MWS65

EVALUATION DATA

DWG No. FA001-53-01		
APPD	CHK	DWG
Frank. Chiang 26/Jul/2011	Amos Chen 26. Jul. '11	Tony Chiu 26. Jul. '11

INDEX

2. Characteristics

2.1 Steady state data **PAGE**

Terminology used

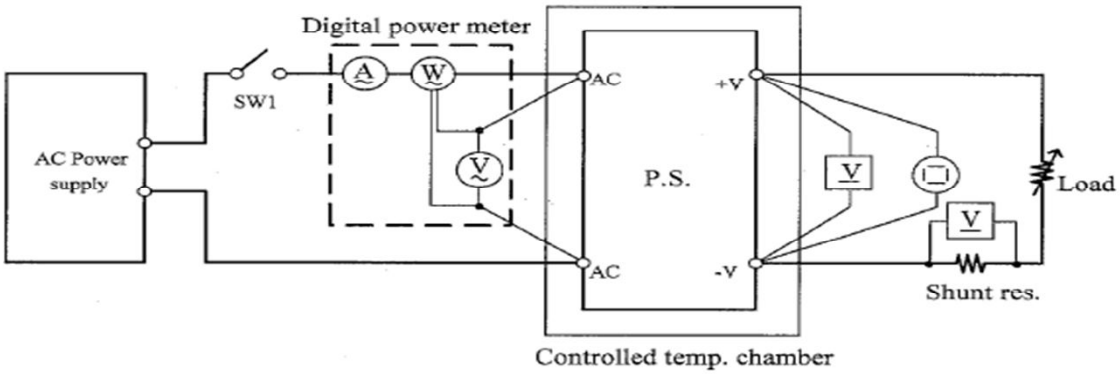
	Definition
Vin	Input Voltage
Vout	Output Voltage
Iin	Input Current
Iout	Output Current
Pin	Input Power
Ta	Ambient Temperature
f	Frequency

1. Evaluation method

1.1 Circuit used for determination

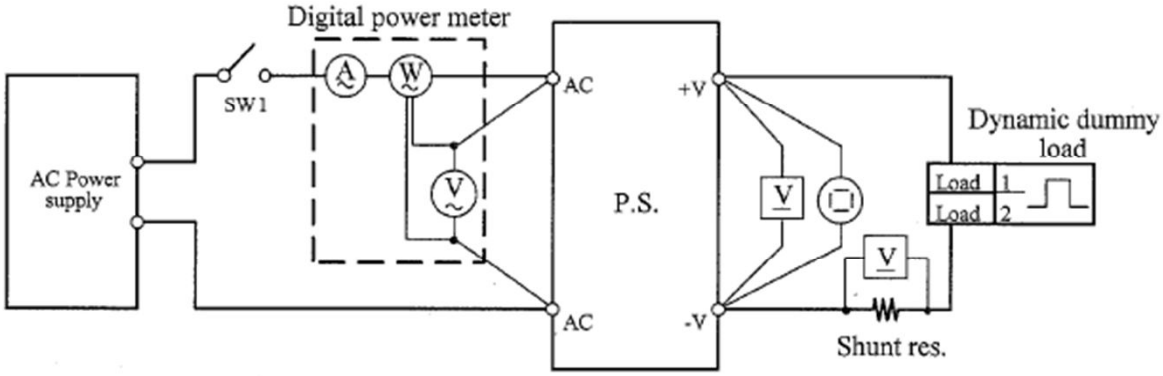
Circuit 1 used for determination

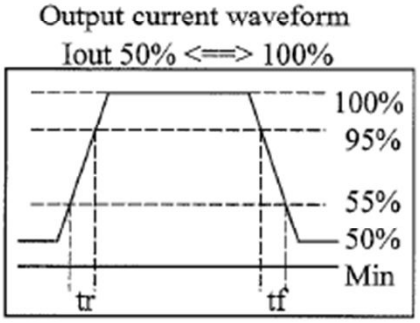
- Steady state data
- Over current protection (OCP)characteristics
- Over voltage protection (OVP)characteristics
- Output rise characteristics
- Output fall characteristics
- Hold up time characteristics



Circuit 2 used for determination

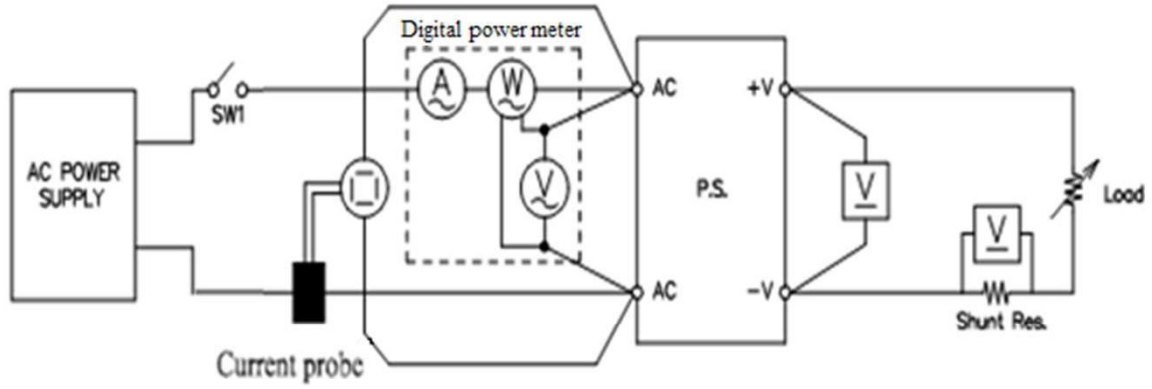
- Dynamic load response characteristics





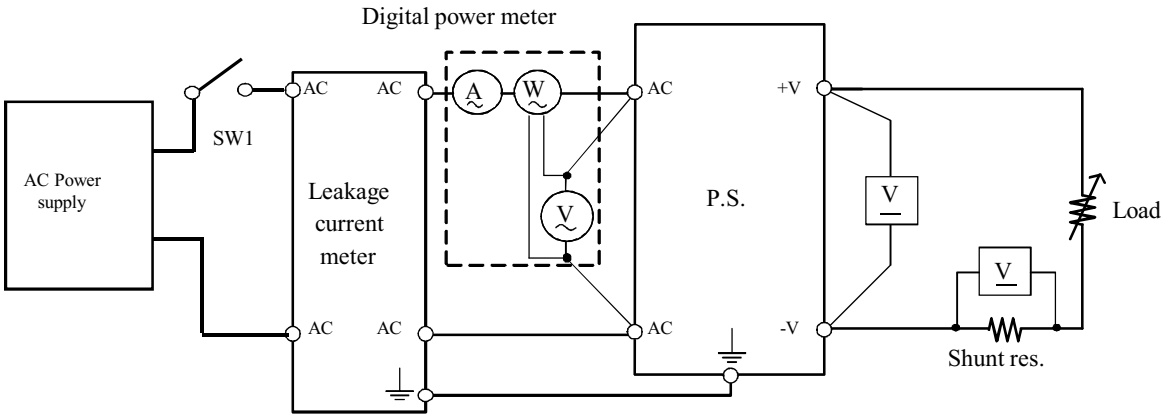
Circuit 3 used for determination

■ Inrush current waveform



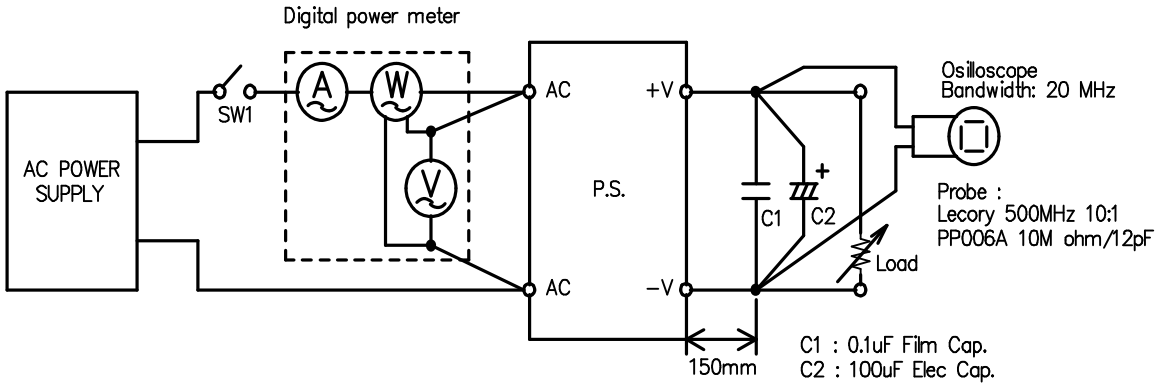
Circuit 4 used for determination

■ Leakage current characteristics



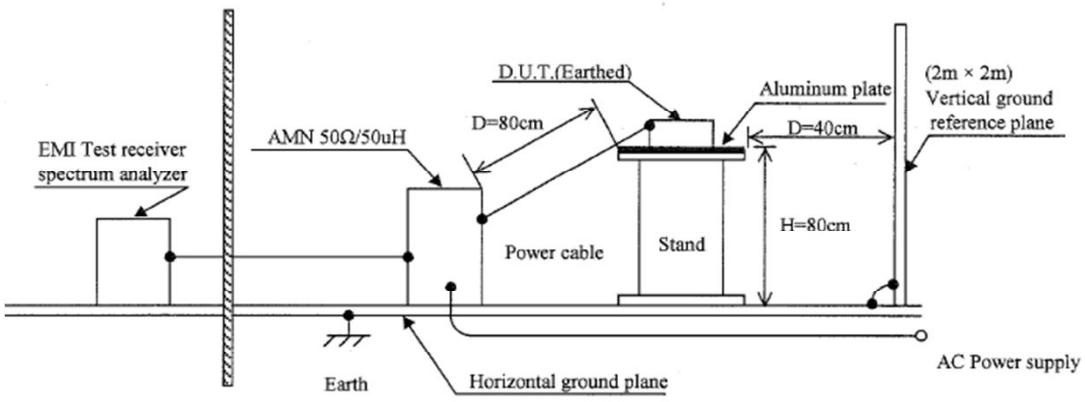
Circuit 5 use for determination

■ Output ripple and noise waveform

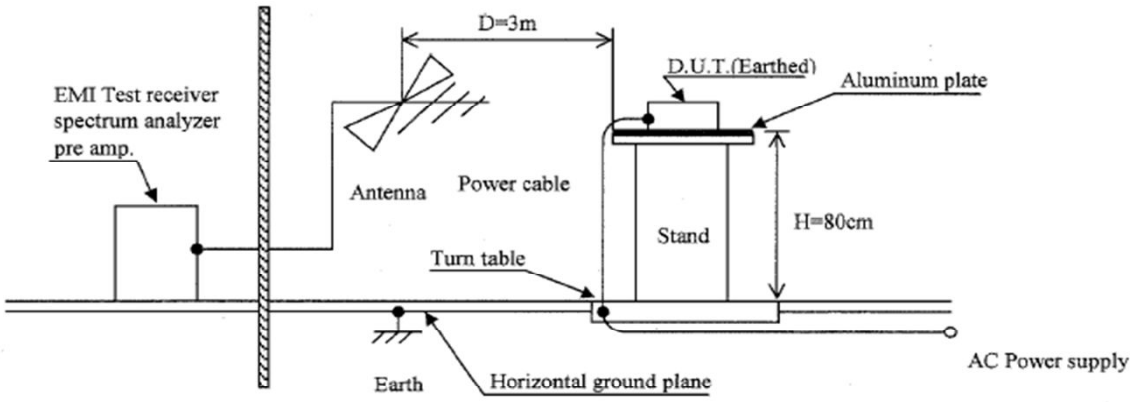


Configuration used for determination
Electromagnetic interference characteristics

(a) Conducted emission



(b)Radiated emission



1.2 List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	DIGITAL STORAGE OSCILLOSCOPE	LeCroy	LT354
2	DIGITAL MULTMETER	HP	3401A
3	DIGITAL POWER MULTMETER	YOKOGAWA ELECT	WT210
4	CURRENT PROBE	TEKTRONIX	TPC 312
5	CURRENT PROBE/AMP	TEKTRONIX	TPC A300
6	DYANMIC DUMMY LOAD	Chroma	63030
7	DUMMY LOAD	Chroma	63030
8	LEAKAGE CURRENT METER	EXTECH	7611
9	CONTROLLED TEMP.CHAMBER	KSON	THS-B4L
10	EMI TEST RECEIVER/SPECTRUM ANALYZER	R&S	ESCS 30
11	ANTENNA	Schaffer Chase	CBL6112B
12	HARMONIC/FLICKER ANALYZER	Schaffer	NSG 1007
13	COAXIAL CABLE	Huber+Suhner	RG 214
14	LISN	R&S	ENV4200
15	LISN	R&S	ENV216
16	PULSE LIMITER	R&S	ESH3-Z2
17	COAXIAL CABLE	Huber+Suhner	RG 400

2. Characteristics

2.1 Steady state data

(1) Regulation· line and load, Temperature drift/ Start up voltage and Drop out voltage

5V

1. Regulation· line and load

Condition Ta: 25℃

Iout\Vin	85VAC	115VAC	230VAC	265VAC	Line regulation	
0%	5.009 V	5.009 V	5.009 V	5.009 V	0.0mV	0.00%
50%	5.007 V	5.007 V	5.005 V	5.003 V	4.0mV	0.08%
100%	5.000 V	5.000 V	5.000 V	4.998 V	2.0mV	0.04%
Load	9.0mV	9.0mV	9.0mV	11.0mV		
regulation	0.18%	0.18%	0.18%	0.22%		

2.Temperature drift

Condition Vin:115VAC
Iout:100%

Ta	-10℃	+25℃	+50℃	Temperature stability	
Vout	5.005 V	5.000 V	5.003 V	5.0mV	0.10%

3.Start up voltage and Drop out voltage

Condition Vin:115VAC
Iout:100%

Start up voltage(Vin)	72.6VAC
Drop out voltage(Vin)	71.4VAC

12V

1. Regulation· line and load

Condition Ta: 25℃

Iout\Vin	85VAC	115VAC	230VAC	265VAC	Line regulation	
0%	12.023 V	12.023 V	12.023 V	12.023 V	0.0mV	0.00%
50%	12.021 V	12.017 V	12.014 V	12.012 V	9.0mV	0.08%
100%	12.020 V	12.019 V	12.013 V	12.008 V	12.0mV	0.10%
Load	3.0mV	6.0mV	10.0mV	15.0mV		
regulation	0.03%	0.05%	0.08%	0.13%		

2. Temperature drift

Condition Vin:115VAC
Iout:100%

Ta	-10℃	+25℃	+50℃	Temperature stability	
Vout	12.035 V	12.019 V	12.065 V	46.0mV	0.38%

3.Start up voltage and Drop out voltage

Condition Vin:115VAC
Iout:100%

Start up voltage(Vin)	64.4VAC
Drop out voltage(Vin)	62.8VAC

24V

1.Regulation· line and load

Condition Ta: 25℃

Iout\Vin	85VAC	115VAC	230VAC	265VAC	Line regulation	
0%	24.013 V	24.011 V	24.022 V	24.020 V	11.0mV	0.05%
50%	24.015 V	24.012 V	24.023 V	24.017 V	11.0mV	0.05%
100%	24.014 V	24.018 V	24.025 V	24.019 V	11.0mV	0.05%
Load	2.0mV	7.0mV	3.0mV	3.0mV		
regulation	0.01%	0.03%	0.01%	0.01%		

2. Temperature drift

Condition Vin:115VAC
Iout:100%

Ta	-10℃	+25℃	+50℃	Temperature stability	
Vout	24.028 V	24.018 V	24.100 V	82.0mV	0.34%

3.Start up voltage and Drop out voltage

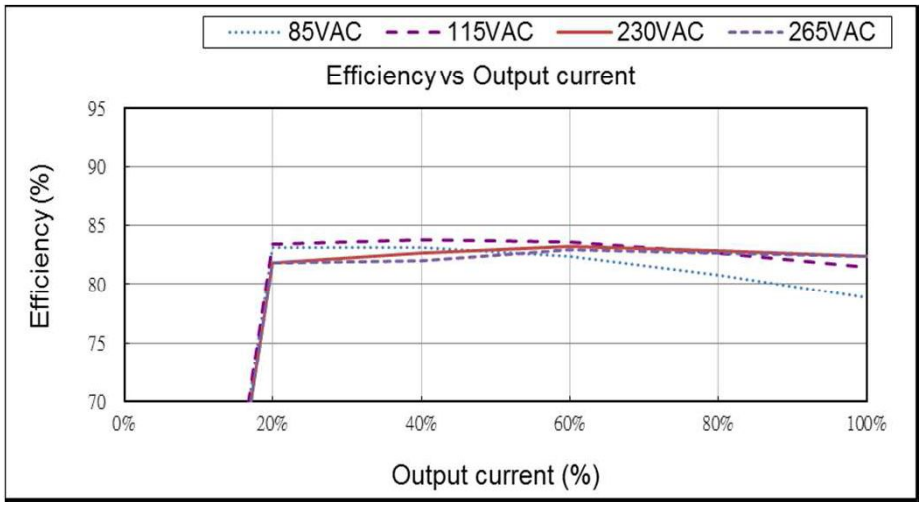
Condition Vin:115VAC
Iout:100%

Start up voltage(Vin)	69.1VAC
Drop out voltage(Vin)	67.4VAC

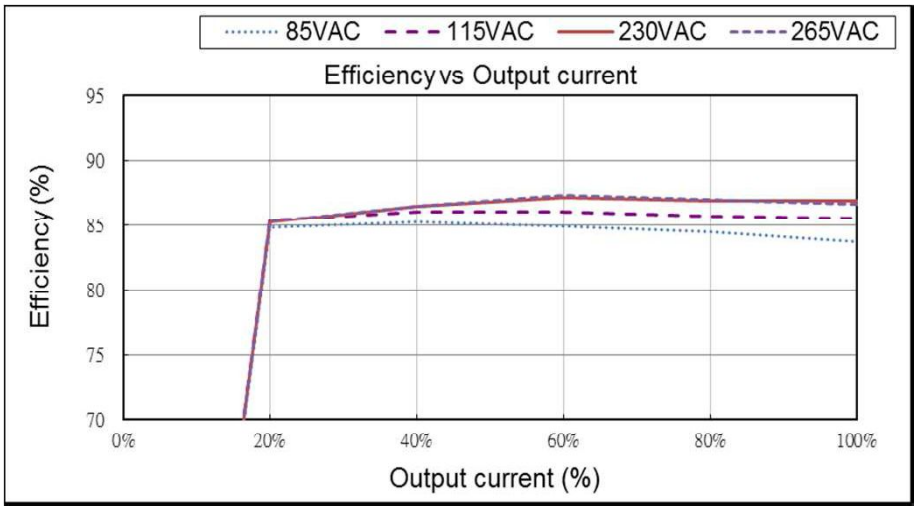
(2) Efficiency v.s Output current

Conditions: Vin：85 VAC
：115 VAC
：230 VAC
：265 VAC
Ta:25℃

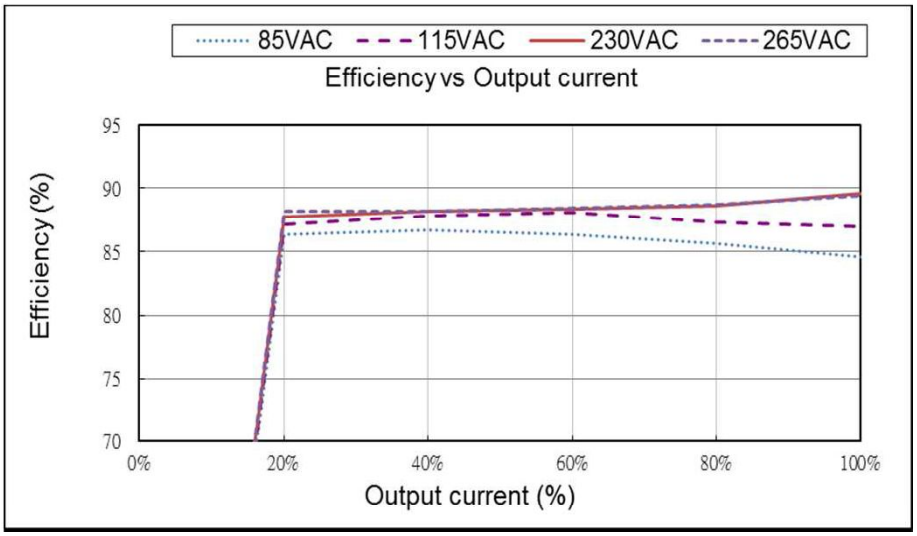
5V



12V



24V

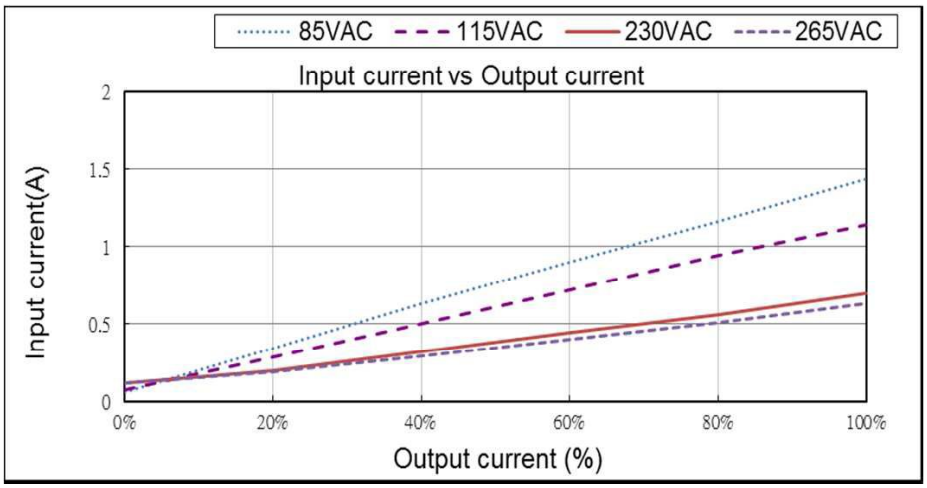


(3) Input current v.s Output current

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃

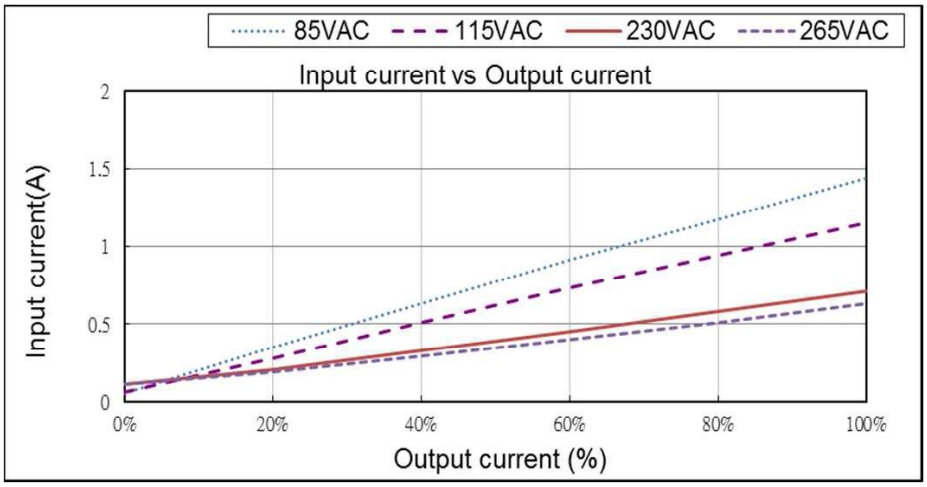
5V

Vin	Input Current Io=0%
85VAC	**0.06A**
115VAC	**0.07A**
230VAC	**0.12A**
265VAC	**0.12A**



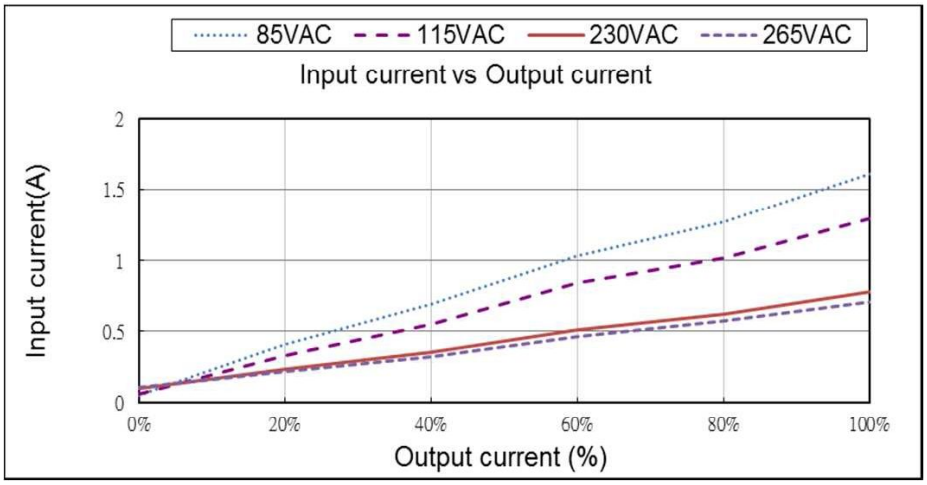
12V

Vin	Input Current Io=0%
85VAC	0.05A
115VAC	0.06A
230VAC	0.10A
265VAC	0.11A



24V

Vin	Input Current Io=0%
85VAC	0.05A
115VAC	0.06A
230VAC	0.10A
265VAC	0.11A

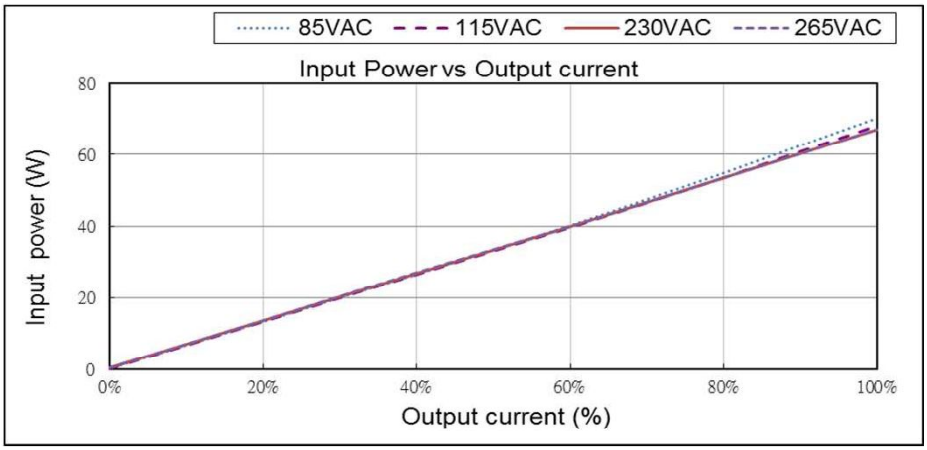


(4) Input power v.s Output current

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃

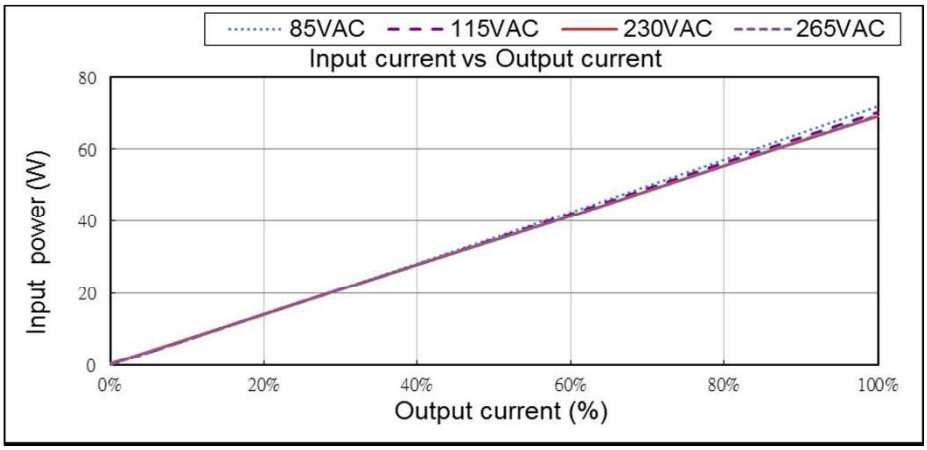
5V

Vin	Input power Io=0%
85VAC	0.16W
115VAC	0.17W
230VAC	0.26W
265VAC	0.28W



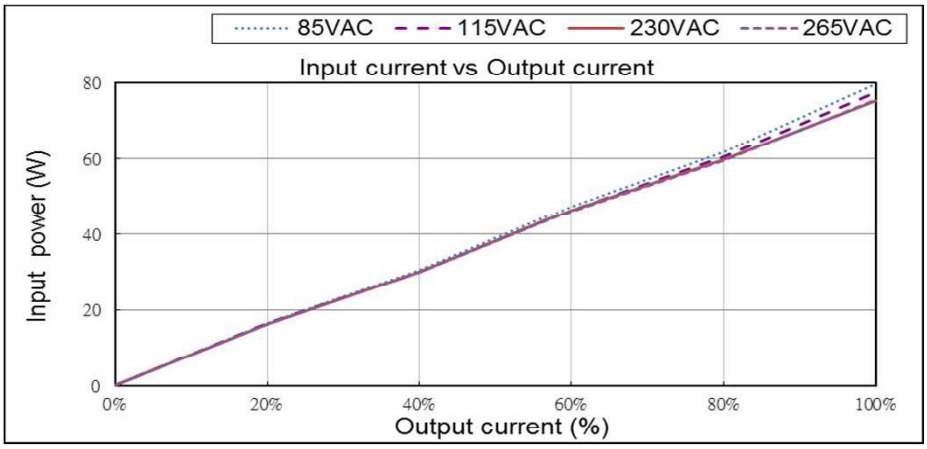
12V

Vin	Input power Io=0%
85VAC	0.11W
115VAC	0.12W
230VAC	0.19W
265VAC	0.21W



24V

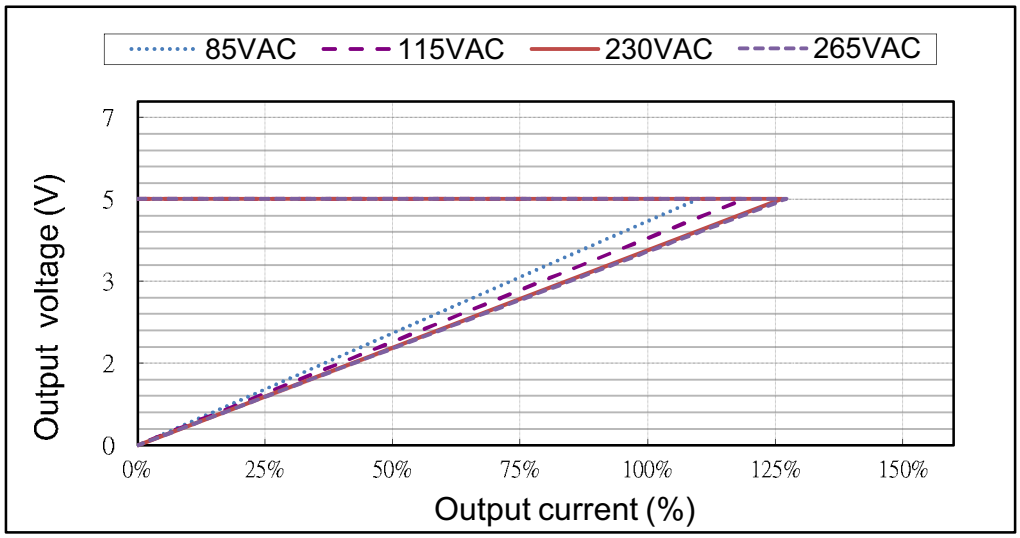
Vin	Input power Io=0%
85VAC	0.21W
115VAC	0.21W
230VAC	0.28W
265VAC	0.32W



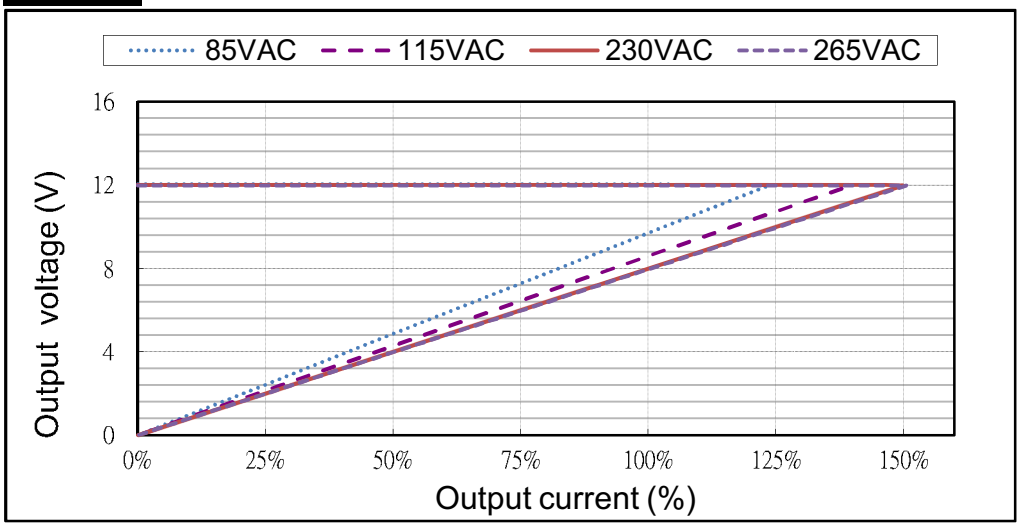
2.2 Over current protection (OCP)characteristics

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃

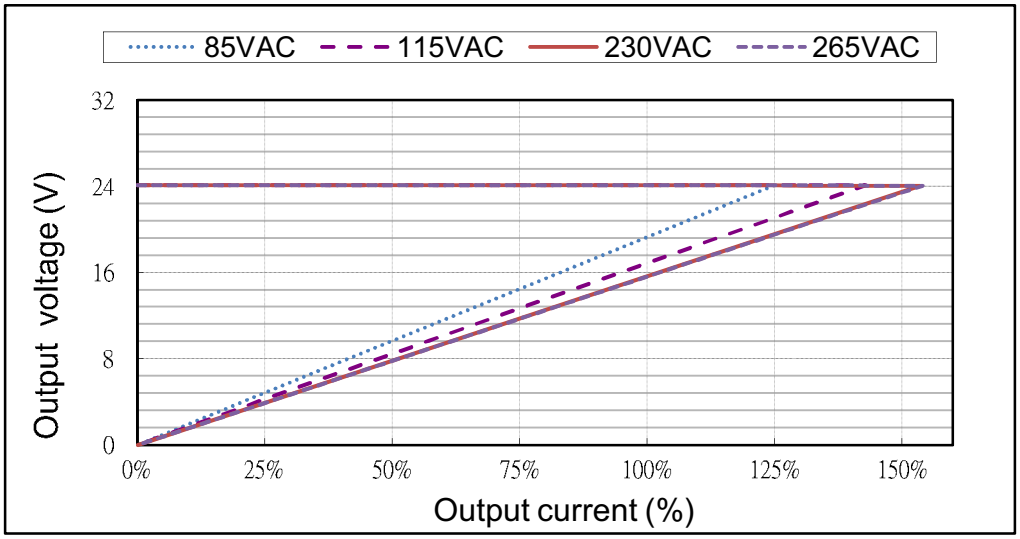
5V



12V



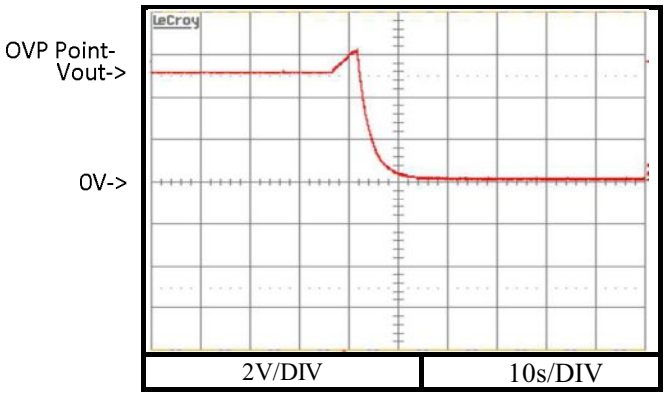
24V



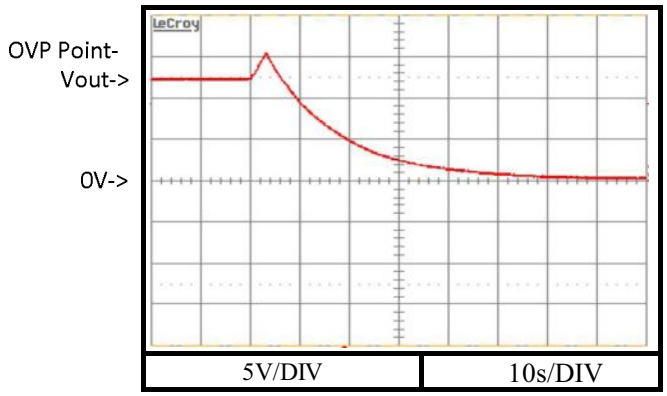
2.3 Over Voltage protection (OVP)characteristics

Condition Vin : 115 VAC
: Io=0%
Ta:25℃

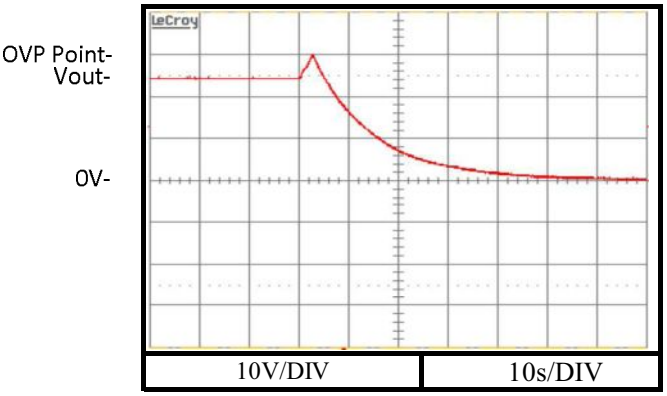
5V



12V



24V



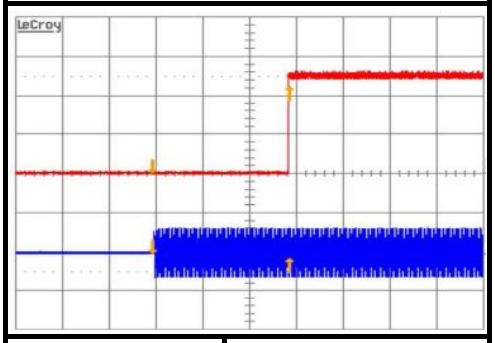
2.4 Output rise characteristics

Conditions: Vin：85 VAC
：115 VAC
：230 VAC
：265 VAC
Ta:25℃

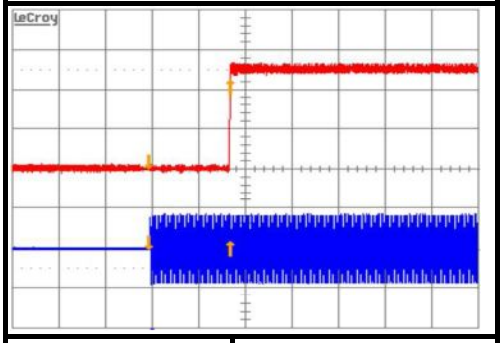
5V

Load=100%

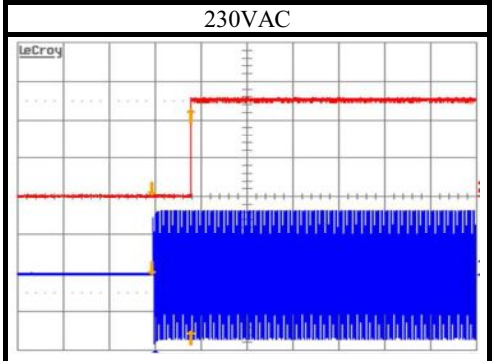
85VAC



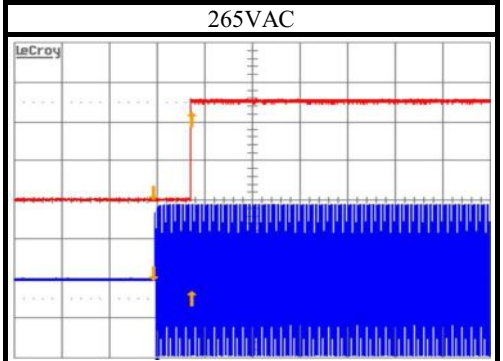
115VAC



230VAC

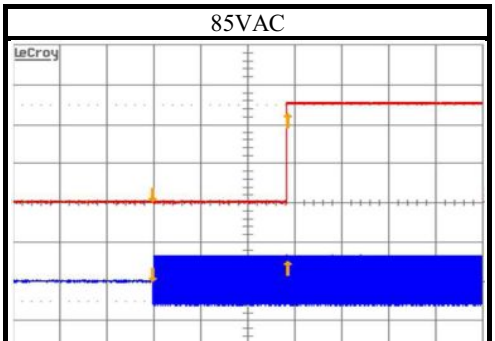


265VAC

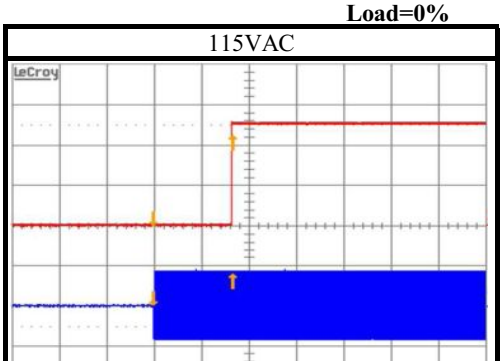


Load=0%

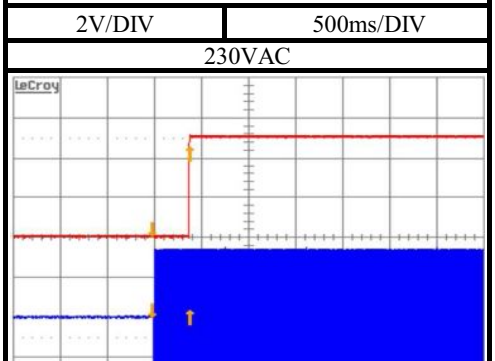
85VAC



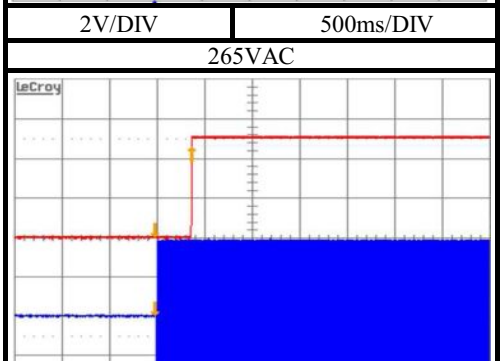
115VAC



230VAC



265VAC

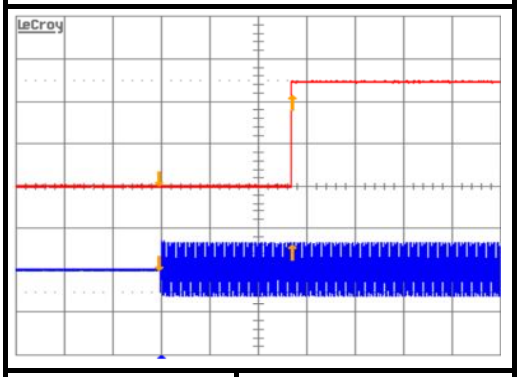


2.4 Output rise characteristics

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃
Load=100%

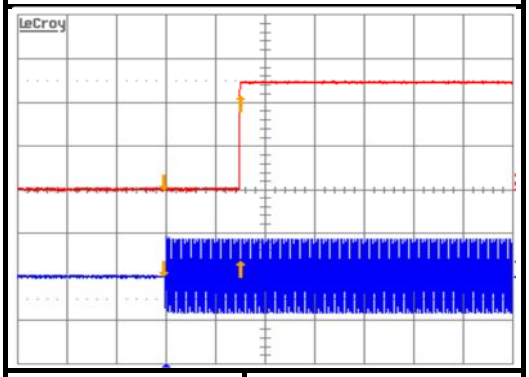
12V

85VAC



5V/DIV | 500ms/DIV

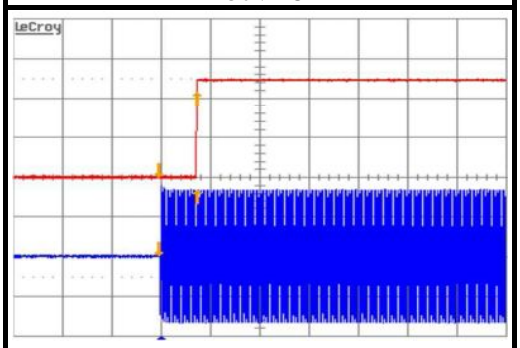
115VAC



5V/DIV | 500ms/DIV

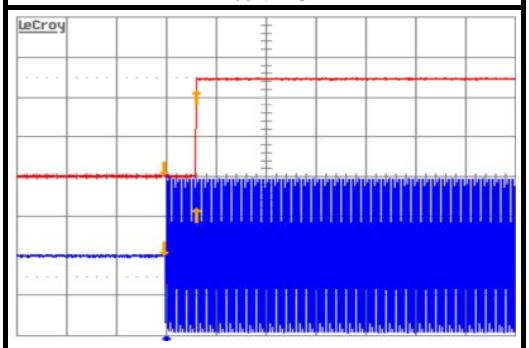
<-Vout->
<-0V->
<-Vin->

230VAC



5V/DIV | 500ms/DIV

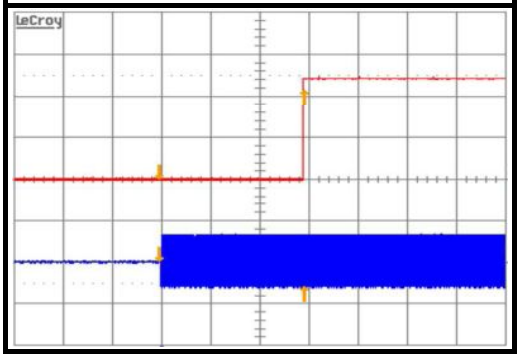
265VAC



5V/DIV | 500ms/DIV

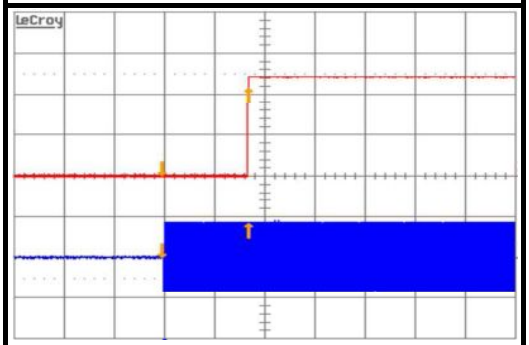
Load=0%

85VAC



5V/DIV | 500ms/DIV

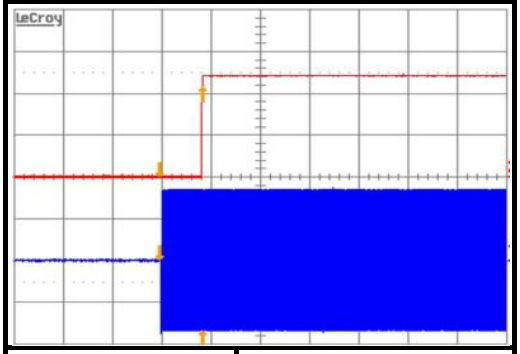
115VAC



5V/DIV | 500ms/DIV

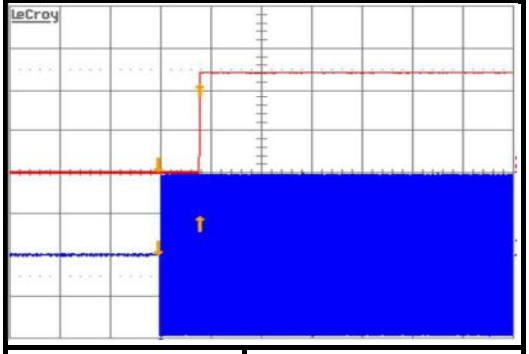
<-Vout->
<-0V->
<-Vin->

230VAC



5V/DIV | 500ms/DIV

265VAC

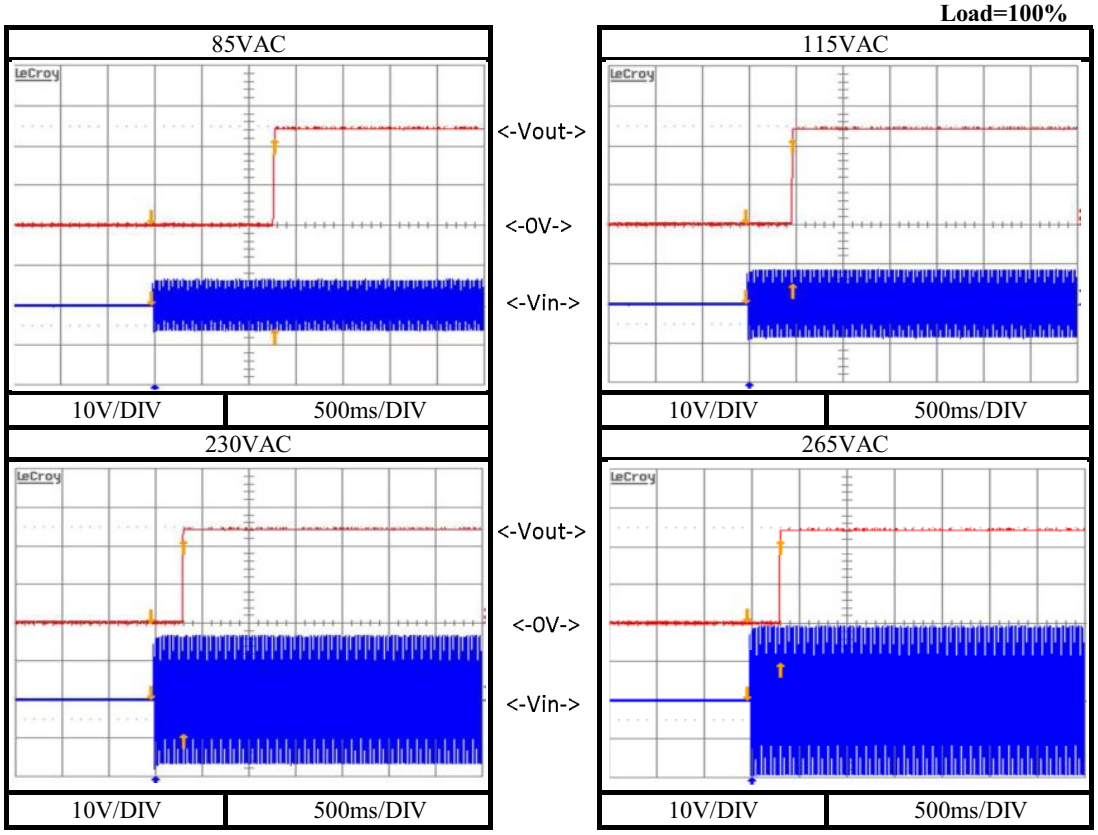


5V/DIV | 500ms/DIV

2.4 Output rise characteristics

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃
Load=100%

24V



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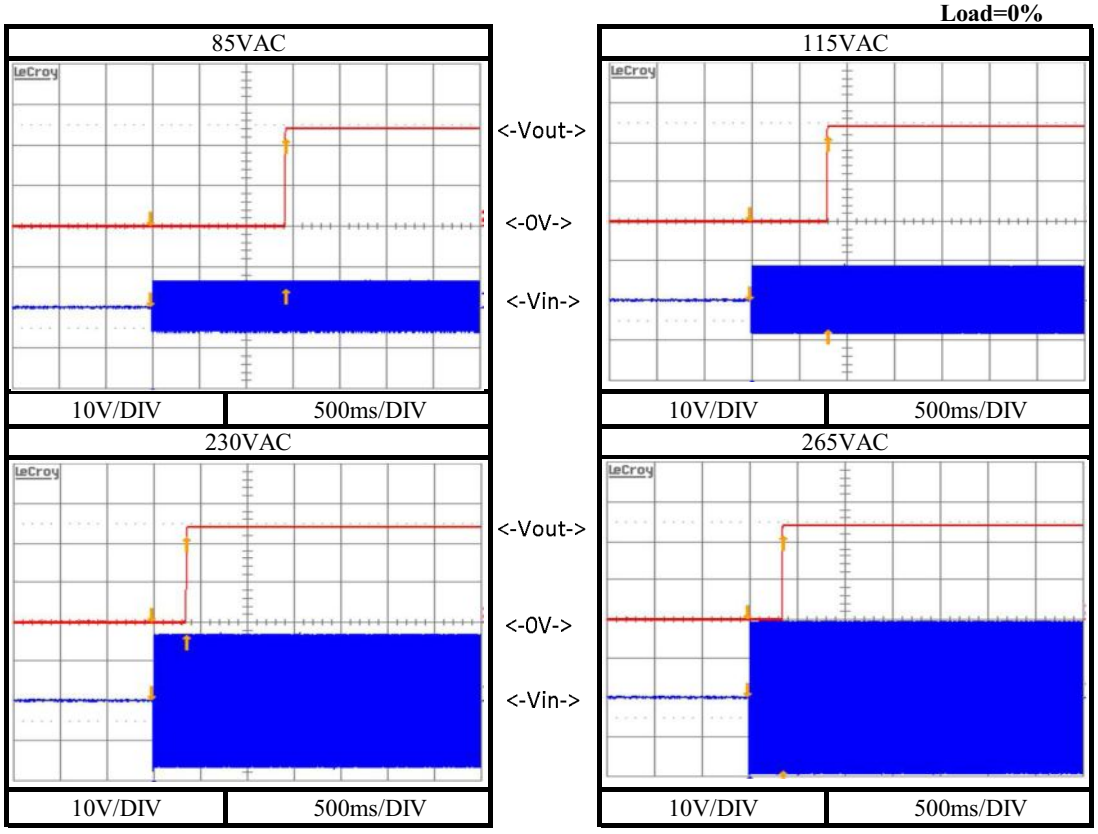
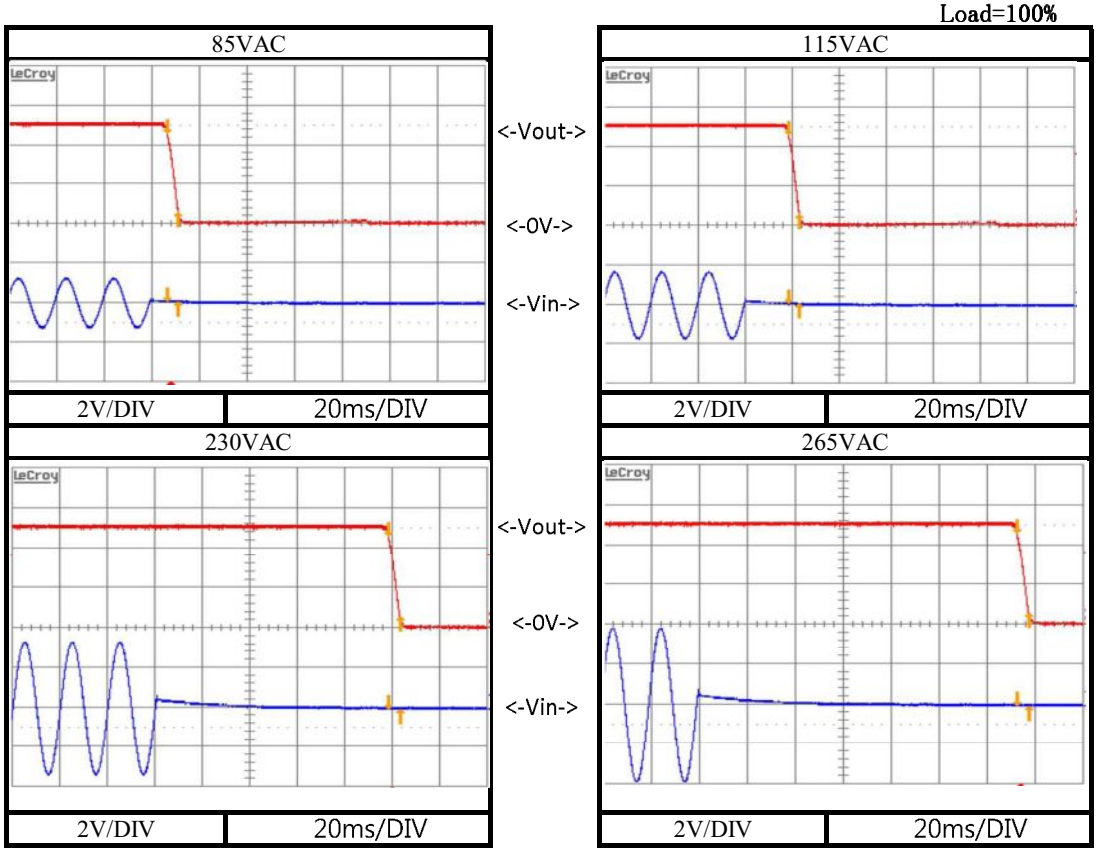


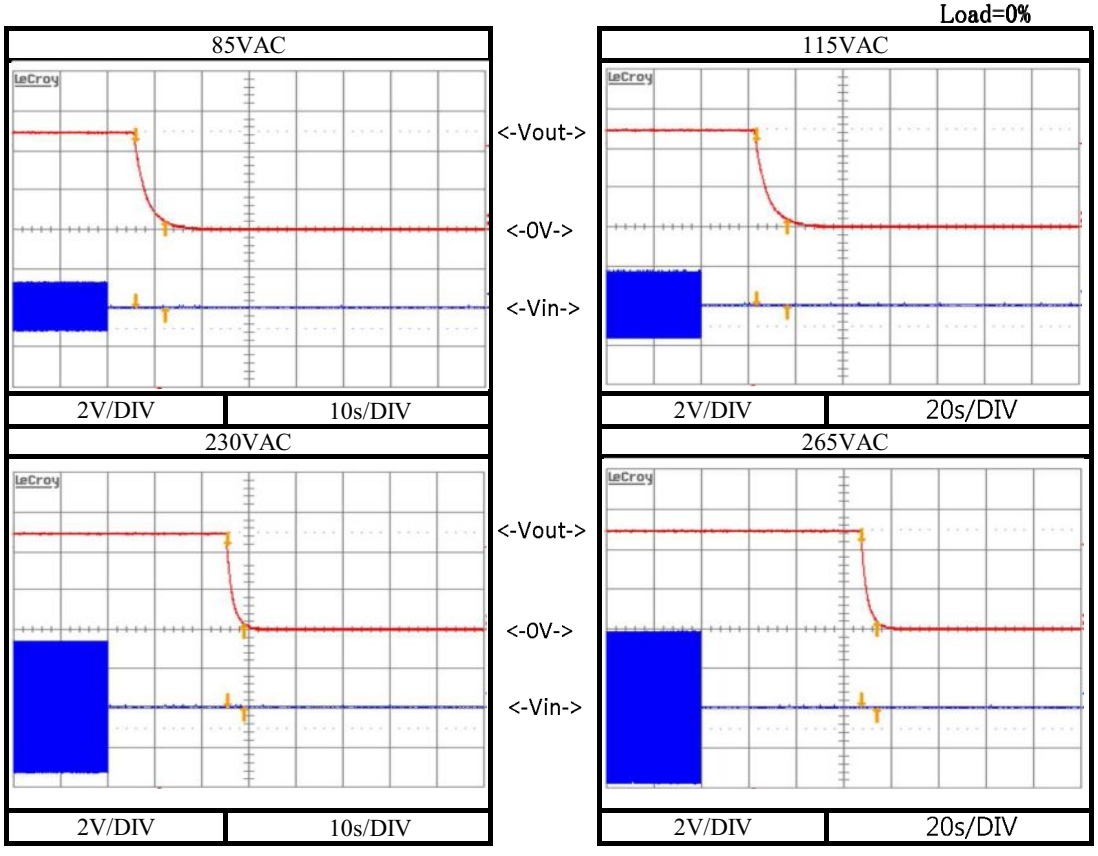
2.5 Output fall characteristics

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃
Load=100%

5V



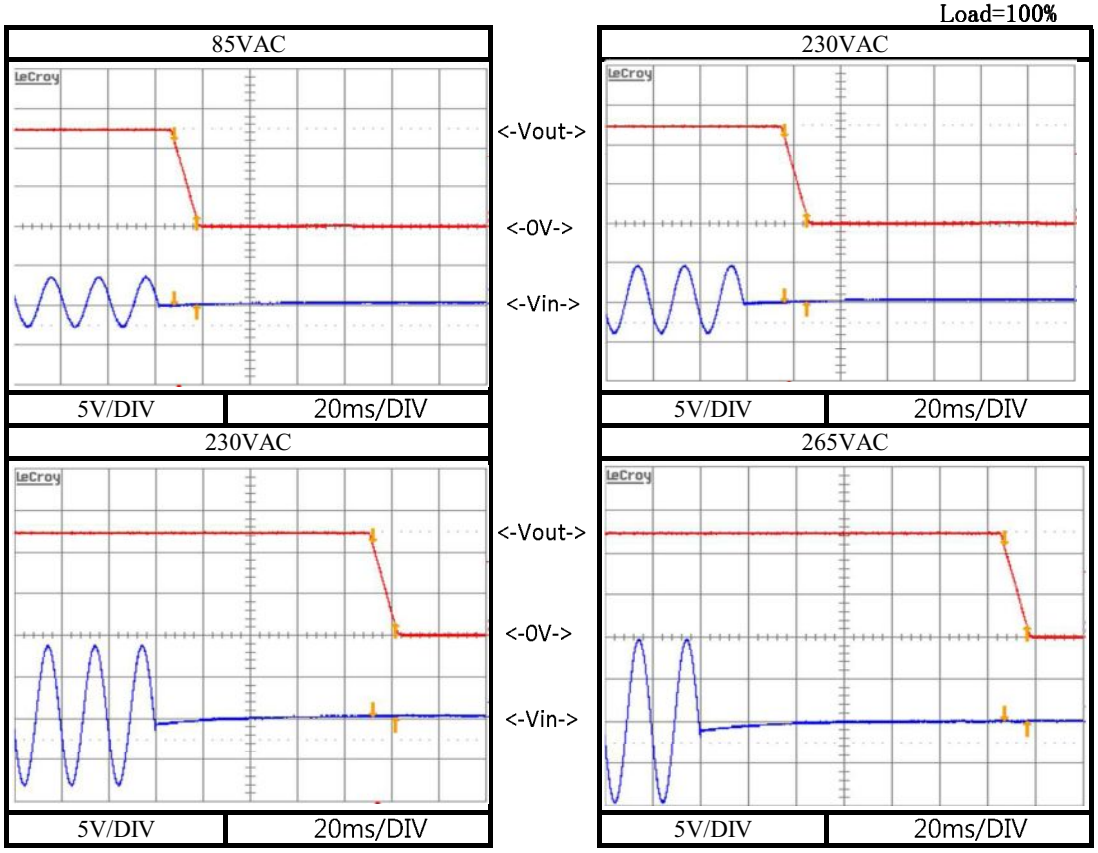
Load=0%



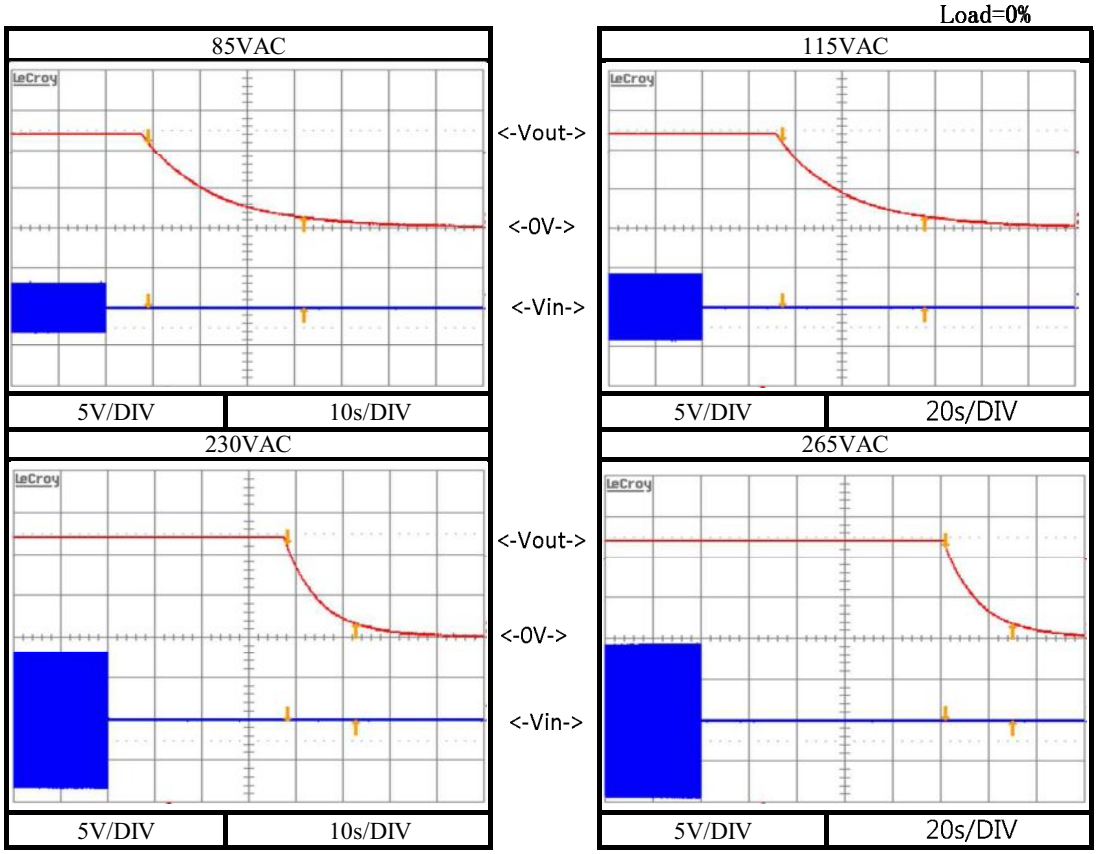
2.5 Output fall characteristics

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃
Load=100%

12V



Load=0%

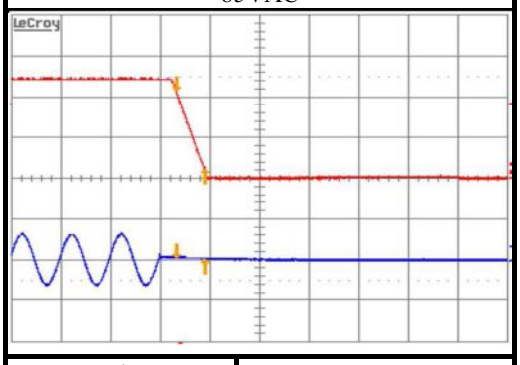


2.5 Output fall characteristics

Conditions: Vin : 85 VAC
: 115 VAC
: 230 VAC
: 265 VAC
Ta:25℃
Load=100%

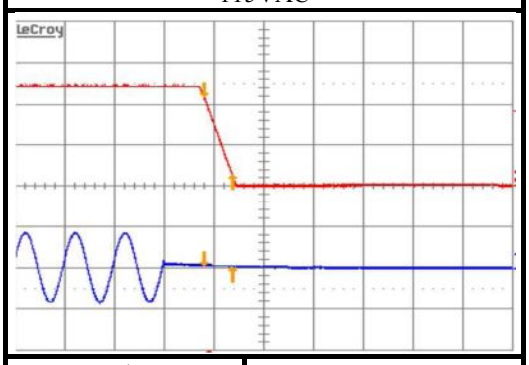
24V

85VAC



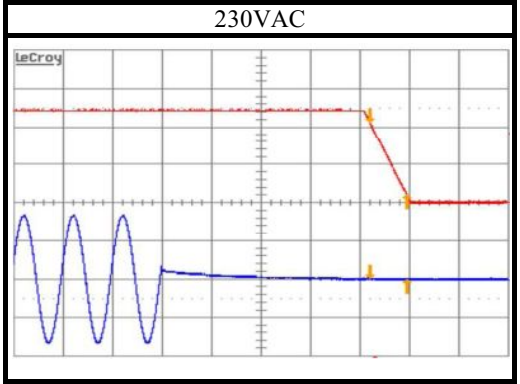
10V/DIV | 20ms/DIV

115VAC



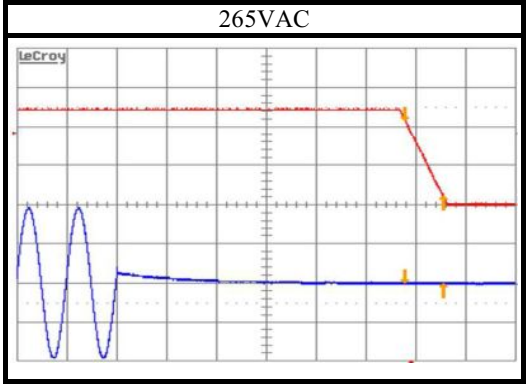
10V/DIV | 20ms/DIV

230VAC



10V/DIV | 20ms/DIV

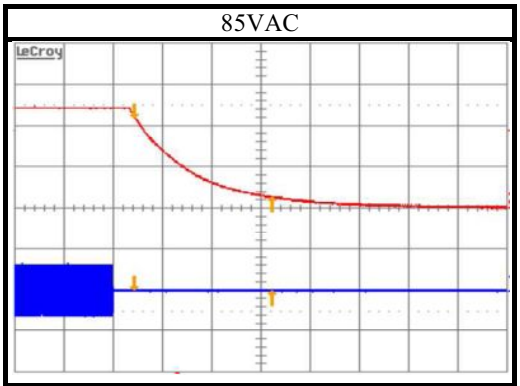
265VAC



10V/DIV | 20ms/DIV

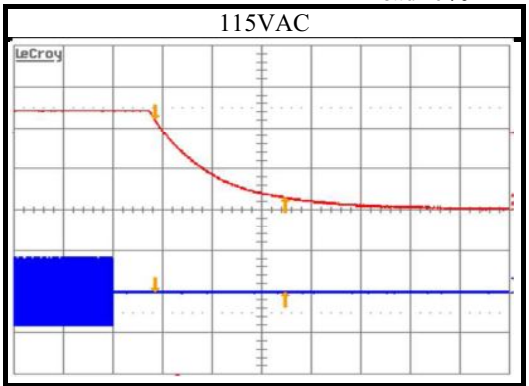
Load=0%

85VAC



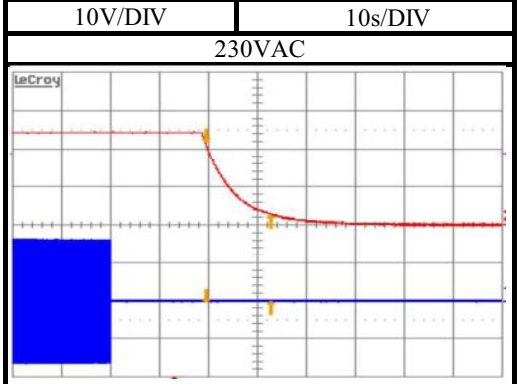
10V/DIV | 10s/DIV

115VAC



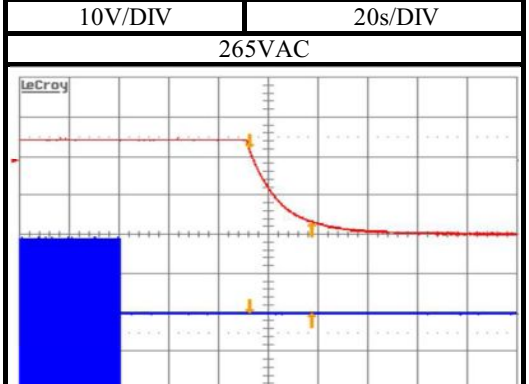
10V/DIV | 20s/DIV

230VAC



10V/DIV | 10s/DIV

265VAC

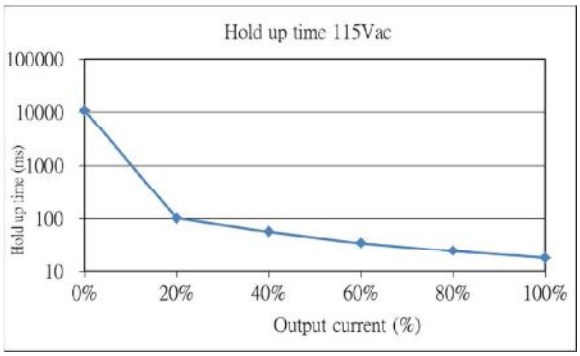


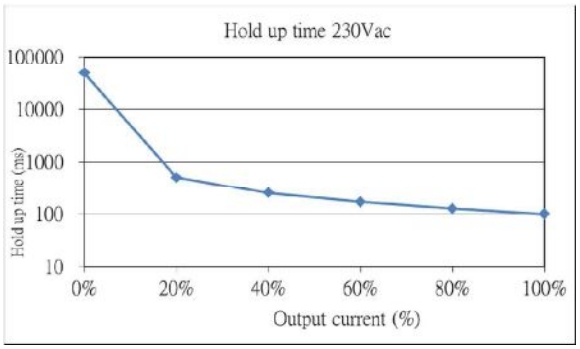
10V/DIV | 20s/DIV

2.6 Hold up time characteristics

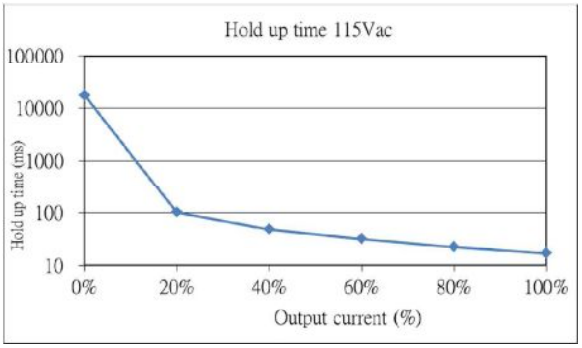
Conditions: Vin：115VAC
：230VAC
Ta:25℃

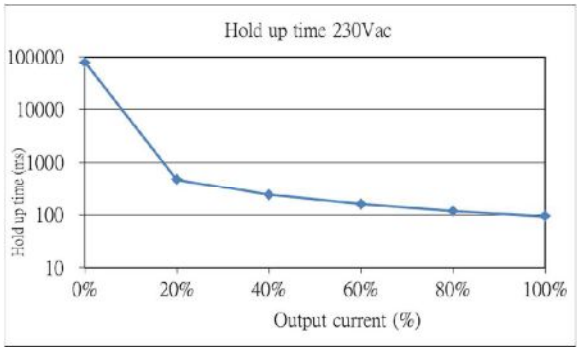
5V



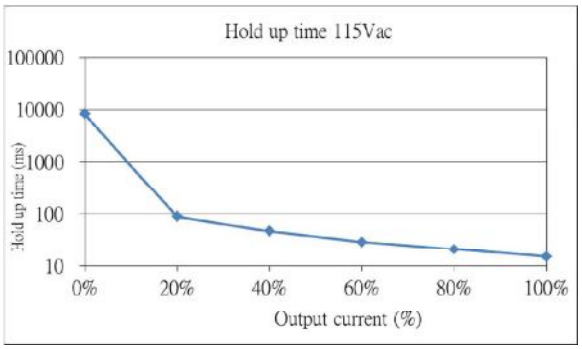


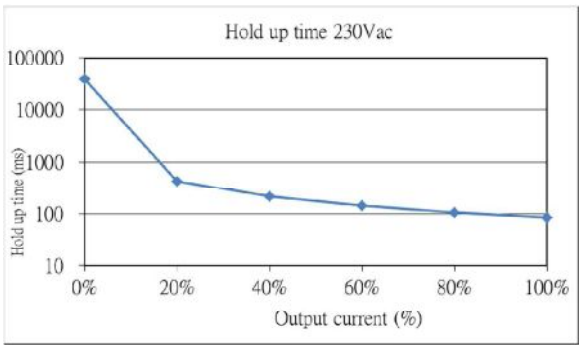
12V





24V

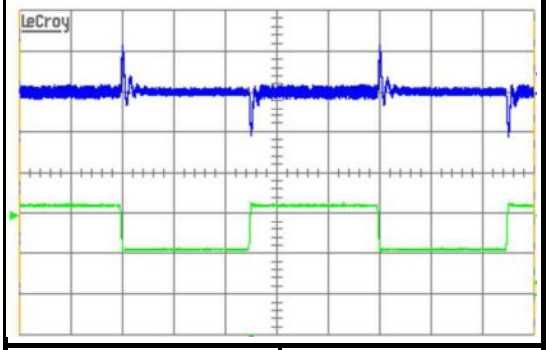
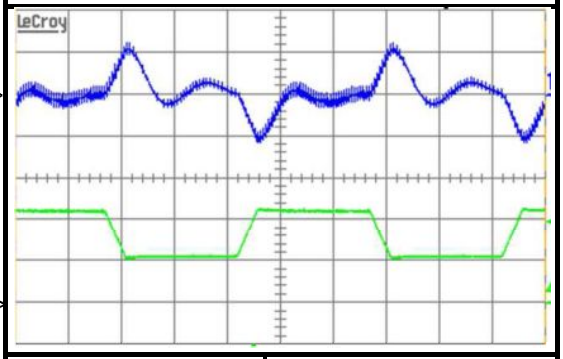




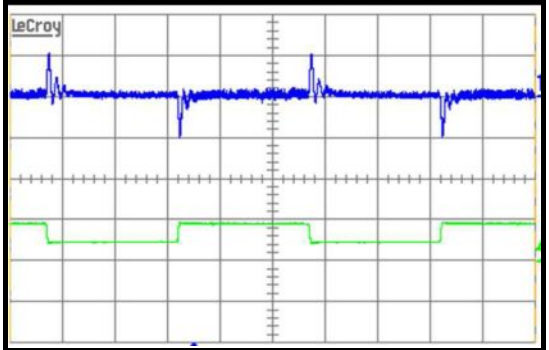
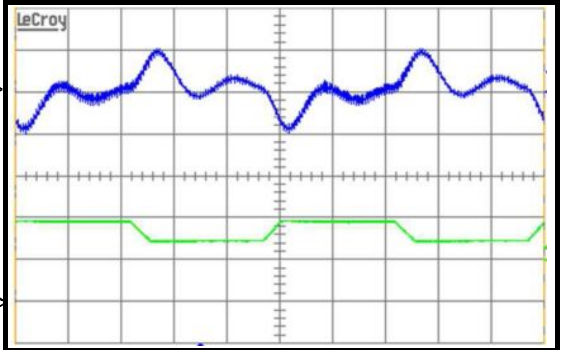
2.7 Dynamic load response characteristics

Conditions: Vin：115VAC
Iout：50%~100%
Tr=Tf=75us
Ta:25℃

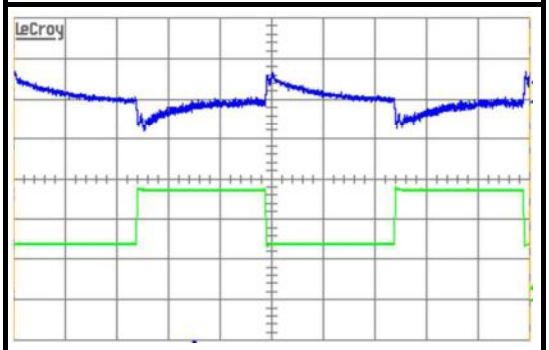
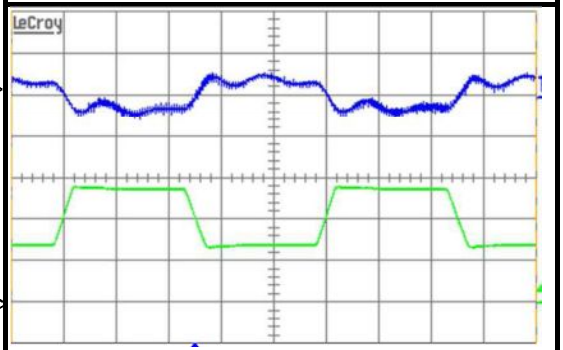
5V

100Hz			1kHz	
				
200mV/DIV	2ms/DIV	<-Vout-> <-Iout-> <-Io 0A->	200mV/DIV	200us/DIV
4.72%	-4.52%		4.98%	-4.66%

12V

100Hz			1kHz	
				
200mV/DIV	2ms/DIV	<-Vout-> <-Iout- <-Io 0A->	200mV/DIV	200us/DIV
1.73%	-1.76%		1.68%	-1.76%

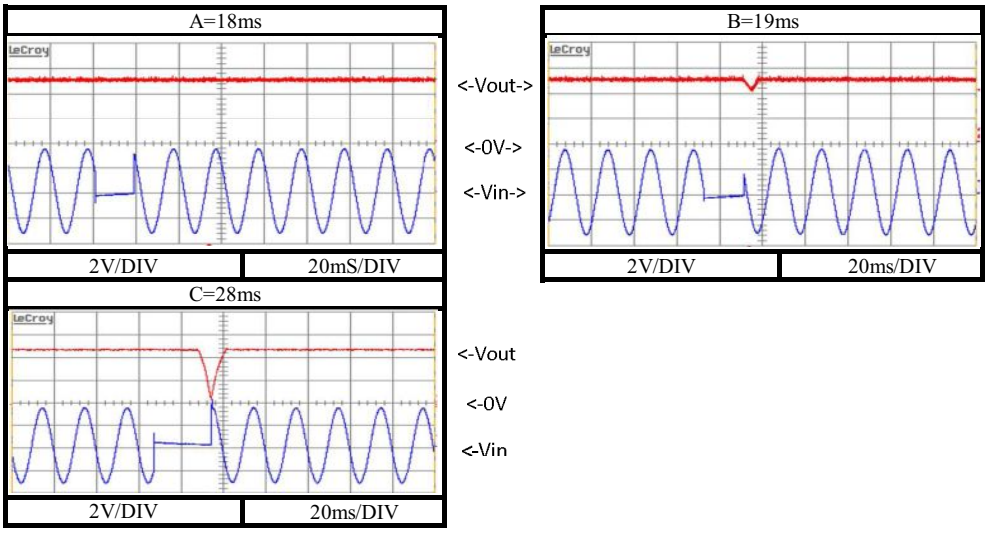
24V

100Hz			1kHz	
				
200mV/DIV	2ms/DIV	<-Vout-> <-Iout- <-Io 0A->	200mV/DIV	200us/DIV
0.61%	-0.66%		0.48%	-0.48%

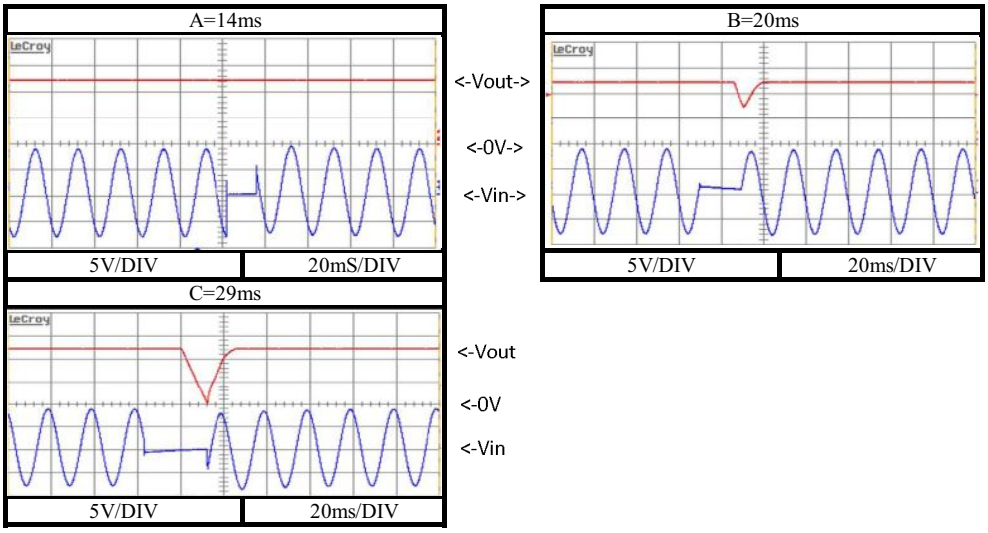
2.8 Response to brown out characteristics

Conditions: Vin：115 VAC
Io：100%
Ta:25℃

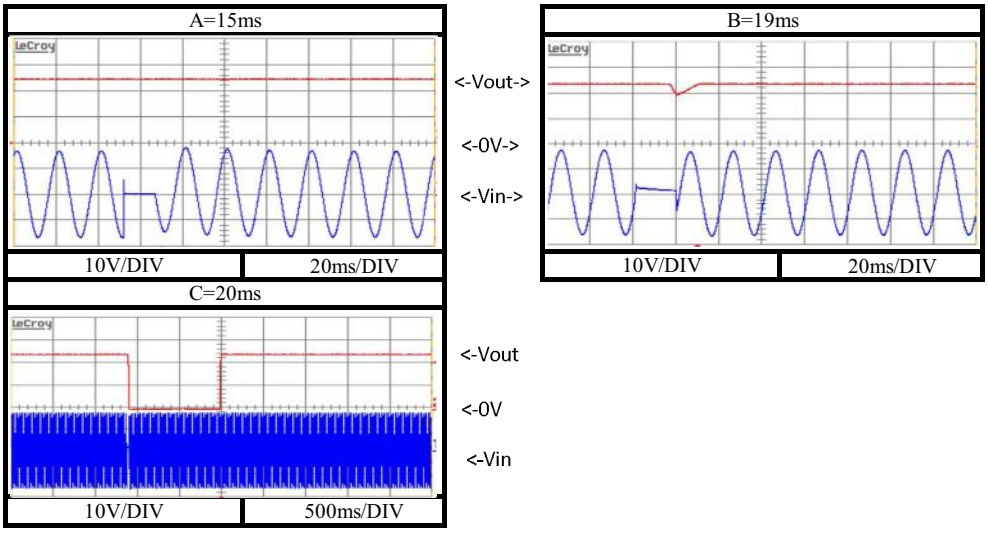
5V



12V



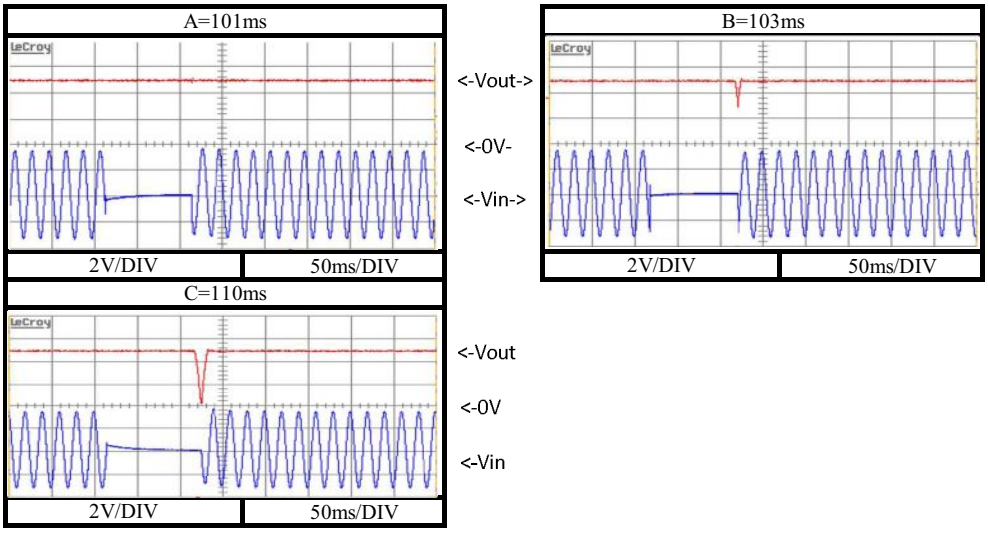
24V



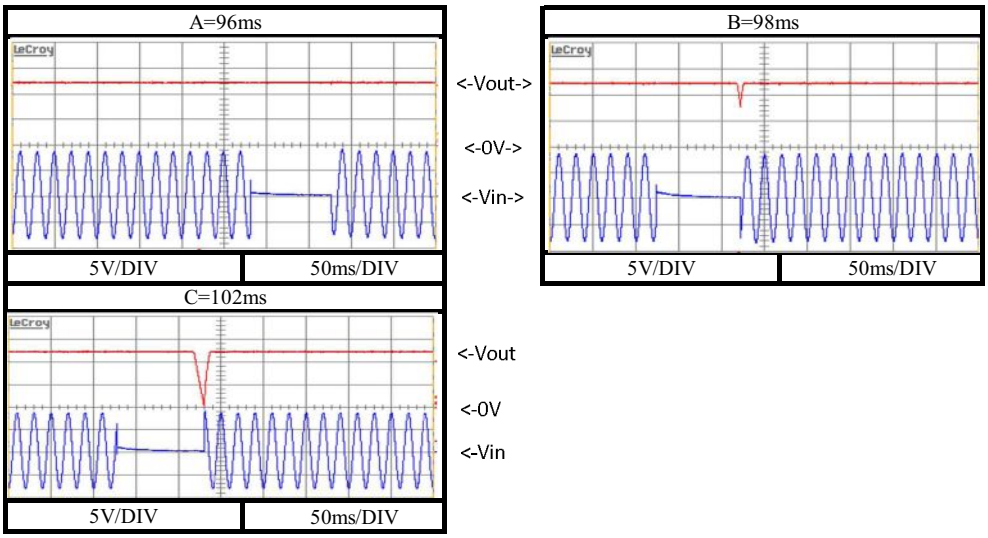
2.8 Response to brown out characteristics

5V

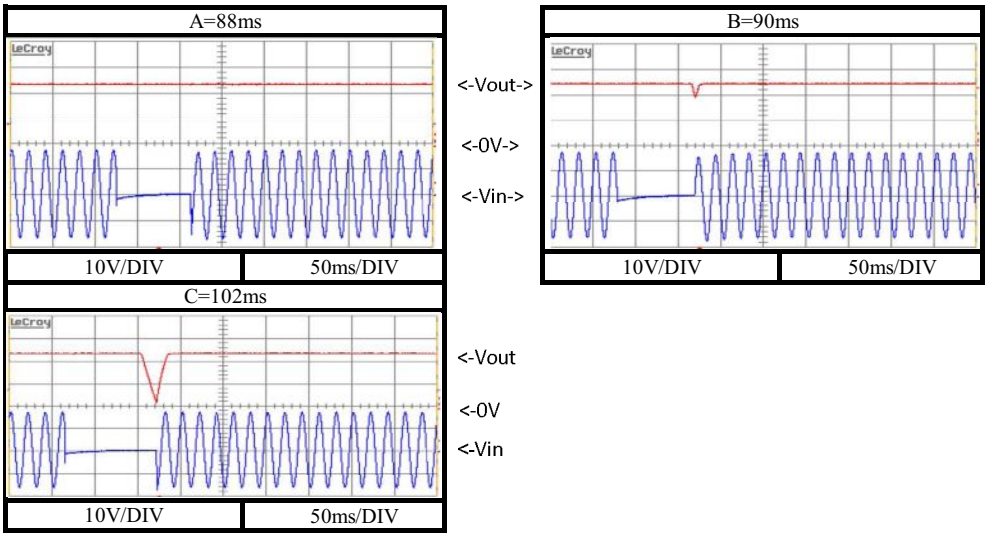
Conditions: Vin：230 VAC
Io：100%
Ta:25℃



12V



24V

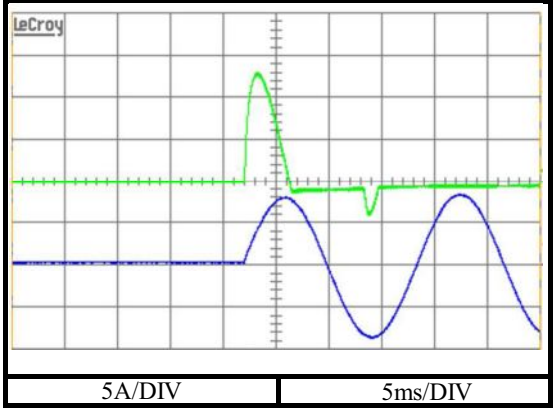


2.9 Inrush current waveform

Conditions: Vin：230 VAC
Io：100%
Ta:25℃

5V

Switch on phase angle of input AC voltage ψ=0

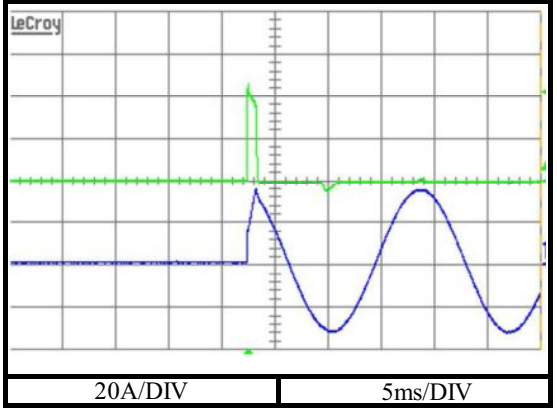


5A/DIV | 5ms/DIV

<-Iin->

<-Vin->

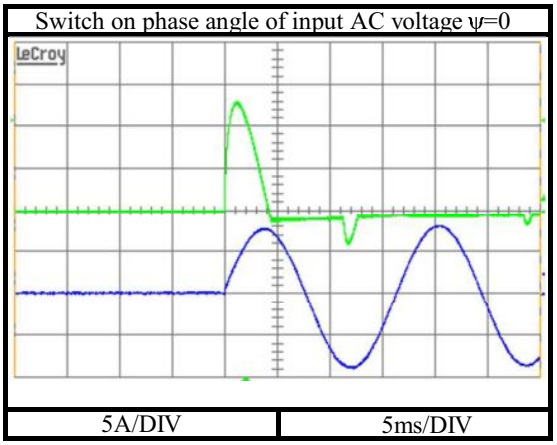
Switch on phase angle of input AC voltage ψ=90



20A/DIV | 5ms/DIV

12V

Switch on phase angle of input AC voltage ψ=0

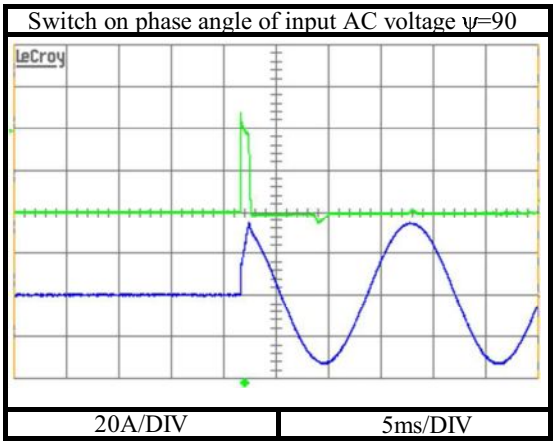


5A/DIV | 5ms/DIV

<-Iin->

<-Vin->

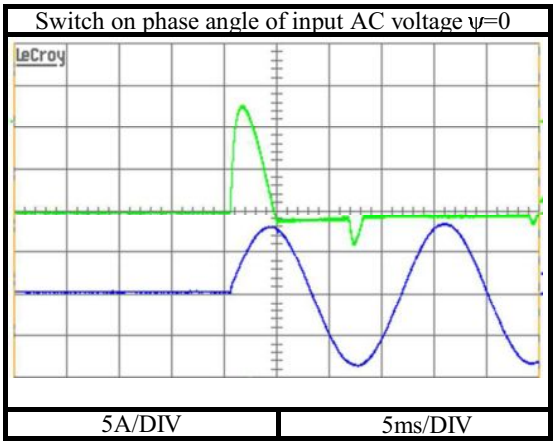
Switch on phase angle of input AC voltage ψ=90



20A/DIV | 5ms/DIV

24V

Switch on phase angle of input AC voltage ψ=0

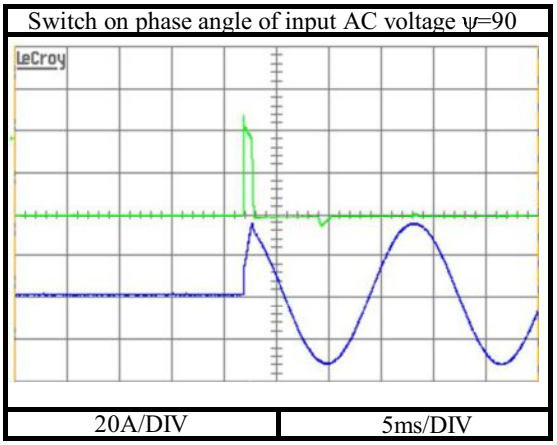


5A/DIV | 5ms/DIV

<-Iin-

<-Vin->

Switch on phase angle of input AC voltage ψ=90



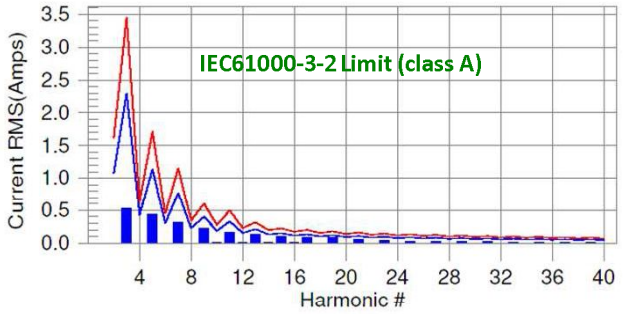
20A/DIV | 5ms/DIV

2.10 Current harmonics

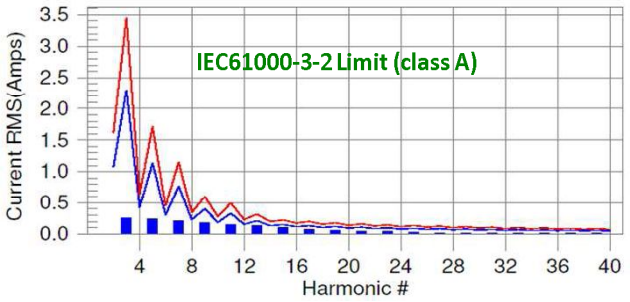
Conditions: Io：100%
Ta:25℃
Red=150% Limit
Blue=100%Limit
Bar chart= Actual

5V

Vin：115VAC

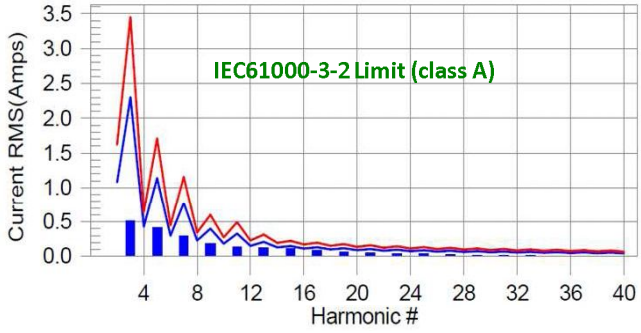


Vin：230VAC

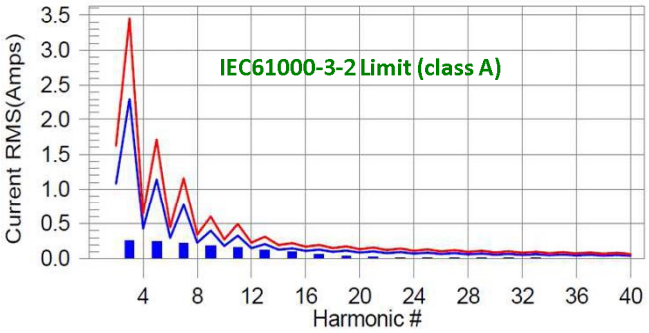


12V

Vin：115VAC

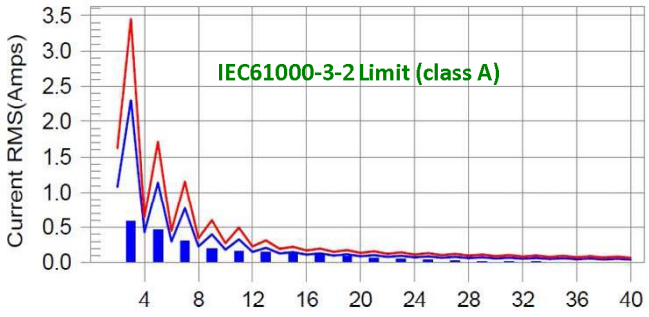


Vin：230VAC

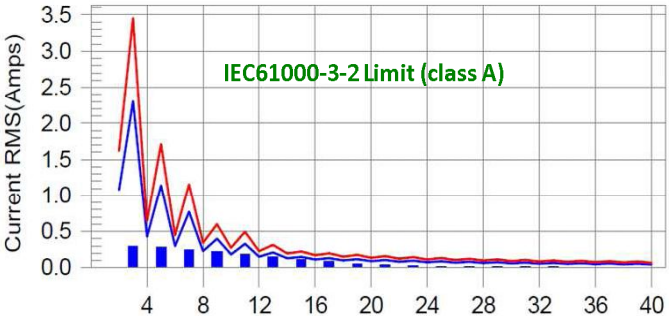


24V

Vin：115VAC



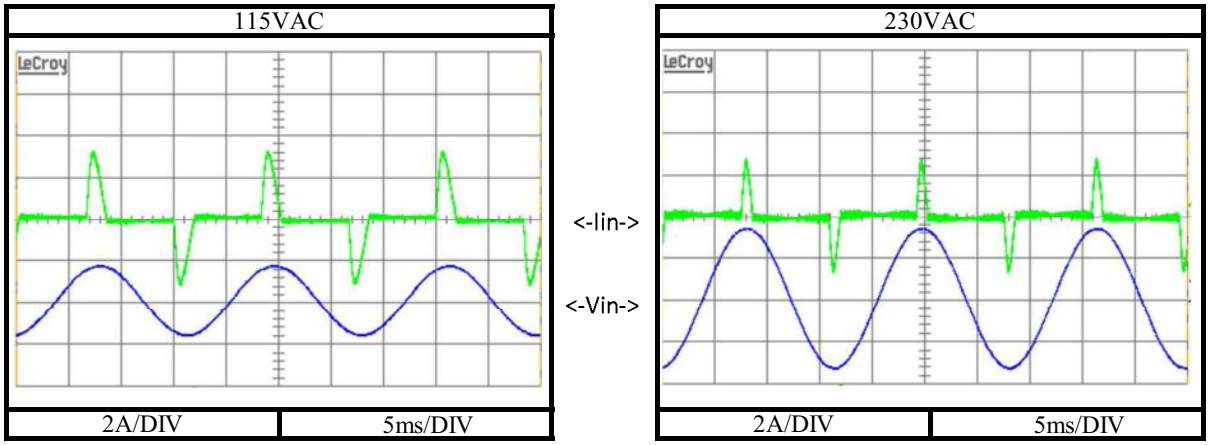
Vin：230VAC



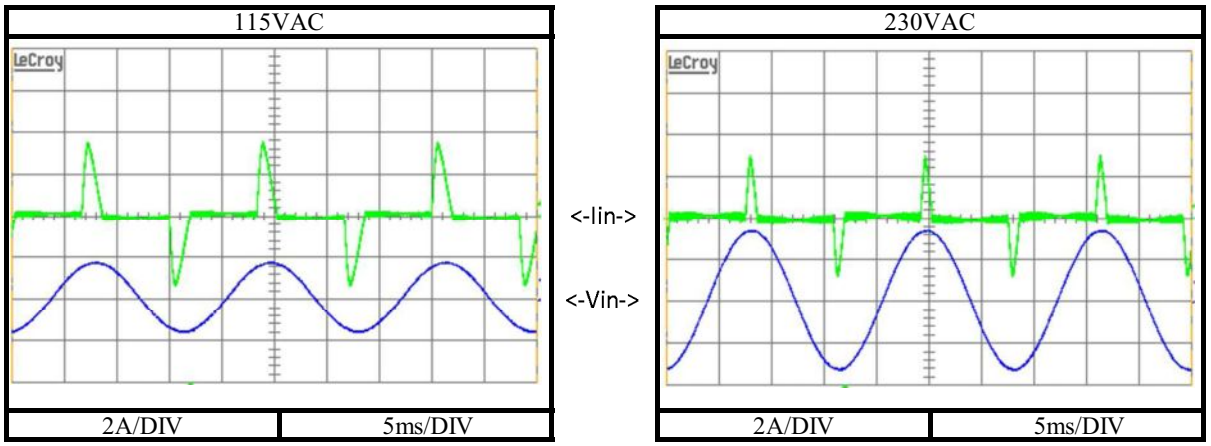
2.11 Input current waveform

Conditions: Vin：115 VAC
: 230 VAC
Io：100%
Ta:25℃

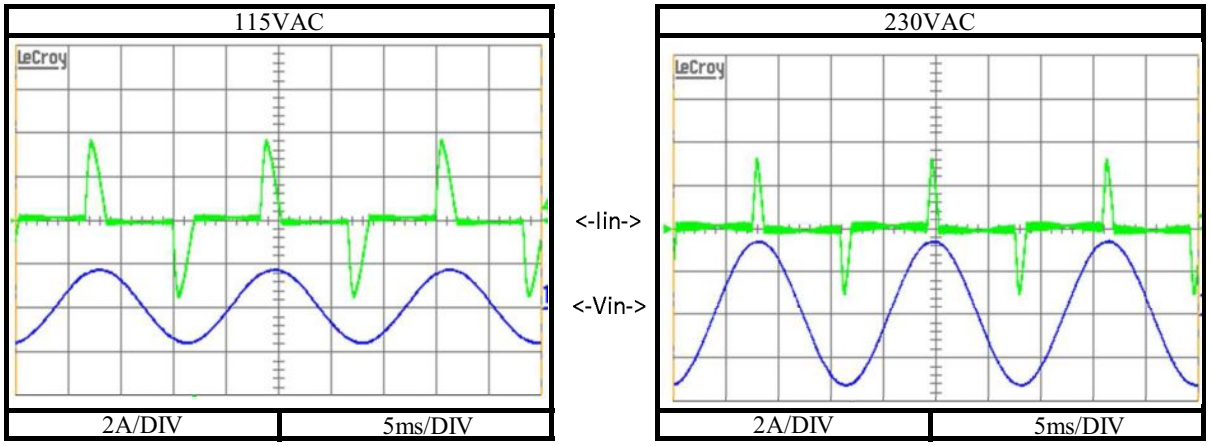
5V



12V



24V

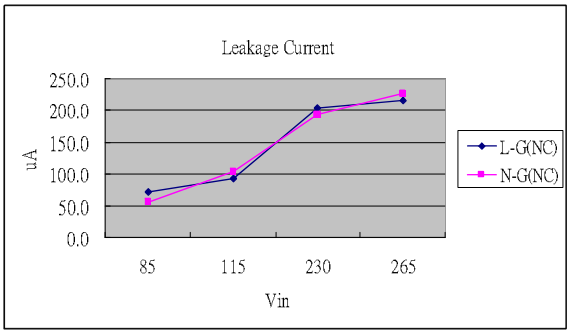


2.12 Leakage current characteristics

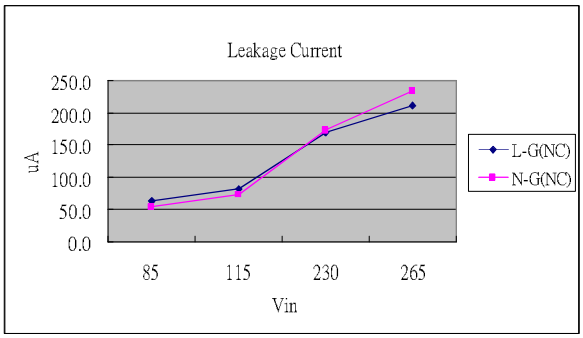
Conditions: Vin：85 / 115 / 230 / 265 VAC
Iout：0%,100%
Ta:25℃

5V

Iout =0% f=63Hz

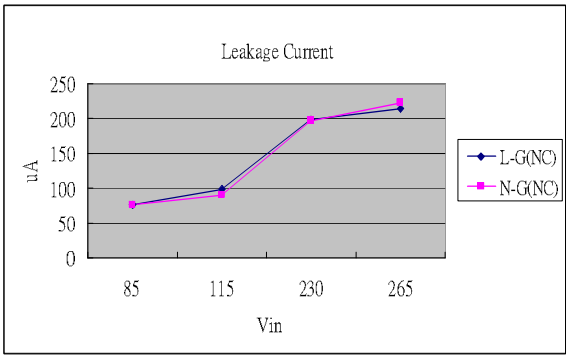


Iout =100% f=63Hz

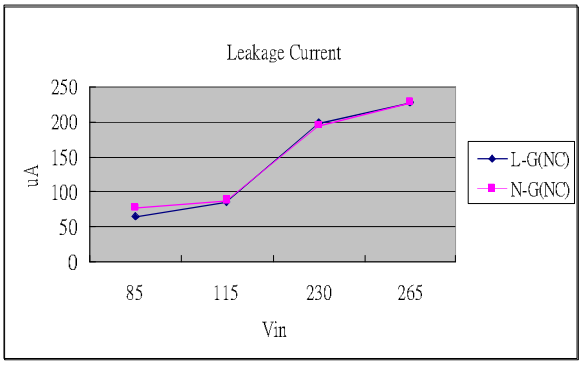


12V

Iout =0% f=63Hz

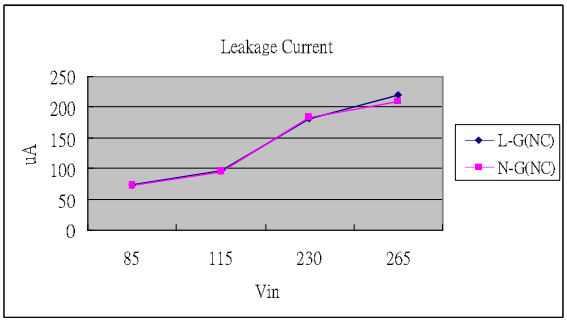


Iout =100% f=63Hz

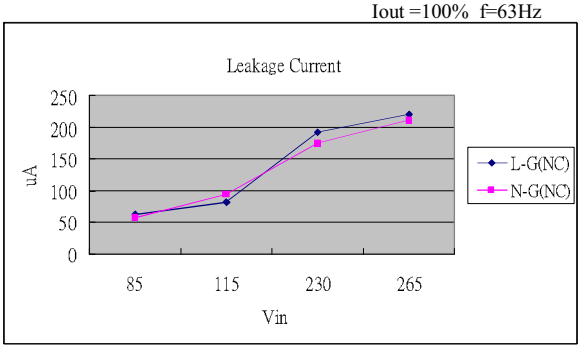


24V

Iout =0% f=63Hz



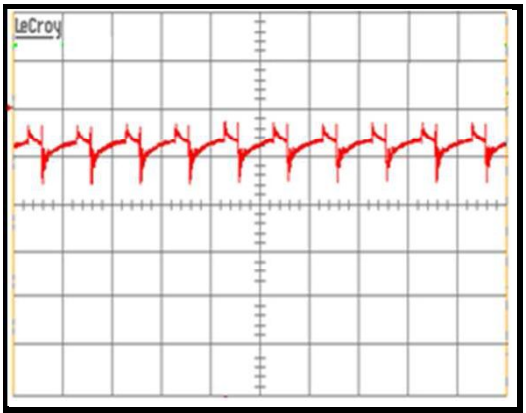
Iout =100% f=63Hz



2.13 Output ripple and noise Waveform

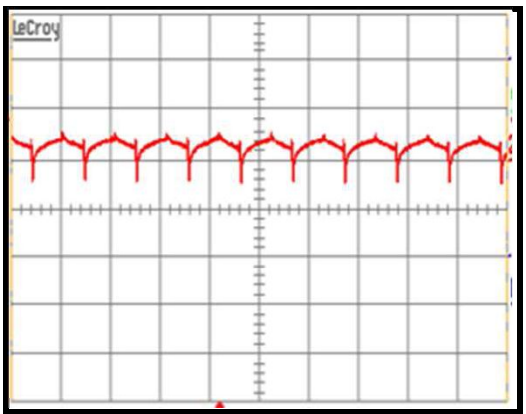
Conditions Vin：115 VAC
Io：100%
Ta:25℃

5V



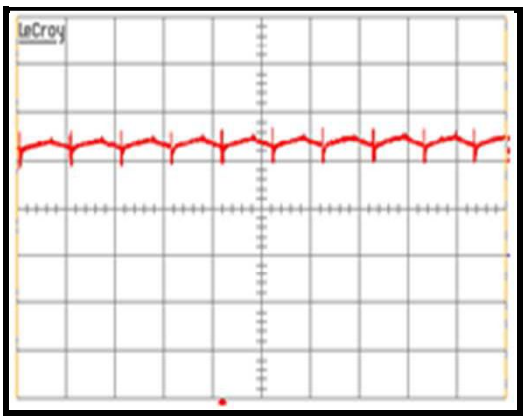
50mV/DIV	10us/DIV

12V



50mV/DIV	10us/DIV

24V



50mV/DIV	10us/DIV

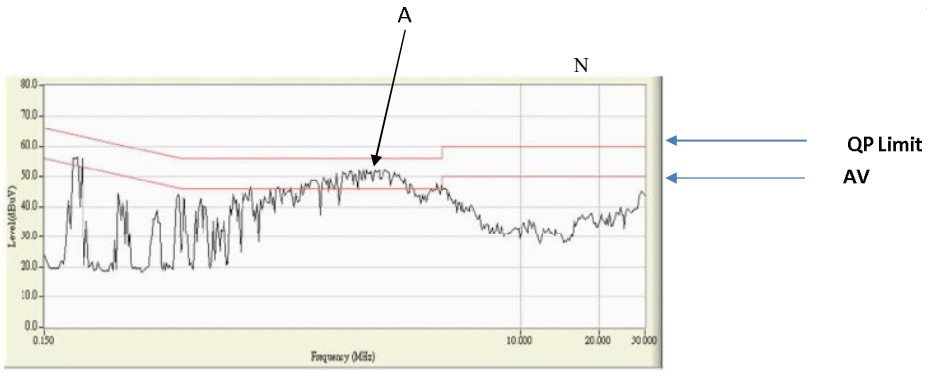
2.14 Electronagnetic interference characteristics

Conducted emission

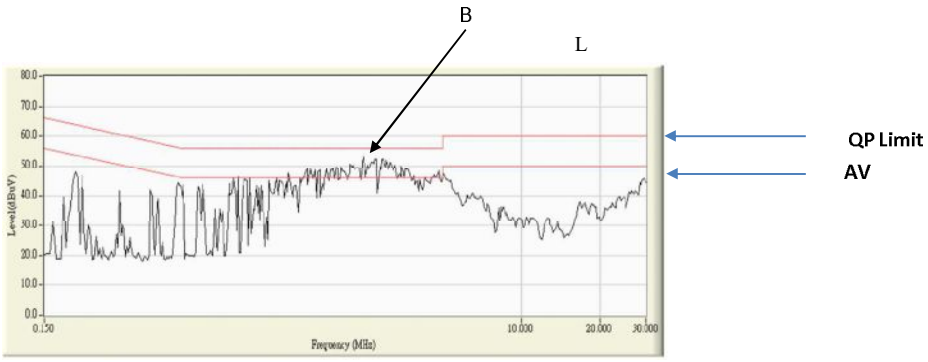
5V

Conditions: Vin：115 VAC
Iout：100%
Ta:25℃

Ref. Data	PointA (3.09MHz) Limit (dBuV)	Measure (dBuV)
QP	56	46
AV	46	31

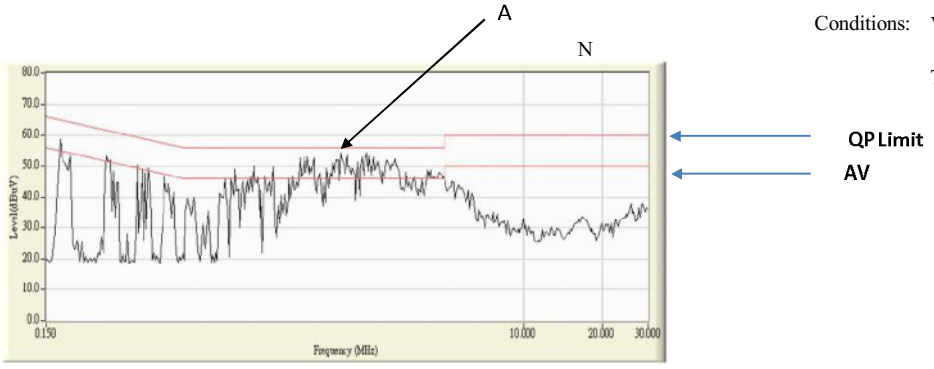


Ref. Data	PointB (2.74MHz) Limit (dBuV)	Measure (dBuV)
QP	56	48
AV	46	35

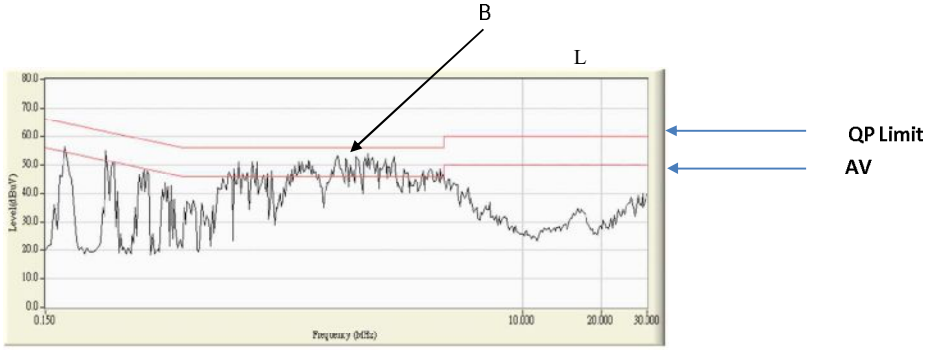


Conditions: Vin：230 VAC
Iout：100%
Ta:25℃

Ref. Data	PointA (1.54MHz) Limit (dBuV)	Measure (dBuV)
QP	56	47
AV	46	33



Ref. Data	PointB (1.97MHz) Limit (dBuV)	Measure (dBuV)
QP	56	50
AV	46	38



Limit EN5501-B, EN55022-B are same as its VCCI class B

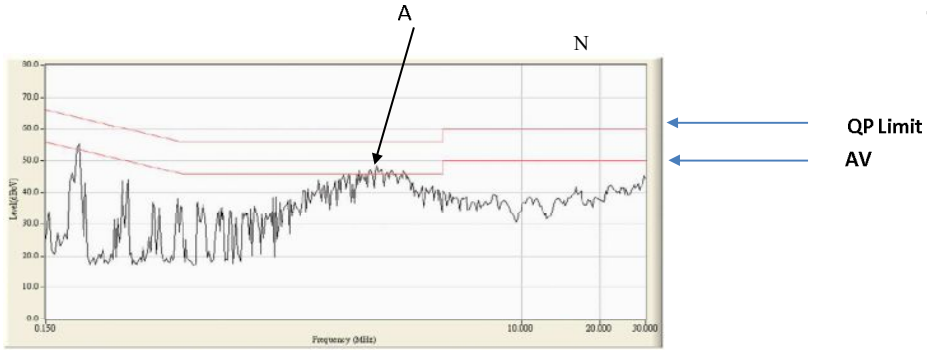
2.14 Electronagnetic interference characteristics

Conducted emission

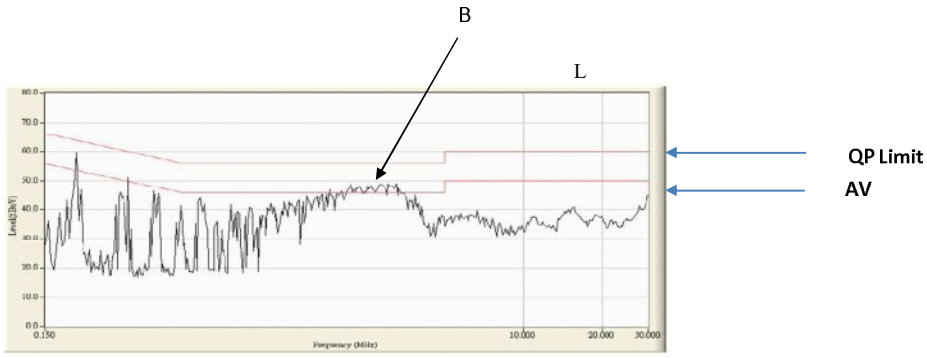
12V

Conditions: Vin：115 VAC
Iout：100%
Ta:25℃

Ref. Data	PointA (2.66MHz) Limit (dBuV)	Measure (dBuV)
QP	56	48
AV	46	35

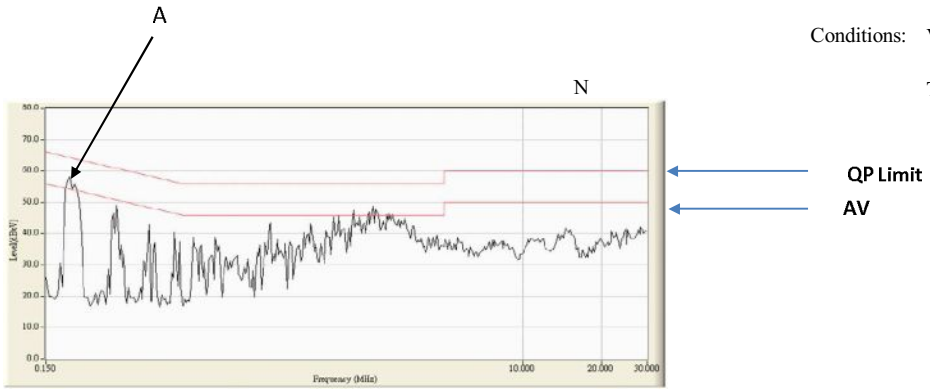


Ref. Data	Point B (2.73MHz) Limit (dBuV)	Measure (dBuV)
QP	56	48
AV	46	34

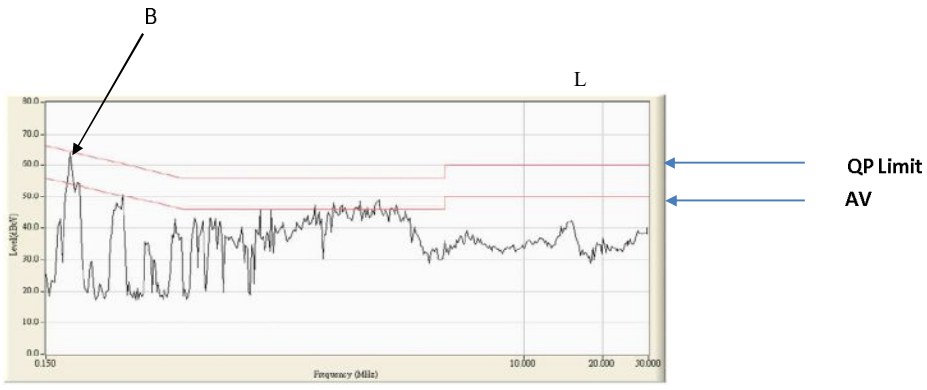


Conditions: Vin：230 VAC
Iout：100%
Ta:25℃

Ref. Data	PointA (0.18MHz) Limit (dBuV)	Measure (dBuV)
QP	64	58
AV	54	48



Ref. Data	PointB (0.19MHz) Limit (dBuV)	Measure (dBuV)
QP	63	57
AV	53	46



Limit EN5501-B, EN55022-B are same as its VCCI class B

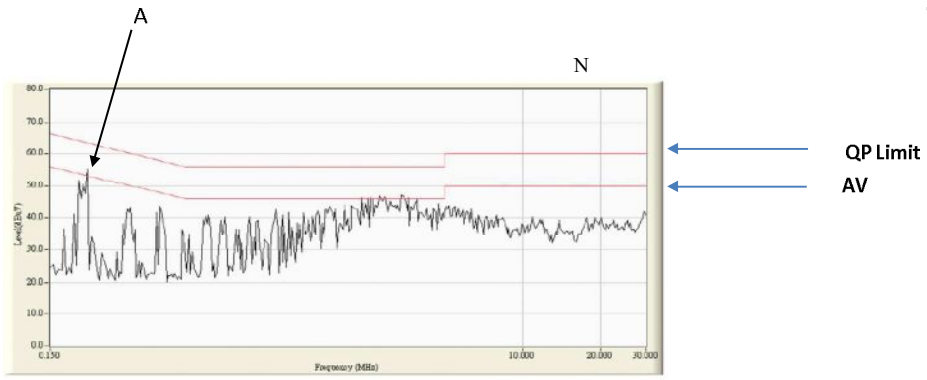
2.14 Electronagnetic interference characteristics

Conducted emission

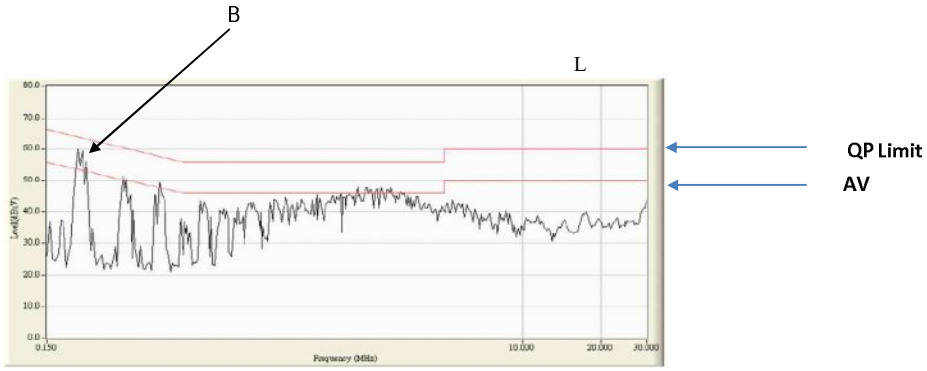
24V

Conditions: Vin：115 VAC
Iout：100%
Ta:25℃

Ref. Data	Point A (0.19MHz) Limit (dBuV)	Measure (dBuV)
QP	63	54
AV	53	44

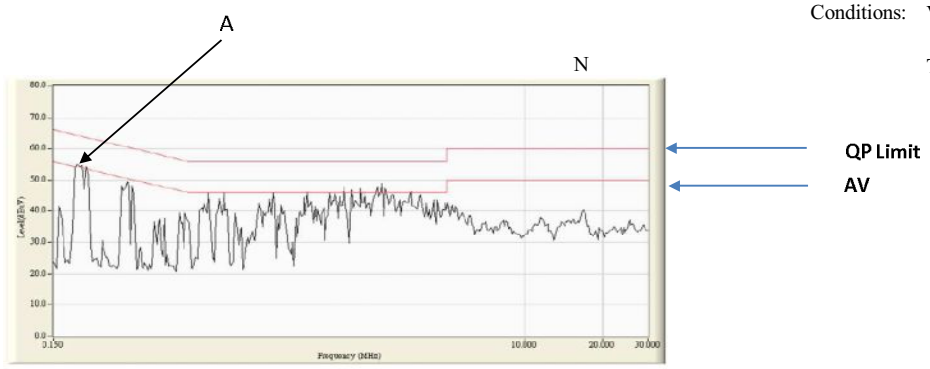


Ref. Data	Point B (0.19MHz) Limit (dBuV)	Measure (dBuV)
QP	63	55
AV	53	43

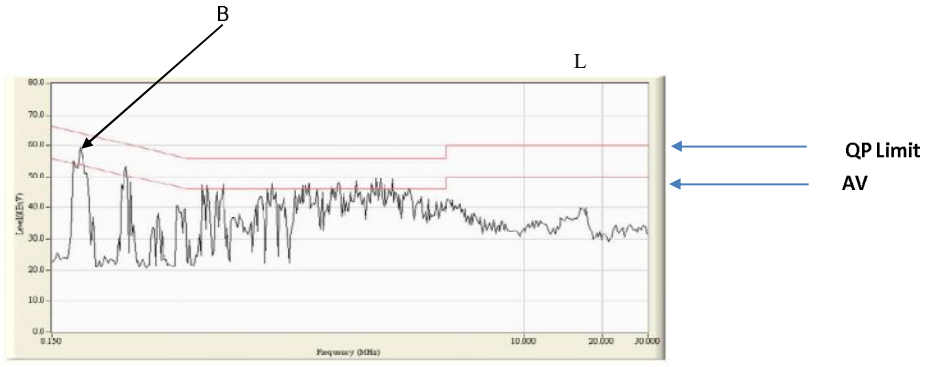


Conditions: Vin：230 VAC
Iout：100%
Ta:25℃

Ref. Data	Point A (0.18MHz) Limit (dBuV)	Measure (dBuV)
QP	64	52
AV	54	42



Ref. Data	Point B (0.18MHz) Limit (dBuV)	Measure (dBuV)
QP	64	55
AV	54	46



Limit EN5501-B, EN55022-B are same as its VCCI class B

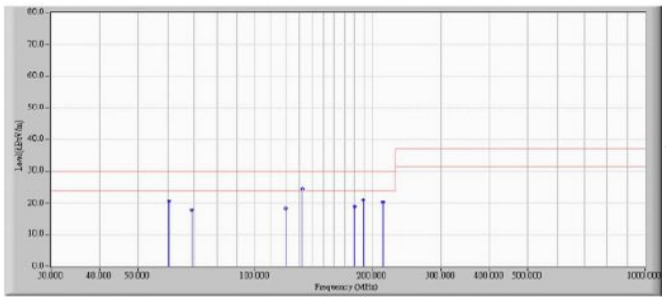
2.14 Electronagnetic interference characteristics

Radiated emission

Conditions: Vin：115 VAC
Iout：100%
Ta:25℃

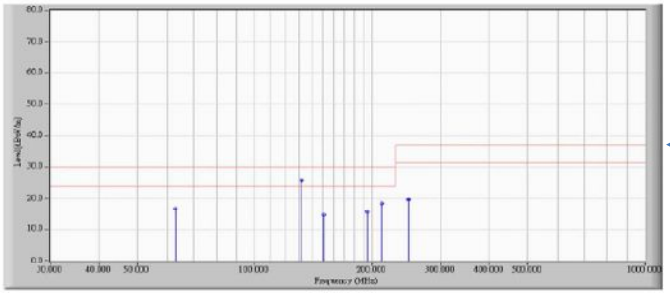
5V

Vertical



QP Limit

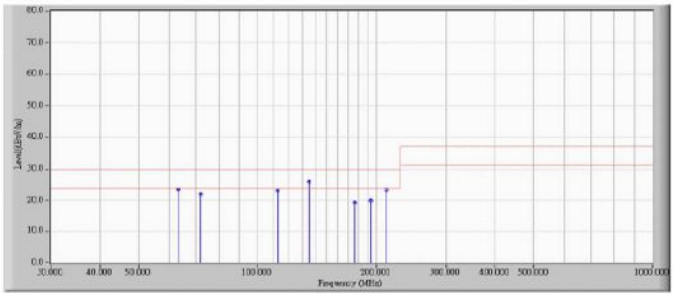
Horizontal



QP Limit

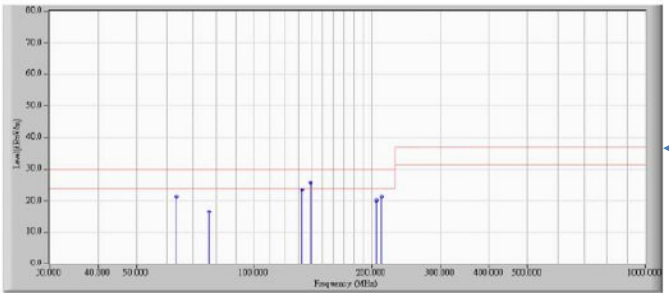
Conditions Vin：230 VAC
Iout：100%
Ta:25℃

Vertical



QP Limit

Horizontal



QP Limit

Limit EN5501-B, EN55022-B are same as its VCCI class B
Indication is QP values

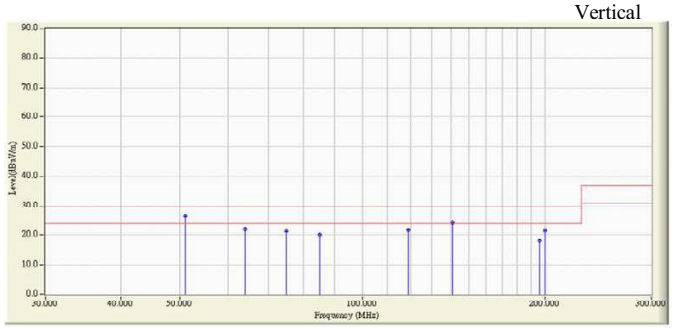
2.14 Electronagnetic interference characteristics

Radiated emission

Conditions: Vin：115 VAC
Iout：100%
Ta:25℃

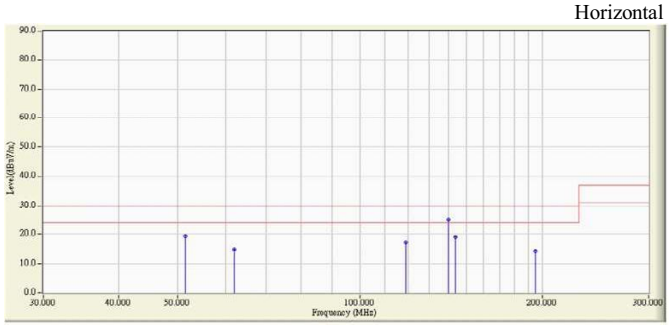
12V

Vertical



QP Limit

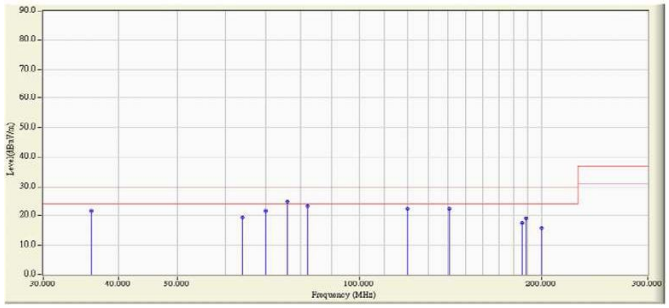
Horizontal



QP Limit

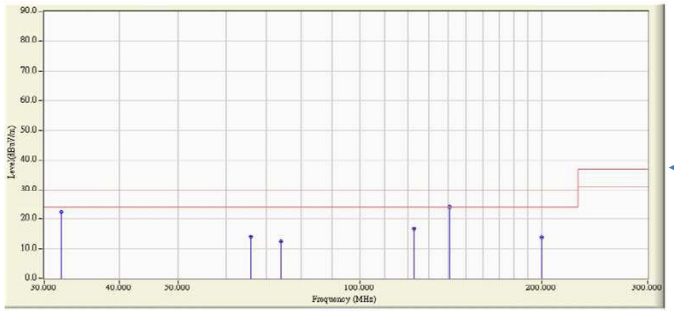
Conditions: Vin：230 VAC
Iout：100%
Ta:25℃

Vertical



QP Limit

Horizontal



QP Limit

Limit EN5501-B, EN55022-B are same as its VCCI class B
Indication is QP values

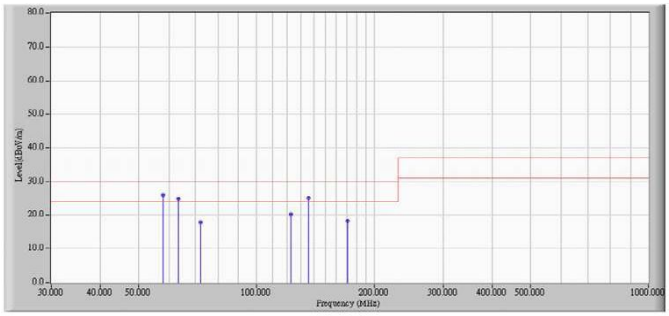
2.14 Electronagnetic interference characteristics

Radiated emission

Conditions: Vin：115 VAC
Iout：100%
Ta:25℃

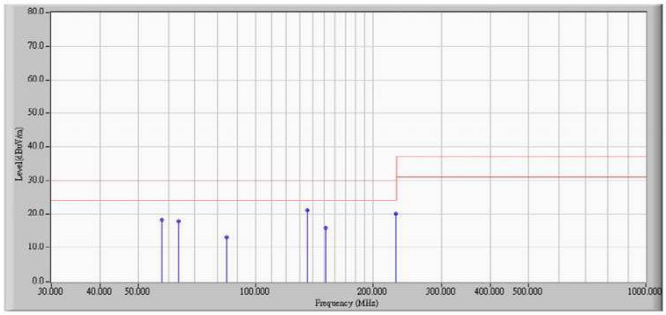
24V

Vertical



QP Limit

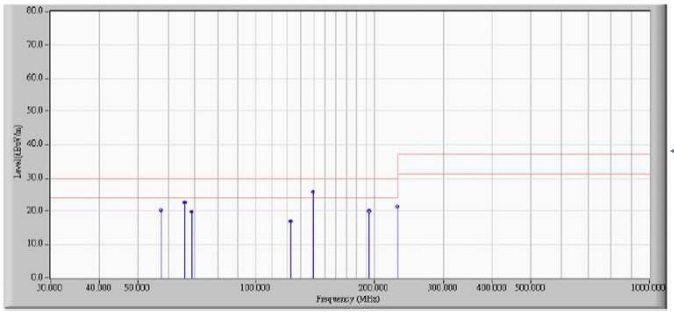
Horizontal



QP Limit

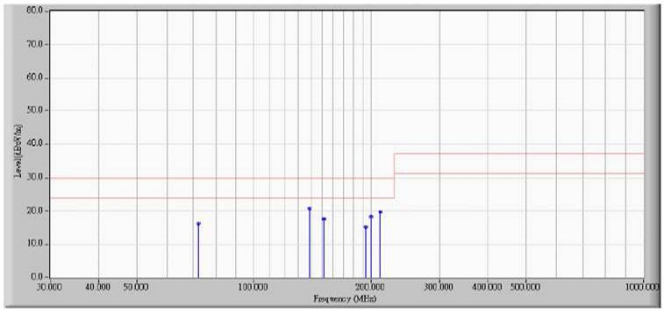
Conditions: Vin：230 VAC
Iout：100%
Ta:25℃

Vertical



QP Limit

Horizontal



QP Limit

Limit EN5501-B, EN55022-B are same as its VCCI class B
Indication is QP values