

NON-ISOLATED DC/DC CONVERTERS

12 Vdc Input 1.2 Vdc - 5.0 Vdc / 10 A Output

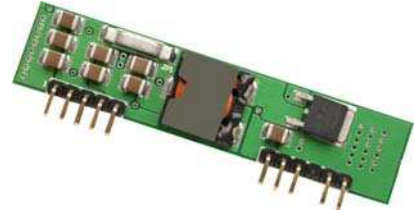
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POWER PRODUCTS

VRPC-10Axxx Series

RoHS Compliant

Rev.A

- Non-Isolated
- High Efficiency
- Fixed Frequency
- Low Cost
- Remote On/Off
- Under-voltage Lockout (UVLO)
- OCP/SCP
- Remote Sense (Options)



Description

The VRPC-10Axxx is part of the low-cost non-isolated dc/dc converters that operate from a nominal 12 Vdc source. The modules use a SIP package for ease of layout and space savings. The output is closely regulated and the efficiency for 5.0 Vdc output is typically 94% at full load. Standard features include remote on/off, input under-voltage lockout, over current protection, short current protection, and remote sense.

Part Selection

Output Voltage	Input Voltage	Max. Output Current	Max. Output Power	Typical Efficiency	Model Number Remote Sense	Model Number No Remote Sense
5.0 V	12 V	10 A	50 W	94%	VRPC-10A50S	VRPC-10A500
3.3 V	12 V	10 A	33 W	91%	VRPC-10A33S	VRPC-10A330
2.5 V	12 V	10 A	25 W	89%	VRPC-10A25S	VRPC-10A250
1.8 V	12 V	10 A	18 W	86%	VRPC-10A18S	VRPC-10A180
1.5 V	12 V	10 A	15 W	85%	VRPC-10A15S	VRPC-10A150
1.2 V	12 V	10 A	12 W	82%	VRPC-10A12S	VRPC-10A120

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 number 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	-40 °C	-	100 °C	

Input Specifications

Parameter	Min	Typ	Max	Notes
Input Voltage	10.8	-	13.2 V	
Input Current (full load)	-	-	5.5 A	
Input Current (no load)	-	-	50 mA	
Remote Off Input Current	-	3	15 mA	
Input Reflected Ripple Current (pk-pk)	-	-	180 mA	Tested with a 470 uF/16 V input capacitor with ESR=0.03 ohm max at 100 kHz & simulated source impedance of 500 nH, 5 Hz to 20 MHz.
Input Reflected Ripple Current (rms)	-	-	50 mA	
I ² t Inrush Current Transient	-	0.08 A ² s	0.16 A ² s	
Turn-on Voltage Threshold	-	9.7 V	-	
Turn-off Voltage Threshold	8.0 V	8.8 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				Test conditions: Vin=12V, Iout= full load
Vo=5.0 V	4.900 V	5.0 V	5.100 V	
Vo=3.3 V	3.247 V	3.3 V	3.353 V	
Vo=2.5 V	2.460 V	2.5 V	2.540 V	
Vo=1.8 V	1.771 V	1.8 V	1.829 V	
Vo=1.5 V	1.476 V	1.5 V	1.524 V	
Vo=1.2 V	1.181 V	1.2 V	1.219 V	
Load Regulation				
Vo=5.0 V	-	10 mV	20 mV	
Vo=3.3 V	-	7 mV	16 mV	
Vo=2.5 V	-	5 mV	10 mV	
Vo=1.8 V	-	5 mV	10 mV	
Vo=1.5 V	-	3 mV	10 mV	
Vo=1.2 V	-	3 mV	10 mV	
Line Regulation	-	3 mV	10 mV	
Regulation Over Temperature (0 °C to 70 °C)				
Vo=5.0 V	-	10 mV	46 mV	
Vo=3.3 V	-	5 mV	46 mV	
Vo=2.5 V	-	5 mV	35 mV	
Vo=1.8 V	-	5 mV	25 mV	
Vo=1.5 V	-	5 mV	20 mV	
Vo=1.2 V	-	5 mV	20 mV	
Output Current	0 A	-	10 A	
Current Limit Threshold	13 A	-	22 A	
Short Circuit Surge Transient				
Vo=5.0 V	-	0.35 A ² s	0.8 A ² s	
Vo=3.3 V	-	0.35 A ² s	0.7 A ² s	
Vo=2.5 V	-	0.40 A ² s	0.8 A ² s	
Vo=1.8 V	-	0.35 A ² s	0.7 A ² s	
Vo=1.5 V	-	0.35 A ² s	0.7 A ² s	
Vo=1.2 V	-	0.35 A ² s	0.7 A ² s	
Output Ripple and Noise (pk-pk)				Test conditions: 0-20 MHz BW, with 0.1 uF ceramic capacitor at the output
Vo=5.0 V	-	75 mV	120 mV	
Vo=3.3 V	-	55 mV	100 mV	
Vo=2.5 V	-	50 mV	100 mV	
Vo=1.8 V	-	45 mV	100 mV	
Vo=1.5 V	-	45 mV	100 mV	
Vo=1.2 V	-	30 mV	60 mV	
Output Ripple and Noise (rms)				
Vo=5.0 V	-	25 mV	45 mV	
Vo=3.3 V	-	17 mV	25 mV	
Vo=2.5 V	-	15 mV	25 mV	
Vo=1.8 V	-	10 mV	25 mV	
Vo=1.5 V	-	10 mV	25 mV	
Vo=1.2 V	-	5 mV	15 mV	
Turn on Time	-	50 mS	180 mS	
Overshoot at Turn on	-	0%	3%	
Output Capacitance	100 uF	-	3300 uF	

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12 Vdc Input 1.2 Vdc - 5.0 Vdc / 10 A Output



Output Specifications (continued)

Parameter		Min	Typ	Max	Notes
Transient Response					
50% ~ 100% Max Load	Vo = 5.0 V	-	100 mV	150 mV	di/dt=0.5 A/uS; Vin=12 V; and with a 470 uF Aluminum capacitor at the output.
Settling Time		-	40 uS	70 uS	
100% ~ 50% Max Load		-	100 mV	150 mV	
Settling Time		-	40 uS	70 uS	
50% ~ 100% Max Load	Vo = 3.3 V	-	80 mV	150 mV	
Settling Time		-	30 uS	70 uS	
100% ~ 50% Max Load		-	80 mV	150 mV	
Settling Time		-	30 uS	70 uS	
50% ~ 100% Max Load	Vo = 2.5 V	-	100 mV	150 mV	
Settling Time		-	40 uS	70 uS	
100% ~ 50% Max Load		-	100 mV	150 mV	
Settling Time		-	40 uS	70 uS	
50% ~ 100% Max Load	Vo = 1.8 V	-	90 mV	150 mV	
Settling Time		-	40 uS	70 uS	
100% ~ 50% Max Load		-	90 mV	150 mV	
Settling Time		-	40 uS	70 uS	
50% ~ 100% Max Load	Vo = 1.5 V	-	60 mV	150 mV	
Settling Time		-	30 uS	70 uS	
100% ~ 50% Max Load		-	60 mV	150 mV	
Settling Time		-	30 uS	70 uS	
50% ~ 100% Max Load	Vo = 1.2 V	-	60 mV	150 mV	
Settling Time		-	40 uS	70 uS	
100% ~ 50% Max Load		-	60 mV	150 mV	
Settling Time		-	40 uS	70 uS	

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

General Specifications

Parameter	Min	Typ	Max	Notes
Efficiency (Vin=12 V, Io=Io-max)				Vin=12 V, full load
Vo=5.0 V	91%	94%	-	
Vo=3.3 V	88%	91%	-	
Vo=2.5 V	86%	89%	-	
Vo=1.8 V	83%	86%	-	
Vo=1.5 V	82%	85%	-	
Vo=1.2 V	80%	82%	-	
Switching Frequency	180 kHz	200 kHz	220 kHz	
Output Voltage Trim Range				
Vo=5.0 V	90%	-	110%	
Vo=3.3 V	85%	-	110%	
Vo=2.5 V	70%	-	120%	
Vo=1.8 V	90%	-	110%	
Vo=1.5 V	90%	-	120%	
Vo=1.2 V	90%	-	110%	
MTBF	3,403,119 hours			Calculated Per Bell Core SR-332 (Io = 80% load; Vin=12 V; Ta = 25 °C)
Dimensions				
Inches (L x W x H)	2.5 x 0.55 x 0.37			
Millimeters (L x W x H)	63.5 x 13.97 x 9.4			
Remote sense compensation	-	-	0.5 V	
Weight	-	9.5 g	-	

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

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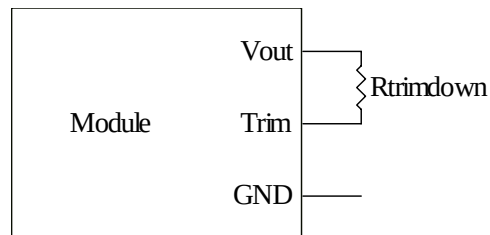
Control Specifications

Parameter	Min	Typ	Max	Notes
Remote On/Off				
Signal Low (Unit Off)	-0.3 V	-	0.3 V	Remote on/off pin open, unit on.
Signal High (Unit On)	2.8 V	-	13.2 V	

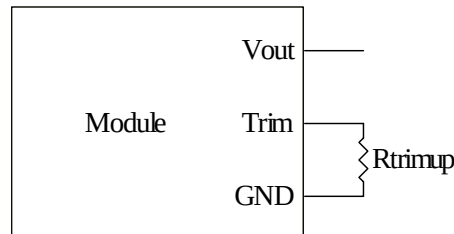
Output Trim Equations

Equations for calculating the trim resistor (in kΩ) given the desired adjusted voltage (V_{adj}) and the nominal output voltage of the converter (V_o) 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.

$$R_{trimdown} = \frac{A}{V_o - V_{adj}} - B$$



$$R_{trimup} = \frac{C}{V_{adj} - V_o} - D$$



V_o	A	B	C	D
5.0	10.519	4.990	2.000	2.490
3.3	7.923	7.810	2.536	4.640
2.5	3.691	4.770	1.728	2.610
1.8	3.849	19.23	3.064	15.4
1.5	0.749	2.530	0.848	1.470
1.2	0.427	2.530	0.848	1.470

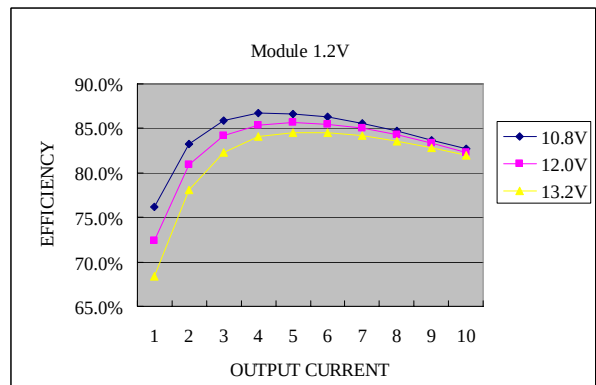
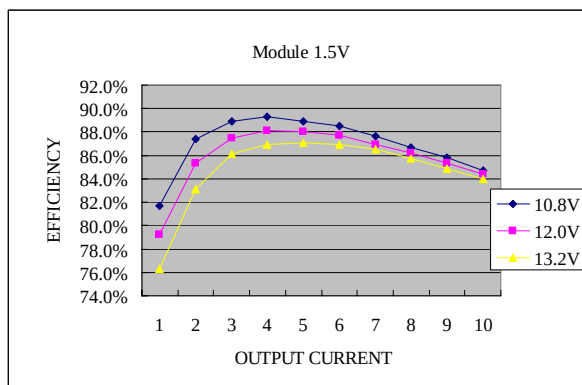
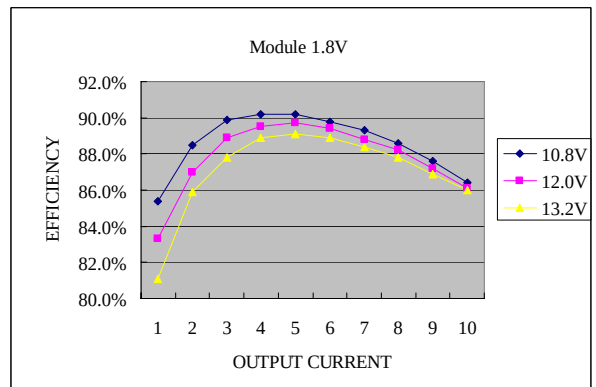
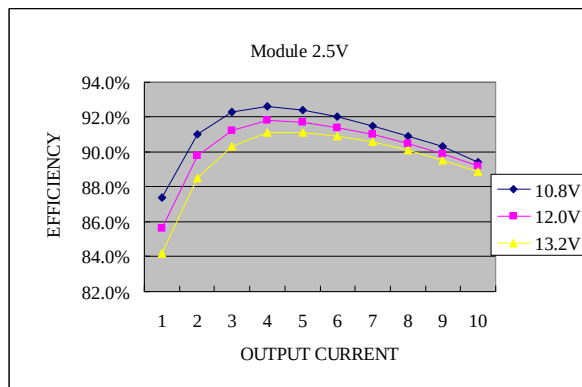
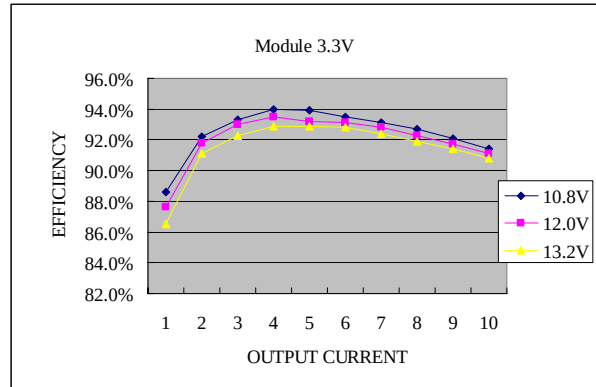
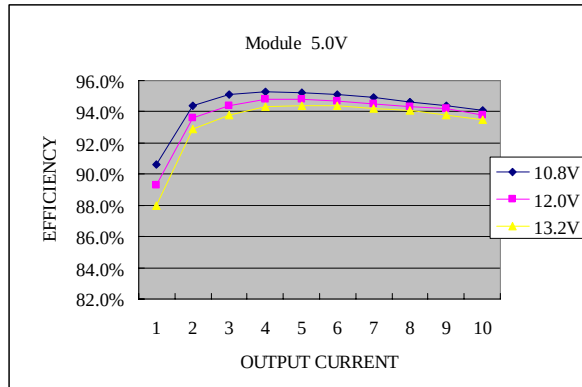
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Efficiency Data



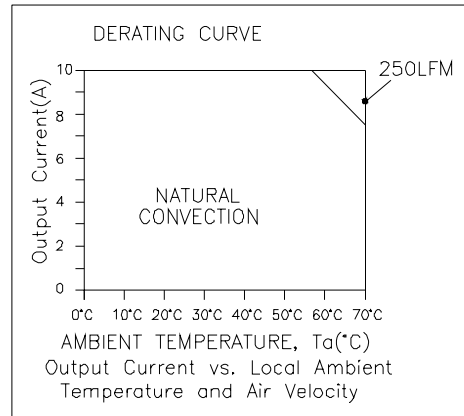
NON-ISOLATED DC/DC CONVERTERS

12 Vdc Input

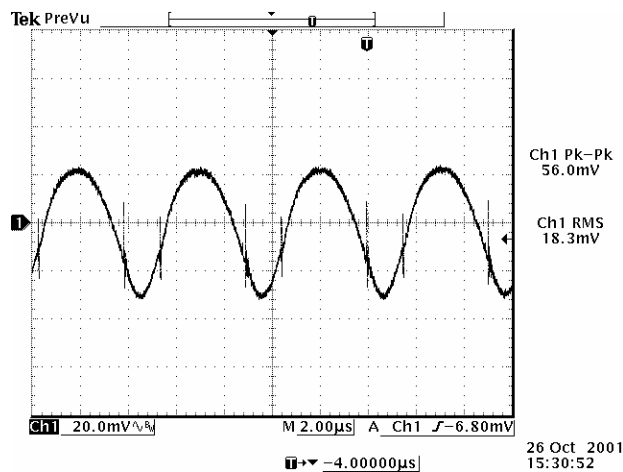
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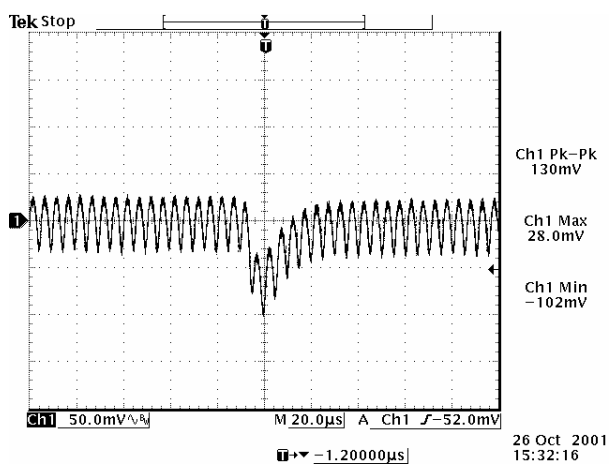
Thermal Derating Curve



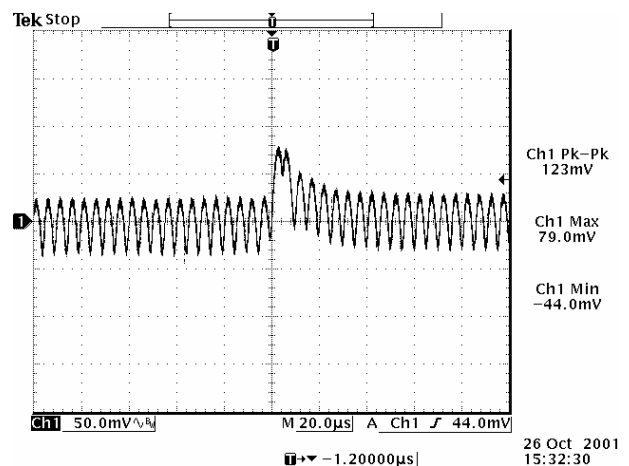
Ripple and noise Waveform



Transient Response Waveforms



50% to 100% load Transient at 12V input and $T_a=25^{\circ}\text{C}$



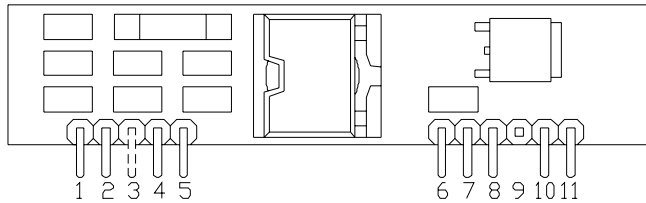
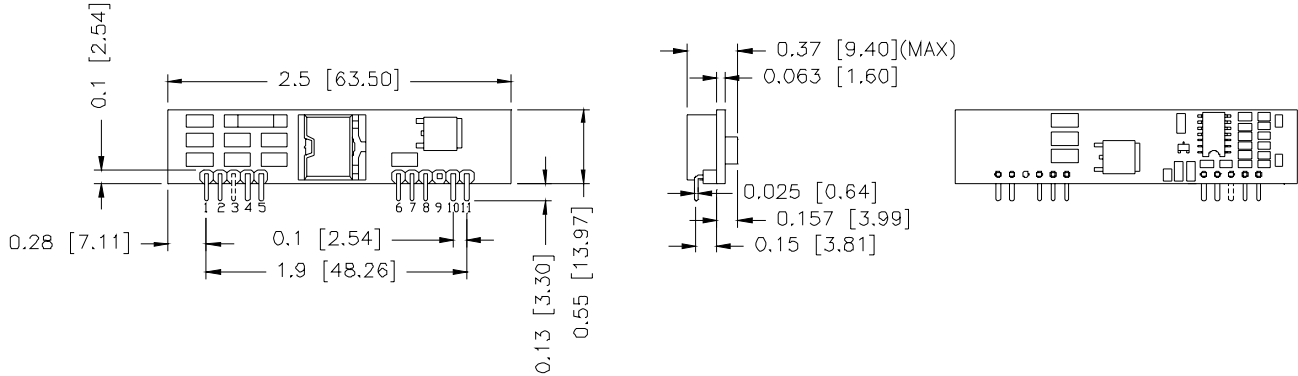
100% to 50% load Transient at 12V input and $T_a=25^{\circ}\text{C}$

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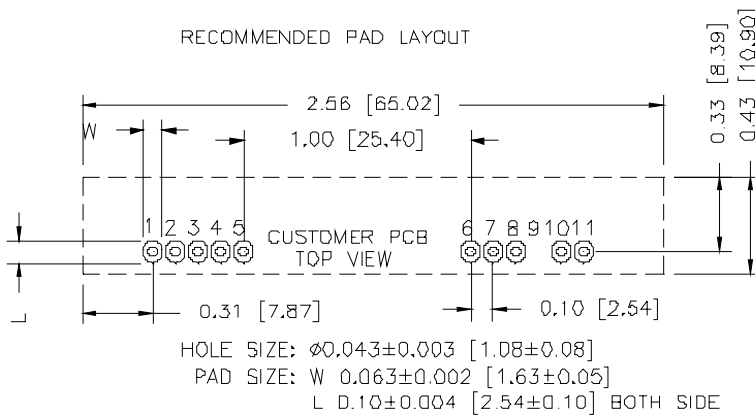
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Mechanical Outline



RECOMMENDED PAD LAYOUT



Pin Connections

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

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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