

4MBI600VB-170R2-50

IGBT Modules

IGBT Power Module (V series)

1700V/600A/IGBT, $\pm 1200\text{V}/600\text{A}/\text{RB-IGBT}$, 4-in-1 package

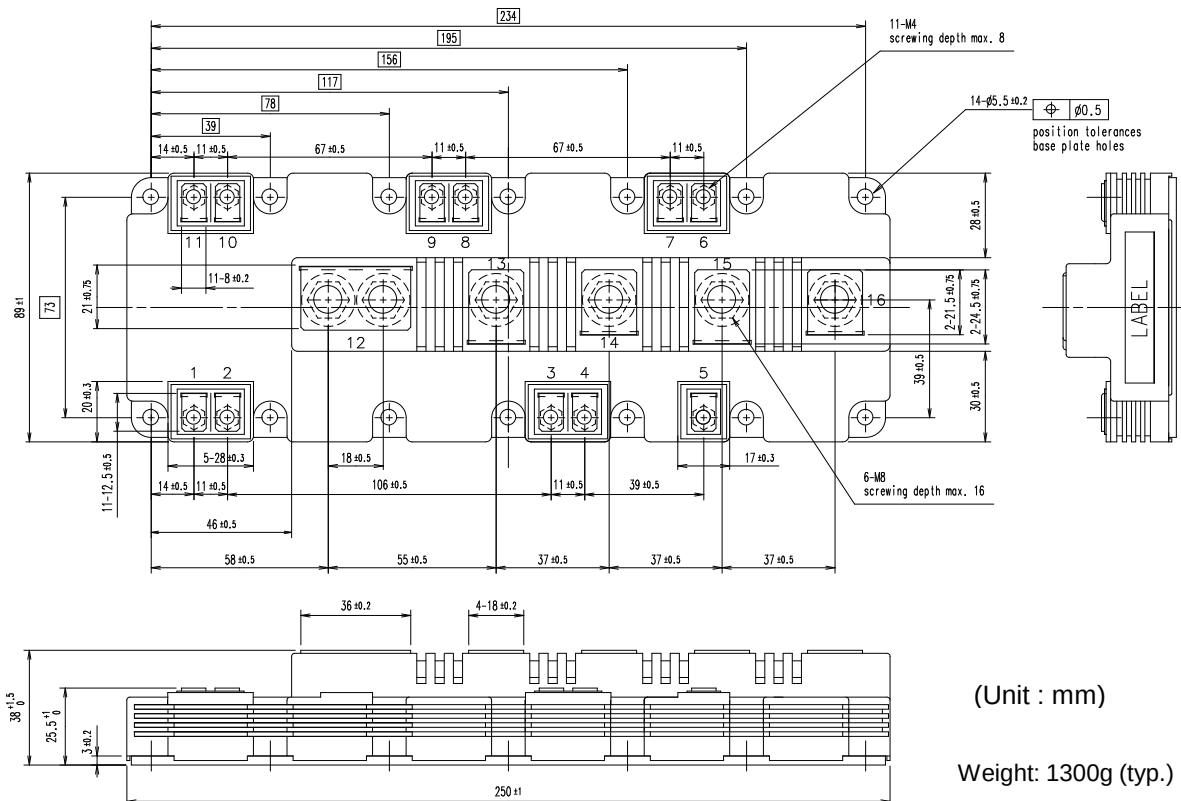
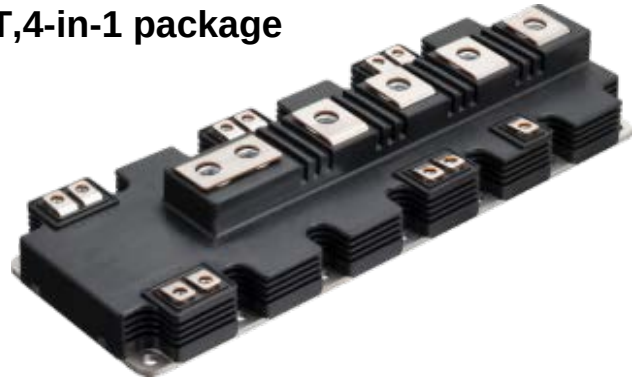
■ Features

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

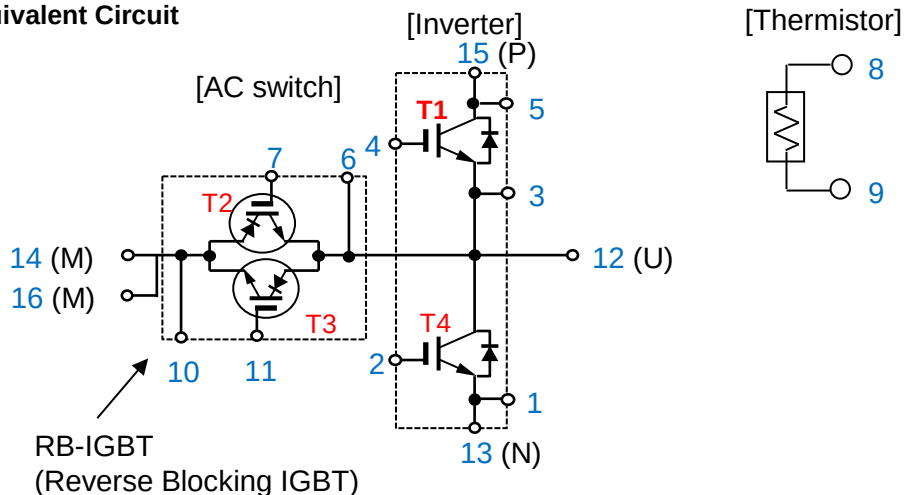
■ Applications

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

■ Outline drawing



■ Equivalent Circuit



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■ Absolute Maximum Ratings (at $T_c = 25^\circ\text{C}$ 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	I_C	Continuous	$T_c = 25^\circ\text{C}$	1000	A
				$T_c = 100^\circ\text{C}$	600	
		I_{CP}	1ms		1200	
		$-I_C$	Continuous		600	
	Collector power dissipation	P_C	1 device		3410	W
					175	
	Junction temperature	T_{vj}			150	$^\circ\text{C}$
	Operating temperature (under switching conditions)	T_{vjop}			150	$^\circ\text{C}$
AC Switch	Collector-Emitter voltage	V_{CES}			± 1200	V
	Gate-Emitter voltage	V_{GES}			± 20	V
	Collector current	I_C	Continuous	$T_c = 25^\circ\text{C}$	900	A
				$T_c = 80^\circ\text{C}$	600	
		I_C pulse	1ms		1200	
	Collector power dissipation	P_C	1 device		3680	W
	Junction temperature	T_{vj}			150	$^\circ\text{C}$
	Operating temperature (under switching conditions)	T_{vjop}			125	
Case temperature		T_c			125	
Storage temperature		T_{stg}			$-40 \sim +125$	
Isolation voltage	between terminal and copper base (*1) between thermistor and others (*2)	V_{iso}	AC : 1min.		4000	Vrms
Screw torque (*3)	Mounting	-	M5		6	Nm
	Main Terminals	-	M8		10	
	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) 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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■ Electrical characteristics (at $T_{vj}=25^{\circ}\text{C}$ unless otherwise specified)

Items		Symbols	Conditions	Characteristics			Units
				min.	typ.	max.	
Inverter	Zero gate voltage collector current	I_{CES}	$V_{GE} = 0\text{V}$ $V_{CE} = 1700\text{V}$	-	-	6	mA
	Gate-Emitter leakage current	I_{GES}	$V_{GE} = 0\text{V}$ $V_{GE} = \pm 20\text{V}$	-	-	1200	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 600\text{mA}$	6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	$V_{GE} = 15\text{V}$ $I_C = 600\text{A}$	$T_{vj} = 25^{\circ}\text{C}$	-	2.00	2.25
				$T_{vj} = 125^{\circ}\text{C}$	-	2.45	-
				$T_{vj} = 150^{\circ}\text{C}$	-	2.50	1
		$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 600\text{A}$	$T_{vj} = 25^{\circ}\text{C}$	-	2.00	2.50
				$T_{vj} = 125^{\circ}\text{C}$	-	2.45	-
				$T_{vj} = 150^{\circ}\text{C}$	-	2.50	-
	Internal gate resistance	r_g	-	-	1.25	-	Ω
	Input capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	60.0	-	nF
	Turn-on time	t_{on}	SW mode : A (*1) $V_{cc} = 750\text{V}$ $I_C = 600\text{A}$	-	0.72	-	μs
		t_r		-	0.24	-	
		$t_{r(l)}$		-	0.07	-	
	Turn-off time	t_{off}	$V_{GE} = \pm 15\text{V}$ $R_G = +2.7/-0.22\Omega$	-	0.87	-	μs
		t_f		-	0.14	-	
	Forward on voltage	V_F (chip)	$I_F = 600\text{A}$	$T_{vj} = 25^{\circ}\text{C}$	-	1.80	1.95
				$T_{vj} = 125^{\circ}\text{C}$	-	2.00	-
				$T_{vj} = 150^{\circ}\text{C}$	-	2.00	-
		V_F (terminal)	$I_F = 600\text{A}$	$T_{vj} = 25^{\circ}\text{C}$	-	1.90	2.40
				$T_{vj} = 125^{\circ}\text{C}$	-	2.10	-
				$T_{vj} = 150^{\circ}\text{C}$	-	2.10	-
	Reverse recovery time	t_{rr}	SW mode : B (*1) $V_{cc} = 750\text{V}$ $I_F = 600\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = +5.6/-10\Omega$	-	0.13	-	μs
AC Switch	Zero gate voltage collector current	I_{CES}	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	-	-	12.0	mA
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}$ $V_{GE} = \pm 20\text{V}$	-	-	2400	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 650\text{mA}$	5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	$V_{GE} = 15\text{V}$ $I_C = 600\text{A}$	$T_{vj} = 25^{\circ}\text{C}$	-	2.70	3.00
				$T_{vj} = 125^{\circ}\text{C}$	-	3.00	-
		$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 600\text{A}$	$T_{vj} = 25^{\circ}\text{C}$	-	2.70	3.30
				$T_{vj} = 125^{\circ}\text{C}$	-	3.00	-
	Internal gate resistance	r_g	-	-	3.40	-	Ω
	Input capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	53	-	nF
	Turn-on time	t_{on}	SW mode : B (*1) $V_{cc} = 750\text{V}$ $I_C = 600\text{A}$	-	0.42	-	μs
		t_r		-	0.25	-	
		$t_{r(l)}$		-	0.07	-	
	Turn-off time	t_{off}	$V_{GE} = \pm 15\text{V}$ $R_G = +5.6/-10\Omega$	-	1.57	-	μs
		t_f		-	0.11	-	
	Reverse recovery time	t_{rr}	SW mode : A (*1) $V_{cc} = 750\text{V}$ $I_C = 600\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = +2.7/-0.22\Omega$	-	0.16	-	μs
Thermistor	Resistance	R	$T = 25^{\circ}\text{C}$	-	5000	-	Ω
	B Value	B	$T = 100^{\circ}\text{C}$	465	495	520	K
			$T = 25/50^{\circ}\text{C}$	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	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	T1, T2 IGBT	-	-	0.044	$^{\circ}\text{C/W}$
		T1, T2 FWD	-	-	0.084	
		T3, T4 RB-IGBT	-	-	0.034	
Contact thermal resistance (1device) (*2)	$R_{th(c-f)}$	T1, T2	-	0.0083	-	
		T3, T4	-	0.0042	-	

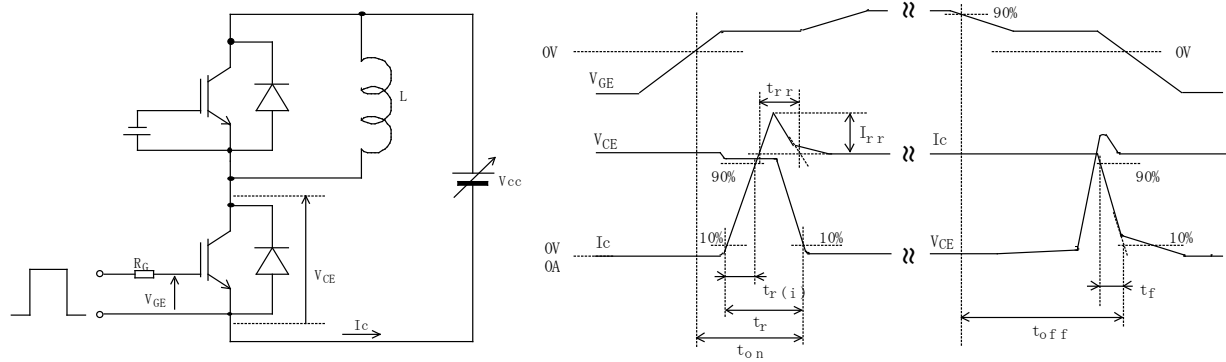
(*2) This is the value which is defined mounting on the additional cooling fin with thermal compound.

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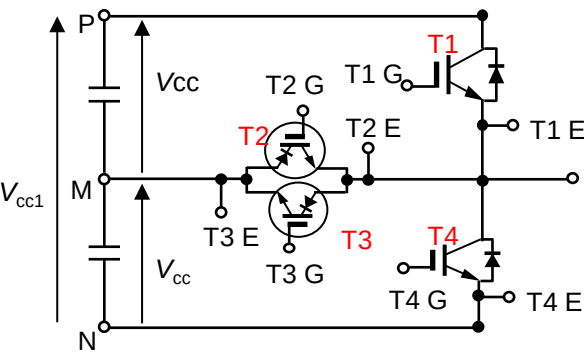
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Definitions of switching time



Definitions of switching mode

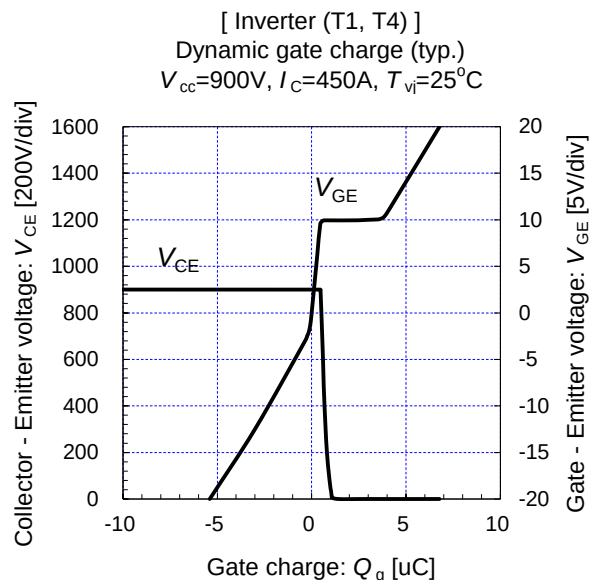
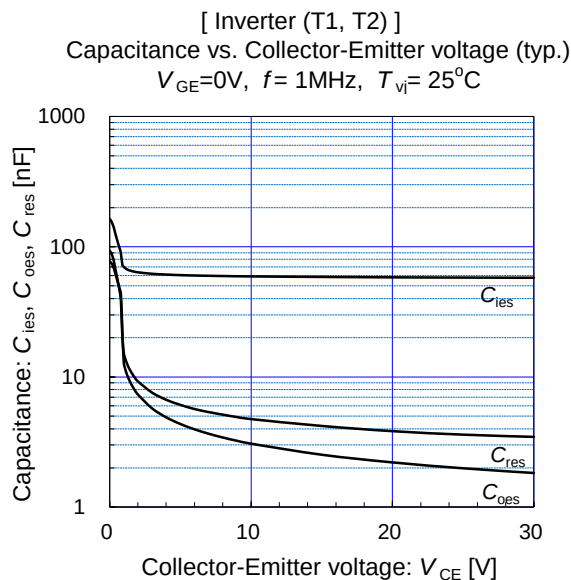
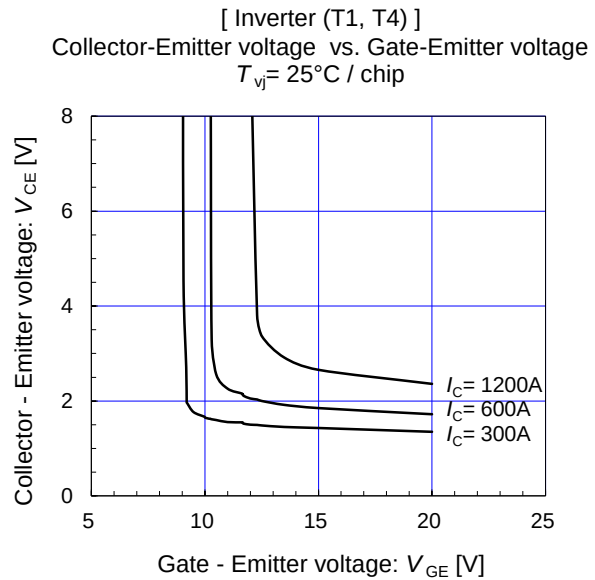
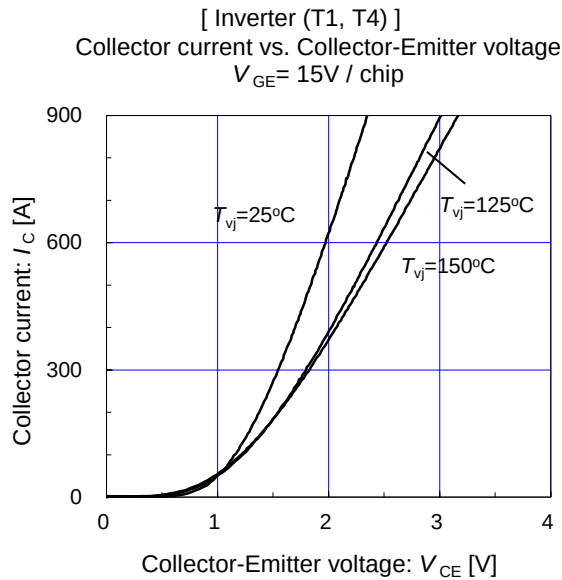
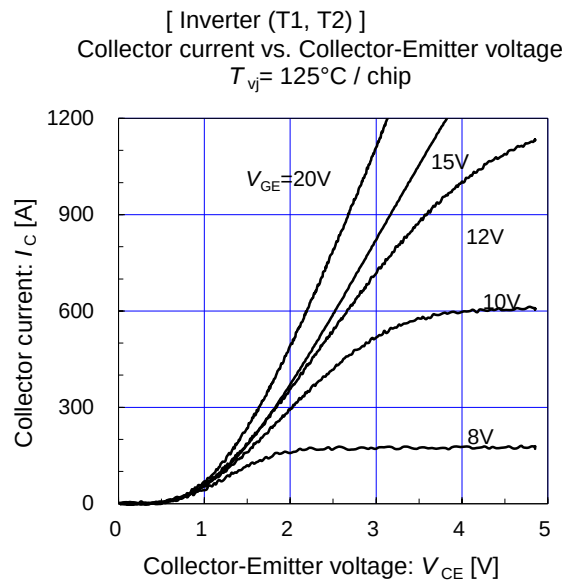
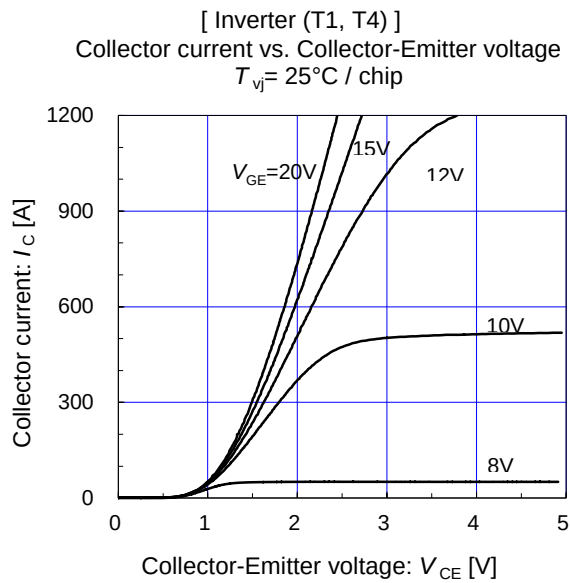


SW mode	Load L	T1	T2	T3	T4
A	M-U	SW	ON	OFF	OFF
	M-U	OFF	OFF	ON	SW
B	U-N	OFF	SW	ON	OFF
	P-U	OFF	ON	SW	OFF

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

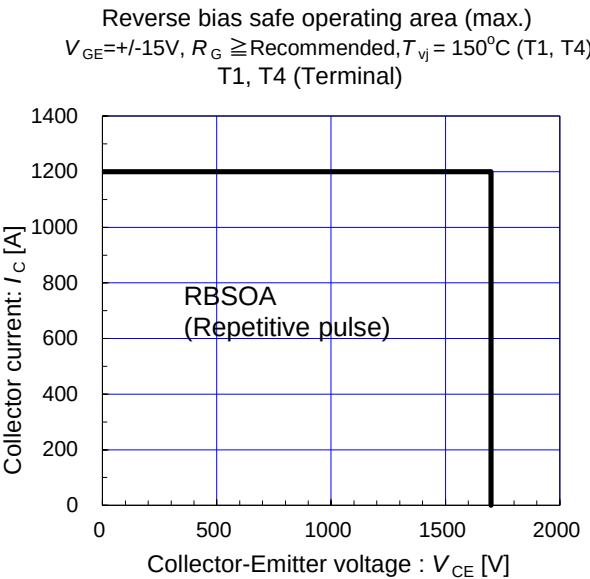
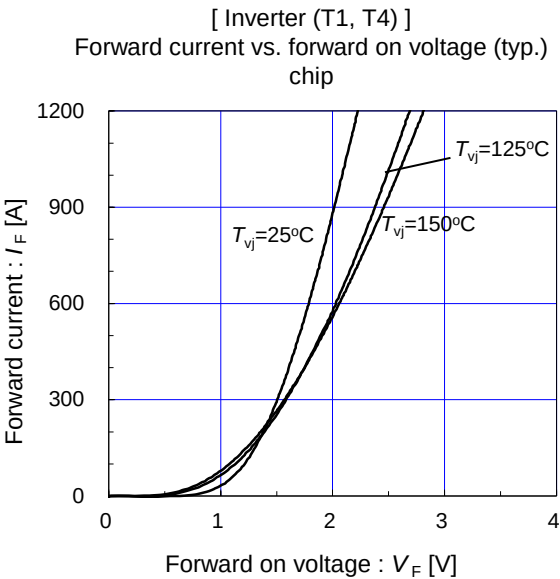
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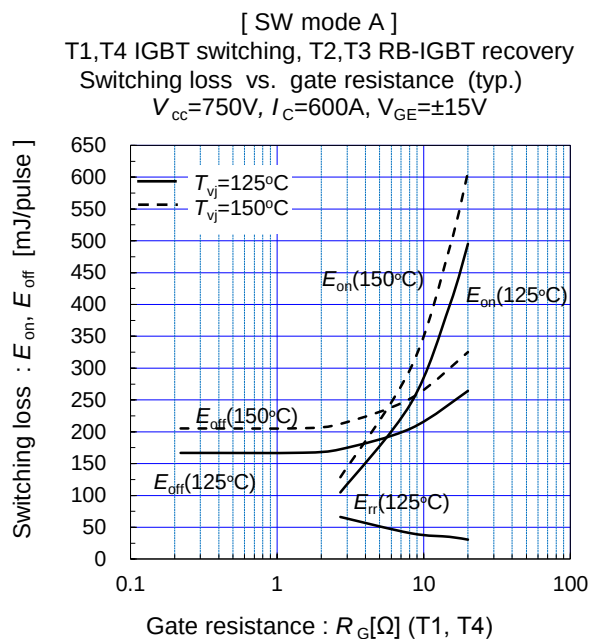
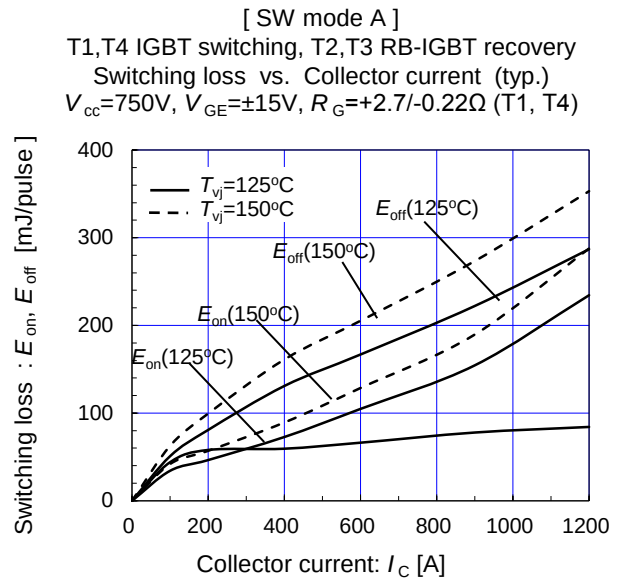
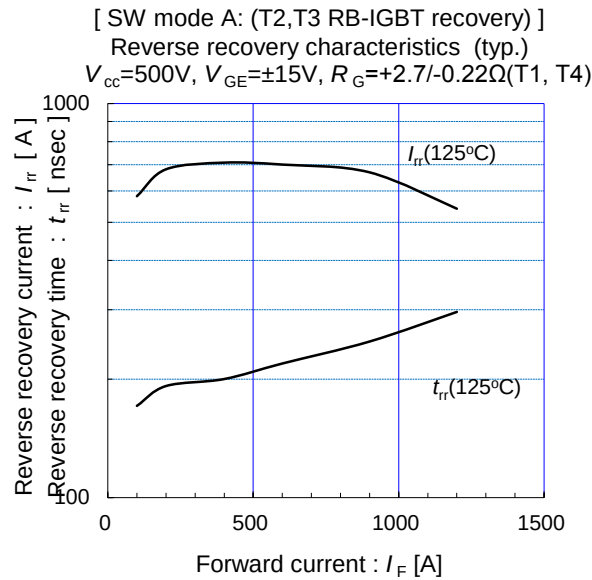
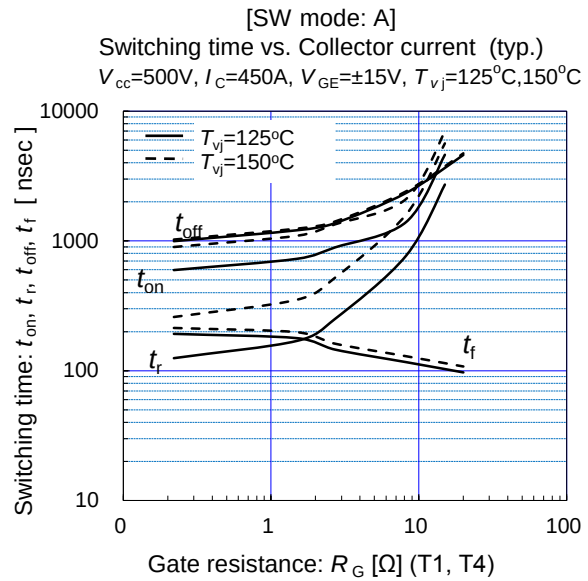
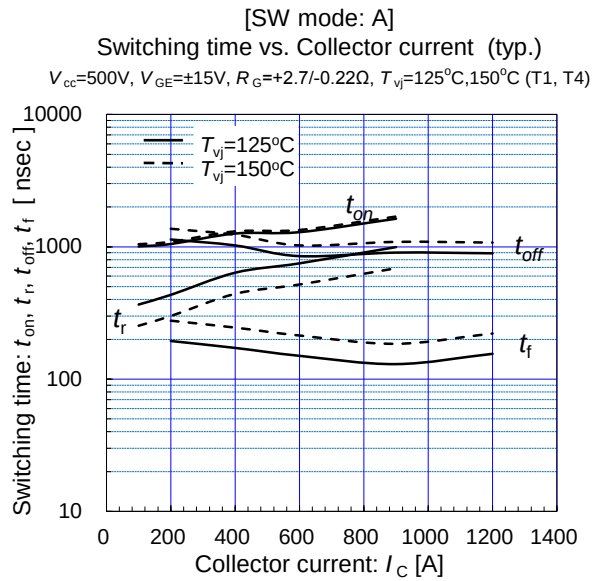
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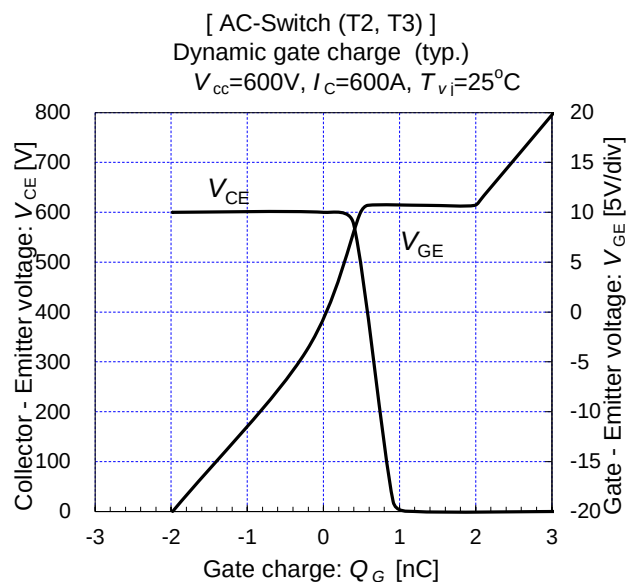
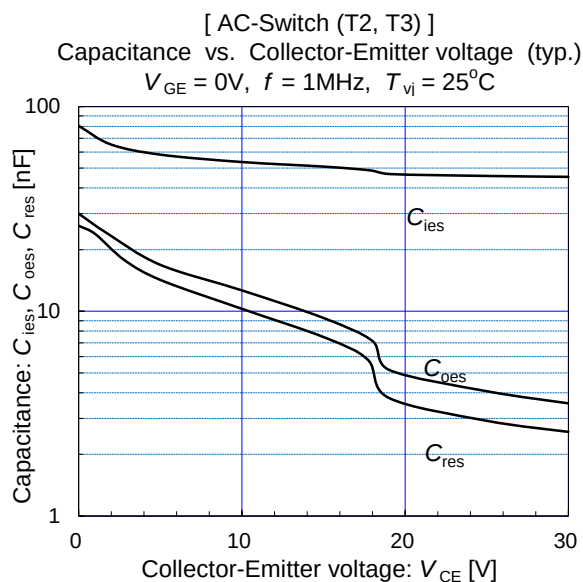
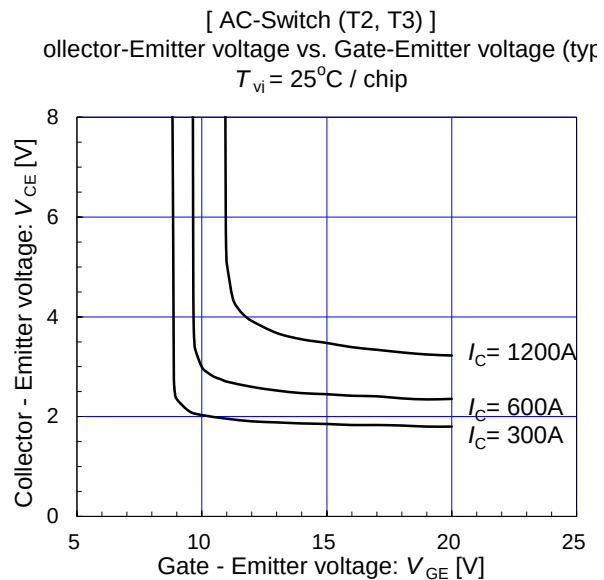
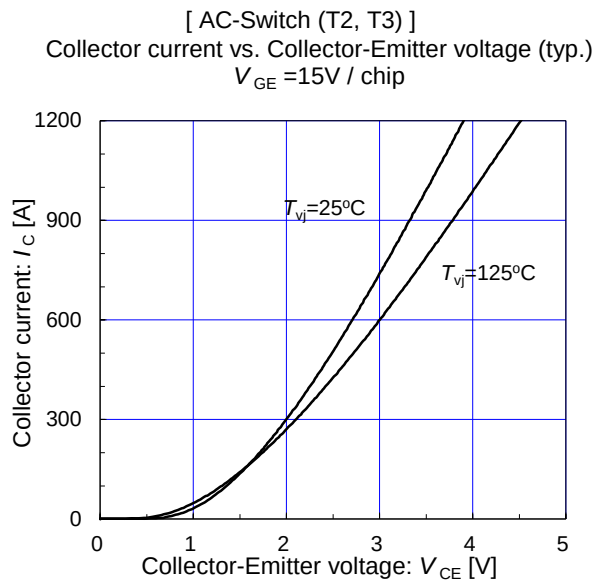
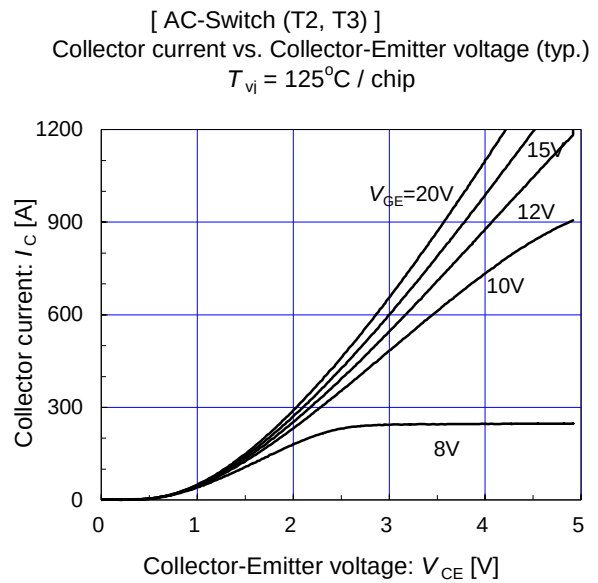
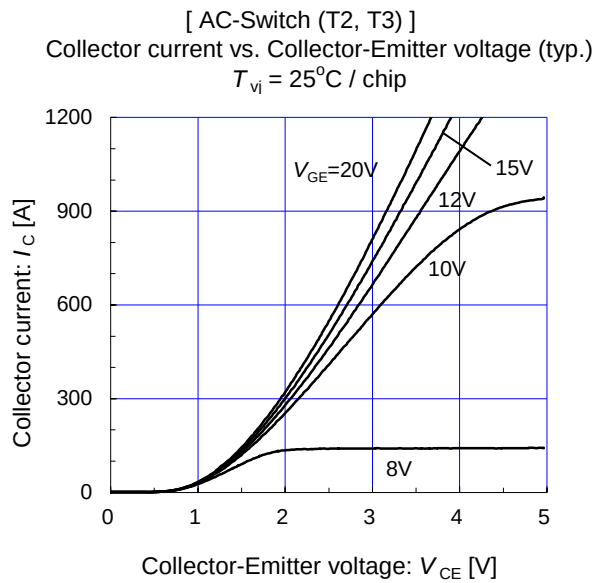
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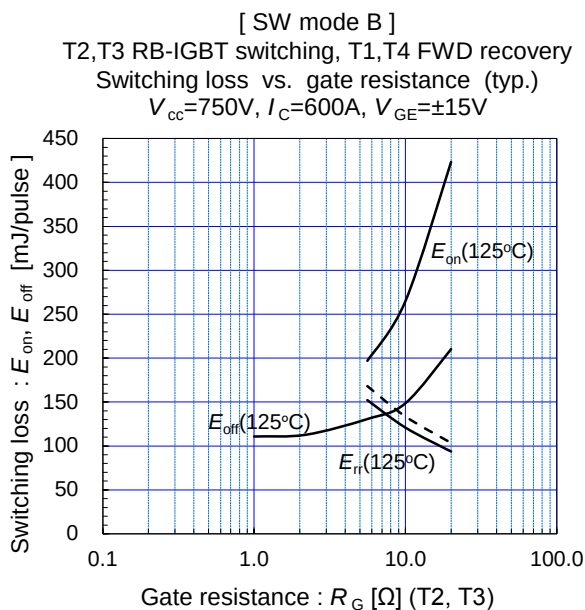
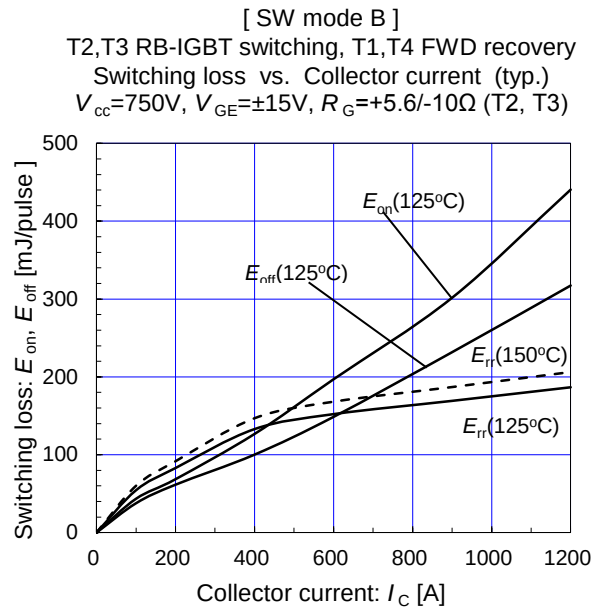
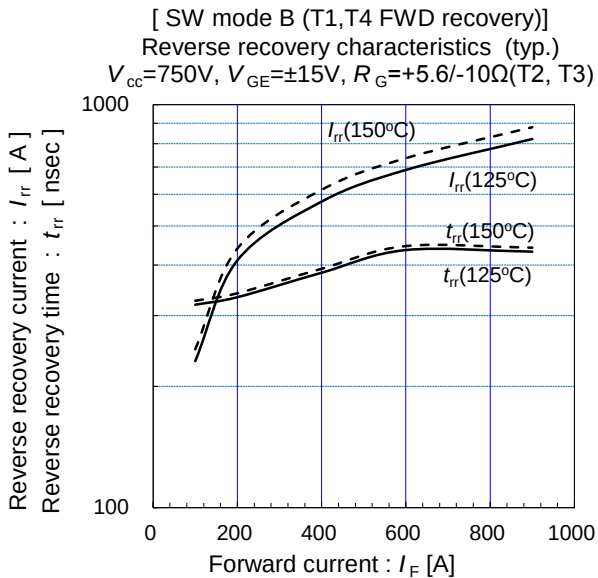
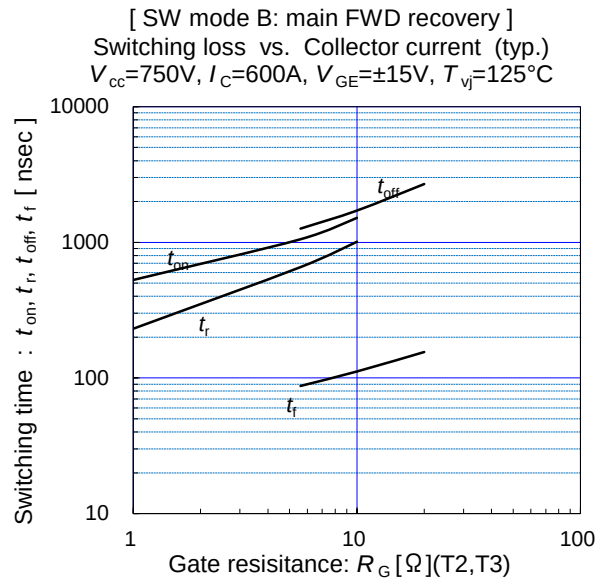
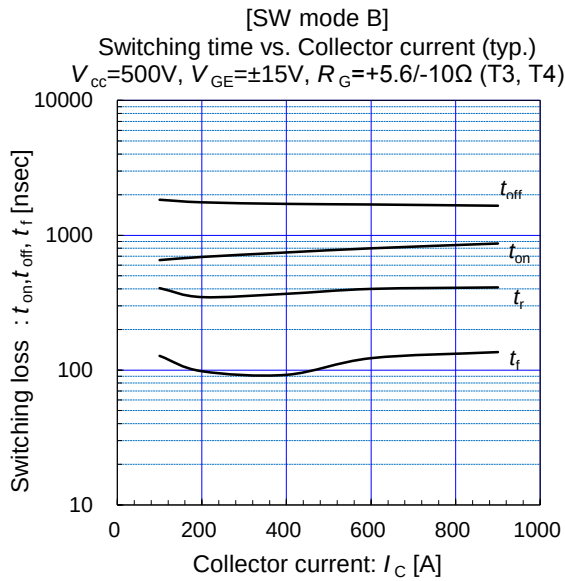
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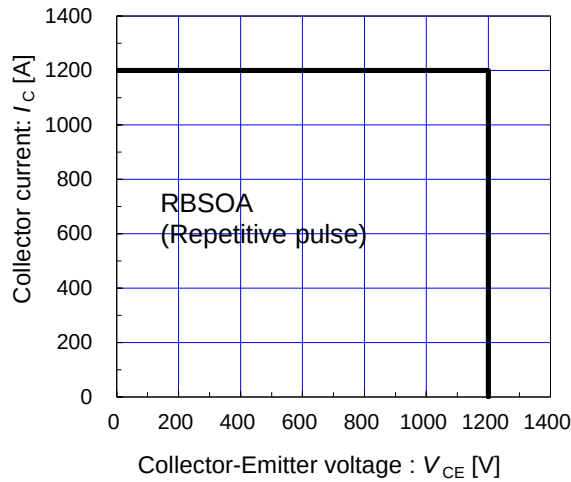
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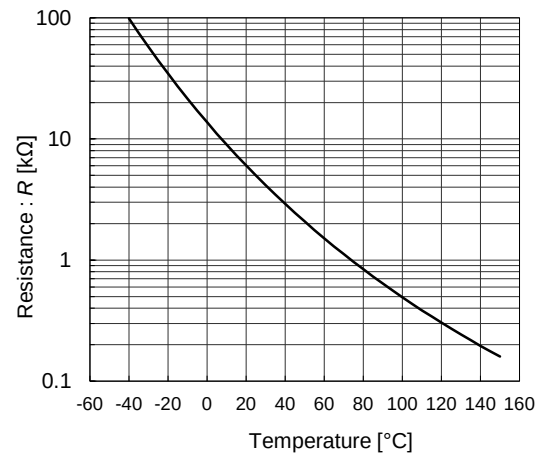
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Reverse bias safe operating area (max.)
 $V_{GE} = \pm 15V$, $R_G \geq \text{Recommended}$, $T_{vj} = 125^\circ C$ (T2, T3)
 T2, T3 (Terminal)

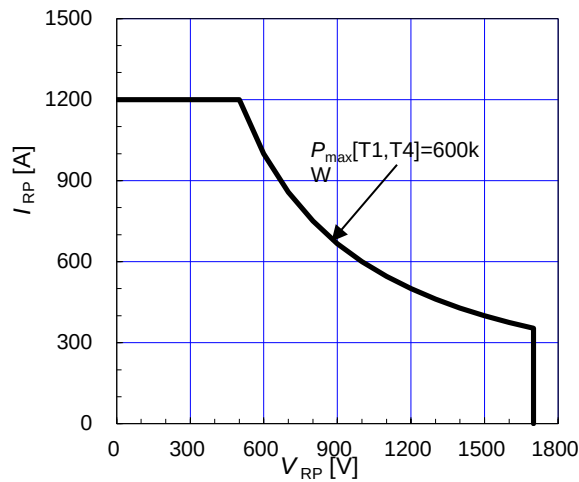


[THERMISTOR]

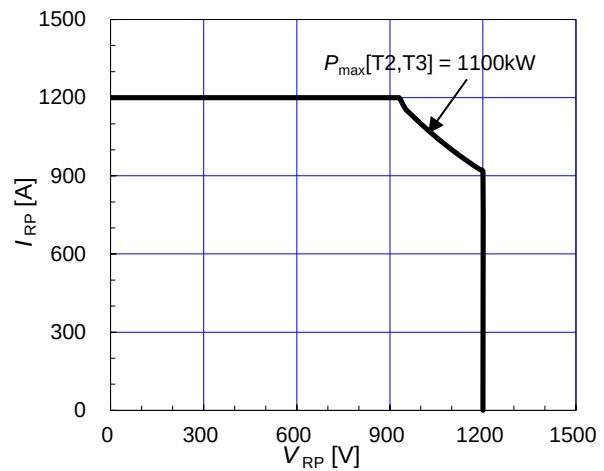
Temperature characteristic (typ.)



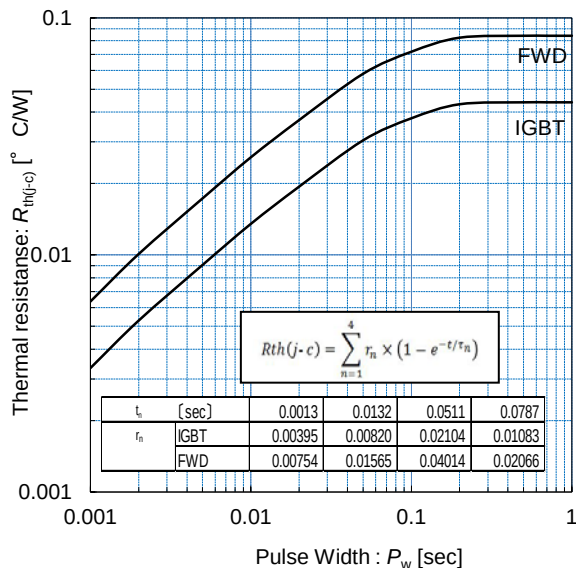
Reverse recovery withstand capability for FWD
 $T_{vj} = 150^\circ C$



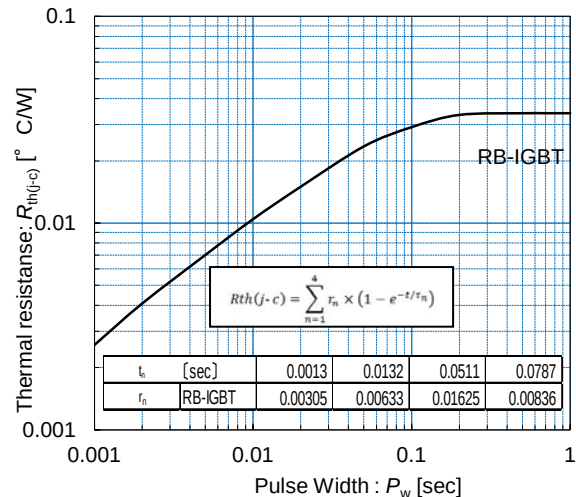
Reverse recovery withstand capability for RB-IGBT
 $T_{vj} = 125^\circ C$



Transient Thermal Resistance (max.)



Transient Thermal Resistance (max.)



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