



## Iw3614-00 for 30V350mA LED Driver

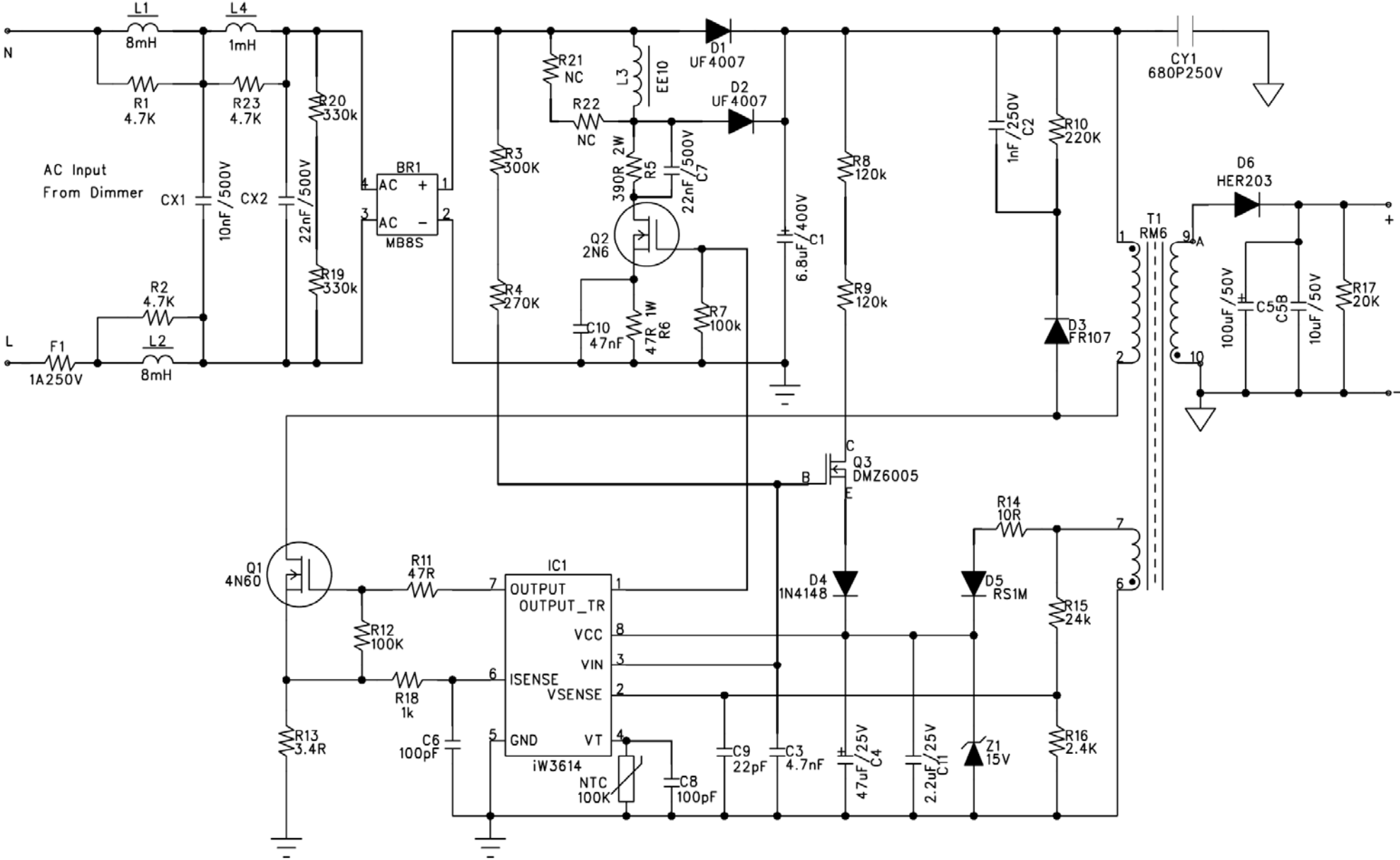
### General Design Specification:

1. AC Input Range 180-264Vac
2. DC Output 30V, 350mA(Constant Current )
3. Isolated High efficiency ,High PF
4. Best dimming performance with wide world dimmers, Leading edge and trailing edge

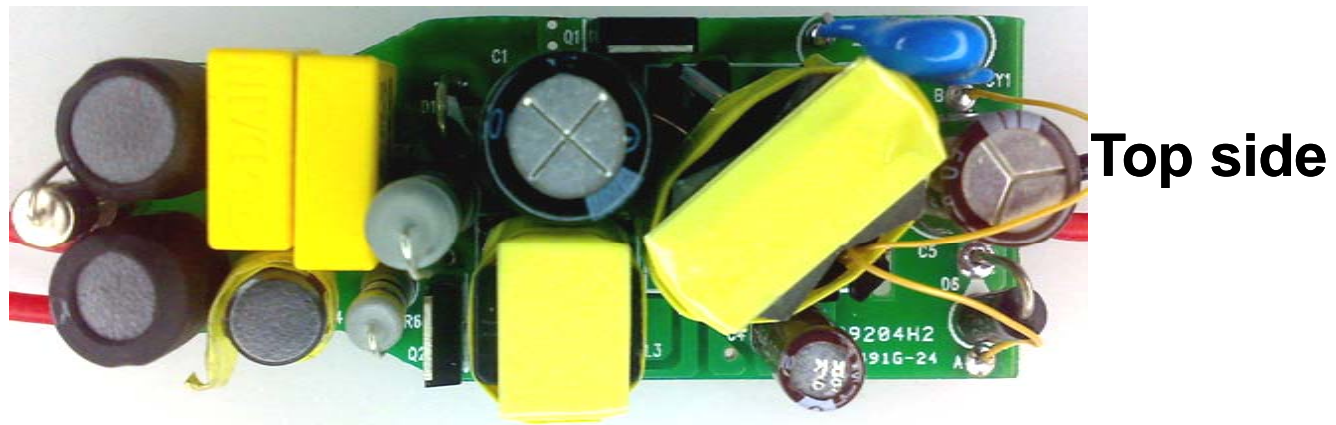
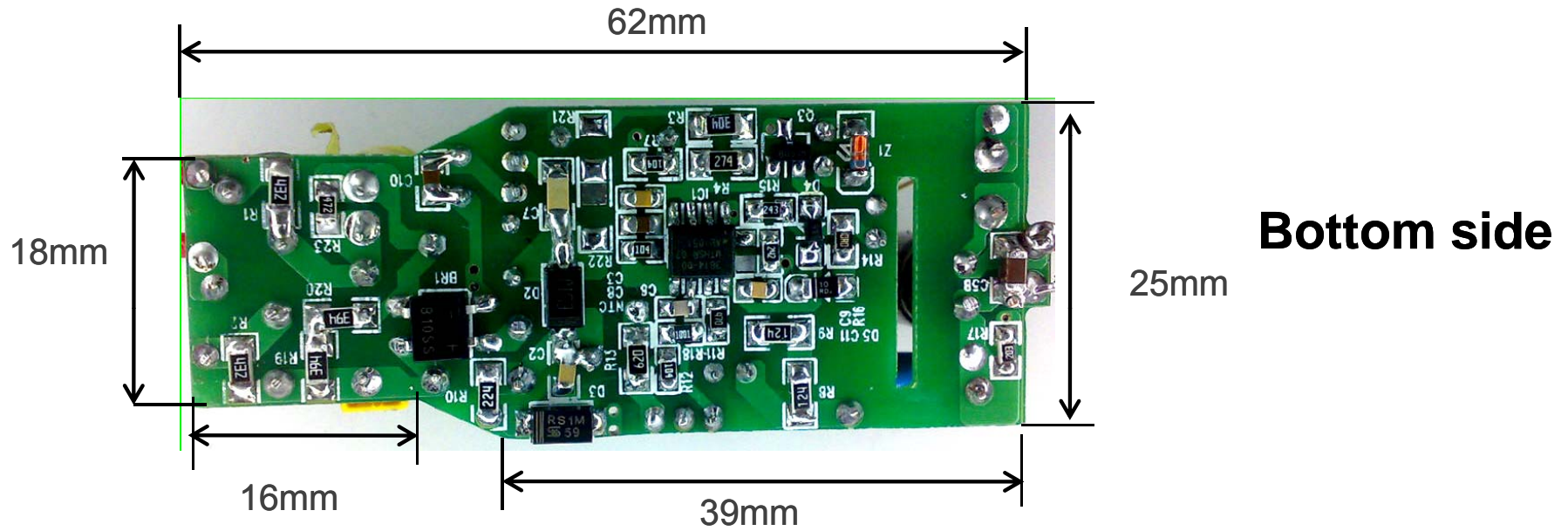
# 1. Specification

| Description                                    |                | Symbol         | Min            | Typ  | Max | Units           | Comment                       |
|--|----------------|----------------|----------------|------|-----|-----------------|-------------------------------|
| Input  |                |                |                |      |     |                 |                               |
| Voltage  |                | $V_{IN}$       | 180            |      | 264 | V <sub>AC</sub> | 2 Wire                        |
| Frequency                                      |                | $f_{LINE}$     | 47             | 50   | 63  | Hz              |                               |
| Open-load Input Power<br>(264V <sub>AC</sub> ) |                |                |                |      |     | W               |                               |
| Output   |                |                |                |      |     |                 |                               |
| Const Voltage                                  | Output Voltage | $V_{OUT\_CV}$  |                | 30   |     | V               | Measured at the PCB connector |
|  | Output Current | $I_{OUT\_CV}$  |                |      |     | A               |                               |
| Const Current                                  | Output Voltage | $V_{OUT\_CV}$  |                |      |     | V               | Min Vout is depend on Vcc     |
|  | Output Current | $I_{OUT\_CV}$  |                | 350  |     | mA              |                               |
| Total Output Power                             |                |                |                |      |     |                 |                               |
| Continuous Output Power                        |                | $P_{OUT}$      |                | 12   |     | W               |                               |
| Over Current Protection                        |                | $I_{OUT\_MAX}$ |                |      |     | A               | Auto-restart                  |
| Efficiency                                     |                | $\eta$         | 82             |      |     | %               | Measured at end of PCB@230    |
| Power Fact                                     |                | $PF$           |                | 0.96 |     |                 | Harmonic meet IEC61000-3-2    |
| Turn on Delay Time                             |                |                |                |      |     | Sec             |                               |
| Conducted EMI                                  |                |                | Meets EN55015B |      |     |                 |                               |
| Hi-pot test                                    |                |                |                |      |     | KV              |                               |
| Operation temperature                          |                | $T_{opr}$      |                | 40   |     | ° C             | Free convection, sea level    |

# 2 Schematic

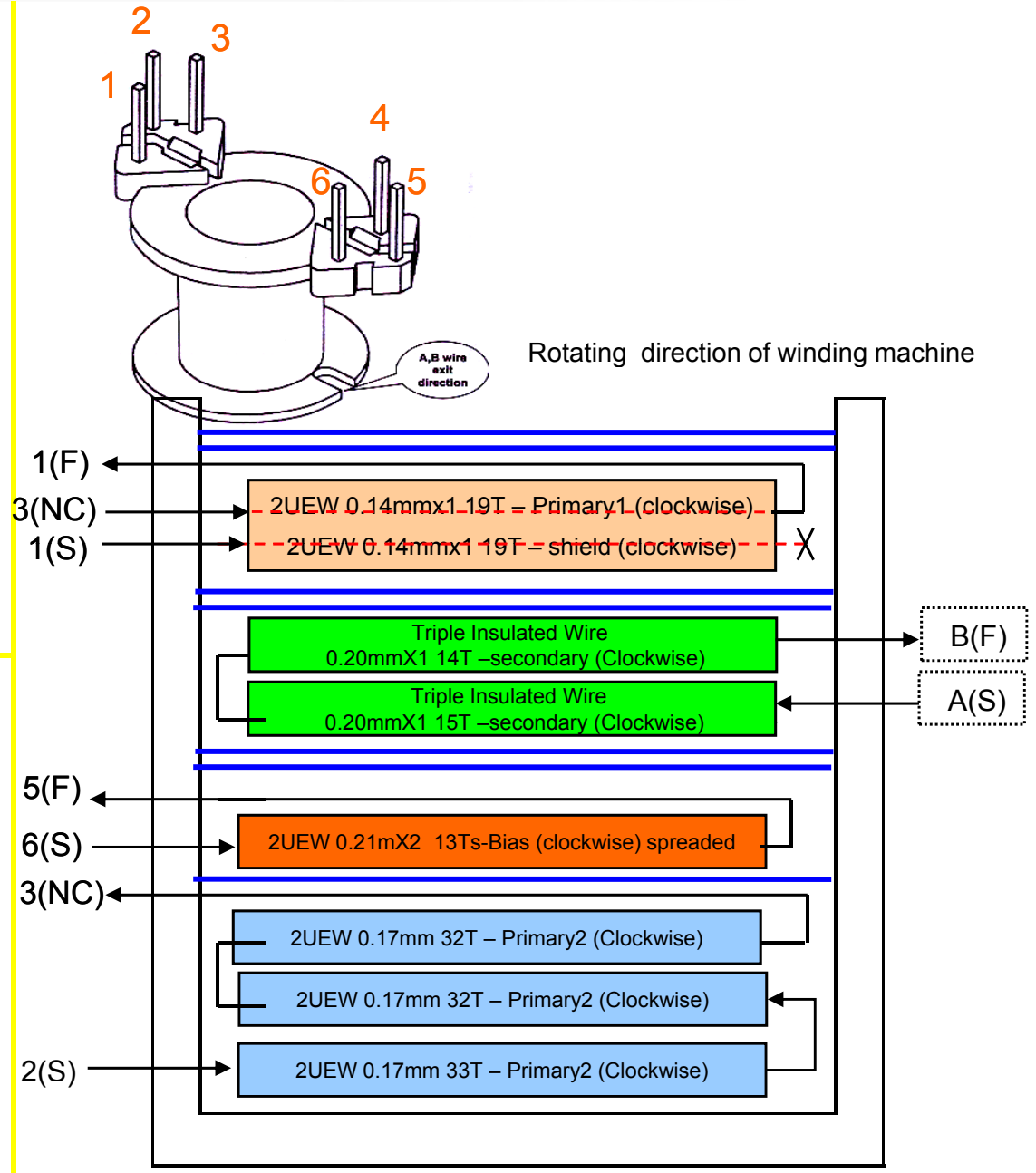
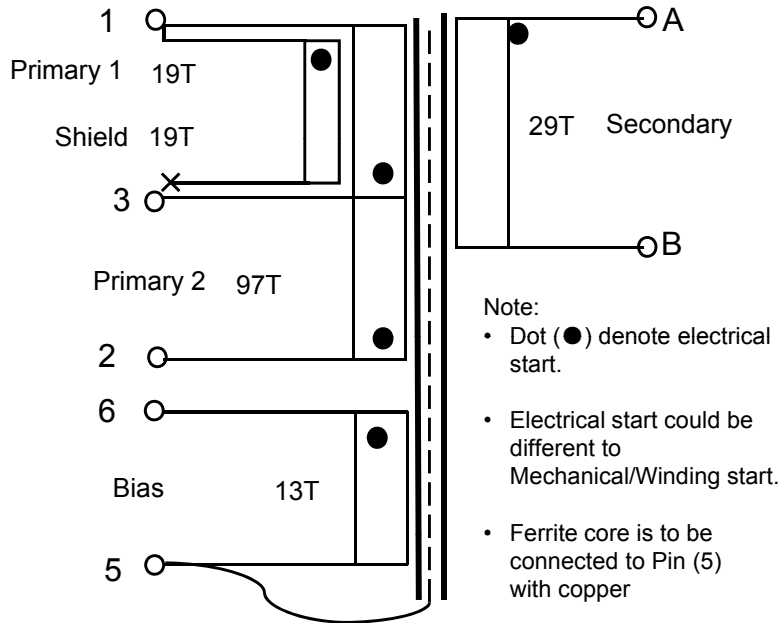


### 3. Circuit Board Photograph



# 4. Transformer Design

## SCHEMATIC



## ELECTRICAL SPECIFICATIONS:

1. Primary Inductance ( $L_p$ ) = 3.6mH @10KHz
2. Primary Leakage Inductance ( $L_k$ ) <= 60uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz, 1Min

## MATERIALS:

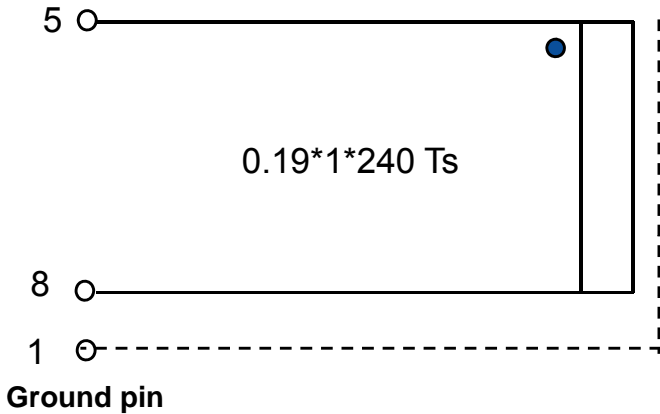
1. Core : RM6 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : RM6 Horizontal. Primary=3, Secondary=3
3. Magnet Wires (Pri) : Type 2-UEW
4. Magnet Wire (Sec) : Triple Insulated Wires
5. Layer Insulation Tape : 3M1298 or equivalent.

## FINISHED :

1. Cut remained of Pin after wires termination
2. Core is connected to PRI-GND pin5.
3. Varnish the complete assembly

# 5.PFC choke and EMI Inductor\_\_ For input 230Vac

## L3 SCHEMATIC



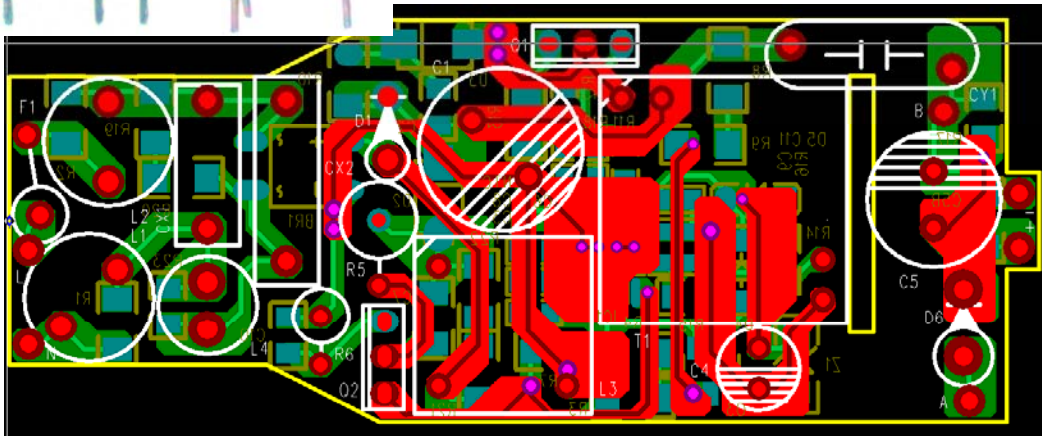
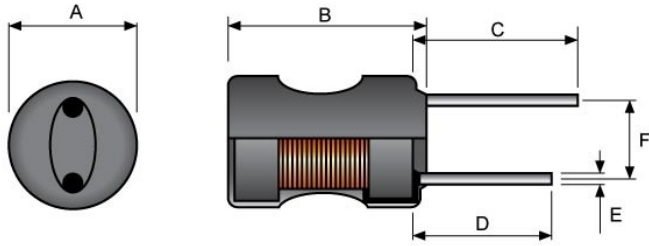
Copper shielding is connected to pin 1

## ELECTRICAL SPECIFICATIONS:

1. Inductance ( $L_p$ ) = 3.3mH @10KHz
2. Core : EE10 (Ferrite Material TDK PC40 or equivalent)
3. Bobbin : EE10 Horizontal
4. Ferrite core is connected to Pin 1 after assembling
5. Cut Pin 2 ,3,4,6,7 after wires termination
6. Varnish the complete assembly



## EMI Inductor L1,L2



Ferrite core size : Ax B 8x10mm 0.15\*500T  
 Inductance @10kHz, 1V: 8mH +/-20%  
 DCR: 8 OHM +/-20%

# 6.BOM \_\_Input 230Vac \_\_30V350mA

| Ref.       | Description                                      | Qty | Ref.    | Description                           | Qty |
|------------|--|-----|---------|---------------------------------------|-----|
| IC1        | iW3614-00, Digital PWM Controller,Dimmable, SO-8 | 1   | HS1     | aluminum 15*10*21                     | 1   |
| CX1        | 0.01uF,275V, X2                                  | 1   | C10     | 47nF,50V, X7R, SMD 0805               | 1   |
| CX2        | 0.022uF,275V, X2                                 | 1   | R11     | 47Ω ±5 %, SMD-0805                    | 1   |
| C7         | 22nF/500V , SMD 1206                             | 1   | R14     | 10Ω ±5 %, SMD-0805                    | 1   |
| C1         | 6.8uF, 450V, E-CAP, 105°C                        | 1   | R15     | 24KΩ ±1 %, SMD-0805                   | 1   |
| C2         | 1nF, 250V, X7R, SMD1206                          | 1   | R16     | 2.4KΩ ±1 %, SMD-0603                  | 1   |
| C8         | 100pF,25V, X7R, SMD 0603                         | 1   | NTC     | 100KΩ ±5 %, SMD-0603                  | 1   |
| C6         | 100pF,25V, X7R, SMD 0603                         | 1   | R17     | 20KΩ ±5 %, SMD-1206                   | 1   |
| C9         | 22pF,50V, X7R, SMD 0603                          | 1   | R19,R20 | 330KΩ ±5 %, SMD-1206                  | 2   |
| C3         | 4.7nF,50V, X7R, SMD 0603                         | 1   | FR1     | T1A250V                               | 1   |
| C11        | 2.2uF, 25V, X7R, SMD 1206                        | 1   | BR1     | DB107S, SMD                           | 1   |
| C4         | 47uF, 25V, E-CAP                                 | 1   | D1,D2   | UF4007                                | 2   |
| C5         | 100uF,50V,E-CAP                                  | 1   | D3      | FR107,1A1000V                         | 1   |
| R1, R2,R23 | 4.7KΩ ±5 %, SMD-1206                             | 3   | D4      | 1N4148 0.1A/100V, SMD                 | 1   |
| R3         | 300KΩ,±1 %, SMD-1206                             | 1   | D5      | RS1M 1A 1000V SMD                     | 1   |
| R4         | 270KΩ,±1 %, SMD-1206                             | 1   | D6      | HER203 2A/200V                        | 1   |
| R5         | 390Ω,±5 %, 2W                                    | 1   | Z1      | Zener, 15V, SMD                       | 1   |
| R6         | 47Ω ,±5 %, 1W                                    | 1   | CY1     | Y1,680pF,250V                         | 1   |
| R10        | 220KΩ,±5 %, SMD-1206                             | 1   | C5B     | 10uF/50V,SMD 1206                     | 1   |
| R7,R12     | 100KΩ±5 %, SMD-0805                              | 2   | Q1      | 4N60,TO-251                           | 1   |
| R8,R9      | 120KΩ,±5 %, SMD-1206                             | 2   | Q2      | 2N60, TO-251                          | 1   |
| R18        | 1KΩ ±1 %, SMD-0603                               | 1   | Q3      | DMZ6005, N-Depletion, 600V, SOT-23    | 1   |
| R13        | 3.4Ω ±1 %, SMD-1206                              | 1   | L1,L2   | 8mH, Drum choke, 8X10mm, 0.15mm,500Ts | 2   |
| L3         | 3.3mH, EE10,0.19mmX240Ts                         | 1   | L5      | 1mH, Drum choke, 6X8mm, 0.15mm 180Ts  | 1   |
| T1         | RM6, Transformer                                 | 1   |         |                                       |     |

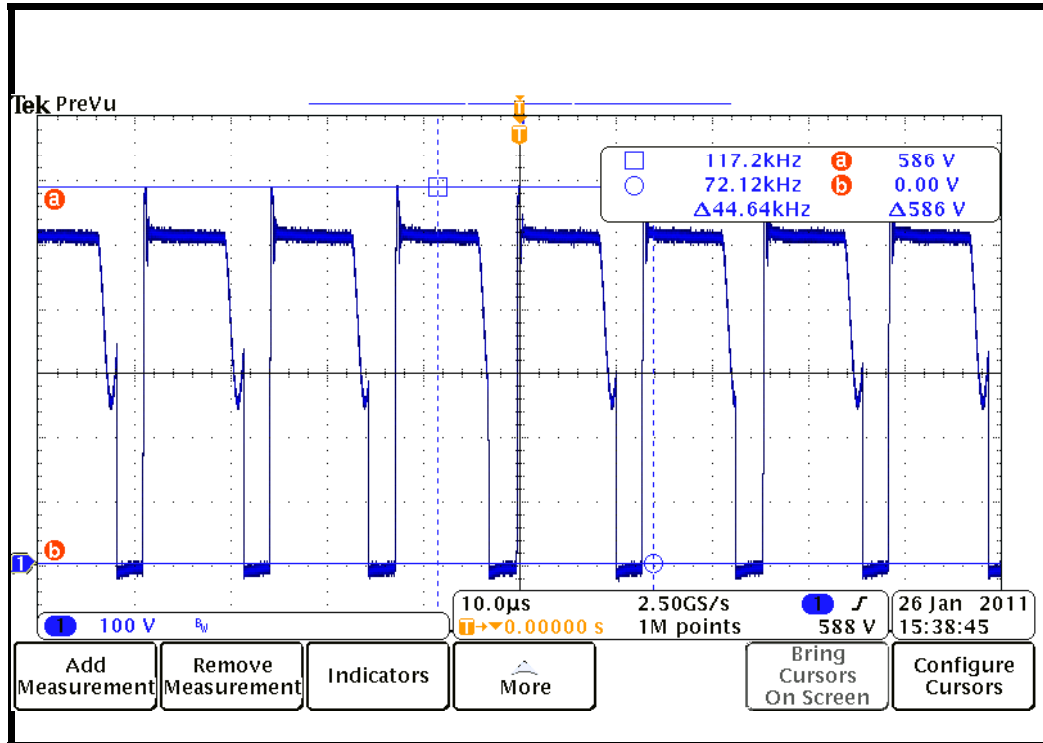
# 7.Constant Current and Efficiency \_\_No Dimmer

(AC input 180~264Vac,Output 9 LEDs)

| #of LEDs | Vin | Pin   | Vout  | Iout  | ripple current(mA) | efficiency | PF    |
|----------|-----|-------|-------|-------|--------------------|------------|-------|
|          | (V) | (W)   | (V)   | (A)   |                    |            |       |
| 9LEDs    | 180 | 13.74 | 31.27 | 0.360 | 68                 | 81.92%     | 0.990 |
|          | 190 | 13.68 | 31.26 | 0.360 | 64                 | 82.27%     | 0.990 |
|          | 200 | 13.71 | 31.28 | 0.360 | 64                 | 82.14%     | 0.989 |
|          | 210 | 13.61 | 31.21 | 0.359 | 64                 | 82.32%     | 0.986 |
|          | 220 | 13.61 | 31.19 | 0.359 | 64                 | 82.27%     | 0.982 |
|          | 230 | 13.65 | 31.31 | 0.361 | 64                 | 82.81%     | 0.977 |
|          | 240 | 13.50 | 31.16 | 0.358 | 68                 | 82.63%     | 0.969 |
|          | 250 | 13.49 | 31.15 | 0.358 | 60                 | 82.67%     | 0.958 |
|          | 260 | 13.48 | 31.13 | 0.358 | 60                 | 82.67%     | 0.942 |
|          | 264 | 13.48 | 31.12 | 0.357 | 56                 | 82.42%     | 0.931 |



# 8. $V_{ds}$ waveform



Test Condition:

$V_{IN}=264V_{AC}$ ,  $I_{out}=350mA$

Result:

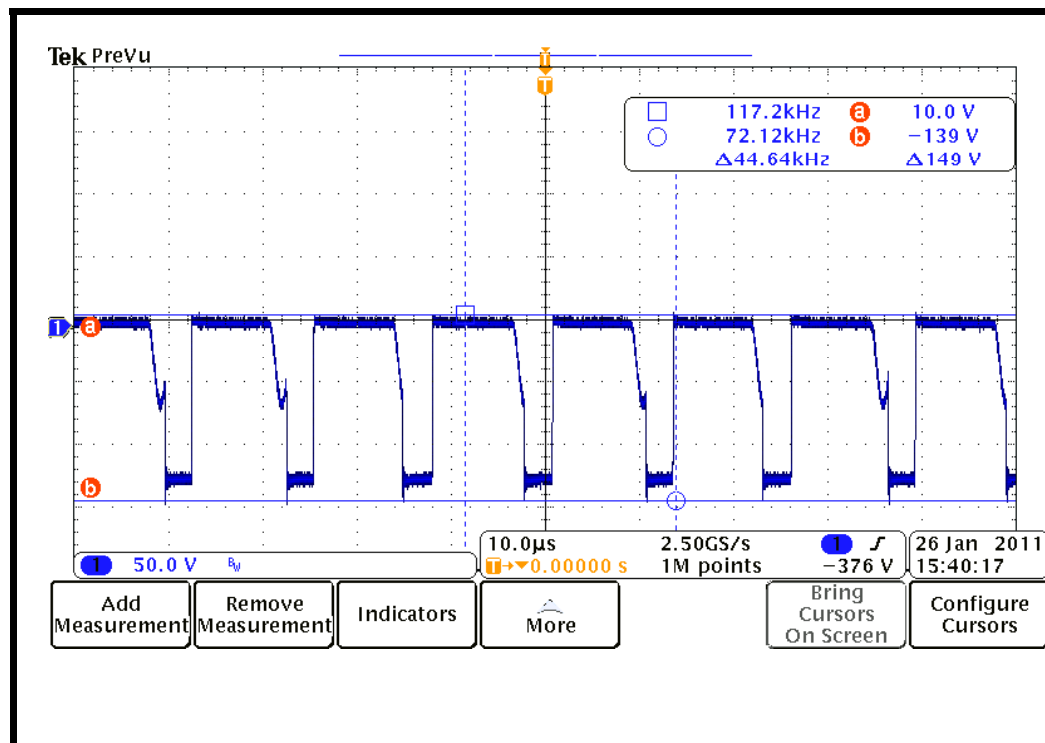
$V_R (pk-pk)=586V$

Q2: SPD02N60C3/A04N60C3 (INFINEON)

Electrical Characteristics, at  $T_J=25^{\circ}C$  unless otherwise specified

| Parameter                                | Symbol        | Conditions                   | Values |      |      | Unit |
|--|---------------|------------------------------|--------|------|------|------|
|  |               |                              | min.   | typ. | max. |      |
| Drain-source breakdown voltage           | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=0.25mA$      | 600    | -    | -    | V    |
| Drain-Source avalanche breakdown voltage | $V_{(BR)DS}$  | $V_{GS}=0V, I_D=0.25A$       | -      | 700  | -    |      |
| Gate threshold voltage                   | $V_{GS(th)}$  | $I_D=80\mu A, V_{GS}=V_{DS}$ | 2.1    | 3    | 3.9  |      |

# 9. $V_R$ waveform



Test Condition:

$V_{IN}=230VAC$ ,  $I_{out}=350mA$

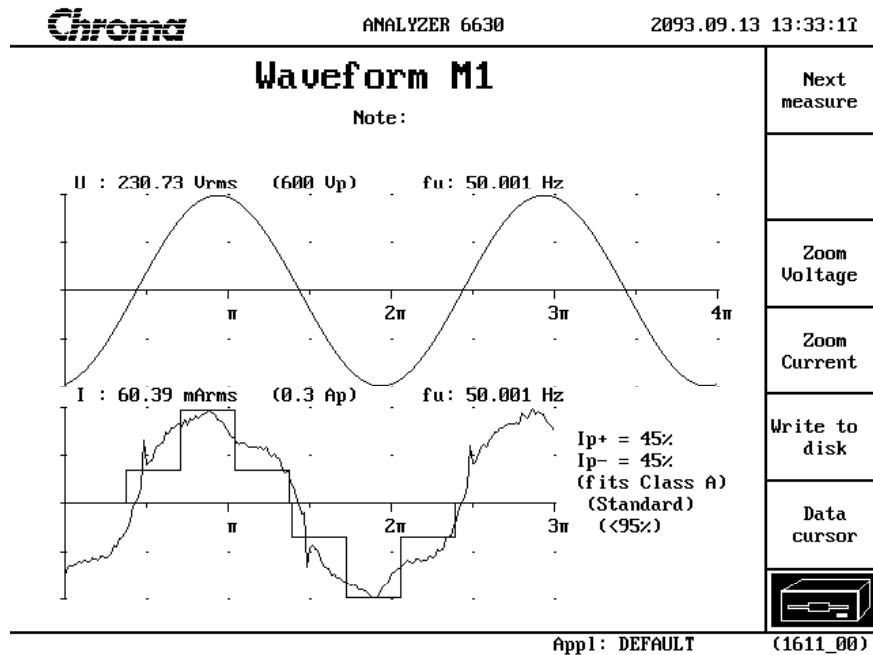
Result:

$V_R (pk-pk)=156V$

Output rectifier diode: HER203(2A 200V)

| Characteristic  | Symbol       | HER 201 | HER 202 | HER 203 | HER 204 | HER 205 | HER 206 | HER 207 | HER 208 | Unit |
|---|--------------|---------|---------|---------|---------|---------|---------|---------|---------|------|
| Peak Repetitive Reverse Voltage                                   | $V_{RRM}$    |         |         |         |         |         |         |         |         |      |
| Working Peak Reverse Voltage                                      | $V_{RWM}$    | 50      | 100     | 200     | 300     | 400     | 600     | 800     | 1000    | V    |
| DC Blocking Voltage   | $V_R$        |         |         |         |         |         |         |         |         |      |
| RMS Reverse Voltage   | $V_{R(RMS)}$ | 35      | 70      | 140     | 210     | 280     | 420     | 560     | 700     | V    |
| Average Rectified Output Current<br>(Note 1) @ $T_A = 55^\circ C$ | $I_o$        | 2.0     |         |         |         |         |         |         |         | A    |

# 10. Harmonic and current waveform 3614-00



Harmonics current  
@230Vac

Meet IEC61000-3-2  
requirement

**Chroma** ANALYZER 6630 2093.09.13 13:32:09

### Current Harmonics

Setup: CLASS\_D Gen setting: 1(1) U : 229.85 V fu: 50.001 Hz  
Live Analysed periods: 4 I : 60.52 mA P: 13.56 W  
Module: M1 Limit: Class D (Standard) I1: 59.44 mA  
Note:  
THD=18.49 % (PF=0.975) PASSED  
P < 75 W

| No | mA    | Lim mA | No | mA   | Lim mA | No | mA   | Lim mA |
|----|-------|--------|----|------|--------|----|------|--------|
| 1  | 59.44 |        | 15 | 0.64 |        | 29 | 0.59 |        |
| 2  | 0.26  |        | 16 | 0.19 |        | 30 | 0.17 |        |
| 3  | 8.59  |        | 17 | 0.43 |        | 31 | 0.62 |        |
| 4  | 0.11  |        | 18 | 0.08 |        | 32 | 0.10 |        |
| 5  | 5.83  |        | 19 | 0.58 |        | 33 | 0.69 |        |
| 6  | 0.15  |        | 20 | 0.11 |        | 34 | 0.10 |        |
| 7  | 1.10  |        | 21 | 0.64 |        | 35 | 0.82 |        |
| 8  | 0.06  |        | 22 | 0.05 |        | 36 | 0.14 |        |
| 9  | 1.74  |        | 23 | 0.82 |        | 37 | 0.70 |        |
| 10 | 0.13  |        | 24 | 0.23 |        | 38 | 0.11 |        |
| 11 | 1.30  |        | 25 | 0.70 |        | 39 | 0.84 |        |
| 12 | 0.19  |        | 26 | 0.21 |        | 40 | 0.08 |        |
| 13 | 0.80  |        | 27 | 0.65 |        |    |      |        |
| 14 | 0.12  |        | 28 | 0.04 |        |    |      |        |

Current range: 0.1 Ap

App1: DEFAULT (1212\_01)

Ac current waveform  
@230Vac

PF=0.975

# 11.1 Dimmer Compatibility Test



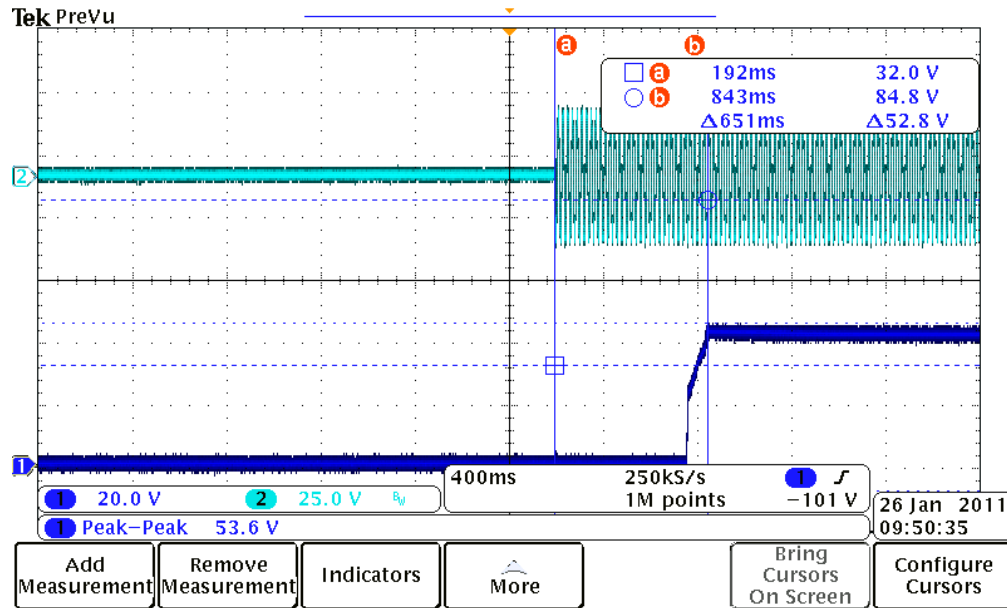
| Dimmer         | Input | Maximum Level |       |                  |                  | Middle level |      |                  |                  |              | Minimum level |      |                  |                  |
|----------------|-------|---------------|-------|------------------|------------------|--------------|------|------------------|------------------|--------------|---------------|------|------------------|------------------|
|                | Volt. | Pin           | Pout  | V <sub>LED</sub> | I <sub>LED</sub> | Pin          | Pout | V <sub>LED</sub> | I <sub>LED</sub> | AC peak curr | Pin           | Pout | V <sub>LED</sub> | I <sub>LED</sub> |
|                | (V)   | (W)           | (W)   | (V)              | (mA)             | (W)          | (W)  | (V)              | (mA)             | (mA)         | (W)           | (W)  | (V)              | (mA)             |
| Etman          | 180   | 14.03         | 10.43 | 30.86            | 338              | 8.21         | 5.15 | 29.61            | 174              | 600          | 2.57          | 0.21 | 26.24            | 8                |
| ETM321S 315w   | 230   | 15.14         | 10.77 | 30.77            | 350              | 8.86         | 4.83 | 29.29            | 165              | 600          | 3.76          | 0.29 | 26.47            | 11               |
| Trailing       | 264   | 15.76         | 10.85 | 30.81            | 352              | 9.77         | 4.90 | 29.34            | 167              | 720          | 4.73          | 0.35 | 26.61            | 13               |
| Niko           | 180   | 10.93         | 8.11  | 30.61            | 265              | 7.25         | 4.71 | 29.60            | 159              | 520          | 2.5           | 0.52 | 27.18            | 19               |
| 320W           | 230   | 13.75         | 10.48 | 31.09            | 337              | 7.93         | 4.96 | 29.70            | 167              | 540          | 3.97          | 1.14 | 27.07            | 42               |
| Trailing       | 264   | 15.90         | 10.83 | 30.78            | 352              | 10.20        | 5.12 | 29.41            | 174              | 680          | 6.37          | 1.36 | 27.67            | 49               |
| Wuyun          | 180   | 14.33         | 11.05 | 31.22            | 354              | 7.51         | 5.17 | 29.74            | 174              | 1760         | 0.52          | 0.02 | 24.16            | 1                |
| 400W           | 230   | 13.71         | 11.12 | 31.24            | 356              | 7.90         | 5.17 | 29.73            | 174              | 1840         | 0.64          | 0.05 | 24.25            | 2                |
| Leading        | 264   | 13.77         | 11.02 | 31.22            | 353              | 8.24         | 5.23 | 29.73            | 176              | 1840         | 0.93          | 0.18 | 26.23            | 7                |
| Phasenbschnitt | 180   | 14.76         | 11.02 | 31.23            | 353              | 7.66         | 5.39 | 29.77            | 181              | 540          | 2.47          | 0.80 | 27.44            | 29               |
| T46 315W       | 230   | 14.11         | 11.11 | 31.29            | 355              | 7.87         | 5.17 | 29.72            | 174              | 540          | 3.17          | 1.02 | 27.68            | 37               |
| Trailing       | 264   | 14.06         | 11.11 | 31.29            | 355              | 8.23         | 5.20 | 29.74            | 175              | 580          | 3.59          | 1.05 | 27.72            | 38               |

# 11.2 Dimmer Compatibility Test



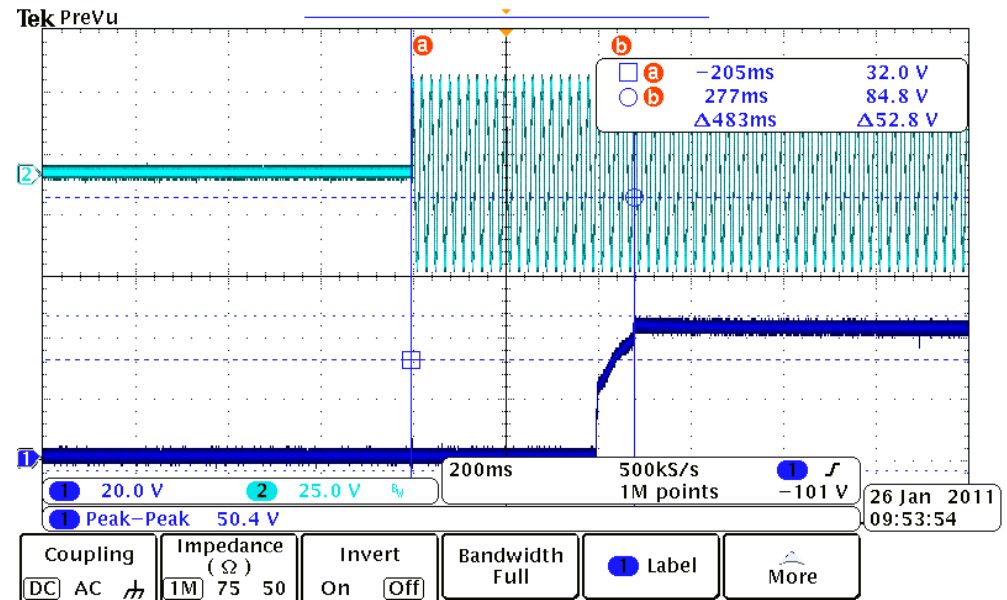
|                | Input | Maximum Level |       |                  |                  | Middle level |      |                  |                  |              | Minimum level |      |                  |                  |
|----------------|-------|---------------|-------|------------------|------------------|--------------|------|------------------|------------------|--------------|---------------|------|------------------|------------------|
| Dimmer         | Volt. | Pin           | Pout  | V <sub>LED</sub> | I <sub>LED</sub> | Pin          | Pout | V <sub>LED</sub> | I <sub>LED</sub> | AC peak curr | Pin           | Pout | V <sub>LED</sub> | I <sub>LED</sub> |
|                | (V)   | (W)           | (W)   | (V)              | (mA)             | (W)          | (W)  | (V)              | (mA)             | (mA)         | (W)           | (W)  | (V)              | (mA)             |
| LICHTRGLER     | 180   | 13.66         | 11.00 | 31.07            | 354              | 7.48         | 5.37 | 29.69            | 181              | 1500         | 0.84          | 0.27 | 26.60            | 10               |
| T43 400w       | 230   | 13.34         | 11.04 | 31.09            | 355              | 7.50         | 5.16 | 29.63            | 174              | 1800         | 0.85          | 0.21 | 26.48            | 8                |
| Leading        | 264   | 13.37         | 11.06 | 31.15            | 355              | 7.72         | 5.19 | 29.65            | 175              | 1880         | 3.23          | 1.69 | 28.16            | 60               |
| LUFENG         | 180   | 13.08         | 9.60  | 30.76            | 312              | 7.98         | 5.12 | 29.61            | 173              | 500          | 2.32          | 0.49 | 27.00            | 18               |
| 220V 300W      | 230   | 15.29         | 11.25 | 31.25            | 360              | 8.43         | 4.99 | 29.72            | 168              | 540          | 3.60          | 0.97 | 27.73            | 35               |
| Trailing China | 264   | 15.63         | 11.02 | 31.05            | 355              | 8.83         | 4.96 | 29.55            | 168              | 560          | 4.26          | 1.14 | 27.74            | 41               |
| Songben        | 180   | 14.38         | 10.92 | 31.01            | 352              | 8.06         | 5.11 | 29.55            | 173              | 1440         | 1.27          | 0.13 | 25.64            | 5                |
| 220V 300W      | 230   | 14.48         | 10.98 | 31.03            | 354              | 8.62         | 5.37 | 29.66            | 181              | 1800         | 1.63          | 0.05 | 24.24            | 2                |
| leading China  | 264   | 14.97         | 10.93 | 30.96            | 353              | 12.51        | 6.39 | 29.84            | 214              | 1820         | 2.31          | 0.18 | 26.25            | 7                |
| TCL            | 180   | 14.52         | 10.88 | 31.00            | 351              | 7.58         | 4.86 | 29.46            | 165              | 1260         | 1.36          | 0.07 | 24.95            | 3                |
| 300W           | 230   | 14.85         | 10.94 | 30.99            | 353              | 8.68         | 5.11 | 29.54            | 173              | 1600         | 2.14          | 0.18 | 26.20            | 7                |
| Leading China  | 264   | 15.42         | 10.97 | 31.09            | 353              | 9.14         | 4.92 | 29.48            | 167              | 1780         | 3.90          | 0.99 | 27.56            | 36               |

# 12. Turn On Delay Time



180V<sub>AC</sub>, Full Load

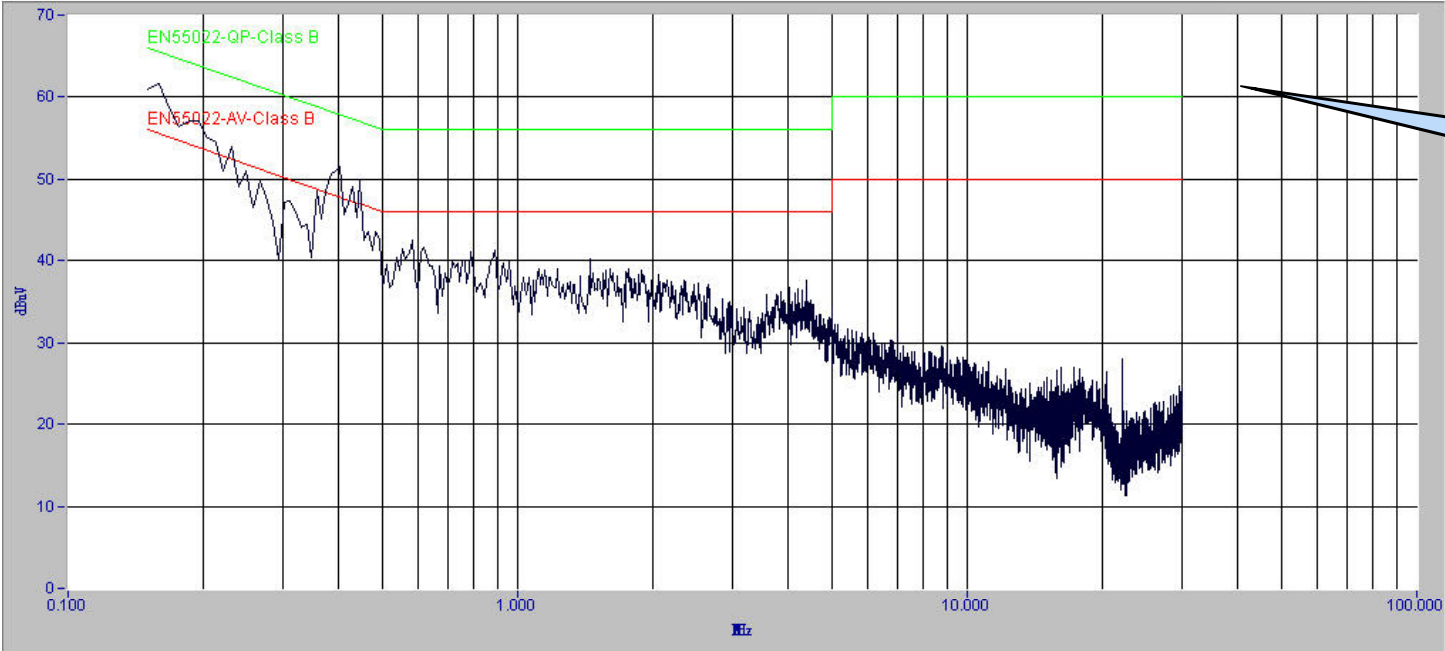
$T_{ST\_DELAY} = 653\text{ms}$



264V<sub>AC</sub>, Full Load

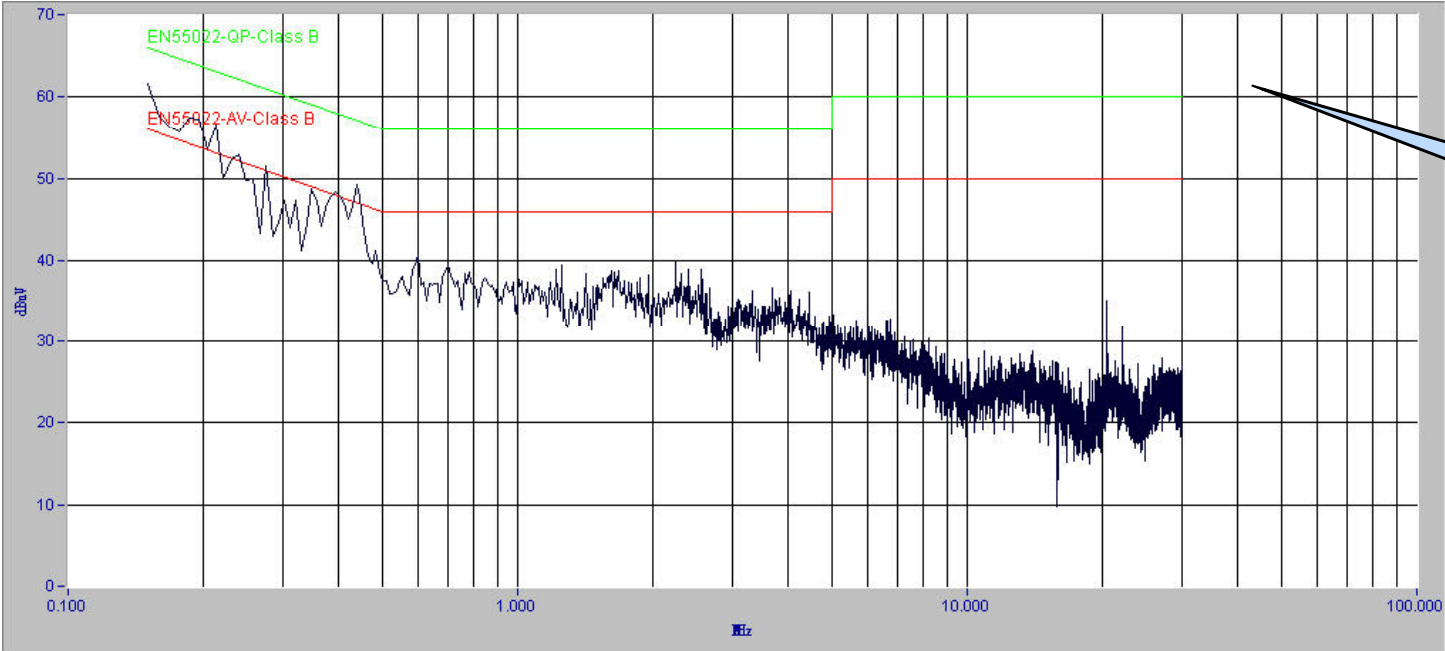
$T_{ST\_DELAY} = 483\text{ms}$

# 13. Conducted EMI



PK Scan  
QP Limit line

PK scan L



PK Scan  
QP Limit line

PK scan N

# 14.lw3614驱动板工作后, 首先检查的项目

| 检查项目    | 检查内容              | 判断标准  |      | 结论         |
|---------|-------------------|---|------|------------|
| MOSFET  | 在输入电压最高的时候的 Vds 值 | 0.8~0.9*Vds Max.  |      |            |
| 输出整流管   | 反向电压及Trr 的参数范围    | 低输出电压   | 肖特基  | HER20<br>3 |
|         |                   | 较高输出电压  | HER  |            |
|         |                   | 高电压小电流  | 超快恢复 |            |
| Vcc 整流管 | 反向电压及Trr的参数范围     | 推荐用1N4148或FR102/FR103                                   |      | 1N4148     |
| Vcc 电压  | 调光最大位置和最小位置时的Vcc  | 最大亮度/最多灯数   | <16V | 14         |
|         |                   | 最小亮度/最小灯数   | >8V  | 9V         |
| 变压器     | Bmax.             |   |      |            |
| Vsense  | 正常工作时的 Vsense电压   | 最高输出电压时的 Vsense (Knee) 应该低于1.4V, 以确保工作于CC mode(<1.538V) |      |            |
| OVP     | 输出开路时 Vsense 电压   | OVP 是1.7V,确认 输出开路时 MOSFET Vds是安全的, 输出整流管电压及 Vcc 的值      |      |            |