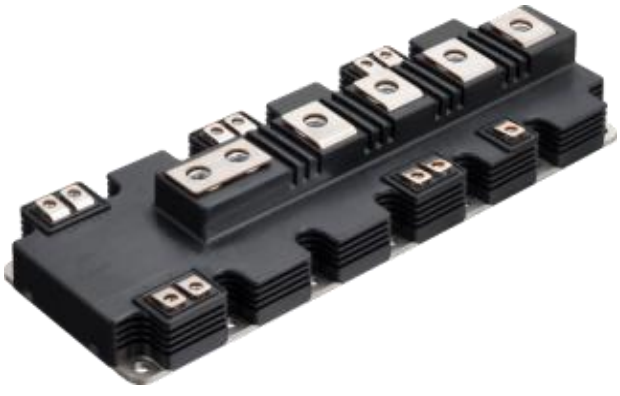
4MBI600VC-120-50

IGBT Modules

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



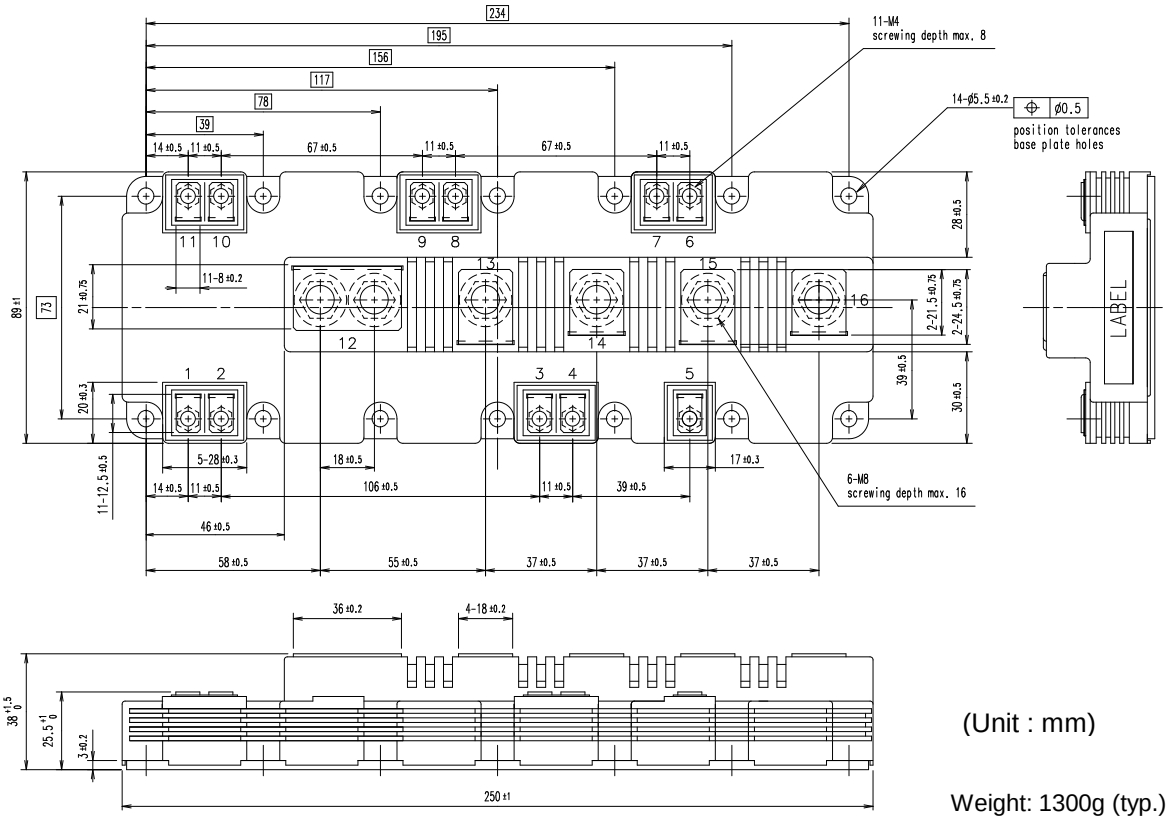
■ Features

Higher efficiency
Standard I-type 3-level circuit
Low inductance module structure

■ Applications

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

■ Outline drawing

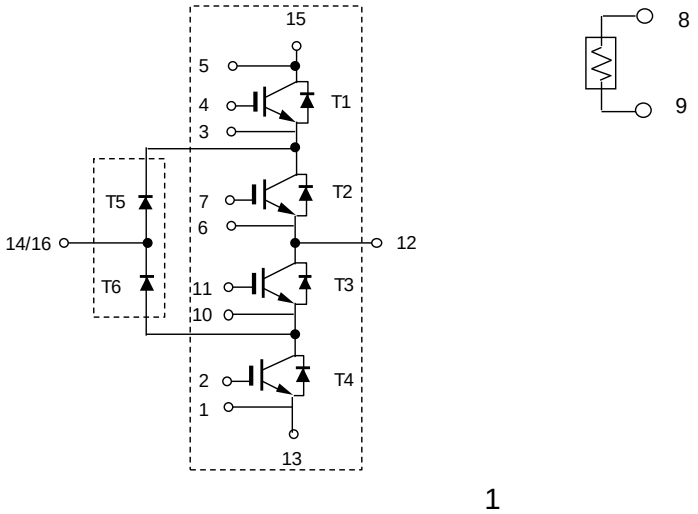


(Unit : mm)

Weight: 1300g (typ.)

■ Equivalent Circuit

[Clamp diode] [Inverter] [Thermistor]



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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}			1200	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current	IGBT	I_C	Continuous	T_c=25°C	800	A
					T_c=100°C Duty=82%	600	
			I_C pulse	1ms		1200	
		FWD	$-I_C$			600	
			$-I_C$ pulse	1ms		1200	
	Collector power dissipation		P_C	1 device		2460	W
Clamp diode	Repetitive peak reverse voltage	FWD	V_R			1200	A
	Forward current		I_F			600	
			I_F pulse	1ms		1200	
Junction temperature			T_{vj}			175	°C
Operating junction temperature (under switching conditions)			T_{vjop}			150	
Case temperature			T_c			125	
Storage temperature			T_{stg}			-40 ~ 125	
Isolation voltage	between terminal and copper base		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.	Unit
Inverter	Zero gate voltage Collector current	I_{CES}	V_{GE} = 0V, V_{CE} = 1200V		-	-	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 = 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	-	1.85	2.10	V
				T_{vj}=125°C	-	2.20	-	
				T_{vj}=150°C	-	2.25	-	
		$V_{CE(sat)}$ (terminal)	V_{GE} = 15V, I_C = 600A	T_{vj}=25°C	-	1.95	-	
				T_{vj}=125°C	-	2.30	-	
				T_{vj}=150°C	-	2.35	-	
	Internal gate	$R_{G(int)}$	-		-	1.25	-	Ω
	Input capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	50	-	nF
	Turn-on time	t_{on}	SW mode : A, B		-	0.60	-	μs
		t_r	V_{CC} = 750V		-	0.30	-	
		$t_{r(i)}$	I_C = 600A		-	0.05	-	
	Turn-off time	t_{off}	V_{GE}= ±15V		-	0.70	-	
		t_f	R_G = +3.9/-0.56Ω L_s=15nH		-	0.10	-	
	Forward on voltage	V_F (chip)	I_F = 600A	T_{vj}=25°C	-	1.70	1.95	V
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.80	-	
		V_F (terminal)	I_F = 600A	T_{vj}=25°C	-	1.75	-	
				T_{vj}=125°C	-	1.90	-	
				T_{vj}=150°C	-	1.85	-	
	Reverse recovery time	t_{rr}	Switching mode: B V_{CC}= 750V I_F = 600A V_{GE}= ±15V R_G = +3.9/-0.56Ω		-	0.15	-	μs
Clamp diode	Reverse leakage current	I_R	V_R=1200V		-	-	3.0	mA
	Forward on voltage	V_F (chip)	I_F = 600A	T_{vj}=25°C	-	1.70	1.95	V
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.80	-	
		V_F (terminal)	I_F = 600A	T_{vj}=25°C	-	1.80	-	
				T_{vj}=125°C	-	1.95	-	
				T_{vj}=150°C	-	1.90	-	
	Reverse recovery time	t_{rr}	Switching mode: A V_{CC}= 750V I_F = 600A V_{GE}= ±15V R_G = +3.9/-0.56Ω		-	0.15	-	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

■ Thermal resistance characteristics

Item	Symbol	Condition	Characteristics min.	typ.	max.	Unit
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter-IGBT	-	-	0.061	°C/W
		Inverter-FWD	-	-	0.092	
		Clamp diode-FWD	-	-	0.092	
Contact thermal resistance (1device) (*1)	$R_{th(c-f)}$	with Thermal Compound	-	0.0167	-	

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

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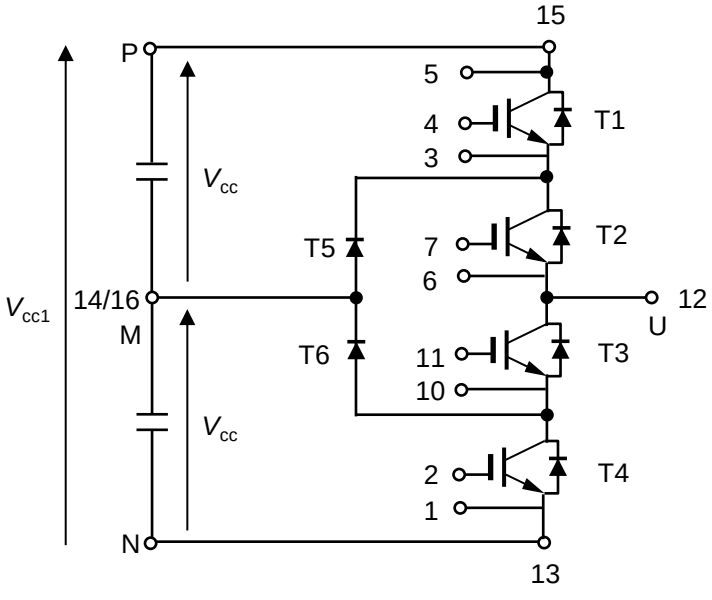
■ Definitions of on-stage voltage at terminal and switching characteristics

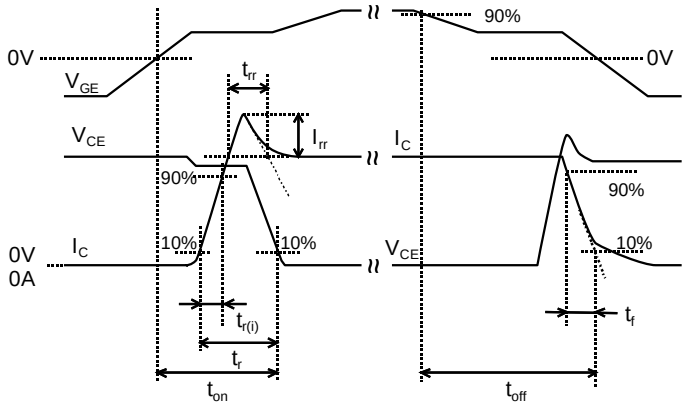


$V_{CE(sat)}/V_F$ values are measured between
sense 5 and sense 3 for T1 arm,
sense 3 and sense 6 for T2 arm,
sense 6 and sense 10 for T3 arm,
sense 10 and sense 1 for T4 arm,
sense 14 and sense 3 for T5 arm and
sense 10 and sense 14 for T6 arm.

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**	OFF	OFF
	P-U	OFF	OFF	**SW**	OFF

SW: Connect to drive circuit and input gate signal
ON: Bias voltage of gate +15V
OFF: Reverse bias voltage of gate -15V
$V_{cc1}=2\times V_{cc}$

■ Definitions of switching time



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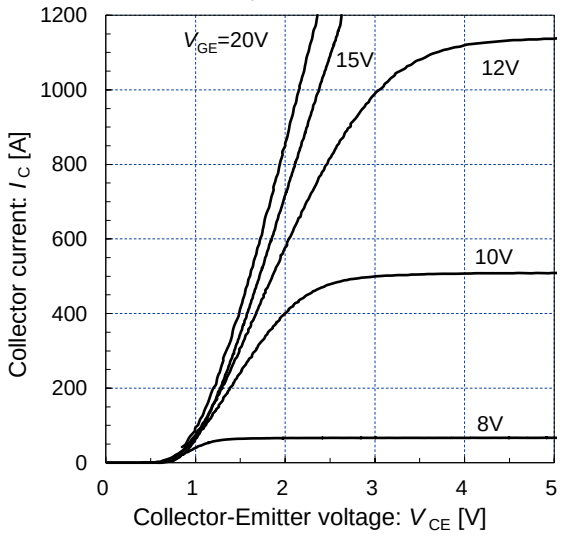
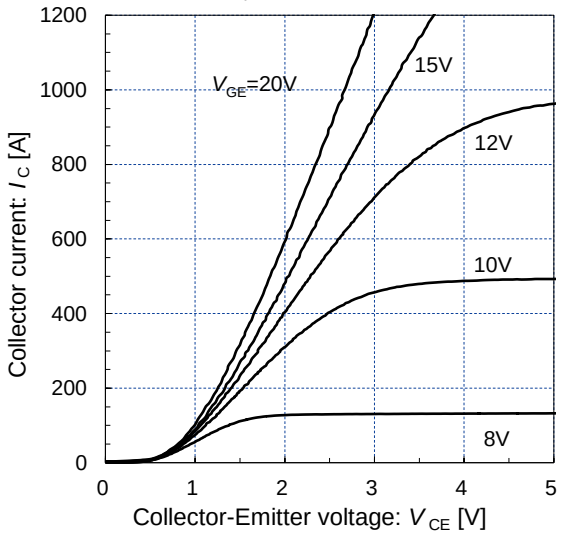
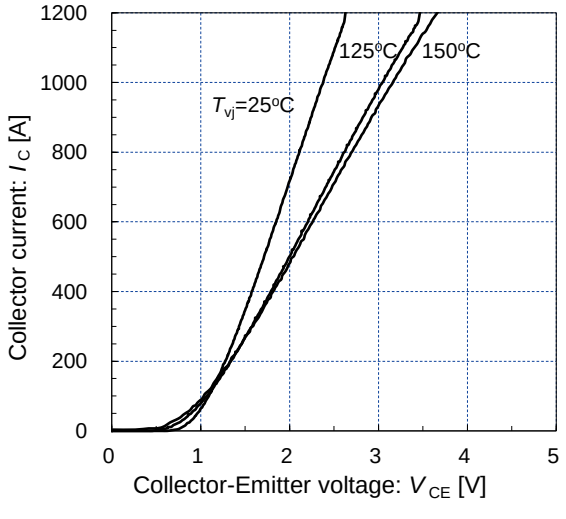
Collector current vs. Collector-Emitter voltage
T_{vj}= 25°C / chip



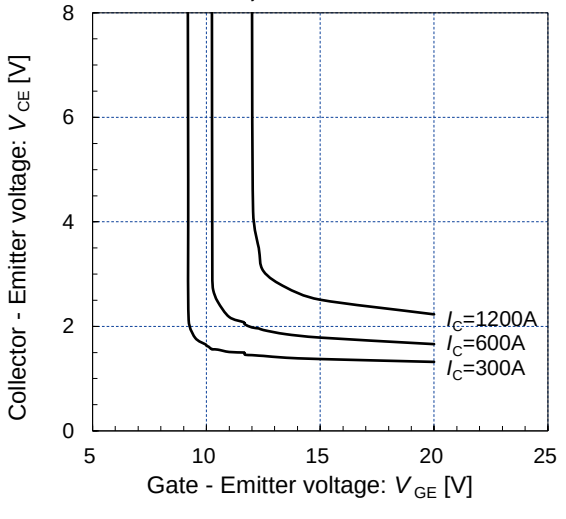
Collector current vs. Collector-Emitter voltage
T_{vj}= 150°C / chip



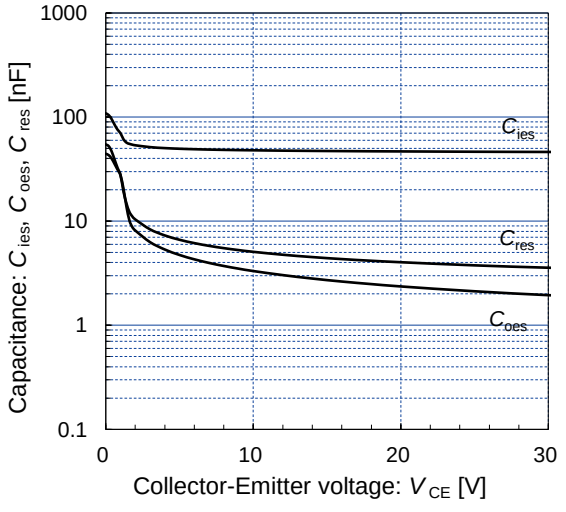
Collector current vs. Collector-Emitter voltage
V_{GE}= 15V / chip



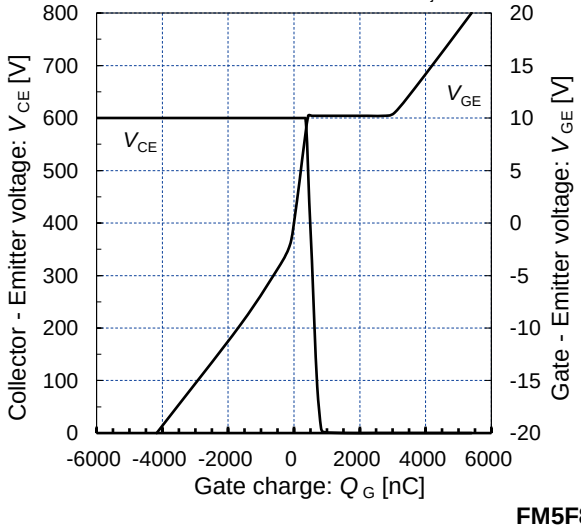
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj}= 25°C / chip



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



Dynamic gate charge (typ.)
V_{CC}=600V, I_C= 600A, T_{vj}=25°C



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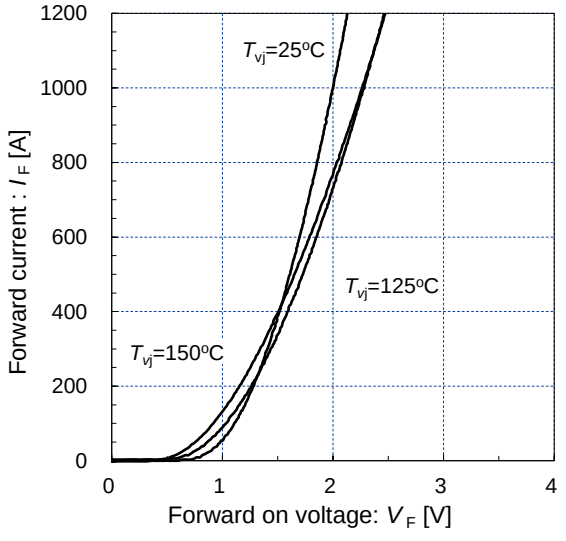
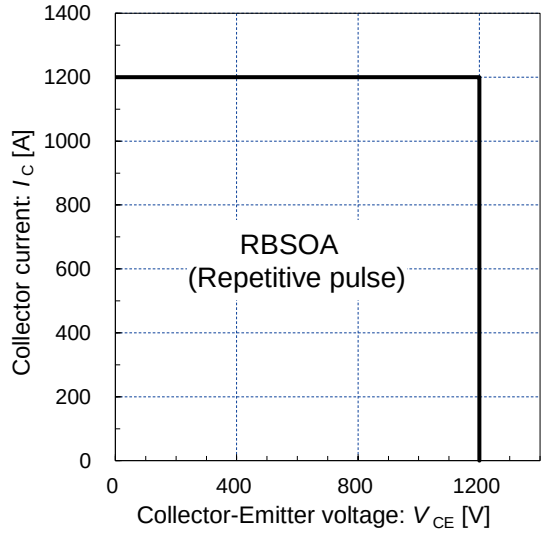
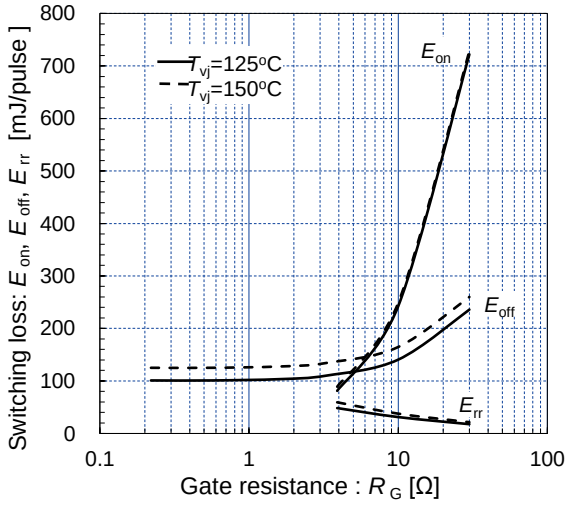
Forward current vs. forward on voltage (typ.)
chip



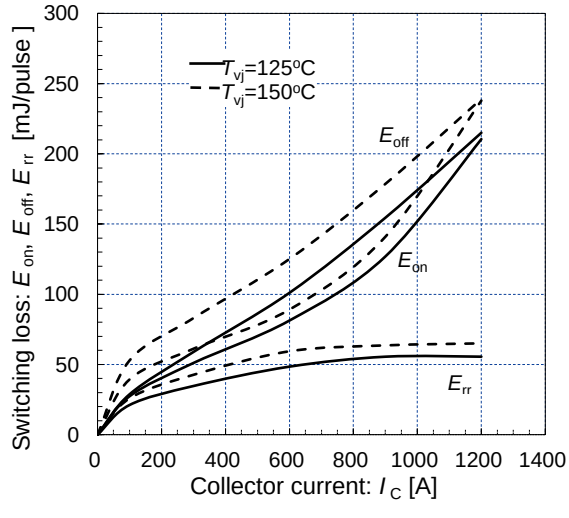
Revese bias safe operating area (max.)
V_{GE}=±15V, R_G ≧standard, T_{vj}=150°C
Terminal



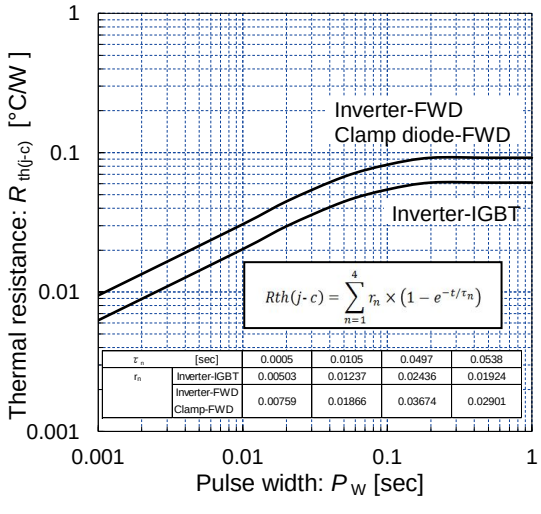
Switching loss vs. gate resistance (typ.)
V_{cc}=750V, I_C=600A, V_{GE}=±15V(Amode&Bmode)



Switching loss vs. Collector current (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+3.9/-0.56Ω(Amode&Bmode)

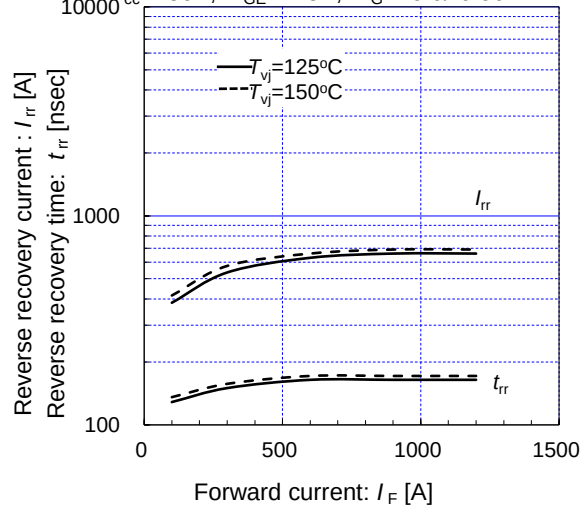


Transient thermal resistance (max.)



τn [sec]		0.0005	0.0105	0.0497	0.0538
rn	Inverter-IGBT	0.00503	0.01237	0.02436	0.01924
	Inverter-FWD Clamp-FWD	0.00759	0.01866	0.03674	0.02901

Reverse recovery characteristics (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+3.9/-0.56Ω



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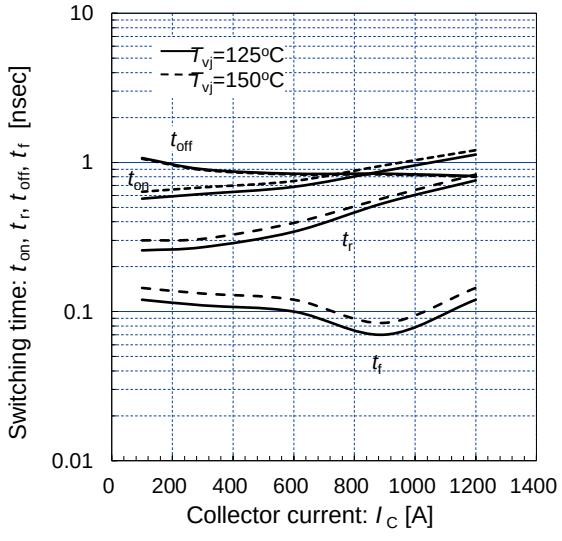
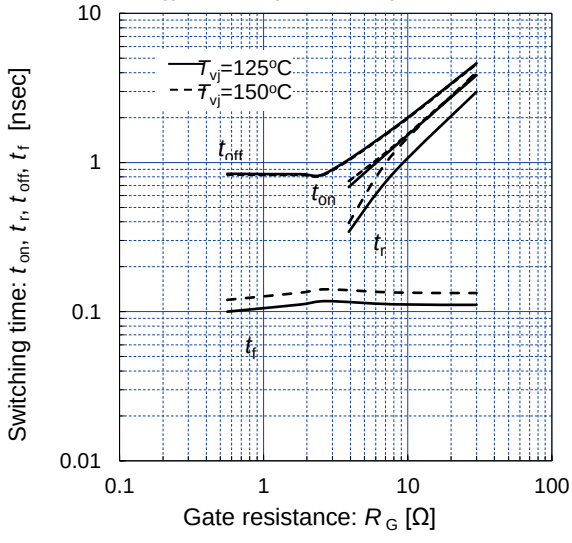
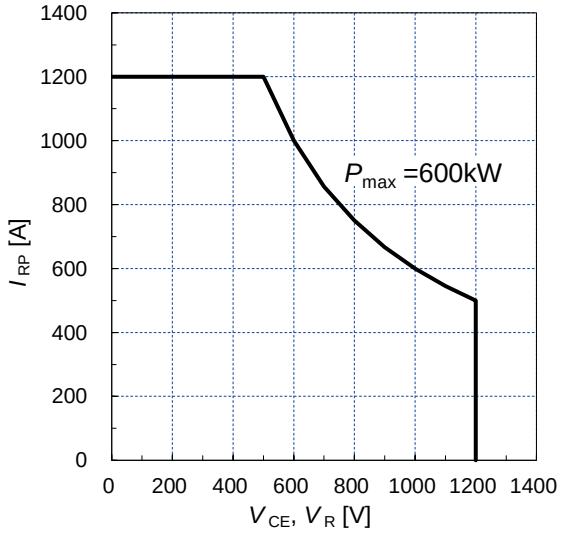
Switching time vs. Collector current (typ.)
V_{cc}=750V, V_{GE}=±15V, R_G=+3.9/-0.56Ω



Switching time vs. Collector current (typ.)
V_{cc}=750V, I_C=600A, V_{GE}=±15V

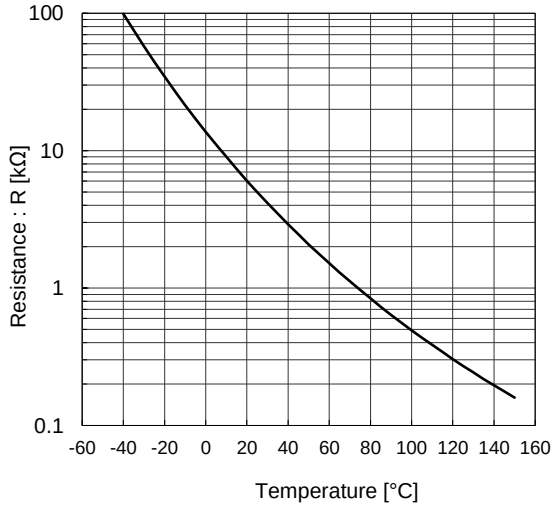


Reverse recovery withstand capability
T_{vj}=150°C



[THERMISTOR]

Temperature characteristic (typ.)



V_{CE},V_R are measured between :

sense 5 and 6 for T1&T2
sense 6 and 1 for T3&T4
sense 14 and 3 for T5
sense 10 and 14 for T6

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