



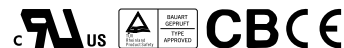
65W Quad Output Switching Power Supply

RQ-65 series



■ Features :

- Universal AC input / Full range
- Protections: Short circuit / Overload / Over voltage
- Cooling by free air convection
- LED indicator for power on
- 100% full load burn-in test
- All using 105°C long life electrolytic capacitors
- Withstand 300VAC surge input for 5 second
- High operating temperature up to 70°C
- Withstand 5G vibration test
- High efficiency, long life and high reliability
- 3 years warranty

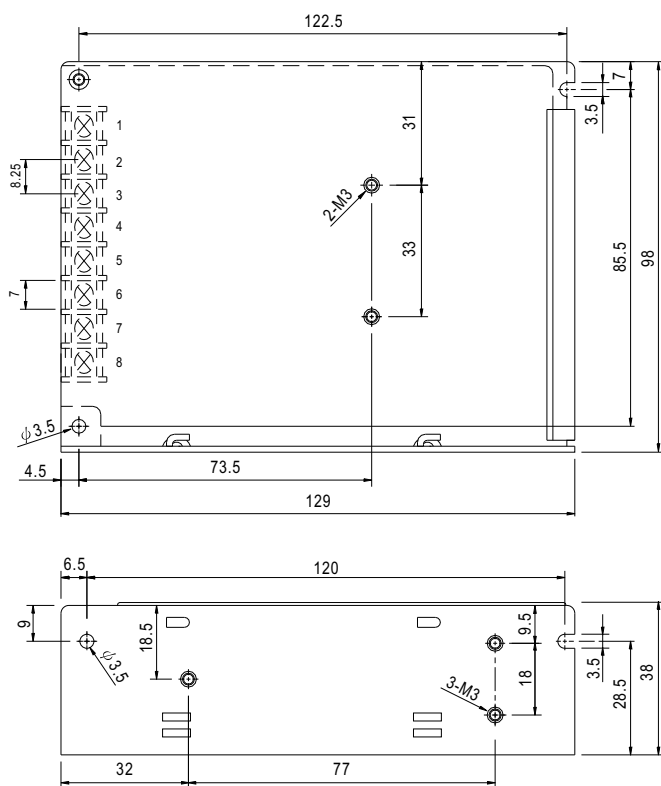


SPECIFICATION

MODEL		RQ-65B				RQ-65C				RQ-65D			
OUTPUT	OUTPUT NUMBER	CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4	CH1	CH2	CH3	CH4
	DC VOLTAGE	5V	12V	-5V	-12V	5V	15V	-5V	-15V	5V	12V	24V	-12V
	RATED CURRENT	6A	2A	0.5A	0.5A	5A	2A	0.5A	0.5A	4A	1.5A	1A	0.5A
	CURRENT RANGE Note.6	0.5 ~ 8A	0.2 ~ 3A	0 ~ 1A	0 ~ 1A	0.5 ~ 8A	0.2 ~ 3A	0 ~ 1A	0 ~ 1A	0.5 ~ 8A	0.2 ~ 3A	0.1 ~ 1.5A	0 ~ 1A
	RATED POWER Note.6	62.5W				65W				68W			
	RIPPLE & NOISE (max.) Note.2	80mVp-p	120mVp-p	80mVp-p	80mVp-p	80mVp-p	120mVp-p	80mVp-p	80mVp-p	80mVp-p	120mVp-p	180mVp-p	80mVp-p
	VOLTAGE ADJ. RANGE	CH1: 4.75 ~ 5.5V				CH1: 4.75 ~ 5.5V				CH1: 4.75 ~ 5.5V			
	VOLTAGE TOLERANCE Note.3	±2.0%	+7,-5%	±5.0%	±5.0%	±2.0%	+10,-4%	±5.0%	±5.0%	±2.0%	±6.0%	±8.0%	±5.0%
	LINE REGULATION Note.4	±0.5%	±1.5%	±0.5%	±0.5%	±0.5%	±1.5%	±0.5%	±0.5%	±0.5%	±1.5%	±2.0%	±0.5%
	LOAD REGULATION Note.5	±0.5%	±3.0%	±1.0%	±1.0%	±0.5%	±4.0%	±1.0%	±1.0%	±0.5%	±3.0%	±5.0%	±1.0%
SETUP, RISE TIME		500ms, 20ms/230VAC 1200ms, 30ms/115VAC at full load											
HOLD UP TIME (Typ.)		60ms/230VAC 14ms/115VAC at full load											
INPUT	VOLTAGE RANGE	88 ~ 264VAC 125 ~ 373VDC (Withstand 300VAC surge for 5sec. Without damage)											
	FREQUENCY RANGE	47 ~ 63Hz											
	EFFICIENCY (Typ.)	76%					76%				78%		
	AC CURRENT (Typ.)	2A/115VAC 1.2A/230VAC											
	INRUSH CURRENT (Typ.)	COLD START 40A/230VAC											
	LEAKAGE CURRENT	<2mA / 240VAC											
PROTECTION	OVERLOAD	110 ~ 150% rated output power Protection type : Hiccup mode, recovers automatically after fault condition is removed											
	OVER VOLTAGE	CH1: 5.75 ~ 6.75V Protection type : Hiccup mode, recovers automatically after fault condition is removed											
ENVIRONMENT	WORKING TEMP.	-25 ~ +70℃ (Refer to output load derating curve)											
	WORKING HUMIDITY	20 ~ 90% RH non-condensing											
	STORAGE TEMP., HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH											
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃) on +5V output											
	VIBRATION	10 ~ 500Hz, 5G 10min./1cycle, period for 60min. each along X, Y, Z axes											
SAFETY & EMC (Note 7)	SAFETY STANDARDS	UL60950-1, TUV EN60950-1 approved											
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC											
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms / 500VDC / 25℃ / 70% RH											
	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22) Class B											
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3											
	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN61000-6-2 (EN50082-2), heavy industry level, criteria A											
OTHERS	MTBF	245.5Khrs min. MIL-HDBK-217F (25℃)											
	DIMENSION	129*98*38mm (L*W*H)											
	PACKING	0.44Kg; 30pcs/13.2Kg/0.72CUFT											
NOTE	1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature. 2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor. 3. Tolerance : includes set up tolerance, line regulation and load regulation. 4. Line regulation is measured from low line to high line at rated load. 5. Load regulation is measured from 20% to 100% rated load, and other output at 60% rated load. 6. Each output can work within current range. But total output power can't exceed rated output power. 7. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives.												

■ Mechanical Specification

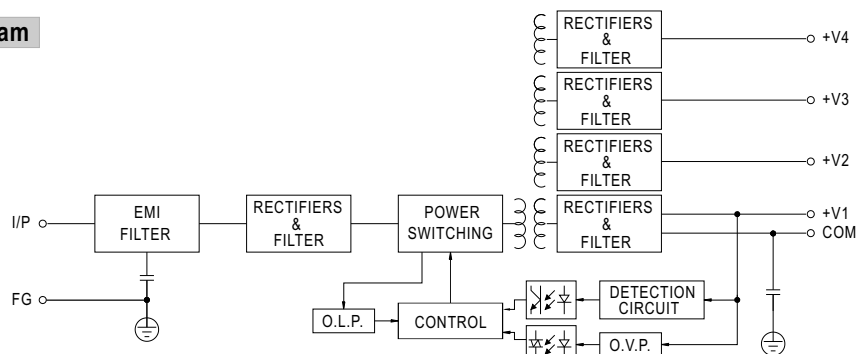
Case No. 903 Unit:mm



Terminal Pin No. Assignment

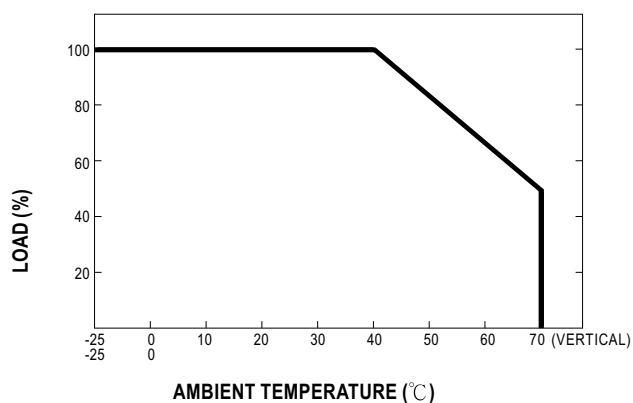
Pin No.	Assignment	Pin No.	Assignment
1	AC/L	5	DC OUTPUT V3
2	AC/N	6	DC OUTPUT +V2
3	FG $\perp$	7	DC OUTPUT COM
4	DC OUTPUT -V4	8	DC OUTPUT +V1

■ Block Diagram

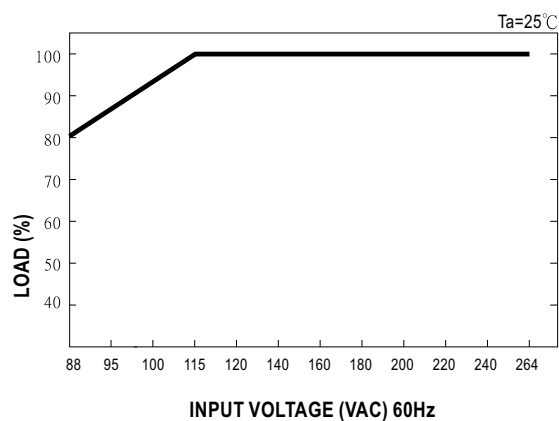


fosc : 60KHz

Derating Curve



■ Output Derating VS Input Voltage



MODEL : RQ-65C

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	RIPPLE & NOISE	V1: 80 mVp-p (Max) V2: 120 mVp-p (Max) V3: 80 mVp-p (Max) V4: 80 mVp-p (Max)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	V1: 20 mVp-p (Max) V2: 8 mVp-p (Max) V3:9 mVp-p (Max) V4:10 mVp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 4.75 V~ 5.5 V	I/P: 230 VAC I/P: 115 VAC O/P:MIN LOAD Ta:25°C	4.46V~ 5.83 V/ 230VAC 4.46V~ 5.83 V/ 115 VAC	P
3	OUTPUT VOLTAGE TOLERANCE	V1: -2 %~ 2 % (Max) V2: -4 %~ 8 % (Max) V3: -5 %~ 5 % (Max) V4: -5 %~ 5 % (Max)	I/P: 115 VAC / 264 VAC O/P:FULL/ MIN 40 % LOAD Ta:25°C	V1: 0.2%~-0.2 % V2: 2.2%~-2.2 % V3: 0.2%~-0.2 % V4: 0.1 %~-0.1 %	P
4	LINE REGULATION	V1: -0.5 %~ 0.5 % (Max) V2: -1.5 %~ 1.5 % (Max) V3: -0.5 %~ 0.5 % (Max) V4: -0.5 %~ 0.5 % (Max)	I/P: 115 VAC ~ 264 VAC O/P:FULL LOAD Ta:25°C	V1: 0 %~ 0 % V2: 0.05 %~-0.9 % V3: 0%~ 0% V4: 0%~ 0%	P
5	LOAD REGULATION	V1: -0.5 %~ 0.5 % (Max) V2: -3 %~ 3 % (Max) V3: -1 %~ 1 % (Max) V4: -1 %~ 1 % (Max)	I/P: 230 VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: 0%~-0.2 % V2: 0.3 %~-0.8 % V3: 0.2%~-0.2% V4: 0.1 %~-0.1 %	P
6	CROSS REGULATION	V1: -0.5 %~ 0.5 % (Max) V2: -3 %~ 3 % (Max) V3: -1 %~ 1 % (Max) V4: -1 %~ 1 % (Max)	I/P: 230 VAC O/P: Testing O/P 60%LOAD Other O/P 40%LOAD Change Ta:25°C	V1: 0 %~ 0 % V2: 1.5 %~-1.5 % V3: 0.2%~ 0 % V4: 0.1 %~-0.1 %	P
7	SET UP TIME	230 VAC/ 500 ms (Max) 115 VAC/ 1200 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230 VAC/ 195 ms 115 VAC/ 734 ms	P
8	RISE TIME	230 VAC/ 20 ms (Max) 115 VAC/ 20 ms (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230 VAC/ 8.3 ms 115 VAC/ 8 ms	P
9	HOLD UP TIME	230 VAC/ 50 ms (TYP) 115 VAC/ 10 ms (TYP)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	230 VAC/ 78 ms 115 VAC/ 15 ms	P
10	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	TEST: < 5 %	P
11	DYNAMIC LOAD	V1: 1000 mVp-p	I/P: 230 VAC O/P:FULL /Min LOAD 90%DUTY/1KHZ Ta:25°C	205 mVp-p	P

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	88VAC~ 264 VAC	I/P:TESTING O/P:FULL LOAD Ta:25°C	57 V~ 264 V	P
			I/P: LOW-LINE-3V= 85 V HIGH-LINE+15%= 300 V O/P:FULL/MIN LOAD ON: 30 Sec . OFF: 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	TEST: OK	
2	INPUT FREQUENCY RANGE	47 HZ ~ 63 HZ NO DAMAGE OSC	I/P: 88 VAC ~264 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK	P
3	EFFICIENCY	76 % (TYP)	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	76.9 %	P
4	INPUT CURRENT	230 V/ 1.2 A (TYP) 115 V/ 2 A (TYP)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25°C	I = 0.8 A/ 230 VAC I = 1.3 A/ 115 VAC	P
5	INRUSH CURRENT	230 V/ 40 A (TYP) COLD START	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	I = 30.6 A/ 230 VAC	P
6	LEAKAGE CURRENT	< 2 mA/ VAC	I/P: 254 VAC O/P:Min LOAD Ta:25°C	L-FG: 0.54 mA N-FG: 0.54 mA	P

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	110 %~ 150 %	I/P: 230 VAC I/P: 115 VAC O/P: TESTING Ta:25℃	130%/ 230 VAC 131%/ 115 VAC Hiccup Mode	P
2	OVER VOLTAGE PROTECTION	CH1: 5.75 V~ 6.75 V	I/P: 230 VAC I/P: 115 VAC O/P: MIN LOAD Ta:25℃	6.38V/ 230 VAC 6.38V/ 115 VAC Hiccup Model	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264 VAC O/P: Full LOAD Ta:25℃	NO DAMAGE Hiccup Mode	P

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																																
1	TEMPERATURE RISE TEST	MODEL : RQ-65C 1. ROOM AMBIENT BURN-IN : HRS I/P: 230VAC O/P: FULL LOAD Ta= 27.2 °C 2. HIGH AMBIENT BURN-IN : HRS I/P: 230VAC O/P: FULL LOAD Ta=46.3 °C <table><thead><tr><th>NO</th><th>Position</th><th>P/N</th><th>ROOM AMBIENT Ta= 27.2 °C</th><th>HIGH AMBIENT Ta= 46.3 °C</th></tr></thead><tbody><tr><td>1</td><td>BD1</td><td>D4SB80 4A/800V SHI</td><td>71.5°C</td><td>85.7°C</td></tr><tr><td>2</td><td>LF1</td><td>TF-479</td><td>67.0°C</td><td>81.3°C</td></tr><tr><td>3</td><td>C5</td><td>150U/400V 105°C HU4</td><td>64.9°C</td><td>79.7°C</td></tr><tr><td>4</td><td>Q1</td><td>K2545 6A/600V TOS</td><td>87.6°C</td><td>103.1°C</td></tr><tr><td>5</td><td>U1</td><td>1203</td><td>86.1°C</td><td>99.6°C</td></tr><tr><td>6</td><td>C10</td><td>100U/35V 105°C RUB YXF</td><td>78.6°C</td><td>92.3°C</td></tr><tr><td>7</td><td>D1</td><td>HER302 3A/200V REC</td><td>94.6°C</td><td>108.3°C</td></tr><tr><td>8</td><td>T1 COIL</td><td>TF-1037 LS</td><td>93.2°C</td><td>105.3°C</td></tr><tr><td>9</td><td>T1 CORE</td><td>TF-1037 LS</td><td>87.0°C</td><td>98.9°C</td></tr><tr><td>10</td><td>D55</td><td>MBR1545CT 15A/45V ON</td><td>99.1°C</td><td>112.6°C</td></tr><tr><td>11</td><td>D50</td><td>BYQ28X-200 10A/200V PH</td><td>98.6°C</td><td>112.2°C</td></tr><tr><td>12</td><td>D58</td><td>HER302 3A/100V REC</td><td>98.9°C</td><td>112.5°C</td></tr><tr><td>13</td><td>D56</td><td>HER302 3A/100V REC</td><td>95.7°C</td><td>109.7°C</td></tr><tr><td>14</td><td>C56</td><td>2200U/16V 105°C NCC KY</td><td>79.3°C</td><td>93.2°C</td></tr><tr><td>15</td><td>C53</td><td>560U/35V 105°C NCC KY</td><td>77.2°C</td><td>91.0°C</td></tr></tbody></table>			NO	Position	P/N	ROOM AMBIENT Ta= 27.2 °C	HIGH AMBIENT Ta= 46.3 °C	1	BD1	D4SB80 4A/800V SHI	71.5°C	85.7°C	2	LF1	TF-479	67.0°C	81.3°C	3	C5	150U/400V 105°C HU4	64.9°C	79.7°C	4	Q1	K2545 6A/600V TOS	87.6°C	103.1°C	5	U1	1203	86.1°C	99.6°C	6	C10	100U/35V 105°C RUB YXF	78.6°C	92.3°C	7	D1	HER302 3A/200V REC	94.6°C	108.3°C	8	T1 COIL	TF-1037 LS	93.2°C	105.3°C	9	T1 CORE	TF-1037 LS	87.0°C	98.9°C	10	D55	MBR1545CT 15A/45V ON	99.1°C	112.6°C	11	D50	BYQ28X-200 10A/200V PH	98.6°C	112.2°C	12	D58	HER302 3A/100V REC	98.9°C	112.5°C	13	D56	HER302 3A/100V REC	95.7°C	109.7°C	14	C56	2200U/16V 105°C NCC KY	79.3°C	93.2°C	15	C53	560U/35V 105°C NCC KY	77.2°C	91.0°C	P
NO	Position	P/N	ROOM AMBIENT Ta= 27.2 °C	HIGH AMBIENT Ta= 46.3 °C																																																																																	
1	BD1	D4SB80 4A/800V SHI	71.5°C	85.7°C																																																																																	
2	LF1	TF-479	67.0°C	81.3°C																																																																																	
3	C5	150U/400V 105°C HU4	64.9°C	79.7°C																																																																																	
4	Q1	K2545 6A/600V TOS	87.6°C	103.1°C																																																																																	
5	U1	1203	86.1°C	99.6°C																																																																																	
6	C10	100U/35V 105°C RUB YXF	78.6°C	92.3°C																																																																																	
7	D1	HER302 3A/200V REC	94.6°C	108.3°C																																																																																	
8	T1 COIL	TF-1037 LS	93.2°C	105.3°C																																																																																	
9	T1 CORE	TF-1037 LS	87.0°C	98.9°C																																																																																	
10	D55	MBR1545CT 15A/45V ON	99.1°C	112.6°C																																																																																	
11	D50	BYQ28X-200 10A/200V PH	98.6°C	112.2°C																																																																																	
12	D58	HER302 3A/100V REC	98.9°C	112.5°C																																																																																	
13	D56	HER302 3A/100V REC	95.7°C	109.7°C																																																																																	
14	C56	2200U/16V 105°C NCC KY	79.3°C	93.2°C																																																																																	
15	C53	560U/35V 105°C NCC KY	77.2°C	91.0°C																																																																																	
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P: 230 VAC O/P: 130% LOAD Ta:25°C	TEST : OK	P																																																																																
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P: 230VAC O/P: 100% LOAD Ta= -20°C	TEST : OK	P																																																																																
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40 °C NO DAMAGE	I/P: 272VAC O/P:FULL LOAD Ta= 40°C HUMIDITY= 95 %R.H	TEST : OK	P																																																																																
5	TEMPERATURE COEFFICIENT	± 0.03%(0~50°C)	I/P: 230 VAC O/P:FULL LOAD	± 0.01 %(0~50°C)	P																																																																																
6	VIBRATION TEST	1 Set Operating at I/P: 230 VAC NO LOAD (1) Waveform: Sine Wave (2) Frequency:10~500Hz (3) Sweep Time:10min/sweep cycle (4) Acceleration:5G (5) Test Time:1 hour in each axis (X.Y.Z) (6) Ta:25°C		TEST : OK	P																																																																																

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P: 3 KVAC/min I/P-FG: 1.5 KVAC/min O/P-FG: 0.5 KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 1.8 KVAC/min O/P-FG: 0.6 KVAC/min Ta:25℃	I/P-O/P: 3.65 mA I/P-FG: 3.44 mA O/P-FG: 2.05 mA NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25℃	I/P-O/P: 1.2G Ω I/P-FG: 1.7G Ω O/P-FG: 1.5 G Ω NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta:25℃	15 mΩ	P
4	APPROVAL	TUV: Certificate NO : R50045775 UL: File NO : E183223			P

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS A	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab	P
3	RADIATION	EN55022 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25℃	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 INDUSTRY AIR:8KV / Contact:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	P
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N :2KV L,N-PE:4KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

M.T.B.F & LIFE CYCLE CALCULATION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	CAPACITOR LIFE CYCLE	SUPPOSE C56 IS THE MOST CRITICAL COMPONENT I/P: 230 VAC O/P:FULL LOAD Ta= 25 ℃ LIFE TIME=82486 HRS I/P: 230 VAC O/P:FULL LOAD Ta= 40 ℃ LIFE TIME=41839 HRS			P
2	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE: 245.5K HRS			P

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated 2SK2545: 600 V 6 A	I/P:High-Line +3V = 267 V O/P: (1)Full Load Turn on (2) Full Load (3)Output Short Ta:25°C	(1) 474 V (2) 578 V (3) 586 V	P
2	Diode Peak Voltage	D 55 Rated MBR1545: 45 V 15 A D 50 Rated BYQ28X-200: 200 V 10 A D 58 Rated HER303: 200 V 3 A D 56 Rated HER303: 200 V 3 A	I/P:High-Line +3V = 267 V O/P: (1)Full Load Turn on (2) Full Load (3)Output Short (1)Full Load Turn on (2) Full Load (3)Output Short (1)Full Load Turn on (2) Full Load (3)Output Short (1)Full Load Turn on (2) Full Load (3)Output Short Ta:25°C	(1) 32.2 V (2) 37.4 V (3) 32.2 V (1) 67.6 V (2) 77.2 V (3) 72.0 V (1) 104 V (2) 120 V (3) 104 V (1) 72.8 V (2) 48.4 V (3) 47.6 V	P
3	Clamp Diode Peak Voltage	D 1 Rated HER306: 600 V 3 A	I/P:High-Line +3V = 267 V O/P: (1)Full Load (2) Dynamic Load 90%Duty/1KHz Ta:25°C	(1) 568 V (2) 568 V	P
4	Input Capacitor Voltage	C 5 Rated HSTACH: 150 u / 400 V	I/P:High-Line +3V = 267 V O/P: (1)Full Load (2) Min load (3)Full Load /Min load Change Ta:25°C	(1) 388 V (2) 370 V (3) 370 V	P
5	Control IC Voltage Test	U 1 Rated 1203: 16 V	I/P:High-Line +3V = 267 V O/P: (1)Full Load (2) Min load (3)Full Load /Min load Change Ta:25°C	(1) 12.8 V (2) 12.8 V (3) 10.5 V	P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2003/10/7	RD SAMPLE	PASS	VINCENT TSENG	MAX LIN
2004/6/17	PRODUCT SAMPLE A403C25	PASS	VINCENT TSENG	MAX LIN

2003/12/12 A50-F023