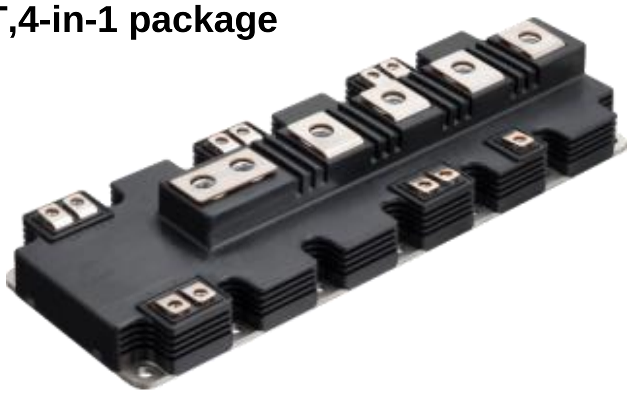
4MBI600VB-170R2-50

IGBT Modules

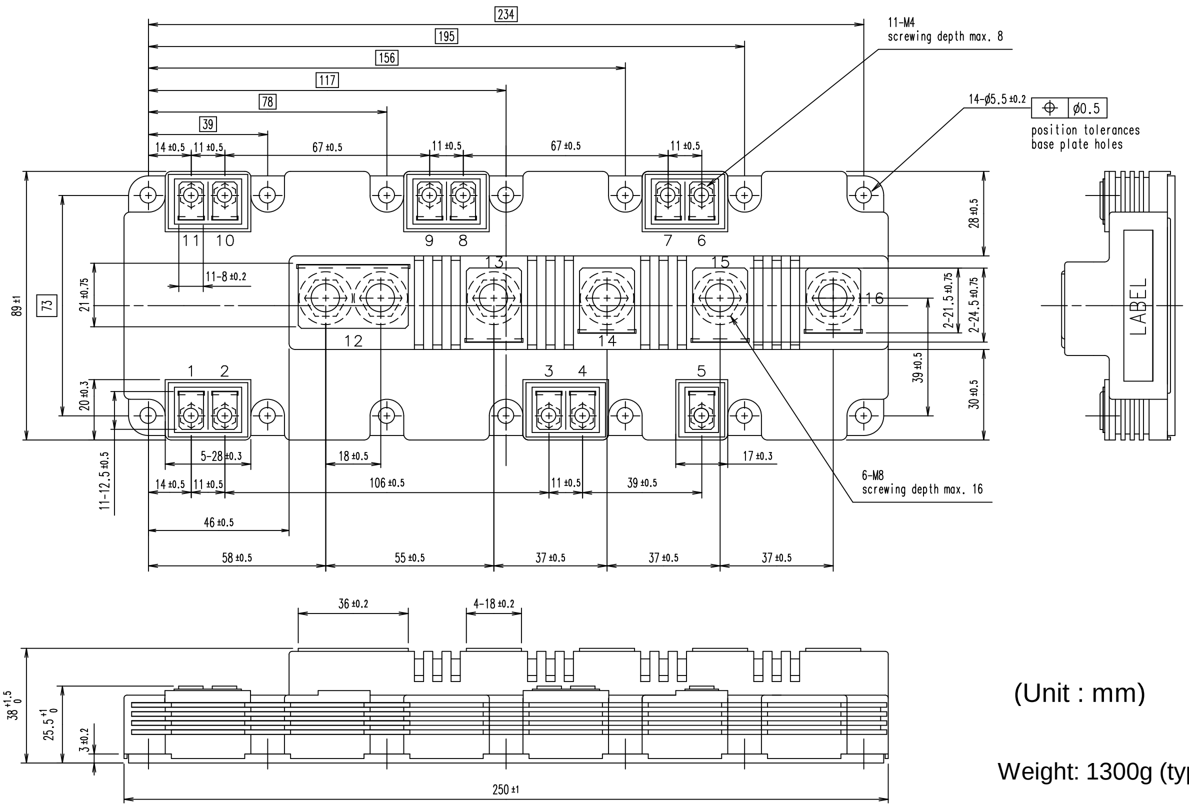
IGBT Power Module (V series)
1700V/600A/IGBT, ±1200V/600A/RB-IGBT,4-in-1 package



■ 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 powre supply
Power conditioner for PV, Wind turbine

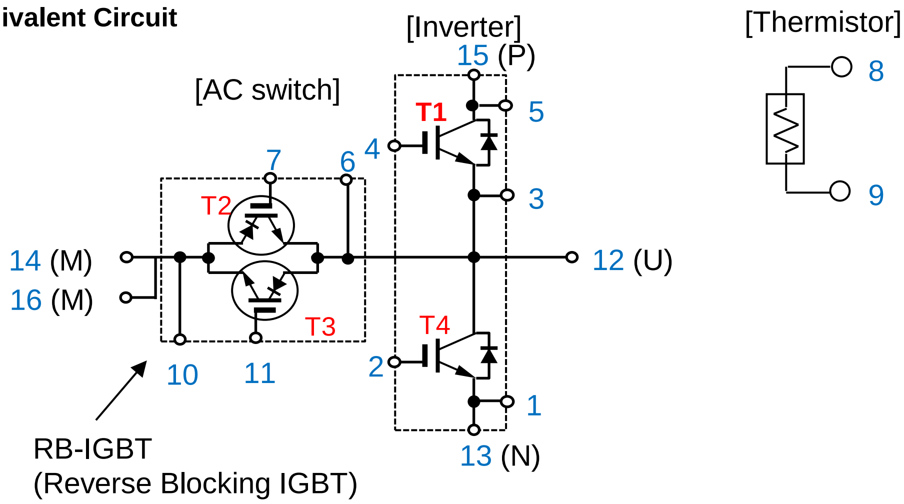
■ Outline drawing



(Unit : mm)

Weight: 1300g (typ.)

■ Equivalent Circuit



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IGBT Modules

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

Item			Symbol	Condition		Maximum Rating	Unit
Inverter	Collector-Emitter voltage		V_{CES}			1700	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current	IGBT	I_C	Continuous	T_c=25°C	1000	A
					T_c=100°C	600	
			I_{CP}	1ms		1200	
		FWD	$-I_C$	Continuous		600	
			$-I_C$ pulse	1ms		1200	
	Collector power dissipation		P_C	1 device		3410	W
	Junction temperature		T_{vj}			175	°C
	Operating junction temperature (under switching conditions)		T_{vjop}			150	
AC Switch	Collector-Emitter voltage	RB-IGBT	V_{CES}			±1200	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	T_c=25°C	900	A
					T_c=80°C	600	
			I_C pulse	1ms		1200	
	Collector power dissipation		P_C	1 device		3680	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	Nm
	Main Terminals		-	M8		10	
	SenseTerminals		-	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) Recommendable Value : Mounting 3.0 ~ 6.0 Nm (M5)
Recommendable Value : Main Terminals 8.0 ~ 10.0 Nm (M8)
Recommendable Value : Sense Terminals 1.8 ~ 2.1 Nm (M4)

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IGBT Modules

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

	Items	Symbols	Conditions		min.	typ.	max.	Units
Inverter	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V, V_{CE}= 1700V		-	-	6	mA
	Gate-Emitter leakage current	I_{GES}	V_{GE} = 0V, V_{GE} = ±20V		-	-	1200	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	$V_{CE(sat)}$ (chip)	V_{GE} = 15V, I_C = 600A	T_{vj}= 25°C	-	2.00	2.25	V
				T_{vj}=125°C	-	2.45	-	
				T_{vj}=150°C	-	2.50	-	
		$V_{CE(sat)}$ (terminal)	V_{GE} = 15V, I_C = 600A	T_{vj}= 25°C	-	2.00	2.50	
				T_{vj}=125°C	-	2.45	-	
				T_{vj}=150°C	-	2.50	-	
	Internal gate rasistance	r_g	-		-	1.25	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V,V_{GE}=0V,f=1MHz		-	60.0	-	nF
	Turn-on time	t_{on}	SW mode : A (*1)		-	0.72	-	µs
		t_r	V_{cc} = 750V		-	0.24	-	
		$t_{r(i)}$	I_C = 600A		-	0.07	-	
	Turn-off time	t_{off}	V_{GE}= ±15V		-	0.87	-	
		t_f	R_G = +2.7/-0.22Ω		-	0.14	-	
	Forward voltage	V_F (chip)	I_F = 600A	T_{vj}= 25°C	-	1.80	1.95	V
				T_{vj}=125°C	-	2.00	-	
				T_{vj}=150°C	-	2.00	-	
		V_F (terminal)	I_F = 600A	T_{vj}= 25°C	-	1.90	2.40	
				T_{vj}=125°C	-	2.10	-	
				T_{vj}=150°C	-	2.10	-	
	Reverse recovery time	t_{rr}	SW mode : B (*1), V_{cc}= 750V, I_F = 600A, V_{GE}= ±15V, R_G = +5.6/-10Ω		-	0.13	-	µs
AC Switch	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V, V_{CE}= 1200V		-	-	12.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE}= ±20V		-	-	2400	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V, I_C = 600mA		5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	V_{GE}= 15V, I_C = 600A	T_{vj}= 25°C	-	2.70	3.00	V
				T_{vj}=125°C	-	3.00	-	
		$V_{CE(sat)}$ (terminal)	V_{GE}= 15V, I_C = 600A	T_{vj}= 25°C	-	2.70	3.30	
				T_{vj}=125°C	-	3.00	-	
	Internal gate rasistance	r_g	-		-	3.40	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V,V_{GE}=0V,f=1MHz		-	53	-	nF
	Turn-on time	t_{on}	SW mode : B (*1)		-	0.42	-	µs
		t_r	V_{cc}= 750V		-	0.25	-	
		$t_{r(i)}$	I_C = 600A		-	0.07	-	
	Turn-off time	t_{off}	V_{GE}= ±15V		-	1.57	-	
		t_f	R_G = +5.6/-10Ω		-	0.11	-	
	Reverse recovery time	t_{rr}	SW mode : A (*1), V_{cc}= 750V, I_F = 600A, V_{GE}= ±15V, R_G = +2.7/-0.22Ω		-	0.16	-	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 p.4, there is definition of A mode and B mode.

■ Thermal resistance characteristics

Item	Symbol	Condition		min.	typ.	max.	Units
Thermal resistance (1device)	$R_{th(j-c)}$	T1, T2 IGBT		-	-	0.044	°C/W
		T1, T2 FWD		-	-	0.084	
		T3, T4 RB-IGBT		-	-	0.034	
Contact thermal resistance (1device) (*2)	$R_{th(c-f)}$	T1, T2	with thermal compound	-	0.0083	-	
		T3, T4		-	0.0042	-	

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

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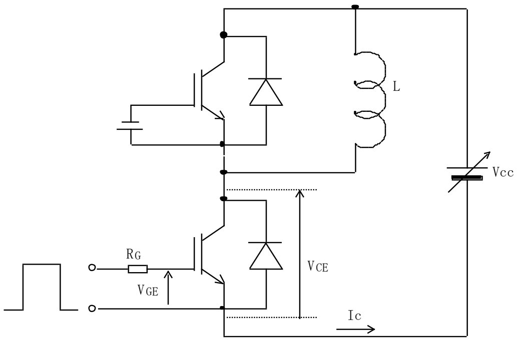
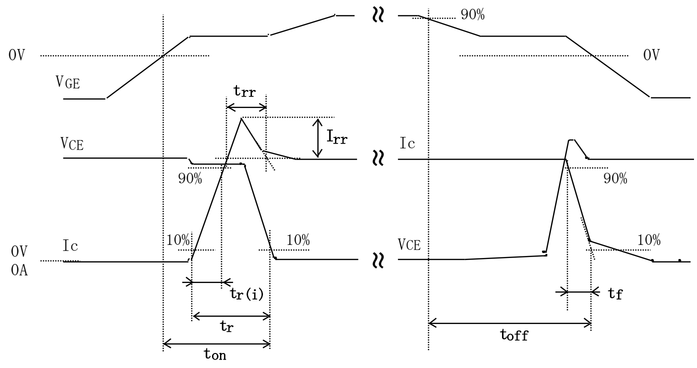
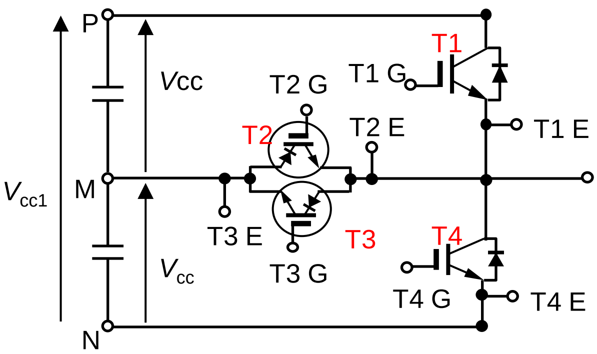
IGBT Modules

■ Definitions of switching time





■ Definitions of switching mode



V_{CE}, V_F value of terminal and Switching characteristics are 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 .

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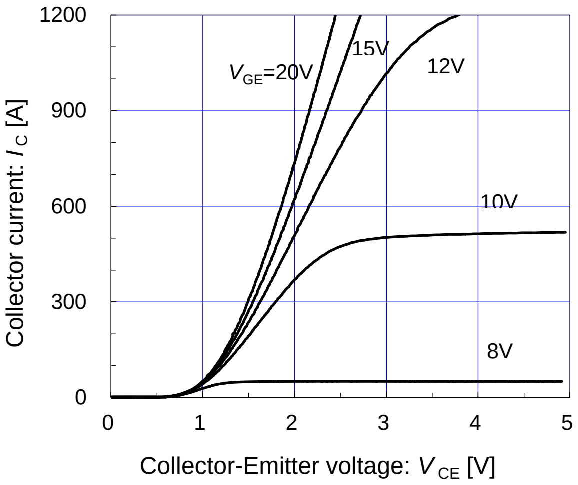
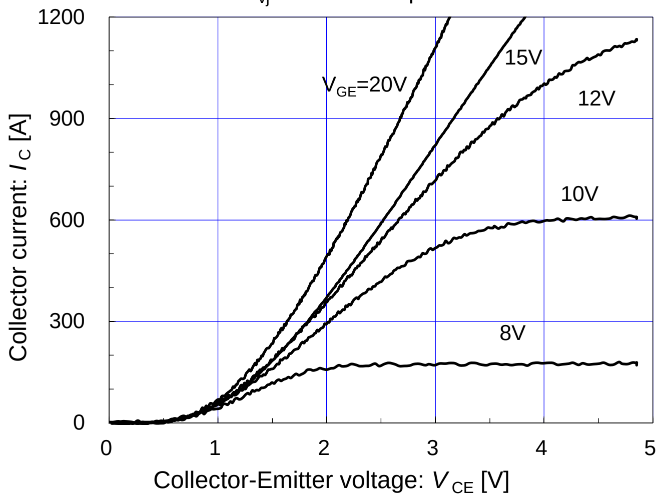
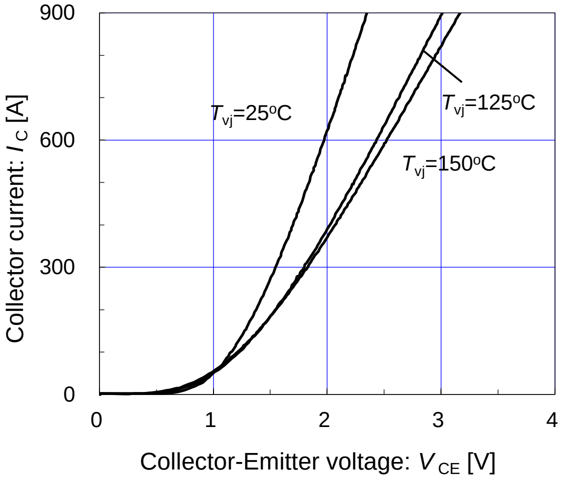
[Inverter (T1, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}= 25°C / chip



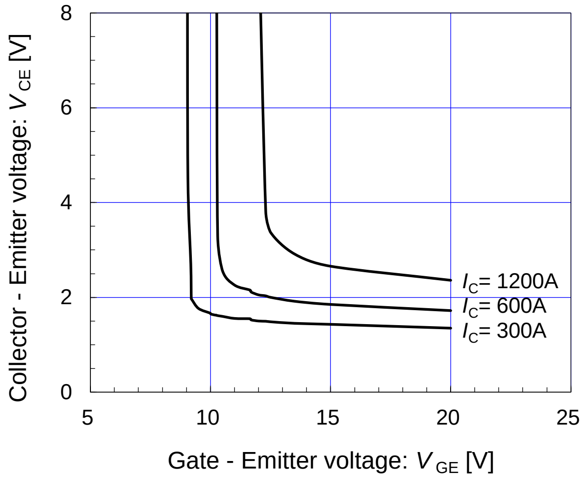
[Inverter (T1, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}= 150°C / chip



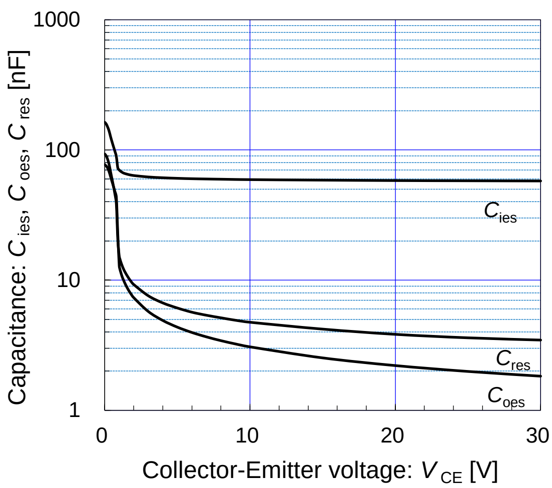
[Inverter (T1, T4)]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE}= 15V / chip



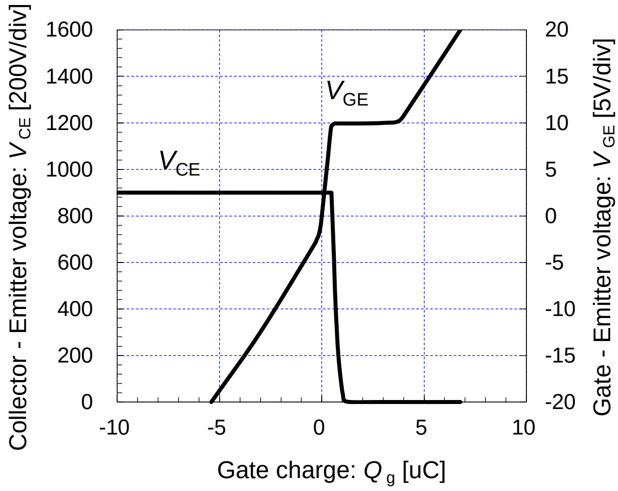
[Inverter (T1, T4)]
Collector-Emitter voltage vs. Gate-Emitter voltage
T_{vj}= 25°C / chip



[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}=900V, I_C=600A, T_{vj}=25°C



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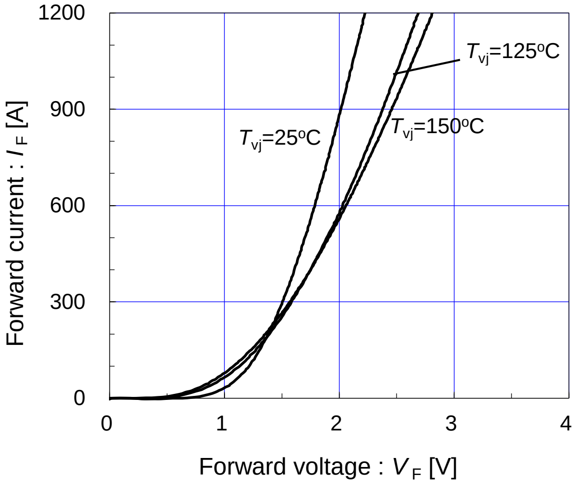
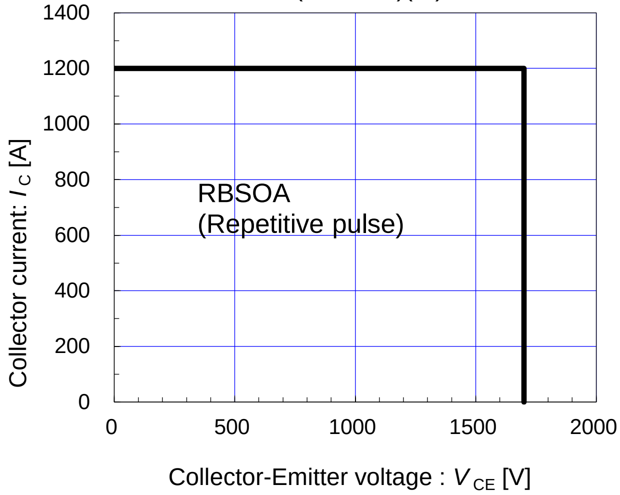
[Inverter (T1, T4)]
Forward current vs. forward voltage (typ.)
chip



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



(*1)Please refer to p.4,there is definition of terminal

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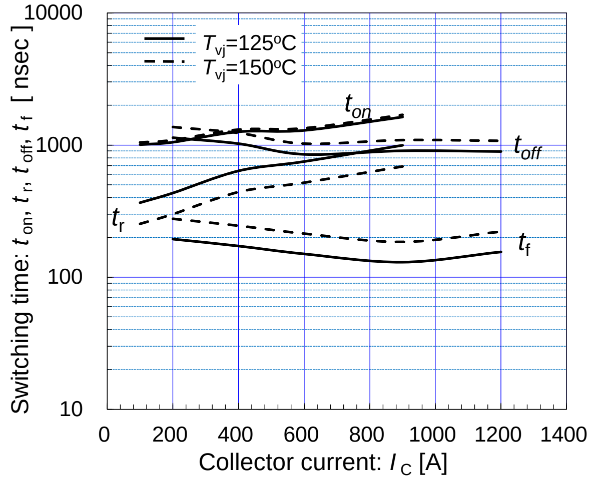
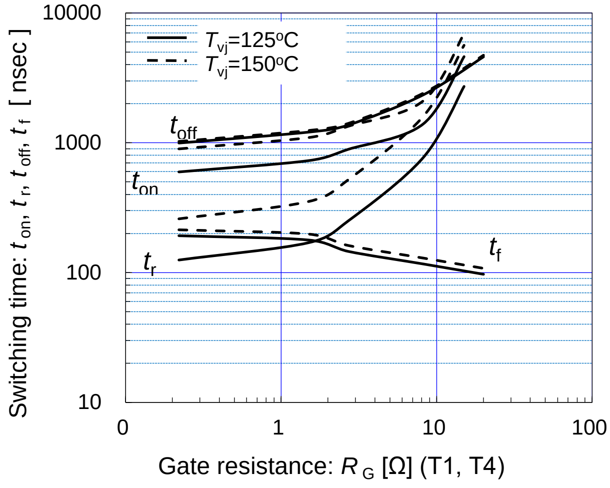
IGBT Modules

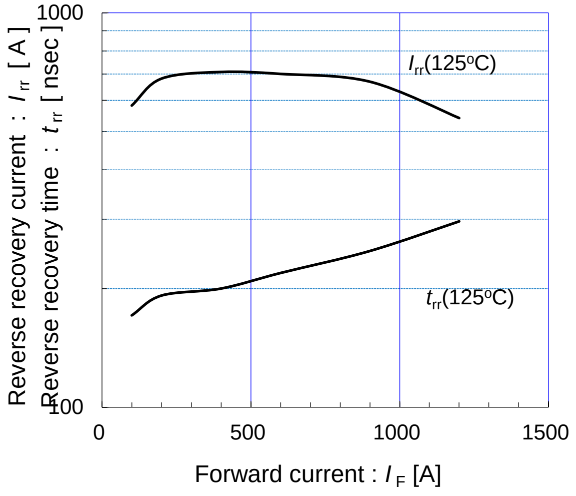
[SW mode: A]
Switching time vs. Collector current (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+2.7/-0.22Ω, T_{vj}=125°C,150°C (T1, T4)



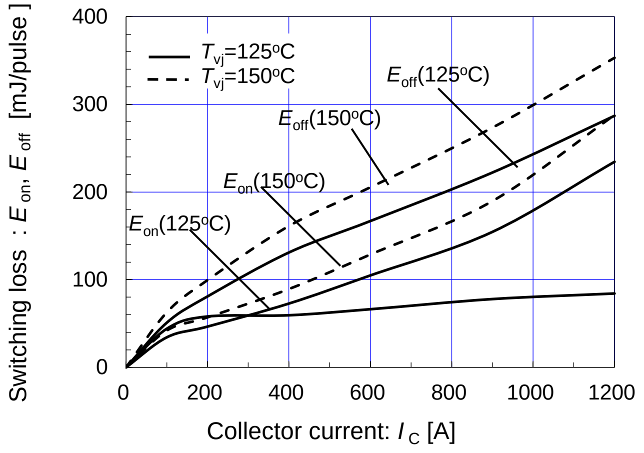
[SW mode: A]
Switching time vs. Collector current (typ.)
V_{cc}=750V, I_C=600A, V_{GE}=±15V, T_{vj}=125°C,150°C



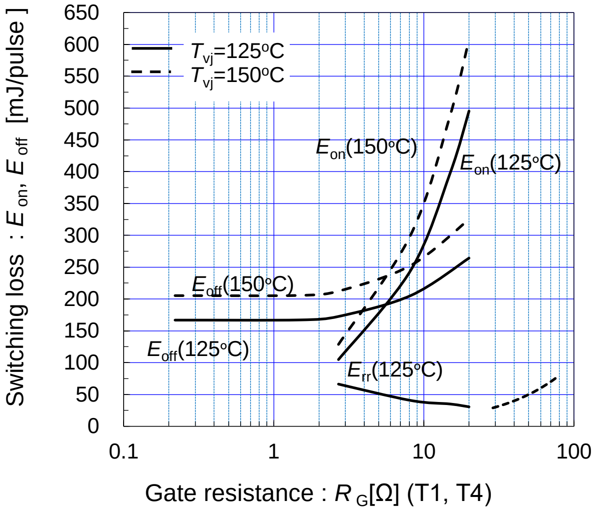
[SW mode A: (T2,T3 RB-IGBT recovery)]
Reverse recovery characteristics (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+2.7/-0.22Ω(T1, T4)



[SW mode A]
T1,T4 IGBT switching, T2,T3 RB-IGBT recovery
Switching loss vs. Collector current (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+2.7/-0.22Ω (T1, T4)



[SW mode A]
T1,T4 IGBT switching, T2,T3 RB-IGBT recovery
Switching loss vs. gate resistance (typ.)
V_{cc}=750V, I_C=600A, V_{GE}=±15V



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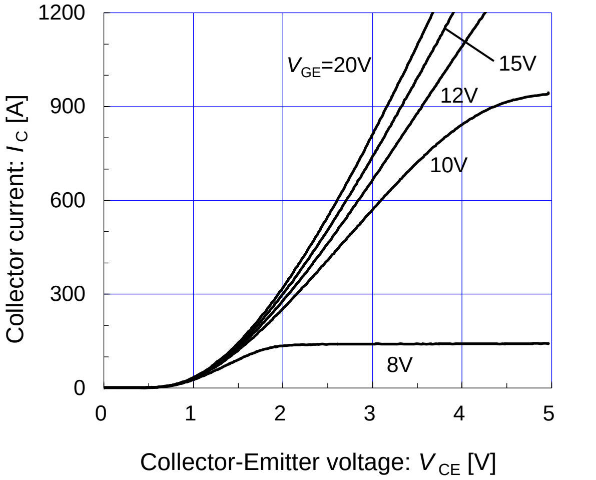
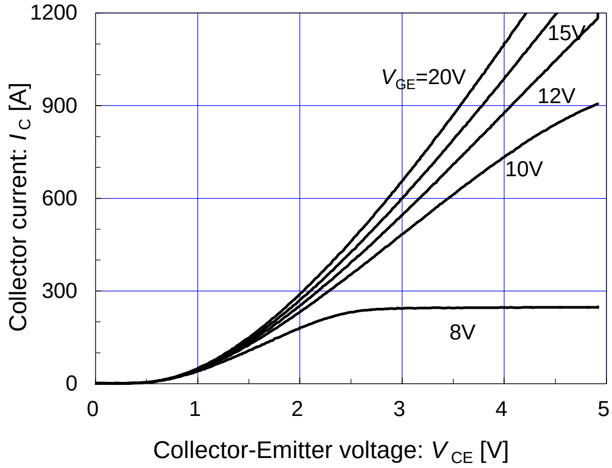
IGBT Modules

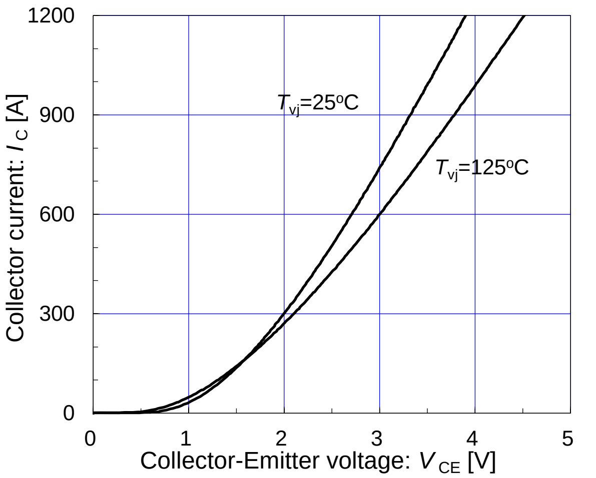
[AC-Switch (T2, T3)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vi} = 25°C / chip



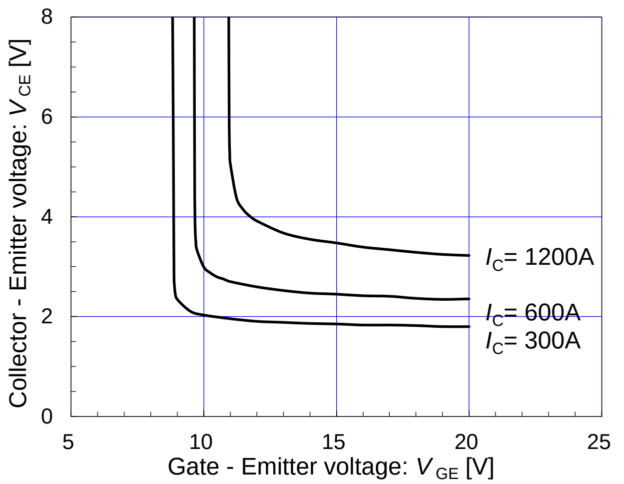
[AC-Switch (T2, T3)]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vi} = 125°C / chip



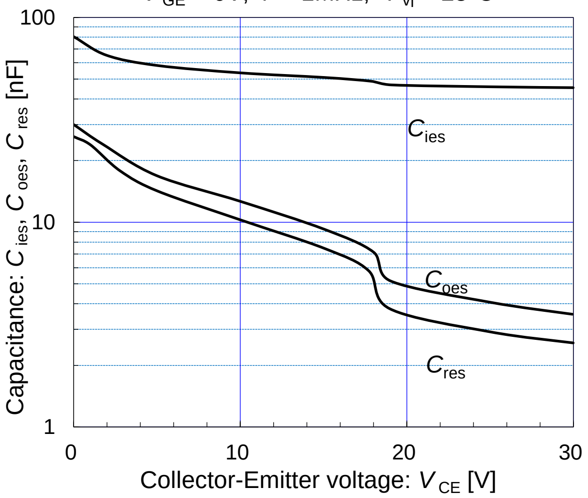
[AC-Switch (T2, T3)]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} =15V / chip



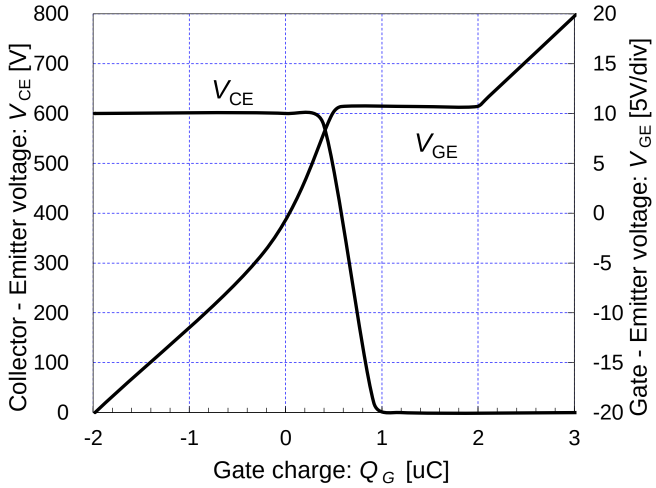
[AC-Switch (T2, T3)]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vi} = 25°C / chip



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



[AC-Switch (T2, T3)]
Dynamic gate charge (typ.)
V_{cc}=600V, I_C=600A, T_{vi}=25°C



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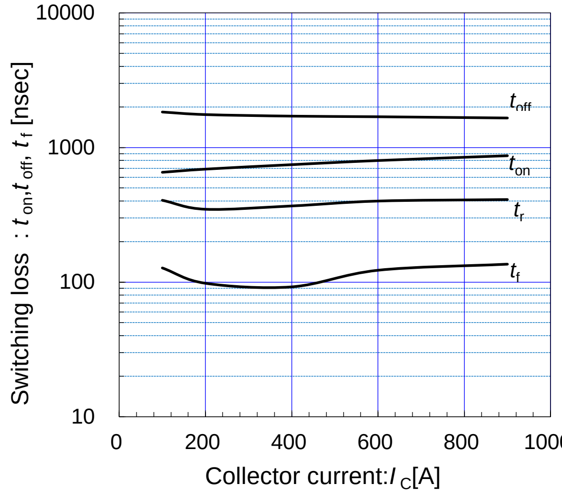
IGBT Modules

[SW mode B]
Switching time vs. Collector current (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+5.6/-10Ω, T_{vj}=125°C (T2, T3)



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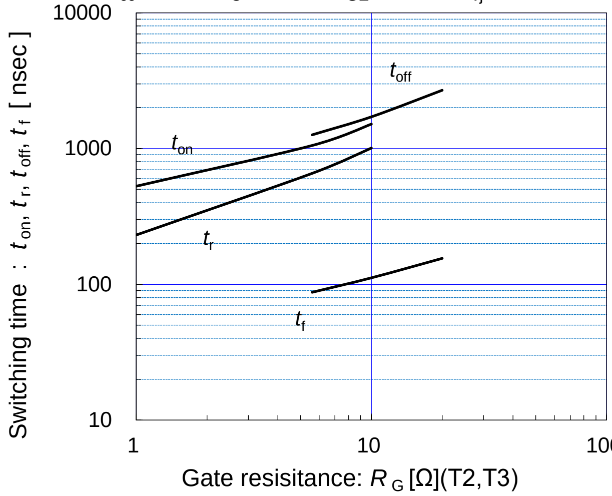
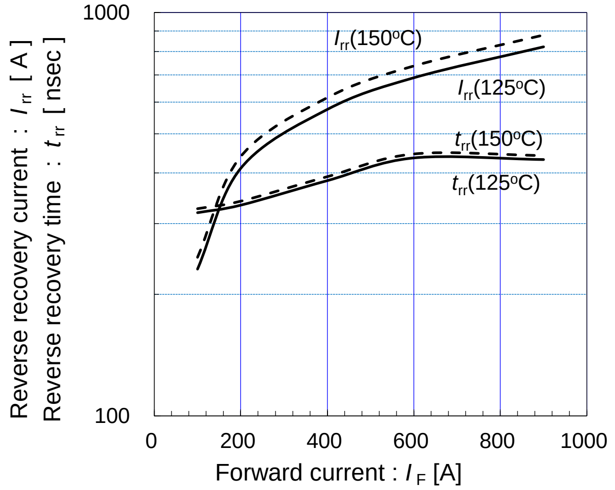
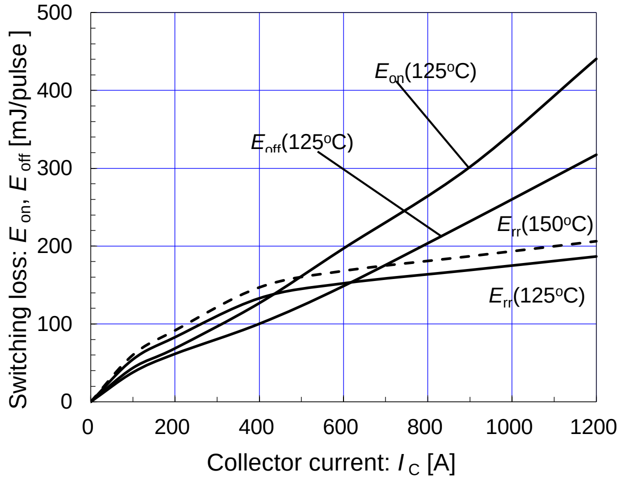
[SW mode B]
Switching loss vs. Collector current (typ.)
V_{cc}=750V, I_C=600A, V_{GE}=±15V, T_{vj}=125°C



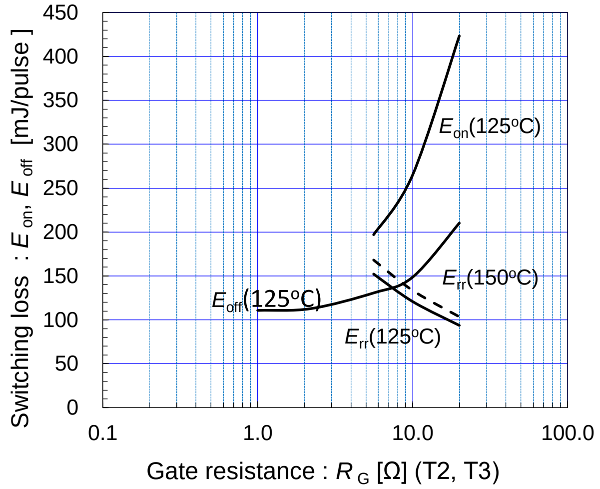
[SW mode B (T1,T4 FWD recovery)]
Reverse recovery characteristics (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+5.6/-10Ω(T2, T3)



[SW mode B]
T2,T3 RB-IGBT switching, T1,T4 FWD recovery
Switching loss vs. Collector current (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+5.6/-10Ω (T2, T3)



[SW mode B]
T2,T3 RB-IGBT switching, T1,T4 FWD recovery
Switching loss vs. gate resistance (typ.)
V_{cc}=750V, I_C=600A, V_{GE}=±15V



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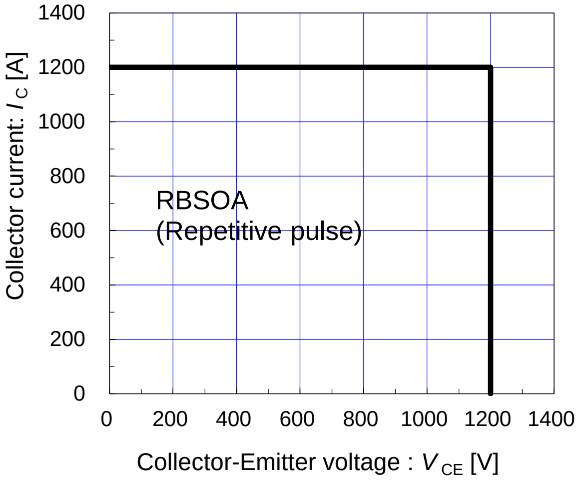
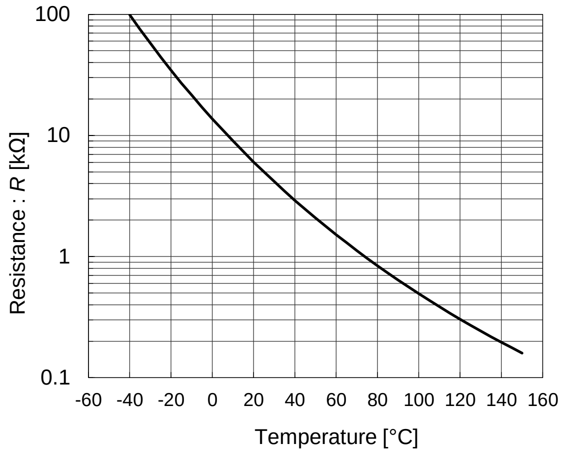
Reverse bias safe operating area (max.)
V_{GE}=+/-15V, R_G ≧Recommended, T_{vj} = 125°C (T2, T3)
T2, T3 (Terminal) (*1)



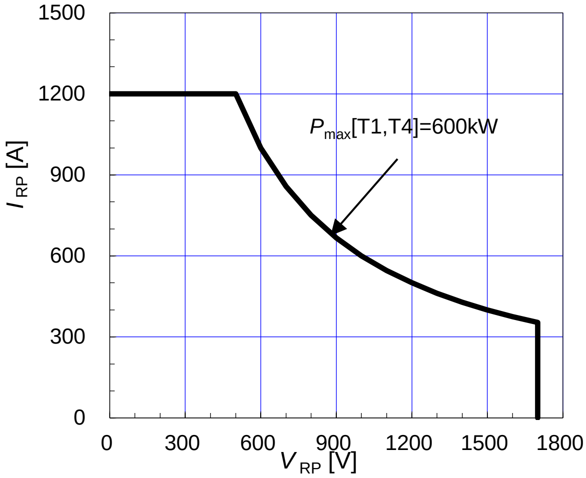
(*1)Please refer to p.4,there is definition of termonal

[THERMISTOR]

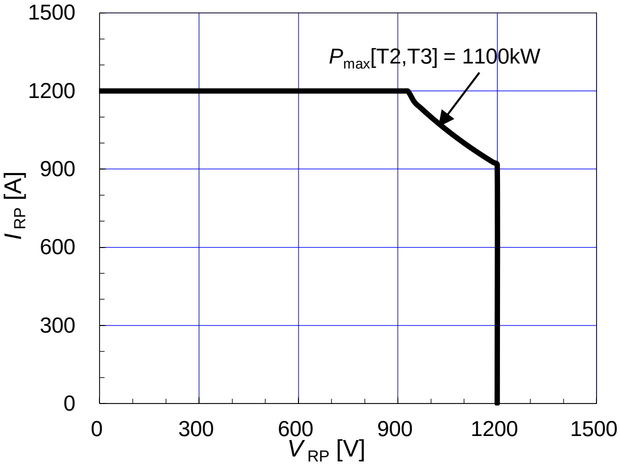
Temperature characteristic (typ.)



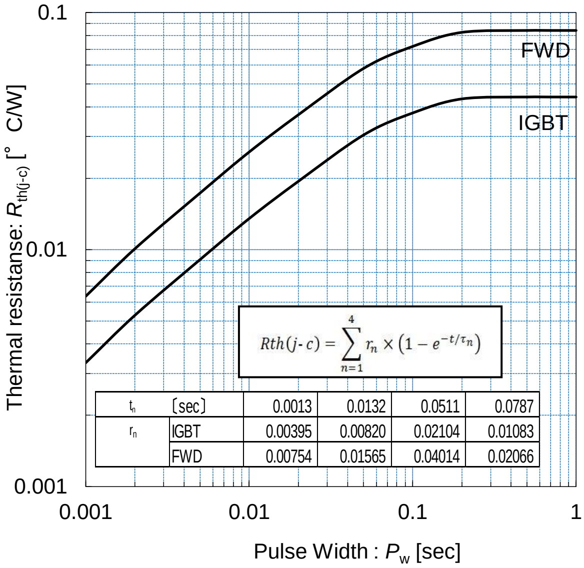
Reverse recovery withstand capability for FWD
T_{vj}=150°C



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



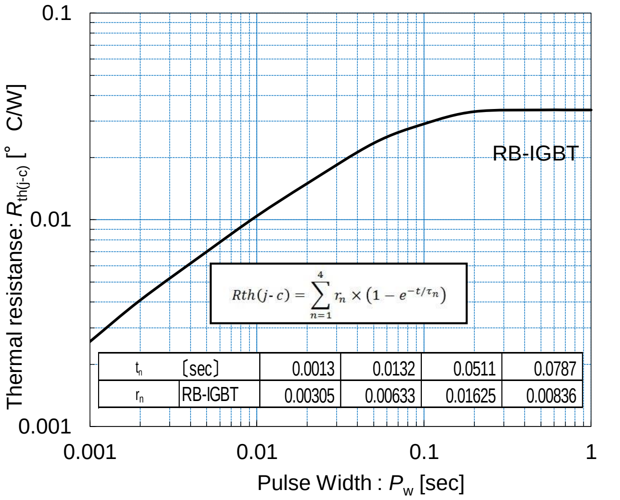
Transient Thermal Resistance (max.)



$$Rth(j\text{-}c) = \sum_{n=1}^{4} r_n \times (1 - e^{-t/\tau_n})$$

t_n	[sec]	0.0013	0.0132	0.0511	0.0787
r_n	IGBT	0.00395	0.00820	0.02104	0.01083
	FWD	0.00754	0.01565	0.04014	0.02066

Transient Thermal Resistance (max.)



$$Rth(j\text{-}c) = \sum_{n=1}^{4} r_n \times (1 - e^{-t/\tau_n})$$

t_n	[sec]	0.0013	0.0132	0.0511	0.0787
r_n	RB-IGBT	0.00305	0.00633	0.01625	0.00836

4MBI600VB-170R2-50

IGBT Modules

Warnings

1. This Catalog contains the product specifications, characteristics, data, materials, and structures as of 7/2018
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

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

- Please refer to URLs below for futher information about products, application manuals and design support.
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