

**DRL10-1**

**EVALUATION DATA**

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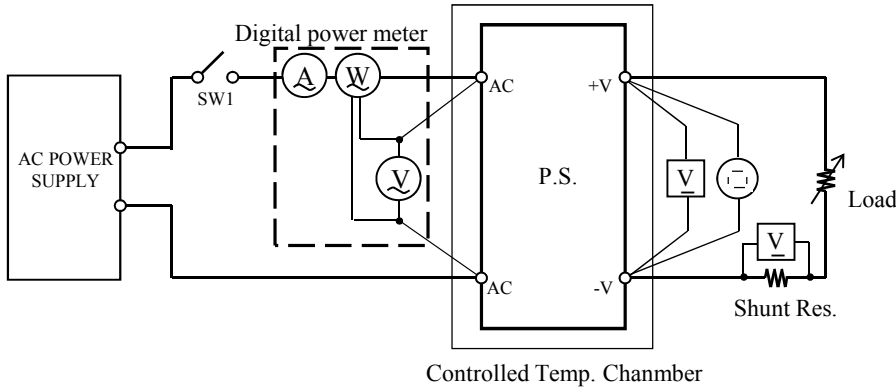
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Vin .....	Input voltage
Vout .....	Output voltage
Iin .....	Input current
Iout .....	Output current
Ta .....	Ambient temperature
f .....	Frequency

1. Evaluation Method

1.1 Circuit used for determination

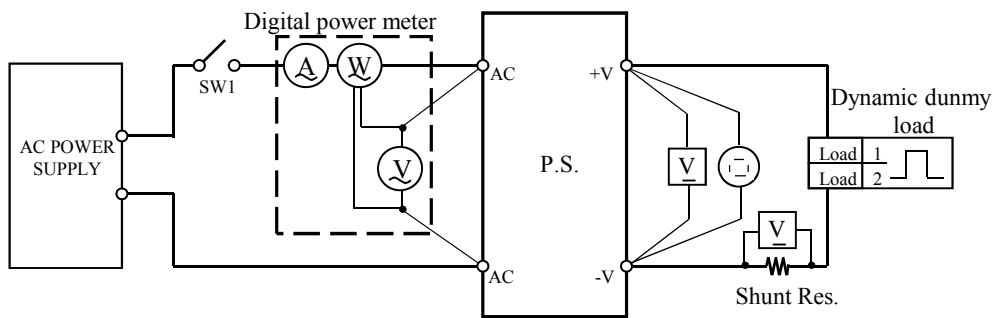
Circuit 1 used for determination

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

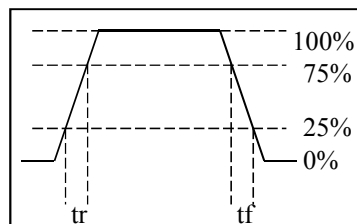


Circuit 2 used for determination

- Dynamic load response characteristics

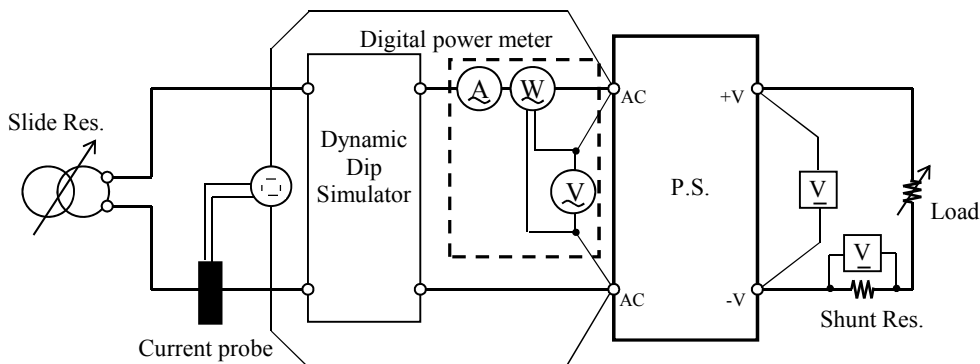


Output current waveform

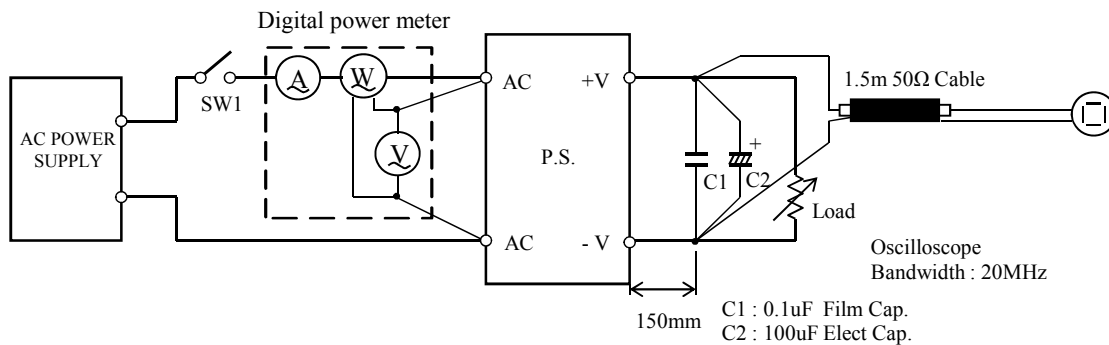


Circuit 3 used for determination

- Inrush current waveform



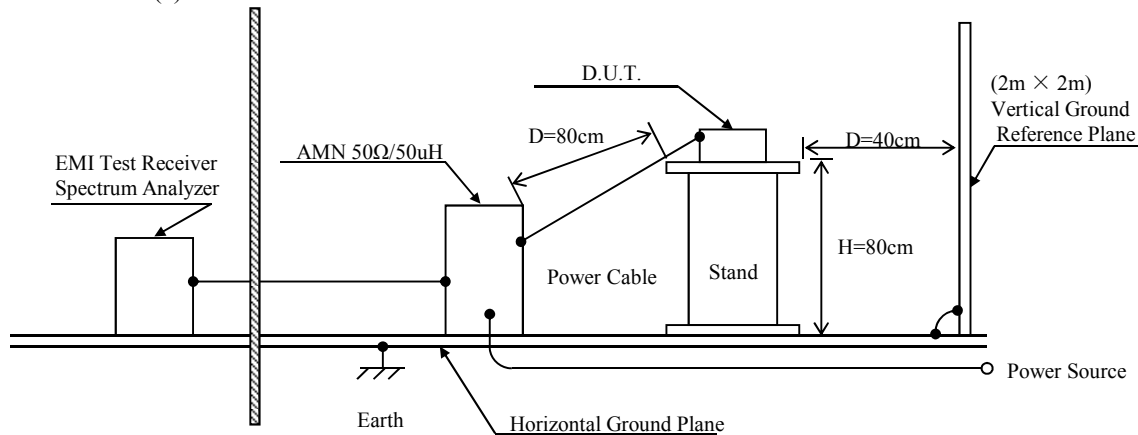
- Output ripple and noise waveform



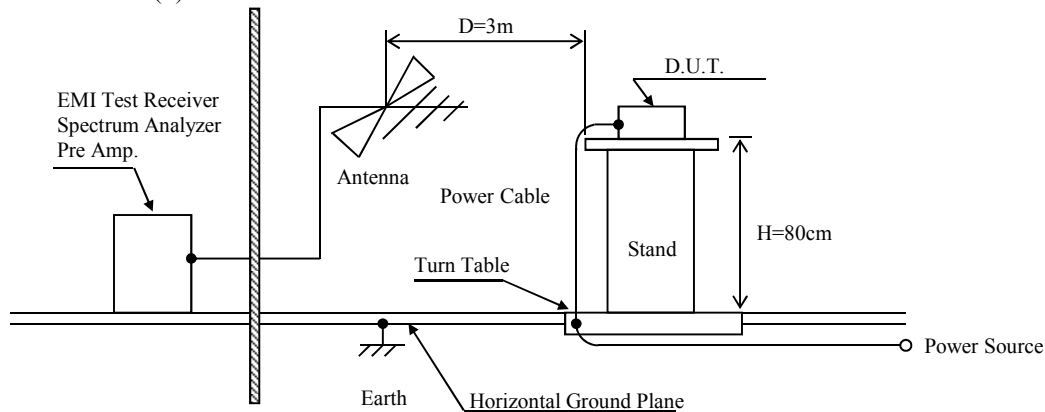
Configuration used for determination

- 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

12V
-----

##### 1. Regulation - line and load

Condition Ta : 25 °C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	12.001V	12.002V	12.002V	12.001V	1mV	0.008%
50%	11.999V	11.999V	11.998V	11.998V	1mV	0.008%
100%	11.996V	11.995V	11.995V	11.995V	1mV	0.008%
load regulation	5mV	7mV	7mV	6mV		
	0.042%	0.058%	0.058%	0.050%		

##### 2. Temperature drift

Conditions Vin : 115 VAC

Iout : 100 %

Ta	-20°C	+25°C	+71°C	temperature stability	
Vout	11.949V	11.995V	11.989V	46mV	0.383%

##### 3. Start up voltage and Drop out voltage

Conditions Ta : 25 °C

Iout : 100 %

Start up voltage (Vin)	52.0VAC
Drop out voltage (Vin)	59.0VAC

24V
-----

##### 1. Regulation - line and load

Condition Ta : 25 °C

Iout \ Vin	85VAC	115VAC	230VAC	265VAC	line regulation	
0%	23.788V	23.786V	23.786V	23.788V	2mV	0.008%
50%	23.786V	23.786V	23.786V	23.786V	0mV	0.000%
100%	23.784V	23.785V	23.785V	23.785V	1mV	0.004%
load regulation	4mV	1mV	1mV	3mV		
	0.017%	0.004%	0.004%	0.013%		

##### 2. Temperature drift

Conditions Vin : 115 VAC

Iout : 100 %

Ta	-20°C	+25°C	+71°C	temperature stability	
Vout	23.691V	23.785V	23.781V	94mV	0.392%

##### 3. Start up voltage and Drop out voltage

Conditions Ta : 25 °C

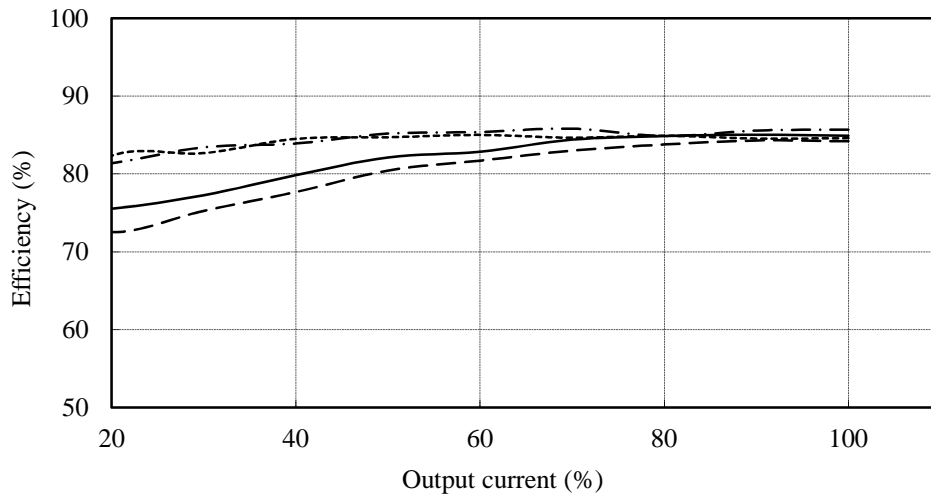
Iout : 100 %

Start up voltage (Vin)	41.0VAC
Drop out voltage (Vin)	40.0VAC

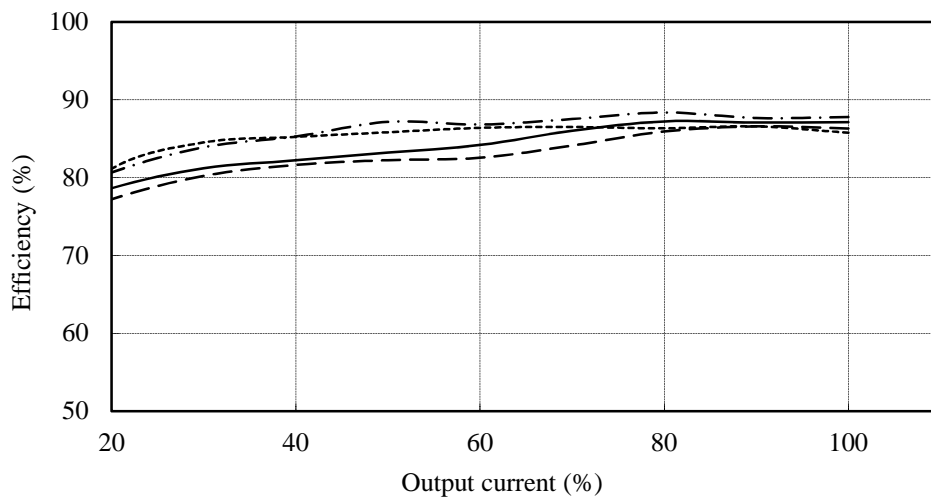
(2) Efficiency vs. Output current

Conditions Vin : 85 VAC -----  
 : 115 VAC -.-.-.-  
 : 230 VAC ————  
 : 265 VAC - - - -  
 Ta : 25 °C

12V



24V



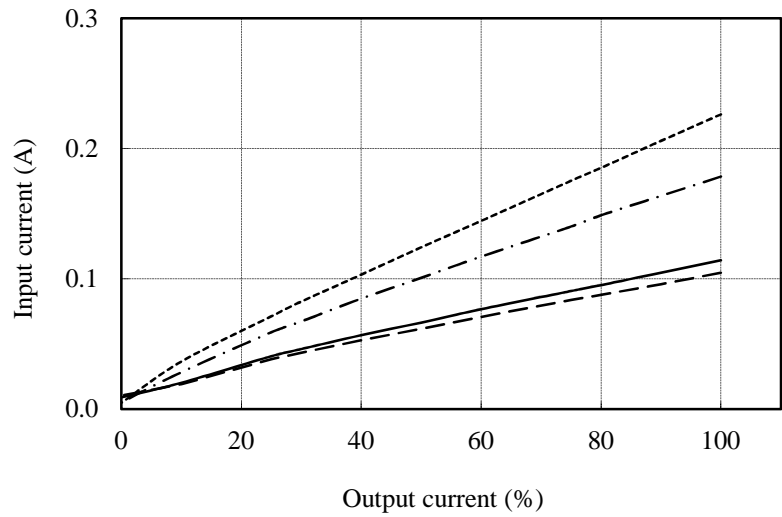
**(3) Input current vs. Output current**

Conditions Vin : 85 VAC -----  
 : 115 VAC -.-.-.-  
 : 230 VAC ————  
 : 265 VAC - - - -  
 Ta : 25 °C

12V

Io: 100%

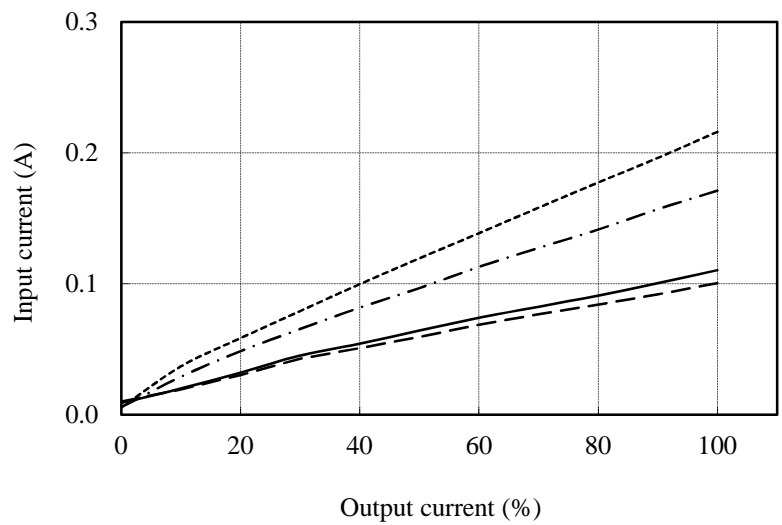
Vin	Input current
85VAC	0.226A
115VAC	0.179A
230VAC	0.114A
265VAC	0.105A



24V

Io: 100%

Vin	Input current
85VAC	0.216A
115VAC	0.171A
230VAC	0.110A
265VAC	0.100A





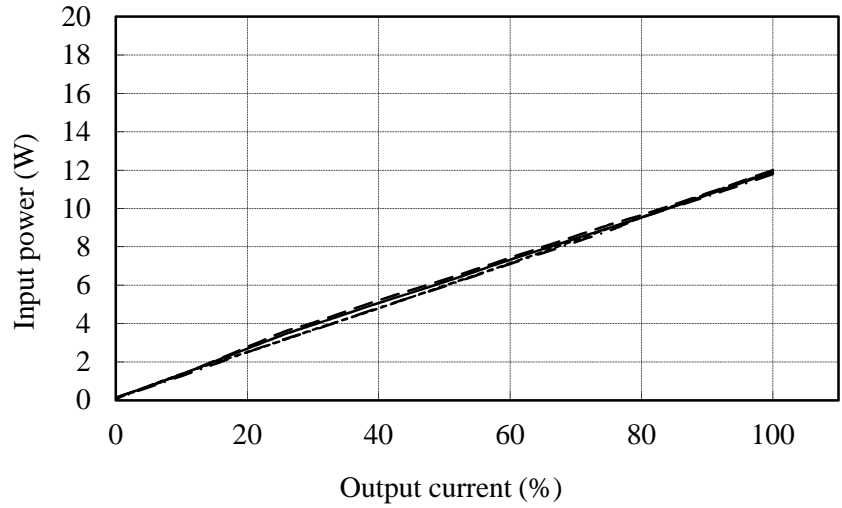
(4) Input power vs. Output current

Conditions Vin : 85 VAC -----  
 : 115 VAC -.-.-.  
 : 230 VAC ———  
 : 265 VAC - - - -  
 Ta : 25 °C

12V

Io: 100%

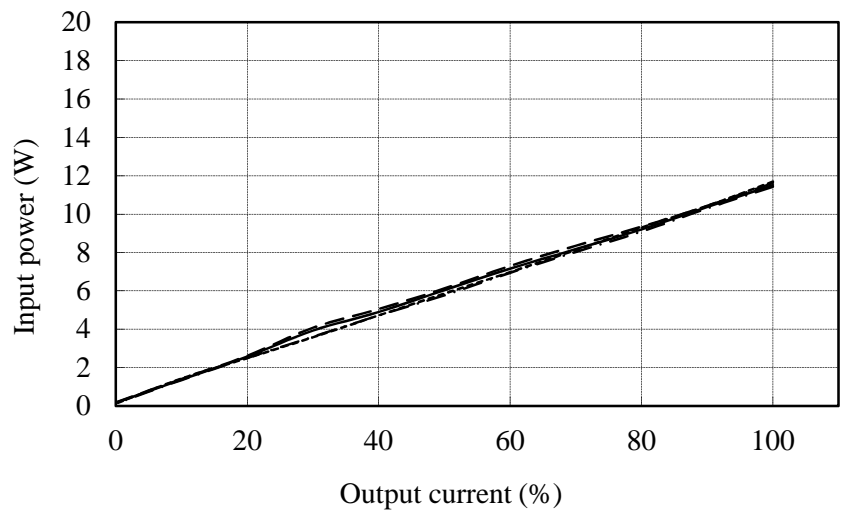
Vin	Input power
85VAC	11.95W
115VAC	11.80W
230VAC	11.90W
265VAC	12.00W



24V

Io: 100%

Vin	Input power
85VAC	11.70W
115VAC	11.43W
230VAC	11.51W
265VAC	11.62W

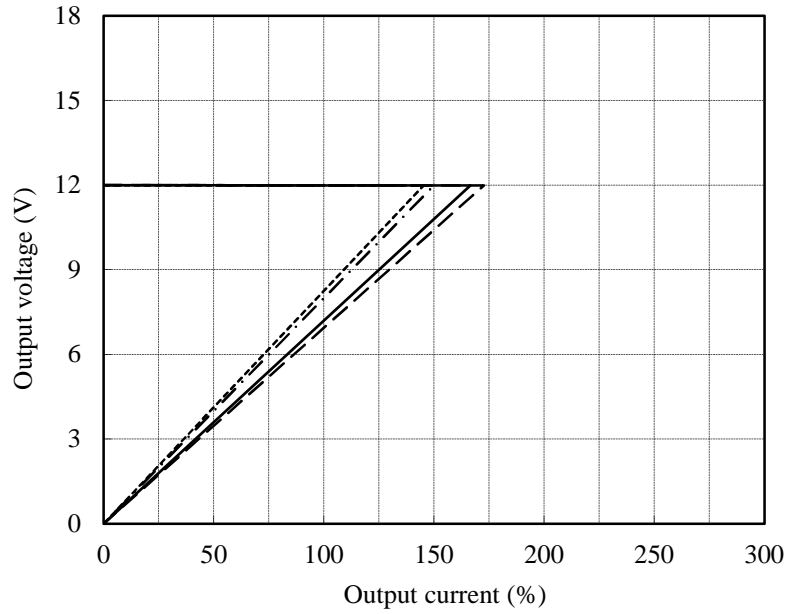


## 2.2 Over current protection (OCP) characteristics

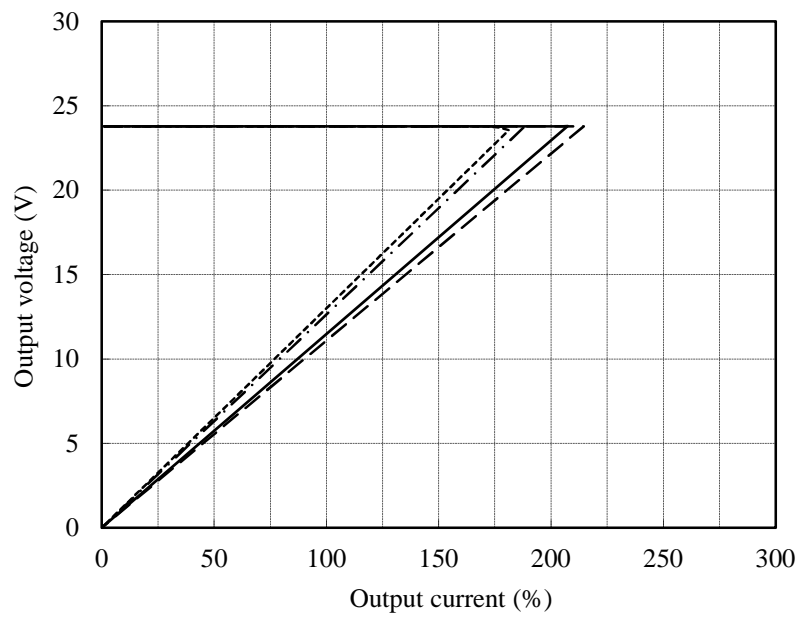
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Conditions Vin : 85 VAC -----  
115 VAC -.-.-.-  
230 VAC ————  
265 VAC - - - -  
Ta : 25 °C

12V



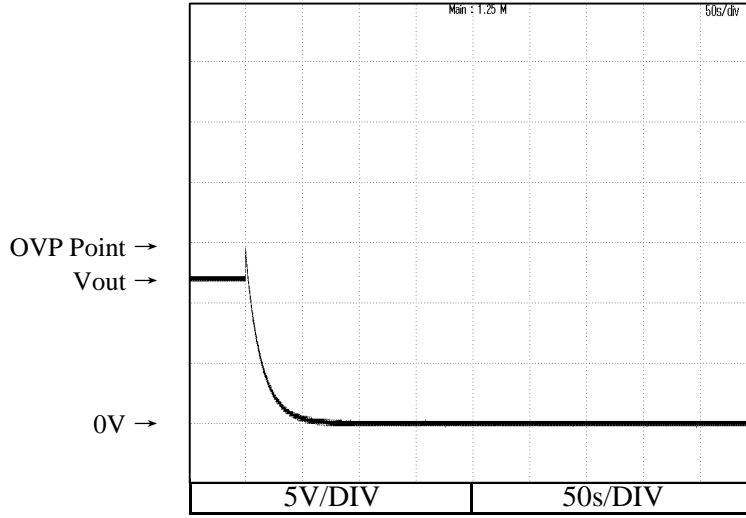
24V



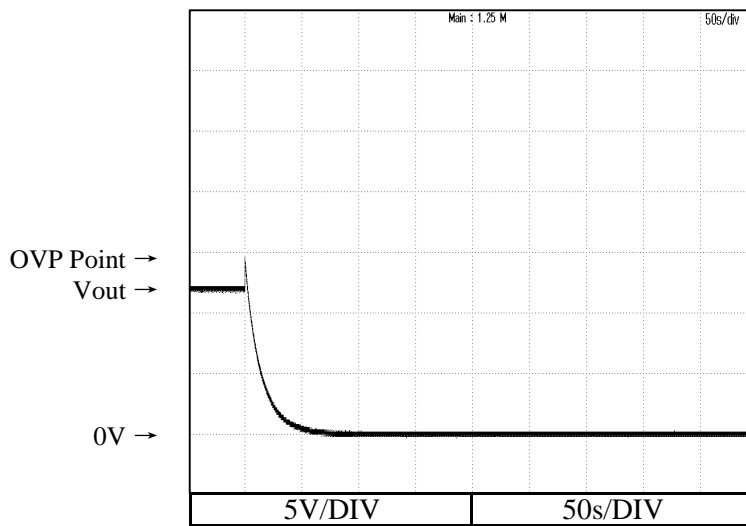
### 2.3 Over voltage protection (OVP) characteristics

Conditions Vin : 115 VAC  
Iout : 0 %  
Ta : 25 °C

12V



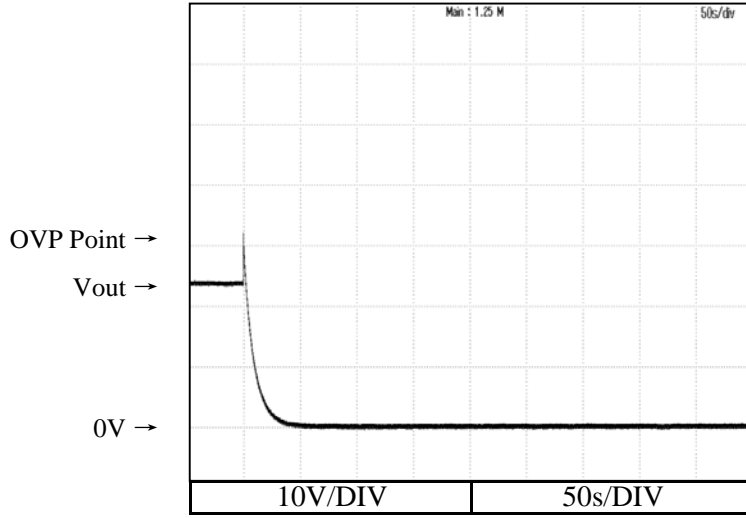
Conditions Vin : 230 VAC  
Iout : 0 %  
Ta : 25 °C



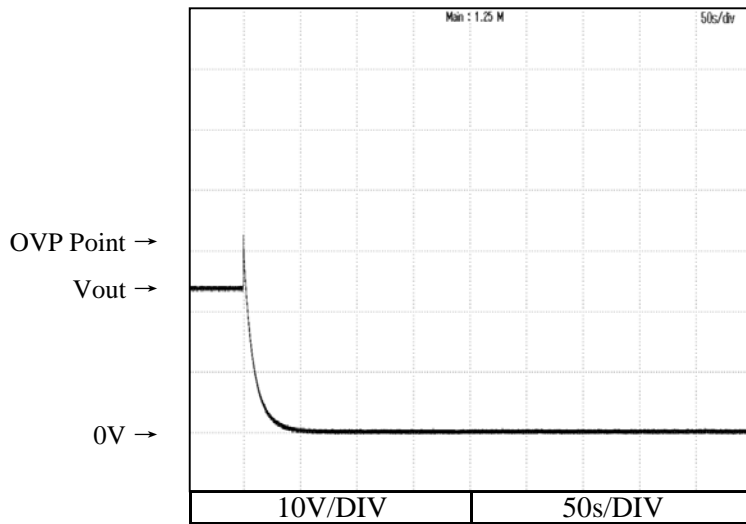
### 2.3 Over voltage protection (OVP) characteristics

Conditions Vin : 115 VAC  
Iout : 0 %  
Ta : 25 °C

24V



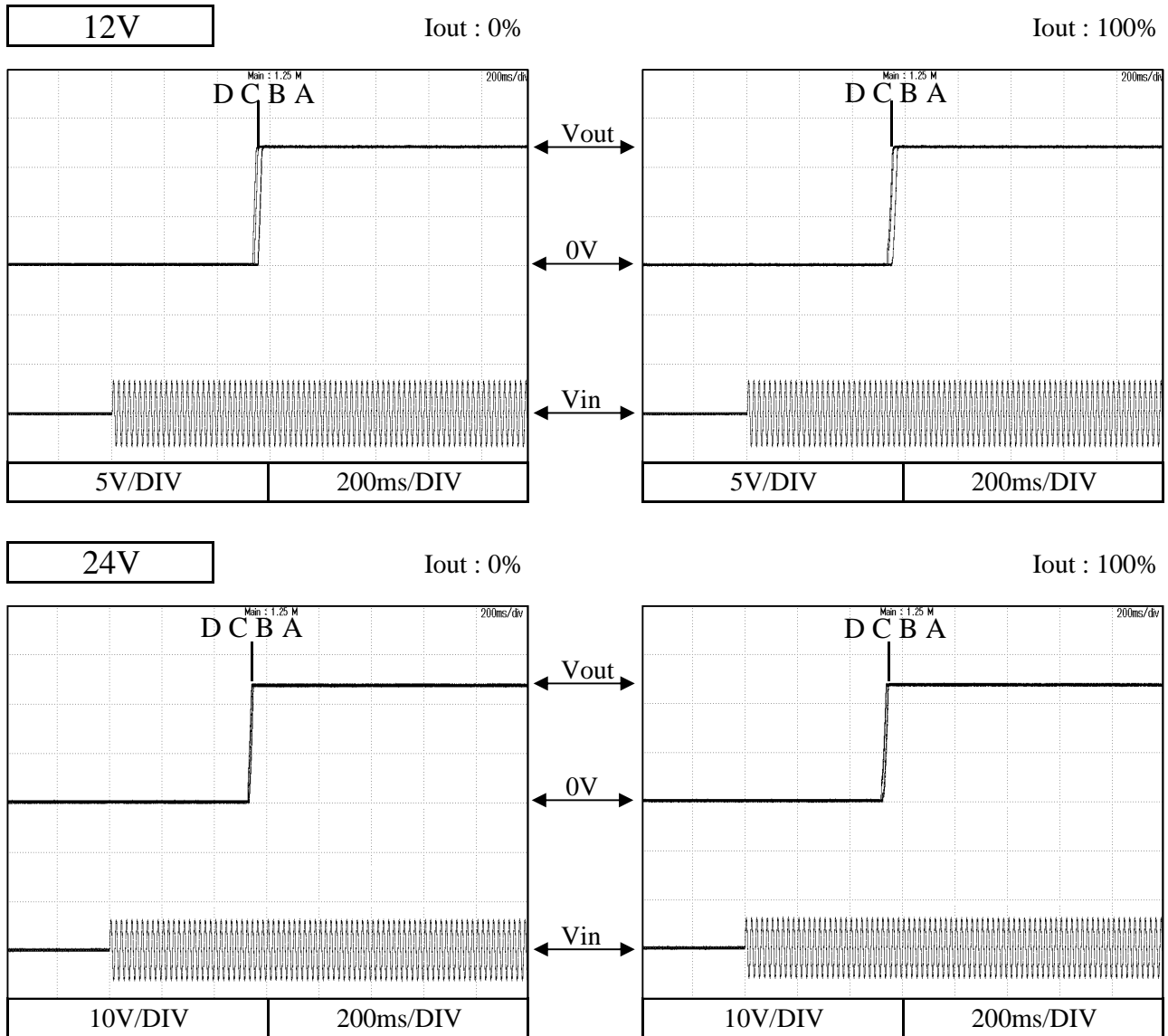
Conditions Vin : 230 VAC  
Iout : 0 %  
Ta : 25 °C



## 2.4 Output rise characteristics

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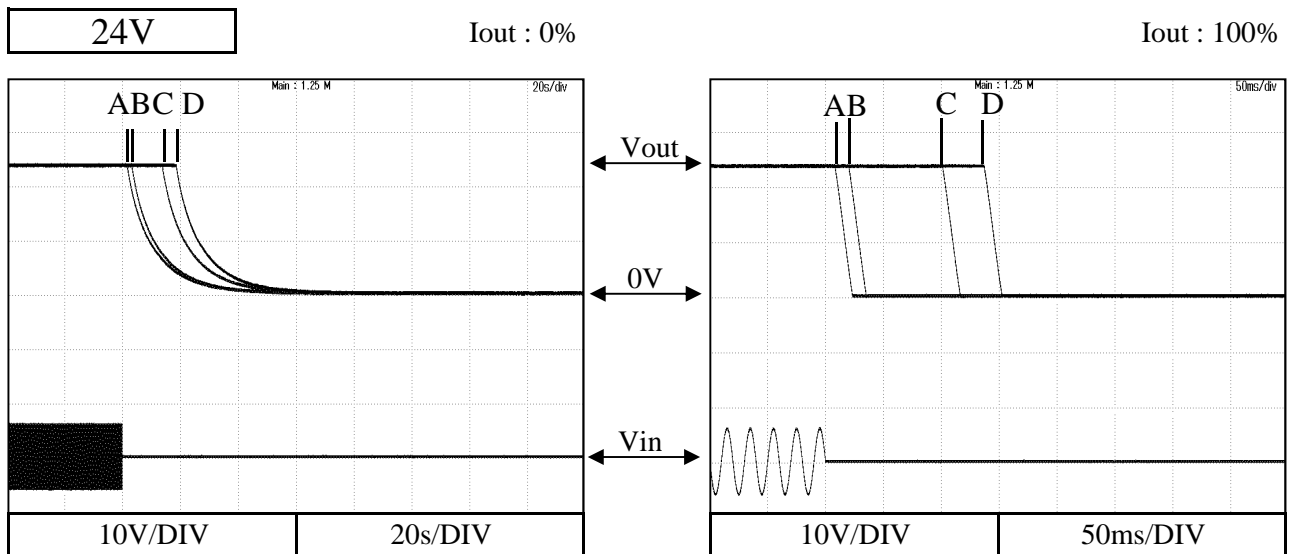
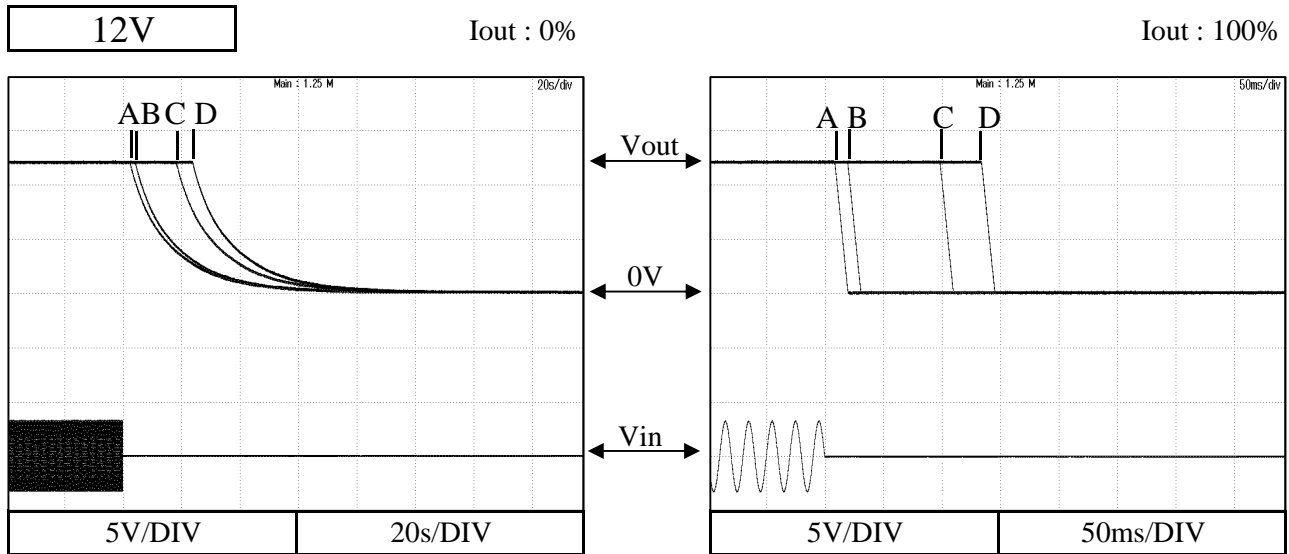
Conditions Vin : 85 VAC (A)  
 115 VAC (B)  
 230 VAC (C)  
 265 VAC (D)  
 Ta : 25 °C



## 2.5 Output fall characteristics

DRL10-1

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

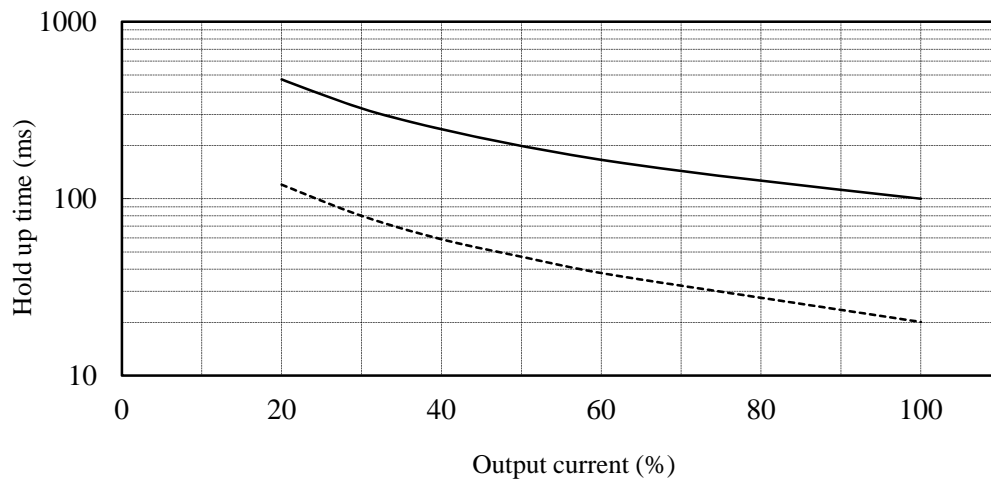


## 2.6 Hold up time characteristics

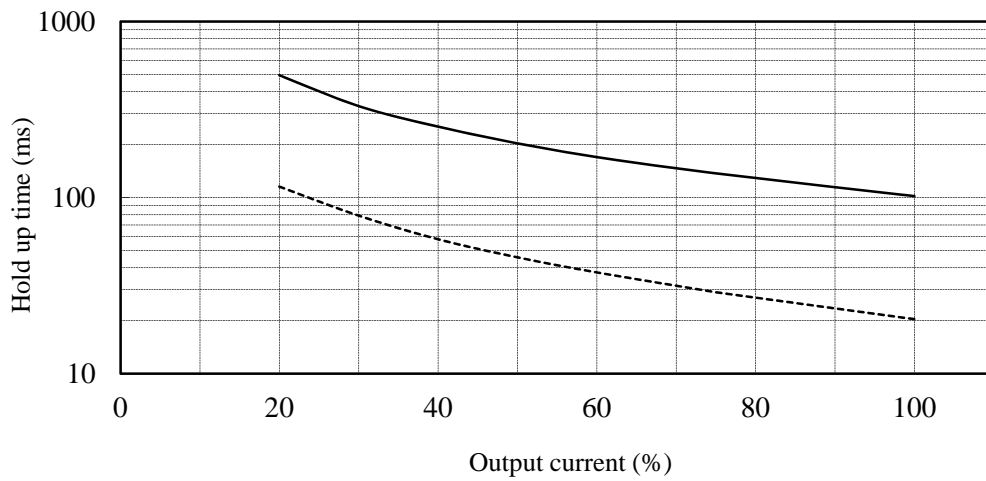
DRL10-1

Conditions  $V_{in}$  : 115 VAC -----  
                  230 VAC ————  
 $T_a$  : 25 °C

12V



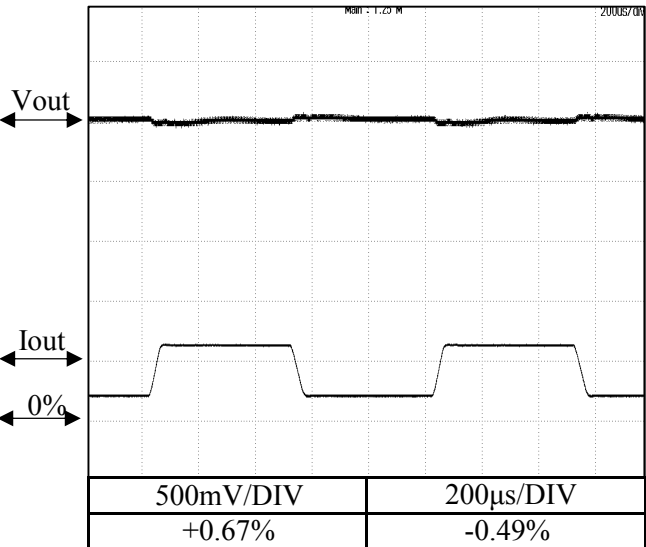
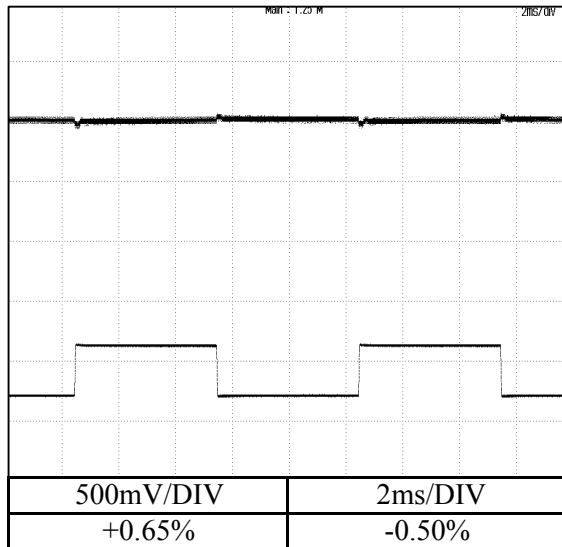
24V



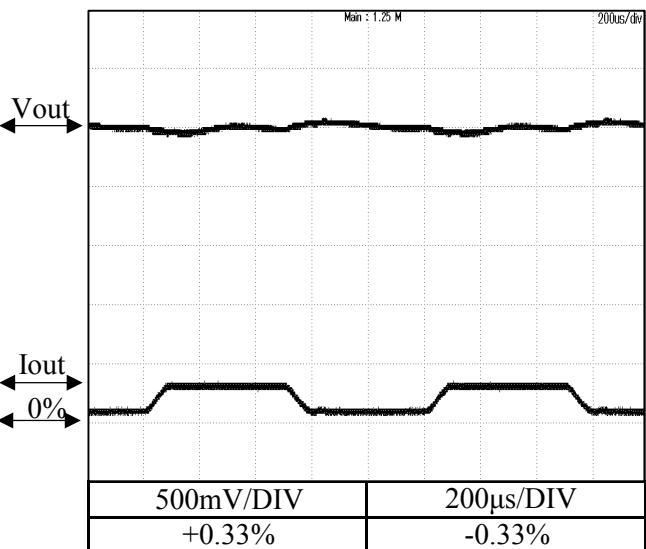
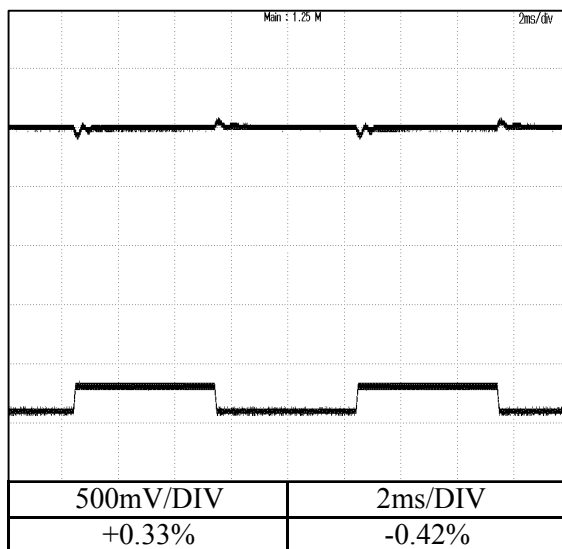
2.7 Dynamic load response characteristics

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

12V



24V

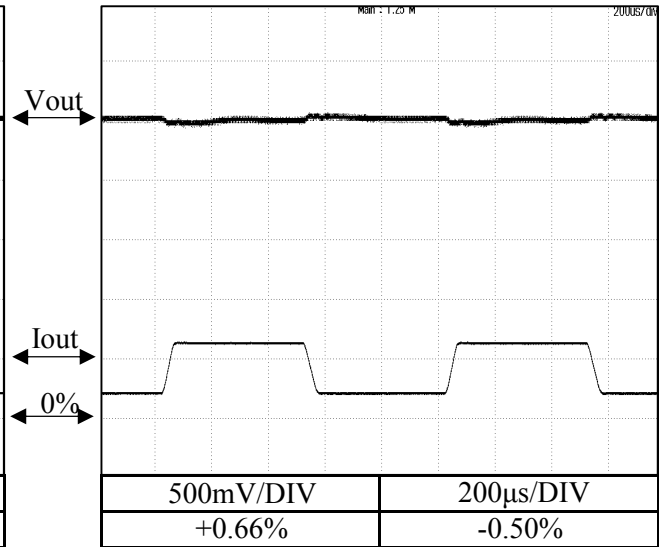
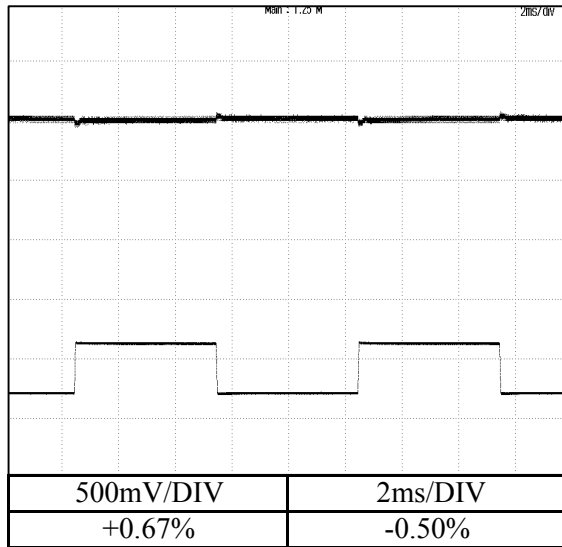




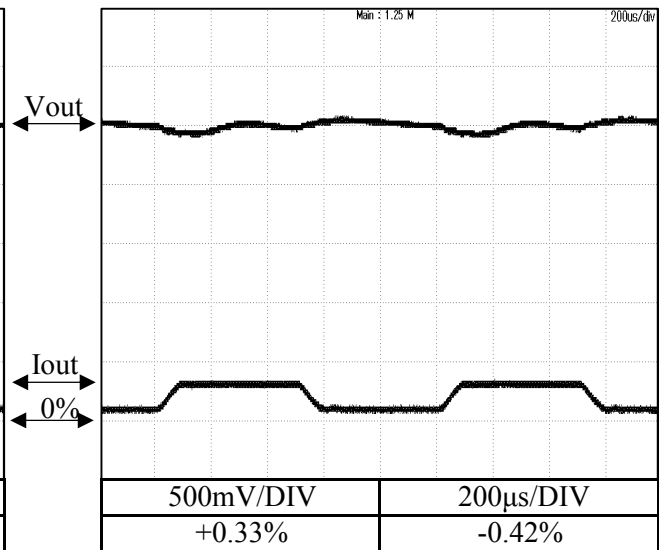
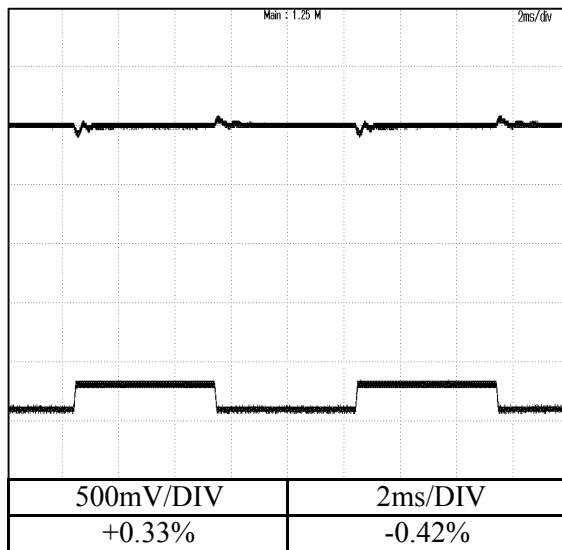
2.7 Dynamic load response characteristics

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

12V



24V



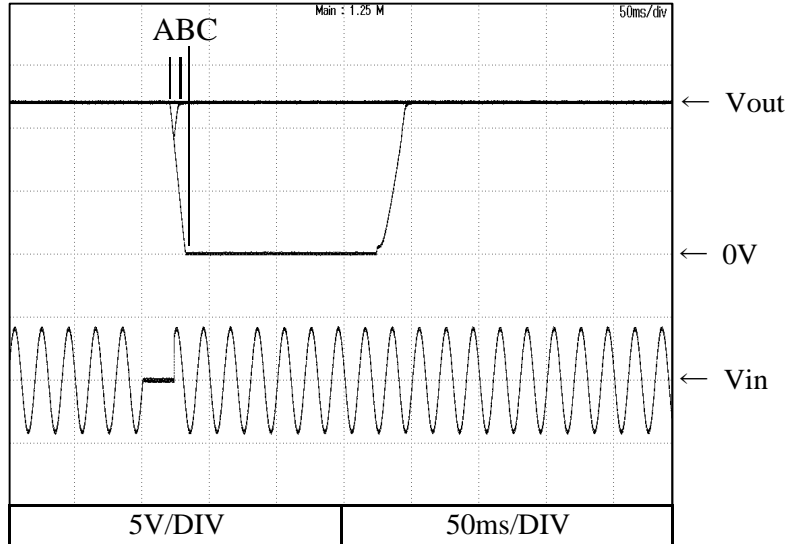
2.8 Response to brown out characteristics

Conditions Vin : 115 VAC  
 Iout : 100 %  
 Ta : 25 °C

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

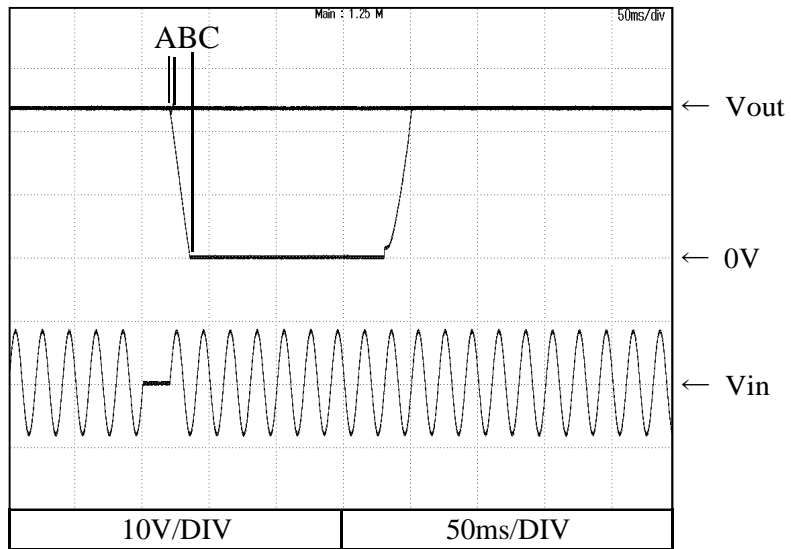
12V

- A = 18ms
- B = 23ms
- C = 37ms



24V

- A=18ms
- B=19ms
- C=39ms



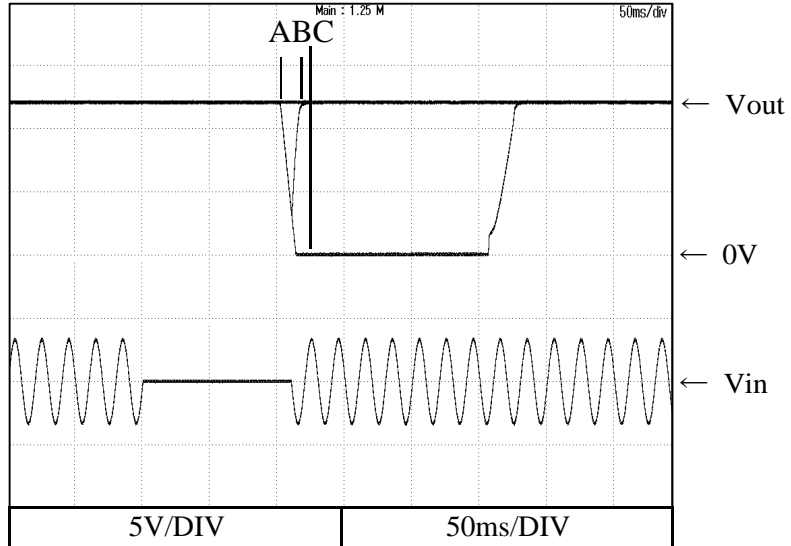
2.8 Response to brown out characteristics

Conditions Vin : 230 VAC  
 Iout : 100 %  
 Ta : 25 °C

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

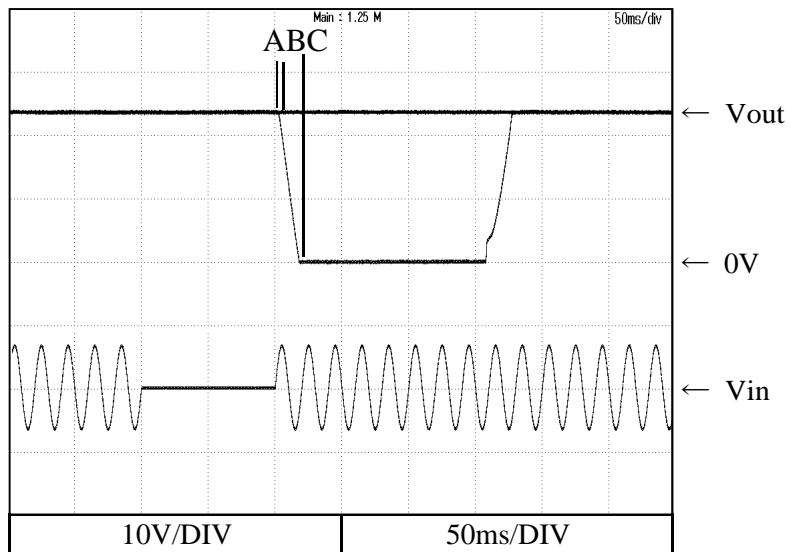
12V

- A = 100ms
- B = 110ms
- C = 119ms



24V

- A=102ms
- B=103ms
- C=120ms

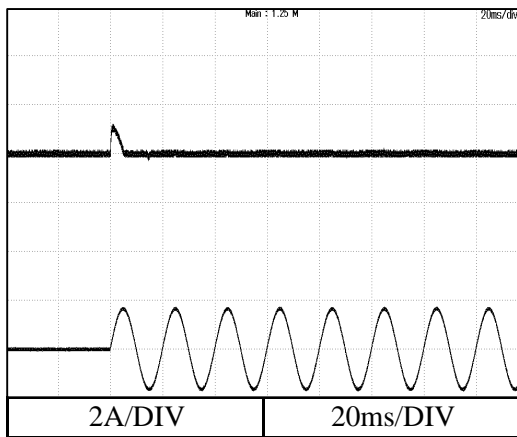


2.9 Inrush current waveform

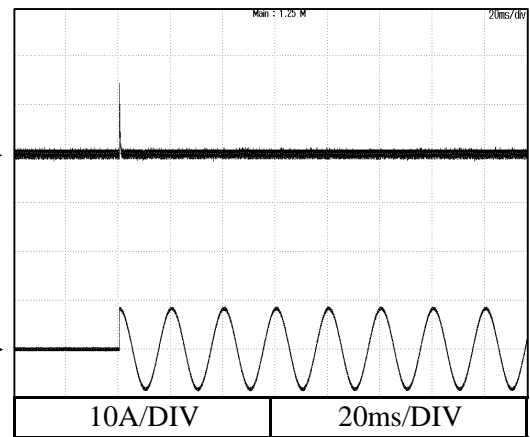
12V

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

Switch on phase angle of input AC voltage  
 $\phi = 0^\circ$

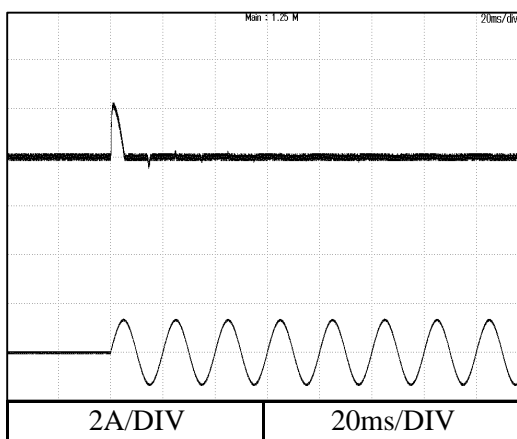


Switch on phase angle of input AC voltage  
 $\phi = 90^\circ$

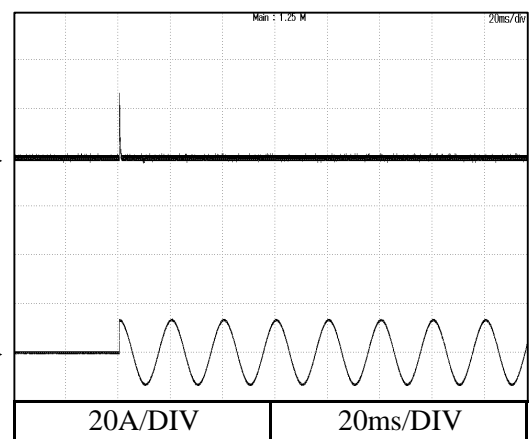


Conditions Vin : 230 VAC  
 Iout : 100 %  
 Ta : 25 °C  
 (Cold start)

Switch on phase angle of input AC voltage  
 $\phi = 0^\circ$



Switch on phase angle of input AC voltage  
 $\phi = 90^\circ$

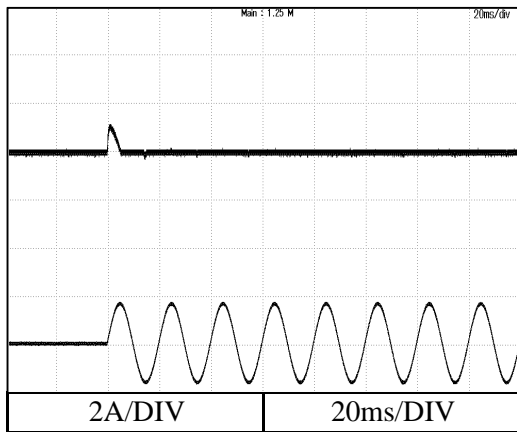


2.9 Inrush current waveform

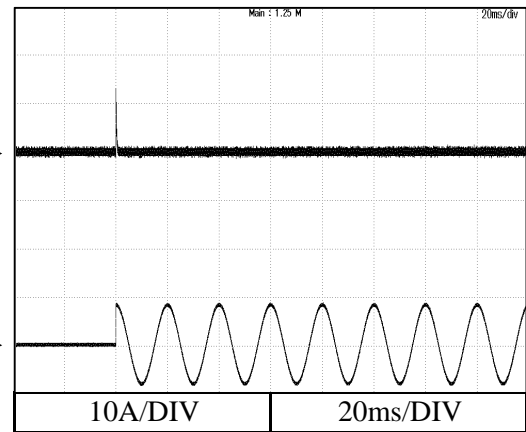
24V

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

Switch on phase angle of input AC voltage  
 $\phi = 0^\circ$

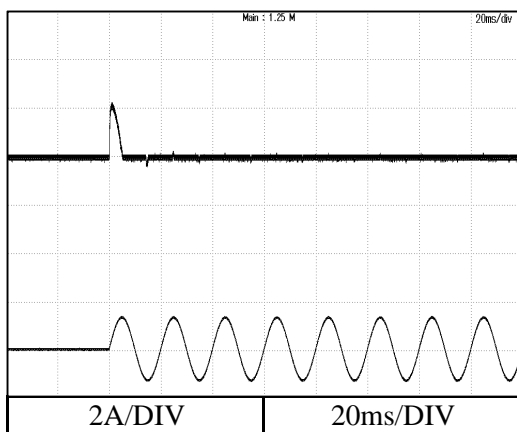


Switch on phase angle of input AC voltage  
 $\phi = 90^\circ$

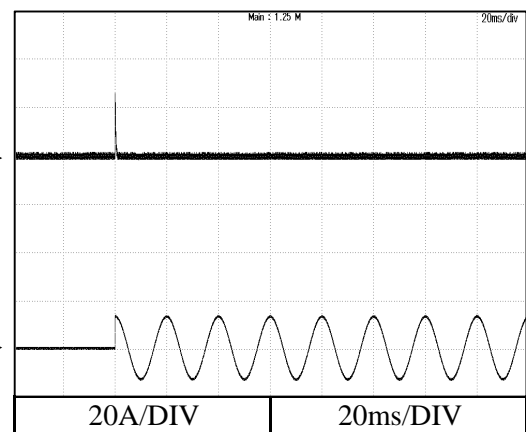


Conditions Vin : 230 VAC  
 Iout : 100 %  
 Ta : 25 °C  
 (Cold start)

Switch on phase angle of input AC voltage  
 $\phi = 0^\circ$



Switch on phase angle of input AC voltage  
 $\phi = 90^\circ$



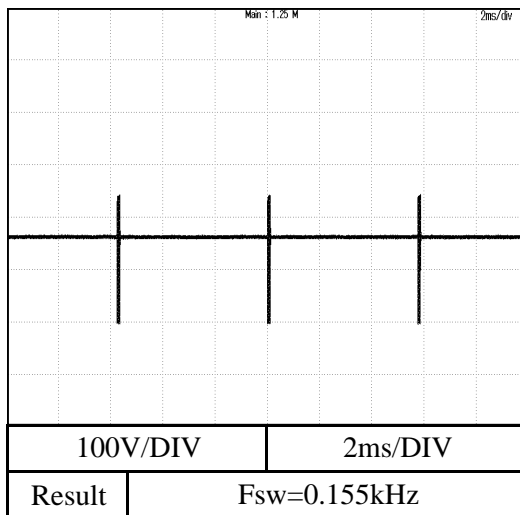
2.10 Switching frequency

12V

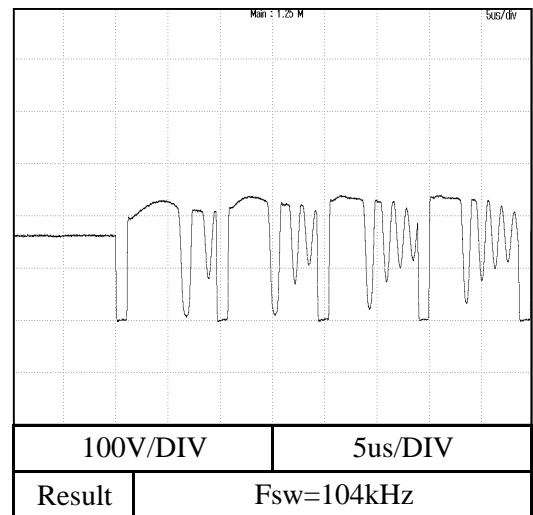
Condition : 25 °C

Conditions: Vin = 115Vac, load = 0%

Conditions: Vin = 115Vac, load = 0%

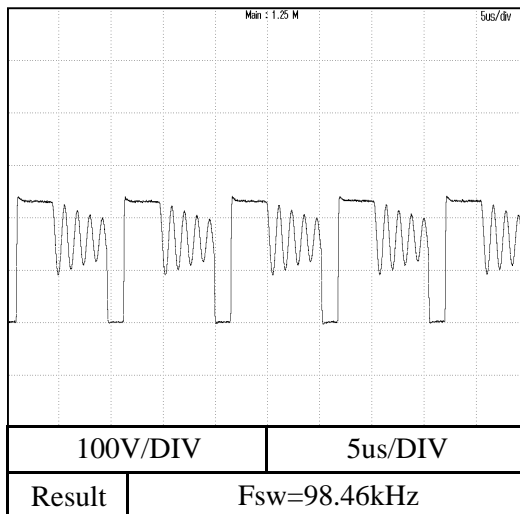


Zoom  
Vds  
0V

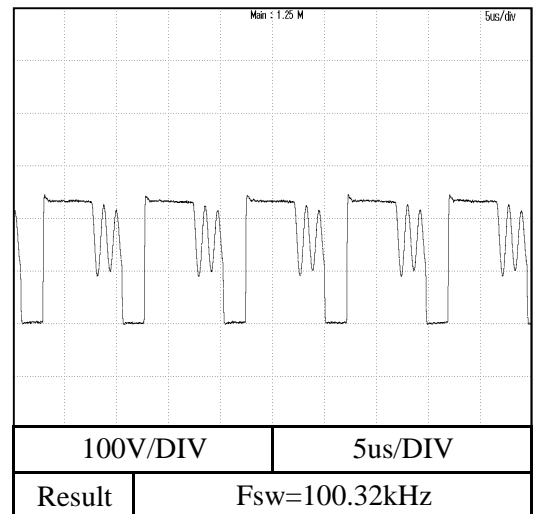


Conditions: Vin = 115Vac, load = 50%

Conditions: Vin = 115Vac, load = 100%



Vds  
0V

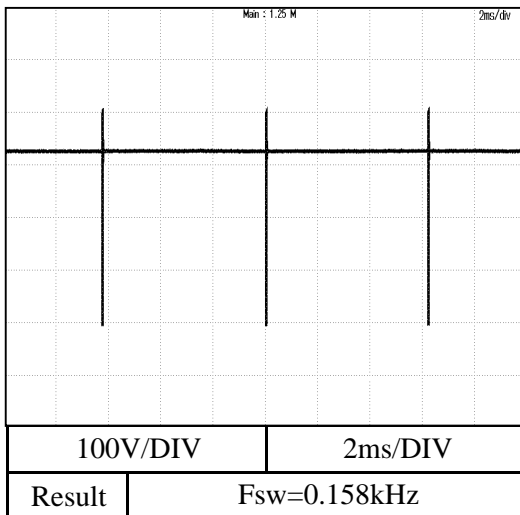


2.10 Switching frequency

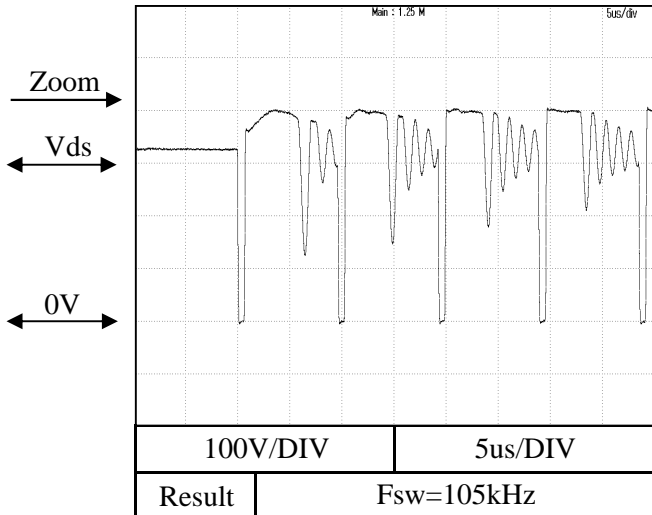
12V

Condition : 25 °C

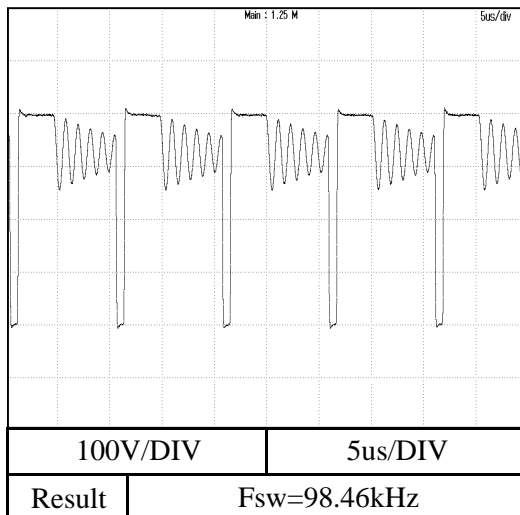
Conditions: Vin = 230Vac, load = 0%



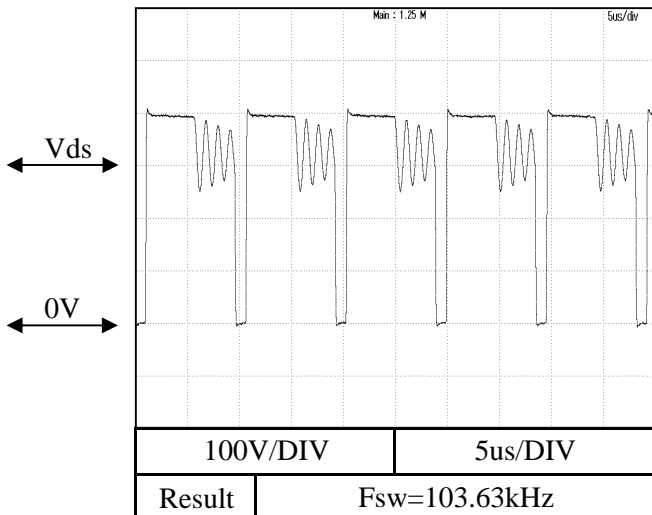
Conditions: Vin = 230Vac, load = 0%



Conditions: Vin = 230Vac, load = 50%



Conditions: Vin = 230Vac, load = 100%



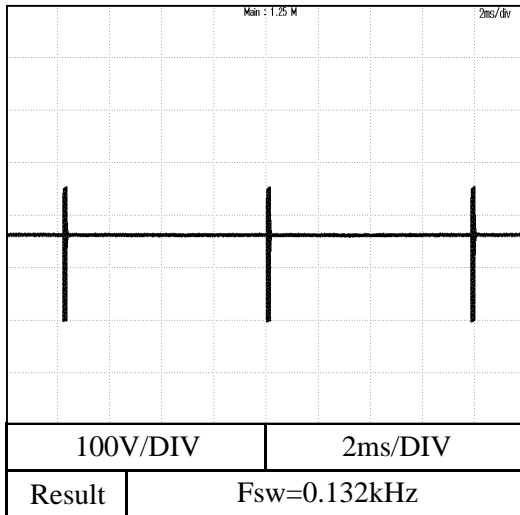
2.10 Switching frequency

24V

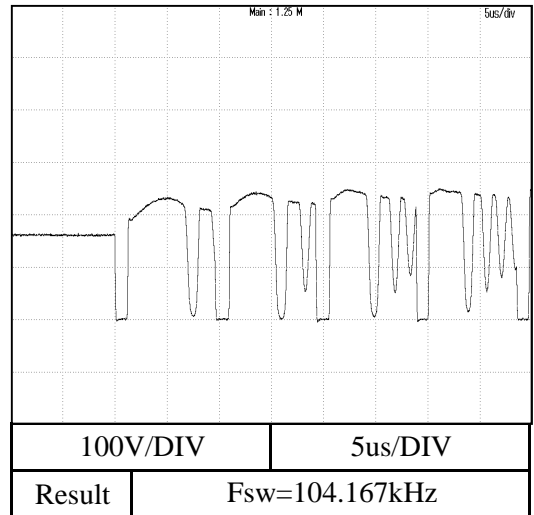
Condition : 25 °C

Conditions: Vin = 115Vac, load = 0%

Conditions: Vin = 115Vac, load = 0%

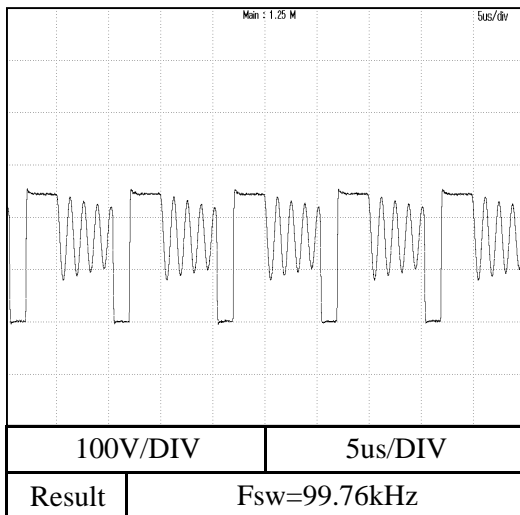


Zoom  
Vds  
0V

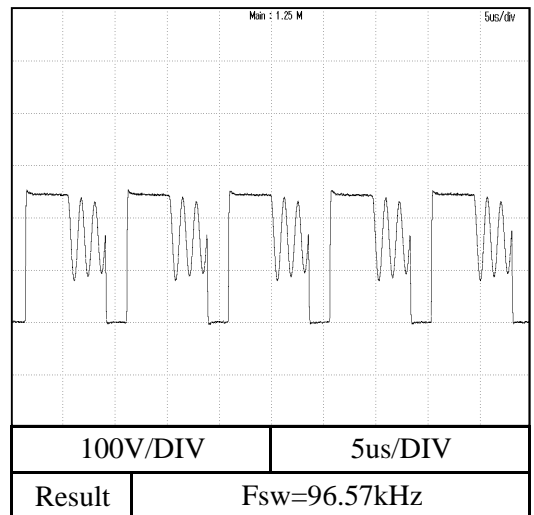


Conditions: Vin = 115Vac, load = 50%

Conditions: Vin = 115Vac, load = 100%



Vds  
0V





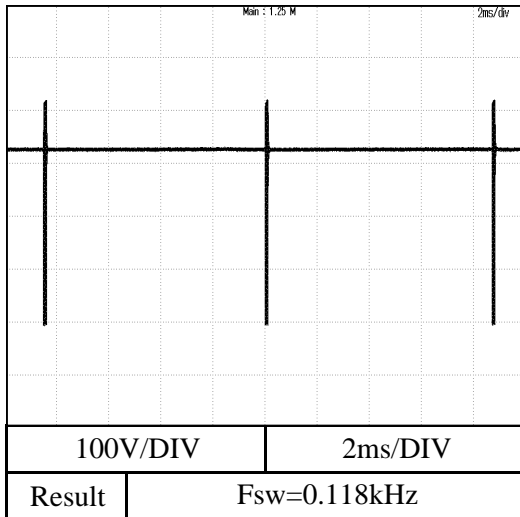
2.10 Switching frequency

24V

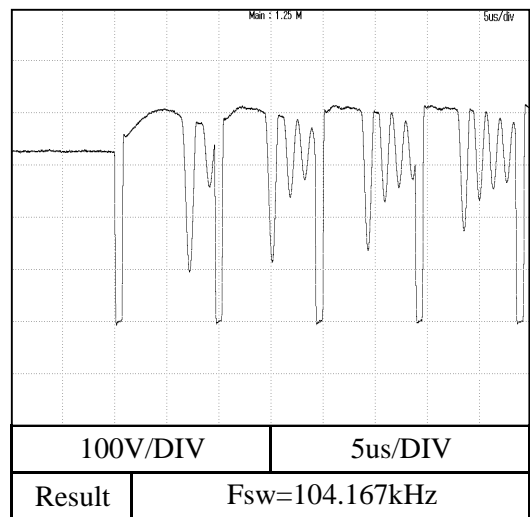
Condition : 25 °C

Conditions: Vin = 230Vac, load = 0%

Conditions: Vin = 230Vac, load = 0%

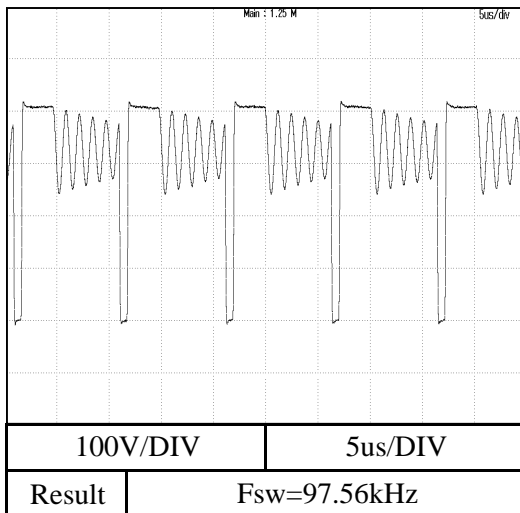


Zoom  
Vds  
0V

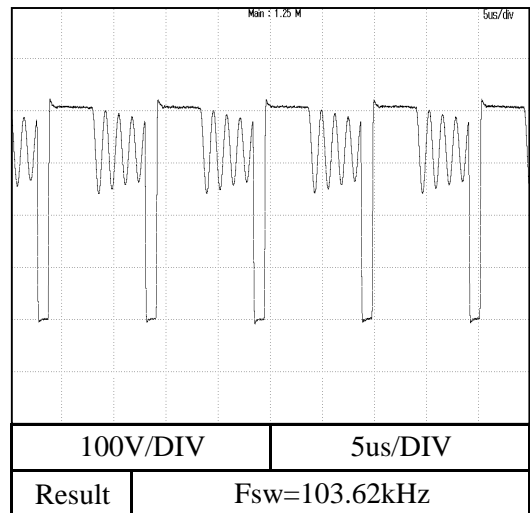


Conditions: Vin = 230Vac, load = 50%

Conditions: Vin = 230Vac, load = 100%



Vds  
0V

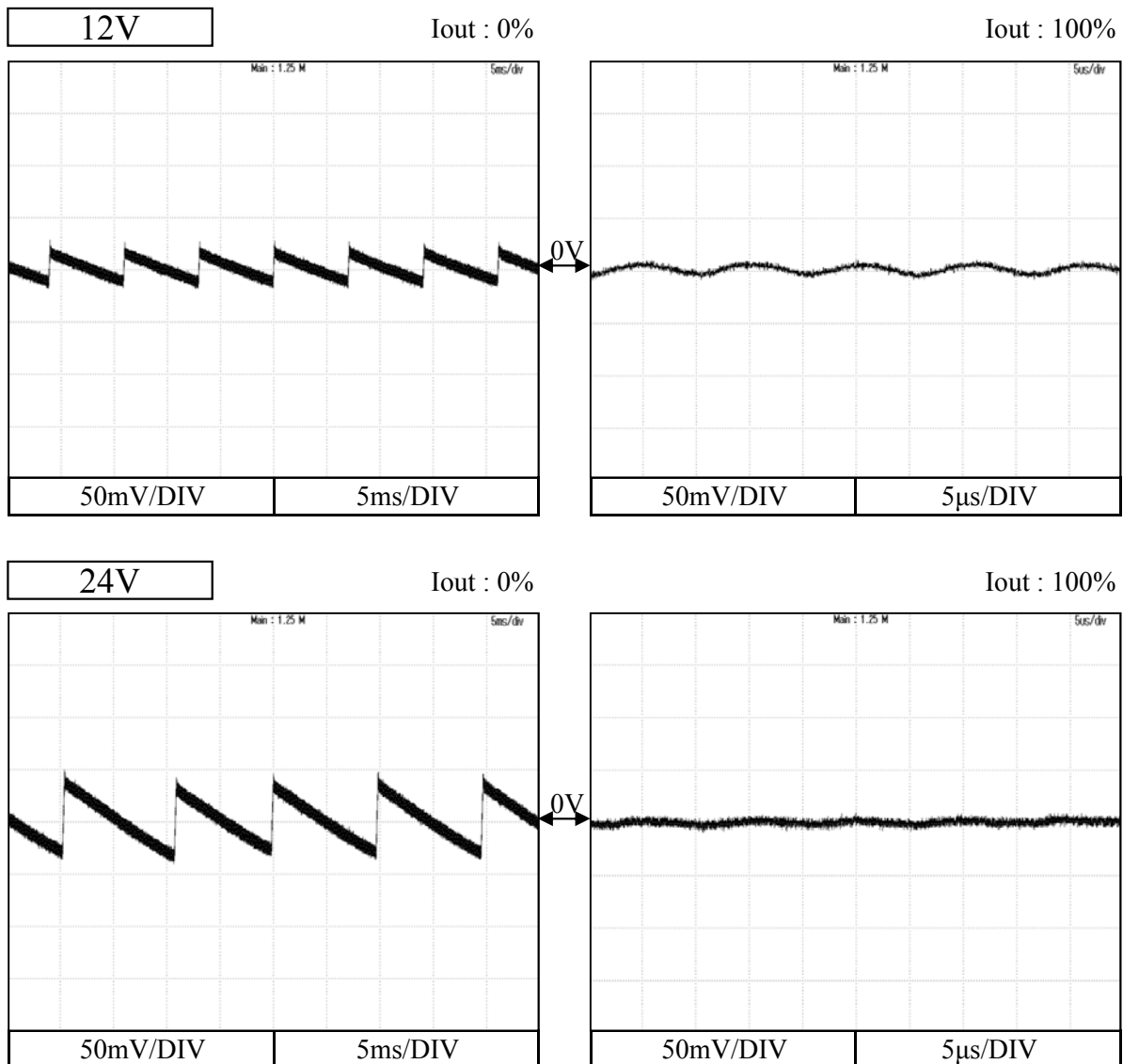


2.11 Output ripple and noise waveform

Conditions

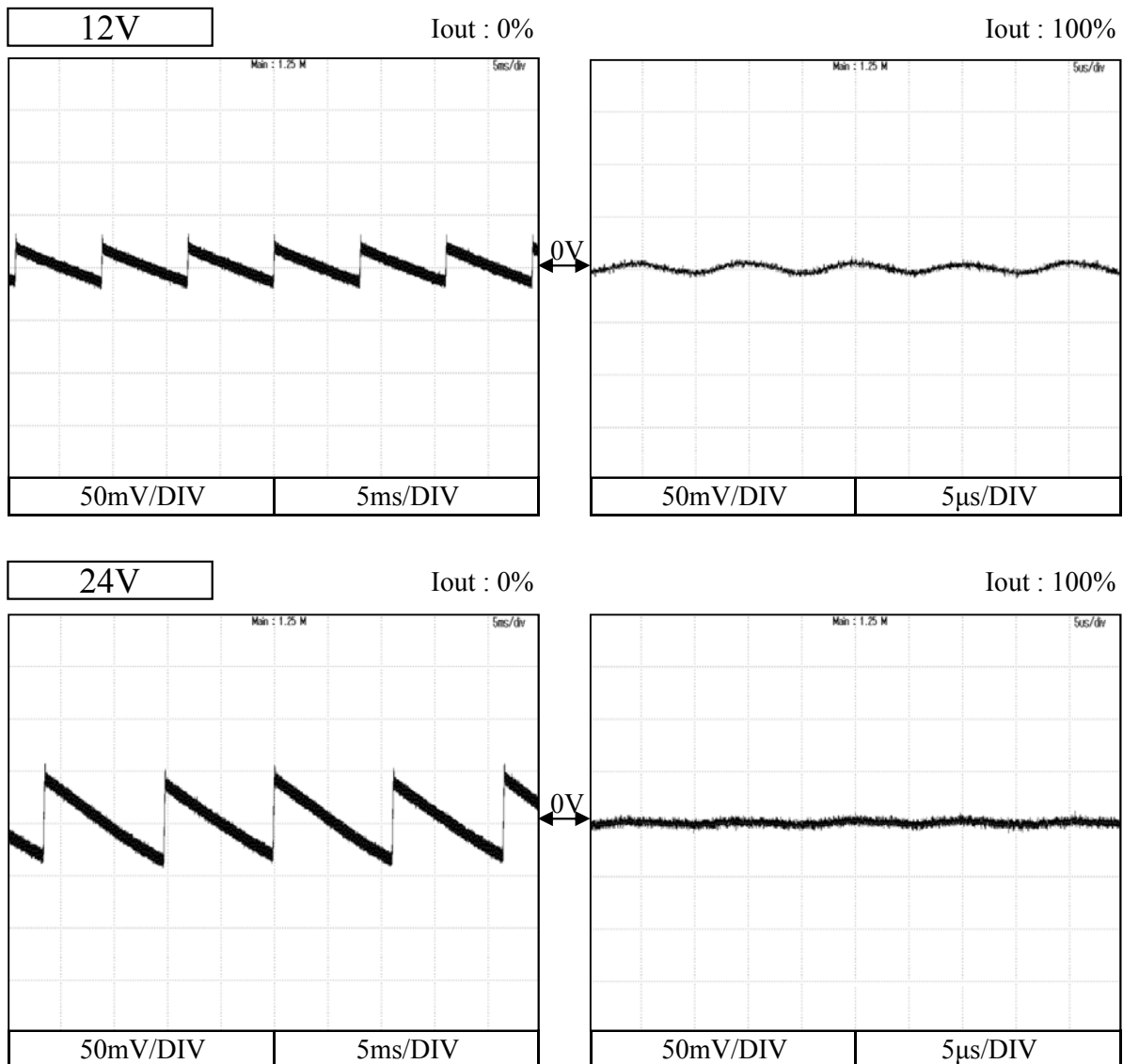
Vin : 115 VAC

Ta : 25 °C



2.11 Output ripple and noise waveform

Conditions Vin : 230 VAC  
Ta : 25 °C



2.12 Electro-Magnetic Interference characteristics

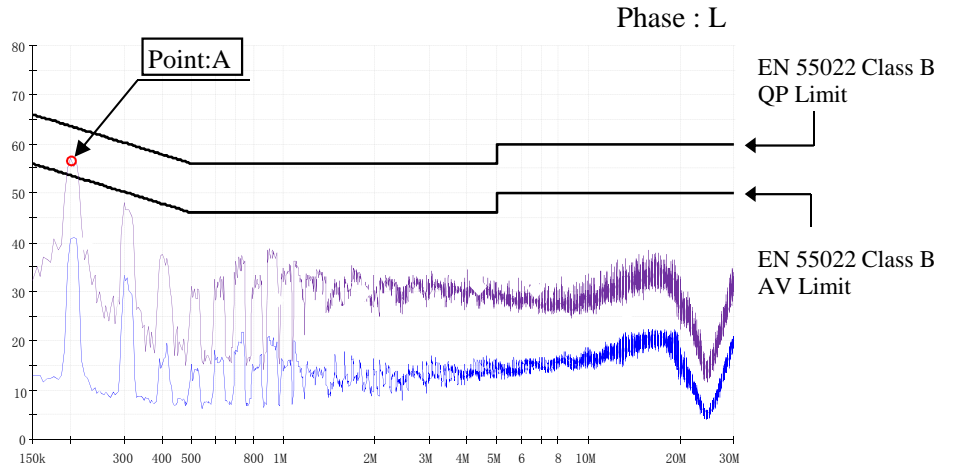
DRL10-1

Conditions Vin : 115 VAC  
 Iout : 100 %  
 Ta : 25 °C

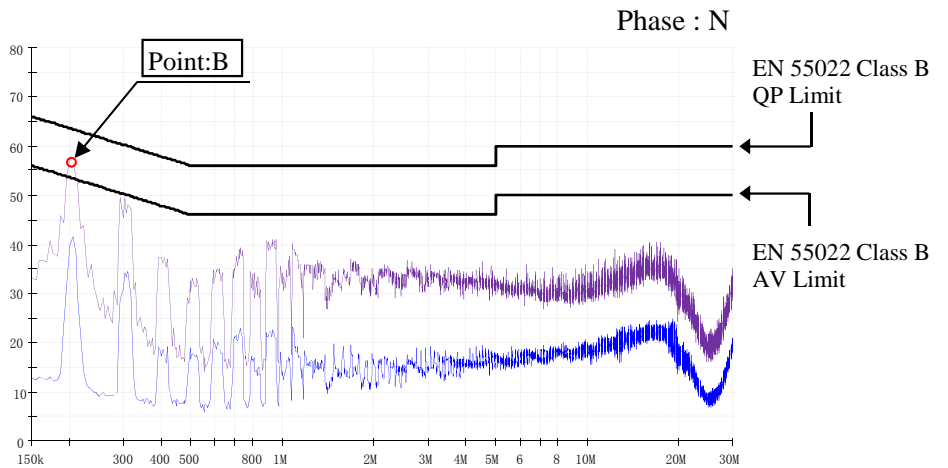
Conducted Emission

12V

Point A (0.204MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.4	54.2
AV	53.6	38.8



Point B (0.204MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.4	54.6
AV	53.4	40.9



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

2.12 Electro-Magnetic Interference characteristics

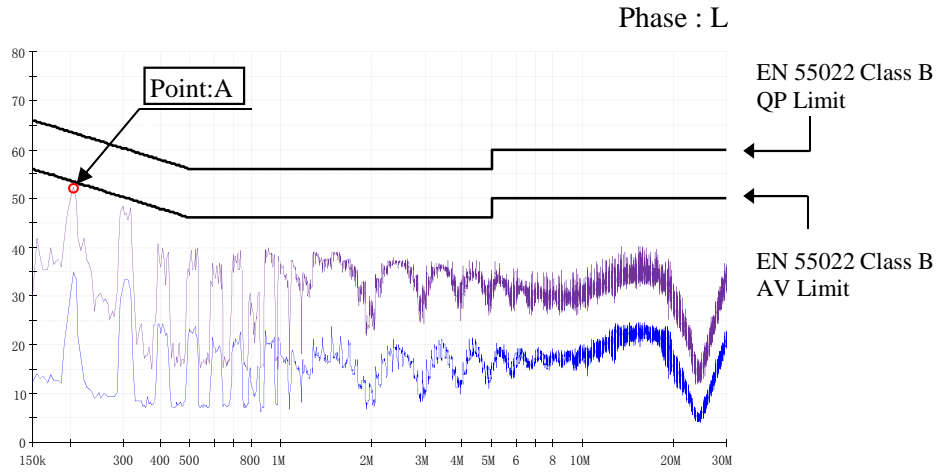
DRL10-1

Conditions Vin : 230 VAC  
Iout : 100 %  
Ta : 25 °C

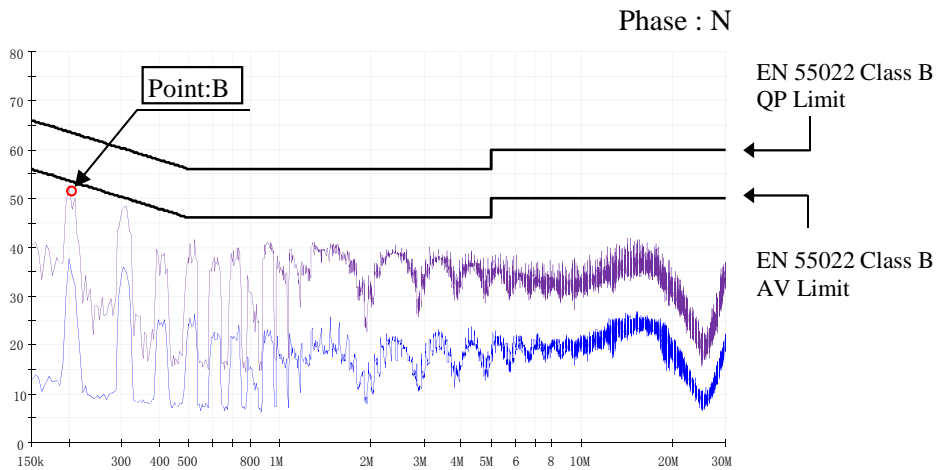
Conducted Emission

12V

Point A (0.1995MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.6	50.0
AV	50.2	34.2



Point B (0.2085MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.3	49.3
AV	49.9	35.1



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

2.12 Electro-Magnetic Interference characteristics

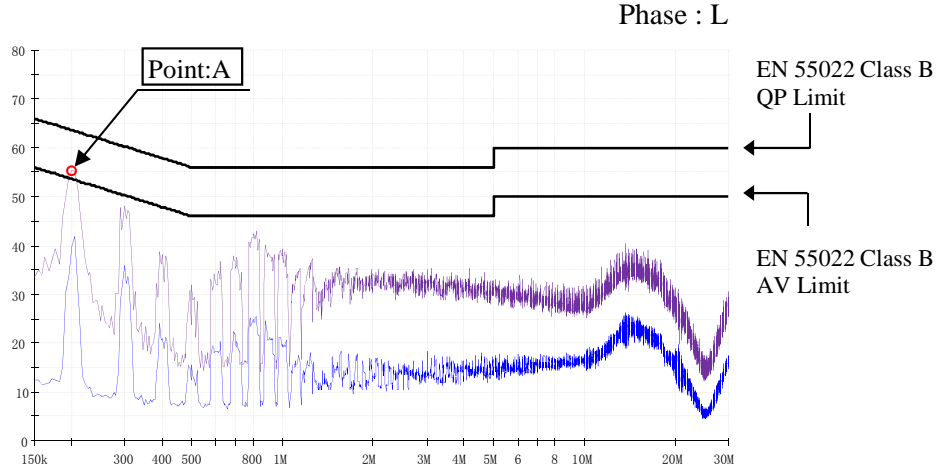
DRL10-1

Conditions Vin : 115 VAC  
 Iout : 100 %  
 Ta : 25 °C

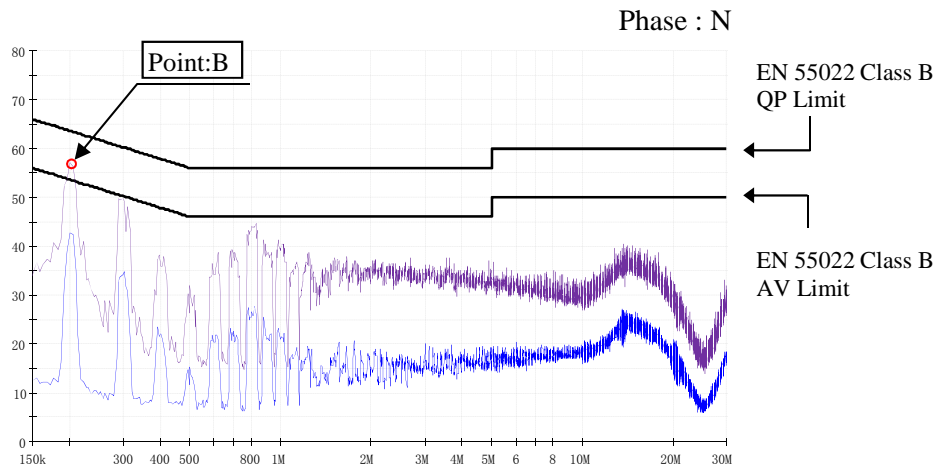
Conducted Emission

24V

Point A (0.204MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.4	53.1
AV	53.6	40.1



Point B (0.204MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.4	54.2
AV	53.6	41.8



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

2.12 Electro-Magnetic Interference characteristics

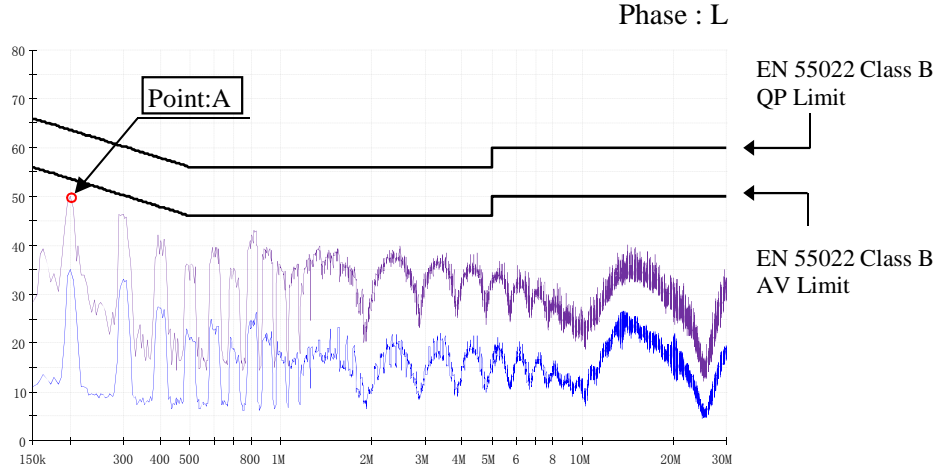
DRL10-1

Conditions Vin : 230 VAC  
 Iout : 100 %  
 Ta : 25 °C

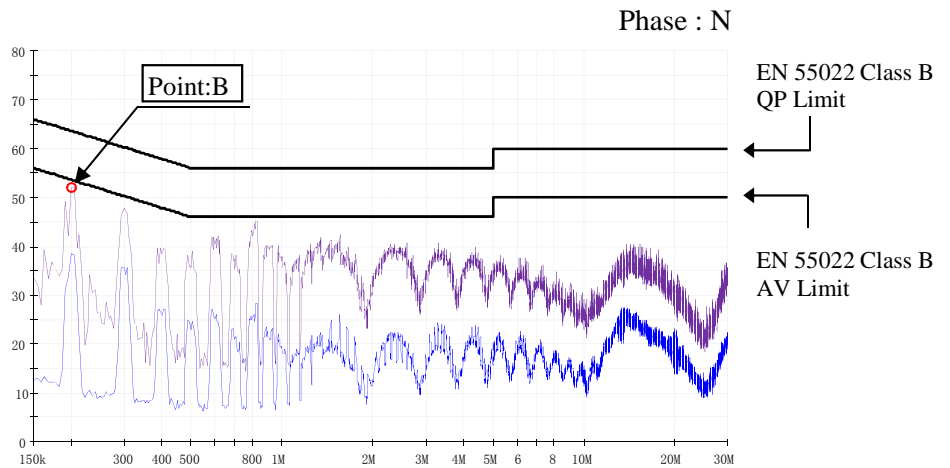
Conducted Emission

24V

Point A (0.1995MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.6	48.4
AV	50.2	34.1



Point B (0.1995MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	63.6	50.0
AV	50.4	35.3



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

2.12 Electro-Magnetic Interference characteristics

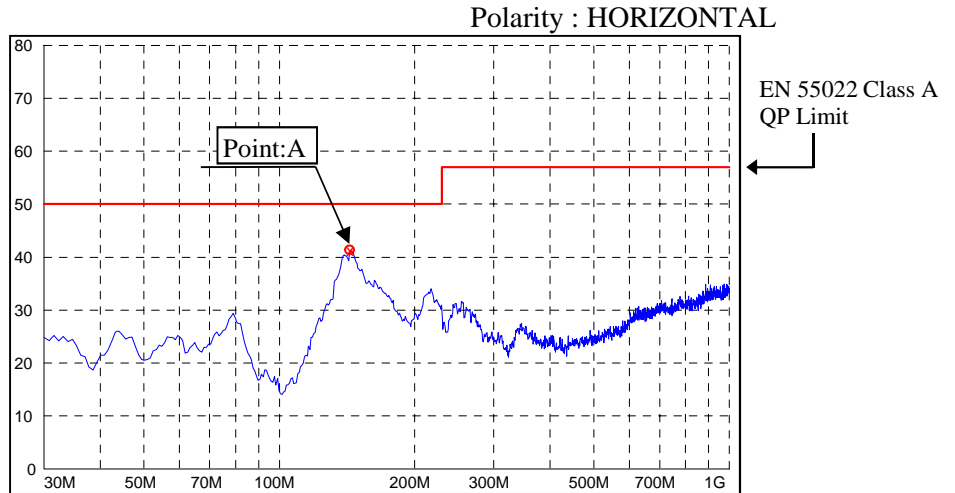
DRL10-1

Conditions Vin : 115 VAC  
 Iout : 100 %  
 Ta : 25 °C

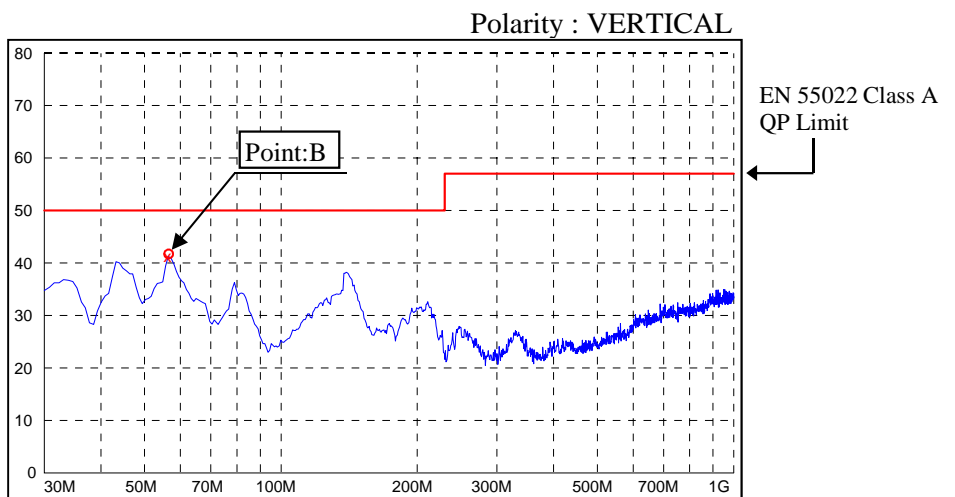
Radiated Emission

12V

Point A (144.07MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	41.3



Point B (56.38MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	41.2



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



## 2.12 Electro-Magnetic Interference characteristics

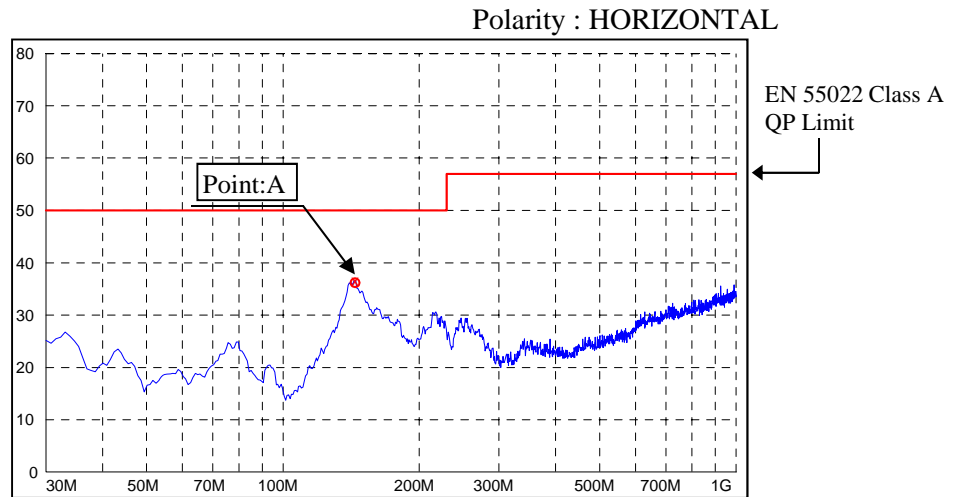
DRL10-1

Conditions Vin : 230 VAC  
Iout : 100 %  
Ta : 25 °C

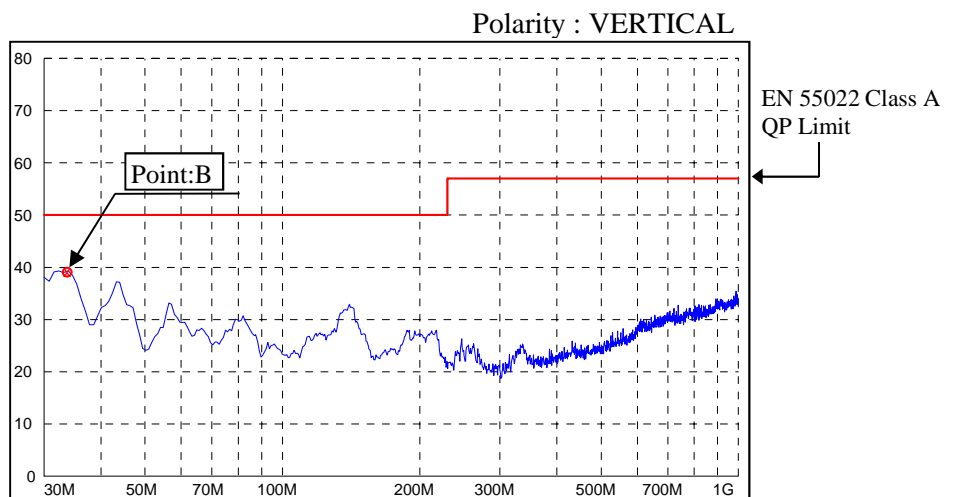
Radiated Emission

12V

Point A (145.62MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	36.5



Point B (33.88MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	39.3



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

2.12 Electro-Magnetic Interference characteristics

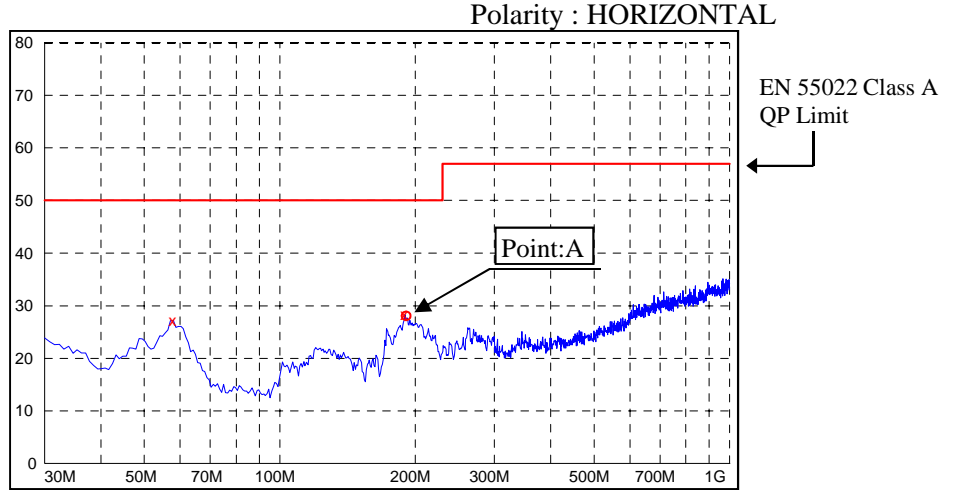
DRL10-1

Conditions Vin : 115 VAC  
 Iout : 100 %  
 Ta : 25 °C

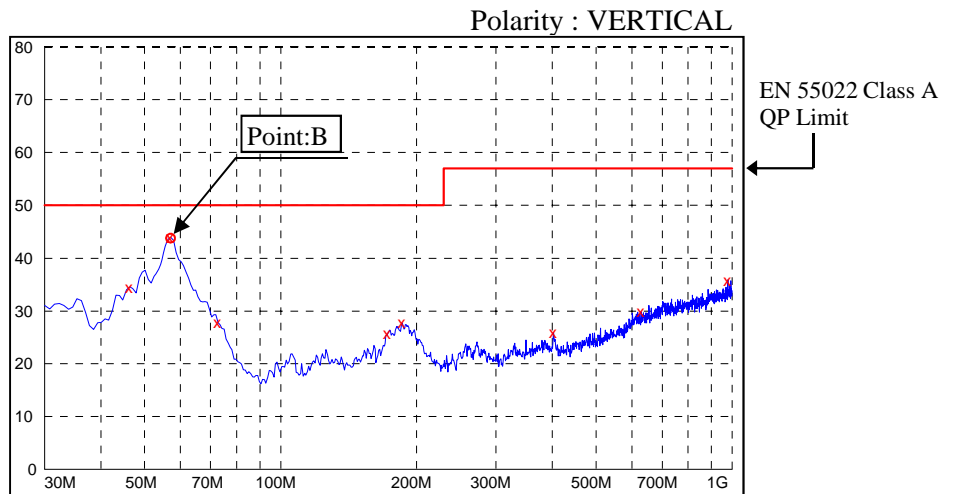
Radiated Emission

24V

Point A (189.86MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	28.3



Point B (57.16MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	43.9



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

2.12 Electro-Magnetic Interference characteristics

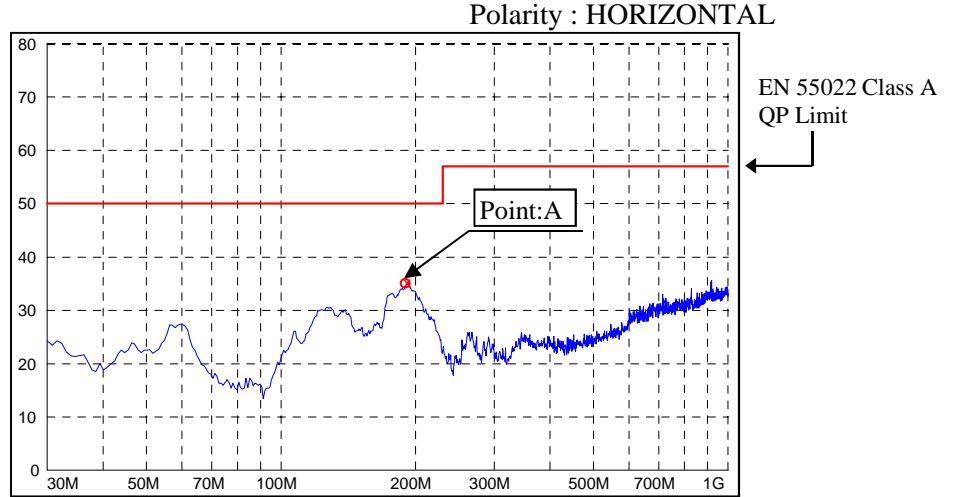
DRL10-1

Conditions Vin : 230 VAC  
 Iout : 100 %  
 Ta : 25 °C

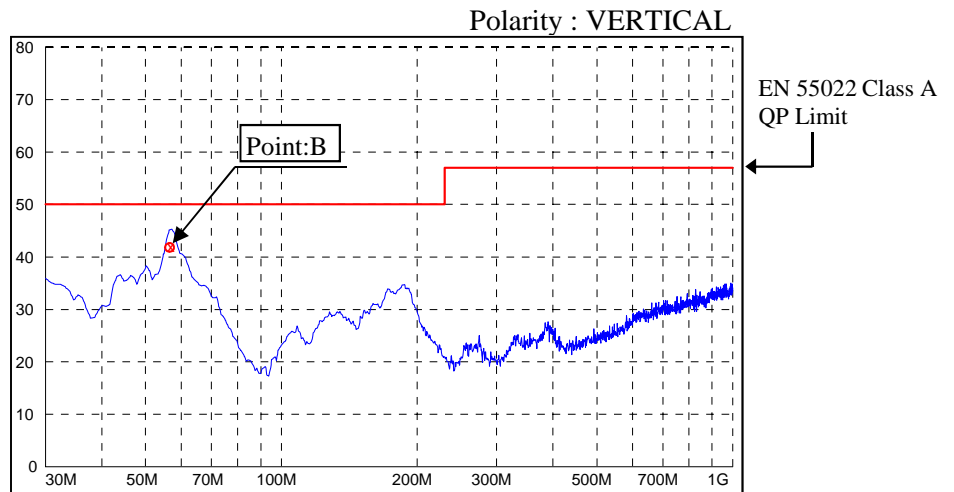
Radiated Emission

24V

Point A (192.18MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	35.2



Point B (57.08MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	50.0	42.0



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

2.12 Electro-Magnetic Interference characteristics

DRL10-1

Conditions Vin : 115 VAC  
Iout : 100 %  
Ta : 25 °C

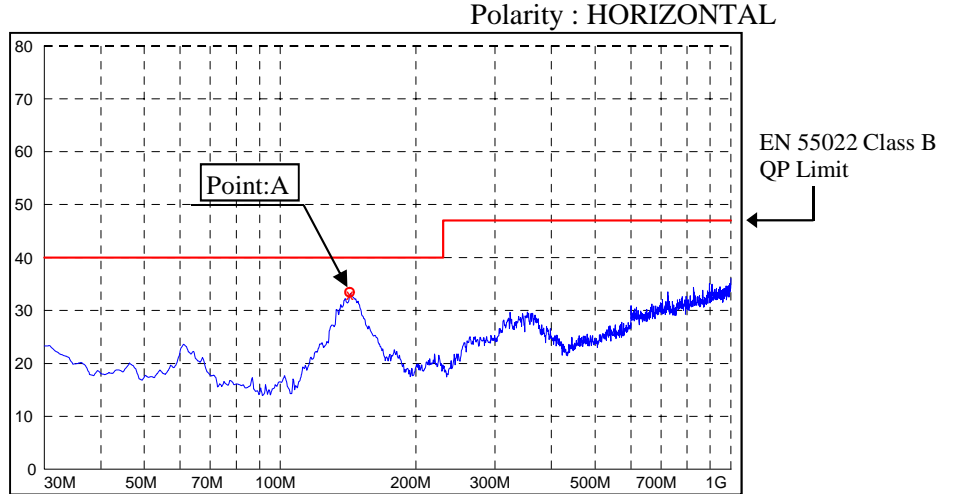
Radiated Emission

External coil :

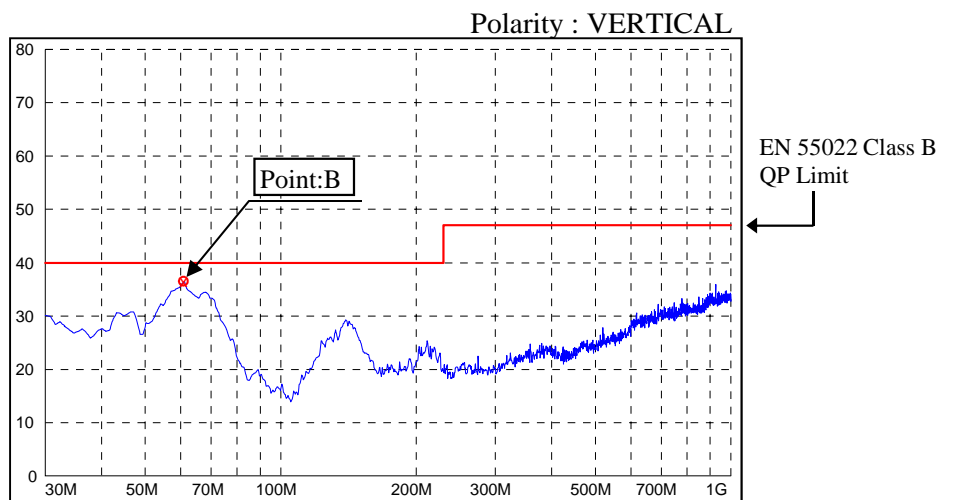
Input : H18.5\*9.7\*7.4P DN80H(DMEGC) , 4 paired turns

12V

Point A (143.3MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	33.2



Point B (61.04MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	36.5



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

2.12 Electro-Magnetic Interference characteristics

DRL10-1

Conditions Vin : 230 VAC  
Iout : 100 %  
Ta : 25 °C

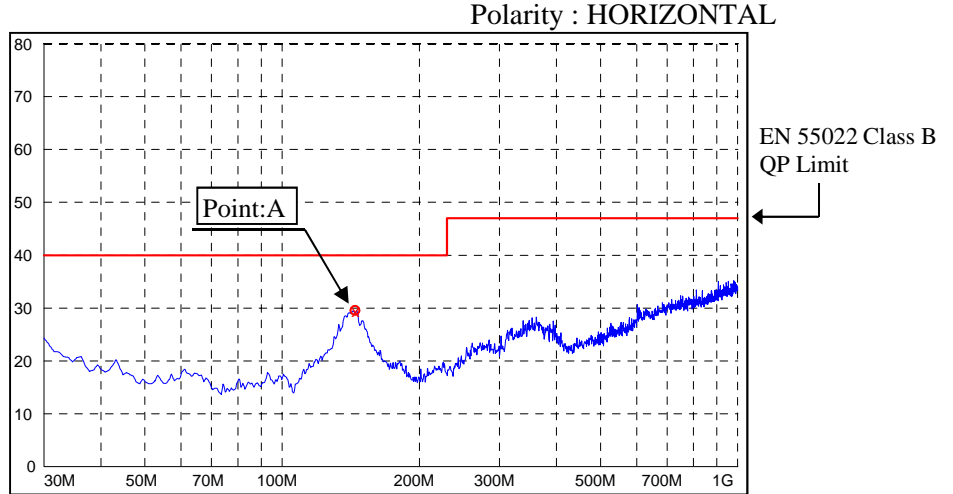
Radiated Emission

External coil :

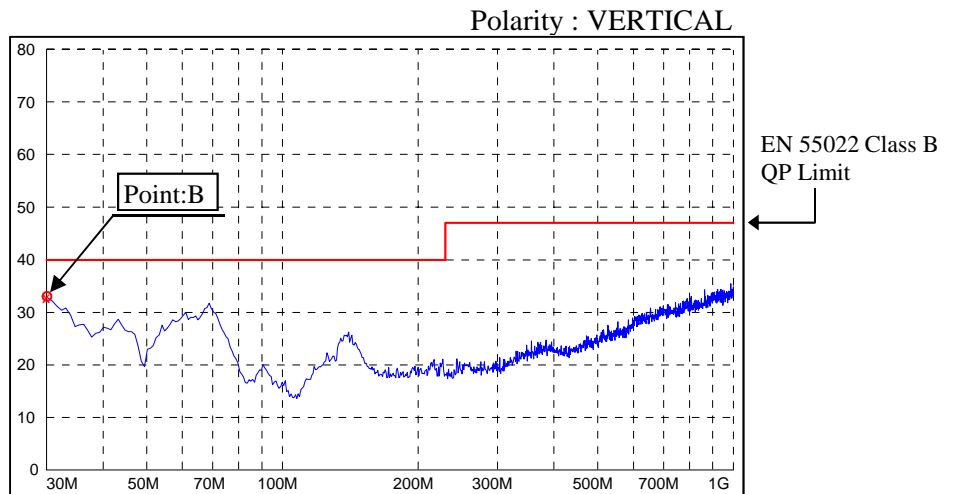
Input : H18.5\*9.7\*7.4P DN80H(DMEGC) , 4 paired turns

12V

Point A (145.62MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	29.5



Point B (30MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	32.9



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

2.12 Electro-Magnetic Interference characteristics

DRL10-1

Conditions Vin : 115 VAC  
Iout : 100 %  
Ta : 25 °C

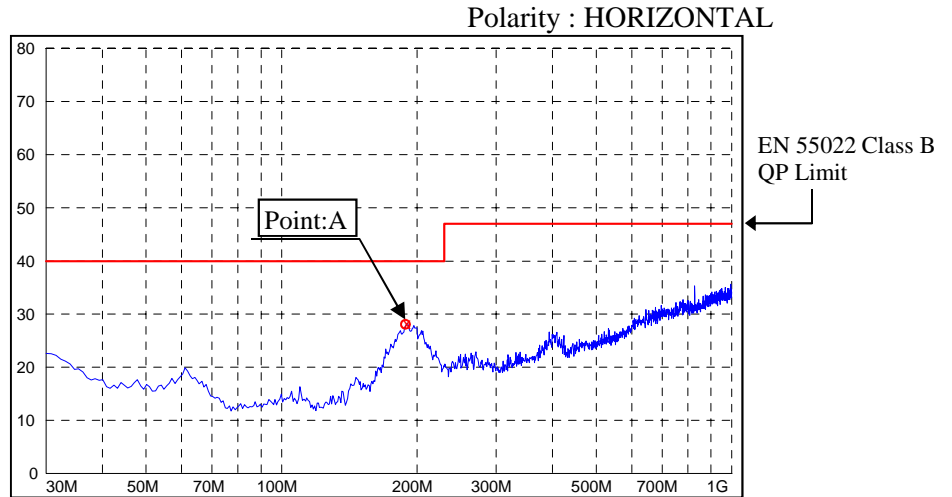
Radiated Emission

External coil :

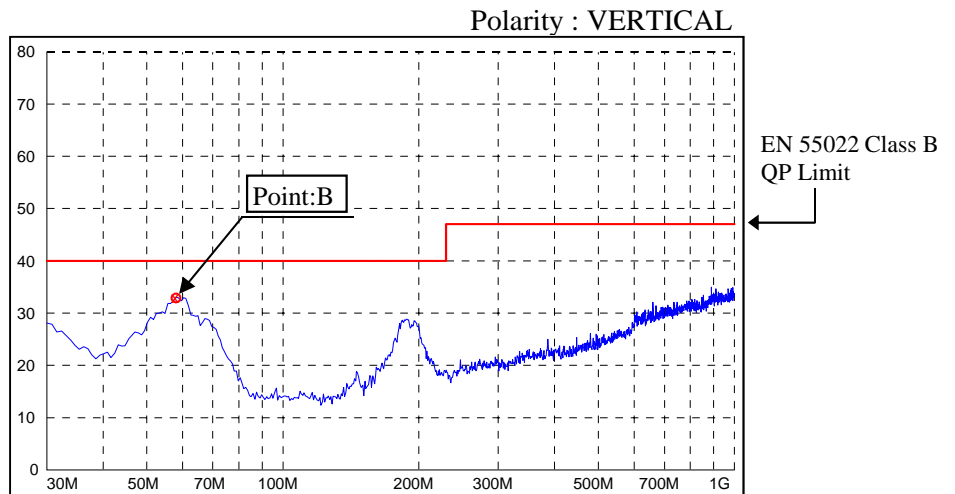
Input : H18.5\*9.7\*7.4P DN80H(DMEGC) , 4 paired turns

24V

Point A (190.63MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	28.2



Point B (57.94MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	33.0



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

2.12 Electro-Magnetic Interference characteristics

DRL10-1

Conditions Vin : 230 VAC  
Iout : 100 %  
Ta : 25 °C

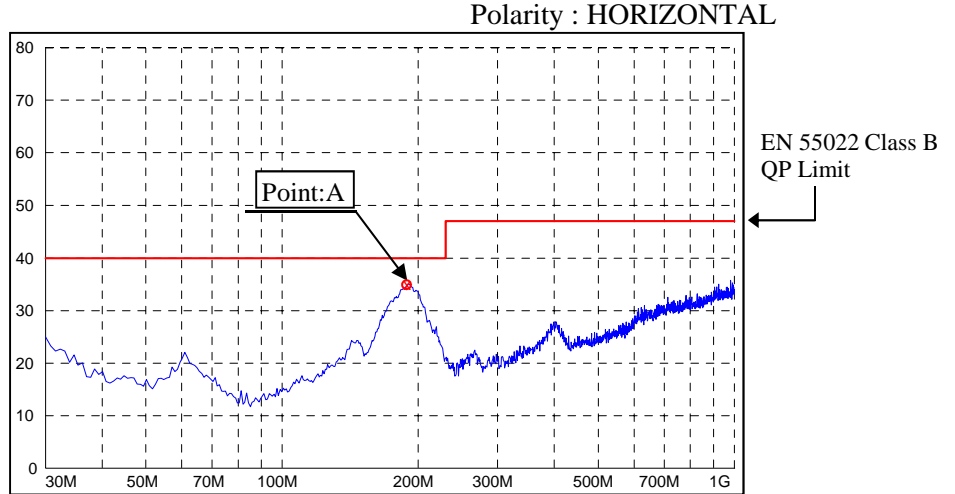
Radiated Emission

External coil :

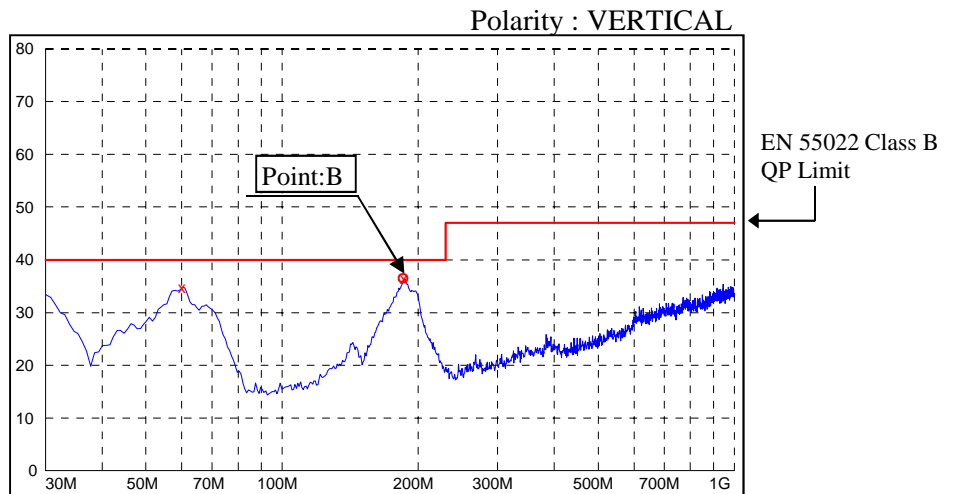
Input : H18.5\*9.7\*7.4P DN80H(DMEGC) , 4 paired turns

24V

Point A (189.86MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	35.0



Point B (186.75MHz)		
Ref. Data	Limit (dBuV)	Measure (dBuV)
QP	40.0	36.4



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

2.13 Limit power source (UL1310 class2)

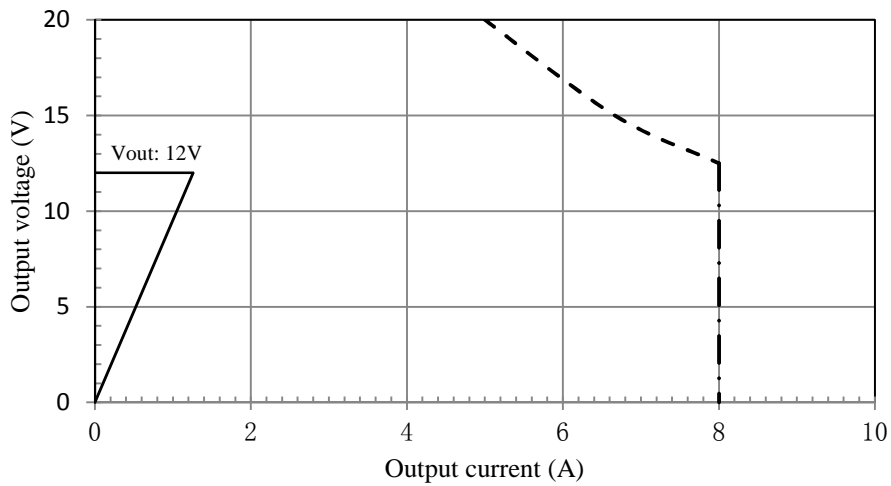
Conditions Vin : 115 VAC  
Ta : 25 °C

--- Limit of 100W  
-.-.- Limit of 8A  
— Output voltage vs. Output current

12V

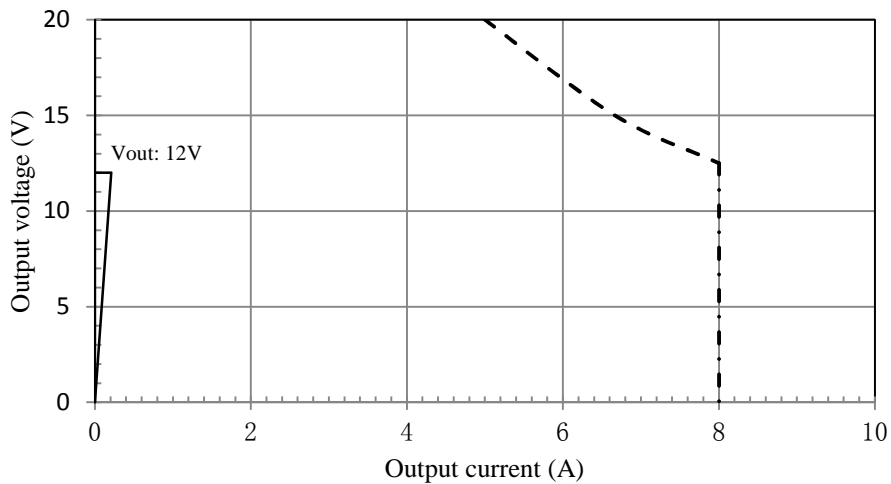
O.C.P condition

Basic protection function - Over current protection.



Single fault condition

Disable over current protection function by shorting the current sense resistor.





2.13 Limit power source (UL1310 class2)

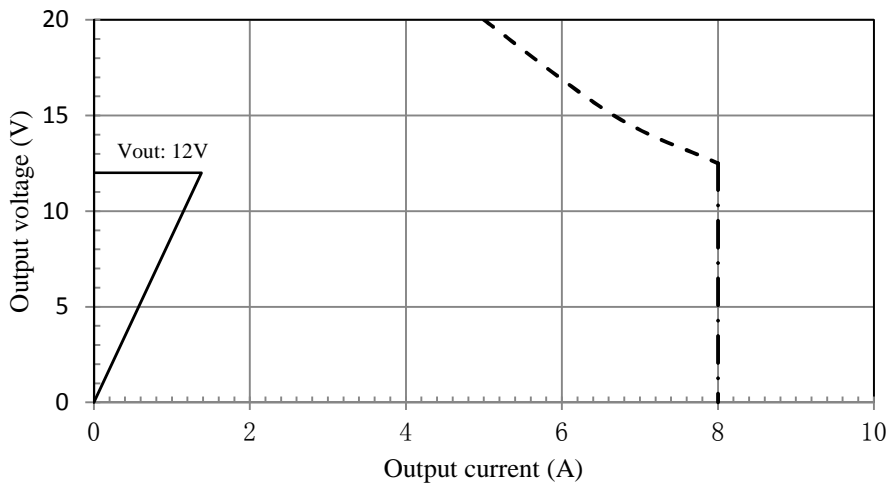
Conditions Vin : 230 VAC  
Ta : 25 °C

12V

--- Limit of 100W  
-.-.- Limit of 8A  
— Output voltage vs. Output current

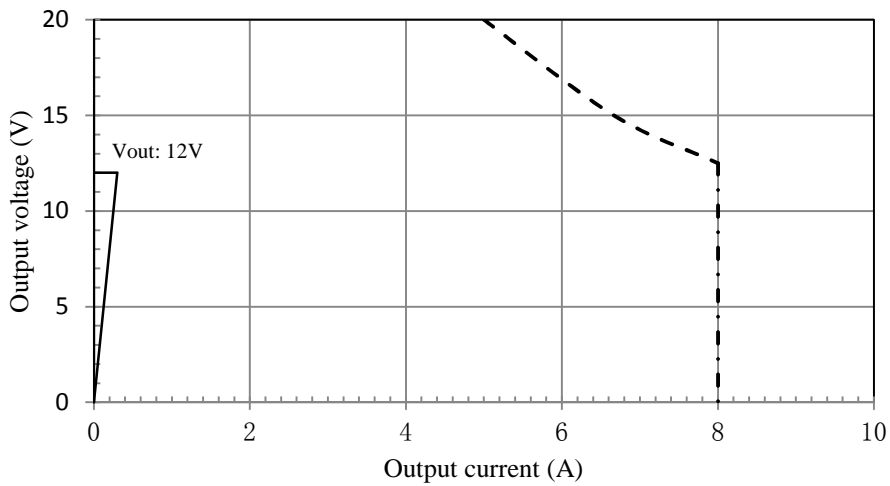
O.C.P condition

Basic protection function - Over current protection.



Single fault condition

Disable over current protection function by shorting the current sense resistor.



2.13 Limit power source (UL1310 class2)

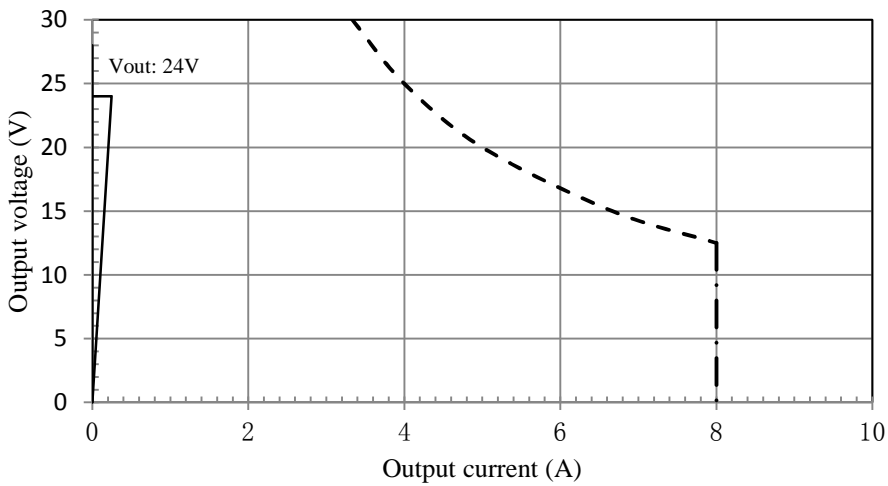
Conditions Vin : 115 VAC  
Ta : 25 °C

24V

--- Limit of 100W  
-.-.- Limit of 8A  
— Output voltage vs. Output current

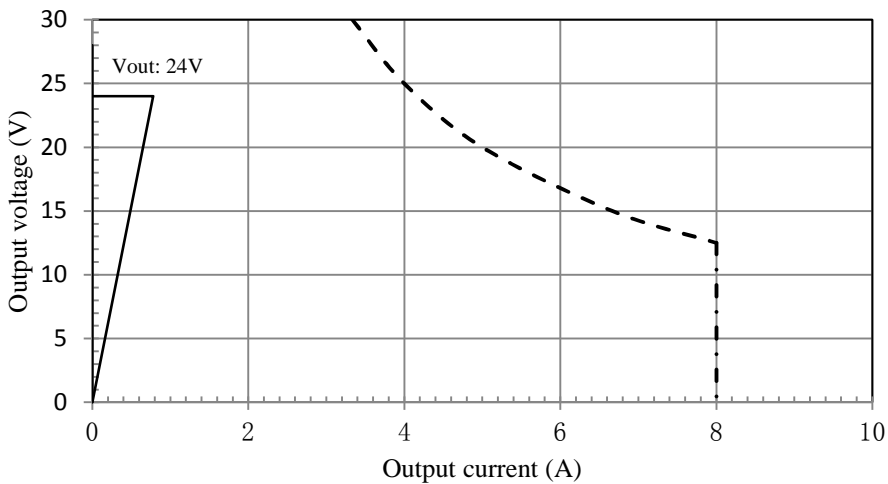
O.C.P condition

Basic protection function - Over current protection.



Single fault condition

Disable over current protection function by shorting the current sense resistor.



2.13 Limit power source (UL1310 class2)

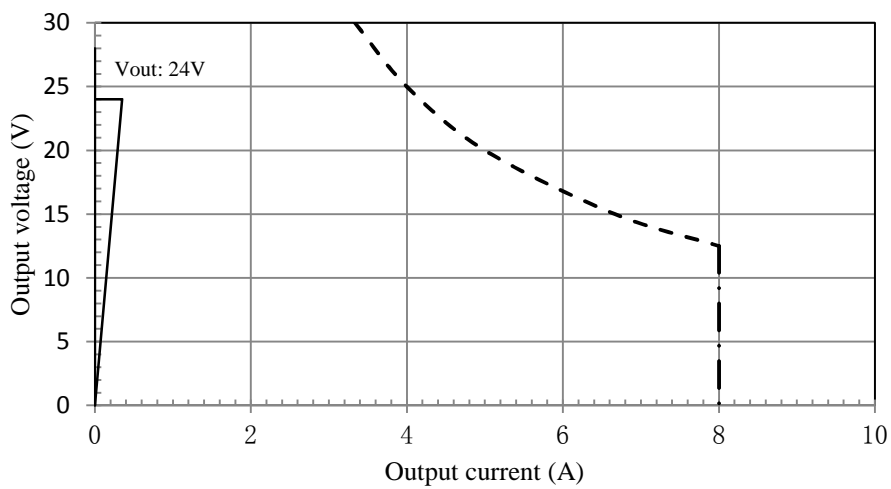
Conditions Vin : 230 VAC  
 Ta : 25 °C

24V

--- Limit of 100W  
 -.-.- Limit of 8A  
 ——— Output voltage vs. Output current

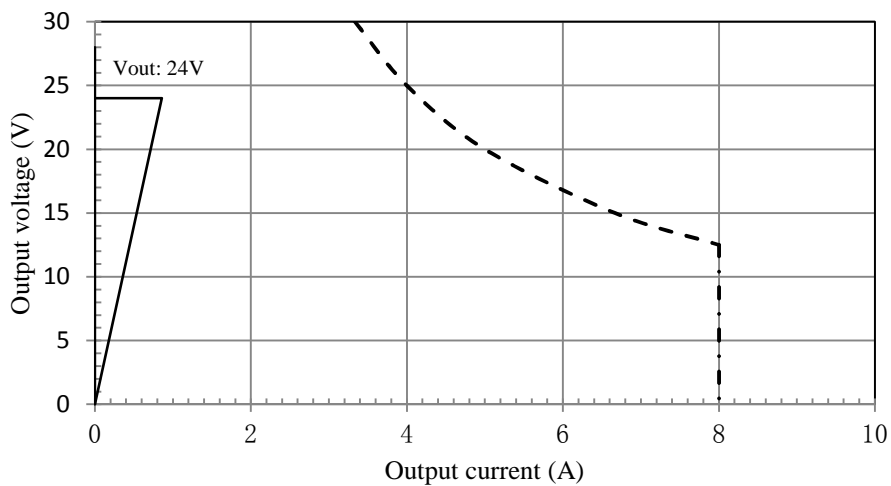
O.C.P condition

Basic protection function - Over current protection.



Single fault condition

Disable over current protection function by shorting the current sense resistor.



## 2.14 Harmonic current characteristics

DRL10-1

Conditions Vin : 230 VAC  
Iout : 100 %  
Ta : 25 °C

