

7MBR75XNA120-50

IGBT Modules

Power Module(X series)
1200V / 75A / PIM

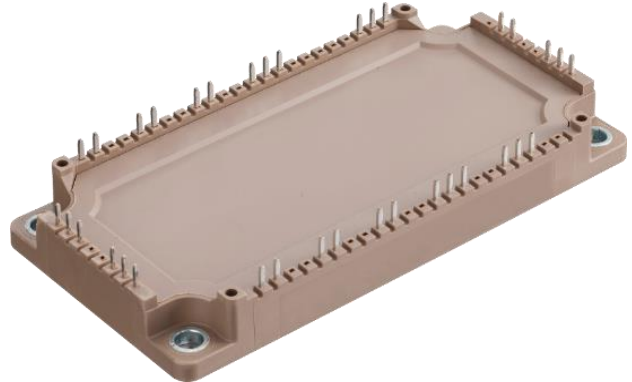
Features

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

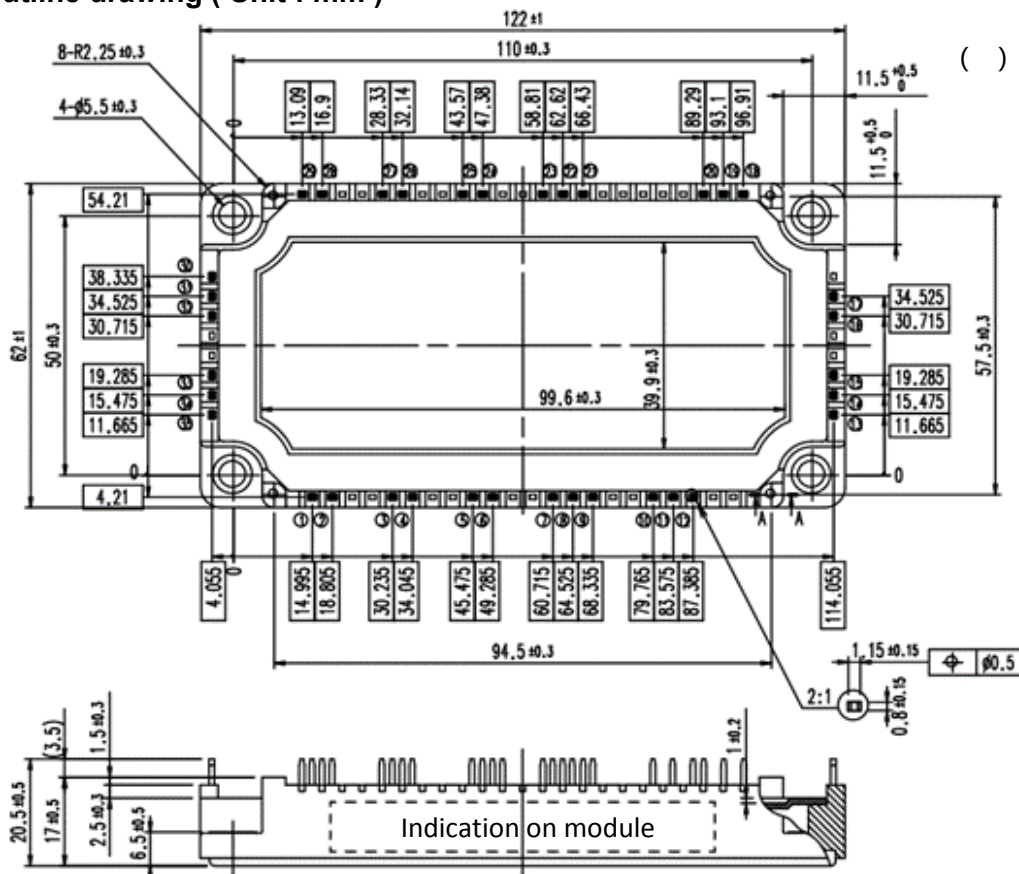
Applications

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

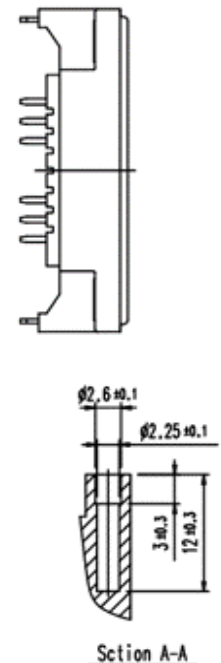
Typical appearance



Outline drawing (Unit : mm)

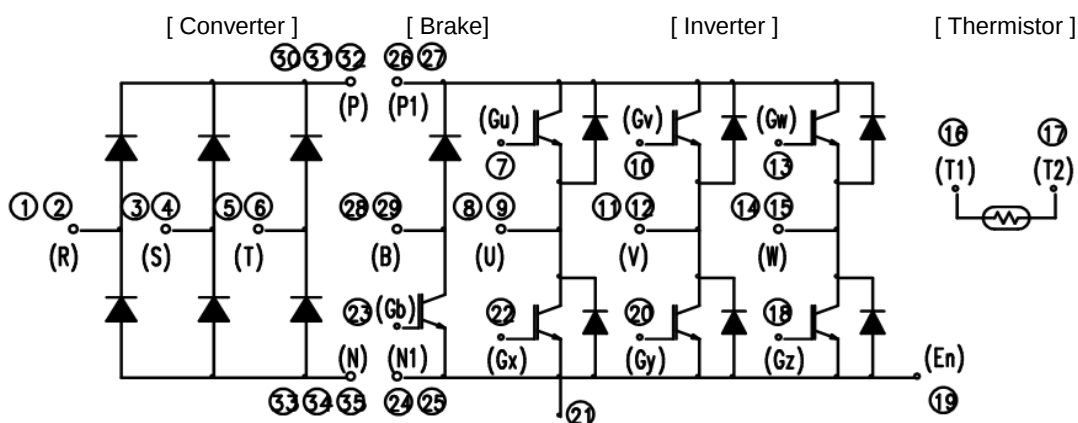


shows theoretical dimension
() shows reference dimension



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

Equivalent circuit



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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	$T_c=100^{\circ}\text{C}$	75	A	
		I_C pulse	1ms		150		
	Forward current	I_F	Continuous		75		
		I_F pulse	1ms		150		
Collector power dissipation		P_C	1 device		335	W	
Brake IGBT	Collector-Emitter voltage	V_{CES}			1200	V	
	Gate-Emitter voltage	V_{GES}			±20	V	
	Collector current	I_C	Continuous	$T_c=100^{\circ}\text{C}$	50	A	
		I_C pulse	1ms		100		
	Collector power dissipation		P_C	1 device		250	W
Brake FWD	Forward current	I_F	Continuous		25	A	
		I_{FRM}	1ms		50		
	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	$T_c=80^{\circ}\text{C}$	75	A	
	Surge current (Non-Repetitive) (*1)	I_{FSM}	$t=10\text{ms}$, Half sine wave form	$T_j=25^{\circ}\text{C}$	630	A	
				$T_j=150^{\circ}\text{C}$	520		
I^2t (Non-Repetitive) (*1)	I^2t	$T_j=25^{\circ}\text{C}$		2000	A ² s		
		$T_j=150^{\circ}\text{C}$		1350			
Junction temperature		T_j	Inverter, Brake		175	°C	
			Converter		150		
Operating junction temperature (under switching conditions)		T_{jop}	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_j : 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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□ Electrical characteristics (at $T_j = 25^\circ\text{C}$ 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	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 75\text{mA}$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{\text{CE(sat)}}$ (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 75\text{A}$	$T_{\text{J}}=25^{\circ}\text{C}$	-	1.70	2.15	V
		$V_{\text{CE(sat)}}$ (chip)		$T_{\text{J}}=25^{\circ}\text{C}$	-	1.50	1.95	
				$T_{\text{J}}=125^{\circ}\text{C}$	-	1.85	-	
				$T_{\text{J}}=150^{\circ}\text{C}$	-	1.95	-	
				$T_{\text{J}}=175^{\circ}\text{C}$	-	2.00	-	
	Internal Gate resistance	r_{g}	-		-	7.5	-	Ω
	Capacitance	C_{ies}	$V_{\text{CE}} = 10\text{V}$, $V_{\text{GE}}=0\text{V}$, $f = 1\text{MHz}$		-	8.0	-	nF
		C_{oes}			-	0.27	-	
		C_{res}			-	0.07	-	
	Gate charge	Q_{G}	$V_{\text{CC}} = 600\text{V}$ $V_{\text{GE}}=-15 \rightarrow +15\text{V}$ $I_{\text{C}} = 75\text{A}$		-	510	-	nC
	Forward voltage	V_{F} (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{F}} = 75\text{A}$	$T_{\text{J}}=25^{\circ}\text{C}$	-	2.00	2.45	V
		V_{F} (chip)		$T_{\text{J}}=25^{\circ}\text{C}$	-	1.80	2.25	
				$T_{\text{J}}=125^{\circ}\text{C}$	-	1.85	-	
				$T_{\text{J}}=150^{\circ}\text{C}$	-	1.80	-	
				$T_{\text{J}}=175^{\circ}\text{C}$	-	1.75	-	
	Switching time (*1)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 75\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{J}}=25^{\circ}\text{C}$	-	0.18	-	μs
				$T_{\text{J}}=125^{\circ}\text{C}$	-	0.21	-	
$T_{\text{J}}=150^{\circ}\text{C}$				-	0.21	-		
$T_{\text{J}}=175^{\circ}\text{C}$				-	0.22	-		
t_{r}		$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 75\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{J}}=25^{\circ}\text{C}$	-	0.04	-		
			$T_{\text{J}}=125^{\circ}\text{C}$	-	0.05	-		
			$T_{\text{J}}=150^{\circ}\text{C}$	-	0.05	-		
			$T_{\text{J}}=175^{\circ}\text{C}$	-	0.05	-		
$t_{\text{d(off)}}$		$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 75\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{J}}=25^{\circ}\text{C}$	-	0.25	-		
			$T_{\text{J}}=125^{\circ}\text{C}$	-	0.28	-		
			$T_{\text{J}}=150^{\circ}\text{C}$	-	0.29	-		
			$T_{\text{J}}=175^{\circ}\text{C}$	-	0.29	-		
t_{f}		$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 75\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{J}}=25^{\circ}\text{C}$	-	0.12	-		
			$T_{\text{J}}=125^{\circ}\text{C}$	-	0.18	-		
			$T_{\text{J}}=150^{\circ}\text{C}$	-	0.20	-		
			$T_{\text{J}}=175^{\circ}\text{C}$	-	0.21	-		
Reverse recovery time	t_{rr}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 75\text{A}$ $L_{\text{S}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 5.1\ \Omega$	$T_{\text{J}}=25^{\circ}\text{C}$	-	0.10	-		
			$T_{\text{J}}=125^{\circ}\text{C}$	-	0.17	-		
			$T_{\text{J}}=150^{\circ}\text{C}$	-	0.21	-		
			$T_{\text{J}}=175^{\circ}\text{C}$	-	0.24	-		

(*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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Items		Symbols	Conditions		Characteristics			Units
					min.	typ.	max.	
Inverter	Switching loss (per pulse)	E_{on}	$V_{CC} = 600V$	$T_j=25^{\circ}C$	-	5.41	-	mJ
			$I_C,I_F = 75A \quad L_s = 30nH$	$T_j=125^{\circ}C$	-	7.80	-	
			$V_{GE} = +15/-15 V$	$T_j=150^{\circ}C$	-	8.48	-	
			$R_G = 5.1 \Omega$	$T_j=175^{\circ}C$	-	9.27	-	
		E_{off}	$V_{CC} = 600V$	$T_j=25^{\circ}C$	-	5.53	-	
			$I_C,I_F = 75A \quad L_s = 30nH$	$T_j=125^{\circ}C$	-	6.64	-	
			$V_{GE} = +15/-15 V$	$T_j=150^{\circ}C$	-	7.23	-	
			$R_G = 5.1 \Omega$	$T_j=175^{\circ}C$	-	7.48	-	
		E_{rr}	$V_{CC} = 600V$	$T_j=25^{\circ}C$	-	2.20	-	
			$I_C,I_F = 75A \quad L_s = 30nH$	$T_j=125^{\circ}C$	-	3.88	-	
			$V_{GE} = +15/-15 V$	$T_j=150^{\circ}C$	-	4.75	-	
			$R_G = 5.1 \Omega$	$T_j=175^{\circ}C$	-	5.33	-	
Brake	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)	$V_{GE} = 15V$ $I_C = 50A$	$T_j=25^{\circ}C$	-	1.65	2.10	V
		$V_{CE(sat)}$ (chip)		$T_j=25^{\circ}C$	-	1.50	1.95	
				$T_j=125^{\circ}C$	-	1.85	-	
				$T_j=150^{\circ}C$	-	1.95	-	
	$T_j=175^{\circ}C$	-	2.00	-				
	Internal Gate resistance	r_g	-		-	0	-	Ω
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$	$T_j=25^{\circ}C$	-	0.09	-	μs
			$I_C = 50A \quad L_s = 30nH$	$T_j=125^{\circ}C$	-	0.09	-	
			$V_{GE} = +15/-15 V$	$T_j=150^{\circ}C$	-	0.09	-	
			$R_G = 18 \Omega$	$T_j=175^{\circ}C$	-	0.10	-	
		t_r	$V_{CC} = 600V$	$T_j=25^{\circ}C$	-	0.04	-	
			$I_C = 50A \quad L_s = 30nH$	$T_j=125^{\circ}C$	-	0.04	-	
			$V_{GE} = +15/-15 V$	$T_j=150^{\circ}C$	-	0.04	-	
			$R_G = 18 \Omega$	$T_j=175^{\circ}C$	-	0.04	-	
$t_{d(off)}$		$V_{CC} = 600V$	$T_j=25^{\circ}C$	-	0.24	-		
		$I_C = 50A \quad L_s = 30nH$	$T_j=125^{\circ}C$	-	0.27	-		
		$V_{GE} = +15/-15 V$	$T_j=150^{\circ}C$	-	0.27	-		
		$R_G = 18 \Omega$	$T_j=175^{\circ}C$	-	0.28	-		
t_f		$V_{CC} = 600V$	$T_j=25^{\circ}C$	-	0.11	-		
		$I_C = 50A \quad L_s = 30nH$	$T_j=125^{\circ}C$	-	0.17	-		
		$V_{GE} = +15/-15 V$	$T_j=150^{\circ}C$	-	0.20	-		
		$R_G = 18 \Omega$	$T_j=175^{\circ}C$	-	0.21	-		
Reverse current	I_{RRM}	$V_R = 1200V$		-	-	50	μA	
Forward voltage	V_F (terminal)	$I_F = 25A$	$T_j=25^{\circ}C$	-	1.95	2.40	V	
	V_F (chip)	$I_F = 25A$	$T_j=25^{\circ}C$	-	1.80	2.25		
			$T_j=125^{\circ}C$	-	1.85	-		
			$T_j=150^{\circ}C$	-	1.80	-		
$T_j=175^{\circ}C$	-	1.75	-					
Converter	Reverse current	I_{RRM}	$V_R = 1600V$		-	-	50	μA
	Forward voltage	V_{FM}	$I_F = 75A$	terminal	-	1.35	1.80	V
chip				-	1.15	1.60		
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	K

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

FM6M01713

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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	-	-	0.45	°C/W
		Inverter FWD	-	-	0.55	
		Brake IGBT	-	-	0.59	
		Brake FWD	-	-	1.00	
		Converter Diode	-	-	0.72	
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.

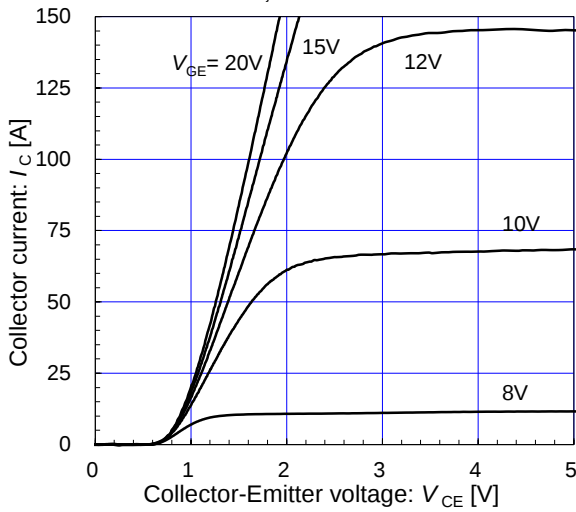
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IGBT Modules

[Inverter]

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

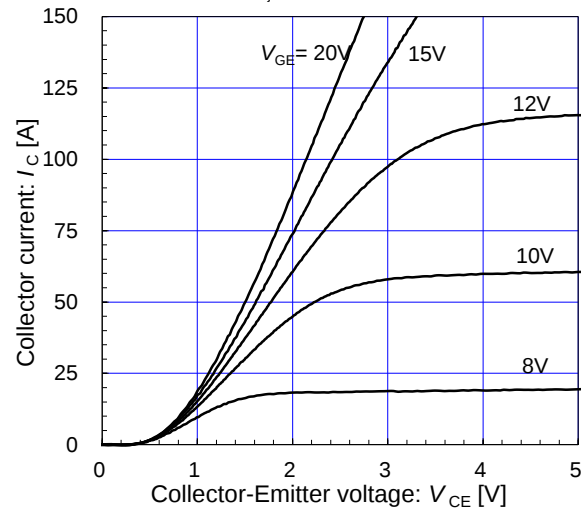
$T_j = 25^\circ\text{C}$ / chip



[Inverter]

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

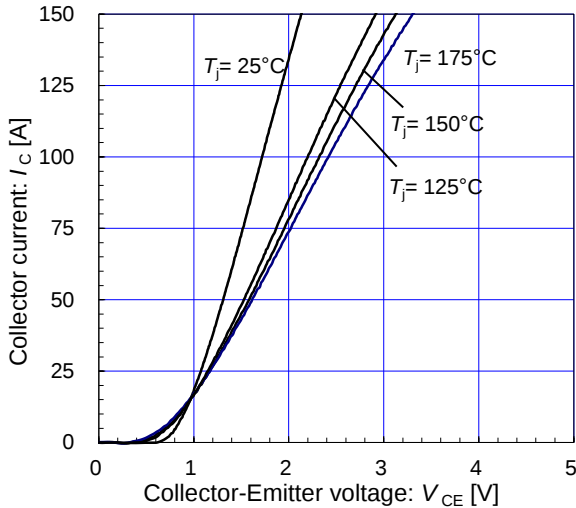
$T_j = 175^\circ\text{C}$ / chip



[Inverter]

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

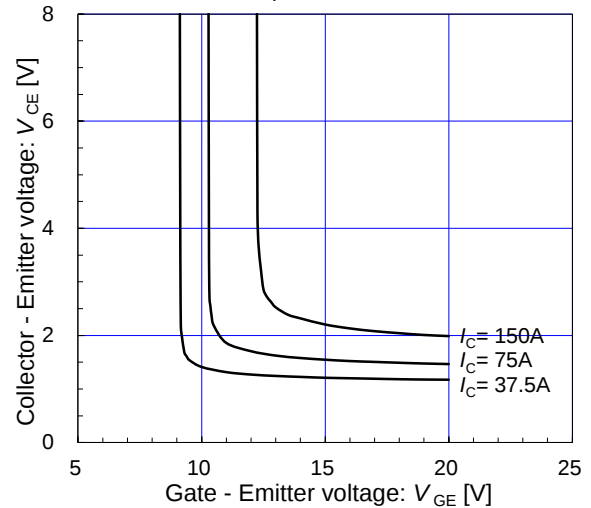
$V_{GE} = 15\text{V}$ / chip



[Inverter]

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

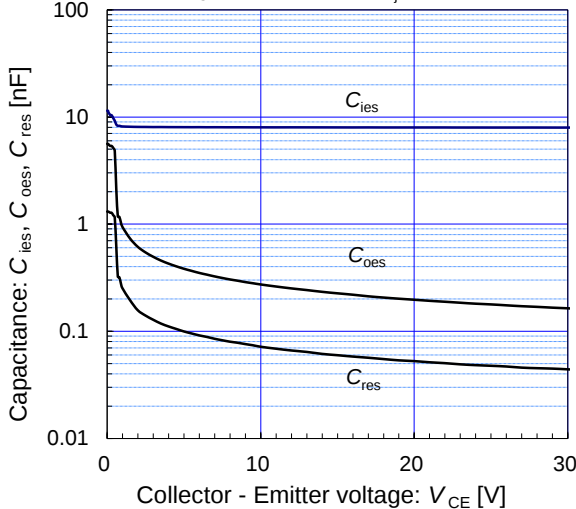
$T_j = 25^\circ\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emittor voltage (typ.)

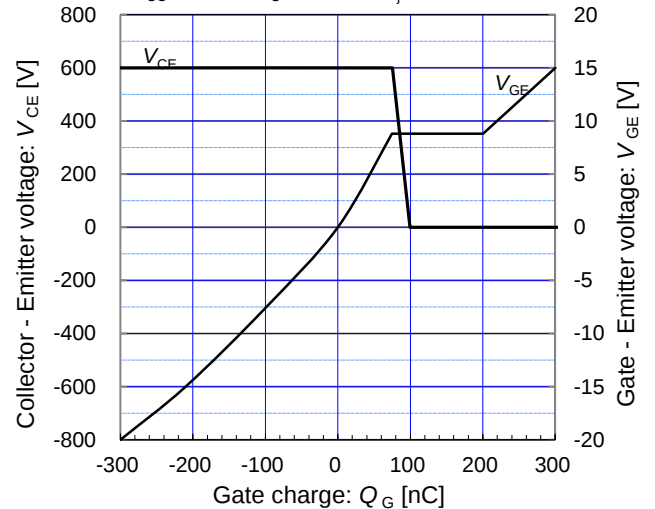
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_j = 25^\circ\text{C}$



[Inverter]

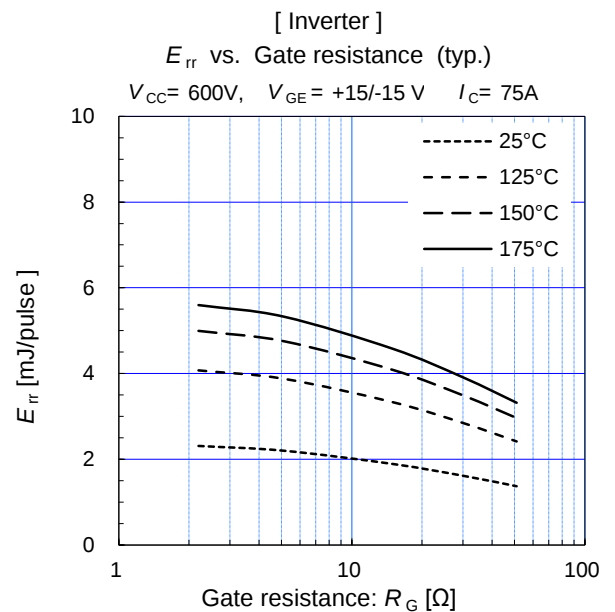
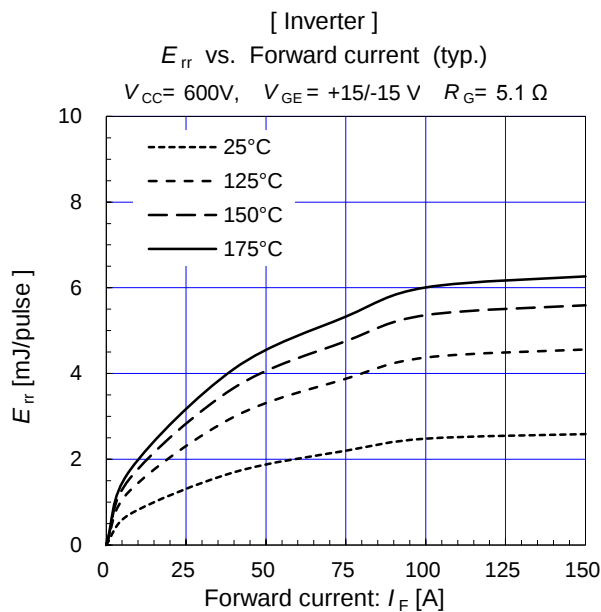
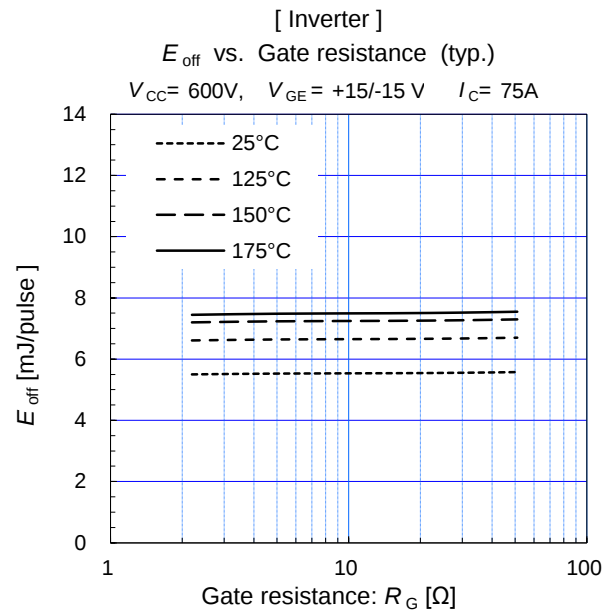
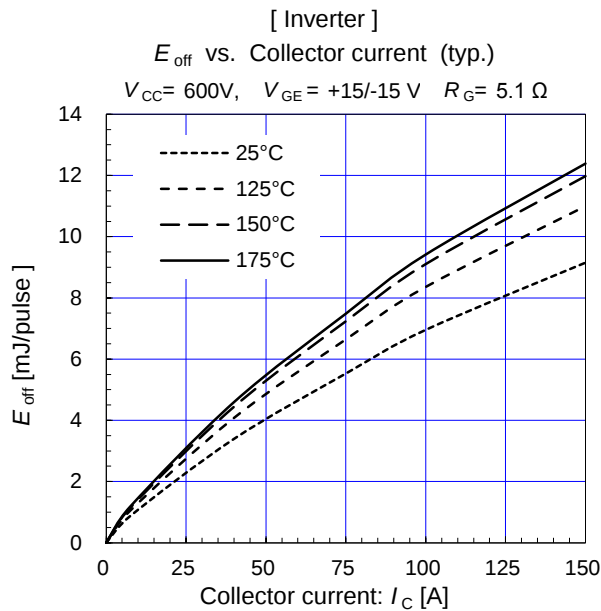
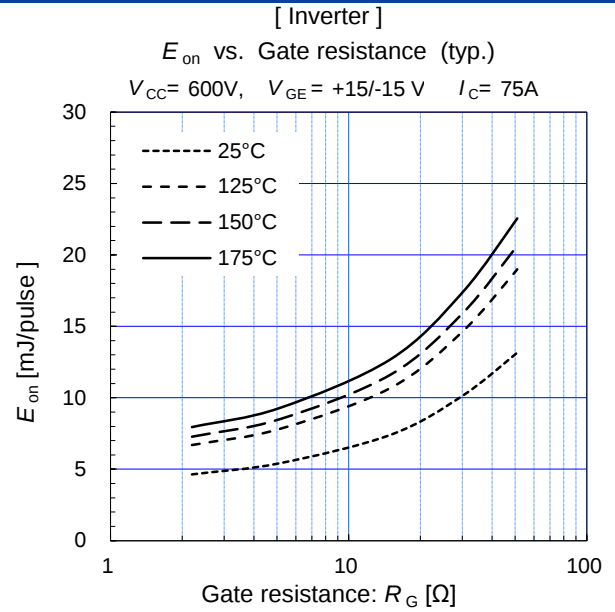
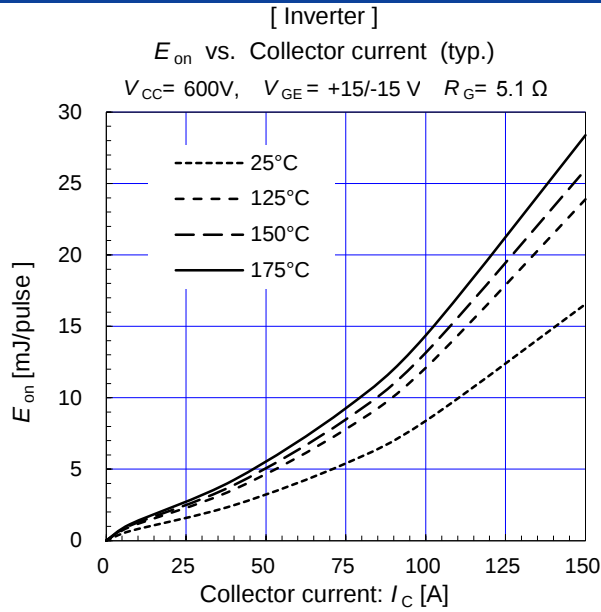
Dynamic Gate charge (typ.)

$V_{CC} = 600\text{V}$, $I_C = 75\text{A}$, $T_j = 25^\circ\text{C}$



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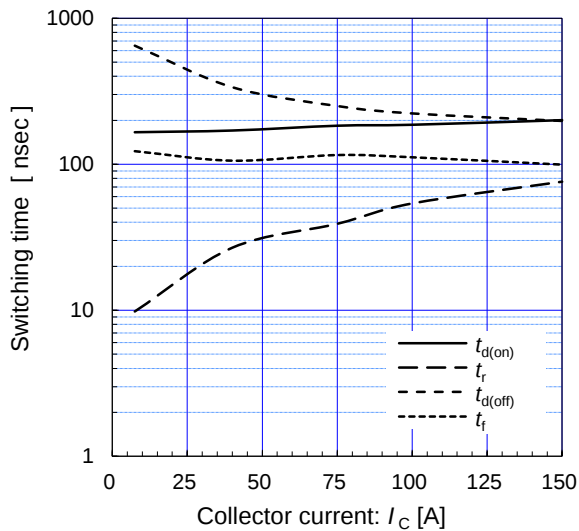
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

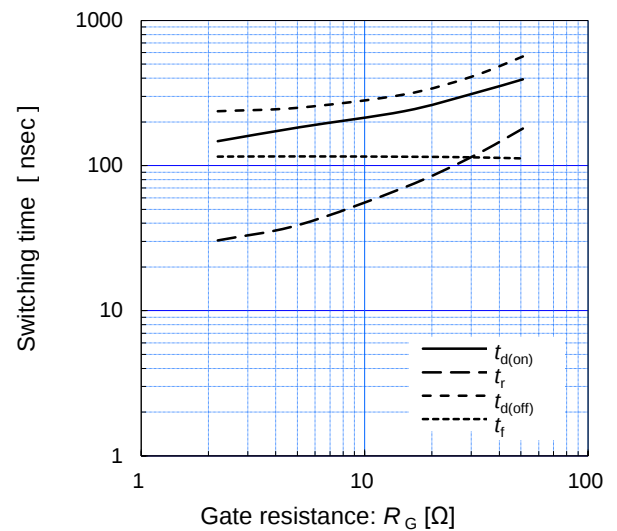
$V_{CC}=600V$, $R_G=5.1\Omega$ $V_{GE}=+15/-15V$, $T_J=25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

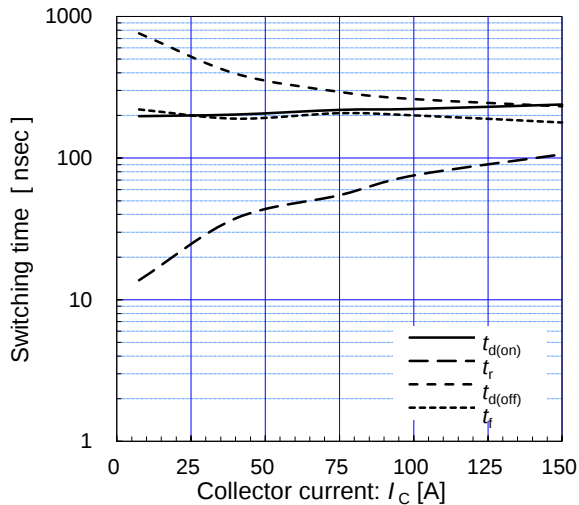
$V_{CC}=600V$, $I_C=75A$, $V_{GE}=+15/-15V$, $T_J=25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

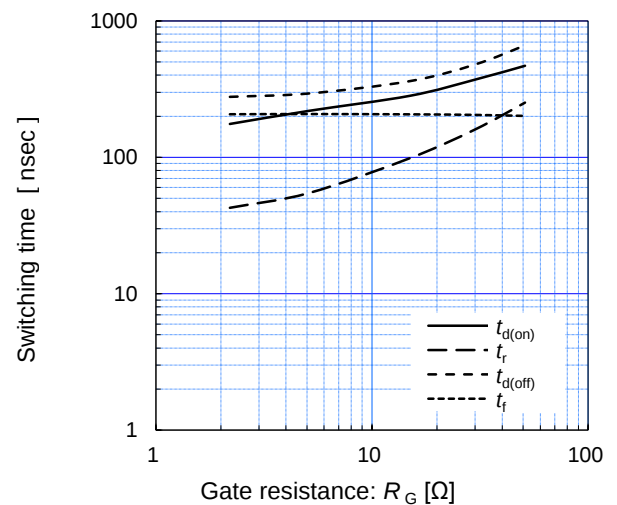
$V_{CC}=600V$, $R_G=5.1\Omega$ $V_{GE}=+15/-15V$, $T_J=175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

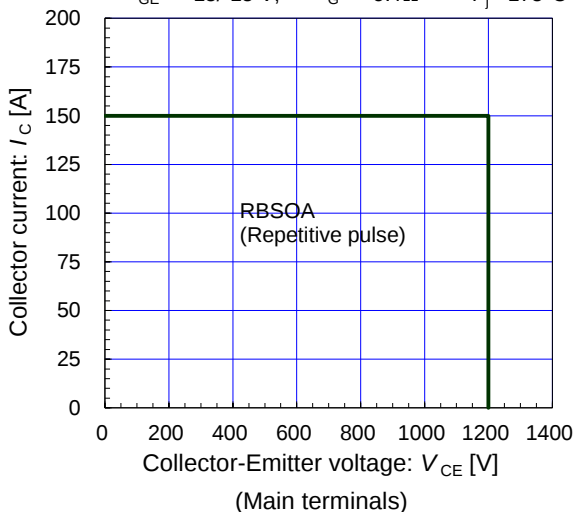
$V_{CC}=600V$, $I_C=75A$, $V_{GE}=+15/-15V$, $T_J=175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

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

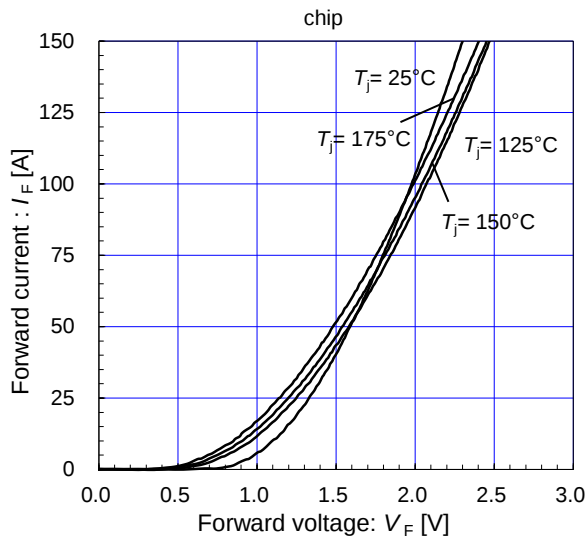


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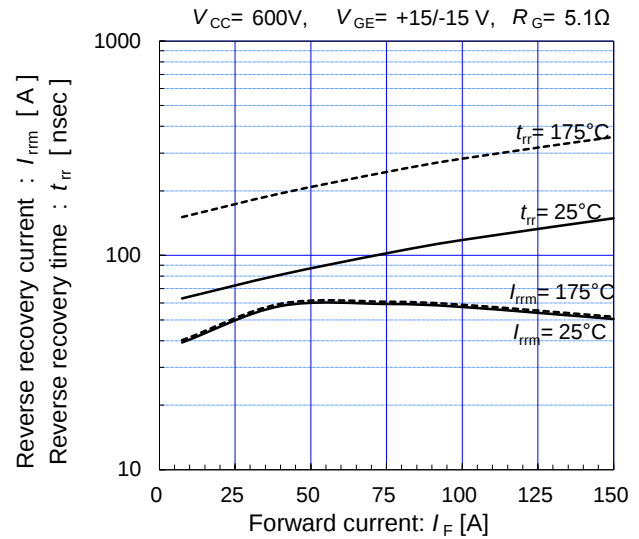
[Inverter]

Forward current vs. Forward voltage (typ.)



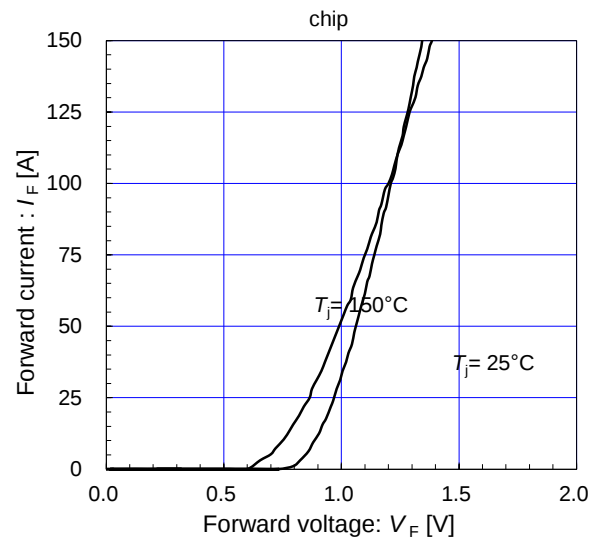
[Inverter]

Reverse recovery characteristics (typ.)

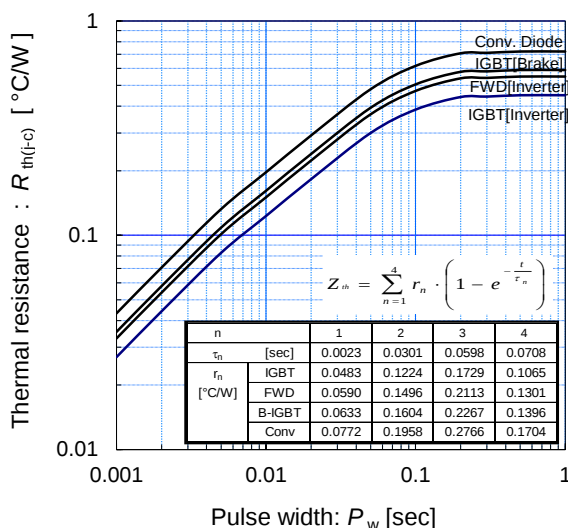


[Converter]

Forward current vs. Forward voltage (typ.)

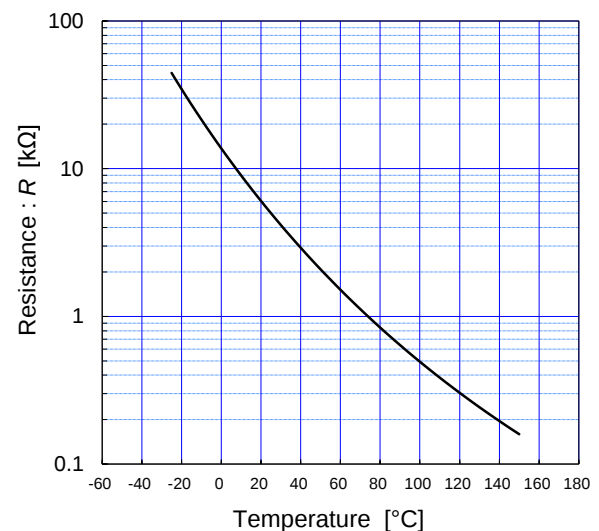


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



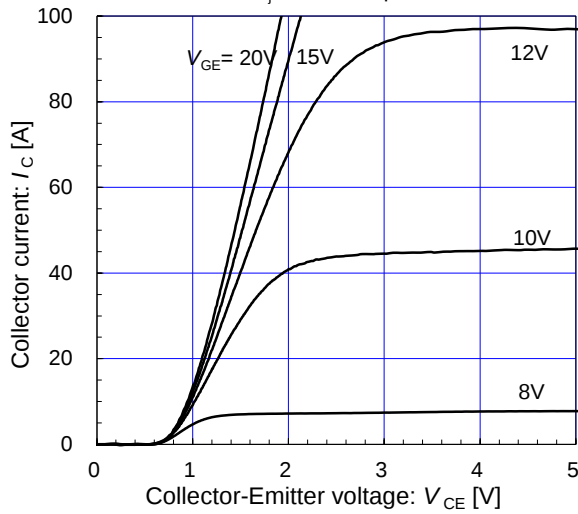
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IGBT Modules

[Brake]

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

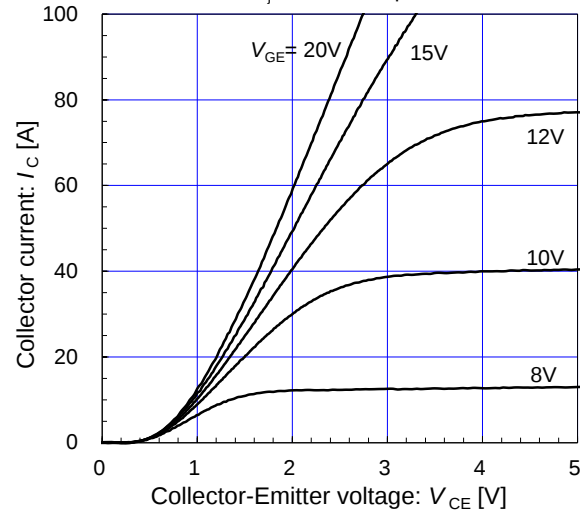
$T_J = 25^\circ\text{C}$ / chip



[Brake]

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

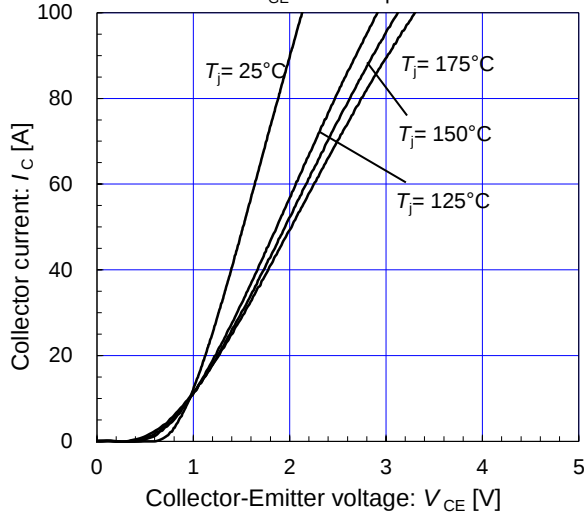
$T_J = 175^\circ\text{C}$ / chip



[Brake]

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

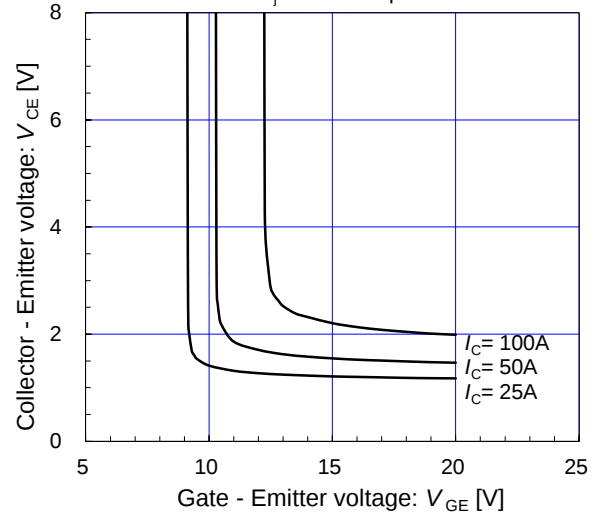
$V_{GE} = 15\text{V}$ / chip



[Brake]

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

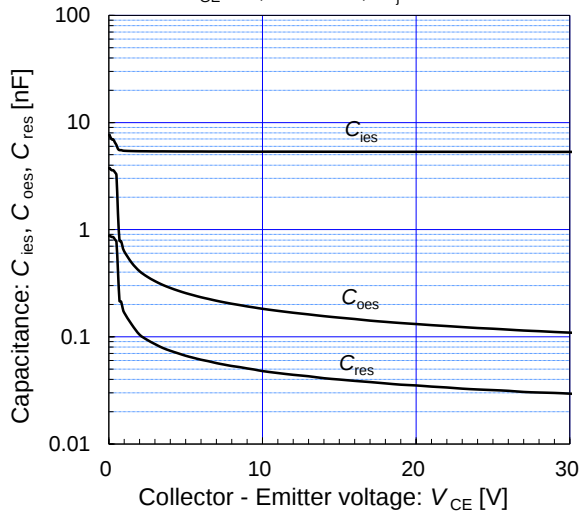
$T_J = 25^\circ\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emmitter voltage (typ.)

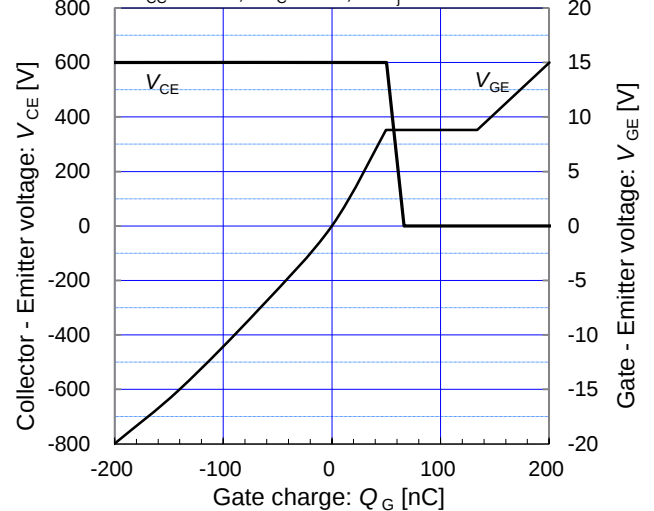
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_J = 25^\circ\text{C}$



[Brake]

Dynamic Gate charge (typ.)

$V_{CC} = 600\text{V}$, $I_C = 50\text{A}$, $T_J = 25^\circ\text{C}$



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