

# 2MBI1800XF120P-50

IGBT Modules

**Power Module (X series)**  
**1200V / 1800A / 2-in-1 package**

■ **Features**

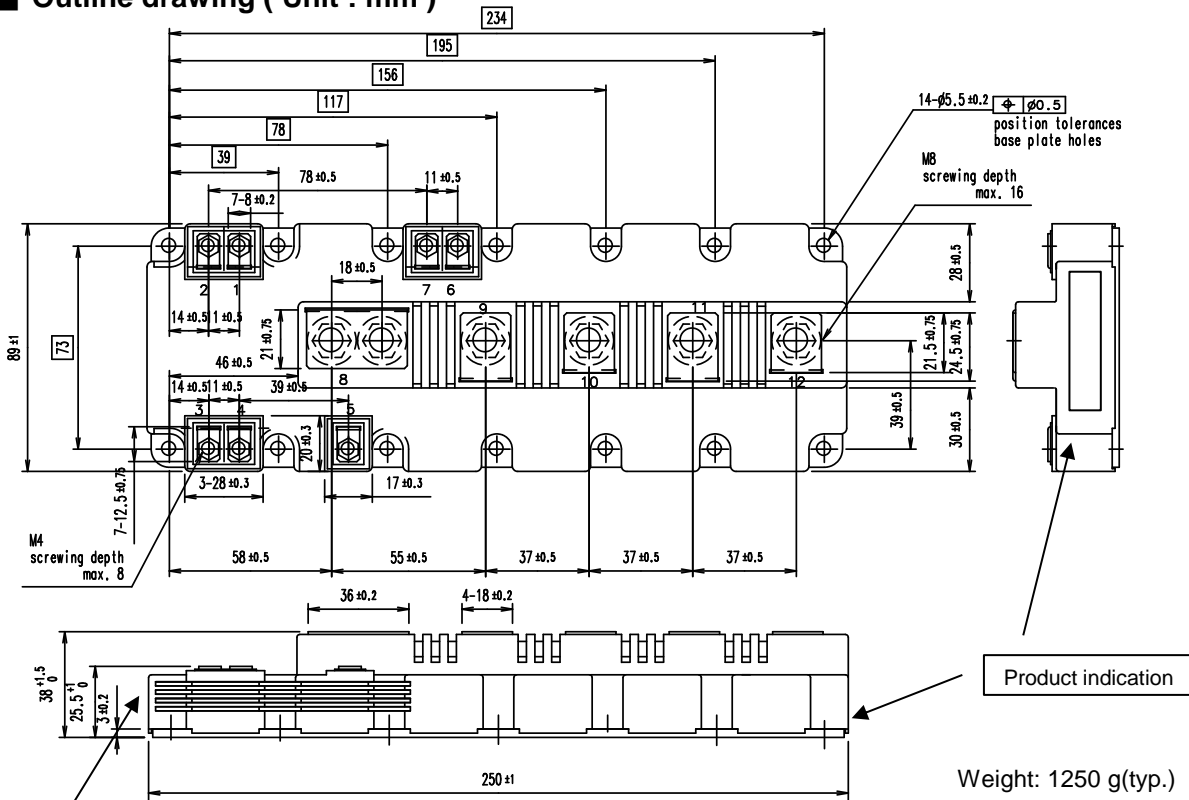
- Low  $V_{CE(sat)}$
- Low Inductance Module structure

■ **Applications**

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



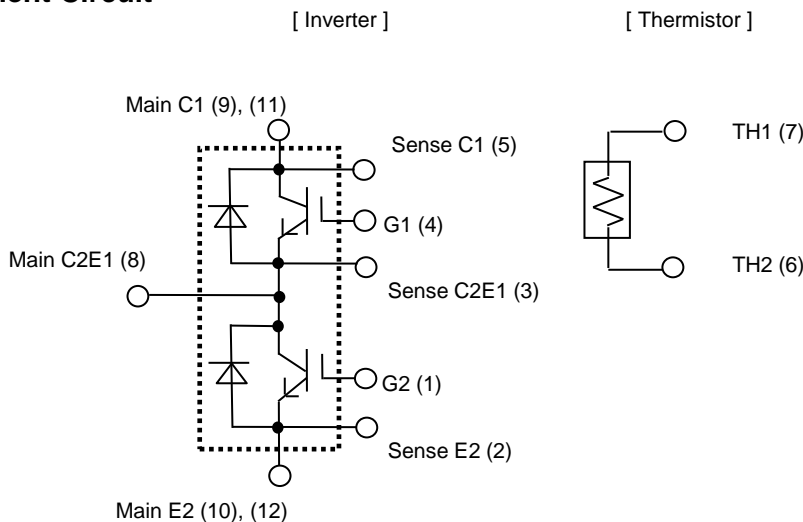
■ **Outline drawing ( Unit : mm )**



Weight: 1250 g(typ.)

Characteristics indication

■ **Equivalent Circuit**



# 2MBI1800XF120P-50

**■ 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	$V_{GES}$		$\pm 20$	V
	Collector current	$I_C$	Continuous   $T_c=100^\circ\text{C}$	1800	A
	Repetitive peak collector current	$I_{CRM}$	1ms	3600	
	Forward current	$I_F$		1800	
	Repetitive peak forward current	$I_{FRM}$	1ms	3600	$^\circ\text{C}$
	Total power dissipation	$P_{tot}$	1 device	10.7	
	Virtual junction temperature	$T_{vj}$		175	
	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)

# 2MBI1800XF120P-50

■ 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	$I_{CES}$	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	-	-	600	$\mu\text{A}$	
Gate leakage current, collector-emitter short-circuited	$I_{GES}$	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-	-	1200	nA	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 1800\text{mA}$	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 1800\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.50	1.95	V
			$T_{vj}=25^{\circ}\text{C}$	-	1.45	1.90	
	$T_{vj}=125^{\circ}\text{C}$		-	1.70	-		
	$T_{vj}=150^{\circ}\text{C}$		-	1.75	-		
	$T_{vj}=175^{\circ}\text{C}$		-	1.85	-		
Internal gate resistance	$r_g$	-	-	2.08	-	$\Omega$	
	Capacitance	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	$C_{ies}$	-	192	-	nF
			$C_{oes}$	-	6.5	-	
$C_{res}$			-	1.7	-		
Gate charge	$Q_G$	$V_{CC} = 600\text{V}, I_C = 1800\text{A}$ $V_{GE} = -15 \rightarrow +15\text{V}$	-	12.4	-	$\mu\text{C}$	
Forward voltage	$V_F$ (terminal)	$V_{GE} = 0\text{V}$ $I_F = 1800\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.65	2.10	V
			$T_{vj}=25^{\circ}\text{C}$	-	1.60	2.05	
	$T_{vj}=125^{\circ}\text{C}$		-	1.65	-		
	$T_{vj}=150^{\circ}\text{C}$		-	1.60	-		
	$T_{vj}=175^{\circ}\text{C}$		-	1.60	-		
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600\text{V}$ $I_C, I_F = 1800\text{A}$ $V_{GE} = +15/-15\text{V}$ $R_G = +0.56/-0.56\ \Omega$ $L_S = 40\text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	1.10	-	$\mu\text{s}$
			$T_{vj}=125^{\circ}\text{C}$	-	1.10	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.10	-	
			$T_{vj}=175^{\circ}\text{C}$	-	1.10	-	
	$t_r$		$T_{vj}=25^{\circ}\text{C}$	-	0.20	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.22	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.22	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.22	-	
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.90	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.94	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.96	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.97	-	
	$t_f$		$T_{vj}=25^{\circ}\text{C}$	-	0.16	-	
$T_{vj}=125^{\circ}\text{C}$		-	0.17	-			
$T_{vj}=150^{\circ}\text{C}$		-	0.18	-			
$T_{vj}=175^{\circ}\text{C}$		-	0.20	-			
Reverse recovery time	$t_{rr}$	$T_{vj}=25^{\circ}\text{C}$	-	0.29	-		
		$T_{vj}=125^{\circ}\text{C}$	-	0.47	-		
		$T_{vj}=150^{\circ}\text{C}$	-	0.49	-		
		$T_{vj}=175^{\circ}\text{C}$	-	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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**IGBT Modules**
**■ 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)	$E_{on}$	$V_{CC} = 600\text{V}$ $I_C, I_F = 1800\text{A}$ $V_{GE} = +15/-15\text{V}$ $R_G = +0.56/-0.56\ \Omega$ $L_S = 40\text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	165	-	mJ
			$T_{vj}=125^{\circ}\text{C}$	-	248	-	
			$T_{vj}=150^{\circ}\text{C}$	-	258	-	
			$T_{vj}=175^{\circ}\text{C}$	-	278	-	
	$E_{off}$		$T_{vj}=25^{\circ}\text{C}$	-	246	-	
			$T_{vj}=125^{\circ}\text{C}$	-	313	-	
			$T_{vj}=150^{\circ}\text{C}$	-	330	-	
			$T_{vj}=175^{\circ}\text{C}$	-	340	-	
	$E_{rr}$		$T_{vj}=25^{\circ}\text{C}$	-	71	-	
			$T_{vj}=125^{\circ}\text{C}$	-	111	-	
			$T_{vj}=150^{\circ}\text{C}$	-	132	-	
			$T_{vj}=175^{\circ}\text{C}$	-	146	-	
Thermistor Resistance	$R$	$T = 25^{\circ}\text{C}$	-	5000	-	$\Omega$	
		$T = 100^{\circ}\text{C}$	465	495	520		
Thermistor B value	$B$	$T = 25/50^{\circ}\text{C}$	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.

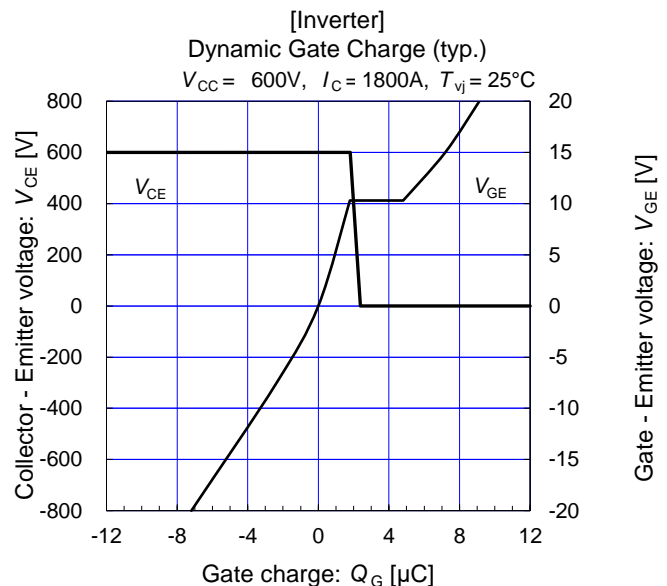
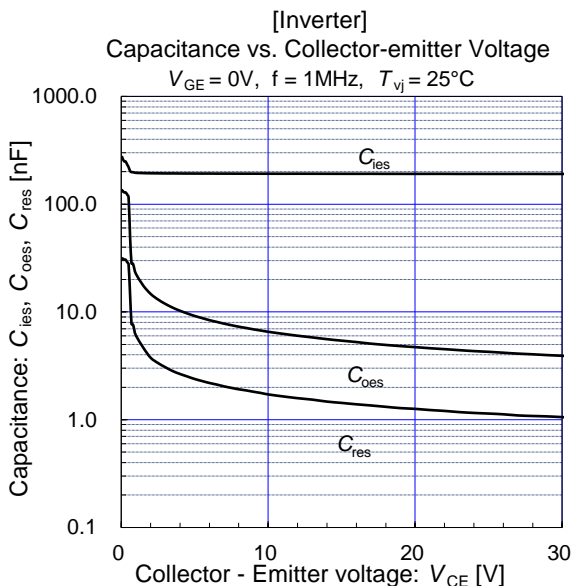
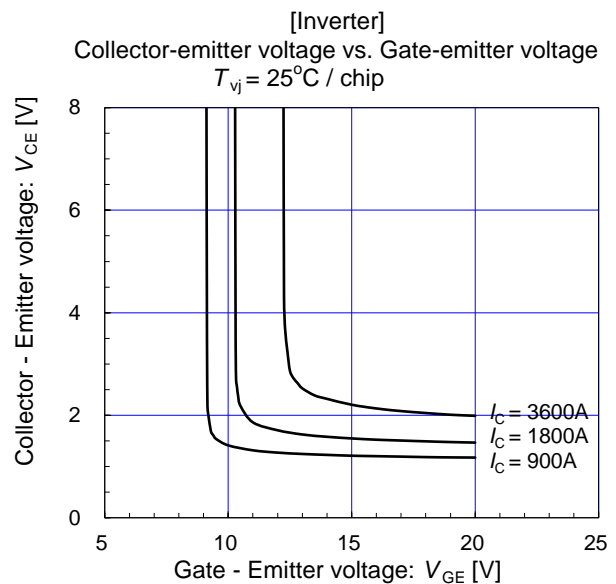
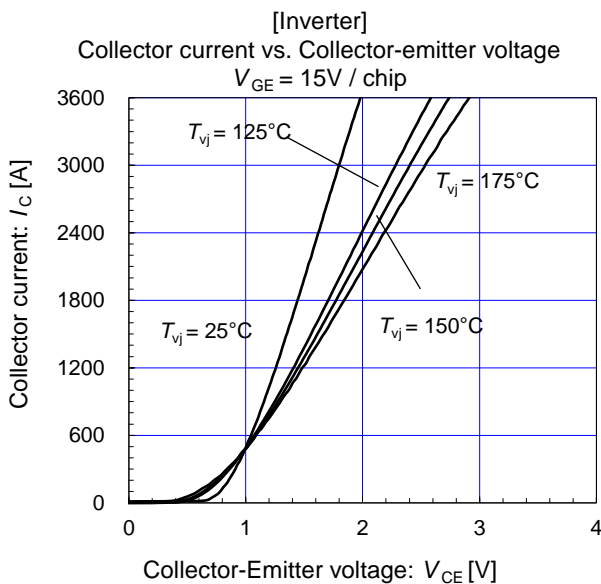
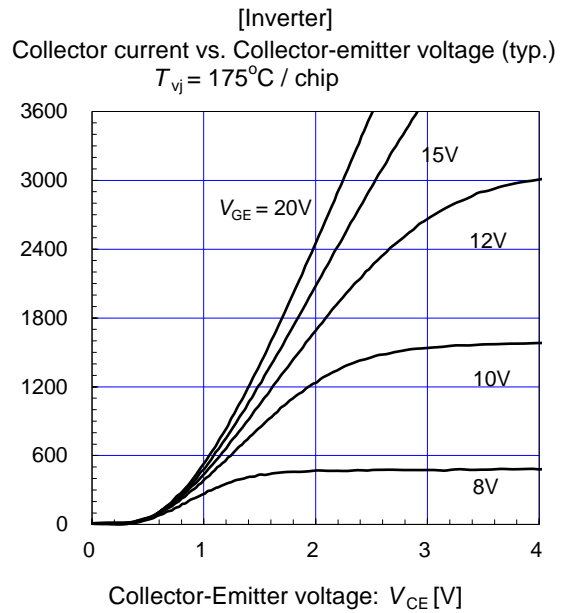
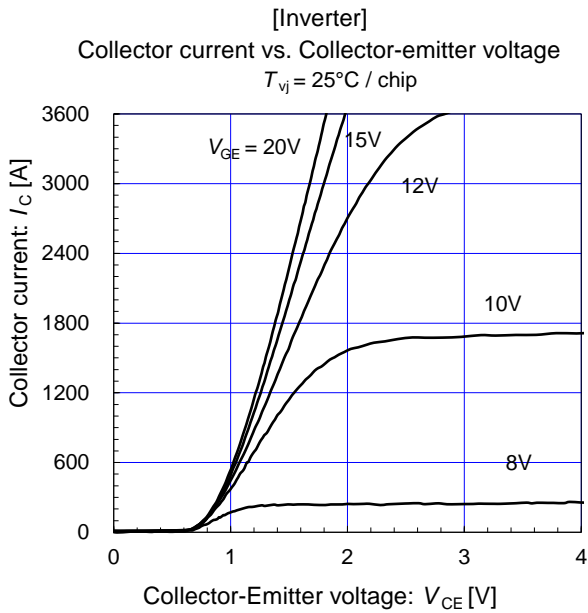
**■ Thermal resistance characteristics**

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	14.0	K/kW
		Inverter FWD	-	-	23.0	
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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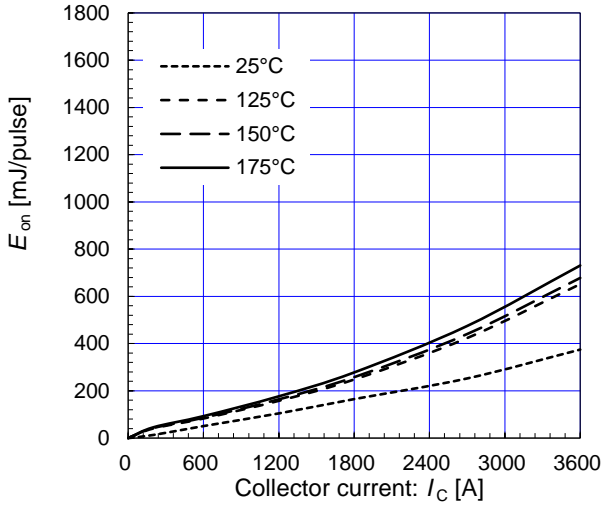
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[Inverter]

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

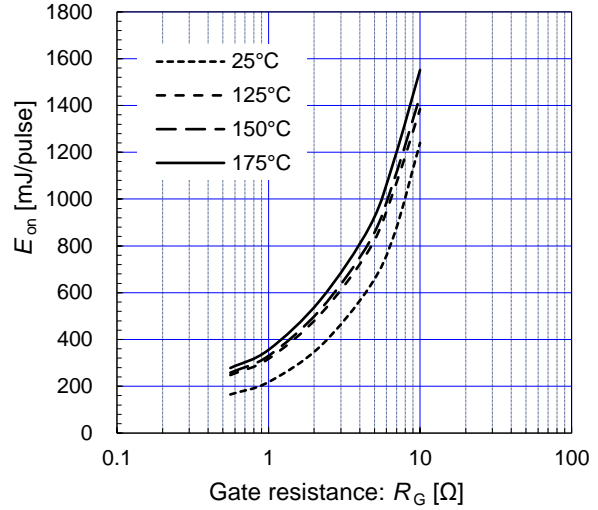
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = +0.56/-0.56 \Omega$



[Inverter]

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

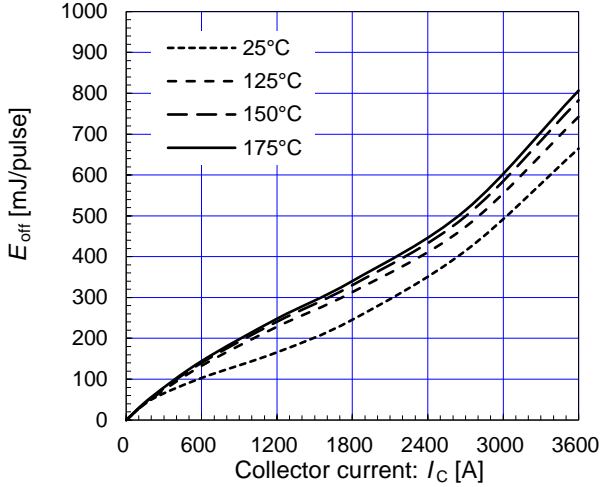
$V_{CC} = 600V, V_{GE} = +15/-15V, I_C = 1800A$



[Inverter]

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

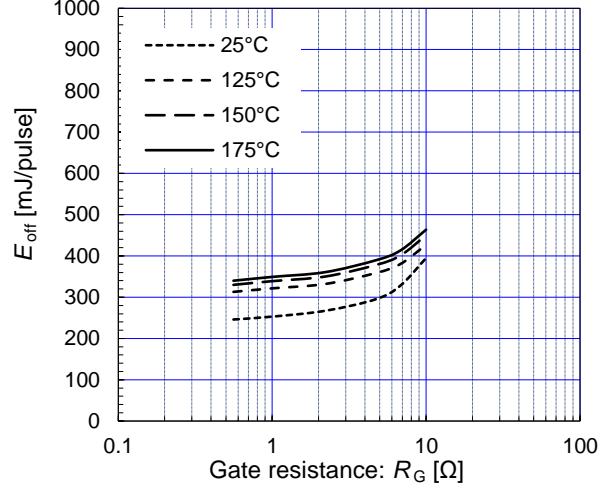
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = +0.56/-0.56 \Omega$



[Inverter]

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

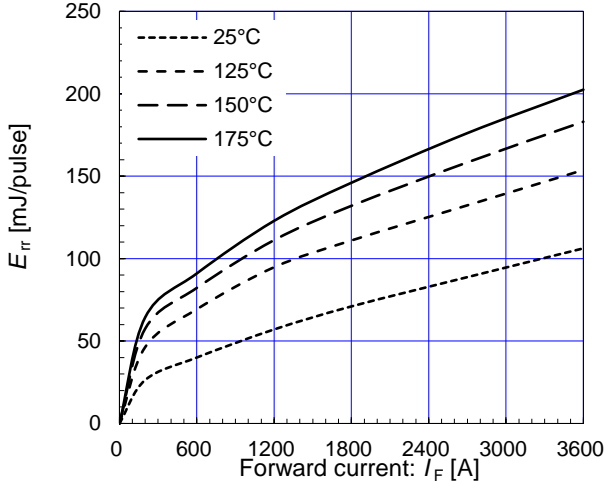
$V_{CC} = 600V, V_{GE} = +15/-15V, I_C = 1800A$



[Inverter]

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

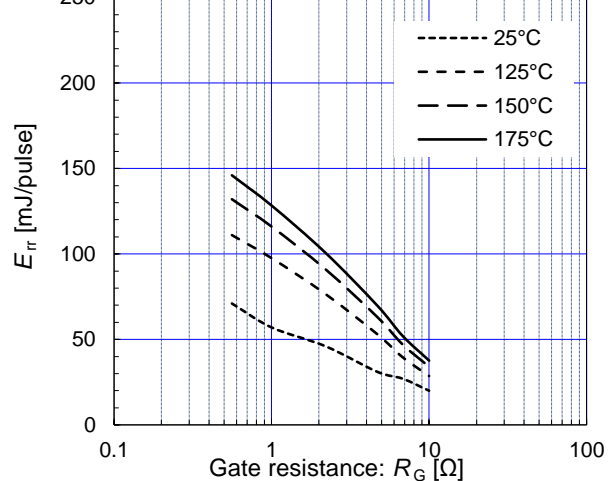
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = +0.56/-0.56 \Omega$



[Inverter]

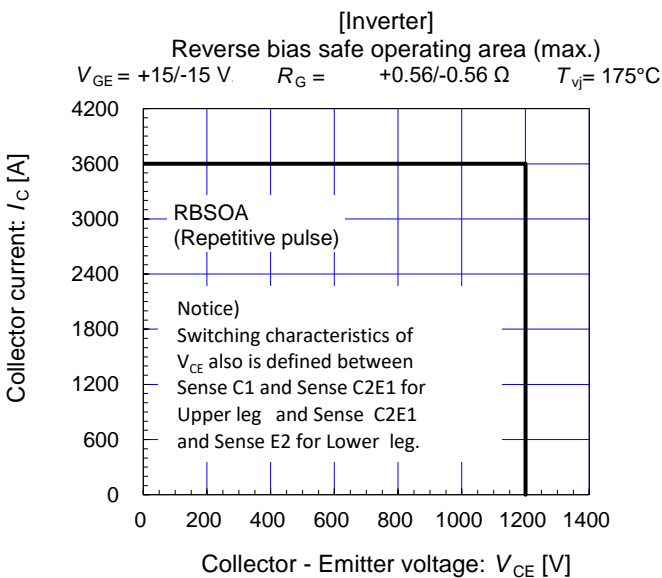
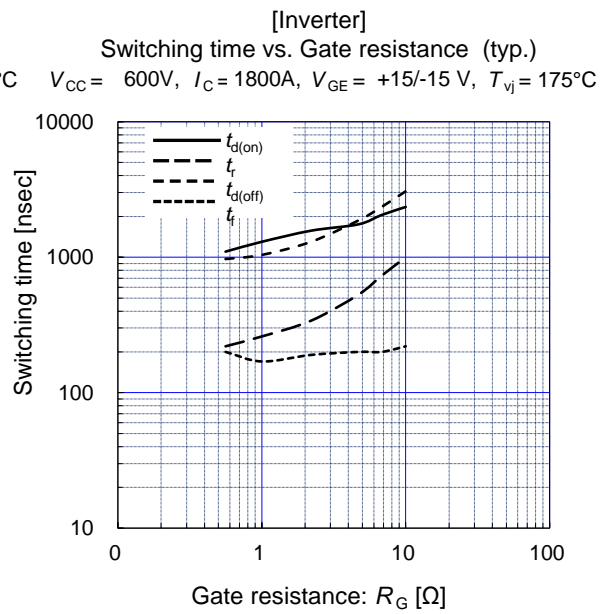
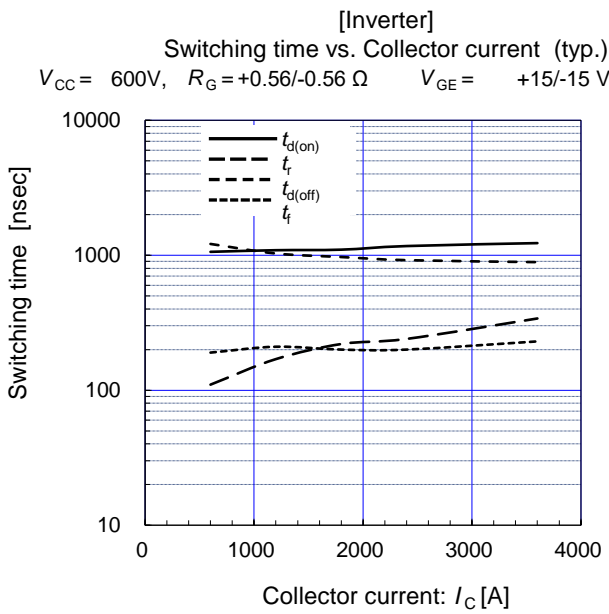
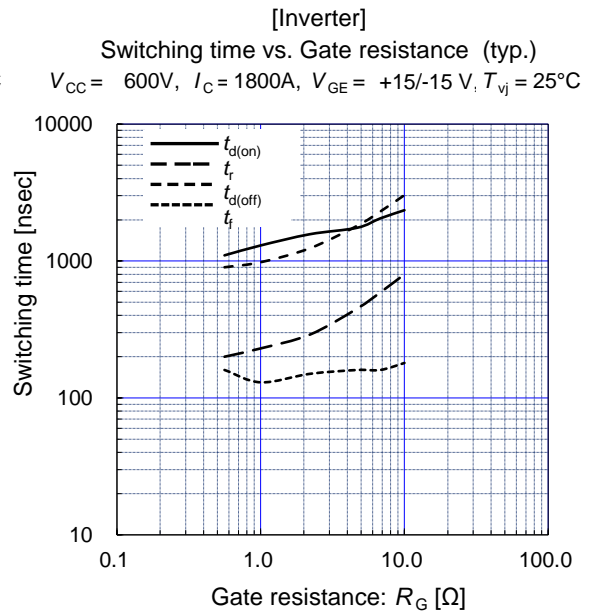
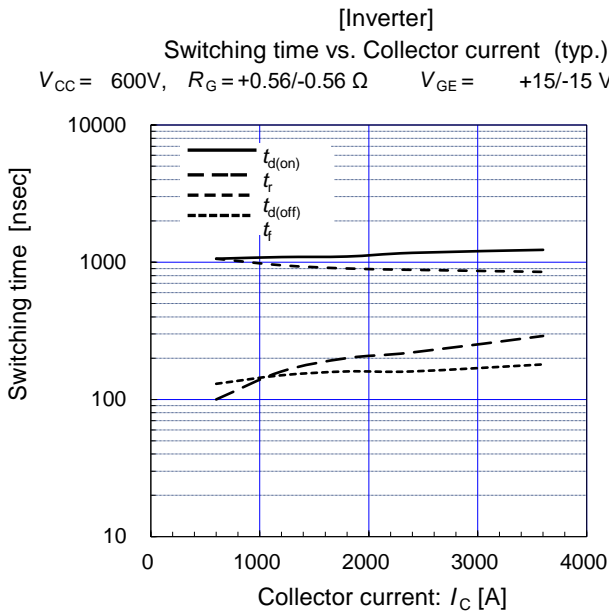
$E_{rr}$  vs. Gate resistance (typ.)

$V_{CC} = 600V, V_{GE} = +15/-15V, I_F = 1800A$



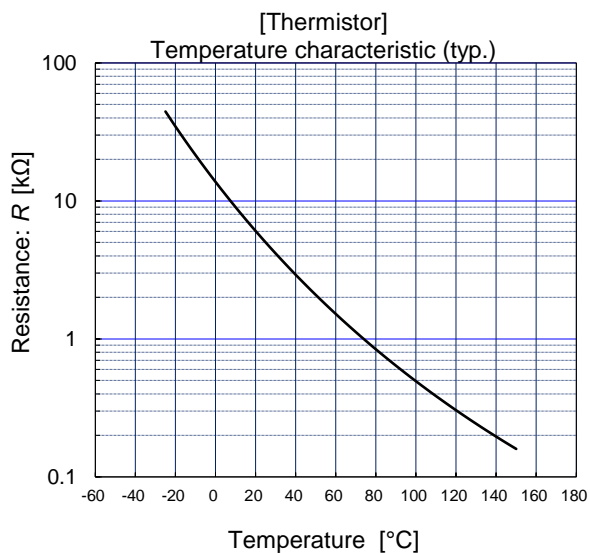
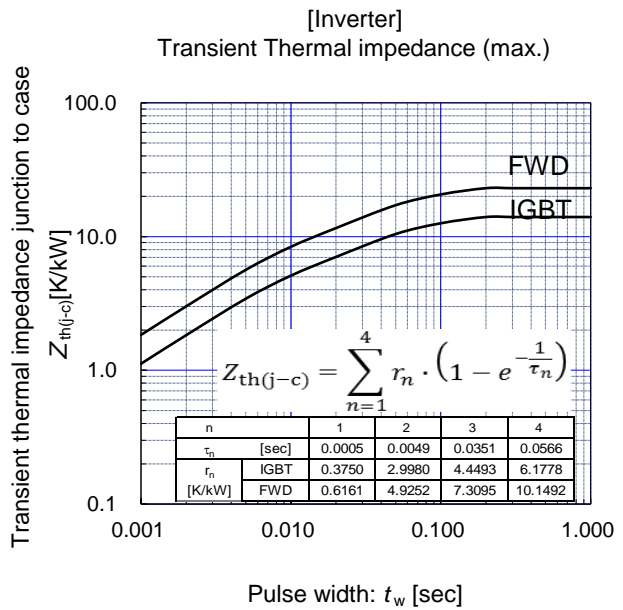
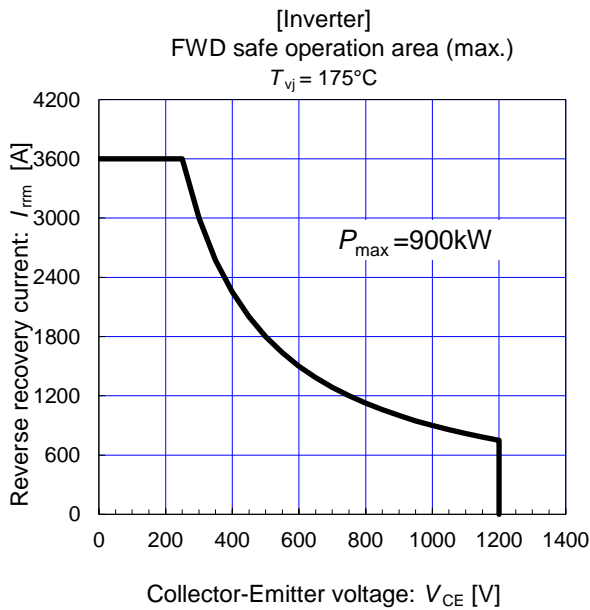
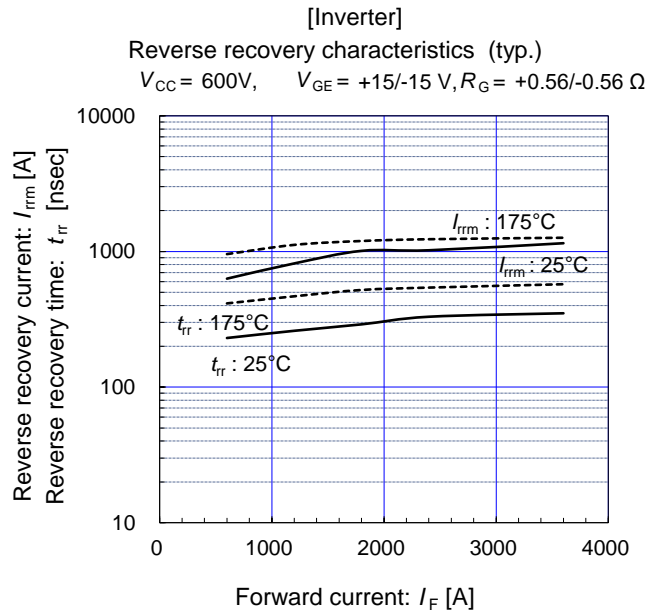
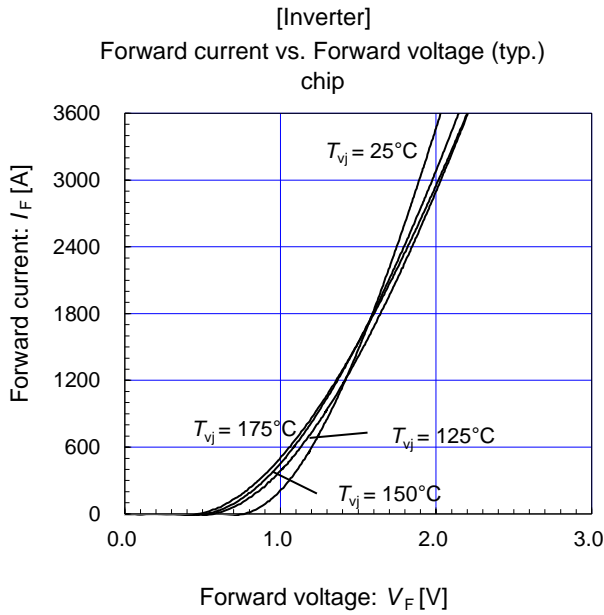
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## IGBT Modules

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