

7MBR50VR120-50

IGBT Modules

IGBT MODULE (V series)

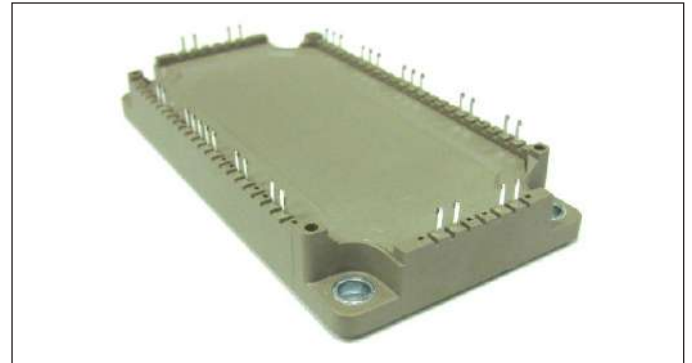
1200V / 50A / PIM

■ 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}		± 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}		± 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	A^2s	
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~+125		
Isolation voltage	between terminal and copper base (*1) between thermistor and others (*2)	V_{iso}	AC : 1min.	2500	VAC	
Screw torque	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)

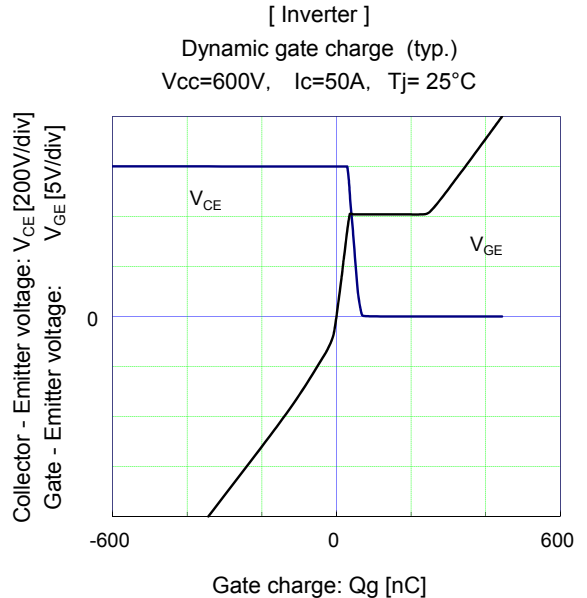
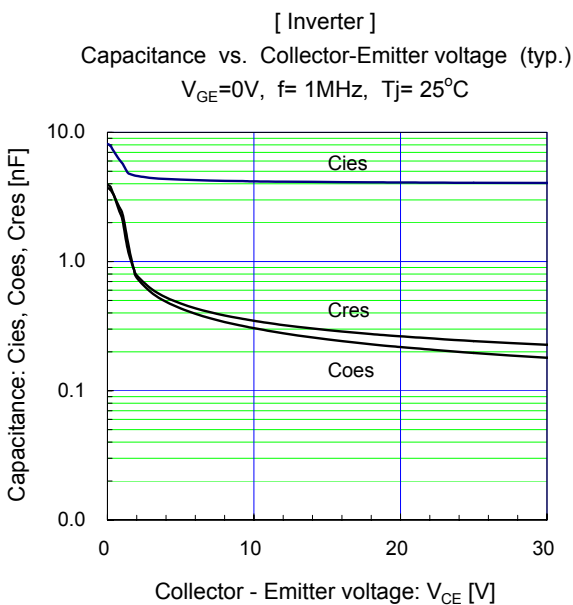
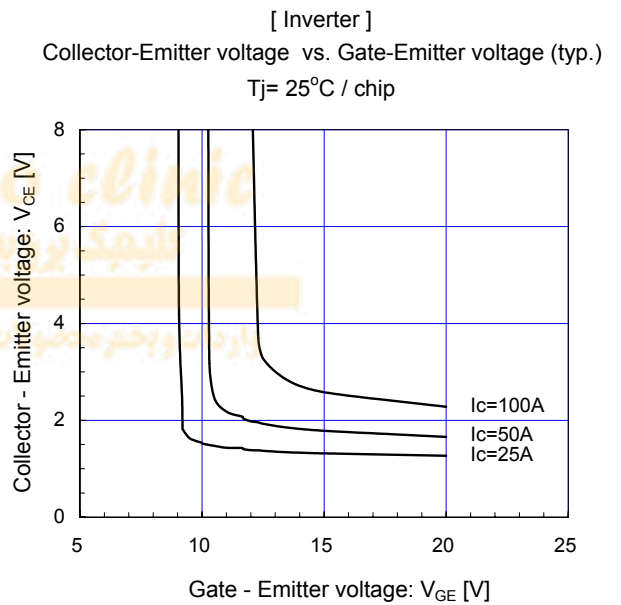
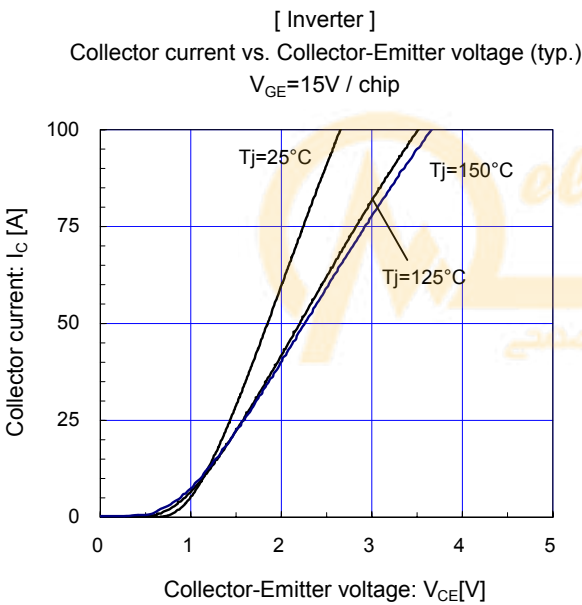
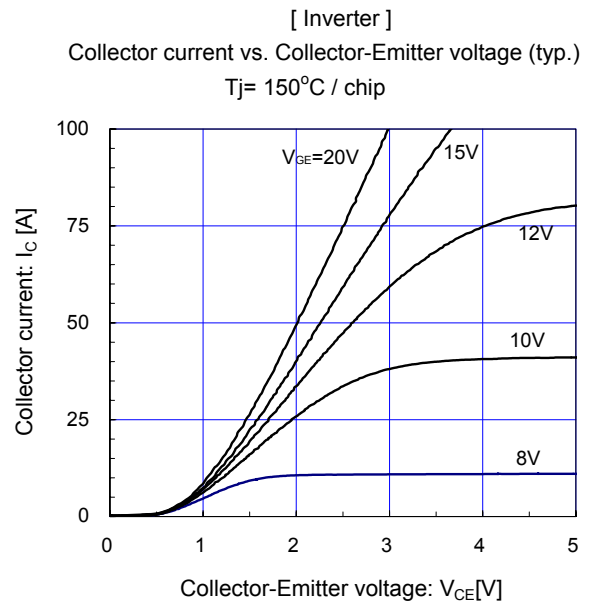
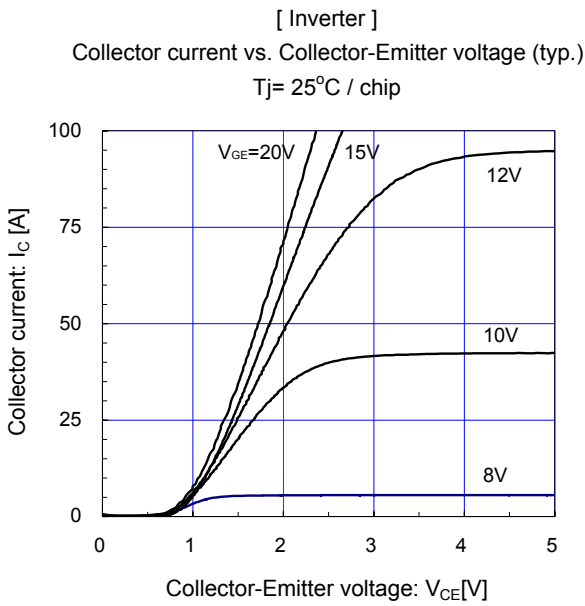
Items	Symbols	Conditions	Characteristics			Units		
			min.	typ.	max.			
Inverter	Zero gate voltage collector current	I_{CES}	$V_{GE} = 0V, V_{CE} = 1200V$	-	-	1.0	mA	
	Gate-Emitter leakage current	I_{GES}	$V_{GE} = 0V, V_{CE} = \pm 20V$	-	-	200	nA	
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V, I_c = 50mA$	6.0	6.5	7.0	V	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_c = 50A$	Tj=25°C	-	2.15	2.60	V
				Tj=125°C	-	2.50	-	
				Tj=150°C	-	2.55	-	
		$V_{CE(sat)}$ (chip)	$V_{GE} = 15V$ $I_c = 50A$	Tj=25°C	-	1.85	2.30	
				Tj=125°C	-	2.20	-	
	Tj=150°C	-	2.25	-				
	Internal gate resistance	$R_{g(int)}$	-	-	4	-	Ω	
	Input capacitance	C_{ies}	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$	-	4.2	-	nF	
	Turn-on time	t_{on}	$V_{CC} = 600V$ $I_c = 50A$	-	0.39	1.20	μs	
		t_r		-	0.09	0.60		
		$t_r(i)$		-	0.03	-		
	Turn-off time	t_{off}	$V_{GE} = +15 / -15V$ $R_G = 15Ω$	-	0.53	1.00	μs	
t_f		-		0.06	0.30			
Forward on voltage	V_F (terminal)	$I_F = 50A$	Tj=25°C	-	2.00	2.45	V	
			Tj=125°C	-	2.15	-		
			Tj=150°C	-	2.10	-		
	V_F (chip)	$I_F = 50A$	Tj=25°C	-	1.70	2.15		
			Tj=125°C	-	1.85	-		
Tj=150°C	-	1.80	-					
Reverse recovery time	t_{rr}	$I_F = 50A$	-	-	0.35	μs		
Brake	Zero gate voltage collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$	-	-	1.0	mA	
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0V$ $V_{GE} = +20 / -20V$	-	-	200	nA	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_c = 35A$	Tj=25°C	-	2.10	2.55	V
				Tj=125°C	-	2.45	-	
				Tj=150°C	-	2.50	-	
		$V_{CE(sat)}$ (chip)	$V_{GE} = 15V$ $I_c = 35A$	Tj=25°C	-	1.85	2.30	
				Tj=125°C	-	2.20	-	
	Tj=150°C	-	2.25	-				
	Internal gate resistance	$R_{g(int)}$	-	-	0	-	Ω	
	Turn-on time	t_{on}	$V_{CE} = 600V$ $I_c = 35A$	-	0.39	1.20	μs	
t_r		-		0.09	0.60			
Turn-off time	t_{off}	$V_{GE} = +15 / -15V$ $R_G = 27Ω$	-	0.53	1.00	μs		
	t_f		-	0.06	0.30			
Reverse current	I_{RRM}	$V_R = 1200V$	-	-	1.00	mA		
Converter	Forward on voltage	$I_F = 50A$	terminal	-	1.65	2.10	V	
			chip	-	1.35	-		
Reverse current	I_{RRM}	$V_R = 1600V$	-	-	1.0	mA		
Thermistor	Resistance	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)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.54	°C/W
		Inverter FWD	-	-	0.73	
		Brake IGBT	-	-	0.72	
		Converter Diode	-	-	0.54	
Contact thermal resistance (1device) (*4)	$R_{th(c-f)}$	with Thermal Compound	-	0.05	-	

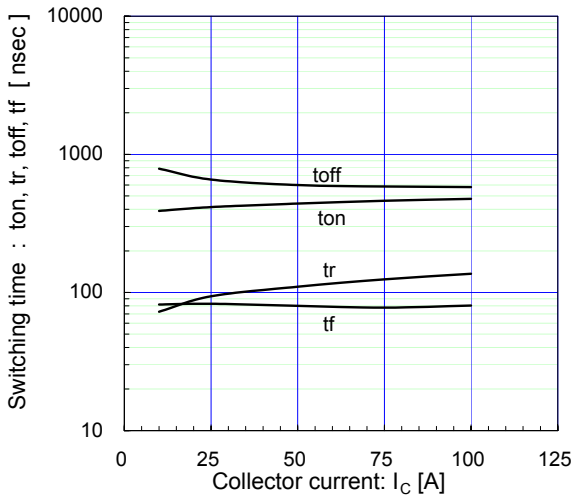
Note *4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)



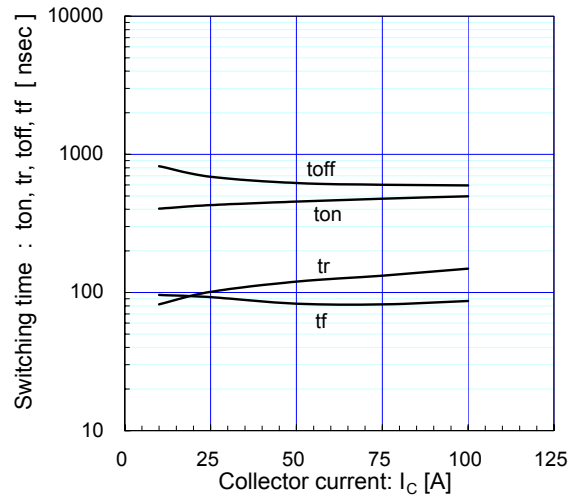
[Inverter]

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



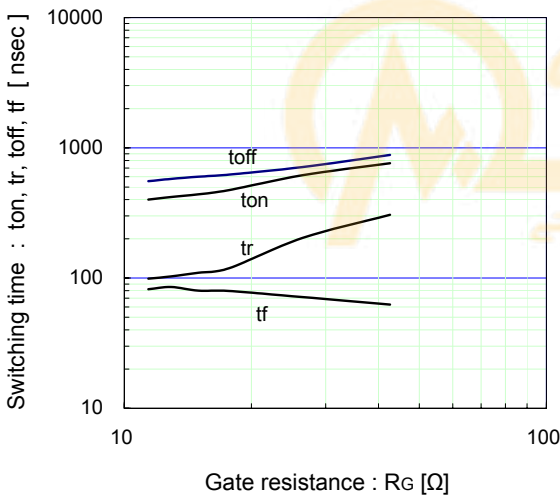
[Inverter]

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



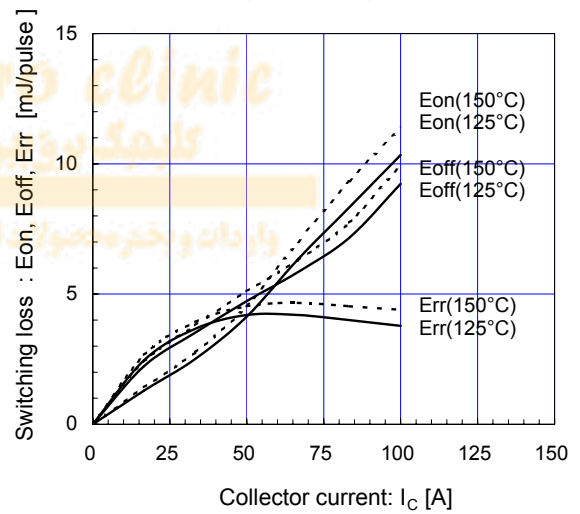
[Inverter]

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



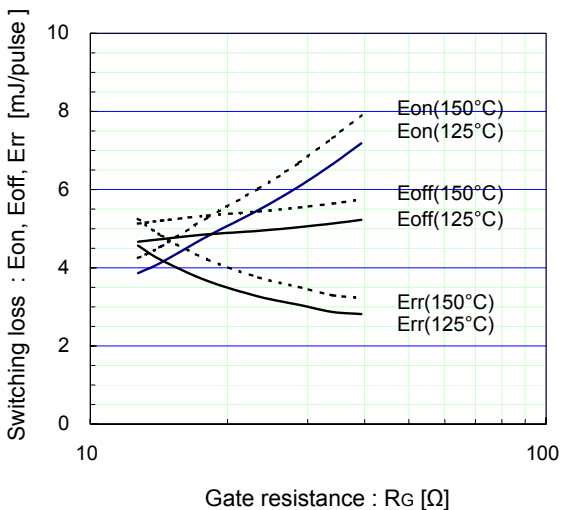
[Inverter]

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



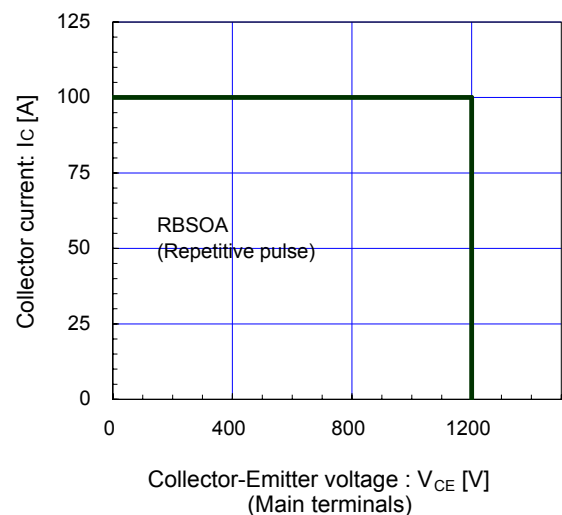
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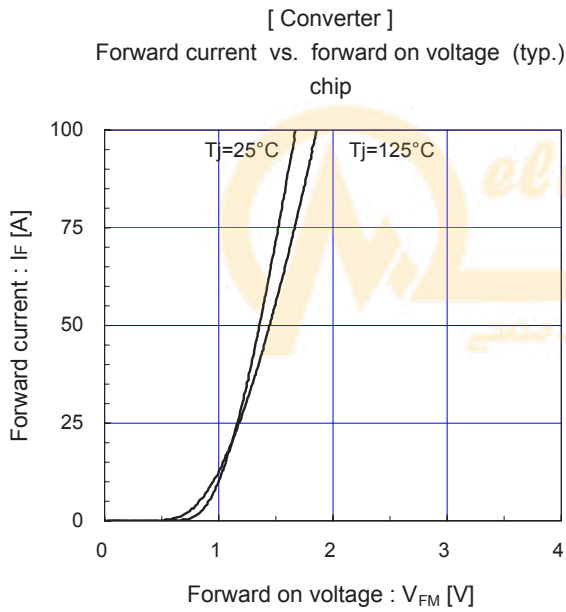
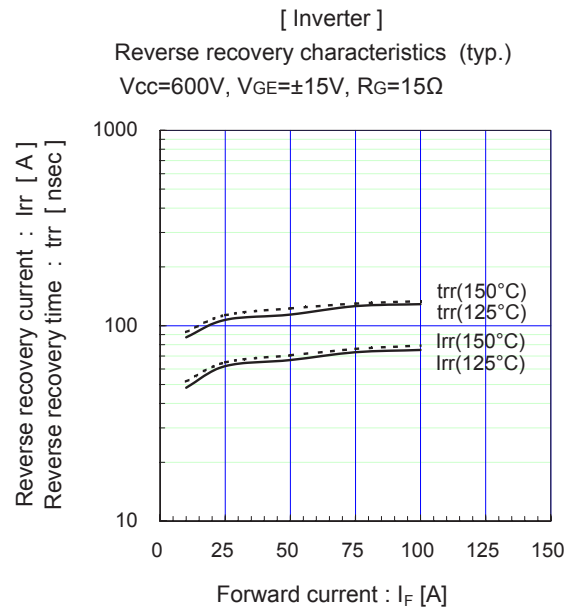
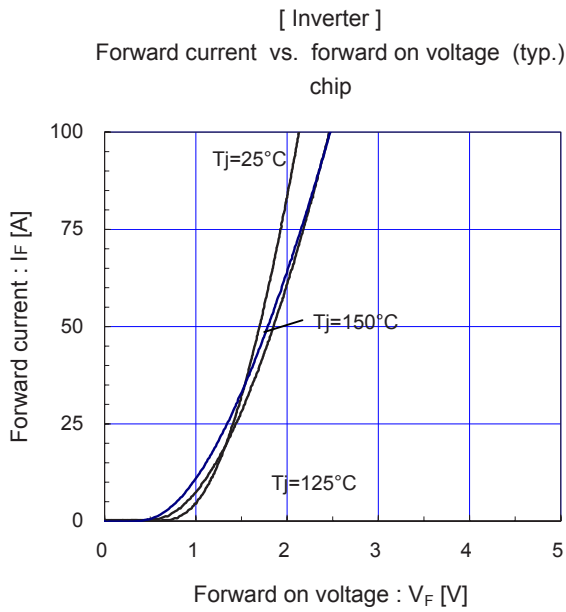
Switching loss vs. gate resistance (typ.)
 $V_{CC}=600V, I_C=50A, V_{GE}=\pm 15V$



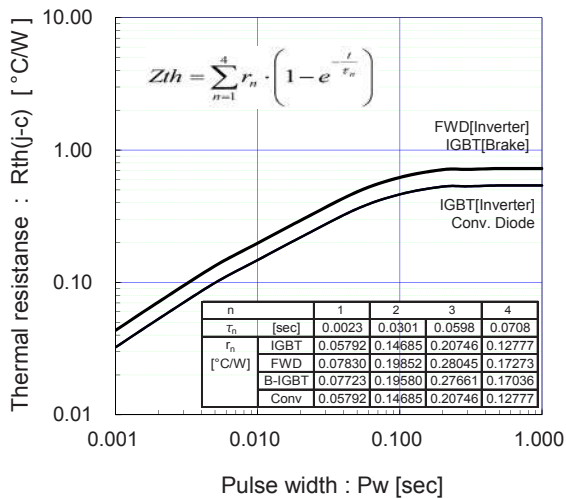
[Inverter]

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

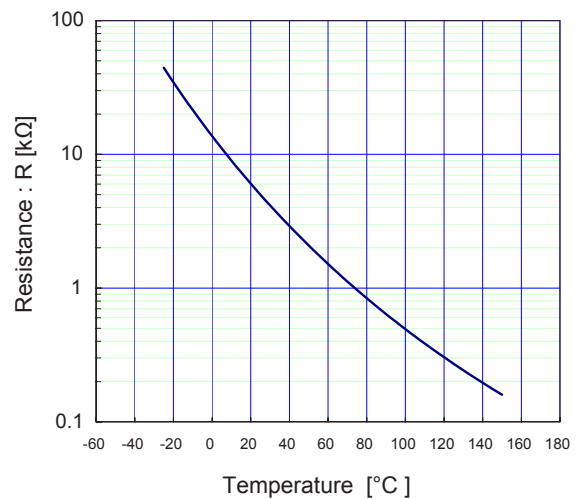




Transient thermal resistance (max.)



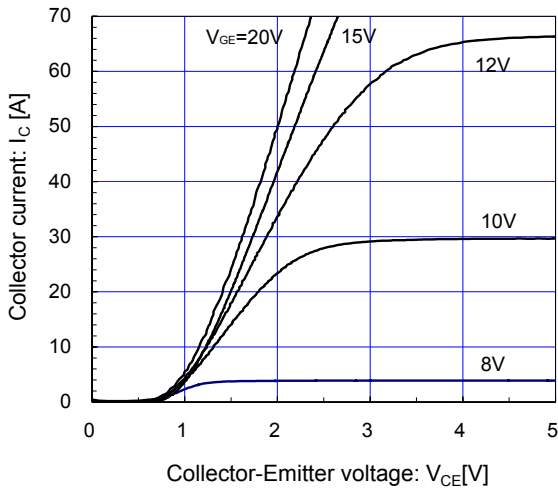
[Thermistor]
Temperature characteristic (typ.)



[Brake]

Collector current vs. Collector-Emmitter voltage (typ.)

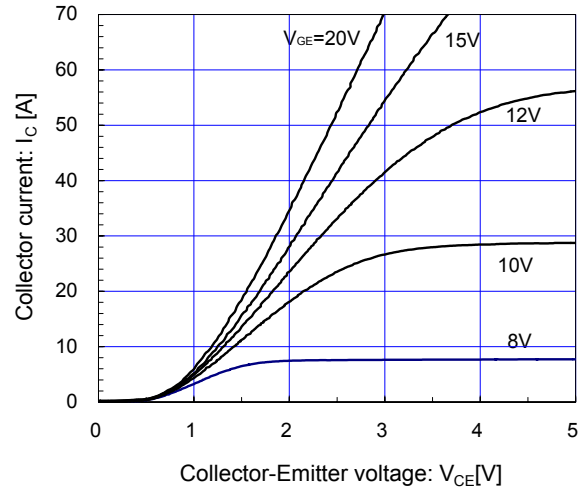
$T_j = 25^\circ\text{C}$ / chip



[Brake]

Collector current vs. Collector-Emmitter voltage (typ.)

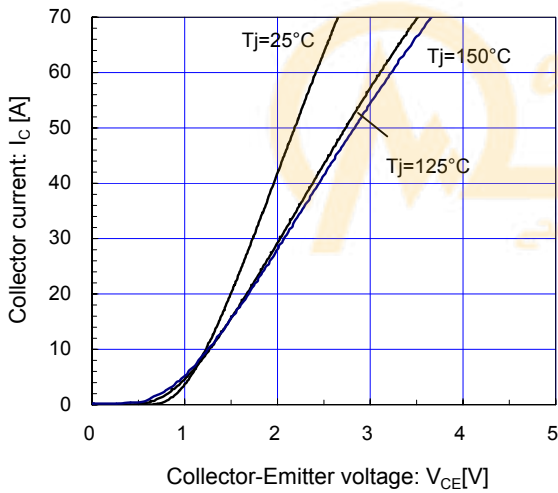
$T_j = 150^\circ\text{C}$ / chip



[Brake]

Collector current vs. Collector-Emmitter voltage (typ.)

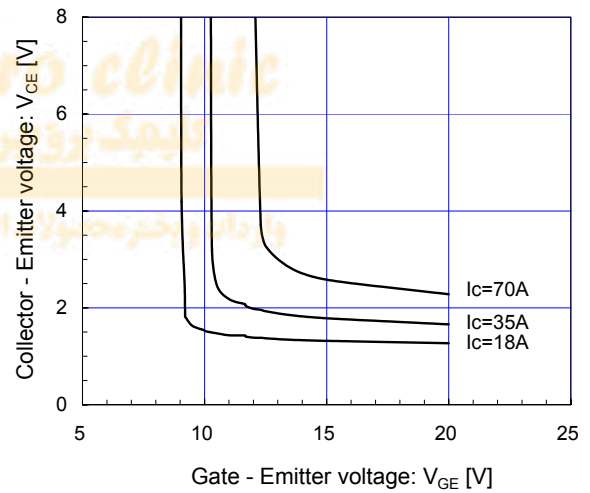
$V_{GE} = 15\text{V}$ / chip



[Brake]

Collector-Emmitter voltage vs. Gate-Emmitter voltage (typ.)

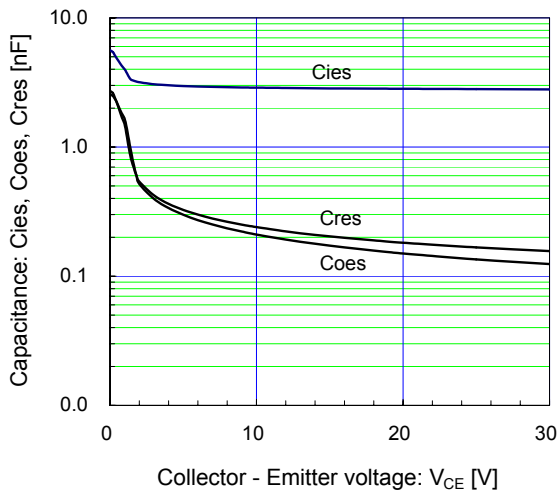
$T_j = 25^\circ\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emmitter voltage (typ.)

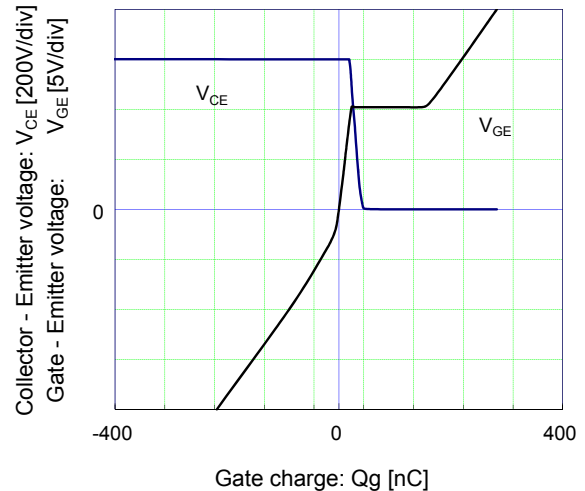
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_j = 25^\circ\text{C}$



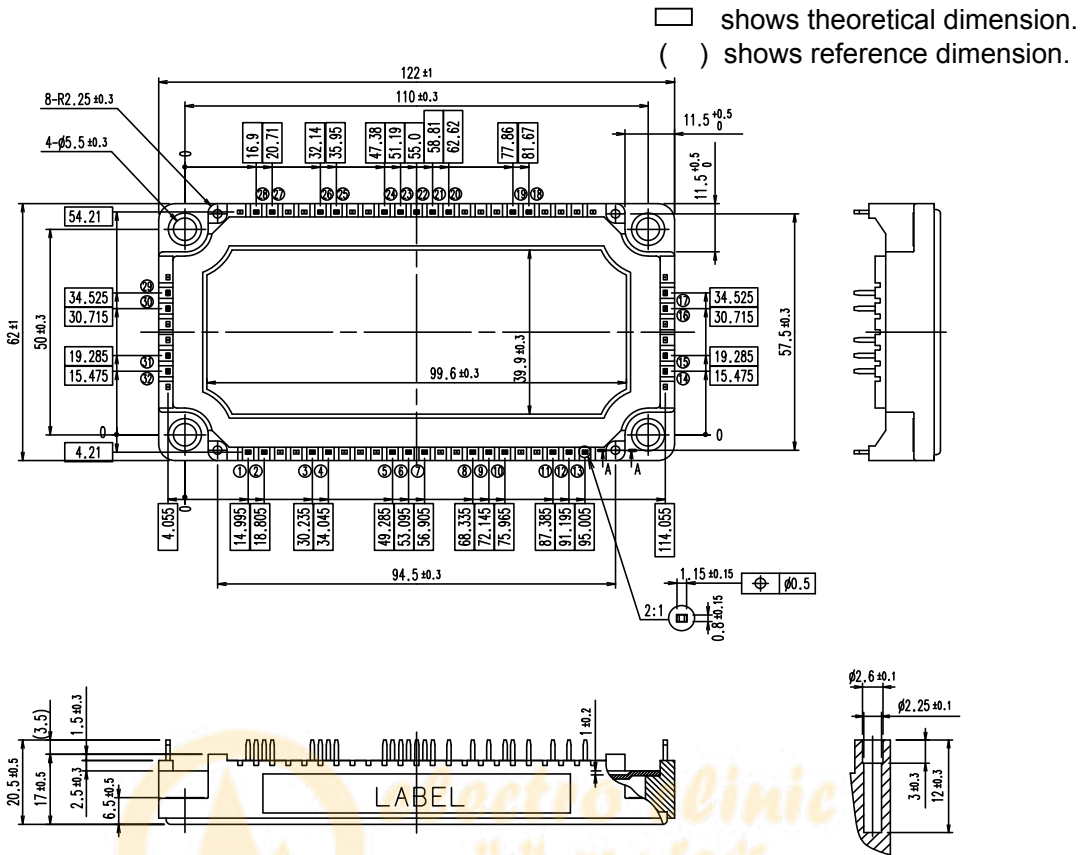
[Brake]

Dynamic gate charge (typ.)

$V_{CC} = 600\text{V}$, $I_c = 35\text{A}$, $T_j = 25^\circ\text{C}$



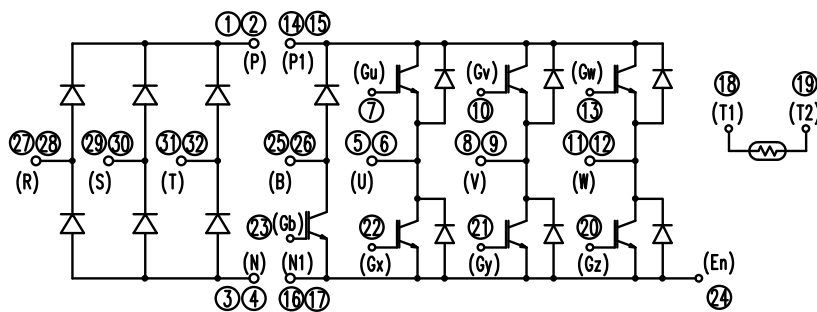
■ Outline Drawings (Unit: mm)



Section A-A
 Weight: 310g (typ.)

■ Equivalent Circuit

[Converter] [Brake] [Inverter] [Thermistor]



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IGBT Modules

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