TEST REPORT: HDR-60-5

60W Ultra Slim Step Shape DIN Rail

■ 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

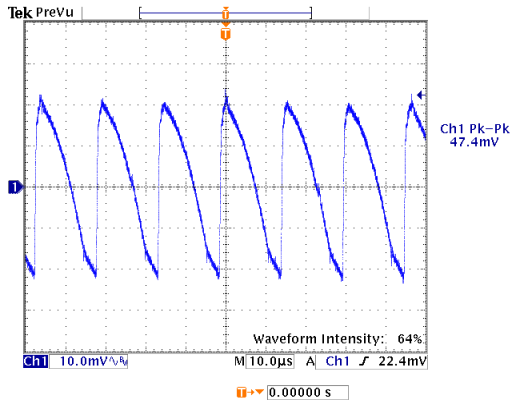
- ENVIRONMENT TEST

■ DESIGN VERIFY TEST

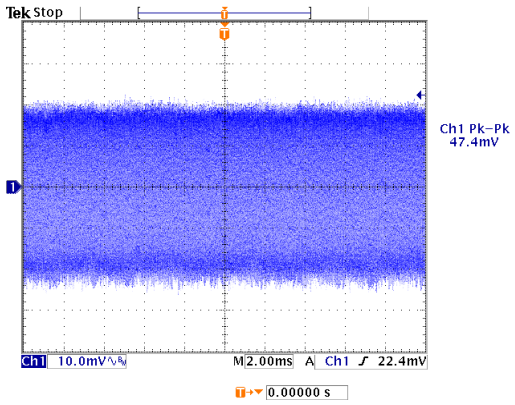
OUTPUT FUNCTION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 5.00V ~ 5.50V	I/P : 230VAC O/P: MIN LOAD TA : 25℃	CH1: 4.02V ~ 6.16V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 2.0% ~ -2.0%	I/P : 100VAC / 277VAC O/P: FULL / MINLOAD TA= 25℃	V1: 0.60% ~ 0.00%
3	LINE REGULATION (MAX.)	V1 : 1.0% ~ -1.0%	I/P : 100VAC / 277VAC O/P: FULL LOAD TA : 25℃	V1: 0.00% ~ -0.20%
4	LOAD REGULATION (MAX.)	V1 : 1.0% ~ -1.0%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25℃	V1: 0.20% ~ -0.40%
5	OVER/UNDERSHOOT TEST	< ±10%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	TEST< 2.0 %
6	RIPPLE & NOISE(Max)	V1 : 80 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25℃	V1 : 47.4 mVp-p

high frequency：



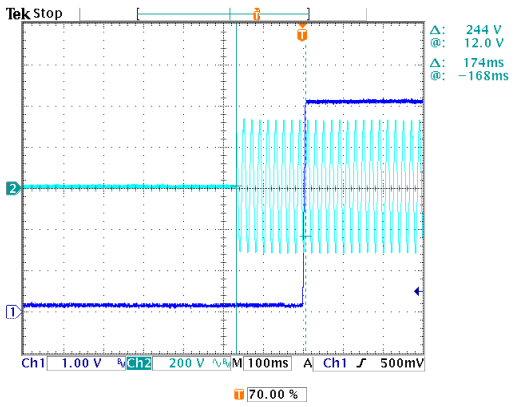
low frequency：



NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
7	SET UP TIME (MAX.)	230VAC : 500ms 115VAC : 500ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 174ms 115VAC : 170ms

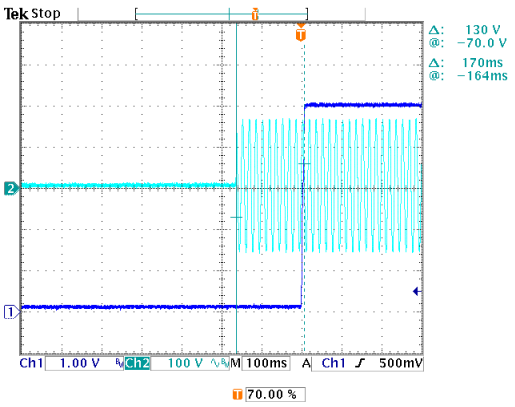
INPUT=230VAC/50HZ @ FULL LOAD

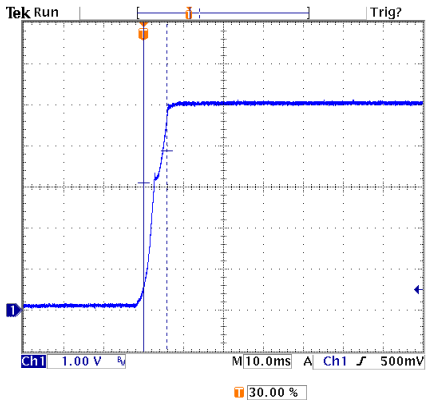
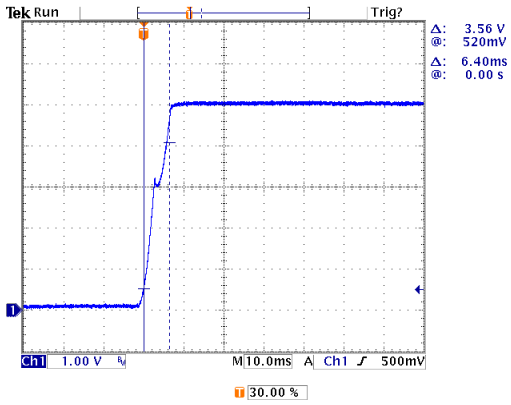
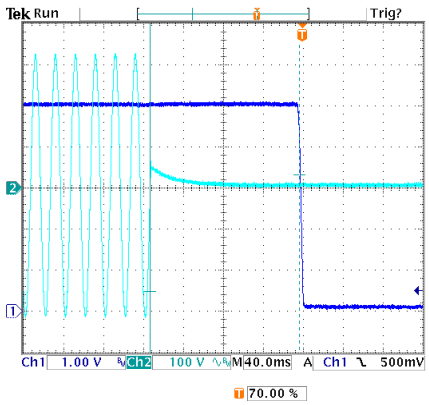
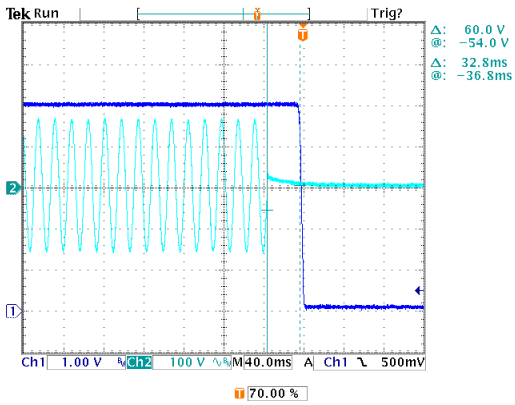
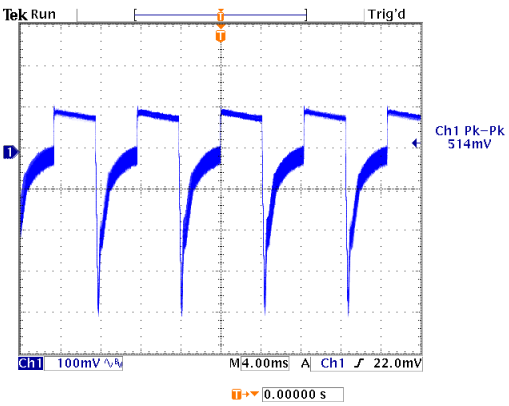
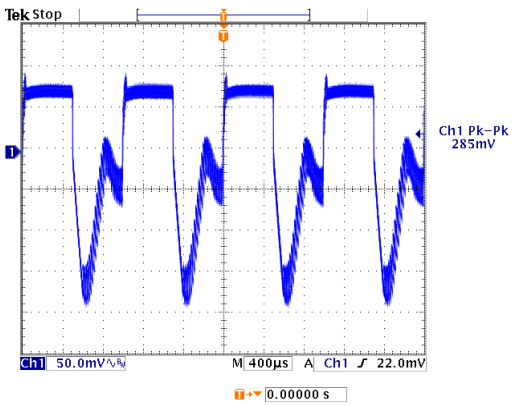
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD

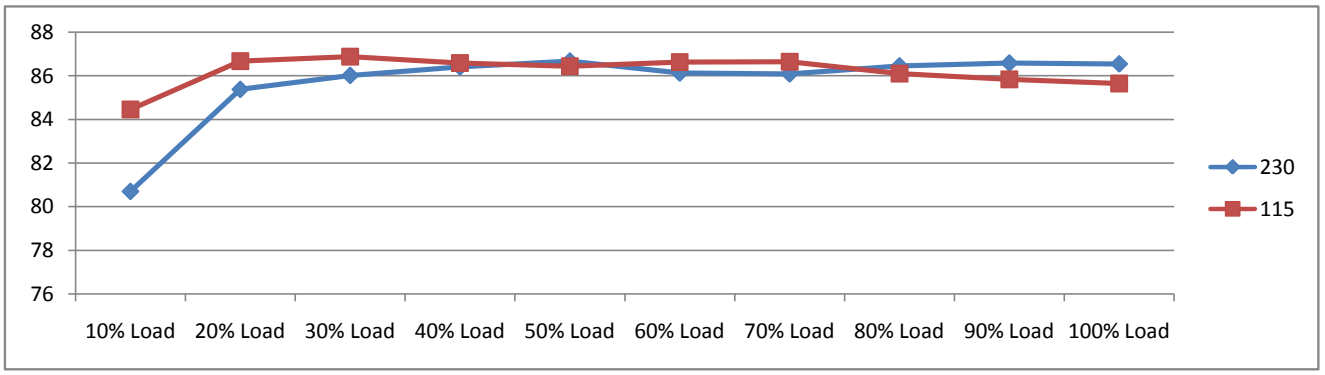
CH1 : Output Voltage CH2 : AC Input Voltage



8	RISE TIME (MAX.)	230VAC : 50ms 115VAC : 50ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 5.8ms 115VAC : 6.4ms	
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage		
				
9	HOLD UP TIME (TYP.)	230VAC : 30ms 115VAC : 12ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	230VAC : 149.6ms 115VAC : 32.8ms	
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		
				
10	DYNAMIC LOAD	V1 : 1000 mVp-p	I/P : 230VAC O/P: (1)Full/Min load 50%duty/120HZ (2)Full/Min load 50%duty/1KHZ TA : 25℃	(1). (2). unit:mVp-p V1: 514mv 285mv	
	FULL /MIN LOAD 50%DUTY / 120HZ		FULL /MIN% LOAD 50%DUTY / 1KHZ		
				

INPUT FUNCTION TEST

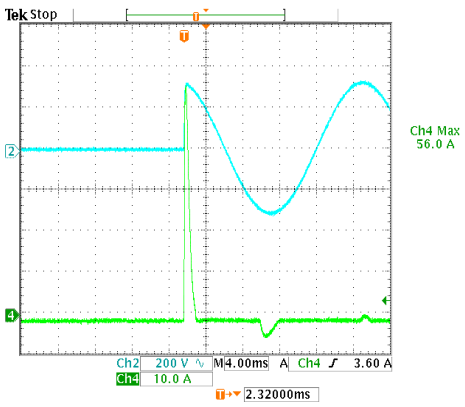
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
			I/P : TESTING O/P : FULL LOAD Ta : 25℃	67.0VAC ~ 277VAC
1	INPUT VOLTAGE RANGE	85VAC ~ 277VAC	I/P : LOW-LINE = 97VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 63HZ NO DAMAGE	I/P : 100VAC ~ 277VAC O/P : FULL~MIN LOAD Ta : 25℃	TEST : OK
3	INPUT CURRENT (TYP.)	0.80A / 230VAC 1.20A / 115VAC	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	I= 0.34A / 230VAC I= 0.53A / 115VAC
4	NO LOAD POWER CONSUMPTION	< 0.30W	I/P : 230VAC O/P: MIN LOAD TA : 25℃	< 0.2W W
5	EFFICIENCY (TYP.)	85.0%	I/P : 230VAC O/P: FULL LOAD TA : 25℃	86.55 %



6	INRUSH CURRENT (TYP.)	60A / 230VAC 30A / 115VAC twidth= 555 us measured at 50% Ipeak COLD START	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25℃	I= 56.0A / 230VAC I= 25.0A / 115VAC

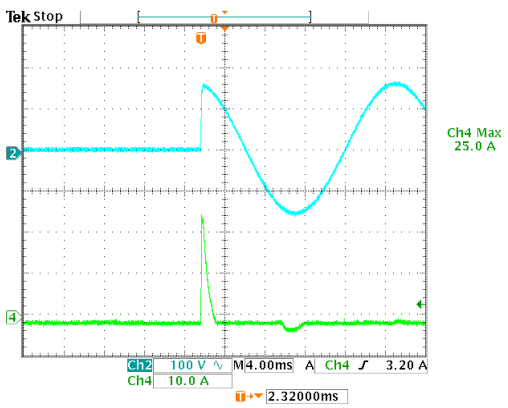
INPUT=230VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current (1V=1A)



INPUT=115VAC/50HZ @ FULL LOAD

CH2 : AC Input Voltage CH4 : Input current (1V=1A)



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105% ~ 160%	I/P: 277VAC I/P: 230VAC I/P: 100VAC O/P: TESTING TA : 25℃	132.14% 277VAC 132.14% 230VAC 132.14% 100VAC Constant Current Limiting
2	OVER VOLTAGE PROTECTION	5.75V ~ 6.75V	I/P: 277VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD TA : 25℃	6.36V 277VAC 6.36V 230VAC 6.36V 85VAC Shut down Re- power ON
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 277VAC I/P: 85VAC O/P: FULL LOAD Ta: 25℃	NO DAMAGE Constant Current Limiting

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	Q1 Rated : 600V 13.0A	I/P : 280VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta : 25℃	VIN: 280VAC VDS: (1). 575.00V (2). 532.00V (3). 542.00V
2	O/P MOSFET	Q100 Rated : 75V 80.0A	I/P : 280VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Fulll load continue Ta : 25℃	Q100 VDS : (1). 57.70V (2). 47.40V (3). 28.40V
3	Input Capacitor	C5 Rated : 120uf 400V	I/P : 280VAC O/P : (1)Full Load Turn on /Off (2)Min load Turn on /Off (3)Full Load /Min load Change Ta : 25℃	(1). 372.00V (2). 392.00V (3). 374.00V
4	Control IC	U101 Rated : 38V (max) 0V (min) U1 Rated : 26V (max) 9V (min)	I/P : 280VAC O/P : (1)Full Load (2)Output Short (3)O.L.P (4)O.V.P (5)Low Line No Load Vo(min) Ta : 25℃	U101 U1 (1). 20.10V 20.50V (2). 7.10V 11.50V (3). 7.80V 11.60V (4). 25.10V 24.30V (5). 12.80V 12.60V
6	Clamp Diode	D42 Rated : 1000V 2.0A	I/P : 280VAC O/P : (1)Dynamic Load Full/Min Load 90%Duty/1KHz (2)Fulll load continue Ta : 25℃	(1). 456.00V (2). 448.00V

■SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P : 4.000KVAC /min	I/P-O/P: 4.400KVAC /min Ta : 25℃	I/P-O/P: 1.01mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ	I/P-O/P: 500VDC Ta : 25℃/70%RH	I/P-O/P: 9999MΩ NO DAMAGE

E.M.C. TEST

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

■RELIABILITY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : HDR-60-5 1. ROOM AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 21.2℃ 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 49.8℃		
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230VAC O/P : 133.85% LOAD Ta : 25℃	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 264VAC / 100VAC O/P : FULL LOAD Ta : -30.0℃	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 45℃ NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 45℃ HUMIDITY= 95.0% RH	TEST : OK
5	TEMPERATURE COEFFICIENT	±0.03% /(0℃~50℃)	I/P : 230VAC O/P : FULL LOAD	±0.0070% /(0℃~50℃)
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		TEST : OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -35℃ ~ +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		TEST : OK

TEMPERATURE RISE TEST

NO.	Position	ROOM AMBIENT 21.2℃	HIGH AMBIENT Ta： 49.8℃
1	LF1	41.9℃	65.6℃
2	BD1	44.5℃	67.9℃
3	C5	46.1℃	69.9℃
4	Q1	56.1℃	74.9℃
5	D42	64.9℃	80.1℃
6	T1	74.2℃	97.1℃
7	C105	67.0℃	90.1℃
8	Q100	69.7℃	92.2℃
9	LF101	68.0℃	90.9℃
10	U1	51.2℃	73.8℃

8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform： Sine Wave (2) Frequency：10~500Hz (4) Acceleration： 2G (5) Test Time： 60 min in each axis (X.Y.Z) (6) Ta：25℃	TEST：OK
9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P： 230VAC O/P：FULL LOAD Ta= 25.0℃ LIFE TIME (2) I/P： 230VAC O/P：FULL LOAD Ta= 45.0℃ LIFE TIME (3) I/P： 230VAC O/P：75% LOAD Ta= 45.0℃ LIFE TIME (4) I/P： 230VAC O/P：50% LOAD Ta= 45.0℃ LIFE TIME	 (1). 158118 HRS (2). 50019 HRS (3). 125618 HRS (4). 158118 HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 927.6K hrs min. MIL-HDBK-217F (25℃)	
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 30000HRS @ TA 45℃	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	FRANK	GESG	WANGDZ