

# 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 T<sub>j</sub> = 25°C unless otherwise specified)

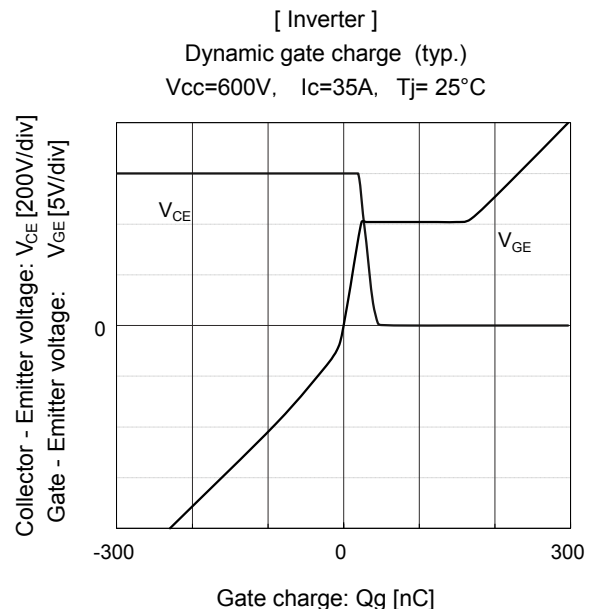
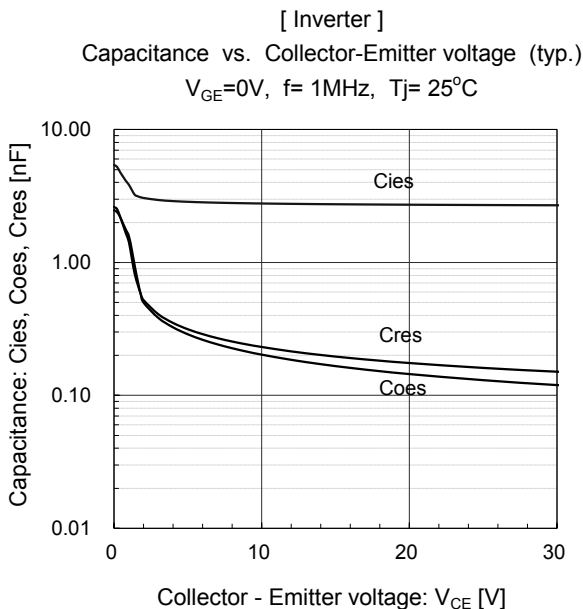
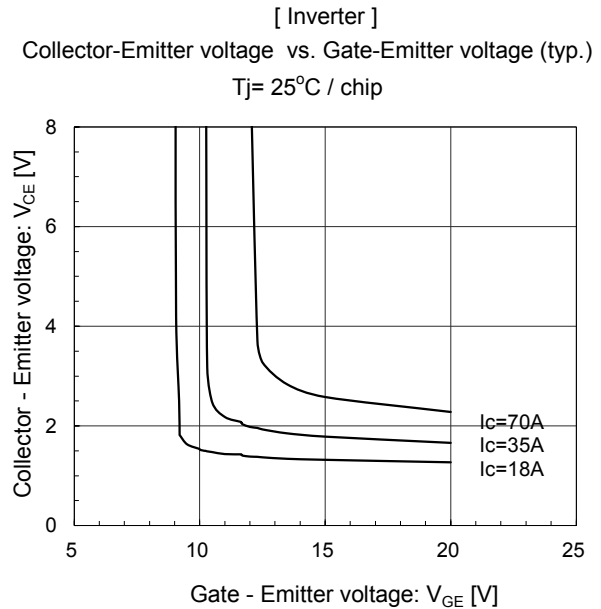
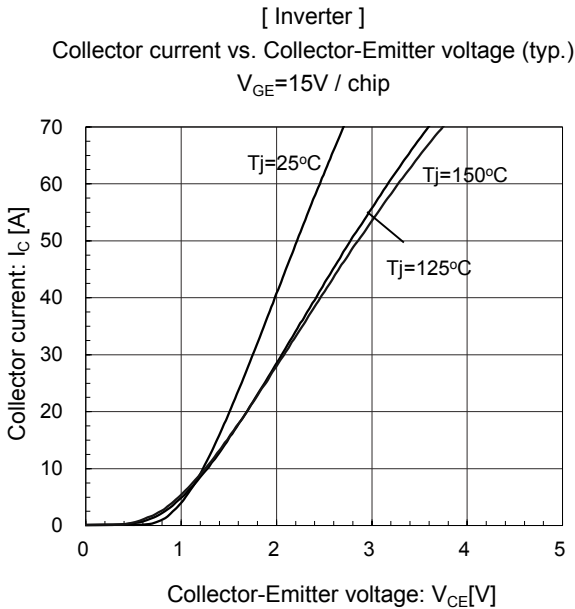
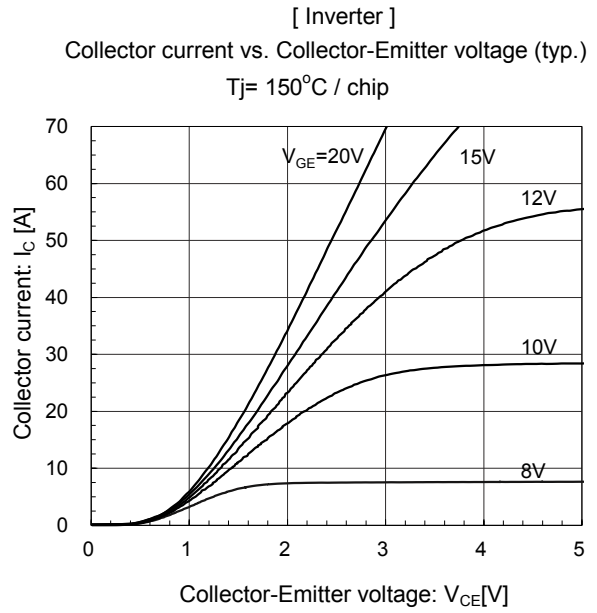
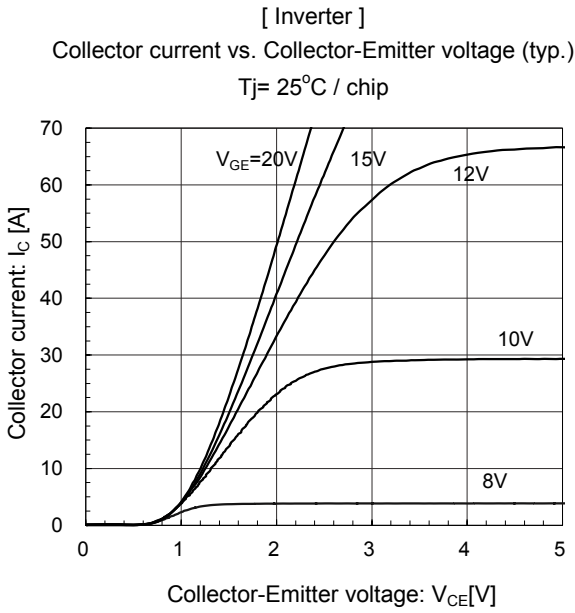
Items	Symbols	Conditions	Characteristics			Units		
			min.	typ.	max.			
Inverter	Zero gate voltage collector current	I <sub>CEs</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V	-	-	1.0	mA	
	Gate-Emitter leakage current	I <sub>GES</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = ±20V	-	-	200	nA	
	Gate-Emitter threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = 20V, I <sub>c</sub> = 35mA	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> = 35A	T <sub>j</sub> = 25°C	-	2.05	2.50	V
				T <sub>j</sub> = 125°C	-	2.45	-	
				T <sub>j</sub> = 150°C	-	2.45	-	
		V <sub>CE(sat)</sub> (chip)	V <sub>GE</sub> = 15V I <sub>c</sub> = 35A	T <sub>j</sub> = 25°C	-	1.85	2.25	
				T <sub>j</sub> = 125°C	-	2.25	-	
	T <sub>j</sub> = 150°C	-	2.25	-				
	Internal gate resistance	R <sub>g(int)</sub>	-	-	0	-	Ω	
	Input capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 10V, V <sub>GE</sub> = 0V, f = 1MHz	-	2.9	-	nF	
	Turn-on time	ton	V <sub>CC</sub> = 600V I <sub>c</sub> = 35A V <sub>GE</sub> = +15 / -15V R <sub>G</sub> = 12Ω	-	0.18	1.20	μs	
		tr		-	0.14	0.60		
		tr(i)		-	0.02	-		
	Turn-off time	toff	R <sub>G</sub> = 12Ω	-	0.29	1.00	μs	
tf		-		0.06	0.30			
Forward on voltage	V <sub>F</sub> (terminal)	I <sub>F</sub> = 35A	T <sub>j</sub> = 25°C	-	1.65	2.10	V	
			T <sub>j</sub> = 125°C	-	1.75	-		
			T <sub>j</sub> = 150°C	-	1.75	-		
	V <sub>F</sub> (chip)	I <sub>F</sub> = 35A	T <sub>j</sub> = 25°C	-	1.45	1.90		
			T <sub>j</sub> = 125°C	-	1.55	-		
T <sub>j</sub> = 150°C	-	1.55	-					
Reverse recovery time	trr	I <sub>F</sub> = 35A	-	-	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	-	2.05	2.50	V
				T <sub>j</sub> = 125°C	-	2.45	-	
				T <sub>j</sub> = 150°C	-	2.45	-	
		V <sub>CE(sat)</sub> (chip)	V <sub>GE</sub> = 15V I <sub>c</sub> = 35A	T <sub>j</sub> = 25°C	-	1.85	2.25	
				T <sub>j</sub> = 125°C	-	2.25	-	
	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	-	0.18	1.20	μs	
tr		-		0.14	0.60			
Turn-off time	toff	V <sub>GE</sub> = +15 / -15V R <sub>G</sub> = 12Ω	-	0.29	1.00	μs		
	tf		-	0.06	0.30			
Reverse current	IRRM	V <sub>R</sub> = 1200V	-	-	1.0	mA		
Converter	Forward on voltage	I <sub>F</sub> = 35A	terminal	-	1.25	1.70	V	
			chip	-	1.05	-		
Reverse current	IRRM	V <sub>R</sub> = 1600V	-	-	1.0	mA		
Thermistor	Resistance	T = 25°C	-	5000	-	Ω		
		T = 100°C	465	495	520			
	B value	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	-	-	0.70	°C/W
		Inverter FWD	-	-	0.90	
		Brake IGBT	-	-	0.70	
		Converter Diode	-	-	1.15	
Contact thermal resistance (1device) (*4)	R <sub>th(c-f)</sub>	Inverter IGBT	-	0.51	-	°C/W
		Inverter FWD	-	0.55	-	
		Brake IGBT	-	0.57	-	
		Converter Diode	-	0.65	-	

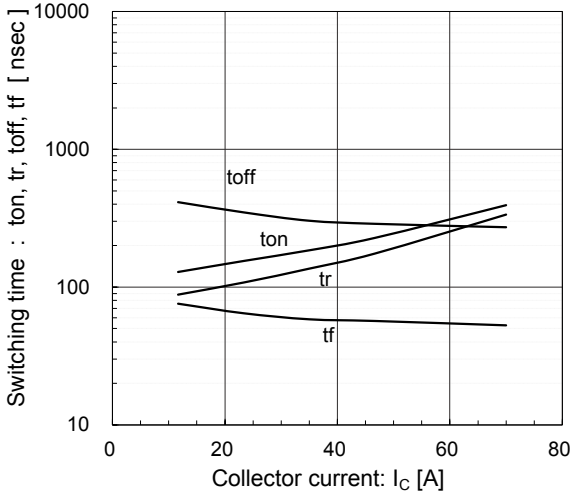
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)



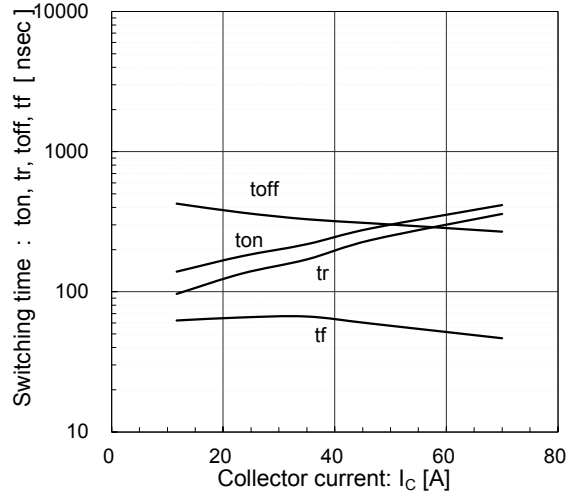
[ Inverter ]

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



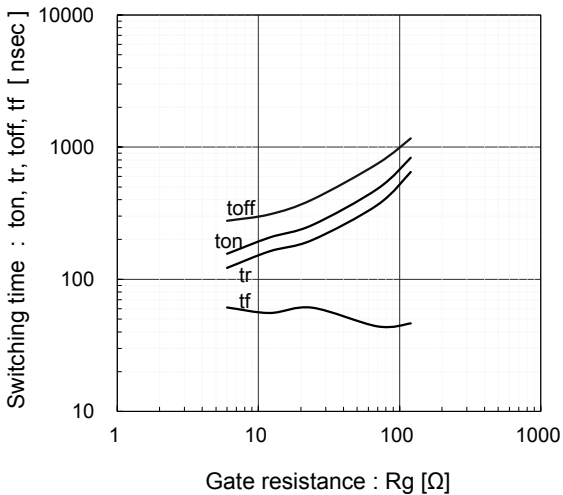
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Switching time vs. Collector current (typ.)  
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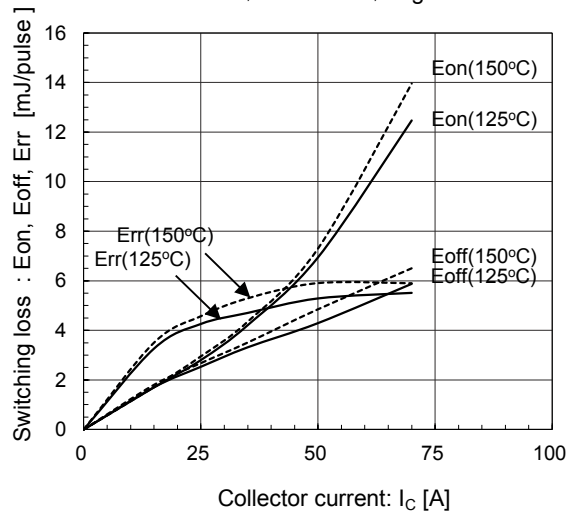
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Switching time vs. gate resistance (typ.)  
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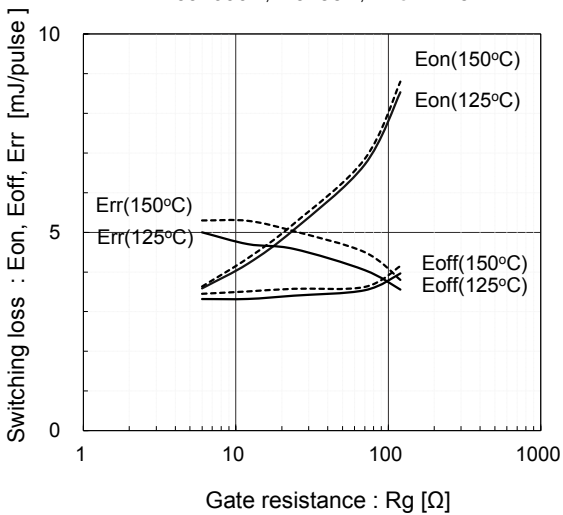
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Switching loss vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_g=12\Omega$



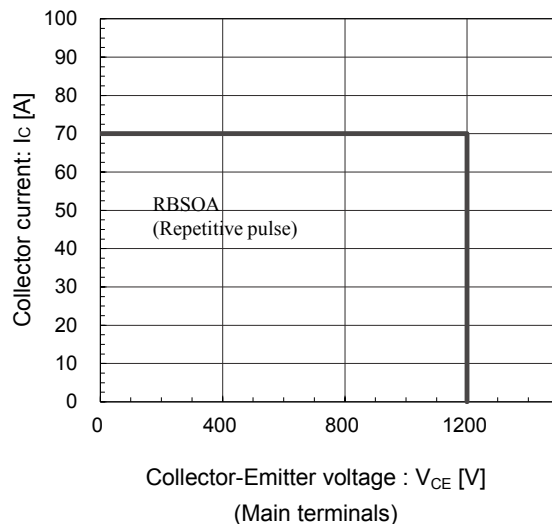
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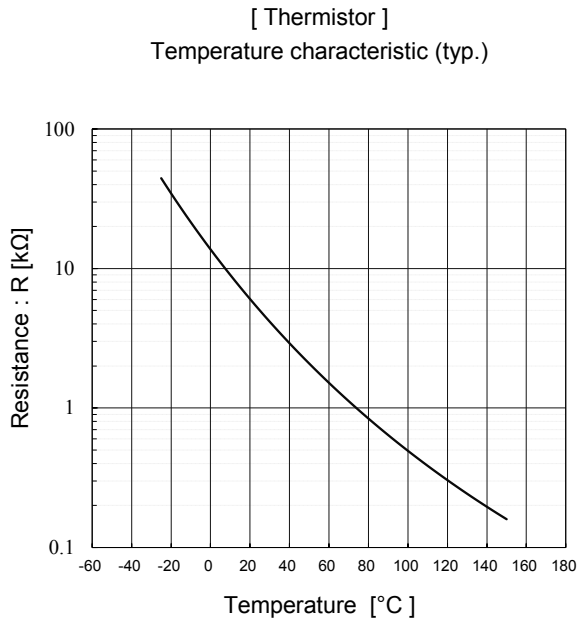
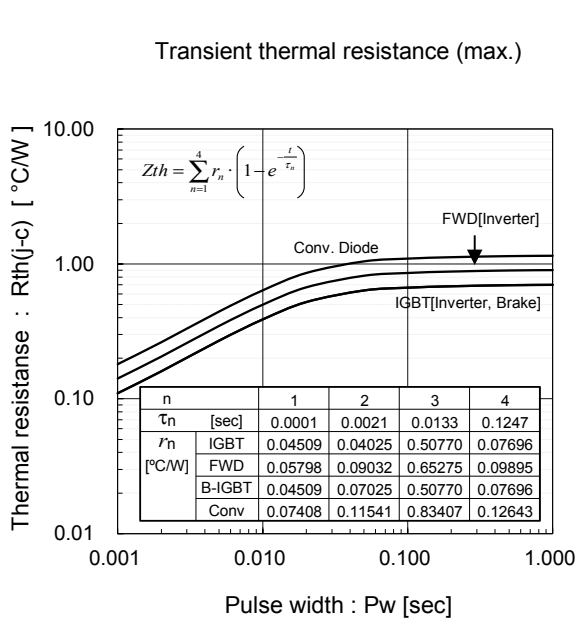
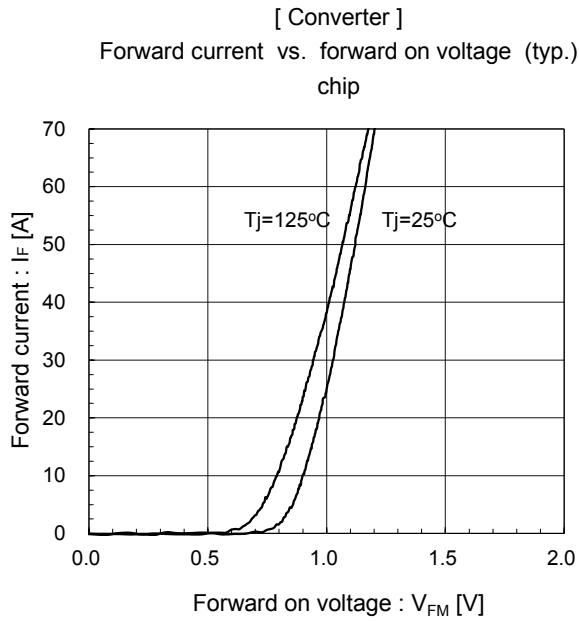
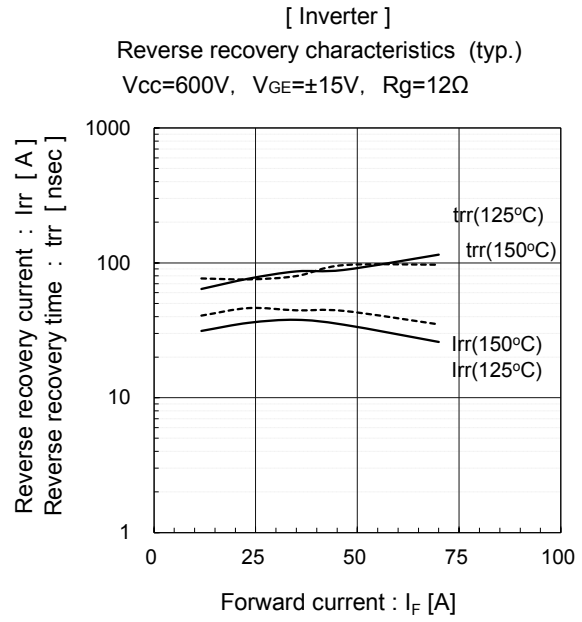
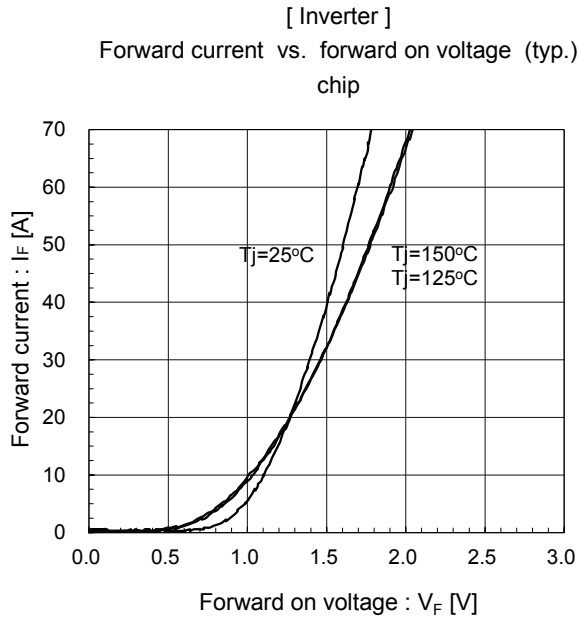
Switching loss vs. gate resistance (typ.)  
 $V_{CC}=600V, I_c=35A, V_{GE}=\pm 15V$



[ Inverter ]

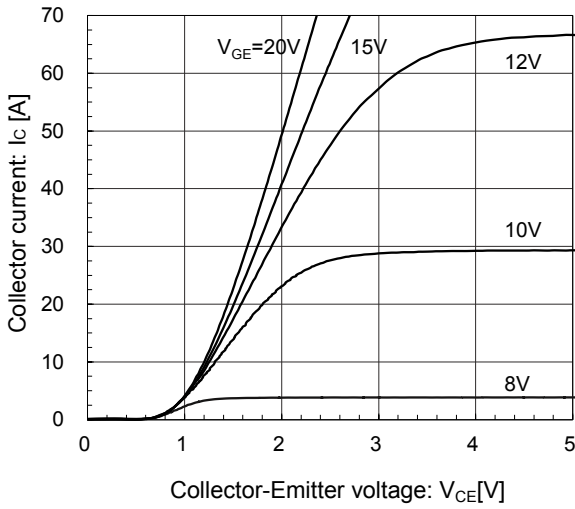
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE} \le 15V, R_g \ge 12\Omega, T_j=150^\circ C$





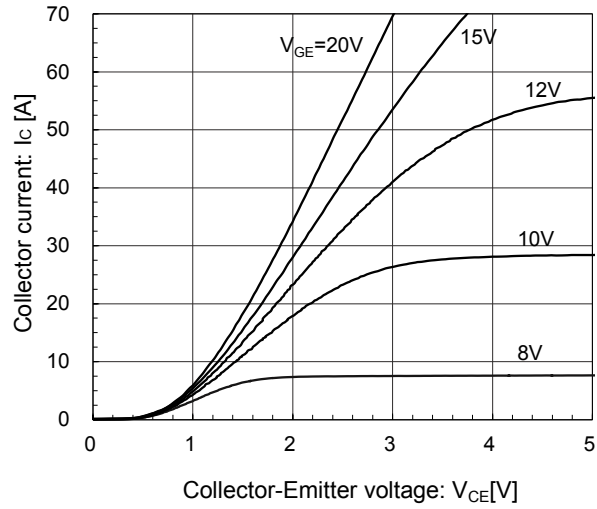
[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)  
Tj= 25°C / chip



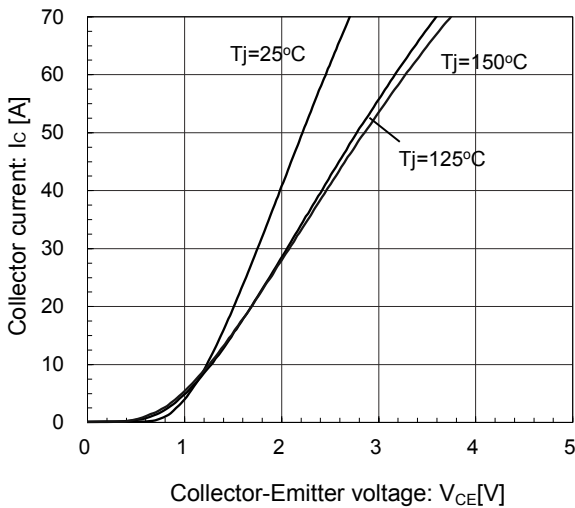
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Collector current vs. Collector-Emittor voltage (typ.)  
Tj= 150°C / chip



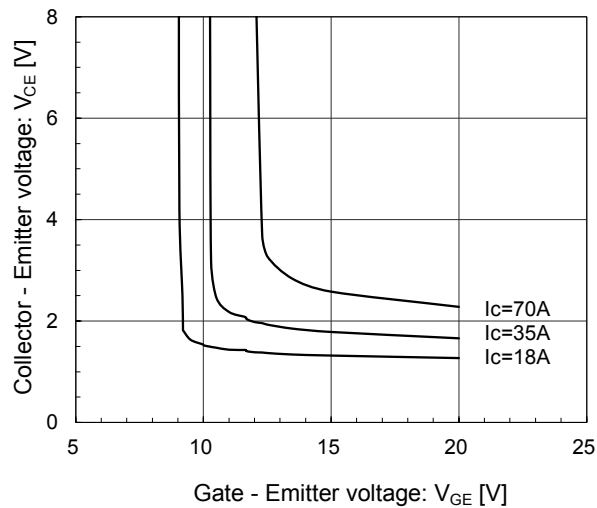
[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)  
Vge=15V / chip



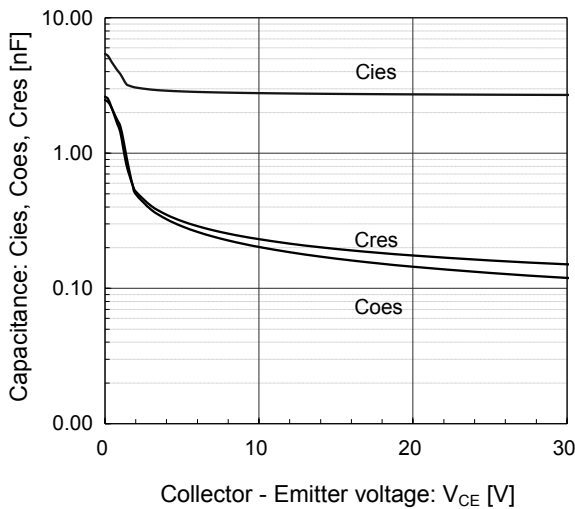
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Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)  
Tj= 25°C / chip



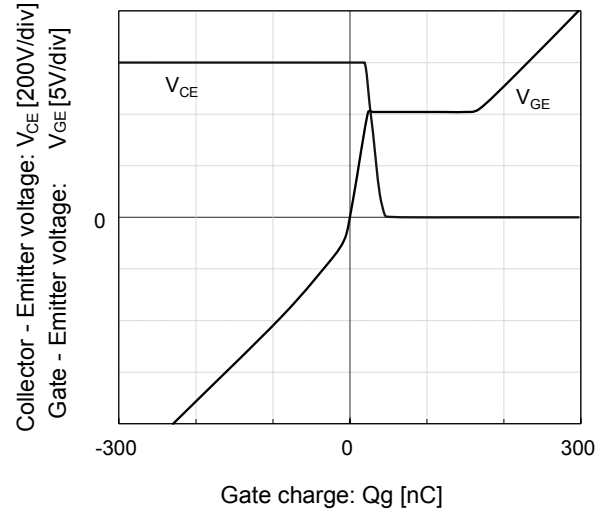
[ Brake ]

Capacitance vs. Collector-Emittor voltage (typ.)  
Vge=0V, f= 1MHz, Tj= 25°C

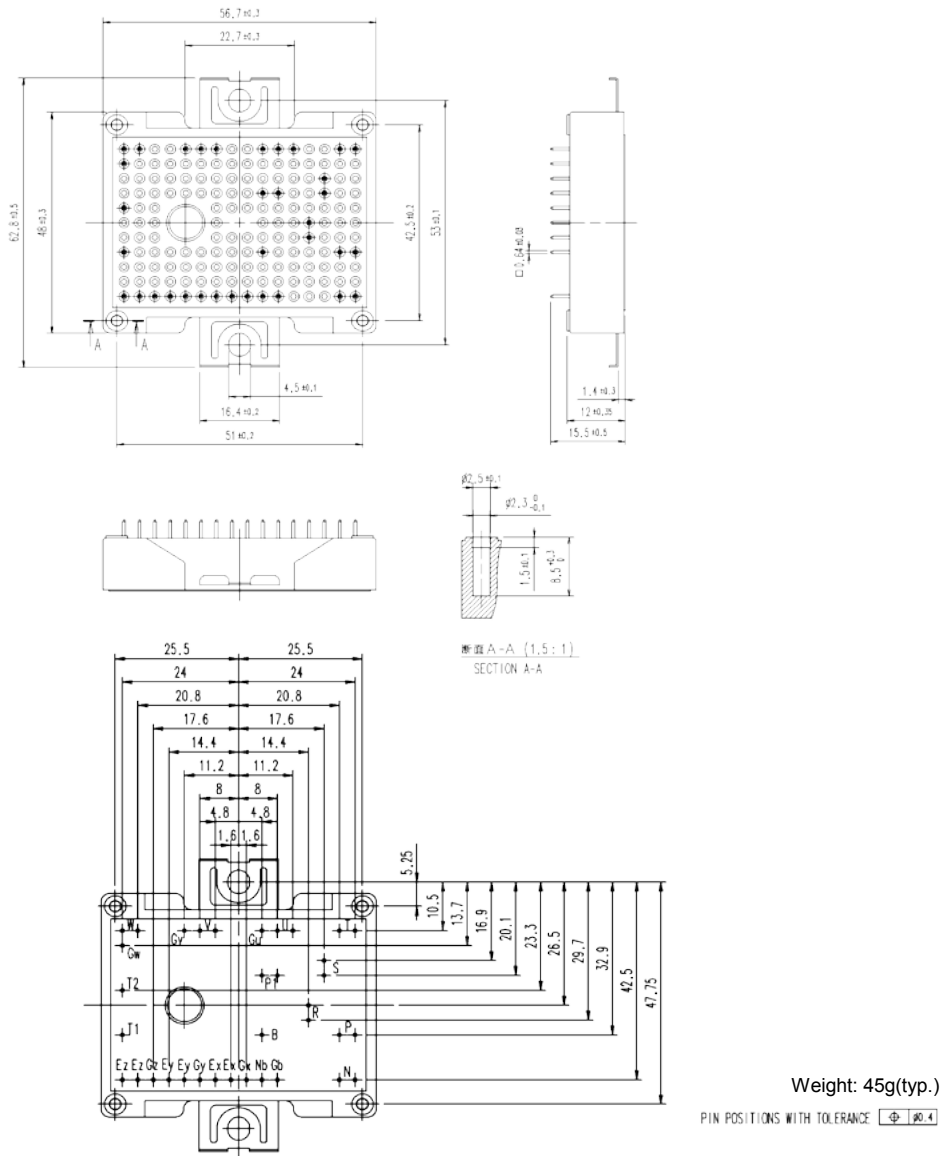


[ Brake ]

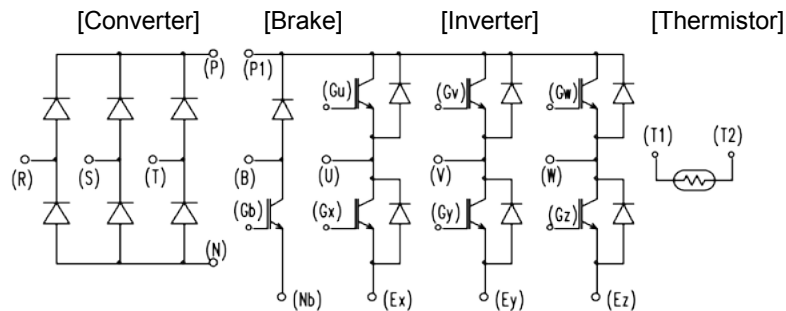
Dynamic gate charge (typ.)  
Vcc=600V, Ic=35A, Tj= 25°C



■ Outline Drawings, mm



■ Equivalent Circuit Schematic



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