DRL100-1

EVALUATION DATA

INDEX

Terminology used

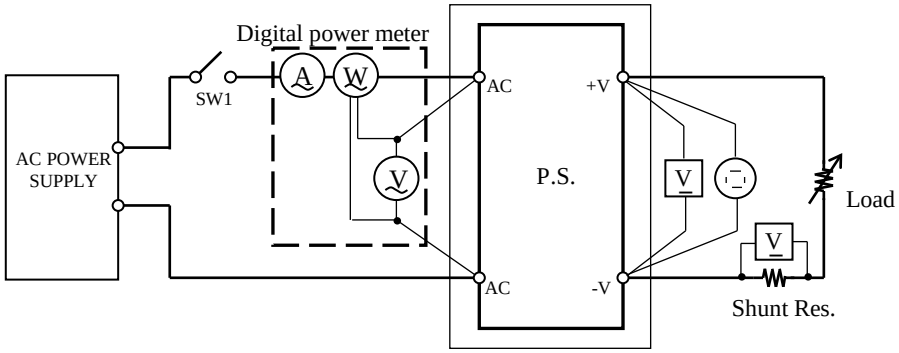
Vin	.....	Input voltage
Vout	.....	Output voltage
Iin	.....	Input current
Iout	.....	Output current
Ta	.....	Ambient temperature
f	.....	Frequency

1. Evaluation Method

1.1 Circuit used for determination

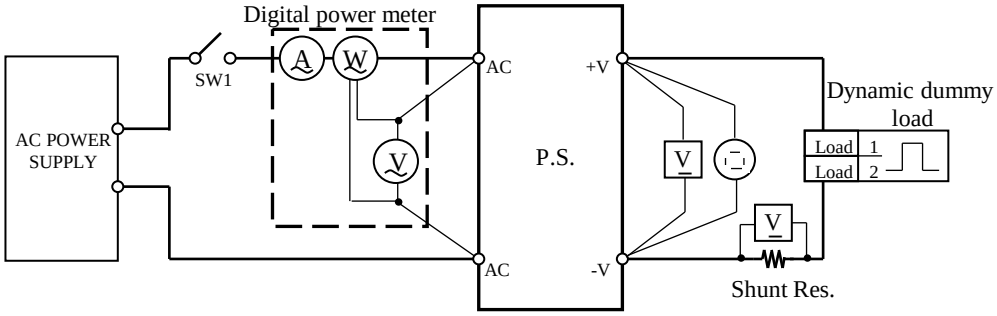
Circuit 1 used for determination

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

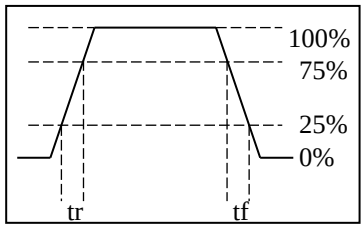


Circuit 2 used for determination

- Dynamic load response characteristics

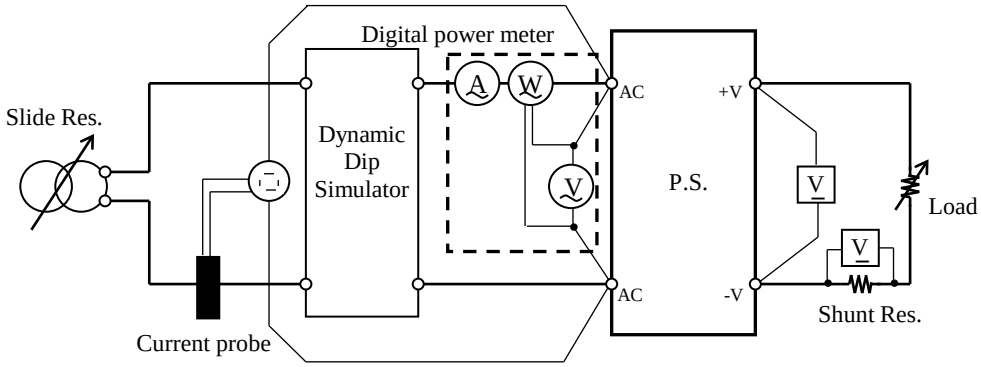


Output current waveform



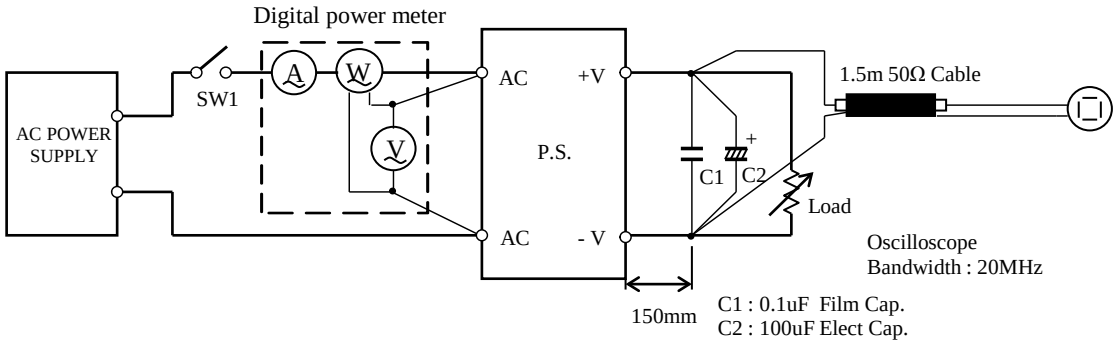
Circuit 3 used for determination

- Inrush current waveform



Circuit 4 used for determination

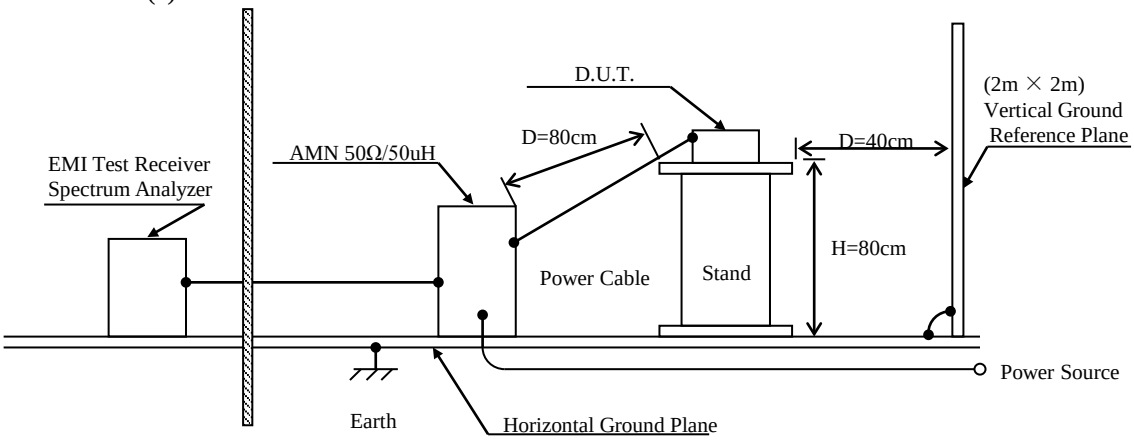
・Output ripple and noise waveform



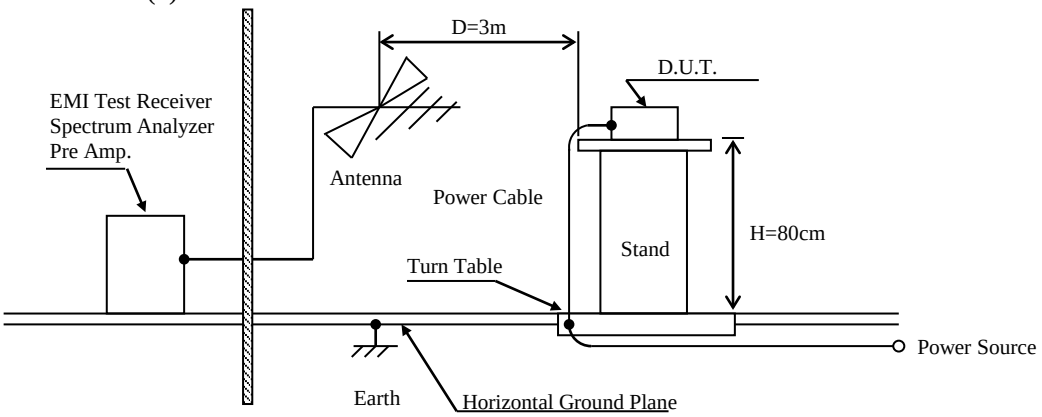
Configuration used for determination

・Electro-Magnetic Interference characteristics

(a) Conducted Emission



(b) Radiated Emission



1.2 List of equipment used

	EQUIPMENT USED	MANUFACTURER	MODEL NO.
1	DIGITAL STORAGE OSCILLOSCOPE	YOKOGAWA ELECT.	DL2054/DL9040
2	DIGITAL MULTIMETER	AGILENT	34970A
3	DIGITAL POWER METER	YOKOGAWA ELECT.	WT210
4	CURRENT PROBE	YOKOGAWA ELECT.	701930
5	DYNAMIC DUMMY LOAD	CHROMA	63030/63610
6	AC SOURCE	KIKUSUI	PCR2000L
7	AC SOURCE	CHROMA	61605
8	CONTROLLED TEMP. CHAMBER	TABAI-ESPEC	63203
9	EMI TEST RECEIVER (Conducted Emission)	ROHDE & SCHWARZ	ESCI-03
10	LISN (Conducted Emission)	ROHDE & SCHWARZ	ENV216
11	BICONICAL ANTENNA (Radiated Emission)	ETS•LINDGREN	3142C
12	EMI TEST RECEIVER (Radiated Emission)	ROHDE & SCHWARZ	ESU 26

2. Characteristics

2.1 Steady state data

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

24V

1. Regulation - line and load Condition Ta : 25 ℃

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	24.055V	24.055V	24.055V	24.055V	0mV	0.000%
50%	24.053V	24.053V	24.053V	24.053V	0mV	0.000%
100%	24.051V	24.051V	24.051V	24.051V	0mV	0.000%
load regulation	4mV	4mV	4mV	4mV		
	0.017%	0.017%	0.017%	0.017%		

2. Temperature drift Conditions Vin : 115 VAC
Iout : 100 %

Ta	-20℃	+25℃	+71℃	temperature stability	
Vout	23.981V	24.051V	24.055V	74mV	0.308%

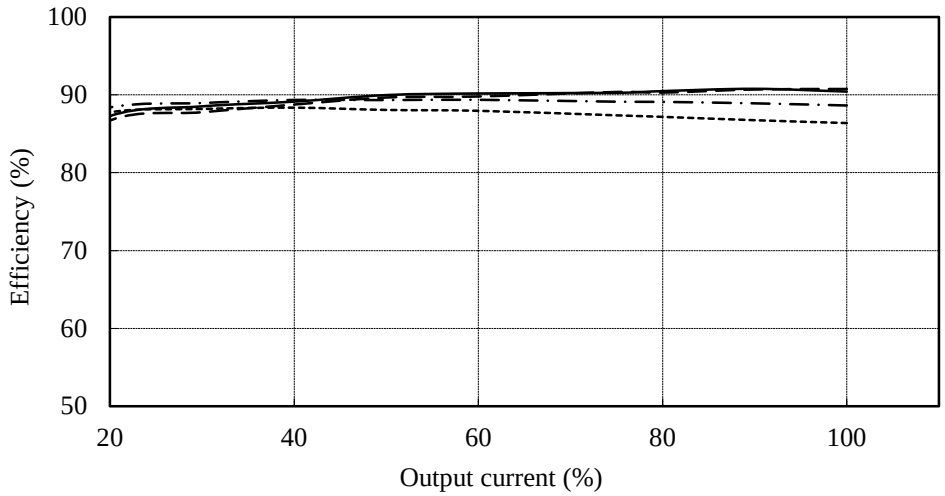
3. Start up voltage and Drop out voltage Conditions Ta : 25 ℃
Iout : 100 %

Start up voltage (Vin)	67.0VAC
Drop out voltage (Vin)	65.2VAC

(2) Efficiency vs. Output current

Conditions Vin : 85 VAC ------
: 115 VAC –·–·–
: 230 VAC ———
: 265 VAC – – – –
Ta : 25 ℃

24V



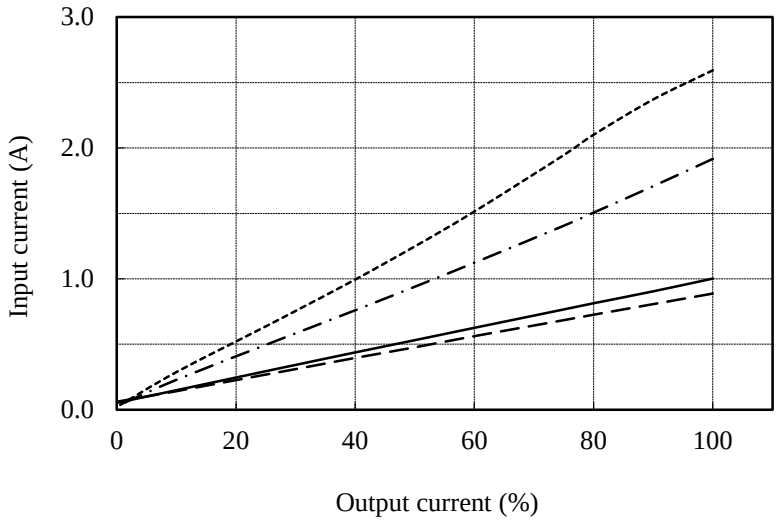
(3) Input current vs. Output current

Conditions Vin : 85 VAC ------
: 115 VAC –·–·–
: 230 VAC ———
: 265 VAC – – – –
Ta : 25 ℃

24V

Io: 100%

Vin	Input current
85VAC	2.594A
115VAC	1.917A
230VAC	1.002A
265VAC	0.888A



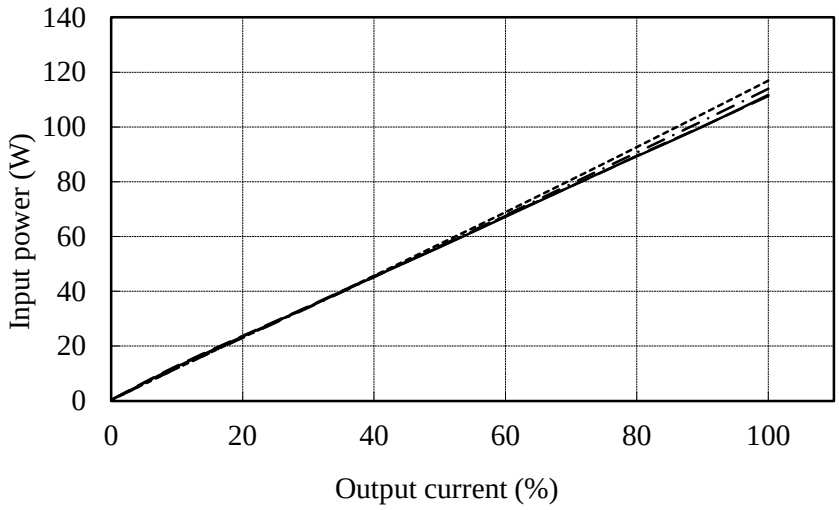
(4) Input power vs. Output current

Conditions Vin : 85 VAC - - - -
: 115 VAC –·–·
: 230 VAC ——
: 265 VAC – – –
Ta : 25 ℃

24V

Io: 100%

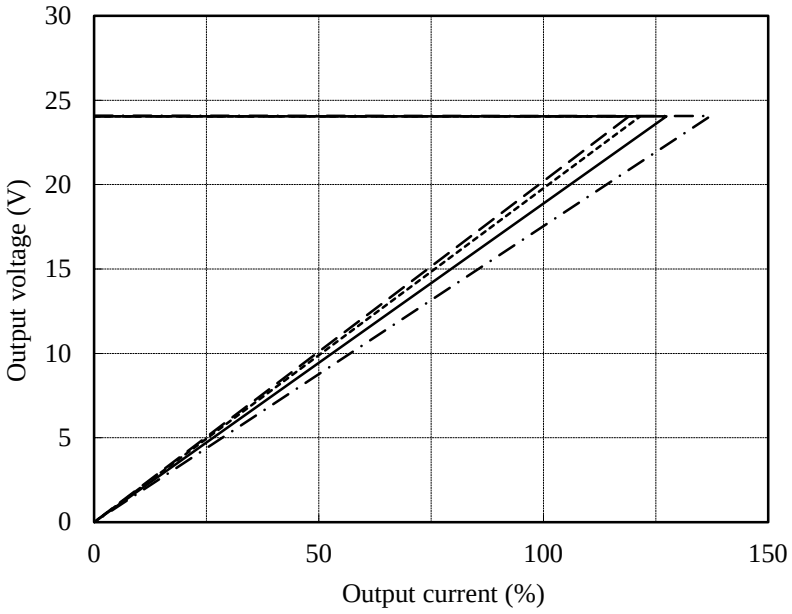
Vin	Input power
85VAC	116.91W
115VAC	113.94W
230VAC	111.70W
265VAC	111.30W



2.2 Over current protection (OCP) characteristics

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

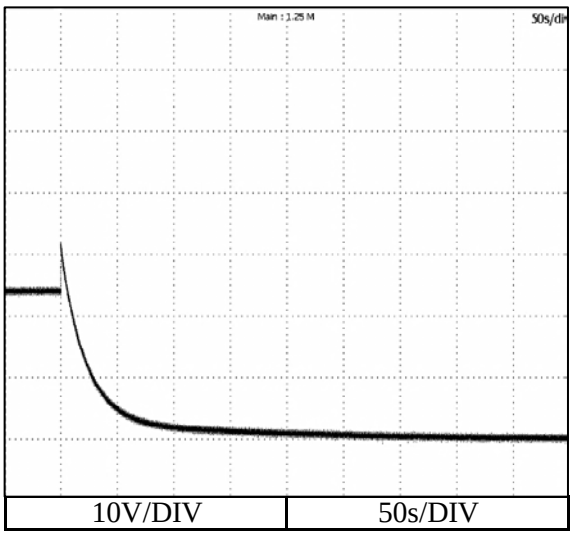
24V



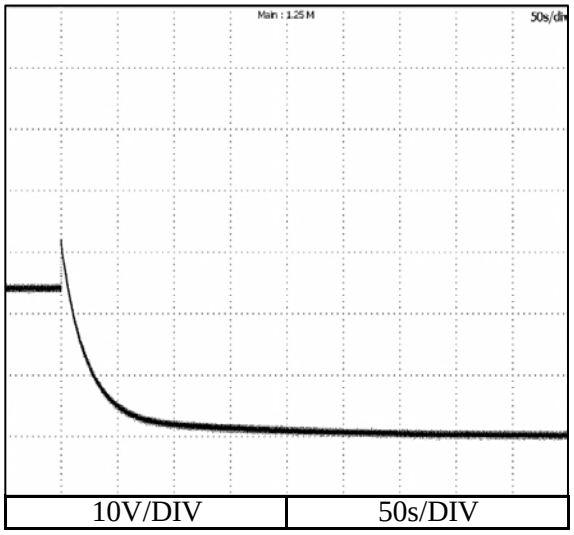
2.3 Over voltage protection (OVP) characteristics

Conditions Vin : 115 VAC
Iout : 0 %
Ta : 25 ℃

24V



Conditions Vin : 230 VAC
Iout : 0 %
Ta : 25 ℃

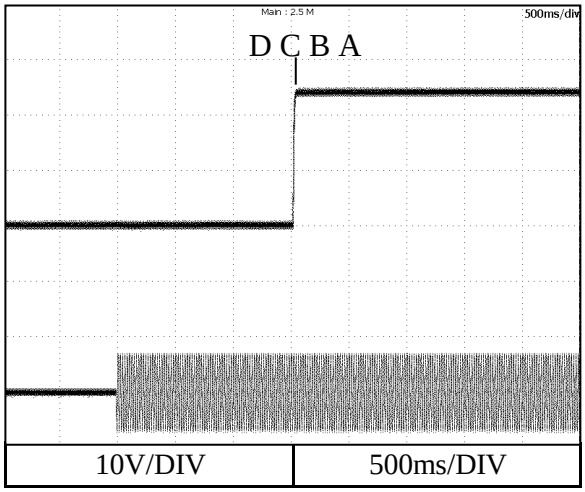


2.4 Output rise characteristics

Conditions Vin : 85 VAC (A)
115 VAC (B)
230 VAC (C)
265 VAC (D)
Ta : 25 ℃

24V

Iout : 0%

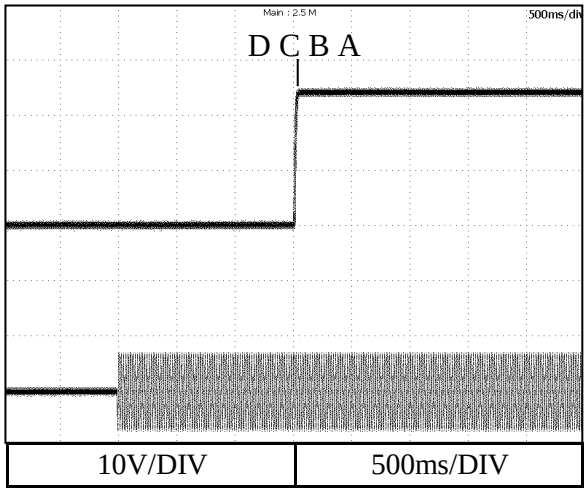


Vout

0V

Vin

Iout : 100%

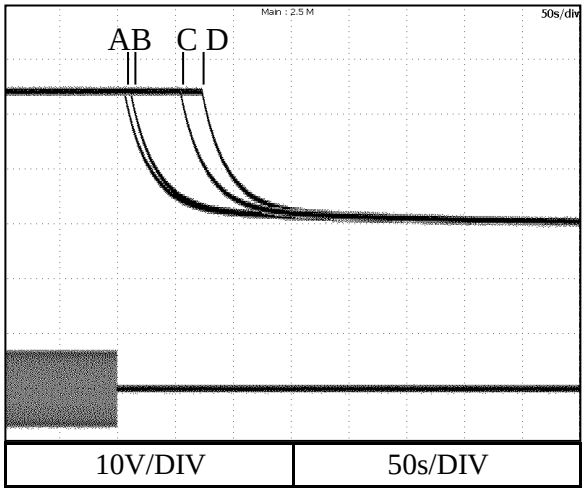


2.5 Output fall characteristics

Conditions Vin : 85 VAC (A)
115 VAC (B)
230 VAC (C)
265 VAC (D)
Ta : 25 ℃

24V

Iout : 0%

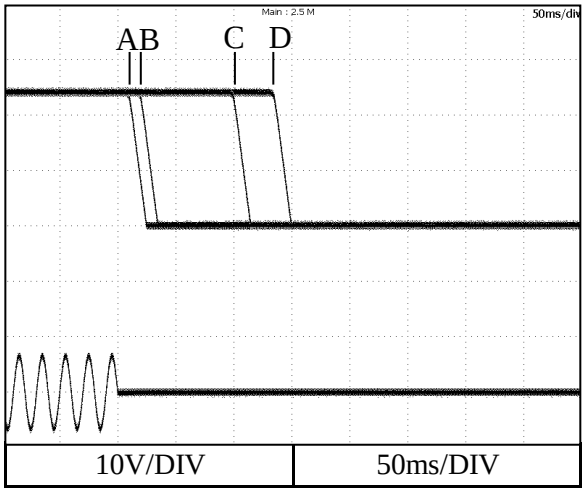


Vout

0V

Vin

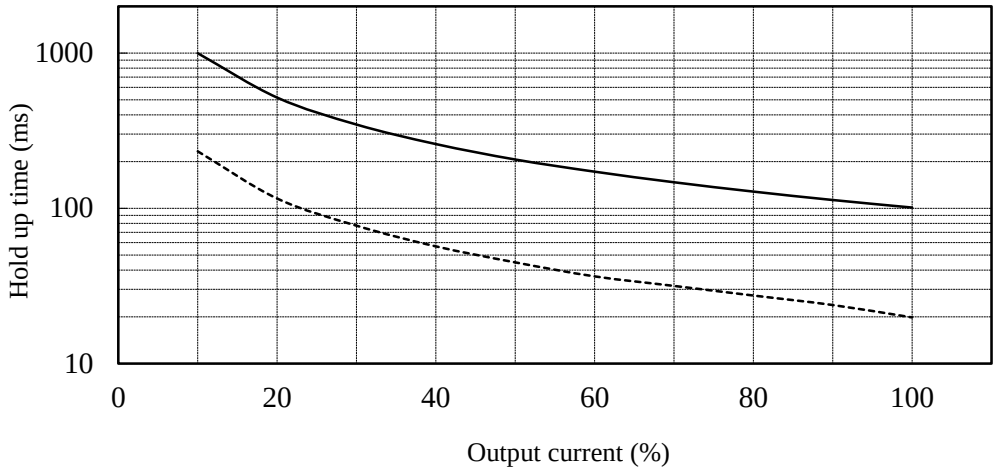
Iout : 100%



2.6 Hold up time characteristics

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

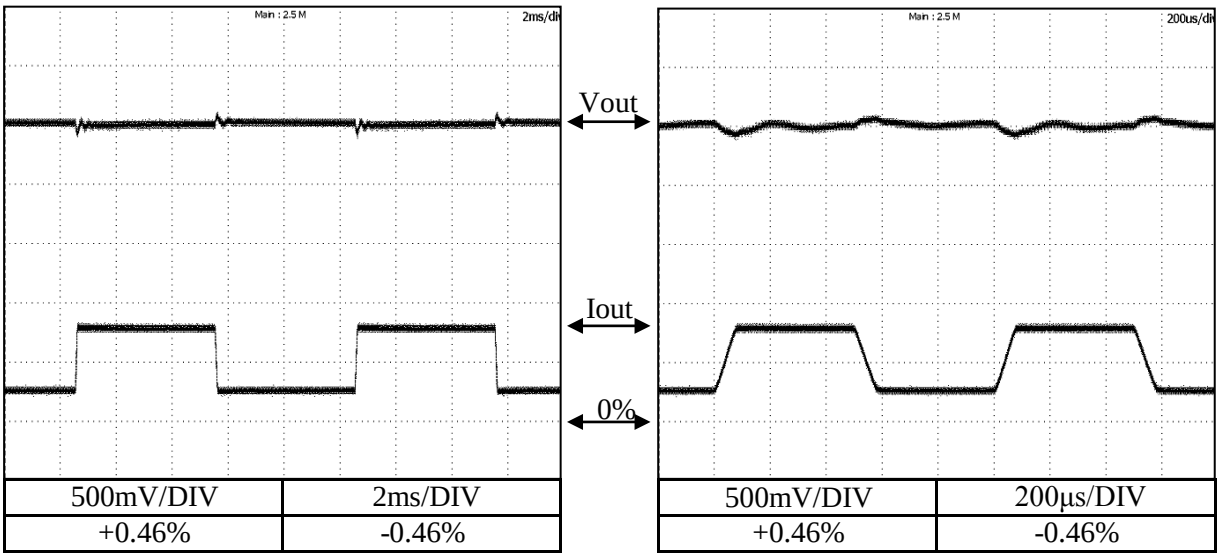
24V



2.7 Dynamic load response characteristics

Conditions Vin : 115 VAC
Iout : 25 %↔ 75 %
(tr = tf = 75us)
Ta : 25 ℃

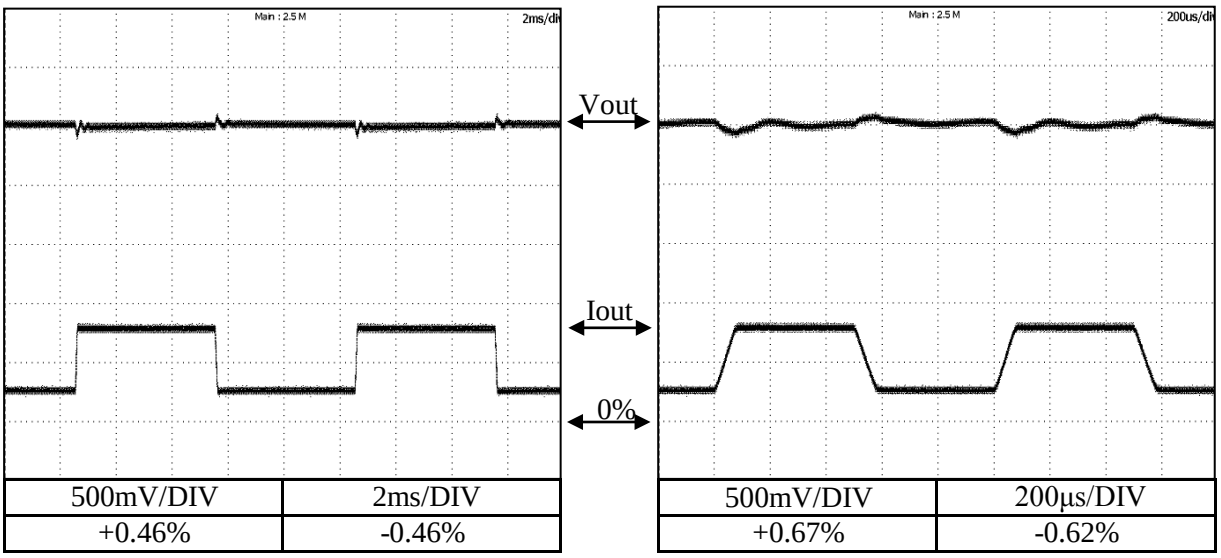
24V



500mV/DIV	2ms/DIV	500mV/DIV	200µs/DIV
+0.46%	-0.46%	+0.46%	-0.46%

Conditions Vin : 230 VAC
Iout : 25 %↔ 75 %
(tr = tf = 75us)
Ta : 25 ℃

24V



500mV/DIV	2ms/DIV	500mV/DIV	200µs/DIV
+0.46%	-0.46%	+0.67%	-0.62%

2.8 Response to brown out characteristics

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

A : Output voltage does not drop.
B,C : Output voltage drop down not reaching 0V.
D : Output voltage drops until 0V.

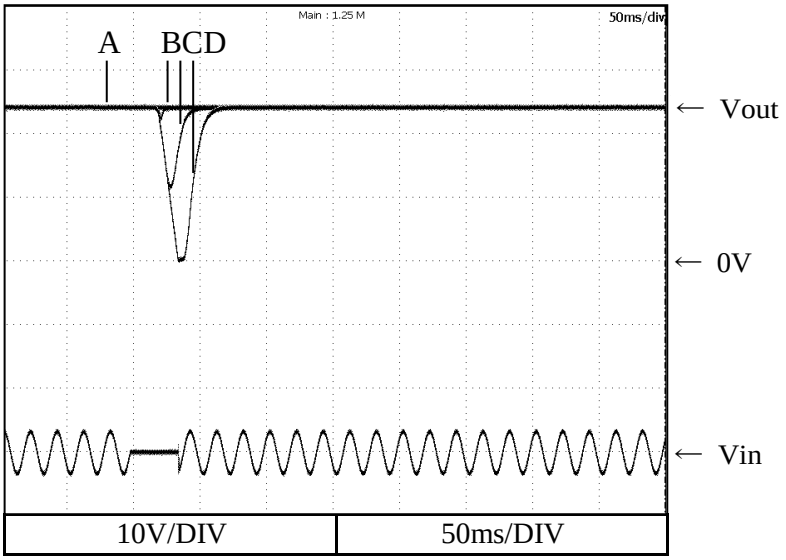
24V

A = 18ms

B = 22ms

C = 25ms

D =36ms



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

A : Output voltage does not drop.
B,C : Output voltage drop down not reaching 0V.
D : Output voltage drops until 0V.

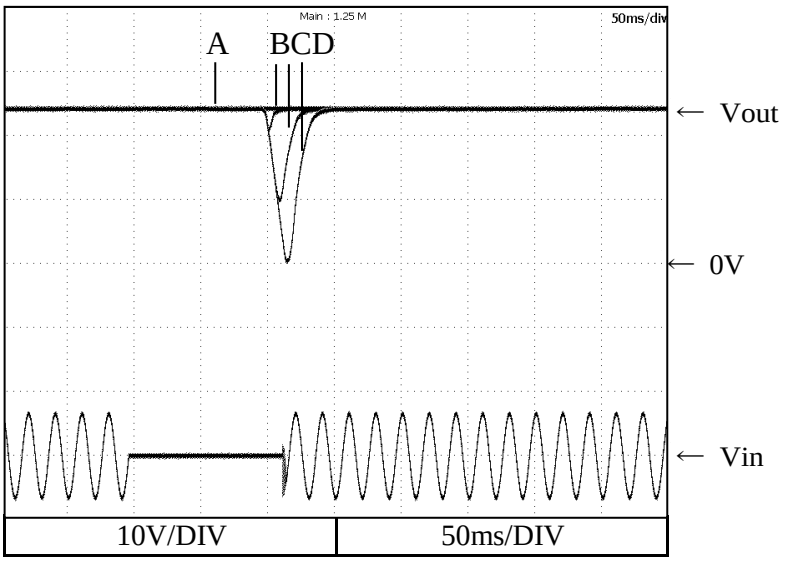
24V

A=100ms

B=103ms

C=106ms

D=114ms

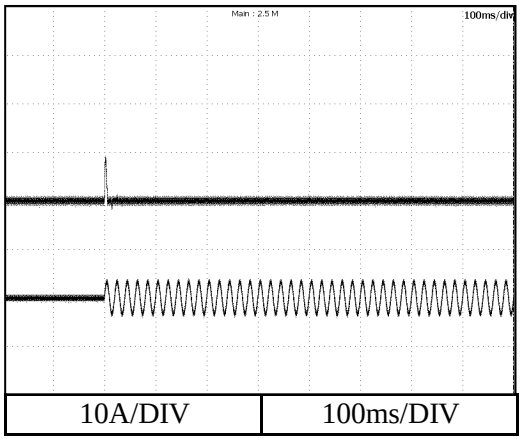


2.9 Inrush current waveform

24V

Conditions Vin : 115 VAC
Iout : 100 %
Ta : 25 ℃
(Cold start)

Switch on phase angle of input AC voltage
ϕ = 0°

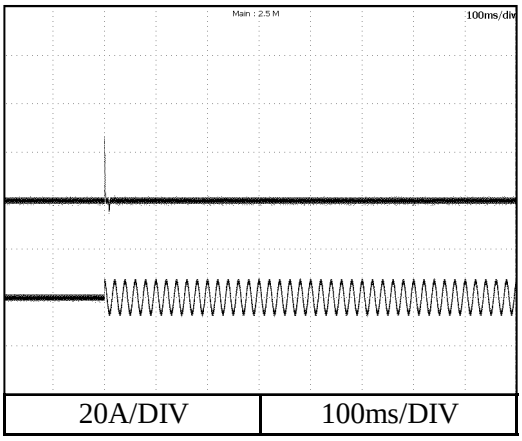


10A/DIV | 100ms/DIV

Iin

Vin

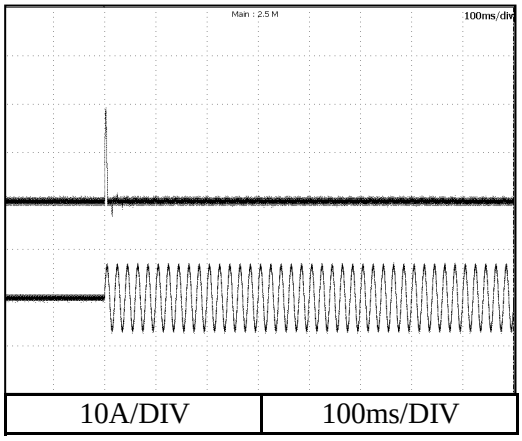
Switch on phase angle of input AC voltage
ϕ = 90°



20A/DIV | 100ms/DIV

Conditions Vin : 230 VAC
Iout : 100 %
Ta : 25 ℃
(Cold start)

Switch on phase angle of input AC voltage
ϕ = 0°

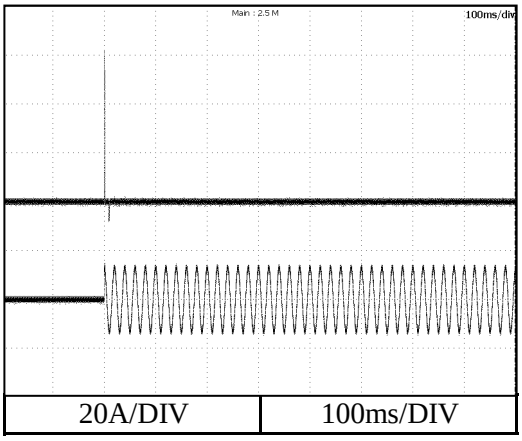


10A/DIV | 100ms/DIV

Iin

Vin

Switch on phase angle of input AC voltage
ϕ = 90°



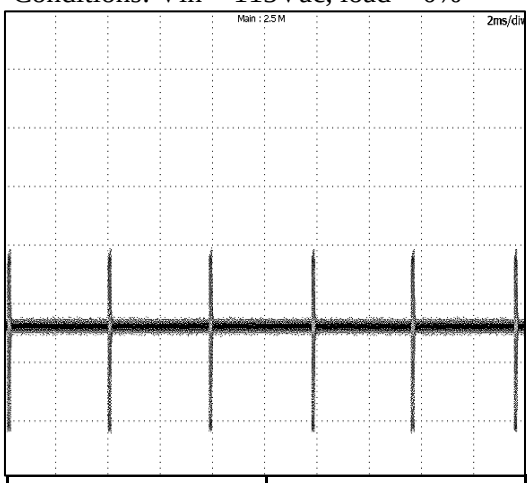
20A/DIV | 100ms/DIV

2.10 Switching frequency

24V

Condition : 25 ℃

Conditions: Vin = 115Vac, load = 0%



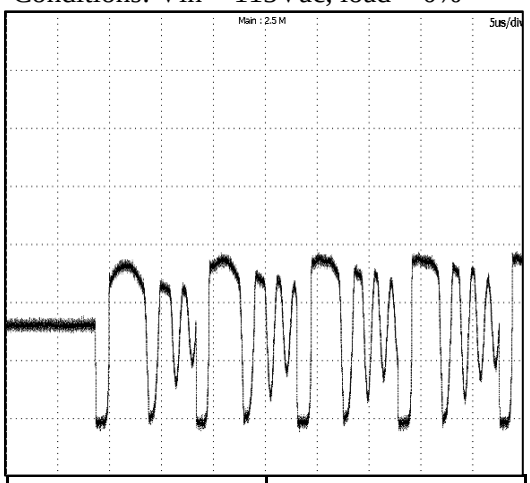
100V/DIV	2ms/DIV
Result	Fsw=0.255kHz

Zoom

Vds

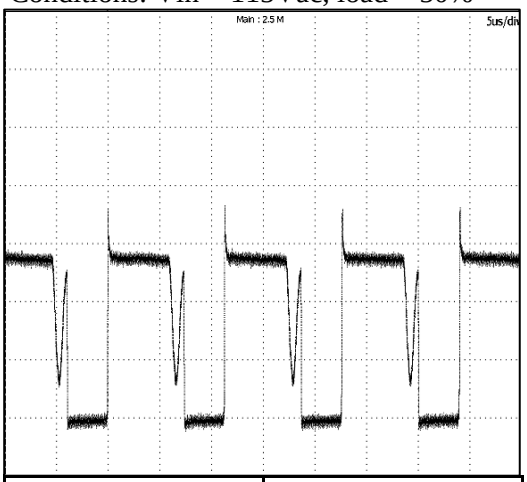
0V

Conditions: Vin = 115Vac, load = 0%



100V/DIV	5us/DIV
Result	Fsw=101.01kHz

Conditions: Vin = 115Vac, load = 50%

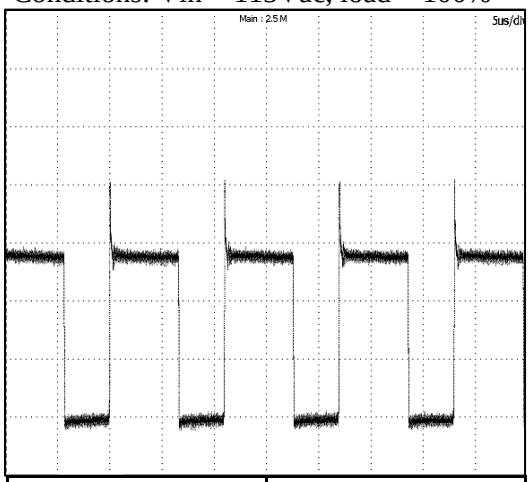


100V/DIV	5us/DIV
Result	Fsw=84.7-95.6kHz

Vds

0V

Conditions: Vin = 115Vac, load = 100%



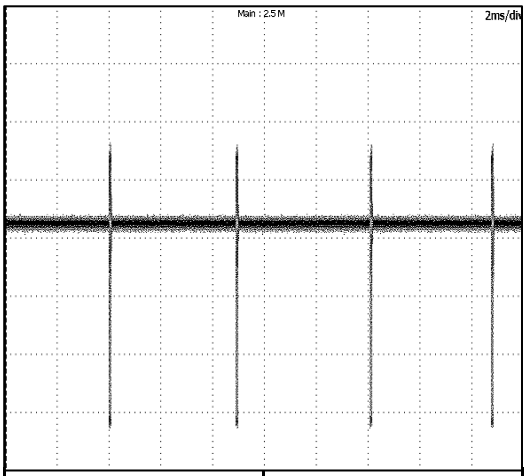
100V/DIV	5us/DIV
Result	Fsw=84.6~96.8kHz

2.10 Switching frequency

24V

Condition : 25 ℃

Conditions: Vin = 230Vac, load = 0%



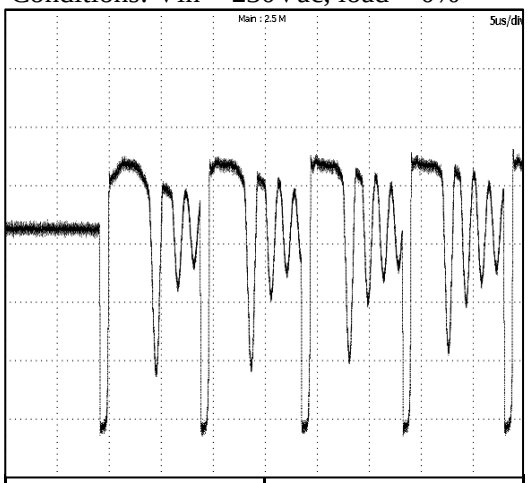
100V/DIV	2ms/DIV
Result	Fsw=0.204kHz

Zoom

Vds

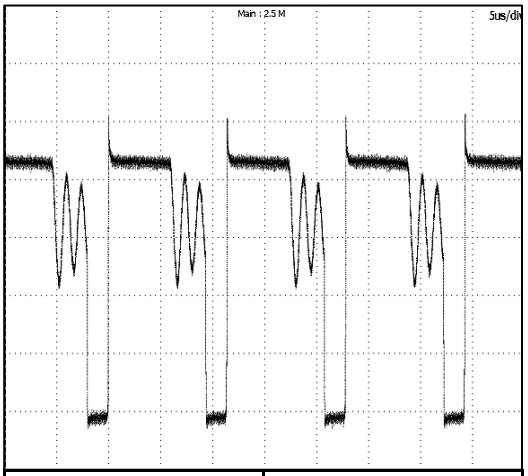
0V

Conditions: Vin = 230Vac, load = 0%



100V/DIV	5us/DIV
Result	Fsw=103kHz

Conditions: Vin = 230Vac, load = 50%

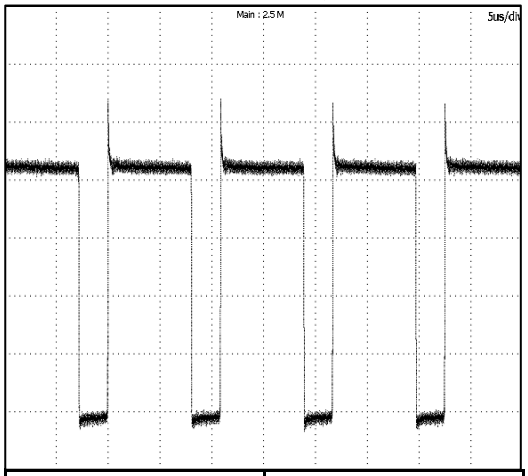


100V/DIV	5us/DIV
Result	Fsw=84.8~95.9kHz

Vds

0V

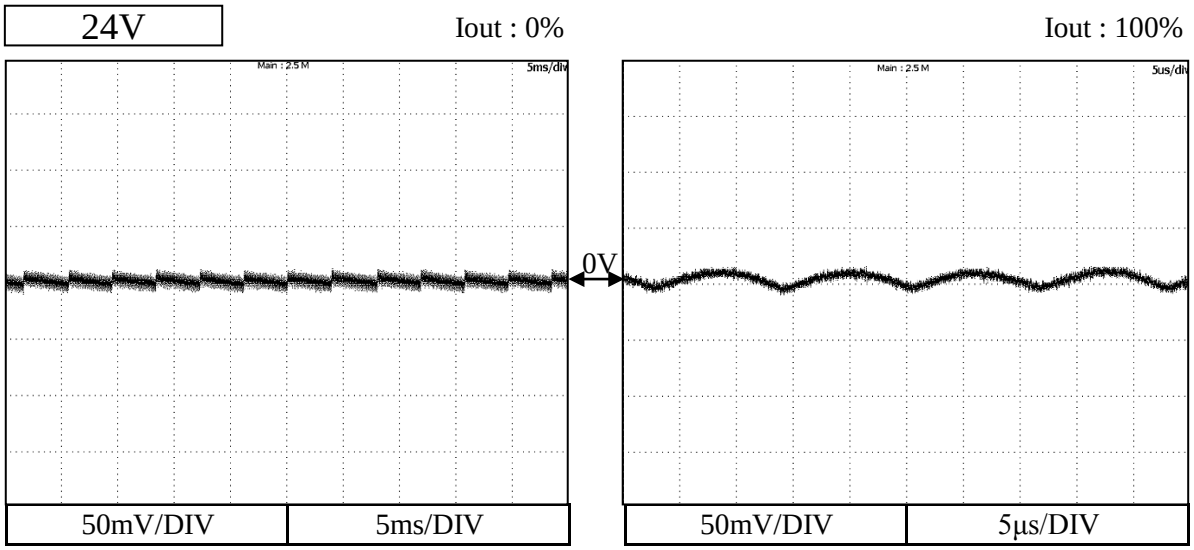
Conditions: Vin = 230Vac, load = 100%



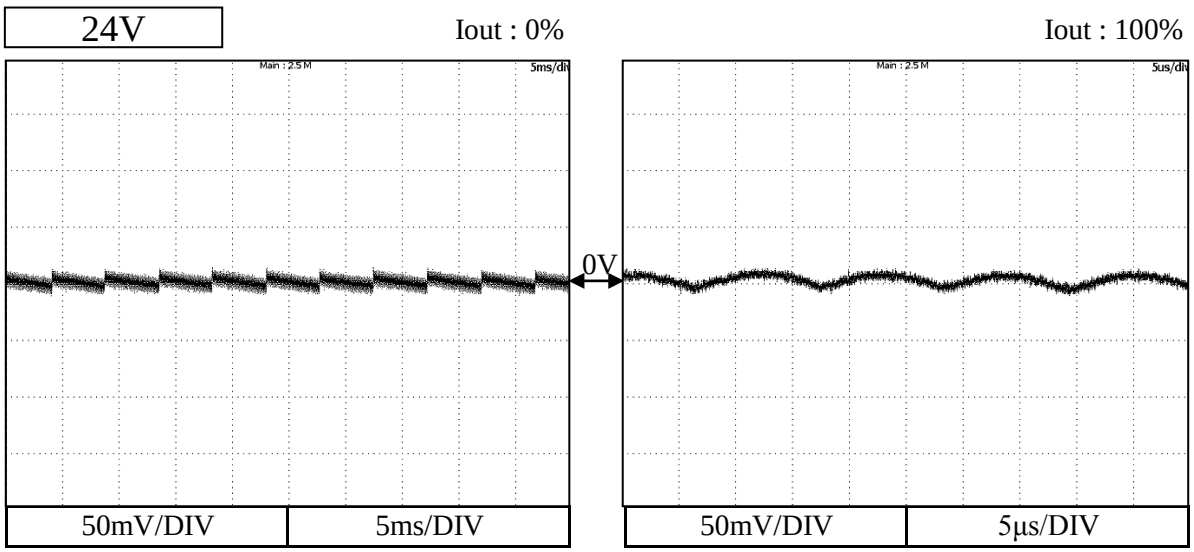
100V/DIV	5us/DIV
Result	Fsw=84.4~95.5kHz

2.11 Output ripple and noise waveform

Conditions Vin : 115 VAC
Ta : 25 ℃



Conditions Vin : 230 VAC
Ta : 25 ℃



2.12 Electro-Magnetic Interference characteristics

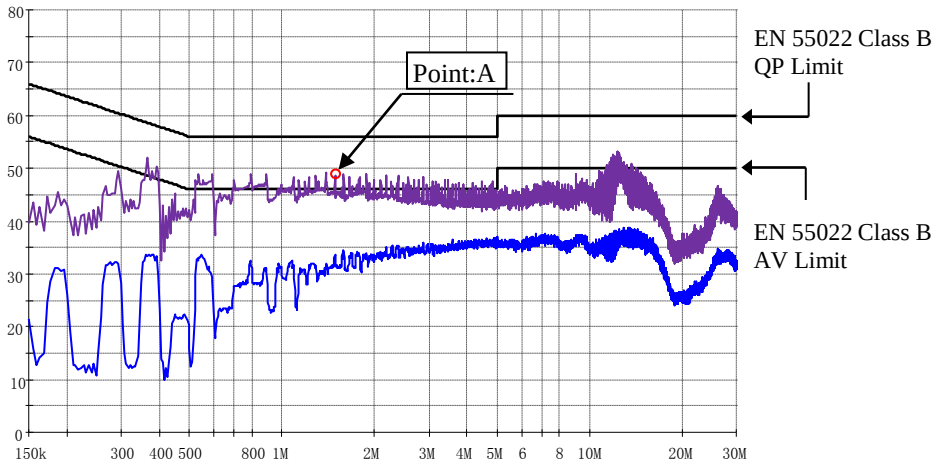
Conditions Vin : 115 VAC
Iout : 100 %
Ta : 25 ℃

Conducted Emission

24V

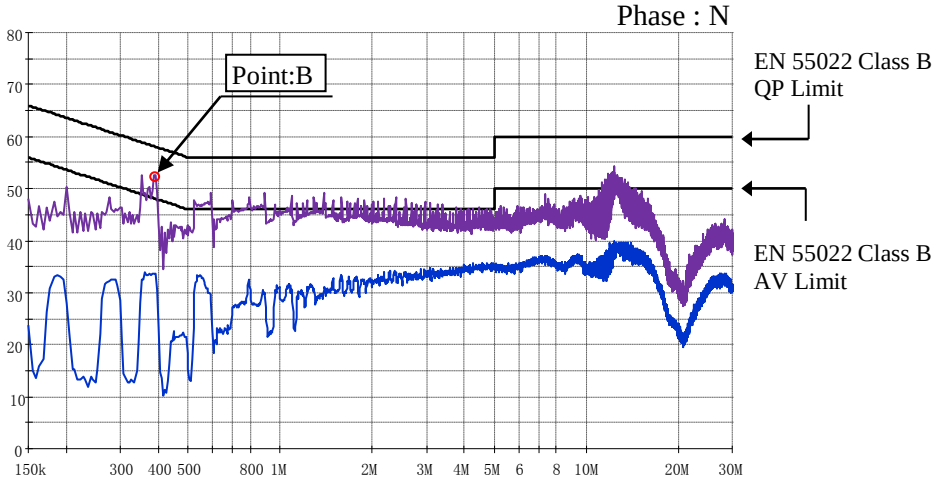
Ref. Data	Point A (1.585MHz) Limit (dBuV)	Measure (dBuV)
QP	56.0	44.2
AV	46.0	36.4

Phase : L



Ref. Data	Point B (0.393MHz) Limit (dBuV)	Measure (dBuV)
QP	58.0	47.7
AV	48.0	34.1

Phase : N



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

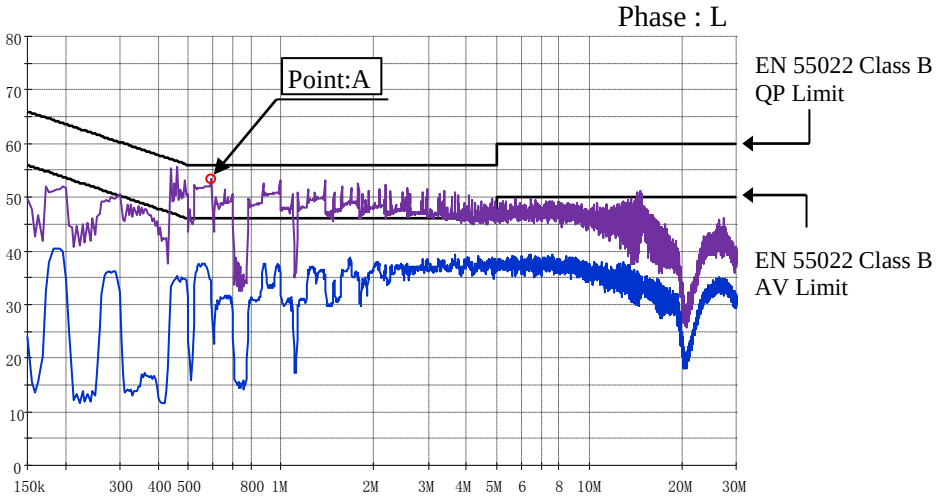
2.12 Electro-Magnetic Interference characteristics

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

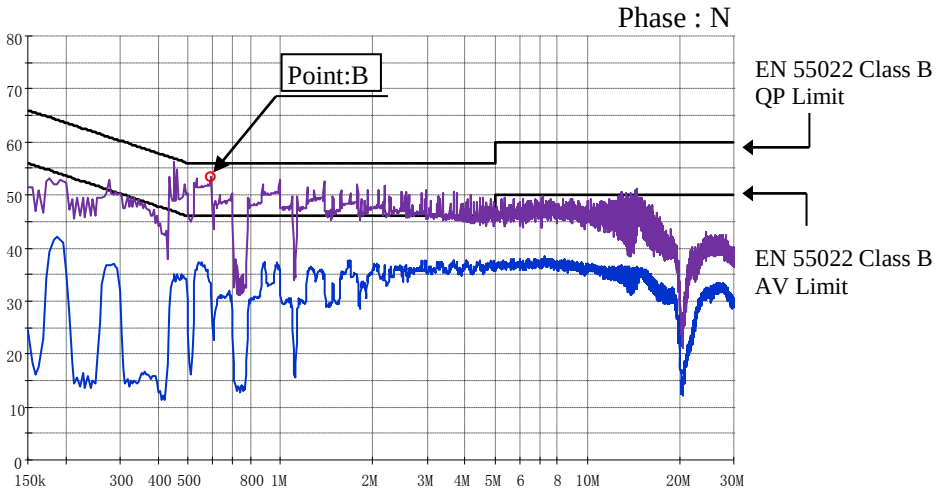
Conducted Emission

24V

Ref. Data	Point A (0.593MHz) Limit (dBuV)	Measure (dBuV)
QP	56.0	52.5
AV	46.0	38.6



Ref. Data	Point B (0.592MHz) Limit (dBuV)	Measure (dBuV)
QP	56.0	52.3
AV	46.0	38.0



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

2.12 Electro-Magnetic Interference characteristics

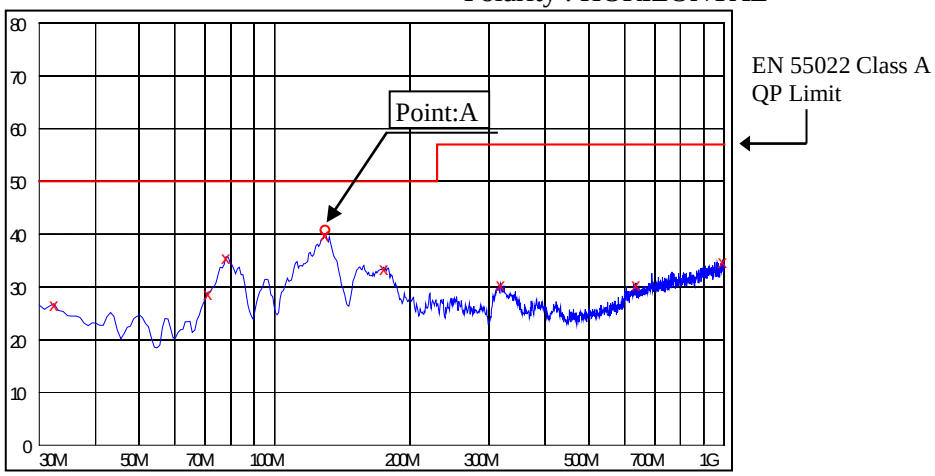
Conditions Vin : 115 VAC
Iout : 100 %
Ta : 25 ℃

Radiated Emission

24V

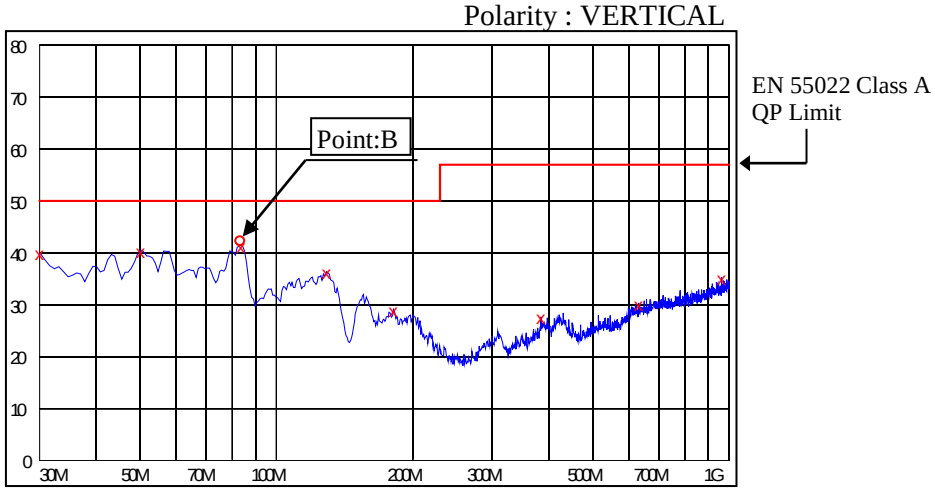
Ref. Data	Point A (129.3MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	40.1

Polarity : HORIZONTAL



Ref. Data	Point B (83.5MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	41.5

Polarity : VERTICAL



Limit of EN55011-A,VCCI-A,FCC-A are same as its EN55022 class A.

2.12 Electro-Magnetic Interference characteristics

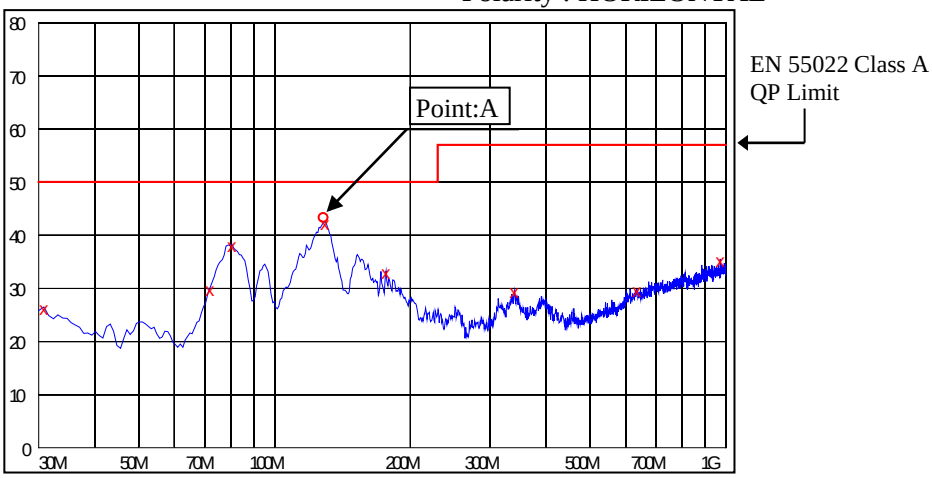
Conditions Vin : 230 VAC
Iout : 100 %
Ta : 25 ℃

Radiated Emission

24V

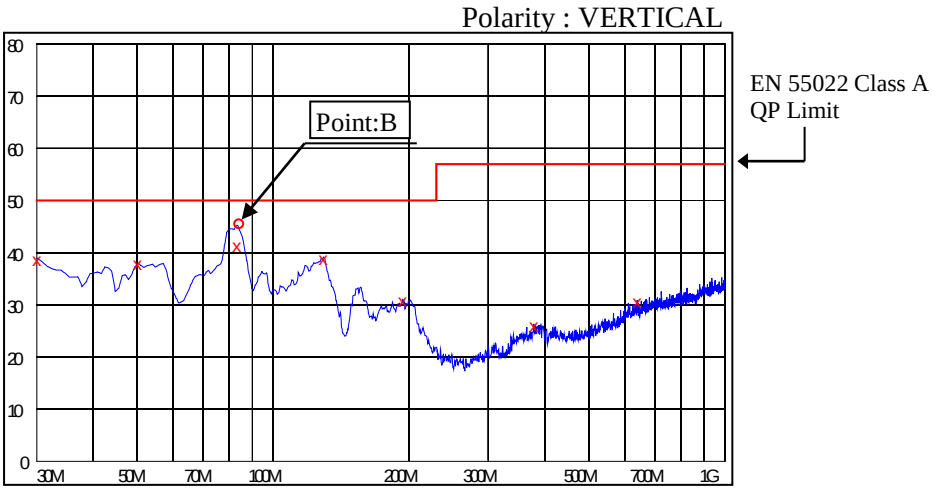
Ref. Data	Point A (129.3MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	42.5

Polarity : HORIZONTAL



Ref. Data	Point B (83.2MHz) Limit (dBuV)	Measure (dBuV)
QP	50.0	41.8

Polarity : VERTICAL



Limit of EN55011-A,VCCI-A,FCC-A are same as its EN55022 class A.

2.12 Electro-Magnetic Interference characteristics

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

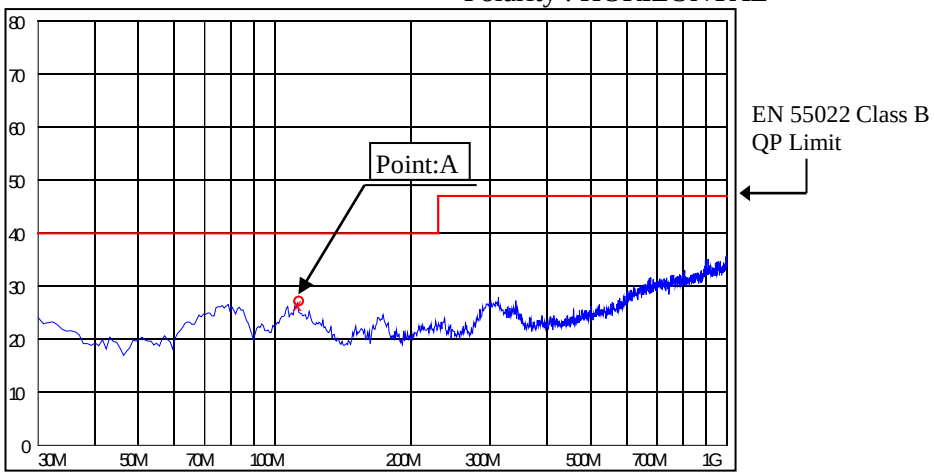
Radiated Emission

External coil :
Input : H19*13*11P DN100H(DMEGC) , 6 paired turns
Output : H19*13*11P DN100H(DMEGC) , 3 paired turns

24V

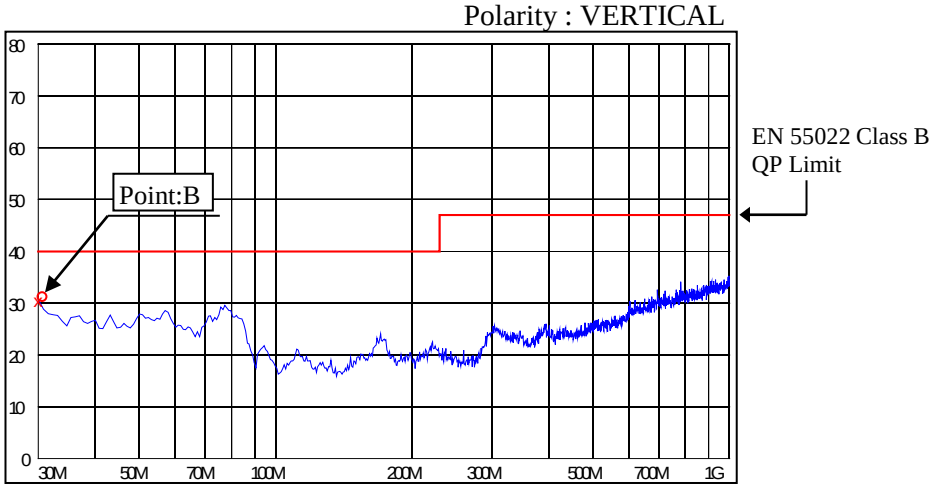
Ref. Data	Point A (112.3MHz) Limit (dBuV)	Measure (dBuV)
QP	40.0	26.8

Polarity : HORIZONTAL



Ref. Data	Point B (30MHz) Limit (dBuV)	Measure (dBuV)
QP	40.0	30.8

Polarity : VERTICAL



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

2.12 Electro-Magnetic Interference characteristics

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

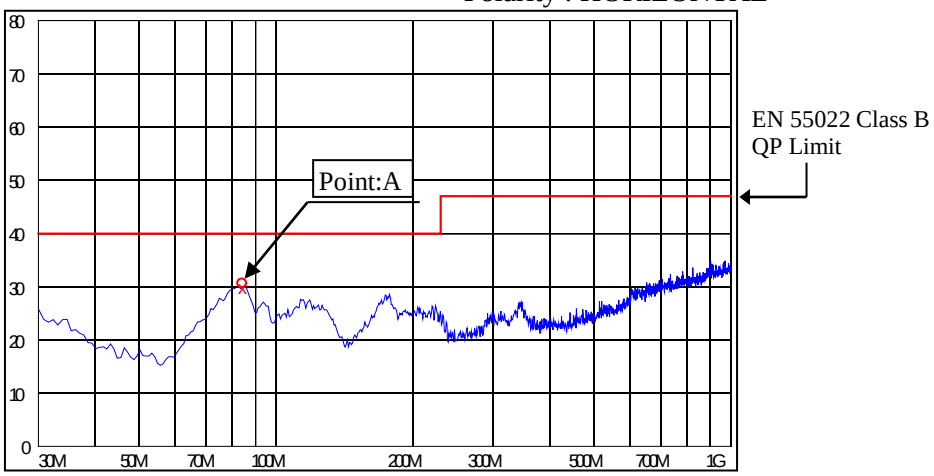
Radiated Emission

External coil :
Input : H19*13*11P DN100H(DMEGC) , 6 paired turns
Output : H19*13*11P DN100H(DMEGC) , 3 paired turns

24V

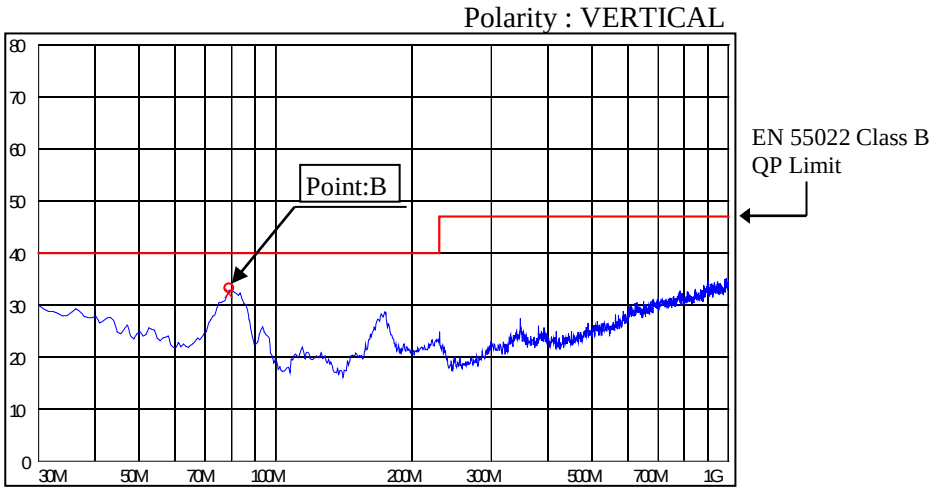
Ref. Data	Point A (84.3MHz) Limit (dBuV)	Measure (dBuV)
QP	40.0	30.1

Polarity : HORIZONTAL



Ref. Data	Point B (78.9MHz) Limit (dBuV)	Measure (dBuV)
QP	40.0	32.9

Polarity : VERTICAL



Limit of EN55011-B,VCCI-B,FCC-B are same as its EN55022 class B.

2.13 Harmonic current characteristics

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