



Test Report: MSP-450-24

450W Single Output Medical Type

■ DESIGN VERIFY TEST

- Output Function Test
- Input Function Test
- Protection Function Test
- Control 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	VERDICT
1	RIPPLE & NOISE	V1 : 150 mVp-p (Max)	I/P : 230VAC O/P : FULL LOAD Ta : 25°C	V1 : 96.4 mVp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1 : 21.6V ~ 28.8 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	20.462 V ~ 30.326 V / 230 VAC 20.462 V ~ 30.326 V / 115 VAC	P
3	OUTPUT VOLTAGE TOLERANCE	V1 : 1% ~ -1% (Max)	I/P : 100 VAC / 264 VAC O/P : FULL / MIN LOAD Ta : 25°C	V1 : 0.16 % ~ -0.16 %	P
4	LINE REGULATION	V1 : 0.2% ~ -0.2% (Max)	I/P : 100 VAC ~ 264 VAC O/P : FULL LOAD Ta : 25°C	V1 : 0.025 % ~ -0.025 %	P
5	LOAD REGULATION	V1 : 0.5 % ~ -0.5% (Max)	I/P : 230 VAC O/P : FULL ~ MIN LOAD Ta : 25°C	V1 : 0.16 % ~ -0.16 %	P
6	SET UP TIME	230VAC : 1000 ms (Max) 115VAC : 2500 ms (Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC / 89 ms 115VAC / 180 ms	P
7	RISE TIME	230VAC : 100 ms (Max) 115VAC : 100 ms (Max)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC / 16 ms 115VAC / 13 ms	P
8	HOLD UP TIME	230VAC : 16 ms (TYP) 115VAC : 16 ms (TYP)	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC / 24 ms 115VAC / 19 ms	P
9	OVER/UNDERSHOOT TEST	< ±5%	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	TEST : <5 %	P
10	DYNAMIC LOAD	V1 : 2400 mVp-p	I/P : 230 VAC (1).O/P : FULL / Min LOAD 90%DUTY / 1KHZ (2).O/P : FULL / Min LOAD 50%DUTY / 120HZ Ta : 25°C	(1). 686 mVp-p (2). 1124 mVp-p	P

INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	100VAC~264 VAC	I/P : TESTING O/P : FULL LOAD Ta : 25°C	71 V~264V	P
			I/P : LOW-LINE-3V= 97 V HIGH-LINE+15%=300 V O/P : FULL/MIN LOAD ON : 30 Sec. OFF : 30 Sec 10MIN (AC POWER ON/OFF NO DAMAGE)	TEST : OK	
2	INPUT FREQUENCY RANGE	47HZ ~63 HZ NO DAMAGE OSC	I/P : 100 VAC ~ 264 VAC O/P : FULL-MIN LOAD Ta : 25°C	TEST : OK	P
3	POWER FACTOR	0.95 / 230 VAC(TYP)	I/P : 230 VAC	PF= 0.979 / 230 VAC	P
		0.99 / 115 VAC(TYP)	I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	PF= 0.995 / 115 VAC	
4	EFFICIENCY	88% (TYP)	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	88.8 %	P
5	INPUT CURRENT	230V/ 2.4 A (TYP)	I/P : 230 VAC	I = 2.3 A/ 230 VAC	P
		115V/ 5 A (TYP)	I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 4.59 A/ 115 VAC	
6	INRUSH CURRENT	230V/ 70 A (TYP)	I/P : 230 VAC	I = 56 A/ 230 VAC	P
		115V/ 35 A (TYP) COLD START	I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I = 28 A/ 115 VAC	
7	LEAKAGE CURRENT	< 300 uA/ for earth leakage current	I/P: 264 VAC O/P:Min LOAD Ta:25°C	L-FG 267 uA N-FG 267 uA	P
		< 100 uA/ for touch leakage current	I/P: 264 VAC O/P:Min LOAD Ta:25°C	L-V+ 78 uA L-V- 78 uA N-V+ 78 uA N-V- 78 uA	
8	No load power consumption	< 0.6 W	I/P : 230 VAC O/P : NO LOAD RC+&RC- SHORT Ta : 25°C	0.4 W	P

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	105% ~ 135 %	I/P : 230 VAC I/P : 115 VAC O/P : TESTING Ta : 25°C	114 %/ 230 VAC 114 %/ 115 VAC Constant current limiting, recovers automatically after fault condition is removed	P
2	OVER VOLTAGE PROTECTION	CH1 : 30V ~ 34.8 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	32.73 V/ 230 VAC 32.67 V/ 115 VAC Shut down Re- power ON	P
3	OVER TEMPERATURE PROTECTION	SPEC : TSW1 : 90 ± 5°C O.T.P. detect on heatsink of power transistor TSW2 : 90 ± 5°C O.T.P. detect on heatsink of power transistor NO DAMAGE	I/P : 230 VAC O/P : FULL LOAD	O.T.P. Active Shut down o/p voltage , recovers automatically after temperature goes down	P
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P : 264 VAC O/P : FULL LOAD Ta : 25°C	NO DAMAGE Constant current limiting, recovers automatically after fault condition is removed	P

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	DC OK SIGNAL	PSU turn on : 3.3 ~ 5.6V ; PSU turn off : 0 ~ 1V	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	PSU turn on : 4.972 V PSU turn off : 0 V	P
2	REMOTE CONTROL	Rc+ / Rc- 4 ~ 10V or open = power on 0 ~ 0.8V or short = power off	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	3.5V ~10 V POWER ON 0 V ~3.4 V POWER OFF	P
3	REMOTE SENSE	>0.5V	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	> 0.5 V	P
4	AUX POWER	4.75V~5.25V / 0.3A Ripple : 50mV	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	4.905V / 0.3A Ripple : 6 mv	P
5	FAN ON/OFF control test	1、FAN ON : 20%± 10%	I/P : 230 VAC O/P : TESTING Ta : 25°C	> 23.9 %LOAD FAN ON < 17.5 %LOAD FAN OFF	P
		2、RTH2 ≥ 50°C	I/P : 230 VAC O/P : FULL LOAD Ta : 25°C	>53.8 °C FAN ON	P

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) Peak Voltage	Q3 Rated : IRFP460A 20A/500V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 420 V (2) 408 V (3) 400 V	P
2	Diode Peak Voltage	Q 101 Rated : FME-220B 20A/150V Q 103 Rated : FME-220B 20A/150V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2)Output Short (3)Full load continue Ta : 25°C	(1) 96.8 V (2) 94.8 V (3) 91.2 V (1) 141 V (2) 134 V (3) 125 V	P
3	Input Capacitor Voltage	C5 Rated : 330u/400V 105°C 30*30 HU	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 375.3 V (2) 377.6 V (3) 377.2 V	P
4	Control IC Voltage Test	U1 Rated : FAN4801NY 9.3V~30V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on /Off (2) Min load Turn on /Off (3)Full Load /Min load Change Ta : 25°C	(1) 15.939 V (2) 15.514 V (3) 15.518 V	P
5	Power Transistor (D to S) or (C to E) Peak Voltage	Q 1 Rated : IRFP460A 20A/500V	I/P : High-Line +3V = 267 V O/P : (1)Full Load Turn on (2) Output Short (3)Full load continue Ta : 25°C	(1) 472 V (2) 392 V (3) 414 V	P

■ SAFETY & E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P : 4 KVAC/min I/P-FG : 2 KVAC/min O/P-FG : 0.5 KVAC/min	I/P-O/P : 4.2 KVAC/min I/P-FG : 2.4 KVAC/min O/P-FG : 0.6 KVAC/min Ta : 25°C	I/P-O/P : 6.64 mA I/P-FG : 5.64 mA O/P-FG : 3.87 mA NO DAMAGE	P
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/70% RH	I/P-O/P : 21.8 GΩ I/P-FG : 19.3 GΩ O/P-FG : 30 GΩ NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta : 25°C /70% RH	9 mΩ	P
4	APPROVAL	TUV : Certificate NO : R50181079 UL : File NO : E183223			P

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2,-3 CLASS A CLASS D	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	PASS	P
2	CONDUCTION	EN55011 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25°C	PASS Test by certified Lab	P
3	RADIATION	EN55011 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25°C	PASS Test by certified Lab	P
4	E.S.D	EN61000-4-2 INDUSTRY AIR : 8KV / Contact : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
5	E.F.T	EN61000-4-4 INDUSTRY INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
6	SURGE	IEC61000-4-5 INDUSTRY L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25°C	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	VERDICT																																																																																																																			
1	TEMPERATURE RISE TEST	MODEL : MSP-450-24 1. ROOM AMBIENT BURN-IN : 1 HRS I/P : 230VAC O/P : FULL LOAD Ta= 27.1 °C 2. HIGH AMBIENT BURN-IN : 4.5 HRS I/P : 230VAC O/P : FULL LOAD Ta= 50 °C			P																																																																																																																			
		<table border="1"> <thead> <tr> <th>NO</th> <th>Position</th> <th>P/N</th> <th>ROOM AMBIENT Ta= 27.1 °C</th> <th>HIGH AMBIENT Ta= 50 °C</th> </tr> </thead> <tbody> <tr><td>1</td><td>LF2</td><td>TR548-R2</td><td>44.4°C</td><td>64.4°C</td></tr> <tr><td>2</td><td>U1</td><td>PWM FAN4801NY</td><td>41.7°C</td><td>61.2°C</td></tr> <tr><td>3</td><td>L3</td><td>TR934 CS270125E18</td><td>53.0°C</td><td>73.7°C</td></tr> <tr><td>4</td><td>C5</td><td>330u/400V 105°C 30*30 HU</td><td>39.8°C</td><td>59.6°C</td></tr> <tr><td>5</td><td>D1</td><td>BYC10-600 10A/600V</td><td>52.1°C</td><td>71.2°C</td></tr> <tr><td>6</td><td>Q1</td><td>IRFP460A 20A/500V</td><td>48.6°C</td><td>68.3°C</td></tr> <tr><td>7</td><td>Q4</td><td>IRFP460A 20A/500V</td><td>41.0°C</td><td>60.9°C</td></tr> <tr><td>8</td><td>T1</td><td>TF2112</td><td>50.8°C</td><td>71.0°C</td></tr> <tr><td>9</td><td>BD1</td><td>10A/800V US10KB80R</td><td>49.9°C</td><td>69.4°C</td></tr> <tr><td>10</td><td>TSW1</td><td>ST-22W-R2 90°C 100mm</td><td>45.2°C</td><td>64.7°C</td></tr> <tr><td>11</td><td>C18</td><td>100u/35V L7Kh 8*11.5 YXF</td><td>41.5°C</td><td>61.2°C</td></tr> <tr><td>12</td><td>C61</td><td>330u/25V UL8Kh 8*11.5 ZLH</td><td>42.1°C</td><td>61.4°C</td></tr> <tr><td>13</td><td>C105</td><td>1000u/35V UL10Kh ZLH</td><td>34.6°C</td><td>53.4°C</td></tr> <tr><td>14</td><td>Q101</td><td>FME-220B 20A/150V</td><td>59.5°C</td><td>78.2°C</td></tr> <tr><td>15</td><td>Q104</td><td>FME-220B 20A/150V</td><td>49.4°C</td><td>68.4°C</td></tr> <tr><td>16</td><td>L100</td><td>TR940 CS270125E18</td><td>41.2°C</td><td>61.1°C</td></tr> <tr><td>17</td><td>TSW2</td><td>ST-22W-R2 90°C 100mm</td><td>40.9°C</td><td>60.4°C</td></tr> <tr><td>18</td><td>C19</td><td>47u/25V L5Kh 5*11 KY</td><td>48.6°C</td><td>68.4°C</td></tr> <tr><td>19</td><td>D900</td><td>TVS ST02D-200</td><td>44.1°C</td><td>62.4°C</td></tr> <tr><td>20</td><td>U900</td><td>PWM TNY275PN</td><td>40.5°C</td><td>60.3°C</td></tr> <tr><td>21</td><td>T900</td><td>TF1593-R2</td><td>39.3°C</td><td>58.2°C</td></tr> <tr><td>22</td><td>C955</td><td>220u/16V UL8Kh 6.3*11 ZLH</td><td>32.7°C</td><td>52.2°C</td></tr> </tbody> </table>	NO	Position		P/N	ROOM AMBIENT Ta= 27.1 °C	HIGH AMBIENT Ta= 50 °C	1	LF2	TR548-R2	44.4°C	64.4°C	2	U1	PWM FAN4801NY	41.7°C	61.2°C	3	L3	TR934 CS270125E18	53.0°C	73.7°C	4	C5	330u/400V 105°C 30*30 HU	39.8°C	59.6°C	5	D1	BYC10-600 10A/600V	52.1°C	71.2°C	6	Q1	IRFP460A 20A/500V	48.6°C	68.3°C	7	Q4	IRFP460A 20A/500V	41.0°C	60.9°C	8	T1	TF2112	50.8°C	71.0°C	9	BD1	10A/800V US10KB80R	49.9°C	69.4°C	10	TSW1	ST-22W-R2 90°C 100mm	45.2°C	64.7°C	11	C18	100u/35V L7Kh 8*11.5 YXF	41.5°C	61.2°C	12	C61	330u/25V UL8Kh 8*11.5 ZLH	42.1°C	61.4°C	13	C105	1000u/35V UL10Kh ZLH	34.6°C	53.4°C	14	Q101	FME-220B 20A/150V	59.5°C	78.2°C	15	Q104	FME-220B 20A/150V	49.4°C	68.4°C	16	L100	TR940 CS270125E18	41.2°C	61.1°C	17	TSW2	ST-22W-R2 90°C 100mm	40.9°C	60.4°C	18	C19	47u/25V L5Kh 5*11 KY	48.6°C	68.4°C	19	D900	TVS ST02D-200	44.1°C	62.4°C	20	U900	PWM TNY275PN	40.5°C	60.3°C	21	T900	TF1593-R2	39.3°C	58.2°C	22	C955	220u/16V UL8Kh 6.3*11 ZLH	32.7°C	52.2°C		
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2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 123 % LOAD Ta : 25°C	TEST : OK	P																																																																																																																			
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -40 °C	TEST : OK	P																																																																																																																			
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK	P																																																																																																																			
5	TEMPERATURE COEFFICIENT	± 0.03 % (0-50°C)	I/P : 230 VAC O/P : FULL LOAD	± 0.01 % (0-50°C)	P																																																																																																																			

6	STORAGE TEMPERATURE TEST	<ol style="list-style-type: none"> 1. Thermal shock Temperature : -45°C~ +90°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	P
7	THERMAL SHOCK TEST	<ol style="list-style-type: none"> 1. Thermal shock Temperature : -40°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 : 230VAC/Full Load AC ON/OFF TEST turn on 58sec ; turn off 2sec 	OK	P
8	VIBRATION TEST	1 Carton & 1 Set <ol style="list-style-type: none"> (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 5G (5) Test Time : 60min in each axis (X.Y.Z) (6) Ta : 25°C 	TEST : OK	P
9	CAPACITOR LIFE CYCLE	MSP-450-24:SUPPOSE C105 IS THE MOST CRITICAL COMPONENT <ol style="list-style-type: none"> (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME 	<ol style="list-style-type: none"> (1) 1849473HRS (2) 434362.5HRS (3) 502524HRS 	P
10	MTBF	Conducted by Parts Stress Analysis Prediction 1171.9Khrs. Telcordia SR-332 (Bellcore) ; 159.4K hrs min. MIL-HDBK-217F (25°C)		P

SAMPLE	TEST RESULT	TESTER	APPROVAL
RD SAMPLE	PASS	SANFORD SU	VINCENT TSENG
PRODUCT SAMPLE	PASS	SANFORD SU	VINCENT TSENG

2009/08/04 A50-F023