

2MBI600XEE120-50

IGBT Modules

Power Module (X series)
1200V / 600A / 2-in-1 package

■ Features

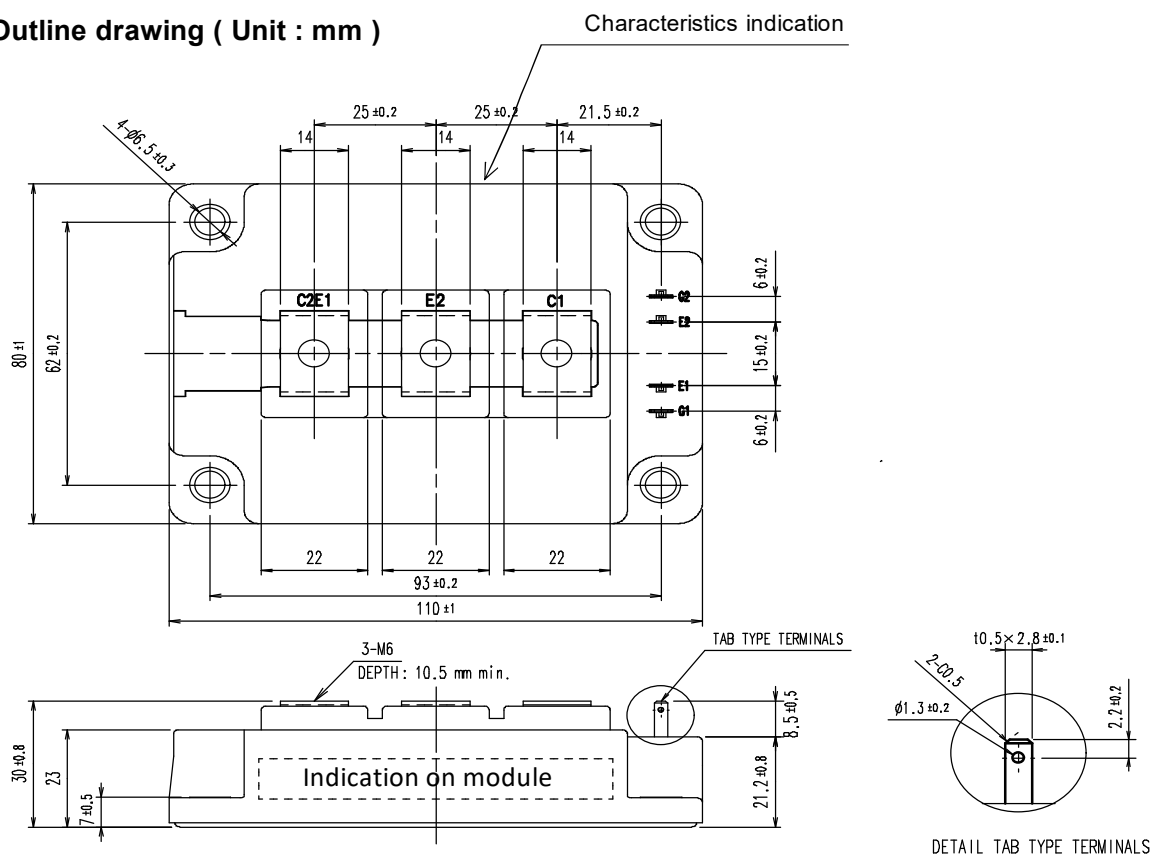
Low $V_{CE(sat)}$
 High speed switching
 Low Inductance Module structure

■ Applications

Inverter for Motor Drives, AC and DC Servo Drives
 Uninterruptible Power Supply Systems,
 Industrial machines, such as Welding machines

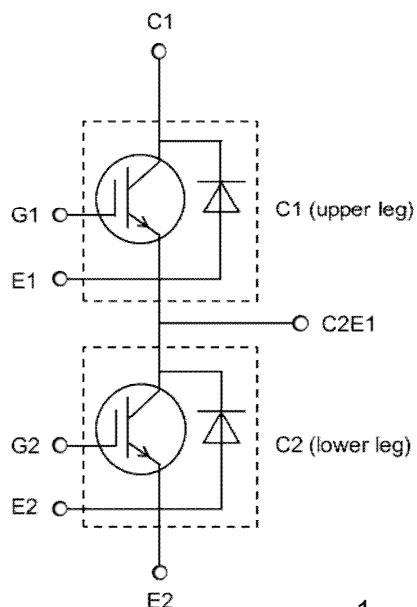


■ Outline drawing (Unit : mm)



Weight: 470 g(typ.)

■ 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, Gate-Emitter short-circuited		V_{CES}		1200	V
Gate-Emitter voltage, Collector-Emitter short-circuited		V_{GES}		± 20	V
Collector current		I_C	Continuous $T_c = 100^\circ\text{C}$	600	A
Repetitive peak collector current		I_{CRM}	1ms	1200	
Forward current		I_F		600	
Repetitive peak forward current		I_{FRM}	1ms	1200	
Total power dissipation		P_{tot}	1 device	3945	W
Virtual junction temperature		T_{vj}		175	$^\circ\text{C}$
Operating virtual junction temperature		T_{vjop}		175	
Case temperature		T_c		125	
Storage temperature		T_{stg}		-40 ~ 125	
Isolation voltage	Between terminal and copper base (*1)	V_{isol}	AC: 1min.	4000	Vrms
Mounting torque of screws to heat sink		M_s	M5 or M6	3.0 ~ 6.0	N m
Mounting torque of screws to terminals		M_t	M6	2.5 ~ 5.0	

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

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

Items	Symbols	Conditions		Characteristics			Units
				min.	typ.	max.	
Collector-Emitter cut -off current, Gate-Emitter short - circuited	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	200	μA
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	400	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	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 600A$	$T_{vj}=25^{\circ}C$	-	1.65	2.10	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.40	1.85	
			$T_{vj}=125^{\circ}C$	-	1.70	-	
			$T_{vj}=150^{\circ}C$	-	1.80	-	
			$T_{vj}=175^{\circ}C$	-	1.85	-	
Internal gate resistance	r_g	-		-	1.63	-	Ω
Input capacitance	C_{ies}	$V_{CE}=10V, V_{GE}=0V, f=1MHz$		-	70	-	nF
Output capacitance	C_{oes}			-	2.4	-	
Reverse transfer capacitance	C_{res}			-	0.62	-	
Gate charge	Q_G	$V_{CC} = 600V, I_C = 600A$ $V_{GE} = -15 \rightarrow +15V$		-	4450	-	nC
Forward voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F = 600A$	$T_{vj}=25^{\circ}C$	-	1.80	2.25	V
	V_F (chip)		$T_{vj}=25^{\circ}C$	-	1.55	2.00	
			$T_{vj}=125^{\circ}C$	-	1.65	-	
			$T_{vj}=150^{\circ}C$	-	1.60	-	
			$T_{vj}=175^{\circ}C$	-	1.55	-	
Turn-on delay time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F = 600A$ $V_{GE} = +15/ -15V$ $R_G = 0.56 \Omega$ $L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}C$	-	415	-	ns
			$T_{vj}=125^{\circ}C$	-	430	-	
			$T_{vj}=150^{\circ}C$	-	435	-	
			$T_{vj}=175^{\circ}C$	-	440	-	
Rise time (*1)	t_r		$T_{vj}=25^{\circ}C$	-	95	-	
			$T_{vj}=125^{\circ}C$	-	105	-	
			$T_{vj}=150^{\circ}C$	-	105	-	
			$T_{vj}=175^{\circ}C$	-	115	-	
Turn-off delay time (*1)	$t_{d(off)}$		$T_{vj}=25^{\circ}C$	-	395	-	
			$T_{vj}=125^{\circ}C$	-	435	-	
			$T_{vj}=150^{\circ}C$	-	445	-	
			$T_{vj}=175^{\circ}C$	-	445	-	
Fall time (*1)	t_f		$T_{vj}=25^{\circ}C$	-	115	-	
			$T_{vj}=125^{\circ}C$	-	175	-	
			$T_{vj}=150^{\circ}C$	-	190	-	
			$T_{vj}=175^{\circ}C$	-	210	-	
Reverse recovery time	t_{rr}		$T_{vj}=25^{\circ}C$	-	275	-	
			$T_{vj}=125^{\circ}C$	-	555	-	
			$T_{vj}=150^{\circ}C$	-	625	-	
			$T_{vj}=175^{\circ}C$	-	690	-	

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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

Items	Symbols	Conditions		Characteristics			Units
				min.	typ.	max.	
Turn-on energy	E_{on}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	35.3	-	mJ
		$I_C, I_F = 600A$	$T_{vj}=125^{\circ}C$	-	60.1	-	
		$V_{GE} = +15/-15V$	$T_{vj}=150^{\circ}C$	-	66.3	-	
		$R_G = 0.56 \Omega$	$T_{vj}=175^{\circ}C$	-	75.2	-	
Turn-off energy	E_{off}	$L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}C$	-	41.1	-	
			$T_{vj}=125^{\circ}C$	-	52.5	-	
			$T_{vj}=150^{\circ}C$	-	55.4	-	
			$T_{vj}=175^{\circ}C$	-	56.9	-	
Reverse recovery energy	E_{rr}		$T_{vj}=25^{\circ}C$	-	16.4	-	
			$T_{vj}=125^{\circ}C$	-	30.4	-	
			$T_{vj}=150^{\circ}C$	-	33.9	-	
			$T_{vj}=175^{\circ}C$	-	38.3	-	

NOTICE:

The external gate resistance (R_G) shown above is one of our recommended 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.

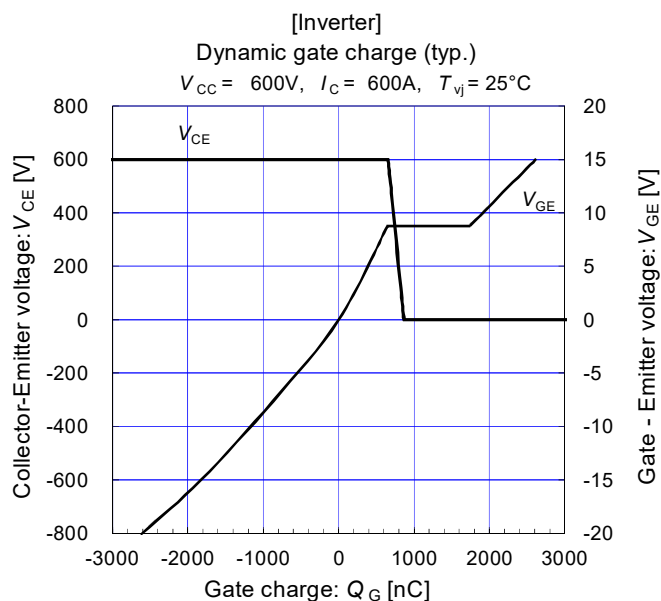
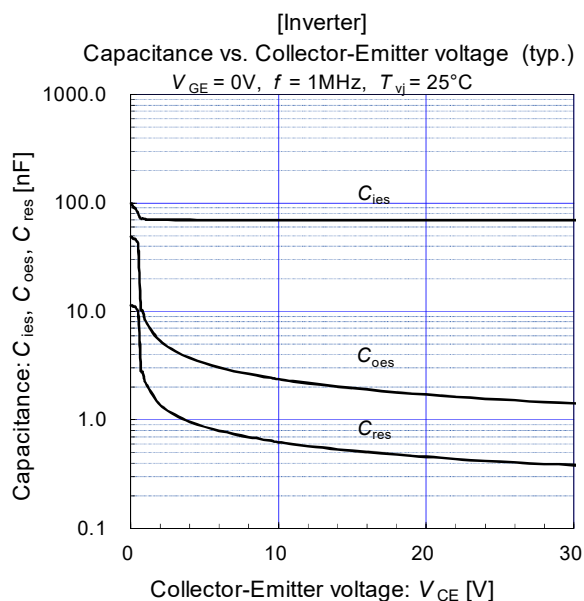
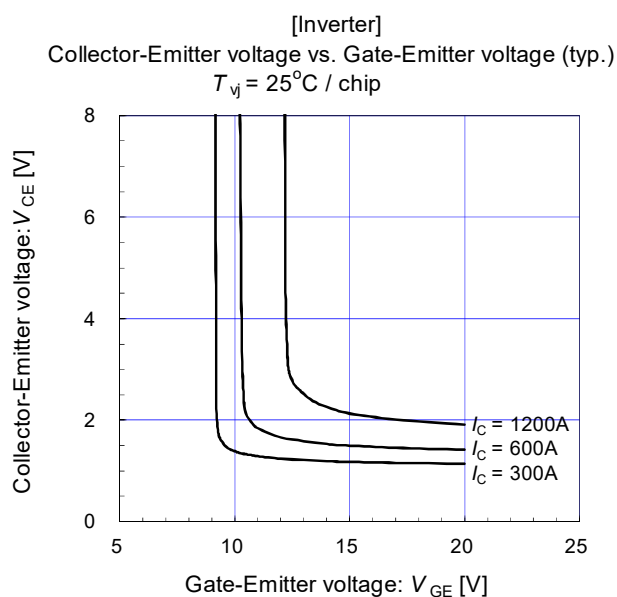
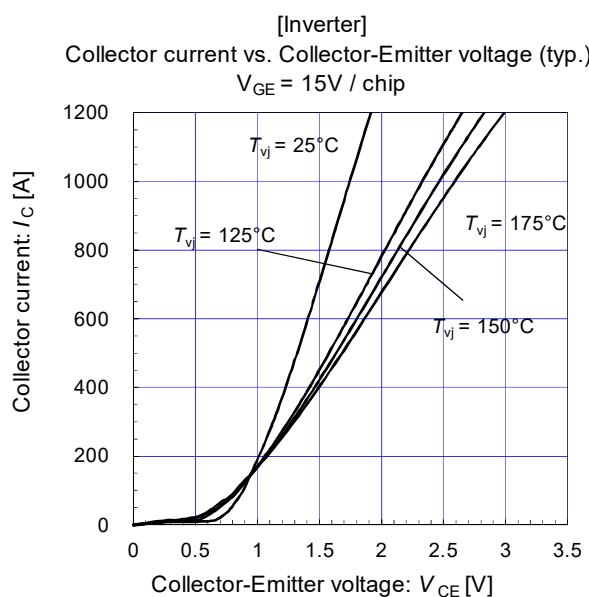
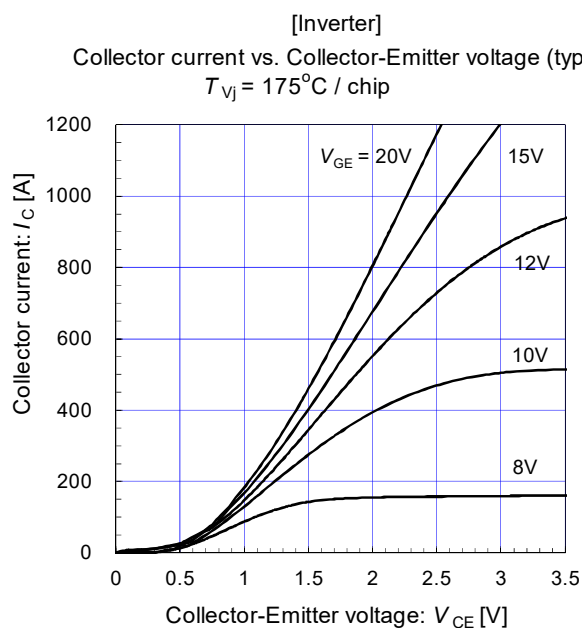
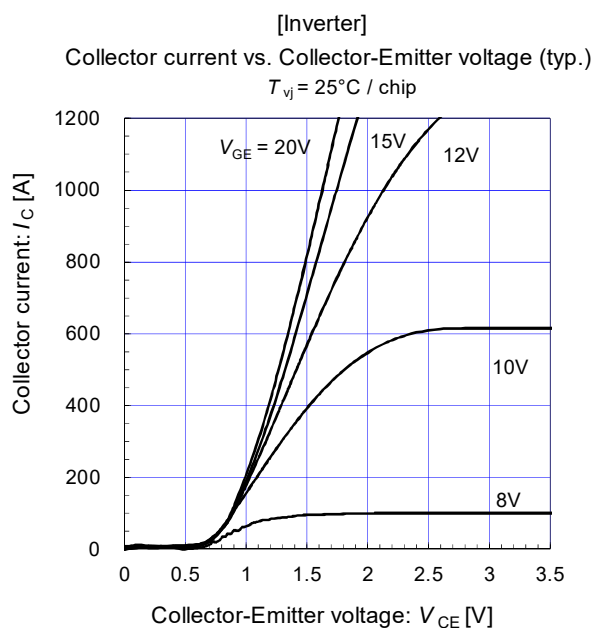
■ Thermal resistance characteristics

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.038	K/W
		Inverter FWD	-	-	0.063	
Thermal resistance case to heat sink (1IGBT + 1FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0125	-	

(*1) This is the value which is defined mounting on the additional heat sink with thermal grease.

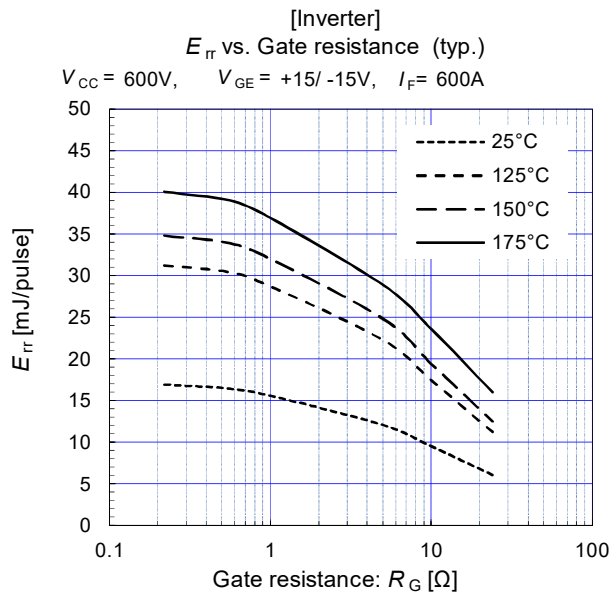
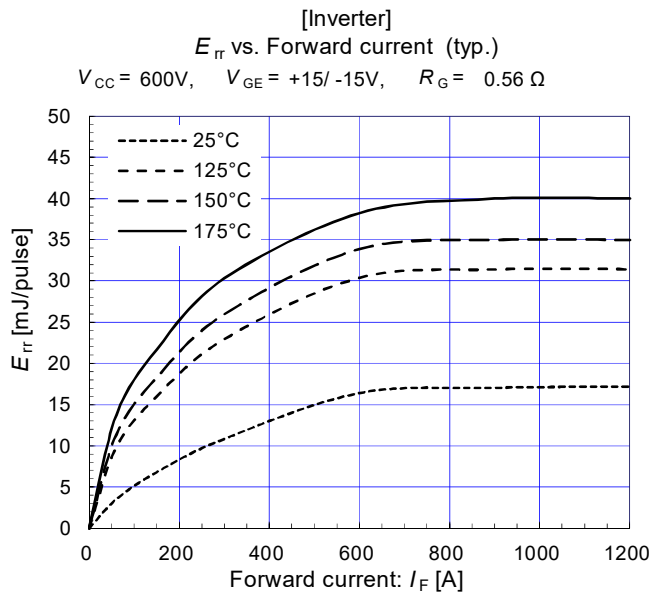
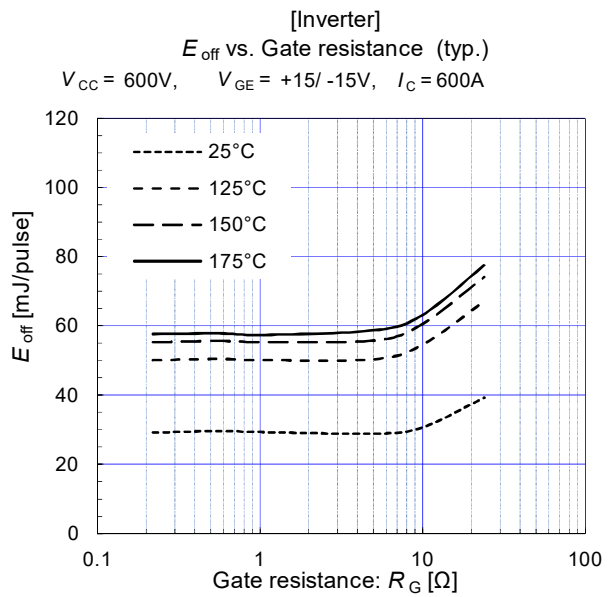
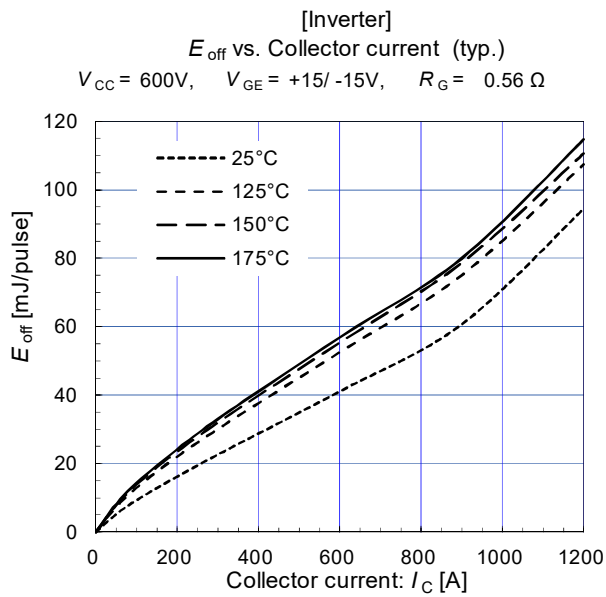
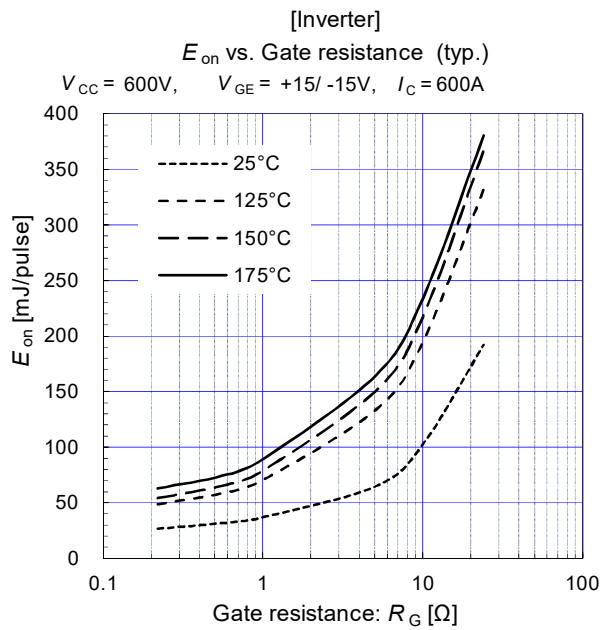
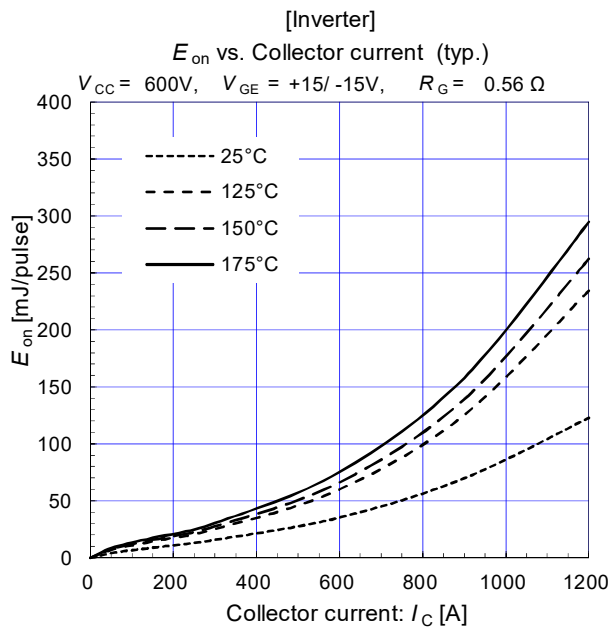
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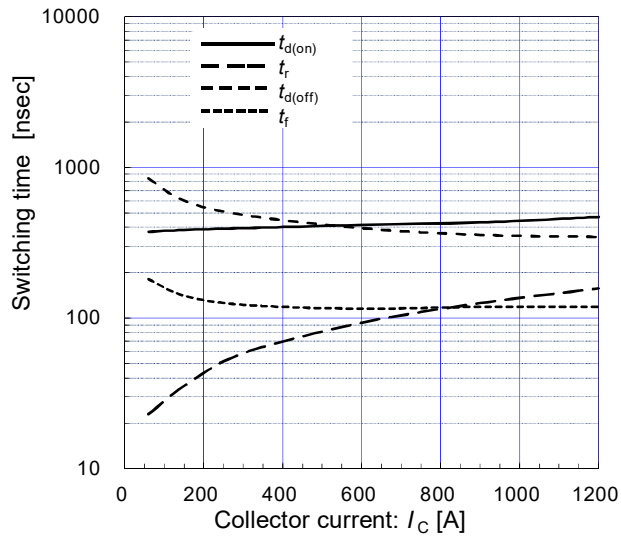
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[Inverter]

Switching time vs. Collector current (typ.)

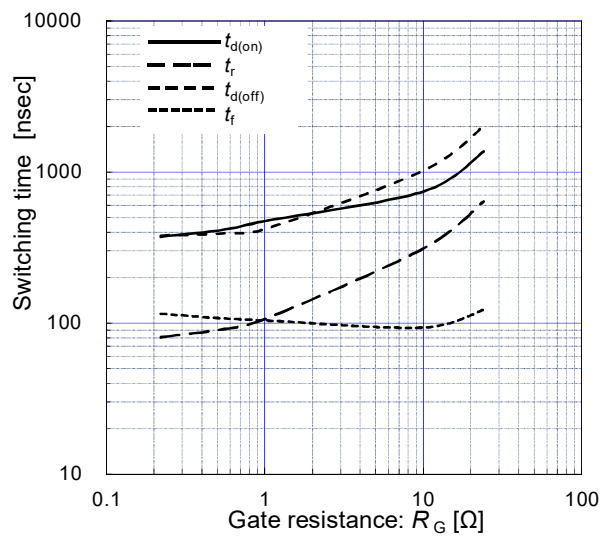
$V_{CC} = 600V$, $R_G = 0.56\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

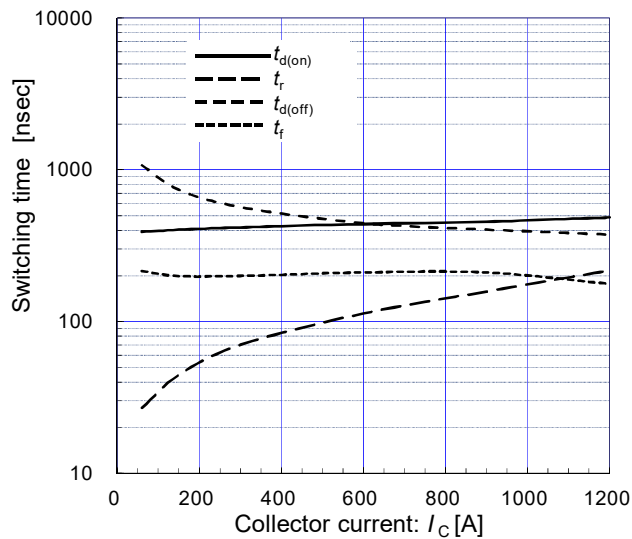
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

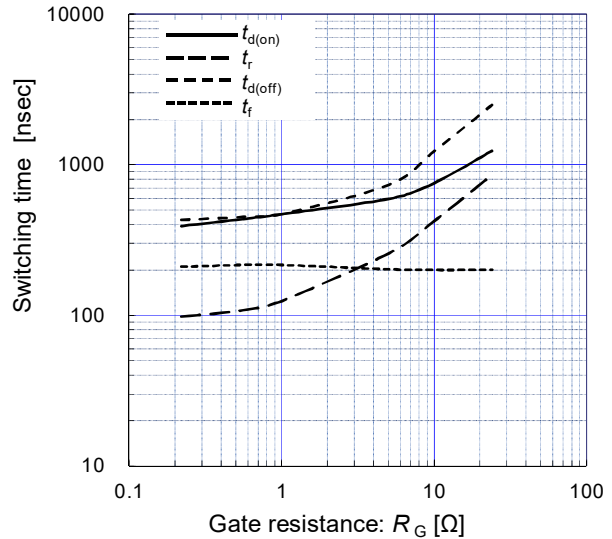
$V_{CC} = 600V$, $R_G = 0.56\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

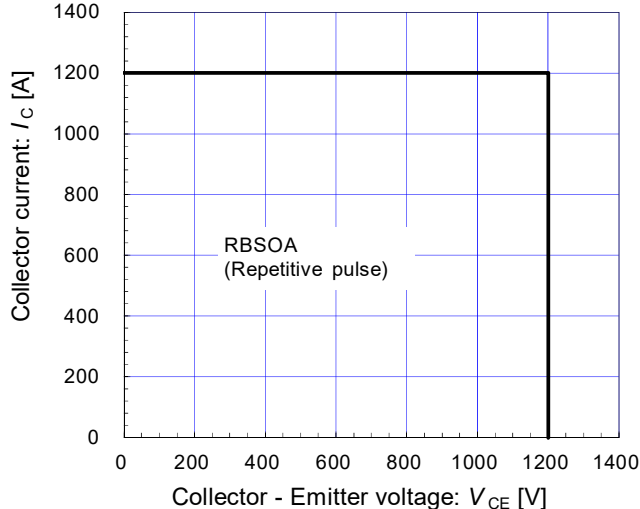
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

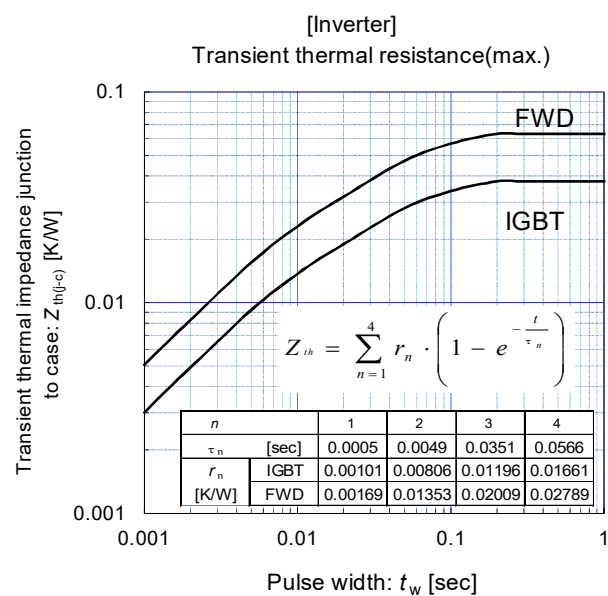
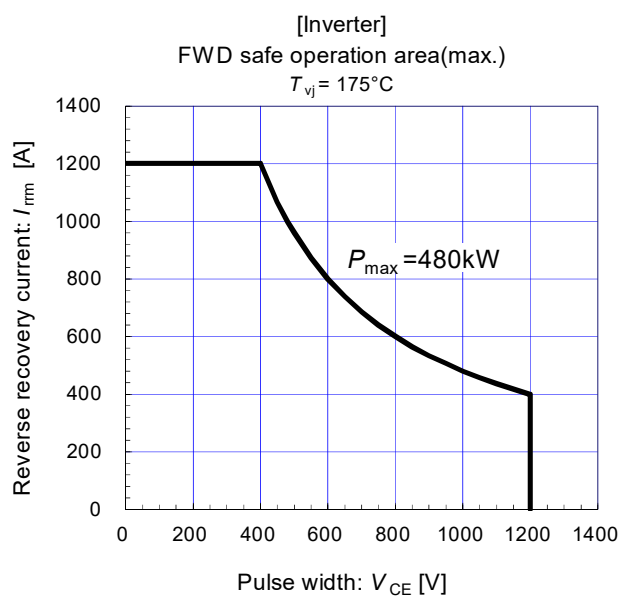
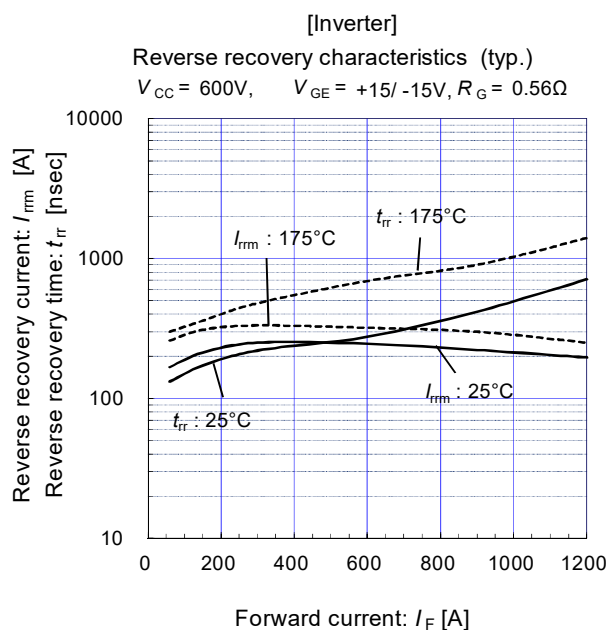
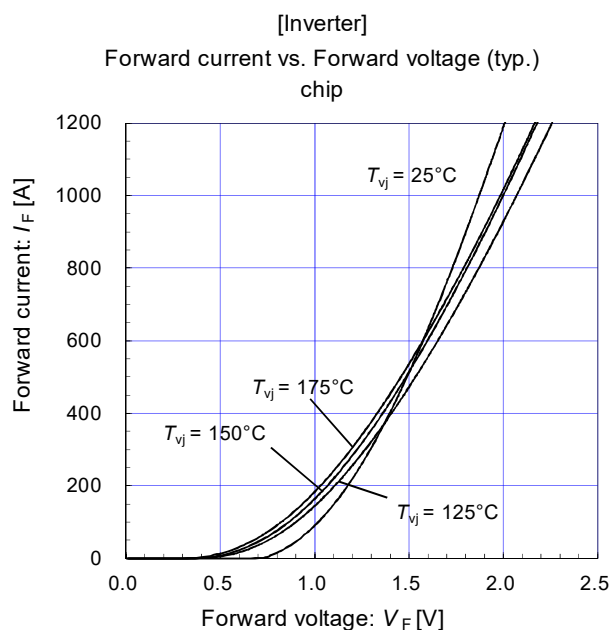
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$, $R_G = 0.56\Omega$, $T_{vj} = 175^\circ C$



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