UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2019-05-09 (Information Technology Equipment - Safety - Part 1: General Requirements) CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10 (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)
Complementary CCN:	N/A
Product:	Switch Mode Power Supply
Model:	EFE300M Series or EFE-300M Series (see model differences for details of models and nomenclature)
Rating:	100-240Vac nom, 4.9Arms max, 45-440Hz (optional) 133-318Vdc nom, 3.5Adc max (optional) (See model differences for details of ratings)
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.

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Prepared By: Borys Bakun / Project Handler Reviewed By: Michał Siudowski / 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

EFE300M series. Switch mode power supplies for building into end equipment.

Model Differences

Nominal Input Voltage Range	100 - 240V AC or 133 - 318VDC
Maximum Input Voltage Range	90** - 264V AC or 120 - 350VDC
Input Frequency	45-440* Hz maximum or DC
Maximum Input Current	4.9A rms or 3.5A DC

** Channel 1 output is linearly derated from 90Vac to 85Vac, 4W per volt to 280W.

All ratings apply for ambient temperatures up to 50°C. From 50 to 70°C the output power is derated at 2.5% per deg C.

EFE300M or -EFE300M models as described below:

(may be prefixed by NS - # / where # may be any characters indicating non safety related model differences)

Products may additionally be marked with U5x or Y5x where x can be any characters indicating non-safety related model differences excluding itemized models shown below.

May be prefixed by SP followed by / or - (SP represents a sales code)

Unit Configuration Code: EFE300Mxy-a-b-cdef-ghijk

where:

x= Nothing or J for Japanese models (may have non-safety differences).

Y= Blank for Y2 capacitors from output to earth, P for Y1 capacitors from output to earth.

a= Channel 1 output Voltage: see Ch1 in the outputs table below, adjustment range column.

b= Standby voltage: see standby voltage table below or 0 for omitted

c= HN for Open frame, no fan, with 12V / 1A fan supply. HU for U chassis, no fan, with 12V / 1A fan supply. HC for Cover + chassis, no fan, with 12V / 1A fan supply. EC for Cover + chassis, end fan (temp controlled). NN for Open frame, no fan, no fan supply. NU for U chassis, no fan, no fan supply. NC for Cover + chassis, no fan, no

fan supply. CN for Open frame, no fan, with 12V / 0.25A fan supply. CU for U chassis, no fan, with 12V / 0.25A fan supply. CC for Cover + chassis, no fan, with 12V / 0.25A fan supply.

d= M for Molex input connector or equivalent, J for JST connector or equivalent.

e= D for dual fused input or L for single fuse in the live line.

f= S for standard Leakage, L for low Leakage, R for reduced Leakage, T for tiny Leakage. *

g= Y for Oring FET included or N for nothing.

h= E for enable, T for inhibit, N for no inhibit, no enable.

i= Nothing for horizontal output connector, -V for vertical output connector, -S for screw terminal

j= Nothing for standard channel 1 output voltage, -xD or -xPD where D is for units with programmed negative load regulation, PD is for units with programmed positive load regulation, x is the voltage of the regulation in 100mVolts and is within the Output Adjustment range (example, 7D = 0.7V of negative load regulation, 24PD = 2.4V of positive load regulation).

k= Nothing or -x where x is three numbers from 0 to 9 which denotes various output voltage/current settings within the specified ranges of each output for a particular unit or blank for standard output settings. (may define non-safety related parameters/feature, e.g. reduced primary current limit, reduced OVP)

* At 440Hz, leakage current is > 3.5mA and therefore must be assessed in the end use application.
L < 300uA leakage, R < 150uA leakage and T < 75uA leakage.

Output parameters:

O/P Channel	Vout nom (V).	Range (V)	Max O/P (A)	Max O/P (W)
CH1	12	11.4 - 13.2*	25	300 (400**)
	24	22.8 - 26.4*	12.5	300 (400**)
	28	27 - 32*	10.72	300 (400**)
	40	36 - 42*	7.5	300 (350***)
	48	47 - 50*	6.25	300 (350***)
	50	50.1 - 54*	6.0	300 (350***)
Standby	5	Fixed	2	10
	12	12	1	12
	13.5	12-13.5*	1	13.5
Fan output	12	Fixed	0.25	3
	12	Fixed	1	12

* Can be adjusted from nominal at the factory only.

** Peak power of 400W for 10 seconds maximum, maximum rms power of 300W:

*** Peak power of 350W for 10 seconds maximum, in any 1 minute cycle, maximum rms power of 300W:

where T1 = peak power time on
and T2 = reduced power time on

Maximum continuous power output 300W (excluding fan output)

Output Limitations

All standard outputs are SELV up to and including 48V nominal. Voltages above 48V nominal are non SELV and must not be accessible to an end operator..
All outputs have basic spacings to earth, and due consideration must be given to this in the end product design, except for Y50029# which has functional spacings to earth.

Non Standard models.

Model: Y5J008# (where # can be any letter) or EFE300MJ-12.1-5-008 or EFE300MJ-12.1-5-008-SGP
Maximum outputs: 12.1V, 21.49A, plus 5V, 2A standby.
Maximum ambient: As standard model.
Orientations: As standard model.
Comments: Fan speed is controlled at 6600rpm up to and between 45 to 50 degrees C ambient after which the fan resumes its normal nominal voltage rating. Can be fitted with or without fan guard.

Model: Y5J006# (where # can be any letter) or EFE300MJ-12-5-006.
Maximum outputs: 11.4V to 13.2V*, 25A, (300W max) plus 5V, 2A standby.
Maximum ambient: As standard model.
Orientations: As standard model.
Comments: Longer version than standard model to accommodate additional reservoir capacitor for a greater hold up time.

Model: Y5J015# (where # can be any letter) or EFE300MJ-12.1-5-009 or EFE300MJ-12.1-5-009-SGP
Maximum outputs: 12.1V, 24.79A plus 5V, 2A standby.
Main output may also be 11.4 to 13.2V at 25A max. limited to 300W max.
Maximum ambient: As standard model.
Orientations: As standard model.
Comments: Model is the same as Y5J008# but is a NN.

Model Y50016# (where # can be any letter), NS-TLA/EFE300M-48.5-12-HNMDL-YE-V
Maximum outputs: 47-54V, 6.25A 300W max, plus 12V, 1A standby plus 12V, 1A fan output.
Maximum ambient: As standard model.
Orientations: As standard model.
Comments: OCP raised by 5% compared to the standard model.

Model Y50018# (where # can be any letter), NS-TLG/EFE300M-54-5-ECMDL-YT
Maximum outputs: 54V 5.5A, plus 5V, 2A standby.
Maximum ambient: As standard model.
Orientations: As standard model.
Comments: Extended U chassis with non-standard OVP to maintain SELV

Model Y50029# (where # can be any letter except E), EFE300M-13-5-HNMDS-NT-S/NS-TLA
Maximum outputs: As standard model
Maximum ambient: As standard model.
Orientations: As standard model.

Comments: Elongated PWB to accommodate additional filtering components.

Model Y50029E, EFE300M-13-5-HNMDS-NT-S/NS-TLA

Maximum outputs: As standard model

Maximum ambient: As standard model.

Orientations: As standard model.

Comments: Based on Y50029# but with a larger value boost capacitor, up to a value of 220 micro-farads, for a better hold up time.

Test Item Particulars	
Mass of equipment (kg)	1kg max.
Equipment mobility	for building-in
Connection to the mains	Connection to mains via host equipment
Operating condition	continuous
Access location	for building-in
Over voltage category (OVC)	OVC II
Mains supply tolerance (%) or absolute mains supply values	+10%, -10% (AC), or 120-350Vdc
Tested for IT power systems	Yes
IT testing, phase-phase voltage (V)	230V
Class of equipment	Class I (earthed)
Considered current rating of protective device as part of the building installation (A)	20A
Pollution degree (PD)	PD 2
IP protection class	IP X0
Altitude of operation (m)	5000m
Altitude of test laboratory (m)	64m

Technical Considerations

- Equipment was evaluated for a maximum supply range of 85-264Vac and 120-350Vdc
- The equipment was evaluated for operation at a maximum altitude of 5 000m. The requirements of IEC60664-1 table A.2 were applied for calculating the required clearances.
- The 50V module is the 48V module, factory preset to 50V nominal output. Testing has been conducted on the 48V model at the worst case conditions including up to 54V output.
- 1.7 The product was investigated to the following additional standards: EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 +A2:2013 (which includes all European national differences, including those specified in this test report).
- 1.2 The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: 50°C (full load); 70°C (output power decreasing linearly by 2.5%/°C above 50°C)
- 1.4 The product is intended for use on the following power systems: IT (Norway only),
- TN,
- DC mains supply
- 1.11 The following were investigated as part of the protective earthing/bonding: Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)

- 1.13 The following are available from the Applicant upon request: Installation (Safety) Instructions / Manual
- 1.5 The equipment disconnect device is considered to be: Provided by the end equipment
- Multi-layer PWB's accepted under CBTR ref. No. E349607-A23 dated 2014-07-31 and letter report in Enclosure 8-06 of this report.

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 operated at frequencies in excess of 63Hz, the requirements of clause 5.1.7 must be considered in the end use equipment as the leakage current for input frequencies above 63Hz may exceed 3.5mA.
- The 48V output is SELV, but due to component tolerances consideration should be given to verifying this in the end-use equipment except for Model EFE300M-54-5-ECMDL-YT (Y50018A) which does meet SELV limits.
- 1.2 The following Production-Line tests are conducted for this product: Electric Strength
  Earthing Continuity
- 1.3 The end-product Electric Strength Test is to be based upon a maximum working voltage of:
  Primary-SELV: 408 Vrms, 880 Vpk
  Primary-Earthed Dead Metal: 392 Vrms, 668 Vpk
- 1.5 The following secondary output circuits are SELV: All standard models up to and including 48V nominal. Voltages above 48V nominal are non SELV and must not be accessible to an end operator.
- 1.6 The following secondary output circuits are at hazardous energy levels: Channel 1 output
- 1.11 The power supply terminals and/or connectors are: Suitable for factory wiring only
- 1.12 The maximum investigated branch circuit rating is: 20 A
- 1.13 The investigated Pollution Degree is: 2
- 1.15 Proper bonding to the end-product main protective earthing termination is: Required
- 1.16 An investigation of the protective bonding terminals has: Been conducted
- 1.18 The following magnetic devices (e.g. transformers or inductor) are provided with an OBJY3 insulation system with the indicated rating greater than Class A (105°C): Transformers TX1 & TX2: Class F (140°C) - See table 1.5.1 for details of insulation systems used.
- 1.19 The following end-product enclosures are required: Mechanical
  Fire
  Electrical
- 1.20 The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing: Input connector J1 (75°C),
  Common mode choke winding L1, L2 (140°C mounted on Nema PWB material),
  X capacitors C7, C8 (100°C),
  Reservoir capacitor C9 (105°C),
  Boost choke winding L3 (140°C),
  Transformer winding TX1 (130°C),
  Transformer core TX1 (130°C),
  Transformer winding TX2 (130°C),
  Transformer core TX2 (130°C),
  Transformer braid (to pin 13) TX2 (130°C),
  Optocoupler U2, U4, U5, U6 (100°C),
  Channel 1 output capacitors C10, C11 (105°C),
  Primary choke (excluding 12V model) L6 (140°C mounted on Nema),
  Channel 1 Output choke L4 (140°C mounted on Nema),
  Fan regulator XU602 (125°C minimum coating rating),
  Boost FET (IMS board) XQ201 (125°C minimum coating rating),
  Channel 1 output FET (adjacent to R4) Q1,Q2 or Q5 (125°C minimum coating rating),
  Primary driver IC XU3 (125°C minimum coating rating),
  All other electrolytic capacitors (105°C)
- 1.35 Fans: The fan provided in this sub-assembly is provided with a fan guard to reduce the risk of operator contact with the rotor.
  The fan provided in this sub-assembly is not intended for operator access.

Additional Information

N/A