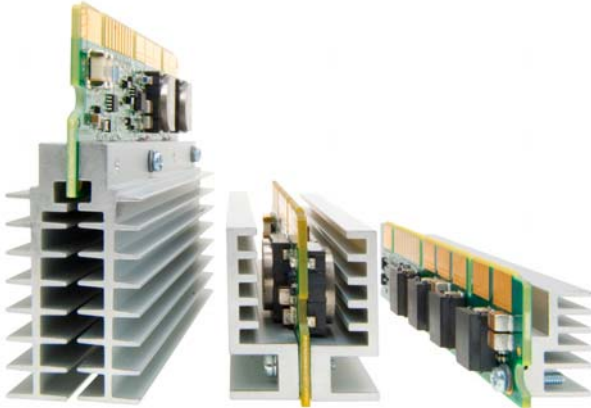


SELECTION GUIDE - STANDARD LOAD LINE					
Model	Input Voltage Range (V)	Output Voltage Range (V)	Peak Current (A)	Device Height	Application Height
VR110B150CS-1C	11.04 – 12.60	0.8375 – 1.60	150	2.5" (63.5mm)	2U
VR110B150CL-1C				1.86" (47.2mm)	1.5U
VR110B150CU-1C				1.18" (29.9mm)	1U
VR110B080CU-1C			80	1.18" (29.9mm)	1U
VR110B080CA-1C				0.78" (19.9mm)	<1U

INPUT CHARACTERISTICS - ALL MODELS					
Parameter	Conditions <sup>1</sup>	MIN.	TYP.	MAX.	Units
Input voltage operating range		11.04	12.0	12.60	V
Under voltage lockout VR110B080CA-1C only	Turn-on threshold		9.5		V
	Turn-off threshold		8.2		
	Hysteresis voltage		1.4		
Under voltage lockout All other models	Turn-on threshold		5.8		V
	Turn-off threshold		5.0		
	Hysteresis voltage		0.85		
Maximum input current	Typical: 130A, 1.325VID		15.3		A
	Max: 150A, 1.6VID			22.4	
No-load input current	Enable state, no load		300		mA
Recommended input capacitance	Sanyo 16SP270M		2		each
Disabled input current	Disabled state		40		mA
Enable - positive logic	On state range	0.9		5.0	V
	Off state range	-0.3		0.4	

OUTPUT CHARACTERISTICS - 150A Models					
Parameter	Conditions <sup>1</sup>	MIN.	TYP.	MAX.	Units
Voltage set point	7-Bit DAC controlled	0.8375		1.6	V
Line regulation		-2	0	2	mV
Load Line <sup>2</sup>		1.22	1.25	1.28	mΩ
Ripple & noise <sup>3</sup>	20MHz bandwidth		6.4		mVp-p
Current operating range		0		150	A
Efficiency for 11.0 TDC	I <sub>O</sub> = 130A, VID = 1.325	83	84		%
Turn-on time	V <sub>IN</sub> present: enable to 90% V <sub>OUT</sub>		4	10	mS
Transient response <sup>4</sup>	100A step, 100A/μS, ΔV <sub>O</sub> , Adj	120	125	130	mV
Remote sense <sup>5</sup>	Compensation range			300	mV
Recommended ceramic <sup>6</sup>	Murata GRM Series or equivalent		50		each
Recommended bulk output	UCC 4PS560MH11 or equivalent		17		

OUTPUT CHARACTERISTICS - 80A Models					
Parameter	Conditions <sup>1</sup>	MIN.	TYP.	MAX.	Units
Voltage set point	7-Bit DAC controlled	0.8375		1.6	V
Line regulation VR110B080CU-1C VR110B080CA-1C		-2	0	2	mV
		-4	0	3	mV
Load Line <sup>2</sup>		1.22	1.25	1.28	mΩ
Ripple & noise <sup>3</sup>	20MHz bandwidth		6.4		mVp-p
Current operating range		0		80	A
Efficiency for 11.0 TDC VR110B080CU-1C VR110B080CA-1C	I <sub>O</sub> = 40A, VID = 1.325	83	84		%
	I <sub>O</sub> = 40A, VID = 1.325	86	88		%
Turn-on time	V <sub>IN</sub> present: enable to 90% V <sub>OUT</sub>		4	10	mS
Transient response <sup>4</sup>	40A step, 100A/μS, ΔV <sub>O</sub> , Adj	45	50	55	mV
Remote sense <sup>5</sup>	Compensation range			300	mV
Recommended ceramic <sup>6</sup>	Murata GRM Series or equivalent	46	50		Each
Recommended bulk output	UCC 4PS560MH11 or equivalent	10	17		



## DESCRIPTION

The VR110 Series is designed to meet the fast load transients required by Intel® Xeon® processors and is fully compliant with the latest Intel® VRM 11.0 specifications. High efficiency of 84% at full load for reduced power dissipation simplifies system thermal management. Available in 2U, 1.5U, 1U and new 0.66U form factors, the VR110 Series is ideal for use in a wide variety of server applications.

## FEATURES

- Intel® VRM 11.0 compliant
- 4 height options 2.5", 1.86", 1.18" and 0.78" (63.5mm, 47.2mm, 29.9mm and 19.9mm)
- DAC programmable output voltage
- Power good output signal
- Differential remote sense
- Remote enable
- Supervisory functions
  - Output overcurrent
  - Short circuit protection
  - Overtemperature indicator
  - Output current level indicator
- Tri-state output when disabled
- Dynamic VID capability
- EN/IEC60950-1 Safety Approval (CB Report)



GENERAL CHARACTERISTICS					
Parameter	Conditions <sup>1</sup>	MIN.	TYP.	MAX.	Units
Operating temperature range		0		65	°C
Storage temperature range	Non-condensing	-40		85	
Semiconductor junction	Package rated to 150°C				
MTBF 150A models 80A models	Calculated (RAC PRISM) 45°C			1.097 1.118	x10 <sup>6</sup> Hrs
Switching frequency	Per phase		300		KHz
Material flammability		UL 94V-0			
Safety Agency Approval	IEC/EN60950-1	VDE REG.-Nr. C663/CB Certificate #DE1-39070			

MECHANICAL CHARACTERISTICS					
Parameter	Form Factor	Part Number	US (L x W x H)	Metric (L x W x H)	
Dimensions	2U	VR110B150CS-1C	3.8" x 0.870" x 2.5"	96.52mm x 22.10mm x 63.50mm	
	1.5U	VR110B150CL-1C	3.8" x 1.0" x 1.86"	96.52mm x 24.50mm x 47.24mm	
	1U	VR110B150CU-1C	3.8" x 0.870" x 1.18"	96.52mm x 22.10mm x 29.97mm	
	1U	VR110B080CU-1C	3.8" x 0.475" x 1.18"	96.52mm x 0.475mm x 29.97mm	
	0.66U	VR110B080CA-1C	3.675" x 0.75" x 0.782"	93.35mm x 19.05mm x 19.86mm	
Parameter	Form Factor	Part Number	US (oz)	Metric (g)	
Weight	2U	VR110B150CS-1C	3.53	100	
	1.5U	VR110B150CL-1C	3.0	85	
	1U	VR110B150CU-1C	3.0	85	
	1U	VR110B080CU-1C	1.06	30	
	0.66U	VR110B080CA-1C	TBD	TBD	

PROTECTION CHARACTERISTICS – 150A Models					
Parameter	Conditions <sup>1</sup>	MIN.	TYP.	MAX.	Units
Output overcurrent shutdown	Latching	160		190	A
Overvoltage shutdown	Latching, above VID		200		mV
Overtemperature indicator	Non-latching, at hot spots		125		°C
	Worst case junction temperature				
Load indicator 150A	VID = 1.325	0A load	0.0	0.22	V
		75A load	0.9	1.2	
		150A load	1.7	2.4	

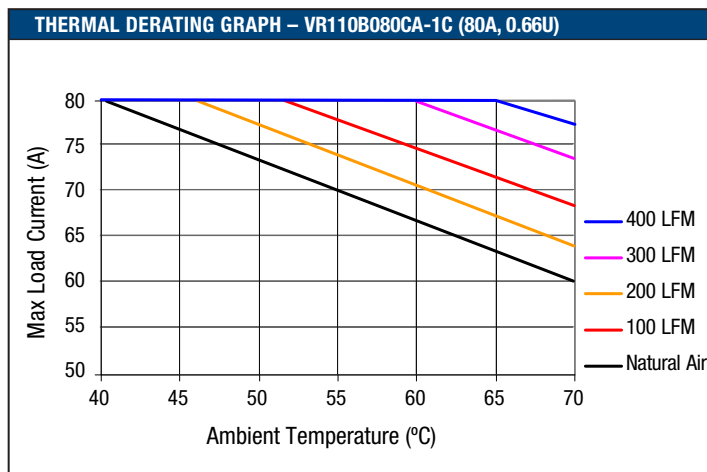
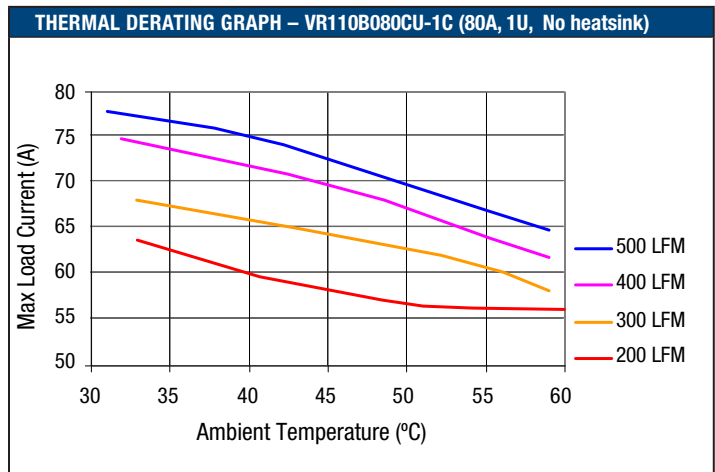
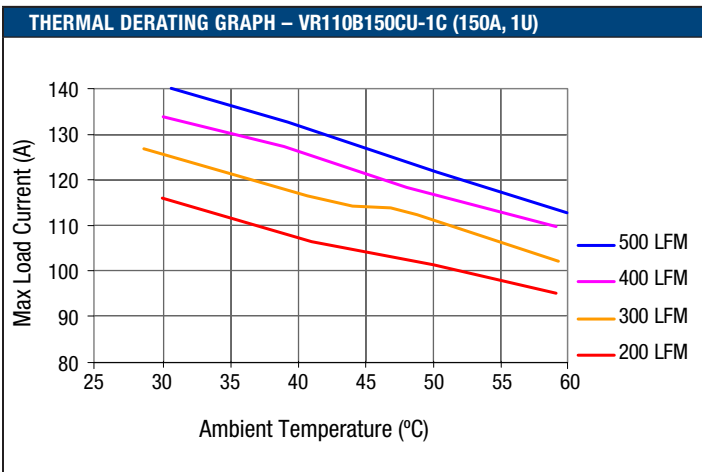
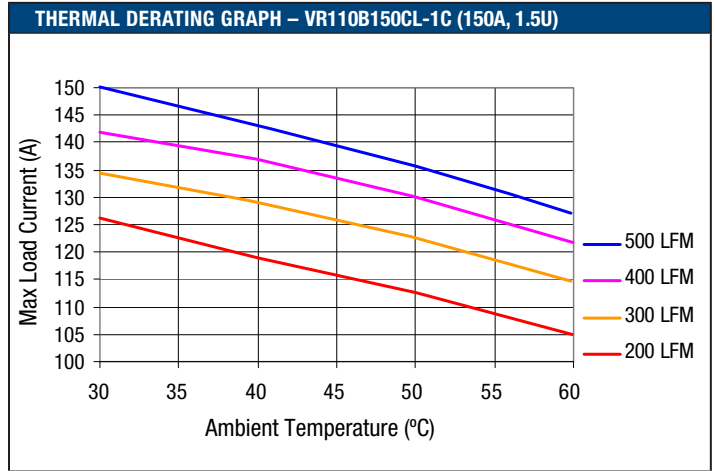
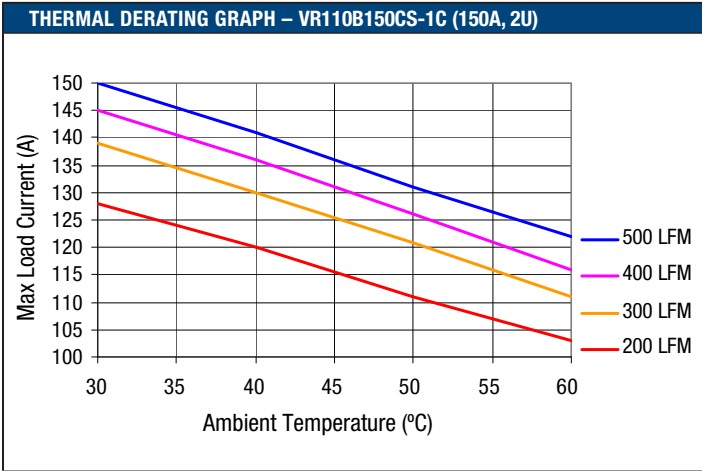
PROTECTION CHARACTERISTICS – VR110B080CU-1C (80A, 1U, No heatsink)					
Parameter	Conditions <sup>1</sup>	MIN.	TYP.	MAX.	Units
Output overcurrent shutdown	Latching	100		120	A
Overvoltage shutdown	Latching, above VID		200		mV
Overtemperature indicator	Non-latching, at hot spots		125		°C
	Worst case junction temperature				
Load indicator 80A	VID = 1.325	0A load	0.0	0.22	V
		40A load	0.9	1.2	
		80A load	1.7	2.4	

PROTECTION CHARACTERISTICS – VR110B080CA-1C (80A, 0.66U)					
Parameter	Conditions <sup>1</sup>	MIN.	TYP.	MAX.	Units
Output overcurrent shutdown	Non-latching	100		120	A
Overvoltage shutdown	Non-latching, above VID		175		mV
Overtemperature indicator	Non-latching, at hot spots		125		°C
	Worst case junction temperature				
Load indicator 80A	VID = 1.325	0A load	0.02	0.17	V
		40A load	0.55	0.75	
		80A load	1.1	1.5	

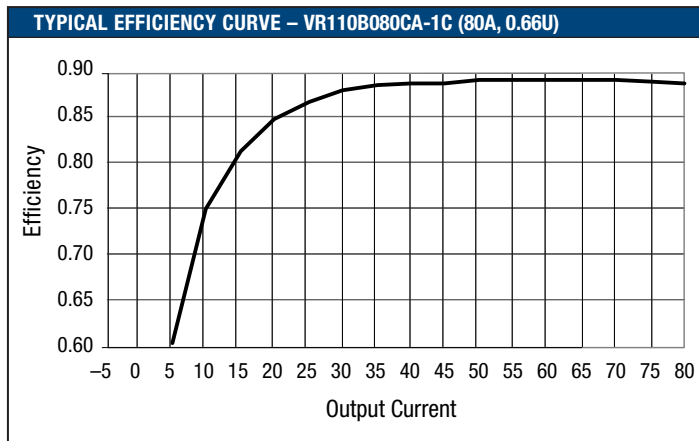
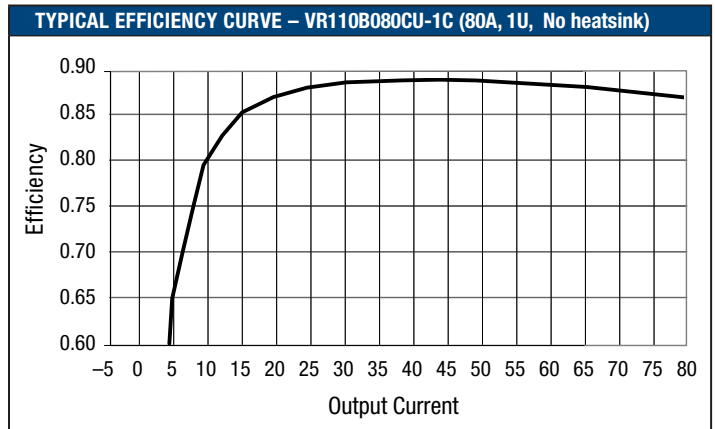
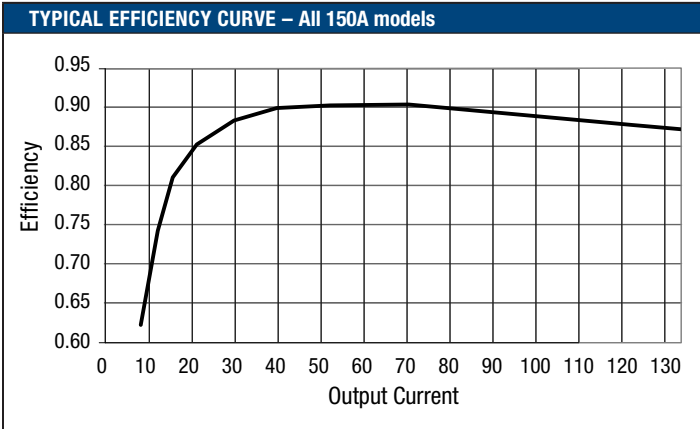
#### NOTES

- V<sub>IN</sub> = 12Vdc, T<sub>A</sub> = 25°C, Airflow = 400LFM unless otherwise noted.
- The output impedance is 1.25mΩ.
- Output ripple voltage is specified when measured with Intel® specified capacitance at the output of the converter.
- Transient response is specified with Intel® specified capacitors at the output of the converter.
- If remote sense is not required or used, the Sense(+) and Sense(-) pins must be connected to Vo(+) and Vo(-) respectively.
- 10µF ceramic X5R or X6S.
- VRM\_PRES and VRM\_ID are connected to Vss on the VRM through a 100Ω resistor.
- LLO, LL1 gives 1.25mΩ load line only.

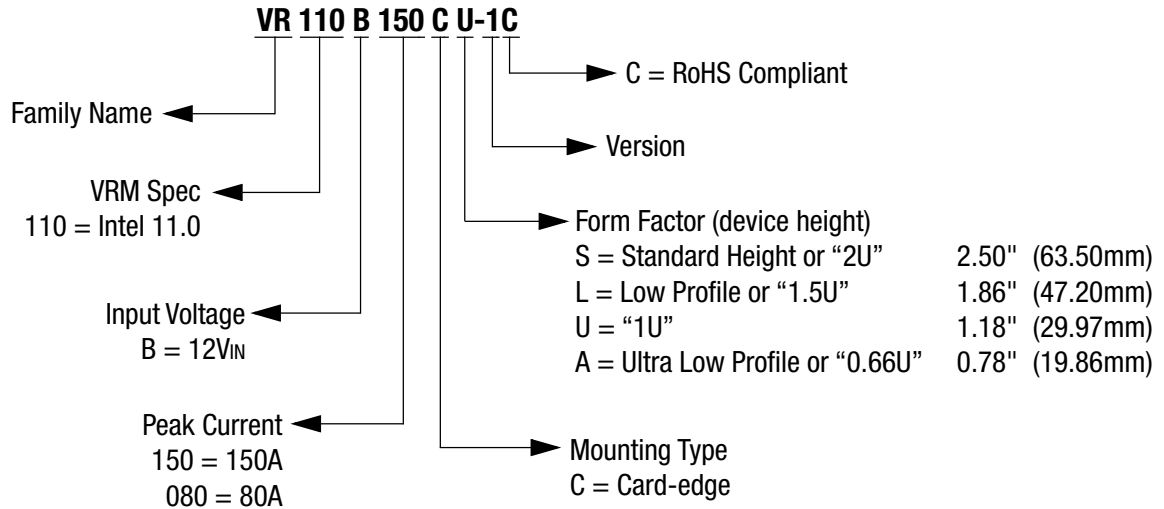
**Typical Performance Curves - Derating**  
( $V_{IN} = 12V$ ;  $V_{ID} = 1.325V$ )



**Typical Performance Curves - Efficiency**  
( $V_{IN} = 12V$ ;  $V_{ID} = 1.325V$ ;  $T_{AMB} = 25^{\circ}C$  with 400 LFM airflow)

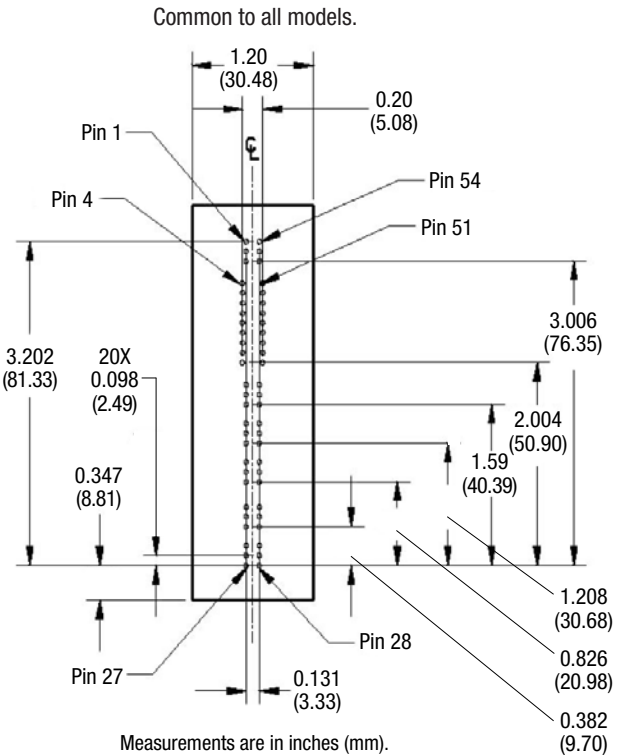


**PART NUMBER CODING**



**PACKAGE SPECIFICATIONS**

PIN ASSIGNMENT - ALL VR110 MODELS			
Pin	Signal	Pin	Signal
1	VSS	54	V <sub>IN</sub> +
2	VSS	53	V <sub>IN</sub> +
3	VSS	52	V <sub>IN</sub> +
4	VID4	51	VID3
5	VID2	50	VID1
6	VID0	49	VID5
7	VO_SEN+	48	VO_SEN-
8	PWRGD	47	VR_HOT
9	OUTEN	46 <sup>8</sup>	LLO
10	LOAD CURRENT	45 <sup>8</sup>	LL1
11	VID6	44	VID_SELECT
12 <sup>7</sup>	VRM_PRES	43 <sup>7</sup>	VRM_ID
13	VO+	42	VO+
14	VO+	41	VO+
15	VO+	40	VO+
16	VSS	39	VSS
17	VSS	38	VSS
18	VSS	37	VSS
19	VO+	36	VO+
20	VO+	35	VO+
21	VO+	34	VO+
22	VSS	33	VSS
23	VSS	32	VSS
24	VSS	31	VSS
25	VO+	30	VO+
26	VO+	29	VO+
27	VO+	28	VO+

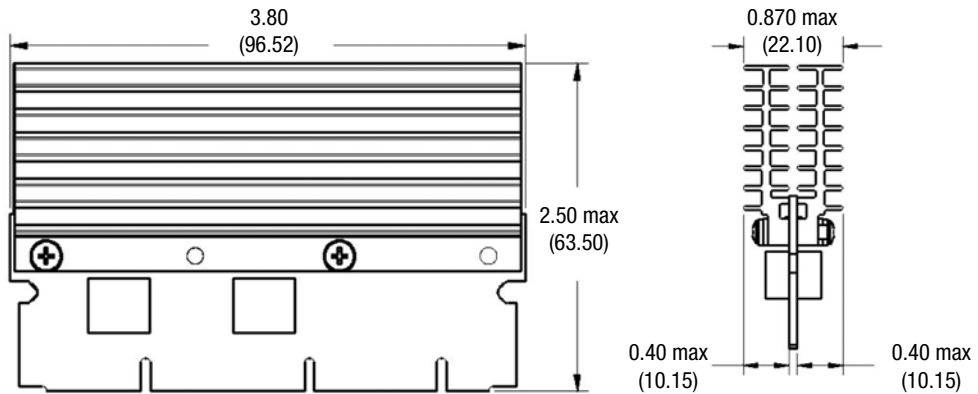


Note: Check with manufacturer for recommended PCB layout.

**Recommended Interface Connector Options**

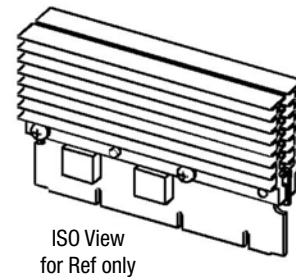
- Tyco/Elcon 281303 (Solder Tail, Long)
- 283-0172-02303 (Solder Tail, Short)
- 284-0202-03003 (Surface Mount)

**MECHANICAL DIMENSIONS – VR110B150CS-1C (150A, 2U)**

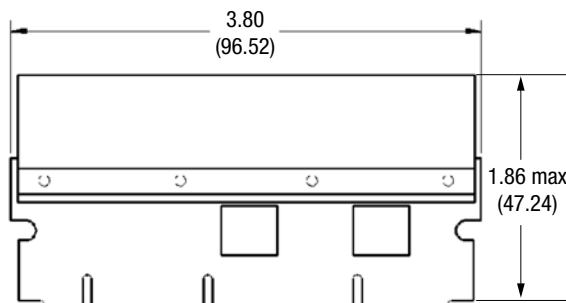


Tolerances are:  
 .x ±.10  
 .xx ±.03  
 .xxx ±.010  
 (Unless otherwise specified)  
 Dimensions in inches (mm)

Installed height  
 2.525  
 (64.14)

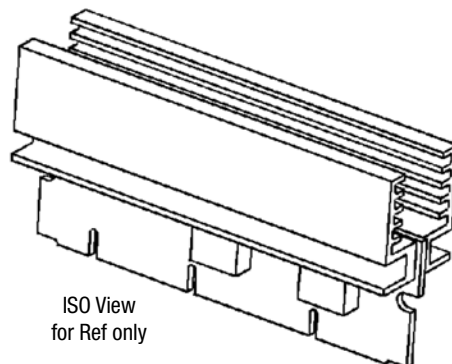
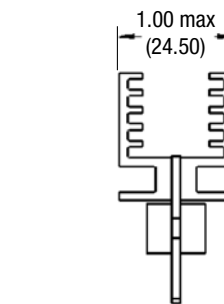


**MECHANICAL DIMENSIONS – VR110B150CL-1C (150A, 1.5U)**

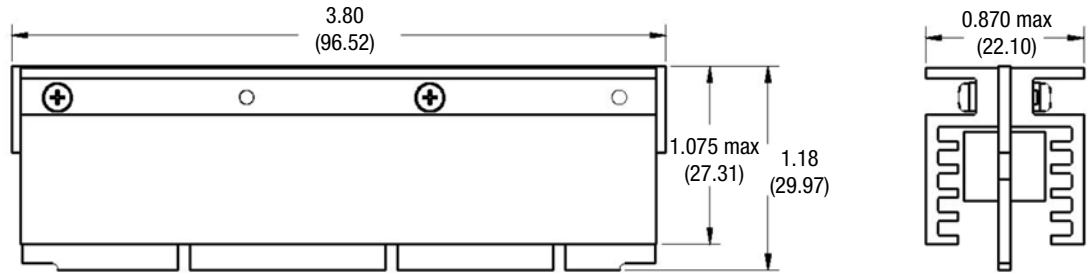


Tolerances are:  
 .x ±.10  
 .xx ±.03  
 .xxx ±.010  
 (Unless otherwise specified)  
 Dimensions in inches (mm)

Installed height  
 1.895  
 (48.13)

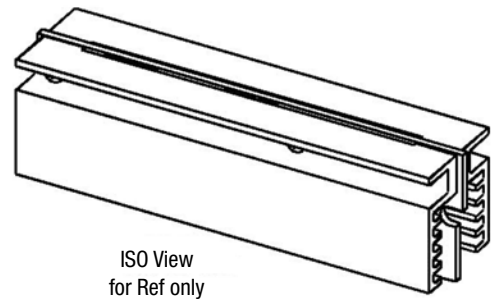


**MECHANICAL DIMENSIONS – VR110B150CU-1C (150A, 1U)**

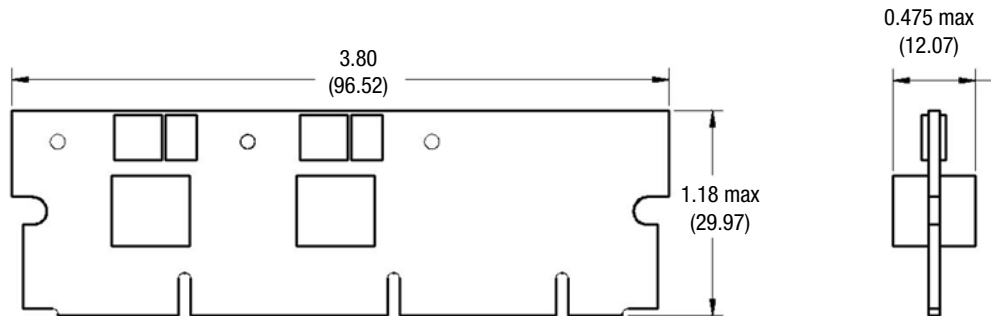


Tolerances are:  
 .x ±.10  
 .xx ±.03  
 .xxx ±.010  
 (Unless otherwise specified)  
 Dimensions in inches (mm)

Installed height  
 1.25  
 (31.75)

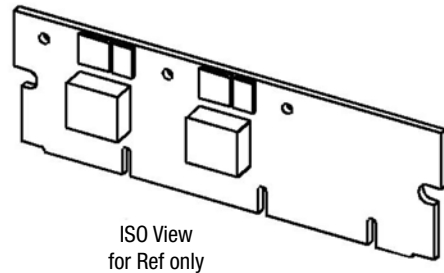


**MECHANICAL DIMENSIONS – VR110B080CU-1C (80A, 1U, No heatsink)**

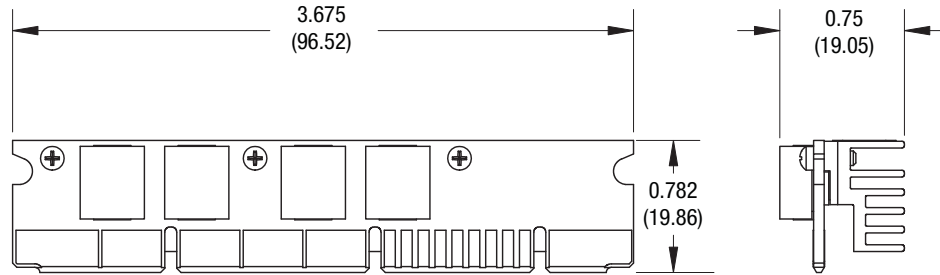


Tolerances are:  
 .x ±.10  
 .xx ±.03  
 .xxx ±.010  
 (Unless otherwise specified)  
 Dimensions in inches (mm)

Installed height  
 1.25  
 (31.75)

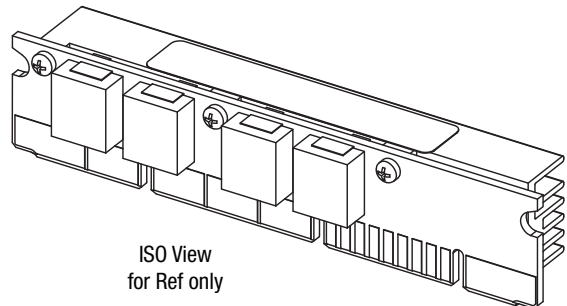


**MECHANICAL DIMENSIONS – VR110B080CA-1C (80A, 0.66U)**



Tolerances are:  
 .x ±.10  
 .xx ±.03  
 .xxx ±.010  
 (Unless otherwise specified)  
 Dimensions in inches (mm)

Installed height  
 0.807  
 (20.49)



**RoHS COMPLIANCY**

The following parts are in compliance with the European Union Directive 2002/95/EC (RoHS) with respect to the following substances: lead (Pb), cadmium (Cd), mercury (Hg), hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE).

- VR110B150CS-1C
- VR110B150CL-1C
- VR110B150CU-1C
- VR110B080CU-1C
- VR110B080CA-1C

**RoHS PROCESS NOTE**

These products are not intended to go through a reflow solder process. See recommended interface options.