-	80 A		
Current Limit Threshold	90 A	110 A	150 A		
Output Ripple and Noise (pk-pk) Vo=5.0 V Vo=3.3 V Vo=2.5 V Vo=1.5 V Vo=1.0 V Vo=0.6 V	- - - - - -	- - - - - -	80 mV 80 mV 60 mV 60 mV 50 mV 50 mV	Test conditions: 0-20 MHz BW, with a 1 µF ceramic capacitor and a 10 µF Tantalum cap at output.	
Output Ripple and Noise (rms) Vo=5.0 V Vo=3.3 V Vo=2.5 V Vo=1.5 V Vo=1.0 V Vo=0.6 V	- - - - - -	- - - - - -	40 mV 40 mV 30 mV 30 mV 25 mV 25 mV		
Turn On Time	-	-	10 mS		
Rise Time	-	-	3 mS		
Overshoot at Turn on and off	-	-	0.5%		
Output Capacitance ESR ≥ 1 mΩ	0 µF	-	4700 µF		
<b>Transient Response</b>					
50% ~ 100% Max Load	Vo=All	-	-	300 mV	Test conditions: di/dt = 2.5 A/µS; Vin =12 V; Ta=25°C, Co=4700 µF.
Settling Time		-	-	100 µS	
100% ~ 50% Max Load		-	-	300 mV	
Settling Time		-	-	100 µS	

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# NON-ISOLATED DC/DC CONVERTERS

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## General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at Vin=12 V, full load.
Vo=5.0 V	91%	95%	-	
Vo=3.3 V	89%	93%	-	
Vo=2.5 V	88%	92%	-	
Vo=1.8 V	86%	90%	-	
Vo=1.5 V	85%	89%	-	
Vo=1.2 V	81%	86%	-	
Vo=1.0 V	79%	83%	-	
Vo=0.6 V	70%	75%	-	
Switching Frequency	-	250 kHz	-	
Output Voltage Trim Range	0.6 V	-	5 V	Trim pin is open, Vo = 0.6 V.
Over Voltage Protection	110% Vo,set	115%Vo,set	130%Vo,set	Vin=12 V, Io=full load.
Over Temperature Protection	-	105 °C	-	The temperature of heatsink.
MTBF	TBD			Calculated Per Bell Core SR-332 (Io = 80%Iomax; Vin=12 V; Ta = 25 °C)
Dimensions				VRP4-80A1A0
Inches (L x W x H)	2.58 x 1.25 x 0.763			
Millimeters (L x W x H)	65.53 x 31.75 x 19.38			
Dimensions				VRP4-80A1AB
Inches (L x W x H)	2.58 x 1.25 x 0.608			
Millimeters (L x W x H)	65.53 x 31.75 x 15.44			
Weight	-	TBD	-	

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

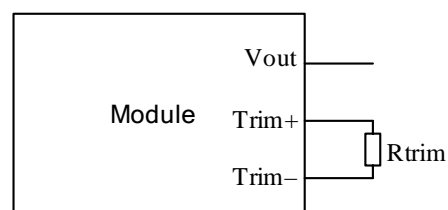
## Control Specifications

Parameter	Min	Typ	Max	Notes
<b>Remote On/Off (Active High)</b>				
Signal Low (Unit Off)	-0.3 V	-	0.8 V	Remote On/Off pin is open, unit is off.
Signal High (Unit On)	2 V	-	Vin,max	
Current Source/Sink	0 mA	-	3.3 mA	
<b>PwGood (PowerGood)</b>				
PwGood = High = Power Good	2.4 V	-	5.25 V	
	-	-	2 mA	
PwGood = Low = Power Not Good	0 V	-	0.4 V	
	-	-	4 mA	

## Output Trim Equation

The Trim resistor should be connected between the Trim+ pin and Trim- pin.

$$R_{trim} = \frac{1.2}{V_o - 0.6} (K\Omega)$$

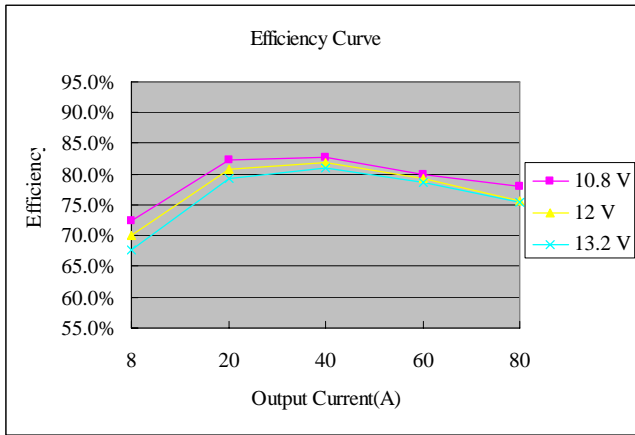


# NON-ISOLATED DC/DC CONVERTERS

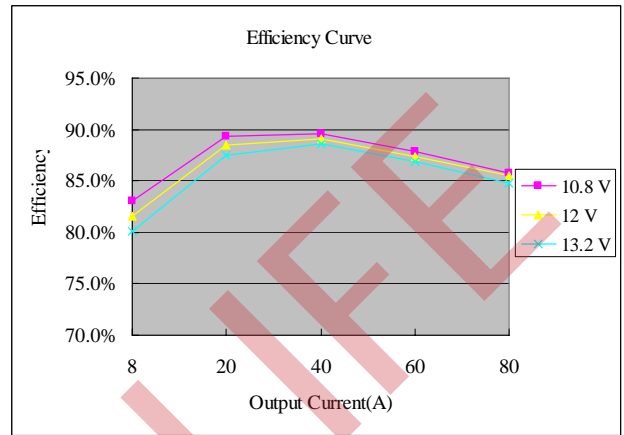
10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



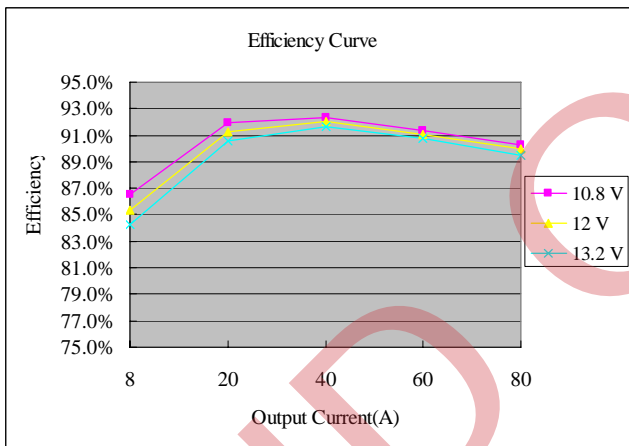
## Efficiency Data



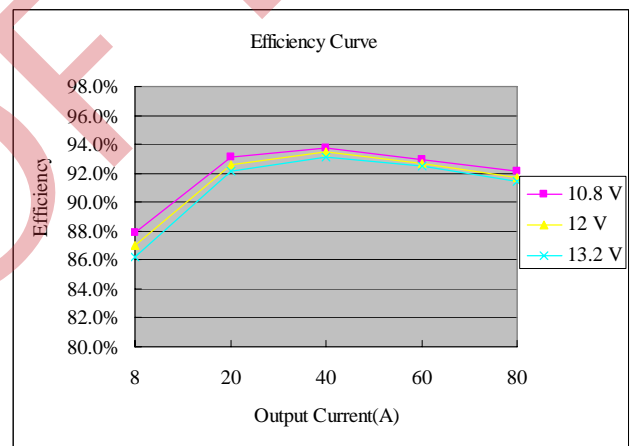
Vo=0.6 V



Vo=1.2 V



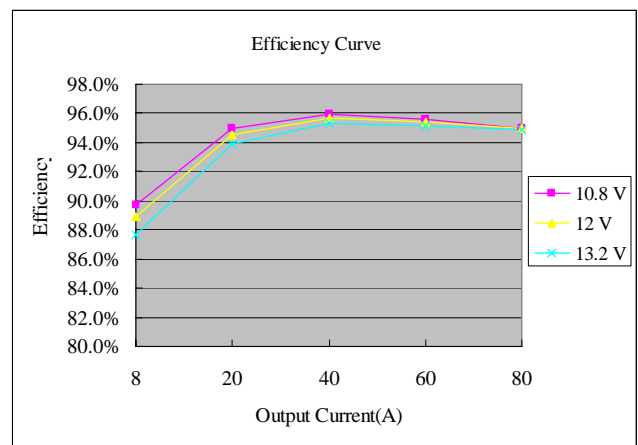
Vo=1.8 V



Vo=2.5 V



Vo=3.3 V



Vo=5.0 V

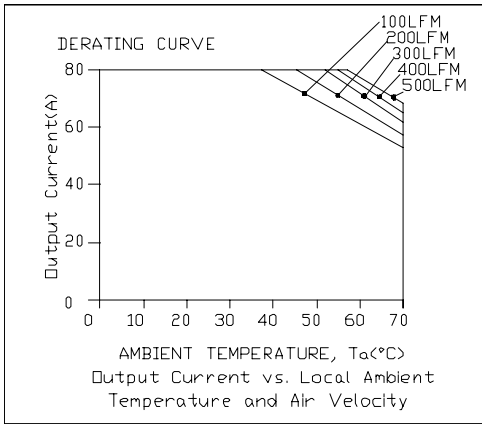
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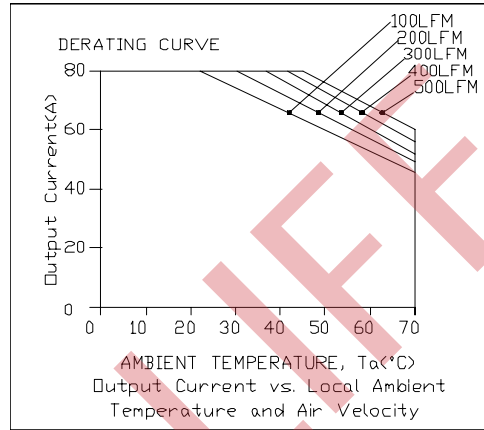
## Thermal Derating Curves

VRP4-80A1A0

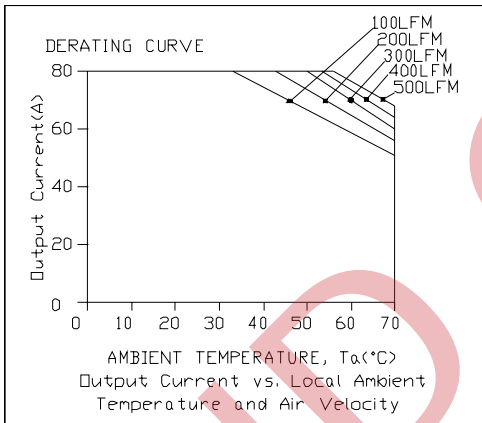


Vo=1.2 V

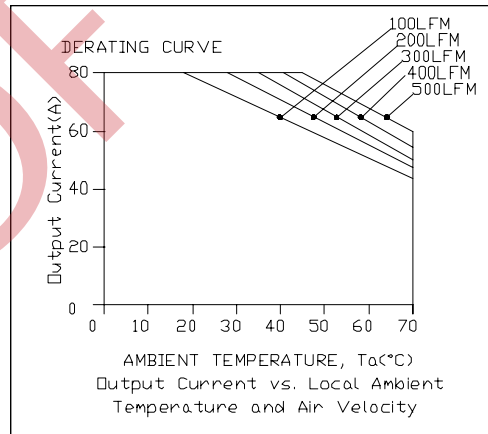
VRP4-80A1AB



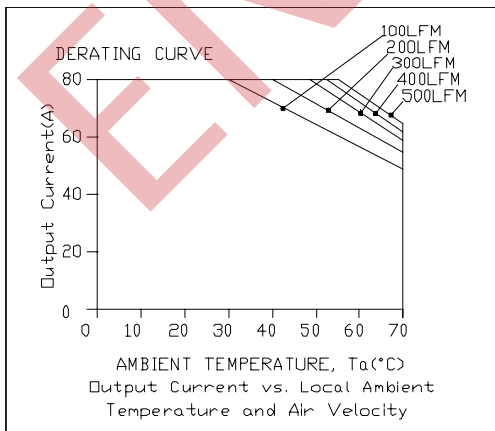
Vo=1.2 V



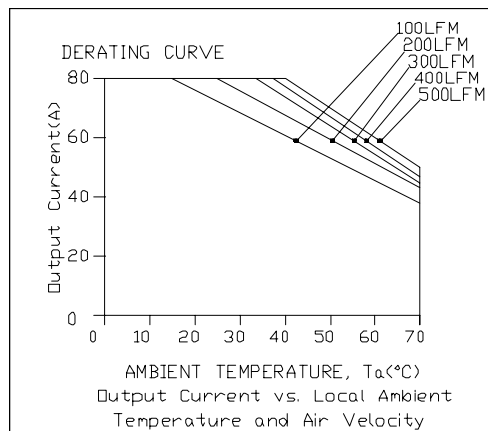
Vo=3.3 V



Vo=3.3 V



Vo=5.0 V



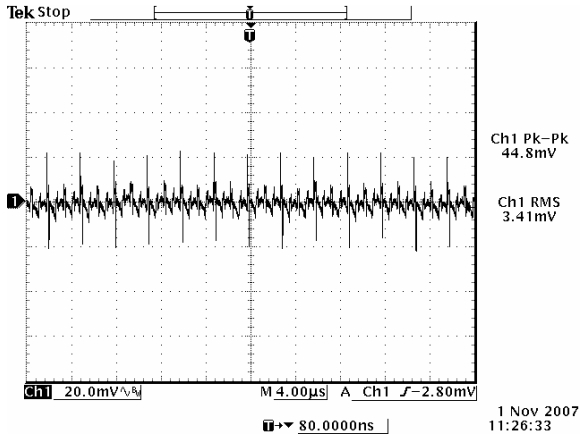
Vo=5.0 V

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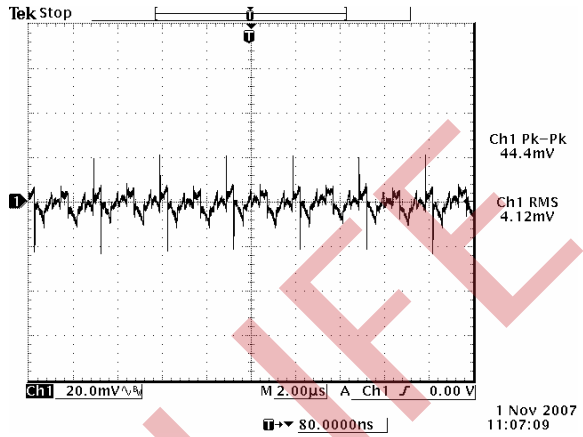
10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



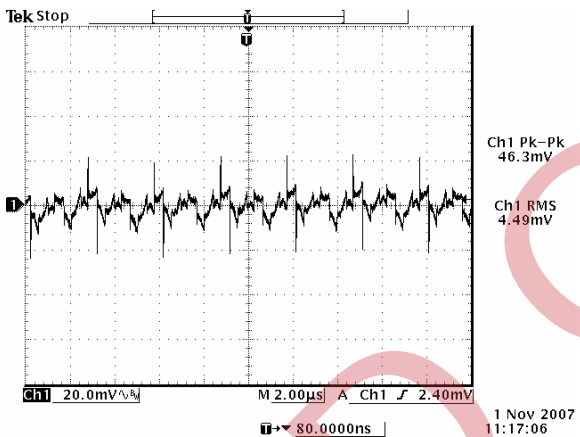
## Ripple and Noise Waveforms



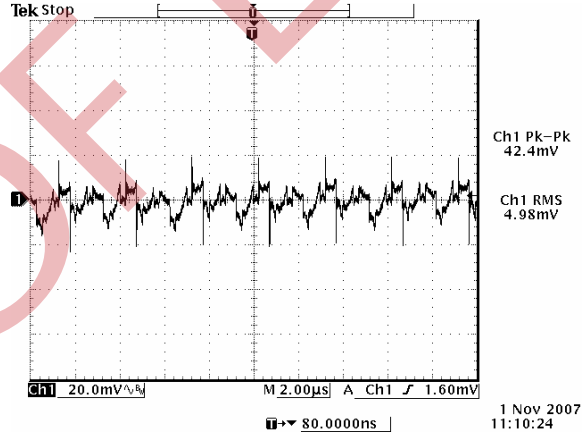
12 Vdc input, 0.6 Vdc/80 A output



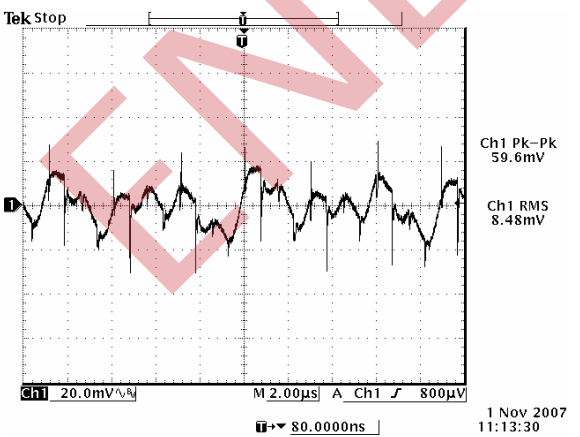
12 Vdc input, 1.2 Vdc/80 A output



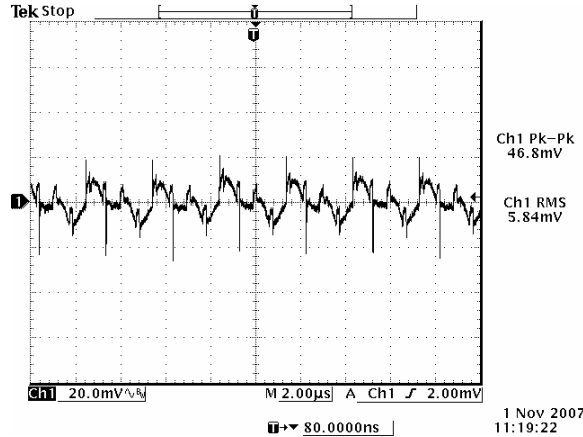
12 Vdc input, 1.5 Vdc/80 A output



12 Vdc input, 1.8 Vdc/80 A output



12 Vdc input, 2.5 Vdc/80 A output



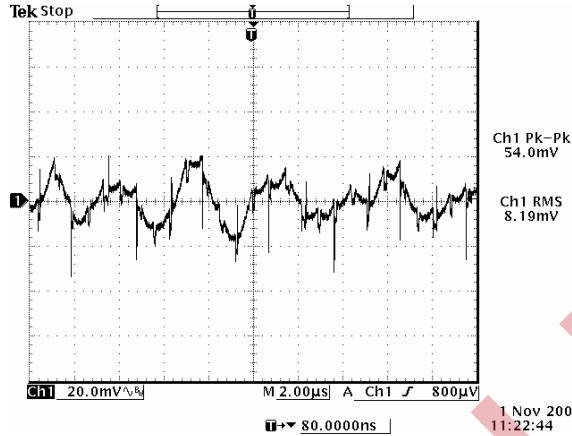
12 Vdc input, 3.3 Vdc/80 A output

# NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



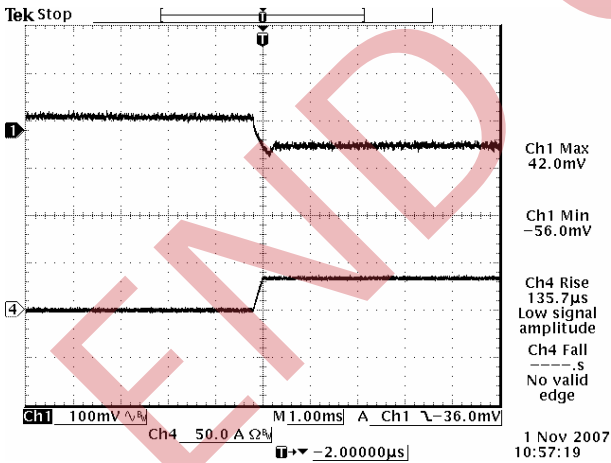
## Ripple and Noise Waveforms (continued)



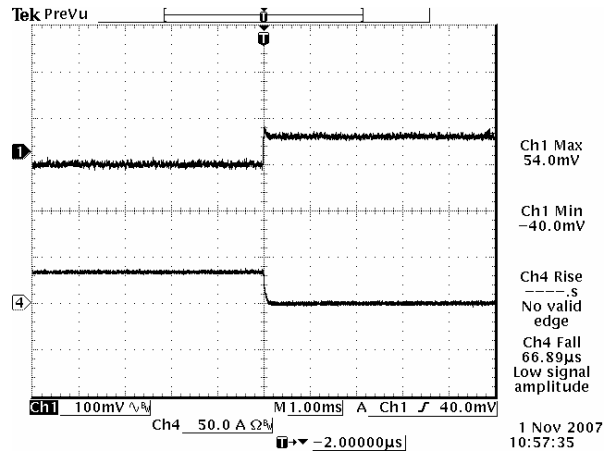
12 Vdc input, 5.0 Vdc/80 A output

**Note:** Ripple and noise at full load, 0-20 MHz BW, with a 10 µF tantalum cap and a 1µF ceramic cap at the output, and Ta=25 deg C.

## Transient Response Waveforms



Vout= 0.6 V 0%-50% Load Transients



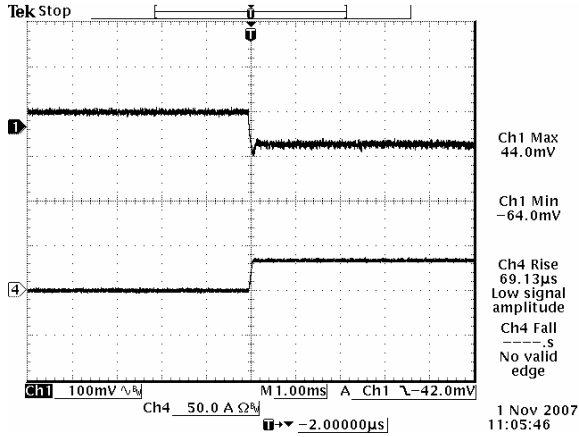
Vout=0.6 V 50%-0% Load Transients

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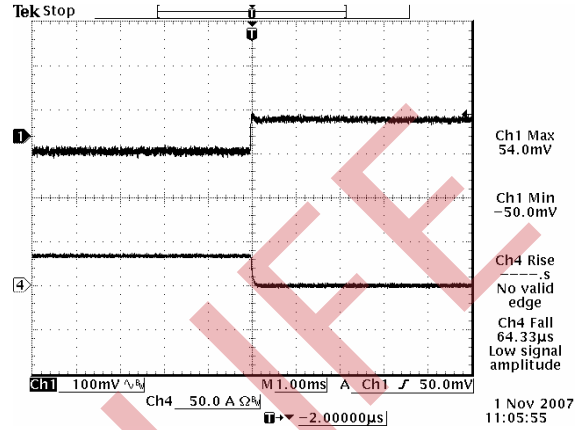
10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



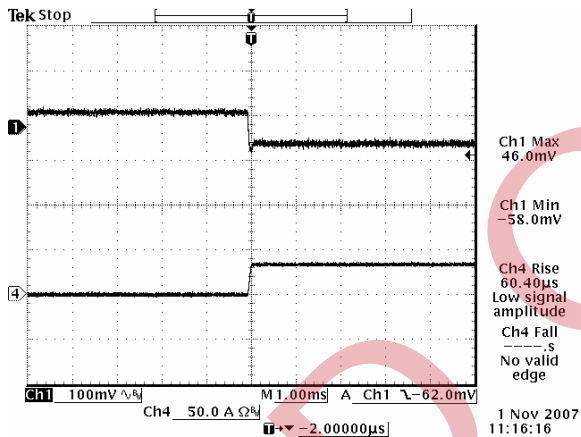
## Transient Response Waveforms (continued)



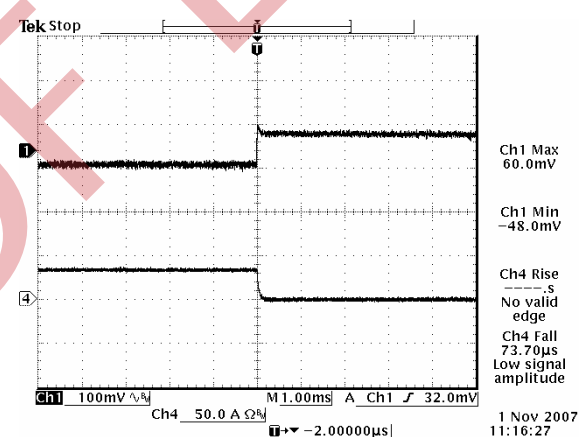
Vout=1.2 V 0%-50% Load Transients



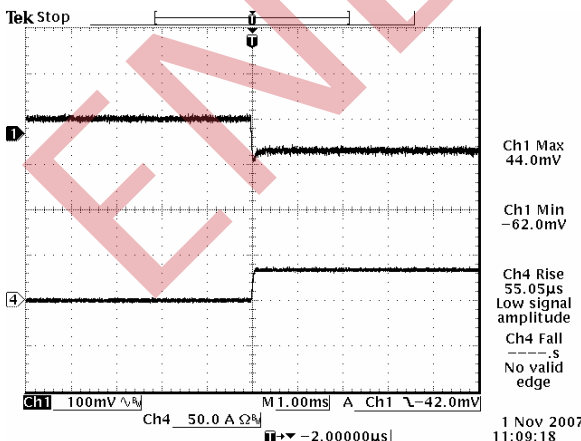
Vout=1.2 V 50%-0% Load Transients



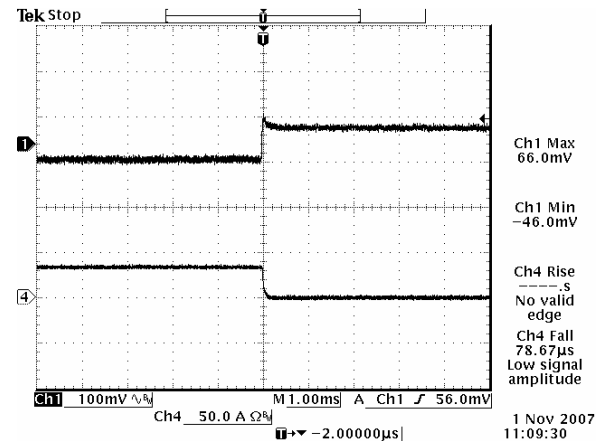
Vout=1.5 V 0%-50% Load Transients



Vout=1.5 V 50%-0% Load Transients



Vout= 1.8 V 0%-50% Load Transients



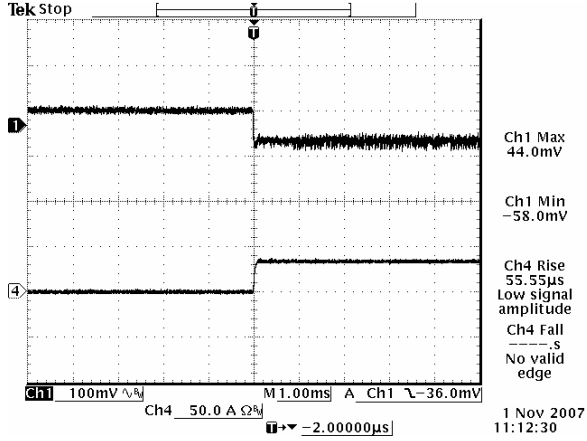
Vout=1.8 V 50%-0% Load Transients



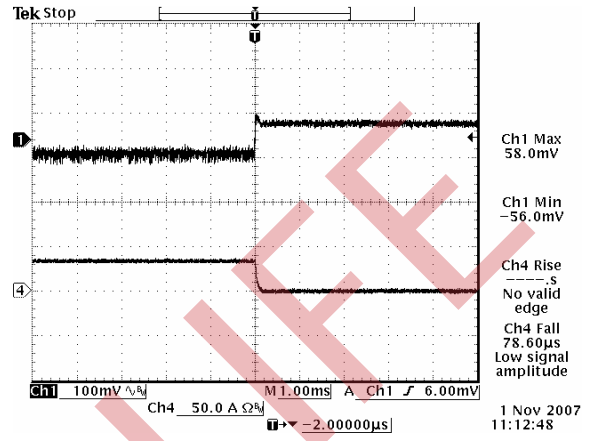
**NON-ISOLATED DC/DC CONVERTERS**  
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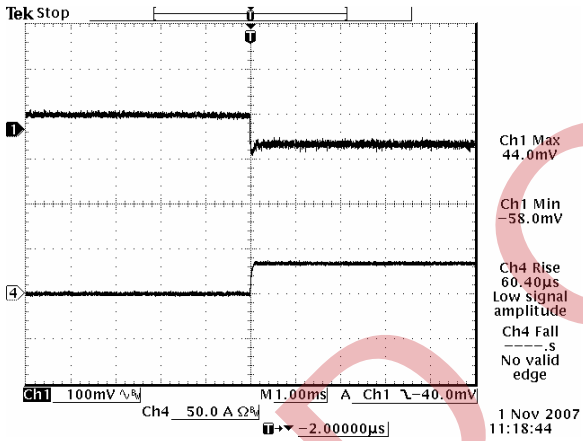
**Transient Response Waveforms (continued)**



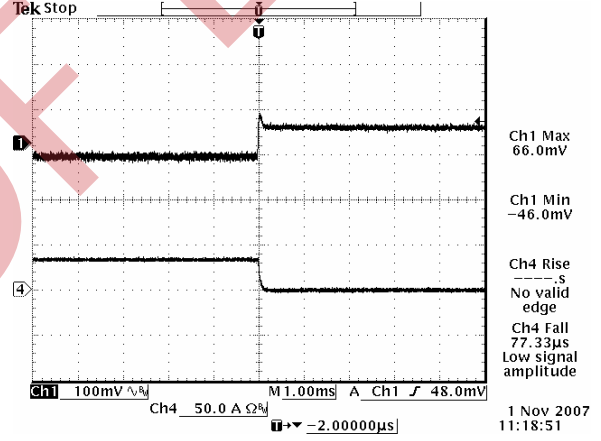
Vout=2.5 V 0%-50% Load Transients



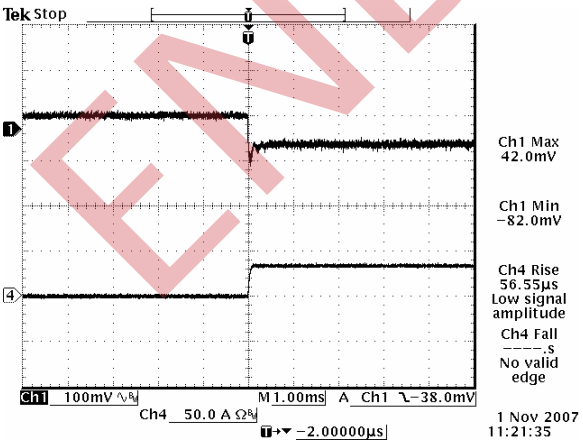
Vout=2.5 V 50%-0% Load Transients



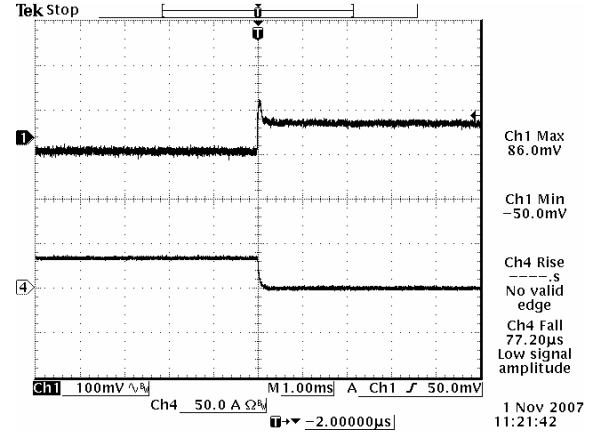
Vout=3.3 V 0%-50% Load Transients



Vout=3.3 V 50%-0% Load Transients



Vout=5 V 0%-50% Load Transients



Vout=5 V 50%-0% Load Transients

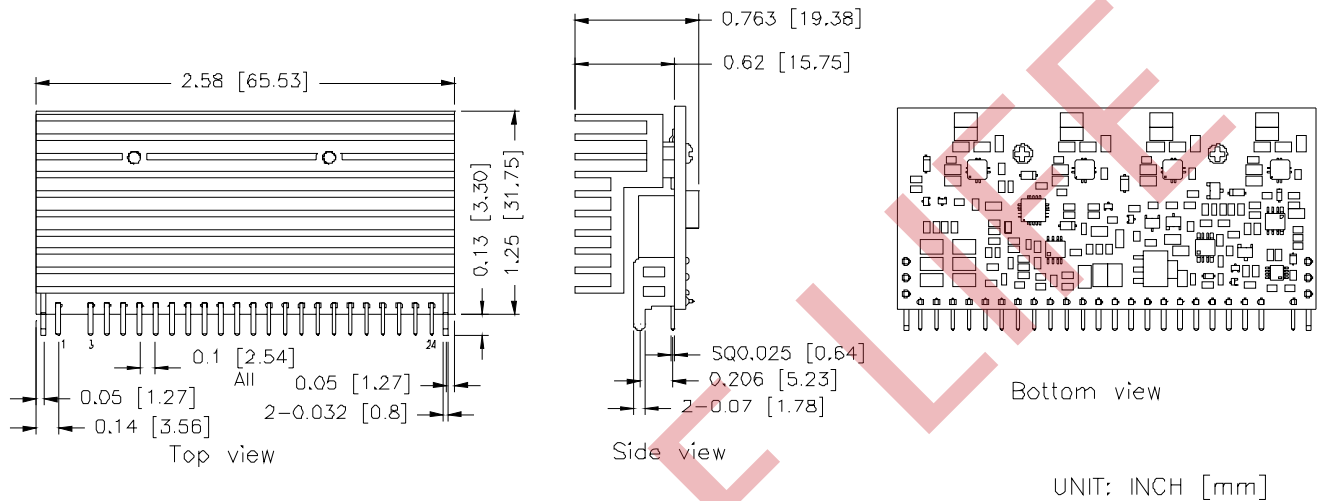
**Note:** Transient response at di/dt = 2.5 A/uS, with external electrolytic cap 4700 uF, and Ta=25 deg C.

**NON-ISOLATED DC/DC CONVERTERS**  
 10.8 Vdc - 13.2 Vdc Input    0.6 Vdc - 5.0 Vdc/80 A Output

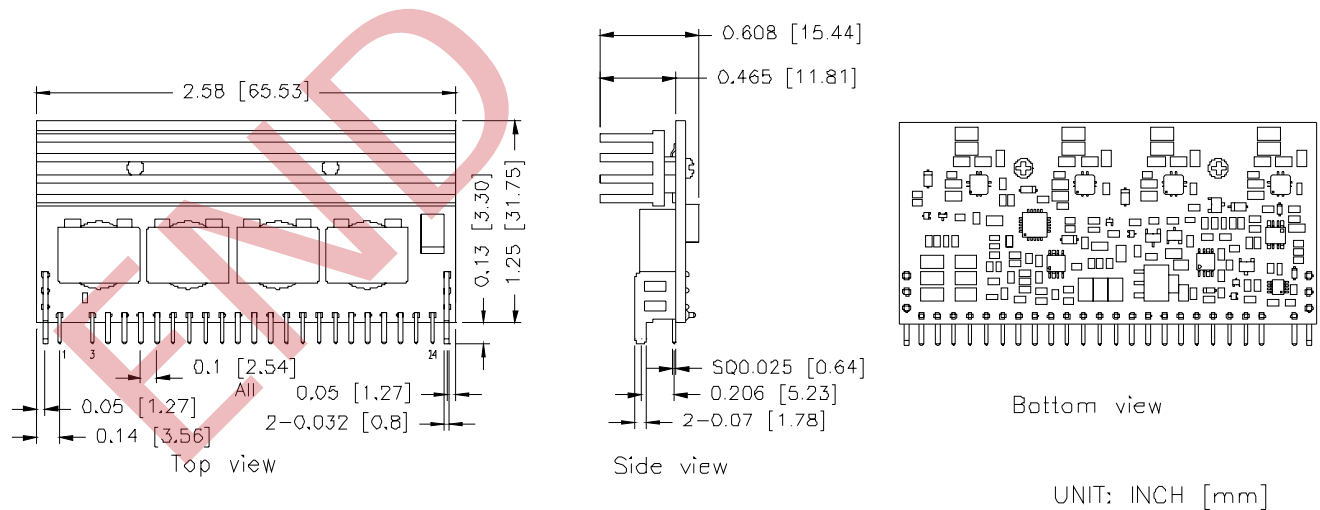


**Mechanical Outline**

**VRP4-80A1A0**



**VRP4-80A1AB**



# NON-ISOLATED DC/DC CONVERTERS

10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



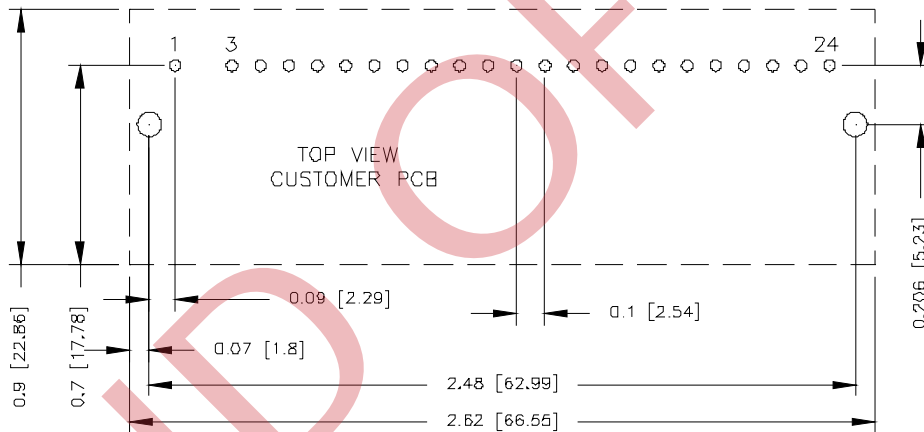
## Mechanical Outline (continued)

### Pin Connections

Pin	Function	Pin	Function	Pin	Function
1	Trim+	9	Enable	17	GND
2	N/A	10	Sense-	18	Vout
3	GND	11	Sense+	19	GND
4	PwGOOD	12	Vin	20	Vout
5	Trim-	13	Vin	21	GND
6	Ishare	14	Vin	22	Vout
7	GND	15	Vout	23	GND
8	GND	16	Vout	24	Vout

**Note:** VRP4-80A1A0 and VRP4-80A1AB are with the same pin function.

### RECOMMENDED PAD LAYOUT



2 SUPPORT PAD THR. HOLES  $\phi 0.085$  [ $\phi 2.2$ ] BOTH SIDE

2.3 PIN PAD THR. HOLES:  $\phi 0.04$  [ $\phi 1.0$ ] BOTH SIDE

### RoHS Compliance

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



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