

2MBI450XHA120-50

IGBT Modules

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

■ Features

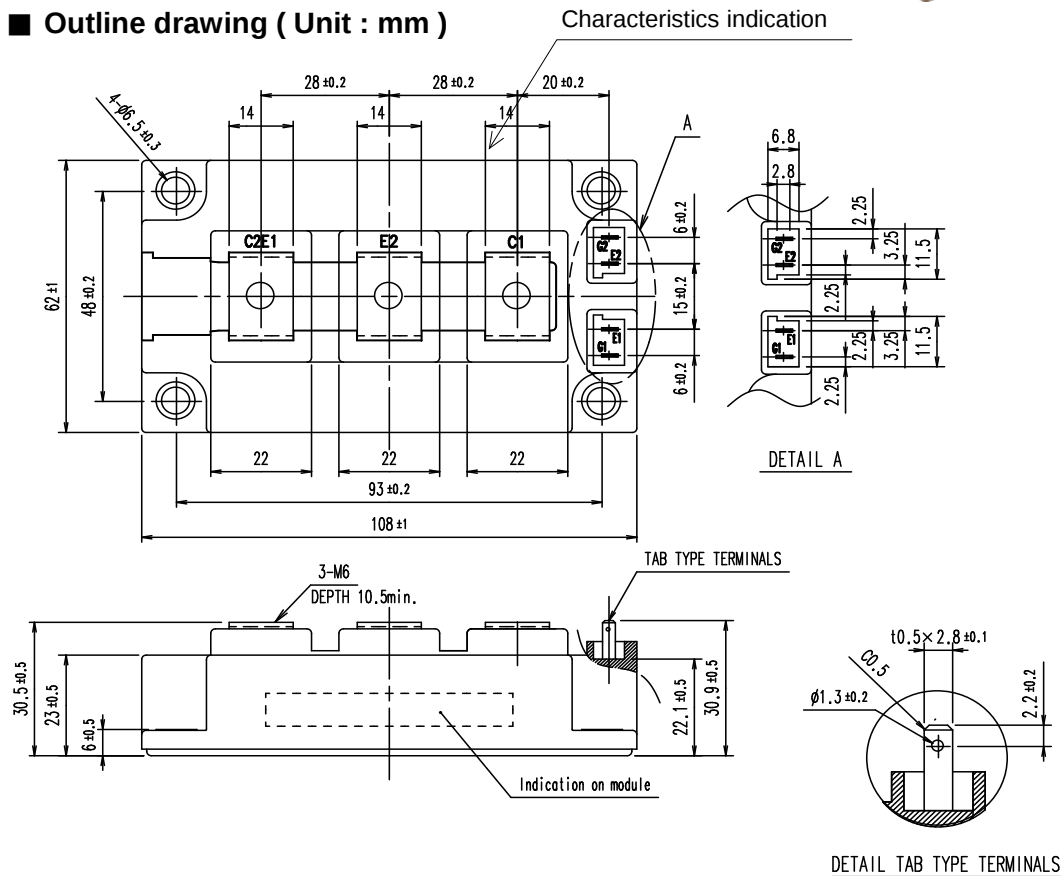
- Low $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

■ Applications

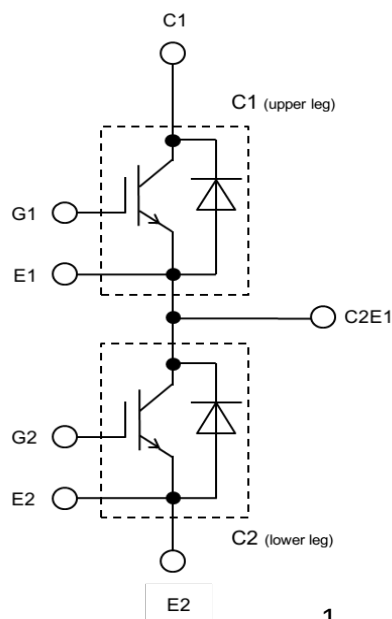
- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems,
- Industrial machines, such as Welding machines



■ 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 $T_c = 100^\circ\text{C}$	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	
	Operating virtual junction temperature	T_{vjop}		175	
	Case temperature	T_c		125	
Storage temperature		T_{stg}		-40 ~ 125	$^\circ\text{C}$
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}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	200	mA
	Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	400	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 450mA$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 450A$	$T_{vj}=25^{\circ}C$	-	1.65	2.10	V
				$T_{vj}=25^{\circ}C$	-	1.45	1.90	
		$V_{CE(sat)}$ (chip)		$T_{vj}=125^{\circ}C$	-	1.85	-	
				$T_{vj}=150^{\circ}C$	-	1.90	-	
				$T_{vj}=175^{\circ}C$	-	2.00	-	
	Internal gate resistance	r_g	-		-	2.25	-	Ω
	Capacitance	C_{ies}	$V_{CE}=10V, V_{GE}=0V, f=1MHz$		-	46	-	nF
		C_{oes}			-	1.6	-	
		C_{res}			-	0.42	-	
	Gate charge	Q_G	$V_{CC} = 600V, I_C = 450A$ $V_{GE} = -15 \rightarrow +15V$		-	3.0	-	μC
	Forward on voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F: 450A$	$T_{vj}=25^{\circ}C$	-	1.85	2.30	V
				$T_{vj}= 25^{\circ}C$	-	1.65	2.10	
		V_F (chip)		$T_{vj}=125^{\circ}C$	-	1.75	-	
				$T_{vj}=150^{\circ}C$	-	1.70	-	
				$T_{vj}=175^{\circ}C$	-	1.70	-	
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F = 450A$ $V_{GE} = +15/-15V$ $R_G = 1\ \Omega$ $L_S = 35\ nH$	$T_{vj}= 25^{\circ}C$	-	0.30	-	μs
				$T_{vj}=125^{\circ}C$	-	0.33	-	
				$T_{vj}=150^{\circ}C$	-	0.34	-	
				$T_{vj}=175^{\circ}C$	-	0.35	-	
		t_r		$T_{vj}= 25^{\circ}C$	-	0.07	-	
				$T_{vj}=125^{\circ}C$	-	0.08	-	
				$T_{vj}=150^{\circ}C$	-	0.08	-	
				$T_{vj}=175^{\circ}C$	-	0.09	-	
$t_{d(off)}$		$T_{vj}= 25^{\circ}C$		-	0.39	-		
		$T_{vj}=125^{\circ}C$		-	0.43	-		
		$T_{vj}=150^{\circ}C$		-	0.45	-		
		$T_{vj}=175^{\circ}C$		-	0.45	-		
t_f		$T_{vj}= 25^{\circ}C$		-	0.12	-		
		$T_{vj}=125^{\circ}C$		-	0.16	-		
		$T_{vj}=150^{\circ}C$		-	0.17	-		
		$T_{vj}=175^{\circ}C$		-	0.18	-		
Reverse recovery time	t_{rr}	$T_{vj}= 25^{\circ}C$	-	0.13	-			
		$T_{vj}=125^{\circ}C$	-	0.24	-			
		$T_{vj}=150^{\circ}C$	-	0.25	-			
		$T_{vj}=175^{\circ}C$	-	0.28	-			

(*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}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 450\text{A}$ $V_{\text{GE}} = +15/ -15\text{V}$ $R_{\text{G}} = 1\ \Omega$ $L_{\text{S}} = 35\ \text{nH}$	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	16.2	-	mJ
				$T_{\text{vj}} = 125^{\circ}\text{C}$	-	27.5	-	
				$T_{\text{vj}} = 150^{\circ}\text{C}$	-	30.3	-	
				$T_{\text{vj}} = 175^{\circ}\text{C}$	-	33.1	-	
		E_{off}		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	42.3	-	
				$T_{\text{vj}} = 125^{\circ}\text{C}$	-	49.7	-	
				$T_{\text{vj}} = 150^{\circ}\text{C}$	-	51.5	-	
				$T_{\text{vj}} = 175^{\circ}\text{C}$	-	53.4	-	
		E_{rr}		$T_{\text{vj}} = 25^{\circ}\text{C}$	-	21.1	-	
				$T_{\text{vj}} = 125^{\circ}\text{C}$	-	32.3	-	
				$T_{\text{vj}} = 150^{\circ}\text{C}$	-	35.1	-	
				$T_{\text{vj}} = 175^{\circ}\text{C}$	-	37.9	-	

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.

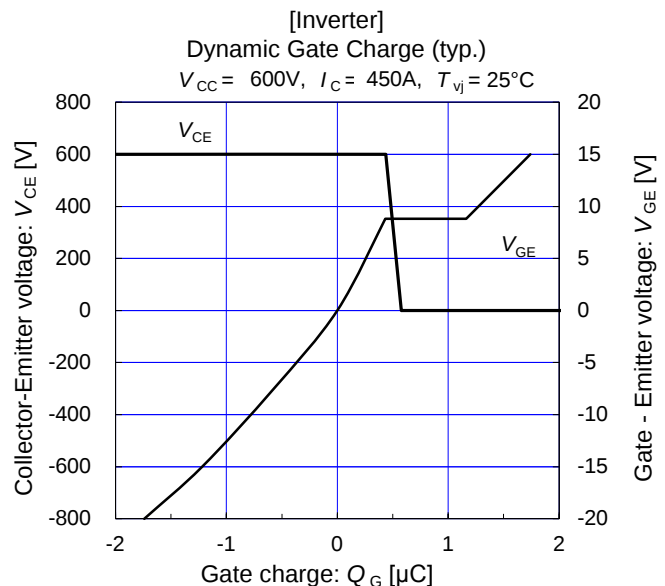
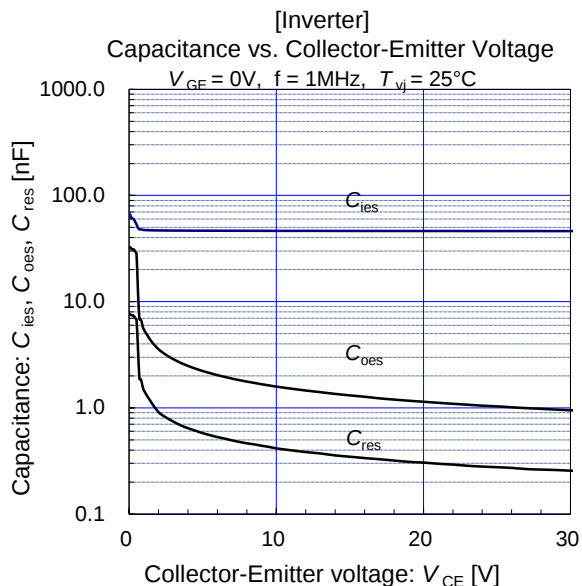
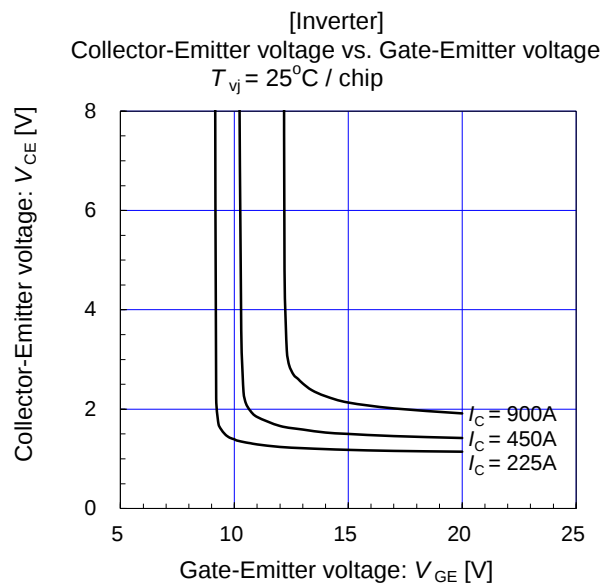
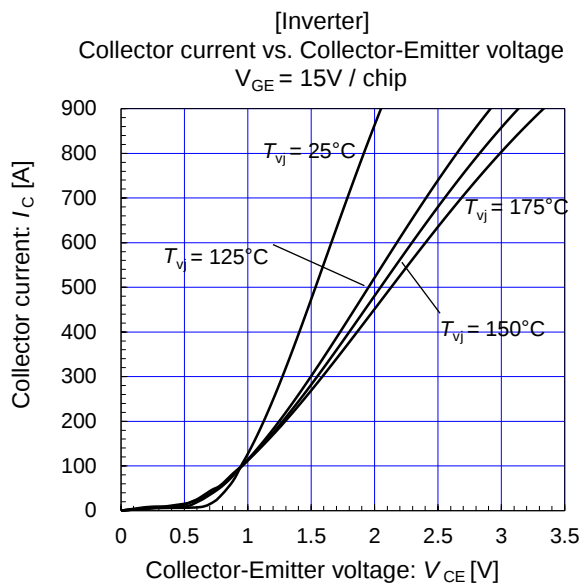
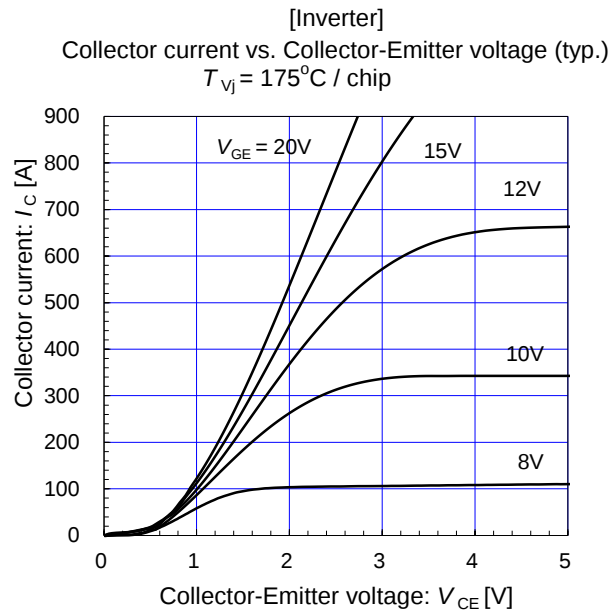
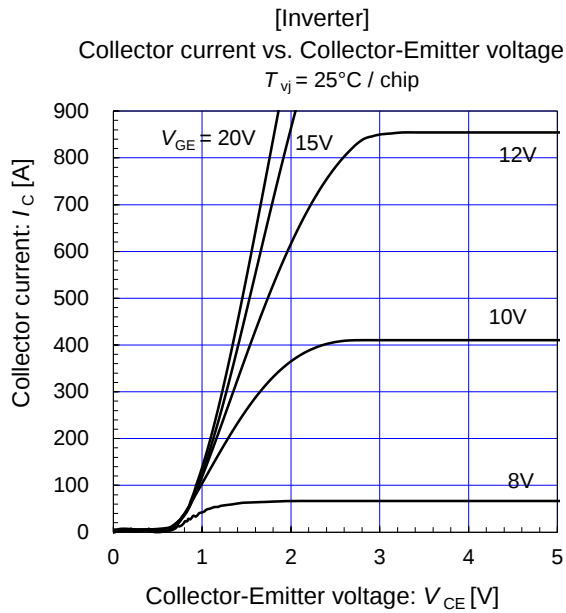
Thermal resistance characteristics

	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.

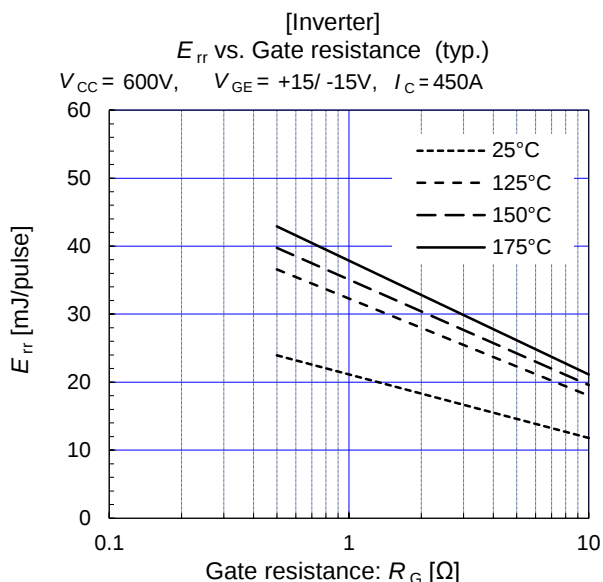
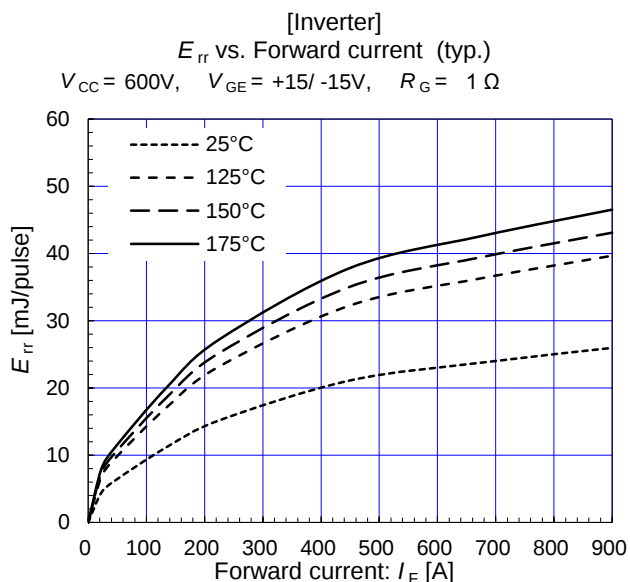
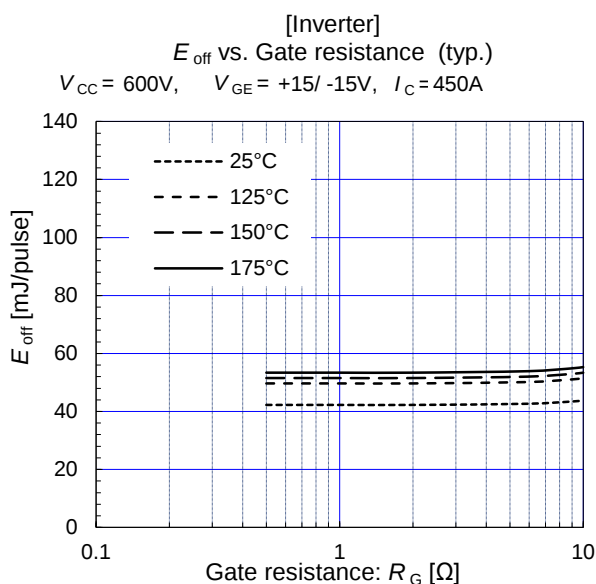
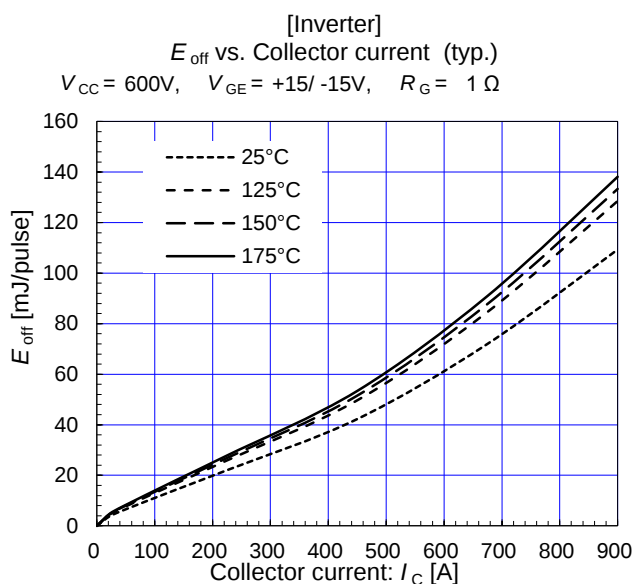
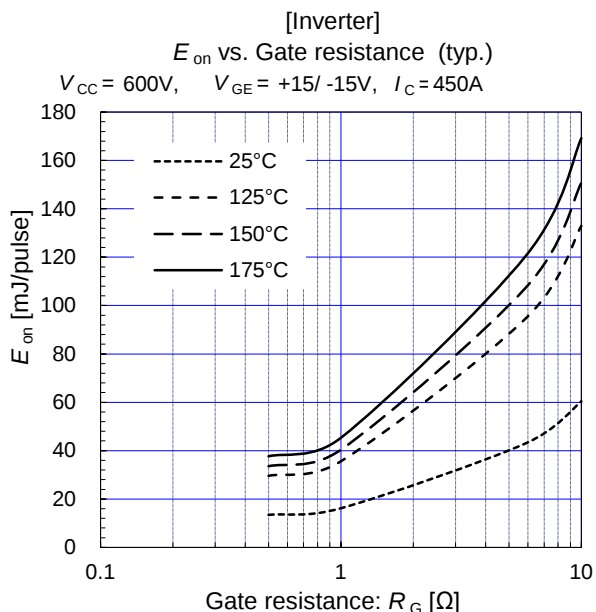
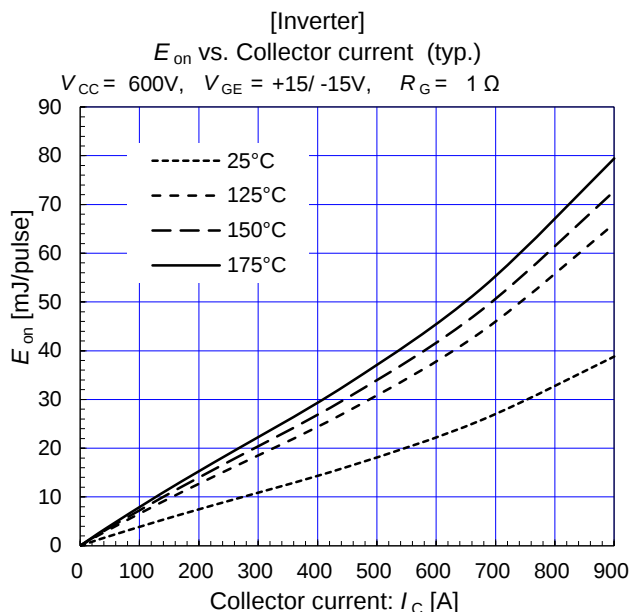
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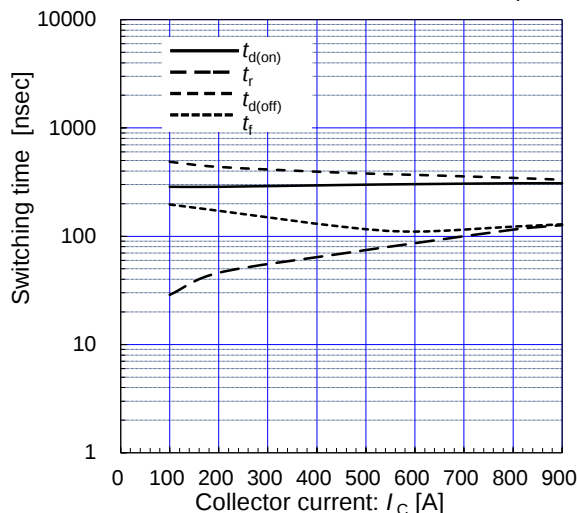
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[Inverter]

Switching time vs. Collector current (typ.)

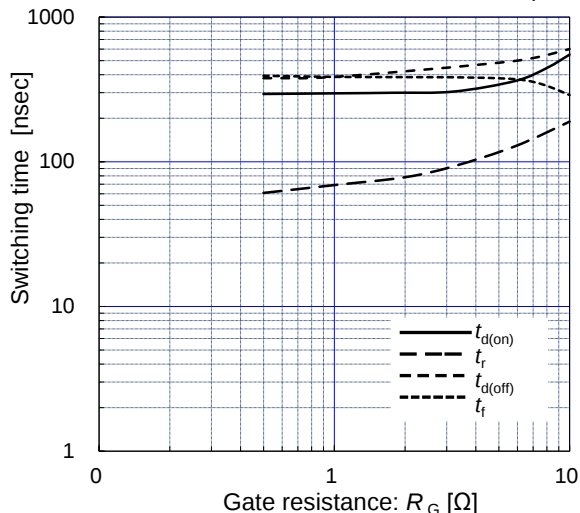
$V_{CC} = 600V$, $R_G = 1\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

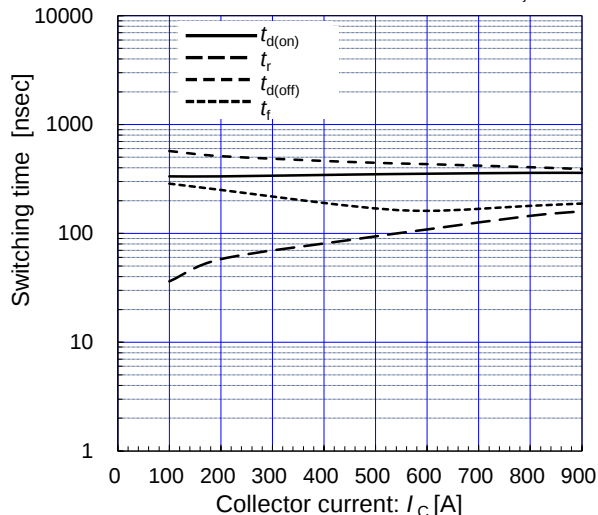
$V_{CC} = 600V$, $I_C = 450A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

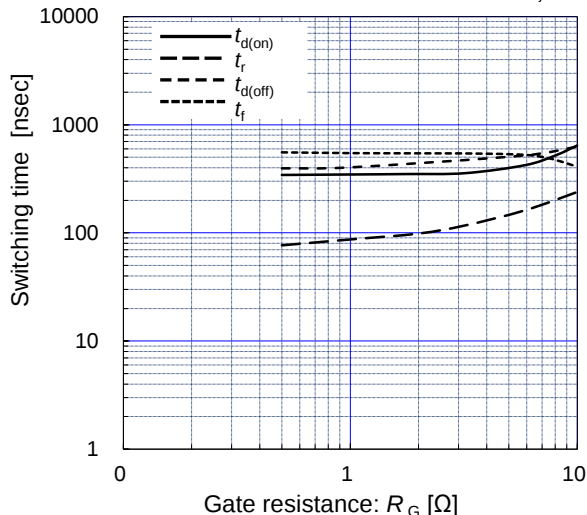
$V_{CC} = 600V$, $R_G = 1\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

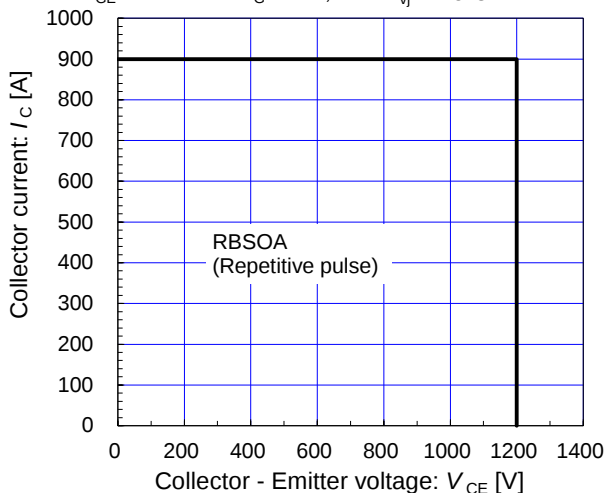
$V_{CC} = 600V$, $I_C = 450A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

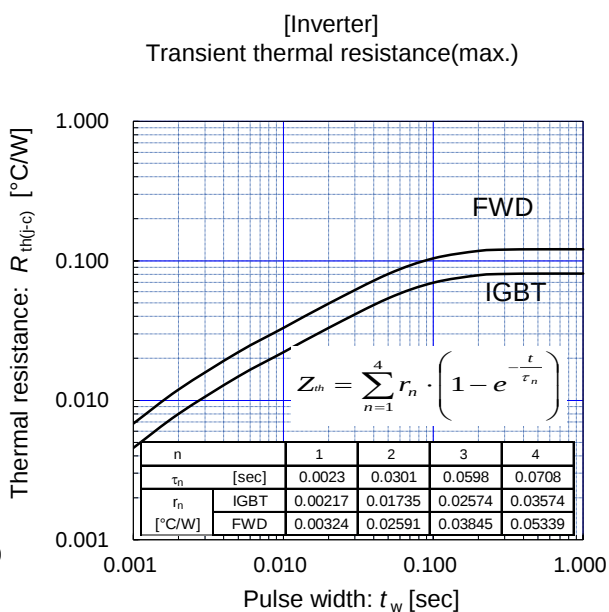
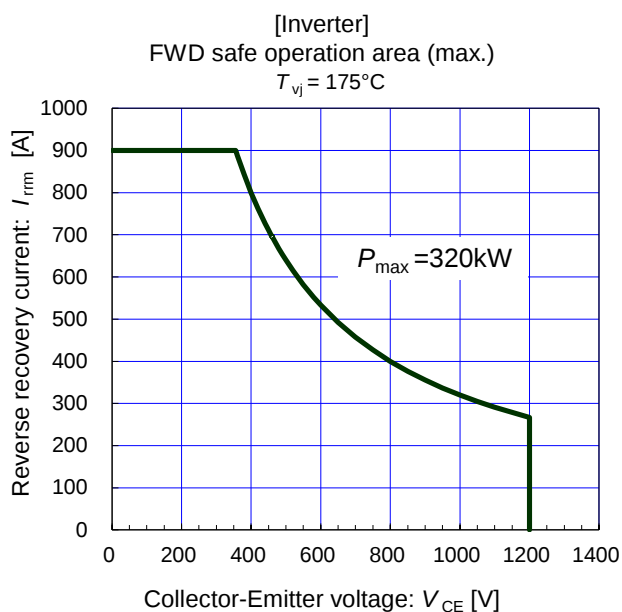
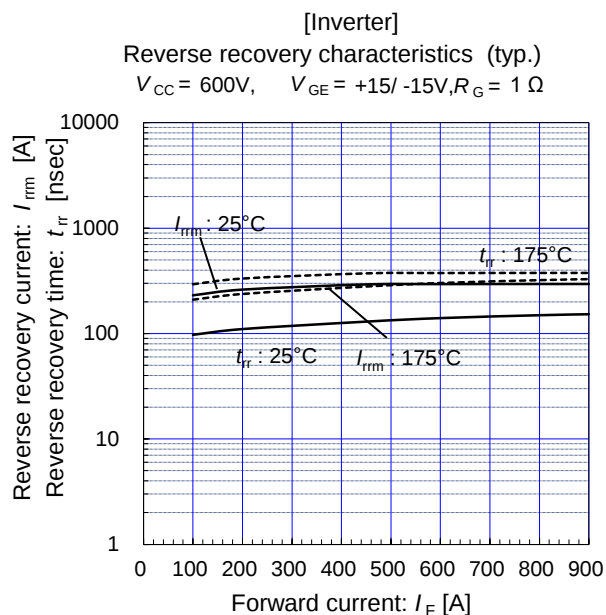
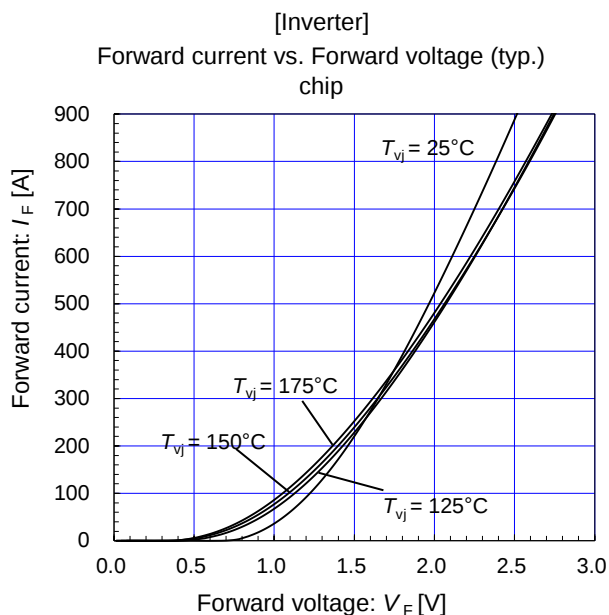
Reverse bias safe operating area (max.)

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



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