2MBI600XNF120-50

IGBT Modules

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

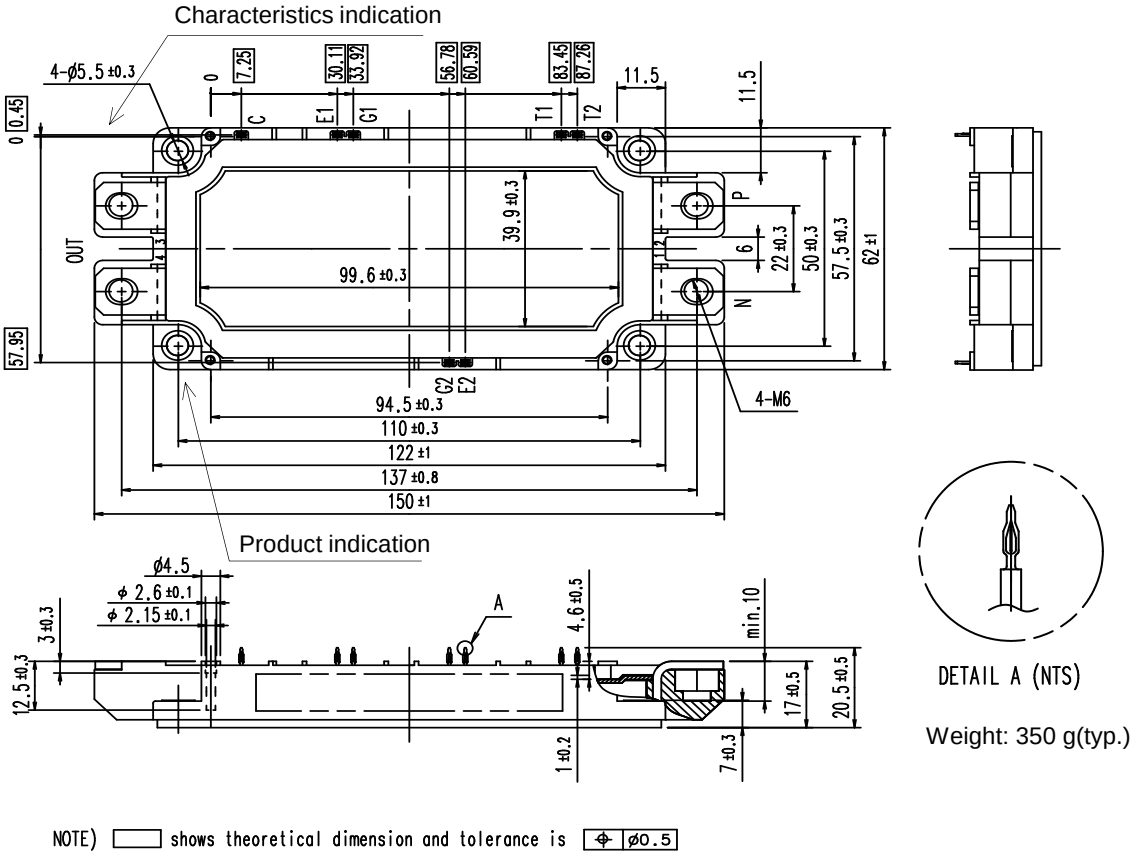
■ Features

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

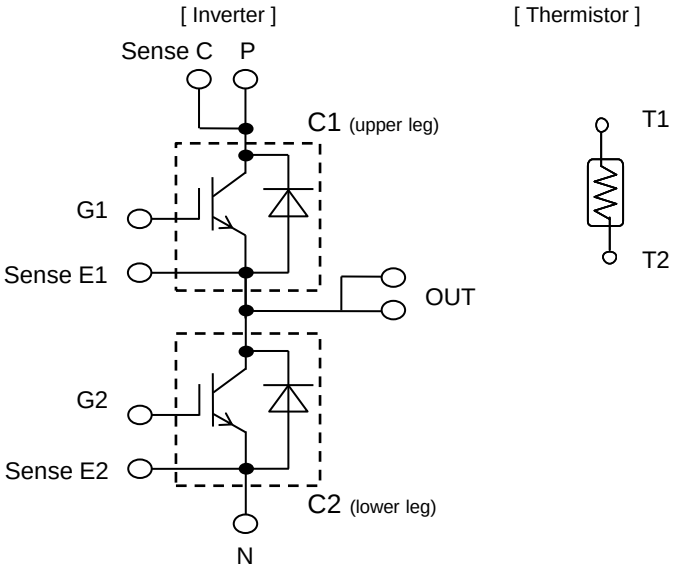


DETAIL A (NTS)

Weight: 350 g(typ.)

NOTE) ☐ shows theoretical dimension and tolerance is ⌖ ø0.5

■ Equivalent Circuit



FM5F9082a
2019/05

■ 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	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	3125	W
	Virtual junction temperature	T_{vj}		175	°C
	Operating junction temperature (under switching conditions)	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
Mounting torque of screws to terminals (*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 and shorted to base plate during the test.

(*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)

2MBI600XNF120-50

■ 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		-	-	150	μA
	Gate leakage current, collector-emitter short-circuited	I_{GES}	V_{CE}=0V, V_{GE}=±20V		-	-	300	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°C	-	2.20	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	-		-	1.67	-	Ω
	Capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	64	-	nF
		C_{oes}			-	2.2	-	
		C_{res}			-	0.57	-	
	Gate charge	Q_G	V_{CC} = 600V, I_C = 600A V_{GE} = -15 → +15V		-	4.2	-	μC
	Forward voltage	V_F (terminal)	V_{GE} = 0V I_F= 600A	T_{vj}=25°C	-	2.35	2.80	V
		V_F (chip)		T_{vj}= 25°C	-	1.60	2.05	
				T_{vj}=125°C	-	1.65	-	
				T_{vj}=150°C	-	1.60	-	
				T_{vj}=175°C	-	1.60	-	
	Switching time (*1)	$t_{d(on)}$	V_{CC} = 600V I_C, I_F = 600A V_{GE} = +15/-15 V R_G = ±0.56Ω L_S = 35 nH	T_{vj}= 25°C	-	0.42	-	μs
				T_{vj}=125°C	-	0.46	-	
				T_{vj}=150°C	-	0.48	-	
				T_{vj}=175°C	-	0.49	-	
		t_r		T_{vj}= 25°C	-	0.09	-	
				T_{vj}=125°C	-	0.11	-	
				T_{vj}=150°C	-	0.11	-	
				T_{vj}=175°C	-	0.12	-	
		$t_{d(off)}$		T_{vj}= 25°C	-	0.42	-	
				T_{vj}=125°C	-	0.47	-	
				T_{vj}=150°C	-	0.48	-	
				T_{vj}=175°C	-	0.49	-	
		t_f		T_{vj}= 25°C	-	0.07	-	
				T_{vj}=125°C	-	0.09	-	
				T_{vj}=150°C	-	0.10	-	
				T_{vj}=175°C	-	0.10	-	
	Reverse recovery time	t_{rr}		T_{vj}= 25°C	-	0.14	-	
				T_{vj}=125°C	-	0.26	-	
				T_{vj}=150°C	-	0.28	-	
				T_{vj}=175°C	-	0.31	-	

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

2MBI600XNF120-50

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

Items		Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Switching loss (per pulse)	E_{on}	V_{CC} = 600V, I_C, I_F = 600A, V_{GE} = +15/-15 V, R_G = ±0.56Ω, L_S = 35 nH	T_{vj}= 25°C	-	38.7	-	mJ
				T_{vj}=125°C	-	59.5	-	
				T_{vj}=150°C	-	63.4	-	
				T_{vj}=175°C	-	73.2	-	
		E_{off}		T_{vj}= 25°C	-	54.2	-	
				T_{vj}=125°C	-	63.1	-	
				T_{vj}=150°C	-	66.0	-	
				T_{vj}=175°C	-	70.7	-	
		E_{rr}		T_{vj}= 25°C	-	20.2	-	
				T_{vj}=125°C	-	41.3	-	
				T_{vj}=150°C	-	49.5	-	
				T_{vj}=175°C	-	53.0	-	
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.

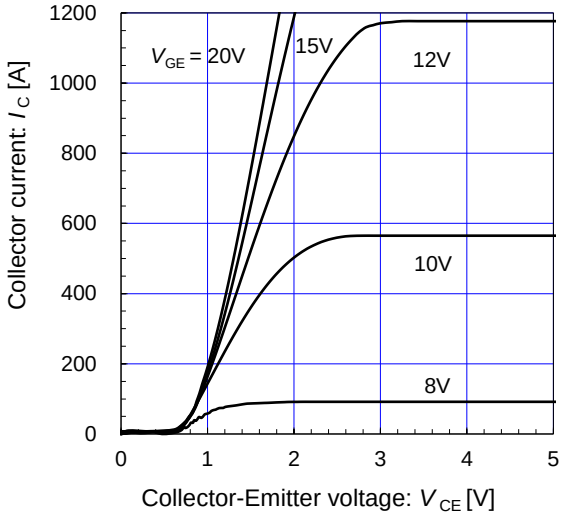
■Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.048	K/W
		Inverter FWD	-	-	0.057	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·°C) thermal grease	-	0.0167	-	

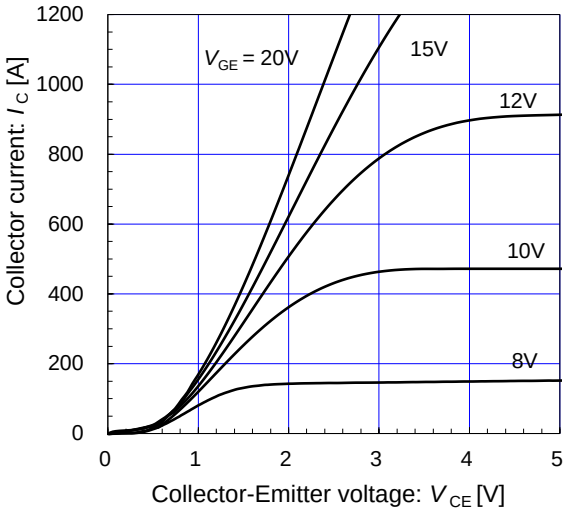
(*1) This is the value which is defined mounting on the additional heatsink with thermal grease.

2MBI600XNF120-50

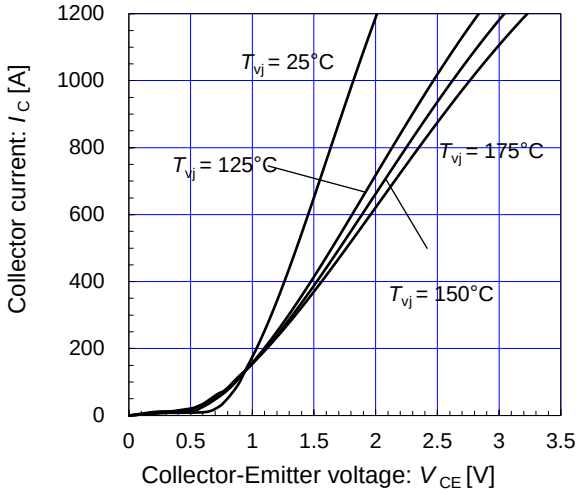
[Inverter]
Collector current vs. Collector-Emitter voltage
T_{vj} = 25°C / chip



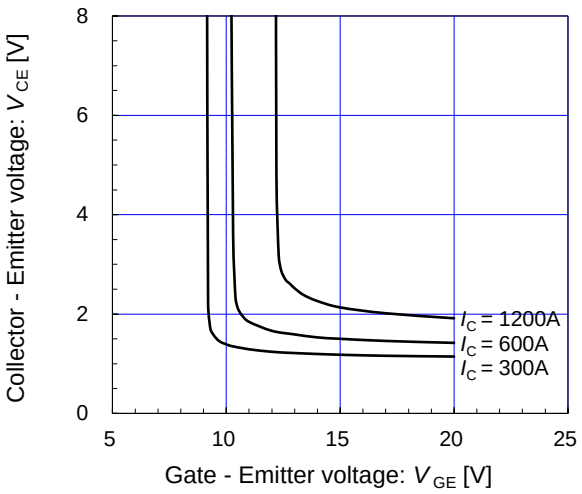
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{Vj} = 175°C / chip



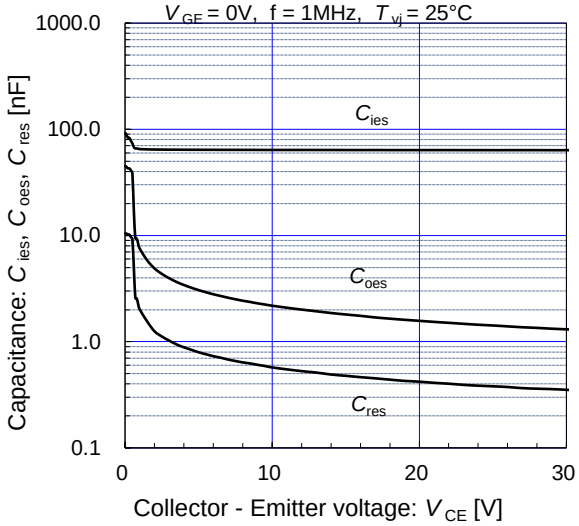
[Inverter]
Collector current vs. Collector-Emitter voltage
V_{GE} = 15V / chip



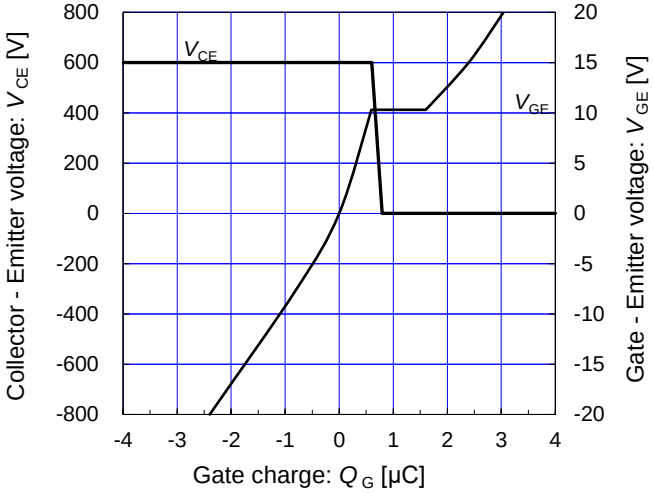
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage
T_{vj} = 25°C / chip



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

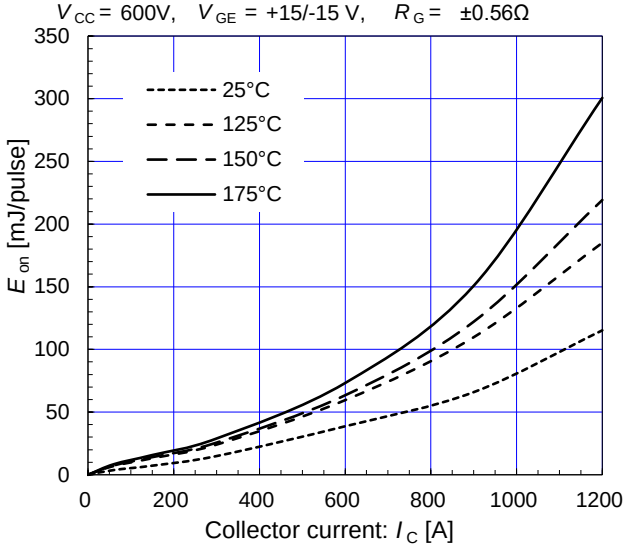


[Inverter]
Dynamic Gate Charge (typ.)
V_{CC} = 600V, I_C = 600A, T_{vj} = 25°C

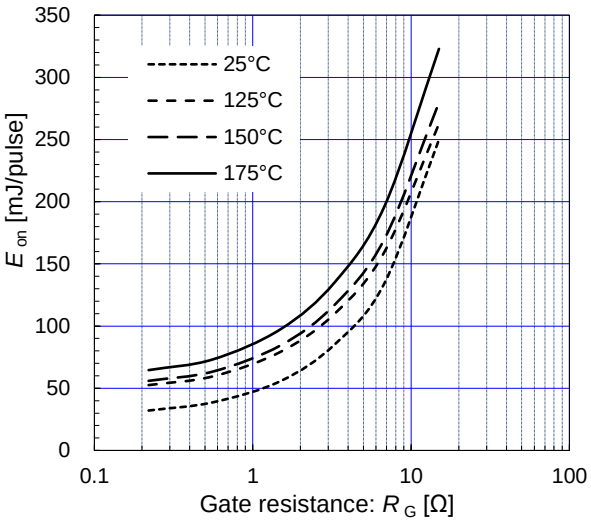


2MBI600XNF120-50

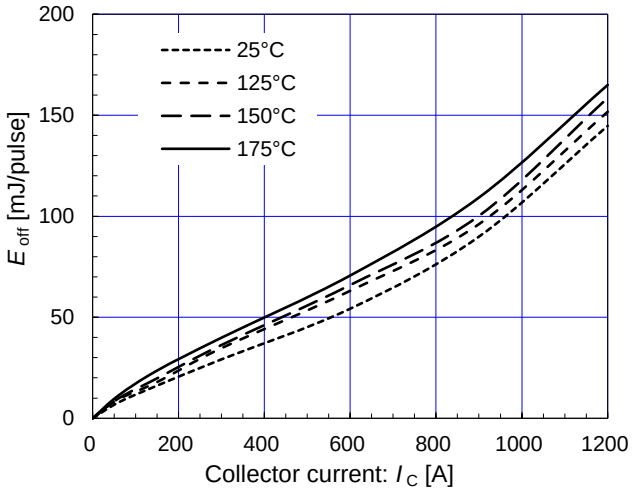
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = ±0.56Ω



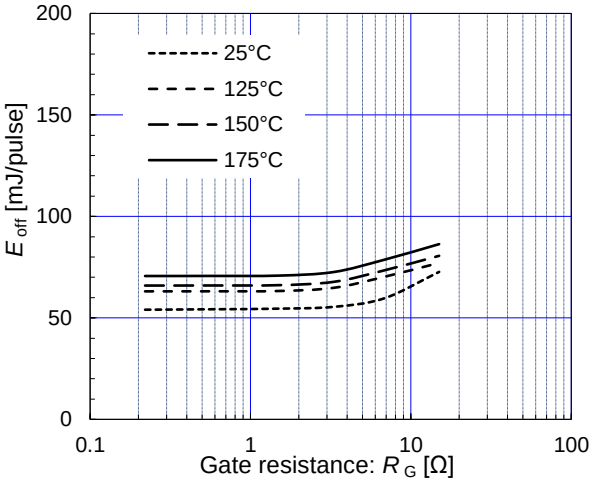
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, I_C = 600A



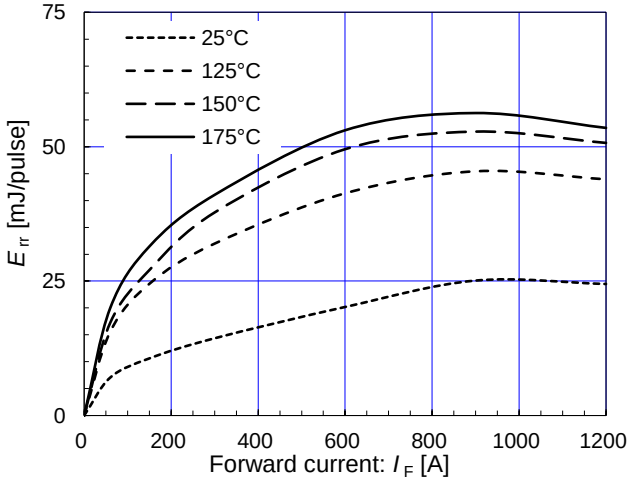
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = ±0.56 Ω



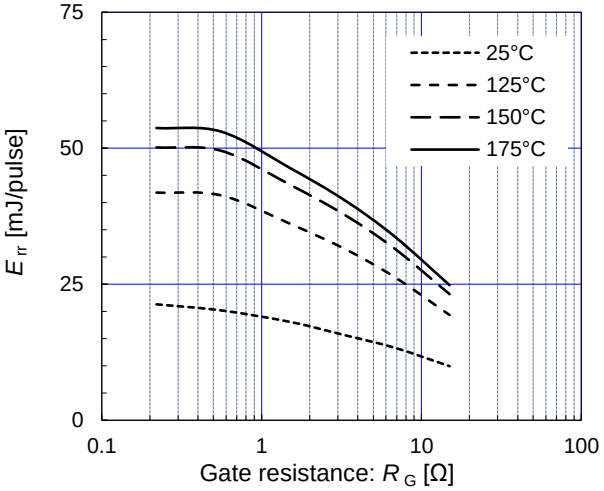
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, I_C = 600A



[Inverter]
E_{rr} vs. Forward current (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = ±0.56Ω

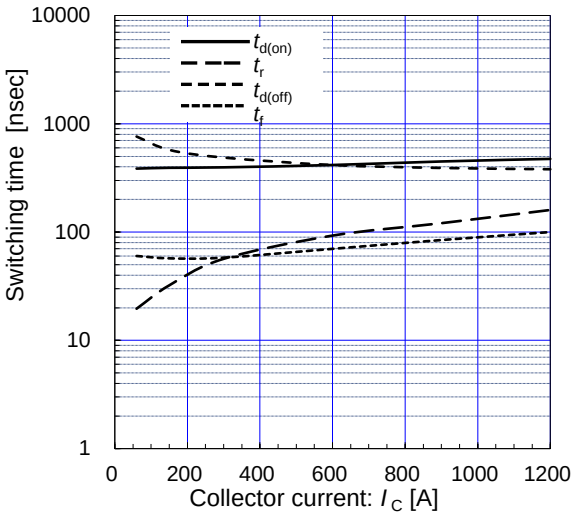


[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, I_F = 600A

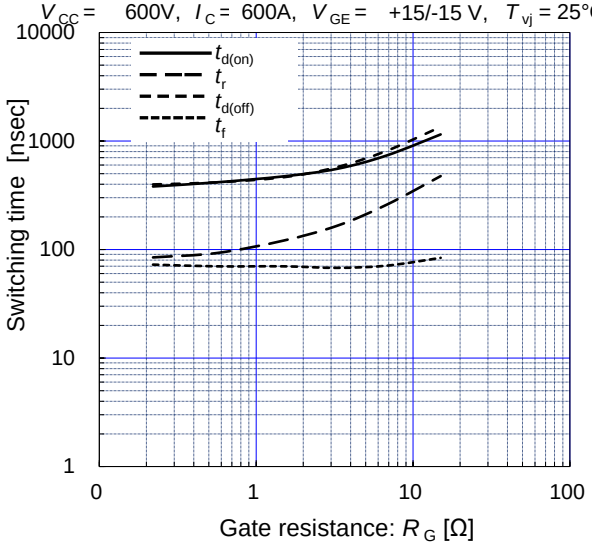


2MBI600XNF120-50

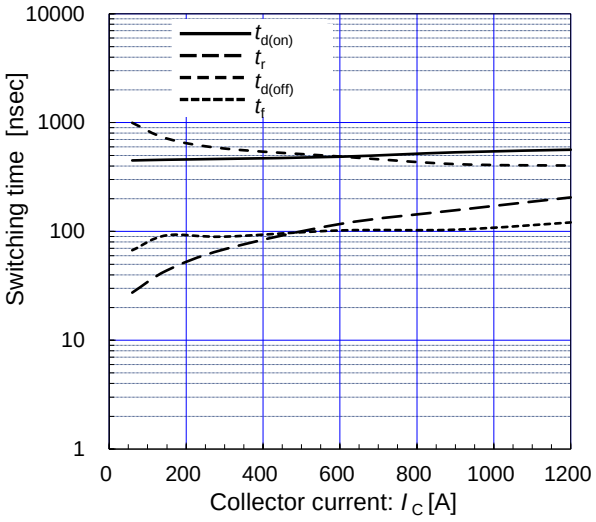
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = ±0.56Ω V_{GE} = +15/-15 V, T_{vj} = 25°C



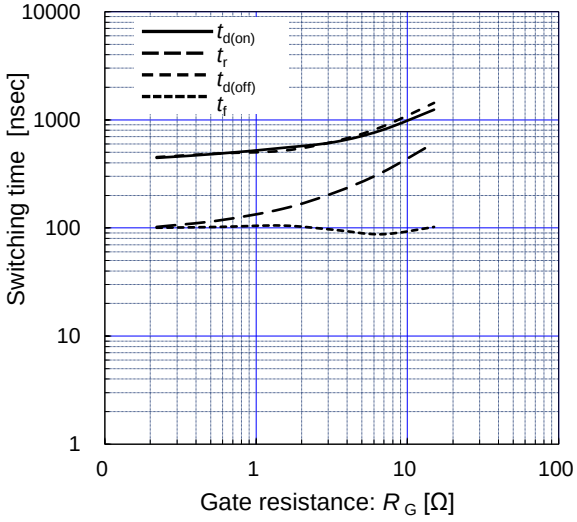
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 600A, V_{GE} = +15/-15 V, T_{vj} = 25°C



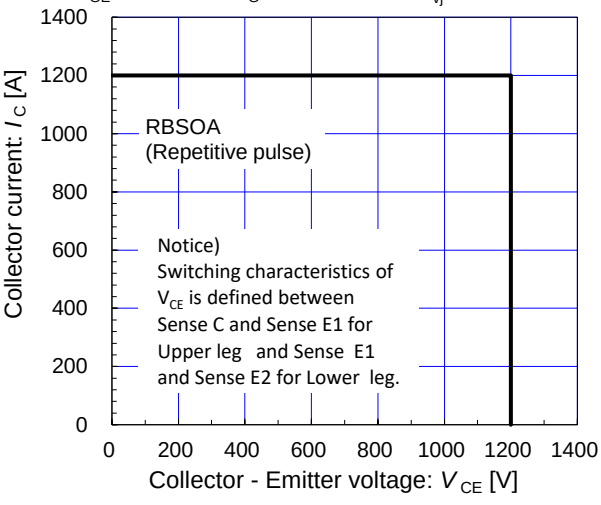
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = ±0.56Ω V_{GE} = +15/-15 V, T_{vj} = 175°C



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

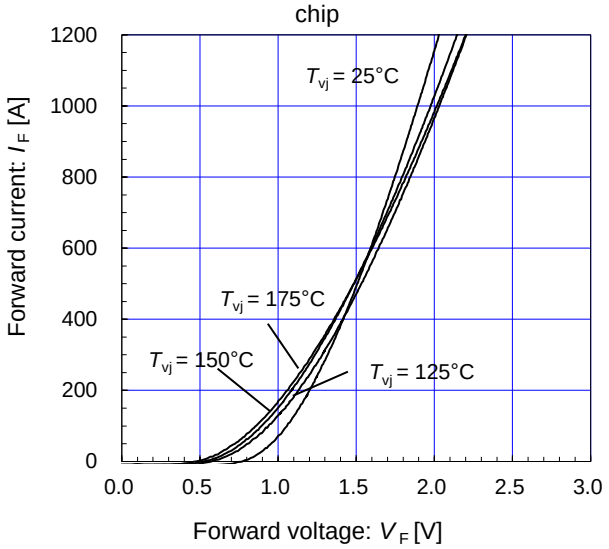


[Inverter]
Reverse bias safe operating area (max.)
V_{GE} = +15/-15 ' R_G = ±0.56Ω T_{vj} = 175°C

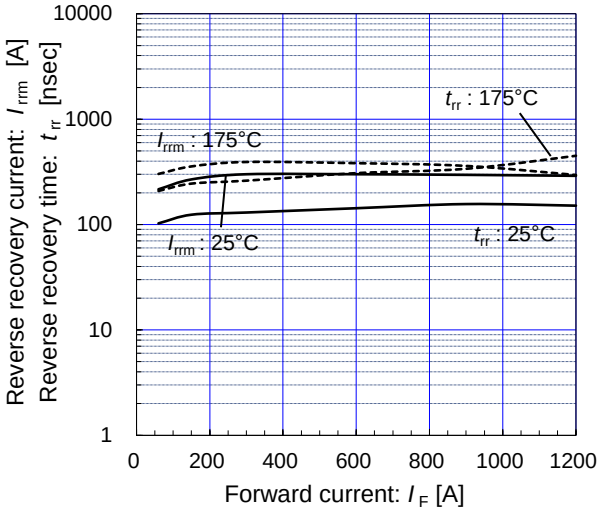


2MBI600XNF120-50

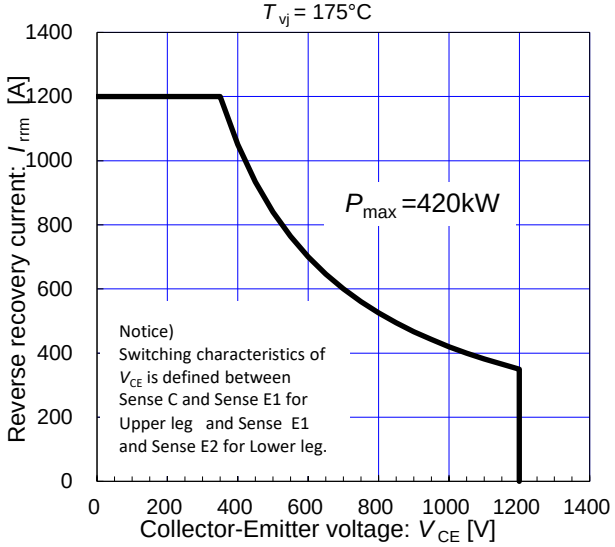
[Inverter]
Forward current vs. Forward vltage (typ.)
chip



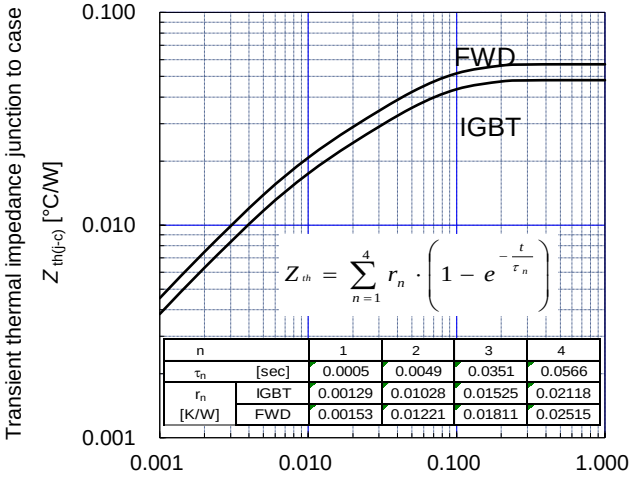
[Inverter]
Reverse recovery characteristics (typ.)
V_{CC} = 600V, V_{GE} = +15/-15 V, R_G = ±0.56Ω



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

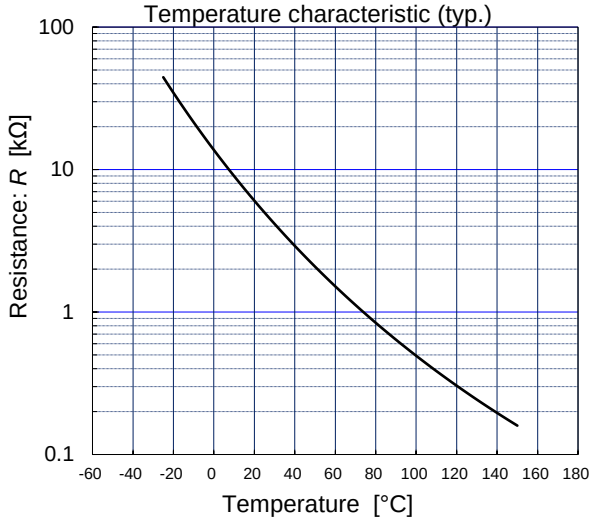


[Inverter]
Transient Thermal Resistance (max.)



n		1	2	3	4
τ_n	[sec]	0.0005	0.0049	0.0351	0.0566
r_n	IGBT	0.00129	0.01028	0.01525	0.02118
[K/W]	FWD	0.00153	0.01221	0.01811	0.02515

[Thermistor]
Temperature characteristic (typ.)



Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 5/2019. 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.

5. If you need to use a product in this Catalog for equipment requiring higher reliability than normal, such as for the equipment listed below, it is imperative to contact Fuji Electric Co., Ltd. to obtain prior approval. When using these products for such equipment, take adequate measures such as a backup system to prevent the equipment from malfunctioning even if a Fuji's product incorporated in the equipment becomes faulty.
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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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