Fuji Electric

Innovating Energy Technology

2MBI1000XRNF120-50

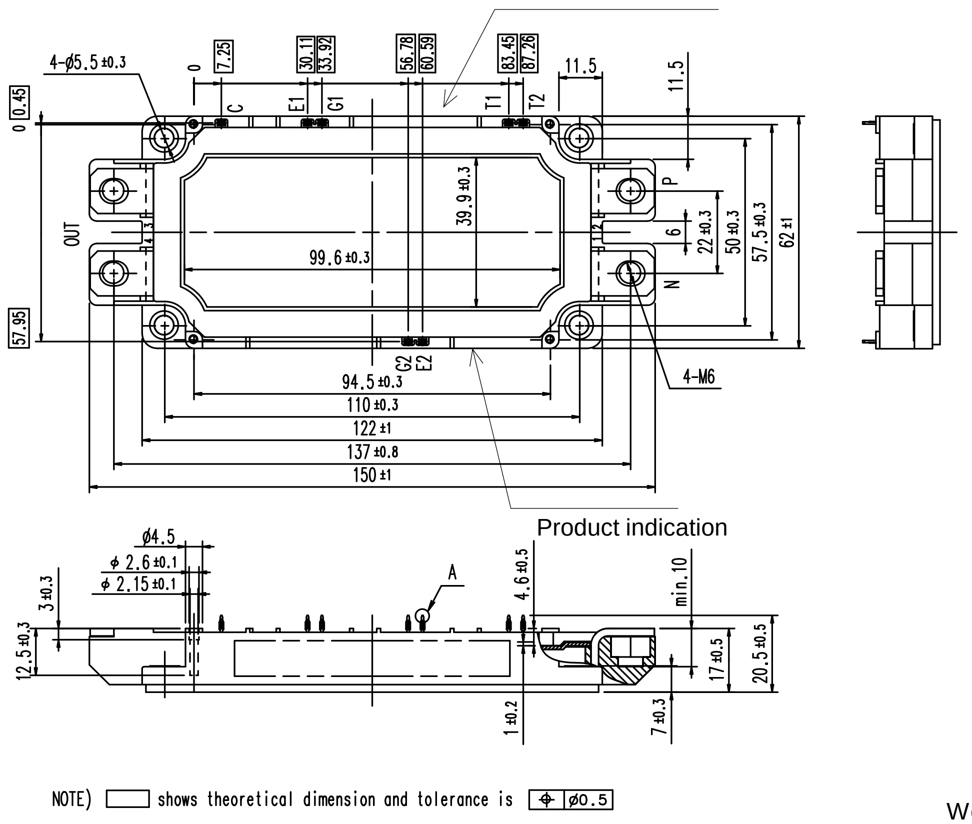
IGBT Modules

Power Module (X series)
1200V / 1000A / 2-in-1 package

■ Features
Low $V_{CE(sat)}$
Low Inductance Module structure
Solder pin terminals

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

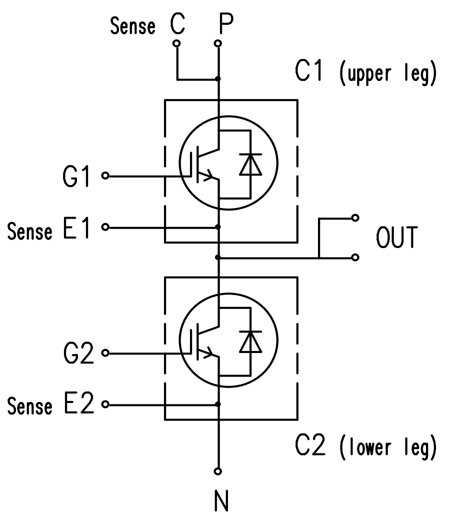
■ Outline drawing (Unit : mm)



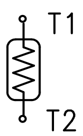
Weight: 350 g(typ.)

■ Equivalent Circuit

[Inverter]



[Thermistor]



FM5F09474
2019/06

■ Absolute Maximum Ratings (at T_C= 25°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°C	1000	A
	Repetitive peak collector current	I_{CRM}	1ms		2000	
	Reverse-conducting current	I_{RC}			1000	
	Repetitive peak reverse-conducting current	I_{RCRM}	1ms		2000	
	Total power dissipation	P_{tot}	1 device		8330	W
	Virtual junction temperature	T_{vj}			175	°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 terminals and copper base (*1) between thermistor and others (*2)	V_{isol}	AC: 1min.		4000	Vrms
Mounting torque for screws to heatsink (*3)		M_s	M5		6.0	N·m
Mounting torque for terminal screws (*3)		M_t	M6		6.0	

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

(*2) Two thermistor terminals should be connected together, other terminals should be connected together

(*3) Recommendable Value: : Mounting torque of screws to heatsink 2.5 ~ 6.0 N·m (M5)
Recommendable Value: : Mounting torque of screws to terminals 3.5 ~ 6.0 N·m (M6)

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

	Items	Symbols	Conditions		Characteristics min.	typ.	max.	Units
Inverter	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}=±20V		-	-	400	nA
	Gate-emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 1000mA		5.8	6.4	7.0	V
	Collector-emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C= 1000A	T_{vj}=25°C	-	2.75	3.30	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.55	2.00	
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.95	-	
				T_{vj}=175°C	-	2.00	-	
	Internal gate resistance	r_g	-		-	0.95	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	126	-	nF
	Output capacitance	C_{oes}			-	5.3	-	
	Reverse transfer capacitance	C_{res}			-	1.19	-	
	Gate charge	Q_G	V_{CC} = 600V, I_C = 1000A V_{GE} = -15 → +15V		-	7.8	-	μC
	Reverse-conducting voltage	V_{RC} (terminal)	V_{GE} = 0V I_{RC}= 1000A	T_{vj}=25°C	-	2.80	3.30	V
		V_{RC} (chip)		T_{vj}= 25°C	-	1.60	2.05	
				T_{vj}=125°C	-	1.75	-	
				T_{vj}=150°C	-	1.75	-	
				T_{vj}=175°C	-	1.75	-	
	Turn-on delay time (*1)	$t_{d(on)}$	V_{CC} = 600V I_C, I_F = 1000A V_{GE} = +15V / -15V R_G = 0.5Ω L_S = 35 nH	T_{vj}= 25°C	-	0.42	-	μs
				T_{vj}=125°C	-	0.43	-	
				T_{vj}=150°C	-	0.43	-	
				T_{vj}=175°C	-	0.43	-	
	Rise time	t_r		T_{vj}= 25°C	-	0.10	-	
				T_{vj}=125°C	-	0.11	-	
				T_{vj}=150°C	-	0.11	-	
				T_{vj}=175°C	-	0.12	-	
	Turn-off delay time (*2)	$t_{d(off)}$		T_{vj}= 25°C	-	0.54	-	
				T_{vj}=125°C	-	0.55	-	
				T_{vj}=150°C	-	0.56	-	
				T_{vj}=175°C	-	0.56	-	
	Fall time	t_f		T_{vj}= 25°C	-	0.12	-	
				T_{vj}=125°C	-	0.15	-	
				T_{vj}=150°C	-	0.15	-	
				T_{vj}=175°C	-	0.16	-	
	Forward recovery time	t_{fr}		T_{vj}= 25°C	-	0.28	-	
				T_{vj}=125°C	-	0.38	-	
				T_{vj}=150°C	-	0.41	-	
				T_{vj}=175°C	-	0.45	-	

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

(*2) Turn off time (t_{off}) = $t_{d(off)}$ + t_f

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

Items		Symbols	Conditions		Characteristics min.	typ.	max.	Units
Inverter	Turn-on energy (per pulse)	E_{on}	V_{CC} = 600V, I_C, I_F = 1000A, V_{GE} = +15V / -15V, R_G = 0.5Ω, L_S = 35 nH	T_{vj}= 25°C	-	75.7	-	mJ
				T_{vj}=125°C	-	98.9	-	
				T_{vj}=150°C	-	103.5	-	
				T_{vj}=175°C	-	110.5	-	
	Turn-off energy (per pulse)	E_{off}		T_{vj}= 25°C	-	106.6	-	
				T_{vj}=125°C	-	117.6	-	
				T_{vj}=150°C	-	125.3	-	
				T_{vj}=175°C	-	134.1	-	
	Forward recovery energy (per pulse)	E_{fr}		T_{vj}= 25°C	-	93.5	-	
				T_{vj}=125°C	-	124.7	-	
				T_{vj}=150°C	-	137.7	-	
				T_{vj}=175°C	-	139.0	-	
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.	typ.	max.	Units
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter RC-IGBT	-	-	0.018	K/W
Thermal resistance case to heatsink (1 device) (*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 hestsink with thermal grease.

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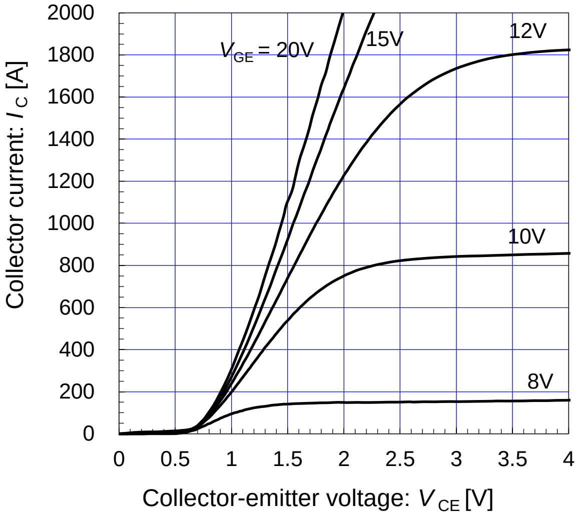
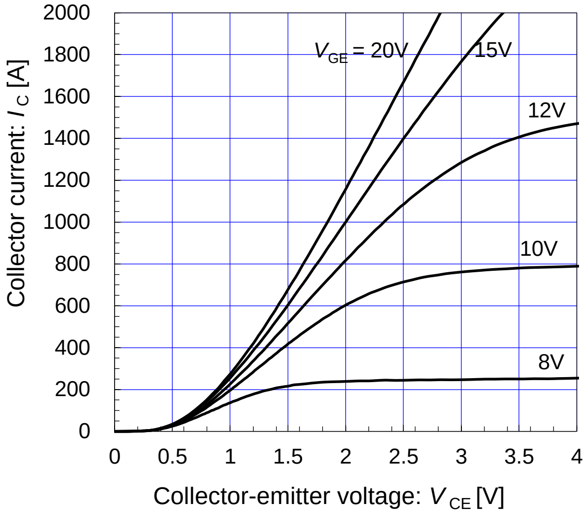
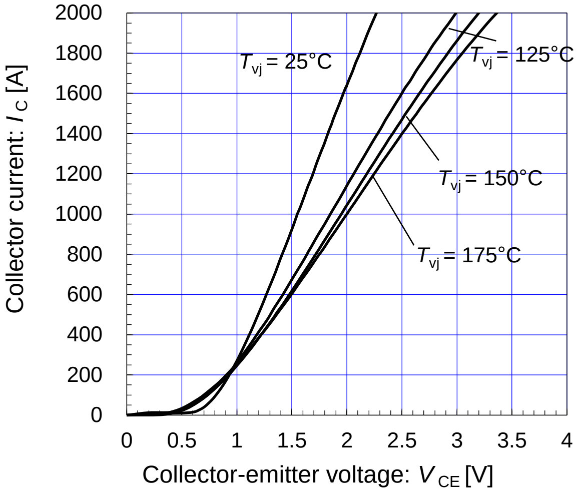
[Inverter]
Collector current vs. Collector-emitter voltage
T_{vj} = 25°C / chip



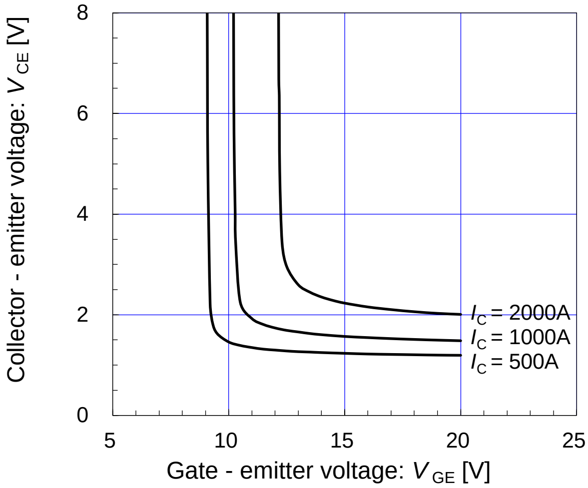
[Inverter]
Collector current vs. Collector-emitter voltage (typ.)
T_{vj} = 175°C / chip



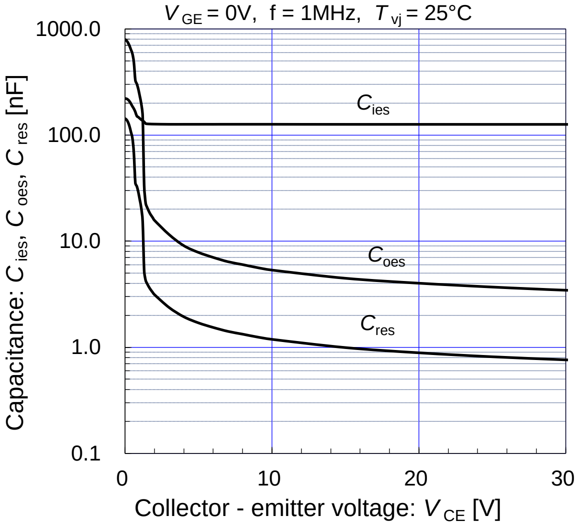
[Inverter]
Collector current vs. Collector-emitter voltage
V_{GE} = 15V / chip



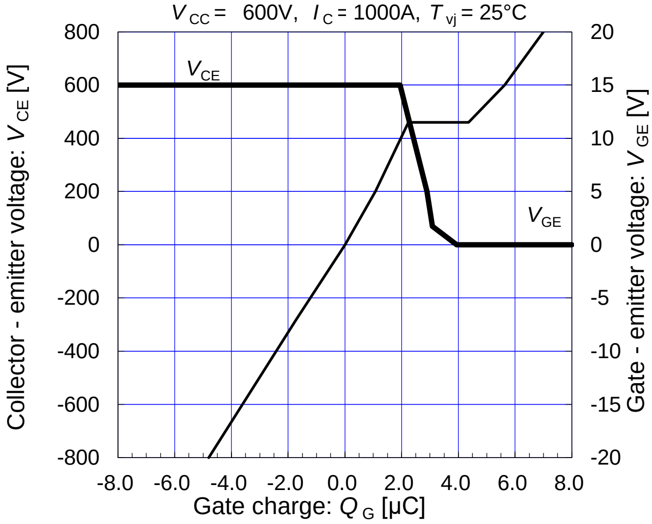
[Inverter]
Collector-emitter voltage vs. Gate-emitter voltage
T_{vj} = 25°C / chip



[Inverter]
Capacitance vs. Collector-emitter Voltage
V_{GE} = 0V, f = 1MHz, T_{vj} = 25°C



[Inverter]
Dynamic Gate charge (typ.)
V_{CC} = 600V, I_C = 1000A, T_{vj} = 25°C



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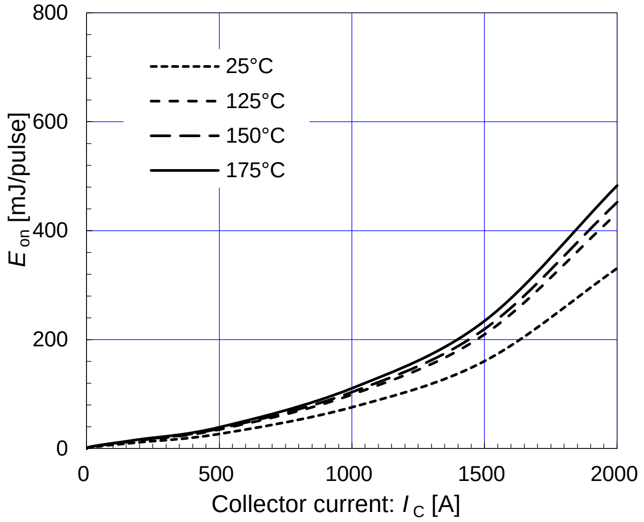
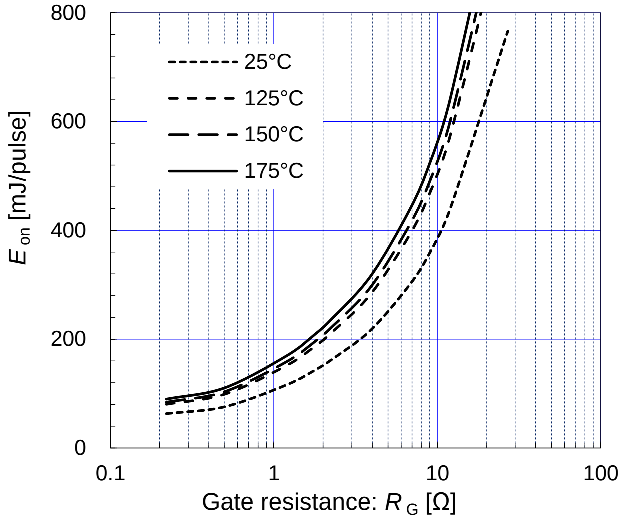
IGBT Modules

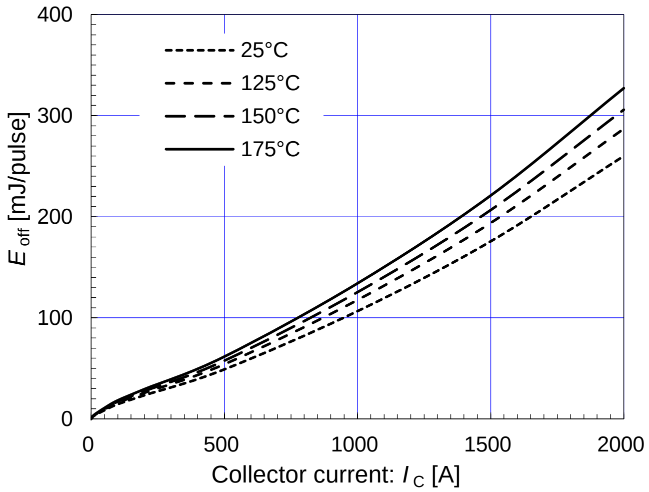
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15V / -15V, R_G = 0.5Ω



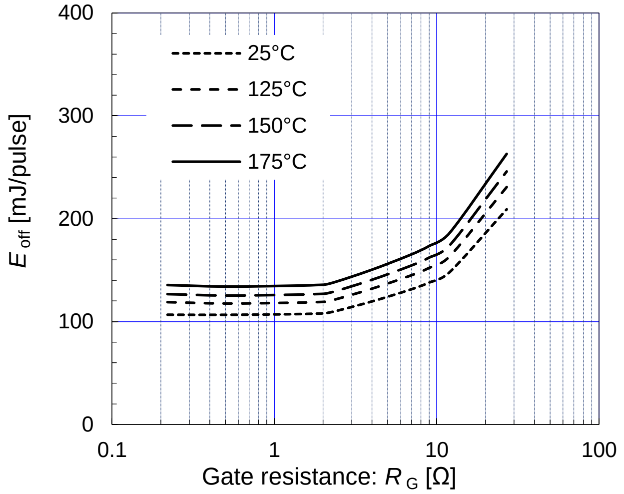
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15V / -15V, I_C = 1000A



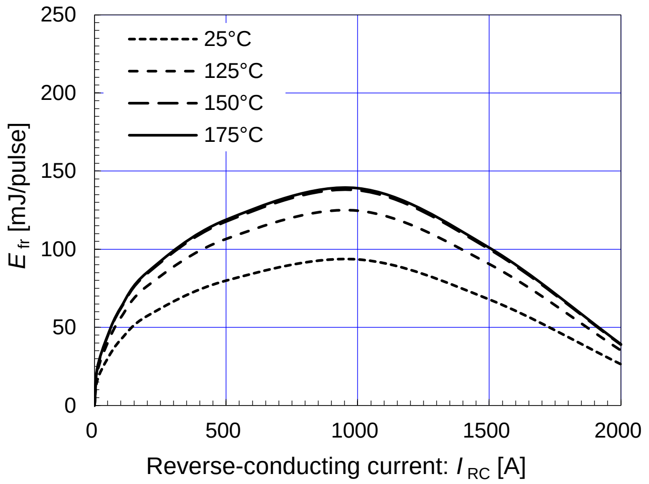
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15V / -15V, R_G = 0.5Ω



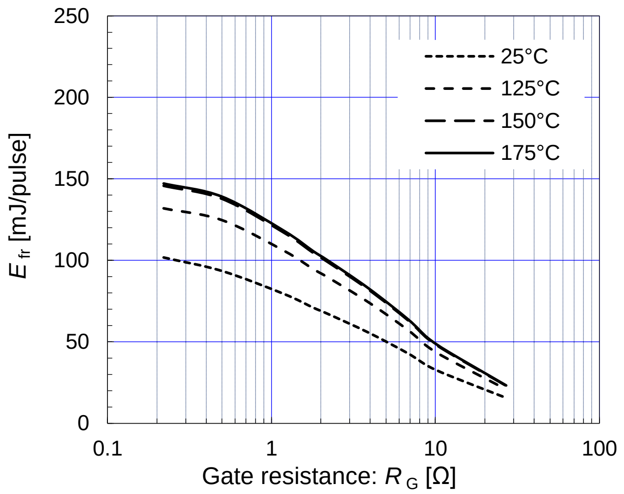
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15V / -15V, I_C = 1000A



[Inverter]
E_{fr} vs. Reverse-conducting current (typ.)
V_{CC} = 600V, V_{GE} = +15V / -15V, R_G = 0.5Ω



[Inverter]
E_{fr} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15V / -15V, I_F = 1000A



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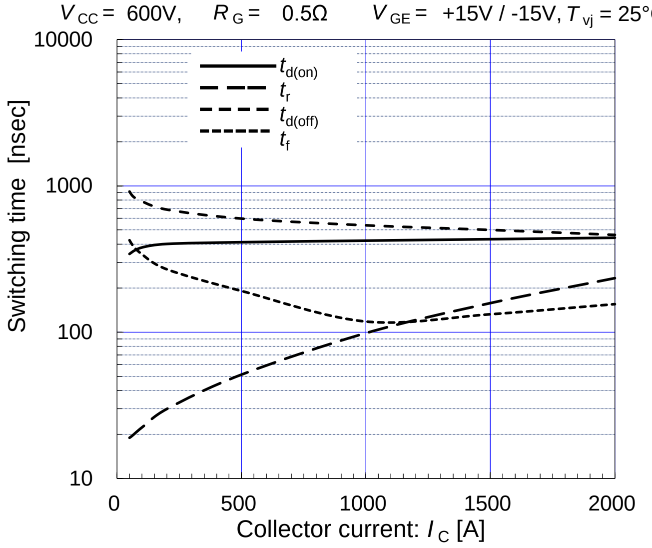
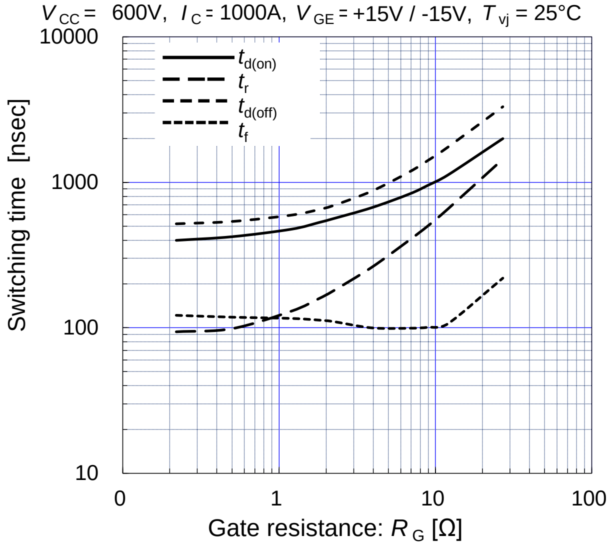
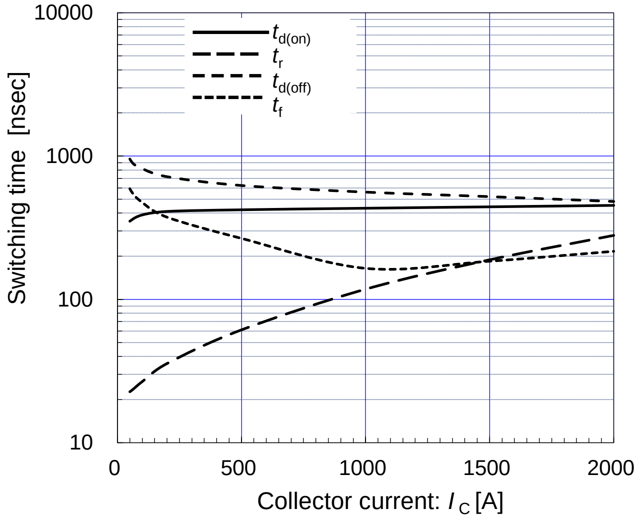
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 0.5Ω V_{GE} = +15V / -15V, T_{vj} = 25°C



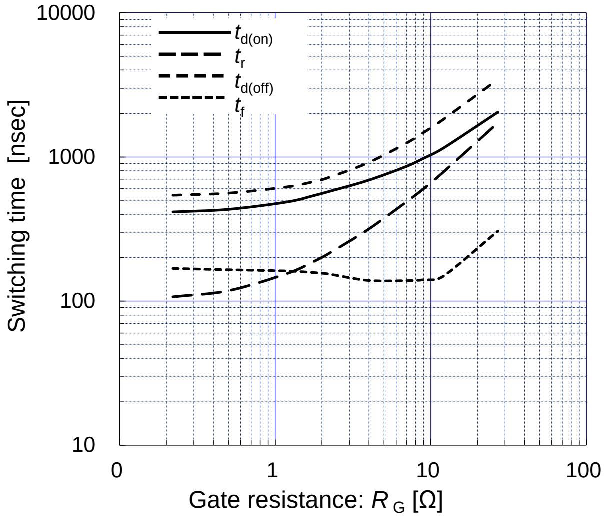
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 1000A, V_{GE} = +15V / -15V, T_{vj} = 25°C



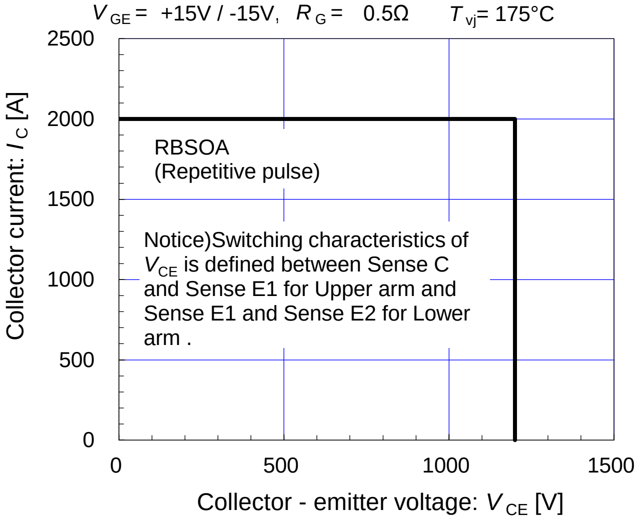
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 0.5Ω V_{GE} = +15V / -15V, T_{vj} = 175°C



[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 1000A, V_{GE} = +15V / -15V, T_{vj} = 175°C



[Inverter]
Reverse bias safe operating area (max.)
V_{GE} = +15V / -15V, R_G = 0.5Ω T_{vj} = 175°C



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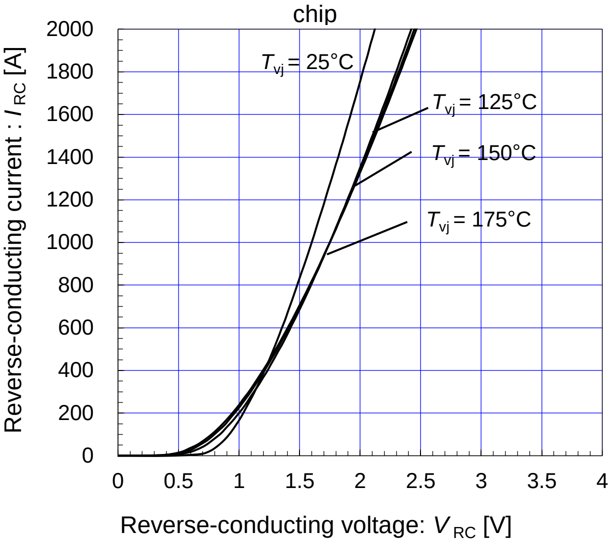
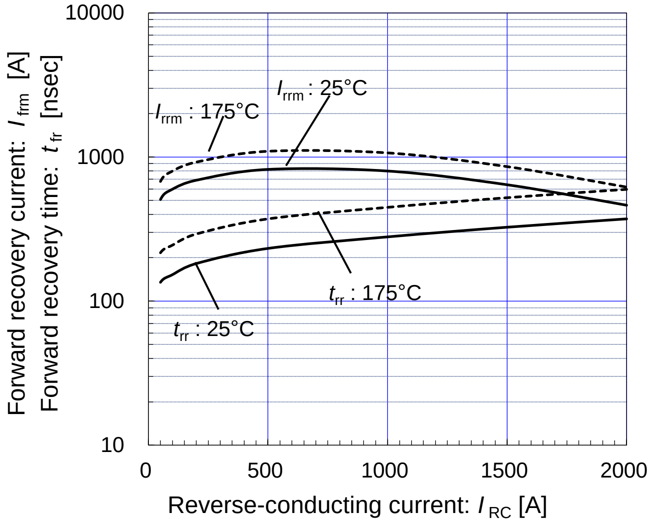
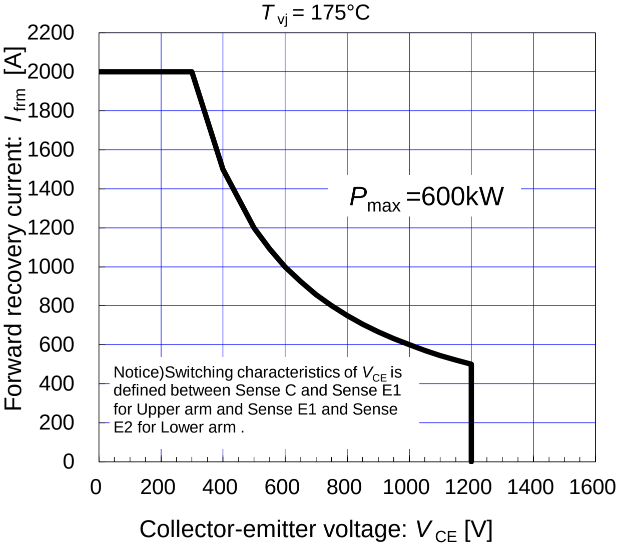
[Inverter]
Reverse-conducting current vs. Reverse-conducting voltage (typ.)
chip



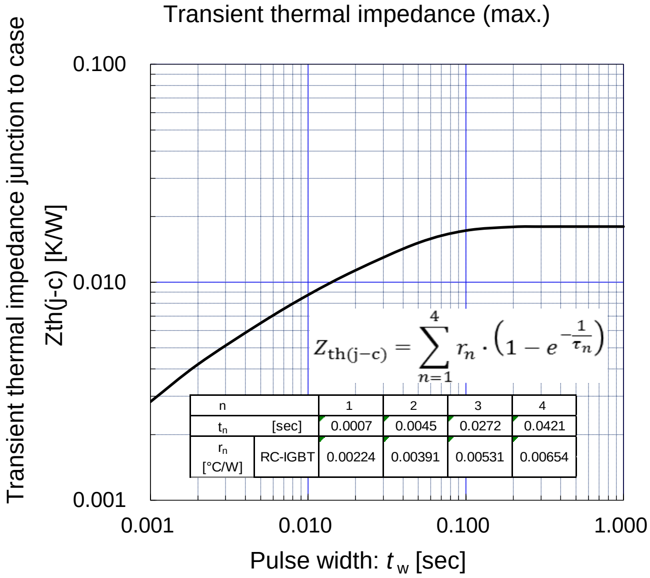
[Inverter]
Forward recovery characteristics (typ.)
V_{CC} = 600V, V_{GE} = +15V / -15V, R_G = 0.5Ω



[Inverter]
FWD safe operation area (max.)
T_{vj} = 175°C



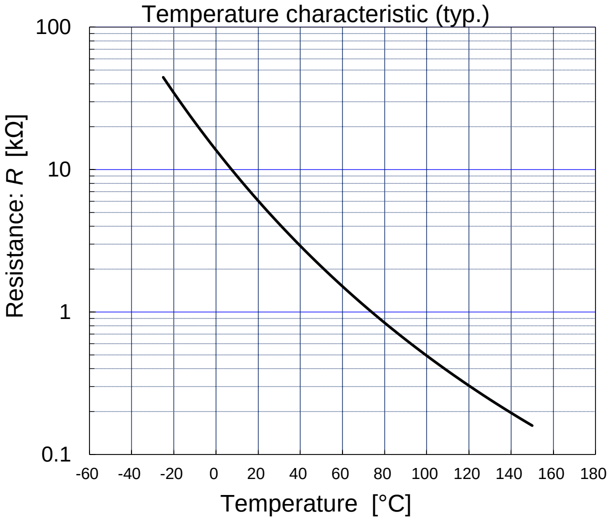
[Inverter]
Transient thermal impedance (max.)



$$Z_{\mathrm{th(j-c)}} = \sum_{n=1}^{4} r_n \cdot \left(1 - e^{-\frac{1}{\tau_n}}\right)$$

n		1	2	3	4
t_n	[sec]	0.0007	0.0045	0.0272	0.0421
r_n [°C/W]	RC-IGBT	0.00224	0.00391	0.00531	0.00654

[Thermistor]
Temperature characteristic (typ.)



Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 6/2019. The contents are subject to change without notice for specification changes or other reasons. When using a product listed in this Catalog, be sure to obtain the latest specifications.

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4. The products introduced in this Catalog are intended for use in the following electronic and electrical equipment which has normal reliability requirements.
・Computers ・OA equipment ・Communications equipment (terminal devices) ・Measurement equipment
・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

6. Do not use products in this Catalog for the equipment requiring strict reliability such as the following and equivalents to strategic equipment (without limitation).
・Space equipment ・Aeronautic equipment ・Nuclear control equipment ・Submarine repeater equipment

7.

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