

2MBI1200XE120P-50

IGBT Modules

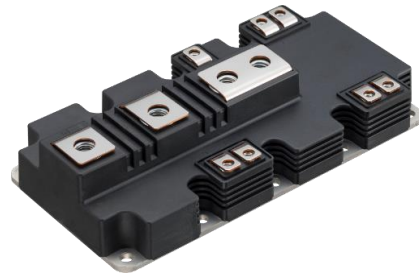
Power Module (X series)
1200V / 1200A / 2-in-1 package

■ **Features**

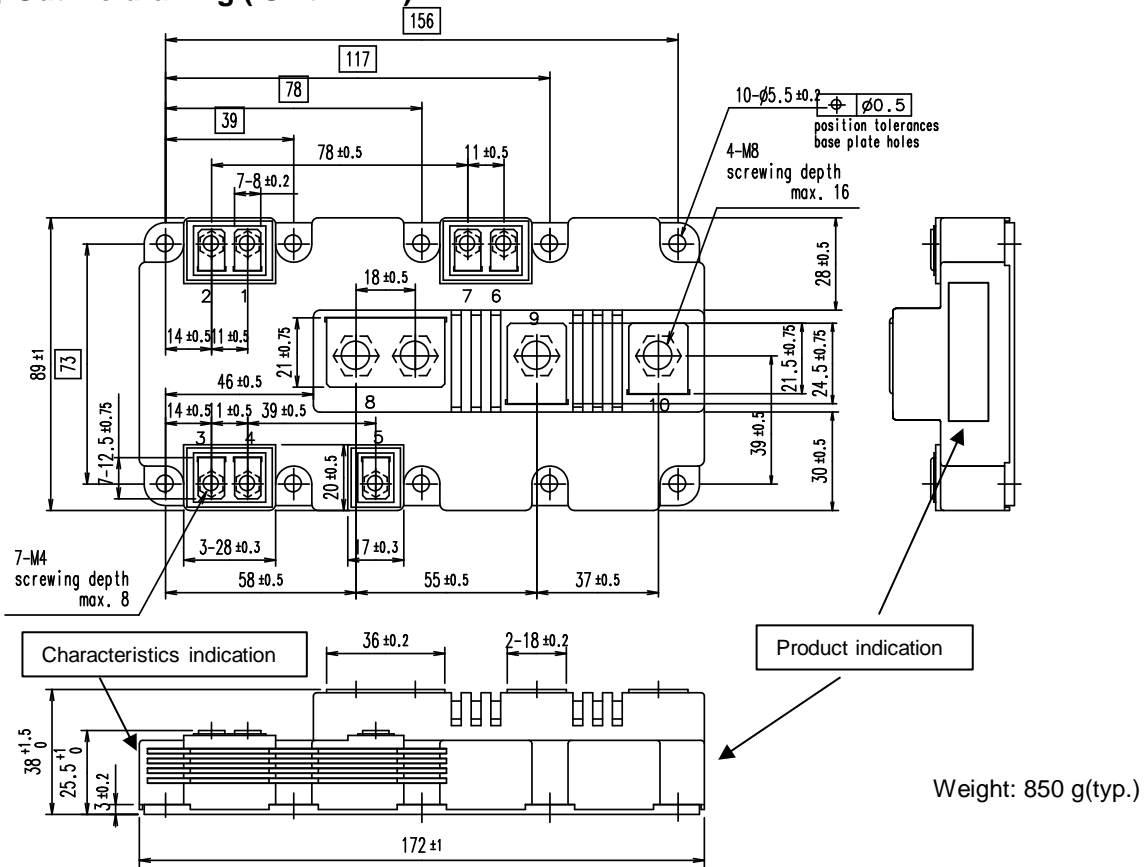
- Low $V_{CE(sat)}$
- Low Inductance Module structure

■ **Applications**

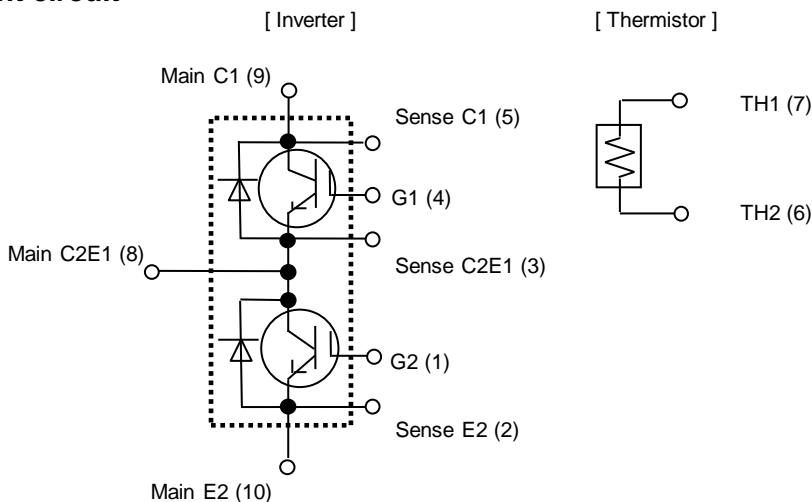
- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems



■ **Outline drawing (Unit : mm)**



■ **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
Inverter	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 $T_C = 100^\circ\text{C}$	1200	A
	Repetitive peak collector current	I_{CRM}	1ms	2400	
	Forward current	I_F		1200	
	Repetitive peak forward current	I_{FRM}	1ms	2400	
	Total power dissipation	P_{tot}	1 device	7.1	kW
	Virtual junction temperature	T_{vj}		175	$^\circ\text{C}$
	Operating virtual junction temperature (under switching conditions)	T_{vjop}		175	
	Case temperature	T_C		150	
Storage temperature	T_{stg}		-40 ~ 150		
Isolation voltage	between terminal and copper base (*1)	V_{isol}	AC: 1min.	4000	Vrms
	between thermistor and others (*2)				
Mounting torque of screws to heatsink (*3)		M_s	M5	6.0	N·m
Mounting torque of screws to main terminals (*3)		M_t	M8	10.0	
Mounting torque of screws to sense terminals (*3)			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) Recommendable Value: : Mounting torque of screws to heatsink 3.0 ~ 6.0 N·m (M5)
 : Mounting torque of screws to main terminals 8.0~ 10.0 N·m (M8)
 : Mounting torque of screws to sense terminals 1.8~ 2.1 N·m (M4)

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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}	$V_{GE} = 0V$ $V_{CE} = 1200V$	-	-	400	μA	
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$	-	-	800	nA	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 1200\text{mA}$	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 1200A$	$T_{vj}=25^{\circ}\text{C}$	-	1.50	1.95	V
			$T_{vj}=25^{\circ}\text{C}$	-	1.45	1.90	
	$T_{vj}=125^{\circ}\text{C}$		-	1.70	-		
	$T_{vj}=150^{\circ}\text{C}$		-	1.75	-		
	$T_{vj}=175^{\circ}\text{C}$		-	1.85	-		
Internal gate resistance	r_g	-	-	3.13	-	Ω	
	Capacitance	$V_{CE}=10V, V_{GE}=0V, f=1\text{MHz}$	C_{ies}	-	128	-	nF
			C_{oes}	-	4.4	-	
C_{res}			-	1.1	-		
Gate charge	Q_G	$V_{CC} = 600V, I_C = 1200A$ $V_{GE} = -15 \rightarrow +15V$	-	8.3	-	μC	
Forward voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F = 1200A$	$T_{vj}=25^{\circ}\text{C}$	-	1.65	2.10	V
			$T_{vj}=25^{\circ}\text{C}$	-	1.60	2.05	
	$T_{vj}=125^{\circ}\text{C}$		-	1.65	-		
	$T_{vj}=150^{\circ}\text{C}$		-	1.60	-		
	$T_{vj}=175^{\circ}\text{C}$		-	1.60	-		
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F = 1200A$ $V_{GE} = +15/-15V$ $R_G = +0.82/-0.82 \Omega$ $L_S = 60 \text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	1.10	-	μs
			$T_{vj}=125^{\circ}\text{C}$	-	1.10	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.10	-	
			$T_{vj}=175^{\circ}\text{C}$	-	1.10	-	
	t_r		$T_{vj}=25^{\circ}\text{C}$	-	0.20	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.22	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.22	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.22	-	
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.90	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.94	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.96	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.97	-	
t_f	$T_{vj}=25^{\circ}\text{C}$	-	0.16	-			
	$T_{vj}=125^{\circ}\text{C}$	-	0.17	-			
	$T_{vj}=150^{\circ}\text{C}$	-	0.18	-			
	$T_{vj}=175^{\circ}\text{C}$	-	0.20	-			
Reverse recovery time	t_{rr}	$T_{vj}=25^{\circ}\text{C}$	-	0.29	-		
		$T_{vj}=125^{\circ}\text{C}$	-	0.47	-		
		$T_{vj}=150^{\circ}\text{C}$	-	0.49	-		
		$T_{vj}=175^{\circ}\text{C}$	-	0.52	-		

(*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.		
Inverter Switching loss (per pulse)	E_{on}	$V_{CC} = 600\text{V}$ $I_C, I_F = 1200\text{A}$ $V_{GE} = +15/-15\text{V}$ $R_G = +0.82/-0.82\ \Omega$ $L_S = 60\text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	110	-	mJ
			$T_{vj}=125^{\circ}\text{C}$	-	165	-	
			$T_{vj}=150^{\circ}\text{C}$	-	172	-	
			$T_{vj}=175^{\circ}\text{C}$	-	185	-	
	E_{off}		$T_{vj}=25^{\circ}\text{C}$	-	164	-	
			$T_{vj}=125^{\circ}\text{C}$	-	209	-	
			$T_{vj}=150^{\circ}\text{C}$	-	220	-	
			$T_{vj}=175^{\circ}\text{C}$	-	227	-	
	E_{rr}		$T_{vj}=25^{\circ}\text{C}$	-	48	-	
			$T_{vj}=125^{\circ}\text{C}$	-	74	-	
			$T_{vj}=150^{\circ}\text{C}$	-	88	-	
			$T_{vj}=175^{\circ}\text{C}$	-	98	-	
Thermistor Resistance	R	$T = 25^{\circ}\text{C}$	-	5000	-	Ω	
		$T = 100^{\circ}\text{C}$	465	495	520		
Thermistor B value	B	$T = 25/ 50^{\circ}\text{C}$	3305	3375	3450	K	

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.

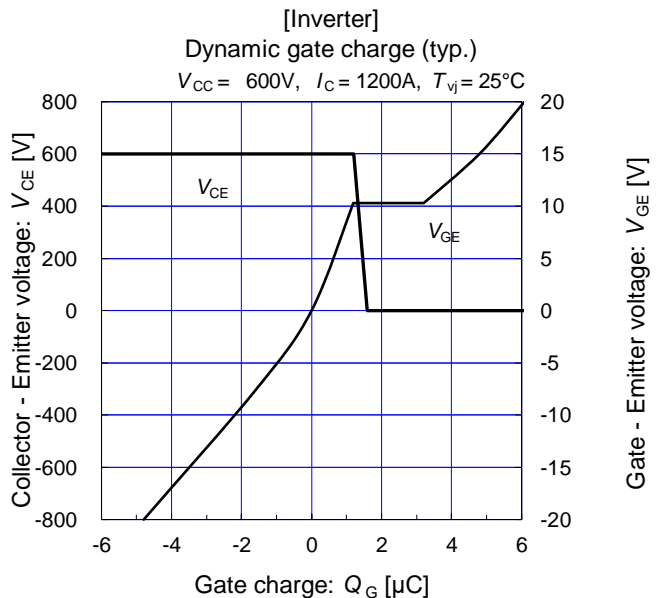
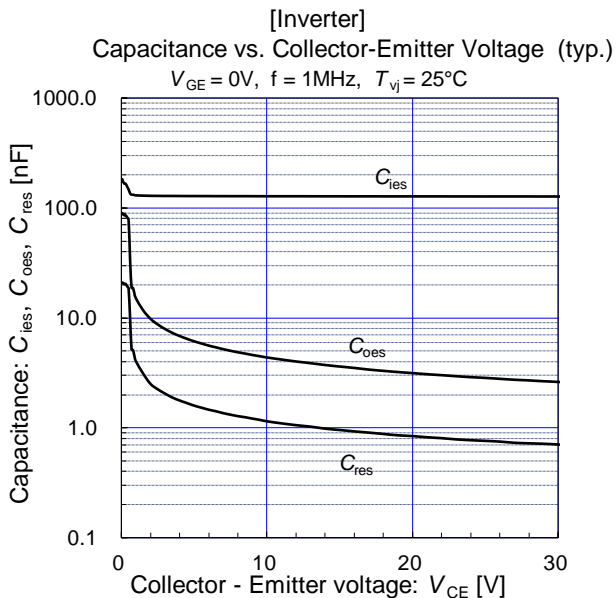
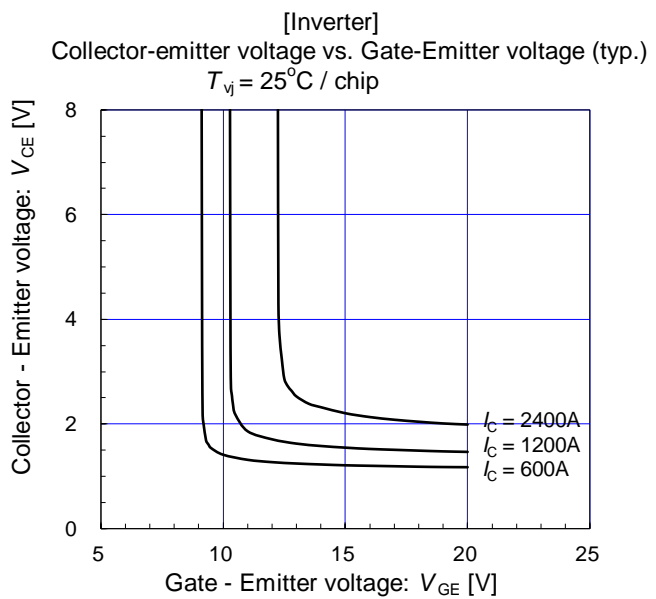
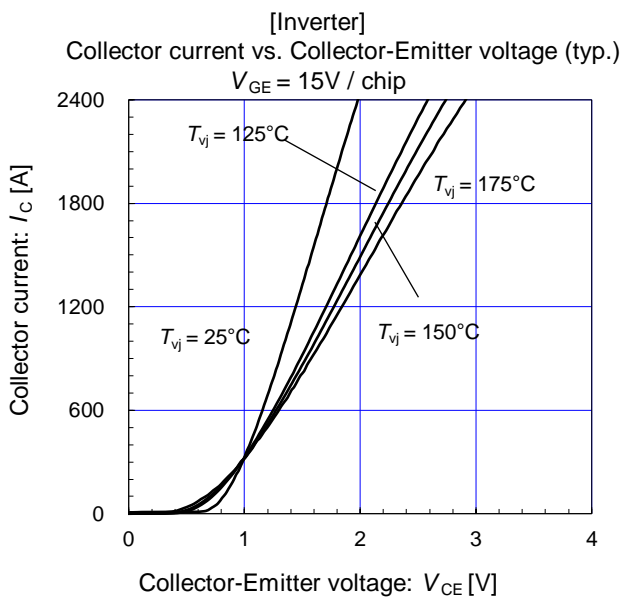
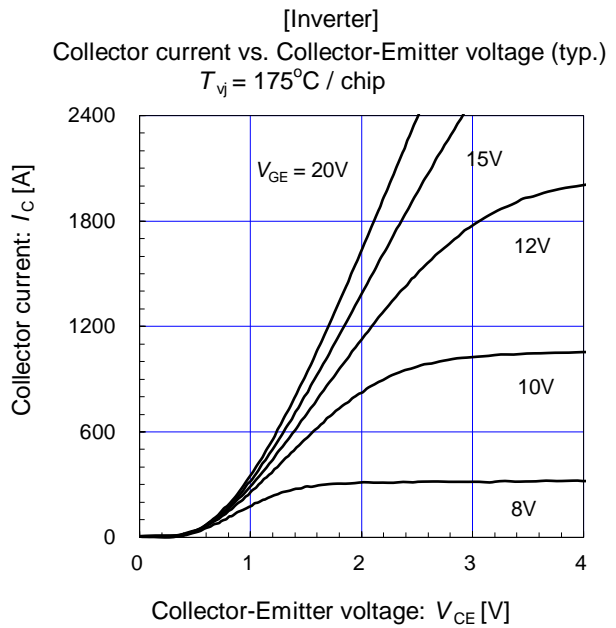
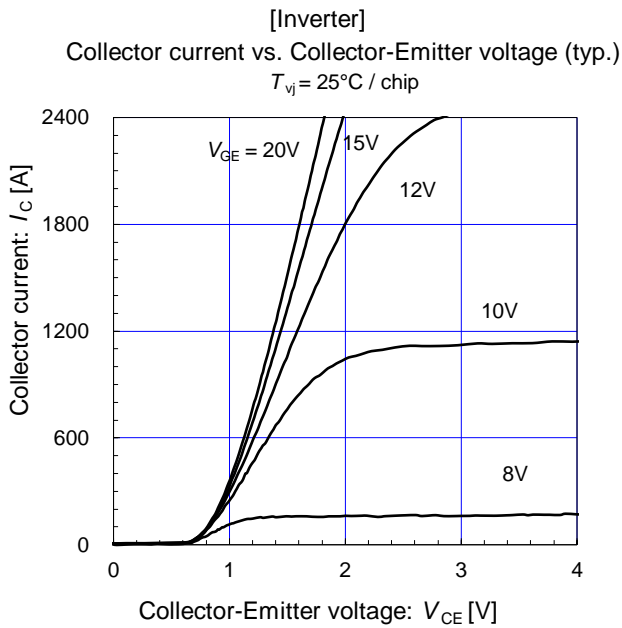
■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	21.0	K/kW
		Inverter FWD	-	-	34.5	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	6.3	-	

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

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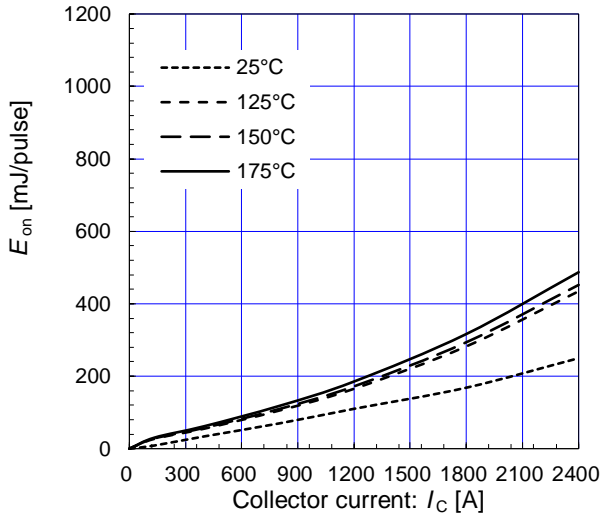
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[Inverter]

E_{on} vs. Collector current (typ.)

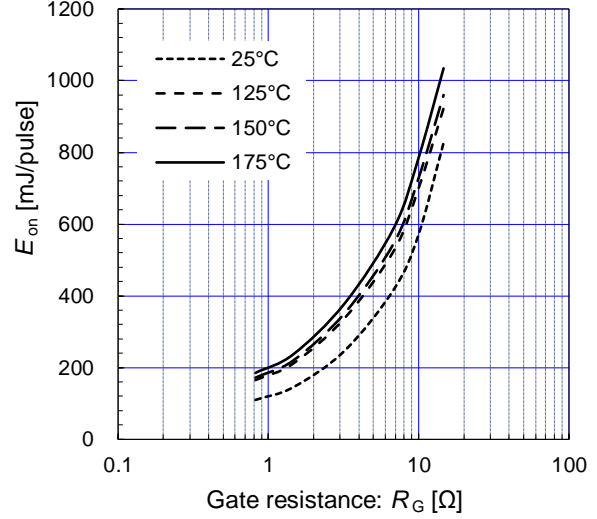
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = +0.82/-0.82 \Omega$



[Inverter]

E_{on} vs. Gate resistance (typ.)

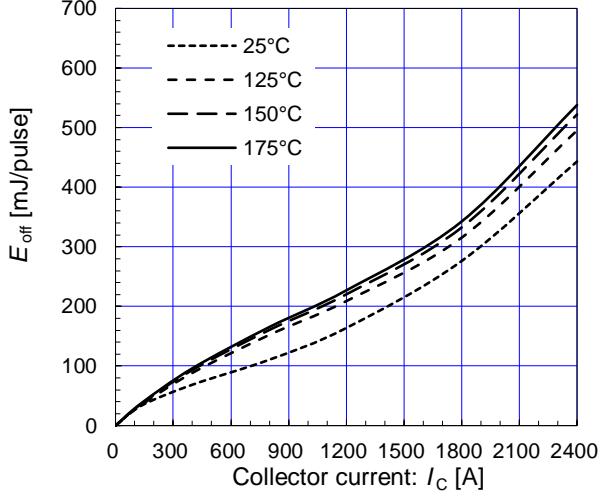
$V_{CC} = 600V, V_{GE} = +15/-15V, I_C = 1200A$



[Inverter]

E_{off} vs. Collector current (typ.)

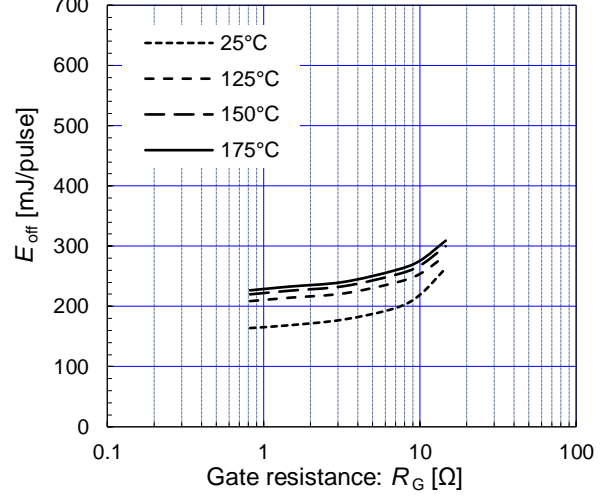
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = +0.82/-0.82 \Omega$



[Inverter]

E_{off} vs. Gate resistance (typ.)

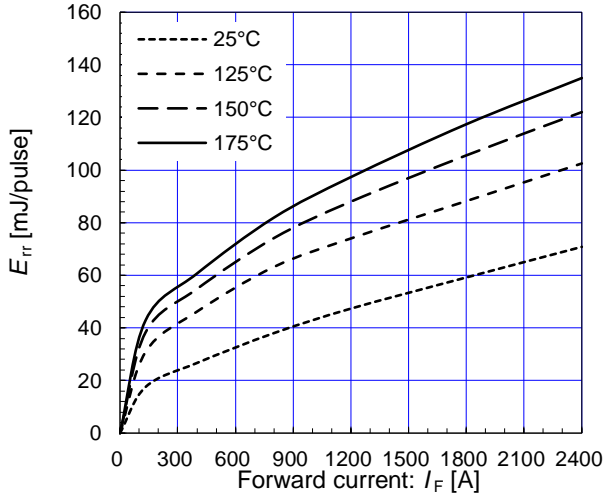
$V_{CC} = 600V, V_{GE} = +15/-15V, I_C = 1200A$



[Inverter]

E_{rr} vs. Forward current (typ.)

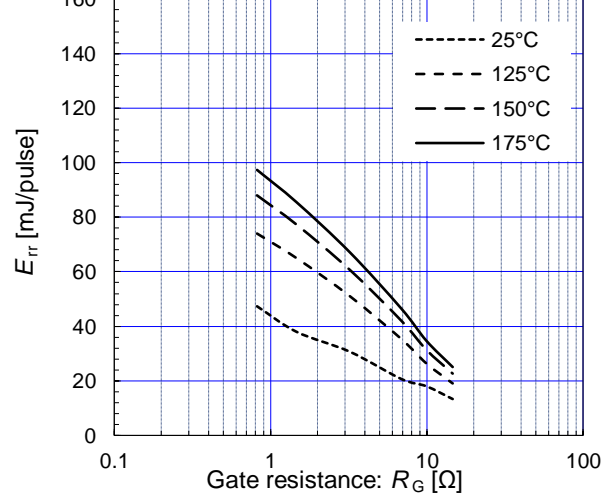
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = +0.82/-0.82 \Omega$



[Inverter]

E_{rr} vs. Gate resistance (typ.)

$V_{CC} = 600V, V_{GE} = +15/-15V, I_F = 1200A$



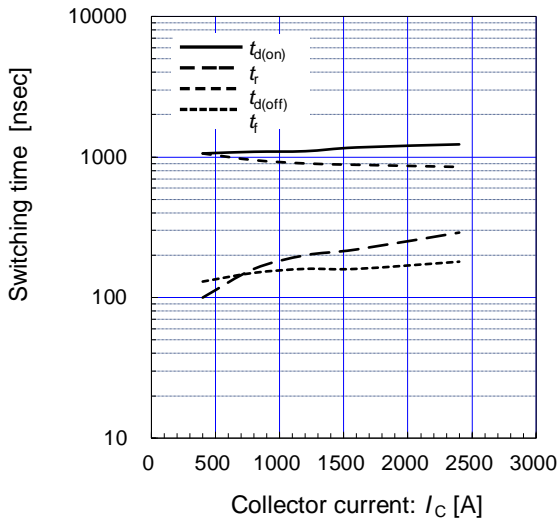
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[Inverter]

Switching time vs. Collector current (typ.)

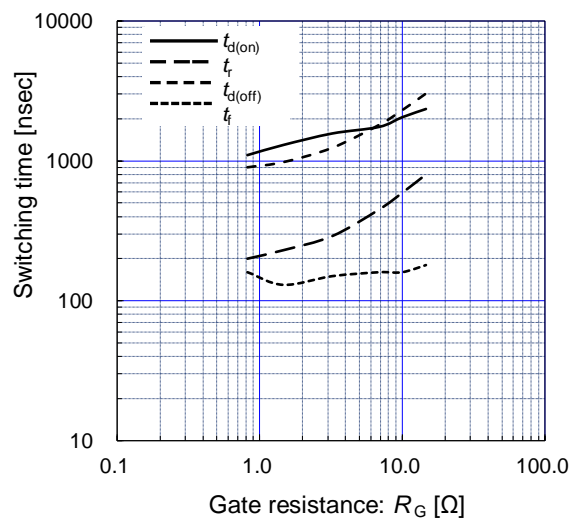
$V_{CC} = 600V, R_G = +0.82/-0.82 \Omega, V_{GE} = +15/-15 V, T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

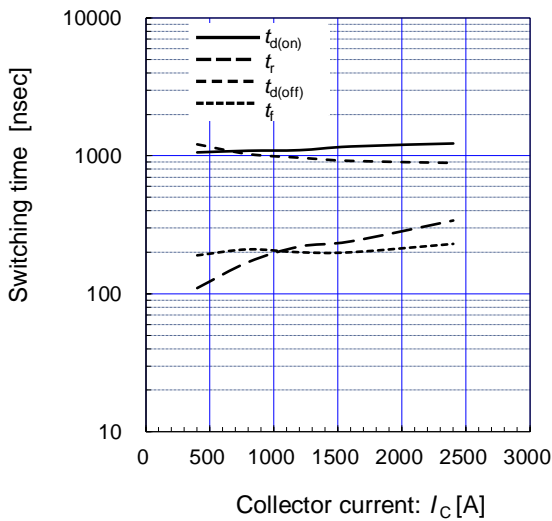
$V_{CC} = 600V, I_C = 1200A, V_{GE} = +15/-15 V, T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

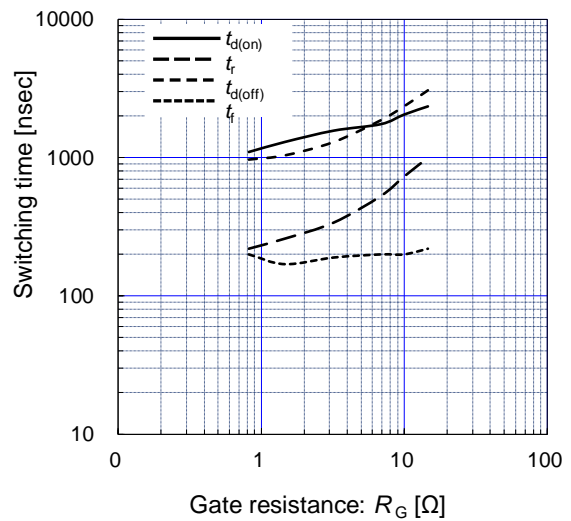
$V_{CC} = 600V, R_G = +0.82/-0.82 \Omega, V_{GE} = +15/-15 V, T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

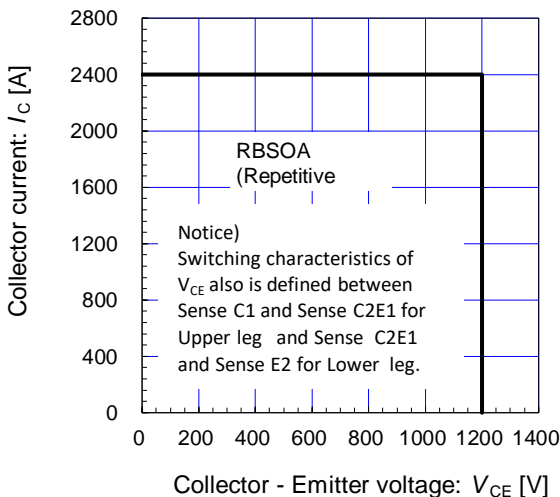
$V_{CC} = 600V, I_C = 1200A, V_{GE} = +15/-15 V, T_{vj} = 175^\circ C$



[Inverter]

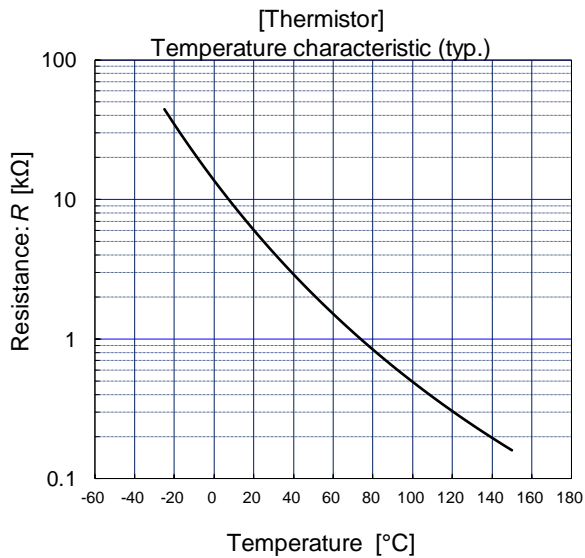
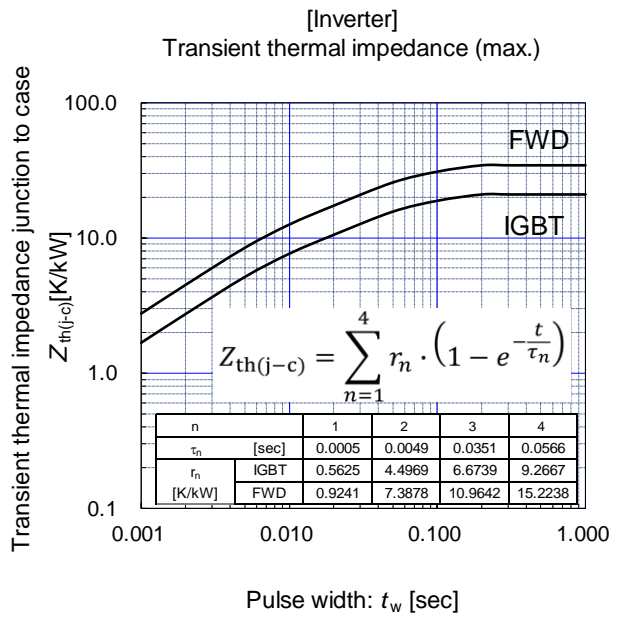
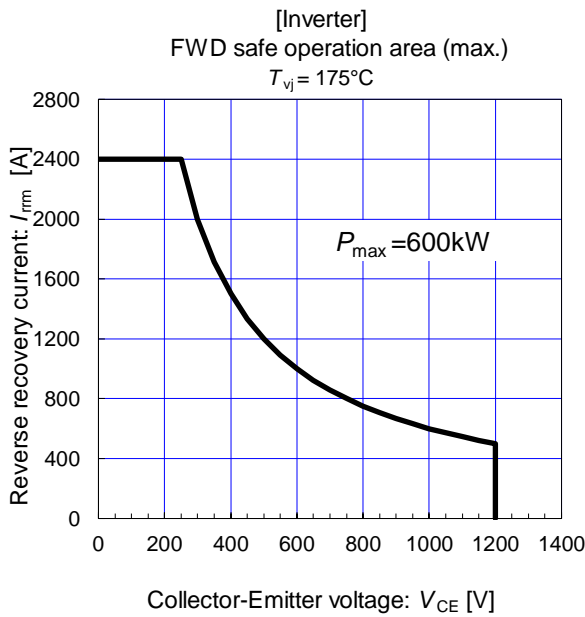
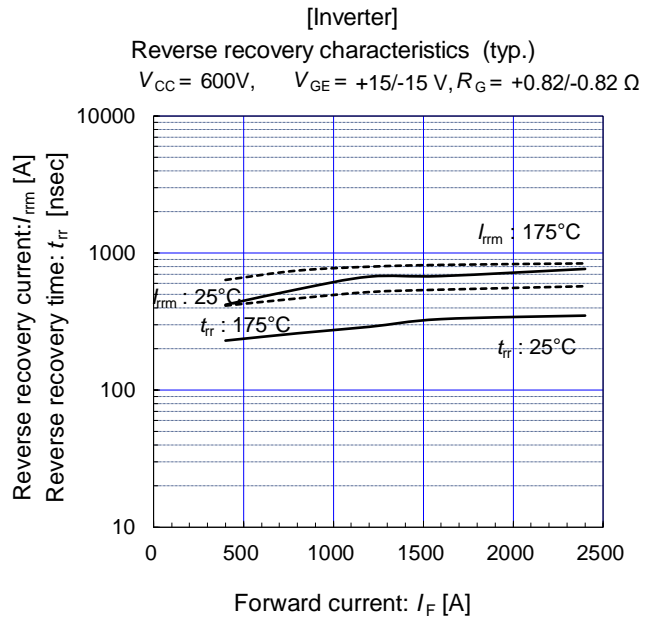
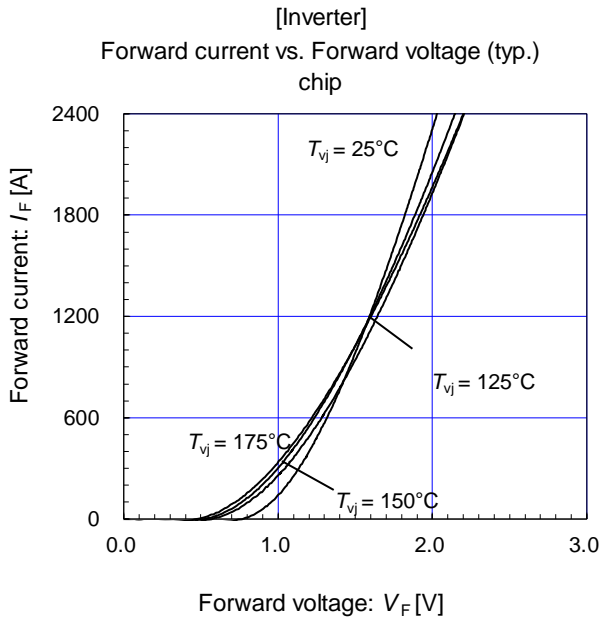
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15 V, R_G = +0.82/-0.82 \Omega, T_{vj} = 175^\circ C$



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