



Test Report: IRM-45-15

45W AC-DC PCB-Mount Green Power Module

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	RIPPLE & NOISE(Max)	V1: 180mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 138 mVp-p	P
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2.5%~ 2.5%	I/P: 85VAC /305VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: 0.1%~ 0.1 %	P
3	LINE REGULATION (Max)	V1: -0.5%~ 0.5%	I/P: 100VAC~305VAC O/P:FULL LOAD Ta:25℃	V1: 0.1%~ 0.1 %	P
4	LOAD REGULATION(Max)	V1: -0.5%~ 0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0.1%~ 0.1 %	P
5	SET UP TIME(Max)	230VAC/1000ms 115VAC/2000ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 472.993ms 115VAC/ 426.422ms	P
6	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 16.563ms 115VAC/ 16.809ms	P
7	HOLD UP TIME(Typ)	230VAC/50ms 115VAC/12ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 76.797ms 115VAC/ 15.758ms	P
8	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	< ±5%	P
9	DYNAMIC LOAD	V1: 1500mVp-p	I/P: 230VAC O/P(1)FULL /Min LOAD 90%DUTY / 1KHZ (2) (1)FULL /Min LOAD 90%DUTY / 3KHZ (3)FULL /Min LOAD 90%DUTY / 5KHZ (4)FULL /Min LOAD 50%DUTY / 120HZ Ta:25℃	276mVp-p 230mVp-p 220mVp-p 250mVp-p	P
10	TRANSIENT RECOVERY TIME	V1: 1500mVp-p <500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	180mVp-p 0 us	P

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	85VAC~305VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	71.775V~305V	P
			I/P: (1)LOW-LINE=3V=97 V HIGH-LINE=305 V O/P:FULL/MIN LOAD ON: 30 Sec OFF: 30 Sec 10MIN (2)230Vac ON: 0.5 Sec OFF: 0.5 Sec 20MIN (3)230Vac ON:3Sec OFF:3Sec 12HOURS (POWER ON/OFF NO DAMAGE)	TEST:OK	
2	INPUT FREQUENCY RANGE	47HZ ~440 HZ NO DAMAGE	I/P:85VAC~305VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK	P
3	EFFICIENCY(TYP)	88.5%	I/P:230 VAC O/P:FULL LOAD Ta:25℃	89.54%	P
4	INPUT CURRENT (Typ)	230V/ 0.9A 115V/ 1.5A 277V/ 0.75A	I/P : 230 VAC/115VAC/277VAC O/P : FULL LOAD Ta : 25℃	I =0.4A/ 230VAC I =0.77A/ 115VAC I =0.335A/ 115VAC	P
5	INRUSH CURRENT(Typ)	230V/60A 115V/30A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	I =40.359A/ 230VAC I =27.5A/ 115VAC	P
6	LEAKAGE CURRENT	< 0.25 mA / 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25℃	L-FG : 0.011 mA N-FG : 0.011 mA	P
7	NO LOAD CONSUMPTION	< 0.15 W	I/P : 115VAC I/P : 230VAC O/P : NO LOAD Ta : 25℃	< 0.0255W < 0.0426W	P

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	115%~ 160%	I/P: 230VAC I/P: 115VAC O/P: TESTING Ta:25°C	144%/ 230VAC 144%/115VAC Hiccup Mode r	P
2	OVER VOLTAGE PROTECTION	CH:15.75V~20.25V	I/P: 230VAC I/P: 115VAC O/P: MIN LOAD Ta:25°C	18.1V shut off o/p voltage, clamping by zener diode	P
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 305VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE Hiccup Mode	P

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated 10A/600V	I/P: High-Line =305V AC ON/OFF VDS: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. I/P: Low-Line -3V = 97V O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0%→400% Load. Ta:25°C	(1) 524V (2) 504V (3) 532V (4) 528V (5) 524V (6) 532V (7) 544V (1) 282V (2) 234V (3) 300V (4) 292V (5) 288V (6) 302V (7) 323V	P
2	Diode Peak Voltage	D100 Rated 30A/100V	I/P: High-Line =305V AC ON/OFF O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz	D100: (1) 81.6V (2) 80V (3) 81.2V (4) 81V (5) 81.2V	P

			(4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD Ta:25℃	(6)81.6V (7)81.2V (8)74.4V	
3	Input Capacitor Voltage	C5 Rated: : 120 μ / 400 V 105℃ / VZ Series	I/P: High-Line =305V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change Ta:25℃	(1)336V (2)338V (3)336V	P
4	Control IC Voltage Test	PWM IC U1 Rated 10V~27V	I/P: High-Line =305V AC ON/OFF O/P:(1)FULL LOAD (2) Output Short (3)O.L.P Ta:25℃	(1) 13V (2) 17V (3) 17V	P
5	Clamp Diode Peak Voltage	D 5 Rated : RD 2A/800V GP20K	I/P : High-Line =305V AC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25℃	(1) 452 V (2) 452 V	P

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P: 4KVAC/min	I/P-O/P:4.4 KVAC/min Ta:25℃	I/P-O/P:1.408mA NO DAMAGE	P
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100M Ω	I/P-O/P: 500 VDC Ta:25℃	I/P-O/P: 9999M Ω NO DAMAGE	P

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:100%,75%,50%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	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
4	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A	P

5	SURGE	IEC61000-4-5 INDUSTRY L-N : 1KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
6	Test by certified Lab & Test Report Prepare				

■ RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																				
1	TEMPERATURE RISE TEST	MODEL : IRM-45-5 1. ROOM AMBIENT BURN-IN : 1HRS I/P : 230VAC O/P : FULL LOAD Ta= 21.7 °C 2. HIGH AMBIENT BURN-IN : 1HRS I/P : 230VAC O/P : FULL LOAD Ta=53°C <table><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=21.7°C</th><th>HIGH AMBIENT Ta=53°C</th></tr></thead><tbody><tr><td>1</td><td>LF1</td><td>59.7°C</td><td>89.6°C</td></tr><tr><td>2</td><td>LF2</td><td>59.6°C</td><td>89.9°C</td></tr><tr><td>3</td><td>BD1</td><td>63.1°C</td><td>93.8°C</td></tr><tr><td>4</td><td>C5</td><td>63.5°C</td><td>93.8°C</td></tr><tr><td>5</td><td>D5</td><td>68.9°C</td><td>99.7°C</td></tr><tr><td>6</td><td>C40</td><td>66.6°C</td><td>97.0°C</td></tr><tr><td>7</td><td>Q1</td><td>69.4°C</td><td>100.5°C</td></tr><tr><td>8</td><td>T1</td><td>69.1°C</td><td>99.3°C</td></tr><tr><td>9</td><td>C105</td><td>61.9°C</td><td>92.4°C</td></tr><tr><td>10</td><td>D100</td><td>72.3°C</td><td>102.5°C</td></tr><tr><td>11</td><td>D101</td><td>72.0°C</td><td>102.4°C</td></tr><tr><td>12</td><td>L100</td><td>63.7°C</td><td>94.3°C</td></tr><tr><td>13</td><td>U1</td><td>62.1°C</td><td>92.5°C</td></tr><tr><td>14</td><td>D40</td><td>69.6°C</td><td>99.8°C</td></tr><tr><td>15</td><td>D43</td><td>60.6°C</td><td>91.0°C</td></tr><tr><td>16</td><td>CASE</td><td>55.9°C</td><td>87.9°C</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta=21.7°C	HIGH AMBIENT Ta=53°C	1	LF1	59.7°C	89.6°C	2	LF2	59.6°C	89.9°C	3	BD1	63.1°C	93.8°C	4	C5	63.5°C	93.8°C	5	D5	68.9°C	99.7°C	6	C40	66.6°C	97.0°C	7	Q1	69.4°C	100.5°C	8	T1	69.1°C	99.3°C	9	C105	61.9°C	92.4°C	10	D100	72.3°C	102.5°C	11	D101	72.0°C	102.4°C	12	L100	63.7°C	94.3°C	13	U1	62.1°C	92.5°C	14	D40	69.6°C	99.8°C	15	D43	60.6°C	91.0°C	16	CASE	55.9°C	87.9°C	P
NO	Position	ROOM AMBIENT Ta=21.7°C	HIGH AMBIENT Ta=53°C																																																																						
1	LF1	59.7°C	89.6°C																																																																						
2	LF2	59.6°C	89.9°C																																																																						
3	BD1	63.1°C	93.8°C																																																																						
4	C5	63.5°C	93.8°C																																																																						
5	D5	68.9°C	99.7°C																																																																						
6	C40	66.6°C	97.0°C																																																																						
7	Q1	69.4°C	100.5°C																																																																						
8	T1	69.1°C	99.3°C																																																																						
9	C105	61.9°C	92.4°C																																																																						
10	D100	72.3°C	102.5°C																																																																						
11	D101	72.0°C	102.4°C																																																																						
12	L100	63.7°C	94.3°C																																																																						
13	U1	62.1°C	92.5°C																																																																						
14	D40	69.6°C	99.8°C																																																																						
15	D43	60.6°C	91.0°C																																																																						
16	CASE	55.9°C	87.9°C																																																																						
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 144 % LOAD Ta : 25°C	TEST : OK	P																																																																				
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 100 % LOAD Ta= -30 °C	TEST : OK	P																																																																				
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50°C NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta=50°C HUMIDITY= 95 %R.H	TEST : OK	P																																																																				
5	TEMPERATURE COEFFICIENT	±0.03%/°C (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	±0.001%/°C (0~50°C)	P																																																																				



6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -45°C ~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 5 CYCLE 5. Input/Output condition : STATIC	OK	P
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -30°C ~ +70°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : 230VAC/Full Load AC ON/OFF TEST turn on 58sec ; turn off 2sec	OK	P
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 12min/sweep cycle (4) Acceleration : 2G (Blank) /5G (ST) (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK	P
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta=25°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta=50°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta=50°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta=50°C LIFE TIME	(1) 97047HRS (2) 18142HRS (3) 30688HRS (4) 63591HRS	P
10	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE : 1212 KHRS		P
11	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 30,000 hours @ TA 50°C		P

TEST RESULT	TESTER	APPROVAL
PASS	FRANK	Wangdz

2007/3/20 A50-S014