

Description**UL TEST REPORT AND PROCEDURE**

Standard:	ANSI/AAMI ES60601-1:2005/(R)2012 and A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012, CSA CAN/CSA-C22.2 NO. 60601-1:14, IEC 60601-1:2005+A1:2012
Certification Type:	Component Recognition
CCN:	QQHM2/QQHM8
Complementary CCNs:	
Product:	Component switch mode power supply
Model:	(K)CUS250M-xxVx/yyyyyy/(NNNNL), where N is a string of numbers which identifies the non-standard requirement and L is an optional letter, starting with 'A' which is incremented for any customer revisions. CUS250M-xxVx/yyyyyy/(SPNN), where SP represents a sales code. NN may be any number of characters indicating non-safety related model differences. (CUS250M may be followed by suffix 'D' for DC Input) (Where xxVx = Channel 1 output voltage, may be 12V, 15V, 18V 24V, 28V, 36V, 48V. The letter "V" only applies to the non-standard output voltages. E.g. 12V6 to represent 12.6V. Where yyyyyy = unit options such as case options (may be blank, U, A, F, or C), Connector options (may be blank or M), Fuse options (may be blank or E), signal, standby options (may be blank, G, J, or K), Leakage current options (may be blank or T), Output connector options (may be blank or L), Coating options (may be blank or P).) (See Model Differences section for more details)
Rating:	100 – 240Vac nominal, 3.1A max, 47-63Hz 133 - 318Vdc nominal, 3.0A max (See model differences for details of ratings)
Applicant Name and Address:	TDK-Lambda UK Ltd Kingsley Avenue Ilfracombe, 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.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

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 as applicable.

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

Prepared by: Maggie Chiu, Project handler

Reviewed by: Grzegorz Kowalski, 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 CUS250M is an AC-DC switch mode power supply designed for building in to end equipment in either a class I or class II configuration. It is available in the following mechanical configurations:

- Standard model with integral metal baseplate,
- U channel,
- U channel with cover,
- U channel with cover and top fan
- Standard model with integral metal baseplate with M3 threaded inserts for underside mounting
- Custom baseplate / U chassis with alternate fixings / inserts

The unit is fitted with two fuses as standard with one fuse in the live line and one in the neutral line. Option E allows for a single fuse to be fitted in the live line.

The unit can be cooled via forced air (top fan and customer air versions), convection or conduction. All variants that are not supplied with a fan are dependent on the end equipment application and therefore testing must be carried out in the end equipment to ensure compliance with the stated component temperatures listed in the "Additional application considerations" section of this report.

For Class I construction, the power supply needs to be reliably earthed, professionally installed and fixed with suitable metal screws.

For Class II construction no earth connection is required however the power supply needs to be fixed so that it is insulated from any unearthed accessible conductive part by reinforced insulation.

For model CUS250M followed by suffix 'D' is available for DC Input and it is limited to altitude of 3000m. Refer to the Report Modifications page for any modifications made to this report.

Model Differences

The CUS250M has a maximum rated power of 250W and has several nominal output voltages of 12Vdc, 15Vdc, 18Vdc, 24Vdc, 28Vdc, 36Vdc and 48Vdc.

Nomenclature

Unit Product Code: CUS250M-xxVx/yyyyyy

CUS250M may be followed by 'D' for DC Input

Where: xxVx = Channel 1 output voltage from within the output voltage adjustment range from the "Output Parameters" table below.

Where yyyyyy = unit options from the list of standard options below

Case Options (all case options and metal base include gap pads)

Blank = Open frame (with integral metal baseplate)
 U = U channel
 A = U channel with cover
 F = U channel, cover and top mounted fan
 C = M3 inserts for underside mounting
 N = Custom baseplate / U chassis with alternate fixings / Inserts

Connector Options:

Blank = JST connector
 M = Molex type connector

Fuse Options:

Blank = Dual fuse (standard)
 E = With single fuse in live line

Signal, Standby Options:

Blank = No option (fan supply is standard)
 G = 5V, 0.1A standby supply, remote on/off (enable), DC_OK, AC_Fail
 J = 5V, 0.1A standby supply, remote on/off (inhibit), DC_OK, AC_Fail
 K = Remove fan supply (CH1 only)

Leakage Current Options:

Blank = Standard leakage (<150µA)
 T = Reduced leakage current (<50µA)

Output Connector Options:

Blank = Screw terminal
 L* = Custom option *can be any number denoting different connector type

Coating Options:

Blank = No coating
 P = Protective coating

Example: CUS250M-24V5/UEP = 24.5V with U channel, JST connector, single fuse in the live line, no options, standard leakage and protective coating

Non-standard Models:

Unit product code may be prefixed with 'K' followed by any standard product code followed by /NNNNL where N is a string of numbers which identifies the non-standard requirement and L is an optional letter, starting with A which is incremented for any customer revision.

Example: KCUS250M-24/0001A

Unit product code may be suffixed by /NNNNL where N is a string of numbers which identifies the non-standard requirement. L is an optional letter, starting with 'A', which is incremented for any customer revision.

Example: CUS250M-24/0001A

Unit product code may be suffixed by SPNN (where NN may be any number of characters indicating non-safety related model differences) (SP represents a sales code).

Example: CUS250M-24/FE/SP01

Input Parameters

Nominal Input Voltage 100* – 240Vac, 133 - 318Vdc
 Input Voltage Range 80** – 264Vac, 120 – 350Vdc

Input Frequency Range 47 – 63Hz
 Maximum Input Current 3.1Arms, 3.0Adc

All ratings apply for ambient temperatures up to 50°C (see Variations and Limitations below)

*Output power is reduced by 1%/V between 100V and 90Vac (225W max at 90Vac)

** Output power is reduced by 2%/V between 90V and 80Vac (180W max at 80Vac)

Output Parameters

The model variants listed below may be fan, forced air, conduction or convection cooled. The output parameters are shown in the table below.

CUS250M CH1 Outputs:

Model	Vout Max Range (V)	Max Iout (A)	Max Pout (W)
12	12 – 13.2	20.83	250
15	15-16.5	16.66	250
18	18-19.8	13.88	250
24	24 – 26.4	10.41	250
28	28-30.8	8.92	250
36	36-39.6	6.94	250
48	48-52.8	5.2	250

CUS250M Standby Output:

Model	Vout Max Fixed (V)	Max Iout (A)	Max Pout (W)
5	5	0.1	0.5

CUS250M Fan Output:

Vout Max Fixed (V)	Iout (A)
11.6	0.5

Variations and Limitations:

- Customer forced air cooling max ambient: 85°C (see note 1)
- Convection and conduction/cold plate cooling (U channel with cover, Option A) max ambient: 75°C (see note 1)
- Convection and conduction/cold plate cooling (U channel and open frame) max ambient: 80°C (see note 1)
- Fan cooling max ambient: 70°C (output power de-rated linearly by 2.5W/°C above 50°C)

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

Additional Information

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturers specification of: 50°C maximum rated ambient (with appropriate deratings), 70°C maximum extended ambient for fan variants, 75°C maximum extended ambient for cover variants, 80°C maximum extended ambient for open frame and U Channel only variants.
- The total output power and current ratings are both de-rated to ensure power curves are met. Refer to the Instruction Manual included in Enclosure of this report.
- The tape, in transformers TX1 and TX300, is for mechanical support only and not safety critical. see Enclosure "Additional application consideration" for more details regarding cooling and safe use.

The following tests were selected as representative of the test program applicable to model covered by this CBTR:

4.11 POWER INPUT

8.4.3 VOLTAGE OR CHARGE LIMITATION

8.7.4.6 TOUCH LEAKAGE CURRENT

8.8.3 DIELECTRIC VOLTAGE WITHSTAND

11 TEMPERATURE**13 ABNORMAL OPERATION TESTING****15.3.2 ENCLOSURE FORCE**

These tests have been witnessed for models selected as representative of the standard covered by this report and the applicable test program.

Technical Considerations

- The product was investigated to the following additional standards: N/A
- 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, Risk Management (ISO 14971).
- The following accessories were investigated for use with the product: N/A
- No Other Considerations

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:

- When installed in an end-product, consideration must be given to the following:
 - The following product-line tests are conducted for this product: Electric Strength, Earthing Continuity
 - The following product-line tests shall be conducted in the end application: Patient Circuit Dielectric Voltage Withstand (all barriers except barrier G)
 - The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-Secondary: 463 Vrms, 618 Vpk, Primary – Earthed Dead Metal: 408 Vrms, 562 Vpk
 - The maximum investigated branch circuit rating is: 20A
 - The investigated Pollution Degree is: 2
 - The following end-product enclosures are required: Mechanical, Electrical, Fire
 - The following magnetic devices (e.g. transformers or inductors) are provided with an OBJY2 insulation system with the indicated rating greater than Class A (105°C): TX1 (Class F), TX300 (Class B)
 - The power supply was evaluated to be used at altitudes up to: 5000m for AC input; 3000m for DC input
 - The power supply terminals and/or connectors are: Not investigated for field wiring
 - The fan provided in this sub-assembly is not intended for operator access
 - The power supply can be forced air (top fan or customer air versions), convection or conduction cooled. All variants that are not supplied with a fan are dependent on the end equipment application and therefore testing must be carried out in the end equipment to ensure compliance with the stated component temperatures listed in the “Additional application considerations” section of this report.
 - 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 voltages
 - For option E (single fuse in the live line) the end equipment must be provided with a polarized plug
 - Proper bonding to the end product main protective earthing termination is: required (except Class II applications)
 - Where installed as a Class I power supply the protective bonding point must be verified in the end equipment
 - Multilayer PWB's accepted under CBTR Ref. No E349607-A23 dated 2014-07-31 and Letter Report included in Enclosure " Cemented Joint Letter Reports" of this report.
 - 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.
- 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 however the power supply needs to be fixed so that it is insulated from any unearthed

accessible conductive part by reinforced insulation.

- A high breaking capacity Mains fuse, minimum 10 kA @ 125 V, shall be considered in the end-use product.
- Series operation is not permitted for this product.
- 12V output units utilizing the JST B4P-VH(LF)(SN) connector under Option L are restricted to 240W.

The following were not part of this submission and shall be assessed in the end application:

- The Risk management and Usability
- Clause 11.8 Interruption of the Power Supply
- Clause 7.2.2 Identification
- Clause 8.11.5 Mains fuses and over-current releases