

2MBI450XHA120-50

IGBT Modules

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

■ **Features**

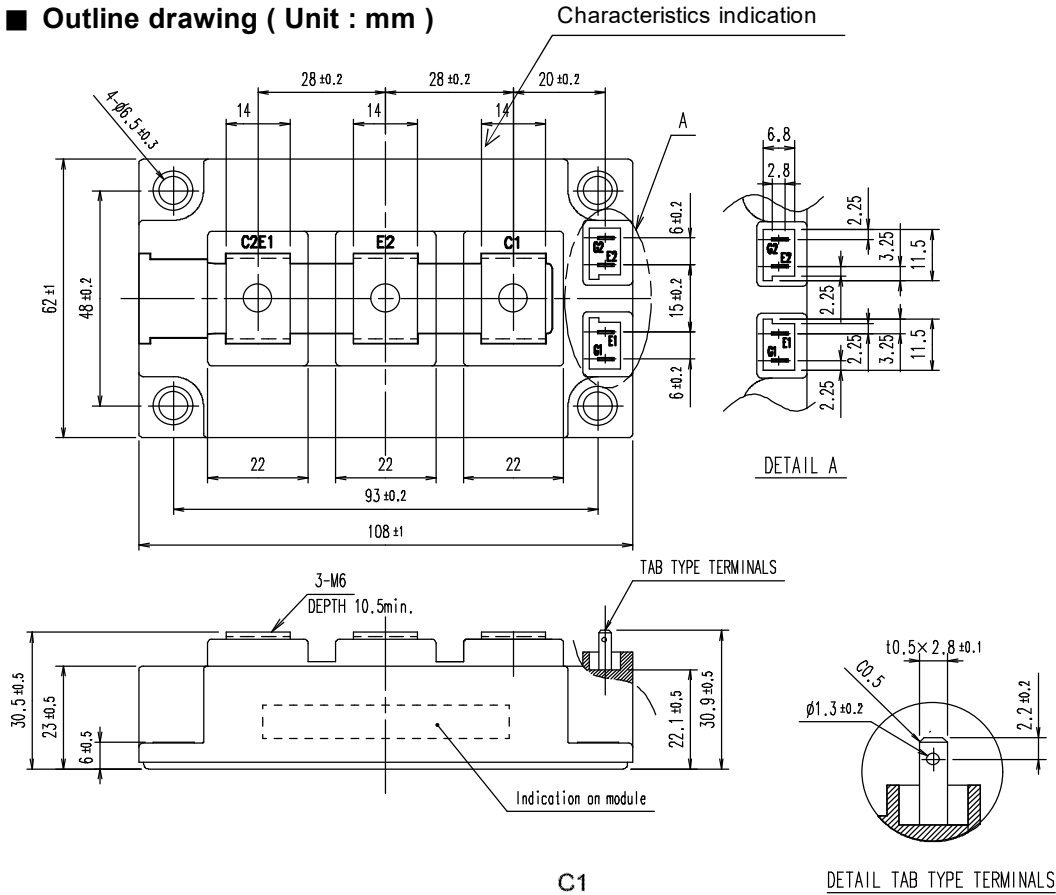
- Low $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

■ **Applications**

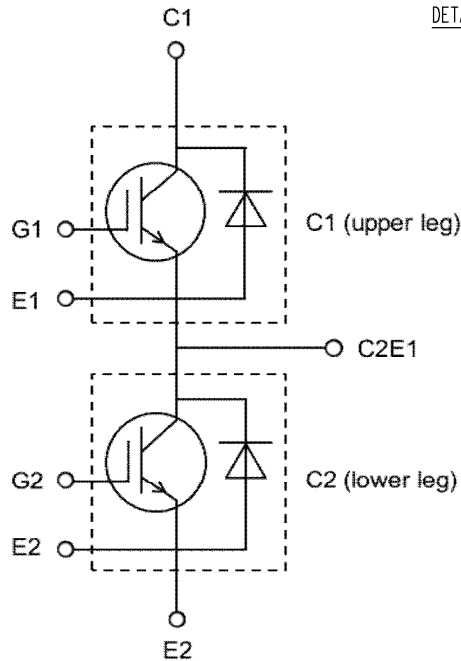
- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems,
- Industrial machines, such as Welding machines



■ **Outline drawing (Unit : mm)**



■ **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 $T_c = 85^\circ\text{C}$	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	1850	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 terminals and copper base (*1)	V_{isol}	AC: 1min.	4000	Vrms
Mounting torque of screws to heat sink		M_s	M5 or M6	3.0 ~ 6.0	N·m
Mounting torque of screws to terminals		M_t	M6	2.5 ~ 5.0	

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

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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}	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	-	-	200	μA	
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-	-	400	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)	$V_{GE} = 15\text{V}$ $I_C = 450\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.65	2.10	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}\text{C}$	-	1.45	1.90	
			$T_{vj}=125^{\circ}\text{C}$	-	1.85	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.90	-	
			$T_{vj}=175^{\circ}\text{C}$	-	2.00	-	
Internal gate resistance	r_g	-	-	2.25	-	Ω	
Capacitance	C_{ies}	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	46	-	nF	
	C_{oes}		-	1.6	-		
	C_{res}		-	0.42	-		
Gate charge	Q_G	$V_{CC} = 600\text{V}, I_C = 450\text{A}$ $V_{GE} = -15 \rightarrow +15\text{V}$	-	3100	-	nC	
Forward on voltage	V_F (terminal)	$V_{GE} = 0\text{V}$ $I_F = 450\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.85	2.30	V
	V_F (chip)		$T_{vj}=25^{\circ}\text{C}$	-	1.65	2.10	
			$T_{vj}=125^{\circ}\text{C}$	-	1.70	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.65	-	
			$T_{vj}=175^{\circ}\text{C}$	-	1.70	-	
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600\text{V}$ $I_C, I_F = 450\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = 1\ \Omega$ $L_S = 30\ \text{nH}$	$T_{vj}=25^{\circ}\text{C}$	-	385	-	ns
			$T_{vj}=125^{\circ}\text{C}$	-	385	-	
			$T_{vj}=150^{\circ}\text{C}$	-	385	-	
			$T_{vj}=175^{\circ}\text{C}$	-	385	-	
	t_r		$T_{vj}=25^{\circ}\text{C}$	-	90	-	
			$T_{vj}=125^{\circ}\text{C}$	-	95	-	
			$T_{vj}=150^{\circ}\text{C}$	-	95	-	
			$T_{vj}=175^{\circ}\text{C}$	-	100	-	
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	345	-	
			$T_{vj}=125^{\circ}\text{C}$	-	370	-	
			$T_{vj}=150^{\circ}\text{C}$	-	380	-	
			$T_{vj}=175^{\circ}\text{C}$	-	375	-	
	t_f		$T_{vj}=25^{\circ}\text{C}$	-	125	-	
			$T_{vj}=125^{\circ}\text{C}$	-	185	-	
			$T_{vj}=150^{\circ}\text{C}$	-	205	-	
			$T_{vj}=175^{\circ}\text{C}$	-	220	-	
Reverse recovery time	t_{rr}	$T_{vj}=25^{\circ}\text{C}$	-	140	-		
		$T_{vj}=125^{\circ}\text{C}$	-	195	-		
		$T_{vj}=150^{\circ}\text{C}$	-	615	-		
		$T_{vj}=175^{\circ}\text{C}$	-	600	-		

(*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}	$V_{CC} = 600\text{V}$ $I_C, I_F = 450\text{A}$ $V_{GE} = \pm 15\text{V}$ $R_G = 1\ \Omega$ $L_S = 30\text{ nH}$	$T_{vj} = 25^{\circ}\text{C}$	-	27.2	-	mJ
			$T_{vj} = 125^{\circ}\text{C}$	-	43.3	-	
			$T_{vj} = 150^{\circ}\text{C}$	-	47.3	-	
			$T_{vj} = 175^{\circ}\text{C}$	-	53.3	-	
	E_{off}		$T_{vj} = 25^{\circ}\text{C}$	-	29.8	-	
			$T_{vj} = 125^{\circ}\text{C}$	-	36.3	-	
			$T_{vj} = 150^{\circ}\text{C}$	-	38.0	-	
			$T_{vj} = 175^{\circ}\text{C}$	-	39.3	-	
	E_{rr}		$T_{vj} = 25^{\circ}\text{C}$	-	10.4	-	
			$T_{vj} = 125^{\circ}\text{C}$	-	20.7	-	
			$T_{vj} = 150^{\circ}\text{C}$	-	23.2	-	
			$T_{vj} = 175^{\circ}\text{C}$	-	26.8	-	

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.

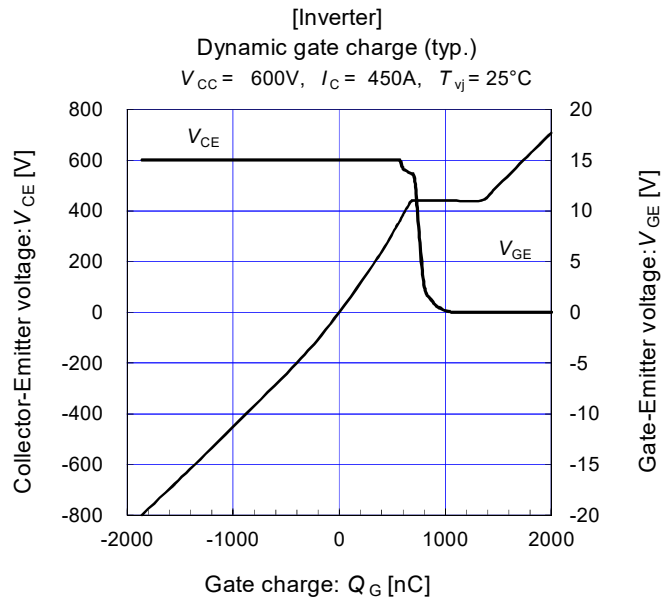
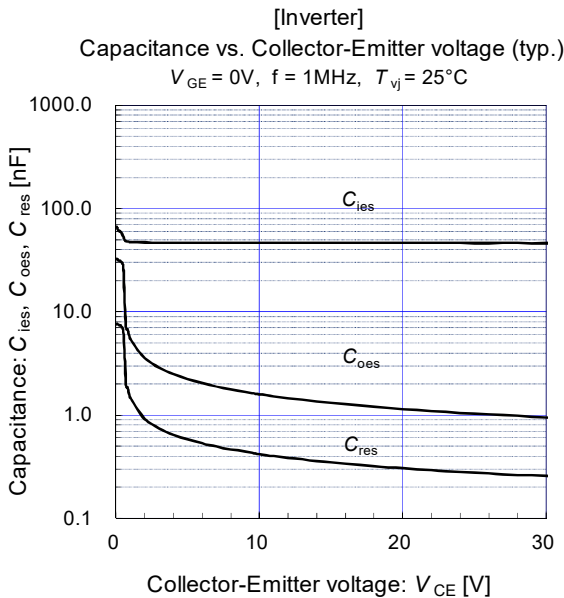
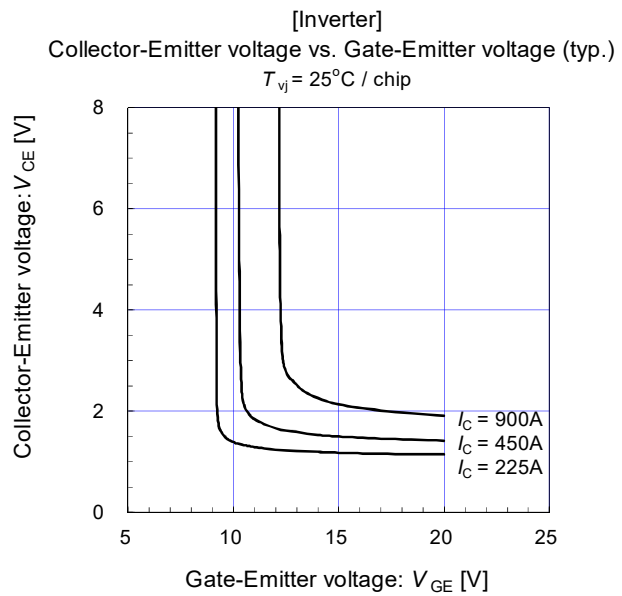
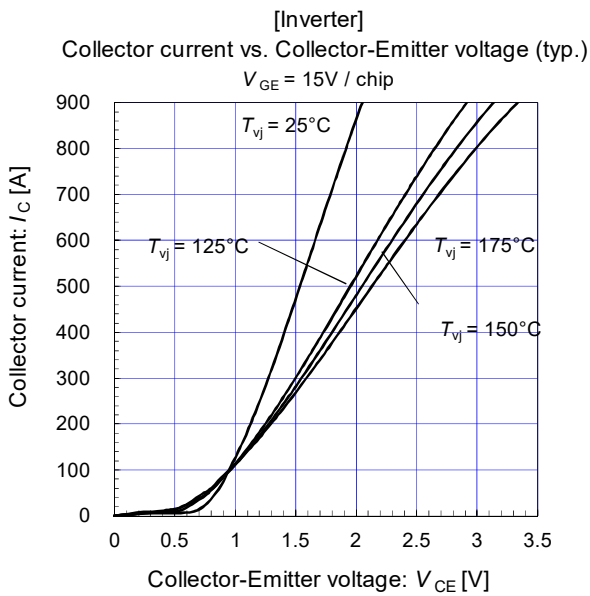
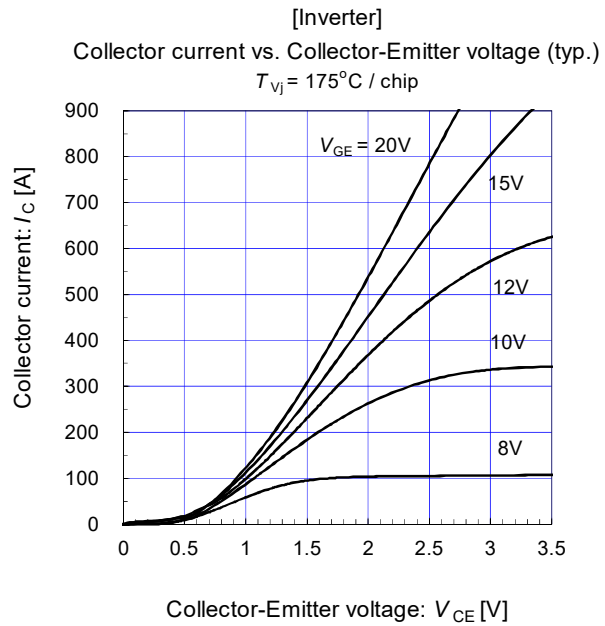
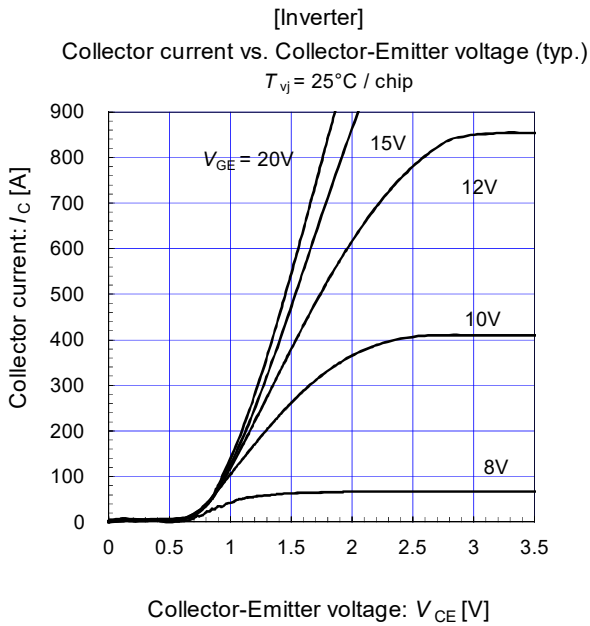
■ Thermal resistance characteristics

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.081	K/W
		Inverter FWD	-	-	0.121	
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 cooling fin with thermal compound.

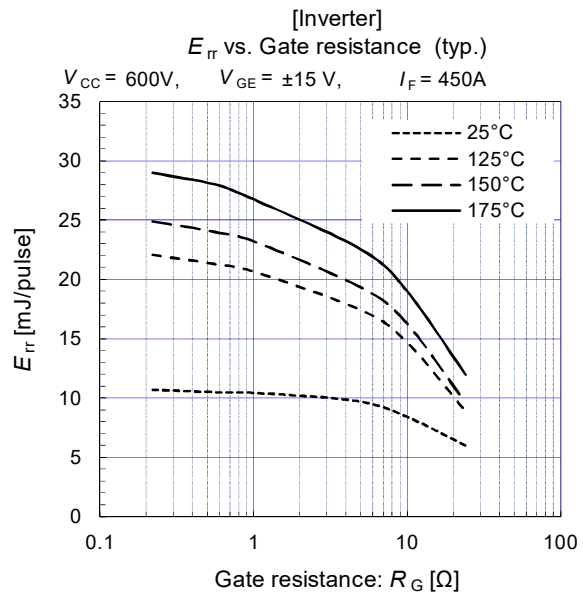
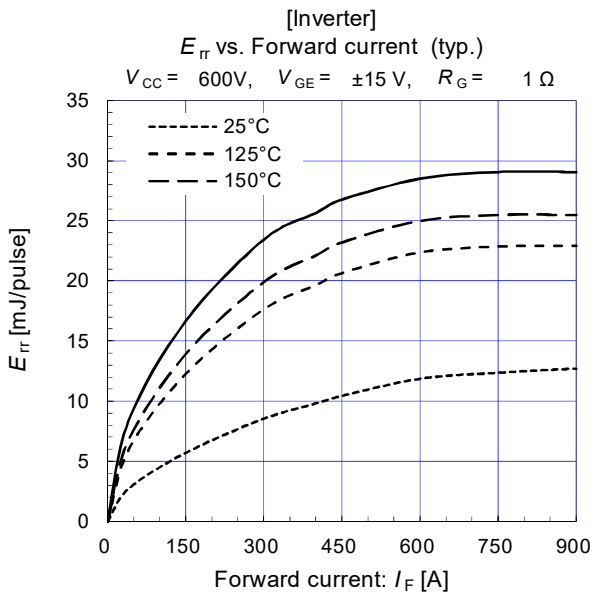
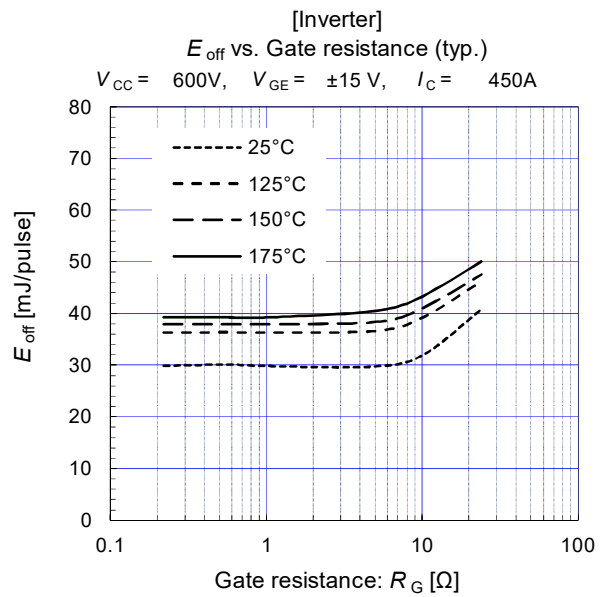
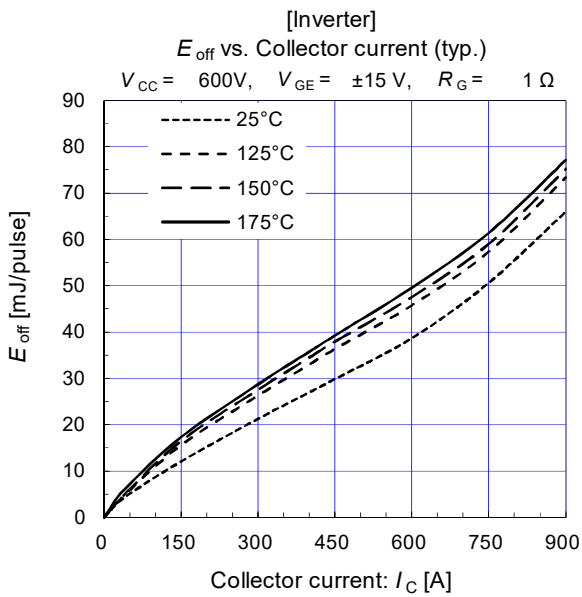
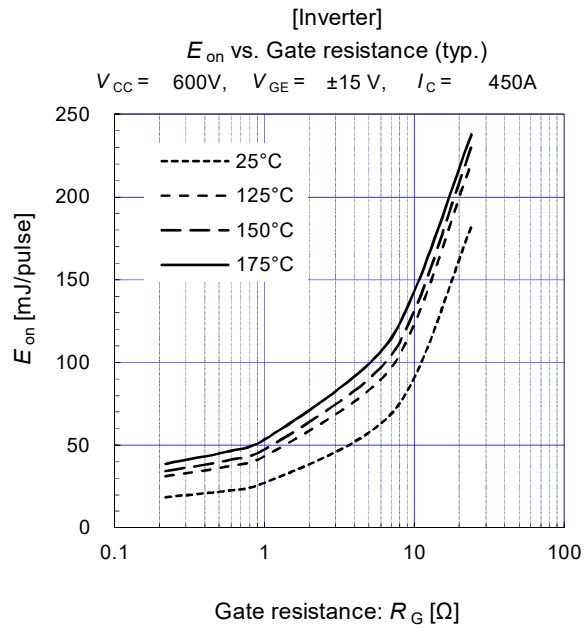
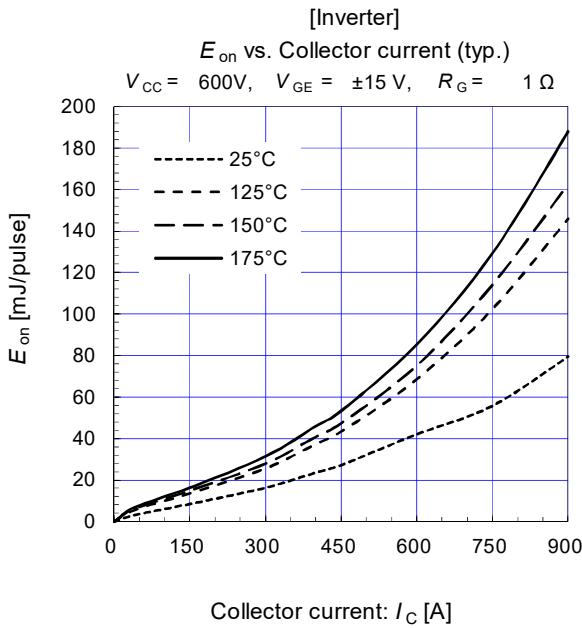
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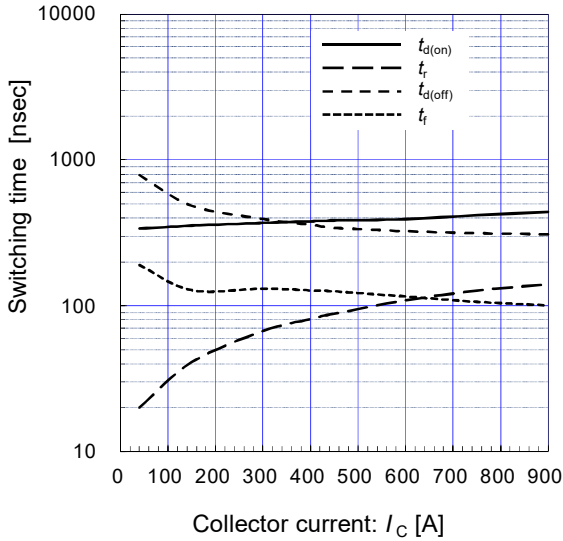
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[Inverter]

Switching time vs. Collector current (typ.)

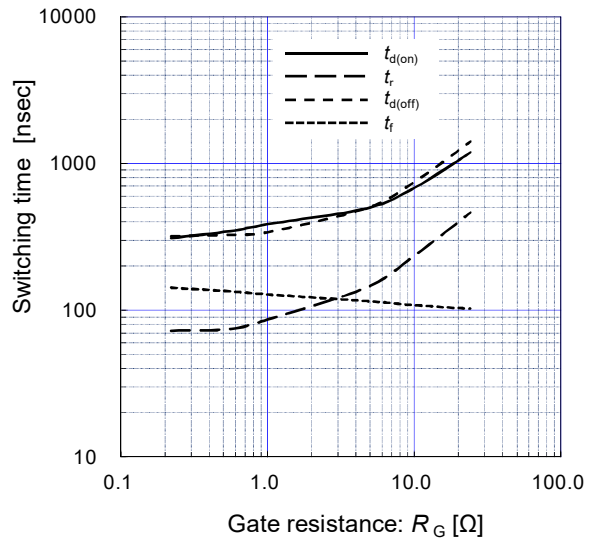
$V_{CC} = 600V, R_G = 1\Omega, V_{GE} = \pm 15V, T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

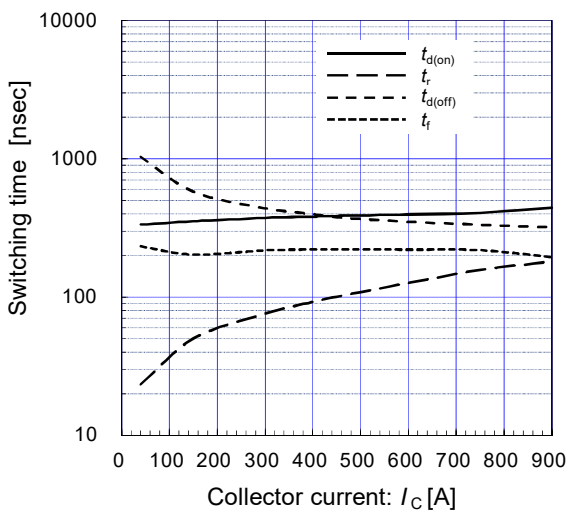
$V_{CC} = 600V, I_C = 450A, V_{GE} = \pm 15V, T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

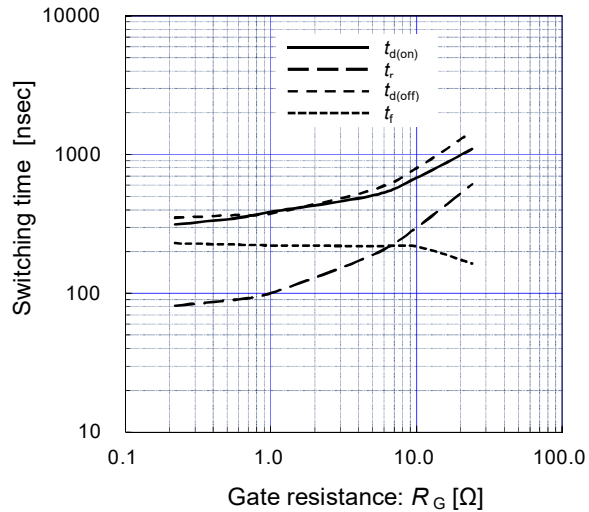
$V_{CC} = 600V, R_G = 1\Omega, V_{GE} = \pm 15V, T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

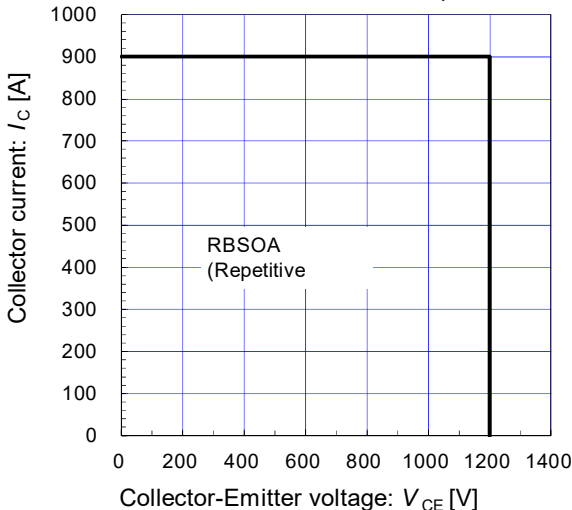
$V_{CC} = 600V, I_C = 450A, V_{GE} = \pm 15V, T_{vj} = 175^\circ C$



[Inverter]

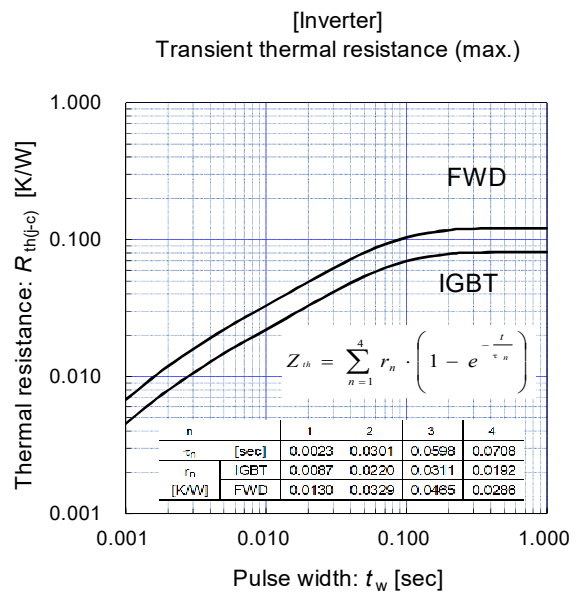
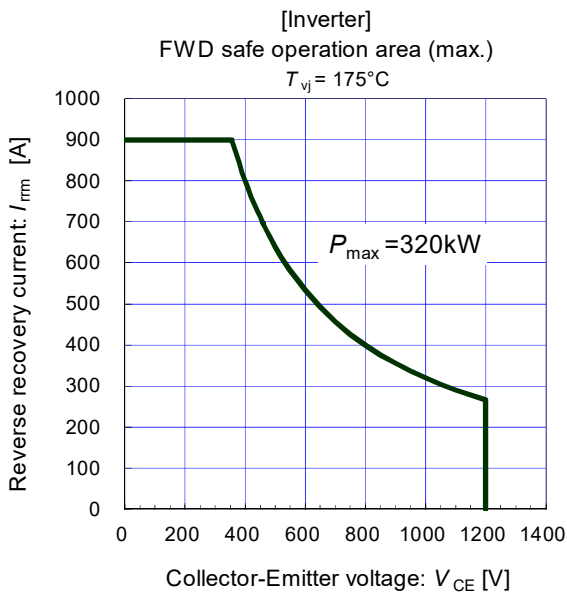
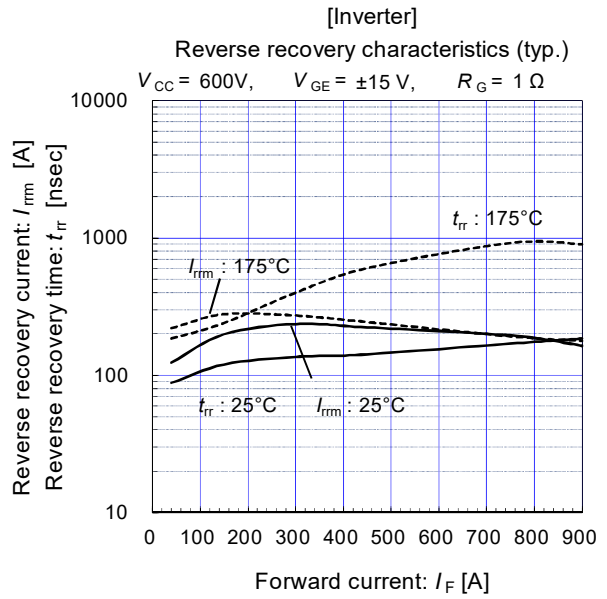
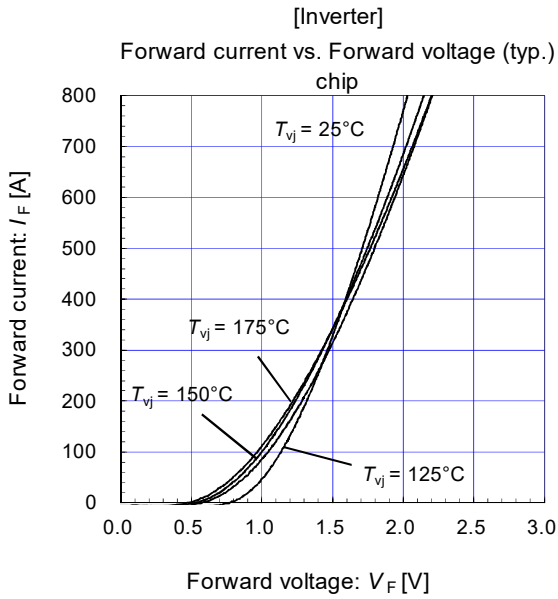
Reverse bias safe operating area (max.)

$V_{GE} = \pm 15V, R_G = 1\Omega, T_{vj} = 175^\circ C$



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