

7MBR150XXE120-50

IGBT Modules

Power Module(X series)
1200V / 150A / PIM

■ Features

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

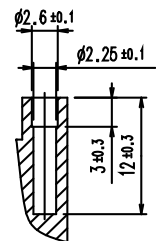
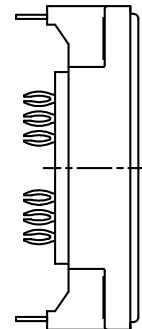
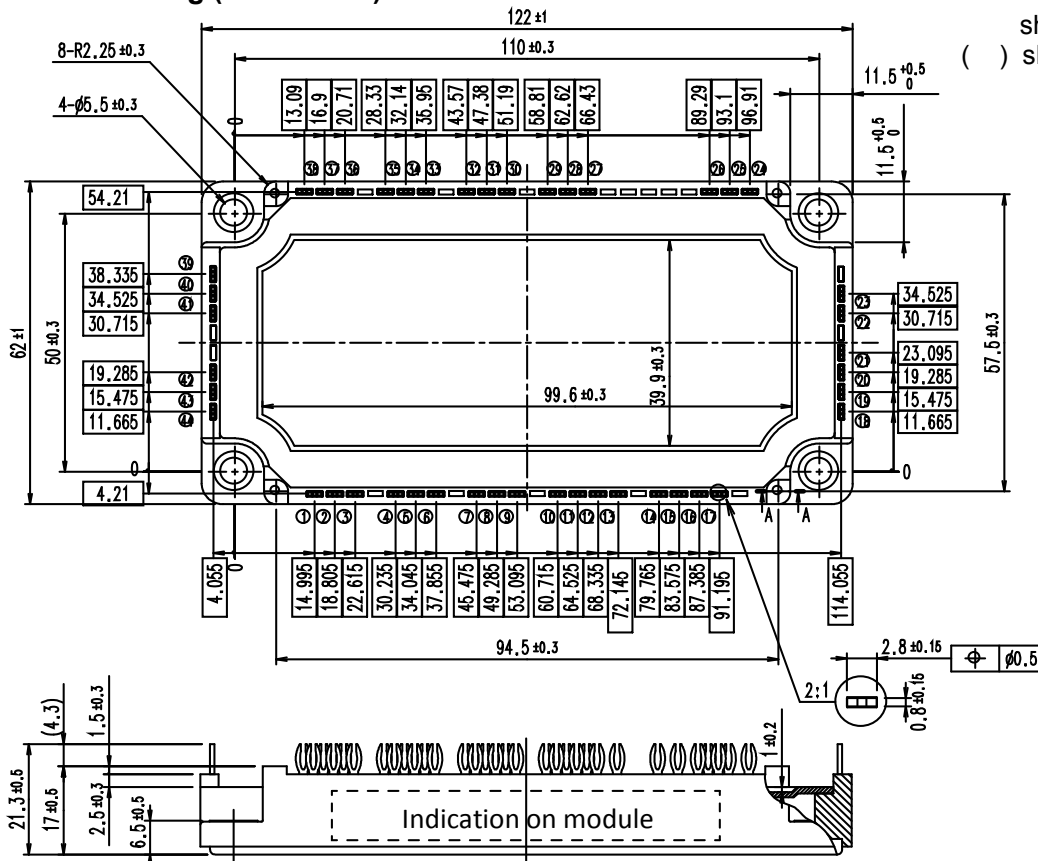
■ Typical appearance



■ Applications

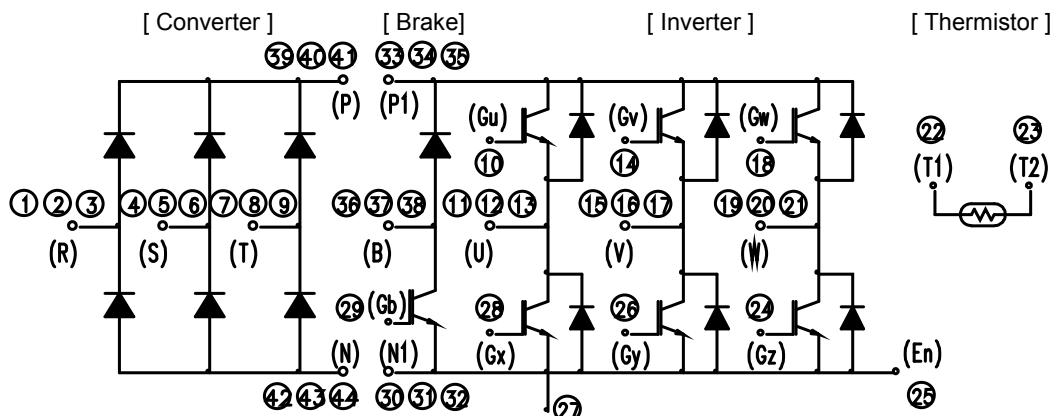
- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply

■ Outline drawing (Unit : mm)



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}			1200	V
	Gate-Emitter voltage	V_{GES}			±20	V
	Collector current	I_C	Continuous	$T_c=100^{\circ}\text{C}$	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		880	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		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	$T_c=80^{\circ}\text{C}$	150	A
	Surge current (Non-Repetitive) (*1)	I_{FSM}	$t=10\text{ms}$, Half sine wave form	$T_{vj}=25^{\circ}\text{C}$	1650	A
				$T_{vj}=150^{\circ}\text{C}$	1400	
	I^2t (Non-Repetitive) (*1)	I^2t		$T_{vj}=25^{\circ}\text{C}$	13540	A ² s
				$T_{vj}=150^{\circ}\text{C}$	9800	
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.	
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	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 150\text{mA}$		6.0	6.5	7.0	V
Collector-Emitter saturation voltage	$V_{\text{CE(sat)}}$ (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 150\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.95	2.45	V
	$V_{\text{CE(sat)}}$ (chip)		$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.50	1.95	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	1.85	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	1.95	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	2.00	-	
Internal Gate resistance	r_{g}	-		-	3.8	-	Ω
Capacitance	C_{ies}	$V_{\text{CE}} = 10\text{V}$, $V_{\text{GE}} = 0\text{V}$, $f = 1\text{MHz}$		-	16.0	-	nF
	C_{oes}			-	0.55	-	
	C_{res}			-	0.14	-	
Gate charge	Q_{G}	$V_{\text{CC}} = 600\text{V}$ $V_{\text{GE}} = -15 \rightarrow +15\text{V}$ $I_{\text{C}} = 150\text{A}$		-	1000	-	nC
Forward voltage	V_{F} (terminal)	$I_{\text{F}} = 150\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	2.25	2.75	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)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 4.7\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.23	-	μs
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.26	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.26	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.28	-	
	t_{r}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 4.7\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.06	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.07	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.07	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.08	-	
	$t_{\text{d(off)}}$	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 4.7\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.30	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.34	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.35	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.36	-	
	t_{f}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 4.7\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.10	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.17	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.18	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.21	-	
Reverse recovery time	t_{rr}	$V_{\text{CC}} = 600\text{V}$ $I_{\text{C}}, I_{\text{F}} = 150\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 4.7\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.13	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.22	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.24	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.26	-	

(*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}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	12.04	-	mJ
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	17.56	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	19.19	-	
			$R_G = 4.7\ \Omega$	$T_{vj}=175^{\circ}C$	-	20.75	-	
		E_{off}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	10.37	-	
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	13.67	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	14.30	-	
			$R_G = 4.7\ \Omega$	$T_{vj}=175^{\circ}C$	-	14.89	-	
		E_{rr}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	4.36	-	
			$I_C, I_F = 150A \ L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	7.92	-	
			$V_{GE} = +15/-15\ V$	$T_{vj}=150^{\circ}C$	-	8.77	-	
			$R_G = 4.7\ \Omega$	$T_{vj}=175^{\circ}C$	-	9.40	-	
Zero Gate voltage collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	50	μA	
Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0V, \ V_{GE} = +20/-20V$		-	-	100	nA	
Brake	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 75A$	$T_{vj}=25^{\circ}C$	-	1.75	2.20	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	-		-	8	-	Ω
	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	2.50	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}	$I_F = 150A$	terminal	-	1.50	2.00	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	K

(*1) Turn on time (t_{on}) = $t_{d(on)} + t_r$, Turn off time (t_{off}) = $t_{d(off)} + t_f$
FM6M01810a

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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	-	-	0.17	°C/W
		Inverter FWD	-	-	0.21	
		Brake IGBT	-	-	0.45	
		Brake FWD	-	-	0.86	
		Converter Diode	-	-	0.30	
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.

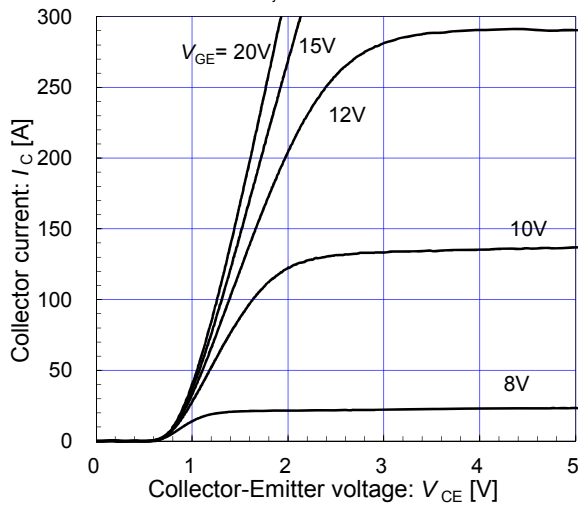
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IGBT Modules

[Inverter]

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

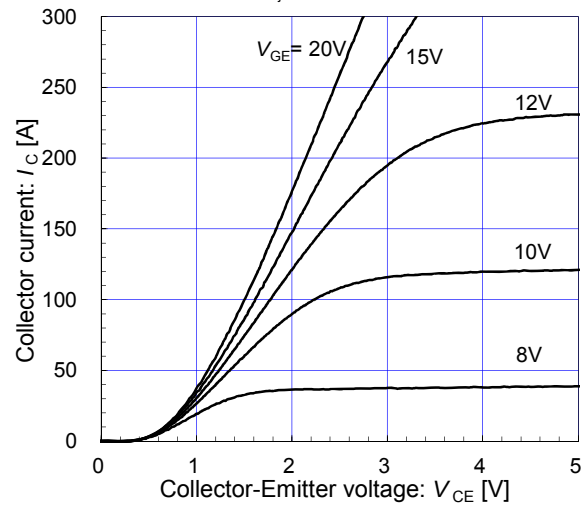
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

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

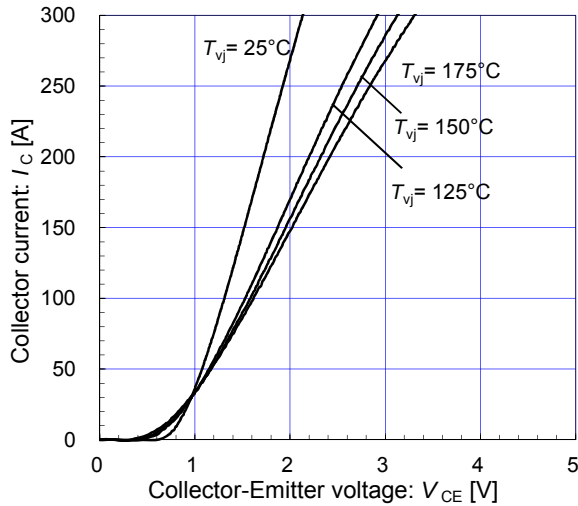
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Inverter]

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

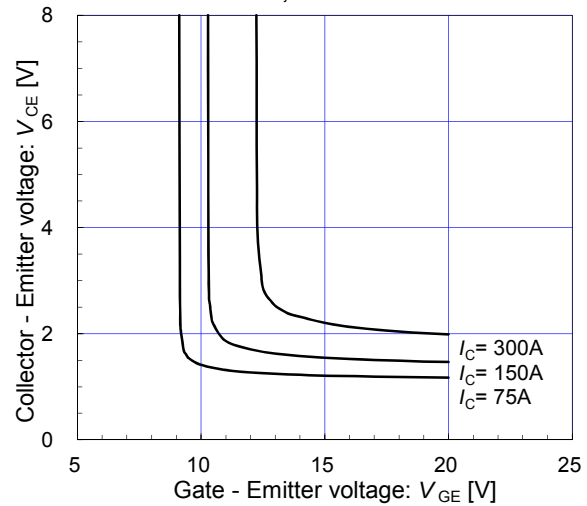
$V_{GE} = 15\text{V}$ / chip



[Inverter]

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

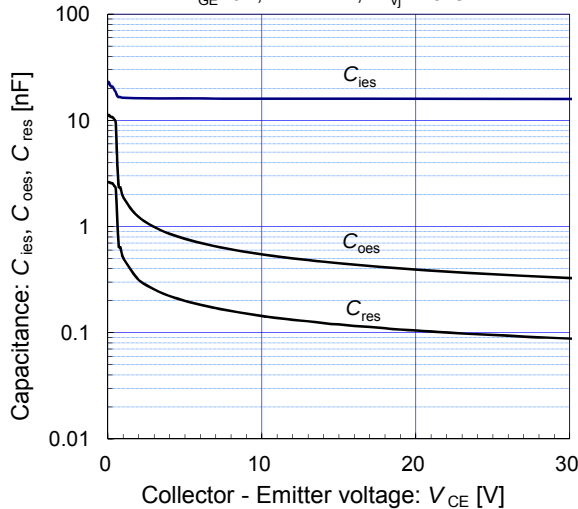
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emittor voltage (typ.)

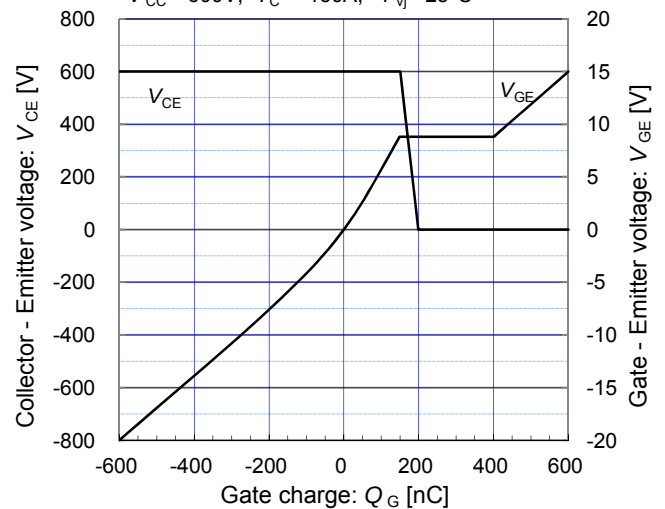
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Inverter]

Dynamic Gate charge (typ.)

$V_{CC} = 600\text{V}$, $I_c = 150\text{A}$, $T_{vj} = 25^{\circ}\text{C}$



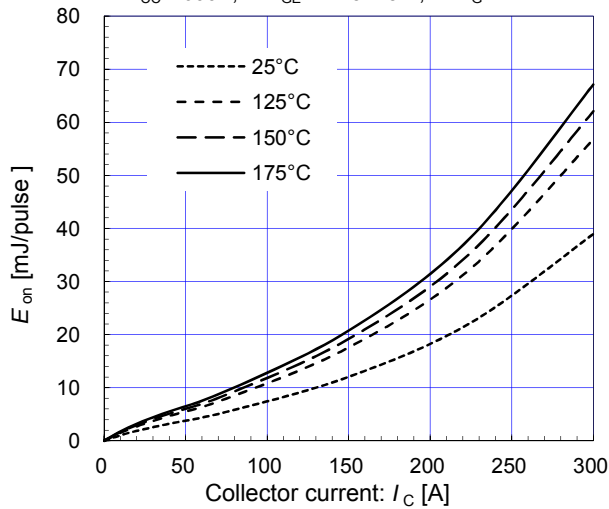
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[Inverter]

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

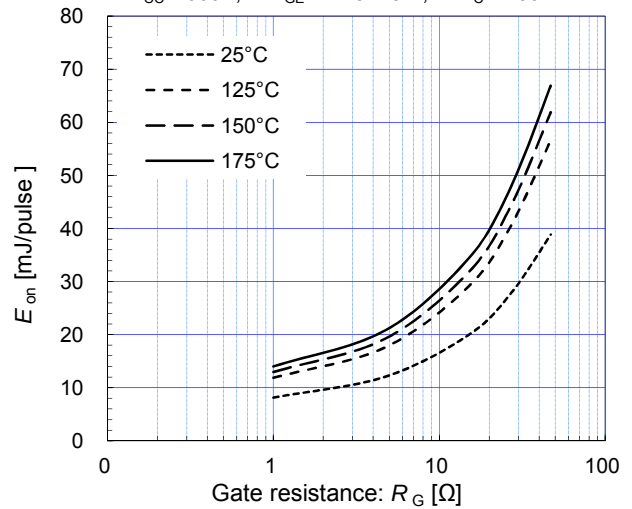
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $R_G=4.7\Omega$



[Inverter]

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

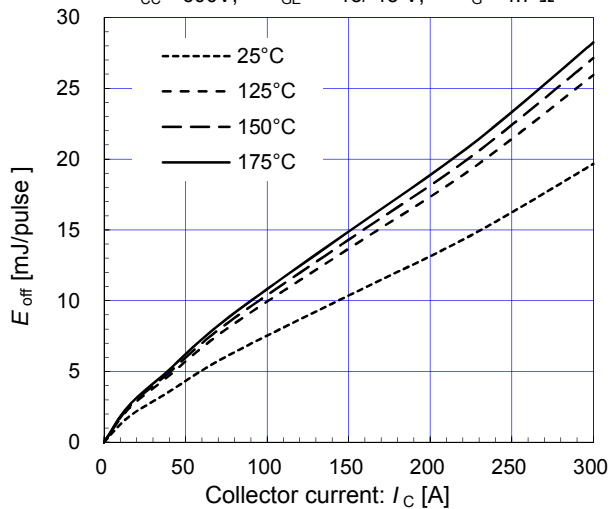
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $I_C=150A$



[Inverter]

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

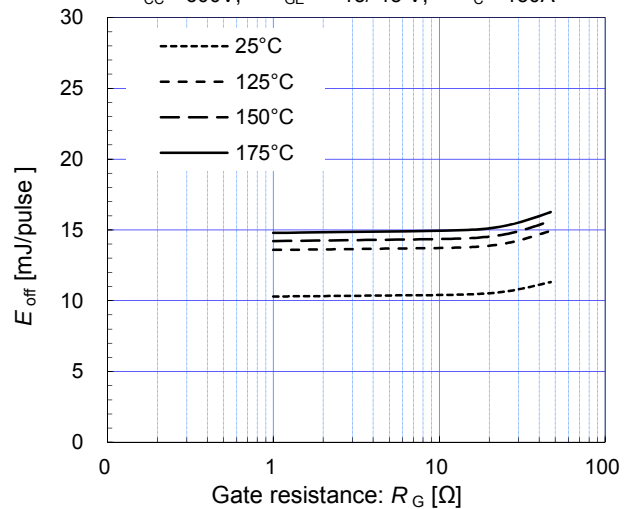
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $R_G=4.7\Omega$



[Inverter]

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

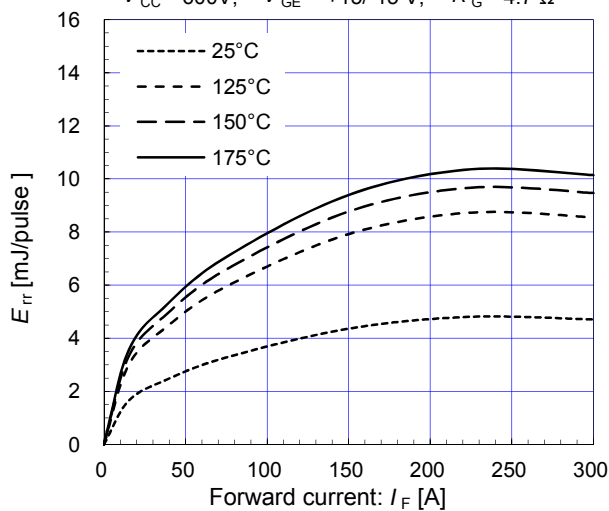
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $I_C=150A$



[Inverter]

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

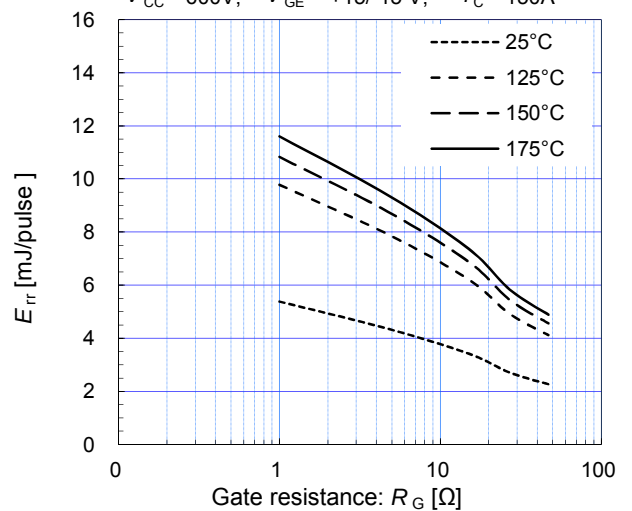
$V_{CC}=600V$, $V_{GE}=+15/-15V$, $R_G=4.7\Omega$



[Inverter]

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

$V_{CC}=600V$, $V_{GE}=+15/-15V$, $I_C=150A$



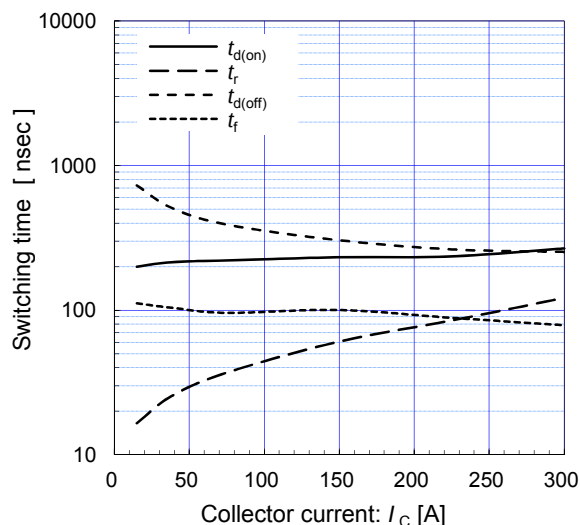
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[Inverter]

Switching time vs. Collector current (typ.)

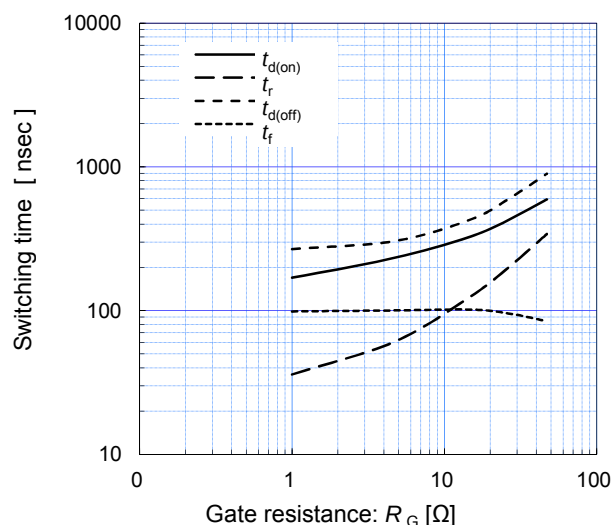
$V_{CC} = 600V$, $R_G = 4.7\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

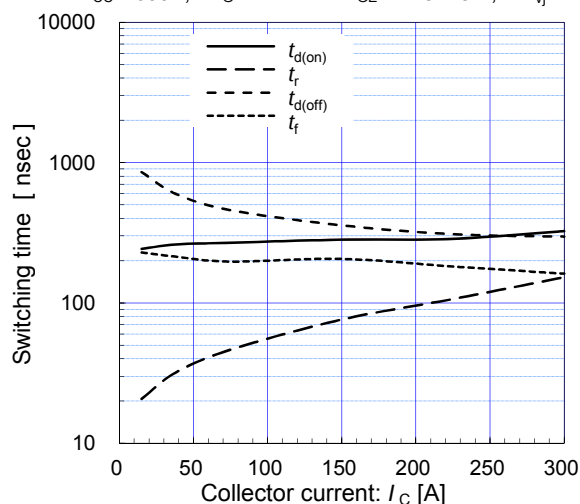
$V_{CC} = 600V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

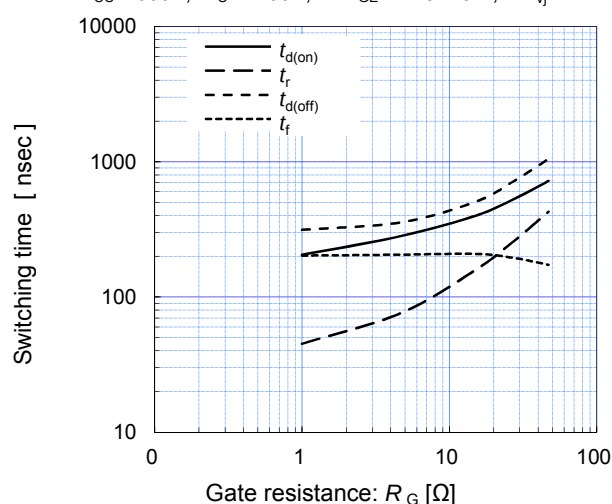
$V_{CC} = 600V$, $R_G = 4.7\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

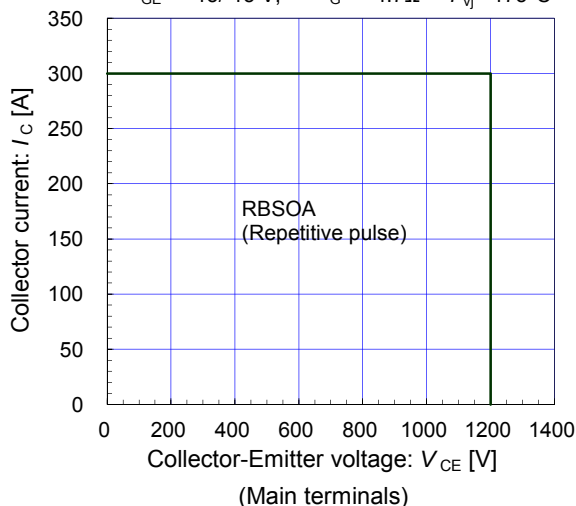
$V_{CC} = 600V$, $I_C = 150A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$, $R_G \geq 4.7\Omega$ $T_{vj} = 175^\circ C$

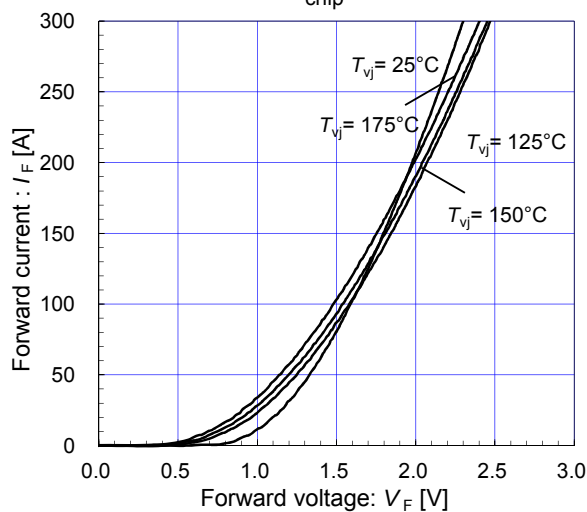


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[Inverter]

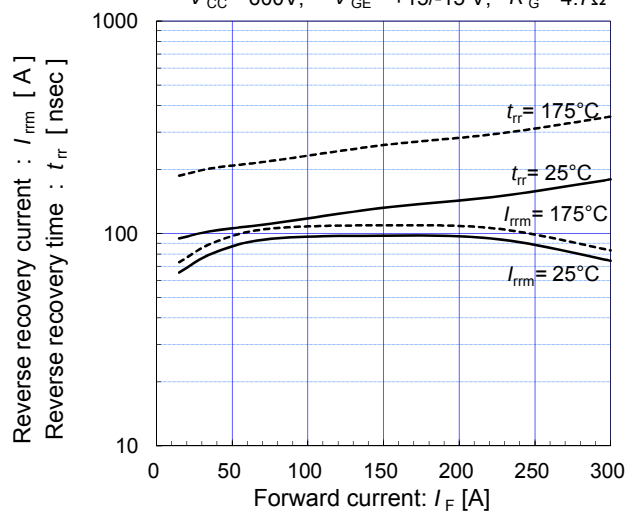
Forward current vs. Forward voltage (typ.)
chip



[Inverter]

Reverse recovery characteristics (typ.)

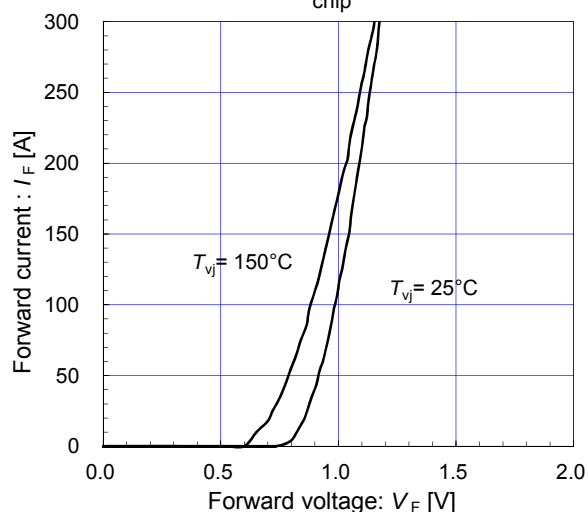
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = 4.7\Omega$



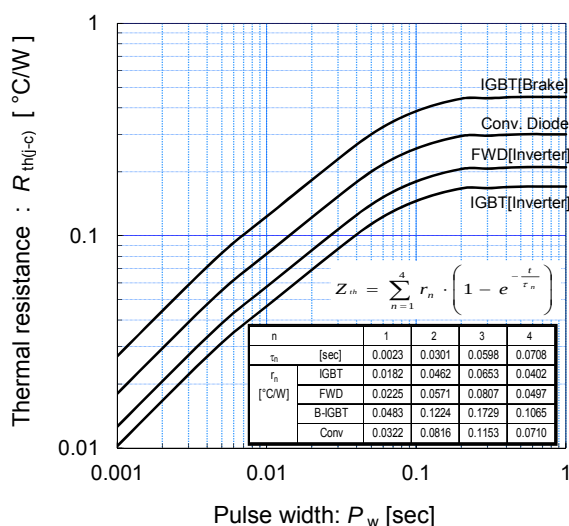
[Converter]

Forward current vs. Forward voltage (typ.)

chip

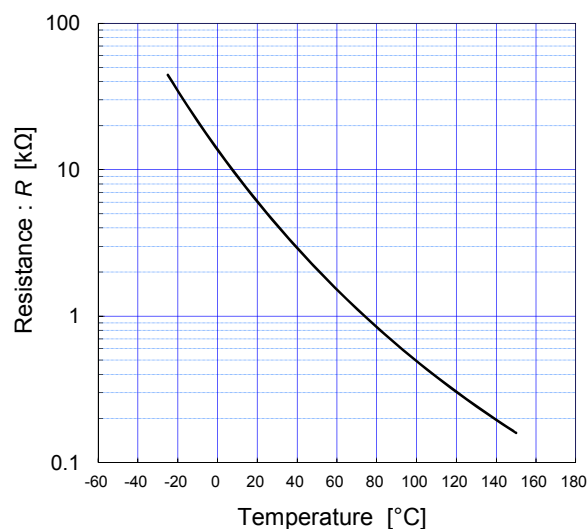


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



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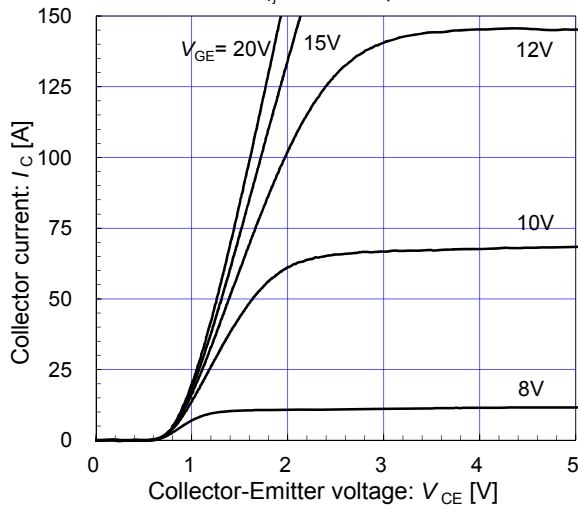
7MBR150XXE120-50

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[Brake]

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

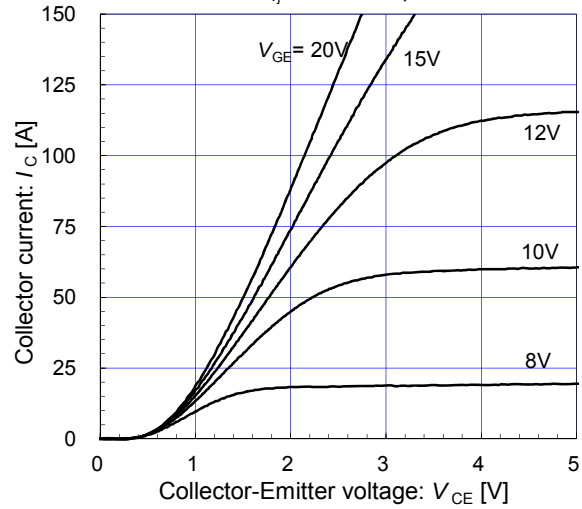
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

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

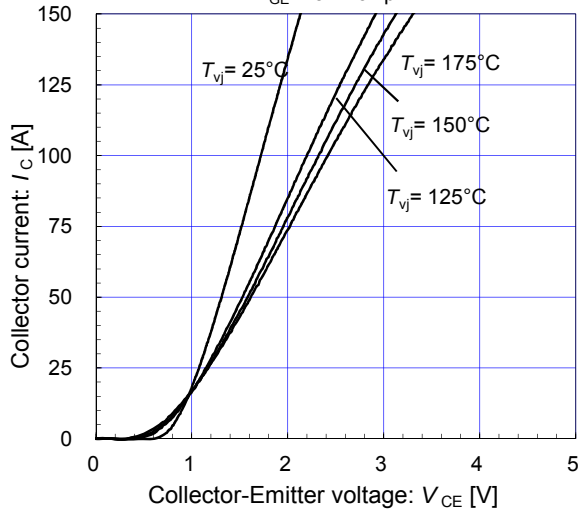
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Brake]

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

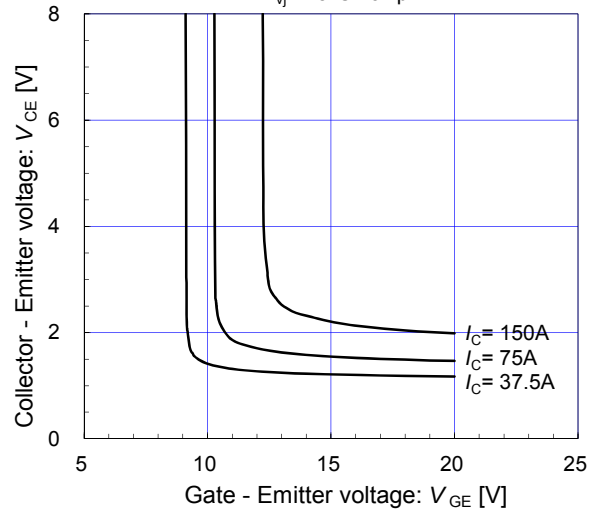
$V_{GE} = 15\text{V}$ / chip



[Brake]

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

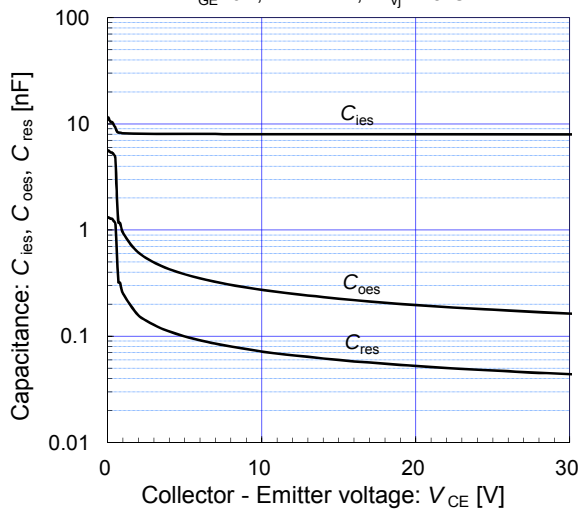
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emittor voltage (typ.)

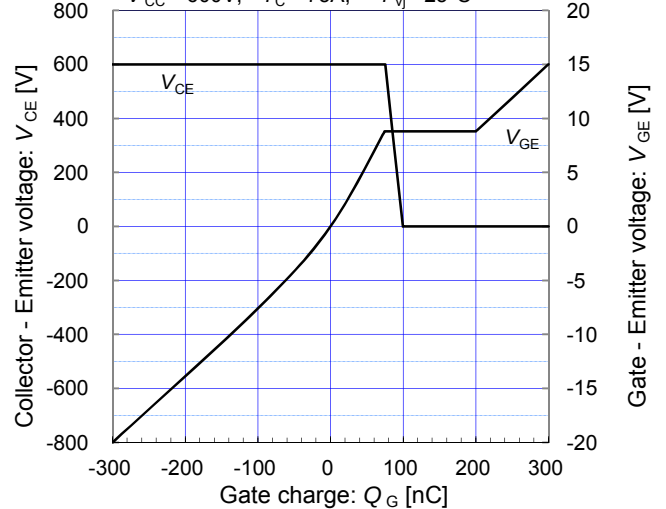
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[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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