

2MBI600XNG120-50

IGBT Modules

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

■ Features

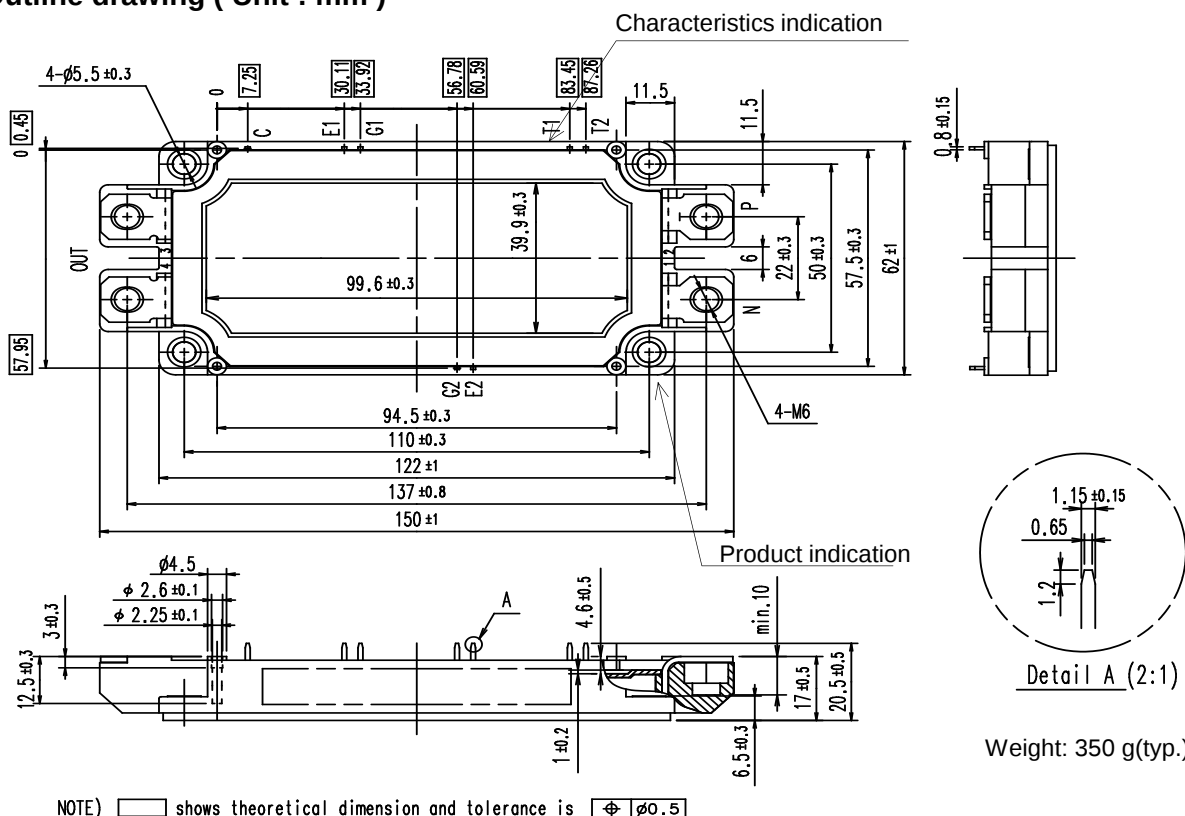
- Low $V_{CE(sat)}$
- Low Inductance Module structure
- Solder pin terminals

■ Applications

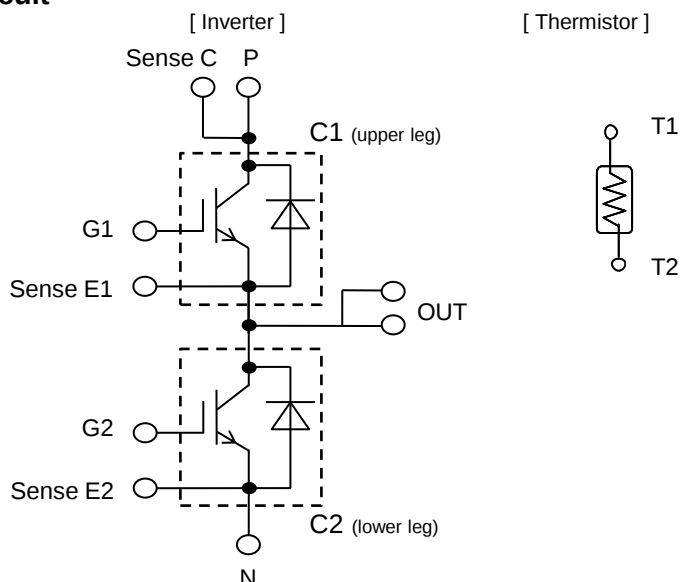
- Inverter for Motor Drives, AC and DC Servo Drives
- Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems



■ 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, gate-emitter short-circuited	V_{CES}		1200	V
	Gate-emitter voltage, collector-emitter short-circuited	V_{GES}		± 20	V
	Collector current	I_C	Continuous $T_c = 100^\circ\text{C}$	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	3125	W
	Virtual junction temperature	T_{vj}		175	$^\circ\text{C}$
	Operating 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)	V_{isol}	AC: 1min.	2500	Vrms
	between thermistor and others (*2)				
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}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	150	μA
	Gate leakage current, collector-emitter short-circuited	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
		$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.45	1.90	
				$T_{vj}=125^{\circ}C$	-	1.80	-	
				$T_{vj}=150^{\circ}C$	-	1.90	-	
				$T_{vj}=175^{\circ}C$	-	1.95	-	
	Internal gate resistance	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 voltage	V_F (terminal)	$V_{GE} = 0V$ $I_F= 600A$	$T_{vj}=25^{\circ}C$	-	2.35	2.80	V
		V_F (chip)		$T_{vj}= 25^{\circ}C$	-	1.60	2.05	
				$T_{vj}=125^{\circ}C$	-	1.65	-	
				$T_{vj}=150^{\circ}C$	-	1.60	-	
				$T_{vj}=175^{\circ}C$	-	1.60	-	
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F = 600A$ $V_{GE} = +15/-15 V$ $R_G = \pm 0.56\Omega$ $L_S = 35 nH$	$T_{vj}= 25^{\circ}C$	-	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	-	
			$R_{\text{G}} = \pm 0.56\Omega$	$T_{\text{vj}}=175^{\circ}\text{C}$	-	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°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.

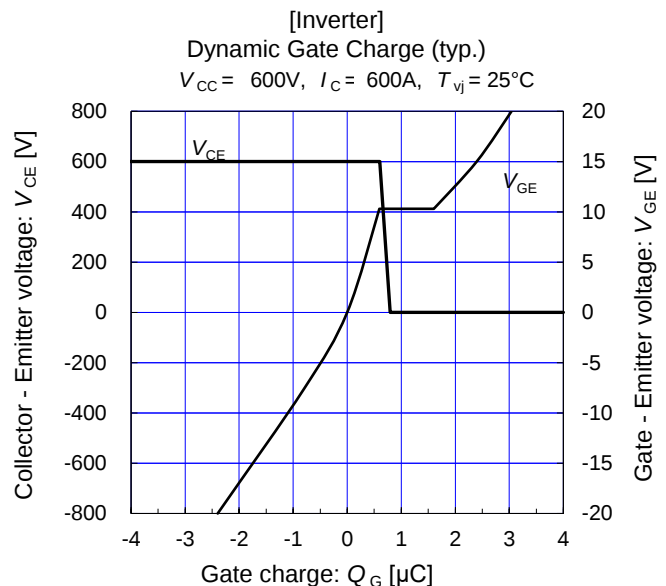
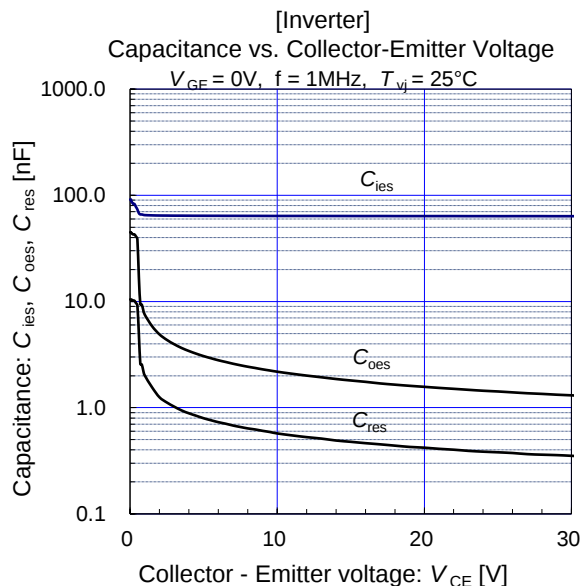
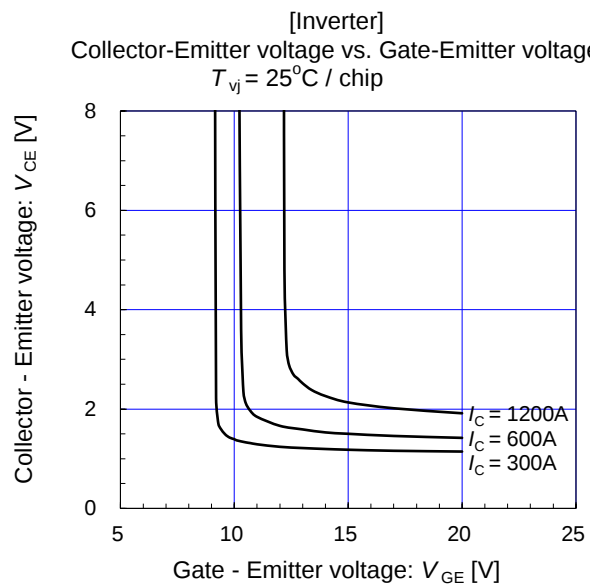
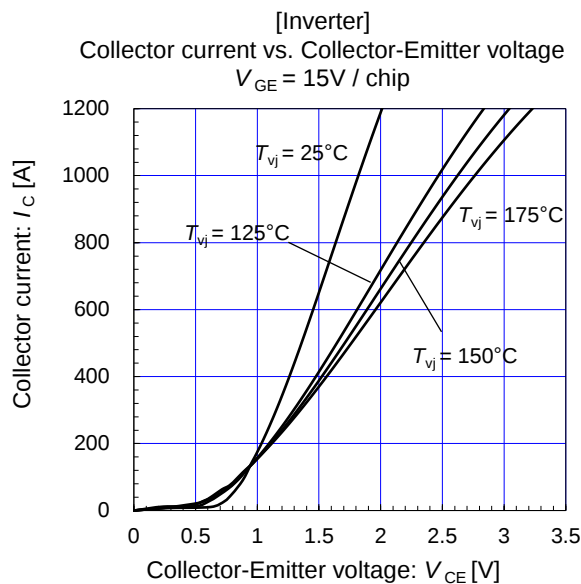
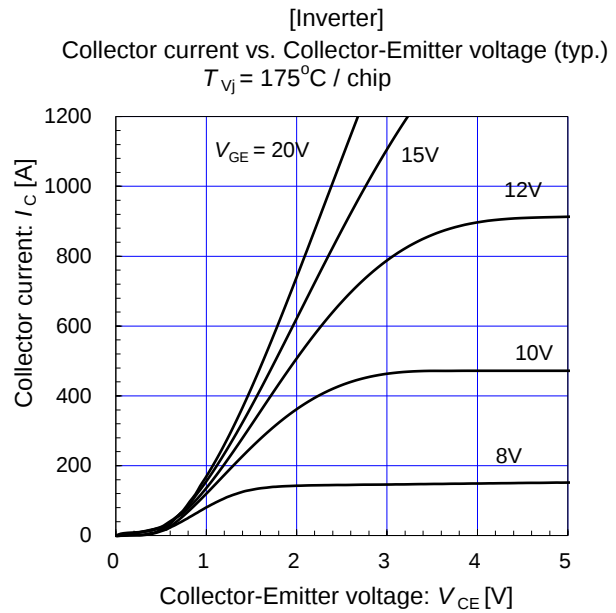
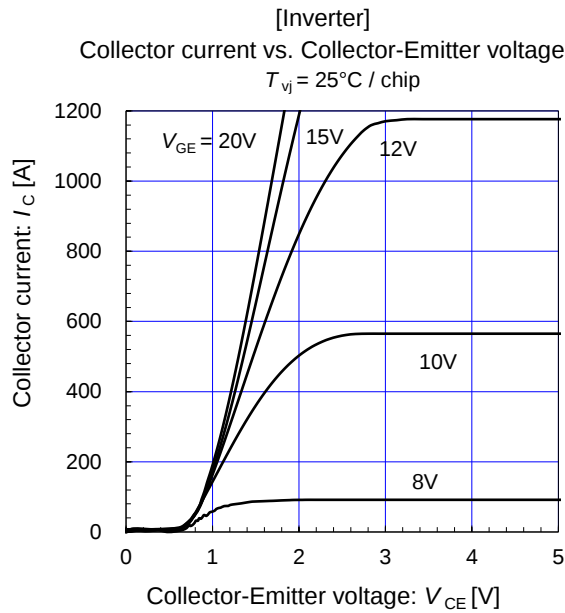
■ Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.048	$^{\circ}\text{C/W}$
		Inverter FWD	-	-	0.057	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/($\text{m} \cdot ^{\circ}\text{C}$) thermal grease	-	0.0167	-	

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

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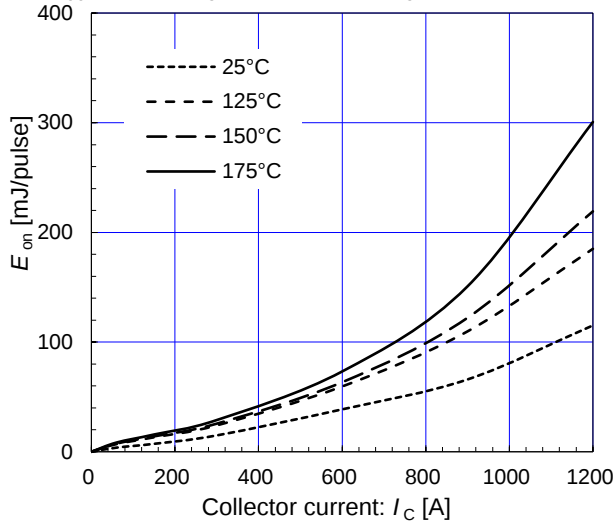
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[Inverter]

E_{on} vs. Collector current (typ.)

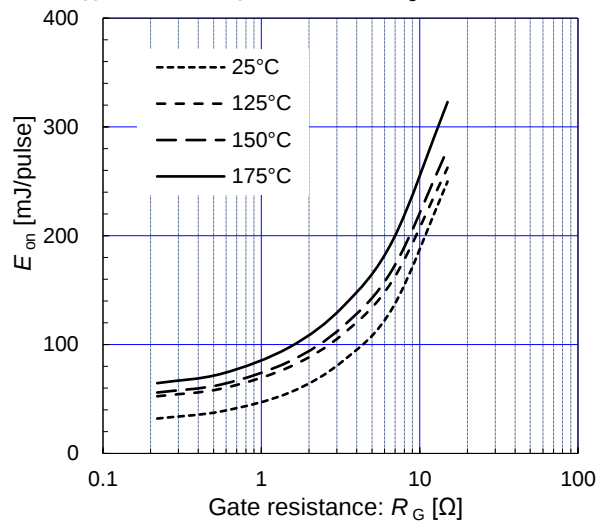
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = \pm 0.56\Omega$



[Inverter]

E_{on} vs. Gate resistance (typ.)

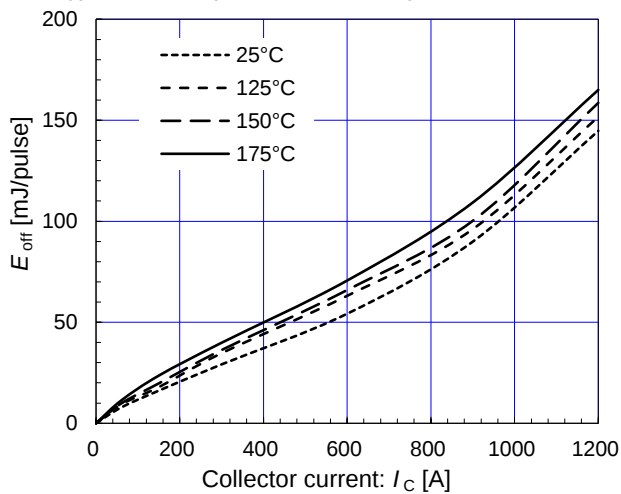
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $I_C = 600A$



[Inverter]

E_{off} vs. Collector current (typ.)

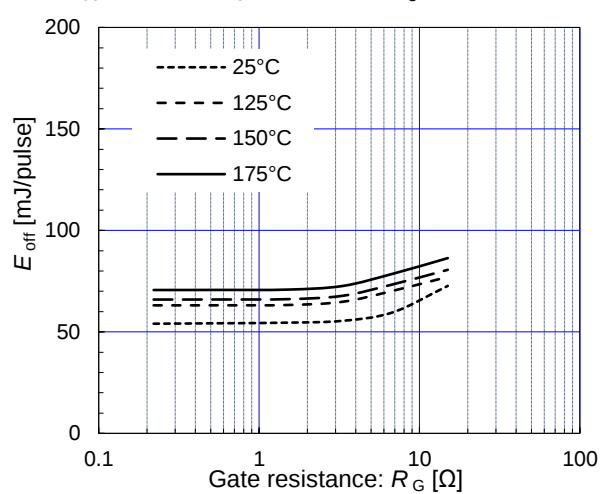
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = \pm 0.56\Omega$



[Inverter]

E_{off} vs. Gate resistance (typ.)

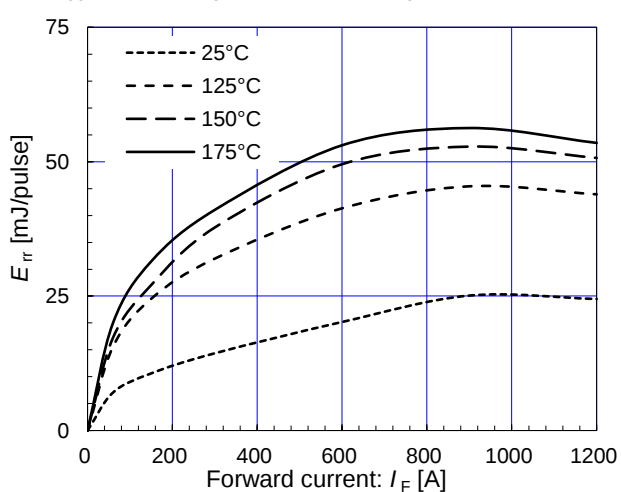
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $I_C = \#REF!$



[Inverter]

E_{rr} vs. Forward current (typ.)

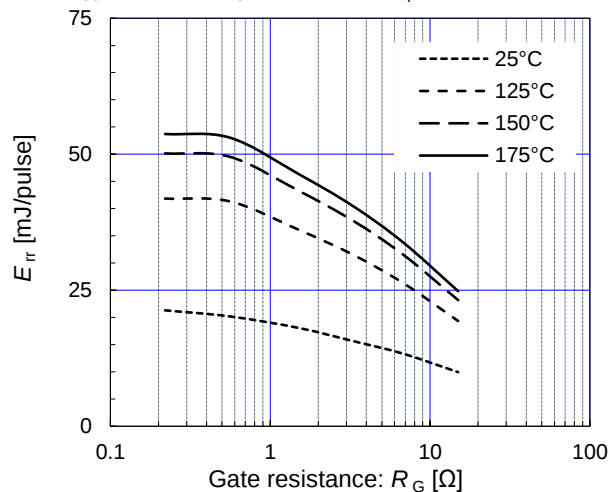
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = \pm 0.56\Omega$



[Inverter]

E_{rr} vs. Gate resistance (typ.)

$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $I_F = 600A$



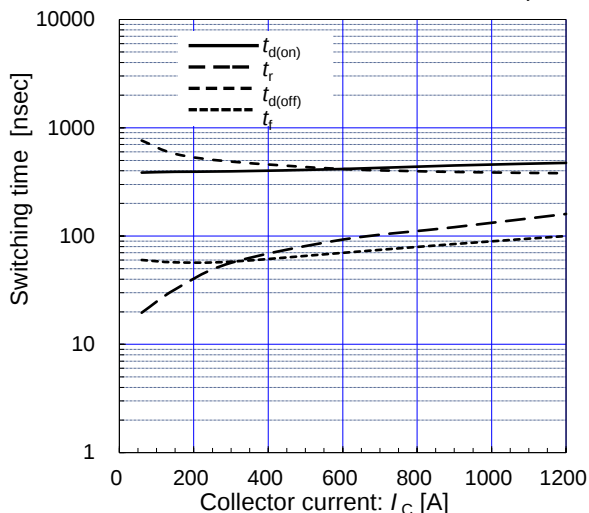
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[Inverter]

Switching time vs. Collector current (typ.)

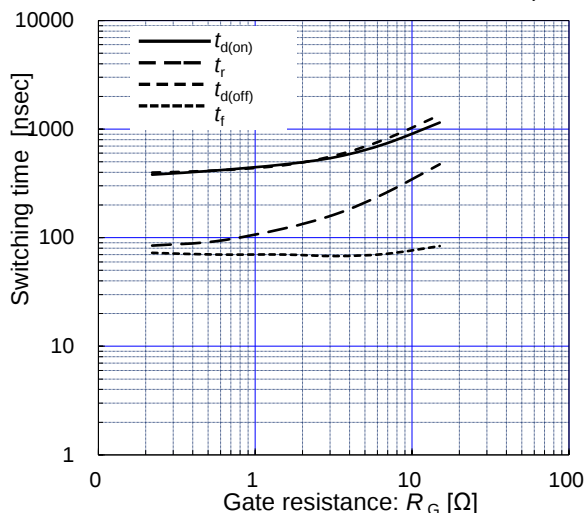
$V_{CC} = 600V$, $R_G = \pm 0.56\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

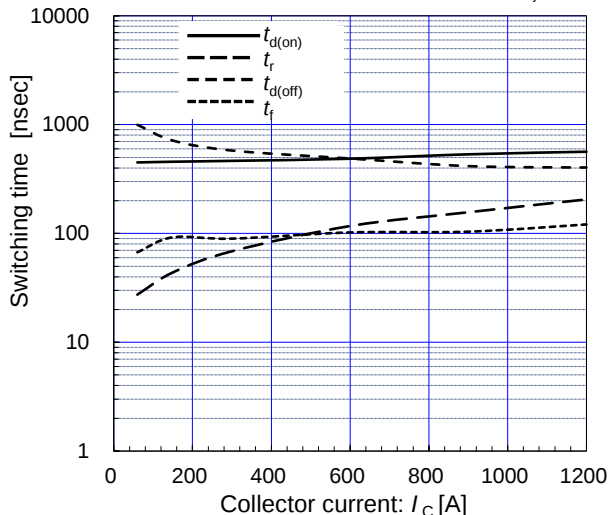
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

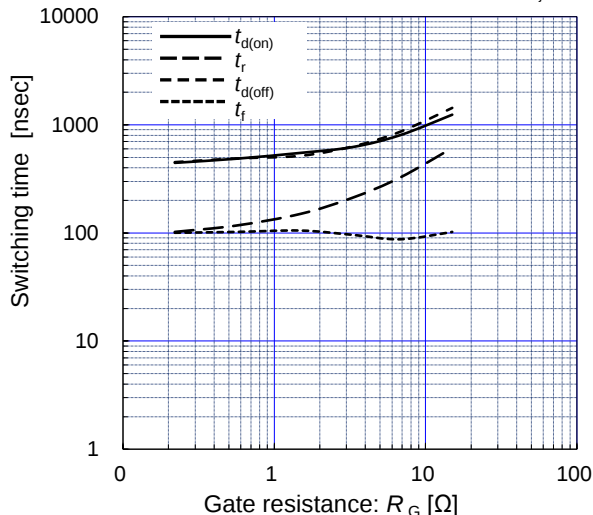
$V_{CC} = 600V$, $R_G = \pm 0.56\Omega$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

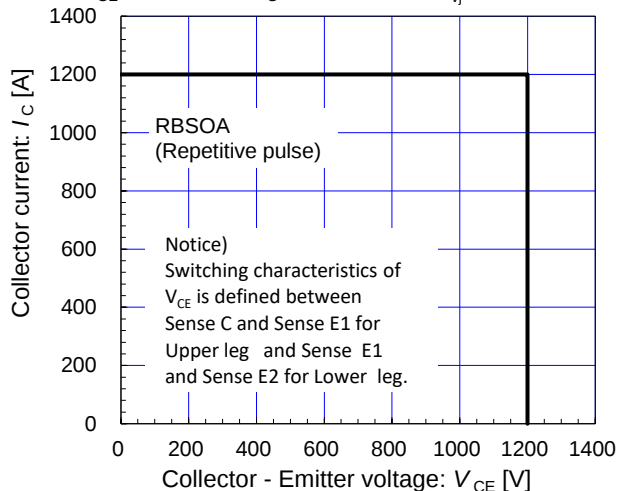
$V_{CC} = 600V$, $I_C = 600A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

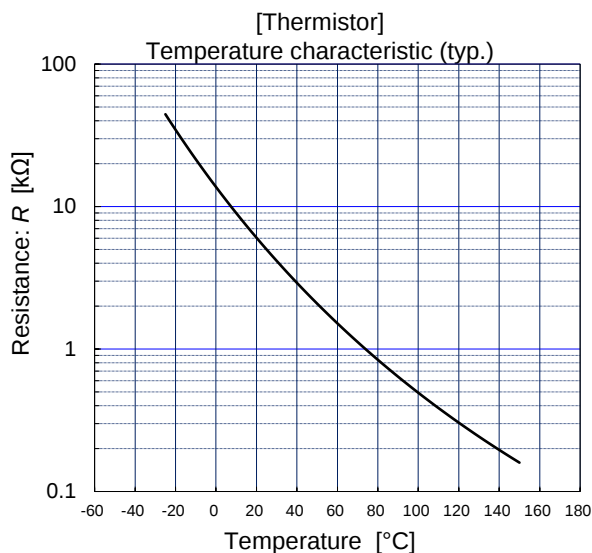
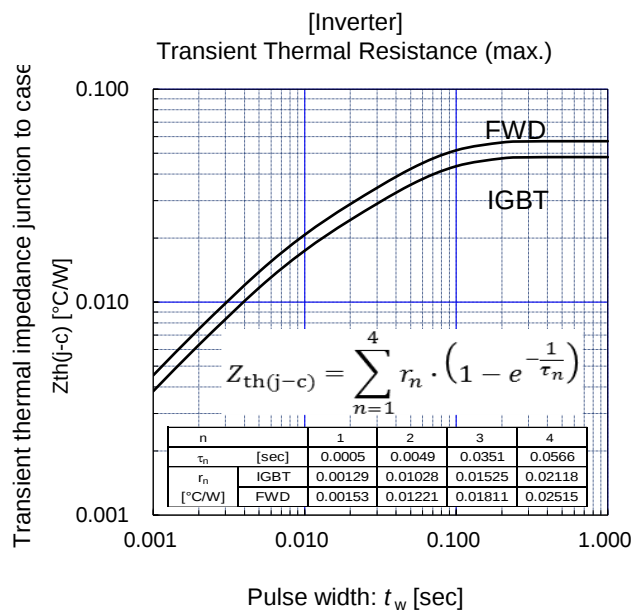
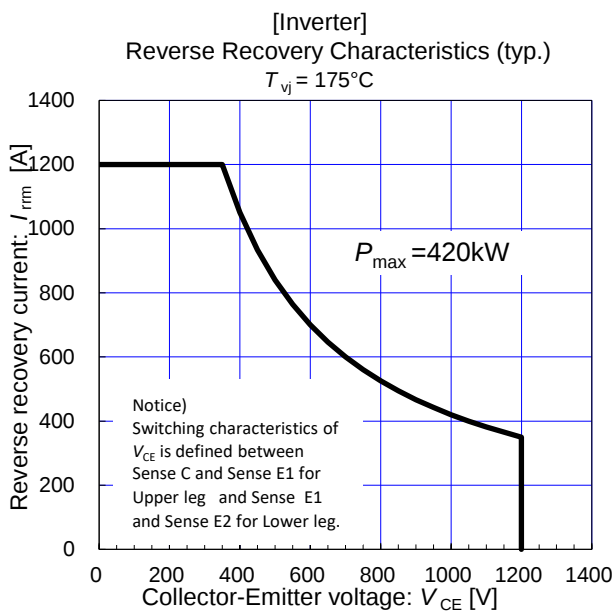
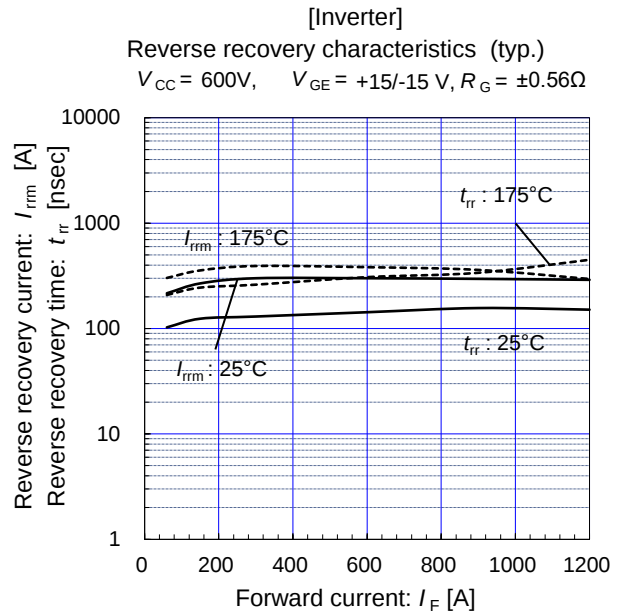
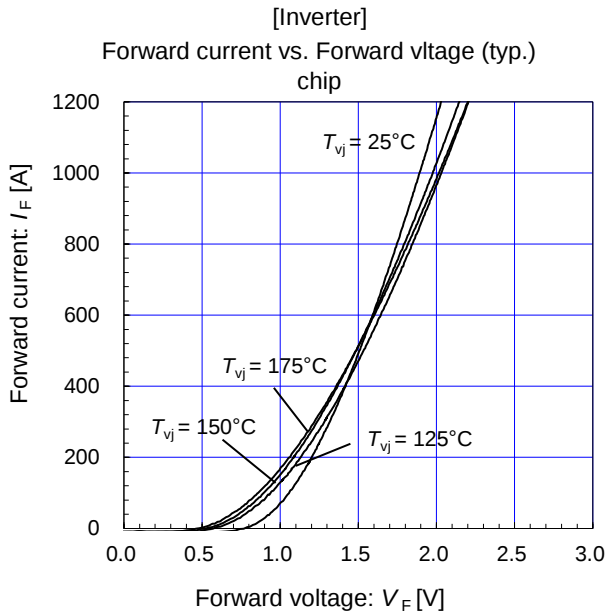
Reverse bias safe operating area (max.)

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



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