

# 2MBI650VXA-170E-50

**IGBT Modules**

## IGBT MODULE (V series) 1700V / 650A / 2 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	
Inverter	Collector-Emitter voltage	V <sub>CEs</sub>	1700	V	
	Gate-Emitter voltage	V <sub>GES</sub>	±20	V	
	Collector current	I <sub>c</sub>	Continuous	Tc=25°C 900	A
				Tc=100°C 650	
		I <sub>c</sub> pulse	1ms	1300	
		-I <sub>c</sub>		650	
	-I <sub>c</sub> pulse	1ms	1300		
Collector power dissipation	P <sub>c</sub>	1 device	4150	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>		150		
Storage temperature	T <sub>stg</sub>		-40 ~ +150		
Isolation voltage	V <sub>iso</sub>	AC : 1min.	4000	VAC	
					between terminal and copper base (*1) 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 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> = 1700V	-	-	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> = 650mA	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	V <sub>CE(sat)</sub> (terminal) (*4)	V <sub>GE</sub> = 15V I <sub>c</sub> = 650A	Tj=25°C	-	2.10	2.55	V
			Tj=125°C	-	2.50	-	
			Tj=150°C	-	2.55	-	
	V <sub>CE(sat)</sub> (chip)		Tj=25°C	-	2.00	2.45	
			Tj=125°C	-	2.40	-	
			Tj=150°C	-	2.45	-	
Internal gate resistance	R <sub>g(int)</sub>	-	-	1.75	-	Ω	
Input capacitance	C <sub>ies</sub>	V <sub>CE</sub> = 10V, V <sub>GE</sub> = 0V, f = 1MHz	-	63	-	nF	
Turn-on time	ton	V <sub>CC</sub> = 900V	-	1.25	-	μsec	
	tr	I <sub>c</sub> = 650A	-	0.50	-		
	tr (i)	V <sub>GE</sub> = ±15V	-	0.15	-		
Turn-off time	toff	R <sub>G</sub> = +1.8/-2.7Ω	-	1.55	-	μsec	
	tf	L <sub>s</sub> =70nH	-	0.15	-		
Forward on voltage	V <sub>F</sub> (terminal) (*4)	V <sub>GE</sub> = 0V I <sub>F</sub> = 650A	Tj=25°C	-	1.95	2.40	V
			Tj=125°C	-	2.20	-	
			Tj=150°C	-	2.15	-	
	V <sub>F</sub> (chip)		Tj=25°C	-	1.85	2.30	
			Tj=125°C	-	2.10	-	
			Tj=150°C	-	2.05	-	
Reverse recovery time	trr	I <sub>F</sub> = 650A	-	0.24	-	μsec	
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 6, there is definition of on-state voltage at terminal.

#### ● Thermal resistance characteristics

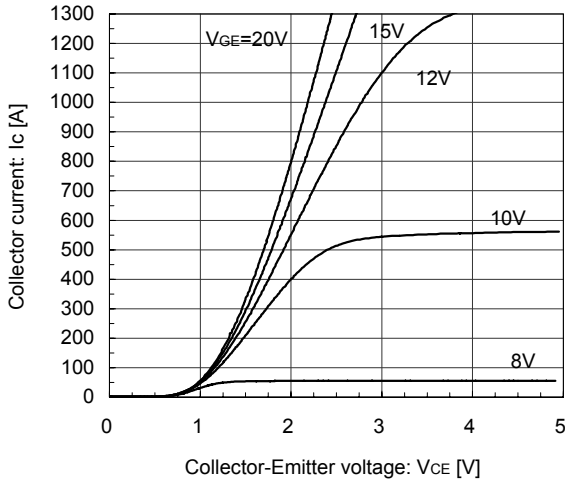
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	R <sub>th(j-c)</sub>	Inverter IGBT	-	-	0.036	°C/W
		Inverter FWD	-	-	0.072	
Contact thermal resistance (1device) (*5)	R <sub>th(c-f)</sub>	with Thermal Compound	-	0.0125	-	

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

■ Characteristics (Representative)

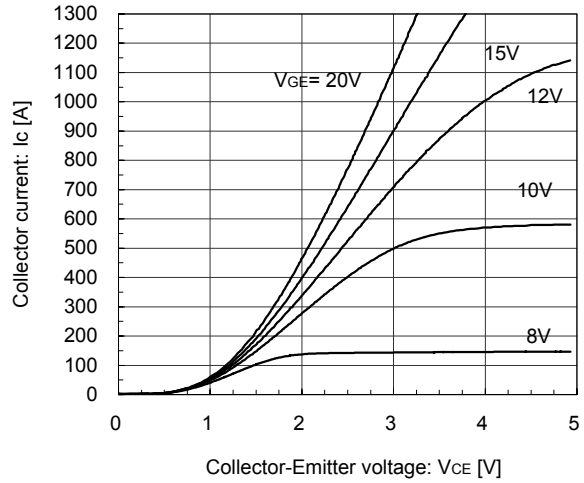
[INVERTER]

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



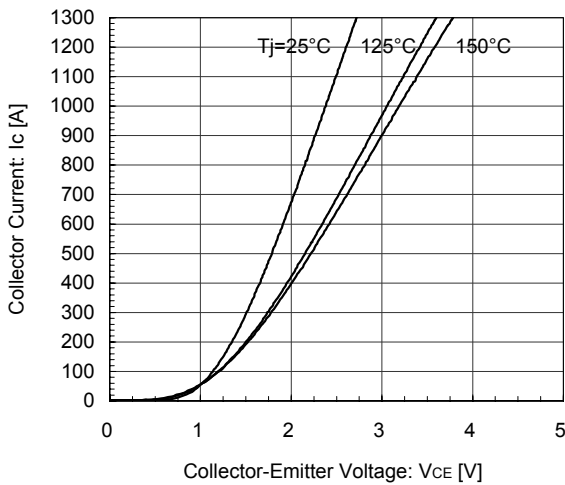
[INVERTER]

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



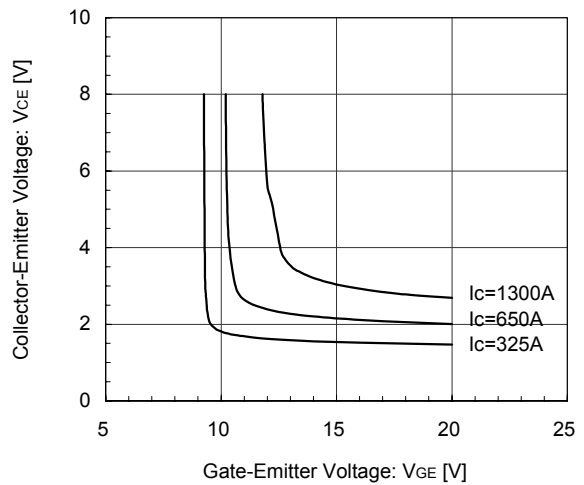
[INVERTER]

Collector current vs. Collector-Emittter voltage (typ.)  
VGE= 15V / chip



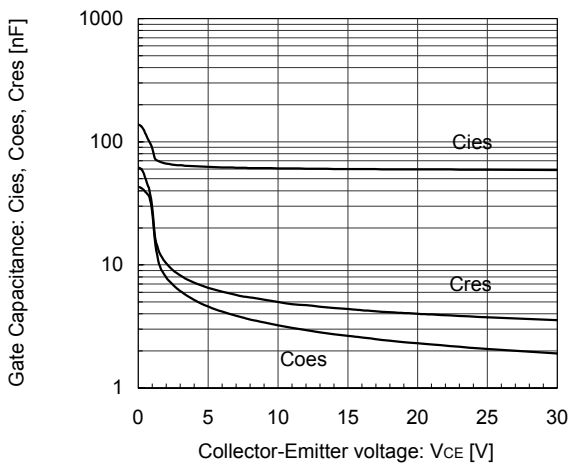
[INVERTER]

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



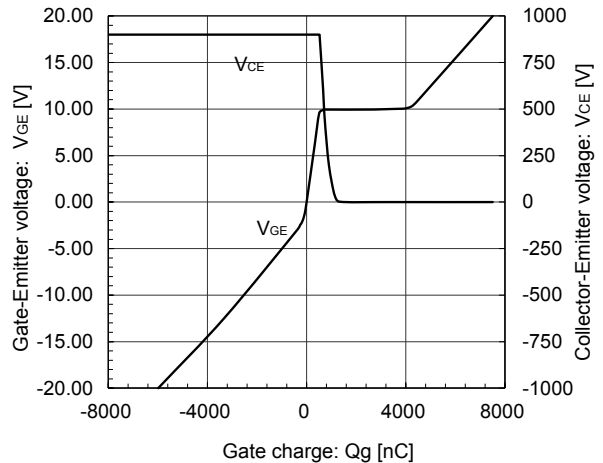
[INVERTER]

Gate Capacitance vs. Collector-Emittter Voltage (typ.)  
VGE= 0V, f= 1MHz, Tj= 25°C



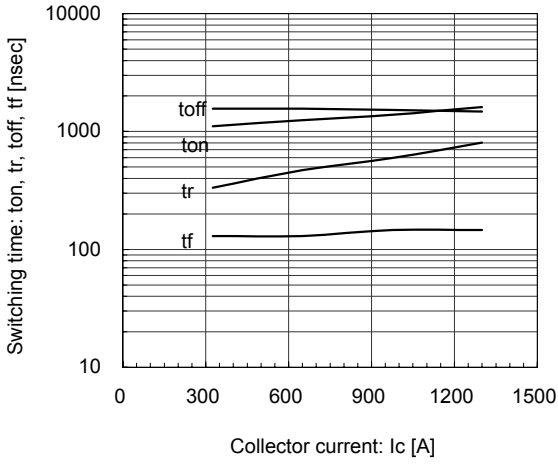
[INVERTER]

Dynamic Gate Charge (typ.)  
Vcc=900V, Ic=650A, Tj= 25°C



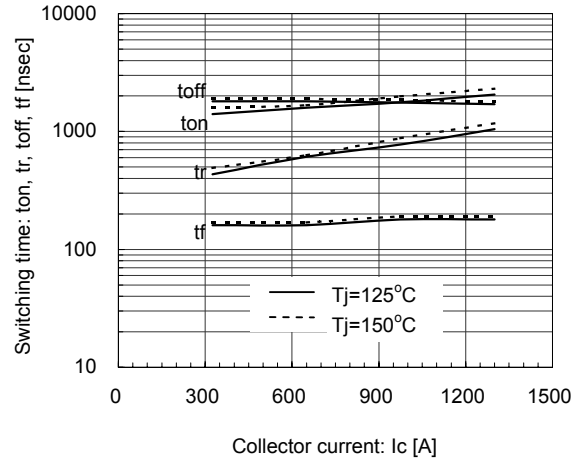
[INVERTER]

Switching time vs. Collector current (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=+1.8/-2.7\Omega, T_J=25^\circ C$



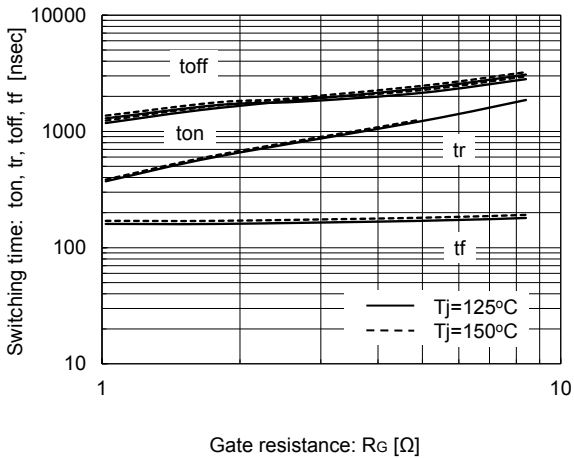
[INVERTER]

Switching time vs. Collector current (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=+1.8/-2.7\Omega, T_J=125^\circ C, 150^\circ C$



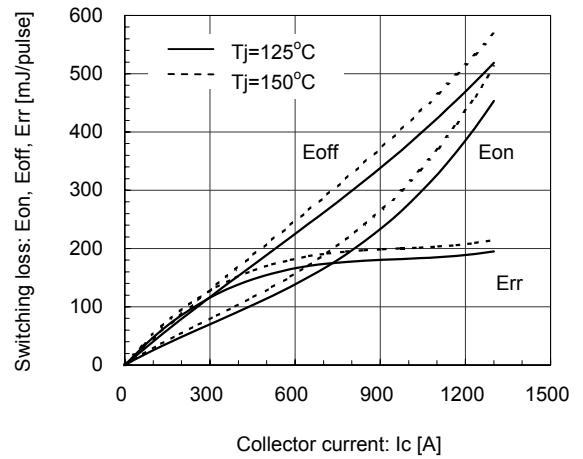
[INVERTER]

Switching time vs. Gate resistance (typ.)  
 $V_{CC}=900V, I_C=650A, V_{GE}=\pm 15V, T_J=125^\circ C, 150^\circ C$



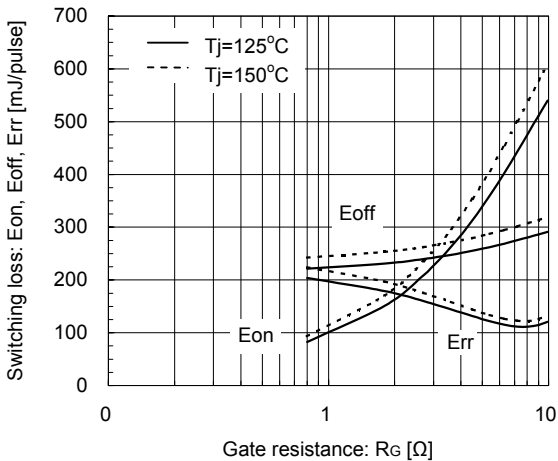
[INVERTER]

Switching loss vs. Collector current (typ.)  
 $V_{CC}=900V, V_{GE}=\pm 15V, R_G=+1.8/-2.7\Omega, T_J=125^\circ C, 150^\circ C$



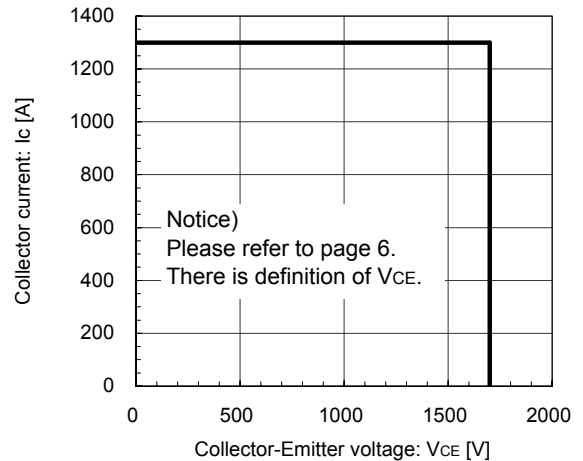
[INVERTER]

Switching loss vs. Gate resistance (typ.)  
 $V_{CC}=900V, I_C=650A, V_{GE}=\pm 15V, T_J=125^\circ C, 150^\circ C$



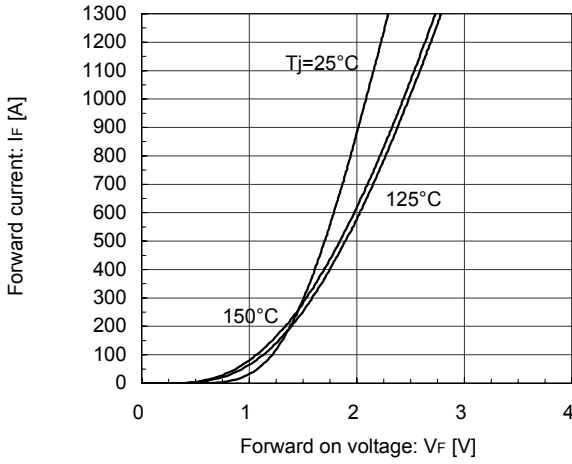
[INVERTER]

Reverse bias safe operating area (max.)  
 $+V_{GE}=15V, -V_{GE}=15V, R_G=+1.8/-2.7\Omega, T_J=150^\circ C$



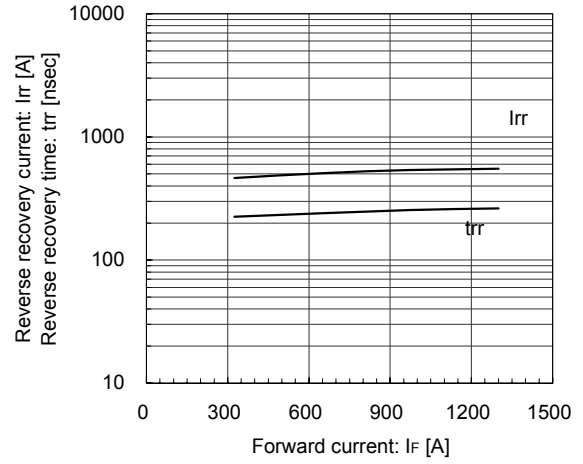
[INVERTER]

Forward Current vs. Forward Voltage (typ.)  
chip



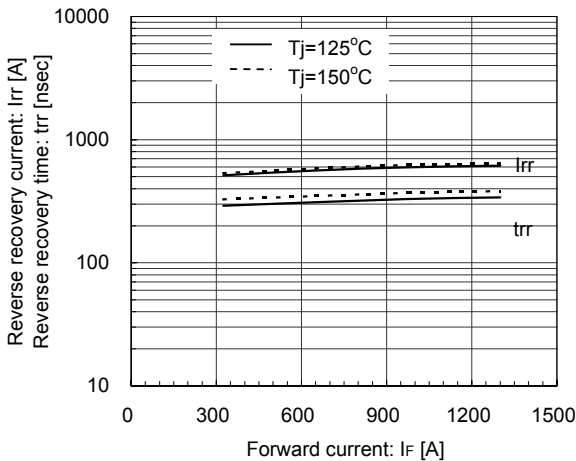
[INVERTER]

Reverse Recovery Characteristics (typ.)  
V<sub>CC</sub>=900V, V<sub>GE</sub>=±15V, R<sub>G</sub>=+1.8/-2.7Ω, T<sub>J</sub>=25°C

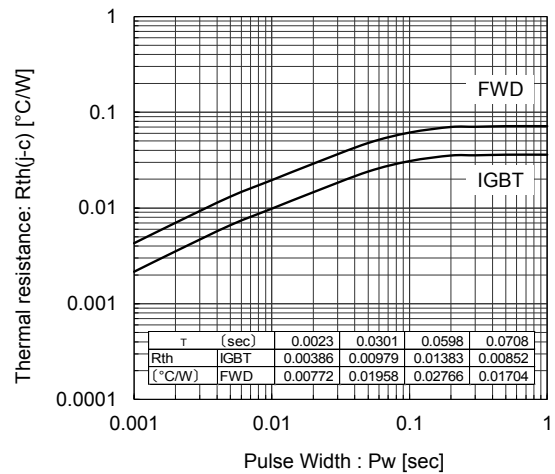


[INVERTER]

Reverse Recovery Characteristics (typ.)  
V<sub>CC</sub>=900V, V<sub>GE</sub>=±15V, R<sub>G</sub>=+1.8/-2.7Ω, T<sub>J</sub>=125°C, 150°C

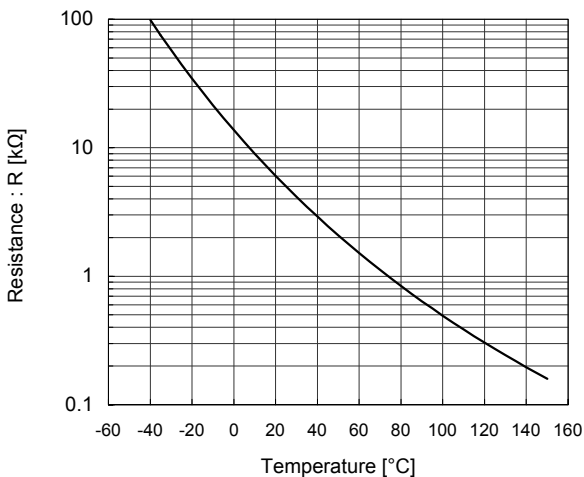


Transient Thermal Resistance (max.)



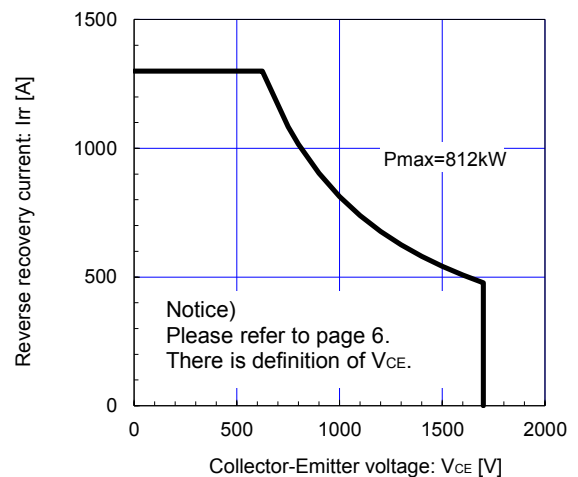
[THERMISTOR]

Temperature characteristic (typ.)

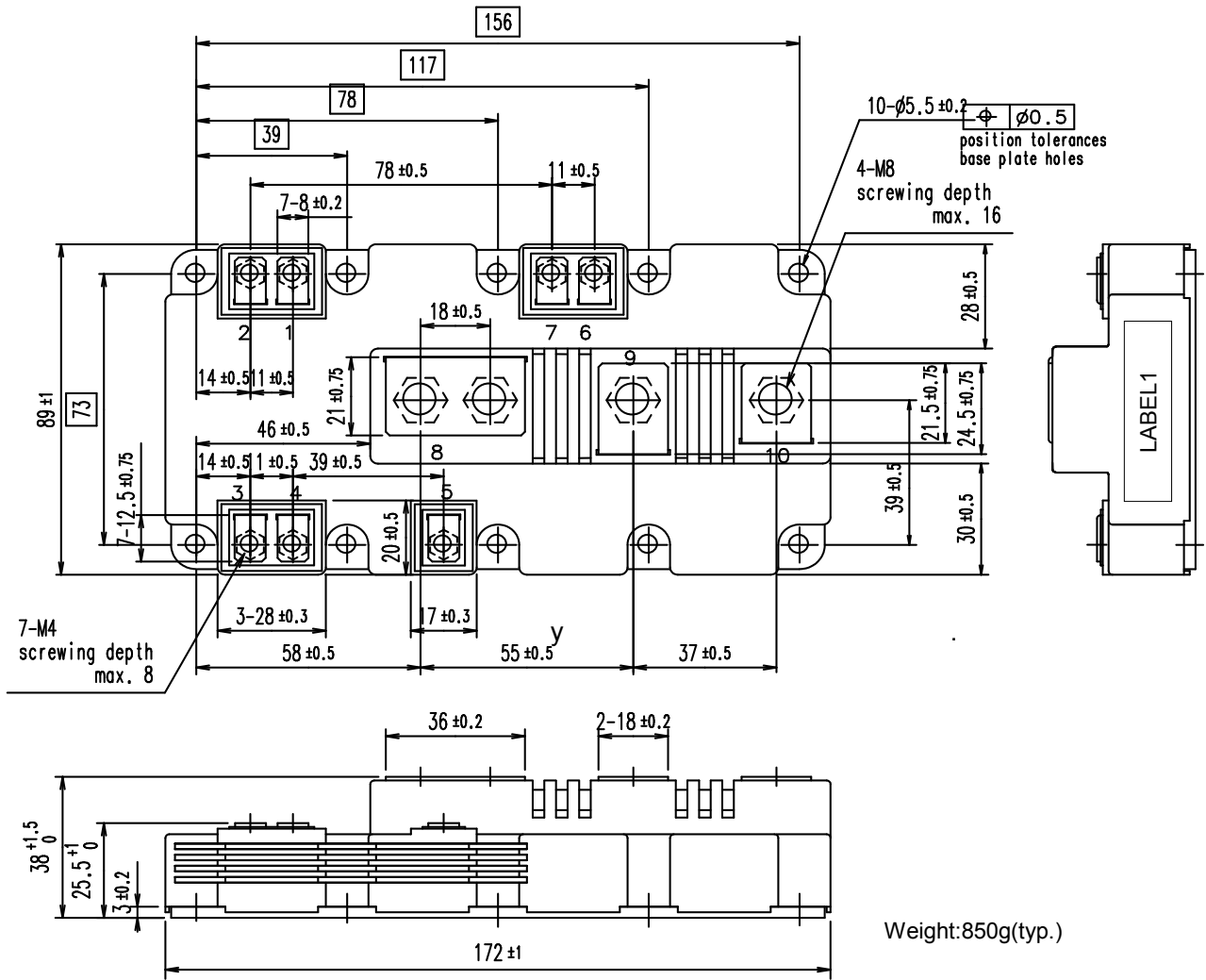


FWD safe operating area (max.)

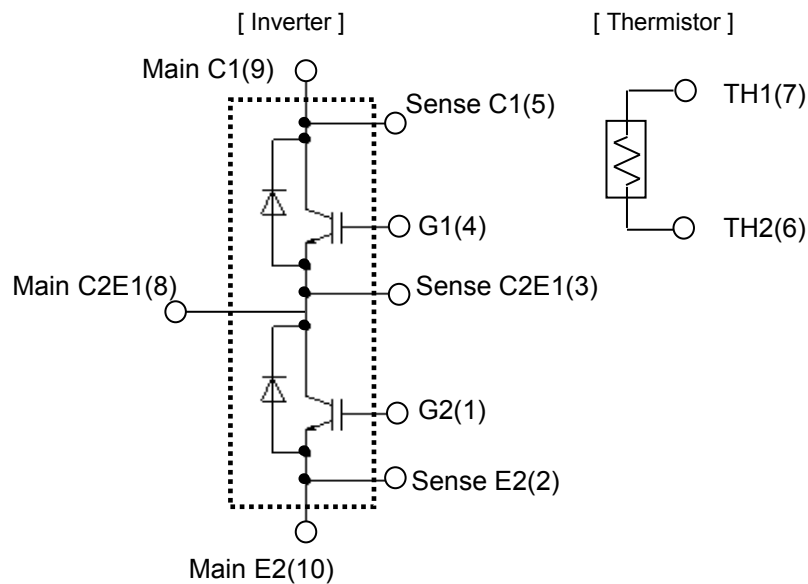
T<sub>J</sub>=150°C



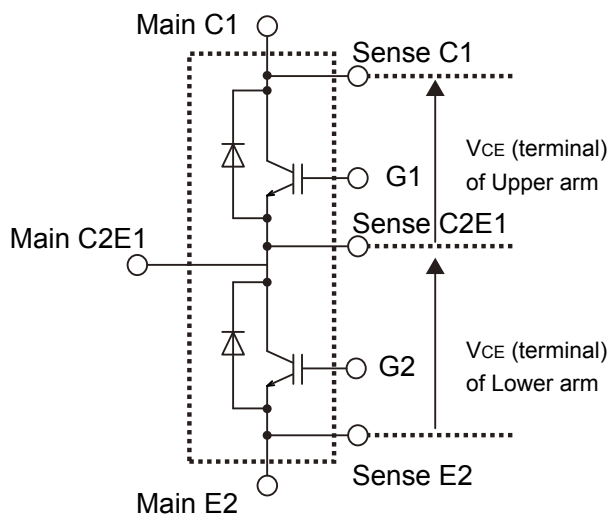
■ Outline Drawings (Unit: mm)



■ Equivalent Circuit



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



Fuji defined  $V_{CE}$  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  $V_{CE}$  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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**IGBT Modules**

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