

# 7MBR35VKD120-50

**IGBT Modules**

## IGBT MODULE (V series)

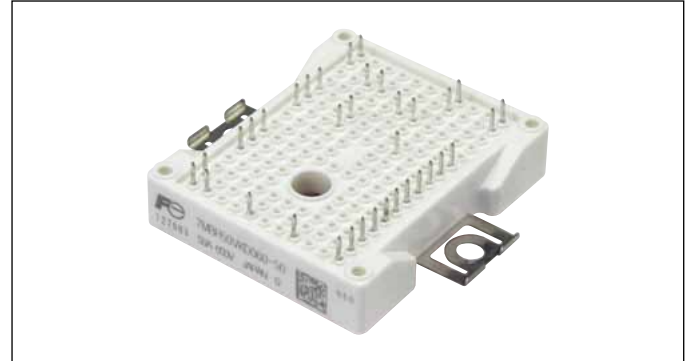
### 1200V / 35A / PIM

#### ■ 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 $T_c=100^\circ\text{C}$	35	A
		$I_{cp}$	1ms $T_c=80^\circ\text{C}$	70	
		$-I_c$		35	
$-I_{c\ pulse}$		1ms	70		
Collector power dissipation	$P_c$	1 device	215	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	215	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	35	A
	Surge current (Non-Repetitive)	$I_{FSM}$	10ms, $T_j=150^\circ\text{C}$	370	A
	$I^2t$ (Non-Repetitive)	$I^2t$	half sine wave	685	$\text{A}^2\text{s}$
Junction temperature	$T_j$	Inverter, Brake	175	$^\circ\text{C}$	
		Converter	150		
Operating junction temperature (under switching conditions)	$T_{jop}$	Inverter, Brake	150	$^\circ\text{C}$	
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)	-	M4	Nm	

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 : 1.3-1.7 Nm (M4)

● Electrical characteristics (at Tj= 25°C unless otherwise specified)

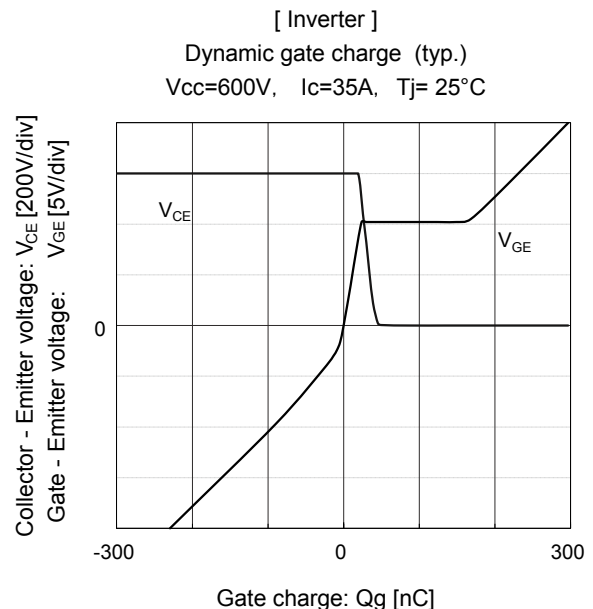
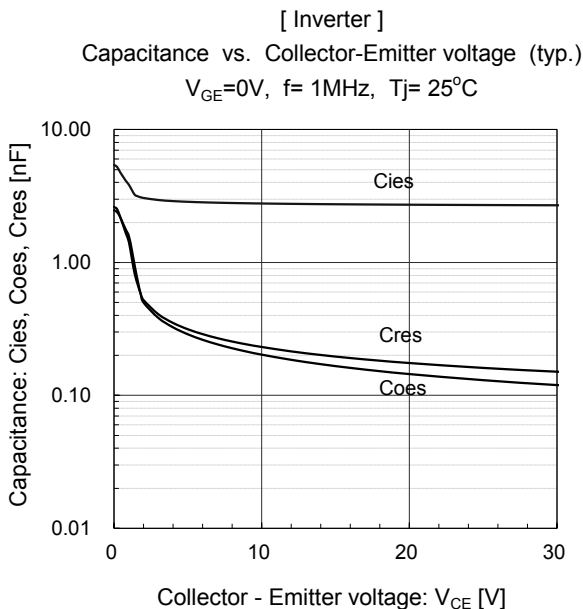
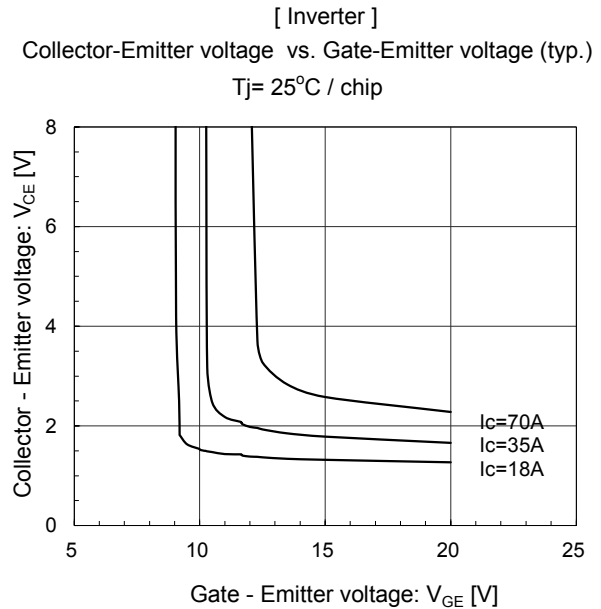
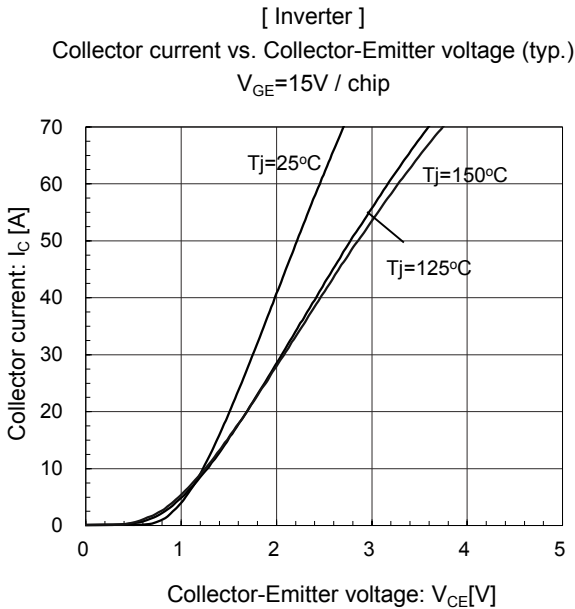
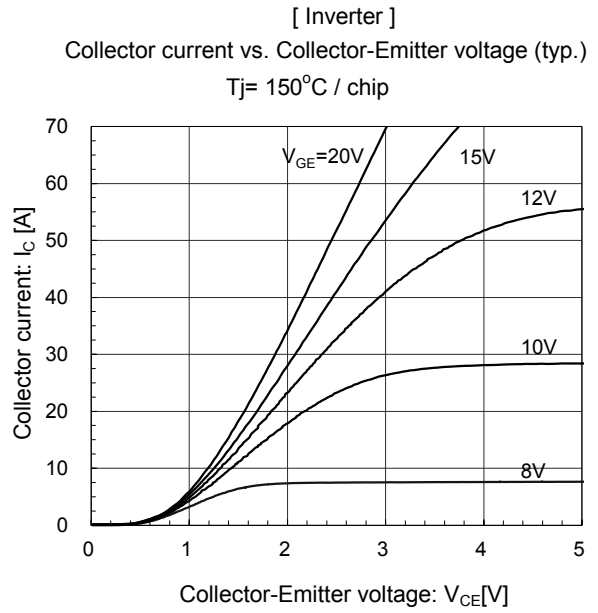
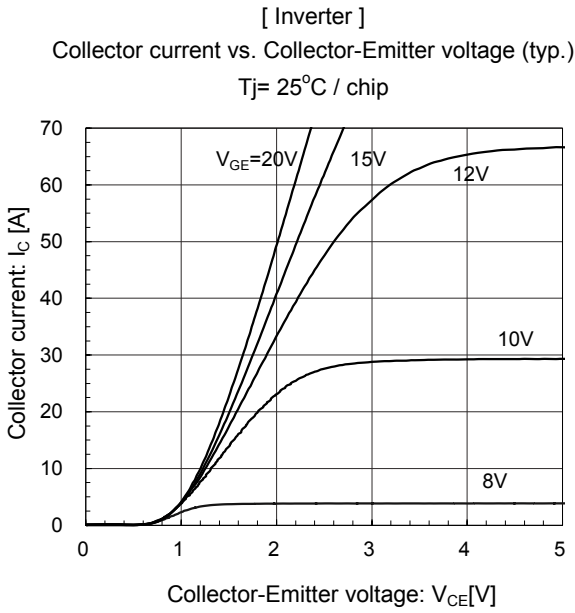
Items	Symbols	Conditions	Characteristics			Units		
			min.	typ.	max.			
Inverter	Zero gate voltage collector current	$I_{CES}$	$V_{GE} = 0V, V_{CE} = 1200V$	-	-	1.0	mA	
	Gate-Emitter leakage current	$I_{GES}$	$V_{GE} = 0V, V_{GE} = \pm 20V$	-	-	200	nA	
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V, I_c = 35mA$	6.0	6.5	7.0	V	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_c = 35A$	Tj=25°C	-	2.05	2.50	V
				Tj=125°C	-	2.45	-	
				Tj=150°C	-	2.45	-	
		$V_{CE(sat)}$ (chip)	$V_{GE} = 15V$ $I_c = 35A$	Tj=25°C	-	1.85	2.25	
				Tj=125°C	-	2.25	-	
	Tj=150°C	-	2.25	-				
	Internal gate resistance	$R_{g(int)}$	-	-	0	-	Ω	
	Input capacitance	$C_{ies}$	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$	-	2.9	-	nF	
	Turn-on time	$t_{on}$	$V_{CC} = 600V$ $I_c = 35A$	-	0.18	1.20	μs	
		$t_r$		-	0.14	0.60		
		$t_r(i)$		-	0.02	-		
	Turn-off time	$t_{off}$	$V_{GE} = +15 / -15V$ $R_G = 12Ω$	-	0.29	1.00	μs	
$t_f$		-		0.06	0.30			
Forward on voltage	$V_F$ (terminal)	$I_F = 35A$	Tj=25°C	-	1.65	2.10	V	
			Tj=125°C	-	1.75	-		
			Tj=150°C	-	1.75	-		
	$V_F$ (chip)	$I_F = 35A$	Tj=25°C	-	1.45	1.90		
			Tj=125°C	-	1.55	-		
Tj=150°C	-	1.55	-					
Reverse recovery time	$t_{rr}$	$I_F = 35A$	-	-	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	-	2.05	2.50	V
				Tj=125°C	-	2.45	-	
				Tj=150°C	-	2.45	-	
		$V_{CE(sat)}$ (chip)	$V_{GE} = 15V$ $I_c = 35A$	Tj=25°C	-	1.85	2.25	
				Tj=125°C	-	2.25	-	
	Tj=150°C	-	2.25	-				
	Internal gate resistance	$R_{g(int)}$	-	-	0	-	Ω	
	Turn-on time	$t_{on}$	$V_{CE} = 600V$ $I_c = 35A$	-	0.18	1.20	μs	
		$t_r$		-	0.14	0.60		
	Turn-off time	$t_{off}$	$V_{GE} = +15 / -15V$ $R_G = 12Ω$	-	0.29	1.00	μs	
		$t_f$		-	0.06	0.30		
	Reverse current	$I_{RRM}$	$V_R = 1200V$	-	-	1.0	mA	
	Converter	Forward on voltage	$I_F = 35A$	terminal	-	1.25	1.70	V
chip				-	1.05	-		
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	-	-	0.70	°C/W
		Inverter FWD	-	-	0.90	
		Brake IGBT	-	-	0.70	
		Converter Diode	-	-	1.15	
Contact thermal resistance (1device) (*4)	$R_{th(c-f)}$	with Thermal Compound	-	0.05	-	

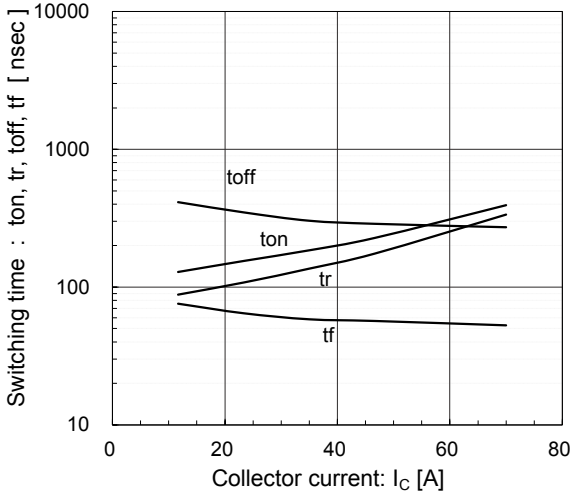
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)



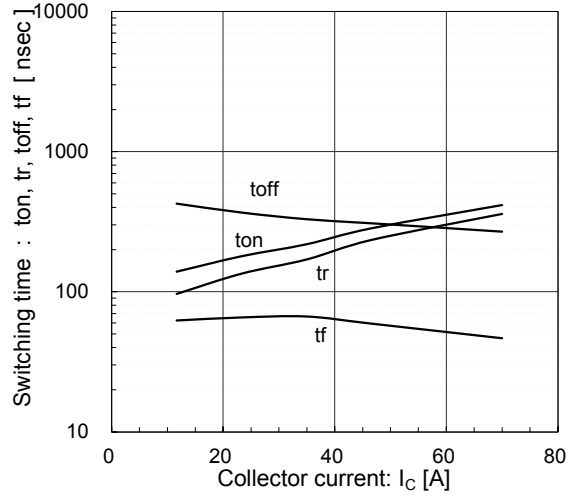
[ Inverter ]

Switching time vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_g=12\Omega, T_j=125^\circ C$



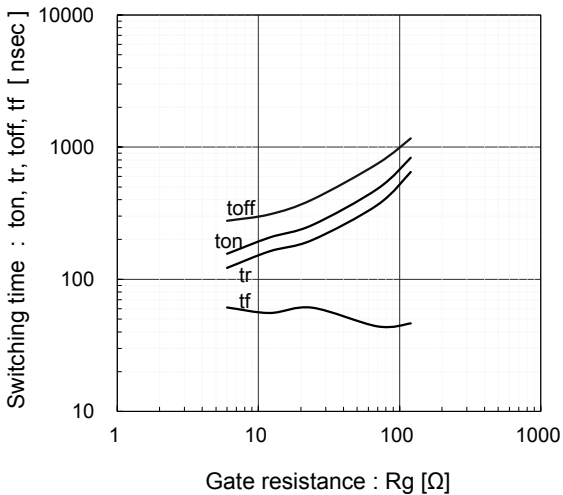
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Switching time vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_g=12\Omega, T_j=150^\circ C$



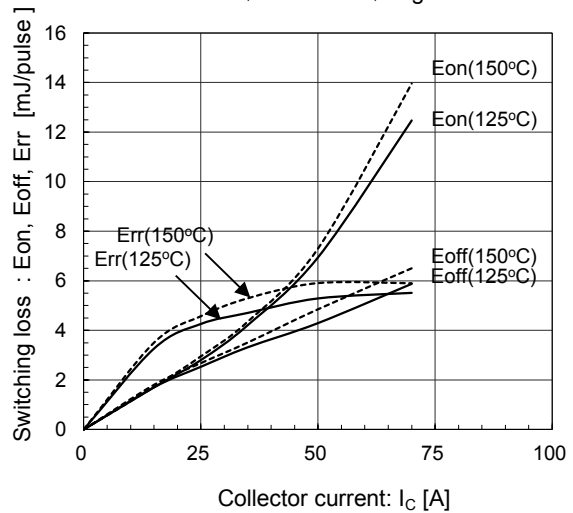
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Switching time vs. gate resistance (typ.)  
 $V_{CC}=600V, I_c=35A, V_{GE}=\pm 15V, T_j=125^\circ C$



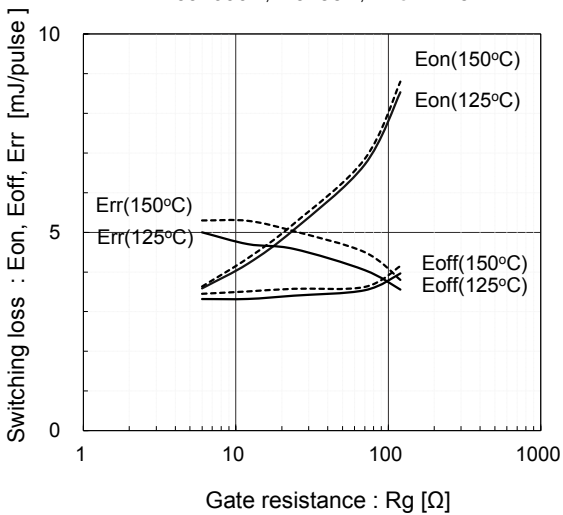
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Switching loss vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_g=12\Omega$



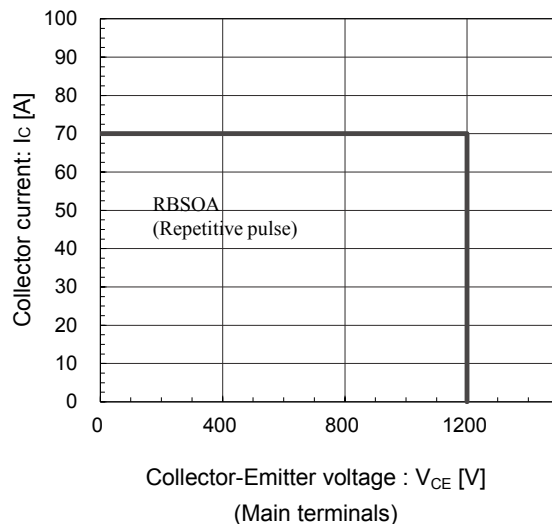
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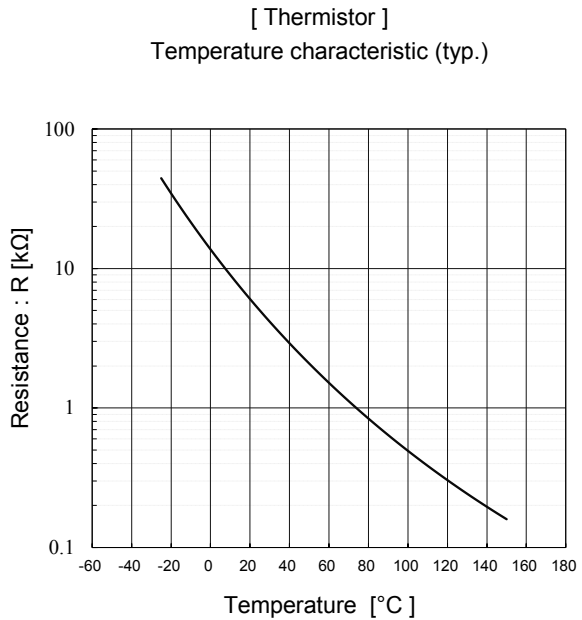
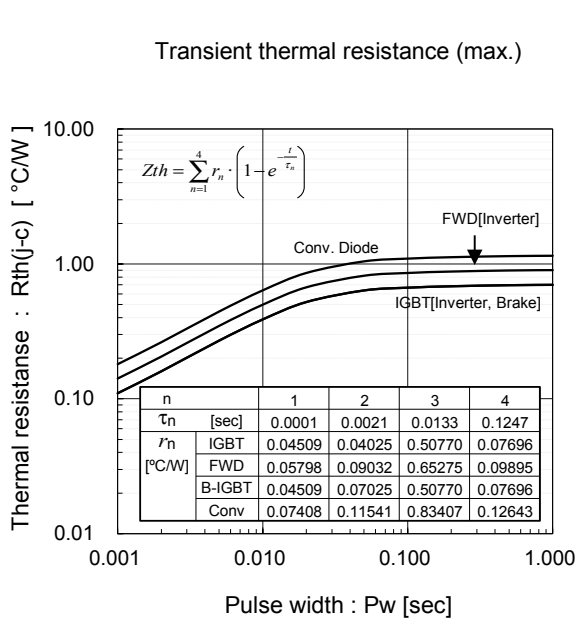
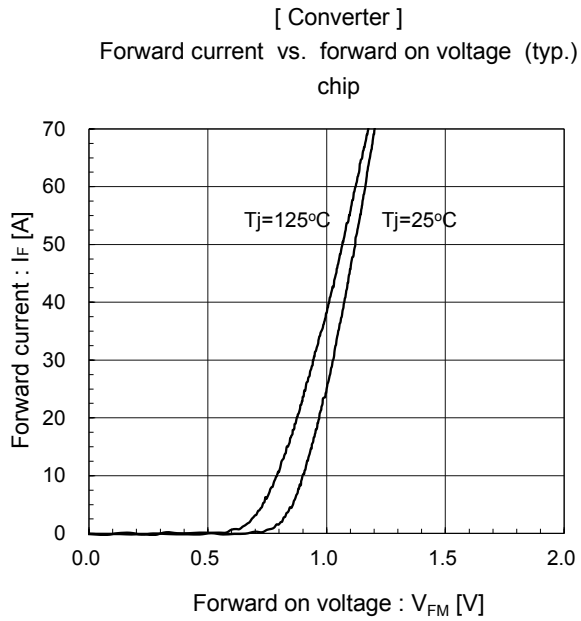
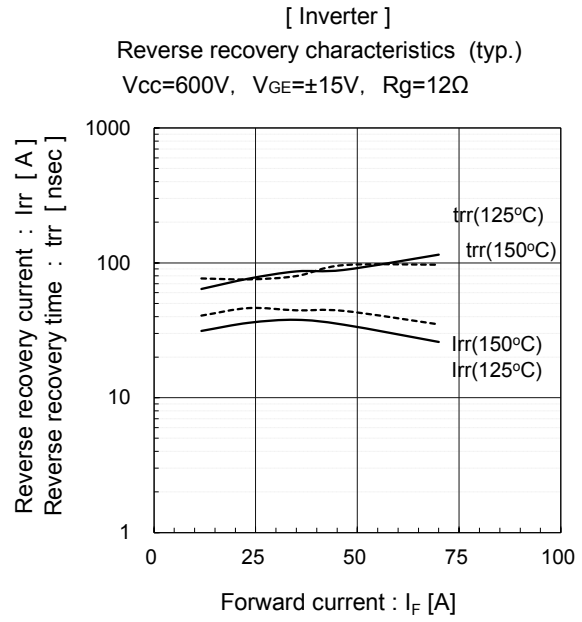
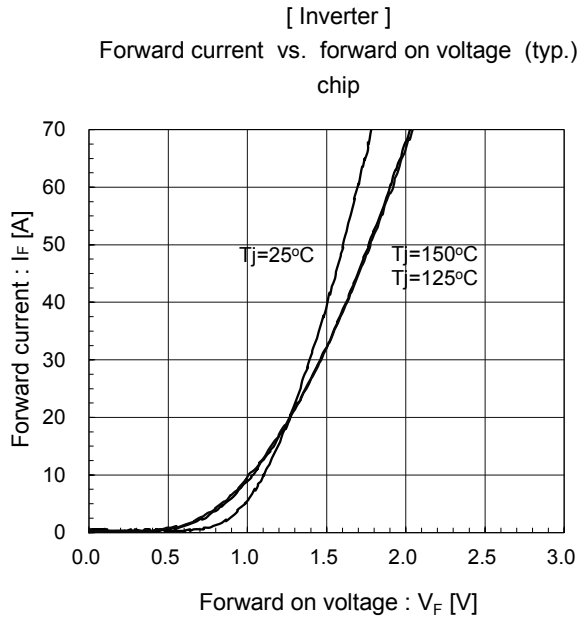
Switching loss vs. gate resistance (typ.)  
 $V_{CC}=600V, I_c=35A, V_{GE}=\pm 15V$



[ Inverter ]

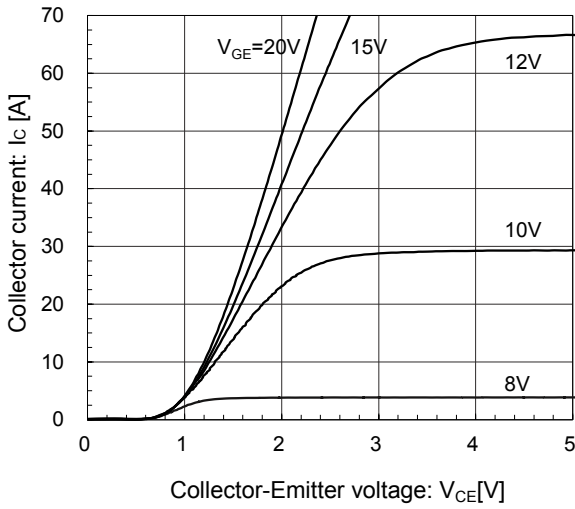
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE} \le 15V, R_g \ge 12\Omega, T_j=150^\circ C$





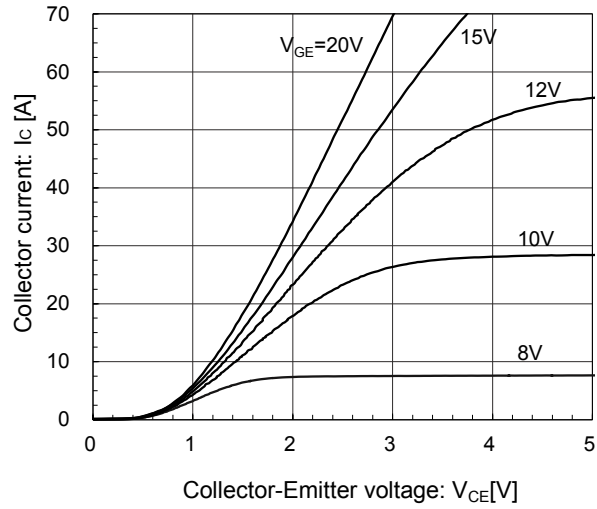
[ Brake ]

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



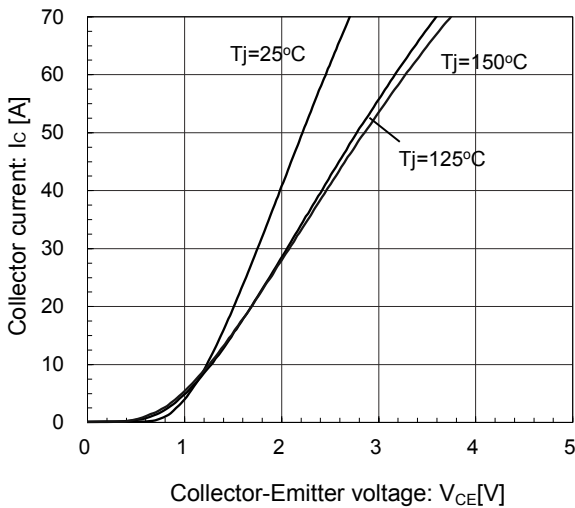
[ Brake ]

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



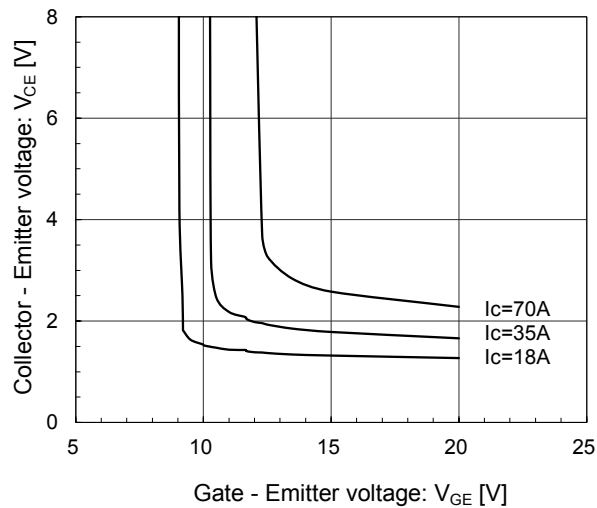
[ Brake ]

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



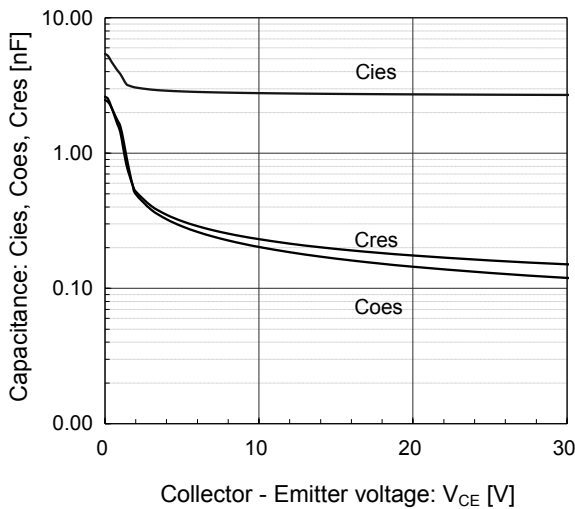
[ Brake ]

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



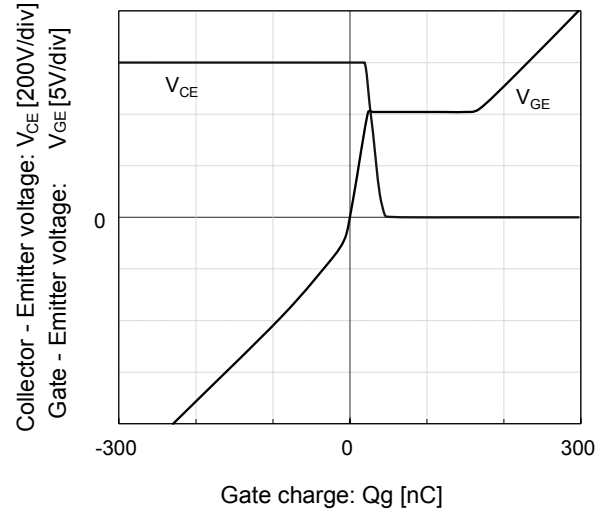
[ Brake ]

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

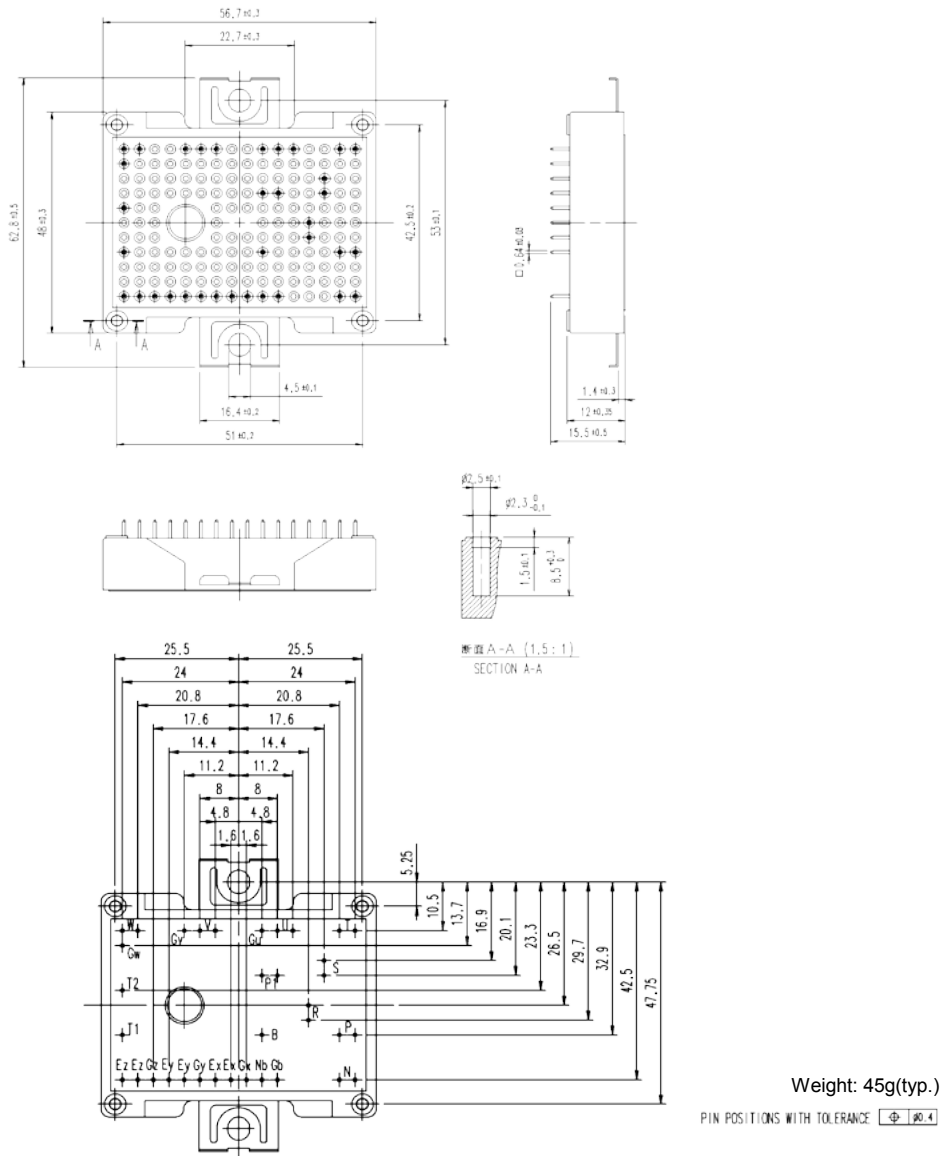


[ Brake ]

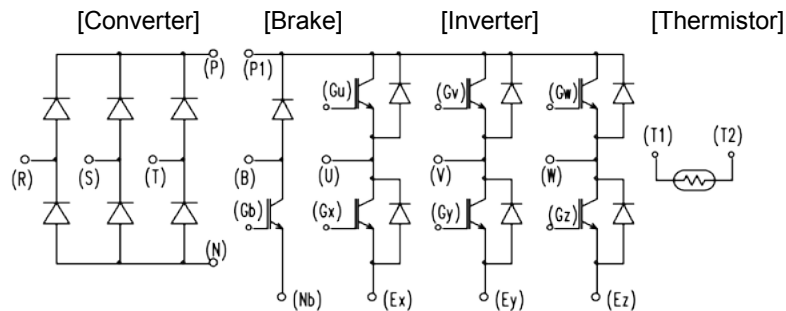
Dynamic gate charge (typ.)  
V<sub>CC</sub>=600V, Ic=35A, T<sub>j</sub>= 25°C



■ Outline Drawings, mm



■ Equivalent Circuit Schematic



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• Submarine repeater equipment		
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