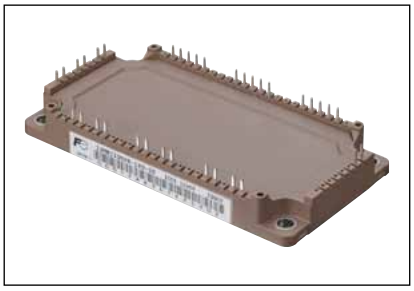
12MBI50VN-120-50

IGBT Modules

IGBT MODULE (V series)
1200V / 50A / IGBT, RB-IGBT 12 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 Tc=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	50	A
			I_{cp}	1ms	T_C=80°C	100	
		FWD	$-I_C$			50	
			$-I_{C\ pulse}$	1ms		100	
	Collector power dissipation		P_C	1 device		230	W
T3, T4	Collector-Emitter voltage		V_{CES}			600	V
	Repetitive peak reverse voltage		V_{RRM}			600	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	T_C=80°C	50	A
			I_{cp}	1ms	T_C=80°C	100	
	Collector power dissipation		P_C	1 device		235	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) between thermistor and others (*2)		V_{iso}	AC : 1min.		2500	VAC
	Mounting (*3)		-	M5		3.5	N m

Note *1: All terminals should be connected together during the test.
Note *2: Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.
Note *3: Recommendable value : 2.5-3.5 Nm (M5)

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

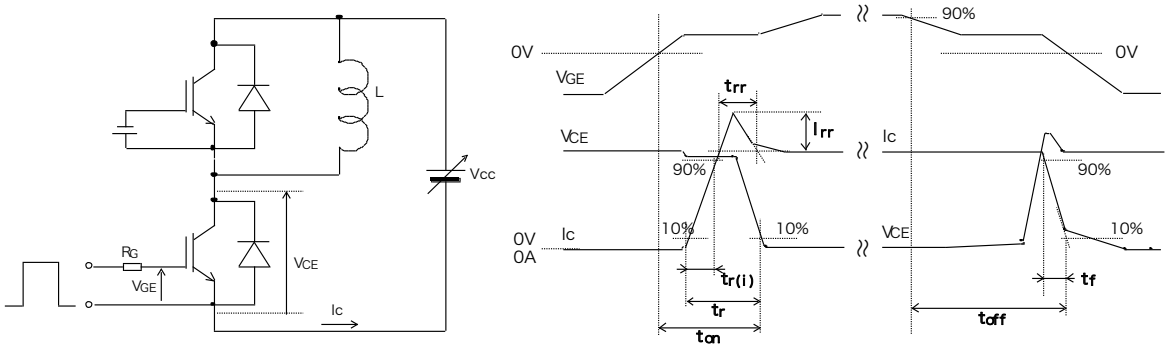
Items		Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
T1, T2	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V, V_{CE} = 1200V		-	-	1.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = ±20V		-	-	200	nA
	Gate-Emitter threshold voltage	$V_{GE\ (th)}$	V_{CE} = 20V, I_C = 50mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE\ (sat)}$ (chip)	V_{GE} = 15V, I_C = 50A	T_j= 25°C	-	1.85	2.30	V
				T_j=125°C	-	2.20	-	
		$V_{CE\ (sat)}$ (P-U, V, W / U, V, W-N terminal)	V_{GE} = 15V, I_C = 50A	T_j= 25°C	-	2.30	2.75	
				T_j=125°C	-	2.65	-	
	Internal gate resistance	$R_{g(int)}$	-		-	4.0	-	Ω
	Input capacitance	C_{ies}	V_{CE} = 10V, V_{GE} =0V, f = 1MHz		-	4.2	-	nF
	Turn-on time	t_{on}	SW mode : A, V_{CC} = 300V, I_C = 50A, V_{GE} = ±15V, R_G = 8.2Ω		-	0.20	1.20	μs
		t_r			-	0.08	0.60	
		$t_{r\ (i)}$			-	0.03	-	
	Turn-off time	t_{off}			-	0.29	1.00	
		t_f			-	0.04	0.30	
	Forward on voltage	V_F (chip)	I_F = 50A	T_j= 25°C	-	1.70	2.15	V
				T_j=125°C	-	1.85	-	
		V_F (P-U, V, W / U, V, W-N terminal)	I_F = 50A	T_j= 25°C	-	2.15	2.60	
				T_j=125°C	-	2.30	-	
	Reverse recovery time	t_{rr}	SW mode : B, V_{CC} = 300V, I_F = 50A, V_{GE} = ±15V, R_G = 6.8Ω		-	-	0.35	μs
T3, T4	Zero gate voltage collector current	I_{CES}	V_{GE} = 0V, V_{CE} = 600V		-	-	1.0	mA
	Gate-Emitter leakage current	I_{GES}	V_{CE} = 0V, V_{GE} = ±20V		-	-	200	nA
	Gate-Emitter threshold voltage	$V_{GE\ (th)}$	V_{CE} = 20V, I_C = 50mA		5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE\ (sat)}$ (chip)	V_{GE} = 15V, I_C = 50A	T_j= 25°C	-	2.45	2.80	V
				T_j=125°C	-	2.60	-	
		$V_{CE\ (sat)}$ (M-U, V, W terminal)	V_{GE} = 15V, I_C = 50A	T_j= 25°C	-	3.25	3.70	
				T_j=125°C	-	3.05	-	
	Internal gate resistance	$R_{g(int)}$	-		-	18.0	-	Ω
	Input capacitance	C_{ies}	V_{CE} = 10V, V_{GE} = 0V, f = 1MHz		-	3.3	-	nF
	Turn-on time	t_{on}	SW mode : B, V_{CC} = 300V, I_C = 50A, V_{GE} = ±15V, R_G = 6.8Ω		-	0.28	1.20	μs
		t_r			-	0.12	0.60	
		$t_{r\ (i)}$			-	0.05	-	
	Turn-off time	t_{off}			-	0.18	1.00	
		t_f			-	0.02	0.30	
	Reverse recovery time	t_{rr}	SW mode : A, V_{CC} = 300V, I_C = 50A, V_{GE} = ±15V, R_G = 8.2Ω		-	-	0.35	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

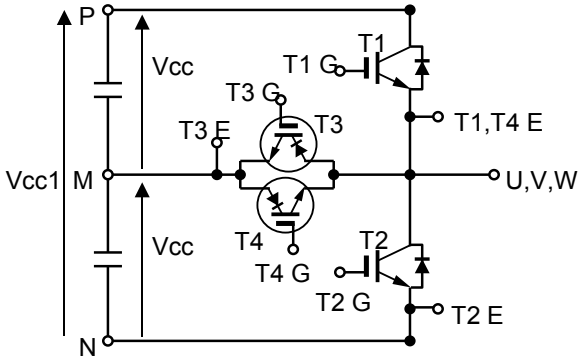
Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance (1device)	$R_{th(j-c)}$	T1, T2 IGBT		-	-	0.54	°C/W
		T1, T2 FWD		-	-	0.73	
		T3, T4 RB-IGBT		-	-	0.53	
Contact thermal resistance (1device) (*4)	$R_{th(c-f)}$	T1, T2	with Thermal Compound	-	0.05	-	
		T3, T4					

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

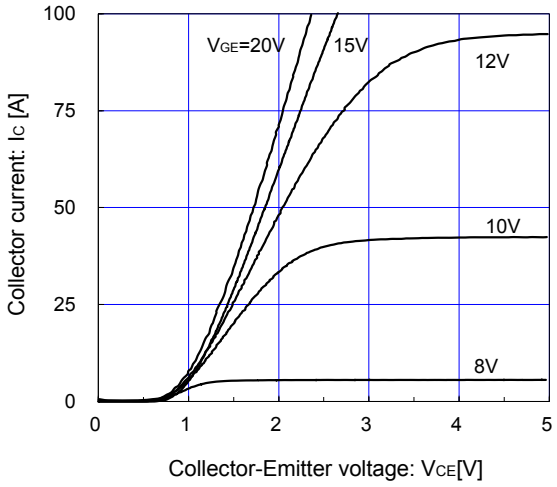


		State of switching device			
SW mode	Load L	T1	T2	T3	T4
A	M-U	**SW**	OFF	OFF	**ON**
	M-U	OFF	**SW**	**ON**	OFF
B	P-U	OFF	OFF	**SW**	**ON**
	U-N	OFF	OFF	**ON**	**SW**

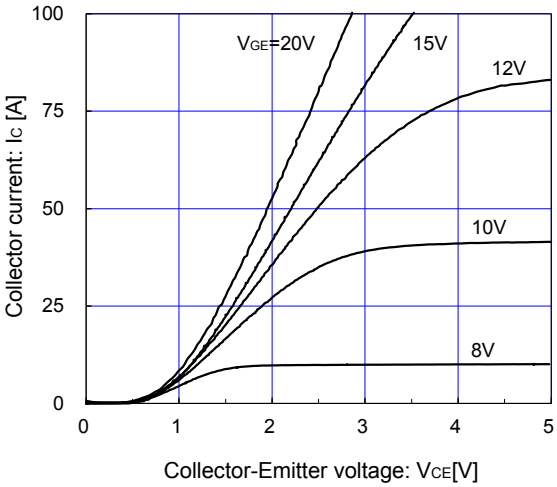
SW: Connect to drive circuit and input gate signal.
ON: Bias voltate of gate +15V.
OFF: Reverse bias voltage of gate -15V.
Vcc=Vcc1/2

■ Characteristics (Representative)

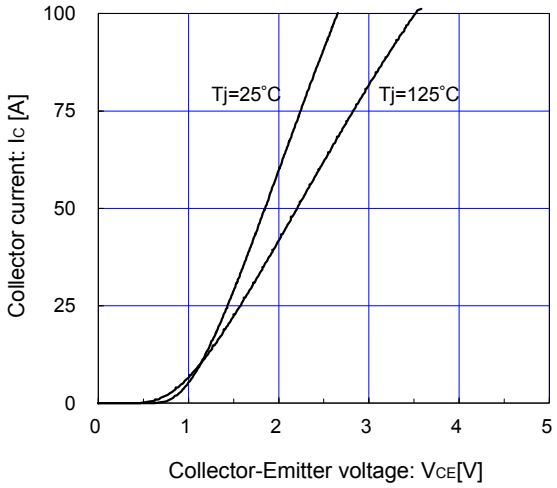
[T1, T2]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 25°C / chip



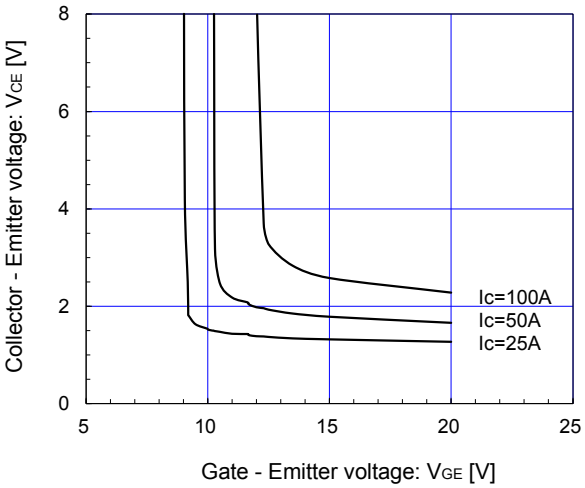
[T1, T2]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 125°C / chip



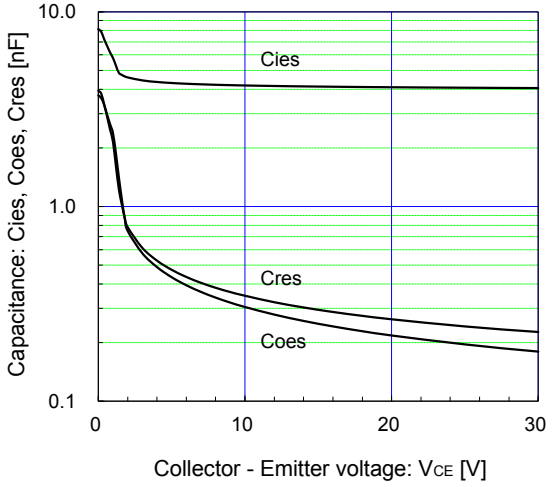
[T1, T2]
Collector current vs. Collector-Emitter voltage (typ.)
VGE=15V / chip



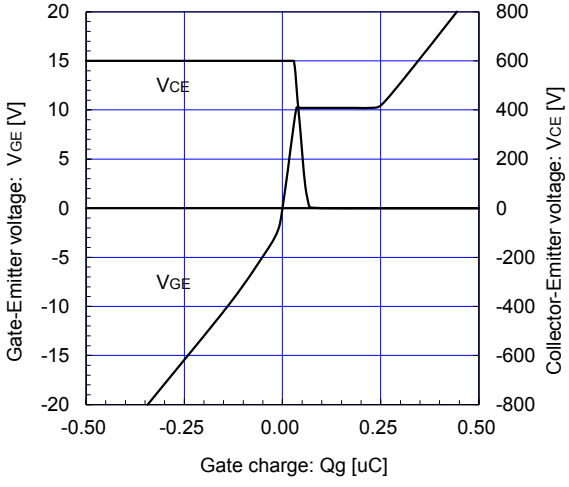
[T1, T2]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
Tj= 25°C / chip



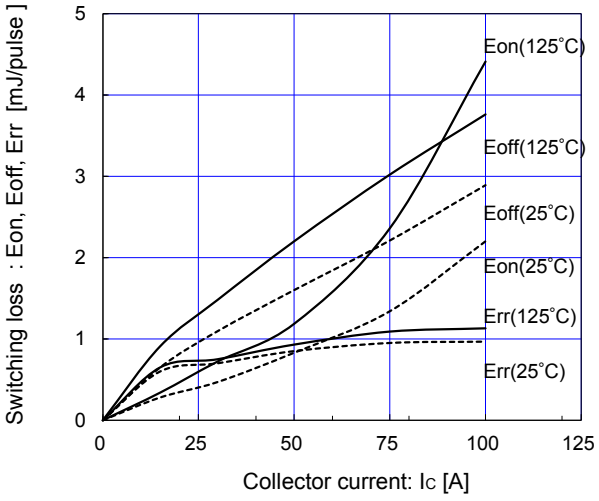
[T1, T2]
Capacitance vs. Collector-Emitter voltage (typ.)
VGE=0V, f= 1MHz, Tj= 25°C



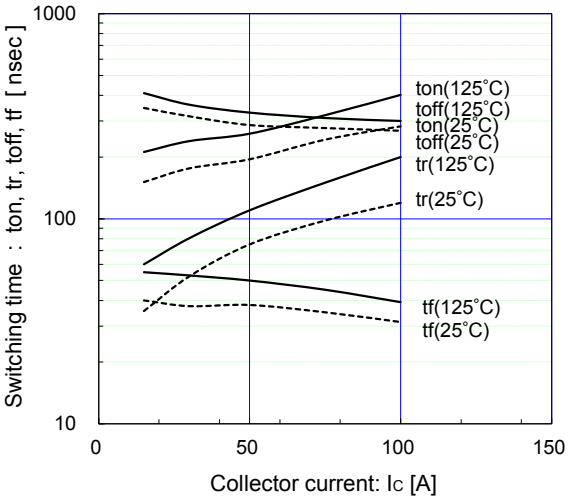
[T1, T2]
Dynamic gate charge (typ.)
Vcc=600V, Ic=50A, Tj=2°C



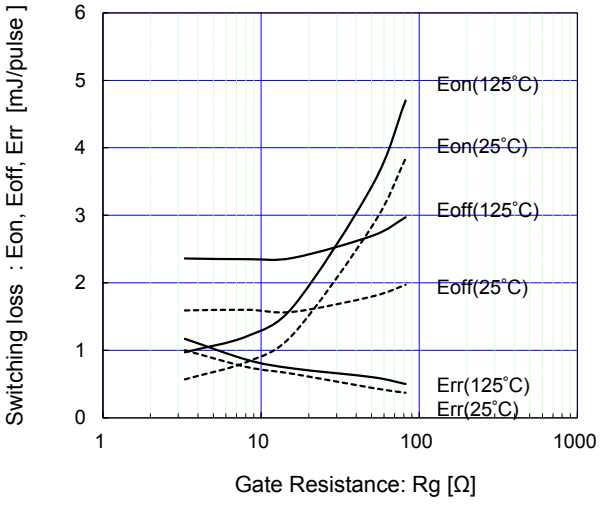
[SW mode A]
Switching loss vs. Collector current (typ.)
Vcc=300V, V_{GE}=±15V, Rg=8.2Ω



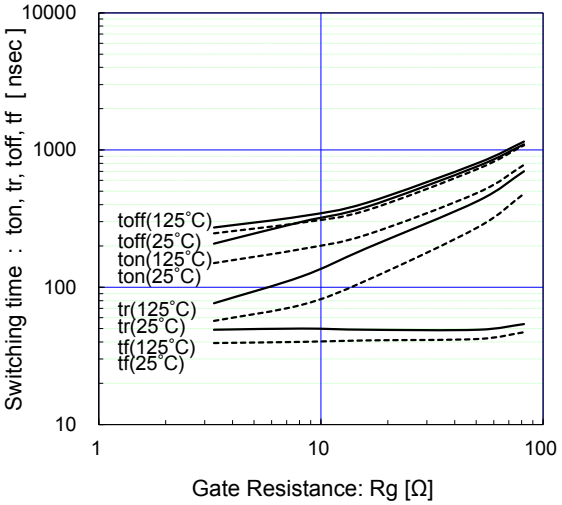
[SW mode A]
Switching time vs. Collector current (typ.)
Vcc=300V, V_{GE}=±15V, Rg=8.2Ω



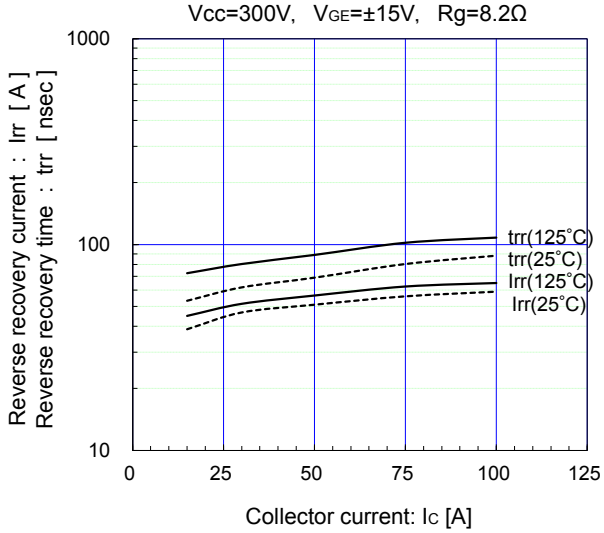
[SW mode A]
Switching loss vs. Gate resistanse (typ.)
Vcc=300V, Ic=50A, V_{GE}=±15V



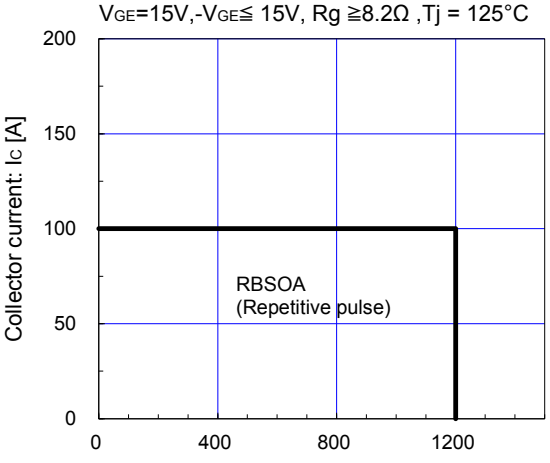
[SW mode A]
Switching time vs. Gate resistanse (typ.)
Vcc=300V, Ic=50A, V_{GE}=±15V



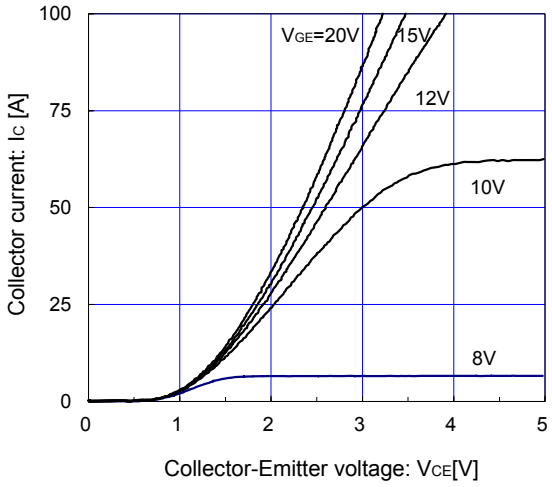
[SW mode A]
Switching time vs. Collector current (typ.)
Vcc=300V, V_{GE}=±15V, Rg=8.2Ω



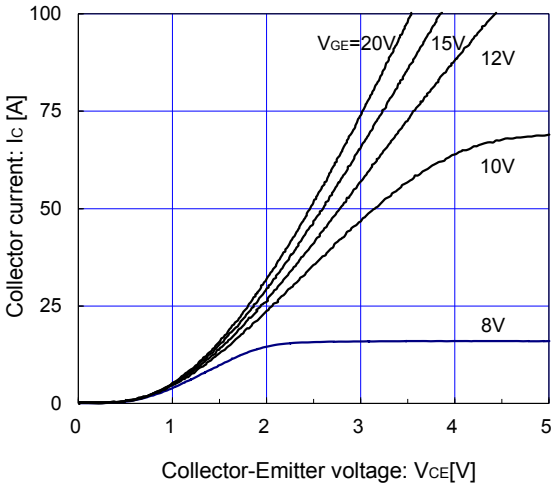
[T1, T2]
Reverse bias safe operating area (max.)
V_{GE}=15V,-V_{GE}≦ 15V, Rg ≧8.2Ω ,Tj = 125°C



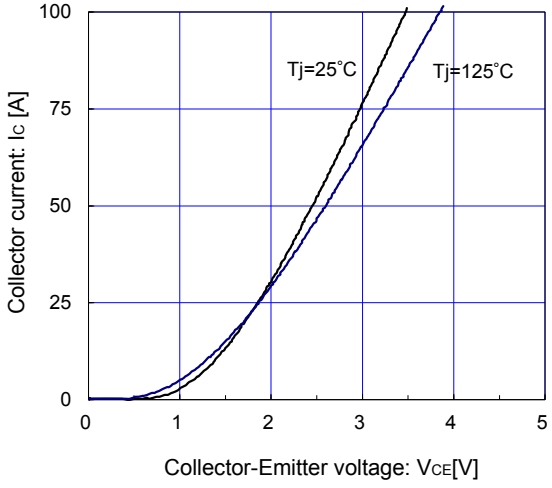
[T3, T4 (RB-IGBT)]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 25°C / chip



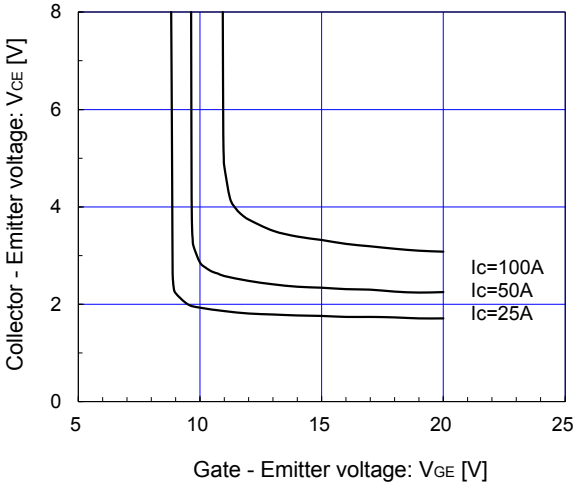
[T3, T4 (RB-IGBT)]
Collector current vs. Collector-Emitter voltage (typ.)
Tj= 125°C / chip



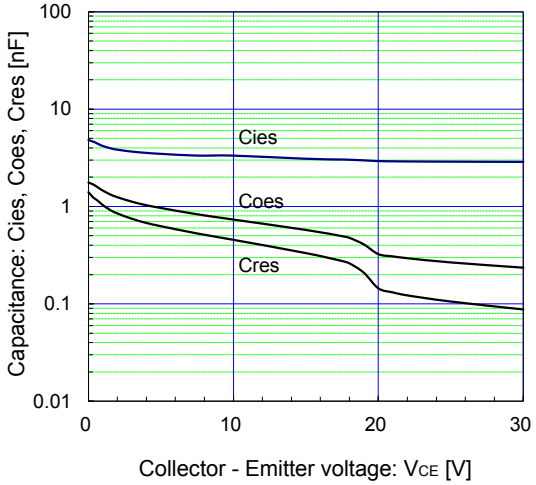
[T3, T4 (RB-IGBT)]
Collector current vs. Collector-Emitter voltage (typ.)
VGE=15V / chip



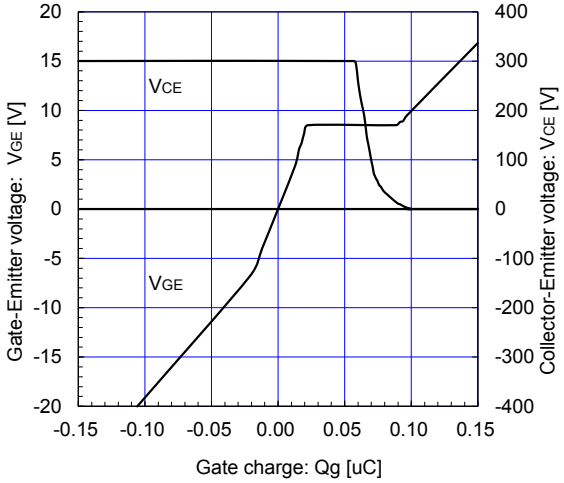
[T3, T4 (RB-IGBT)]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
Tj= 25°C / chip



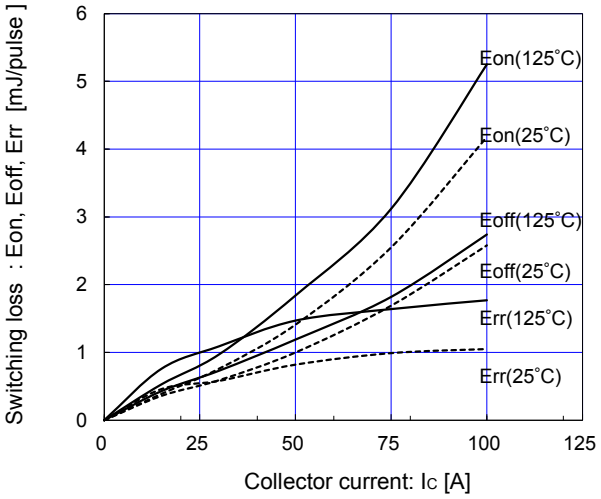
[T3, T4 (RB-IGBT)]
Capacitance vs. Collector-Emitter voltage (typ.)
VGE=0V, f= 1MHz, Tj= 25°C



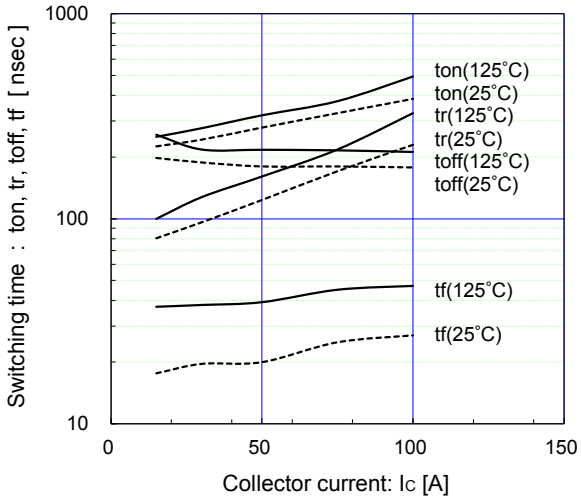
[T3, T4 (RB-IGBT)]
Dynamic gate charge (typ.)
Vcc=300V, Ic=50A, Tj=25°C



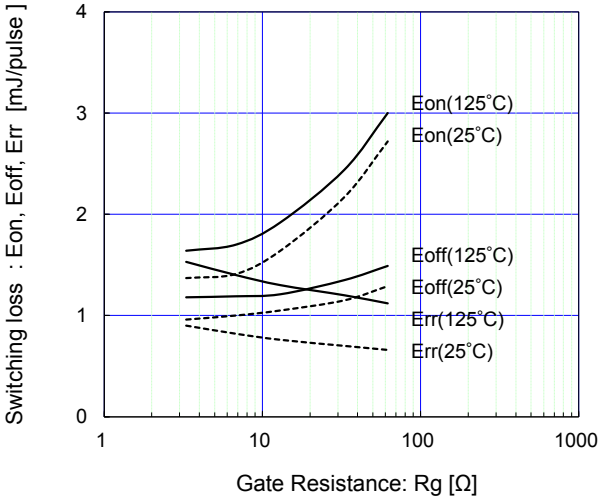
[SW mode B]
Switching loss vs. Collector current (typ.)
Vcc=300V, V_{GE}=±15V, Rg=6.8Ω



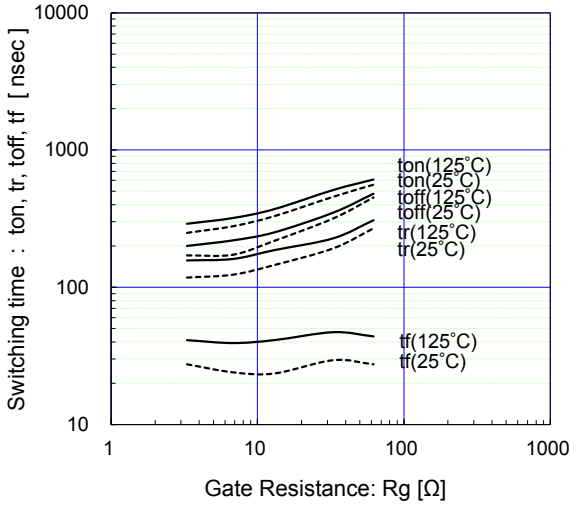
[SW mode B]
Switching time vs. Collector current (typ.)
Vcc=300V, V_{GE}=±15V, Rg=6.8Ω



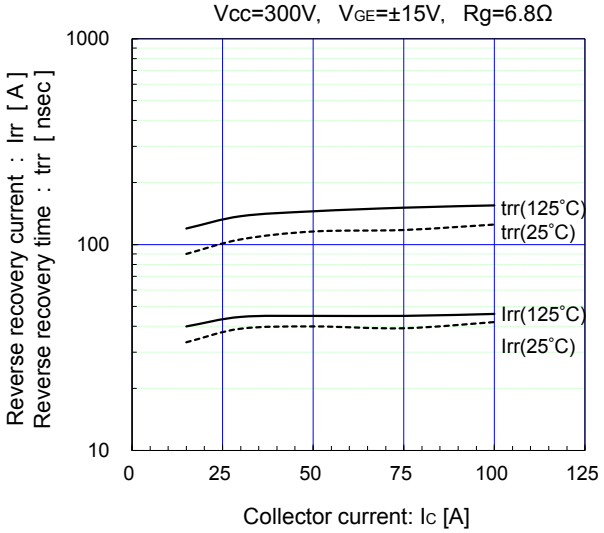
[SW mode B]
Switching loss vs. Gate resistanse (typ.)
Vcc=300V, Ic=50A, V_{GE}=±15V



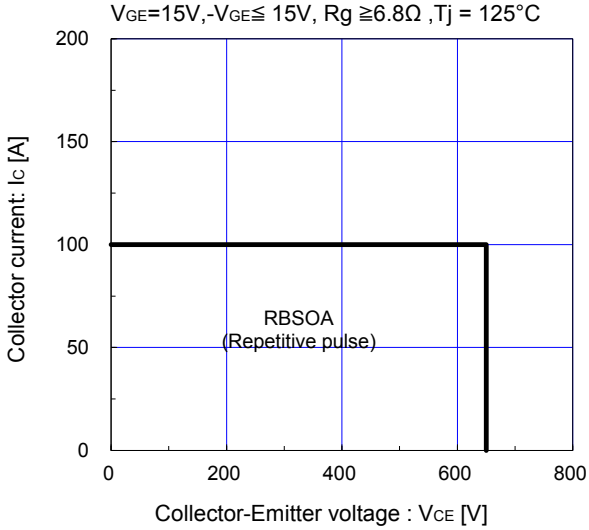
[SW mode B]
Switching time vs. Gate resistanse (typ.)
Vcc=300V, Ic=50A, V_{GE}=±15V



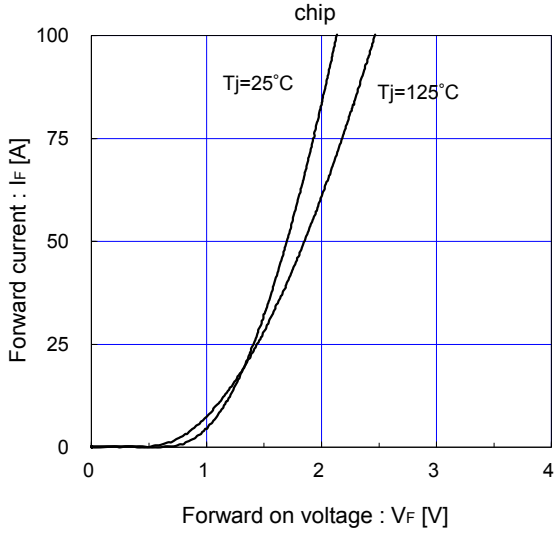
[SW mode B]
Switching time vs. Collector current (typ.)
Vcc=300V, V_{GE}=±15V, Rg=6.8Ω



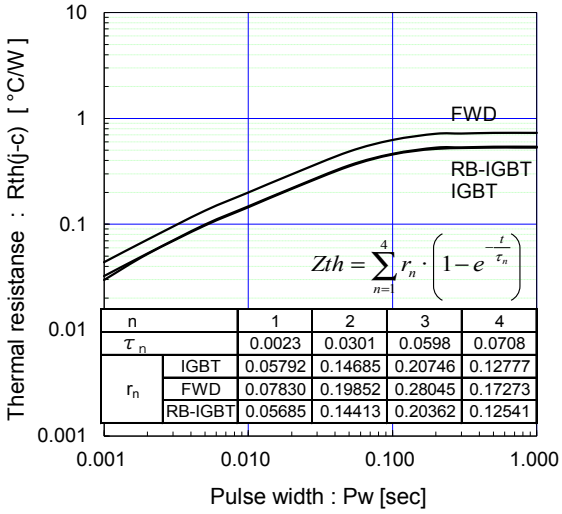
[T3, T4]
Reverse bias safe operating area (max.)
V_{GE}=15V,-V_{GE}≦ 15V, Rg ≧6.8Ω ,Tj = 125°C



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



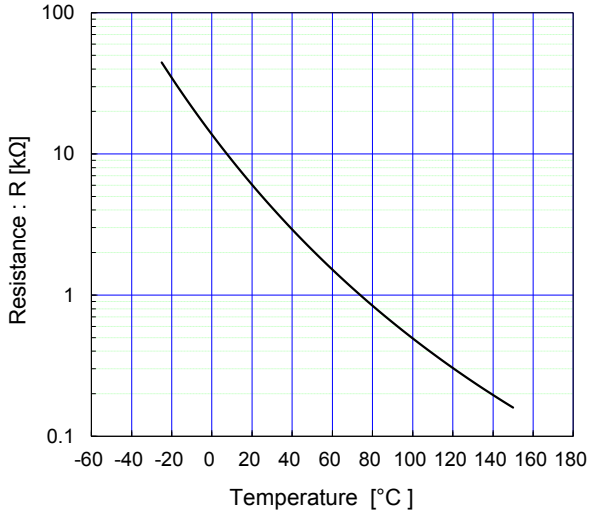
Transient thermal resistance (max.)



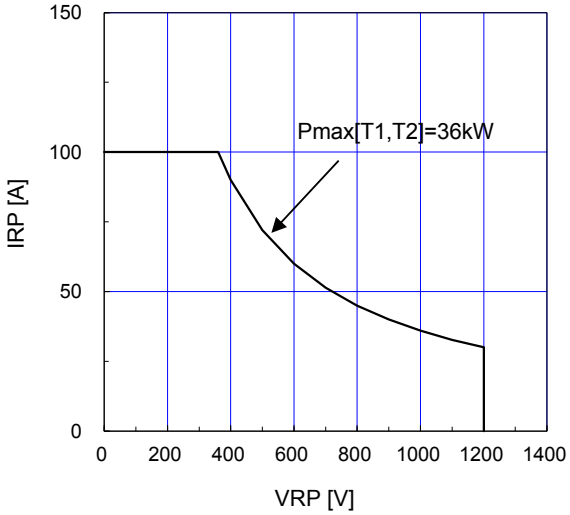
$$Zth = \sum_{n=1}^{4} r_n \cdot \left(1 - e^{-\frac{t}{\tau_n}}\right)$$

n		1	2	3	4
τ_n		0.0023	0.0301	0.0598	0.0708
r_n	IGBT	0.05792	0.14685	0.20746	0.12777
	FWD	0.07830	0.19852	0.28045	0.17273
	RB-IGBT	0.05685	0.14413	0.20362	0.12541

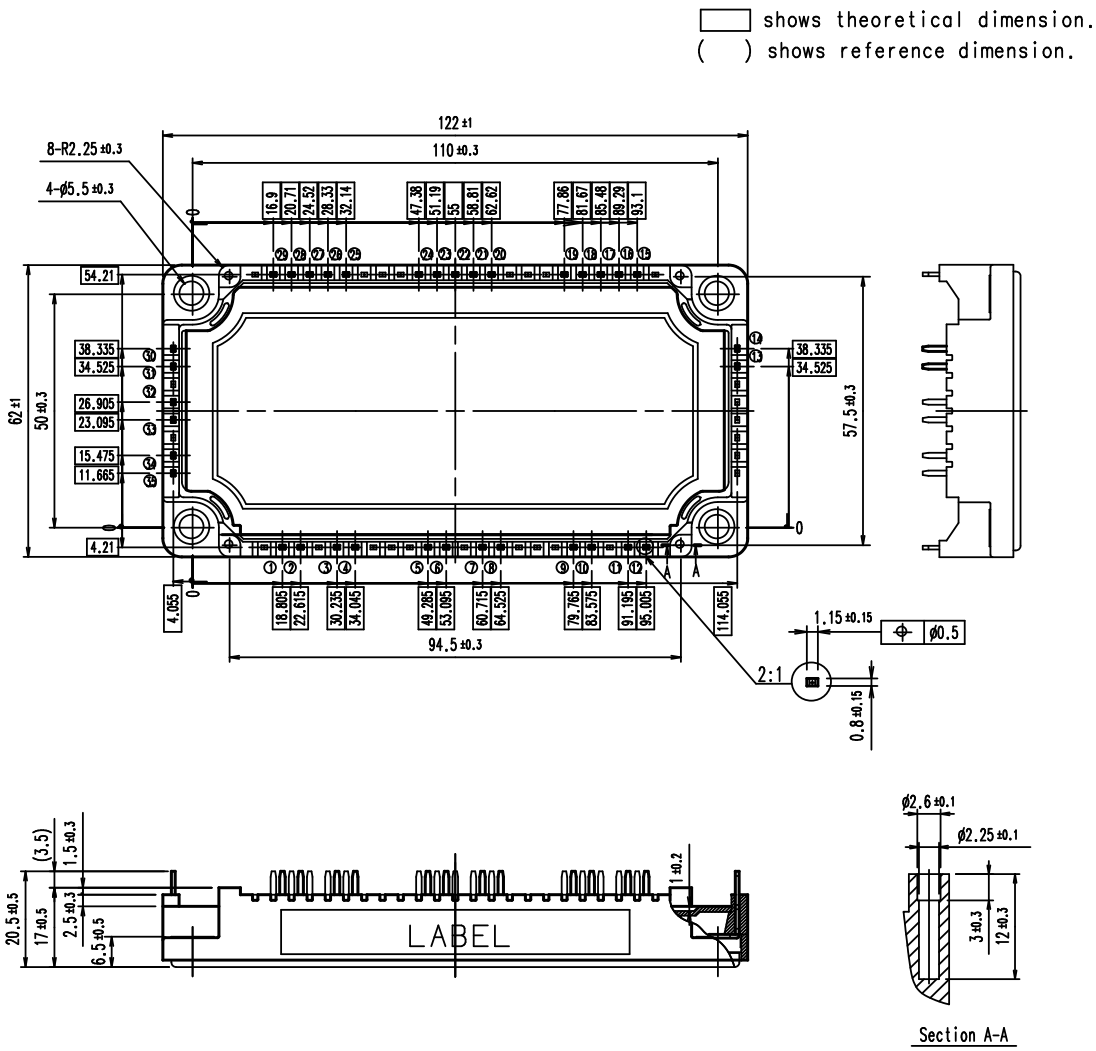
[Thermistor]
Temperature characteristic (typ.)



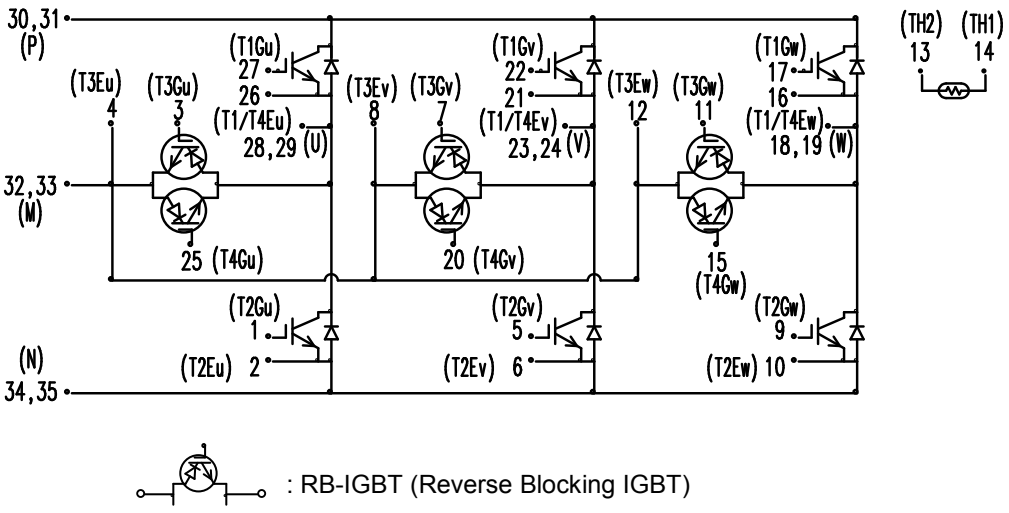
Reverse recovery withstand capability for FWD
Tj=125°C



■ Outline Drawings, mm



■ Equivalent Circuit Schematic



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