

7MBR100XRE120-50

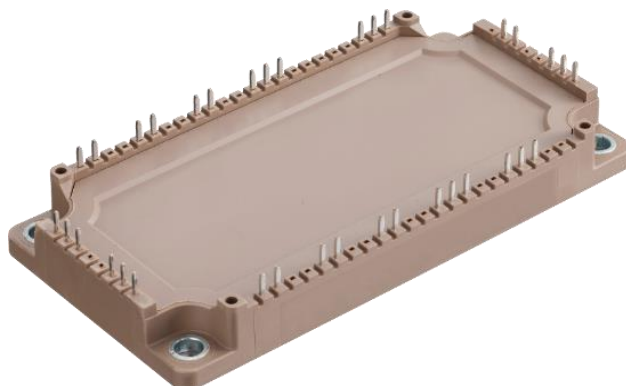
IGBT Modules

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

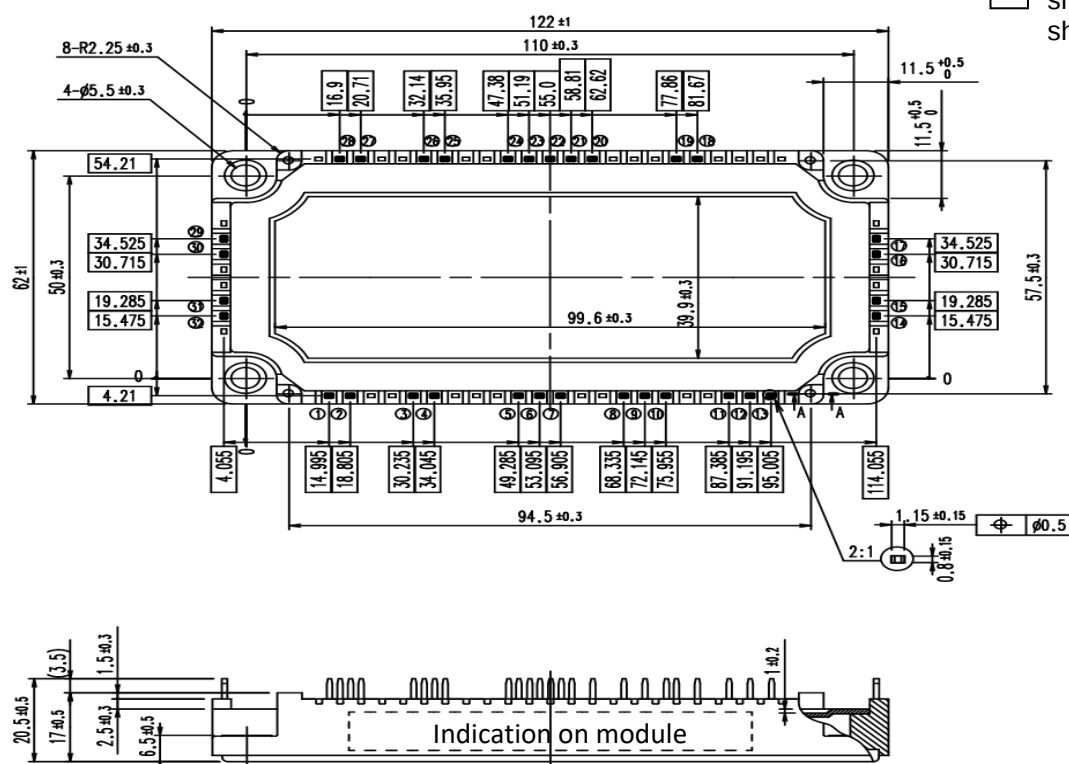
Typical appearance



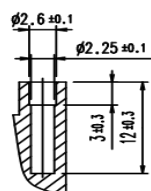
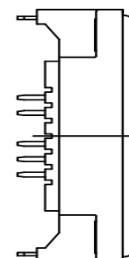
Applications

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

Outline drawing (Unit : mm)



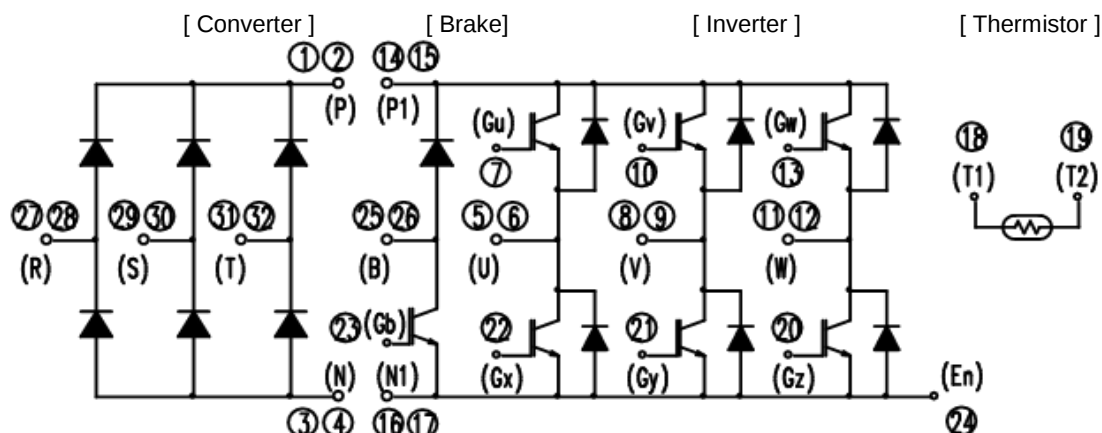
□ shows theoretical dimension.
□ shows reference dimension.



Section A-A

Weight: 310 g (typ.)

Equivalent circuit



7MBR100XRE120-50

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}			±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		685	W	
Brake IGBT	Collector-Emitter voltage		V_{CES}			1200	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	$T_c=100^{\circ}\text{C}$	75	A
			I_C pulse	1ms		150	
	Collector power dissipation		P_C	1 device		330	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 ² 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.	
Inverter	Zero Gate voltage collector current	I_{CES}	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CE}} = 1200\text{V}$		-	-	50	μA
	Gate-Emitter leakage current	I_{GES}	$V_{\text{CE}} = 0\text{V}$ $V_{\text{GE}} = +20/-20\text{V}$		-	-	100	nA
	Gate-Emitter threshold voltage	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 100\text{mA}$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{\text{CE(sat)}}$ (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 100\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.80	2.30	V
		$V_{\text{CE(sat)}}$ (chip)		$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.45	1.90	
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	1.80	-	
				$T_{\text{vj}}=150^{\circ}\text{C}$	-	1.85	-	
				$T_{\text{vj}}=175^{\circ}\text{C}$	-	1.90	-	
	Internal Gate resistance	r_{g}	-		-	5.60	-	Ω
	Capacitance	C_{ies}	$V_{\text{CE}} = 10\text{V}$, $V_{\text{GE}} = 0\text{V}$, $f = 1\text{MHz}$		-	11.6	-	nF
		C_{oes}			-	0.40	-	
		C_{res}			-	0.10	-	
	Gate charge	Q_{G}	$V_{\text{CC}} = 600\text{V}$ $V_{\text{GE}}=-15 \rightarrow +15\text{V}$ $I_{\text{C}} = 100\text{A}$		-	740	-	nC
	Forward voltage	V_{F} (terminal)	$I_{\text{F}} = 100\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	2.15	2.65	V
		V_{F} (chip)		$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.80	2.25	
				$T_{\text{vj}}=125^{\circ}\text{C}$	-	1.85	-	
$T_{\text{vj}}=150^{\circ}\text{C}$				-	1.80	-		
$T_{\text{vj}}=175^{\circ}\text{C}$				-	1.75	-		
Switching time (*1)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 100\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.21	-	μs	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.25	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.25	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.26	-		
	t_{r}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 100\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.05	-		
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.06	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.06	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.06	-		
	$t_{\text{d(off)}}$	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 100\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.29	-		
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.32	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.33	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.34	-		
	t_{f}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 100\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.10	-		
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.16	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.18	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.20	-		
Reverse recovery time	t_{rr}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 100\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.11	-		
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.18	-		
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.22	-		
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.25	-		

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

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IGBT Modules

Items		Symbols	Conditions		Characteristics			Units
					min.	typ.	max.	
Inverter	Switching loss (per pulse)	E_{on}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	7.45	-	mJ
			$I_C, I_F = 100A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	10.51	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	11.50	-	
			$R_G = 5.1\ \Omega$	$T_{vj}=175^{\circ}C$	-	12.79	-	
		E_{off}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	7.07	-	
			$I_C, I_F = 100A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	8.82	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	9.55	-	
			$R_G = 5.1\ \Omega$	$T_{vj}=175^{\circ}C$	-	9.93	-	
		E_{rr}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	3.00	-	
			$I_C, I_F = 100A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	4.88	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	5.88	-	
			$R_G = 5.1\ \Omega$	$T_{vj}=175^{\circ}C$	-	6.51	-	
Zero Gate voltage collector current		I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	50	μA
Gate-Emitter leakage current		I_{GES}	$V_{CE} = 0V, \quad V_{GE} = +20/-20V$		-	-	100	nA
Collector-Emitter saturation voltage		$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 75A$	$T_{vj}=25^{\circ}C$	-	1.75	2.25	V
		$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.50	1.95	
				$T_{vj}=125^{\circ}C$	-	1.85	-	
				$T_{vj}=150^{\circ}C$	-	1.95	-	
				$T_{vj}=175^{\circ}C$	-	2.00	-	
Internal Gate resistance		r_g	-		-	7.5	-	Ω
Brake	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.18	-	μs
			$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.21	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.21	-	
			$R_G = 5.1\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.22	-	
		t_r	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.04	-	
			$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.05	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.05	-	
			$R_G = 5.1\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.05	-	
		$t_{d(off)}$	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.25	-	
			$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.28	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.29	-	
			$R_G = 5.1\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.29	-	
		t_f	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.12	-	
			$I_C = 75A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.18	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	0.20	-	
			$R_G = 5.1\ \Omega$	$T_{vj}=175^{\circ}C$	-	0.21	-	
Reverse current		I_{RRM}	$V_R = 1200V$		-	-	50	μA
Forward voltage		V_F (terminal)	$I_F = 35A$	$T_{vj}=25^{\circ}C$	-	2.05	2.55	V
		V_F (chip)	$I_F = 35A$	$T_{vj}=25^{\circ}C$	-	1.80	2.25	
				$T_{vj}=125^{\circ}C$	-	1.85	-	
				$T_{vj}=150^{\circ}C$	-	1.80	-	
				$T_{vj}=175^{\circ}C$	-	1.75	-	
Reverse current		I_{RRM}	$V_R = 1600V$		-	-	50	μA
Forward voltage		V_{FM}	$I_F = 100A$	terminal	-	1.40	1.90	V
			chip	-	1.05	1.50		
Thermistor	Resistance	R	$T = 25^{\circ}C$		-	5000	-	Ω
			$T = 100^{\circ}C$		465	495	520	
	B value		B	$T = 25/ 50^{\circ}C$		3305	3375	3450

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$
FM6M01849

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IGBT Modules
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 (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.22	°C/W
		Inverter FWD	-	-	0.31	
		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.

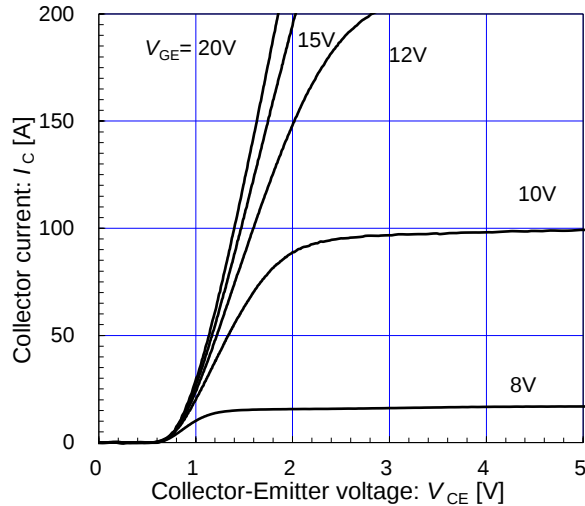
7MBR100XRE120-50

IGBT Modules

[Inverter]

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

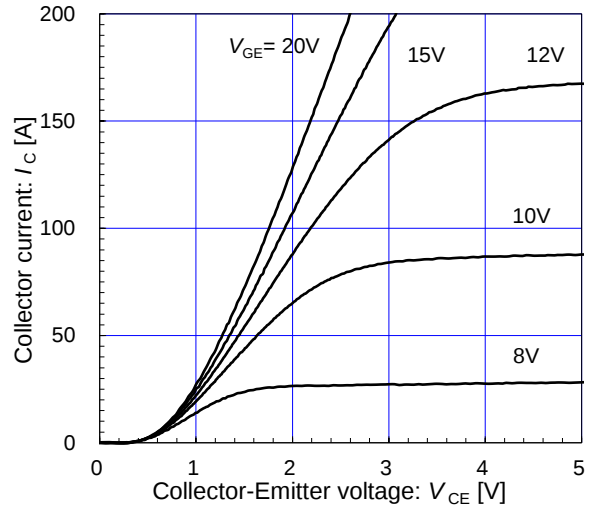
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

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

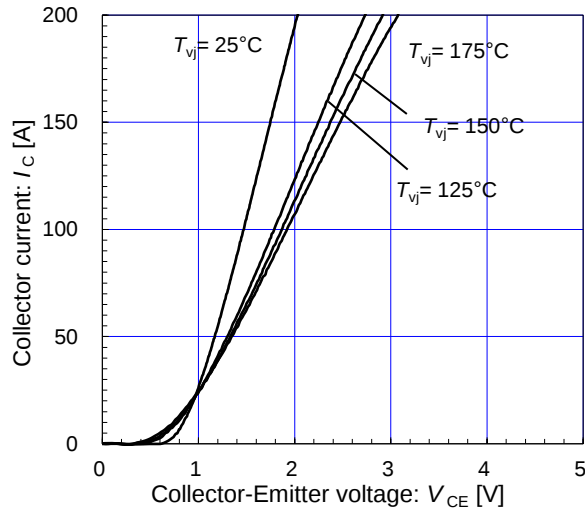
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Inverter]

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

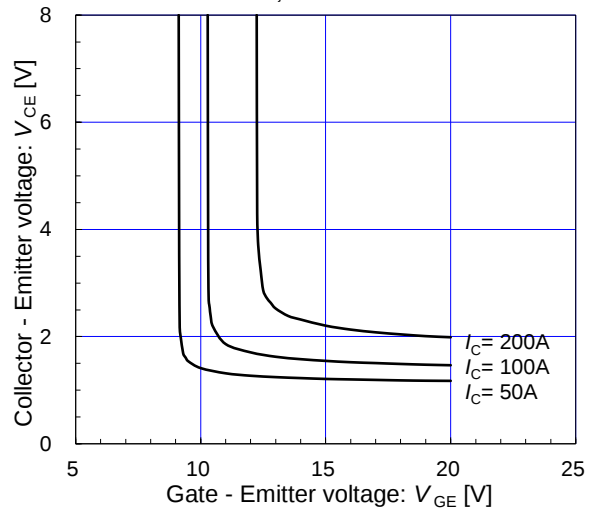
$V_{GE} = 15\text{V}$ / chip



[Inverter]

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

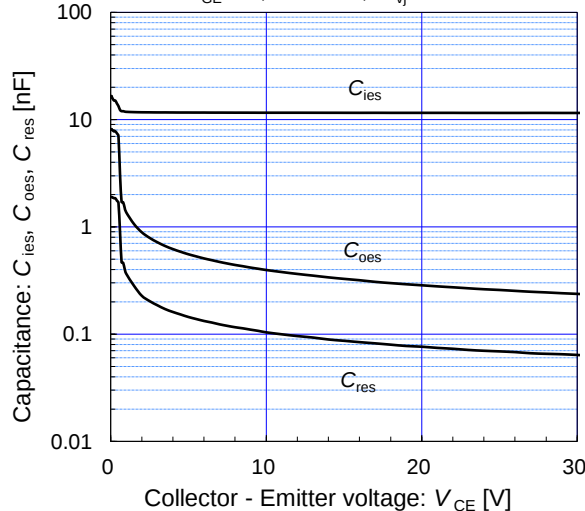
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emittor voltage (typ.)

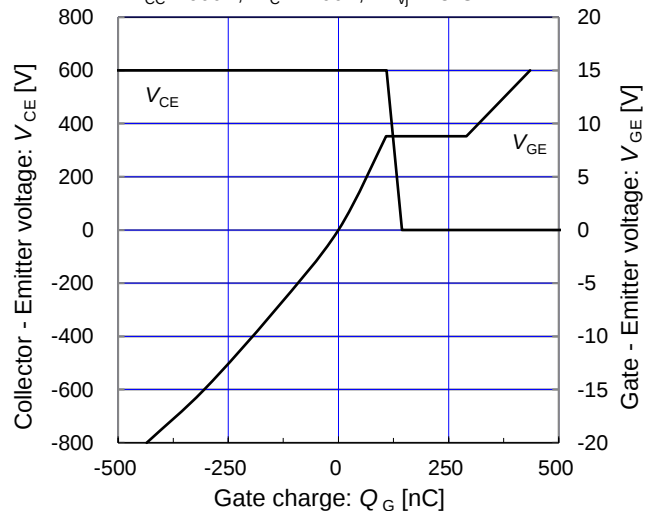
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Inverter]

Dynamic Gate charge (typ.)

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



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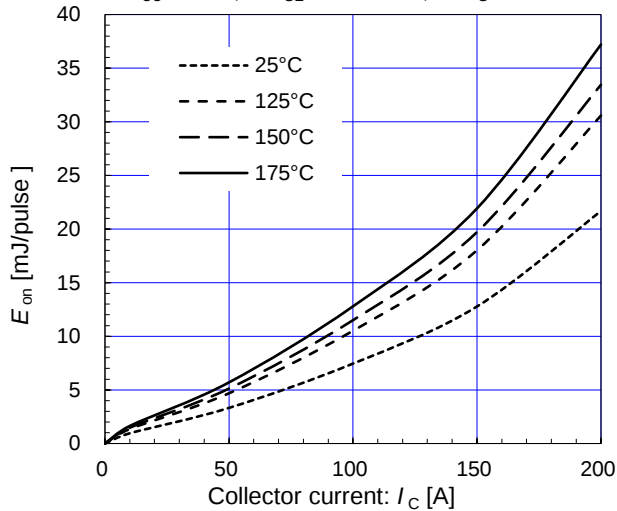
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IGBT Modules

[Inverter]

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

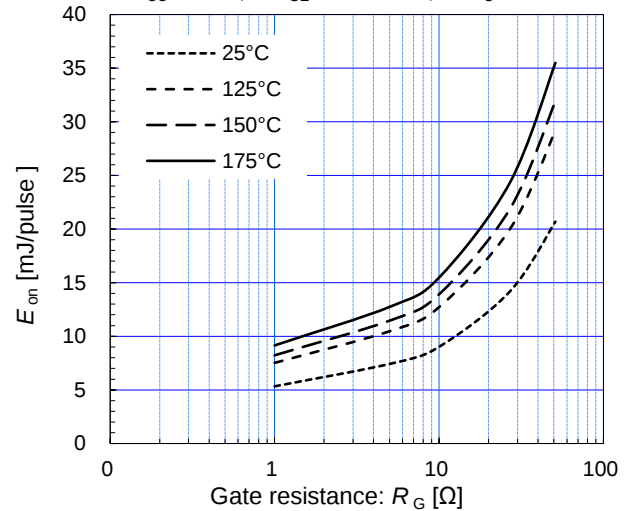
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $R_G=5.1\Omega$



[Inverter]

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

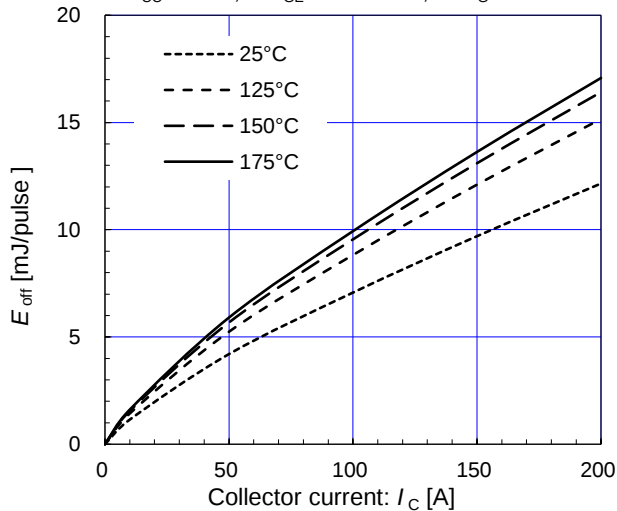
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $I_C=100A$



[Inverter]

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

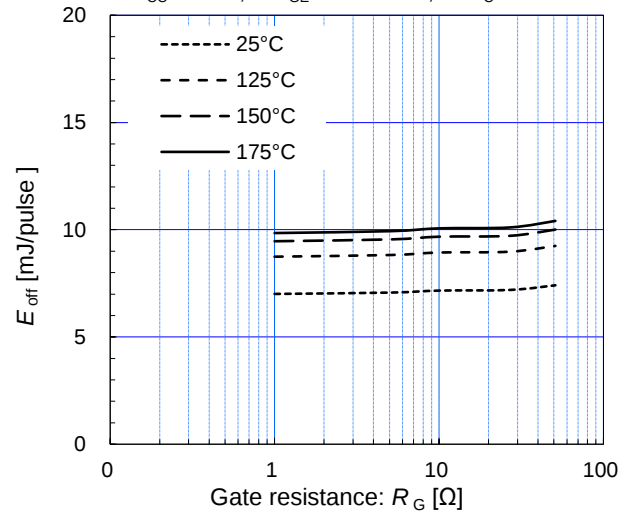
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $R_G=5.1\Omega$



[Inverter]

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

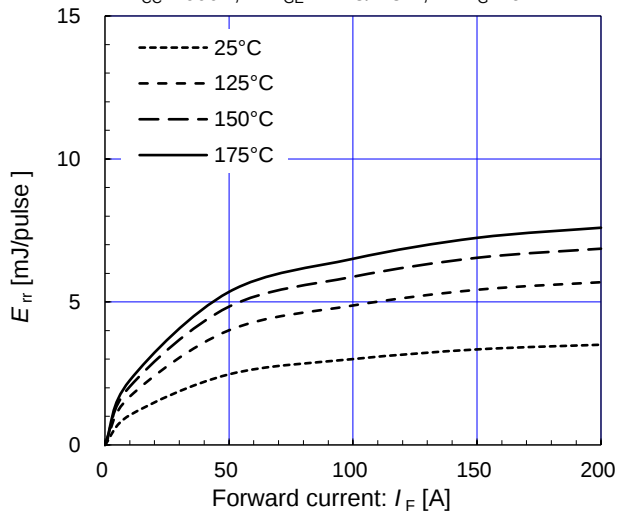
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $I_C=100A$



[Inverter]

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

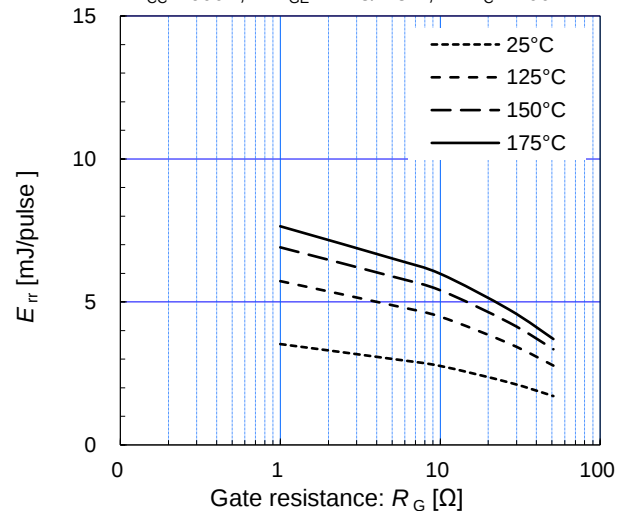
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $R_G=5.1\Omega$



[Inverter]

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

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



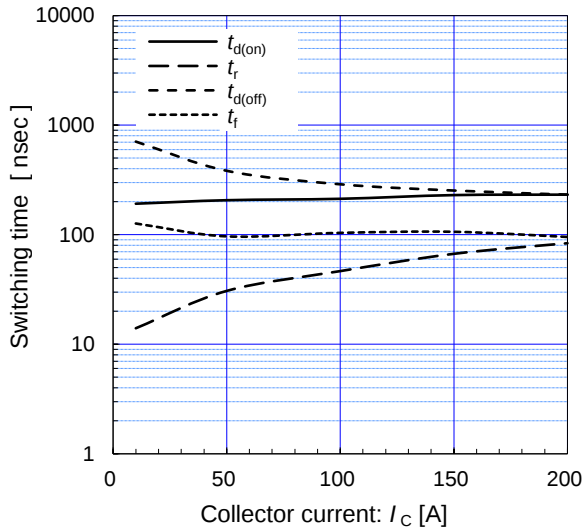
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

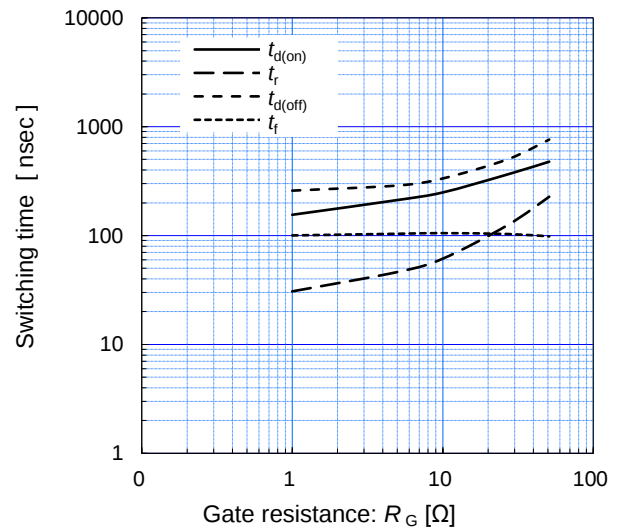
$V_{CC} = 600V$, $R_G = 5.1\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

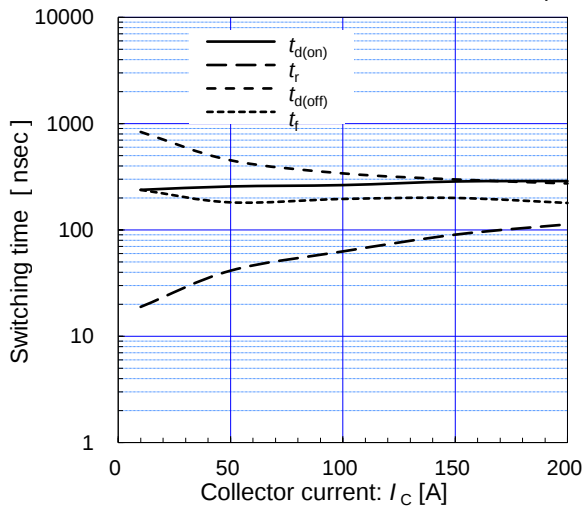
$V_{CC} = 600V$, $I_C = 100A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

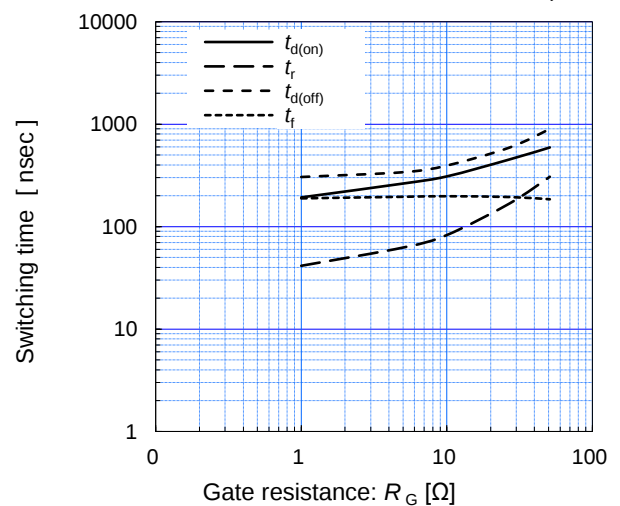
$V_{CC} = 600V$, $R_G = 5.1\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

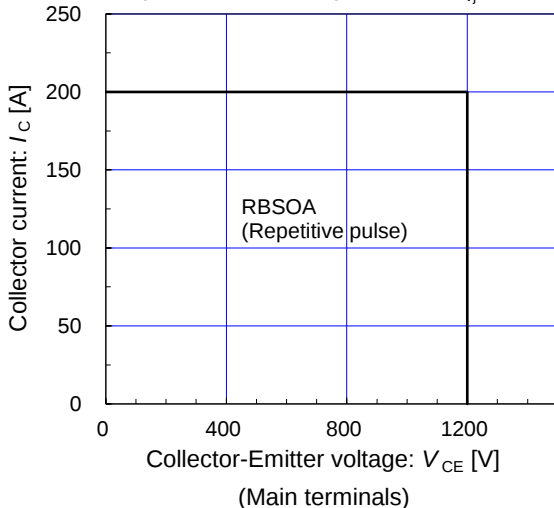
$V_{CC} = 600V$, $I_C = 100A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

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

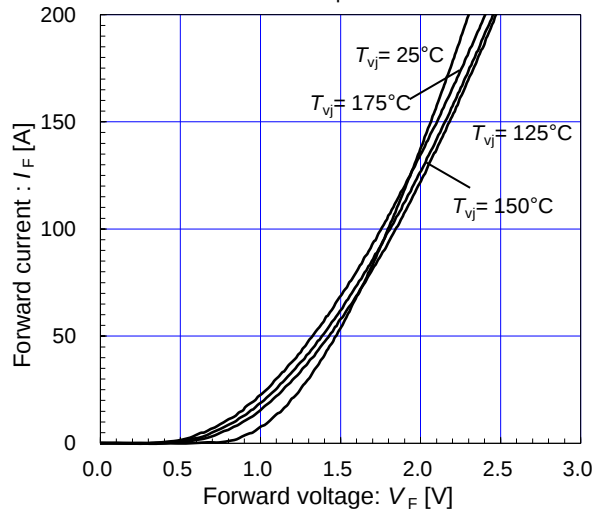


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IGBT Modules

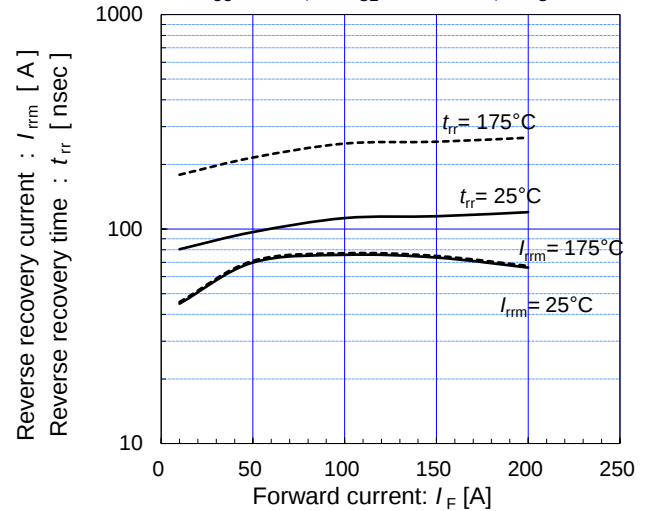
[Inverter]

Forward current vs. Forward voltage (typ.)
chip



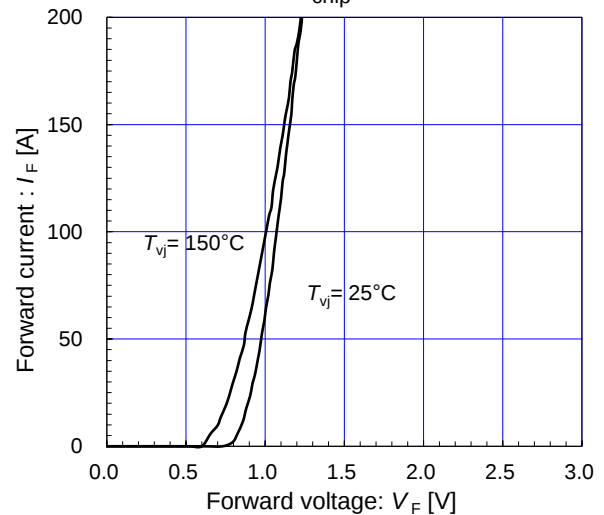
[Inverter]

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

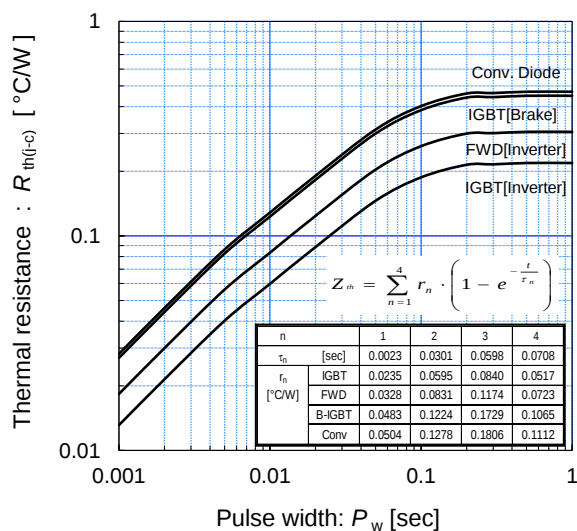


[Converter]

Forward current vs. Forward voltage (typ.)
chip

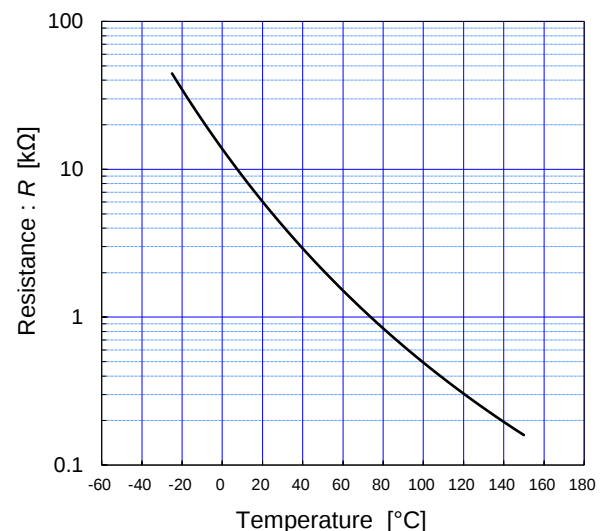


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



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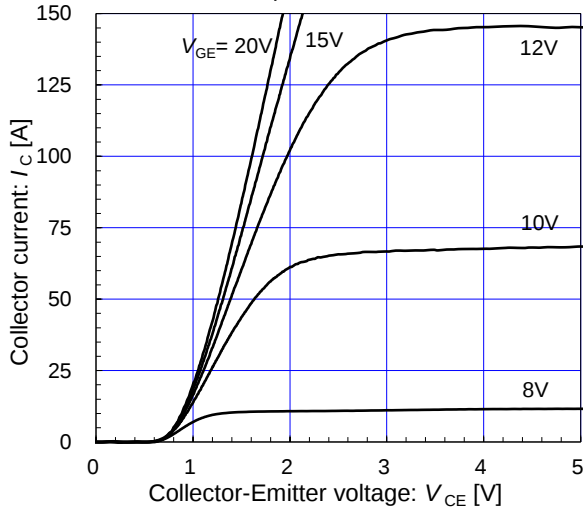
7MBR100XRE120-50

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[Brake]

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

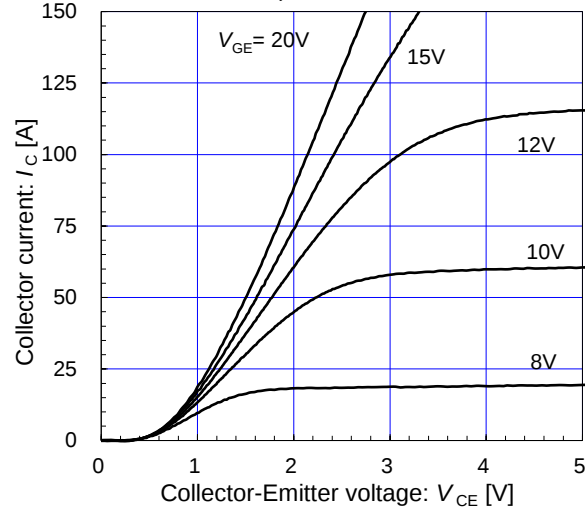
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

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

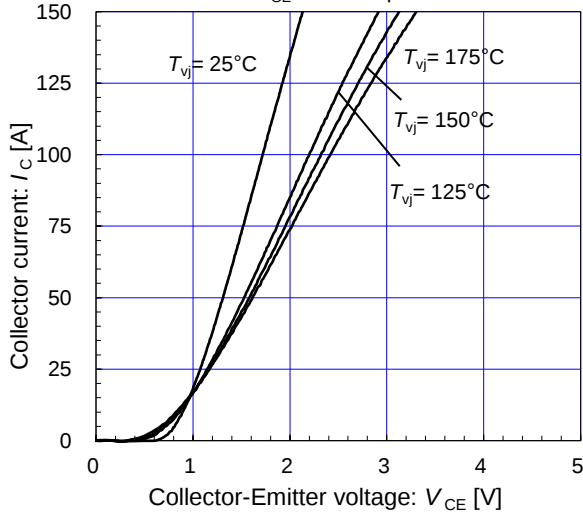
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Brake]

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

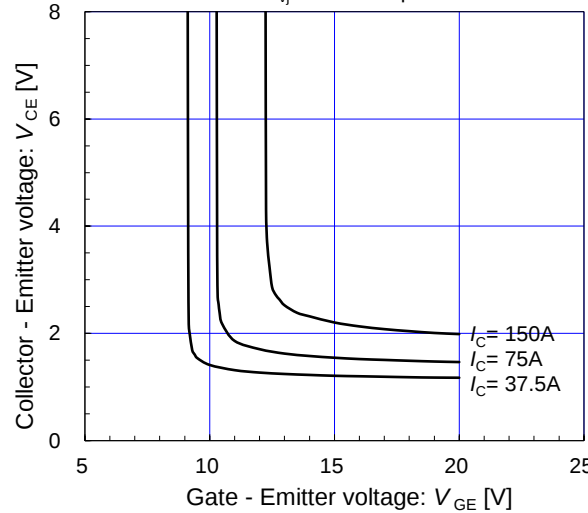
$V_{GE} = 15\text{V}$ / chip



[Brake]

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

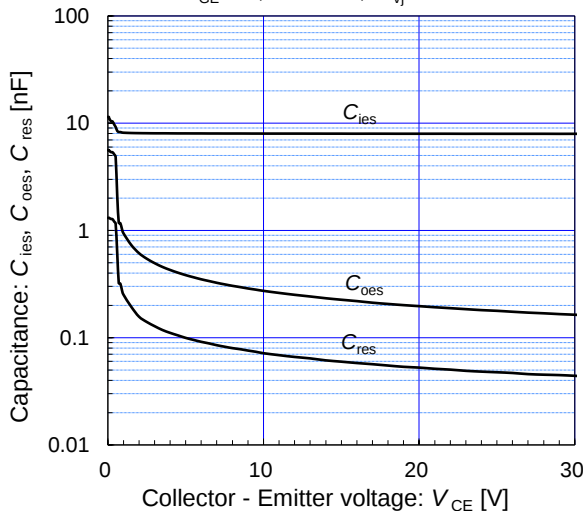
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emittor voltage (typ.)

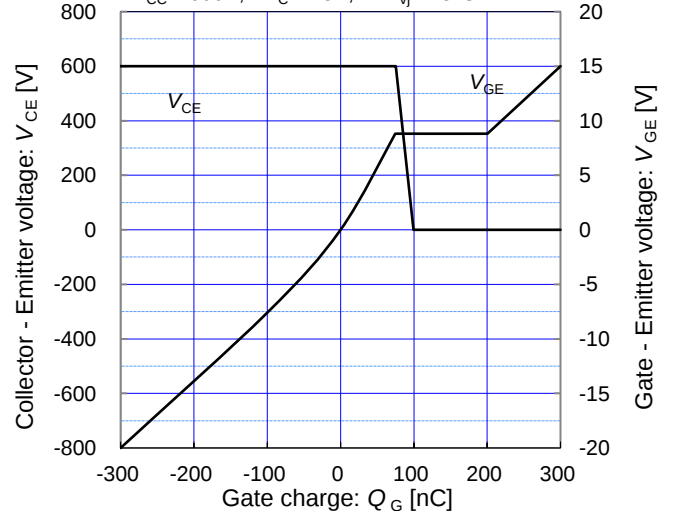
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[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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