

# 6MBI450V-170-50

**IGBT Modules**

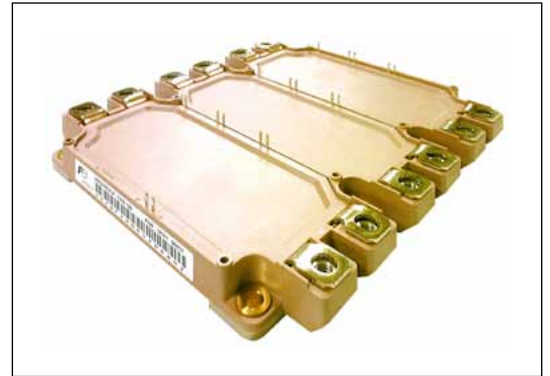
## IGBT MODULE (V series) 1700V / 450A / 6 in one package

### ■ Features

- Compact Package
- P.C.Board Mount
- Low  $V_{CE(sat)}$

### ■ 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	
Inverter	Collector-Emitter voltage	$V_{CES}$		1700	V	
	Gate-Emitter voltage	$V_{GES}$		$\pm 20$	V	
	Collector current	$I_C$	Continuous	$T_c=25^\circ\text{C}$	600	A
				$T_c=100^\circ\text{C}$	450	
		$I_{C,pulse}$	1ms	900		
		$-I_C$		450		
	$-I_{C,pulse}$	1ms	900			
Collector power dissipation	$P_C$	1 device	2500	W		
Junction temperature		$T_j$		175		
Operating junction temperature (under switching conditions)		$T_{jop}$		150	$^\circ\text{C}$	
Case temperature		$T_c$		125		
Storage temperature		$T_{stg}$		-40 ~ 125		
Isolation voltage	Between terminal and copper base (*1)	$V_{iso}$	AC : 1min.	3400	VAC	
	Between thermistor and others (*2)					
Screw torque	Mounting (*3)	-		3.5	N m	
	Terminals (*4)	-		4.5		

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)

Note \*4: Recommendable Value : 3.5-4.5 Nm (M6)

● Electrical characteristics (at  $T_J = 25^\circ\text{C}$  unless otherwise specified)

Items	Symbols	Conditions	Characteristics			Units		
			min.	typ.	max.			
Inverter	Zero gate voltage collector current	$I_{CES}$	$V_{GE} = 0V, V_{CE} = 1700V$	-	-	3.0	mA	
	Gate-Emitter leakage current	$I_{GES}$	$V_{CE} = 0V, V_{GE} = \pm 20V$	-	-	600	nA	
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V, I_C = 450mA$	6.0	6.5	7.0	V	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 450A$	$T_J = 25^\circ\text{C}$	-	2.65	3.10	V
				$T_J = 125^\circ\text{C}$	-	3.10	-	
				$T_J = 150^\circ\text{C}$	-	3.15	-	
		$V_{CE(sat)}$ (chip)	$V_{GE} = 15V$ $I_C = 450A$	$T_J = 25^\circ\text{C}$	-	2.00	2.45	
				$T_J = 125^\circ\text{C}$	-	2.45	-	
	Internal gate resistance	$R_{G(int)}$	-	$T_J = 25^\circ\text{C}$	-	1.67	-	$\Omega$
				$T_J = 150^\circ\text{C}$	-	2.50	-	
	Input capacitance	$C_{ies}$	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$	-	40	-	nF	
	Turn-on time	$t_{on}$	$V_{CC} = 900V$ $I_C = 450A$ $V_{GE} = \pm 15V$	-	900	-	nsec	
		$t_r$		-	400	-		
		$t_{r(i)}$		-	100	-		
	Turn-off time	$t_{off}$	$R_G = 3.3\Omega$ $L_S = 80nH$	-	1300	-	nsec	
$t_f$		-		100	-			
Forward on voltage	$V_F$ (terminal)	$V_{GE} = 0V, I_F = 450A$	$T_J = 25^\circ\text{C}$	-	2.45	2.90	V	
			$T_J = 125^\circ\text{C}$	-	2.75	-		
			$T_J = 150^\circ\text{C}$	-	2.70	-		
	$V_F$ (chip)	$V_{GE} = 0V, I_F = 450A$	$T_J = 25^\circ\text{C}$	-	1.80	2.25		
			$T_J = 125^\circ\text{C}$	-	2.10	-		
			$T_J = 150^\circ\text{C}$	-	2.05	-		
Reverse recovery time	$t_{rr}$	$I_F = 450A$	-	250	-	nsec		
Thermistor	Resistance	$T = 25^\circ\text{C}$	-	5000	-	$\Omega$		
		$T = 100^\circ\text{C}$	465	495	520			
		$T = 25 / 50^\circ\text{C}$	3305	3375	3450			
B value	B	$T = 25 / 50^\circ\text{C}$	3305	3375	3450	K		

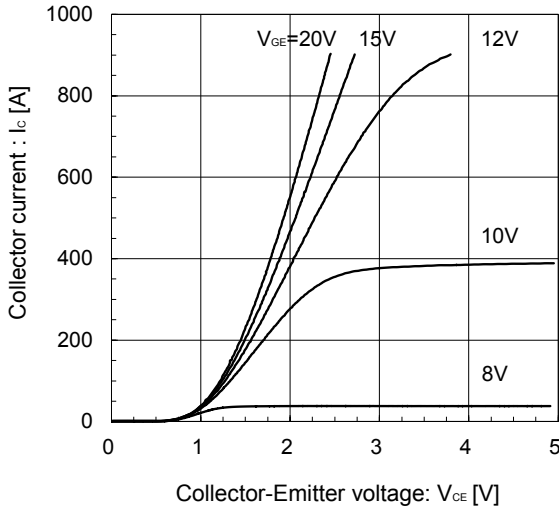
● Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.06	$^\circ\text{C/W}$
		Inverter FWD	-	-	0.10	
Contact thermal resistance (1device) (*5)	$R_{th(c-f)}$	with Thermal Compound	-	0.0167	-	

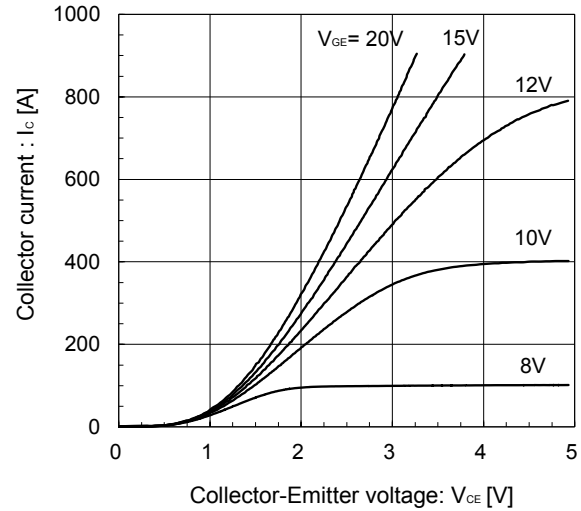
Note \*5: This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Characteristics (Representative)

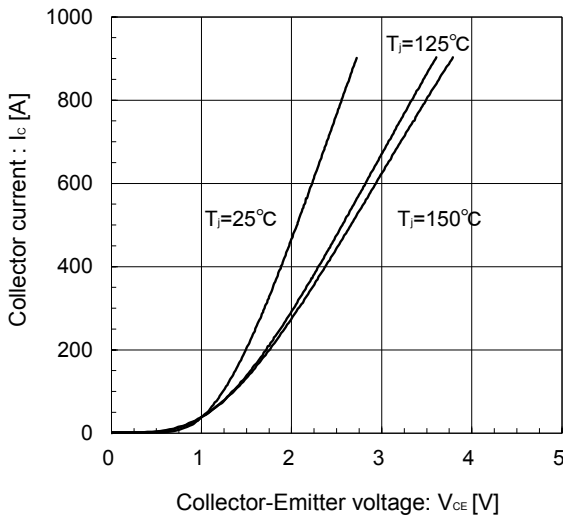
[ Inverter ]  
Collector current vs. Collector-Emittor voltage (typ.)  
 $T_j = 25^\circ\text{C}$  / chip



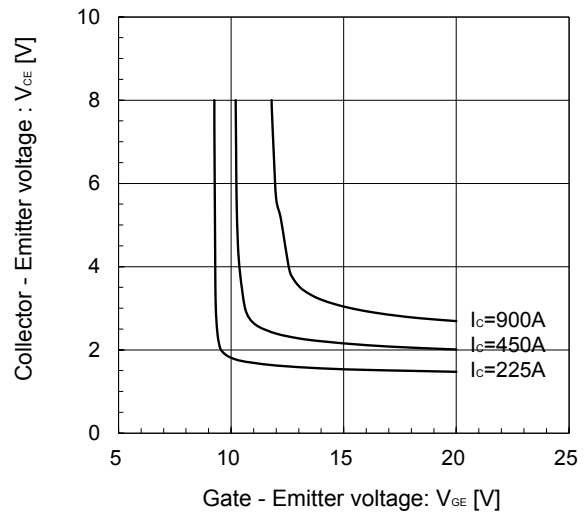
[ Inverter ]  
Collector current vs. Collector-Emittor voltage (typ.)  
 $T_j = 150^\circ\text{C}$  / chip



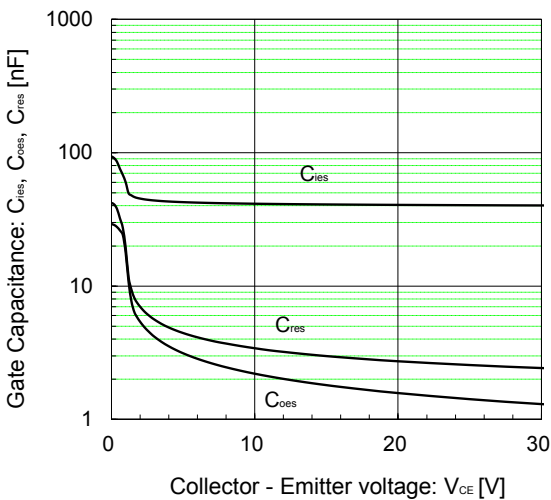
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Collector current vs. Collector-Emittor voltage (typ.)  
 $V_{GE} = 15\text{V}$  / chip



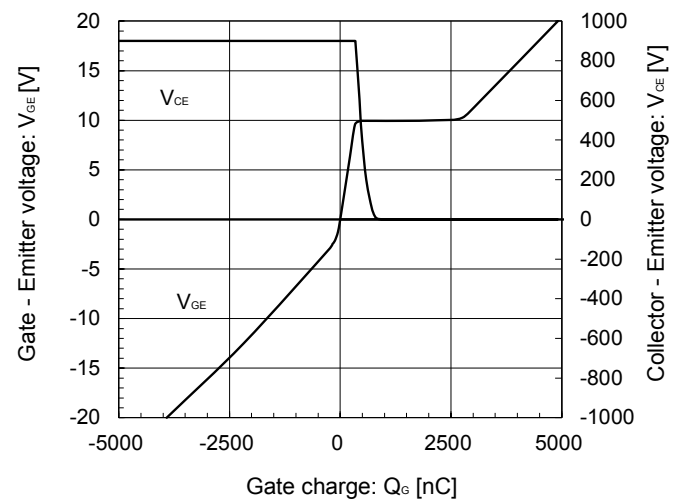
[ Inverter ]  
Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)  
 $T_j = 25^\circ\text{C}$  / chip



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

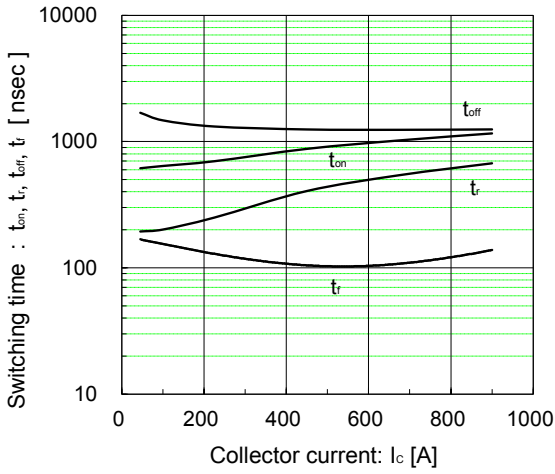


[ Inverter ]  
Dynamic gate charge (typ.)  
 $V_{CC} = 900\text{V}$ ,  $I_c = 450\text{A}$ ,  $T_j = 25^\circ\text{C}$



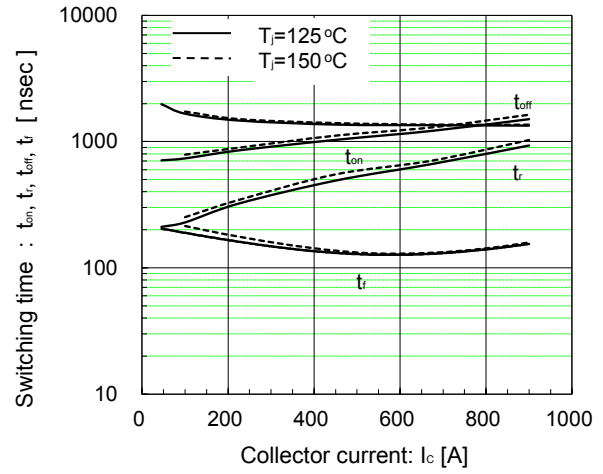
[ Inverter ]

Switching time vs. Collector current (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=25^\circ C$



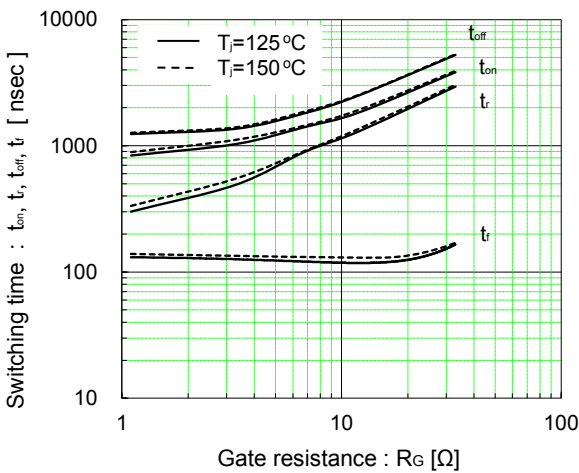
[ Inverter ]

Switching time vs. Collector current (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=125^\circ C, 150^\circ C$



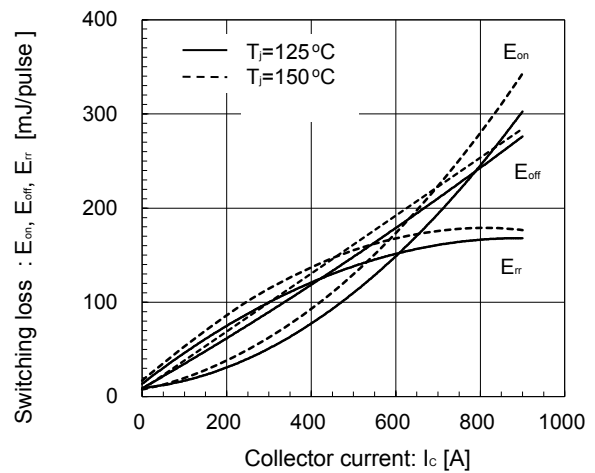
[ Inverter ]

Switching time vs. Gate resistance (typ.)  
 $V_{CC}=900V, I_C=450A, V_{GE}=\pm 15V, T_J=125^\circ C, 150^\circ C$



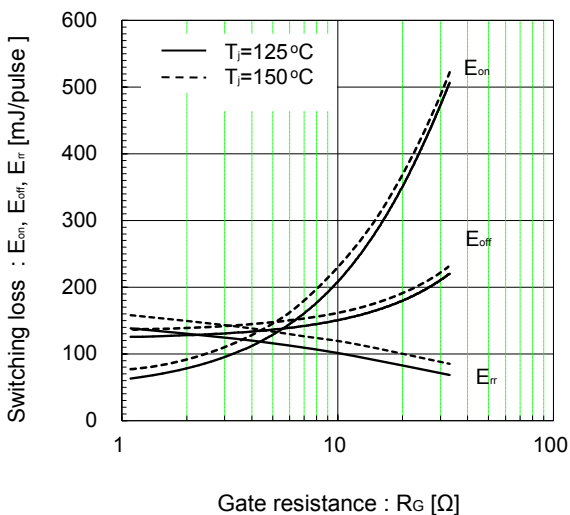
[ Inverter ]

Switching loss vs. Collector current (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=125^\circ C, 150^\circ C$



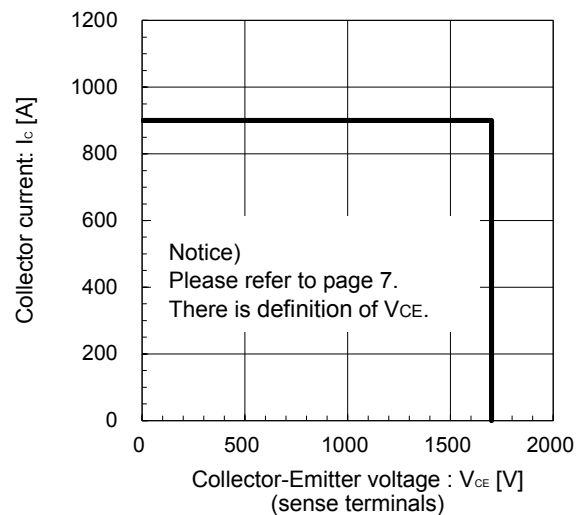
[ Inverter ]

Switching loss vs. Gate resistance (typ.)  
 $V_{CC}=900V, I_C=450A, V_{GE}=\pm 15V, T_J=125^\circ C, 150^\circ C$



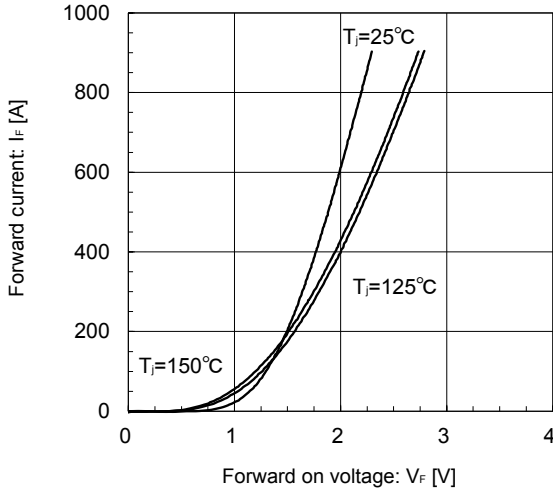
[ Inverter ]

Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE} \le 15V, R_G \ge 3.3\Omega, T_J=150^\circ C$



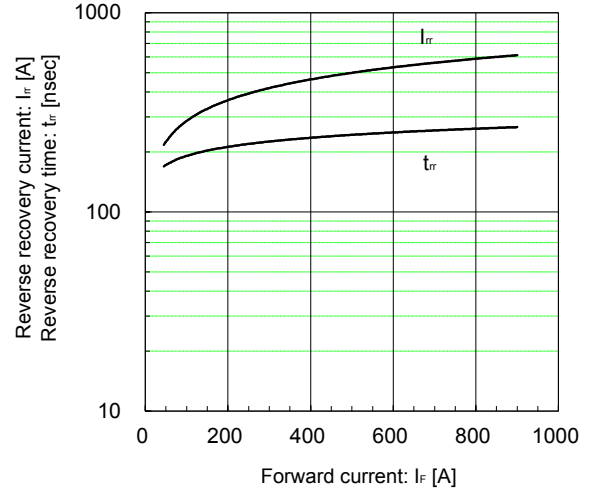
[INVERTER]

Forward Current vs. Forward Voltage (typ.)  
chip



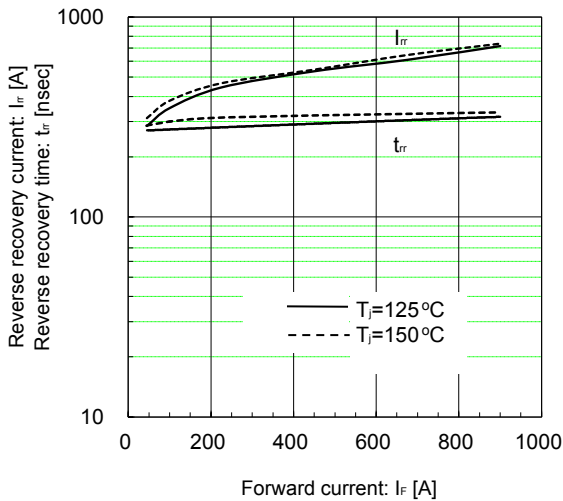
[INVERTER]

Reverse Recovery Characteristics (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=25^\circ C$

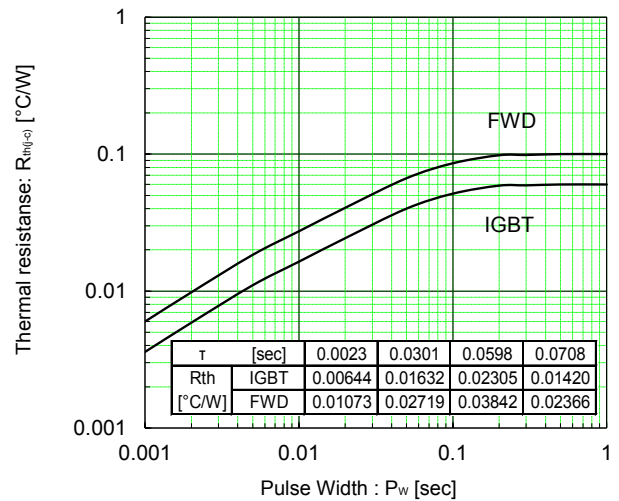


[INVERTER]

Reverse Recovery Characteristics (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=3.3\Omega, T_J=125^\circ C, 150^\circ C$

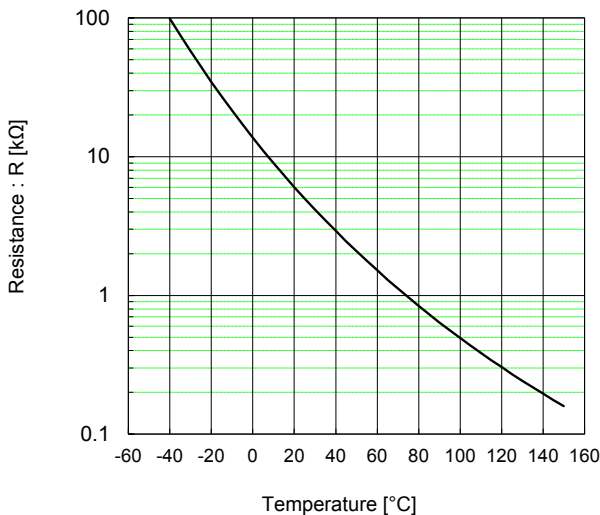


Transient Thermal Resistance (max.)



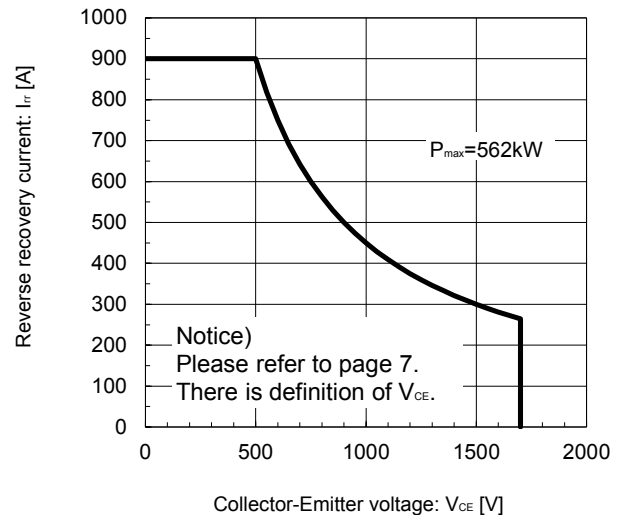
[THERMISTOR]

Temperature characteristic (typ.)

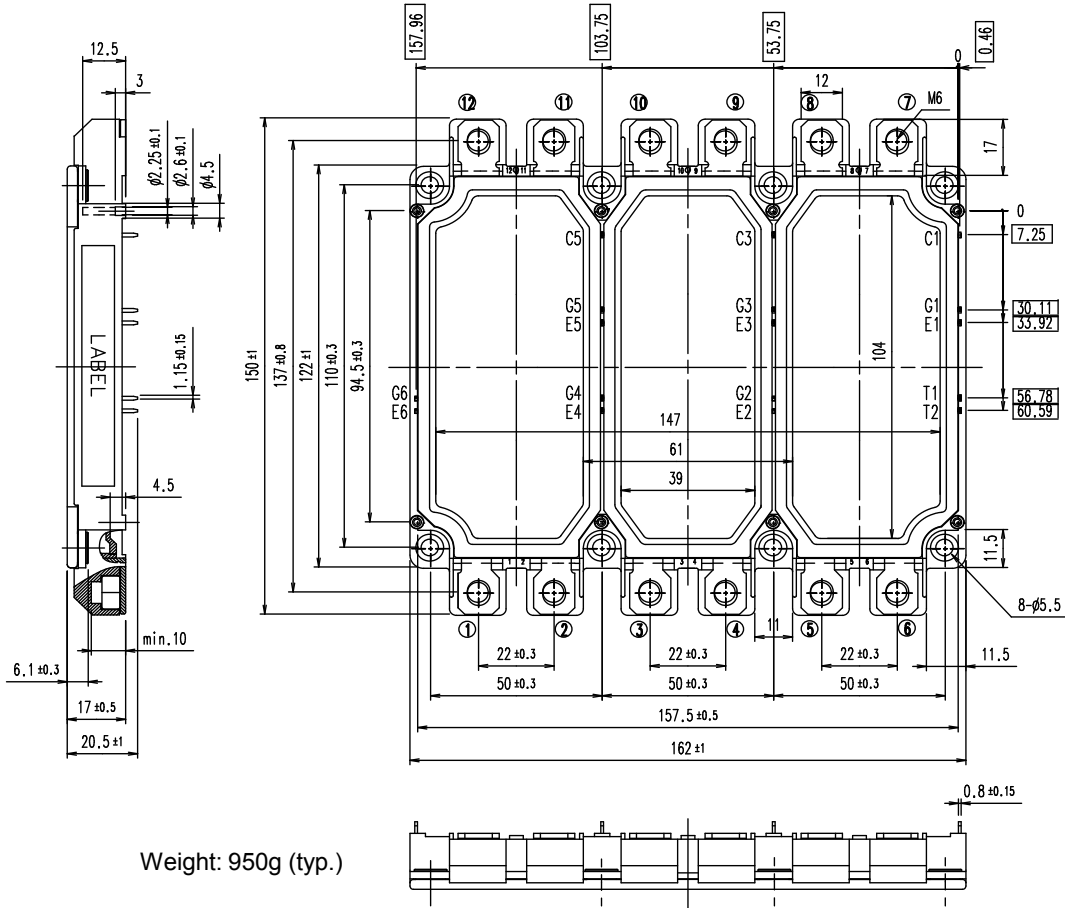


FWD safe operating area (max.)

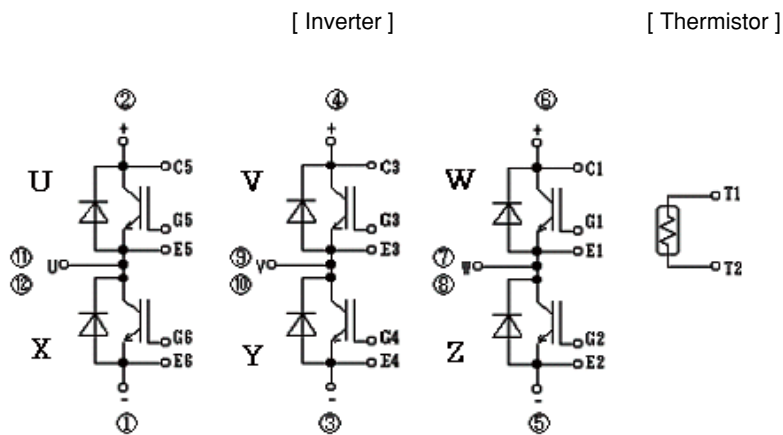
$T_J=150^\circ C$



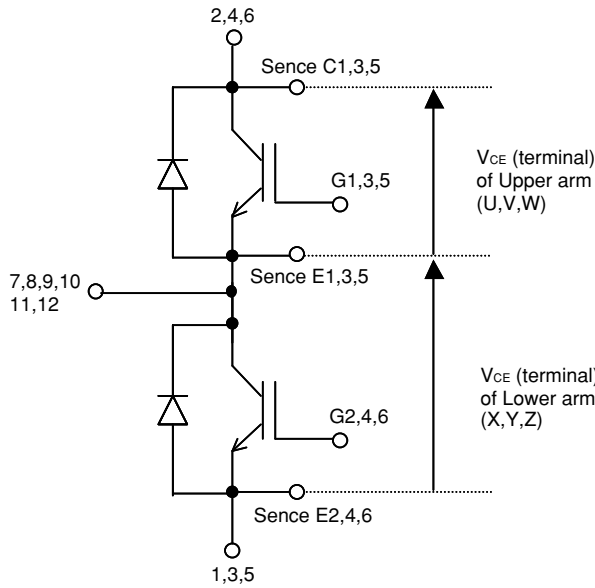
■ Outline Drawings, mm



■ Equivalent Circuit



■ Definition of switching characteristics



Switching characteristics of  $V_{CE}$  is defined between Sense C1,3,5 and Sense E1,3,5 for Upper arm(U,V,W) and Sense E1,3,5 and Sense E2,4,6 for Lower arm(X,Y,Z) .

Please use these terminals whenever measure spike voltage.

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