

# 2MBI600XEE120-50

IGBT Modules

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

■ **Features**

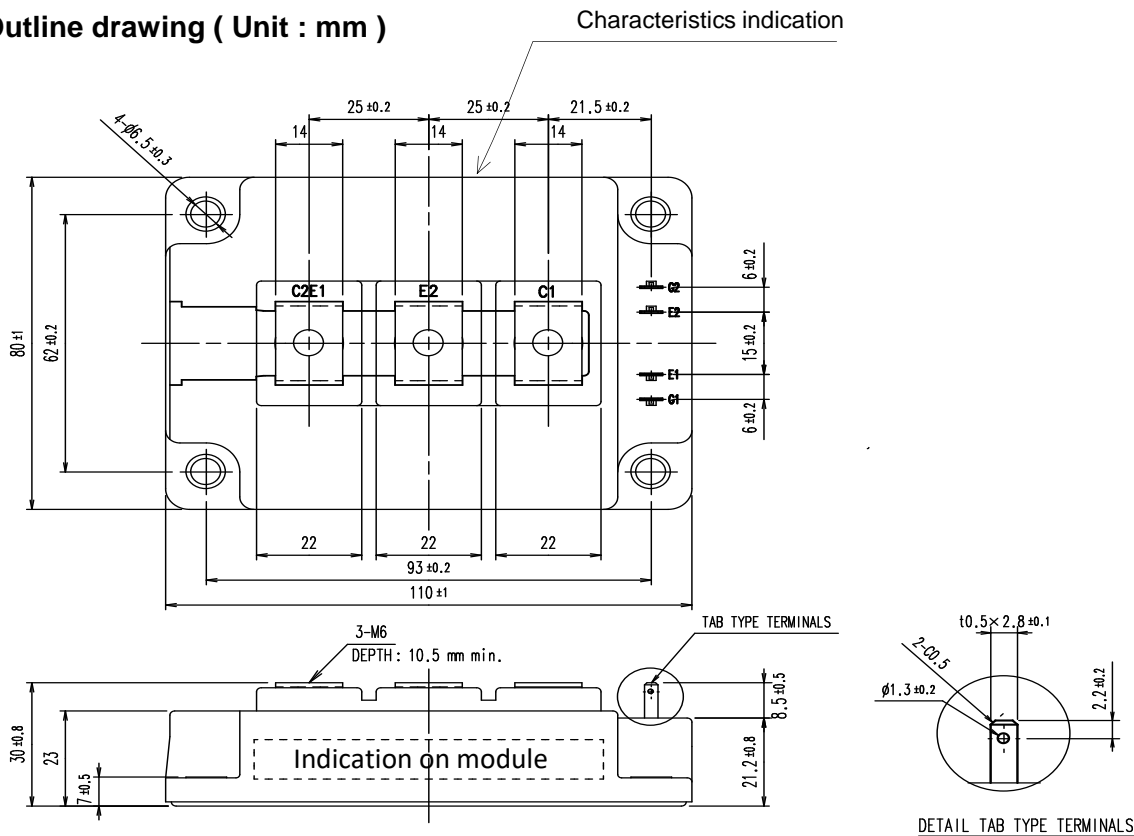
- LOW  $V_{CE(sat)}$
- High speed switching
- Low Inductance Module structure

■ **Applications**

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

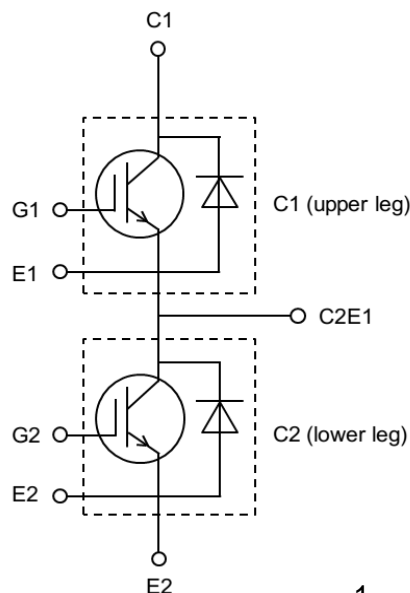


■ **Outline drawing ( Unit : mm )**



Weight: 470 g(typ.)

■ **Equivalent Circuit**





# 2MBI600XEE120-50

**IGBT Modules**
**■ Electrical characteristics (at  $T_{vj}= 25^{\circ}\text{C}$  unless otherwise specified)**

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Collector-Emitter cut -off current, Gate-Emitter short - circuited	$I_{CES}$	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	-	-	200	$\mu\text{A}$	
Gate leakage current, Collector-Emitter short-circuited	$I_{GES}$	$V_{CE}=0\text{V}, V_{GE}=\pm 20\text{V}$	-	-	400	nA	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 600\text{mA}$	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 600\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.65	2.10	V
	$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}\text{C}$	-	1.40	1.85	
			$T_{vj}=125^{\circ}\text{C}$	-	1.70	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.80	-	
			$T_{vj}=175^{\circ}\text{C}$	-	1.85	-	
Internal gate resistance	$r_g$	-	-	1.63	-	$\Omega$	
Input capacitance	$C_{ies}$	$V_{CE}=10\text{V}, V_{GE}=0\text{V}, f=1\text{MHz}$	-	70	-	nF	
Output capacitance	$C_{oes}$		-	2.4	-		
Reverse transfer capacitance	$C_{res}$		-	0.62	-		
Gate charge	$Q_G$	$V_{CC} = 600\text{V}, I_C = 600\text{A}$ $V_{GE} = -15 \rightarrow +15\text{V}$	-	4.5	-	$\mu\text{C}$	
Forward voltage	$V_F$ (terminal)	$V_{GE} = 0\text{V}$ $I_F = 600\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.80	2.25	V
	$V_F$ (chip)		$T_{vj}=25^{\circ}\text{C}$	-	1.55	2.00	
			$T_{vj}=125^{\circ}\text{C}$	-	1.65	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.60	-	
			$T_{vj}=175^{\circ}\text{C}$	-	1.55	-	
Turn-on delay time (*1)	$t_{d(on)}$	$V_{CC} = 600\text{V}$ $I_C, I_F = 600\text{A}$ $V_{GE} = +15/ -15\text{V}$ $R_G = 0.56 \Omega$ $L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	0.32	-	$\mu\text{s}$
			$T_{vj}=125^{\circ}\text{C}$	-	0.36	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.37	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.38	-	
Rise time (*1)	$t_r$		$T_{vj}=25^{\circ}\text{C}$	-	0.07	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.08	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.08	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.09	-	
Turn-off delay time (*1)	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.45	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.51	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.52	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.53	-	
Fall time (*1)	$t_f$		$T_{vj}=25^{\circ}\text{C}$	-	0.12	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.15	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.17	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.17	-	
Reverse recovery time	$t_{rr}$	$T_{vj}=25^{\circ}\text{C}$	-	0.26	-		
		$T_{vj}=125^{\circ}\text{C}$	-	0.47	-		
		$T_{vj}=150^{\circ}\text{C}$	-	0.50	-		
		$T_{vj}=175^{\circ}\text{C}$	-	0.56	-		

(\*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.		
Turn-on energy	$E_{on}$	$V_{CC} = 600\text{V}$ $I_C, I_F = 600\text{A}$ $V_{GE} = +15/ -15\text{V}$ $R_G = 0.56 \Omega$ $L_S = 30 \text{ nH}$	$T_{vj}=25^{\circ}\text{C}$	-	18.9	-	mJ
			$T_{vj}=125^{\circ}\text{C}$	-	28.7	-	
			$T_{vj}=150^{\circ}\text{C}$	-	30.3	-	
			$T_{vj}=175^{\circ}\text{C}$	-	31.9	-	
Turn-off energy	$E_{off}$		$T_{vj}=25^{\circ}\text{C}$	-	56.0	-	
			$T_{vj}=125^{\circ}\text{C}$	-	65.8	-	
			$T_{vj}=150^{\circ}\text{C}$	-	68.3	-	
			$T_{vj}=175^{\circ}\text{C}$	-	70.7	-	
Reverse recovery energy	$E_{rr}$		$T_{vj}=25^{\circ}\text{C}$	-	28.5	-	
			$T_{vj}=125^{\circ}\text{C}$	-	43.6	-	
			$T_{vj}=150^{\circ}\text{C}$	-	47.4	-	
			$T_{vj}=175^{\circ}\text{C}$	-	51.1	-	

**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.

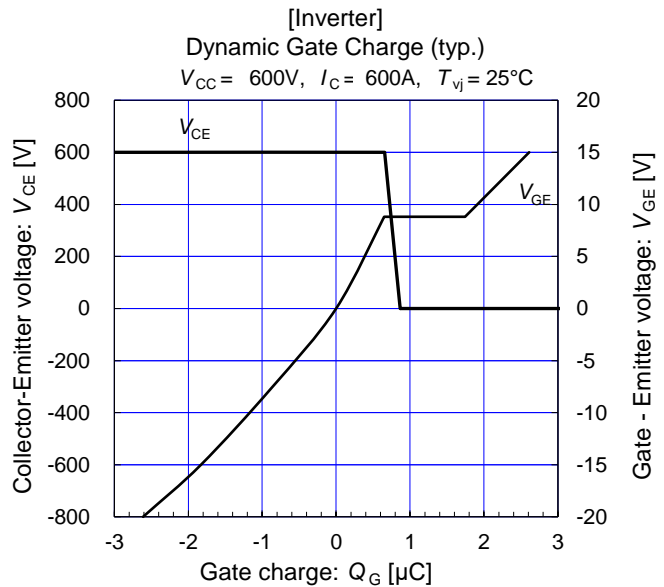
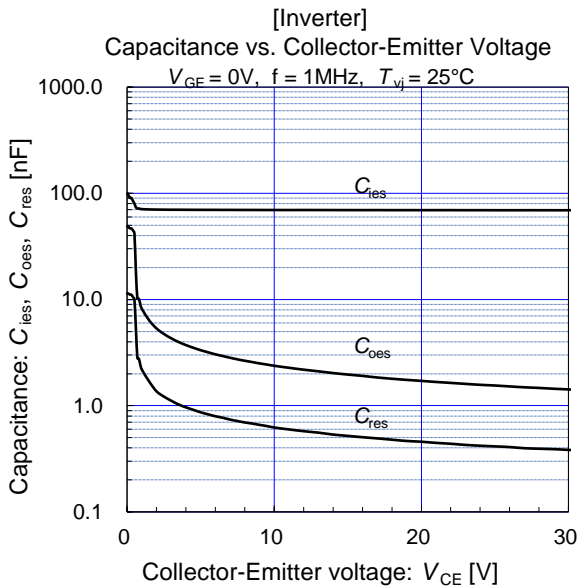
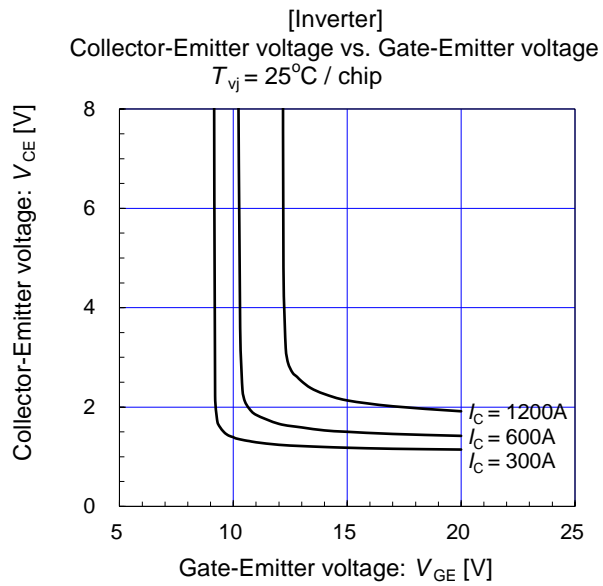
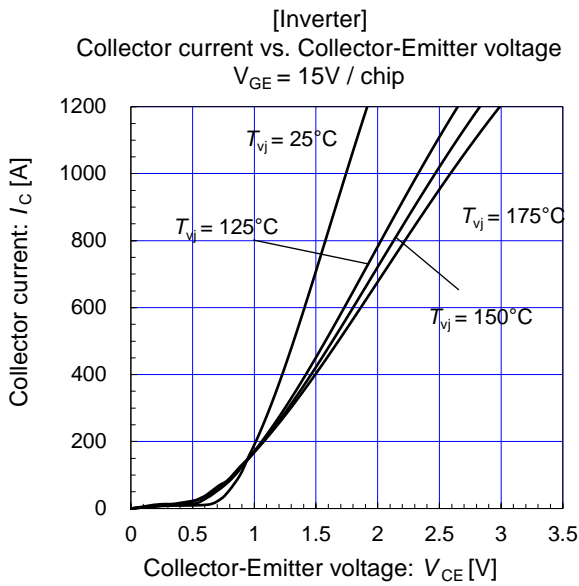
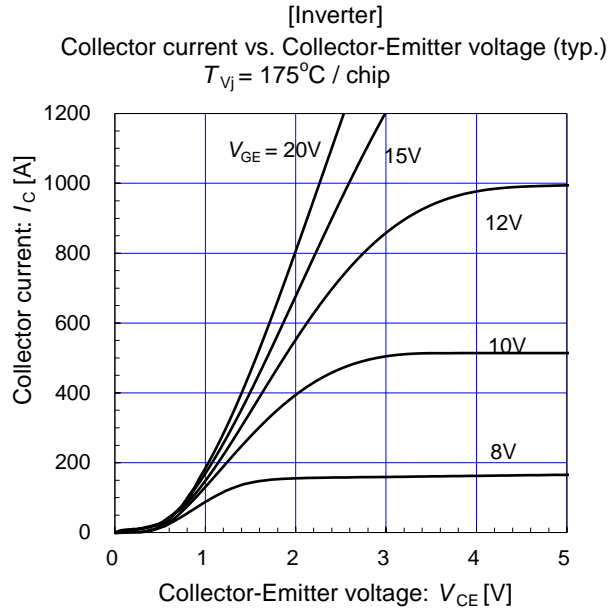
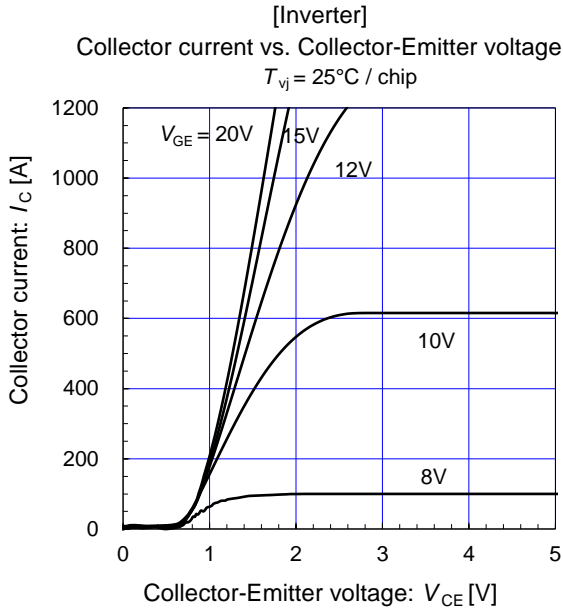
**■ Thermal resistance characteristics**

	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.038	K/W
		Inverter FWD	-	-	0.063	
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 heat sink with thermal grease.

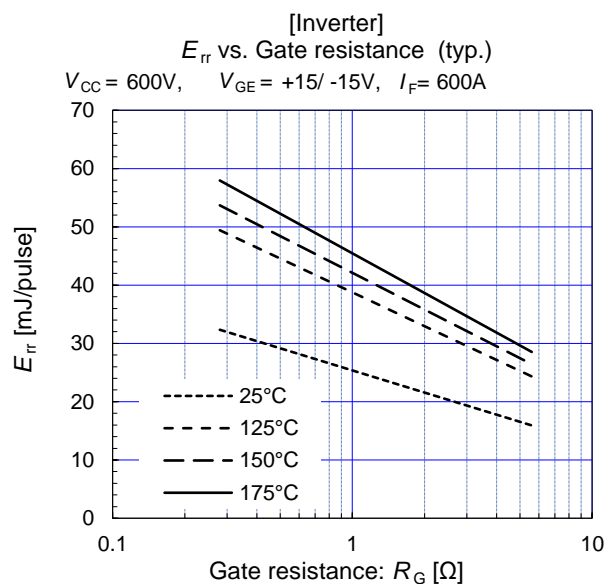
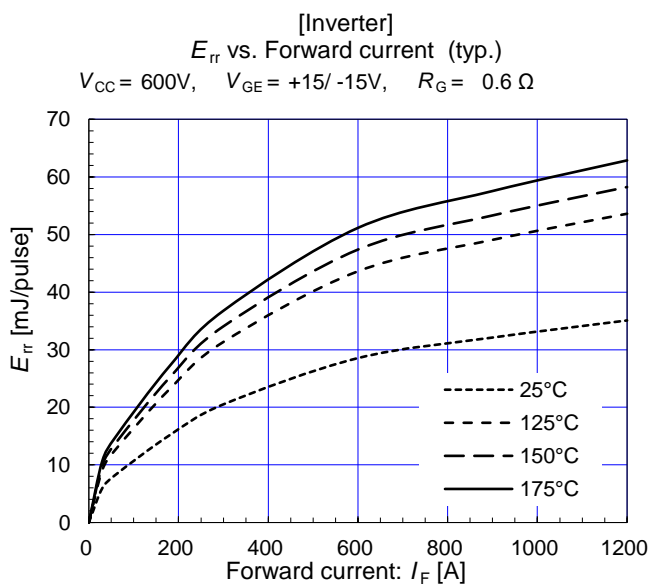
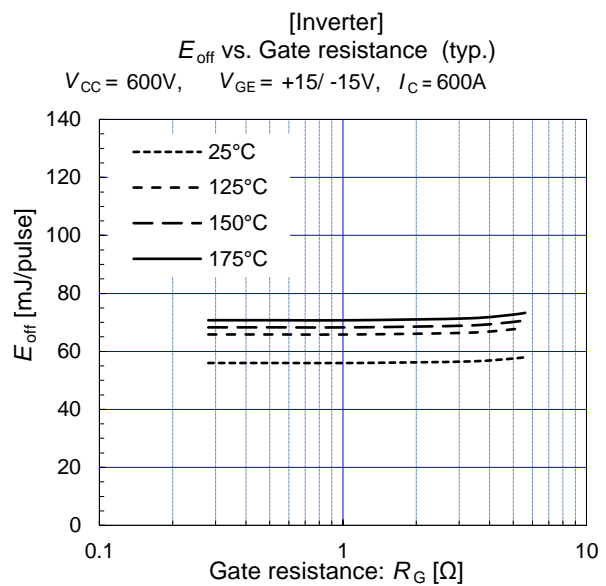
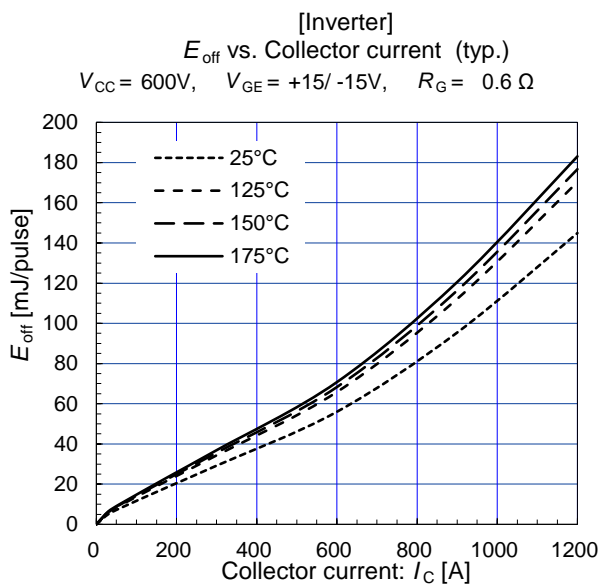
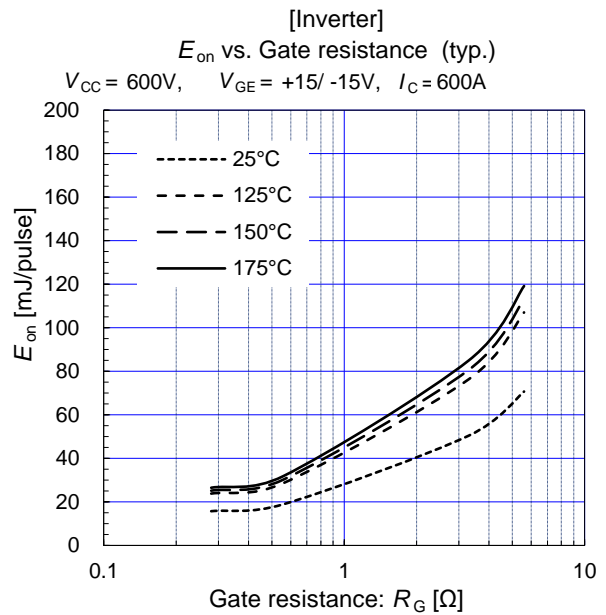
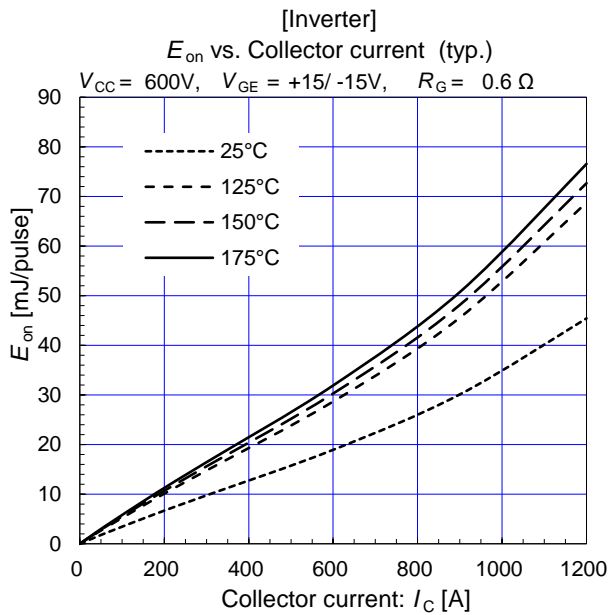
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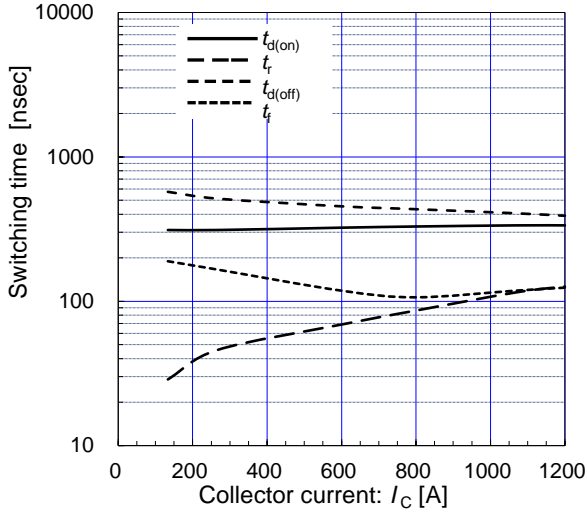
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

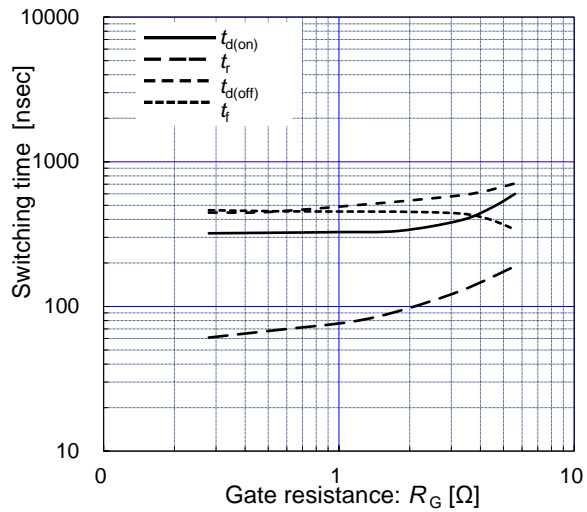
$V_{CC} = 600V, R_G = 0.56\Omega, V_{GE} = +15/-15V, T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

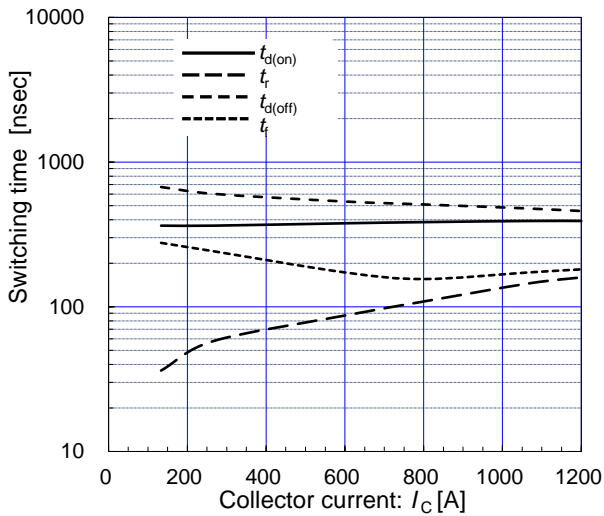
$V_{CC} = 600V, I_C = 600A, V_{GE} = +15/-15V, T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

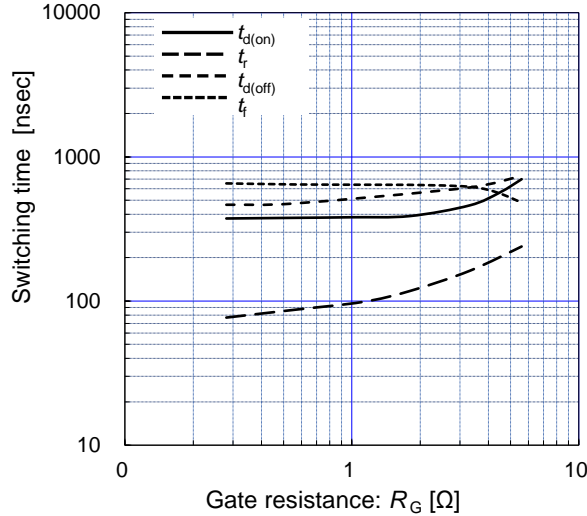
$V_{CC} = 600V, R_G = 0.56\Omega, V_{GE} = +15/-15V, T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

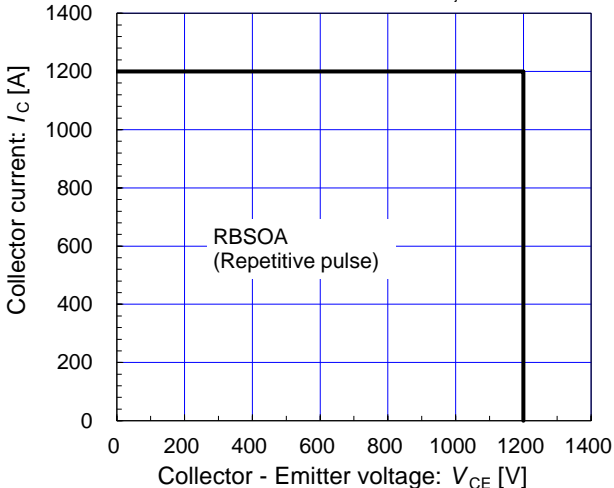
$V_{CC} = 600V, I_C = 600A, V_{GE} = +15/-15V, T_{vj} = 175^\circ C$



[Inverter]

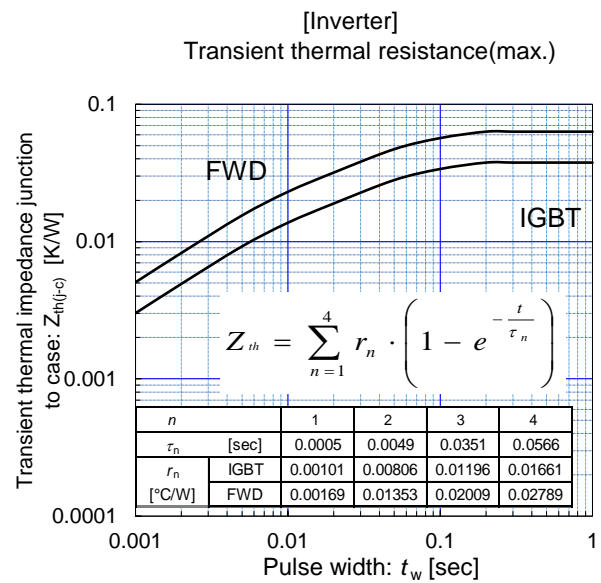
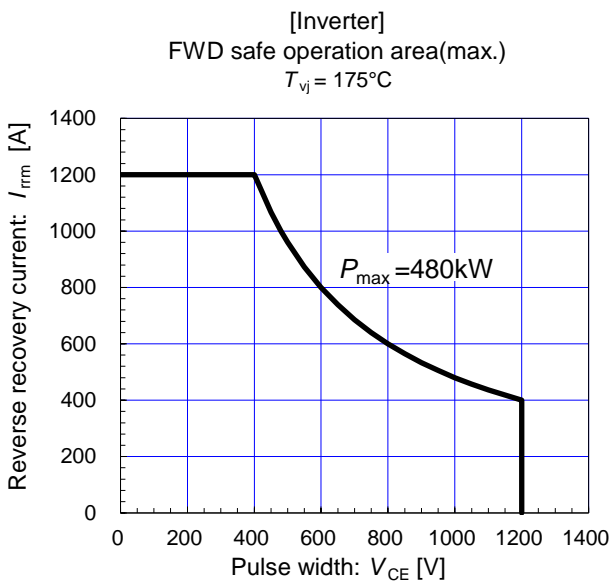
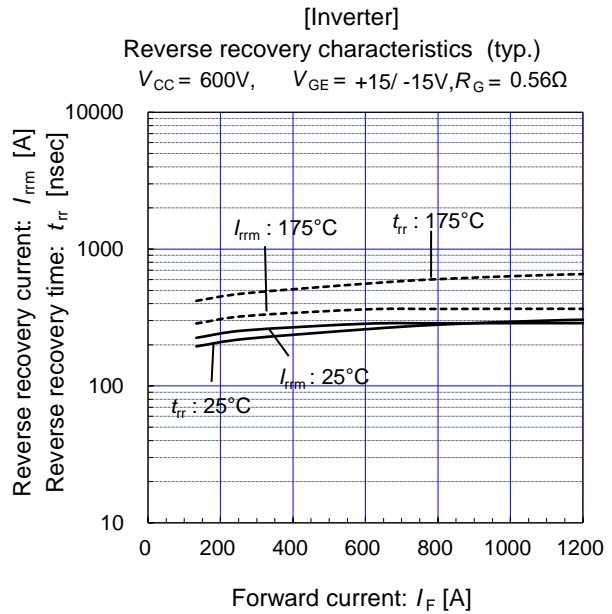
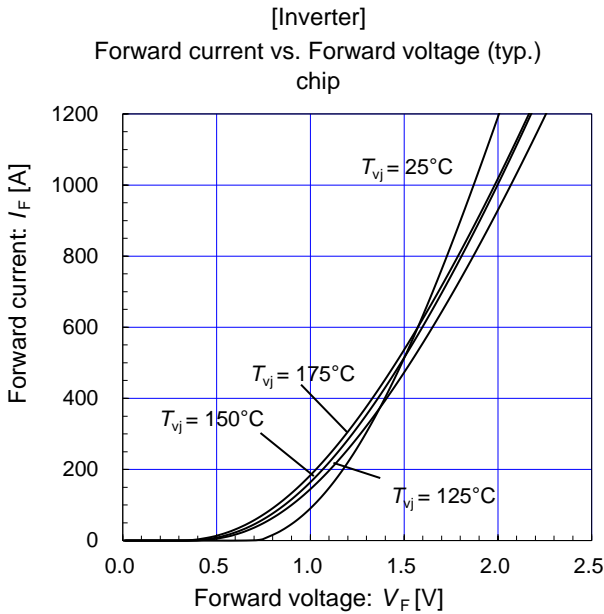
Reverse bias safe operating area (max.)

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



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