



Test Report: IRM-60-12

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: 120mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25℃	V1: 68mVp-p	p
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -2.5%~ 2.5%	I/P: 85VAC /305VAC O/P:FULL/ MIN. LOAD Ta:25℃	V1: -0.12%~ 0.12%	p
3	LINE REGULATION (Max)	V1: -0.5%~ 0.5%	I/P: 100VAC~ 305VAC O/P:FULL LOAD Ta:25℃	V1: 0%~ 0%	p
4	LOAD REGULATION(Max)	V1: -1%~ 1%	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: -0.12%~0.12 %	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/ 425.026ms 115VAC/ 404.439ms	p
6	RISE TIME (Max)	230VAC/30ms 115VAC/30ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25℃	230VAC/ 10.357ms 115VAC/ 10.539ms	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/ 80.205ms 115VAC/ 16.614ms	p
8	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25℃	0%	p
9	DYNAMIC LOAD	V1: 1200mVp-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℃	184mVp-p 198mVp-p 202mVp-p 160mVp-p	p
10	TRANSIENT RECOVERY TIME	V1: 1200mVp-p <500us	I/P: 230VAC O/P:40% LOAD CHANGE 50%DUTY/120HZ 1.25A/us	100mVp-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	71.787 V~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)	87.5%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	89.3%	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=0.585A/ 230VAC I = 0.874A/115VAC I = 0.486A/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 = 48.328 A/ 230VAC I =27.32A/ 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 : 0.011 mA	P
7	NO LOAD CONSUMPTION	< 0.15 W	I/P : 115VAC I/P : 230VAC O/P : NO LOAD Ta : 25°C	< 0.015 W < 0.0383 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°C	150.2%/ 230VAC 145.2%/115VAC Hiccup Mode	P
2	OVER VOLTAGE PROTECTION	CH:12.6V~16.2V	I/P: 230VAC I/P: 115VAC O/P: MIN LOAD Ta:25°C	125%/ 230VAC 125%/115VAC 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°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 11A/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) 588V (2) 592V (3) 590V (4) 580V (5) 588V (6) 588V (7) 596V (1) 348V (2) 380V (3) 352V (4) 384V (5) 380V (6) 376V (7) 360V	P
2	Diode Peak Voltage	D100 Rated 30A/120V	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) 67.6V (2) 72.4V (3) 70.8V (4) 71.6V (5) 70.8V	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)70.4V (7)70.7V (8)71.2V	
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 : 27 V 10 V(MIN.)	I/P: High-Line=305V AC ON/OFF O/P:(1)FULL LOAD (2) Output Short (3)O.L.P Ta:25℃	(1) 18.1V (2) 19.1V (3) 19.2V	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) 267 V (2) 252 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:1.85mA 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:99999 M 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-60-12 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta=32.9℃ 2. HIGH AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta=50.5℃ <table><thead><tr><th>NO</th><th>Position</th><th>ROOM AMBIENT Ta=32.9℃</th><th>HIGH AMBIENT Ta=50.5℃</th></tr></thead><tbody><tr><td>1</td><td>R42</td><td>75.5℃</td><td>94.4℃</td></tr><tr><td>2</td><td>LF1</td><td>69.9℃</td><td>86.7℃</td></tr><tr><td>3</td><td>BD1</td><td>74.4℃</td><td>93.2℃</td></tr><tr><td>4</td><td>C5</td><td>73.6℃</td><td>92.0℃</td></tr><tr><td>5</td><td>D40</td><td>73.2℃</td><td>92.3℃</td></tr><tr><td>6</td><td>U1</td><td>71.1℃</td><td>89.5℃</td></tr><tr><td>7</td><td>D100</td><td>78.0℃</td><td>96.5℃</td></tr><tr><td>8</td><td>LF2</td><td>68.8℃</td><td>86.8℃</td></tr><tr><td>9</td><td>T1</td><td>78.8℃</td><td>98.1℃</td></tr><tr><td>10</td><td>C105</td><td>74.9℃</td><td>90.5℃</td></tr><tr><td>11</td><td>C40</td><td>74.9℃</td><td>93.4℃</td></tr><tr><td>12</td><td>L100</td><td>69.4℃</td><td>88.1℃</td></tr><tr><td>13</td><td>Q1</td><td>78.9℃</td><td>98.7℃</td></tr><tr><td>14</td><td>D5</td><td>78.6℃</td><td>98.5℃</td></tr></tbody></table>			NO	Position	ROOM AMBIENT Ta=32.9℃	HIGH AMBIENT Ta=50.5℃	1	R42	75.5℃	94.4℃	2	LF1	69.9℃	86.7℃	3	BD1	74.4℃	93.2℃	4	C5	73.6℃	92.0℃	5	D40	73.2℃	92.3℃	6	U1	71.1℃	89.5℃	7	D100	78.0℃	96.5℃	8	LF2	68.8℃	86.8℃	9	T1	78.8℃	98.1℃	10	C105	74.9℃	90.5℃	11	C40	74.9℃	93.4℃	12	L100	69.4℃	88.1℃	13	Q1	78.9℃	98.7℃	14	D5	78.6℃	98.5℃	P
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 140% 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℃ NO DAMAGE	I/P : 305 VAC O/P : FULL LOAD Ta=50℃ HUMIDITY= 95 %R.H	TEST : OK	P
5	TEMPERATURE COEFFICIENT	± 0.03 %/℃ (0~50℃)	I/P : 230 VAC O/P : FULL LOAD	± 0.018%/℃ (0~50℃)	P
6	STORAGE TEMPERATURE TEST	1. Thermal shock Temperature : -40℃~ +85℃ 2. Temperature change rate : 25℃ / 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℃~ +50℃ 2. Temperature change rate : 25℃ / 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℃		TEST : OK	P
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta=25℃ LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta=50 ℃ LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta=50 ℃ LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta=50 ℃ LIFE TIME		(1) 139578HRS (2) 28356HRS (3) 55110HRS (4) 95991HRS	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℃			P

TEST RESULT	TESTER	APPROVAL
PASS	FRANK	WANGDZ

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