

2MBI400XBE065-50

IGBT Modules

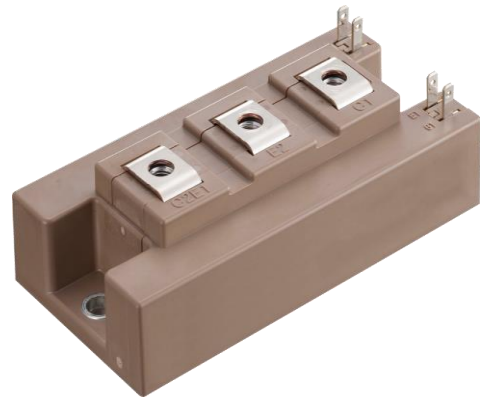
Power Module (X series)
650V / 400A / 2-in-1 package

■ **Features**

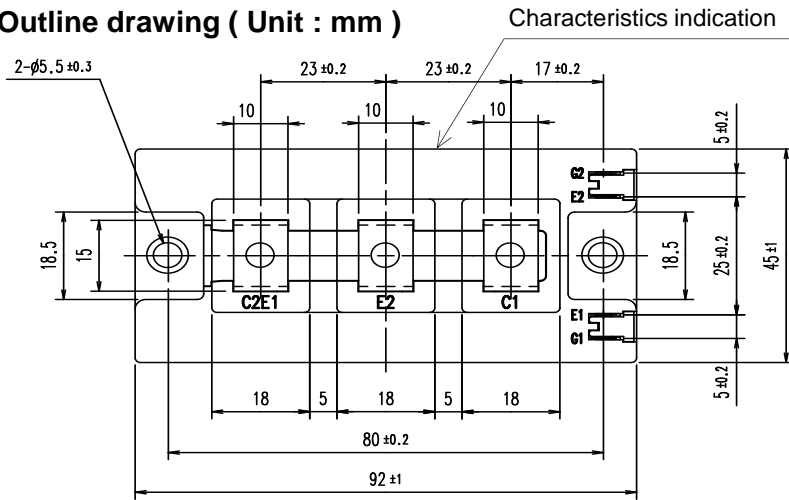
- LOW $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

■ **Applications**

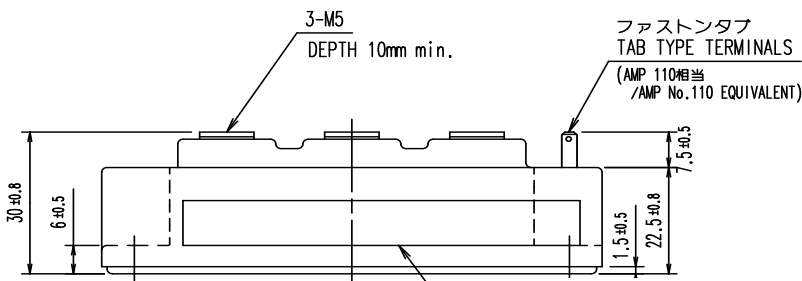
- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems,
- Industrial machines, such as Welding machines



■ **Outline drawing (Unit : mm)**



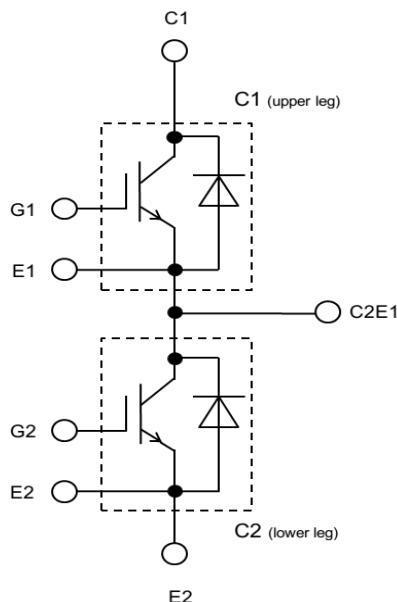
Characteristics indication



Indication on module

Weight: 270 g(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	
Inverter	Collector-Emitter voltage	V_{CES}		650	V	
	Gate-Emitter voltage	V_{GES}		± 20	V	
	Collector current	I_C	Continuous	$T_C=100^\circ\text{C}$	400	A
		I_{CRM}	1ms		800	
	Forward current	I_F			400	
		I_{FRM}	1ms		800	
	Collector power dissipation	P_c	1 device		1740	W
	Junction temperature	T_{vj}			175	°C
	Operating virtual junction temperature (under switching conditions)	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	
Screw torque (*2)	Mounting	-	M5	3.5	N m	
	Terminals		M5	3.5		

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

(*2) Recommendable Value: Mounting 2.5 ~ 3.5 N·m (M5)
 Terminals 2.5 ~ 3.5 N·m (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.		
Zero Gate voltage collector current	I_{CES}	$V_{GE} = 0\text{V}$ $V_{CE} = 650\text{V}$	-	-	100	μA	
Gate-Emitter leakage current	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-	-	200	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)	$V_{GE} = 15\text{V}$ $I_C = 400\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.55	2.00	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}\text{C}$	-	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	r_g	-	-	1.50	-	Ω	
Capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	46	-	nF	
	C_{oes}		-	1.8	-		
	C_{res}		-	0.62	-		
Gate charge	Q_G	$V_{CC} = 300\text{V}, I_C = 400\text{A}$ $V_{GE} = -15 \rightarrow +15\text{V}$	-	3.3	-	μC	
Forward voltage	V_F (terminal)	$V_{GE} = 0\text{V}$ $I_F = 400\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.80	2.25	V
	V_F (chip)		$T_{vj}=25^{\circ}\text{C}$	-	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	-		
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300\text{V}$ $I_C, I_F = 400\text{A}$ $V_{GE} = +15/ -15\text{V}$ $R_G = (\text{on})3.3\Omega/(\text{off})10\Omega$ $L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	0.35	-	μs
			$T_{vj}=125^{\circ}\text{C}$	-	0.39	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.40	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.41	-	
	t_r		$T_{vj}=25^{\circ}\text{C}$	-	0.12	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.14	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.14	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.15	-	
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.68	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.76	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.78	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.79	-	
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}	$T_{vj}=25^{\circ}\text{C}$	-	0.11	-		
		$T_{vj}=125^{\circ}\text{C}$	-	0.20	-		
		$T_{vj}=150^{\circ}\text{C}$	-	0.22	-		
		$T_{vj}=175^{\circ}\text{C}$	-	0.24	-		

(*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.		
Inverter Switching loss (per pulse)	E_{on}	$V_{CC} = 300\text{V}$ $I_C, I_F = 400\text{A}$ $V_{GE} = +15/ -15\text{V}$ $R_G = (\text{on})3.3\Omega/(\text{off})10\Omega$ $L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	11.3	-	mJ
			$T_{vj}=125^{\circ}\text{C}$	-	17.1	-	
			$T_{vj}=150^{\circ}\text{C}$	-	18.6	-	
			$T_{vj}=175^{\circ}\text{C}$	-	20.0	-	
	E_{off}		$T_{vj}=25^{\circ}\text{C}$	-	18.7	-	
			$T_{vj}=125^{\circ}\text{C}$	-	21.7	-	
			$T_{vj}=150^{\circ}\text{C}$	-	22.7	-	
			$T_{vj}=175^{\circ}\text{C}$	-	24.3	-	
	E_{rr}		$T_{vj}=25^{\circ}\text{C}$	-	1.6	-	
			$T_{vj}=125^{\circ}\text{C}$	-	3.5	-	
			$T_{vj}=150^{\circ}\text{C}$	-	3.9	-	
			$T_{vj}=175^{\circ}\text{C}$	-	4.4	-	

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.

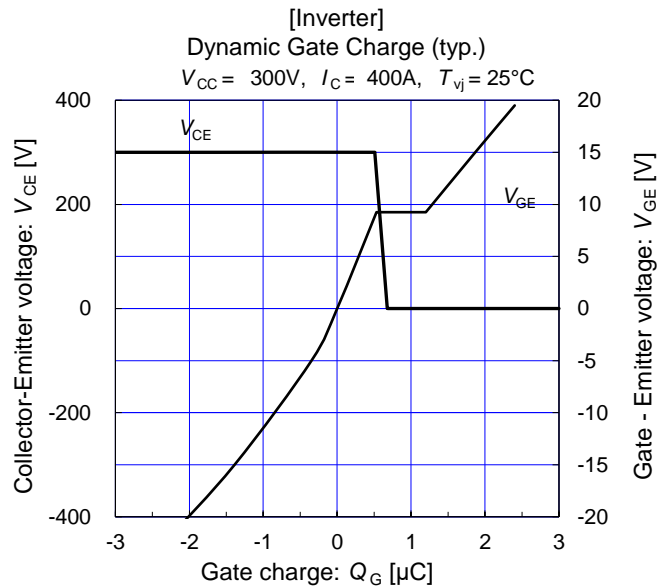
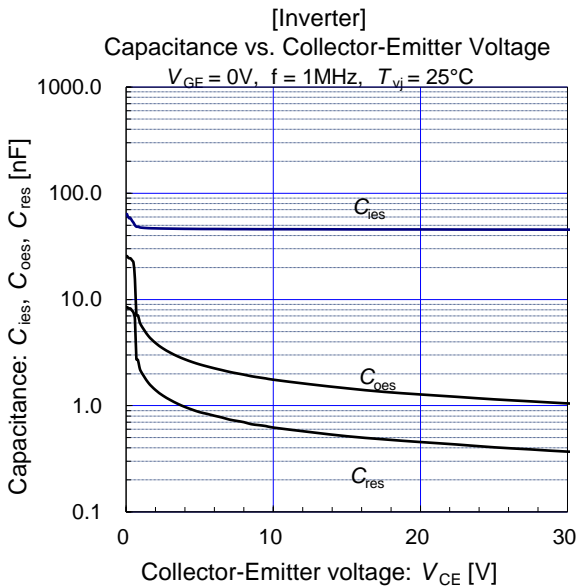
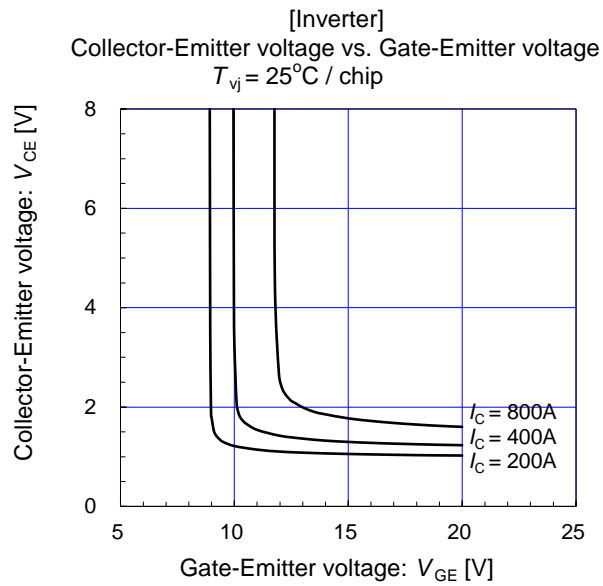
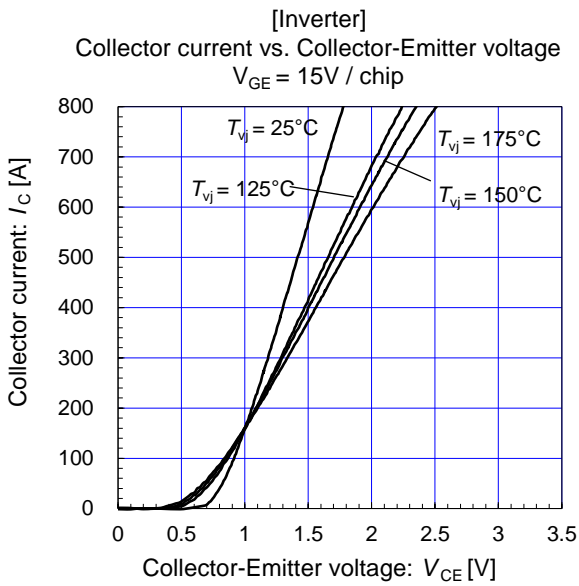
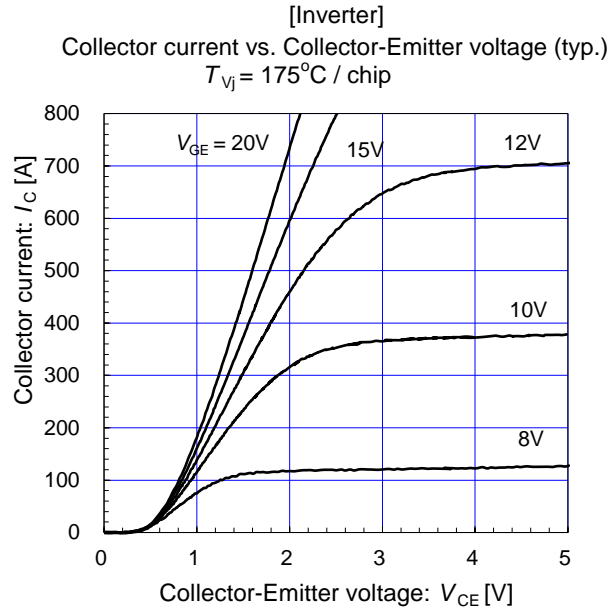
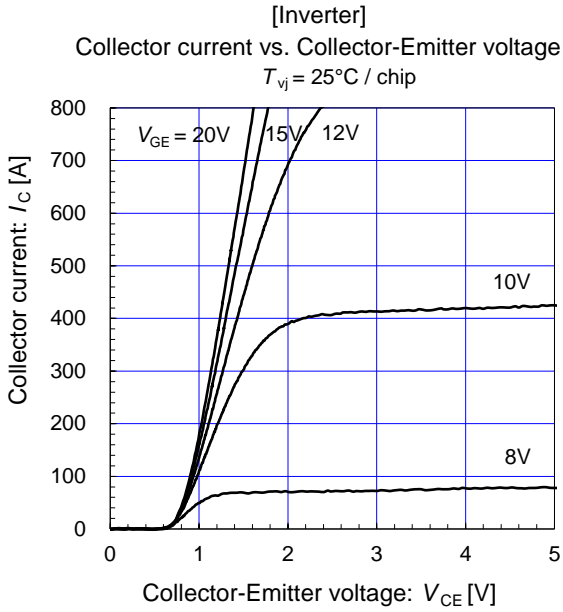
■ Thermal resistance characteristics

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case (1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.086	$^{\circ}\text{C/W}$
		Inverter FWD	-	-	0.118	
Thermal resistance case to heat sink (1IGBT + 1FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0250	-	

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

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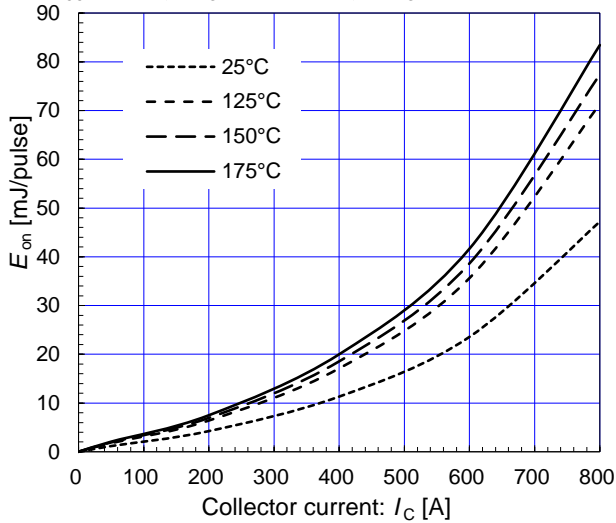
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[Inverter]

E_{on} vs. Collector current (typ.)

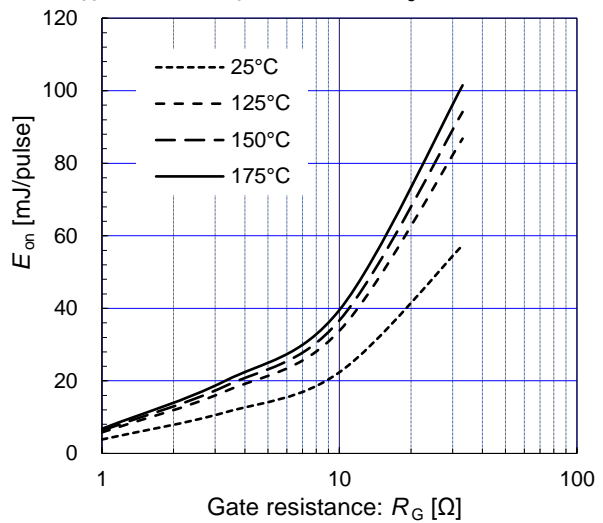
$V_{CC} = 300V, V_{GE} = +15/-15V, R_G = 3.3/10\Omega$



[Inverter]

E_{on} vs. Gate resistance (typ.)

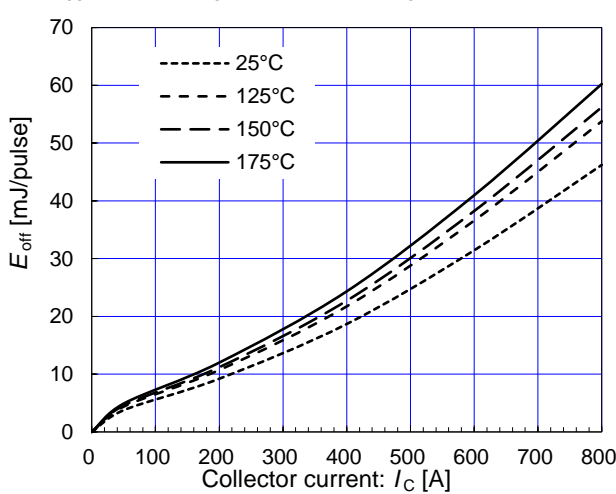
$V_{CC} = 300V, V_{GE} = +15/-15V, I_C = 400A$



[Inverter]

E_{off} vs. Collector current (typ.)

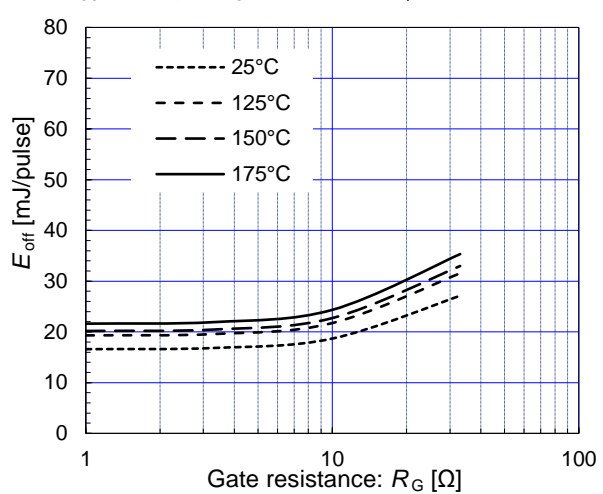
$V_{CC} = 300V, V_{GE} = +15/-15V, R_G = 3.3/10\Omega$



[Inverter]

E_{off} vs. Gate resistance (typ.)

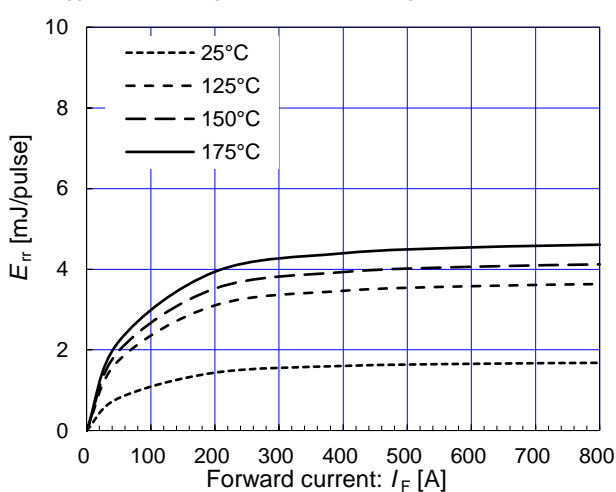
$V_{CC} = 300V, V_{GE} = +15/-15V, I_F = 400A$



[Inverter]

E_{rr} vs. Forward current (typ.)

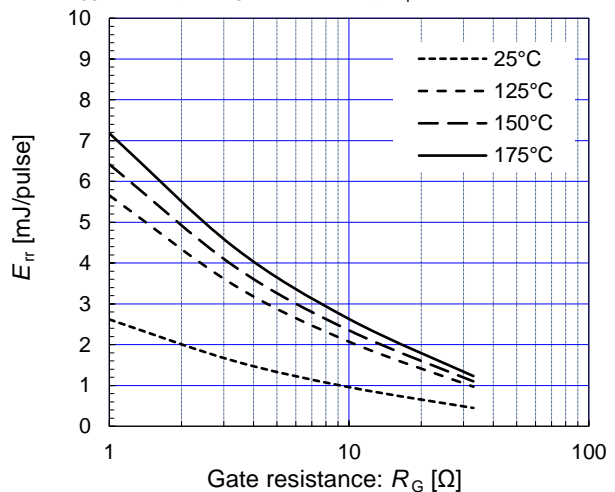
$V_{CC} = 300V, V_{GE} = +15/-15V, R_G = 3.3/10\Omega$



[Inverter]

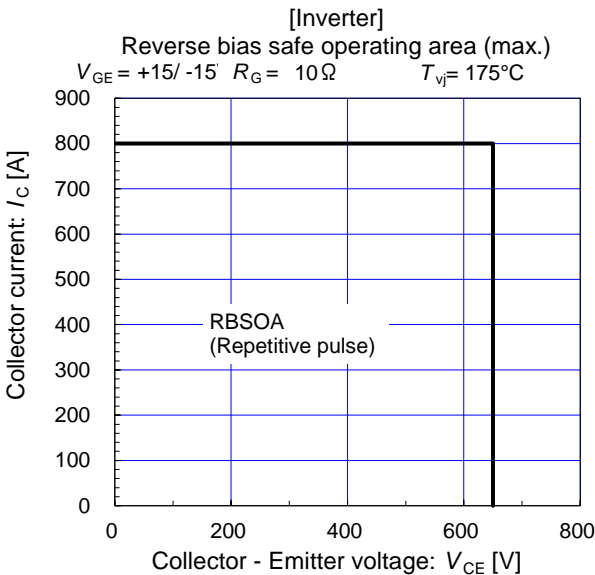
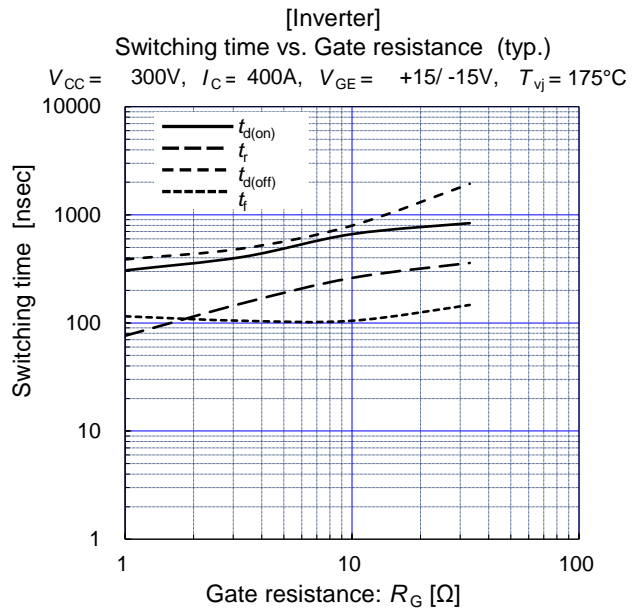
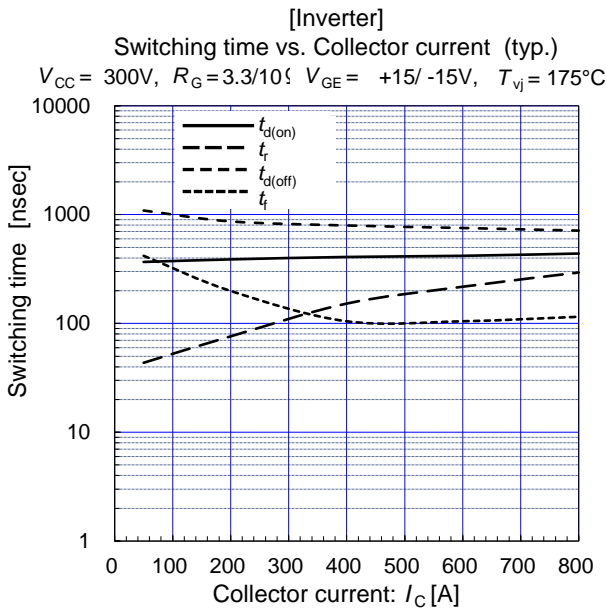
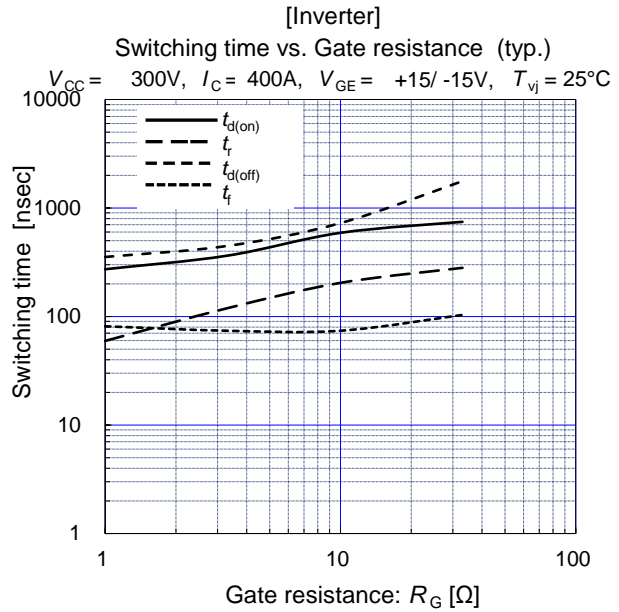
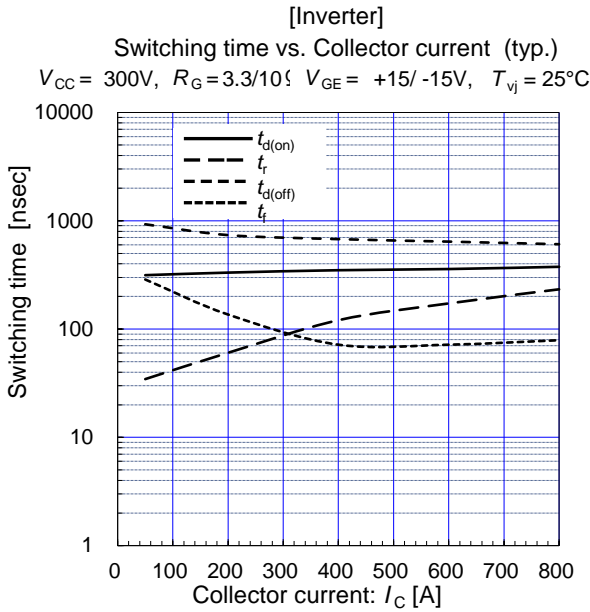
E_{rr} vs. Gate resistance (typ.)

$V_{CC} = 300V, V_{GE} = +15/-15V, I_F = 400A$



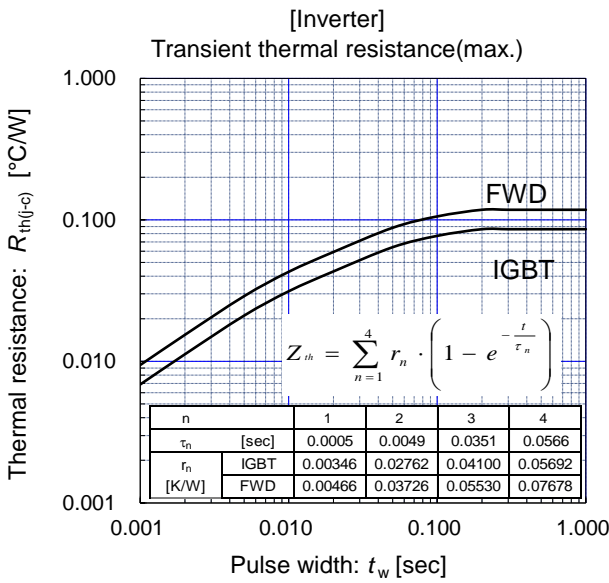
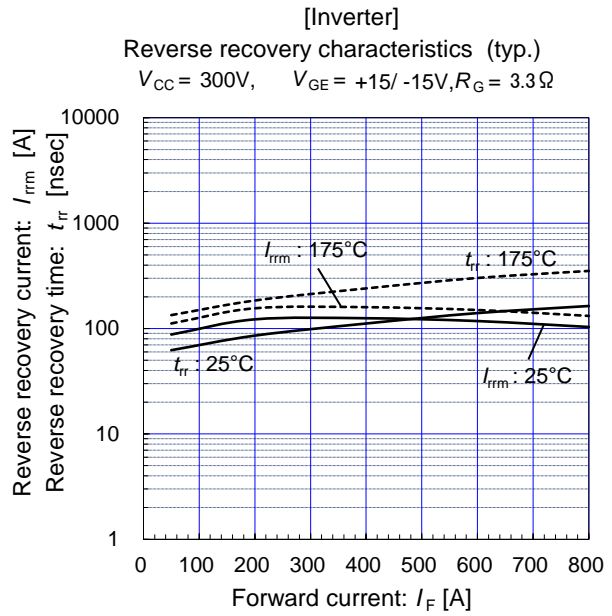
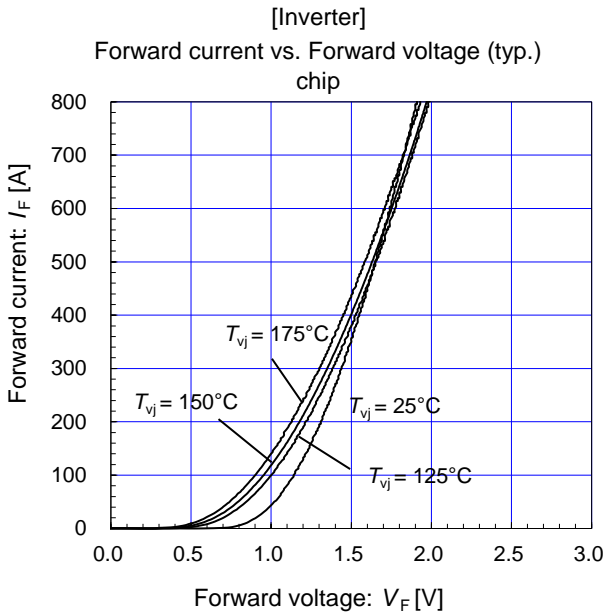
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