

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

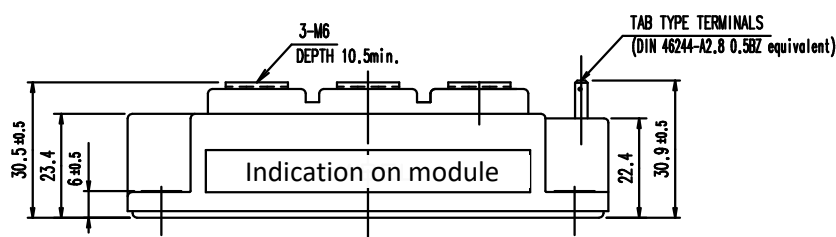
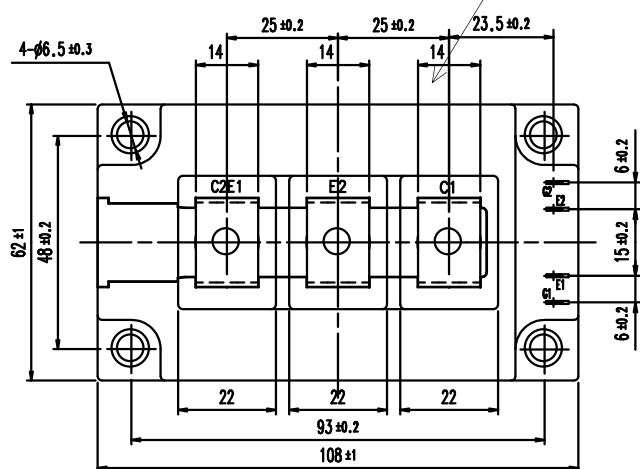
Uninterruptible Power Supply Systems,

Industrial machines, such as Welding machines



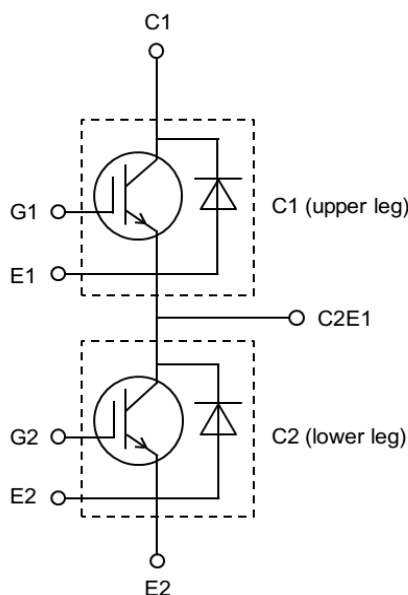
■ Outline drawing (Unit : mm)

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}	$V_{GE} = 0V$ $V_{CE} = 650V$		-	-	200	μA
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	400	nA
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 400mA$		6.0	6.5	7.0	V
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 400A$	$T_{vj}=25^{\circ}C$	-	1.45	1.90	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.30	1.75	
			$T_{vj}=125^{\circ}C$	-	1.45	-	
			$T_{vj}=150^{\circ}C$	-	1.50	-	
			$T_{vj}=175^{\circ}C$	-	1.55	-	
Internal gate resistance	r_g	-		-	1.69	-	Ω
Input capacitance	C_{ies}	$V_{CE}=10V, V_{GE}=0V, f=1MHz$		-	46	-	nF
Output capacitance	C_{oes}			-	1.8	-	
Reverse transfer capacitance	C_{res}			-	0.62	-	
Gate charge	Q_G	$V_{CC} = 300V, I_C = 400A$ $V_{GE} = -15 \rightarrow +15V$		-	3.3	-	μC
Forward voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F= 400A$	$T_{vj}=25^{\circ}C$	-	1.70	2.15	V
	V_F (chip)		$T_{vj}= 25^{\circ}C$	-	1.55	2.00	
			$T_{vj}=125^{\circ}C$	-	1.50	-	
			$T_{vj}=150^{\circ}C$	-	1.50	-	
			$T_{vj}=175^{\circ}C$	-	1.45	-	
Turn-on delay time (*1)	$t_{d(on)}$	$V_{CC} = 300V$ $I_C, I_F = 400A$ $V_{GE} = +15/-15V$ $R_G = 6.8 \Omega$ $L_S = 30 nH$	$T_{vj}= 25^{\circ}C$	-	0.45	-	μs
			$T_{vj}=125^{\circ}C$	-	0.49	-	
			$T_{vj}=150^{\circ}C$	-	0.51	-	
			$T_{vj}=175^{\circ}C$	-	0.52	-	
Rise time (*1)	t_r		$T_{vj}= 25^{\circ}C$	-	0.16	-	
			$T_{vj}=125^{\circ}C$	-	0.18	-	
			$T_{vj}=150^{\circ}C$	-	0.18	-	
			$T_{vj}=175^{\circ}C$	-	0.20	-	
Turn-off delay time (*1)	$t_{d(off)}$		$T_{vj}= 25^{\circ}C$	-	0.61	-	
			$T_{vj}=125^{\circ}C$	-	0.63	-	
			$T_{vj}=150^{\circ}C$	-	0.65	-	
			$T_{vj}=175^{\circ}C$	-	0.66	-	
Fall time (*1)	t_f		$T_{vj}= 25^{\circ}C$	-	0.07	-	
			$T_{vj}=125^{\circ}C$	-	0.09	-	
			$T_{vj}=150^{\circ}C$	-	0.10	-	
			$T_{vj}=175^{\circ}C$	-	0.10	-	
Reverse recovery time	t_{rr}		$T_{vj}= 25^{\circ}C$	-	0.12	-	
			$T_{vj}=125^{\circ}C$	-	0.22	-	
			$T_{vj}=150^{\circ}C$	-	0.23	-	
			$T_{vj}=175^{\circ}C$	-	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}	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}} = 400\text{A}$ $V_{\text{GE}} = +15/ -15\text{V}$ $R_{\text{G}} = 6.8 \ \Omega$ $L_{\text{S}} = 30 \ \text{nH}$	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	18.1	-	mJ
			$T_{\text{vj}} = 125^{\circ}\text{C}$	-	22.3	-	
			$T_{\text{vj}} = 150^{\circ}\text{C}$	-	23.0	-	
			$T_{\text{vj}} = 175^{\circ}\text{C}$	-	23.7	-	
Turn-off energy	E_{off}		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	19.0	-	
			$T_{\text{vj}} = 125^{\circ}\text{C}$	-	21.0	-	
			$T_{\text{vj}} = 150^{\circ}\text{C}$	-	21.5	-	
			$T_{\text{vj}} = 175^{\circ}\text{C}$	-	22.0	-	
Reverse recovery energy	E_{rr}		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	1.7	-	
			$T_{\text{vj}} = 125^{\circ}\text{C}$	-	2.8	-	
			$T_{\text{vj}} = 150^{\circ}\text{C}$	-	3.1	-	
			$T_{\text{vj}} = 175^{\circ}\text{C}$	-	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.

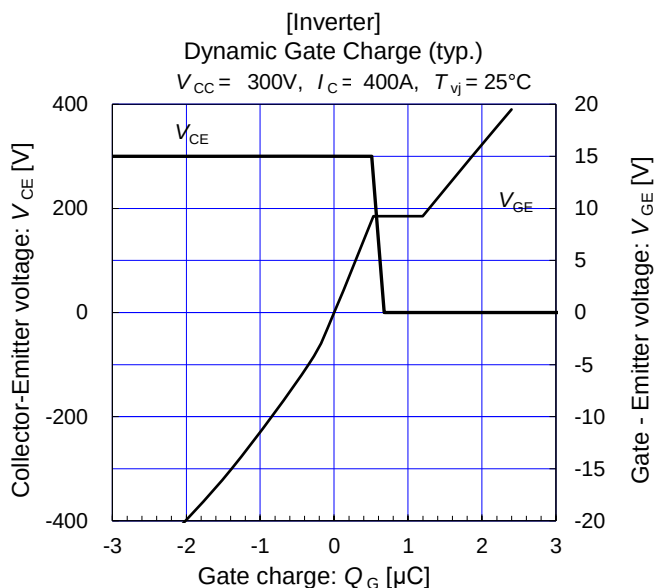
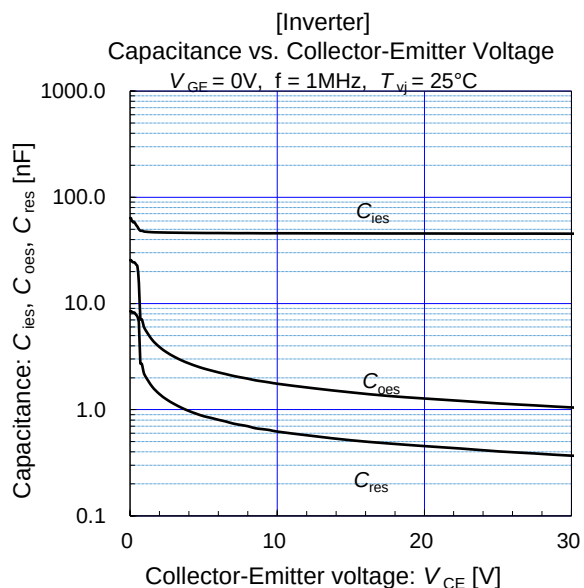
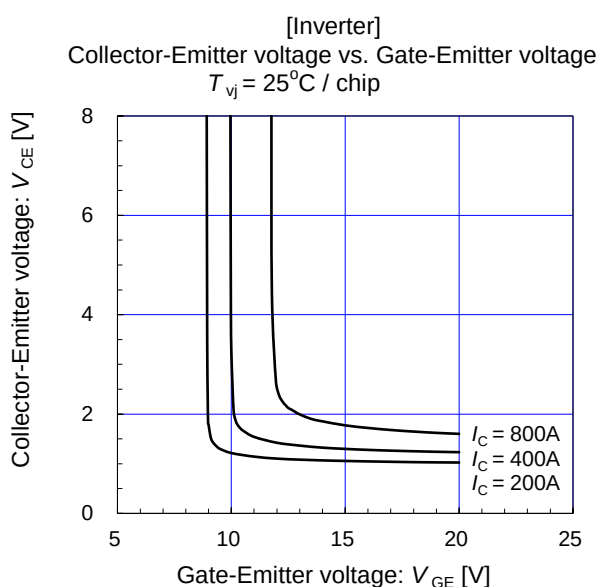
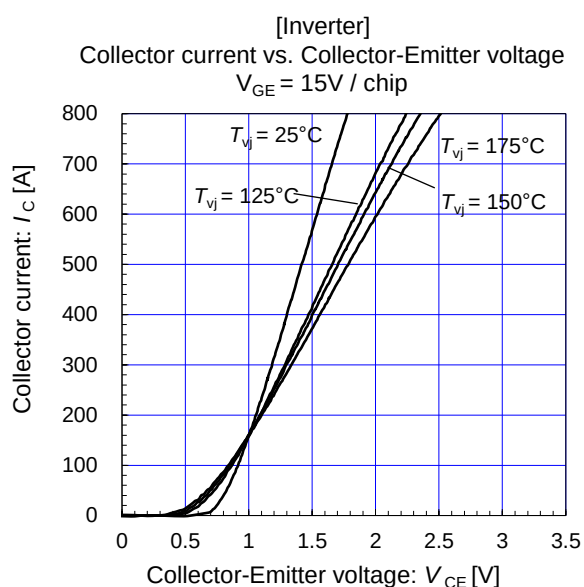
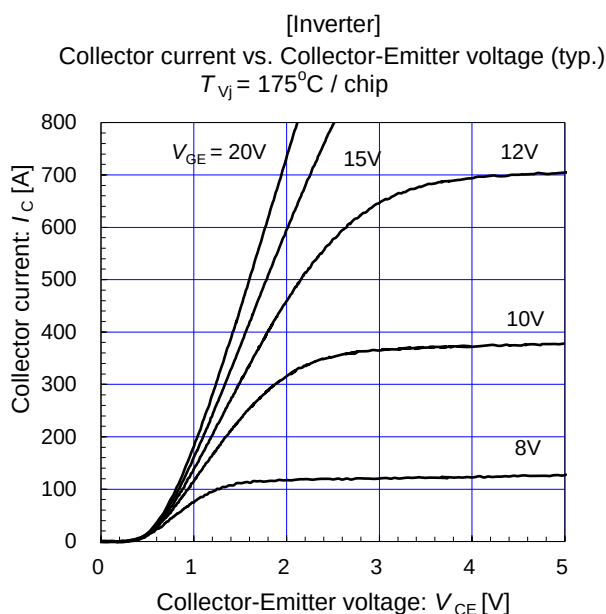
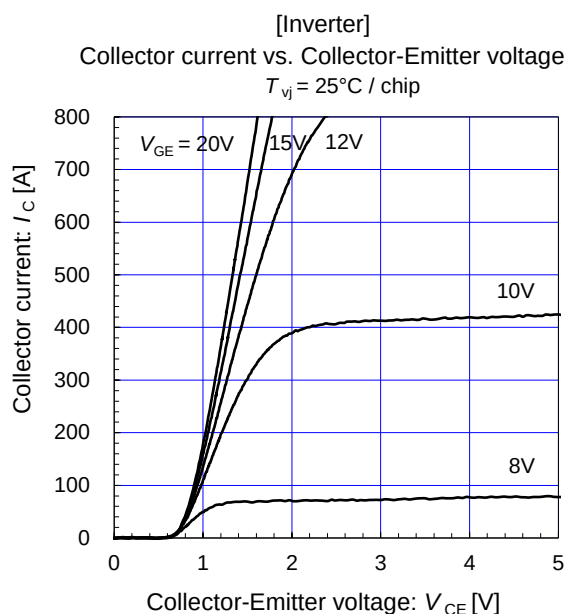
Thermal resistance characteristics

	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.

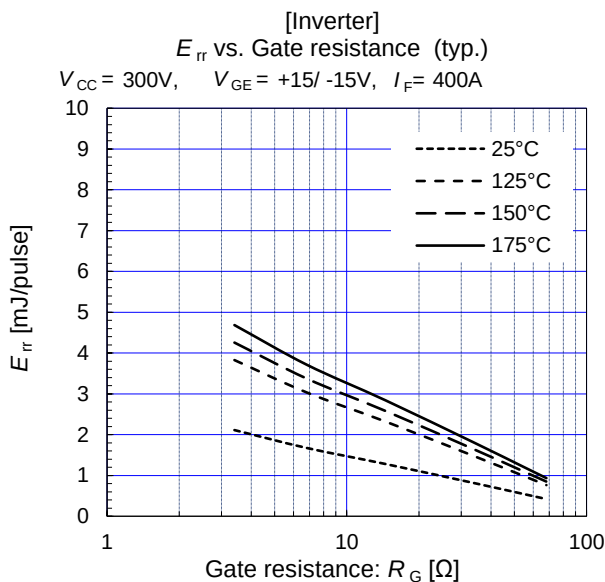
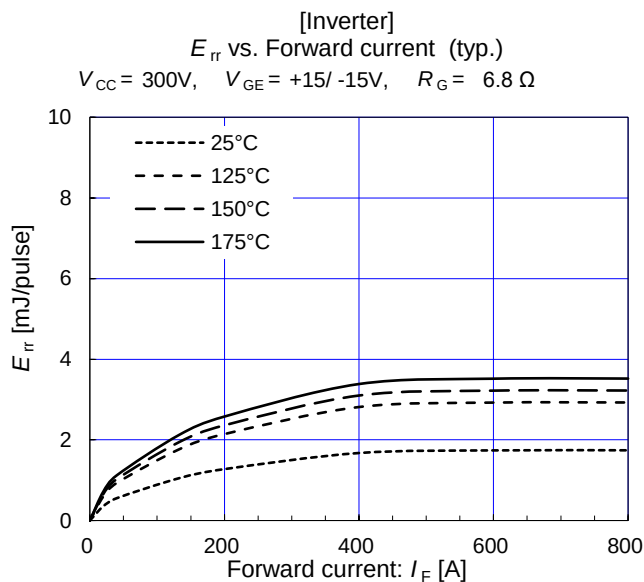
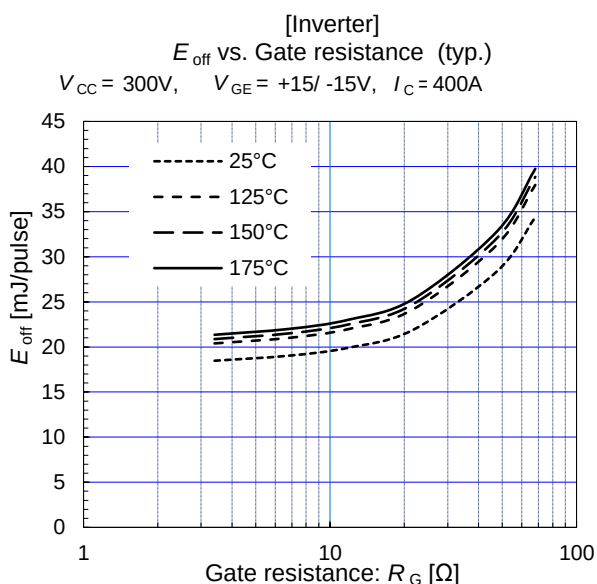
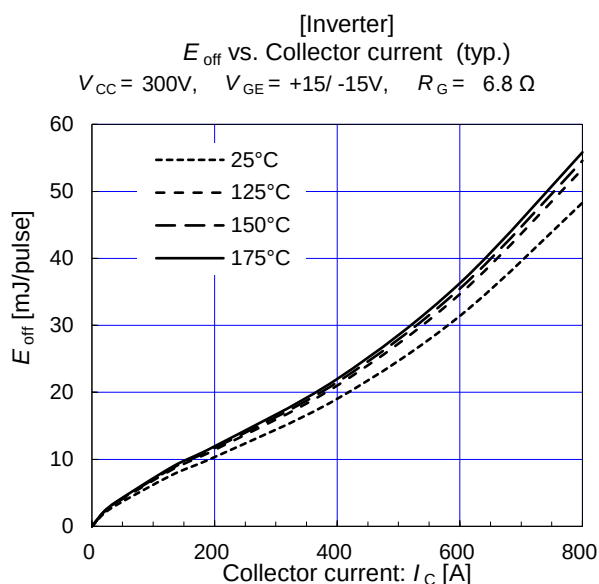
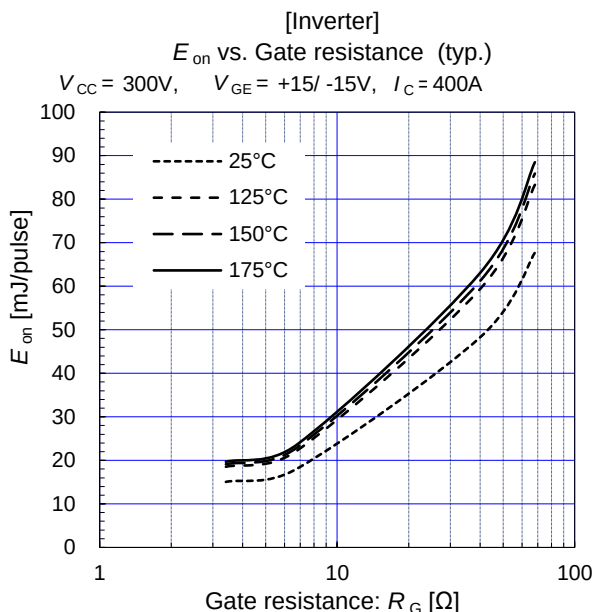
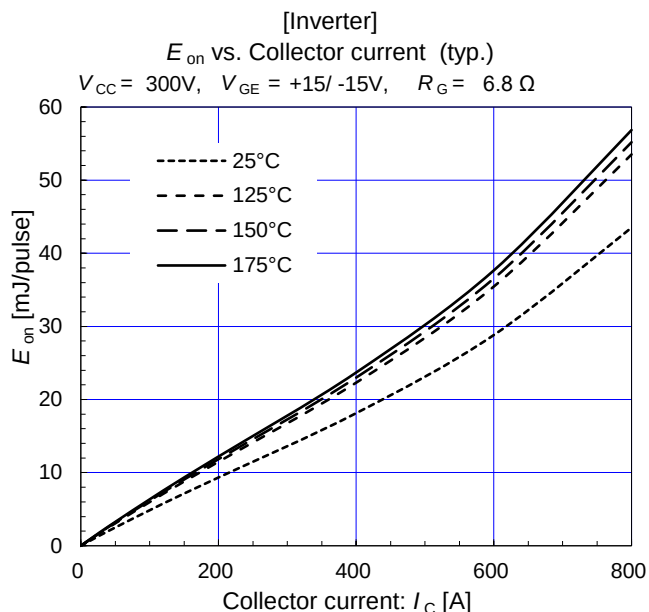
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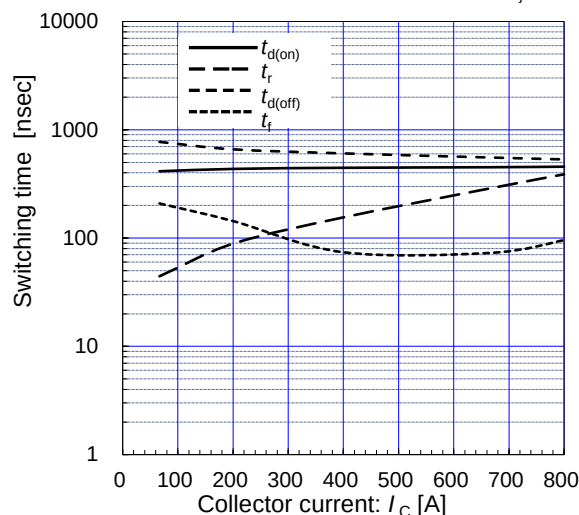
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[Inverter]

Switching time vs. Collector current (typ.)

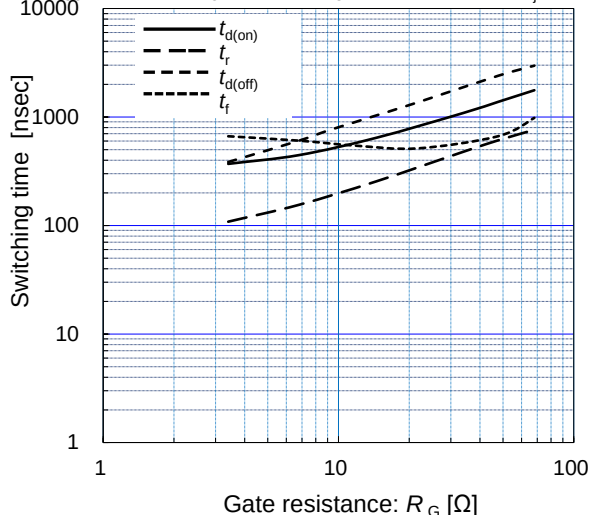
$V_{CC} = 300V$, $R_G = 6.8\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

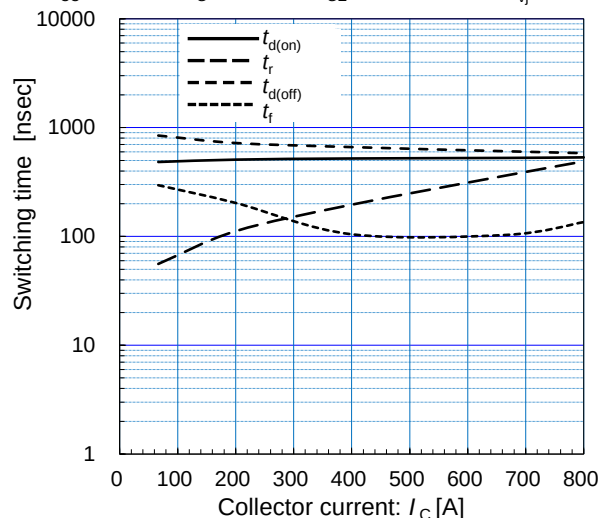
$V_{CC} = 300V$, $I_C = 400A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

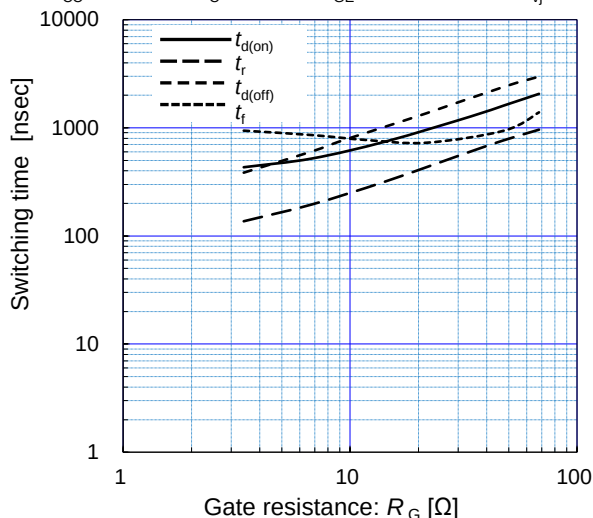
$V_{CC} = 300V$, $R_G = 6.8\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

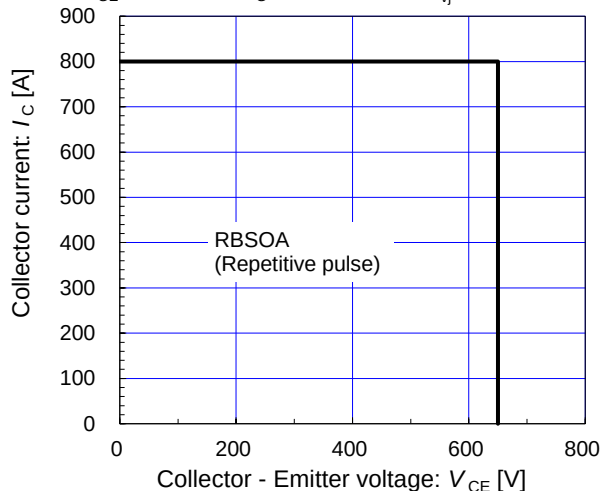
$V_{CC} = 300V$, $I_C = 400A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

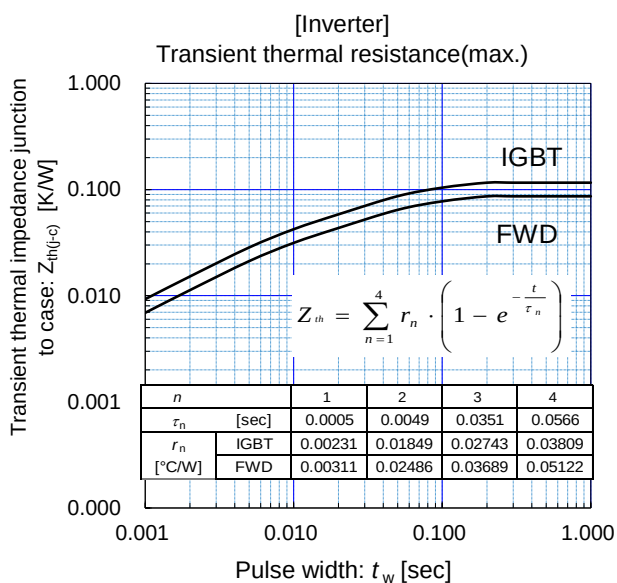
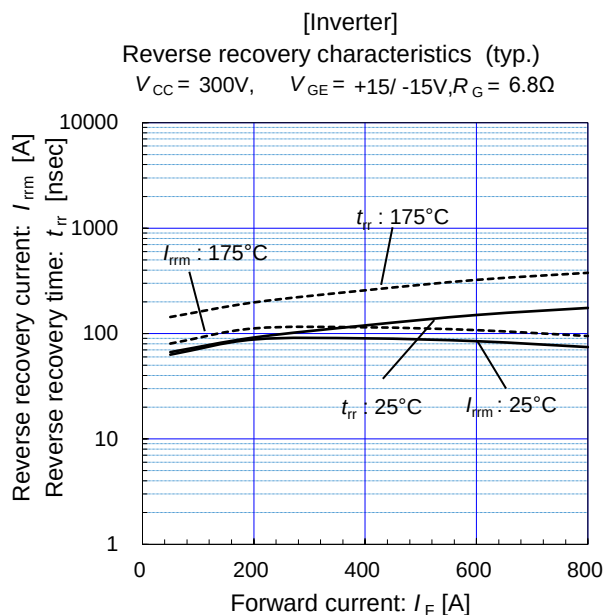
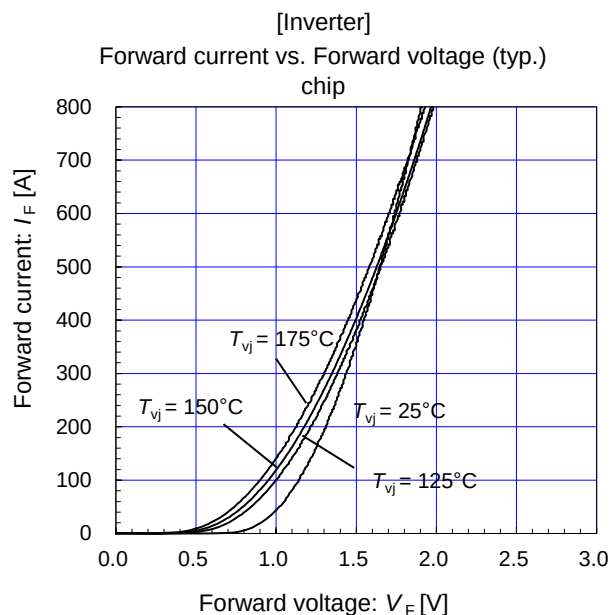
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15$, $R_G = 6.8\Omega$, $T_{vj} = 175^\circ C$



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