

# 1MBI900VXA-120PC-54

IGBT Modules

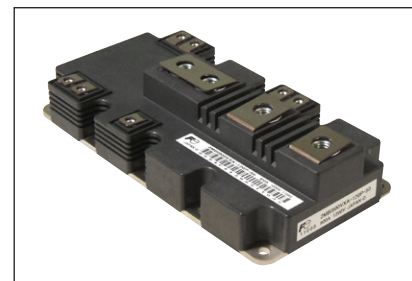
## IGBT MODULE (V series) 1200V / 900A / 1 in one package

### ■ Features

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

### ■ Applications

- NPC 3-level Inverter
- Inverter DB for Motor Drive
- AC and DC Servo Drive Amplifier (DB)
- Active PFC
- Industrial machines



### ■ Maximum Ratings and Characteristics

#### ● Maximum Ratings (at T<sub>c</sub>=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 for IGBT and Inverse Diode	I <sub>C</sub>	Continuous	T <sub>C</sub> =25°C	1200	A
			T <sub>C</sub> =100°C	900	
		I <sub>C pulse</sub>	1ms	1800	
		-I <sub>C</sub>		120	
		-I <sub>C pulse</sub>	1ms	240	
Collector Power Dissipation		P <sub>C</sub>	1 device	5100	W
Reverse voltage for FWD		V <sub>R</sub>		1200	V
Forward current for FWD	I <sub>F</sub>	Continuous	900	A	
	I <sub>F pulse</sub>	1ms	1800		
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>		150	
Storage temperature		T <sub>stg</sub>		-40 ~ +150	
Isolation voltage	between terminal and copper base (*1)	V <sub>iso</sub>	AC : 1min.	4000	VAC
	between thermistor and others (*2)				
Screw Torque (*3)	Mounting	-	M5	6.0	N m
	Main Terminals	-	M8	10.0	
	Sense Terminals	-	M4	2.1	

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 : Mounting 3.0 ~ 6.0 Nm (M5)  
Recommendable Value : Main Terminals 8.0 ~ 10.0 Nm (M8)  
Recommendable Value : Sense Terminals 1.8 ~ 2.1 Nm (M4)

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

Items		Symbols	Conditions		Characteristics			Units	
					min.	typ.	max.		
IGBT/Inverse Diode	Zero gate voltage collector current	I <sub>CES</sub>	V <sub>CE</sub> = 1200V V <sub>GE</sub> = 0V		-	-	8.0	mA	
	Gate-Emitter leakage current	I <sub>GES</sub>	V <sub>CE</sub> = 0V V <sub>GE</sub> =±20V		-	-	1600	nA	
	Gate-Emitter threshold voltage	V <sub>GE(th)</sub>	V <sub>CE</sub> = 20V I <sub>C</sub> = 900mA		6.0	6.5	7.0	V	
	Collector-Emitter saturation voltage	V <sub>CE(sat)</sub> (terminal) (*4)	I <sub>C</sub> = 900A V <sub>GE</sub> =15V	T <sub>J</sub> = 25°C	-	1.75	2.20	V	
				T <sub>J</sub> =125°C	-	2.10	-		
				T <sub>J</sub> =150°C		2.15	-		
		V <sub>CE(sat)</sub> (chip)		T <sub>J</sub> = 25°C	-	1.65	2.10		
				T <sub>J</sub> =125°C	-	2.00	-		
				T <sub>J</sub> =150°C		2.05	-		
	Internal gate resistance	R <sub>G (int)</sub>	-				1.19	-	Ω
	Input capacitance	C <sub>ies</sub>	V <sub>CE</sub> =10V, V <sub>GE</sub> =0V,f=1MHz			-	83	-	nF
	Turn-on time	t <sub>on</sub>	V <sub>CC</sub> = 600V I <sub>C</sub> = 900A V <sub>GE</sub> = ±15V			-	1100	-	nsec
		t <sub>r</sub>				-	500	-	
		t <sub>r (i)</sub>				-	150	-	
	Turn-off time	t <sub>off</sub>	R <sub>G</sub> = 1.6 Ω L <sub>S</sub> = 70nH			-	1200	-	
		t <sub>f</sub>				-	150	-	
	Forward on voltage	V <sub>F</sub> (terminal) (*4)	I <sub>F</sub> = 120A V <sub>GE</sub> =0V	T <sub>J</sub> = 25°C	-	1.70	2.15	V	
T <sub>J</sub> =125°C				-	1.80	-			
T <sub>J</sub> =150°C					1.75	-			
V <sub>F</sub> (chip)		T <sub>J</sub> = 25°C		-	1.65	2.10			
		T <sub>J</sub> =125°C		-	1.75	-			
		T <sub>J</sub> =150°C			1.70	-			
Reverse Current	I <sub>R</sub>	V <sub>CE</sub> = 1200V		-	-	8.0	mA		
FWD	Forward on voltage	V <sub>F</sub> (terminal) (*4)	I <sub>F</sub> = 900A V <sub>GE</sub> =0V	T <sub>J</sub> = 25°C	-	1.70	2.15	V	
				T <sub>J</sub> =125°C	-	1.80	-		
				T <sub>J</sub> =150°C		1.75	-		
		V <sub>F</sub> (chip)		T <sub>J</sub> = 25°C	-	1.60	2.05		
				T <sub>J</sub> =125°C	-	1.70	-		
				T <sub>J</sub> =150°C		1.65	-		
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 900A		-	200	-	nsec		
Thermistor	Resistance	R	T = 25°C		-	5000	-	Ω	
		T = 100°C		465	495	520			
	B value	B	T = 25/50°C		3305	3375	3450	K	

Note \*4: Please refer to page 8, there is definition of on-state voltage at terminal.

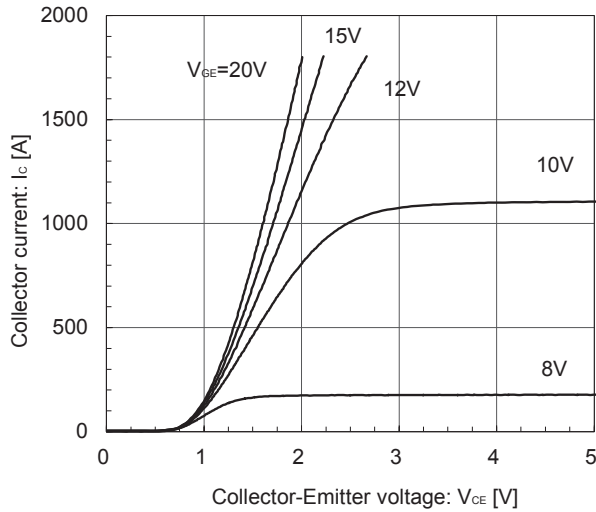
## ● Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.030	$^\circ\text{C/W}$
		Inverse Diode	-	-	0.250	
		FWD	-	-	0.033	
Contact thermal resistance (1device) (*5)	$R_{th(c-f)}$	with Thermal Compound	-	0.00625	-	

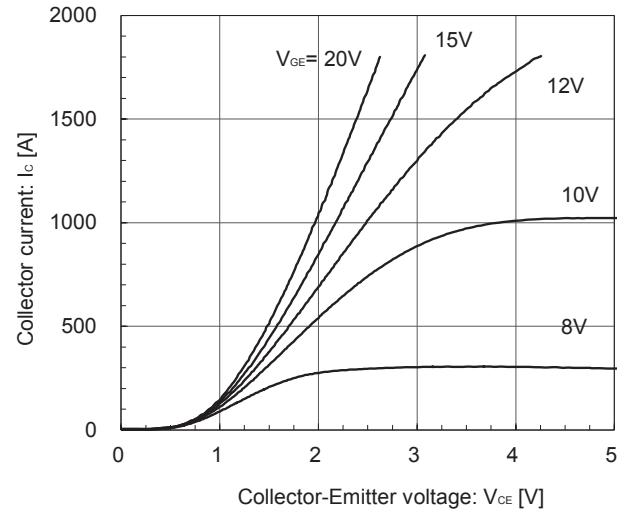
Note \*5: This is the value which is defined mounting on the additional cooling fin with thermal compound.

## ■ Characteristics (Representative)

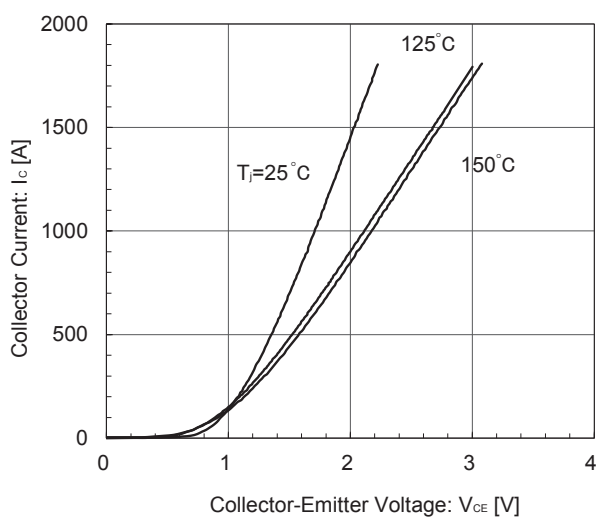
Collector current vs. Collector-Emitter voltage (typ.)  
 $T_J = 25^\circ\text{C}$  / chip



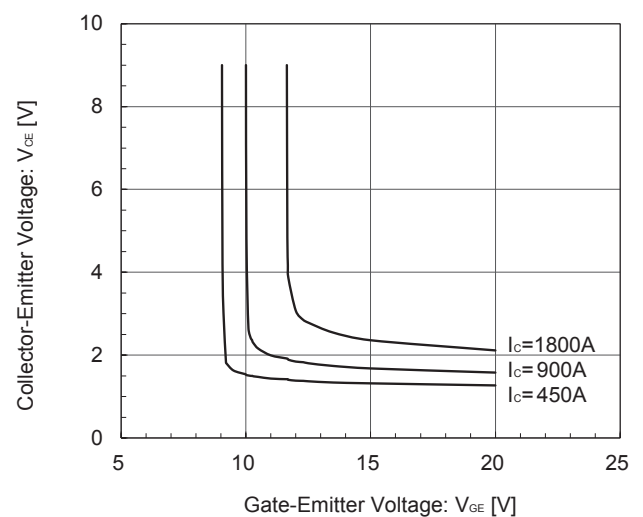
Collector current vs. Collector-Emitter voltage (typ.)  
 $T_J = 150^\circ\text{C}$  / chip



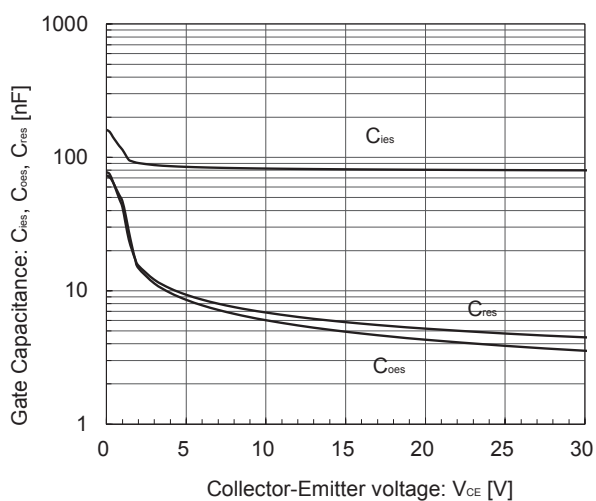
Collector current vs. Collector-Emitter voltage (typ.)  
 $V_{GE} = 15\text{V}$  / chip



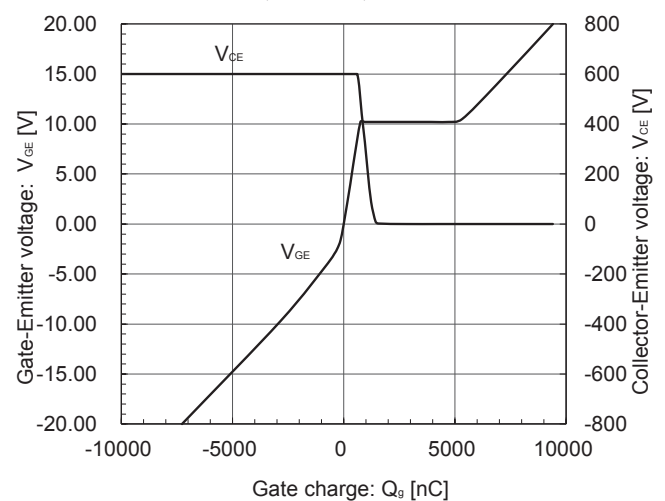
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)  
 $T_J = 25^\circ\text{C}$  / chip



Gate Capacitance vs. Collector-Emitter Voltage (typ.)  
 $V_{GE} = 0\text{V}$ ,  $f = 1\text{MHz}$ ,  $T_J = 25^\circ\text{C}$

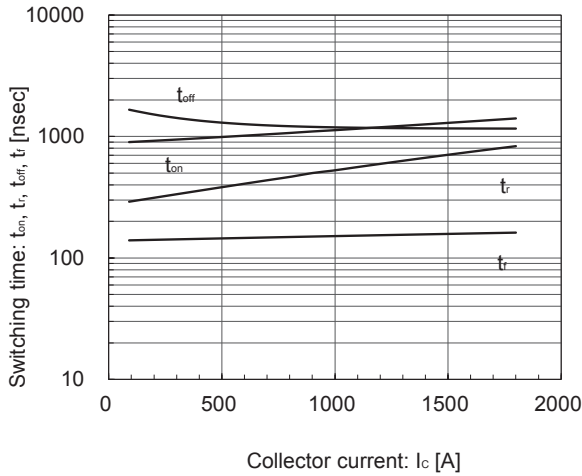


Dynamic Gate Charge (typ.)  
 $V_{CC} = 600\text{V}$ ,  $I_C = 900\text{A}$ ,  $T_J = 25^\circ\text{C}$



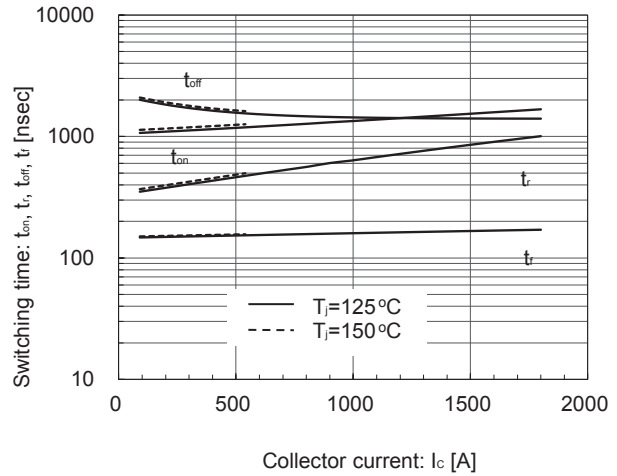
Switching time vs. Collector current (typ.)

$V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=1.6\Omega$ ,  $T_J=25^\circ C$



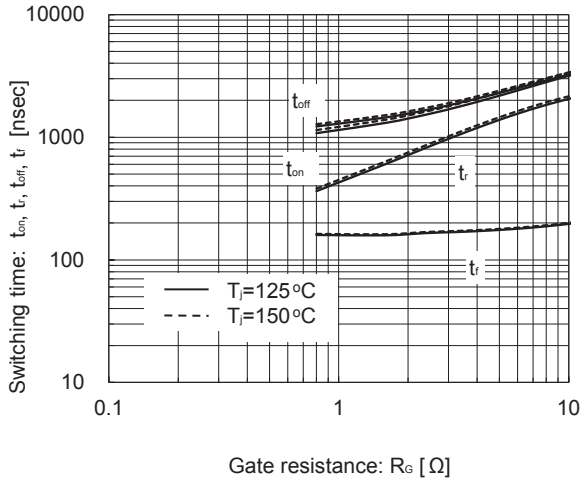
Switching time vs. Collector current (typ.)

$V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=1.6\Omega$ ,  $T_J=125^\circ C, 150^\circ C$



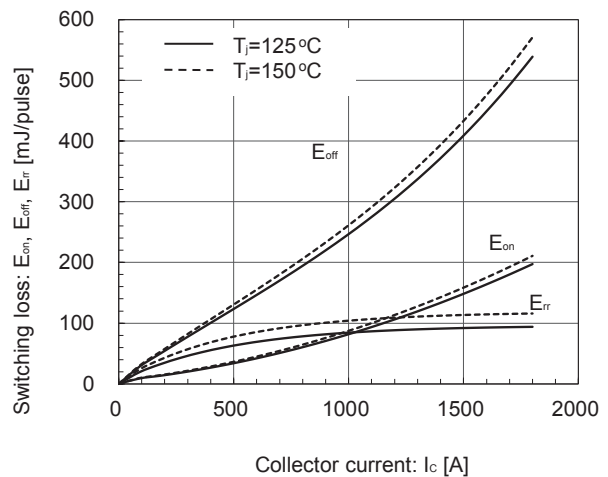
Switching time vs. Gate resistance (typ.)

$V_{CC}=600V$ ,  $I_C=900A$ ,  $V_{GE}=\pm 15V$ ,  $T_J=125^\circ C, 150^\circ C$



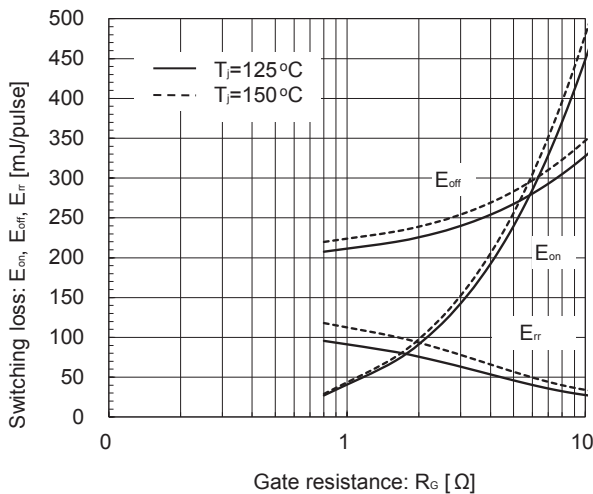
Switching loss vs. Collector current (typ.)

$V_{CC}=600V$ ,  $V_{GE}=\pm 15V$ ,  $R_G=1.6\Omega$ ,  $T_J=125^\circ C, 150^\circ C$



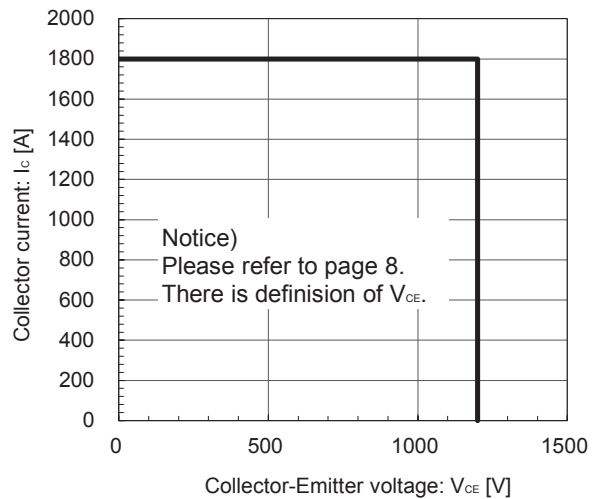
Switching loss vs. Gate resistance (typ.)

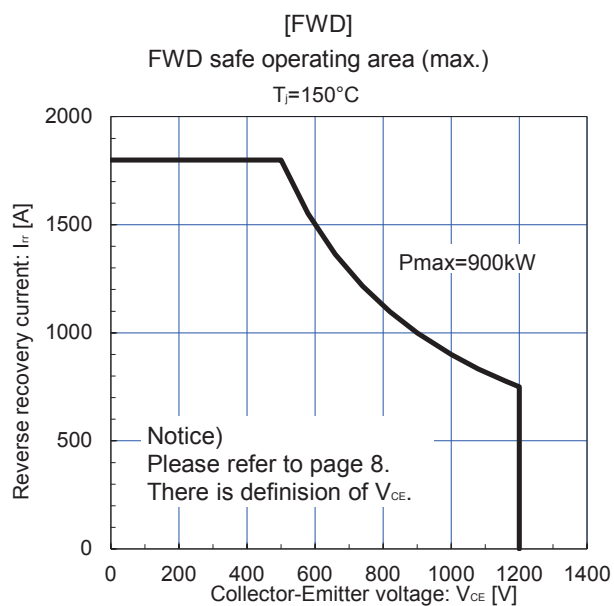
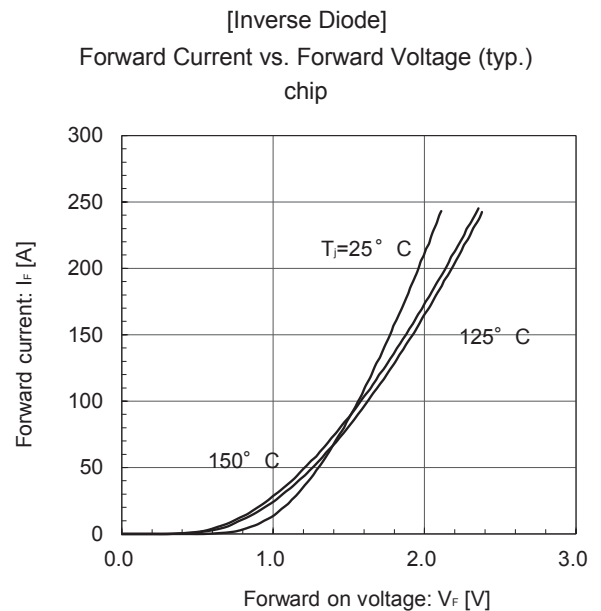
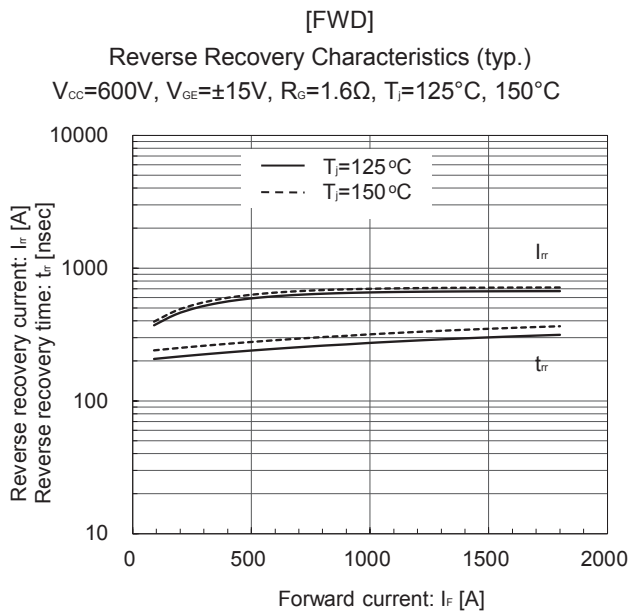
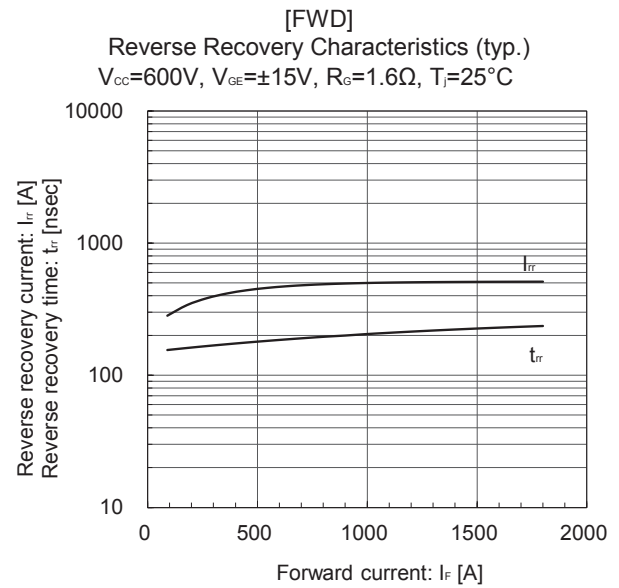
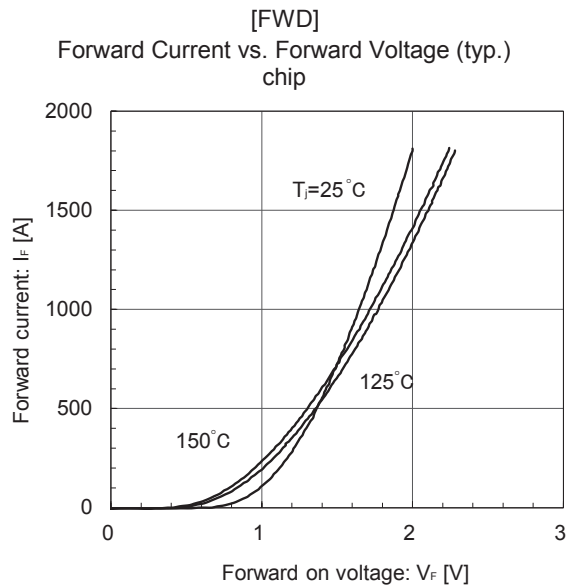
$V_{CC}=600V$ ,  $I_C=900A$ ,  $V_{GE}=\pm 15V$ ,  $T_J=125^\circ C, 150^\circ C$

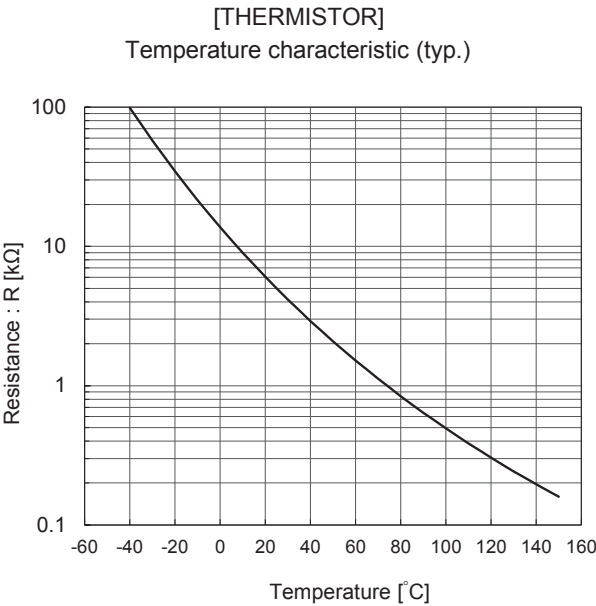
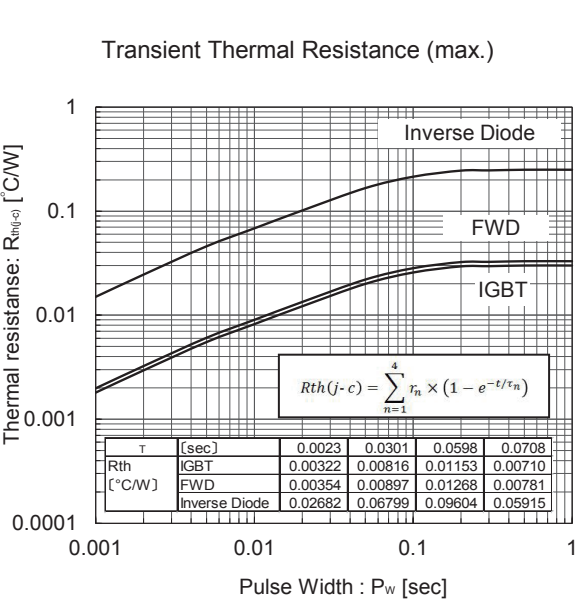


Reverse bias safe operating area (max.)

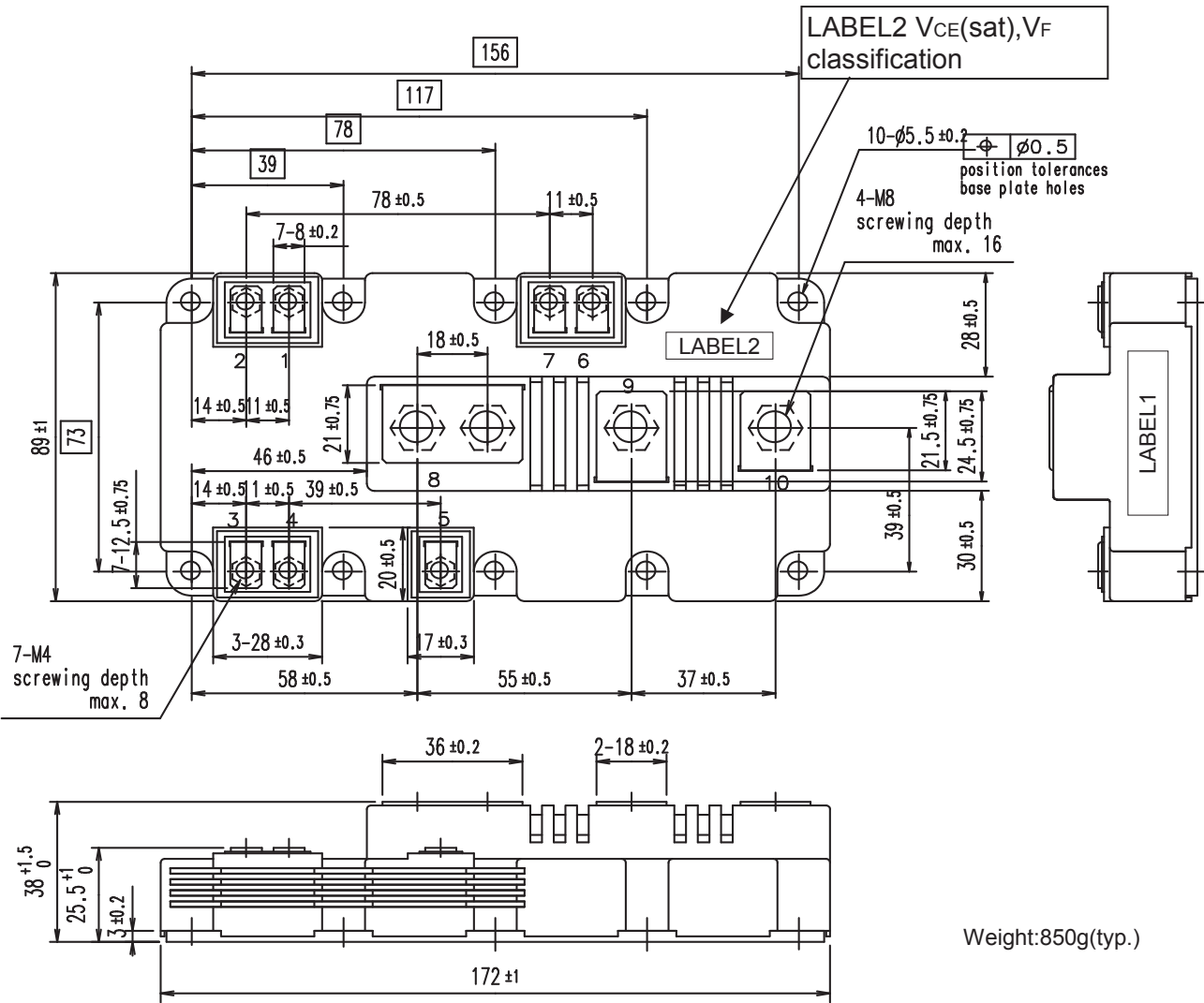
$+V_{GE}=15V$ ,  $-V_{GE}=15V$ ,  $R_G=1.6\Omega$ ,  $T_J=150^\circ C$



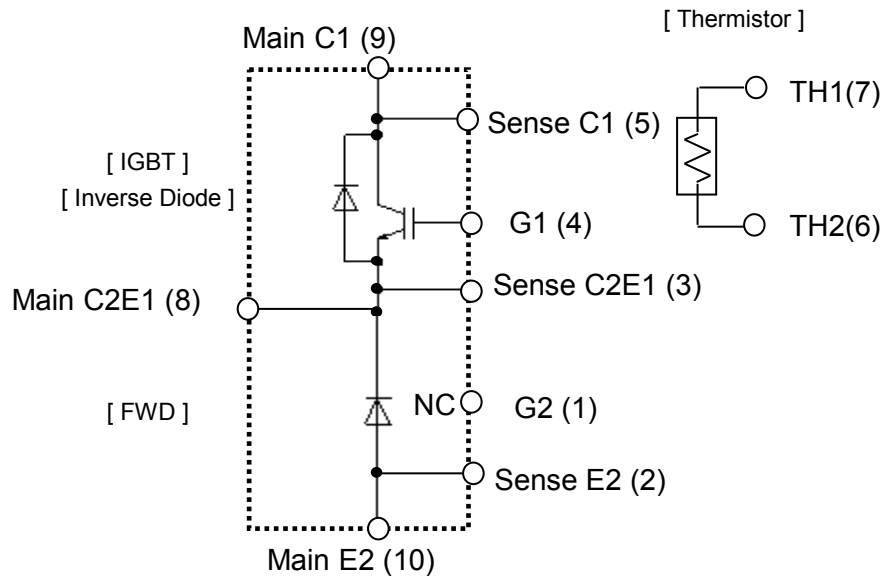




Outline Drawings, mm

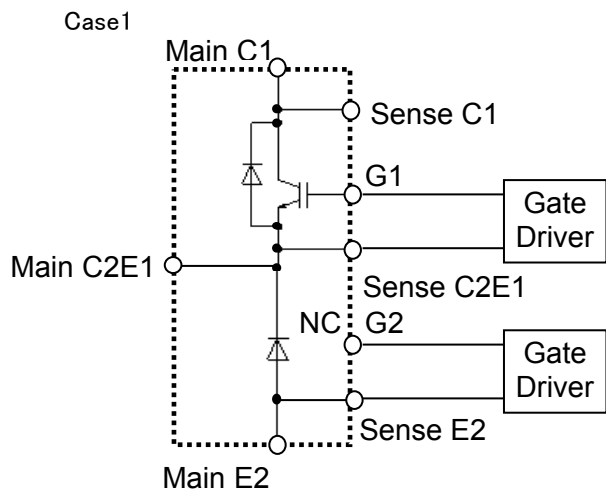


## Equivalent Circuit Schematic

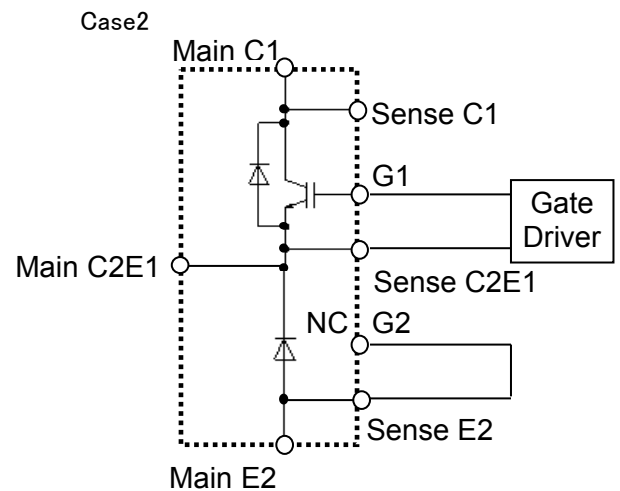


Notice) There is recommendation of wiring for NC terminal as follows

## Fuji recommends wire connection of CASE1 or CASE2 to fix NC terminal voltage.

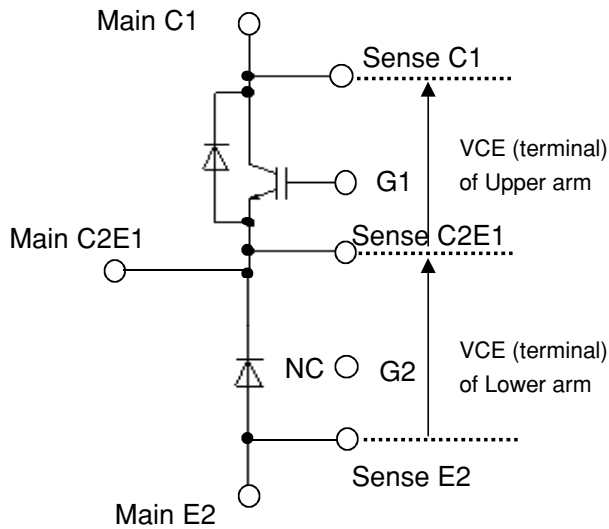


NC terminal (G2) and sense E2 should be connected by Gate-Driver.



NC terminal (G2) and sense E2 should be connected by wire.

## ■ Definition of on-state voltage at terminal and switching characteristics



Fuji defined VCE value of terminal by using Sense C1 and Sense C2E1 for Upper arm and Sense C2E1 and Sense E2 for Lower arm .

Switching characteristics of VCE also is defined between Sense C1 and Sense C2E1 for Upper arm and Sense C2E1 and Sense E2 for Lower arm .

Please use these terminals whenever measure spike voltage and on-state voltage .

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