

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:	Switching power supply
Model:	LCM1500Q-T, LCM1500W-T, LCM1500U-T, LCM1500L-T, LCM1500N-T, LCM1500R-T, LCM1000Q-T, LCM1000W-T, LCM1000L-T, LCM1000N-T, LCM1000U-T, LCM1500W-T-5-411
Rating:	AC Input: 100-240V, 19.0A Max, 50/60Hz For model: LCM1500Q-T +24V, 63.0A Max, 1500W Max; (forward fan airflow only) +24V, 31.25A Max, 750W Max; (reverse fan airflow only) +5Vsb, 2.0A Max (Optional); For model: LCM1500W-T +48V, 32.0A Max, 1500W Max; forward fan airflow only +48V, 20.83A Max, 1000W Max; (reverse fan airflow only) +5Vsb, 2.0A Max (Optional); For model: LCM1500U-T +36V, 42.0A Max, 1500W Max; (forward fan airflow only) +5Vsb, 2.0A Max (Optional); For model: LCM1500L-T +12V, 125.0A Max, 1500W Max; (forward fan airflow only) +5Vsb, 2.0A Max (Optional); For model: LCM1500N-T +15V, 100.0A Max, 1500W Max; (forward fan airflow only) +5Vsb, 2.0A Max (Optional); For model: LCM1500R-T +28V, 53.6A Max, 1500W Max; (forward fan airflow only) +5Vsb, 2.0A Max (Optional); For model: LCM1000Q-T +24V, 42.0A Max, 1000W Max; (forward fan airflow only) +24V, 31.25A Max, 750W Max; (reverse fan airflow only) +5Vsb, 2.0A Max (Optional); For model: LCM1000W-T +48V, 21.0A Max, 1000W Max; (forward fan airflow only)

+48V, 20.83A Max, 1000W Max; (reverse fan airflow only)
+5Vsb, 2.0A Max (Optional);

For model: LCM1000L-T
+12V, 84.0A Max, 1000W Max; (forward fan airflow only)
+5Vsb, 2.0A Max (Optional);

For model: LCM1000N-T
+15V, 67.0A Max, 1000W Max; (forward fan airflow only)
+5Vsb, 2.0A Max (Optional);

For model: LCM1000U-T
+36V, 28.0A Max, 1000W Max; (forward fan airflow only)
+5Vsb, 2.0A Max (Optional);

For model: LCM1500W-T-5-411
+48V, 32.0A Max., 1500W Max; (forward fan airflow only)
+5Vsb, 1.0A Max (Optional)

Applicant Name and Address:

ASTECH INTERNATIONAL LIMITED
16TH FLOOR, LU PLAZA 2 WING YIP STREET, KWUN TONG,
KOWLOON, HONG KONG

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: Brian Wong / Project Handler

Reviewed by: Steve Chiu / 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 equipment is switching power supply, intended for building in as a component used in information technology equipment which employs isolating transformers. Reinforced insulation is provided between primary and secondary. Basic insulation is provided between primary and PE (Protective Earth).

Model Differences

Models LCM1500W-T, LCM1500U-T are identical to previous tested model LCM1500Q-T except for model number, input / output ratings, transformer's T801, Choke (L1, L2), Fan, heatsink (HTSK1, HTSK3, HTSK4) and minor secondary component changes.

Model LCM1500L-T is identical to previous tested model LCM1500Q-T except for model number, output ratings, Power Transformer (T801), Fan, heatsink (HTSK1, HTSK3, HTSK4), Base and Cover Enclosures and minor secondary component changes.

Model LCM1000Q-T, LCM1000W-T, LCM1000L-T, LCM1000N-T and LCM1000U-T are identical to previous tested models LCM1500Q-T, LCM1500W-T, LCM1500L-T, LCM1500N-T and LCM1500U-T respectively except for model number, output rating and output power.

Model LCM1500N-T is identical to previous tested model LCM1500L-T except for model number, output ratings, Power Transformer (T801) and fan source.

Model LCM1500R-T is identical to previous tested model LCM1500Q-T except for model number, output ratings and Power Transformer (T801).

Model LCM1500W-T-5-411 is identical to previous tested model LCM1500W-T except for model number, 5Vsb current rating with additional 5Vsb auxiliary board, auxiliary transformer (T607) and bridging capacitors (C136, C137) and bridging capacitor on 5Vsb board (C636).

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : To be determined in end system
- Operating condition : continuous
- Access location : operator accessible
- Over voltage category (OVC) : OVC II
- Mains supply tolerance (%) or absolute mains supply values : +10%, -10%

- Tested for IT power systems : Yes (for Norway)
- 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) : 30 A
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : 5000 meters (3048 meters only for Model LCM1500W-T-5-411)
- Altitude of test laboratory (m) : less than 2000 meters
- Mass of equipment (kg) : less than 18
- The product was submitted and evaluated for use at the maximum ambient temperature (T_{ma}) permitted by the manufacturer's specification of: 50°C at full load up to 70°C at derated output power for the main output (50%). Derated load up to 70deg C is applicable to forward fan airflow only.
- The means of connection to the mains supply is: To be determined in end system
- The product is intended for use on the following power systems: TN and IT
- The equipment disconnect device is considered to be: for consideration at end system
- 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).
- 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 power supply in this equipment was: Investigated to IEC 60950-1. As part of the investigation of this product, the power supply and its test report were reviewed and found to comply with IEC 60950-1.
- The Clearances and Creepage distances have additionally been assessed for suitability up to 5000m elevation except for model LCM1500W-T-5-411 which was evaluated for use of up to 3048m only.

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 end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-SELV: 391 Vrms, 716 Vpk, Primary-Earthed Dead Metal: 390.6 Vrms, 698 Vpk, , For Model LCM1500L-T,, Primary-SELV: 396.2 Vrms, 716 Vpk, Primary-Earthed Dead Metal: 393.5 Vrms, 725 Vpk , , For Model LCM1500N-T, , Primary-SELV: 394.7 Vrms, 734 Vpk, Primary-Earthed Dead Metal: 395.1Vrms, 734 Vpk., , For model LCM1500R-T, Primary-SELV: 247.4 Vrms, 460 Vpk, Primary-Earthed Dead Metal: 248.8 Vrms, 457 Vpk.
- The following secondary output circuits are SELV: +12V/ +15V/ +24V/ +48V/ +36V/ +28V, +5vsb
- The following secondary output circuits are at hazardous energy levels: +12V/ +15V/ +24V/ +48V/ +36V/ +28V
- The following secondary output circuits are at non-hazardous energy levels: +5Vsb
- The power supply terminals and/or connectors are: Not investigated for field wiring
- The maximum investigated branch circuit rating is: 30 A

- The investigated Pollution Degree is: 2
- Proper bonding to the end-product main protective earthing termination is: Required
- An investigation of the protective bonding terminals has: Been conducted
- 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): T101, T801, T302 (ClassF), T607 (Class B, for LCM1500W-T-5-411 only)
- The following end-product enclosures are required: Mechanical, Fire, Electrical
- The equipment is suitable for direct connection to: AC mains supply
- Fans: The fan provided in this sub-assembly is provided with a fan guard to reduce the risk of operator contact with the stator.
- The secondary output connector has not been evaluated for field connections.
- The power supply has been evaluated for use in Class 1 equipment as defined in UL 60950-1 Second edition and CAN/CSA C22.2 No. 60950-1-07. An additional evaluation shall be made if the power supply is intended for use in other than Class 1 equipment.
- This equipment was not evaluated for end system mounting. When installed in the end system, the proper evaluation should be considered.
- Compliance to the temperature limits of user touchable parts and surfaces of the power supply shall be considered at the end system.
- For Model LCM1500Q-T: Additional evaluations have been considered for the +24V +/- 10% output voltage adjustability limited to the following combined conditions: maximum allowed 63.0 A output current and 1500W output power. Output voltage adjustability and limited output current/power is also applicable to Model LCM1000Q-T.
- For Model LCM1500W-T: Additional evaluations have been considered for the +48V -12.5% / +10% output voltage adjustability limited to the following combined conditions: maximum allowed 32.0A output current and 1500W output power. Output voltage adjustability and limited output current/power is also applicable to Model LCM1000W-T.
- For Model LCM1500U-T: Additional evaluations have been considered for the +36V +/- 10% output voltage adjustability limited to the following combined conditions: maximum allowed 42.0A output current and 1500W output power. Output voltage adjustability and limited output current/power is also applicable to Model LCM1000U-T.
- For Model LCM1500L-T: Additional evaluations have been considered for the +12V output voltage adjustability from 10V to 13.2V limited to the following combined conditions: maximum allowed 125.0A output current and 1500W output power. Output voltage adjustability and limited output current/power is also applicable to Model LCM1000L-T.
- For operating temperature up to 50°C, the +12V / +24V / +48V/ +36V/ +28V output of the equipment can be loaded full loading. For operating temperature over 50°C and up to 70°C, the output loading should be decreased by 2.5% per 1 degree rise.
- The following are the output loading conditions used in the entire testing of model LCM1500Q-T: , Loading 1: +23.81V, 63.0A; +5Vsb, 2.0A, Loading 2: +26.4V, 56.82A; +5Vsb, 2.0A, Loading 3: +24.0V, 62.5A; +5Vsb, 2.0A, Loading 4: +23.81V, 31.5A; +5Vsb, 2.0A (50% load of Loading 1 at ambient temp 70°C), Loading 5: +23.81V, 47.25A; +5Vsb, 2.0A (75% load of Loading 1 at ambient temp 60°C).
- The following are the output loading conditions used in the entire testing of model LCM1500W-T: , Loading 1: +46.88V, 32.0A; +5Vsb, 2.0A, Loading 2: +52.80V, 28.41A; +5Vsb, 2.0A, Loading 3: +48.0V, 31.25A; +5Vsb, 2.0A, Loading 4: +46.88V, 24.0A; +5Vsb, 2.0A (75% load of Loading 1 at ambient temp 60°C), Loading 5: +46.88V, 16.0A; +5Vsb, 2.0A (50% load of Loading 1 at ambient temp 70°C).

- The following are the output loading conditions used in the entire testing of model LCM1500U-T: , Loading 1: +35.72V, 42.0A; +5Vsb, 2.0A, Loading 2: +39.60V, 37.88A; +5Vsb, 2.0A, Loading 3: +36.0V, 41.67A; +5Vsb, 2.0A, Loading 4: +35.72V, 31.5A; +5Vsb, 2.0A (75% load of Loading 1 at ambient temp 60°C), Loading 5: +35.72V, 21.0A; +5Vsb, 2.0A (50% load of Loading 1 at ambient temp 70°C).
- The following are the output loading conditions used in the entire testing of model LCM1500L-T: , Loading 1: +12.0V, 125.0A; +5Vsb, 2.0A, Loading 2: +13.2V, 113.64A; +5Vsb, 2.0A, Loading 3: +12.0V, 93.75A; +5Vsb, 2.0A (75% load of Loading 1 at ambient temp 60°C), Loading 4: +12.0V, 62.5A; +5Vsb, 2.0A, (50% load of Loading 1 at ambient temp 70°C).
- For Model LCM1500N-T: Voltage adjustability of +/- 10% is applicable for +15V output but limited to the following combined conditions: maximum allowed 100A output current and 1500W output power. Output voltage adjustability and limited output current/power is also applicable to Model LCM1000N-T.
- The following are the output loading conditions used in the entire testing of model LCM1500N-T: , Loading 1: +15V, 100A; +5Vsb, 2.0A, Loading 2: +16.5V, 90.91A; +5Vsb, 2.0A, Loading 3: +15V, 75A; +5Vsb, 2.0A (75% load of Loading 1 at ambient temp 60°C), Loading 4: +15V, 50A; +5Vsb, 2.0A (50% load of Loading 1 at ambient temp 70°C), Loading 5: +15.0V, 0A; +5Vsb, 2.0A.
- For Model LCM1500R-T: Additional evaluations have been considered for the +28V +/- 10% output voltage adjustability limited to the following combined conditions: maximum allowed 53.6 A output current and 1500W output power.
- The following are the output loading conditions used in the entire testing of model LCM1500R-T: , Loading 1: +25.2V, 53.6A; +5Vsb, 2.0A, Loading 2: +28.0V, 53.6A; +5Vsb, 2.0A, Loading 3: +30.8V, 48.71A; +5Vsb, 2.0A, Loading 4: +28.0V, 40.2A; +5Vsb, 2.0A (75% load of Loading 2 at ambient temp 60°C), Loading 5: +28.0V, 26.8A; +5Vsb, 2.0A (50% load of Loading 2 at ambient temp 70°C), Loading 6: +28.0V, 0A; +5Vsb, 2.0A.
- Additional evaluation has been considered for adding reverse fan airflow direction (air from input/output side going out towards the fan side) at specific loading condition applicable for models LCM1500Q-T, LCM1500W-T, LCM1000Q-T, LCM1000W-T
- Reverse fan airflow was evaluated at the following limited loading conditions: for model LCM1500Q-T and LCM1000Q-T: +24V, 31.25A max; 5Vsb, 2A, 750W max output power at AC 90 – 264V at 70 deg C max ambient temperature; for model LCM1500W-T and LCM1000W-T: +48V, 20.83A max; 5Vsb, 2A, 1000W max output power at AC 100 – 264V at 50 deg C ambient temperature, 900W max output power at AC 90 – 264V at 70 deg C ambient temperature.
- The following are the output loading conditions used in the entire testing of model LCM1500W-T-5-411: Loading 1: +48.0V, 31.25A; +5Vsb, 1.0A, Loading 2: +46.88V, 32A; +5Vsb, 1.0A, Loading 3: +46.88V, 24.0A; +5Vsb, 1.0A (75% load of Loading 2 at ambient temp 60°C), Loading 4: +46.88V, 16.0A; +5Vsb, 1.0A (50% load of Loading 2 at ambient temp 70°C).
- Additional evaluation was considered for model LCM1500W-T-5-411 for power supply inhibit mode condition at 50°C ambient temp using loading 5: +48V (OFF); +5Vsb, 0.5A max only.