

2MBI600XNE120-50

IGBT Modules

Power Module (X series)
1200V / 600A / 2-in-1 package

■ Features

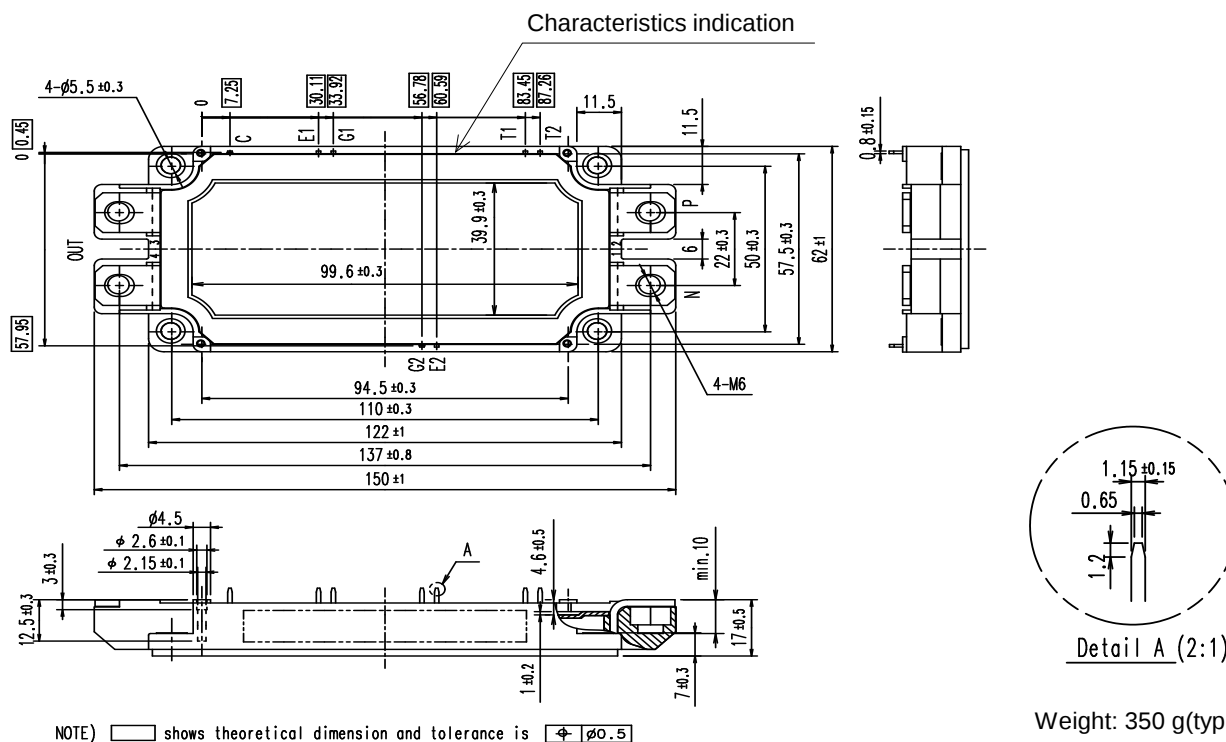
- Low $V_{CE(sat)}$
- Low Inductance Module structure
- Solder pin terminals

■ Applications

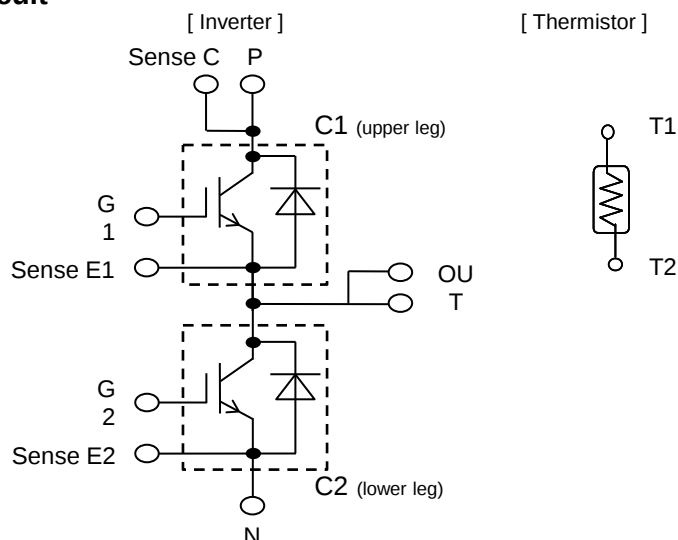
- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems



■ Outline drawing (Unit : mm)



■ 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		V_{CES}			1200	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	$T_C=100^{\circ}\text{C}$	600	A
			I_{CRM}	1ms		1200	
	Forward current		I_F			600	
			I_{FRM}	1ms		1200	
	Collector power dissipation		P_C	1 device		3125	
	Junction temperature		T_{vj}			175	W
	Operating junction temperature (under switching conditions)		T_{vjop}			175	°C
	Case temperature		T_c			125	
Storage temperature		T_{stg}			-40 ~ 125		
Isolation voltage	between terminal and copper base (*1)		V_{iso}	AC: 1min.		4000	Vrms
	between thermistor and others (*2)						
Screw Torque(*3)	Mounting		-	M5		6.0	N m
	Terminals			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

(*3) Recommendable Value: Mounting 2.5 ~ 6.0 N·m (M5)
Recommendable Value: 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	Zero gate voltage Collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	150	mA
	Gate-Emitter leakage current	I_{GES}	$V_{CE}=0V, V_{GE}=\pm 20V$		-	-	300	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 600mA$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 600A$	$T_{vj}=25^{\circ}C$	-	2.20	2.65	V
				$T_{vj}=25^{\circ}C$	-	1.45	1.90	
		$V_{CE(sat)}$ (chip)		$T_{vj}=125^{\circ}C$	-	1.80	-	
				$T_{vj}=150^{\circ}C$	-	1.90	-	
				$T_{vj}=175^{\circ}C$	-	1.95	-	
	Internal gate	R_G	-		-	1.67	-	Ω
	Capacitance	C_{ies}	$V_{CE}=10V, V_{GE}=0V, f=1MHz$		-	64	-	nF
		C_{oes}			-	2.2	-	
		C_{res}			-	0.57	-	
	Gate charge	Q_G	$V_{CC} = 600V, I_C = 600A$ $V_{GE} = -15 \rightarrow +15V$		-	4.2	-	μC
	Forward on voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F= 600A$	$T_{vj}=25^{\circ}C$	-	2.35	2.80	V
				$T_{vj}= 25^{\circ}C$	-	1.60	2.05	
		V_F (chip)		$T_{vj}=125^{\circ}C$	-	1.65	-	
				$T_{vj}=150^{\circ}C$	-	1.60	-	
				$T_{vj}=175^{\circ}C$	-	1.60	-	
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F= 600A$ $V_{GE} = +15/ -15V$ $R_G = 0.56 \Omega$ $L_S = 35 nH$	$T_{vj}= 25^{\circ}C$	-	0.42	-	μs
				$T_{vj}=125^{\circ}C$	-	0.46	-	
$T_{vj}=150^{\circ}C$				-	0.48	-		
$T_{vj}=175^{\circ}C$				-	0.49	-		
t_r		$T_{vj}= 25^{\circ}C$		-	0.09	-		
		$T_{vj}=125^{\circ}C$		-	0.11	-		
		$T_{vj}=150^{\circ}C$		-	0.11	-		
		$T_{vj}=175^{\circ}C$		-	0.12	-		
$t_{d(off)}$		$T_{vj}= 25^{\circ}C$		-	0.42	-		
		$T_{vj}=125^{\circ}C$		-	0.47	-		
		$T_{vj}=150^{\circ}C$		-	0.48	-		
		$T_{vj}=175^{\circ}C$		-	0.49	-		
t_f		$T_{vj}= 25^{\circ}C$		-	0.07	-		
		$T_{vj}=125^{\circ}C$		-	0.09	-		
		$T_{vj}=150^{\circ}C$		-	0.10	-		
		$T_{vj}=175^{\circ}C$		-	0.10	-		
Reverse recovery time		t_{rr}		$T_{vj}= 25^{\circ}C$	-	0.14	-	
	$T_{vj}=125^{\circ}C$		-	0.26	-			
	$T_{vj}=150^{\circ}C$		-	0.28	-			
	$T_{vj}=175^{\circ}C$		-	0.31	-			

(*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}	$V_{\text{CC}} = 600\text{V}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	38.7	-	mJ
			$I_{\text{C}}, I_{\text{F}} = 600\text{A}$	$T_{\text{vj}}=125^{\circ}\text{C}$	-	59.5	-	
			$V_{\text{GE}} = +15/ -15\text{V}$	$T_{\text{vj}}=150^{\circ}\text{C}$	-	63.4	-	
			$R_{\text{G}} = 0.56\ \Omega$	$T_{\text{vj}}=175^{\circ}\text{C}$	-	73.2	-	
		E_{off}	$L_{\text{S}} = 35\ \text{nH}$	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	54.2	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	63.1	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	66.0	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	70.7	-		
		E_{rr}	$T_{\text{vj}} = 25^{\circ}\text{C}$	-	20.2	-		
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	41.3	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	49.5	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	53.0	-		
Thermistor	Resistance	R	$T = 25^{\circ}\text{C}$	-	5000	-	Ω	
			$T = 100^{\circ}\text{C}$	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.

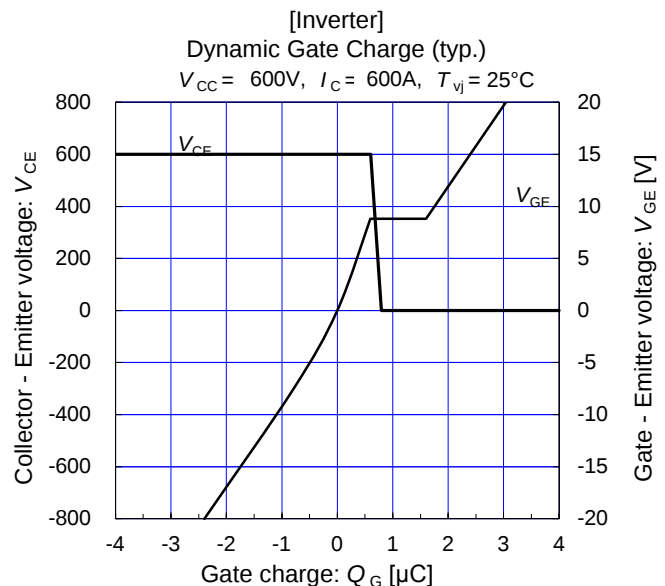
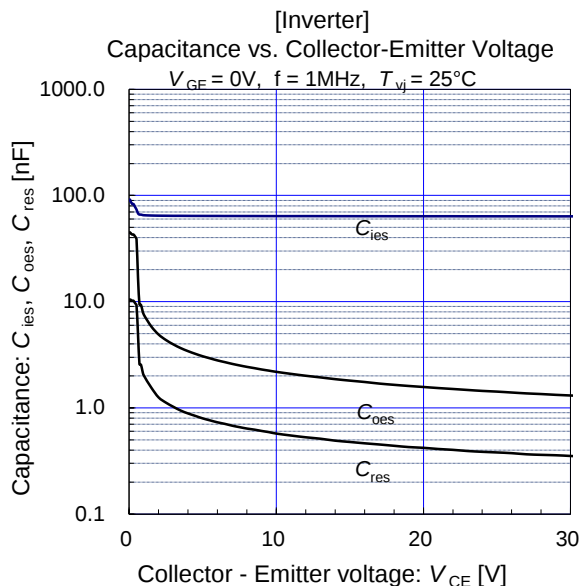
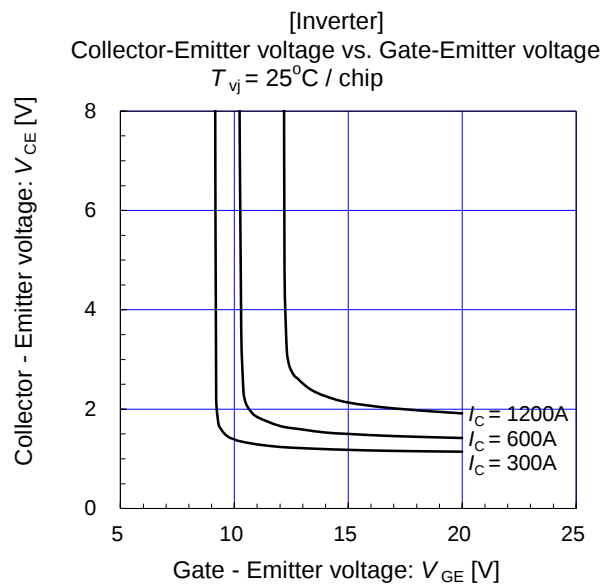
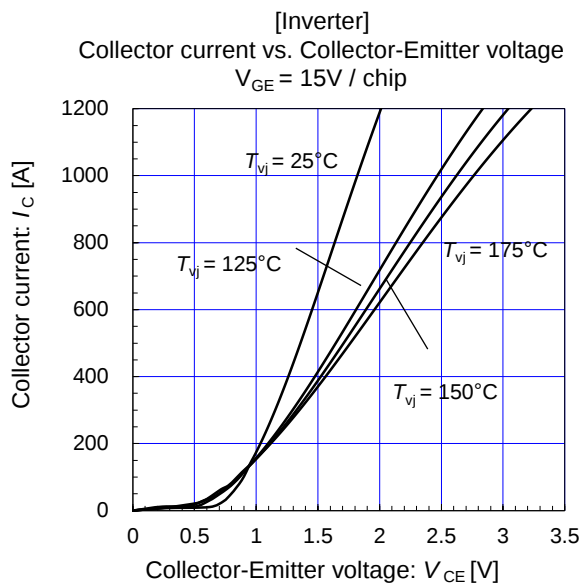
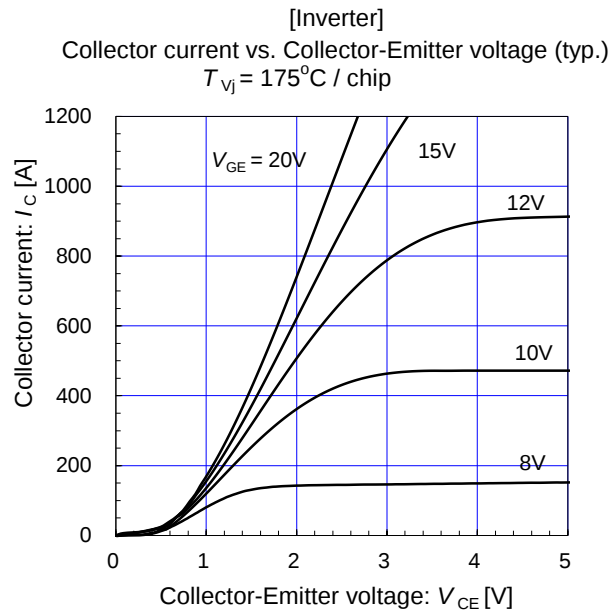
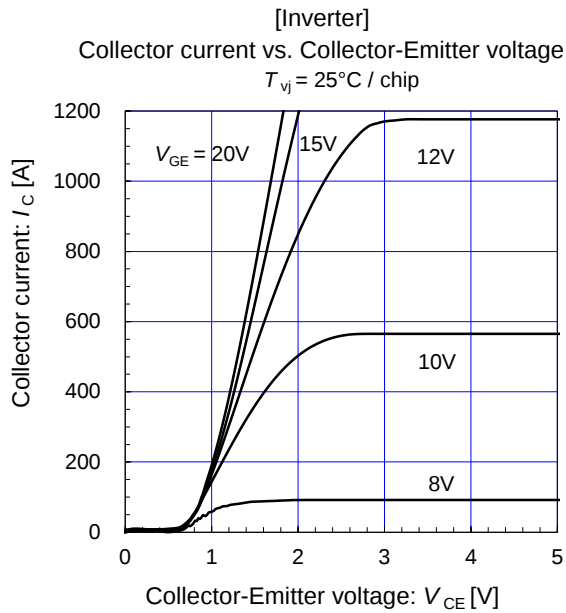
■ Thermal resistance characteristics

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.048	$^{\circ}\text{C/W}$
		Inverter FWD	-	-	0.057	
Contact thermal resistance (1device) (*1)	$R_{th(c-f)}$	with 1 W/(m·K) thermal grease	-	0.0167	-	

(*1) This is the value which is defined mounting on the additional cooling fin with thermal compound.

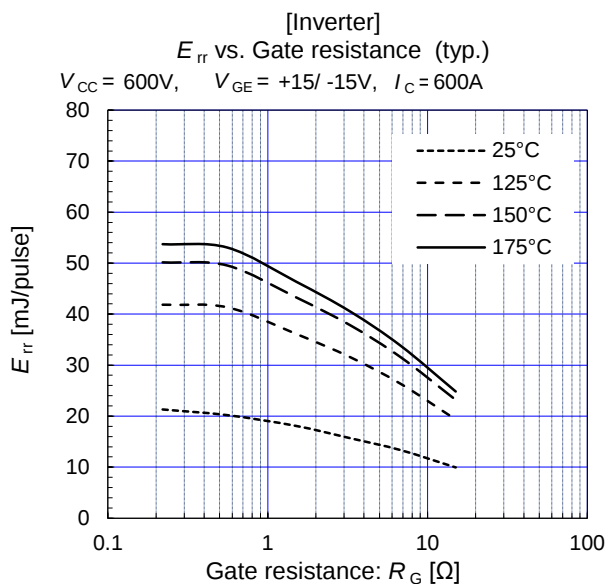
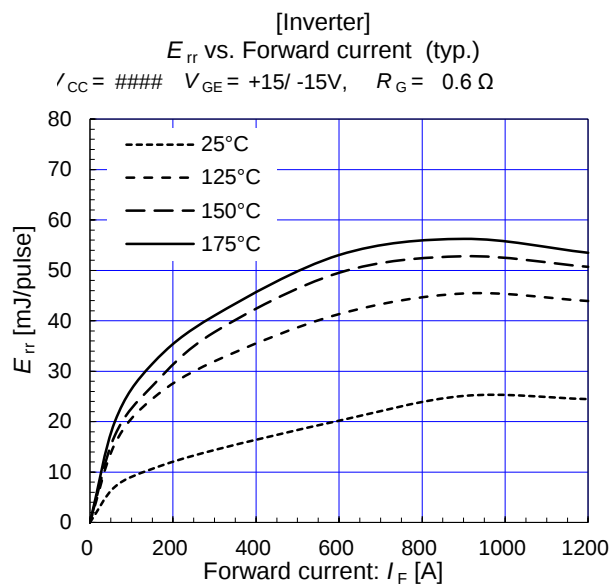
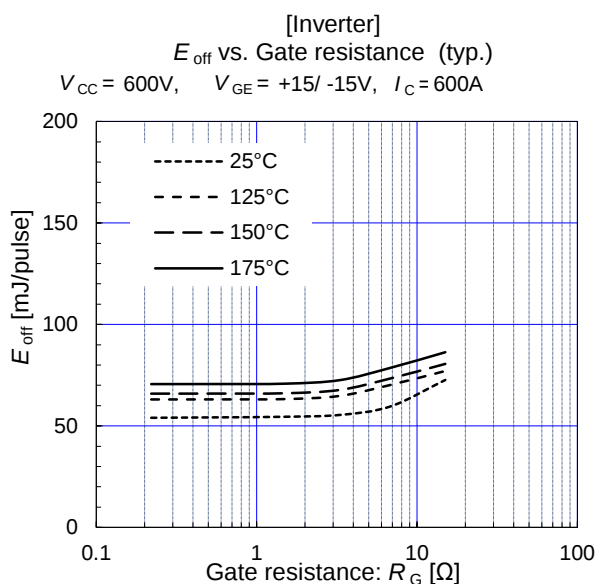
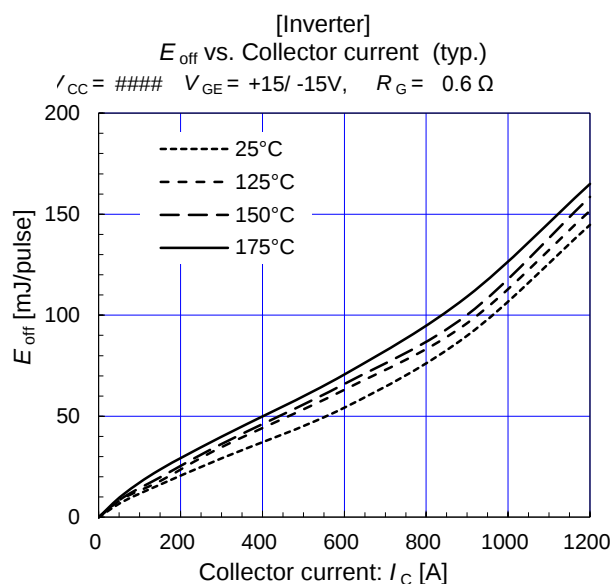
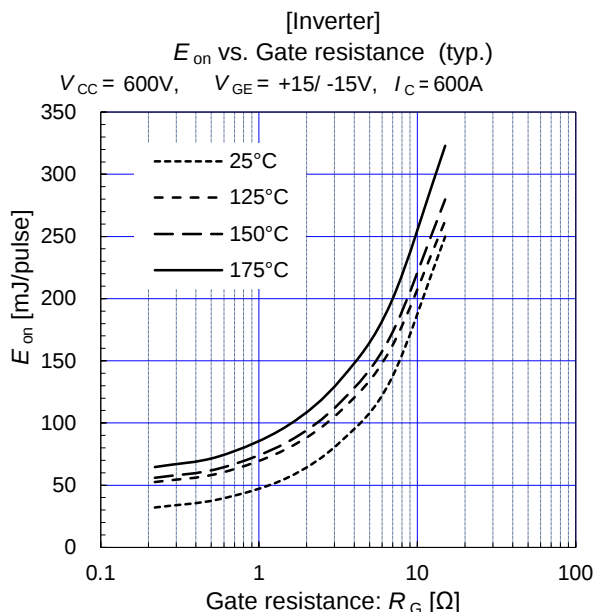
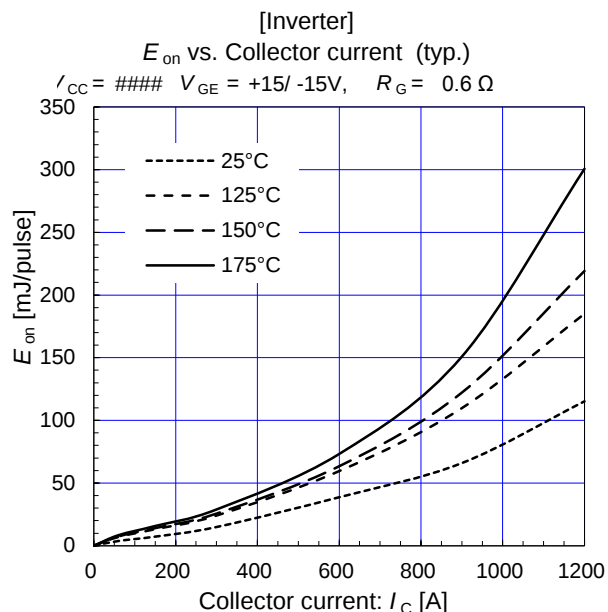
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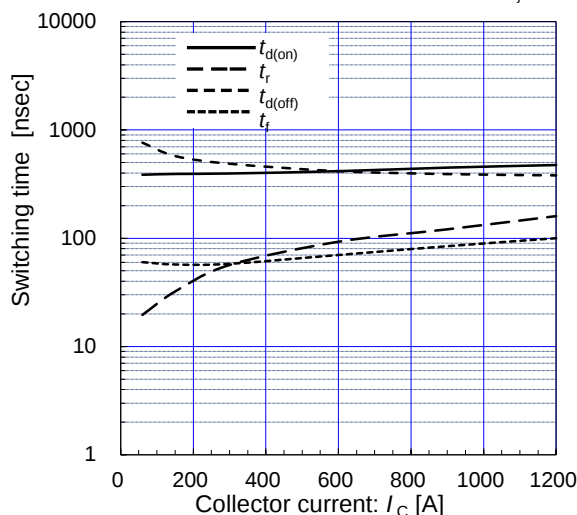
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[Inverter]

Switching time vs. Collector current (typ.)

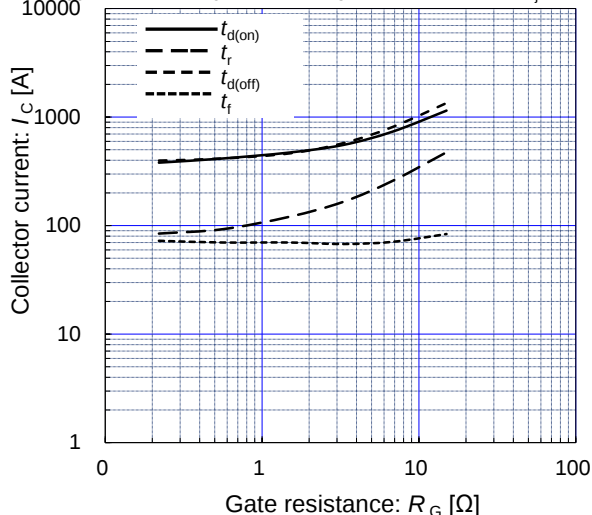
$V_{CC} = 600V$, $R_G = 0.6\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

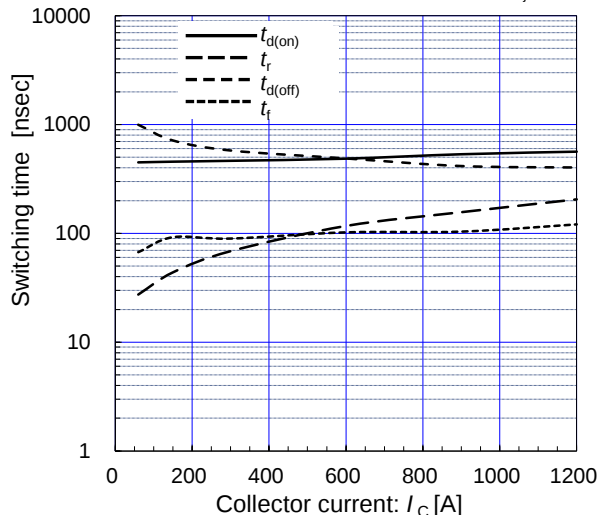
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

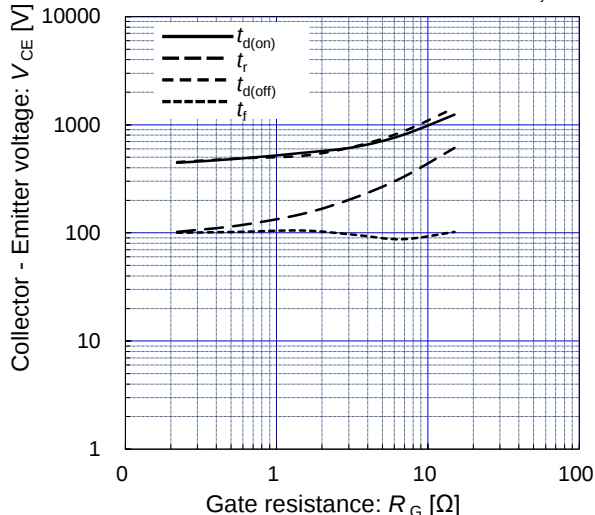
$V_{CC} = 600V$, $R_G = 0.6\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

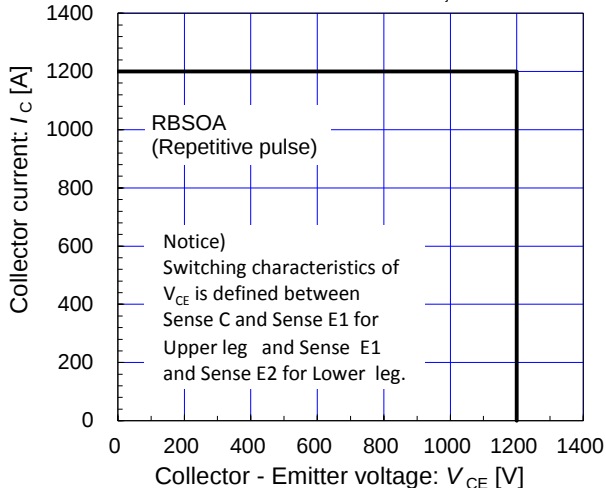
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

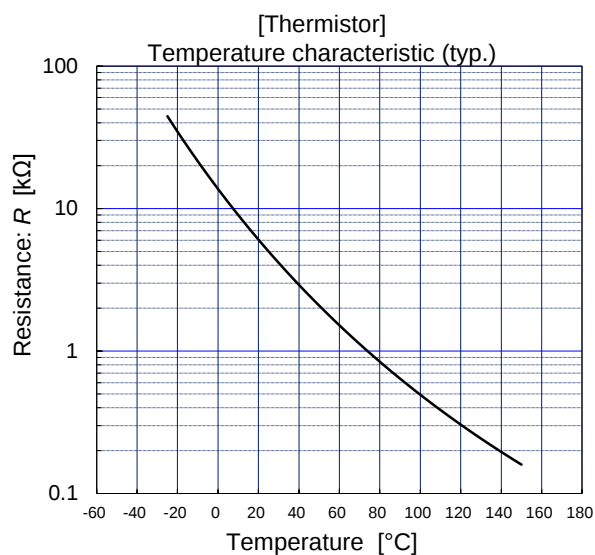
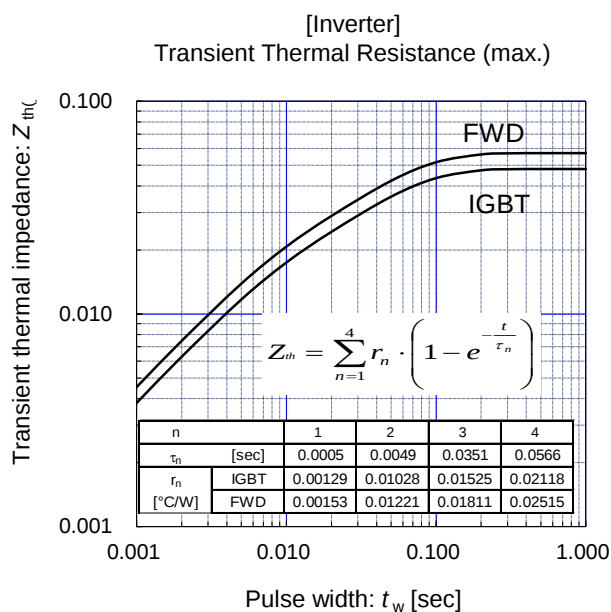
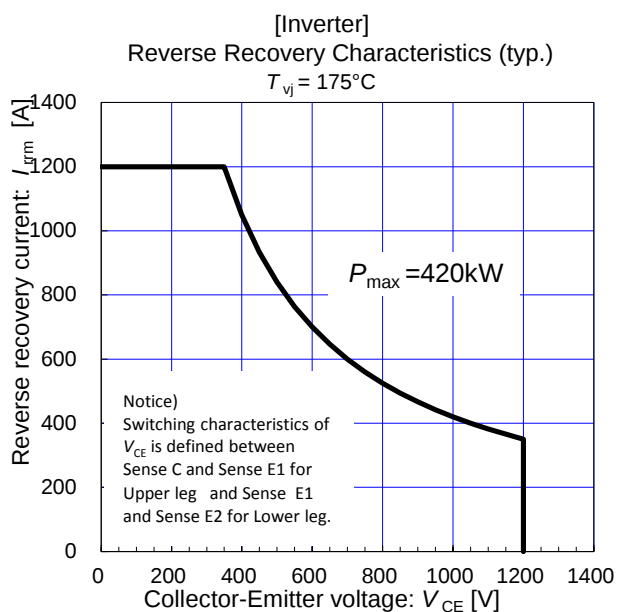
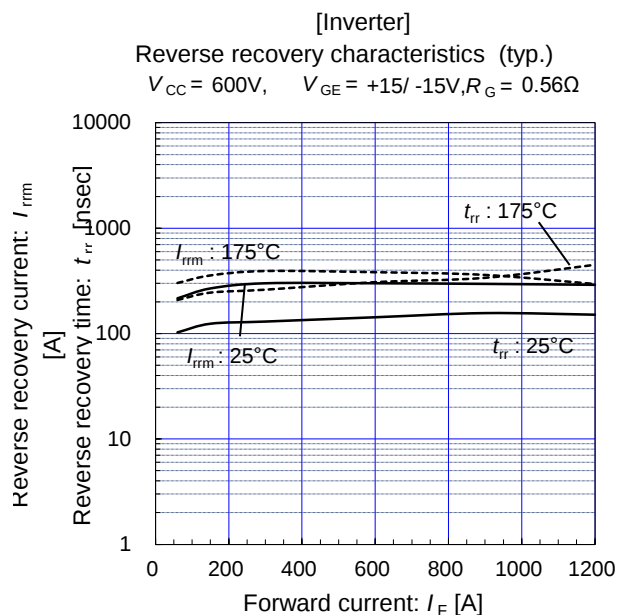
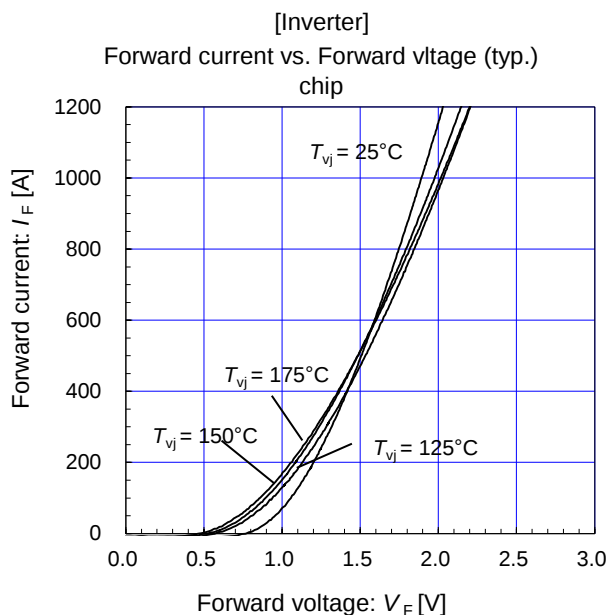
Reverse bias safe operating area (max.)

$V_{GE} = +15/-15$, $R_G = 0.56\Omega$, $T_{vj} = 175^\circ C$



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