6MBI200XBE120-50

IGBT Modules

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



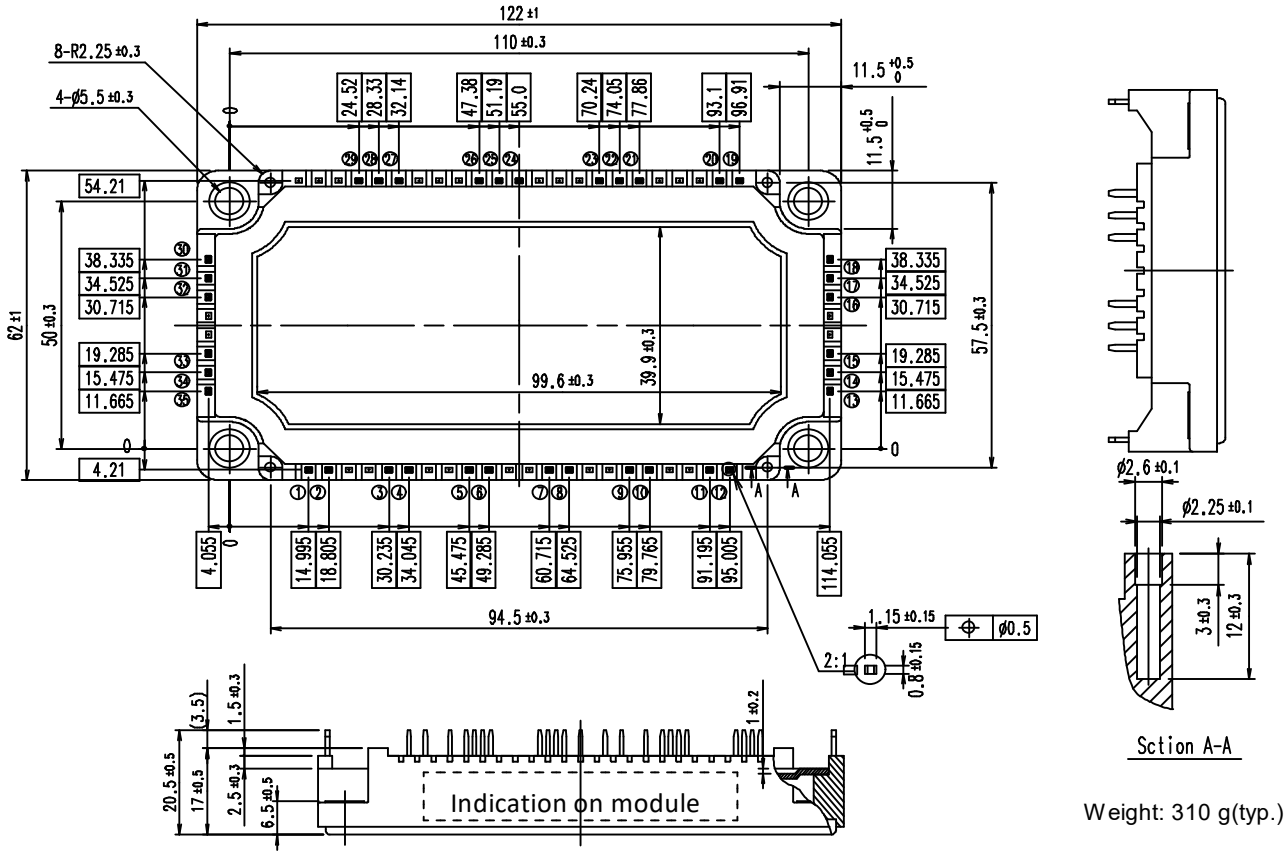
■ Features

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

■ Applications

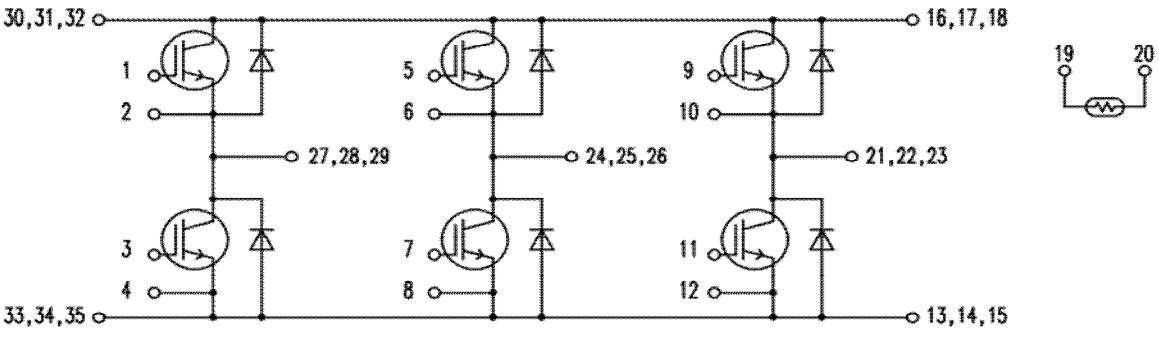
Inverter for Motor Drives,
AC and DC Servo Drive Amplifier
Uniterruptible Power Supply

■ Outline drawing (Unit : mm)



Weight: 310 g(typ.)

■ Equivalent circuit



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■ Absolute maximum ratings (at T_c= 25°C unless otherwise specified)

Items		Symbols	Conditions		Maximum ratings	Units
Collector-Emitter voltage, Gate-Emitter short-circuite		V_{CES}			1200	V
Gate-Emitter voltage, Collector-Emitter short-circuite		V_{GES}			±20	V
Collector current		I_C	Continuous	T_c=100°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	°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) Between termistor and others (*2)	V_{isol}	AC: 1min.		4000	Vrms
Mounting torque of screws to heatsink		M_s	M5		2.5～6.0	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.

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■ Electrical characteristics (at T_{vj}= 25°C unless otherwise specified)

	Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	V_{GE} = 0V V_{CE} = 1200V		-	-	50	μA
	Gate leakage current , Collector-Emitter short-circuited	I_{GES}	V_{CE}=0V, V_{GE}=±20V		-	-	100	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 200mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C= 200A	T_{vj}=25°C	-	2.15	2.65	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.45	1.90	
				T_{vj}=125°C	-	1.80	-	
				T_{vj}=150°C	-	1.90	-	
				T_{vj}=175°C	-	1.95	-	
	Internal gate resistance	r_g	-		-	5.00	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	21.3	-	nF
	Output capacitance	C_{oes}			-	0.73	-	
	Reverse transfer capacitance	C_{res}			-	0.19	-	
	Gate charge	Q_G	V_{CC} = 600V, I_C = 200A V_{GE} = -15 → +15V		-	1400	-	nC
	Forward voltage	V_F (terminal)	V_{GE} = 0V I_F= 200A	T_{vj}=25°C	-	2.50	3.00	V
		V_F (chip)		T_{vj}= 25°C	-	1.80	2.25	
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.80	-	
				T_{vj}=175°C	-	1.75	-	
	Turn-on delay time (*1)	$t_{d(on)}$	V_{CC} = 600V I_C, I_F = 200A V_{GE} = +15/-15 V R_G = 1.8 Ω L_S = 30 nH	T_{vj}= 25°C	-	0.27	-	μs
				T_{vj}=125°C	-	0.30	-	
				T_{vj}=150°C	-	0.31	-	
				T_{vj}=175°C	-	0.32	-	
	Rise time (*1)	t_r		T_{vj}= 25°C	-	0.08	-	
				T_{vj}=125°C	-	0.09	-	
				T_{vj}=150°C	-	0.09	-	
				T_{vj}=175°C	-	0.10	-	
	Turn-off delay time (*1)	$t_{d(off)}$		T_{vj}= 25°C	-	0.34	-	
				T_{vj}=125°C	-	0.39	-	
				T_{vj}=150°C	-	0.40	-	
				T_{vj}=175°C	-	0.41	-	
	Fall time (*1)	t_f		T_{vj}= 25°C	-	0.12	-	
				T_{vj}=125°C	-	0.13	-	
				T_{vj}=150°C	-	0.19	-	
				T_{vj}=175°C	-	0.10	-	
	Reverse recovery time	t_{rr}		T_{vj}= 25°C	-	0.18	-	
				T_{vj}=125°C	-	0.23	-	
				T_{vj}=150°C	-	0.26	-	
				T_{vj}=175°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°C unless otherwise specified)

Items		Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Turn-on energy	E_{on}	V_{CC} = 600V, I_C, I_F = 200A, V_{GE} = +15/-15 V, R_G = 1.8 Ω, L_S = 30 nH	T_{vj}=25°C	-	16.48	-	mJ
				T_{vj}=125°C	-	23.94	-	
				T_{vj}=150°C	-	26.79	-	
				T_{vj}=175°C	-	29.69	-	
	Turn-off energy	E_{off}		T_{vj}=25°C	-	14.91	-	
				T_{vj}=125°C	-	19.28	-	
				T_{vj}=150°C	-	20.51	-	
				T_{vj}=175°C	-	21.46	-	
	Reverse recovery energy	E_{rr}		T_{vj}=25°C	-	5.80	-	
				T_{vj}=125°C	-	9.83	-	
				T_{vj}=150°C	-	10.60	-	
				T_{vj}=175°C	-	12.09	-	
Thermistor	Resistance	R	T = 25°C		-	5000	-	Ω
			T = 100°C		465	495	520	
	B value	B	T = 25/ 50°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 min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance junction to case (1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.15	K/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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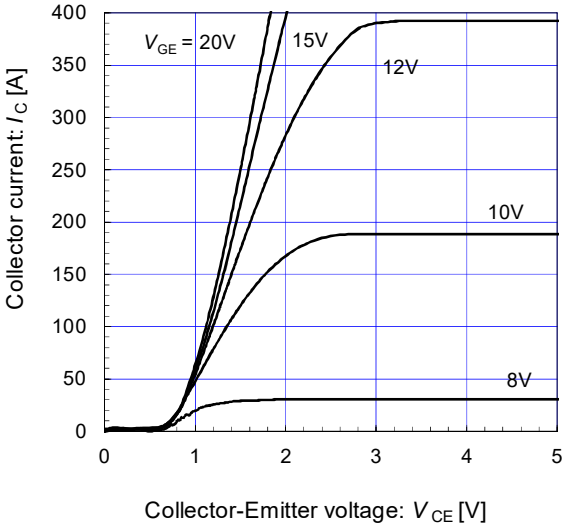
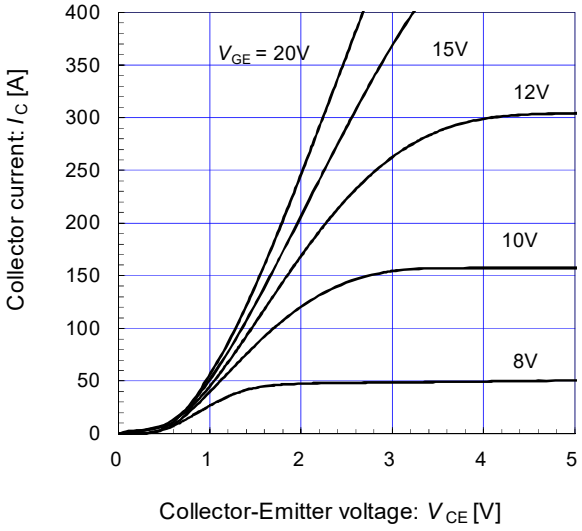
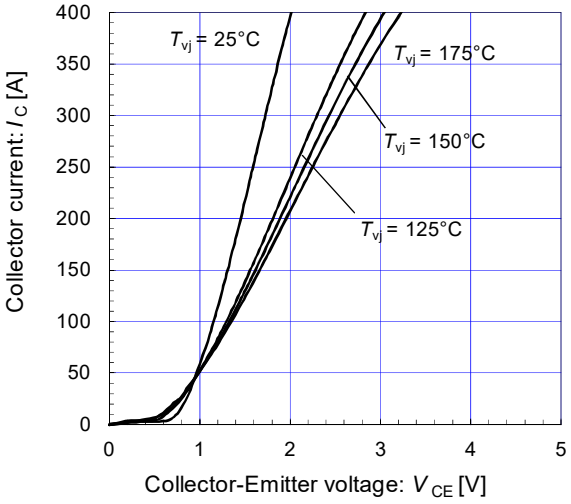
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 25°C / chip



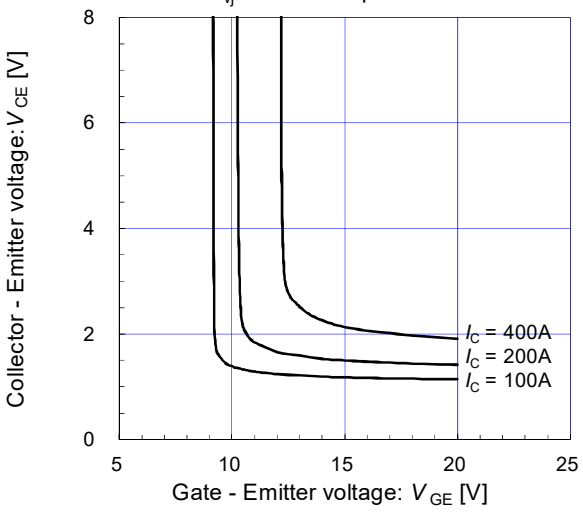
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{Vj} = 175°C / chip



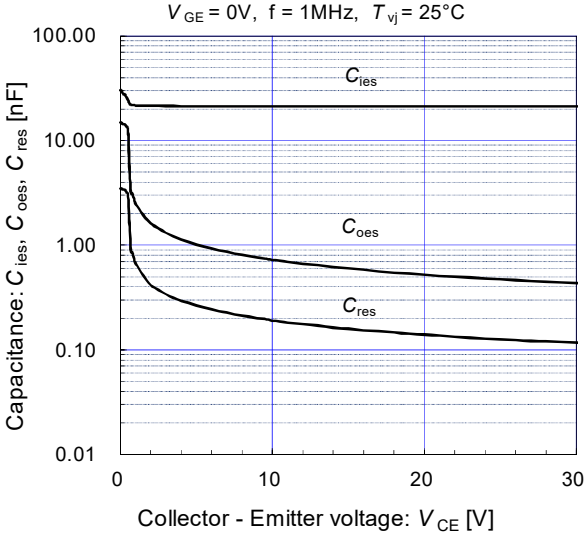
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} = 15V / chip



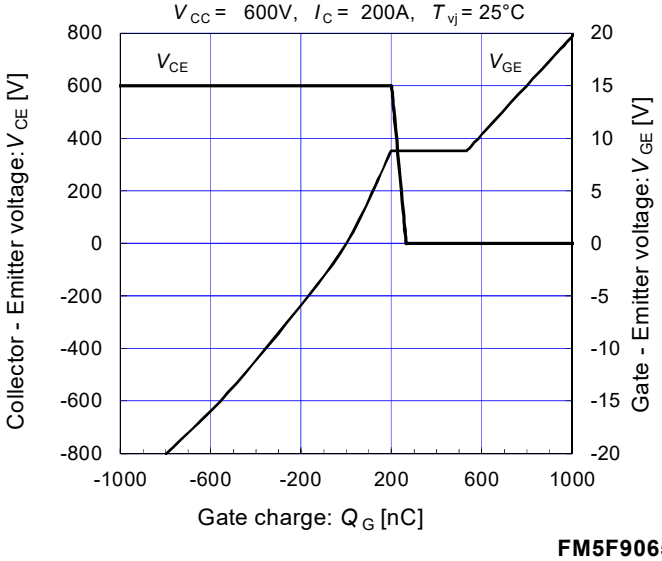
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj} = 25°C / chip



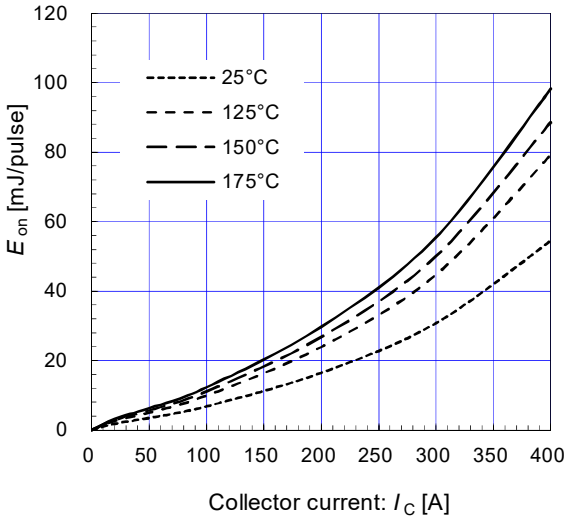
[Inverter]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE} = 0V, f = 1MHz, T_{vj} = 25°C



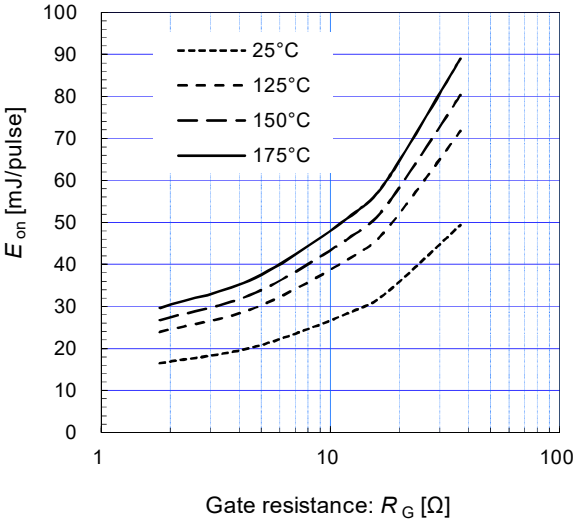
[Inverter]
Dynamic gate charge (typ.)
V_{CC} = 600V, I_C = 200A, T_{vj} = 25°C



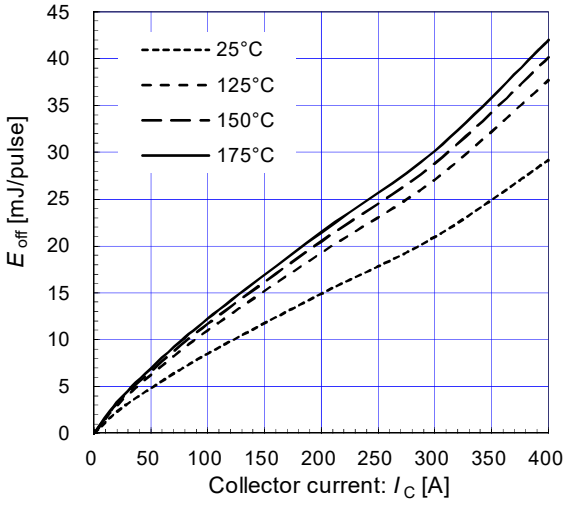
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = 1.8 Ω



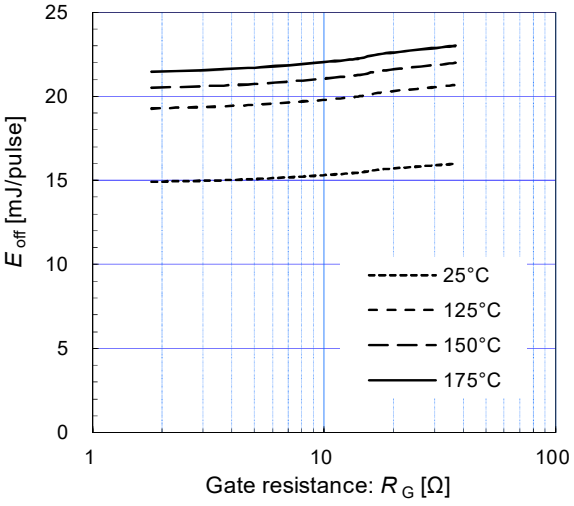
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, I_C = 200A



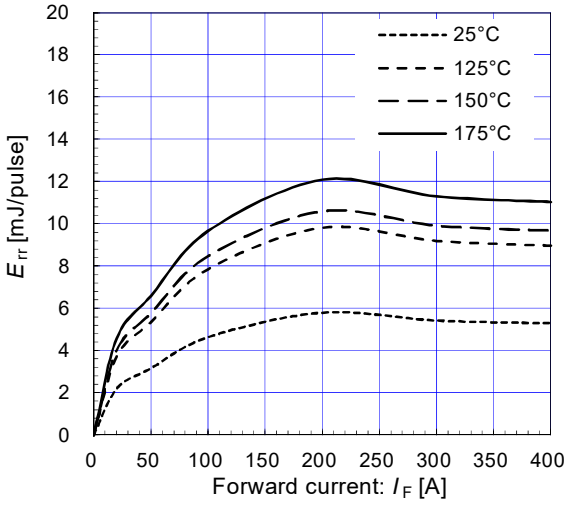
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = 1.8 Ω



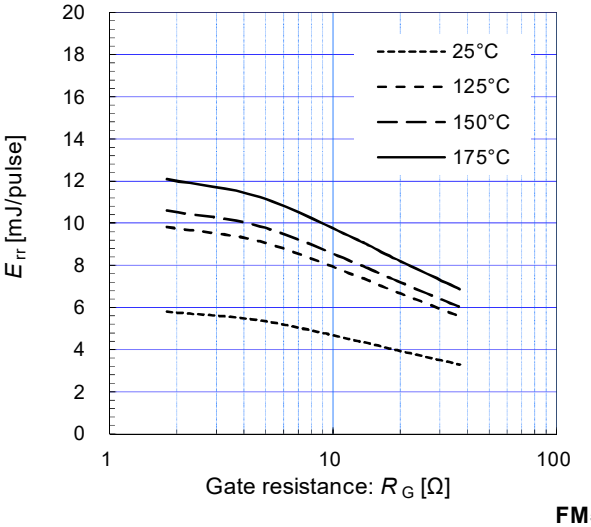
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, I_C = 200A



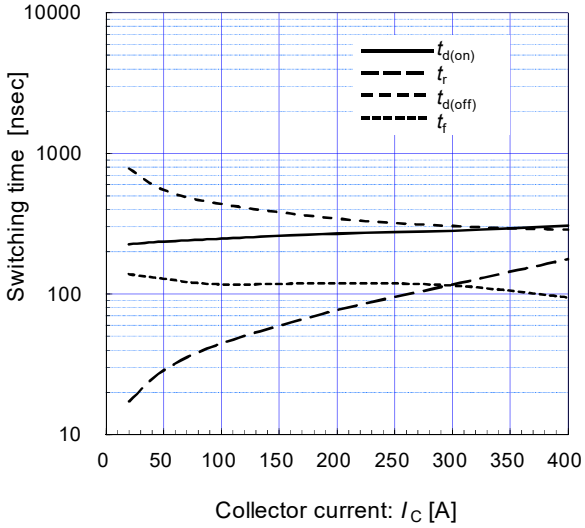
[Inverter]
E_{rr} vs. Forward current (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = 1.8 Ω



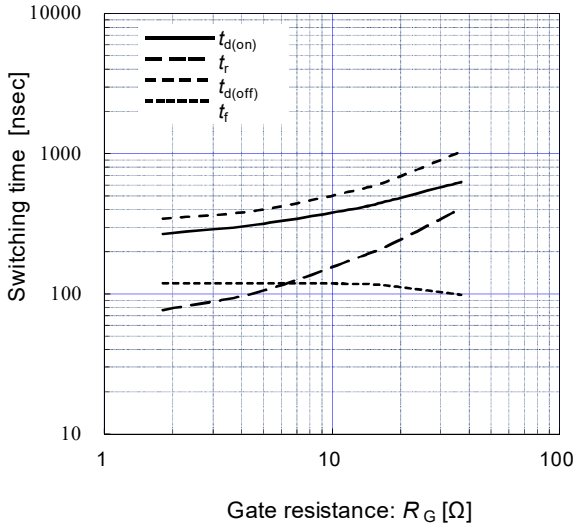
[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, I_F = 200A



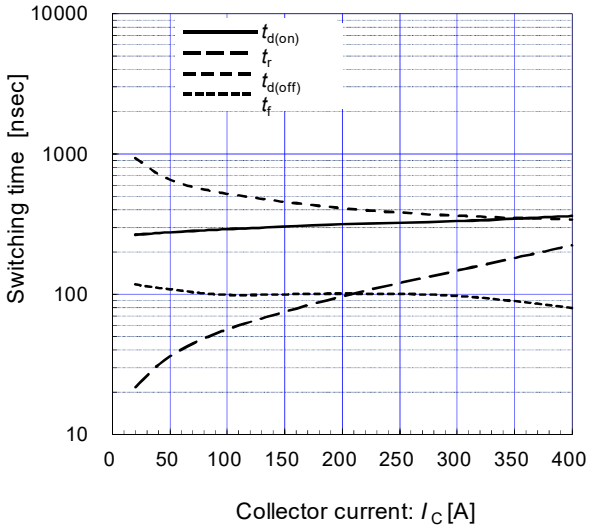
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 1.8 Ω, V_{GE} = +15/-15 V, T_{vj} = 25°C



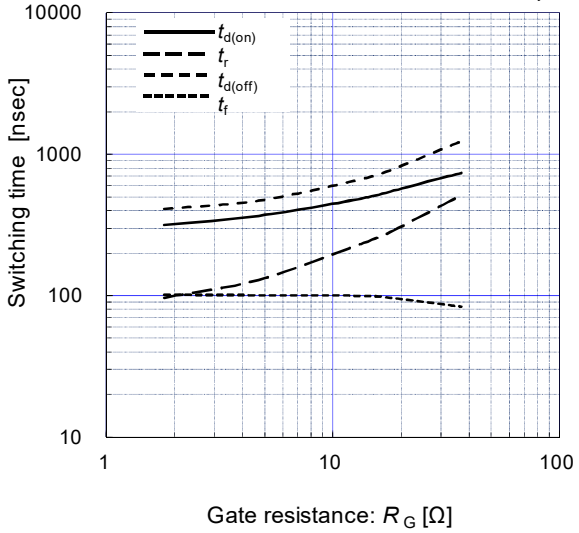
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 200A, V_{GE} = +15/-15 V, T_{vj} = 25°C



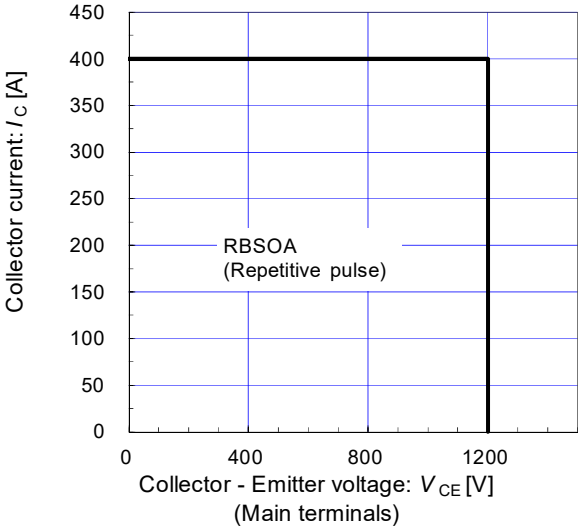
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 1.8 Ω, V_{GE} = +15/-15 V, T_{vj} = 175°C



[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 200A, V_{GE} = +15/-15 V, T_{vj} = 175°C



[Inverter]
Reverse bias safe operating area (max.)
V_{GE} = +15/-15 V, R_G = 1.8 Ω, T_{vj} = 175°C



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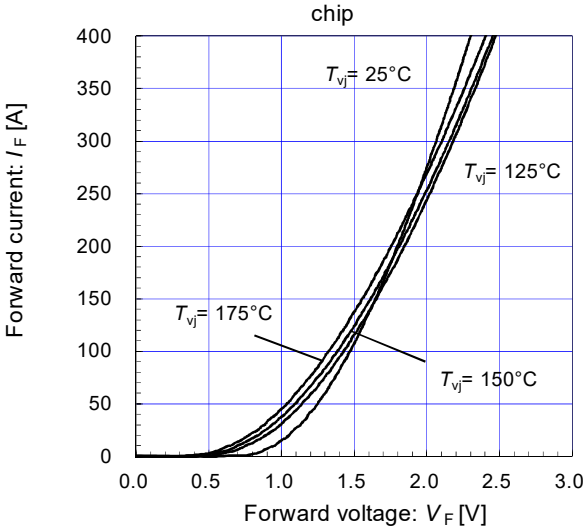
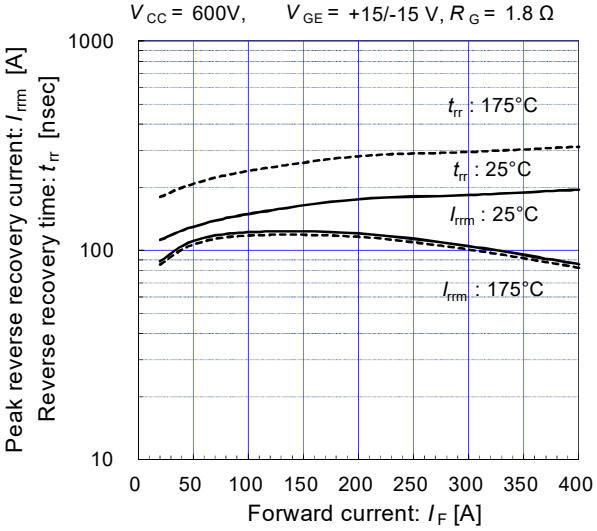
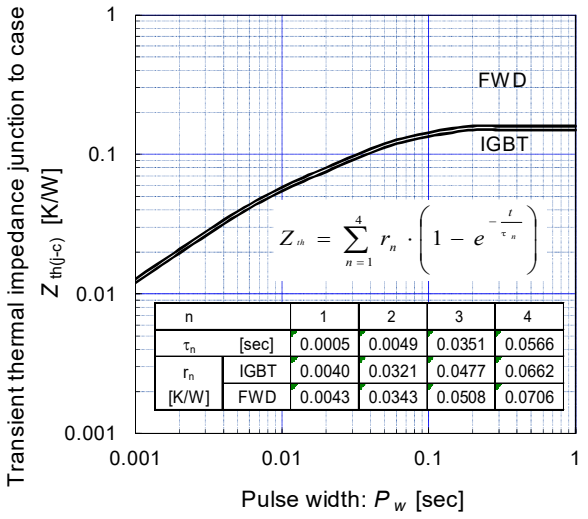
[Inverter]
Forward current vs. Forward voltage (typ.)
chip



[Inverter]
Reverse recovery characteristics (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = 1.8 Ω

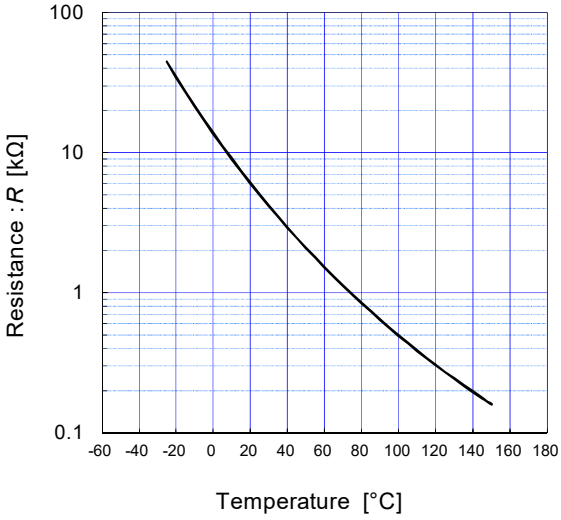


Transient thermal impedance (max.)



n		1	2	3	4
τ_n	[sec]	0.0005	0.0049	0.0351	0.0566
r_n [K/W]	IGBT	0.0040	0.0321	0.0477	0.0662
	FWD	0.0043	0.0343	0.0508	0.0706

[Thermistor]
Temperature characteristic (typ.)



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・Machine tools ・Audiovisual equipment ・Electrical home appliances ・Personal equipment ・Industrial robots etc.

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・Traffic-signal control equipment ・Gas leakage detectors with an auto-shut-off feature
・Emergency equipment for responding to disasters and anti-burglary devices ・Safety devices ・Medical equipment

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富士電機 Innovating Energy Technology

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IGBT Modules

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6 IGBT 损耗模拟软件	www.fujielectric.com/products/semiconductor/cn/model/igbt/simulation/
7 富士电机技报	www.fujielectric.com/products/semiconductor/cn/journal/
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