Test Report:
DP60-400S12

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

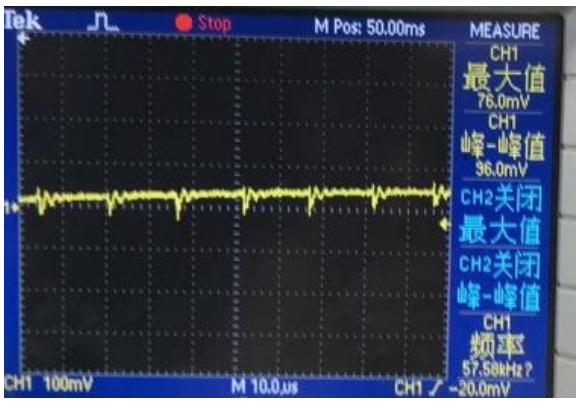
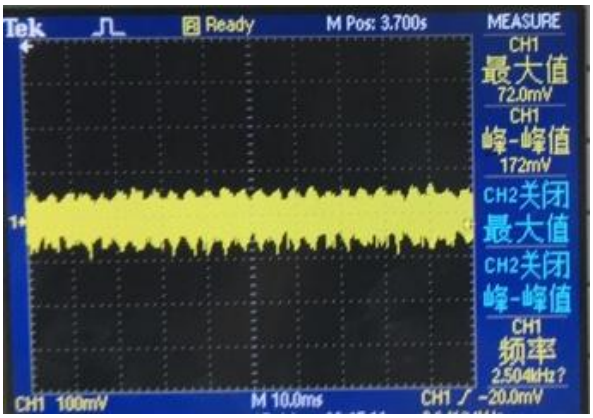
Safety Test
E.M.C. Test

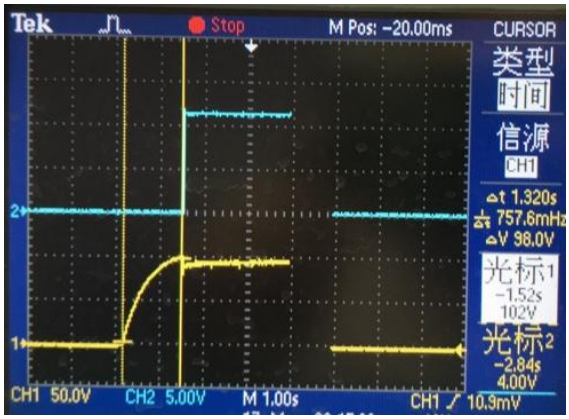
■ RELIABILITY TEST

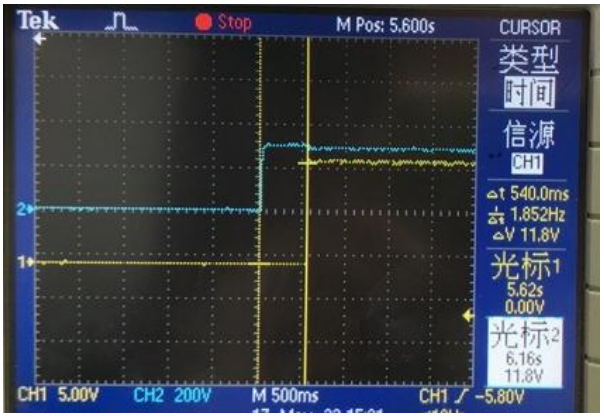
ENVIRONMENT TEST

■ DESIGN VERIFY TEST

OUTPUT FUNCTION TEST

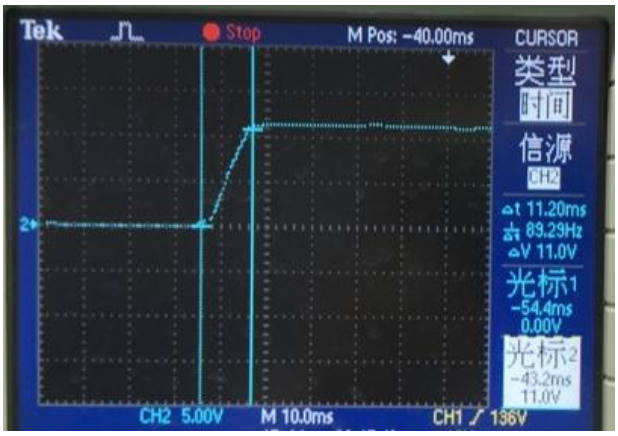
NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	/	I/P： 100VDC I/P： 400VDC I/P:700VDC O/P：MIN LOAD Ta：25℃	/
2	OUTPUT VOLTAGE(Max) TOLERANCE	-1 %~ 1 %	I/P: 100VDC /400VDC O/P:FULL/ MIN. LOAD Ta:25℃	0.42%
3	LINE REGULATION (Max)	-1 %~ 1 %	I/P: 100VDC~ 400VDC O/P:FULL LOAD Ta:25℃	-0.33%
4	LOAD REGULATION(Max)	-1.0 %~1.0%	I/P: 400VDC O/P:FULL ~MIN LOAD Ta:25℃	0.42%
5	OVER/UNDERSHOOT TEST	< ± 5 %	I/P: 400VDC O/P:FULL LOAD Ta:25℃	< ± 1.37 %
6	RIPPLE & NOISE(Max)	100mVp-p	I/P:400VDC O/P:FULL LOAD Ta:25℃	72mVp-p
	Hight 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℃	100VDC/ 1320ms 400VDC/ 540ms
	INPUT=100VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage		INPUT=400VDC @ FULL LOAD CH1 : Output Voltage CH2 : DC Input Voltage	



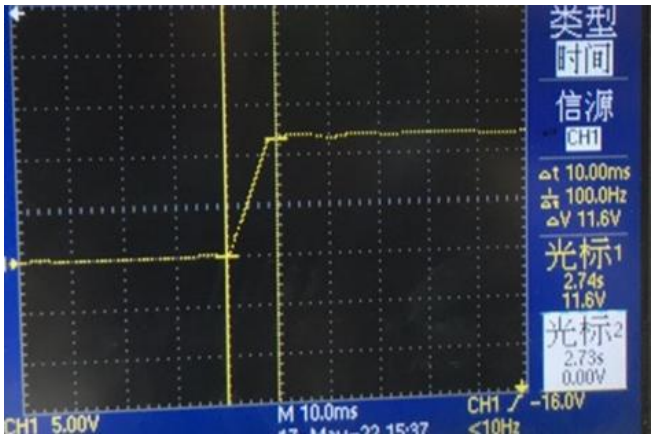


8	RISE TIME (Max)	100VDC/ 30 ms 400VDC/ 30 ms	I/P： 100 VDC I/P： 400 VDC O/P： FULL LOAD Ta：25℃	100VDC/ 1 1 . 2 ms 400VDC/ 10 ms

INPUT=100VDC @ FULL LOAD
CH1 : Output Voltage



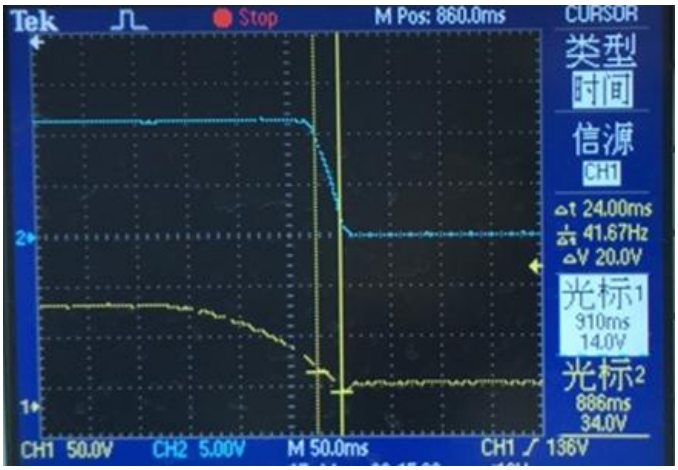
INPUT=400VDC @ FULL LOAD
CH1 : Output Voltage



9	HOLD UP TIME (Typ.)	100VDC/ 3 0 ms 400VDC/ 20 ms	I/P： 100VDC I/P： 400VDC O/P： FULL LOAD Ta：25℃	100VDC/ 2 4 ms 4000VDC / 3ms

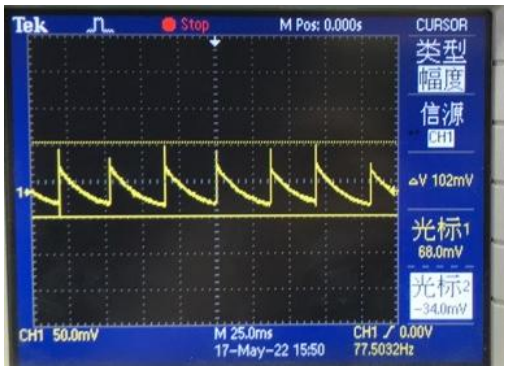
INPUT=100VDC @ FULL LOAD
CH1 : Output Voltage CH2 : DC Input Voltage

INPUT=400VDC @ FULL LOAD
CH1 : Output Voltage CH2 : DC Input Voltage

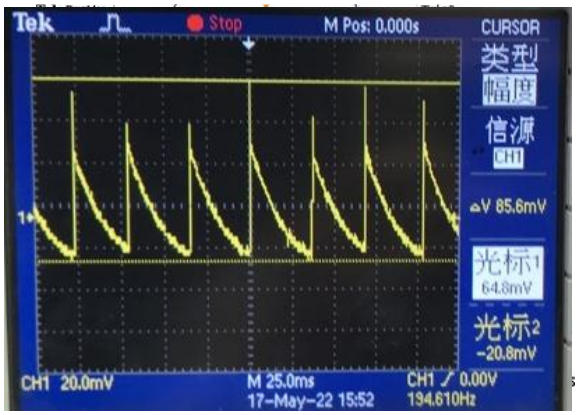


10	DYNAMIC LOAD	V1: 1200 mVp-p	I/P: 400VDC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 90%DUTY / 1KHZ Ta:25℃	102 mVp-p 85.6mVp-p

FULL /50% LOAD 50%DUTY / 120HZ



FULL /50% LOAD 90%DUTY / 1KHZ

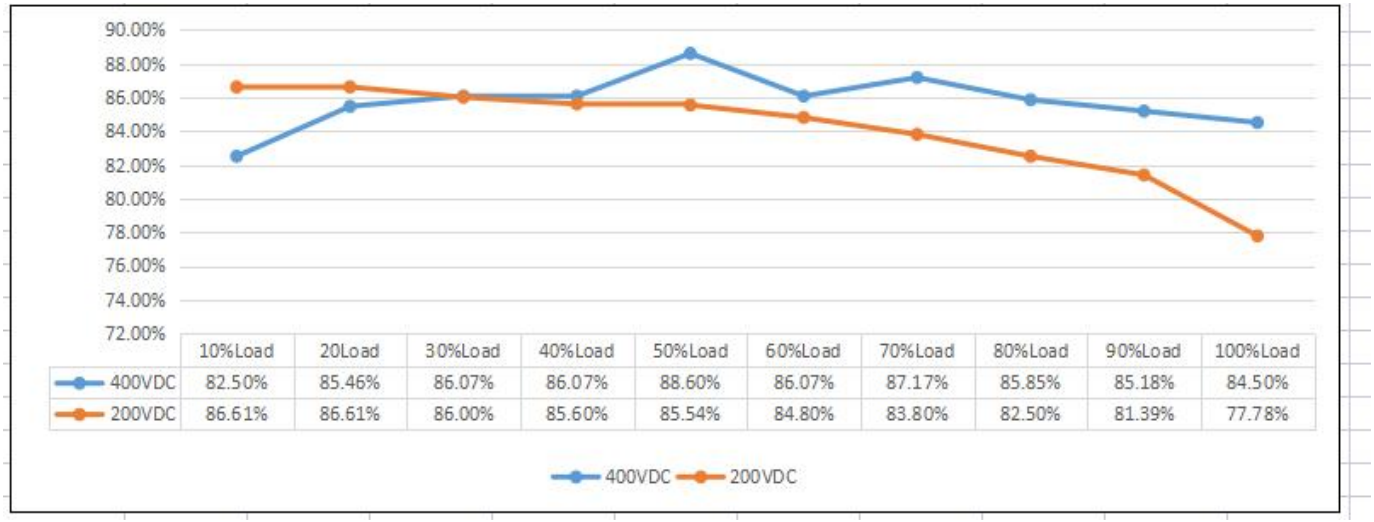


INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	INPUT VOLTAGE RANGE	100VDC~700VDC	I/P:TESTING O/P:FULL LOAD Ta:25℃	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℃	I = 0.72 / 100VDC I = 0 . 1 5 7 A/ 400VDC

4	LEAKAGE CURRENT	< 0.75mA / 400VDC	I/P： 400VDC O/P：Min LOAD Ta：25℃	L-FG： / mA N-FG： / mA
5	NO LOAD CONSUMPTION	< 0.3W	I/P：200VDC I/P：400VDC O/P：NO LOAD Ta：25℃	< 0.39 W < 0.35 W
6	EFFICIENCY(Typ.)	85%	I/P:400 VDC O/P:FULL LOAD Ta:25℃	84.5%

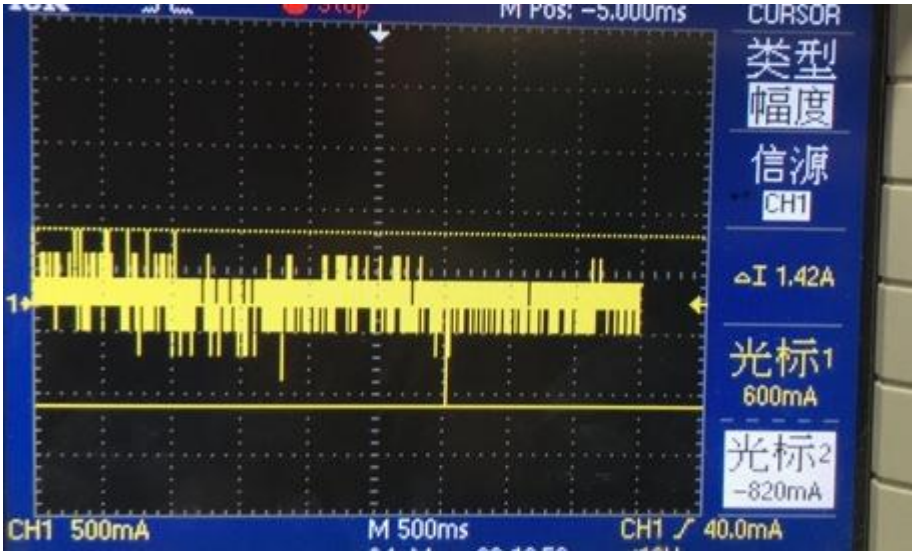
EFFICIENCY vs LOAD



	10%Load	20Load	30%Load	40%Load	50%Load	60%Load	70%Load	80%Load	90%Load	100%Load
400VDC	82.50%	85.46%	86.07%	86.07%	88.60%	86.07%	87.17%	85.85%	85.18%	84.50%
200VDC	86.61%	86.61%	86.00%	85.60%	85.54%	84.80%	83.80%	82.50%	81.39%	77.78%

8	INRUSH CURRENT(Typ.)	400V/10A COLD START	I/P:400VDC O/P:FULL LOAD Ta:25℃	I= 1.42A/ 400VDC

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℃	100VDC 1000UF 400VDC 1000UF 700VDC 1000UF

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℃	159%/ 700VDC 138%/ 400VDC 114%/100VDC Hiccup ModePROTECTION TYPE：Hiccup mode, recovers automatically after fault condition is removed
2	OVER VOLTAGE PROTECTION	14-15V	I/P: 700VDC I/P: 400VDC I/P: 100VDC O/P:MIN LOAD Ta:25℃	14V 14V 14.4V
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℃	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℃	VDS: (1) 910V (2)900V (3) 910V
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℃	Q100: VDS: (1)102V (2)130V (3)104V
3	**Input Capacitor Voltage**	C5 Rated: : 47uF / 400V*2 105 ℃	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℃	(1)676V (2)690V (3)687V
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℃	（1）16.06V (2) 12.94V (3) 13.34 V

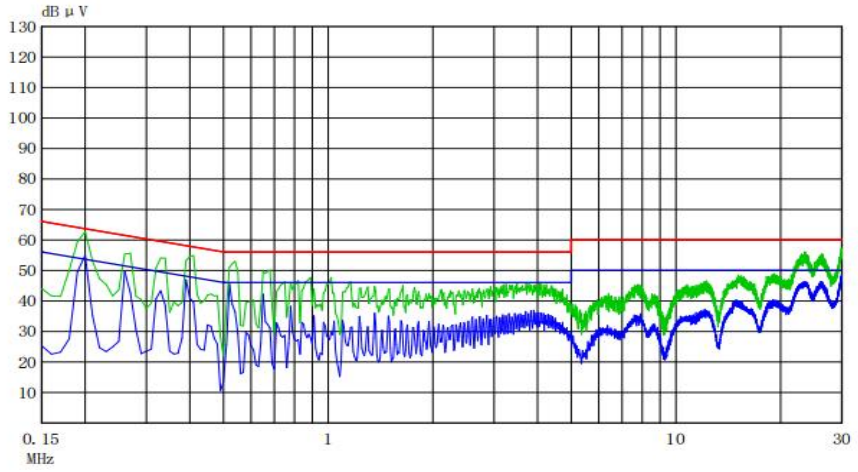
SAFETY TEST

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℃	I/P-O/P: 1.41mA 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℃	I/P-O/P:>1999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	/ mΩ

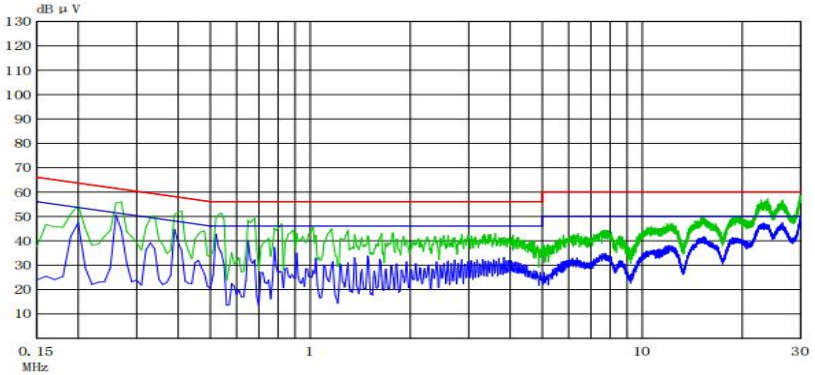
E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:400VDC/50HZ O/P:FULL LOAD Ta:25℃	--
2	CONDUCTION	EN55022 CLASS B	I/P：400VDC (50HZ) O/P： FULL/50% LOAD Ta：25℃	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℃	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℃	CRITERIA A
5	E.F.T	EN61000-4-4 INDUSTRY INPUT： 4KV	I/P：400VDC/50HZO/P：FULL LOAD Ta：25℃	CRITERIA A
6	SURGE	IEC61000-4-5 INDUSTRY L-N ： 2KV	I/P：400VDC/50HZO/P：FULL LOAD Ta：25℃	CRITERIA A
7	Test by certified Lab ＆ Test Report Prepare			

RELIABILITY TEST

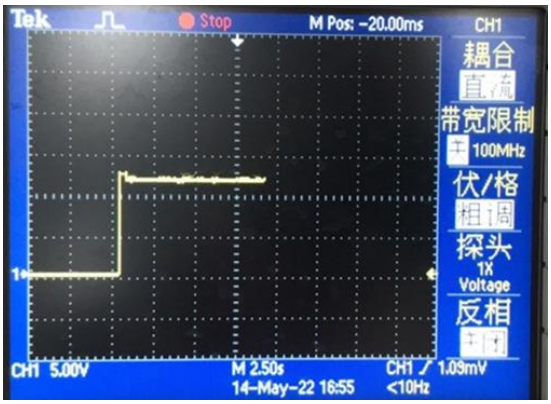
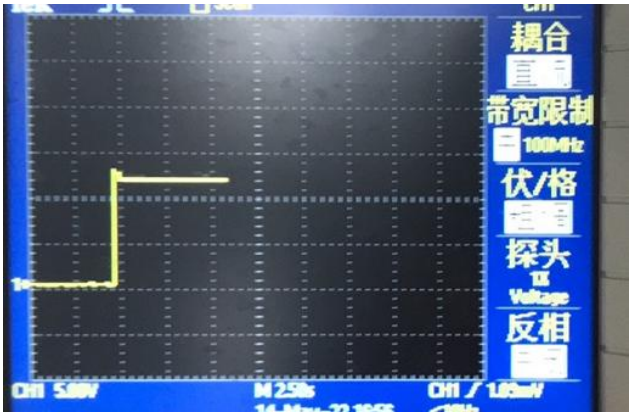
ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST			

MODEL： DP60-400S12

1. HIGH AMBIENT BURN-IN： 2 HRS　I/P： 100VDC　O/P： 70% LOAD Ta=50.61℃
2. HIGH AMBIENT BURN-IN： 2 HRS　I/P： 200VDC　O/P：80% LOAD Ta=50.82℃
3. HIGH AMBIENT BURN-IN： 2 HRS　I/P： 400VDC　O/P：90% LOAD Ta=52℃
4. HIGH AMBIENT BURN-IN： 2 HRS　I/P： 700VDC　O/P： 70%LOAD Ta=49.64℃

NO	Position	PART NUMBER	HIGH AMBIENT Ta= 50.61℃ I/P： 100VDC O/P：70% LOAD	HIGH AMBIENT Ta=50.82℃ I/P： 200VDC O/P： 80% LOAD	HIGH AMBIENT Ta= 52℃ I/P： 400VDC O/P：90% LOAD	HIGH AMBIENT Ta= 49.64℃ I/P：700VDC O/P： 70%LOAD
1	输入电容	C1 C2 C3	82.35	81.33	85.36	75.8
2	共模电感	NF	81.91	76.61	75.29	66.75
3	MOS管	Q21	92.9	88.85	91.68	85.91
4	Y电容	CY1	99.79	100.35	107.47	92.4
5	光耦	U22	91.55	90.32	95.01	84.11
6	二极管	D30	110.36	113.23	123.26	102.99
7	输出电容	C31	91.9	94.3	102.86	86.7
8	整流二极管	D24A	83.68	83.23	87.2	78.6
9	采样电阻	R213	93.52	89.15	91.65	83.11
10	变压器线包	T20	89.03	90.38	99.99	84.8
11	变压器磁芯	T20	81.4	83.9	96.42	79.82
12	贴片热敏 150K	/	90.33	87.12	90.58	91.46
13	PCB底部	/	85.03	87.12	97.58	81.44
14	吸收电阻	R211	89.27	81.49	74.16	66.78

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P： 400 VDC O/P： 115％LOAD Ta：25℃	**TEST：OK**
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P：700VDC/100VDC O/P： 100 ％LOAD Ta= -30℃	TEST：OK
	I/P：700VDC O/P：100 ％LOAD Ta= - 40℃ 	I/P：100VDC O/P：100 ％LOAD Ta= - 40℃ 		
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 40℃ NO DAMAGE	I/P： 400 VDC O/P： FULL LOAD Ta=40℃ HUMIDITY= 95 %R.H	TEST：OK
5	TEMPERATURE COEFFICIENT	+ 0.03%/℃(0~50℃)	I/P： 400 VDC O/P： FULL LOAD	+0.008%/℃(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		OK
7	THERMAL SHOCK TEST	1. Thermal shock Temperature： -30℃~ +70℃ 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
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℃	TEST：OK
10	CAPACITOR LIFE CYCLE	SUPPOSE C32 IS THE MOST CRITICAL COMPONENT (1) I/P： 400VDC O/P：FULL LOAD Ta=25℃ LIFE TIME (2) I/P： 400VDC O/P：FULL LOAD Ta=40℃ LIFE TIME (3) I/P： 400VDC O/P：75% LOAD Ta=40℃ LIFE TIME (4) I/P： 400VDC O/P：50% LOAD Ta=40℃ 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℃	

TEST RESULT	TESTER	APPROVAL

2022/5/6