

7MBR150XNA065-50

IGBT Modules

Power Module(X series)
650V / 150A / PIM

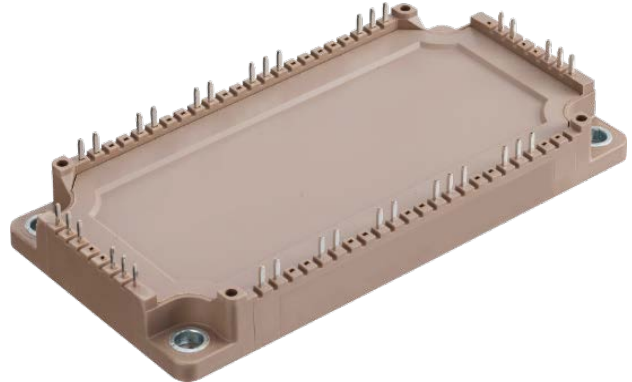
□ Features

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

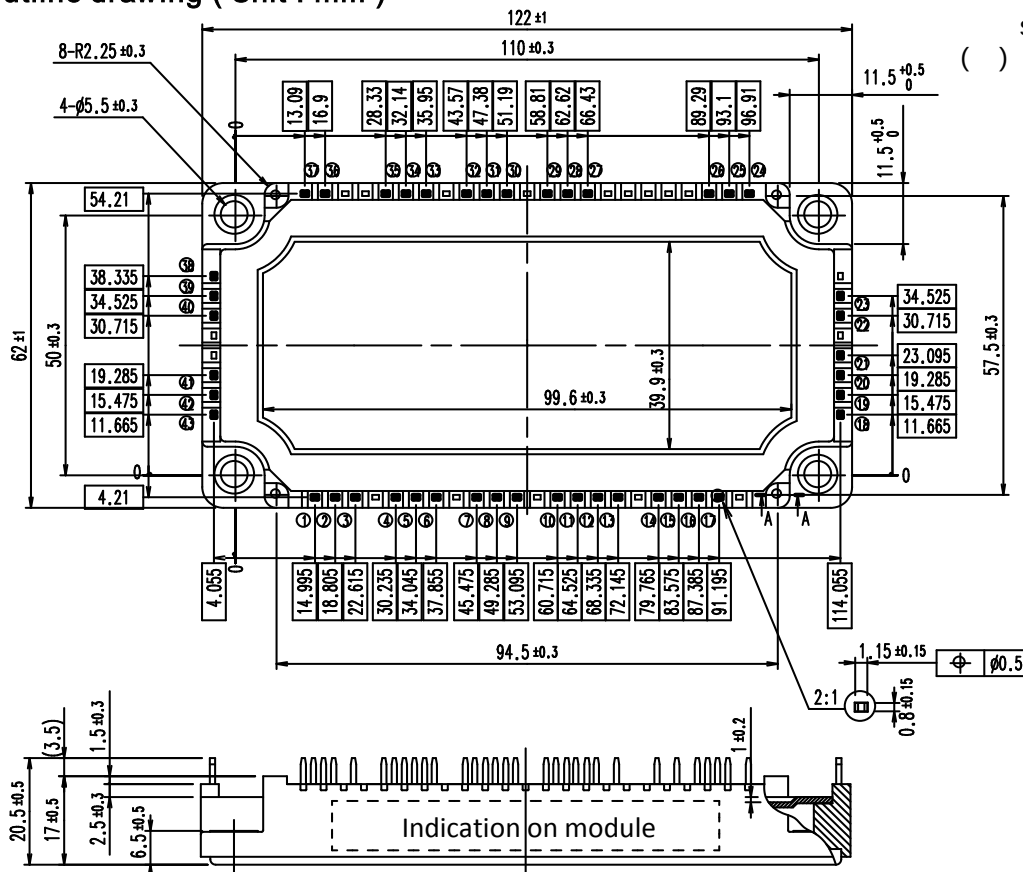
□ Applications

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

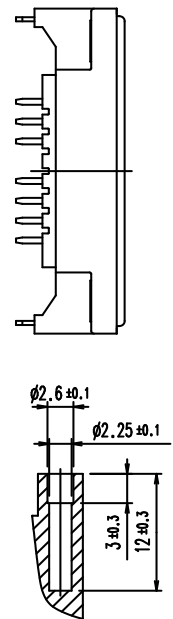
□ Typical appearance



□ Outline drawing (Unit : mm)



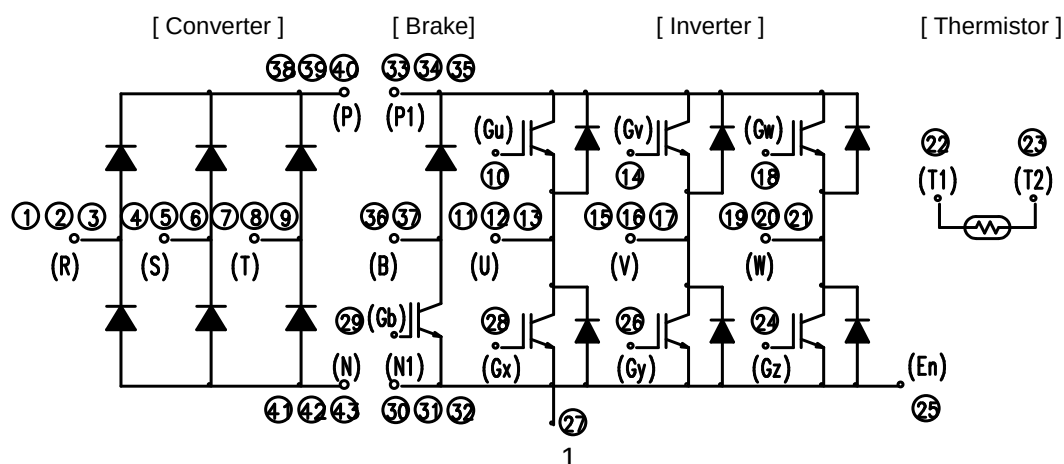
shows theoretical dimension
() shows reference dimension



Section A-A

Weight: 310 g (typ.)

□ Equivalent circuit



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□ Maximum ratings (at $T_c = 25^\circ\text{C}$ unless otherwise specified)

Items			Symbols	Conditions		Maximum ratings	Units
Inverter	Collector-Emitter voltage		V_{CES}			650	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	$T_c=80^{\circ}\text{C}$	150	A
			I_C pulse	1ms		300	
	Forward current		I_F	Continuous		150	
			I_F pulse	1ms		300	
Collector power dissipation		P_C	1 device		450	W	
Brake IGBT	Collector-Emitter voltage		V_{CES}			650	V
	Gate-Emitter voltage		V_{GES}			±20	V
	Collector current		I_C	Continuous	$T_c=80^{\circ}\text{C}$	75	A
			I_C pulse	1ms		150	
	Collector power dissipation		P_C	1 device		270	W
Brake FWD	Forward current		I_F	Continuous		50	A
			I_{FRM}	1ms		100	
	Repetitive peak reverse voltage		V_{RRM}			650	V
Converter	Repetitive peak reverse voltage		V_{RRM}			800	V
	Average output current		I_O	Three-phase full wave rectified	$T_c=80^{\circ}\text{C}$	150	A
	Surge current (Non-Repetitive) (*1)		I_{FSM}	$t=10\text{ms}$, Half sine wave form	$T_j=25^{\circ}\text{C}$	1440	A
					$T_j=150^{\circ}\text{C}$	1260	
I^2t (Non-Repetitive) (*1)		I^2t		$T_j=25^{\circ}\text{C}$	10400	A ² s	
				$T_j=150^{\circ}\text{C}$	8000		
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}	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CE}} = 650\text{V}$		-	-	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	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 150\text{mA}$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{\text{CE(sat)}}$ (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 150\text{A}$	$T_{\text{j}}=25^{\circ}\text{C}$	-	1.65	2.10	V
		$V_{\text{CE(sat)}}$ (chip)		$T_{\text{j}}=25^{\circ}\text{C}$	-	1.30	1.75	
				$T_{\text{j}}=125^{\circ}\text{C}$	-	1.45	-	
				$T_{\text{j}}=150^{\circ}\text{C}$	-	1.50	-	
				$T_{\text{j}}=175^{\circ}\text{C}$	-	1.55	-	
	Internal Gate resistance	r_{g}	-		-	4.5	-	Ω
	Capacitance	C_{ies}	$V_{\text{CE}} = 10\text{V}, V_{\text{GE}}=0\text{V}, f = 1\text{MHz}$		-	17.2	-	nF
		C_{oes}			-	0.66	-	
		C_{res}			-	0.23	-	
	Gate charge	Q_{G}	$V_{\text{CC}} = 300\text{V}$ $V_{\text{GE}}=-15 \rightarrow +15\text{V}$ $I_{\text{C}} = 150\text{A}$		-	1200	-	nC
	Forward voltage	V_{F} (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{F}} = 150\text{A}$	$T_{\text{j}}=25^{\circ}\text{C}$	-	1.90	2.35	V
		V_{F} (chip)		$T_{\text{j}}=25^{\circ}\text{C}$	-	1.55	2.00	
				$T_{\text{j}}=125^{\circ}\text{C}$	-	1.50	-	
				$T_{\text{j}}=150^{\circ}\text{C}$	-	1.50	-	
$T_{\text{j}}=175^{\circ}\text{C}$				-	1.45	-		
Switching time (*1)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}}=150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 18\ \Omega$	$T_{\text{j}}=25^{\circ}\text{C}$	-	0.48	-	μs	
			$T_{\text{j}}=125^{\circ}\text{C}$	-	0.52	-		
			$T_{\text{j}}=150^{\circ}\text{C}$	-	0.54	-		
			$T_{\text{j}}=175^{\circ}\text{C}$	-	0.52	-		
	t_{r}	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}}=150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 18\ \Omega$	$T_{\text{j}}=25^{\circ}\text{C}$	-	0.12	-		
			$T_{\text{j}}=125^{\circ}\text{C}$	-	0.16	-		
			$T_{\text{j}}=150^{\circ}\text{C}$	-	0.16	-		
			$T_{\text{j}}=175^{\circ}\text{C}$	-	0.18	-		
	$t_{\text{d(off)}}$	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}}=150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 18\ \Omega$	$T_{\text{j}}=25^{\circ}\text{C}$	-	0.54	-		
			$T_{\text{j}}=125^{\circ}\text{C}$	-	0.58	-		
			$T_{\text{j}}=150^{\circ}\text{C}$	-	0.59	-		
			$T_{\text{j}}=175^{\circ}\text{C}$	-	0.60	-		
	t_{f}	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}}=150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 18\ \Omega$	$T_{\text{j}}=25^{\circ}\text{C}$	-	0.05	-		
			$T_{\text{j}}=125^{\circ}\text{C}$	-	0.05	-		
			$T_{\text{j}}=150^{\circ}\text{C}$	-	0.06	-		
			$T_{\text{j}}=175^{\circ}\text{C}$	-	0.06	-		
Reverse recovery time	t_{rr}	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}}=150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{ V}$ $R_{\text{G}} = 18\ \Omega$	$T_{\text{j}}=25^{\circ}\text{C}$	-	0.11	-		
			$T_{\text{j}}=125^{\circ}\text{C}$	-	0.23	-		
			$T_{\text{j}}=150^{\circ}\text{C}$	-	0.24	-		
			$T_{\text{j}}=175^{\circ}\text{C}$	-	0.30	-		

(*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}	$V_{CC} = 300V$	$T_j=25^{\circ}C$	-	5.94	-	mJ
			$I_C,I_F=150A \ L_s= 30nH$	$T_j=125^{\circ}C$	-	8.59	-	
			$V_{GE} = +15/-15\ V$	$T_j=150^{\circ}C$	-	9.46	-	
			$R_G = 18\ \Omega$	$T_j=175^{\circ}C$	-	10.27	-	
		E_{off}	$V_{CC} = 300V$	$T_j=25^{\circ}C$	-	4.86	-	
			$I_C,I_F=150A \ L_s= 30nH$	$T_j=125^{\circ}C$	-	6.19	-	
			$V_{GE} = +15/-15\ V$	$T_j=150^{\circ}C$	-	6.48	-	
			$R_G = 18\ \Omega$	$T_j=175^{\circ}C$	-	6.81	-	
		E_{rr}	$V_{CC} = 300V$	$T_j=25^{\circ}C$	-	0.64	-	
			$I_C,I_F=150A \ L_s= 30nH$	$T_j=125^{\circ}C$	-	0.90	-	
			$V_{GE} = +15/-15\ V$	$T_j=150^{\circ}C$	-	1.12	-	
			$R_G = 18\ \Omega$	$T_j=175^{\circ}C$	-	1.24	-	
Brake	Zero Gate voltage collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 650V$		-	-	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)	$V_{GE} = 15V$ $I_C = 75A$	$T_j=25^{\circ}C$	-	1.45	1.95	V
		$V_{CE(sat)}$ (chip)	$T_j=25^{\circ}C$	-	1.30	1.75		
			$T_j=125^{\circ}C$	-	1.45	-		
			$T_j=150^{\circ}C$	-	1.50	-		
		$T_j=175^{\circ}C$	-	1.55	-			
	Internal Gate resistance	r_g	-		-	0	-	Ω
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$	$T_j=25^{\circ}C$	-	0.35	-	μs
			$I_C = 75A \ L_s= 30nH$	$T_j=125^{\circ}C$	-	0.34	-	
			$V_{GE} = +15/-15\ V$	$T_j=150^{\circ}C$	-	0.36	-	
			$R_G = 43\ \Omega$	$T_j=175^{\circ}C$	-	0.34	-	
		t_r	$V_{CC} = 300V$	$T_j=25^{\circ}C$	-	0.12	-	
			$I_C = 75A \ L_s= 30nH$	$T_j=125^{\circ}C$	-	0.14	-	
			$V_{GE} = +15/-15\ V$	$T_j=150^{\circ}C$	-	0.16	-	
			$R_G = 43\ \Omega$	$T_j=175^{\circ}C$	-	0.15	-	
$t_{d(off)}$		$V_{CC} = 300V$	$T_j=25^{\circ}C$	-	0.47	-		
		$I_C = 75A \ L_s= 30nH$	$T_j=125^{\circ}C$	-	0.52	-		
		$V_{GE} = +15/-15\ V$	$T_j=150^{\circ}C$	-	0.52	-		
		$R_G = 43\ \Omega$	$T_j=175^{\circ}C$	-	0.53	-		
t_f		$V_{CC} = 300V$	$T_j=25^{\circ}C$	-	0.04	-		
		$I_C = 75A \ L_s= 30nH$	$T_j=125^{\circ}C$	-	0.05	-		
		$V_{GE} = +15/-15\ V$	$T_j=150^{\circ}C$	-	0.04	-		
		$R_G = 43\ \Omega$	$T_j=175^{\circ}C$	-	0.04	-		
Reverse current	I_{RRM}	$V_R = 650V$		-	-	50	μA	
Forward voltage	V_F (terminal)	$I_F = 50A$	$T_j=25^{\circ}C$	-	1.70	2.20	V	
	V_F (chip)	$I_F = 50A$	$T_j=25^{\circ}C$	-	1.55	2.00		
		$T_j=125^{\circ}C$	-	1.50	-			
		$T_j=150^{\circ}C$	-	1.50	-			
	$T_j=175^{\circ}C$	-	1.45	-				
Converter	Reverse current	I_{RRM}	$V_R = 800V$		-	-	50	μA
	Forward voltage	V_{FM}	$I_F = 150A$	terminal	-	1.45	1.90	V
			chip	-	1.10	1.55		
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}) = $t_{d(off)} + t_f$
FM6M01774

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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	-	-	0.33	°C/W
		Inverter FWD	-	-	0.43	
		Brake IGBT	-	-	0.55	
		Brake FWD	-	-	0.86	
		Converter Diode	-	-	0.36	
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.

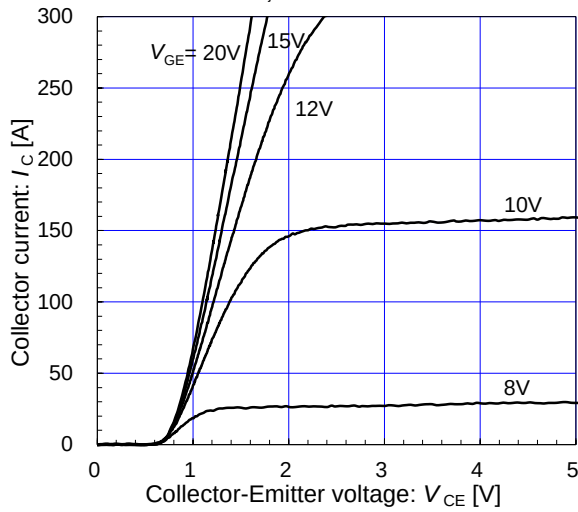
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IGBT Modules

[Inverter]

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

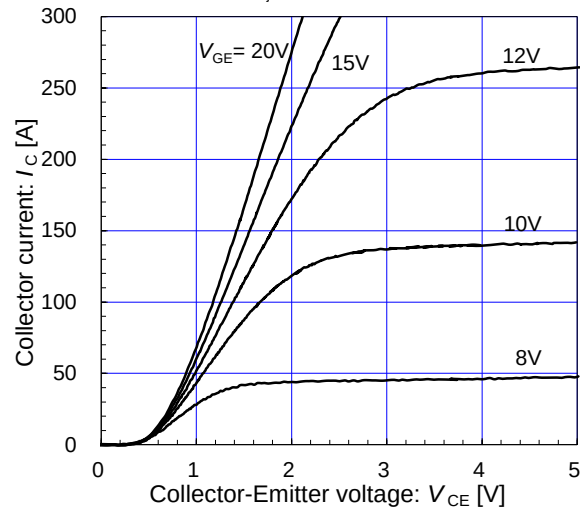
$T_j = 25^\circ\text{C}$ / chip



[Inverter]

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

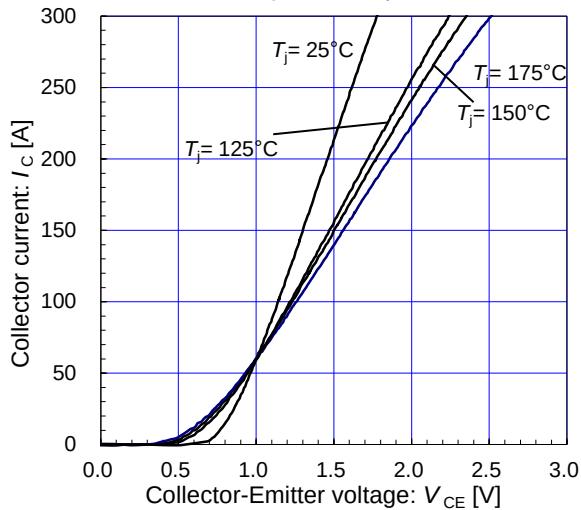
$T_j = 175^\circ\text{C}$ / chip



[Inverter]

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

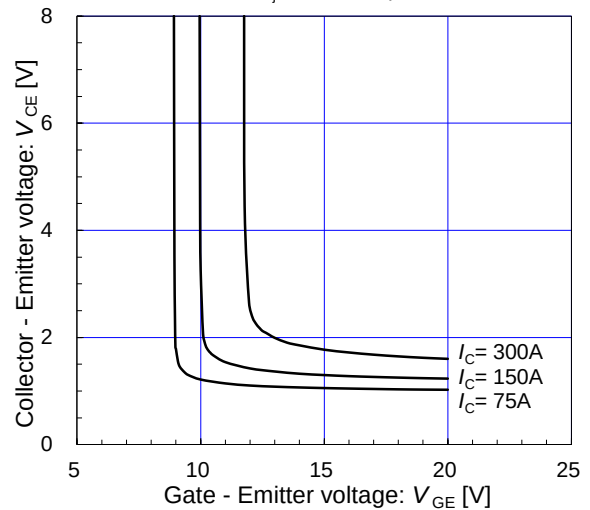
$V_{GE} = 15\text{V}$ / chip



[Inverter]

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

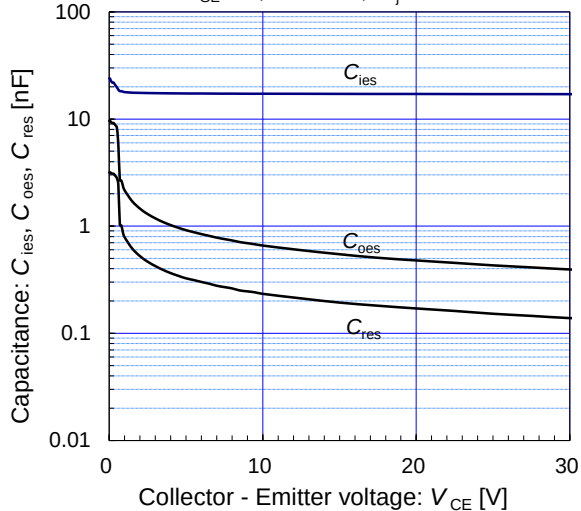
$T_j = 25^\circ\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emittor voltage (typ.)

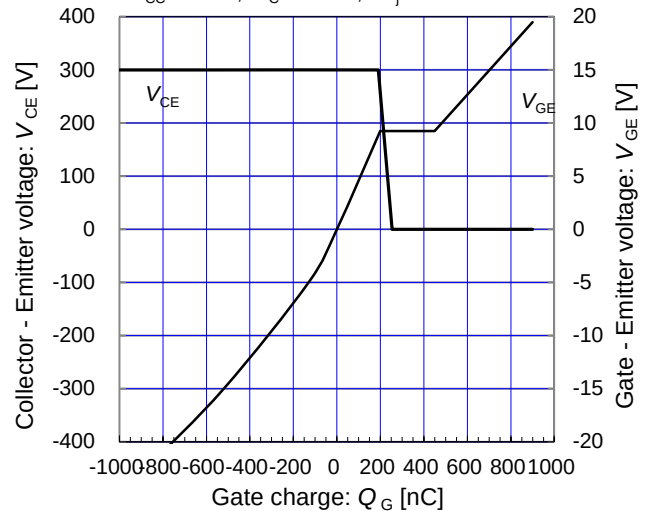
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_j = 25^\circ\text{C}$



[Inverter]

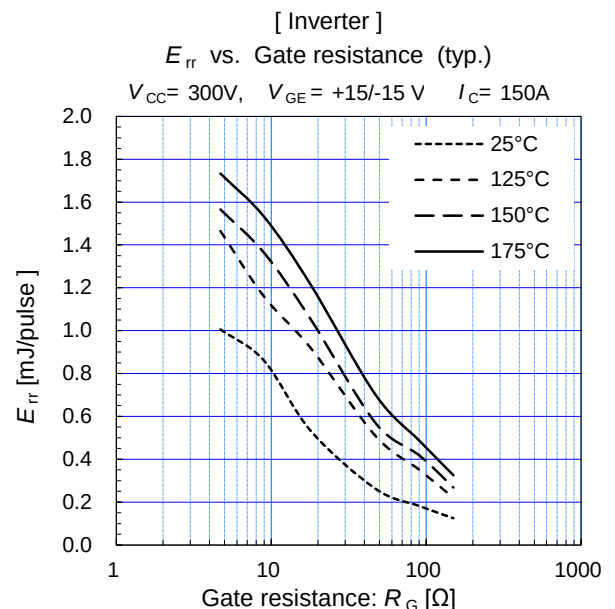
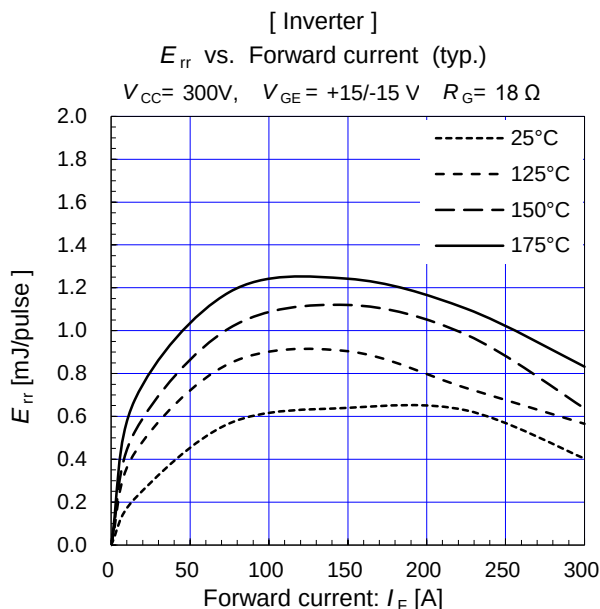
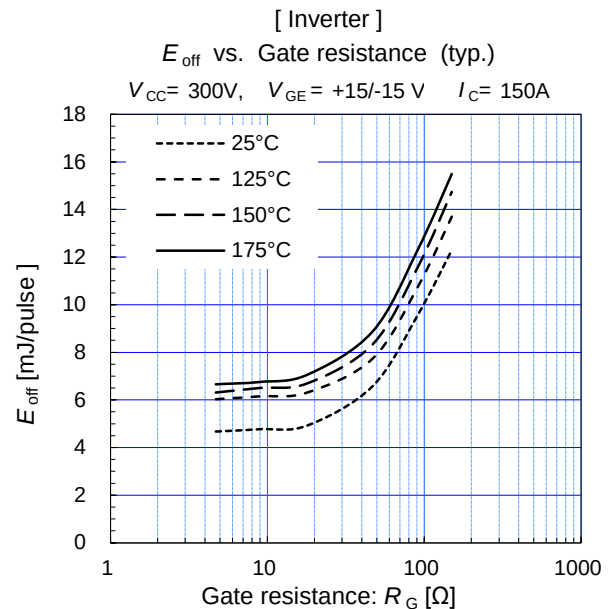
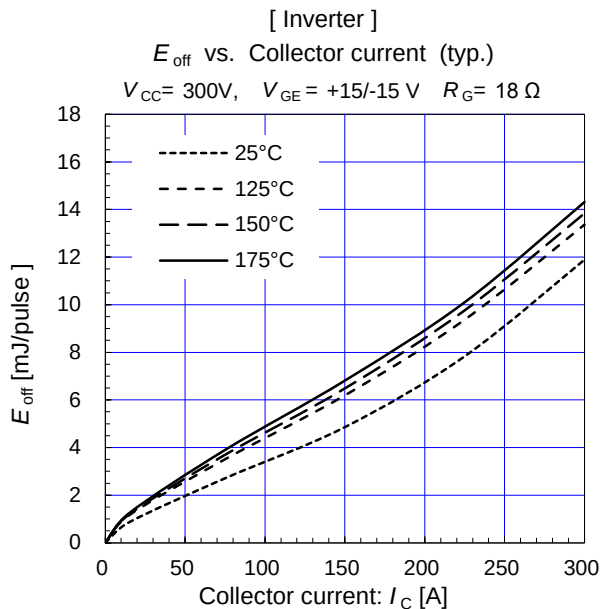
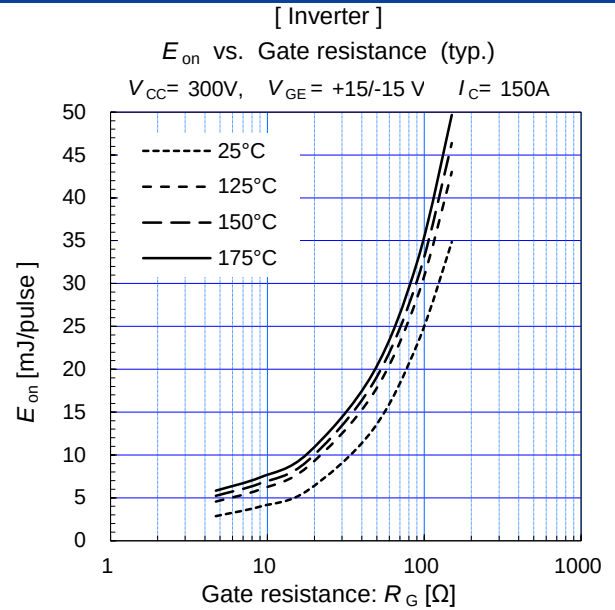
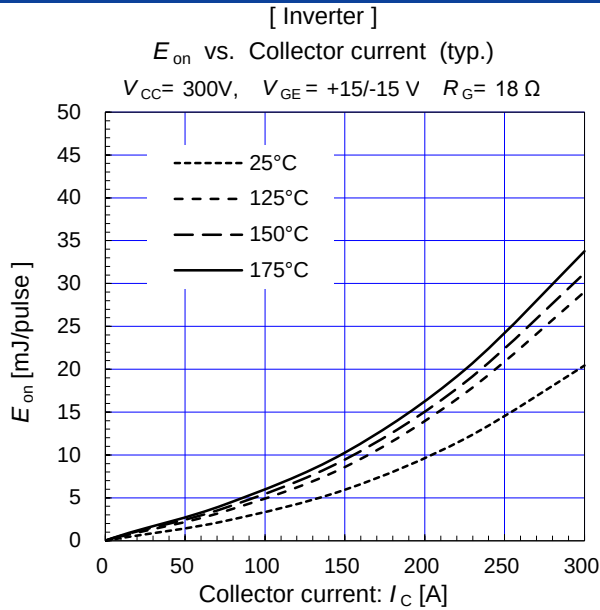
Dynamic Gate charge (typ.)

$V_{CC} = 300\text{V}$, $I_C = 150\text{A}$, $T_j = 25^\circ\text{C}$



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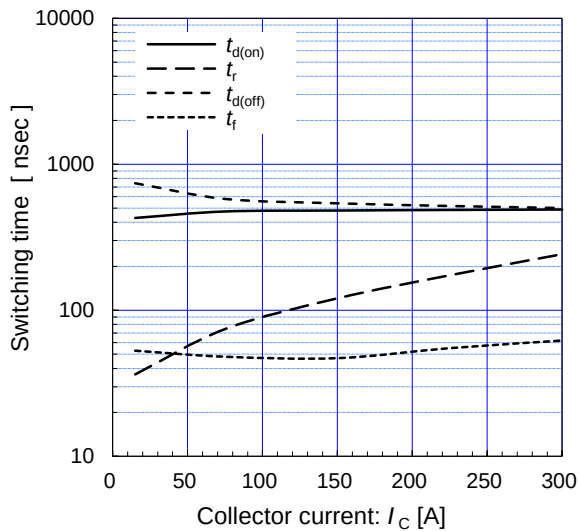
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

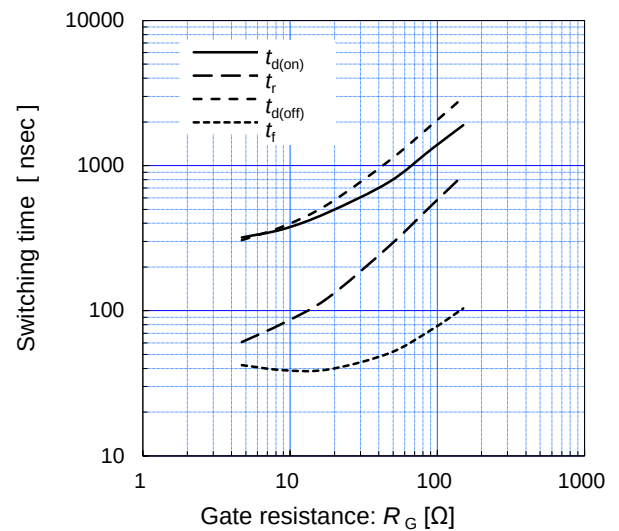
$V_{CC} = 300V$, $R_G = 18\Omega$ $V_{GE} = +15/-15V$, $T_J = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

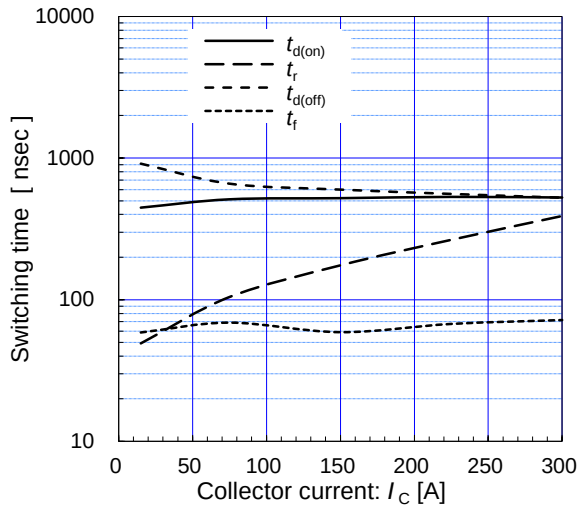
$V_{CC} = 300V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_J = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

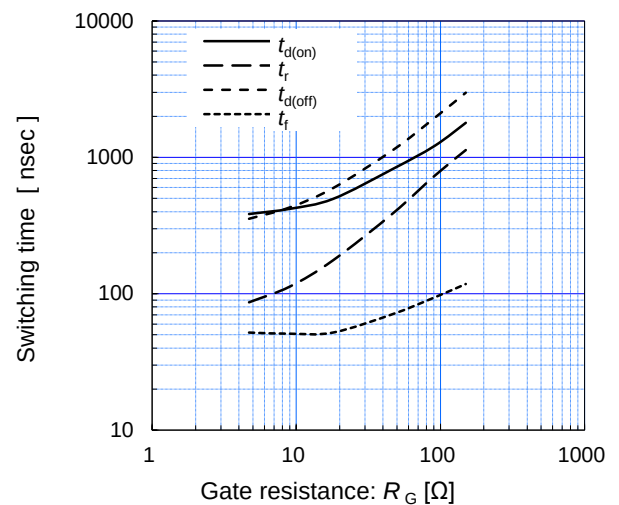
$V_{CC} = 300V$, $R_G = 18\Omega$ $V_{GE} = +15/-15V$, $T_J = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

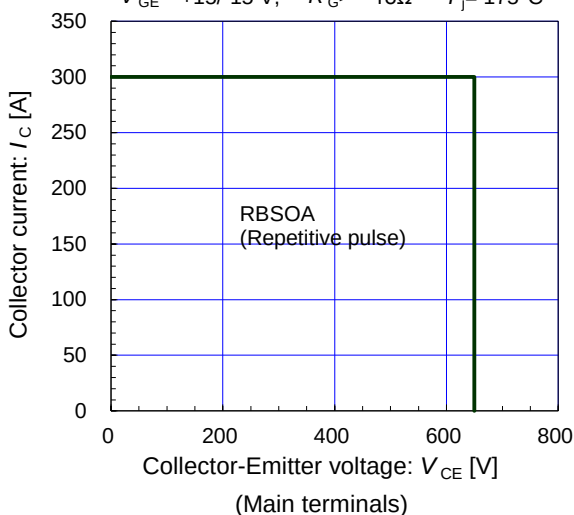
$V_{CC} = 300V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_J = 175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$, $R_G \geq 18\Omega$ $T_J = 175^\circ C$

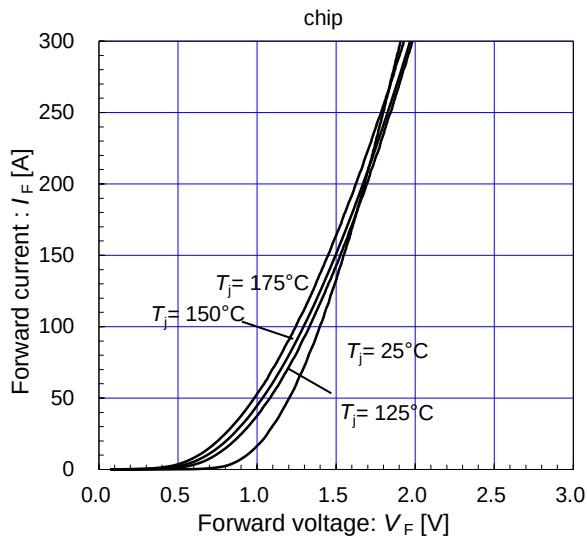


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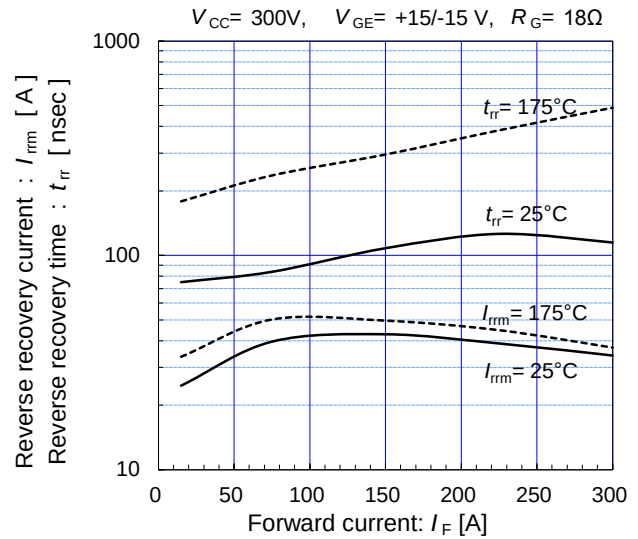
[Inverter]

Forward current vs. Forward voltage (typ.)



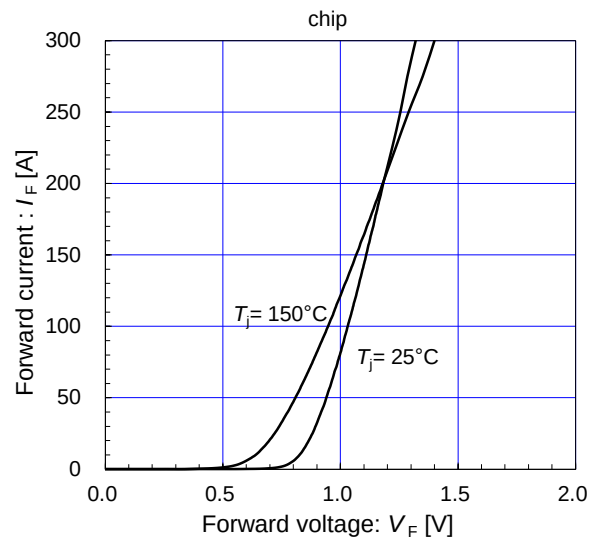
[Inverter]

Reverse recovery characteristics (typ.)

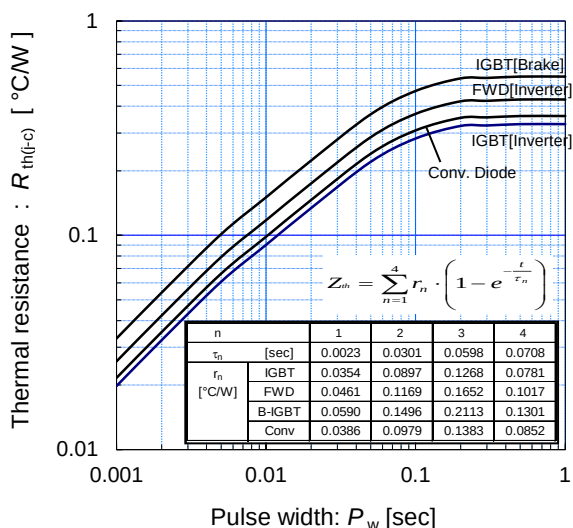


[Converter]

Forward current vs. Forward voltage (typ.)

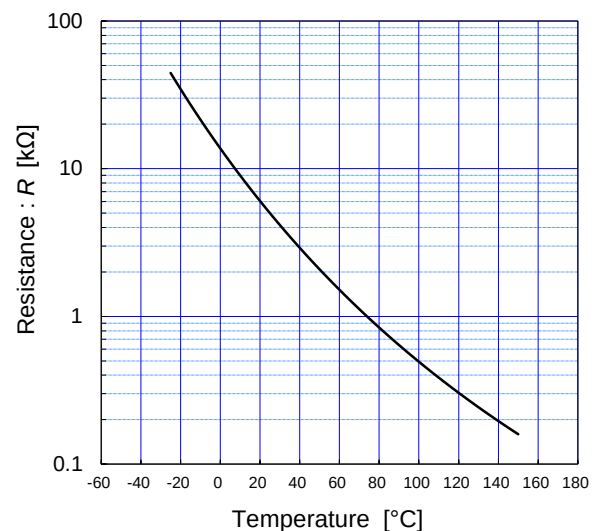


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



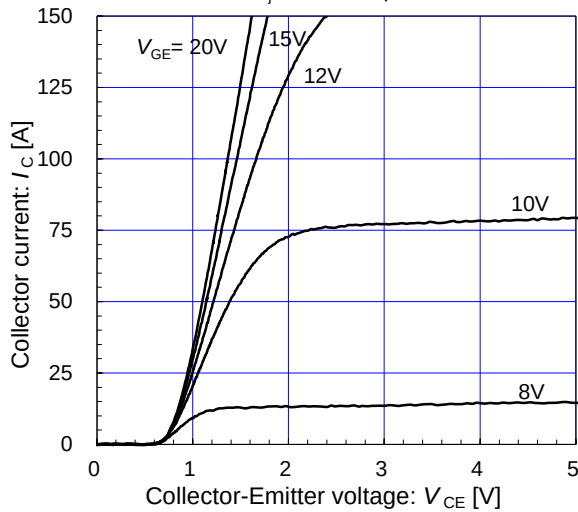
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[Brake]

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

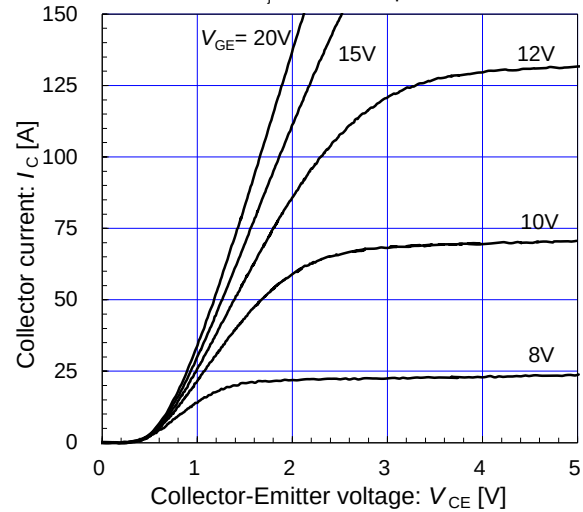
$T_j = 25^\circ\text{C}$ / chip



[Brake]

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

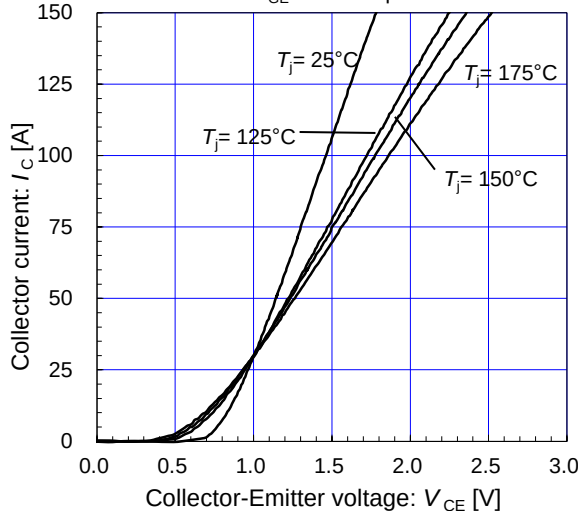
$T_j = 175^\circ\text{C}$ / chip



[Brake]

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

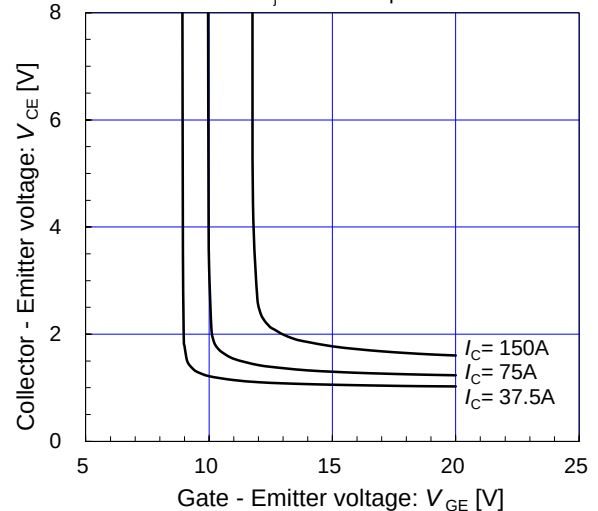
$V_{GE} = 15\text{V}$ / chip



[Brake]

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

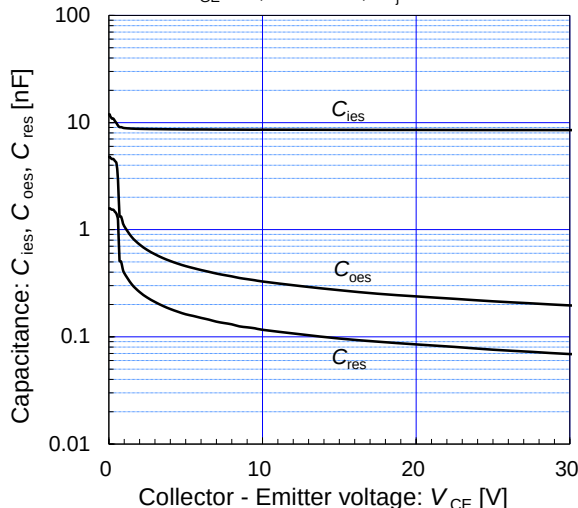
$T_j = 25^\circ\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emmitter voltage (typ.)

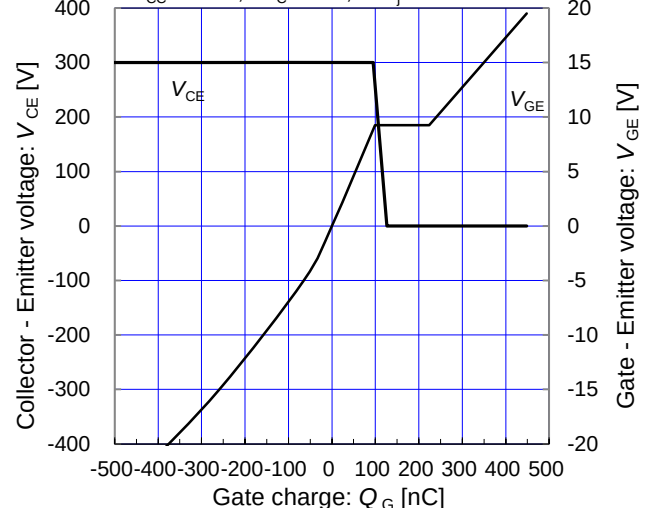
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_j = 25^\circ\text{C}$



[Brake]

Dynamic Gate charge (typ.)

$V_{CC} = 300\text{V}$, $I_C = 75\text{A}$, $T_j = 25^\circ\text{C}$



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