

2MBI1400XXB120P-50

IGBT Modules

Power Module (X series)
1200V / 1400A / 2-in-1 package

■ Features

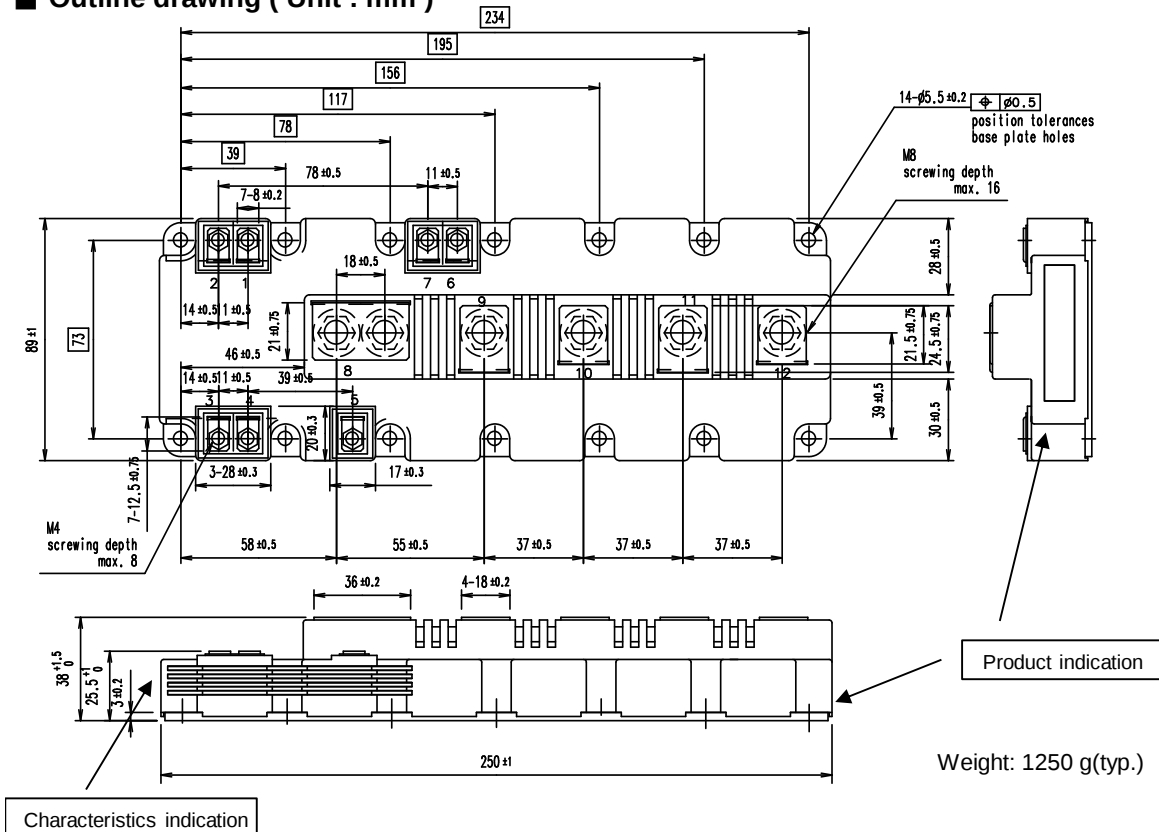
- LOW $V_{CE(sat)}$
- Low Inductance Module structure

■ Applications

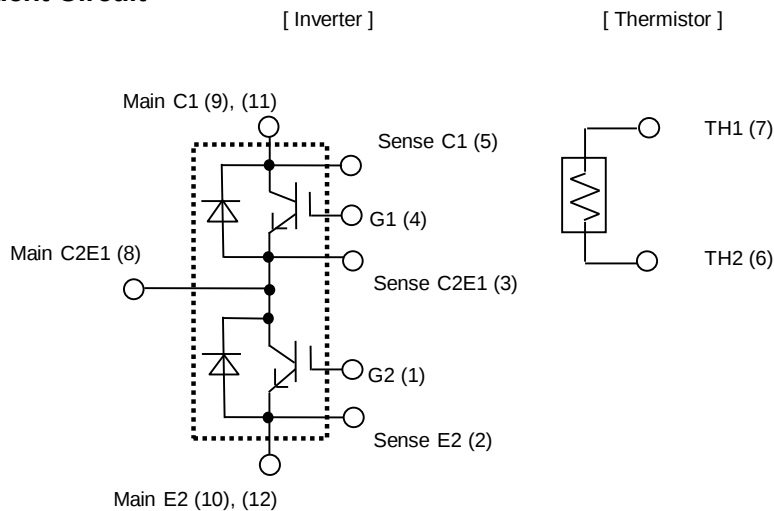
- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems



■ Outline drawing (Unit : mm)



■ 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, Gate-Emitter short-circuited		V_{CES}			1200	V
	Gate-Emitter voltage, Collector-Emitter short-circuited		V_{GES}			±20	V
	Collector current		I_C	Continuous	$T_C=90^{\circ}\text{C}$	1400	A
	Repetitive peak collector current		I_{CRM}	1ms		2800	
	Forward current		I_F			1400	
	Repetitive peak forward current		I_{FRM}	1ms		2800	
	Total power dissipation		P_{tot}	1 device		5.4	kW
	Virtual junction temperature		T_{vj}			175	$^{\circ}\text{C}$
	Operating virtual junction temperature (under switching conditions)		T_{vjop}			175	
	Case temperature		T_c			150	
	Storage temperature		T_{stg}			-40 ~ 150	
Isolation voltage	between terminal and copper base (*1)		V_{isol}	AC: 1min.		4000	Vrms
	between thermistor and others (*2)						
Mounting torque of screws to heatsink (*3)			M_s	M5		6.0	N·m
Mounting torque of screws to main terminals (*3)			M_t	M8		10.0	
Mounting torque of screws to sense terminals (*3)				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 torque of screws to heatsink	3.0 ~ 6.0 N·m	(M5)
: Mounting torque of screws to main terminals	8.0 ~ 10.0 N·m	(M8)
: Mounting torque of screws to sense terminals	1.8 ~ 2.1 N·m	(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	Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	600	μA
	Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	1200	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 1400mA$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 1400A$	$T_{vj}=25^{\circ}C$	-	1.50	1.95	V
		$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.45	1.90	
				$T_{vj}=125^{\circ}C$	-	1.70	-	
				$T_{vj}=150^{\circ}C$	-	1.80	-	
				$T_{vj}=175^{\circ}C$	-	1.85	-	
	Internal gate resistance	r_g	-		-	2.50	-	Ω
	Capacitance	C_{ies}	$V_{CE}=10V, V_{GE}=0V, f=1MHz$		-	147	-	nF
		C_{oes}			-	5.0	-	
		C_{res}			-	1.3	-	
	Gate charge	Q_G	$V_{CC} = 600V, I_C = 1400A$ $V_{GE} = -15 \rightarrow +15V$		-	9.5	-	μC
	Forward voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F= 1400A$	$T_{vj}=25^{\circ}C$	-	1.70	2.15	V
		V_F (chip)		$T_{vj}= 25^{\circ}C$	-	1.65	2.10	
				$T_{vj}=125^{\circ}C$	-	1.70	-	
				$T_{vj}=150^{\circ}C$	-	1.65	-	
				$T_{vj}=175^{\circ}C$	-	1.65	-	
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F = 1400A$ $V_{GE} = \pm 15 V$ $R_G = \pm 0.68 \Omega$ $L_S = 40 nH$	$T_{vj}= 25^{\circ}C$	-	1.10	-	μs
$T_{vj}=125^{\circ}C$				-	1.10	-		
$T_{vj}=150^{\circ}C$				-	1.10	-		
$T_{vj}=175^{\circ}C$				-	1.10	-		
t_r		$T_{vj}= 25^{\circ}C$		-	0.20	-		
		$T_{vj}=125^{\circ}C$		-	0.22	-		
		$T_{vj}=150^{\circ}C$		-	0.22	-		
		$T_{vj}=175^{\circ}C$		-	0.22	-		
$t_{d(off)}$		$T_{vj}= 25^{\circ}C$		-	0.90	-		
		$T_{vj}=125^{\circ}C$		-	0.94	-		
		$T_{vj}=150^{\circ}C$		-	0.96	-		
		$T_{vj}=175^{\circ}C$		-	0.97	-		
t_f		$T_{vj}= 25^{\circ}C$		-	0.16	-		
		$T_{vj}=125^{\circ}C$		-	0.17	-		
	$T_{vj}=150^{\circ}C$	-	0.18	-				
	$T_{vj}=175^{\circ}C$	-	0.20	-				
Reverse recovery time	t_{rr}	$T_{vj}= 25^{\circ}C$	-	0.29	-			
		$T_{vj}=125^{\circ}C$	-	0.47	-			
		$T_{vj}=150^{\circ}C$	-	0.49	-			
		$T_{vj}=175^{\circ}C$	-	0.52	-			

(*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}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 1400\text{A}$ $V_{\text{GE}} = \pm 15\text{ V}$ $R_{\text{G}} = \pm 0.68\ \Omega$ $L_{\text{S}} = 40\text{ nH}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	128	-	mJ
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	193	-	
				$T_{\text{vj}}=150^{\circ}\text{C}$	-	201	-	
				$T_{\text{vj}}=175^{\circ}\text{C}$	-	216	-	
		E_{off}		$T_{\text{vj}}=25^{\circ}\text{C}$	-	191	-	
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	243	-	
				$T_{\text{vj}}=150^{\circ}\text{C}$	-	257	-	
				$T_{\text{vj}}=175^{\circ}\text{C}$	-	265	-	
		E_{rr}		$T_{\text{vj}}=25^{\circ}\text{C}$	-	55	-	
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	87	-	
				$T_{\text{vj}}=150^{\circ}\text{C}$	-	103	-	
				$T_{\text{vj}}=175^{\circ}\text{C}$	-	114	-	
Thermistor	Resistance	R	$T =$	25°C	-	5000	-	Ω
			$T =$	100°C	465	495	520	
	B value	B	$T =$	25/ 50°C	3305	3375	3450	K

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.

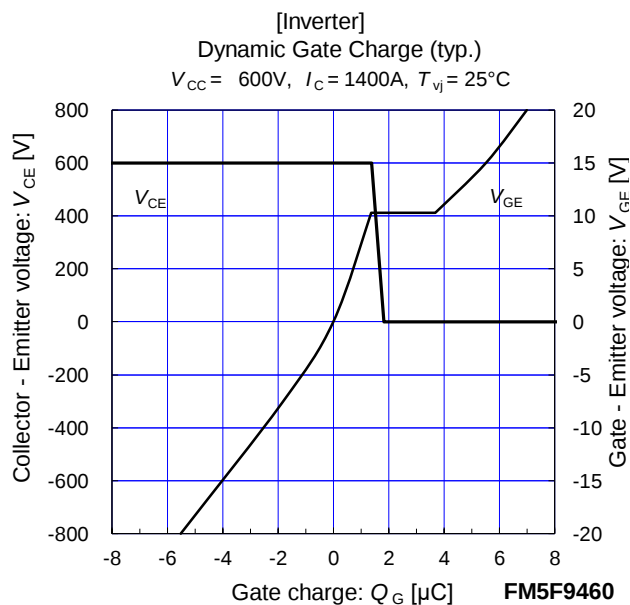
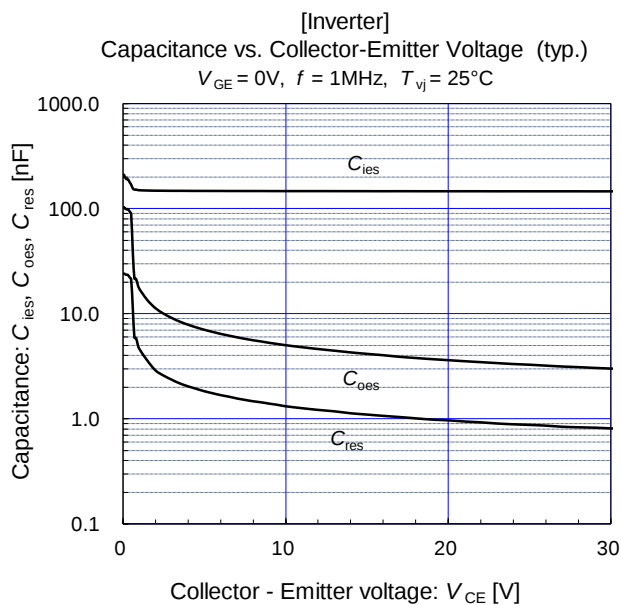
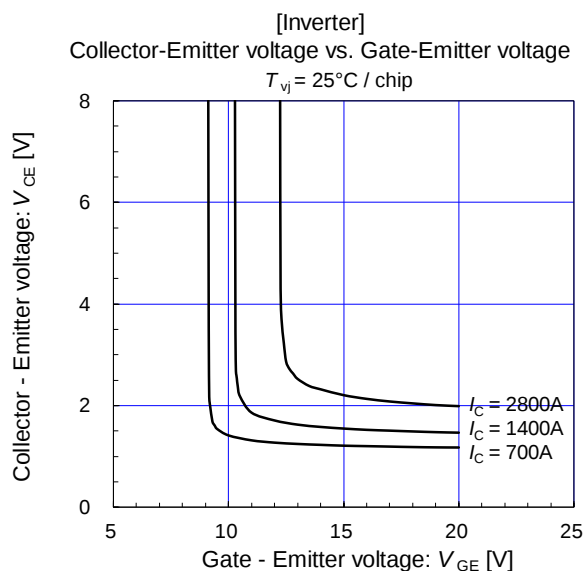
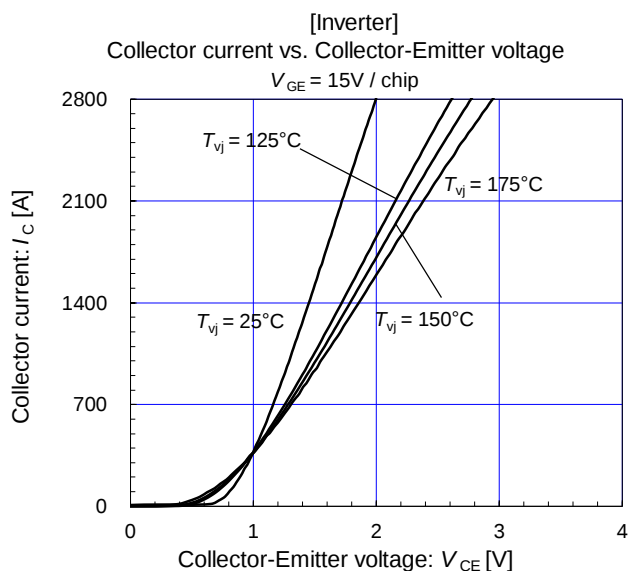
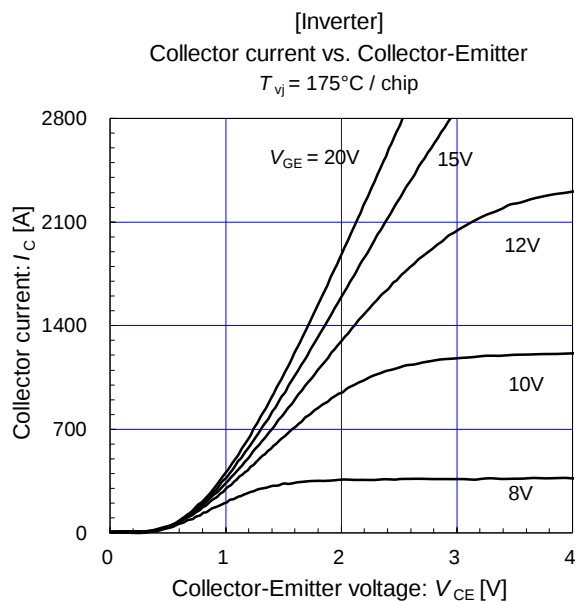
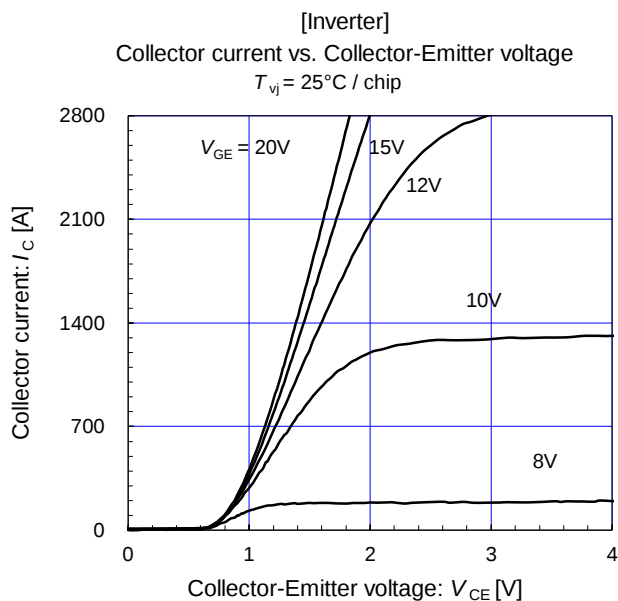
■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	27.5	K/kW
		Inverter FWD	-	-	48.0	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	4.2	-	

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

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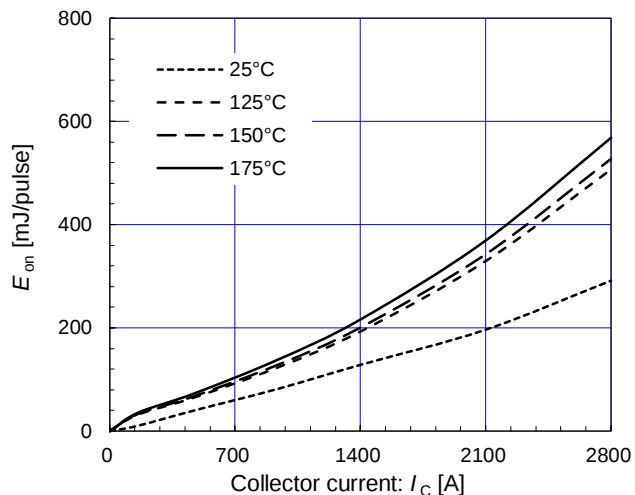
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[Inverter]

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

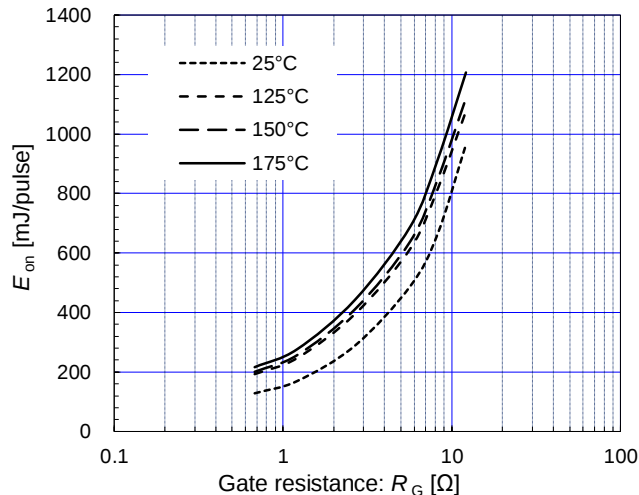
$V_{CC} = 600V$, $V_{GE} = \pm 15V$, $R_G = \pm 0.68 \Omega$



[Inverter]

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

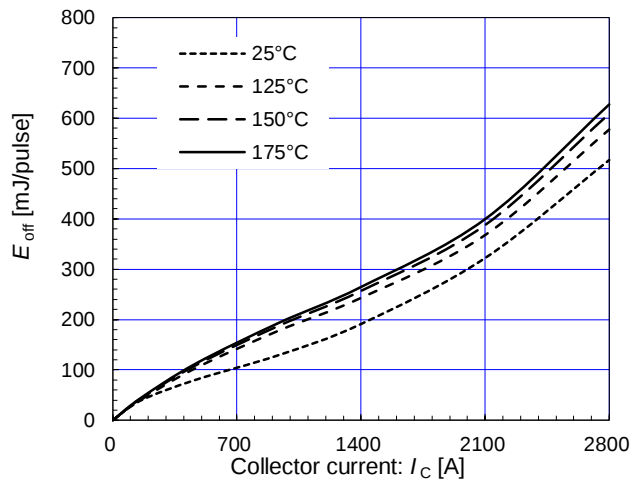
$V_{CC} = 600V$, $V_{GE} = \pm 15V$, $I_C = 1400A$



[Inverter]

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

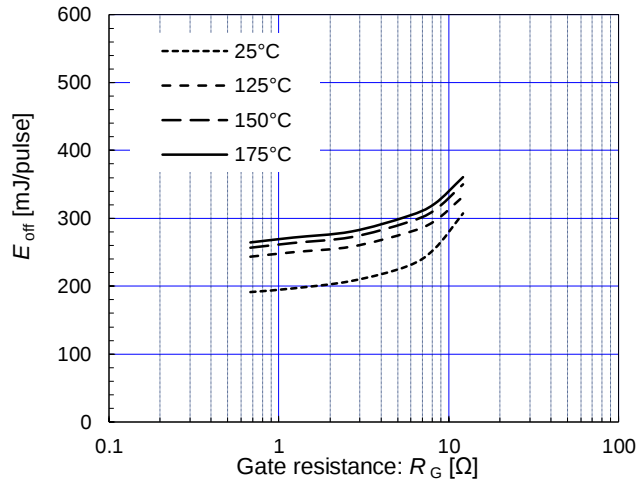
$V_{CC} = 600V$, $V_{GE} = \pm 15V$, $R_G = \pm 0.68 \Omega$



[Inverter]

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

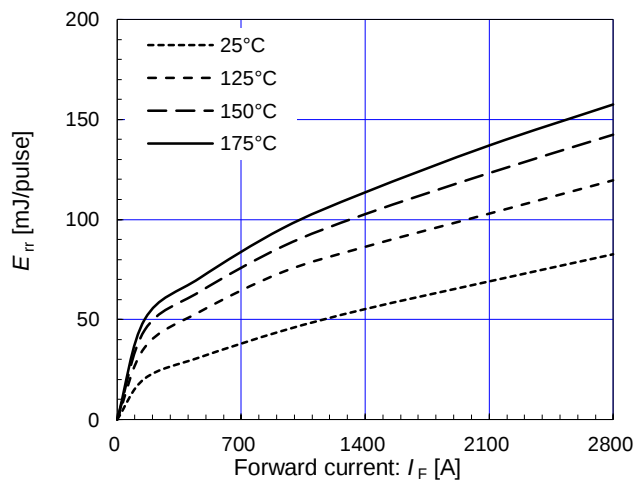
$V_{CC} = 600V$, $V_{GE} = \pm 15V$, $I_C = 1400A$



[Inverter]

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

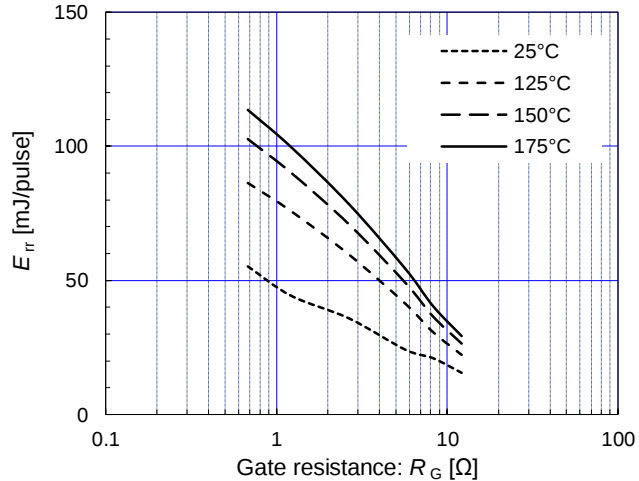
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[Inverter]

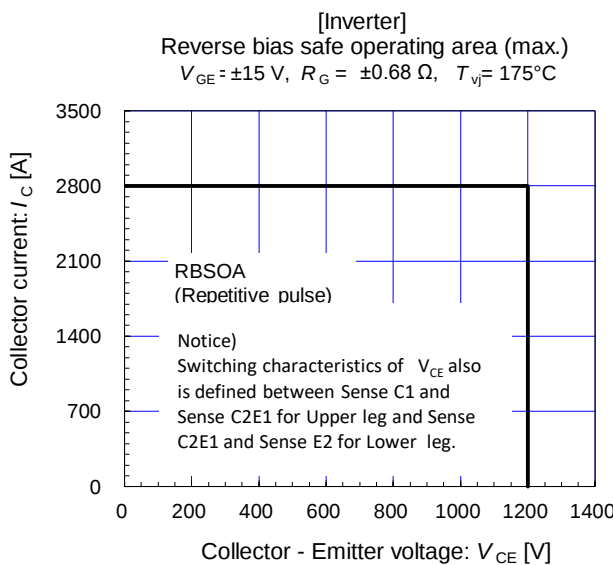
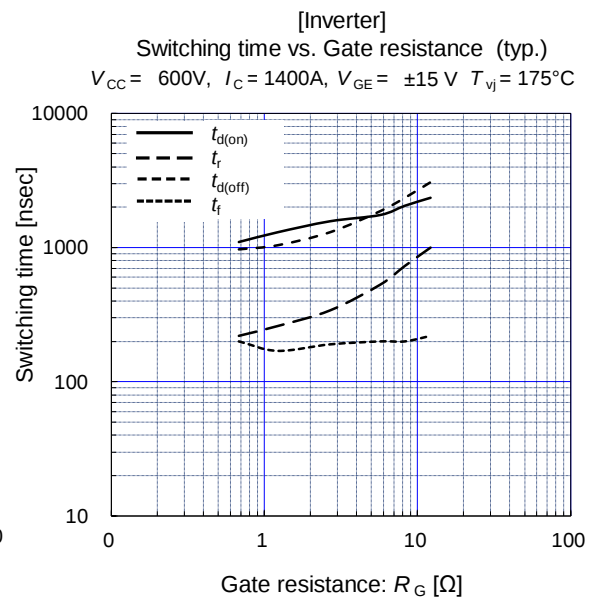
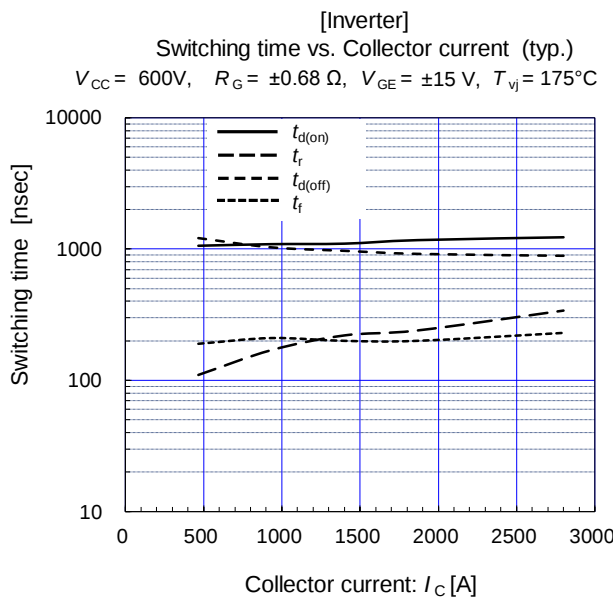
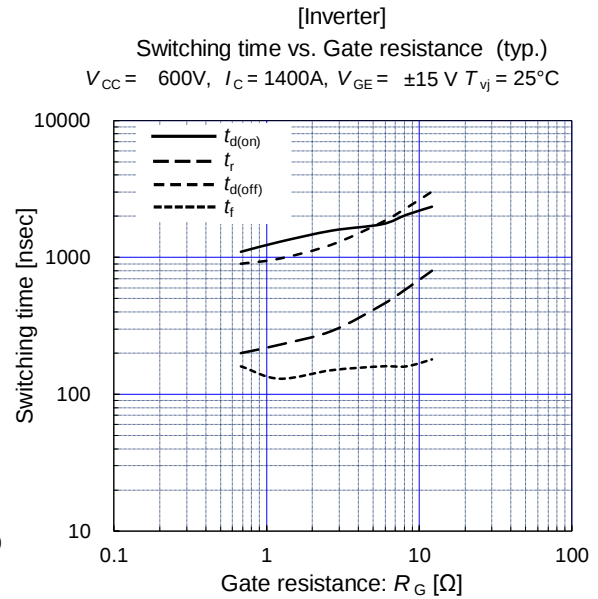
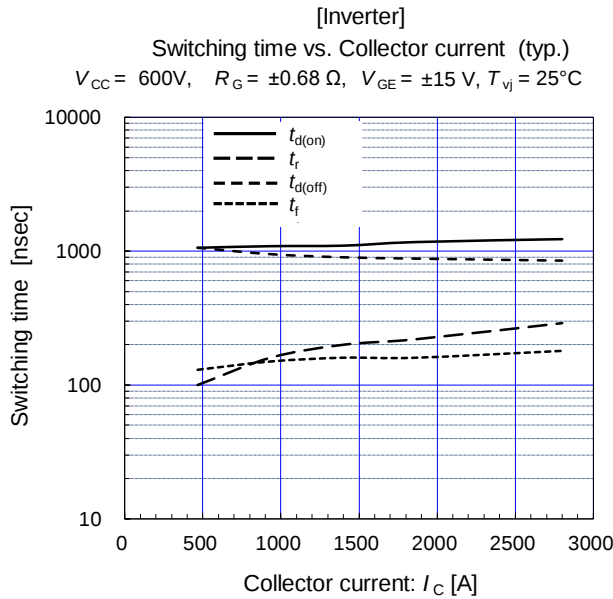
E_{rr} vs. Gate resistance (typ.)

$V_{CC} = 600V$, $V_{GE} = \pm 15V$, $I_F = 1400A$



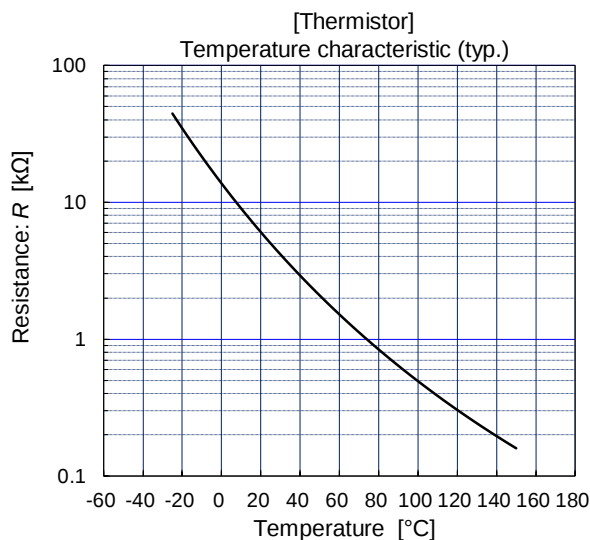
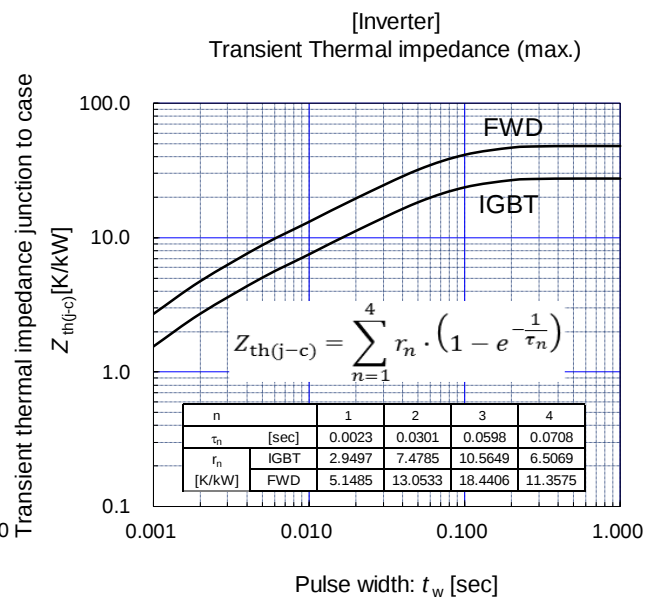
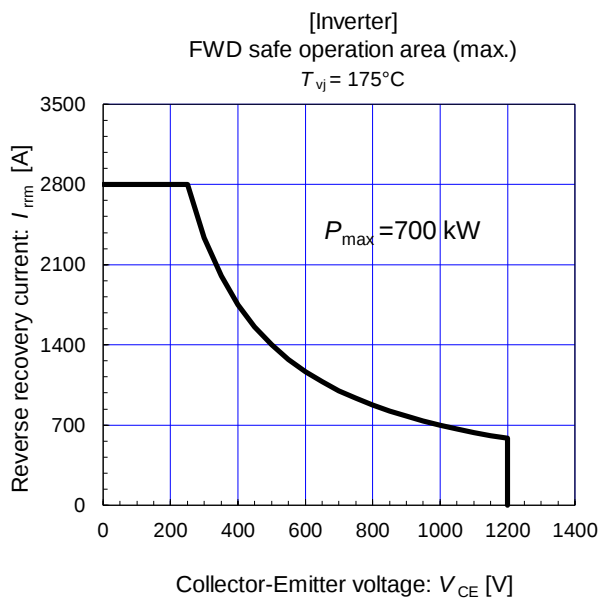
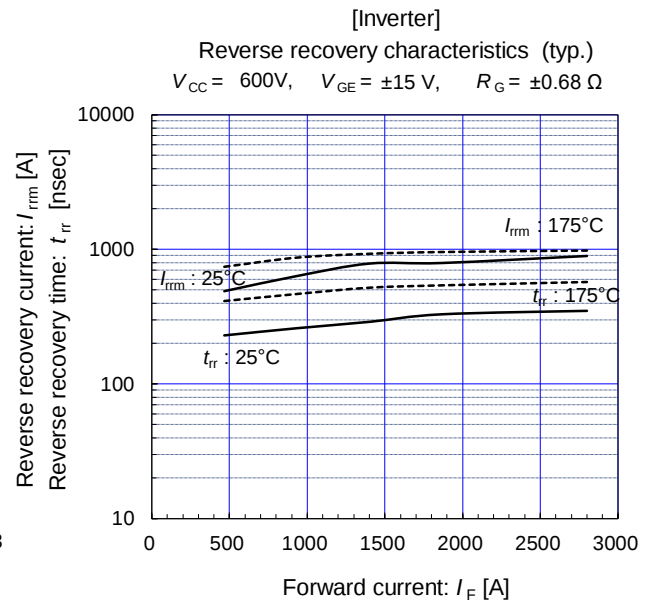
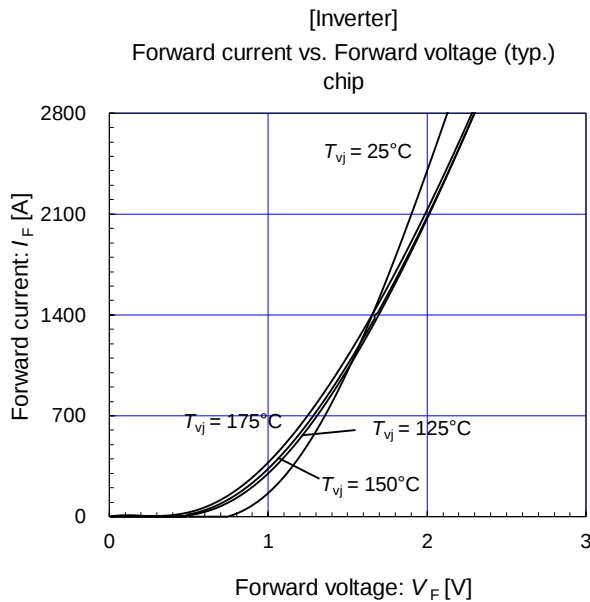
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