

6MBI200XXE120-50

IGBT Modules

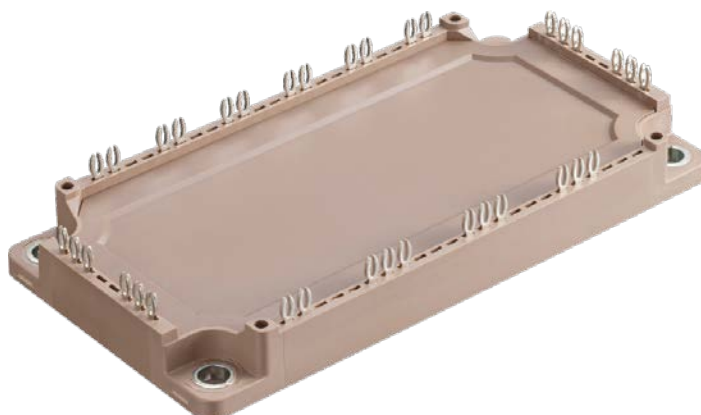
Power Module (X series)
1200V / 200A / 6-in-1 package

■ Features

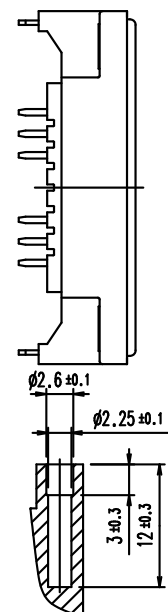
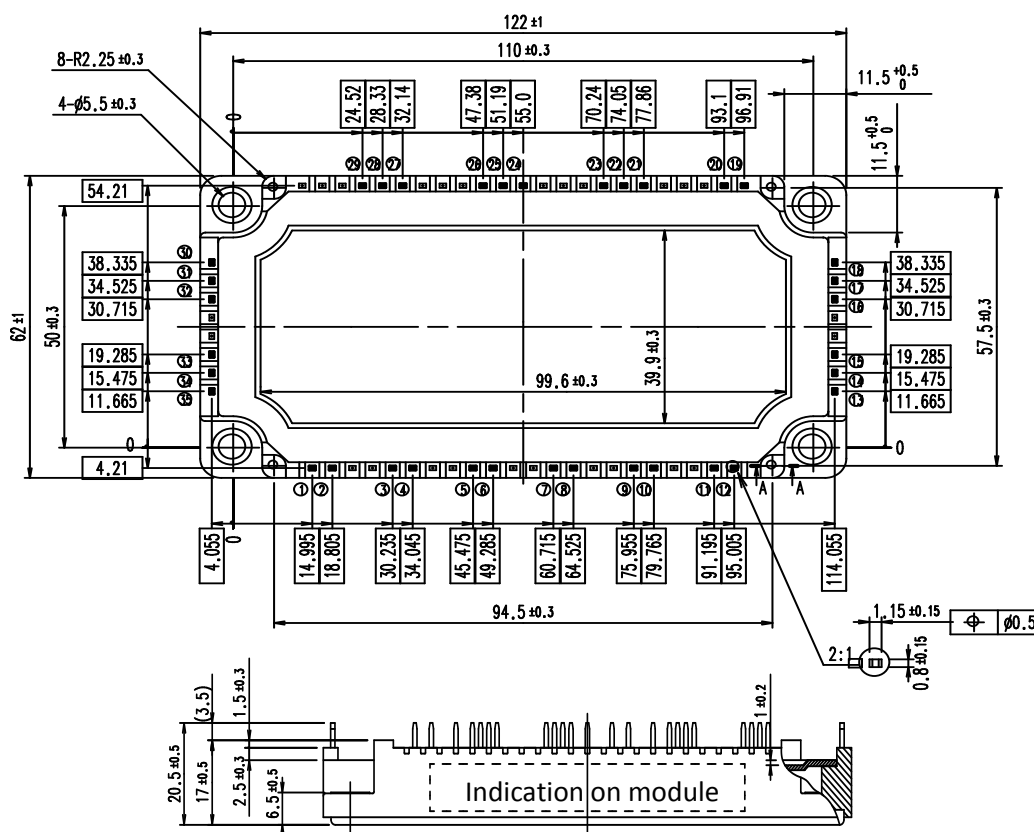
- Low $V_{CE(sat)}$
- Compact Package
- P.C.Board Mount Module
- Converter Diode Bridge Dynamic Brake Circuit
- RoHS compliant Product

■ Applications

- Inverter for Motor Drives,
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply



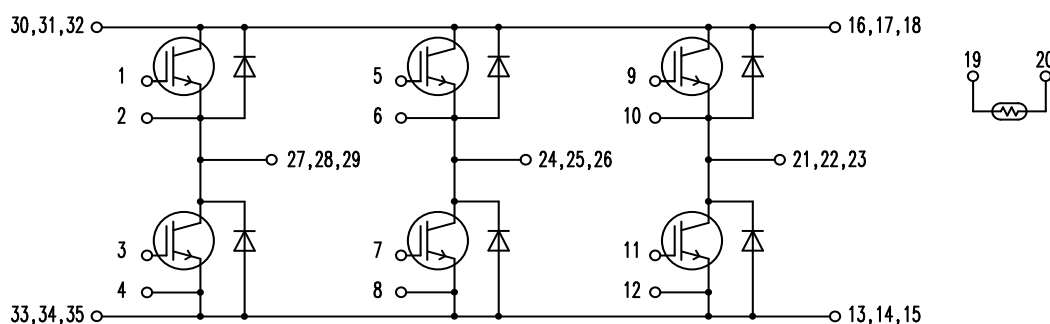
■ Outline drawing (Unit : mm)



Section A-A

Weight: 310 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 $T_c = 80^\circ\text{C}$	200	A
Repetitive peak collector current		I_{CRM}	1ms	400	
Forward current		I_F	Continuous	200	
Repetitive peak forward current		I_{FRM}	1ms	400	
Total power dissipation		P_{tot}	1 device	1000	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
	between thermistor and others (*2)				
Mounting torque of screws to heatsink (*3)		M_s	M5	6.0	N·m

(*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 2.5 ~ 6.0 N·m (M5)

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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	Collector-emitter cut-off current, gate-emitter short-circuited	I_{CES}	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CE}} = 1200\text{V}$		-	-	50	μA
	Gate leakage current , collector-emitter short-circuited	I_{GES}	$V_{\text{CE}}\!=\!0\text{V}, V_{\text{GE}}\!=\!\pm 20\text{V}$		-	-	100	nA
	Gate-Emitter threshold voltage	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 200\text{mA}$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{\text{CE(sat)}}(\text{terminal})$	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 200\text{A}$	$T_{\text{vj}}\!=\!25^{\circ}\text{C}$	-	2.20	2.75	V
		$V_{\text{CE(sat)}}(\text{chip})$		$T_{\text{vj}}\!=\!25^{\circ}\text{C}$	-	1.45	1.90	
				$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	1.80	-	
				$T_{\text{vj}}\!=\!150^{\circ}\text{C}$	-	1.90	-	
				$T_{\text{vj}}\!=\!175^{\circ}\text{C}$	-	1.95	-	
	Internal Gate resistance	r_{g}	-		-	5.00	-	Ω
	Input capacitance	C_{ies}	$V_{\text{CE}}\!=\!10\text{V}, V_{\text{GE}}\!=\!0\text{V}, f\!=\!1\text{MHz}$		-	21.3	-	nF
	Output capacitance	C_{oes}			-	0.7	-	
	Reverse transfer capacitance	C_{res}			-	0.19	-	
	Gate charge	Q_{G}	$V_{\text{CC}} = 600\text{V}, I_{\text{C}} = 200\text{A}$ $V_{\text{GE}} = -15 \rightarrow +15\text{V}$		-	1400.0	-	μC
	Forward on voltage	$V_{\text{F}}(\text{terminal})$	$V_{\text{GE}} = 0\text{V}$ $I_{\text{F}} = 200\text{A}$	$T_{\text{vj}}\!=\!25^{\circ}\text{C}$	-	2.55	3.10	V
		$V_{\text{F}}(\text{chip})$		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	1.80	2.25	
				$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	1.85	-	
				$T_{\text{vj}}\!=\!150^{\circ}\text{C}$	-	1.80	-	
				$T_{\text{vj}}\!=\!175^{\circ}\text{C}$	-	1.75	-	
	Turn-on delay time (*1)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 200\text{A}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 1.8\ \Omega$ $L_{\text{S}} = 30\text{ nH}$	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	0.27	-	μs
				$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	0.30	-	
$T_{\text{vj}}\!=\!150^{\circ}\text{C}$				-	0.31	-		
$T_{\text{vj}}\!=\!175^{\circ}\text{C}$				-	0.32	-		
Rise time (*1)	t_{r}	$T_{\text{vj}} = 25^{\circ}\text{C}$		-	0.08	-		
		$T_{\text{vj}}\!=\!125^{\circ}\text{C}$		-	0.09	-		
		$T_{\text{vj}}\!=\!150^{\circ}\text{C}$		-	0.09	-		
		$T_{\text{vj}}\!=\!175^{\circ}\text{C}$		-	0.10	-		
Turn-off delay time (*1)	$t_{\text{d(off)}}$	$T_{\text{vj}} = 25^{\circ}\text{C}$		-	0.34	-		
		$T_{\text{vj}}\!=\!125^{\circ}\text{C}$		-	0.39	-		
		$T_{\text{vj}}\!=\!150^{\circ}\text{C}$		-	0.40	-		
		$T_{\text{vj}}\!=\!175^{\circ}\text{C}$		-	0.41	-		
Fall time (*1)	t_{f}	$T_{\text{vj}} = 25^{\circ}\text{C}$		-	0.12	-		
		$T_{\text{vj}}\!=\!125^{\circ}\text{C}$		-	0.13	-		
		$T_{\text{vj}}\!=\!150^{\circ}\text{C}$		-	0.19	-		
		$T_{\text{vj}}\!=\!175^{\circ}\text{C}$		-	0.10	-		
Reverse recovery time	t_{rr}	$T_{\text{vj}} = 25^{\circ}\text{C}$		-	0.18	-		
		$T_{\text{vj}}\!=\!125^{\circ}\text{C}$		-	0.23	-		
		$T_{\text{vj}}\!=\!150^{\circ}\text{C}$		-	0.26	-		
		$T_{\text{vj}}\!=\!175^{\circ}\text{C}$		-	0.28	-		

(*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}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	16.48	-	mJ
			$I_C, I_F = 200A$	$T_{vj}=125^{\circ}C$	-	23.94	-	
			$V_{GE} = +15/-15\text{ V}$	$T_{vj}=150^{\circ}C$	-	26.79	-	
			$R_G = 1.8\ \Omega$	$T_{vj}=175^{\circ}C$	-	29.69	-	
		E_{off}	$L_S = 30\text{ nH}$	$T_{vj}=25^{\circ}C$	-	14.91	-	
				$T_{vj}=125^{\circ}C$	-	19.28	-	
				$T_{vj}=150^{\circ}C$	-	20.51	-	
				$T_{vj}=175^{\circ}C$	-	21.46	-	
		E_{rr}		$T_{vj}=25^{\circ}C$	-	5.80	-	
				$T_{vj}=125^{\circ}C$	-	9.83	-	
				$T_{vj}=150^{\circ}C$	-	10.60	-	
				$T_{vj}=175^{\circ}C$	-	12.09	-	
Thermistor	Resistance	R	$T = 25^{\circ}C$	-	5000	-	Ω	
			$T = 100^{\circ}C$	465	495	520		
	B value	B	$T = 25/ 50^{\circ}C$	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.

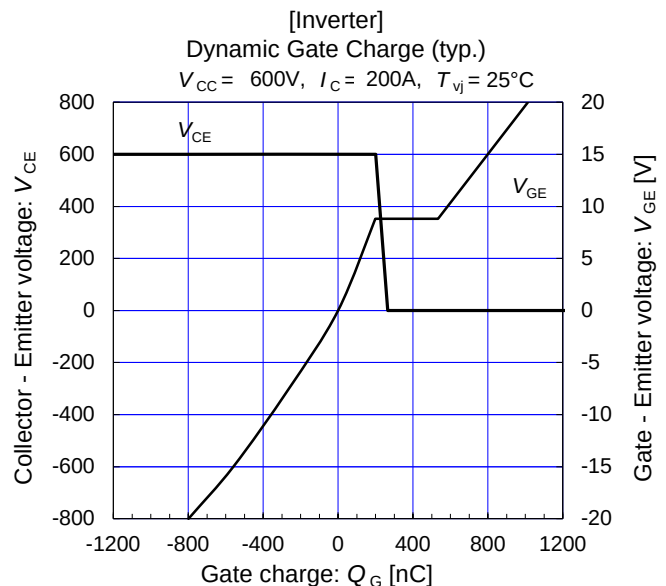
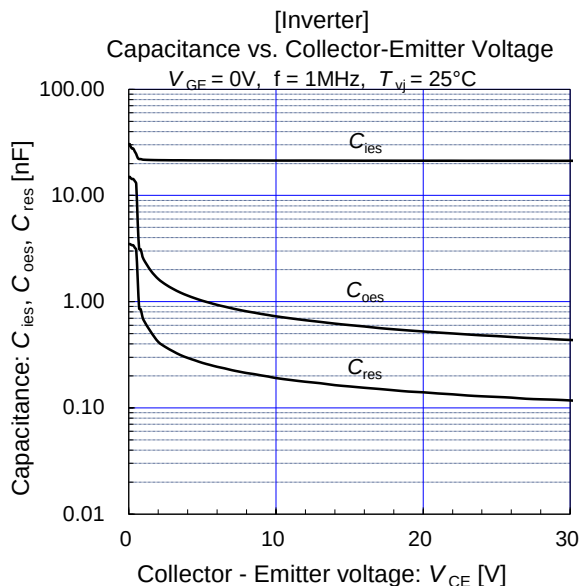
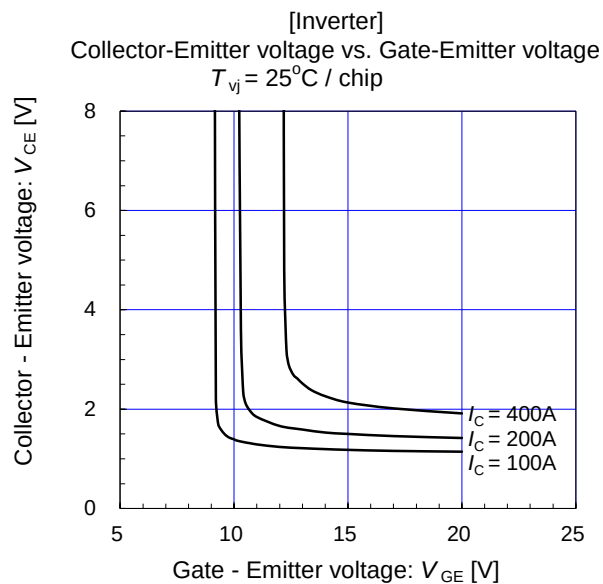
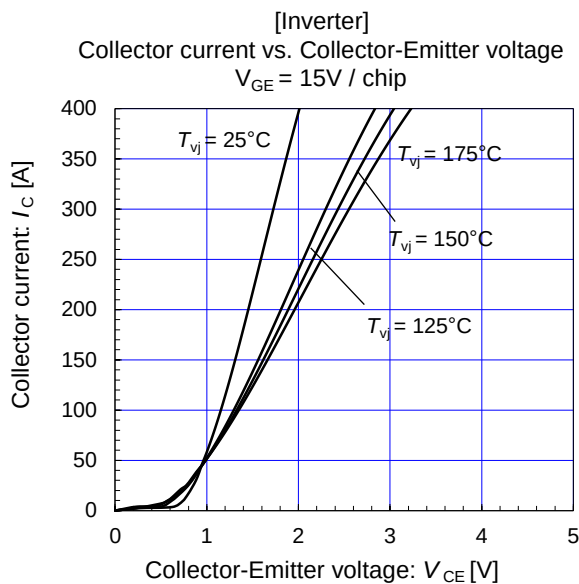
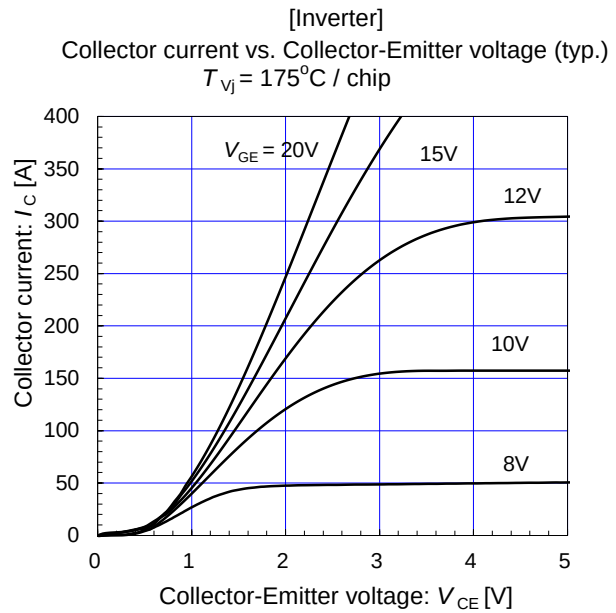
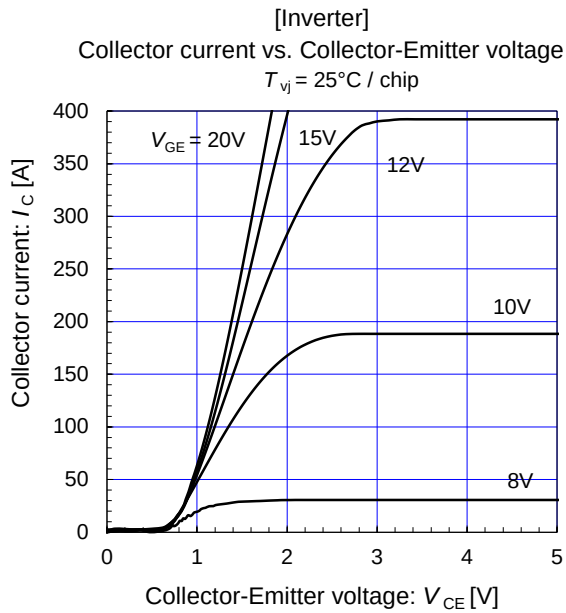
■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case (1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.15	$^{\circ}\text{C/W}$
		Inverter FWD	-	-	0.16	
Thermal resistance case to heatsink (1 IGBT + 1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.05	-	

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

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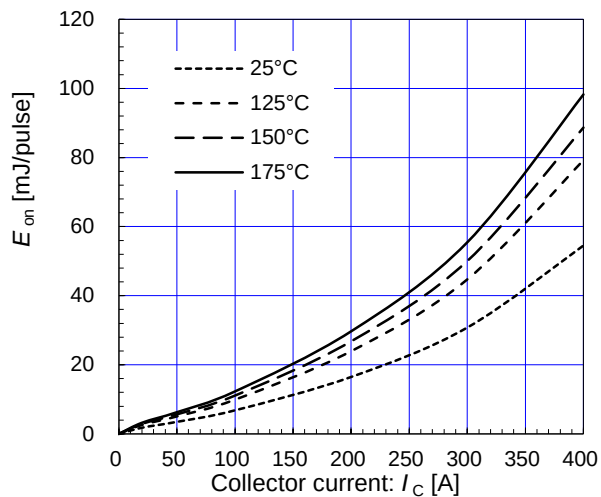
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IGBT Modules

[Inverter]

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

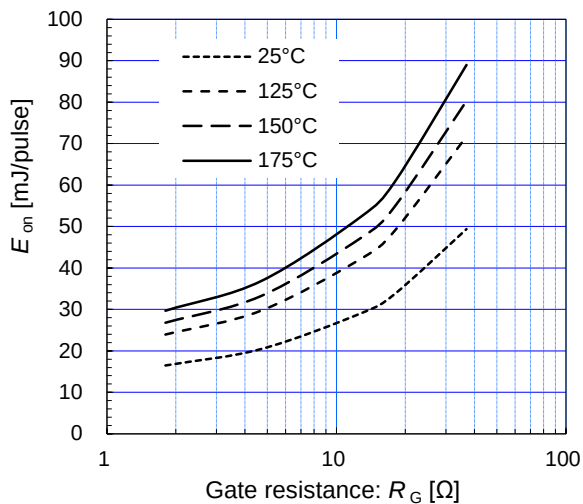
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = 1.8\ \Omega$



[Inverter]

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

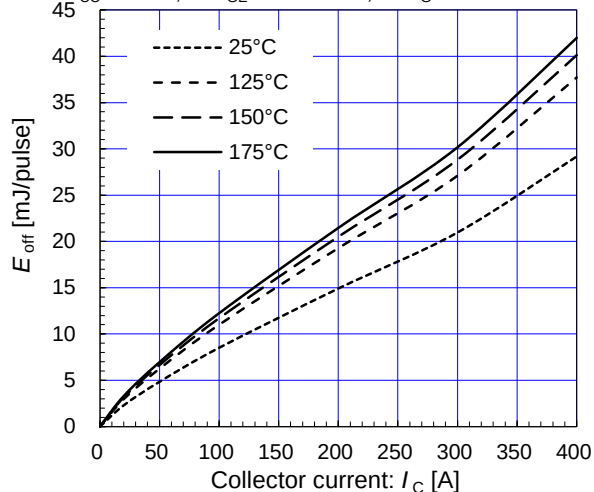
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $I_C = 200A$



[Inverter]

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

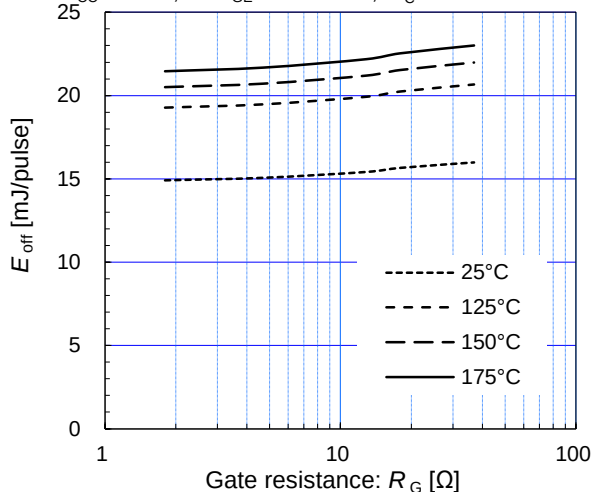
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = 1.8\ \Omega$



[Inverter]

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

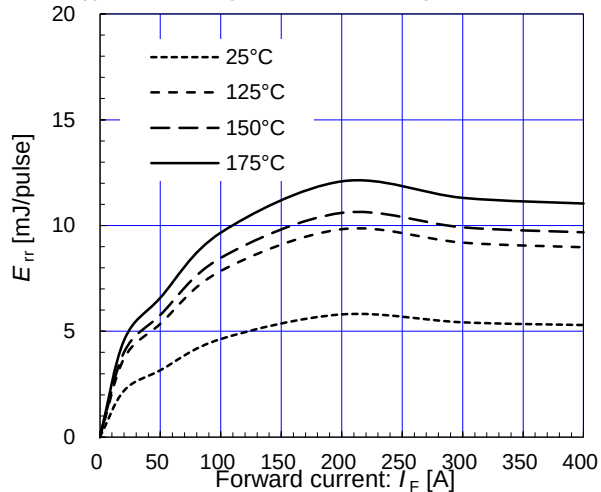
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $I_C = 200A$



[Inverter]

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

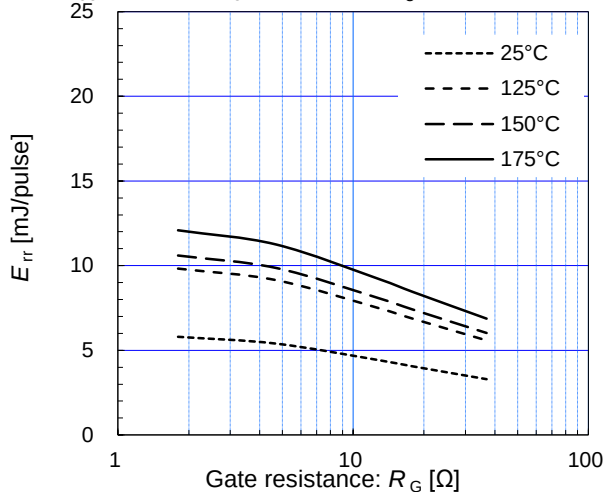
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = 1.8\ \Omega$



[Inverter]

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

$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $I_C = 200A$



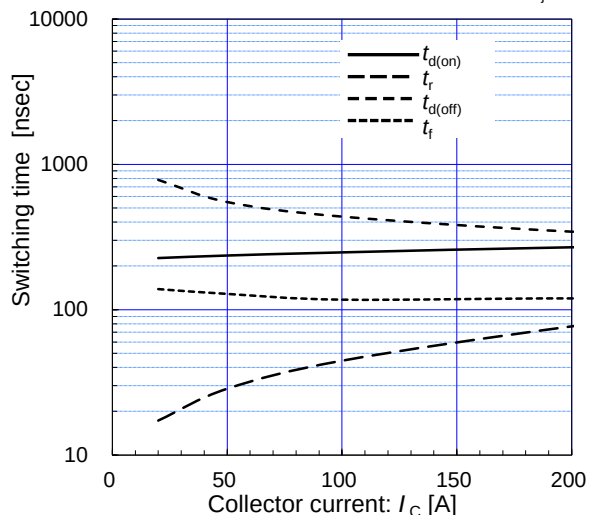
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[Inverter]

Switching time vs. Collector current (typ.)

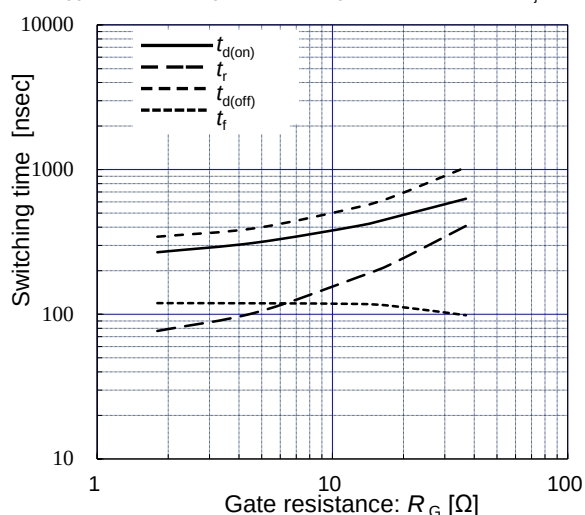
$V_{CC} = 600V$, $R_G = 1.8 \Omega$, $V_{GE} = +15/-15 V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

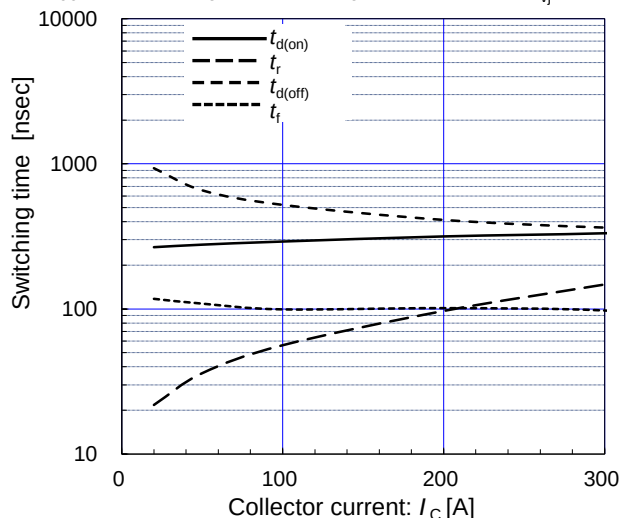
$V_{CC} = 600V$, $I_C = 200A$, $V_{GE} = +15/-15 V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

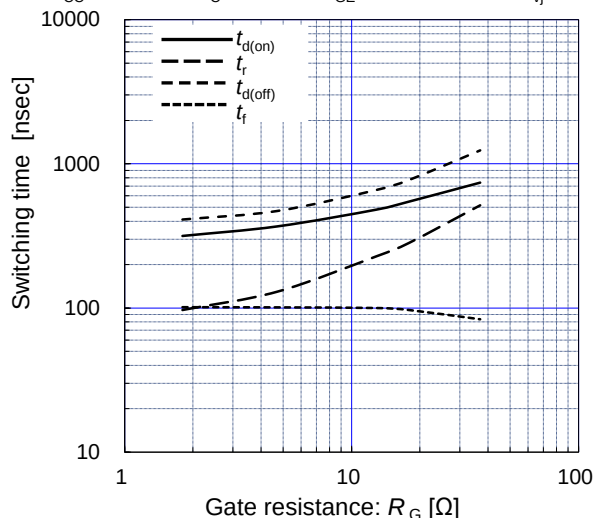
$V_{CC} = 600V$, $R_G = 1.8 \Omega$, $V_{GE} = +15/-15 V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

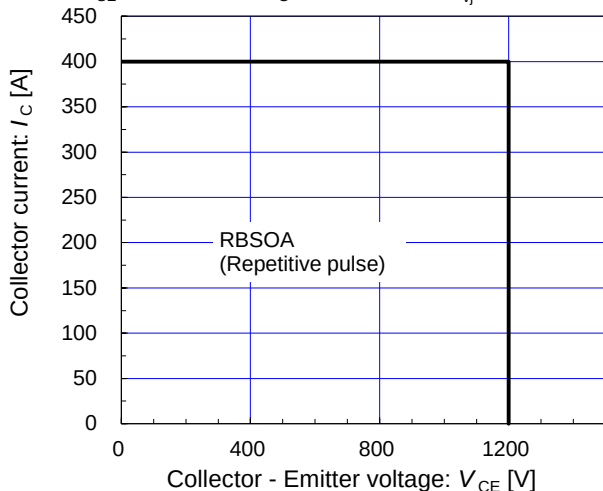
$V_{CC} = 600V$, $I_C = 200A$, $V_{GE} = +15/-15 V$, $T_{vj} = 175^\circ C$



[Inverter]

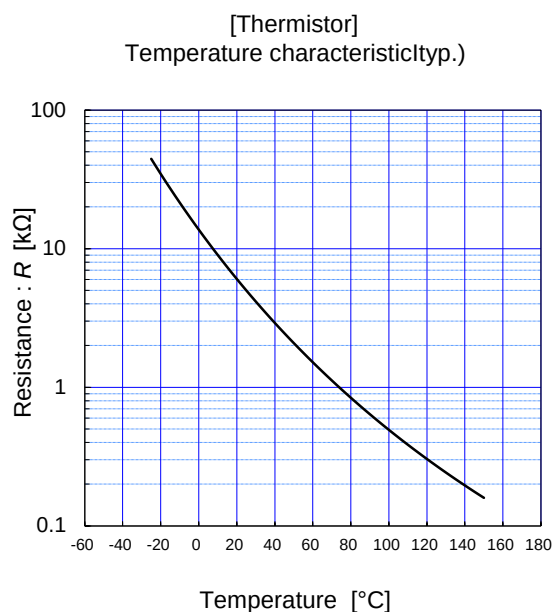
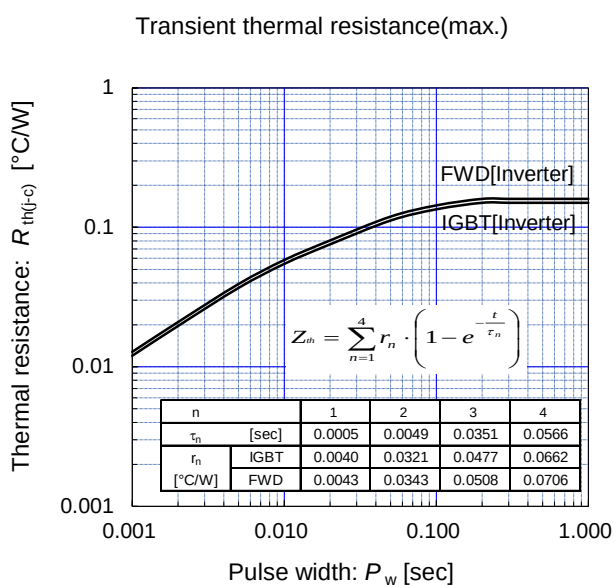
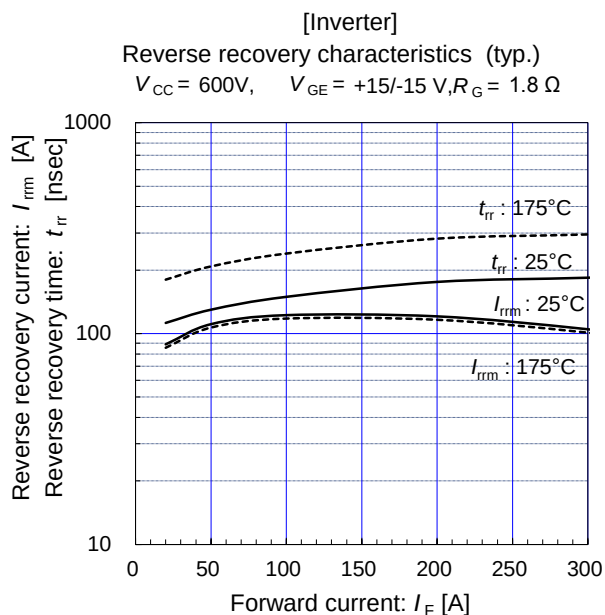
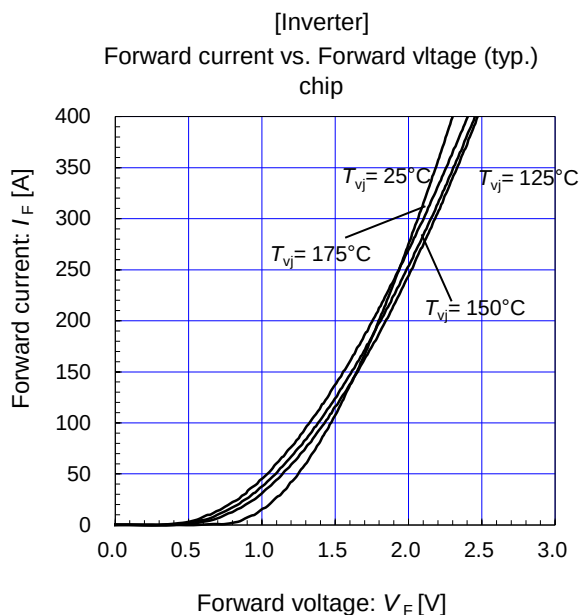
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15 V$, $R_G = 1.8 \Omega$, $T_{vj} = 175^\circ C$



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IGBT Modules

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