

# 1MBI600V-120-50

IGBT Modules

## IGBT MODULE (V series) 1200V / 600A / 1 in one package

### ■ Features

- High speed switching
- Voltage drive
- Low Inductance module structure

### ■ Applications

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply
- Industrial machines, such as Welding machines



### ■ Maximum Ratings and Characteristics

#### ● Absolute Maximum Ratings (at Tc=25°C unless otherwise specified)

Items	Symbols	Conditions	Maximum ratings	Units
Collector-Emitter voltage	V <sub>CEs</sub>		1200	V
Gate-Emitter voltage	V <sub>GES</sub>		±20	V
Collector current	I <sub>c</sub>	Continuous	Tc=100°C 600 Tc=25°C 720	A
	I <sub>c</sub> pulse	1ms	1200	
	-I <sub>c</sub>		600	
	-I <sub>c</sub> pulse	1ms	1200	
Collector power dissipation	P <sub>c</sub>	1 device	3000	W
Junction temperature	T <sub>j</sub>		175	°C
Operating junction temperature (under switching conditions)	T <sub>jop</sub>		150	
Case temperature	T <sub>c</sub>		125	
Storage temperature	T <sub>stg</sub>		-40~+125	
Isolation voltage	Between terminal and copper base (*1) V <sub>iso</sub>	AC : 1min.	2500	VAC
Screw torque	Mounting (*2)	M5 ro M6	6.0	Nm
	Terminals (*3)	M4	2.0	
		M6	5.0	

Note \*1: All terminals should be connected together during the test.

Note \*2: Recommendable Value : 3.0-6.0 Nm (M5, M6)

Note \*3: Recommendable Value : 1.1-2.0 Nm (M4)

Recommendable Value : 2.5-5.0 Nm (M6)

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

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Zero gate voltage collector current	I <sub>CEs</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 1200V	-	-	2.0	mA	
Gate-Emitter leakage current	I <sub>GES</sub>	V <sub>CE</sub> = 0V, V <sub>GE</sub> = ±20V	-	-	800	nA	
Gate-Emitter threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = 20V, I <sub>c</sub> = 600mA	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> = 600A	Tj=25°C	-	2.05	2.50	V
			Tj=125°C	-	2.35	-	
			Tj=150°C	-	2.40	-	
	V <sub>CE(sat)</sub> (chip)		Tj=25°C	-	1.75	2.15	
			Tj=125°C	-	2.05	-	
			Tj=150°C	-	2.10	-	
Input capacitance	C <sub>ies</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V, f = 1MHz	-	48.5	-	nF	
Turn-on time	ton	V <sub>CC</sub> = 600V, I <sub>c</sub> = 600A V <sub>GE</sub> = ±15V, R <sub>G</sub> = 1.2Ω Tj=150°C, L <sub>s</sub> =35nH	-	0.70	-	μs	
	tr		-	0.25	-		
	tr(i)		-	0.10	-		
Turn-off time	toff		-	0.90	-		
	tf		-	0.10	-		
			-	0.10	-		
Forward on voltage	V <sub>F</sub> (terminal)	V <sub>GE</sub> = 0V I <sub>F</sub> = 600A	Tj=25°C	-	1.85	2.30	V
			Tj=125°C	-	2.00	-	
			Tj=150°C	-	1.95	-	
	V <sub>F</sub> (chip)		Tj=25°C	-	1.70	2.15	
			Tj=125°C	-	1.85	-	
			Tj=150°C	-	1.80	-	
Reverse recovery time	trr	I <sub>F</sub> = 600A	-	0.27	-	μs	

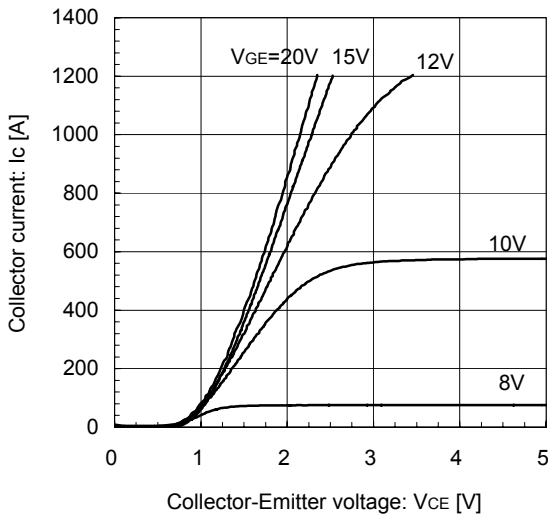
## ● Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	Rth(j-c)	IGBT	-	-	0.050	°C/W
		FWD	-	-	0.070	
Contact thermal resistance (*4)	Rth(c-f)	with Thermal Compound	-	0.0063	-	

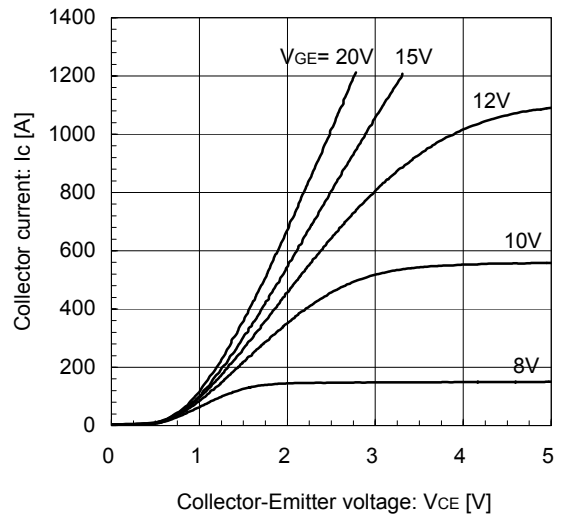
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)

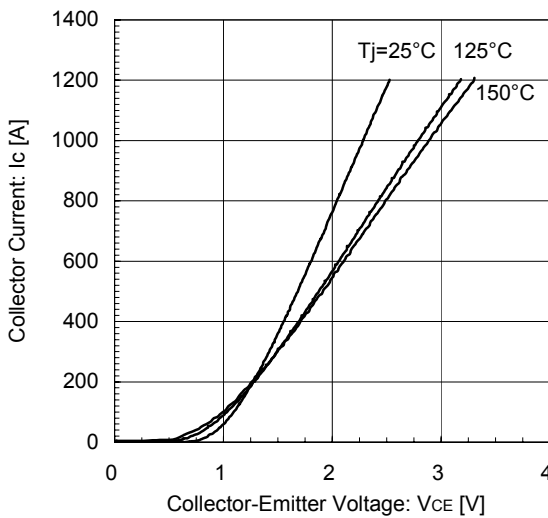
Collector current vs. Collector-Emittter voltage (typ.)  
T<sub>j</sub> = 25°C / chip



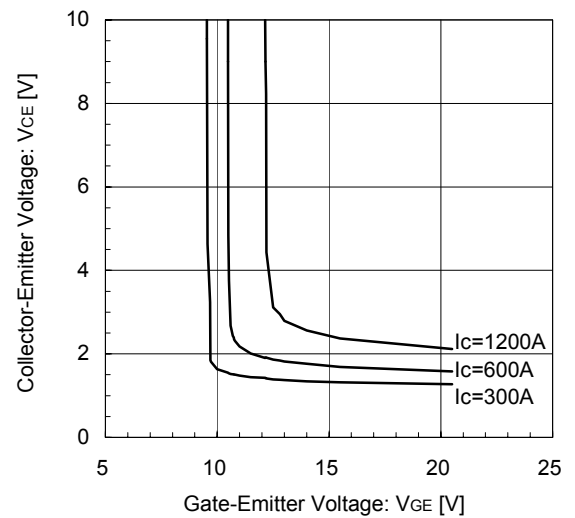
Collector current vs. Collector-Emittter voltage (typ.)  
T<sub>j</sub> = 150°C / chip



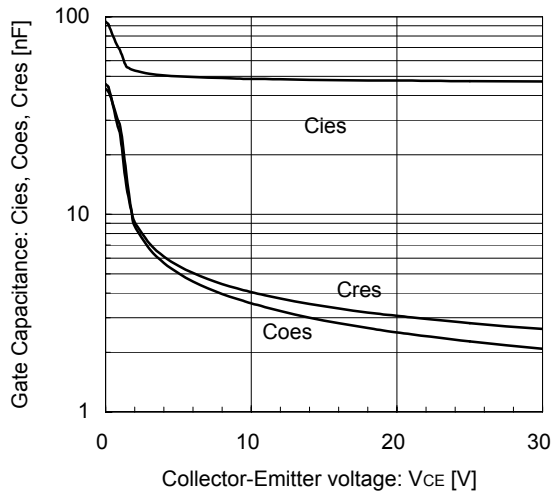
Collector current vs. Collector-Emittter voltage (typ.)  
V<sub>GE</sub> = 15V / chip



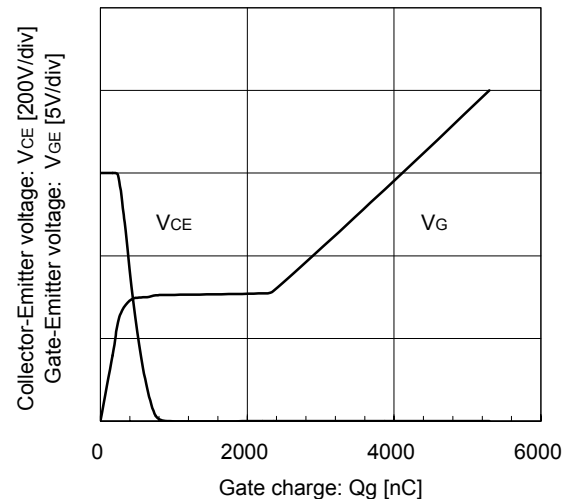
Collector-Emittter voltage vs. Gate-Emittter voltage  
T<sub>j</sub> = 25°C / chip



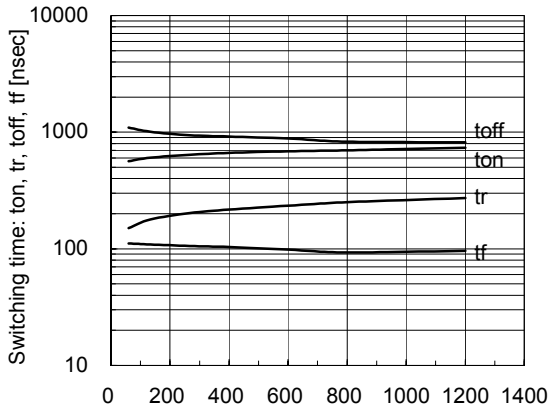
Gate Capacitance vs. Collector-Emittter Voltage  
V<sub>GE</sub> = 0V, f = 1MHz, T<sub>j</sub> = 25°C



Dynamic Gate Charge (typ.)  
V<sub>CC</sub> = 600V, I<sub>C</sub> = 600A, T<sub>j</sub> = 25°C

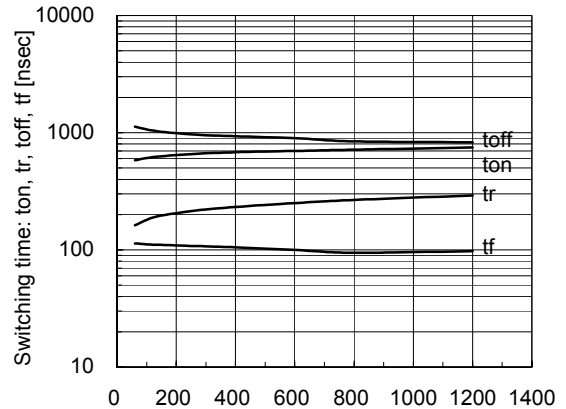


Switching time vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_G=1.2\Omega, T_j=125^\circ C$



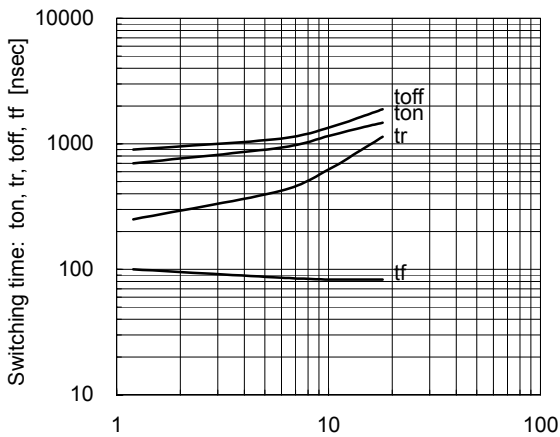
Collector current:  $I_c$  [A]

Switching time vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_G=1.2\Omega, T_j=150^\circ C$



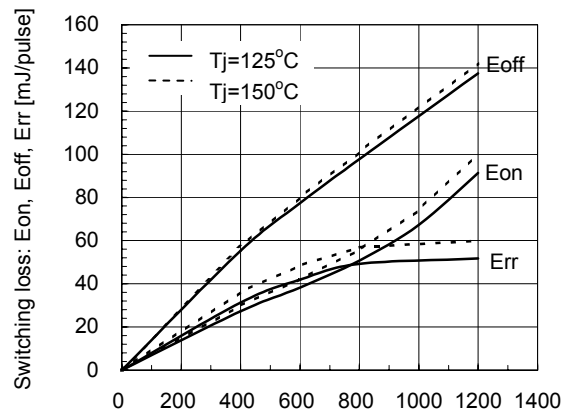
Collector current:  $I_c$  [A]

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



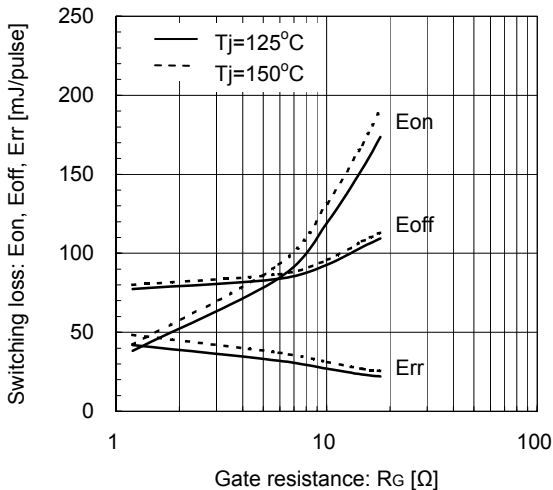
Gate resistance:  $R_g$  [ $\Omega$ ]

Switching loss vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_G=1.2\Omega, T_j=125^\circ C, 150^\circ C$



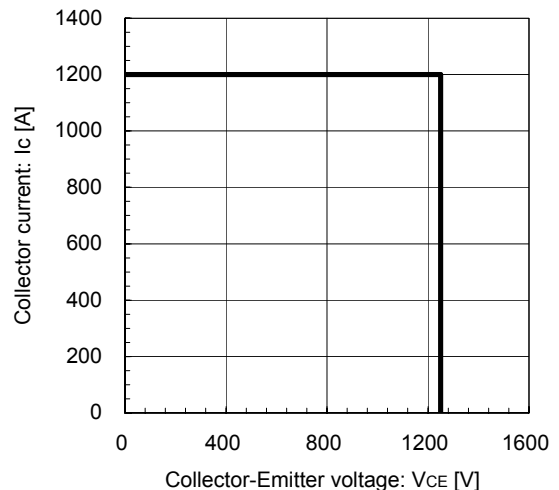
Collector current:  $I_c$  [A]

Switching loss vs. Gate resistance (typ.)  
 $V_{CC}=600V, I_c=600A, V_{GE}=\pm 15V, T_j=125^\circ C, 150^\circ C$

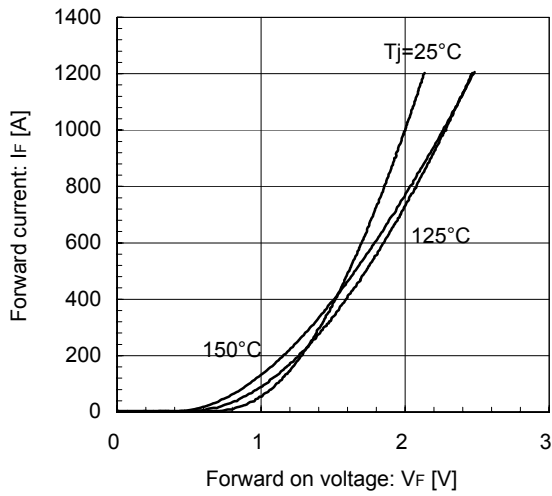


Gate resistance:  $R_g$  [ $\Omega$ ]

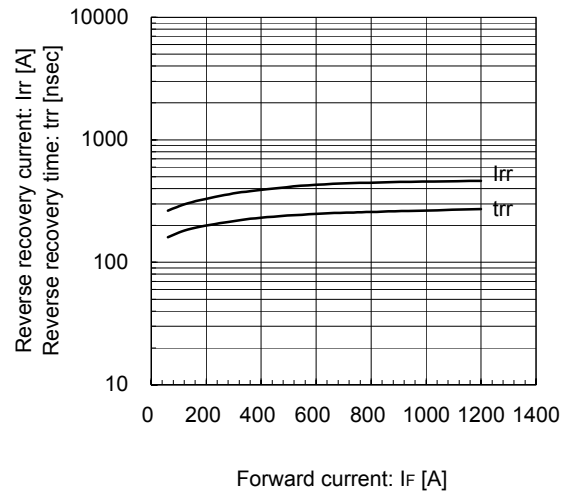
Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE}=15V, R_G=1.2\Omega, T_j=150^\circ C, L_s=35nH$



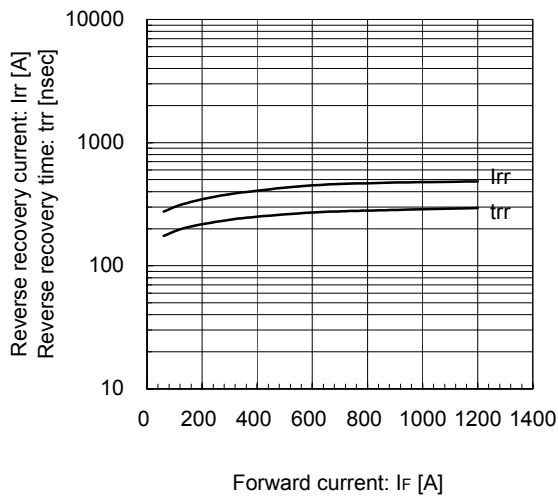
Forward Current vs. Forward Voltage (typ.)  
chip



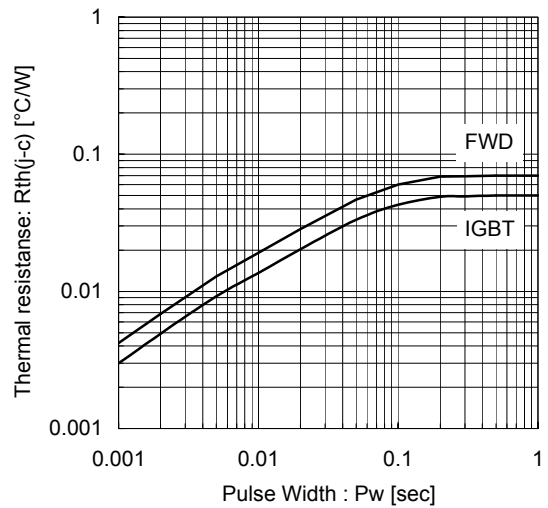
Reverse Recovery Characteristics (typ.)  
V<sub>CC</sub>=600V, V<sub>GE</sub>=±15V, R<sub>G</sub>=1.2Ω, T<sub>J</sub>=125°C



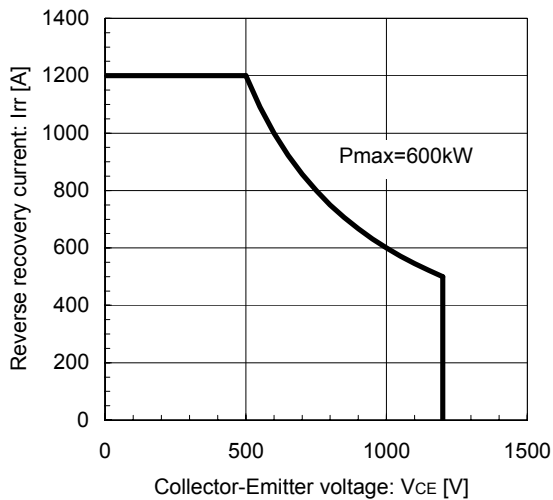
Reverse Recovery Characteristics (typ.)  
V<sub>CC</sub>=600V, V<sub>GE</sub>=±15V, R<sub>G</sub>=1.2Ω, T<sub>J</sub>=150°C



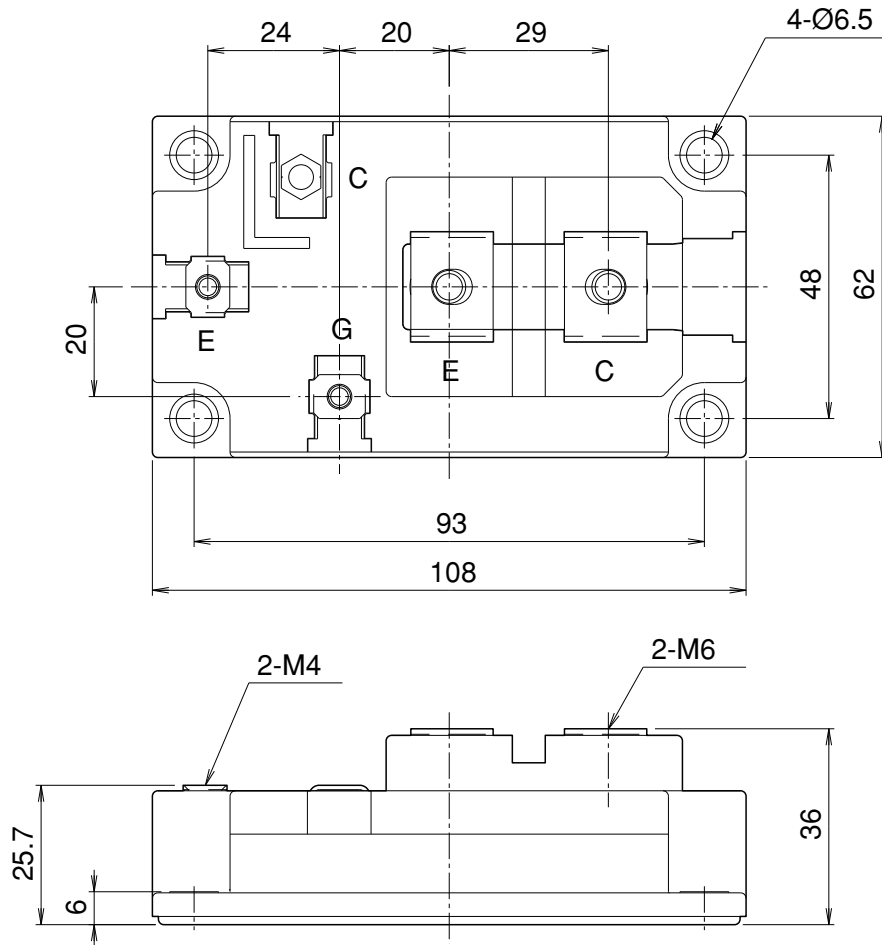
Transient Thermal Resistance (max.)



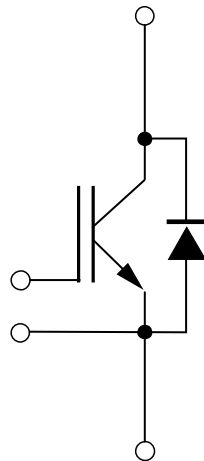
FWD safe operating area (max.)  
T<sub>J</sub>=150°C



■ Outline Drawings, mm



■ Equivalent Circuit Schematic



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