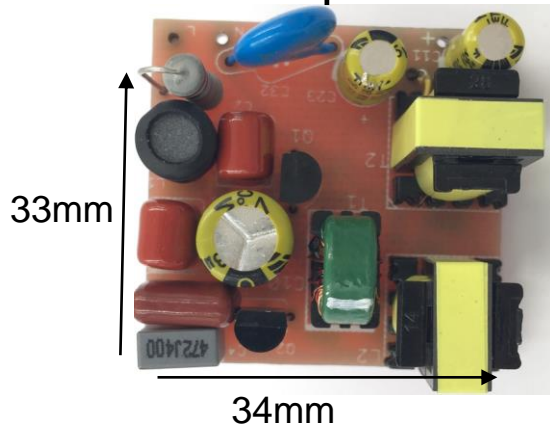




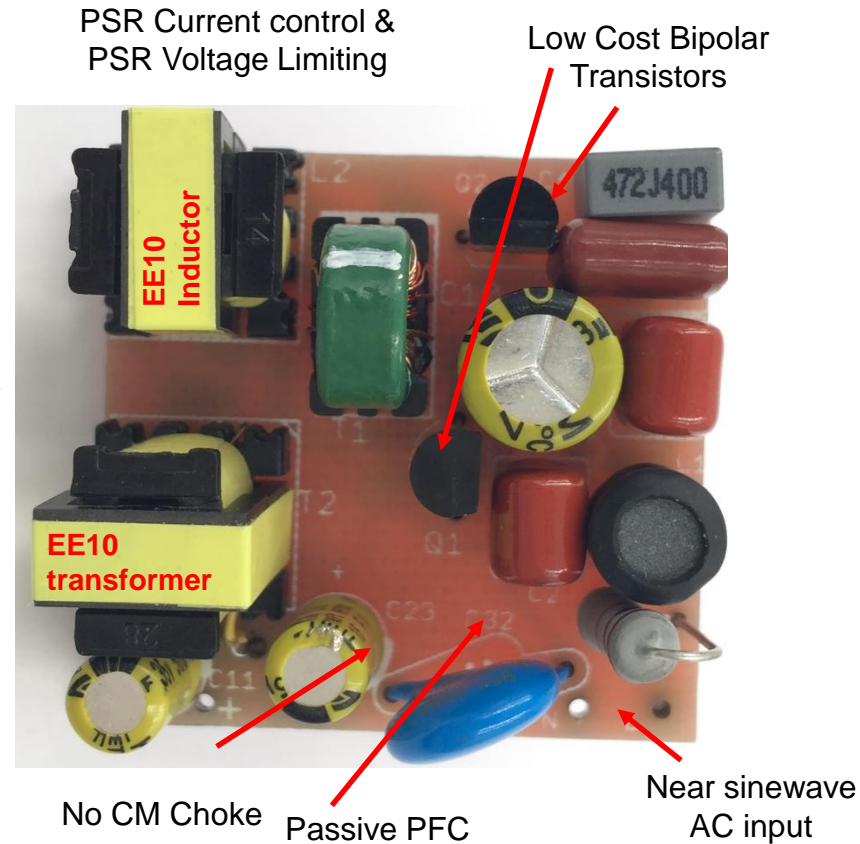
RED2421

10W 250mA LED Driver Design Report

- RED2421 SOT23-6 controller IC
- Flicker-free
- High Efficiency 88.6%
- THD<10%
- High Power Factor >0.9
- 250mA 30-42V output
- EMI pass without CM choke
- Ultra-compact 1-sided PCB



1-Stage LLC converter

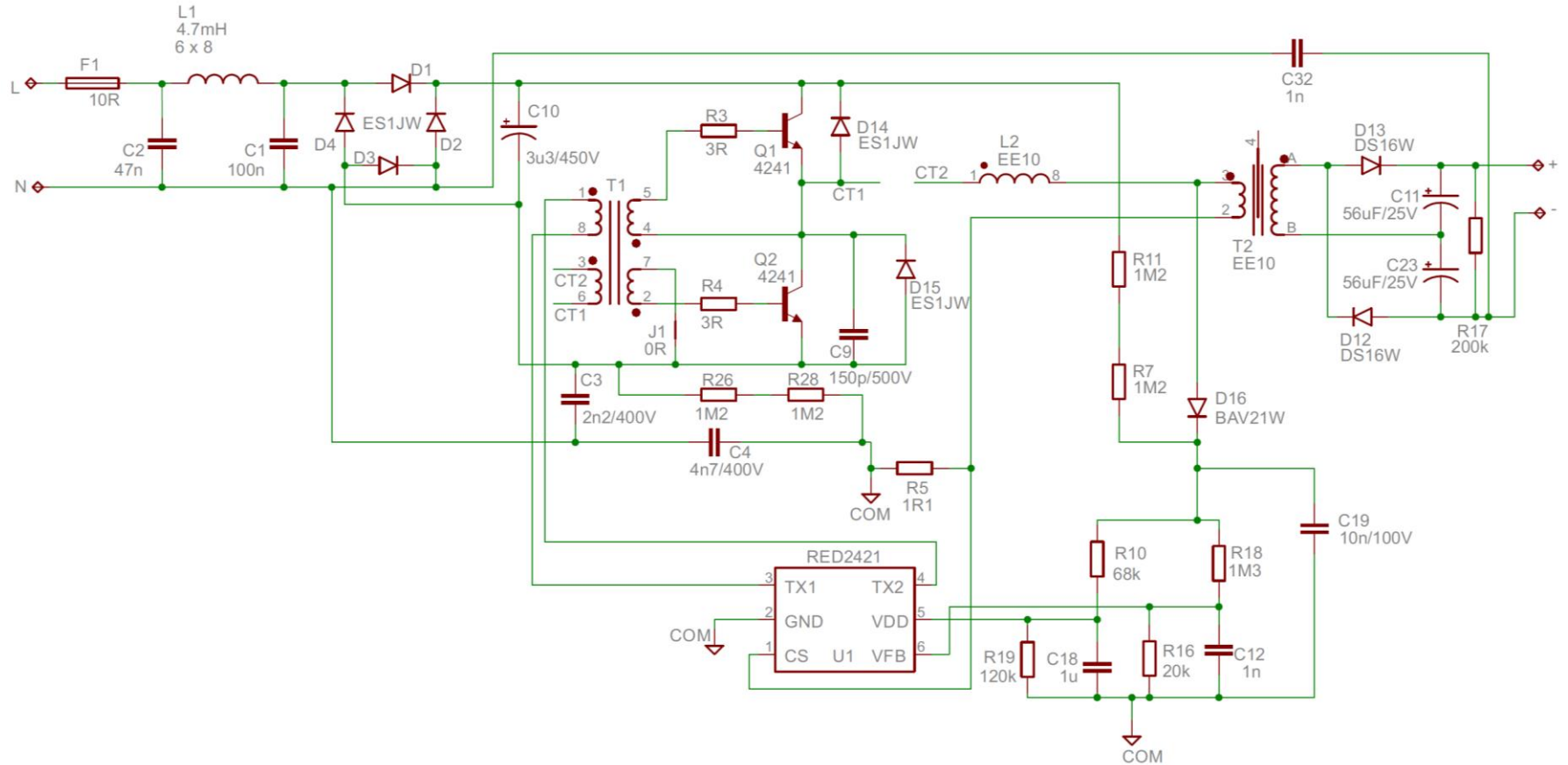


Specifications



Specification	Value	Test condition
Input voltage 50Hz	198 - 264VAC	Functional specifications
Input functional range	170 - 320VAC	5 minute survival
Output voltage	30 - 42V	198 - 264VAC
Output current	250mA \pm 5%	198 - 264VAC
LF Ripple (Flicker)	< 1%	230VAC, 36VDC
Harmonic compliance	220 - 240VAC	30-42VDC
Total Ripple	< 20%	230VAC, 42VDC
Time to light	< 110ms	230VAC, 42VDC
Efficiency	> 88.5%	230VAC, 42VDC
Power factor	> 0.94	230VAC, 42VDC
THD	< 10%	230VAC, 42VDC
No-load voltage	< 50V	264VAC
Protection	Overtemperature, short circuit, open circuit	
EMI test	9dB Margin	LED driver on LED panel
Surge	1kV DM	
Ambient Temperature	-20 to 50°C	

Schematic



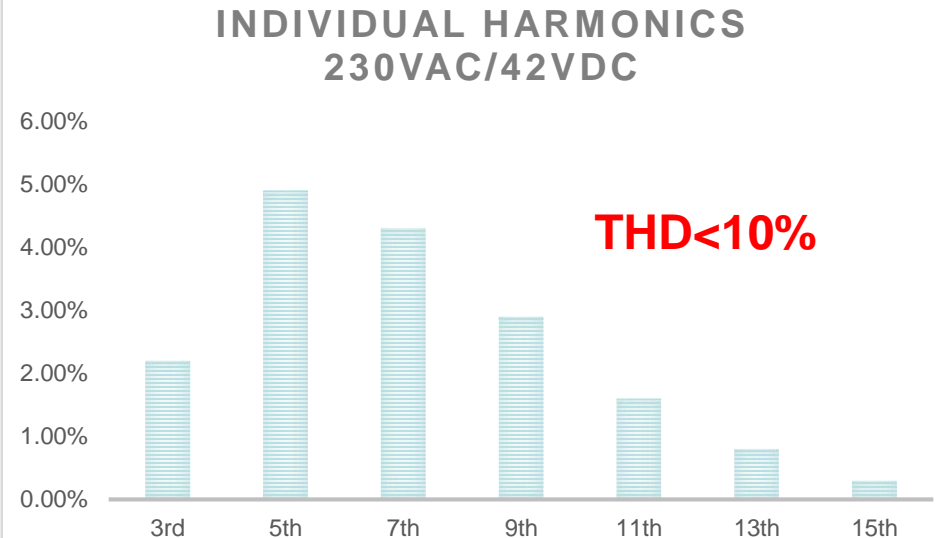
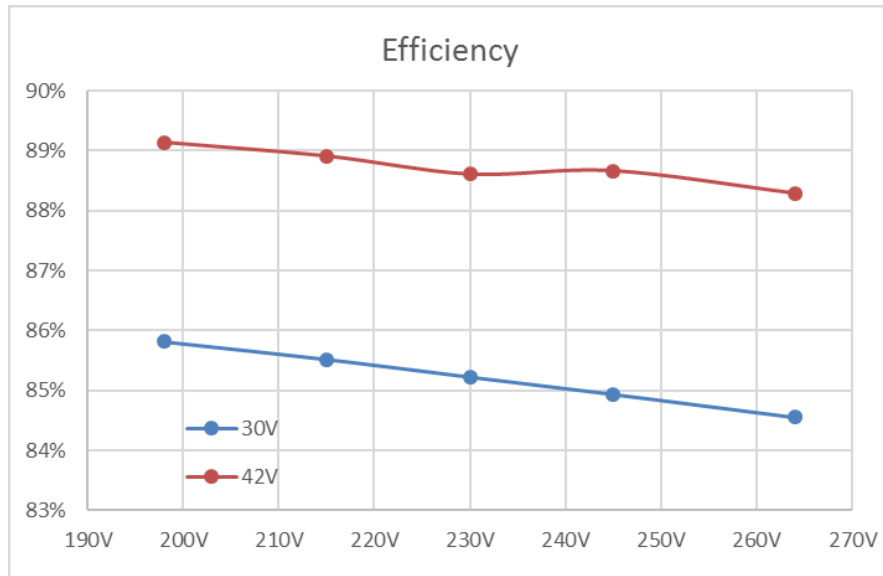
Code	Value	Description	Qty
C1	100n	CL21 MEF 250VAC	1
C2	47n	CL21 MEF 250VAC	1
C3	2n2	MKP 5% 400VDC	1
C4	4n7	MKP 5% 400VDC	1
C10	3u3	ELEC 20% 450VDC	1
C11,23	56u	ELEC 20% 25VDC	2
C9	150p	0805 NPO 5% 500VDC	1
C12	1n	0603 X7R 10% 50VDC	1
C19	10n	0805 X7R 10% 100VDC	1
C18	1u	0603 X7R 10% 16VDC	1
C32	1n	Y-CAP	1
D1,2,3,4,14,15	ES1JW	SMA Fast Diode 600VDC 1A	6
D16	BAV21W	MiniMELF	1
D12,13	DS16W	SMC Schottky Diode 60VDC 1A	2
F1	10R	Fuse Resistor	1
L1	4m7H	6x8 Drum Core	1
L2	1995uH	EE10 Main Inductor	1
R3,4	3R	0805 0.06W 1.0%	2
R5	1R1	0805 0.25W 1.0%	1
R7,11,26,28	1M2	1206 0.125W 1.0%	4
R19	120k	0603 0.06W 1.0%	1
R10	68k	0603 0.06W 1.0%	1
R16	20k	0603 0.06W 1.0%	1
R17	200k	0805 0.25W 1.0%	1
R18	1M3	0603 0.06W 1.0%	1
Q1,Q2	4241	TO92 1.2A NPN Transistor	2
T1	A062 T9x5x4,	Base Drive	1
T2	EE10	Output Transformer	1
U1	RED2421 S0T23-6	LLC LED controller IC	1
TOTAL			41

Test Results



Output Voltage	30V					42V				
Input voltage	198V	215V	230V	245V	264V	198V	215V	230V	245V	264V
Output current	250mA	250mA	250mA	250mA	250mA	250mA	250mA	250mA	251mA	251mA
Input Power	8.74	8.77	8.80	8.83	8.87	11.78	11.81	11.85	11.89	11.94
Output Power	7.50	7.50	7.50	7.50	7.50	10.50	10.50	10.50	10.54	10.54
Efficiency	85.8%	85.5%	85.2%	84.9%	84.6%	89.1%	88.9%	88.6%	88.7%	88.3%
Power Factor	0.939	0.914	0.890	0.865	0.831	0.955	0.953	0.942	0.924	0.898
THD	11.1%	17.3%	22.3%	26.6%	31.2%	12.3%	6.6%	8.0%	13.3%	19.4%
Ripple (Flicker) @36V	0.90%	0.77%	0.67%	0.59%	0.55%					

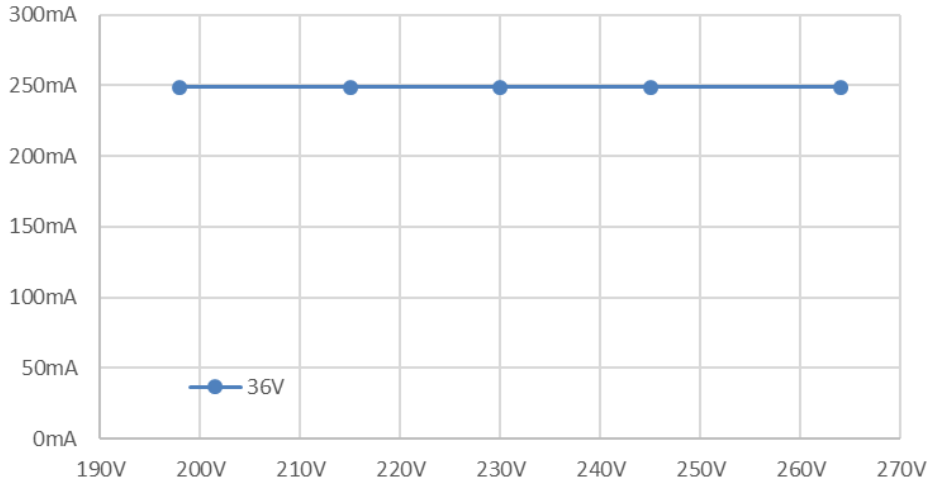
Test	Result	Condition
Peak no-load Voltage	48V	230VAC
Time To light	110ms	230VAC



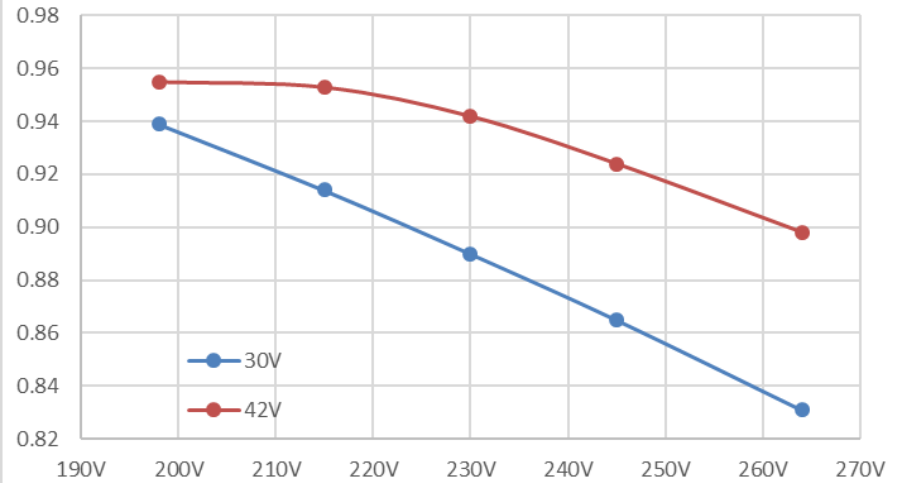
Test Results



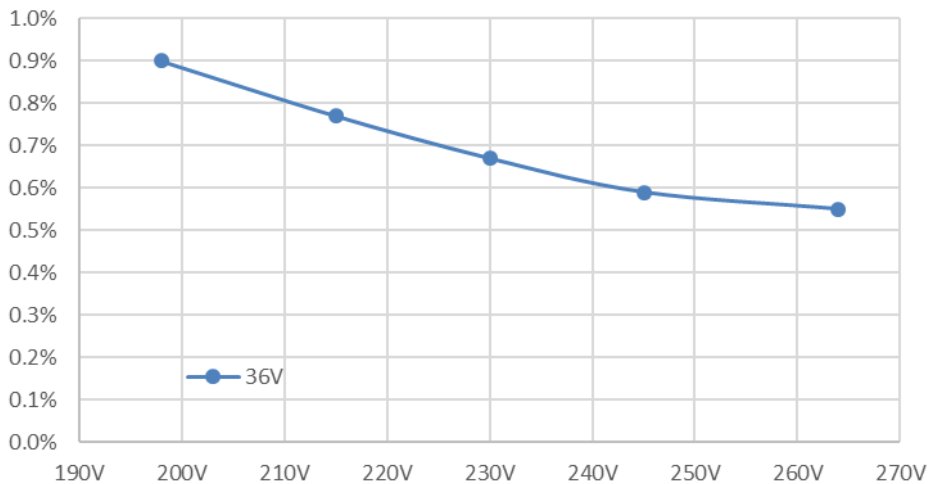
Current Regulation



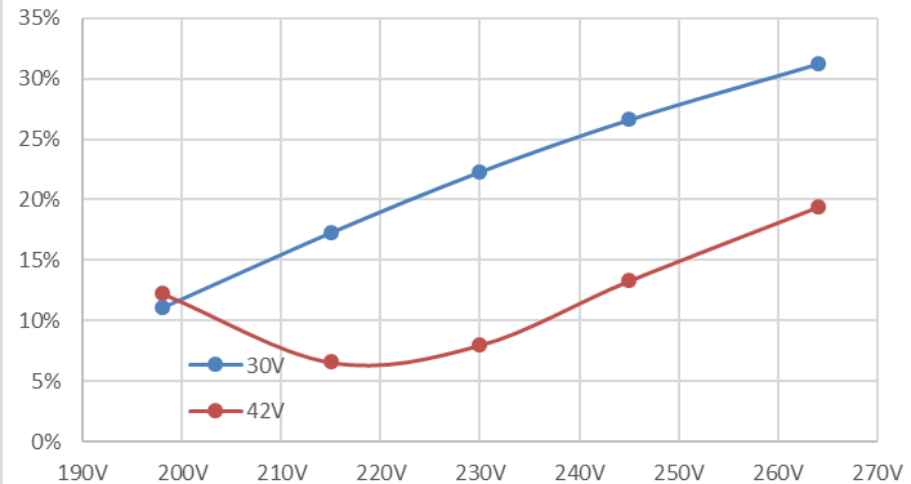
PF



Flicker



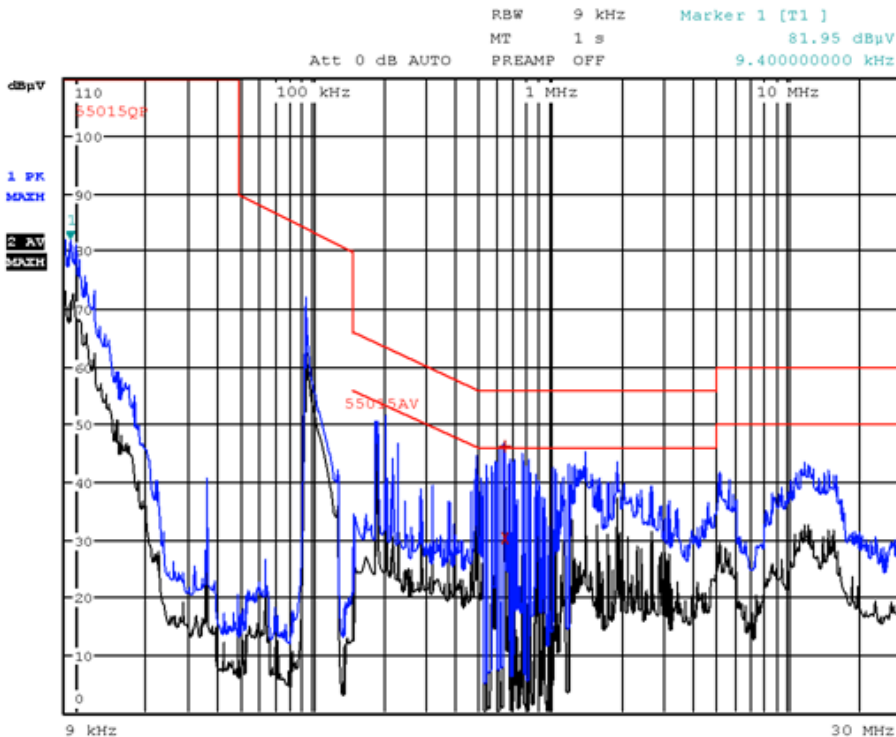
THD



Test Results – EMI & Surge

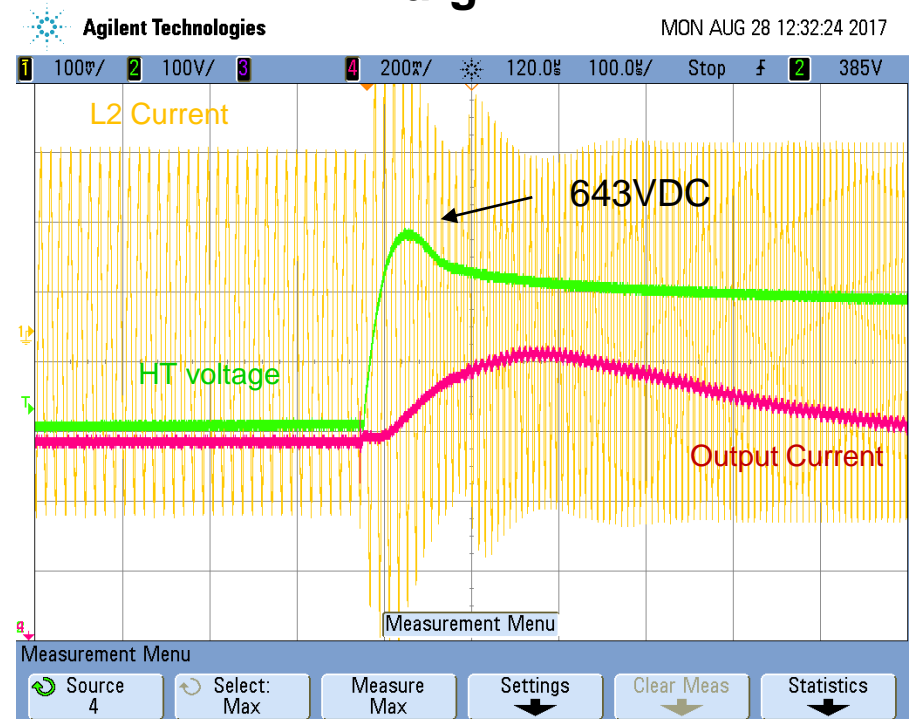


>9dB Margin Pass



Conducted EMI 9k~30MHz
Driver located on LED panel

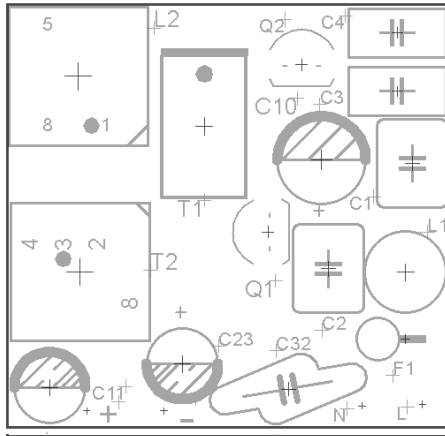
1kV surge pass with margin



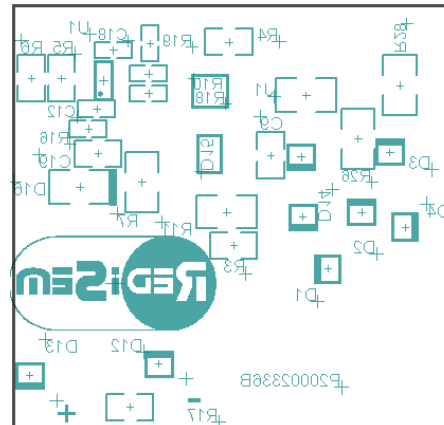
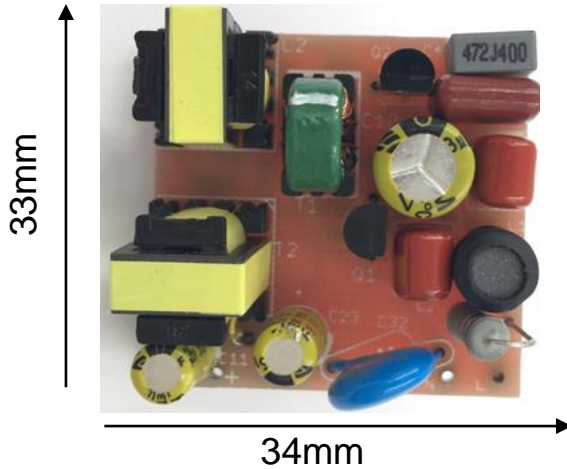
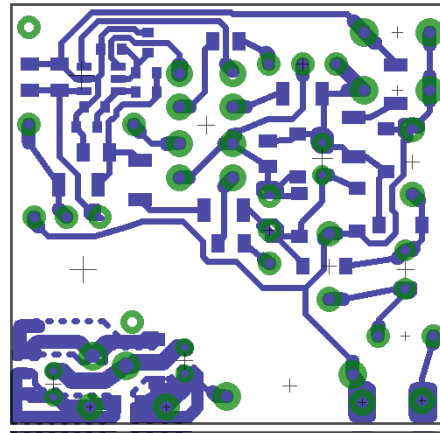
Plot of HT bus voltage and L2
(resonant) current during 1kV surge
with fuse resistor

PCB layout

Top Side



Bottom Side



- Single sided PCB
- 1mm thick
- 1 Oz copper

RED2421 Datasheet



RED2421

Low Power LED Controller for LLC converters

Features

- Advanced LED Controller IC for high efficiency low-cost LLC converters with bipolar transistors and integrated PFC
- PSR - +/-5% Primary Side Regulation of LED current and voltage with no Flicker
- 50% duty cycle, variable frequency control of resonant half-bridge
- Automatic dead-time control and capacitive mode protection
- Protection modes:
 - Overload
 - No-Load
 - Over-temperature
- Low output capacitance allows live LED connection
- Very low output current ripple – 0.5%
- Small SOT23-6 IC package



SOT23-6

Applications

- High frequency CC LED drivers up to 22W
- Optimized for low-cost passive PFC
- Pin compatible with RED2401

Order code

Part Number	Package	Packaging
RED2421AL-TR7	SOT23-6	Tape and reel

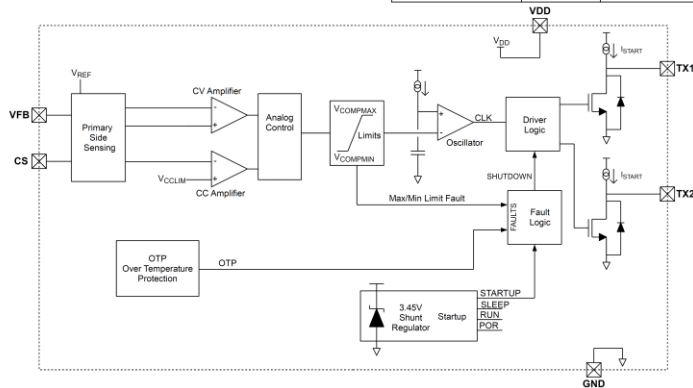


Figure 1: Block diagram



RED2421 LED LLC Controller

Device Pins

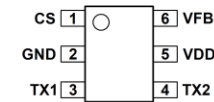
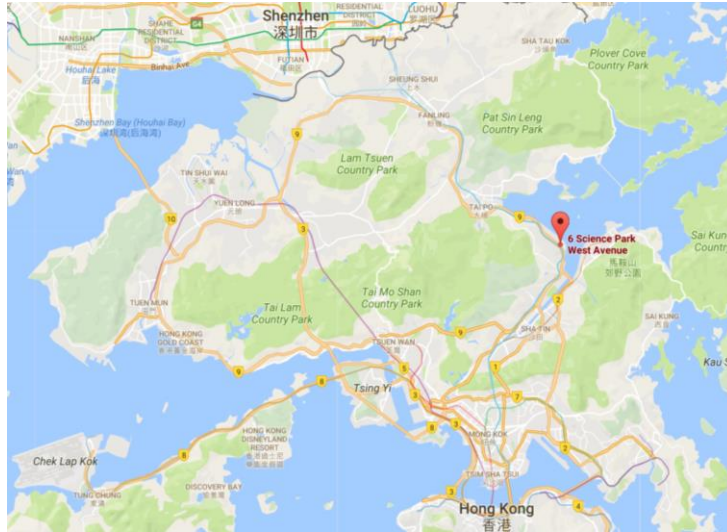


Figure 2: SOT23-6 pin connections (top view)

Pin Functions

Pin #	Name	Function
1	CS	PSR Current Sense input provides output current regulation and cycle-by-cycle over-current protection. The CS pin is connected to the half-bridge current sense resistor
2	GND	Chip ground.
3	TX1	Output to control transformer.
4	TX2	Output to control transformer.
5	VDD	IC Power Supply pin – nominally 3.45V
6	VFB	PSR Feedback input for output voltage regulation. Connect to primary sense winding.

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