

2MBI400XDE065-50

IGBT Modules

Power Module (X series)
650V / 400A / 2-in-1 package

■ **Features**

- LOW $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

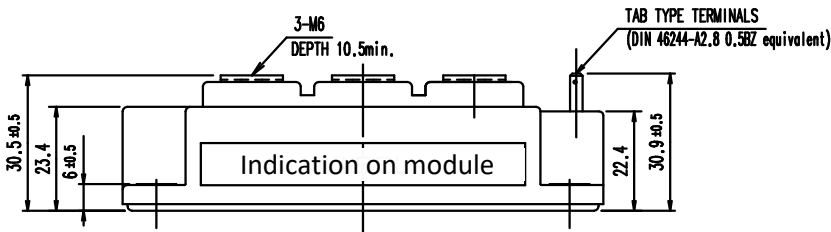
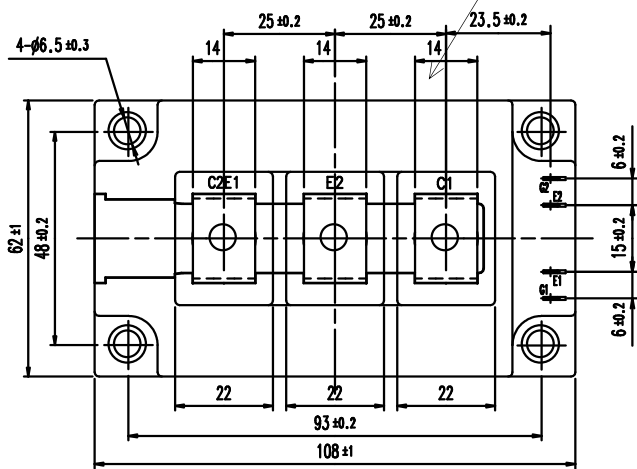
■ **Applications**

- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems,
- Industrial machines, such as Welding machines



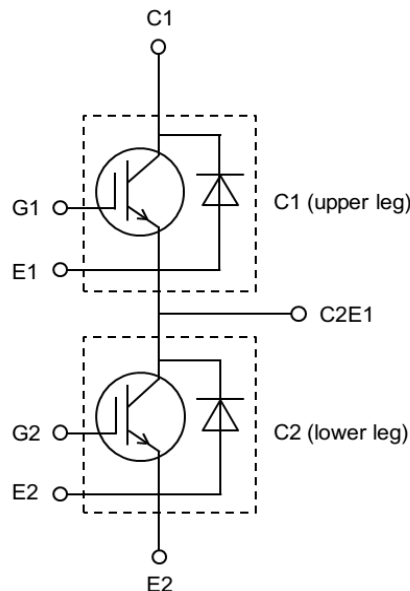
■ **Outline drawing (Unit : mm)**

Characteristics indication



Weight: 370g(typ.)

■ **Equivalent Circuit**



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■ Absolute Maximum Ratings (at $T_C=25^{\circ}\text{C}$ unless otherwise specified)

Items		Symbols	Conditions	Maximum Ratings	Units
Collector-Emitter voltage, Gate-Emitter short-circuited		V_{CES}		650	V
Gate-Emitter voltage, Collector-Emitter short-circuited		V_{GES}		± 20	V
Collector current		I_C	Continuous $T_C=100^{\circ}\text{C}$	400	A
Repetitive peak collector current		I_{CRM}	1ms	800	
Forward current		I_F		400	
Repetitive peak forward current		I_{FRM}	1ms	800	
Total power dissipation		P_{tot}	1 device	1740	W
Virtual Junction temperature		T_{vj}		175	$^{\circ}\text{C}$
Operating virtual junction temperature		T_{vjop}		175	
Case temperature		T_C		125	
Storage temperature		T_{stg}		-40 ~ 125	
Isolation voltage	between terminal and copper base (*1)	V_{isol}	AC: 1min.	4000	Vrms
Mounting torque of screws to heat sink(*2)		M_s	M5 or M6	6.0	N m
Mounting torque of screws to terminals(*2)		M_t	M6	5.0	

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

(*2) Recommendable Value: Mounting 3.0 ~ 6.0N·m (M5 or M6)
 Recommendable Value: Terminals 2.5 ~ 5.0 N·m (M6)

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■ Electrical characteristics (at $T_{vj}= 25^{\circ}\text{C}$ unless otherwise specified)

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	$V_{GE} = 0\text{V}$ $V_{CE} = 650\text{V}$	-	-	200	μA	
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-	-	400	nA	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 400\text{mA}$	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 400\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.45	1.90	V
			$T_{vj}=25^{\circ}\text{C}$	-	1.30	1.75	
	$T_{vj}=125^{\circ}\text{C}$		-	1.45	-		
	$T_{vj}=150^{\circ}\text{C}$		-	1.50	-		
	$T_{vj}=175^{\circ}\text{C}$		-	1.55	-		
Internal gate resistance	r_g	-	-	1.69	-	Ω	
			-	46	-	nF	
Input capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	1.8	-		
Output capacitance	C_{oes}		-	0.62	-		
Reverse transfer capacitance	C_{res}		-	3.3	-		μC
Gate charge	Q_G		$V_{CC} = 300\text{V}, I_C = 400\text{A}$ $V_{GE} = -15 \rightarrow +15\text{V}$	-	3.3	-	
Forward voltage	V_F (terminal)	$V_{GE} = 0\text{V}$ $I_F = 400\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.70	2.15	V
			$T_{vj}=25^{\circ}\text{C}$	-	1.55	2.00	
	$T_{vj}=125^{\circ}\text{C}$		-	1.50	-		
	$T_{vj}=150^{\circ}\text{C}$		-	1.50	-		
	$T_{vj}=175^{\circ}\text{C}$		-	1.45	-		
Turn-on delay time (*1)	$t_{d(on)}$	$V_{CC} = 300\text{V}$ $I_C, I_F = 400\text{A}$ $V_{GE} = +15/ -15\text{V}$ $R_G = 6.8 \Omega$ $L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	0.45	-	μs
			$T_{vj}=125^{\circ}\text{C}$	-	0.49	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.51	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.52	-	
Rise time (*1)	t_r		$T_{vj}=25^{\circ}\text{C}$	-	0.16	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.18	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.18	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.20	-	
Turn-off delay time (*1)	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.61	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.63	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.65	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.66	-	
Fall time (*1)	t_f		$T_{vj}=25^{\circ}\text{C}$	-	0.07	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.09	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.10	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.10	-	
Reverse recovery time	t_{rr}	$T_{vj}=25^{\circ}\text{C}$	-	0.12	-		
		$T_{vj}=125^{\circ}\text{C}$	-	0.22	-		
		$T_{vj}=150^{\circ}\text{C}$	-	0.23	-		
		$T_{vj}=175^{\circ}\text{C}$	-	0.26	-		

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$

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■ Electrical characteristics (at $T_{vj}= 25^{\circ}\text{C}$ unless otherwise specified)

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Turn-on energy	E_{on}	$V_{CC} = 300\text{V}$ $I_C, I_F = 400\text{A}$ $V_{GE} = +15/ -15\text{V}$ $R_G = 6.8 \Omega$ $L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	18.1	-	mJ
			$T_{vj}=125^{\circ}\text{C}$	-	22.3	-	
			$T_{vj}=150^{\circ}\text{C}$	-	23.0	-	
			$T_{vj}=175^{\circ}\text{C}$	-	23.7	-	
Turn-off energy	E_{off}		$T_{vj}=25^{\circ}\text{C}$	-	19.0	-	
			$T_{vj}=125^{\circ}\text{C}$	-	21.0	-	
			$T_{vj}=150^{\circ}\text{C}$	-	21.5	-	
			$T_{vj}=175^{\circ}\text{C}$	-	22.0	-	
Reverse recovery energy	E_{rr}		$T_{vj}=25^{\circ}\text{C}$	-	1.7	-	
			$T_{vj}=125^{\circ}\text{C}$	-	2.8	-	
			$T_{vj}=150^{\circ}\text{C}$	-	3.1	-	
			$T_{vj}=175^{\circ}\text{C}$	-	3.4	-	

NOTICE:

The external gate resistance (R_G) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment. We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

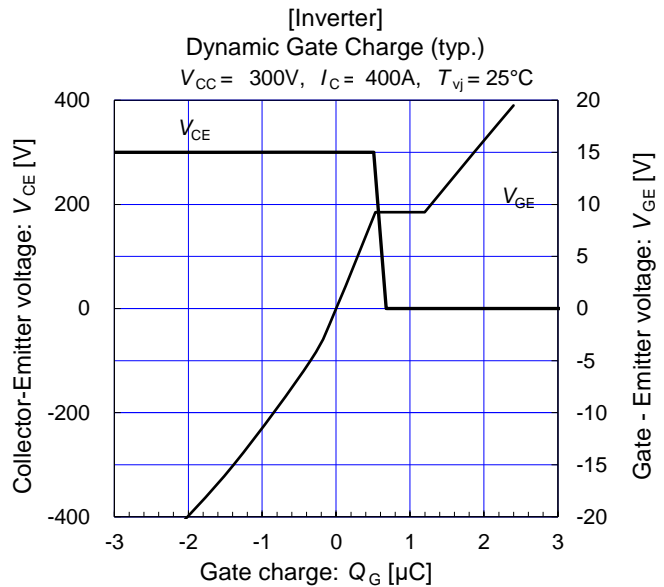
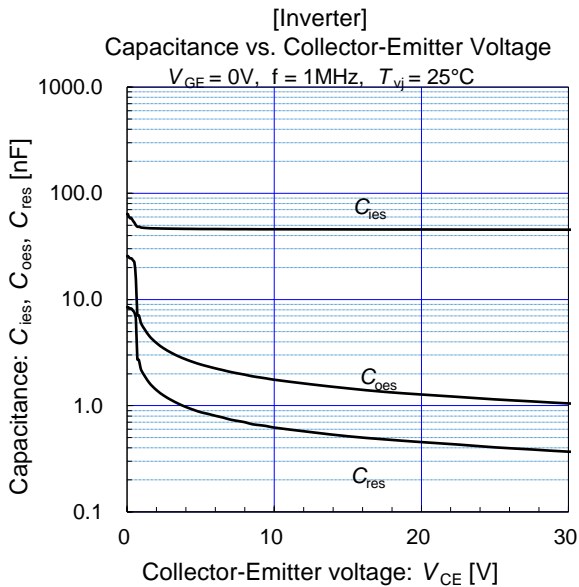
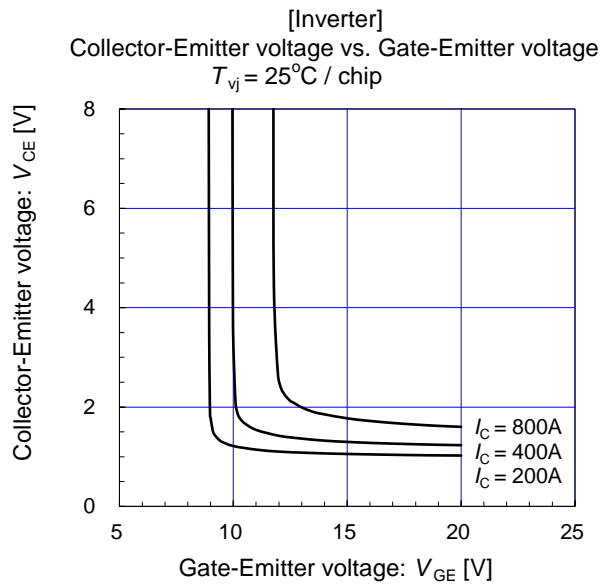
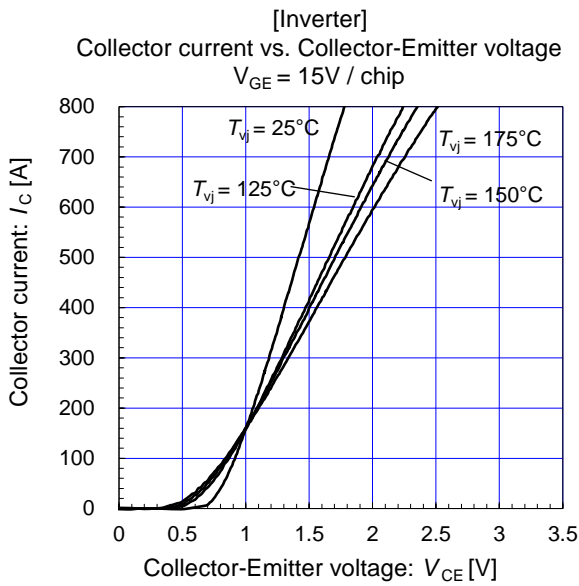
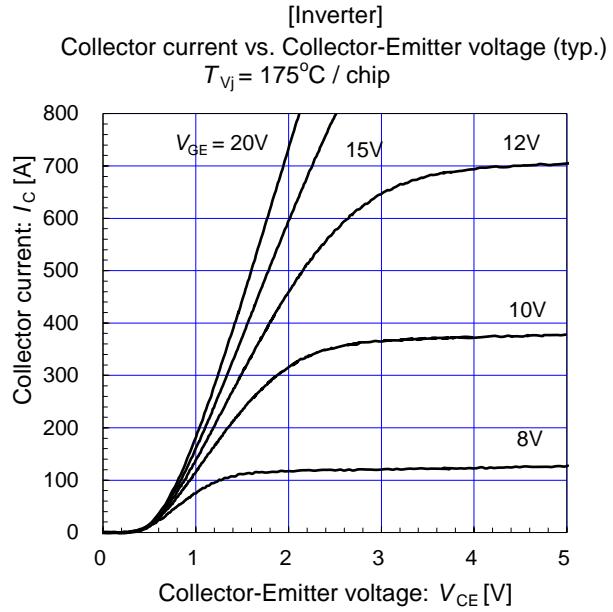
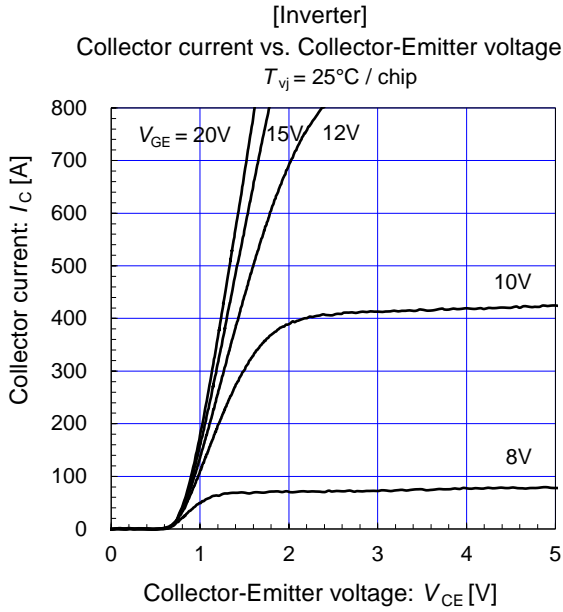
■ Thermal resistance characteristics

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.086	K/W
		Inverter FWD	-	-	0.116	
Thermal resistance case to heat sink (1IGBT + 1FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0125	-	

(*1) This is the value which is defined mounting on the additional heat sink with thermal grease.

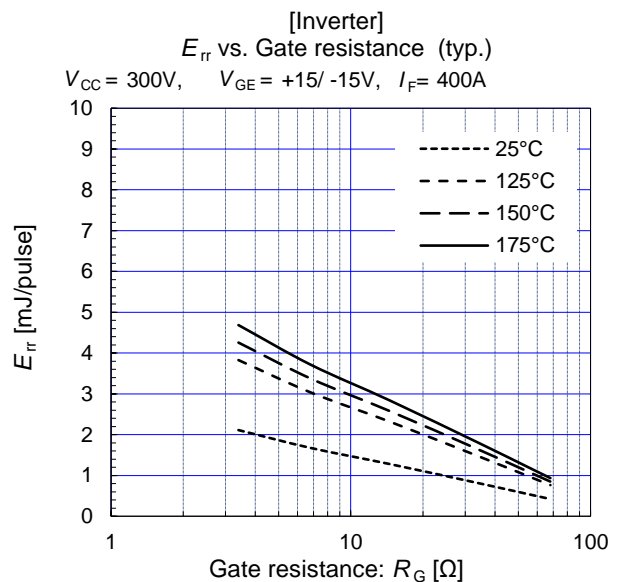
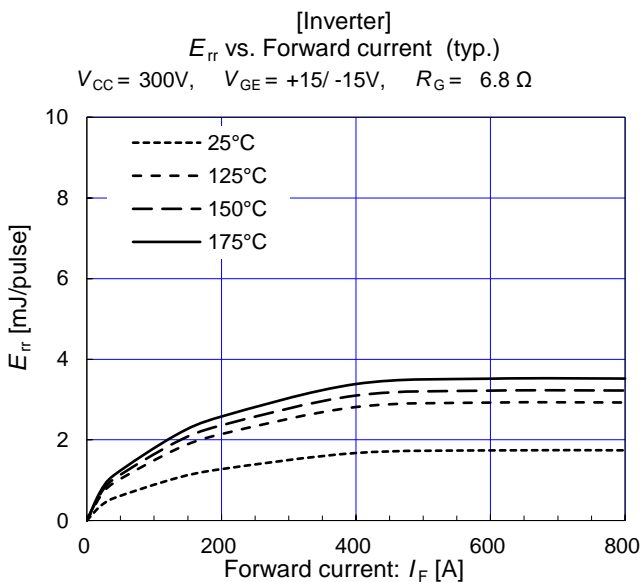
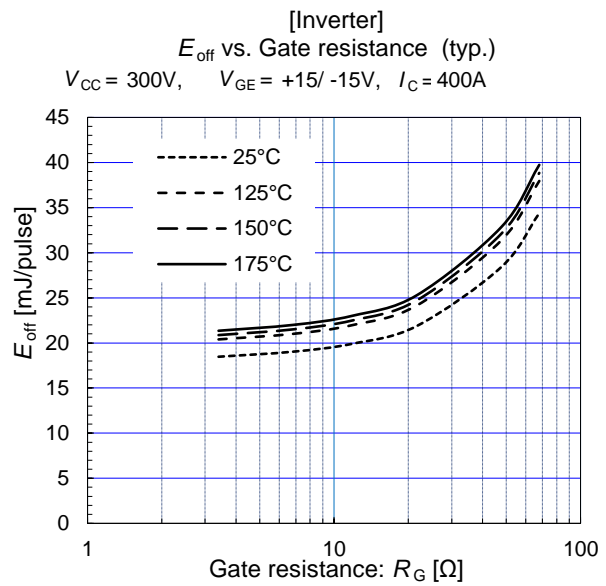
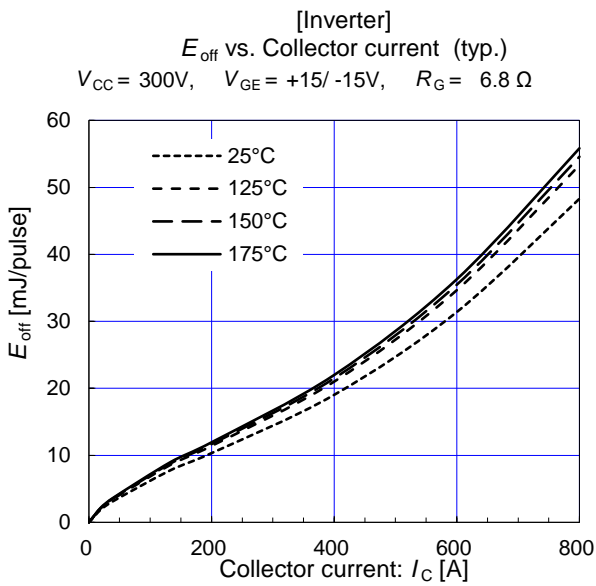
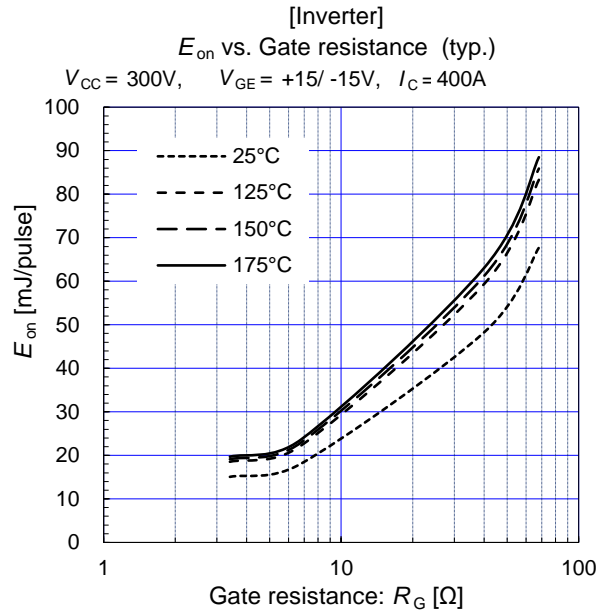
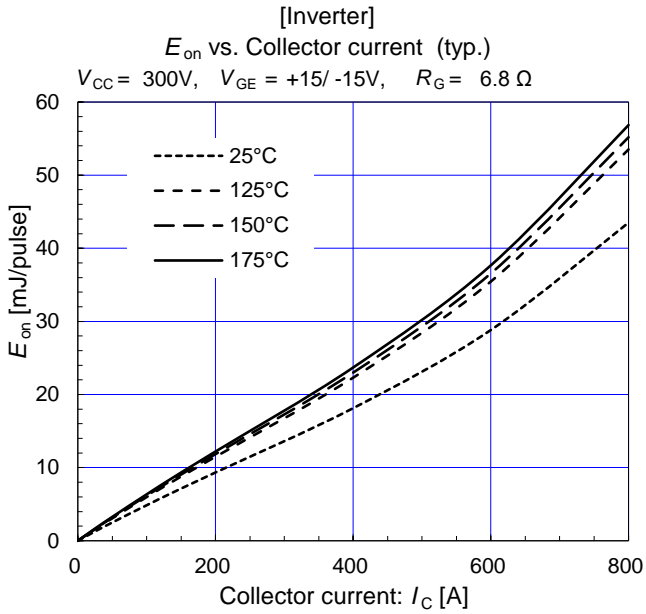
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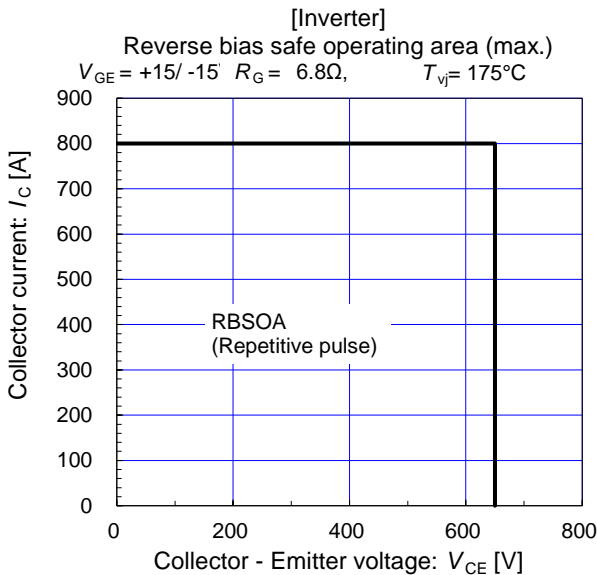
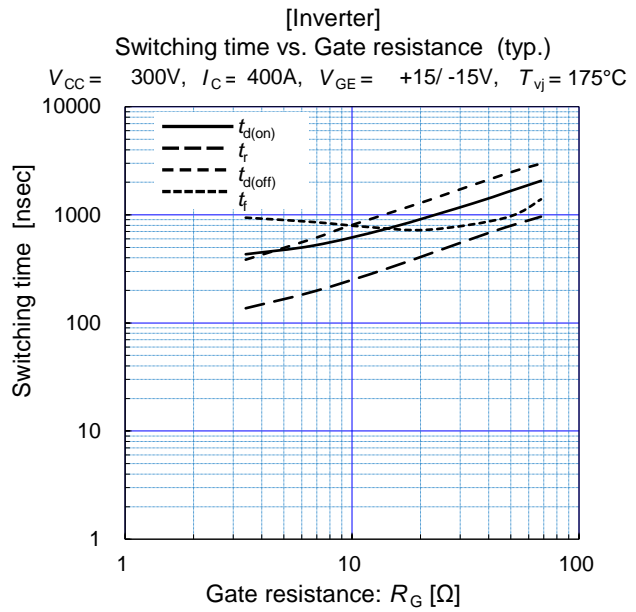
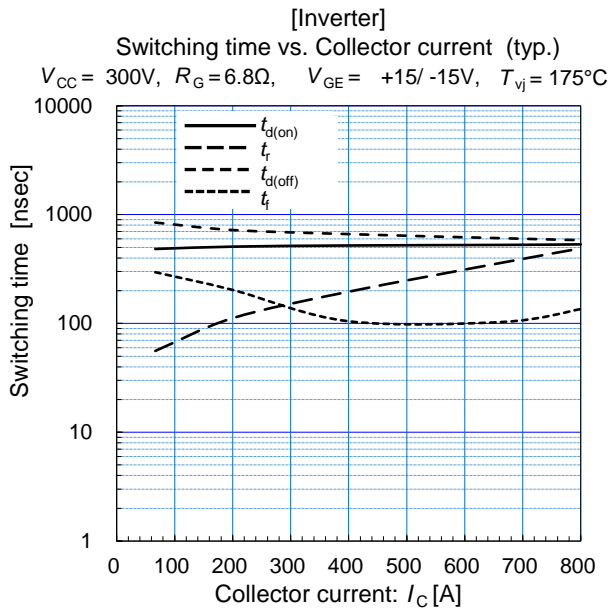
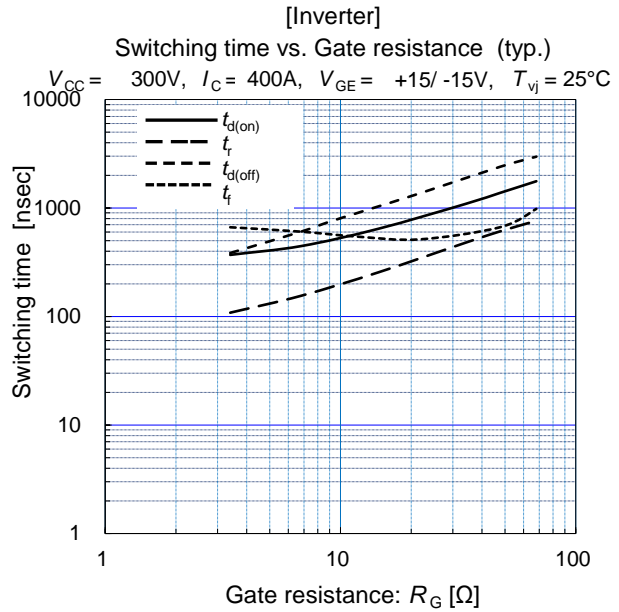
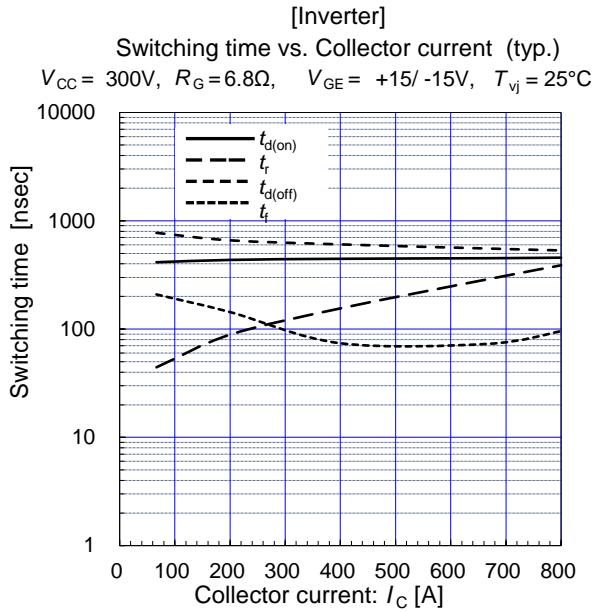
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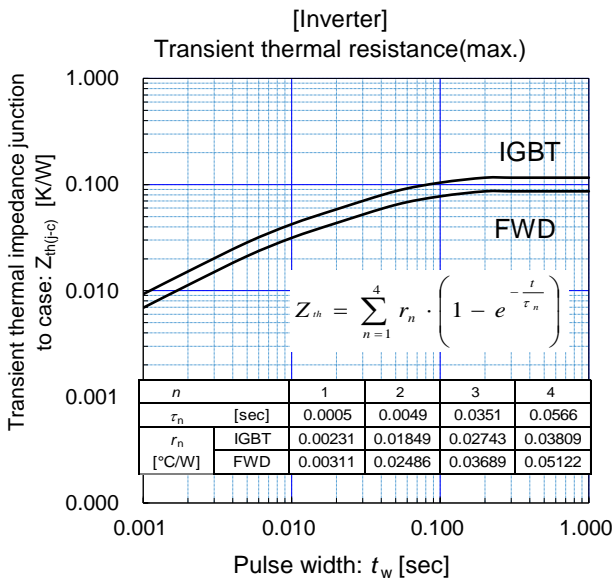
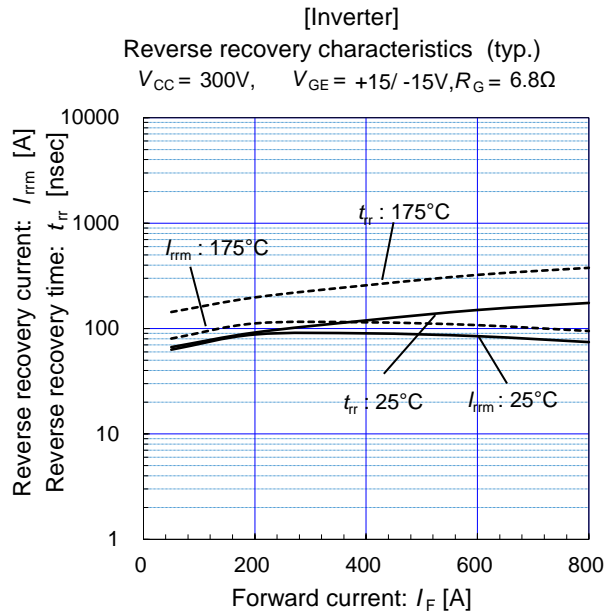
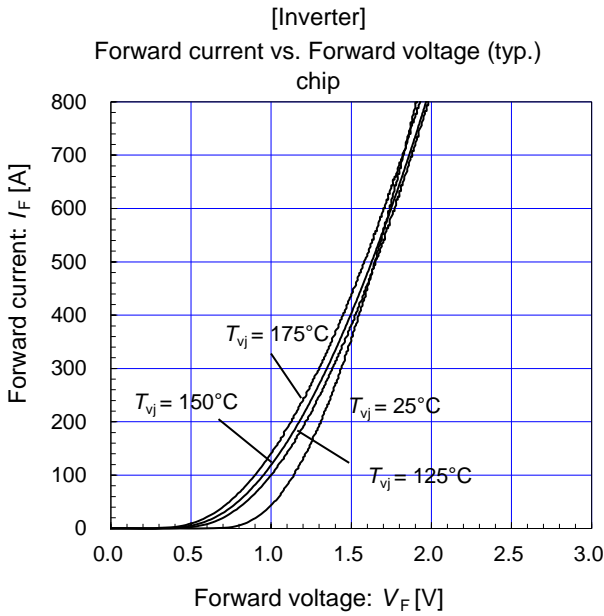
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