

7MBR10XKC065-50

IGBT Modules

Power Module(X series)
650V / 10A / PIM

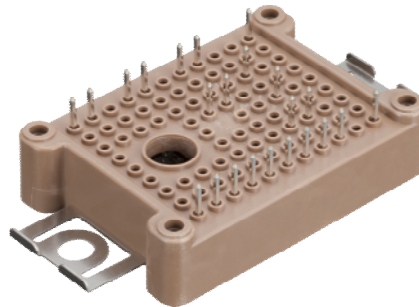
■ Features

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

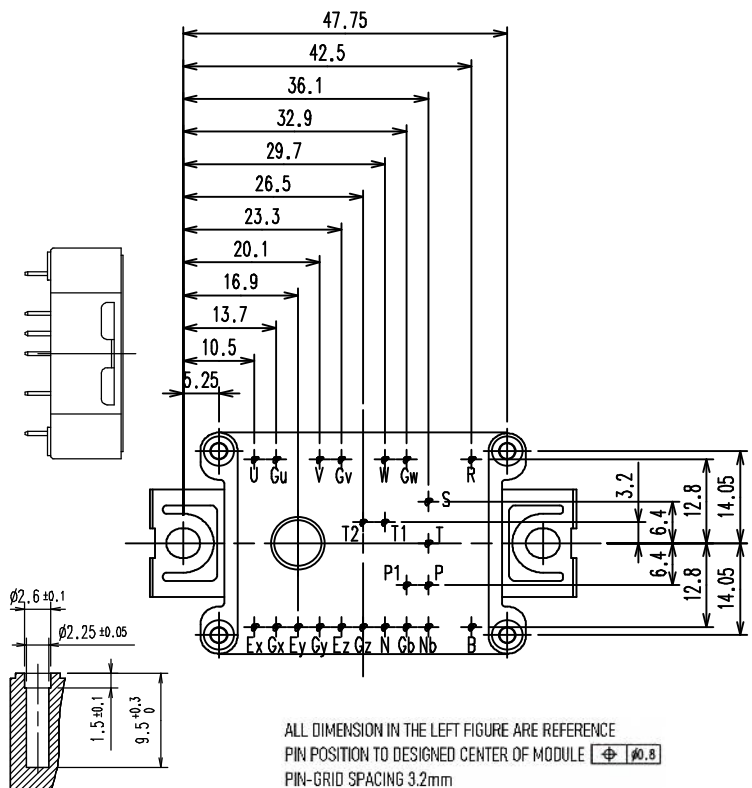
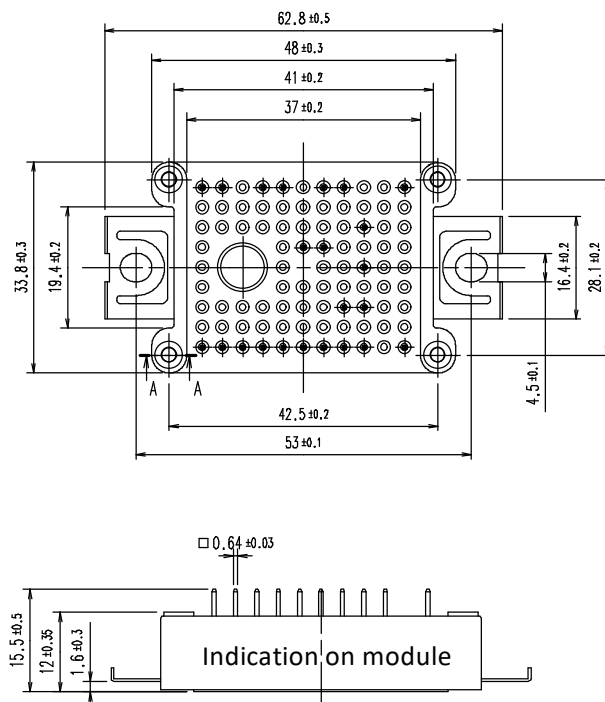
■ Applications

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

■ Typical appearance



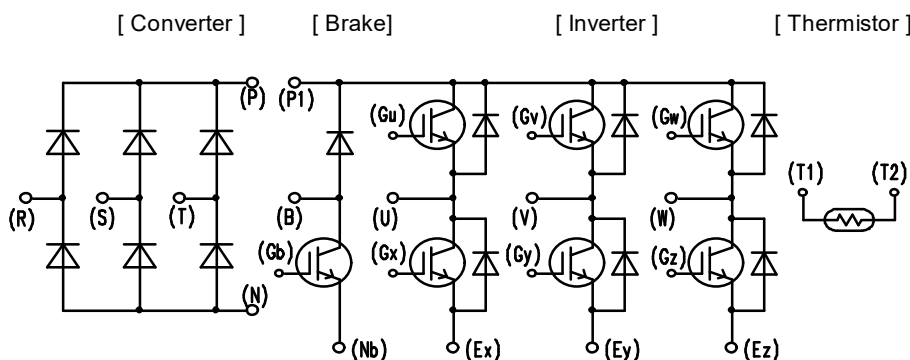
■ Outline drawing (Unit : mm)



断面 A-A (1.5 : 1)
SECTION A-A

Weight: 25 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, Gate-Emitter short-circuited	V_{CES}			650	V
	Gate-Emitter voltage, Collector-Emitter short-circuited	V_{GES}			± 20	V
	Collector current	I_C	Continuous	$T_c = 100^\circ\text{C}$	10	A
	Repetitive peak collector current	I_{CRM}	1ms		20	
	Forward current	I_F	Continuous		10	
	Repetitive peak forward current	I_{FRM}	1ms		20	
	Total power dissipation	P_{tot}	1 device		90	W
Brake IGBT	Collector-Emitter voltage, Gate-Emitter short-circuited	V_{CES}			650	V
	Gate-Emitter voltage, Collector-Emitter short-circuited	V_{GES}			± 20	V
	Collector current	I_C	Continuous	$T_c = 100^\circ\text{C}$	10	A
	Repetitive peak collector current	I_{CRM}	1ms		20	
Brake FWD	Total power dissipation	P_{tot}	1 device		90	W
	Forward current	I_F	Continuous		10	A
	Repetitive peak forward current	I_{FRM}	1ms		20	
Converter	Repetitive peak reverse voltage	V_{RRM}			650	V
	Repetitive peak reverse voltage	V_{RRM}			800	V
	Average output current	I_O	Three-phase full wave rectified current	$T_c = 80^\circ\text{C}$	10	A
	Surge current (Non-Repetitive) (*1)	I_{FSM}	$t = 10\text{ms}$, Half sine wave form	$T_{vj} = 25^\circ\text{C}$	390	A
				$T_{vj} = 150^\circ\text{C}$	340	
	I^2t (Non-Repetitive) (*1)	I^2t		$T_{vj} = 25^\circ\text{C}$	760	A^2s
				$T_{vj} = 150^\circ\text{C}$	585	
Virtual junction temperature		T_{vj}	Inverter, Brake		175	$^\circ\text{C}$
			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) between thermistor and others (*3)	V_{isol}	A.C. : 1min.		2500	Vrms
Screw torque	Mounting torque of screws to heat sink	M_s	M4		1.3 ~ 1.7	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.

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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.	
Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	$V_{\text{GE}} = 0\text{V}$ $V_{\text{CE}} = 650\text{V}$		-	-	50	μA
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{\text{CE}} = 0\text{V}$ $V_{\text{GE}} = +20/-20\text{V}$		-	-	100	nA
Gate-Emitter threshold voltage	$V_{\text{GE(th)}}$	$V_{\text{CE}} = 20\text{V}$ $I_{\text{C}} = 10\text{mA}$		6.0	6.5	7.0	V
Collector-Emitter saturation voltage	$V_{\text{CE(sat)}}$ (terminal)	$V_{\text{GE}} = 15\text{V}$ $I_{\text{C}} = 10\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.40	1.85	V
	$V_{\text{CE(sat)}}$ (chip)		$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.30	1.75	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	1.45	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	1.50	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	1.55	-	
Internal gate resistance	r_{g}	-		-	0	-	Ω
Capacitance	C_{ies}	$V_{\text{CE}} = 10\text{V}, V_{\text{GE}} = 0\text{V}, f = 1\text{MHz}$		-	1.1	-	nF
	C_{oes}			-	0.04	-	
	C_{res}			-	0.02	-	
Gate charge	Q_{G}	$V_{\text{CC}} = 300\text{V}$ $V_{\text{GE}}=-15 \rightarrow +15\text{V}$ $I_{\text{C}} = 10\text{A}$		-	81	-	nC
Forward voltage	V_{F} (terminal)	$I_{\text{F}} = 10\text{A}$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.65	2.10	V
	V_{F} (chip)		$T_{\text{vj}}=25^{\circ}\text{C}$	-	1.55	2.00	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	1.50	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	1.50	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	1.45	-	
Switching time (*1)	$t_{\text{d(on)}}$	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}} = 10\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 30\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.04	-	μs
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.04	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.04	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.04	-	
	t_{r}	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}} = 10\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 30\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.02	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.02	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.02	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.02	-	
	$t_{\text{d(off)}}$	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}} = 10\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 30\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.14	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.17	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.17	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.17	-	
	t_{f}	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}} = 10\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 30\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.04	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.05	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.05	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.05	-	
Reverse recovery time	t_{rr}	$V_{\text{CC}} = 300\text{V}$ $I_{\text{C}}, I_{\text{F}} = 10\text{A}$ $L_{\text{s}} = 30\text{nH}$ $V_{\text{GE}} = +15/-15\text{V}$ $R_{\text{G}} = 30\ \Omega$	$T_{\text{vj}}=25^{\circ}\text{C}$	-	0.04	-	
			$T_{\text{vj}}=125^{\circ}\text{C}$	-	0.08	-	
			$T_{\text{vj}}=150^{\circ}\text{C}$	-	0.10	-	
			$T_{\text{vj}}=175^{\circ}\text{C}$	-	0.11	-	

(*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}	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.15	-	mJ
			$I_C, I_F = 10A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.23	-	
			$V_{GE} = +15/-15 V$	$T_{vj}=150^{\circ}C$	-	0.25	-	
			$R_G = 30 \Omega$	$T_{vj}=175^{\circ}C$	-	0.29	-	
		E_{off}	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.30	-	
			$I_C, I_F = 10A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.38	-	
			$V_{GE} = +15/-15 V$	$T_{vj}=150^{\circ}C$	-	0.40	-	
			$R_G = 30 \Omega$	$T_{vj}=175^{\circ}C$	-	0.43	-	
		E_{rr}	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.08	-	
			$I_C, I_F = 10A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.14	-	
			$V_{GE} = +15/-15 V$	$T_{vj}=150^{\circ}C$	-	0.16	-	
			$R_G = 30 \Omega$	$T_{vj}=175^{\circ}C$	-	0.19	-	
Collector-Emitter cut-off current, Gate-Emitter short-circuited		I_{CES}	$V_{GE} = 0V$ $V_{CE} = 650V$		-	-	50	μA
Gate leakage current, Collector-Emitter short-circuited		I_{GES}	$V_{CE} = 0V, \quad V_{GE} = +20/-20V$		-	-	100	nA
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 10A$	$T_{vj}=25^{\circ}C$	-	1.40	1.85	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)	$t_{d(on)}$	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.04	-	μs
			$I_C = 10A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.04	-	
			$V_{GE} = +15/-15 V$	$T_{vj}=150^{\circ}C$	-	0.04	-	
			$R_G = 30 \Omega$	$T_{vj}=175^{\circ}C$	-	0.04	-	
		t_r	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.02	-	
			$I_C = 10A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.02	-	
			$V_{GE} = +15/-15 V$	$T_{vj}=150^{\circ}C$	-	0.02	-	
			$R_G = 30 \Omega$	$T_{vj}=175^{\circ}C$	-	0.02	-	
		$t_{d(off)}$	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.14	-	
			$I_C = 10A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.17	-	
			$V_{GE} = +15/-15 V$	$T_{vj}=150^{\circ}C$	-	0.17	-	
			$R_G = 30 \Omega$	$T_{vj}=175^{\circ}C$	-	0.17	-	
		t_f	$V_{CC} = 300V$	$T_{vj}=25^{\circ}C$	-	0.04	-	
			$I_C = 10A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.05	-	
			$V_{GE} = +15/-15 V$	$T_{vj}=150^{\circ}C$	-	0.05	-	
			$R_G = 30 \Omega$	$T_{vj}=175^{\circ}C$	-	0.05	-	
		Reverse current		I_{RRM}	$V_R = 650V$		-	
Forward voltage	V_F (terminal)	$I_F = 10A$	$T_{vj}=25^{\circ}C$	-	1.65	2.10	V	
	V_F (chip)	$I_F = 10A$	$T_{vj}=25^{\circ}C$	-	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	-		
Converter	Reverse current	I_{RRM}	$V_R = 800V$		-	-	50	μA
	Forward voltage	V_{FM}	$I_F = 10A$	terminal	-	1.00	1.45	V
				chip	-	0.90	1.35	
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}) = $t_{d(off)} + t_f$

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2023/3

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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 junction to case (1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	1.63	K/W
		Inverter FWD	-	-	1.92	
		Brake IGBT	-	-	1.63	
		Brake FWD	-	-	1.92	
		Converter Diode	-	-	0.75	
Thermal resistance case to heat sink(*1) (1 device)	$R_{th(c-f)}$	Inverter IGBT	-	0.83	-	
		Inverter FWD	-	0.97	-	
		Brake IGBT	-	0.87	-	
		Brake FWD	-	0.80	-	
		Converter Diode	-	0.79	-	

(*1) This is the value which is defined mounting on the additional cooling fin with 1 W/(m·K) thermal grease.

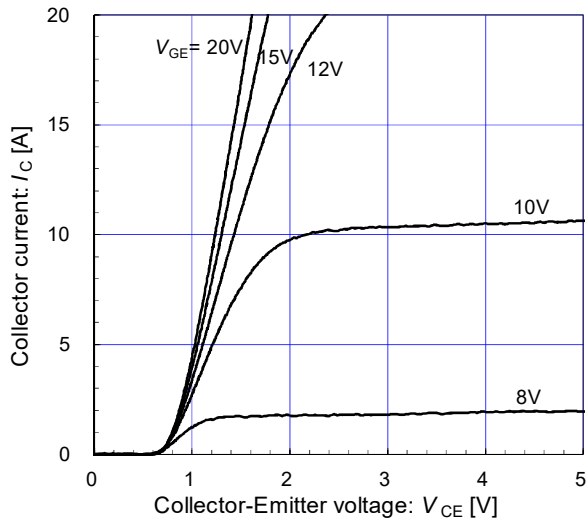
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IGBT Modules

[Inverter]

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

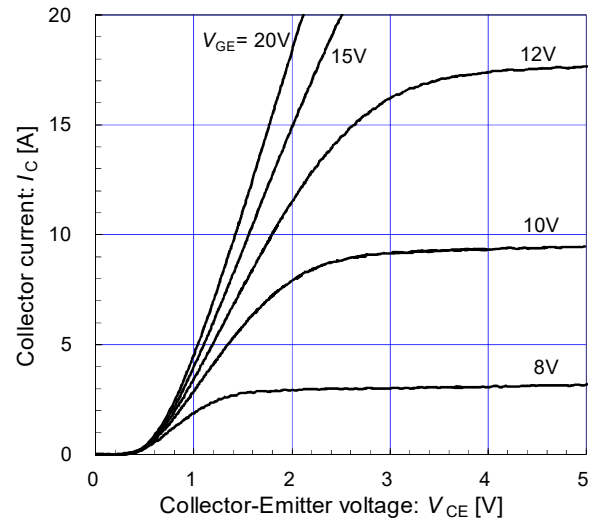
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

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

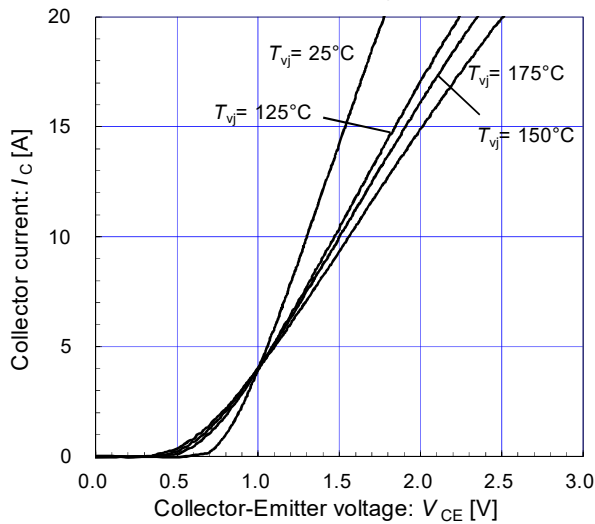
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Inverter]

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

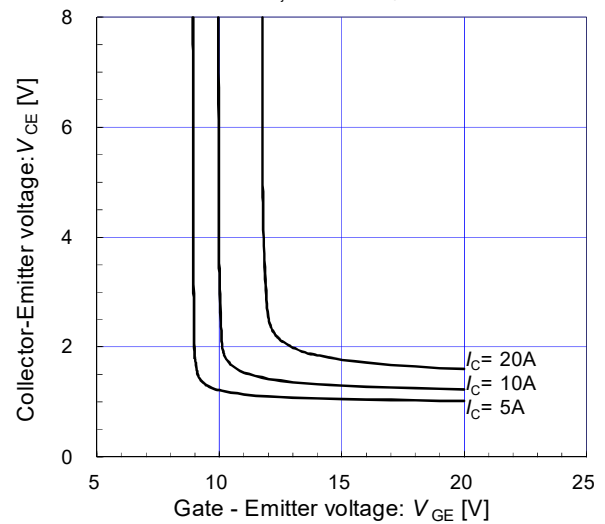
$V_{GE} = 15\text{V}$ / chip



[Inverter]

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

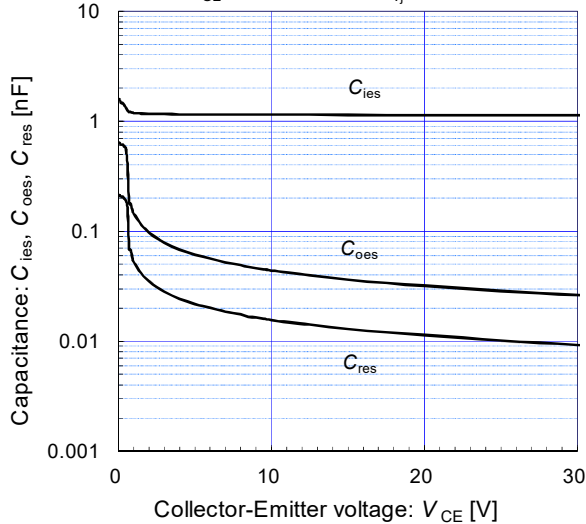
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emittor voltage (typ.)

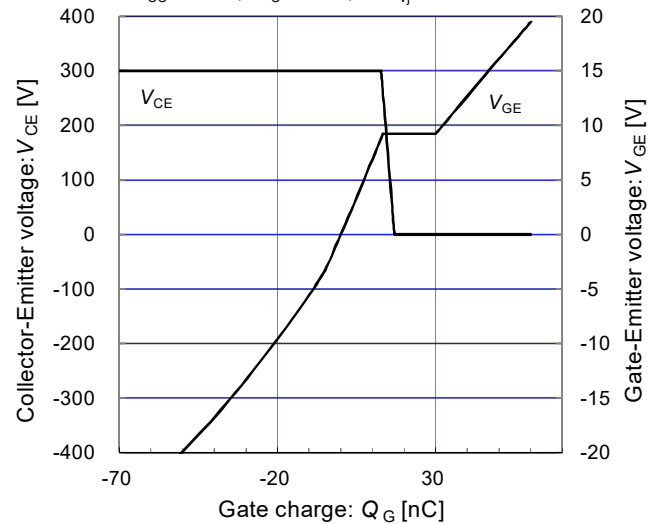
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Inverter]

Dynamic gate charge (typ.)

$V_{CC} = 300\text{V}$, $I_C = 10\text{A}$, $T_{vj} = 25^{\circ}\text{C}$



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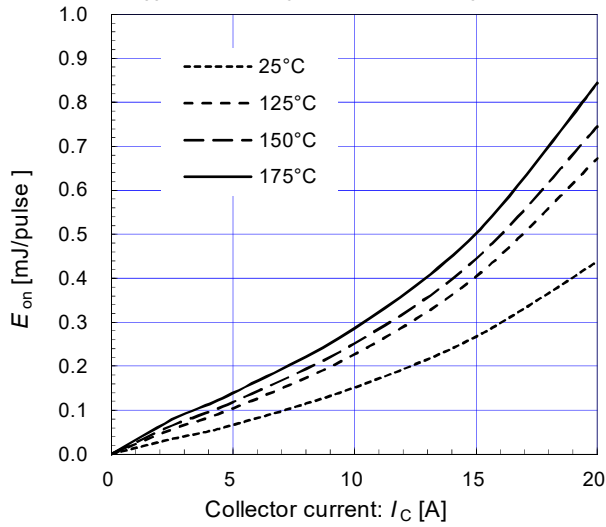
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IGBT Modules

[Inverter]

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

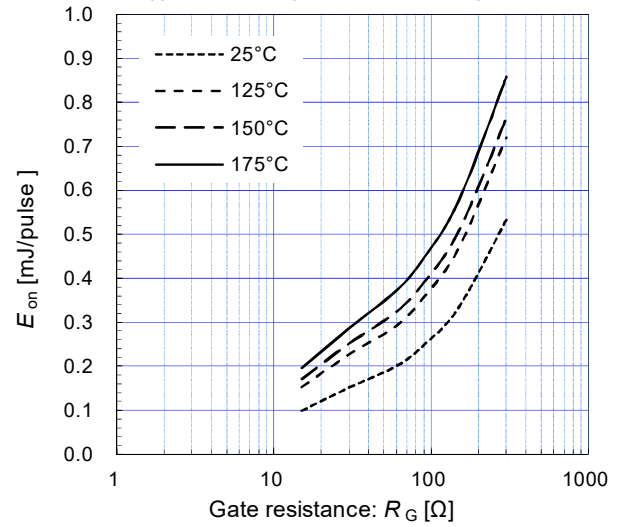
$V_{CC} = 300V$, $V_{GE} = +15/-15V$, $R_G = 30\Omega$



[Inverter]

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

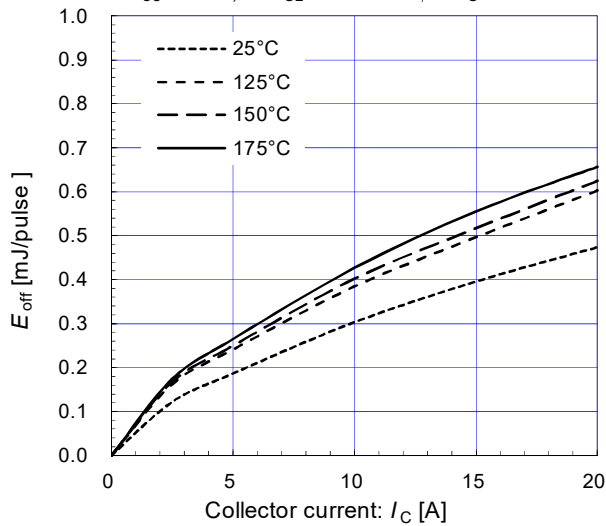
$V_{CC} = 300V$, $V_{GE} = +15/-15V$, $I_C = 10A$



[Inverter]

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

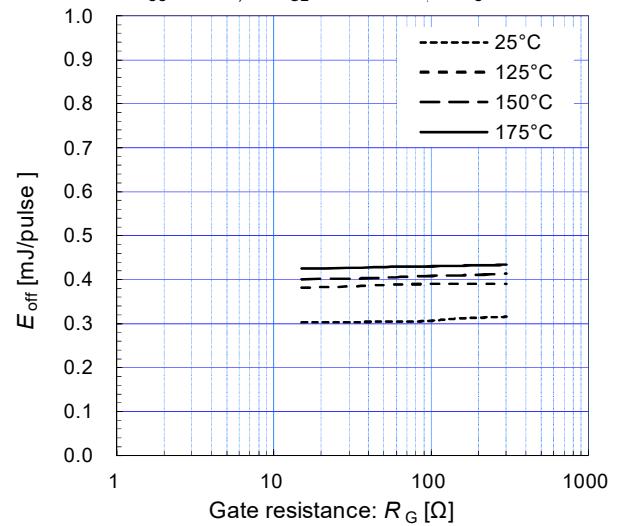
$V_{CC} = 300V$, $V_{GE} = +15/-15V$, $R_G = 30\Omega$



[Inverter]

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

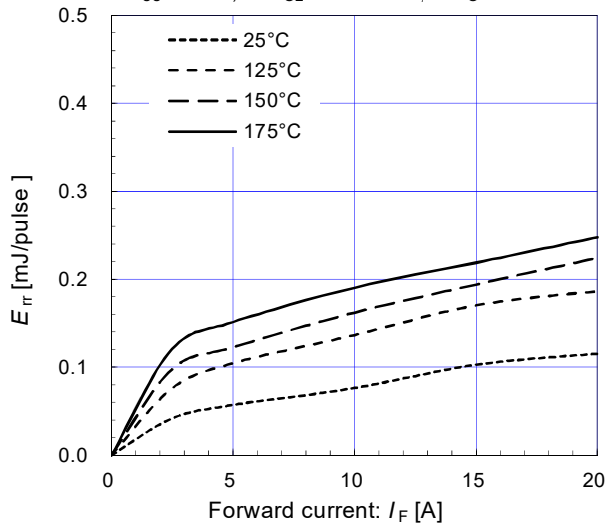
$V_{CC} = 300V$, $V_{GE} = +15/-15V$, $I_C = 10A$



[Inverter]

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

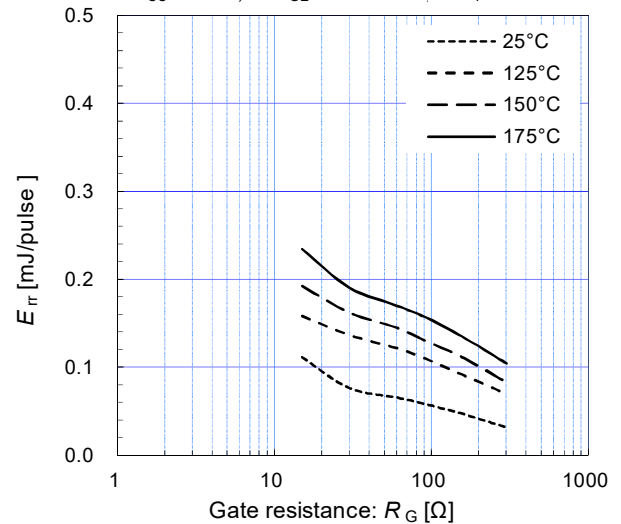
$V_{CC} = 300V$, $V_{GE} = +15/-15V$, $R_G = 30\Omega$



[Inverter]

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

$V_{CC} = 300V$, $V_{GE} = +15/-15V$, $I_F = 10A$



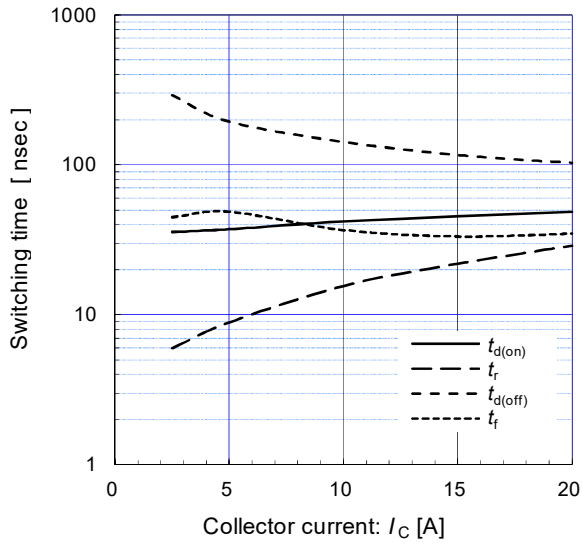
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

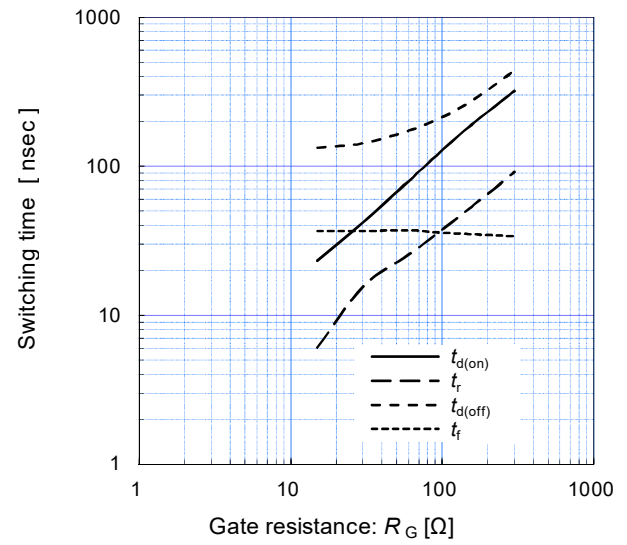
$V_{CC} = 300V$, $R_G = 30\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

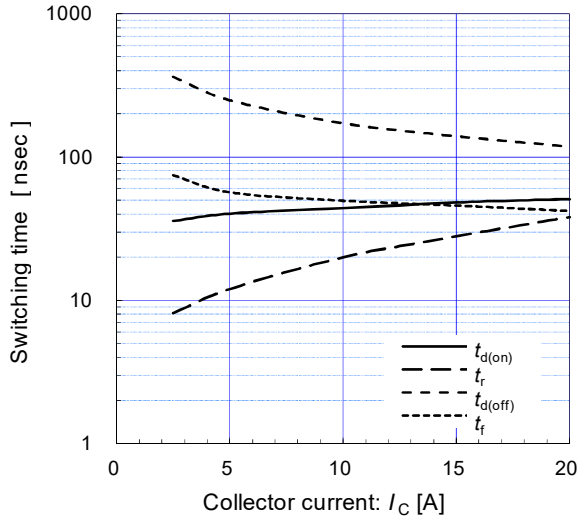
$V_{CC} = 300V$, $I_C = 10A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

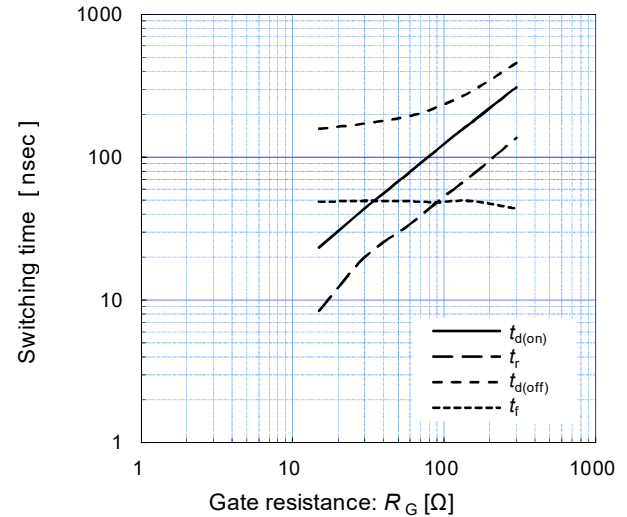
$V_{CC} = 300V$, $R_G = 30\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

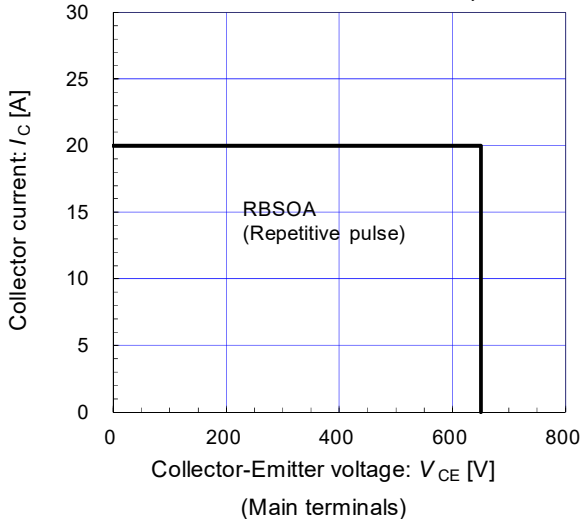
$V_{CC} = 300V$, $I_C = 10A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$, $R_G \geq 30\Omega$ $T_{vj} = 175^\circ C$

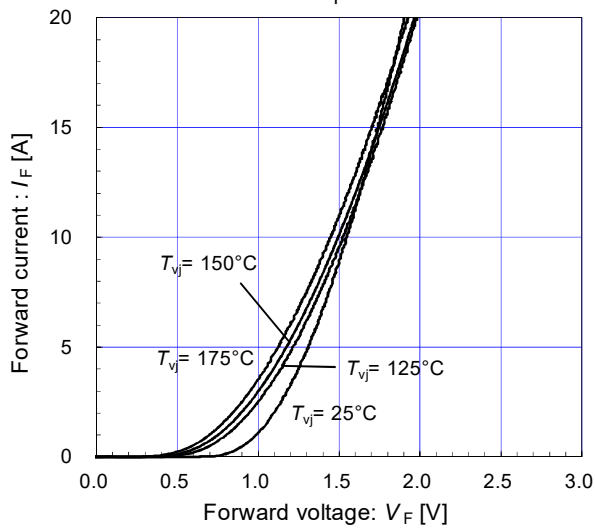


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[Inverter]

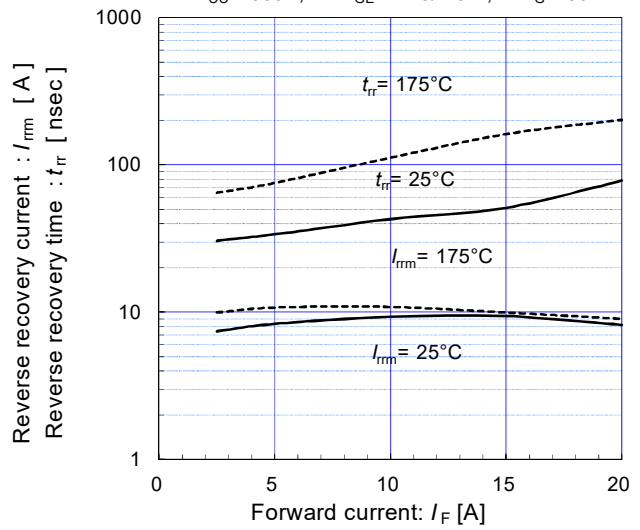
Forward current vs. Forward voltage (typ.)
chip



[Inverter]

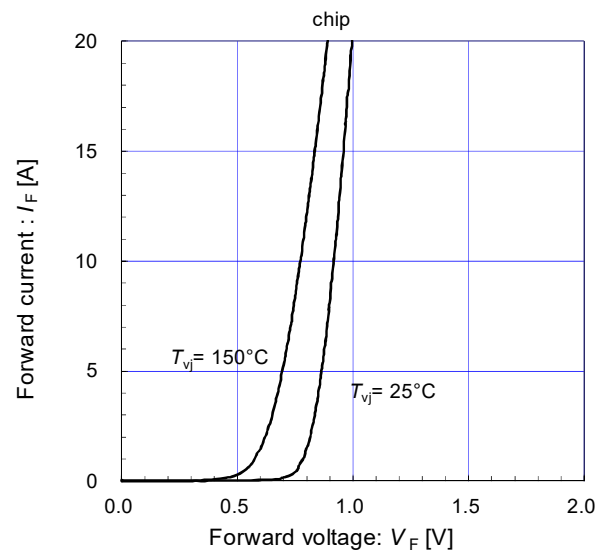
Reverse recovery characteristics (typ.)

$V_{CC} = 300V$, $V_{GE} = +15/-15V$, $R_G = 30\Omega$



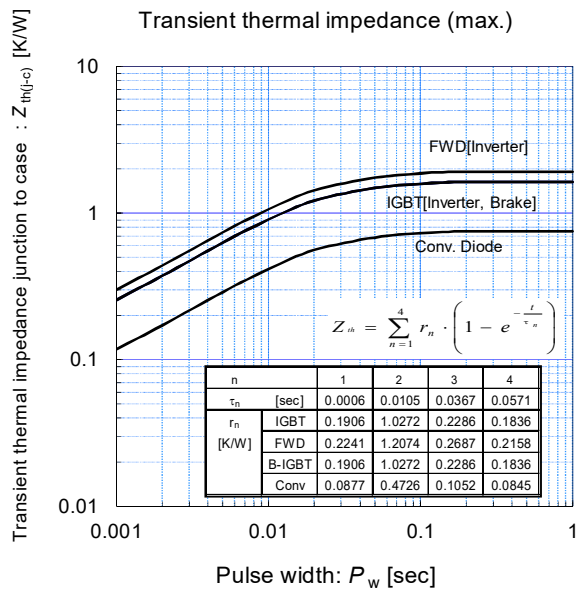
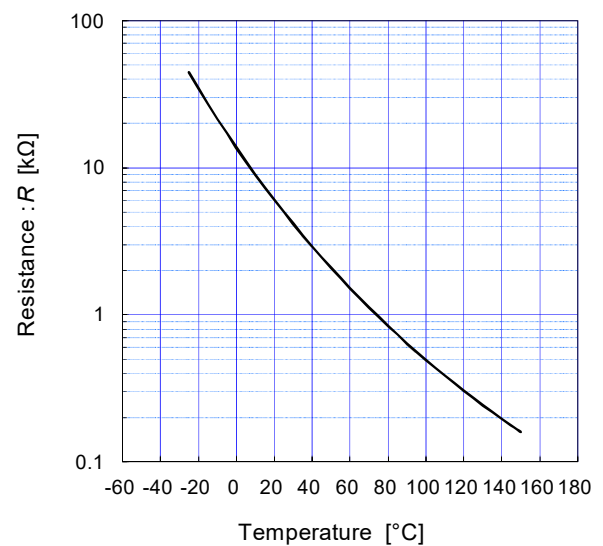
[Converter]

Forward current vs. Forward voltage (typ.)



[Thermistor]

Temperature characteristic (typ.)



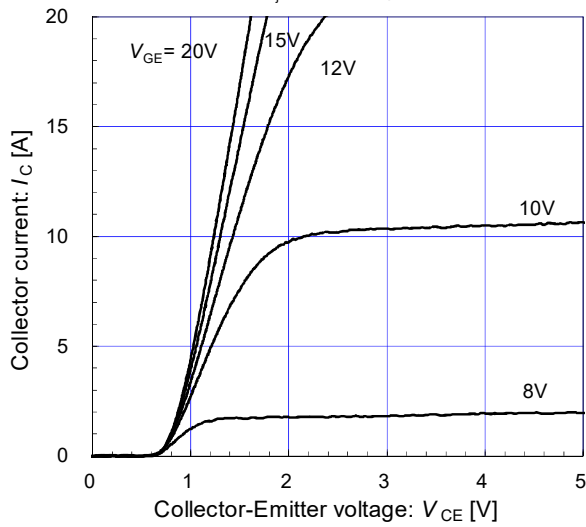
7MBR10XKC065-50

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[Brake]

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

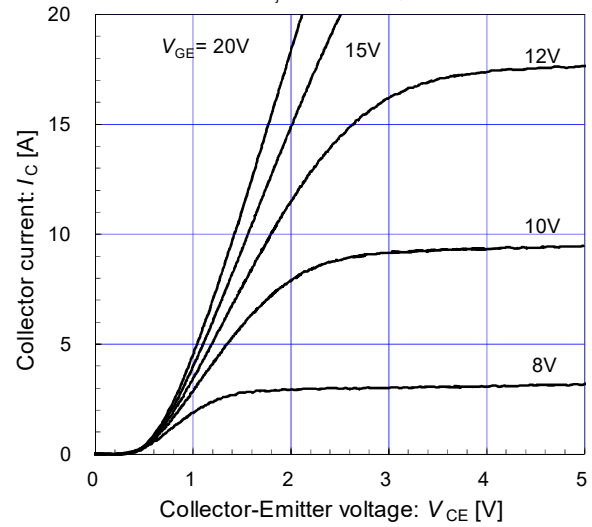
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

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

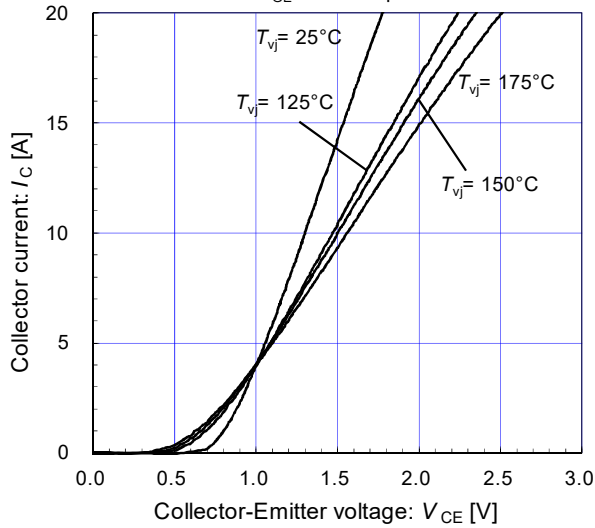
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Brake]

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

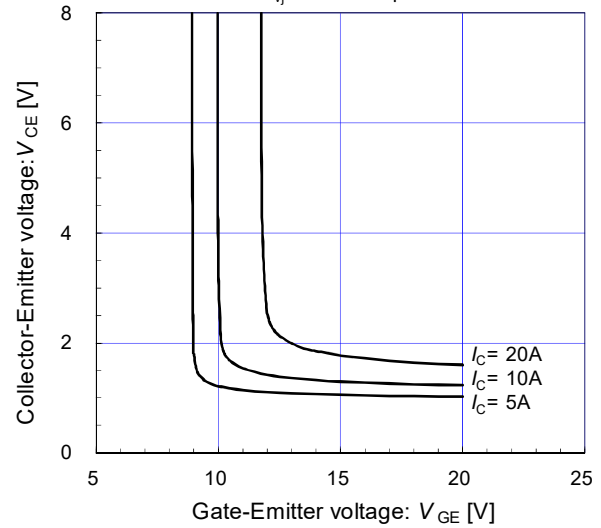
$V_{GE} = 15\text{V}$ / chip



[Brake]

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

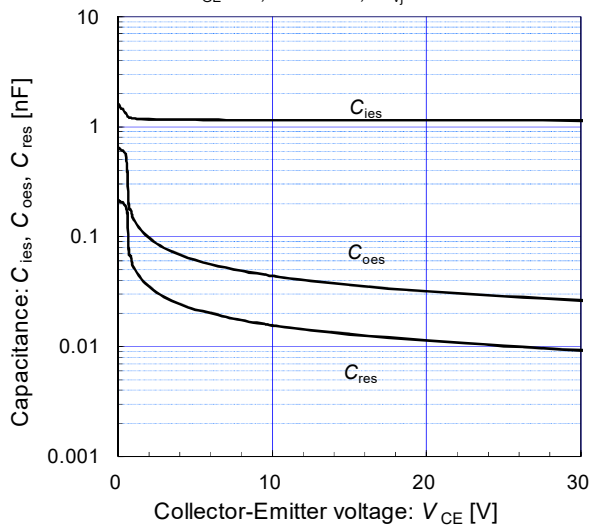
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emittor voltage (typ.)

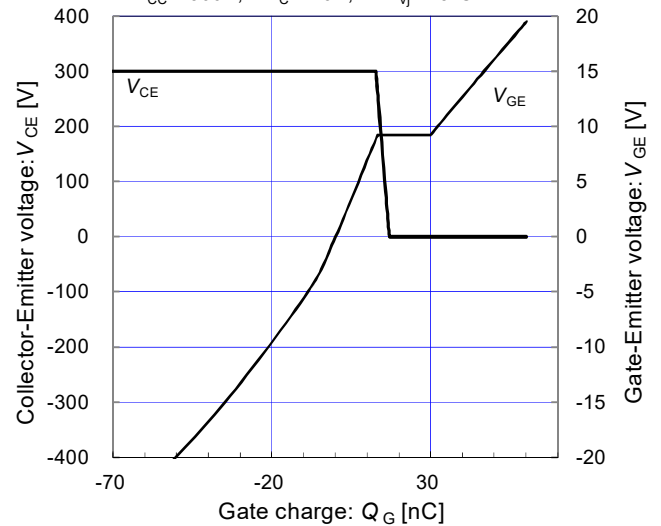
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Brake]

Dynamic gate charge (typ.)

$V_{CC} = 300\text{V}$, $I_C = 10\text{A}$, $T_{vj} = 25^{\circ}\text{C}$



FM6M01754d

2023/3

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