

**DLP100-24-1**

**EVALUATION DATA**

## INDEX

|   | PAGE    |
|---|---------|
| 1. Evaluation Method  |         |
| 1.1 Circuit used for determination .....                      | T-1~4   |
| (1) Steady state data   |         |
| (2) Warm up voltage drift characteristics                     |         |
| (3) Over current protection (OCP) characteristics             |         |
| (4) Over voltage protection (OVP) characteristics             |         |
| (5) Output rise characteristics                               |         |
| (6) Output fall characteristics                               |         |
| (7) Dynamic line response characteristics                     |         |
| (8) Input voltage dip test                                    |         |
| (9) Dynamic load response characteristics                     |         |
| (10) Inrush current characteristics                           |         |
| (11) Leakage current characteristics                          |         |
| (12) Output ripple and noise waveform                         |         |
| (13) Stand-by current   |         |
| (14) Electro Magnetic Interference characteristics            |         |
| 1.2 List of equipment used .....                              | T-5     |
| 2. Characteristics  |         |
| 2.1 Steady state data   |         |
| (1) Regulation - line and load, temperature drift .....       | T-6     |
| (2) Output voltage and ripple voltage vs. input voltage ..... | T-7     |
| (3) Efficiency and input current vs. output current .....     | T-8     |
| 2.2 Warm up voltage drift characteristics .....               | T-9     |
| 2.3 Over current protection (OCP) characteristics .....       | T-10~11 |
| 2.4 Over voltage protection (OVP) characteristics .....       | T-12    |
| 2.5 Output rise characteristics .....                         | T-13~14 |
| 2.6 Output fall characteristics .....                         | T-15~16 |

|  |         |
|--|---------|
| 2.7 Dynamic line response characteristics . . . . .          | T-17    |
| 2.8 Input voltage dip test . . . . .                         | T-18    |
| 2.9 Dynamic load response characteristics . . . . .          | T-19    |
| 2.10 Response to brown out characteristics . . . . .         | T-20    |
| 2.11 Inrush current waveform . . . . .                       | T-21~22 |
| 2.12 Input current waveform . . . . .                        | T-23    |
| 2.13 Input current harmonics . . . . .                       | T-24    |
| 2.14 Leakage current characteristics . . . . .               | T-25    |
| 2.15 Output ripple and noise waveform . . . . .              | T-26    |
| 2.16 Stand-by current . . . . .                              | T-27    |
| 2.17 Hold up time characteristics . . . . .                  | T-28    |
| 2.18 Electro Magnetic Interference characteristics . . . . . | T-29~32 |

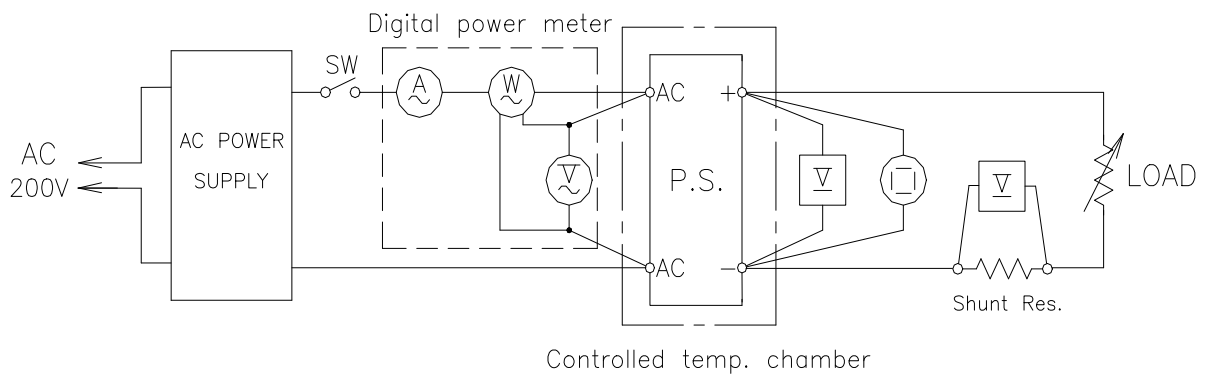
## Terminology used

|           | Definition          |
|-----------|---------------------|
| $V_{in}$  | Input voltage       |
| $V_{out}$ | Output voltage      |
| $I_{in}$  | Input current       |
| $I_{out}$ | Output current      |
| $f$       | Frequency           |
| $T_a$     | Ambient temperature |

## 1.1 Circuit used for determination

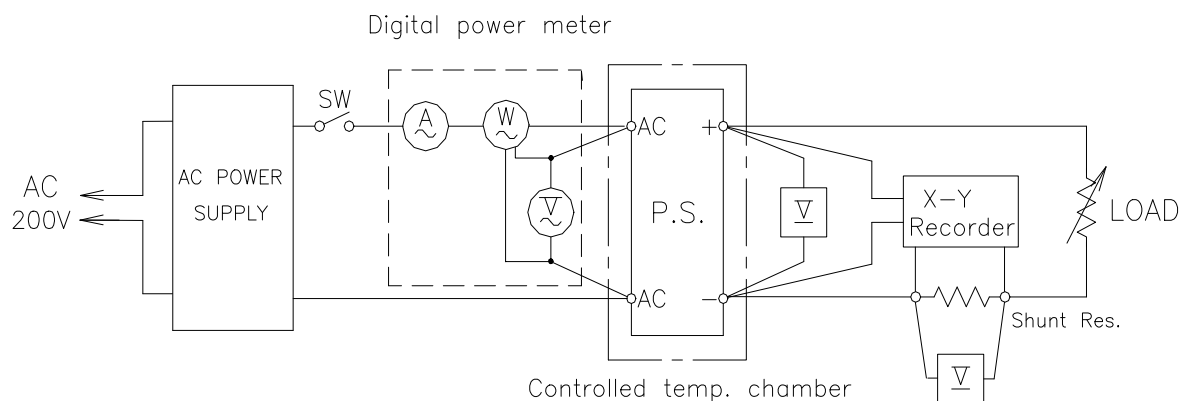
### (1) Measurement Circuit. 1

- Steady state data
- Warm up voltage drift characteristics
- Over voltage protection (OVP) characteristics
- Output rise characteristics
- Output fall characteristics
- Dynamic line response characteristics
- Stand-by current characteristics



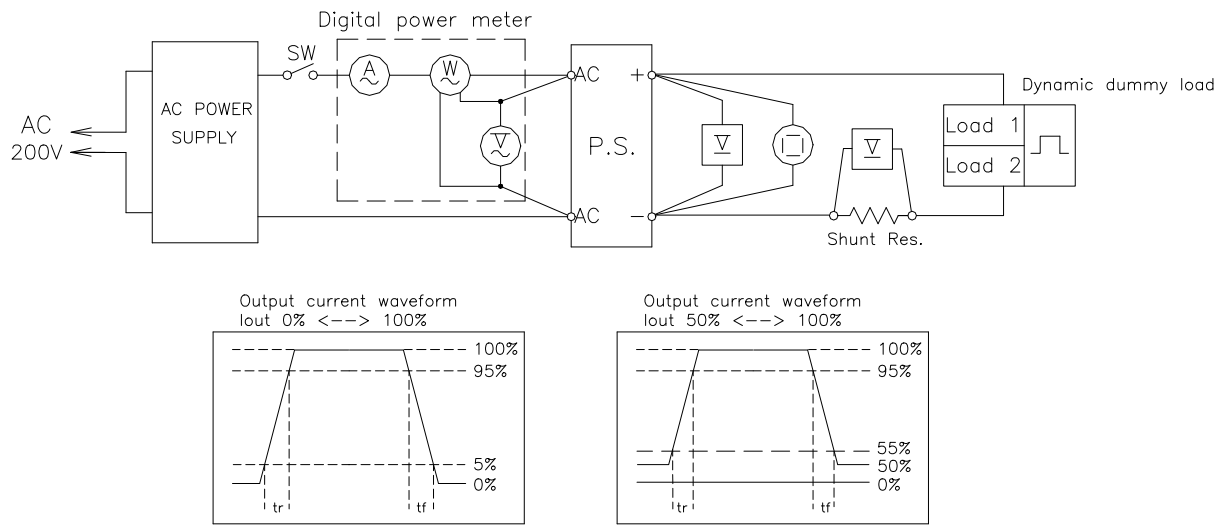
### (2) Measurement Circuit. 2

- Over current protection (OCP) characteristics



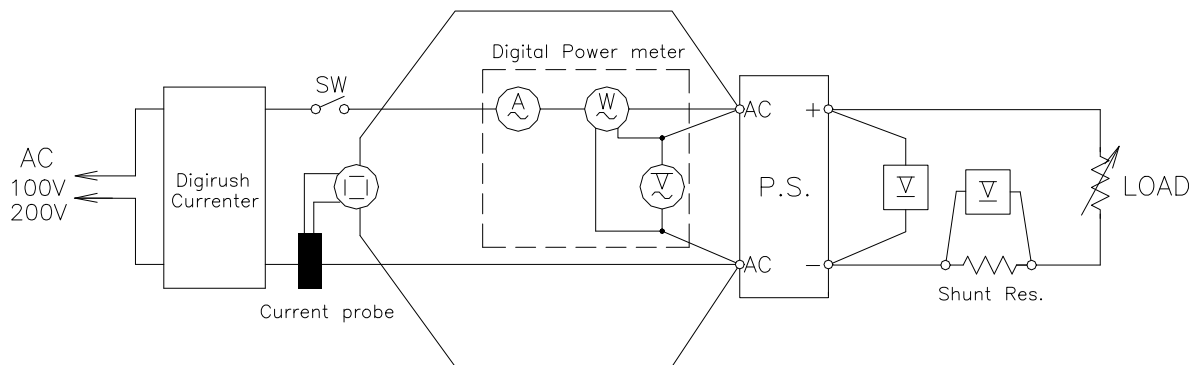
**Measurement circuit. 3**

• Dynamic load response characteristics



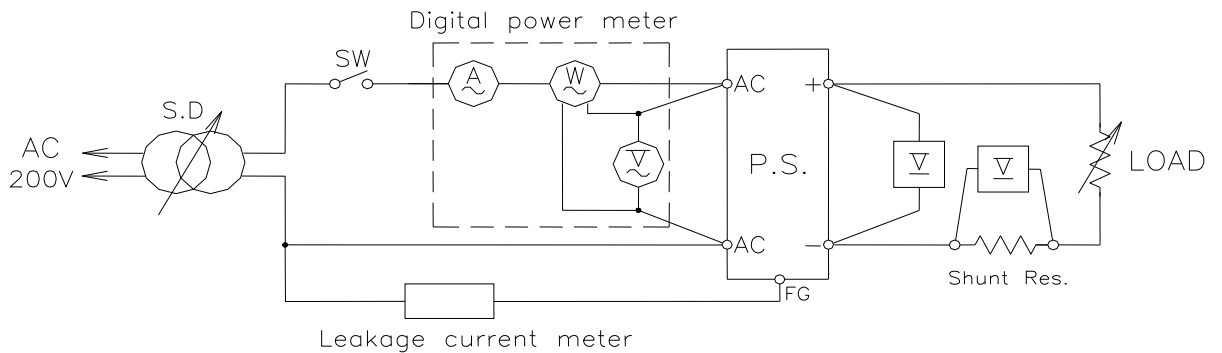
**Measurement circuit. 4**

• Inrush current characteristics



**Measurement circuit. 5**

• Leakage current characteristics



NOTE : Leakage current measured through a 1k ohm resistor.

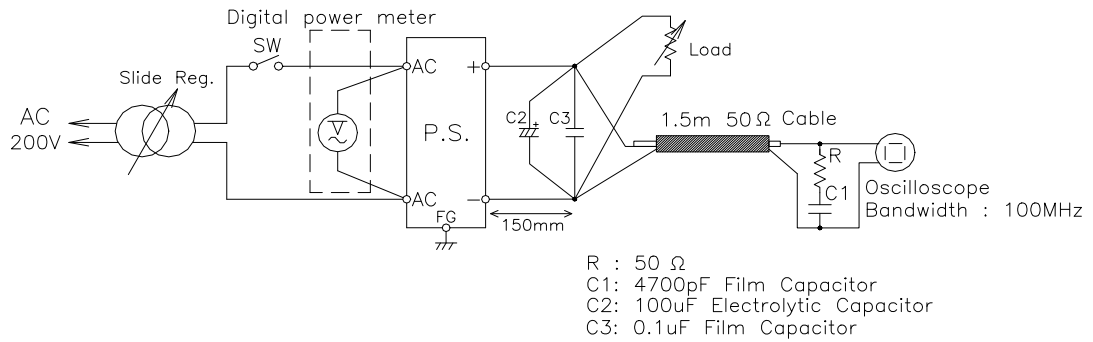
Range used --- AC + DC (For YOKOGAMA : TYPE3226)

AC (For SIMPSON : MODEL 228)

**Measurement circuit. 6**

• Output ripple and noise

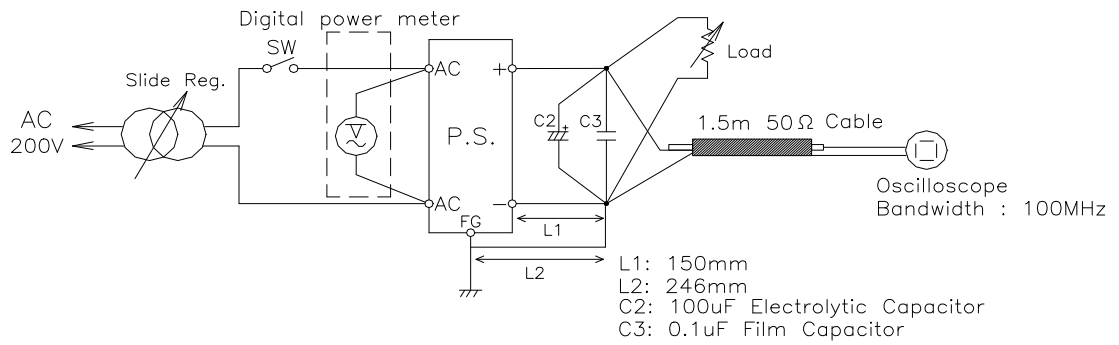
(a) Normal Mode (JEITA Standard RC-9131)



**Measurement circuit. 7**

• Output ripple and noise

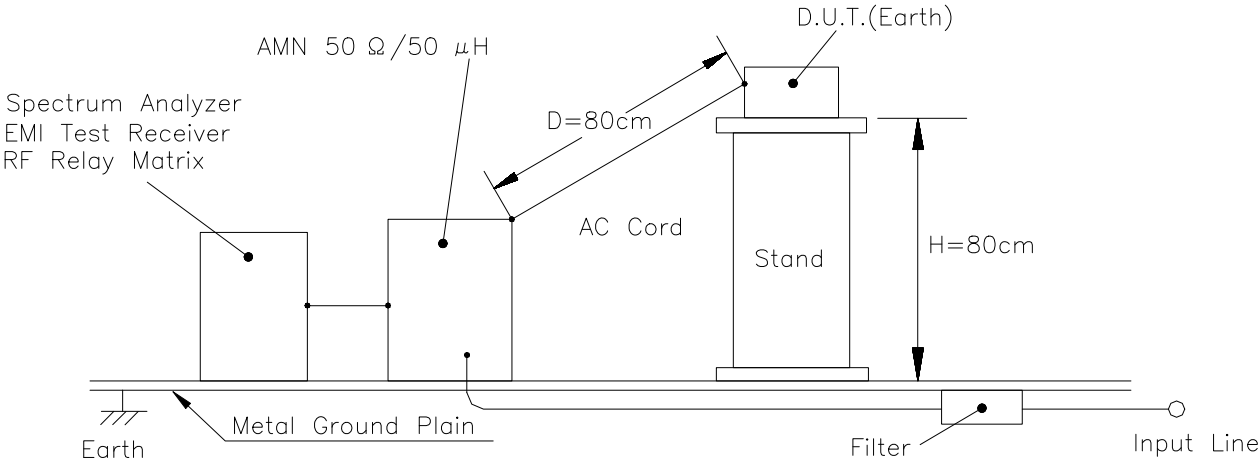
(b) Normal + Common Mode



**Measurement circuit. 8**

• Electro-Magnetic Interference characteristics

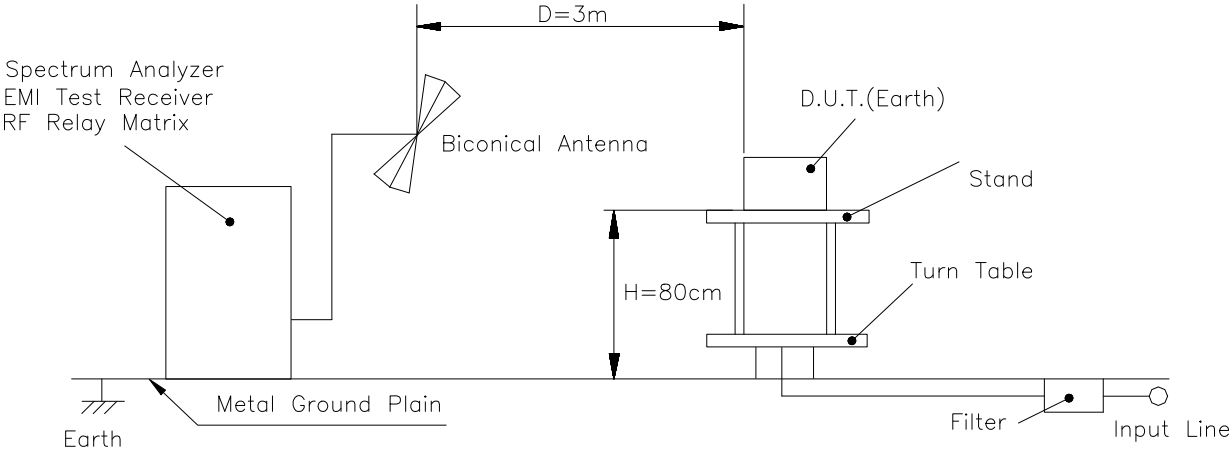
(a) Conducted Emission Noise



**Measurement circuit. 9**

• Electro-Magnetic Interference characteristics

(b) Radiated Emission Noise



## 1.2 LIST OF EQUIPMENT USED

|    | EQUIPMENT USED                 | MANUFACTURER           | MODEL NO.       |
|----|--------------------------------|------------------------|-----------------|
| 1  | Oscilloscope                   | HITACHI                | V-1050F         |
| 2  | Digital storage oscilloscope   | TEKTRONIX              | TDS 714L        |
| 3  | Digital volt meter             | LEADER                 | 856             |
| 4  | Digital power meter            | YOKOGAWA               | 2533            |
| 5  | DC ampere meter                | YOKOGAWA               | 2051            |
| 6  | Dynamic dummy load             | KIKUSUI                | PLZ152W         |
| 7  | Current probe/amplifier        | TEKTRONIX              | A6303/AM503B    |
| 8  | Controlled temperature chamber | TABAI-ESPEC            | SU-240          |
| 9  | Leakage current meter          | YOKOGAWA<br>SIMPSON    | TYPE3226<br>228 |
| 10 | Digirush currenter             | TAKAMIZAWA CYBERNETICS | PSA-200         |
| 11 | EMI receiver                   | HEWLETT PACKARD        | HP8546A         |
| 12 | LISN                           | EMCO                   | 3825/2          |
| 13 | Biconical antenna              | EMCO                   | 3110B           |



2. Characteristics

2.1 Steady state data

(1) Regulation - line and load, temperature drift

24V

1. Regulation-line and load

| Iout \ Vin | 85VAC   | 100VAC  | 230VAC  | 265VAC  | line regulation |        |
|------------|---------|---------|---------|---------|-----------------|--------|
| 0%         | 24.027V | 24.025V | 24.021V | 24.020V | 0.007V          | 0.029% |
| 50%        | 24.012V | 24.009V | 24.006V | 24.005V | 0.007V          | 0.029% |
| 100%       | 23.996V | 23.994V | 23.991V | 23.990V | 0.006V          | 0.025% |
| load       | 0.031V  | 0.031V  | 0.030V  | 0.030V  |                 |        |
| regulation | 0.129%  | 0.129%  | 0.125%  | 0.125%  |                 |        |

2. Temperature drift

Conditions; Vin = 100VAC

Iout = 100%

| Ta   | -10°C   | +25°C   | +50°C   | Temperature stability |       |
|------|---------|---------|---------|-----------------------|-------|
| Vout | 24.049V | 23.994V | 23.987V | 0.062V                | 0.26% |

(2) Output voltage and Ripple voltage v.s. Input voltage

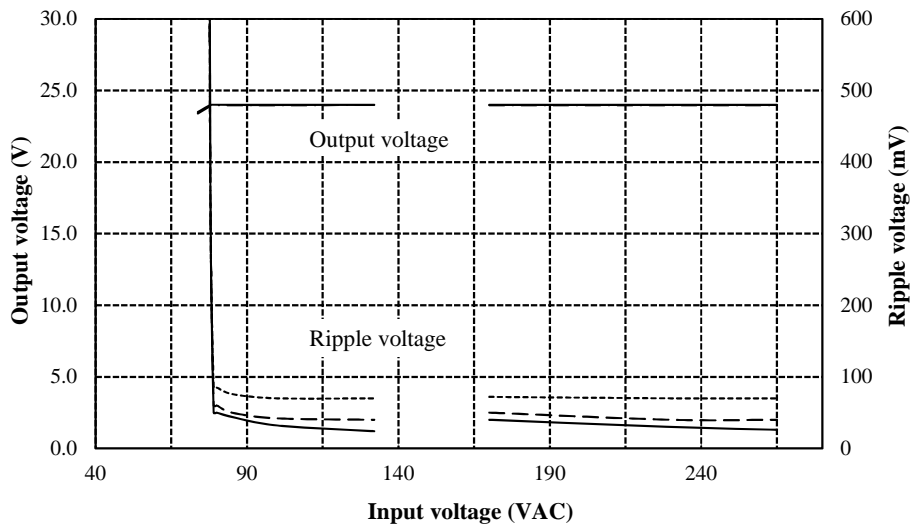
Conditions; Iout : 100%

Ta : -10°C -----

: 25°C - - - - -

: 50°C \_\_\_\_\_

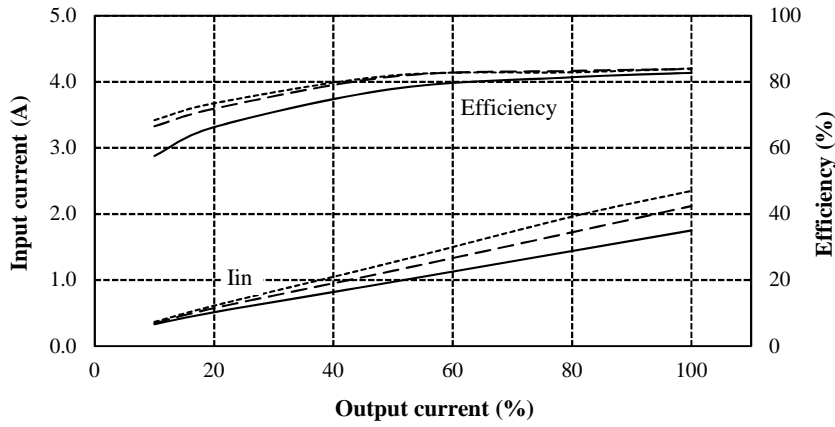
24V



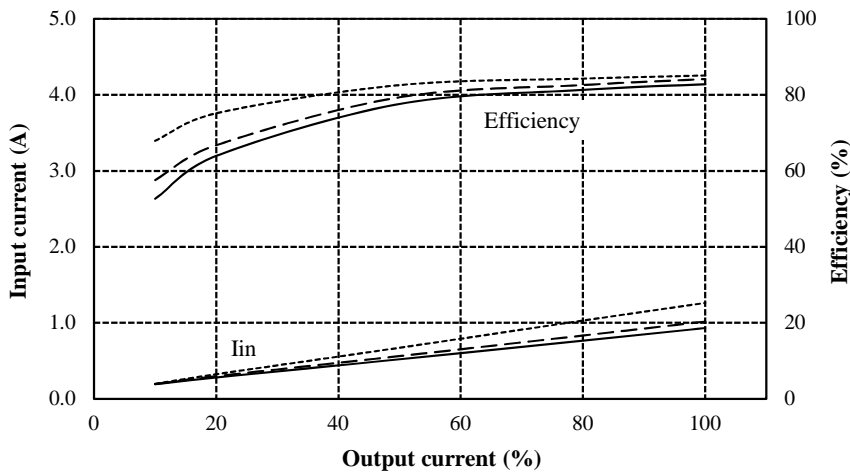
2.1 (3) Efficiency and input current v.s. Output current

Conditions;  $V_{in}$  : 85VAC -----  
 : 100VAC - - - - -  
 : 132VAC \_\_\_\_\_  
 $T_a$  : 25°C

24V



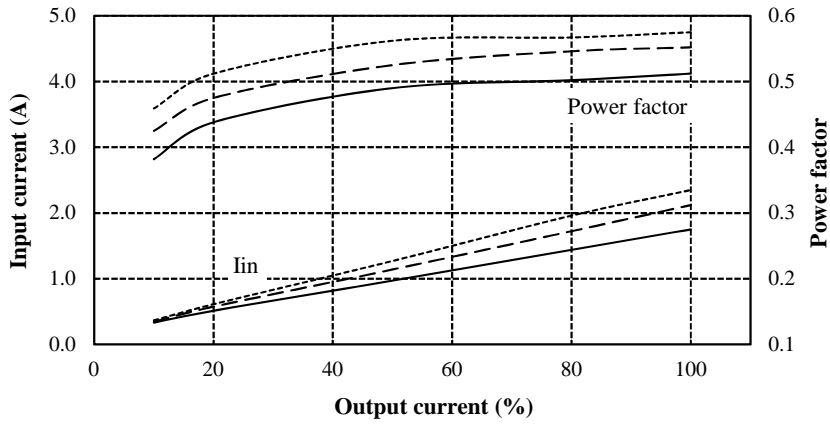
Conditions;  $V_{in}$  : 170VAC -----  
 : 230VAC - - - - -  
 : 265VAC \_\_\_\_\_  
 $T_a$  : 25°C



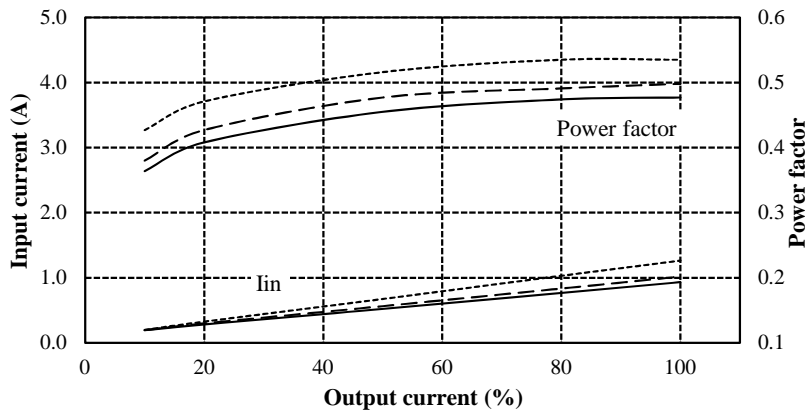
2.1 (4) Power factor and Input current v.s Output current

Conditions;  $V_{in}$  : 85VAC -----  
 : 100VAC - - - - -  
 : 132VAC ————  
 $T_a$  : 25°C

24V



Conditions;  $V_{in}$  : 170VAC -----  
 : 230VAC - - - - -  
 : 265VAC ————  
 $T_a$  : 25°C



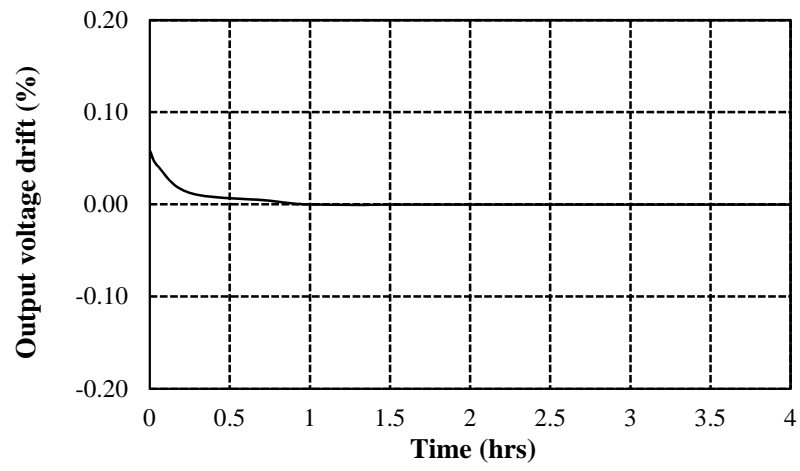
2.2 Warm up voltage drift characteristics

Conditions  $V_{in}$  : 100VAC

$I_{out}$  : 100%

$T_a$  : 25°C

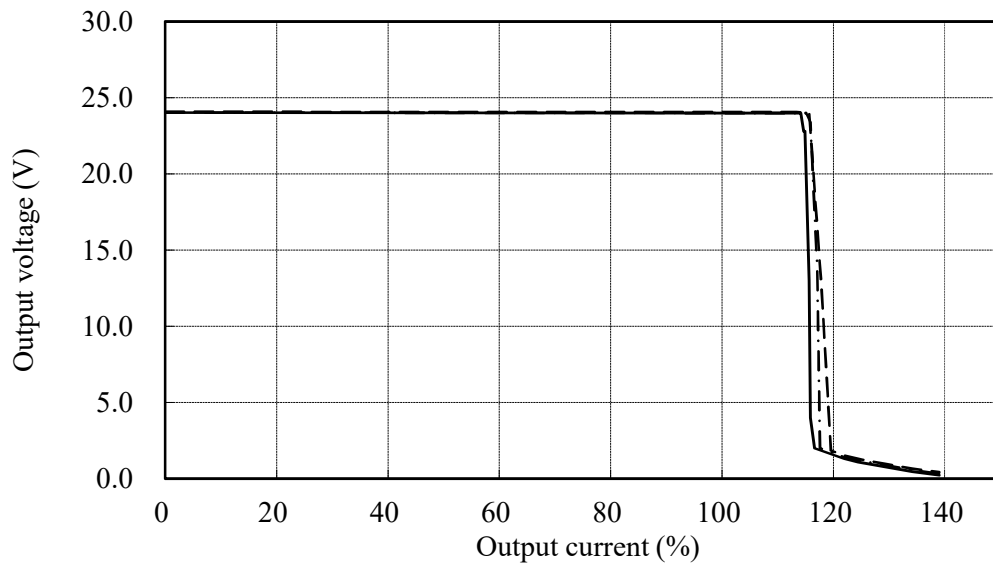
24V



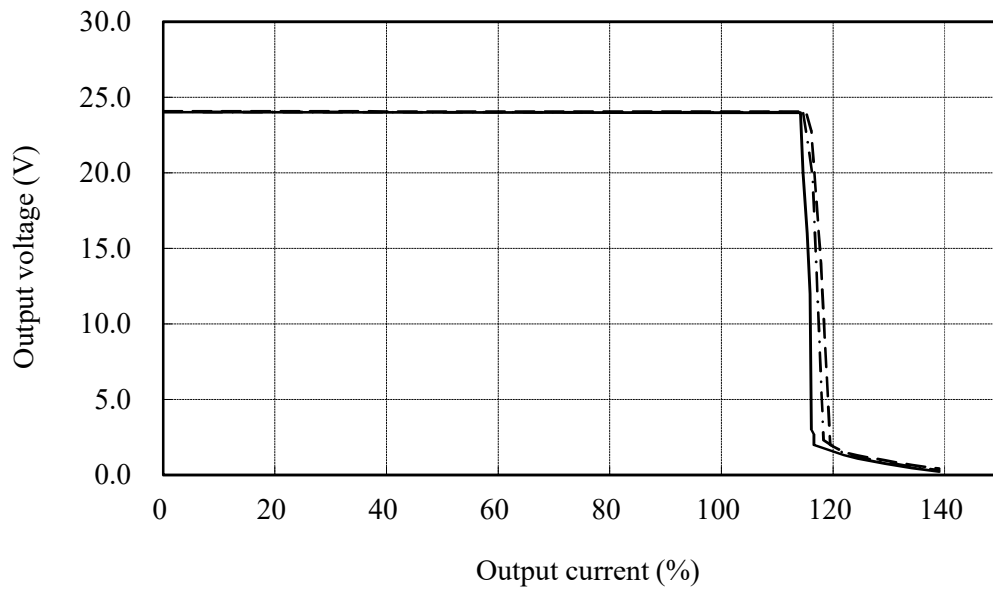
2.3 Over current protection (OCP) characteristics

24V

Conditions Ta : -10 °C -----  
 : 25 °C -.-.-.-  
 : 50 °C ———  
 Vin: 100VAC



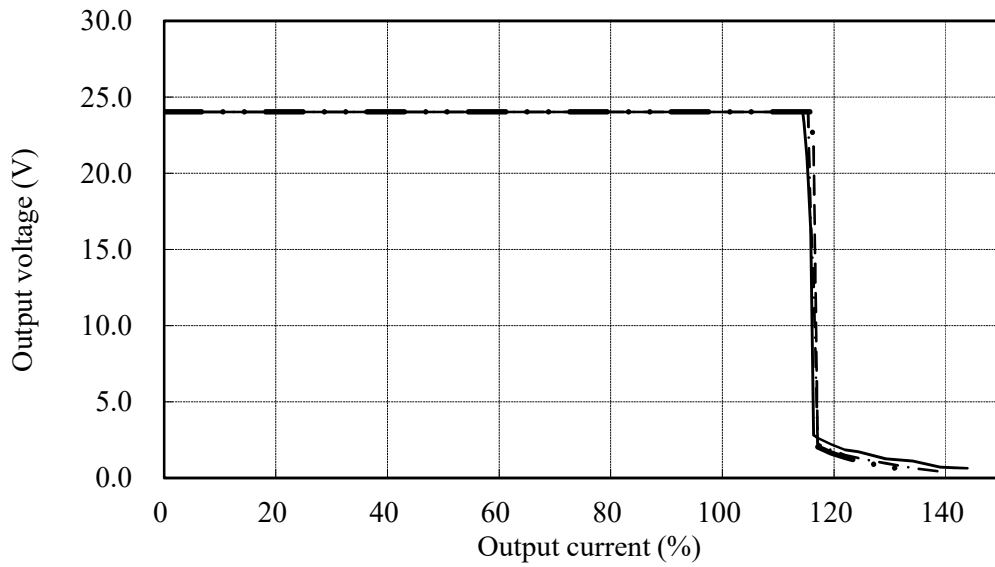
Conditions Ta : -10 °C -----  
 : 25 °C -.-.-.-  
 : 50 °C ———  
 Vin: 230VAC



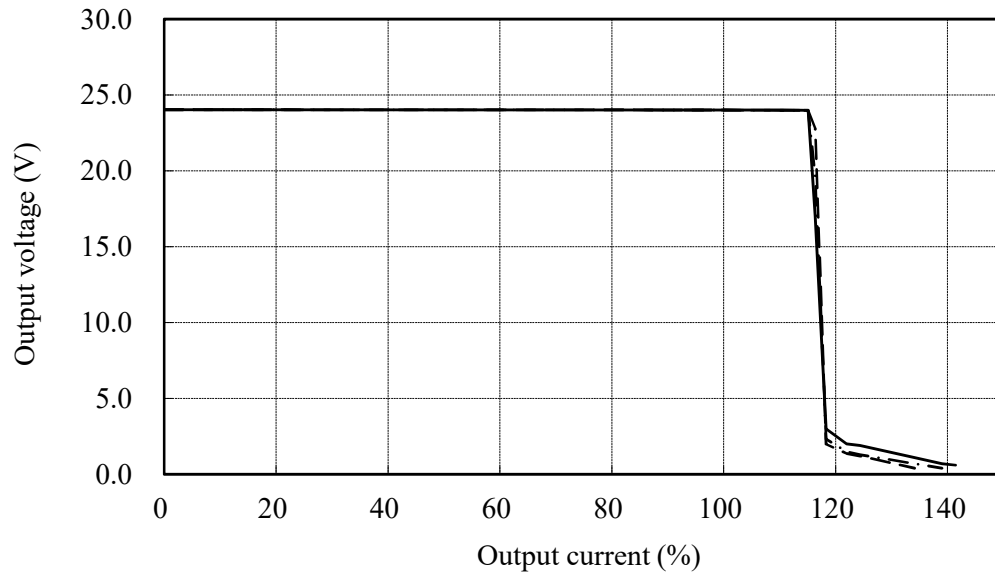
2.3 Over current protection (OCP) characteristics

24V

Conditions; Vin : 85VAC -----  
 : 100VAC -.-.-.-  
 : 132VAC ———  
 Ta : 25°C



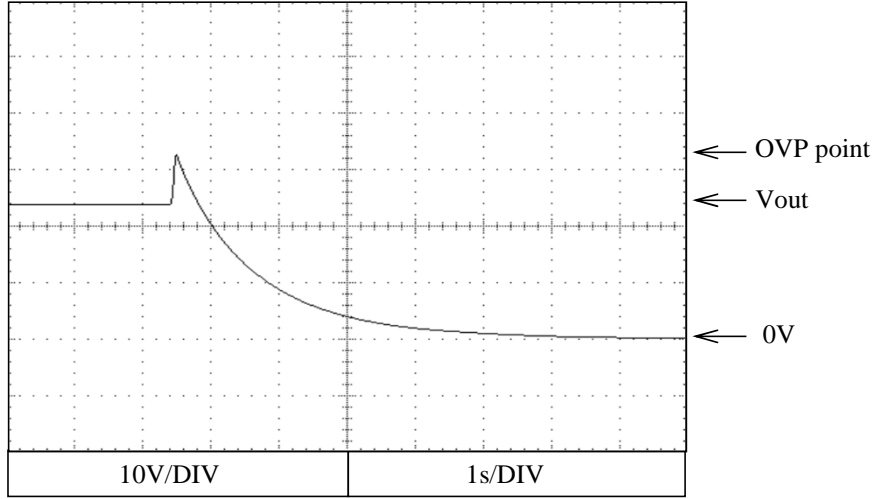
Conditions; Vin : 170VAC -----  
 : 230VAC -.-.-.-  
 : 265VAC ———  
 Ta : 25°C



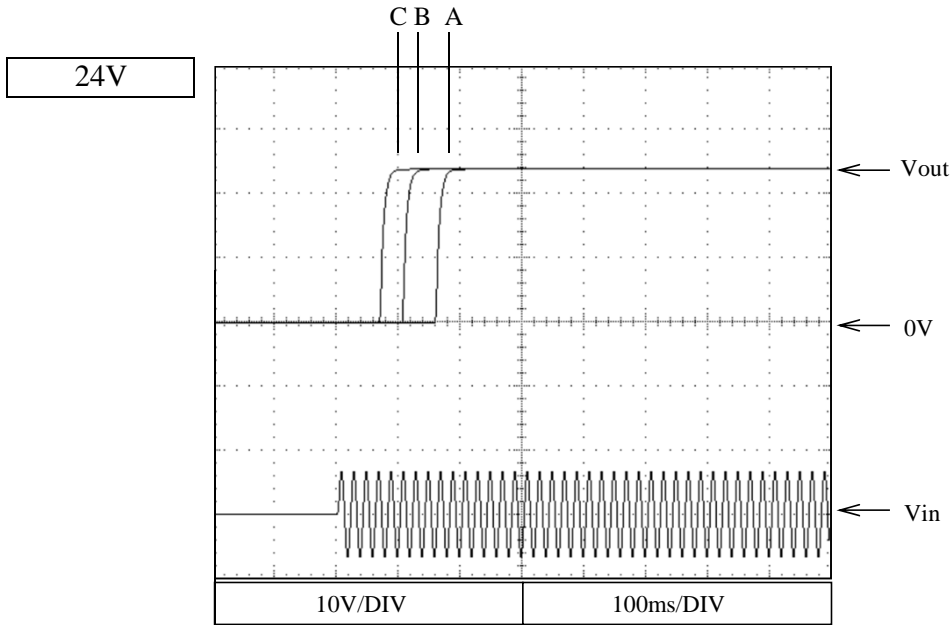
2.4 Over voltage protection (OVP) characteristics

Conditions Vin : 100VAC  
Iout : 0%  
Ta : 25°C

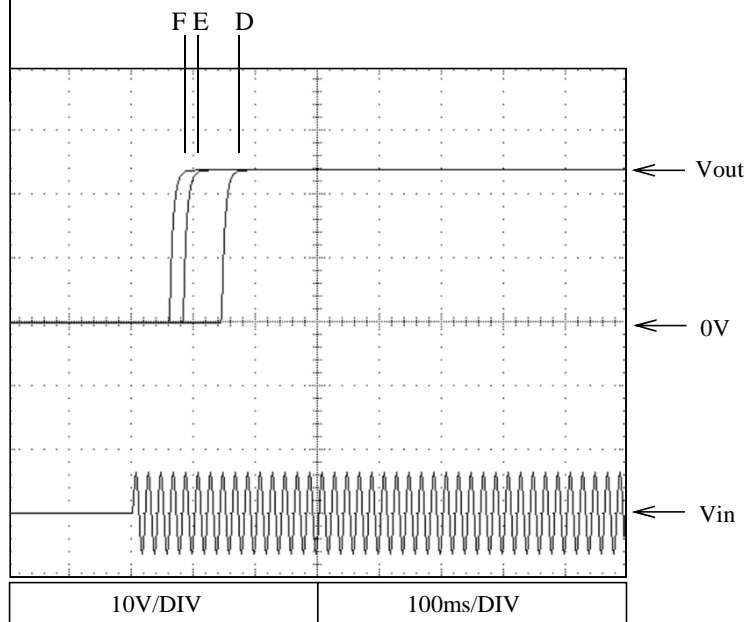
24V



2.5 Output rise characteristics



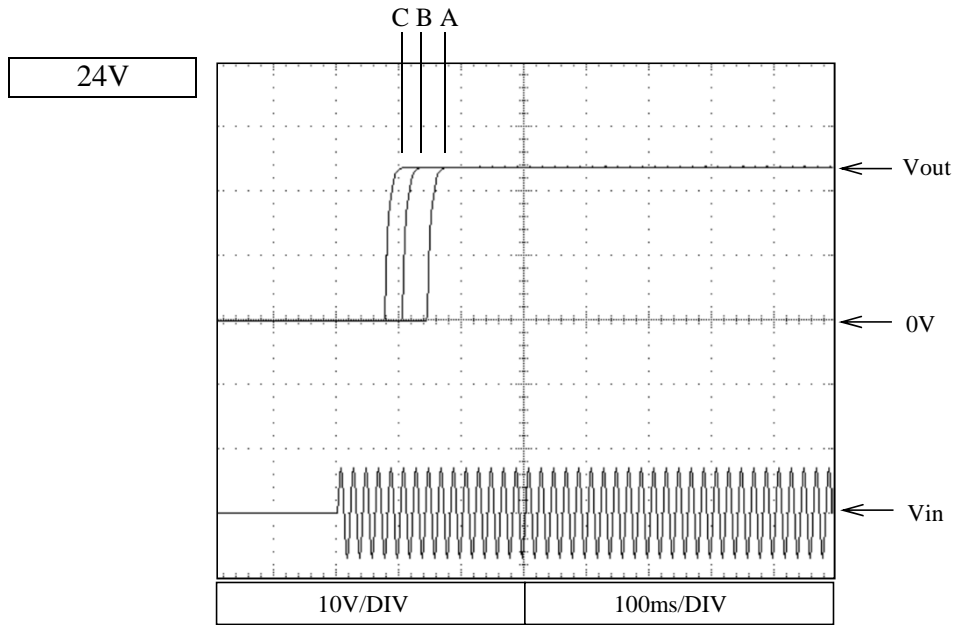
Conditions ;  
 Vin : 85VAC (A)  
 : 100VAC (B)  
 : 132VAC (C)  
 Iout : 0%  
 Ta : 25°C



Conditions ;  
 Vin : 170VAC (D)  
 : 230VAC (E)  
 : 265VAC (F)  
 Iout : 0%  
 Ta : 25°C

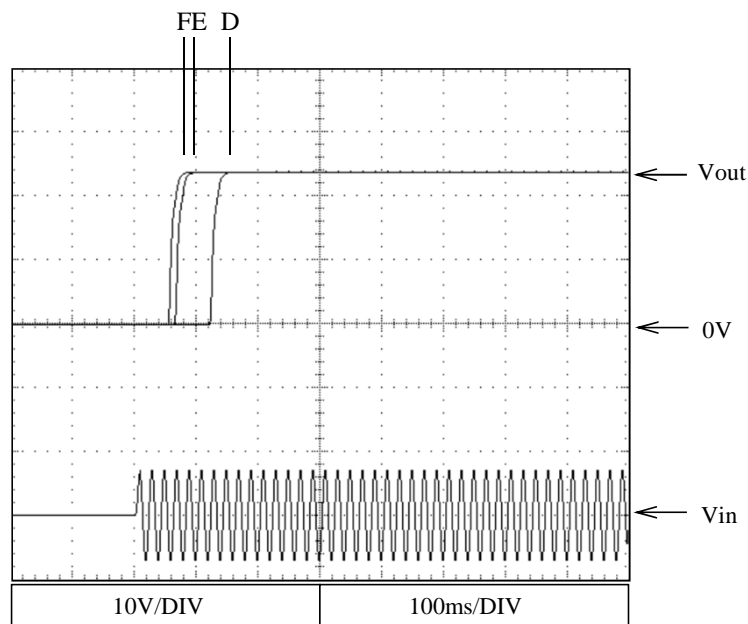


2.5 Output rise characteristics



Conditions ;

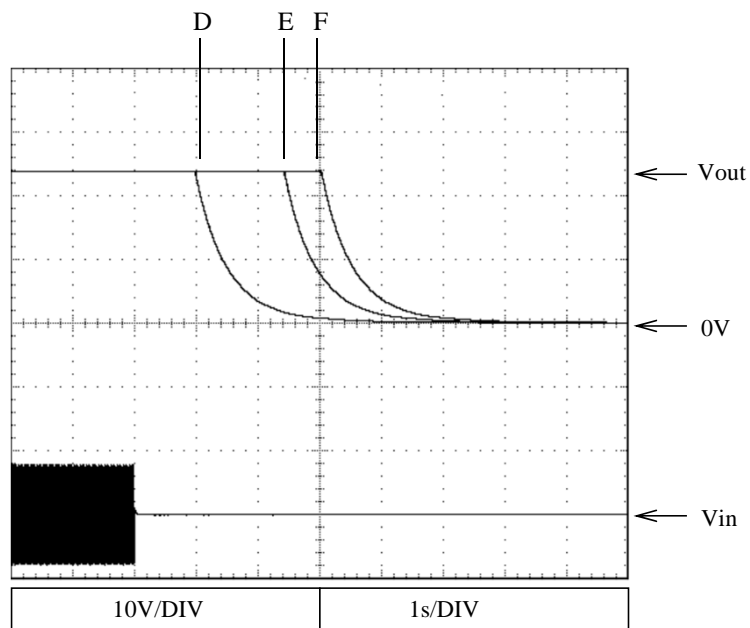
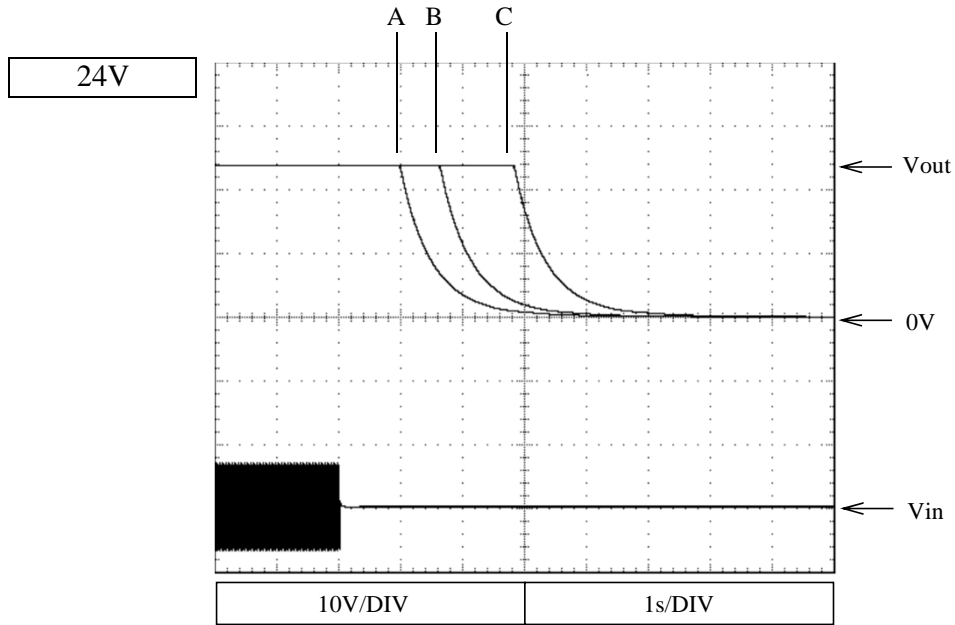
- Vin : 85VAC (A)
- : 100VAC (B)
- : 132VAC (C)
- Iout : 100%
- Ta : 25°C



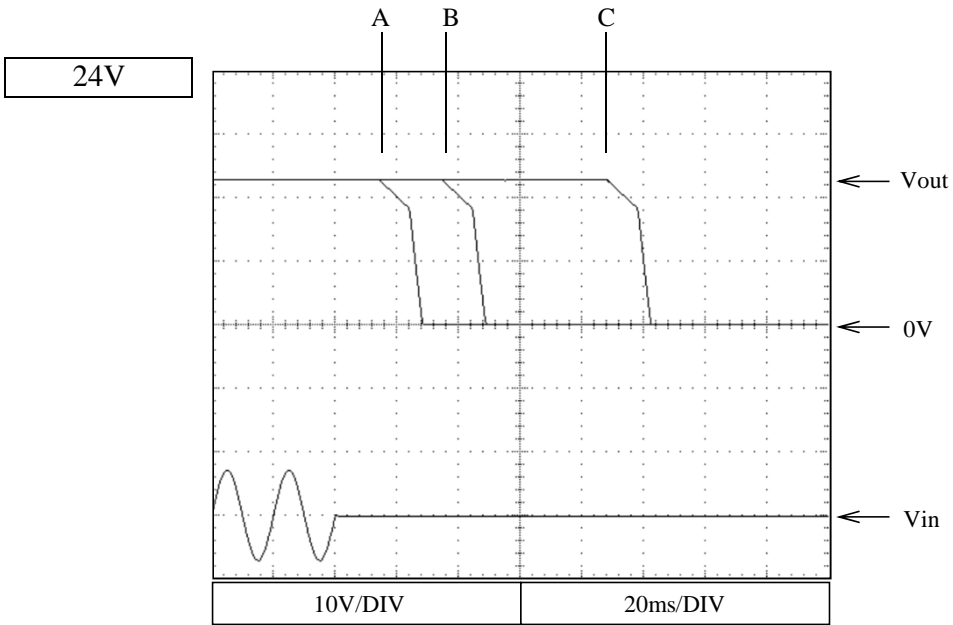
Conditions ;

- Vin : 170VAC (D)
- : 230VAC (E)
- : 265VAC (F)
- Iout : 100%
- Ta : 25°C

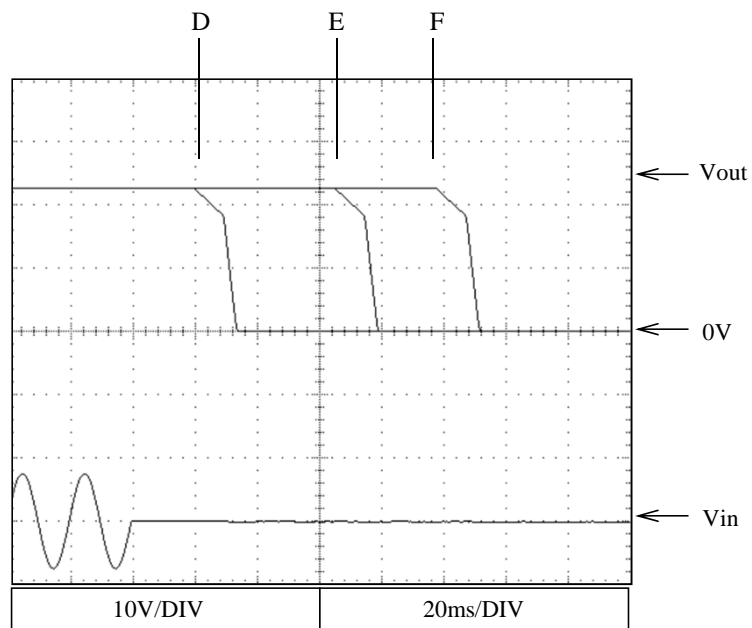
2.6 Output fall characteristics



2.6 Output fall characteristics



Conditions ;  
 Vin : 85VAC (A)  
      : 100VAC (B)  
      : 132VAC (C)  
 Iout : 100%  
 Ta : 25°C

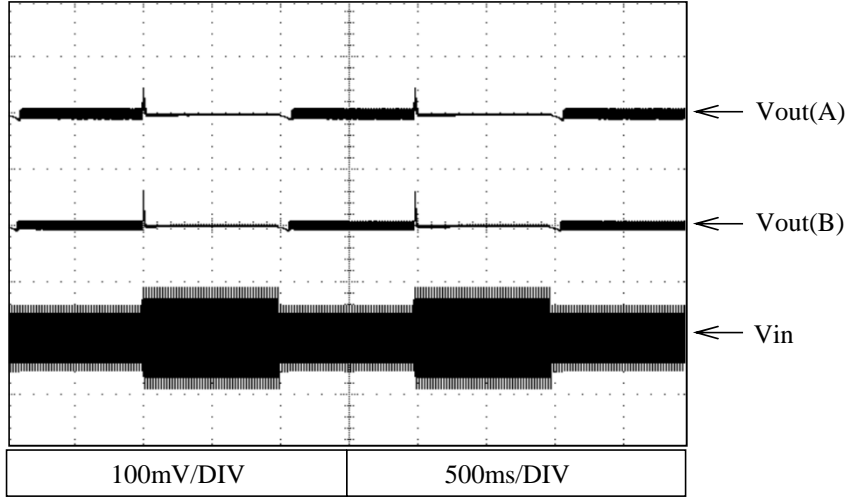


Conditions ;  
 Vin : 170VAC (D)  
      : 230VAC (E)  
      : 265VAC (F)  
 Iout : 100%  
 Ta : 25°C

2.7 Dynamic line response characteristics

Conditions Vin : 85VAC ↔ 132VAC(A)  
 170VAC ↔ 265VAC(B)  
 Iout : 100%  
 Ta : 25°C

24V

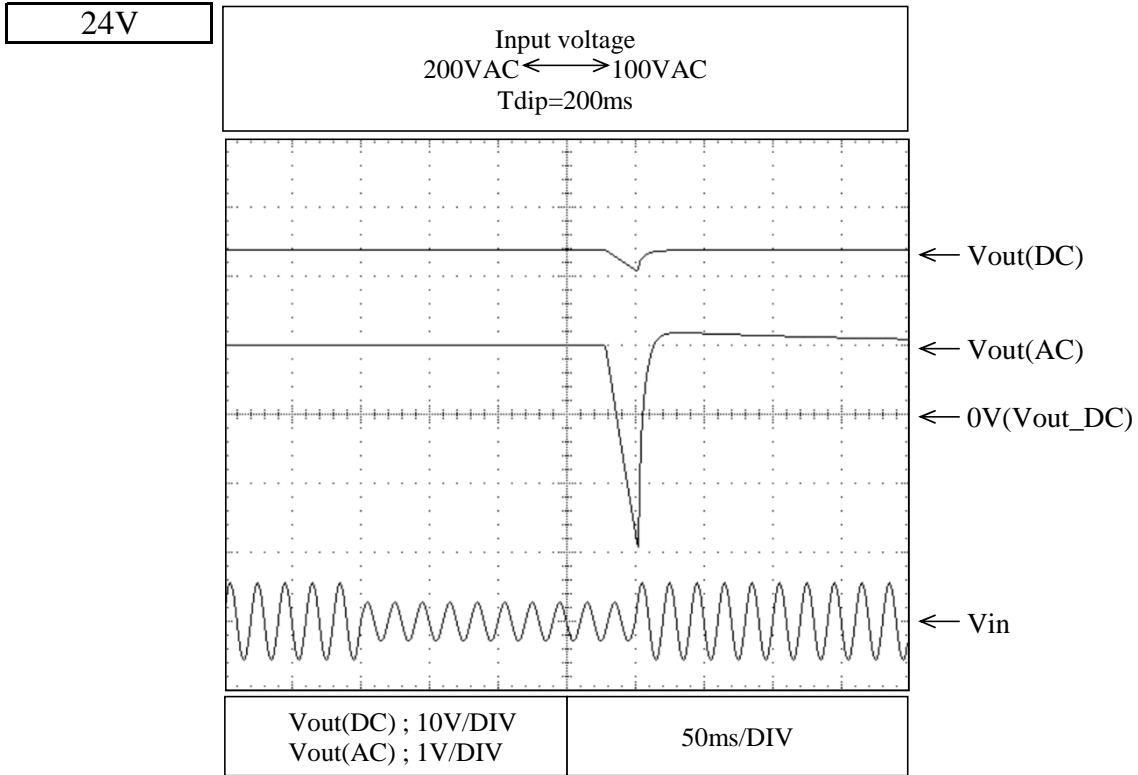


2.8 Input voltage DIP test

Conditions ;

Ta : 25°C

Iout : 25%

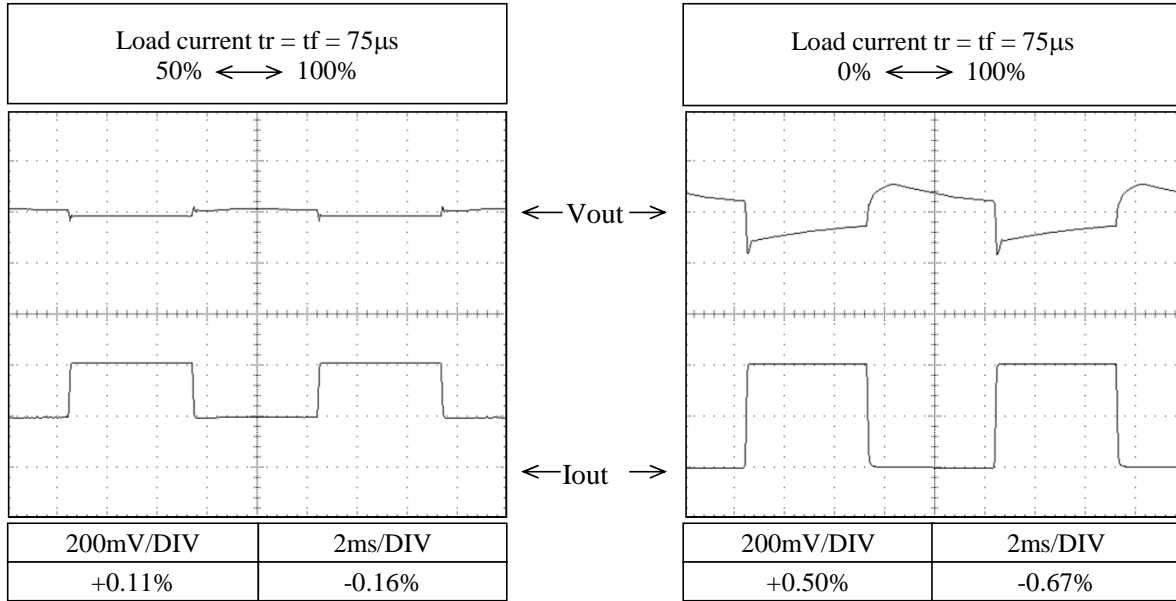


2.9 Dynamic load response characteristics

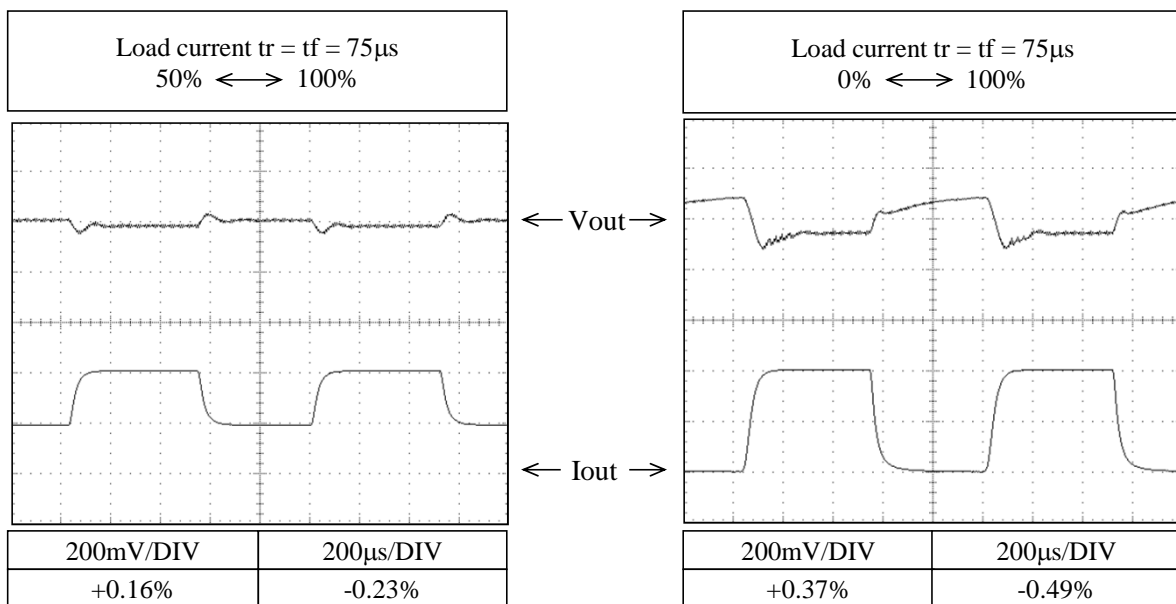
Conditions Vin : 100VAC  
Ta : 25°C

24V

f=100Hz

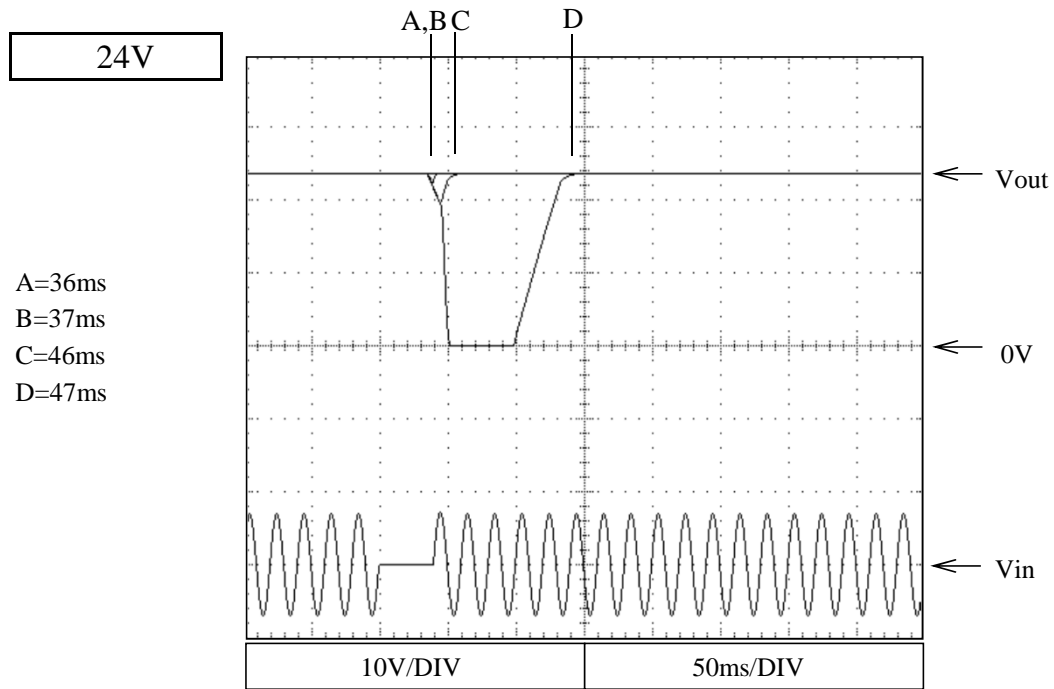


f=1kHz

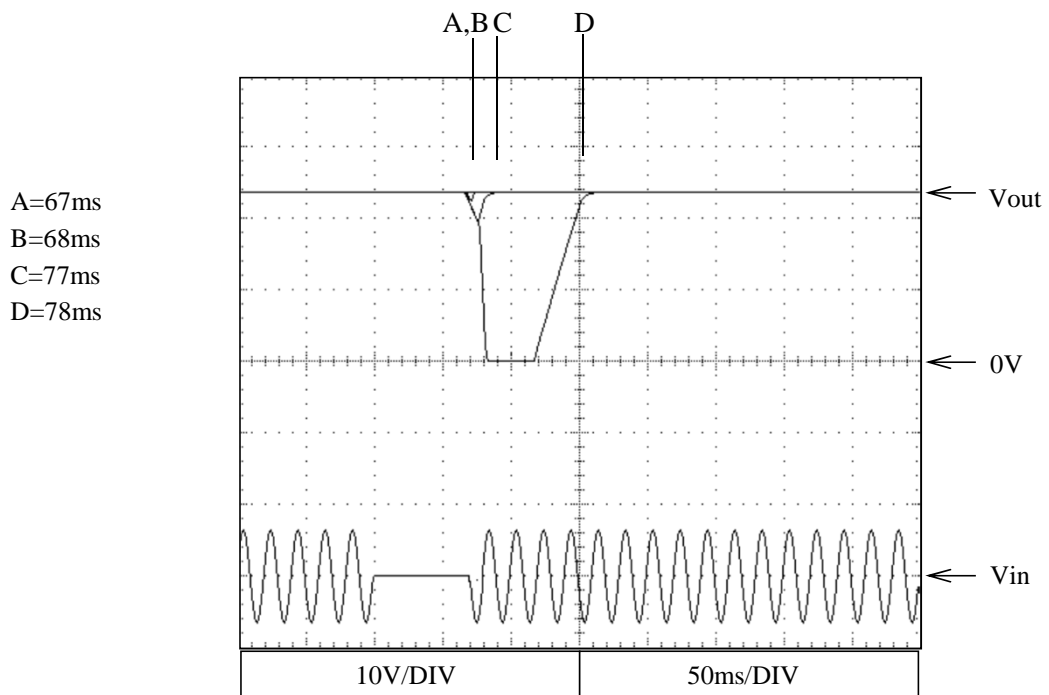


2.10 Response to brown out characteristics

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



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

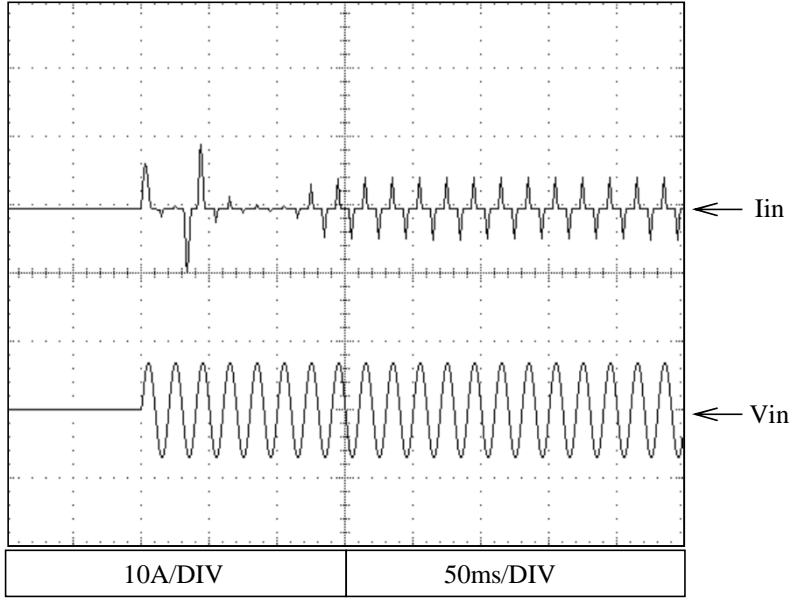


2.11 Inrush current waveform

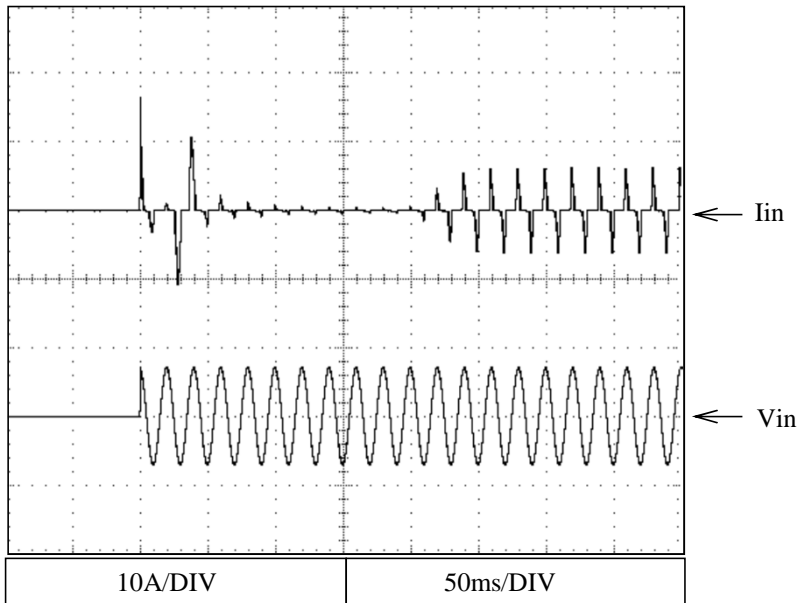
Conditions Vin : 100VAC  
 Iout : 100%  
 Ta : 25°C

24V

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



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



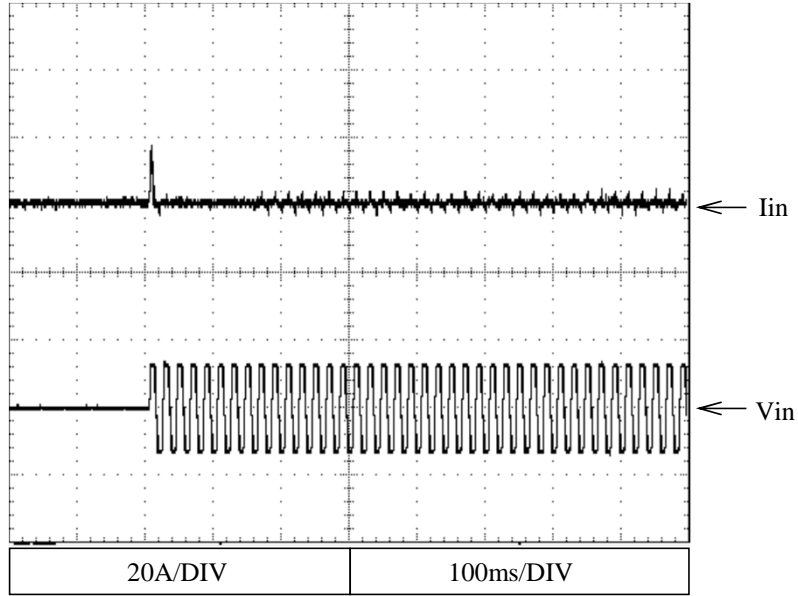


2.11 Inrush current waveform

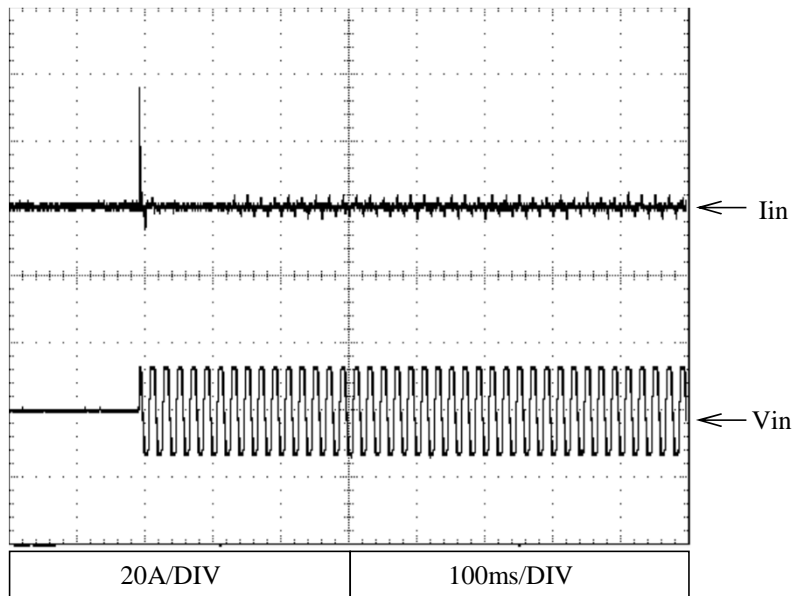
Conditions Vin : 230VAC  
 Iout : 100%  
 Ta : 25°C

24V

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



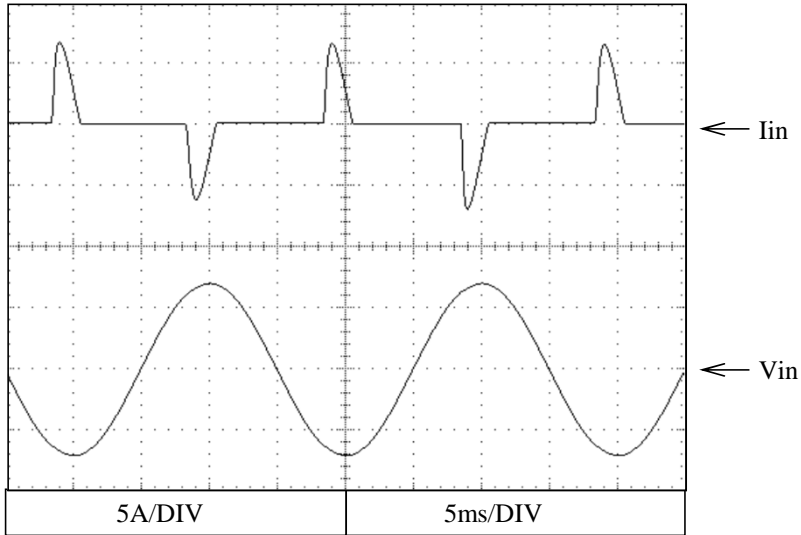
Switch on phase angle  
 of input AC voltage  
 $\phi = 90^\circ$



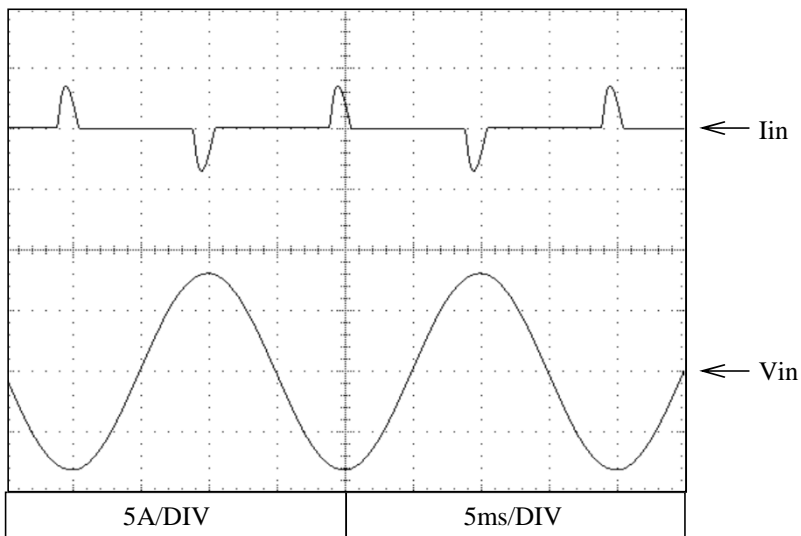
2.12 Input current waveform

24V

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



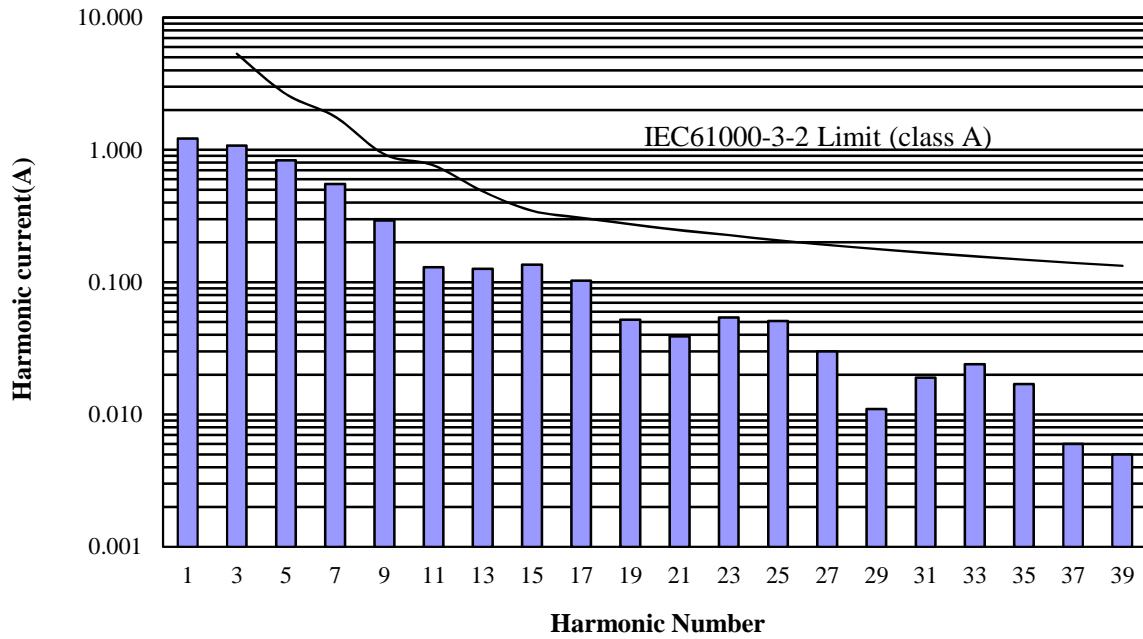
Conditions Vin : 230VAC  
 Iout : 100%  
 Ta : 25°C



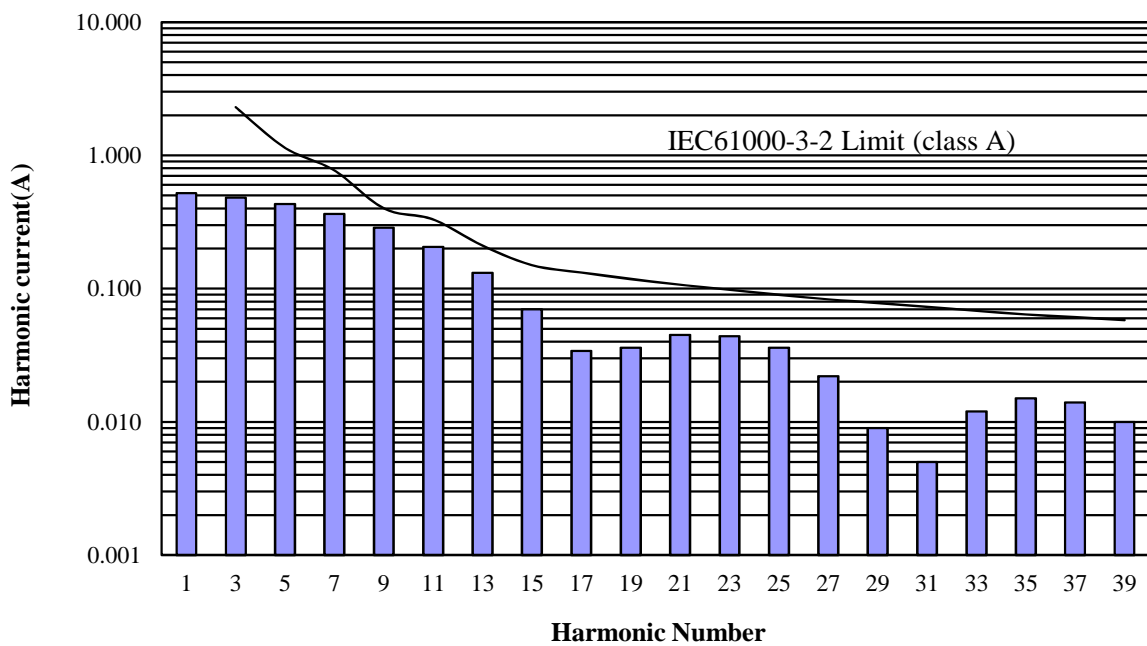
2.13 Input current harmonics

24V

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



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

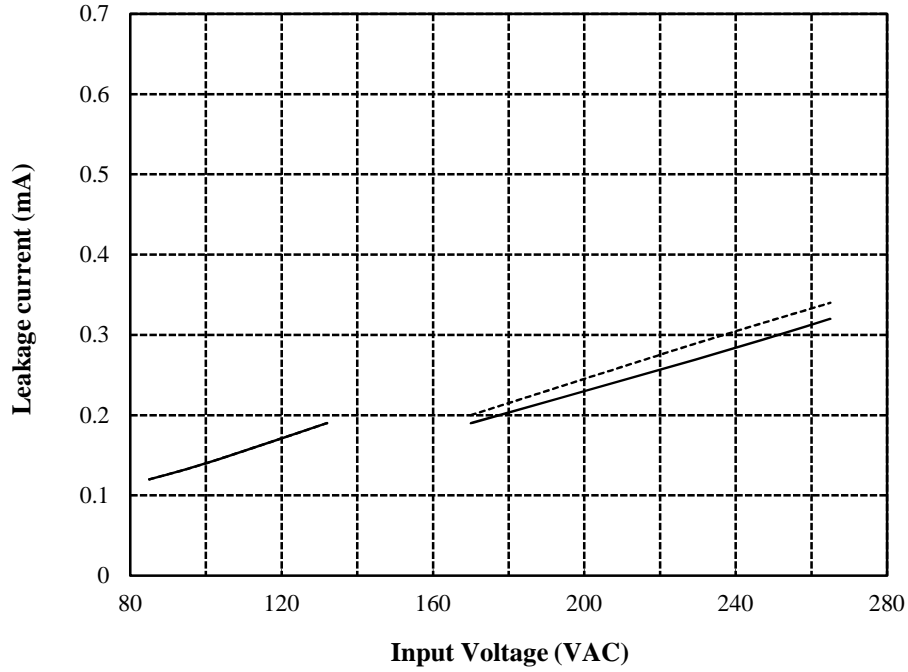


**2.14 Leakage current characteristics**

Conditions; Iout : 0% -----  
 : 100% ————  
 Ta : 25°C  
 f : 50Hz

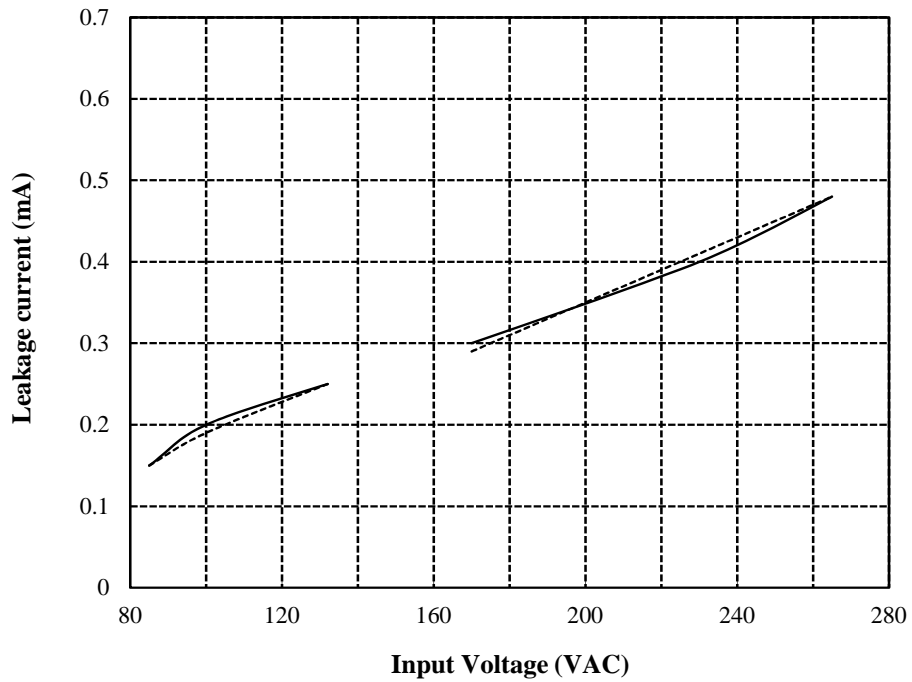
24V

Equipment used : MODEL 228 (Simpson)



Conditions; Iout : 0% -----  
 : 100% ————  
 Ta : 25°C  
 f : 50Hz

Equipment used : TYPE 3226 (YOKOGAWA)

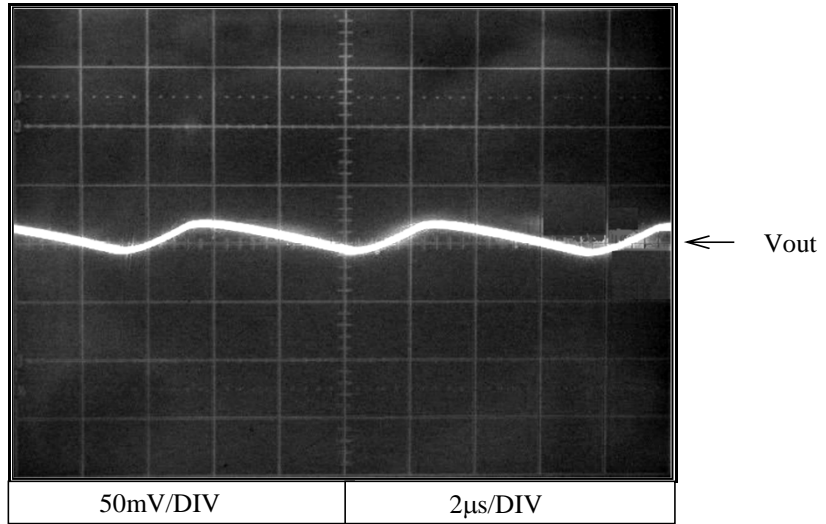


**2.15 Output ripple and noise waveform**

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

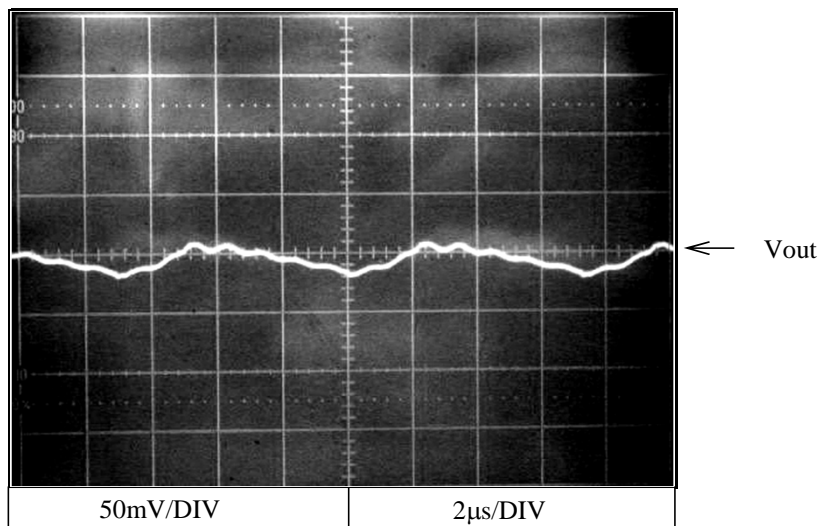
NORMAL MODE

24V



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

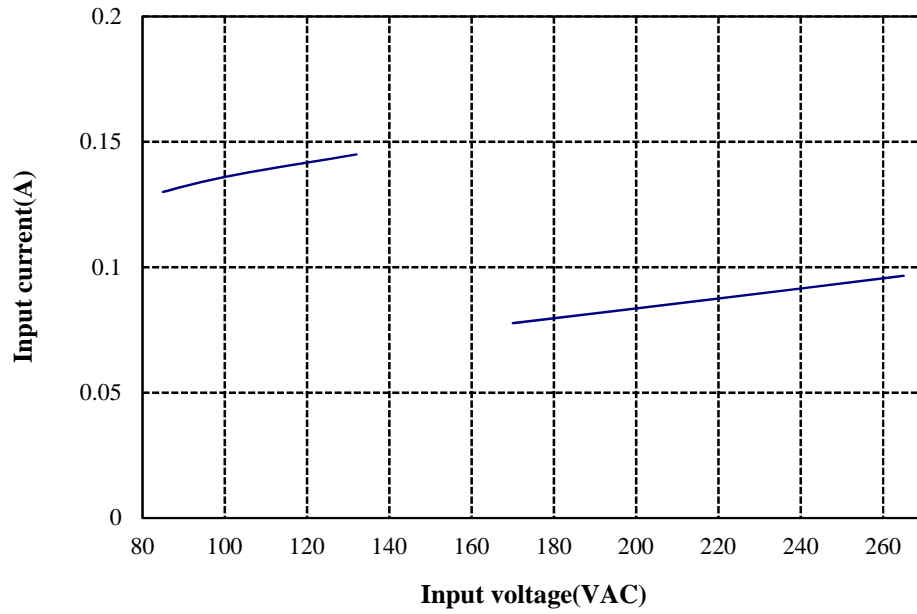
NORMAL + COMMON MODE



**2.16 Stand-by current**

Conditions; Ta : 25°C  
Iout : 0%

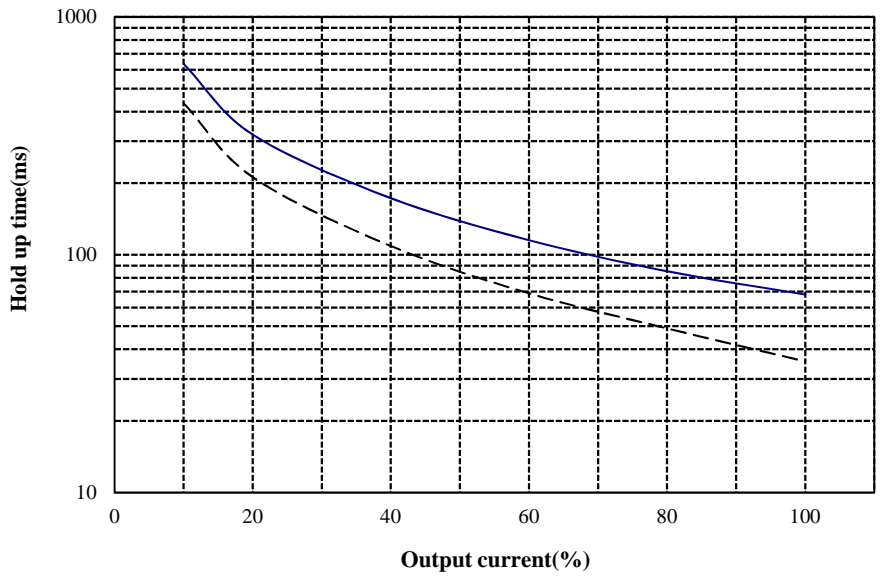
24V



2.17 Hold up time characteristics

Conditions; Vin : 100VAC -----  
                  : 230VAC -----  
                  Ta : 25°C

24V



2.18 Electro-Magnetic Interference characteristics

Conducted Emission

24V

Conditions

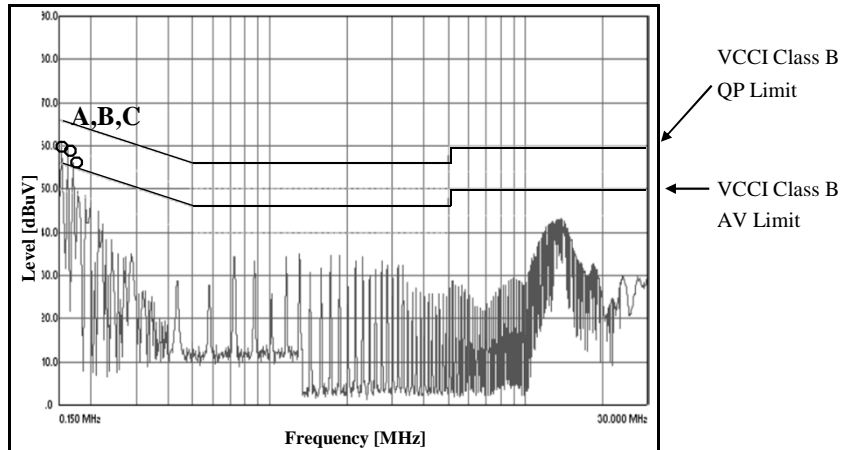
Vin : 100VAC

Iout : 100%

| Point A<br>(0.15MHz) |                 |                   |
|----------------------|-----------------|-------------------|
| Ref.                 | Limit<br>(dBuV) | Measure<br>(dBuV) |
| Data                 |                 |                   |
| QP                   | 66.0            | 55.4              |
| AV                   | 56.0            | 38.8              |

| Point B<br>(0.16MHz) |                 |                   |
|----------------------|-----------------|-------------------|
| Ref.                 | Limit<br>(dBuV) | Measure<br>(dBuV) |
| Data                 |                 |                   |
| QP                   | 65.7            | 51.1              |
| AV                   | 55.7            | 34.5              |

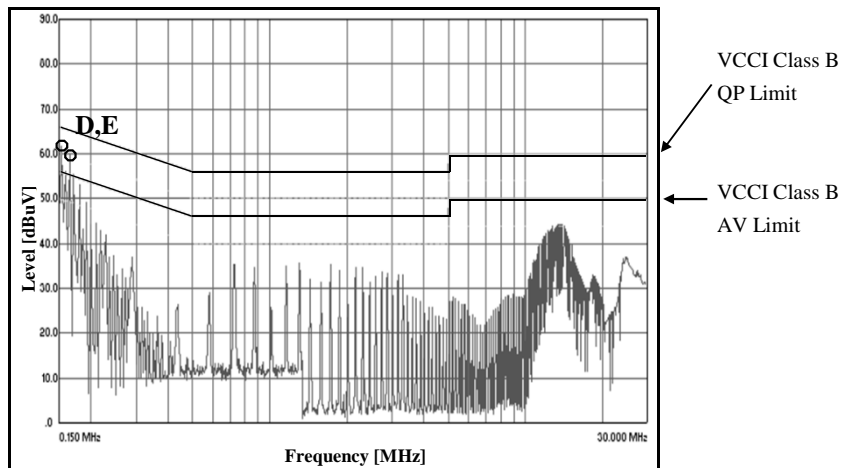
| Point C<br>(0.17MHz) |                 |                   |
|----------------------|-----------------|-------------------|
| Ref.                 | Limit<br>(dBuV) | Measure<br>(dBuV) |
| Data                 |                 |                   |
| QP                   | 65.4            | 46.9              |
| AV                   | 55.4            | 29.6              |



Phase : L

| Point D<br>(0.15MHz) |                 |                   |
|----------------------|-----------------|-------------------|
| Ref.                 | Limit<br>(dBuV) | Measure<br>(dBuV) |
| Data                 |                 |                   |
| QP                   | 66.0            | 57.0              |
| AV                   | 56.0            | 45.0              |

| Point E<br>(0.16MHz) |                 |                   |
|----------------------|-----------------|-------------------|
| Ref.                 | Limit<br>(dBuV) | Measure<br>(dBuV) |
| Data                 |                 |                   |
| QP                   | 65.7            | 54.8              |
| AV                   | 55.7            | 43.1              |



Phase : N

Limits of EN55032-B,FCC Class B are same as its VCCI class B.



2.18 Electro-Magnetic Interference characteristics

Conducted Emission

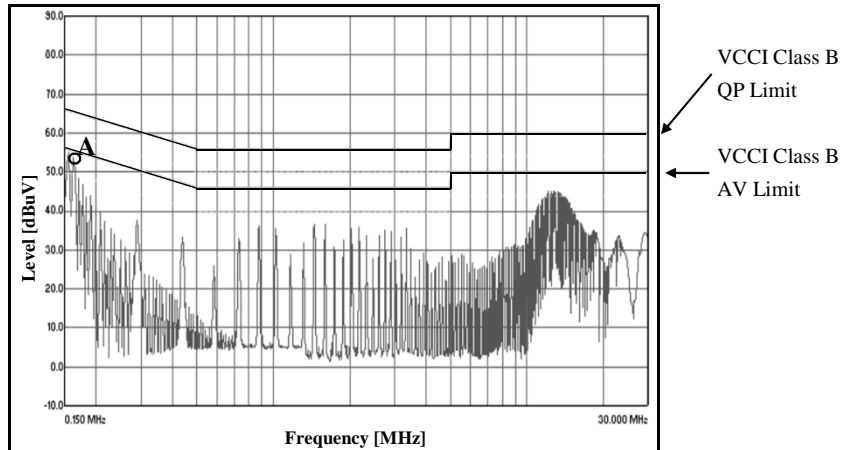
24V

Conditions

Vin : 230VAC

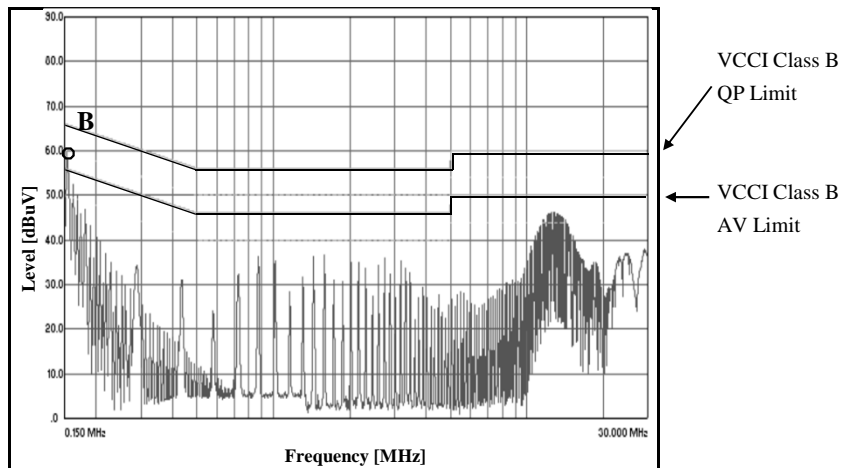
Iout : 100%

| Ref. | Point A<br>(0.16MHz) |                   |
|------|----------------------|-------------------|
|      | Limit<br>(dBuV)      | Measure<br>(dBuV) |
| QP   | 65.7                 | 48.6              |
| AV   | 55.7                 | 33.1              |



Phase : L

| Ref. | Point B<br>(0.15MHz) |                   |
|------|----------------------|-------------------|
|      | Limit<br>(dBuV)      | Measure<br>(dBuV) |
| QP   | 66.0                 | 54.6              |
| AV   | 56.0                 | 43.3              |



Phase : N

Limits of EN55032-B,FCC Class B are same as its VCCI class B.

2.18 Electro-Magnetic Interference characteristics

Radiated Emission

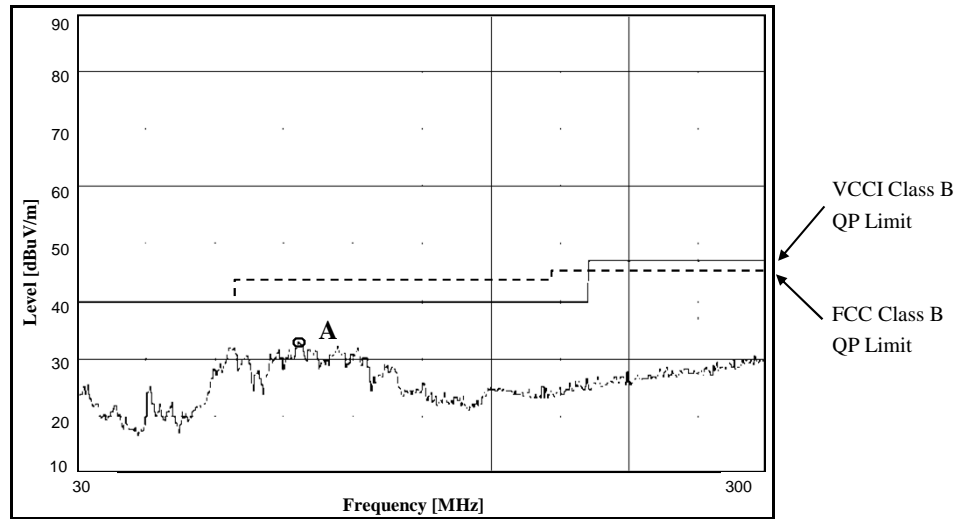
Conditions

Vin : 100VAC

Iout : 100%

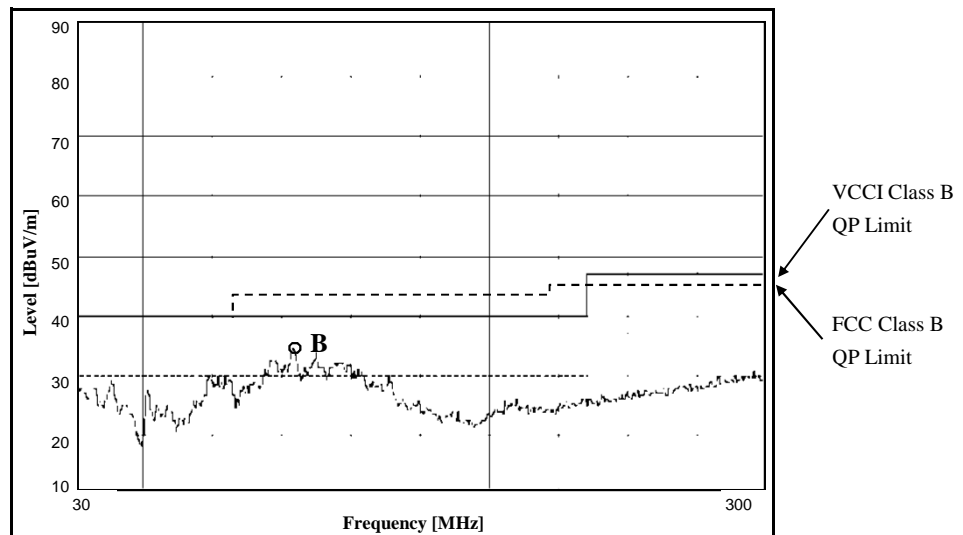
24V  
HORIZONTAL:

| Point A<br>(116.4MHz) |                     |
|-----------------------|---------------------|
| Limit<br>(dBuV/m)     | Measure<br>(dBuV/m) |
| 40.0                  | 30.1                |



VERTICAL:

| Point B<br>(114.6MHz) |                     |
|-----------------------|---------------------|
| Limit<br>(dBuV/m)     | Measure<br>(dBuV/m) |
| 40.0                  | 30.7                |



Limits of EN55032-B are same as its VCCI class B.

## 2.18 Electro-Magnetic Interference characteristics

### Radiated Emission

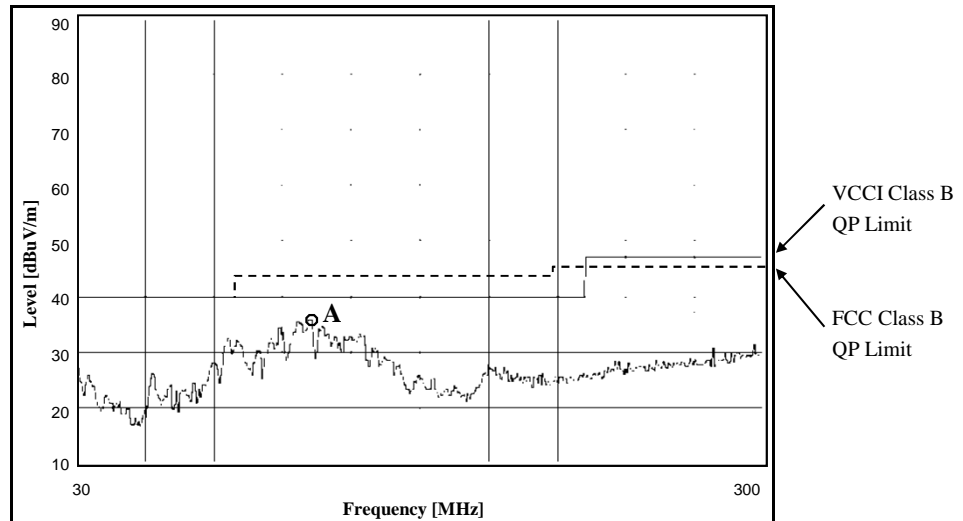
24V  
HORIZONTAL:

Conditions

Vin : 230VAC

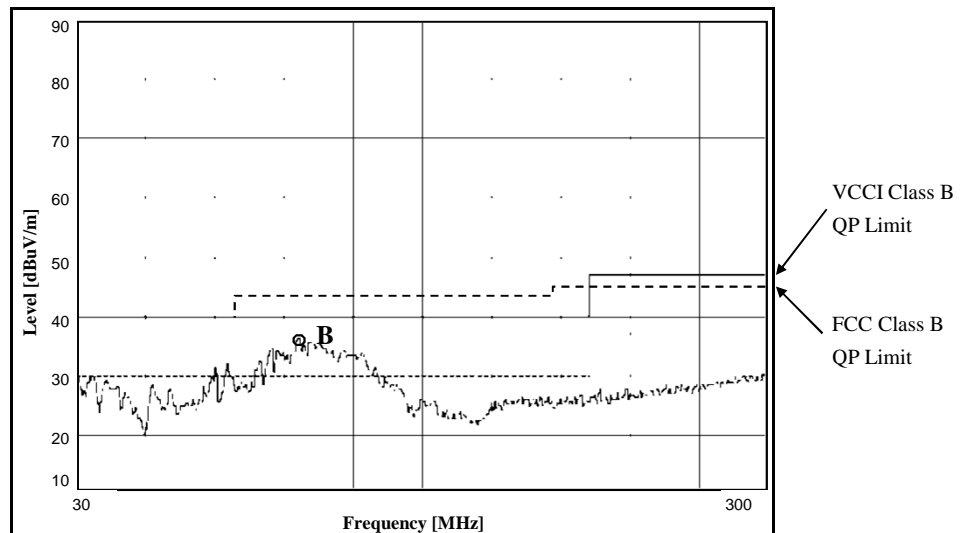
Iout : 100%

| Point A<br>(122.4MHz) |                     |
|-----------------------|---------------------|
| Limit<br>(dBuV/m)     | Measure<br>(dBuV/m) |
| 40.0                  | 30.9                |



VERTICAL:

| Point B<br>(116.3MHz) |                     |
|-----------------------|---------------------|
| Limit<br>(dBuV/m)     | Measure<br>(dBuV/m) |
| 40.0                  | 32.4                |



Limits of EN55032-B are same as its VCCI class B.