4MBI400VF-120R-50

IGBT Modules

IGBT Power Module (V series)
1200V/400A/IGBT, ±600V/450A/RB-IGBT, 4-in-1 package

■ Features

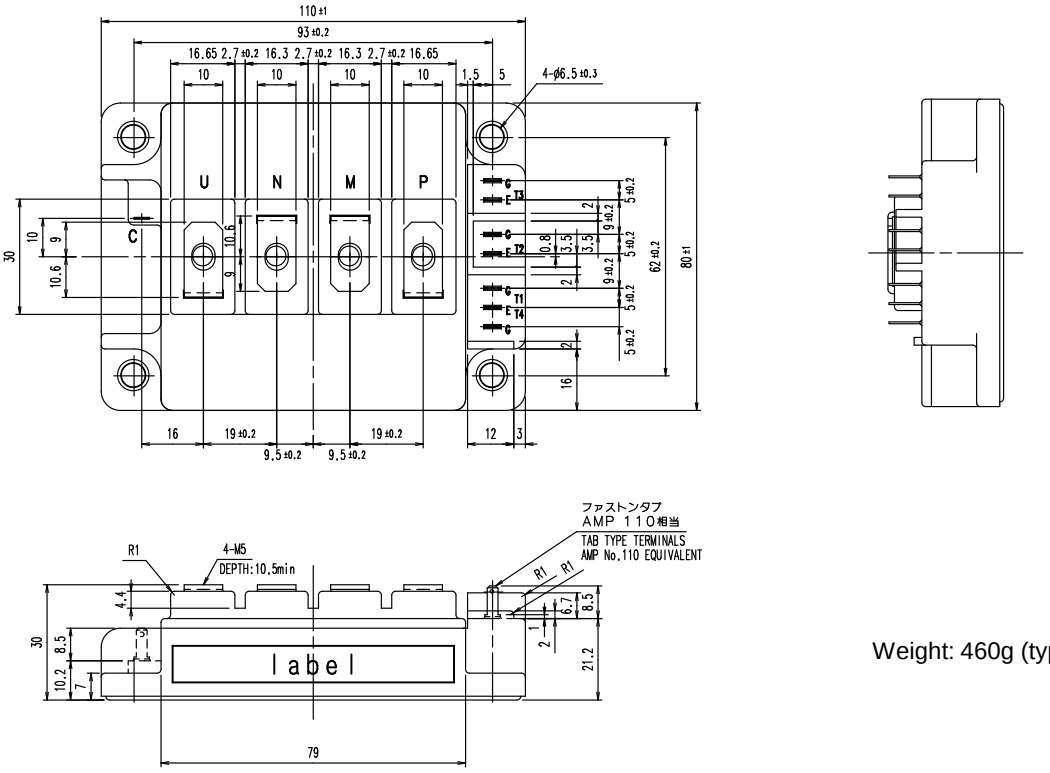
Higher efficiency
Optimized Advanced T-type circuit
Low inductance module structure

■ Applications

Inverter for motor drive
Uninterruptible powre supply
Power conditioner

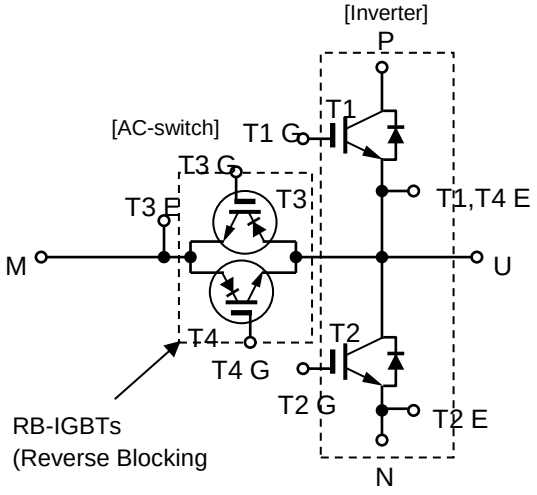
■ Outline drawing

(Unit : mm)



Weight: 460g (typ.)

■ Equivalent Circuit



FM5F8336
2014/06

4MBI400VF-120R-50

IGBT Modules

■ Absolute Maximum Ratings (at Tc= 25°C unless otherwise specified)

Item			Symbol	Condition		Maximum Rating	Unit
T1, T2	Collector-Emitter voltage		V_{CES}			1200	A
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current	IGBT	I_C	Continuous	Tc=80°C	400	A
			I_C pulse	1ms	Tc=80°C	800	
		FWD	$-I_C$			300	
			$-I_C$ pulse			800	
	Collector power dissipation		P_C	1 device		1835	W
	Junction temperature		T_j			150	°C
	Operating temperature		T_{jop}			125	
T3, T4	Collector-Emitter voltage		V_{CES}			125	A
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	Tc=80°C	450	A
			I_C pulse	1ms	Tc=80°C	900	
	Collector power dissipation		P_C	1 device		2230	W
	Junction temperature		T_j			150	°C
	Operating temperature		T_{jop}			125	
Case temperature			T_C			125	
Storage temperature			T_{stg}			-40 ~ +125	
Isolation voltage	between terminal and copper base (*1		V_{iso}	AC : 1min.		2500	VAC
Screw torque	Mounting (*2)		-	M5 or M6		3.5	Nm
	Terminal (*3)		-	M5		3.5	

(*1) All terminals should be connected together during the test.
(*2) Recommendable Value : 3.0-6.0 Nm (M5 or M6)
(*3) Recommendable Value : 2.5-5.0 Nm (M6)

4MBI400VF-120R-50

IGBT Modules

■ Electrical characteristics (at Tj= 25°C unless otherwise specified)

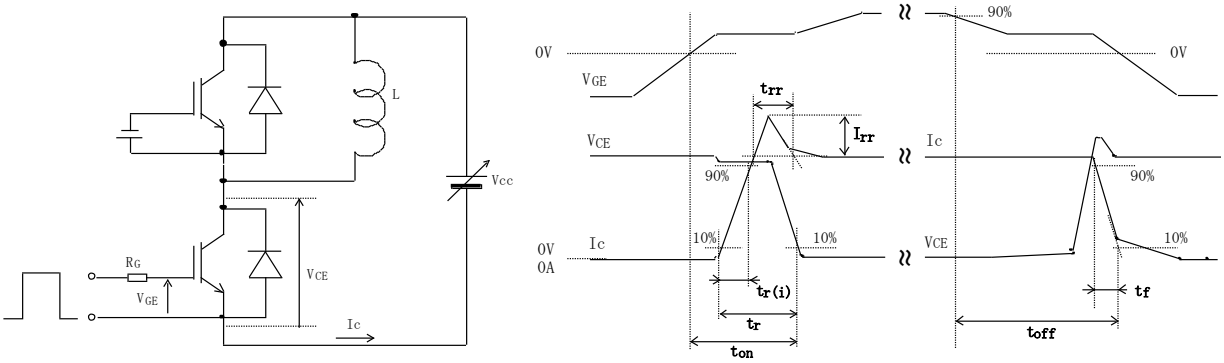
	Item	Symbol	Condition		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Zero gate voltage Collector current	I_{CES}	V_{GE} = 0V V_{CE} = 1200V		-	-	2.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V V_{GE} = ±20V		-	-	400	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 400mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	V_{GE} = 15V I_C = 400A	T_j=25°C	-	2.00	2.25	V
				T_j=125°C		2.40	-	
		$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C = 400A	T_j=25°C	-	2.20	2.55	
				T_j=125°C		2.60	-	
	Internal gate	$R_{G(int)}$	-		-	2.50	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	27.6	-	s
	Turn-on time	t_{on}	Switching mode: A V_{CC}= 400V I_C = 400A		-	1.10	-	nsec
		t_r			-	0.60	-	
		$t_{r(i)}$			-	0.20	-	
	Turn-off time	t_{off}	V_{GE}= ±15V R_G = +8.2/-1Ω		-	0.60	-	
		t_f			-	0.10	-	
	Forward on voltage	V_F (chip)	I_F = 300A	T_j=25°C	-	1.95	2.20	V
				T_j=125°C	-	2.20	-	
		V_F (terminal)	I_F = 300A	T_j=25°C	-	2.15	2.45	
				T_j=125°C	-	2.40	-	
	Reverse recovery time	t_{rr}	Switching mode: B V_{CC}= 400V I_F = 400A V_{GE}= ±15V R_G = +6/-30Ω		-	0.15	-	nsec
AC-switch	Zero gate voltage Collector current	I_{CES}	V_{GE} = 0V V_{CE} = 600V		-	-	4.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V V_{GE} = ±20V		-	-	800	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 400mA		5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	V_{GE} = 15V I_C = 400A	T_j=25°C	-	2.45	2.80	
				T_j=125°C		2.60	-	
		$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C = 400A	T_j=25°C	-	2.65	3.15	
				T_j=125°C		2.80	-	
	Internal gate	$R_{G(int)}$	-		-	2.20	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	26.0	-	s
	Turn-on time	t_{on}	Switching mode: B V_{CC}= 400V I_C = 400A		-	0.35	-	nsec
		t_r			-	0.20	-	
		$t_{r(i)}$			-	0.10	-	
	Turn-off time	t_{off}	V_{GE}= ±15V R_G = +6.0/-30Ω		-	1.00	-	
		t_f			-	0.10	-	
	Reverse recovery time	t_{rr}	Switching mode: A V_{CC}= 400V I_F = 400A V_{GE}= ±15V R_G = +8.2/-1Ω		-	0.15	-	nsec
Internal inductance			P-N		-	40	-	nH
			P-M		-	33	-	
			M-N		-	33	-	

■ Thermal resistance characteristics

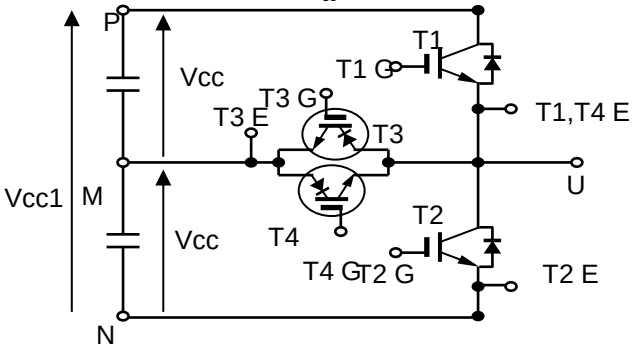
Item	Symbol	Condition		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance (1device)	$R_{th(j-c)}$	T1, T2 IGBT		-	-	0.068	°C/W
		T1, T2 FWD		-	-	0.173	
		T3, T4 RB-IGBT		-	-	0.056	
Contact thermal resistance	$R_{th(c-f)}$	T1, T2	with thermal compaound	-	0.025	-	
		T3, T4		-	0.013	-	

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

■ Definitions of switching time



■ Definitions of switching mode

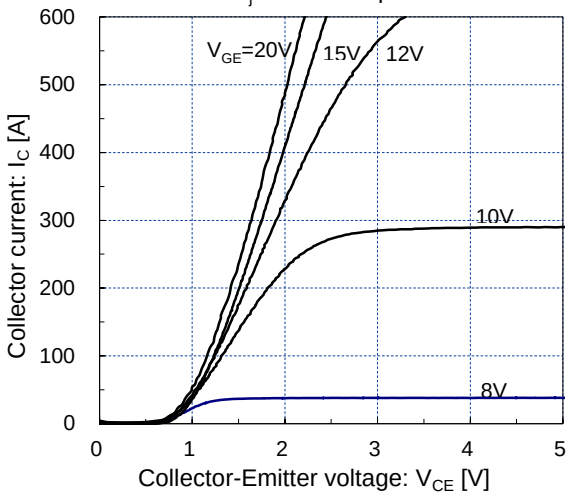


SW mode	Load L	T1	T2	T3	T4
A	M-U	**SW**	OFF	OFF	**ON**
	M-U	OFF	**SW**	**ON**	OFF
B	P-U	OFF	OFF	**SW**	**ON**
	U-N	OFF	OFF	**ON**	**SW**

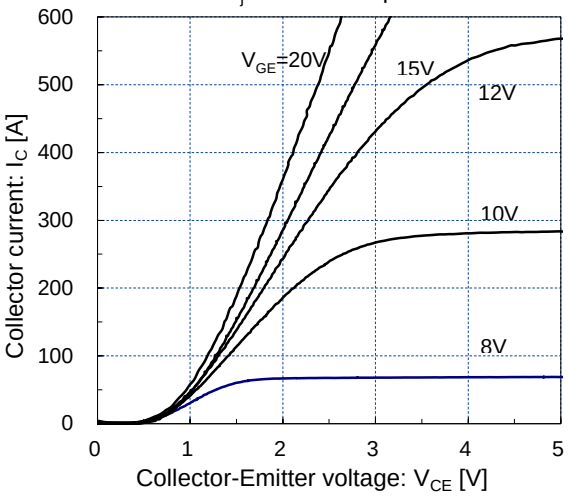
SW: Connect to drive circuit and input gate signal
ON: Bias voltage of gate +15V
OFF: Reverse bias voltage of gate -15V
Vcc=Vcc1/2

4MBI400VF-120R-50

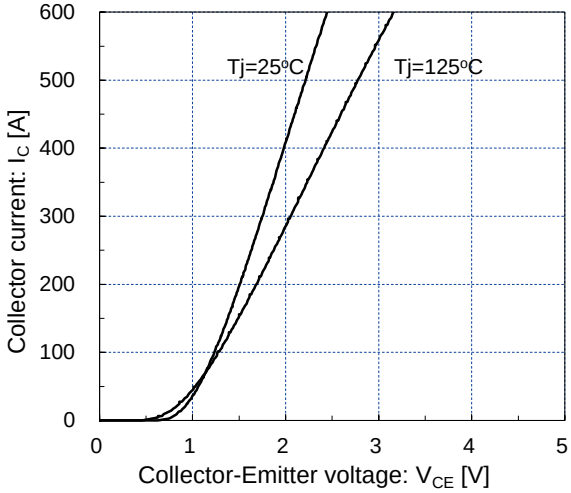
[Inverter (T1, T2)]
Collector current vs. Collector-Emitter voltage
T_j= 25°C / chip



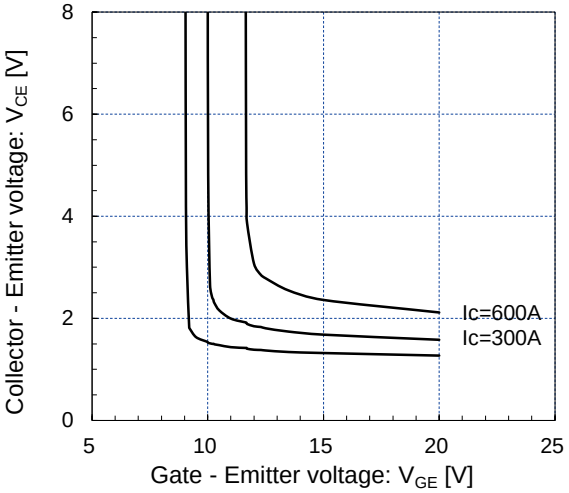
[Inverter (T1, T2)]
Collector current vs. Collector-Emitter voltage
T_j= 125°C / chip



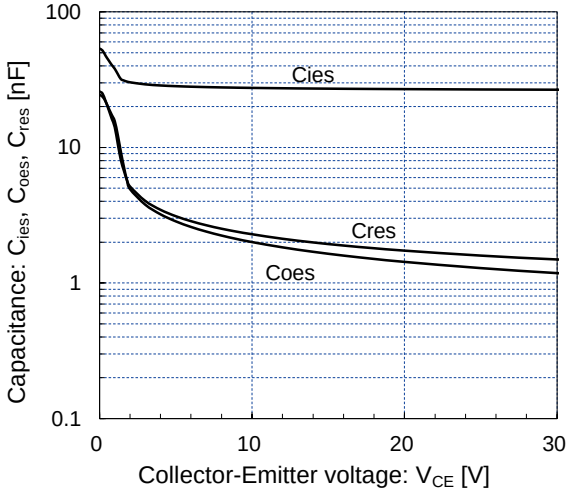
[Inverter (T1, T2)]
Collector current vs. Collector-Emitter voltage
V_{GE}= 15V / chip



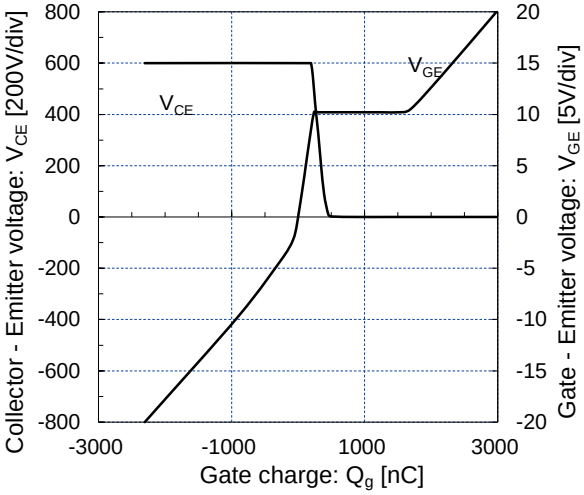
[Inverter (T1, T2)]
Collector-Emitter voltage vs. Gate-Emitter voltage
Tj= 25°C / chip



[Inverter (T1, T2)]
Capacitance vs. Collector-Emitter voltage (typ.)
VGE=0V, f= 1MHz, Tj= 25oC

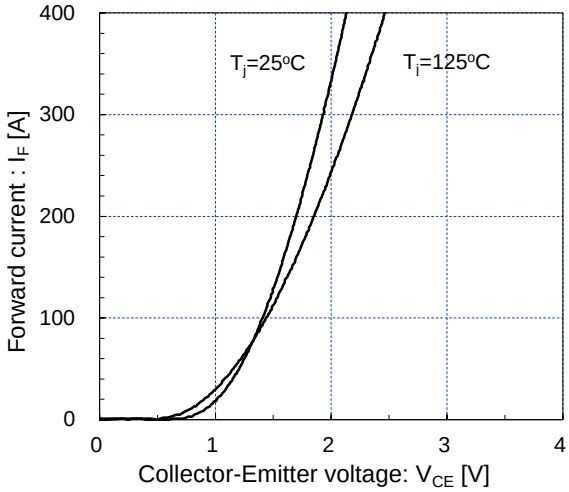


[Inverter (T1, T2)]
Dynamic gate charge (typ.)
Vcc=600V, Ic=300A, Tj=25oC

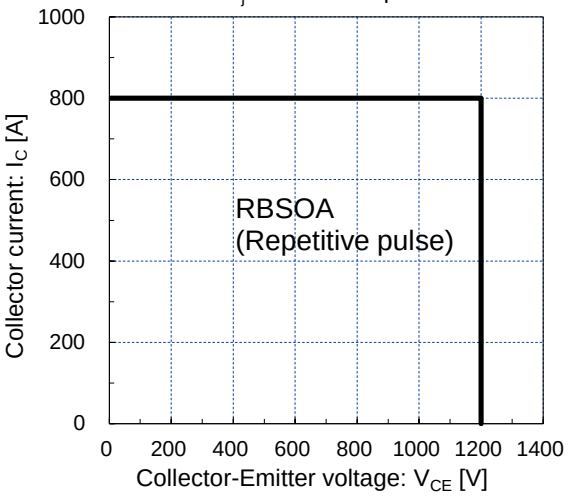


4MBI400VF-120R-50

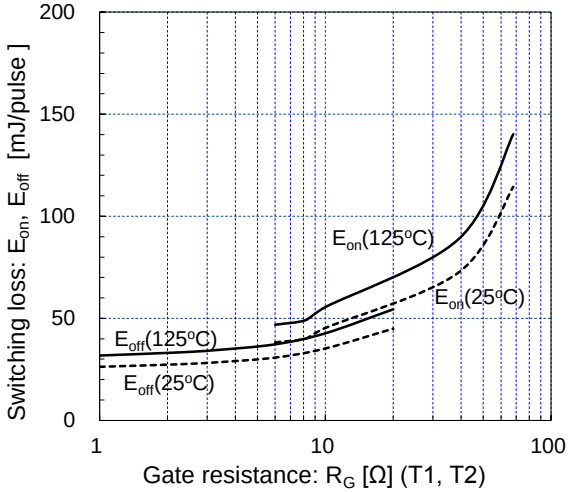
[Inverter (T1, T2)]
Forward current vs. forward on voltage (typ.)
chip



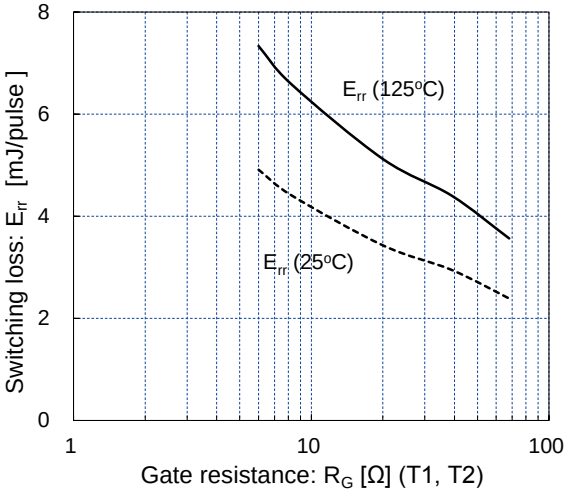
[Inverter (T1, T2)]
V_{GE}=±15V, R_G ≧Recommended, T_j=125ºC (T1, T2)
T_j= 125°C / chip



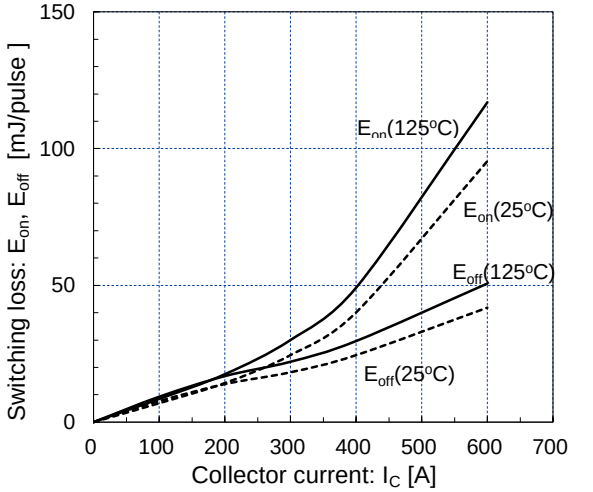
[Inverter (T1, T2)]
Switching loss vs. gate resistance (typ.)
V_{cc}= 400V, I_C= 400A V_{GE}= ±15V



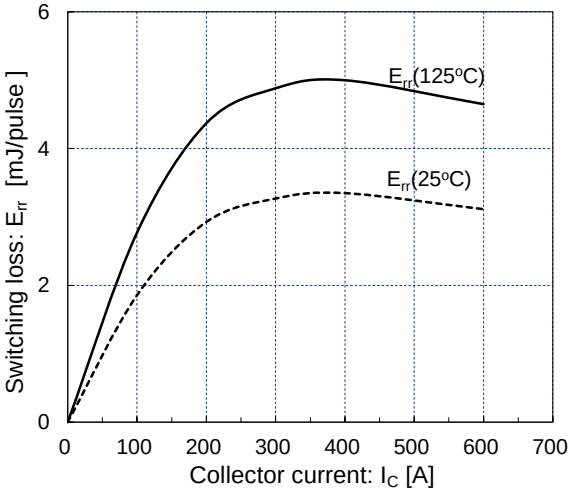
[Inverter (T1, T2)]
Switching loss vs. gate resistance (typ.)
V_{cc}= 400V, I_C= 400A V_{GE}= ±15V



[SW mode: A]
Switching loss vs. Collector current (typ.)
V_{cc}= 400V, V_{GE}= ±15V, R_G= +8.2/-1Ω (T1, T2



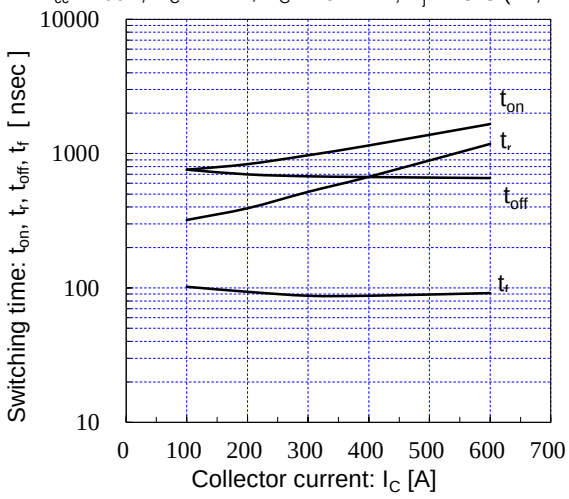
[SW mode: A (T3,T4 RB-IGBT recovery)]
Switching loss vs. Collector current (typ.)
V_{cc}= 400V, V_{GE}= ±15V, R_G= +8.2/-1Ω (T1, T2



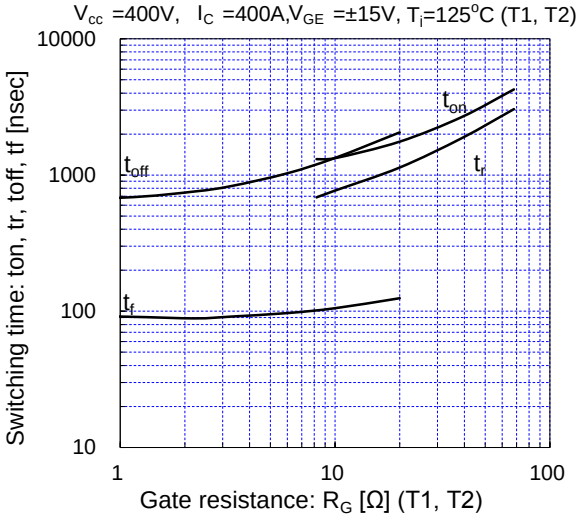
4MBI400VF-120R-50

IGBT Modules

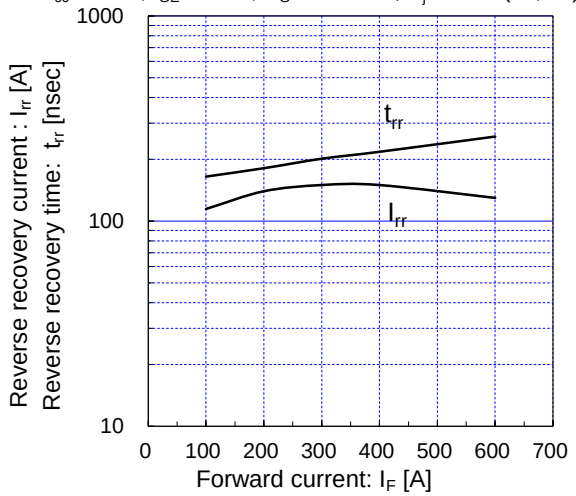
[SW mode: A]
Switching time vs. Collector current (typ.)
V_{cc} =400V, I_C =400A, R_G =+8.2/-1Ω, T_j=125°C (T1, T2)



[SW mode: A]
Switching time vs. Collector current (typ.)
V_{cc} =400V, I_C =400A,V_{GE} =±15V, T_j=125°C (T1, T2)



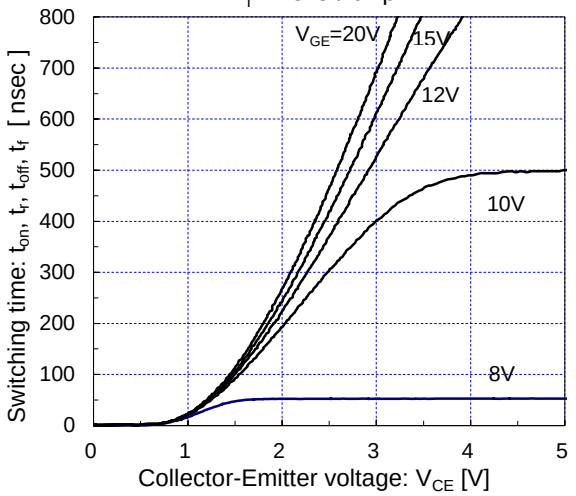
[SW mode: A (T3, T4 RB-IGBT recovery)]
Reverse recovery characteristics (typ.)
V_{cc} =400V,V_{GE} =±15V, R_G =+8.2/-1Ω, T_j=125°C (T1, T2)



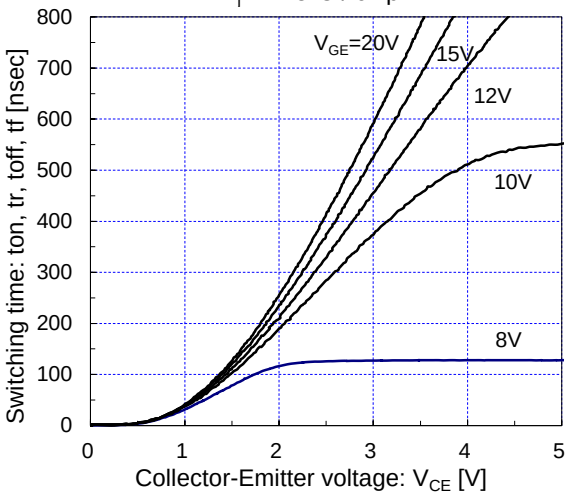
FM5F8336
2014/06

4MBI400VF-120R-50

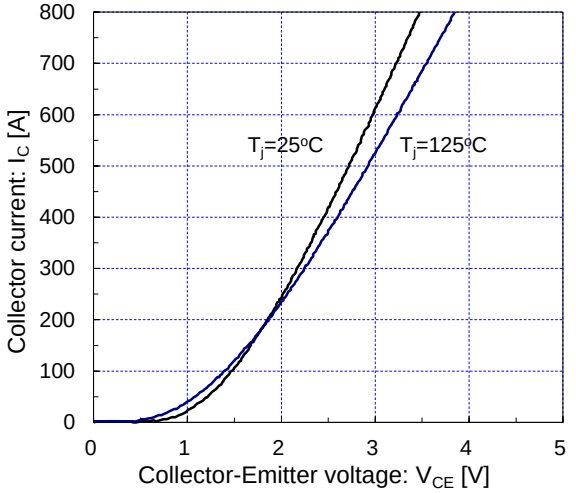
[AC-switch (T3, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
T_j = 25°C / chip



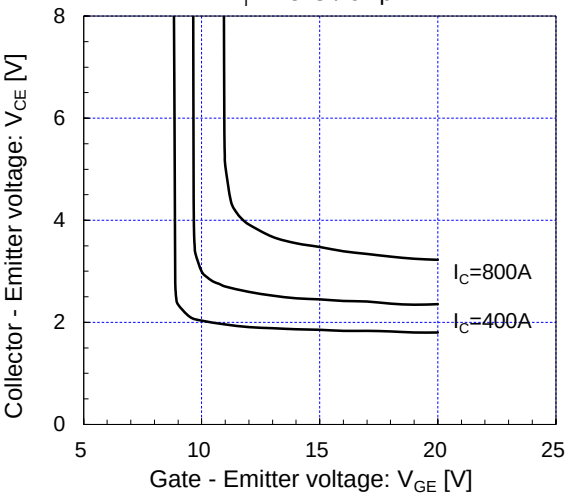
[AC-switch (T3, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
T_j = 125°C / chip



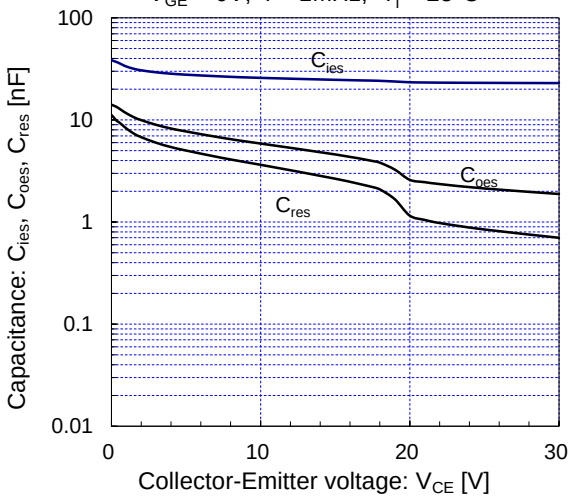
[AC-switch (T3, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} =15V / chip



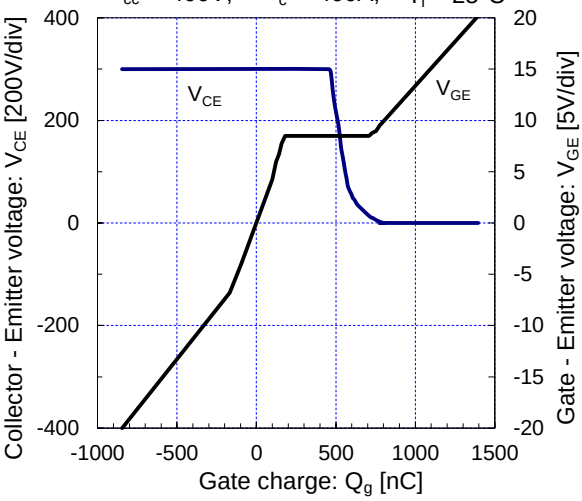
[AC-switch (T3, T4)]
ollector-Emitter voltage vs. Gate-Emitter voltage (typ
T_j = 25°C / chip



[AC-switch (T3, T4)]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE} = 0V, f = 1MHz, T_j = 25°C

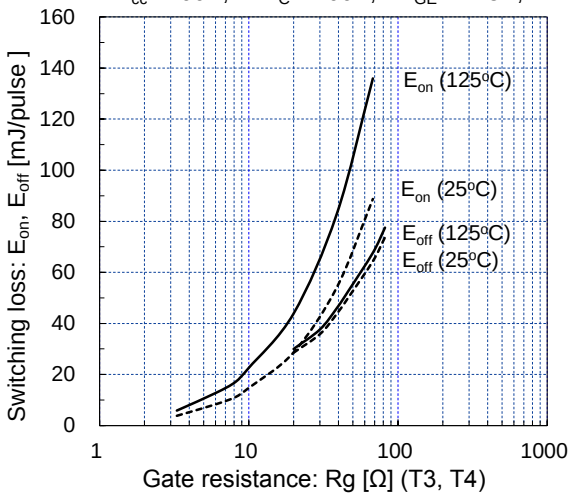


[AC-switch (T3, T4)]
Dynamic gate charge (typ.)
V_{cc} = 400V, I_c = 400A, T_j = 25°C

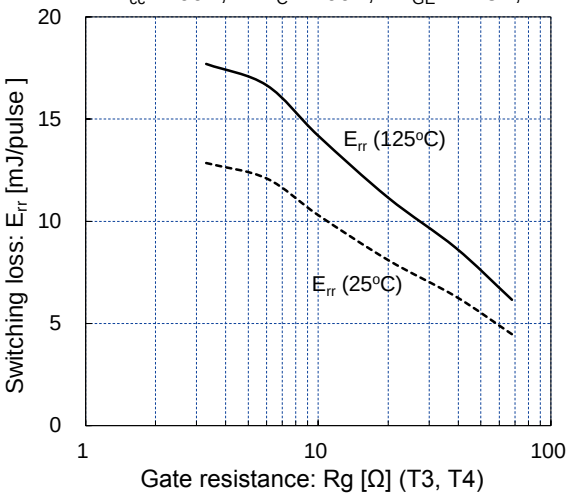


4MBI400VF-120R-50

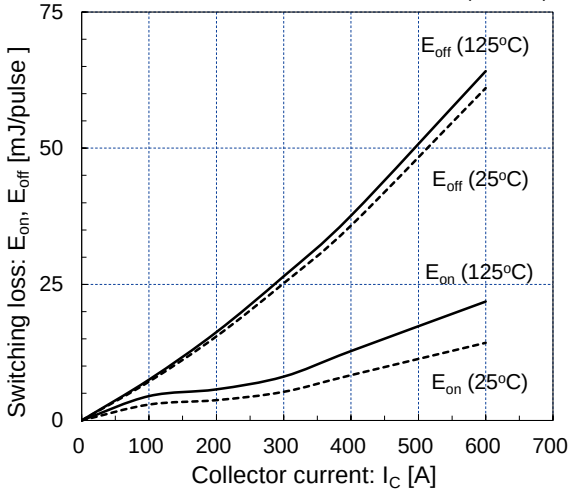
[SW mode: B]
Switching loss vs. gate resistance (typ.)
V_{cc} =400V, I_C =400A, V_{GE} =±15V,



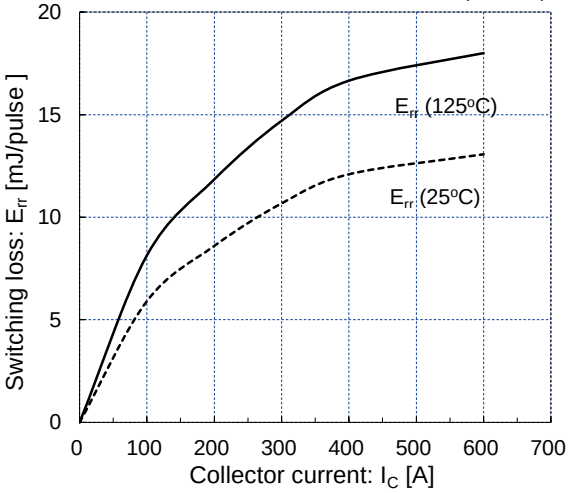
[SW mode: B (T1,T2 FWD recovery)]
Switching loss vs. gate resistance (typ.)
V_{cc} =400V, I_C =400A, V_{GE} =±15V,



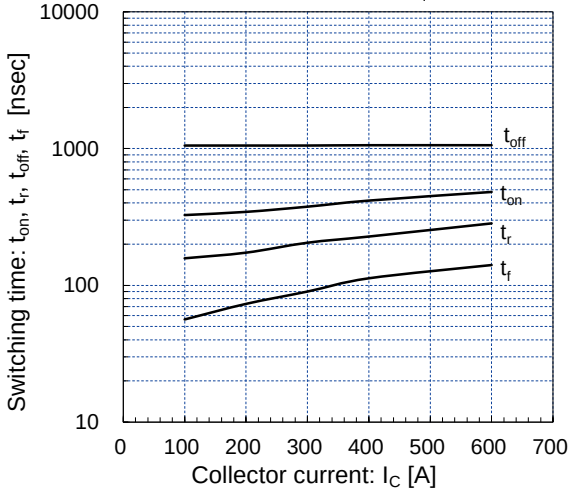
[SW mode: B]
Switching loss vs. Collector current (typ.)
V_{cc}= 400V, $/_{GE}$ =±15VR_G =+6.0/-30Ω (T3, T4)



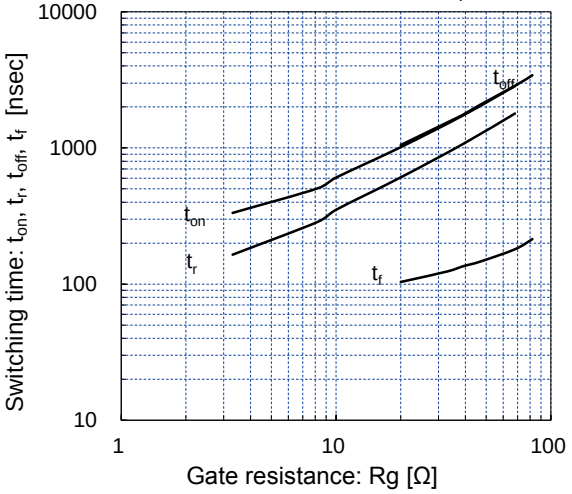
[SW mode: B (T1,T2 FWD recovery)]
Switching loss vs. Collector current (typ.)
V_{cc}= 400V, $/_{GE}$ =±15VR_G =+6.0/-30Ω (T3, T4)



[SW mode: B]
Switching time vs. Collector current (typ.)
V_{cc} =400V,V_{GE} =±15V, R_G =+6.0/-30Ω T_j=125°C (T3, T4)

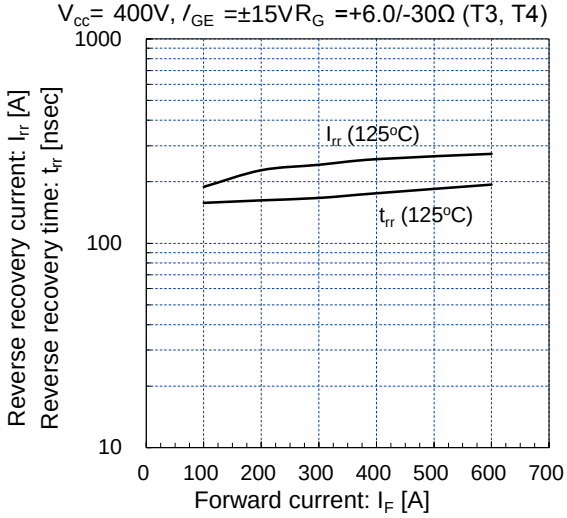


[SW mode: B]
Switching time vs. Collector current (typ.)
V_{cc} =400V I_C =400A$/_{GE}$ =±15V T_j=125°C

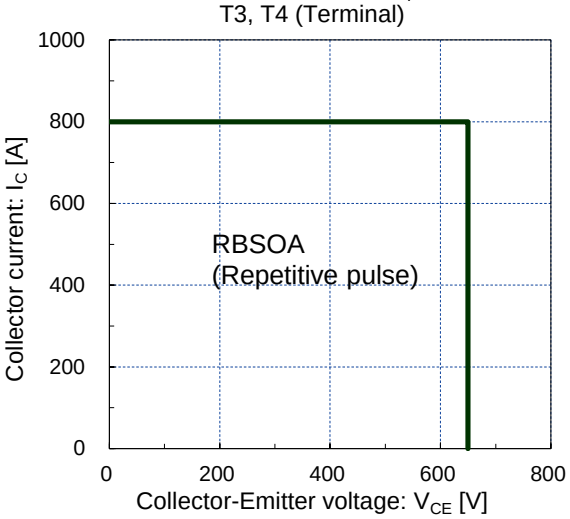


4MBI400VF-120R-50

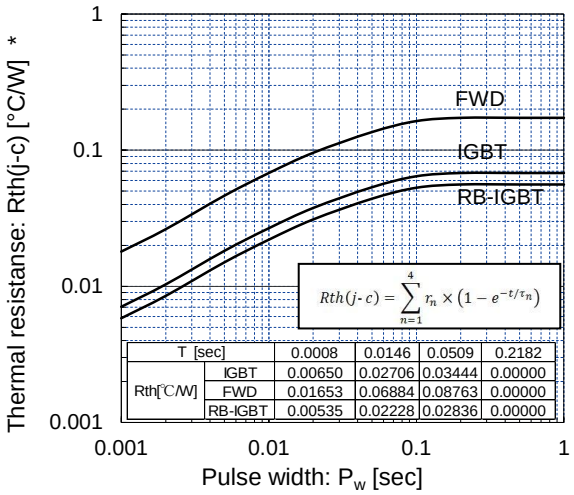
[SW mode: B (T1,T2 FWD recovery)]
Reverse recovery characteristics (typ.)
V_{cc}= 400V, $/_{GE}$ =±15VR_G =+6.0/-30Ω (T3, T4)



Reverse bias safe operating area (max.)
V_{GE}=±15V, R_G ≧Recommended, T_j=125°C (T3, T4)
T3, T4 (Terminal)

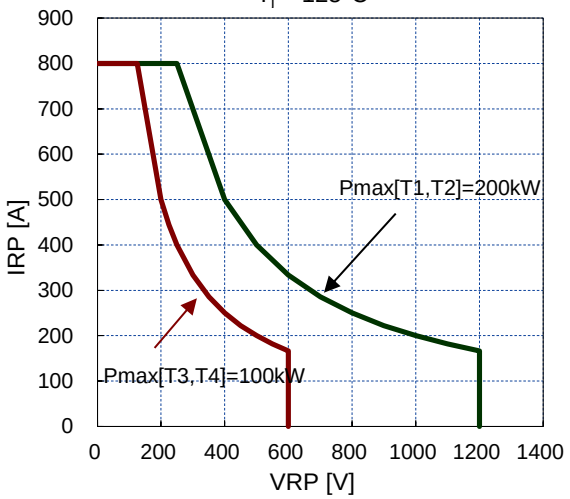


Transient thermal resistance (max.)



T [sec]		0.0008	0.0146	0.0509	0.2182
Rth[℃/W]	IGBT	0.00650	0.02706	0.03444	0.00000
	FWD	0.01653	0.06884	0.08763	0.00000
	RB-IGBT	0.00535	0.02228	0.02836	0.00000

Reverse recovery withstand capability for FWD, RB-IGBT
T_j = 125°C



Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as 2014/6/9
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. Copyright c1996-1900 by Fuji Electric Co., Ltd. All rights reserved.
No part of this Catalog may be reproduced in any form or by any means without the express permission of Fuji Electric Co., Ltd.

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.