芯格诺
Mixed-signal Integrated

# XP3358_XP2115_XP1101_58V_1.05A_REPORT

## General Design Specification:

AC Input Range: 90Vac-300$V_{AC}$

DC Output: 58V/1.05A, Flyback +Buck

PF >0.95 at 90V-300Vac input at full load

THD <5% at 90V-300Vac with full load

# 1. Specification

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| Description | | Symbol | Min | Typ | Max | Units | Comment |
|---|---|---|---|---|---|---|---|
| **Input** | | | | | | | |
| Voltage | | $V_{IN}$ | 90 | 230 | 300 | $V_{AC}$ | 2 Wire |
| Frequency | | $f_{LINE}$ | | 50/60 | | Hz | |
| Open-load Input Power () | | | | | 0.35 | W | light off |
| **Output** | | | | | | | |
| Const Voltage | Output Voltage | $V_{OUT\_CC}$ | | | | V | Measured at the PCB connector |
| | Output Current | $I_{OUT\_CC}$ | | | | mA | |
| Const Current | Output Voltage | $V_{OUT\_CC}$ | 3 | | 58 | V | Min Vout is depend on Vcc |
| | Output Current | $I_{OUT\_CC}$ | 1 | | 1050 | mA | |
| **Total Output Power** | | | | | | | |
| Continuous Output Power | | $P_{OUT}$ | | 60 | | W | |
| Over Current Protection | | $I_{OUT\_MAX}$ | | | | A | Auto-restart |
| Efficiency | | $\eta$ | | | | % | Measured at end of PCB |
| Power Fact | | $PF$ | 0.95 | | | | Harmonic meet IEC61000-3-2 |
| Turn on Delay Time | | | | | | Sec | |
| Conducted EMI | | | Meets EN55015B | | | | |
| THD | | | | | 5 | % | |
| Operation temperature | | $T_{opr}$ | | 40 | | °C | Free convection, sea level |

# 2. Schematics

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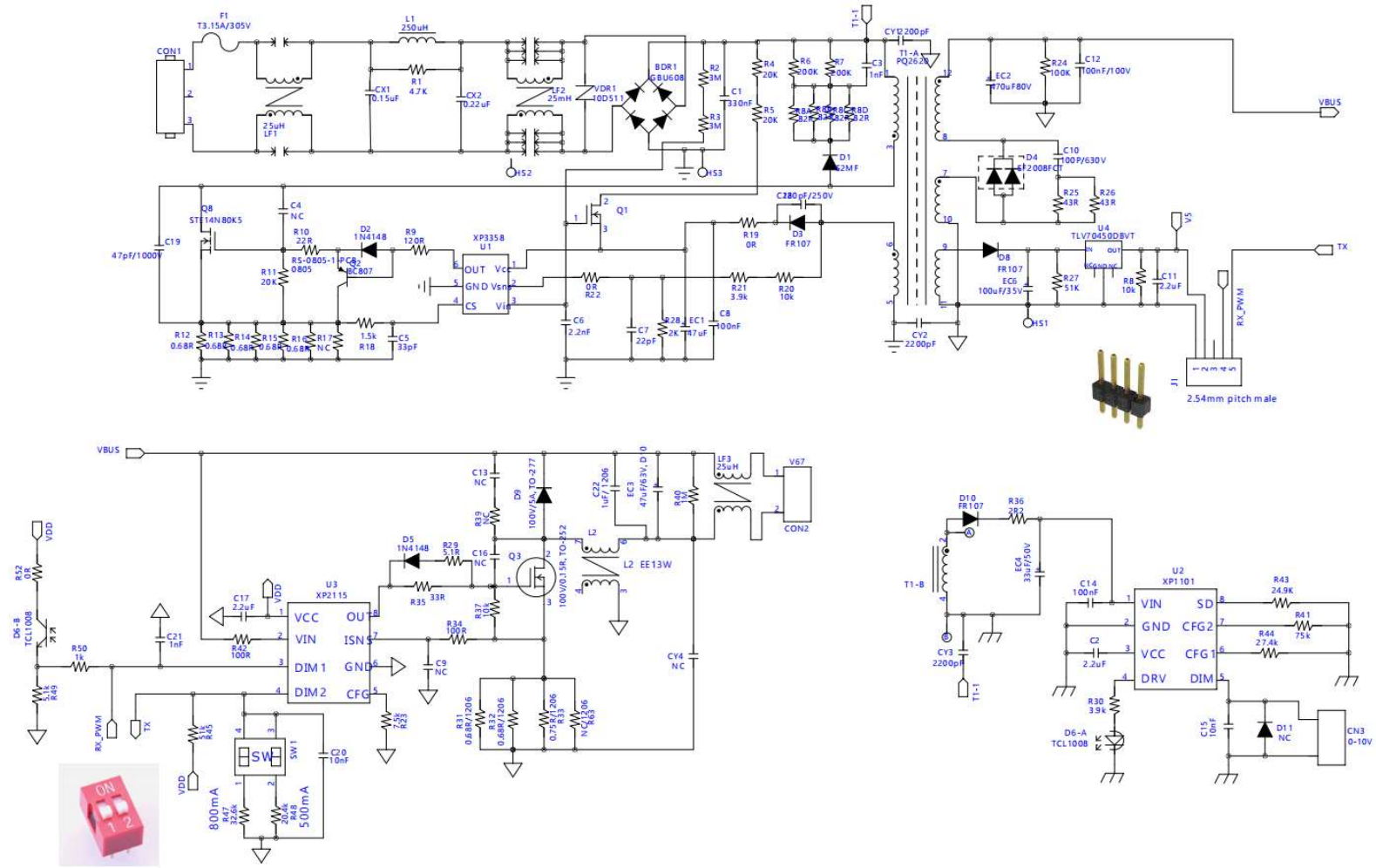

# 3. Circuit Board Photograph

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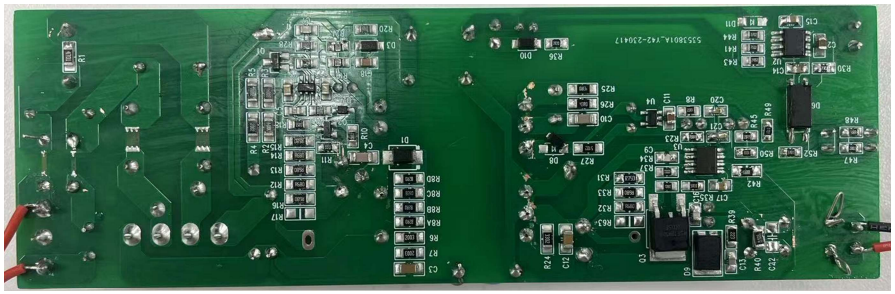
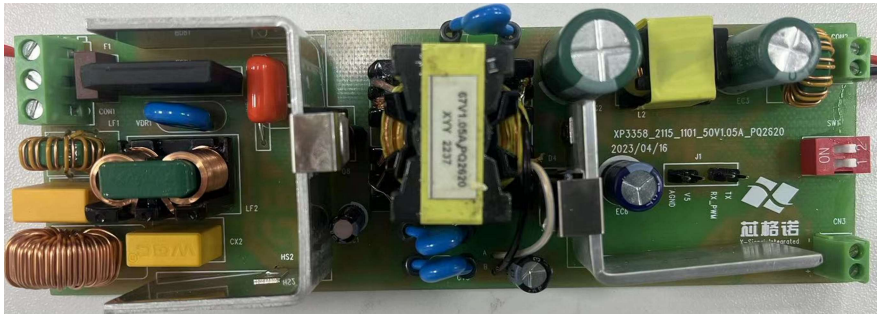
Input




Output



# 4. BOM

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| Item | Qty | Reference | Description |
|---|---|---|---|
| 1 | 1 | BDR1 | BD-D2SB60A-SCH,GBU608 |
| 2 | 1 | C1 | CB-223-SCH,330nF/450V |
| 3 | 1 | EC3 | CE-D10-SCH,47uF/63V, D10 |
| 4 | 1 | EC2 | CE-D16-SCH,470uF/80V |
| 5 | 1 | EC1 | CE-D5-SCH,47uF/25V |
| 6 | 1 | EC6 | CE-D8-SCH,100uF/35V |
| 7 | 1 | EC4 | CE-D8-SCH,33uF/50V |
| 8 | 1 | C10 | CS-SMD-SCH,100P/630V |
| 9 | 2 | C8 C14 | CS-SMD-SCH,100nF/0805 |
| 10 | 1 | C12 | CS-SMD-SCH,100nF/100V |
| 11 | 2 | C15 C20 | CS-SMD-SCH,10nF/0805 |
| 12 | 1 | C19 | CS-SMD-SCH,47pF/1000V |
| 13 | 1 | C3 | CS-SMD-SCH,1nF/630V |
| 14 | 1 | C21 | CS-SMD-SCH,1nF/0805 |
| 15 | 3 | C2 C11 C17 | CS-SMD-SCH,2.2uF/0805 |
| 16 | 1 | C18 | CS-SMD-SCH,220pF/250V |
| 17 | 1 | C7 | CS-SMD-SCH,22pF/0805 |
| 18 | 1 | C5 | CS-SMD-SCH,33pF/0805 |
| 19 | 1 | C6 | CS-SMD-SCH,2.2nF/0805 |
| 20 | 1 | C16 | CS-SMD-SCH,10PF/0805 |
| 21 | 1 | CX1 | CX-154-SCH,0.15uF |
| 22 | 1 | CX2 | CX-224-SCH,0.22uF |
| 23 | 3 | CY1-3 | CY-222-SCH,2200pF, 引脚增加磁珠 |
| 24 | 2 | D2 D5 | DS-SMD-SCH,1N4148/SOD323 |
| 25 | 3 | D3 D8 D10 | DS-SMD-SCH,FR107/SOD123 |
| 26 | 1 | D1 | DS-SMD-SCH,S2MF/SMB |
| 27 | 1 | D9 | DS-TO277-SCH,100V/5A, TO-277 |
| 28 | 1 | D4 | DT-01D-SCH,SF2008FCT/TO-220 |
| 29 | 1 | D6 | OptoCoupler,TCL1008 |
| 30 | 1 | F1 | FQ-4X8-SCH,T3.15A/305V |
| 31 | 1 | L1 | LH-10X18-SCH,250uH |
| 32 | 1 | L2 | EE13, 320uH |
| 33 | 1 | T1 | TV-PQ2620N-82-1-SCH,PQ2620, |
| 34 | 1 | LF2 | LT-14X20-SCH,25mH |
| 35 | 2 | LF1 LF3 | LT-8X13-SCH,25uH |
| 36 | 1 | Q1 | QS-SOT23-SCH,DMZ6005 |
| 37 | 1 | Q2 | QS-SOT23P-SCH,BC807 |
| 38 | 1 | Q3 | QS-TO252-SCH,100V/0.15R, TO-252 |
| 39 | 1 | Q8 | QD-TO220NM-SCH,STF14N80K5，D脚增加磁珠 |
| 40 | 1 | U1 | IC-SCH,XP3358 |
| 41 | 1 | U2 | US-8P-SCH,XP1101 |
| 42 | 1 | U3 | US-8P-SCH,XP2115 |
| 43 | 1 | U4 | US-TLV704-SCH,TLV70450DBVT |

| Item | Qty | Reference | Description |
|---|---|---|---|
| 44 | 4 | R8A R8B R8C R8D | RD-2W-SCH,82R/1206 |
| 45 | 5 | R12-16 | RS-SMD-SCH,0.68R/1206 |
| 46 | 2 | R31-32 | RS-SMD-SCH,0.68R/1206 |
| 47 | 1 | R33 | RS-SMD-SCH,0.75R/1206 |
| 48 | 3 | R19 R22 R52 | RS-SMD-SCH,0R/0805 |
| 49 | 1 | R18 | RS-SMD-SCH,1.5k/0805 |
| 50 | 1 | R24 | RS-SMD-SCH,100K/1206 |
| 51 | 2 | R34 R42 | RS-SMD-SCH,100R/0805 |
| 52 | 3 | R8 R20 R37 | RS-SMD-SCH,10k/1206 |
| 53 | 1 | R9 | RS-SMD-SCH,120R/0805 |
| 54 | 1 | R40 | RS-SMD-SCH,1M/0805 |
| 55 | 1 | R50 | RS-SMD-SCH,1k/0805 |
| 56 | 1 | R48 | RS-SMD-SCH,20.4k/0805 |
| 57 | 2 | R6-7 | RS-SMD-SCH,200K/1206 |
| 58 | 2 | R4-5 | RS-SMD-SCH,20K/1206 |
| 59 | 1 | R11 | RS-SMD-SCH,20K/0805 |
| 60 | 1 | R10 | RS-SMD-SCH,22R/0805 |
| 61 | 1 | R43 | RS-SMD-SCH,24.9K/0805 |
| 62 | 1 | R44 | RS-SMD-SCH,27.4k/0805 |
| 63 | 1 | R28 | RS-SMD-SCH,2K/0805 |
| 64 | 1 | R36 | RS-SMD-SCH,2R2/0805 |
| 65 | 2 | R21 R30 | RS-SMD-SCH,3.9k/0805 |
| 66 | 1 | R47 | RS-SMD-SCH,32.6k/0805 |
| 67 | 2 | R2-3 | RS-SMD-SCH,3M/1206 |
| 68 | 1 | R1 | RS-SMD-SCH,4.7K/0805 |
| 69 | 2 | R25-26 | RS-SMD-SCH,43R/1206 |
| 70 | 1 | R35 | RS-SMD-SCH,33R/0805 |
| 71 | 1 | R29 | RS-SMD-SCH,5.1R/0805 |
| 72 | 1 | R49 | RS-SMD-SCH,5.1k/0805 |
| 73 | 1 | R27 | RS-SMD-SCH,51K/1206 |
| 74 | 1 | R45 | RS-SMD-SCH,51k/0805 |
| 75 | 1 | R23 | RS-SMD-SCH,7.5k/0805 |
| 76 | 1 | R41 | RS-SMD-SCH,75k/0805 |
| 77 | 1 | VDR1 | RV-511D10-SCH,10D511 |
| 78 | 1 | SW1 | US-4P-DIP-SW-SCH,EE10H |
| 79 | 1 | J1 | HEADER_5,2.54mm pitch male |
| 80 | 1 | CN3 | JD-2P-SCH,0-10V |
| 81 | 1 | CON2 | JD-2P-SCH,V67 |
| 82 | 1 | CON1 | JD-3P-SCH,Connector |
| 83 | 5 | A B HS1-3 | PD-SCH,0307 |
| 84 | 8 | PE1-8 | PE-SCH,0307 |

# 5. Transformer

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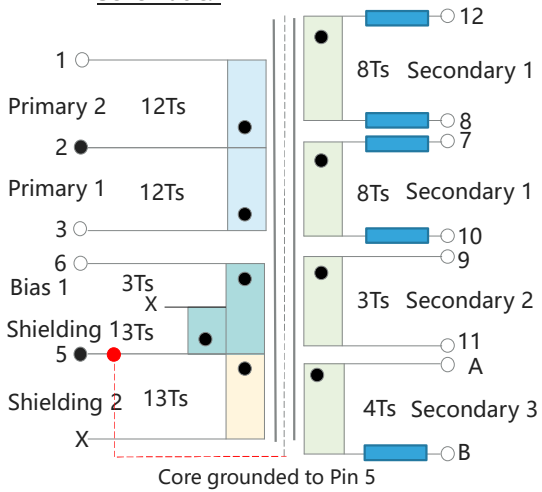
**Schematic:**




**ELECTRICAL SPECIFICATIONS:**

1. Primary Inductance (Lp) = 175uH ±5% @10KHz
2. Primary Leakage Inductance (Lk)< 8uH @100KHz
3. Electrical Strength = 3KV, 50/60Hz,1Min

**MATERIALS:**

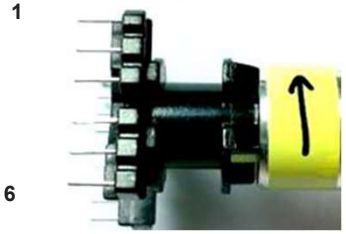
1. Core : PQ2620 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : PQ2620. Vertical; Primary=6Pin, Secondary=6Pin
3. Magnet Wires (Pri) : Type 2-UEW
4. Magnet Wire (Sec) : Triple Insulated Wires
5. Layer Insulation Tape : 3M1298 or equivalent.

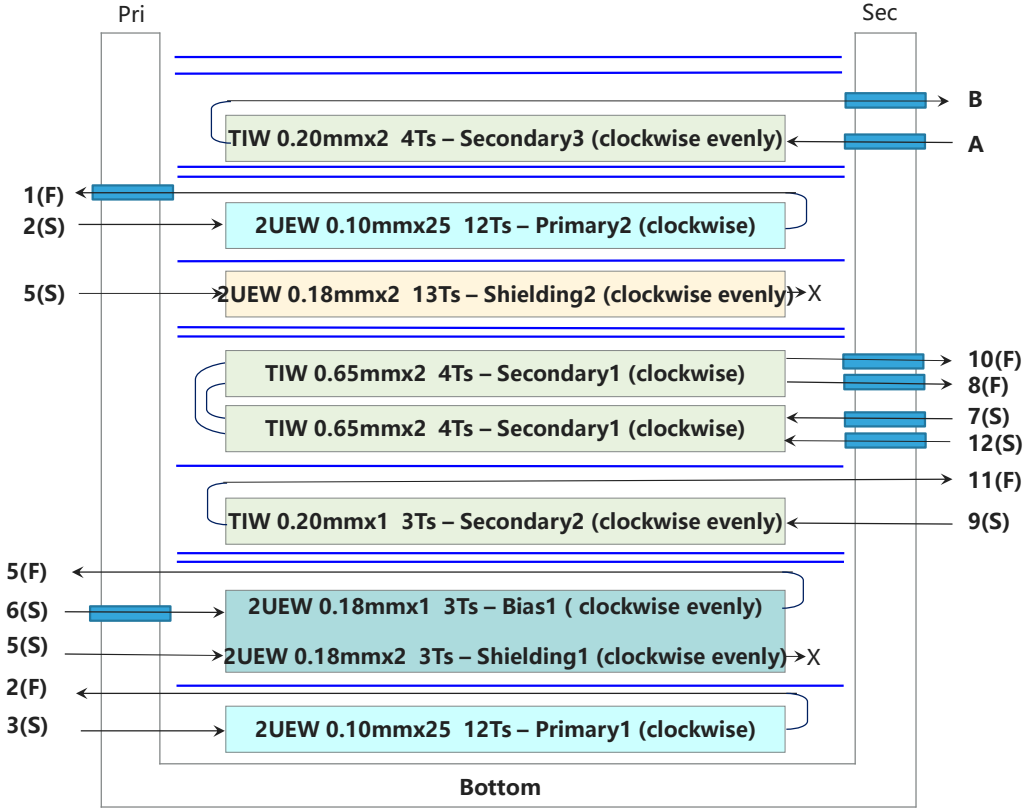
**FINISHED :**

1. Cut Pin 4 and cut Pin2 2/3 after wires termination
2. Varnish the complete assembly
3. NS adding the annular tubes, secondary3 is flying wire, L=30mm, adding annular tube on B, distinguished to A.

**Construction:**

Note:
Winding Start pin-3& End pin-2
in "Clockwise" direction
looking from bottom side of the Bobbin.



# 6. Inductor

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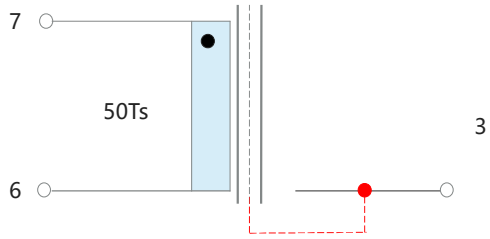
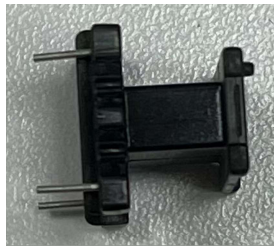
**Schematic:**




Core grounded to Pin 3

**Construction:**

Note:
Winding Start pin-7& End pin-6
in "Clockwise" direction
looking from bottom side of the Bobbin.




**ELECTRICAL SPECIFICATIONS:**

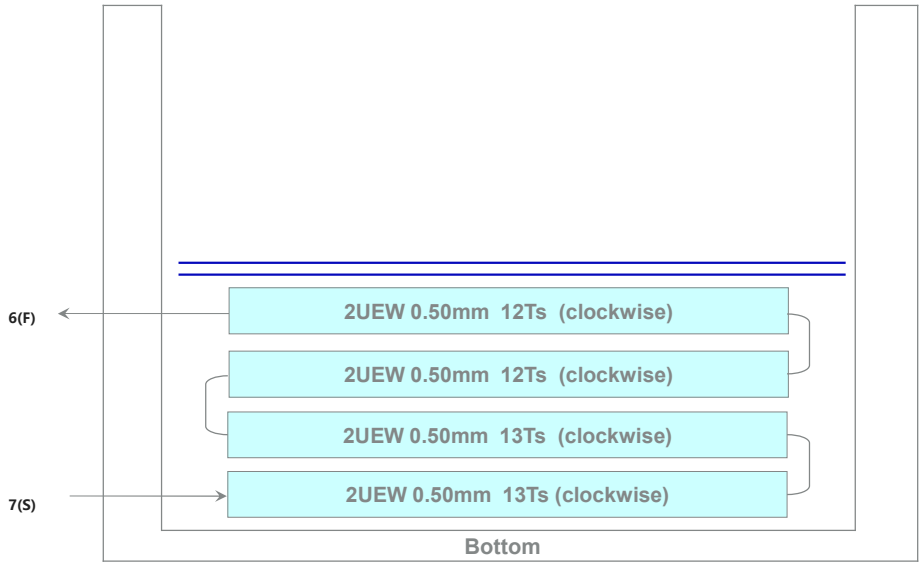
1. Inductance (Lp) = 320uH ±5% @10KHz

**MATERIALS:**

1. Core : EE13 (Ferrite Material TDK PC40 or equivalent)
2. Bobbin : EE13. Vertical; Primary=5Pin, Secondary=5Pin
3. Magnet Wires : Type 2-UEW
4. Layer Insulation Tape : 3M1298 or equivalent.

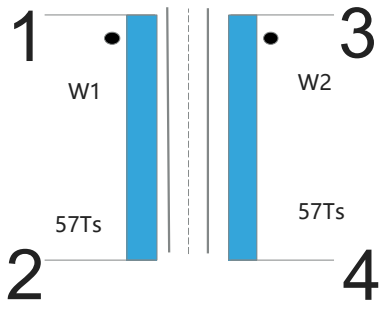
**FINISHED :**

1. Cut Pin1、 2、4 、5、8、9、10
2. Varnish the complete assembly
3. NS adding the annular tubes.



# 7. Inductor

**SCHEMATIC LF2:**



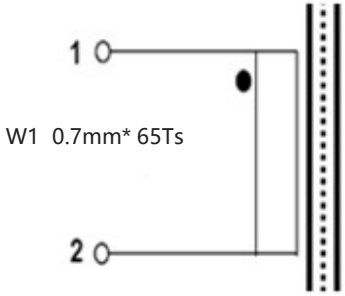

0.13t*1.0mm Flat wire

0.13t*1.0mm Flat wire

**ELECTRICAL SPECIFICATIONS:**

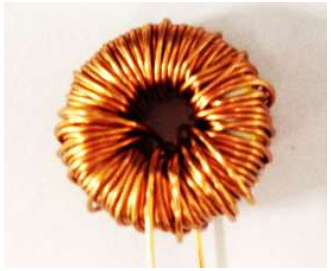
1. Primary Inductance (Lm) > 28mH @10KHz, 1V
2. Electrical Strength = 1500V, 50/60Hz, 1Min(W1 to W2)

**SCHEMATIC L1:**




**ELECTRICAL SPECIFICATIONS:**

1. Ferrite core: Fe-Zn, T15.5*8.0*6.5 Wire gauge: 0.7mm, 58Turns
2. Inductance @10kHz, 1V: 200uH ±10% DCR: 0.08 OHM ±20%



# 8. Common Mode Inductor

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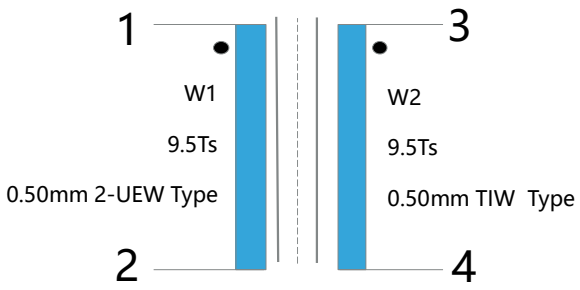
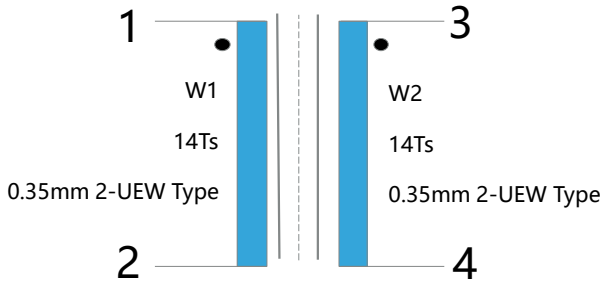
**SCHEMATIC LF3:**




**ELECTRICAL SPECIFICATIONS:**

1. Ferrite core: Ni-Zn, T12*6*4
2. Wire gauge: 0.50mm, 9.5Turns
3. Inductance @10kHz, 1V: 160uH±10%
4. DCR: 0.1 OHM ±20%

**SCHEMATIC LF1:**

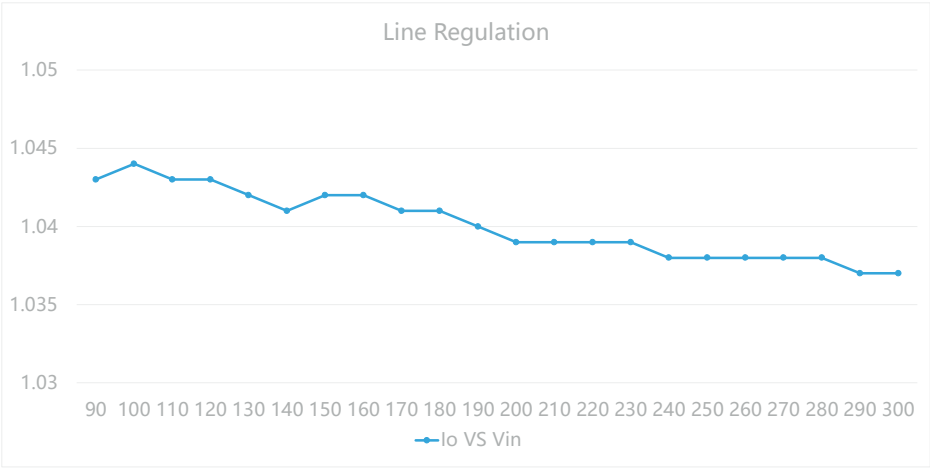



**ELECTRICAL SPECIFICATIONS:**

1. Primary Inductance (Lm) = 165uH ±10% @10KHz, 1V
2. Ferrite Material: Ni-Zn
3. CORE: T10*5*5
4. Electrical Strength = 500V, 50/60Hz, 1Min(W1 to W2)

# 9. Line Regulation And Efficiency

| Vin (V) | Pin (W) | Vout (V) | Iout (A) | PF | THD | Eff (%) |
|---|---|---|---|---|---|---|
| 90 | 66.01 | 56.1 | 1.043 | 0.999 | 2.98 | 88.64% |
| 100 | 65.67 | 56.1 | 1.044 | 0.999 | 2.82 | 89.19% |
| 110 | 65.36 | 56.1 | 1.043 | 0.999 | 2.72 | 89.52% |
| 120 | 65.08 | 56.1 | 1.043 | 0.999 | 2.60 | 89.91% |
| 130 | 64.88 | 56.1 | 1.042 | 0.999 | 2.48 | 90.10% |
| 140 | 64.71 | 56.1 | 1.041 | 0.999 | 2.47 | 90.25% |
| 150 | 64.49 | 56.0 | 1.042 | 0.999 | 2.36 | 90.48% |
| 160 | 64.52 | 56.0 | 1.042 | 0.998 | 1.67 | 90.44% |
| 170 | 64.41 | 56.0 | 1.041 | 0.997 | 1.67 | 90.51% |
| 180 | 64.32 | 56.0 | 1.041 | 0.996 | 1.71 | 90.63% |
| 190 | 64.27 | 56.0 | 1.040 | 0.995 | 1.80 | 90.62% |
| 200 | 64.20 | 56.0 | 1.039 | 0.994 | 1.59 | 90.63% |
| 210 | 64.24 | 56.0 | 1.039 | 0.992 | 1.69 | 90.57% |
| 220 | 64.29 | 56.0 | 1.039 | 0.990 | 1.85 | 90.50% |
| 230 | 64.27 | 56.0 | 1.039 | 0.988 | 2.02 | 90.53% |
| 240 | 64.23 | 56.0 | 1.038 | 0.985 | 2.21 | 90.50% |
| 250 | 64.23 | 56.0 | 1.038 | 0.983 | 2.43 | 90.50% |
| 260 | 64.25 | 56.0 | 1.038 | 0.979 | 2.64 | 90.47% |
| 270 | 64.26 | 56.0 | 1.038 | 0.976 | 2.86 | 90.46% |
| 280 | 64.28 | 56.0 | 1.038 | 0.972 | 3.12 | 90.43% |
| 290 | 64.31 | 56.0 | 1.037 | 0.968 | 3.37 | 90.30% |
| 300 | 64.35 | 56.0 | 1.037 | 0.963 | 3.65 | 90.24% |



# 10. Load Regulation And Efficiency

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| Vin (V) | Pin (W) | Vout (V) | Iout(max) (A) | PF | THD | Eff (%) | Eff(%) AVG |
|---|---|---|---|---|---|---|---|
| 90 | 0.278 | 0 | 0 | / | / | / | |
| | 4.7 | 3.01 | 1.041 | 0.93 | 5.26 | 66.67% | / |
| | 13.84 | 11.01 | 1.04 | 0.992 | 1.27 | 82.73% | 87.07% |
| | 27.56 | 23.02 | 1.041 | 0.999 | 1.062 | 86.95% | |
| | 40.17 | 34.02 | 1.043 | 0.999 | 1.58 | 88.33% | |
| | 52.75 | 44.9 | 1.042 | 0.999 | 2.38 | 88.69% | |
| | 65.95 | 56 | 1.044 | 0.999 | 2.07 | 88.65% | |
| 120 | 0.280 | 0 | 0 | / | / | / | |
| | 4.72 | 3.012 | 1.042 | 0.819 | 11.6 | 66.49% | / |
| | 13.84 | 11.01 | 1.042 | 0.972 | 0.03 | 82.89% | 87.76% |
| | 27.48 | 23.02 | 1.043 | 0.995 | 1.19 | 87.37% | |
| | 39.72 | 34.02 | 1.039 | 0.998 | 1.57 | 88.99% | |
| | 52.10 | 44.9 | 10.4 | 0.999 | 2.12 | 896.28% | |
| | 64.65 | 55.9 | 1.04 | 0.999 | 1.95 | 89.92% | |
| 220 | 0.288 | 0 | 0 | / | / | / | |
| | 4.73 | 3.013 | 1.04 | 0.451 | 30.27 | 66.25% | / |
| | 13.97 | 11.01 | 1.039 | 0.773 | 14.13 | 81.89% | 87.70% |
| | 27.38 | 23.01 | 1.039 | 0.964 | 7.86 | 87.32% | |
| | 39.75 | 34.01 | 1.04 | 0.988 | 7.35 | 88.98% | |
| | 51.88 | 44.9 | 1.038 | 0.975 | 3.61 | 89.83% | |
| | 64.25 | 55.9 | 1.04 | 0.984 | 2.85 | 90.48% | |
| 277 | 0.305 | 0 | 0 | / | / | / | |
| | 4.78 | 3.014 | 1.04 | 0.347 | 33.28 | 65.58% | / |
| | 14.30 | 11.01 | 1.04 | 0.633 | 20.78 | 80.07% | 86.94% |
| | 27.67 | 23.02 | 1.041 | 0.899 | 12.69 | 86.61% | |
| | 39.93 | 34.01 | 1.037 | 0.964 | 11.63 | 88.33% | |
| | 52.13 | 44.9 | 1.038 | 0.941 | 5.99 | 89.40% | |
| | 64.31 | 55.9 | 1.039 | 0.960 | 4.71 | 90.31% | |

# 11. Regulation and Efficiency @277Vac

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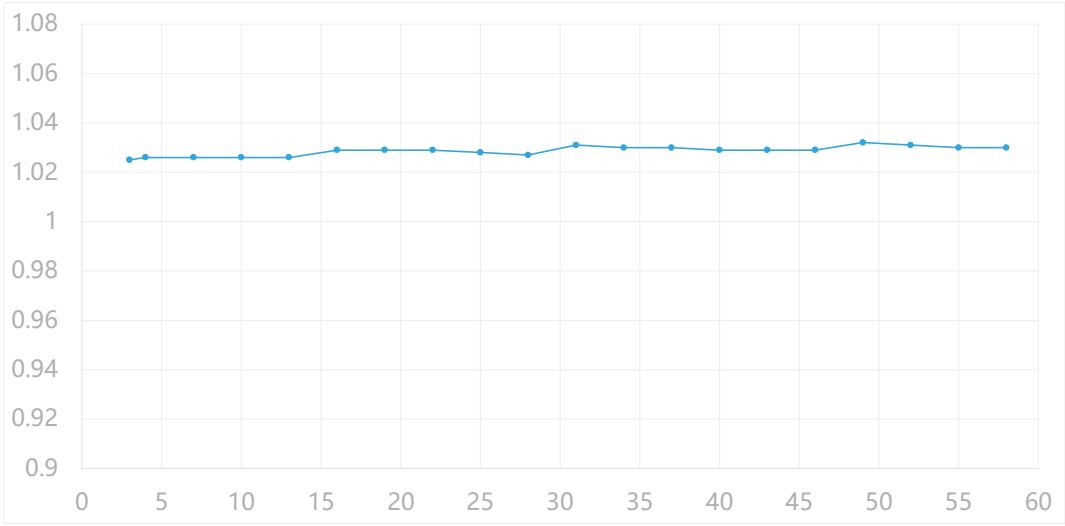
| Vin | $P_{IN}$ | $V_{OUT}$ | $I_{OUT}$ | | PF | THD | η | Average |
|---|---|---|---|---|---|---|---|---|
| (Vac) | (W) | (V) | (A) | | | | (%) | η(%) |
| 277 | 4.83 | 3.02 | 1.046 | 5% Load | 0.349 | 33.29 | 65.40% | 84.26% |
| | 8.32 | 6.01 | 1.045 | 10% Load | 0.478 | 28.94 | 75.49% | |
| | 14.29 | 11.01 | 1.044 | 20% Load | 0.635 | 20.77 | 80.44% | |
| | 20.71 | 16.81 | 1.042 | 30% Load | 0.818 | 12.01 | 84.58% | |
| | 27.21 | 22.52 | 1.044 | 40% Load | 0.897 | 12.51 | 86.41% | |
| | 33.32 | 28.02 | 1.041 | 50% Load | 0.862 | 11.8 | 87.54% | |
| | 39.56 | 33.62 | 1.039 | 60% Load | 0.964 | 11.7 | 88.30% | |
| | 45.69 | 39.02 | 1.042 | 70% Load | 0.977 | 11.6 | 88.99% | |
| | 51.98 | 44.7 | 1.040 | 80% Load | 0.940 | 6.02 | 89.43% | |
| | 58.15 | 50.4 | 1.038 | 90% Load | 0.951 | 5.34 | 89.97% | |
| | 64.34 | 55.9 | 1.040 | 100% Load | 0.960 | 4.69 | 90.36% | |

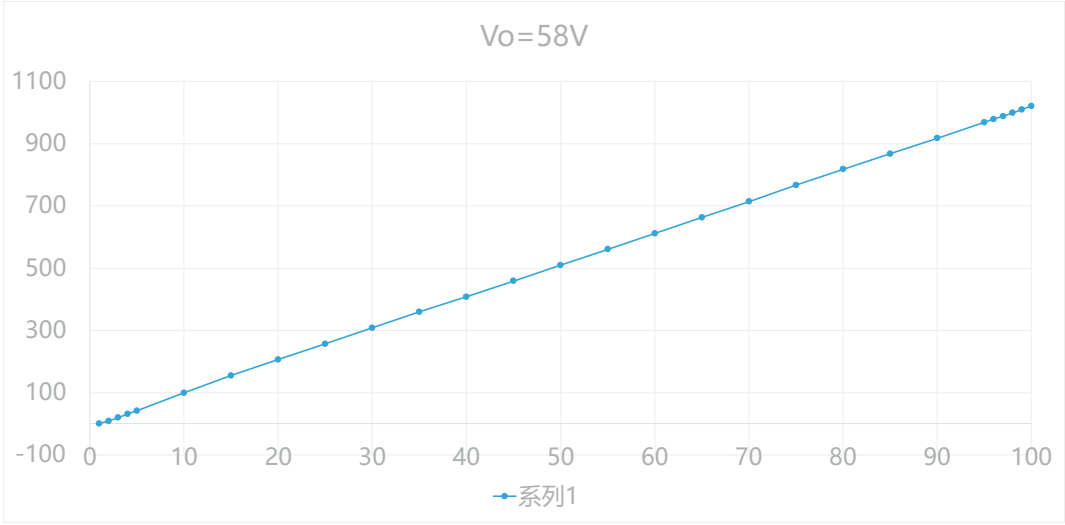
# 12. Vout VS. Iout

| voltage（V） | current（A） |
|---|---|
| 58 | 1.03 |
| 55 | 1.03 |
| 52 | 1.031 |
| 49 | 1.032 |
| 46 | 1.029 |
| 43 | 1.029 |
| 40 | 1.029 |
| 37 | 1.030 |
| 34 | 1.030 |
| 31 | 1.031 |
| 28 | 1.027 |
| 25 | 1.028 |
| 22 | 1.029 |
| 19 | 1.029 |
| 16 | 1.029 |
| 13 | 1.026 |
| 10 | 1.026 |
| 7 | 1.026 |
| 4 | 1.026 |
| 3 | 1.025 |



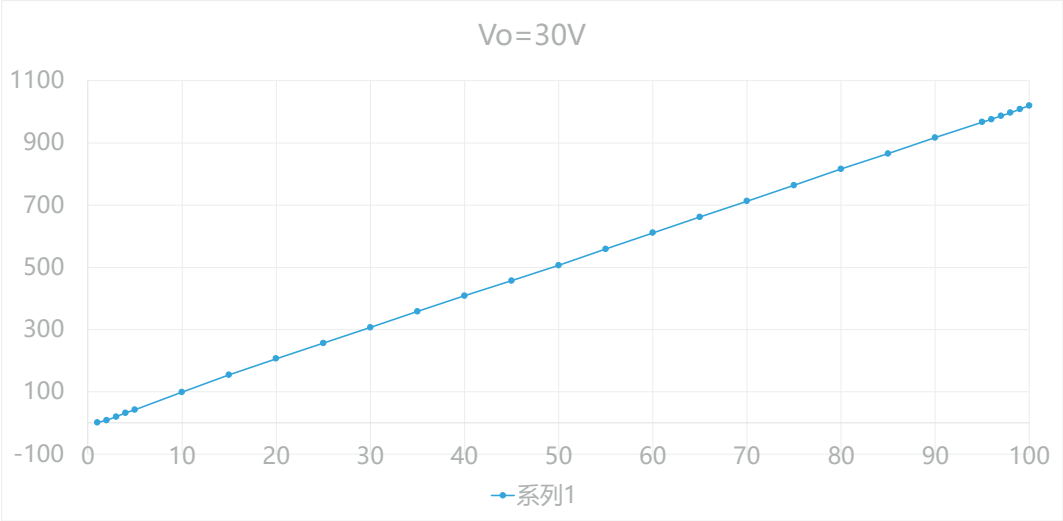
# 13. Dimming curve (Output voltage 58V=19*3)

| PWM | Iout（mA) |
|---|---|
| 1 | 1.02 |
| 2 | 8.73 |
| 3 | 19.74 |
| 4 | 31.79 |
| 5 | 41.70 |
| 10 | 99.3 |
| 15 | 155 |
| 20 | 206.1 |
| 25 | 257.1 |
| 30 | 308.2 |
| 35 | 359.8 |
| 40 | 408 |
| 45 | 459 |
| 50 | 510 |
| 55 | 561 |
| 60 | 612 |
| 65 | 663 |
| 70 | 714 |
| 75 | 767 |
| 80 | 818 |
| 85 | 868 |
| 90 | 918 |
| 95 | 969 |
| 96 | 979 |
| 97 | 988 |
| 98 | 999 |
| 99 | 1010 |
| 100 | 1021 |



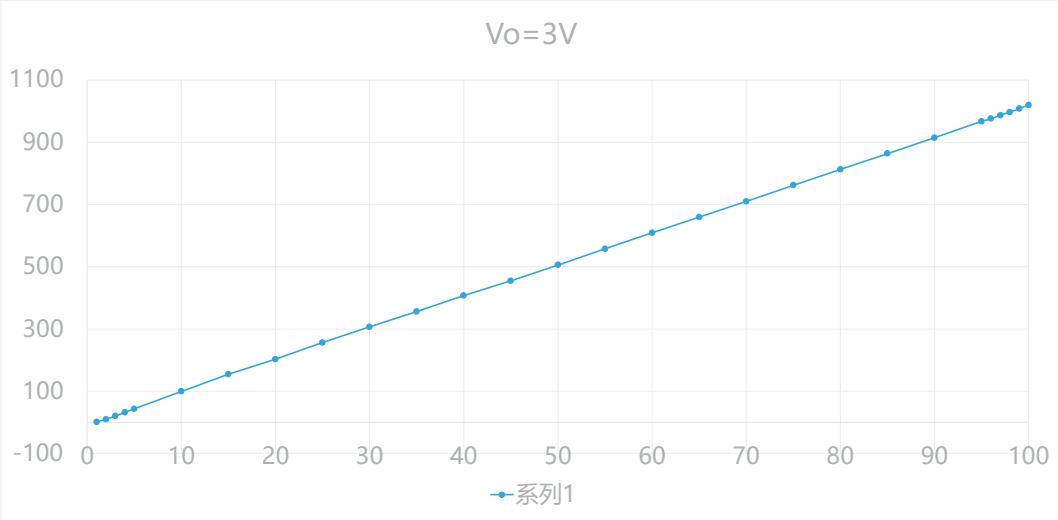
# 14. Dimming curve (Output voltage 30V=10*3)

| PWM | Output Current（mA) |
|---|---|
| 1 | 1.1 |
| 2 | 8.95 |
| 3 | 19.92 |
| 4 | 32.05 |
| 5 | 42.9 |
| 10 | 99.5 |
| 15 | 154.9 |
| 20 | 206.7 |
| 25 | 256.9 |
| 30 | 306.9 |
| 35 | 358.5 |
| 40 | 408.9 |
| 45 | 457 |
| 50 | 507 |
| 55 | 559 |
| 60 | 611 |
| 65 | 662 |
| 70 | 713 |
| 75 | 764 |
| 80 | 816 |
| 85 | 866 |
| 90 | 917 |
| 95 | 967 |
| 96 | 976 |
| 97 | 987 |
| 98 | 997 |
| 99 | 1009 |
| 100 | 1020 |



# 15. Dimming curve (Output voltage 3V=1*3)

| PWM | Output Current（mA） |
|---|---|
| 1 | 1.16 |
| 2 | 9.12 |
| 3 | 20.18 |
| 4 | 32.17 |
| 5 | 43.1 |
| 10 | 99.6 |
| 15 | 154.7 |
| 20 | 203.2 |
| 25 | 256.2 |
| 30 | 306.8 |
| 35 | 356.3 |
| 40 | 407.4 |
| 45 | 455 |
| 50 | 506 |
| 55 | 558 |
| 60 | 609 |
| 65 | 660 |
| 70 | 710 |
| 75 | 762 |
| 80 | 813 |
| 85 | 864 |
| 90 | 915 |
| 95 | 967 |
| 96 | 976 |
| 97 | 987 |
| 98 | 997 |
| 99 | 1008 |
| 100 | 1020 |



# 16. EMI（CE）

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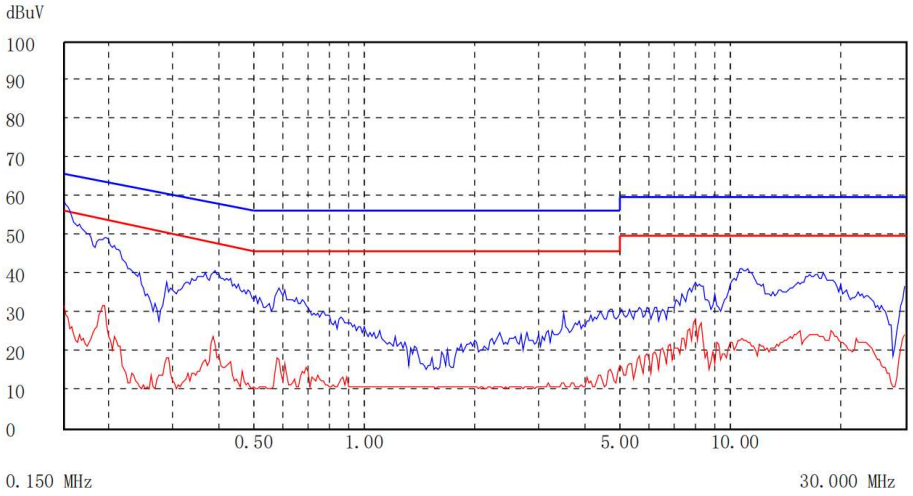
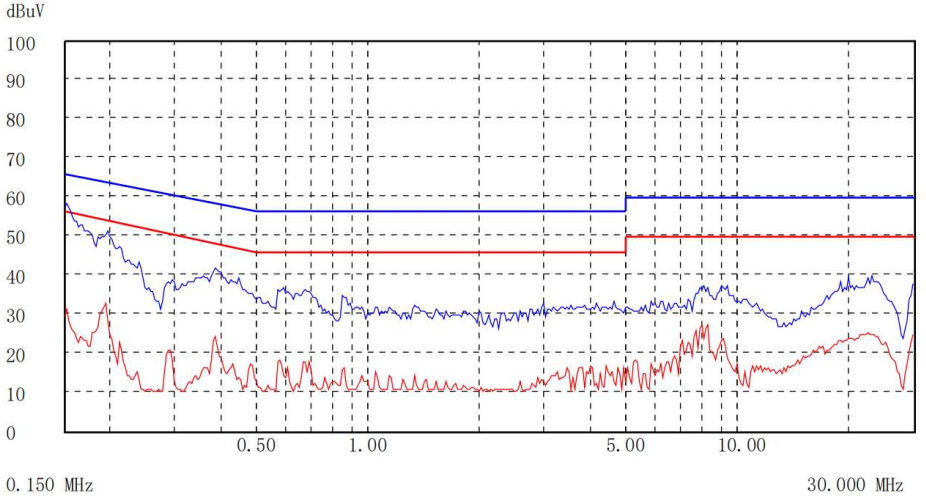
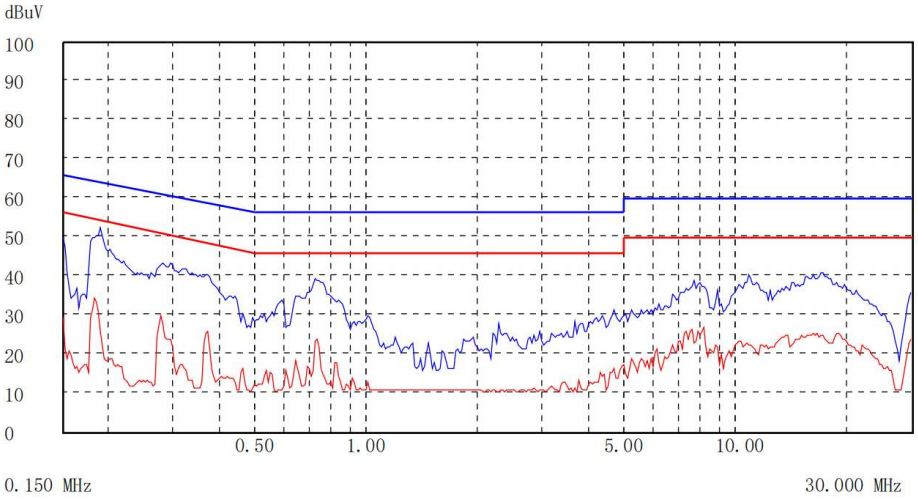
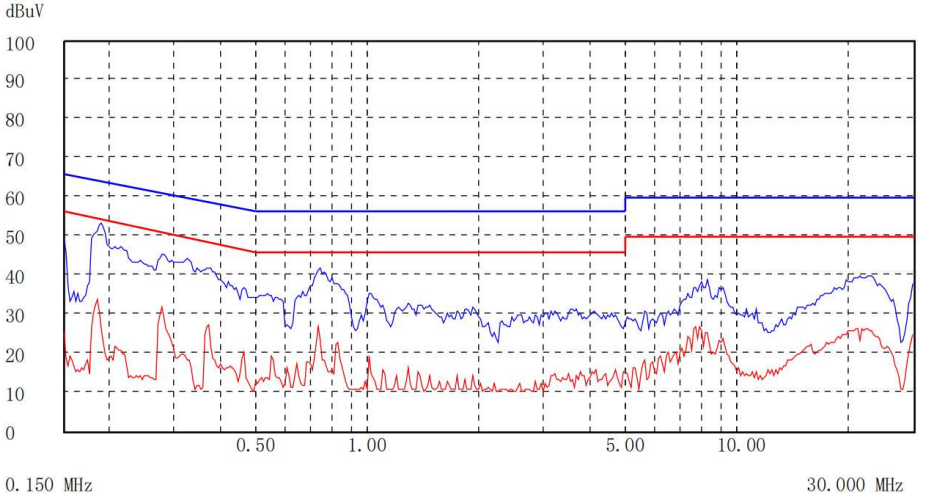
Vin=120Vac



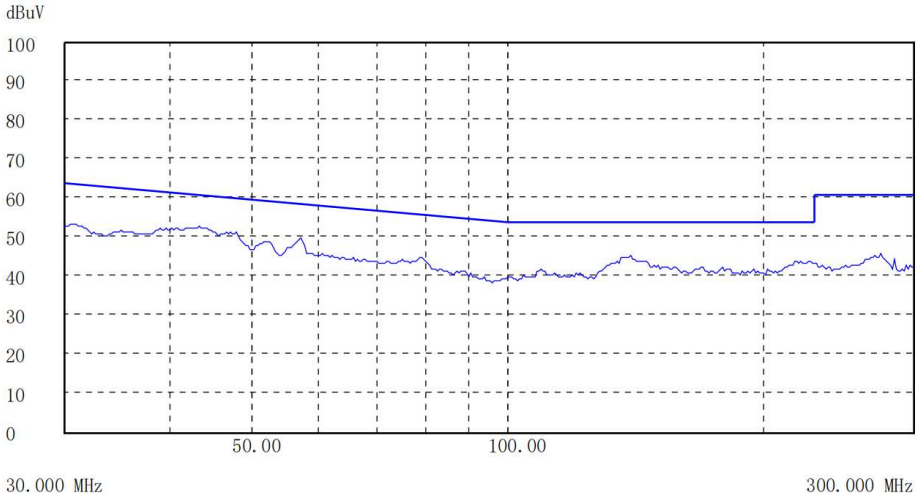

Vin=230Vac



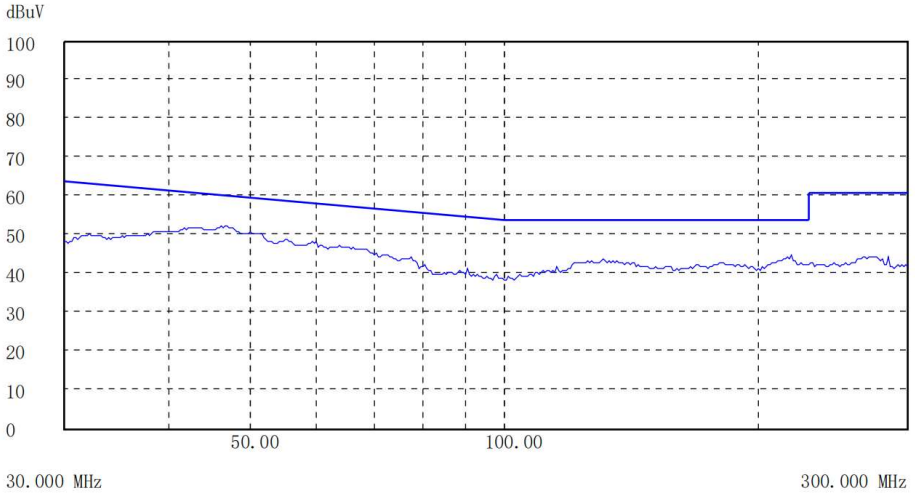



# 17. EMI（RE）

Vin=120Vac




Vin=230Vac



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# THANKS!

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