

# 2MBI600VE-120-50

IGBT Modules

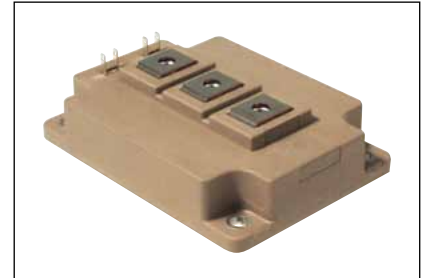
## IGBT MODULE (V series) 1200V / 600A / 2 in one package

### ■ Features

- High speed switching
- Voltage drive
- Low Inductance module structure

### ■ Applications

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply
- Industrial machines, such as Welding machines



### ■ Maximum Ratings and Characteristics

#### ● Absolute Maximum Ratings (at Tc=25°C unless otherwise specified)

| Items                                                       | Symbols               | Conditions | Maximum ratings                   | Units |
|-------------------------------------------------------------|-----------------------|------------|-----------------------------------|-------|
| Collector-Emitter voltage                                   | V <sub>CE</sub>       |            | 1200                              | V     |
| Gate-Emitter voltage                                        | V <sub>GE</sub>       |            | ±20                               | V     |
| Inverter<br>Collector current                               | I <sub>C</sub>        | Continuous | Tc=100°C<br>600<br>Tc=25°C<br>700 |       |
|                                                             | I <sub>C</sub> pulse  | 1ms        | 1200                              |       |
|                                                             | -I <sub>C</sub>       |            | 600                               |       |
|                                                             | -I <sub>C</sub> pulse | 1ms        | 1200                              |       |
|                                                             | P <sub>C</sub>        | 1 device   | 4800                              | W     |
| Junction temperature                                        | T <sub>J</sub>        |            | 175                               | °C    |
| Operating junction temperature (under switching conditions) | T <sub>JOP</sub>      |            | 150                               |       |
| Case temperature                                            | T <sub>C</sub>        |            | 125                               |       |
| Storage temperature                                         | T <sub>stg</sub>      |            | -40 ~ +125                        |       |
| Isolation voltage                                           | V <sub>iso</sub>      | AC : 1min. | 2500                              | VAC   |
| Screw torque                                                | Mounting (*2)         |            | 6.0                               | N m   |
|                                                             | Terminals (*3)        |            | 5.0                               |       |

Note \*1: All terminals should be connected together during the test.

Note \*2: Recommendable Value : 3.0-6.0 Nm (M5 or M6)

Note \*3: Recommendable Value : 2.5-5.0 Nm (M6)

#### ● Electrical characteristics (at Tj= 25°C unless otherwise specified)

| Items                    |                                      | Symbols                             | Conditions                                            |                       | Characteristics |      |      | Units |
|--------------------------|--------------------------------------|-------------------------------------|-------------------------------------------------------|-----------------------|-----------------|------|------|-------|
|                          |                                      |                                     |                                                       |                       | min.            | typ. | max. |       |
| Inverter                 | Zero gate voltage collector current  | I <sub>CE</sub>                     | V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V         |                       | -               | -    | 2.0  | mA    |
|                          | Gate-Emitter leakage current         | I <sub>GES</sub>                    | V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V          |                       | -               | -    | 800  | nA    |
|                          | Gate-Emitter threshold voltage       | V <sub>GE (th)</sub>                | V <sub>CE</sub> = 20V, I <sub>C</sub> = 600mA         |                       | 6.0             | 6.5  | 7.0  | V     |
|                          | Collector-Emitter saturation voltage | V <sub>CE (sat)</sub><br>(terminal) | V <sub>GE</sub> = 15V<br>I <sub>C</sub> = 600A        | T <sub>J</sub> =25°C  | -               | 2.05 | 2.70 | V     |
|                          |                                      |                                     |                                                       | T <sub>J</sub> =125°C | -               | 2.40 | -    |       |
|                          |                                      |                                     |                                                       | T <sub>J</sub> =150°C | -               | 2.45 | -    |       |
|                          |                                      | V <sub>CE (sat)</sub><br>(chip)     |                                                       | T <sub>J</sub> =25°C  | -               | 1.75 | 2.15 |       |
|                          |                                      |                                     |                                                       | T <sub>J</sub> =125°C | -               | 2.05 | -    |       |
|                          |                                      |                                     | T <sub>J</sub> =150°C                                 | -                     | 2.10            | -    |      |       |
|                          | Input capacitance                    | C <sub>ies</sub>                    | V <sub>CE</sub> = 10V, V <sub>GE</sub> = 0V, f = 1MHz |                       | -               | 49   | -    | nF    |
|                          | Turn-on time                         | t <sub>on</sub>                     | V <sub>CC</sub> = 600V    L <sub>S</sub> = 30nH       |                       | -               | 0.60 | -    | μs    |
|                          |                                      | t <sub>r</sub>                      | I <sub>C</sub> = 600A                                 |                       | -               | 0.20 | -    |       |
|                          |                                      | t <sub>r (i)</sub>                  | V <sub>GE</sub> = ±15V                                |                       | -               | 0.05 | -    |       |
|                          | Turn-off time                        | t <sub>off</sub>                    | R <sub>G</sub> = 0.62Ω                                |                       | -               | 0.80 | -    |       |
|                          |                                      | t <sub>f</sub>                      | T <sub>J</sub> = 150°C                                |                       | -               | 0.08 | -    |       |
|                          | Forward on voltage                   | V <sub>F</sub><br>(terminal)        | V <sub>GE</sub> = 0V<br>I <sub>F</sub> = 600A         | T <sub>J</sub> =25°C  | -               | 1.85 | 2.35 | V     |
| T <sub>J</sub> =125°C    |                                      |                                     |                                                       | -                     | 2.00            | -    |      |       |
| T <sub>J</sub> =150°C    |                                      |                                     |                                                       | -                     | 1.95            | -    |      |       |
| V <sub>F</sub><br>(chip) |                                      | T <sub>J</sub> =25°C                |                                                       | -                     | 1.70            | 2.15 |      |       |
|                          |                                      | T <sub>J</sub> =125°C               |                                                       | -                     | 1.85            | -    |      |       |
|                          |                                      | T <sub>J</sub> =150°C               | -                                                     | 1.80                  | -               |      |      |       |
| Reverse recovery time    | t <sub>rr</sub>                      | I <sub>F</sub> = 600A               |                                                       | -                     | 0.15            | -    | us   |       |

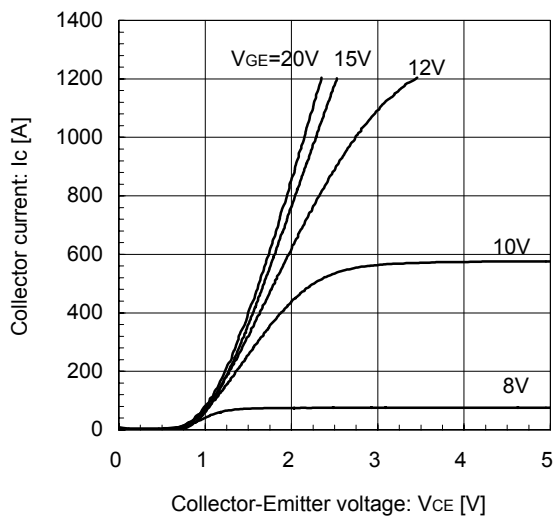
#### ● Thermal resistance characteristics

| Items                                     | Symbols              | Conditions            | Characteristics |        |       | Units |
|-------------------------------------------|----------------------|-----------------------|-----------------|--------|-------|-------|
|                                           |                      |                       | min.            | typ.   | max.  |       |
| Thermal resistance (1device)              | R <sub>th(j-c)</sub> | IGBT<br>FWD           | -               | -      | 0.031 | °C/W  |
| Contact thermal resistance (1device) (*4) | R <sub>th(c-f)</sub> | with Thermal Compound | -               | 0.0125 | -     |       |

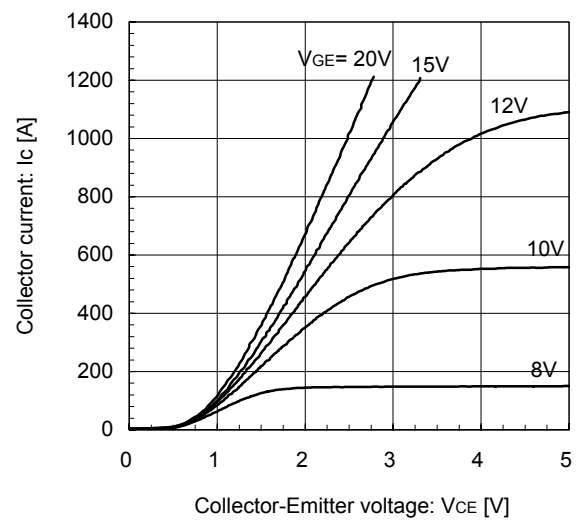
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

## ■ Characteristics (Representative)

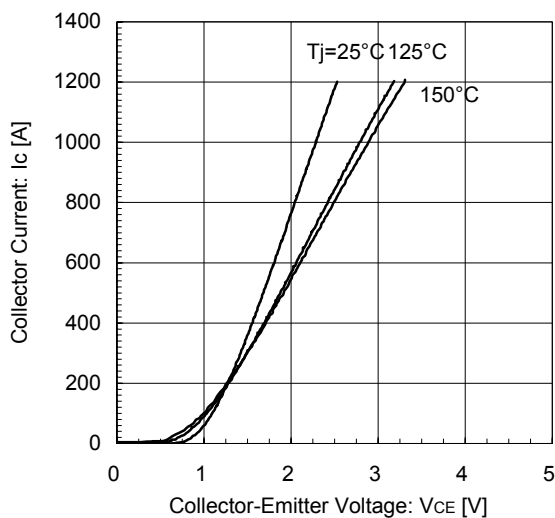
Collector current vs. Collector-Emitter voltage (typ.)  
T<sub>j</sub> = 25°C / chip



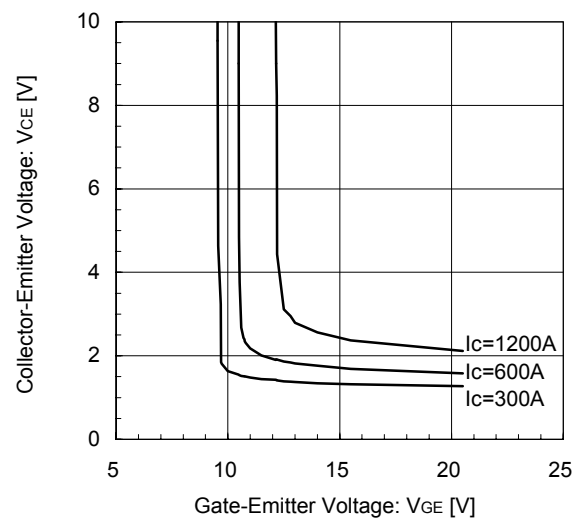
Collector current vs. Collector-Emitter voltage (typ.)  
T<sub>j</sub> = 150°C / chip



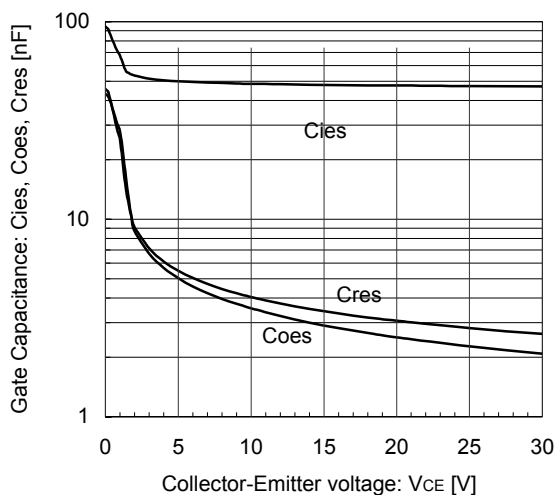
Collector current vs. Collector-Emitter voltage (typ.)  
V<sub>GE</sub> = 15V / chip



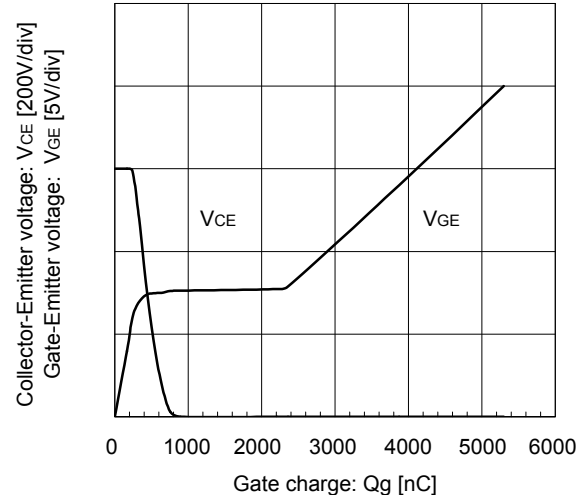
Collector-Emitter voltage vs. Gate-Emitter voltage  
T<sub>j</sub> = 25°C / chip



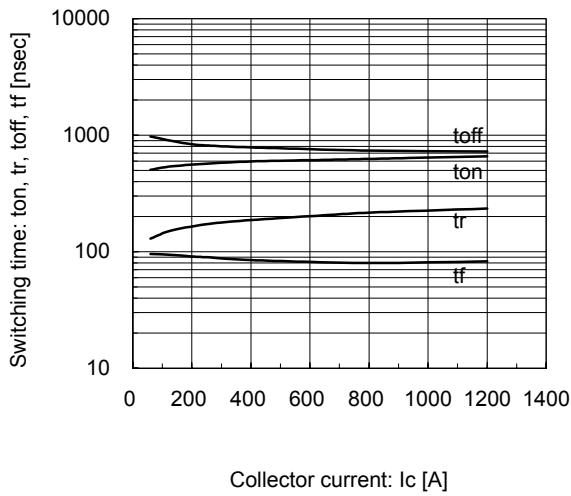
Gate Capacitance vs. Collector-Emitter Voltage  
V<sub>GE</sub> = 0V, f = 1MHz, T<sub>j</sub> = 25°C



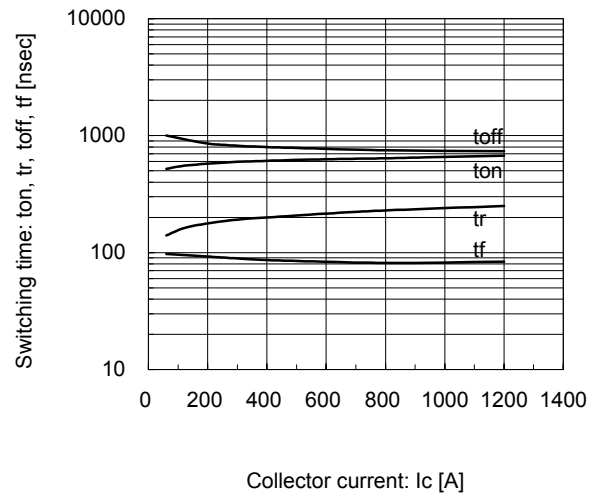
Dynamic Gate Charge (typ.)  
V<sub>CC</sub> = 600V, I<sub>C</sub> = 600A, T<sub>j</sub> = 25°C



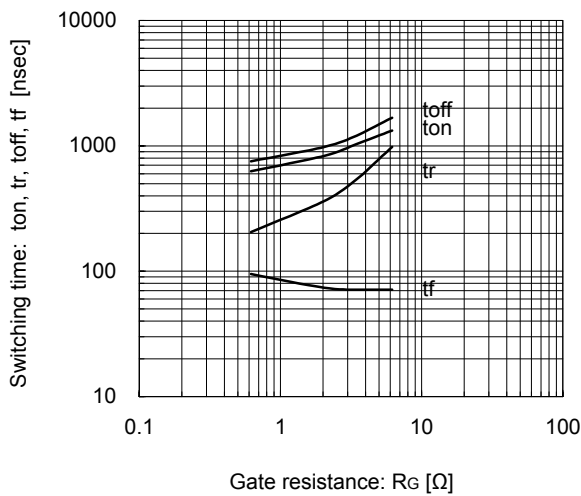
Switching time vs. Collector current (typ.)  
 $V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=0.62\Omega$ ,  $T_J=125^\circ C$



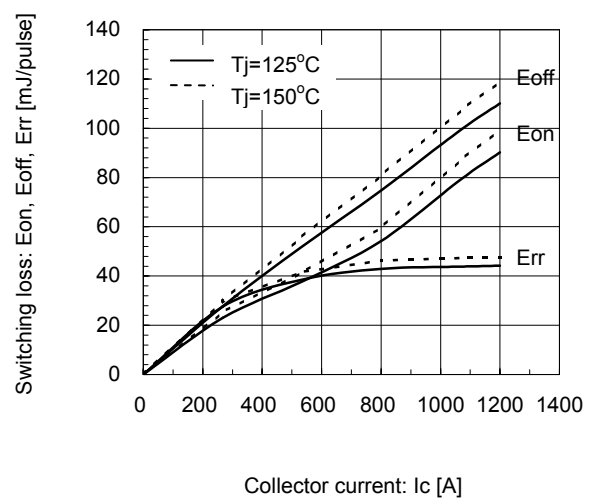
Switching time vs. Collector current (typ.)  
 $V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=0.62\Omega$ ,  $T_J=150^\circ C$



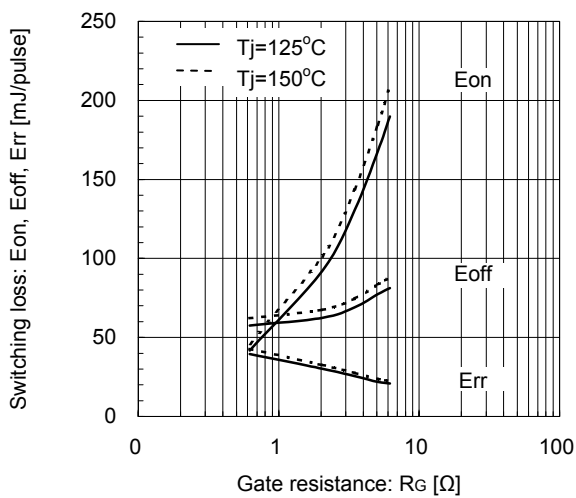
Switching time vs. Gate resistance (typ.)  
 $V_{CC}=600V$ ,  $I_C=600A$ ,  $V_{GE}=\pm 15V$ ,  $T_J=125^\circ C$



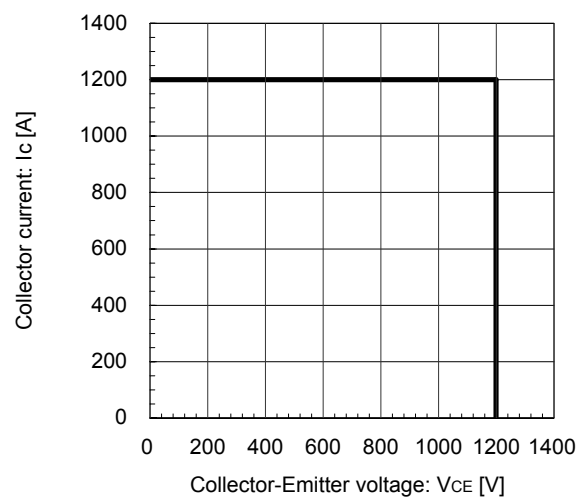
Switching loss vs. Collector current (typ.)  
 $V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=0.62\Omega$ ,  $T_J=125^\circ C$ ,  $150^\circ C$



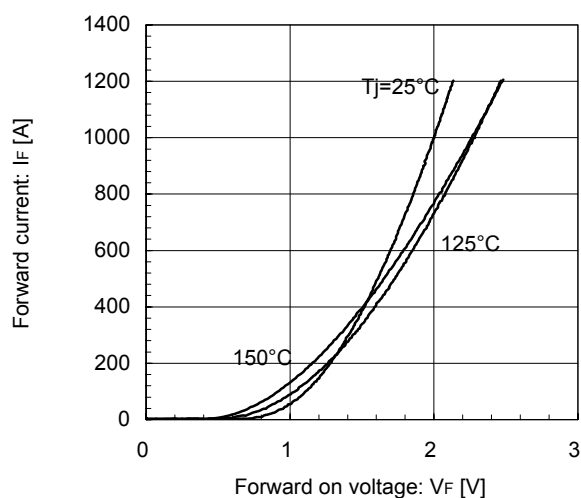
Switching loss vs. Gate resistance (typ.)  
 $V_{CC}=600V$ ,  $I_C=600A$ ,  $V_{GE}=\pm 15V$ ,  $T_J=125^\circ C$ ,  $150^\circ C$



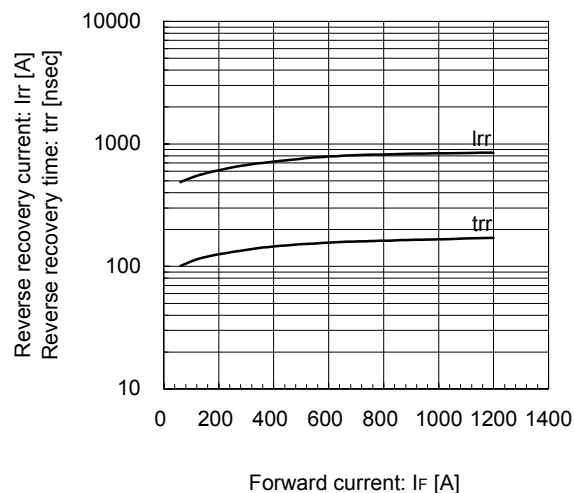
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V$ ,  $-V_{GE}=15V$ ,  $R_G=0.62\Omega$ ,  $T_J=150^\circ C$



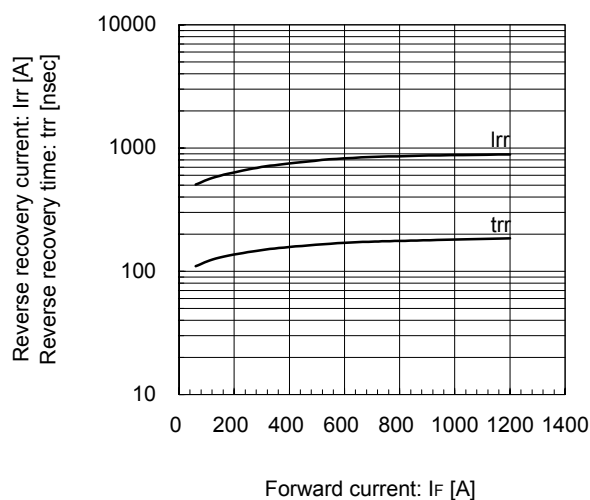
Forward Current vs. Forward Voltage (typ.)  
chip



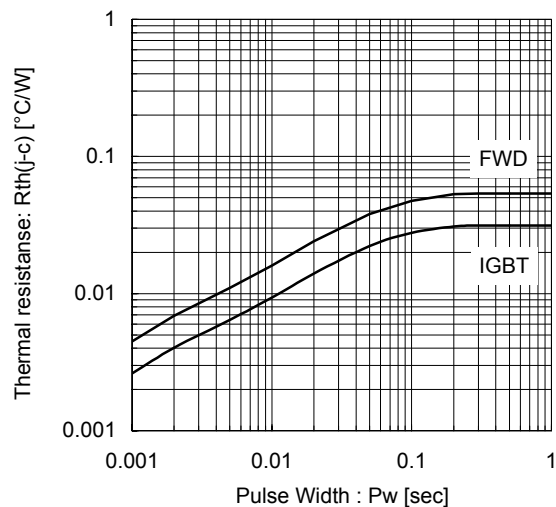
Reverse Recovery Characteristics (typ.)  
 $V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=0.62\Omega$ ,  $T_J=125^\circ C$



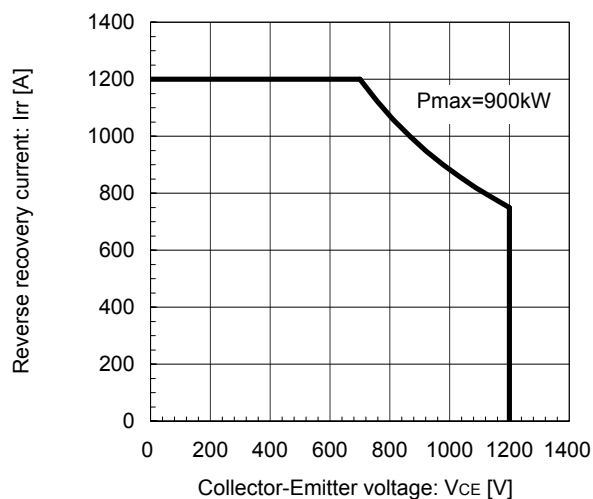
Reverse Recovery Characteristics (typ.)  
 $V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=0.62\Omega$ ,  $T_J=125^\circ C$ ,  $150^\circ C$



Transient Thermal Resistance (max.)



FWD safe operating area (max.)  
 $T_J=150^\circ C$



Technical drawing of the 48VDC power supply unit, showing front and side views with dimensions.

**Front View Dimensions:**

- Overall width:  $110 \pm 1$
- Overall height:  $80 \pm 1$
- Top mounting holes:  $4 - \varnothing 6.5 \pm 0.3$
- Terminal block mounting holes:  $\varnothing 2$ ,  $\varnothing 2$ ,  $\varnothing 1$ ,  $\varnothing 1$
- Terminal block dimensions:  $6 \pm 0.2$ ,  $15 \pm 0.2$ ,  $6 \pm 0.2$
- Internal component dimensions:  $25 \pm 0.2$ ,  $25 \pm 0.2$ ,  $21.5 \pm 0.2$ ,  $14$ ,  $14$ ,  $14$
- Internal component labels: C2E1, E2, C1
- Internal component spacing:  $22$ ,  $22$ ,  $22$
- Internal component total width:  $93 \pm 0.2$

**Side View Dimensions:**

- Overall height:  $30 \pm 0.8$
- Label height:  $23$
- Label width:  $7 \pm 0.5$
- Label depth:  $10.5 \text{ min.}$
- Label text: LABEL
- Terminal block height:  $6.5 \pm 0.5$
- Terminal block width:  $21.2 \pm 0.8$
- Terminal block label: TAB TYPE TERMINALS (DIN 46244-A2.8 0.5BZ equivalent)

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|                 |                         |                                               |                          |
|-----------------|-------------------------|-----------------------------------------------|--------------------------|
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| • Machine tools | • Audiovisual equipment | • Electrical home appliances                  | • Personal equipment     |
|                 |                         |                                               | • Industrial robots etc. |
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|                                                                             |                                                       |
|-----------------------------------------------------------------------------|-------------------------------------------------------|
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| • Traffic-signal control equipment                                          | • Gas leakage detectors with an auto-shut-off feature |
| • Emergency equipment for responding to disasters and anti-burglary devices | • Safety devices                                      |
| • Medical equipment                                                         |                                                       |
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|                                |                        |                             |
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| • Submarine repeater equipment |                        |                             |
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