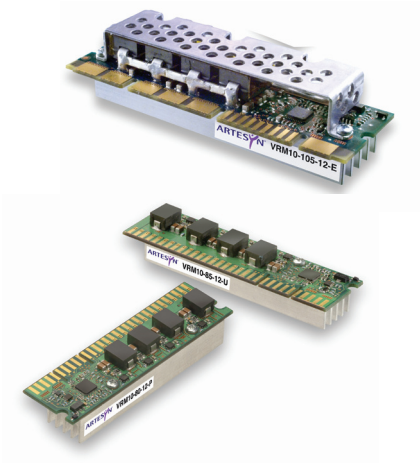
VRM10 Series
Single Output

Input Voltage: 12 Vdc
# of Outputs: Single



Special Features

- Designed for use in low profile applications where VRM10.0 or 10.1 specifications are required
- Output current up to 105 A continuous
- Open-collector power good (PWRGD) output
- 6-bit microprocessor voltage identification input (VID)
  - 0.8375 Vdc to 1.6000 Vdc in 12.5mV steps
  - Allows dynamic VID code changes
- Differential remote sense for improved load regulation
- Vertical plug-in to standard motherboard connector
- Selectable output load line impedances, via LL0 and LL1
- Output over-voltage signal (OVP)
- Monotonic output turn-on and turn-off with no overshoot or undershoot
- RoHS compliant
- 2 Year Warranty

Safety

VDE Certificate
No. 2487000-3336-0016

The VRM10 non-isolated DC-DC converters are designed to meet the exceptionally fast transient response requirements of today's microprocessors and fast switching logic in a compact size at a very affordable price. Advanced circuit techniques, component selection and placement optimization, state-of-the-art thermal packaging, and surface-mount technologies provide a high power density, highly reliable, and very precise voltage regulation system for advanced microprocessors.

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Specifications

Unless otherwise stated, all specifications are typical at nominal input, maximum continuous rated load at 25 °C and voltages are referenced to Vin-.

OUTPUT SPECIFICATIONS

Voltage adjustability	(See VID codes,Table 3)	0.8375-1.6000 Vdc
Output current (Iout)		0 A min.
VRM10-85-12-UY	Continuous	85 A max.
	Peak non-sustained	100 A max.
VRM10-80-12-PY	Continuous	80 A max.
	Peak non-sustained	91 A max.
VRM10-105-12-EJ	Continuous	105 A max.
	Peak non-sustained	120 A max.
Load line (LL) adjustability (See LL codes, Table 1)		0.91-1.25 mW
Output voltage (Vout) (Vo sen+ minus Vo sen-) (See Notes 3, B)	Vo max	VID - Rout * Iout V
	Vo min	VID - Rout * Iout - 0.040V (-U/-E)
	Vo min	VID - Rout * Iout - 0.038V (-P)
	Where	VID = programmed voltage (V)
	Rout	Fixed or programmable output impedance (W)
	Iout	Output current (A)
Ripple and noise (See Notes 1, 2)	20 MHz bandwidth	8 mV pk-pk
Short circuit protection		Continuous current limit, brickwall automatic recovery
Remote sensing compensating voltage		Up to 300 mV max.

INPUT SPECIFICATIONS

Input voltage range	12 Vin nominal	11.0-12.6 Vdc
Input current		
VRM10-85-12-UY	11Vin, VID=1.325 V, Iout=100 A	15.3 A
VRM10-80-12-PY	11Vin, VID=1.400 V, Iout=91 A	14.2 A
VRM10-105-12-EJ	11VIN, VID=1.325V, Iout=120 A	18.5 A
No load		25 0 mA typ., 300 mA max.
OUTEN OFF		50 mA max.
UVLO turn ON voltage	0 ºC <tamb <60 ºC	9.5 V ± 2.6%
UVLO turn OFF voltage	0 ºC <tamb <60 ºC	8.7 V ± 4.5%
Hysteresis		0.8 V typ
Start-up time (using OUTEN)	11.0 V < Vin <12.6 V (PWRGD transitioning high	10 ms max.

INPUT SPECIFICATIONS CONTD.

OUTEN, VID and LL signal valid states:	
ON or Logic '1'	0.8 Vdc min., 5.5 Vdc max.
OFF or Logic '0'	-0.3 Vdc min., 0.4 Vdc max.

GENERAL CHARACTERISTICS

Efficiency	See table 2 on page 2	VID = 1.325 V
Switching frequency	80 A/85 A	2.2 MHz
Fixed (See Note 4)	105 A	1.1 MHz
Approvals and standards	(See Note 5)	IEC/EN60950 VDE
Material flammability		UL94V-0
Weight	80 A/85 A	38 g (1.34 oz)
105 A	70 g (2.47 oz)	
MTBF	80 A/85 A	2,000,000 hours
Telecordia SR-332	105 A	1,648,000 hours
Mating connector	80 A/85 A	See Figure 7
105 A	See Figure 8	
Connector fingers		Gold plated, 30 µ-inches

ENVIRONMENTAL SPECIFICATIONS

Temperature shock	Operating	10 °C/hour
non-operating	20 °C/hour	
Humidity	Operating	85% RH
(Non-condensing)	storage	95% RH
Altitude	Operating	10,000 feet max.
storage	50,000 feet max.	
Shock	Operational and	30 G 11ms
non-operational	Half sine wave	
Vibration	Operational and	0.02 G^2/Hz max.
(See Note 6)	non-operational	
Thermal performance	Operating ambient	0 °C to +60 °C
(See Note 7)	temperature	
Storage temperature	(Non-condensing)	-40 °C to + 100 °C

Specifications

INPUT VOLTAGE	OUTPUT VOLTAGE	OVP [8]	OUTPUT CURRENT (MIN)	OUTPUT CURRENT (MAX.) CONTINUOUS	OUTPUT CURRENT (MAX.) NON-SUSTAINED	EFFICIENCY (TYP.)	REGULATION LOAD	MODEL NUMBER
12 Vdc	0.8375-1.6000 Vdc	1.8 V	0 A	80 A	91 A	85%	1.24 mV/A	VRM10-80-12-PY [11]
12 Vdc	0.8375-1.6000 Vdc	1.8 V	0 A	85 A	100 A	85%	See Table 1	VRM10-85-12-UY [11]
12 Vdc	0.8375-1.6000 Vdc	1.8 V	0 A	105 A	120 A	84%	See table 1	VRM10-105-12-EY [11]

MODEL	LL0	LL1	LOAD LINE SLOPE, Rout	UNITS
VRM10-85-12-UY	0	0	1.25	mW
VRM10-85-12-UY	0	1	1.25	mW
VRM10-85-12-UY	1	0	1.25	mW
VRM10-85-12-UY	1	1	Reserved	mW
VRM10-80-12-PY	N/A	N/A	1.24	mW
VRM10-105-12-EY	0	0	1.25	mW
VRM10-105-12-EY	0	1	1.25	mW
VRM10-105-12-EY	1	0	1.25	mW
VRM10-105-12-EY	1	1	Reserved	mW

Table 1: LL0, LL1 Load Line Codes

EFFICIENCY TABLE	
OUTPUT VOLTAGE	EFFICIENCY (typ.)
VID = 1.325 V @ 85 A	85%
VID = 1.325 V @ 80 A	85%
VID = 1.325 V @ 105 A	84%

Table 2: Efficiency Values

Notes

1 Recommended output capacitance, 12 x 560 µF aluminium polymer and 44 x 10 µF MLCC for slew rates up to 430 A/µs, 14 x 560 µF aluminum polymer and 45 x 10 µF MLCC for slew rates up to 930 A/µs.
2 8 mV pk-pk ripple. Vin = 12 V, Vout = 1.35 V, Iout = 85 A.
3 With the recommended capacitors (See Note 1) across the output, the output voltage stays within the load regulation window for all loads and transient events, up to 100 A for the VRM10-85-12-UY (91 A for the VRM10-80-12-PY) over a 20MHz bandwidth, 0 ºC < T_{amb} < 60 ºC.
4 VRM10 uses a four phase buck topology. Each phase switches at 550 KHz for the VRM10-85-12-UY and VRM10-80-12-PY. This gives an equivalent switching frequency of 2.2 MHz. For the VRM10-105-12-EJ, each phase switches at 275 KHz. This gives an equivalent switching frequency of 1.1 MHz
5 Recommended input fusing: one 20 A (or two 10 A in parallel) very fast acting fuse(s). The VRM10 is a high current device. Use appropriate care in handling and installation of this device, which is intended only for use within enclosed equipment.
6 0.01 G^2/Hz from 5 Hz to 20 Hz, maintaining 0.02 G^2/Hz from 20 Hz to 500 Hz, all axes.
7 Maximum current requires adequate forced air over the converter. Please consult Figures 2 and 3 for thermal de-rating.
8 When the VRM detects an output over-voltage event, the OVP pin transitions to logic high. This signal can be used to shut down the supply to the VRM, or drive a crowbar device.
9 Pins 12 and 51 are not connected on VRM10-80-12-PY. On VRM10-85-12-UY, do not leave these pins floating.
10 When included in the users system ESD event shall cause no out-of-regulation conditions.
11 The 'Y' suffix indicates that these parts are TSE RoHS 5/6 (non Pb-free) compliant.

Specifications

VOLTAGE IDENTIFICATION (VID) CODES						
VID4	VID3	VID2	VID1	VID0	VID5	VID (V)
0	1	0	1	0	0	0.8375
0	1	0	0	1	1	0.8500
0	1	0	0	1	0	0.8625
0	1	0	0	0	1	0.8750
0	1	0	0	0	0	0.8875
0	0	1	1	1	1	0.9000
0	0	1	1	1	0	0.9125
0	0	1	1	0	1	0.9250
0	0	1	1	0	0	0.9375
0	0	1	0	1	1	0.9500
0	0	1	0	1	0	0.9625
0	0	1	0	0	1	0.9750
0	0	1	0	0	0	0.9875
0	0	0	1	1	1	1.0000
0	0	0	1	1	0	1.0125
0	0	0	1	0	1	1.0250
0	0	0	1	0	0	1.0375
0	0	0	0	1	1	1.0500
0	0	0	0	1	0	1.0625
0	0	0	0	0	1	1.0750
0	0	0	0	0	0	1.0875
1	1	1	1	1	1	OFF
1	1	1	1	1	0	OFF
1	1	1	1	0	1	1.1000
1	1	1	1	0	0	1.1125
1	1	1	0	1	1	1.1250
1	1	1	0	1	0	1.1375
1	1	1	0	0	1	1.1500
1	1	1	0	0	0	1.1625
1	1	0	1	1	1	1.1750
1	1	0	1	1	0	1.1875
1	1	0	1	0	1	1.2000

VOLTAGE IDENTIFICATION (VID) CODES (CONTD.)						
VID4	VID3	VID2	VID1	VID0	VID5	VID (V)
1	1	0	1	0	0	1.2125
1	1	0	0	1	1	1.2250
1	1	0	0	1	0	1.2375
1	1	0	0	0	1	1.2500
1	1	0	0	0	0	1.2625
1	0	1	1	1	1	1.2750
1	0	1	1	1	0	1.2875
1	0	1	1	0	1	1.3000
1	0	1	1	0	0	1.3125
1	0	1	0	1	1	1.3250
1	0	1	0	1	0	1.3375
1	0	1	0	0	1	1.3500
1	0	1	0	0	0	1.3625
1	0	0	1	1	1	1.3750
1	0	0	1	1	0	1.3875
1	0	0	1	0	1	1.4000
1	0	0	1	0	0	1.4125
1	0	0	0	1	1	1.4250
1	0	0	0	1	0	1.4375
1	0	0	0	0	1	1.4500
1	0	0	0	0	0	1.4625
0	1	1	1	1	1	1.4750
0	1	1	1	1	0	1.4875
0	1	1	1	0	1	1.5000
0	1	1	1	0	0	1.5125
0	1	1	0	1	1	1.5250
0	1	1	0	1	0	1.5375
0	1	1	0	0	1	1.5500
0	1	1	0	0	0	1.5625
0	1	0	1	1	1	1.5750
0	1	0	1	1	0	1.5875
0	1	0	1	0	1	1.6000

Table 3: Voltage Identification Codes

Specifications

SIGNAL ELECTRICAL INTERFACE CHARACTERISTIC - SIGNAL NAME	SYMBOL	MIN	TYP	MAX	UNITS	NOTES AND CONDITIONS
OUTEN - on	$V_{OUTEN\ (on)}$	0.8		5.5	V	No pull up resistor provided by the VRM
OUTEN - off	$V_{OUTEN\ (off)}$	-0.3		0.4	V	No pull up resistor provided by the VRM
OUTEN - leakage current		-1		1	µA	
PWRGD - low	$V_{PWRGD\ (low)}$			0.4	V	Sink current 4 mA
PWRGD - sink current	$I_{PWRGD\ (sink)}$			4	mA	Open-collector output to not more than 5.5 V
PWRGD - low threshold		72	74	76	%	Percentage of VID code setting
PWRGD - turn-on response to OUTEN going high	T_{rise}	0	4	10	ms	For waveforms, refer to Application Note 171
VID - high	$V_{ih\ (VID)}$	0.8		5.5	V	
VID - low	$V_{il\ (VID)}$	-0.3		0.4	V	
VID - pull up current	$I_{(VID)}$	35	50	65	µA	
OVP signal trip point	$R_{(VID)}$	1.7		VID + 0.2	V	
OVP drive voltage			1.9 (5.5)		V	I_{ovp} = -100 mA (I_{ovp} = -1 mA
LL - high	$V_{ih\ (LL)}$	0.8		5.5	V	VRM10-85-12-UY only
LL - low	$V_{il\ (LL)}$	-0.3		0.4	V	VRM10-85-12-UY only
LL - input impedance	$Z_{i\ (LL)}$	2.18	2.21		kW	VRM10-85-12-UY only
VR_Hot# - low	$V_{VR\_HOT\#\ (low)}$	0		0.4	V	Sink current 30 mA. VR_HOT# is pulled as a thermal event is present in the VRM
VR_Hot# - sink current	$I_{VR\_HOT\#\ (sink)}$	0		30mA		Open-collector output to not more than Vin. Sinks current as long as thermal event is present in the VRM

ELECTROMAGNETIC COMPATIBILITY CHARACTERISTIC - SIGNAL NAME	SYMBOL	MIN	TYP	MAX	UNITS	NOTES AND CONDITIONS
ESD - operating (See Note 10)		15	kV			IEC61000-4-2. In end user equipment
ESD - non-operating				25	kV	IEC61000-4-2. In end user equipment
Radiated emissions		B			Class	FCC and EN55022. In end user equipment
Input characteristics: Input current - operating	I_{IN}		10.7		A	V_{in} = V_{in} (typ.), $I_{out\ (cont.)}$ = 85A, VID = 1.325 V
Input capacitance - external bypass	C_{INext}	680	1000		µF	

Specifications

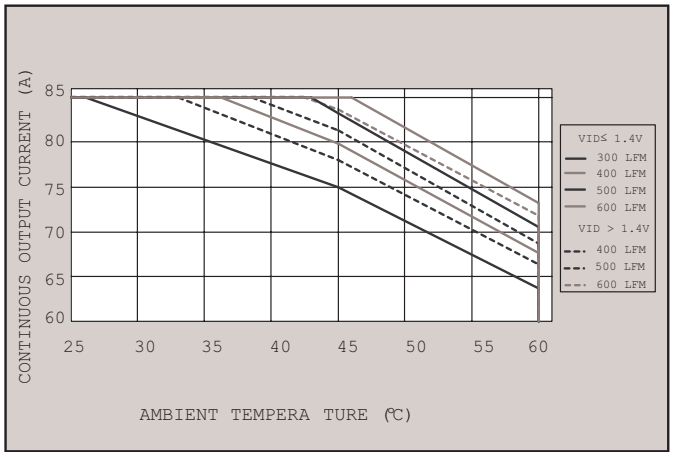


Figure 1: Thermal Derating Curve for VRM10-85-12-UY (See Note A)

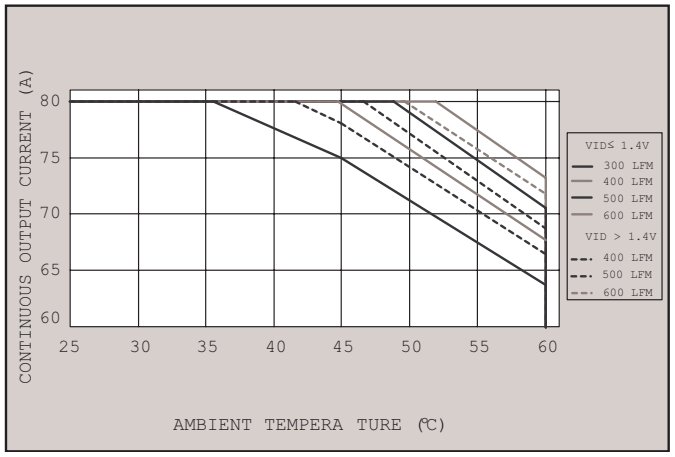


Figure 2: Thermal Derating Curve for VRM10-80-12-PY (See Note A)

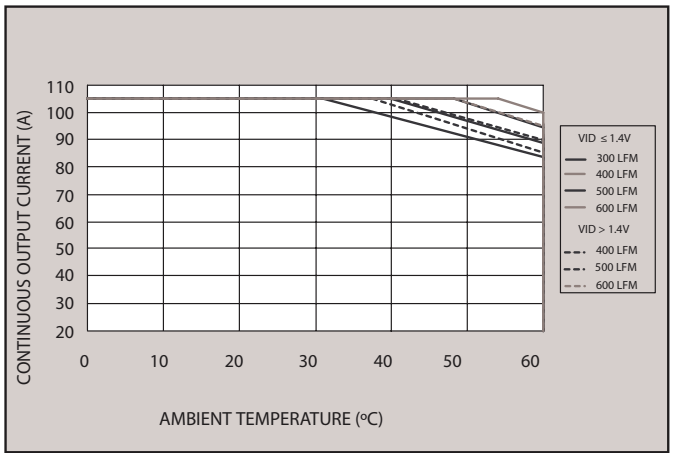


Figure 3: Thermal Derating Curve for VRM10-105-12-EY (See Note A)

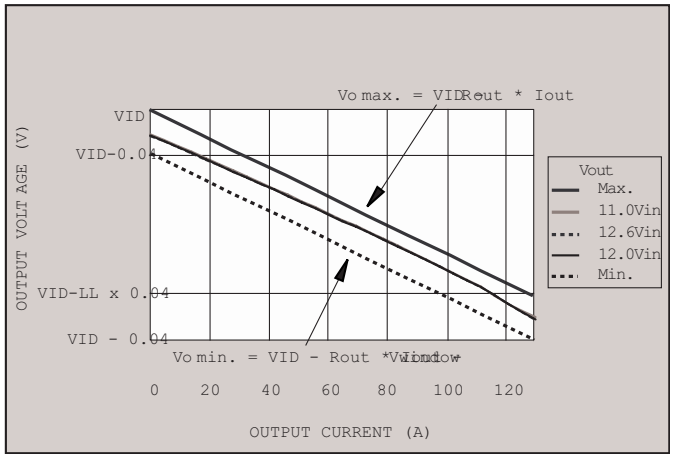


Figure 4: Load Regulation (See Notes 3 and B)

Notes

A For the LFM and VID conditions graphed, there is no derating between 0 ºC and 25 ºC.

B For load regulation equations: VID is in Volts, programmed by the VID bits (refer to Table 3); Rout is in W's, programmed by the LL bits (refer to Table 1); and the output current, Iout is in amps. V_{Window} is 0.040 for VRM10-85-12-UY and 0.038 for VRM10-80-12-PY.

C Efficiency Vs load plotted is representative of a typical VRM10-85-12-UY with VID = 1.4 V, LL0 = 0, LL1 = 1.

D Shown for a VRM10-80-12-P with VID = 1.4 V.

Specifications

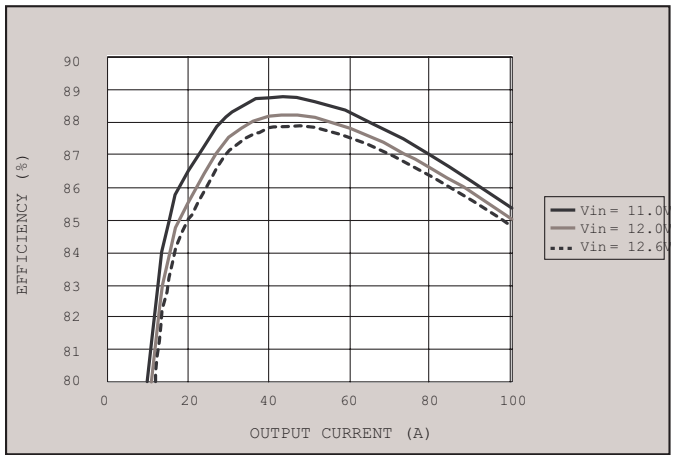


Figure 5: Typical Efficiency Vs Load (See Note C)
For VRM10-85-12-UY and VRM10-80-12-PY

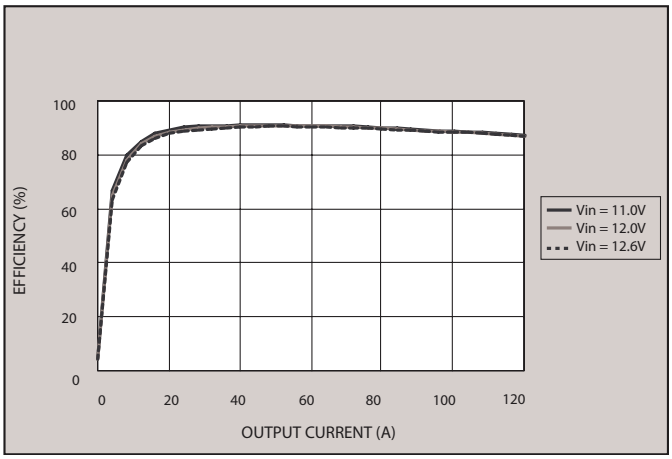


Figure 5a: Typical Efficiency Vs Load (See Note C)
For VRM10-105-12-EJ

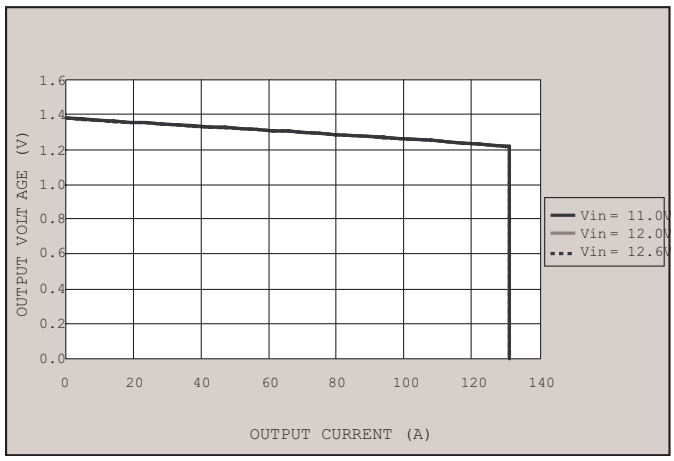
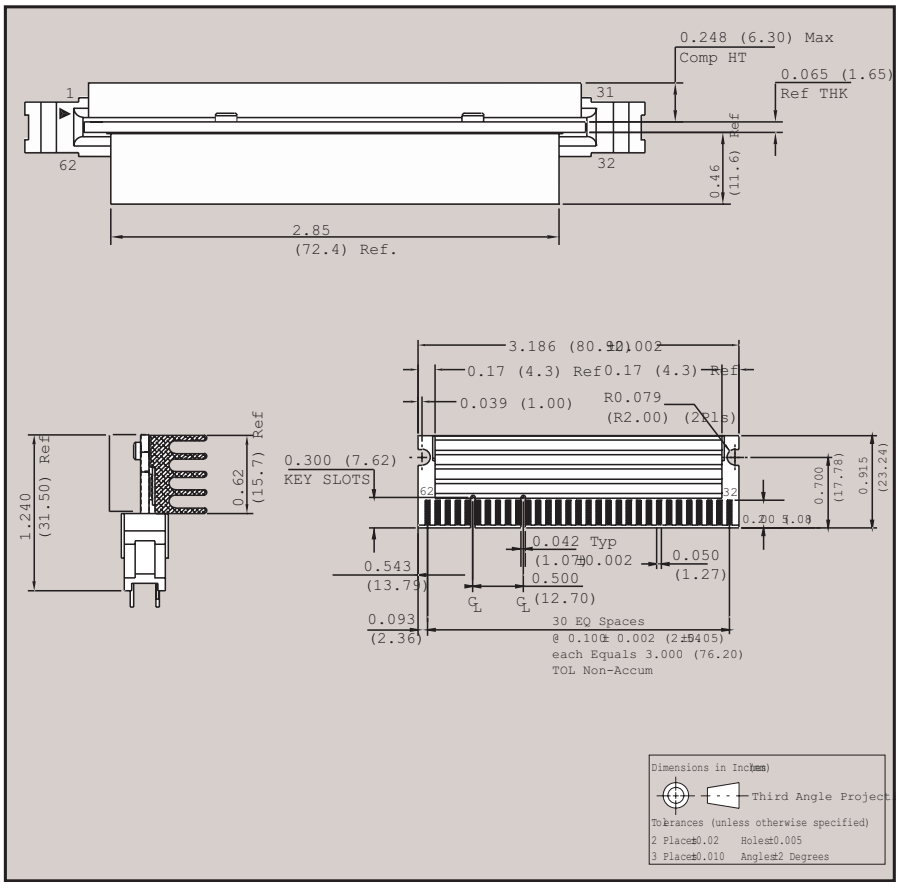


Figure 6: Short Circuit and Over Current Protection (See Note D)
For VRM10-85-12-UY and VRM10-80-12-PY

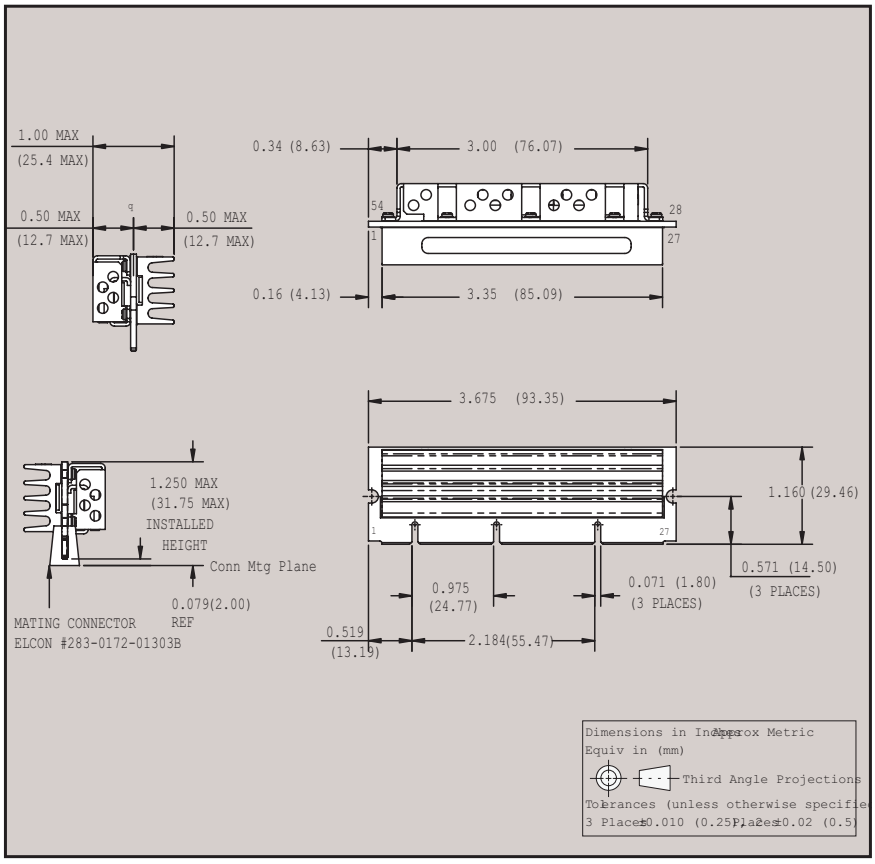
Specifications



PIN CONNECTIONS			
PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	Vin+	62	Vin-
2	Vin+	61	Vin-
3	Vin+	60	Vin-
4	Vin+	59	Vin-
5	N/U	58	VRM_pres#
6	VID4	57	Key
7	VID3	56	VID2
8	VID1	55	VID0
9	OVP	54	VID5
10	PWRGD	53	Outen
11	Vo sen-	52	Vo sen+
12	LL0 (9)	51	LL1 (9)
13	Vo-	50	Vo+
14	Vo+	49	Vo+
15	Vo-	48	Vo-
16	Vo+	47	Vo+
17	Vo-	46	Vo-
18	Vo+	45	Vo+
19	Vo-	44	Vo-
20	Vo+	43	Vo+
21	Vo-	42	Vo-
22	Vo+	41	Vo+
23	Vo-	40	Vo-
24	Vo+	39	Vo+
25	Vo-	38	Vo-
26	Vo+	37	Vo+
27	Vo-	36	Vo-
28	Vo+	35	Vo+
29	Vo-	34	Vo-
30	Vo+	33	Vo+
31	Vo-	32	Vo-

Figure 7: 80/85 A Mechanical Drawing and Pinout Table

Specifications



PIN CONNECTIONS			
PIN NO.	FUNCTION	PIN NO.	FUNCTION
1	Vin-	54	Vin+
2	Vin-	53	Vin+
3	Vin-	52	Vin+
4	VID4	51	VID3
5	VID2	50	VID1
6	VID0	49	VID5
7	Vo sen+	48	Vo_sen-
8	V_{cc} PWRGD	47	VR_HOT#
9	Outen	46	LL0[9]
10	OVP	45	LL1[9]
11	NA	44	NA
12	VRM_pres#	43	NA
13	Vo+	42	Vo+
14	Vo+	41	Vo+
15	Vo+	40	Vo+
16	Vo-	39	Vo-
17	Vo-	38	Vo-
18	Vo-	37	Vo-
19	Vo+	36	Vo+
20	Vo+	35	Vo+
21	Vo+	34	Vo+
22	Vo-	33	Vo-
23	Vo-	32	Vo-
24	Vo-	31	Vo-
25	Vo+	30	Vo+
26	Vo+	29	Vo+
27	Vo+	28	Vo+

Figure 8: 105 A Mechanical Drawing and Pinout Table

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