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Report Reference #

E135494-A6063-UL

Revision Date: 2024-03-26

UL TEST REPORT AND PROCEDURE

Standard:	UL 62368-1, 3rd Ed, 2021-10-22 (Audio/video, information and communication technology equipment Part 1: Safety requirements) CAN/CSA C22.2 No. 62368-1:19, 3rd Ed, 2021-10-22 (Audio/video, information and communication technology equipment Part 1: Safety requirements)
Certification Type:	Component Recognition
CCN:	QQJQ2, QQJQ8 (Power Supplies for Use in Audio/Video, Information and Communication Technology Equipment)
Complementary CCN:	N/A
Product:	AC-DC Switch Mode Power Supply
Model:	- (K)CUS250M-xxVx/yyyyyyy/(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/yyyyyyy/(SPNN), where SP represents a sales code. NN may be any number of characters indicating non-safety related model differences e.g.: Extra labels on the unit. - (K)CUS250MD-xxVx/yyyyyyy/(NNNNL), where D represents DC input, 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. - CUS250MD-xxVx/yyyyyyy/(SPNN), where D represents DC input, SP represents a sales code. NN may be any number of characters indicating non-safety related model differences e.g.: Extra labels on the unit. Where xxVx = Channel 1 standard output voltages, 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).
Rating:	Input: 100-240Vac, 3.1A max, 47-440Hz Input: 133-318Vdc, 3.0A max Output: 12 Vdc, 20.83 A or

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15 Vdc, 16.66 A or
18 Vdc, 13.88 A or
24 Vdc, 10.42 A or
28 Vdc, 8.92 A or
36 Vdc, 6.94 A or
48 Vdc, 5.2 A

Applicant Name and Address:

TDK-LAMBDA UK LTD
KINGSLEY AVE
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.

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.

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

Prepared By: Daniel Wong / Project Handler

Reviewed By: David Snook / 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.

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

For end-product Class II configuration, 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.

The CUS250M can be cooled via forced air (top fan and customer air versions), convection or conduction. It is available in the following mechanical configurations:

- Standard model with integral metal baseplate.
- U channel,
- U channel with cover,
- U channel, cover and top mounted fan,
- M3 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.

Input Parameters

Nominal Input Voltage	100* – 240Vac, 133 – 318Vdc
Input Voltage Range	80** – 264Vac, 120 – 350Vdc
Input Frequency Range	47 – 440Hz
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) however product was tested with full load (250W 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 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	10.42	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 Fixed (V)	Max Iout (A)	Max Pout (W)
5	5	0.1	0.5

CUS250M Fan Output:

Model	Vout Fixed (V)	Iout (A)
F	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 (U Option) and open frame) max ambient: 80°C (see note 1)
- Fan cooling max ambient: 70°C (F Option) (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. Refer to the CUS250M Instruction Manual included in Enclosure 6-01 of this report for further details.

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. Output parameters are shown in the table above.

Nomenclature

Unit Product Code: CUS250M-xxVx/yyyyyy

CUS250M may be followed by 'D' for DC Input

Where: xxVx = Channel 1 output voltage, may be any value, from within the output voltage adjustment range from the "Output Parameters" table above.

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

Case Options

Blank = Open frame (with integral 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 = Single fuse in live line

Signal, Standby Options:

Blank = No options (CH1 and fan supply are 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:

1) 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 revisions denoting different output connector types.

Example: KCUS250M-24/0001A

2) 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 revisions denoting different output connector types.

Example: CUS250M-24/0001A

3) Unit product code may be suffixed by /SPNN (where NN may be any number of characters indicating non-safety related model differences e.g.: Extra labels on the unit) (SP represents a sales code).

Example: CUS250M-24/FE/SP01

Test Item Particulars

Product group	built-in component
Classification of use by	Skilled person
Supply Connection	AC Mains DC Mains
Supply tolerance	+10%/-10%
Supply connection – type	mating connector
Considered current rating of protective device	20 A; Location: building
Equipment mobility	for building-in
Over voltage category (OVC)	OVC II
Class of equipment	Class I Class II
Special installation location	N/A
Pollution degree (PD)	PD 2
Manufacturer's specified Tma (°C)	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
IP protection class	IPX0
Power systems	TN TT
Altitude during operation (m)	5000 m
Altitude of test laboratory (m)	2000 m or less
Mass of equipment (kg)	<1

Technical Considerations

- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's 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 product is intended for use on the following power systems : TN, TT, DC mains supply
- Considered current rating of protective device as part of the building installation (A) : 20
- Mains supply tolerance (%) or absolute mains supply : +10%/-10% for both AC and DC supplies
- The equipment disconnect device is considered to be : Provided in the end-equipment
- The following were investigated as part of the protective earthing/bonding : Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)
- The following are available from the Applicant upon request : Installation (Safety) Instructions / Manual
- The product was investigated to the following additional standard : EN IEC 62368-1:2020+A11:2020, CAN/CSA C22.2 No. 62368-1:19, 3rd Edition
- The means of connection to the mains supply is: to be determined in the end-equipment
- 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.
- Capacitors are rated for 230V due to the IT power system used in Norway. Further evaluation may be required in the end equipment for IT power systems
- 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 6-01 of this report.
- IEC 62368-1:2014 2nd Edition report has been accepted for UL/IEC 62368-1:2018 3rd Edition since the technical requirements are the same. Test results from the 2nd Edition report are considered valid for UL/IEC 62368-1 3rd Edition.

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 product-line tests are conducted for this product : Earthing Continuity Test, Electric Strength
- The end-product Electric Strength Test is to be based upon a maximum working voltage of : Primary – Earthed Dead Metal: 408 Vrms/562 Vpk, Primary-Secondary: 463 Vrms/618 Vpk
- The following output circuits are at ES1 energy levels : CH1 output (12V, 15V, 18V, 24V, 28V, 36V models)
- The following output circuits are at ES2 energy levels : CH1 output (48V model)
- The following output circuits are at PS3 energy levels : All circuits (declared)
- The maximum investigated branch circuit rating is : 20 A
- The investigated Pollution Degree is : 2
- Proper bonding to the end-product main protective earthing termination is : Required (except Class II models)
- An investigation of the protective bonding terminals has : not been conducted
- The following input terminals/connectors must be connected to the end-product supply neutral : Neutral terminal marked as "N" of input connector
- The following end-product enclosures are required : Electrical, Fire, Mechanical
- 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) : TX1 (Class F), TX300 (Class B).
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing : see "CUS250M forced air cooling temperature table:" in additional information section.
- The power supply was evaluated to be used at altitudes up to : "5,000 m"
- The power supply terminals and/or connectors are: Not investigated for field wiring
- 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
- For protection from moving parts, the required mechanical enclosure must prevent access to the fan blades. Fan blades should only be accessible to a skilled person after the removal of the metal enclosure. The moving part is obvious.
- Prospective touch voltage, touch current and protective conductor current has not been evaluated for frequency above 63Hz supply and must be evaluated in the end equipment
- Prospective touch voltage and touch current has not been evaluated for Class II constructions and must be evaluated in the end equipment.
- Marking for equipment provided with fuses located in both line and neutral of a single phase mains to be considered in end-product
- Fan provided classified as MS1 class and is not accessible to Ordinary or Instructed persons.
- This product is not permitted to be connected in series.
- 12V units utilizing the JST B4P-VH(LF)(SN) connector under Option L are restricted to 240W.

Additional Information

The marking label provided is representative of all models and ratings.

The following tests were selected as representative of the test program applicable to model covered by this CBTR: Operating temperature measurement conditions (Cl. B.2.6), Simulated Abnormal Operating Conditions (B.3), and Electric Strength (Cl. 5.4.9).

These tests have been witnessed for models selected as representative of the standard covered by this report and the applicable test program. (4790099713, DA file 331).

This report is based on previously conducted testing and the review of product construction evaluated per IEC/UL 62368-1 2nd edition in CB report Ref. No E135494-A6052-CB-1 with certificate no. DK-120503-UL issued on 2021-11-05.

The following method must be used for determining the safe operation of PSUs. The PSU shall be evaluated by Heating Test in the end product application. The components listed in the following table must not exceed the temperatures given.

CUS250M forced air cooling temperature table:

Circuit Reference	Description Max.	Temperature (°C)
L1	Common Mode Choke	110
L3	PFC Choke	125
L4	Differential Mode Choke	140
C5	Film Capacitors	105
C6, C104, XC104, XC105, XC400, XC502	Electrolytic Capacitors	85 (105)
C1	X Capacitors	110
C2, C3, C100, C102, C103	Y Capacitors	119 (125)
TX1	Transformer Winding	125
TX300	Transformer Winding	110
XU100, XU301, XU402	Opto-couplers	106 (125)
XD1, XD2, XD3, XD4	Bridge Diodes	130
XQ2	FET	130
J1	Input Connector	105

The CUS250M has a set of power curves defined by the design specification (copies of these curves are provided in the Instruction Manual) which state the maximum power level at different ambient temps. Testing was carried out to reflect the various points of consideration for each power curve.

Heating test at +/- 10% input tolerance at full rated load was conducted at unit with top fan (F option). The unit was able to operate at this condition, as required by the standard, without failure.

Additional Standards

The product fulfills the requirements of: EN IEC 62368-1:2020+A11:2020
CSA/UL 62368-1:2019
J62368-1(2023)

Markings and Instructions

Clause Title	Marking or Instruction Details
Equipment identification marking – Manufacturer identification	Listee's or Recognized Company's name, Trade Name, Trademark or File Number
Equipment identification marking – model identification	Model Number
Equipment rating marking – ratings	"Input Ratings (voltage, frequency/dc, current/power)", "Output Ratings (voltage, frequency/dc, current/power)"

Special Instructions to UL Representative

This procedure shall describe essentially the same construction as in the procedure E135494-A6052.