

2MBI450XNA120-50

IGBT Modules

Power Module (X series)
1200V / 450A / 2-in-1 package

■ **Features**

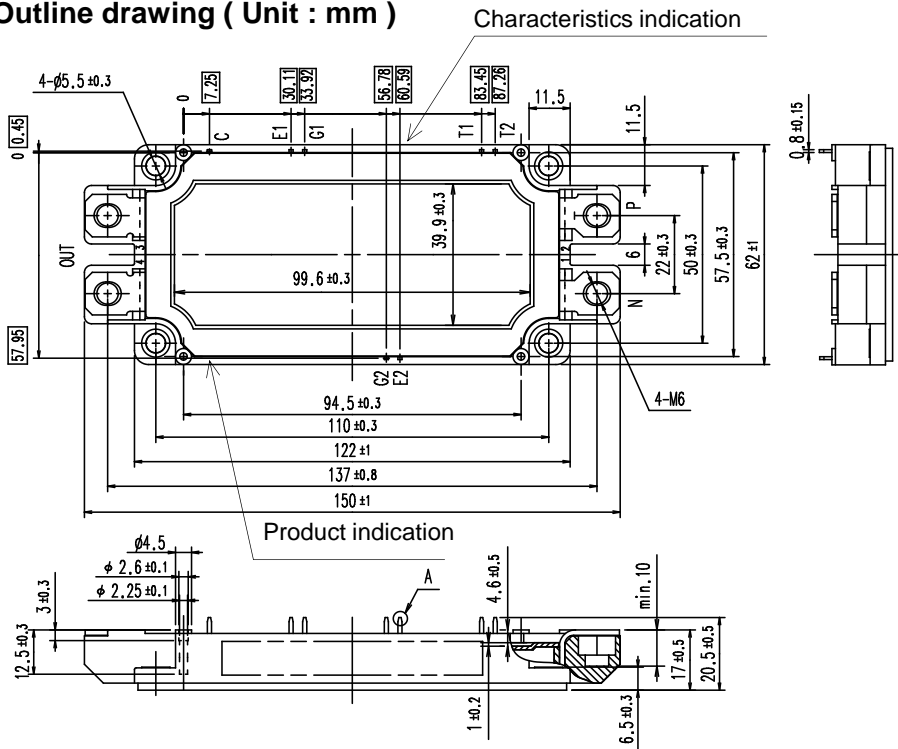
- Low $V_{CE(sat)}$
- Low Inductance Module structure
- Solder pin terminals

■ **Applications**

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



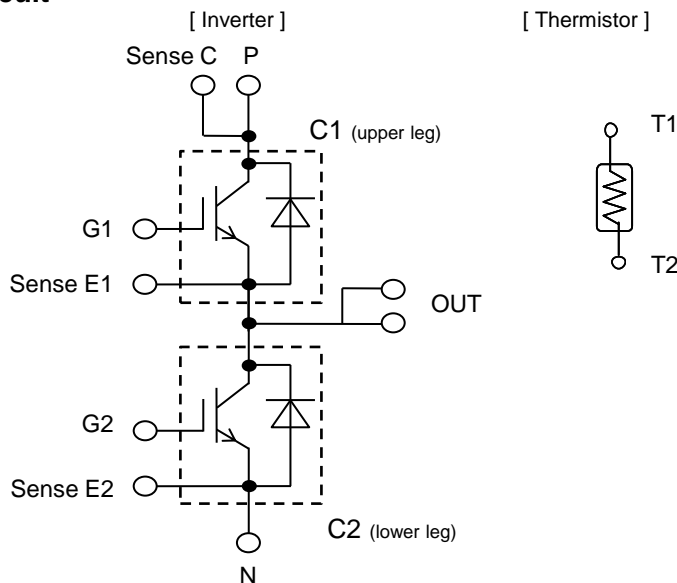
■ **Outline drawing (Unit : mm)**



NOTE) shows theoretical dimension and tolerance is $\phi \pm 0.5$

Weight: 350 g(typ.)

■ **Equivalent Circuit**



2MBI450XNA120-50

■ 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}		± 20	V
	Collector current	I_C	Continuous $T_C=90^\circ\text{C}$	450	A
	Repetitive peak collector current	I_{CRM}	1ms	900	
	Forward current	I_F		450	
	Repetitive peak forward current	I_{FRM}	1ms	900	
	Total power dissipation	P_{tot}	1 device	1760	
	Virtual junction temperature	T_{vj}		175	°C
	Operating 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.	2500	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 terminals (*3)		M_t	M6	6.0	

(*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 2.5 ~ 6.0 N·m (M5)
 Recommendable Value: : Mounting torque of screws to terminals 3.5 ~ 6.0 N·m (M6)

2MBI450XNA120-50

IGBT Modules

■ 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}	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	-	-	150	μA	
Gate leakage current, collector-emitter short-circuited	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-	-	300	nA	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 450\text{mA}$	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 450\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.85	2.30	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}\text{C}$	-	1.40	1.85	
			$T_{vj}=125^{\circ}\text{C}$	-	1.70	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.80	-	
		$T_{vj}=175^{\circ}\text{C}$	-	1.85	-		
Internal gate resistance	r_g	-	-	2.00	-	Ω	
Capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	52	-	nF	
	C_{oes}		-	1.8	-		
	C_{res}		-	0.47	-		
Gate charge	Q_G	$V_{CC} = 600\text{V}, I_C = 450\text{A}$ $V_{GE} = -15 \rightarrow +15\text{V}$	-	3.4	-	μC	
Forward voltage	V_F (terminal)	$V_{GE} = 0\text{V}$ $I_F = 450\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	2.05	2.50	V
	V_F (chip)		$T_{vj}=25^{\circ}\text{C}$	-	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)	$t_{d(on)}$	$V_{CC} = 600\text{V}$ $I_C, I_F = 450\text{A}$ $V_{GE} = +15/-15\text{V}$ $R_G = \pm 0.68\Omega$ $L_S = 35\text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	0.37	-	μs
			$T_{vj}=125^{\circ}\text{C}$	-	0.40	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.41	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.42	-	
	t_r		$T_{vj}=25^{\circ}\text{C}$	-	0.08	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.10	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.10	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.11	-	
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.40	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.43	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.44	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.46	-	
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}	$T_{vj}=25^{\circ}\text{C}$	-	0.15	-		
		$T_{vj}=125^{\circ}\text{C}$	-	0.28	-		
		$T_{vj}=150^{\circ}\text{C}$	-	0.39	-		
		$T_{vj}=175^{\circ}\text{C}$	-	0.42	-		

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

2MBI450XNA120-50

■ 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}	$V_{CC} = 600\text{V}$ $I_C, I_F = 450\text{A}$ $V_{GE} = +15/-15\text{V}$ $R_G = \pm 0.68\Omega$ $L_S = 35\text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	31.4	-	mJ
			$T_{vj}=125^{\circ}\text{C}$	-	51.3	-	
			$T_{vj}=150^{\circ}\text{C}$	-	60.7	-	
			$T_{vj}=175^{\circ}\text{C}$	-	67.3	-	
	E_{off}		$T_{vj}=25^{\circ}\text{C}$	-	39.6	-	
			$T_{vj}=125^{\circ}\text{C}$	-	48.9	-	
			$T_{vj}=150^{\circ}\text{C}$	-	53.0	-	
			$T_{vj}=175^{\circ}\text{C}$	-	55.3	-	
	E_{rr}		$T_{vj}=25^{\circ}\text{C}$	-	16.9	-	
			$T_{vj}=125^{\circ}\text{C}$	-	29.3	-	
			$T_{vj}=150^{\circ}\text{C}$	-	36.1	-	
			$T_{vj}=175^{\circ}\text{C}$	-	38.5	-	
Thermistor Resistance	R	$T = 25^{\circ}\text{C}$	-	5000	-	Ω	
		$T = 100^{\circ}\text{C}$	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.

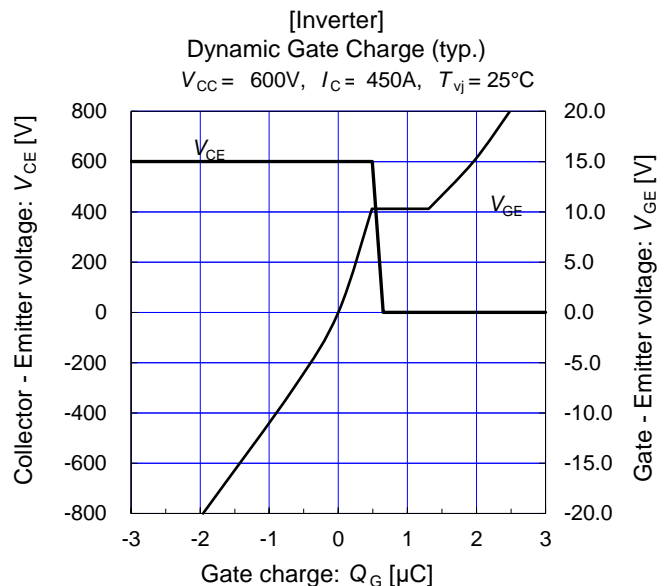
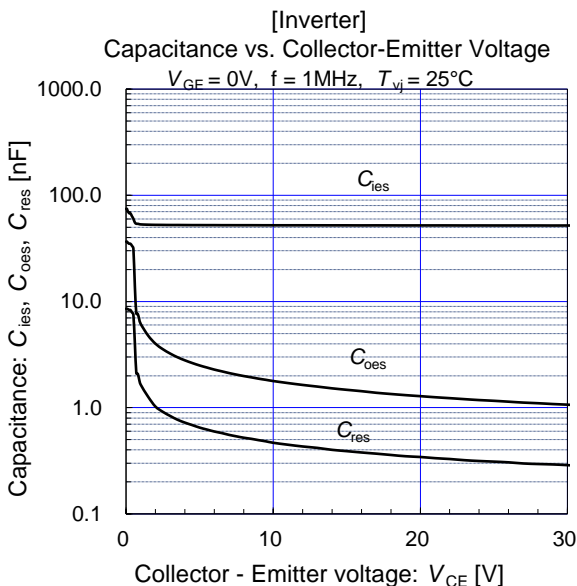
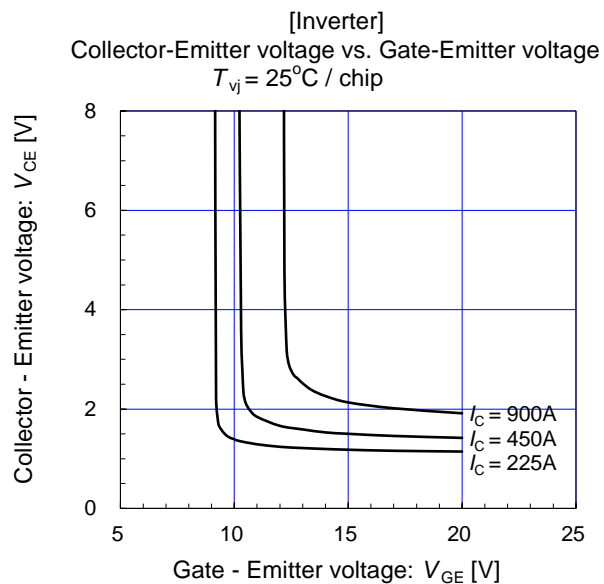
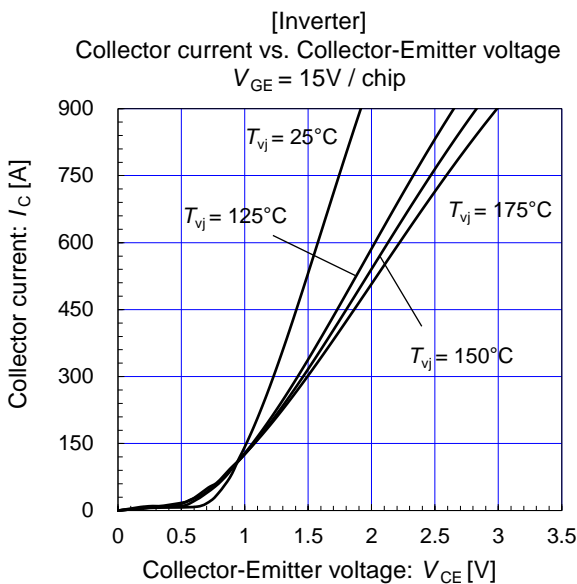
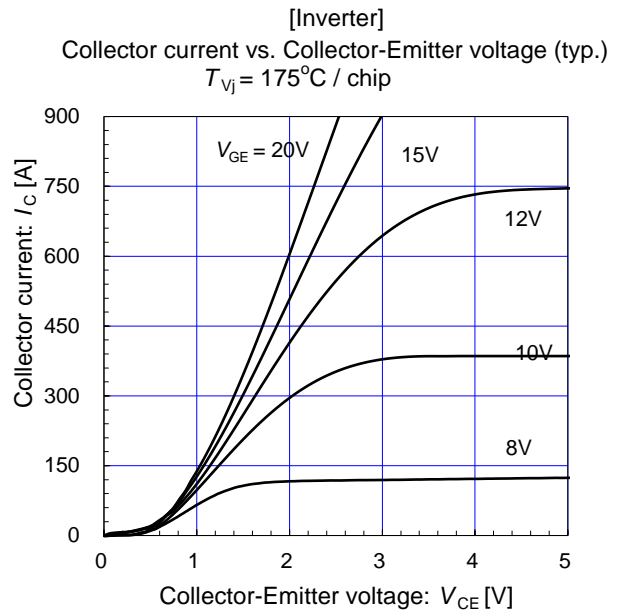
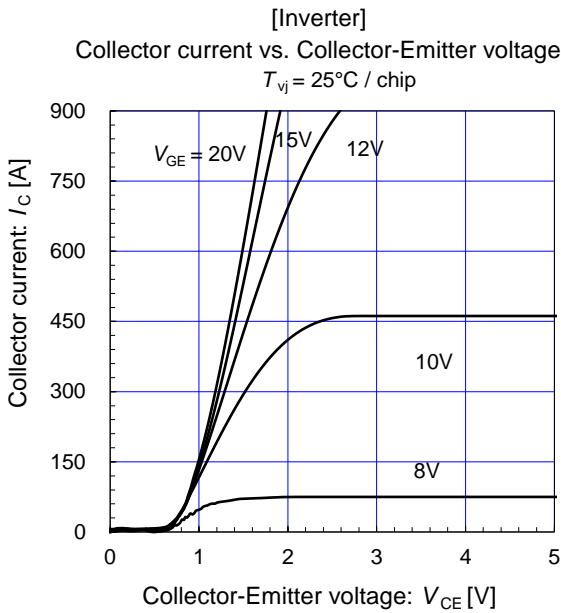
■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.085	$^{\circ}\text{C}/\text{W}$
		Inverter FWD	-	-	0.112	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/($\text{m}\cdot^{\circ}\text{C}$) thermal grease	-	0.0167	-	

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

2MBI450XNA120-50

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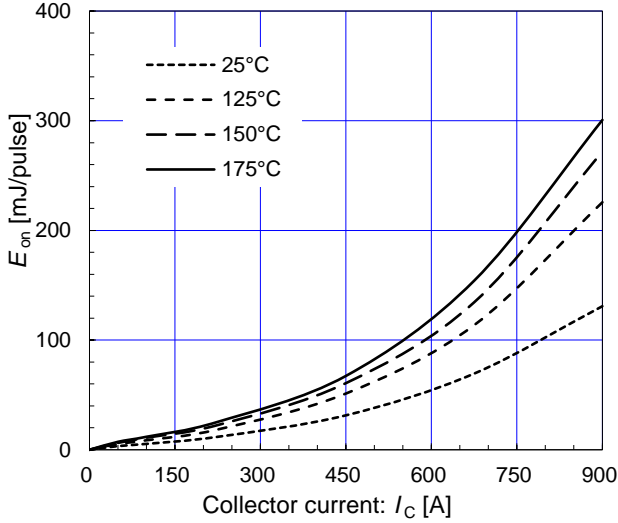
2MBI450XNA120-50

IGBT Modules

[Inverter]

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

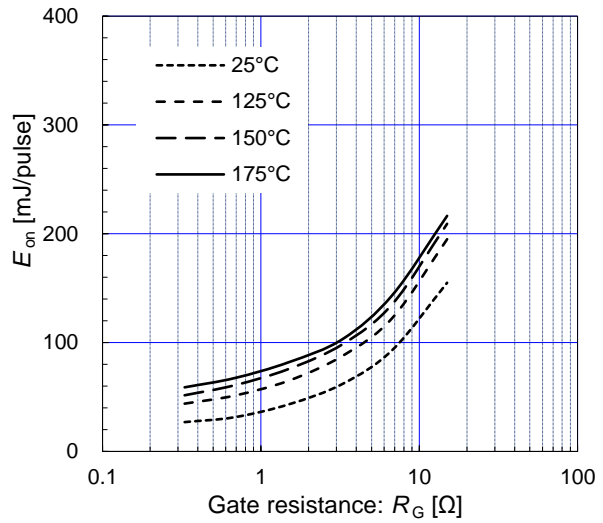
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = \pm 0.68\Omega$



[Inverter]

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

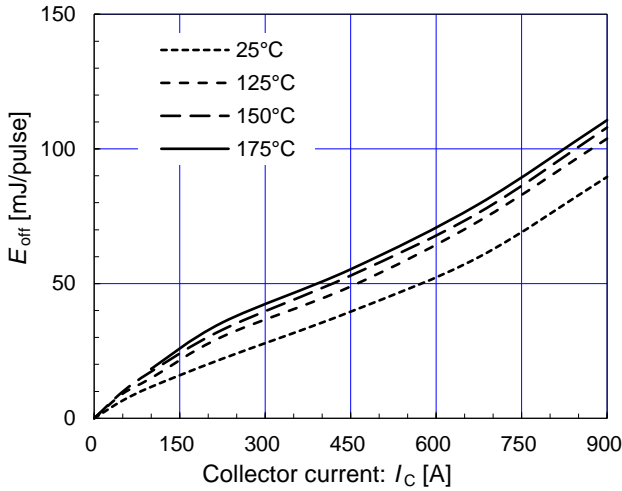
$V_{CC} = 600V, V_{GE} = +15/-15V, I_C = 450A$



[Inverter]

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

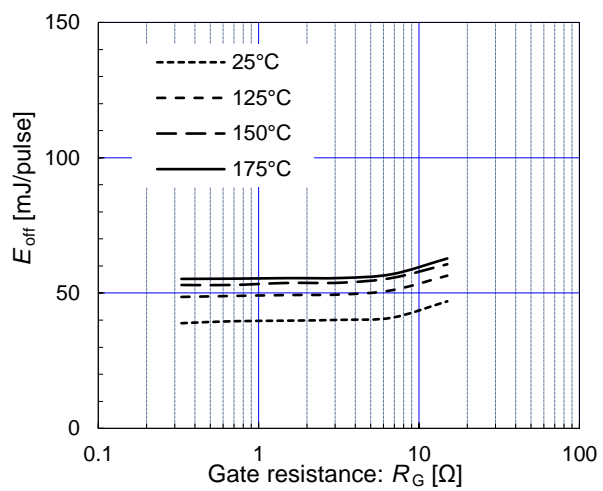
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = \pm 0.68\Omega$



[Inverter]

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

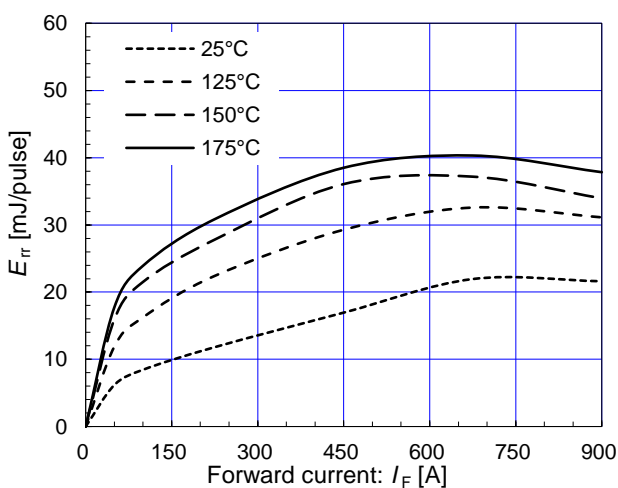
$V_{CC} = 600V, V_{GE} = +15/-15V, I_C = 450A$



[Inverter]

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

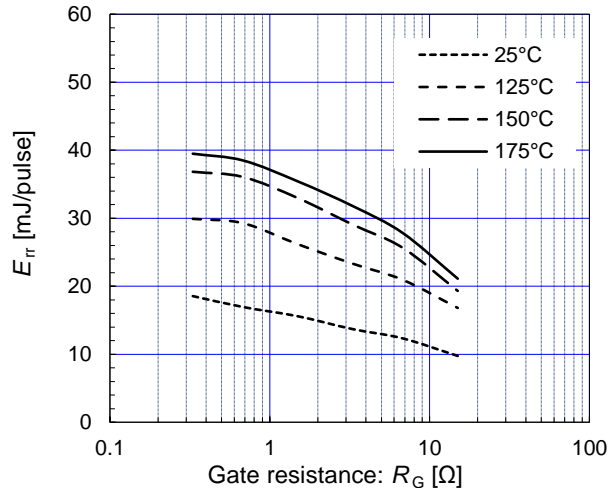
$V_{CC} = 600V, V_{GE} = +15/-15V, R_G = \pm 0.68\Omega$



[Inverter]

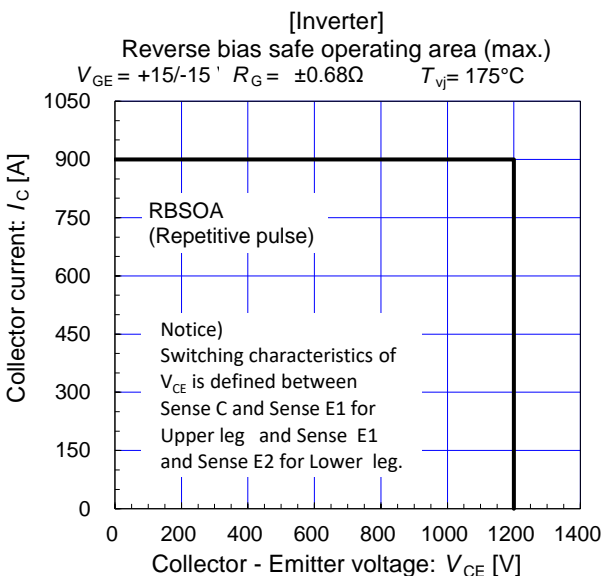
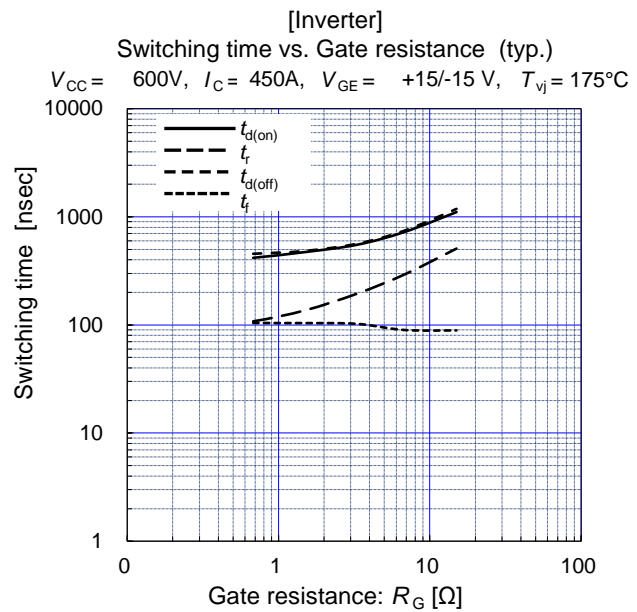
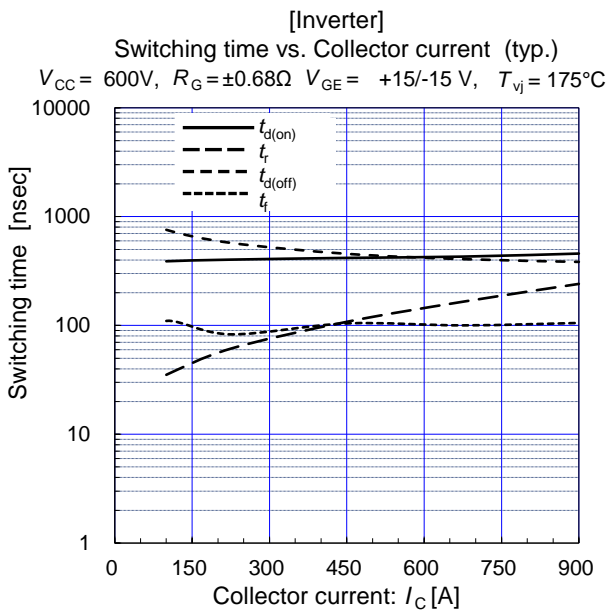
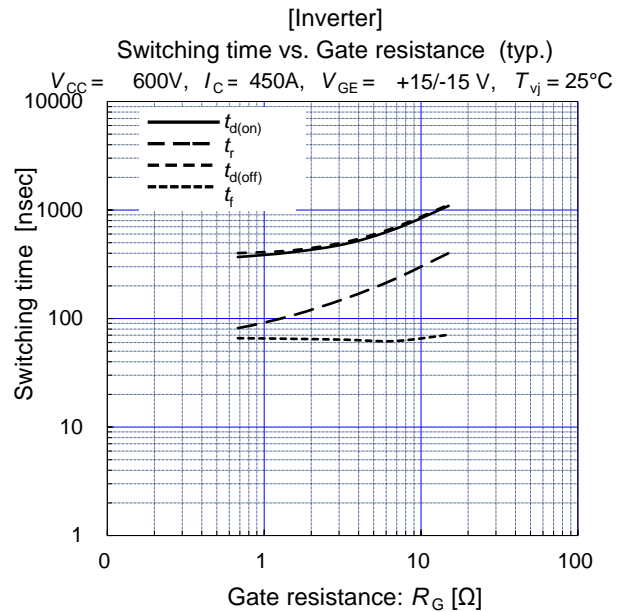
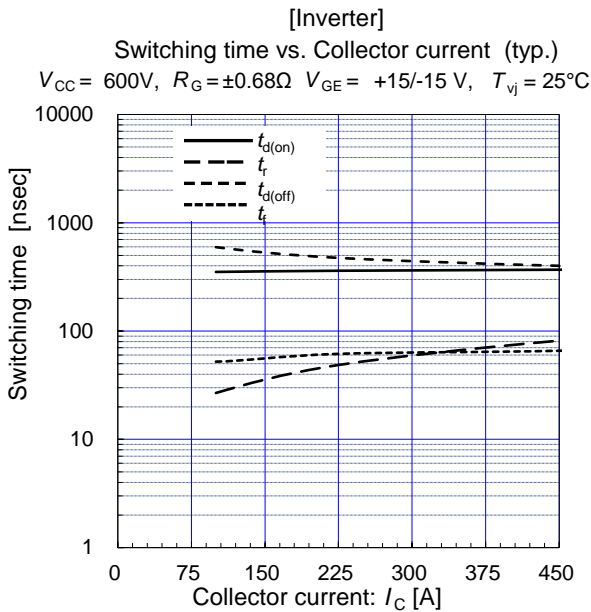
E_{rr} vs. Gate resistance (typ.)

$V_{CC} = 600V, V_{GE} = +15/-15V, I_F = 450A$



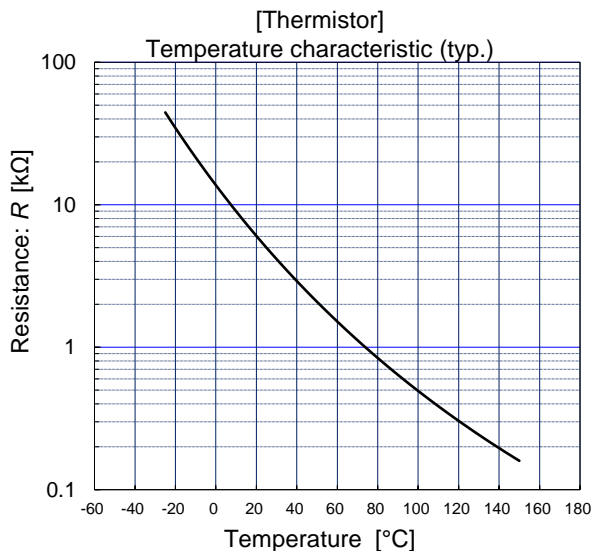
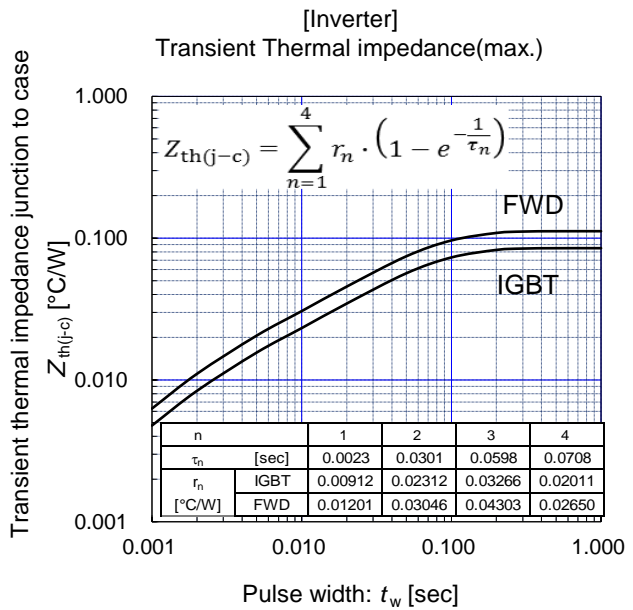
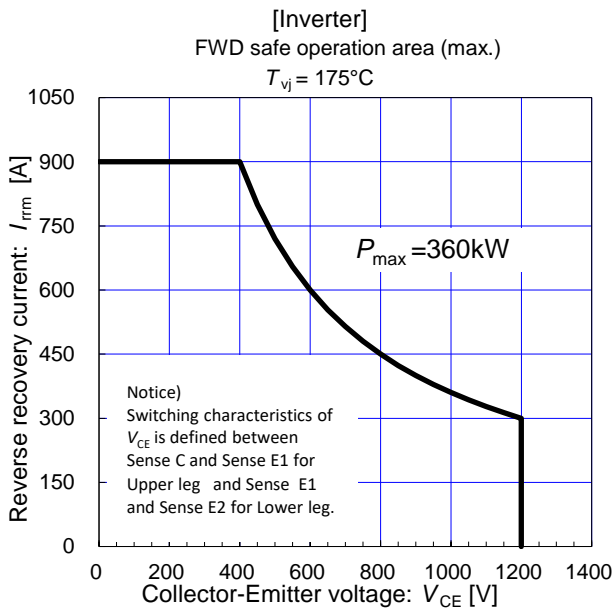
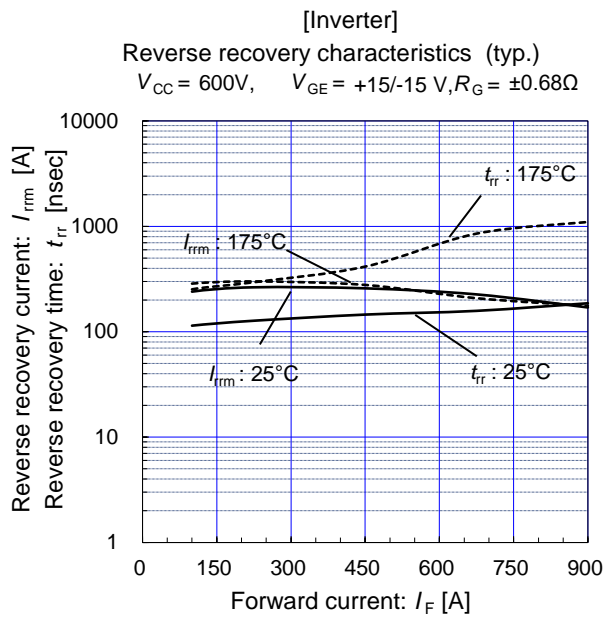
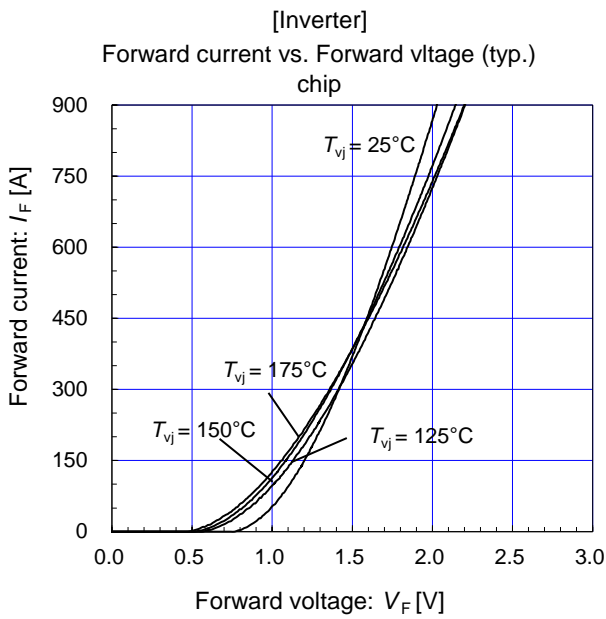
2MBI450XNA120-50

IGBT Modules



2MBI450XNA120-50

IGBT Modules



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