



# TEST REPORT: NFM-20-15

## 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

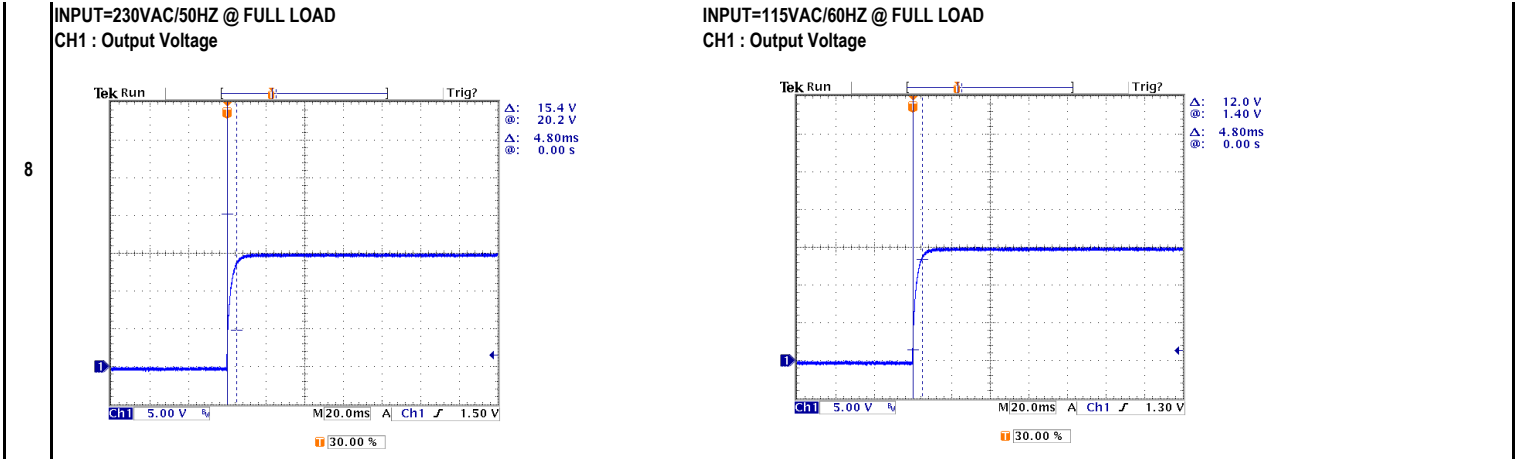
E.M.C. Test

### ■ RELIABILITY TEST

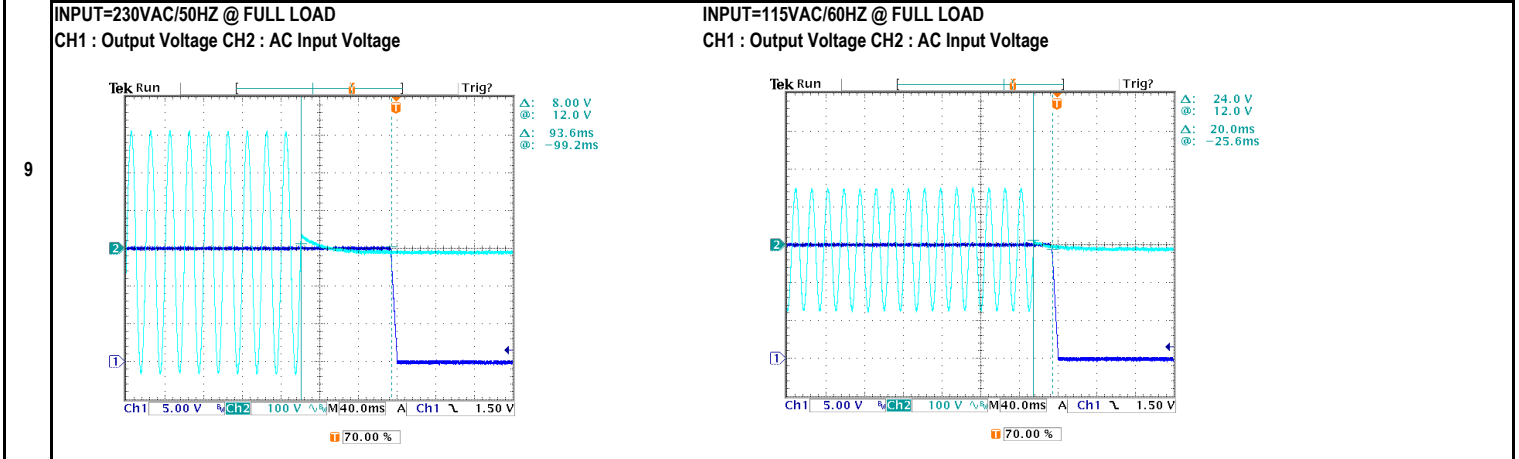
ENVIRONMENT TEST

DESIGN VERIFY TEST  
OUTPUT FUNCTION

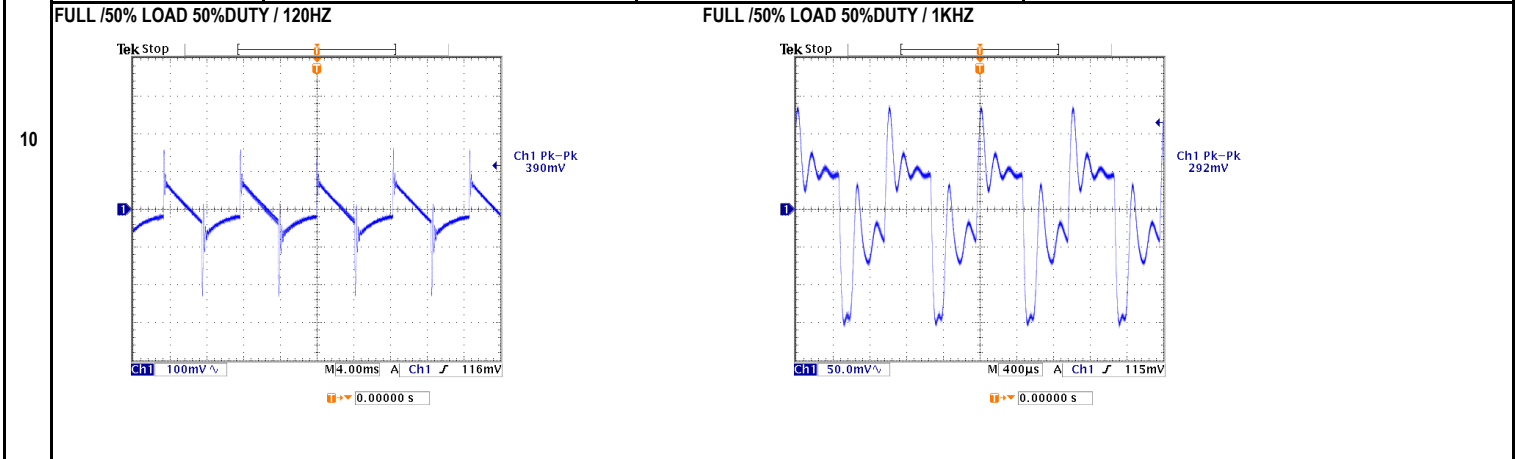
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE RANGE	CH1: 13.500V ~ 16.500V	I/P : 230VAC O/P: MIN LOAD TA : 25°C	CH1: 12.51V ~ 17.38V
2	OUTPUT VOLTAGE TOLERANCE (Max)	V1 : 1.0% ~ -1.0%	I/P : 115VAC / 264VAC O/P: FULL / MINLOAD TA= 25°C	V1: 0.00% ~ 0.00%
3	LINE REGULATION (MAX.)	V1 : 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< 1.987 %
6	RIPPLE & NOISE(Max)	V1 : 150 mVp-p	I/P : 230VAC O/P: FULL LOAD TA : 25°C	V1 : 21.4 mVp-p
7	SET UP TIME (MAX.)	230VAC : 500ms	I/P : 230VAC	230VAC : 148ms
		115VAC : 500ms	I/P : 115VAC	115VAC : 124ms
	INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage		INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage	
		115VAC : 20ms	I/P : 115VAC O/P: FULL LOAD TA : 25°C	115VAC : 4.8ms



<b>HOLD UP TIME (TYP.)</b>	230VAC : 50ms 115VAC : 15ms	I/P : 230VAC I/P : 115VAC O/P: FULL LOAD TA : 25°C	230VAC : 93.6ms 115VAC : 20.0ms
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<b>DYNAMIC LOAD</b>	V1 : 1500 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). 390.0mv (2). 292.0mv
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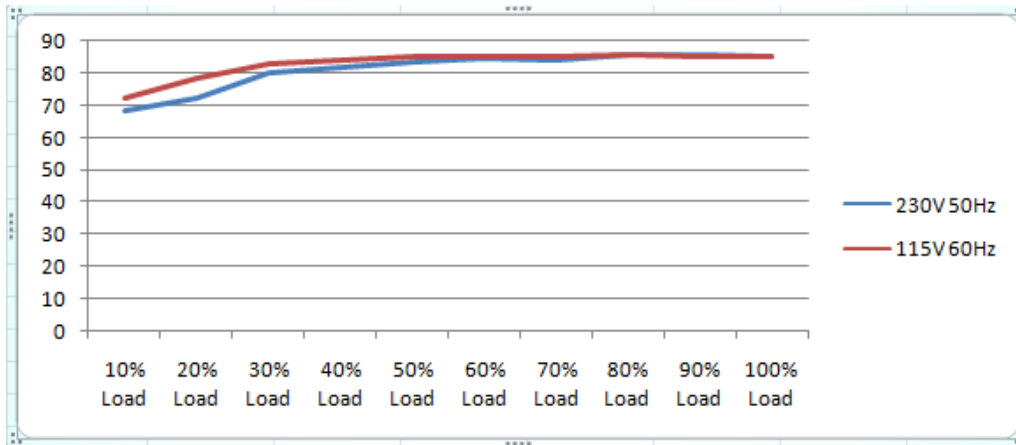




INPUT FUNCTION TEST

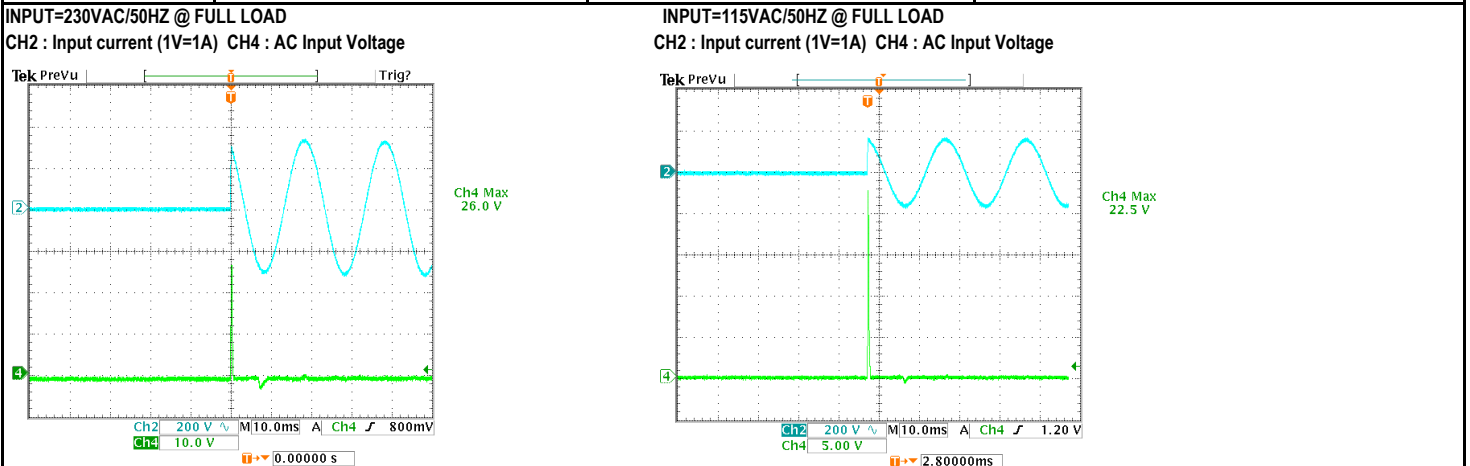
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	85VAC ~ 264VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	50.2VAC ~ 264VAC
			I/P : LOW-LINE = 112VAC HIGH-LINE = 300VAC O/P : FULL/MIN LOAD ON:30 Sec ; OFF:30 Sec 10MIN ( POWER ON/OFF NO DAMAGE )	TEST : OK
2	INPUT FREQUENCY RANGE	47HZ ~ 440HZ NO DAMAGE	I/P : 115VAC ~ 264VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK
3	INPUT CURRENT (TYP.)	0.4 / 230VAC 0.6 / 115VAC	I/P : 230VAC I/P : 115VAC O/P : FULL LOAD TA : 25°C	I= 0.212A / 230VAC I= 0.336A / 115VAC
4	LEAKAGE CURRENT	< 0.10mA	I/P : 264VAC O/P : MIN LOAD TA : 25°C	L-FG: 0.0405 mA N-FG: 0.0405 mA
5	NO LOAD POWER CONSUMPTION	< 0.750W	I/P : 230VAC O/P : MIN LOAD TA : 25°C	< 0.334 W
	EFFICIENCY (TYP.)	83.0%	I/P : 230VAC O/P : FULL LOAD TA : 25°C	85.94 %

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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= 26.00A / 230VAC I= 22.50A / 115VAC
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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	219% 264VAC 216% 230VAC 192% 115VAC Hiccup Mode
2	OVER VOLTAGE PROTECTION	17.25V ~ 20.25V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD TA : 25°C	17.40V 264VAC 17.40V 230VAC 17.40V 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). 474.00V (2). 548.00V (3). 474.00V
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). 362.00V (2). 362.00V (3). 362.00V
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	(1). 19.70V (2). 15.50V (3). 19.90V (4). 14.50V
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). 121.00V (2). 117.00V (3). 121.00V
5	Clamp Diode	D1 Rated : 1000V 1.0A	I/P : 267VAC O/P : (1)Full load continue Ta : 25°C	(1). 440.00V

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: 1.08mA I/P-FG: 0.28mA O/P-FG: 0.23mA 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

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°C 2. HIGH AMBIENT BURN-IN : 1.0hrs IP: 230VAC O/P: 100% LOAD TA= 45.7°C	<table border="1"> <thead> <tr> <th>NO.</th> <th>Position</th> <th>ROOM AMBIENT 28.1°C</th> <th>HIGH AMBIENT Ta: 45.7°C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF1</td><td>47.6°C</td><td>64.6°C</td></tr> <tr><td>2</td><td>BD1</td><td>47.2°C</td><td>64.1°C</td></tr> <tr><td>3</td><td>C5</td><td>42.9°C</td><td>59.7°C</td></tr> <tr><td>4</td><td>C36</td><td>50.7°C</td><td>68.8°C</td></tr> <tr><td>5</td><td>U1</td><td>65.0°C</td><td>84.7°C</td></tr> <tr><td>6</td><td>T1</td><td>66.6°C</td><td>83.9°C</td></tr> <tr><td>7</td><td>D100</td><td>72.3°C</td><td>88.8°C</td></tr> <tr><td>8</td><td>C105</td><td>56.9°C</td><td>73.7°C</td></tr> <tr><td>9</td><td>C106</td><td>55.9°C</td><td>73.1°C</td></tr> <tr><td>10</td><td>L100</td><td>52.1°C</td><td>68.9°C</td></tr> <tr><td>11</td><td>C110</td><td>42.8°C</td><td>60.7°C</td></tr> </tbody> </table>	NO.	Position	ROOM AMBIENT 28.1°C	HIGH AMBIENT Ta: 45.7°C	1	LF1	47.6°C	64.6°C	2	BD1	47.2°C	64.1°C	3	C5	42.9°C	59.7°C	4	C36	50.7°C	68.8°C	5	U1	65.0°C	84.7°C	6	T1	66.6°C	83.9°C	7	D100	72.3°C	88.8°C	8	C105	56.9°C	73.7°C	9	C106	55.9°C	73.1°C	10	L100	52.1°C	68.9°C	11	C110	42.8°C	60.7°C	
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 230VAC O/P : 144% LOAD Ta : 25°C	TEST : OK																																																
3	LOW TEMPERATURE TURN ON TEST	NO DAMAGE 1 HOUR ( MIN )	I/P : 264VAC / 115VAC O/P : FULL LOAD Ta : -20.0°C	TEST : OK																																																
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50°C NO DAMAGE	I/P : 272VAC O/P : FULL LOAD Ta : 50°C HUMIDITY= 95.0% RH	TEST : OK																																																
5	TEMPERATURE COEFFICIENT	±0.03% /°C(0~50°C)	I/P : 230VAC O/P : FULL LOAD	±0.0000% /°C(0~50°C)																																																
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		TEST : OK																																																
7	THERMAL SHOCK TEST	1. Thermal shock Temperature : -25°C ~ +55°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 :		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	

<b>TEST RESULT</b>	<b>TESTER</b>	<b>REVIEW</b>	<b>APPROVAL</b>
PASS	FRANK	GESG	WANGDZ

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