FEB-FL7733MY-C-1

12W LED Lighting Power for Bulb Application

Rev. 1.0

Contents

FEBxxx-001	1. Disclaimer and Warning.	Instituted by	Steel.Huang

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FEBxxx-001	1. Disclaimer and Warning.	Instituted by	Steel.Huang

2. Warning

This Evaluation Board may employ high voltages so appropriate safety precautions should be used when operating this board. Replace components on the Evaluation Board only with those parts shown on the BOM. Contact an authorized Fairchild representative with any questions..

1. General Introduction

This document is an engineering report describing a 12W LED Lighting Power for Bulb application, which using Fairchild's latest LED device FL7733MY, it could meet customer's high PF, low THD request, and the Circuitry is very simple.

The highly integrated FL7733MY provides several features to enhance the performance. The single stage topology with PSR could implement best performance and cost using fewest external components, In order to implement high PF and low THD, Constant on time is utilized with an external capacitor, connected to COMI.

Precise constant-current control regulates accurate output current versus changes in input voltage and output voltage. The operational frequency is proportionally changed by the output voltage to guarantee DCM operation.

FL7733MY have several protections to enhance the device's performance. Such as Open LED Protection, Short LED Protection; Sense Resistor Short Protection ,Cycle by cycle current limit and Over-temperature Protection etc.

FL7733MY also has frequency hopping function in the oscillator for better EMI performance.FL7733MY controller is available in 8-pin SOP.

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FEBxxx-001	2. General Introduction and Spec.	Instituted by	Steel.Huang

2. General Specification

Specification	Min	Typ.	Max	Units
Input				
Voltage	90	100-240	264	Vac
Frequency	47		63	Hz
Output				
Voltage	20	24	28	V
Current		0.5		A
PF	0.9			
THD			15	%

FEBxxx-001	3. Functional Check Report	Instituted by	Steel.Huang

Test Model	FEB-FL7733MY-C-1
Test Date	Feb. 18, 2014
Test Temperature	Ambient
Test Equipment	AC source:Chroma 61502 Load: PRODIGIT 3331A Dual DC Electronic Load Current/Voltage meter:Tektronix TCP202 Oscilloscope: Tektronix TDS3034B EMI conductive tester: KHC KH3935 PF/THD Tester: Chroma Power Analyzer 6630 Power Meter: WT210
Test Items	1 PF and THD. 2 Efficiency 3 Constant Current Test 4 No Load Test 5 Start-up Test 6 Normal Operation Test 7 Overshoot Test 8 Output Short Test 9 EMI Test 10 Thermal Test

FEBxxx-001	3. Functional Check Report	Instituted by	Steel.Huang

1 PF and THD

1.1 Test condition

Measure the power board PF&THD in 90, 115, 230, 264VAC; With Electronic load.

1.2 Test Result

PF/THD	90Vac	115Vac	230Vac	264Vac
28V	0.998 / 3.78%	0.996 / 3.67%	0.954 / 6.19%	0.927 / 8.02%
26V	0.998 / 3.97%	0.995 / 3.85%	0.948 / 6.68%	0.918 / 9.18%
24V	0.998 / 3.60%	0.995 / 3.13%	0.941 / 7.34%	0.906 / 9.77%
22V	0.998 / 2.84%	0.994 / 3.15%	0.932 / 7.71%	0.895 / 10.38%
20V	0.997 / 2.55%	0.993 / 3.11%	0.921 / 8.43%	0.881 / 11.41%
18V	0.997 / 2.55%	0.992 / 2.71%	0.908 / 9.37%	0.862 / 12.60%
16V	0.996 / 2.47%	0.990 / 2.95%	0.891 / 10.45%	0.840 / 14.12%
14V	0.995 / 2.22%	0.988 / 2.93%	0.869 / 12.04%	0.811 / 16.01%
12V	0.933 / 2.35%	0.984 / 3.10%	0.839 / 14.01%	0.775 / 18.22%

2 Efficiency

2.1 Test condition

Measure the Efficiency of the Power board in 90,115,230,264Vac with Electronic load.

2.2 Tested waveform

Efficiency	90Vac	115Vac	230Vac	264Vac
28V	86.34%	87.89%	89.33%	89.22%
26V	86.44%	87.91%	89.26%	88.99%
24V	86.34%	87.80%	89.02%	88.78%
22V	86.25%	87.50%	88.76%	88.59%
20V	86.11%	87.31%	88.31%	88.14%
18V	85.81%	86.80%	87.77%	87.77%
16V	85.34%	86.21%	87.25%	86.89%
14V	84.61%	85.50%	86.42%	86.14%
12V	83.66%	84.30%	85.10%	84.98%

3 Constant Current Test

3.1 Test condition

Measure the Constant Current Performance of the Power in 90,115,230,264Vac with Electronic load.

3.2 Test result

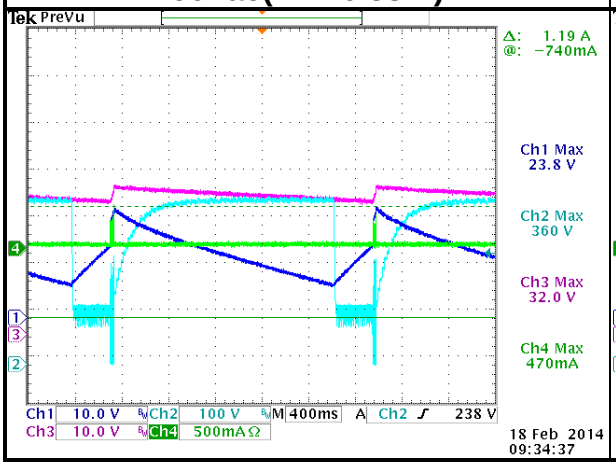
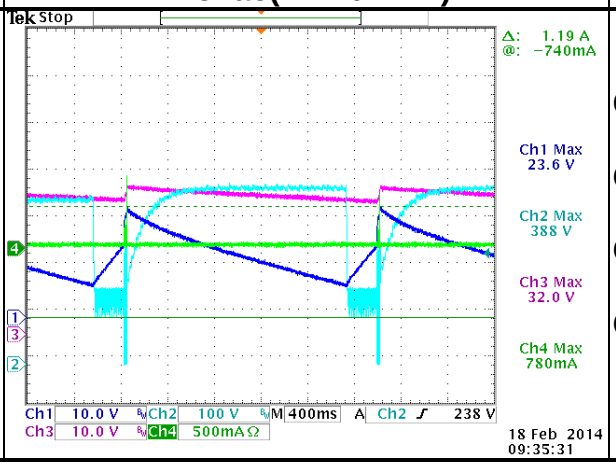
CC	90Vac	115Vac	230Vac	264Vac	Accuracy
28V	0.504A	0.505A	0.509A	0.510A	/+2%
26V	0.502A	0.505A	0.510A	0.511A	/+2.2%
24V	0.503A	0.505A	0.510A	0.512A	/+2.4%
22V	0.503A	0.505A	0.510A	0.512A	/+2.4%
20V	0.503A	0.505A	0.510A	0.512A	/+2.4%
18V	0.503A	0.504A	0.510A	0.512A	/+2.4%
16V	0.502A	0.504A	0.509A	0.511A	/+2.2%
14V	0.501A	0.502A	0.507A	0.508A	/+1.6%
12V	0.499A	0.501A	0.505A	0.506A	-0.2%/+1.2%
Accuracy	-0.2%/+0.8%	/+1%	/+2%	/+2.4%	

4 No Load Test

4.1 Test condition

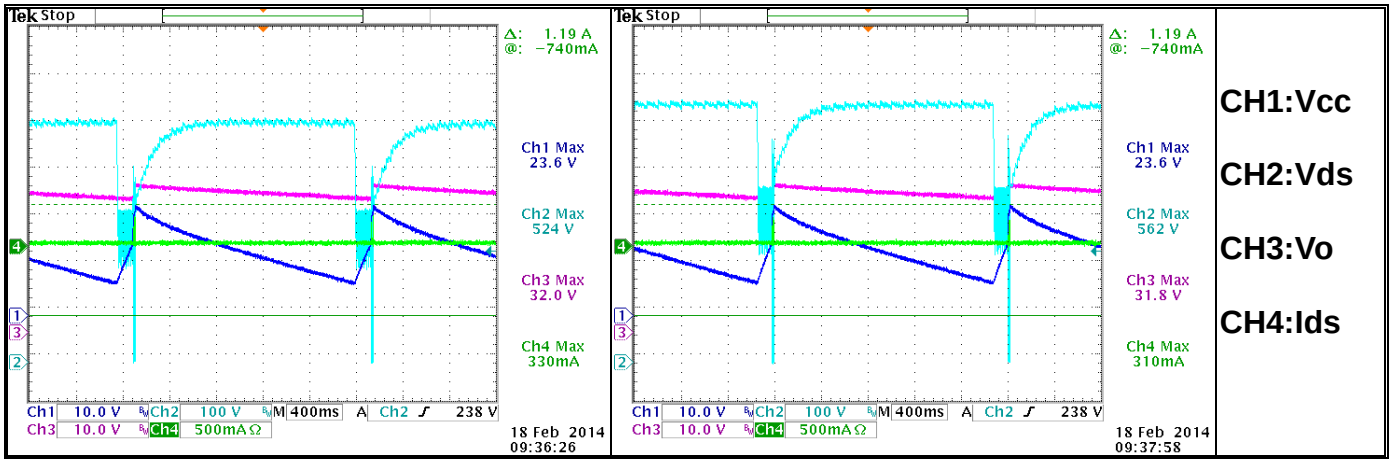
Measure the Power operation waveform at no load in 90,115,230,264Vac with Electronic load

4.2 Tested waveform

90Vac(Pin=0.38W)	115Vac(Pin=0.44W)	
		**CH1:Vcc** **CH2:Vds** **CH3:Vo** **CH4:Ids**

230Vac(Pin=0.53W)	264Vac(Pin=0.59W)	

FEBxxx-001	3. Functional Check Report	Instituted by	Steel.Huang

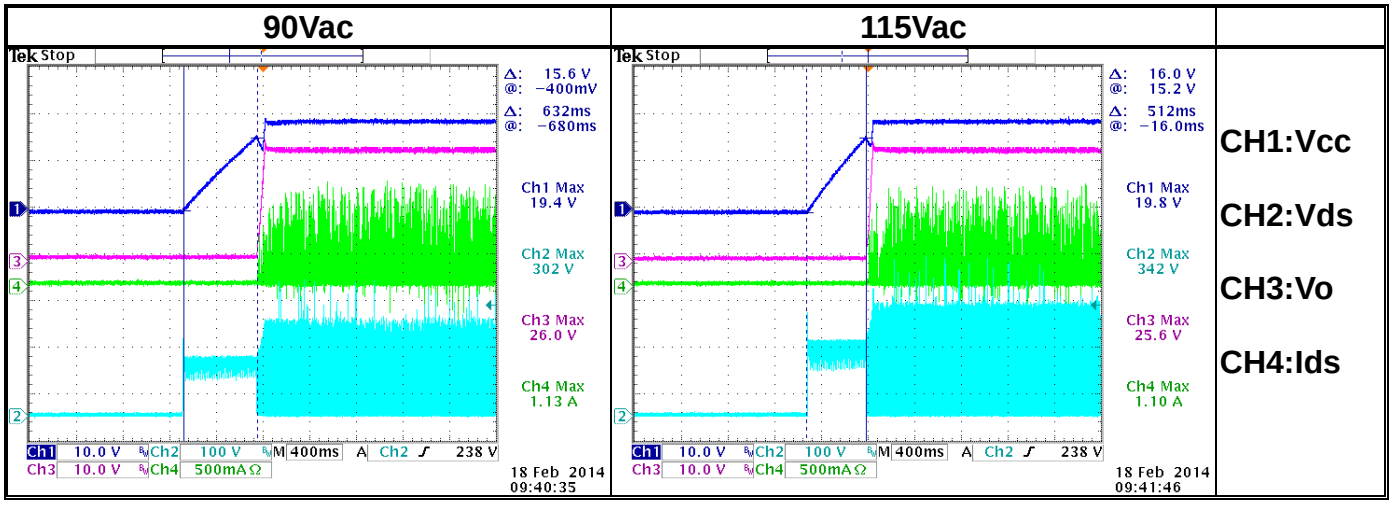


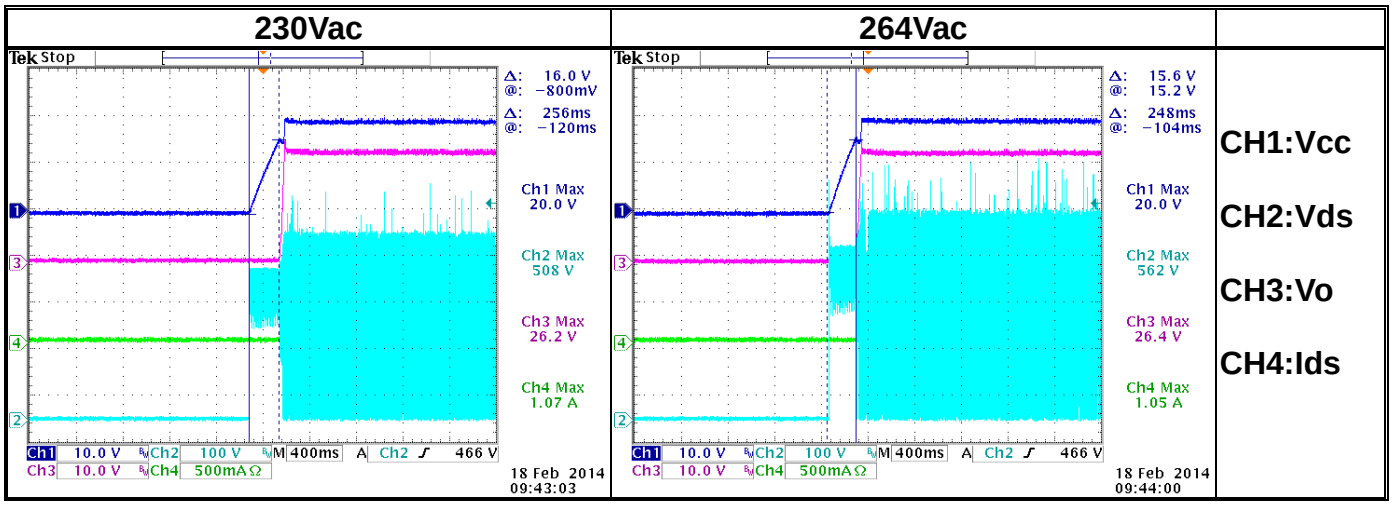
5 Start-up Test

5.1 Test condition

Measure the Start-up waveform in 90,115,230V,264Vac,with Electronic load @full load

5.2 Tested waveform





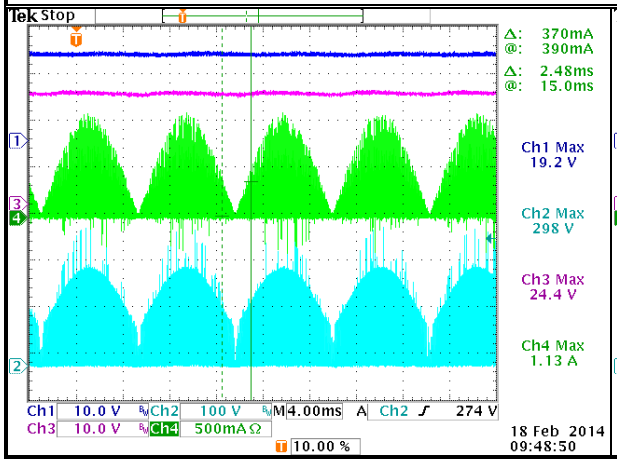
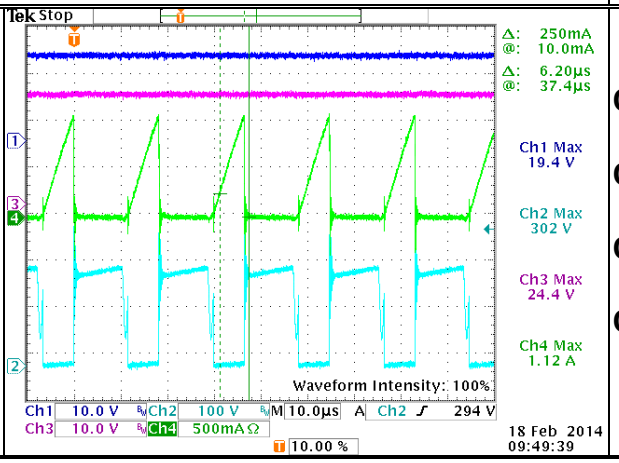
FEBxxx-001	3. Functional Check Report	Instituted by	Steel.Huang

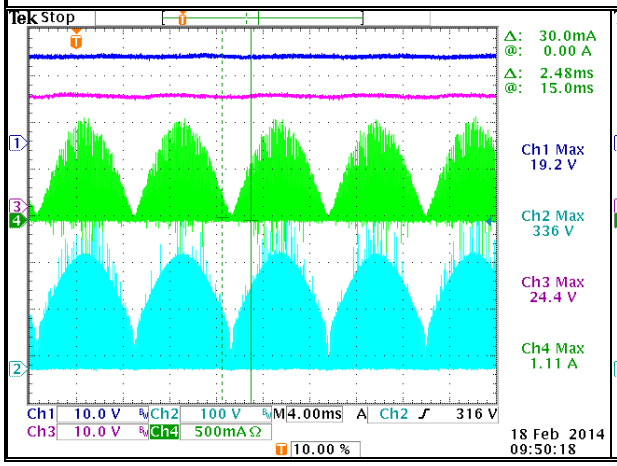
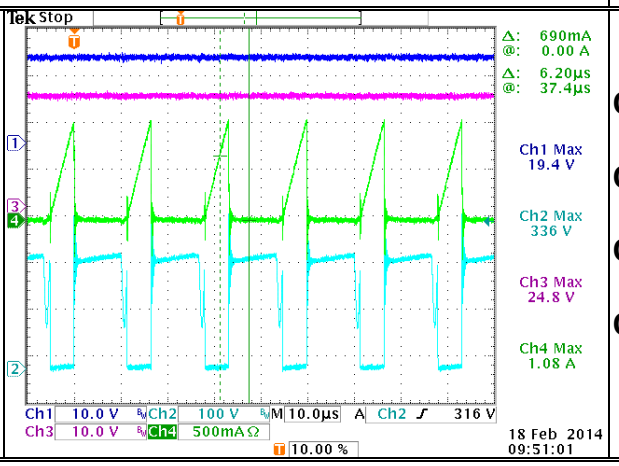
6 Normal Operation Test

6.1 Test condition

Measure the Normal Operation waveform in 90,115,230V,264Vac,with Electronic load @full load

6.2 Tested waveform

90Vac	
 	CH1:Vcc CH2:Vds CH3:Vo CH4:Ids

115Vac	
 	CH1:Vcc CH2:Vds CH3:Vo CH4:Ids

230Vac	

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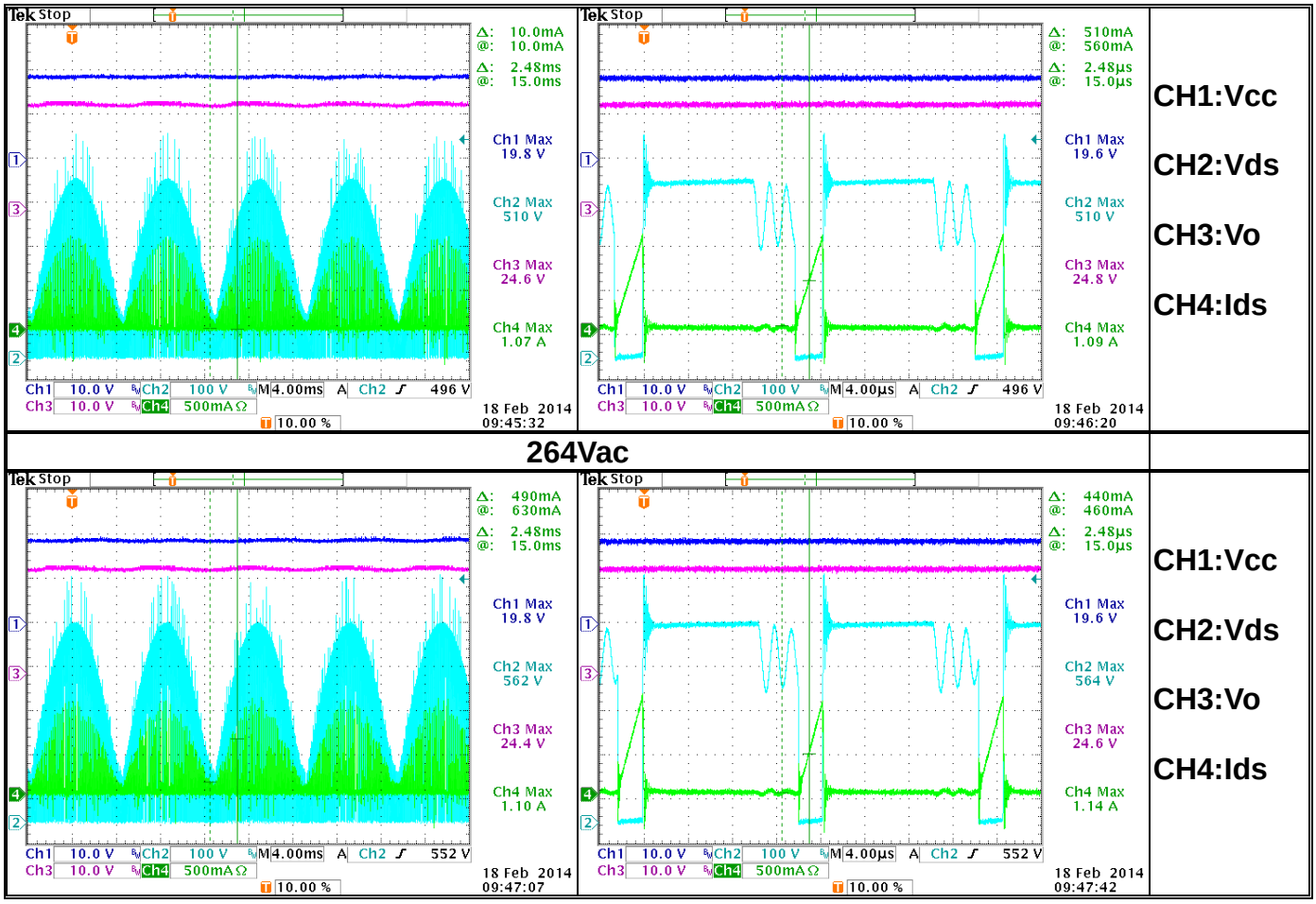
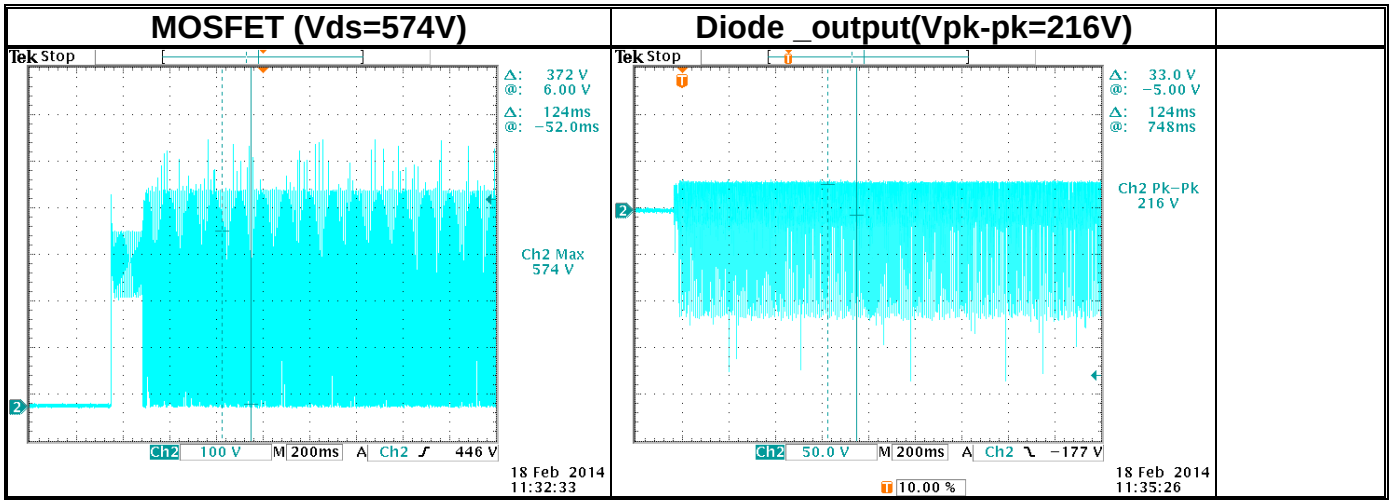


7 Overshoot Test

7.1 Test condition

Measure the MOSFET and Diode Overshoot voltage in 264Vac and output is 28V full Load

7.2 Tested waveform

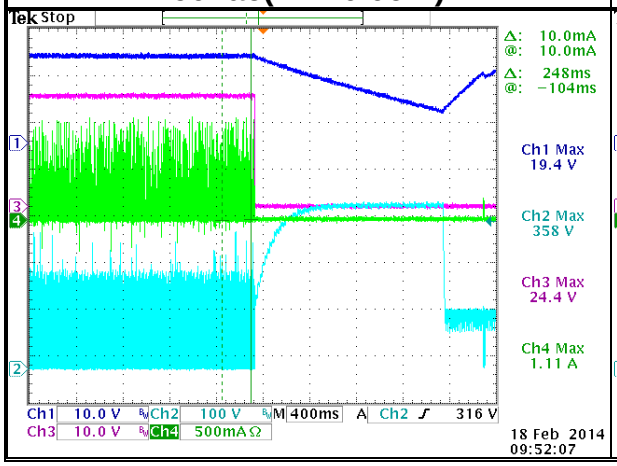
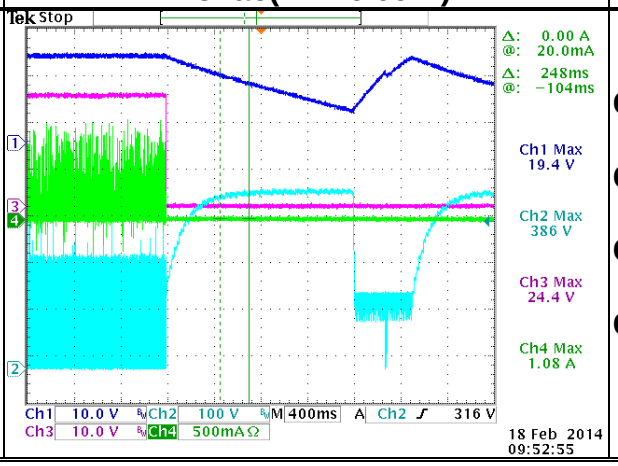


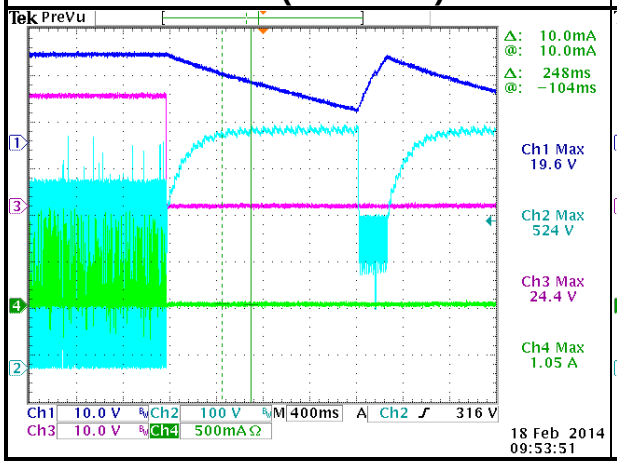
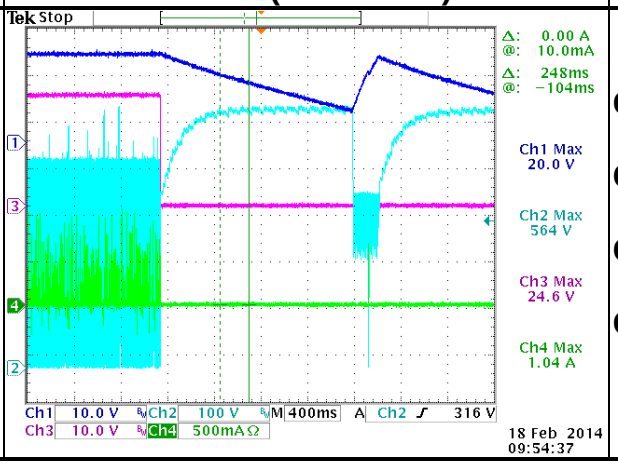
8 Output Short Protection Test

8.1 Test condition

Measure the Output Short Protection waveform and the Input Watt in 90,115,230, 264Vac.

8.2 Tested waveform

90Vac(Pin=0.06W)	115Vac(Pin=0.09W)	
		CH1:Vcc CH2:Vds CH3:Vo CH4:Ids

230Vac(Pin=0.2W)	264Vac(Pin=0.23W)	
		CH1:Vcc CH2:Vds CH3:Vo CH4:Ids

9 EMI Test

9.1 Test condition

Measure the Conduction emission of the Power with real LED Load

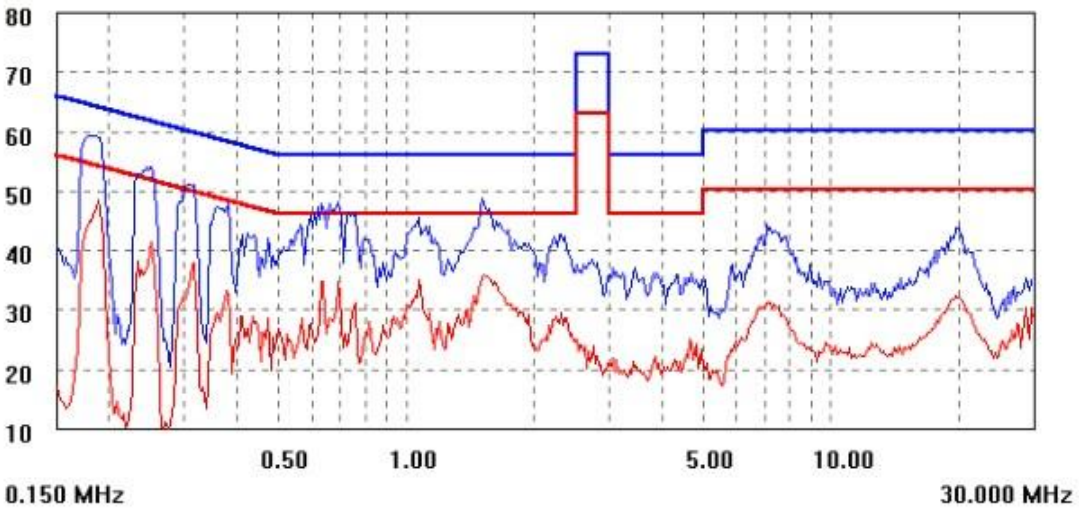
9.2 Tested waveform

L-Line

freq, step

Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.002
2.000	10.000	0.010
10.000	30.000	0.025

scan result

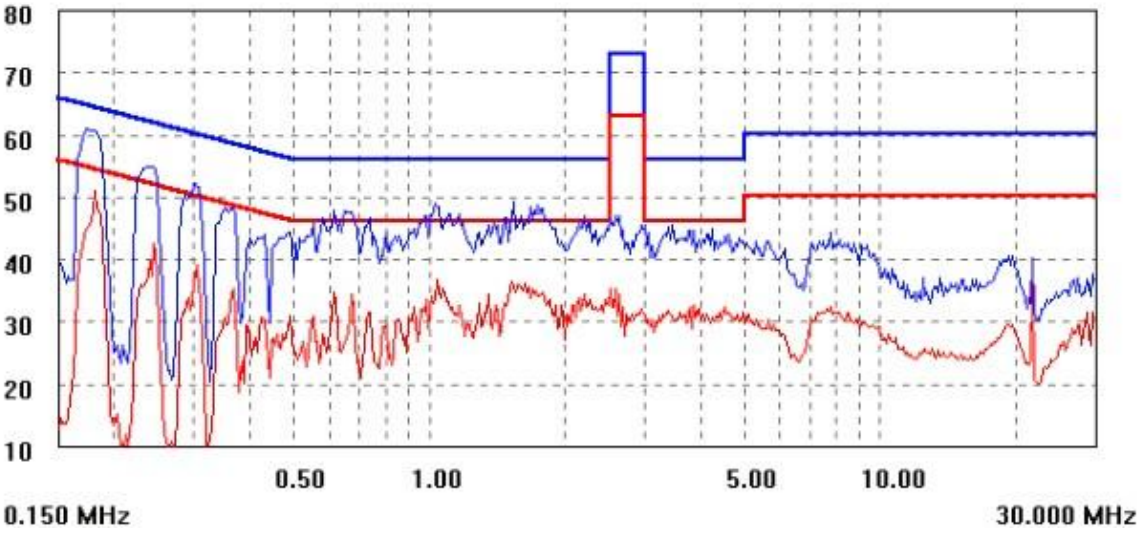


N-Line

freq, st

Start(MHz)	End(MHz)	Step(MHz)
0.150	2.000	0.002
2.000	10.000	0.010
10.000	30.000	0.025

scan re



10 Thermal Test

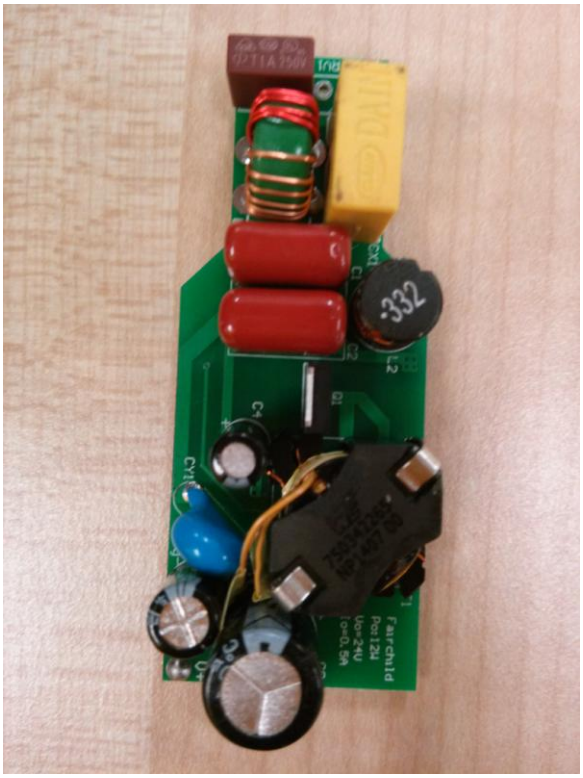
10.1 Test condition

Measure the main component's temperature under 90Vac and 264Vac @full load

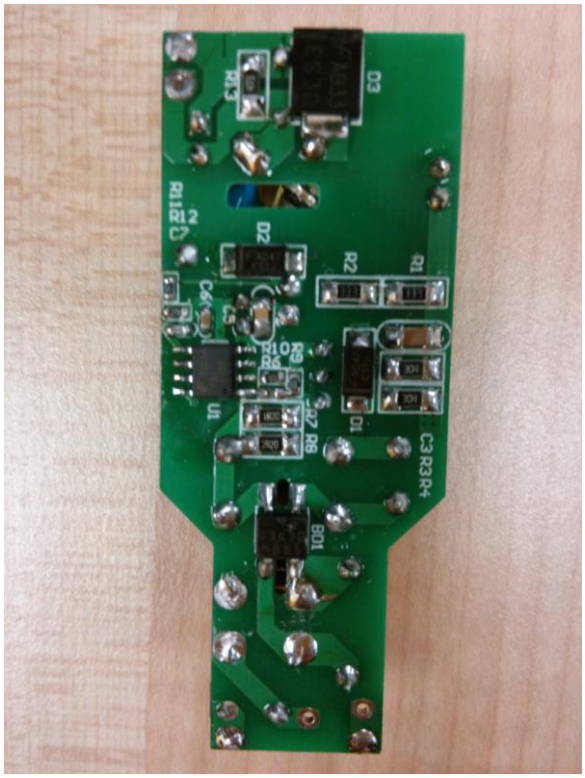
10.2 Test Result

	Transformer	MOSFET	Diode-output
90Vac	63.1℃	61.5℃	45℃
264Vac	60.6℃	59.3℃	44.8℃

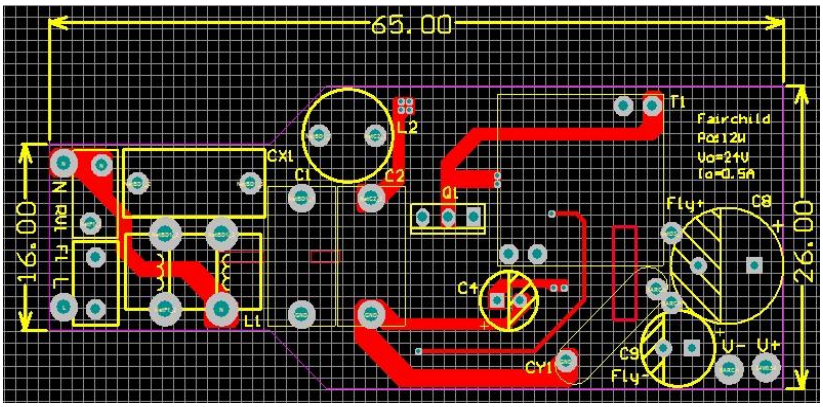
Remark: Test under ambient temperature, the real temperature is 22.5℃



Toper Layer



Bottom Layer



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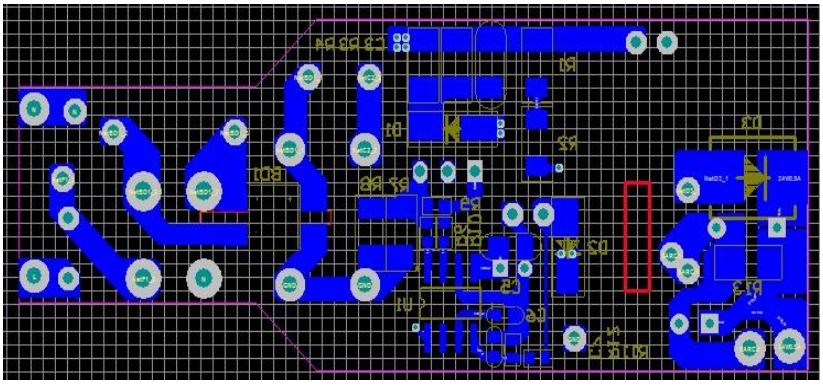

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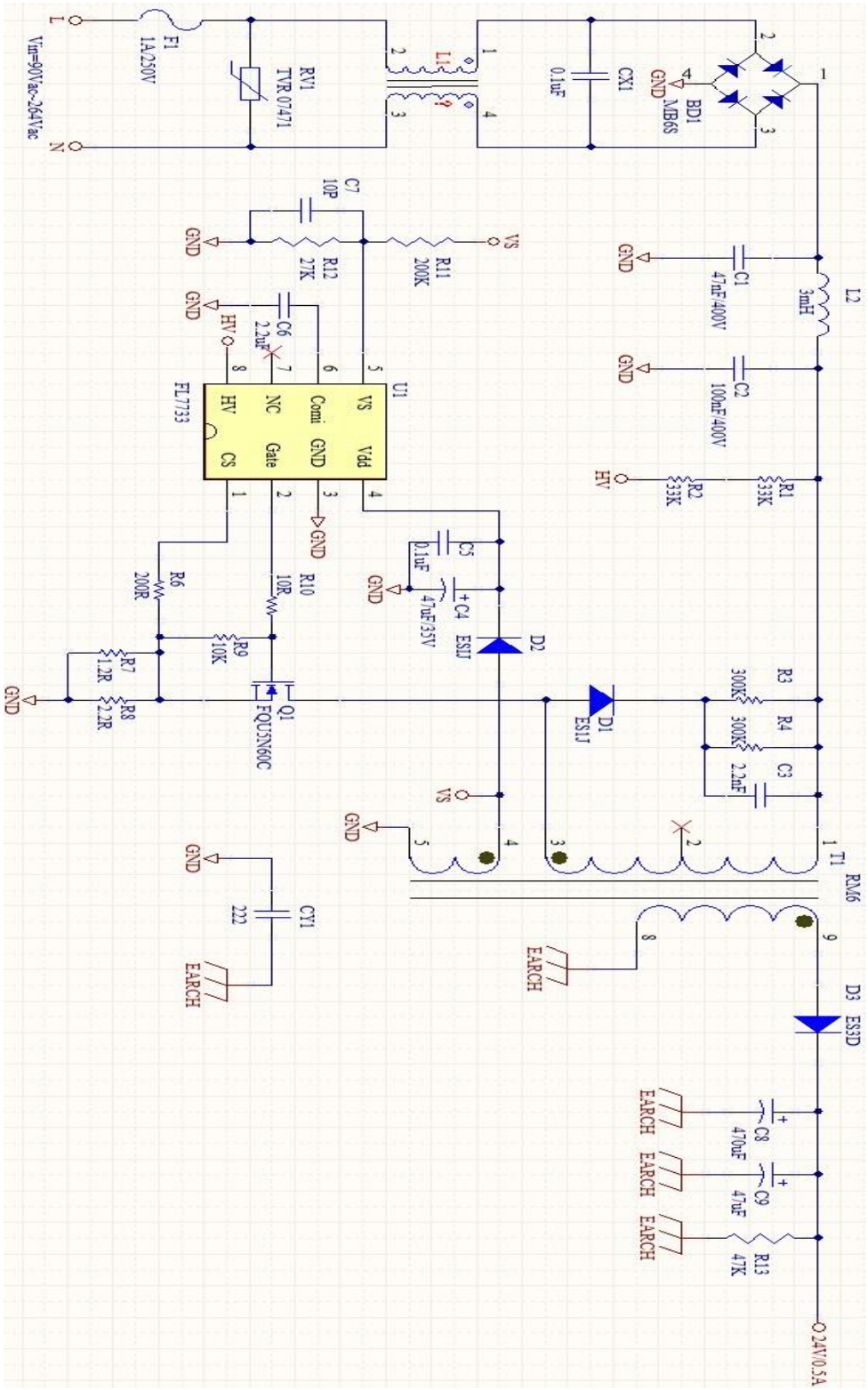

Vin=90Vac-264Vac
F1
1A/250V
RV1
TVR 07471
L1
0.1uF
CX1
BD1
MB6S
C7
10P
R12
27K
R11
200K
C6
2.2uF
U1
FL7733
HV
NC
Comi
VS
Vdd
CS
Gate
GND
C1
47nF/400V
L2
3mH
C2
100nF/400V
R2
33K
R1
33K
C5
0.1uF
C4
47uF/35V
ES1J
D2
D1
ES1J
R3
300K
R4
300K
C3
2.2nF
R6
200R
R10
10R
R9
10K
R7
1.2R
R8
2.2R
Q1
FQU5N60C
T1
RM6
CY1
222
EARCH
D3
ES3D
C8
470uF
C9
47uF
R13
47K
24V/0.5A

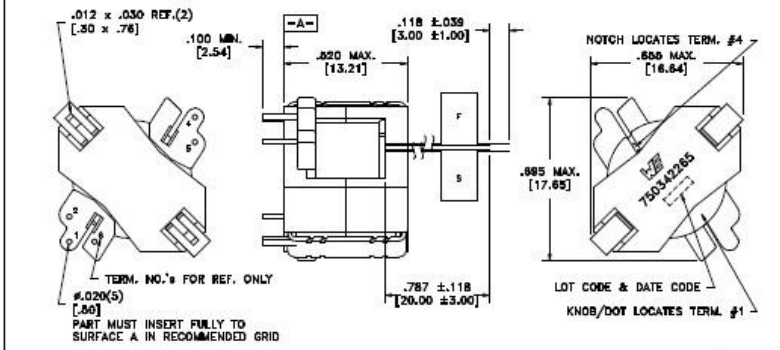
Designator	Value	Description	Footprint	Q'ty	Vendor
BD1	MB6S	Bridge	MB6S	1	**Fairchild Semiconductor**
U1	FL7733MY	Main control IC	SO8	1	**Fairchild Semiconductor**
Q1	FQU5N60C	N-Channel MOSFET	I-PAK	1	**Fairchild Semiconductor**
D1,D2	ES1J	Default Diode	DO214	2	**Fairchild Semiconductor**
D3	ES3D	Rectifier Diode	ES3D	1	**Fairchild Semiconductor**
T1	RM6	RM6 Transformer. PN:750342265	RM6	1	**Wuerth Electronic**
L2	3.3mH	Differential Inductor. PN:744772332	Inductance	1	**Wuerth Electronic**
RV1	TVR 07471	Vavistor. PN:820552711	MOV2	1	**Wuerth Electronic**
L1	850uH	Common chock,5*7	common chock	1	**Universal component**
C1	47nF/400V	Film Capacitor	Cf	1	**Universal component**
C2	100nF/400V	Film Capacitor	Cf	1	**Universal component**
C3	2.2nF/1KV	Capacitor-SMD	C1206_1	1	**Universal component**
C4	47uF/35V	Polarized Capacitor	CAP2/5	1	**Universal component**
C5	0.1uF	Capacitor-SMD	C0805_1	1	**Universal component**
C6	2.2uF	Capacitor-SMD	C0603	1	**Universal component**
C7	10P	Capacitor-SMD	C0603	1	**Universal component**
C8	470uF/35V	Polarized Capacitor	CAP 5/10	1	**Universal component**
C9	100uF/35V	Polarized Capacitor	CAP 5/10	1	**Universal component**
CX1	0.1uF/275Vac	X2 Capacitor	Cf2	1	**Universal component**
CY1	222	Y2 cap	Y-CAP	1	**Universal component**
R1, R2	33K	Resistor-SMD	R1206	2	**Universal component**
R3, R4	300K	Resistor-SMD	R1206	2	**Universal component**
R6	200R	Resistor-SMD	R0603	1	**Universal component**
R7	1.2R 1%	Resistor-SMD	R1206	1	**Universal component**
R8	2.2R 1%	Resistor-SMD	R1206	1	**Universal component**
R9	10K	Resistor-SMD	R0603	1	**Universal component**
R10	10R	Resistor-SMD	R0603	1	**Universal component**
R11	200K	Resistor-SMD	R0603	1	**Universal component**
R12	27K	Resistor-SMD	R0603	1	**Universal component**
R13	47K	Resistor-SMD	R1206	1	**Universal component**
F1	1A/250V	Fuse	FUSE	1	**Universal component**

1 Transformer specification

Manufacture : Wuerth Electronic

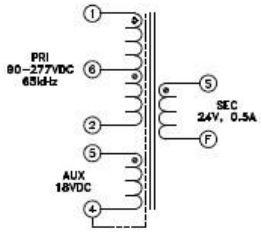
Part No.:750342265

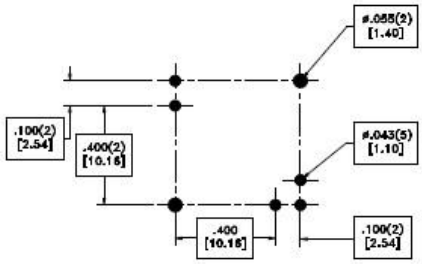
CUSTOMER TERMINAL	RoHS	LEAD(Pb)–FREE
Sn96%, Ag4%	Yes	Yes



ELECTRICAL SPECIFICATIONS @ 25°C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1–2	@20°C	1.43 ohms max
D.C. RESISTANCE	5–4	@20°C	0.41 ohms max
D.C. RESISTANCE	S–F	@20°C	0.23 ohms max
INDUCTANCE	1–2	10kHz, 1.0VAC, Ls	760uH ±10%
LEAKAGE INDUCTANCE	1–2	tie(4+5+S+F), 100kHz, 100mVAC, Ls	18.0 uH max
DIELECTRIC	1–S	tie(1+4),3750VAC, 1 second	–
DIELECTRIC	S–CORE	3750VAC, 1 second	–
TURNS RATIO		(1–2):(5–4)	4.333:1, ±2%
TURNS RATIO		(1–2):(S–F)	3.25:1, ±2%





RECOMMENDED
P.C. PATTERN, COMPONENT SIDE

GENERAL SPECIFICATIONS:
OPERATING TEMPERATURE RANGE: –40°C to +120°C including temp rise.

Designed to comply with the following requirements as defined by IEC60950–1.
– Reinforced insulation for a primary circuit at a working voltage of 400VDC.

Wire insulation & RoHS status not affected by wire color.
Wire insulation color may vary depending on availability.

REV.	DATE	Packaging Specifications	Tolerances unless otherwise specified:	DRAWING TITLE	PART NO.
		Method: Tray	Angles: ±1° Decimals: ±.005 [.13]	TRANSFORMER	750342265
		PKG–0103	Fractions: ±1/64 Footprint: ±.001 [.03]		
		www.we–online.com/midcom	This drawing is dual dimensioned. Dimensions in brackets are in millimeters.	eISos p/n: 750342265	
00	1/14	SEE REVISION SHEET FOR REVISION LEVEL			SPECIFICATION SHEET 1 OF 1