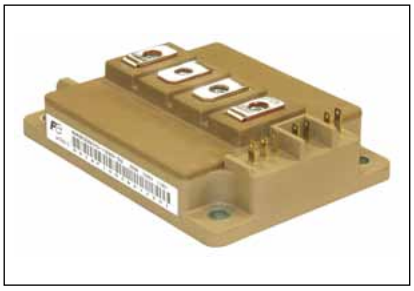
4MBI300VG-120R-50

IGBT Modules

IGBT MODULE (V series)
1200V / 300A / IGBT, 600V/300A/RB-IGBT, 4 in one package



Features
Higher Efficiency
Optimized A (T-type) -3 level circuit
Low inductance module structure
Featuring Reverse Blocking IGBT (RB-IGBT)

Applications
Inverter for Motor Drive
Uninterruptible Power Supply
Power conditioner

Maximum Ratings and Characteristics
● Absolute Maximum Ratings (at T_c=25°C unless otherwise specified)

Items			Symbols	Conditions		Maximum ratings	Units
T1, T2	Collector-Emitter voltage		V_{CES}			1200	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current	IGBT	I_C	Continuous	T_C=80°C	300	A
			I_{cp}	1ms	T_C=80°C	600	
		FWD	$-I_C$			300	
			$-I_{C\ pulse}$	1ms		600	
	Collector power dissipation		P_C	1 device		1250	W
T3, T4	Collector-Emitter voltage		V_{CES}			600	V
	Repetitive peak reverse voltage		V_{PRM}			600	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	T_C=80°C	300	A
			I_{cp}	1ms	T_C=80°C	600	
	Collector power dissipation		P_C	1 device		1250	W
Junction temperature			T_j			150	°C
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	N m
	Terminals (*3)		-	M5		3.5	

Note *1: All terminals should be connected together during the test.
Note *2: Recommendable value : 2.5-3.5 Nm (M5 or M6)
Note *3: Recommendable value : 2.5-3.5 Nm (M5)

● Electrical characteristics (at T_j= 25°C unless otherwise specified)

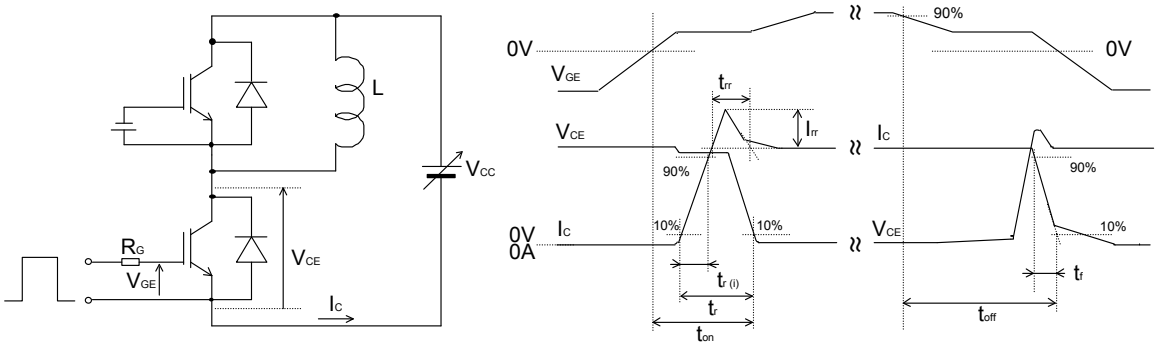
Items		Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
T1, T2	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V, V_{CE} = 1200V		-	-	2.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = ±20V		-	-	400	nA
	Gate-Emitter threshold voltage	$V_{GE\ (th)}$	V_{CE} = 20V, I_C = 300mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE\ (sat)}$ (chip)	V_{GE} = 15V, I_C = 300A	T_j= 25°C	-	1.85	2.10	V
				T_j=125°C	-	2.20	-	
		$V_{CE\ (sat)}$ (terminal)	V_{GE} = 15V, I_C = 300A	T_j= 25°C	-	2.05	2.35	
				T_j=125°C	-	2.40	-	
	Internal gate resistance	Rg(int)	-		-	2.50	-	Ω
	Input capacitance	C_{ies}	V_{CE} = 10V, V_{GE} =0V, f = 1MHz		-	25.2	-	nF
	Turn-on time	t_{on}	SW mode : A, V_{CC} = 400V, I_C = 300A, V_{GE} = ±15V, R_G = +10/-1Ω		-	0.75	1.30	μs
		t_r			-	0.45	0.80	
		$t_{r\ (i)}$			-	0.15	-	
	Turn-off time	t_{off}			-	0.60	1.00	
		t_f			-	0.10	0.35	
	Forward on voltage	V_F (chip)	I_F = 300A	T_j= 25°C	-	1.70	1.95	V
				T_j=125°C	-	1.85	-	
		V_F (terminal)	I_F = 300A	T_j= 25°C	-	1.95	2.25	
				T_j=125°C	-	2.10	-	
	Reverse recovery time	t_{rr}	SW mode : B, V_{CC} = 400V, I_F = 300A, V_{GE} = ±15V, R_G = +8.2/-39Ω		-	-	0.30	μs
T3, T4	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V, V_{CE} = 600V		-	-	3.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = ±20V		-	-	600	nA
	Gate-Emitter threshold voltage	$V_{GE\ (th)}$	V_{CE} = 20V, I_C = 300mA		5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE\ (sat)}$ (chip)	V_{GE} = 15V, I_C = 300A	T_j= 25°C	-	2.45	2.80	V
				T_j=125°C	-	2.60	-	
		$V_{CE\ (sat)}$ (terminal)	V_{GE} = 15V, I_C = 300A	T_j= 25°C	-	2.55	2.95	
				T_j=125°C	-	2.70	-	
	Internal gate resistance	Rg(int)	-		-	2.93	-	Ω
	Input capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V, f = 1MHz		-	19.5	-	nF
	Turn-on time	t_{on}	SW mode : B, V_{CC} = 400V, I_C = 300A, V_{GE} = ±15V, R_G = +8.2/-39Ω		-	0.45	1.05	μs
		t_r			-	0.27	0.53	
		$t_{r\ (i)}$			-	0.12	-	
	Turn-off time	t_{off}			-	1.32	3.00	
		t_f			-	0.11	0.35	
	Reverse recovery time	t_{rr}	SW mode : A, V_{CC} = 400V, I_F = 300A, V_{GE} = ±15V, R_G = +10/-1Ω		-	-	0.30	μs
Internal inductance		L	P-N		-	40	-	nH
			P-M		-	33	-	
			M-N		-	33	-	

● Thermal resistance characteristics

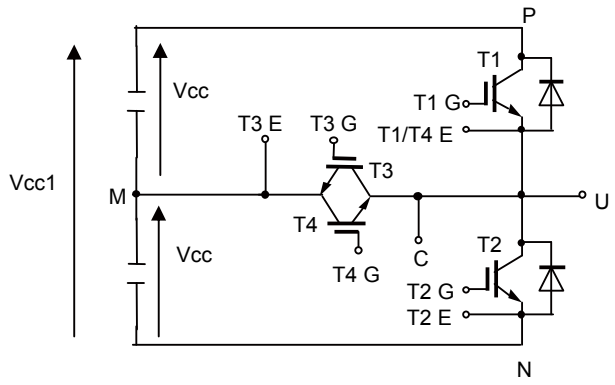
Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance (1device)	$R_{th(j-c)}$	T1, T2 IGBT		-	-	0.10	°C/W
		T1, T2 FWD		-	-	0.16	
		T3, T4 RB-IGBT		-	-	0.10	
Contact thermal resistance (1device) (*4)	$R_{th(c-f)}$	T1, T2	with Thermal Compound	-	0.025	-	
		T3, T4		-	0.017	-	

Note *4: This is the value which is defined mounting on the additional cooling fin with thermal compound (thermal conductivity = 1W/m ·k).

■ Definitions of switching time



Definitions of switching mode

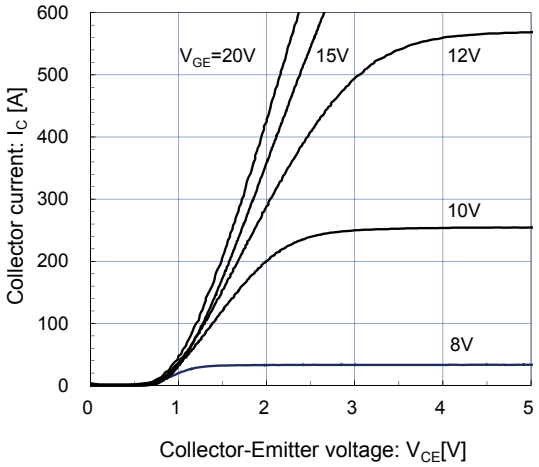


SW mode	Load L	T1	T2	T3	T4
A	M-U	**SW**	OFF	OFF	**ON**
	M-U	OFF	**SW**	**ON**	OFF
B	P−U	OFF	OFF	**SW**	**ON**
	U−N	OFF	OFF	**ON**	**SW**

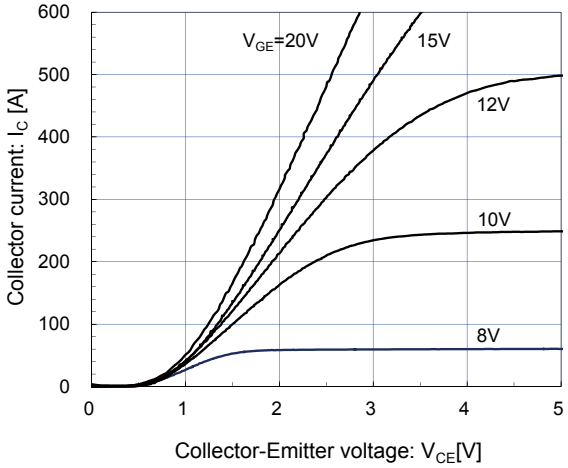
SW: Connect to drive circuit and input gate signal
ON: Bias voltage of gate +15V
OFF: Reverse bias voltage of gate -15V
Vcc1=2 × Vcc

■ Characteristics (Representative)

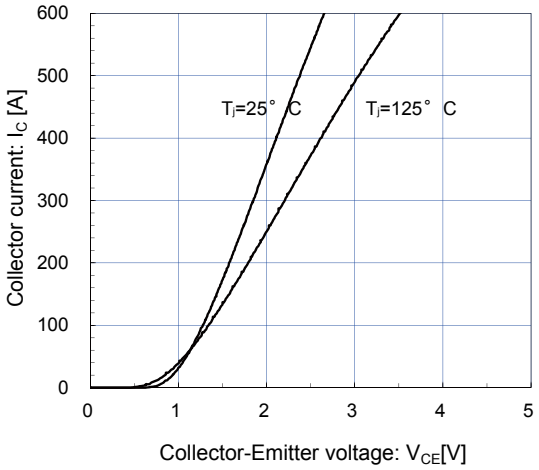
[T1, T2]
Collector current vs. Collector-Emitter voltage (typ.)
T_j= 25°C / chip



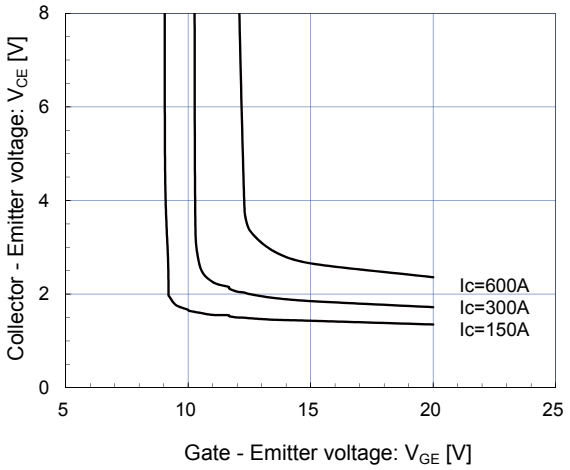
[T1, T2]
Collector current vs. Collector-Emitter voltage (typ.)
T_j= 125°C / chip



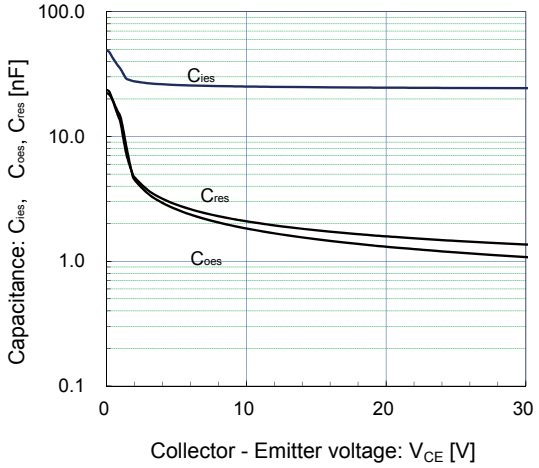
[T1, T2]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE}=15V / chip



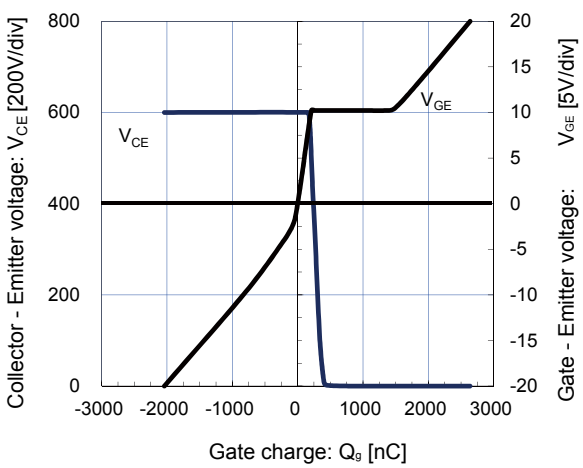
[T1, T2]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_j= 25°C / chip



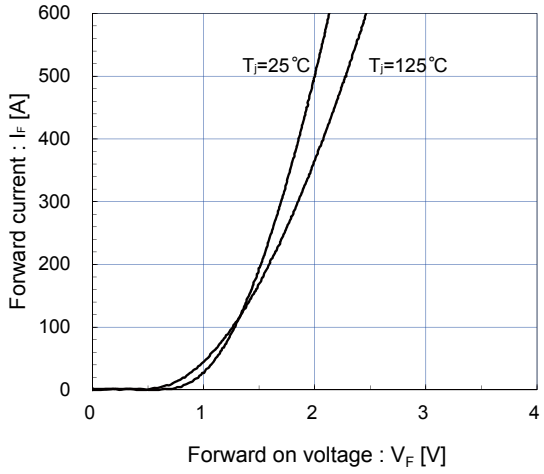
[T1, T2]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE}=0V, f= 1MHz, T_j= 25°C



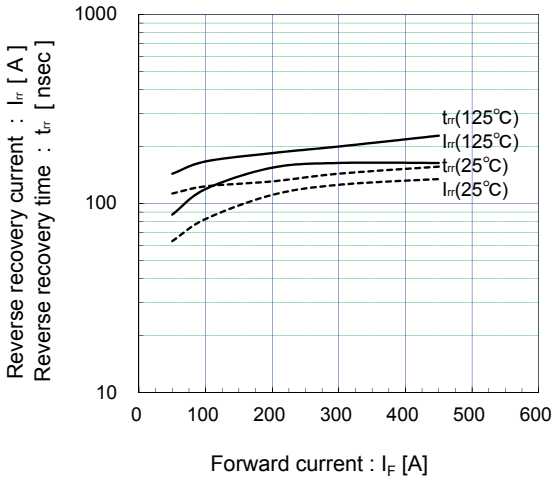
[T1, T2]
Dynamic gate charge (typ.)
Vcc=600V, Ic=300A, T_j=25°C



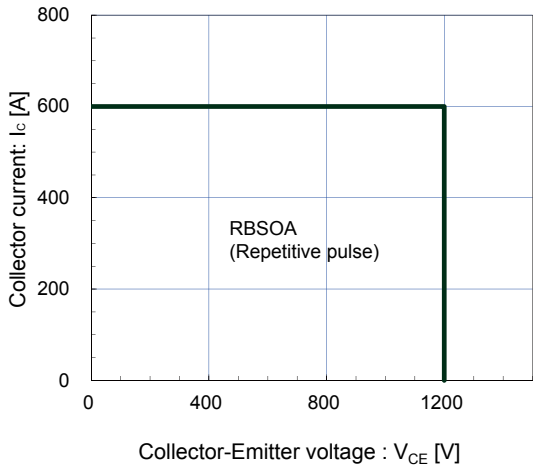
[T1, T2]
Forward current vs. forward on voltage (typ.)
chip



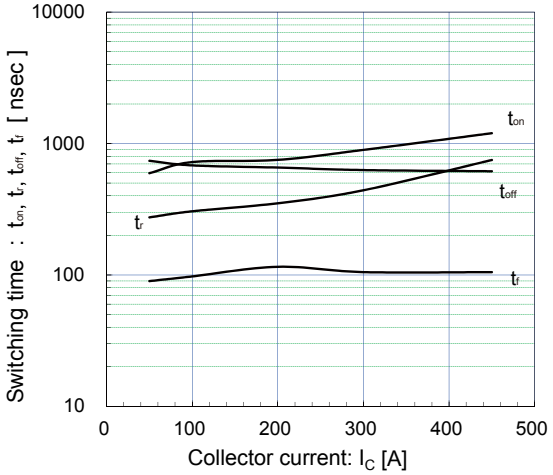
[T1, T2]
Reverse recovery characteristics (typ.)
Vcc=400V, VGE=±15V, RG=+10/-1Ω(T1, T2)



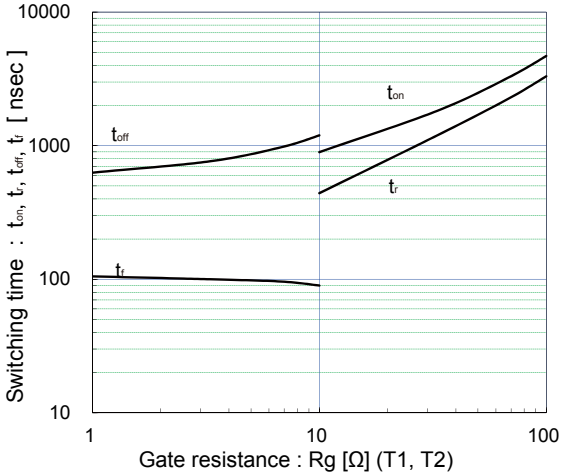
Reverse bias safe operating area (max.)
VGE=15V, -VGE ≦ 15V, RG ≧+10/-1Ω, Tj ≦ 125oC, Ls=46nH (T1, T2)
T1, T2 (Terminal)



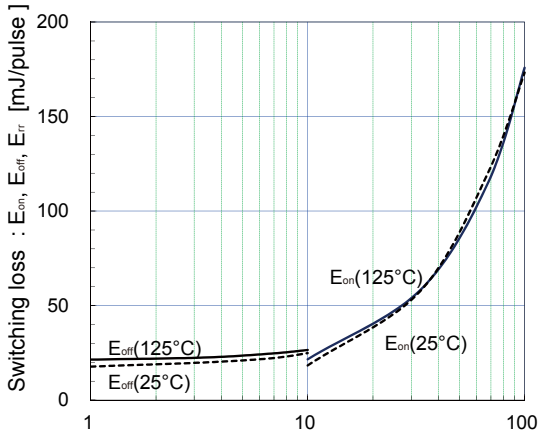
[SW mode A]
Switching time vs. Collector current (typ.)
Vcc=400V, V_{GE}=±15V, R_G=+10/-1 Ω, T_j=125°C (T1, T2)



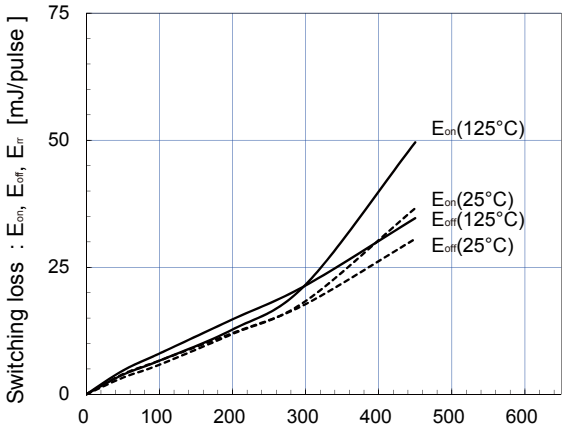
[SW mode A]
Switching time vs. Collector current (typ.)
Vcc=400V, Ic=300A, V_{GE}=±15V, T_j=125°C



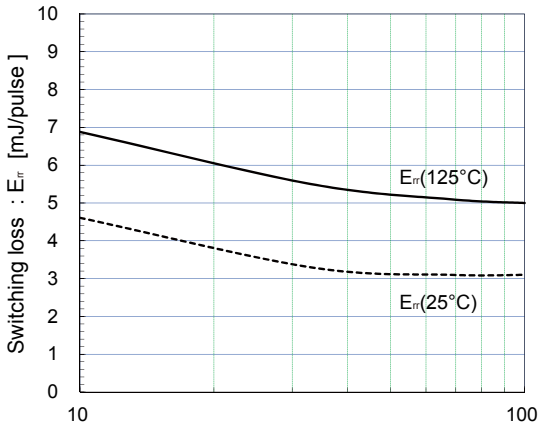
[SW mode A]
Switching loss vs. gate resistance (typ.)
Vcc=400V, Ic=300A, V_{GE}=±15V



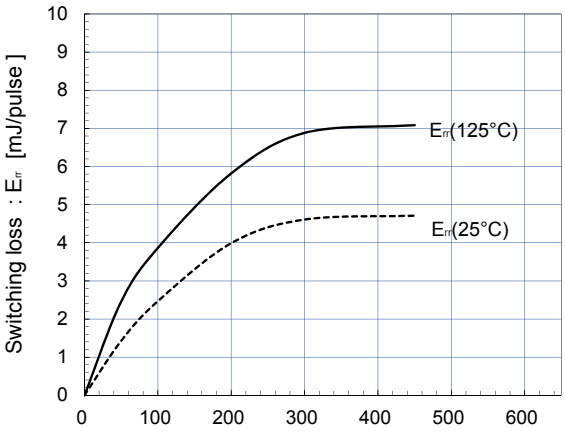
[SW mode A]
Switching loss vs. Collector current (typ.)
Vcc=400V, V_{GE}=±15V, R_G=+10/-1Ω (T1, T2)



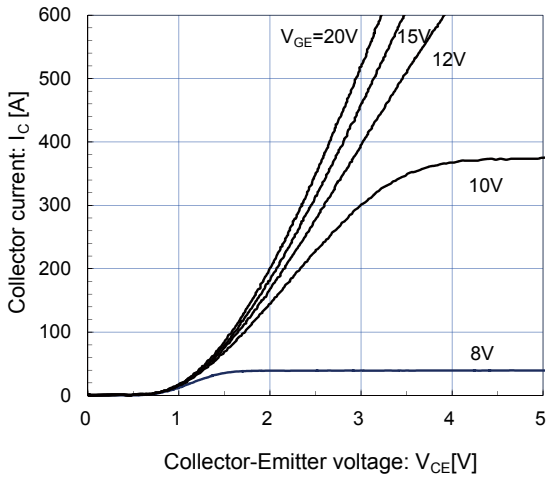
[SW mode A (T3,T4 RB-IGBT recovery)]
Switching loss vs. gate resistance (typ.)
Vcc=400V, Ic=300A, V_{GE} =±15V



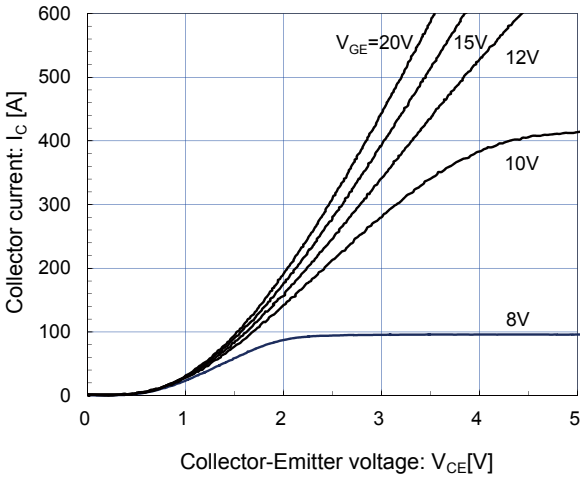
[SW mode A (T3,T4 RB-IGBT recovery)]
Switching loss vs. Collector current (typ.)
Vcc=400V, V_{GE} =±15V, R_G=+10/-1Ω (T1, T2)



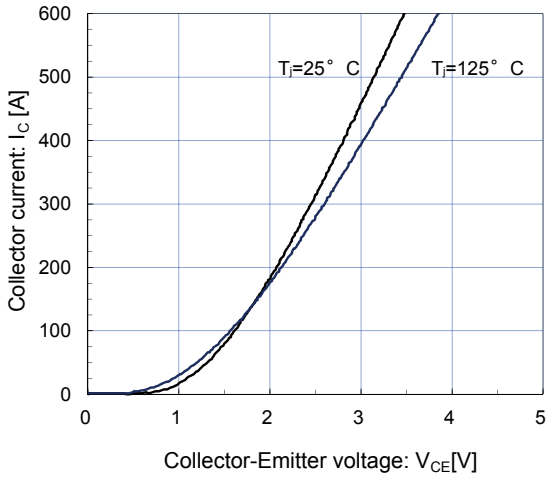
[T3, T4]
Collector current vs. Collector-Emitter voltage (typ.)
T_j= 25°C / chip



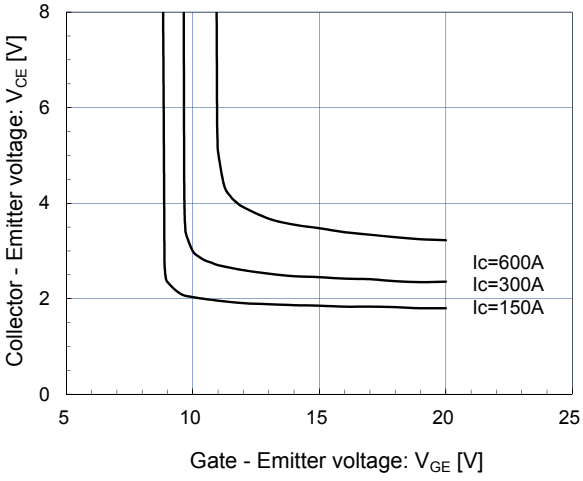
[T3, T4]
Collector current vs. Collector-Emitter voltage (typ.)
T_j= 125°C / chip



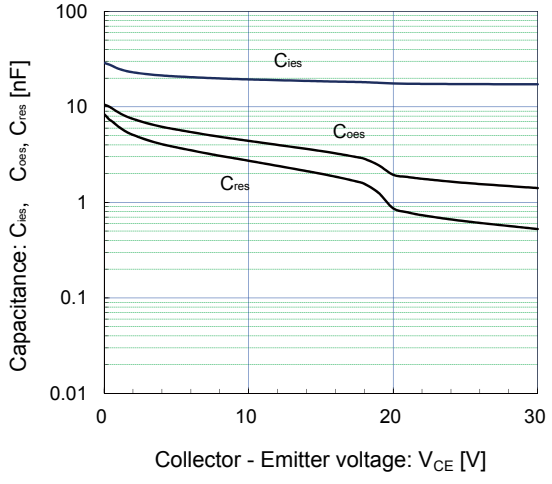
[T3, T4]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE}=15V / chip



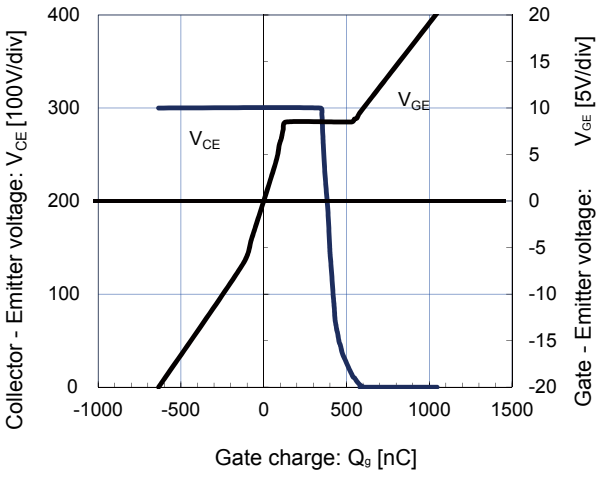
[T3, T4]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_j= 25°C / chip



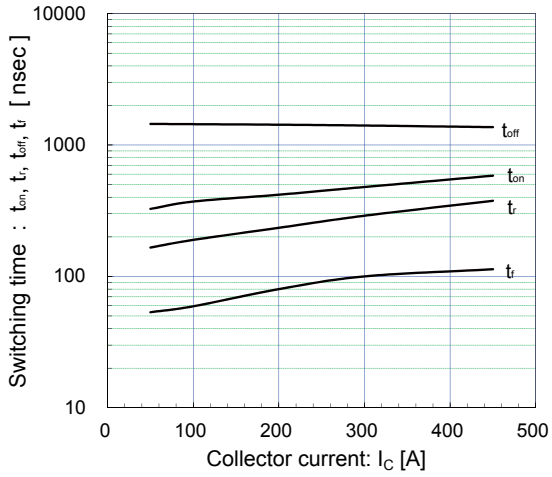
[T3, T4]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE}=0V, f= 1MHz, T_j= 25°C



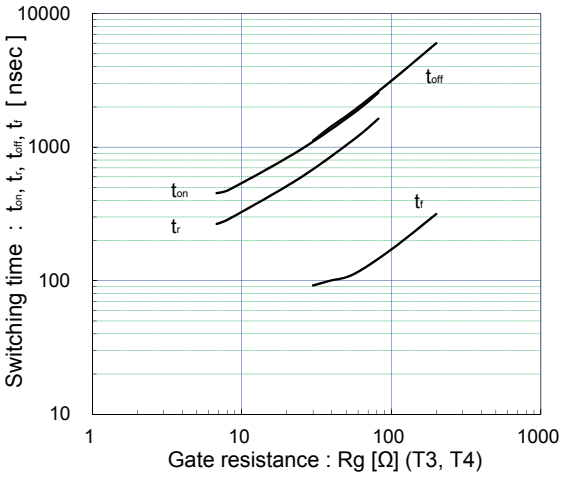
[T3, T4]
Dynamic gate charge (typ.)
Vcc=300V, Ic=300A, T_j=25°C



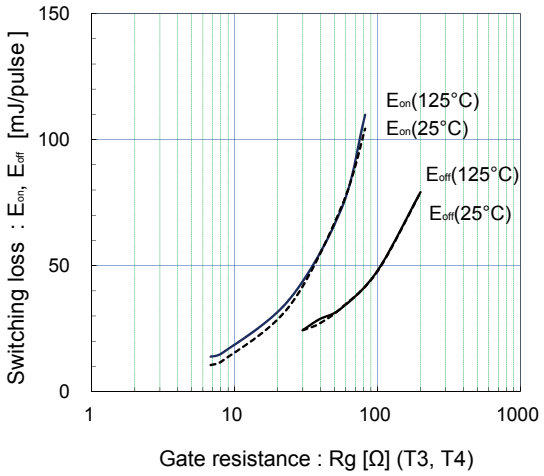
[SW mode B]
Switching time vs. Collector current (typ.)
Vcc=400V, V_{GE}=±15V, R_G=+8.2/-39 Ω, T_j=125°C (T3, T4)



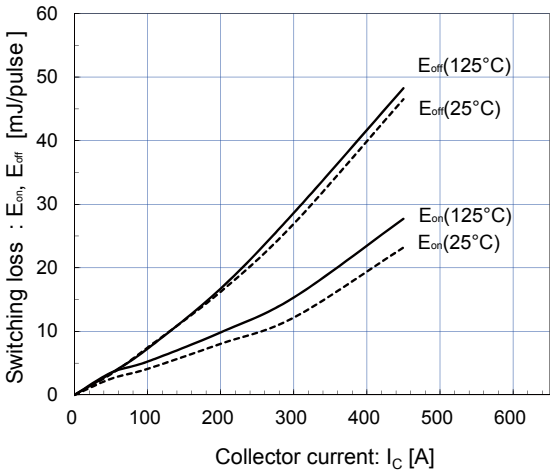
[SW mode B]
Switching time vs. Collector current (typ.)
Vcc=400V, Ic=300A, V_{GE}=±15V, T_j=125°C



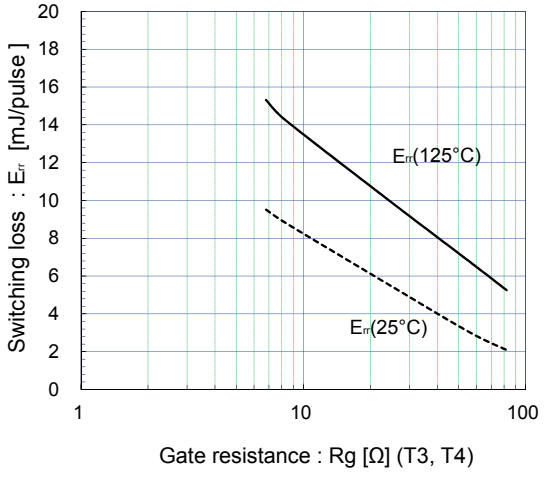
[SW mode B]
Switching loss vs. gate resistance (typ.)
Vcc=400V, Ic=300A, V_{GE}=±15V



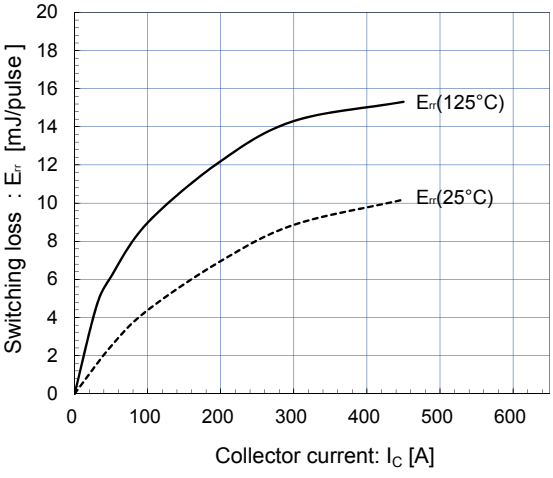
[SW mode B]
Switching loss vs. Collector current (typ.)
Vcc=400V, V_{GE}=±15V, R_G=+8.2/-39 Ω (T3, T4)



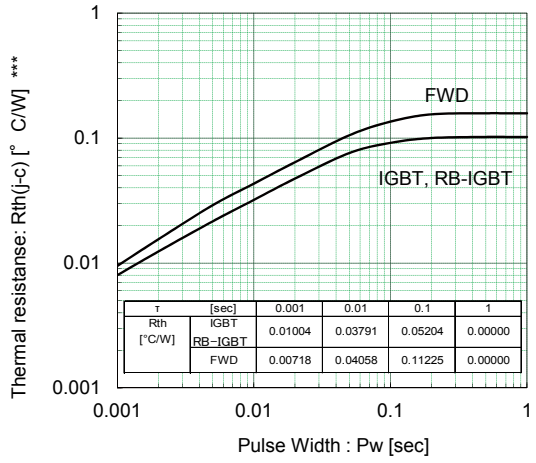
[SW mode B (T1,T2 FWD recovery)]
Switching loss vs. gate resistance (typ.)
Vcc=400V, Ic=300A, V_{GE}=±15V



[SW mode B (T1,T2 FWD recovery)]
Switching loss vs. Collector current (typ.)
Vcc=400V, V_{GE}=±15V, R_G=+8.2/-39Ω (T3, T4)



Transient Thermal Resistance (max.)

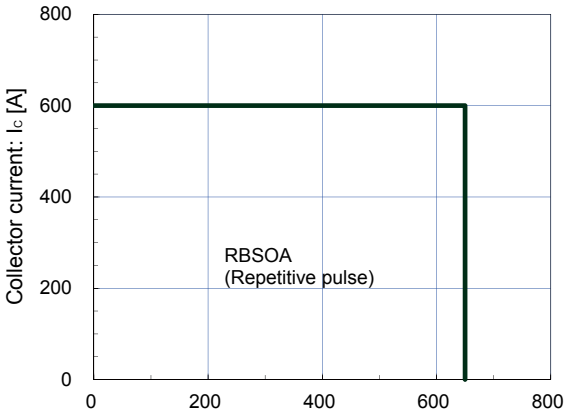


τ	[sec]	0.001	0.01	0.1	1
Rth [°C/W]	IGBT	0.01004	0.03791	0.05204	0.00000
	RB-IGBT				
	FWD	0.00718	0.04058	0.11225	0.00000

Reverse bias safe operating area (max.)

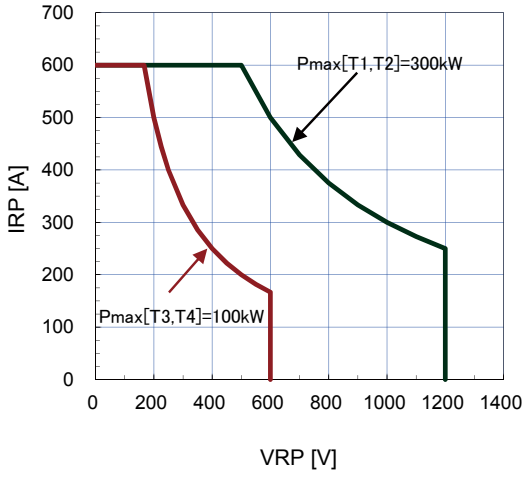
V_{GE}=15V,-V_{GE} ≦ 15V, R_G ≧+8.2/-39Ω, T_j ≦ 125°C, Ls=46nH (T3, T4)

T3, T4 (Terminal)

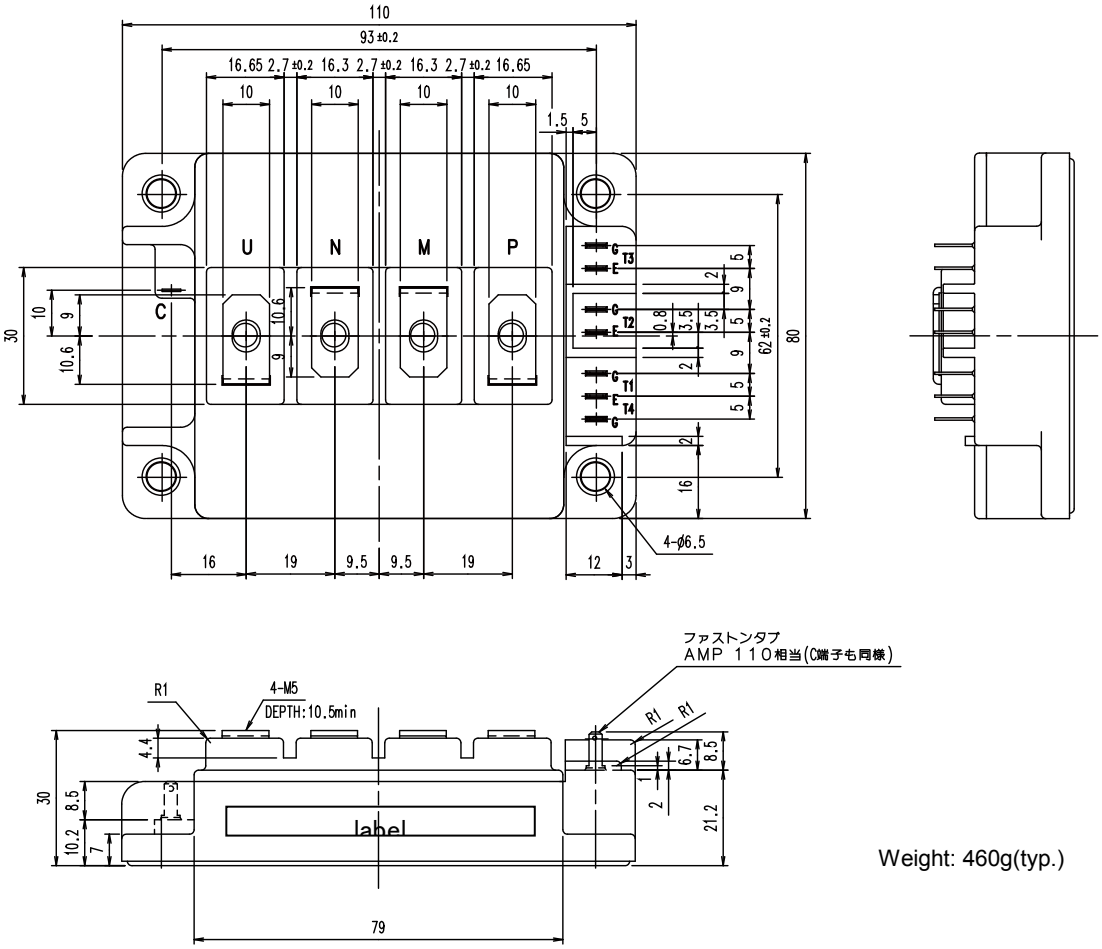


Reverse recovery withstand capability for FWD, RB-IGBT

Tj=125°C

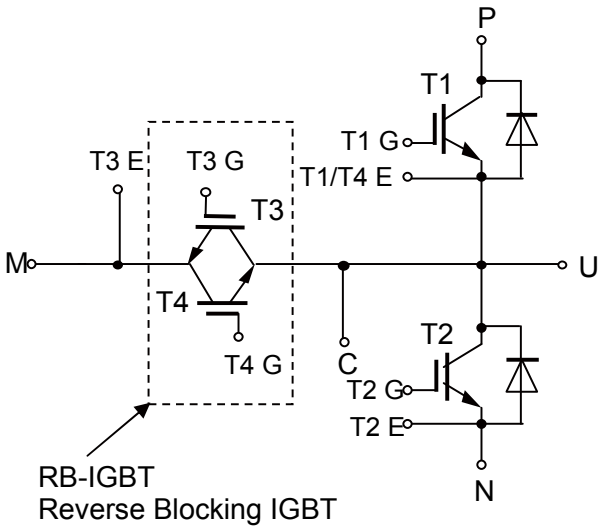


■ Outline Drawings, mm



Weight: 460g(typ.)

■ Equivalent Circuit Schematic



WARNING

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of March 2014.
The contents are subject to change without notice for specification changes or other reasons. When using a product listed in this Catalog, be sur 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.

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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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• 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).
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• Submarine repeater equipment

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.
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富士電機

Innovating Energy Technology

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IGBT Modules

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