

NON-ISOLATED DC/DC CONVERTERS

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



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 ¹ |

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 ² t Inrush Current Transient | - | - | 1 A ² 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 | | |
| Transient Response | | | | | |
| 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 | |

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

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.

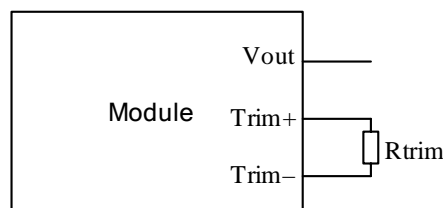
Control Specifications

| Parameter | Min | Typ | Max | Notes |
|------------------------------------|--------|-----|---------|---|
| Remote On/Off (Active High) | | | | |
| 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 | |
| PwGood (PowerGood) | | | | |
| 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.

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

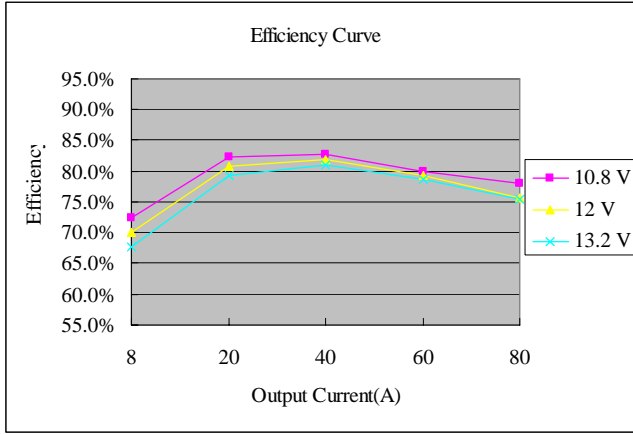


NON-ISOLATED DC/DC CONVERTERS

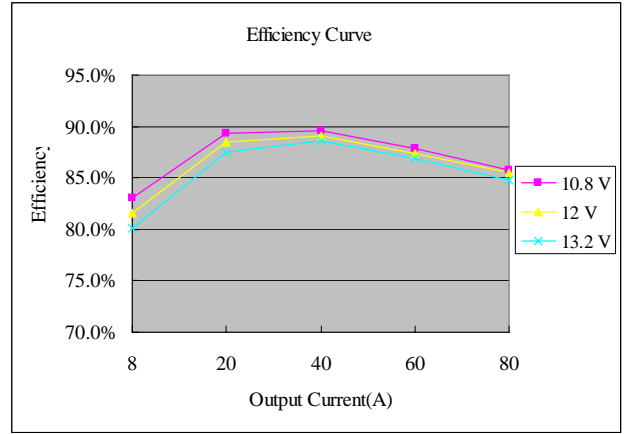
10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



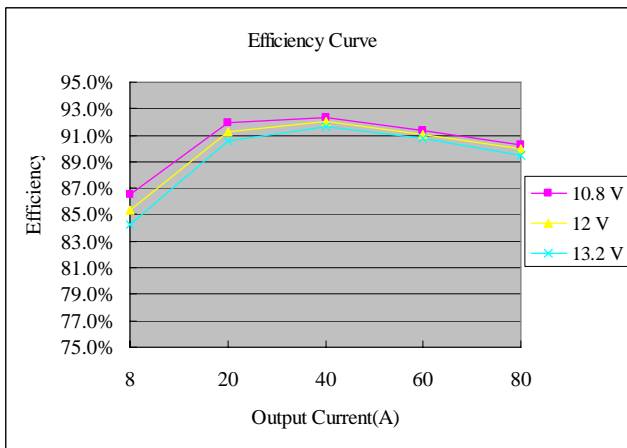
Efficiency Data



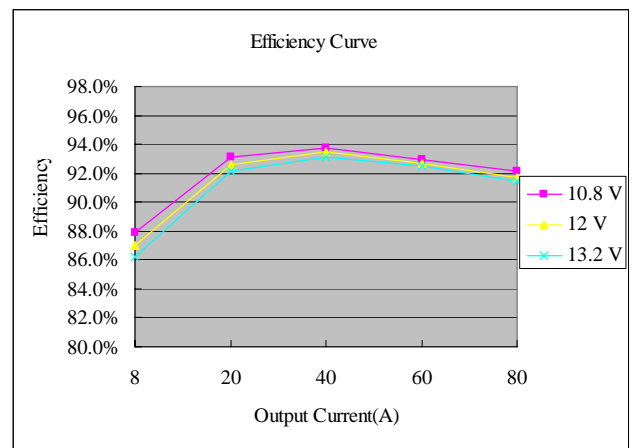
$V_o=0.6\text{ V}$



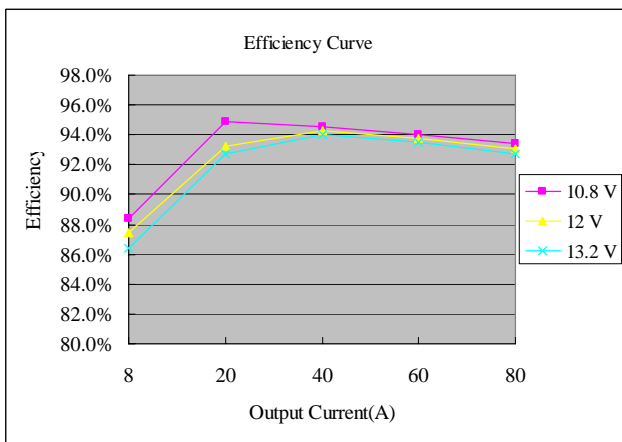
$V_o=1.2\text{ V}$



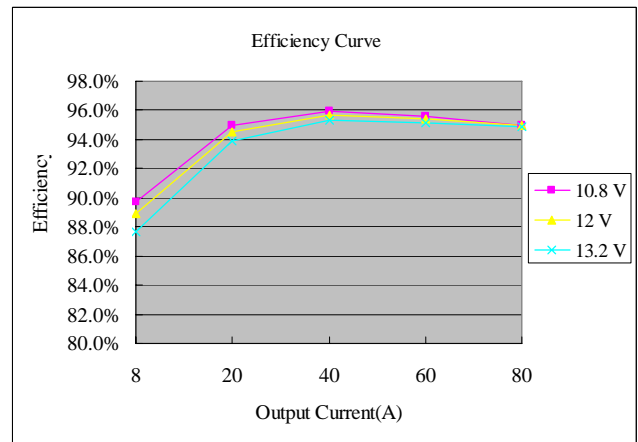
$V_o=1.8\text{ V}$



$V_o=2.5\text{ V}$



$V_o=3.3\text{ V}$



$V_o=5.0\text{ V}$

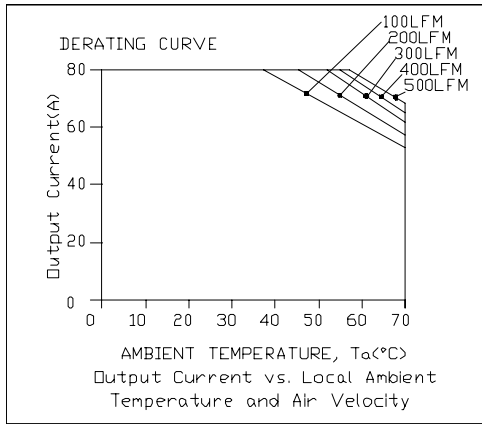
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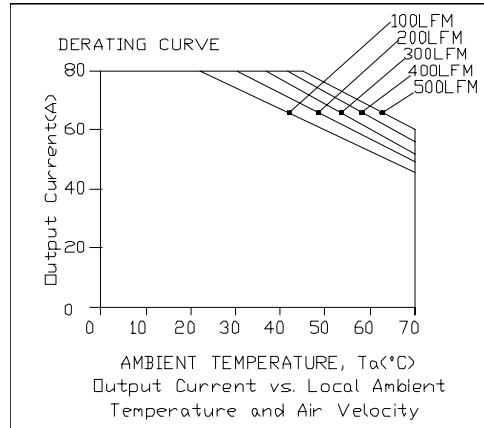
Thermal Derating Curves

VRP4-80A1A0

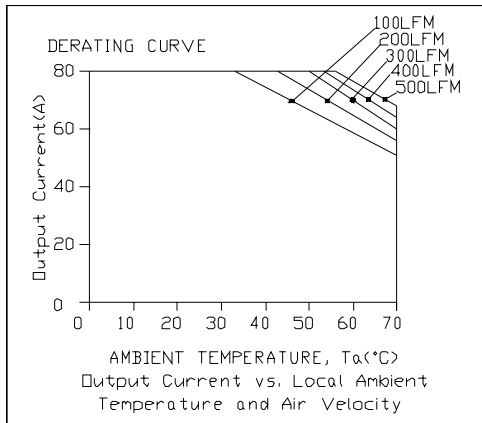


$V_o=1.2\text{ V}$

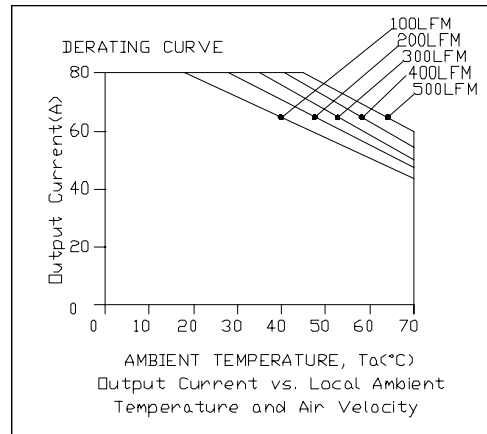
VRP4-80A1AB



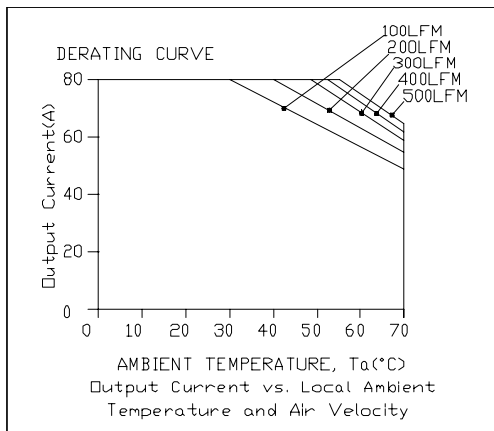
$V_o=1.2\text{ V}$



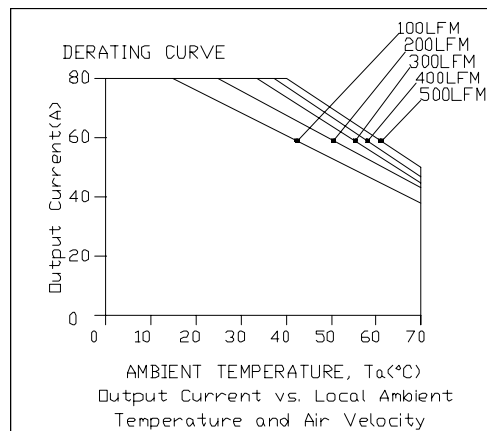
$V_o=3.3\text{ V}$



$V_o=3.3\text{ V}$



$V_o=5.0\text{ V}$



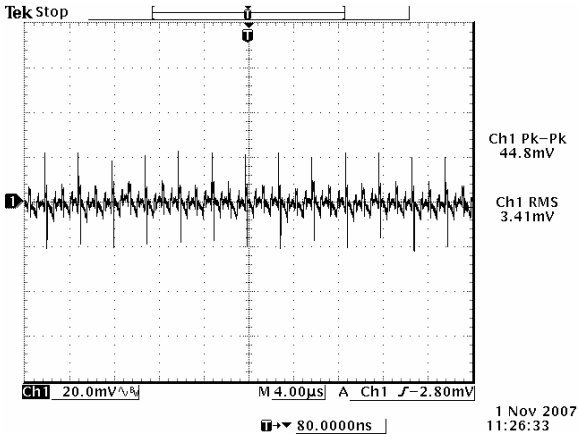
$V_o=5.0\text{ V}$

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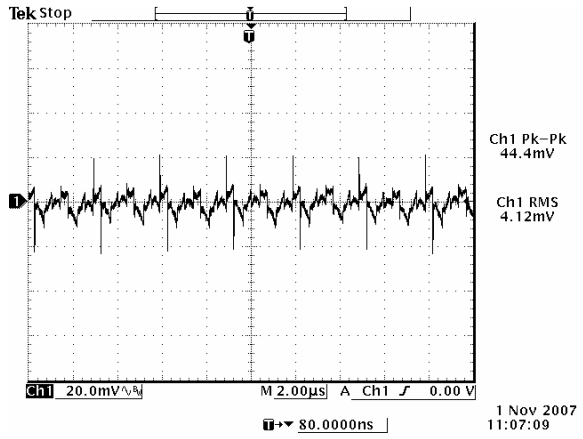
10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



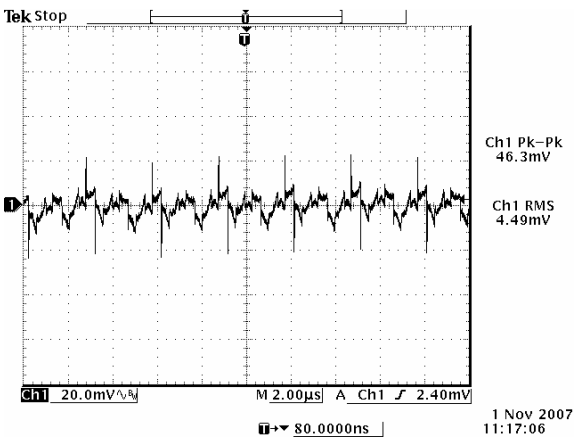
Ripple and Noise Waveforms



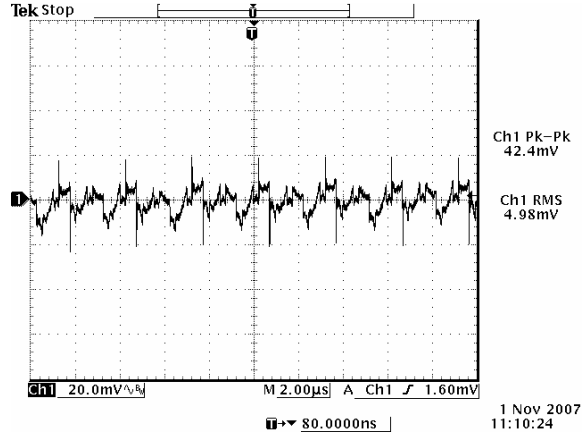
12 Vdc input, 0.6 Vdc/80 A output



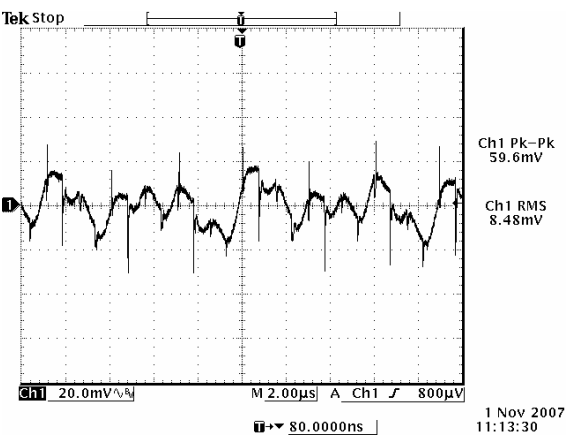
12 Vdc input, 1.2 Vdc/80 A output



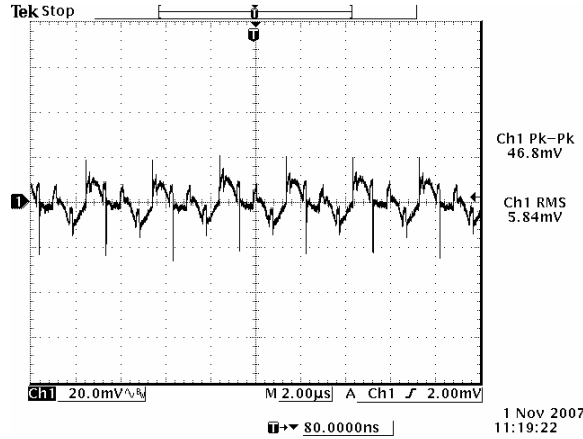
12 Vdc input, 1.5 Vdc/80 A output



12 Vdc input, 1.8 Vdc/80 A output



12 Vdc input, 2.5 Vdc/80 A output



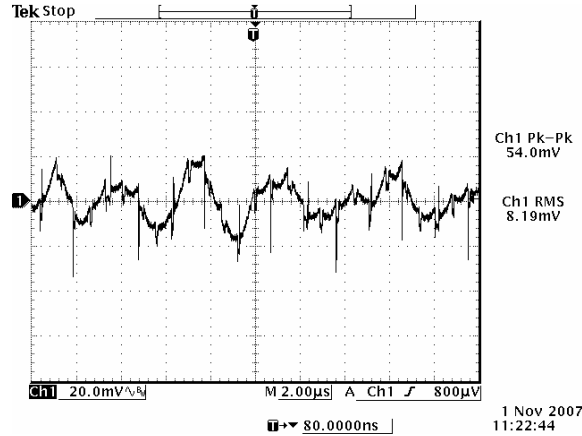
12 Vdc input, 3.3 Vdc/80 A output

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



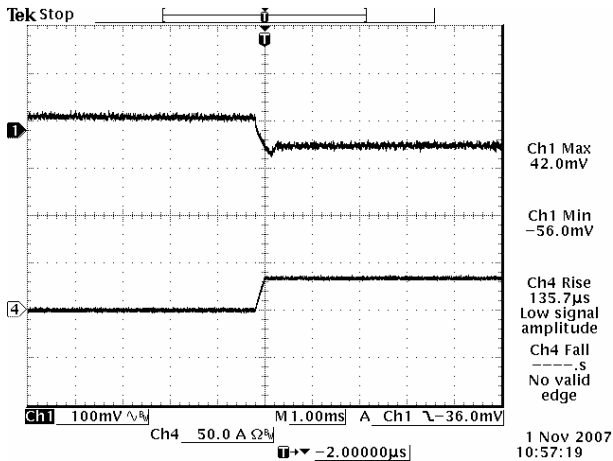
Ripple and Noise Waveforms (continued)



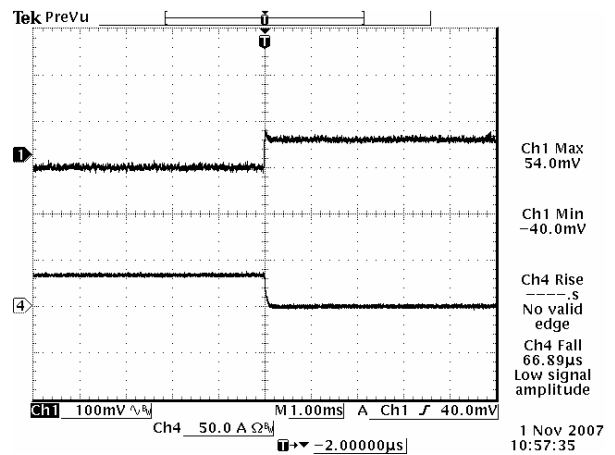
12 Vdc input, 5.0 Vdc/80 A output

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

Transient Response Waveforms



Vout= 0.6 V 0%-50% Load Transients



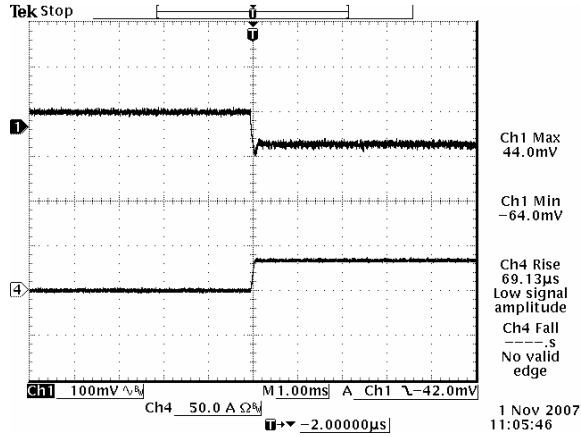
Vout=0.6 V 50%-0% Load Transients

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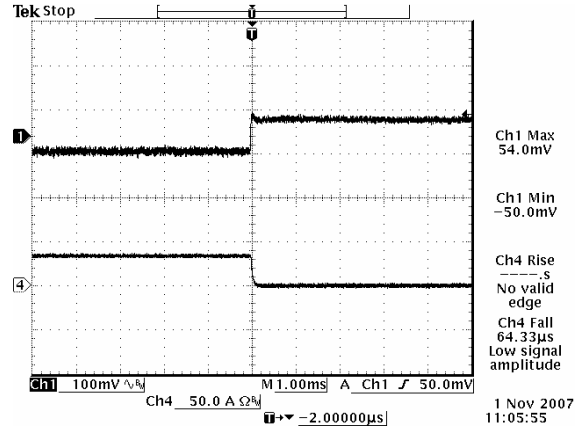
10.8 Vdc - 13.2 Vdc Input 0.6 Vdc - 5.0 Vdc/80 A Output



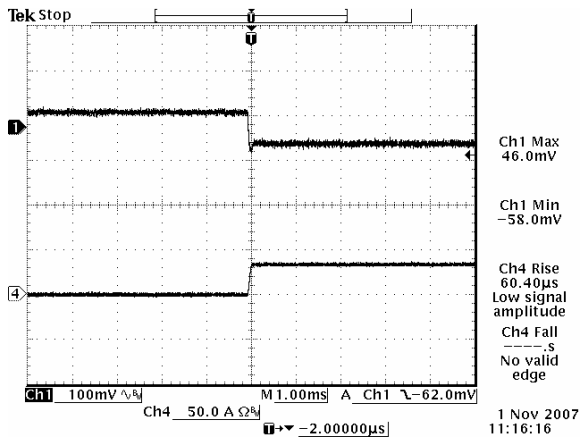
Transient Response Waveforms (continued)



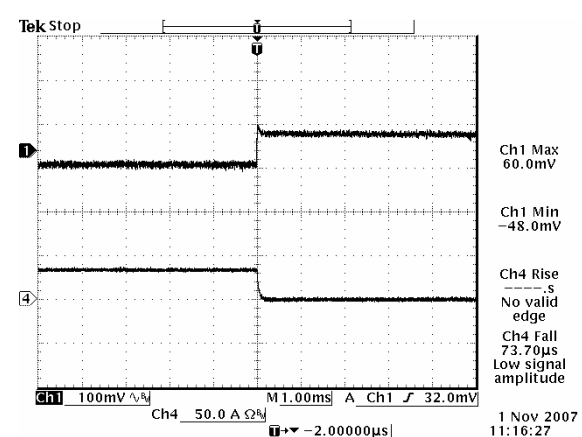
Vout=1.2 V 0%-50% Load Transients



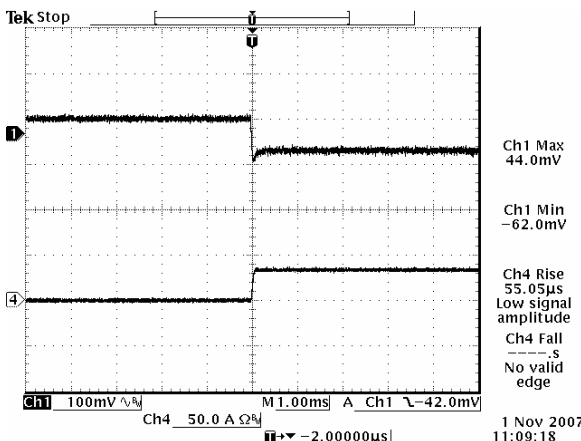
Vout=1.2 V 50%-0% Load Transients



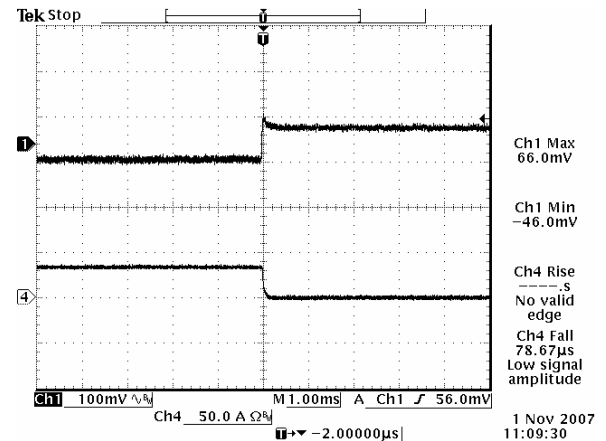
Vout=1.5 V 0%-50% Load Transients



Vout=1.5 V 50%-0% Load Transients



Vout= 1.8 V 0%-50% Load Transients



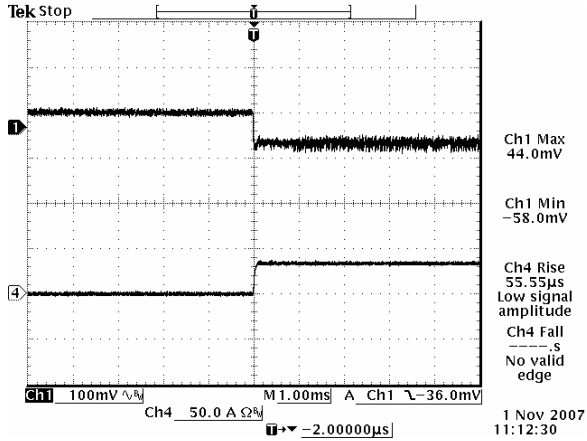
Vout=1.8 V 50%-0% Load Transients

NON-ISOLATED DC/DC CONVERTERS

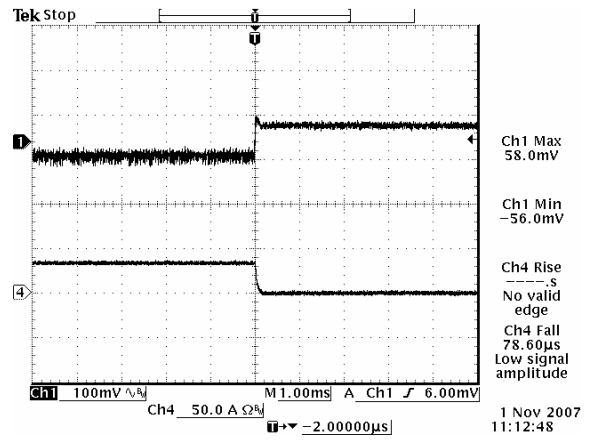
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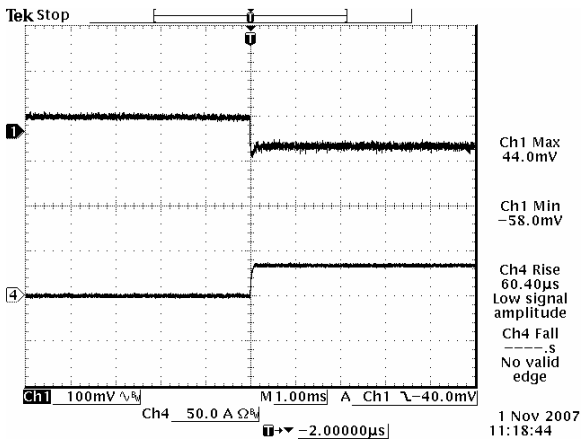
Transient Response Waveforms (continued)



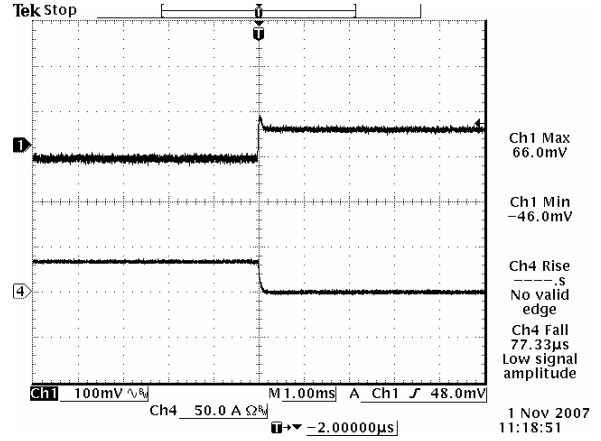
Vout=2.5 V 0%-50% Load Transients



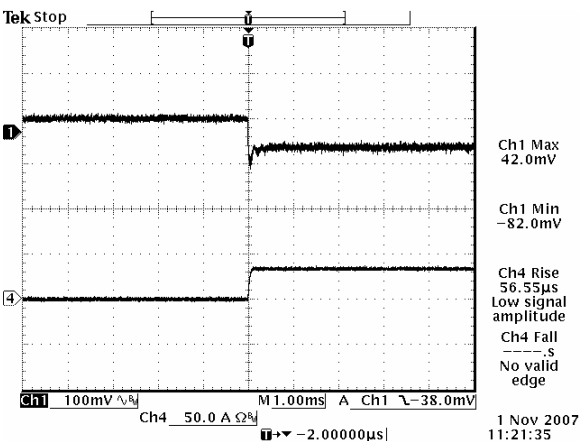
Vout=2.5 V 50%-0% Load Transients



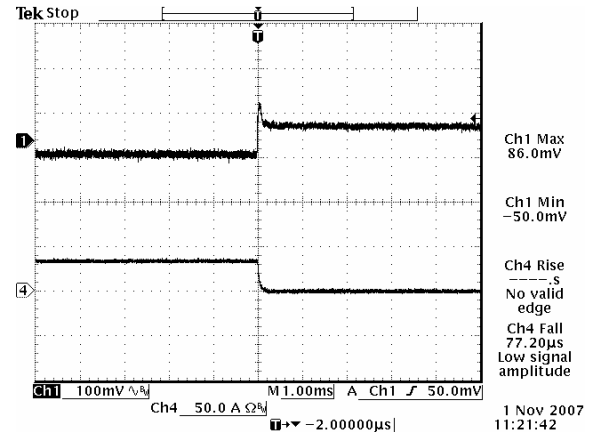
Vout=3.3 V 0%-50% Load Transients



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 $di/dt = 2.5 \text{ A}/\mu\text{s}$, with external electrolytic cap 4700 μF , and $T_a = 25 \text{ deg C}$.

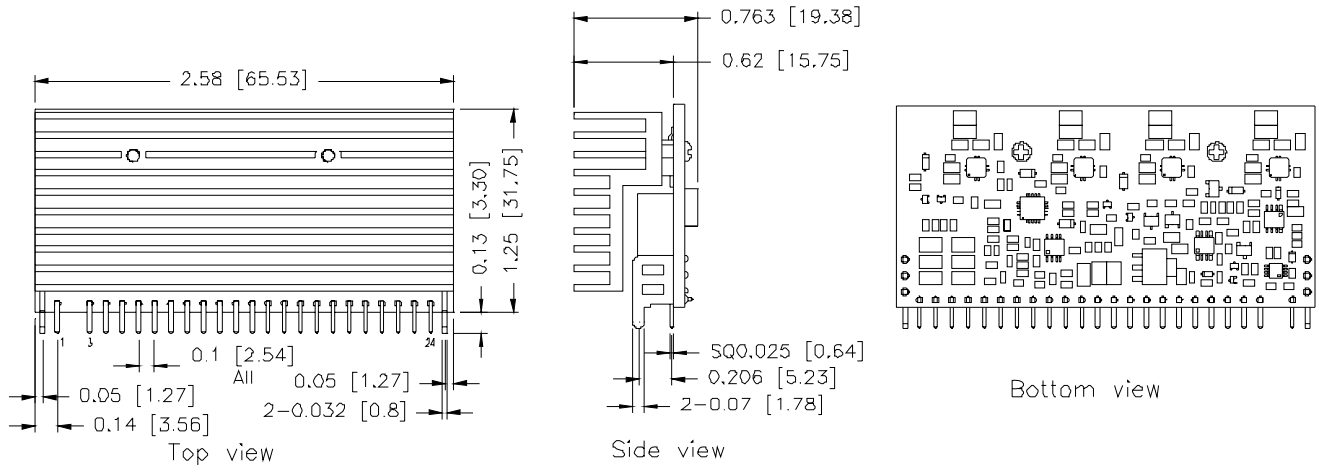
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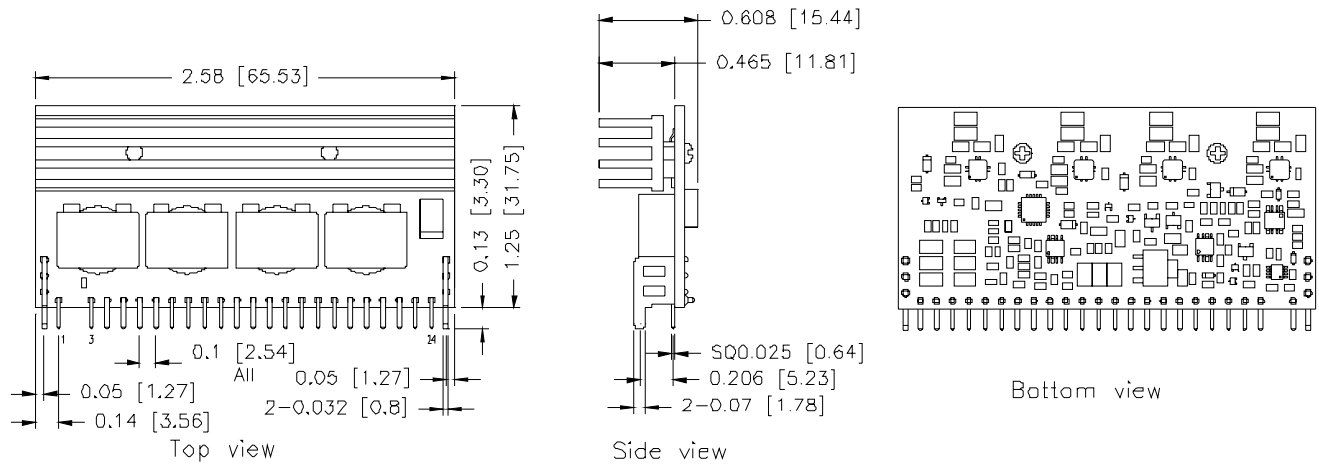
Mechanical Outline

VRP4-80A1A0



UNIT: INCH [mm]

VRP4-80A1AB



UNIT: INCH [mm]

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



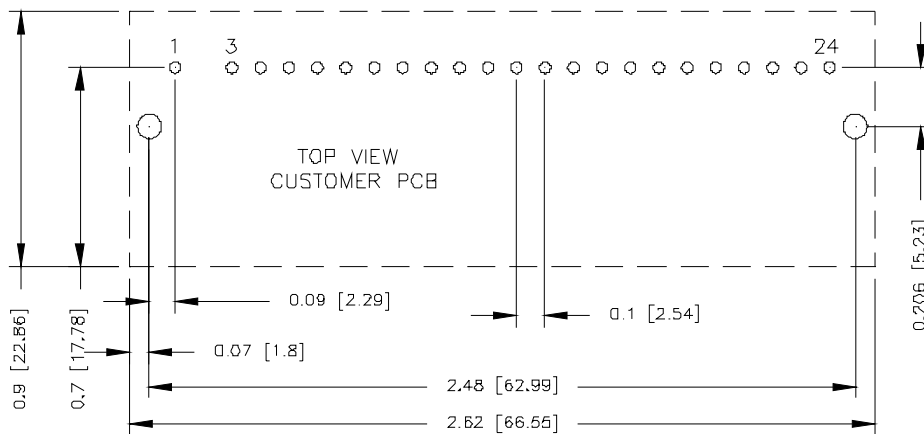
Mechanical Outline (continued)

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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