

2MSI600VAN-120-53

SiC Hybrid Modules

Power Module (V-series IGBT&SiC SBD Hybrid type)
1200V / 600A / 2-in-1 package

■ **Features**

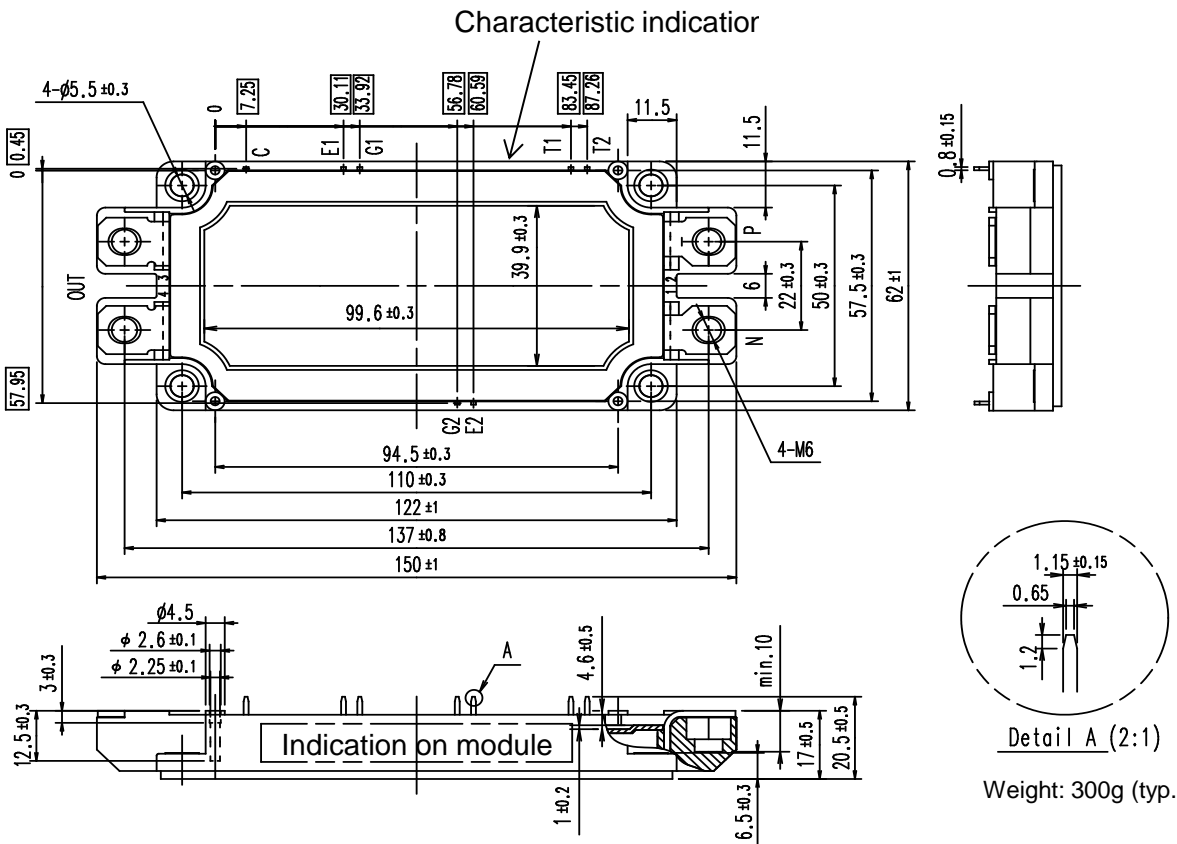
- High speed switching
- Voltage drive
- Low switching loss
- Low Inductance module structure

■ **Applications**

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply
- Active Front End

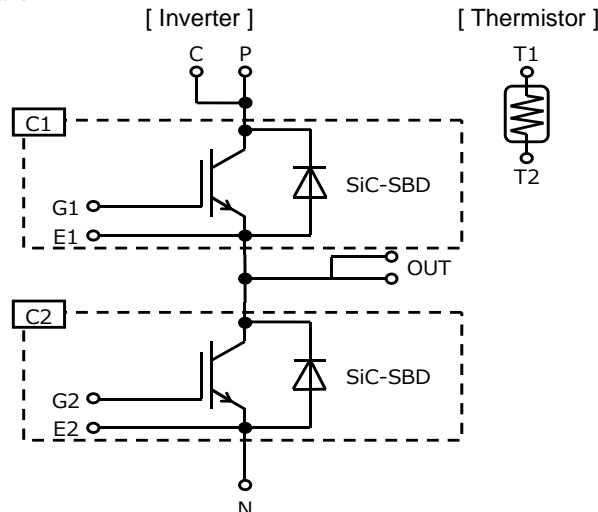


■ **Outline drawing (Unit : mm)**



NOTE) shows theoretical dimension and tolerance is ± 0.5

■ **Equivalent Circuit**



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■ 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}		± 20	V
Collector current		I_C	Continuous	$T_c = 25^\circ\text{C}$ 750 $T_c = 100^\circ\text{C}$ 600	A
		I_C pulse	1ms	1200	
		$-I_C$		600	
		$-I_C$ pulse	1ms	1200	
Collector power dissipation		P_C	1 device	3720	W
Junction temperature		T_{vj}	1 device	175	°C
Operating junction temperature (under switching conditions)		T_{vjop}		150	
Case temperature		T_c		125	
Storage temperature		T_{stg}		-40~125	
Isolation voltage	between terminal and copper base (*1)	V_{isol}	AC: 1min.	2500	VAC
	between thermistor and others (*2)				
Screw Torque	Mounting (*3)	-		3.5	N m
	Terminals (*4)	-		4.5	

(*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) Recommendable Value : 2.5-3.5 Nm (M5)

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

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

NOTICE:

The external gate resistance (R_G) shown in below is one of our recommend value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment. We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

Items	Symbols	Conditions	Characteristics			Units		
			min.	typ.	max.			
Inverter	Zero gate voltage Collector current	I_{CES}	$V_{GE} = 0\text{ V}, V_{CE} = 1200\text{ V}$	-	-	5.0	mA	
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0\text{ V}, V_{GE} = \pm 20\text{ V}$	-	-	600	nA	
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{ V}, I_C = 600\text{ mA}$	6.0	6.5	7.0	V	
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{ V}, I_C = 600\text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	-	2.65	3.10	V
				$T_{vj} = 125^{\circ}\text{C}$	-	3.15	-	
				$T_{vj} = 150^{\circ}\text{C}$	-	3.30	-	
		$V_{CE(sat)}$ (chip)		$T_{vj} = 25^{\circ}\text{C}$	-	1.85	2.30	
				$T_{vj} = 125^{\circ}\text{C}$	-	2.20	-	
	Internal gate resistance	$r_{g(int)}$	-	$T_{vj} = 25^{\circ}\text{C}$	-	1.25	-	Ω
				$T_{vj} = 150^{\circ}\text{C}$	-	2.25	-	
	Input capacitance	C_{ies}	$V_{CE} = 10\text{ V}, V_{GE} = 0\text{ V}, f = 100\text{ kHz}$	-	41	-	nF	
	Turn-on time	t_{on}	$V_{CC} = 600\text{ V}, I_C = 600\text{ A},$ $V_{GE} = \pm 15\text{ V}, R_G = 0.62\Omega,$ $L_s = 40\text{ nH}$	-	470	-	nsec	
		t_r		-	90	-		
		$t_{r(i)}$		-	80	-		
Turn-off time	t_{off}	$L_s = 40\text{ nH}$	-	790	-	nsec		
	t_f		-	100	-			
Forward voltage	V_F (terminal)	$V_{GE} = 0\text{ V}, I_F = 600\text{ A}$	$T_{vj} = 25^{\circ}\text{C}$	-	2.55	2.90	V	
			$T_{vj} = 125^{\circ}\text{C}$	-	3.20	-		
			$T_{vj} = 150^{\circ}\text{C}$	-	3.45	-		
	V_F (chip)		$T_{vj} = 25^{\circ}\text{C}$	-	1.80	2.10		
			$T_{vj} = 125^{\circ}\text{C}$	-	2.25	-		
Reverse recovery time	t_{rr}	$I_F = 600\text{ A}$	-	60	-	nsec		
Thermister	Resistance	$T = 25^{\circ}\text{C}$	-	5000	-	Ω		
		$T = 100^{\circ}\text{C}$	465	495	520			
B value	B	$T = 25/50^{\circ}\text{C}$	-	3375	3450	K		

5. Thermal resistance characteristics

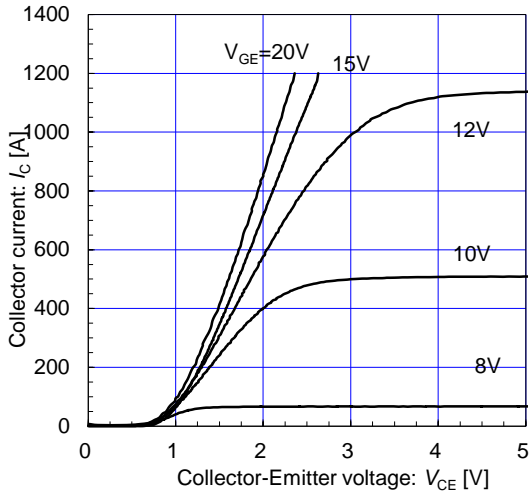
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance(1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.040	$^{\circ}\text{C/W}$
		Inverter FWD	-	-	0.070	
Contact thermal resistance (1device) (*1)	$R_{th(c-f)}$	with Thermal Compound	-	0.0167	-	

(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

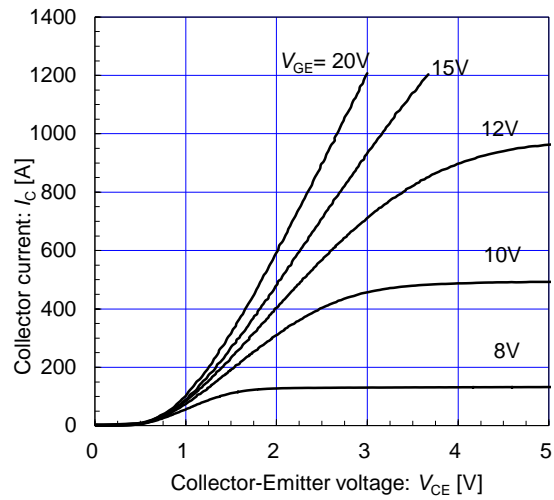
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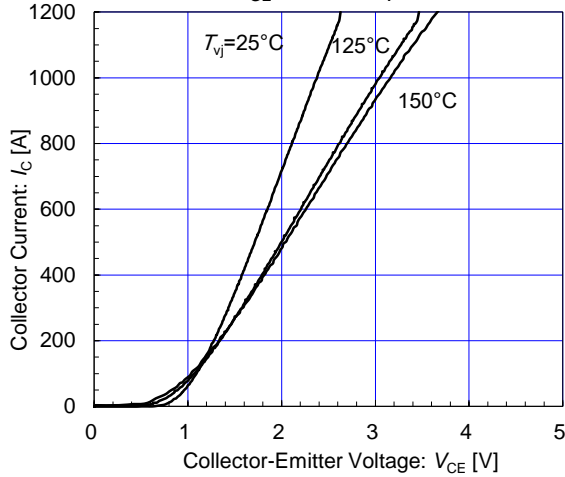
[INVERTER]
Collector current vs. Collector-Emittor voltage (typ.)
 $T_{vj} = 25^{\circ}\text{C}$ / chip



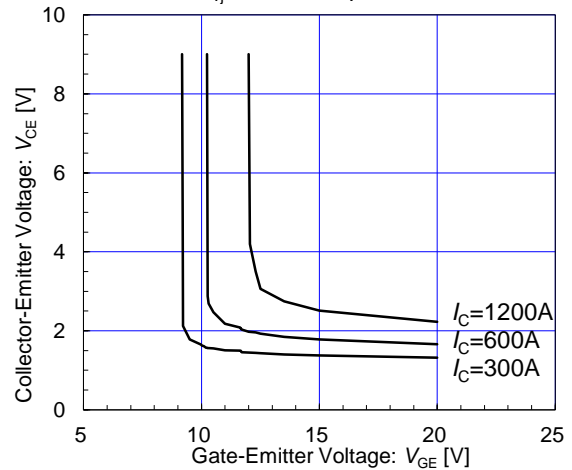
[INVERTER]
Collector current vs. Collector-Emittor voltage (typ.)
 $T_{vj} = 150^{\circ}\text{C}$ / chip



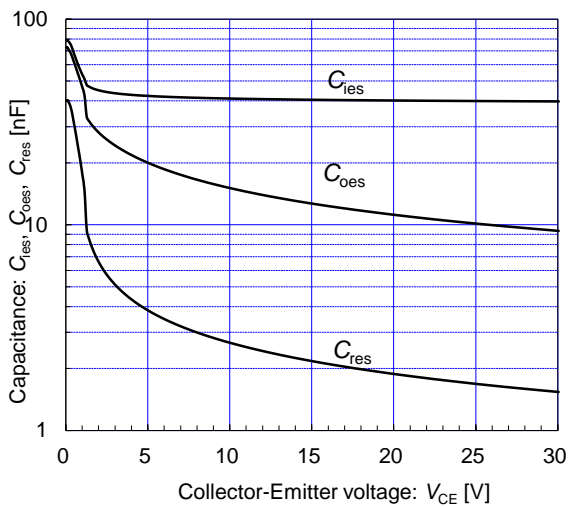
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Collector current vs. Collector-Emittor voltage (typ.)
 $V_{GE} = 15\text{V}$ / chip



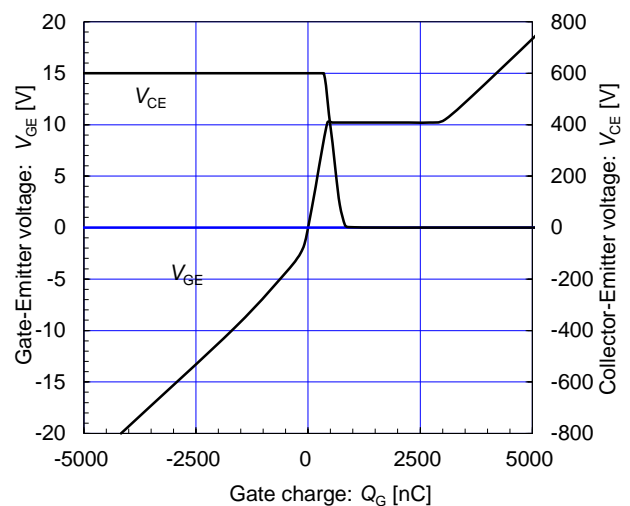
[INVERTER]
Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)
 $T_{vj} = 25^{\circ}\text{C}$ / chip



[INVERTER]
Gate Capacitance vs. Collector-Emittor Voltage (typ.)
 $V_{GE} = 0\text{V}$, $f = 100\text{kHz}$, $T_{vj} = 25^{\circ}\text{C}$

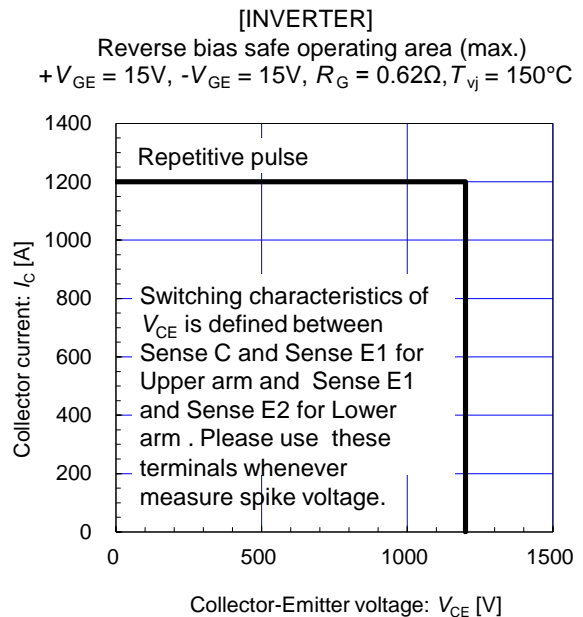
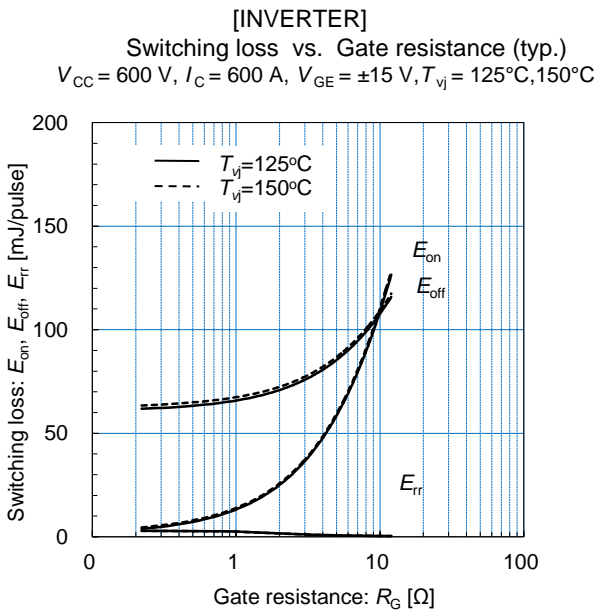
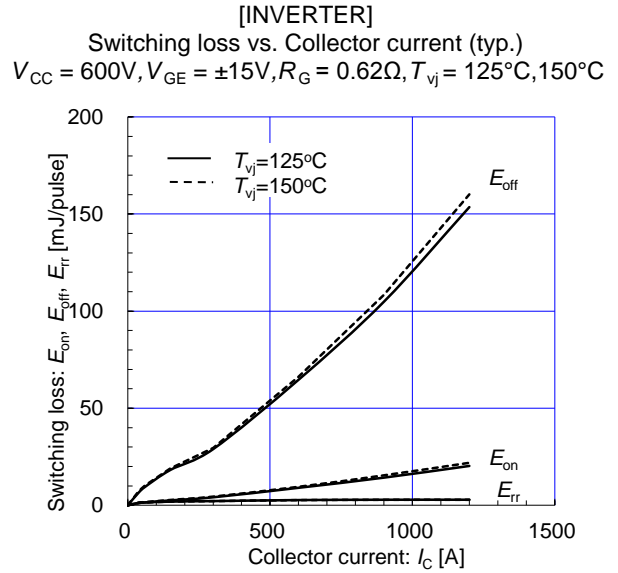
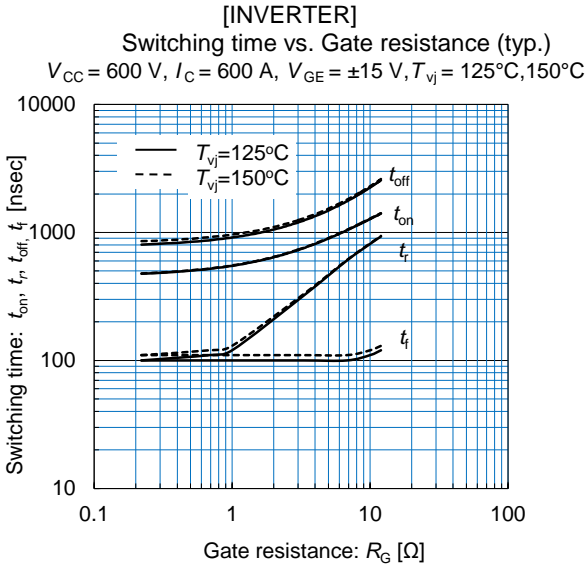
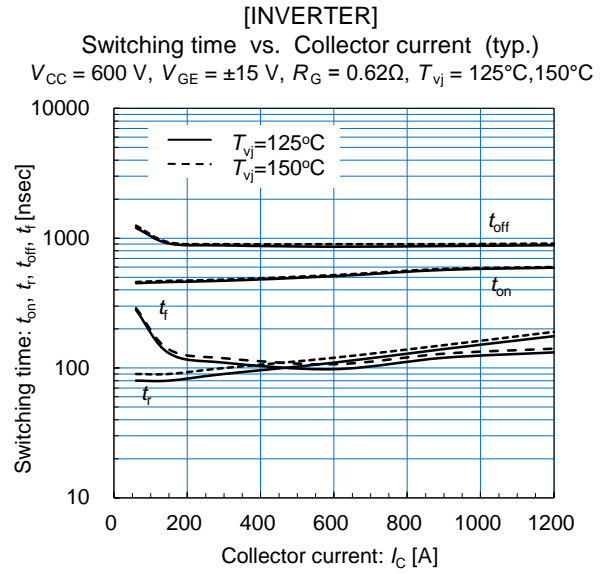
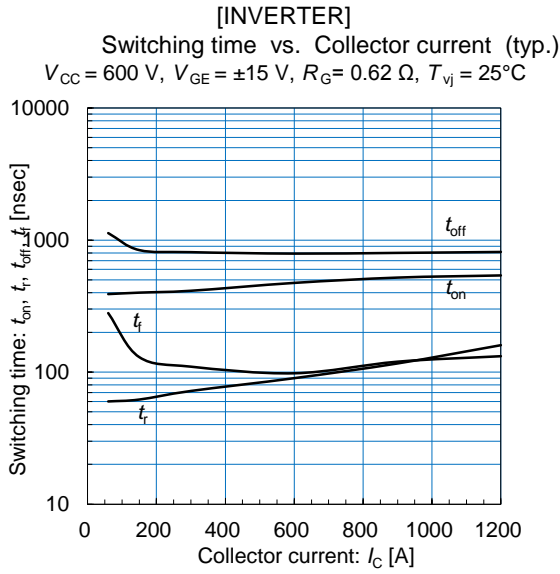


[INVERTER]
Dynamic Gate Charge (typ.)
 $V_{CC} = 600\text{V}$, $I_C = 600\text{A}$, $T_{vj} = 25^{\circ}\text{C}$



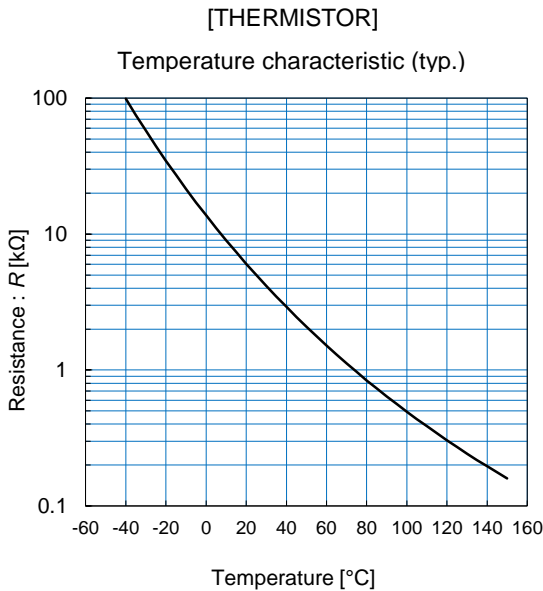
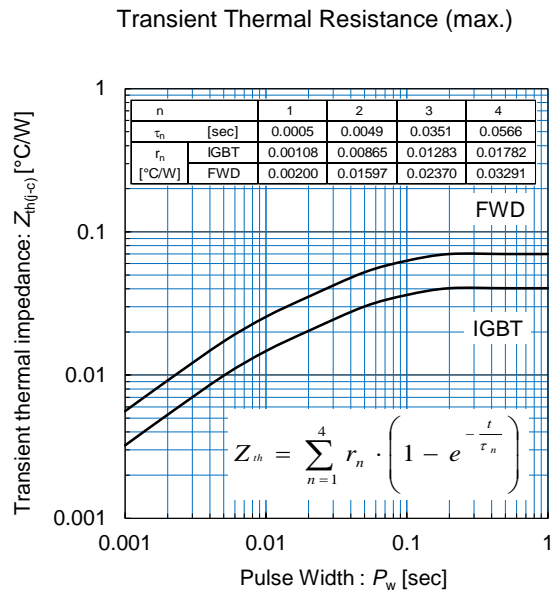
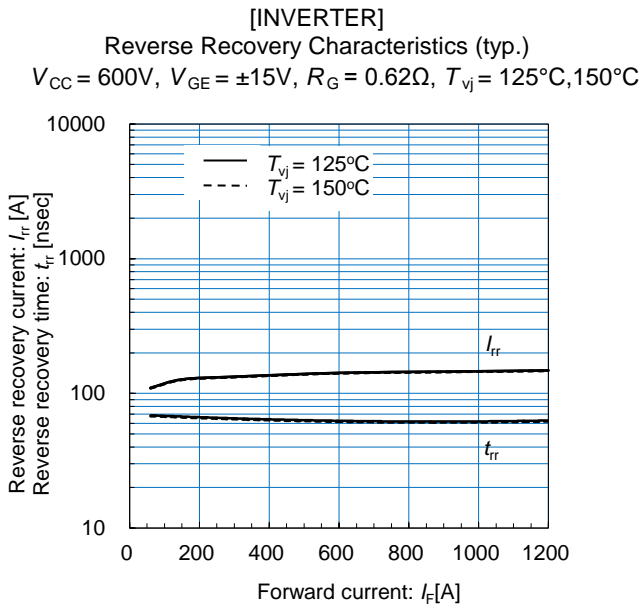
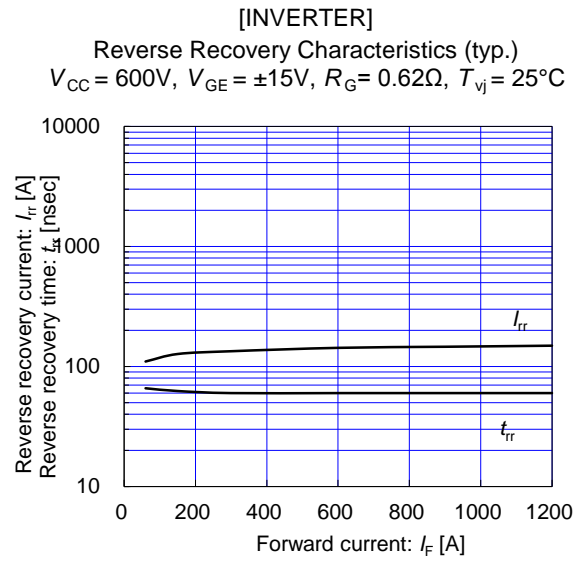
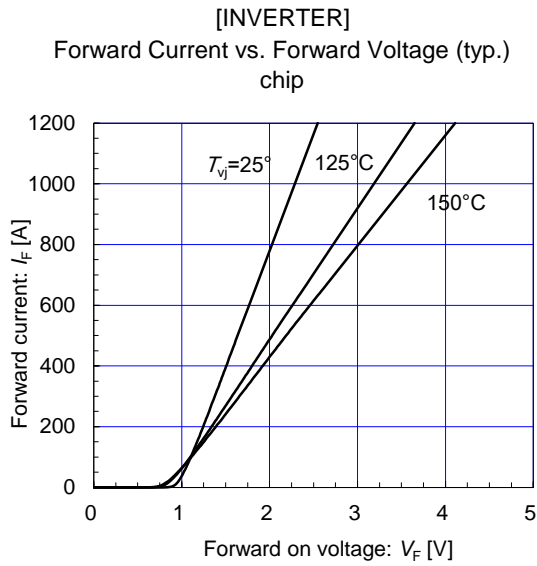
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