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:	Power Supply
Model:	NV350 or NV3 or NV-350 (these models are identical) (may be prefixed by NS - # / or - where # may be up to any four letters and may be followed by - $; where $ maybe any number between 000 to 999, indicating non-safety related model differences.)
Rating:	100-240 Vac nominal, (85-264 Vac including tolerances) 47-440 Hz, 5.5 A rms max.
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: Mike Burns Reviewed by: David Snook

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

A range of switch mode power supplies for building in.

Model Differences

Unit Configuration Code:

NV350 or NV3 or NV-350 (these models are identical)

(may be prefixed by NS - # / or - where # may be up to any four letters and may be followed by - $; where $ maybe any number between 000 to 999, indicating non-safety related model differences)

followed by: S, R, Q, P, V, C, T, U, K or L where:

Option Letter	Airflow Option
S	Forward airflow, standard fan
R	Reverse airflow, standard fan
Q	Forward airflow, quiet fan
P	Reverse airflow, quiet fan
V	Forward airflow, temperature controlled fan
C	Customer air, fan not fitted
T	Forward airflow, top fan
U	Customer air, fan not fitted, cover not fitted
K	Custom fan/chassis assembly
L	Fixed speed fan (see non-standards below)

followed by: S, I or J where:

Option Letter	Input Option
S	Screw input terminals
I	IEC input
J	IEC input dual fused

followed by: S, M, L, R, or T, where:

Option Letter	Leakage Option
S	Standard Leakage (Class B Filter)
M	Medium Leakage
L	Low Leakage

R	Reduced Leakage
T	Tiny Leakage

Unit configuration may be given using the above code and/or by the option description. The input terminal type (screw or IEC) may alternatively be determined by examination of the unit.

optionally followed by: EN#V, EN12V, EN13.5V, IN#V, IN12V, IN13.5V, ES#V, ES12V, ES13.5V, IS#V, IS12V or IS13.5V. Where:

Description	Option Description
EN#V	AC good, global module good, PSU enable, 5-5.5V, 2A standby output
EN*V	AC good, global module good, PSU enable, 12-13.5V, 1A standby output
IN#V	AC good, global module good, PSU inhibit, 5-5.5V, 2A standby output
IN*V	AC good, global module good, PSU inhibit, 12-13.5V, 1A standby output
ES#V	AC good, PSU enable, 5-5.5V, 2A standby output
ES*V	AC good, PSU enable, 12-13.5V, 1A standby output
IS#V	AC good, PSU inhibit, 5-5.5V, 2A standby output
IS*V	AC good, PSU inhibit, 12-13.5V, 1A standby output

Where: # represents the standby output voltage and is in the range 5 to 5.5V.
Where * represents the standby output voltage and is in the range of 12-13.5V.
The Global Options Inhibit and Enable functions permit the customer to turn off or on the main PSUs outputs and the fan. The standby supply is for use by the customer and provides an SELV output that continues to operate when all the main PSUs outputs have been turned off using the Inhibit or Enable functions. All the functions of the Global Option pass through a single 8 way PWB socket and are all rated SELV.
NV350 Modules:

Up to 3 of the following modules types may be fitted:

@B
or @BH
or @C
or @CM

where @ is the output voltage of the module and is within the range given in the single output module table.

or @/#DB (/ can be replaced with a _)

where @ is the output voltage of channel 1 and # is the output voltage of channel 2 of the module. Voltages are within the range given in the DB module tables.

or @/#DA (/ can be replaced with a _)

where @ is the output voltage of channel 1 and # is the output voltage of channel 2 of the module. Voltages are within the range given in the DA module tables. Only 1 DA module may be fitted.

or B/S

where B/S indicates that a blanking plate is fitted in place of a module.

The following nomenclature may optionally be used for outputs connected in series:

(Note that outputs may be connected in series even when this nomenclature is not used)

@BB or @ BHB or @BBH or @BHBH or @CC or @CCM

where @ is the total voltage of any two B, BH, C or CM modules connected in series.

or @/#BDB or @BHDB (/ can be replaced with a _)

where @ is the total series voltage of any B or BH module and DB module channel 1. # is the output voltage of the DB module channel 2. Voltages for # are within the range given in the DB module tables.

or @HDB

where @ is the total series voltage of any DB module channel 1 and channel 2.

Note.
For all outputs connected in series:
Permissible min. value for @ is given by summing the min. voltage ratings of the outputs connected in series.
Permissible max. value for @ is given by summing the max. voltage ratings of the outputs connected in series.

Custom Models:

Model: NV350 SJS 24B 24/24DB 12/12DB (K30012)
Maximum outputs: 24V, 8A; 24V, 7A; 24V, 2A; 12V, 13A; 12V, 5A (total power 350W max.)
Maximum ambient: 50°C
Orientations: Horizontal with chassis lowest, on either side or vertical with the airflow upwards.
Comments: PSU is fitted with dual fused IEC inlet and double pole mains switch (option J).

Model: NV350 SJS 24B 24/24DB 24/12DB (K30036)
Maximum outputs: 24V, 8A; 24V, 7A; 24V, 2A; 24V, 7A; 12V, 5A (total power 350W max.)
Maximum ambient: 50°C
Orientations: Horizontal with chassis lowest, on either side or vertical with the airflow upwards.
Comments: PSU is fitted with dual fused IEC inlet and double pole mains switch (option J).

Model: NV350 LSS 24/24DB 15.5/5.5DB (K30045A)
Maximum outputs: 24V, 1A; 24V, 0.7A; 15.5V, 6.4A; 5.5V, 6.4A. (total power 175W max.)
Maximum ambient: 50°C
Orientations: Horizontal with chassis lowest, on either side.
Comments: PSU has fan drive voltage fixed at 5.5V.

Model: NV350 LSS 24/24DB (K30045B)
Maximum outputs: 24V, 7A; 24V, 0.7A. (total power 184.8W max.)
Maximum ambient: 50°C
Orientations: Horizontal with chassis lowest, on either side.
Comments: PSU has fan drive voltage fixed at 5.5V.

Model: NV350 TSS 24B 15BH 5/15DB (K30052X, where X can be any character)
Maximum outputs: 350W max.
Comments: PSU has top fan fitted.
Compliant with EN/IEC/UL/CSA 60950-1 only

Model: NV350 KISES5V 12/12DB 5B (X00004#, where # can be any number of characters)

Maximum outputs: 350W max.
Comments: PSU has top fan, at an angle fitted. Output cables of 12 to 24 AWG, max 50 cm long are supplied with this model.
Compliant with EN/IEC/UL/CSA 60950-1 only

Model: NV350 NV3LISIS5V 3.3B 12BH (K30068X, where X can be any character)
Maximum outputs: 201.4W max.
Comments: PSU has fixed, reduced speed fan set to 5.5V.
Compliant with EN/IEC/UL/CSA 60950-1 only

ELECTRICAL & THERMAL RATINGS:

Input Parameters

Nominal input voltage (V)	100 - 240
Input voltage range (V)	85 - 264
Input frequency range (Hz)	47 - 63
Maximum input current (A)	5.5
Inrush Current (A)	<15

For input voltages between 85 and 89.9V the output power is derated to 94% of the values given in the Cooling Options Table.

Output Modules:

Module	Output Voltage	Slots	Maximum Average Current According to Slot Position (A)				
			Slot 1	Slot 2	Slot 3	Slot 4	Slot 5
B	3.14-3.6V	2	40	-	40	40	40
	4.75-5.5V 2	40*	-	40*	40*	40*	
	7-9V	2	2.5**	-	22.5**	22.5**	22.5**
	12-15.5V	2	16***	-	16***	16***	16***
	24-28V	2	8****	-	8****	8****	8****
BH	12-15.5V	2	20#	-	20#	20#	20#
	24-28V	2	10##	-	10##	10##	10##
C	12-13.2V	3	33.34†	-	33.34†	33.34†	-
	15-16.5V	3	26.67†	-	26.67†	26.67†	-
	24-26.4V	3	16.67†	-	16.67†	16.67†	-
	27-32V	3	14.82††	-	14.82††	14.82††	-
CM	12-13.2V	3	-	33.34†††	33.34†††	33.34†††	-
	15-16.5V	3	-	26.67†††	26.67†††	26.67†††	-
	24-26.4V	3	-	16.67†††	16.67†††	16.67†††	-
	27-32V	3	-	14.82†††	14.82†††	14.82†††	-
DA CH1	11.88-12.25V	1	-	-	-	-	3¥
DA CH2	11.9 to -11.6V	1	-	-	-	-	1¥¥
DB	3.14-3.6V	2	25	-	25	25	25
CH1	4.75-5.5V	2	25	-	25	25	25
	5.5-6.5V††††	2	25	-	25	25	25
	12-15.5V	2	13¥¥¥	-	13¥¥¥	13¥¥¥	13¥¥¥
	24-28V	2	7¥¥¥¥	-	7¥¥¥¥	7¥¥¥¥	7¥¥¥¥
DB	3.3-6V‡	2	10	-	10	10	10
CH2	7-15.5V	2	5	-	5	5	5
	24-32V	2	2	-	2	2	2

* - Linearly derate from 40 to 36A over the voltage range 5.2 to 5.5 V.
** - Linearly derate from 22.5 to 20A over the voltage range 8 to 9V.
*** - Linearly derate from 16 to 13A over the voltage range 13.5 to 15.5 V.
**** - Linearly derate from 8 to 7A over the voltage range 26 to 28 V.
# - Linearly derate from 20 to 16.5A over the voltage range 13.2 to 15.5 V.
- Linearly derate from 10 to 8.5A over the voltage range 25.7 to 28 V.
† - C & CM modules may output up to 600W for up to 10 seconds providing that the converter ratings are not exceeded and the average power from the module does not exceed the following: 400W for 115 - 264Vac input or 350W for 90Vac input (average power may be linearly interpolated between 90 and 115Vac input).
†† - Derate to 400W above 27V. C & CM modules may output up to 600W for up to 10 seconds providing that the converter ratings are not exceeded and the average power from the module does not exceed the following: 400W for 115 - 264Vac input or 350W for 90Vac input (average power may be linearly interpolated between 90 and 115Vac input).
††† - CM Module cannot be fitted to slot 1 due to medical spacing requirements.
†††† - See Table below

	DB modules with 6V nominal, Output Channel1	
Cooling options C, S, T & V	O/P 1 : 5.5 - 6V	O/P 1 + O/P 2 : 195W total.
	O/P 1 : 6 - 6.5V	O/P 1 + O/P 2 : Linearly derate from 195 to 170W total.
Cooling option Q	O/P 1 : 5.5 - 6V	O/P 1 + O/P 2 : 180W total.
	O/P 1 : 6 - 6.5V	O/P 1 + O/P 2 : Linearly derate from 180 to 140W total.
Cooling options P & R	O/P 1 : 5.5 - 6.5V	O/P 1 + O/P 2 : 120W total.

DB modules with 6V nominal channel 1 are not allowed when channel 2 exceeds 5.5V.

¥ - 3A forward air, 2A reverse air.
¥¥ - 1A forward air, 0.6A reverse air.
¥¥¥ - Linearly derate from 13 to 10A over the voltage range 12.5 to 15.5 V.
¥¥¥¥ - Linearly derate from 7 to 6A over the voltage range 25 to 28 V.
‡ - Voltage measured at the module power terminals. This voltage at the power terminals must not be exceeded when remote sense is used.

Cooling Options:

Cooling option	Input volts	continuous O/P power	peak power O/P (W)	Ambient(°C)	Derating(°C) †
S, V ,T Forward air standard fan	90-264(Vac) ‡	350W	400 peak if 350 average #	65	2.5% per°C above 50
S, V Forward air standard fan	115-264(Vac)	450W	510 peak if 450 average #	65	2.5% per°C above 50

S, V, T Forward air standard fan	180-264(Vac)	664W	740 peak if 600 average #	65	2.5% per°C above 50
R Reverse air standard fan	90-264(Vac) ‡	250W	N/A	65	2.5% per°C above 50
Q Forward air quiet fan	90-264(Vac) ‡	350W	N/A	65	2.5% per°C above 50
P Reverse air quiet fan	90-264(Vac) ‡	250W	N/A	60	3.8% per°C above 50

C, U Cooling Option : Customer air, fan not fitted. Refer to Customer Air Cooling section in for details.

† Both the total output power and the module output currents are derated by the given value.
‡ For input voltages between 85 and 89.9V the output power is derated to 94% of the values given for 90V input.
# The PSU may output the given peak power for up to 10 seconds providing that the average power from the PSU does not exceed the stated value.
• Continuous, peak and average power ratings may be linearly interpolated for input voltages between 90 and 180V.
• Global Option standby outputs (12-13.5V at 1A or 5-5.5V at 2A) should not be included when calculating total PSU output power, but they are subject to the current deratings for operation above 50°C.
• Global Options with output voltages between 5.01 and 5.5V have their max. output current linearly derated from 2A at 50°C ambient to 1.4A at 65°C ambient.
• For reverse airflow cooling all B, BH and DB modules are limited to a maximum output power of 150W (total for both channels on dual output modules).

NV350 FEP or NF3 (these models are identical)
followed by: S, R, C, or T where:

S = Forward airflow, standard fan
R = Reverse airflow, standard fan
C = Customer air, fan not fitted
T = Top fan, Forward airflow
followed by: S, I, or J where:

S = Screw input terminals
I = IEC input
J = Dual fused IEC input
followed by: S, where:

S = Standard Leakage (Class B Filter)

Unit configuration may be given using the above code and/or by the option description. The input terminal

type (screw or IEC) may alternatively be determined by examination of the unit.

optionally followed by: ES#V or IS#V, where:

ES5V = AC good, PSU enable, 5-5.5V, 2A standby output
ES12V = AC good, PSU enable, 12-13.5V, 1A standby output
IS5V = AC good, PSU inhibit, 5-5.5V, 2A standby output
IS12V = AC good, PSU inhibit, 12-13.5V, 1A standby output

where # represents the standby output voltage.

The Global Options Inhibit and Enable functions permit the customer to turn off or on the main psu outputs and the fan. The standby supply is for use by the customer and provides an SELV output that continues to operate when all the main psu outputs have been turned off using the Inhibit or Enable functions. All the functions of the Global Option pass through a single 8 way PWB socket and are all rated SELV.

followed by @FE

where @ is the output voltage of the module and is within the range given in the FE module table as follows:

NV350 FEP Module:

FE Module, Output 1

Nominal Voltage (V)	Voltage Range (V)	#Max. Current (A)	Max. Power (W)
12	11.5 - 15.5	29.2	350*

FE Module, Output 2

Nominal Voltage (V)	Voltage Range (V)	Max. Current (A)	Max. Power (W)
12	Fixed 12V	2	24.2*

* - Total Output Power must not exceed 350W.
# Voltage measured at the module power terminals must not exceed the value shown in the table when remote sense is used. For 50°C max. ambient operation: 11.5 - 12.5V 350W total power. From 12.5 - 13.2V: Linearly derate total power from 350 to 306W. For 350W total output power (O/P 1 + O/P 2) : 11.5 - 12.5V: 50°C max. ambient. From 12.5 - 13.2V: Linearly derate max. ambient from 50 to 45°C

Cooling Options

COOLING OPTION:	TOTAL POWER
S (FORWARD AIRFLOW)	350W
R (REVERSE AIRFLOW)	350W
C (CUSTOMER AIR)	350W
T (TOP FAN)	350W

The above ratings apply for ambient temperatures up to 50°C. From 50 to 65°C the total output power and the module current ratings are both derated at 2.5% per °C.

Global Option standby outputs (12V at 1A or 5V at 2A) should not be included when calculating total PSU output power, but they are subject to the output current deratings for operation above 50°C.

5V global options are derated to 1.8A max. when the psu is inhibited

NV350 PFC

ELECTRICAL & THERMAL RATINGS:

Input Parameters

Nominal input voltage (V)	100 - 240
Input voltage range (V)	85 - 264
Input frequency range (Hz)	47 - 63
Maximum input current (A)	5.5
Inrush Current (A)	<15

For input voltages between 85 and 89.9V the output power is derated to 94% of the values given in the Cooling Options Table.

Output Parameters

Max Output Power is 350W up to 50°C. Above 50°C, derate by 2.5%/°C.
Output Voltage - 375V +/- 20V
Fan Output - 12V nom at 0.25A max

Customer Air Cooling (options C or U):

The following method must be used for determining the safe operation of PSUs when C or U option (Customer Air) is fitted, i.e. fan not fitted to PSU. The minimum permitted airflow for customer air cooling is 0.5m/s.

For PSUs cooled by customer supplied airflow the components listed in the following table must not exceed the temperatures given. Additionally ratings specified for units with an internal fan must still be complied with, e.g. mains input voltage range, maximum output power, module voltage / current ratings and maximum ambient temperature. To determine the component temperatures the heating tests must be conducted in accordance with the requirements of the appropriate standards.

Test requirements include: PSU to be fitted in its end-use equipment and operated under the most adverse conditions permitted in the end-use equipment handbook/specification and which will result in the highest temperatures in the PSU. To determine the most adverse conditions consideration should be given to the end use equipment maximum operating ambient, the PSU/assembly loading and input voltage, ventilation, end use equipment orientation, the position of doors & covers, etc. Temperatures should be monitored using type K fine wire thermocouples (secured with cyanoacrylate adhesive, or similar) placed on the hottest part of the component (out of any direct airflow) and the equipment should be run until all temperatures have stabilized.

Technical Considerations

- Equipment mobility : for building-in
- Connection to the mains : Connection to mains via host equipment, or via appliance inlet
- Operating condition : continuous
- Access location : for building-in
- Over voltage category (OVC) : OVC II
- Mains supply tolerance (%) or absolute mains supply values : +10%, -10%
- Tested for IT power systems : Yes
- IT testing, phase-phase voltage (V) : 230V (Norway only)
- Class of equipment : Class I (earthed)

- Considered current rating of protective device as part of the building installation (A) : 5.5
- Pollution degree (PD) : PD 2
- IP protection class : IP X0
- Altitude of operation (m) : 5000
- Altitude of test laboratory (m) : 64
- Mass of equipment (kg) : 1 kg max
- The NV350 range is suitable for use at an altitude of 5000 metres.
- 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) to 65°C maximum (see enclosure 7-01 for models and conditions to which the extended ambient applies) with de-ratings.
- The product is intended for use on the following power systems: TN, IT (Norway only)
- 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 equipment disconnect device is considered to be: appliance inlet (if fitted), or provided by the end equipment.
- The product was investigated to the following additional standards: CSA C22.2 No. 60950-1-07+A1:2011, EN 60950-1:2006 +A11:2009+ A12:2011+A1:2010 +A2:2013, UL 60950-1 2nd Ed. Revised 2011-12-19(which includes all European national differences, including those specified in this test report).
- The means of connection to the mains supply is: Pluggable A (models fitted with an IEC60320 inlet only).
- Multlayer PWB's accepted under CBTR Ref. No. E349607-A23 dated 2014-07-31 and letter report, enclosure 7-06 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:

- The following Production-Line tests are conducted for this product: Earthing Continuity Electric Strength
- The following secondary output circuits are SELV: All.
- The end-product Electric Strength Test is to be based upon a maximum working voltage of: Primary-SELV: 363 Vrms, 650 Vpk Primary-Earthed Dead Metal: 343 Vrms, 622 Vpk. These figures are based on the original test data.
- The power supply terminals and/or connectors are: Screw terminals (where used) are suitable for factory wiring only.
- The investigated Pollution Degree is: 2
- Proper bonding to the end-product main protective earthing termination is: Required
- The following end-product enclosures are required: Mechanical, Fire, Electrical with the exception of the IEC inlet face of units fitted with an IEC60320 inlet.
- The following output terminals were referenced to earth during performance testing: All outputs and their return lines individually referenced to obtain maximum working voltage.
- The maximum investigated branch circuit rating is: 20 A
- 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): T1, T2, TX1 & TX2 (all Class F). See table 1.5.1 for details of insulation systems used.
- The following secondary output circuits are at hazardous energy levels: 12BH, 24BH, 12C, 16C, 24C, 30C, 12CM, 12FE(NV350FEP model), 16CM, 24CM and 30CM modules.
- The following components require special consideration during end-product Thermal (Heating) tests due to the indicated maximum temperature measurements during component-level testing: Converter: L1 (130°C), L2 (155°C), L3 (155°C), T1 (130°C), C1 (100°C), C3 (100°C), C4 (100°C), RL1 (100°C); Modules: TX1 (130°C), TX2 (130°C), XL1 (130°C), B, BH & DB module L1 (130°C), C & CM module L1 (140°C); Global Option: T2 (130°C); All electrolytic capacitors: 105°C.
- The equipment is suitable for direct connection to: AC mains supply (units with an IEC60320 inlet only). Only the end face with the IEC60320 inlet may be accessible to an end operator.
- Fans: The end fan provided in this sub-assembly is provided with a fan guard to reduce the risk of operator contact with the stator., The top fan provided in this sub-assembly is not intended for operator access., , ,

Additional Information

This report, to include IEC60950-1 amendment 2: 2013, is a re-issue of CBTR ref No: E135494-A57-CB-2 dated 2012-10-29 with CB Test Certificate Ref. No. DK-28914-UL issued 2012-10-29, amendment 1 issued 2013-11-27 with CB Test Certificate Ref. No. DK-28914-A1-UL issued 2013-11-27 and amendment 2 issued 2014-06-11 with CB Test Certificate Ref. No. DK-28914-A2-UL issued 2014-06-11. Based on the previously conducted testing and the review of product technical documentation including photos, schematics, wiring diagrams and similar, has been determined that the product continues to comply with the standard. Only the tests listed below was deemed necessary.
The original report was modified to include the following changes/additions:
Range approval for a dual fused input connector (option J). This option has been used before as a non-standard. Thermal comparison with worst case configuration to allow use across the range.
Range approval for top fan (option T). This option has been used before as a non-standard. Thermal comparison with worst case configuration to allow use across the range.
NV3 FEP restored back to original value: 11.5 - 15.5V
DB module, CH2 voltage range may be extended up to 6.0V (60W max) for some PSU configurations. Consultation with the factory is required. This is in line with the 61010-1 report No: E331788-A17-CB-1
L option added to nomenclature for fixed speed fan (Non-standard only)
Alternative fuse testing (not mains input fuse)
Alternative J1 connector to include Tianli B825 series (same ratings no testing required)
Alternative/second source fan testing
Assessed for 5000 meters
Model: NV3 KISE5V 12/12DB 5B (X00004#) should have been: NV3 KISES5V 12/12DB 5B (X00004#)
Removed Avnet and Arrow from the manufacturers list.
Updated handbook
Addition/deletion of multilayer PWBs to critical component list
Correction/addition to the critical component list
Updated licenses
Updated drawings

Only limited testing was conducted to reflect these additions and all other tests were considered covered by the testing covered by Test Report Reference E135494-A57-CB-2 issued 2012-10-29 (CB Certificate DK-28914-UL), amendment 1 issued 2013-11-27 (CB Certificate DK-28914-A1-UL) and amendment 2 issued 2014-06-11 (CB Certificate DK-28914-A2-UL).

Additional Standards

The product fulfills the requirements of: CSA C22.2 No. 60950-1-07+A1:2011, UL 60950-1 2nd Ed. Revised 2011-12-19, EN 60950-1:2006 + A1:2010 + A11:2009 + A12:2011 + A2:2013

Markings and instructions	
Clause Title	Marking or Instruction Details
1.7.1 Power rating - Ratings	Ratings (voltage, frequency/dc, current)
1.7.1 Power rating - Company identification	Listee's or Recognized company's name, Trade Name, Trademark or File Number
1.7.1 Power rating - Model	Model Number
1.7.6 Fuses - Non-operator access/soldered-in fuses	Unambiguous reference to service documentation for instructions for replacement of fuses replaceable only by service personnel
2.7.6 Warning to service personnel	"CAUTION: Double pole/neutral fusing"
Special Instructions to UL Representative	
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Production-Line Testing Requirements

Electric Strength Test Special Constructions - Refer to Generic Inspection Instructions, Part AC for further information.

Model	Component	Removable Parts	Test probe location	V rms	V dc	Test Time, s
N/A	-	-	-	-	-	-

Earthing Continuity Test Exemptions - This test is not required for the following models:

-

Electric Strength Test Exemptions - This test is not required for the following models:

-

Electric Strength Test Component Exemptions - The following solid-state components may be disconnected from the remainder of the circuitry during the performance of this test:

-

Sample and Test Specifics for Follow-Up Tests at UL

Model	Component	Material	Test	Sample(s)	Test Specifics
-	-	-	-	-	-

1.5.1	**TABLE: list of critical components**					Pass
Object/part or Description	Manufacturer/ trademark	type/model	technical data	Product Category CCN(s)	Required Marks of Conformity	Supplement ID
PWBs, single or double sided	Interchangeable	Interchangeable	94V-1 (Minimum) 130°C	ZPMV2	Ul	
IMS PWBs	Interchangeable	Interchangeable	94V-1 (Minimum)120°C	ZPMV2	UL	
Multi layer PWBs	As below	Primary winding Converter B/DB & C modules Pri control board (B & DB) DC-DC boards Output option (Vitesse)	-	-	-	
PWB's (alternate) (multi-layer)	Eurotech	2	94V-1 (Minimum) 130°C, (Min. internal spacing, Reinforced:0.60mm)	ZPMV2	UL (E76441)	
PWB's (alternate) (multi-layer)	Tak Shing Technology (Hong Kong) Ltd	TS-M	94V-1 (Minimum) 130°C, (Min. internal spacing, Reinforced:0.58mm)	ZPMV2	UL (E305886)	
PWB's (alternate) (multi-layer)	Oki Printed Circuits Co.Ltd.	OM-11	94V-1 (Minimum) 130°C, (Min. internal spacing, Reinforced:0.403mm)	ZPMV2	UL (E48977)	
PWB's (alternate) (multi-layer)	MFS Technology (PCb) Co., Ltd	MDL10	94V-1 (Minimum) 130°C, (Min. internal spacing, Reinforced:0.36mm)	ZPMV2	UL (E94919)	
PWB's (alternate) (multi-layer)	Yan Tat Technology Ltd	Y-16	94V-1 (Minimum) 130°C, (Min. internal spacing, Reinforced:0.57mm)	ZPMV2	UL (E152990)	
PWB's (alternate) (multi-layer)	Garner Osbourne Circuits	3	94V-1 (Minimum) 130°C, (Min. internal spacing, Reinforced:0.60mm)	ZPMV2	UL (E176375)	
FILTER / PFC ASSEMBLY (NV350,	-	-	-	-	-	

NV350FEP,NV350PFC)						
J1 Mains terminal block. (Alternate)	Molex Inc. (Beau)	old p/n 70 series, new number: 38700-7503	UL: 300V, 20A, 130°C	XCFR2	UL E48521	
J1 Mains terminal block. (Alternate)	Tyco (Buchanan)	4DB series	UL: 300V, 20A, (105°C)	XCFR2	UL E54800	
J1 Mains terminal block. (Alternate)	Tianli Electrical Machinery (Ningbo) Co. Ltd	B825 Series	UL: 300V, 20A, 105°C	XCFR2	UL E206029	
Wiring from IEC 60320 inlet to terminal block Live and Neutral	Interchangeable	Interchangeable	20AWG min, 300V min. 80°C min.	AVLV2	UL	
Wiring from IEC 60320 inlet to terminal block Earth	Interchangeable	Interchangeable	18AWG min, 300V min. 80°C min.	AVLV2	UL	
IEC 60320 Inlet (Input option I only)	Schurter AG	6100-41xx, where xx is a number (panel thickness)	250V, 10A, 250V, 15A UL	AXUT2	UL E96454	
Dual fused IEC inlet (Input option J)	Bulgin Components PLC now part of Elektron	PF0033	250V, 10A,	AYVZ2	UL E92187	
Mains switch (Input option J). (Alternate)	Arcolectric/ Elektron Components Ltd	R8550	250V, 10A, 250V, 15A UL, 105°C	W0YR2	ULE45221	
Mains switch (Input option J). (Alternate)	Solteam	MR22-N2BB-F2	250V, 12A, 85°C	W0YR2	UL E148157	
F1 fuse (Alternate)	Schurter AG	0001.1012PT, (SP series)	F6.3AH, 250V, 5x20mm	JDYX2	UL E41599	
F1 fuse (Alternate)	Littelfuse	21606.3	F6.3AH, 250V, 5x20mm	JDYX2	UL E10480	
XR1, XR2, XR3, XR4 Discharge resistors	Interchangeable	Interchangeable	470K Ohm max, 1W min	-	-	
C3, C4 X capacitor (Alternate)	Kemet	PHE840MB series	0.47uF max., 275V, X2 105°C	FOWX2	UL E73869	
C3, C4 X Capacitor ((Alternate))	Vishay	MKP338-2 series (22223382)	0.47uF max., 275V, 105°C	FOWX2	UL E354331	
C3, C4 X Capacitor ((Alternate))	Carli Electronics Co. Ltd.	MPX series	0.47uF max, 275Vac (250Vac UL), X2, 100°C	FOWX2	UL E120045	

C3, C4 X Capacitor (Alternate)	Xiamen Faratronic Co. Ltd.	MKP62 series	0.47uF max, 275Vac (250Vac UL), X2, 110°C	FOWX2	UL E186600	
C3, C4 X Capacitor (Alternate)	Kemet	R.46 series	1uF max., 250V, 110°C	FOWX2	UL E97797	
C5, C6, C7 Y capacitors (Alternate)	Kemet	PME271Y	1.5nF max, 250Vac, Y2, 100°C	FOWX2	UL E73869	
C5, C6, C7 Y capacitors (Alternate)	Kemet	PHE850 series	1.5nF max., 300Vac (UL 250Vac), Y2 110°C	FOWX2	UL E73869	
C5, C6, C7 Y capacitors (Alternate)	Wilhelm Westermann Spezialvertrieb Elektronischer (WIMA)	MP 3-Y2 series	1.5nF max., 250Vac, Y2, 110°C	FOWX2	UL (E100438)	
C5, C6, C7 Y capacitors (Alternate)	Faratronic (Xiamen)	MKP-63 series	1.5nF max, 250Vac, Y2, 105°C	FOWX2	UL E186600	
C5, C6, C7 Y capacitors (Alternate)	Vishay	338-6 series	1.5nF max, 250Vac, Y2, 105°C	FOWX2	UL E354331	
C5, C6, C7 Y capacitors (optional) (alternate)	Kemet Electronics Corp	ERP 610 Series	1.5nF maximum, 250V, Y1, 125°C	FOWX2	UL (E356389)	
L2, L3 Common mode choke	Interchangeable	Interchangeable	Core: OD 22mm ID 13mm, depth 13mm. Wire: ECW Class F min., 0.71mm min.	-	-	
L2, L3 cradle	EI Dupont	Rynite FR530 or FR530L	94V-0, 155°C (RTI), 0.9mm min. thick	QMFZ2	UL E41938	
L4, Common mode choke	Interchangeable	Interchangeable	Core: OD 16mm ID 11mm, depth 7mm. Wire: ECW Class F min., 0.71mm min.	-	-	
RL1 Relay	Tyco	RE030012 (1393217-4)	250V, 6A, coil 12V	NLDX2	UL E214025	
XTH101 Thermistor. (Alternate)	Murata	PRF18BA471+++++ where + may be any number or letter	125°C Required for safety.	XGPU2	UL (E137188)	
XTH101 Thermistor. (Alternate)	Murata	PRF18BB471+++++ where + may be any number or letter	115°C Required for safety.	XGPU2	UL (E137188)	
L1 Boost choke	Interchangeable	Interchangeable	Cores: 27 by 24 by 19mm	-	-	

			overall. Wire: ECW Class B min., 35 min. strands of 0.12mm min.			
L1 bobbin	Sumitomo Bakelite	PM9820	94V-0, 150°C (RTI), 0.9mm min. thick	QMFZ2	ULE41429	
C1 Reservoir capacitor	Interchangeable	Interchangeable	270uF max, 400V min., 105°C.	-	-	
XFS1 or F2 Fuse. (Alternate)	Schurter	OMF250 series.	F1AL, 250V	JDYX2	UL E41599	
XFS1 or F2 Fuse. (Alternate)	Schurter	OMT250 series	T2AL, 250Vac, 125Vdc	JDYX2	UL E41599	
XFS1 or F2 Fuse. (Alternate)	Bussman	PC-Tron PCB 1A	F1AL, 450Vdc, 250Vac	JDYX2	UL E19180	
F2 Fuse (alternate)	Daito	DCP 1A	F1AL, 450Vdc	JDYX2	UL (E59783)	
F2 Fuse (alternate)	Daito	DCP 2A	F2AL 450Vdc	JDYX2	UL (E59783)	
F2 Fuse (alternate)	Hollyland Co. Ltd.	5EF series	F1AL, 250Vac	JDYX2	E156471	
T1 flyback transformer	TDK-Lambda UK Ltd or Trio Engineering Co Ltd	TDKL Part No: 33037. May be followed by T.	Class F Reinforced insulation, systems CEL-CF4 or TEC-CF4 or CEL-CF2 or TEC-CF2 or NLF1	OBJY3 or OBJY2	UL, (E148927 or E182446)	
T1 Flyback transformer core	Interchangeable	Interchangeable	2 E-cores total 16mm x 16mm x 4mm	-	-	
T1 flyback transformer bobbin	Interchangeable	Interchangeable	Material manufactured by EI Dupont Rynite FR530 or FR530L (155°C - RTI), 1.0mm thick	QMFZ2	UL E41938	
T1 Flyback transformer triple insulated wire. (Alternate)	Totoku	3S-ETFE or TIW-E	Triple insulated wire. 26 AWG (0.4mm dia.) min. Provides reinforced insulation Class F	OBJT2	UL E166483	
T1 Flyback transformer triple insulated wire (Alternate)	New England Wire Technologies Corp.	WxxT1.5EyyyTC1A (xx may be 26 or 24 and y may be any number between 0-9)	Triple insulated wire 26AWG (0.4mm diameter) min. Provides reinforced insulation. Class F	OBJT2, EN/IEC60950-1	UL E205791	
XU4 Opto coupler	Vishay	SFH6156 or Model SFH61, may be followed	4420Vac min (UL). Provides Reinforced insulation.	FPQU2	UL E52744	

		by additional letters and numbers				
XU4 Opto coupler. Alternate	Renesas Electronics Corporation	PS2581L2	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU4 Opto coupler Alternate	Renesas Electronics Corporation	PS2561L2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU4 Opto coupler Alternate	Renesas Electronics Corporation	PS2561DL2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
J20 to J24 Connector	Molex	38-00-1335 (4455 series)	250V, 2.5A UL94 V-0	ECBT2	UL E29179	
CHASSIS & COVER INSULATORS:	-	-	-	-	-	
Insulation on chassis	Interchangeable	Interchangeable	Polyester or polyimide tape. Provides Basic and Reinforced insulation	OANZ2	UL	
Insulation on cover	Interchangeable	Interchangeable	Polyester or polyimide tape. Provides Basic and Reinforced insulation	OANZ2	UL	
Insulator for module heatsinks (Alternate)	Bergquist Co.	GPVOUS-0.040 Gap Pad V0 Ultra Soft	Provides Supplementary Insulation	QMFZ2	UL E59150	
Insulator for module heatsinks (Alternate)	Shiu Li Technology Co Ltd	L37-3 or H48-2	Provides Supplementary Insulation	QMFZ2, OCDT2	UL E256821 E317540	
B, BH and DB	-	-	-	-	-	

MODULES:						
Module cradle	EI Dupont	Rynite FR530 or FR530L	94V-0, 155°C (RTI), 0.9mm min. thick	QMFZ2	UL E41938	
L1 choke (optional)	Interchangeable	Interchangeable	Core: OD 8mm ID 4mm, depth 3mm. Wire: ECW Class B min., 0.3mm min. Nema rated to 140°C	-	-	
3.3V & 5V Ch. 1: XL1 choke (base board)	Interchangeable	Interchangeable	Cores: 12 by 12 by 9mm max. overall. Rated 40.5A min.	-	-	
12V Ch. 1: XL1 choke (base board)	Interchangeable	Interchangeable	Cores: 12 by 12 by 9mm max. overall. Rated 22.2A min.	-	-	
24V Ch. 1: XL1 choke (base board)	Interchangeable	Interchangeable	Cores: 12 by 12 by 9mm max. overall. Rated 11.2A min.	-	-	
XR23 Thermistor (fitted to module base PWB. Protects single modules and channel 1 on twin output modules).	Murata	PRF18AR471+++ ++ where + may be any number or letter	135°C Required for safety	XGPU2	UL (E137188)	
XR23 Thermistor (fitted to module base PWB. Protects 12B, 12BH, DB24/5, 12, 24 modules)	Murata	PRF18BB471+++ ++ where + may be any number or letter	115°C Required for safety	XGPU2	UL (E137188)	
XR23 Thermistor (fitted to module base PWB. Protects 24B & 24BH modules)	Murata	PRF18BC471+++ ++ where + may be any number or letter	105°C Required for safety	XGPU2	UL (E137188)	
XR23 Thermistor (fitted to module base PWB. Protects 24B & 24BH modules)	Murata	PRF18BB471+++ ++ where + may be any number or letter	115°C Required for safety	XGPU2	UL (E137188)	
XR23 Thermistor (fitted to module base PWB. Protects 24B & 24BH modules)	Murata	PRF18AR471+++ ++ where + may be any number or letter	135°C Required for safety	XGPU2	UL (E137188)	
XR9 (18 & 24V O/Ps) Thermistor for channel 2 on twin output modules).	Murata	PRF18BB471+++ ++ where + may be any number or	115°C Required for safety	XGPU2	UL (E137188)	

		letter				
XR16 (5 & 12V O/Ps) (Thermistor for channel 2 on twin output modules).	Murata	PRF18BA471+++++ where + may be any number or letter	125°C Required for safety	XGPU2	UL (E137188)	
XU1, XU3 & XU4 Opto coupler	Vishay	SFH6156 or Model SFH61, may be followed by additional letters and numbers	4420Vac min. (UL). Provides Reinforced Insulation.	FPQU2	UL E52744	
XU1, XU3 & XU4 Opto coupler	Renesas Electronics Corporation	PS2581L2	5000Vac May be marked NEC and/or Renesas	FPQU2	UL (E72422)	
XU1, XU3 & XU4 Opto coupler	Renesas Electronics Corporation	PS2561L2-1	5000Vac May be marked NEC and/or Renesas	FPQU2	UL (E72422)	
XU1, XU3 & XU4 Opto coupler	Renesas Electronics Corporation	PS2561DL2-1	5000Vac May be marked NEC and/or Renesas	FPQU2	UL (E72422)	
Twin output modules: 12V Ch. 2: XL1 choke	Interchangeable	Interchangeable	Cores: 12 by 12 by 5mm overall.	-	-	
B, BH & DB Module Power Transformers:	-	-	-	-	-	
TX1 Power trx. Bobbin	Interchangeable	TDKL Part No: 66757	Manufactured from Rynite FR530 or FR530L (155°C-RTI), 1mm thick	QMFZ2	UL E41938	
TX1 Power trx. Clip	Interchangeable	TDKL Part No: 66765	Manufactured from Rynite FR530 or FR530L (155°C-RTI) or Sumikasuper E4008L (130°C-RTI), 1mm thick	QMFZ2	UL E41938	
TX1 Power trx. Cores	Interchangeable	Interchangeable	Cores: 27 by 19 by 18mm overall	-	-	
TX1 Power trx. PWB 11 turn, type A	Interchangeable	TDKL Part No: 12634	UL94V-1 min, 130°C.	ZPMV2	UL	4-01
TX1 Power trx. PWB 11 turn, type B	Interchangeable	TDKL Part No: 12635	UL94V-1 min, 130°C.	ZPMV2	UL	4-01

TX1 Power trx. PWB 12 turn, type A	Interchangeable	TDKL Part No: 12636	UL94V-1 min, 130°C.	ZPMV2	UL	4-01
TX1 Power trx. PWB 12 turn, type B	Interchangeable	TDKL Part No: 12637	UL94V-1 min, 130°C.	ZPMV2	UL	4-01
TX1 Power trx. PWB 14 turn, type A	Interchangeable	TDKL Part No: 13922	UL94V-1 min, 130°C.	ZPMV2	UL	4-01
TX1 Power trx. PWB 14 turn, type B	Interchangeable	TDKL Part No: 13923	UL94V-1 min, 130°C.	ZPMV2	UL	4-01
TX1 Power trx. PWB 16 turn, type A	Interchangeable	TDKL Part No: 12638	UL94V-1 min, 130°C.	ZPMV2	UL	4-01
TX1 Power trx. PWB 16 turn, type B	Interchangeable	TDKL Part No: 12639	UL94V-1 min, 130°C.	ZPMV2	UL	4-01
TX1 triple insulated wire	New England Wire Technologies Corp.	W21T1.5EyyyMW 80S60A (where yyy may be any number between 000-999)	Triple insulated 21AWG winding wire rated (Class F). Provides reinforced insulation	OBJT2	UL (E205791)	
Note: The TX1 Power Trx. PWBs listed above provide Reinforced insulation.	-	-	-	-	-	
Secondary winding, 1 turn	Interchangeable	TDKL Part No: 52121, 52321, 52331	Secondary winding, 1 turn	QMTS2	UL E124294 E192337	
Secondary winding, 2 turn	Interchangeable	TDKL Part No: 52122, 52322, 52332	Secondary winding, 2 Turn (assessed in application)	QMTS2	UL E124294 E192337	
Secondary winding, 3 turn	Interchangeable	TDKL Part No: 52123, 52323, 52333	Secondary winding, 3 Turn (assessed in application)	QMTS2	UL E124294 E192337	
Secondary winding, 4 turn	Interchangeable	TDKL Part No: 52124, 52324, 52334	Secondary winding, 4 Turn	QMTS2	UL E124294 E192337	
Secondary winding, 5 turn	Interchangeable	TDKL Part No: 52125, 52325, 52335	Secondary winding, 5 Turn	-QMTS2	UL E124294 E192337	
Secondary winding, 6	Interchangeable	TDKL Part No:	Secondary winding, 6 Turn	QMTS2	UL E124294	

turn		52126, 52326, 52336			E192337	
C & CM MODULES:	-	-	-	-	-	
Module cradle	EI Dupont	Rynite FR530 or FR530L	94V-0, 155°C (RTI), 0.9mm min. thick	QMFZ2	UL E41938	
L1 choke (optional)	Interchangeable	Interchangeable	Core outer dimension: 9mm; inner dimension: 4mm; 4mm depth Class F 0.22mm min. ECW. Base:- Manufactured by EI Dupont Rynite FR530 or FR530L, 0.8mm thick rated 94V-0, RTI 155°C. Or interchangeable manufacturers, Nema FR4, 1.6mm 94V-0, RTI 140°C	-	-	
TX2 transformer	TDK-Lambda UK Ltd or Trio Engineering Co Ltd	TDKL Part No: 33600, 33601, 33602, 33603. May be followed by T.	Class F Reinforced insulation, system CEL-CF4 or TEC-CF4	OBJY3	UL, (E148927)	
TX2 cradle	EI Dupont	Rynite FR530 or FR530L	94V-0, 155°C (RTI), 1mm thick	QMFZ2	UL E41938	
TX2 bobbin	EI Dupont	Rynite FR530 or FR530L	94V-0, 155°C (RTI), 0.8mm thick	QMFZ2	UL E41938	
TX2 cores	Interchangeable	Interchangeable	Core dimension: 27 x 18 x 13mm	-	-	
TX2 triple insulated wire	New England Wire Technologies Corp.	W21T1.5EyyyMW 80S60A (where yyy may be any number between 000-999)	Triple insulated 21AWG winding wire rated (Class F) providing reinforced insulation.	OBJT2	UL E205791	
XR23 Thermistor (Alternate)	Murata	PRF18BB471+++ ++ where + may be any number or letter	115°C	XGPU2	UL (E137188)	
XR23 (Alternate)	Murata	PRF18BC471+++ ++ where + may	105°C	XGPU2	UL (E137188)	

		be any number or letter				
XU1, XU3, XU4 opto-couplers	Vishay	SFH6156 or Model SFH61, may be followed by additional letters and numbers	4420V	FPQU2	UL E52744	
XU1, XU3, XU4 opto-couplers	Renesas Electronics Corporation	PS2581L2	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU1, XU3, XU4 opto-couplers	Renesas Electronics Corporation	PS2561L2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU1, XU3, XU4 opto-couplers	Renesas Electronics Corporation	PS2561DL2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
Insulator on module heatsinks. (Alternate)	Bergquist Co	GPVOUS-0.040 Gap pad V0	Rated VTM-0	QMFZ2	UL E59150	
Insulator on module heatsinks. (Alternate)	Shiu Li Technology Co Ltd	L-37-3 or H48-2	Rated VTM-0	QMFZ2, OCDT2	UL E256821	
DA MODULE:	-	-	-	-	-	
XU3 Opto coupler	Vishay	SFH6156 or Model SFH61, may be followed by additional letters and numbers	4420Vac min(UL). Provides Reinforced insulation.	FPQU2	UL E52744	

XU3 Opto coupler	Renesas Electronics Corporation	PS2581L2	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU3 Opto coupler	Renesas Electronics Corporation	PS2561L2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU3 Opto coupler	Renesas Electronics Corporation	PS2561DL2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
TX1 transformer assembly.	TDK-Lambda UK Ltd or Trio Engineering Co Ltd	TDKL Part No: 33349 Components manufactured by Trio Engineering Co have been identified by the suffix 'T'	Class F Reinforced insulation, systems CEL-CF4 or TEC-CF4 or CEL-CF2 or TEC-CF2 or NLF1	TDK-Lambda UK Ltd or Trio Engineering Co Ltd	UL	
TX1 transformer bobbin.	Interchangeable	TDKL Part No: 20172	Manufactured by EI Dupont Rynite FR530 or FR530L (155°C - RTI) or Sumitomo Bakelite E4008L (130°C - RTI), 0.6mm thick	Interchangeable	UL	
TX1 transformer E cores	TDK-Lambda UK Ltd.	Interchangeable	2 E-cores total 20mm x 20mm x 7mm	TDK-Lambda UK Ltd.	-	
TX1 transformer triple insulated wire. (Alternate)	Totoku	3S-ETFE or TIW-E	Triple insulated wire. 0.4mm dia. minimum. Provides reinforced insulation. (Class F)	OBJT2	UL E166483	

TX1 transformer triple insulated wire (Alternate)	New England Wire Technologies Corp.	WxxT1.5EyyyTC1A (xx may be 26, 24 or 22 and yyy may be any number between 000-999)	Triple insulated wire. 26 AWG minimum. Provides reinforced insulation. (Class F)	OBJT2	UL E205791	
GLOBAL OPTIONS:	-	-	-	-	-	
XU3, XU4, XU5, XU6, XU7 Opto couplers (Optional dependant upon global option type)	Vishay	SFH6156 or Model SFH61, may be followed by additional letters and numbers	4420Vac (UL). Provides Reinforced insulation.	FPQU2	UL E52744	
XU3, XU4, XU5, XU6, XU7 Opto couplers (Optional dependant upon global option type)	Renesas Electronics Corporation	PS2581L2	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU3, XU4, XU5, XU6, XU7 Opto couplers (Optional dependant upon global option type)	Renesas Electronics Corporation	PS2561L2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU3, XU4, XU5, XU6, XU7 Opto couplers (Optional dependant upon global option type)	Renesas Electronics Corporation	PS2561DL2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
Global option trx. T2 assembly. (Alternate)	TDK-Lambda UK Ltd.	CLL Assy Part No 32456, 32457, 33408, 33407	Class F Reinforced insulation, systems CEL-CF2 or CEL-CF4	OBJY3	UL	
Global option trx. T2 assembly. (Alternate)	TDK-Lambda UK Ltd or Trio Engineering Co Ltd	TDKL Part No: 33407, 33408. Components	Class F Reinforced insulation, systems CEL-CF4 or TEC-CF4 or CEL-CF2 or TEC-CF2 or	OBJY3	UL	

		manufactured by Trio Engineering Co have been identified by the suffix 'T'	NLF1			
Global option trx. T2 bobbin	Interchangeable	TDKL Part No: 20172	Manufactured by EI Dupont Rynite FR530 or FR530L (155°C - RTI) or Sumitomo Bakelite E4008L (130°C - RTI), 0.6mm thick	QMFZ2	UL	
Global option trx. T2 E cores	TDK-Lambda UK Ltd.	Interchangeable	2 E-cores total 20mm x 20mm x 7mm Assessed in-application	-	-	
Global option trx. T2 wire.	Totoku	3S-ETFE or TIW-E	Triple insulated wire. 24 AWG minimum. Provides reinforced insulation. (Class F)	OBJT2	ULE166483	
Global option trx. T2 wire (Alternate)	New England Wire Technologies Corp.	WxxT1.5EyyyTC1A (xx may be 24 or 22 and yyy may be any number between 000-999)	Triple insulated wire. 24 AWG minimum. Provides reinforced insulation. (Class F)	OBJT2	ULE205791	
12FE Module (for use in NV350FEP only):	-	-	-	-	-	
XF1 fuse. (Alternate)	Littelfuse	R451 004 (Nano2 series, gold plated)	FF4AL, 125V (surface mount)	JDYX2	UL (E10480)	
XF1 fuse. (Alternate)	Littelfuse	R453 004 (Nano2 series, silver plated)	FF4AL, 125V (surface mount)	JDYX2	UL (E10480)	
XL1 choke	Interchangeable	Interchangeable	12 by 12by 9mm max. overall	-	-	
XR23 Thermistor	Murata	PRF18BB471QB1RB	115°C Required for safety	XGPU2	UL (E137188)	
XR23 Thermistor Alternate	Murata	PRF18BA471QB1RB	125°C Required for safety	XGPU2	UL (E137188)	
XU3 & XU4 Opto coupler	Vishay	SFH6156 or Model SFH61,	4420Vac min. (UL). Provides Reinforced insulation.	FPQU2	UL (E52744)	

		may be followed by additional letters and numbers				
XU3 & XU4 Opto coupler	Renesas Electronics Corporation	PS2581L2	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU3 & XU4 Opto coupler	Renesas Electronics Corporation	PS2561L2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
XU3 & XU4 Opto coupler	Renesas Electronics Corporation	PS2561DL2-1	5000Vac May be marked NEC and/or Renesas provides reinforced insulation. 0.4mm internal insulation, external creepage 8mm	FPQU2	UL (E72422)	
TX1, TX2 Transformers. (Alternate)	TDK-Lambda UK Ltd.	CLL Part No. 33364	Class F Reinforced insulation, systems CEL-CF2 or CEL-CF4	OBJY3	UL	
TX1, TX2 Transformers. (Alternate)	Trio Engineering Co. Ltd.	CLL Part No. 33364T	Class F Reinforced insulation, TEC-CF2 or TEC-CF4	OBJY3	UL	
TX1, TX2 Transformer moulding	Interchangeable Fabrications	Sumitomo Bakelite PM9820	94V-0, 150°C (RTI), 0.9mm min. thick. Mechanical support only	QMFZ2	UL	
TX1, TX2 Transformer cores	Interchangeable	Interchangeable	PQ Cores: 26mm x 25mm x 19mm overall	-	-	
TX1,TX2 Transformer triple insulated wire. (Alternate)	Totoku	3S-ETFE	Triple insulated wire. 0.4mm dia. minimum. Provides reinforced insulation	OBJT2	UL E166483	
TX1,TX2 Transformer triple insulated wire. (Alternate)	Totoku	TIW-E	Triple insulated wire. 0.4mm dia. minimum. Provides reinforced insulation	OBJT2	UL	

TX1,TX2 Transformer triple insulated wire. (Alternate)	New England Wire Technologies Corp	WxxT1.5EyyyTC1A where xx can be 22, 24 or 26 & yyy can be any number	Triple insulated wire. 22, 24 or 26 AWG. Provides reinforced insulation. Class F	OBJT2	UL E205791	
TX1, TX2 Transformer foil	Interchangeable	Interchangeable	13mm wide x 0.1mm thick copper covered by 2 layers of Kapton tape. Provided reinforced insulation	-	-	
Insulator on side of chassis	Interchangeable	Interchangeable	145.8mm by 35.8mm min. polyester or polyimide tape with cut-outs. Provides Basic insulation	OANZ2	UL	
Insulator on cover	Interchangeable	Interchangeable	168 by 84mm min. polyester or polyimide tape. Provides Basic insulation	-	-	
12FE Module channel 2 components	-	-	-	-	-	
XL601 Output Inductor	Interchangeable	Interchangeable	13 by 13 by 6mm max overall	-	-	
OUTPUT INTERFACE ASSEMBLIES:	-	-	-	-	-	
Output interface assemblies may contain any of the following critical components. Additional non-critical components (not described) may also be used. Documentation to be made available to the customer detailing ratings of all assembly outputs.	-	-	-	-	-	
Fuse	Interchangeable	Interchangeable	Used within the manufacturers voltage and current rating. 40Adc max. Max circuit voltage 160Vdc. Secondary circuit only.	JDYX2	UL	

			Not operator accessible			
Fuse holder	Interchangeable	Interchangeable	Used within the manufacturers voltage and current rating, UL94V-1 min. 40Adc max. Max circuit voltage 160Vdc. Secondary circuit only. Not operator accessible	JDYX2	UL	
Connector-Secondary	Interchangeable	Interchangeable	Used within the manufacturers voltage and current rating UL94V-1 min.	ECBT2	UL	
Choke	Interchangeable	Interchangeable	Used within the manufacturers voltage and current rating UL94V-1 min.	-	-	
Indicator lamps or LEDs	Interchangeable	Interchangeable	Any colour except red. Class 1-565nm pk Wavelength	-	-	
MISC. ITEMS:	-	-	-	-	-	
Fan (S, R and V cooling options only)	YS Tech	FD124020UB-H	12V, 14.4cfm	GPWV2	UL, approvals pending (E187205)	
Fan (S, R and V cooling options only)	Sunonwealth	PMD1204PKB3	12V, 13.3cfm,	GPWV2	UL E77551	
Fan (P & Q cooling options only) (Alternate)	Sanyo	109P0412Hxxx, where xxx is any number	12V, 8.0cfm,	GPWV2	UL E46810	
Fan (P & Q cooling options only) (Alternate)	ARX	FD1240-C2041M or FD1240-C2042M	12V, 12.95cfm,	GPWV2	UL E145724	
Fan (P and Q cooling option only)	Sunonwealth	PMD1204PKB3 Series	, 12V 13.3cfm	GPWV2	UL (E77551)	
Fan (T cooling option only)	Sanyo Denki Co. Ltd.	109P0812H7xx where x is any number from 0 to 9	12V, 32.1cfm,	GPWV2	UL E46810	
Fan (T cooling option only) (Alternate)	Yen Sun Technology Corp.	FD128015(X)(Y), where (X) may be	12V, 35.8cfm,	GPWV2	UL E145724	

		E, H, M or L, (Y) may be B or S				
Fan (K cooling option only)	EBM-Papst	3412NG	12V, 49.4 CFM	GPWV2	UL (E38324)	
Blanking plates (fitted to close unused module slots)	Interchangeable	Interchangeable	Aluminium, having overall dimensions 127 by 37 by 38mm or 127 by 37 by 26mm or 127 by 37 by 22mm or 143 by 37 by 12mm or 82 by 37 by 13 mm	-	-	
Sleeving, used on fan leadouts	Interchangeable	Interchangeable	Rated 300V minimum 125°C, VW-1	UZFT2	UL	
Sleeving, used on fan leadouts - (Alternate)	Interchangeable	Interchangeable	Rated 300V minimum 125°C, VW-1	YDPU2	UL	
Non-conformal coating (optional)	Dymax Corp	984-LVUF	V-1 120°C	QMJU2	UL (E140512)	
Non-conformal coating (optional)	Lackwerke Peters GmbH & Co	KG DSL 1600E-FLZ	V-0, 125°C	QMJU2	UL (E80315)	
Non-conformal coating (optional)	Dow Corning Corp	1-2577 Low VOC	V-0, 130°C	QMJU2	UL (E81611)	
Non-conformal coating (optional)	Dow Corning Corp	1-2577	V-0, 130°C	QMJU2	UL (E81611)	

Enclosures

Type	Supplement Id	Description
Photographs	3-07	NV350 PSU
Photographs	3-08	NV350PSU cover removed
Photographs	3-09	NV350FEP cover removed
Photographs	3-10	NV350 PSU Option 1 (Appliance Inlet)
Photographs	3-11	NV350 top fan
Diagrams	4-01	Transformer drawings
Schematics + PWB	5-01	PFC converter
Schematics + PWB	5-02	X00004, custom model
Schematics + PWB	5-03	Options
Schematics + PWB	5-04	Modules
Manuals	6-07	NV350 Manual
Manuals	6-08	NV350 FEP manual
Manuals	6-09	NV350 PFC manual
Miscellaneous	7-05	Impact Analysis of 60950-1 1st edition to 2nd edition
Miscellaneous	7-06	PWB letter report