

2MBI450XHA120-50

IGBT Modules

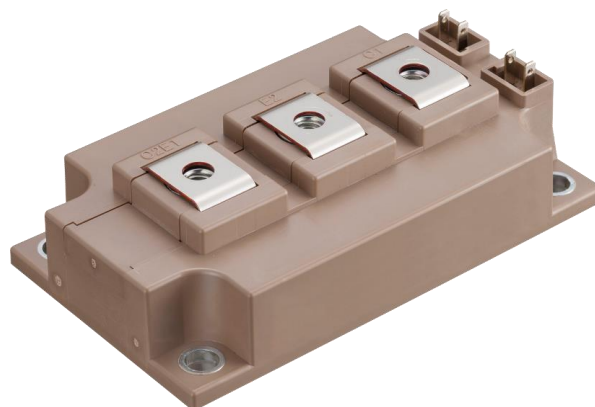
Power Module (X series)
1200V / 450A / 2-in-1 package

■ Features

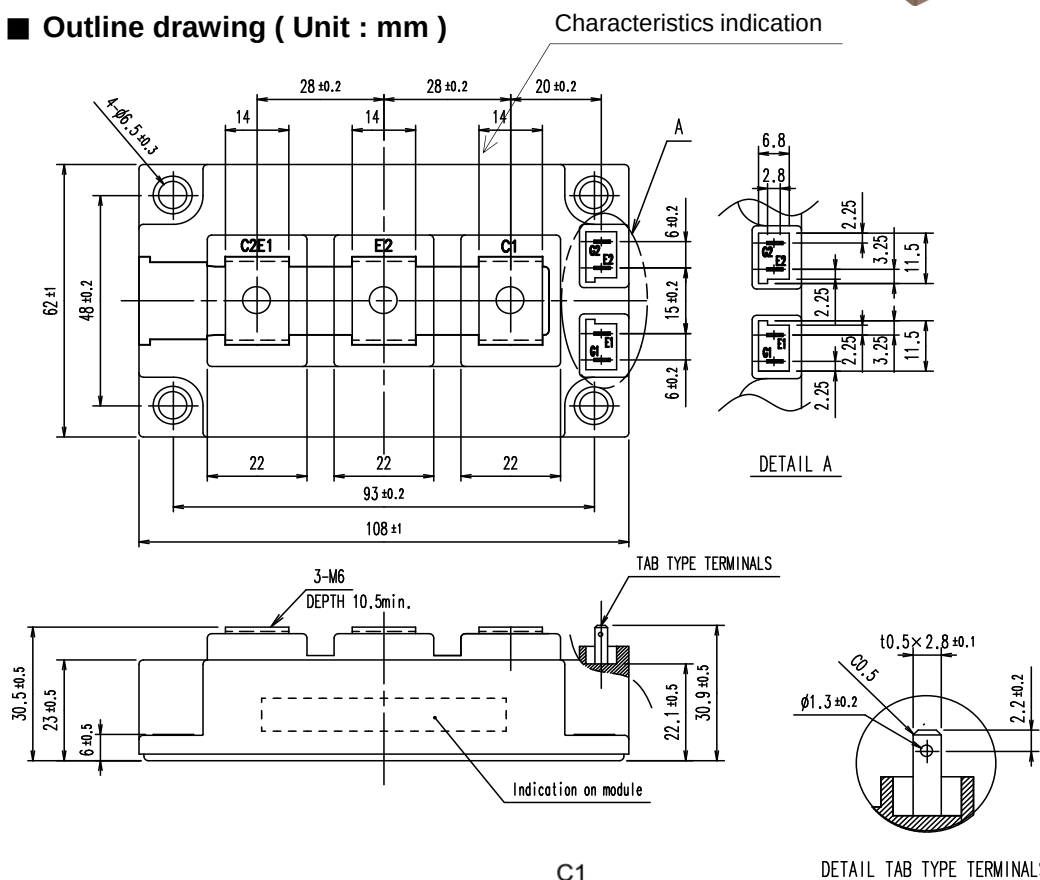
- LOW $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

■ Applications

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

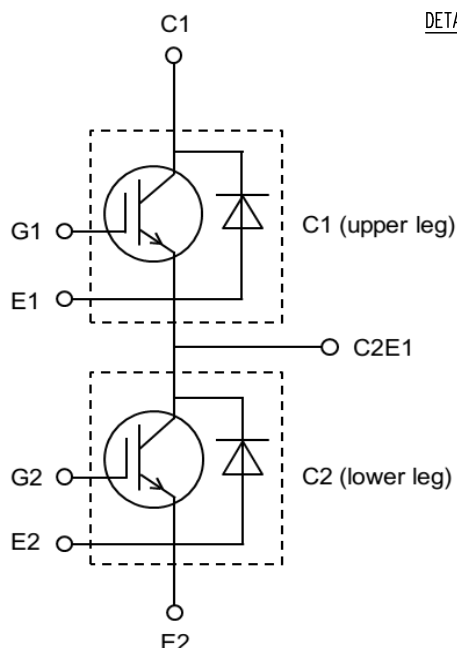


■ Outline drawing (Unit : mm)



Weight: 370 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 Gate-Emitter short-circuited	V_{CES}		1200	V
	Gate-Emitter voltage Collector-Emitter short-circuited	V_{GES}		± 20	V
	Collector current	I_C	Continuous $T_c = 100^\circ\text{C}$	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 terminal and copper base (*1)	V_{isol}	AC: 1min.	4000	Vrms
Mounting torque of screws to heat sink (*2)		M_s	M5 or M6	6.0	N·m
Mounting torque of screws to terminals (*2)		M_t	M6	5.0	

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

(*2) Recommendable Value: Mounting 3.0 ~ 6.0 N·m (M5 or M6)
Recommendable Value: Terminals 2.5 ~ 5.0 N·m (M6)

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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}	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CE}} = 1200\text{V}$		-	-	200	μA
	Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{\text{CE}}\!=\!0\text{V}$, $V_{\text{GE}}\!=\!\pm 20\text{V}$		-	-	400	nA
	Gate-Emitter threshold voltage	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 450\text{mA}$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{\text{CE(sat)}}$ (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 450\text{A}$	$T_{\text{vj}}\!=\!25^{\circ}\text{C}$	-	1.65	2.10	V
		$V_{\text{CE(sat)}}$ (chip)		$T_{\text{vj}}\!=\!25^{\circ}\text{C}$	-	1.45	1.90	
				$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	1.85	-	
				$T_{\text{vj}}\!=\!150^{\circ}\text{C}$	-	1.90	-	
				$T_{\text{vj}}\!=\!175^{\circ}\text{C}$	-	2.00	-	
	Internal gate resistance	r_{g}	-		-	2.25	-	Ω
	Capacitance	C_{ies}	$V_{\text{CE}}\!=\!10\text{V}$, $V_{\text{GE}}\!=\!0\text{V}$, $f\!=\!1\text{MHz}$		-	46	-	nF
		C_{oes}			-	1.6	-	
		C_{res}			-	0.42	-	
	Gate charge	Q_{G}	$V_{\text{CC}} = 600\text{V}$, $I_{\text{C}} = 450\text{A}$ $V_{\text{GE}} = -15 \rightarrow +15\text{V}$		-	2950	-	nC
	Forward on voltage	V_{F} (terminal)	$V_{\text{GE}} = 0\text{V}$ $I_{\text{F}}\!=\!450\text{A}$	$T_{\text{vj}}\!=\!25^{\circ}\text{C}$	-	1.85	2.30	V
		V_{F} (chip)		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	1.65	2.10	
				$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	1.75	-	
				$T_{\text{vj}}\!=\!150^{\circ}\text{C}$	-	1.70	-	
				$T_{\text{vj}}\!=\!175^{\circ}\text{C}$	-	1.70	-	
	Switching time (*1)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 450\text{A}$ $V_{\text{GE}} = +15/\text{-}15\text{V}$ $R_{\text{G}} = 1\ \Omega$ $L_{\text{S}} = 35\text{ nH}$	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	385	-	ns
				$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	385	-	
				$T_{\text{vj}}\!=\!150^{\circ}\text{C}$	-	385	-	
				$T_{\text{vj}}\!=\!175^{\circ}\text{C}$	-	385	-	
		t_{r}		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	90	-	
				$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	95	-	
				$T_{\text{vj}}\!=\!150^{\circ}\text{C}$	-	95	-	
				$T_{\text{vj}}\!=\!175^{\circ}\text{C}$	-	100	-	
$t_{\text{d(off)}}$		$T_{\text{vj}} = 25^{\circ}\text{C}$		-	345	-		
		$T_{\text{vj}}\!=\!125^{\circ}\text{C}$		-	370	-		
		$T_{\text{vj}}\!=\!150^{\circ}\text{C}$		-	380	-		
		$T_{\text{vj}}\!=\!175^{\circ}\text{C}$		-	375	-		
t_{f}		$T_{\text{vj}} = 25^{\circ}\text{C}$		-	125	-		
		$T_{\text{vj}}\!=\!125^{\circ}\text{C}$		-	185	-		
		$T_{\text{vj}}\!=\!150^{\circ}\text{C}$		-	205	-		
		$T_{\text{vj}}\!=\!175^{\circ}\text{C}$		-	220	-		
Reverse recovery time	t_{rr}	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	260	-			
		$T_{\text{vj}}\!=\!125^{\circ}\text{C}$	-	555	-			
		$T_{\text{vj}}\!=\!150^{\circ}\text{C}$	-	630	-			
		$T_{\text{vi}}\!=\!175^{\circ}\text{C}$	-	710	-			

(*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}	$V_{CC} = 600V$ $I_C, I_F = 450A$ $V_{GE} = +15/ -15V$ $R_G = 1 \Omega$ $L_S = 35 \text{ nH}$	$T_{vj}= 25^{\circ}C$	-	27.2	-	mJ
				$T_{vj}=125^{\circ}C$	-	43.3	-	
				$T_{vj}=150^{\circ}C$	-	47.3	-	
				$T_{vj}=175^{\circ}C$	-	53.3	-	
		E_{off}		$T_{vj}= 25^{\circ}C$	-	29.8	-	
				$T_{vj}=125^{\circ}C$	-	36.3	-	
				$T_{vj}=150^{\circ}C$	-	38.0	-	
				$T_{vj}=175^{\circ}C$	-	39.3	-	
		E_{rr}		$T_{vj}= 25^{\circ}C$	-	10.4	-	
				$T_{vj}=125^{\circ}C$	-	20.7	-	
				$T_{vj}=150^{\circ}C$	-	23.2	-	
				$T_{vj}=175^{\circ}C$	-	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.

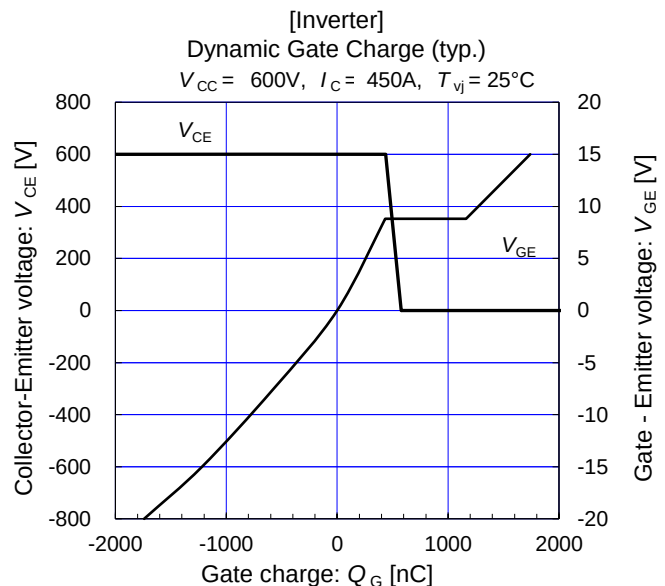
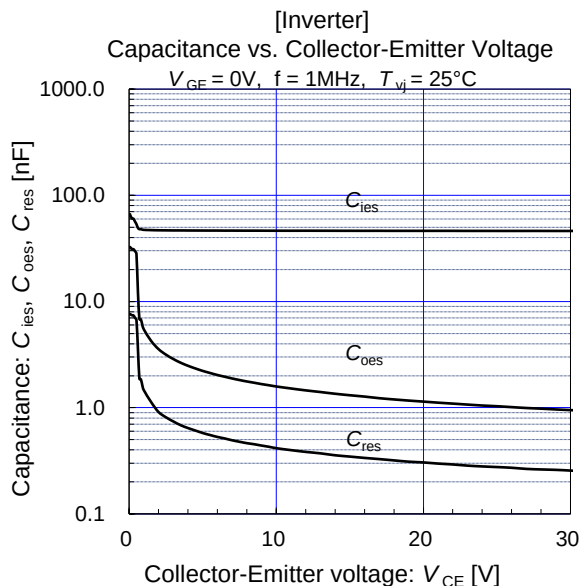
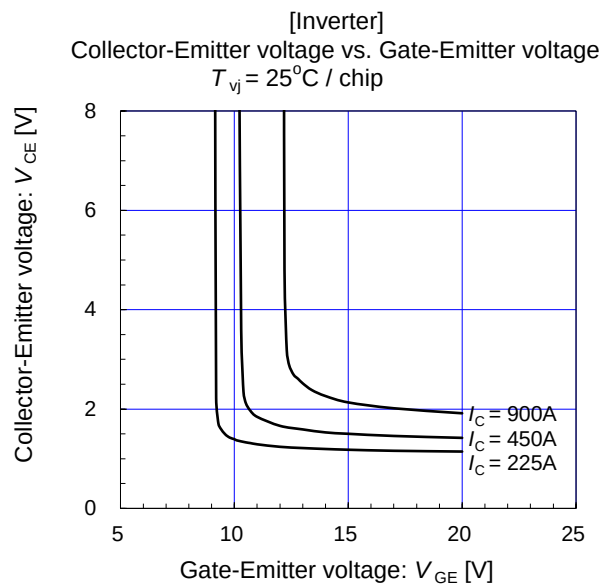
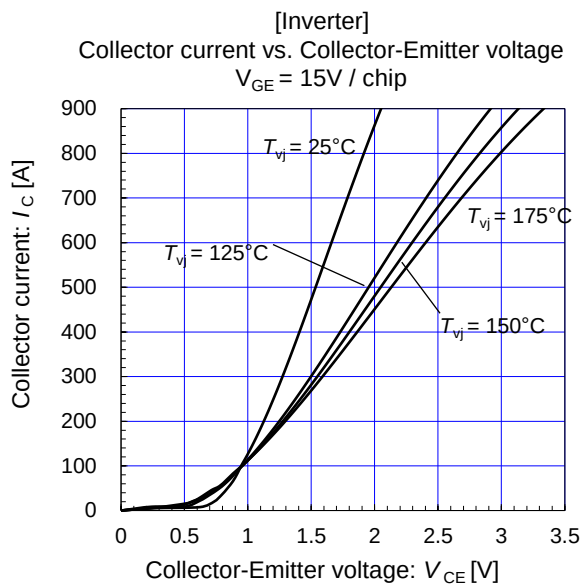
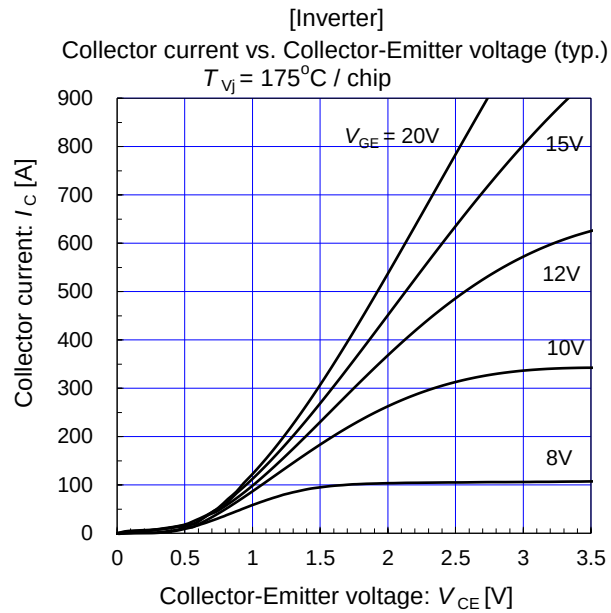
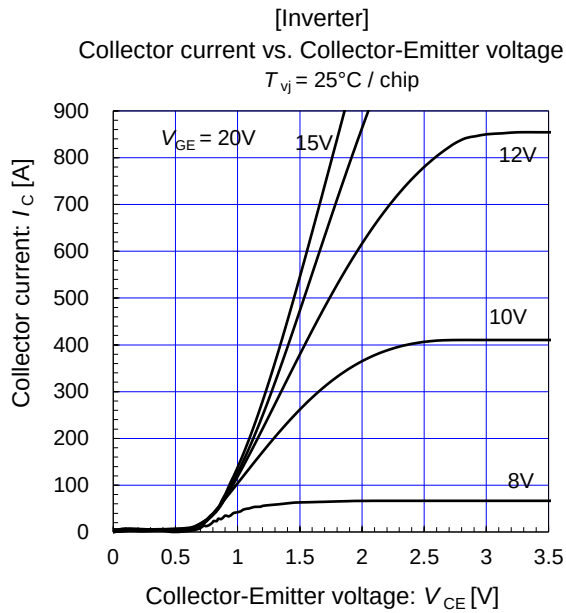
Thermal resistance characteristics

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.081	$^{\circ}\text{C/W}$
		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.

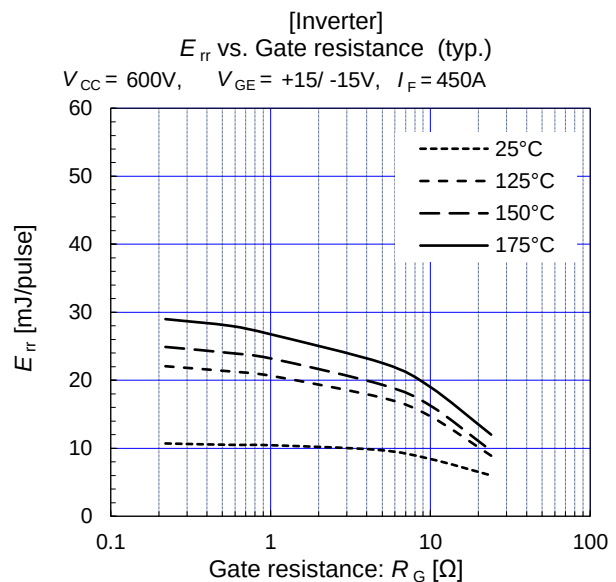
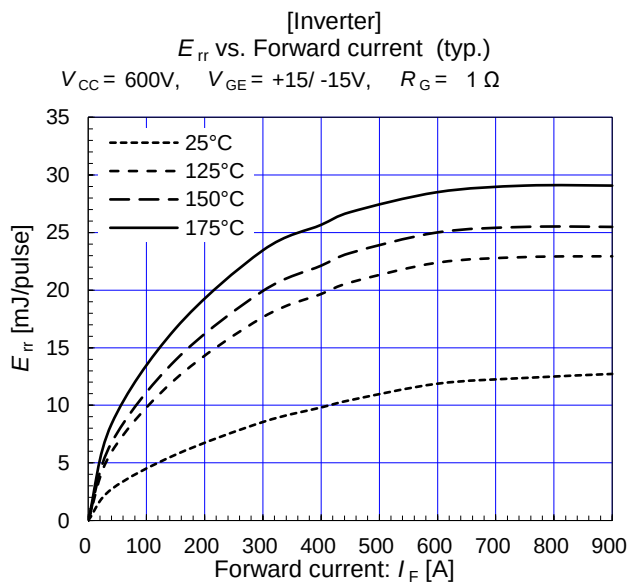
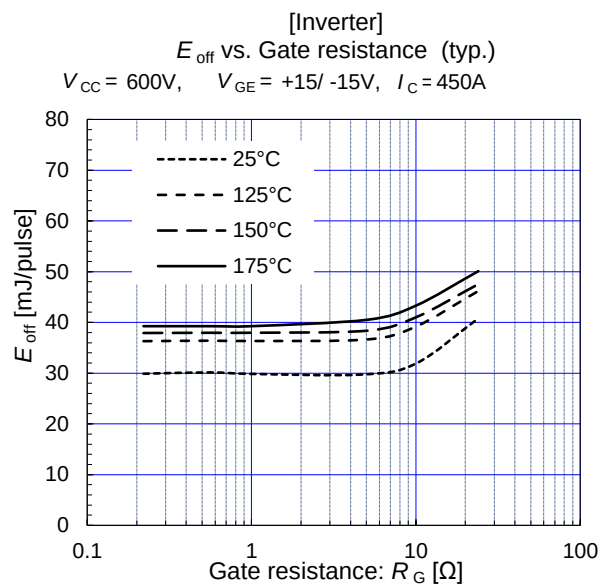
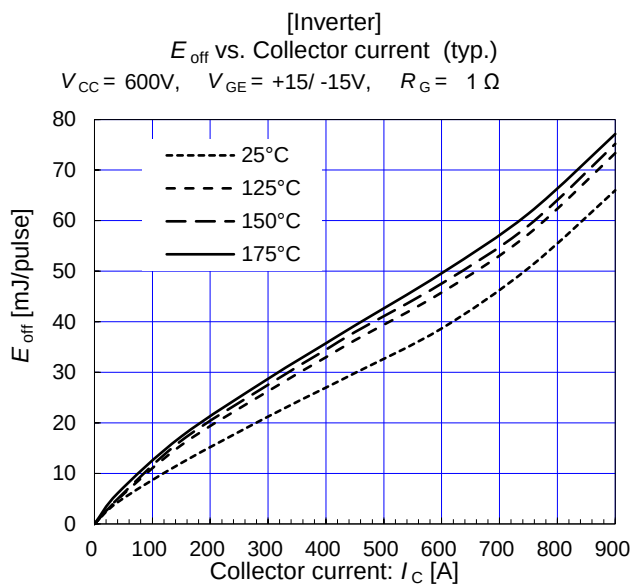
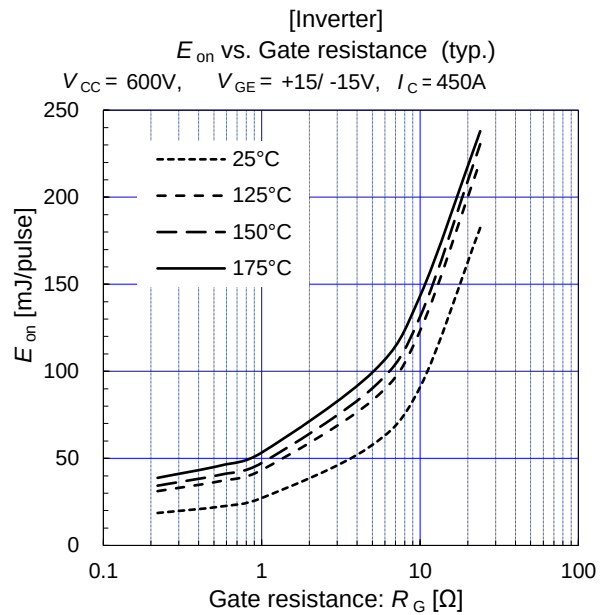
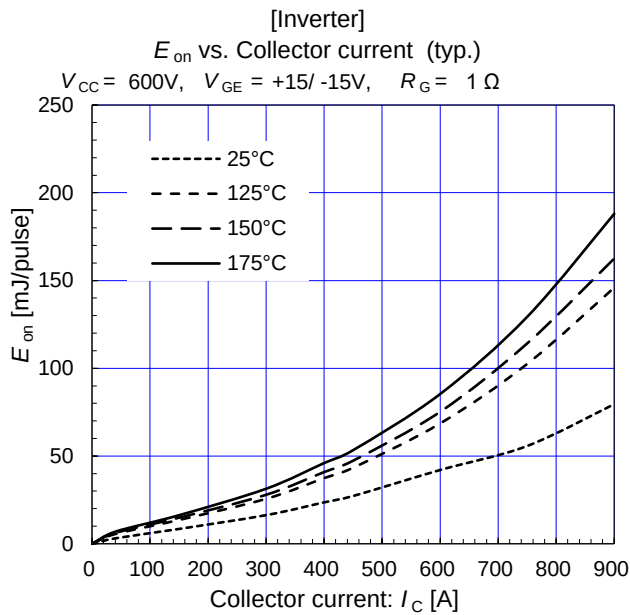
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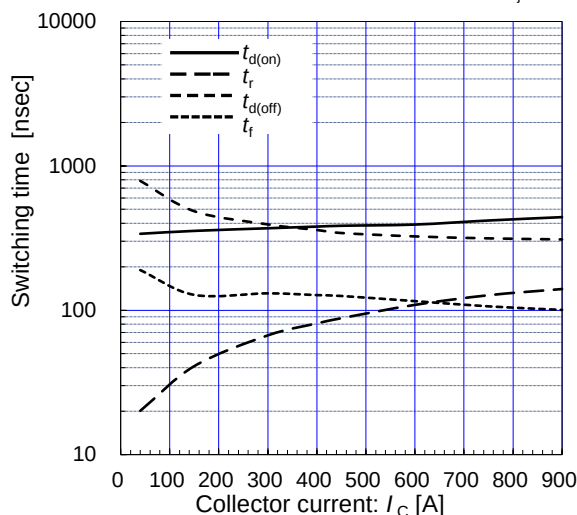
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[Inverter]

Switching time vs. Collector current (typ.)

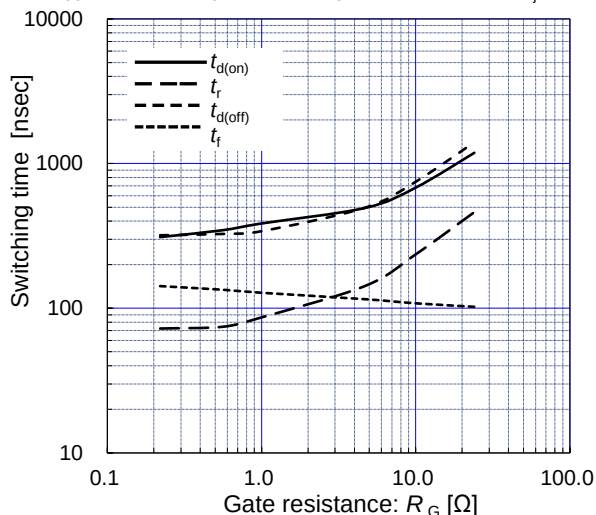
$V_{CC} = 600V$, $R_G = 1\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

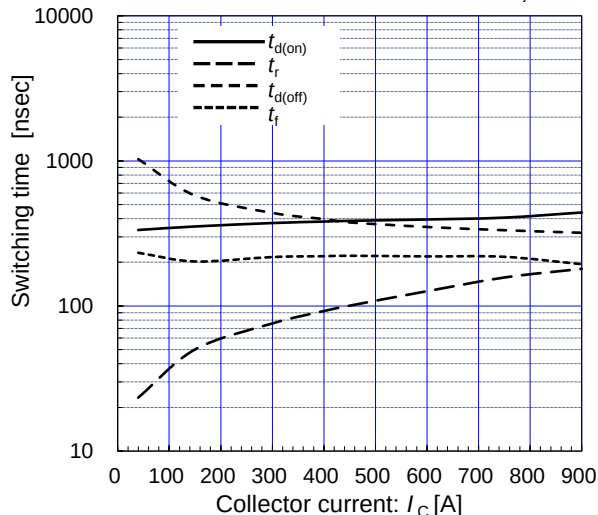
$V_{CC} = 600V$, $I_C = 450A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

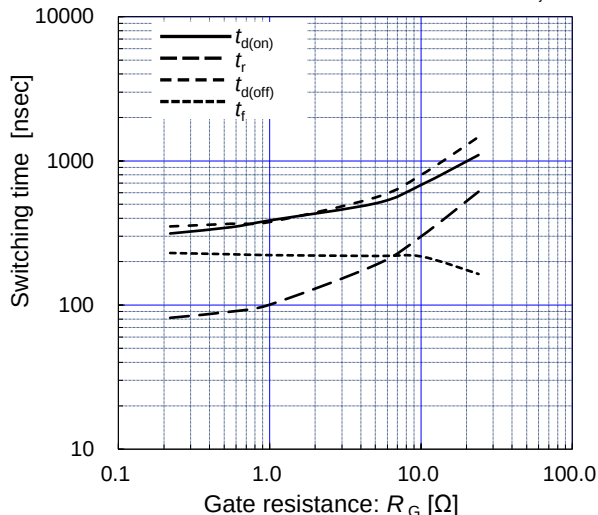
$V_{CC} = 600V$, $R_G = 1\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

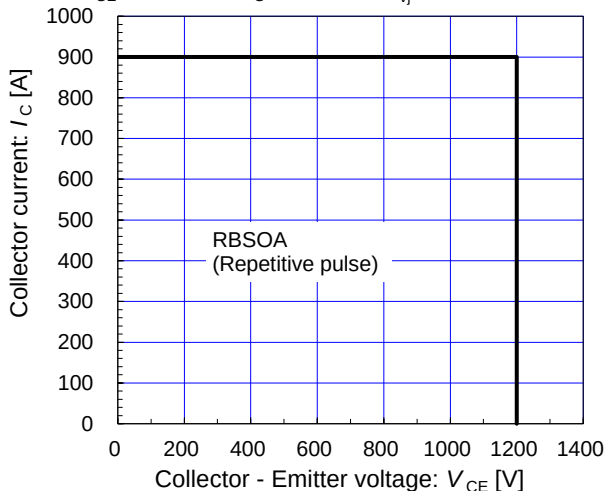
$V_{CC} = 600V$, $I_C = 450A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

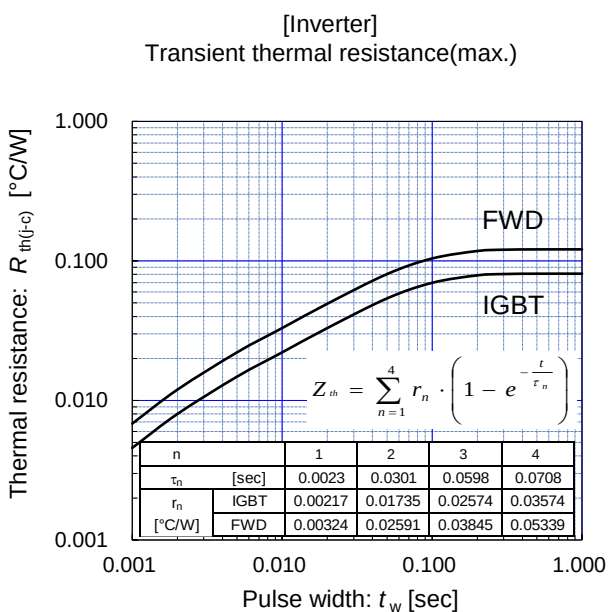
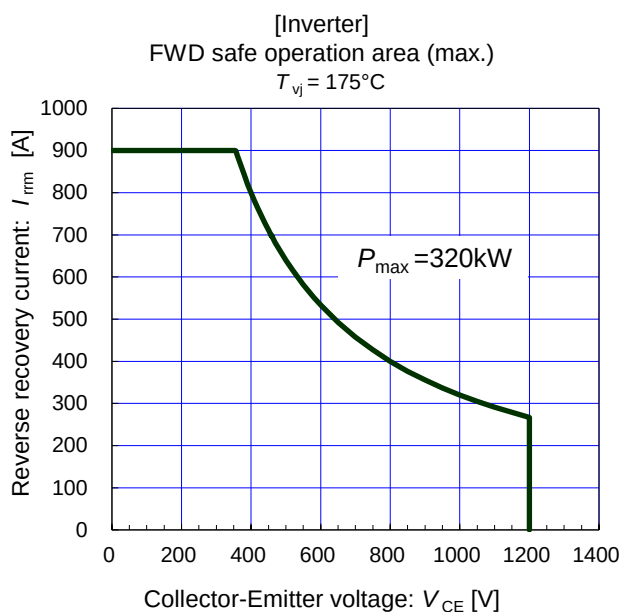
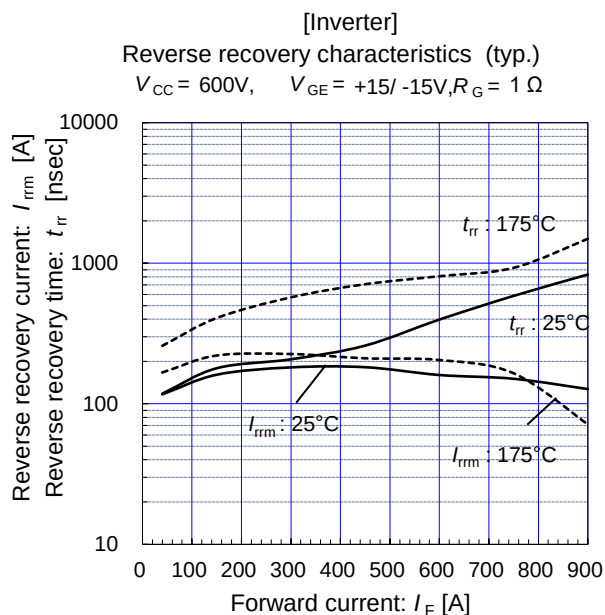
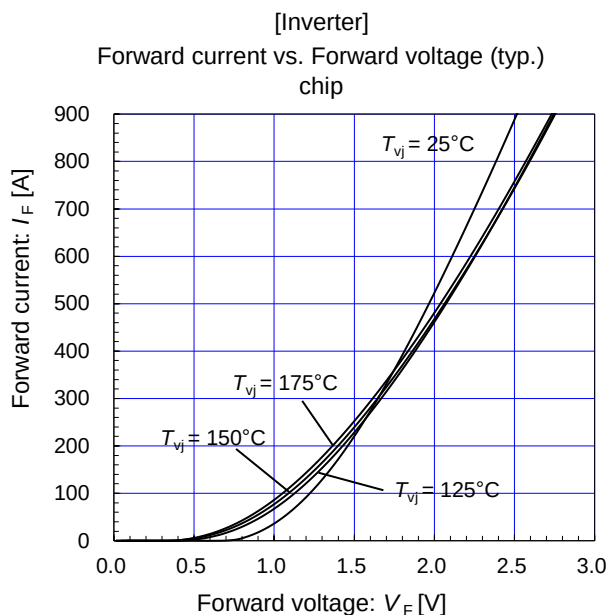
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15$, $R_G = 1\Omega$, $T_{vj} = 175^\circ C$



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