



TEST REPORT: NFM-20-24

20W Single Output Switching Power Supply

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

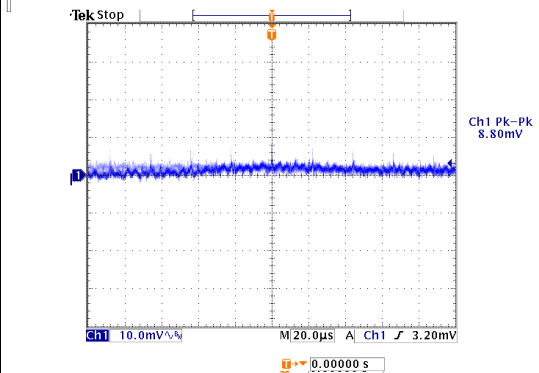
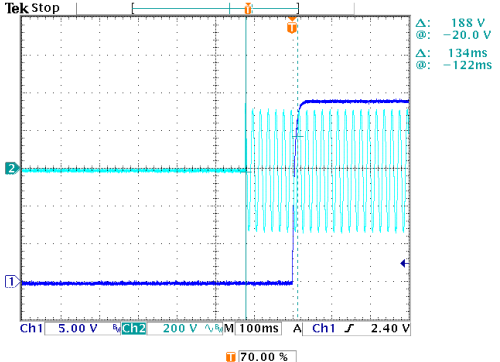
Safety Test

E.M.C. Test

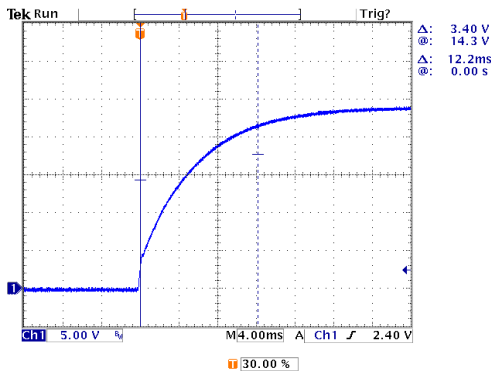
■ RELIABILITY TEST

ENVIRONMENT TEST

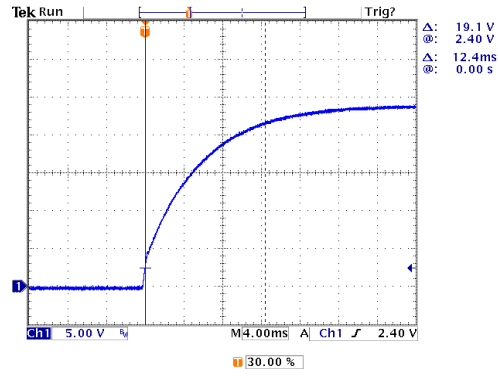
DESIGN VERIFY TEST OUTPUT FUNCTION

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE RANGE	CH1: 21.600V ~ 26.400V	I/P : 230VAC O/P: MIN LOAD TA : 25°C	CH1: 20.41V ~ 28.24V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 1.0% ~ -1.0%	I/P : 115VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.00% ~ 0.00%
3	LINE REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 115VAC / 264VAC O/P: FULL LOAD TA : 25°C	V1: 0.00% ~ 0.00%
4	LOAD REGULATION (MAX.)	V1 : 0.5% ~ -0.5%	I/P : 230VAC O/P: MIN LOAD ~ FULL LOAD TA : 25°C	V1: 0.00% ~ 0.00%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230VAC O/P: FULL LOAD TA : 25°C	TEST< 1.240 %
6	RIPPLE & NOISE(Max)	V1 : 240 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 10.4 mVp-p
		high frequency : 		
7	SET UP TIME (MAX.)	230VAC : 500ms 115VAC : 500ms	I/P : 230VAC I/P : 115VAC	230VAC : 134ms 115VAC : 104ms
		INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage 		
	RISE TIME (MAX.)	230VAC : 20ms 115VAC : 20ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 12.2ms 115VAC : 12.4ms

INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage



INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage



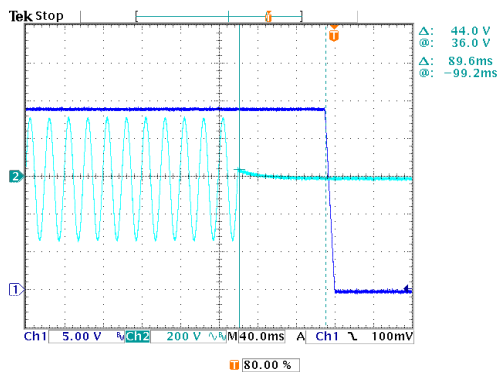
HOLD UP TIME (TYP.)

230VAC : 50ms
115VAC : 15ms

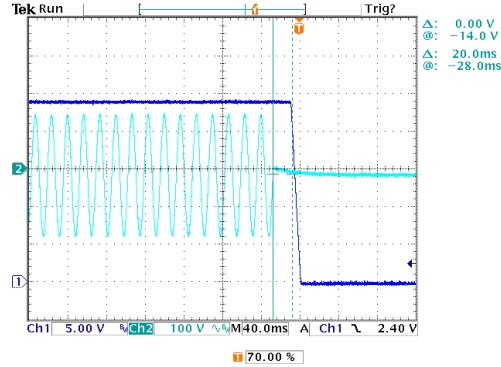
I/P : 230VAC
I/P : 115VAC
O/P: FULL LOAD
TA : 25°C

230VAC : 89.6ms
115VAC : 20.0ms

INPUT=230VAC/50HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage



INPUT=115VAC/60HZ @ FULL LOAD
CH1 : Output Voltage CH2 : AC Input Voltage



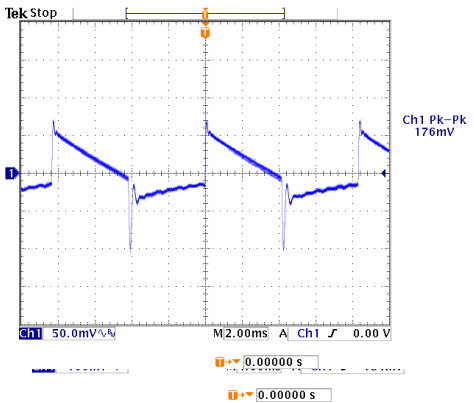
DYNAMIC LOAD

V1 : 2400 mVp-p

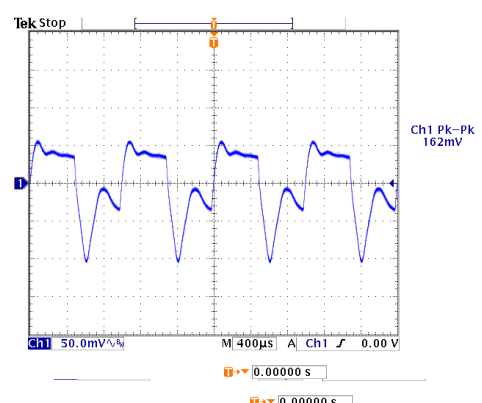
I/P : 230VAC
O/P:
(1) Full/Min load 50% duty/120HZ
(2) Full/Min load 50% duty/1KHZ
TA : 25°C

V1: (1). 176.0mv (2). 162.0mv

FULL /50% LOAD 50%DUTY / 120HZ



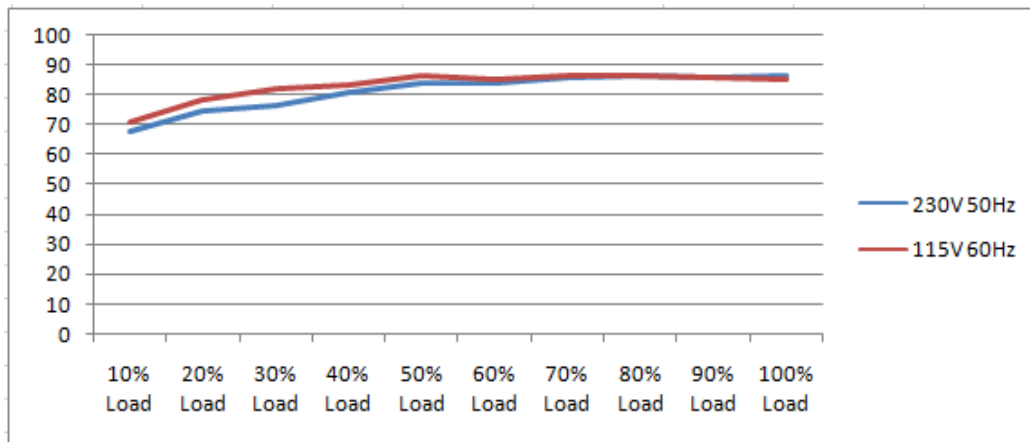
FULL /50% LOAD 50%DUTY / 1KHZ



INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	46.3VAC ~ 264VAC
			I/P : LOW-LINE = 112VAC 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 ~ 440HZ NO DAMAGE	I/P : 115VAC ~ 264VAC O/P : FULL-MIN LOAD Ta : 25°C	OK TEST :
3	INPUT CURRENT (TYP.)	0.4 / 230VAC 0.6 / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 0.217A / 230VAC I= 0.356A / 115VAC
4	LEAKAGE CURRENT	< 0.10mA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	L-FG: 0.0402 mA N-FG: 0.0402 mA
5	NO LOAD POWER CONSUMPTION	< 0.750W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.386 W
	EFFICIENCY (TYP.)	84.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	87.35 %

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INRUSH CURRENT (TYP.)

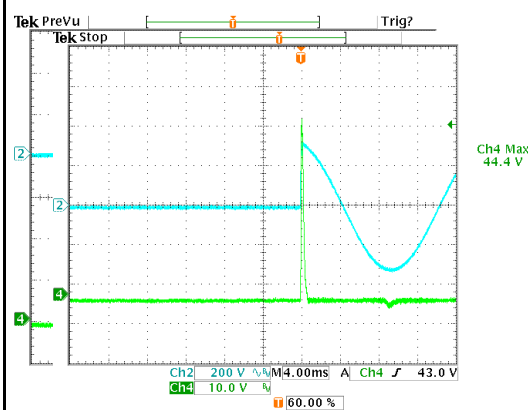
65A / 230VAC
30A / 115VAC
twidth= 0 us measured at 50% Ipeak
COLD START

I/P : 230VAC
I/P : 115VAC
O/P : FULL LOAD
TA : 25°C

I= 44.40A / 230VAC
I= 22.60A / 115VAC

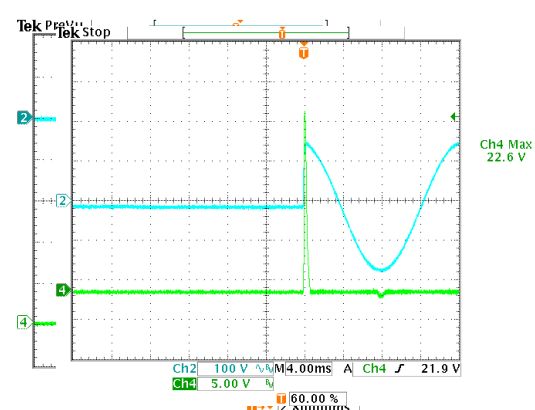
INPUT=230VAC/50HZ @ FULL LOAD

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



INPUT=115VAC/50HZ @ FULL LOAD

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



PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105% ~	I/P: 264VAC I/P: 230VAC I/P: 115VAC O/P: TESTING Ta : 25°C	229% 264VAC 224% 230VAC 193% 115VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	27.60V ~ 32.40V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD Ta : 25°C	29.60V 264VAC 29.60V 230VAC 29.60V 85VAC Shut off o/p voltage, clamping by zener diode
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD Ta: 25°C	NO DAMAGE Hiccup Mode

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Power Transistor	Q1 Rated : 700V 4.0A	I/P : 267VAC VDS : O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	VIN: 267VAC VDS: (1). 544.00V (2). 578.00V (3). 466.00V
2	Input Capacitor	C5 Rated : 47uf 400V	I/P : 267VAC O/P : (1)Full Load Turn on /Off (2)Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1). 359.00V (2). 361.00V (3). 361.00V
3	Control IC	U1 Rated : 32.00V (max) 0.0V (min)	I/P : 267VAC O/P : (1)Full Load (2)Output Short (3)O.L.P (4)Low Line No Load Vo(min) Ta : 25°C	U1 (1). 19.40V (2). 15.30V (3). 18.10V (4). 15.60V
4	O/P Diode	D100 Rated : 200V 10.0A	I/P : 267VAC O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1). 169.00V (2). 154.00V (3). 166.00V
5	Clamp Diode	D1 Rated : 1000V 1.0A	I/P : 267VAC O/P : (1)Full load continue Ta : 25°C	(1). 442.00V

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-FG : 2.000KVAC /min O/P-FG : 1.500KVAC /min	I/P-O/P: 4.400KVAC /min I/P-FG: 2.400KVAC /min O/P-FG: 1.800KVAC /min Ta : 25°C	I/P-O/P: 1.05mA I/P-FG: 0.28mA O/P-FG: 0.22mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P : 500VDC>100MΩ I/P-FG : 500VDC>100MΩ O/P-FG : 500VDC>100MΩ	I/P-O/P: 500VDC I/P-FG: 500VDC O/P-FG: 500VDC Ta : 25°C/70%RH	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 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°C	PASS
2	CONDUCTION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD / 50% LOAD Ta : 25°C	PASS Test by certified Lab
3	RADIATION	EN55022 CLASS B	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 MEDICAL AIR: 8KV / Contact: 6KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 MEDICAL INPUT: 2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 MEDICAL L-N:1KV;L/N-PE: 2KV	I/P : 230VAC /50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A

RELIABILITY TEST

RELIABILITY TEST				
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : NFM-20-12		
		1. ROOM AMBIENT BURN-IN : 1.0hrs		
		IP: 230VAC O/P: 100% LOAD TA= 28.1℃		
		2. HIGH AMBIENT BURN-IN : 1.0hrs		
		IP: 230VAC O/P: 100% LOAD TA= 45.7℃		
		NO. Position	ROOM AMBIENT 28.1℃	HIGH AMBIENT Ta: 45.7℃
		1 LF1	47.6℃	64.6℃
		2 BD1	47.2℃	64.1℃
		3 C5	42.9℃	59.7℃
		4 C36	50.7℃	68.8℃
		5 U1	65.0℃	84.7℃
		6 T1	66.6℃	83.9℃
		7 D100	72.3℃	88.8℃
2	OVER LOAD BURN-IN TEST	NO DAMAGE	I/P : 230VAC	TEST : OK
		1 HOUR (MIN)	O/P : 144% LOAD	
			Ta : 25℃	
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 264VAC / 115VAC O/P : FULL LOAD Ta : -20.0℃	TEST : OK
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50℃ NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 50℃ HUMIDITY= 95.0% RH	TEST : OK
5	TEMPERATURE COEFFICIENT	±0.03% /℃(0~50℃)	I/P : 230VAC O/P : FULL LOAD	±0.0000% /℃(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 : -25℃ ~ +55℃ 2. Temperature change rate : 25℃ / MI 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition :		TEST : OK



		230VAC Full Load AC ON/OFF test turn on 58sec ; turn off 2sec	
8	VIBRATION TEST	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (4) Acceleration : 2G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C	TEST : OK
9	CAPACITOR LIFE CYCLE	:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25.0°C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50.0°C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50.0°C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50.0°C LIFE TIME	(1). 312185.3 HRS (2). 58344 HRS (3). 80245.4 HRS (4). 114264.5 HRS
10	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE : 487.8 KHRS	
11	DMTBF /Accelerated Life test	Demonstration Mean Time Between Failure (Expected Life): Above 50000HRS @ TA 50°C	

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	FRANK	GESG	WAMGDZ

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