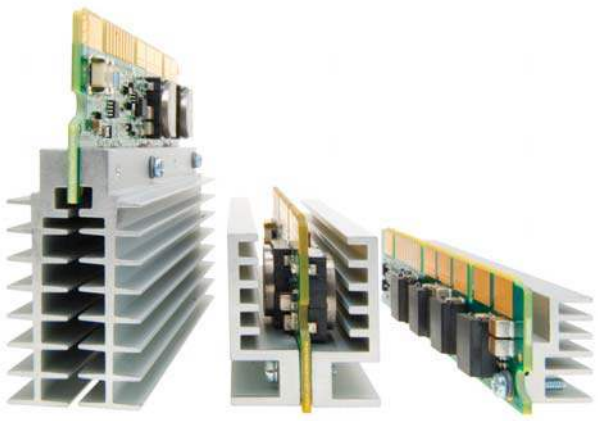
Murata Power Solutions

VR111 Series

Solutions for Intel® VRM 11.1

PRELIMINARY



DESCRIPTION

The VR111 Series is designed to meet the fast load transients required by Intel® Nehalem® processors and is fully compliant with the latest Intel® VRM 11.1 specifications. High efficiency of up to 85% at full load for reduced power dissipation simplifies system thermal management. Available in 2U, 1.5U, 1U and new 0.66U form factors, the VR111 Series is ideal for use in a wide variety of server applications.

FEATURES

- Intel® VRM 11.1 compliant
- 4 height options 2.5˝, 1.86˝, 1.18˝ and 0.78˝ (63.5mm, 47.2mm, 29.9mm and 19.9mm)
- 1.4mΩ load line version for Vcache applications
- VID 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) **PENDING**

RoHS COMPLIANT 2002/95/EC

For full details go to www.murata-ps.com/rohs

SELECTION GUIDE - STANDARD LOAD LINE

Model	Input Voltage Range (V)	Output Voltage Range (V)	Peak Current (A)	Load Line (Droop) (mΩ)	Available Heatsink / Height Options (*x*)	IMON Setting (*y*)
VR111B150C*x*-*y*C	11.04 - 12.60	0.5 - 1.60	150	0.8	1U, 1.5U, 2U	See cross-reference, page 5
VR111B100C*x*-*y*C			100	0.8	1U, 1.5U, 2U	
VR111B080CU-*y*C			80	0.8	1U	
VR111B080CA-*y*C			80	0.8	.66U	
VR11FB080CU-*y*C			80	1.4	1U	

INPUT CHARACTERISTICS - ALL MODELS

Parameter	Conditions ①	MIN.	TYP.	MAX.	Units
Input voltage operating range		11.04	12.0	12.60	V
Under voltage lockout	Turn-on threshold		7.4		V
	Turn-off threshold		6.4		
	Hysteresis voltage		1.0		
Maximum input current - 150A	Typical: 110A, 1.1VID		11.9		A
	Max: 150A, 1.6VID			26.3	
Maximum input current - 80A	Typical: 60A, 1.1VID		6.5		A
	Max: 80A, 1.6VID			14.5	
No-load input current	Enable state, PSI asserted		70		mA
Recommended input capacitance	OSCON 270 µF, 16V Bulk		4		each
	4.7 µF, 16V Ceramic ④		4		
Disabled input current	Disabled state		55		mA
Enable - positive logic	On state range	0.92		5.0	V
	Off state range	0		0.4	

OUTPUT CHARACTERISTICS - 150A Models

Parameter	Conditions ①	MIN.	TYP.	MAX.	Units
Voltage set point	8-Bit DAC controlled	0.5		1.6	V
Line regulation		–2.5	0	2.5	mV
Load Line (Droop) ②		0.77	0.8	0.83	mΩ
Ripple & noise ③	20MHz bandwidth		6.4		mVp-p
Current operating range		0		150	A
Efficiency for 11.1 TDC	IO = 110A, 1.1VID		83		%
Power Dissipation	VID = 1.1, 4 to 22A, PSI asserted			5	W
Turn-on time	VIN present: enable to 90% VOUT		4	10	mS
Transient response - overshoot ④	104A step, 110A/µS, 1.1 Vout			50	mV
Transient response-time ④	104A step, 110A/µS, 1.1 Vout			25	µS
Remote sense ⑤	Compensation range			300	mV
Recommended output capacitance	10µF, 4V Ceramic ⑥		49		each
	22µF, 6.3V Ceramic ⑥		5		
	560µF, 2.5V, Oscon		4		

OUTPUT CHARACTERISTICS - 80A Models

Parameter	Conditions ①	MIN.	TYP.	MAX.	Units
Voltage set point	8-Bit DAC controlled	0.5		1.6	V
Line regulation		–2	0	2	mV
Load Line (Droop) ②					
VR111B080C<u>x</u>-C		0.77	0.8	0.83	mΩ
VR11FB080CE-C		1.37	1.40	1.43	mΩ
Ripple & noise ③	20MHz bandwidth		6.4		mVp-p
Current operating range		0		80	A
Efficiency for 11.1 TDC	IO = 60A, VID = 1.1		85		%
Power Dissipation	VID = 1.1, 4 to 20A PSI asserted			5	W
Turn-on time	VIN present: enable to 90% VOUT		4	10	mS
Transient response - overshoot ④	59A step, 300A/µS, 1.1 Vout			50	mV
Transient response-time ④	59A step, 300A/µS, 1.1 Vout			25	µS
Remote sense ⑤	Compensation range			300	mV
Recommended output capacitance	47µF, 4V Ceramic ⑥		26		each
	22µF, 4V Ceramic ⑥		12		
	330µF, 2V, 6mΩ bulk		3		

GENERAL CHARACTERISTICS					
Parameter	Conditions ①	MIN.	TYP.	MAX.	Units
Operating temperature range		0		65	ºC
Storage temperature range	Non-condensing	–40		85	
Semiconductor junction	Package rated to 150ºC				
MTBF 150A models 80A models	Calculated (RAC PRISM) 25ºC			1.36	x10⁶ Hrs
Switching frequency	Per phase		440		KHz
Material flammability		UL 94V-0			
Safety Agency Approval	IEC/EN60950-1	Pending			

MECHANICAL CHARACTERISTICS – TYPICAL				
Parameter	Form Factor	Part Number	US (L x W x H)	Metric (L x W x H)
Dimensions	2U	VR111B150CS-*y*C	3.8"x 0.85" x 2.41"	96.45mm x 21.6mm x 61.15mm
	1.5U	VR111B150CL-*y*C	3.8" x 0.92" x 1.87"	96.45mm x 23.37mm x 47.42mm
	1U	VR111B150CU-*y*C	3.8" x 0.92" x 1.187"	96.45mm x 23.37mm x 30.15mm
	1U	VR111B100CU-*y*C	3.8" x 0.92" x 1.187"	96.45mm x 23.37mm x 30.15mm
	1U	VR111B080CU-*y*C	3.8" x 0.46" x 1.187"	96.45mm x 11.7mm x 30.15mm
	1U	VR11FB080CE-*y*C	3.8" x 0.49" x 1.187"	96.45mm x 11.7mm x 30.15mm
	0.66U	VR111B080CA-*y*C	3.675" x 0.74" x 0.782"	93.35mm x 18.7mm x 19.87mm
Parameter	Form Factor	Part Number	US (oz)	Metric (g)
Weight	2U	VR111B150CS-*y*C	3.6	102
	1.5U	VR111B150CL-*y*C	2.75	78
	1U	VR111B150CU-*y*C		
	1U	VR111B100CU-*y*C		
	1U	VR111B080CU-*y*C	0.9	26
	1U	VR11FB080CE-*y*C	1.41	40
	0.66U	VR111B080CA-*y*C	1.40	39

PROTECTION CHARACTERISTICS – 150A Models						
Parameter	Conditions ①		MIN.	TYP.	MAX.	Units
Output overcurrent shutdown	Hiccup mode			160	190	A
Overvoltage shutdown	Non-latching, above VID			175		mV
Overtemperature indicator	Non-latching, at hot spots			125		ºC
	Worst case junction temperature					
Load indicator (IMON) ⑦	VID = 1.1	0A load	0		203	mV
		75A load	375		439	
		180A load	900		1035	

PROTECTION CHARACTERISTICS – 80A Models						
Parameter	Conditions ①		MIN.	TYP.	MAX.	Units
Output overcurrent shutdown	Hiccup mode			90	104	A
Overvoltage shutdown	Non-latching, above VID			175		mV
Overtemperature indicator	Non-latching, at hot spots			125		ºC
	Worst case junction temperature					
Load indicator (IMON) ⑦	VID = 1.1	0A load	0		203	mV
		40A load	450		518	
		80A load	900		1035	

NOTES

① Vin = 12Vdc, Ta = 25ºC, Airflow = 400LFM unless otherwise noted.

② The output impedance for VRM 11.1 models (VR111 Series) powering V_{CORE} is 0.8mΩ. VR11FB080CE-C is designed to power V_{CACHE}, which requires 1.4mΩ.

③ Output ripple voltage is specified when measured with Intel® specified capacitance at the output of the converter.

④ Transient response is specified with Intel® specified capacitors at the output of the converter. See recommended output capacitance.

⑤ If remote sense is not required or used, the Sense(+) and Sense(–) pins must be connected to Vo(+) and Vo(–) respectively.

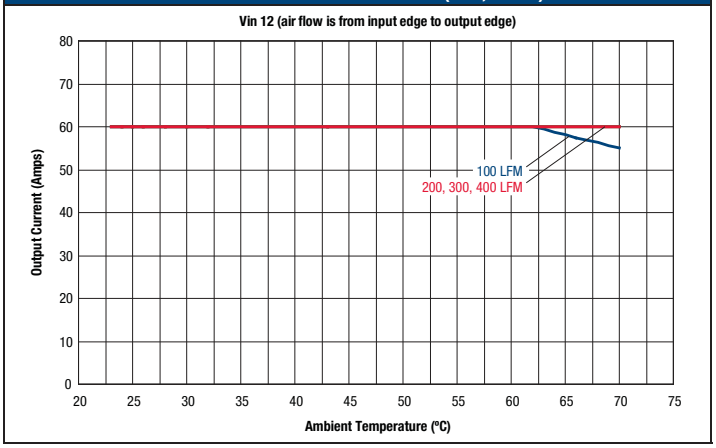
⑥ Murata GRM Series or equivalent.

⑦ All specifications are based on the requirements detailed in the Intel® Design Guideline for VRM 11.1: Document # 321736, Rev 001.

Typical Performance Curves - Derating

(V_{IN} = 12V; VID = 1.1V)

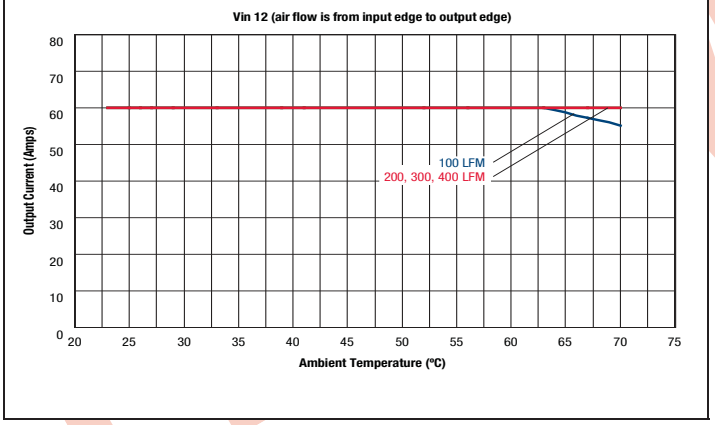
THERMAL DERATING GRAPH – VR111B080CA-C (80A, 0.66U)



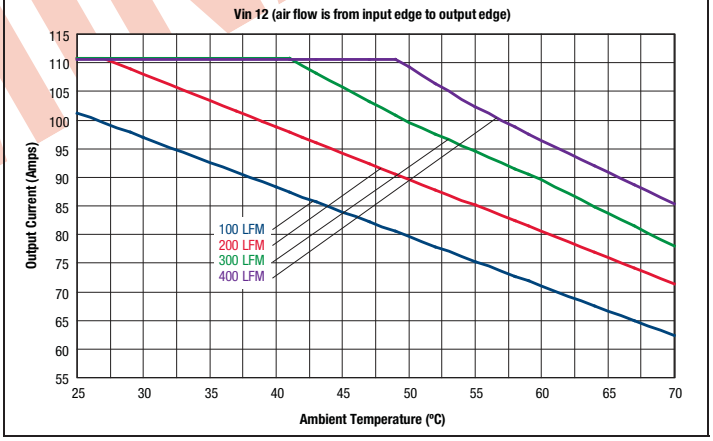
THERMAL DERATING GRAPH – VR111B080CU-C (80A, 1U, No heatsink)

TBD

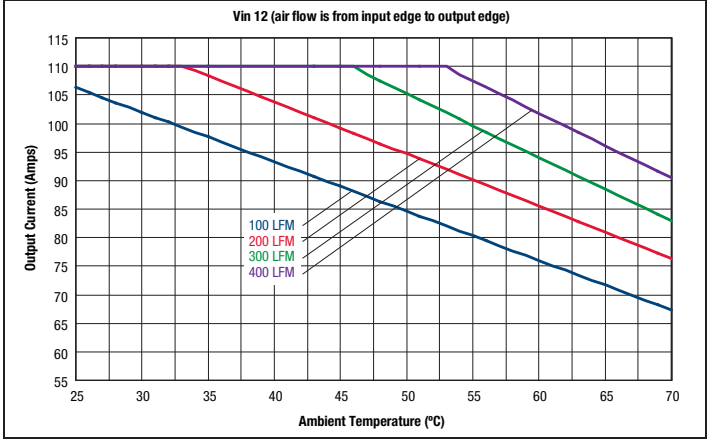
THERMAL DERATING GRAPH – VR11FB080CE-C (80A, 1U, HEAT BARS)



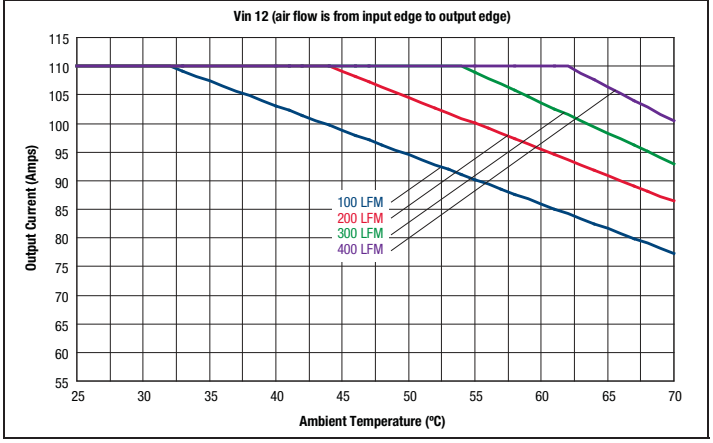
THERMAL DERATING GRAPH – VR111B150CU-C (150A, 1U)



THERMAL DERATING GRAPH – VR111B150CL-C (150A, 1.5U)



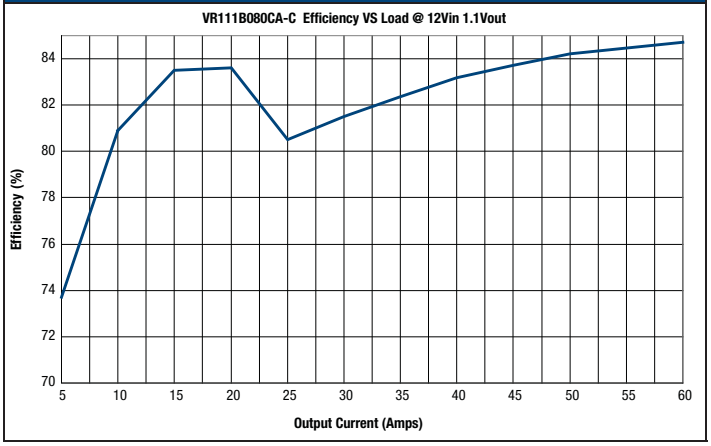
THERMAL DERATING GRAPH – VR111B150CS-C (150A, 2U)



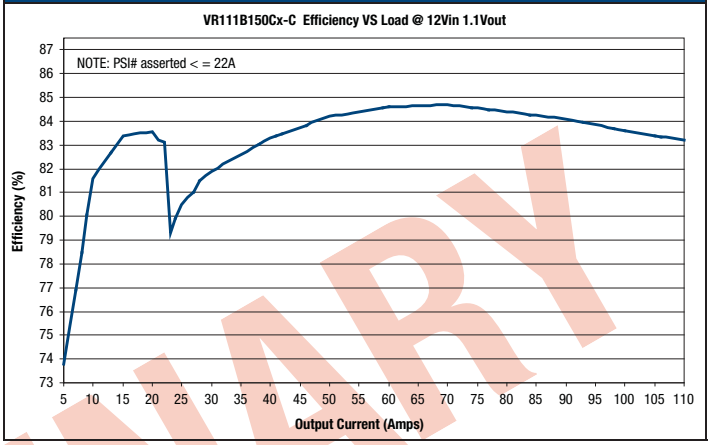
Typical Performance Curves - Efficiency

(V_{IN}= 12V; VID = 1.1V; T_{AMB} = 25°C with 400 LFM airflow)

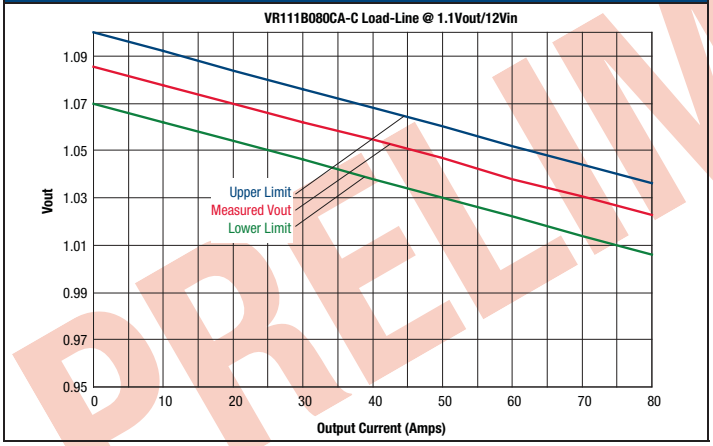
TYPICAL EFFICIENCY CURVE – 80A models



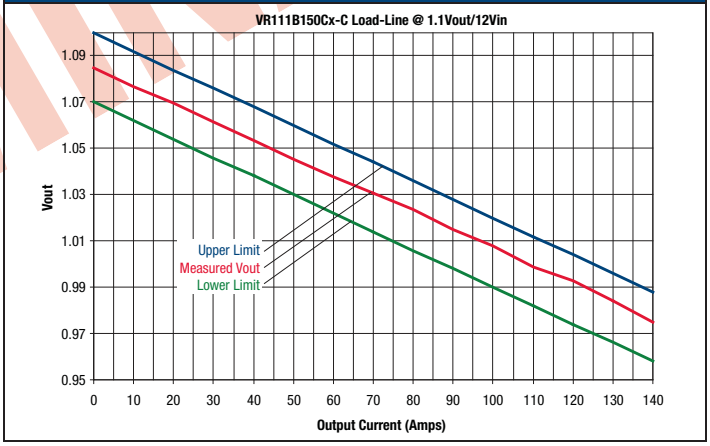
TYPICAL EFFICIENCY CURVE – All 150A models



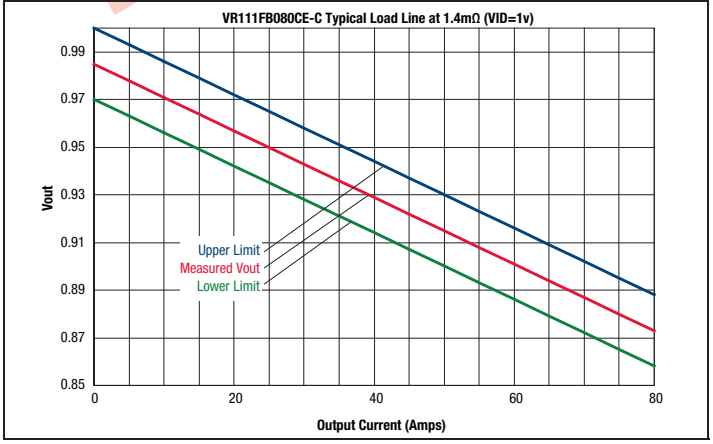
LOAD LINE (DROOP) 80A MODELS WITH VR111 PREFIX



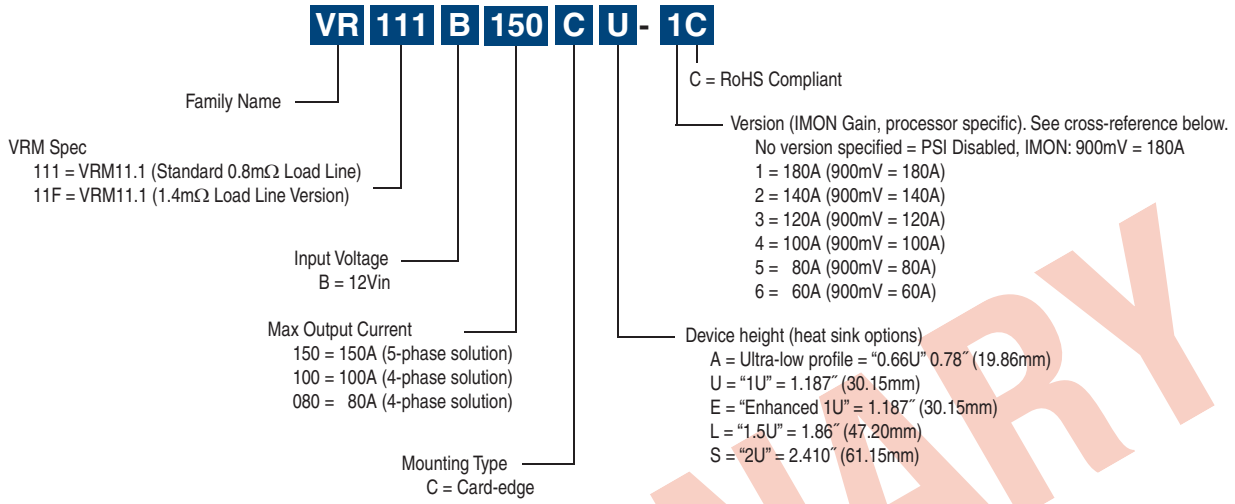
LOAD LINE (DROOP) 150A MODELS



LOAD LINE (DROOP) VR11FB080CE-C 80A 1.4mΩ



PART NUMBER CODING



INTEL® PROCESSOR CROSS-REFERENCE

Nehalem, Westmere and Xeon® 5500 Series Processors

Processor (Vcore)	ICCTDC (A)	ICCMAX (A)	TDP (W)	IMON Gain (slope) 900mV = Imax	VID Setting [5:3]	Base Murata-Ps Part Number
Intel Xeon Processor 5500 Series / Westmere-EP130W SKU / Nehalem-EP 130W SKU	110	150	130	900mV = 180A	111b	VR111B150Cx-1C
Westmere-EX 130W SKU see the latest PDG	110	140	130	900mV = 140A	110b	VR111B150Cx-2C
Intel Xeon Processor 5500 Series (Nehalem-EP) 95W SKU	85	120	95	900mV = 120A	101b	VR111B150Cx-3C
Westmere-EP 95W SKU	101	120	95	900mV = 120A	101b	
Nehalem-EX 130W SKU see the latest PDG	105	120	130	900mV = 120A	101b	
Intel Xeon Processor 5500 Series (Nehalem-EP 80W) / Westmere-EP 80W SKU	70	100	80	900mV = 100A	100b	VR111B100CU-4C VR111B150Cx-4C
Nehalem-EX / Westmere-EX 105W SKU see the latest PDG	85	95	105	900mV = 100A	100b	
Nehalem-EX / Westmere-EX 95W SKU see the latest PDG	85	95	95	900mV = 100A	100b	
Intel Xeon Processor 5500 Series (Nehalem-EP 60W) / Westmere-EP 60W SKU	60	80	60	900mV = 80A	011b	VR111B080Cx-5C
Intel Xeon Processor 5500 Series / Westmere-EP 38W SKU	28	40	38	900mV = 40A	001b	TBD

Jasper Forest Series Processors

Processor (Vcore)	ICCTDC (A)	ICCMAX (A)	TDP (W)	IMON Gain (slope) 900mV = Imax	VID Setting [5:3]	Base Murata-Ps Part Number
SKU1	70	100	85	?	?	VR111B100CU-4C VR111B150CU-4C
SKU2			Not Defined			
SKU3			85			
SKU4			65			
SKU5			60			
SKU6			65			
SKU7	39	54	48			VR111B080Cx-5C VR111B080Cx-6C
SKU8			Not Defined			
SKU9			50			
SKU10	20	24	32			TBD
SKU11	10	11	23			TBD

MECHANICAL DIMENSIONS – ALL MODELS

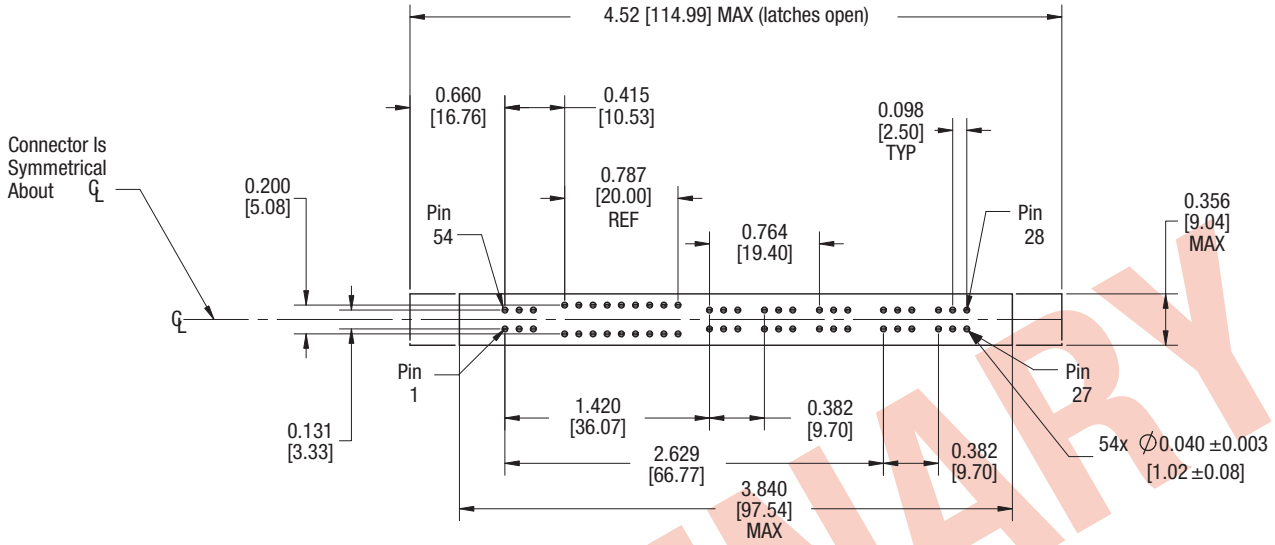


Figure 1. Connector Footprint (Thru-Hole Connector) Viewed From VRM (Top) Side

Recommended Mating Connectors

Tyco 1651826-1 (Vertical, 0.18" Solder Tail, Long)
1651929-1 (Vertical, 0.12" Solder Tail, Short)
1766336-1 (Vertical, Surface Mount)
1766436-1 (Vertical, Compliant Pin)

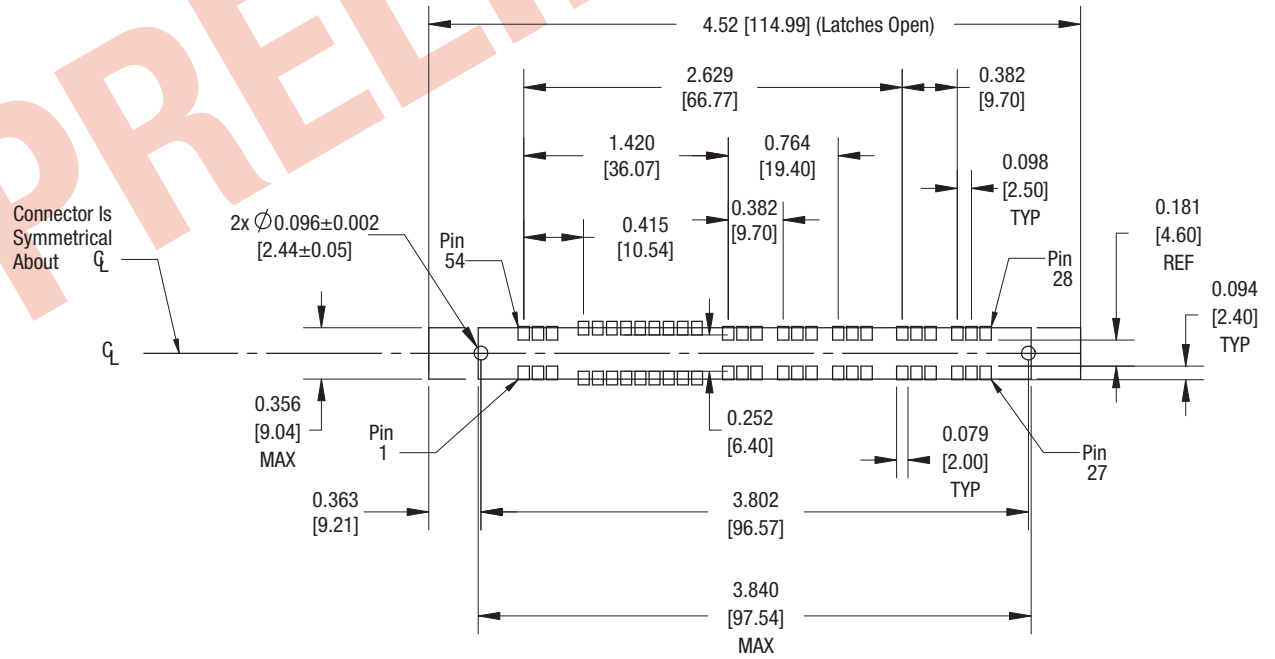


Figure 2. Connector Footprint (Surface Mount Connector) Viewed From VRM (Top) Side

Dimensions are in inches [mm]

Tolerances (Unless otherwise Specified)
X.XX ±.02 (±0.5mm)
X.XXX ±.010 (±0.25mm)

THIRD ANGLE PROJECTION

MECHANICAL DIMENSIONS

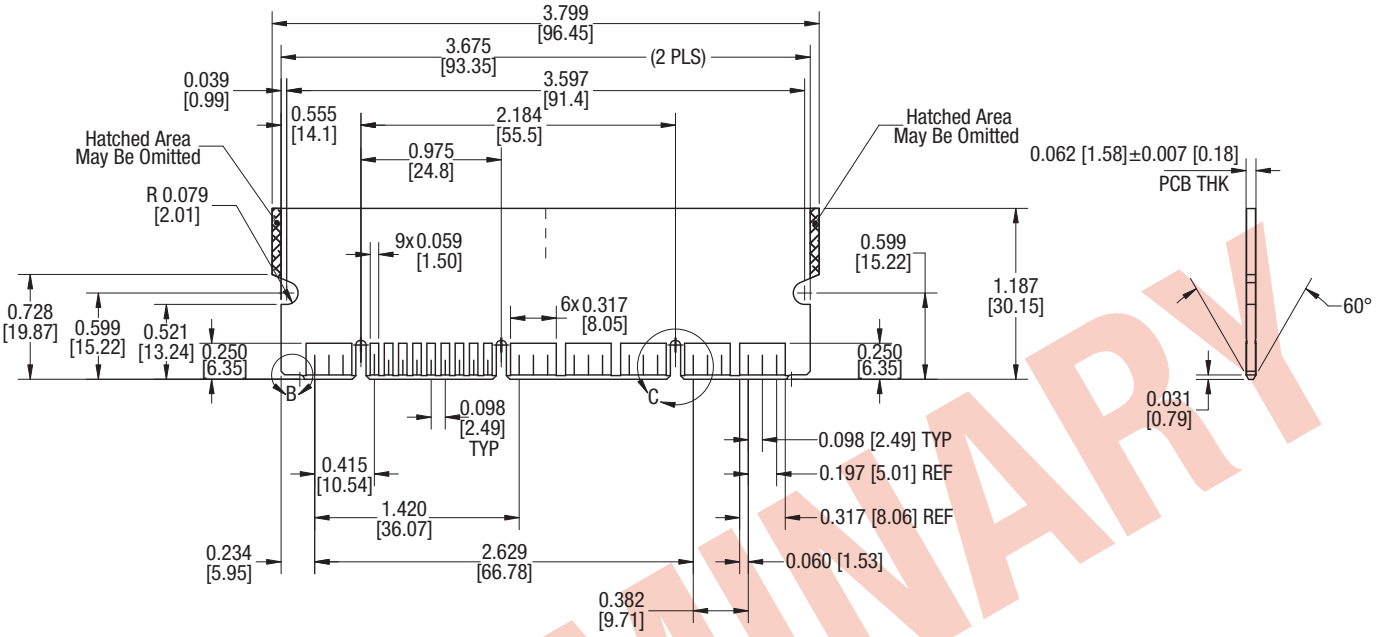


Figure 3. Circuit Board Outline (1U and taller)

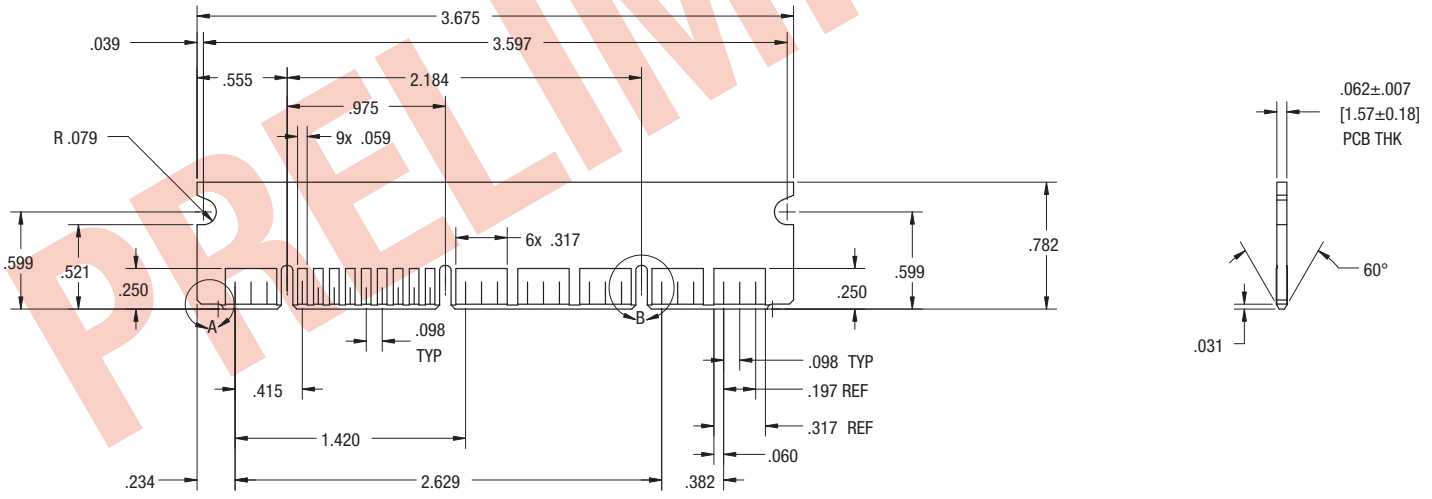


Figure 4. Circuit Board Outline (low profile 0.66U)

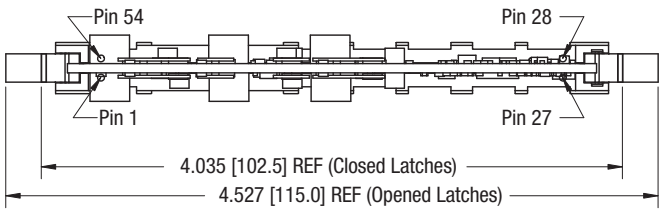


Figure 5. Top View (shown without heat sinks)

Dimensions are in inches [mm]

Tolerances (Unless otherwise Specified)
X.XX ±.02 (±0.5mm)
X.XXX ±.010 (±0.25mm)

THIRD ANGLE PROJECTION

MECHANICAL DIMENSIONS

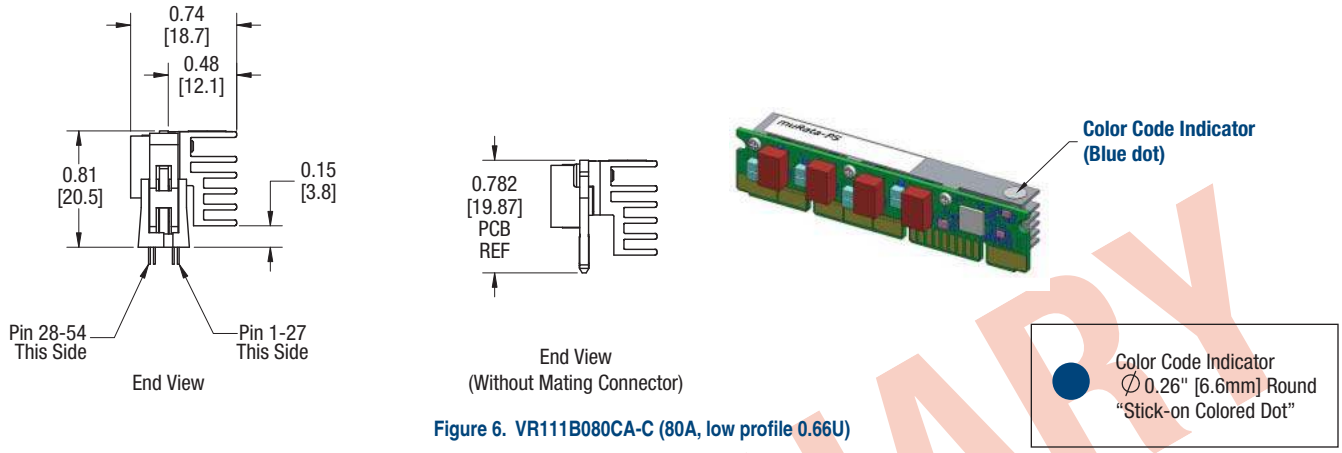


Figure 6. VR111B080CA-C (80A, low profile 0.66U)

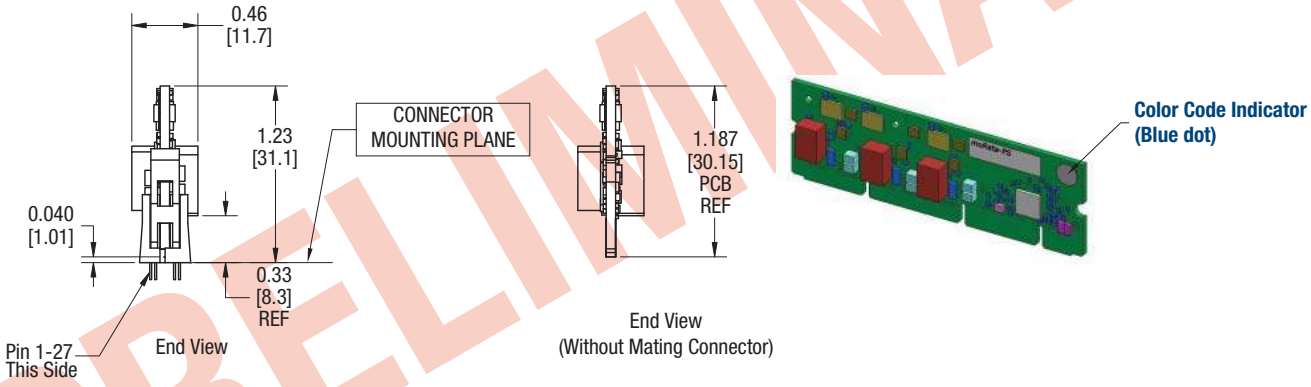


Figure 7. VR111B080CU-C (80A, 1U, no heatsink)

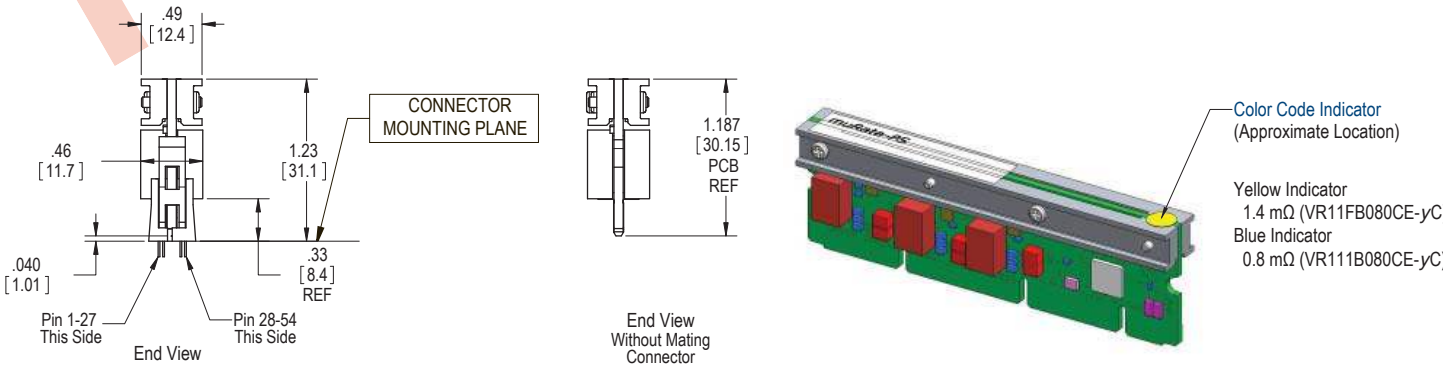


Figure 8. VR11FB080CE-C (80A, 1U, with heat bars)

Notes

A. Characters are shown on labels only to depict orientation.

B. Locations of color code dots and labels typical and are for reference only.

Dimensions are in inches [mm]

Tolerances (Unless otherwise Specified)
X.XX ±.02 (±0.5mm)
X.XXX ±.010 (±0.25mm)

THIRD ANGLE PROJECTION

MECHANICAL DIMENSIONS

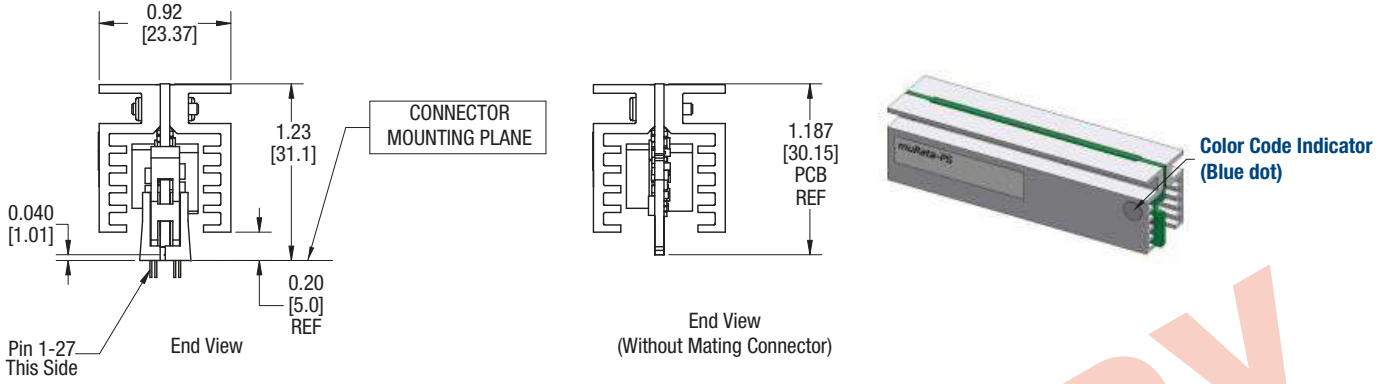


Figure 9. VR111B1xxCU-C (100A and 150A, with 1U heatsink)

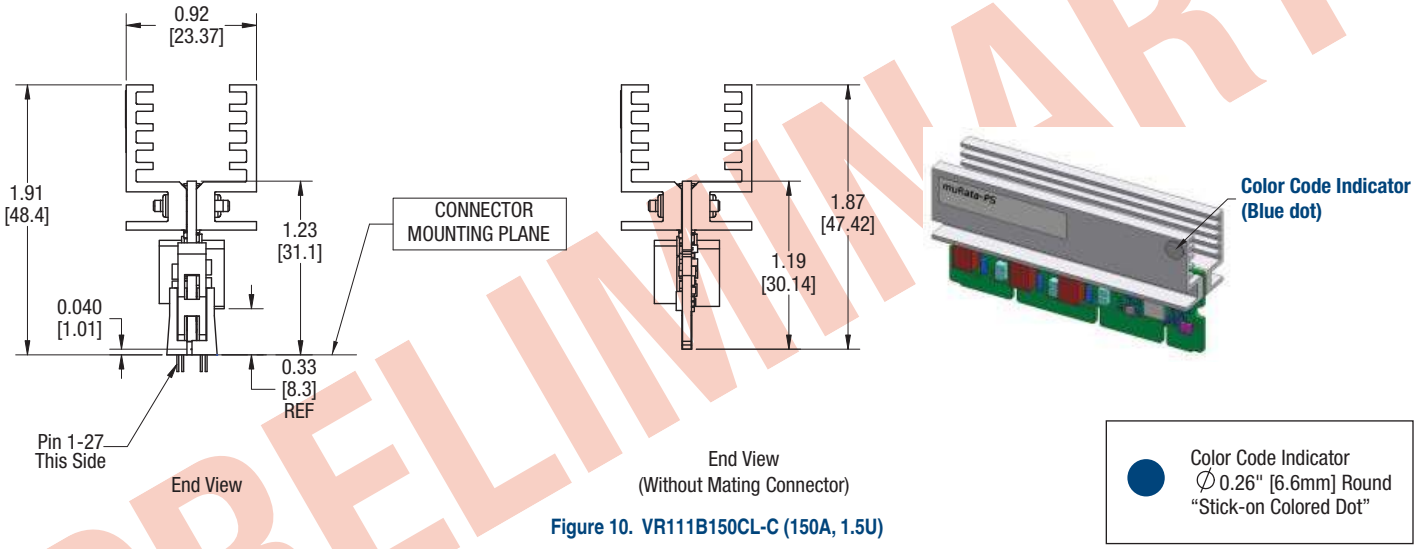


Figure 10. VR111B150CL-C (150A, 1.5U)

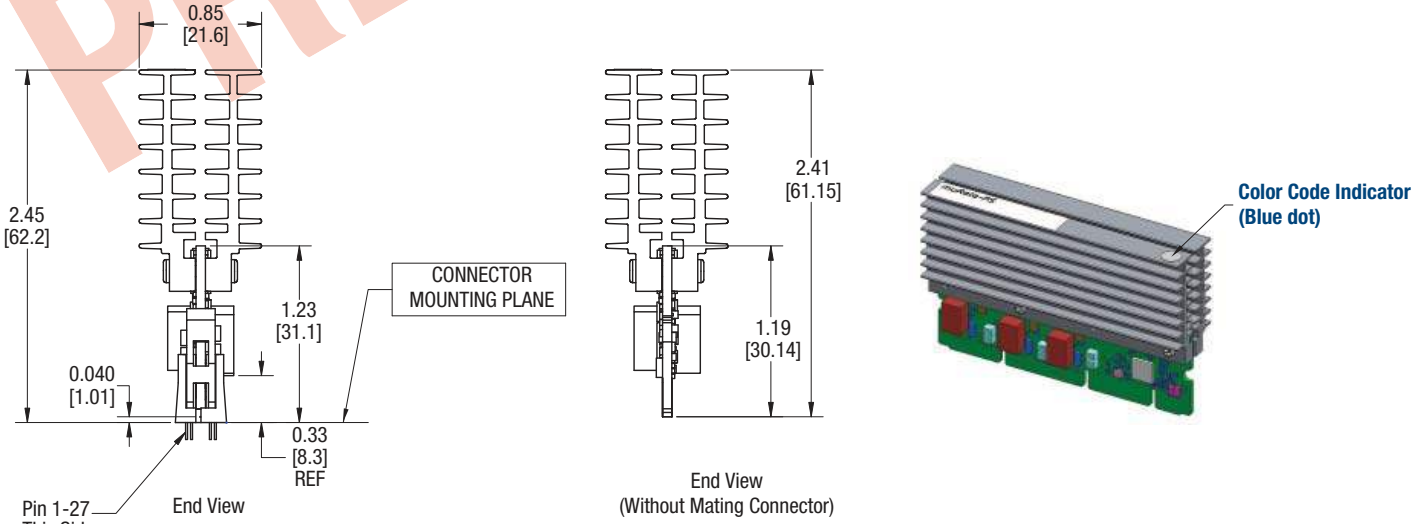


Figure 11. VR111B150CS-C (150A, 2U)

Notes

A. Characters are shown on labels only to depict orientation.

B. Locations of color code dots and labels typical and are for reference only.

Dimensions are in inches [mm]

Tolerances (Unless otherwise Specified)
X.XX ±.02 (±0.5mm)
X.XXX ±.010 (±0.25mm)

THIRD ANGLE PROJECTION

PACKAGE SPECIFICATIONS

PIN ASSIGNMENT - ALL VR111 SERIES MODELS			
Pin	Signal	Pin	Signal
1	VSS	**54**	V_{IN}+
2	VSS	**53**	V_{IN}+
3	VSS	**52**	V_{IN}+
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**	VID7
10	IMON	**45**	PSI#
11	VID6	**44**	VRM_PRES#0
12	VRM_PRES#2	**43**	VRM_PRES#1
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+

RoHS COMPLIANCE

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).

VR111B150C*x*-*y*C
VR111B100C*x*-*y*C
VR111B080CU-*y*C
VR111B080CA-*y*C
VR11FB080CU-*y*C

x = Heat sink option; *y* = Version. See part number coding, page 5.

RoHS PROCESS NOTE

These products are not intended to go through a reflow solder process. See recommended mating connectors, page 6.

Murata Power Solutions, Inc.
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