

2MBI600XNF170-50

IGBT Modules

Power Module (X series)
1700V / 600A / 2-in-1 package

■ Features

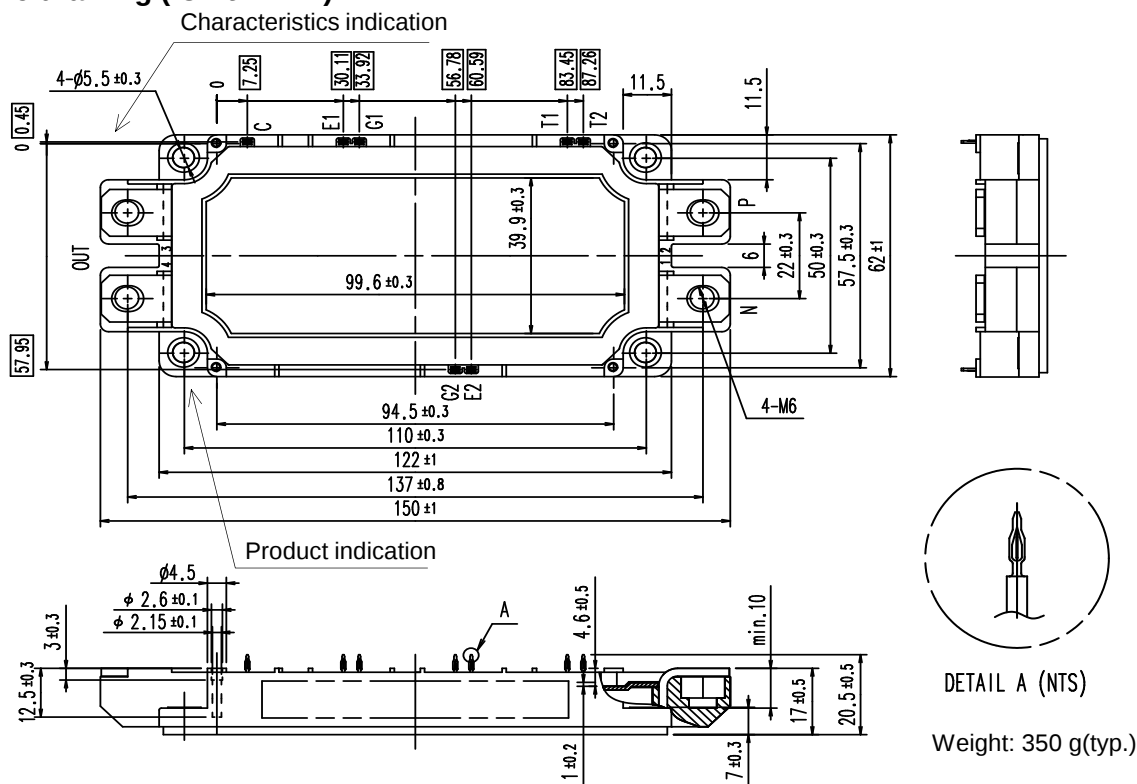
- LOW $V_{CE(sat)}$
- Low Inductance Module structure
- Press fit pin terminals

■ Applications

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

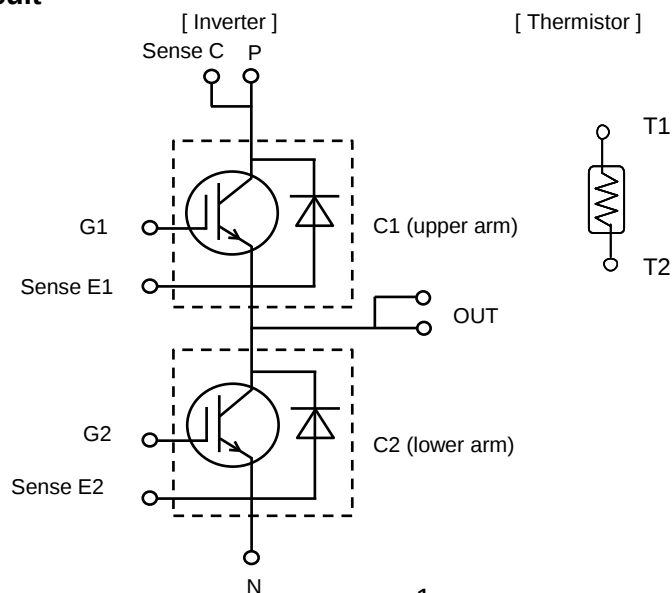


■ Outline drawing (Unit : mm)



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

■ 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}		1700	V
	Gate-emitter voltage, collector-emitter short-circuited	V_{GES}		± 20	V
	Collector current	I_C	Continuous $T_c = 100^\circ\text{C}$	600	A
	Repetitive peak collector current	I_{CRM}	1ms	1200	
	Forward current	I_F		600	
	Repetitive peak forward current	I_{FRM}	1ms	1200	
	Total power dissipation	P_{tot}	1 device	3845	W
	Virtual junction temperature	T_{vj}		175	$^\circ\text{C}$
	Operating virtual 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) between thermistor and others (*2)	V_{isol}	AC: 1min.	4000	Vrms
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)

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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}	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CE}} = 1700\text{V}$		-	-	150	μA
	Gate leakage current, collector-emitter short-circuited	I_{GES}	$V_{\text{CE}}=0\text{V}, V_{\text{GE}}=\pm 20\text{V}$		-	-	300	nA
	Gate-emitter threshold voltage	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 600\text{mA}$		6.0	6.5	7.0	V
	Collector-emitter saturation voltage	$V_{\text{CE(sat)}}$ (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 600\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	2.45	2.90	V
		$V_{\text{CE(sat)}}$ (chip)		$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.70	2.15	
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	2.10	-	
				$T_{\text{vj}}=150^{\circ}\text{C}$	-	2.25	-	
				$T_{\text{vj}}=175^{\circ}\text{C}$	-	2.35	-	
	Internal gate resistance	r_{g}	-		-	1.67	-	Ω
	Capacitance	C_{ies}	$V_{\text{CE}}=10\text{V}, V_{\text{GE}}=0\text{V}, f=1\text{MHz}$		-	75	-	nF
		$C_{\text{o es}}$			-	2.1	-	
		C_{res}			-	0.47	-	
	Gate charge	Q_{G}	$V_{\text{CC}} = 900\text{V}, I_{\text{C}} = 600\text{A}$ $V_{\text{GE}} = -15 \rightarrow +15\text{V}$		-	4.7	-	μC
	Forward voltage	V_{F} (terminal)	$V_{\text{GE}} = 0\text{V}$ $I_{\text{F}} = 600\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	2.45	2.90	V
		V_{F} (chip)		$T_{\text{vj}}= 25^{\circ}\text{C}$	-	1.70	2.15	
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	1.80	-	
				$T_{\text{vj}}=150^{\circ}\text{C}$	-	1.85	-	
				$T_{\text{vj}}=175^{\circ}\text{C}$	-	1.80	-	
	Switching time (*1)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 900\text{V}$ $I_{\text{C}}, I_{\text{F}} = 600\text{A}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = \pm 1\Omega$ $L_{\text{S}} = 35\text{ nH}$	$T_{\text{vj}}= 25^{\circ}\text{C}$	-	0.49	-	μs
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.60	-	
				$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.61	-	
				$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.62	-	
		t_{r}		$T_{\text{vj}}= 25^{\circ}\text{C}$	-	0.11	-	
$T_{\text{vj}}=125^{\circ}\text{C}$				-	0.12	-		
$T_{\text{vj}}=150^{\circ}\text{C}$				-	0.13	-		
$T_{\text{vj}}=175^{\circ}\text{C}$				-	0.14	-		
$t_{\text{d(off)}}$		$T_{\text{vj}}= 25^{\circ}\text{C}$		-	0.58	-		
		$T_{\text{vj}}=125^{\circ}\text{C}$		-	0.63	-		
		$T_{\text{vj}}=150^{\circ}\text{C}$		-	0.65	-		
		$T_{\text{vj}}=175^{\circ}\text{C}$		-	0.66	-		
t_{f}		$T_{\text{vj}}= 25^{\circ}\text{C}$		-	0.42	-		
		$T_{\text{vj}}=125^{\circ}\text{C}$		-	0.61	-		
		$T_{\text{vj}}=150^{\circ}\text{C}$		-	0.66	-		
		$T_{\text{vj}}=175^{\circ}\text{C}$		-	0.71	-		
Reverse recovery time	t_{rr}	$T_{\text{vj}}= 25^{\circ}\text{C}$	-	0.30	-			
		$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.41	-			
		$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.46	-			
		$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.55	-			

(*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}	$V_{\text{CC}} = 900\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	152	-	mJ
			$I_{\text{C}}, I_{\text{F}} = 600\text{A}$	$T_{\text{vj}}=125^{\circ}\text{C}$	-	194	-	
			$V_{\text{GE}} = +15/-15\text{ V}$	$T_{\text{vj}}=150^{\circ}\text{C}$	-	212	-	
			$R_{\text{G}} = \pm 1\Omega$	$T_{\text{vj}}=175^{\circ}\text{C}$	-	241	-	
		E_{off}	$L_{\text{S}} = 35\text{ nH}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	140	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	177	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	188	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	198	-		
		E_{rr}	$T_{\text{vj}}=25^{\circ}\text{C}$	-	70	-		
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	128	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	143	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	165	-		
Thermistor	Resistance	R	$T =$	25°C	-	5000	-	Ω
			$T =$	100°C	465	495	520	
	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.

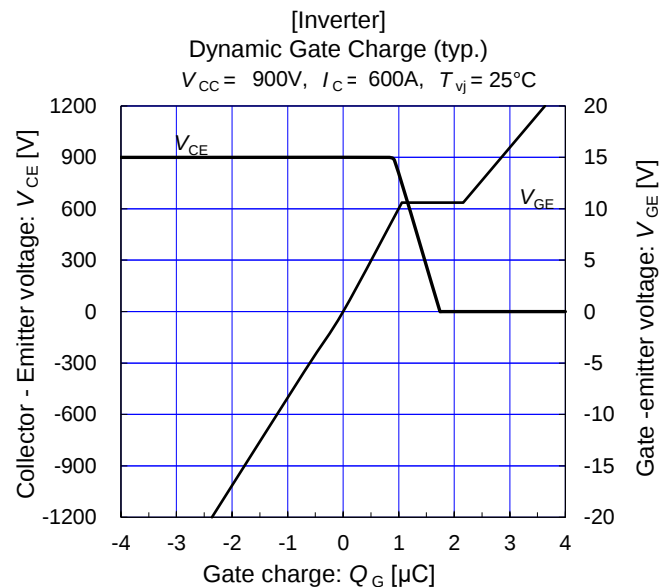
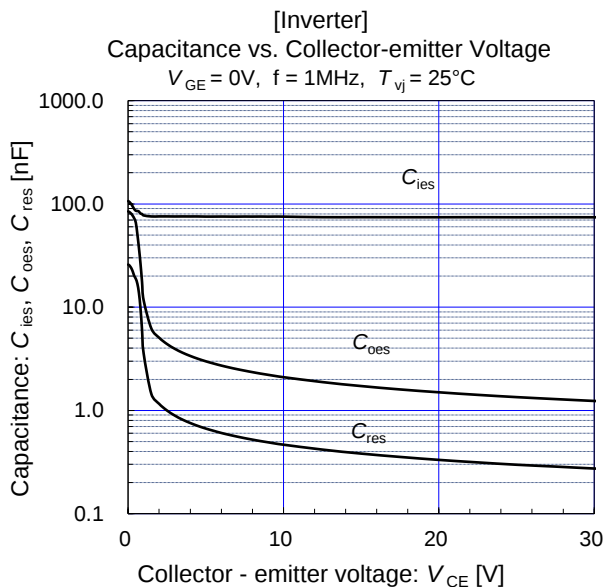
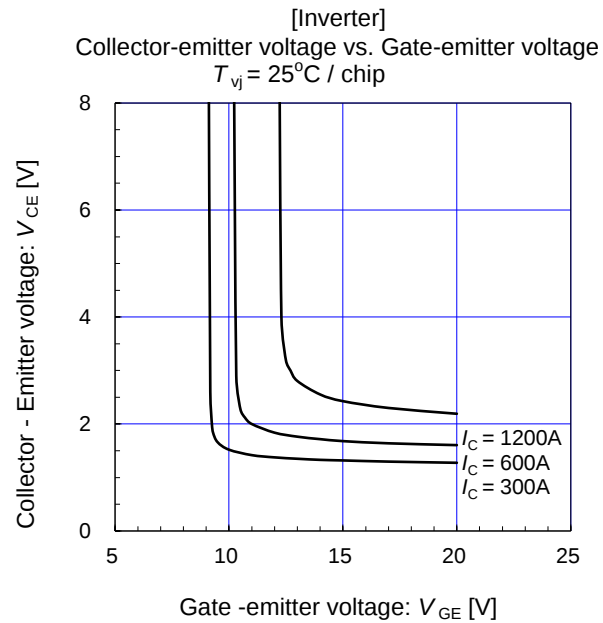
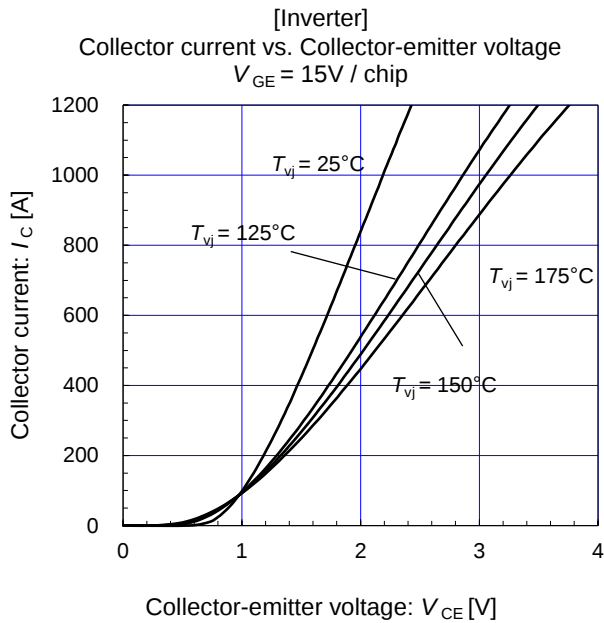
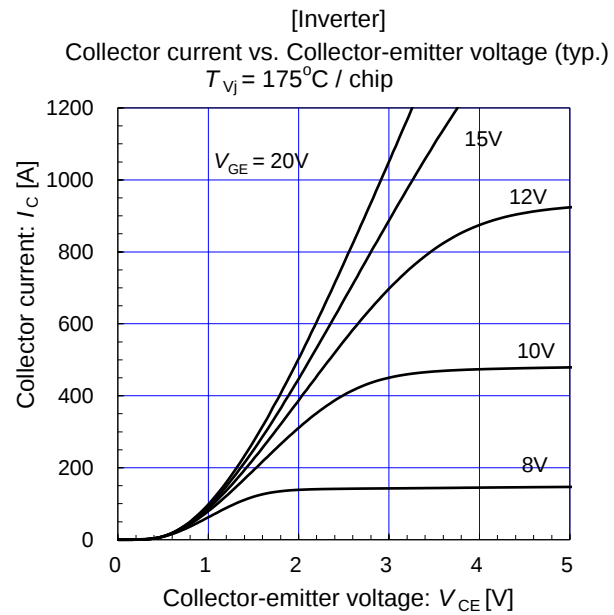
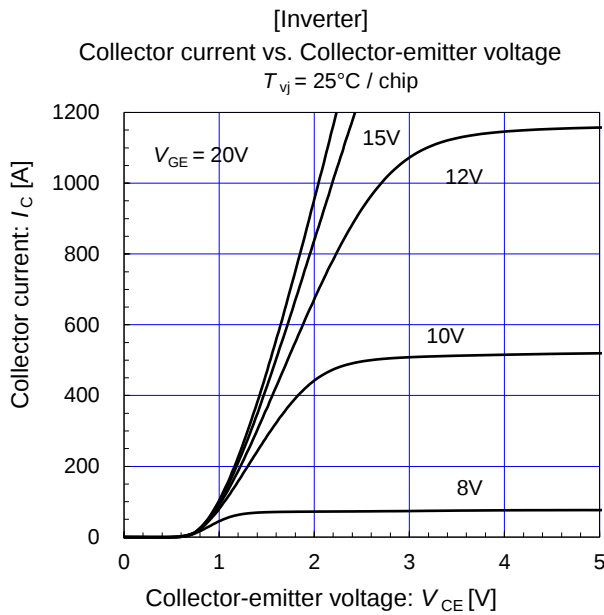
■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.039	K/W
		Inverter FWD	-	-	0.055	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0167	-	

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

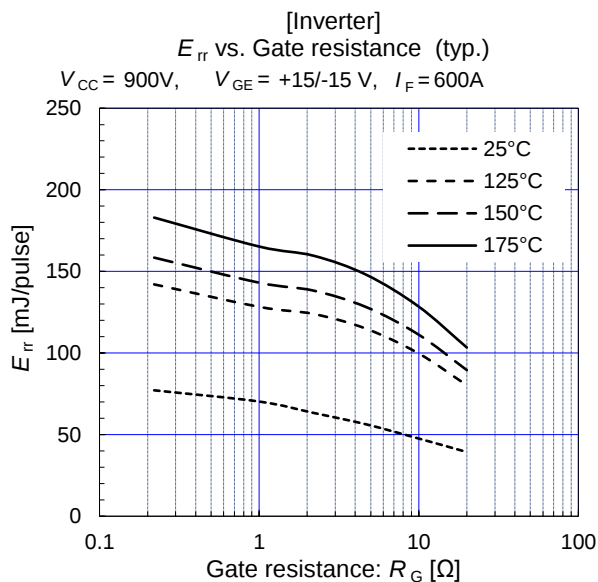
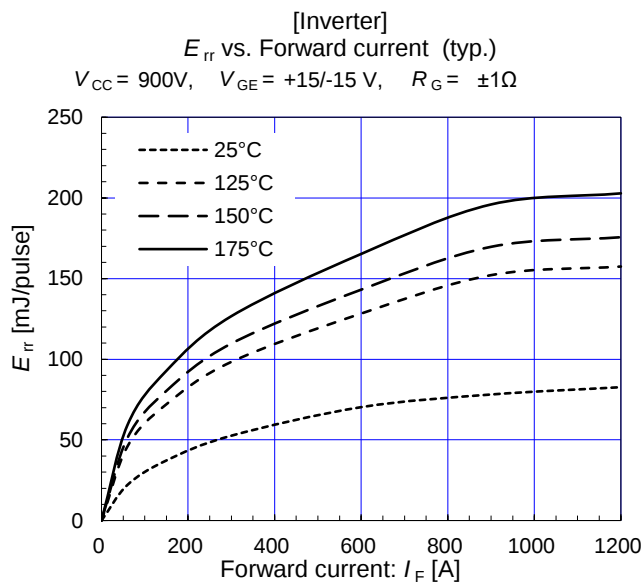
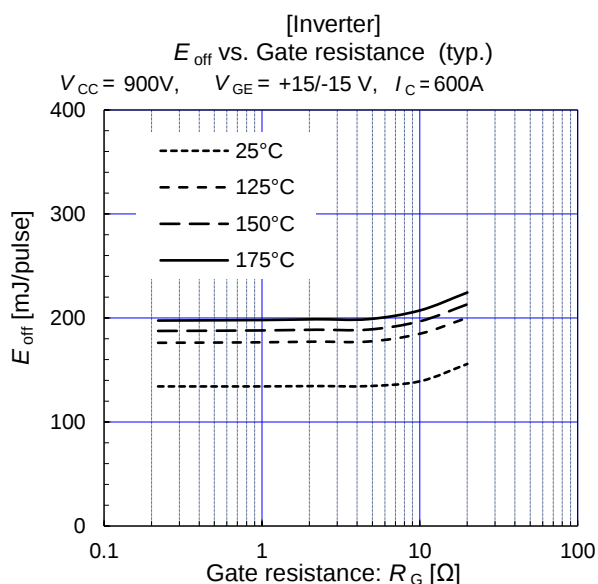
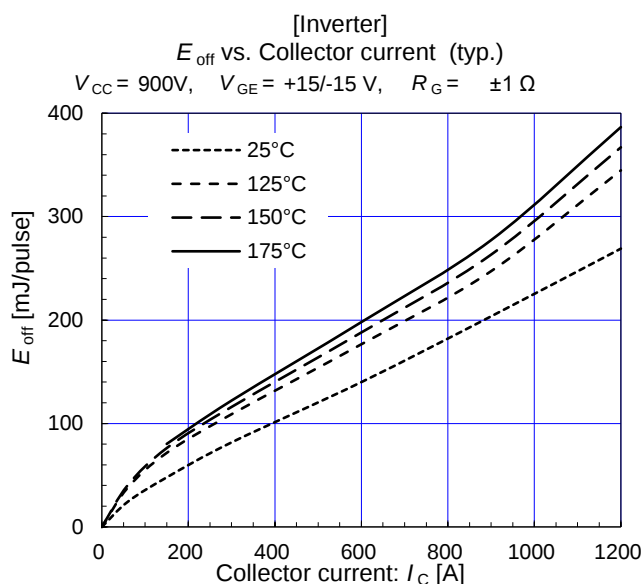
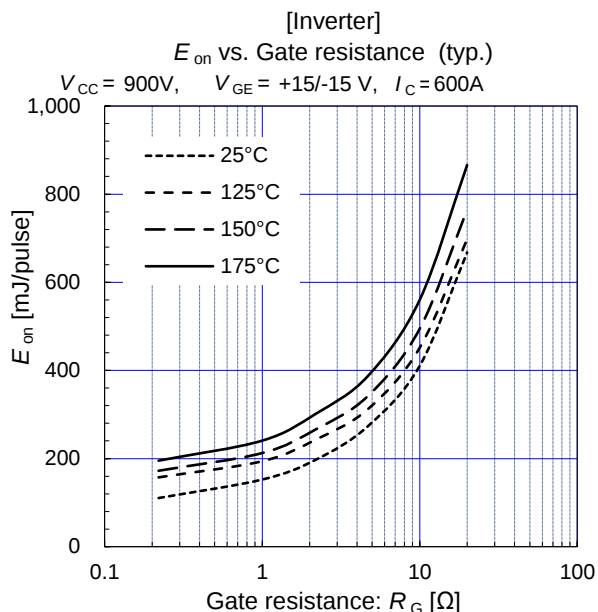
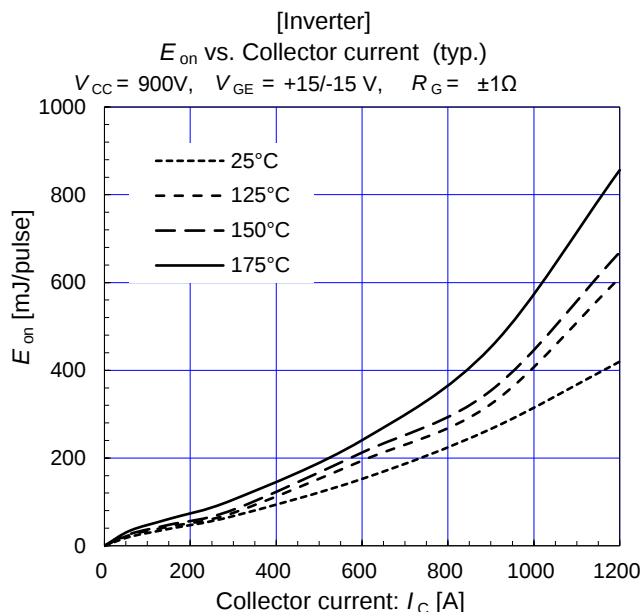
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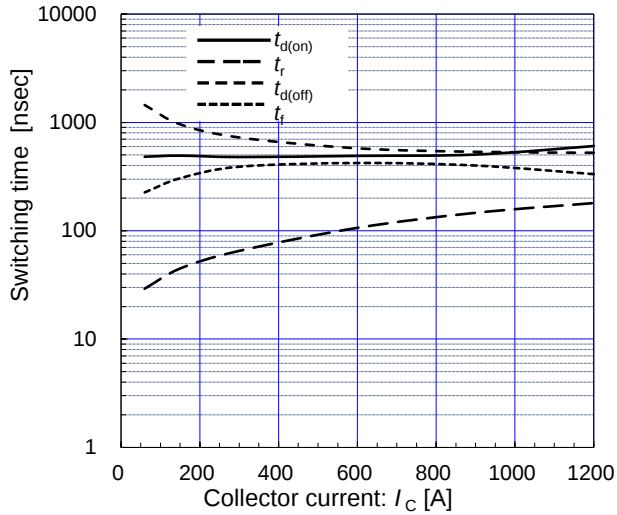
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[Inverter]

Switching time vs. Collector current (typ.)

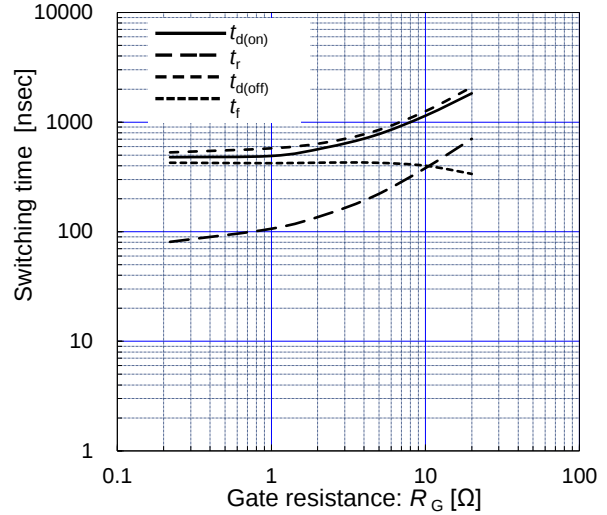
$V_{CC} = 900V$, $R_G = \pm 1\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

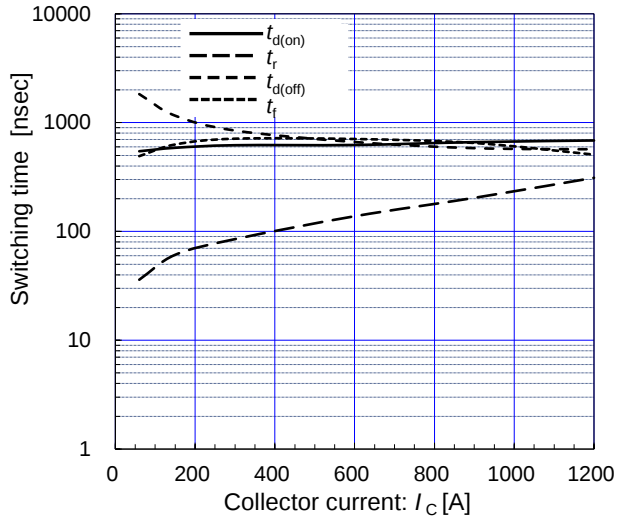
$V_{CC} = 900V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

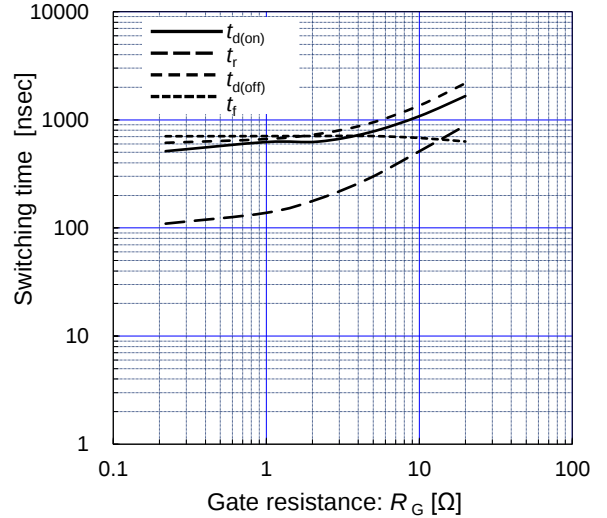
$V_{CC} = 900V$, $R_G = \pm 1\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

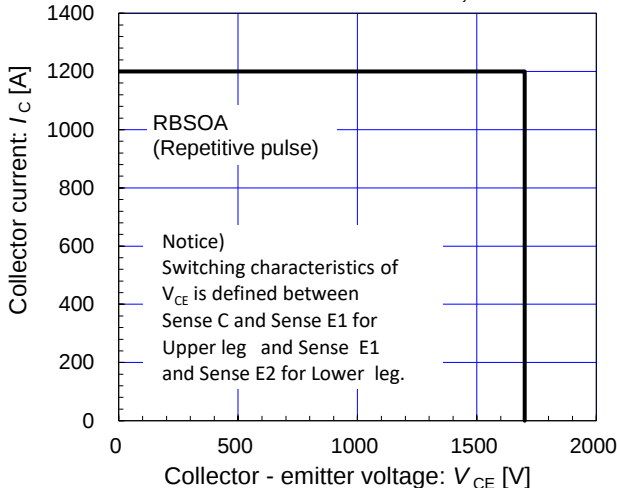
$V_{CC} = 900V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

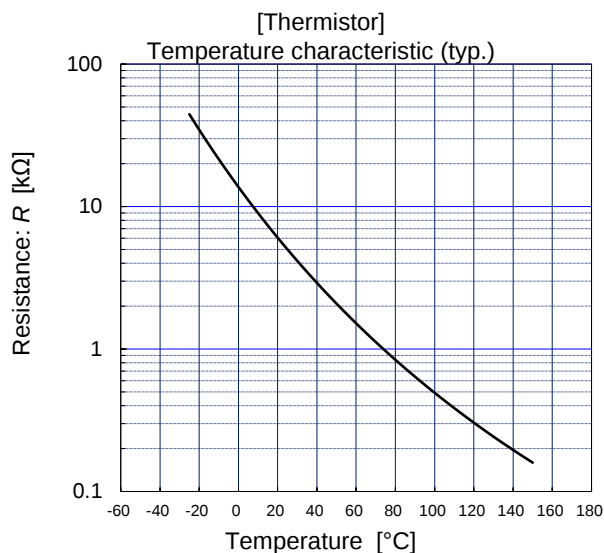
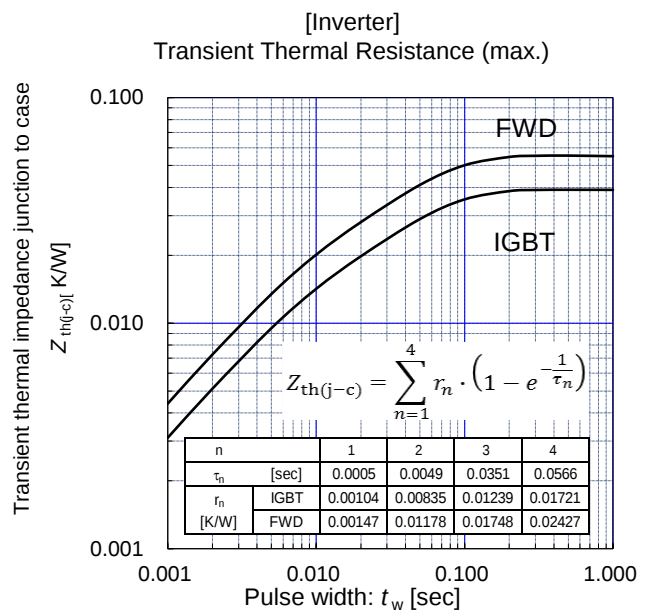
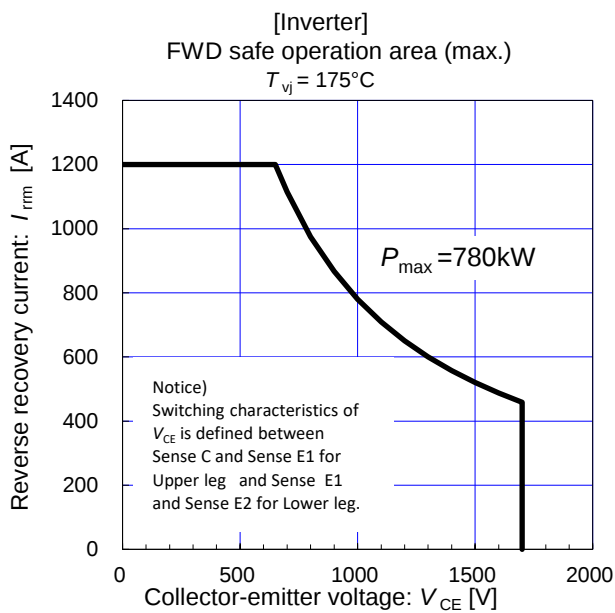
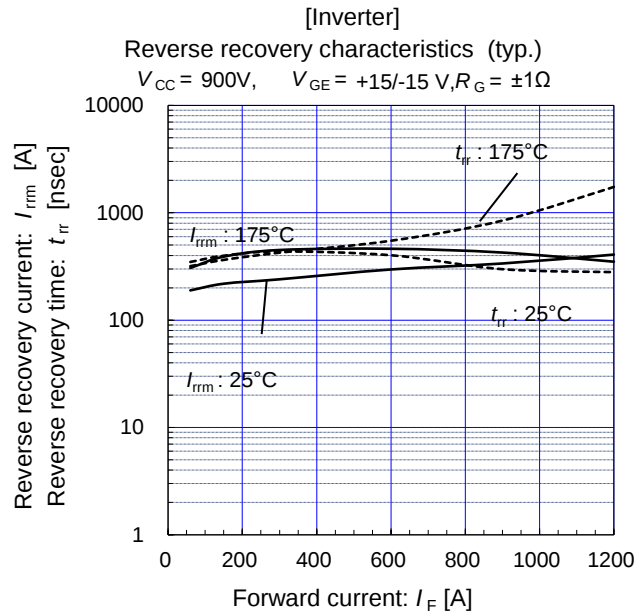
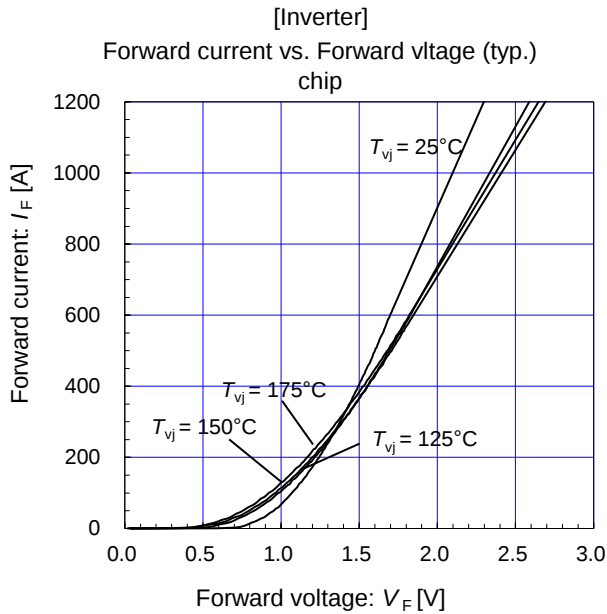
Reverse bias safe operating area (max.)

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



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