

4MBI600VC-120-50

IGBT Modules

IGBT Power Module (V series) 1200V/600A/IGBT, 4-in-1 package

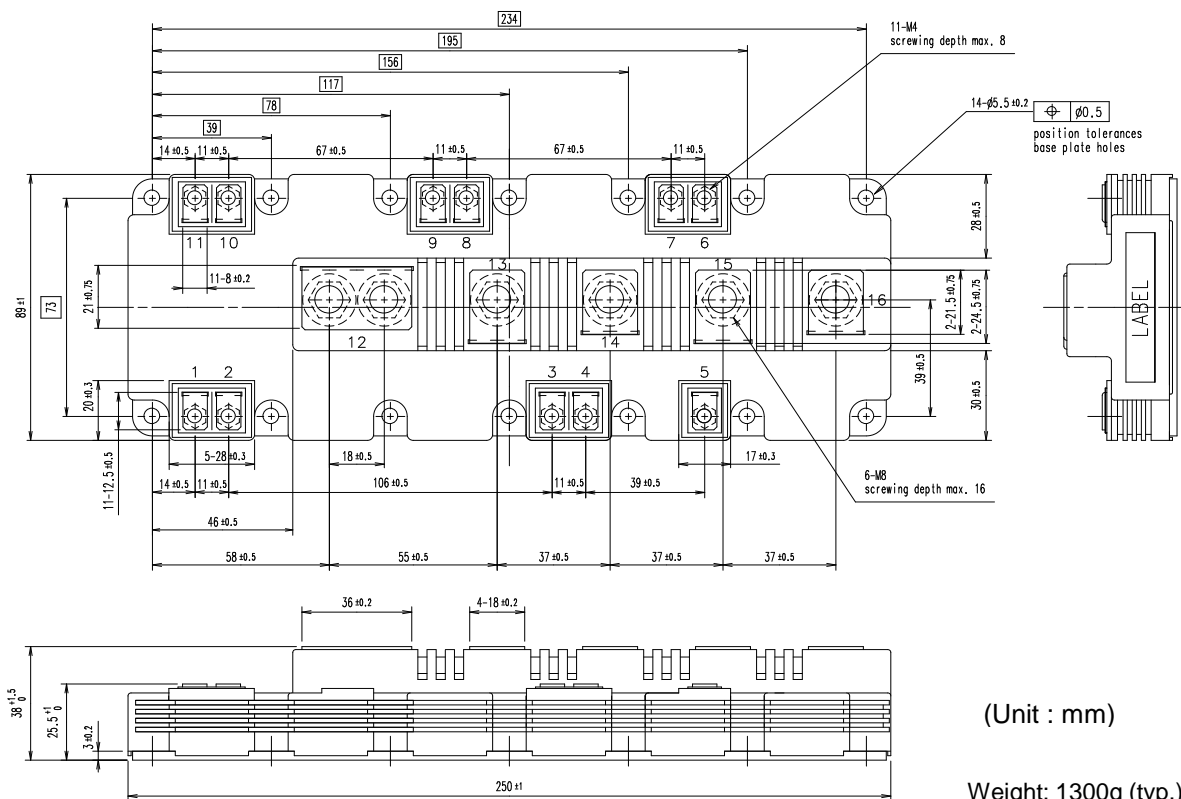
■ **Features**

- Higher efficiency
- Standard I-type 3-level circuit
- Low inductance module structure

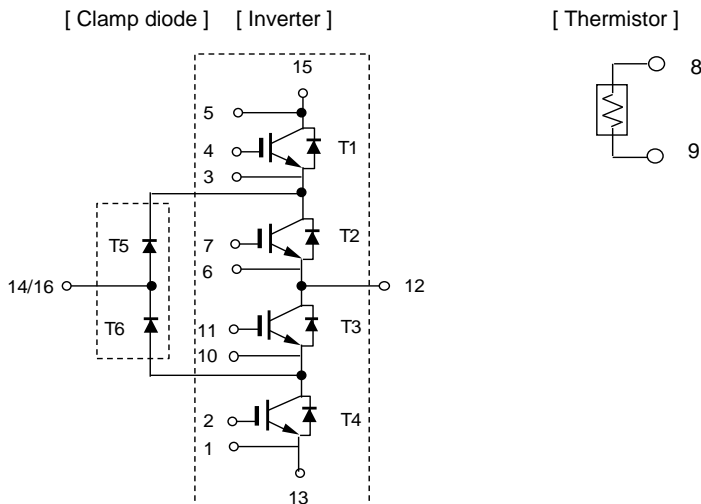
■ **Applications**

- Inverter for motor drive
- Uninterruptible power supply
- Power conditioner for PV, Wind turbine

■ **Outline drawing**



■ **Equivalent Circuit**



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■ Absolute Maximum Ratings (at $T_c = 25^\circ\text{C}$ unless otherwise specified)

Item		Symbol	Condition	Maximum Rating	Unit	
Inverter	Collector-Emitter voltage	V_{CES}		1200	V	
	Gate-Emitter voltage	V_{GES}		± 20	V	
	Collector current	IGBT	I_C	Continuous	$T_c=25^\circ\text{C}$ 800 $T_c=80^\circ\text{C}$ 600	A
			I_C pulse	1ms	1200	
		FWD	$-I_C$		600	
			$-I_C$ pulse	1ms	1200	
Collector power dissipation	P_C	1 device	2460	W		
Clamp diode	Repetitive peak reverse voltage	V_R		1200	A	
	Forward current	FWD	I_F	600		
			I_F pulse	1ms		1200
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 between thermistor and others (*2)	V_{iso}	AC: 1min.	4000	Vrms	
Screw	Mounting	-	M5	6.0	N m	
Torque (*3)	Main terminals	-	M8	10.0		
	Sense terminals	-	M4	2.1		

(*1) All terminals should be connected together during the test.

(*2) Two thermistor terminals should be connected together,
other terminals should be connected together and shorted to base plate during the test.

(*3) Recommended value : Mounting 3.0 ~ 6.0 Nm (M5)
Recommended value : Main Terminals 8.0 ~ 10.0 Nm (M8)
Recommended value : Sense Terminals 1.8 ~ 2.1 Nm (M4)

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

Item	Symbol	Condition	Characteristics			Units		
			min.	typ.	max.			
Inverter	Zero gate voltage Collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$	-	-	3.0	mA	
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0V$ $V_{GE} = \pm 20V$	-	-	600	nA	
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 600mA$	6.0	6.5	7.0	V	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	$V_{GE} = 15V$ $I_C = 600A$	$T_j = 25^\circ\text{C}$	-	1.85	2.10	V
				$T_j = 125^\circ\text{C}$	-	2.20	-	
				$T_j = 150^\circ\text{C}$	-	2.25	-	
		$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 600A$	$T_j = 25^\circ\text{C}$	-	1.95	-	
				$T_j = 125^\circ\text{C}$	-	2.30	-	
				$T_j = 150^\circ\text{C}$	-	2.35	-	
	Internal gate	$R_{G(int)}$	-	-	1.25	-	Ω	
	Input capacitance	C_{ies}	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$	-	50	-	nF	
	Turn-on time	t_{on}	SW mode : A, B $V_{CC} = 750V$ $I_C = 600A$	t_{on}	-	0.45	-	μs
				t_r	-	0.15	-	
				$t_{r(l)}$	-	0.05	-	
	Turn-off time	t_{off}	$V_{GE} = \pm 15V$ $R_G = +1.2/-0.56\Omega, L_g = 60nH$	t_{off}	-	0.70	-	
t_f				-	0.10	-		
Forward on voltage	V_F (chip)	$I_F = 600A$	$T_j = 25^\circ\text{C}$	-	1.70	1.95	V	
			$T_j = 125^\circ\text{C}$	-	1.85	-		
			$T_j = 150^\circ\text{C}$	-	1.80	-		
	V_F (terminal)	$I_F = 600A$	$T_j = 25^\circ\text{C}$	-	1.75	-		
			$T_j = 125^\circ\text{C}$	-	1.90	-		
			$T_j = 150^\circ\text{C}$	-	1.85	-		
Reverse recovery time	t_{rr}	Switching mode: B $V_{CC} = 750V, I_F = 600A$ $V_{GE} = \pm 15V, R_G = +1.2/-0.56\Omega$	-	0.15	-	μs		
Clamp diode	Reverse leakage current	I_R	$V_R = 1200V$	-	-	3.0	mA	
	Forward on voltage	V_F (chip)	$I_F = 600A$	$T_j = 25^\circ\text{C}$	-	1.70	1.95	V
				$T_j = 125^\circ\text{C}$	-	1.85	-	
				$T_j = 150^\circ\text{C}$	-	1.80	-	
	V_F (terminal)	$I_F = 600A$	$T_j = 25^\circ\text{C}$	-	1.80	-		
$T_j = 125^\circ\text{C}$			-	1.95	-			
			$T_j = 150^\circ\text{C}$	-	1.90	-		
Reverse recovery time	t_{rr}	Switching mode: A $V_{CC} = 750V, I_F = 600A$ $V_{GE} = \pm 15V, R_G = +1.2/-0.56\Omega$	-	0.15	-	μs		
Thermistor	Resistance	R	$T = 25^\circ\text{C}$	-	5000	-	Ω	
	B Value	B	$T = 100^\circ\text{C}$	465	495	520	K	
			$T = 25/50^\circ\text{C}$	3305	3375	3450	K	

■ Thermal resistance characteristics

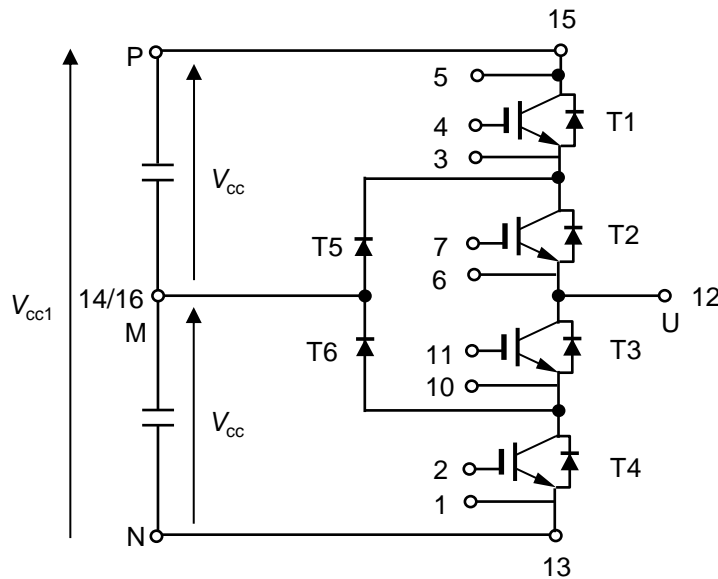
Item	Symbol	Condition	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1 device)	$R_{th(j-c)}$	Inverter-IGBT	-	-	0.061	$^\circ\text{C/W}$
		Inverter-FWD	-	-	0.092	
		Clamp diode-FWD	-	-	0.092	
Contact thermal resistance (1 device) (*1)	$R_{th(c-f)}$	Inverter-IGBT	-	0.0167	-	
		Inverter-FWD	-	0.0167	-	
		Clamp diode-FWD	-	0.0167	-	

(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound. (thermal conductivity = $1W/m \cdot k$)

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Definitions of on-stage voltage at terminal and switching characteristics

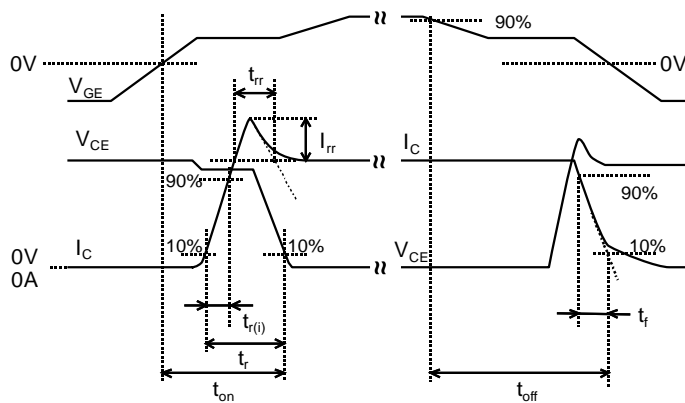


$V_{CE(sat)}/V_F$ values are measured between sense 5 and sense 3 for T1 arm, sense 3 and sense 6 for T2 arm, sense 6 and sense 10 for T3 arm, sense 10 and sense 1 for T4 arm, sense 14 and sense 3 for T5 arm and sense 10 and sense 14 for T6 arm.

SW mode	Load L	T1	T2	T3	T4
A	M-U	SW	ON	OFF	OFF
	M-U	OFF	OFF	ON	SW
B	U-N	OFF	SW	OFF	OFF
	P-U	OFF	OFF	SW	OFF

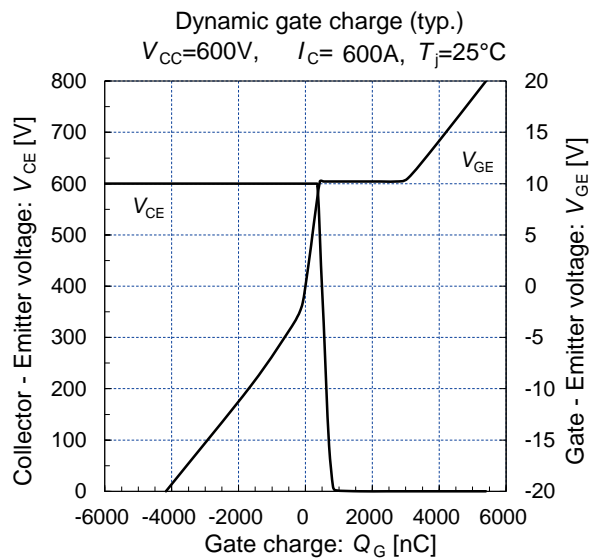
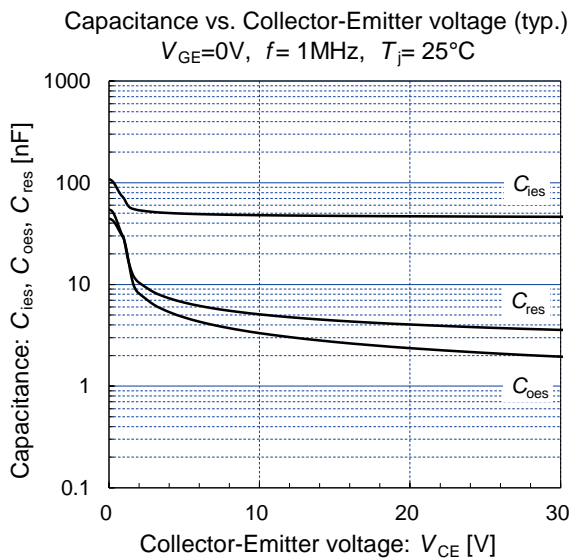
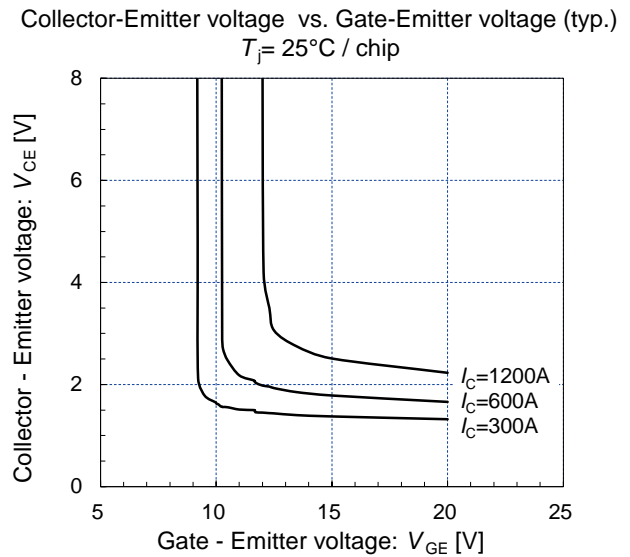
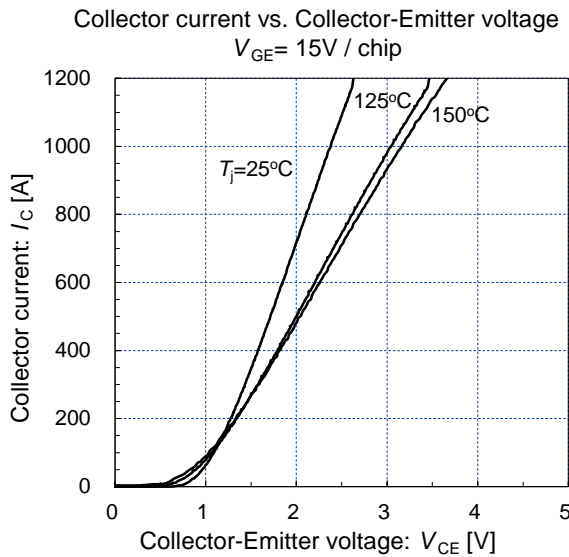
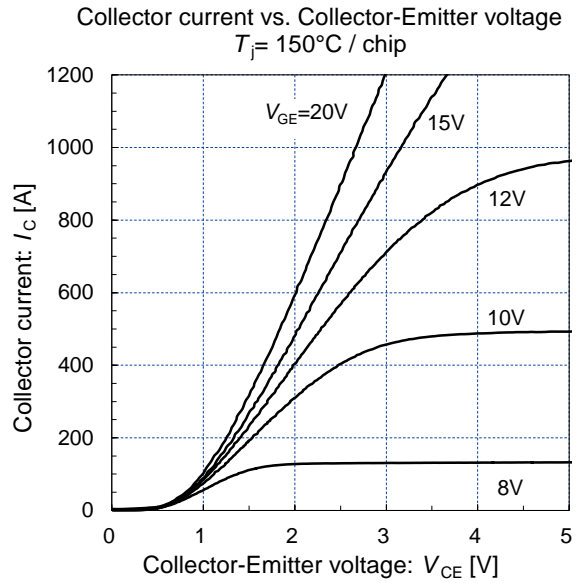
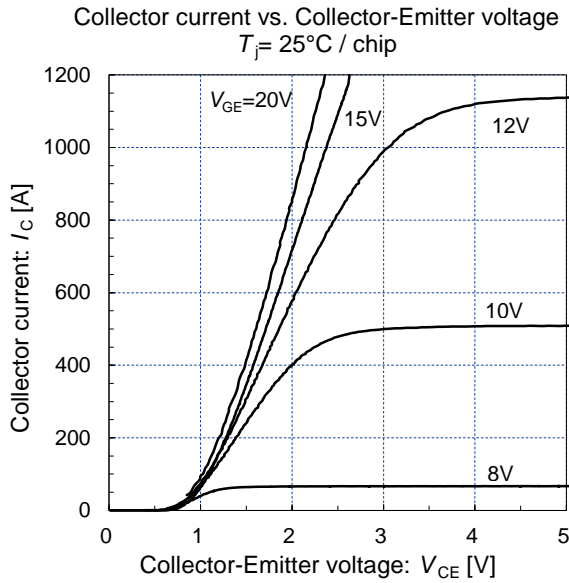
SW: Connect to drive circuit and input gate signal
 ON: Bias voltage of gate +15V
 OFF: Reverse bias voltage of gate -15V
 $V_{cc1}=2 \times V_{cc}$

Definitions of switching time



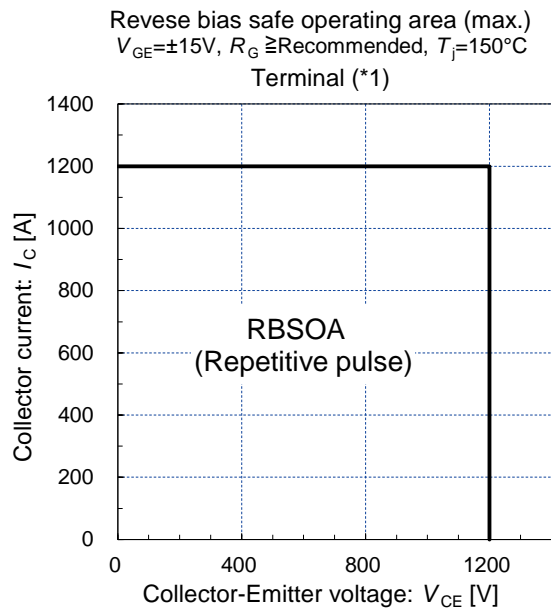
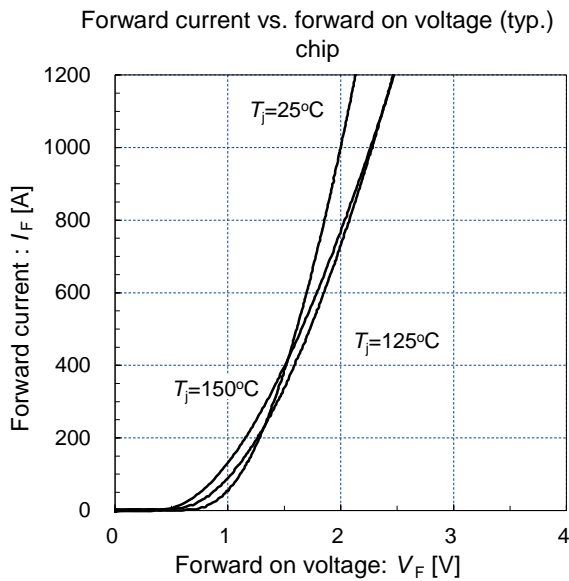
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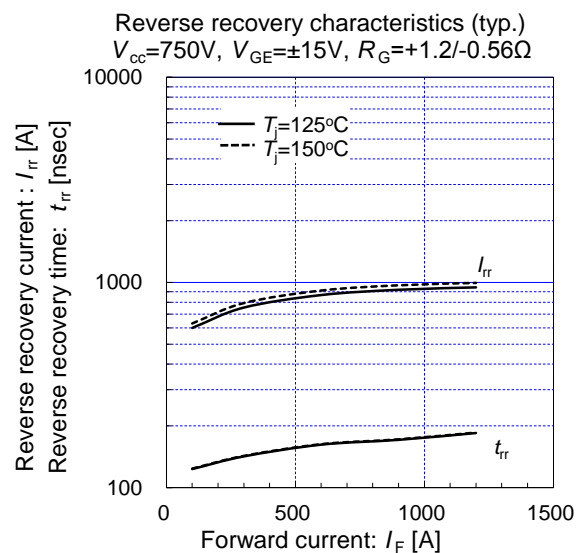
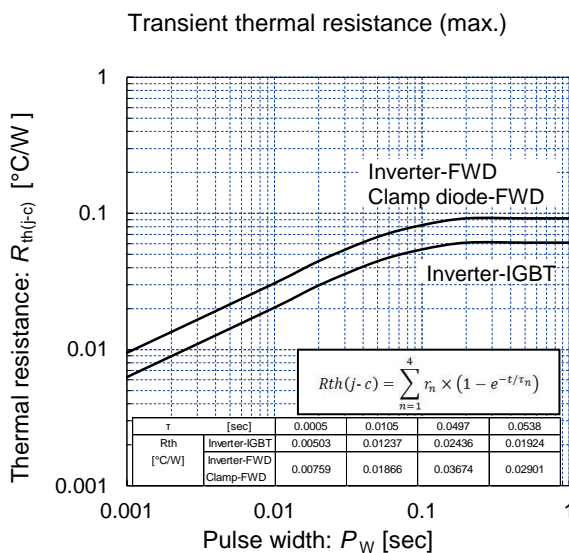
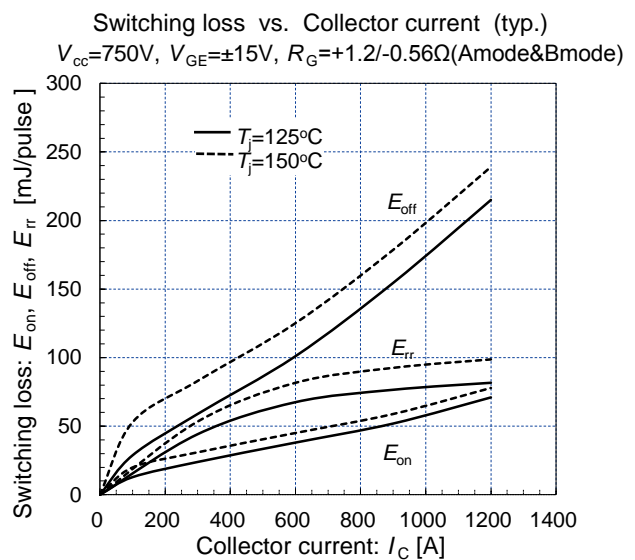
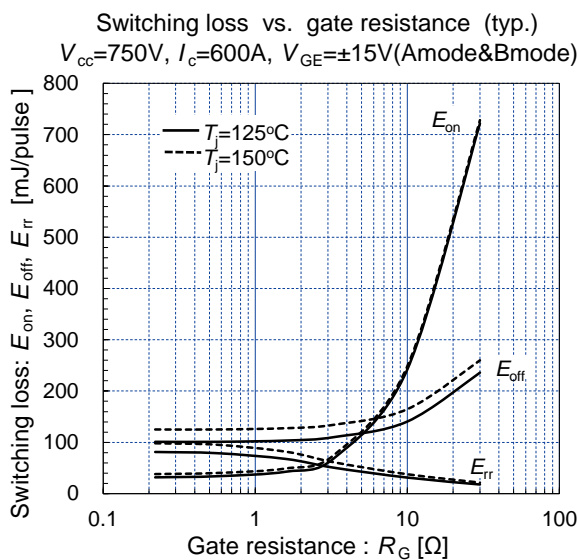


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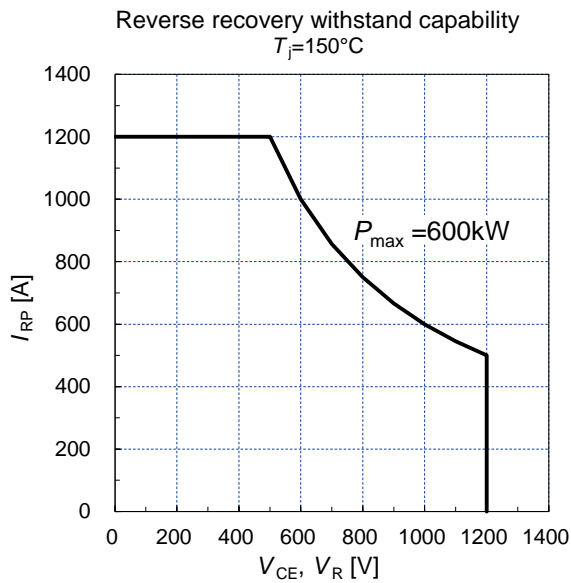
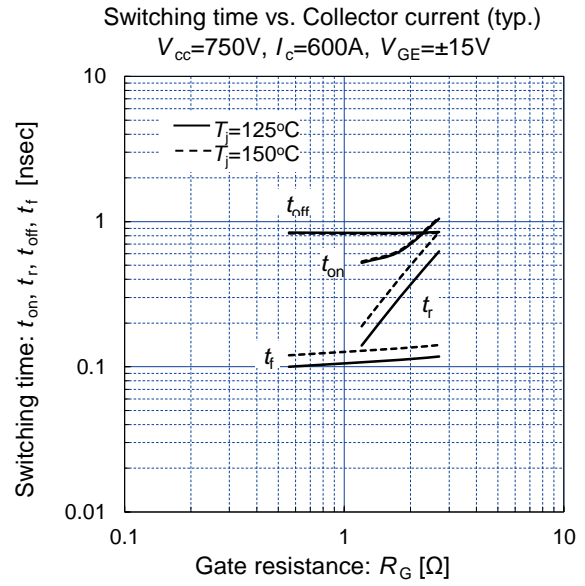
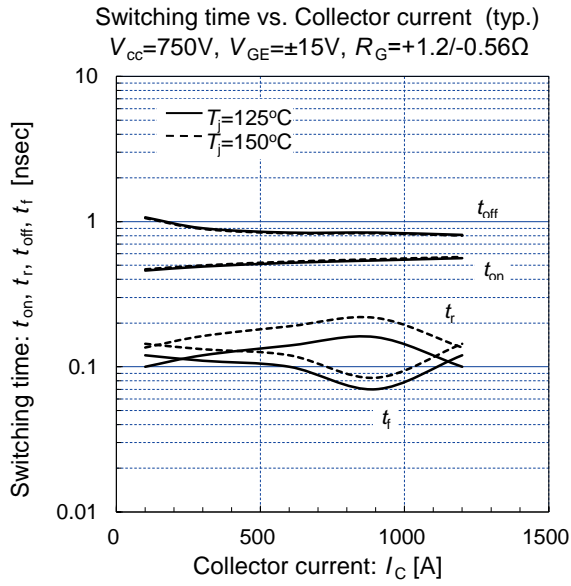


(*1) Please refer to Section 6 which has definition of terminal.



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V_{CE}, V_R are measured between :

- sense 5 and 6 for T1&T2
- sense 6 and 1 for T3&T4
- sense 14 and 3 for T5
- sense 10 and 14 for T6

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