

# 7MBR50VP120-50

**IGBT Modules**

## IGBT MODULE (V series)

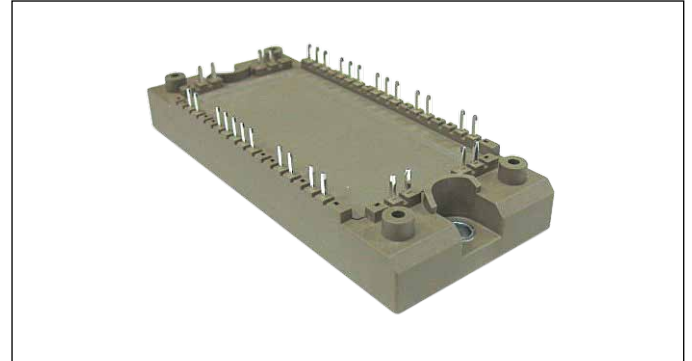
### 1200V / 50A / PIM

#### ■ Features

- Low  $V_{CE(sat)}$
- Compact Package
- P.C.Board Mount Module
- Converter Diode Bridge Dynamic Brake Circuit
- RoHS compliant product

#### ■ Applications

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply



#### ■ Maximum Ratings and Characteristics

##### ● Absolute Maximum Ratings (at $T_c=25^\circ\text{C}$ unless otherwise specified)

Items	Symbols	Conditions	Maximum ratings	Units	
Inverter	Collector-Emitter voltage	$V_{CES}$	1200	V	
	Gate-Emitter voltage	$V_{GES}$	$\pm 20$	V	
	Collector current	$I_c$	Continuous $T_c=100^\circ\text{C}$	50	A
		$I_{cp}$	1ms $T_c=80^\circ\text{C}$	100	
		$-I_c$		50	
$-I_c$ pulse		1ms	100		
Collector power dissipation	$P_c$	1 device	280	W	
Brake	Collector-Emitter voltage	$V_{CES}$	1200	V	
	Gate-Emitter voltage	$V_{GES}$	$\pm 20$	V	
	Collector current	$I_c$	Continuous $T_c=80^\circ\text{C}$	35	A
		$I_{cp}$	1ms $T_c=80^\circ\text{C}$	70	
	Collector power dissipation	$P_c$	1 device	210	W
Repetitive peak reverse voltage (Diode)	$V_{RRM}$		1200	V	
Converter	Repetitive peak reverse voltage	$V_{RRM}$	1600	V	
	Average output current	$I_o$	50Hz/60Hz, sine wave	50	A
	Surge current (Non-Repetitive)	$I_{FSM}$	10ms, $T_j=150^\circ\text{C}$	360	A
	$I^2t$ (Non-Repetitive)	$I^2t$	half sine wave	648	$\text{A}^2\text{s}$
Junction temperature	$T_j$	Inverter, Brake	175	$^\circ\text{C}$	
		Converter	150		
Operating junction temperature (under switching conditions)	$T_{jop}$	Inverter, Brake	150		
		Converter	150		
Case temperature	$T_c$		125		
Storage temperature	$T_{stg}$		-40 to +125		
Isolation voltage	between terminal and copper base (*1) between thermistor and others (*2)	$V_{iso}$	AC : 1min.	VAC	
Screw torque	Mounting (*3)	-	M5	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 T<sub>j</sub> = 25°C unless otherwise specified)

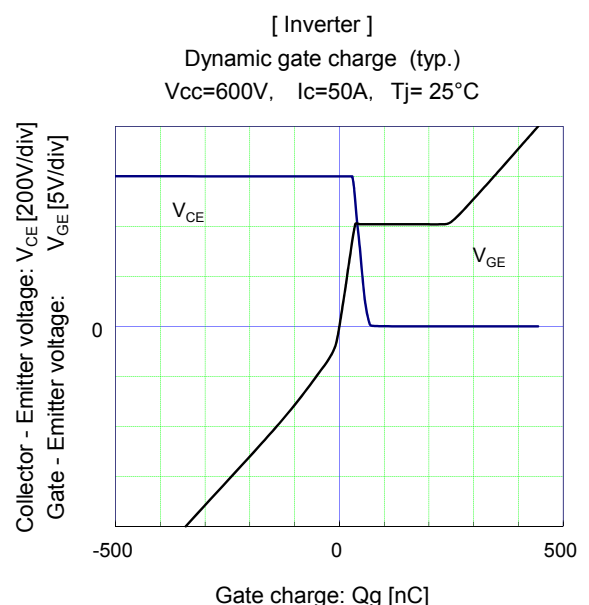
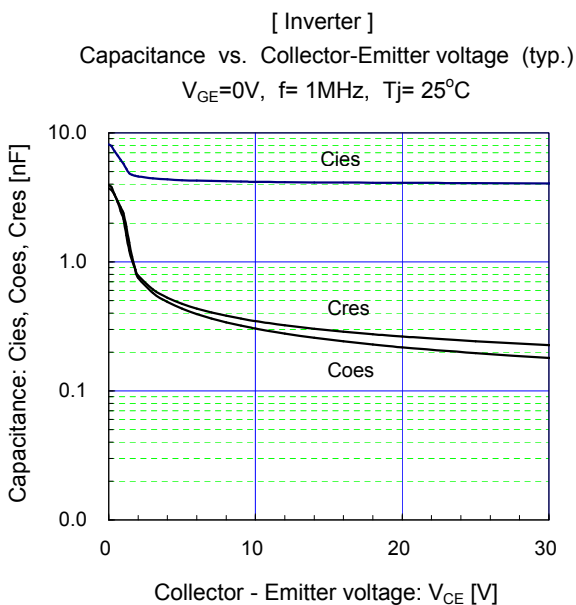
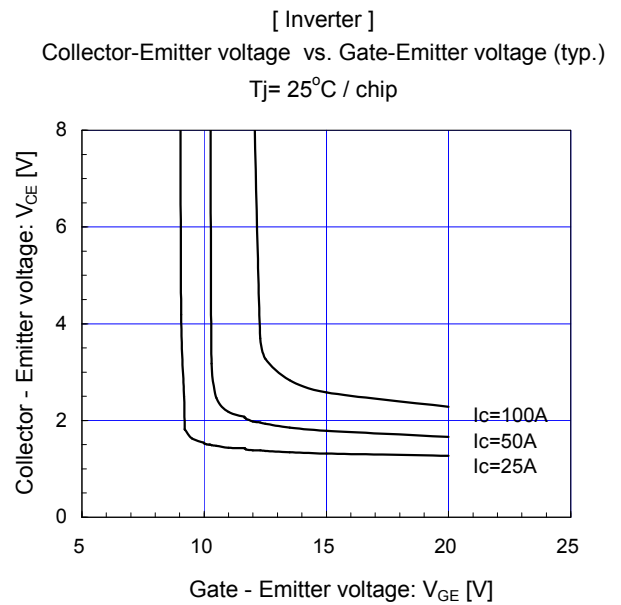
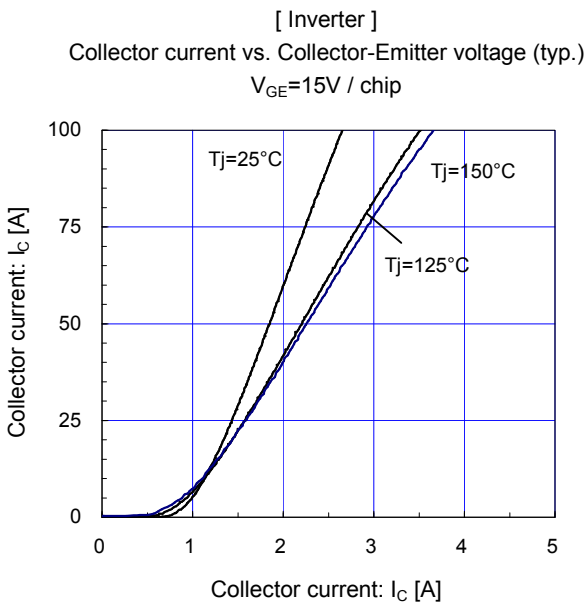
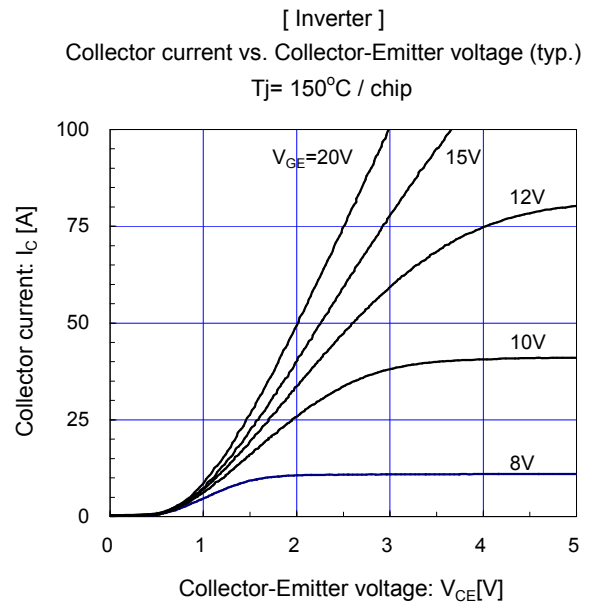
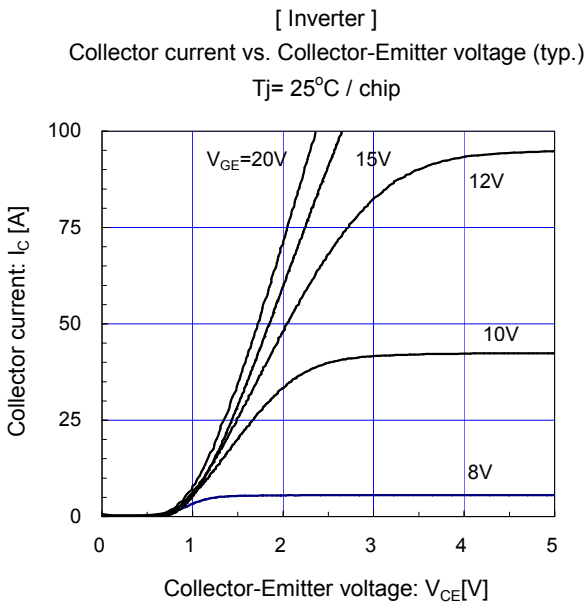
Items	Symbols	Conditions	Characteristics			Units		
			min.	typ.	max.			
Inverter	Zero gate voltage collector current	I <sub>CES</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V	-	-	1.0	mA	
	Gate-Emitter leakage current	I <sub>GES</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = ±20V	-	-	200	nA	
	Gate-Emitter threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = 20V, I <sub>c</sub> = 50mA	6.0	6.5	7.0	V	
	Collector-Emitter saturation voltage	V <sub>CE(sat)</sub> (terminal)	V <sub>GE</sub> = 15V I <sub>c</sub> = 50A	T <sub>j</sub> = 25°C	-	2.15	2.60	V
				T <sub>j</sub> = 125°C	-	2.50	-	
				T <sub>j</sub> = 150°C	-	2.55	-	
		V <sub>CE(sat)</sub> (chip)	V <sub>GE</sub> = 15V I <sub>c</sub> = 50A	T <sub>j</sub> = 25°C	-	1.85	2.30	
				T <sub>j</sub> = 125°C	-	2.20	-	
	T <sub>j</sub> = 150°C	-	2.25	-				
	Internal gate resistance	R <sub>g(int)</sub>	-	-	4	-	Ω	
	Input capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 10V, V <sub>GE</sub> = 0V, f = 1MHz	-	4.2	-	nF	
	Turn-on time	ton	V <sub>CC</sub> = 600V I <sub>c</sub> = 50A	-	0.39	1.20	μs	
		tr		-	0.09	0.60		
		tr(i)		-	0.03	-		
	Turn-off time	toff	V <sub>GE</sub> = +15 / -15V R <sub>G</sub> = 15Ω	-	0.53	1.00	μs	
tf		-		0.06	0.30			
Forward on voltage	V <sub>F</sub> (terminal)	I <sub>F</sub> = 50A	T <sub>j</sub> = 25°C	-	2.20	2.65	V	
			T <sub>j</sub> = 125°C	-	2.45	-		
			T <sub>j</sub> = 150°C	-	2.40	-		
	V <sub>F</sub> (chip)	I <sub>F</sub> = 50A	T <sub>j</sub> = 25°C	-	1.90	2.35		
			T <sub>j</sub> = 125°C	-	2.15	-		
T <sub>j</sub> = 150°C	-	2.10	-					
Reverse recovery time	trr	I <sub>F</sub> = 50A	-	-	0.35	μs		
Brake	Zero gate voltage collector current	I <sub>CES</sub>	V <sub>GE</sub> = 0V V <sub>CE</sub> = 1200V	-	-	1.0	mA	
	Gate-Emitter leakage current	I <sub>GES</sub>	V <sub>CE</sub> = 0V V <sub>GE</sub> = +20 / -20V	-	-	200	nA	
	Collector-Emitter saturation voltage	V <sub>CE(sat)</sub> (terminal)	V <sub>GE</sub> = 15V I <sub>c</sub> = 35A	T <sub>j</sub> = 25°C	-	2.10	2.55	V
				T <sub>j</sub> = 125°C	-	2.45	-	
				T <sub>j</sub> = 150°C	-	2.50	-	
		V <sub>CE(sat)</sub> (chip)	V <sub>GE</sub> = 15V I <sub>c</sub> = 35A	T <sub>j</sub> = 25°C	-	1.85	2.30	
				T <sub>j</sub> = 125°C	-	2.20	-	
	T <sub>j</sub> = 150°C	-	2.25	-				
	Internal gate resistance	R <sub>g(int)</sub>	-	-	0	-	Ω	
	Turn-on time	ton	V <sub>CE</sub> = 600V I <sub>c</sub> = 35A	-	0.39	1.20	μs	
tr		-		0.09	0.60			
Turn-off time	toff	V <sub>GE</sub> = +15 / -15V R <sub>G</sub> = 27Ω	-	0.53	1.00	μs		
	tf		-	0.06	0.30			
Reverse current	IRRM	V <sub>R</sub> = 1200V	-	-	1.00	mA		
Converter	Forward on voltage	V <sub>FM</sub> (chip)	terminal	-	1.65	2.10	V	
			chip	-	1.35	-		
Reverse current	IRRM	V <sub>R</sub> = 1600V	-	-	1.0	mA		
Thermistor	Resistance	R	T = 25°C	-	5000	-	Ω	
			T = 100°C	465	495	520		
	B value	B	T = 25 / 50°C	3305	3375	3450	K	

## ● Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	R <sub>th(j-c)</sub>	Inverter IGBT	-	-	0.54	°C/W
		Inverter FWD	-	-	0.91	
		Brake IGBT	-	-	0.72	
		Converter Diode	-	-	0.54	
Contact thermal resistance (1device) (*4)	R <sub>th(c-f)</sub>	with Thermal Compound	-	0.05	-	

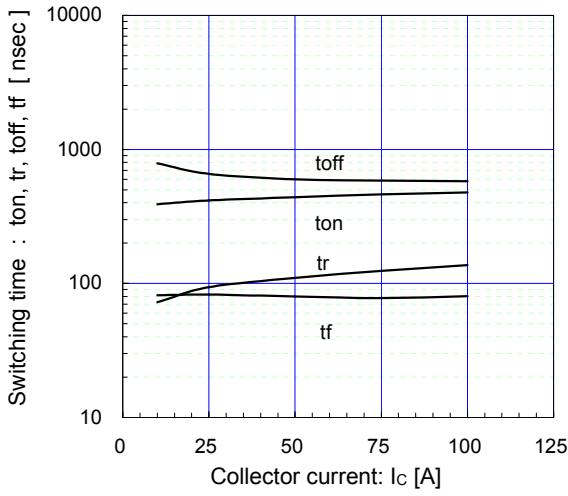
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)



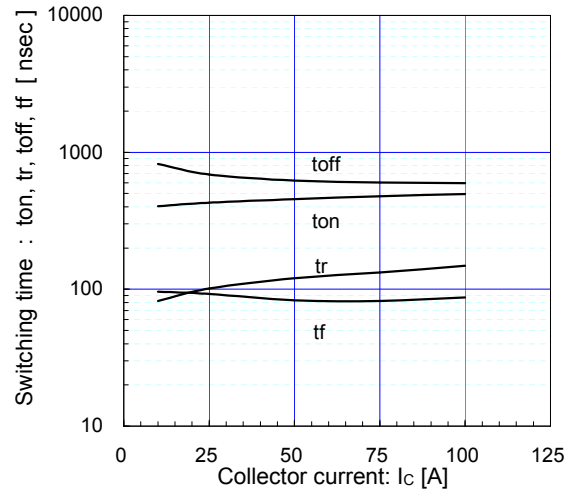
[ Inverter ]

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



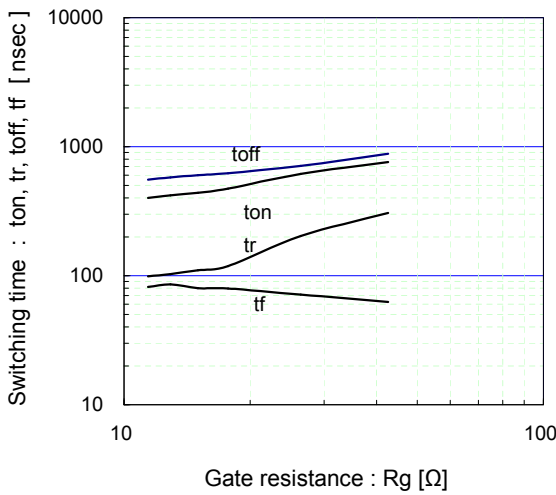
[ Inverter ]

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



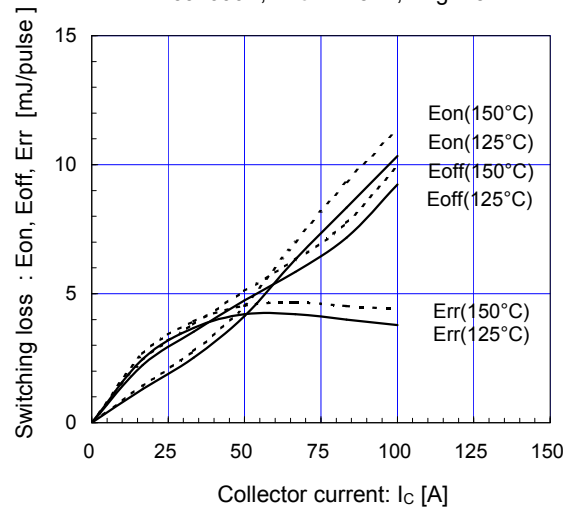
[ Inverter ]

Switching time vs. gate resistance (typ.)  
 $V_{CC}=600V, I_c=50A, V_{GE}=\pm 15V, T_j=125^\circ C$



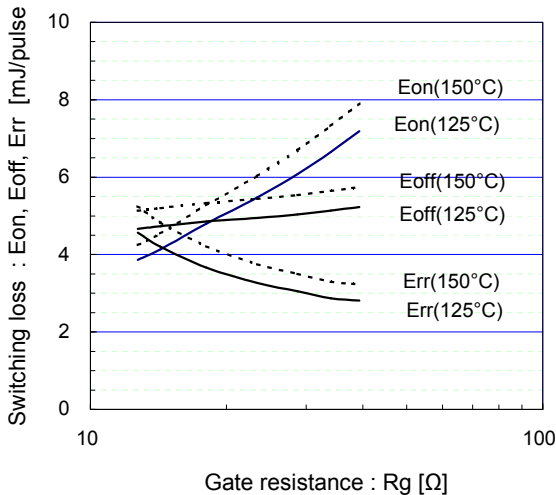
[ Inverter ]

Switching loss vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_g=15\Omega$



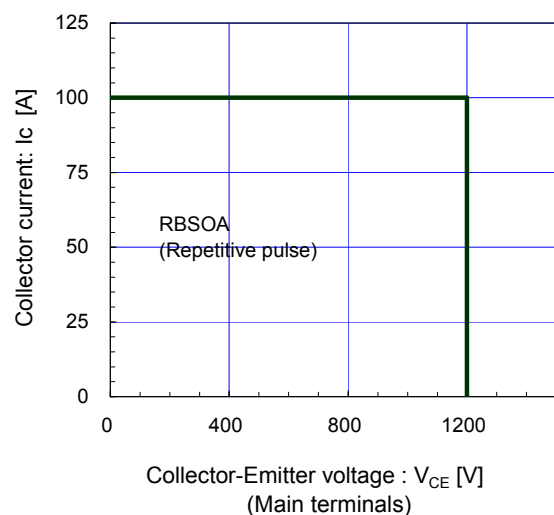
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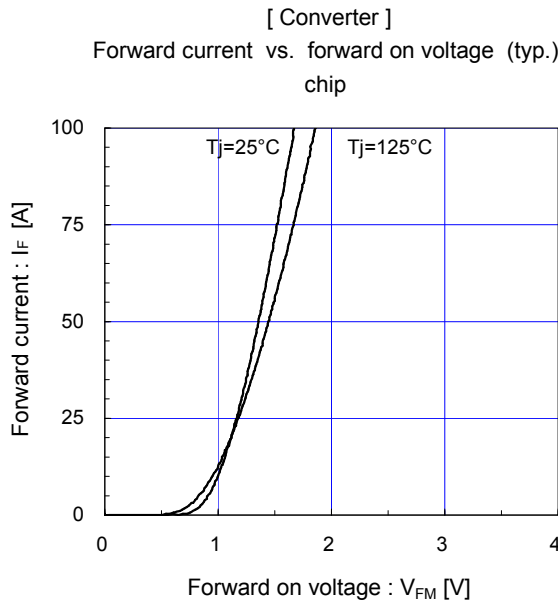
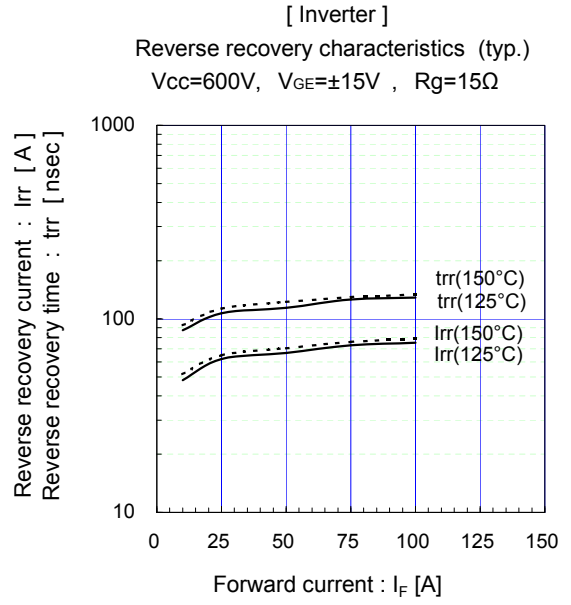
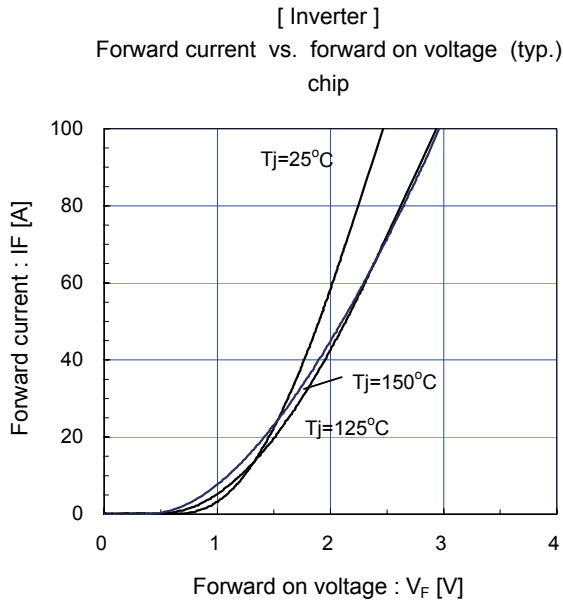
Switching loss vs. gate resistance (typ.)  
 $V_{CC}=600V, I_c=50A, V_{GE}=\pm 15V$



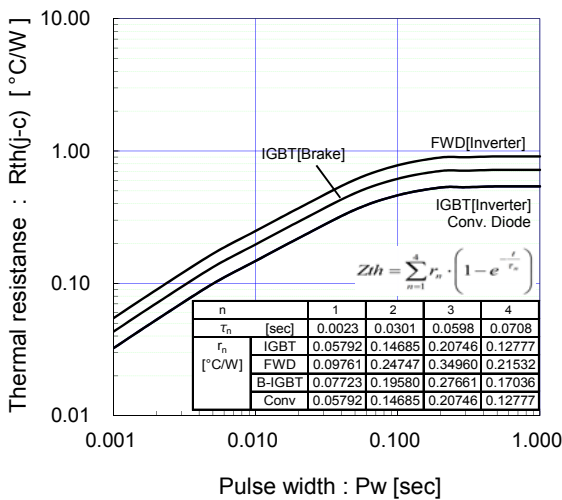
[ Inverter ]

Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE} \leq 15V, R_g \geq 15\Omega, T_j = 150^\circ C$

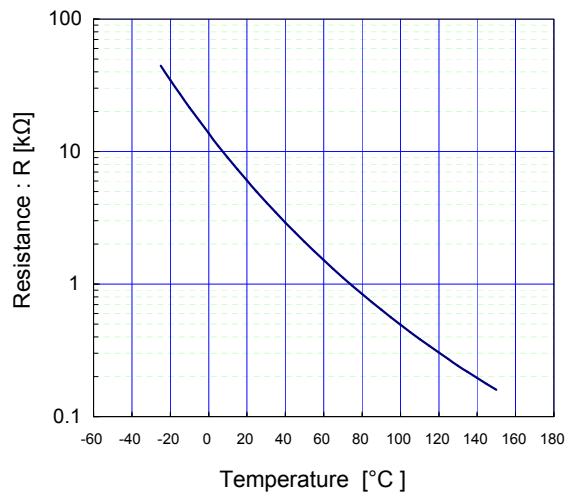




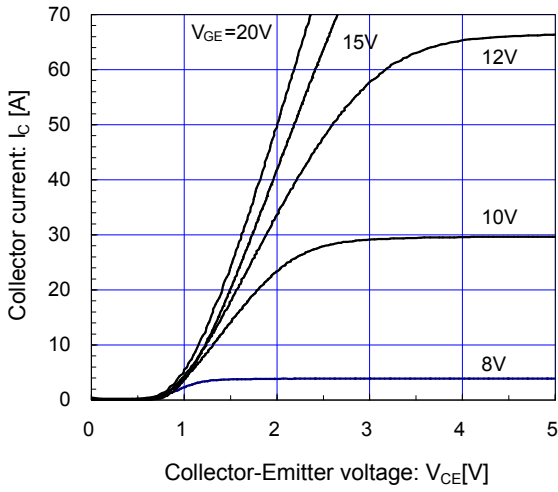
Transient thermal resistance (max.)



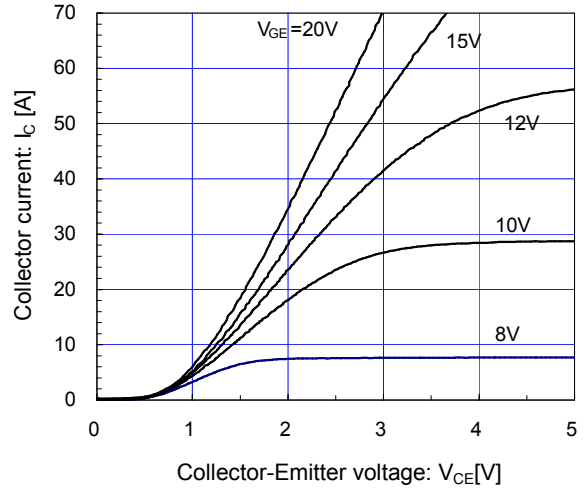
[ Thermistor ]  
Temperature characteristic (typ.)



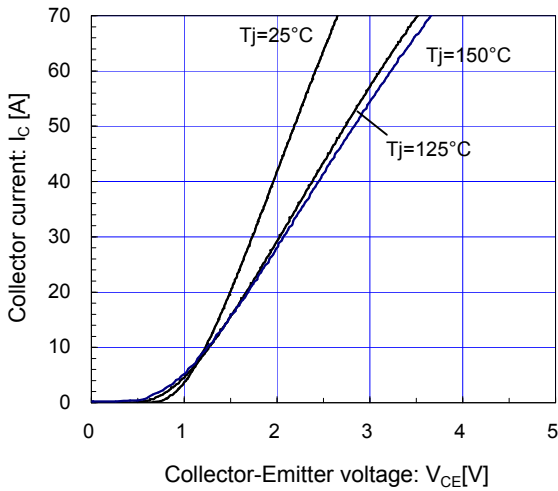
[ Brake ]  
 Collector current vs. Collector-Emmitter voltage (typ.)  
 $T_j = 25^\circ\text{C} / \text{chip}$



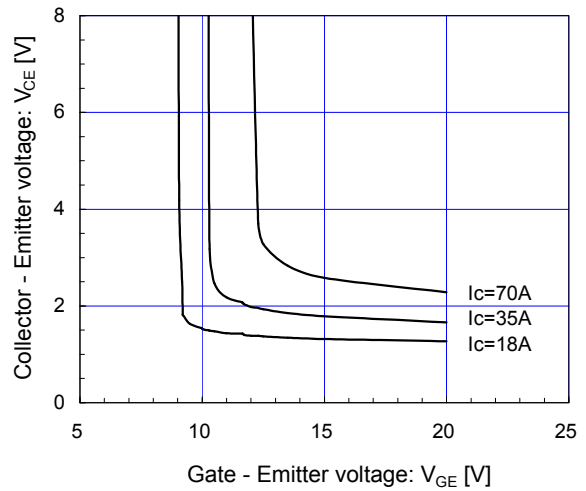
[ Brake ]  
 Collector current vs. Collector-Emmitter voltage (typ.)  
 $T_j = 150^\circ\text{C} / \text{chip}$



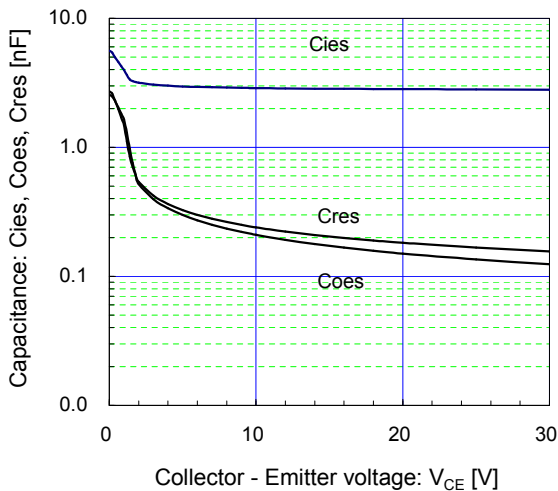
[ Brake ]  
 Collector current vs. Collector-Emmitter voltage (typ.)  
 $V_{GE} = 15\text{V} / \text{chip}$



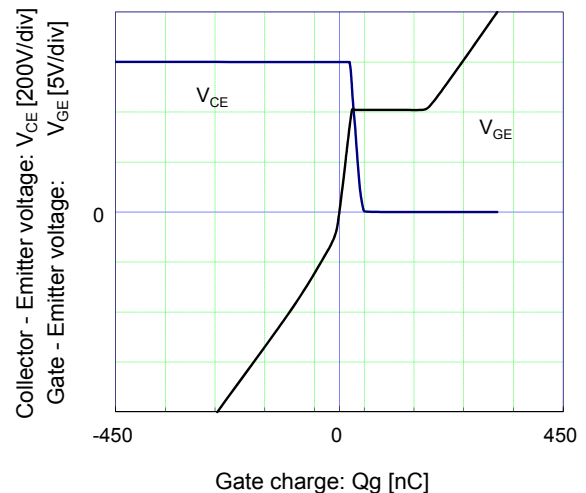
[ Brake ]  
 Collector-Emmitter voltage vs. Gate-Emmitter voltage (typ.)  
 $T_j = 25^\circ\text{C} / \text{chip}$



[ Brake ]  
 Capacitance vs. Collector-Emmitter voltage (typ.)  
 $V_{GE} = 0\text{V}, f = 1\text{MHz}, T_j = 25^\circ\text{C}$

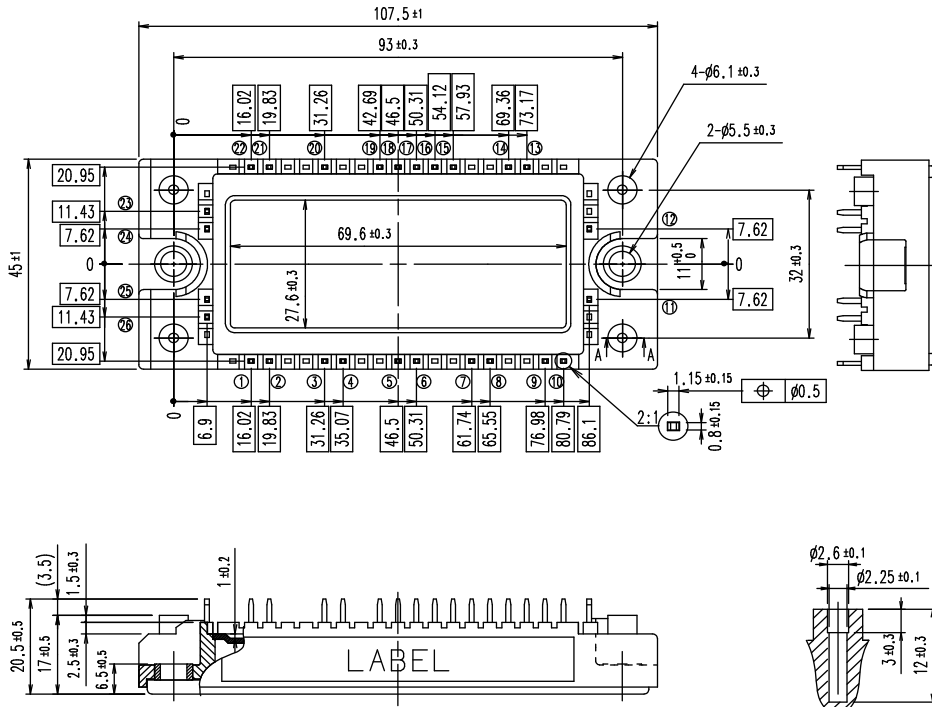


[ Brake ]  
 Dynamic gate charge (typ.)  
 $V_{CC} = 600\text{V}, I_c = 35\text{A}, T_j = 25^\circ\text{C}$



■ Outline Drawings (Unit: mm)

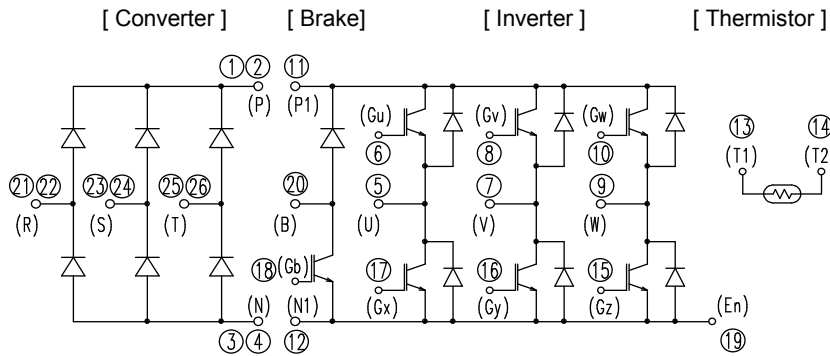
□ shows theoretical dimension.  
 ( ) shows reference dimension.



Section A-A

Weight: 200g (typ.)

■ Equivalent Circuit



**WARNING**

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  - Measurement equipment
  - Machine tools
  - Audiovisual equipment
  - Electrical home appliances
  - Personal equipment
  - Industrial robots etc.
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  - Gas leakage detectors with an auto-shut-off feature
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  - Safety devices
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