

UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2007-03-27 (Information Technology Equipment - Safety - Part 1: General Requirements) CSA C22.2 No. 60950-1-07, 2nd Edition, 2007-03 (Information Technology Equipment - Safety - Part 1: General Requirements)
Certification Type:	Component Recognition
CCN:	QQGQ2, QQGQ8 (Power Supplies for Information Technology Equipment Including Electrical Business Equipment)
Product:	DC/DC Converter
Model:	PRM Series
Rating:	See Miscellaneous Enclosure for model nomenclature. Input:45V Output: 48V Max Power: 600W Max.
Applicant Name and Address:	VICOR CORP 25 FRONTAGE RD ANDOVER MA 01810 UNITED STATES

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of UL LLC ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

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UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability.

Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL.

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Supporting Documentation

The following documents located at the beginning of this Procedure supplement the requirements of this Test Report:

- A. Authorization - The Authorization page may include additional Factory Identification Code markings.
- B. Generic Inspection Instructions -
 - i. Part AC details important information which may be applicable to products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of this Test Report.
 - ii. Part AE details any requirements which may be applicable to all products covered by this Procedure. Products described in this Test Report must comply with any applicable items listed unless otherwise stated in the body of each Test Report.
 - iii. Part AF details the requirements for the UL Certification Mark which is not controlled by the technical standard used to investigate these products. Products are permitted to bear only the Certification Mark(s) corresponding to the countries for which it is certified, as indicated in each Test Report.

Product Description

The full size VI Chip PRM is a non-isolating DC-DC front end Pre-Regulator Module that is designed to be used with a VI Chip VTM to make a complete regulated DC-DC converter. The PRM DC-DC converters are designed for building-in and the input is intended to be derived from a TNV-2, SELV, or non-hazardous secondary circuit.

Model Differences

See Miscellaneous Enclosure for model nomenclature.

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : Not connected directly to mains
- Operating condition : continuous
- Access location : building-in
- Over voltage category (OVC) : Not connected directly to mains
- Mains supply tolerance (%) or absolute mains supply values : No direct connection
- Tested for IT power systems : No
- IT testing, phase-phase voltage (V) : -
- Class of equipment : Class II
- Considered current rating (A) : -
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : 150
- Altitude of test laboratory (m) : 2000
- Mass of equipment (kg) : 0.0125
- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) permitted by the manufacturer's specification of: semiconductor junction temperature of the VI Chip not exceeding 125°C

Engineering Conditions of Acceptability

For use only in or with complete equipment where the acceptability of the combination is determined by UL LLC. When installed in an end-product, consideration must be given to the following:

- The input to the PRM is intended to be supplied from a TNV-2 circuit, or other non-hazardous secondary circuit
- The PRM is a non-isolating device. The output of the PRM can be considered SELV when the input is SELV with the exception of the VIZ0051. The output of the VIZ0051 can exceed the SELV limits under a fault condition but it does not exceed the limits of TNV-2 circuits.
- Max Temperature: Keep the maximum semiconductor junction temperature of the VI Chip at 125°C or less. There are two methods to demonstrate compliance. Method 1: Keep $T_{casemax} < 100^{\circ}\text{C}$ under all conditions where $T_{casemax}$ is the maximum case temp of the VI chip. Method 2: Keep $T_{casemax} < 125^{\circ}\text{C} - (P_{dissmax} \times 1.5)$ under all conditions where $P_{dissmax} = P_{inputmax} - P_{outputmax}$. $P_{dissmax}$ is the amount of power in Watts dissipated within the device. The thermal resistance of the full size VI Chip from the internal semiconductor junction to the case is 1.5°C/Watts.
- If the internal semiconductor junction temperature exceeds 125°C the module may be damaged.
- PRM models rated up to 320W were evaluated with a Littelfuse Nano2Fuse rated 10A. PRM models rated 400W were evaluated with a Littelfuse Nano2Fuse rated 15A. PRM models rated 600W were evaluated with a Littelfuse Nano2 456 series fuse rated 20A and an SOC 25CF rated 18A
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-SELV: 75 Vrms, 76.8 Vpk
- The power supply terminals and/or connectors are: Not investigated for field wiring
- The investigated Pollution Degree is: 2
- The following end-product enclosures are required: Mechanical , Fire , Electrical
- The output of the VIZ0051, VIZ0051x may be considered TNV-2 or external circuitry may be added and evaluated in the end product in order to provide output over voltage protection and compliance with the limits of SELV circuits.
- Outputs above 240W are considered hazardous energy and shall be investigated in the end use for accessibility.

Additional Information

Report was upgraded under project 09ME09537 to second edition of standard UL 60950-1. CB Cert DE-58297 and report reference 090-909538-000 provided as additional information, see test reference for details.

VI CHIP PRM Model Number: **Pbbbcdddeffxx** example: **P045F048T40RS**

P = P

PRM Family (Pre-regulator Module)	
P	Constant

bbb = 045

Input Voltage	Nominal (range)	Input Voltage	Nominal (range)
024	24 Vdc (18-36)	045	45 Vdc (38-55)
028	28 Vdc (16-50)	048	48 Vdc (36-75)
036	36 Vdc (18-60)		

c = F

Package Size	In Board BGA	On Board J-Lead	Through Hole
Full VIC	K	F	T

ddd = 048

Output Voltage Designator			
036	36.0 Vdc (26-55)	048	48.0 Vdc (26-55)

e = T

Product Grade			
T	-40 to 125C	M	-55 to 125C

ff = 32

Output Power Designator					
12	120 W	24	240 W	40	400 W
17	170 W	32	320 W	60	600 W

xx = AL

Feedback Style Designator (optional)			
AL	Adaptive Loop	RS	Remote Sense

Customer Special Models:

Customer Special Model Numbers	Equivalent Standard Model Number
VIP0001, VIP0001x	P045F048T40RS
VIZ0017, VIZ0017x	P045F048T32AL
VIZ0032, VIZ0032x	P048F048T24AL
VIZ0036, VIZ0036x	P045F048T32AL
VIZ0051, VIZ0051x (see license conditions)	P045F048T40RS
VIZ0067, VIZ0067x	P045F048T32AL
MP028F036M12AL, VIZ0076, VIZ0076x	P028F036M12AL
VIZ0079, VIZ0079x	P036F048T12AL
VIZ0081, VIZ0081x	P048F048T24AL
VIZ0082, VIZ0082x	P045F048T32AL
x = revision, any letter A through Z, non-safety related	

VI CHIP PRM2 Model Number: PRMbbbccddefffxzz

Example: PRM48BF480T400A00

PRM = Constant

PRM Family (Pre-regulator Module)	
PRM	Standard version
MPRM	Mil-COTS version

bbb = 48B

Input Voltage	Nominal (range)	Input Voltage	Nominal (range)
24A	24 Vdc (18-36)	48A	48 Vdc (36-75)
28A	28 Vdc (16-50)	48B	48 Vdc (38-55)
28B	28 Vdc (5-50)	48D	48 Vdc (38-60)
36A	36 Vdc (18-60)	48J	48 Vdc (42-55)
36B	36 Vdc (26-50)		

c = F

Package Size and Lead Designator	
F	Full VI Chip J-Lead
T	Full VI Chip Though-hole

ddd = 480

Output Voltage Designator	
360	36.0 Vdc (26-55)
480	48.0 Vdc (26-55)

e = T

Product Grade	
T	-40 to 125C
M	-55 to 125C

fff = 400

Output Power Designator (can be any three digits from 120 to 600) non-inclusive list of examples below			
120	120W	320	320W
170	170W	400	400W
200	200W	500	500W
240	240W	600	600W

x = A

Revision (non-safety related)	
x	Any alphanumeric character

zz = 00

Customer reference (non-safety related)	
zz	Any alphanumeric character or Blank

Customer Special Models:

Customer special Model Numbers	Equivalent Standard Model Number
VIZ0055, VIZ0055x (see license conditions)	PRM48BF480T600A00

Full Size Customer Configured PRM Model Number: PRMxyaa-zzzzzz
Example: PRM2A01-123456

PRM = Constant

PRM Family (Pre-regulator Module)

x = 2

Controller Revision, 0 through 9 (non-safety related)

y = A

Product Revision, A through Z (non-safety related)

aa = 01

Hardware Configuration, max ratings, actual ratings may be less			
HW Configuration	Vin (Vdc)	Vout (Vdc)	Pout (W)
01 = full size narrow range	38-55V	55V	500W
02 = full size wide range	36-75V	55V	400W

zzzzzz = 123456

Any 6 digit numeric combination, customer specific configuration, non-safety related, J-Lead or Through-Hole, T or M grade, and Feedback Style