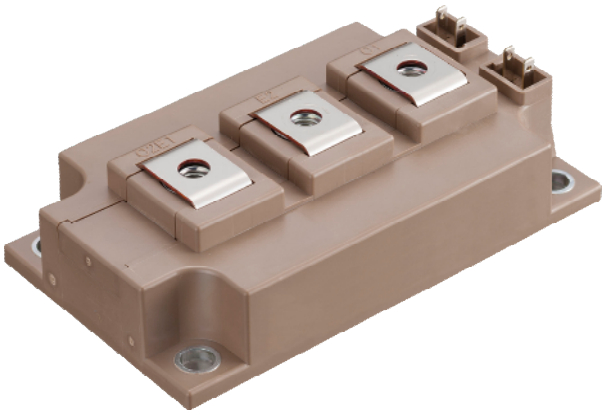
2MBI600XHA120-50

IGBT Modules

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



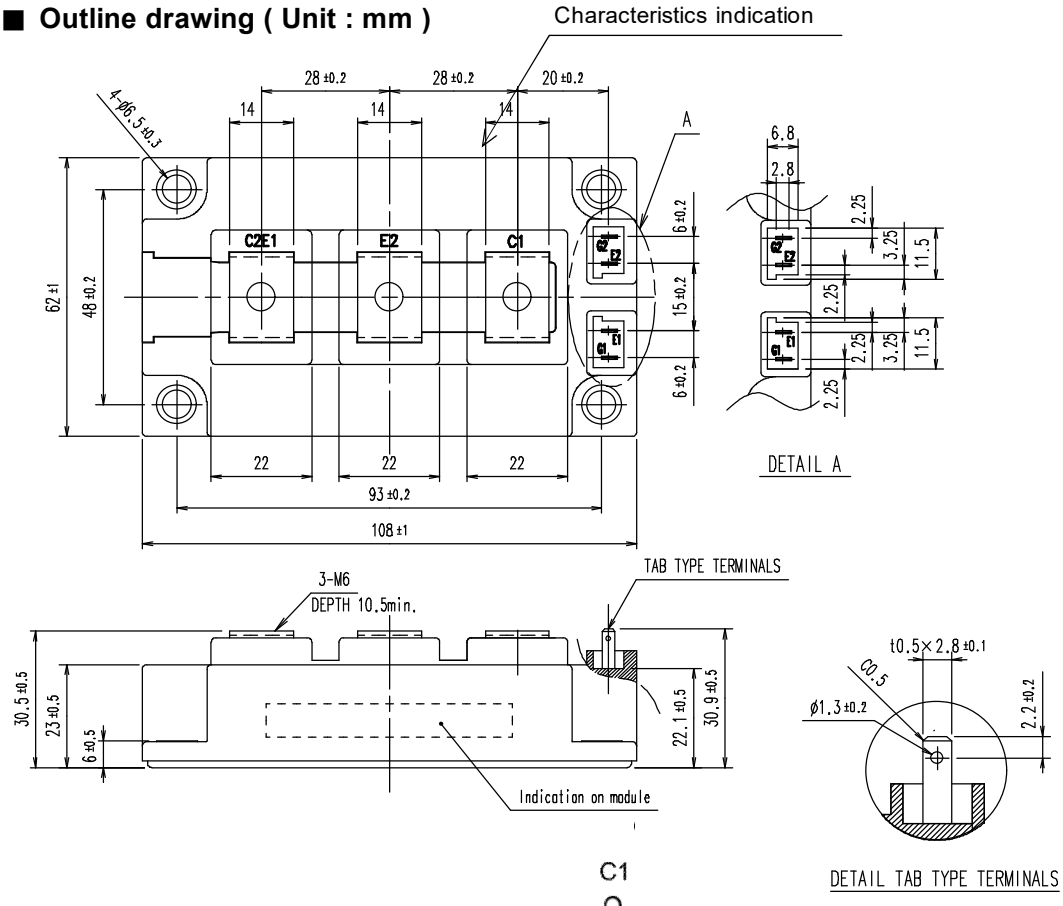
■ Features

Low $V_{CE(sat)}$
High speed switching
Low Inductance Module structure

■ Applications

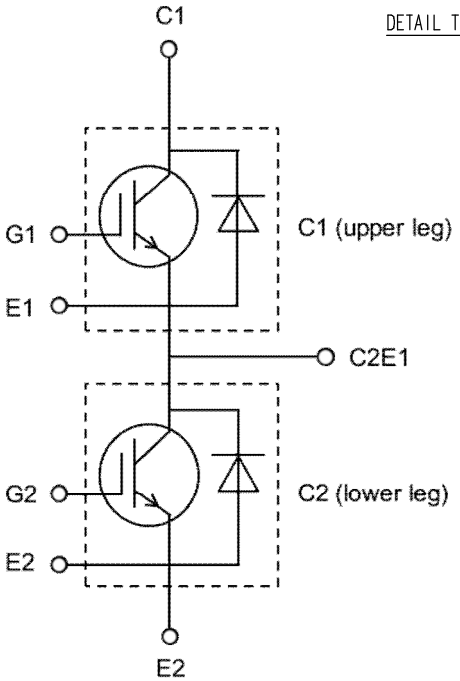
Inverter for Motor Drives, AC and DC Servo Drives
Uniterruptible Power Supply Systems,
Industrial machines,such as Welding machines

■ Outline drawing (Unit : mm)



Weight: 370 g(typ.)

■ Equivalent circuit



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2024/01

2MBI600XHA120-50

IGBT Modules

■ 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		2340	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)	V_{isol}	AC: 1min.		4000	Vrms
Mounting torque of screws to heat sink		M_s	M5 or M6		3.0 ~ 6.0	N·m
Mounting torque of screws to terminals		M_t	M6		2.5 ~ 5.0	

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

2MBI600XHA120-50

■ 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		-	-	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= 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	-	1.70	2.15	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.45	1.90	
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.90	-	
				T_{vj}=175°C	-	2.00	-	
	Internal gate resistance	r_g	-		-	1.63	-	Ω
	Capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	63	-	nF
		C_{oes}			-	2.1	-	
		C_{res}			-	0.56	-	
	Gate charge	Q_G	V_{CC} = 600V, I_C = 600A V_{GE} = -15 → +15V		-	4000	-	nC
	Forward voltage	V_F (terminal)	V_{GE} = 0V I_F= 600A	T_{vj}=25°C	-	1.90	2.35	V
		V_F (chip)		T_{vj}=25°C	-	1.65	2.10	
				T_{vj}=125°C	-	1.70	-	
				T_{vj}=150°C	-	1.65	-	
				T_{vj}=175°C	-	1.65	-	
	Switching time (*1)	$t_{d(on)}$	V_{CC} = 600V I_C, I_F = 600A V_{GE} = +15/ -15V R_G = 0.56 Ω L_S = 30 nH	T_{vj}=25°C	-	400	-	ns
				T_{vj}=125°C	-	410	-	
				T_{vj}=150°C	-	415	-	
				T_{vj}=175°C	-	420	-	
		t_r		T_{vj}=25°C	-	95	-	
				T_{vj}=125°C	-	100	-	
				T_{vj}=150°C	-	100	-	
				T_{vj}=175°C	-	105	-	
		$t_{d(off)}$		T_{vj}=25°C	-	370	-	
				T_{vj}=125°C	-	405	-	
				T_{vj}=150°C	-	415	-	
				T_{vj}=175°C	-	420	-	
		t_f		T_{vj}=25°C	-	105	-	
				T_{vj}=125°C	-	170	-	
				T_{vj}=150°C	-	185	-	
				T_{vj}=175°C	-	210	-	
	Reverse recovery time	t_{rr}		T_{vj}=25°C	-	295	-	
				T_{vj}=125°C	-	285	-	
				T_{vj}=150°C	-	590	-	
				T_{vj}=175°C	-	635	-	

(*1) Turn on time (t_{on}) = $t_{d(on)}$+ t_r , 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.	Characteristics typ.	Characteristics max.	Units
Inverter	Switching loss (per pulse)	E_{on}	V_{CC} = 600V I_C, I_F = 600A V_{GE} = +15/ -15V R_G = 0.56 Ω L_S = 30 nH	T_{vj}= 25°C	-	30.0	-	mJ
				T_{vj}=125°C	-	48.7	-	
				T_{vj}=150°C	-	53.4	-	
				T_{vj}=175°C	-	59.7	-	
		E_{off}		T_{vj}= 25°C	-	38.7	-	
				T_{vj}=125°C	-	50.5	-	
				T_{vj}=150°C	-	53.5	-	
				T_{vj}=175°C	-	55.3	-	
		E_{rr}		T_{vj}= 25°C	-	15.8	-	
				T_{vj}=125°C	-	28.2	-	
				T_{vj}=150°C	-	31.3	-	
				T_{vj}=175°C	-	34.3	-	

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.

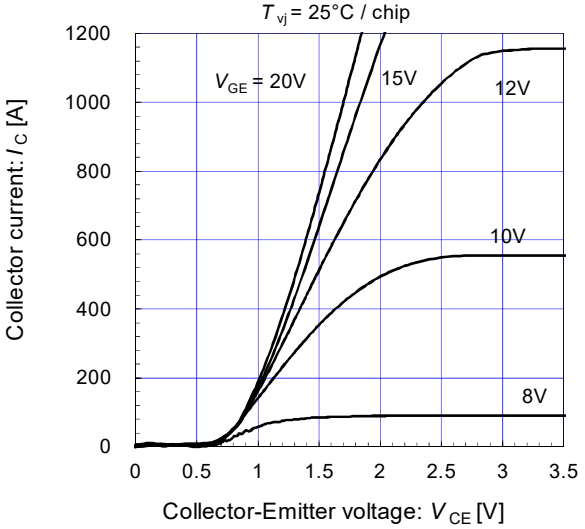
■Thermal resistance characteristics

	Symbols	Conditions	Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance junction to case (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.064	K/W
		Inverter FWD	-	-	0.090	
Thermal resistance case to heat sink (1IGBT + 1FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0125	-	

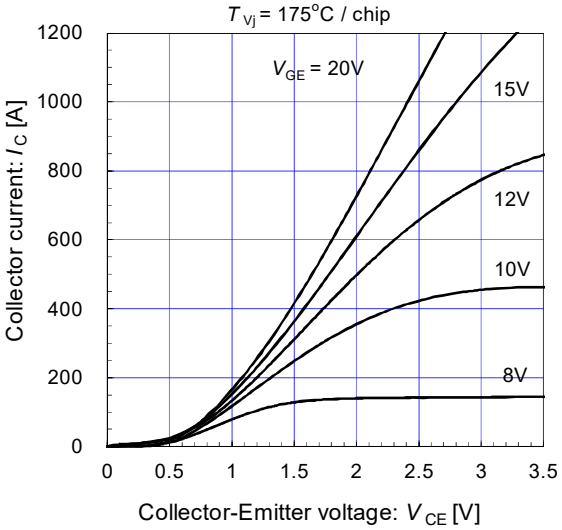
(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

2MBI600XHA120-50

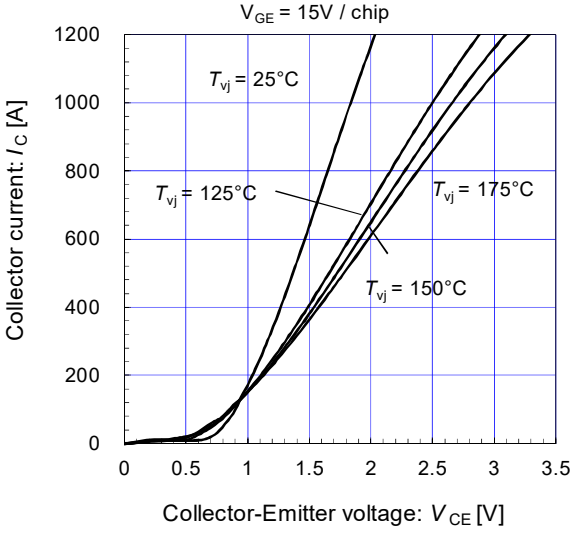
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 25°C / chip



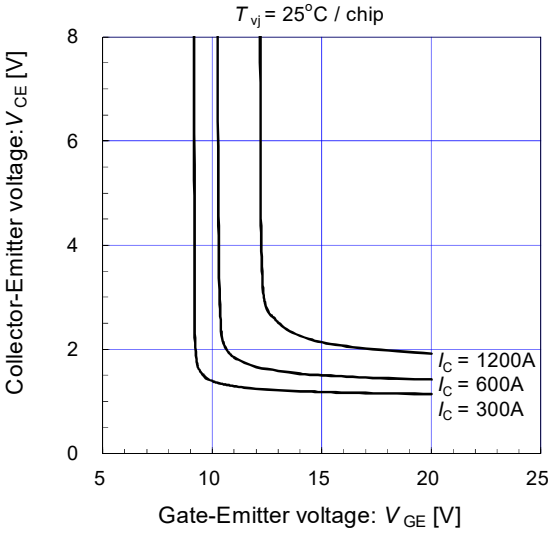
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 175°C / chip



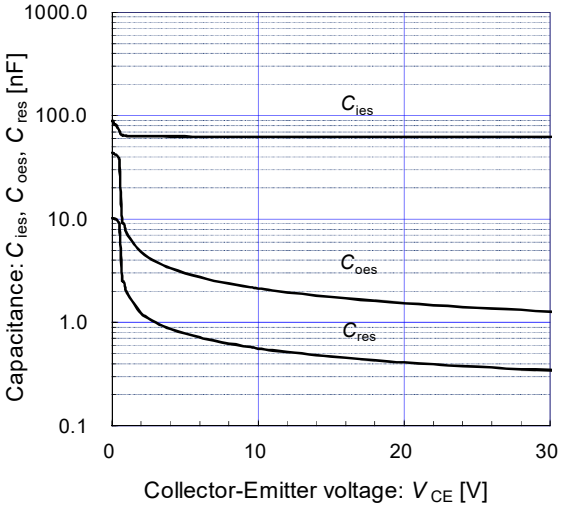
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} = 15V / chip



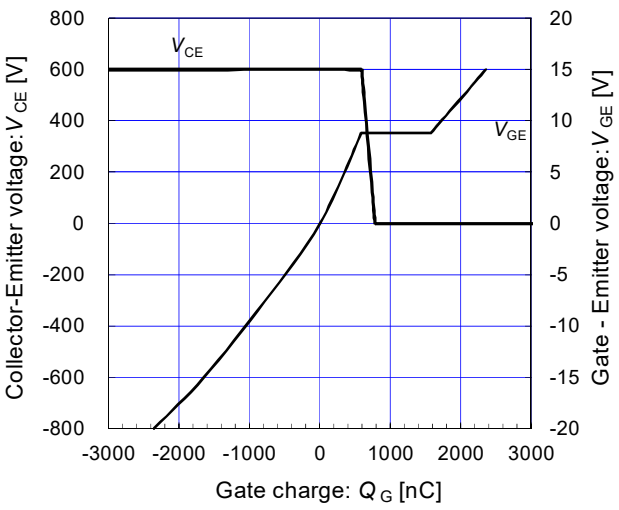
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj} = 25°C / chip



[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 = 600A, T_{vj} = 25°C



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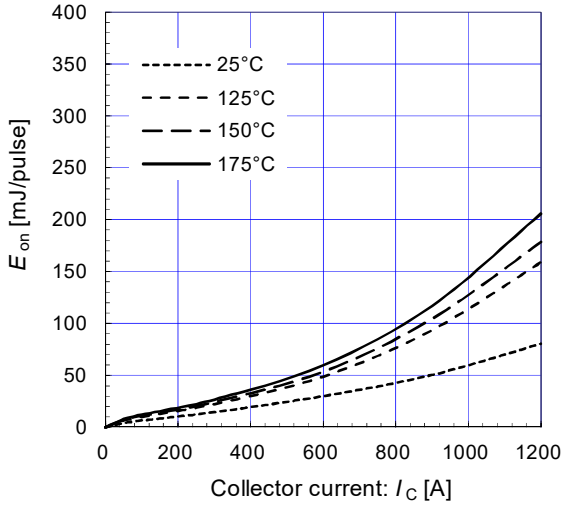
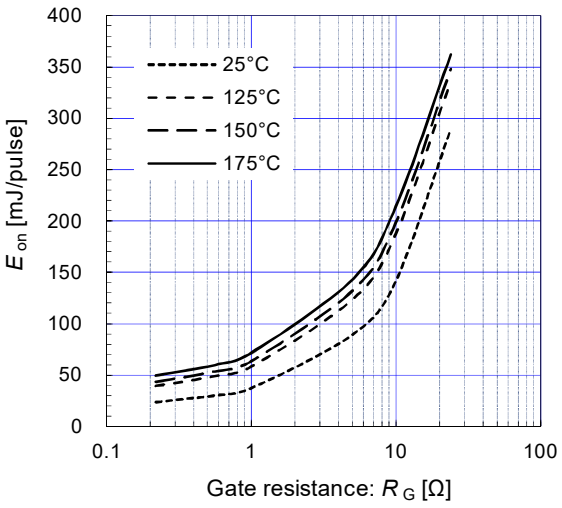
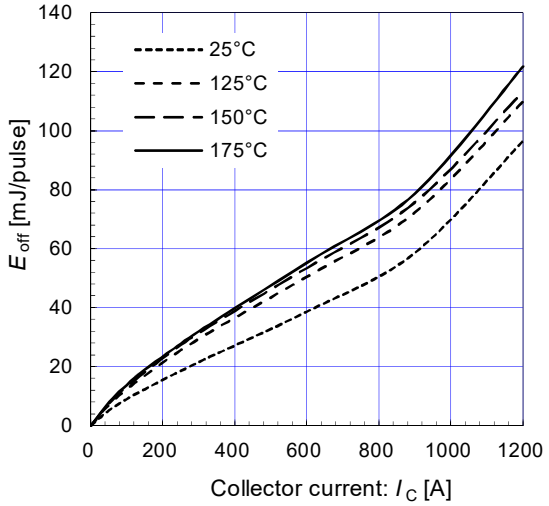
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = 0.56 Ω



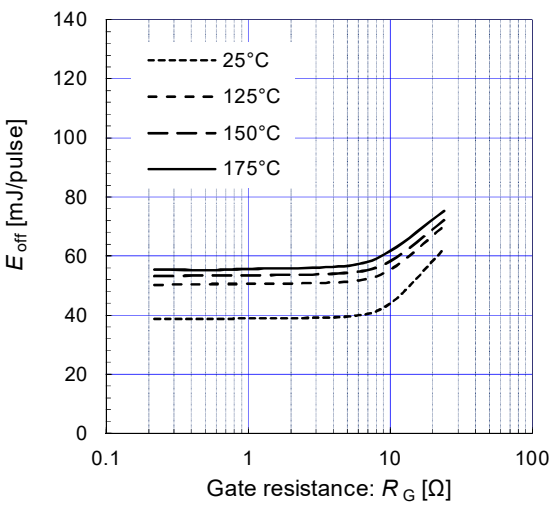
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A



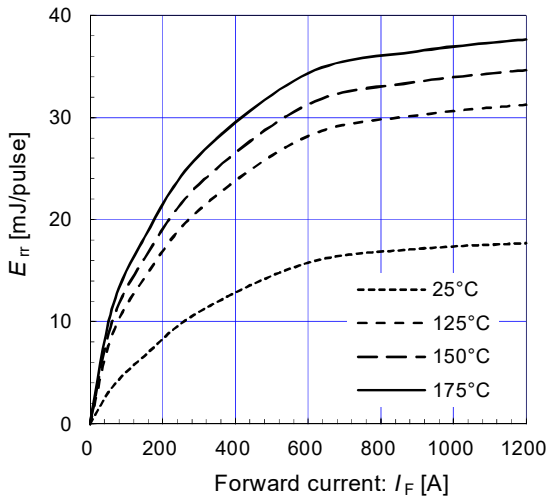
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = 0.56 Ω



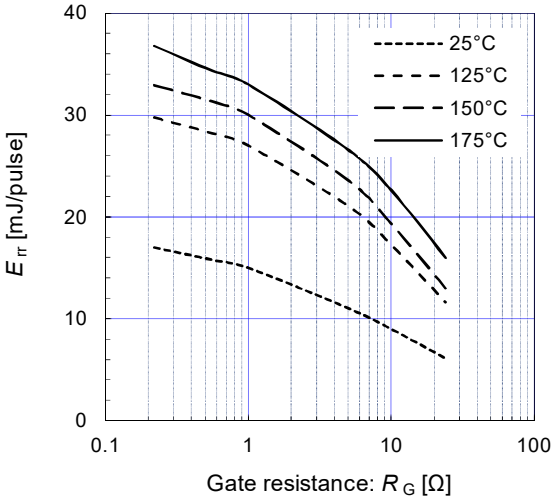
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A



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

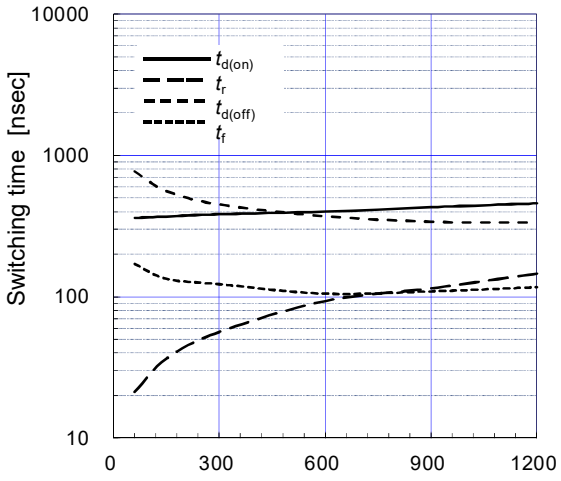


[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A

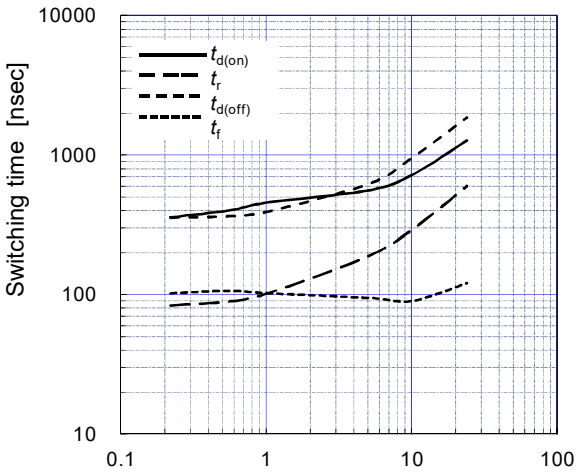


2MBI600XHA120-50

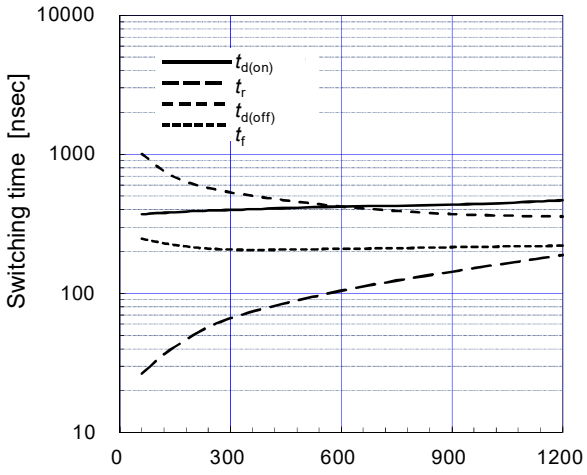
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 0.6Ω, V_{GE} = +15/ -15V, T_{vj} = 25°C



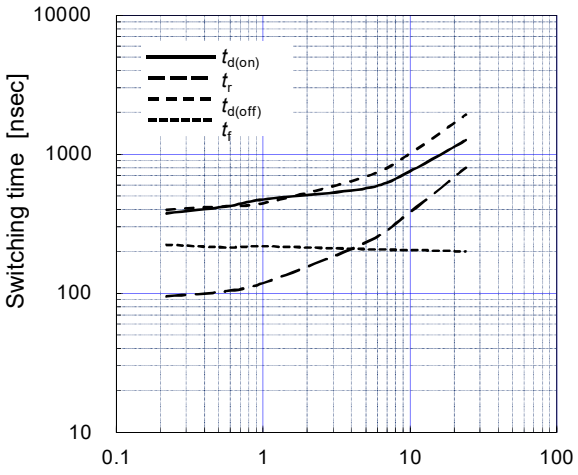
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 600A, V_{GE} = +15/ -15V, T_{vj} = 25°C



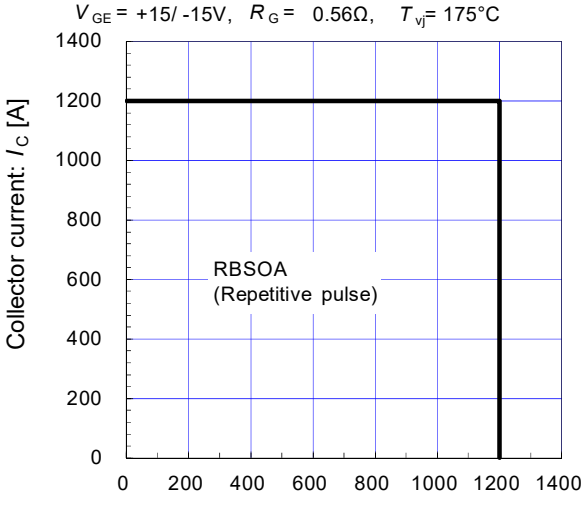
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 0.6Ω, V_{GE} = +15/ -15V, T_{vj} = 175°C



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



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

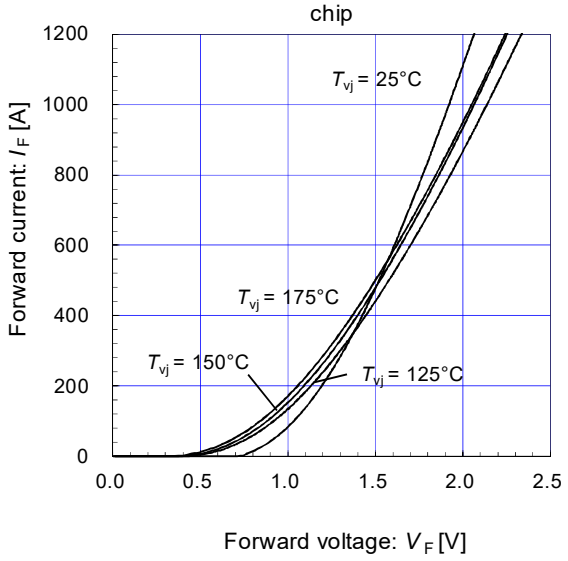


2MBI600XHA120-50

[Inverter]

Forward current vs. Forward voltage (typ.)

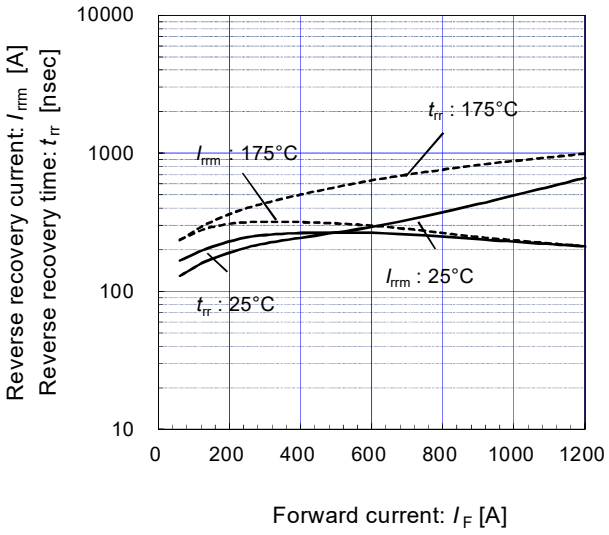
chip



[Inverter]

Reverse recovery characteristics (typ.)

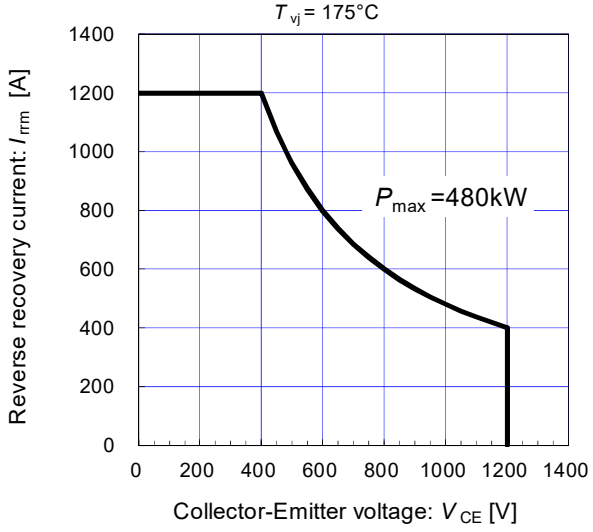
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = 0.56 Ω



[Inverter]

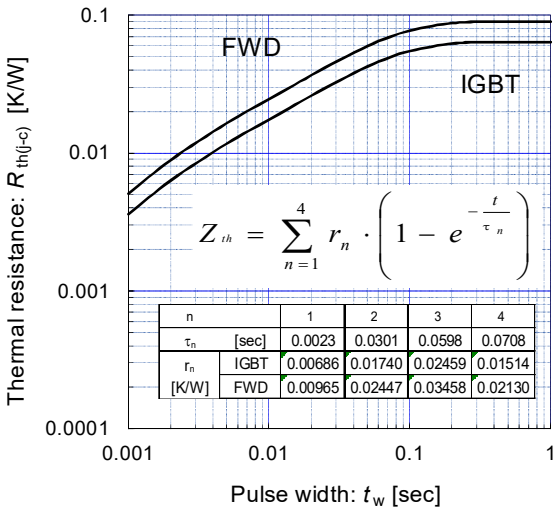
FWD safe operation area (max.)

T_{vj} = 175°C



[Inverter]

Transient thermal resistance(max.)



n		1	2	3	4
τ_n	[sec]	0.0023	0.0301	0.0598	0.0708
r_n [K/W]	IGBT	0.00686	0.01740	0.02459	0.01514
	FWD	0.00965	0.02447	0.03458	0.02130

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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
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富士電機 Innovating Energy Technology

Technical Information

IGBT Modules

- Please refer to URLs below for futher information about products, application manuals and design support.
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4 Design Support	www.fujielectric.com/products/semiconductor/model/igbt/technical/
5 Mounting Instructions	www.fujielectric.com/products/semiconductor/model/igbt/mounting/
6 IGBT Loss Simulation Software	www.fujielectric.com/products/semiconductor/model/igbt/simulation/
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3 应用手册	www.fujielectric.com/products/semiconductor/cn/model/igbt/application/
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