

NON-ISOLATED DC/DC CONVERTERS

5 Vdc - 13.8 Vdc Input 0.6 Vdc - 5.0 Vdc/40 A Output



xRP2-40E1AC RoHS Compliant Rev.A

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



Description

The xRP2-40E1AC is a non-isolated dc/dc converter that operates over a wide range of input voltage ($V_{in} = 5 \text{ Vdc} - 13.8 \text{ Vdc}$). This unit can provide a precisely regulated output voltage from 0.6 Vdc to 5.0 Vdc and can deliver up to 40 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 ($V_o=1.8 \text{ Vdc}$)	Part Number Horizontal Mount	Part Number Vertical Mount
0.6 Vdc - 5.0 Vdc	5.0 Vdc - 13.8 Vdc	40 A	200 W	87%	0RP2-40E1AC	VRP2-40E1AC

Notes: 1. All part numbers above indicate RoHS 6. Change the second letter "R" to "7" for RoHS 5 part numbers.
2. 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				
	$V_o \leq 2.8 \text{ V}$	5 V	12 V	13.8 V
	$V_o > 2.8 \text{ V}$	$1.8 \cdot V_o$	12 V	13.8 V
Input Current (full load)	-	-	30 A	
Input Reflected Ripple Current (pk-pk)	-	35 mA	-	With simulated source impedance of 1 μH , 5 Hz to 20 MHz. Use a 1000 $\mu\text{F}/16 \text{ V}$ electrolytic capacitor with ESR=0.1 ohm max, at 100 kHz at 25°C.
Input Reflected Ripple Current (rms)	-	10 mA	-	
I^2t Inrush Current Transient	-	-	1 A ² s	
Turn-on Voltage Threshold	4.4 V	4.6 V	4.8 V	
Under Voltage Threshold	4.0 V	4.3 V	4.6 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 $V_o \geq 1\text{ V}$ $V_o < 1\text{ V}$	-1.5 % V_o -10 mV	- -	+1.5 % V_o +10 mV	$V_{in} = V_{inmin}$, $I_o = I_{omax}$	
Load Regulation $V_o \geq 2.5\text{ V}$ $V_o < 2.5\text{ V}$	- -	- -	0.6% V_o 12 mV		
Line Regulation $V_o \geq 2.5\text{ V}$ $V_o < 2.5\text{ V}$	- -	- -	0.3% V_o 9 mV		
Regulation Over Temperature (0 °C to +70 °C)	-	-	0.02% V_o/C		
Output Current	0 A	-	40 A		
Current Limit Threshold	105% I_o	130% I_o	160% I_o		
Output Ripple and Noise (pk-pk) $V_o = 5.0\text{ V}$ $V_o = 3.3\text{ V}$ $V_o = 2.5\text{ V}$ $V_o = 1.5\text{ V}$ $V_o = 1.0\text{ V}$ $V_o = 0.6\text{ V}$	- - - - - -	- - - - - -	120 mV 60 mV 40 mV 40 mV 30 mV 30 mV	Test conditions: 0-20MHz BW, with a 1µF ceramic capacitor and a 10 uF Tantalum cap at output.	
Output Ripple and Noise (rms) $V_o = 5.0\text{ V}$ $V_o = 3.3\text{ V}$ $V_o = 2.5\text{ V}$ $V_o = 1.5\text{ V}$ $V_o = 1.0\text{ V}$ $V_o = 0.6\text{ V}$	- - - - - -	- - - - - -	30 mV 30 mV 20 mV 20 mV 15 mV 15 mV		
Turn On Time	-	-	10 mS		
Rise Time	-	-	3 mS		
Overshoot at Turn on and off	-	-	0.5%		
Output Capacitance $ESR \geq 1\text{ m}\Omega$	0 uF	-	4700 uF		
Transient Response					
0% ~ 50% Max Load	$V_o = \text{All}$	-	-	300 mV	Test conditions: $di/dt = 10\text{ A/uS}$; $V_{in} = 12\text{ V}$;
Settling Time		-	-	100 uS	
50% ~ 0% Max Load		-	-	300 mV	
Settling Time		-	-	100 uS	

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General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency				Measured at Vin=12 V, full load.
Vo=5.0 V	91%	94%	-	
Vo=3.3 V	89%	92%	-	
Vo=2.5 V	87%	90%	-	
Vo=1.8 V	84%	87%	-	
Vo=1.5 V	82%	85%	-	
Vo=1.2 V	79%	82%	-	
Vo=1.0 V	76%	79%	-	
Vo=0.6 V	68%	71%	-	
Switching Frequency	-	500 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.
MTBF	2,392,000 hours			Calculated Per Bell Core SR-332 (Io = 80%Iomax; Vin=12 V; Ta = 25 °C;0RP2-40E1AC)
	3,061,000 hours			Calculated Per Bell Core SR-332 (Io = 80%Iomax; Vin=12 V; Ta = 25 °C;VRP2-40E1AC)
Dimensions (horizontal mount) Inches (L x W x H) Millimeters (L x W x H)	1.45 x 1.10 x 0.50 36.83 x 27.94 x 12.7			
Dimensions (vertical mount) Inches (L x W x H) Millimeters (L x W x H)	1.45 x 1.10 x 0.377 36.83 x 27.94 x 9.58			
Weight	-	19 g	-	

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

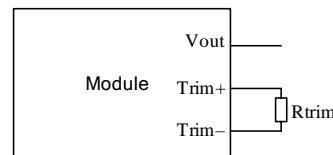
Control Specifications

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 on.
Signal High (Unit On)	2.0 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.

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

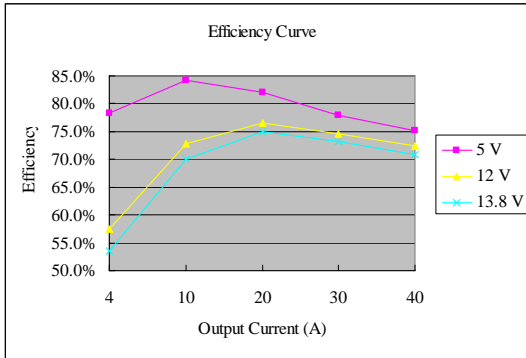


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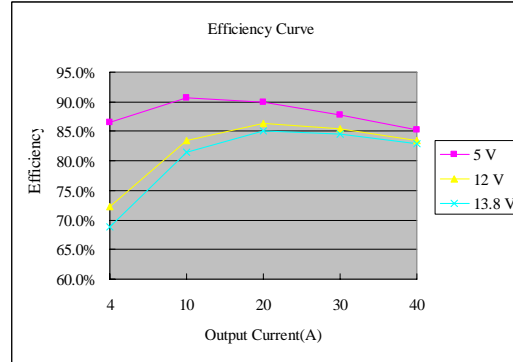
5 Vdc - 13.8 Vdc Input 0.6 Vdc - 5.0 Vdc/40 A Output



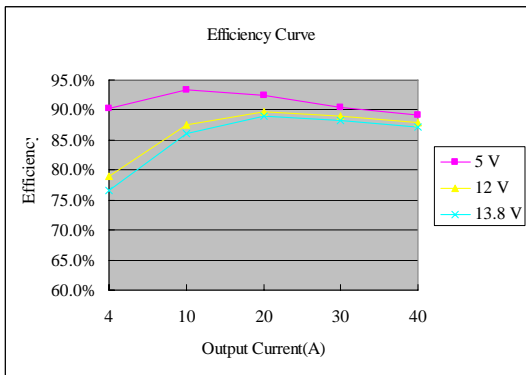
Efficiency Data



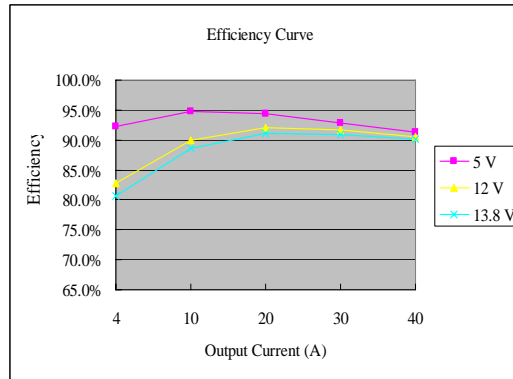
Vout = 0.6 V



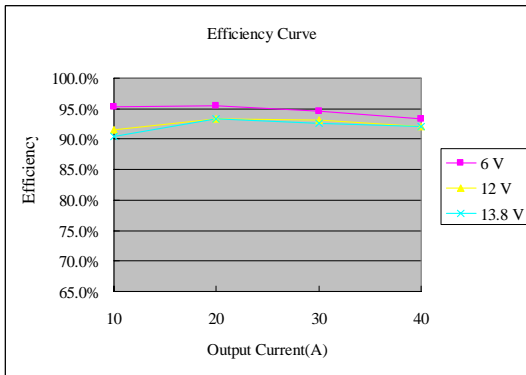
Vout = 1.2 V



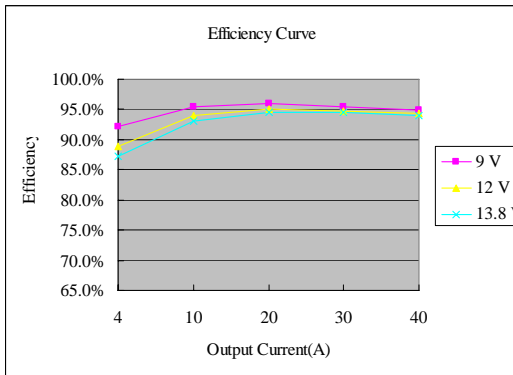
Vout = 1.8 V



Vout = 2.5 V



Vout = 3.3 V

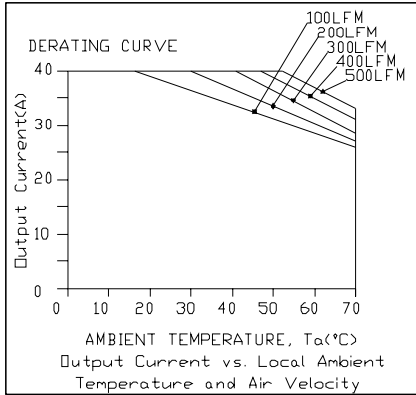


Vout = 5.0 V

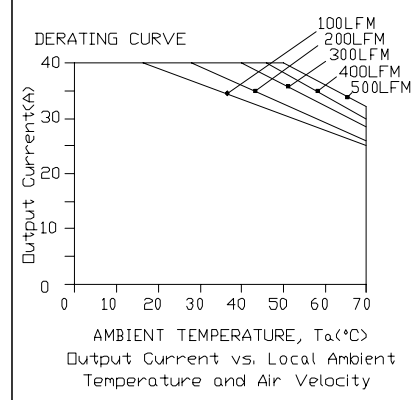
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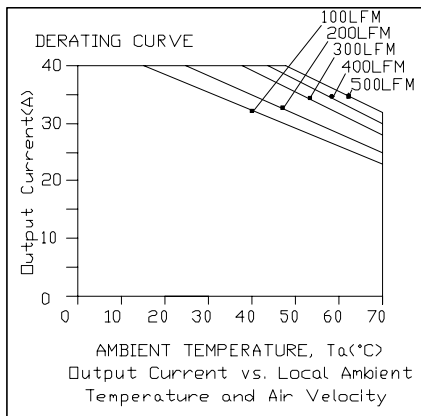
Thermal Derating Curves



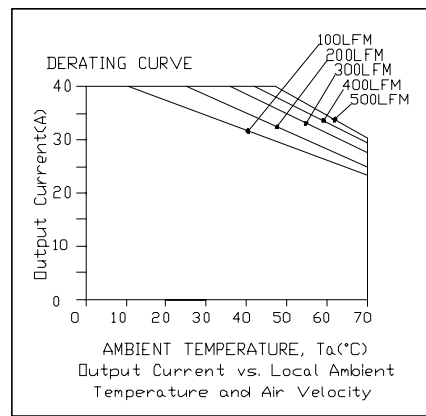
Vin=12 V, Vo=0.6 V



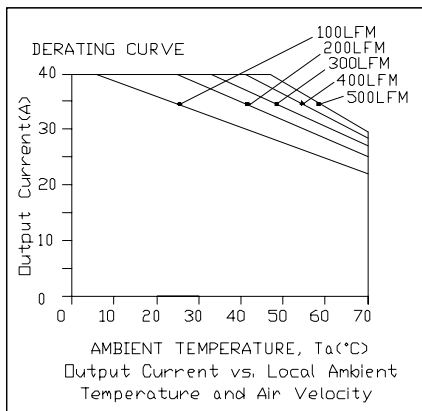
Vin=12 V, Vo=1.2 V



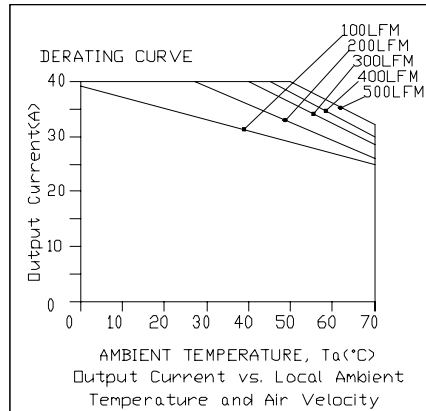
Vin=12 V, Vo=1.8 V



Vin=12 V, Vo=2.5 V



Vin=12 V, Vo=3.3 V



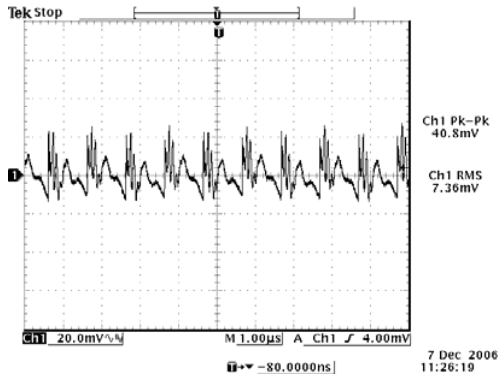
Vin=12 V, Vo=5.0 V

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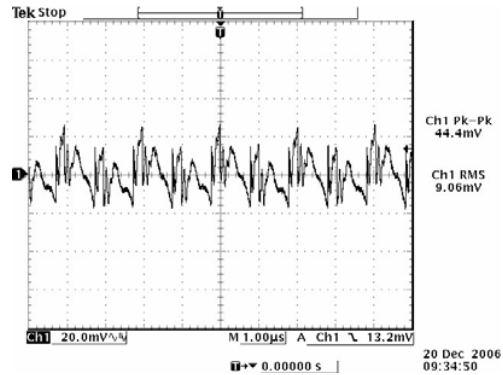
5 Vdc - 13.8 Vdc Input 0.6 Vdc - 5.0 Vdc/40 A Output



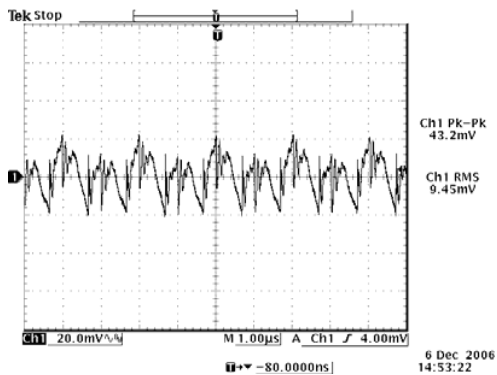
Ripple and Noise Waveforms



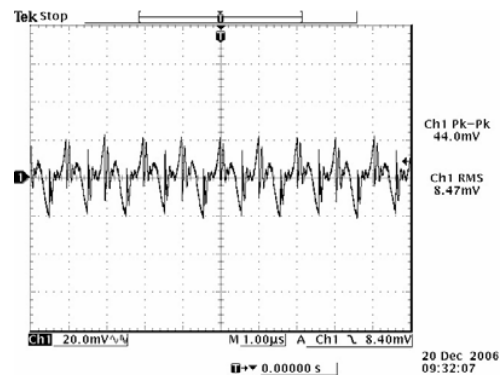
12 Vdc input, 0.6 Vdc/40 A output



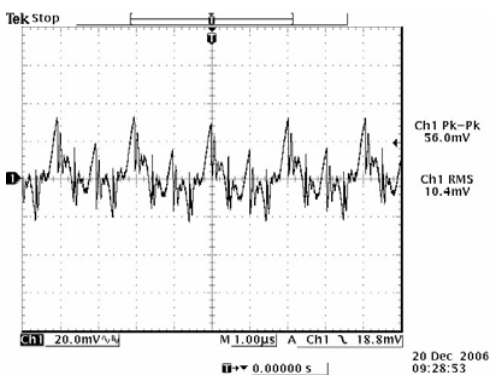
12 Vdc input, 1.2 Vdc/40 A output



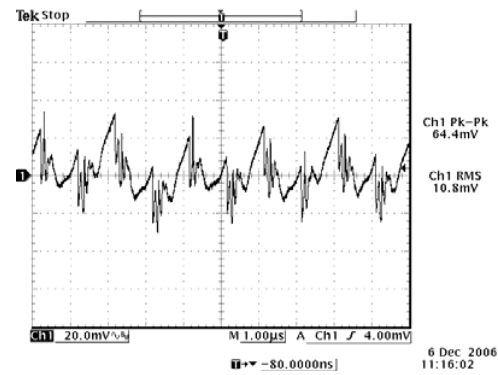
12 Vdc input, 1.8 Vdc/40 A output



12 Vdc input, 2.5 Vdc/40 A output



12 Vdc input, 3.3 Vdc/40 A output



12 Vdc input, 5.0 Vdc/40 A output

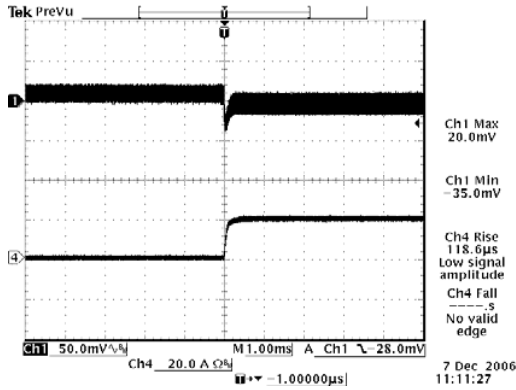
Note: Ripple and noise at full load, 0-20 MHz BW, with a 10 μ F tantalum cap and a 1 μ F ceramic cap at the output, and $T_a=25$ deg C.

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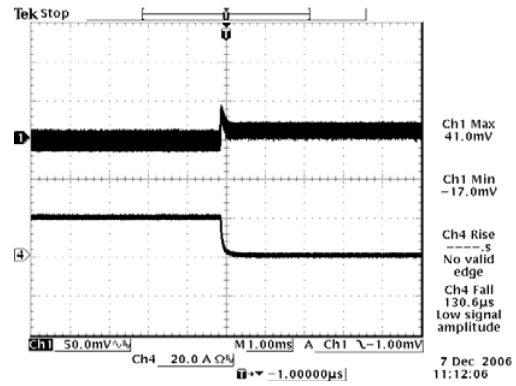
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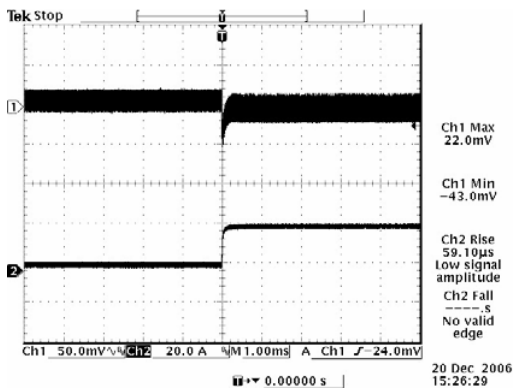
Transient Response Waveforms



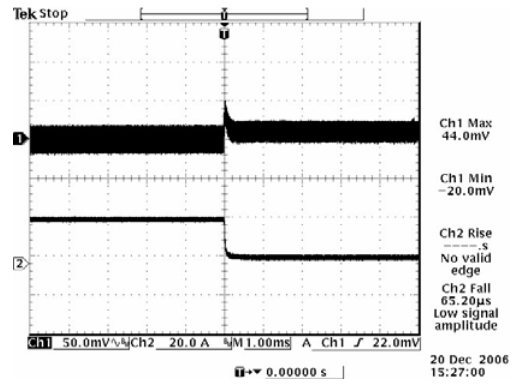
Vout= 0.6 V 0%-50% Load Transients



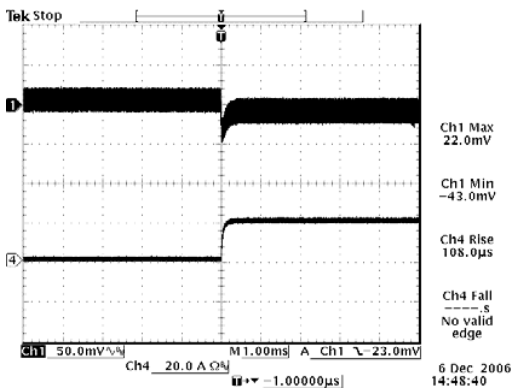
Vout=0.6 V 50%-0% Load Transients



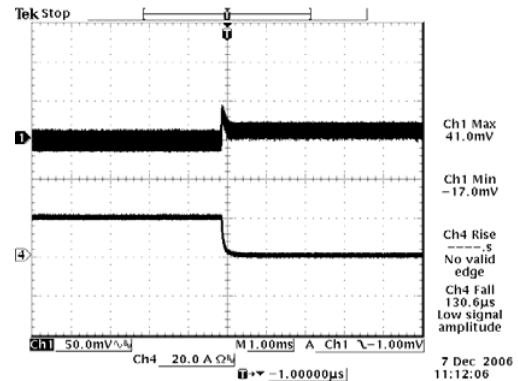
Vout=1.2 V 0%-50% Load Transients



Vout=1.2 V 50%-0% Load Transients



Vout=1.8 V 0%-50% Load Transients



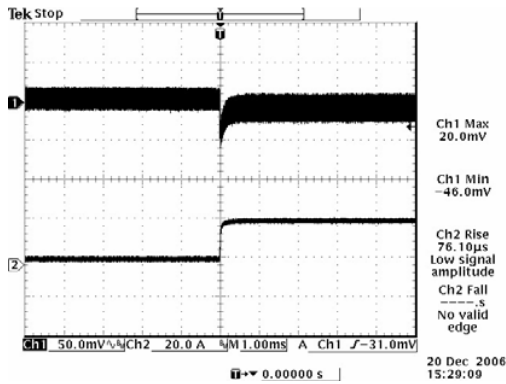
Vout=1.8 V 50%-0% Load Transients

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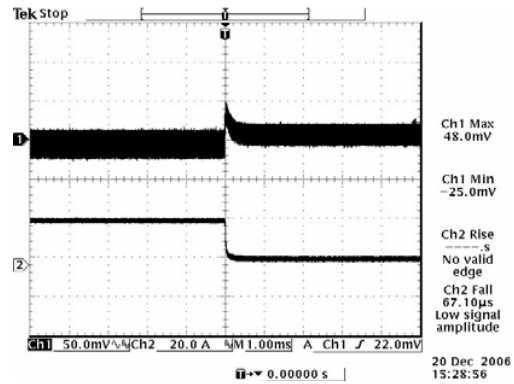
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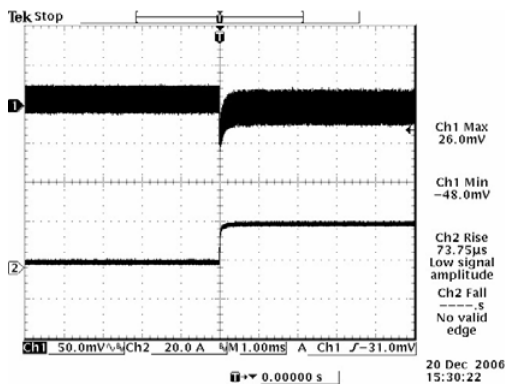
Transient Response Waveforms (continued)



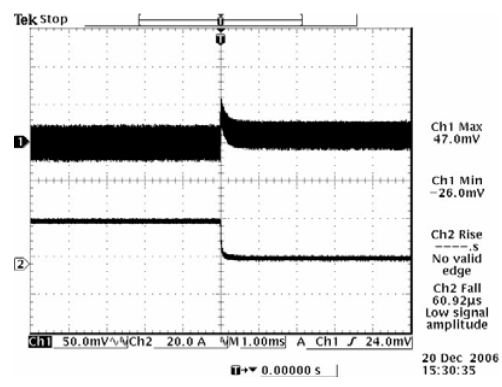
Vout= 2.5 V 0%-50% Load Transients



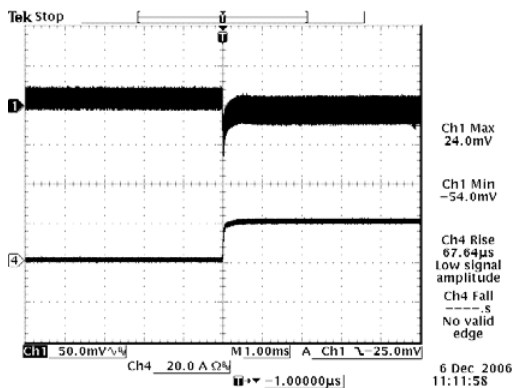
Vout=2.5 V 50%-0% Load Transients



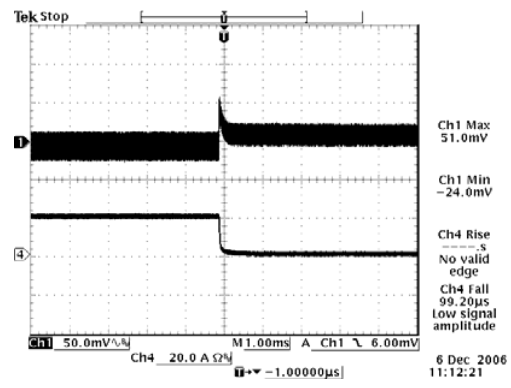
Vout=3.3 V 0%-50% Load Transients



Vout=3.3 V 50%-0% Load Transients



Vout=5 V 0%-50% Load Transients



Vout=5 V 50%-0% Load Transients

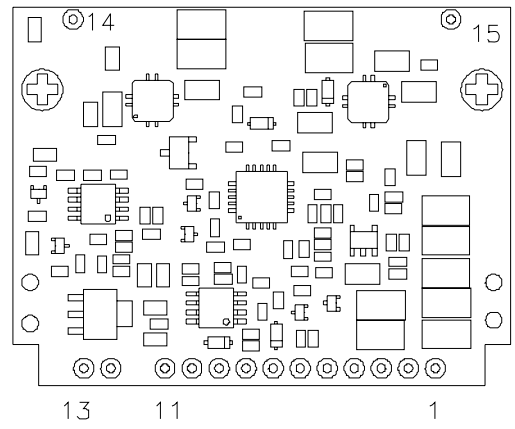
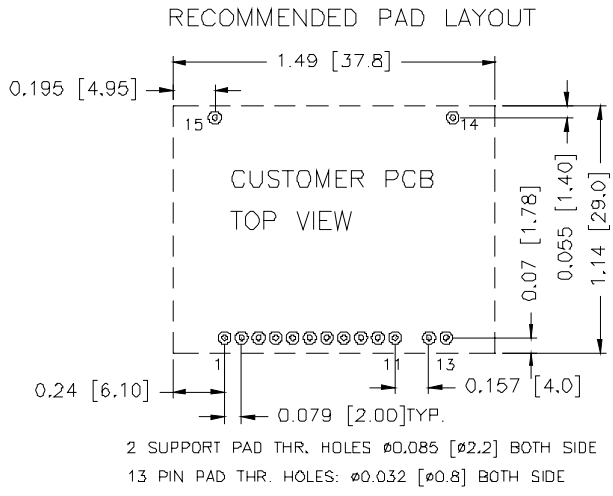
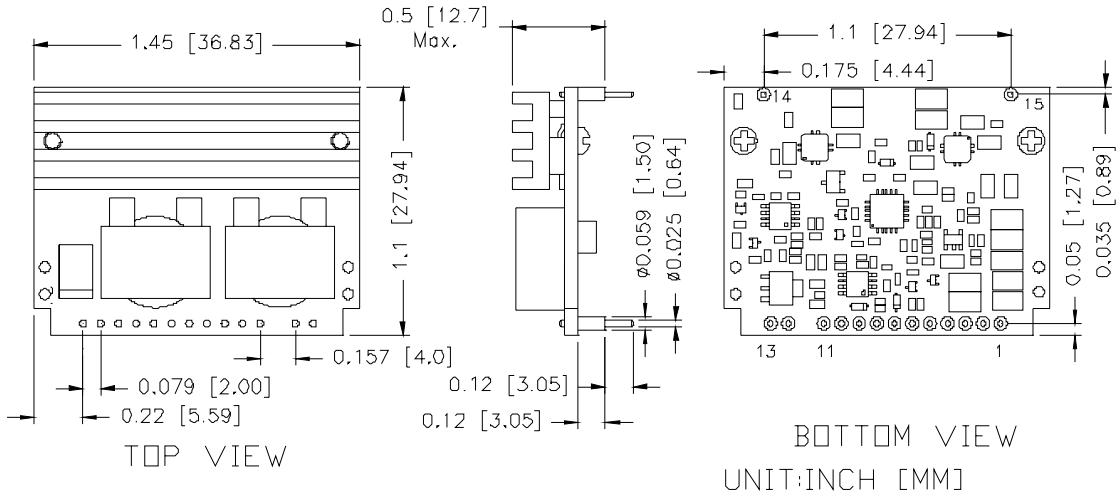
Note: Transient response at $di/dt = 10 \text{ A}/\mu\text{S}$, with external electrolytic cap 4700 μF , and $T_a=25 \text{ deg C}$.

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Mechanical Outline

ORP2-40E1AC



Pin Connections

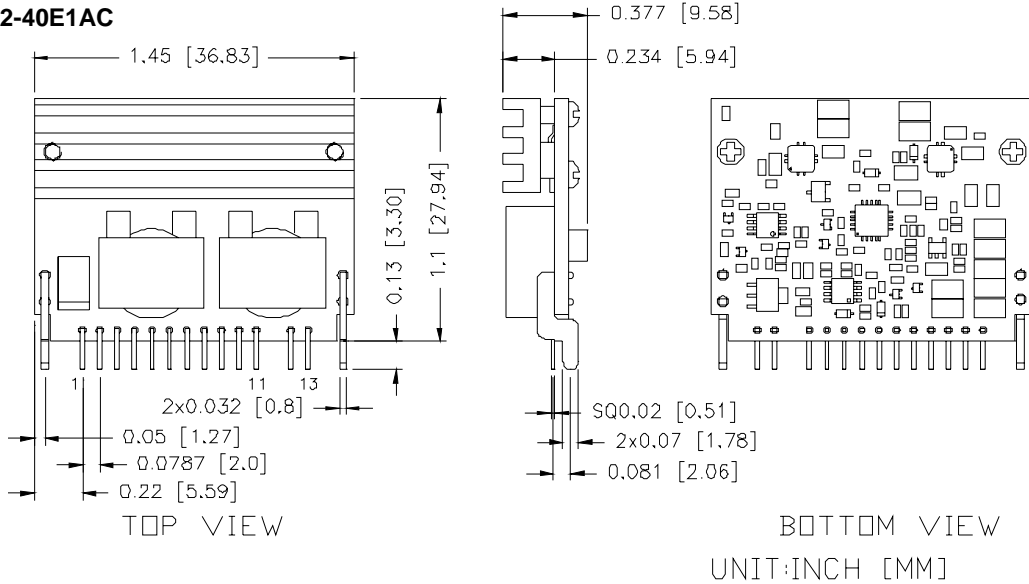
Pin	Function	Pin	Function
1	Vout	9	PwGOOD
2	Vout	10	Sense-
3	Vout	11	Sense+
4	GND	12	Vin
5	GND	13	Vin
6	Enable	14	Mech.Support
7	Trim-	15	Mech.Support
8	Trim+		

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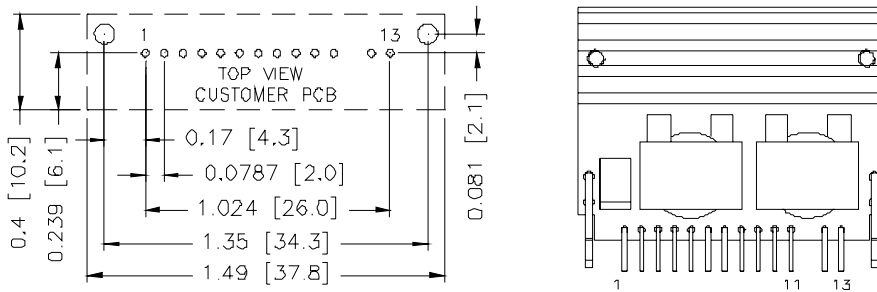


Mechanical Outline (continued)

VRP2-40E1AC



RECOMMENDED PAD LAYOUT



2 SUPPORT PAD THR. HOLES: $\varnothing 0.085$ [2.2] BOTH SIDE
 13 PIN PAD THR. HOLES: $\varnothing 0.032$ [0.8] BOTH SIDE

Pin Connections

Pin	Function
1	Vout
2	Vout
3	Vout
4	GND
5	GND
6	Enable
7	Trim-
8	Trim+
9	PwGOOD
10	Sense-
11	Sense+
12	Vin
13	Vin

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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