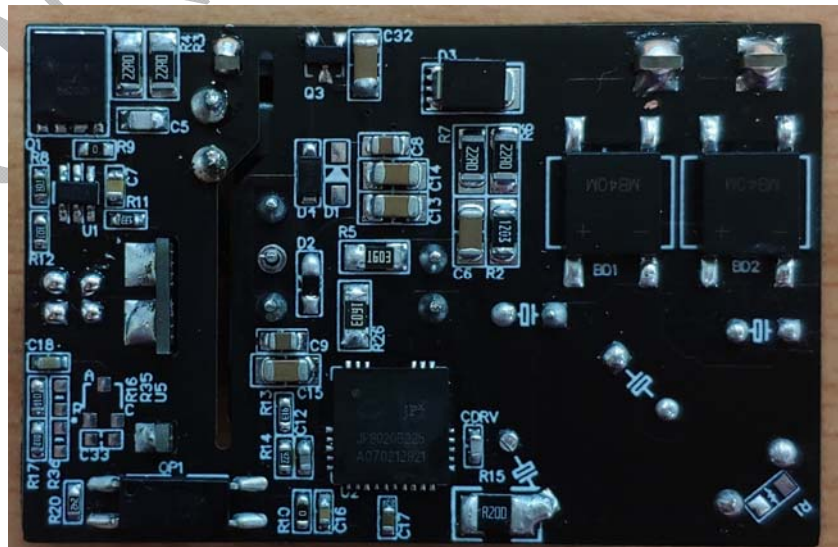
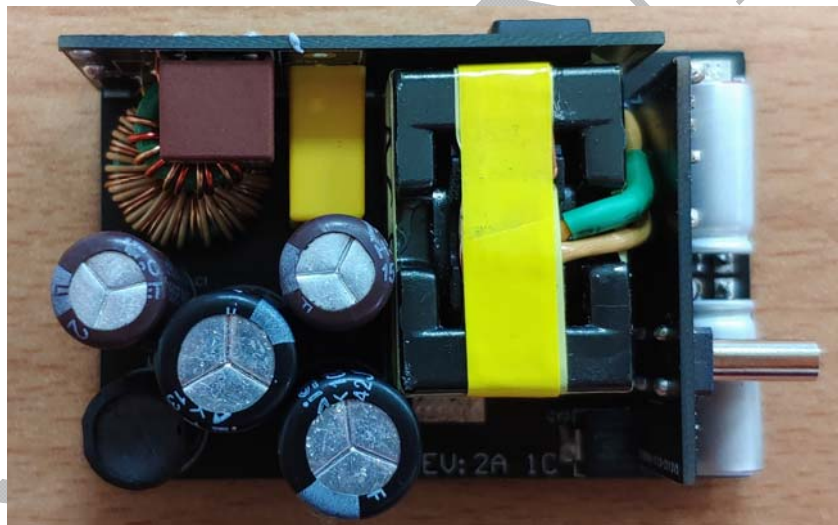


## 1. Operating Conditions

Parameter	Value
Input Voltage Range	100~240 Vac
Input Frequency Range	60/50 Hz
Output Voltage @ PD FOR TYPE C Output Current @ PD FOR TYPE C	5/9/12/15/20V 3A/3A/3A/3.25A
Max. Output Wattage	65W
Operating Temperature	--
Performance	
No-Load / Stand-by Power Consumption 230Vac/50Hz	< 75mW
Meet EN55022 CLASS B EMI	
Meets DOE6 and CoC V Tier 2	
Power density using GaN switch 22.89 W / inch <sup>3</sup> without enclosure	



## 2. Power Supply Specification

### ● Input

Description	Symbol	Min	Typ	Max	Units	Comment/Conditions
Voltage	VIN	100		240	VAC	2 Wire, no P.E
Frequency	fLINE	47	50/60	63	Hz	
No-load Input Power	PIN			75	mW	Input 230 VAC

### ● Output

Description	Symbol	Min	Typ	Max	Units	Comment/Conditions
Output Voltage(5V)			5		V	Measured at the End of PCB
Output Current(5V)			3		A	
Output Ripple Voltage(5V)				300	mV	
Output Voltage(9V)			9		V	Measured at the End of PCB
Output Current(9V)			3		A	
Output Ripple Voltage(9V)				300	mV	
Output Voltage(12V)			12		V	Measured at the End of PCB
Output Current(12V)			3		A	
Output Ripple Voltage(12V)				300	mV	
Output Voltage(15V)			15		V	Measured at the End of PCB
Output Current(15V)			3		A	
Output Ripple Voltage(15V)				300	mV	
Output Voltage(20V)			20		V	Measured at the End of PCB
Output Current(20V)			3.25		A	
Output Ripple Voltage(20V)				300	mV	
Continuous Output Power			65		W	
Average Efficiency	$\eta$					
Ambient Temperature	TAMB	0		40	°C	





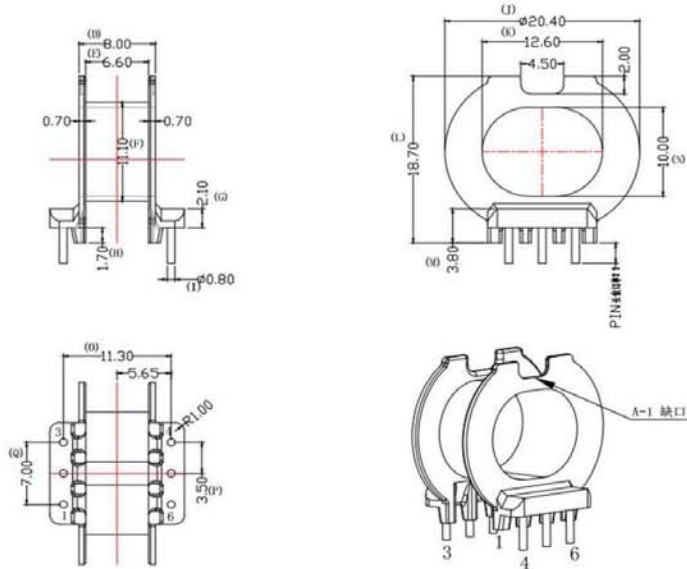
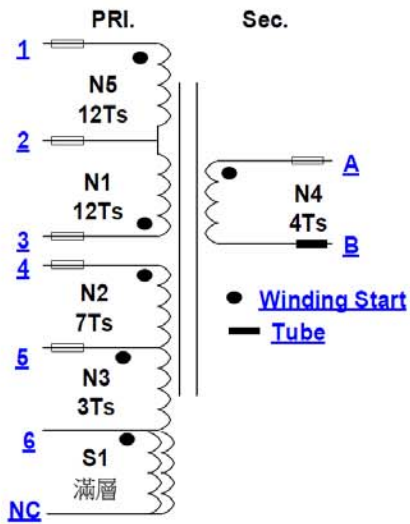
## 4. BOM

POSITION	ITEM DESCRIPTION	Footprint	QTY
BD1, BD2	DI208S	BRIDGE_DBS	2
C12	晶片電容 91pF/25V/X7R	C0603	1
C16	晶片電容 10nF/25V/X7R	C0603	1
C18	晶片電容 0.1uF/25V/X7R	C0603	1
C20	晶片電容 1uF/25V/X7R	C0603	1
C25, C29	晶片電容 330pF/25V/X7R	C0603	2
C26	晶片電容 3.3nF/25V/X7R	C0603	1
C27	晶片電容 68nF/25V/X7R	C0603	1
C7, C17, C28	晶片電容 1uF/50V/X7R	C0603	3
C11	晶片電容 0.1uF/50V/X7R	C0805	1
C5	晶片電容 1000pF/200V/X7R	C0805	1
C19	晶片電容 10uF/25V/X5R	C0805	1
C30	晶片電容 1uF/25V/X5R	C0805	1
C8, C9	晶片電容 2.2uF/50V/X7R	C0805	2
C13, C14, C15	晶片電容 10uF/50V/X5R	C1206	3
C32	晶片電容 1uF/100V	C1206	1
C6	晶片電容 1500pF/1KV	C1206	1
CX1	X2 電容 0.22UF/275VAC/X2 ±10%, 15mm LS	CAP_X2_6*13	1
CY1	Y 電容 220pF/400V TRX-SMD	CAP-Y-7R8x5R4	1
CY3	Y 電容 2200pF/400V TRX-SMD	CAY_Y_4*10	1
C1, C2	電解電容, 33uF/400V,105°C 10*20	CEC10_V_P5	2
C3, C4	電解電容, 22uF/400V,105°C 8*16	CEC16_8_3.5	2
C10, C21	電解電容, 470uF/25V,105°C 8*15	CEC6.3X14_H_P2.5	2
CNP1	CU18S19S_TYPEC-16PIN	USB Type-C 16PIN SMT L=10.0	1
D1	二極體 SMD 1000V 1A P/N: GS1010	D_SOD-123_JL	1
D2	二極體 SMD 1N4148	1206(D)	1
D3	二極體 SMD 1000V 3A P/N: RS3M	D_DO-214	1
D4	二極體 SMD 1000V 1A P/N: RS1010	D_SOD-123_JL	1
F1	保險絲 3.15A 300V 4X8.3_V_P5.24	FUSE_4X8.3_V_P5.24	1
IC1	智融 SW2303 IC	SW230X_QFN16-4X4	1
LF1	LINE FILTER 330uH	L-Chock_9X5X3	1
LF2	LINE FILTER 6mH	L-CHOKE_10X6X4	1
LF3	L=100uH	DR 8X10	1
OP1	光耦合器 EL1019 SMD	PHOTO_SMD	1
Q1	MOSFET N-CH,FDMS86202ET120 120V102A	PG-TDSON-8	1
Q2	MOSFET N-CH,NTTFS4930N 30V23A	WDFN8_3.3X3.3	1

POSITION	ITEM DESCRIPTION	Footprint	QTY
Q3	MOSFET N-CH,DMZ1015E 100V0.1A	SOT-23	1
R23	晶片 電阻 1% 510Ω	R0402	1
R8, R12	晶片 電阻 1% 300Ω	R0603	2
R9, R10, R18	晶片 電阻 1% 0Ω	R0603	3
R11	晶片 電阻 1% 43KΩ	R0603	1
R13	晶片 電阻 1% 91K	R0603	1
R14	晶片 電阻 1% 4.7K	R0603	1
R16	晶片 電阻 1% 100Ω	R0603	1
R17, R24, R25	晶片 電阻 1% 1K	R0603	3
R19	晶片 電阻 1% 36K	R0603	1
R20	晶片 電阻 1% 2.4K	R0603	1
R21	晶片 電阻 1% 100K	R0603	1
R1	晶片 電阻 1% 3.3K	R0805	1
R3, R4	晶片 電阻 1% 22Ω	R1206	2
R5, R26	晶片 電阻 1% 160K	R1206	2
R2	晶片 電阻 1% 110K	R1206	1
R6, R7	晶片 電阻 1% 30Ω	R1206	2
R22	合金電阻 5mΩ 1%	R1206	1
R39, R40	晶片 電阻 1% 1.5MΩ	R1206	2
R15	晶片 電阻 1% 0.18Ω	R1210	1
TR1	變壓器 ATQ23.7	T_ATQ23	1
U1	SR IC MP6908	SOT-26	1
U2	PWM IC JP8020	QFN-26_8X8	1

## 5. Transformer Specification

變壓器示意圖



\* A及B 飛線長度30mm

變壓器結構說明

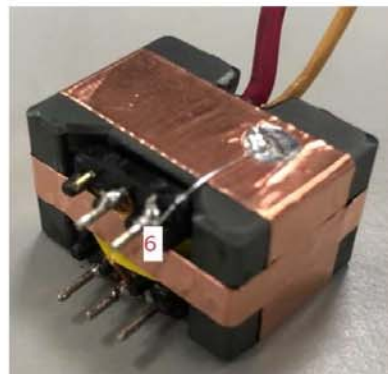
Step	Winding No.	Start	End	Wire Diameter	Turns	Winding	Tube
1	N1	3	1	2UEW, 0.1mm x 12	12	1 layers, 密繞	YES
2	N2	4	5	2UEW, 0.13mm x 2	7	1 layers, 密繞	YES
3	N3	5	6	2UEW, 0.13mm x 2	3	1 layers, 密繞	YES
4	N4	A	B	三層絕緣線, 0.1mm x 100	4	1 layers, 密繞	YES
5	S1	6	NC	2UEW, 0.13mm x 1	滿層	1 layers, 密繞	YES
6	N5	1	2	2UEW, 0.1mm x 12	12	1 layers, 密繞	YES

繞線結構說明



變壓器電氣特性

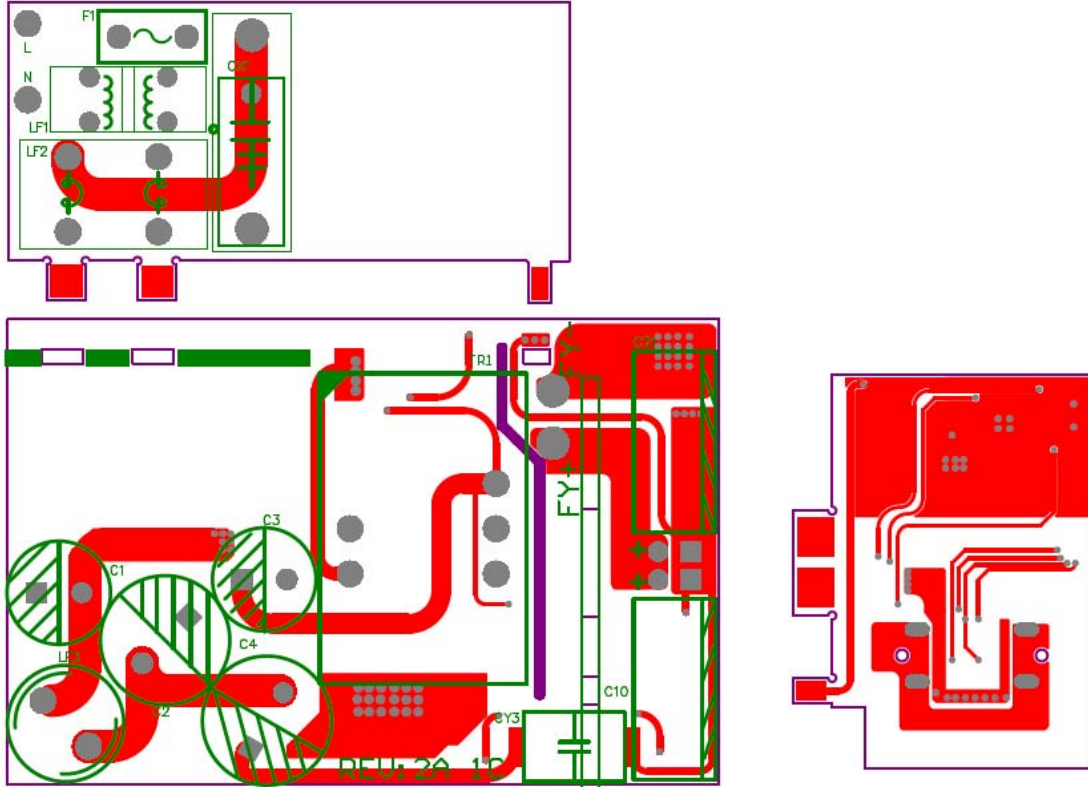
Parameter	Condition	Value
Primary Inductance	Lp(3-2)	200uH
Leakage Inductance	Lk(3-2)	6uH, max
Core	ATQ23	N95
Bobbin	ATQ23	3pin + 3pin



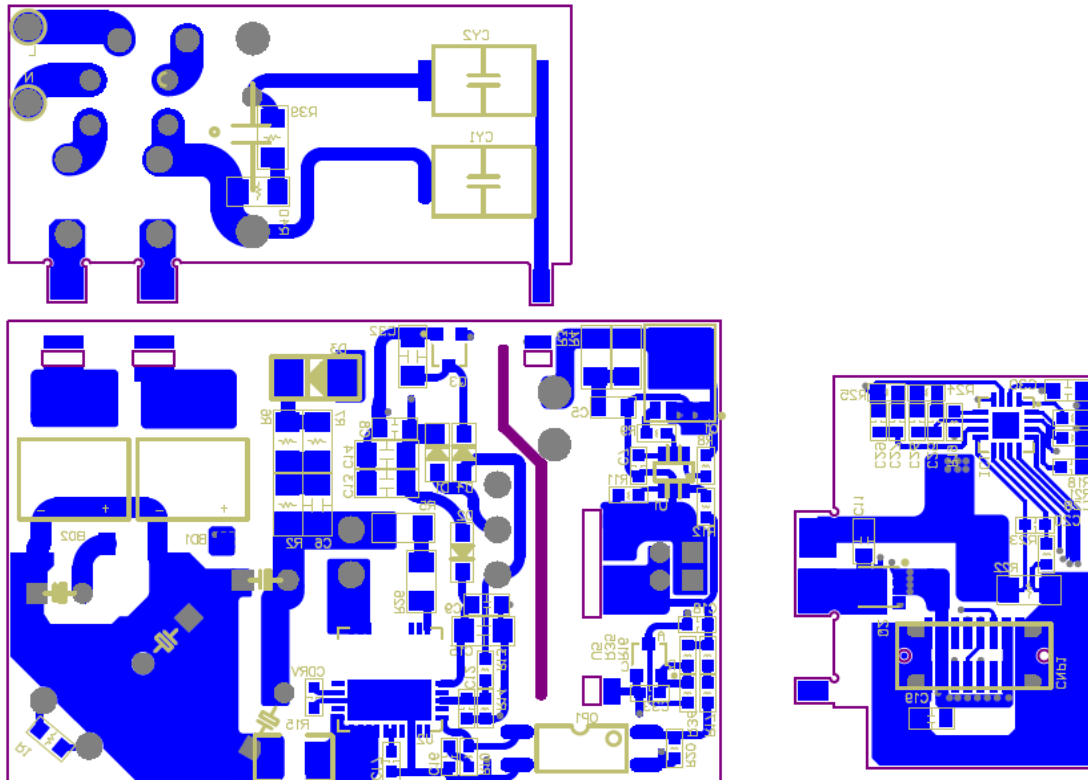
註

變壓器外層須包覆十字銅箔，並出引線至PIN6  
下圖為參考圖面

**6. PCB Layout (Note: Not in Scale)**



**Top View of PCB**



**Bottom View of PCB**



## 7. Performance Evaluation

### 7.1 Standby Power

	PIN	SPEC
230V/50HZ	53mW	<75mW

### 7.2 System efficiency

#### Vout @ PCB end @115Vac/60Hz

5V						
115V 60Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	4.29	5.11	0.755	89.93%	89.41%	81.39%
50%	8.62	5.13	1.5	89.27%		
75%	12.9	5.15	2.25	89.83%		
100%	17.5	5.17	3	88.63%		

9V						
115V 60Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	7.49	9.11	0.755	91.83%	91.84%	86.62%
50%	14.8	9.13	1.5	92.53%		
75%	22.5	9.16	2.25	91.60%		
100%	30.1	9.17	3	91.40%		

12V						
115V 60Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	9.98	12.1	0.755	91.54%	92.10%	87.40%
50%	19.7	12.12	1.5	92.28%		
75%	29.7	12.14	2.25	91.97%		
100%	39.4	12.16	3	92.59%		

15V						
115V 60Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	12.4	15.08	0.755	91.82%	92.08%	87.73%
50%	24.6	15.11	1.5	92.13%		
75%	36.9	15.13	2.25	92.26%		
100%	49.3	15.14	3	92.13%		

20V						
115V 60Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	17.9	20.04	0.816	91.36%	92.16%	88.00%
50%	35.4	20.07	1.626	92.19%		
75%	53	20.09	2.43	92.11%		
100%	70.3	20.11	3.25	92.97%		

**@230Vac/50Hz**

5V						
230V 50Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	4.5	5.11	0.755	85.73%	87.64%	81.39%
50%	8.72	5.13	1.5	88.25%		
75%	13.1	5.15	2.25	88.45%		
100%	17.6	5.17	3	88.13%		

9V						
230V 50Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	7.65	9.11	0.755	89.91%	90.72%	86.62%
50%	15.1	9.14	1.5	90.79%		
75%	22.6	9.15	2.25	91.10%		
100%	30.2	9.17	3	91.09%		

12V						
230V 50Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	10.2	12.1	0.755	89.56%	91.21%	87.40%
50%	19.9	12.1	1.5	91.36%		
75%	29.7	12.2	2.25	92.05%		
100%	39.7	12.2	3	91.89%		

15V						
230V 50Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	12.7	15.1	0.755	89.65%	91.03%	87.73%
50%	24.8	15.1	1.5	91.39%		
75%	37.1	15.1	2.23	90.94%		
100%	49.3	15.1	3	92.13%		

20V						
230V 50Hz	PI	VO	IO	EFF	AVG	DOE 6 Spec
25%	18.2	20	0.816	89.85%	91.87%	88.00%
50%	35.4	20.1	1.626	92.19%		
75%	52.7	20.1	2.43	92.59%		
100%	70.4	20.1	3.25	92.84%		

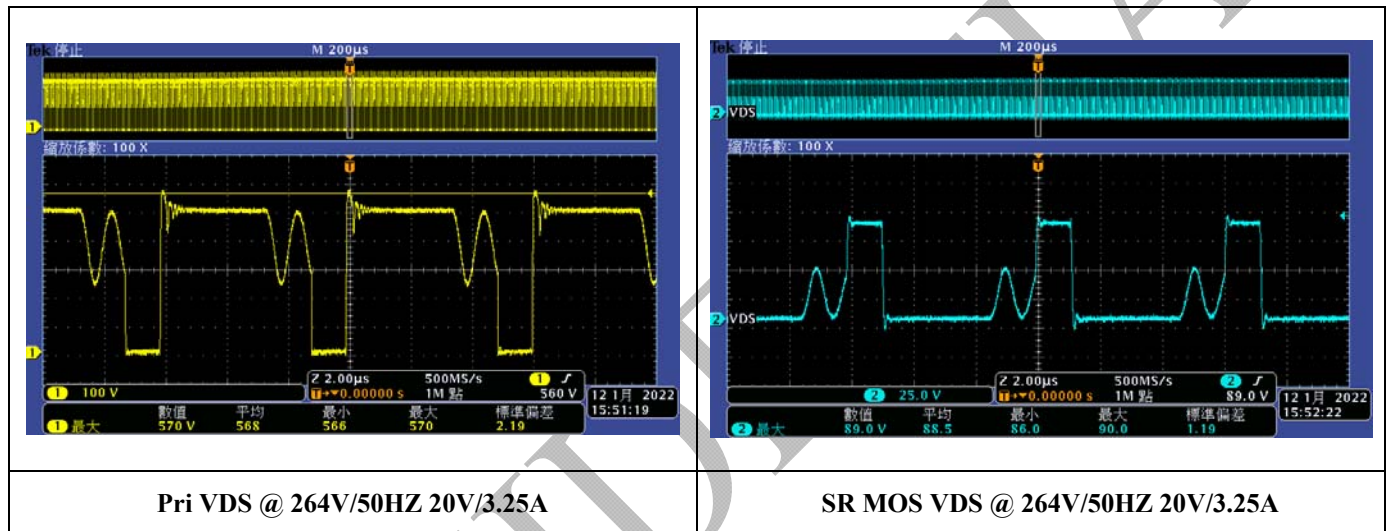
### 7.3 Ripple & Noise

TYPE C		
VIN	5V	
	No Load	Full load
100V/60HZ	86mV	54mV
240V/50HZ	48mV	60mV
VIN	9V	
	No Load	Full load
100V/60HZ	38mV	60mV
240V/50HZ	40mV	220mV
VIN	12V	
	No Load	Full load
100V/60HZ	38mV	29mV
240V/50HZ	34mV	48mV
VIN	15V	
	No Load	Full load
100V/60HZ	36mV	36.8mV
240V/50HZ	20mV	50mV
VIN	20V	
	No Load	Full load
100V/60HZ	34mV	80mV
240V/50HZ	22mV	60mV

### 7.4 Maximum Drain Voltage

Pri_DRAIN VOLTAGE		
Item	Input voltage	Measured Results
Normal full load	264V/50HZ	570V

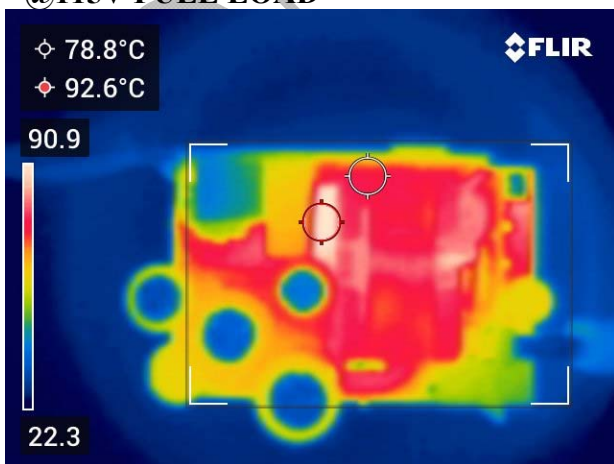
SR_MOSFET		
Item	Input voltage	Measured Results
Normal full load	264V/50HZ	90V



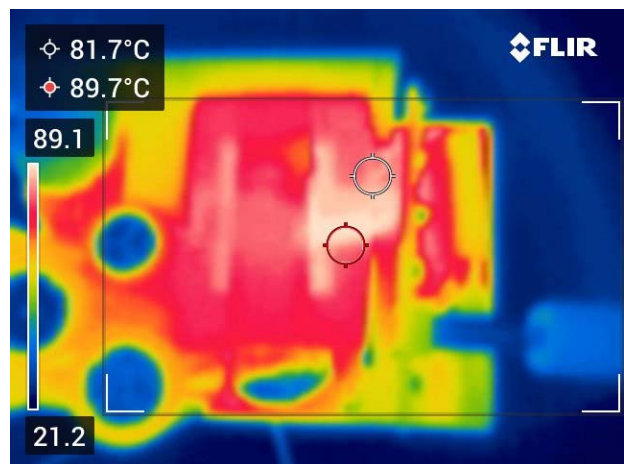
### 7.5 Thermal Test

Thermal performance is measured room temperature.

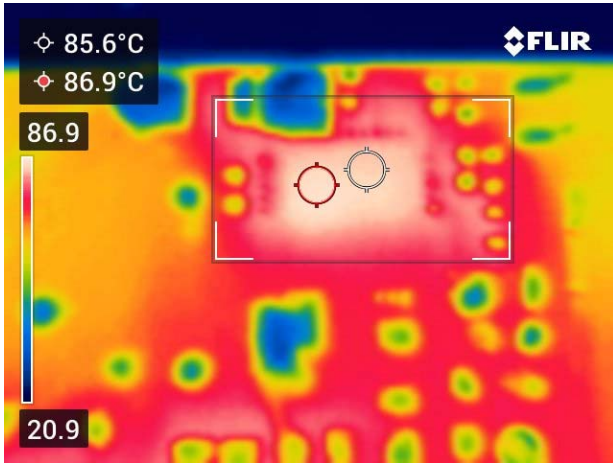
**@115V FULL LOAD**



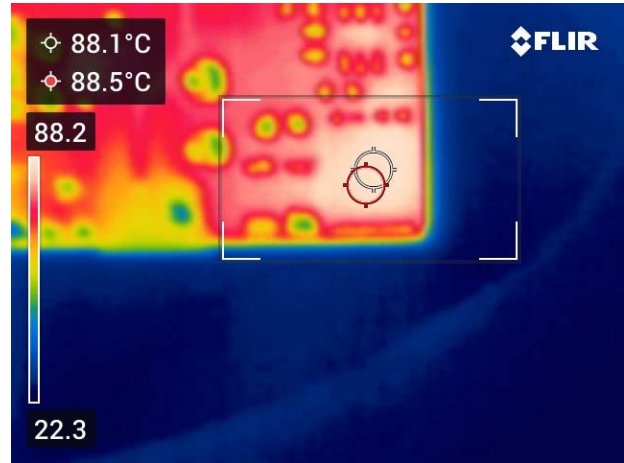
**Transformer Winding (T1) : 92.6°C**



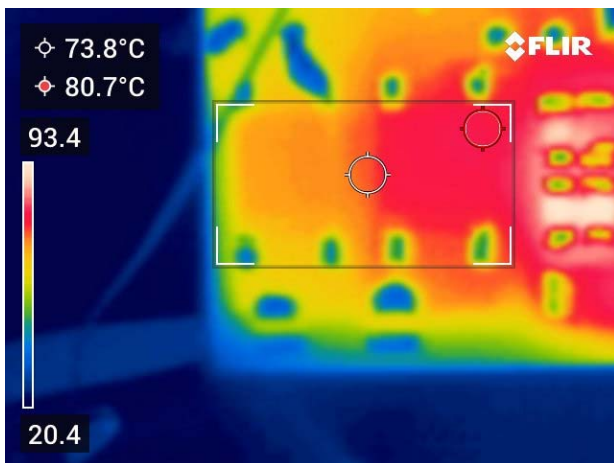
**Transformer Winding (T1) : 89.7°C**



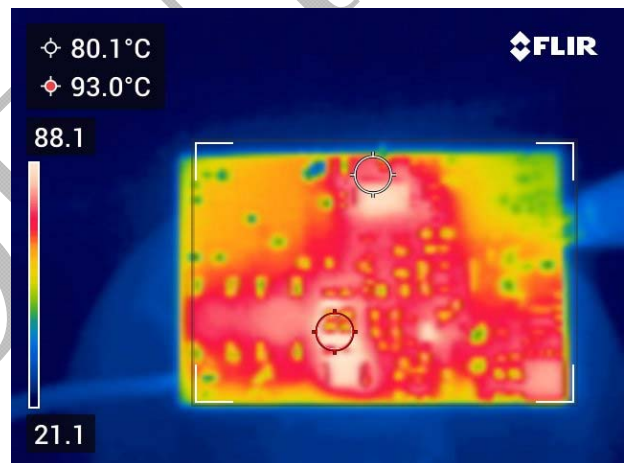
**JP8020 (U2) : 86.9°C**



**SR MOS (Q1) : 88.5°C**



**Bridge (BD1) : 80.7°C**

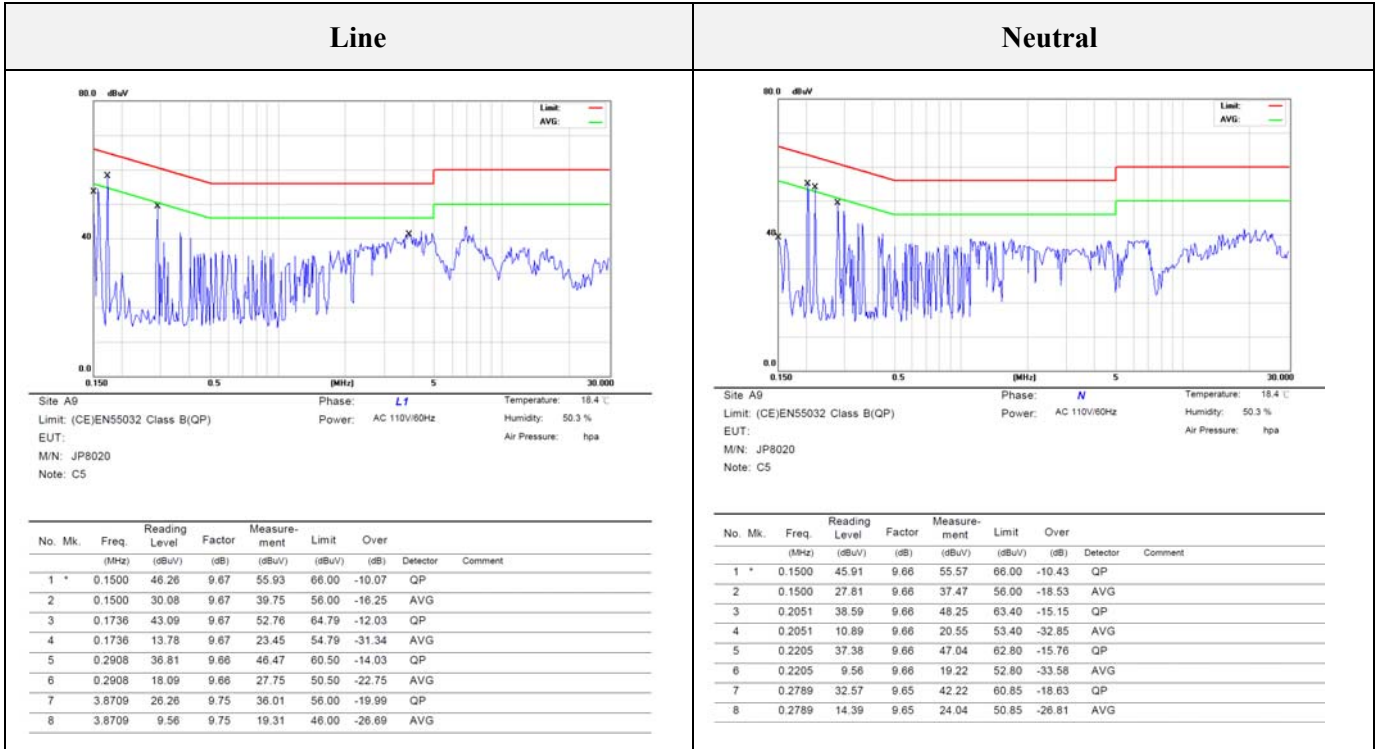


**Snubber resistance (R6) : 93°C**

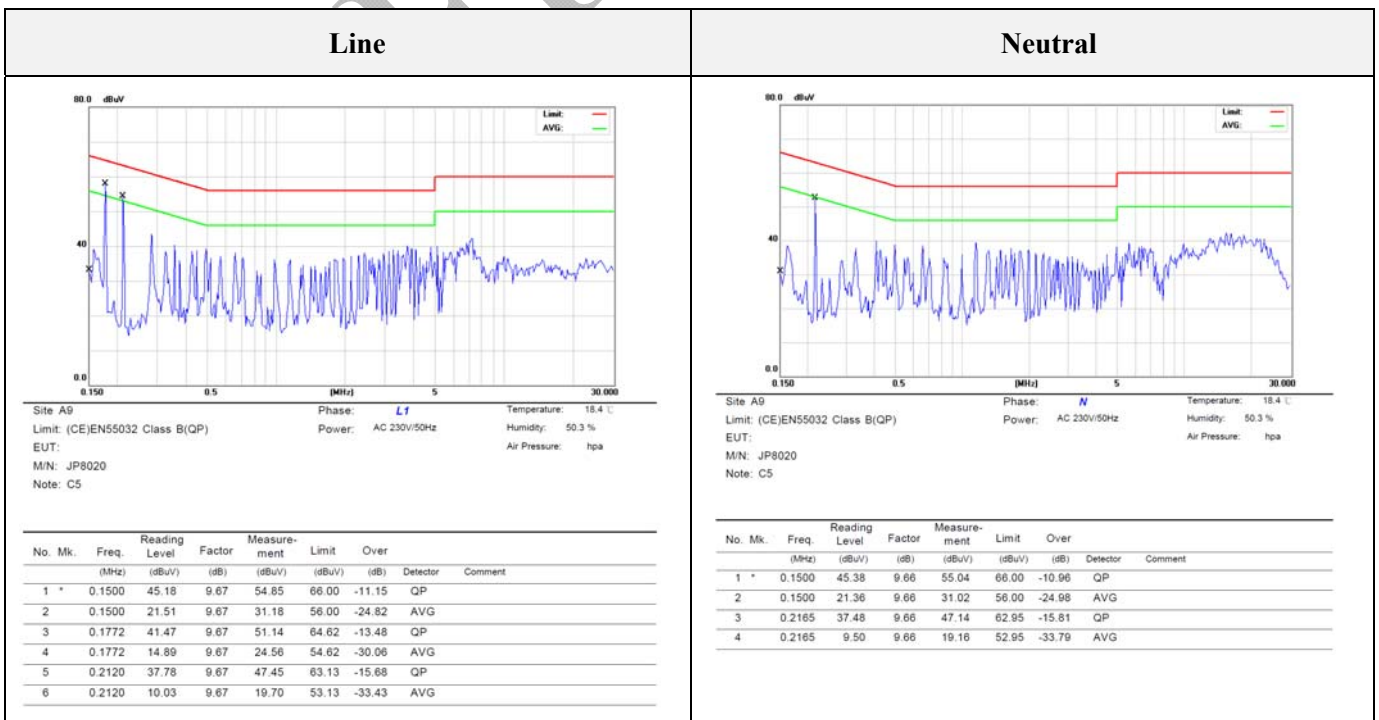
## 8. Conducted Emission – PK and AV

### ● EN55022 CLASS B @ FULL LOAD

#### 110VAC/60HZ



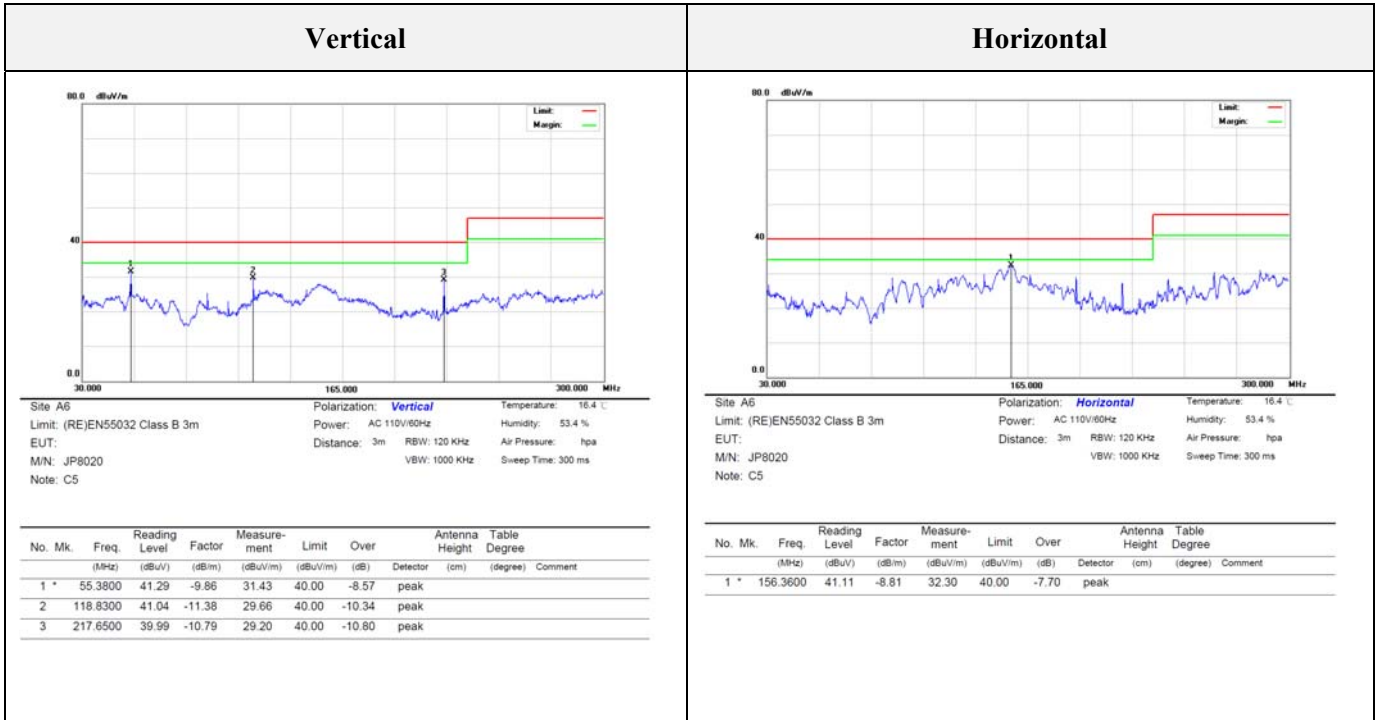
#### 230VAC/50HZ



## 9. Radiated Emission

### ● EN55022 CLASS B @ FULL LOAD

#### 110VAC/60HZ



#### 230VAC/50HZ

