

7MBR10XKC065-50

IGBT Modules

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

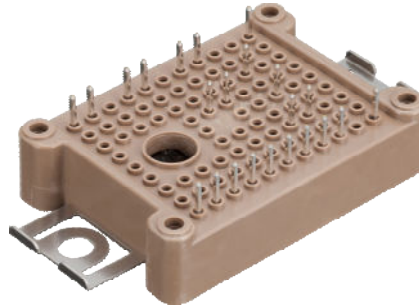
■ **Features**

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

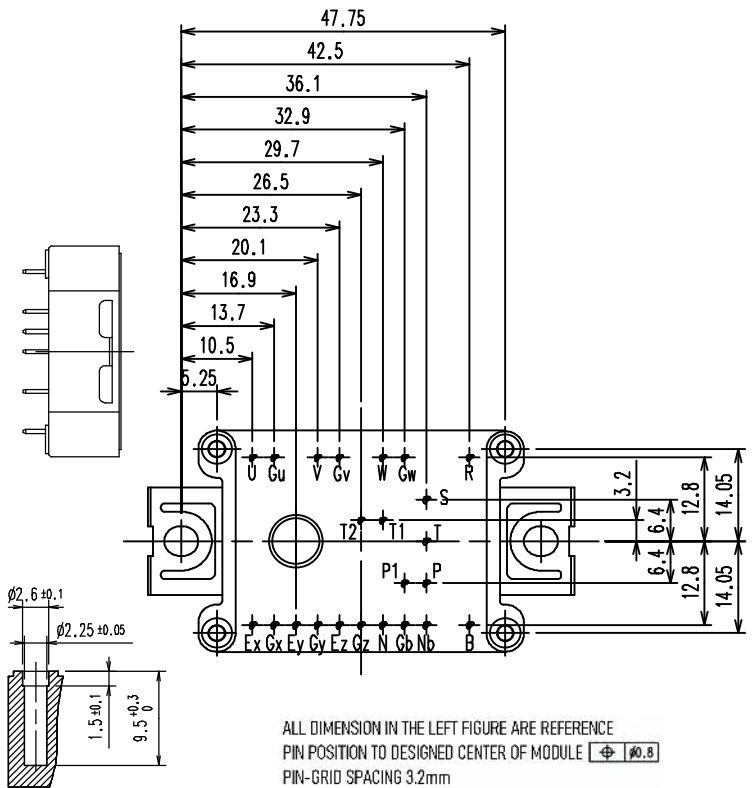
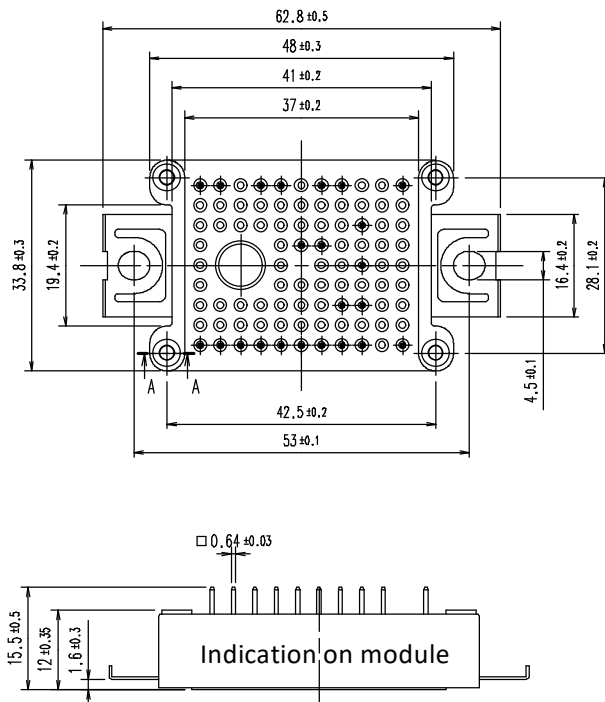
■ **Applications**

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

■ **Typical appearance**



■ **Outline drawing (Unit : mm)**

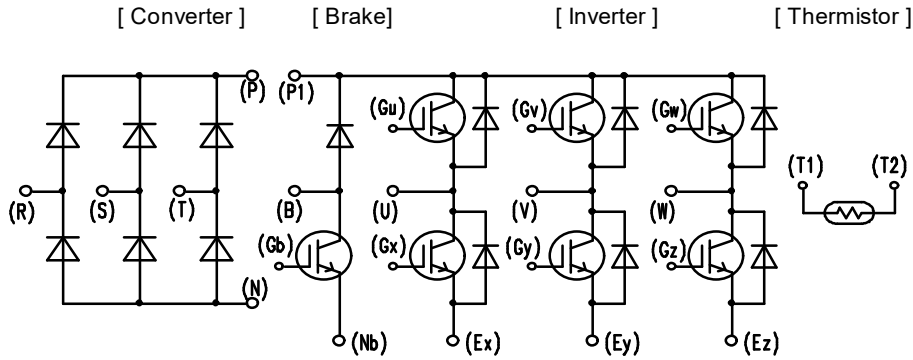


ALL DIMENSION IN THE LEFT FIGURE ARE REFERENCE
 PIN POSITION TO DESIGNED CENTER OF MODULE $\square \phi 0.8$
 PIN-GRID SPACING 3.2mm

断面A-A (1.5 : 1)
 SECTION A-A

Weight: 25 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, 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		
Total power dissipation	P_{tot}	1 device	90	W		
Brake FWD	Forward current	I_F	Continuous	10	A	
	Repetitive peak forward current	I_{FRM}	1ms	20		
	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 $T_c=80^\circ\text{C}$	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 ² s
		$T_{vj}=150^\circ\text{C}$	585			
Virtual 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) 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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■ 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}	$V_{GE} = 0\text{V}$ $V_{CE} = 650\text{V}$	-	-	50	μA	
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	$V_{CE} = 0\text{V}$ $V_{GE} = +20/-20\text{V}$	-	-	100	nA	
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 10\text{mA}$	6.0	6.5	7.0	V	
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 10\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.40	1.85	V
			$T_{vj}=25^{\circ}\text{C}$	-	1.30	1.75	
	$T_{vj}=125^{\circ}\text{C}$		-	1.45	-		
	$T_{vj}=150^{\circ}\text{C}$		-	1.50	-		
	$T_{vj}=175^{\circ}\text{C}$		-	1.55	-		
Internal gate resistance	r_g	-	-	0	-	Ω	
	Capacitance	$V_{CE} = 10\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	C_{ies}	-	1.1	-	nF
			C_{oes}	-	0.04	-	
C_{res}			-	0.02	-		
Gate charge	Q_G	$V_{CC} = 300\text{V}$ $V_{GE} = -15 \rightarrow +15\text{V}$ $I_C = 10\text{A}$	-	81	-	nC	
Forward voltage	V_F (terminal)	$I_F = 10\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.65	2.10	V
	V_F (chip)		$T_{vj}=25^{\circ}\text{C}$	-	1.55	2.00	
			$T_{vj}=125^{\circ}\text{C}$	-	1.50	-	
			$T_{vj}=150^{\circ}\text{C}$	-	1.50	-	
			$T_{vj}=175^{\circ}\text{C}$	-	1.45	-	
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300\text{V}$ $I_C, I_F = 10\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 30\Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.04	-	μs
			$T_{vj}=125^{\circ}\text{C}$	-	0.04	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.04	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.04	-	
	t_r		$T_{vj}=25^{\circ}\text{C}$	-	0.02	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.02	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.02	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.02	-	
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.14	-	
			$T_{vj}=125^{\circ}\text{C}$	-	0.17	-	
			$T_{vj}=150^{\circ}\text{C}$	-	0.17	-	
			$T_{vj}=175^{\circ}\text{C}$	-	0.17	-	
t_f	$T_{vj}=25^{\circ}\text{C}$	-	0.04	-			
	$T_{vj}=125^{\circ}\text{C}$	-	0.05	-			
	$T_{vj}=150^{\circ}\text{C}$	-	0.05	-			
	$T_{vj}=175^{\circ}\text{C}$	-	0.05	-			
Reverse recovery time	t_{rr}	$T_{vj}=25^{\circ}\text{C}$	-	0.04	-		
		$T_{vj}=125^{\circ}\text{C}$	-	0.08	-		
		$T_{vj}=150^{\circ}\text{C}$	-	0.10	-		
		$T_{vj}=175^{\circ}\text{C}$	-	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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Items	Symbols	Conditions		Characteristics			Units
				min.	typ.	max.	
Inverter Switching loss (per pulse)	E_{on}	$V_{CC} = 300V$ $I_C, I_F = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 30\Omega$	$T_{vj} = 25^\circ C$	-	0.15	-	mJ
			$T_{vj} = 125^\circ C$	-	0.23	-	
			$T_{vj} = 150^\circ C$	-	0.25	-	
			$T_{vj} = 175^\circ C$	-	0.29	-	
	E_{off}	$V_{CC} = 300V$ $I_C, I_F = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 30\Omega$	$T_{vj} = 25^\circ C$	-	0.30	-	
			$T_{vj} = 125^\circ C$	-	0.38	-	
			$T_{vj} = 150^\circ C$	-	0.40	-	
			$T_{vj} = 175^\circ C$	-	0.43	-	
	E_{rr}	$V_{CC} = 300V$ $I_C, I_F = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 30\Omega$	$T_{vj} = 25^\circ C$	-	0.08	-	
			$T_{vj} = 125^\circ C$	-	0.14	-	
			$T_{vj} = 150^\circ C$	-	0.16	-	
			$T_{vj} = 175^\circ C$	-	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
			$T_{vj} = 25^\circ C$	-	1.30	1.75	
	$V_{CE(sat)}$ (chip)		$T_{vj} = 125^\circ C$	-	1.45	-	
			$T_{vj} = 150^\circ C$	-	1.50	-	
Internal gate resistance	r_g	-	$T_{vj} = 25^\circ C$	-	0	-	Ω
			$T_{vj} = 25^\circ C$	-	0	-	
			$T_{vj} = 125^\circ C$	-	0	-	
			$T_{vj} = 175^\circ C$	-	0	-	
Brake Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 30\Omega$	$T_{vj} = 25^\circ C$	-	0.04	-	μs
			$T_{vj} = 125^\circ C$	-	0.04	-	
			$T_{vj} = 150^\circ C$	-	0.04	-	
			$T_{vj} = 175^\circ C$	-	0.04	-	
	t_r	$V_{CC} = 300V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 30\Omega$	$T_{vj} = 25^\circ C$	-	0.02	-	
			$T_{vj} = 125^\circ C$	-	0.02	-	
			$T_{vj} = 150^\circ C$	-	0.02	-	
			$T_{vj} = 175^\circ C$	-	0.02	-	
	$t_{d(off)}$	$V_{CC} = 300V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 30\Omega$	$T_{vj} = 25^\circ C$	-	0.14	-	
			$T_{vj} = 125^\circ C$	-	0.17	-	
			$T_{vj} = 150^\circ C$	-	0.17	-	
			$T_{vj} = 175^\circ C$	-	0.17	-	
	t_f	$V_{CC} = 300V$ $I_C = 10A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 30\Omega$	$T_{vj} = 25^\circ C$	-	0.04	-	
			$T_{vj} = 125^\circ C$	-	0.05	-	
			$T_{vj} = 150^\circ C$	-	0.05	-	
			$T_{vj} = 175^\circ C$	-	0.05	-	
Reverse current	I_{RRM}	$V_R = 650V$		-	-	50	μA
Forward voltage	V_F (terminal)	$I_F = 10A$	$T_{vj} = 25^\circ C$	-	1.65	2.10	V
			$T_{vj} = 25^\circ C$	-	1.55	2.00	
	V_F (chip)		$T_{vj} = 125^\circ C$	-	1.50	-	
			$T_{vj} = 150^\circ C$	-	1.50	-	
Reverse current	I_{RRM}	$V_R = 800V$	$T_{vj} = 25^\circ C$	-	-	50	μA
			$T_{vj} = 25^\circ C$	-	-	50	
			$T_{vj} = 125^\circ C$	-	-	50	
			$T_{vj} = 150^\circ C$	-	-	50	
Forward voltage	V_{FM}	$I_F = 10A$	terminal	-	1.00	1.45	V
			chip	-	0.90	1.35	
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

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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 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.

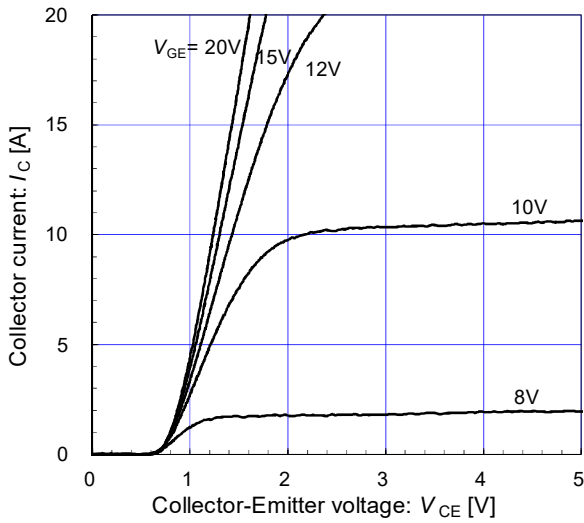
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IGBT Modules

[Inverter]

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

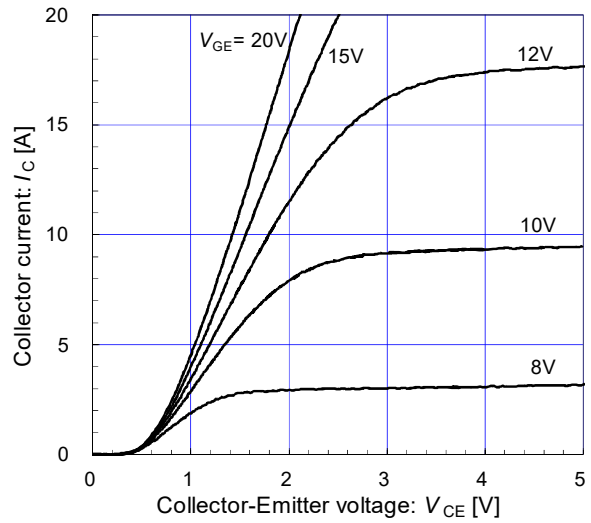
$T_{vj} = 25^{\circ}\text{C} / \text{chip}$



[Inverter]

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

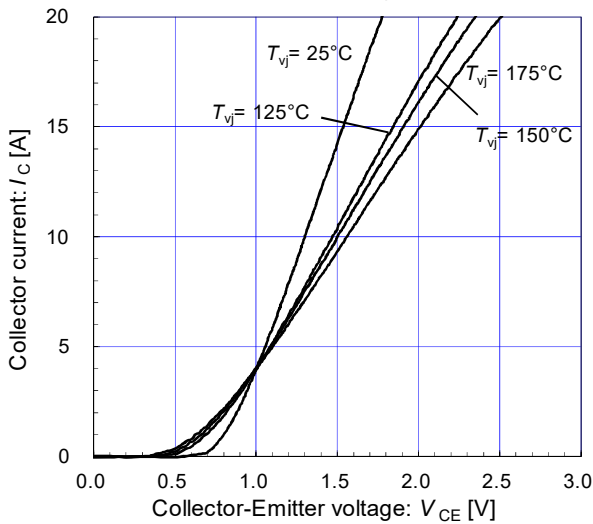
$T_{vj} = 175^{\circ}\text{C} / \text{chip}$



[Inverter]

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

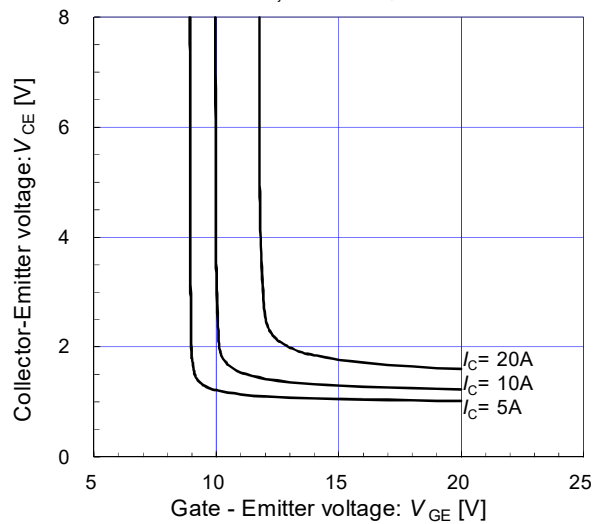
$V_{GE} = 15\text{V} / \text{chip}$



[Inverter]

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

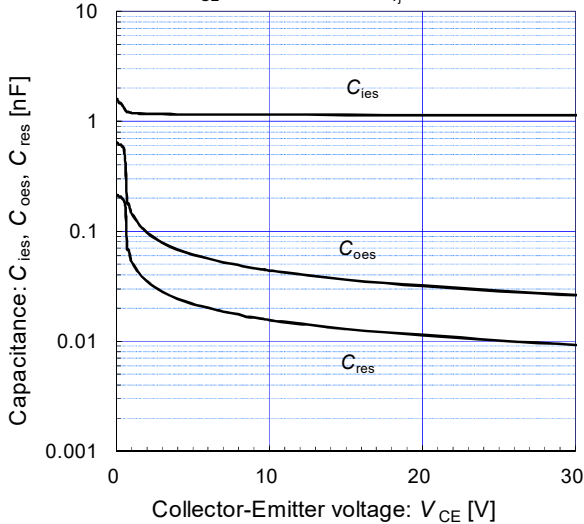
$T_{vj} = 25^{\circ}\text{C} / \text{chip}$



[Inverter]

Capacitance vs. Collector-Emmitter voltage (typ.)

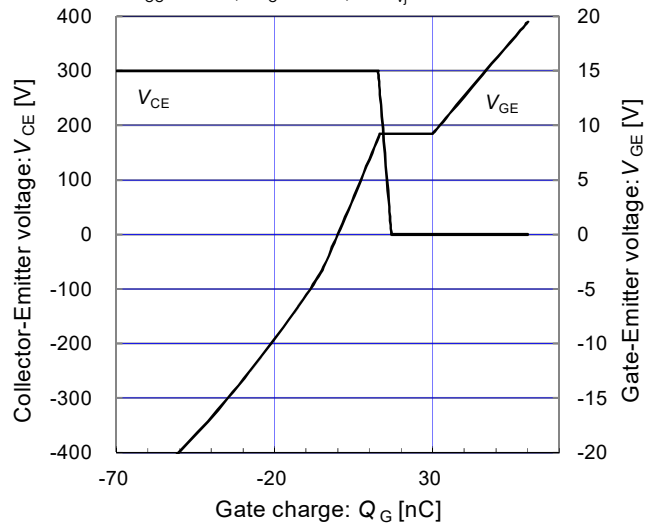
$V_{GE} = 0\text{V}, f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}$



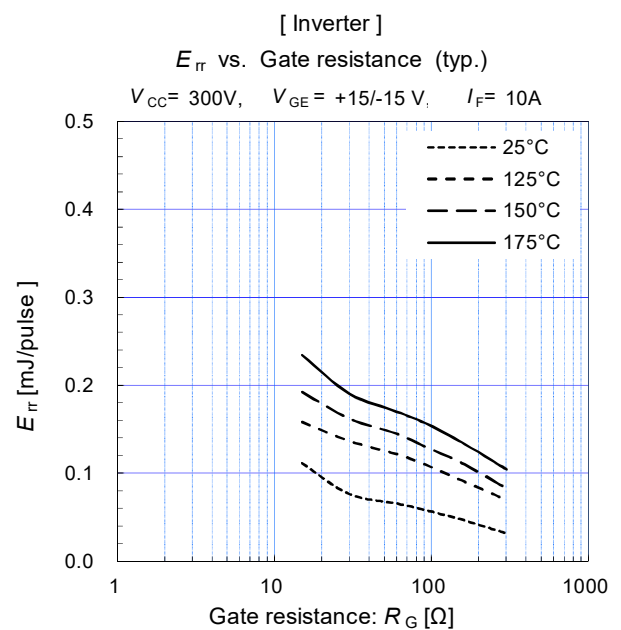
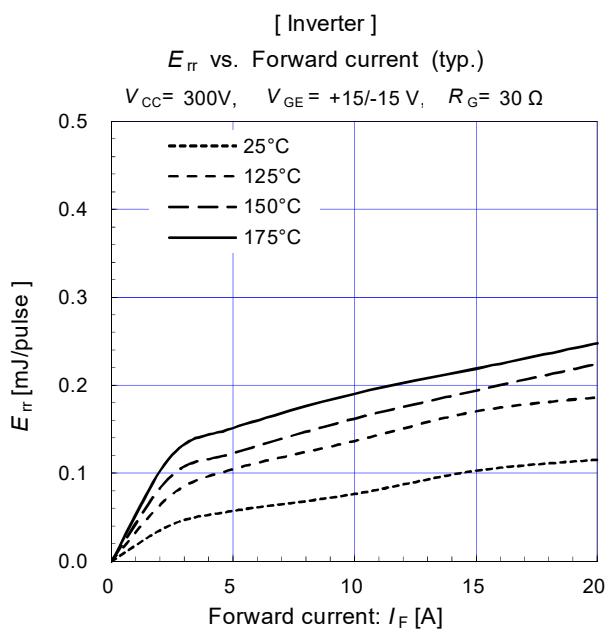
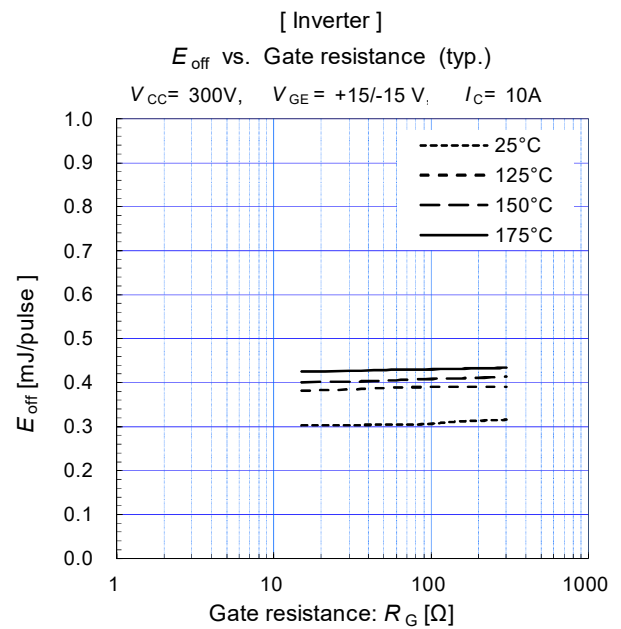
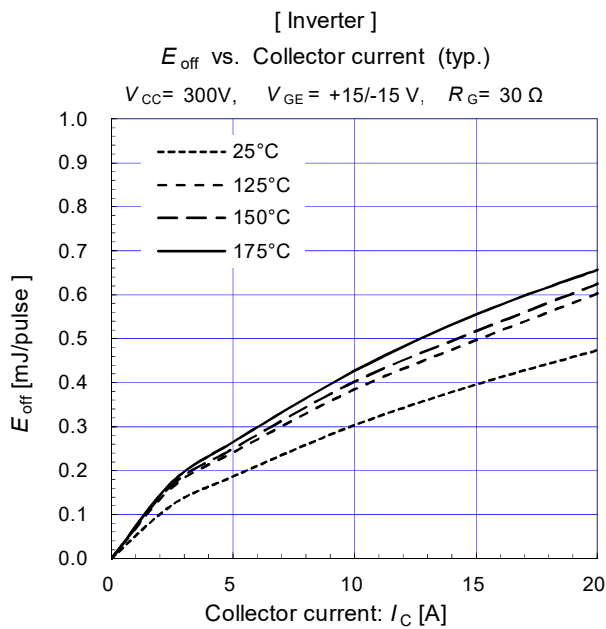
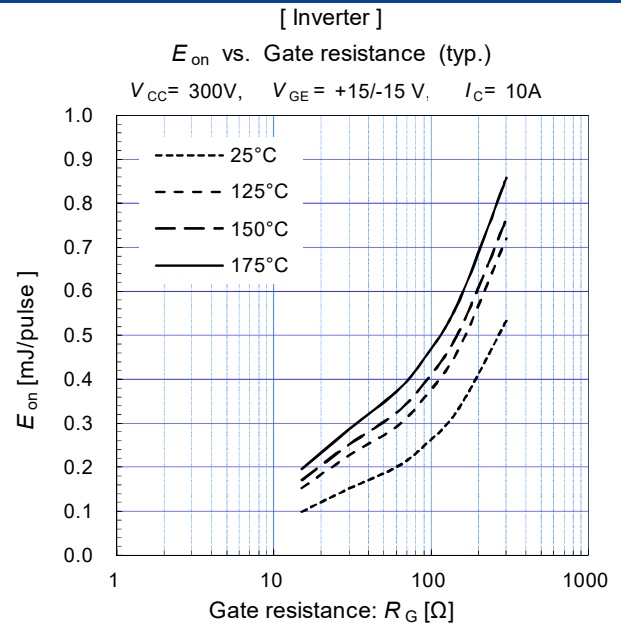
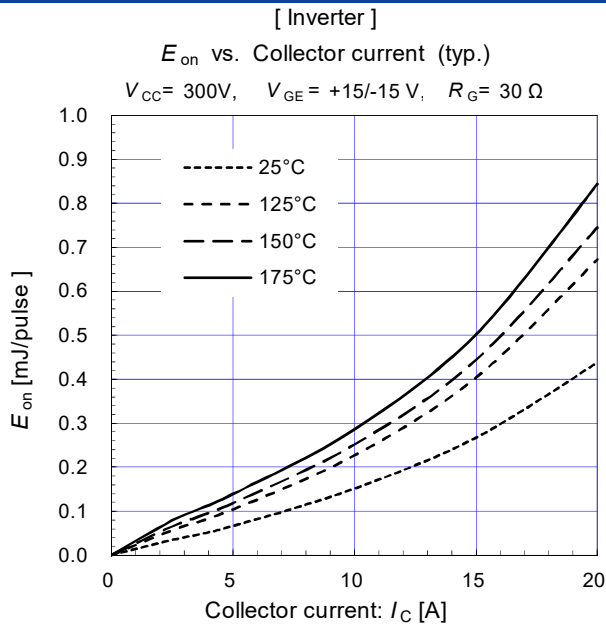
[Inverter]

Dynamic gate charge (typ.)

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



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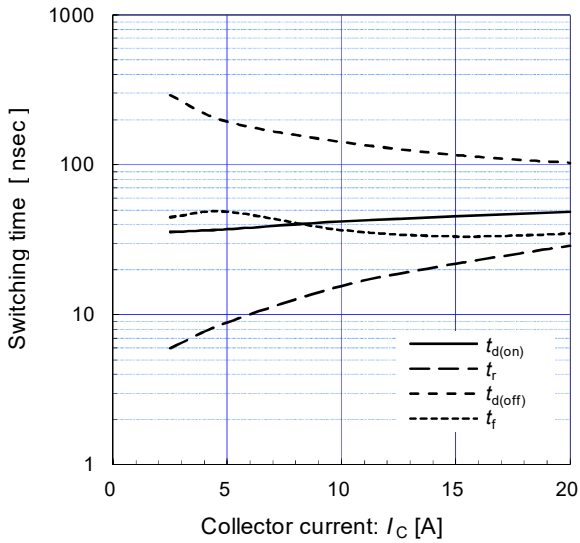
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IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

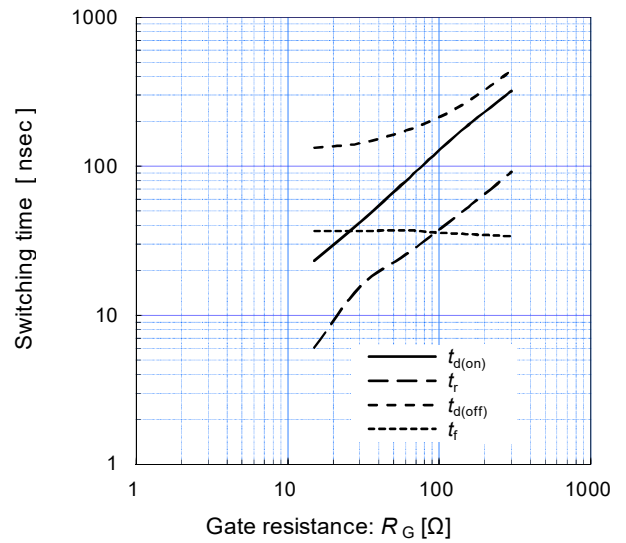
$V_{CC}= 300V, R_G= 30\Omega \quad V_{GE}= +15/-15 V, T_{vj}= 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

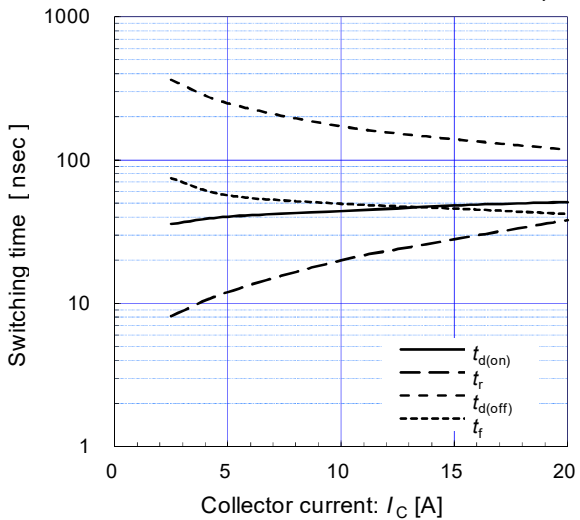
$V_{CC}= 300V, I_C= 10A, V_{GE}= +15/-15 V, T_{vj}= 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

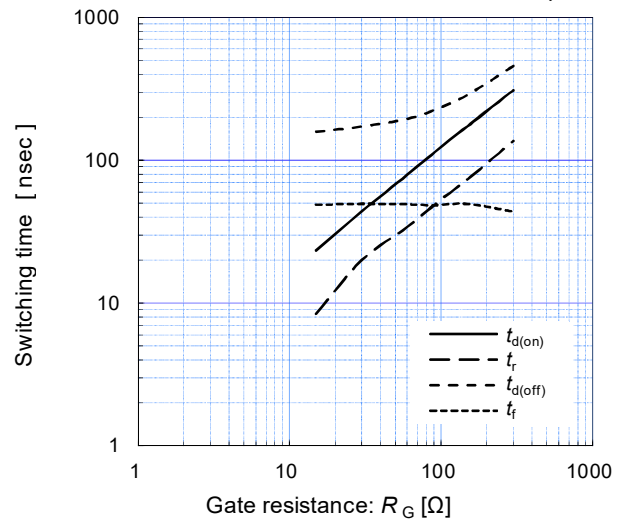
$V_{CC}= 300V, R_G= 30\Omega \quad V_{GE}= +15/-15 V, T_{vj}= 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

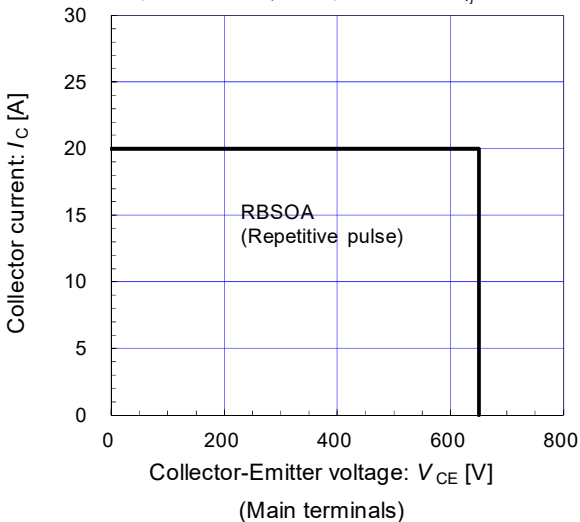
$V_{CC}= 300V, I_C= 10A, V_{GE}= +15/-15 V, T_{vj}= 175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

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

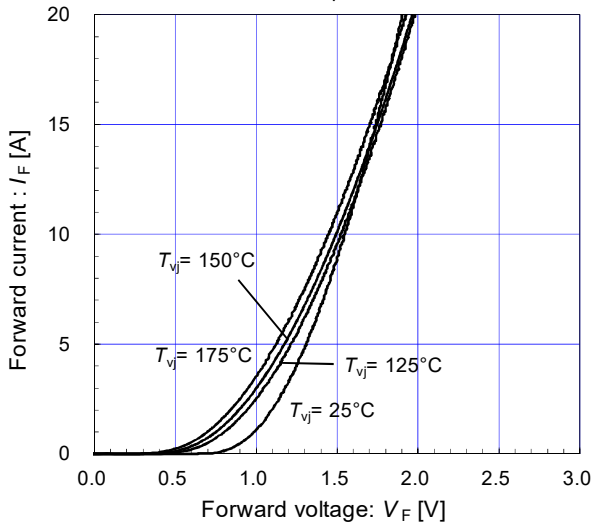


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IGBT Modules

[Inverter]

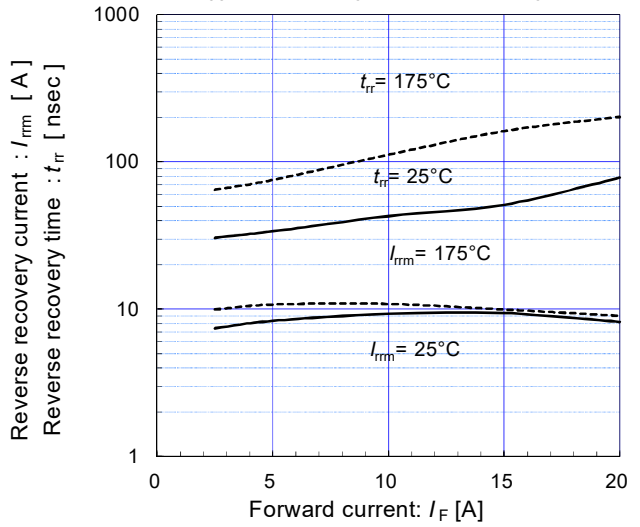
Forward current vs. Forward voltage (typ.)
chip



[Inverter]

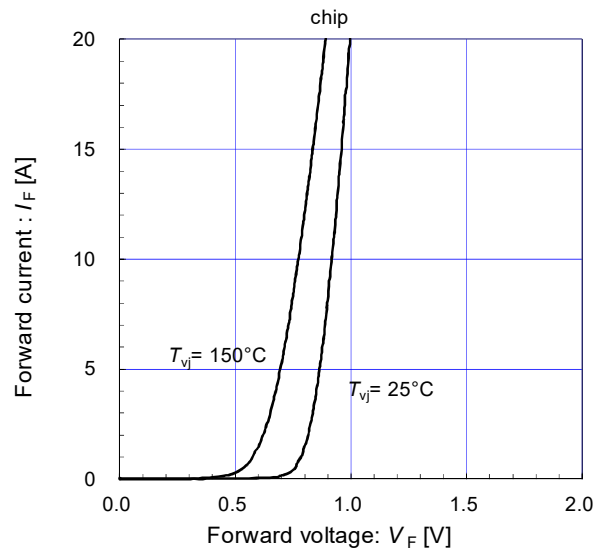
Reverse recovery characteristics (typ.)

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



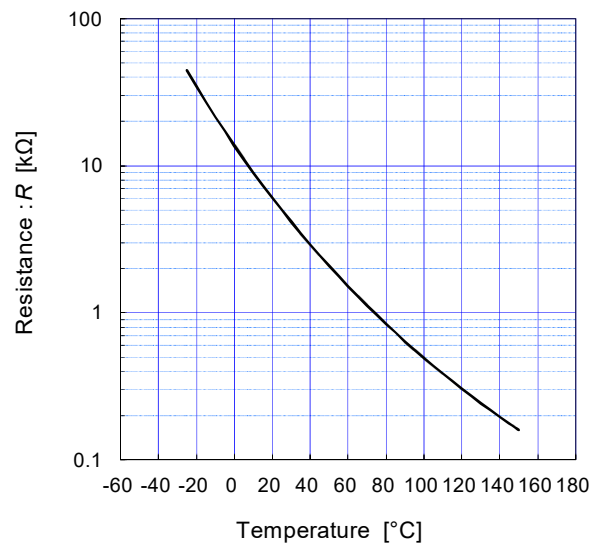
[Converter]

Forward current vs. Forward voltage (typ.)

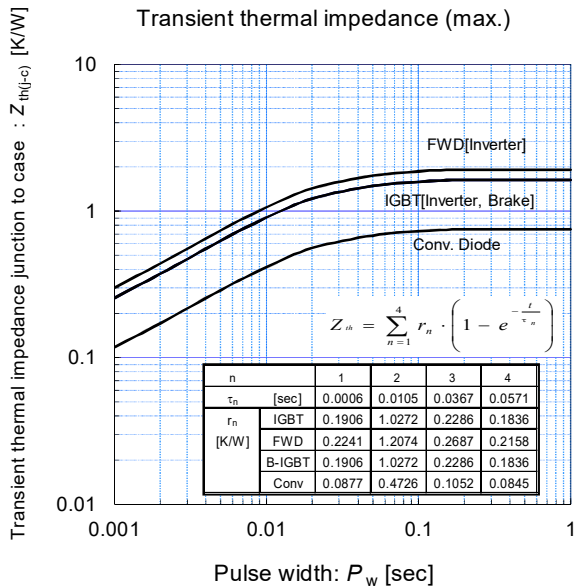


[Thermistor]

Temperature characteristic (typ.)



Transient thermal impedance (max.)



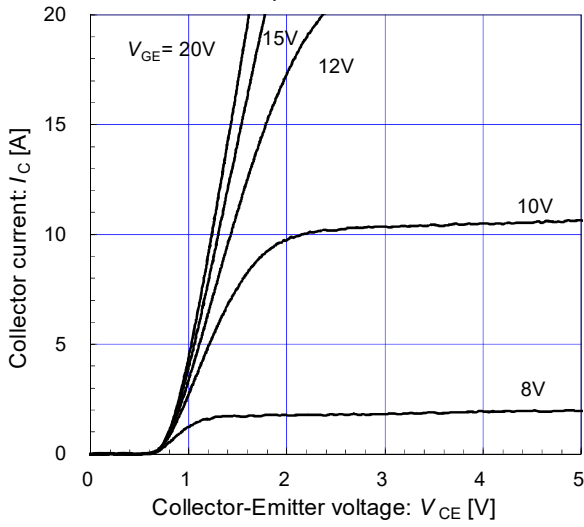
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IGBT Modules

[Brake]

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

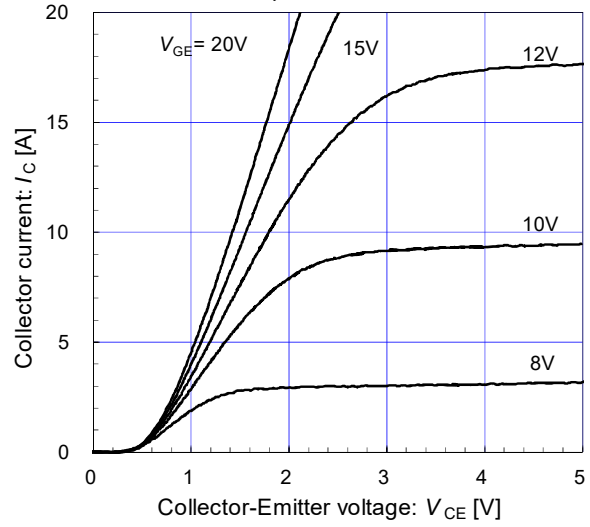
$T_{vj} = 25^\circ\text{C} / \text{chip}$



[Brake]

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

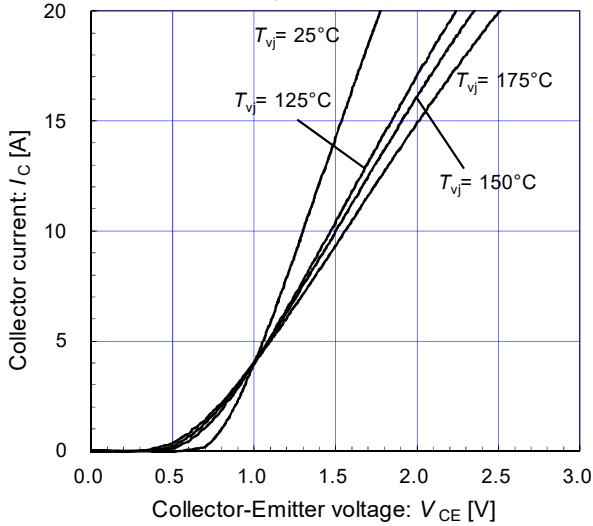
$T_{vj} = 175^\circ\text{C} / \text{chip}$



[Brake]

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

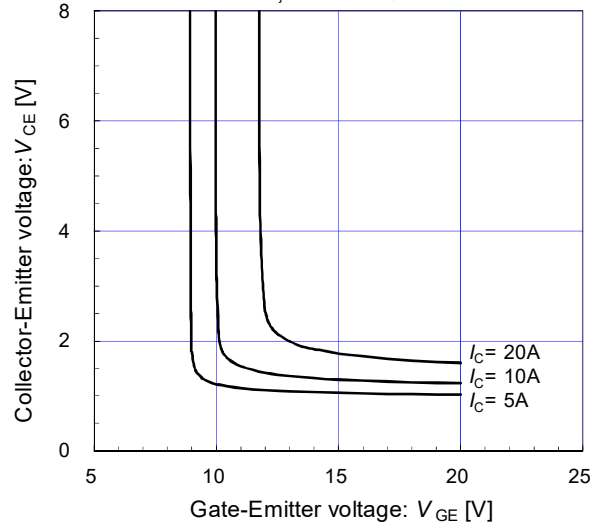
$V_{GE} = 15\text{V} / \text{chip}$



[Brake]

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

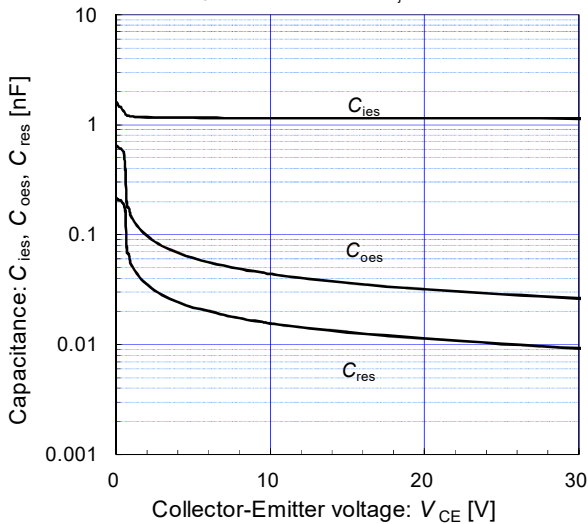
$T_{vj} = 25^\circ\text{C} / \text{chip}$



[Brake]

Capacitance vs. Collector-Emittor voltage (typ.)

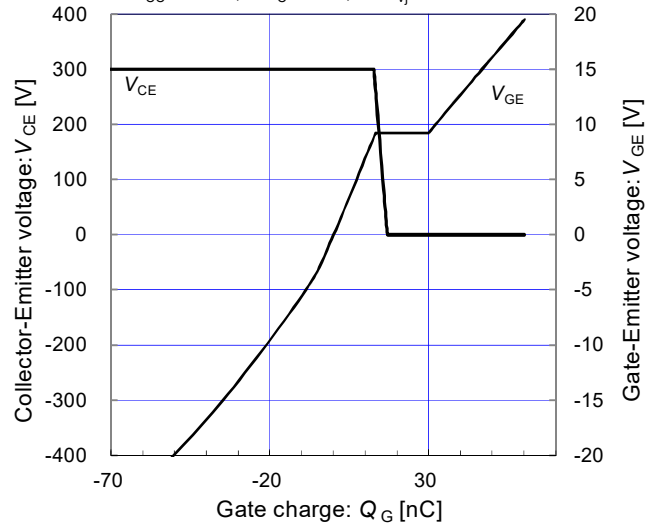
$V_{GE} = 0\text{V}, f = 1\text{MHz}, T_{vj} = 25^\circ\text{C}$



[Brake]

Dynamic gate charge (typ.)

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



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