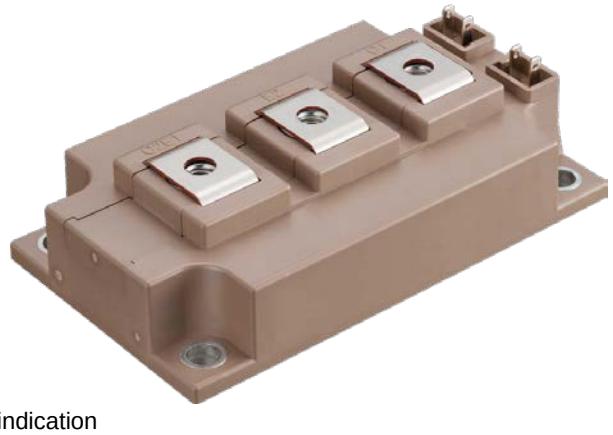
2MBI600XHA120-50

IGBT Modules

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



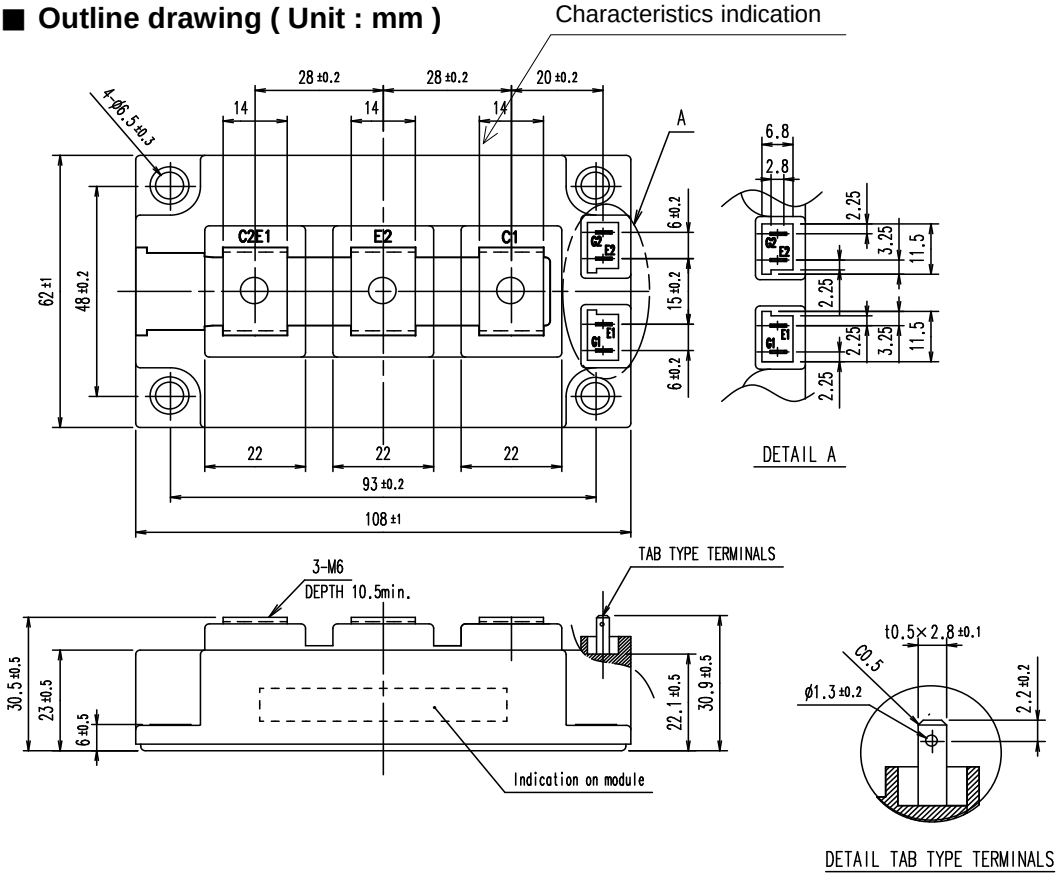
■ Features

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

■ Applications

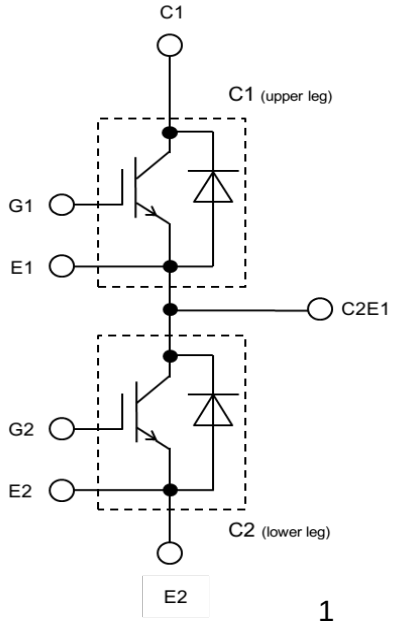
Inverter for Motor Drives, AC and DC Servo Drives
Uniterruptible Power Supply Systems,
Industrial machines,such as Welding machines

■ Outline drawing (Unit : mm)



Weight: 370 g(typ.)

■ Equivalent Circuit



FM5F9130
2018/01

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	
	Virtual junction temperature	T_{vj}			175	W
	Operating virtual junction temperature	T_{vjop}			175	°C
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 (*2)		M_s	M5 or M6		6.0	N·m
Mounting torque of screws to terminals (*2)		M_t	M6		5.0	

(*1) All terminals should be connected together during the test.
(*2) Recommendable Value: Mounting 3.0 ~ 6.0 N·m (M5 or M6)
Recommendable Value: Terminals 2.5 ~ 5.0 N·m (M6)

■ 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	mA
	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		-	4.0	-	μC
	Forward on 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	-	0.30	-	μs
				T_{vj}=125°C	-	0.33	-	
				T_{vj}=150°C	-	0.34	-	
				T_{vj}=175°C	-	0.35	-	
		t_r		T_{vj}= 25°C	-	0.07	-	
				T_{vj}=125°C	-	0.08	-	
				T_{vj}=150°C	-	0.08	-	
				T_{vj}=175°C	-	0.09	-	
		$t_{d(off)}$		T_{vj}= 25°C	-	0.39	-	
				T_{vj}=125°C	-	0.43	-	
				T_{vj}=150°C	-	0.45	-	
				T_{vj}=175°C	-	0.45	-	
		t_f		T_{vj}= 25°C	-	0.12	-	
				T_{vj}=125°C	-	0.16	-	
				T_{vj}=150°C	-	0.17	-	
				T_{vj}=175°C	-	0.18	-	
	Reverse recovery time	t_{rr}		T_{vj}= 25°C	-	0.15	-	
				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

■ 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	-	13.6	-	mJ
				T_{vj}=125°C	-	23.1	-	
				T_{vj}=150°C	-	25.4	-	
				T_{vj}=175°C	-	27.8	-	
		E_{off}		T_{vj}= 25°C	-	58.2	-	
				T_{vj}=125°C	-	68.4	-	
				T_{vj}=150°C	-	71.0	-	
				T_{vj}=175°C	-	73.6	-	
		E_{rr}		T_{vj}= 25°C	-	30.1	-	
				T_{vj}=125°C	-	46.0	-	
				T_{vj}=150°C	-	50.0	-	
				T_{vj}=175°C	-	54.0	-	

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.

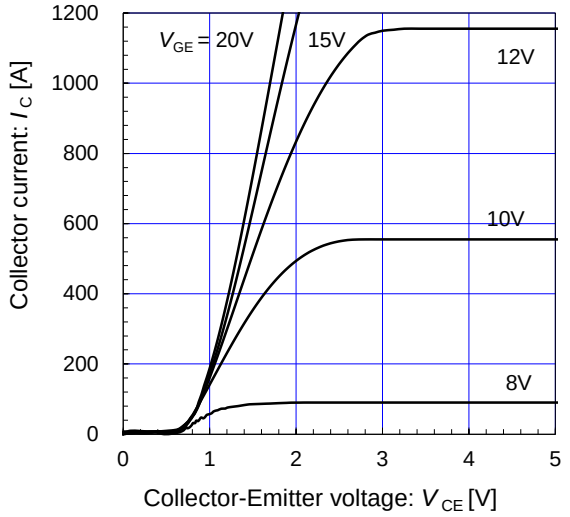
■Thermal resistance characteristics

	Symbols	Conditions	Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance junction to case (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.064	°C/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	-	

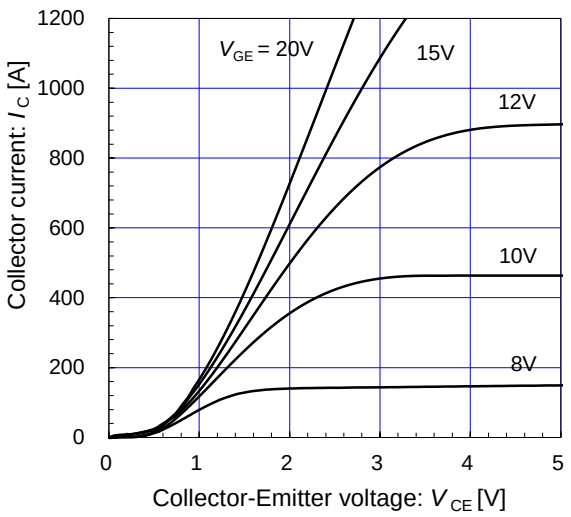
(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

2MBI600XHA120-50

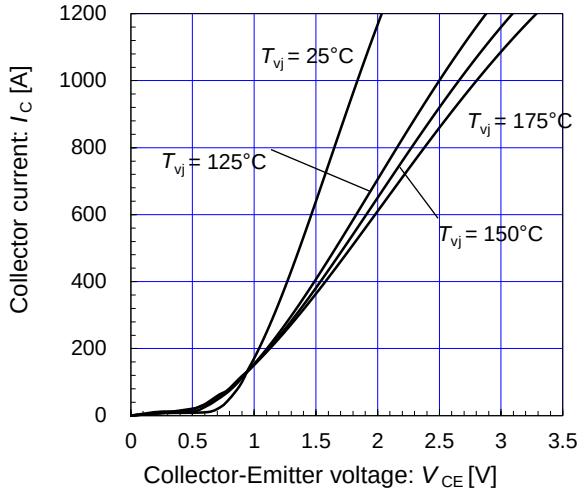
[Inverter]
Collector current vs. Collector-Emitter voltage
T_{vj} = 25°C / chip



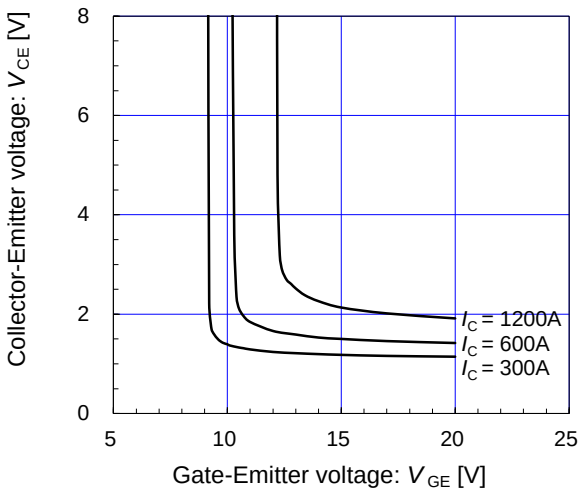
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 175°C / chip



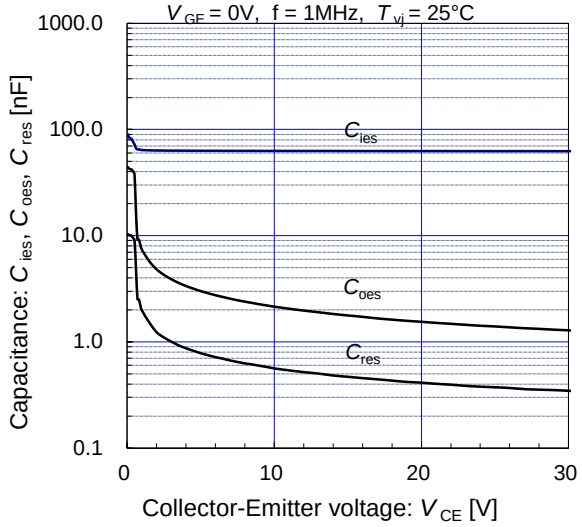
[Inverter]
Collector current vs. Collector-Emitter voltage
V_{GE} = 15V / chip



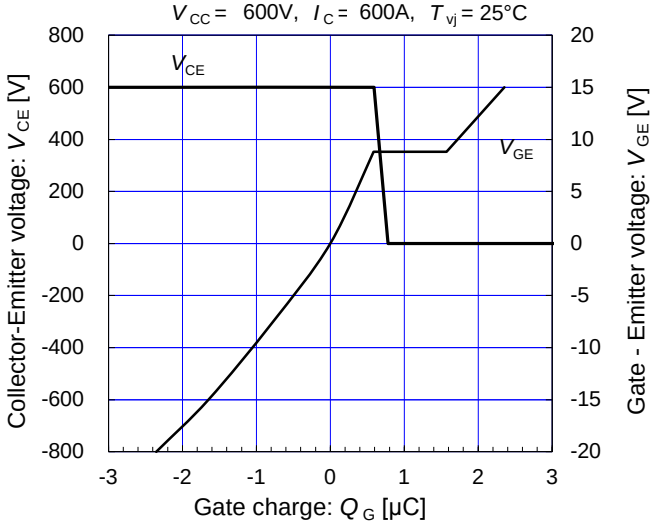
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage
T_{vj} = 25°C / chip



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

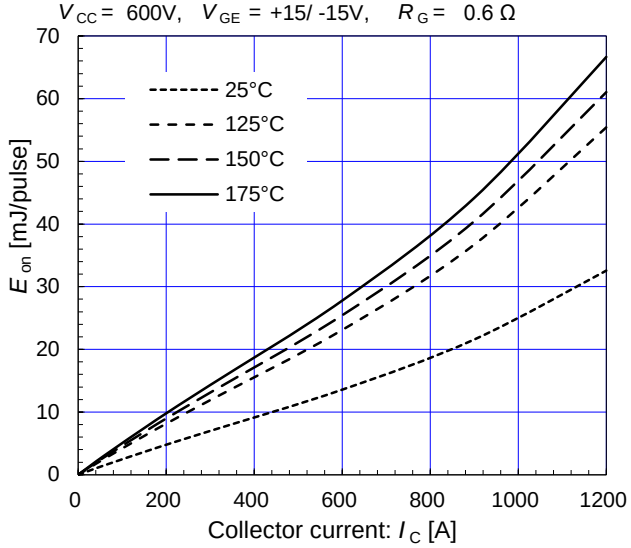


[Inverter]
Dynamic Gate Charge (typ.)
V_{CC} = 600V, I_C = 600A, T_{vj} = 25°C

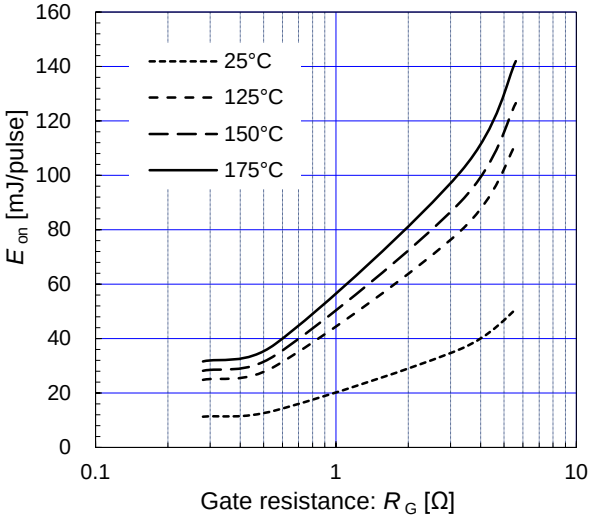


2MBI600XHA120-50

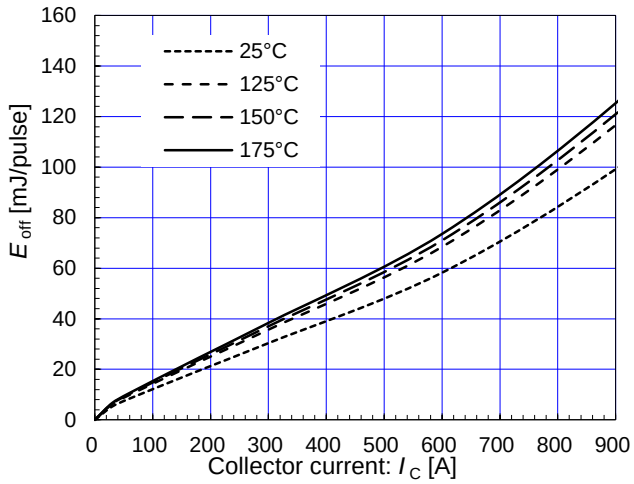
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = 0.6 Ω



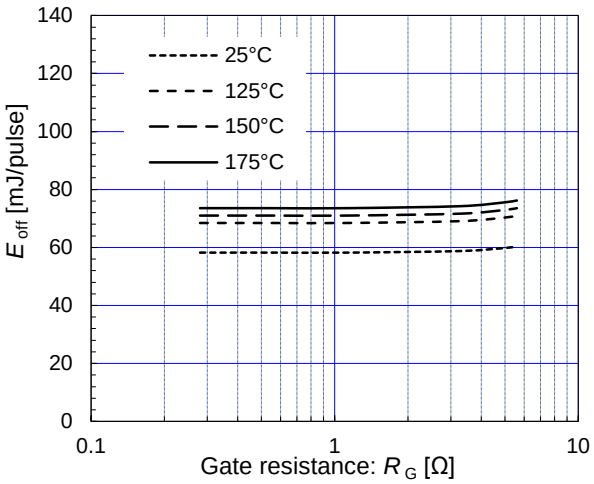
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A



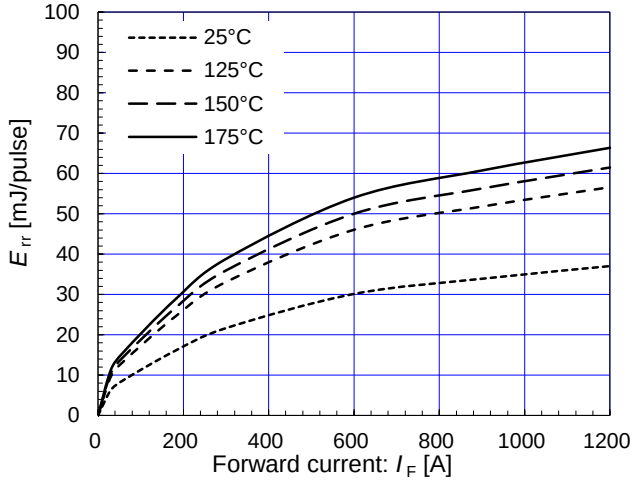
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = 0.6 Ω



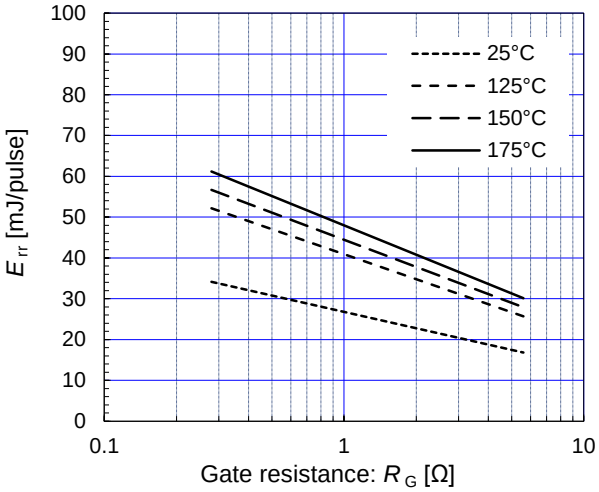
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A



[Inverter]
E_{rr} vs. Forward current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = 0.6 Ω

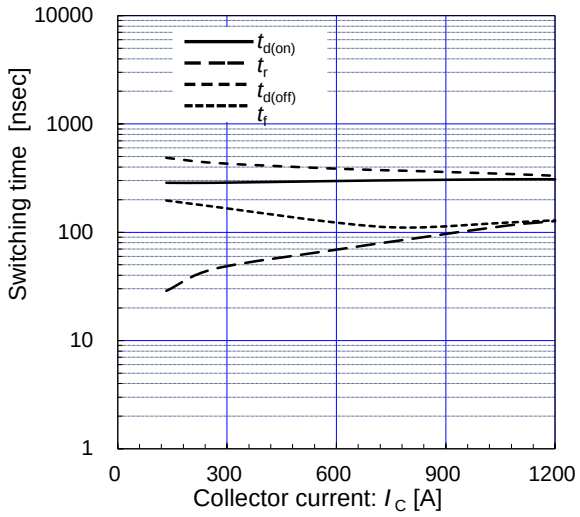


[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A

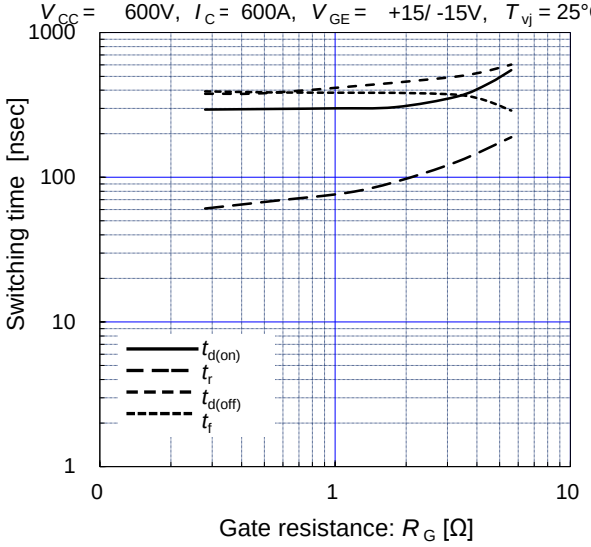


2MBI600XHA120-50

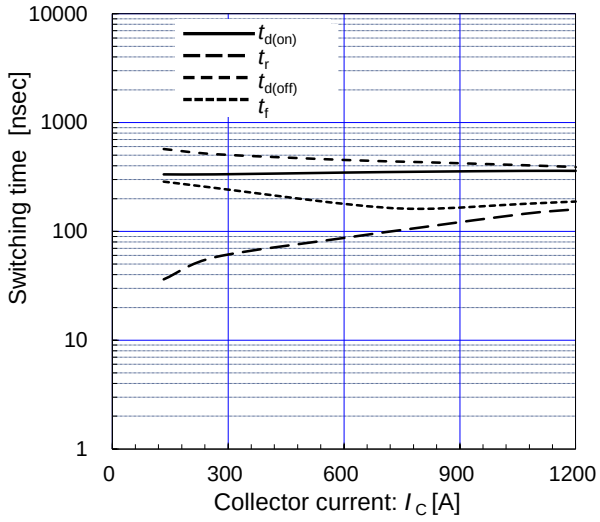
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 0.6Ω, V_{GE} = +15/ -15V, T_{vj} = 25°C



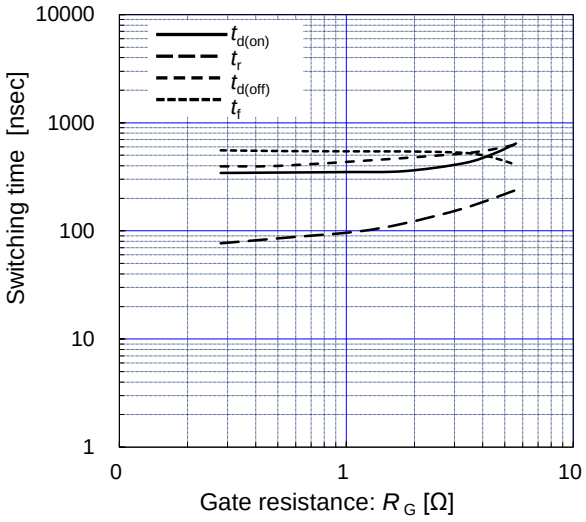
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 600A, V_{GE} = +15/ -15V, T_{vj} = 25°C



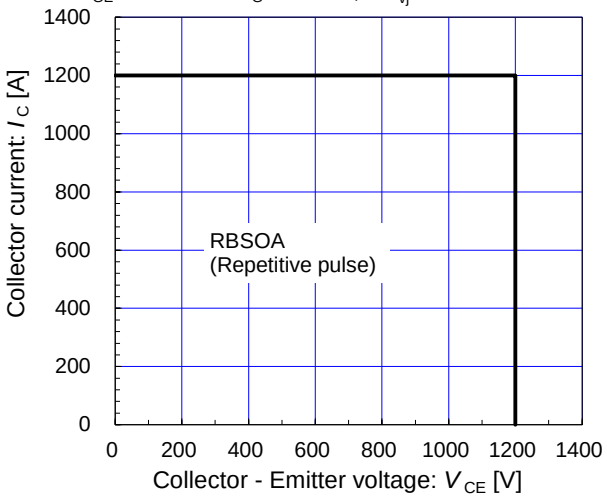
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = 0.6Ω, V_{GE} = +15/ -15V, T_{vj} = 175°C



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

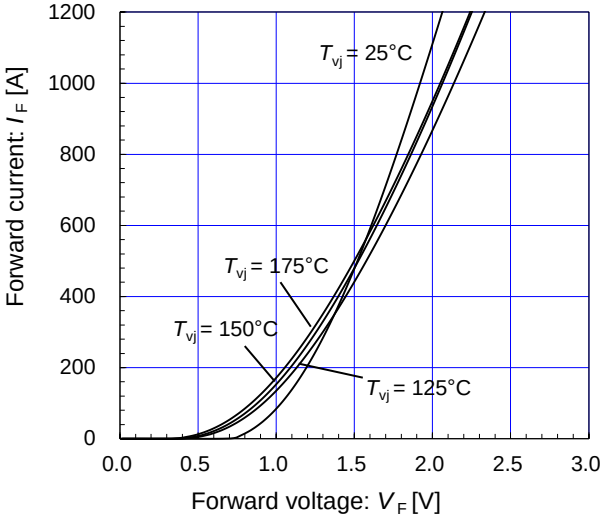


[Inverter]
Reverse bias safe operating area (max.)
V_{GE} = +15/ -15 R_G = 0.56Ω, T_{vj} = 175°C

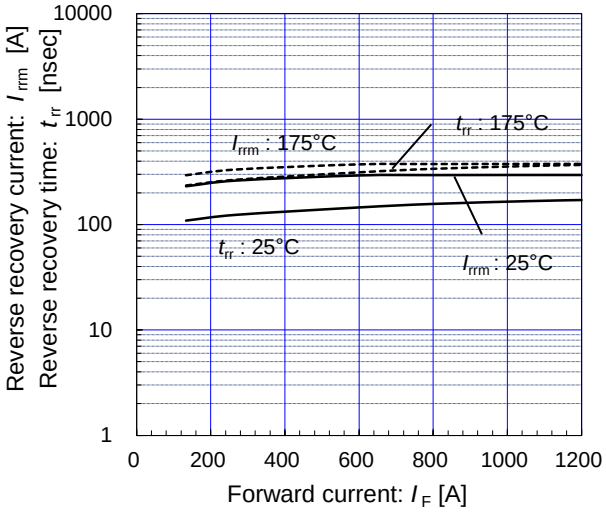


2MBI600XHA120-50

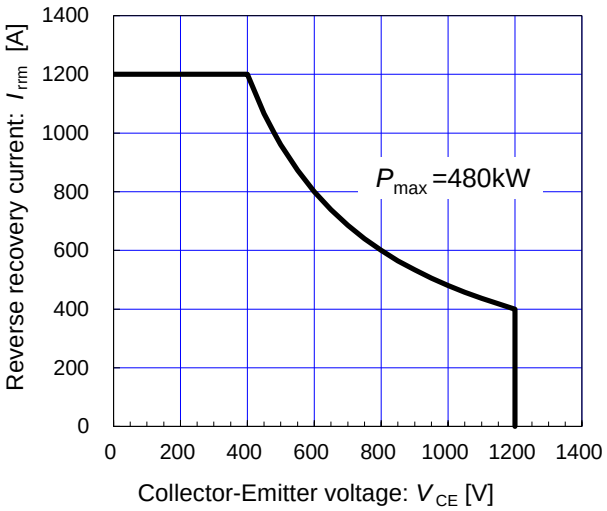
[Inverter]
Forward current vs. Forward vltage (typ.)
chip



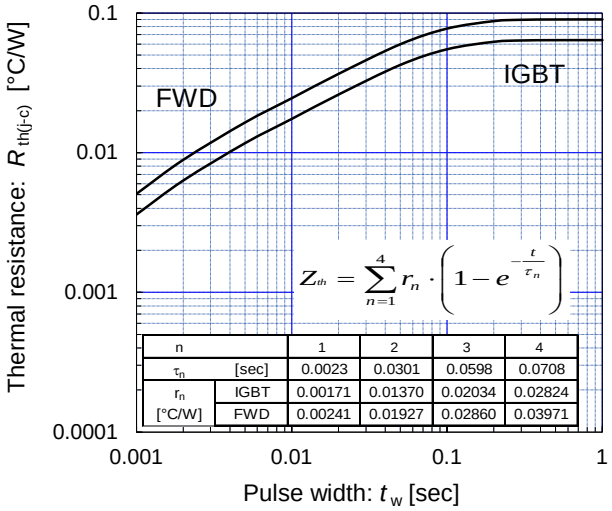
[Inverter]
Reverse recovery characteristics (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = 0.6 Ω



[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 [°C/W]	IGBT	0.00171	0.01370	0.02034	0.02824
	FWD	0.00241	0.01927	0.02860	0.03971

Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 1/2018. 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.

2. All applications described in this Catalog exemplify the use of Fuji's products for your reference only. No right or license, either express or implied, under any patent, copyright, trade secret or other intellectual property right owned by Fuji Electric Co., Ltd. is (or shall be deemed) granted. Fuji Electric Co., Ltd. makes no representation or warranty, whether express or implied, relating to the infringement or alleged infringement of other's intellectual property rights which may arise from the use of the applications described herein.

3. Although Fuji Electric Co., Ltd. is enhancing product quality and reliability, a small percentage of semiconductor products may become faulty. When using Fuji Electric semiconductor products in your equipment, you are requested to take adequate safety measures to prevent the equipment from causing a physical injury, fire, or other problem if any of the products become faulty. It is recommended to make your design fail-safe, flame retardant, and free of malfunction.

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.
   ・Transportation equipment (mounted on cars and ships) ・Trunk communications equipment
   ・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.

8. If you have any question about any portion in this Catalog, ask Fuji Electric Co., Ltd. or its sales agents before using the product. Neither Fuji Electric Co., Ltd. nor its agents shall be liable for any injury caused by any use of the products not in accordance with instructions set forth herein.

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.
- 关于本规格书中没有记载的产品信息，应用手册，技术信息等，请参考以下链接。
- 本データシートに記載されていない製品情報，アプリケーションマニュアル，デザインサポートは以下のURLをご参照下さい。

FUJI ELECTRIC Power Semiconductor WEB site

日本	www.fujielectric.co.jp/products/semiconductor/
Global	www.fujielectric.com/products/semiconductor/
中国	www.fujielectric.com.cn/products/semiconductor/
Europe	www.fujielectric-europe.com/en/power_semiconductor/
North America	www.americas.fujielectric.com/products/semiconductors/

Information

日本

1 半導体総合カタログ	www.fujielectric.co.jp/products/semiconductor/catalog/
2 製品情報	www.fujielectric.co.jp/products/semiconductor/model/
3 アプリケーションマニュアル	www.fujielectric.co.jp/products/semiconductor/model/igbt/application/
4 デザインサポート	www.fujielectric.co.jp/products/semiconductor/model/igbt/technical/
5 マウンティングインストラクション	www.fujielectric.co.jp/products/semiconductor/model/igbt/mounting/
6 IGBT 損失シミュレーションソフト	www.fujielectric.co.jp/products/semiconductor/model/igbt/simulation/
7 富士電機技報	www.fujielectric.co.jp/products/semiconductor/journal/
8 製品のお問い合わせ	www.fujielectric.co.jp/products/semiconductor/contact/
9 改廃のお知らせ	www.fujielectric.co.jp/products/semiconductor/discontinued/

Global

1 Semiconductors General Catalog	www.fujielectric.com/products/semiconductor/catalog/
2 Product Information	www.fujielectric.com/products/semiconductor/model/
3 Application Manuals	www.fujielectric.com/products/semiconductor/model/igbt/application/
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/
7 Fuji Electric Journal	www.fujielectric.com/products/semiconductor/journal/
8 Contact	www.fujielectric.com/contact/
9 Revised and discontinued product information	www.fujielectric.com/products/semiconductor/discontinued/

中国

1 半导体综合目录	www.fujielectric.com.cn/products/semiconductor/catalog/
2 产品信息	www.fujielectric.com.cn/products/semiconductor/model/
3 应用手册	www.fujielectric.com.cn/products/semiconductor/model/igbt/application/
4 技术信息	www.fujielectric.com.cn/products/semiconductor/model/igbt/technical/
5 安装说明书	www.fujielectric.com.cn/products/semiconductor/model/igbt/mounting/
6 IGBT 损耗模拟软件	www.fujielectric.com.cn/products/semiconductor/model/igbt/simulation/
7 富士电机技报	www.fujielectric.com.cn/products/semiconductor/journal/
8 产品咨询	www.fujielectric.com/contact/
9 产品更改和停产信息	www.fujielectric.com.cn/products/semiconductor/discontinued/