

# VRNE-60ED10/20 Series

## Non-Isolated DC-DC Converter

The VRNE-60ED10/20 has dual non-isolated step down DC/DC converters providing up to 40A/ 5A (VDD/ VTT) of output current and designed to be compatible with the Intel VRM12 requirements. Standard features include remote on/off, over current protection, remote sense, Power Good and VR\_ Hot signal. These products may be used almost anywhere low-voltage silicon is being employed and a nominal 12V source is available. Typical applications include file servers, work stations and other computing applications.



### Key Features & Benefits

- 6 VDC – 13.8 VDC Input
- 0.6 VDC – 2.0 VDC /30 A Output
- Dual Output
- Thermal Warning
- High Efficiency
- Remote ON/OFF
- High Power Density
- 2-Wire Remote Sense
- Wide Input Range (6.0-13.8V)
- OCP/SCP
- Output Current Monitor
- SVID
- Input under-voltage protection
- VR12.0 Compliant
- Output Overvoltage Protection
- Class II, Category 2, Non-Isolated DC/DC Converter (refer to IPC-9592A)

### Applications

- Networking
- Computers and Peripherals
- Telecommunications



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## 1. MODEL SELECTION

OUTPUT VOLTAGE	INPUT VOLTAGE	MAX. OUTPUT CURRENT	MAX. OUTPUT POWER	TYPICAL EFFICIENCY	MODEL NUMBER ACTIVE HIGH
1.5 VDC – 0.75 VDC	6.0 VDC - 13.8 VDC	40 A/5 A	60 W + 3.75 W	85%	VRNE-60ED10 VRNE-60ED20

**NOTE:** 1.Add “G” suffix at the end of the model numbers listed above to indicate “Tray Packaging”.

### PART NUMBER EXPLANATION

V	R	NE	-	60	E	Dx	0	x
Mounting type	RoHS status	Series name		Output power	Input range	Enable pin location	Logic status	Package
Vertical mount	RoHS 6	VRNE series		60W	6.0 -13.8V	D1-pin23 enable, pin24-NIL D2- pin24 enable, pin23-NIL	Active high	G -Tray

## 2. ABSOLUTE MAXIMUM RATINGS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNITS
Continuous non-operating Input Voltage		-0.3	-	15	V
Input Transient Voltage	100mS maximum	-	-	22	V
Remote On/Off		-0.3	-	5.3	V
Ambient Temperature		0	-	70	°C
Storage Temperature		-40	-	125	°C

**NOTE:** Ratings used beyond the maximum ratings may cause a reliability degradation of the converter or may permanently damage the device.

## 3. INPUT SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Operating Input Voltage		6	12	13.8	V
Input Current (full load)	Vin=6V	-	-	13.5	A
Input Current (no load)	Vin=12V	160	200	250	mA
Remote Off Input Current		-	40	100	mA
Input Reflected Ripple Current (rms)	With simulated source impedance of 10 $\mu$ H, 5 Hz to 20 MHz. Use a 100 $\mu$ F/100 V electrolytic capacitor with ESR=1ohm max, at 200 KHz @ 25°C.	-	10	20	mA
Input Reflected Ripple Current (pk-pk)		-	50	90	mA
Turn-on Voltage Threshold	No load	5.6	5.8	6	V
	Full load, VDD_set=1.5V, VTT_set=0.75V	5.6	5.8	6	V
Turn-off Voltage Threshold	No load	5.2	5.4	5.6	V
	Full load, VDD_set=1.5V, VTT_set=0.75V	5.4	5.7	5.8	V

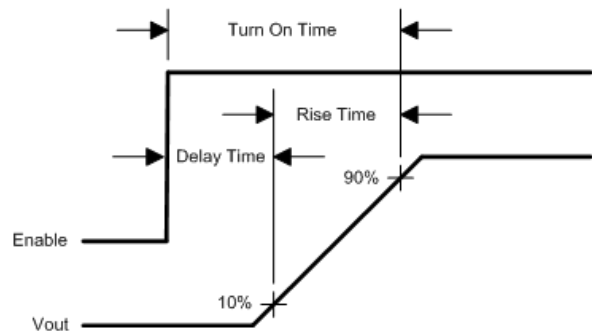
**CAUTION:** This converter is not internally fused. An input line fuse must be used

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

## 4. OUTPUT SPECIFICATIONS

PARAMETER		DESCRIPTION	MIN	TYP	MAX	UNIT
Boot Voltage	VDD		-	1.5	-	V
	VTT	Vin=12 V, Io=0 A at 25°C ambient.	-	0.75	-	V
Output Voltage Set Point	-		-	per VR12 VID	-	V
Load Regulation	VDD	Vin=12 V, Io=0 A to 40 A	-	2	8	mV
	VTT	Vin=12 V, Io=0 A to 5 A	-	1	6	mV
Line Regulation	VDD	Io=40 A, Vin=6 V to 13.8 V	-	2	8	mV
	VTT	Io=5 A, Vin=6 V to 13.8 V	-	1	6	mV
Regulation Over Temperature	VDD	Working ambient temperature range is from 0°C to 70°C.	-5	1	13	mV
	VTT		-5	9	20	mV
Output Ripple and Noise (Pk-Pk)	VDD	Vin=12 V, Io=40 A	-	10	13	mV
	VTT	Vin=12 V, Io=5 A	-	32	40	mV
Output Ripple and Noise(RMS)	VDD	Vin=12 V, Io=40 A	-	2	4	mV
	VTT	Vin=12 V, Io= 5 A	-	6	7	mV
Output Current Range	VDD	Thermal design	0	-	40	A
	VTT	Thermal design	0	-	5	
	VDD	Peak current rating	0	-	60	
	VTT	Peak current rating	0	-	5	
Output DC Current Limit	VDD	The output behaves in latch mode when VDD rail OCP is triggered . <sup>2</sup>	68	72	76	A
	VTT	The output behaves in hiccup mode when VTT rail OCP is triggered <sup>3,4</sup>	5	8	11	
Rise time <sup>5</sup>	VDD rail		0.2	-	0.8	ms
	VTT rail		0.2	-	0.8	
Turn on Time <sup>5</sup> (Enable from remote ON/OFF)	VDD rail		1	1.6	2.2	ms
	VTT rail		1	1.6	2.2	
Output Capacitance	VDD	VDD rail recommendation: 4 x 470 µF Polymer (ESR=7mR), 24 x 10 µF Ceramic (ESR=3.5mR), 2 x 100 µF Ceramic (ESR=3.5mR).	-	2320	-	µF
	VTT	VTT rail recommendation: 8 x 10 µF Ceramic (ESR=3.5mR).	-	80	-	

- NOTE:** 1. All specifications are typical at nominal input, full load at 25°C unless noted.  
 2. Only power recycle and re-enable can clear the OCP latch.  
 3. The interval in hiccup mode is about 56mS. The OCP exit when the output current is lower than the limit.  
 4. Because Vtt output tracks half of Vdd output, the Vtt output is also latched if Vdd rail OCP is triggered.  
 5. The turn on waveform with parameter measurement locations is shown below.



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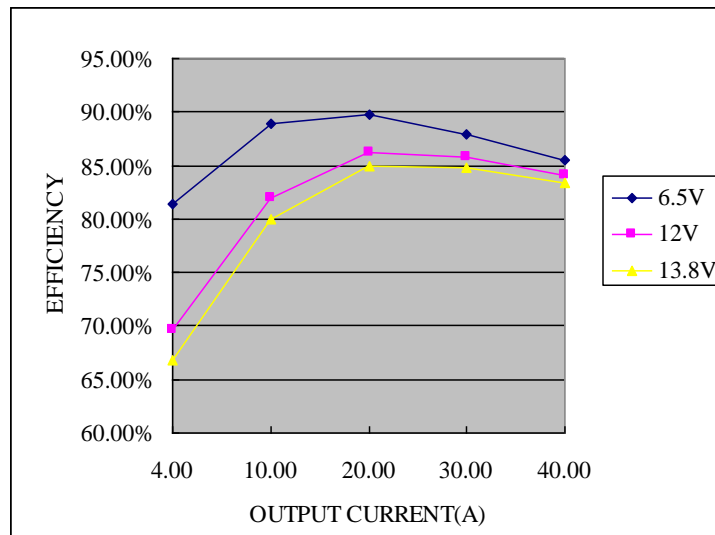
North America  
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## 5. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Efficiency	The efficiency is measured at Vin=12V, IDD=20A, ITT=3A and Ta=25°C.	-	85	-	%
Switching Frequency	VDD rail, single phase frequency	280	330	380	kHz
	VTT rail	360	410	460	
Address	VRNE-60ED10	-	2	-	-
	VRNE-60ED20	-	4	-	
address selection threshold	J1-27 maximum rating is 10V	0.5	1	1.5	V
Weight		-	23.6	-	g
Dimensions (L x W xH)		2.49 x 0.26 x 1.29			inch
		63.25 x 6.60x 32.76			mm

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

## 6. EFFICIENCY DATA



## 7. THERMAL DERATING CURVES

Maximum junction temperature of semiconductors derated to 120 °C

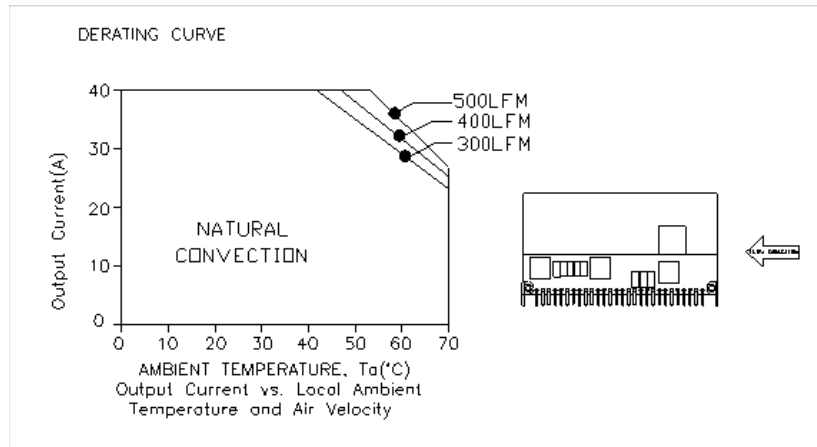


Figure 1. Derating curve under normal input

## 8. RIPPLE AND NOISE WAVEFORM

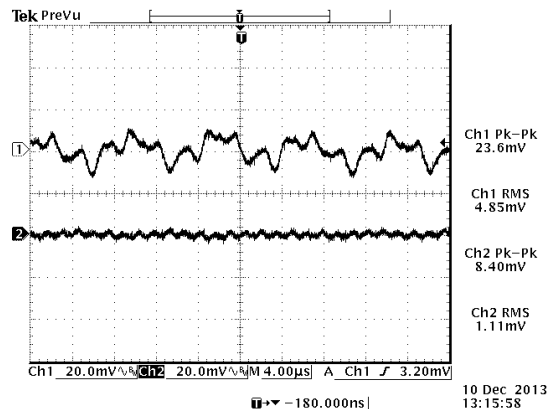


Figure . Ripple and noise at full load, 12VDC input  
1.5VDC/40A output and 0.75Vdc/5A output , Ta=25 °C

**NOTE:** The first Trace is Vtt. The second Trace is Vdd.

## 9. STARTUP & SHUTDOWN

### STARTUP TIME

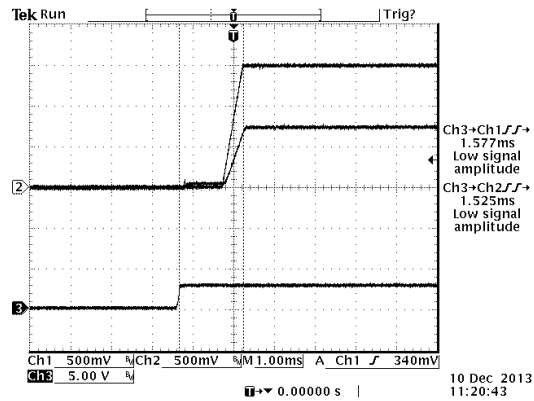


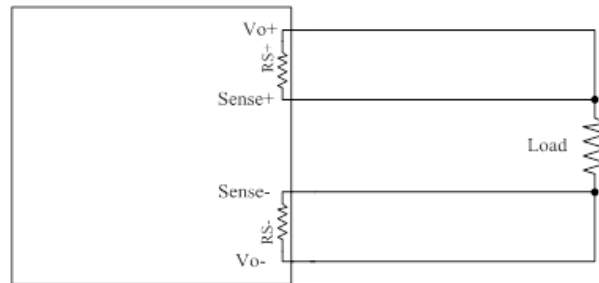
Figure . Startup from on/off  
Ch1: Vdd  
Ch2: Vtt Ch3: on/off

NOTE: Test Condition: 12Vin, Idd=40A, Itt=5A, 25°C

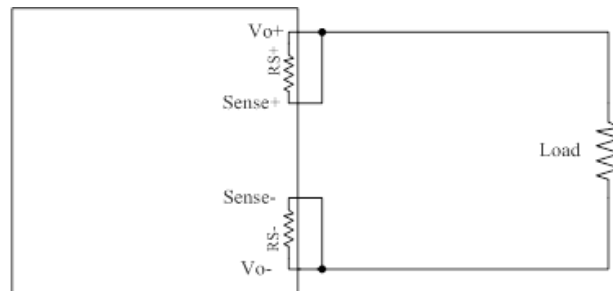
## 10. REMOTE SENSE

This module has remote sense compensation feature. It can minimize the effects of resistance between module's output and load in system layout and facilitates accurate voltage regulation at load terminals or other selected point.

1. The remote sense lines carries very little current and hence do not require a large cross-sectional area.
2. This module compensates for a maximum drop of 10% of the nominal output voltage.
3. If the unit is already trimmed up, the available remote sense compensation range should be correspondingly reduced. The total voltage increased by trim and remote sense should not exceed 10% of the nominal output voltage.
4. When using remote sense compensation, all the resistance, parasitic inductance and capacitance of the system are incorporated within the feedback loop of this module. This can make an effect on the module's compensation, affecting the stability and dyn.
5. Recommend the connection of remote sense compensation as below figure. There are a resistor  $RS+$  ( $10\ \Omega$ ) from  $Vo+$  to  $Sense+$  and a resistor  $RS-$  ( $10\ \Omega$ ) from  $Vo-$  to  $Sense-$  inside of this module.



6. If not using remote sense compensation, please connect sense directly to output at module's pin, that is, connect sense+ to  $Vo+$  and sense- to  $Vo-$  at module's pin, the shorter the better. See below figure.



## 11. POWER GOOD

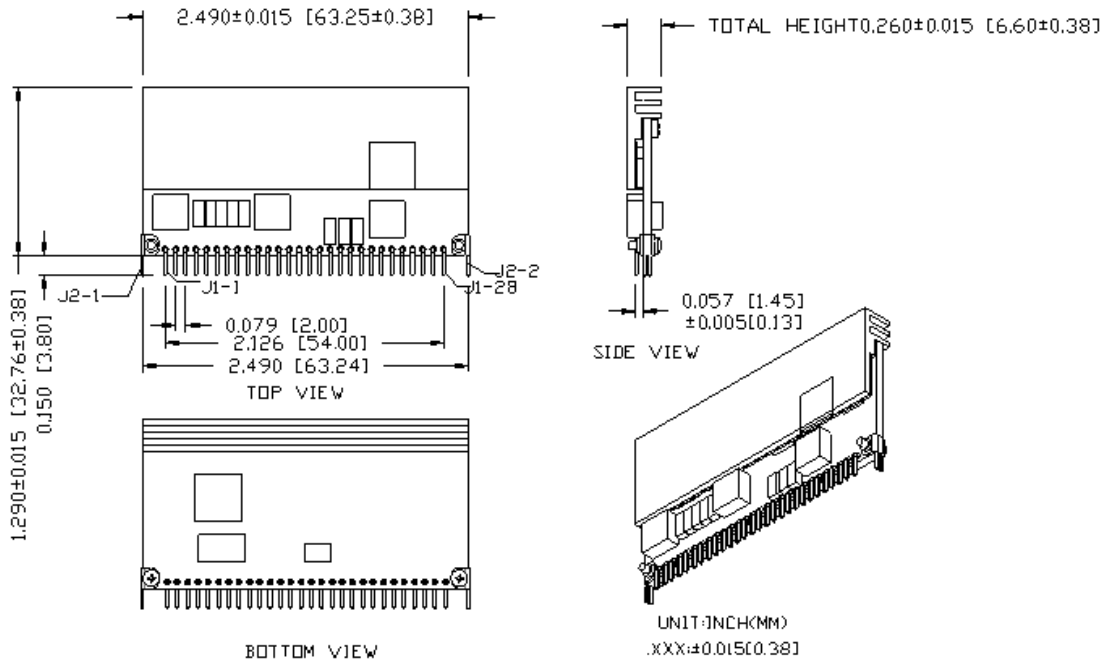
1. Each rail has a power good indicator output in this module (J1-21, J1-22), to indicate this rail is ready to supply regulated voltage. Power good pins use positive logic and are open collector.
2. For the VDD output, the signal is asserted high at the end of turn-on indicating that the output has reached the boot voltage.
3. For the VTT output, the signal is asserted high when the output is within 9% of normal output regulation point after soft start with 6% hysteresis.

PARAMETER	DESCRIPTION	MIN	TYP	MAX	UNIT
Pull-up resistor		0.95	1	1.05	k $\Omega$
Pull-up voltage		0.8	3.3	5.5	V
Sink current	Vdd rail, PowerGood=3.3V	-	-	1	$\mu$ A
	Vtt rail, PowerGood=0.8V	-	-	23	mA



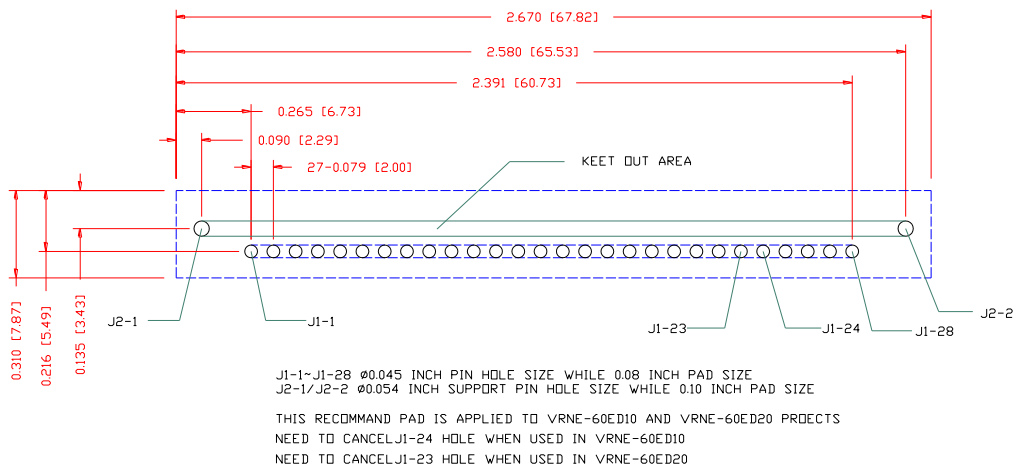
## 12. MECHANICAL OUTLINE

### VRNE-60ED10/20

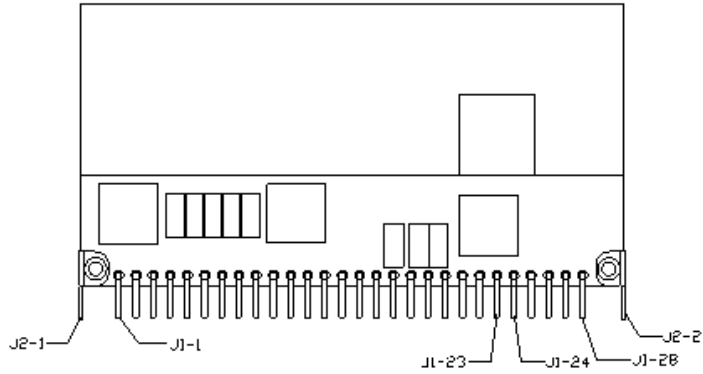


THIS MECHANICAL DRAWING IS APPLIED TO VRNE-60ED10 AND VRNE-60ED20 PROJECTS  
 NEED TO CANCEL J1-24 PIN WHEN USED IN VRNE-60ED10 PROJECT  
 NEED TO CANCEL J1-23 PIN WHEN USED IN VRNE-60ED20 PROJECT

**NOTE:** This module is recommended and compatible with Pb-Free Wave Soldering and must be soldered using a peak solder temperature of no more than 260 °C for less than 5 seconds.



RECOMMEND PAD



THIS MECHANICAL DRAWING IS APPLIED TO VRNE-60ED10 AND VRNE-60ED20 PROJECTS  
 NEED TO CANCEL J1-24 PIN WHEN USED IN VRNE-60ED10 PROJECT  
 NEED TO CANCEL J1-23 PIN WHEN USED IN VRNE-60ED20 PROJECT

PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION	PIN	FUNCTION
J1-1	Vout1-	J1-9	Vout1+	J1-17	VDD_SEN-	J1-25	VR_HOT#
J1-2	Vout1+	J1-10	Vin-	J1-18	VDD_SEN+	J1-26	ALERT#
J1-3	Vout1+	J1-11	Vin-	J1-19	VTT_SEN-	J1-27	VDIO
J1-4	Vout1-	J1-12	Vin+	J1-20	VTT_SEN+	J1-28	VCLK
J1-5	Vout1-	J1-13	Vin+	J1-21	VRRDY_VDD	J2-1	support pin
J1-6	Vout1+	J1-14	Vout2-	J1-22	VRRDY_VTT	J2-2	support pin
J1-7	Vout1-	J1-15	Vout2+	J1-23	ENABLE (VRNE-60ED10) No Pin (VRNE-60ED20)		
J1-8	Vout1+	J1-16	Vout2-	J1-24	No Pin (VRNE-60ED10) ENABLE (VRNE-60ED20)		

## 13. REVISION HISTORY

DATE	REVISION	CHANGES DETAIL	APPROVAL
2012-5-14	PA	First release	J Yan
2013-5-31	PB	Add detail information	J Yan
2013-12-18	PC	Outline, VTT ripple, VTT start up, PG	J Yan

**For more information on these products consult: [tech.support@psbel.com](mailto:tech.support@psbel.com)**

**NUCLEAR AND MEDICAL APPLICATIONS** - Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.

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