

7MBR150XNA065-50

IGBT Modules

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

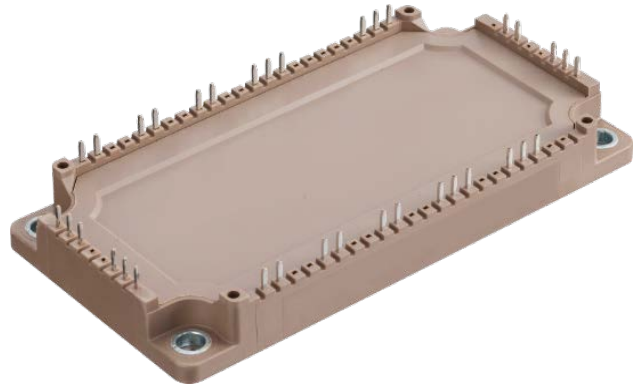
Features

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

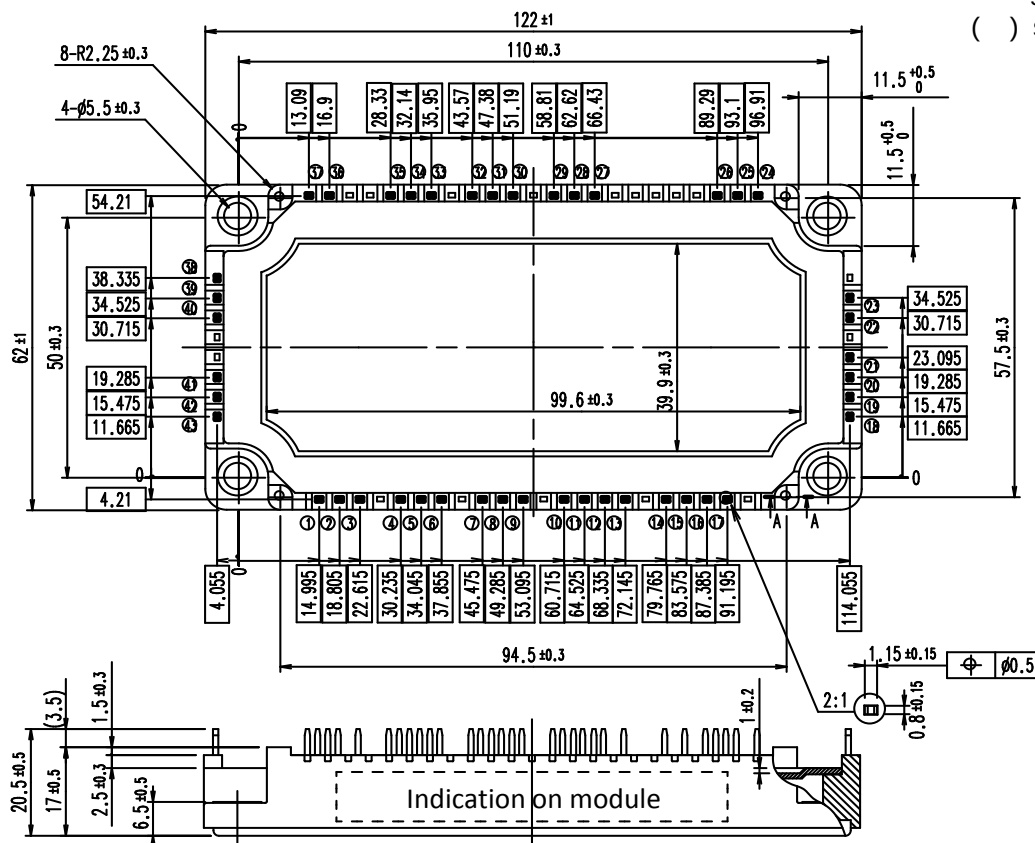
Applications

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

Typical appearance

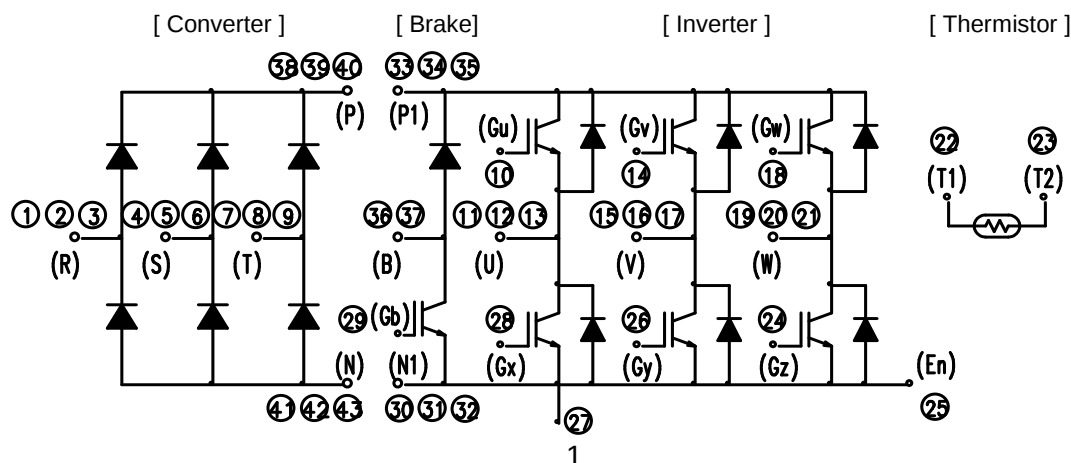


Outline drawing (Unit : mm)



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
			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 current	$T_c=80^{\circ}\text{C}$	150	A
		Surge current (Non-Repetitive) (*1)	I_{FSM}	$t=10\text{ms}$, Half sine wave form	$T_{vj}=25^{\circ}\text{C}$	1440	A
	$T_{vj}=150^{\circ}\text{C}$				1260		
	I^2t (Non-Repetitive) (*1)	I^2t	$T_{vj}=25^{\circ}\text{C}$		10400	A ² s	
			$T_{vj}=150^{\circ}\text{C}$		8000		
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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□ 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}	$V_{GE} = 0V$ $V_{CE} = 650V$		-	-	50	μA
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0V \quad V_{GE} = +20/-20V$		-	-	100	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 150mA$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 150A$	$T_{Vj}=25^{\circ}C$	-	1.65	2.10	V
		$V_{CE(sat)}$ (chip)		$T_{Vj}=25^{\circ}C$	-	1.30	1.75	
				$T_{Vj}=125^{\circ}C$	-	1.45	-	
				$T_{Vj}=150^{\circ}C$	-	1.50	-	
				$T_{Vj}=175^{\circ}C$	-	1.55	-	
	Internal Gate resistance	r_g	-		-	4.5	-	Ω
	Capacitance	C_{ies}	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$		-	17.2	-	nF
		C_{oes}			-	0.66	-	
		C_{res}			-	0.23	-	
	Gate charge	Q_G	$V_{CC} = 300V \quad V_{GE} = -15 \rightarrow +15V$ $I_C = 150A$		-	1200	-	nC
	Forward voltage	V_F (terminal)	$I_F = 150A$	$T_{Vj}=25^{\circ}C$	-	1.90	2.35	V
		V_F (chip)		$T_{Vj}=25^{\circ}C$	-	1.55	2.00	
				$T_{Vj}=125^{\circ}C$	-	1.50	-	
				$T_{Vj}=150^{\circ}C$	-	1.50	-	
$T_{Vj}=175^{\circ}C$				-	1.45	-		
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 18 \Omega$	$T_{Vj}=25^{\circ}C$	-	0.48	-	μs	
			$T_{Vj}=125^{\circ}C$	-	0.52	-		
			$T_{Vj}=150^{\circ}C$	-	0.54	-		
			$T_{Vj}=175^{\circ}C$	-	0.52	-		
	t_r	$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 18 \Omega$	$T_{Vj}=25^{\circ}C$	-	0.12	-		
			$T_{Vj}=125^{\circ}C$	-	0.16	-		
			$T_{Vj}=150^{\circ}C$	-	0.16	-		
			$T_{Vj}=175^{\circ}C$	-	0.18	-		
	$t_{d(off)}$	$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 18 \Omega$	$T_{Vj}=25^{\circ}C$	-	0.54	-		
			$T_{Vj}=125^{\circ}C$	-	0.58	-		
			$T_{Vj}=150^{\circ}C$	-	0.59	-		
			$T_{Vj}=175^{\circ}C$	-	0.60	-		
	t_f	$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 18 \Omega$	$T_{Vj}=25^{\circ}C$	-	0.05	-		
$T_{Vj}=125^{\circ}C$			-	0.05	-			
$T_{Vj}=150^{\circ}C$			-	0.06	-			
$T_{Vj}=175^{\circ}C$			-	0.06	-			
Reverse recovery time	t_{rr}	$V_{CC} = 300V$ $I_C, I_F = 150A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 18 \Omega$	$T_{Vj}=25^{\circ}C$	-	0.11	-		
			$T_{Vj}=125^{\circ}C$	-	0.23	-		
			$T_{Vj}=150^{\circ}C$	-	0.24	-		
			$T_{Vj}=175^{\circ}C$	-	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}	$V_{CC} = 300V$	$T_{Vj}=25^{\circ}C$	-	5.94	-	mJ			
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{Vj}=125^{\circ}C$	-	8.59	-				
			$V_{GE} = +15/-15\ V$	$T_{Vj}=150^{\circ}C$	-	9.46	-				
			$R_G = 18\ \Omega$	$T_{Vj}=175^{\circ}C$	-	10.27	-				
		E_{off}	$V_{CC} = 300V$	$T_{Vj}=25^{\circ}C$	-	4.86	-				
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{Vj}=125^{\circ}C$	-	6.19	-				
			$V_{GE} = +15/-15\ V$	$T_{Vj}=150^{\circ}C$	-	6.48	-				
			$R_G = 18\ \Omega$	$T_{Vj}=175^{\circ}C$	-	6.81	-				
		E_{rr}	$V_{CC} = 300V$	$T_{Vj}=25^{\circ}C$	-	0.64	-				
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{Vj}=125^{\circ}C$	-	0.90	-				
			$V_{GE} = +15/-15\ V$	$T_{Vj}=150^{\circ}C$	-	1.12	-				
			$R_G = 18\ \Omega$	$T_{Vj}=175^{\circ}C$	-	1.24	-				
Zero Gate voltage collector current		I_{CES}	$V_{GE} = 0V$ $V_{CE} = 650V$		-	-	50	μA			
Gate-Emitter leakage current		I_{GES}	$V_{CE} = 0V, \ V_{GE} = +20/-20V$		-	-	100	nA			
Collector-Emitter saturation voltage		$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 75A$	$T_{Vj}=25^{\circ}C$	-	1.45	1.95	V			
		$V_{CE(sat)}$ (chip)		$T_{Vj}=25^{\circ}C$	-	1.30	1.75				
				$T_{Vj}=125^{\circ}C$	-	1.45	-				
				$T_{Vj}=150^{\circ}C$	-	1.50	-				
				$T_{Vj}=175^{\circ}C$	-	1.55	-				
Internal Gate resistance		r_g	-		-	0	-	Ω			
Brake	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$	$T_{Vj}=25^{\circ}C$	-	0.35	-	μs			
			$I_C = 75A \ L_s = 30nH$	$T_{Vj}=125^{\circ}C$	-	0.34	-				
			$V_{GE} = +15/-15\ V$	$T_{Vj}=150^{\circ}C$	-	0.36	-				
			$R_G = 43\ \Omega$	$T_{Vj}=175^{\circ}C$	-	0.34	-				
		t_r	$V_{CC} = 300V$	$T_{Vj}=25^{\circ}C$	-	0.12	-				
			$I_C = 75A \ L_s = 30nH$	$T_{Vj}=125^{\circ}C$	-	0.14	-				
			$V_{GE} = +15/-15\ V$	$T_{Vj}=150^{\circ}C$	-	0.16	-				
			$R_G = 43\ \Omega$	$T_{Vj}=175^{\circ}C$	-	0.15	-				
		$t_{d(off)}$	$V_{CC} = 300V$	$T_{Vj}=25^{\circ}C$	-	0.47	-				
			$I_C = 75A \ L_s = 30nH$	$T_{Vj}=125^{\circ}C$	-	0.52	-				
			$V_{GE} = +15/-15\ V$	$T_{Vj}=150^{\circ}C$	-	0.52	-				
			$R_G = 43\ \Omega$	$T_{Vj}=175^{\circ}C$	-	0.53	-				
		t_f	$V_{CC} = 300V$	$T_{Vj}=25^{\circ}C$	-	0.04	-				
			$I_C = 75A \ L_s = 30nH$	$T_{Vj}=125^{\circ}C$	-	0.05	-				
			$V_{GE} = +15/-15\ V$	$T_{Vj}=150^{\circ}C$	-	0.04	-				
			$R_G = 43\ \Omega$	$T_{Vj}=175^{\circ}C$	-	0.04	-				
		Reverse current		I_{RRM}	$V_R = 650V$		-		-	50	μA
		Forward voltage		V_F (terminal)	$I_F = 50A$	$T_{Vj}=25^{\circ}C$	-		1.70	2.20	V
				V_F (chip)	$I_F = 50A$	$T_{Vj}=25^{\circ}C$	-		1.55	2.00	
	$T_{Vj}=125^{\circ}C$				-	1.50	-				
	$T_{Vj}=150^{\circ}C$				-	1.50	-				
	$T_{Vj}=175^{\circ}C$				-	1.45	-				
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.

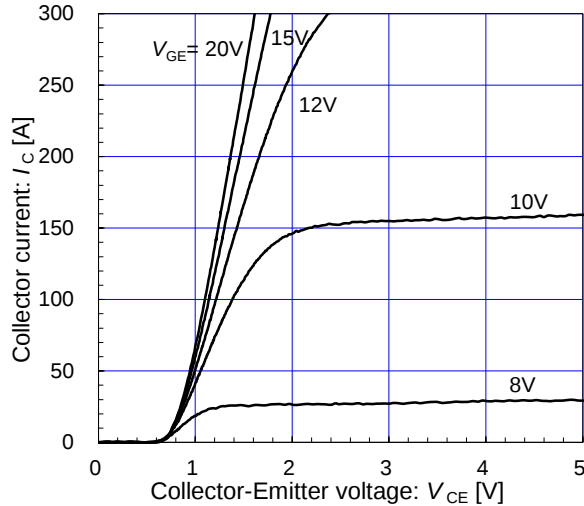
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IGBT Modules

[Inverter]

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

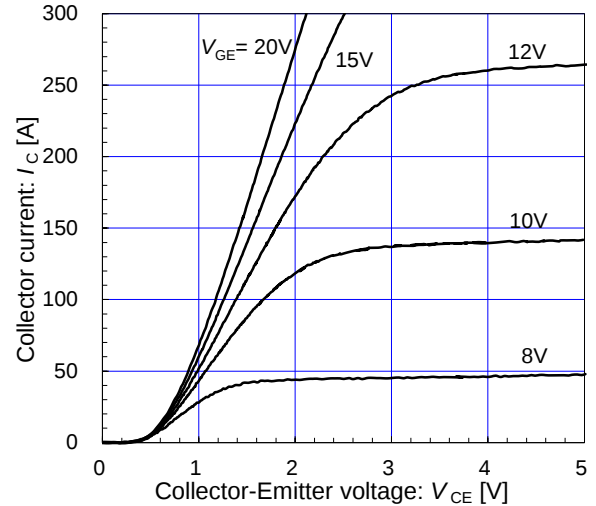
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

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

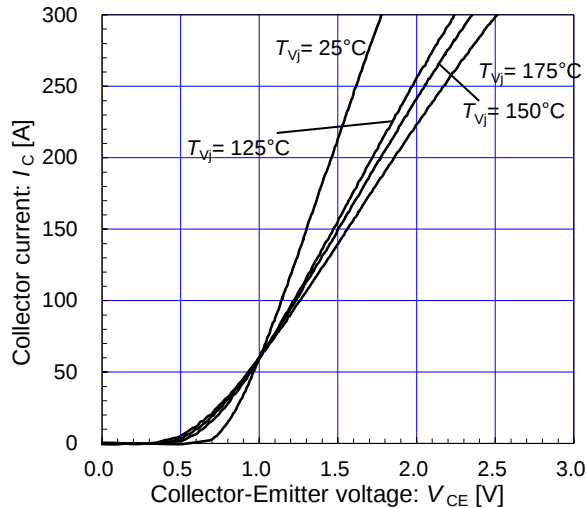
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Inverter]

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

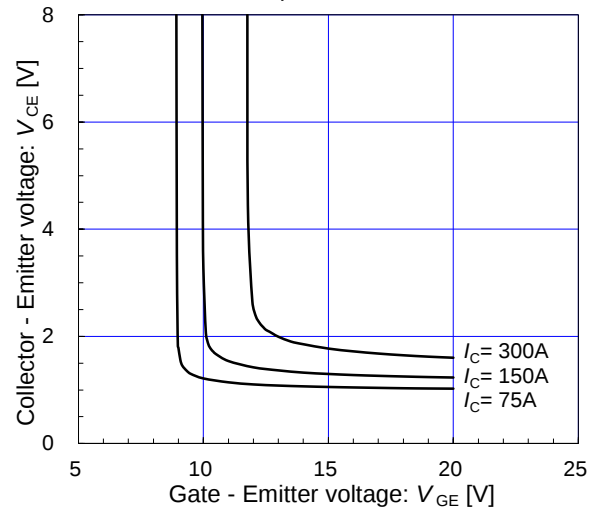
$V_{GE} = 15\text{V}$ / chip



[Inverter]

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

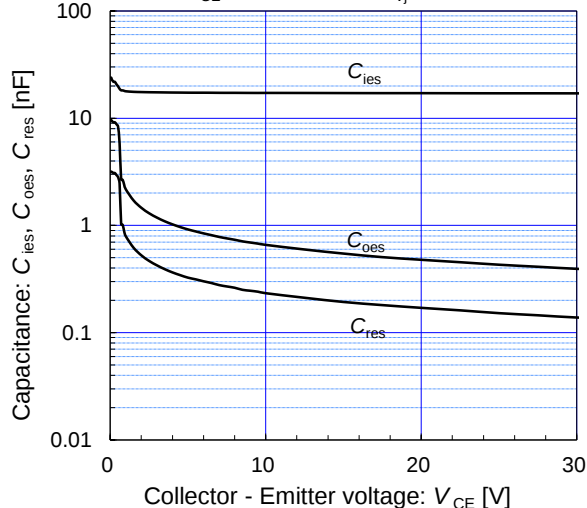
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emittor voltage (typ.)

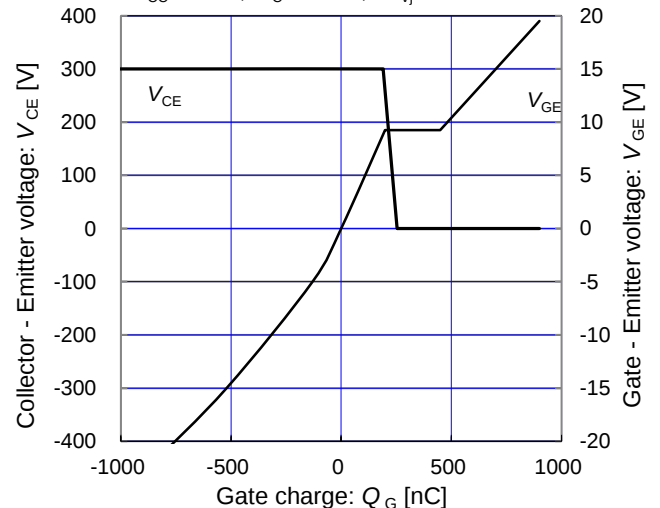
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Inverter]

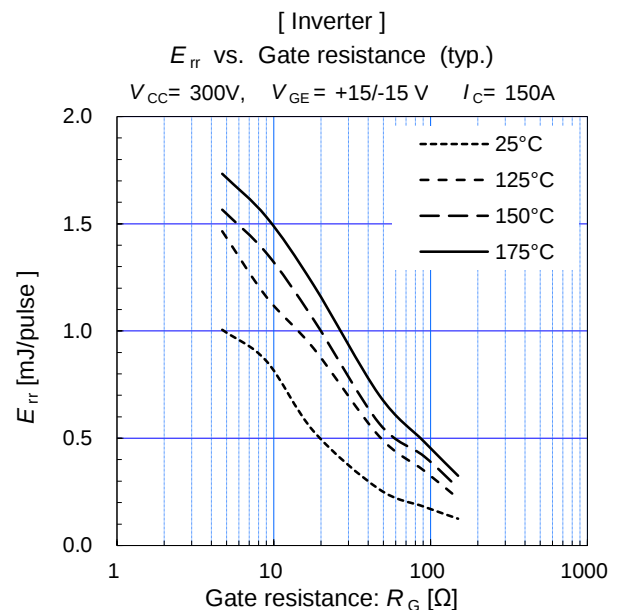
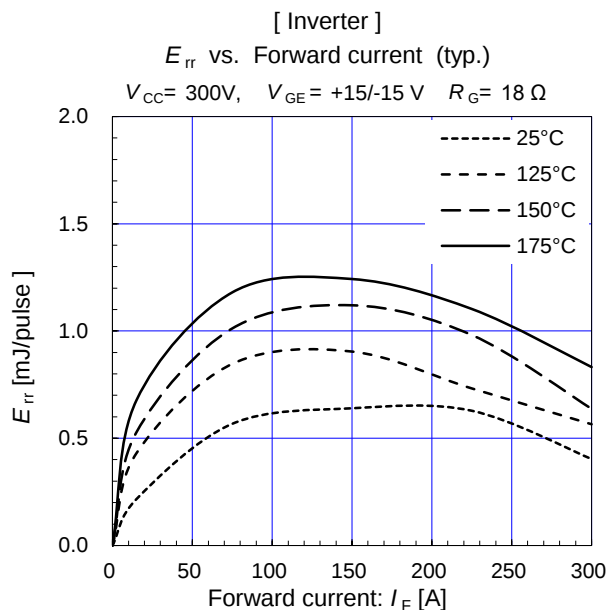
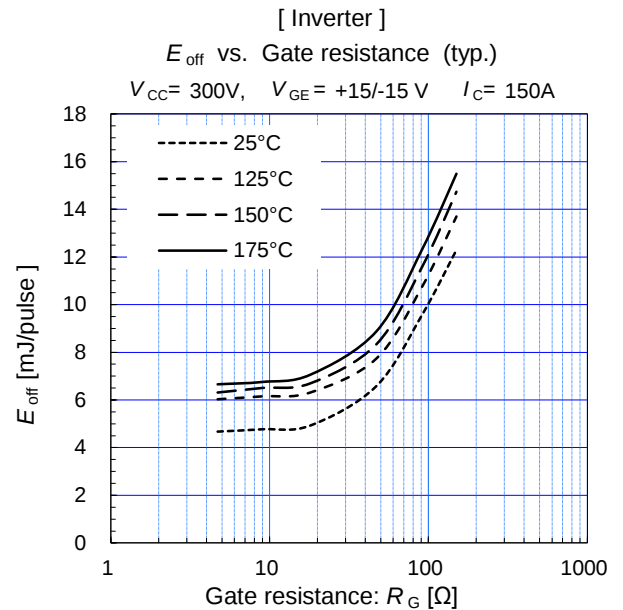
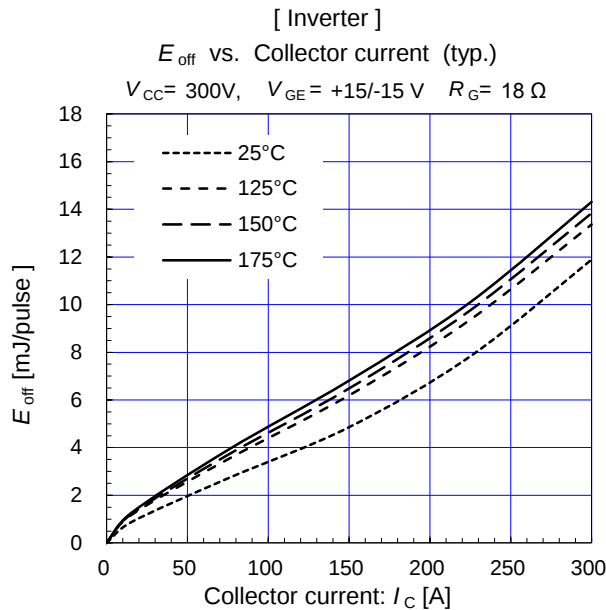
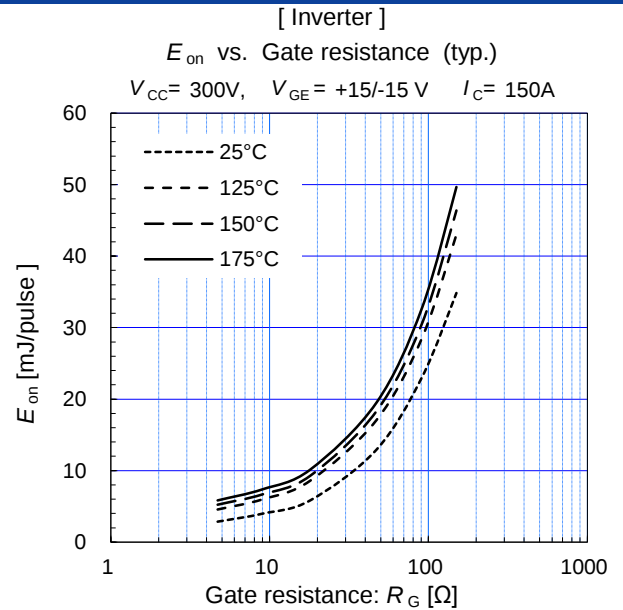
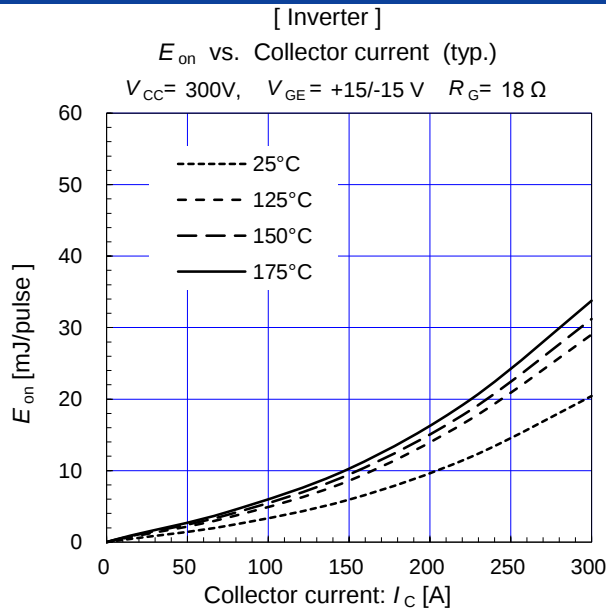
Dynamic Gate charge (typ.)

$V_{CC} = 300\text{V}$, $I_c = 150\text{A}$, $T_{vj} = 25^{\circ}\text{C}$



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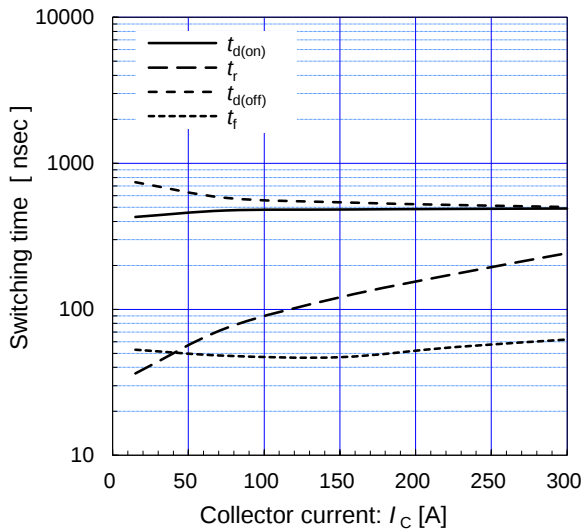
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

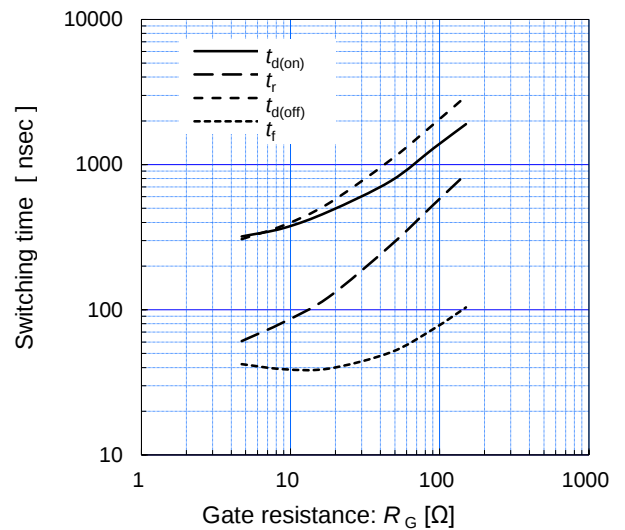
$V_{CC} = 300V$, $R_G = 18\Omega$ $V_{GE} = +15/-15V$, $T_{Vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

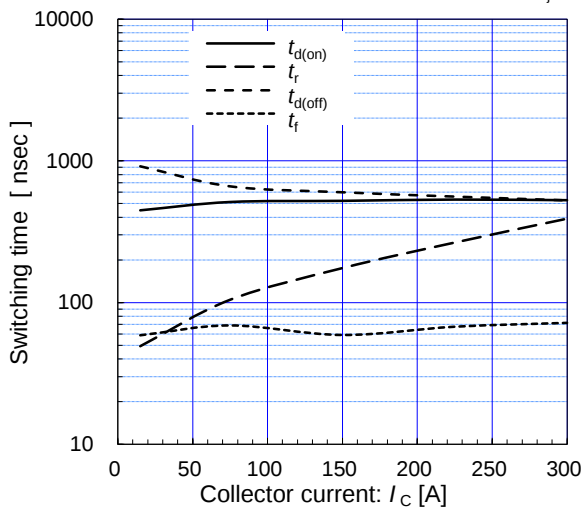
$V_{CC} = 300V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_{Vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

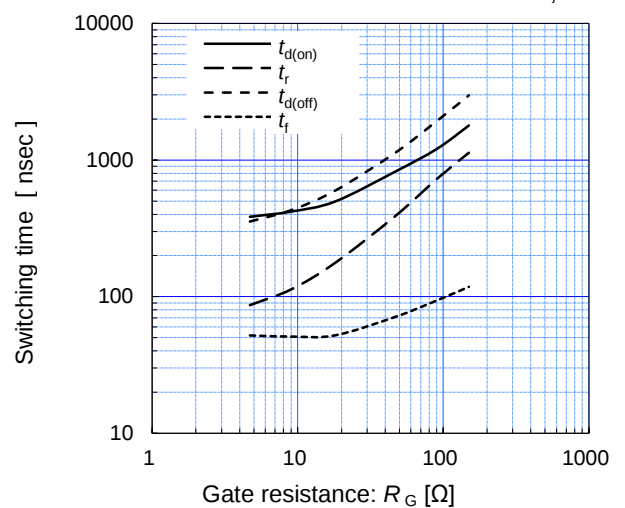
$V_{CC} = 300V$, $R_G = 18\Omega$ $V_{GE} = +15/-15V$, $T_{Vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

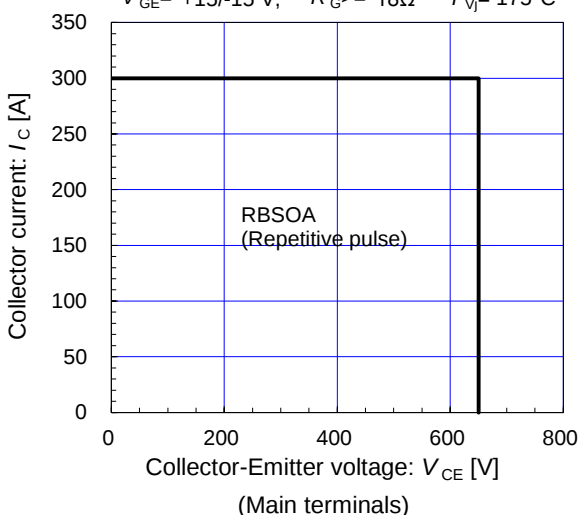
$V_{CC} = 300V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_{Vj} = 175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

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

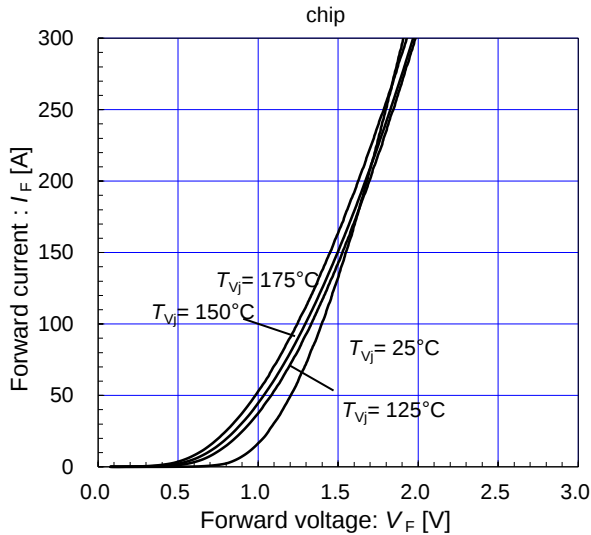


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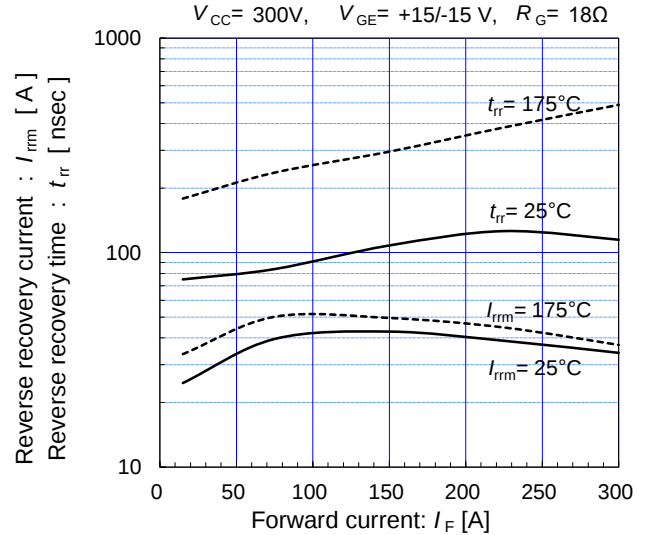
[Inverter]

Forward current vs. Forward voltage (typ.)



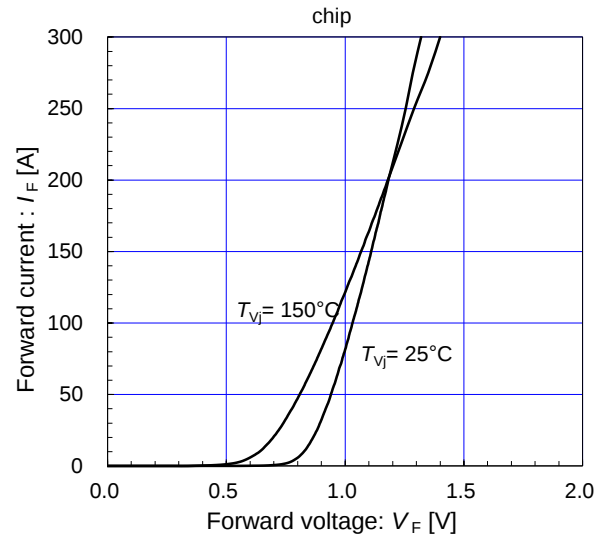
[Inverter]

Reverse recovery characteristics (typ.)

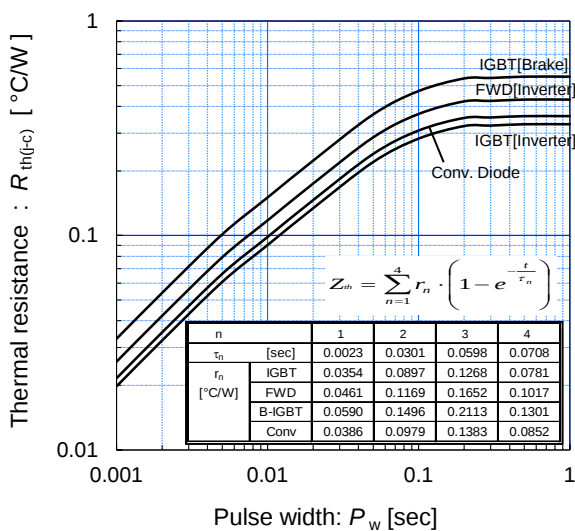


[Converter]

Forward current vs. Forward voltage (typ.)

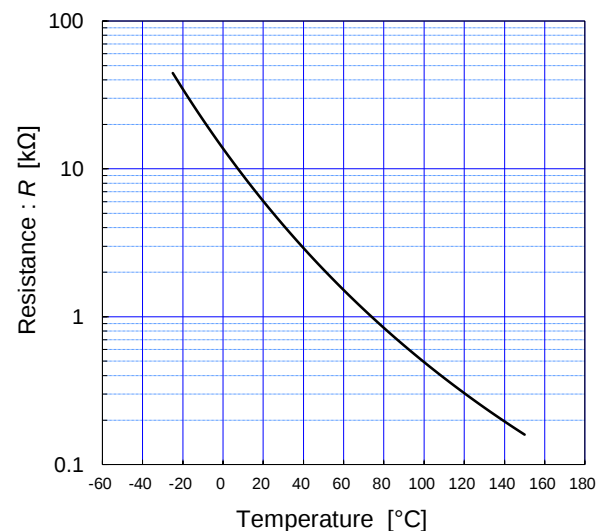


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



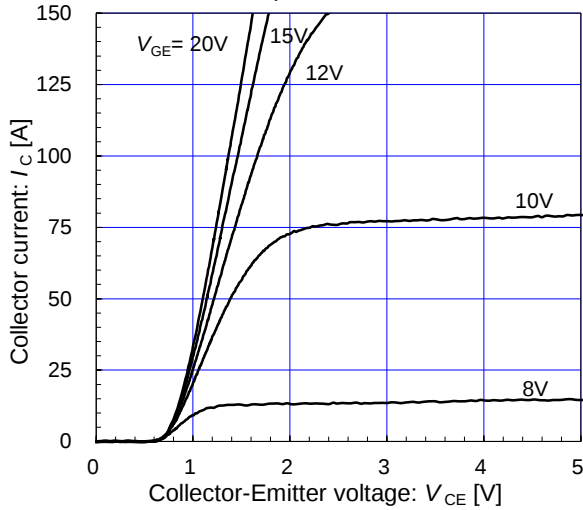
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[Brake]

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

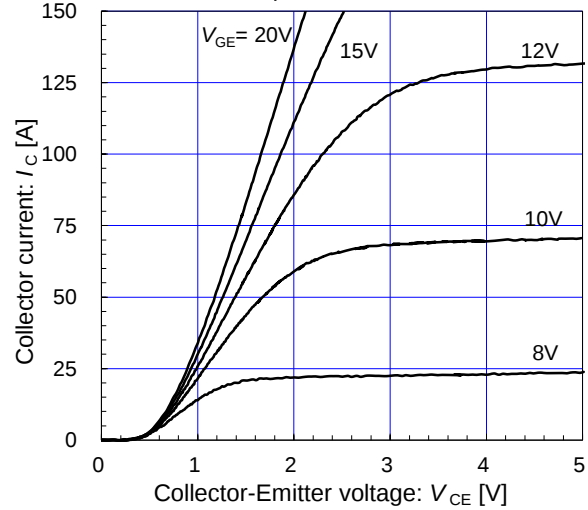
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

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

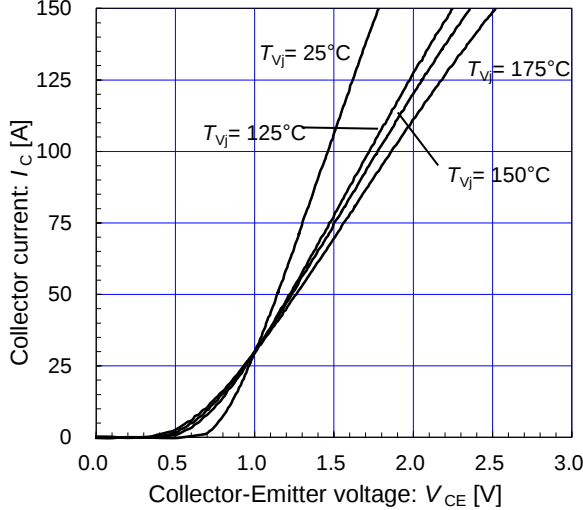
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Brake]

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

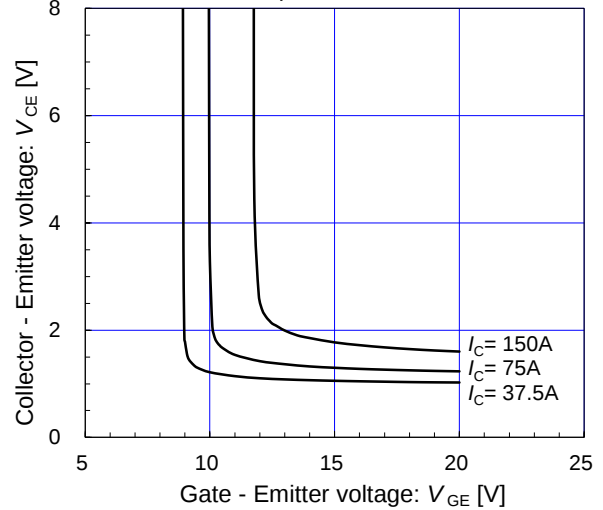
$V_{GE} = 15\text{V}$ / chip



[Brake]

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

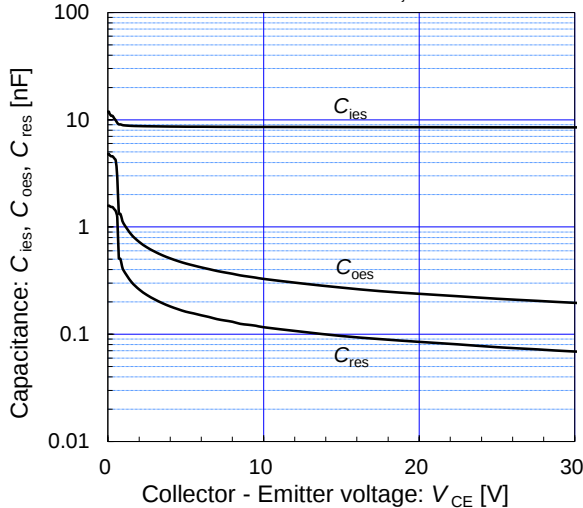
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emittor voltage (typ.)

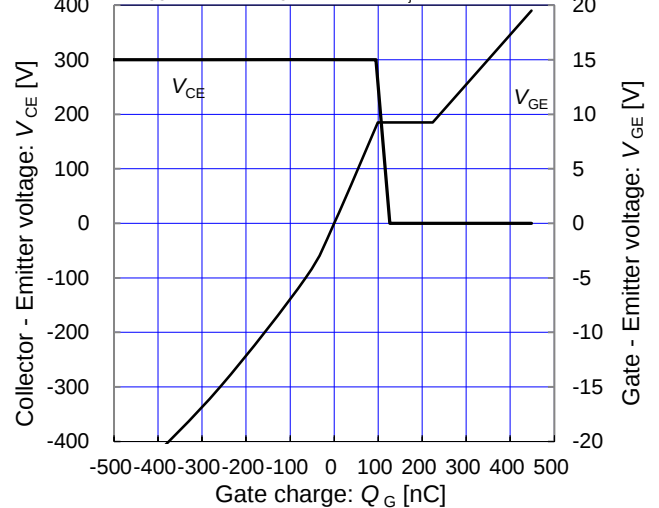
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Brake]

Dynamic Gate charge (typ.)

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



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