

UL TEST REPORT AND PROCEDURE

Standard:	UL 60950-1, 2nd Edition, 2014-10-14 (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)
Product:	Switch Mode Power Supply
Model:	Series Alpha 800, Alpha 800W, CA800 Series Alpha 1000, Alpha 1000W, CA1000 CA1250 12C_MF_PP 12F_PP 12F_PP 12F_PP CA1250 12C_MF 12FF 12FF 12FF (see 'Model Differences' for details)
Rating:	94.5-240 Vac nominal, 133-328 V dc nominal (85-264 Vac, 120-360 Vdc including tolerance) 16 A ac, 11 A dc 47-63Hz (see 'Model Differences' for details)
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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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 product is a modular switching power supply unit. A range of output modules can be mounted in 7 available slots. The primary sub-assembly, including the primary windings of the main barrier transformer, is common to all products in this family. The secondary regulators are built into separate modules and have flexible secondary windings attached to them. See also 'Model Differences'.

Model Differences

The Model Alpha 800 and Alpha 1000 Series Power Supplies are nearly electrically and mechanically identical. The difference between the two series relates to the fact that the Alpha 800 Series has a 800 W maximum output and the Alpha 1000 Series has a 1000 W maximum output. CA1250 models are special custom units which are identical to CA1000 except that they have a restricted input voltage range and 1250W output power.

Units may be marked with a Product Code: J1x or H1x for Alpha 1000 and J8 or H8 for Alpha 800, where x may be any number of characters.

Unit Configuration Code (Description :) may be prefixed by NS # followed by / or - (where # may be any number of characters indicating non- safety related model differences).

RATINGS & LIMITATIONS:

Max power & per converter	720W
Max. Ampere Turns per converter	120
Max. Ampere Turns (total)	200
Max number of secondary windings per converter	10
Max ambient	50°C
Maximum operating altitude	3000m

Input voltage range/ frequency	Max Input Current	Max. ambient	Max. mode	Operating power	Max. output
90-99.9Vac, 47-63Hz	16A	45°C		Continuous	1000W
100-264Vac, 47-63Hz	16A	50°C		Continuous	1000W
85-264Vac, 47-63Hz	16A	50°C		Continuous	800W
120-360Vdc	11A	45°C		Continuous	800W
85-90Vac, 47-63Hz	16A	50°C		Intermittent	1000W

Intermittent: Duty cycle is 30 sec. max at up to 1000W output followed by 60 sec. min. at up to 800W output. Ampere Turns is sum of (Amperes x Number of Secondary Turns) for all outputs.

There are two converters in the psu: one for module slots 1-5 and the other for slots 3-7.

The above ratings apply for all PSU mounting orientations. The ratings also apply whether or not input and/or output connector housings are fitted. Ratings apply to Alpha 800 and 1000 ranges unless otherwise stated.

When an MFPF option is fitted input voltage range is limited to 180 - 264Vac only.

The Alpha 800 or CA800 or Alpha 1000 or CA1000 Series may be followed by: LL, RL, TL, ML or nothing for a standard filter.

Where:

LL = Tiny leakage input filter.

RL = Reduced Leakage Input filter

TL = Low Leakage Input filter

ML = Medium leakage input filter

followed by up to seven of any of the following:

@ followed by AA, A, AL, BB, B, CC, C, CL, CM, CH, DD, D, FF, F, GG, G, JJ, J, KK, K, LL, L, MM, M, NN, N, QQ, Q, RR, R, SS, S, TT, T, UU, U, WW, W, ZZ or Z.

or B/S optionally followed by:

_MF, _X, _XL, MFL, MFE, MFU, MFV or _MFV, MFPF, MFT, _PA, _IN, _PP, _RP, RPA, RPB, RPC, RPD, _D, _MG or _CD

@/@ (/ can be replaced with a _) followed by: E, EB, EQ, EL, EH, H, P or PL:

where:

@ and @/@ = applicable voltage range and the following one or two letters are the module type.

_MF, MFE = Mains fail option (may also be called X).

MFU = Mains fail option with uncommitted output connections.

MFV = Mains fail option with VME bus

MFPF = Mains fail, module parallel, PSU/fan inhibit and 5V, 50mA auxiliary output

MFT = Mains fail, PSU/fan inhibit and 12V, 150mA auxiliary output

MFL, _XL = Mains fail latch

B/S = Blanking slot which occupies one 23mm slot.

Only up to Seven 23 mm slots may be filled up per unit, noting that all modules occupy one 23 mm slot except for AA, A, F, FF, G, J, K, R, S or T modules which occupy two 23 mm slots.

Valid voltage ranges for @ and @/@ for each module are as follows:

Module	Voltage (V)	Current (A)	Width (mm)	Occupied Slots	Turns	Ampere Turns
A	@4.5 - 6	60	46	2	1	60
AA	@4.5 - 7	60	46	2	1	60
AL	@4.75 - 5.3	60	46	2	1	60
BB	@4.5 - 7	25	23	1	1	25
B	@4.5 - 6	25	23	1	1	25

C, CC	@5 - 16	16	23	1	2	32
CL	@4.6 - 5.6	16	23	1	2	32
CM	@5 - 7	16	23	1	2	32
CH	@11.4 - 13.5	16	23	1	2	32
D, DD	@18 - 29	9	23	1	4	36
E	@/@5 - 16 / 5 - 16	8/8	23	1	2/2	16/16
EL	@5 - 7 / 11 - 13	8/8	23	1	2/2	16/16
EH	@11 - 13 / 11 - 13	8/8	23	1	2/2	16/16
EB	@/@4.5 - 5.5 / 4.5 - 5.5	9/9	23	1	1/1	9/9
EQ	@/@4.5 - 5.5 / 2.7 - 3.9	9/9	23	1	1/1	9/9
F	@9 - 16	33	46	2	2	66
FF	@9 - 16	34.5	46	2	2	69
G, GG	@17.5 - 29	25	46	2	4	100
H	@/@18 - 32 / 18 - 32	5/5	23	1	4/4	20/20
J, JJ	@30 - 48	10	46	2	8	80
K, KK	@18 - 31	15	35	2	4	60
L, LL	@1.8 - 3.2	25	23	1	1	25
M, MM	@5 - 16	8	23	1	2	16
N, NN	@18 - 32	5	23	1	4	20
P	@/@18 - 29 / 5 - 16 5/8	23	1		4/2	20/16
PL	@22 - 26 / 5 - 7	5/8	23	1	4/2	20/16
Q, QQ	@2.7 - 3.9	25	23	1	1	25
R, RR	@2.7 - 3.9	60	46	2	1	60
S, SS	@1 - 5.7	85	46	2	1	75
T, TT	@1.8 - 3.2	60	46	2	1	60
U, UU	@10 - 21	16	23	1	3	48
W, WW	@4.5 - 5.5	15	23	1	1	15
Z, ZZ	@4.5 - 5.7	25	23	1	1	25

A, AA and AL modules can be used up to 37A in slots 6 and 7 and used up to 60A in all other slots.

B and BB modules can be used up to 15A in slot 7 and used up to 25A in all other slots.

(a) C CC, CL, CM & CH modules can be used up to 16A for outputs up to 12V. For 15-16V outputs C modules can be used at up to 12A. Maximum module output current derates linearly between 12V and 15V.

(b) C, CC, CL, CM & CH modules can be used up to 10A in slot 7 and up to 16A in all other slots, subject to the limitations of (a).

D & DD modules can be used at up to 9A at up to 24V in all slots. At greater than 24V D & DD modules can be used at up to 8A in all slots.

E, EL & EH modules can be used up to 5A in slot 7 and up to 8A in all other slots.

EQ and EB modules can be used up to 5.6A in slot 7 and up to 9A in all other slots.

F modules can be used up to 20A in slots 6 and 7 and up to 33A in all other slots.

FF modules can be used up to 34.5A in all slots.

G & GG modules can be used up to 15A in slots 6 and 7 and up to 25A in all other slots.

H modules can be used up to 3A in slot 7 and up to 5A in all other slots. For 29.01 - 32V output current is limited to 1A max for all slots.

J & JJ modules can be used up to 6A in slots 6 and 7 (for 30-48V). For all other slots the max. permitted current is limited to 8A at 48V and 10A at 41V. For intermediate voltages interpolation is used to determine the max. permitted current. For outputs in the range 36-41V max. current is 10A.

K & KK modules can be used up to 10A in slot 6/7 and up to 15A in all other slots.

L & LL modules can be used up to 15A in slot 7 and used up to 25A in all other slots.

M & MM modules can be used up to 5A in slot 7 and up to 8A in all other slots.

(a) N & NN modules can be used up to 5A for outputs up to 29V. For 29-32V output current is limited to 1A max.

(b) N & NN modules can be used up to 3A in slot 7 and up to 5A in all other slots.

P and PL modules can be used up to 5A in the 18-29V channel in slots 1 to 6 and up to 3A in slot 7.
P and PL modules can be used up to 8A in the 5-16V channel in slots 1 to 6 and up to 5A in slot 7.
Q & QQ modules can be used up to 25A in any slot.
R & RR modules can be used up to 60A in any slot.
S & SS modules can be used up to 75A in slots 1/2, 76A in slots 2/3; 51A in slots 6/7 and up to 85A in all other slots. When the psu is operated in a horizontal orientation (with the ratings label uppermost) the S & SS modules may be used up to 85A in slots 2/3.
T & TT modules can be used up to 37A in slot 6 and 7 and used up to 60A in all other slots.
U & UU modules can be used up to 16A in all slots.
W & WW modules can be used up to 15A in all slots.
Z & ZZ modules can be used up to 15A in slot 7 and used up to 25A in all other slots.

Secondary Options:

Option	Description
_MG	Provides a module good signal with indicates output voltage is within limits.
_PA	Forces paralleled modules to share load current. Additionally it also provides the module good signal.
_PP	Provides either of the following functions: a) Reduces module current limit and caters for paralleled modules with busbar linking. For use with modules providing a max output of up to 16V only; or b) Identical to _PA except that the module is paralleled at the output of the module with busbar linking.
_IN	Provides an external signal which may be used to inhibit the output of the module.
_EN	Provides a delay in the turn on time of a module output. Additionally allows an external signal voltage to enable a module output (output off when no signal applied).
_RP	Provides remote programming of the module output voltage.
RPA	Provides voltage programming of the module output voltage only.
RPB	Provides voltage programming of the module output voltage and has an output VA limiting circuit.
RPC	Provides an output VA limiting circuit
RPD	Provides voltage programming of the module output voltage and has an output VA limiting circuit.
_D	Delay option. Provides a delay in the turn on time of the output.

Note:

The RPA option can only be used on modules with output voltages rated up to 32V.
The RP, RPB, RPC and RPD options can only be used on modules with output voltages rated up to 16V.
Not for use with a module voltage range of 18-29V or twin output modules.

Custom Models:

Model: CA1000LSF 5.25B 12.7C 16/16E 24G 18D 18D (NS-FOSS-002)
Input: 90 - 264Vac, 47-63Hz
Max. Output(s): 6V, 3A; 13.7V, 9A; 16V, 0.5A; 16V, 0.5A; 25V, 25A; 19V, 2.5A; 19V, 2.5A (877.3W)
Max. Ambient: 40°C
Orientation: Vertical with airflow upwards
Cooling: Papst 612 fans. Forward direction airflow.

CA1000RA B/S_MF 5S_PP 5B_PP 12F (NS-AMD-001)
Input voltage range: 198 - 264Vac.
Outputs: S Module: 5.5V max., 80A max.
 B Module: 5.5V max., 25A max.
 F Module: 12.5V max., 33A max.
All orientations are permitted.

CA1000 B/S_MF 24G_PP 24D_PP 15/15E 5M_IN

Input voltage range: 90 - 264Vac.

Outputs: G Module: 24V max., 20A max.

D Module: 24V max., 8A max.

E Module: 15/15V max., 8/6A max.

N Module: 5V max., 8A max.

Permitted orientation: Vertical with the fans lowest.

Fans: Papst 612NGM (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

CA1000 LSF B/S_MF 24G 15/15E 5M_IN (NS-TEG-010)

Input voltage range: 85 - 264Vac.

Outputs: G Module: 24V max., 20A max.

E Module: 15/15V max., 4/4A max.

M Module: 5V max., 8A max.

Permitted orientation: Horizontal

Fans: Papst 612NML or 612NGML (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

CA1000 LSF B/S_MF 24G 15/15E 5M_IN 36J (NS-TEG-011)

Input voltage range: 85 - 264Vac.

Outputs: G Module: 24V max., 18A max.

E Module: 15/15V max., 3/3A max.

M Module: 5V max., 8A max.

J Module: 36V max., 5.5A max.

Permitted orientation: Horizontal

Fans: Papst 612NML or 612NGML (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

CA1250 12C_MF_PP 12F_PP 12F_PP 12F_PP (NS-AMD-002)

Input voltage range: 207 - 264Vac.

Outputs: C Module: 13V max., 16A max.

F Module: 13V max., 30A max.

F Module: 13V max., 30A max.

F Module: 13V max., 30A max.

Permitted orientation: All except vertical with airflow downwards.

CA1250 12C_MF 12FF 12FF 12FF (NS-AMD-005)

Input voltage range: 207 - 264Vac.

Outputs: C Module: 13V max., 16A max.

F Module: 13V max., 30A max.

F Module: 13V max., 30A max.

F Module: 13V max., 30A max.

Permitted orientation: Horizontal only.

CA1000 LSFLL 22K_IN 12C-IN 48J-IN 24N_IN 24N_IN (J10077A)

Input voltage range: 90 - 264Vac.

Outputs: K Module: 22V max., 15A max.

C Module: 12V max., 10A max.

J Module: 48V max., 5A max.

N Module: 24V max., 5A max.

N Module: 24V max., 5A max.

Permitted orientation: Horizontal only.

Max. Ambient: 40°C

Fans: Papst 612NGME or 612NME (lower airflow than fans fitted to standard Alpha 800/1000 PSUs).

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : to be determined in the end application
- Operating condition : continuous
- Access location : for building-in
- Over voltage category (OVC) : OVC II
- Mains supply tolerance (%) or absolute mains supply values : 85-264 Vac max, 120-360 Vdc max
- Tested for IT power systems : Yes (Norway only)
- IT testing, phase-phase voltage (V) : 230
- 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) : 3000 m
- Altitude of test laboratory (m) : 64 m
- Mass of equipment (kg) : 3 kg max (depends on series)
- The product was submitted and evaluated for use at the maximum ambient temperature (Tma) permitted by the manufacturer's specification of: 50°C or 45°C (See 'Products Covered' enclosure).
- The product is intended for use on the following power systems: TN
- The equipment disconnect device is considered to be: evaluated in the end-use application
- The following were investigated as part of the protective earthing/bonding: Printed wiring board trace (refer to Enclosure - Schematics + PWB for layouts)
- The product was investigated to the following additional standards: EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011 +A2:2013 (which includes all european national differences, including those specified in this test 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:

- The Clearances and Creepage Distances have additionally been assessed for suitability up to 3000 m elevation.
- Additional requirements may apply if product used in end application in Restricted Access Location.
- The following secondary output circuits are SELV: Outputs can be connected in series thus producing non-SELV levels, and this must be taken into account in the end-use application. When non-seriesed outputs are earthed in the end use equipment they are SELV. If the outputs are not earthed they must be considered hazardous, as a single fault in the secondary may make them exceed the SELV limits between output and earth. If any output is non-SELV then all outputs become non- SELV. Additional evaluation may be needed in end product
- The following secondary output circuits are at hazardous energy levels: modules A, AA, AL, C, CC, CH, D, DD, F, FF, G, GG, J, JJ, K, KK, R, RR, S, SS, T, TT, U and UU
- The following secondary output circuits are at non-hazardous energy levels: modules B, BB, CL, CM, E, EB, EH, EL, EQ, H, L, LL, M, MN, N, NN, P, PL, Q, QQ, W, WW, Z and ZZ
- The power supply terminals and/or connectors are: Not investigated for field wiring
- 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
- 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): T202 (Class F), T302 (Class F), T4/T1 (Class F or Class A optional - refer to CCL)
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-Earthed Dead Metal: 360 Vrms, 384 Vpk, Primary-SELV: 377 Vrms, 824 Vpk
- The following end-product enclosures are required: Mechanical, Electrical, Fire
- The following output terminals were referenced to earth during performance testing: Both the positive and negative outputs in turn were earthed to determine the worst case.
- 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
- The following Production-Line tests are conducted for this product: Earthing Continuity, Electric Strength
- These units are forced-air cooled. They require a minimum of 50mm clearance in the vicinity of the, ventilation holes
- Fans: The fans provided in this sub-assembly are not intended for operator access.

Additional Information

This report is a reissue of CBTR Ref. No: E135494-A56-CB-2 dated 2012-12-03 including amendments and corrections with CB certificate Ref. No: DK-29555-UL dated 2012-12-03 to upgrade to IEC 60950-1 2nd Edition + Amd 2. Additionally covers change of factory name, from Trio Engineering Co Ltd to Panyu Trio Microtronic Co. Ltd. Based on previously conducted testing and the review/update of product technical documentation including photos, schematics, wiring diagrams and similar, it has been determined that the product continues to comply with the standard. Only the tests listed below were deemed necessary.

- (4.5) Thermal for new non-standard (J10077A) which uses a quiet fan.
- (B.7) Locked rotor for EBM-PAPST 612NMGE fan.

This report is a reissue of CBTR Ref. No. E135494-A56-CB-1 to CBTR Ref. No. E135494-A56-CB-1 am. 1, CB Test Certificate Ref. No DK-17785-A1 dated 2011-01-25 to upgrade to IEC 60950-1:2005 + A1:2009. Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, and on limited testing (Annex B.7 DC Fan Locked Rotor test) it has been determined that the product continues to comply with the standard. The following revisions were made during this upgrade: Critical Components table (renumber fuses FS1 to FS101, F2 to FS1, and addition of alternate FS101 & FS1); updating the Handbook (manual), Licenses and Transformer drawings in enclosures; removed one Factory location (TDK-Lambda Germany).

These products use optional coatings which are normally applied with a brush and are used within the primary area of the power supply on limited surface therefore deemed as non-safety critical. The coatings are not used for any safety purpose although they improve dielectric strength.

Additional Standards

The product fulfills the requirements of: CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10, EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011+A2:2013, UL 60950-1 2nd Edition, 2014-10-14.