

TOSHIBA IGBT Module Silicon N Channel IGBT

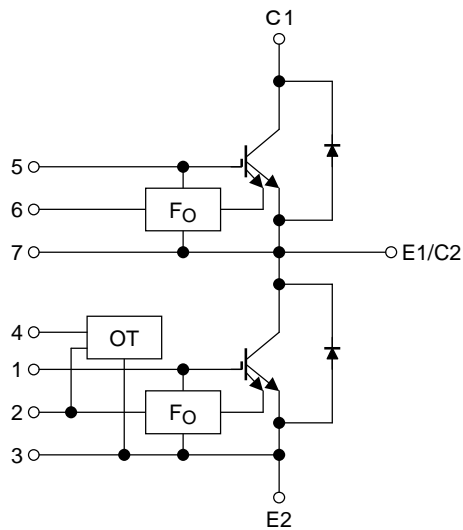
# MG400Q2YS60A

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

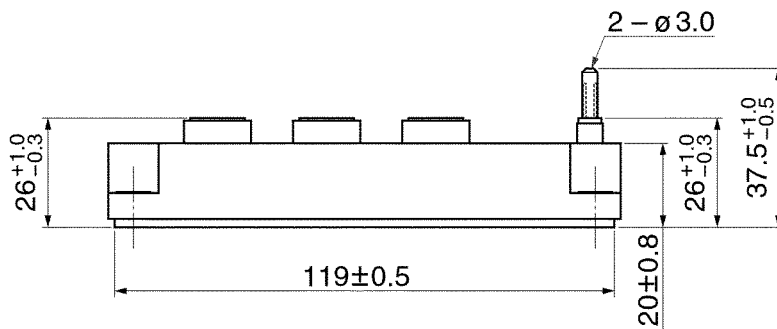
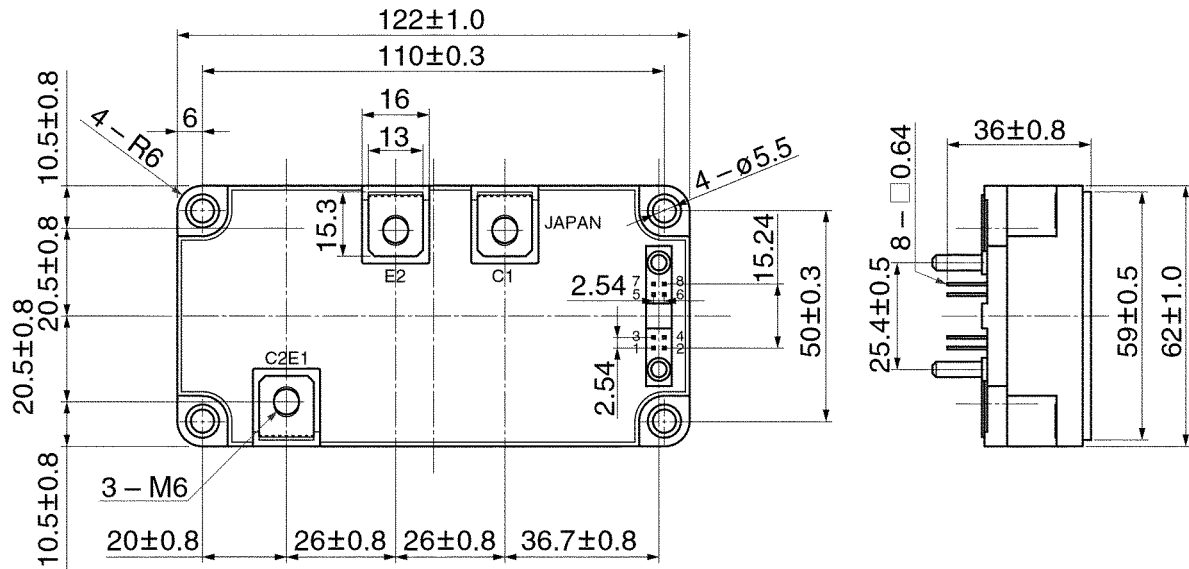


Signal terminal

1.	G (L)	2.	FO (L)	3.	E (L)	4.	$V_D$
5.	G (H)	6.	FO (H)	7.	E (H)	8.	Open

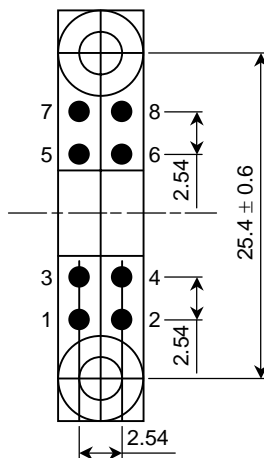
## Package Dimensions: 2-123C1B

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	$I_C$	400	A
		1 ms	$I_{CP}$	800	
	Forward current	DC	$I_F$	400	A
		1 ms	$I_{FM}$	800	
Collector power dissipation (Tc = 25°C)		$P_C$	3750	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		$V_{GE} \text{ (off)}$	$V_{CE} = 5 \text{ V}, I_C = 400 \text{ mA}$	6.0	7.0	8.0	V	
Collector-emitter saturation voltage		$V_{CE} \text{ (sat)}$	$V_{GE} = 15 \text{ V}, I_C = 400 \text{ A}$	Tj = 25°C	—	2.4	2.8	V
				Tj = 125°C	—	—	3.2	
Input capacitance		$C_{ies}$	$V_{CE} = 10 \text{ V}, V_{GE} = 0, f = 1 \text{ MHz}$	—	31000	—	pF	
Switching time	Turn-on delay time	$t_d \text{ (on)}$	$V_{CC} = 600 \text{ V}, I_C = 400 \text{ A}$ $V_{GE} = \pm 15 \text{ V}, R_G = 5.1 \Omega$ (See page 4) (Note 1)	0.10	—	1.00	μs	
	Turn-off time	$t_{off}$		—	—	2.00		
	Fall time	$t_f$		—	—	0.50		
Reverse recovery time		$t_{rr}$		—	—	0.50		
Forward voltage		$V_F$	$I_F = 400 \text{ A}$	—	2.4	2.8	V	

Note 1: Switching time test circuit & timing chart

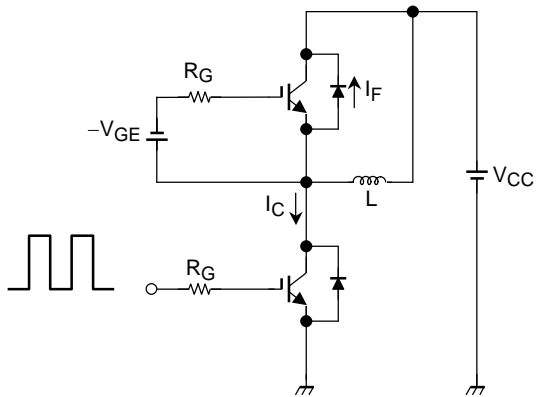
### 2. Control (Tc = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Fault output current	OC	$V_{GE} = 15 \text{ V}$	480	—	—	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

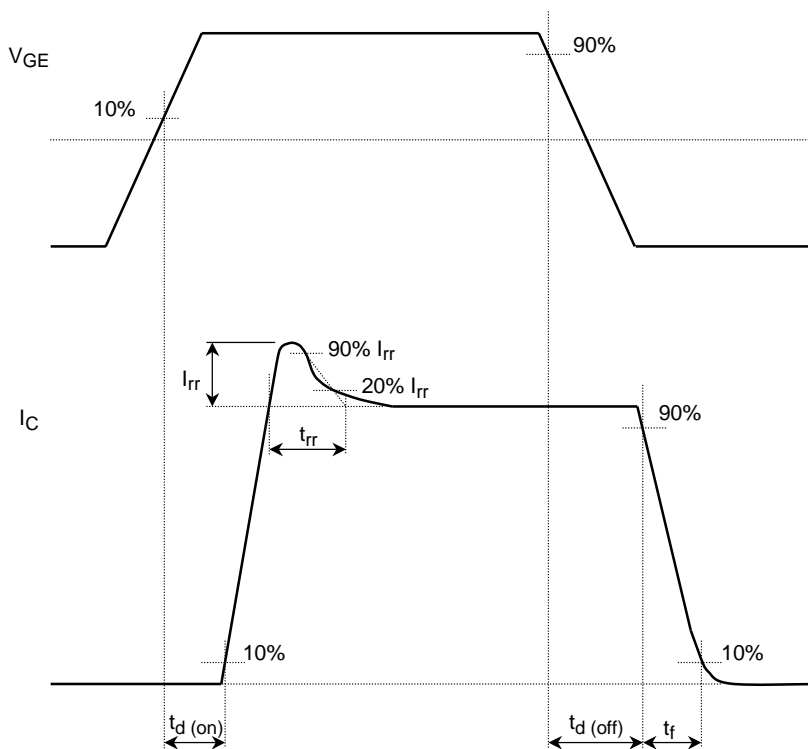
### 3. Module (Tc = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	Inverter IGBT stage	—	—	0.033	°C/W
		Inverter FRD stage	—	—	0.068	
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
  - $R_G \geq 5.1$   $\Omega$
  - $T_j \leq 125^\circ$ C

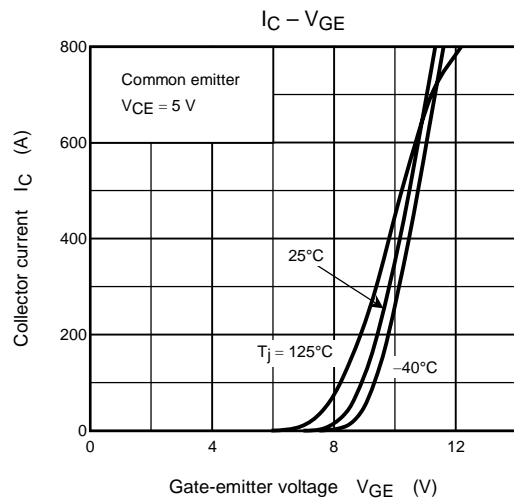
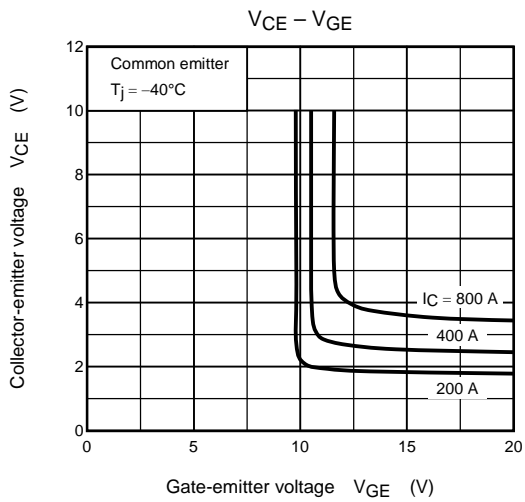
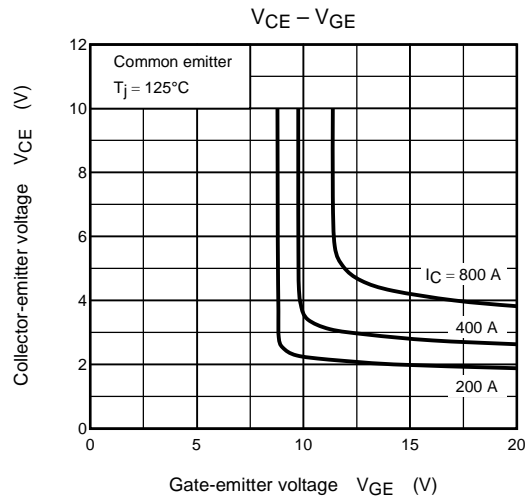
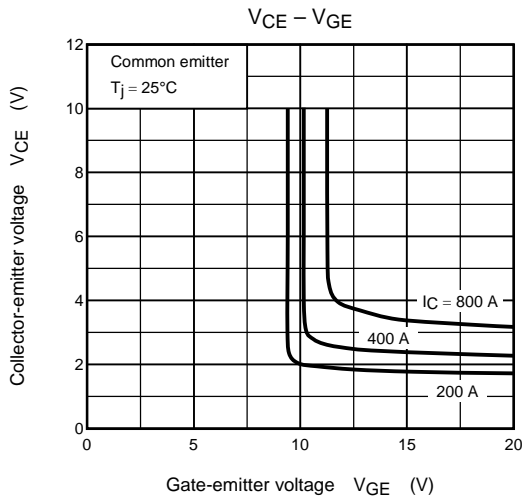
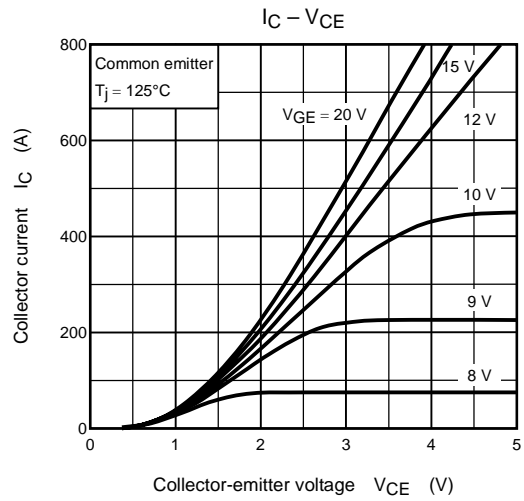
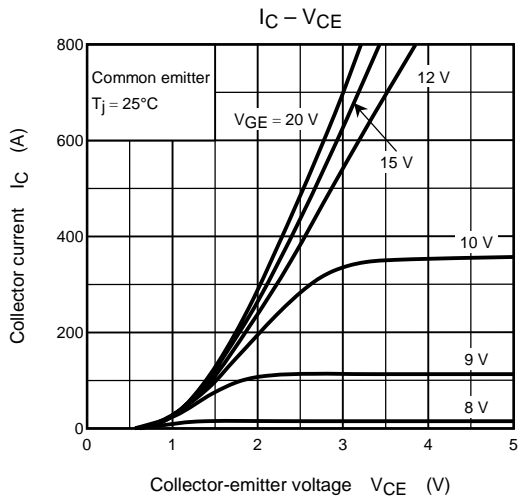
**<Gate voltage >**

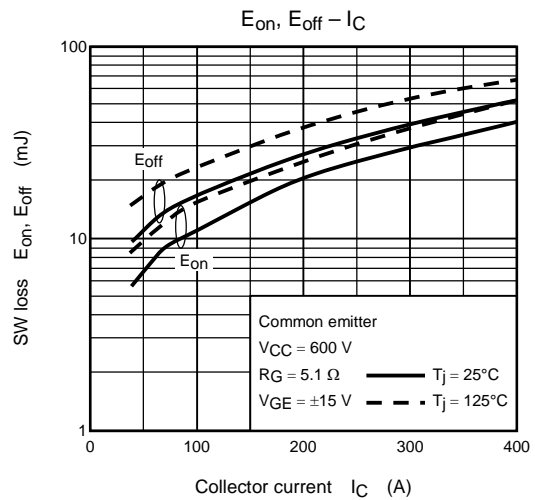
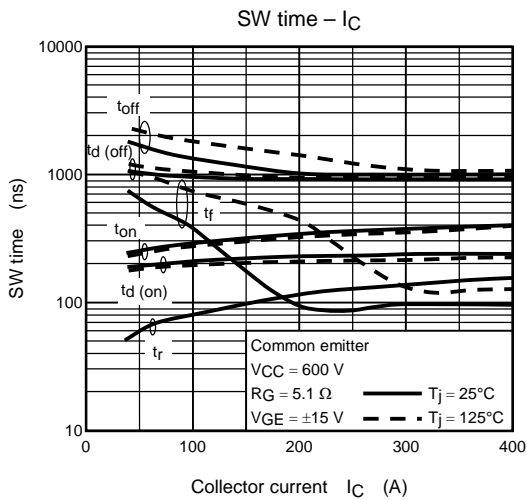
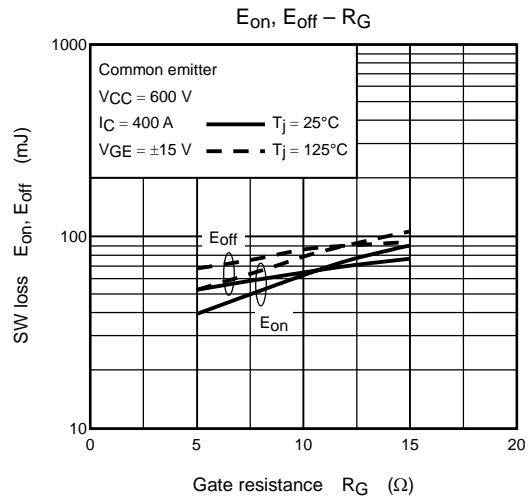
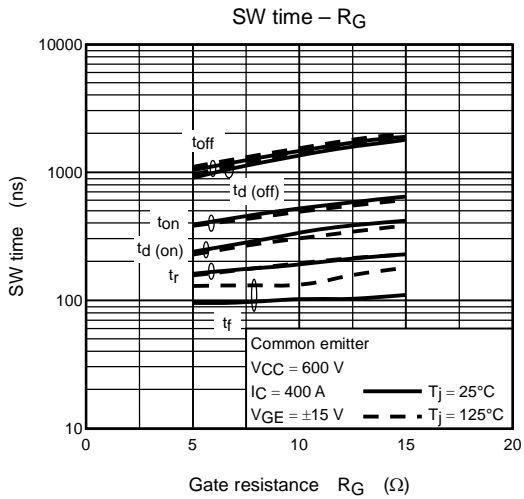
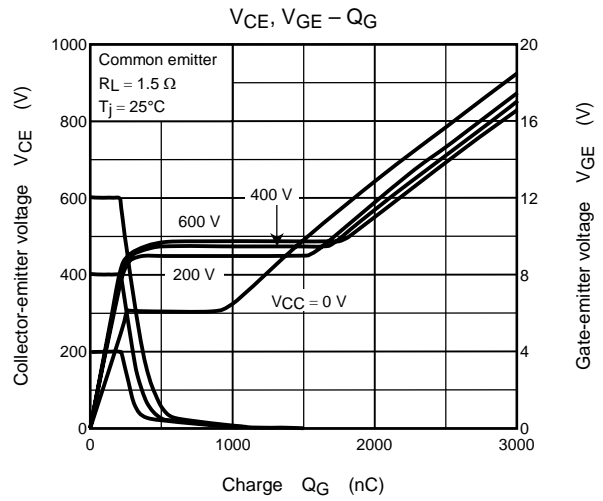
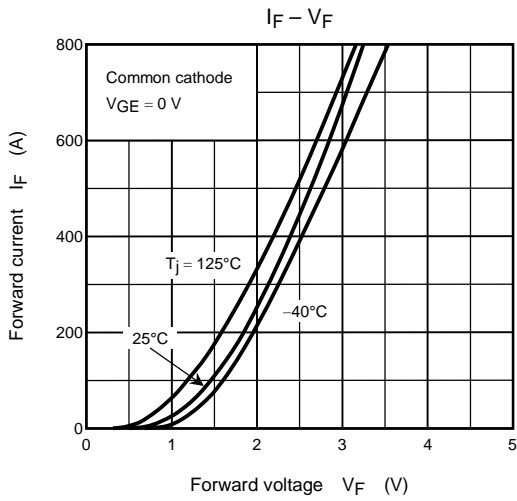
- To use this product,  $V_{GE}$  must be provided higher than 14.8 V  
In case  $V_{GE}$  is less than 14.8 V, fault signal FO may not be output even under error conditions.

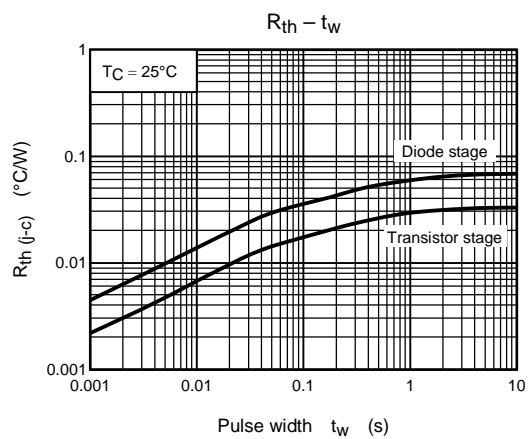
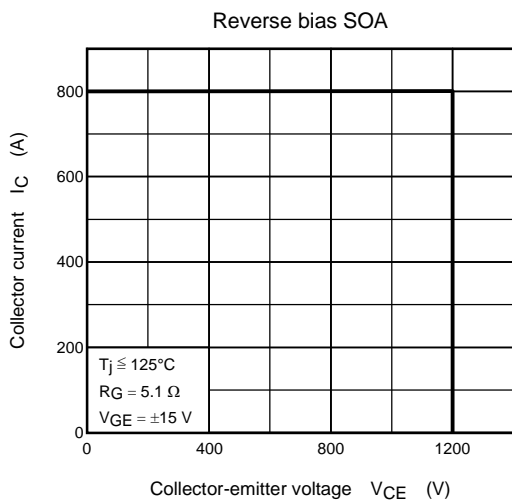
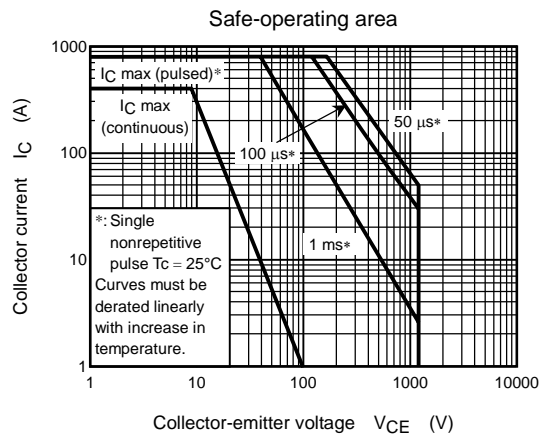
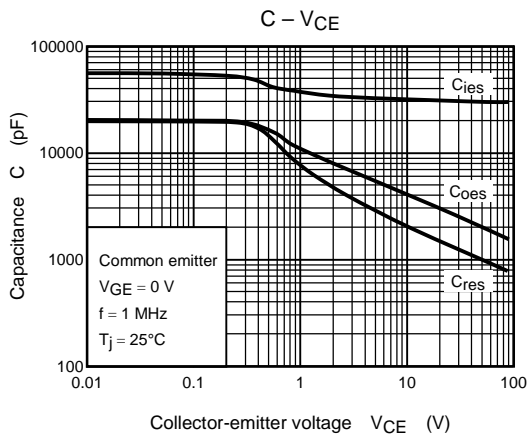
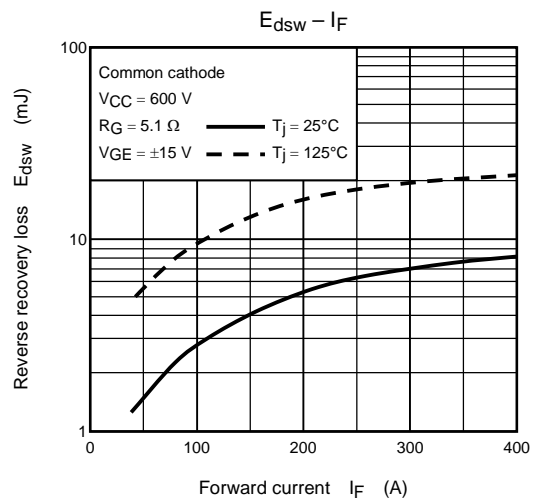
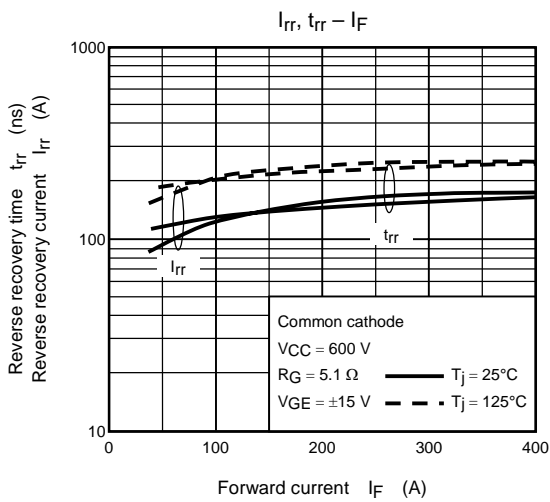
**<For parallel use>**

- For parallel use of this product, please use the same rank for both  $V_{CE(sat)}$  and  $V_F$  among IGBT in parallel without fail.

$V_{CE(sat)}$	$V_F$	Min	Max
24	E	2.1	2.4
26	F	2.3	2.6
28	G	2.5	2.8









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