

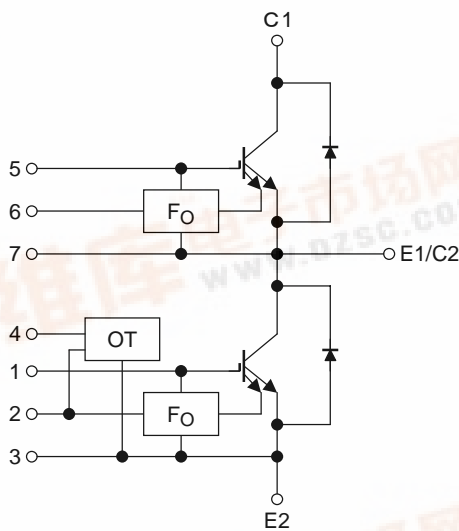
TOSHIBA IGBT Module Silicon N Channel IGBT

# MG400J2YS60A(600V/400A 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
- $V_{CE(sat)} = 1.8\text{ V (typ.)}$

## Equivalent Circuit

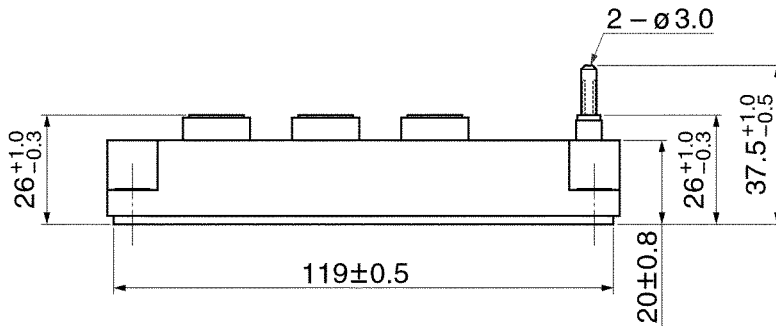
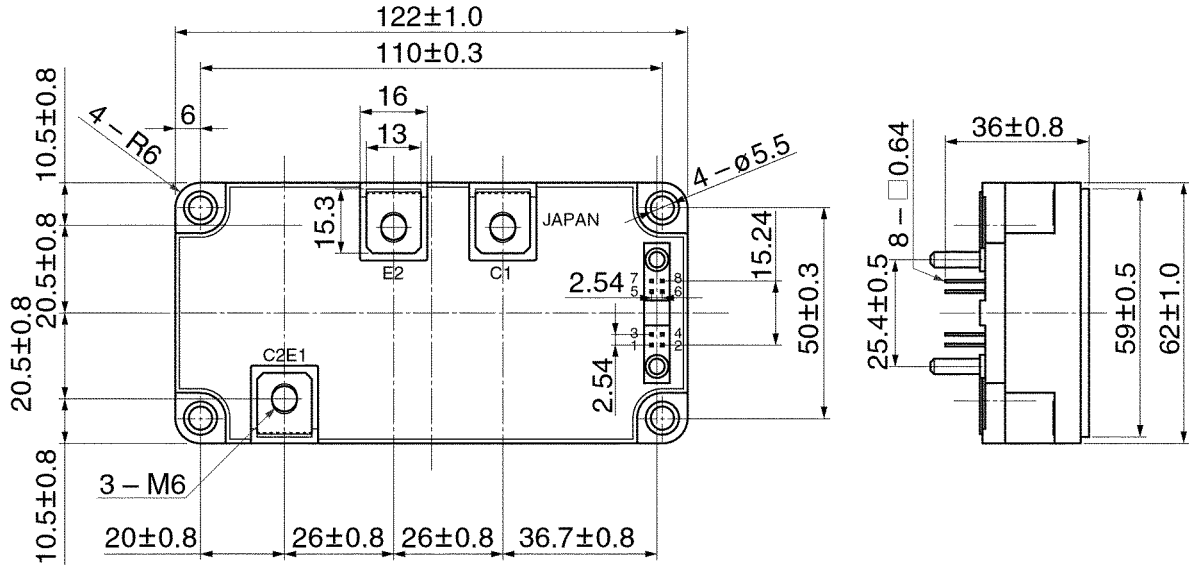


Signal terminal

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

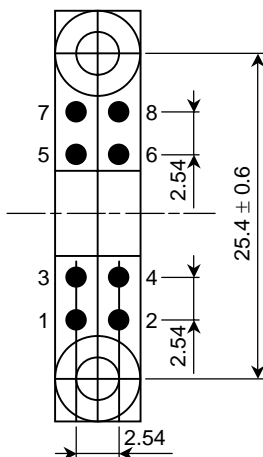
## Package Dimensions: 2-123C1B

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 <sub>CES</sub>	600	V	
	Gate-emitter voltage	V <sub>GES</sub>	±20	V	
	Collector current	DC	I <sub>C</sub>	400	A
		1 ms	I <sub>CP</sub>	800	
	Forward current	DC	I <sub>F</sub>	400	A
		1 ms	I <sub>FM</sub>	800	
Collector power dissipation (T <sub>c</sub> = 25°C)		P <sub>C</sub>	2160	W	
Control	Control voltage (OT)	V <sub>D</sub>	20	V	
	Fault input voltage	V <sub>FO</sub>	20	V	
	Fault input current	I <sub>FO</sub>	20	mA	
Module	Junction temperature	T <sub>j</sub>	150	°C	
	Storage temperature range	T <sub>stg</sub>	-40~125	°C	
	Operation temperature range	T <sub>ope</sub>	-20~100	°C	
	Isolation voltage	V <sub>isol</sub>	2500 (AC 1 min)	V	
	Screw torque	—	3 (M5)	N·m	

## Electrical Characteristics (T<sub>j</sub> = 25°C)

### 1. Inverter Stage

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit	
Gate leakage current	I <sub>GES</sub>	V <sub>GE</sub> = ±20 V, V <sub>CE</sub> = 0	—	—	+3/-4	mA	
		V <sub>GE</sub> = +10 V, V <sub>CE</sub> = 0	—	—	100	nA	
Collector cut-off current	I <sub>CES</sub>	V <sub>CE</sub> = 600 V, V <sub>GE</sub> = 0	—	—	1.0	mA	
Gate-emitter cut-off voltage	V <sub>GE (off)</sub>	V <sub>CE</sub> = 5 V, I <sub>C</sub> = 400 mA	5.0	6.5	8.0	V	
Collector-emitter saturation voltage	V <sub>CE (sat)</sub>	V <sub>GE</sub> = 15 V, I <sub>C</sub> = 400 A	T <sub>j</sub> = 25°C	—	1.8	2.1	V
			T <sub>j</sub> = 125°C	—	—	2.3	
Input capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 10 V, V <sub>GE</sub> = 0, f = 1 MHz	—	3500	—	pF	
Switching time	Turn-on delay time	t <sub>d (on)</sub>	0.10	—	1.00	μs	
	Turn-off time	t <sub>off</sub>	—	—	2.00		
	Fall time	t <sub>f</sub>	—	—	0.50		
Reverse recovery time	t <sub>rr</sub>		—	—	0.50		
Forward voltage	V <sub>F</sub>	I <sub>F</sub> = 400 A	—	1.8	2.2	V	

Note 1: Switching time test circuit & timing chart

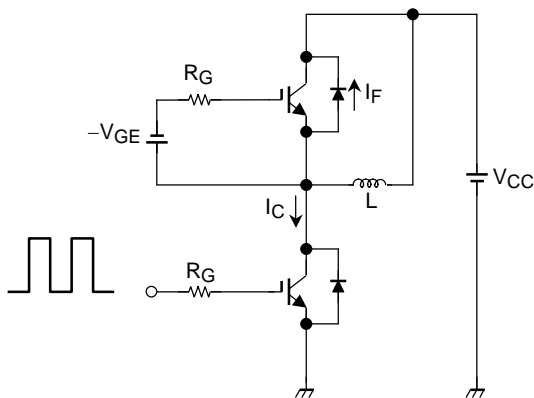
### 2. Control (T<sub>c</sub> = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Fault output current	OC	V <sub>GE</sub> = 15 V	480	—	—	A
Over temperature	OT	—	100	—	125	°C
Fault output delay time	t <sub>d (Fo)</sub>	V <sub>CC</sub> = 300 V, V <sub>GE</sub> = ±15 V	—	—	6.5	μs

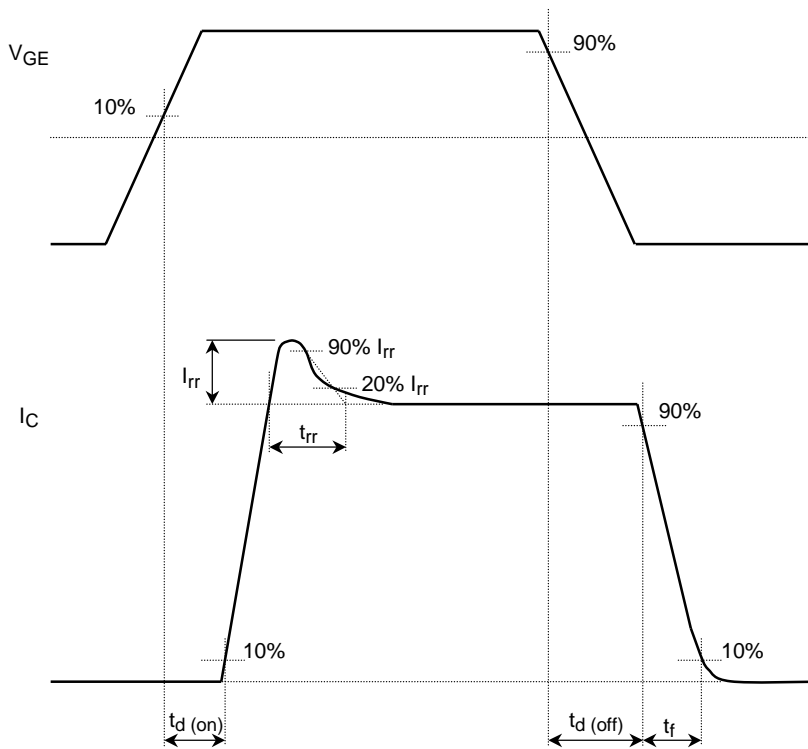
### 3. Module ( $T_c = 25^\circ\text{C}$ )

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Junction to case thermal resistance	$R_{th(j-c)}$	Inverter IGBT stage	—	—	0.057	$^\circ\text{C/W}$
		Inverter FRD stage	—	—	0.068	
Case to fin thermal resistance	$R_{th(c-f)}$	With silicon compound	—	0.013	—	$^\circ\text{C/W}$

### Switching Time Test Circuit



### Timing Chart

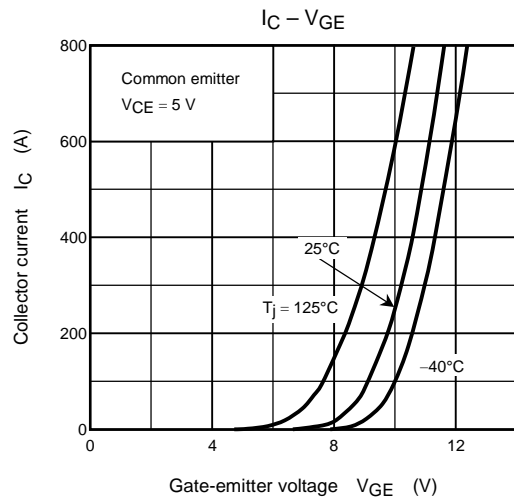
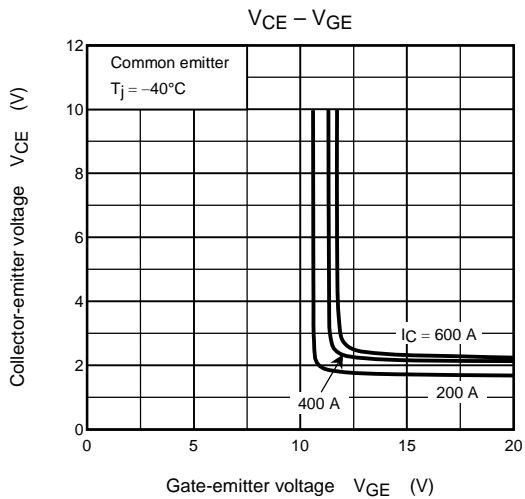
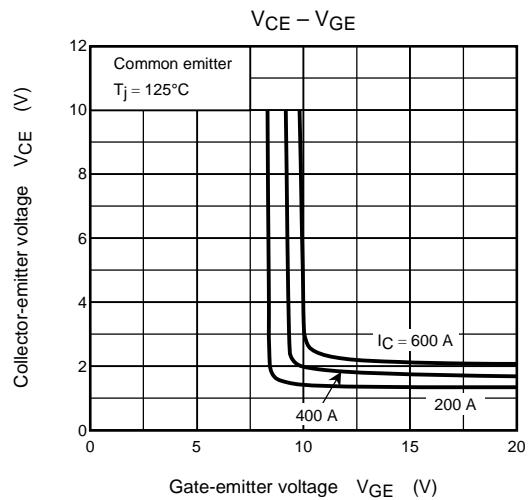
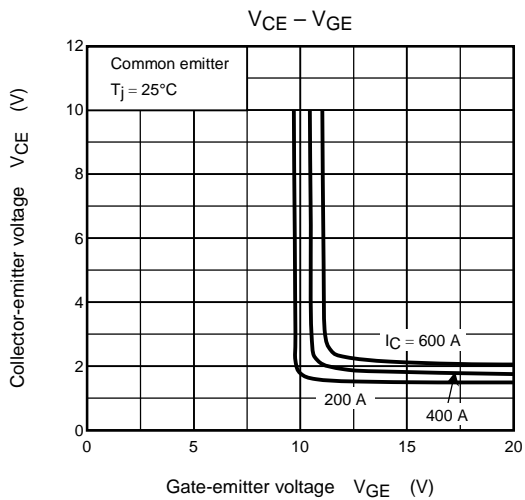
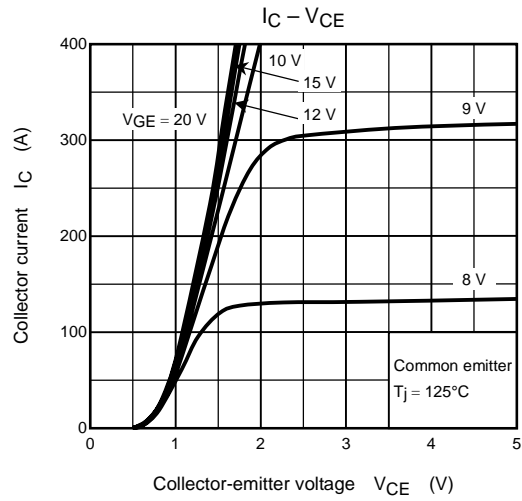
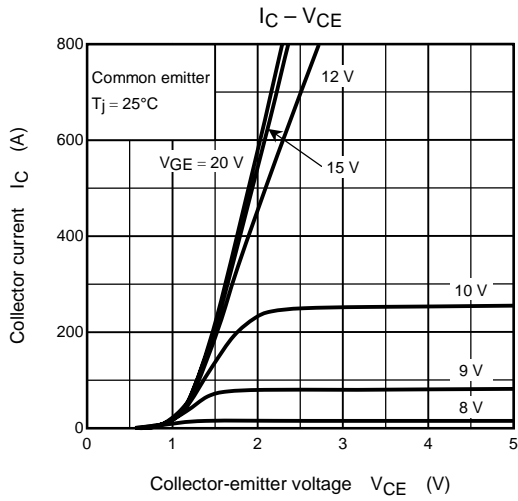


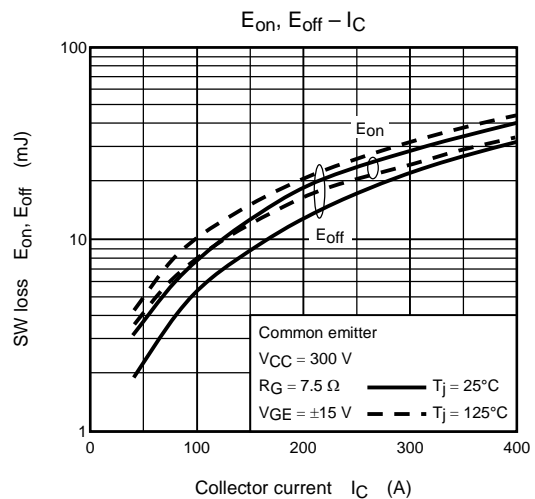
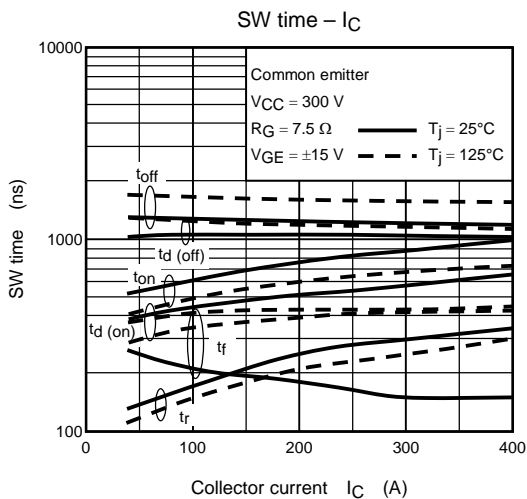
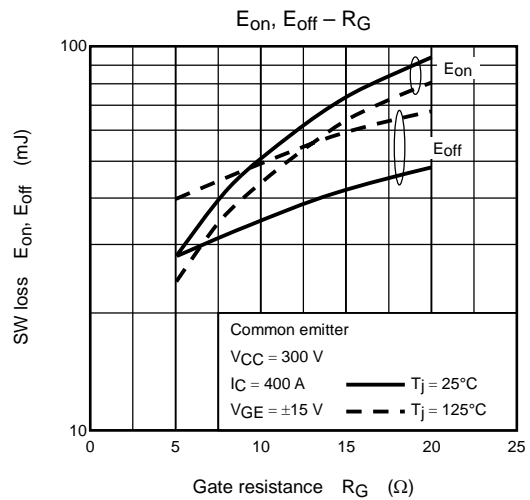
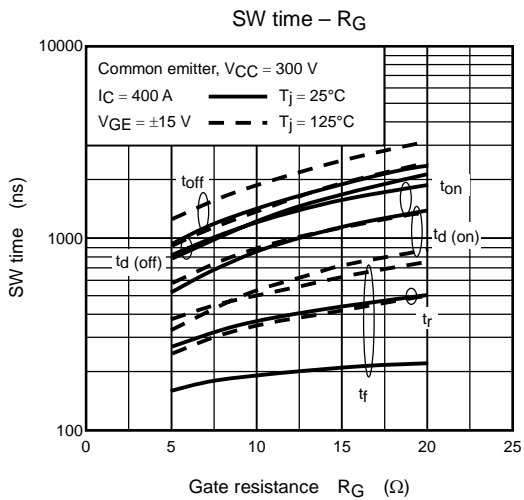
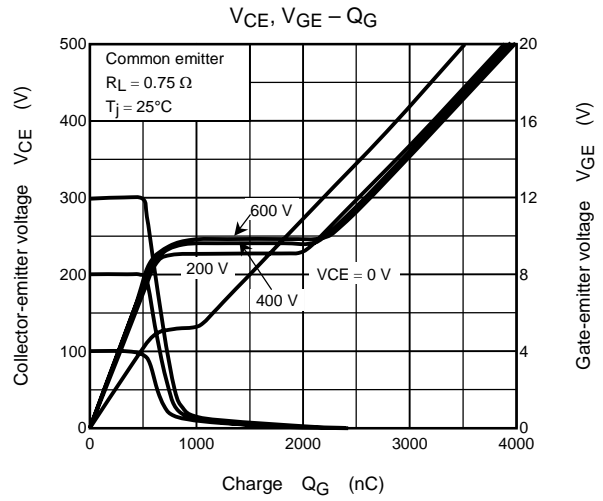
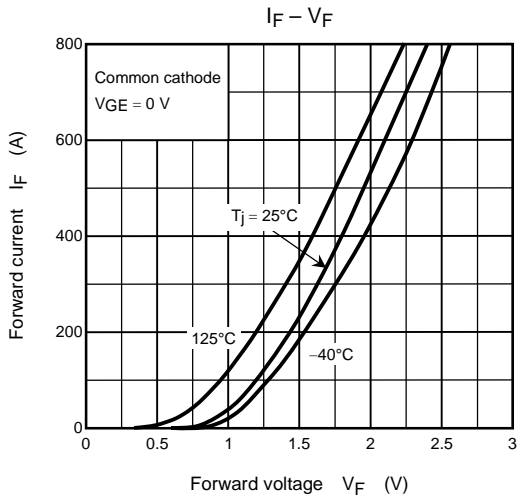
**Remark****<Short circuit capability condition>**

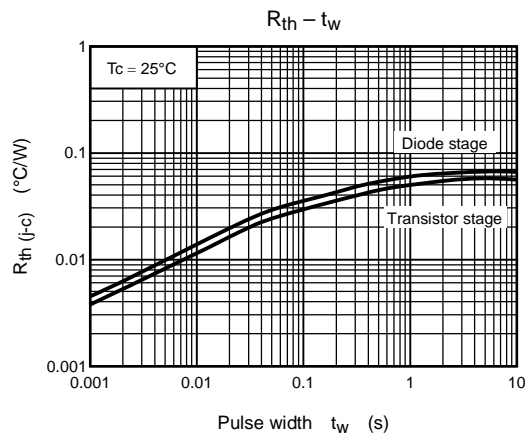
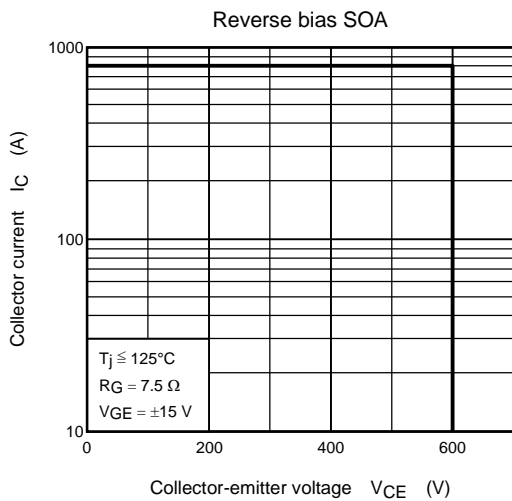
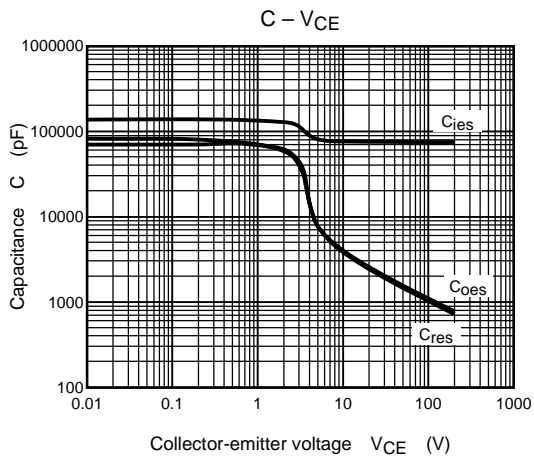
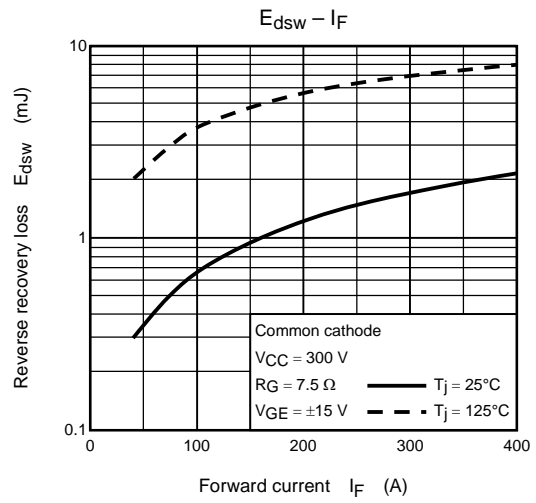
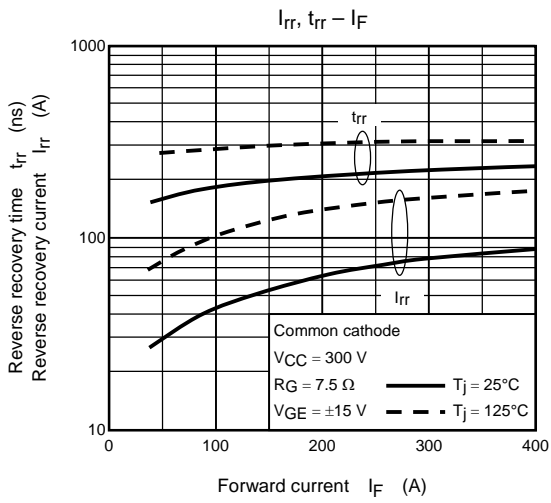
- Short circuit capability is 6  $\mu$ s after fault output signal.  
Please keep following condition to use fault output signal.
  - $V_{CC} \leq 375$  V
  - $13.8$  V  $\leq V_{GE} \leq 16.0$  V
  - $R_G \geq 7.5$   $\Omega$
  - $T_j \leq 50^\circ$ C

**<Gate voltage>**

- To use this product,  $V_{GE}$  must be provided higher than 13.8 V.  
In case  $V_{GE}$  is less than 13.8 V, fault signal FO may not be output even under error conditions.









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