



## LED Driver Design with iW1678

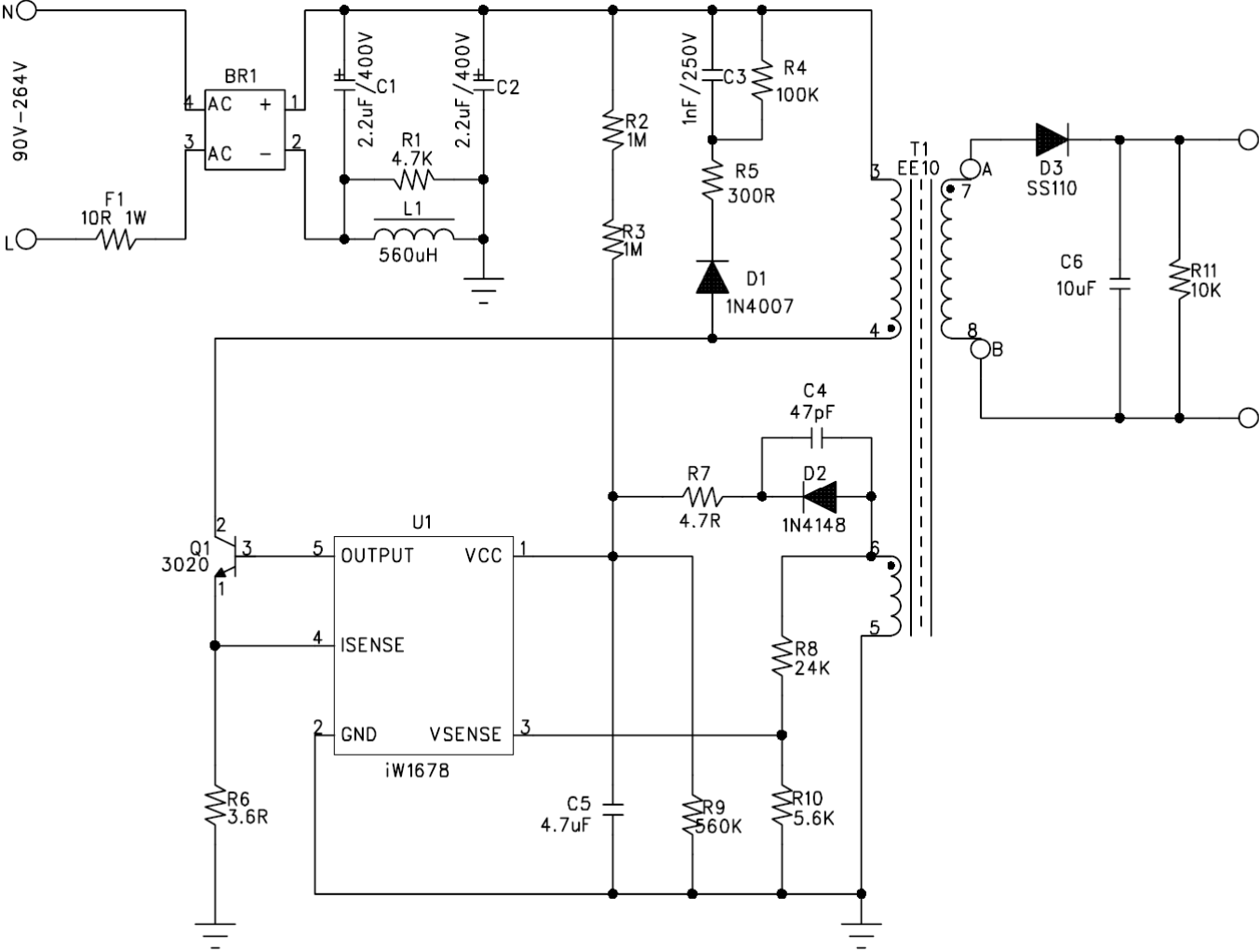
### Summary and Features :

1. LED driver, 12V, CC@0.32A ; Wide range AC input range @90-264Vac
2. For Isolated or Non-isolated Applications
3. High Efficiency and Minimum Parts count
4. Meet EMI EN55015B-QP & AV limits
5. Fully protected against AC input UV, OV, O/P Short/Open, meet single point failure test.

# 1. Specification

Description		Symbol	Min	Typ	Max	Units	Comment
Input							
Voltage		$V_{IN}$	90	100/240	264	V <sub>AC</sub>	2 Wire
Frequency		$f_{LINE}$	47	50/60	63	Hz	
Open-load Input Power (264V <sub>AC</sub> )				3		W	
Output							
Const Voltage	@ 0-350 m A	$V_{OUT\_CV}$		12	15	V	Measured at the PCB connector
Const Current	@ 7--12V	$I_{OUT\_CV}$	0.30	0.32	0.34	A	
Output Ripple Current						mA	Measured at the LED load
Continuous Output Power		$P_{OUT}$				W	
Output short circuit test		$I_{OUT\_MAX}$				A	Auto-restart
Efficiency		$\eta$	70			%	Measured at end of PCB @ 115Vac
Others							
Turn on Delay Time				1		Sec	At rated input voltage <u>115</u> Vac
Inrush current				10		A	At rated input voltage <u>115</u> Vac
Hi-pot test				4		kV	<u>Isolated</u> / Non-isolated
Conducted EMI			Meets EN55015B				Floating / Grounding
Surge Test							Differential mode
Operation Temperature		$T_{opr}$			50	° C	Free convection, sea level

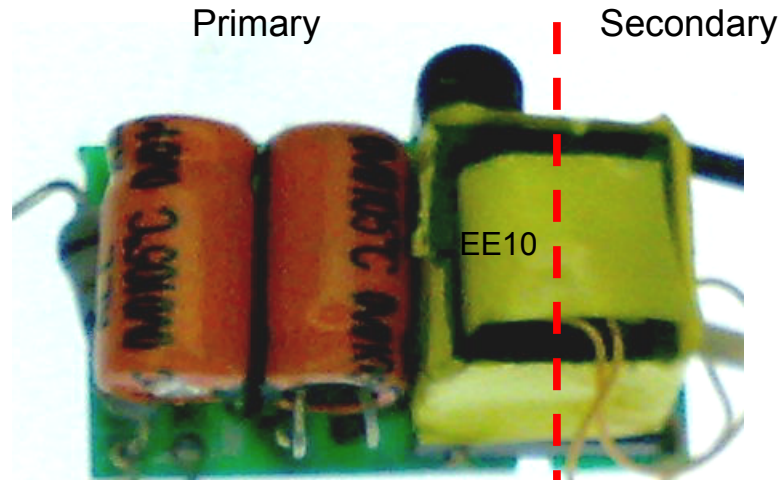
# 2. Schematic Circuit



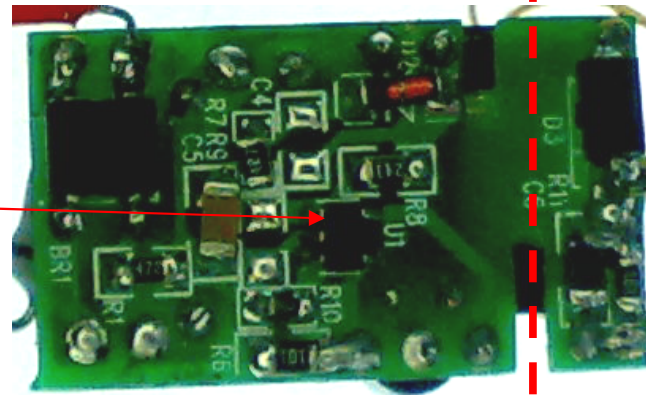
### 3. Bill of Material

Item	Qty.	Ref.	Description	Cost (US Cent) / unit	Sub-Total (Cent)
1	1	U1	iW1678, Off-line digital PWM Controller, SOT-5		
2	2	C1 C2	2.2uF, 400V, E-CAP, 105°C		
3	1	C3	1nF, 250V, Ceramic Capacitor,SMD-0805		
4	1	C5	4.7uF/25V, SMD-1206		
5	1	C6	10uF/25V, SMD-1206		
6	1	BR1	MB8S		
7	1	D1	1N4007, SMD		
8	1	D2	1N4148 0.1A/100V, LL-34		
9	1	D3	SS110 ,1A100V, SMD		
10	1	R1	4.7KΩ±5%, SMD-0603		
11	2	R2,R3	1MΩ,±5%, SMD-1206		
12	1	R4	100KΩ ±5%, SMD-1206		
13	1	R5	300Ω±5%, SMD-0805		
14	1	R6	3.6Ω±1%, SMD-0805		
15	1	R8	24KΩ±1%, SMD-0603		
16	1	R10	5.6KΩ±1%, SMD-0603		
17	1	R11	10KΩ ±5%, SMD-0805		
18	1	R9	560KΩ,±5%, SMD-0805		
19	1	R7	4.7Ω,±5%, SMD-0603		
20	1	FR1	10R,1W, FUSE Resistor		
21	1	L1	560uH, 0410		
22	1	Q1	3DG3020 or STBV42, TO-92		
23	1	T1	EE10, Transformer		

# 4.Circuit Board Photograph



Top side



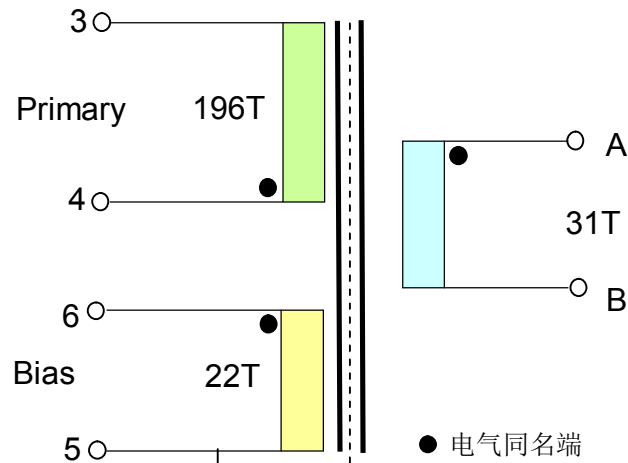
Bottom side

iW1678-00

A thin Mylar insulation sheet (1mm) is to be placed under the transformer & between safety barrier for meeting clearance/ creepage per applicable safety standards

# 5. Transformer Design

## SCHEMATIC



## ELECTRICAL SPECIFICATIONS:

1. Primary Inductance ( $L_p$ ) = 2.2mH @10KHz
2. Primary Leakage Inductance ( $L_k$ )  $\leq$  150uH@10KHz

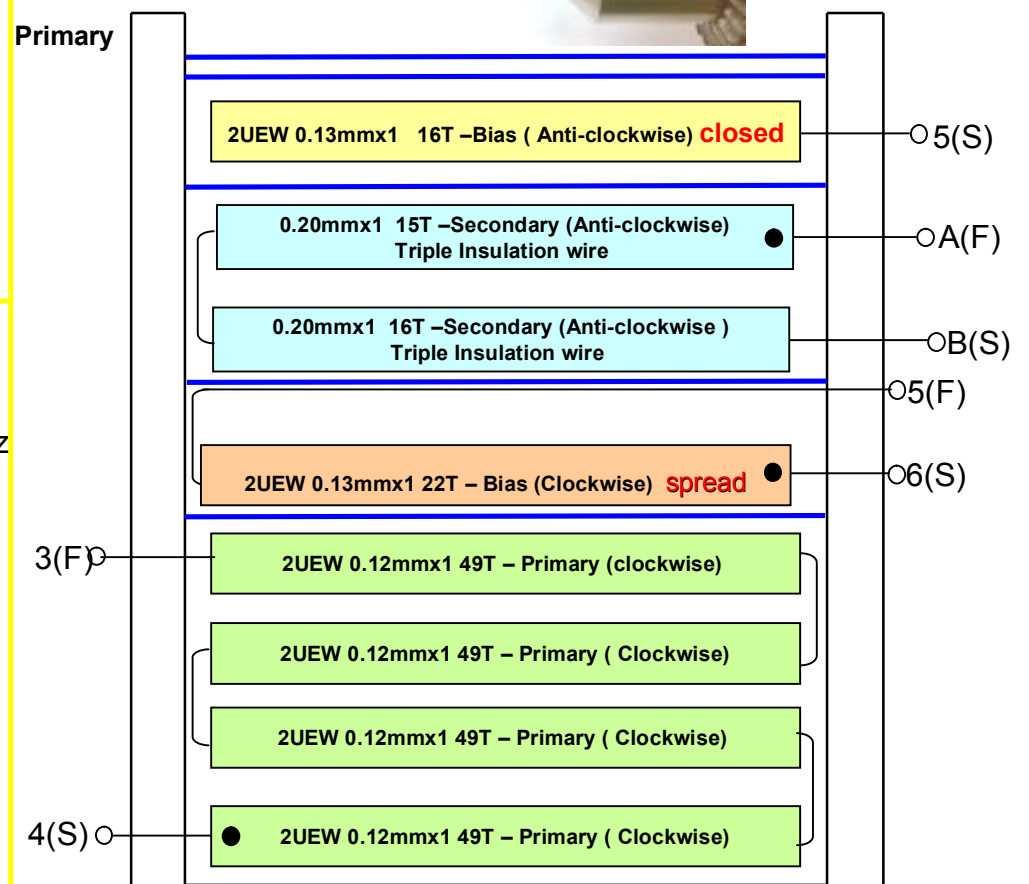
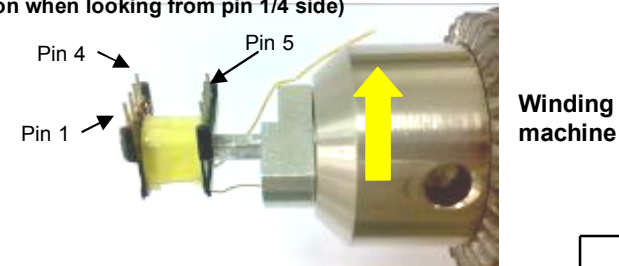
## MATERIALS:

1. Core : EE10 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : EE10 Vertical
3. Magnet Wires : Type 2-UEW
4. Layer Insulation Tape : 3M1298 or equivalent.

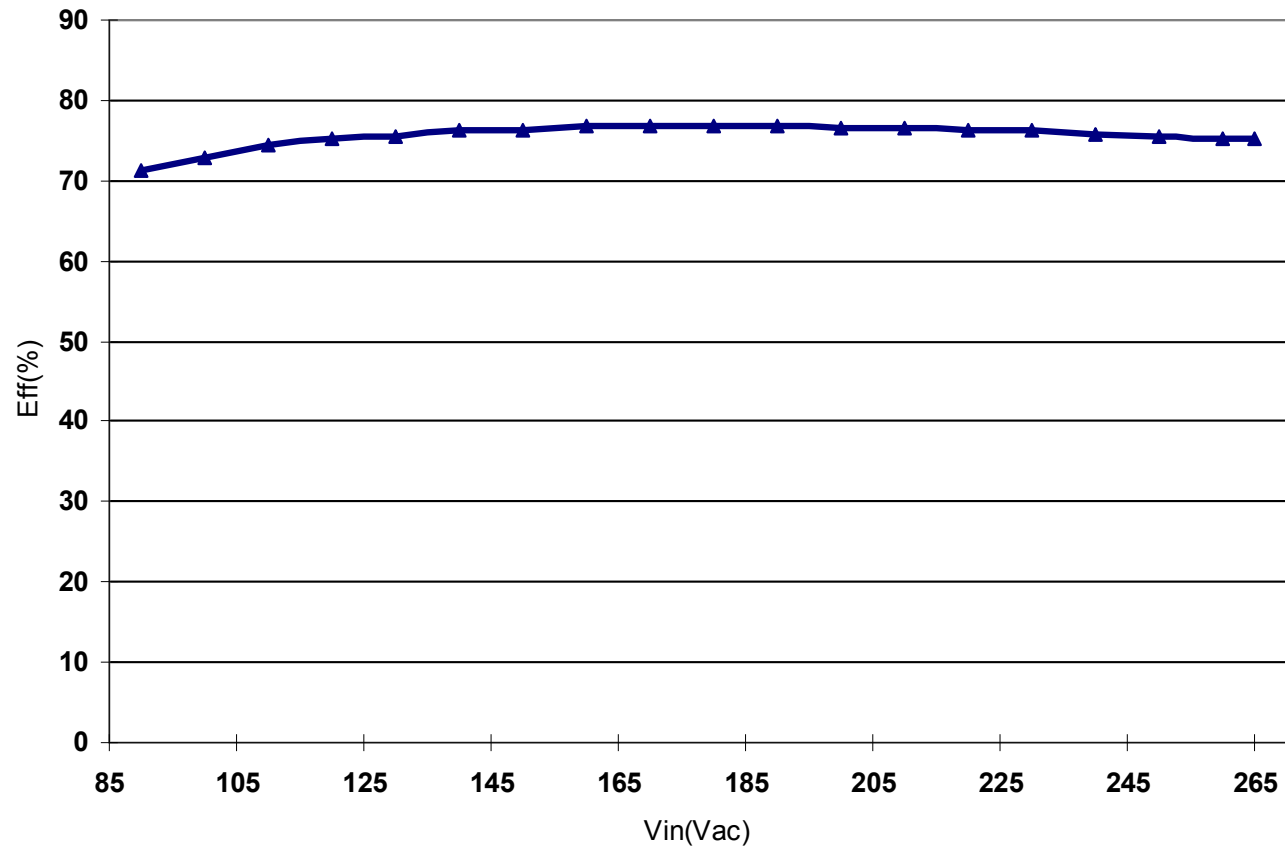
## FINISHED :

1. Varnish the complete assembly
2. Core is connected to pin5 ( primary ground )

- Bobbin to be "rotated" in Anti-clockwise direct looking from pin 1/4 side.
- (Wire to be "started" from pin-4 & "ended" at pin-3 in a Clockwise direction when looking from pin 1/4 side)



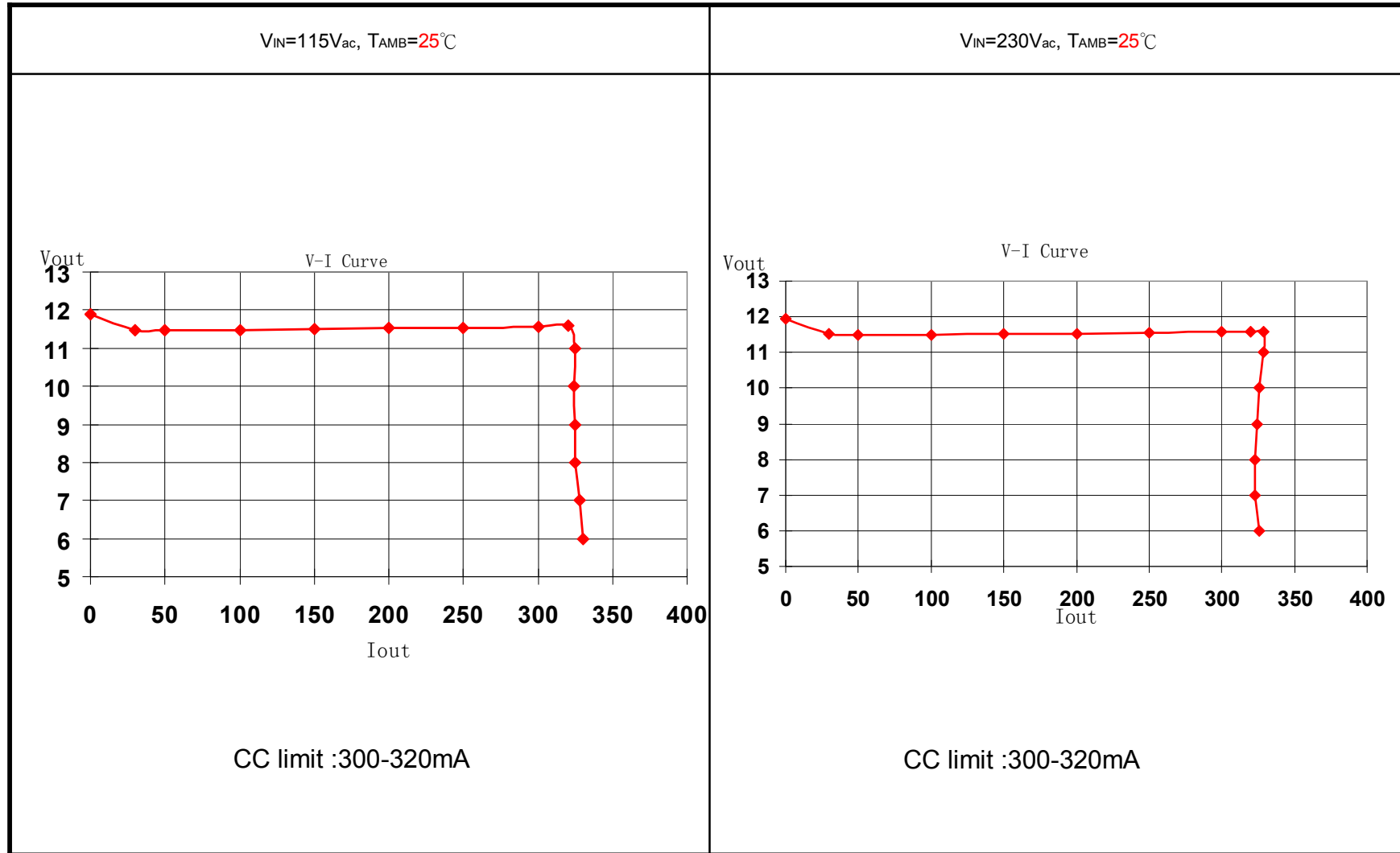
## 6. Efficiency Vs Input Voltage



**\* Note: Output voltage measured at end of PCB.**

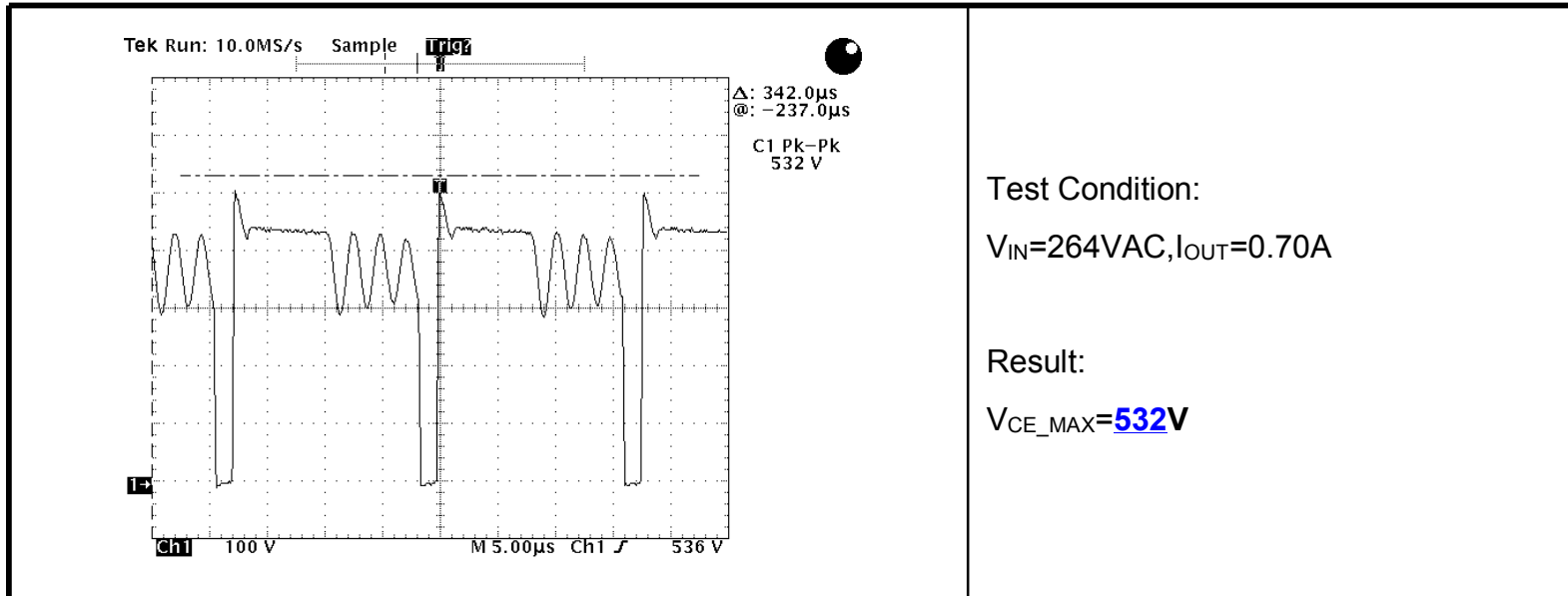
# 7. Output VI Characteristics

\* Note: Output voltage measured at PCB end,  $T_{AMB}=25\text{ }^{\circ}\text{C}$





# 8. V<sub>CE</sub> Waveform

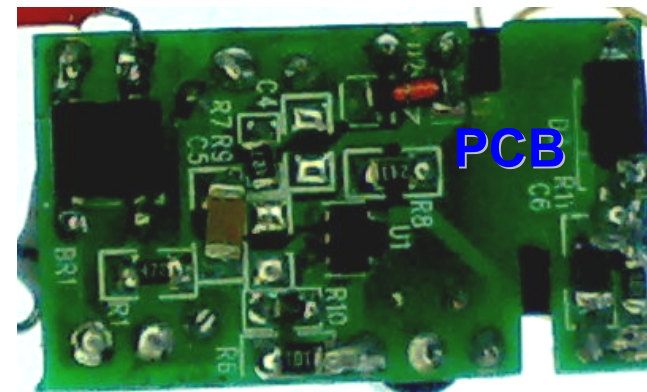
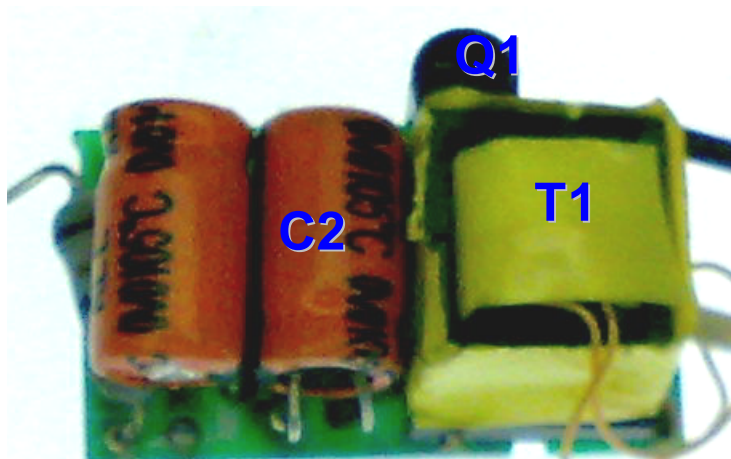


Appendix – Simple Specification for used transistor 3DG3020A1)

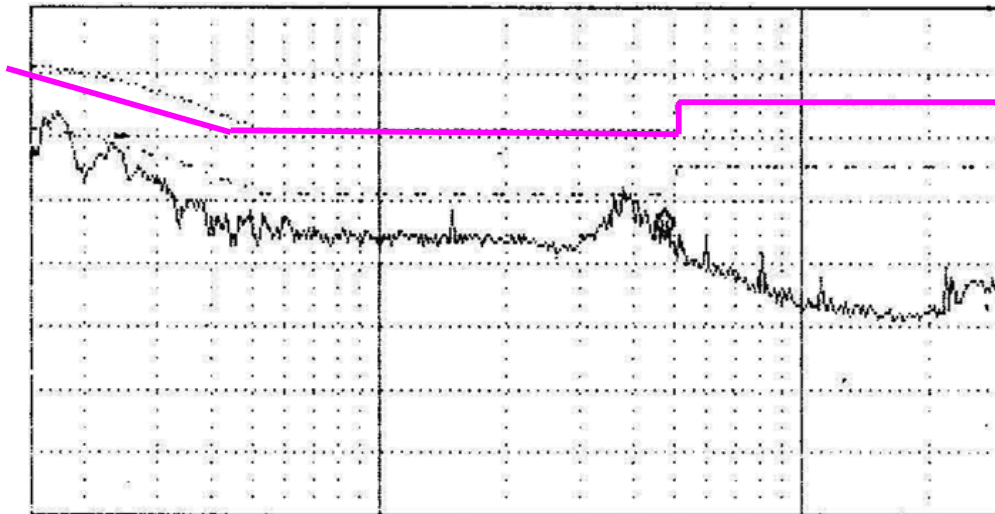
Parameter Note	Symbol	Rating	Unit
Collector-Base Breakdown Voltage	$V_{CBO}$	800	V
Collector-Emitter Breakdown Voltage	$V_{CEO}$	450	V
Emitter-Base Breakdown Voltage	$V_{EBO}$	9	V
Collector Current	$I_C$	1.5	A
Power Dissipation	$P_{tot}$	$T_a=25^{\circ}C$ 0.8	W
Junction Temperature		150	
Storage Temperature	$T_{stg}$	-55~150	$^{\circ}C$

# 9. Thermal test

Component s	90Vac	180Vac	264Vac
Q1 , 3DD3020	91.5 ° C	85.8 ° C	85.4 ° C
C2 , 2.2uF/400V	86.5 ° C	77.1 ° C	78.1 ° C
T1 winding	90.5 ° C	86.6 ° C	88.7 ° C
T1 core	90.5 ° C	84.3 ° C	88.7 ° C
PCB	88.8 ° C	84.1 ° C	86.9 ° C
Ambient	25.2 ° C	25.0 ° C	26.6 ° C

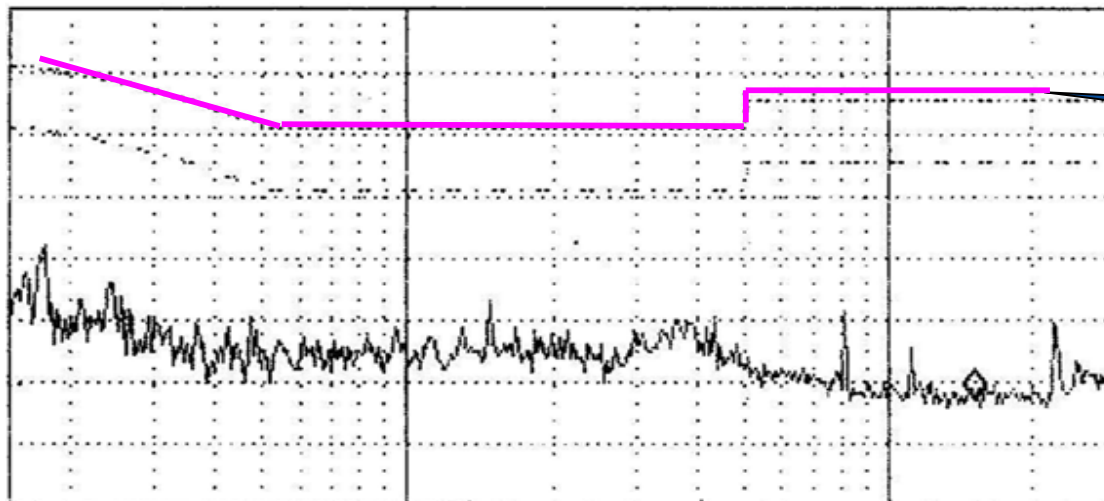


# 10. Conducted EMI ( Input 230Vac Full Load, output floating )



Peak Scan  
QP Limit line

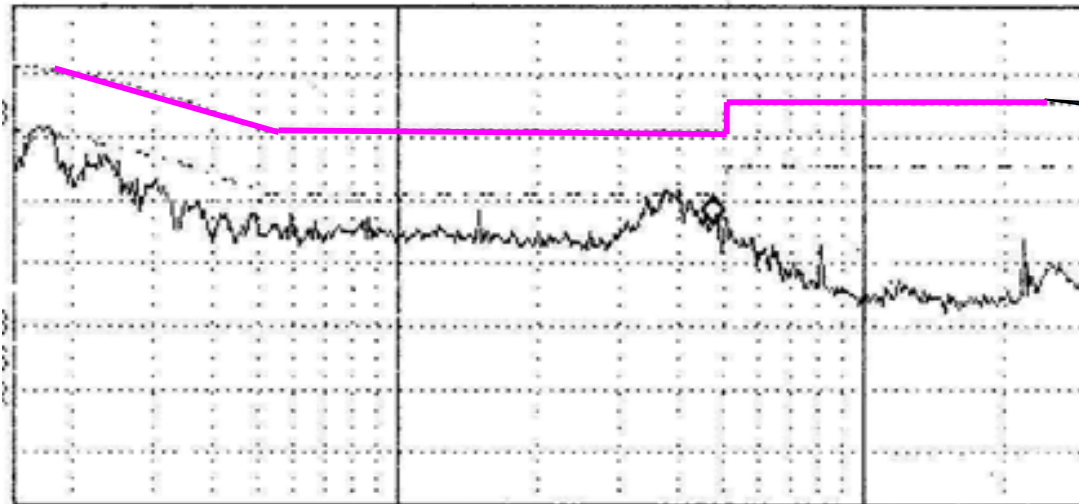
L line Peak scan



Average Scan  
AV Limit line

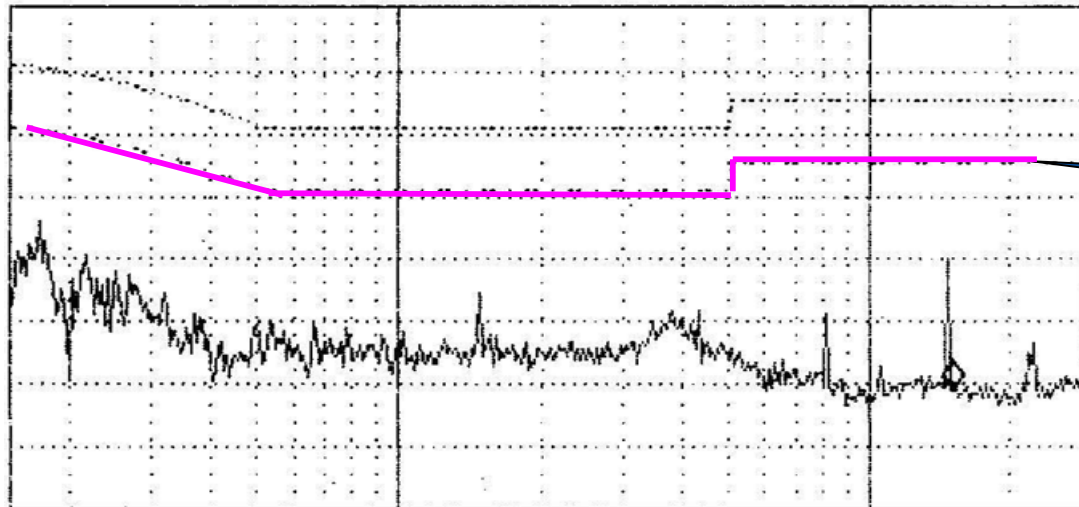
L line Average scan

# 11. Conducted EMI ( Input 230Vac Full Load, output floating )



Peak Scan  
QP Limit line

N line Peak scan



Average Scan  
AV Limit line

N line Average scan