iWatt

Iw3614-00 for 30V350mA LED Driver

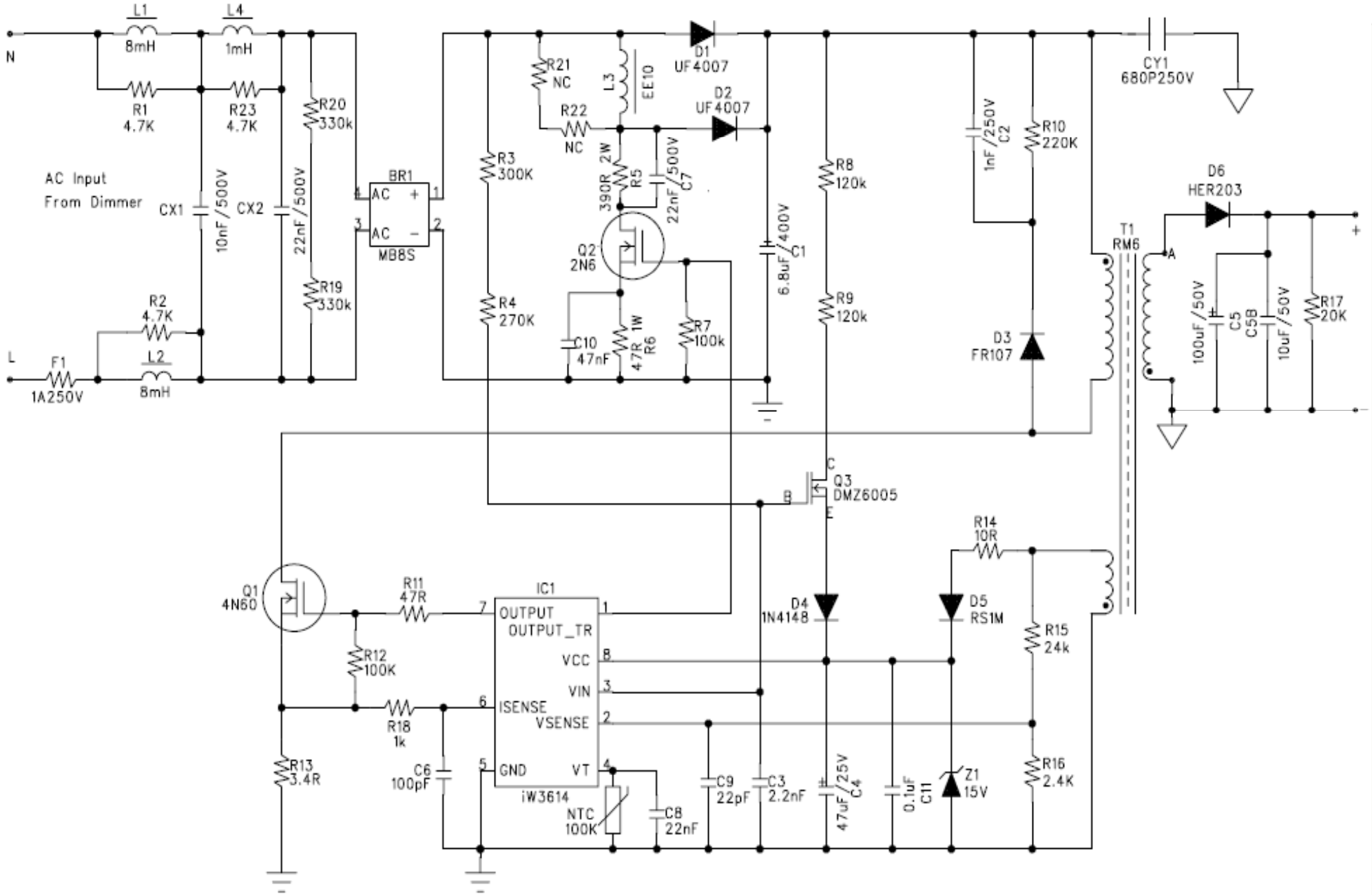
General Design Specification:

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_{AC}	2 Wire
Frequency		f_{LINE}	47	50	63	Hz	
Open-load Input Power (264V_{AC})						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		η		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

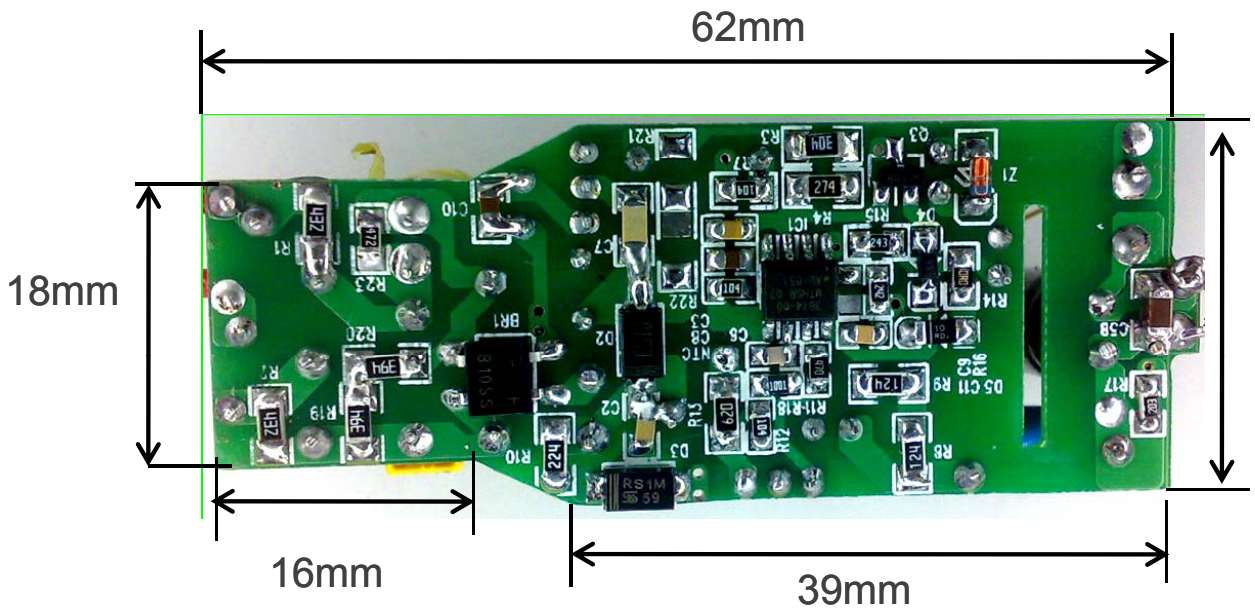
2 Schematic 30V350mA 230Vac



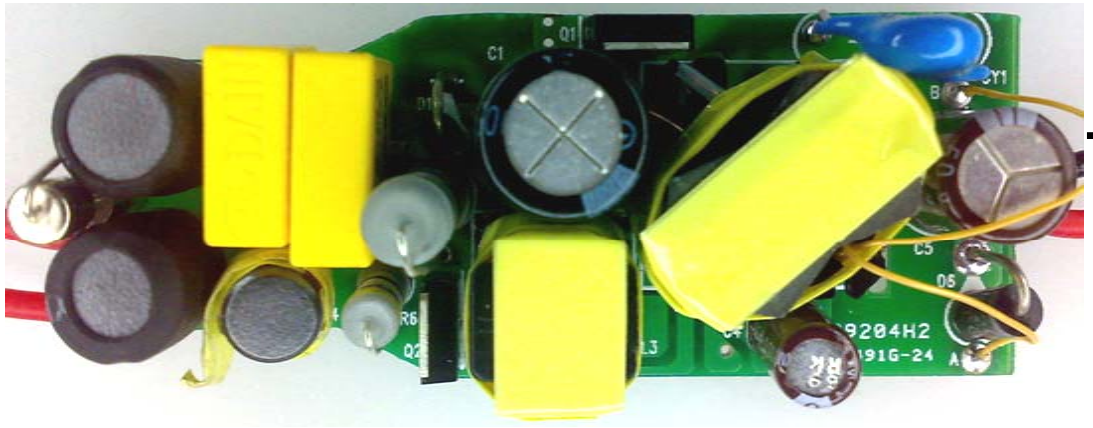
3.BOM __Input 230Vac __30V350mA

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

4. Circuit Board Photograph



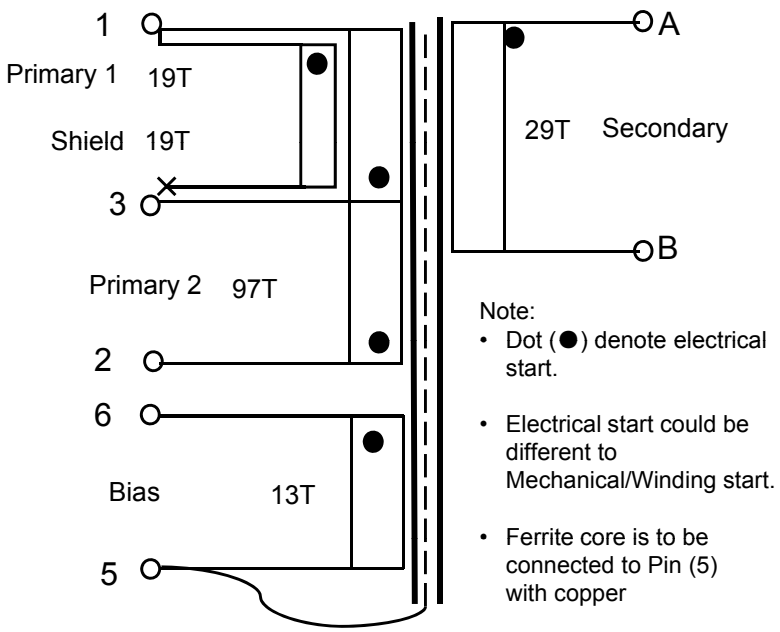
Bottom side



Top side

5. Transformer Design 230Vac 30V350mA

SCHEMATIC



Note:
- Dot (●) denote electrical start.
- Electrical start could be different to Mechanical/Winding start.
- Ferrite core is to be connected to Pin (5) with copper

ELECTRICAL SPECIFICATIONS:

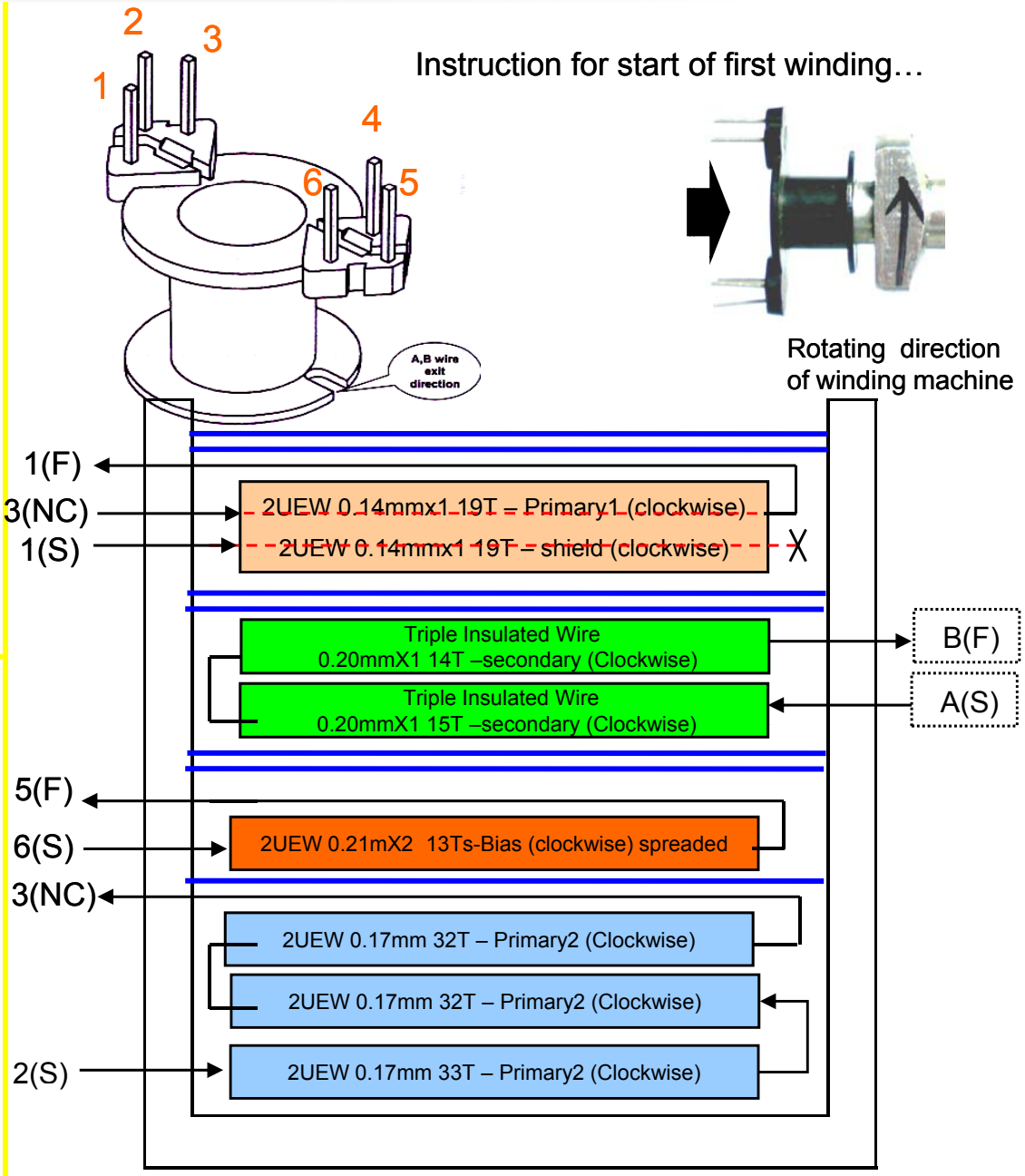
1. Primary Inductance (Lp) = 3.6mH @10KHz
2. Primary Leakage Inductance (Lk)< = 60uH @10KHz
3. Electrical Strength = 3KV, 50/60Hz,1Min

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.

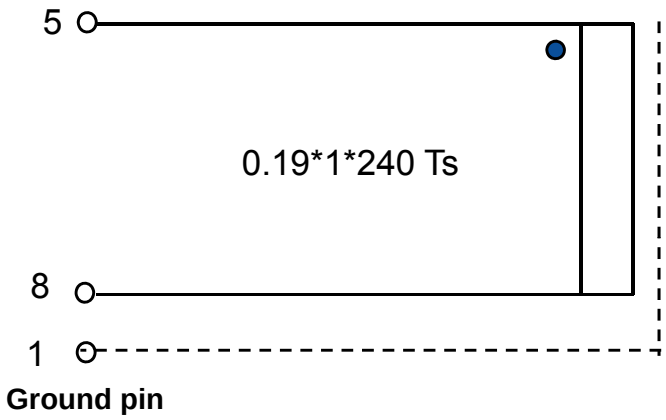
FINISHED :

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



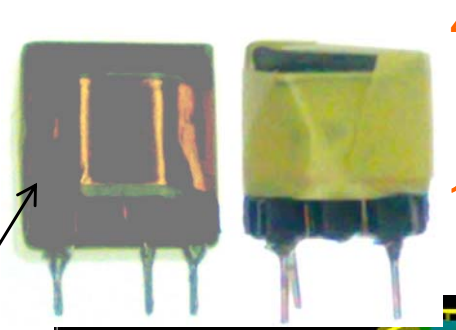
6.PFC choke and EMI Inductor__ For input 230Vac

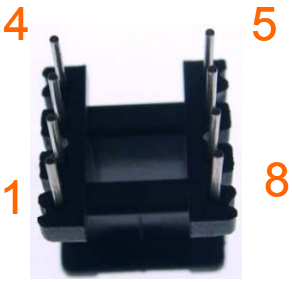
L3 SCHEMATIC



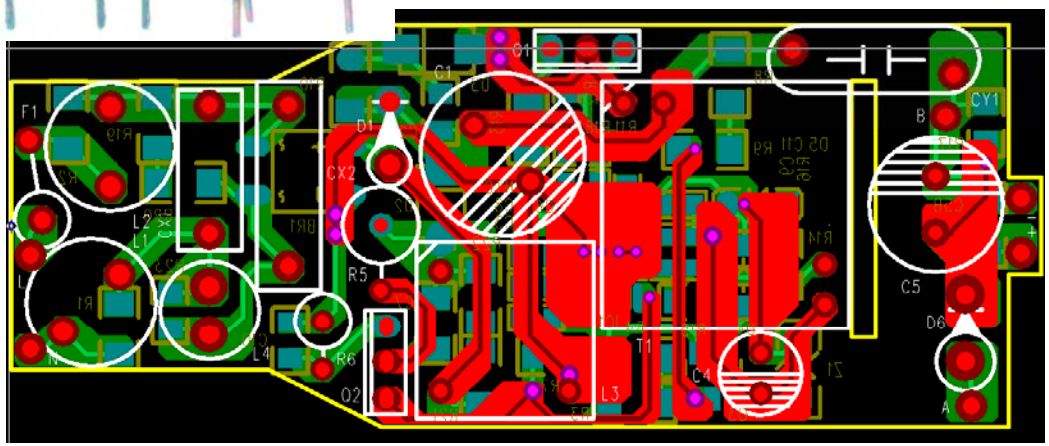
ELECTRICAL SPECIFICATIONS:

1. Inductance (Lp) = 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

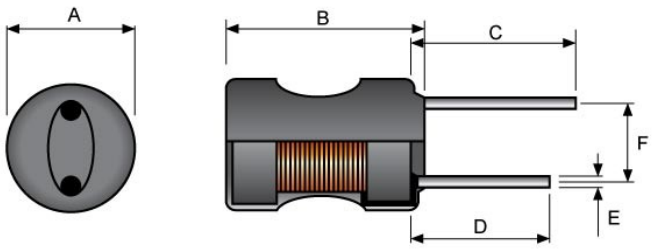




Copper shielding is connected to pin 1



EMI Inductor L1,L2



Ferrite core size : AxB 8x10mm 0.15*500T

Inductance @10kHz, 1V: 8mH +/-20%

DCR: 8 OHM +/-20%

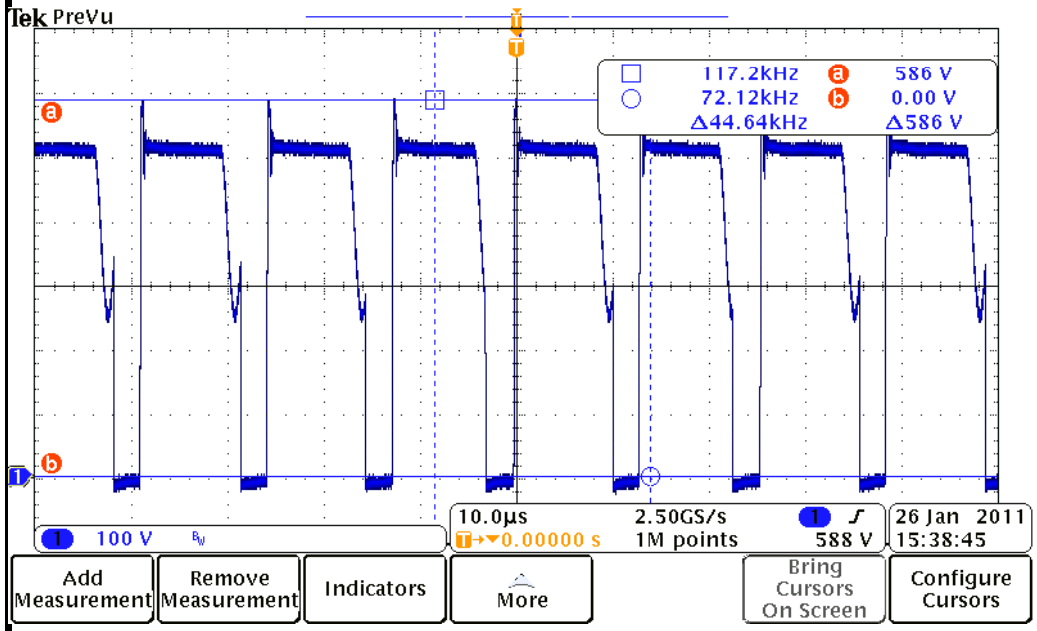
7.Constant Current and Efficiency __No Dimmer

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

#of LEDs	Vin (V)	Pin (W)	Vout (V)	Iout (A)	ripple current(mA)	efficiency	PF
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. MOSFET V_{ds} waveform



Test Condition:

V_{IN}=264VAC, Iout=350mA

Result:

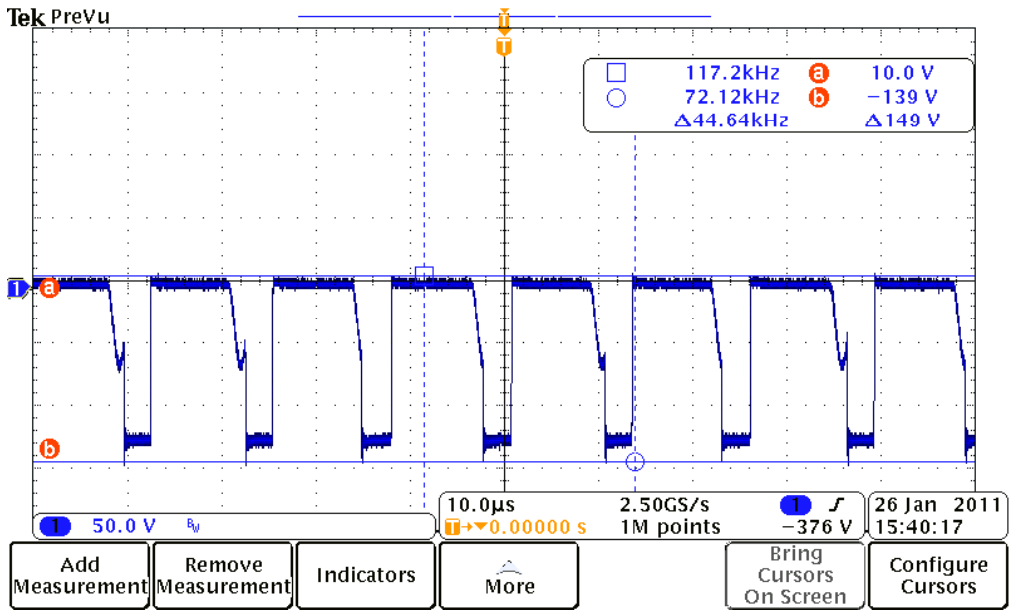
$V_{R\ (pk—pk)}$=586V

Q2: SPD02N60C3/A04N60C3 (INFINEON)

Electrical Characteristics, at T_j=25°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=80µA, V_{GS}=V_{DS}	2.1	3	3.9	

9. V_R waveform



Test Condition:

V_{IN}=230VAC, Iout=350mA

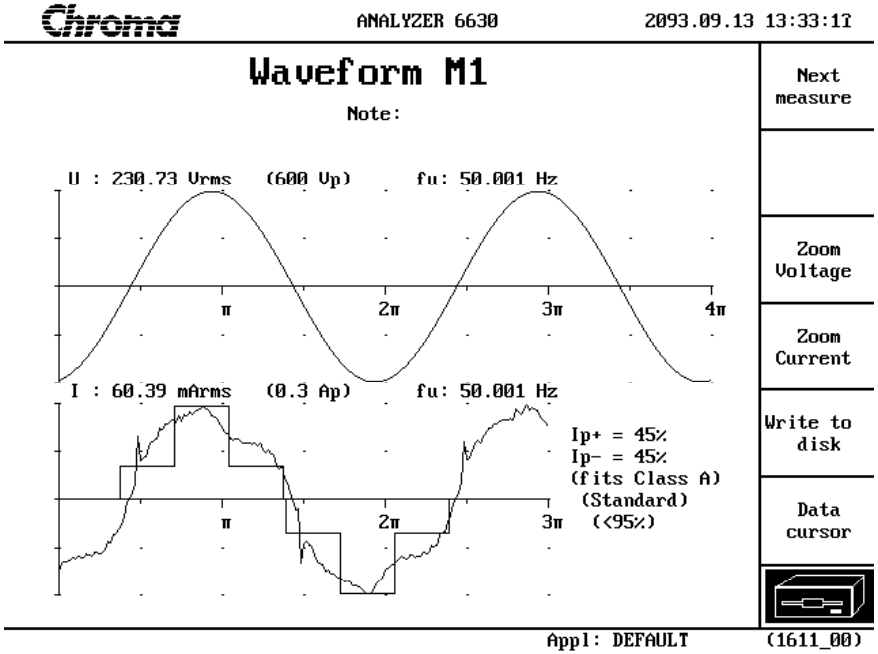
Result:

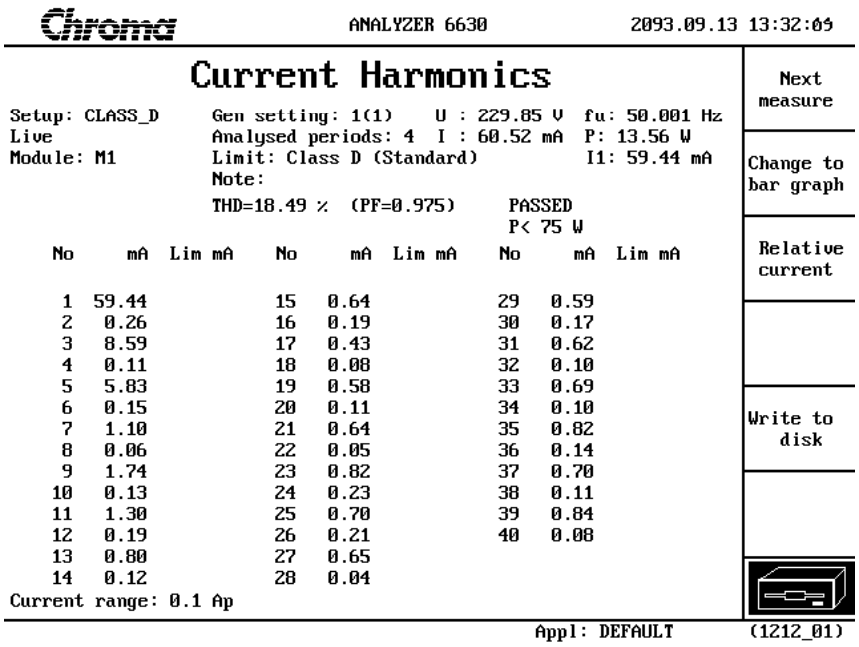
$V_{R\ (pk—pk)}$=156V

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 Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	300	400	600	800	1000	V
RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	210	280	420	560	700	V
Average Rectified Output Current (Note 1) @T_A = 55°C	Io	2.0								A

10. Harmonic and current waveform 3614-00





Harmonics current @230Vac

Meet IEC61000-3-2 requirement

Ac current waveform @230Vac

PF=0.975

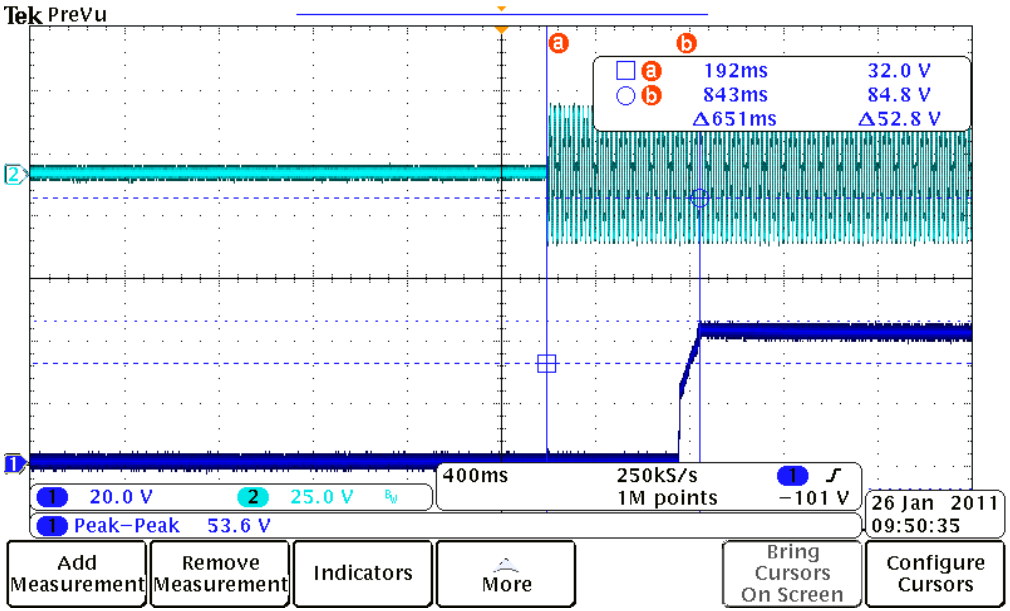
11.1 Dimmer Compatibility Test

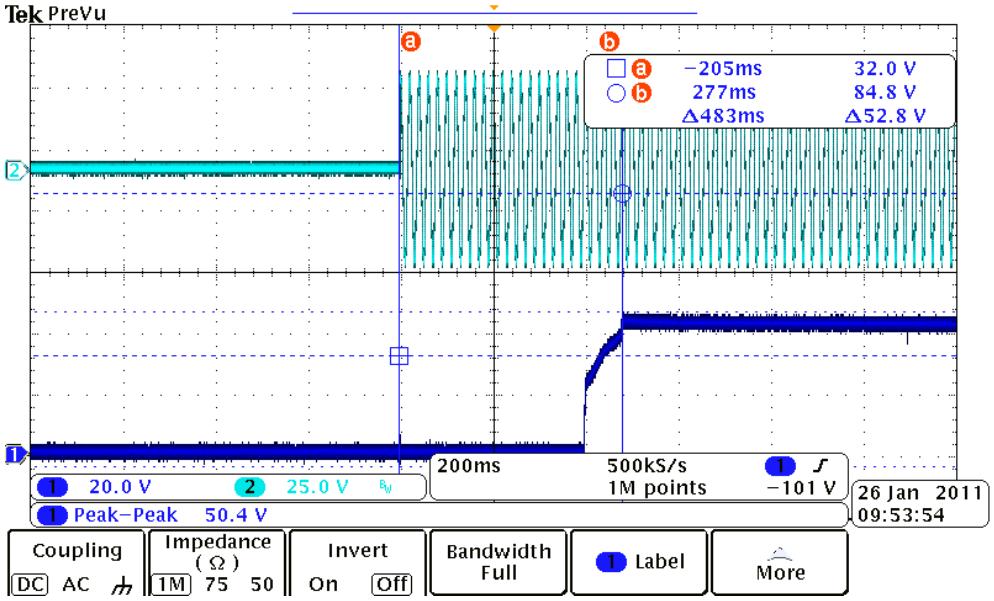
	Input	Maximum Level				Middle level					Minimum level			
Dimmer	Volt.	Pin	Pout	V_{LED}	I_{LED}	Pin	Pout	V_{LED}	I_{LED}	AC peak curr	Pin	Pout	V_{LED}	I_{LED}
	(V)	(W)	(W)	(V)	(mA)	(W)	(W)	(V)	(mA)	(mA)	(W)	(W)	(V)	(mA)
Etman	180	14.03	10.43	30.86	338	8.21	5.15	29.61	174	600	2.57	0.21	26.24	8
ETM321S 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_{LED}	I_{LED}	Pin	Pout	V_{LED}	I_{LED}	AC peak curr	Pin	Pout	V_{LED}	I_{LED}
	(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





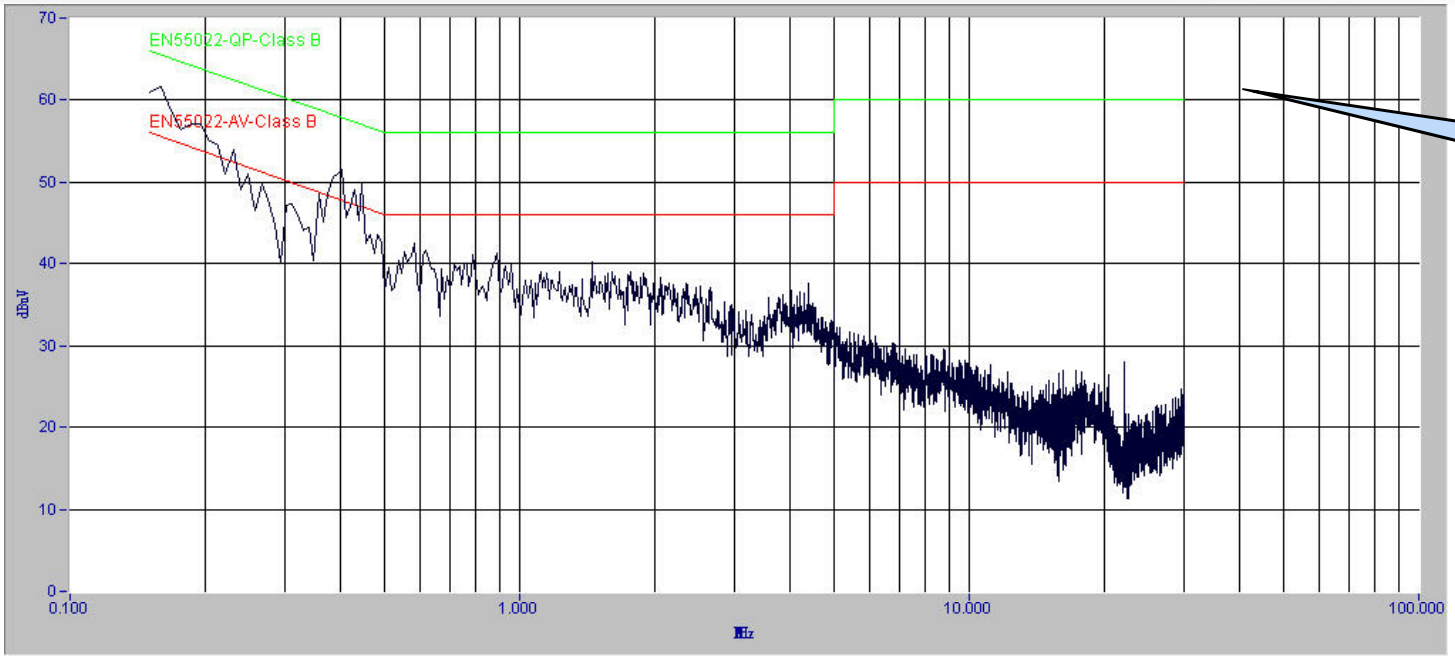
180V_{AC},Full Load

T_{ST_DELAY}=653mS

264V_{AC},Full Load

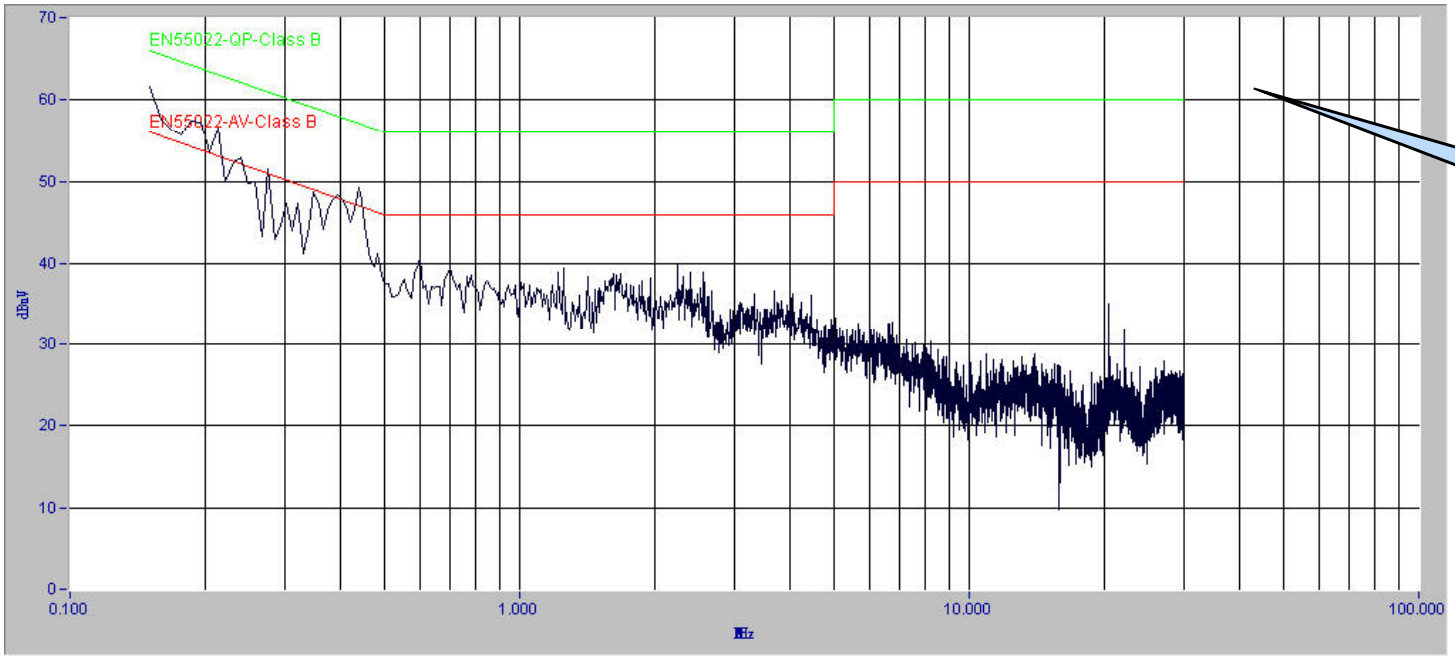
T_{ST_DELAY}=483mS

13. Conducted EMI



PK Scan
QP Limit line

PK scan L



PK Scan
QP Limit line

PK scan N