

4MBI220VF-170R2-50

IGBT Modules

IGBT Power Module (V series)

1700V/220A/IGBT, ±1200V/220A/RB-IGBT, 4-in-1 package

■ Features

Higher efficiency
Optimized Advanced T-type circuit
Low inductance module structure

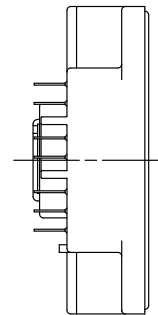
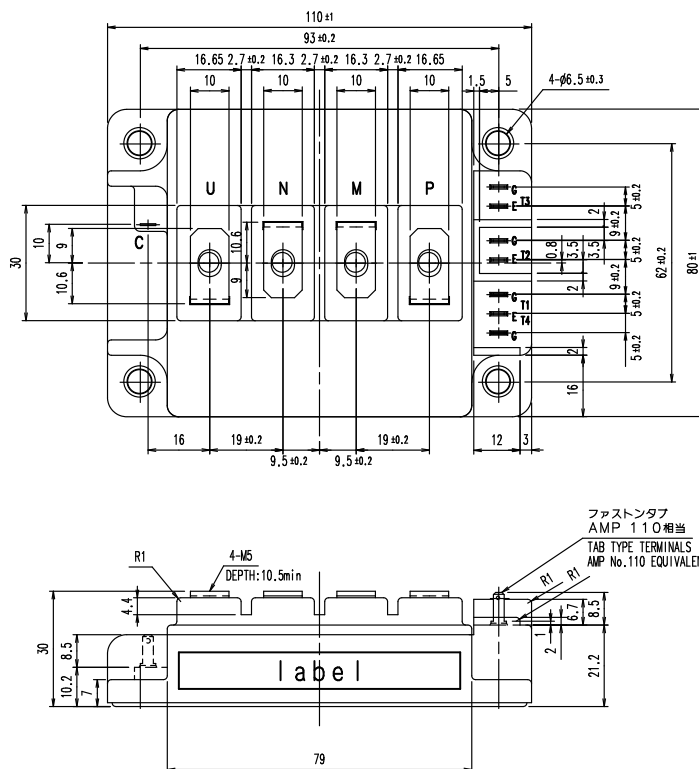
■ Applications

Inverter for motor drive
Uninterruptible powere supply
Power conditioner



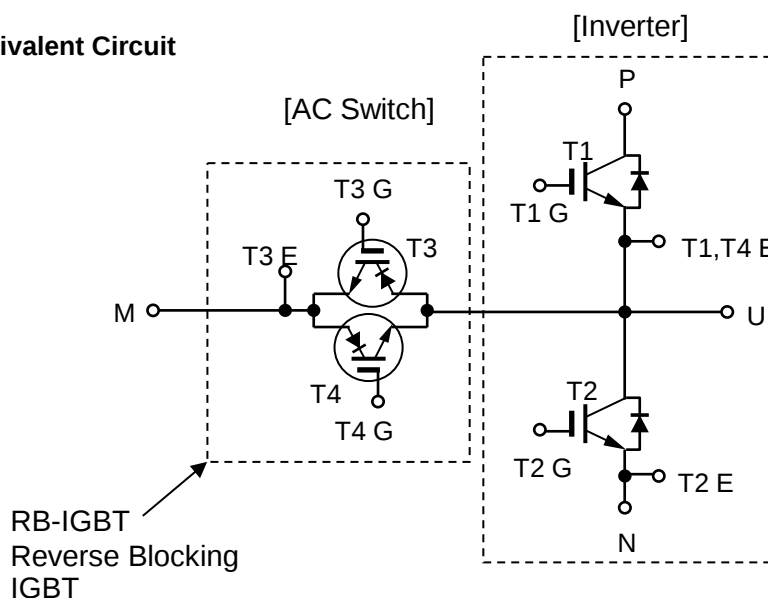
■ Outline drawing

(Unit : mm)



Weight: 460g (typ.)

■ 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	$T_c = 80^\circ\text{C}$	220	A
				$T_c = 80^\circ\text{C}$	400	
		$-I_C$	1ms	$T_c = 80^\circ\text{C}$	220	
				$T_c = 80^\circ\text{C}$	400	
	Collector power dissipation	P_C	1 device		1500	W
	Junction temperature	T_{vj}			175	$^\circ\text{C}$
	Operating temperature (under switching conditions)	T_{vjop}			150	
AC Switch	Collector-Emitter voltage	V_{CES}			± 1200	V
	Gate-Emitter voltage	V_{GES}			± 20	V
	Collector current	I_C	Continuous	$T_c = 80^\circ\text{C}$	220	A
				$T_c = 80^\circ\text{C}$	400	
	Collector power dissipation	P_C	1 device		1865	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)	V_{iso}	AC : 1min.		2500	VAC
Screw torque	Mounting (*2)	-	M5 or M6		3.5	Nm
	Terminal (*3)	-	M5		3.5	

(*1) All terminals should be connected together during the test.

(*2) Recommendable value : 2.5-3.5 Nm (M5 or M6)

(*3) Recommendable value : 2.5-3.5 Nm (M5)

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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}	$V_{GE} = 0\text{V}$ $V_{CE} = 1700\text{V}$	-	-	2.0	mA
	Gate-Emitter leakage current	I_{GES}	$V_{GE} = 0\text{V}$ $V_{GE} = \pm 20\text{V}$	-	-	400	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 200\text{mA}$	6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	$V_{GE} = 15\text{V}$ $I_C = 200\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	2.00	V
				$T_{vj}=125^{\circ}\text{C}$	-	2.45	
				$T_{vj}=150^{\circ}\text{C}$	-	2.50	
		$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 200\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	2.15	
				$T_{vj}=125^{\circ}\text{C}$	-	2.60	
				$T_{vj}=150^{\circ}\text{C}$	-	2.65	
	Internal gate resistance	r_g	-	-	3.75	-	Ω
	Input capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	19.8	-	nF
	Turn-on time	t_{on}	SW mode : A $V_{cc} = 500\text{V}$ $I_C = 300\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = +1/-1\Omega$ $L_S = 50\text{nH}$	-	0.70	-	μs
		t_r		-	0.30	-	
		$t_{r(l)}$		-	0.05	-	
	Turn-off time	t_{off}		-	0.65	-	μs
		t_f		-	0.08	-	
				-	0.08	-	
	Forward on voltage	V_F (chip)	$I_F = 200\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.80	V
				$T_{vj}=125^{\circ}\text{C}$	-	2.00	
				$T_{vj}=150^{\circ}\text{C}$	-	2.00	
		V_F (terminal)	$I_F = 200\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.85	
				$T_{vj}=125^{\circ}\text{C}$	-	2.05	
				$T_{vj}=150^{\circ}\text{C}$	-	2.05	
	Reverse recovery time	t_{rr}	SW mode : B $V_{cc} = 500\text{V}$ $I_F = 200\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = +1/-1\Omega$	-	0.16	-	μs
AC Switch	Zero gate voltage collector current	I_{CES}	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	-	-	4.0	mA
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}$ $V_{GE} = \pm 20\text{V}$	-	-	800	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 200\text{mA}$	5.5	6.5	7.5	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (chip)	$V_{GE} = 15\text{V}$ $I_C = 200\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	2.70	V
				$T_{vj}=125^{\circ}\text{C}$	-	3.00	
		$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 200\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	2.75	
				$T_{vj}=125^{\circ}\text{C}$	-	3.05	
	Internal gate resistance	r_g	-	-	2.50	-	Ω
	Input capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	17.6	-	nF
	Turn-on time	t_{on}	SW mode : B $V_{cc} = 500\text{V}$ $I_C = 200\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = +1/-1\Omega$ $L_S = 50\text{nH}$	-	0.25	-	μs
		t_r		-	0.15	-	
		$t_{r(l)}$		-	0.05	-	
	Turn-off time	t_{off}		-	0.30	-	μs
		t_f		-	0.05	-	
	Reverse recovery time	t_{rr}	SW mode : A $V_{cc} = 500\text{V}$ $I_C = 200\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = +1/-1\Omega$	-	0.15	-	μs
	Internal inductance	L	P-N	-	40	-	nH
			P-M	-	33	-	
			M-N	-	33	-	

■ Thermal resistance characteristics

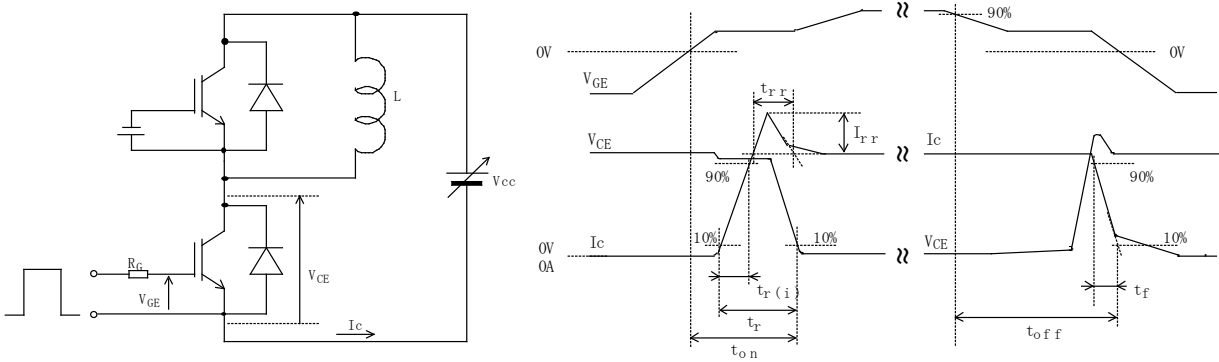
Item	Symbol	Condition	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	T1, T2 IGBT	-	-	0.100	$^{\circ}\text{C/W}$
		T1, T2 FWD	-	-	0.164	
		T3, T4 RB-IGBT	-	-	0.067	
Contact thermal resistance (1device) (*1)	$R_{th(c-f)}$	T1, T2	-	0.025	-	
		T3, T4 with thermal compound	-	0.013	-	

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

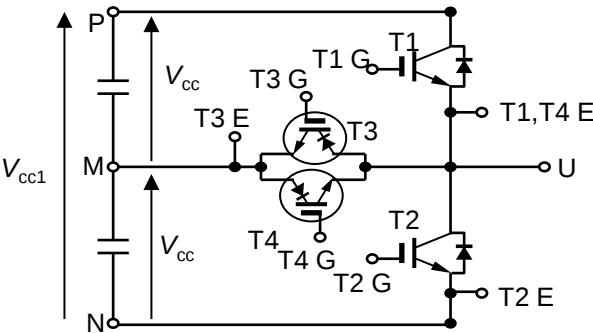
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Definitions of switching time



Definitions of switching mode



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

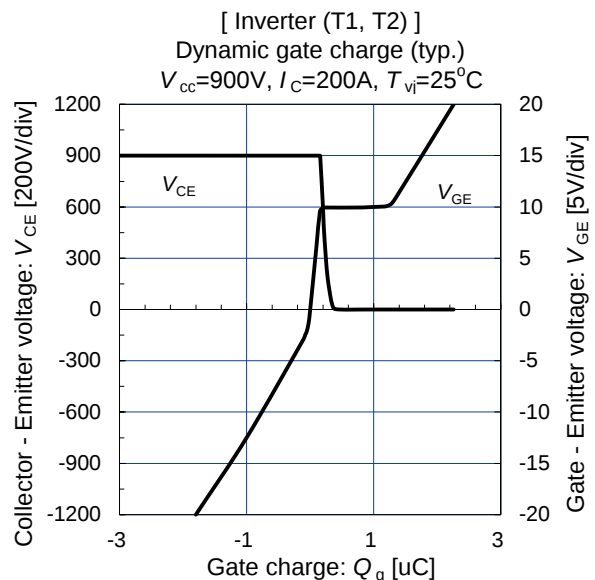
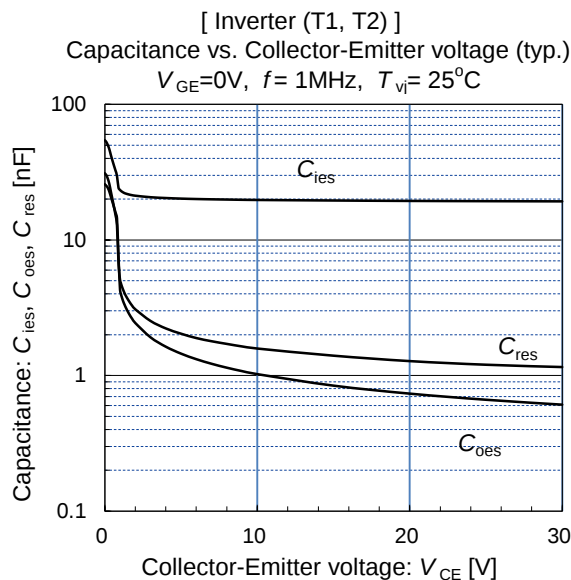
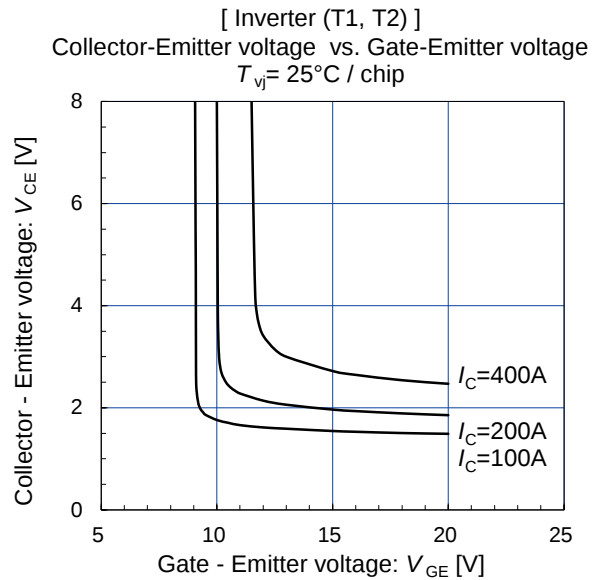
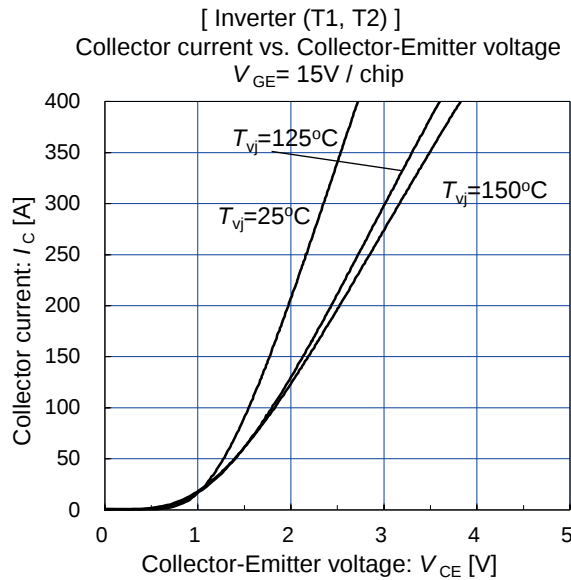
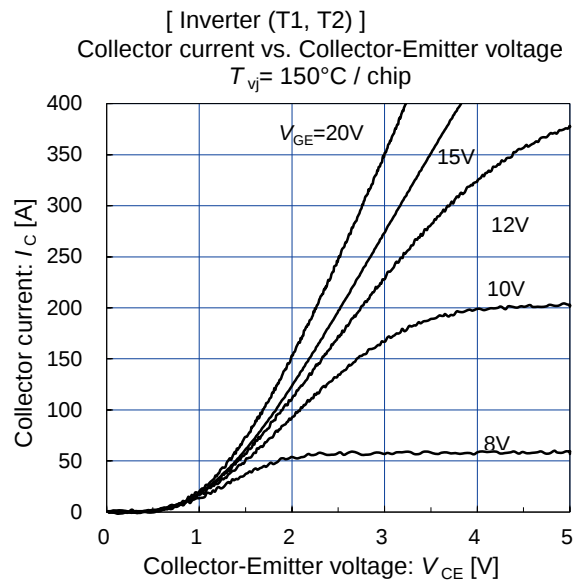
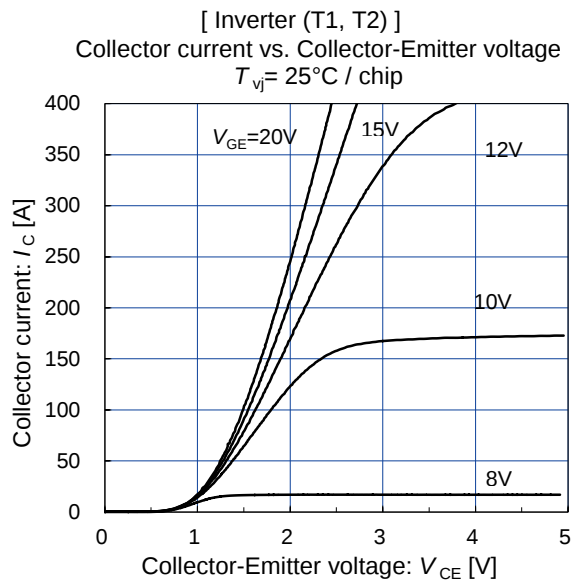
SW: Connect to drive circuit and input gate signal
ON: Bias voltage of gate +15V
OFF: Reverse bias voltage of gate -15V
 $V_{cc}=V_{cc1}/2$

Warning

When reverse voltage is applied to C-E of RB-IGBT without forward gate bias voltage (+V_{GE}), the reverse leakage current at C-E will be large. In order to reduce the reverse leakage current, +V_{GE} should be applied to G-E of RB-IGBT when reverse voltage is being applied to C-E. (Recommended value : +V_{GE}=15V)

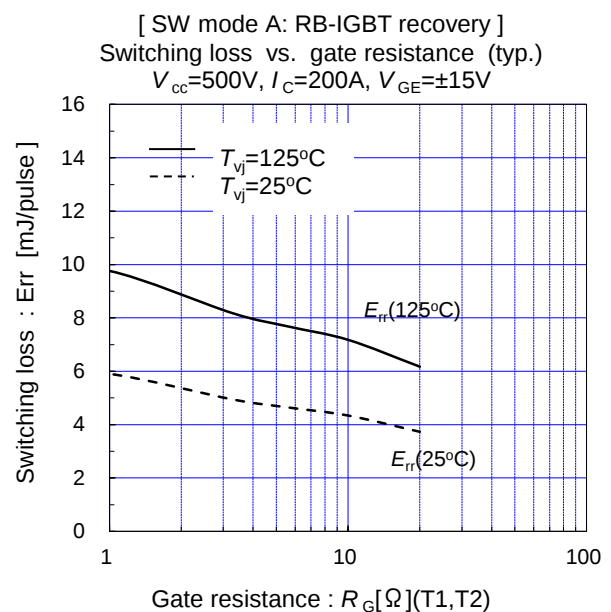
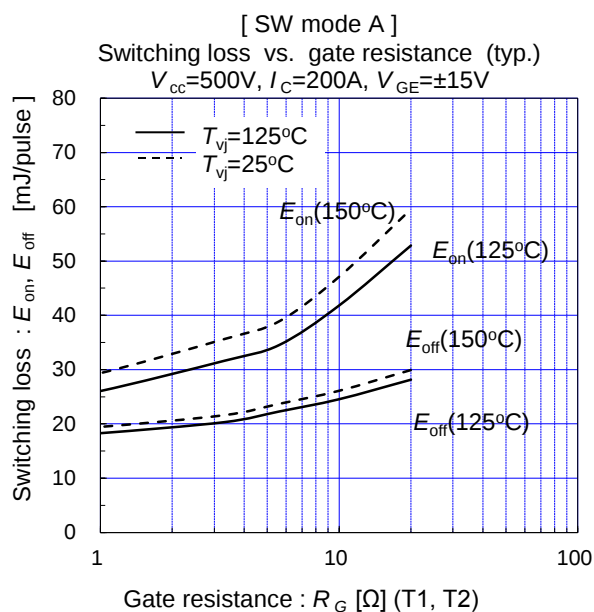
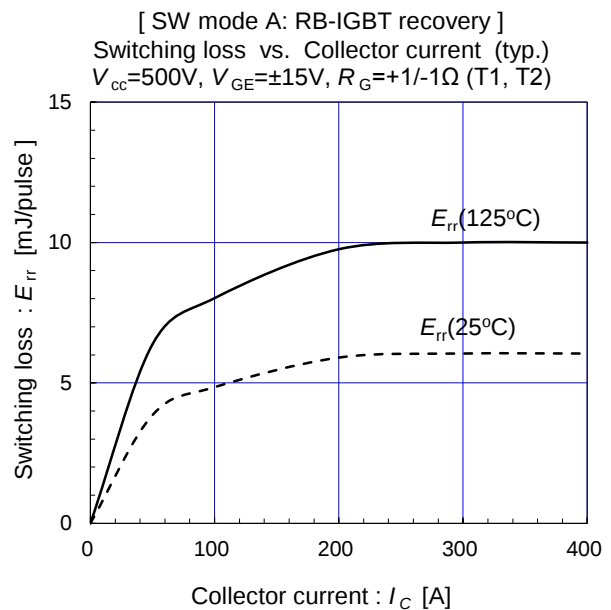
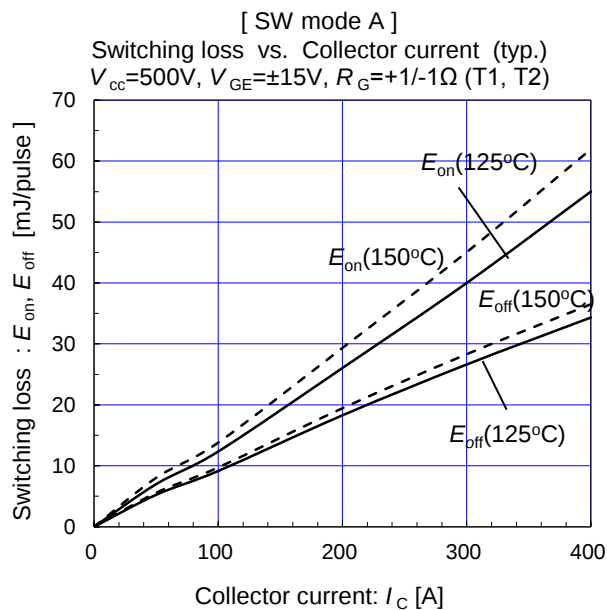
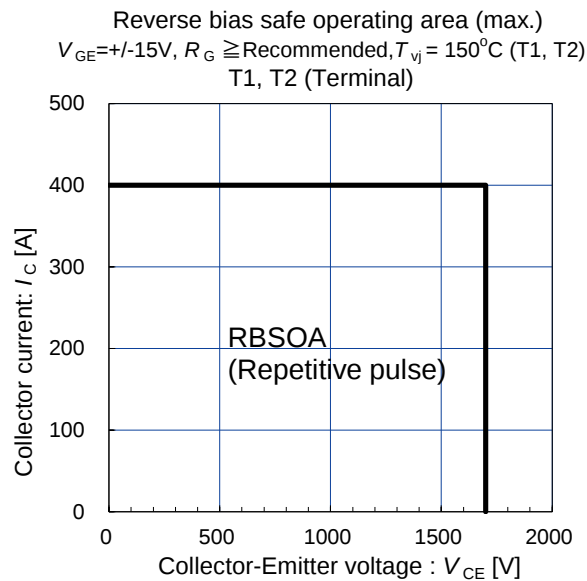
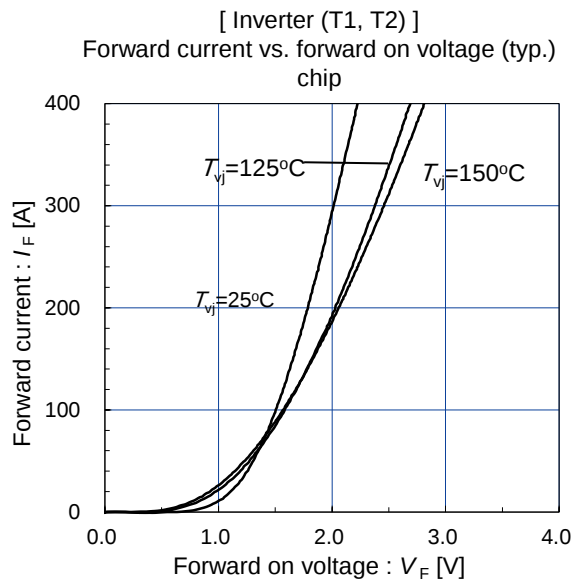
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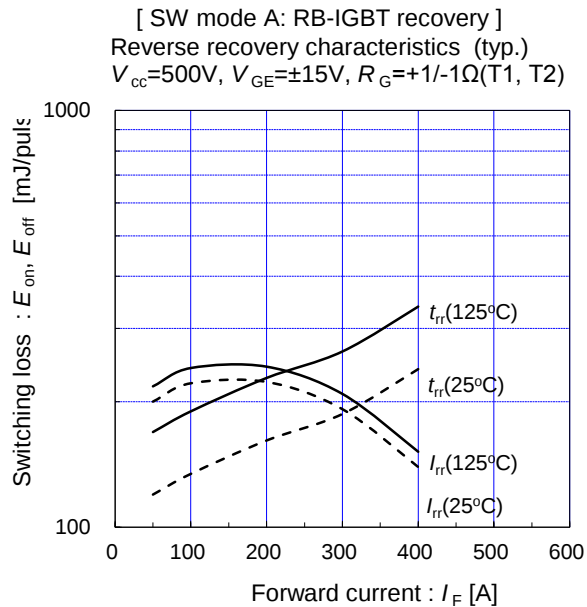
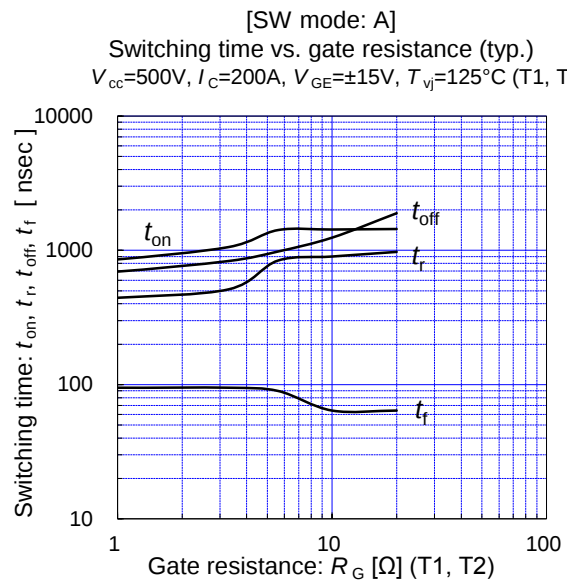
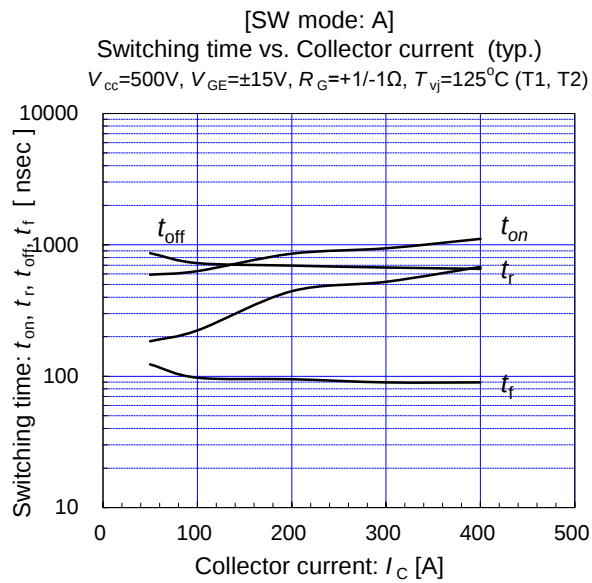
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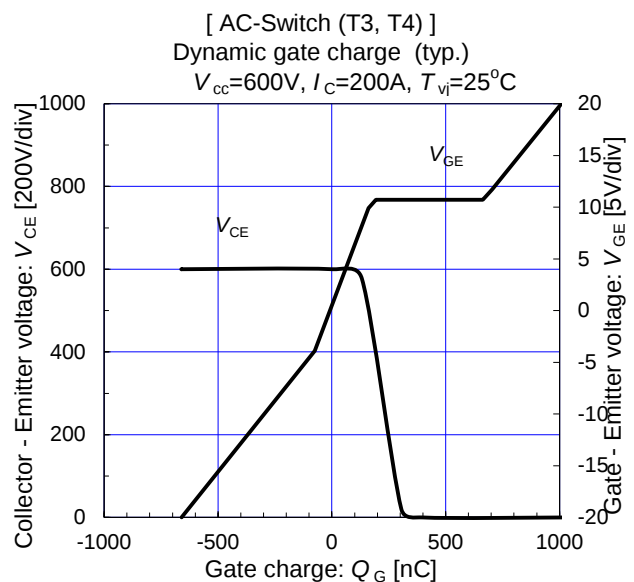
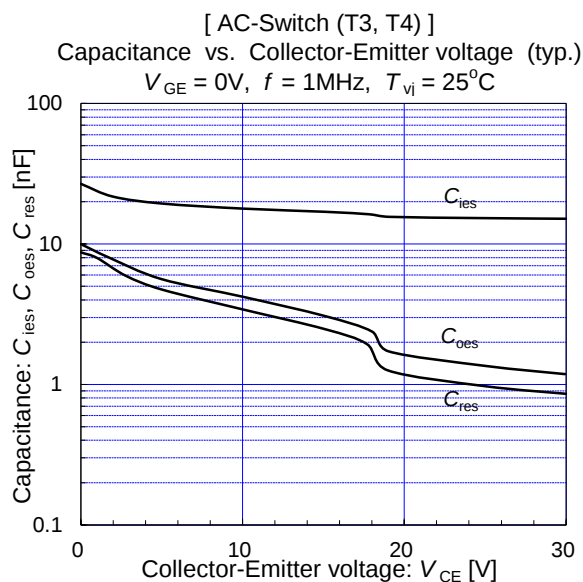
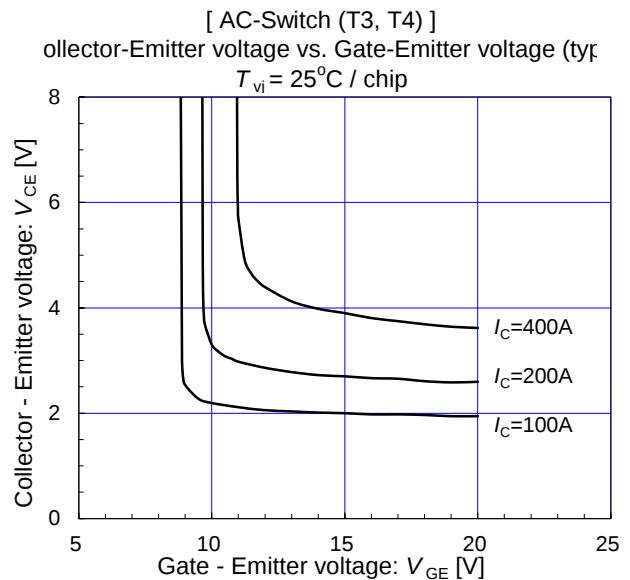
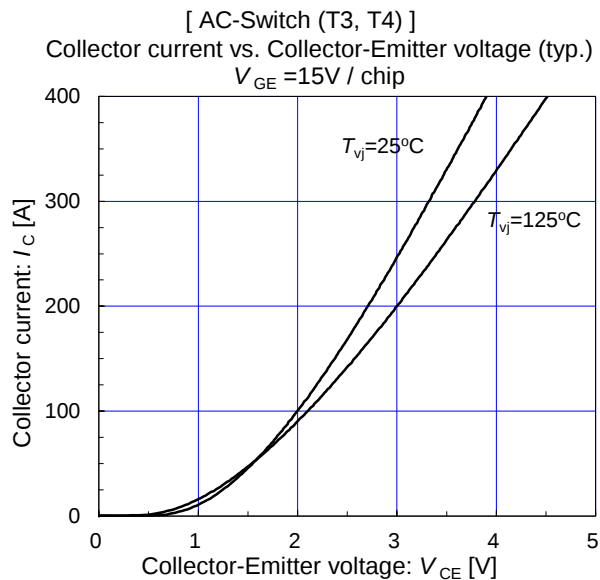
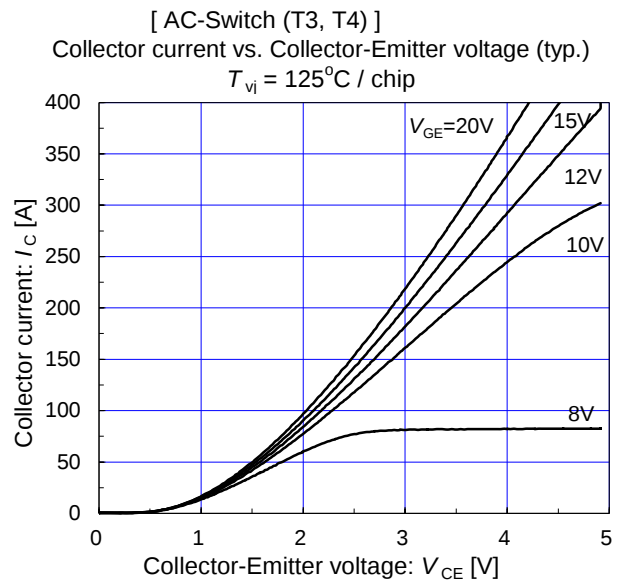
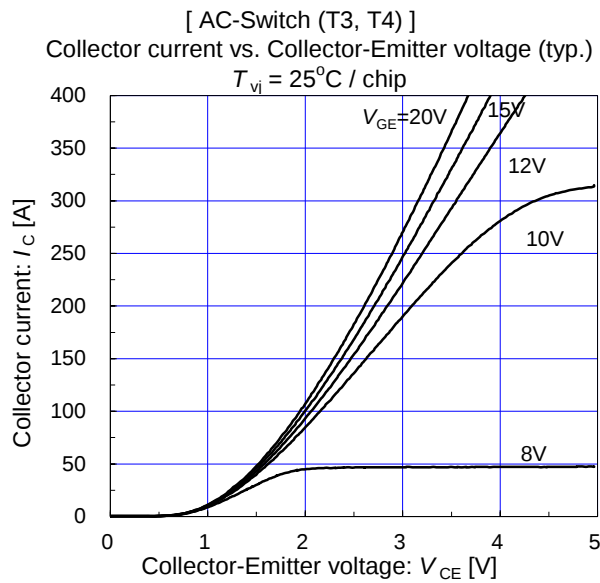
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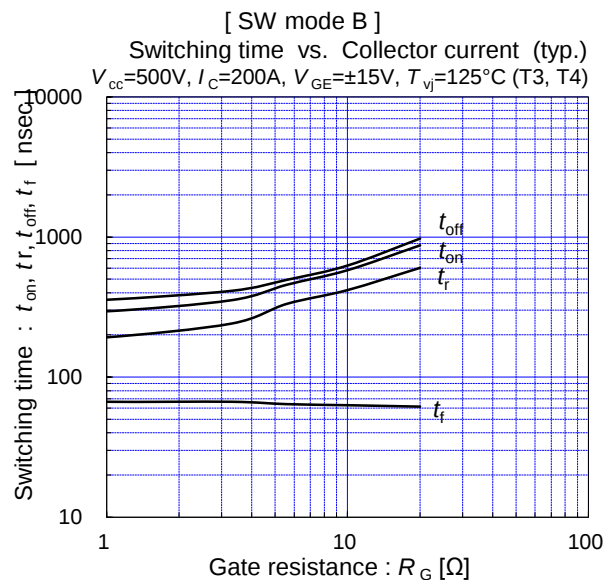
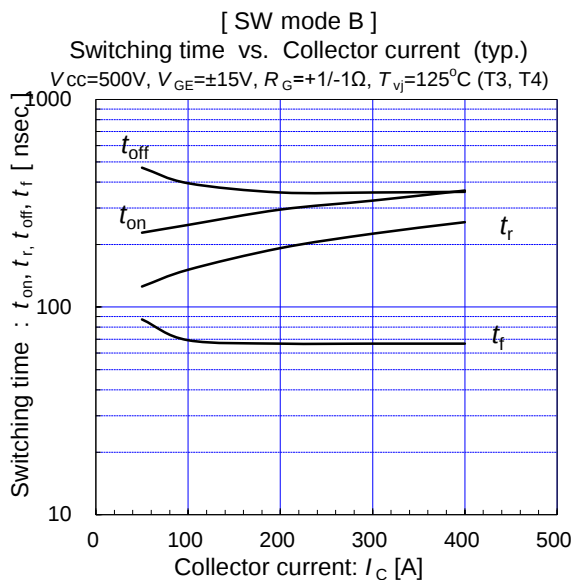
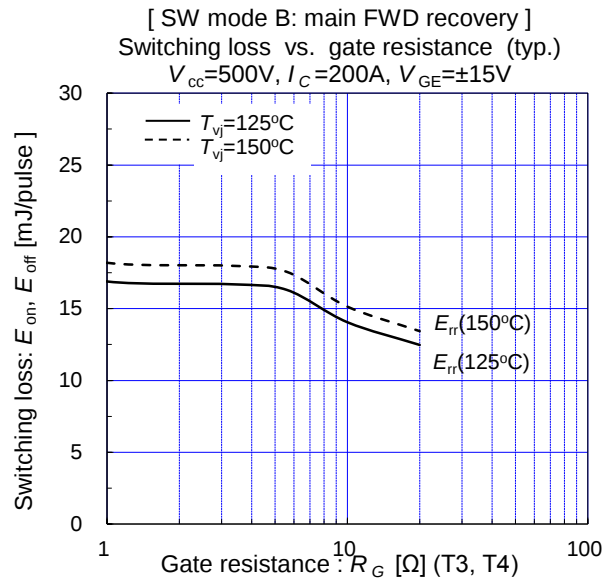
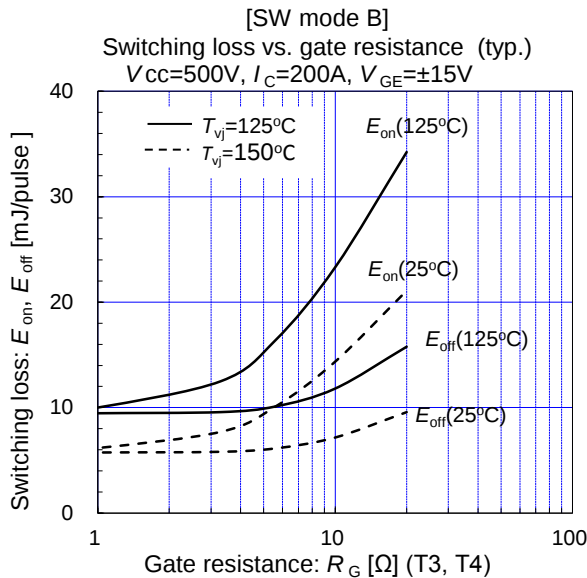
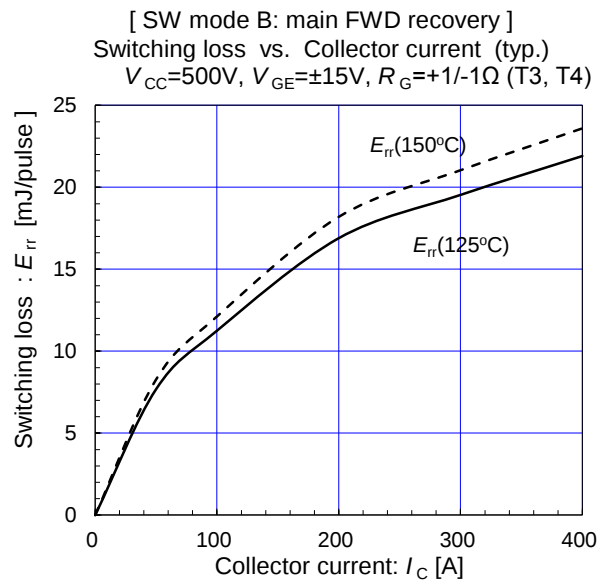
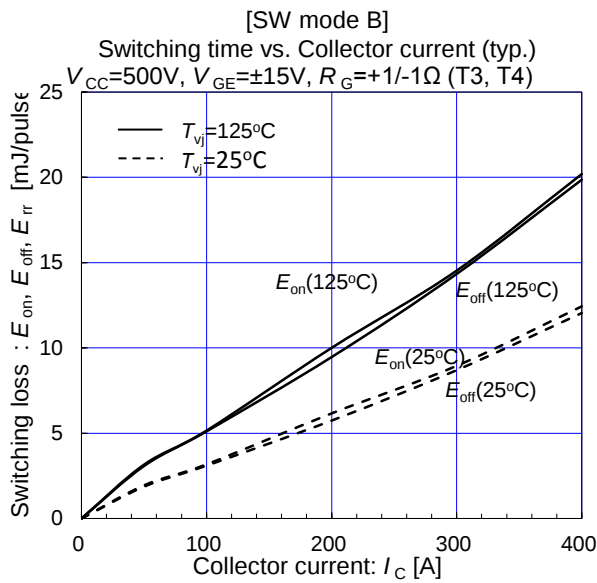
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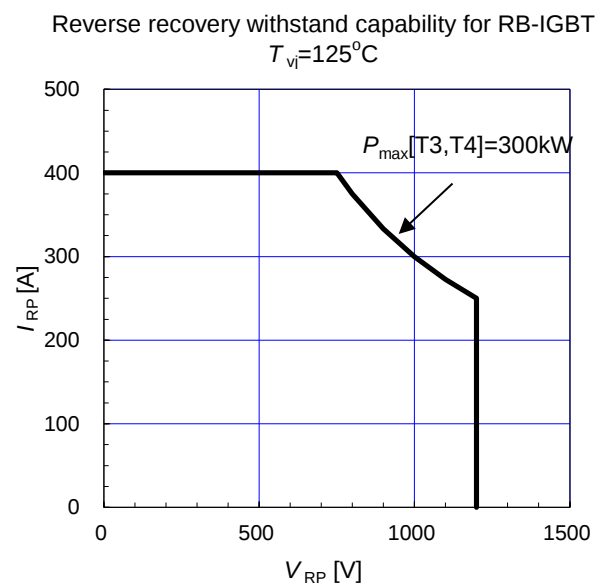
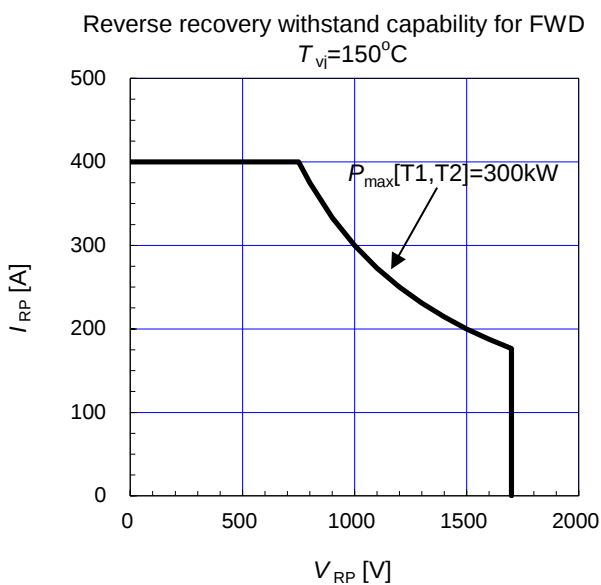
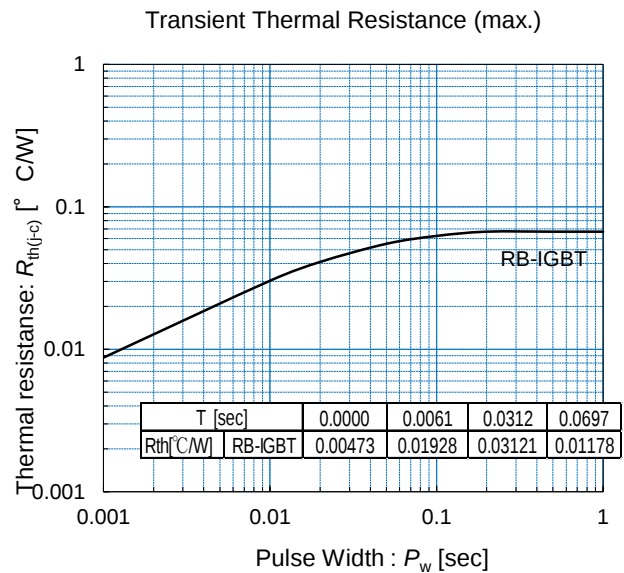
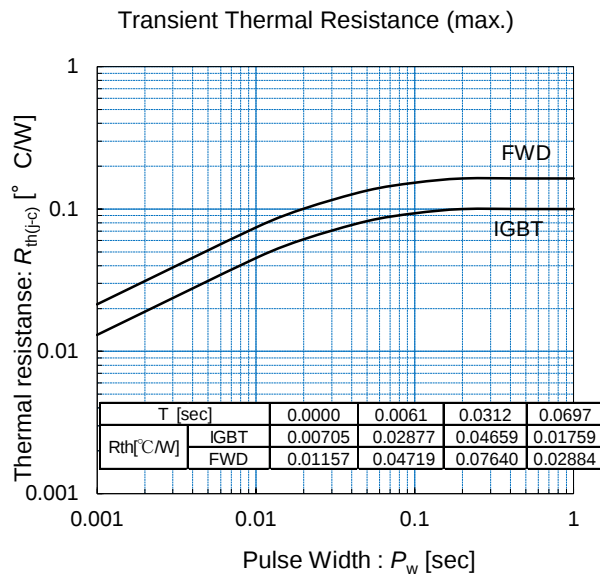
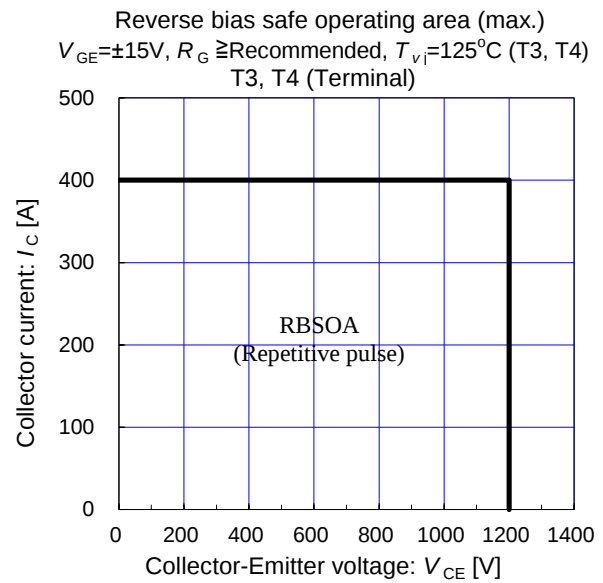
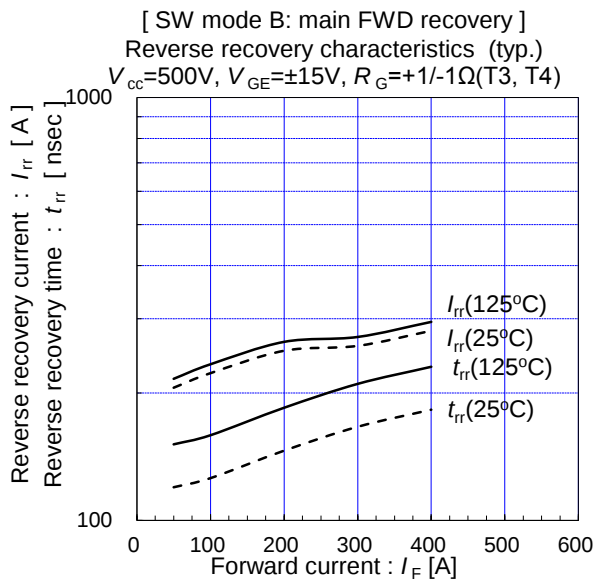
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