Description

UL TEST REPORT AND PROCEDURE

Standard:	ANSI/AAMI ES60601-1: A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012, CSA CAN/CSA-C22.2 NO. 60601-1:14
Certification Type:	Component Recognition
CCN:	QQHM2 / QQHM8
Product:	Switch-mode power supplies
Model:	CUS150M (may be prefixed and followed by alphanumeric characters - See model differences section for details of nomenclature) CUS100ME (may be prefixed and followed by alphanumeric characters - See model differences section for details of nomenclature)
Rating:	Input: CUS150M-xxVx/yyyy 100-240Vac; 47-63Hz; 2.2Arms Max. CUS150MD-xxVx/yyyy 133-318Vdc, 1.8A CUS100ME-xxVx/yyyy 100-240Vac; 47-63Hz; 1.4Arms Max. Output: CUS100ME-12/yyyy output: 12-13.2Vdc 8.33A CUS100ME-15/yyyy output: 15-16.5Vdc 6.66A CUS100ME-18/yyyy output: 18-19.8Vdc 5.55A CUS100ME-24/yyyy output: 24-26.4Vdc 4.16A CUS100ME-28/yyyy output: 28-30.8Vdc 3.57A CUS100ME-36/yyyy output: 36-39.6Vdc 2.77A CUS100ME-48/yyyy output: 48-50Vdc 2.08A CUS150M-12/yyyy output: 12-13.2Vdc 12.5A CUS150M-15/yyyy output: 15-16.5Vdc 10A CUS150M-18/yyyy output: 18-19.8Vdc 8.33A CUS150M-24/yyyy output: 24-26.4Vdc 6.25A CUS150M-28/yyyy output: 28-30.8Vdc 5.4A CUS150M-36/yyyy output: 36-39.6Vdc 4.2A CUS150M-48/yyyy output: 48-50Vdc 3.125A Each output has a range shown in the table above which is factory configurable only. For further details please see model differences section.
Applicant Name and Address:	TDK-Lambda UK Ltd Kingsley Avenue, Ilfracombe Devon, EX34 8ES, UNITED KINGDOM

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.

Prepared by:	Krzysztof Wasilewski, Project Handler	Reviewed by:	Bruno Motta, Reviewer

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 CUS150M is a power supply for building in to end equipment. It is available as open frame, U chassis, U chassis and lid, base plate and with a top fan version.

The power supply can be used as either a Class I or a Class II construction.

- For Class I construction, the power supply will need to be reliably earthed, professionally installed and fixed with suitable, metal screws.
-For Class II construction no earthing connection is required. The power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation.

The power supply provides two fuses for input protection. One in the Live line and one in the Neutral line. Option E uses one fuse only. This is fitted in the live line only.

The power supply can be forced air (top fan or customer air), convection or conduction cooled. Due to the fact that air flow for cooling depends on end product use, only convection cooling and top fan configurations were considered during temperature measurement.

The component temperatures listed in the additional information shall not be exceeded.

Refer to the Report Modifications for any modifications made to this report.

Model Differences

The CUS has two ranges of 100W and 150W each with seven nominal output voltages of 12, 15, 18, 24, 28, 36 and 48 Volt. Each output has a range shown in the table below which is factory configurable only.

CUS models as described below:

Units may be marked with a Product Code: CUSZ-xxVx/yyyy where Z is 100ME or 150M and x may be any number of numbers or left blank to indicate the output voltage. V represents a decimal place when required or can left be left blank. y can be blank or any number of numbers or letters (excluding M, E, U, A, F, B, H) when indicating non-safety related model differences. y can be M, E, U, A, F, B when indicating the standard options as listed below.

Unit Product Code may be prefixed by K, SP # and/or NS # followed by / or - (where # may be any number of characters indicating non-safety related model differences).

Unit Product Code:
CUSZ-xxVx/yyyy

Where:
Z = 150M for 150W model (may be followed by 'D' for DC input), 100ME for 100W model
xxVx = Channel 1 output voltage from within the output voltage adjustment range from the Output Parameters Tables below.
yyyy = Unit options from list of standard unit options below, or non-safety related model differences:
/M = Molex connectors
/E = Single fuse in the live line
/U = U chassis
/A = Cover and U chassis
/F = Top fan, cover and U chassis (CUS150M model only)
/B = Baseplate

Input Parameters

Nominal input voltage:	100 - 240Vac,	133 - 318Vdc*
Input voltage range :	85 - 264Vac,	120 - 350Vdc*
Input frequency range:	47 - 63Hz,	DC*
Maximum input current:	2.2A rms (CUS150M), 1.4A rms (CUS100ME)	1.8A*

* 60601-1 2nd ed, 300Vdc input max. DC rating applies for CUS150M family only.
All ratings apply for ambient temperatures up to 50°C. (see Variations and Limitations below)
Output power is reduced linearly by 10% for input voltages from 90 to 85Vac

Output Parameters

There are seven CUS150M and CUS100ME standard models as shown in the tables below. All of these models may be fan(CUS150M model only), forced air, conduction or convection cooled. The output parameters are shown in the tables below.
Outputs are not user adjustable but can be factory set.

CUS150M

	Vout	*Fan	Max	Max		*Fan Output ratings	
Model	Range (V)	Vnom (V)	Iout (A)	Pout (W)	Inom (A)	Pnom (W)	
12	12-13.2	11.6	12.5	150	0.5	5.8	
15	15-16.5	9.8	10	150	0.5	4.9	
18	18-19.8	11.6	8.33	150	0.5	5.8	
24	24-26.4	11.6	6.25	150	0.5	5.8	
28	28-30.8	10.8	5.4	150	0.5	5.4	
36	36-39.6	11.6	4.2	150	0.5	5.8	
48	48-50	11.6	3.125	150	0.5	5.8	

* Fan output tracks Vout Range
Variation and Limitations:
Customer Forced Air Cooling max ambient 85°C (note 1)
Convection and conduction/cold plate Cooling (U chassis with lid-Option A) max ambient 75°C (note 1)
Convection and conduction/cold plate Cooling (U chassis and open frame) max ambient 80°C (note 1)
Fan supplied ratings/Option F max ambient 70°C, from 50°C to 70°C the output power is de-rated by 0.5°C per watt
Note 1. Maximum output power and current ratings are dependent on the ambient used in the end equipment.

CUS100M

	Vout	Max	Max
Model	Range (V)	Iout (A)	Pout (W)
12	12-13.2	8.33	100
15	15-16.5	6.66	100
18	18-19.8	5.55	100
24	24-26.4	4.16	100
28	28-30.8	3.57	100

36	36-39.6	2.77	100
48	48-50	2.08	100

Variation and Limitations:

Customer Forced Air Cooling max ambient 85°C (note 1)

Convection and conduction/cold plate Cooling (U chassis with lid-Option A) max ambient 75°C (note 1)

Convection and conduction/cold plate Cooling (U chassis and open frame) max ambient 80°C (note 1)

Note 1. Maximum output power and current ratings are dependent on the ambient used in the end equipment.

Additional Information

Cooling for units with forced air cooling (Except option F)

The product can also operate at input voltage lowered to 85Vac with linear output de-rating to -10%.

The following method must be used for determining the safe operation of PSUs.
The components listed in the following table must not exceed the temperatures given. To determine the component temperatures the heating tests must be conducted in accordance with the requirements of the standard in question. Consideration should also be given to the requirements of other safety standards.
Test requirements include: PSU to be fitted in its end-use equipment and operated under the most adverse conditions permitted in the end-use equipment handbook/specification and which will result in the highest temperatures in the PSU. To determine the most adverse conditions consideration should be given to the end use equipment maximum operating ambient, the PSU loading and input voltage, ventilation, end use equipment orientation, the position of doors & covers, etc. Temperatures should be monitored using type K fine wire thermocouples (secured with cyanoacrylate adhesive or similar) placed on the hottest part of the component (out of any direct airflow) and the equipment should be run until all temperatures have stabilized.

CUS150M Cooling for Unit Temperature Table:

Circuit Ref.	Description Max.	Temperature (°C)
L1	Common Mode Choke	110 (130)
L2	PFC choke 125	(130)
L3	Differential mode choke	125 (130)
C1	Film capacitor	105
C2, C110	Electrolytic Capacitors	86 (105)
C6, C102, C104, C105	Electrolytic Capacitors	92 (105)
C3	X Capacitor	100
C5, C100, C101, C103,	Y Capacitors	105
TX100	Transformer Winding	110
XU101, XU102	Opto-Coupler 100	(110)
XD8	Diode	130
J1	Input Connector	105
J100	Output Connector	105

CUS100ME Cooling for Unit Temperature Table:

Circuit Ref.	Description Max.	Temperature(°C)
L1	Common Mode Choke	110 (130)
L2	PFC choke	125 (130)
L3	Differential mode choke	125 (130)

C1	Film capacitor	105
C2	Electrolytic Capacitors	90 (105)
C104, C105	Electrolytic Capacitors	92 (105)
C6, C102	Electrolytic Capacitors	93 (105)
C3	X Capacitor	100
C5, C100, C101, C103,	Y Capacitors	105
TX100	Transformer Winding	110
XU101, XU102	Opto-Coupler	100 (110)
XD8	Diode	130
J1	Input Connector	105
J100	Output Connector	105

Higher temperature limits (in brackets) may be used but product life may be reduced.

Technical Considerations

- The product was investigated to the following additional standards: EN 60601-1:2006/A1:2013, KS C IEC 60601-1, ANSI/AAMI ES60601-1: A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012, CSA CAN/CSA-C22.2 NO. 60601-1:14, BS EN 60601:2006 A1, SS-EN 60601-1:2006+A11:2011+A1:2013+AC1:2014+A12:2014
- The following additional investigations were conducted: n/a
- The product was not investigated to the following standards or clauses: Biocompatibility, PESS, EMC, Annex Z of EN standards for compliance with the MDD
- The following accessories were investigated for use with the product: n/a
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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 following production line tests are conducted for this product: Electric Strength, Earthing Continuity
- The following output terminals were referenced to earth during performance testing: All outputs and their return lines individually referenced to earth to obtain maximum working voltage
- The power supply terminals and/or connectors are: not investigated for field wiring
- The maximum investigated branch circuit rating is: 20A
- The investigated pollution degree is: II
- Proper bonding to the end product main protective earthing termination is: required in a Class I application
- The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY2 insulation system with the indicated rating greater than Class A (105°C): TX100 (class B)
- The following end-product enclosures are required: Mechanical, Fire, Electrical
- EMC compliance has not been verified nor has it been taken into consideration. An accredited EMC Test Report will be required in conjunction with the Certification of the end product.
- All models require component temperatures to be monitored as detailed in the additional information.
- The end-product Dielectric Strength Test is to be based upon a maximum working voltage of: Primary-Secondary: 240 Vrms, 480 Vpk, Primary-Earthed Dead Metal: 350 Vrms,410 Vpk, Secondary outputs-Earthed Dead Metal: 240Vrms, 340Vpk.