TECHNICAL DOCUMENTATION

COMMERCIAL CODE: K8400

PRODUCT NAME:
Vertex

DATE: 2/10/2014

REVISION: 01

TECHNICAL DOCUMENTATION

MANUFACTURED BY

Velleman NV
Legen Heirweg 33
9890 Gavere
Belgium

PREPARED BY	APPROVED BY
M. Denecker	
Date:2/10/2014	Date:

PRODUCT FEATURES AND SPECIFICATIONS:

PRINTING

- Print technology: Fused Filament Fabrication (FFF)
- Layer resolution: standard: 0.1 mm
  (maximum: 0.2 mm – minimum: 0.05 mm)
- Build volume: 180 x 240 x 190 mm (7” x 9.4” x 7.5”)
- Print speed: 30 mm/s – 120 mm/s
- Travel speed: 30 mm/s – 300 mm/s
- Build plate surface: Removable layer of BuildTak™
  (consumable; also sold separately)
- Filament diameter: 1.75 mm
  (accepts all filament spools with a mounting hole ≥ 53 mm).
  Open filament policy
- Prints: PLA, ABS, HIPS
  Testing with other materials in progress
- Nozzle 1&2 diameter: 0.35mm
  One nozzle supplied. Second nozzle optional
- Distance between nozzles: 23.7 mm
- Maximum nozzle operating temperature: 270 °C

SOFTWARE

- Firmware: Modified Open Source Marlin 3D Printer
  Firmware – user upgradable
- Software: Repetier – CuraEngine – Slic3(RepRap compatible)

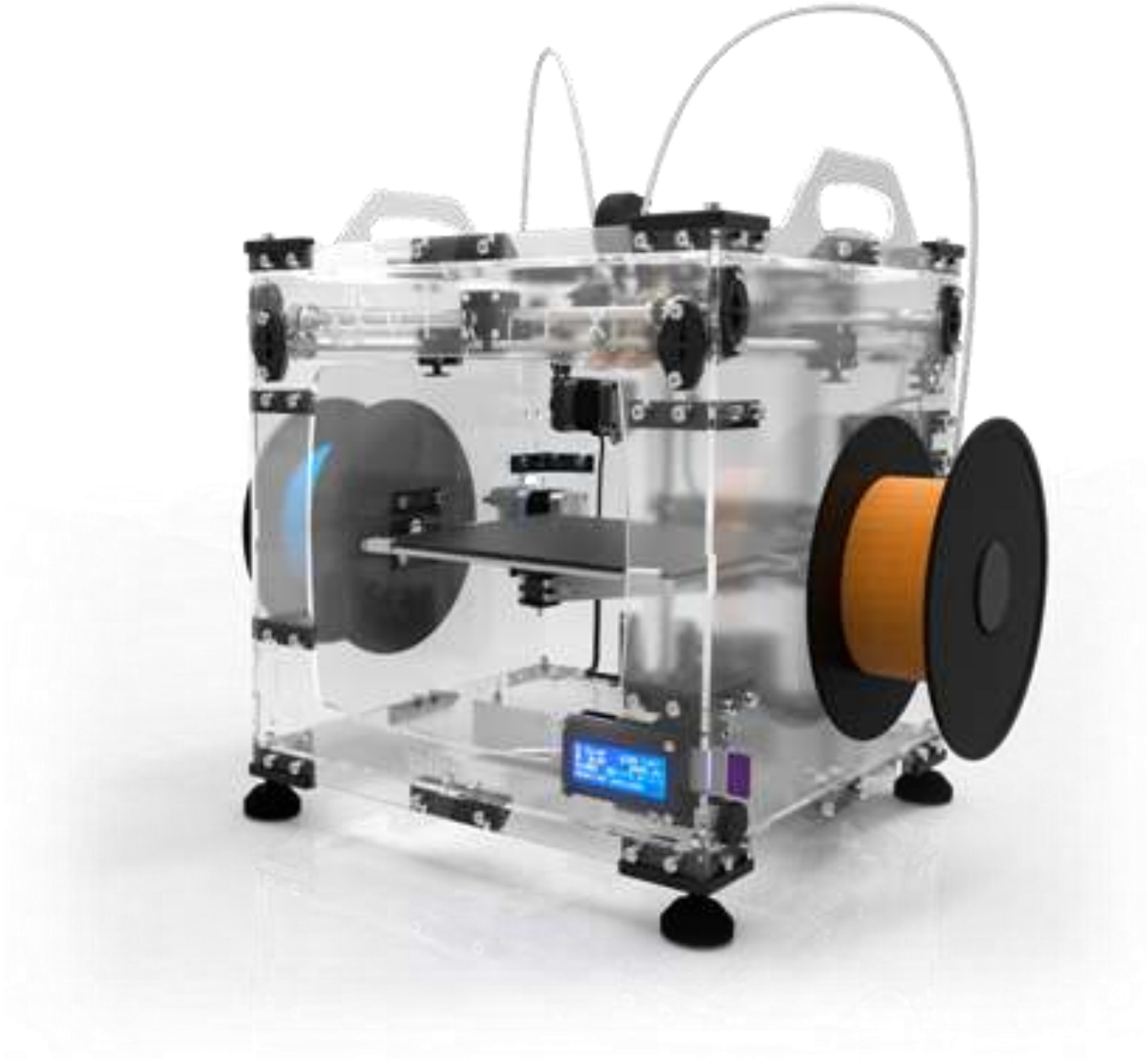
PHYSICAL

- Dimensions: X Y Z 360 – 380 – 395 mm
  (14” x 15” x 15.5”) (without filament spools)
- Frame: Polycarbonate panels

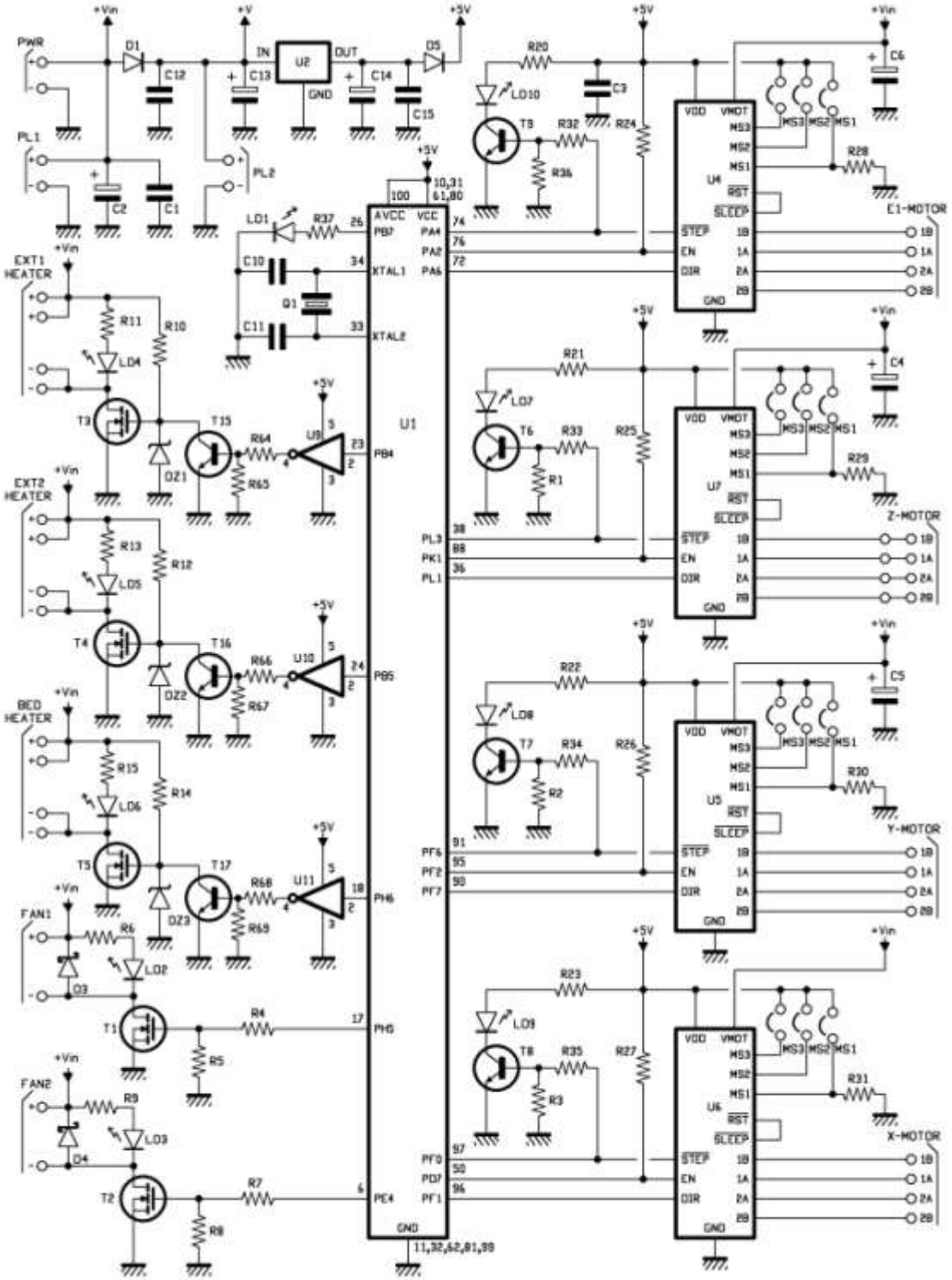
ELECTRICAL

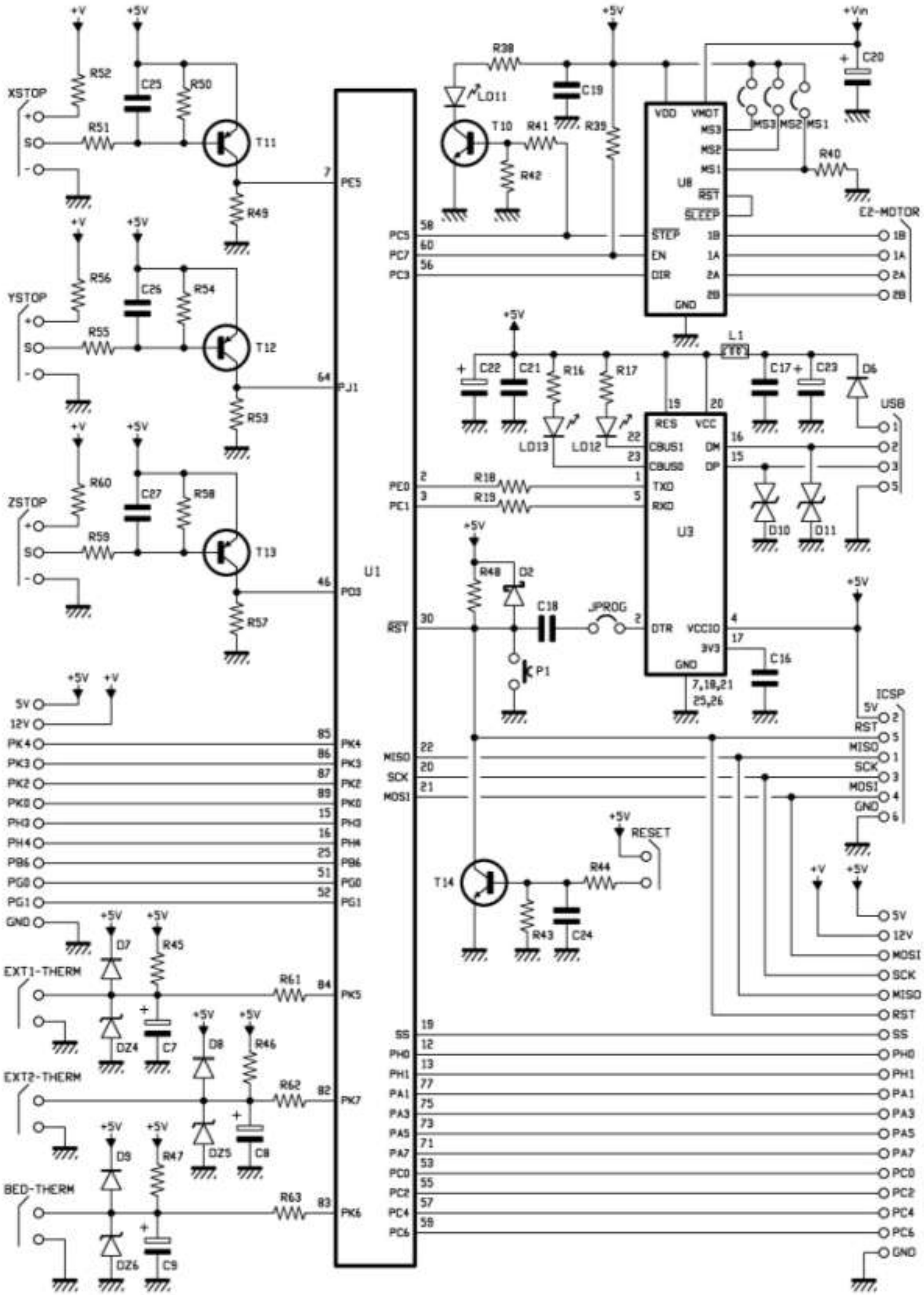
- Communication: USB 2.0 or SD card
- Controller board: AVR ATmega2560 based
  Dual head and heated bed capable
- 3 Optical endstops
- Display: 4 x 20 ch. blue LCD with white backlight
- External power supply MEAN WELL RS-150-15
  I/P: U_{ac}: 88-132V~ / 176-264V~ (selected by switch), f: 47-63Hz, I_{typ}:3A@115V~ / 2A@230V~
  O/P: U_{dc}:15Vdc, I_{max} : 10A, P_{max}: 150W

PRODUCT PICTURE:

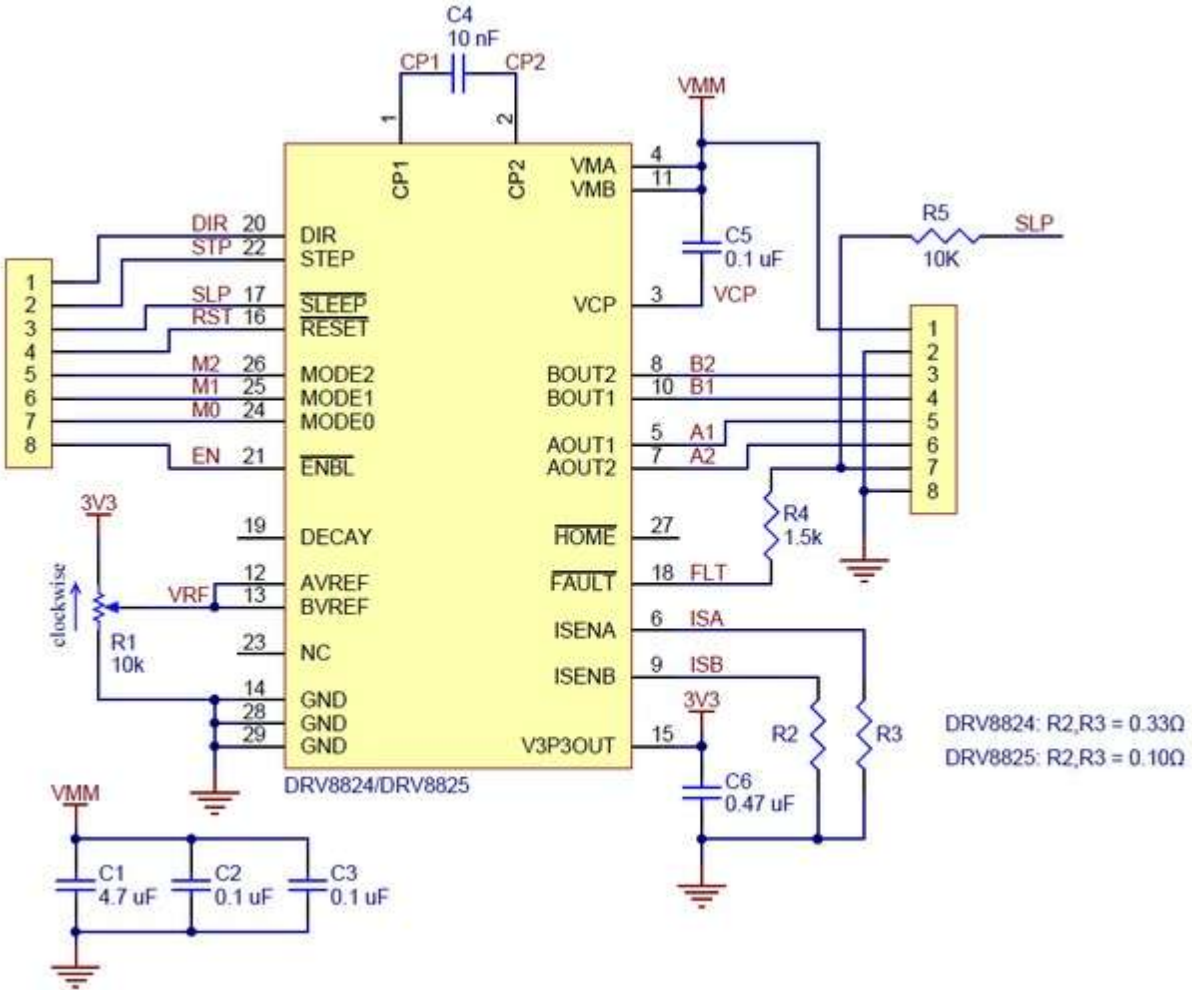


SCHEMATIC DIAGRAM MAIN BOARD:

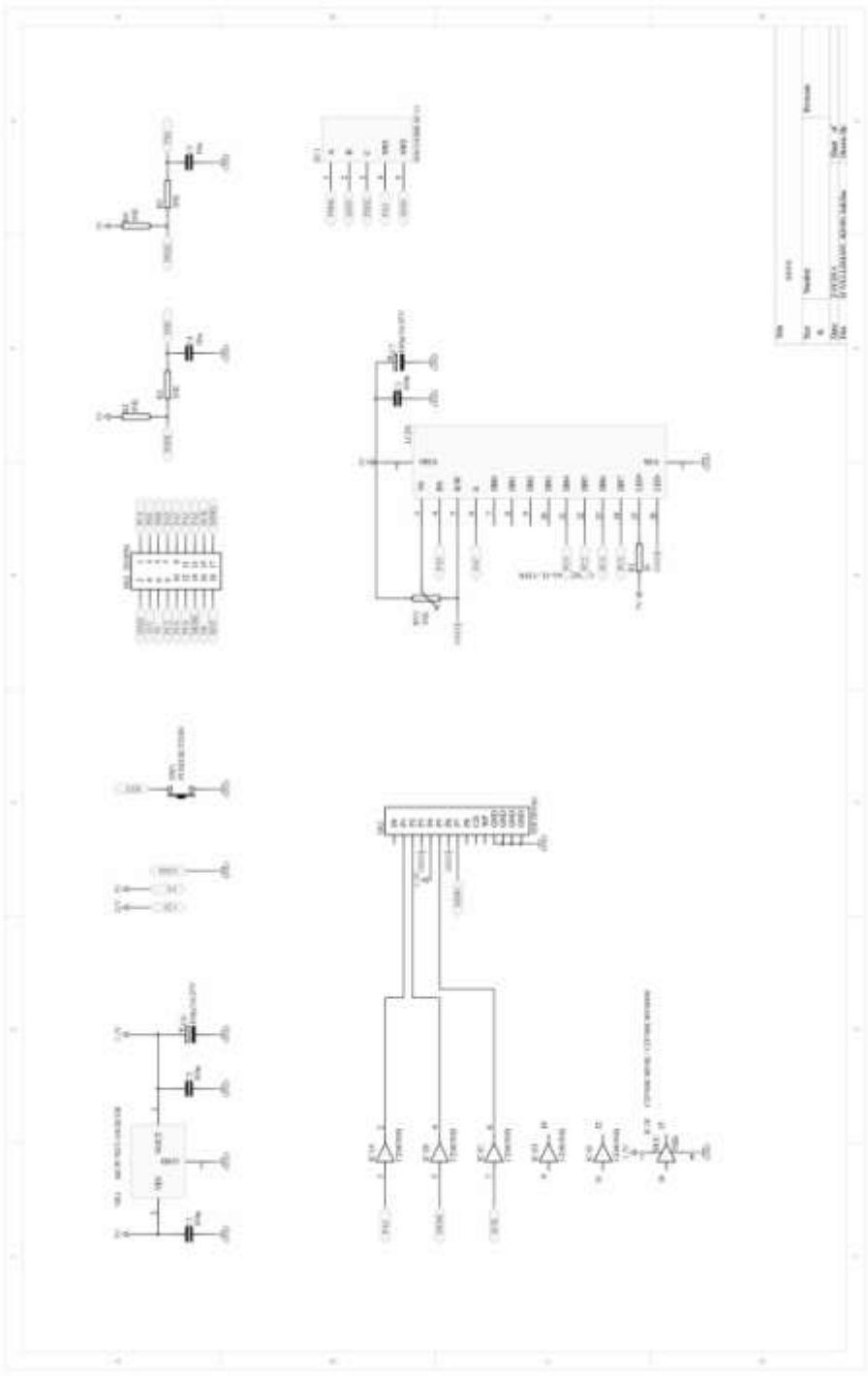



XSTOP
YSTOP
ZSTOP
T11
T12
T13
T10
T14
U1
U3
U8
E2-MOTOR
USB
ICSP
RESET
JPROG
P1
LD11
LD12
LD13
EXT1-THERM
EXT2-THERM
BED-THERM
R38
R39
R40
R41
R42
R43
R44
R48
R49
R50
R51
R52
R53
R54
R55
R56
R57
R58
R59
R60
R61
R62
R63
C7
C8
C9
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
D2
D6
D7
D8
D9
D10
D11
DZ4
DZ5
DZ6
L1
MS1
MS2
MS3
VDD
VMOT
RST
SLEEP
STEP
EN
DIR
GND
RES
VCC
CBUS1
CBUS0
TXD
RXD
DTR
VCCIO
3V3
DM
DP
PE5
PJ1
PD3
PC5
PC7
PC3
PE0
PE1
MISO
SCK
MOSI
SS
+5V
+V
+Vin
5V
12V
PK4
PK3
PK2
PK0
PH3
PH4
PB6
PG0
PG1
PK5
PK7
PK6
PH0
PH1
PA1
PA3
PA5
PA7
PC0
PC2
PC4
PC6

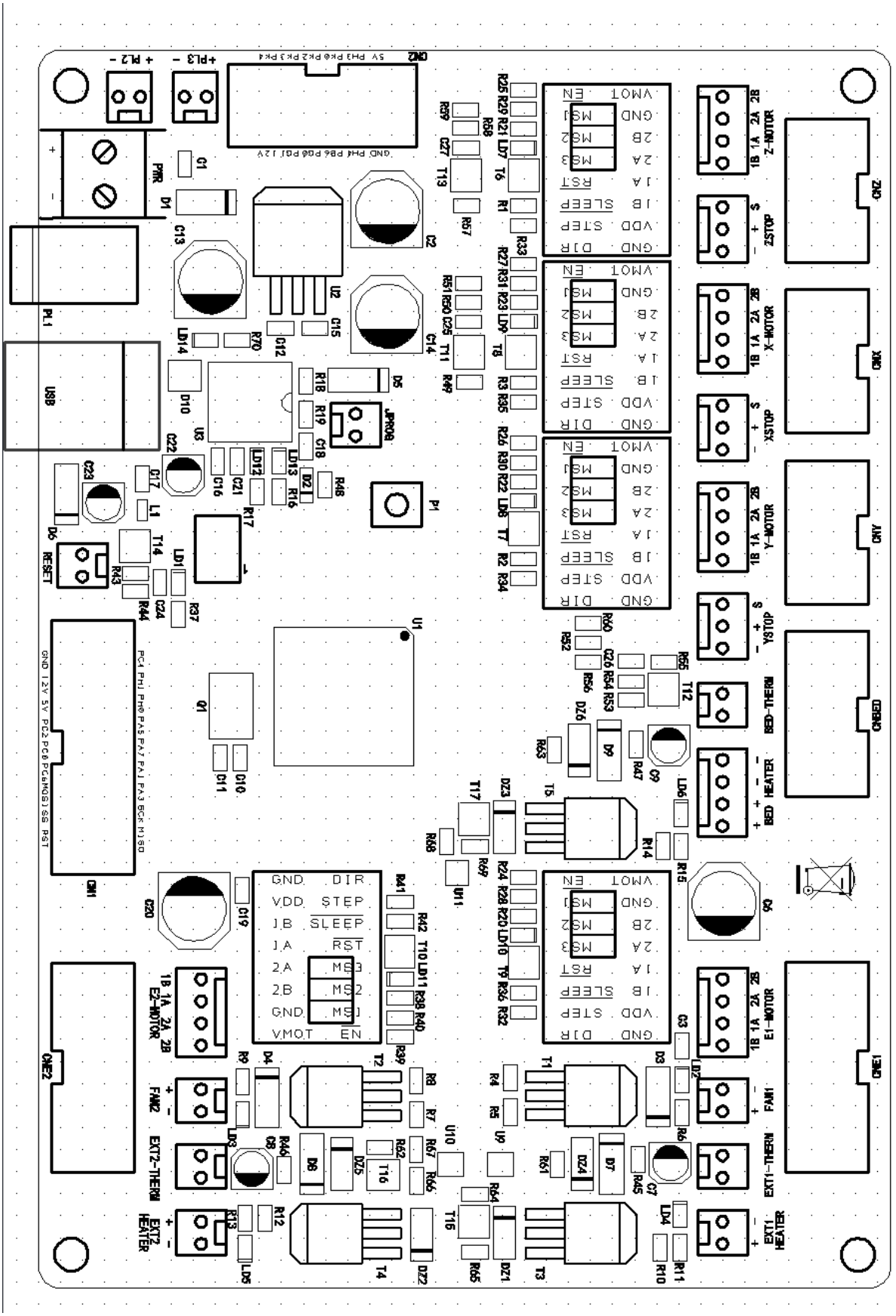
SCHEMATIC DIAGRAM STEPPER DRIVER BOARD:



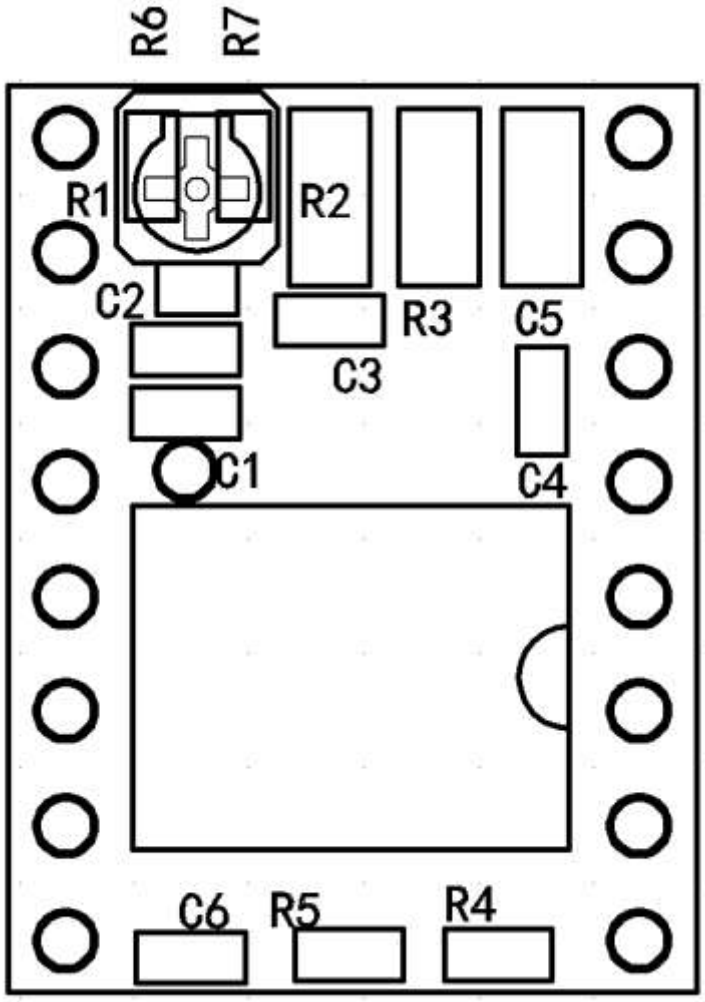
SCHEMATIC DIAGRAM STAND-ALONE CONTROLLER:



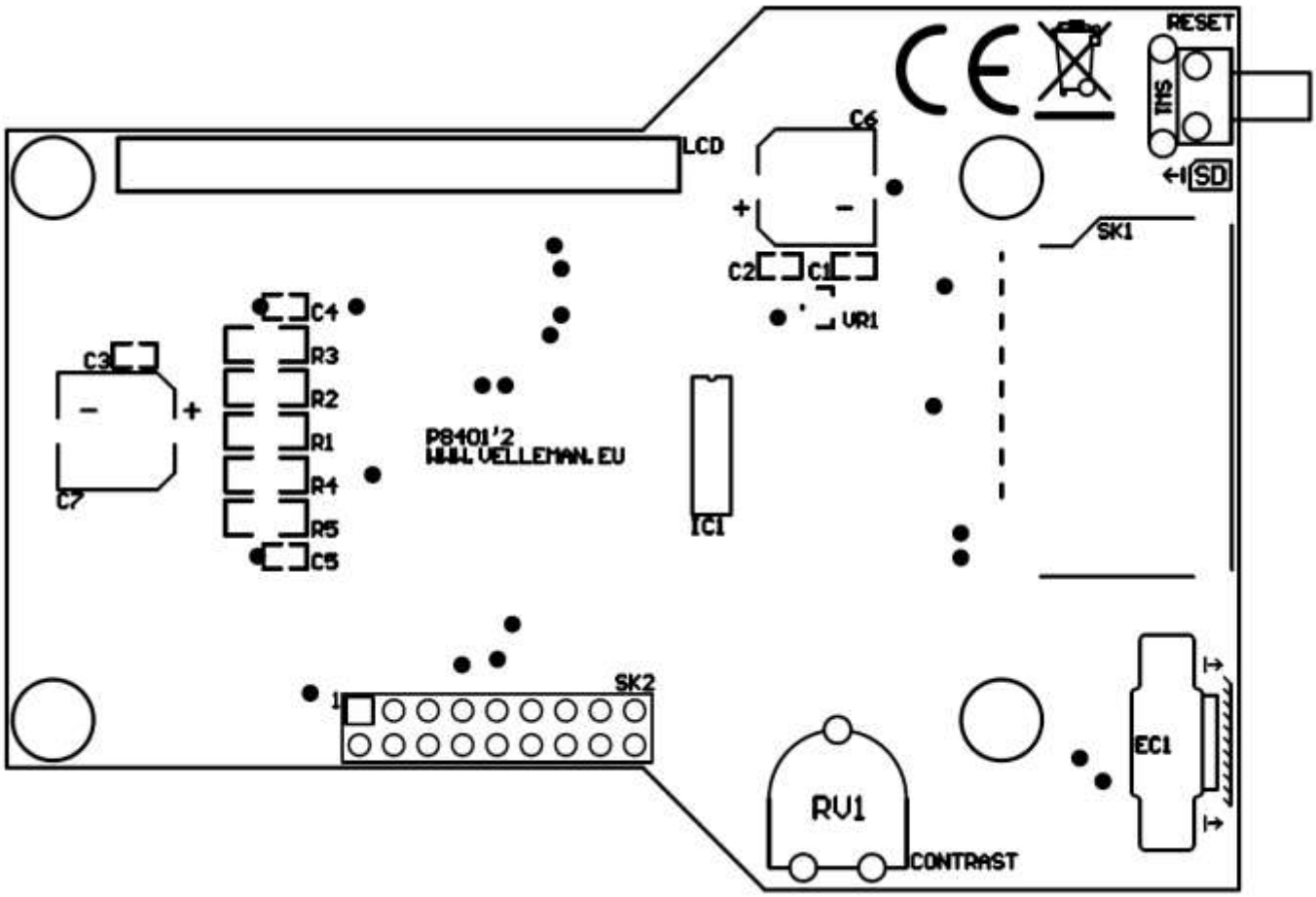
PCB LAYOUT MAIN BOARD:



PCB LAYOUT STEPPER DRIVER BOARD:



PCB LAYOUT STAND-ALONE CONTROLLER:



BOM MAIN BOARD:

Name	Designator	Description
PCB		
Resistors		
	R1	10 kohm
	R2	10 kohm
	R3	10 kohm
	R4	10 ohm
	R5	100 kohm
	R6	1,8 kohm
	R7	10 ohm
	R8	100 kohm
	R9	1,8 kohm
	R10	4,7 kohm
	R11	1,8 kohm
	R12	4,7 kohm
	R13	1,8 kohm
	R14	4,7 kohm
	R15	1,8 kohm
	R16	470 ohm
	R17	470 ohm
	R18	10 ohm
	R19	10 ohm
	R20	330 ohm
	R21	330 ohm
	R22	330 ohm
	R23	330 ohm
	R24	10 kohm
	R25	10 kohm
	R26	10 kohm
	R27	10 kohm
	R28	100 kohm
	R29	100 kohm
	R30	100 kohm
	R31	100 kohm
	R32	4,7 kohm
	R33	4,7 kohm
	R34	4,7 kohm
	R35	4,7 kohm
	R36	10 kohm
	R37	330 ohm
	R38	330 ohm
	R39	10 kohm
	R40	100 kohm
	R41	4,7 kohm
	R42	10 kohm
	R43	10 kohm
	R44	4,7 kohm
	R45	4,7 kohm
	R46	4,7 kohm
	R47	4,7 kohm
	R48	4,7 kohm
	R49	10 kohm

R50	1 kohm
R51	1 kohm
R52	
R53	10 kohm
R54	1 kohm
R55	1 kohm
R56	
R57	10 kohm
R58	1 kohm
R59	1 kohm
R60	
R61	4,7 kohm
R62	4,7 kohm
R63	4,7 kohm
R64	4,7 kohm
R65	10 kohm
R66	4,7 kohm
R67	10 kohm
R68	4,7 kohm
R69	10 kohm
R70	4,7 kohm

Capacitors

C1	100nF ceramic
C2	100µF/25V electrolytic
C3	100nF ceramic
C4	
C5	
C6	100µF/25V electrolytic
C7	10µF/35V electrolytic
C8	10µF/35V electrolytic
C9	10µF/35V electrolytic
C10	22pF ceramic
C11	22pF ceramic
C12	100nF ceramic
C13	100µF/25V electrolytic
C14	100µF/25V electrolytic
C15	100nF ceramic
C16	100nF ceramic
C17	100nF ceramic
C18	100nF ceramic
C19	100nF ceramic
C20	100µF/25V electrolytic
C21	100nF ceramic
C22	4,7µF/35V electrolytic
C23	4,7µF/35V electrolytic
C24	100nF ceramic
C25	100nF ceramic
C26	100nF ceramic
C27	100nF ceramic

Diodes

D1	GF1M
D2	BAT42W

D3	MBRA140TRPBF
D4	MBRA140TRPBF
D5	GF1M
D6	GF1M
D7	GF1M
D8	GF1M
D9	GF1M
D10	PGB102ST23WR

Transistors

T1	BUK6215-75C
T2	BUK6215-75C
T3	BUK6215-75C
T4	BUK6215-75C
T5	BUK6215-75C
T6	BC817
T7	BC817
T8	BC817
T9	BC817
T10	BC817
T11	BC807
T12	BC807
T13	BC807
T14	BC817
T15	BC817
T16	BC817
T17	BC817

IC

U1	ATMEGA2560-16AU
U2	MC7805ABD2T
U3	FT232RL
U4	Female header pitch 2,54 8 pole (2x) (for stepper driver)
U5	Female header pitch 2,54 8 pole (2x) (for stepper driver)
U6	Female header pitch 2,54 8 pole (2x) (for stepper driver)
U7	Female header pitch 2,54 8 pole (2x) (for stepper driver)
U8	Female header pitch 2,54 8 pole (2x) (for stepper driver)
U9	SN74LVC1G14DBVR
U10	SN74LVC1G14DBVR
U11	SN74LVC1G14DBVR

LED

LD1	green top view universal (Kingbright KP-2012CGCK)
LD2	red top view universal (Kingbright KP-2012EC)
LD3	red top view universal (Kingbright KP-2012EC)
LD4	red top view universal (Kingbright KP-2012EC)
LD5	red top view universal (Kingbright KP-2012EC)
LD6	red top view universal (Kingbright KP-2012EC)
LD7	red top view universal (Kingbright KP-2012EC)
LD8	red top view universal (Kingbright KP-2012EC)
LD9	red top view universal (Kingbright KP-2012EC)
LD10	red top view universal (Kingbright KP-2012EC)
LD11	red top view universal (Kingbright KP-2012EC)

	LD12	green top view universal (Kingbright KP-2012CGCK)
	LD13	red top view universal (Kingbright KP-2012EC)
	LD14	green top view universal (Kingbright KP-2012CGCK)

XTAL

	Q1	X-tal 16 MHz

Zener diodes

	DZ1	BZV55-C10
	DZ2	BZV55-C10
	DZ3	BZV55-C10
	DZ4	BZV55-C5V1
	DZ5	BZV55-C5V1
	DZ6	BZV55-C5V1

Coil

	L1	BK0603HS330-T

Misc.

	PL1	DC jack 2,1mm / 5,5mm
	P1	tactile switch 6x6mm h:5mm
	USB	USB-B connector through hole
	11x	Board to wire - male - 2 pole
	3x	Board to wire - male - 3 pole
	6x	Board to wire - male - 4 pole
	1x	Pin header male pitch 2,54 3+3 pole
	1x	Jumper

BOM STEPPER DRIVER BOARD:

Name	Designator	Description
PCB		
Resistors		
	R1	Trimmer 10 kohm (cfr. Panasonic EVM2WSX80B14)
	R2	0,10 ohm
	R3	0,10 ohm
	R4	1,5 kohm
	R5	10 kohm
	R6	
	R7	
Capacitors		
	C1	2,2µF / 25V ceramic
	C2	100nF ceramic
	C3	100nF ceramic
	C4	10nF ceramic
	C5	100nF ceramic
	C6	470nF ceramic
IC		
	U1	DRV8825 (Texas instruments)
Connector		
	2x	Male pin header pitch 2,54 8 pin

BOM STAND-ALONE CONTROLLER:

Name:	Designator	Description
P8401'1	/	PCB P8401'1
100µF/25V	C6,C7	ELCO RADIAL
10K	R2,R3,R4,R5	SMD RESISTOR 10K
33E	R1	SMD RESISTOR 33E
100nF	C1,C2,C3	SMD CAPACITOR
10nF	C4,C5	SMD CAPACITOR
MCP1702T-3302E/CB	VR1	LOW DROP REGULATOR 3,3V
CD74HC4050M96	IC1	HEX BUFFER SMD SOIC-16
K010SV	RV1	TRIMMER 10K (SMALL - VERT - FOR SCREWDRIVER)
CC092	for LCD	16-POLE SINGLE ROW FEMALE HEADER STRAIGHT PITCH 2,54mm HEIGHT 5mm
211-12-09-G-B	SK2	18-POLE DUAL ROW MALE HEADER 90° PITCH 2,54 mm
EC11MSDHBFZ	EC1	SHAFT ENCODER 11mm METAL - 20 PULSE WITH PUSHBUTTON
SDC009A0	SK1	SD CARD CONNECTOR
TS-04PV	SW1	TACT SWITCH

EC-Conformity Declaration

For the following equipment :

Product Name: Switching Power Supplies

Model Designation: Rx-yz (x=S,D,ID,T,Q / y=125,150 / z=-3.3,-5,-12,-15,-24,-48,A,B,C,D) ; RID-125-1205 ; RID-125-2405 ; NES-150-3.3 ; NES-150-5 ;NES-150-7.5 ;NES-150-9 ; NES-150-12 ; NES-150-15 ; NES-150-24 ; NES-150-48 ; RS-150-7.5 ; RS-150-9 ; RS-150-19

is herewith confirmed to comply with the requirements set out in the Council Directive, the following standards were applied :

RoHS Directive (2011/65/EU)

Low Voltage Directive (2006/95/EC) :

EN60950-1:2006+A11+A1+A12 TUV certificate No : R50046942

Electromagnetic Compatibility Directive (2004/108/EC) :

EMI (Electro-Magnetic Interference)

Conducted emission / Radiated emission		
	EN55022:2010	Class B
	EN55011:2009+A1:2010 (Group 1)	Class B
Harmonic current	EN61000-3-2:2006+A1:2009+A2:2009	
Voltage flicker	EN61000-3-3:2008	

EMS (Electro-Magnetic Susceptibility)

EN55024:2010 EN61204-3:2000 EN61000-6-2:2005

ESD air	EN61000-4-2:2009	Level 3	8KV
ESD contact	EN61000-4-2:2009	Level 2	4KV
RF field susceptibility	EN61000-4-3:2006+A1:2008+A2:2010	Level 3	10V/m
EFT bursts	EN61000-4-4:2012	Level3	2KV/5KHz
Surge susceptibility	EN61000-4-5:2006	Level 4	2KV/Line-Line 4KV/Line-Earth
Conducted susceptibility	EN61000-4-6:2009	Level 3	10V
Magnetic field immunity	EN61000-4-8:2010	Level 4	30A/m
Voltage dip, interruption	EN61000-4-11:2004	>95% dip 0.5 periods	30% dip 25 periods >95% interruptions 250 periods

Note:
A component power supply with load will be installed into final equipment which consists of an electronically shielded metal enclosure. Since EMC performance will be affected by the complete installation, the final equipment manufacturers must re-qualify EMC Directive on the complete installation again.
The EMC tests mentioned above are performed using a well defined metal plate to simulate said metal enclosure.
For guidance on how to perform these EMC tests, please refer to "EMI testing of component power supplies".(as available on http://www.meanwell.com)".

This Declaration is effective from serial number EB3xxxxxxx

Person responsible for marking this declaration :

Mean Well Enterprises Co., Ltd.
(Manufacturer Name)

No.28, Wuquan 3rd Rd., Wugu Dist., New Taipei City 248, Taiwan (R.O.C.)
(Manufacturer Address)

Johnny Huang/Senior Verification Engineer : _____ Ted Cheng/Product Manager : _____
(Name / Position) (Signature) (Name / Position) (Signature)

Taiwan Aug. 29, 2013
(Place) (Date)

150W Single Output Switching Power Supply

RS-150 series

Features :

- Protections: Short circuit / Overload / Over voltage
- Cooling by free air convection
- LED indicator for power on
- 100% full load burn-in test
- All using 105℃ long life electrolytic capacitors
- Withstand 300VAC surge input for 5 second
- High operating temperature up to 70℃
- Withstand 5G vibration test
- High efficiency, long life and high reliability
- 3 years warranty

SPECIFICATION

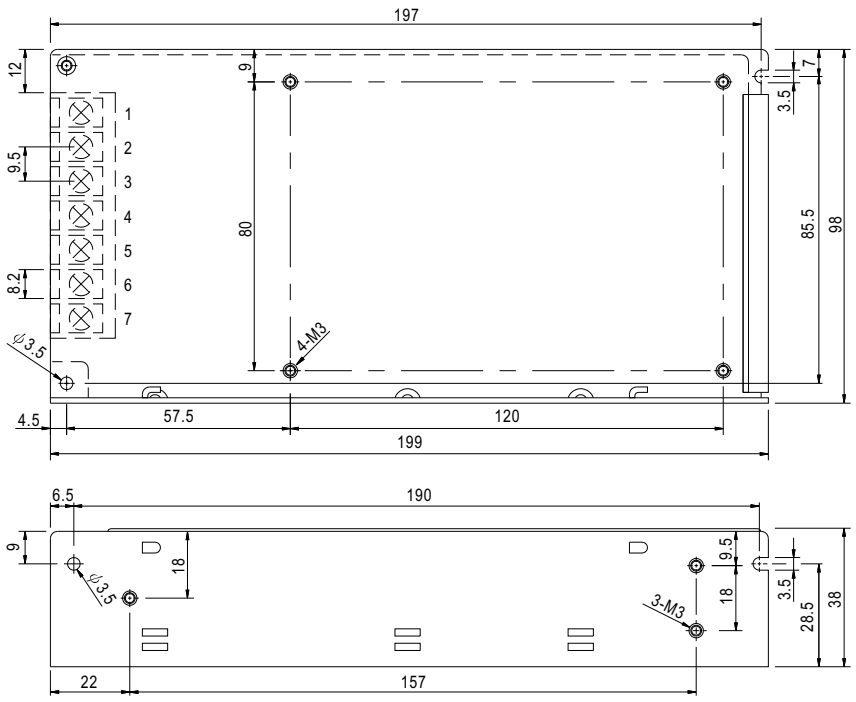
MODEL		RS-150-3.3	RS-150-5	RS-150-12	RS-150-15	RS-150-24	RS-150-48
OUTPUT	DC VOLTAGE	3.3V	5V	12V	15V	24V	48V
	RATED CURRENT	30A	26A	12.5A	10A	6.5A	3.3A
	CURRENT RANGE	0 ~ 30A	0 ~ 26A	0 ~ 12.5A	0 ~ 10A	0 ~ 6.5A	0 ~ 3.3A
	RATED POWER	99W	130W	150W	150W	156W	158.4W
	RIPPLE & NOISE (max.) Note.2	80mVp-p	80mVp-p	120mVp-p	120mVp-p	120mVp-p	200mVp-p
	VOLTAGE ADJ. RANGE	3.2V ~ 3.5V	4.75 ~ 5.5V	11.4 ~ 13.2V	14.25 ~ 16.5V	22.8 ~ 26.4V	45.6 ~ 52.8V
	VOLTAGE TOLERANCE Note.3	±3.0%	±2.0%	±1.0%	±1.0%	±1.0%	±1.0%
	LINE REGULATION Note.4	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%	±0.5%
	LOAD REGULATION Note.5	±2.0%	±1.0%	±0.5%	±0.5%	±0.5%	±0.5%
	SETUP, RISE TIME	800ms, 20ms/230VAC 1200ms, 30ms/115VAC at full load					
	HOLD UP TIME (Typ.)	28ms/230VAC 20ms/115VAC at full load					
INPUT	VOLTAGE RANGE	88 ~ 132VAC / 176 ~ 264VAC selected by switch 248 ~ 373VDC(Withstand 300VAC surge for 5sec. Without damage)					
	FREQUENCY RANGE	47 ~ 63Hz					
	EFFICIENCY(Typ.)	74%	78%	83%	84%	86%	87%
	AC CURRENT (Typ.)	3A/115VAC 2A/230VAC					
	INRUSH CURRENT (Typ.)	COLD START 40A/230VAC					
	LEAKAGE CURRENT	<2mA / 240VAC					
PROTECTION	OVERLOAD Note.8	110 ~ 150% rated output power					
		Protection type : Hiccup mode, recovers automatically after fault condition is removed					
	OVER VOLTAGE	3.8 ~ 4.45V	5.75 ~ 6.75V	13.8 ~ 16.2V	17.25 ~ 20.25V	27.6 ~ 32.4V	55.2 ~ 64.8V
		Protection type : Hiccup mode, recovers automatically after fault condition is removed					
ENVIRONMENT	WORKING TEMP.	-25 ~ +70℃ (Refer to output load derating curve)					
	WORKING HUMIDITY	20 ~ 90% RH non-condensing					
	STORAGE TEMP., HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH					
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃)					
	VIBRATION	10 ~ 500Hz, 5G 10min./1cycle, period for 60min. each along X, Y, Z axes					
SAFETY & EMC (Note 6)	SAFETY STANDARDS	UL60950-1, TUV EN60950-1 approved					
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:1.5KVAC O/P-FG:0.5KVAC					
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:100M Ohms / 500VDC / 25℃ / 70% RH					
	EMI CONDUCTION & RADIATION	Compliance to EN55022 (CISPR22) Class B					
	HARMONIC CURRENT	Compliance to EN61000-3-2,-3					
	EMS IMMUNITY	Compliance to EN61000-4-2,3,4,5,6,8,11; ENV50204, EN61000-6-2 (EN50082-2), heavy industry level, criteria A					
OTHERS	MTBF	244KHrs min. MIL-HDBK-217F (25℃)					
	DIMENSION	199*98*38mm (L*W*H)					
	PACKING	0.7Kg; 20pcs/15Kg/0.8CUFT					

NOTE

1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature.
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor.
3. Tolerance : includes set up tolerance, line regulation and load regulation.
4. Line regulation is measured from low line to high line at rated load.
5. Load regulation is measured from 0% to 100% rated load.
6. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. For guidance on how to perform these EMC tests, please refer to “EMI testing of component power supplies.” (as available on http://www.meanwell.com)
7. Length of set up time is measured at cold first start. Turning ON/OFF the power supply very quickly may lead to increase of the set up time.
8. Extra consideration should be taken when selecting output wiring for 3.3V and 5V models. This is to prevent the protection modes for overload and short circuit from becoming constant power.

■ Mechanical Specification

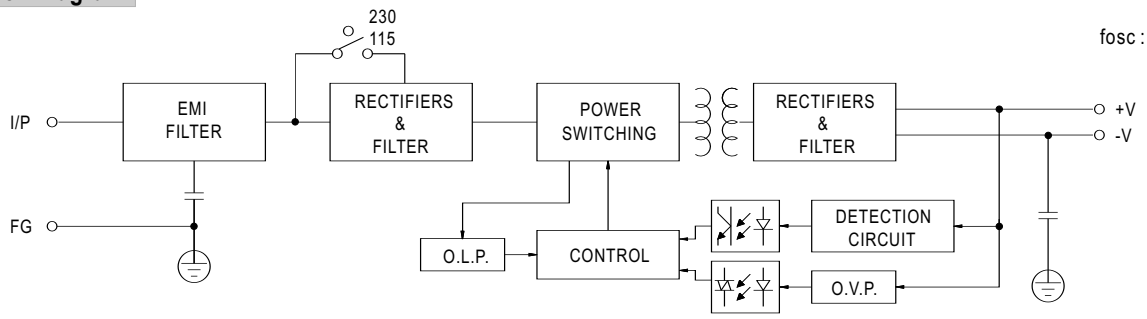
Case No. 902A Unit:mm



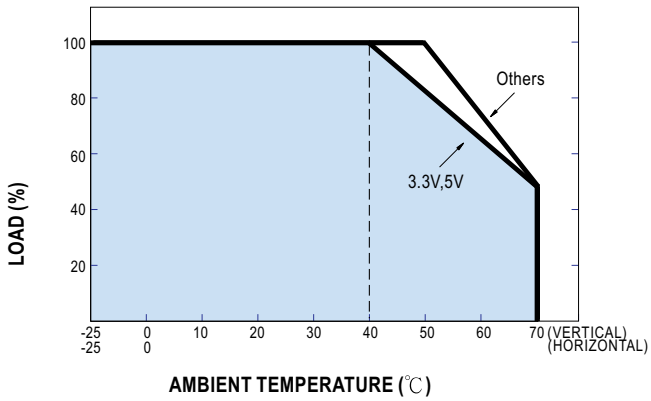
Terminal Pin No. Assignment

Pin No.	Assignment	Pin No.	Assignment
1	AC/L	4,5	DC OUTPUT -V
2	AC/N	6,7	DC OUTPUT +V
3	FG ⏚		

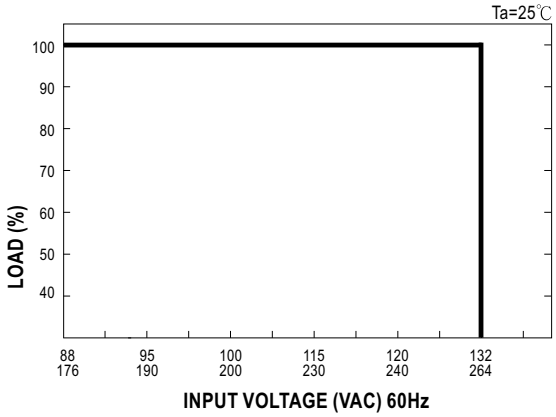
■ Block Diagram



■ Derating Curve



■ Static Characteristics



MODEL：RS-150-15

OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	RIPPLE & NOISE	V1: 120 mVp-p (Max)	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	V1: 29 mVp-p (Max)	P
2	OUTPUT VOLTAGE ADJUST RANGE	CH1: 14.25 V~ 16.5 V	I/P: 230 VAC I/P: 115 VAC O/P:MIN LOAD Ta:25℃	13.93V~ 16.95V/ 230VAC 13.93V~ 16.95 V/ 115VAC	P
3	OUTPUT VOLTAGE TOLERANCE	V1: -1 %~ 1 % (Max)	I/P: 176 VAC / 264 VAC O/P:FULL/ 0 % LOAD Ta:25℃	V1: 0.05 %~ -0.05 %	P
4	LINE REGULATION	V1:-0.5 %~ 0.5 % (Max)	I/P: 176 VAC ~ 264 VAC O/P:FULL LOAD Ta:25℃	V1: 0 %~ 0 %	P
5	LOAD REGULATION	V1: -0.5 %~ 0.5 % (Max)	I/P:230 VAC O/P:FULL ~MIN LOAD Ta:25℃	V1: 0.05 %~ -0.05 %	P
6	SET UP TIME	230 VAC/800 ms (Max) 115 VAC/1200 ms (Max)	I/P:230 VAC I/P:115 VAC O/P:FULL LOAD Ta:25℃	230VAC/ 492 ms 115VAC/ 440 ms	P
7	RISE TIME	230 VAC/20 ms (Max) 115 VAC/30 ms (Max)	I/P:230 VAC I/P:115 VAC O/P:FULL LOAD Ta:25℃	230 VAC/ 11 ms 115 VAC/ 11 ms	P
8	HOLD UP TIME	230 VAC/ 20 ms (Min) 115 VAC/ 10 ms (Min)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	230VAC/ 31 ms 115VAC/ 27 ms	P
9	OVER/UNDERSHOOT TEST	＜±5%	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	TEST: ＜5 %	P
10	DYNAMIC LOAD	V1: 1500 mVp-p	I/P: 230 VAC O/P:FULL /Min LOAD 90%DUTY/1KHZ Ta:25℃	320 mVp-p	P

INPUT FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	INPUT VOLTAGE RANGE	176VAC~ 264 VAC	I/P:TESTING O/P:FULL LOAD Ta:25℃	111 V~ 264 V	P
			I/P: LOW-LINE-3V= 173 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	47 HZ ~ 63 HZ NO DAMAGE OSC	I/P: 176 VAC ~ 264 VAC O/P:FULL~MIN LOAD Ta:25℃	TEST: OK	P
3	EFFICIENCY	84 % (TYP)	I/P: 230 VAC O/P:FULL LOAD Ta:25℃	84.1 %	P
4	INPUT CURRENT	230 V/ 2 A (Max) 115 V/ 3 A (Max)	I/P: 230 VAC I/P: 115 VAC O/P:FULL LOAD Ta:25℃	I = 1.5 A/ 230 VAC I = 2.7 A/ 115 VAC	P
5	INRUSH CURRENT	230 V/ 50 A (Max) COLD START	I/P:230 VAC O/P:FULL LOAD Ta:25℃	I = 36 A/ 230 VAC	P
6	LEAKAGE CURRENT	< 2 mA / 240 VAC	I/P:254 VAC O/P:Min LOAD Ta:25℃	L-FG: 0.56 mA N-FG: 0.56 mA	P

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	OVER LOAD PROTECTION	110 %~ 150 %	I/P: 230 VAC I/P: 115 VAC O/P:TESTING Ta:25℃	119 %/ 230 VAC 119 %/ 115 VAC Hiccup Mode	P
2	OVER VOLTAGE PROTECTION	CH1: 17.25V~ 20.25 V	I/P: 230 VAC I/P: 115 VAC O/P:MIN LOAD Ta:25℃	18.3 V/ 230 VAC 18.3 V/ 115 VAC Hiccup Model	P
3	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264 VAC O/P: Full LOAD Ta:25℃	NO DAMAGE Hiccup Mode	P

ENVIRONMENT TEST

<table>
<tr><th>NO</th><th>TEST ITEM</th><th>SPECICATION</th><th>TEST CONDITION</th><th>RESULT</th><th>VERDICT</th></tr>
<tr><td>1</td><td>TEMPERATURE RISE TEST</td><td colspan="3">MODEL： RS-150-24
1. ROOM AMBIENT BURN-IN：14 HRS
I/P: 230 VAC O/P: FULL LOAD Ta= 30.1 ℃
2. HIGH AMBIENT BURN-IN： 3 HRS
I/P: 230 VAC O/P: FULL LOAD Ta= 46.7 ℃

<table>
<tr><th>NO</th><th>Position</th><th>P/N</th><th>ROOM AMBIENT Ta= 30.1 ℃</th><th>HIGH AMBIENT Ta= 46.7 ℃</th></tr>
<tr><td>1</td><td>LF1</td><td>LF-058</td><td>57.9℃</td><td>72.5℃</td></tr>
<tr><td>2</td><td>BD1</td><td>RS606M 6A/800V REC</td><td>81.4℃</td><td>95.1℃</td></tr>
<tr><td>3</td><td>C5</td><td>330U/200V RUB 105℃</td><td>70.8℃</td><td>83.5℃</td></tr>
<tr><td>4</td><td>T1 CORE</td><td>TF-1058 LS</td><td>82.8℃</td><td>96.4℃</td></tr>
<tr><td>5</td><td>T1 COIL</td><td>TF-1058 LS</td><td>83.6℃</td><td>96.6℃</td></tr>
<tr><td>6</td><td>ZD1</td><td>P6KE300A PAN</td><td>85.3℃</td><td>98.5℃</td></tr>
<tr><td>7</td><td>D60</td><td>D9202 20A/200V FUJI</td><td>83.5℃</td><td>96.6℃</td></tr>
<tr><td>8</td><td>D1</td><td>HER208 2A/1KV REC</td><td>82.6℃</td><td>96.5℃</td></tr>
<tr><td>9</td><td>U1</td><td>1203 ON</td><td>75.4℃</td><td>88.4℃</td></tr>
<tr><td>10</td><td>Q1</td><td>2SK2082 9A/800V FUJI</td><td>76.0℃</td><td>91.4℃</td></tr>
<tr><td>11</td><td>L60</td><td>TR-411</td><td>93.7℃</td><td>106.8℃</td></tr>
<tr><td>12</td><td>C10</td><td>220U/35V NCC 105℃ YXF</td><td>66.0℃</td><td>80.5℃</td></tr>
<tr><td>13</td><td>C65</td><td>470U/35V NCC 105℃ KY</td><td>58.6℃</td><td>72.4℃</td></tr>
<tr><td>14</td><td>R71</td><td>680Ω /2W R/MO</td><td>112.7℃</td><td>125℃</td></tr>
<tr><td>15</td><td></td><td></td><td></td><td></td></tr>
</table></td><td>P</td></tr>
<tr><td>2</td><td>OVER LOAD BURN-IN TEST</td><td>NO DAMAGE
1 HOUR (MIN)</td><td>I/P: 230 VAC
O/P: 117%LOAD
Ta:25℃</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>3</td><td>LOW TEMPERATURE
TURN ON TEST</td><td>TURN ON AFTER 2 HOUR</td><td>I/P: 230 VAC
O/P: 100% LOAD
Ta= -25 ℃</td><td>TEST： OK</td><td>P</td></tr>
<tr><td>4</td><td>HIGH HUMIDITY
HIGH TEMPERATURE
HIGH VOLTAGE
TURN ON TEST</td><td>AFTER 12 HOURS
IN CHAMBER ON
CONTROL 45 ℃
NO DAMAGE</td><td>I/P: 272 VAC
O/P:FULL LOAD
Ta= 45 ℃
HUMIDITY= 95 %R.H</td><td>TEST：OK</td><td>P</td></tr>
<tr><td>5</td><td>TEMPERATURE
COEFFICIENT</td><td>± 0.03 %(0~50℃)</td><td>I/P: 230 VAC
O/P:FULL LOAD</td><td>± 0.01 %(0~50℃)</td><td>P</td></tr>
<tr><td>6</td><td>VIBRATION TEST</td><td colspan="2">1 Set Operating at I/P: 230 VAC NO LOAD
(1) Waveform: Sine Wave
(2) Frequency:10~500Hz
(3) Sweep Time:10min/sweep cycle
(4) Acceleration:5G
(5) Test Time:1 hour in each axis (X.Y.Z)
(6) Ta:25℃</td><td>TEST： OK</td><td>P</td></tr>
</table>

SAFETY TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	WITHSTAND VOLTAGE	I/P-O/P: 3 KVAC/min I/P-FG: 1.5 KVAC/min O/P-FG: 0.5 KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 1.8 KVAC/min O/P-FG: 0.6 KVAC/min Ta:25℃	I/P-O/P: 4.48 mA I/P-FG: 3.79 mA O/P-FG: 3.31 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℃	I/P-O/P: 7 G Ω I/P-FG: 6 G Ω O/P-FG: 9 G Ω NO DAMAGE	P
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40 A / 2min Ta:25℃	11 mΩ	P
4	APPROVAL	TUV: Certificate NO ：R50046942 UL: File NO ：E183223			P

E.M.C TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	HARMONIC	EN61000-3-2 CLASS A	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS	P
2	CONDUCTION	EN55022 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL/50% LOAD Ta:25℃	PASS Test by certified Lab	P
3	RADIATION	EN55022 CLASS B	I/P: 230 VAC (50HZ) O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A	P
5	E.F.T	EN61000-4-4 INDUSTRY INPUT: 2KV	I/P: 230 VAC/50HZ O/P:FULL LOAD Ta:25℃	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℃	CRITERIA A	P
7	Test by certified Lab & Test Report Prepare				

M.T.B.F & LIFE CYCLE CALCULATION

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	CAPACITOR LIFE CYCLE	SUPPOSE C 65 IS THE MOST CRITICAL COMPONENT I/P: 230 VAC O/P:FULL LOAD Ta= 25 ℃ LIFE TIME= 304498 HRS I/P: 230 VAC O/P:FULL LOAD Ta= 45 ℃ LIFE TIME= 92438 HRS			P
2	MTBF	MIL-HDBK-217F NOTICES2 PARTS COUNT TOTAL FAILURE RATE: 244K HRS			P

COMPONENT STRESS TEST

NO	TEST ITEM	SPECICATION	TEST CONDITION	RESULT	VERDICT
1	Power Transistor (D to S) or (C to E) **Peak Voltage**	Q1 Rated 2SK2082 : 800V / 9 A	I/P:High-Line +3V =267 V O/P: (1)Full Load Turn on (2) Full Load (3)Output Short Ta:25℃	(1) 688 V (2) 634 V (3) 676 V	P
2	Diode Peak **Voltage**	D60 Rated YG805C10 : 100V / 20 A	I/P:High-Line +3V =267 V O/P: (1)Full Load Turn on (2) Full Load (3)Output Short Ta:25℃	(1) 70 V (2) 70.8 V (3) 76.4 V	P
3	Clamp Diode Peak **Voltage**	D1 Rated HER208 :1K V / 2 A	I/P:High-Line +3V =267 V O/P: (1)Full Load (2) Dynamic Load 90%Duty/1KHz Ta:25℃	(1) 614 V (2) 630 V	P
4	**Input Capacitor Voltage**	C5 Rated : 330u /200 V	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℃	(1) 189 V (2) 188 V (3) 188 V	P
5	**Control IC Voltage Test**	U1 Rated 1203 : 16 V	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℃	(1) 15.1 V (4) 15.1 V (5) 14.4 V	P

DATE	SAMPLE	TEST RESULT	TESTER	APPROVAL
2004/3/19	RD SAMPLE	PASS	VINCENT TSENG	MAX LIN
2004/7/8	PRODUCT SAMPLE A404B34	PASS	VINCENT TSENG	MAX LIN

2003/12/12 A50-F023