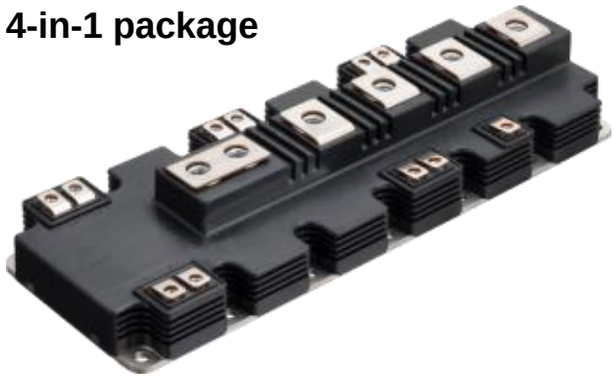
4MBI900VB-120RA-50

IGBT Modules

IGBT Power Module (V series)
1200V/900A/IGBT, ±600V/900A/RB-IGBT, 4-in-1 package



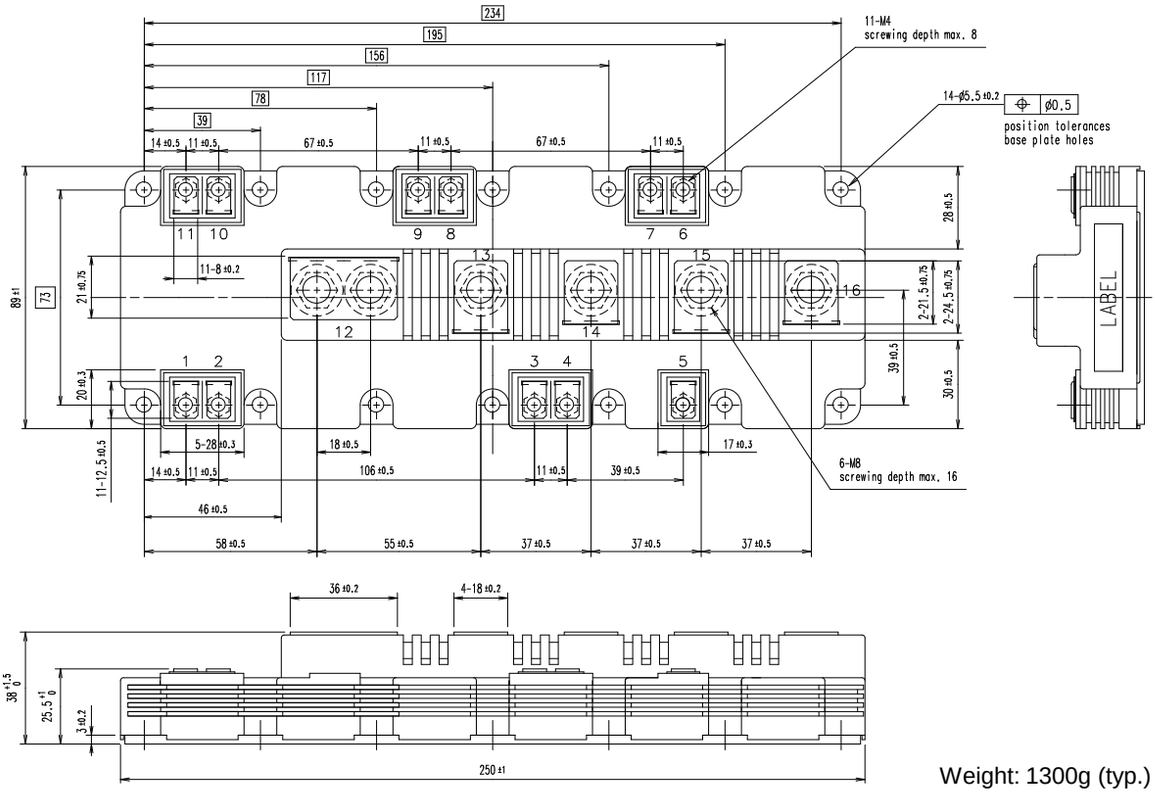
■ Features

Higher efficiency
Optimized Advanced T-type circuit
Revese-Blocking IGBT as for AC Switch
Low inductance module structure

■ Applications

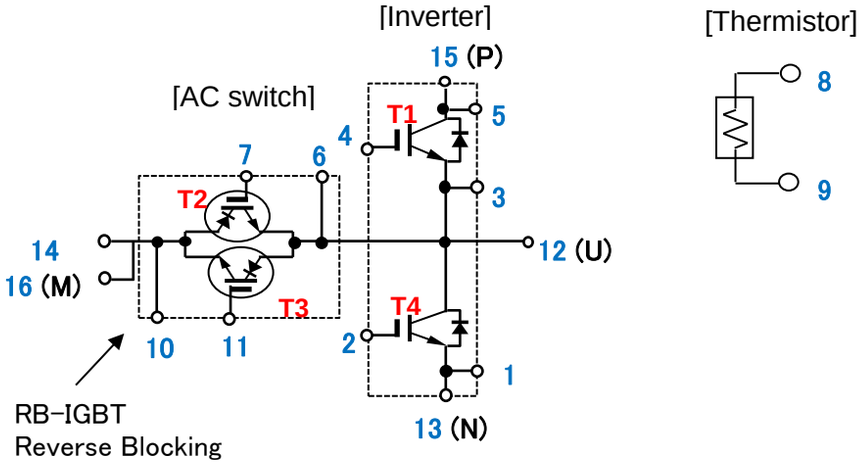
Inverter for motor drive
Uninterruptible power supply
Power conditioner for PV, Wind turbine

■ Outline drawing (Unit : mm)



Weight: 1300g (typ.)

■ Equivalent Circuit



FM5F9123
2018/05

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

Item			Symbol	Condition		Maximum Rating	Unit
Inverter	Collector-Emitter voltage		V_{CES}			1200	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current	IGBT	I_C	Continuous	T_c=25°C	1200	A
					T_c=100°C Duty=88%	900	
			I_{CP}	1ms		1800	
		FWD	$-I_C$			900	
			$-I_C$ pulse	1ms		1800	
	Collector power dissipation		P_C	1 device		3950	W
	Junction temperature		T_{vj}			175	°C
	Operating junction temperature (under switching conditions)		T_{vjop}			150	
Clamp diode	Collector-Emitter voltage	RB-IGBT	V_{CES}			±600	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	T_c=25°C	1200	A
					T_c=88°C Duty=56%	900	
			I_C pulse	1ms		1800	
	Collector power dissipation		P_C	1 device		2660	W
	Junction temperature		T_{vj}			150	°C
	Operating junction temperature (under switching conditions)		T_{vjop}			125	
Case temperature			T_c			125	
Storage temperature			T_{stg}			-40～125	
Isolation voltage	between terminal and copper base (*1)		V_{iso}	AC: 1min.		4000	Vrms
	between thermistor and others (*2)						
Screw Torque (*3)	Mounting		-	M5		6.0	N m
	Main terminals		-	M8		10.0	
	Sense terminals		-	M4		2.1	

(*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) Recommended value : Mounting 3.0 ~ 6.0 Nm (M5)
Recommended value : Main Terminals 8.0 ~ 10.0 Nm (M8)
Recommended value : Sense Terminals 1.8 ~ 2.1 Nm (M4)

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

	Item	Symbol	Condition		Characteristics min.	typ.	max.	Units
Inverter	Zero gate voltage Collector current	I_{CES}	V_{GE} = 0V V_{CE} = 1200V		-	-	6.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V V_{GE} = ±20V		-	-	1200	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 900mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	V_{GE} = 15V I_C = 900A	T_{vj}=25°C	-	1.85	2.35	V
				T_{vj}=125°C	-	2.20	-	
				T_{vj}=150°C	-	2.25	-	
		$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C = 900A	T_{vj}=25°C	-	1.95	2.45	
				T_{vj}=125°C	-	2.30	-	
				T_{vj}=150°C	-	2.35	-	
	Internal gate resistance	$r_{g(int)}$	-		-	0.80	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	75.5	-	nF
	Turn-on time	t_{on}	SW mode : A (*1)		-	0.60	-	μs
		t_r	V_{CC} = 300V		-	0.26	-	
		$t_{r(i)}$	I_C = 900A		-	0.14	-	
	Turn-off time	t_{off}	V_{GE}= ±15V		-	0.85	-	
		t_f	R_G = +3.9/-1.0Ω		-	0.09	-	
	Forward voltage	V_F (chip)	I_F = 900A	T_{vj}=25°C	-	1.70	2.20	V
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.80	-	
		V_F (terminal)	I_F = 900A	T_{vj}=25°C	-	1.85	2.35	
				T_{vj}=125°C	-	2.00	-	
				T_{vj}=150°C	-	1.95	-	
	Reverse recovery time	t_{rr}	SW mode: B (*1) V_{CC}= 300V I_F = 900A V_{GE}= ±15V R_G = +2.7/-15Ω		-	0.18	-	μs
AC switch	Zero gate voltage Collector current	I_{CES}	V_{GE} = 0V V_{CE}= 600V		-	-	9	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V V_{GE}= ±20V		-	-	1800	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 900mA		5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	V_{GE}= 15V I_C = 900A	T_{vj}=25°C	-	2.45	2.80	V
				T_{vj}=125°C	-	2.60	-	
		$V_{CE(sat)}$ (terminal)	V_{GE}= 15V I_C = 900A	T_{vj}=25°C	-	2.55	3.20	
				T_{vj}=125°C	-	2.70	-	
	Internal gate resistance	$r_{g(int)}$	-		-	2.80	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	58.5	-	nF
	Turn-on time	t_{on}	SW mode : B (*1)		-	0.66	-	μs
		t_r	V_{CC} = 300V		-	0.27	-	
		$t_{r(i)}$	I_C = 900A		-	0.18	-	
	Turn-off time	t_{off}	V_{GE}= ±15V		-	1.69	-	
		t_f	R_G = +2.7/-15Ω		-	0.16	-	
	Reverse recovery time	t_{rr}	SW mode: A (*1) V_{CC}= 300V I_F = 900A V_{GE}= ±15V R_G= +3.9/-1.0Ω		-	0.13	-	μs
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

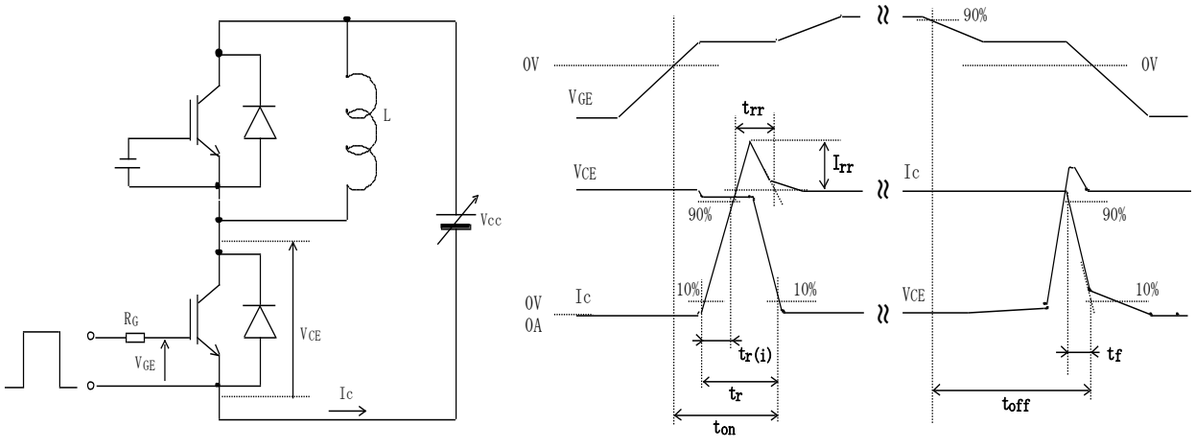
(*1)Please refer to Page4, there is definition of A mode and B mode.

■ Thermal resistance characteristics

Item	Symbol	Condition		Characteristics min.	typ.	max.	Units
Thermal resistance (1device)	$R_{th(j-c)}$	T1,T4 IGBT		-	-	0.038	°C/W
		T1,T4 FWD		-	-	0.054	
		T2,T3 RB-IGBT		-	-	0.047	
Contact thermal resistance (1device) (*2)	$R_{th(c-f)}$	T1,T4	with Thermal	-	0.0083	-	
		T2,T3	Compound	-	0.0056	-	

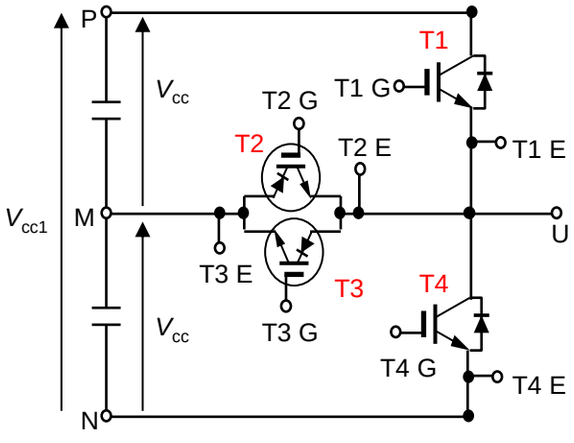
(*2) This is the value which is defined mounting on the additional cooling fin with thermal compound.

■ Definitions of switching time



■ Definitions of switching mode

■ Definition on-state voltage at terminal and switching characteristics



Fuji defined V_{CE} value of terminal by using
Sense P and Sense T1E for T1 arm ,
Sense T3E and Sense T2E for T2 arm ,
Sense T2E and Sense T3E for T3 arm and
Sense T1E and Sense T4E for T4 arm .

Switching characteristics of V_{CE} also is defined
between Sense P and Sense T1E for T1 arm ,
Sense T3E and Sense T2E for T2 arm ,
Sense T2E and Sense T3E for T3 arm and
Sense T1E and Sense T4E for T4 arm .

Please use these terminals whenever
measure spike voltage and on-state voltage .

■ Definition of switching mode

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

SW: Connect to drive circuit and input gate signal
ON: Bias voltage of gate +15V
OFF: Reverse bias voltage of gate -15V
$V_{CC1}=2\times V_{CC}$

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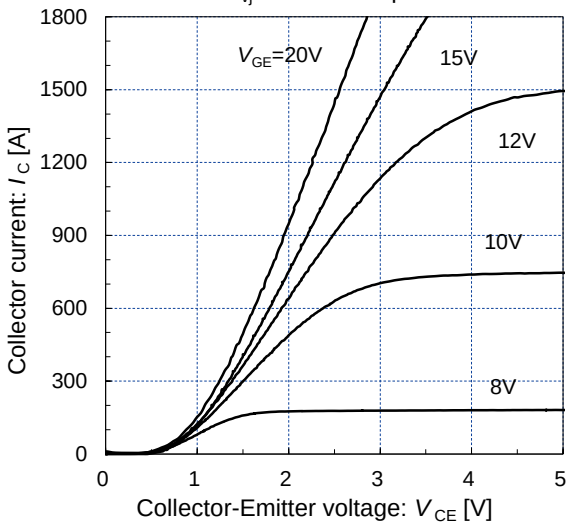
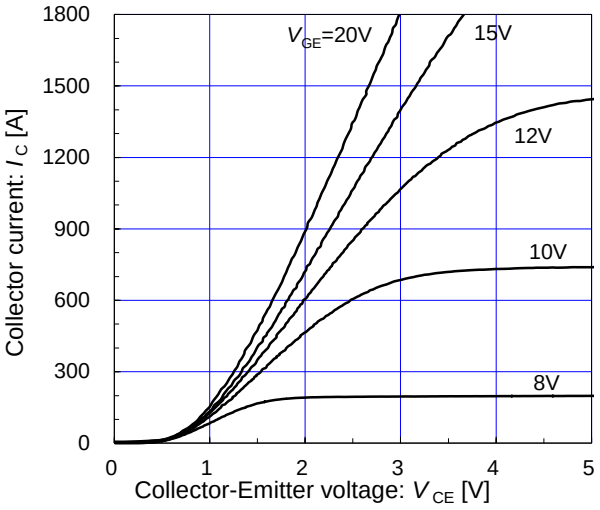
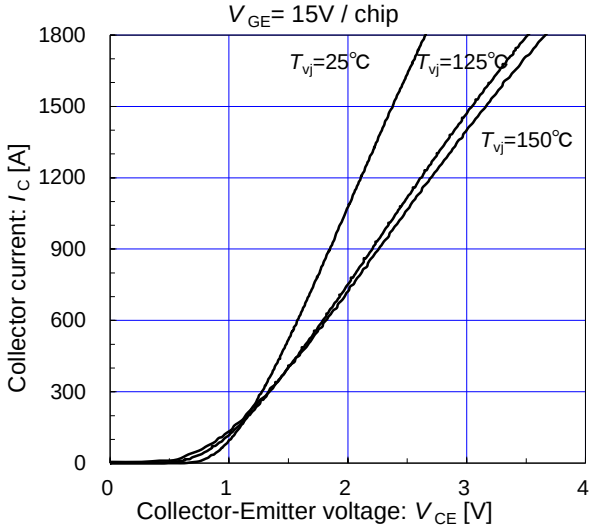
[Inverter (T1, T4)]
Collector current vs. Collector-Emitter voltage
T_{vj}= 125°C / chip



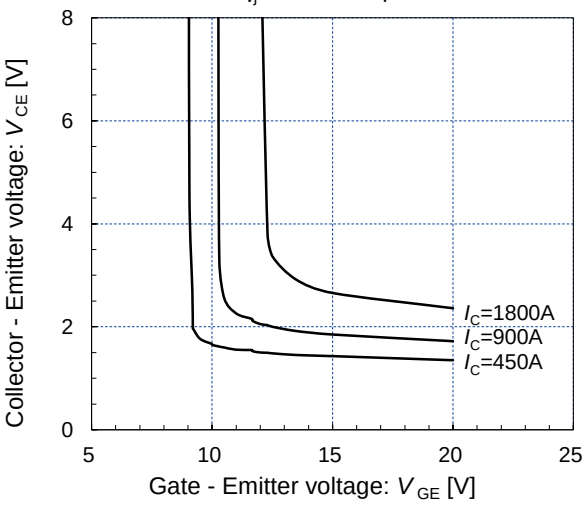
[Inverter (T1, T4)]
Collector current vs. Collector-Emitter voltage
T_{vj}= 150°C / chip



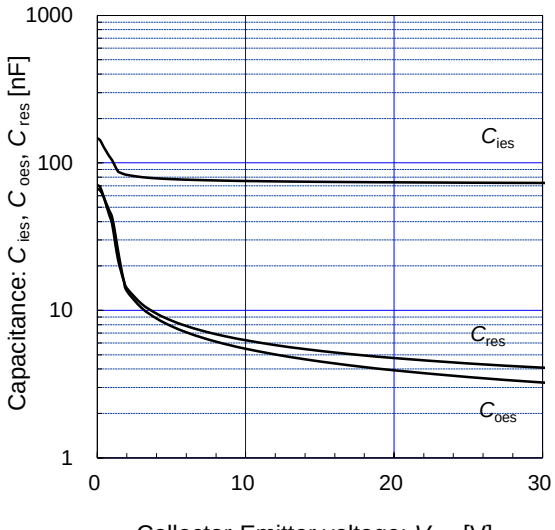
[Inverter (T1, T4)]
Collector current vs. Collector-Emitter voltage
V_{GE}= 15V / chip



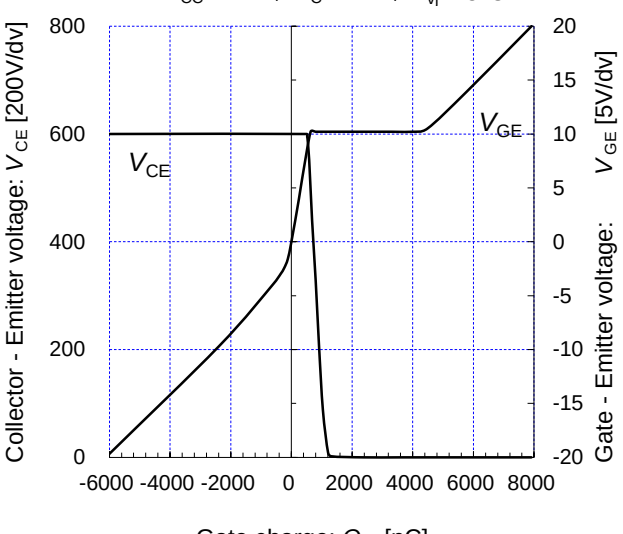
[Inverter (T1, T4)]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj}= 25°C / chip



[Inverter (T1, T4)]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE}=0V, f= 1MHz, T_{vj}= 25°C



[Inverter (T1, T4)]
Dynamic gate charge (typ.)
V_{CC}=600V, I_C=900A, T_{vj}=25°C



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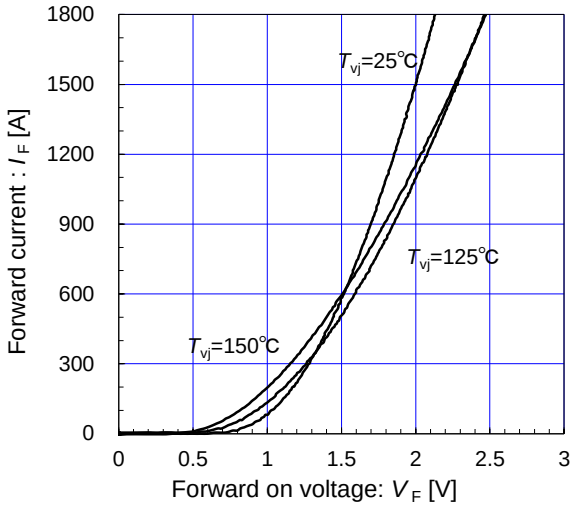
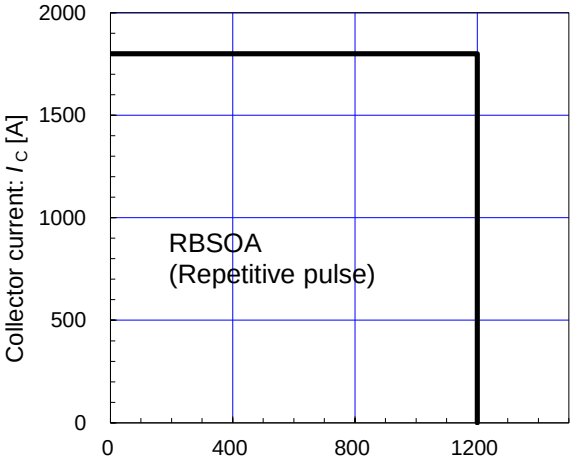
[Inverter (T1, T4)]
Forward current vs. forward on voltage (typ.)
chip

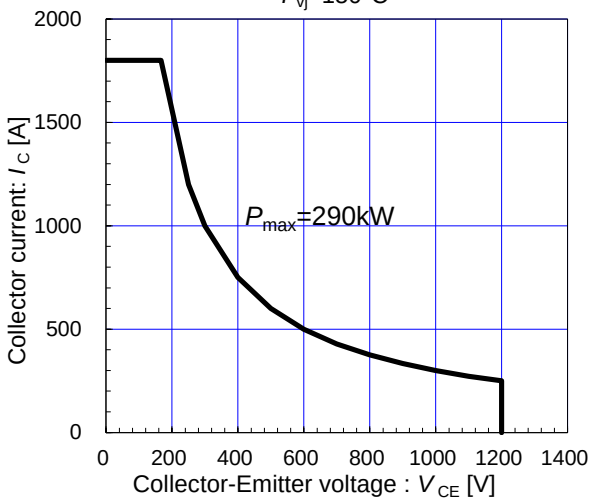


Revese bias safe operating area (max.)
V_{GE}=±15V, R_G ≧Recommended, T_{vj}=150°C(T1,T4)
T1,T4（Terminal）(*1)

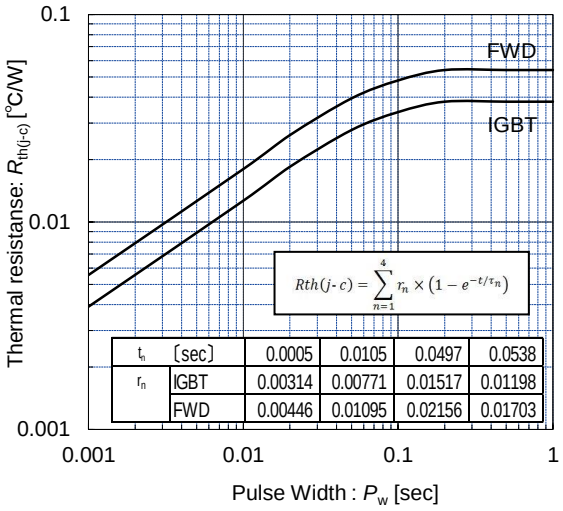


Collector-Emitter voltage: V_{CE} [V]
(*1)Please refer to P4,there is definition of terminal

Reverse recovery withstand capability for FWD
T_{vj}=150°C



Transient Thermal Resistance (max.)



t_n 〔sec〕		0.0005	0.0105	0.0497	0.0538
r_n	IGBT	0.00314	0.00771	0.01517	0.01198
	FWD	0.00446	0.01095	0.02156	0.01703

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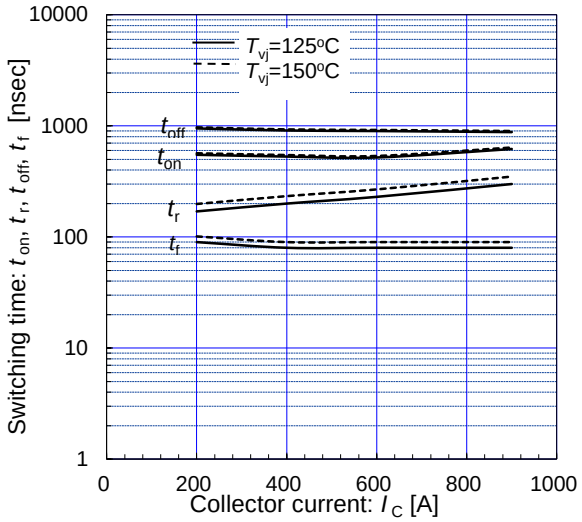
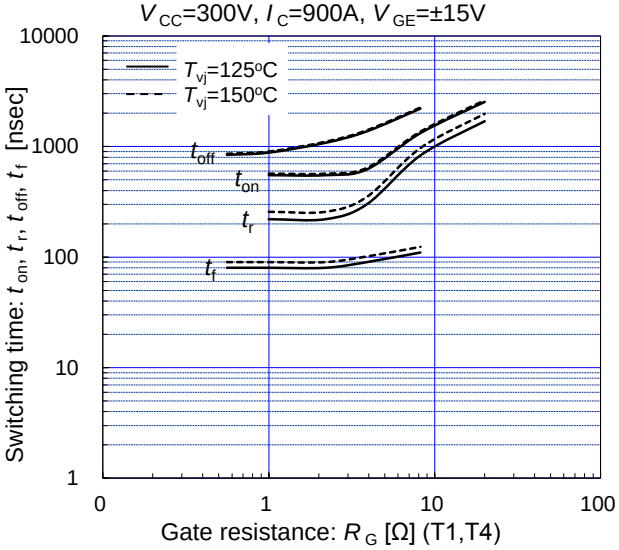
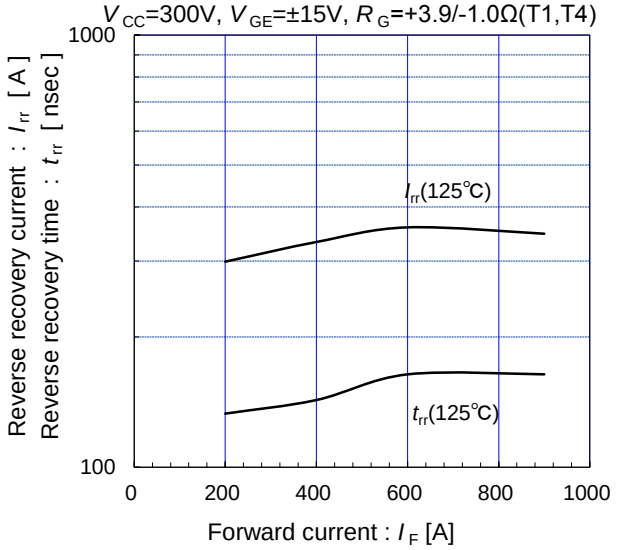
[SW mode A]
Switching time vs. Collector current (typ.)
V_{CC}=300V, V_{GE}=±15V, R_G=+3.9/-1.0Ω, T_{vj}=125°C(T1,T4)



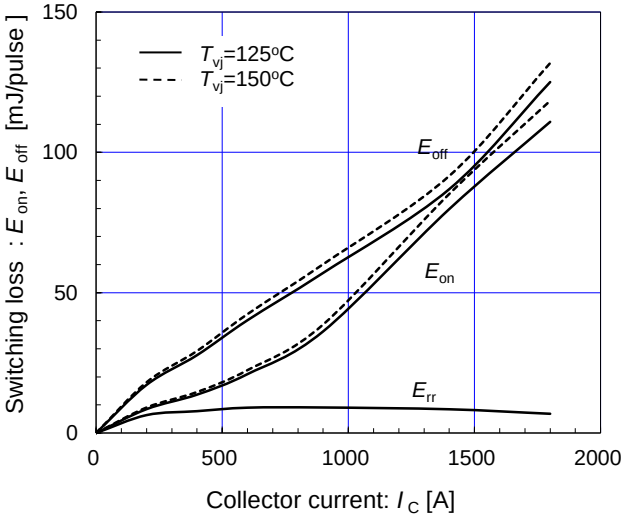
[SW mode A]
Switching time vs. Collector current (typ.)
V_{CC}=300V, I_C=900A, V_{GE}=±15V



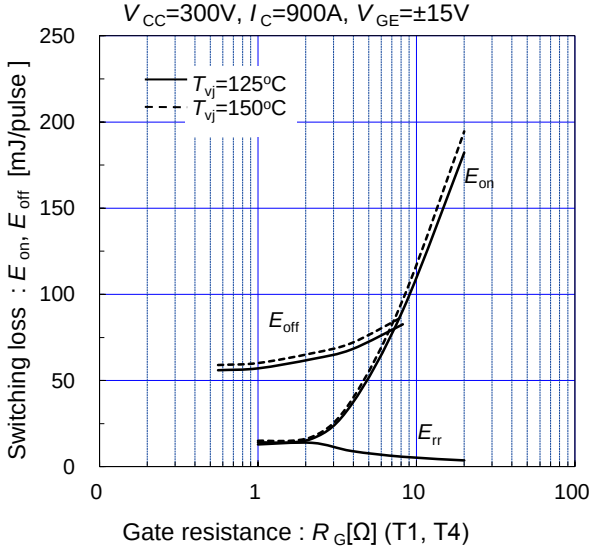
[A mode(T2,T3 RB-IGBT recovery)]
Reverse recovery characteristics(typ.)
V_{CC}=300V, V_{GE}=±15V, R_G=+3.9/-1.0Ω(T1,T4)



[SW mode A]
T1,T4 IGBT switching, T2,T3 RB-IGBT recovery
Switching loss vs. Collector current (typ.)
V_{CC}=300V, V_{GE}=±15V, R_G=+3.9/-1.0Ω (T1, T4)



[SW mode A]
T1,T4 IGBT switching, T2,T3 RB-IGBT recovery
Switching loss vs. gate resistance (typ.)
V_{CC}=300V, I_C=900A, V_{GE}=±15V



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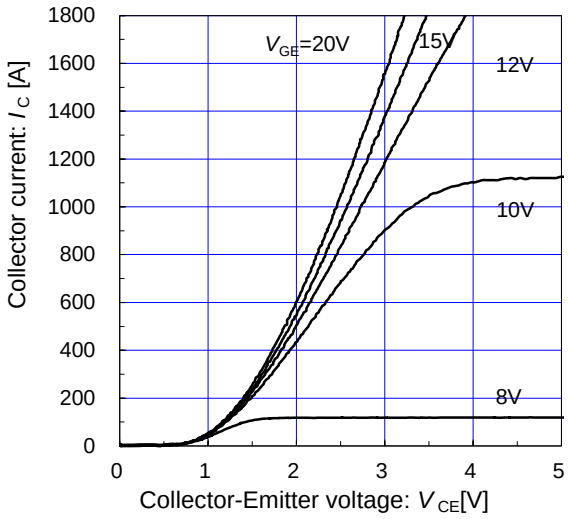
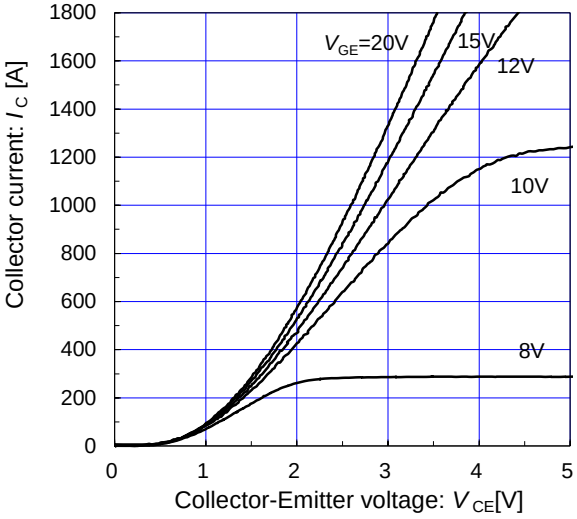
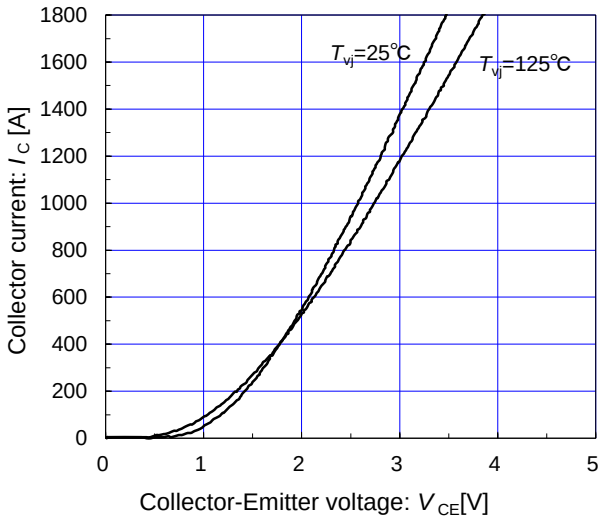
[AC switch(T2,T3)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}=25℃/chip



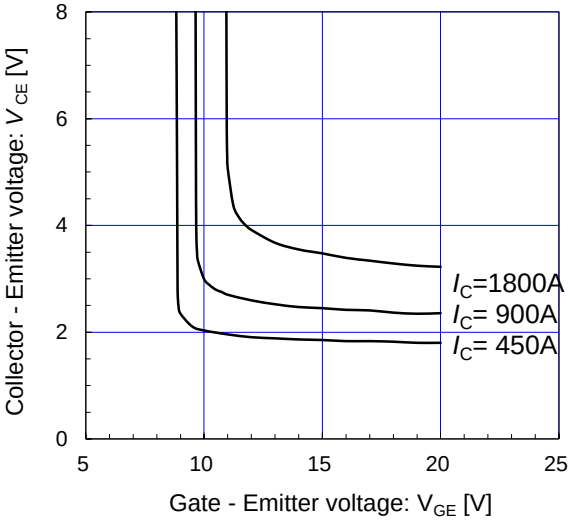
[AC switch(T2,T3)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}=125℃/chip



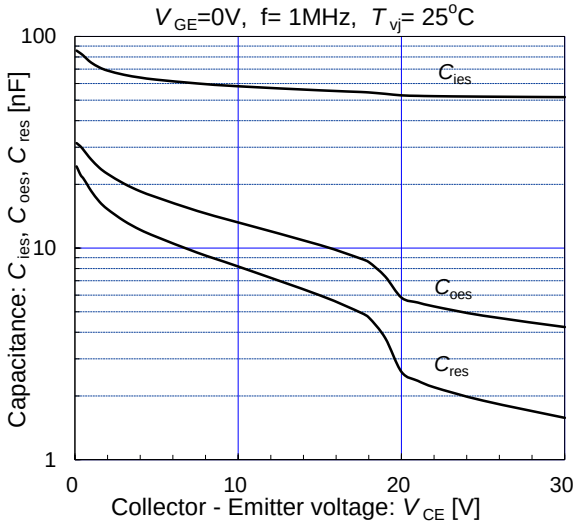
[AC switch(T2,T3)]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE}=15V/chip



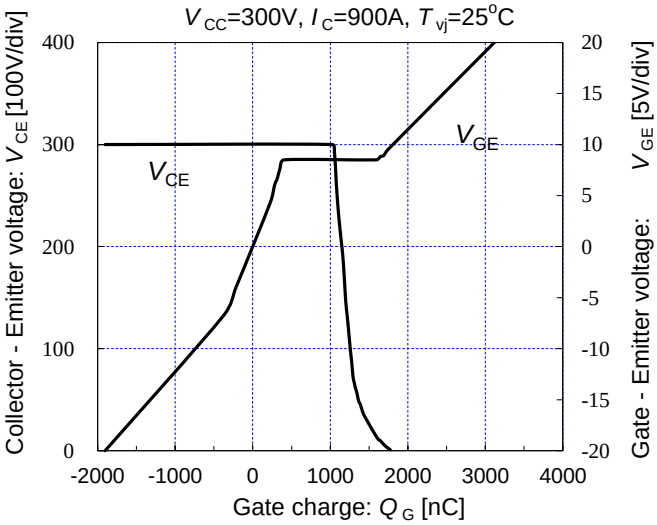
[AC switch(T2,T3)]
Collector current vs. Gate-Emitter voltage (typ.)
T_{vj}=25℃/chip



[AC switch(T2,T3)]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE}=0V, f= 1MHz, T_{vj}= 25°C



[AC switch (T2, T3)]
Dynamic gate charge (typ.)
V_{CC}=300V, I_C=900A, T_{vj}=25°C



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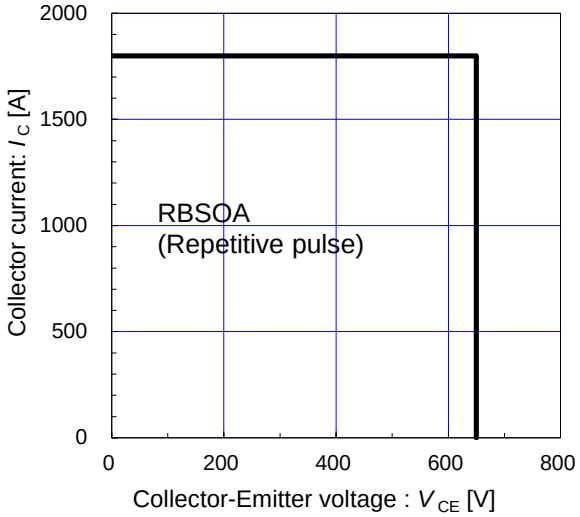
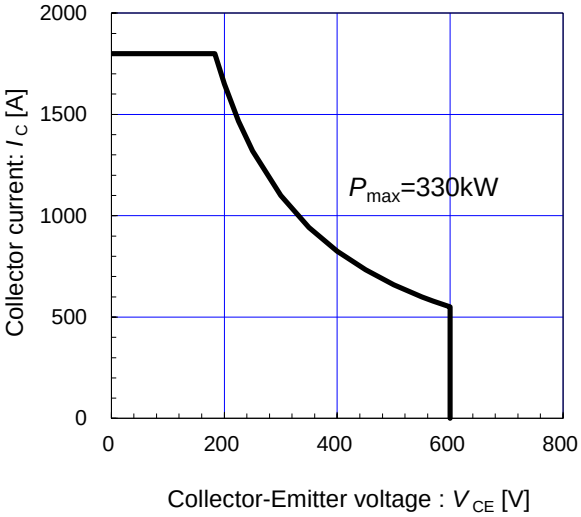
Reverse bias safe operating area (max.)
V_{GE}=+/-15V, R_G ≧Recommended, T_{vj} = 125°C (T2, T3)
T2, T3 (Terminal) (*1)

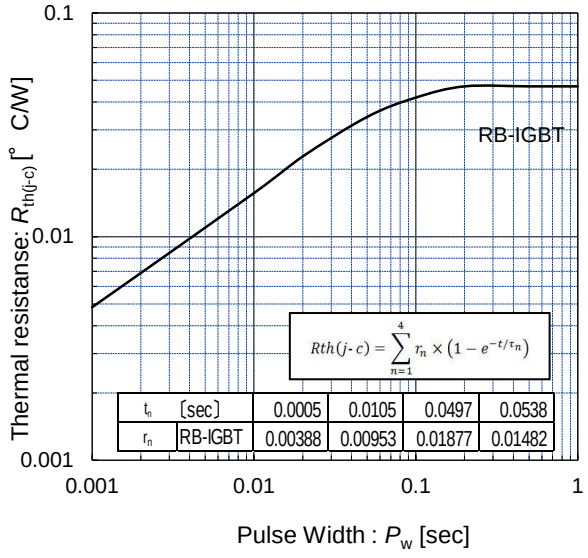


The reverse bias blocking voltage for coupled RB-IGBT can be guaranteed with 650V by applying V_{GE}=+15V.
(*1) Please refer to P4 which has definition of terminal.

Reverse recovery withstand capability for RB-IGBT
T_{vj}=125°C



Transient Thermal Resistance (max.)



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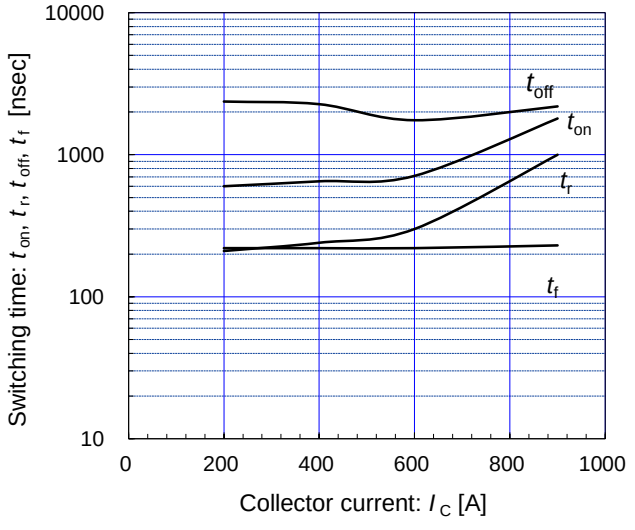
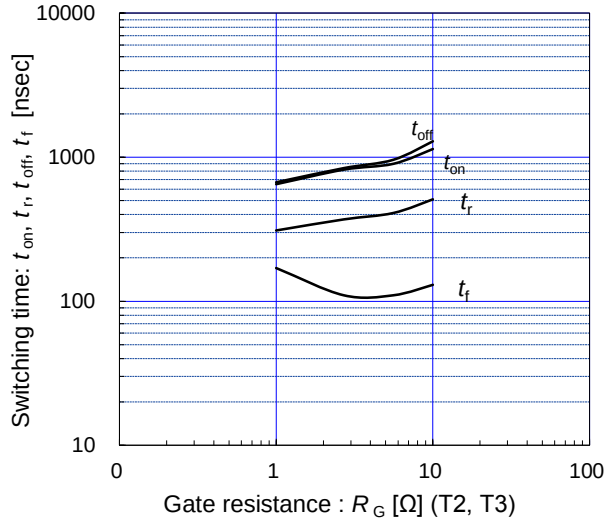
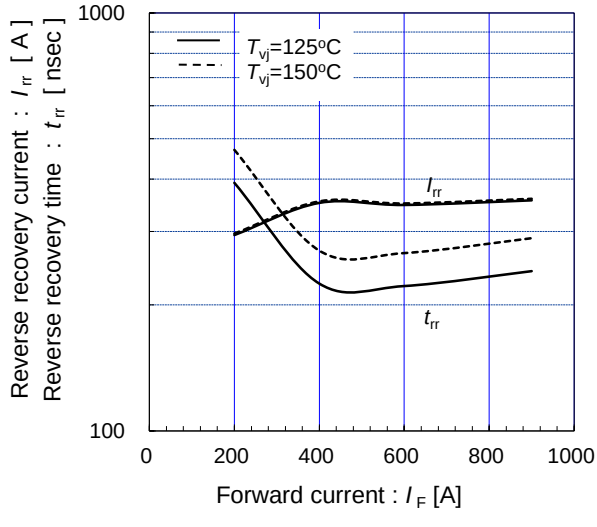
[SW mode B]
Switching time vs. Collector current (typ.)
V_{CC}=300V, V_{GE}=±15V, R_G=+2.7/-15Ω, T_{vj}=125℃(T2,T3)



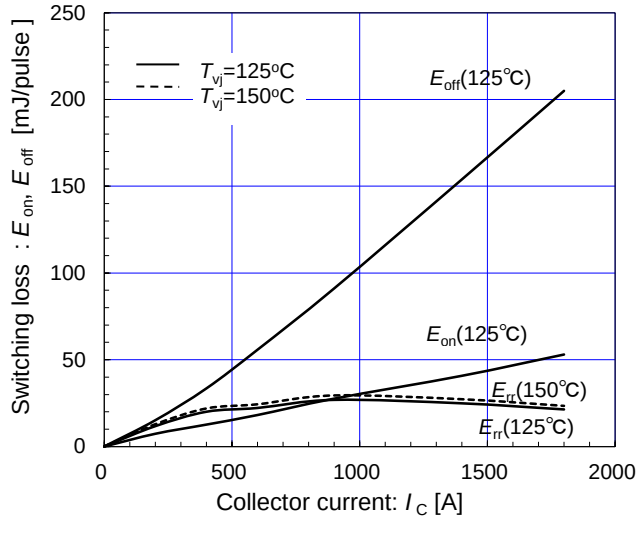
[SW mode B]
Switching time vs. Collector current (typ.)
V_{CC}=300V, I_C=900A, V_{GE}=±15V, T_{vj}=125℃



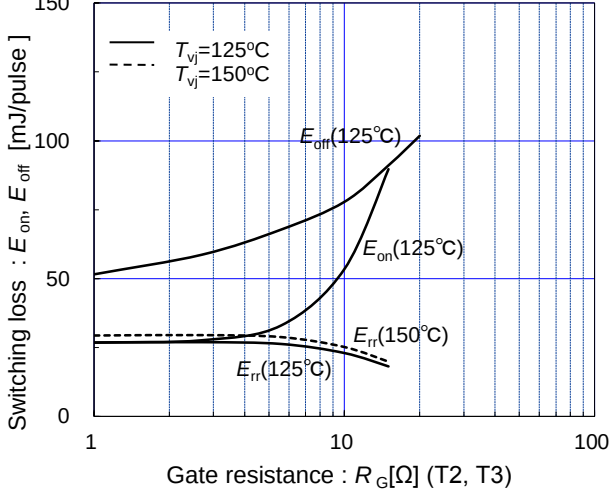
[B mode(T1,T4 FWD reverse recovery)]
Reverse recovery characteristics(typ.)
V_{CC}=300V, V_{GE}=±15V, R_G=+2.7/-15Ω(T2,T3)



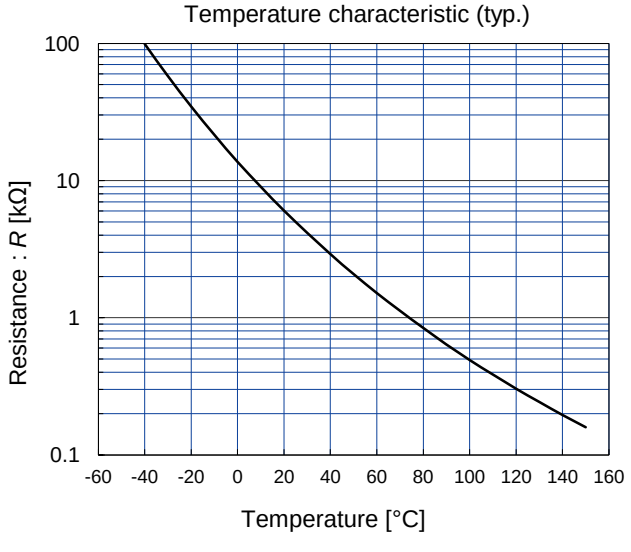
[SW mode B]
T2,T3 RB- IGBT switching, T1,T4 FWD recovery
Switching loss vs. Collector current (typ.)
V_{CC}=300V, V_{GE}=±15V, R_G=+2.7/-15Ω (T2, T3)



[SW mode B]
T2,T3 RB-IGBT IGBT switching, T1,T4 FWD recovery
Switching loss vs. gate resistance (typ.)
V_{CC}=300V, I_C=900A, V_{GE}=±15V



[THERMISTOR]
Temperature characteristic (typ.)



Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 5/2018.
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.

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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.
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・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).
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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.

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IGBT Modules

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