



Test Report: IRM-60-24

60W 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: 150mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 103mVp-p	P
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2.5%~ 2.5%	I/P: 85VAC /305VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.074%~ 0.206%	P
3	LINE REGULATION (Max)	V1: -0.5%~ 0.5%	I/P: 100VAC~ 305VAC O/P:FULL LOAD Ta:25℃	V1: -0.049%~ 0.074%	P
4	LOAD REGULATION(Max)	V1: -0.5%~ 0.5%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.074%~ 0.206%	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/ 410.618ms 115VAC/ 486.318ms	P
6	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 8.141ms 115VAC/ 12.223ms	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/ 82.216ms 115VAC/ 16.914ms	P
8	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	< ±5%	P
9	DYNAMIC LOAD	V1: 2400mVp-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℃	318mVp-p 223mVp-p 178mVp-p 336mVp-p	P
10	TRANSIENT RECOVERY TIME	V1: 2400mVp-p <500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	146 mVp-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°C	71.762V~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:85 VAC ~305 VAC O/P:FULL~MIN LOAD Ta:25°C	TEST: OK	P
3	EFFICIENCY(TYP)	90%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	91.63 %	P
4	INPUT CURRENT (Typ)	230V/ 1A 115V/ 1.8A 277V/ 0.9A	I/P : 230 VAC/115 VAC/277VAC O/P : FULL LOAD Ta : 25°C	I=0.5026A/ 230VAC I=0.9694A/ 115VAC I=0.4182A/ 277VAC	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°C	I=46.265A/ 230VAC I=27.3A/ 115VAC	P
6	LEAKAGE CURRENT	< 0.25 mA / 277 VAC	I/P : 277 VAC O/P : Min LOAD Ta : 25°C	L-FG : 0.011 mA N-FG : 0.012 mA	P
7	NO LOAD CONSUMPTION	< 0.15 W	I/P : 115VAC I/P : 230VAC O/P : NO LOAD Ta : 25°C	< 0.0505 W < 0.0375 W	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℃	142.48%/ 230VAC 143.17%/115VAC Hiccup Mode	P
2	OVER VOLTAGE PROTECTION	CH:25.2V~32.4V	I/P: 230VAC I/P: 115VAC O/P: MIN LOAD Ta:25℃	30.4V Other : 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℃	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 13A/650V	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℃	(1) 590V (2) 564V (3) 610V (4) 600V (5) 596V (6) 608V (7) 618V (1) 360V (2) 273V (3) 378V (4) 370V (5) 360V (6) 374V (7) 372V	P
2	Diode Peak Voltage	D100 Rated 20A/200V	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) 130V (2) 164V (3) 129V (4) 130V (5) 132V	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)128V (7)152V (8)120V	
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)362V (2)364V (3)364V	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) 17.5V (2) 17.6V (3) 17.5V	P
5	Clamp Diode Peak Voltage	D 5 Rated : RD 2A/800V	I/P : High-Line =305V AC ON/OFF O/P : (1) Dynamic Load 90%Duty/1KHz (2)Full load continue Ta : 25℃	(1) 520 V (2) 518 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:1.99mA 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°C	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	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°C	CRITERIA A	P
4	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	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-60-24 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta=18.2℃ 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta=51.4℃ <table><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=18.2℃</th><th>HIGH AMBIENT Ta=51.4℃</th></tr></thead><tbody><tr><td>1</td><td>LF1</td><td>51.2℃</td><td>77.0℃</td></tr><tr><td>2</td><td>LF2</td><td>53.3℃</td><td>80.1℃</td></tr><tr><td>3</td><td>BD1</td><td>55.5℃</td><td>82.0℃</td></tr><tr><td>4</td><td>Q1</td><td>58.7℃</td><td>84.7℃</td></tr><tr><td>5</td><td>C5</td><td>52.3℃</td><td>79.5℃</td></tr><tr><td>6</td><td>C40</td><td>54.8℃</td><td>81.9℃</td></tr><tr><td>7</td><td>D100</td><td>57.0℃</td><td>84.3℃</td></tr><tr><td>8</td><td>C105</td><td>53.2℃</td><td>80.9℃</td></tr><tr><td>9</td><td>T1</td><td>56.2℃</td><td>84.2℃</td></tr><tr><td>10</td><td>D5</td><td>58.5℃</td><td>86.2℃</td></tr><tr><td>11</td><td>R42</td><td>57.5℃</td><td>83.8℃</td></tr><tr><td>12</td><td>U1</td><td>51.7℃</td><td>79.0℃</td></tr><tr><td>13</td><td>D40</td><td>54.3℃</td><td>81.5℃</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta=18.2℃	HIGH AMBIENT Ta=51.4℃	1	LF1	51.2℃	77.0℃	2	LF2	53.3℃	80.1℃	3	BD1	55.5℃	82.0℃	4	Q1	58.7℃	84.7℃	5	C5	52.3℃	79.5℃	6	C40	54.8℃	81.9℃	7	D100	57.0℃	84.3℃	8	C105	53.2℃	80.9℃	9	T1	56.2℃	84.2℃	10	D5	58.5℃	86.2℃	11	R42	57.5℃	83.8℃	12	U1	51.7℃	79.0℃	13	D40	54.3℃	81.5℃		P
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 136% LOAD Ta : 25℃	TEST : OK	P																																																									
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 305VAC/100VAC O/P : 100 % LOAD Ta=-30℃	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	± 0.004%/°C (0~50°C)	P
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40°C ~ +85°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 ~ +50°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) 274536HRS (2) 69618HRS (3) 93726HRS (4) 153381HRS	P
10	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE : 1226 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

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