

# 7MBR50VN120-50

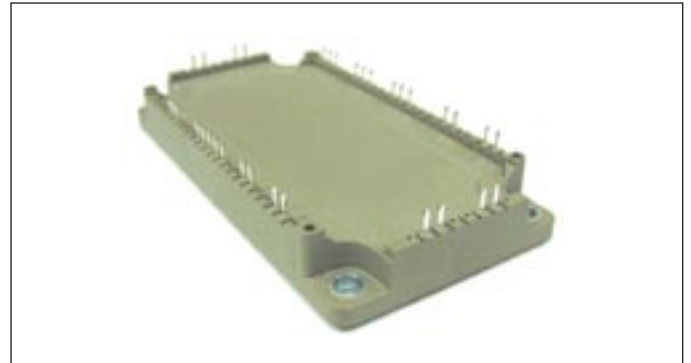
## IGBT MODULE (V series) 1200V / 50A / PIM

### ■ 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 $T_c=80^\circ\text{C}$	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	260	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 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	$I_{GES}$	$V_{GE} = 0V, V_{GE} = \pm 20V$	-	-	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	-	2.20	2.65	V
				Tj=125°C	-	2.55	-	
				Tj=150°C	-	2.60	-	
		$V_{CE(sat)}$ (chip)	$V_{GE} = 15V$ $I_c = 50A$	Tj=25°C	-	1.85	2.30	
				Tj=125°C	-	2.20	-	
	Tj=150°C	-	2.25	-				
	Input capacitance	$C_{ies}$	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$	-	4.2	-	nF	
	Turn-on time	$t_{on}$	$V_{CC} = 600V$ $I_c = 50A$ $V_{GE} = +15 / -15V$ $R_G = 15\Omega$	-	0.39	1.20	μs	
		$t_r$		-	0.09	0.60		
		$t_r(i)$		-	0.03	-		
	Turn-off time	$t_{off}$	$R_G = 15\Omega$	-	0.53	1.00	μs	
		$t_f$		-	0.06	0.30		
Forward on voltage	$V_F$ (terminal)	$I_F = 50A$	Tj=25°C	-	2.05	2.50	V	
			Tj=125°C	-	2.20	-		
			Tj=150°C	-	2.15	-		
	$V_F$ (chip)	$I_F = 50A$	Tj=25°C	-	1.70	2.15		
			Tj=125°C	-	1.85	-		
Tj=150°C	-	1.80	-					
Reverse recovery time	$t_{rr}$	$I_F = 50A$	-	-	0.1	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	-				
	Turn-on time	$t_{on}$	$V_{CE} = 600V$ $I_c = 35A$ $V_{GE} = +15 / -15V$ $R_G = 27\Omega$	-	0.39	1.20	μs	
		$t_r$		-	0.09	0.60		
Turn-off time	$t_{off}$	$R_G = 27\Omega$	-	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	-	1.70	2.15	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		

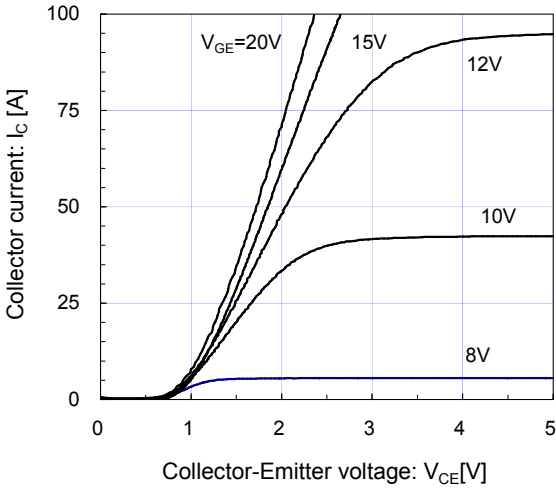
● Thermal resistance characteristics

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	-	

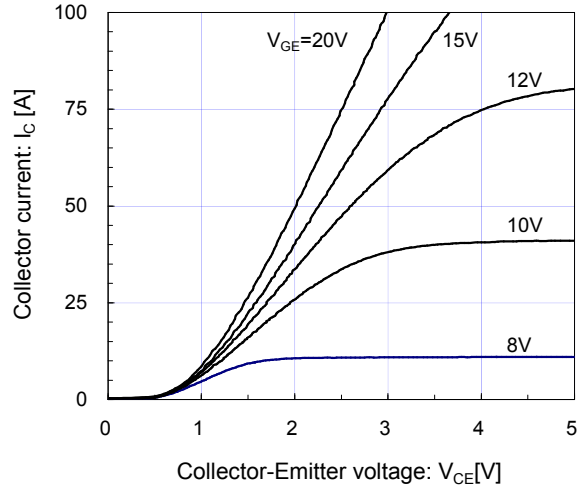
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)

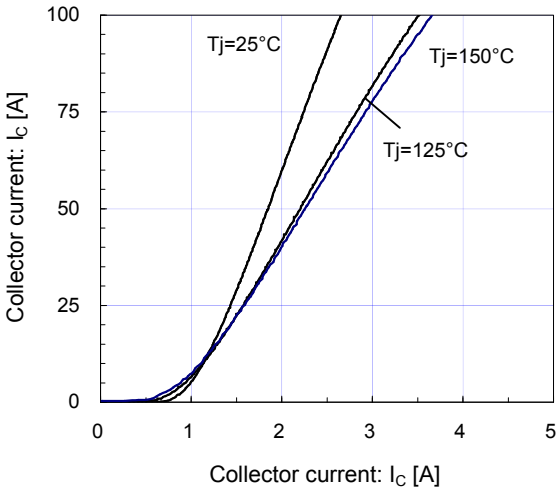
[ Inverter ]  
 Collector current vs. Collector-Emmitter voltage (typ.)  
 $T_j = 25^\circ\text{C}$  / chip



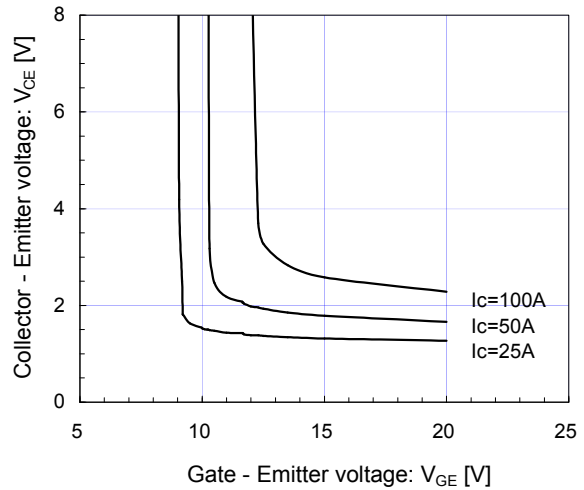
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 Collector current vs. Collector-Emmitter voltage (typ.)  
 $T_j = 150^\circ\text{C}$  / chip



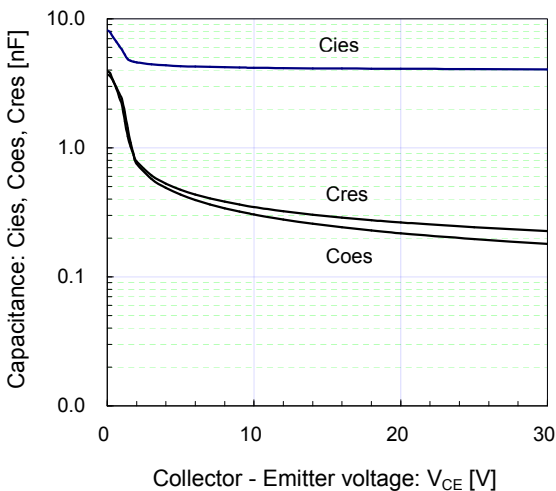
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 Collector current vs. Collector-Emmitter voltage (typ.)  
 $V_{GE} = 15\text{V}$  / chip



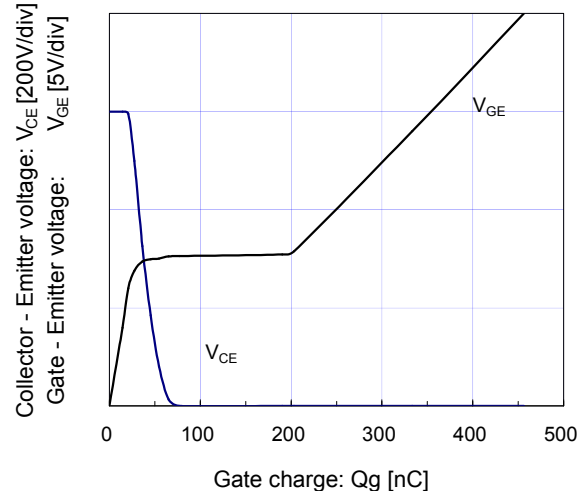
[ Inverter ]  
 Collector-Emmitter voltage vs. Gate-Emmitter voltage (typ.)  
 $T_j = 25^\circ\text{C}$  / chip



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

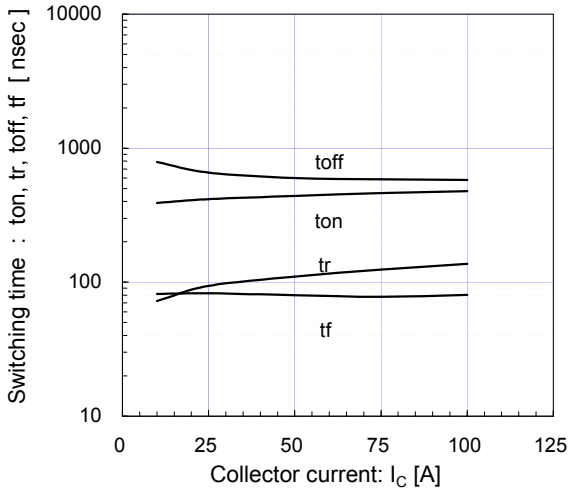


[ Inverter ]  
 Dynamic gate charge (typ.)  
 $V_{CC} = 600\text{V}$ ,  $I_C = 50\text{A}$ ,  $T_j = 25^\circ\text{C}$



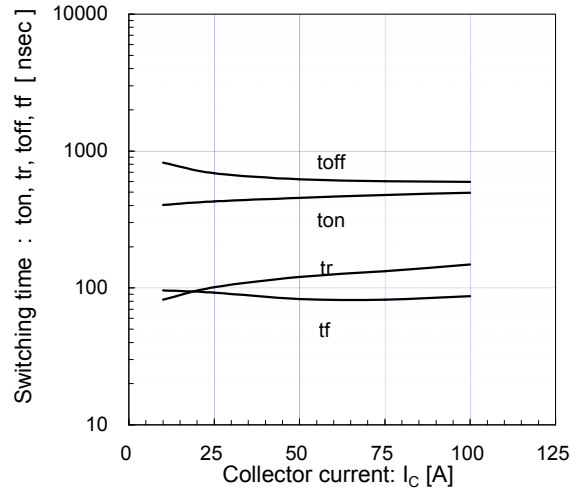
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Switching time vs. Collector current (typ.)  
 $V_{cc}=600V, V_{GE}=\pm 15V, R_g=15\Omega, T_j=125^\circ C$



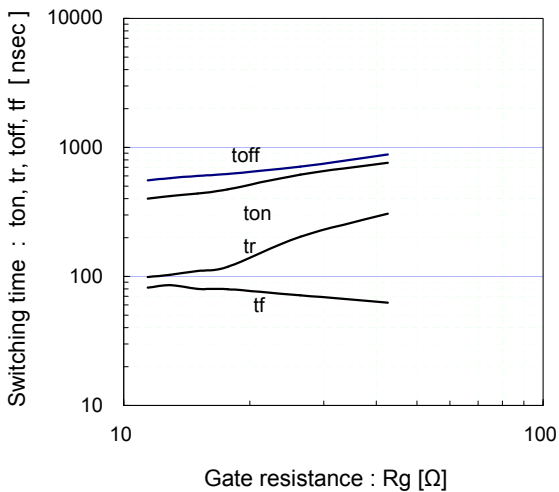
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Switching time vs. Collector current (typ.)  
 $V_{cc}=600V, V_{GE}=\pm 15V, R_g=15\Omega, T_j=150^\circ C$



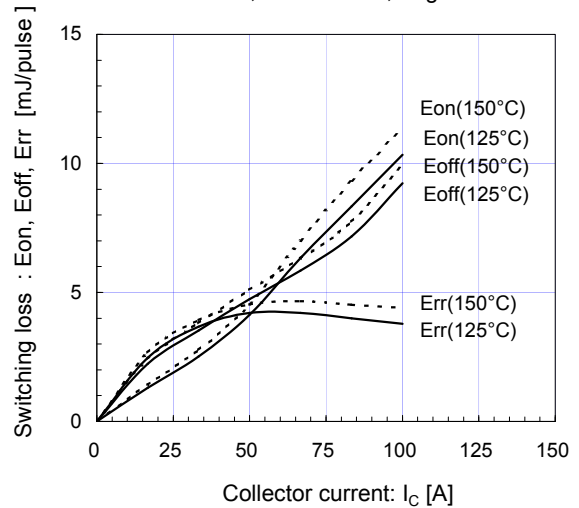
[ Inverter ]

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



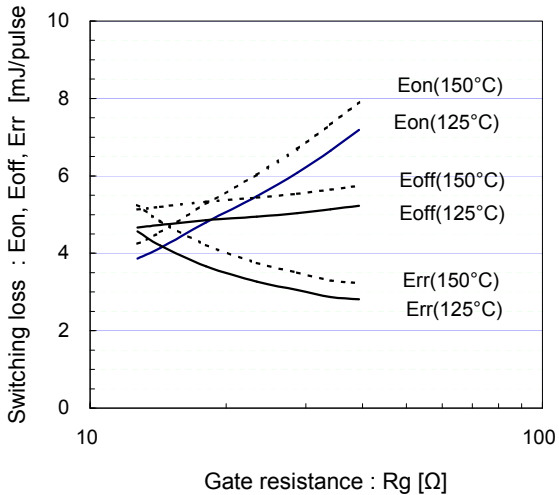
[ Inverter ]

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



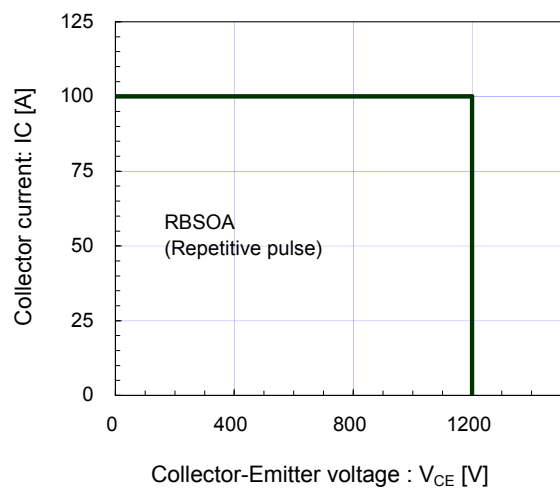
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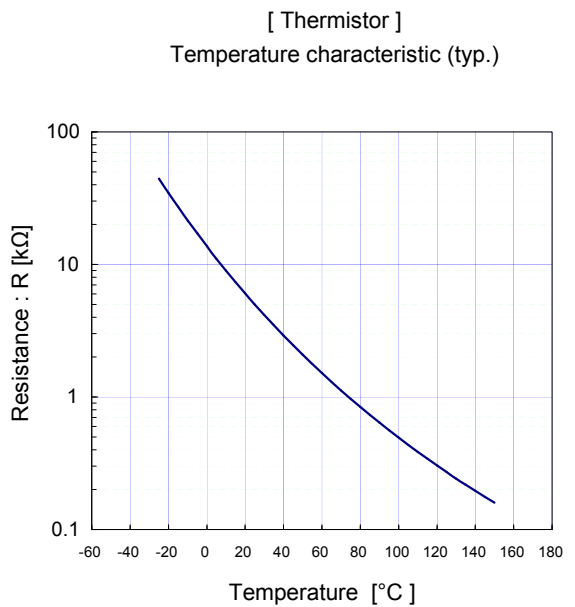
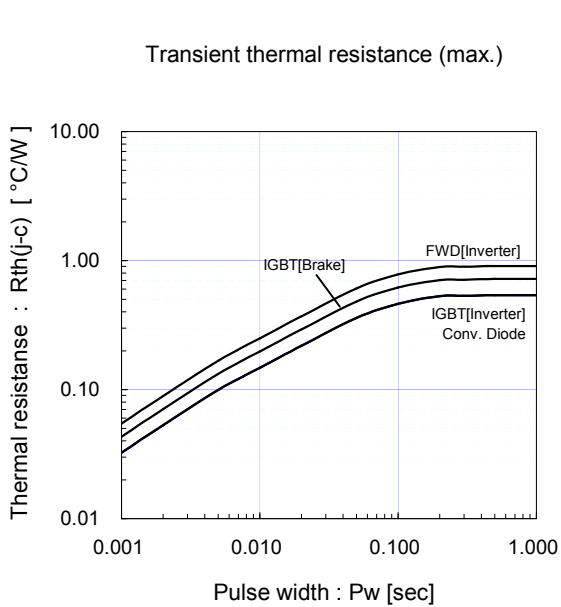
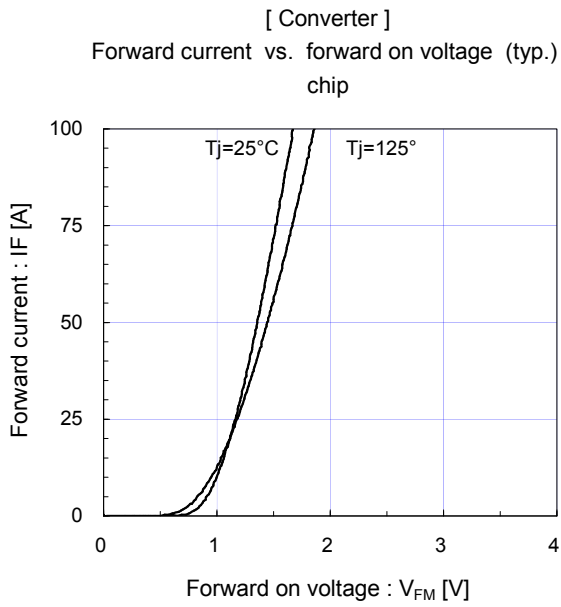
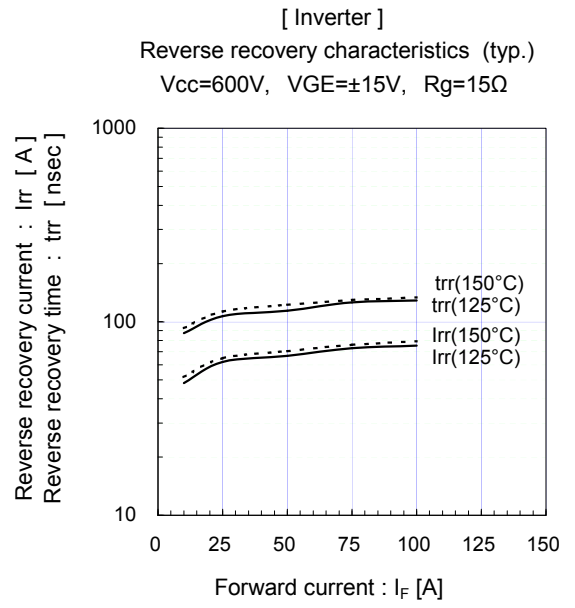
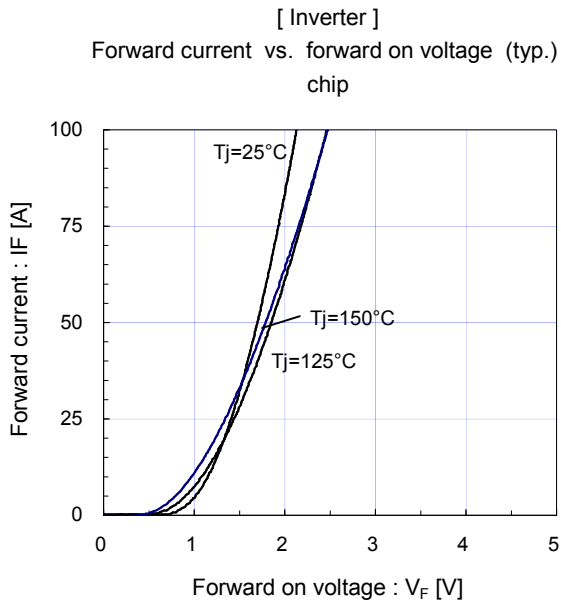
Switching loss vs. gate resistance (typ.)  
 $V_{cc}=600V, I_c=50A, V_{GE}=\pm 15V$



[ Inverter ]

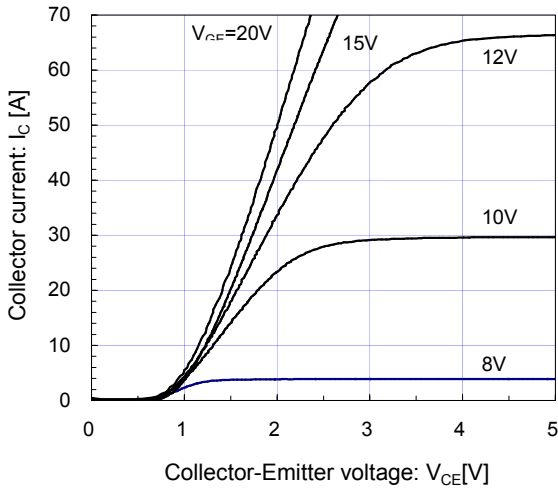
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE} \leq 15V, R_g \geq 15\Omega, T_j \leq 125^\circ C$





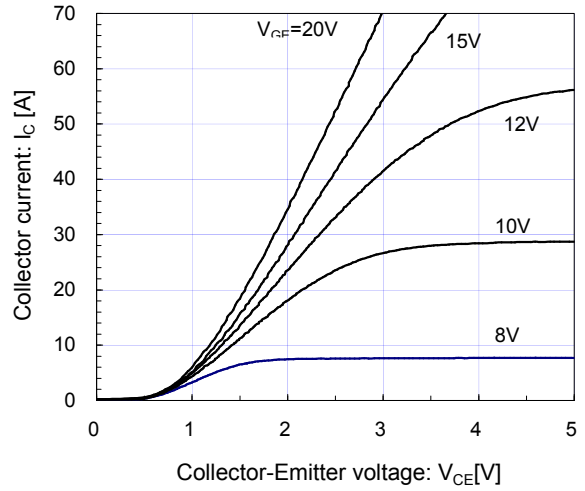
[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)  
T<sub>j</sub>= 25°C / chip



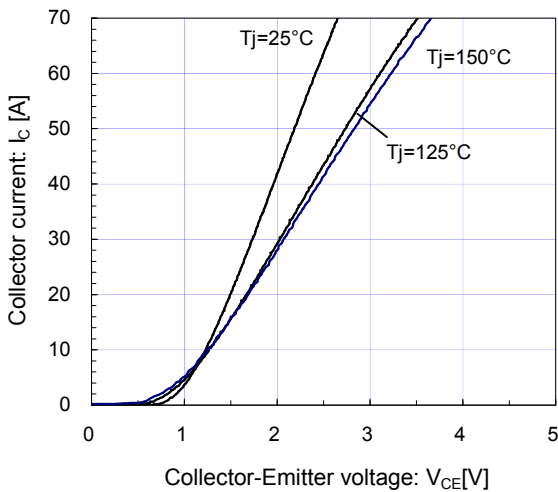
[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)  
T<sub>j</sub>= 150°C / chip



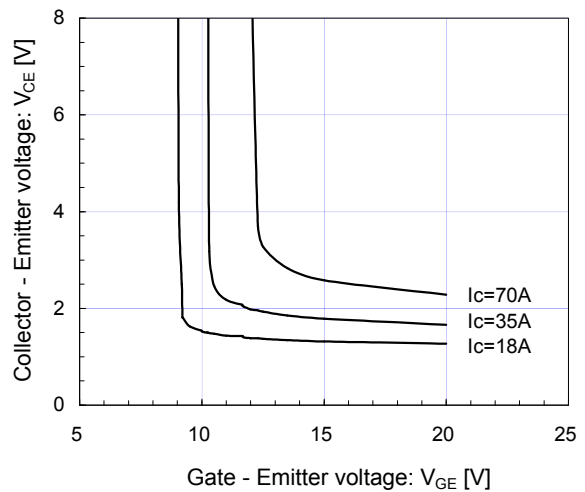
[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)  
V<sub>GE</sub>=15V / chip



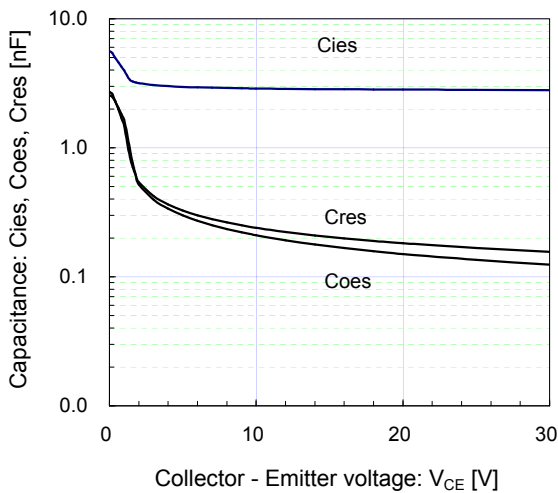
[ Brake ]

Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)  
T<sub>j</sub>= 25°C / chip



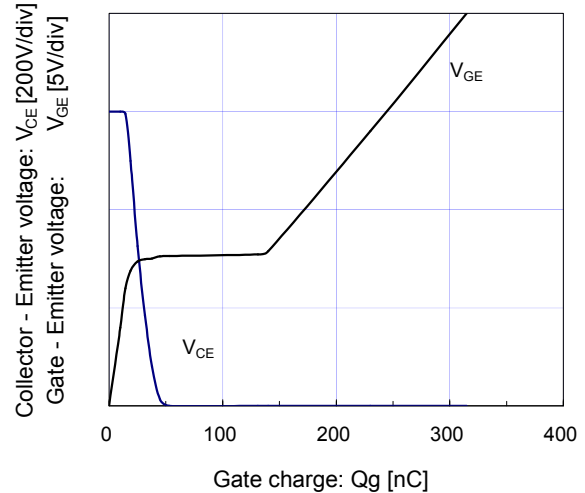
[ Brake ]

Capacitance vs. Collector-Emittor voltage (typ.)  
V<sub>GE</sub>=0V, f= 1MHz, T<sub>j</sub>= 25 °C



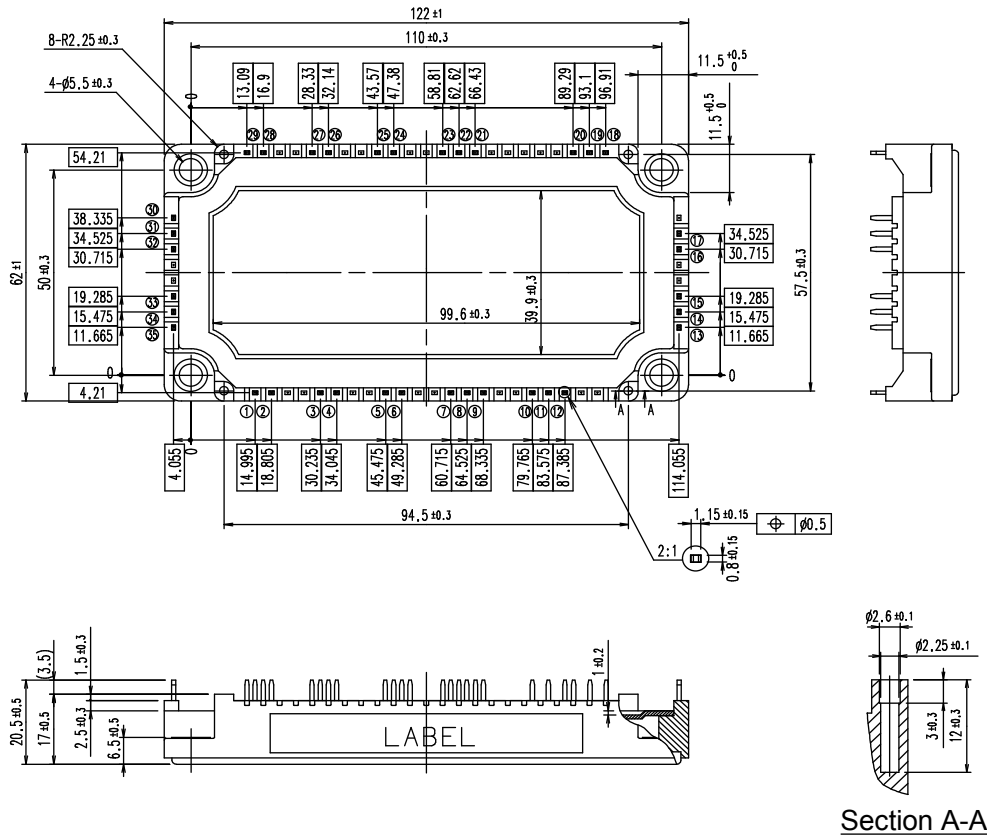
[ Brake ]

Dynamic gate charge (typ.)  
V<sub>CC</sub>=600V, I<sub>c</sub>=50A, T<sub>j</sub>= 25°C



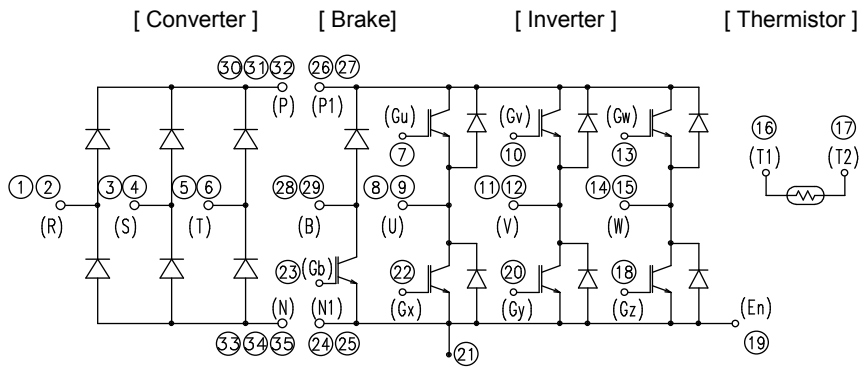
Outline Drawings, mm

□ shows theoretical dimension.  
 ( ) shows reference dimension.



Section A-A

Equivalent Circuit Schematic



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