

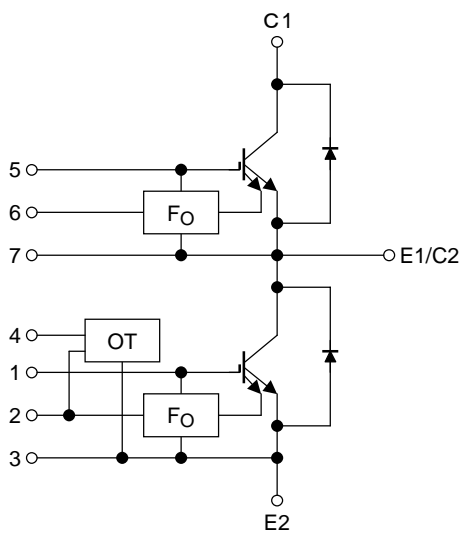
# MG200Q2YS60A(1200V/200A 2in1)

High Power Switching Applications

Motor Control Applications

- Integrates a complete half bridge power circuit and fault-signal output circuit in one package.  
(short circuit and over temperature)
- The electrodes are isolated from case.
- Low thermal resistance
- $V_{CE(sat)} = 2.4\text{ V (typ.)}$

## Equivalent Circuit

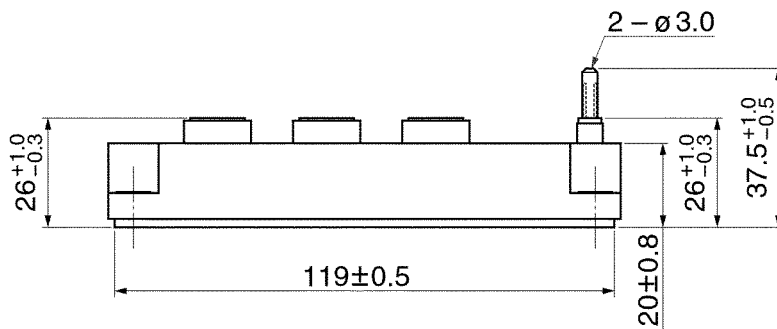
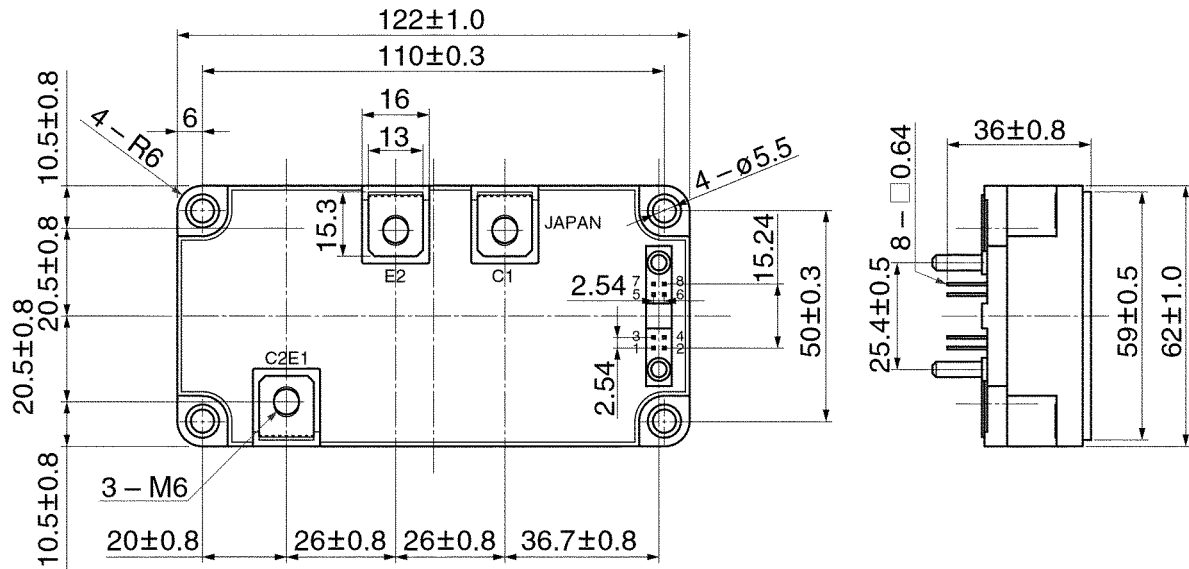


Signal terminal

|    |       |    |                    |    |       |    |                |
|----|-------|----|--------------------|----|-------|----|----------------|
| 1. | G (L) | 2. | F <sub>O</sub> (L) | 3. | E (L) | 4. | V <sub>D</sub> |
| 5. | G (H) | 6. | F <sub>O</sub> (H) | 7. | E (H) | 8. | Open           |

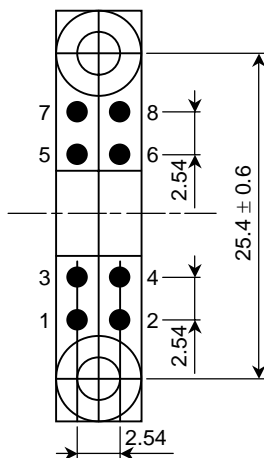
## Package Dimensions: 2-123C1B

Unit: mm



- |    |       |    |                    |    |       |    |                |
|----|-------|----|--------------------|----|-------|----|----------------|
| 1. | G (L) | 2. | F <sub>O</sub> (L) | 3. | E (L) | 4. | V <sub>D</sub> |
| 5. | G (H) | 6. | F <sub>O</sub> (H) | 7. | E (H) | 8. | Open           |

## Signal Terminal Layout



- |    |       |    |                    |    |       |    |                |
|----|-------|----|--------------------|----|-------|----|----------------|
| 1. | G (L) | 2. | F <sub>O</sub> (L) | 3. | E (L) | 4. | V <sub>D</sub> |
| 5. | G (H) | 6. | F <sub>O</sub> (H) | 7. | E (H) | 8. | Open           |

Weight: 375 g

## Maximum Ratings (Ta = 25°C)

| Stage                                   | Characteristics             | Symbol     | Rating          | Unit |   |
|---|-----------------------------|------------|-----------------|------|---|
| Inverter                                | Collector-emitter voltage   | $V_{CES}$  | 1200            | V    |   |
|   | Gate-emitter voltage        | $V_{GES}$  | ±20             | V    |   |
|   | Collector current           | DC         | $I_C$           | 200  | A |
|   |                             | 1 ms       | $I_{CP}$        | 400  |   |
|   | Forward current             | DC         | $I_F$           | 200  | A |
|   |                             | 1 ms       | $I_{FM}$        | 400  |   |
| Collector power dissipation (Tc = 25°C) |                             | $P_C$      | 2000            | W    |   |
| Control                                 | Control voltage (OT)        | $V_D$      | 20              | V    |   |
|   | Fault input voltage         | $V_{FO}$   | 20              | V    |   |
|   | Fault input current         | $I_{FO}$   | 20              | mA   |   |
| Module                                  | Junction temperature        | $T_j$      | 150             | °C   |   |
|   | Storage temperature range   | $T_{stg}$  | -40~125         | °C   |   |
|   | Operation temperature range | $T_{ope}$  | -20~100         | °C   |   |
|   | Isolation voltage           | $V_{isol}$ | 2500 (AC 1 min) | V    |   |
|   | Screw torque                | —          | 3 (M5)          | N·m  |   |

## Electrical Characteristics (Tj = 25°C)

### 1. Inverter Stage

| Characteristics                      | Symbol                 | Test Condition  | Min                       | Typ.  | Max   | Unit |   |   |      |
|--------------------------------------|------------------------|---|---------------------------|-------|-------|------|---|---|------|
| Gate leakage current                 | $I_{GES}$              | $V_{GE} = \pm 20 \text{ V}, V_{CE} = 0$   | —                         | —     | +3/-4 | mA   |   |   |      |
|                                      |                        | $V_{GE} = +10 \text{ V}, V_{CE} = 0$  | —                         | —     | 100   | nA   |   |   |      |
| Collector cut-off current            | $I_{CES}$              | $V_{CE} = 1200 \text{ V}, V_{GE} = 0$   | —                         | —     | 1.0   | mA   |   |   |      |
| Gate-emitter cut-off voltage         | $V_{GE} \text{ (off)}$ | $V_{CE} = 5 \text{ V}, I_C = 200 \text{ mA}$  | 6.0                       | 7.0   | 8.0   | V    |   |   |      |
| Collector-emitter saturation voltage | $V_{CE} \text{ (sat)}$ | $V_{GE} = 15 \text{ V}, I_C = 200 \text{ A}$  | $T_j = 25^\circ\text{C}$  | —     | 2.4   | 2.8  | V |   |      |
|                                      |                        |   | $T_j = 125^\circ\text{C}$ | —     | —     | 3.2  |   |   |      |
| Input capacitance                    | $C_{ies}$              | $V_{CE} = 10 \text{ V}, V_{GE} = 0, f = 1 \text{ MHz}$  | —                         | 15000 | —     | pF   |   |   |      |
| Switching time                       | Turn-on delay time     | $V_{CC} = 600 \text{ V}, I_C = 200 \text{ A}$<br>$V_{GE} = \pm 15 \text{ V}, R_G = 10 \Omega$<br>(Note 1) | 0.10                      | —     | 1.00  | μs   |   |   |      |
|                                      | Turn-off time          |   |                           |       |       |      | — | — | 2.00 |
|                                      | Fall time              |   |                           |       |       |      | — | — | 0.50 |
| Reverse recovery time                | $t_{rr}$               |   | —                         | —     | 0.50  |      |   |   |      |
| Forward voltage                      | $V_F$                  | $I_F = 200 \text{ A}$   | —                         | 2.4   | 2.8   | V    |   |   |      |

Note 1: Switching time test circuit & timing chart

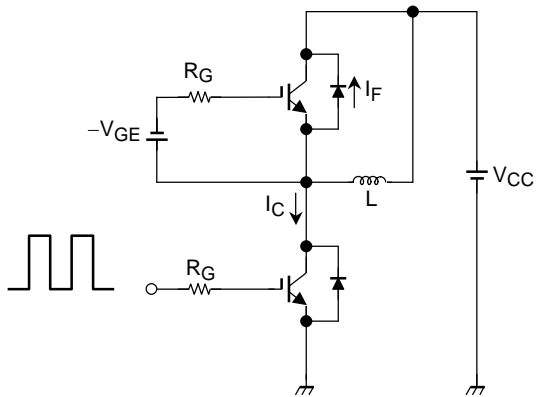
### 2. Control (Tc = 25°C)

| Characteristics         | Symbol             | Test Condition                                      | Min | Typ. | Max | Unit |
|-------------------------|--------------------|---|-----|------|-----|------|
| Fault output current    | OC                 | $V_{GE} = 15 \text{ V}$                             | 240 | —    | —   | A    |
| Over temperature        | OT                 | —   | 100 | —    | 125 | °C   |
| Fault output delay time | $t_d \text{ (Fo)}$ | $V_{CC} = 600 \text{ V}, V_{GE} = \pm 15 \text{ V}$ | —   | —    | 8   | μs   |

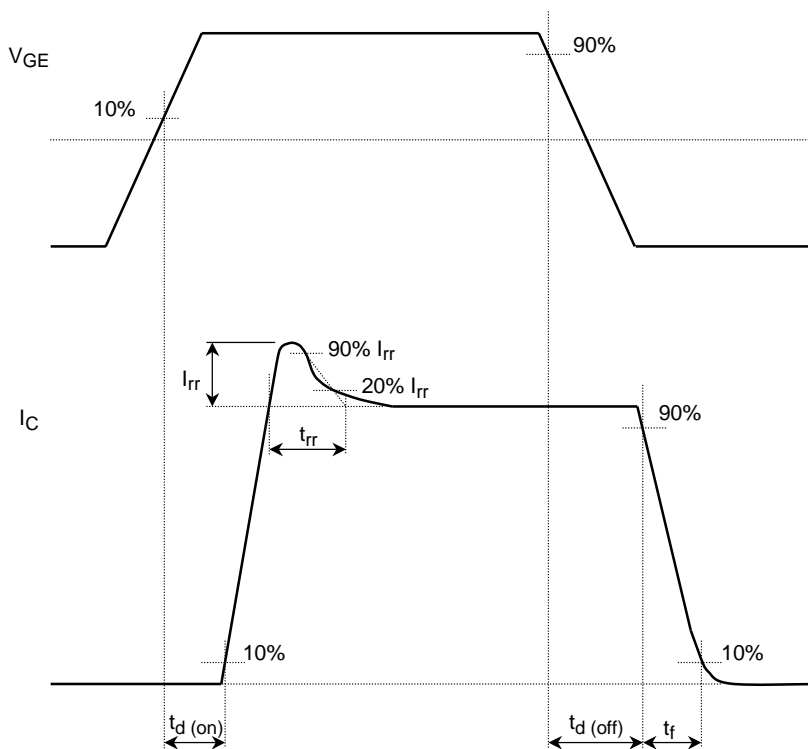
### 3. Module (Tc = 25°C)

| Characteristics                     | Symbol        | Test Condition        | Min | Typ.  | Max   | Unit |
|-------------------------------------|---------------|-----------------------|-----|-------|-------|------|
| Junction to case thermal resistance | $R_{th(j-c)}$ | Inverter IGBT stage   | —   | —     | 0.062 | °C/W |
|                                     |               | Inverter FRD stage    | —   | —     | 0.136 |      |
| Case to fin thermal resistance      | $R_{th(c-f)}$ | With silicon compound | —   | 0.013 | —     | °C/W |

### Switching Time Test Circuit



### Timing Chart

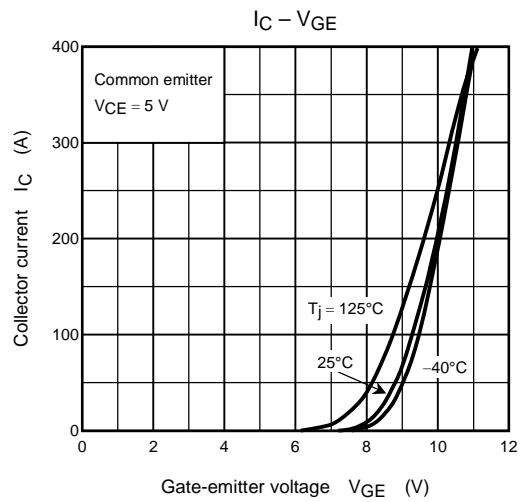
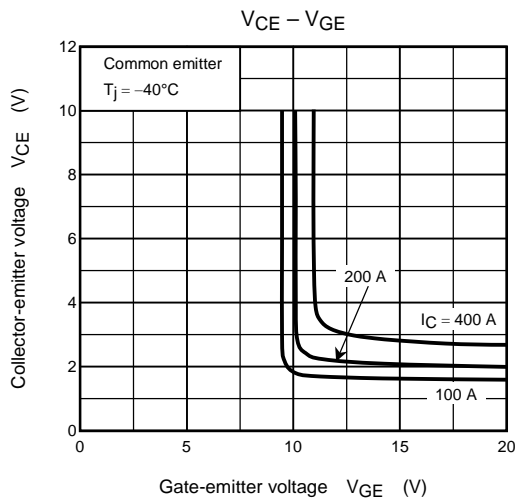
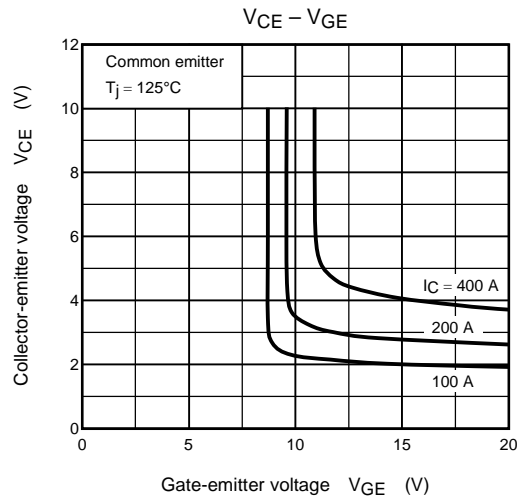
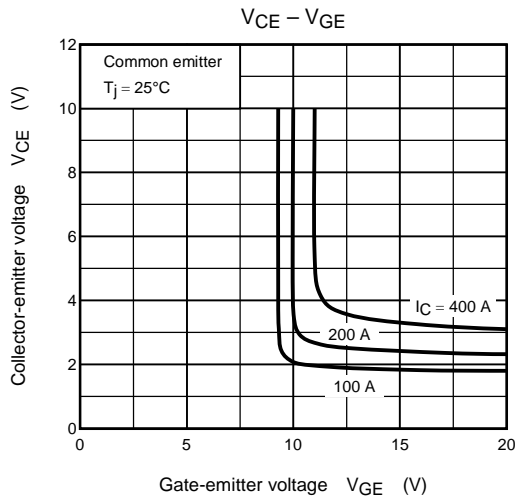
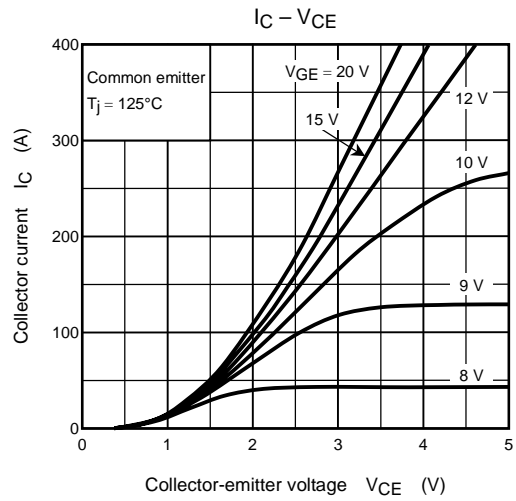
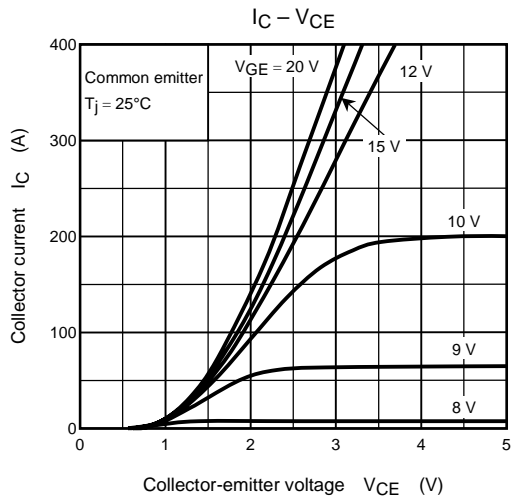


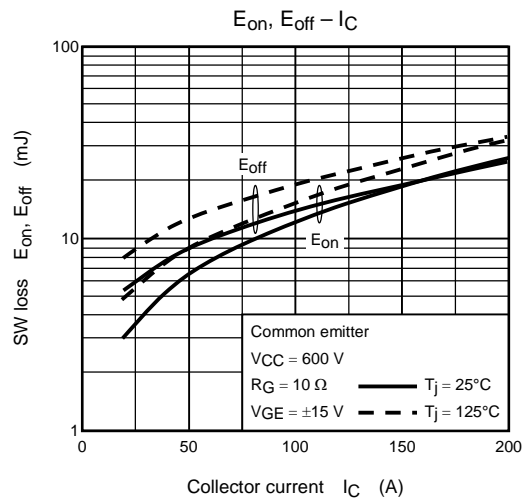
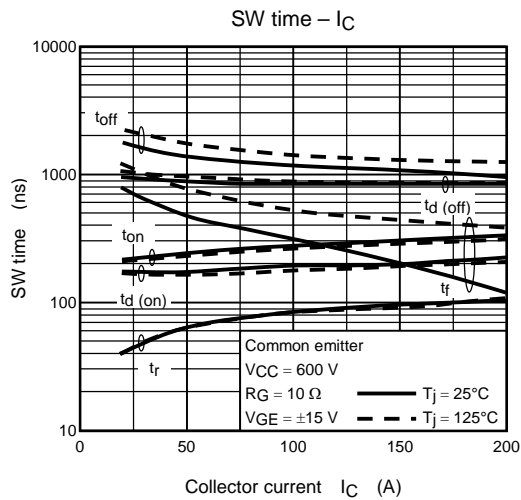
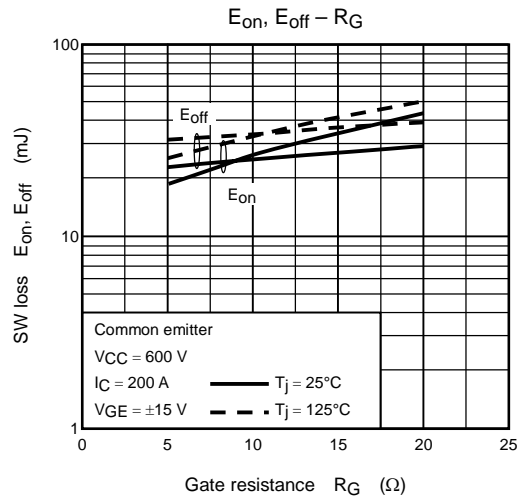
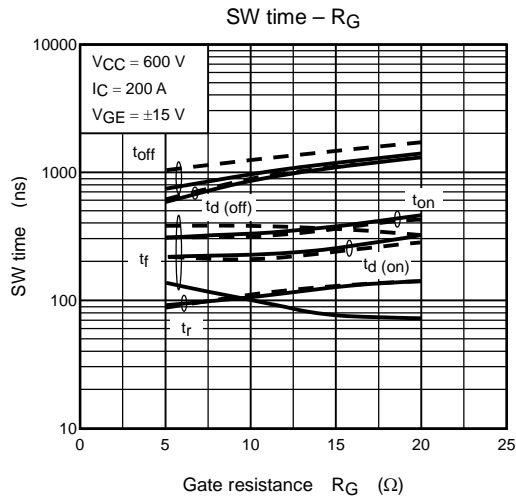
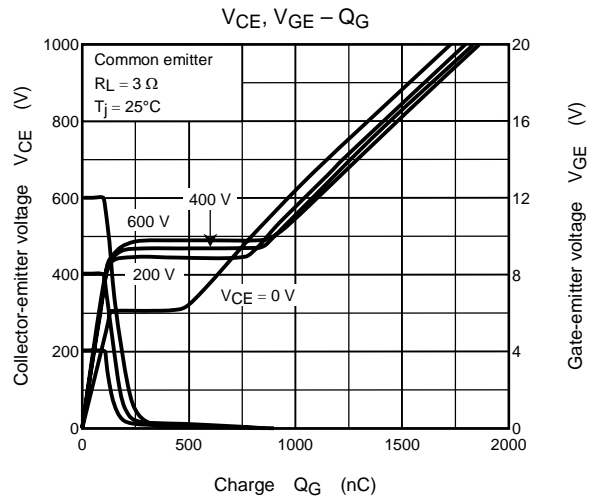
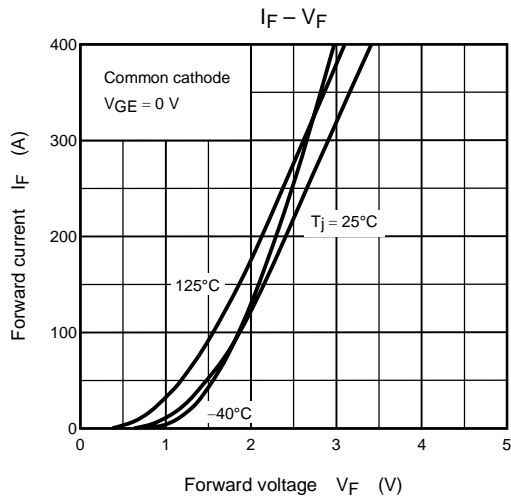
**Remark****<Short circuit capability condition>**

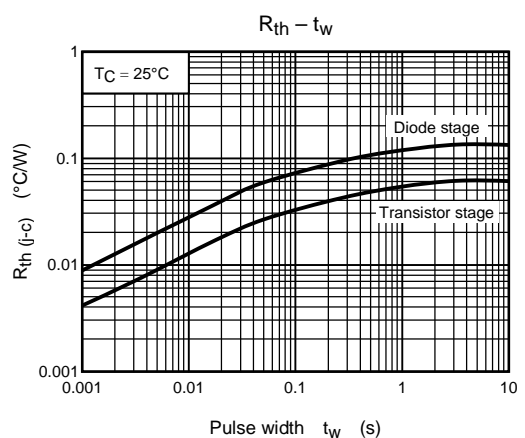
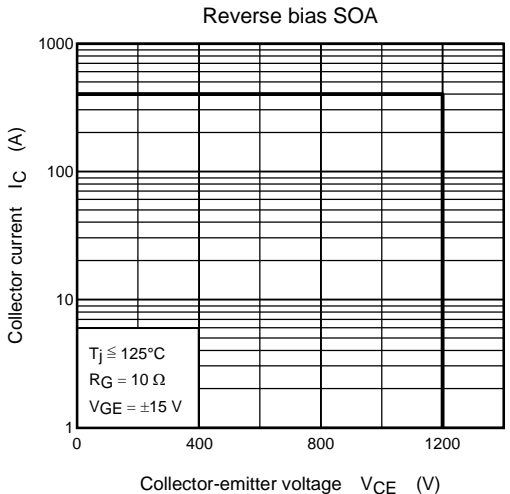
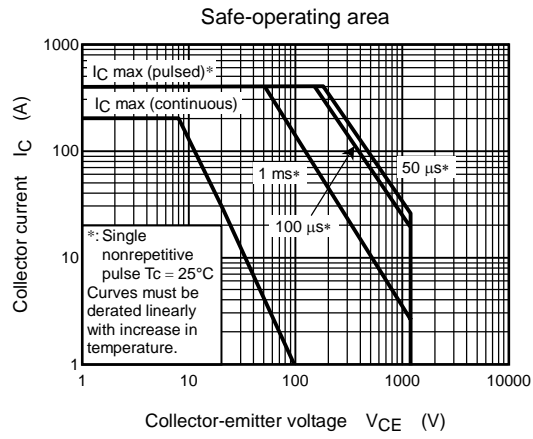
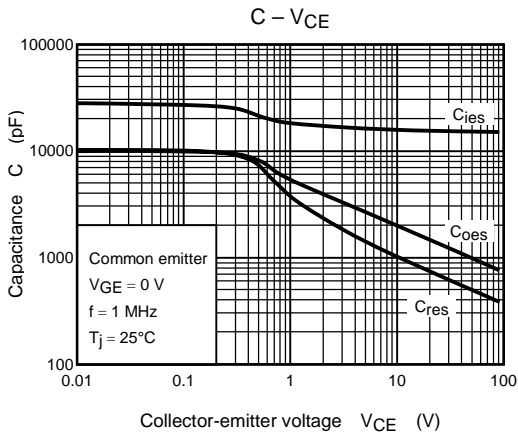
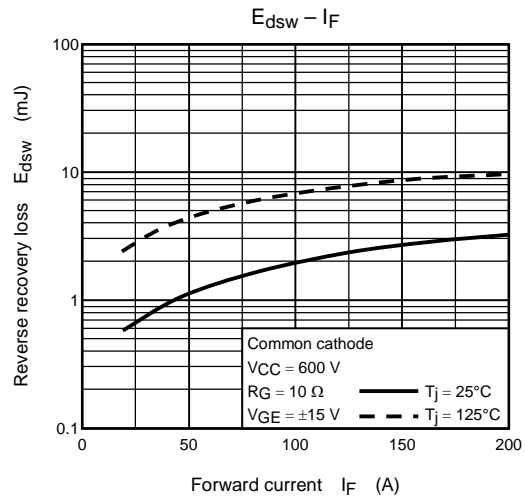
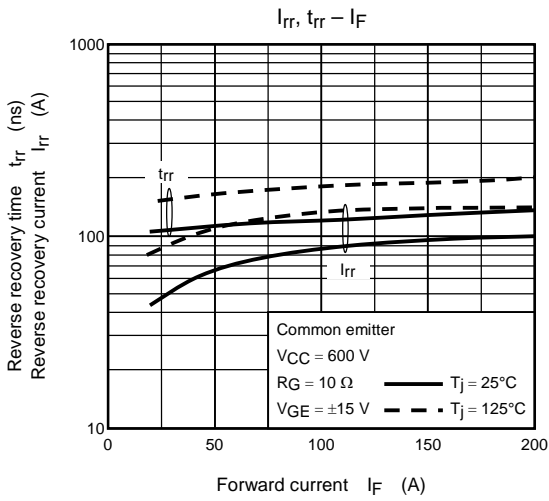
- Short circuit capability is 6  $\mu$ s after fault output signal.  
Please keep following condition to use fault output signal.
  - $V_{CC} \leq 750$  V
  - $14.8$  V  $\leq V_{GE} \leq 17.0$  V
  - $R_G \geq 10$   $\Omega$
  - $T_j \leq 125^\circ$ C

**<Gate voltage>**

- To use this product,  $V_{GE}$  must be provided higher than 14.8 V.  
In case  $V_{GE}$  is less than 14.8 V, fault signal FO may not be output even under error conditions.









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