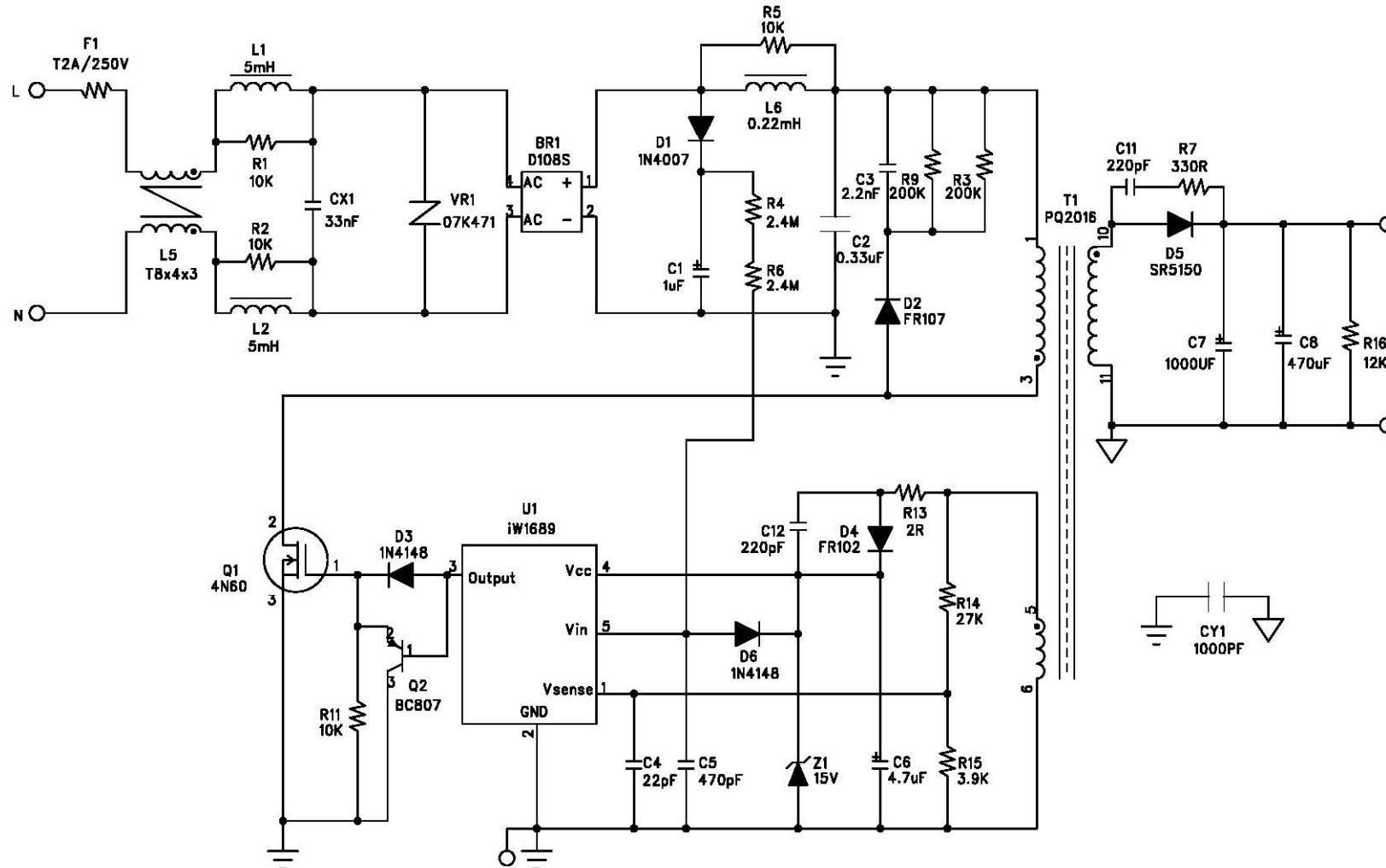


iWatt

HI-PF LED Driver with iW1689
(Input 90~264Vac Output 20V1A)

1.Schematics

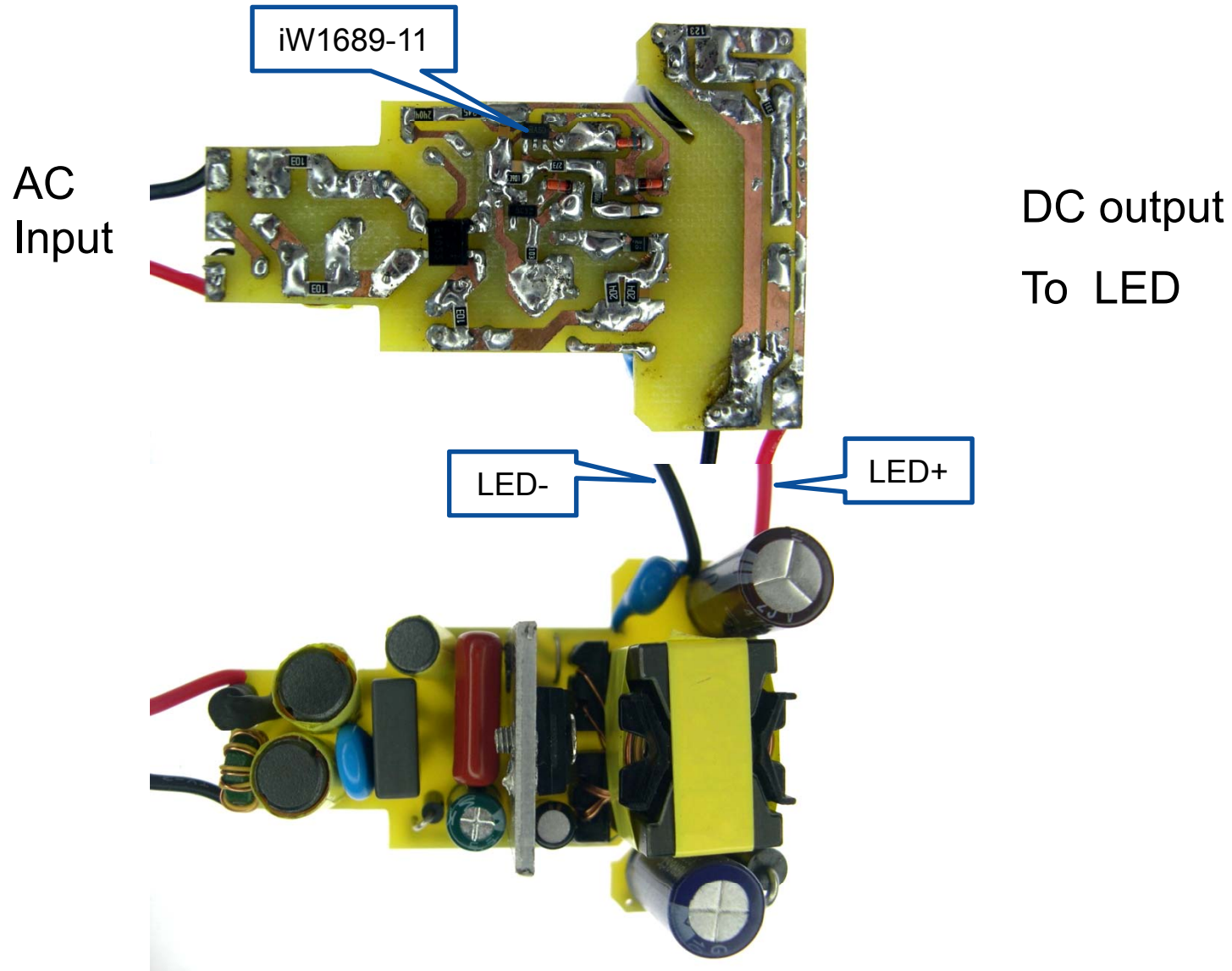
(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)



2.PCB Layout

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)

iWatt

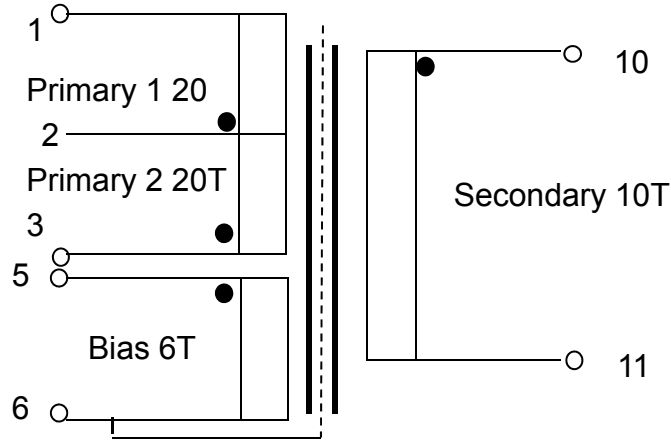


3. Transformer Design

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)



SCHMATIC



ELECTRICAL SPECIFICATIONS:

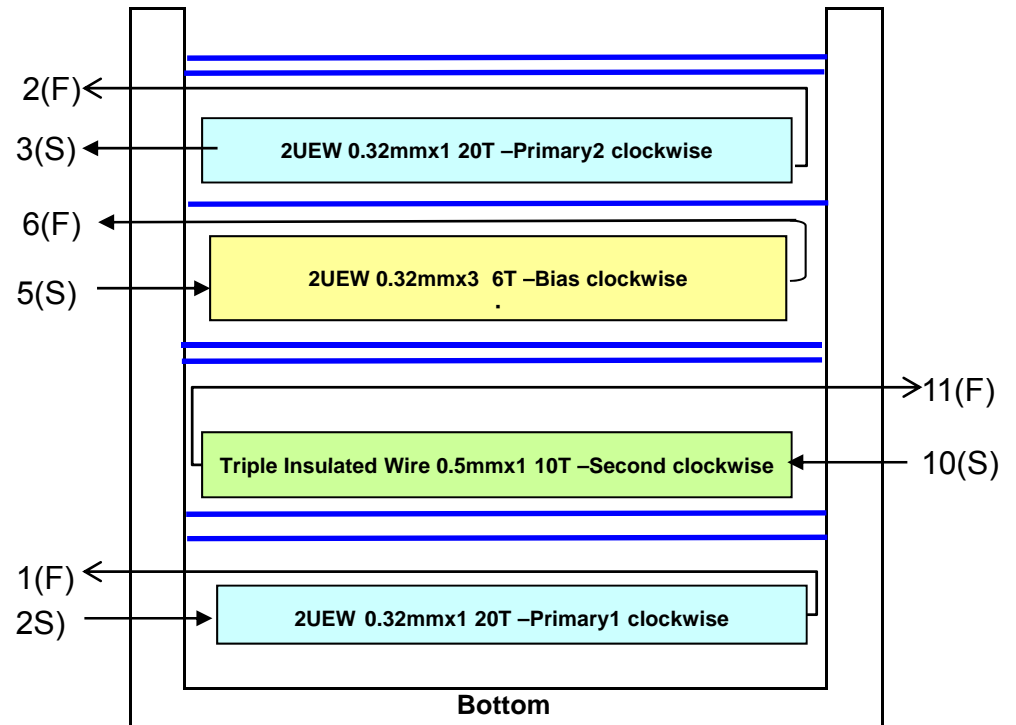
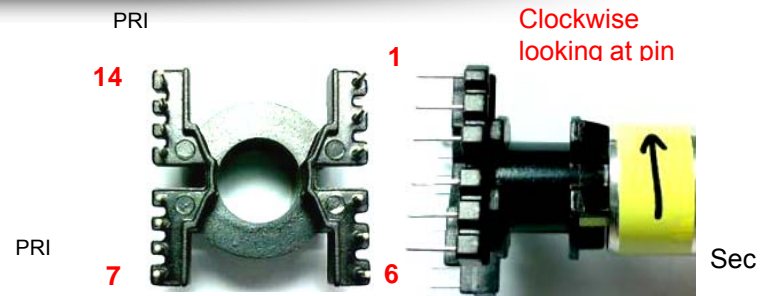
1. Primary Inductance (L_p) = 0.35mH @10KHz
2. Primary Leakage Inductance (L_k) ≤ 10uH@10KHz

MATERIALS:

1. Core : PQ2016 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : PQ2016
3. Magnet Wires : Type 2-UEW
4. Layer Insulation Tape :3M1298 or equivalent.

FINISHED :

1. Cut remained of Pin2,4,7,8,9,12,13,14 after wires termination
2. Varnish the complete assembly
3. Core is connected to primary pin6

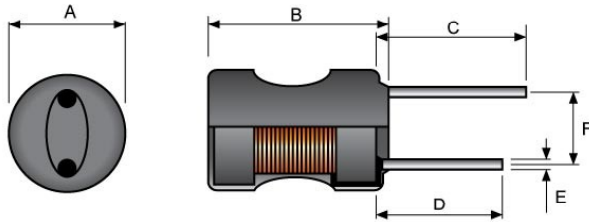


4. Differential Mode Inductor

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)

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4.1 Differential Mode Inductor L1,L2



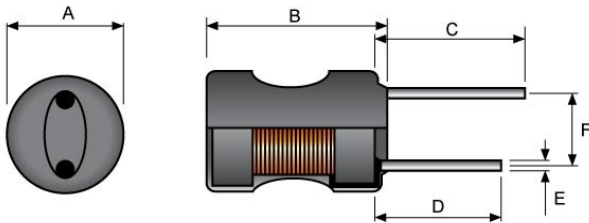
Ferrite core size : Ax B 8x10mm

Wire gauge: 0.18mm, 380 Turns

Inductance @10kHz, 1V: 5mH +/-20%

ICR: 9 OHM +/-20%

4.2 Differential Mode Inductor L3



Ferrite core size : Ax B 6x8mm

Wire gauge: 0.22mm, 90 Turns

Inductance @10kHz, 1V: 230uH +/-20%

ICR: 1 OHM +/-20%

5. Common Mode Inductor

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)

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5.1 Common Mode Inductor L5



core size:T8*4*3

Wire gauge: 0.3mm*2(Insulation& 2-UEW wire)

Turns10.5T

Inductance @10kHz, 1V: 30uH +/-20%

6.BOM

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)



| Item | Qty | Reference | Description | Item | Qty | Reference | Description |
|------|-----|-----------|--|------|-----|-----------|---|
| 1 | 1 | U1 | iW1689-11, Off-line Digital&Primary VMS Controller, 5-Lead SOT | 23 | 2 | L1,L2 | Differential Mode Inductor DR8*10 5mH |
| 2 | 1 | C2 | 0.33uF/400V, CBB21 P=15mm | 24 | 1 | L6 | Differential Mode Inductor DR6*8 0.22mH |
| 3 | 1 | C6 | 4.7uF, 50V 5*11mm E-Cap | 25 | 3 | R1.R2,R5 | 10KΩ ±5%, SMD-1206 |
| 4 | 1 | C1 | 1uF, 400V 6.5*11mm E-Cap | 26 | 2 | R4.R6 | 2.4MΩ ±5%, SMD-1206 |
| 5 | 1 | C7 | 470uF, 25V 10*21mm E-Cap | 27 | 2 | R3,R9 | 200KΩ ±5%, SMD-1206 |
| 6 | 1 | C3 | 2.2nF, 250V SMD-0805 | 28 | 1 | R7 | 330Ω ±5%, SMD-0805 |
| 7 | 1 | C5 | 470pF, 50V X7R, SMD-0805 | 29 | 1 | R11 | 1KΩ ±5%, SMD-0805 |
| 8 | 1 | C4 | 22pF, 50V X7R, SMD-0805 | 30 | 1 | R14 | 27KΩ ±1%, SMD-0805 |
| 9 | 2 | C11,C12 | 220pF, 250V X7R, SMD-0805 | 31 | 1 | R15 | 3.9KΩ ±1%, SMD-0805 |
| 10 | 1 | Q1 | 4N60 4A/600V TO-220F | 33 | 1 | R16 | 12kΩ ±5%, SMD-1206 |
| 11 | 1 | D5 | SR5150 5A/150V DO-201AD | 34 | 1 | T1 | PQ2016 |
| 12 | 1 | BR1 | D108S SMD | 35 | 1 | VR1 | 7D471K |
| 13 | 1 | D1 | 1N4007 DO-41 1A 1000V | 36 | 1 | PCB | one-layer FR-4/CEM-1 |
| 14 | 1 | D2 | FR107 SMD | 37 | 1 | F1 | T2A/250V |
| 15 | 1 | D4 | FR102 SMD | 38 | 1 | FOR F1 | heat-shrinkable tubing φ 4mm*14mm |
| 16 | 1 | D6 | 1N4148WS SOD-323 | 39 | 1 | Q2 | BC807 SO-23 |
| 17 | 1 | Z1 | 15V LL-34 | 40 | 1 | C8 | 1000uF, 25V 10*21mm E-Cap |
| 18 | 1 | L5 | Common Choke T8*4*3 30uH | 41 | | | |
| 19 | 1 | FOR Q1 | Aluminium Radiator 25*20*2mm | 42 | | | |
| 20 | 1 | FOR Q1 | Screw KM3*5 | 43 | | | |
| 21 | 1 | CX1 | 0.033uF 275Vac | 44 | | | |
| 22 | 1 | CY1 | 102/400V P=10mm | | | | |

7.Constant Current and Efficiency

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)

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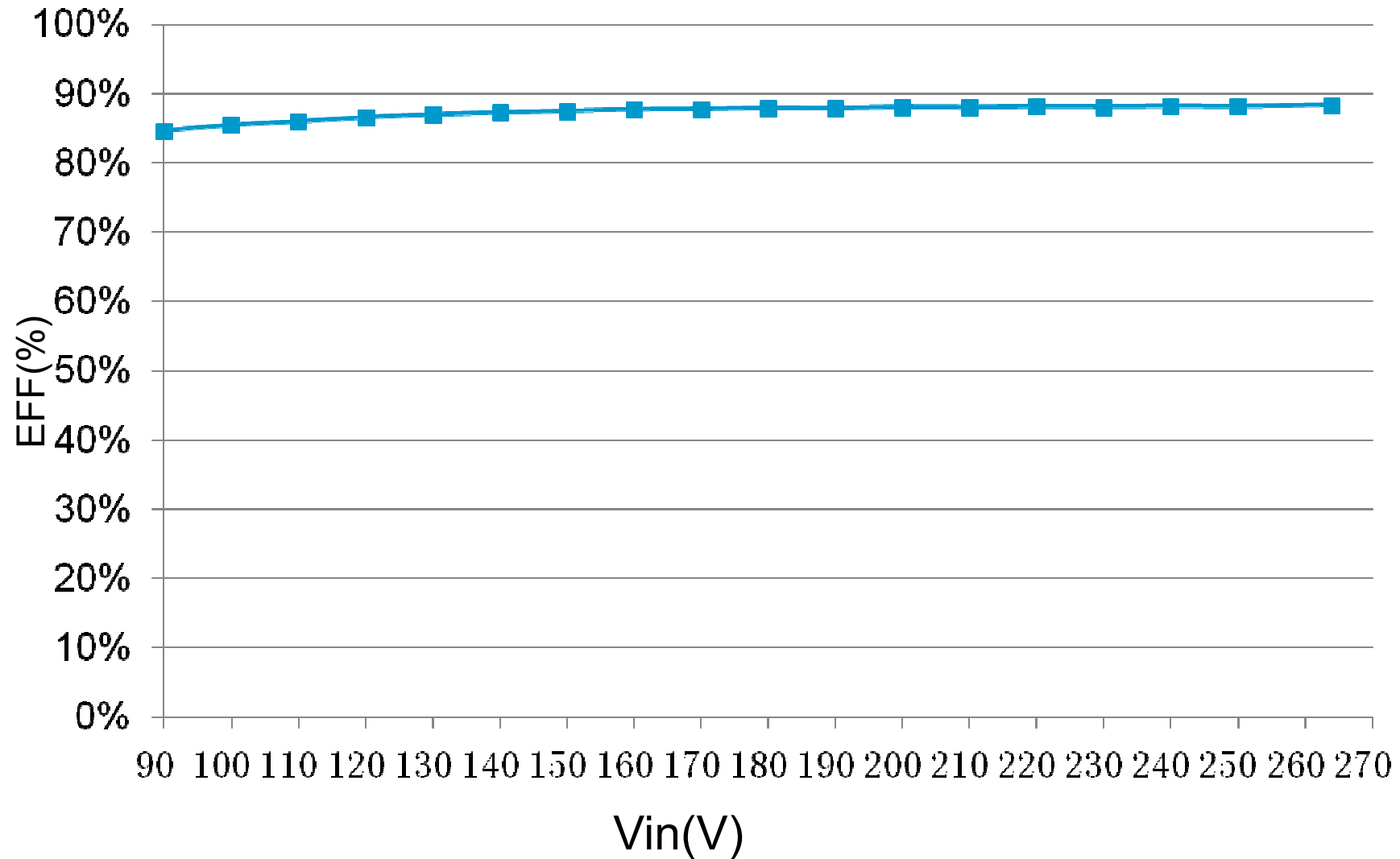
| #of LEDs | Vin | Pin | Vout | Iout | Ripple(PK) | efficiency | PF |
|----------|-------|-------|-------|------|------------|------------|-------|
| | (V) | (W) | (V) | (mA) | (mA) | | |
| 5LEDS | 90 | 18.56 | 16.33 | 962 | 224 | 84.64% | 0.978 |
| | 100 | 18.49 | 16.34 | 967 | 200 | 85.46% | 0.972 |
| | 110 | 18.65 | 16.36 | 980 | 192 | 85.97% | 0.969 |
| | 120 | 18.52 | 16.36 | 980 | 192 | 86.57% | 0.965 |
| | 130 | 18.63 | 16.38 | 989 | 176 | 86.96% | 0.964 |
| | 140 | 18.29 | 16.35 | 976 | 192 | 87.25% | 0.963 |
| | 150 | 18.33 | 16.36 | 980 | 200 | 87.47% | 0.966 |
| | 160 | 17.92 | 16.32 | 963 | 216 | 87.70% | 0.966 |
| | 170 | 17.89 | 16.32 | 962 | 224 | 87.76% | 0.969 |
| | 180 | 17.82 | 16.32 | 960 | 216 | 87.92% | 0.962 |
| | 190 | 18.28 | 16.36 | 982 | 200 | 87.89% | 0.957 |
| | 200 | 18.33 | 16.37 | 986 | 200 | 88.06% | 0.946 |
| | 210 | 18.38 | 16.37 | 988 | 184 | 88.00% | 0.937 |
| | 220 | 18.58 | 16.39 | 999 | 184 | 88.12% | 0.935 |
| | 230 | 18.59 | 16.39 | 999 | 176 | 88.08% | 0.926 |
| | 240 | 18.84 | 16.41 | 1012 | 168 | 88.15% | 0.922 |
| 250 | 18.83 | 16.41 | 1011 | 160 | 88.11% | 0.912 | |
| 264 | 18.61 | 16.39 | 1003 | 168 | 88.34% | 0.901 | |

8. Regulation, Efficiency Measurement

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)

iWatt

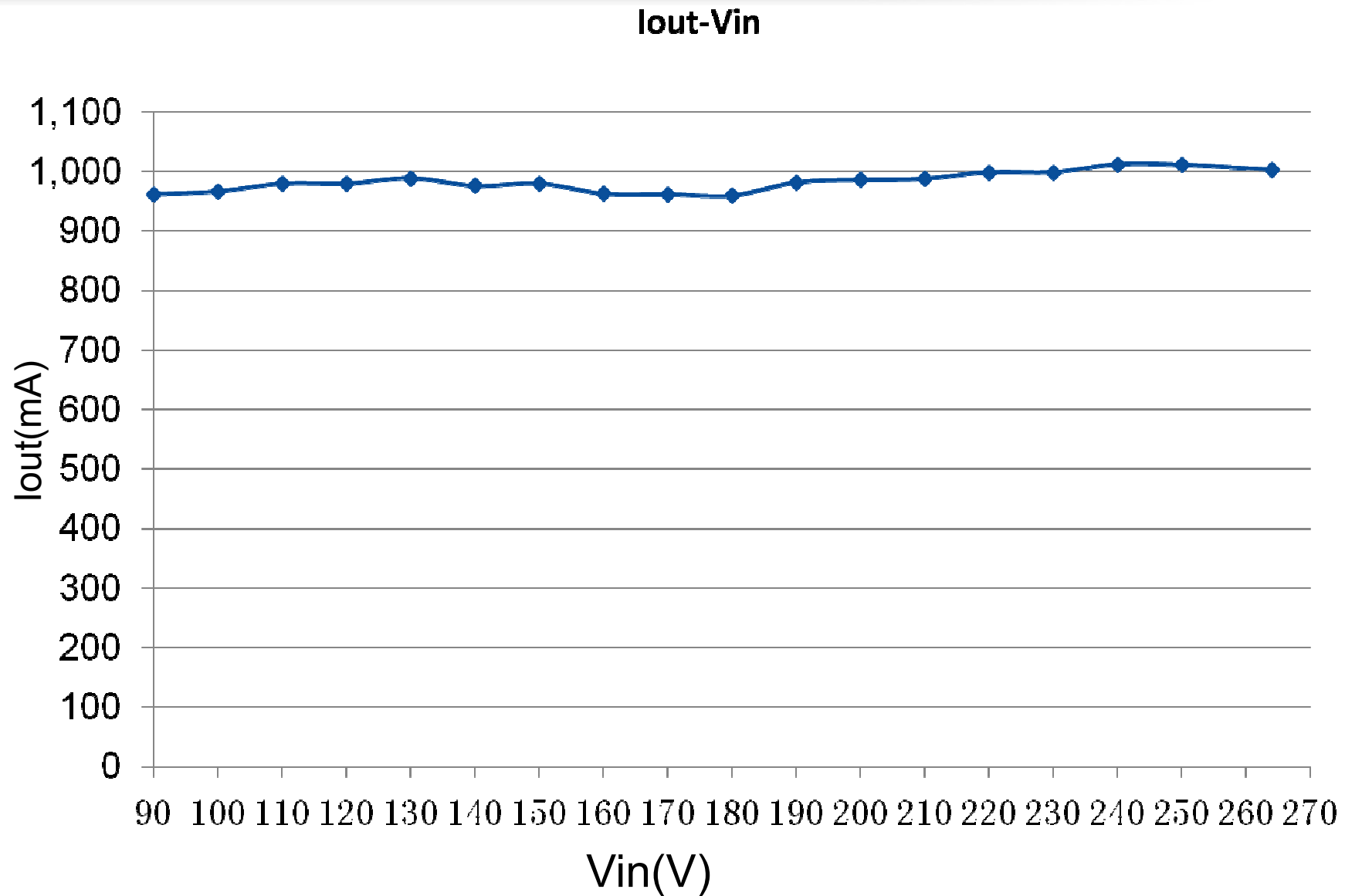
Efficiency-Vin



9. Regulation, I_{out} Measurement

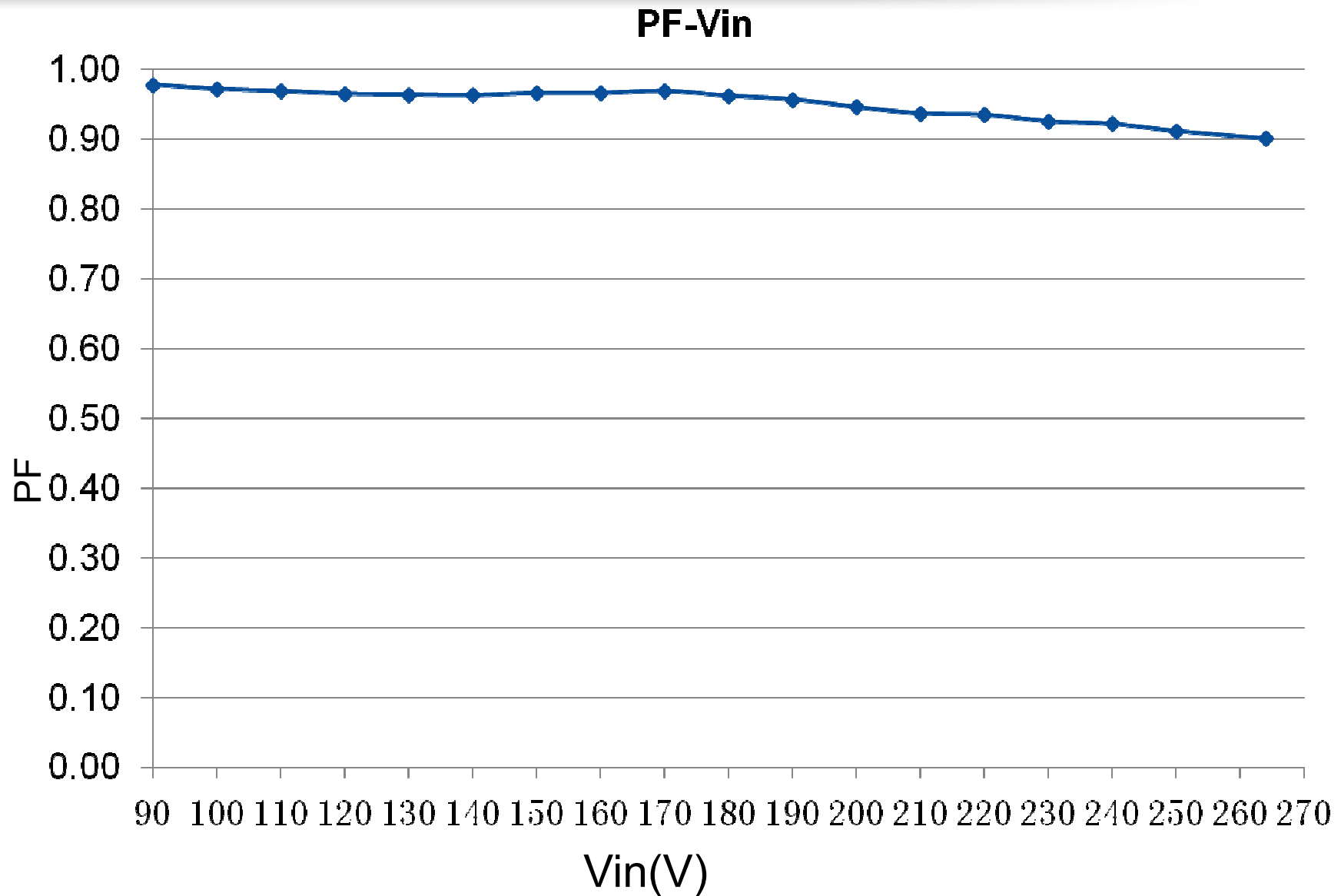
(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)

iWatt



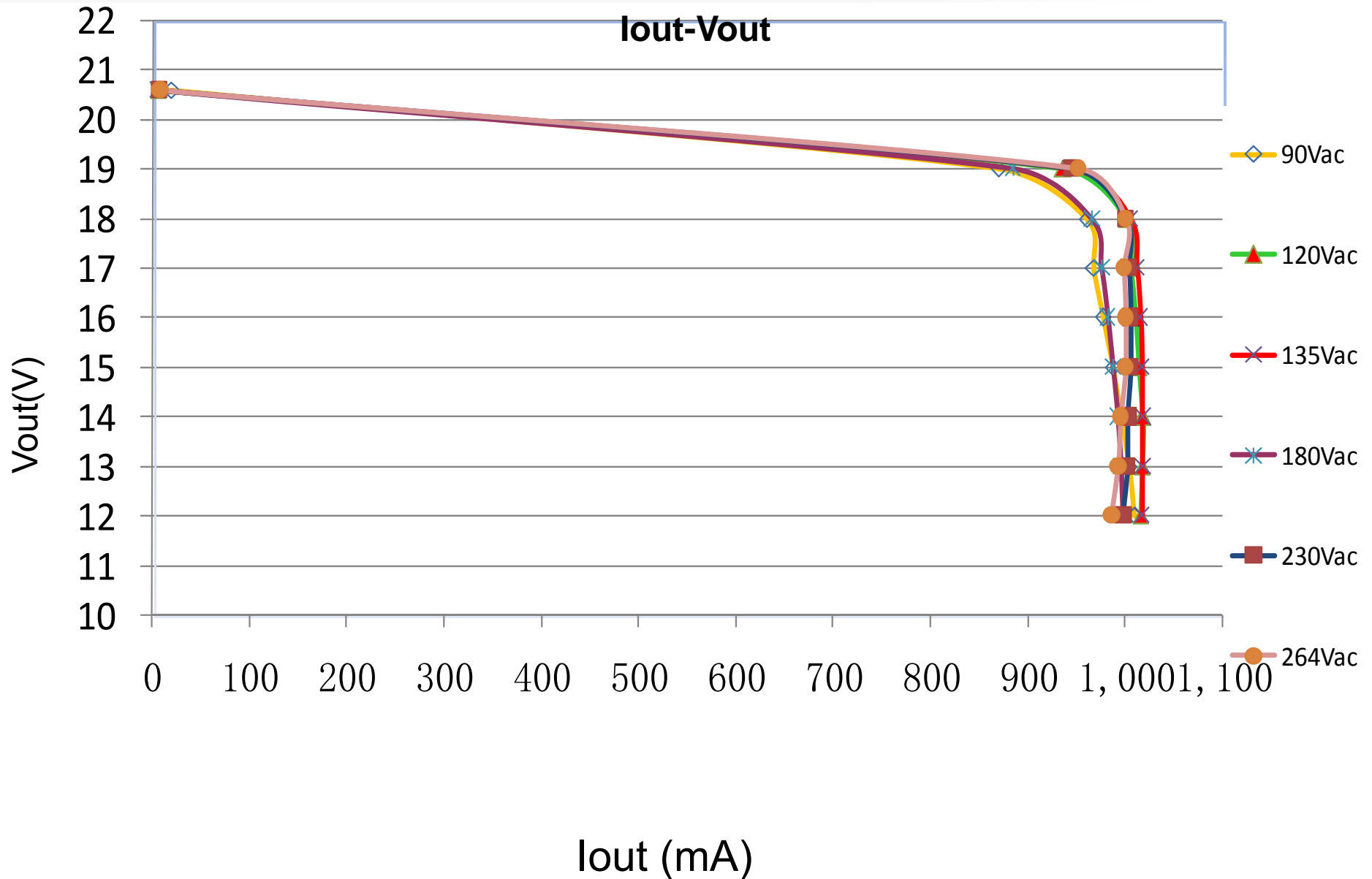
10. Regulation, PF Measurement

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)



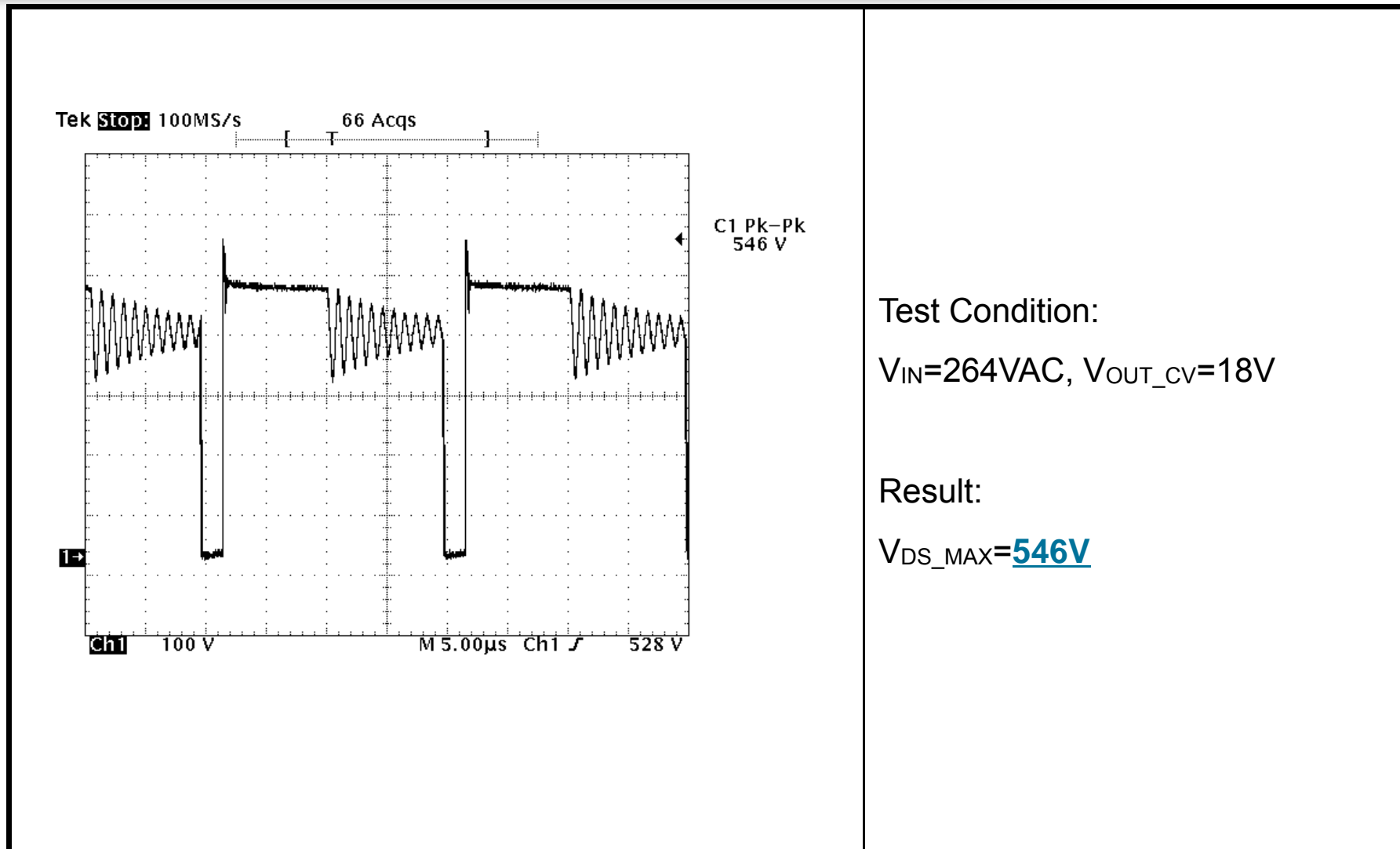
11. Regulation, Iout Measurement

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)



12. V_{DS} waveform

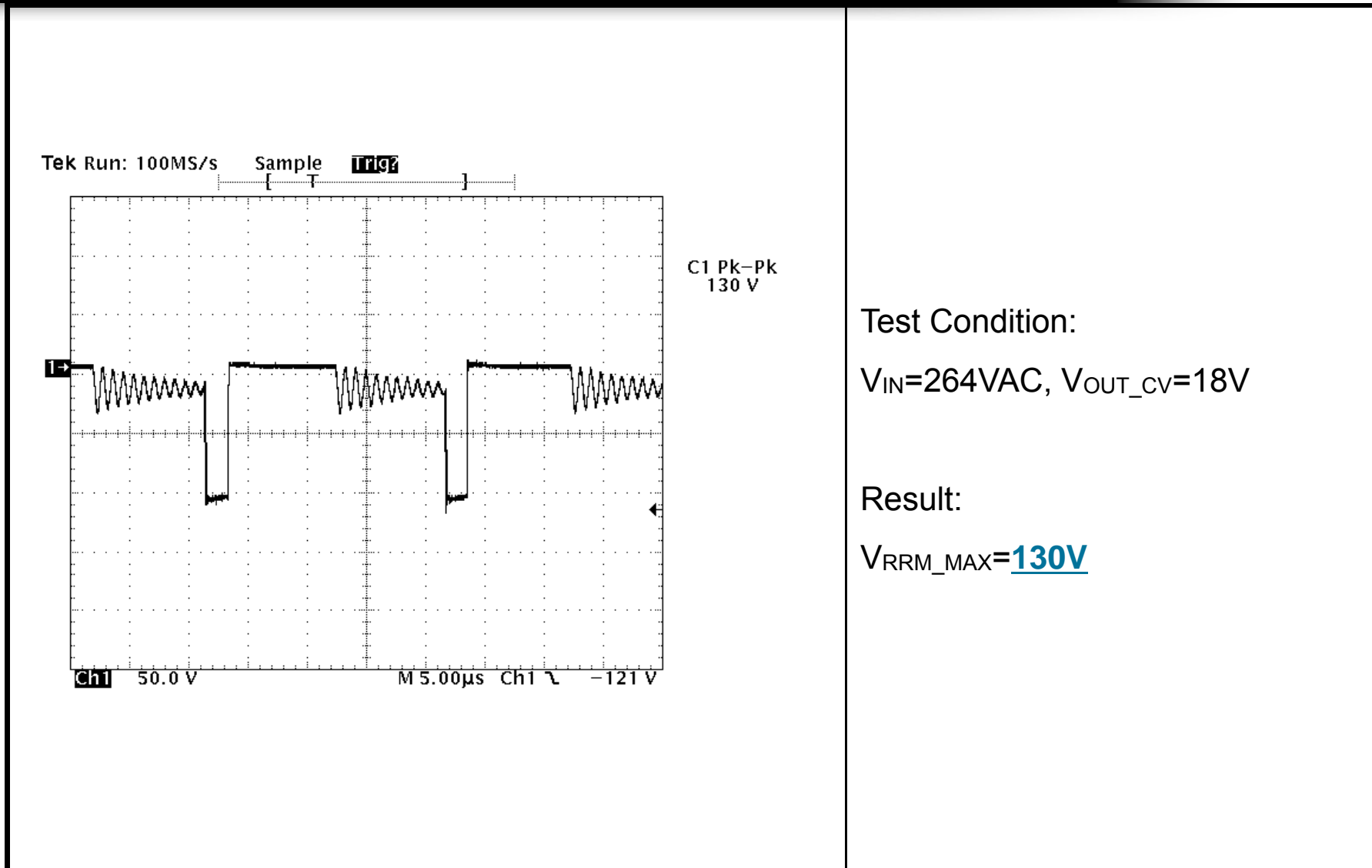
(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)



Remark: Mosfet Spec __4A 600V

13.Secondary rectifying tube waveform

(AC input 90~264Vac,Output 17.5V1000mA 5 LEDs_iW1689)



Test Condition:

$V_{IN}=264VAC$, $V_{OUT_CV}=18V$

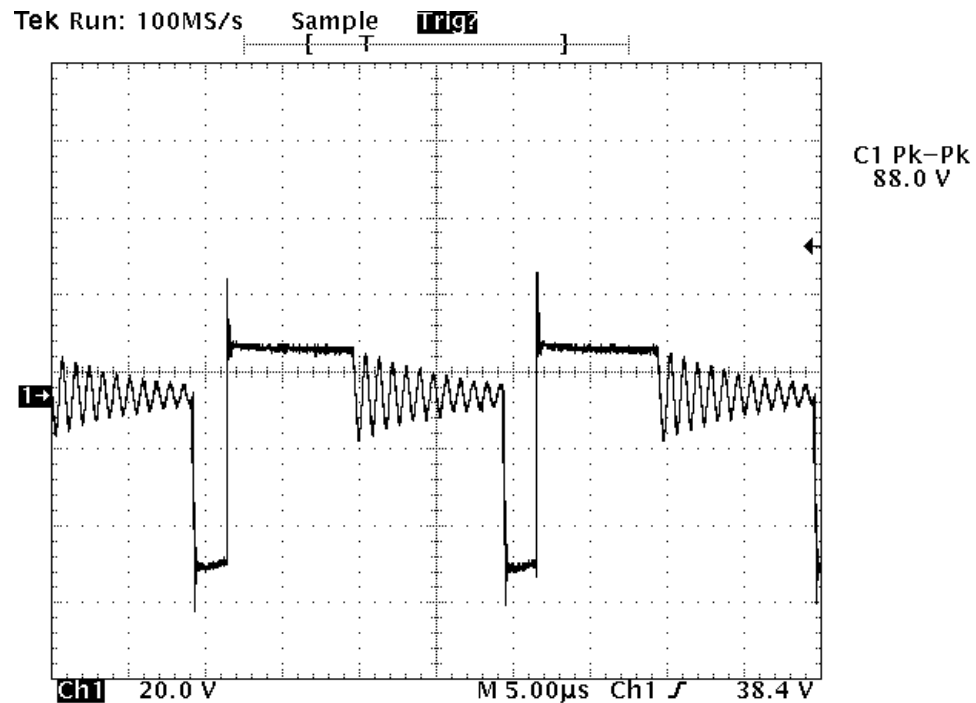
Result:

$V_{RRM_MAX}=\underline{130V}$

Remark: Diode Spec__5A 150V

14.Vcc rectifying tube waveform

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)



Test Condition:

$V_{IN}=264VAC$, $V_{OUT_CV}=18V$

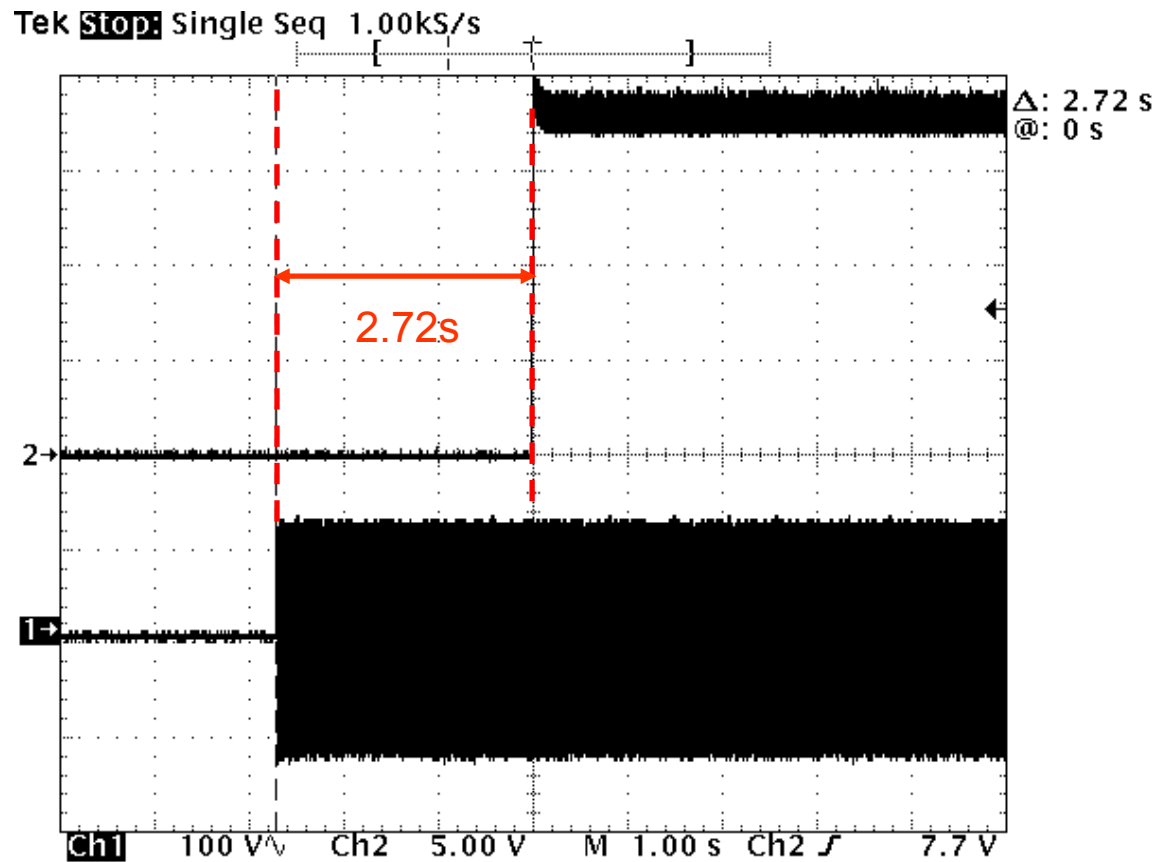
Result:

$V_{RRM_MAX}=88V$

Remark: Diode Spec__1A 1000V

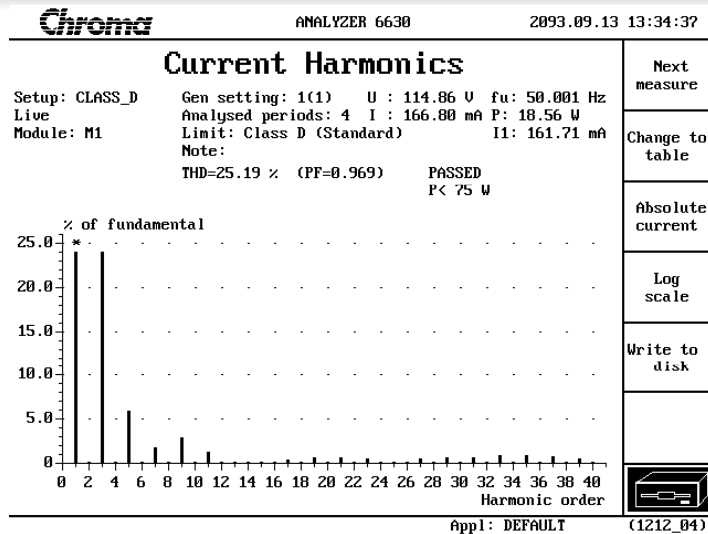
15. Start up time

(AC input 90~264Vac, Output 17.5V1000mA 5 LEDs_iW1689)

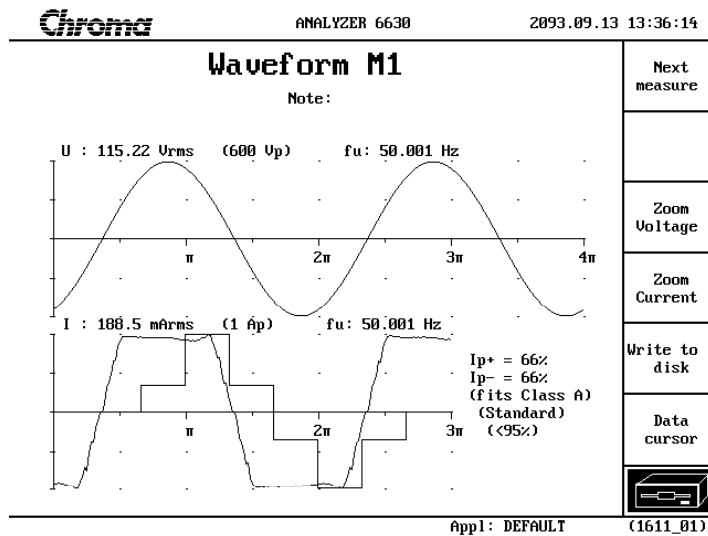


16. Harmonic and current waveform

(AC input 115Vac, Output 17.5V1000mA 5 LEDs_iW1689)



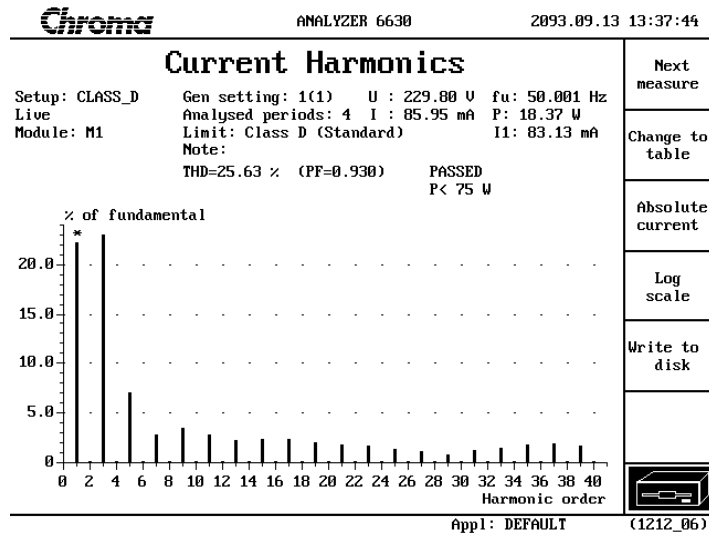
Harmonics current @115Vac THD=25.19%



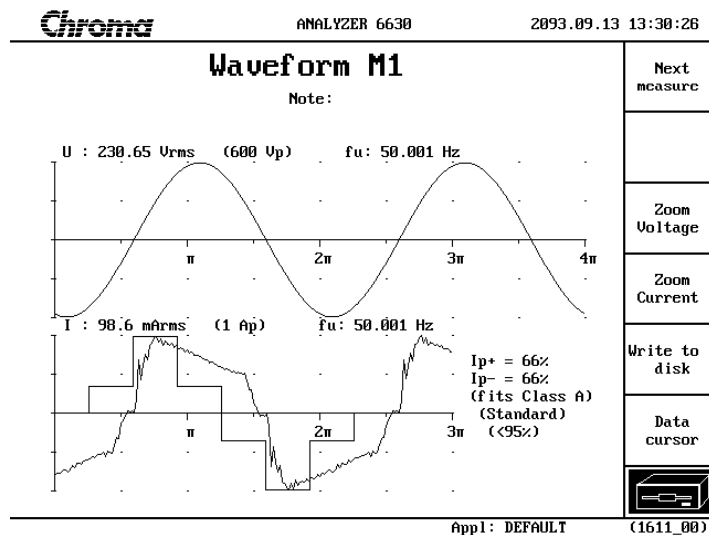
AC current waveform @115Vac PF=0.969

17. Harmonic and current waveform

(AC input 230Vac, Output 17.5V1000mA 5 LEDs_iW1689)

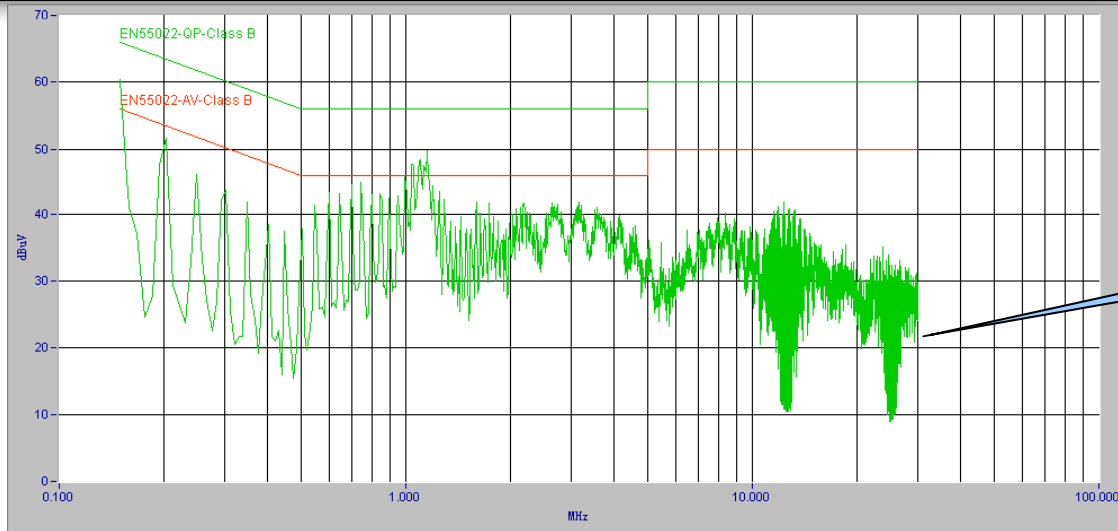


Harmonics current @230Vac THD=25.63%

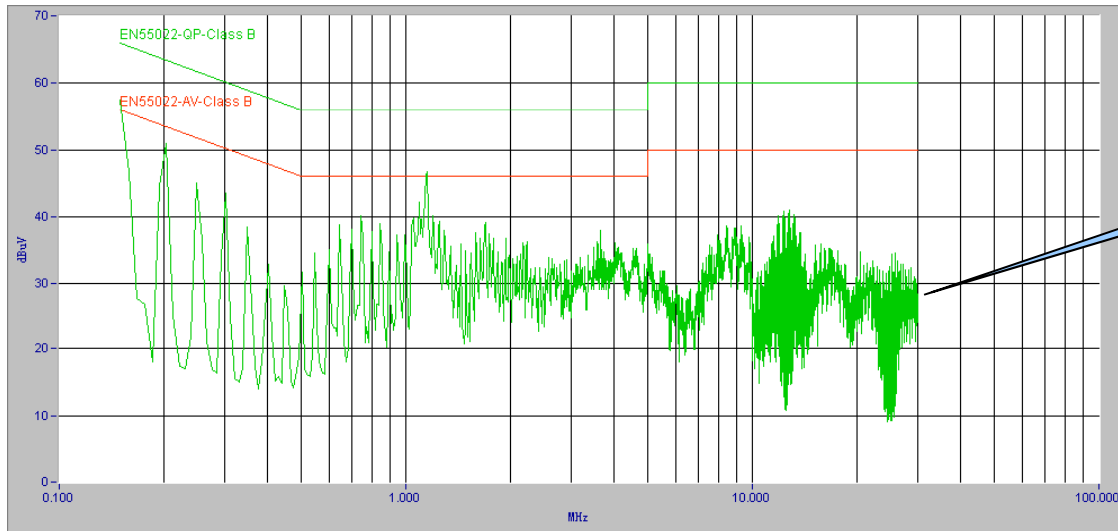


AC current waveform @230Vac PF=0.930

18. Conducted EMI (Full Load, output floating) (AC input 230Vac, Output 17.5V1000mA 5 LEDs_iW1689)



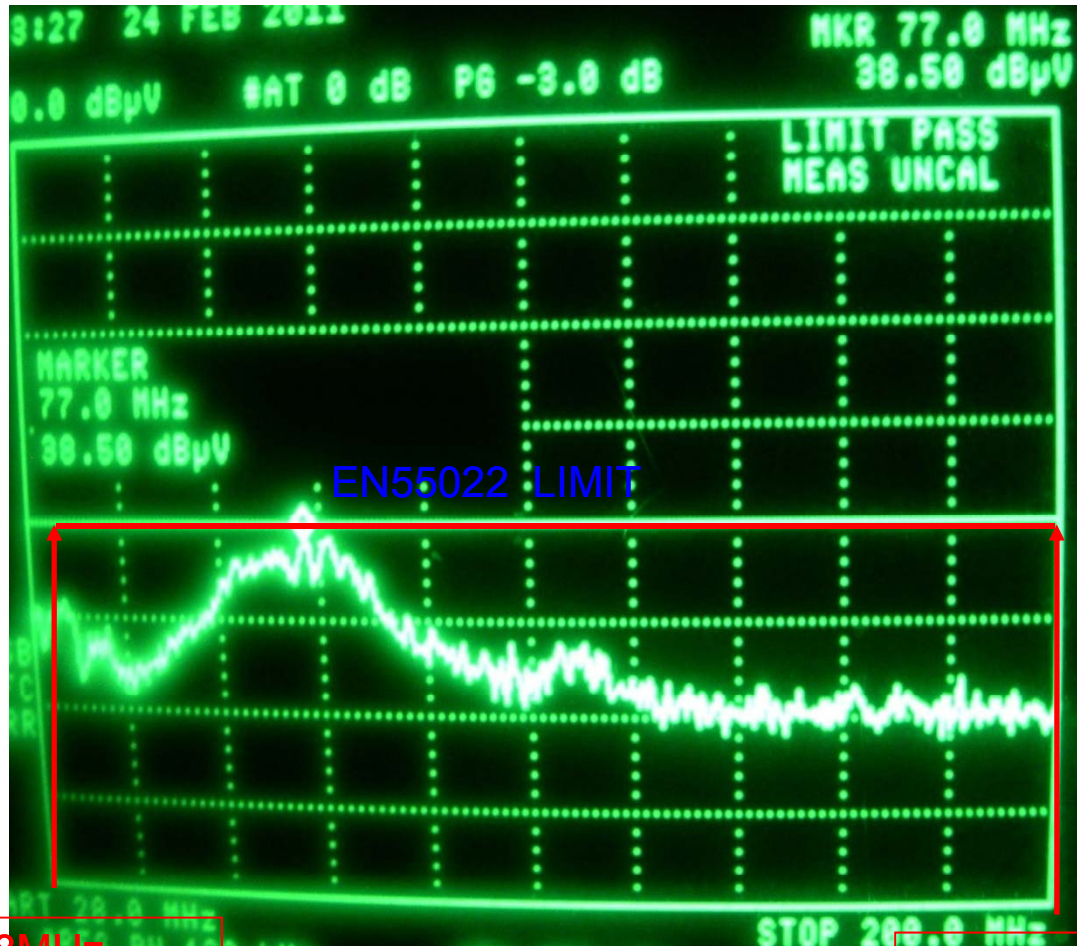
Input=230VAC
L line PK scan



Input=230VAC
N line PK scan

19. Radiated IEM (for reference)

(AC input 230Vac, Output 17.5V1000mA 5 LEDs_iW1689)



28MHz

The radiated EMI margin is 1.41dBuV

200MHz

Note: 1, Vin=230Vac

2, Output is floating