

# 1MBI600VF-120-50

IGBT Modules

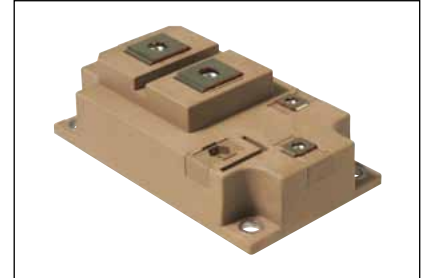
## IGBT MODULE (V series) 1200V / 600A / 1 in one package

### ■ 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 $T_c=25^\circ\text{C}$ unless otherwise specified)

Items	Symbols	Conditions	Maximum ratings	Units
Collector-Emitter voltage	$V_{CES}$		1200	V
Gate-Emitter voltage	$V_{GES}$		$\pm 20$	V
Collector current	$I_c$	Continuous	$T_c=100^\circ\text{C}$ 600	A
	$I_{c\ pulse}$	1ms	720	
	$-I_c$		600	
	$-I_{c\ pulse}$	1ms	1200	
Collector power dissipation	$P_c$	1 device	4680	W
Junction temperature	$T_j$		175	$^\circ\text{C}$
Operating junction temperature (under switching conditions)	$T_{jop}$		150	
Case temperature	$T_c$		125	
Storage temperature	$T_{stg}$		-40~125	
Isolation voltage	Between terminal and copper base (*1)	AC : 1min.	2500	VAC
Screw torque	Mounting (*2)	-	6.0	N m
	Terminals (*3)	M4	2.0	
		M6	5.0	

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

Note \*2: Recommendable Value : 1.96-6.0 Nm (M5, M6)  
Grease type : Shin-Etsu Chemical Co.,Ltd "G-747"

Note \*3: Recommendable Value : 0.98-2.0 Nm (M4)  
Recommendable Value : 1.96-5.0 Nm (M6)

● Electrical characteristics (at T<sub>J</sub>= 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	-	-	4.0	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	T <sub>J</sub> =25°C	-	2.10	2.55	V
			T <sub>J</sub> =125°C	-	2.40	-	
			T <sub>J</sub> =150°C	-	2.45	-	
	V <sub>CE(sat)</sub> (chip)		T <sub>J</sub> =25°C	-	1.75	2.15	
			T <sub>J</sub> =125°C	-	2.05	-	
T <sub>J</sub> =150°C	-	2.10	-				
Internal gate resistance	R <sub>G(int)</sub>	-	-	1.3	-	Ω	
Input capacitance	C <sub>ies</sub>	V <sub>GE</sub> = 0V, V <sub>CE</sub> = 10V, f = 1MHz	-	49	-	nF	
Turn-on time	t <sub>on</sub>	V <sub>CC</sub> = 600V, I <sub>c</sub> = 600A V <sub>GE</sub> = ±15V, R <sub>G</sub> = 1.2Ω T <sub>J</sub> =150°C, L <sub>S</sub> =35nH	-	700	-	nsec	
	t <sub>r</sub>		-	250	-		
	t <sub>r(l)</sub>		-	100	-		
Turn-off time	t <sub>off</sub>		-	900	-		
	t <sub>r</sub>		-	100	-		
Forward on voltage	V <sub>F</sub> (terminal)	V <sub>GE</sub> = 0V I <sub>F</sub> = 600A	T <sub>J</sub> =25°C	-	1.90	2.40	V
			T <sub>J</sub> =125°C	-	2.05	-	
			T <sub>J</sub> =150°C	-	2.00	-	
	V <sub>F</sub> (chip)		T <sub>J</sub> =25°C	-	1.70	2.15	
			T <sub>J</sub> =125°C	-	1.85	-	
T <sub>J</sub> =150°C	-	1.80	-				
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 600A	-	270	-	nsec	

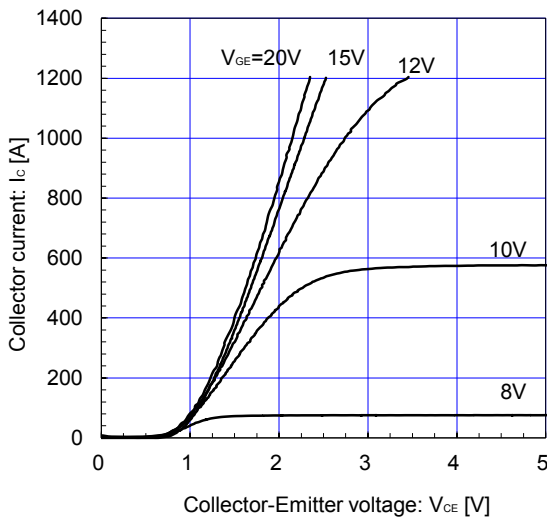
● Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	R <sub>th(j-c)</sub>	IGBT	-	-	0.032	°C/W
		FWD	-	-	0.055	
Contact thermal resistance (1device) (*4)	R <sub>th(c-f)</sub>	with Thermal Compound	-	0.0063	-	

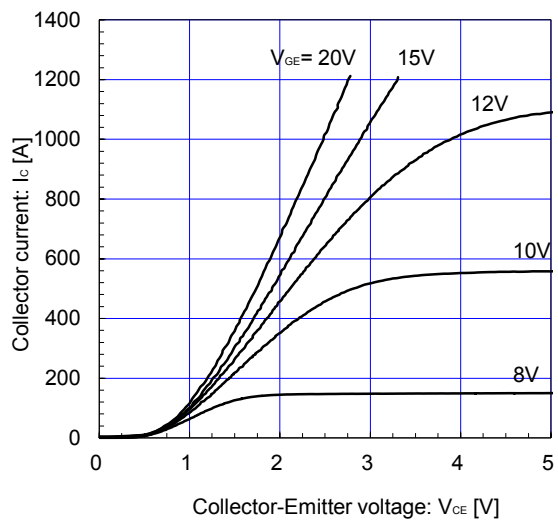
Note \*4: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)

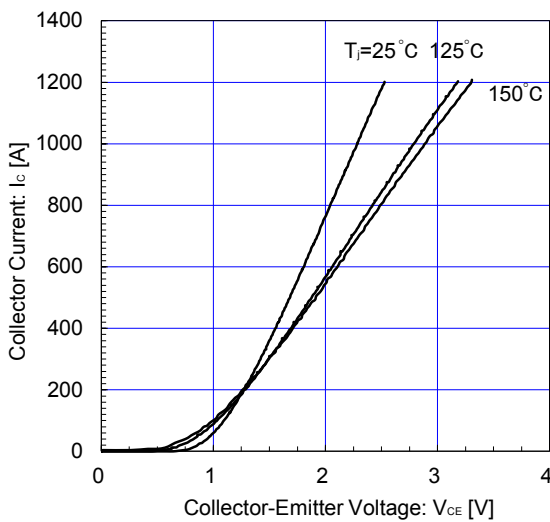
Collector current vs. Collector-Emmitter voltage (typ.)  
 $T_j = 25^\circ\text{C}$  / chip



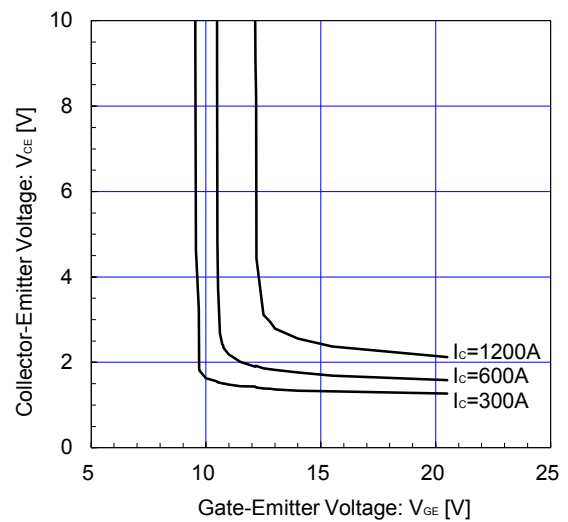
Collector current vs. Collector-Emmitter voltage (typ.)  
 $T_j = 150^\circ\text{C}$  / chip



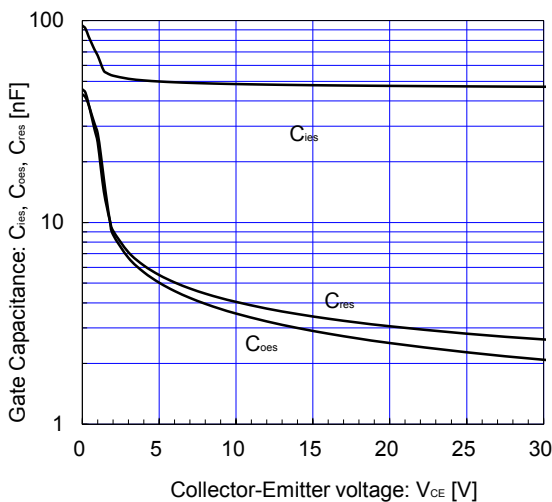
Collector current vs. Collector-Emmitter voltage (typ.)  
 $V_{GE} = 15\text{V}$  / chip



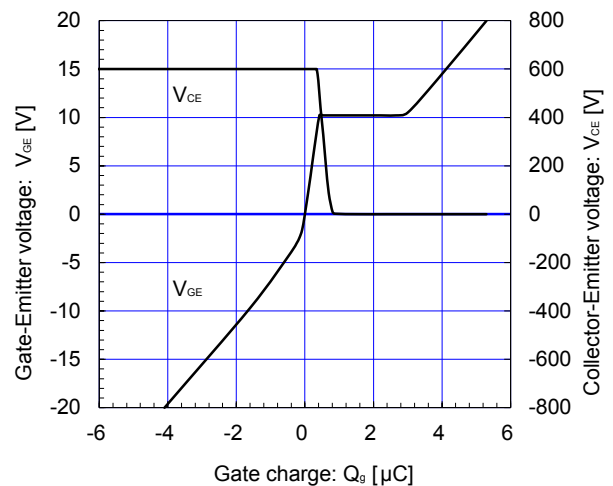
Collector-Emmitter voltage vs. Gate-Emmitter voltage  
 $T_j = 25^\circ\text{C}$  / chip



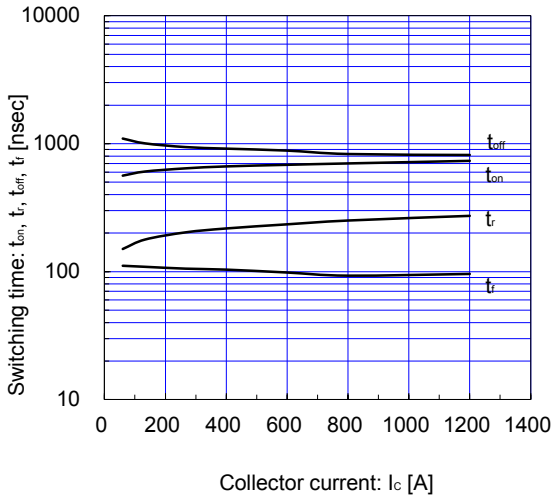
Gate Capacitance vs. Collector-Emmitter Voltage  
 $V_{GE} = 0\text{V}$ ,  $f = 1\text{MHz}$ ,  $T_j = 25^\circ\text{C}$



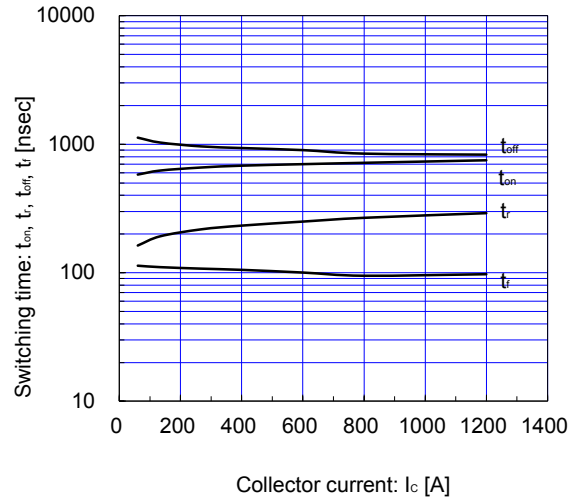
Dynamic Gate Charge (typ.)  
 $V_{CC} = 600\text{V}$ ,  $I_c = 600\text{A}$ ,  $T_j = 25^\circ\text{C}$



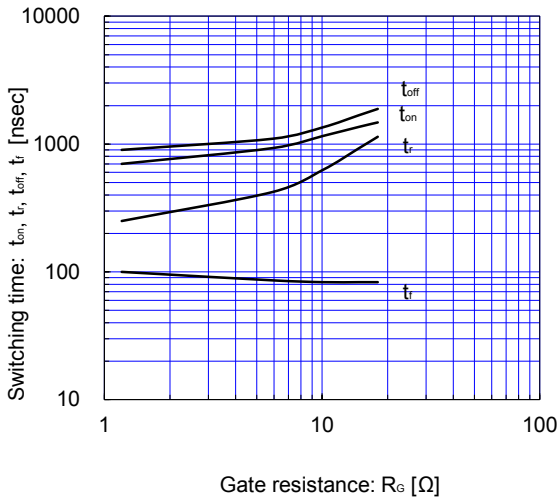
Switching time vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_G=1.2\Omega, T_J=125^\circ C$



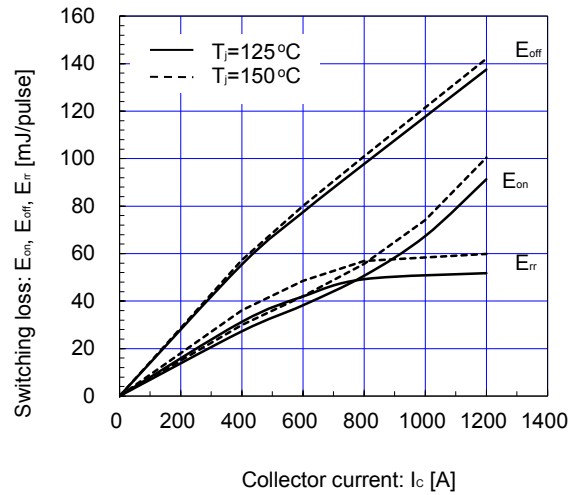
Switching time vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_G=1.2\Omega, T_J=150^\circ C$



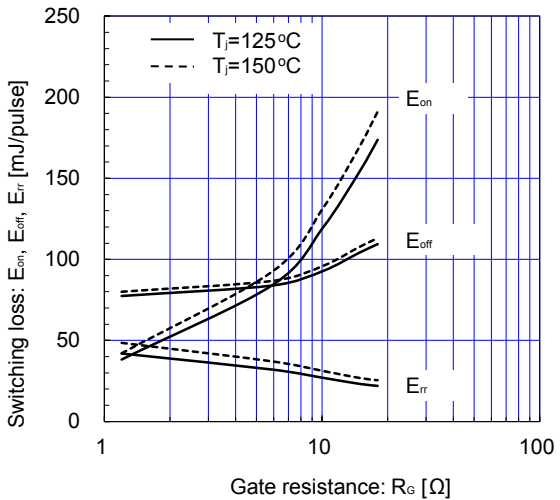
Switching time vs. Gate resistance (typ.)  
 $V_{CC}=600V, I_c=600A, V_{GE}=\pm 15V, T_J=125^\circ C$



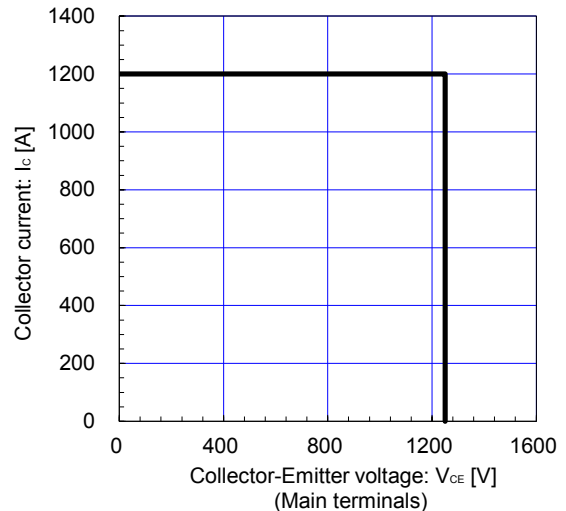
Switching loss vs. Collector current (typ.)  
 $V_{CC}=600V, V_{GE}=\pm 15V, R_G=1.2\Omega, T_J=125^\circ C$



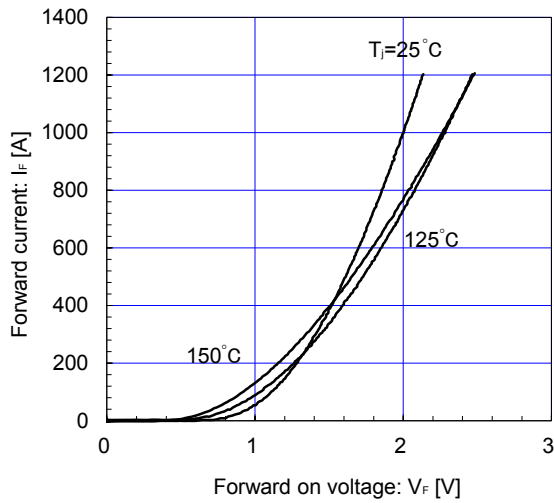
Switching loss vs. Gate resistance (typ.)  
 $V_{CC}=600V, I_c=600A, V_{GE}=\pm 15V, T_J=125^\circ C$



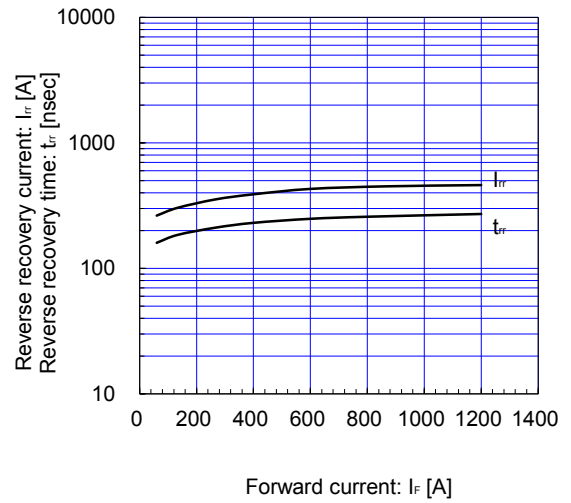
Reverse bias safe operating area (max.)  
 $V_{GE}=\pm 15V, R_G=1.2\Omega, T_J=150^\circ C, L_s=35nH$



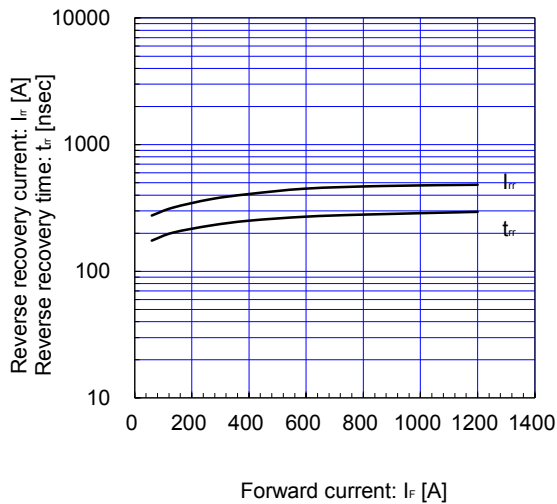
Forward Current vs. Forward Voltage (typ.)  
chip



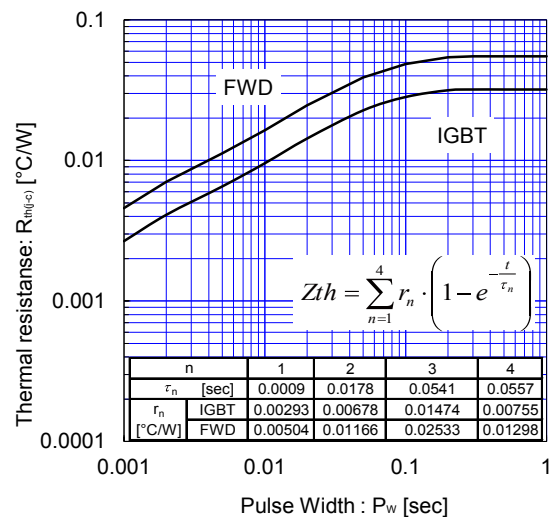
Reverse Recovery Characteristics (typ.)  
V<sub>CC</sub>=600V, V<sub>GE</sub>=±15V, R<sub>G</sub>=1.2Ω, T<sub>J</sub>=125°C



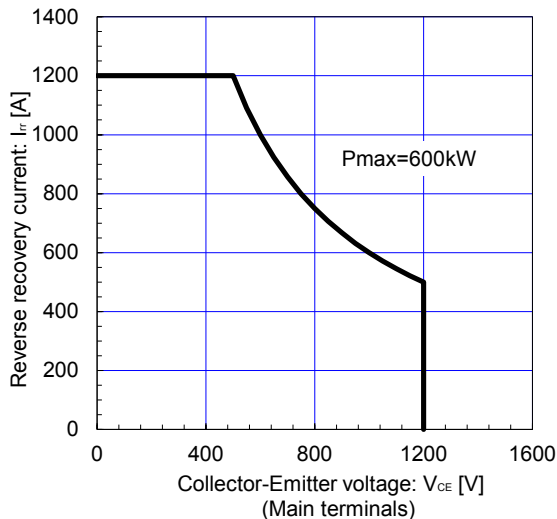
Reverse Recovery Characteristics (typ.)  
V<sub>CC</sub>=600V, V<sub>GE</sub>=±15V, R<sub>G</sub>=1.2Ω, T<sub>J</sub>=150°C



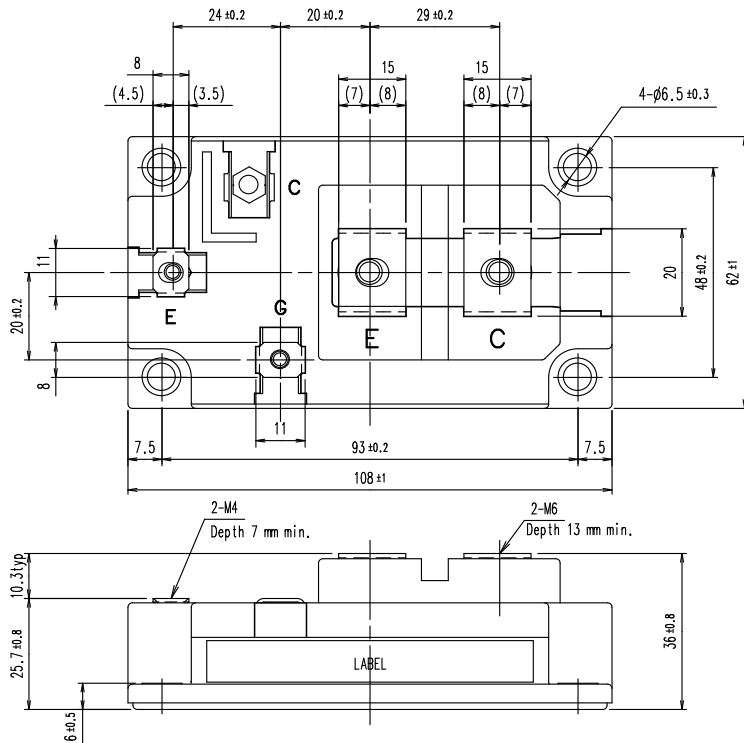
Transient Thermal Resistance (max.)



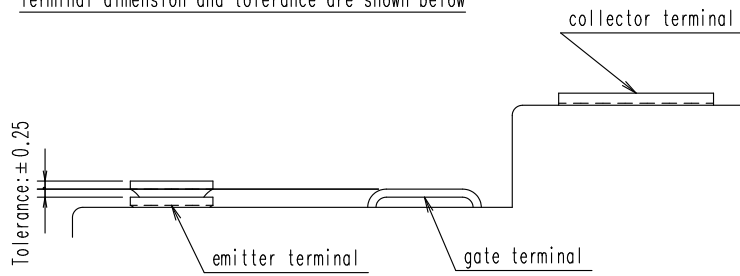
FWD safe operating area (max.)  
T<sub>J</sub>=150°C



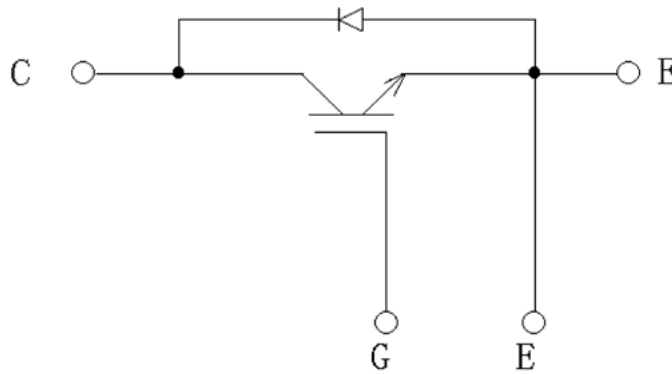
■ Outline Drawings(Unit:mm)



Terminal dimension and tolerance are shown below



■ Equivalent Circuit



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