

# 7MBR100XNA120-50

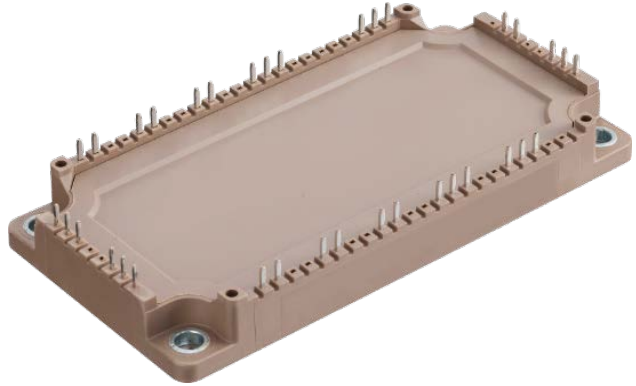
IGBT Modules

**Power Module(X series)**  
1200V / 100A / PIM

□ **Features**

- Low  $V_{CE(sat)}$
- Compact Package
- P.C.Board Mount Module
- Converter Diode Bridge Dynamic Brake Circuit
- RoHS compliant Product

□ **Typical appearance**

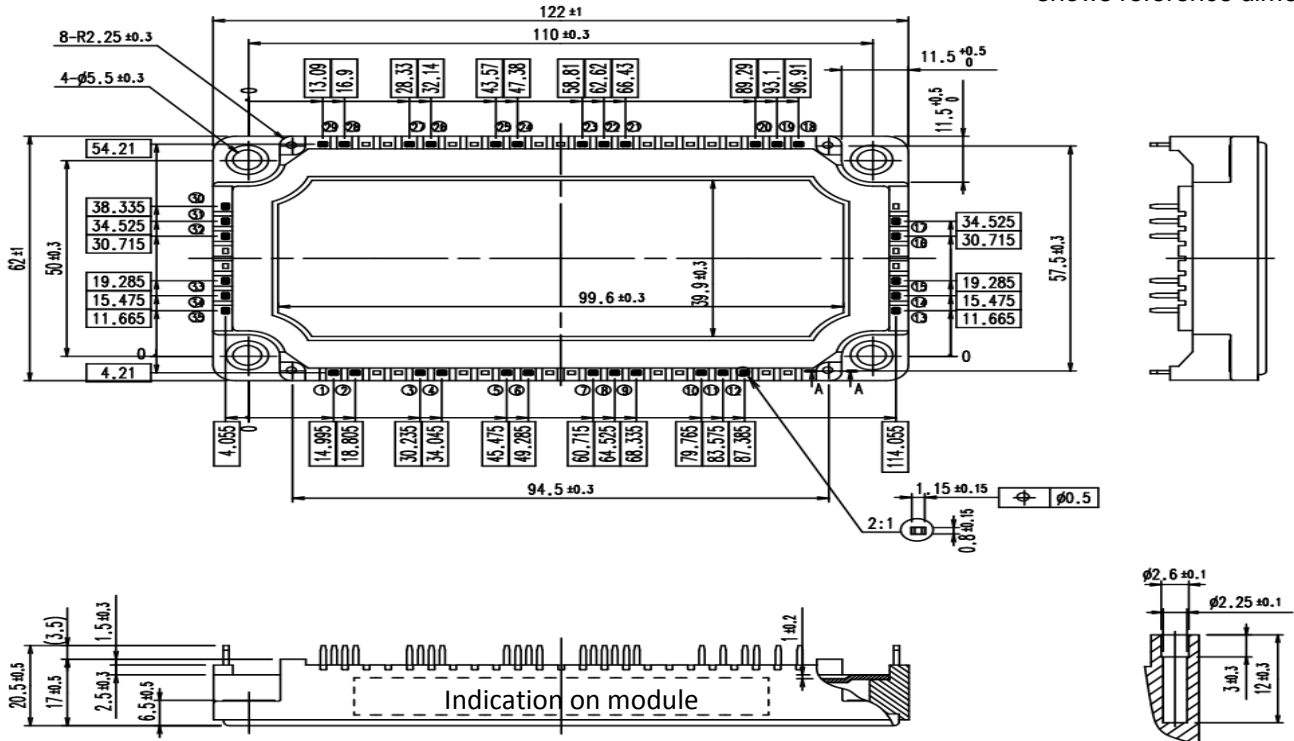


□ **Applications**

- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply

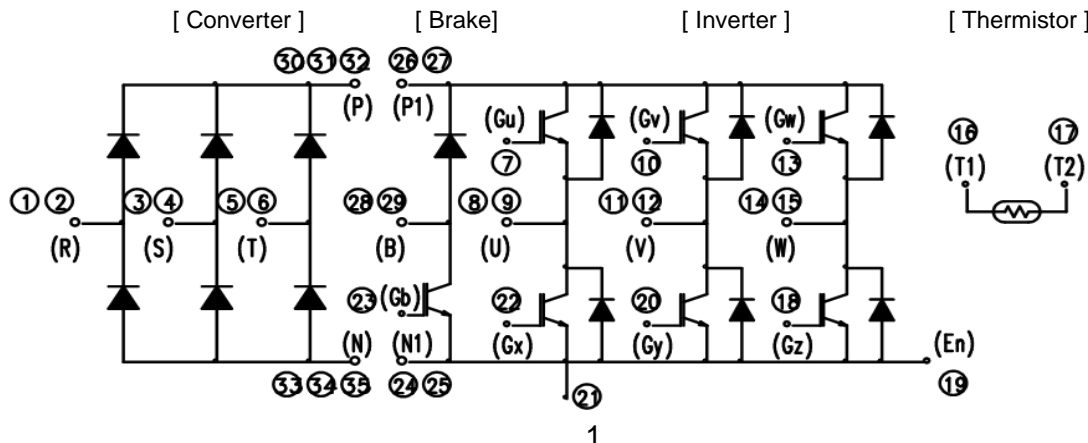
□ **Outline drawing ( Unit : mm )**

□ shows theoretical dimension.  
□ shows reference dimension.



Section A-A  
Weight: 310 g (typ.)

□ **Equivalent circuit**



# 7MBR100XNA120-50

**IGBT Modules**

□ 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	$V_{GES}$			$\pm 20$	V
	Collector current	$I_C$	Continuous	$T_c=100^\circ\text{C}$	100	A
		$I_C$ pulse	1ms		200	
	Forward current	$I_F$	Continuous		100	
		$I_F$ pulse	1ms		200	
Collector power dissipation	$P_C$	1 device		445	W	
Brake IGBT	Collector-Emitter voltage	$V_{CES}$			1200	V
	Gate-Emitter voltage	$V_{GES}$			$\pm 20$	V
	Collector current	$I_C$	Continuous	$T_c=100^\circ\text{C}$	75	A
		$I_C$ pulse	1ms		150	
Collector power dissipation	$P_C$	1 device		335	W	
Brake FWD	Forward current	$I_F$	Continuous		35	A
		$I_{FRM}$	1ms		70	
	Repetitive peak reverse voltage	$V_{RRM}$			1200	V
Converter	Repetitive peak reverse voltage	$V_{RRM}$			1600	V
	Average output current	$I_O$	Three-phase full wave rectified current	$T_c=80^\circ\text{C}$	100	A
	Surge current (Non-Repetitive) (*1)	$I_{FSM}$	$t=10\text{ms}$ , Half sine wave form	$T_{vj}=25^\circ\text{C}$	945	A
				$T_{vj}=150^\circ\text{C}$	775	
	$I^2t$ (Non-Repetitive) (*1)	$I^2t$		$T_{vj}=25^\circ\text{C}$	4485	A <sup>2</sup> s
$T_{vj}=150^\circ\text{C}$				3000		
Junction temperature	$T_{vj}$	Inverter, Brake		175	°C	
		Converter		150		
Operating junction temperature (under switching conditions)	$T_{vjop}$	Inverter, Brake		175		
		Converter		150		
Case temperature	$T_c$			125		
Storage temperature	$T_{stg}$			-40 ~ 125		
Isolation voltage	between terminals and copper base (*2)	$V_{iso}$	A.C. : 1min.	2500	Vrms	
	between thermistor and others (*3)					
Screw torque (*4)	Mounting	-	M5	6.0	N·m	

(\*1)  $T_{vj}$  : Temperature at test start.

(\*2) All terminals should be connected together during the test.

(\*3) Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

(\*4) Recommendable value : Mounting 2.5 ~ 6.0 N·m (M5)

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**IGBT Modules**

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

Items	Symbols	Conditions	Characteristics			Units			
			min.	typ.	max.				
Zero Gate voltage collector current	$I_{CES}$	$V_{GE} = 0\text{V}$ $V_{CE} = 1200\text{V}$	-	-	50	$\mu\text{A}$			
Gate-Emitter leakage current	$I_{GES}$	$V_{CE} = 0\text{V}$ $V_{GE} = +20/-20\text{V}$	-	-	100	nA			
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 100\text{mA}$	6.0	6.5	7.0	V			
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 100\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.70	2.20	V		
			$T_{vj}=25^{\circ}\text{C}$	-	1.45	1.90			
	$T_{vj}=125^{\circ}\text{C}$		-	1.80	-				
	$T_{vj}=150^{\circ}\text{C}$		-	1.85	-				
	$T_{vj}=175^{\circ}\text{C}$		-	1.90	-				
Internal Gate resistance	$r_g$	-	-	5.6	-	$\Omega$			
			Capacitance	$C_{ies}$	$V_{CE} = 10\text{V}$ , $V_{GE} = 0\text{V}$ , $f = 1\text{MHz}$	-	11.6	-	nF
						$C_{oes}$	-	0.40	
$C_{res}$	-	0.10					-		
Gate charge	$Q_G$	$V_{CC} = 600\text{V}$ $V_{GE} = -15 \rightarrow +15\text{V}$ $I_C = 100\text{A}$	-	740	-	nC			
Forward voltage	$V_F$ (terminal)	$I_F = 100\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	2.05	2.55	V		
	$V_F$ (chip)		$T_{vj}=25^{\circ}\text{C}$	-	1.80	2.25			
			$T_{vj}=125^{\circ}\text{C}$	-	1.85	-			
			$T_{vj}=150^{\circ}\text{C}$	-	1.80	-			
			$T_{vj}=175^{\circ}\text{C}$	-	1.75	-			
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600\text{V}$ $I_C, I_F = 100\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 5.1\ \Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.21	-	$\mu\text{s}$		
			$T_{vj}=125^{\circ}\text{C}$	-	0.25	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.25	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.26	-			
	$t_r$		$T_{vj}=25^{\circ}\text{C}$	-	0.05	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.06	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.06	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.06	-			
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.29	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.32	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.33	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.34	-			
$t_f$	$T_{vj}=25^{\circ}\text{C}$	-	0.10	-					
	$T_{vj}=125^{\circ}\text{C}$	-	0.16	-					
	$T_{vj}=150^{\circ}\text{C}$	-	0.18	-					
	$T_{vj}=175^{\circ}\text{C}$	-	0.20	-					
Reverse recovery time	$t_{rr}$	$T_{vj}=25^{\circ}\text{C}$	-	0.11	-				
		$T_{vj}=125^{\circ}\text{C}$	-	0.18	-				
		$T_{vj}=150^{\circ}\text{C}$	-	0.22	-				
		$T_{vj}=175^{\circ}\text{C}$	-	0.25	-				

(\*1) Turn on time ( $t_{on}$ ) =  $t_{d(on)} + t_r$ , Turn off time ( $t_{off}$ ) =  $t_{d(off)} + t_f$

# 7MBR100XNA120-50

**IGBT Modules**

Items	Symbols	Conditions	Characteristics			Units	
			min.	typ.	max.		
Inverter Switching loss (per pulse)	$E_{on}$	$V_{CC} = 600V$ $I_C, I_F = 100A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 5.1 \Omega$	$T_{vj}=25^\circ C$	-	7.45	-	mJ
			$T_{vj}=125^\circ C$	-	10.51	-	
			$T_{vj}=150^\circ C$	-	11.50	-	
			$T_{vj}=175^\circ C$	-	12.79	-	
	$E_{off}$	$V_{CC} = 600V$ $I_C, I_F = 100A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 5.1 \Omega$	$T_{vj}=25^\circ C$	-	7.07	-	
			$T_{vj}=125^\circ C$	-	8.82	-	
			$T_{vj}=150^\circ C$	-	9.55	-	
			$T_{vj}=175^\circ C$	-	9.93	-	
	$E_{rr}$	$V_{CC} = 600V$ $I_C, I_F = 100A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 5.1 \Omega$	$T_{vj}=25^\circ C$	-	3.00	-	
			$T_{vj}=125^\circ C$	-	4.88	-	
			$T_{vj}=150^\circ C$	-	5.88	-	
			$T_{vj}=175^\circ C$	-	6.51	-	
Zero Gate voltage collector current	$I_{CES}$	$V_{GE} = 0V$ $V_{CE} = 1200V$	-	-	50	$\mu A$	
Gate-Emitter leakage current	$I_{GES}$	$V_{CE} = 0V, \quad V_{GE} = +20/-20V$	-	-	100	nA	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 75A$	$T_{vj}=25^\circ C$	-	1.70	2.15	V
			$T_{vj}=125^\circ C$	-	1.50	1.95	
	$V_{CE(sat)}$ (chip)		$T_{vj}=150^\circ C$	-	1.95	-	
			$T_{vj}=175^\circ C$	-	2.00	-	
Internal Gate resistance	$r_g$	-	-	8	-	$\Omega$	
Brake Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C = 75A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 5.1 \Omega$	$T_{vj}=25^\circ C$	-	0.18	-	$\mu s$
			$T_{vj}=125^\circ C$	-	0.21	-	
			$T_{vj}=150^\circ C$	-	0.21	-	
			$T_{vj}=175^\circ C$	-	0.22	-	
	$t_r$	$V_{CC} = 600V$ $I_C = 75A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 5.1 \Omega$	$T_{vj}=25^\circ C$	-	0.04	-	
			$T_{vj}=125^\circ C$	-	0.05	-	
			$T_{vj}=150^\circ C$	-	0.05	-	
			$T_{vj}=175^\circ C$	-	0.05	-	
	$t_{d(off)}$	$V_{CC} = 600V$ $I_C = 75A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 5.1 \Omega$	$T_{vj}=25^\circ C$	-	0.25	-	
			$T_{vj}=125^\circ C$	-	0.28	-	
			$T_{vj}=150^\circ C$	-	0.29	-	
			$T_{vj}=175^\circ C$	-	0.29	-	
	$t_f$	$V_{CC} = 600V$ $I_C = 75A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 5.1 \Omega$	$T_{vj}=25^\circ C$	-	0.12	-	
			$T_{vj}=125^\circ C$	-	0.18	-	
			$T_{vj}=150^\circ C$	-	0.20	-	
			$T_{vj}=175^\circ C$	-	0.21	-	
Reverse current	$I_{RRM}$	$V_R = 1200V$	-	-	50	$\mu A$	
Forward voltage	$V_F$ (terminal)	$I_F = 35A$	$T_{vj}=25^\circ C$	-	2.00	2.45	V
			$T_{vj}=125^\circ C$	-	1.80	2.25	
	$V_F$ (chip)		$T_{vj}=150^\circ C$	-	1.85	-	
			$T_{vj}=175^\circ C$	-	1.80	-	
Converter Reverse current	$I_{RRM}$	$V_R = 1600V$	-	-	50	$\mu A$	
			Forward voltage	$V_{FM}$	terminal	-	1.30
chip	-	1.05				1.50	
Thermistor Resistance	$R$	$T = 25^\circ C$	-	5000	-	$\Omega$	
		$T = 100^\circ C$	465	495	520		
B value	$B$	$T = 25/ 50^\circ C$	3305	3375	3450	K	

 (\*1) Turn on time ( $t_{on}$ ) =  $t_{d(on)} + t_r$ , Turn off time ( $t_{off}$ ) =  $t_{d(off)} + t_f$ 
**FM6M01714**

# 7MBR100XNA120-50

**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 (1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.34	°C/W
		Inverter FWD	-	-	0.45	
		Brake IGBT	-	-	0.45	
		Brake FWD	-	-	0.86	
		Converter Diode	-	-	0.47	
Contact thermal resistance (1 IGBT+1 FWD) (*1)	$R_{th(c-f)}$	with 1 W/(m·K) thermal grease	-	0.05	-	

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

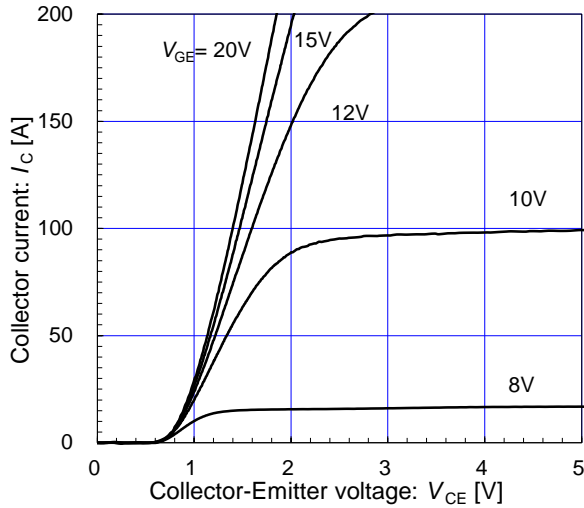
# 7MBR100XNA120-50

IGBT Modules

[ Inverter ]

Collector current vs. Collector-Emittor voltage (typ.)

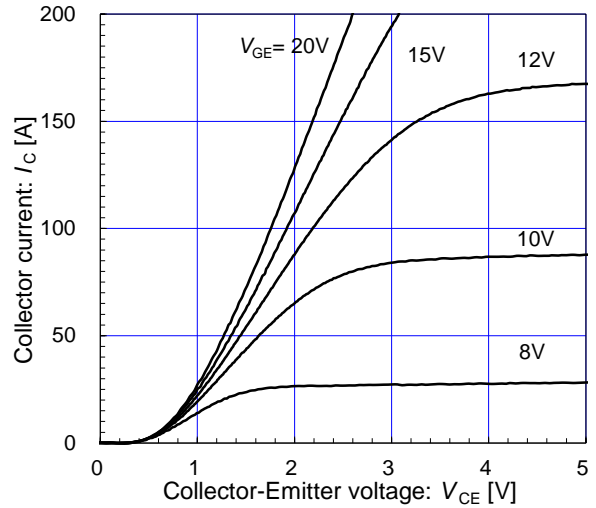
$T_{vj} = 25^{\circ}\text{C} / \text{chip}$



[ Inverter ]

Collector current vs. Collector-Emittor voltage (typ.)

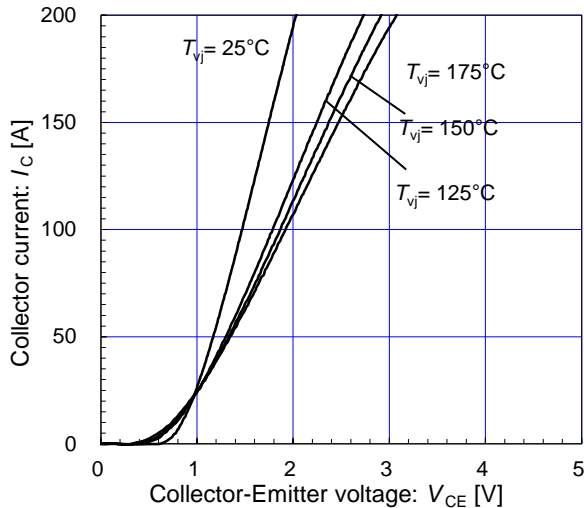
$T_{vj} = 175^{\circ}\text{C} / \text{chip}$



[ Inverter ]

Collector current vs. Collector-Emittor voltage (typ.)

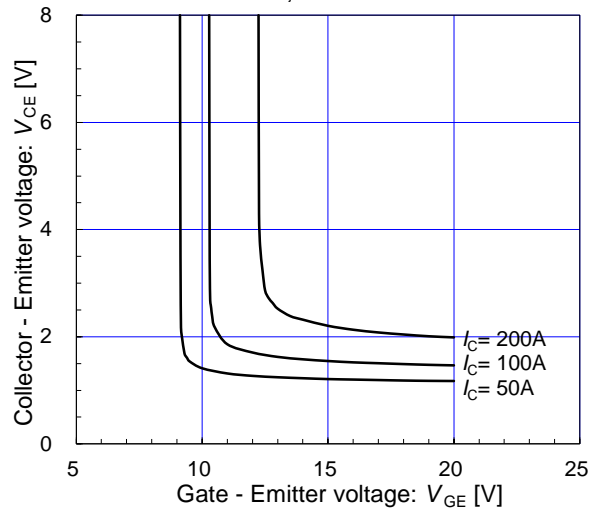
$V_{GE} = 15\text{V} / \text{chip}$



[ Inverter ]

Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)

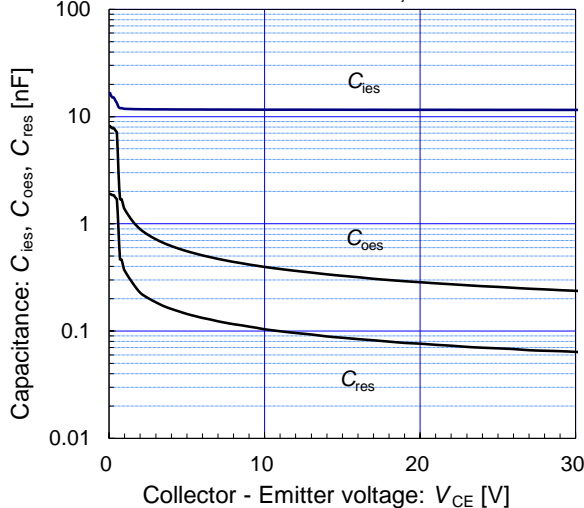
$T_{vj} = 25^{\circ}\text{C} / \text{chip}$



[ Inverter ]

Capacitance vs. Collector-Emittor voltage (typ.)

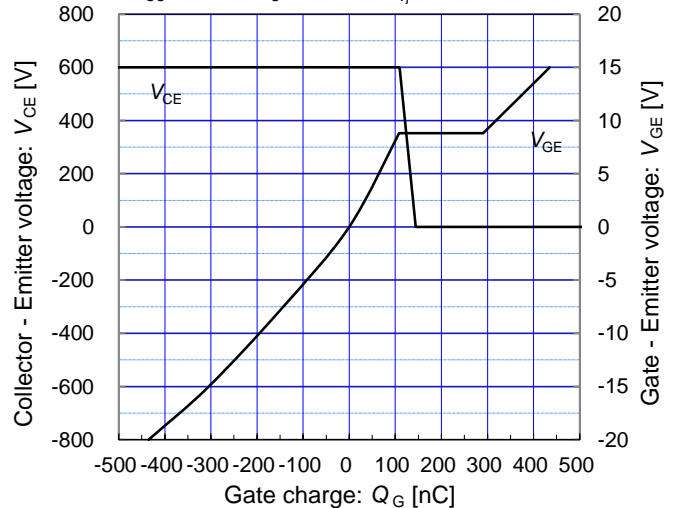
$V_{GE} = 0\text{V}, f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}$



[ Inverter ]

Dynamic Gate charge (typ.)

$V_{CC} = 600\text{V}, I_c = 100\text{A}, T_{vj} = 25^{\circ}\text{C}$



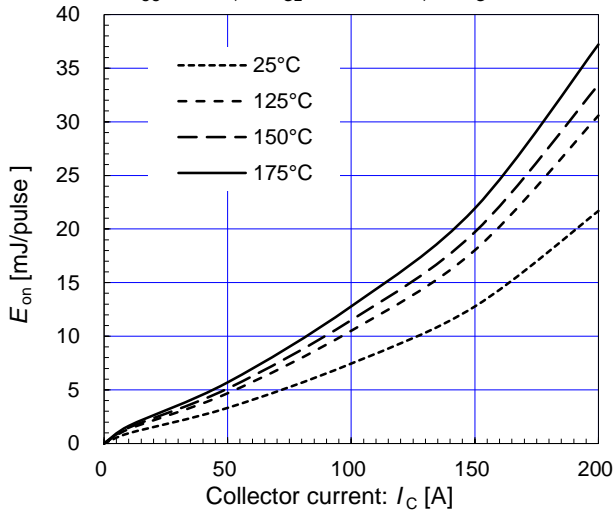
# 7MBR100XNA120-50

IGBT Modules

[ Inverter ]

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

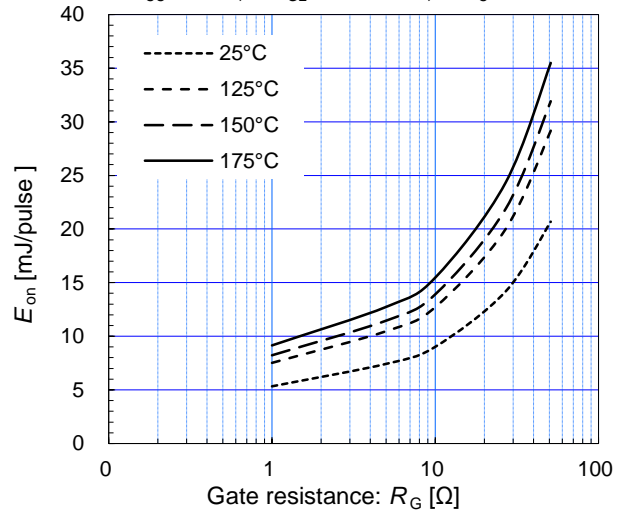
$V_{CC}=600V, V_{GE}=+15/-15V, R_G=5.1\Omega$



[ Inverter ]

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

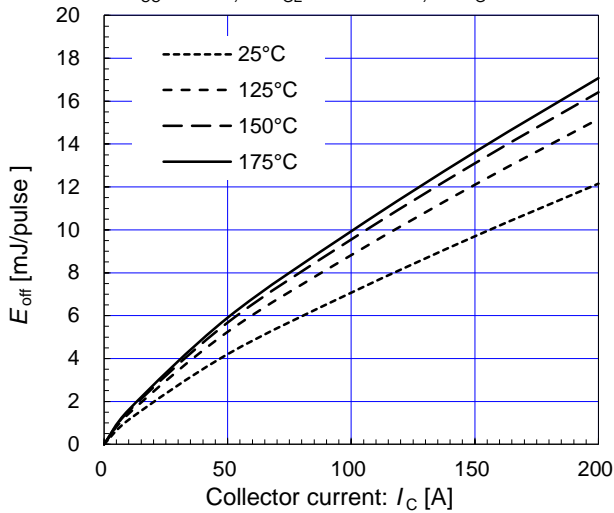
$V_{CC}=600V, V_{GE}=+15/-15V, I_C=100A$



[ Inverter ]

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

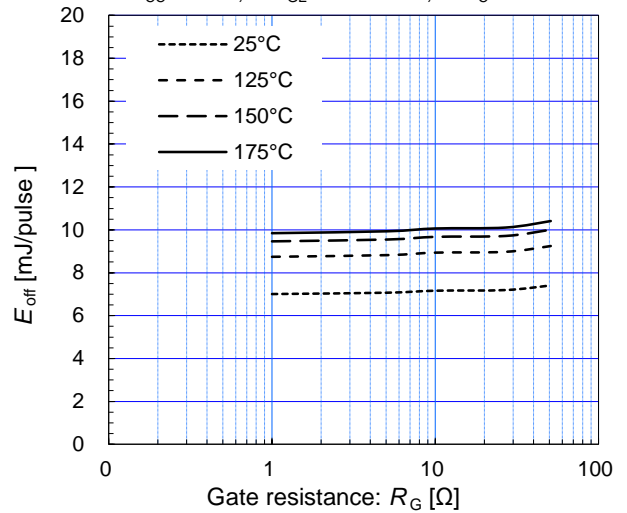
$V_{CC}=600V, V_{GE}=+15/-15V, R_G=5.1\Omega$



[ Inverter ]

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

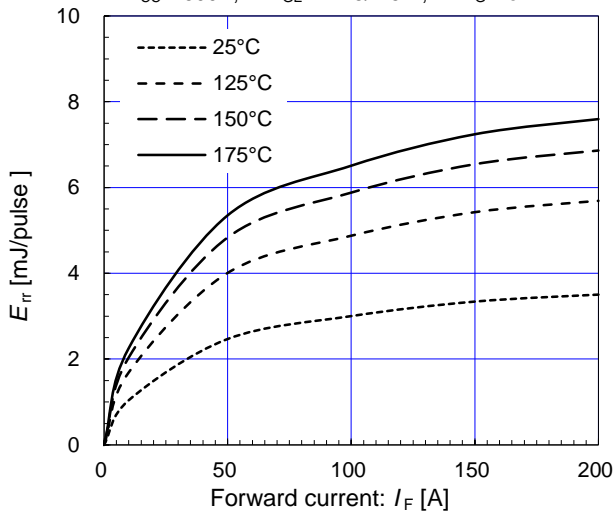
$V_{CC}=600V, V_{GE}=+15/-15V, I_C=100A$



[ Inverter ]

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

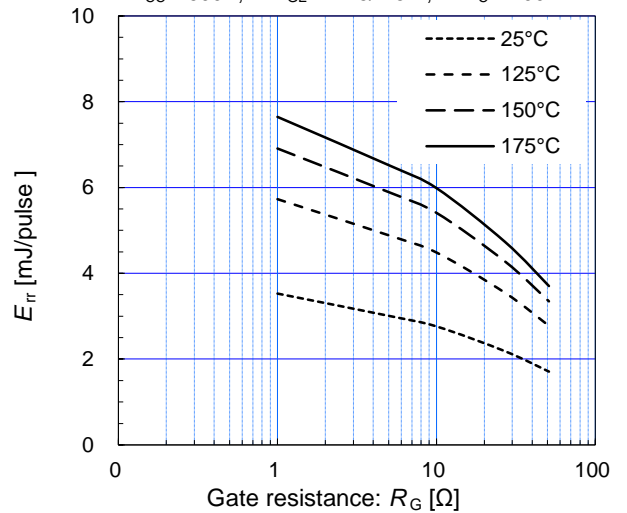
$V_{CC}=600V, V_{GE}=+15/-15V, R_G=5.1\Omega$



[ Inverter ]

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

$V_{CC}=600V, V_{GE}=+15/-15V, I_C=100A$



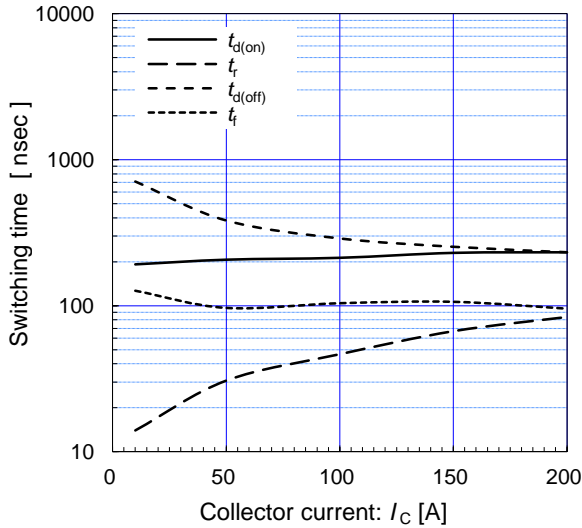
# 7MBR100XNA120-50

IGBT Modules

[ Inverter ]

Switching time vs. Collector current (typ.)

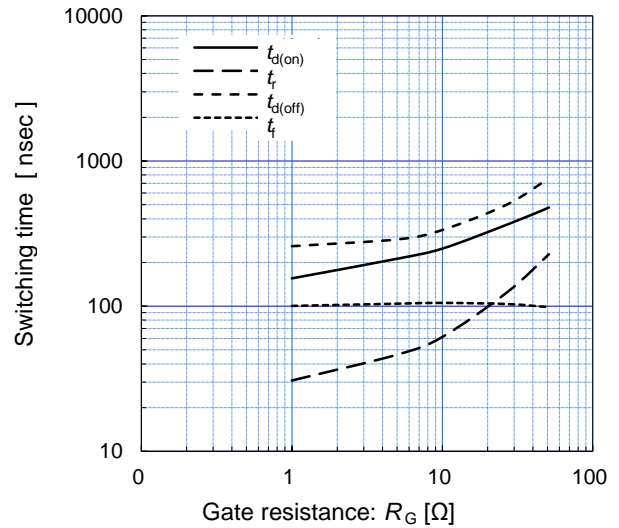
$V_{CC}=600V, R_G=5.1\Omega, V_{GE}=+15/-15V, T_{vj}=25^\circ C$



[ Inverter ]

Switching time vs. Gate resistance (typ.)

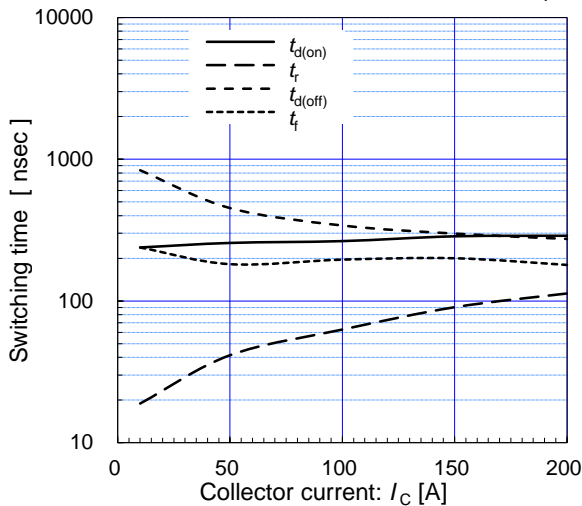
$V_{CC}=600V, I_C=100A, V_{GE}=+15/-15V, T_{vj}=25^\circ C$



[ Inverter ]

Switching time vs. Collector current (typ.)

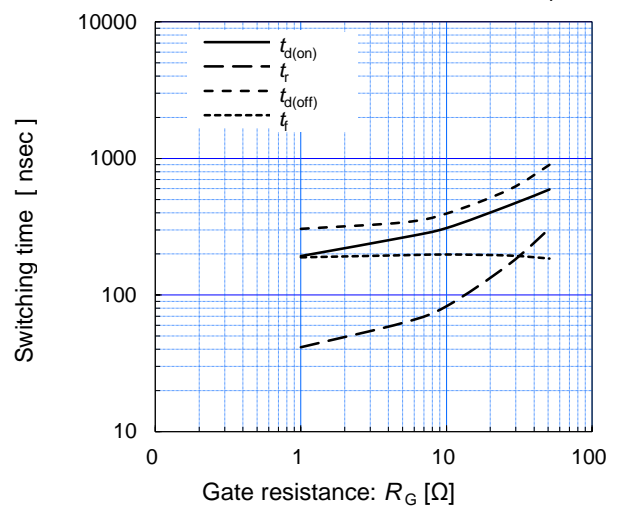
$V_{CC}=600V, R_G=5.1\Omega, V_{GE}=+15/-15V, T_{vj}=175^\circ C$



[ Inverter ]

Switching time vs. Gate resistance (typ.)

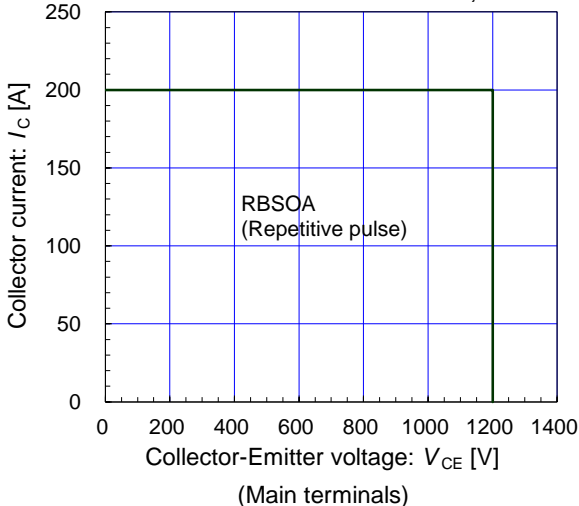
$V_{CC}=600V, I_C=100A, V_{GE}=+15/-15V, T_{vj}=175^\circ C$



[ Inverter ]

Reverse bias safe operating area (max.)

$V_{GE}=+15/-15V, R_G \geq 5.1\Omega, T_{vj}=175^\circ C$



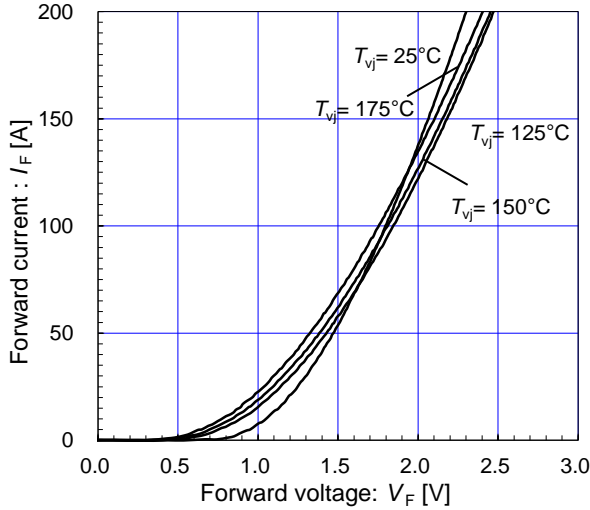


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IGBT Modules

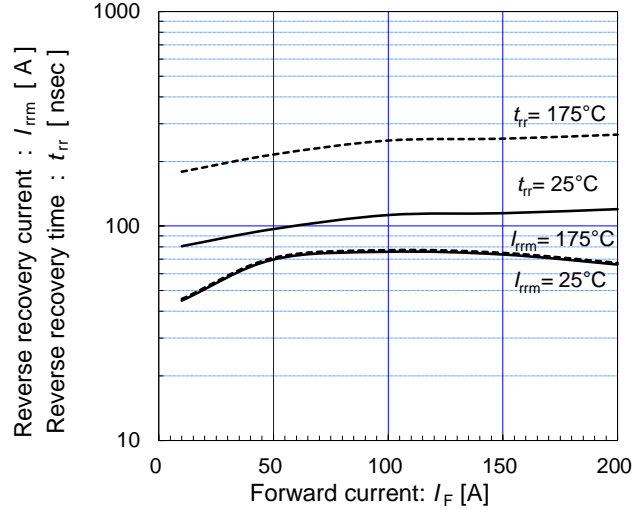
[ Inverter ]

Forward current vs. Forward voltage (typ.)  
chip



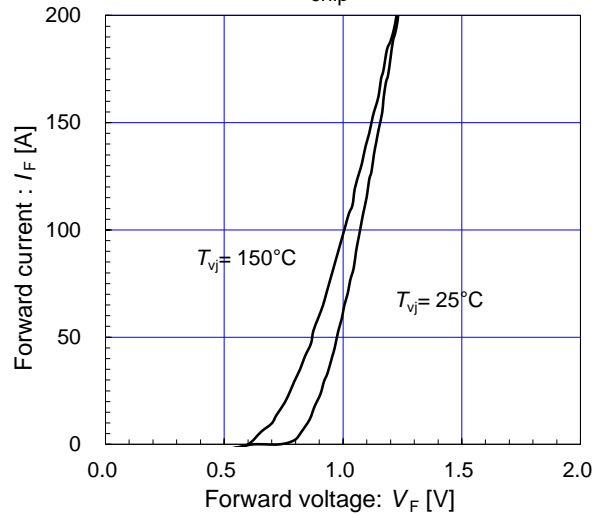
[ Inverter ]

Reverse recovery characteristics (typ.)  
 $V_{CC} = 600V, V_{GE} = +15/-15V, R_G = 5.1\Omega$

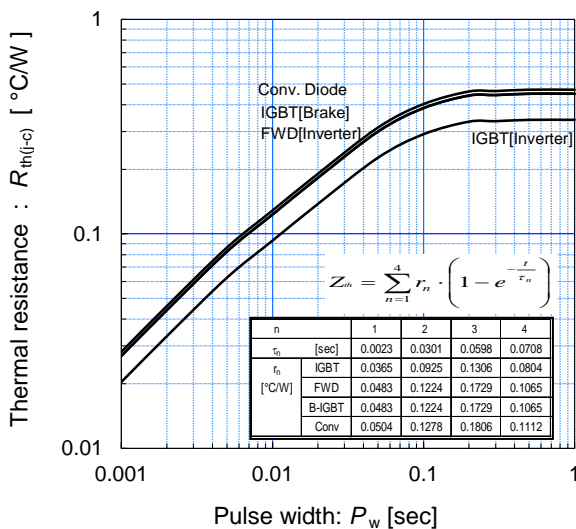


[ Converter ]

Forward current vs. Forward voltage (typ.)  
chip

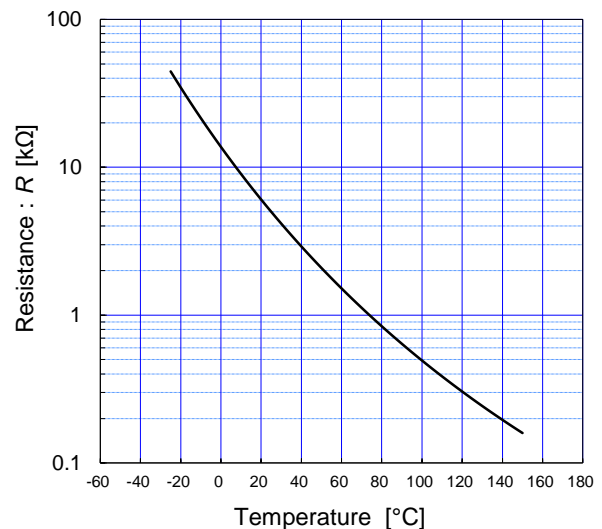


Transient thermal resistance (max.)



[ Thermistor ]

Temperature characteristic (typ.)



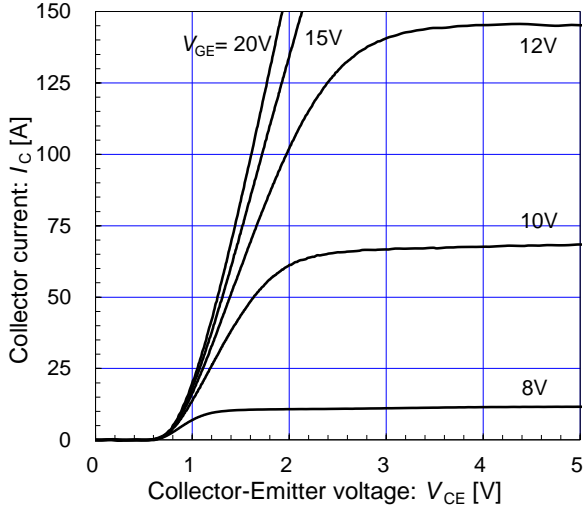
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IGBT Modules

[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)

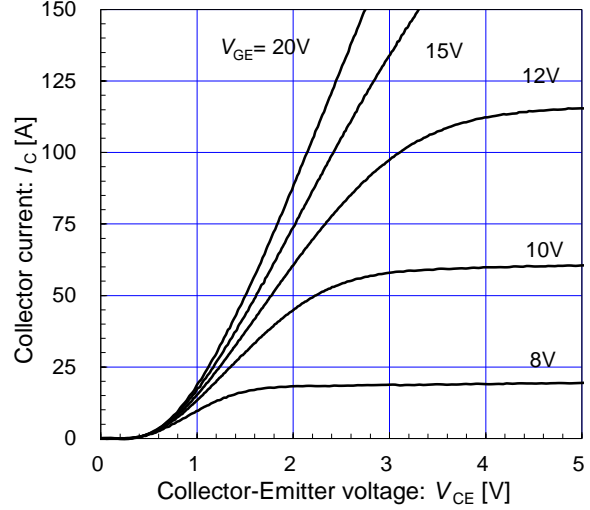
$T_{vj} = 25^\circ\text{C} / \text{chip}$



[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)

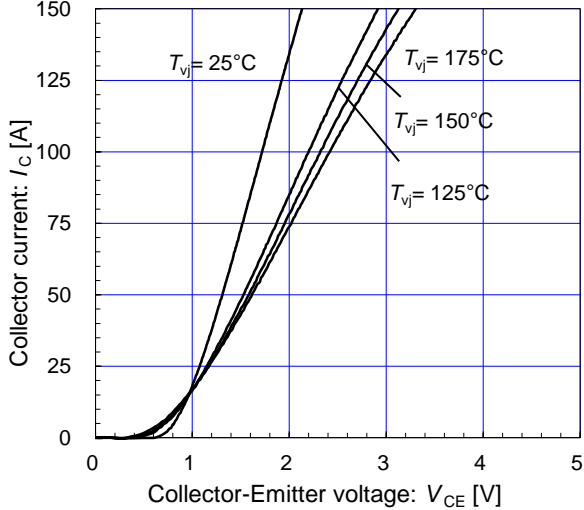
$T_{vj} = 175^\circ\text{C} / \text{chip}$



[ Brake ]

Collector current vs. Collector-Emittor voltage (typ.)

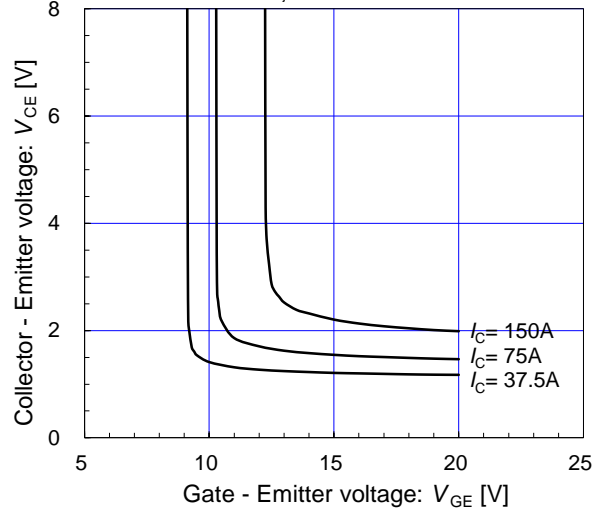
$V_{GE} = 15\text{V} / \text{chip}$



[ Brake ]

Collector-Emittor voltage vs. Gate-Emittor voltage (typ.)

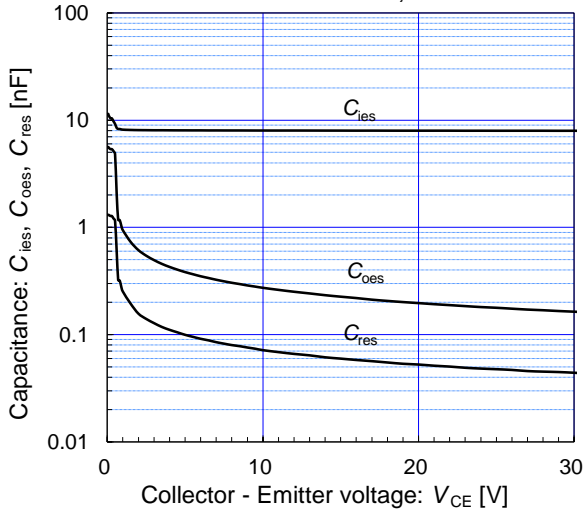
$T_{vj} = 25^\circ\text{C} / \text{chip}$



[ Brake ]

Capacitance vs. Collector-Emittor voltage (typ.)

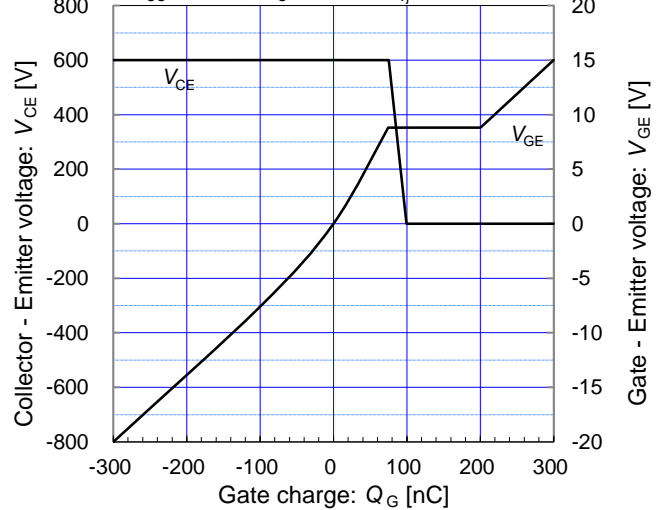
$V_{GE} = 0\text{V}, f = 1\text{MHz}, T_{vj} = 25^\circ\text{C}$



[ Brake ]

Dynamic Gate charge (typ.)

$V_{CC} = 600\text{V}, I_c = 75\text{A}, T_{vj} = 25^\circ\text{C}$



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