

# Test Report: DP60-400S24

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60W 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

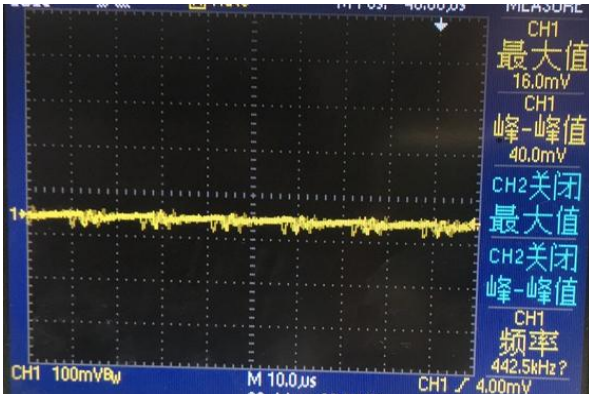
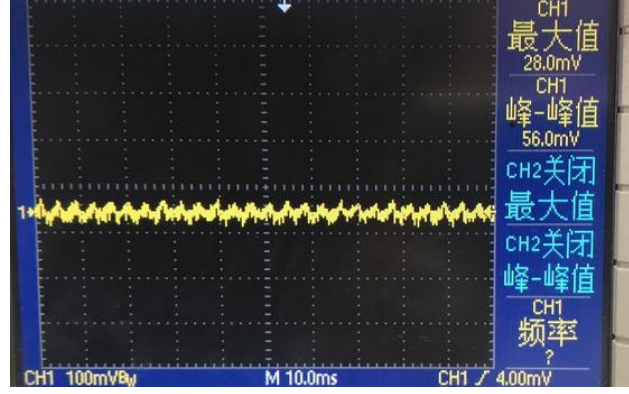
E.M.C. Test

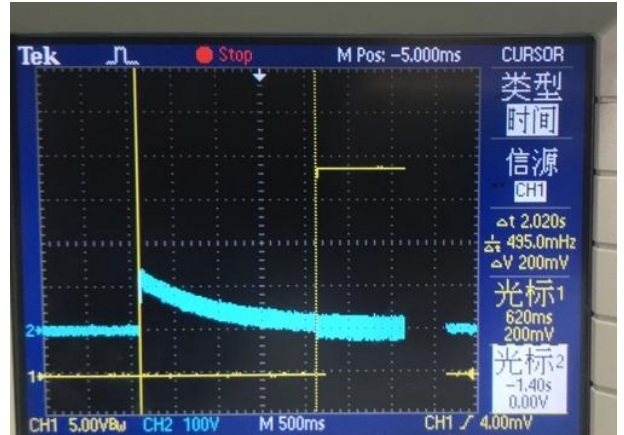
## ■ RELIABILITY TEST

ENVIRONMENT TEST

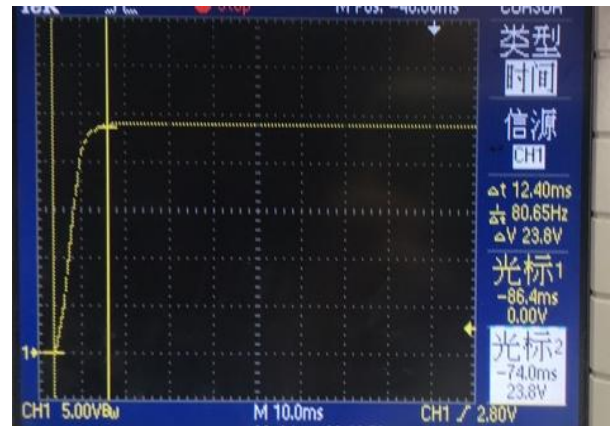
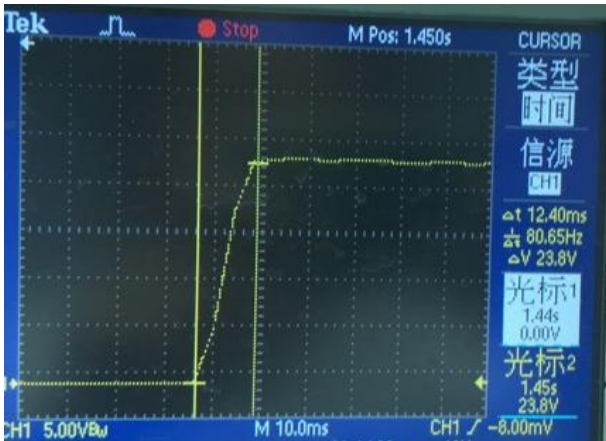
DESIGN VERIFY TEST

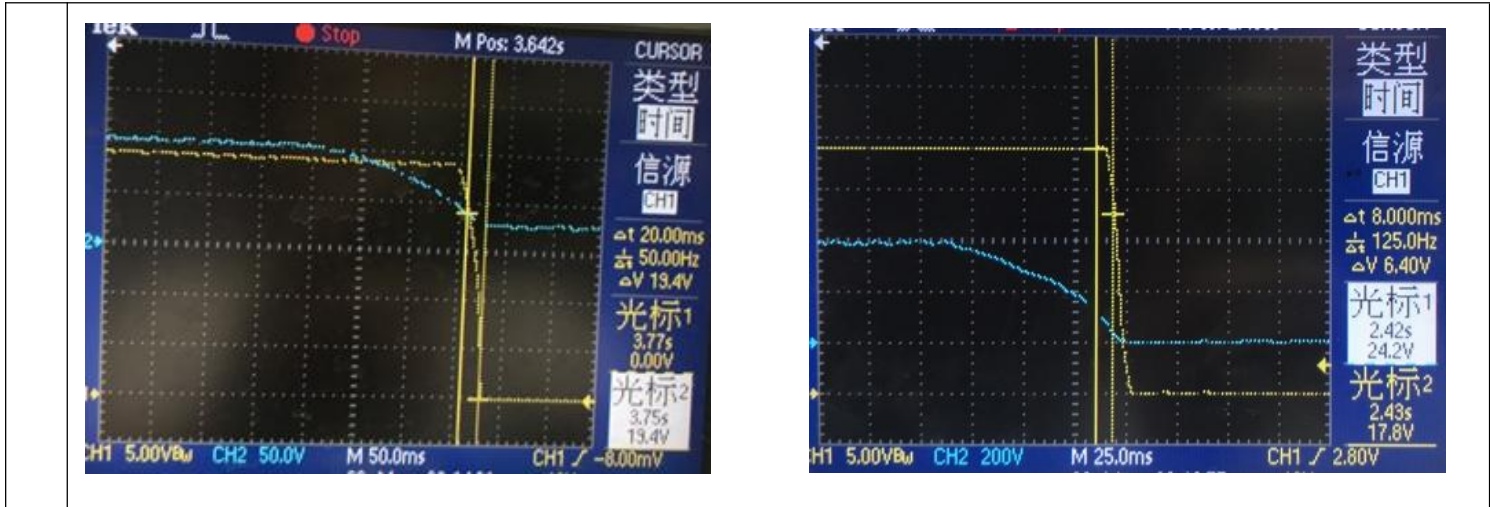
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	/	I/P: 100VDC I/P: 400VDC I/P:700VDC O/P: MIN LOAD Ta: 25°C	/
2	OUTPUT VOLTAGE(Max) TOLERANCE	-1%~ 1 %	I/P: 100VDC /400VDC O/P:FULL/ MIN. LOAD Ta:25°C	0.12%
3	LINE REGULATION (Max)	-1%~ 1 %	I/P: 100VDC~ 400VDC O/P:FULL LOAD Ta:25°C	0.04%
4	LOAD REGULATION(Max)	-1.0 %~1.0%	I/P: 400VDC O/P:FULL ~MIN LOAD Ta:25°C	0.04%
5	OVER/UNDERSHOOT TEST	< ± 5 %	I/P: 400VDC O/P:FULL LOAD Ta:25°C	< ± 1.37 %
6	RIPPLE & NOISE(Max )	100mVp-p	I/P:400VDC O/P:FULL LOAD Ta:25°C	56mVp-p
High frequency				
Low frequency				
7	SET UP TIME(Max)	100VDC/ 5000 ms 400VDC/ 3000 ms	I/P: 100 VDC I/P: 400 VDC O/P: FULL LOAD Ta: 25°C	100VDC/ 1960ms 400VDC/ 2020ms
INPUT=100VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage		INPUT=400VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage		



8	RISE TIME (Max) 100VDC/ 30 ms 400VDC/ 30 ms	I/P: 100VDC I/P: 400VDC O/P: FULL LOAD Ta: 25°C	100VDC/ 12.4 ms 400VDC/ 12.4 ms
INPUT=100VDC @ FULL LOAD CH1 : Output Voltage		INPUT=400VDC @ FULL LOAD CH1 : Output Voltage	
9	HOLD UP TIME (Typ.) 100VDC/ 30 ms 400VDC/ 20 ms	I/P: 100VDC I/P: 400VDC O/P: FULL LOAD Ta: 25°C	100VDC/ 20 ms 400VDC / 8ms
INPUT=100VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage		INPUT=400VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage	

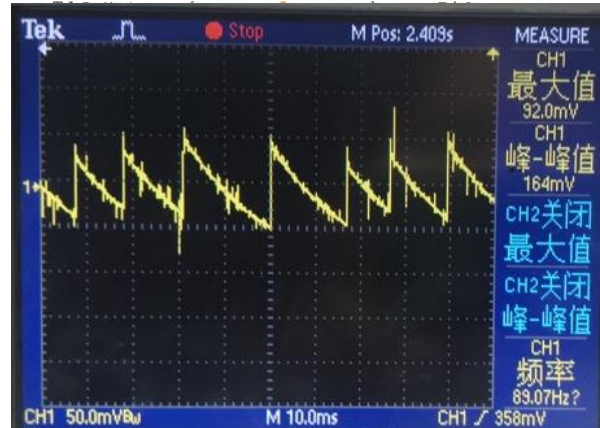
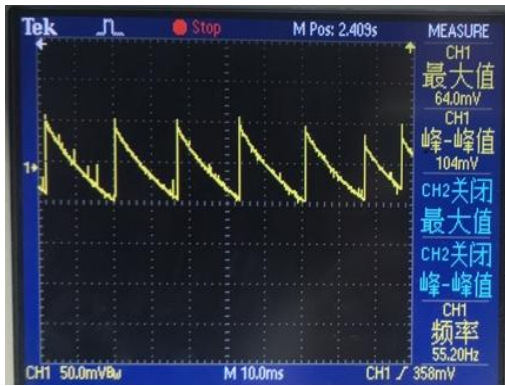




10	DYNAMIC LOAD	V1: 1200mVp-p	I/P: 400VDC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 90%DUTY / 1KHZ Ta:25°C	104 mVp-p 164mVp-p
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FULL /50% LOAD 50%DUTY / 120HZ

FULL /50% LOAD 90%DUTY / 1KHZ

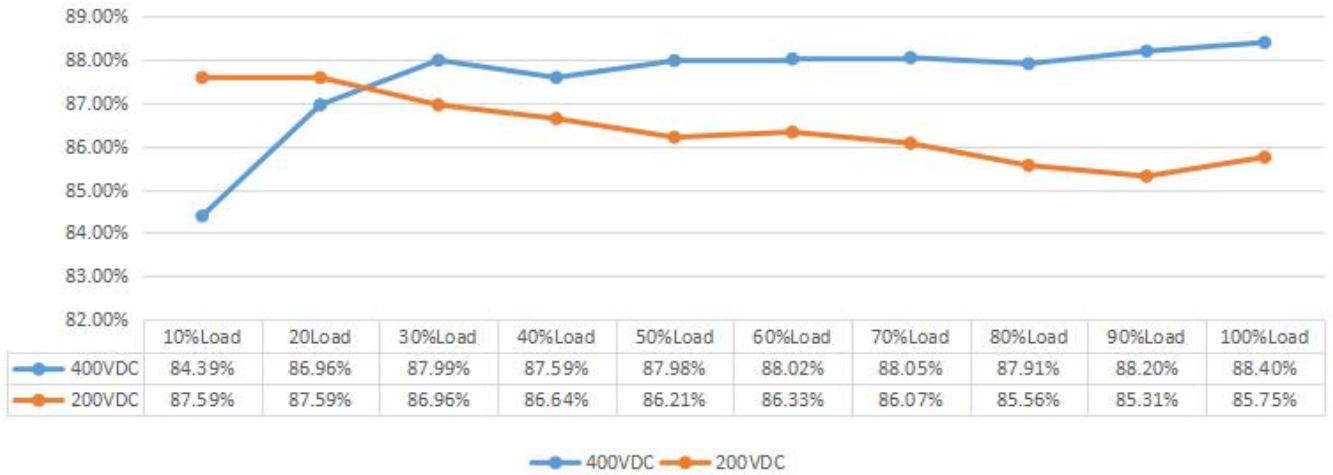


### INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	100VDC~700VDC	I/P:TESTING O/P:FULL LOAD Ta:25°C	100VDC~700VDC
			I/P: LOW-LINE-5V=95V HIGH-LINE+0%=700V O/P:FULL/MIN LOAD (PLEASE CHECK DERATING CURVE) ON: 30 Sec OFF: 30 Sec 10MIN (POWER ON/OFF NO DAMAGE)	TEST: OK
2	INPUT FREQUENCY RANGE	NO DAMAGE	--	--
3	INPUT CURRENT (Typ.)	100VDC/ 0.8 A 400VDC 0.2 A	I/P: 100VDC I/P: 400VDC O/P: FULL LOAD Ta: 25°C	I= 0.704/ 100VDC I= 0.167 A/ 400VDC

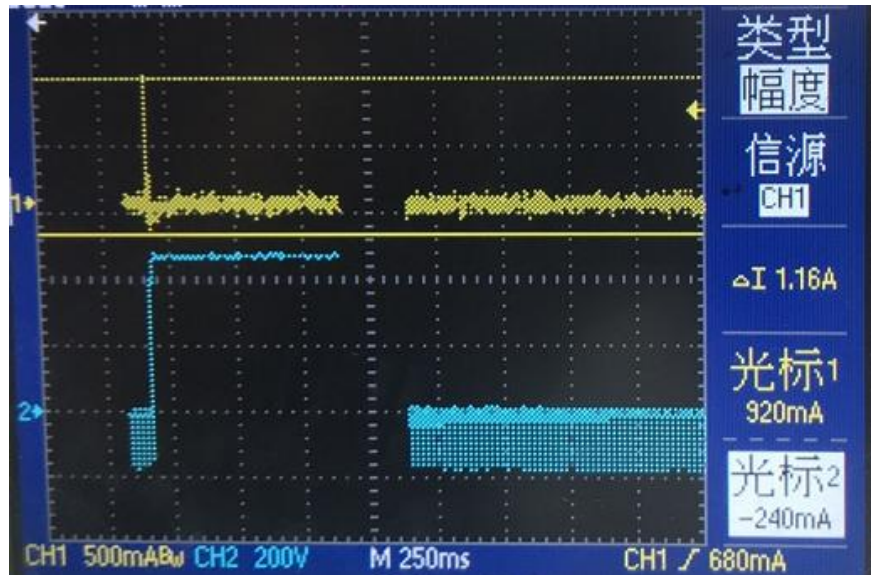
4	LEAKAGE CURRENT	< 0.75mA / 400VDC	I/P: 400VDC O/P: Min LOAD Ta: 25°C	L-FG: / mA N-FG: / mA
5	NO LOAD CONSUMPTION	< 0.3W	I/P: 200VDC I/P: 400VDC O/P: NO LOAD Ta: 25°C	< 0.35 W < 0.37 W
6	EFFICIENCY(Typ.)	88%	I/P:400 VDC O/P:FULL LOAD Ta:25°C	88.4%

EFFICIENCY vs LOAD



8	INRUSH CURRENT(Typ.)	400V/40A COLD START	I/P:400VDC O/P:FULL LOAD Ta:25°C	I <sub>r</sub> = 1.16A/ 400VDC
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INPUT=400VDC50HZ @ FULL LOAD  
CH2 : DC Input Voltage CH4 : Input current



9	Capacitive load		I/P: 100VDC I/P: 400VDC I/P: 700VDC O/P: FULL LOAD Ta:25°C	100VDC 1000UF 400VDC 1000UF 700VDC 1000UF
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### PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	110%--160%	I/P: 700VDC I/P: 400VDC I/P: 100VDC O/P: TESTING Ta: 25°C	138.8%/ 700VDC 138.4%/ 400VDC 125%/100VDC Hiccup Mode PROTECTION TYPE : Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	26-32V	I/P: 700VDC I/P: 400VDC I/P: 100VDC O/P: MIN LOAD Ta: 25°C	32V 31.6V 31.2V
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 700VDC I/P: 400VDC I/P: 100VDC O/P: MIN LOAD Ta: 25°C	NO DAMAGE Hiccup Mode

### COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q21 Rated : 9 A / 900V	I/P: High-Line +3V =703V DC ON/OFF VDS: O/P: (1) Full Load (2) Output Short (3) Full load continue Ta: 25°C	VDS: (1) 872V (2) 859V (3) 839V
2	Diode Peak Voltage	D30 Rated : 10A / 200V	I/P: 700VDC ON/OFF O/P: (1) Full Load (2) Output Short (3) Full load continue Ta: 25°C	Q100: VDS: (1) 130V (2) 134V (3) 124V
3	Input Capacitor Voltage	C5 Rated: : 47uF / 400V*2 105 °C	I/P: High-Line +3V =703V O/P: (1) Full Load input on/off (2) Min load input on /Off (3) Full Load /Min load Change Ta: 25°C	(1) 696V (2) 726V (3) 690V
4	Control IC Voltage Test	PWM IC U1 Rated : 28V  9.5V(MIN.)	I/P: High-Line +3V =703V AC ON/OFF O/P: (1) FULL LOAD TURN ON/OFF (2) MIN LOAD TURN ON/OFF (3) FULL LOAD /MIN LOAD CHANGE  Ta: 25°C	(1) 16.06V (2) 12.25V (3) 13.64 V

**SAFETY TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3KVAC/min I/P-FG: 2 KVAC/min O/P-FG:0.5KVAC/min Ta:25°C	I/P-O/P: 1.43mA 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: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25°C	I/P-O/P:>1999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25°C	/ mΩ

**E.M.C TEST**

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:400VDC/50HZ O/P:FULL LOAD Ta:25°C	--
2	CONDUCTION	EN55022 CLASS B	I/P: 400VDC (50HZ) O/P: FULL/50% LOAD Ta: 25°C	Test by certified Lab: CLASS B
		TEST MODE: LINE		
		TEST MODE: NEUTRAL		

3	RADIATION	EN55022 CLASS B	I/P: 400VDC (50HZ)O/P: FULL LOAD Ta: 25°C	Test by certified Lab
		TEST MODE: HORIZONTAL	Test by certified Lab	
		TEST MODE: VERTICAL	Test by certified Lab	
4	E.S.D	EN61000-4-2 INDUSTRY AIR: 8KV / Contact: 4KV	I/P: 400VDC/50HZO/P: FULL LOAD Ta: 25°C	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 4KV	I/P: 400VDC/50HZO/P: FULL LOAD Ta: 25°C	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV	I/P: 400VDC/50HZO/P: FULL LOAD Ta: 25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare			





2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR ( MIN )	I/P: 400 VDC O/P: 115% LOAD Ta: 25°C	TEST: OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P: 700VDC/100VDC O/P: 100 % LOAD Ta= -30°C	TEST: OK
		I/P: 700VDC O/P: 100 %LOAD Ta= -40°C	I/P: 100VDC O/P: 100 %LOAD Ta= -40°C	
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40°C NO DAMAGE	I/P: 400 VDC O/P: FULL LOAD Ta=40°C HUMIDITY= 95 %R.H	TEST: OK
5	TEMPERATURE COEFFICIENT	+ 0.03%/°C(0~50°C)	I/P: 400 VDC O/P: FULL LOAD	+0.008%/°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		OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature: -30°C ~ +70°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
8	ON OFF TEST	In put: 400VDC,FULL LOAD /3S AND 0VAC FULL LOAD/3S,ALL:10K times。 Required, no damage -		OK -

9	VIBRATION TEST	1 Carton & 1 Set (1) Waveform: Sine Wave (2) Frequency: -- (3) Sweep Time: 12min/sweep cycle (4) Acceleration: 5G (5) Test Time: 60min in each axis (X.Y.Z) (6) Ta: 25°C	TEST: OK
10	CAPACITOR LIFE CYCLE	SUPPOSE C32 IS THE MOST CRITICAL COMPONENT (1) I/P: 400VDC O/P: FULL LOAD Ta=25°C LIFE TIME (2) I/P: 400VDC O/P: FULL LOAD Ta=40°C LIFE TIME (3) I/P: 400VDC O/P: 75% LOAD Ta=40°C LIFE TIME (4) I/P: 400VDC O/P: 50% LOAD Ta=40°C LIFE TIME	(1) HRS (2) HRS (3) HRS (4) HRS
11	MTBF	MIL-HDBK-217F TOTAL FAILURE RATE: 681.2 KHRS	
12	DMTBF/Accelerated Life Test	Demonstration Mean Time Between Failure (Expected Life): Above 50,000 hours @ TA 50°C	

TEST RESULT	TESTER	APPROVAL

2022/5/30