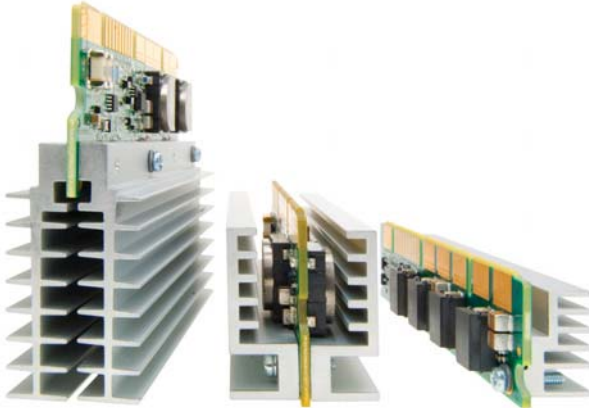


PRELIMINARY



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**



| 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) |
| VR111B150Cx-yC | 11.04 - 12.60 | 0.5 - 1.60 | 150 | 0.8 | 1U, 1.5U, 2U | See cross-reference, page 5 |
| VR111B100Cx-yC | | | 100 | 0.8 | 1U, 1.5U, 2U | |
| VR111B080CU-yC | | | 80 | 0.8 | 1U | |
| VR111B080CA-yC | | | 80 | 0.8 | .66U | |
| VR11FB080CU-yC | | | 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 | I _O = 110A, 1.1VID | | 83 | | % |
| Power Dissipation | VID = 1.1, 4 to 22A, PSI asserted | | | 5 | W |
| Turn-on time | V _{IN} present: enable to 90% V _{OUT} | | 4 | 10 | mS |
| Transient response - overshoot ④ | 104A step, 110A/μS, 1.1 V _{OUT} | | | 50 | mV |
| Transient response-time ④ | 104A step, 110A/μS, 1.1 V _{OUT} | | | 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 | VR111B080Cx-C | 0.77 | 0.8 | 0.83 | mΩ |
| | VR11FB080CE-C | 1.37 | 1.40 | 1.43 | |
| Ripple & noise ③ | 20MHz bandwidth | | 6.4 | | mVp-p |
| Current operating range | | 0 | | 80 | A |
| Efficiency for 11.1 TDC | I _O = 60A, VID = 1.1 | | 85 | | % |
| Power Dissipation | VID = 1.1, 4 to 20A PSI asserted | | | 5 | W |
| Turn-on time | V _{IN} present: enable to 90% V _{OUT} | | 4 | 10 | mS |
| Transient response - overshoot ④ | 59A step, 300A/μS, 1.1 V _{OUT} | | | 50 | mV |
| Transient response-time ④ | 59A step, 300A/μS, 1.1 V _{OUT} | | | 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 | °C |
| Storage temperature range | Non-condensing | -40 | | 85 | |
| Semiconductor junction | Package rated to 150°C | | | | |
| MTBF 150A models 80A models | Calculated (RAC PRISM) 25°C | | | 1.36 | x10 ⁶ Hrs |
| Switching frequency | Per phase | | 440 | | KHz |
| Material flammability | | UL 94V-0 | | | |
| Safety Agency Approval | IEC/EN60950-1 | Pending | | | |

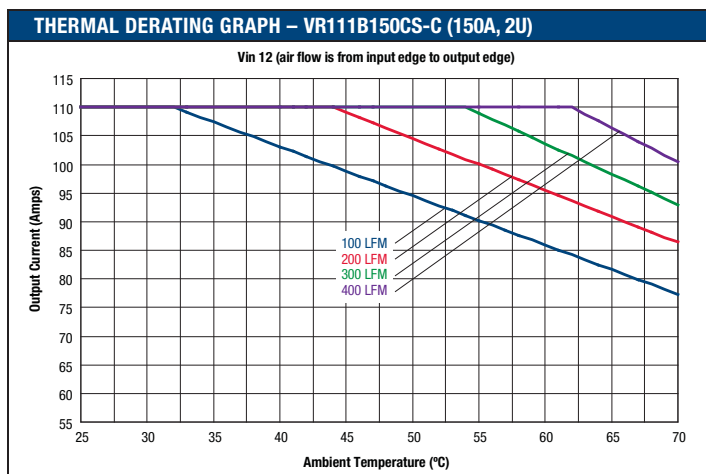
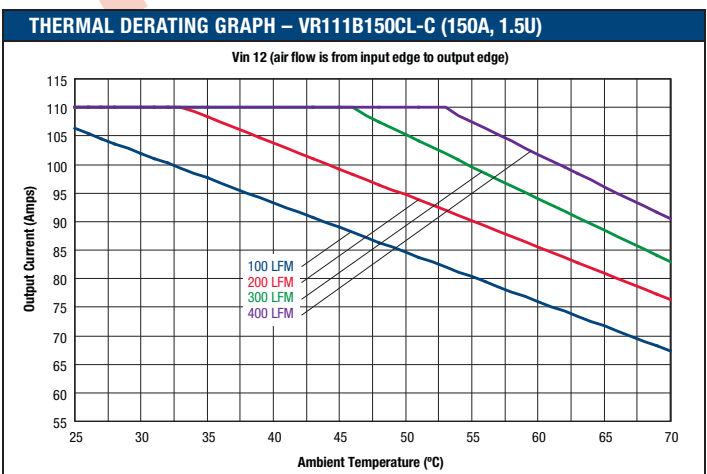
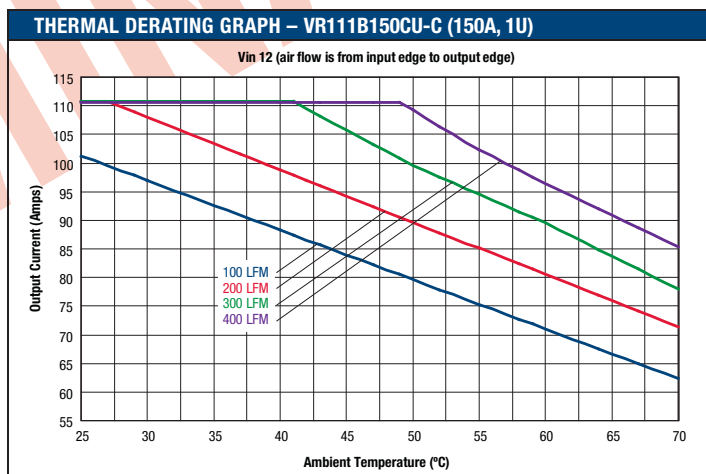
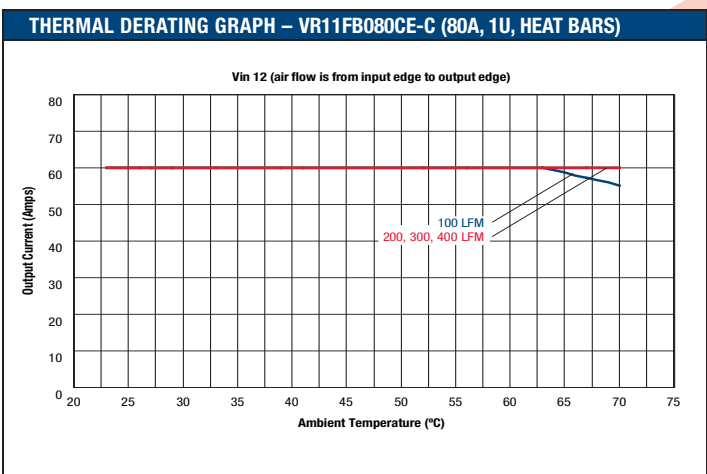
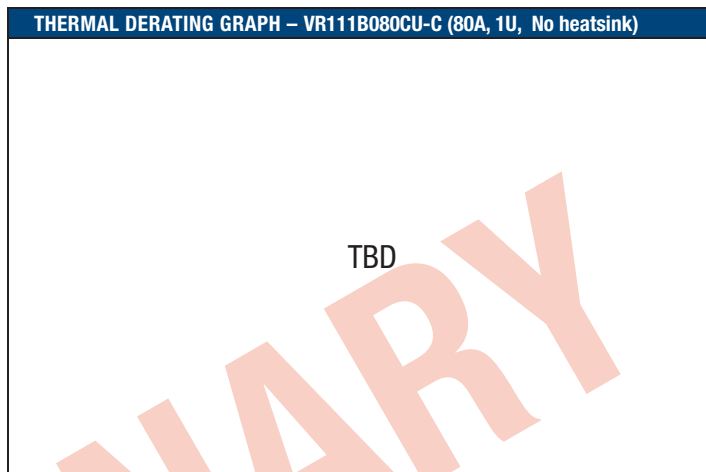
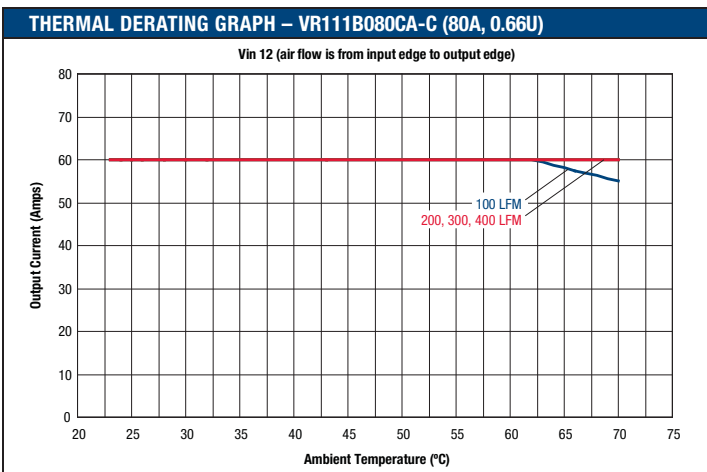
| MECHANICAL CHARACTERISTICS – TYPICAL | | | | |
|--------------------------------------|-------------|----------------|-------------------------|-----------------------------|
| Parameter | Form Factor | Part Number | US (L x W x H) | Metric (L x W x H) |
| Dimensions | 2U | VR111B150CS-yC | 3.8" x 0.85" x 2.41" | 96.45mm x 21.6mm x 61.15mm |
| | 1.5U | VR111B150CL-yC | 3.8" x 0.92" x 1.87" | 96.45mm x 23.37mm x 47.42mm |
| | 1U | VR111B150CU-yC | 3.8" x 0.92" x 1.187" | 96.45mm x 23.37mm x 30.15mm |
| | 1U | VR111B100CU-yC | 3.8" x 0.92" x 1.187" | 96.45mm x 23.37mm x 30.15mm |
| | 1U | VR111B080CU-yC | 3.8" x 0.46" x 1.187" | 96.45mm x 11.7mm x 30.15mm |
| | 1U | VR111B080CE-yC | 3.8" x 0.49" x 1.187" | 96.45mm x 11.7mm x 30.15mm |
| | 0.66U | VR111B080CA-yC | 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-yC | 3.6 | 102 |
| | 1.5U | VR111B150CL-yC | 2.75 | 78 |
| | 1U | VR111B150CU-yC | | |
| | 1U | VR111B100CU-yC | 0.9 | 26 |
| | 1U | VR111B080CU-yC | | |
| | 1U | VR111B080CE-yC | 1.41 | 40 |
| | 0.66U | VR111B080CA-yC | 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 | | °C |
| | Worst case junction temperature | | | | |
| Load indicator (IMON) ⑦ | VID = 1.1 | 0A load | 0 | 203 | mV |
| | | 75A load | 375 | 439 | |
| | | 180A load | 900 | 1035 | |

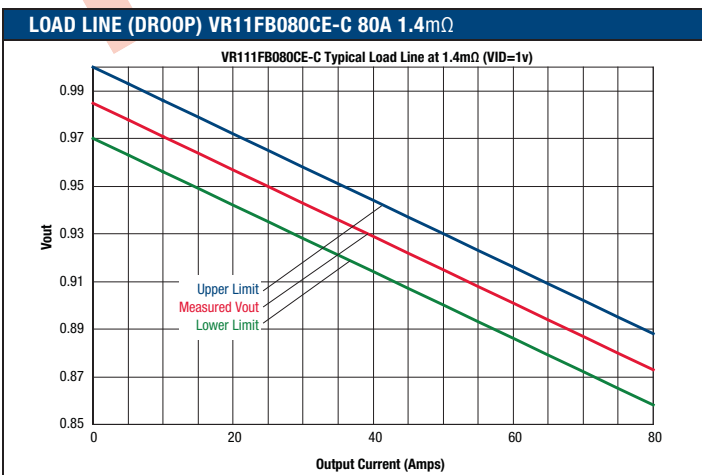
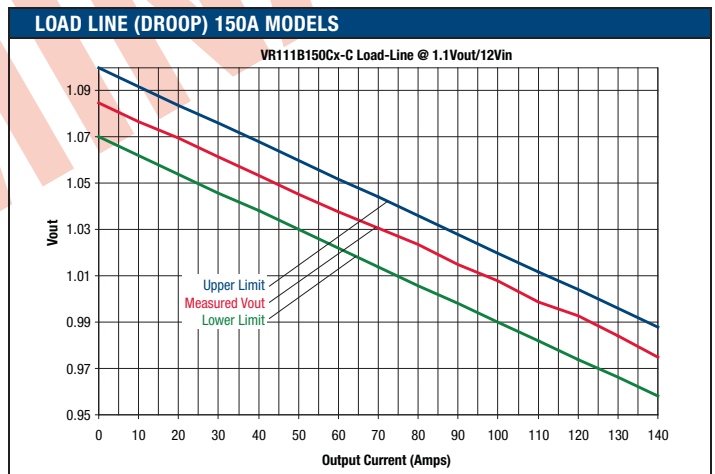
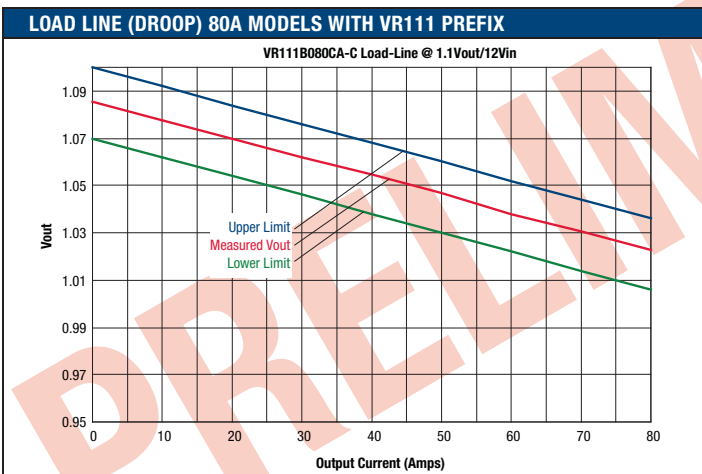
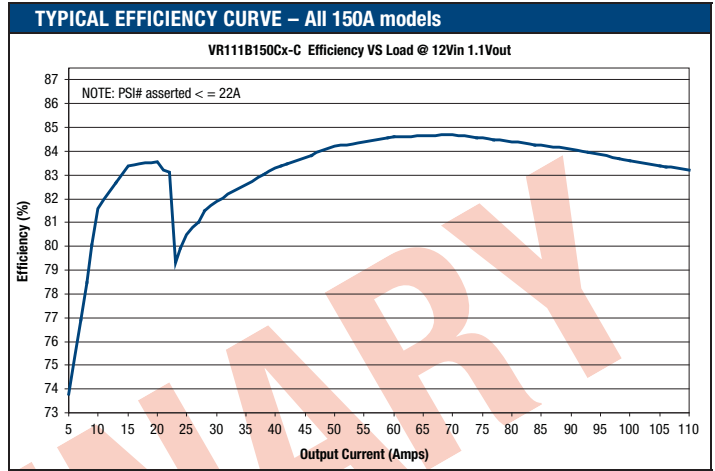
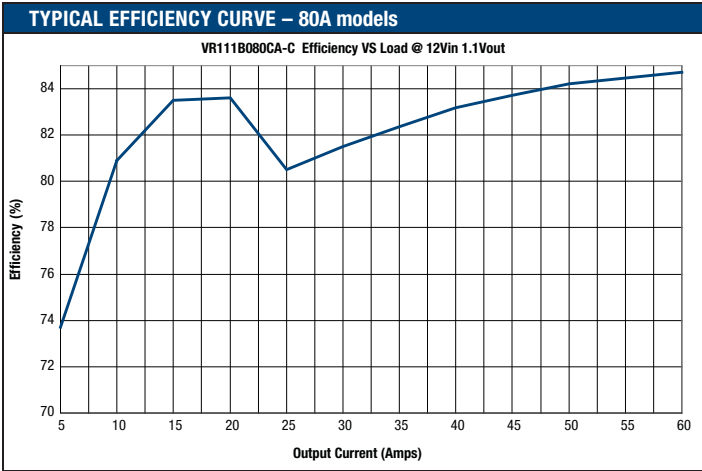
| PROTECTION CHARACTERISTICS – 80A Models | | | | | |
|---|---------------------------------|----------|------|------|-------|
| Parameter | Conditions ① | MIN. | TYP. | MAX. | Units |
| Output overcurrent shutdown | Hiccup mode | | 90 | 104 | A |
| Overvoltage shutdown | Non-latching, above VID | |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

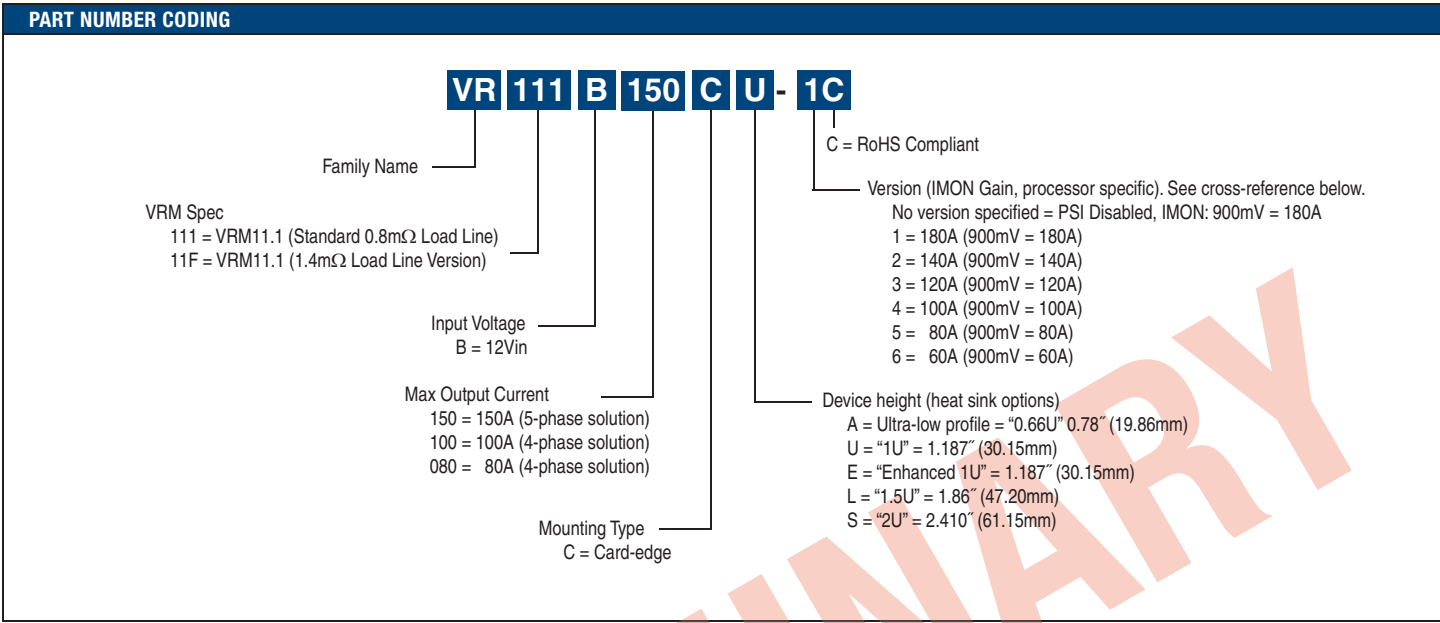
- NOTES**
- ① Vin = 12Vdc, Ta = 25°C, Airflow = 400LFM unless otherwise noted.
 - ② The output impedance for VRM 11.1 models (VR111 Series) powering V_{CORE} is 0.8mΩ. VR111B080CE-C is designed to power V_{CACHE}, which requires 1.4mΩ.
 - ③ Output ripple voltage is specified when measured with Intel® 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
($V_{IN} = 12V$; $V_{ID} = 1.1V$)



Typical Performance Curves - Efficiency
($V_{IN} = 12V$; $V_{ID} = 1.1V$; $T_{AMB} = 25^{\circ}C$ with 400 LFM airflow)





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 |
| Nehalem-EX / Westmere-EX 105W SKU see the latest PDG | 85 | 95 | 105 | 900mV = 100A | 100b | VR111B150Cx-4C |
| 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

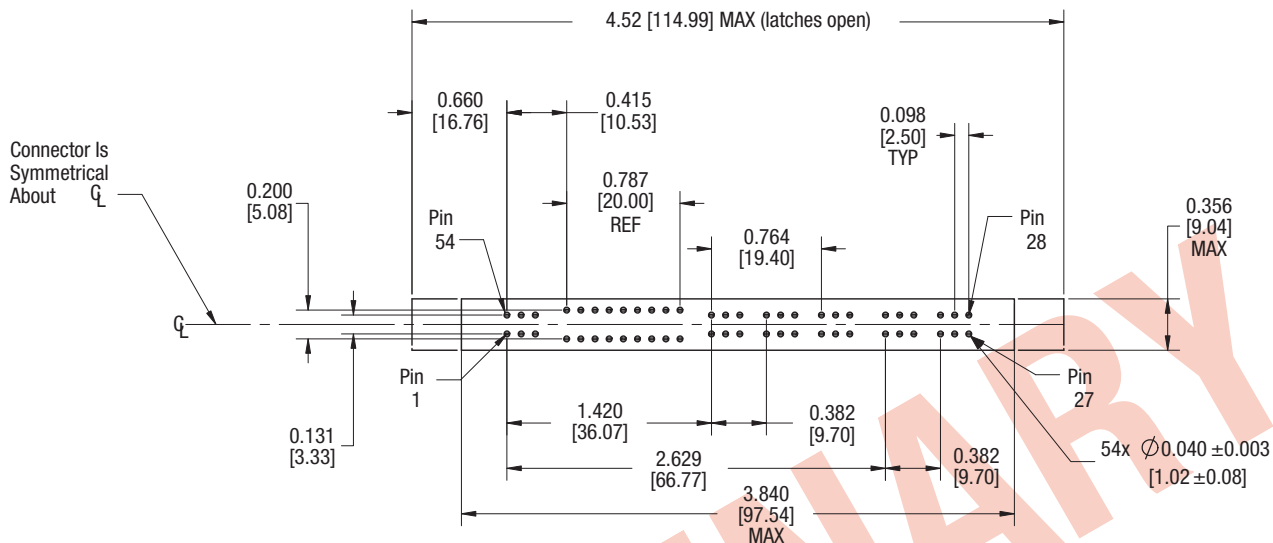


Figure 1. Connector Footprint (Thru-Hole Connector) Viewed From VRM (Top Side)

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) |

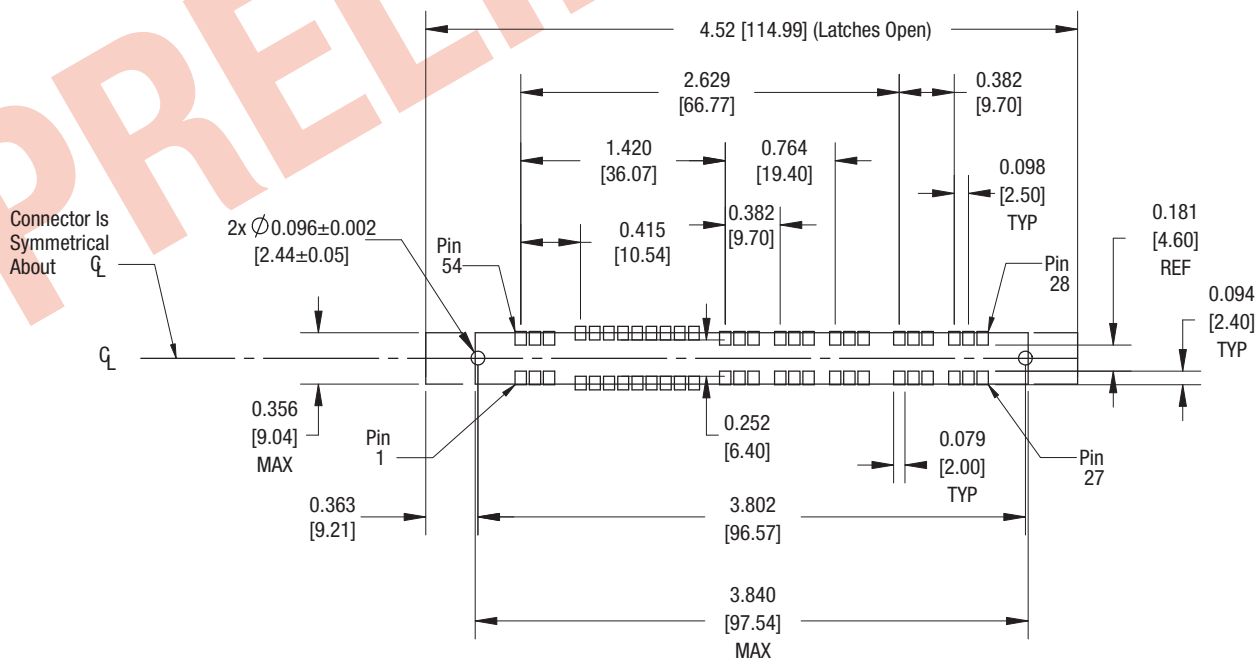
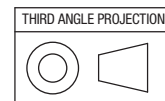


Figure 2. Connector Footprint (Surface Mount Connector) Viewed From VRM (Top Side)

Dimensions are in inches [mm]

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



MECHANICAL DIMENSIONS

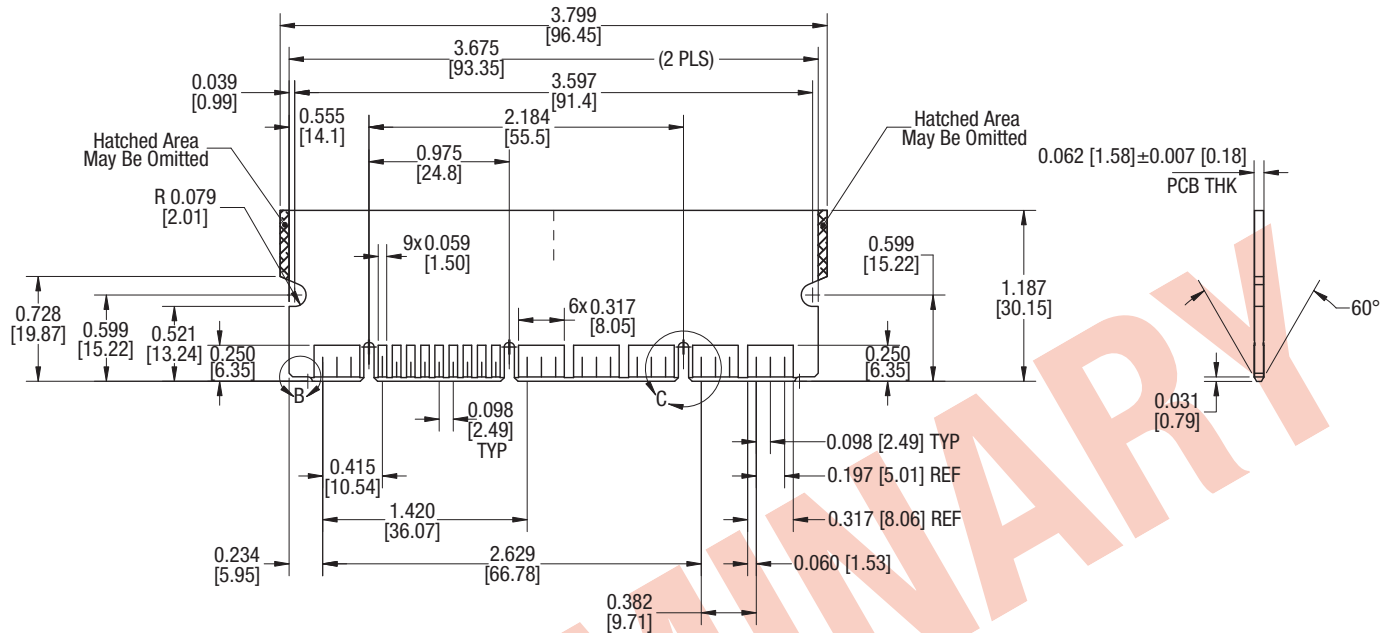


Figure 3. Circuit Board Outline (1U and taller)

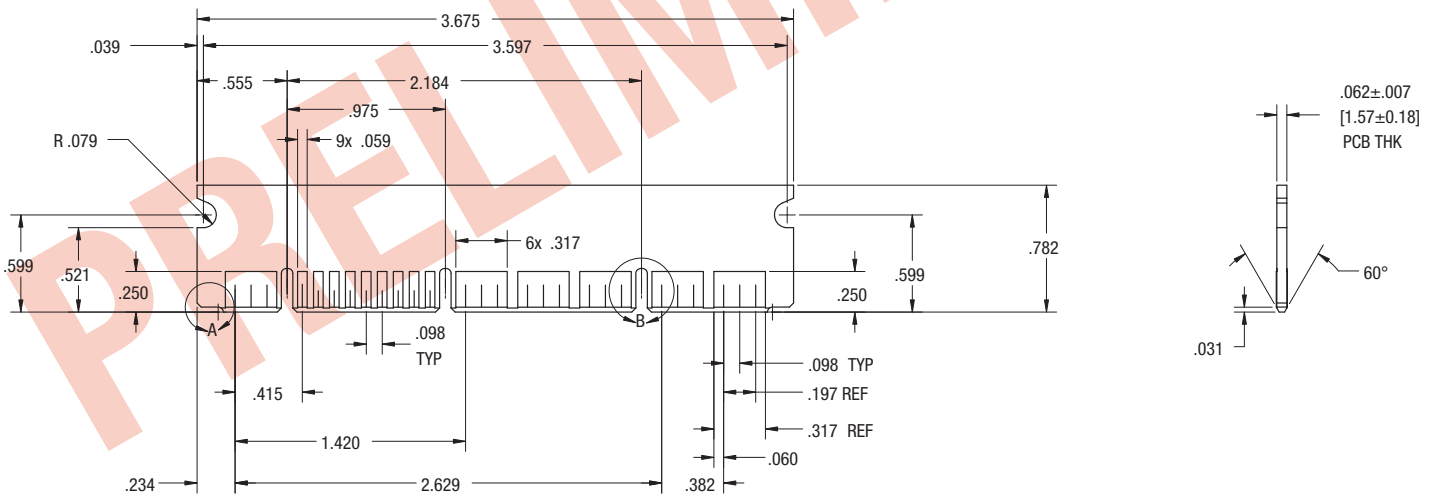


Figure 4. Circuit Board Outline (low profile 0.66U)

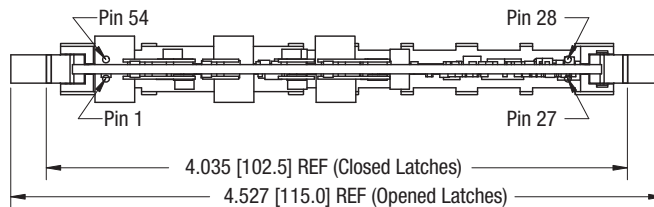
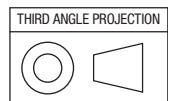


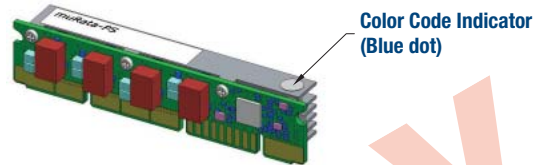
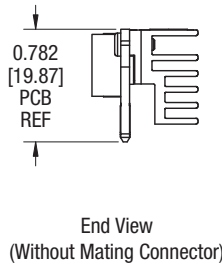
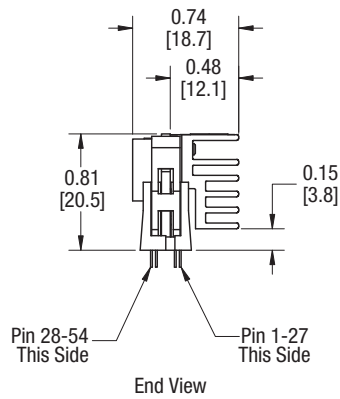
Figure 5. Top View (shown without heat sinks)

Dimensions are in inches [mm]

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



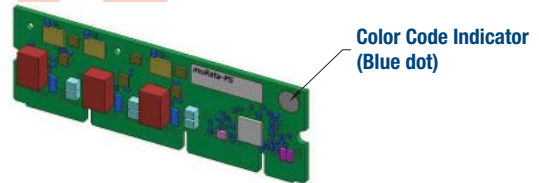
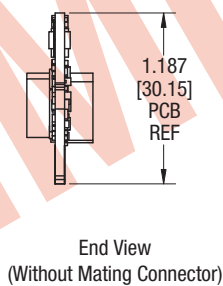
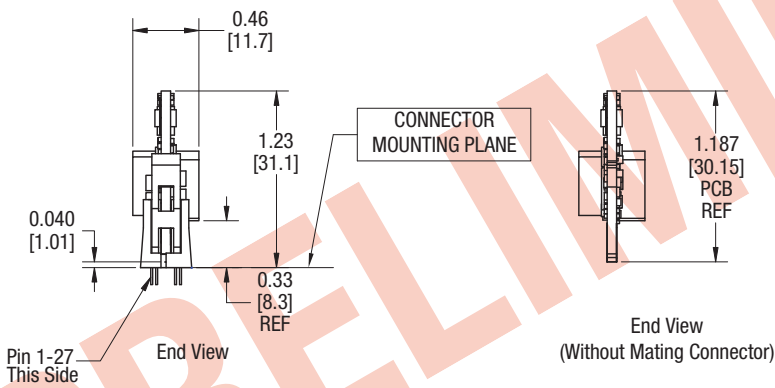
MECHANICAL DIMENSIONS



Color Code Indicator (Blue dot)

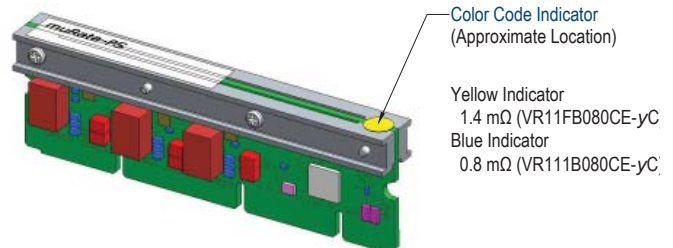
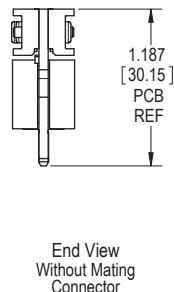
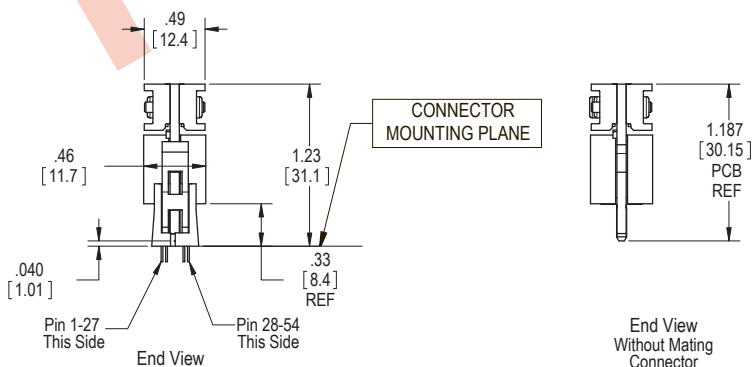
Color Code Indicator
 $\varnothing 0.26$ [6.6mm] Round
 "Stick-on Colored Dot"

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



Color Code Indicator (Blue dot)

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



Color Code Indicator (Approximate Location)

Yellow Indicator
 1.4 mΩ (VR11FB080CE-yC)
 Blue Indicator
 0.8 mΩ (VR111B080CE-yC)

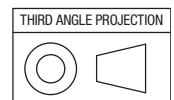
Figure 8. VR11FB080CE-C (80A, 1U, with heat bars)

Notes

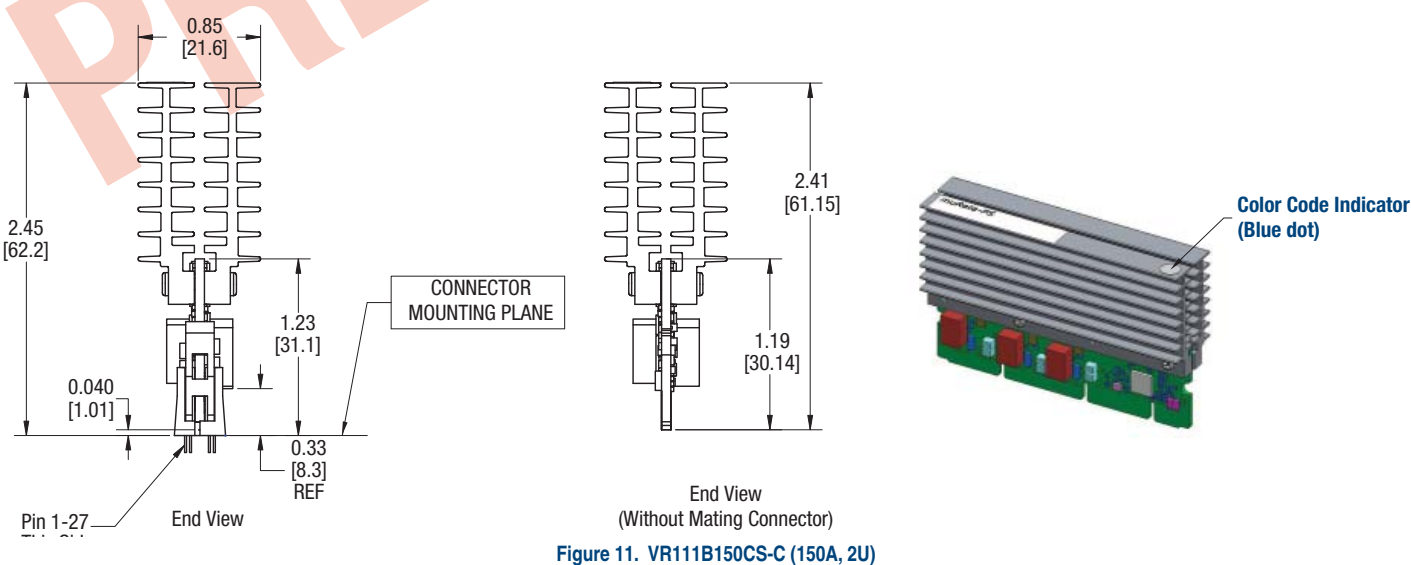
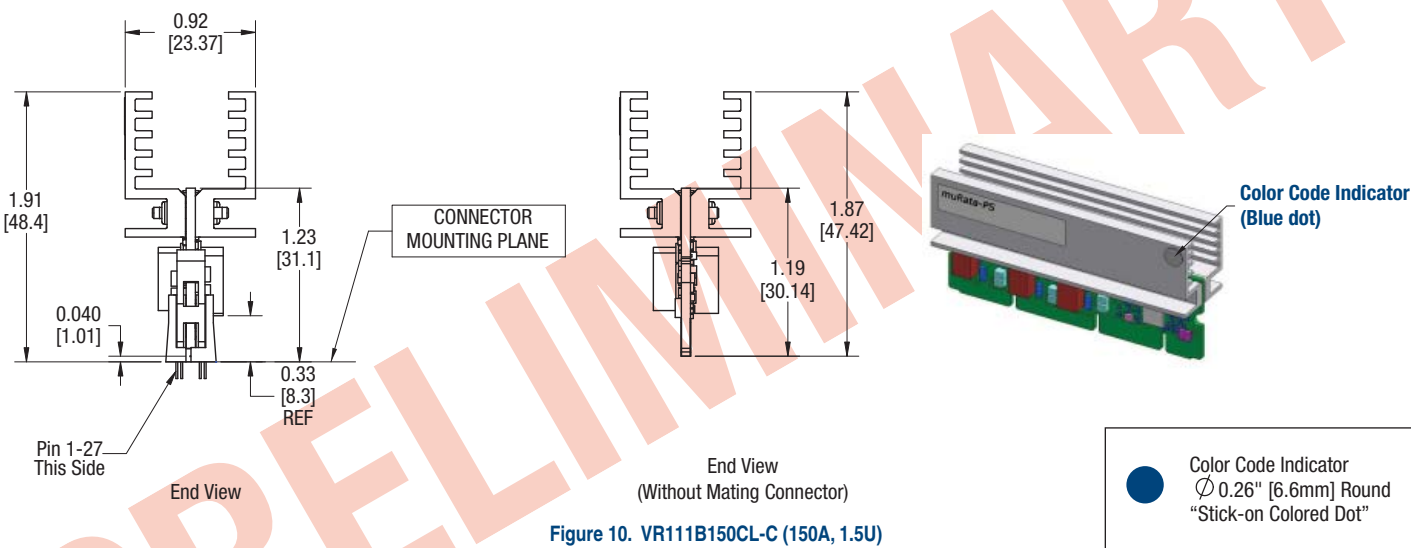
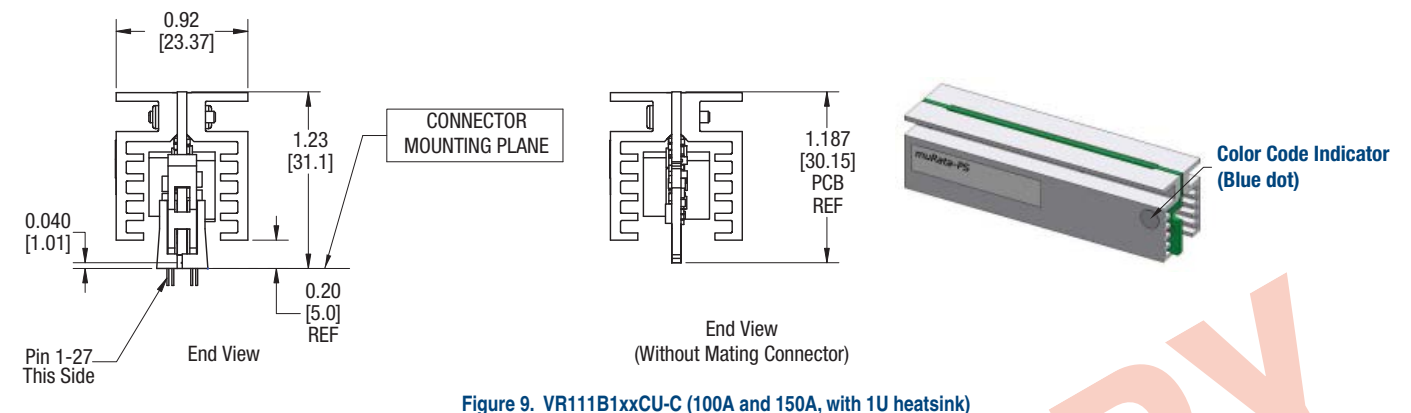
- A. Characters are shown on labels only to depict orientation.
- B. Locations of color code dots and labels typical and are for reference only.

Dimensions are in inches [mm]

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



MECHANICAL DIMENSIONS

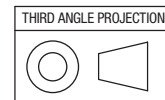


Notes

- 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)



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).

- VR111B150Cx-yC
- VR111B100Cx-yC
- VR111B080CU-yC
- VR111B080CA-yC
- VR111FB080CU-yC

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.

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ISO 9001 and 14001 REGISTERED

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