

# 12MBI100VN-120-50

IGBT Modules

## IGBT MODULE (V series)

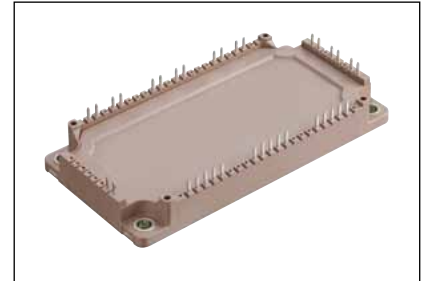
### 1200V / 100A / IGBT, RB-IGBT 12 in one package

#### ■ Features

- Higher Efficiency
- Optimized A (T-type) -3 level circuit
- Low inductance module structure
- Featuring Reverse Blocking IGBT (RB-IGBT)

#### ■ Applications

- Inverter for Motor Drive
- Uninterruptible Power Supply
- Power conditioner



#### ■ Maximum Ratings and Characteristics

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

| Items                       |   | Symbols   | Conditions      |                        | Maximum ratings        | Units |   |
|-----------------------------|---|-----------|-----------------|------------------------|------------------------|-------|---|
| T1, T2                      | Collector-Emitter voltage   | $V_{CES}$ |                 |                        | 1200                   | V     |   |
|                             | Gate-Emitter voltage  | $V_{GES}$ |                 |                        | ±20                    | V     |   |
|                             | Collector current   | IGBT      | $I_C$           | Continuous             | $T_c=80^\circ\text{C}$ | 100   | A |
|                             |   |           | $I_{cp}$        | 1ms                    | $T_c=80^\circ\text{C}$ | 200   |   |
|                             |   | FWD       | $-I_C$          |                        |                        | 100   |   |
|                             |   |           | $-I_{C\ pulse}$ | 1ms                    |                        |       |   |
| Collector power dissipation | $P_C$   | 1 device  |                 | 430                    | W                      |       |   |
| T3, T4                      | Collector-Emitter voltage   | $V_{CES}$ |                 |                        | 600                    | V     |   |
|                             | Repetitive peak reverse voltage   | $V_{RRM}$ |                 |                        | 600                    | V     |   |
|                             | Gate-Emitter voltage  | $V_{GES}$ |                 |                        | ±20                    | V     |   |
|                             | Collector current   | $I_C$     | Continuous      | $T_c=80^\circ\text{C}$ | 100                    | A     |   |
|                             |   | $I_{cp}$  | 1ms             | $T_c=80^\circ\text{C}$ | 200                    |       |   |
| Collector power dissipation | $P_C$   | 1 device  |                 | 400                    | W                      |       |   |
| Junction temperature        | $T_J$   |           |                 | 150                    | °C                     |       |   |
| Case temperature            | $T_C$   |           |                 | 125                    |                        |       |   |
| Storage temperature         | $T_{stg}$   |           |                 | -40 ~ +125             |                        |       |   |
| Isolation voltage           | between terminal and copper base (*1)<br>between thermistor and others (*2) | $V_{iso}$ | AC : 1min.      |                        | 2500                   | VAC   |   |
|                             | Mounting (*3)   | -         | M5              |                        | 3.5                    | N m   |   |

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

Note \*2: Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

Note \*3: Recommendable value : 2.5-3.5 Nm (M5)

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

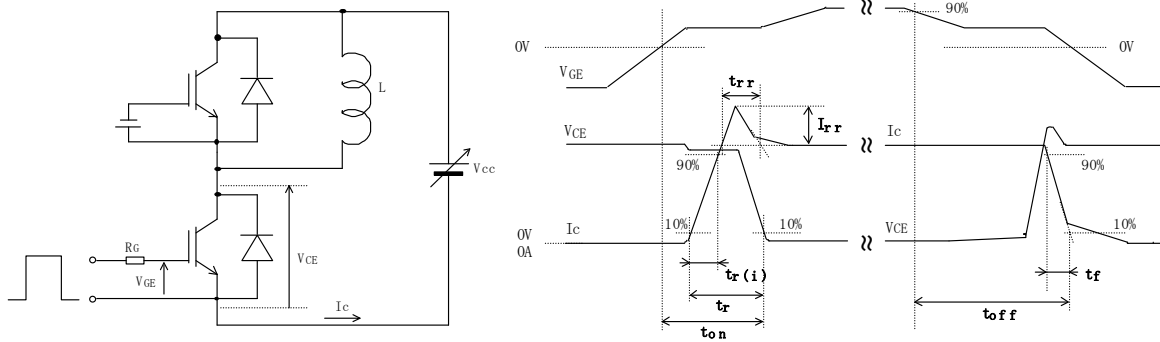
| Items                                  | Symbols                              | Conditions   | Characteristics  |                     |      | Units   |          |   |
|--|--------------------------------------|--|--|---------------------|------|---------|----------|---|
|  |                                      |  | min.   | typ.                | max. |         |          |   |
| T1, T2                                 | Zero gate voltage collector current  | $I_{CES}$  | $V_{GE} = 0V, V_{CE} = 1200V$  | -                   | -    | 1.0     | mA       |   |
|  | Gate-Emitter leakage current         | $I_{GES}$  | $V_{CE} = 0V, V_{GE} = \pm 20V$  | -                   | -    | 200     | nA       |   |
|  | Gate-Emitter threshold voltage       | $V_{GE(th)}$   | $V_{CE} = 20V, I_c = 100mA$  | 6.0                 | 6.5  | 7.0     | V        |   |
|  | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (chip)   | $V_{GE} = 15V$<br>$I_c = 100A$   | $T_j = 25^\circ C$  | -    | 1.75    | 2.20     | V |
|  |                                      |  |  | $T_j = 125^\circ C$ | -    | 2.05    | -        |   |
|  |                                      | $V_{CE(sat)}$ (P-U, V, W / U, V, W-N terminal)   | $V_{GE} = 15V$<br>$I_c = 100A$   | $T_j = 25^\circ C$  | -    | 2.60    | 3.05     |   |
|  |                                      |  |  | $T_j = 125^\circ C$ | -    | 2.90    | -        |   |
|  | Internal gate resistance             | $R_{g(int)}$   | -  | -                   | 7.5  | -       | $\Omega$ |   |
|  | Input capacitance                    | $C_{ies}$  | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$  | -                   | 9.1  | -       | nF       |   |
|  | Turn-on time                         | $t_{on}$   | SW mode : A<br>$V_{CC} = 300V$<br>$I_c = 100A$   | -                   | 0.44 | 1.20    | $\mu s$  |   |
|  |                                      | $t_r$  |  | -                   | 0.11 | 0.60    |          |   |
|  |                                      | $t_{r(f)}$   |  | -                   | 0.05 | -       |          |   |
|  | Turn-off time                        | $t_{off}$  | $V_{GE} = \pm 15V$   | -                   | 0.44 | 1.00    | $\mu s$  |   |
|  |                                      | $t_f$  | $R_G = 1.6\Omega$  | -                   | 0.06 | 0.30    |          |   |
|  | Forward on voltage                   | $V_F$ (chip)   | $I_F = 100A$   | $T_j = 25^\circ C$  | -    | 1.70    | 2.15     | V |
| $T_j = 125^\circ C$                    |                                      |  |  | -                   | 1.85 | -       |          |   |
| $V_F$ (P-U, V, W / U, V, W-N terminal) |                                      | $I_F = 100A$   | $T_j = 25^\circ C$   | -                   | 2.55 | 3.00    |          |   |
|  |                                      |  | $T_j = 125^\circ C$  | -                   | 2.70 | -       |          |   |
| Reverse recovery time                  | $t_{rr}$                             | SW mode : A<br>$V_{CC} = 600V$ $I_F = 100A$<br>$V_{GE} = \pm 15V$ $R_G = 1.6\Omega$          | -  | -                   | 0.35 | $\mu s$ |          |   |
|  |                                      | SW mode : B<br>$V_{CC} = 300V$ $I_F = 100A$<br>$V_{GE} = \pm 15V$ $R_G = 3.3\Omega$ (T3, T4) | -  | -                   | 0.35 |         |          |   |
| T3, T4                                 | Zero gate voltage collector current  | $I_{CES}$  | $V_{GE} = 0V, V_{CE} = 600V$   | -                   | -    | 1.0     | mA       |   |
|  | Gate-Emitter leakage current         | $I_{GES}$  | $V_{CE} = 0V, V_{GE} = \pm 20V$  | -                   | -    | 200     | nA       |   |
|  | Gate-Emitter threshold voltage       | $V_{GE(th)}$   | $V_{CE} = 20V, I_c = 100mA$  | 5.5                 | 6.5  | 7.5     | V        |   |
|  | Collector-Emitter saturation voltage | $V_{CE(sat)}$ (chip)   | $V_{GE} = 15V$<br>$I_c = 100A$   | $T_j = 25^\circ C$  | -    | 2.45    | 2.80     | V |
|  |                                      |  |  | $T_j = 125^\circ C$ | -    | 2.60    | -        |   |
|  |                                      | $V_{CE(sat)}$ (M-U, V, W terminal)   | $V_{GE} = 15V$<br>$I_c = 100A$   | $T_j = 25^\circ C$  | -    | 3.30    | 3.65     |   |
|  |                                      |  |  | $T_j = 125^\circ C$ | -    | 3.45    | -        |   |
|  | Internal gate resistance             | $R_{g(int)}$   | -  | -                   | 8.8  | -       | $\Omega$ |   |
|  | Input capacitance                    | $C_{ies}$  | $V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$  | -                   | 6.5  | -       | nF       |   |
|  | Turn-on time                         | $t_{on}$   | SW mode : B<br>$V_{CC} = 300V$<br>$I_c = 100A$   | -                   | 0.24 | 1.20    | $\mu s$  |   |
|  |                                      | $t_r$  |  | -                   | 0.10 | 0.60    |          |   |
|  |                                      | $t_{r(f)}$   |  | -                   | 0.04 | -       |          |   |
|  | Turn-off time                        | $t_{off}$  | $V_{GE} = \pm 15V$   | -                   | 0.20 | 1.00    | $\mu s$  |   |
|  |                                      | $t_f$  | $R_G = 3.3\Omega$  | -                   | 0.03 | 0.30    |          |   |
|  | Reverse recovery time                | $t_{rr}$   | SW mode : A<br>$V_{CC} = 300V$ $I_c = 100A$<br>$V_{GE} = \pm 15V$ $R_G = 1.6\Omega$ (T1, T2) | -                   | -    | 0.35    | $\mu s$  |   |
| Thermistor                             | Resistance                           | R  | $T = 25^\circ C$   | -                   | 5000 | -       | $\Omega$ |   |
|  |                                      |  | $T = 100^\circ C$  | 465                 | 495  | 520     |          |   |
|  | B value                              | B  | $T = 25/50^\circ C$  | 3305                | 3375 | 3450    | K        |   |

● Thermal resistance characteristics

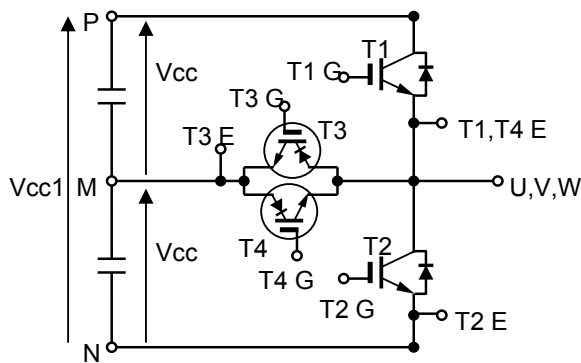
| Items                                     | Symbols       | Conditions       | Characteristics       |      |      | Units        |   |
|---|---------------|------------------|-----------------------|------|------|--------------|---|
|   |               |                  | min.                  | typ. | max. |              |   |
| Thermal resistance (1device)              | $R_{th(j-c)}$ | T1, T2 IGBT      | -                     | -    | 0.29 | $^\circ C/W$ |   |
|   |               | T1, T2 FWD       | -                     | -    | 0.44 |              |   |
|   |               | T3, T4 RB-IGBT   | -                     | -    | 0.31 |              |   |
| Contact thermal resistance (1device) (*4) | $R_{th(c-f)}$ | T1, T2<br>T3, T4 | with Thermal Compound |      | -    | 0.05         | - |

Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound (thermal conductivity = 1W/m ·k).

■ Definitions of switching time



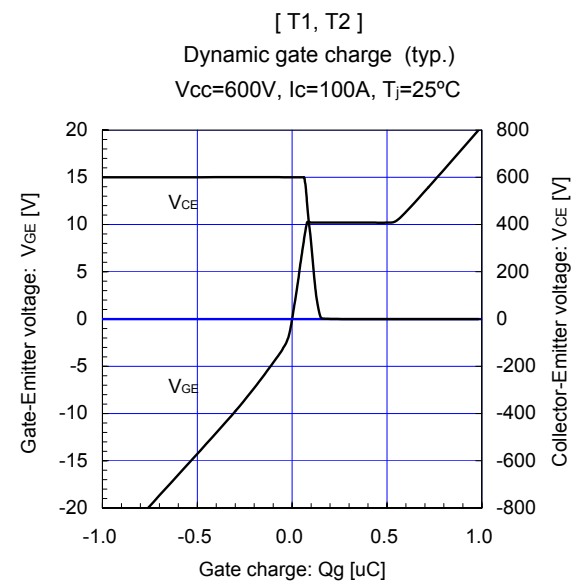
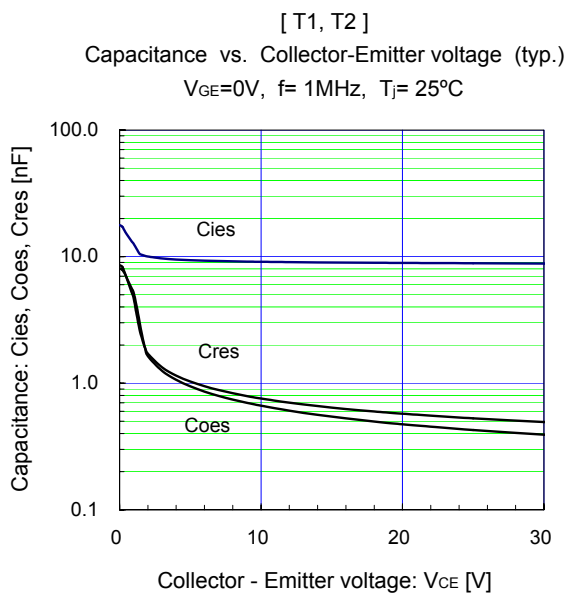
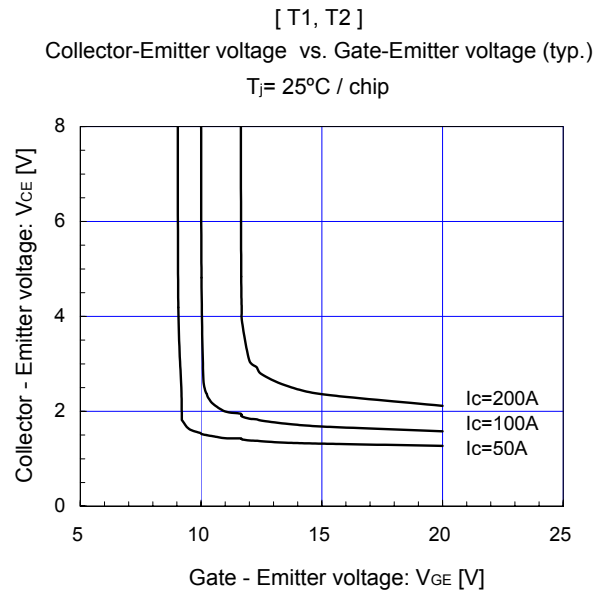
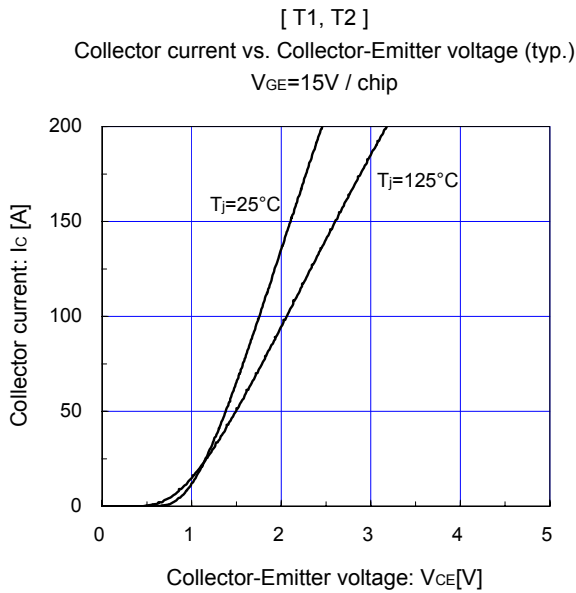
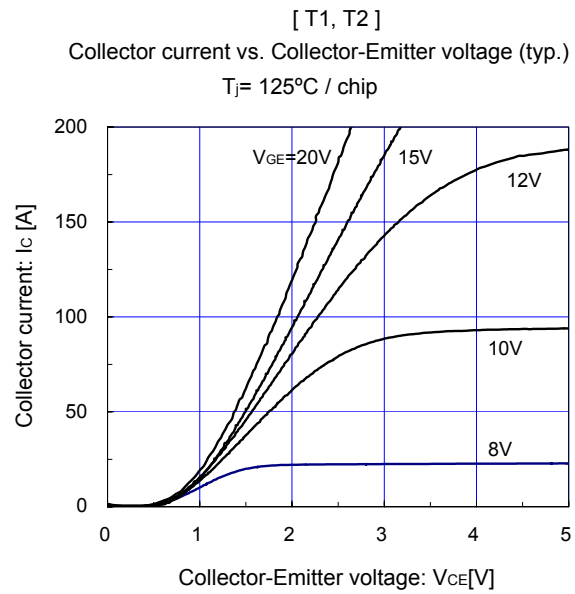
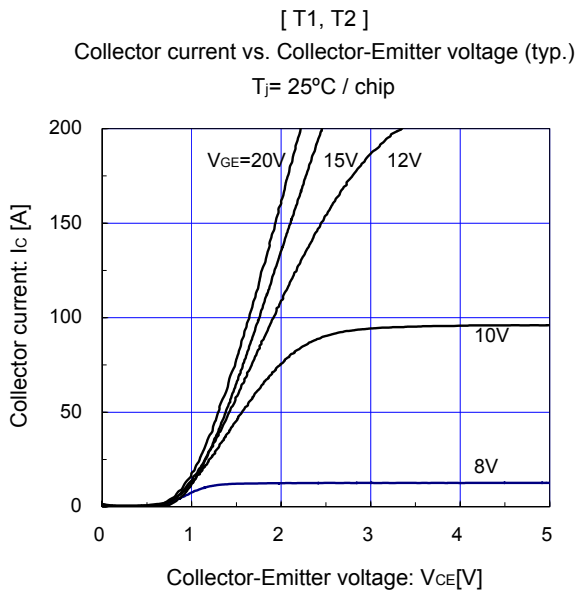
Definitions of switching mode

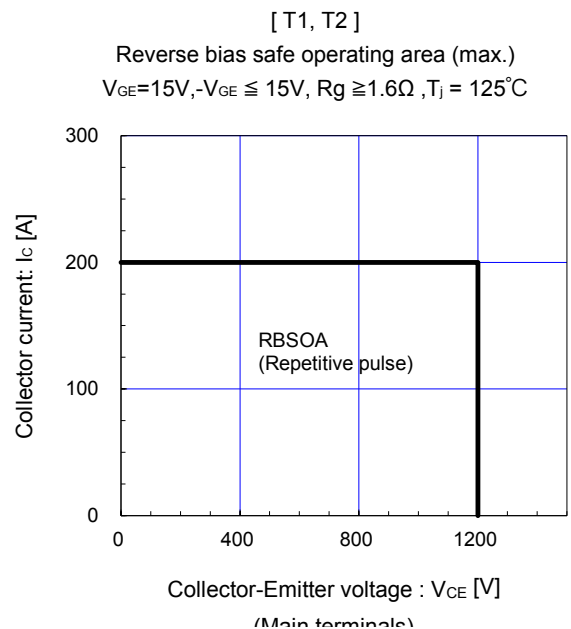
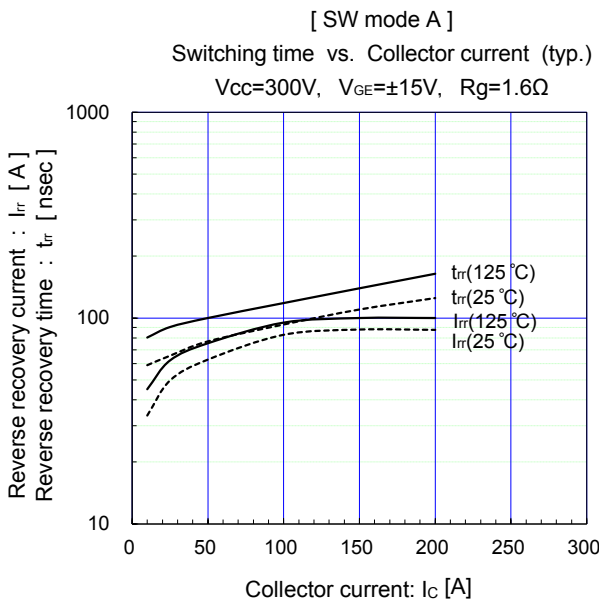
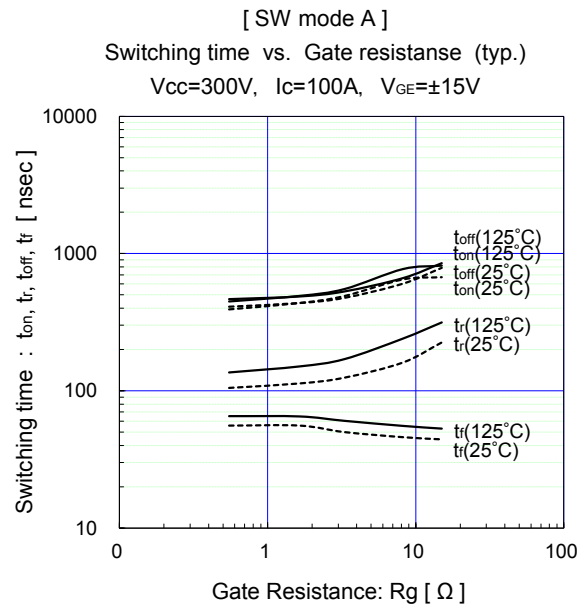
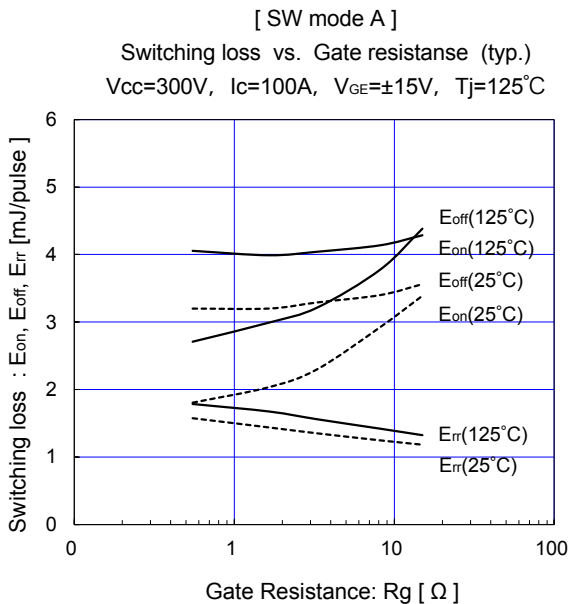
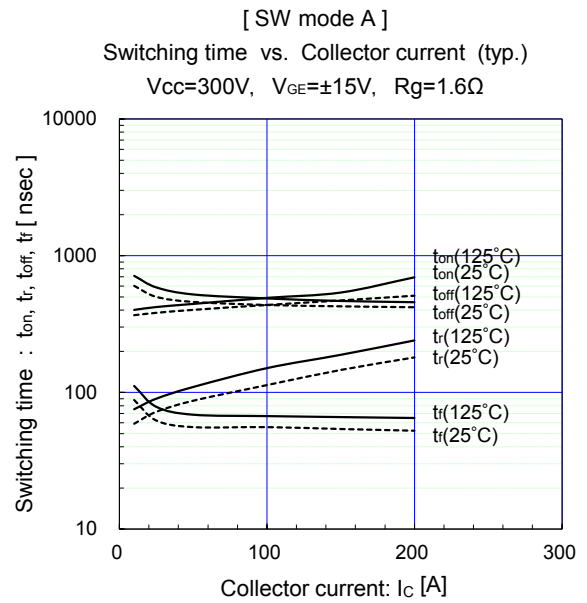
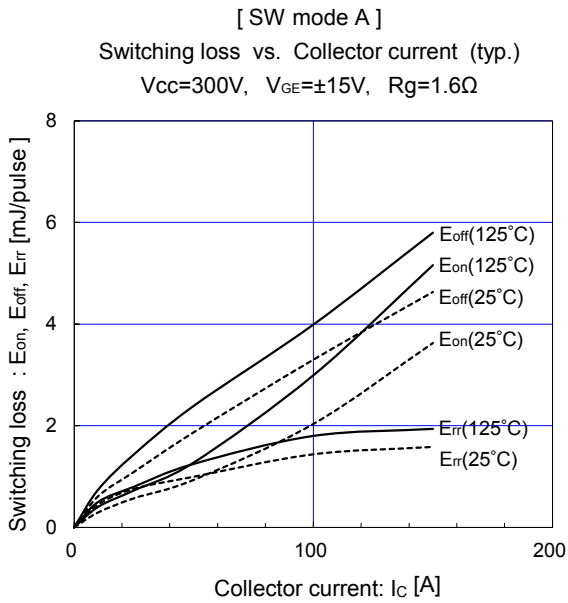


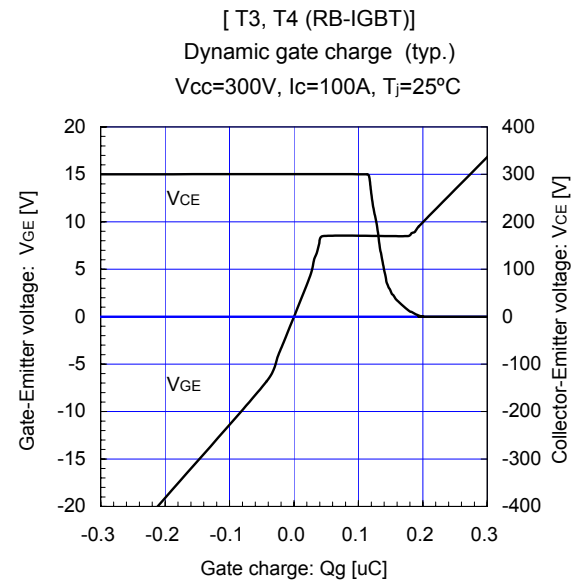
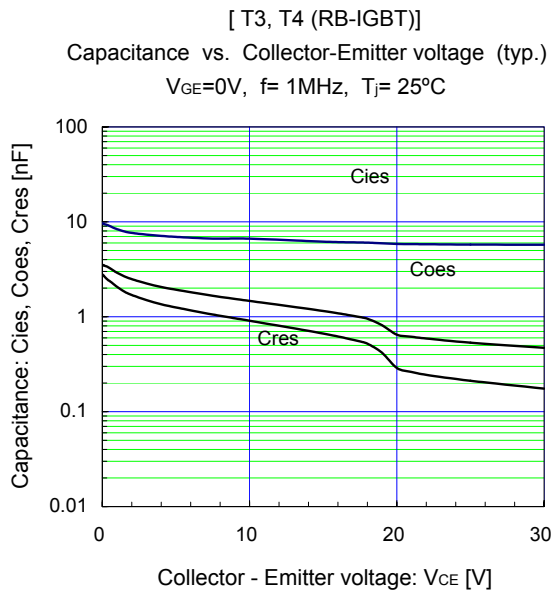
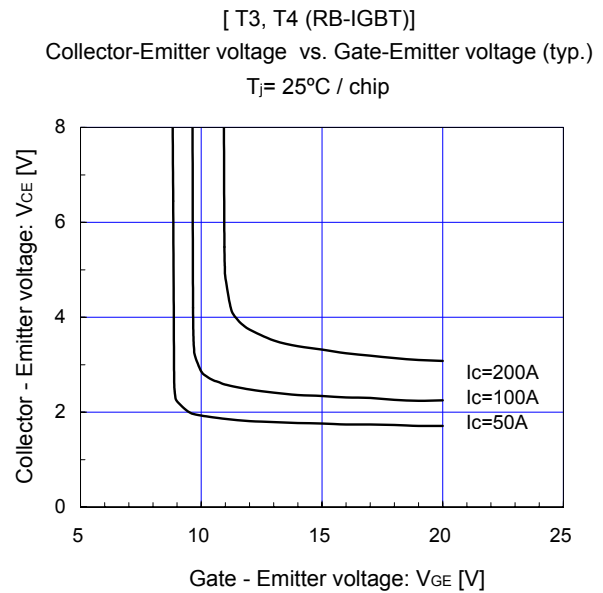
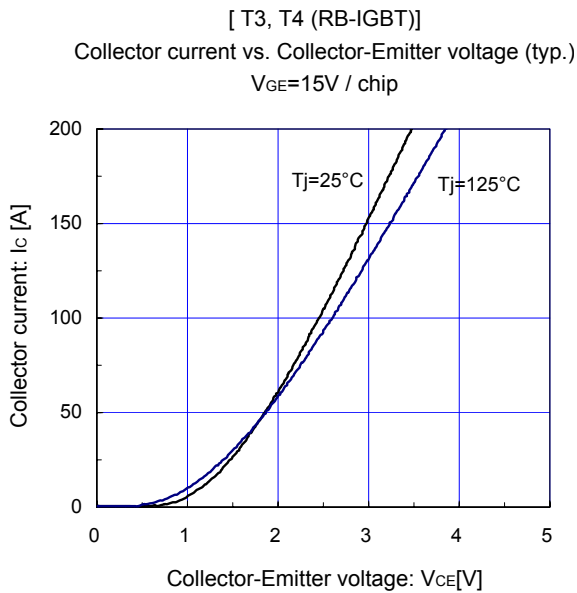
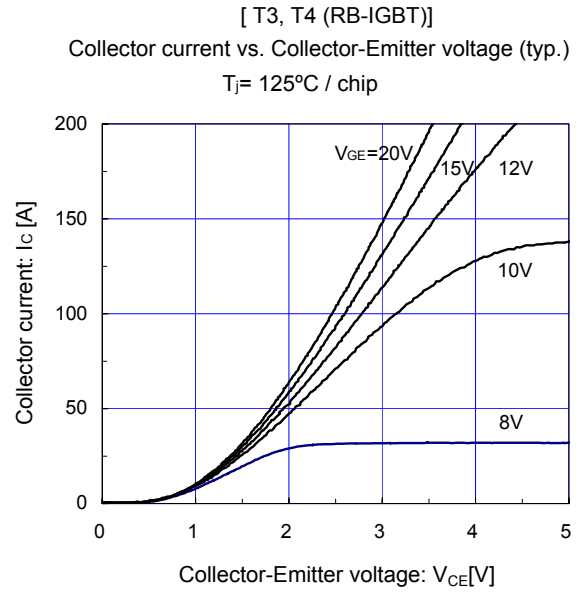
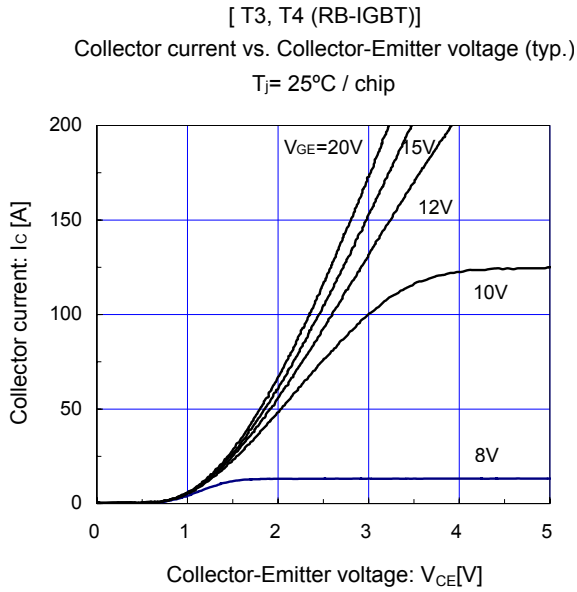
| SW mode | Load L | State of switching device |     |     |     |
|---------|--------|---------------------------|-----|-----|-----|
|         |        | T1                        | T2  | T3  | T4  |
| A       | M-U    | SW                        | OFF | OFF | ON  |
|         | M-U    | OFF                       | SW  | ON  | OFF |
| B       | P-U    | OFF                       | OFF | SW  | ON  |
|         | U-N    | OFF                       | OFF | ON  | SW  |

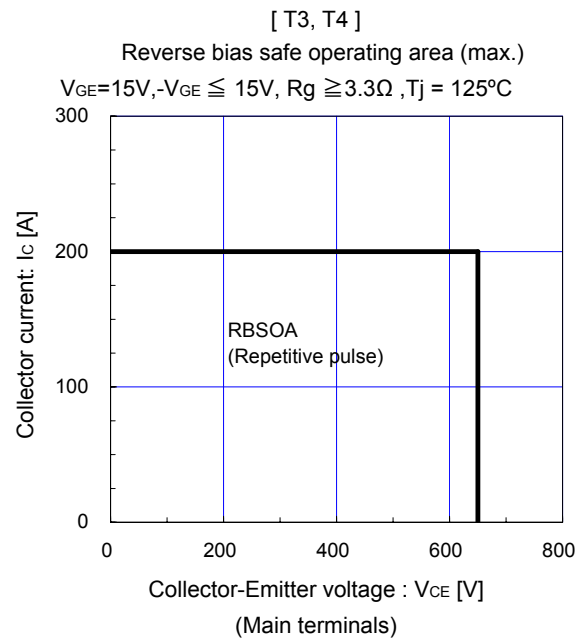
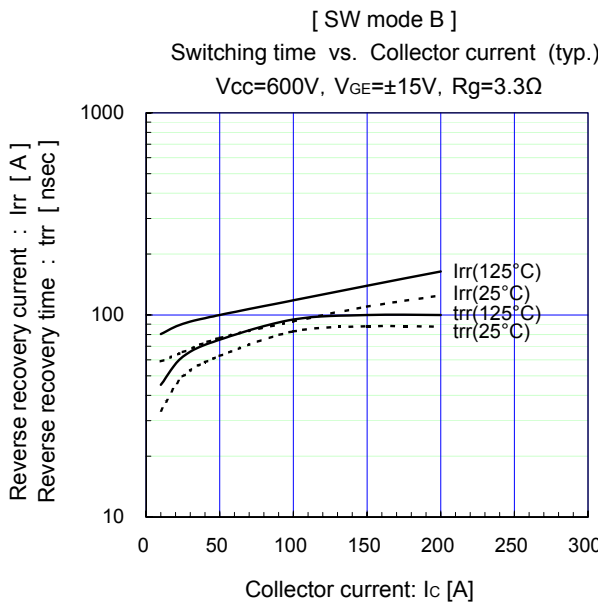
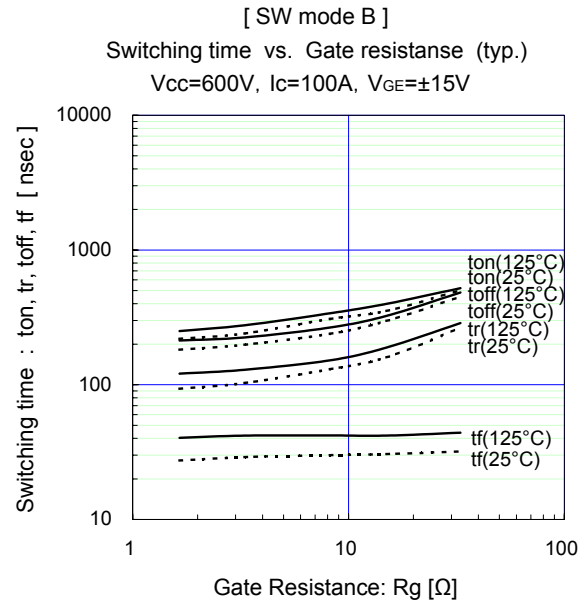
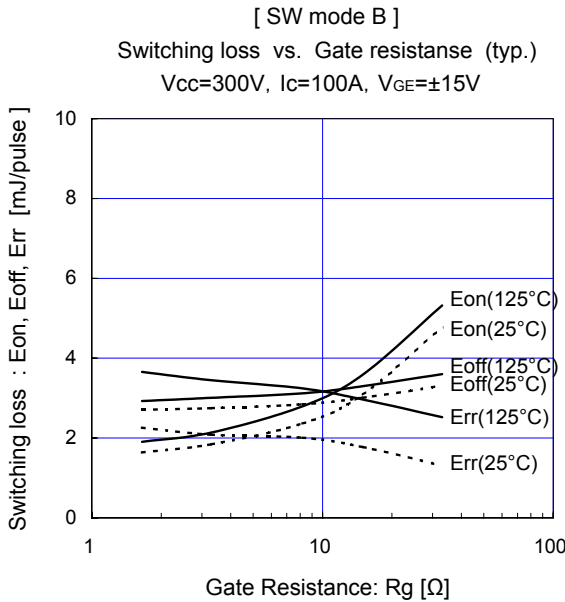
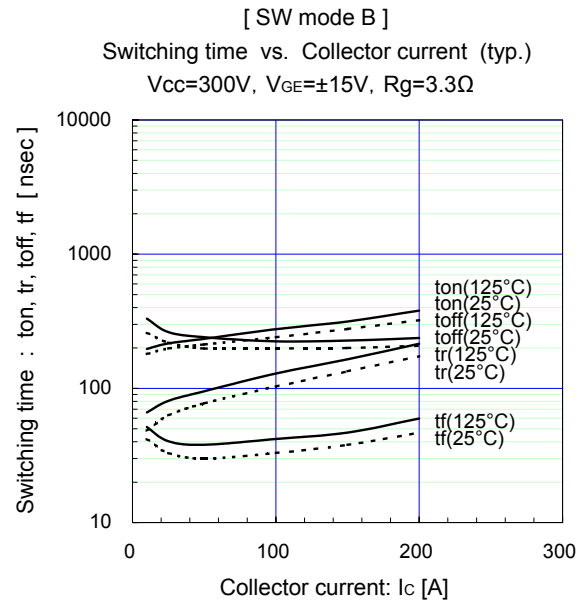
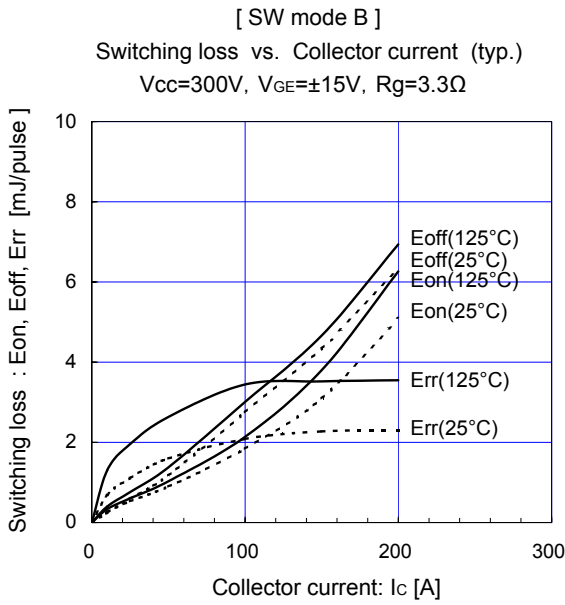
SW: Connect to drive circuit and input gate signal.  
 ON: Bias voltate of gate +15V.  
 OFF: Reverse bias voltage of gate -15V.  
 Vcc=Vcc1/2

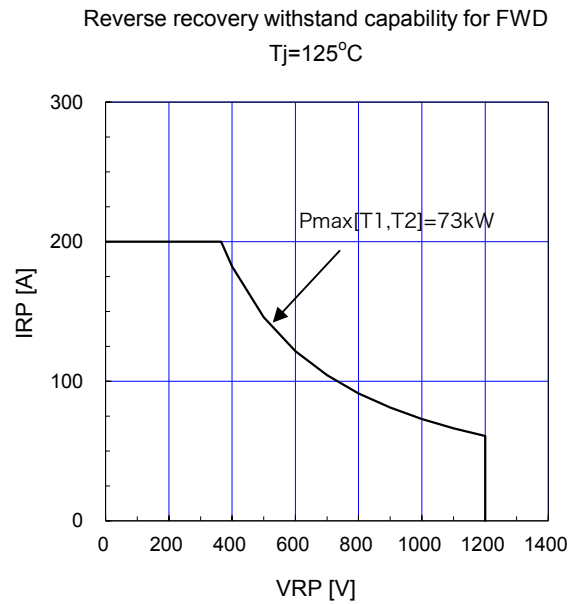
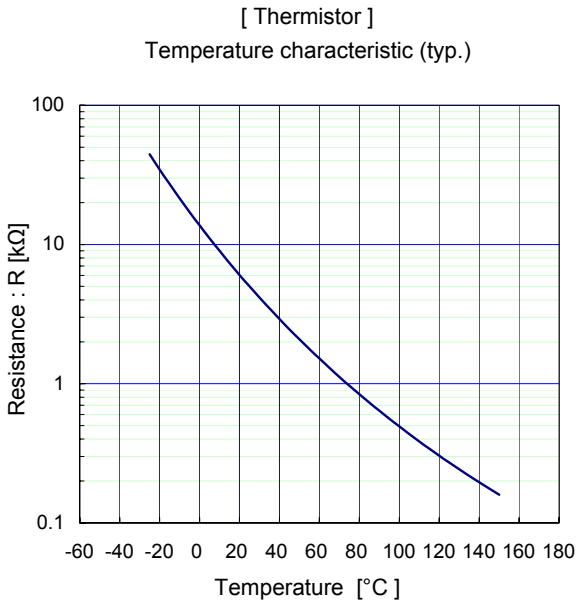
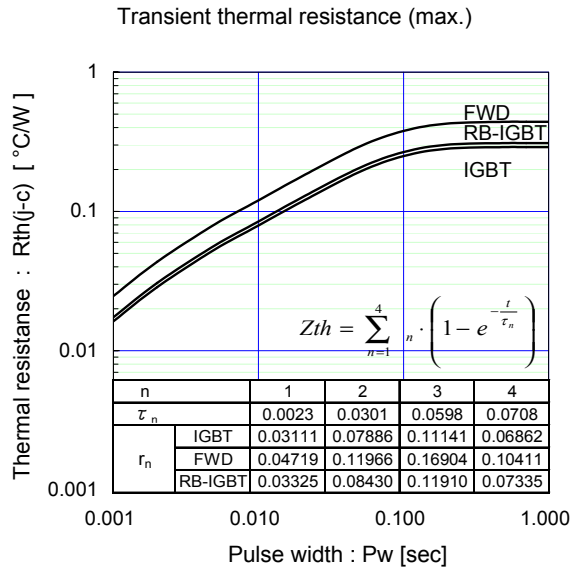
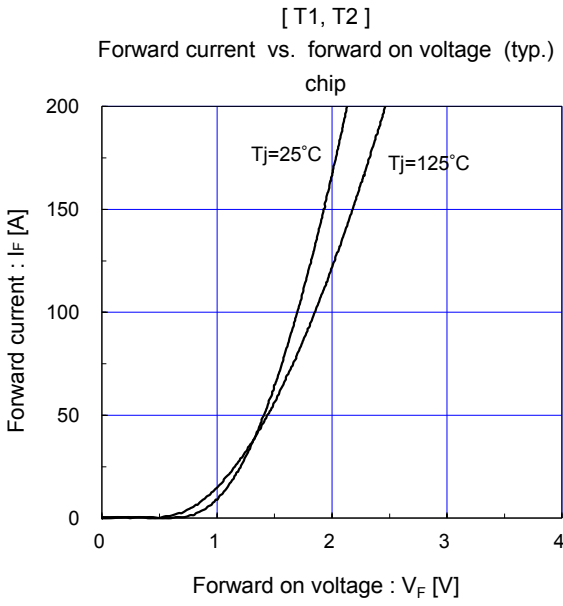
■ Characteristics (Representative)







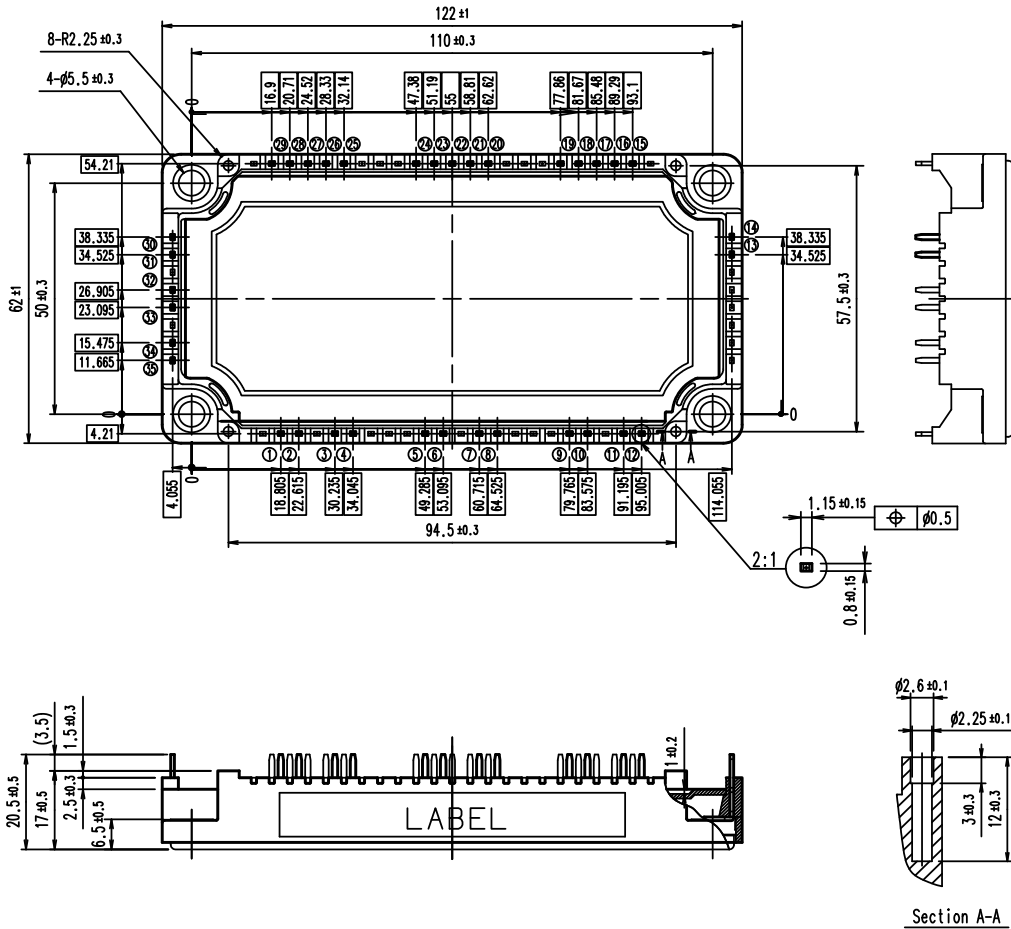






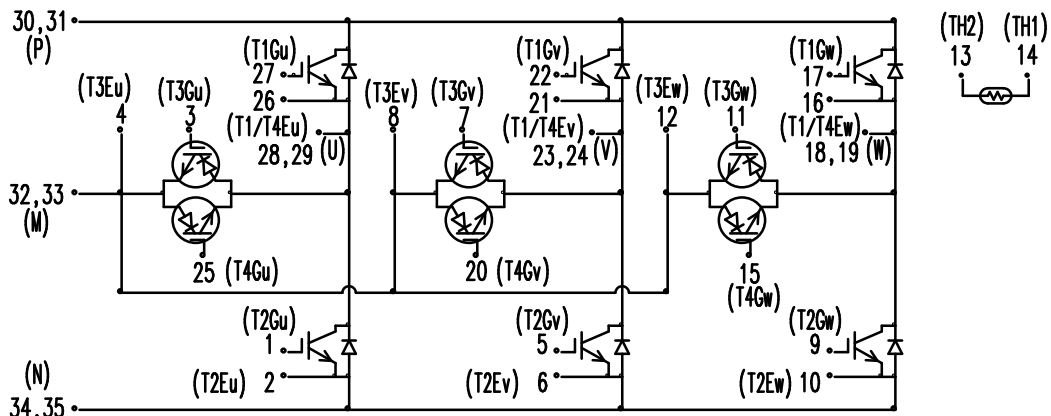
Outline Drawings, mm

□ shows theoretical dimension.  
 ( ) shows reference dimension.



Weight: 302g (typ.)

Equivalent Circuit Schematic



: RB-IGBT (Reverse Blocking IGBT)

**WARNING**

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