UL TEST REPORT AND PROCEDURE

Standard:	UL 60601-1, 1st Edition, 2006-04-26 (Medical Electrical Equipment, Part 1: General Requirements for Safety) CAN/CSA-C22.2 No. 601.1-M90, 2005 (Medical Electrical Equipment - Part 1: General Requirements for Safety)
Certification Type:	Component Recognition
CCN:	QQHM2, QQHM8 (Power Supplies, Medical and Dental)
Product:	Switch mode power supply
Model:	QM5 and QS5, QM7 or QS7, QM8 switch mode power supplies (followed by alphanumeric characters - see model differences section in Test Report for details of models and nomenclature)
Rating:	QM5 or QS5 (700W): 100-240Vac nom, 47-63Hz, 11A rms max QM5 or QS5 (1200W): 200-240Vac nom, 47-63Hz, 9A rms max QM5 or QS5 (700W): 144-272Vdc nom, 7Adc max QM5 or QS5 (1200W): 239-272Vdc nom, 7Adc max QM7 or QS7 (1200W): 100-240Vac nom, 47-63Hz, 19A rms max QM7 or QS7 (1500W): 166.7-240Vac, 47-63Hz, 14A rms max QM8 (1200W): 100-240Vac nom, 47-63Hz, 19A rms max QM8 (1500W): 166.7-240Vac nom, 47-63Hz, 14A rms max
Applicant Name and Address:	TDK LAMBDA UK LTD KINGSLEY AVENUE ILFRACOMBE NORTH DEVON EX34 8ES UNITED KINGDOM

This is to certify that representative samples of the products covered by this Test Report have been investigated in accordance with the above referenced Standards. The products have been found to comply with the requirements covering the category and the products are judged to be eligible for Follow-Up Service under the indicated Test Procedure. The manufacturer is authorized to use the UL Mark on such products which comply with this Test Report and any other applicable requirements of UL LLC ('UL') in accordance with the Follow-Up Service Agreement. Only those products which properly bear the UL Mark are considered as being covered by UL's Follow-Up Service under the indicated Test Procedure.

The applicant is authorized to reproduce the referenced Test Report provided it is reproduced in its entirety.

UL authorizes the applicant to reproduce the latest pages of the referenced Test Report consisting of the first page of the Specific Technical Criteria through to the end of the Conditions of Acceptability.

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

Prepared by: Krzysztof Wasilewski (Project Handler) Reviewed by: Bruno F. Motta (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 QM or QS series of switch mode power supplies consist of:

Main board
1. Input filter, consisting of the input fuse(s), X and Y capacitors, common mode chokes up to the bridge.
2. PFC (boost circuit), consisting of the boost choke and associated switching FETs/circuitry.
3. Low power Standby circuit and Fan outputs consisting of the fly-back transformer and switching IC/circuitry supplying the Low Power Standby option and Fan outputs.
4. Secondary circuits (SELV), consisting of supply to the Low Power Standby output and fan supply.

Modules
5. Forward converter situated on the module, consisting of the main transformer and switching FETs/circuitry.
6. Secondary circuits (SELV), consisting of Module output, CH1/2 good and inhibit/enable.

Standby options
7. High power Standby circuit, consisting of the standby transformer and switching IC/circuitry supplying the High Power standby output.
8. Low power Standby circuit, supplied from the Main board.
9. Secondary circuits (SELV), consisting of High Power Standby output, Low Power Standby output, fan supply,AC fail and inhibit/enable.

(See Model Differences for details of nomenclature)

Model Differences

This report covers the QM and QS series of switch mode power supplies. The QS is identical to the QM series but allows for only one output made up from modules either in series or in parallel. The QM and QS series consists of 5 slot models (QM5/QS5), 7 slot models (QM7/QS7) and 8 slot models (QM8) with each slot capable of fitting single or dual modules (SC module requires two slots) and Non-standard models, see below for details. The QM5 or QS5 are available as 700W or 1200W and the QM7, QM8 or QS7 are available as 1200W or 1500W depending on the input voltage. High power/Low power and PMBus Standby Options may be fitted.

Units may be marked with a Product Code: KQMxy or KQSxy where x is the number of available slots and y may be any number of characters.

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

Nomenclature

QMshabcdefgklm for modular configurations

Where	s	=	5 for QM5 models 7 for QM7 models 8 for QM8 models
	h	=	Hold Up Option Blank for none fitted H for extended hold up
	a	=	Cooling: C for customer air (not applicable to QM5 IEC Models) F for variable speed forward air fan R for variable speed, reverse air
	b	=	Input connector: Blank or S for screw F for faston I for IEC connector (QM5 only)
	c	=	Input fuse: D for dual AC fuses E for single AC fuse in the Live line F for dual AC/DC fuses (QM5 only) G for single AC/DC fuse in the +ve input line (QM5 only)
	d	=	Leakage option: L for 300 µA R for 150 µA T for 60 µA
	e	=	Primary option: blank for none fitted E for global enable T for global inhibit P for PMBus Q for PMBus with individual module enable (KQM700HJx model only, where x can be any letter for non-safety related differences)
	f	=	Standby supply: Blank for none fitted 5 for 5V/2A (Primary option Q or P only) 5H for 5V/2A (Primary option E or T only) 5L for 5V/0.25A (Primary option E or T only) 12 for 12V/1A (Primary option Q or P only) 12H for 12V/1A (Primary option E or T only) 13.5H for 13.5V/0.6A (KQM5001V-x model only)

	g	=	Blank if Primary option P or Q not fitted H for Input Power Present C for Control Pin Active High D for Control Pin Active Low F for PMBus and Control Pin Active High G for PMBus and Control Pin Active Low J for Individual output control, followed by two hexadecimal numbers specifying which modules are on/off (for Q type PMBus option only)

May be followed by:

Single Output modules

vMcd

Where	v	=	output voltage
	M	=	module name (SB or SC)
	c	=	S for screw terminal output 'F' for faston
	d	=	'N' for no signals, omit for standard signals

Optionally followed by '-Dxxx' where xxx is the number of mV of droop

Dual output modules

v1/v2DHcd

Where	v1	=	CH1 output voltage
	v2	=	CH2 output voltage
	DH	=	module name (DH)
	c	=	'S' for screw terminal output, 'F' for faston
	d	=	'N' for no signals, omit for standard signals

v1/v2DMcd

Where	v1	=	CH1 output voltage
	v2	=	CH2 output voltage
	DM	=	module name (DM)
	c	=	'S' for screw terminal output, 'F' for faston
	d	=	'N' for no signals, omit for standard signals

Blanking plates

B/S

Where	B/S	=	Blanking plate

Parallel combinations

vZxcd

Where	v	=	output voltage
	Z	=	Paralleled output module comprising SB or SC modules

	x	=	Number of slots. See table below.
	c	=	'S' for screw terminal output, 'F' for faston
	d	=	'N' for no signals, omit for standard signals

Optionally followed by '-Dxxx' where xxx is the number of mV of droop

Series connected modules

vYxcd

Where	v	=	output voltage
	Y	=	Series output module comprising SB, SC or DH modules
	x	=	Number of slots. See tables below
	c	=	'S' for screw terminal output, 'F' for faston
	d	=	'N' for no signals, omit for standard signals

Optionally followed by '-Dxxx' where xxx is the number of mV of droop

Series connected Paralleled modules

vHxcd

Where	v	=	output voltage
	H	=	Series connected parallel SB and/or SC modules
	x	=	Number of slots. See tables below
	c	=	'S' for screw terminal output, 'F' for faston
	d	=	'N' for no signals, omit for standard signals

Optionally followed by '-Dxxx' where xxx is the number of mV of droop

Combined DM modules - seriated Channel 1 only

vMxcd

Where	v	=	output voltage
	M	=	Series CH1 output comprising DM modules
	x	=	Number of slots. See tables below
	c	=	'S' for screw terminal output, 'F' for faston
	d	=	'N' for no signals, omit for standard signals

Optionally followed by '-Dxxx' where xxx is the number of mV of droop

Unit options

klm

Where	klm	=	Blank for standard output settings, may be three numbers from 0 to 9 (Proceeded by -) which denotes various output voltage/current settings within the specified ranges of each output for a particular unit. (May define non-safety related parameters/features,e.g reduced primary current limit, reduced OVP)

QS[Number of available slots][Hold Up Option]-[Power]-[Voltage][Output Terminal][Standby/Signals][Unit Options]-[non safety related]

Number of available slots	=	5 or 7
Hold Up Option	=	Blank for none fitted, H for Extended Hold Up
Power (max)	=	550, 600, 1080 or 1200 from QS Output Parameters table below
Voltage	=	Output Voltage from the Vout range in the QS Output Parameters table below
Output Terminal	=	Blank for Screw terminal, F for Faston terminal
Standby/Signals	=	Blank or -E5H, -E5L, -T5H, -T5L, -E12H, -T12H, -P5H or -P12H
Where:		E = Enable, T = Inhibit and P = PMBus 5H is 5V/2A, 5L is 5V/0.25A and 12H is 12V/1A Followed by: (P option only) H for Input Power Present C for Control Pin Active High D for Control Pin Active Low F for PMBus and Control Pin Active High G for PMBus and Control Pin Active Low
Unit Options	=	Blank for defaults or all of -[cooling][input connector][input fuse][leakage option]
Where [cooling]	=	F for Variable speed, forward air fan (default), R for Variable speed, reverse air fan, C for Customer air
[Input Connector]	=	S for screw (default), F for Faston, I for IEC
[Input Fuse]	=	D for dual AC fuses (default), E for single AC fuse in the live line F for dual AC/DC fuses, G for single AC/DC fuse in the +ve line (QM5 only)
[Leakage Option]	=	L for 300 µA (default), R for 150 µA, T for 60 µA
[Non-safety related]	=	optional - followed by any number of characters indicating non-safety

QS Output Parameters

Model	Note	Power (max)	Vout (range)	Current (max)	Hazardous Energy	Modules used
QS5	6	550	5-5.5V	110A	Yes	1 x ZF Module
-	-	600	12-13.2V	50A	Yes	1 x SC Module
-	-	600	24-26.4V	25A	Yes	1 x SC Module
-	-	600	30-33V	20A	Yes	1 x YC Module
-	-	600	48-52.8V	12.5A	Yes	1 x SC Module
-	-	600	56-61.6V	10.7A	Yes	1 x YC Module
-	-	600	95-105.6V	6.25A	Yes	1 x YC Module
-	-	1080	12-12.8V	90A	Yes	1 x ZF Module

-	-	1200	24-26.4V	50A	Yes	1 x YF Module
-	-	1200	48-52.8V	25A	Yes	1 x YF Module
QS7	-	1080	12-12.8V	90A	Yes	1 x ZF Module
-	-	1200	24-26.4V	50A	Yes	1 x YF Module
-	-	1200	48-52.8V	25A	Yes	1 x YF Module
-	-	1200	96-105.6V	12.5A	Yes	1 x YF Module

Parallel and Series combinations Table

Series connection number of slots.

Qty of modules	SB		SC		DH	
	Name	Slots	Name	Slots	Name	Slots
1	SB	1	SC	2	YB	1
2	YC	2	YF	4	YP	2
3	YD	3	YM	6	YQ	3
4	YG	4	YN	8	YR	4
5	YH	5	-	-	YS	5
6	YJ	6	-	-	YT	6
7	YK	7	-	-	YV	7
8	YL	8	-	-	YW	8

Limitations of use:
1. Output voltage is the combined seriated modules voltage.
2. Module limitations apply to seriated modules.

Series connection of parallel connected modules

Module	Qty	Slots	Name
ZC	2	4	HC
ZD	2	6	HD
ZF	2	8	HF
ZT	2	6	HT
ZV	2	8	HV
ZC	3	6	HW
ZC	4	8	HX

Limitations of use:
1. Output voltage is the combined seriated modules voltage.
2. Module limitations apply to seriated/parallel modules.

Parallel connection number of slots

Number of modules in parallel

slots	SB	SC	Name
2	2	0	ZC
3	1	1	ZD
4	0	2	ZF
6	0	3	ZH

3	3	0	ZT
4	4	0	ZV

See ratings in Module output ratings table below

DH outputs in series but split to create extra outputs.

Qty of modules	Split after output (first output is 1)	Name
2	1	CB
2	3	CD
3	1	FB
3	3	FD
3	5	FG
4	1	GB
4	3	GD
4	5	GG
4	7	GJ
5	1	JB
5	3	JD
5	5	JG
5	7	JJ
5	9	JL
6	1	KB
6	3	KD
6	5	KG
6	7	KJ
6	9	KL
6	11	KN
7	1	LB
7	3	LD
7	5	LG
7	7	LJ
7	9	LL
7	11	LN
7	13	LQ
8	1	MB
8	3	MD
8	5	MG
8	7	MJ
8	9	ML
8	11	MN
8	13	MQ
8	15	MS

Combined DM modules - seriated Channel 1 only.

Number of modules	outputs	Nomenclature
2	3	v1/v2/v3MC

3	4	v1/v2/v3/v4MD
4	5	v1/v2/v3/v4/v5MF
5	6	v1/v2/v3/v4/v5/v6MG
6	7	v1/v2/v3/v4/v5/v6/v7MH
7	8	v1/v2/v3/v4/v5/v6/v7/v8MJ
8	9	v1/v2/v3/v4/v5/v6/v7/v8/v9MK

Input Parameters

QM5

Input voltage nom.	100 - 240Vac, 144 - 272Vdc (200 - 240Vac, 239 - 272Vdc)*
Input voltage range	90 - 264Vac, 130 - 300Vdc (180 - 264Vac, 215 - 300Vdc)*
Input frequency range	47 - 63Hz
Maximum input current	11Arms or 7Adc (9Arms or 7Adc for 1200W model)

* Input for 1200W models.
Maximum ambient 70°C, (65°C for option I) total output power and module output power de-rated by 2.5% per °C above 50°C

QM7

input voltage nom.	100 - 240Vac (166.7 - 240Vac)*
Input voltage range	90 - 264Vac (150 - 264Vac)*
Input frequency range	47 - 63Hz
Maximum input current	19Arms (14Arms for 1500W model)

* Input for 1500W models.
Maximum ambient 70°C, total output power and module output power de-rated by 2.5% per °C above 50°C

QM8

input voltage nom.	100 - 240Vac (166.7 - 240Vac)*
Input voltage range	90 - 264Vac (150 - 264Vac)*
Input frequency range	47 - 63Hz
Maximum input current	19Arms (14Arms for 1500W model)

* Input for 1500W models.
Maximum ambient 70°C, total output power and module output power de-rated by 2.5% per 2°C above 50°C

QM5, QM7 and QM8 Output parameters

Module output ratings table.

Module	Note	Number of slots	Output Channel	Vout nom	Adjustment range	Output Current	Output Power	Hazardous Energy
DM	5,8	1	CH1	12	11.9 to 16.1	10	120	Yes
DM	2	1	CH1	17	16 to 21.6	7.5	120	Yes
DM	4,5	1	CH1	24	20.8 to 28.2	5	120	Yes
DM	-	1	CH2	3.3	2.8 to 3.8	10	33	No
DM	-	1	CH2	5	4.25 to 5.75	10	50	No
DM	-	1	CH2	8	7 to 9.5	10	95	No
DM	3,8	1	CH2	14	11.9 to 16.1	8.3	100	No
DM	3	1	CH2	24	23.5 to 24.5	4.16	100	No
DH	1	1	CH1	12	10.2 to 13.8	10	120	Yes
DH	1	1	CH1	15	12.75 to 17.25	8	120	Yes
DH	1	1	CH1	24	20.4 to 27.6	5	120	Yes
DH	1	1	CH1	27	23 to 31	4.4	120	Yes

DH	2	1	CH2	12	10.2 to 13.8	10	120	Yes
DH	2	1	CH2	15	12.75 to 17.25	8	120	Yes
DH	2	1	CH2	24	20.4 to 27.6	5	120	Yes
DH	2	1	CH2	27	23 to 31	4.4	120	Yes
SB	-	1	CH1	3.3	3.3 to 3.63	37	122	No
SB	7	1	CH1	3.4	3.2 to 3.6	37	126	No
SB	-	1	CH1	5	5 to 5.5	30	150	No
SB	-	1	CH1	8.1	8 to 8.8	25	200	Yes
SB	-	1	CH1	12	12 to 13.2	25	300	Yes
SB	-	1	CH1	15	15 to 16.5	20	300	Yes
SB	-	1	CH1	18	18 to 19.8	16.7	300	Yes
SB	-	1	CH1	20	20 to 22	15	300	Yes
SB	-	1	CH1	24	24 to 26.4	12.5	300	Yes
SB	-	1	CH1	28	28 to 30.8	10.7	300	Yes
SB	-	1	CH1	48	48 to 52.8	6.25	300	Yes
SC	6	2	CH1	5	5 to 5.5	60	300	Yes
SC	-	2	CH1	12	12 to 13.2	50	600	Yes
SC	-	2	CH1	17	17 to 18.7	35.29	600	Yes
SC	-	2	CH1	24	24 to 26.4	25	600	Yes
SC	-	2	CH1	30	30 to 33	20	600	Yes
SC	-	2	CH1	48	48 to 52.8	12.5	600	Yes
ZC	-	2	CH1	15	15 to 16	36	540	Yes
ZC	-	2	CH1	18	18 to 19.2	30	540	Yes
ZC	-	2	CH1	28	28 to 30	19.3	540	Yes
ZD	-	3	CH1	5	5 to 5.3	80	400	Yes
ZD	-	3	CH1	12	12 to 12.8	65	780	Yes
ZD	-	3	CH1	24	24 to 25.6	30	720	Yes
ZD	-	3	CH1	48	48 to 51.2	15	720	Yes
ZF	6	4	CH1	5	5 to 5.3	110	550	Yes
ZF	-	4	CH1	12	12 to 12.8	90	1080	Yes
ZF	9	4	CH1	17	17 to 18.19	63.5	1080	Yes
ZH	10	6	CH1	24	24 to 25.6	62.4	1200	Yes
ZT	-	3	CH1	15	15 to 16	50	750	Yes
ZV	-	4	CH1	15	15 to 16	66.4	996	Yes

Note 1: CH1 limited to 80W when CH2 at 120W. Maximum of 200W across module.
Note 2: CH2 Limited to 80W when CH1 at 120W. Maximum of 200W across module.
Note 3: CH2 has a maximum of 100W. Maximum of 200W across the module.
Note 4: CH1 (24V) has a reduced adjustment range when CH2 is 24V. Reduced adjustment range is 21.6V to 28.8V.
Note 5: CH1 limited to 100W when CH2 at 100W. Maximum of 200W across module. Achievable if the ambient temperature is reduced to 40°C.
Note 6: Please see Further De-ratings Table below
Note 7: Not used for 60601-1
Note 8: 12/12DM Module limited to 180W in slot 2 or 45°C ambient. (QM8 only)
Note 9: 67A for 10 seconds
Note 10: 1500W at high-line

Further De-ratings Table

Converter Module	40°C Ambient	45°C Ambient	50°C Ambient	Global Option fitted	Comments (applicable to 50°C ambient only)

QM5*	SC	60A	-	50A	N/A	-
-	YF	60A	-	50A	N/A	-
-	ZF	110A	-	90A	N/A	-
QM8	SC	-	60A	50A	Yes	Fitted in slots 1+2
-	SC	-	60A	60A	No	Fitted in slots 1+2
-	SC	-	60A	55A	No	Fitted in slots 3+4
-	SC	-	60A	60A	Yes	Fitted in slots 3+4
-	SC	-	60A	55A	N/A	Fitted in slots 7+8
-	YF,YM & YN	-	60A	55A	No	Limited by SC Module in slots 1+2
-	YF,YM & YN	-	60A	50A	Yes	Limited by SC Module in slots 1+2
-	HF	-	110A	90A	Yes	-
-	ZF	-	110A	90A	Yes	Fitted in slots 1 to 4
-	ZF	-	110A	100A	Yes	Fitted in slots 3 to 8

QS5*

Cooling options QM5/QS5

Cooling option	Input voltage (Vac nom)	Output power (W)	Ambient °C
F (Forward air, variable speed)	100-240*	700	50
	200-240**	1200	50
C (Customer air***)	100-240*	700	50
***not applicable to IEC version	200-240**	1200	50
R (Reverse air, variable speed fan)	100-240*	700	35
	200-240**	1200	30

*144 - 272Vdc nom.
**239 - 272Vdc nom.

Cooling options QM7/QS7

Cooling option	Input voltage (Vnom)	Output power (W)	Ambient (°C)
F (Forward air, variable speed)	100-240	1200	50
	166.7-240	1500	50
C (Customer air)	100-240	1200	50
	166.7-240	1500	50
R (Reverse air, variable speed fan)	100-240	1200	40

Cooling options QM8

Cooling option	Input voltage (Vnom)	Output power (W)	Ambient (°C)
F (Forward air, variable speed)	100-240	1200	50
	166.7-240	1500	50
C (Customer air)	100-240	1200	50
	166.7-240	1500	50
R (Reverse air, variable speed fan)	100-240	1000	45

Non-standard models (as standard models except where stated below):

KQM700HJx (where x may be any letter for non-safety differences)

The KQM700HJx is 7 slot non-standard QM7 model:
NS-TLA/QM7FSDLQ5J3E B/S 24SBS 24SBS 24SBS 24SBS 12SBS B/S
This model has an option Q PMBus fitted in slot 1

Technical Considerations

- Classification of installation and use : Switch mode power supply for building into end medical equipment
- Supply connection : Connection to mains via host equipment or via appliance inlet for QM5 option I only
- Accessories and detachable parts included in the evaluation : None
- Options included : None
- The product was investigated to the following additional standards:: EN 60601-1: 1990 + A1:1993 + A2:1995, (except EMC limitations, EN 60601-1-2, Biocompatibility, EN 10993-1, Programmable Electronic Systems, IEC 60601-1-4), CAN/CSA-C22.2 No. 601.1-M90 (R2005) (includes National Differences for Canada)
- The product was not investigated to the following standards or clauses:: Clause 52.1, Programmable Electronic Systems (IEC 601-1-4), Clause 48, Biocompatibility (ISO 10993-1), Clause 36, Electromagnetic Compatibility (IEC 601-1-2)
- The product is Classified only to the following hazards:: Shock, Fire, Mechanical
- The degree of protection against harmful ingress of water is:: Ordinary
- The following accessories were investigated for use with the product:: No accessories
- The mode of operation is:: Continuous
- Software is relied upon for meeting safety requirements related to mechanical, fire and shock:: No
- The product is suitable for use in the presence of a flammable anesthetics mixture with air or oxygen or with nitrous oxide:: No
- Multilayer 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:

- The following production line tests are conducted for this product: Electric Strength, Earthing Continuity
- The following secondary output circuits are at hazardous energy levels: SC (All models), YB, YC and YF (All models), ZD and ZF (All models). SB (8.1, 12, 15, 18, 20, 24, 28 and 48V models, DH (All models) and DM (CH1 12, 17 and 24V modules)
- The following secondary output circuits are non-hazardous energy levels: 5V, 12V Standby output, SB (3.3 and 5V models), DM (CH2: 3.3, 5, 8, 12 and 24V modules)
- The following output terminals were referenced to earth during performance testing. All outputs and their return lines individually referenced to earth to obtain maximum working voltage
- The power supply terminals and/or connectors are: not investigated for field wiring
- The maximum investigated branch circuit rating is: 20A
- The investigated pollution degree is: II
- Proper bonding to the end product main protective earthing termination is: required
- The following magnetic devices (eg. transformers or inductor) are provided with an OBJY3 insulation system with the indicated rating greater than Class A (105°C): PFC: TX1 Class F, MODULES: TX1 Class B except 12SC which is Class F, GLOBAL OPTION: TX1 Class F. See table 1.5.1 for details of insulation systems used.

- The following end-product enclosures are required: Mechanical, Fire, Electrical (excluding QM5 option I, non-customer air version, front end).
- All models require component temperatures to be monitored as detailed in the additional information
- The product was tested for use at the maximum ambient temperature (TMA) 70° C (output power and module output power de-rated 2.5% per °C above 50°C) in normal conditions permitted by the manufacturer, see additional information for details
- An investigation of the protective bonding terminals has been conducted
- EMC compliance has not been verified nor has it been taken into consideration. An accredited EMC Test Report will be required in conjunction with the Certification of the end product.
- The product was evaluated for use at the maximum altitude of operation: 5000 m

Additional Information

For best thermal performance and to ensure safety requirements are met at full load conditions, products are configured with modules starting from slot 1 in the following order:
1. Highest power SC modules
2. Lower power SC modules
3. Any other modules

Consult TDK-Lambda UK ltd if a non-standard configuration is required.

Cooling for unit
Component temperatures for customer air cooled models, must be monitored in the end use application described in the "Cooling for Unit Temperature Table" below:

The following method must be used for determining the safe operation of PSUs.

The components listed in the following table must not exceed the temperatures given. To determine the component temperatures the heating tests must be conducted in accordance with the requirements of the standard in question. Consideration should also be given to the requirements of other safety 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 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 stabilised.

Cooling for unit temperature table (see layout drawings in handbook):

Cooling for unit temperature table:

Circuit Ref:	Description	Max. Temperature (??C)
PFC	-	-
QM7	-	-
L2	Common Mode Choke	115 (140)
L3	Boost choke	125
C2	Electrolytic Capacitors	71 (105)
C10	Electrolytic Capacitors	64 (105)
C7	Electrolytic Capacitors	64 (105)
C8	Electrolytic Capacitors	73 (105)

C11	Electrolytic Capacitors	77 (105)
C3, C14,	X Capacitor	100
C12	Y Capacitors	105
TX1	Fly back Transformer	120
D1	Diode bridge	114 (130)
D3	PFC diode	130
U4	Opto-coupler	100
U3	Voltage regulator	120 (130)
Q2	Boost FETS	130
QM5	-	-
L2	Common Mode Choke	115 (140)
L4	Boost choke	125
C2	Electrolytic Capacitors	71 (105)
C10	Electrolytic Capacitors	71 (105)
C7	Electrolytic Capacitors	64 (105)
C8	Electrolytic Capacitors	60 (105)
C11	Electrolytic Capacitors	77 (105)
C3, C14,	X Capacitor	100
C12	Y Capacitors	105
TX1	Fly back Transformer	120
D1	Diode bridge	118 (130)
D3	PFC diode	130
U4	Opto-coupler	100
U3	Voltage regulator	120 (130)
Q2	Boost FETS	130
QM8	-	-
L2	Common Mode Choke	115 (140)
L3	Boost choke	125
C2	Electrolytic Capacitors	71 (105)
C10	Electrolytic Capacitors	64 (105)
C7C	Electrolytic Capacitors	74 (105)
C8	Electrolytic Capacitors	73 (105)
C11	Electrolytic Capacitors	77 (105)
C3, C14,	X Capacitor	100
C12	Y Capacitors	105
TX1	Fly back Transformer	120
D1	Diode bridge	114 (130)
D3	PFC diode	130
U4	Opto-coupler	100
U3	Voltage regulator	120 (130)
Q2	Boost FETS	130
Low Power Options -		-
U6	Opto-couplers	100
High Power Options	-	-
C6	Electrolytic Capacitors	73 (105)
XU3	Opto-couplers	100
TX1	Transformer Class F	130
Q PMbus -	-	-
XU3	Opto-couplers	100
DM/DH Modules	-	-
C206	Y Capacitors	105
C207	Electrolytic Capacitors	84 (105)
U8	Opto-couplers	100

Q1	Primary FET	120 (130)
D201	Output diode	124 (130)
TX1	Transformer Class B	110
SC module Modules	-	-
C206	Electrolytic Capacitors	83 (105)
C209	Y Capacitors	105
U1	Opto-couplers	100
TX1	Transformer Class B	110
TX1 (12V)	Transformer Class F	130
Q1	Primary FET	127 (130)
Q203	Secondary FET	130
SB module Modules	-	-
C206	Electrolytic Capacitors	83 (105)
C209	Y Capacitors	105
U1	Opto-couplers	100
TX1	Transformer Class B	110
Q1	Primary FET	127 (130)
Q203	Secondary FET	130

Higher temperature limits (in brackets) may be used but product life may be reduced.

Additional Standards

The product fulfills the requirements of: EN60601-1:1990 + A1:1993 + A2:1995, UL60601-1, 1st Edition 2006-04-26 (includes National Differences for USA), CAN/CSA-C22.2 No. 601-1-M90 (R2005) (includes National Differences for Canada)