

7MBR15XKC065-50

IGBT Modules

Power Module(X series)
650V / 15A / PIM

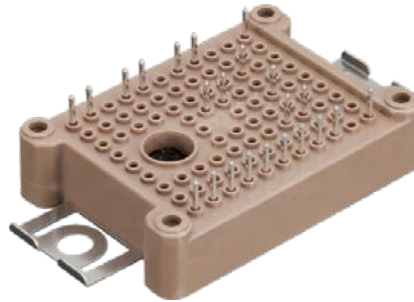
□ **Features**

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

□ **Applications**

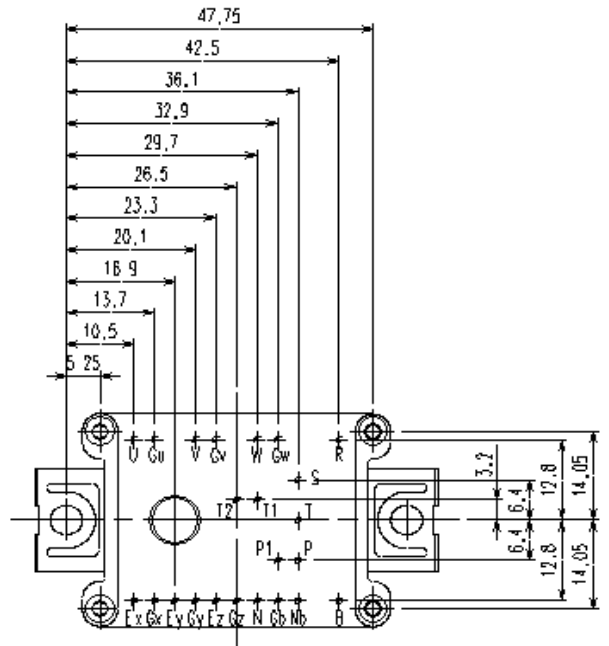
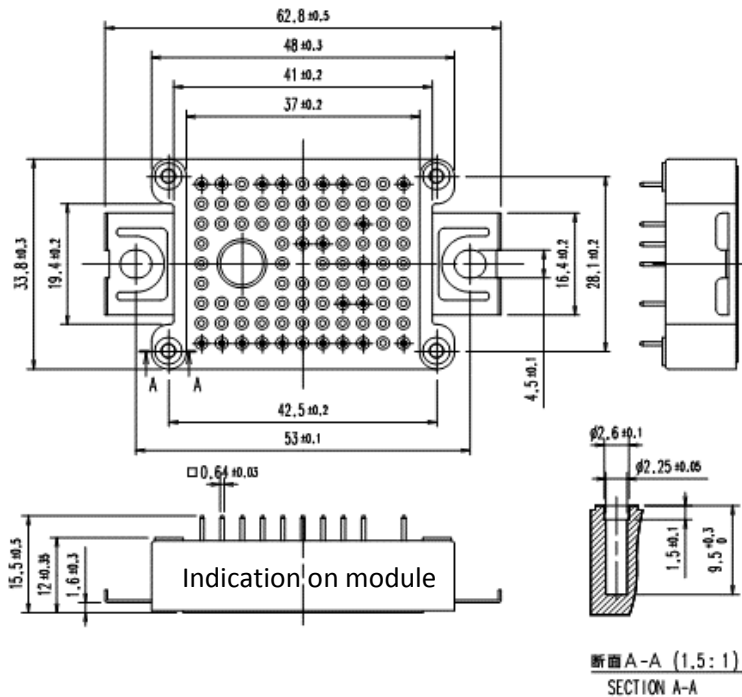
- Inverter for Motor Drive
- AC and DC Servo Drive Amplifier
- Uninterruptible Power Supply

□ **Typical appearance**



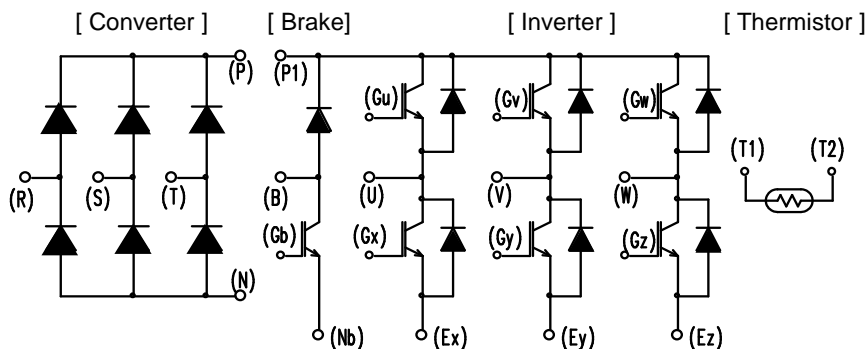
□ **Outline drawing (Unit : mm)**

shows theoretical dimension.
() shows reference dimension.



Weight: 25 g (typ.)
PIN POSITIONS WITH TOLERANCE ± 0.4

□ **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	$T_c = 100^\circ\text{C}$	15	A
		I_C pulse	1ms		30	
	Forward current	I_F	Continuous		15	
		I_F pulse	1ms		30	
Collector power dissipation	P_C	1 device		110	W	
Brake IGBT	Collector-Emitter voltage	V_{CES}			650	V
	Gate-Emitter voltage	V_{GES}			± 20	V
	Collector current	I_C	Continuous	$T_c = 100^\circ\text{C}$	15	A
		I_C pulse	1ms		30	
Collector power dissipation	P_C	1 device		110	W	
Brake FWD	Forward current	I_F	Continuous		10	A
		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	$T_c = 80^\circ\text{C}$	15	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		
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	-	M4		1.7	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 1.3 ~ 1.7 N·m (M4)

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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}	$V_{GE} = 0\text{V}$ $V_{CE} = 650\text{V}$	-	-	50	μA			
Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0\text{V}$ $V_{GE} = +20/-20\text{V}$	-	-	100	nA			
Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20\text{V}$ $I_C = 15\text{mA}$	6.0	6.5	7.0	V			
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15\text{V}$ $I_C = 15\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	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	C_{ies}	$V_{CE} = 10\text{V}, V_{GE} = 0\text{V}, f = 1\text{MHz}$	-	1.7	-	nF
						C_{oes}	-	0.07	
C_{res}	-	0.02				-			
Gate charge	Q_G	$V_{CC} = 300\text{V}$ $V_{GE} = -15 \rightarrow +15\text{V}$ $I_C = 15\text{A}$	-	120	-	nC			
Forward voltage	V_F (terminal)	$I_F = 15\text{A}$	$T_{vj}=25^{\circ}\text{C}$	-	1.60	2.05	V		
			$T_{vj}=25^{\circ}\text{C}$	-	1.50	1.95			
	$T_{vj}=125^{\circ}\text{C}$		-	1.45	-				
	$T_{vj}=150^{\circ}\text{C}$		-	1.45	-				
	$T_{vj}=175^{\circ}\text{C}$		-	1.40	-				
Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300\text{V}$ $I_C, I_F = 15\text{A}$ $L_s = 30\text{nH}$ $V_{GE} = +15/-15\text{V}$ $R_G = 24\ \Omega$	$T_{vj}=25^{\circ}\text{C}$	-	0.05	-	μs		
			$T_{vj}=125^{\circ}\text{C}$	-	0.05	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.05	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.05	-			
	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	-			
	$t_{d(off)}$		$T_{vj}=25^{\circ}\text{C}$	-	0.15	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.17	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.18	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.18	-			
	t_f		$T_{vj}=25^{\circ}\text{C}$	-	0.03	-			
			$T_{vj}=125^{\circ}\text{C}$	-	0.04	-			
			$T_{vj}=150^{\circ}\text{C}$	-	0.05	-			
			$T_{vj}=175^{\circ}\text{C}$	-	0.05	-			
Reverse recovery time	t_{rr}	$T_{vj}=25^{\circ}\text{C}$	-	0.06	-				
		$T_{vj}=125^{\circ}\text{C}$	-	0.10	-				
		$T_{vj}=150^{\circ}\text{C}$	-	0.12	-				
		$T_{vj}=175^{\circ}\text{C}$	-	0.13	-				

 (*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}	$V_{CC} = 300V$ $I_C, I_F = 15A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 24 \Omega$	$T_{vj}=25^\circ C$	-	0.12	-	mJ		
			$T_{vj}=125^\circ C$	-	0.17	-			
			$T_{vj}=150^\circ C$	-	0.20	-			
			$T_{vj}=175^\circ C$	-	0.23	-			
	E_{off}	$V_{CC} = 300V$ $I_C, I_F = 15A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 24 \Omega$	$T_{vj}=25^\circ C$	-	0.38	-			
			$T_{vj}=125^\circ C$	-	0.47	-			
			$T_{vj}=150^\circ C$	-	0.50	-			
			$T_{vj}=175^\circ C$	-	0.53	-			
	E_{rr}	$V_{CC} = 300V$ $I_C, I_F = 15A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 24 \Omega$	$T_{vj}=25^\circ C$	-	0.12	-			
			$T_{vj}=125^\circ C$	-	0.21	-			
			$T_{vj}=150^\circ C$	-	0.26	-			
			$T_{vj}=175^\circ C$	-	0.30	-			
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)	$V_{GE} = 15V$ $I_C = 15A$	$T_{vj}=25^\circ C$	-	1.40	1.85	V		
			$T_{vj}=25^\circ C$	-	1.30	1.75			
	$T_{vj}=125^\circ C$		-	1.45	-				
	$T_{vj}=150^\circ C$		-	1.50	-				
$V_{CE(sat)}$ (chip)	$T_{vj}=175^\circ C$	-	-	1.55	-				
		Internal Gate resistance	r_g	-	-	0	-	Ω	
		Brake Switching time (*1)	$t_{d(on)}$	$V_{CC} = 300V$ $I_C = 15A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 24 \Omega$	$T_{vj}=25^\circ C$	-	0.05	-	μs
					$T_{vj}=125^\circ C$	-	0.05	-	
$T_{vj}=150^\circ C$	-				0.05	-			
$T_{vj}=175^\circ C$	-				0.05	-			
t_r	$V_{CC} = 300V$ $I_C = 15A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 24 \Omega$		$T_{vj}=25^\circ C$	-	0.02	-			
			$T_{vj}=125^\circ C$	-	0.02	-			
			$T_{vj}=150^\circ C$	-	0.02	-			
			$T_{vj}=175^\circ C$	-	0.02	-			
$t_{d(off)}$	$V_{CC} = 300V$ $I_C = 15A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 24 \Omega$		$T_{vj}=25^\circ C$	-	0.15	-			
			$T_{vj}=125^\circ C$	-	0.17	-			
			$T_{vj}=150^\circ C$	-	0.18	-			
			$T_{vj}=175^\circ C$	-	0.18	-			
t_f	$V_{CC} = 300V$ $I_C = 15A \quad L_s = 30nH$ $V_{GE} = +15/-15V$ $R_G = 24 \Omega$		$T_{vj}=25^\circ C$	-	0.03	-			
			$T_{vj}=125^\circ C$	-	0.04	-			
			$T_{vj}=150^\circ C$	-	0.05	-			
			$T_{vj}=175^\circ C$	-	0.05	-			
Reverse current	I_{RRM}	$V_R = 650V$	-	-	50	μA			
Forward voltage	V_F (terminal)	$I_F = 10A$	$T_j=25^\circ C$	-	1.65	2.10	V		
			$T_{vj}=25^\circ C$	-	1.55	2.00			
	$T_{vj}=125^\circ C$		-	1.50	-				
	$T_{vj}=150^\circ C$		-	1.50	-				
V_F (chip)	$T_{vj}=175^\circ C$	-	-	1.45	-				
		Reverse current	I_{RRM}	$V_R = 800V$	-	-	50	μA	
Forward voltage	V_{FM}	$I_F = 15A$	terminal	-	1.05	1.50	V		
			chip	-	0.95	1.40			
Resistance	R	$T = 25^\circ C$	-	5000	-	Ω			
B value	B	$T = 100^\circ C$	465	495	520	K			
		$T = 25/50^\circ C$	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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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	-	-	1.31	°C/W
		Inverter FWD	-	-	1.50	
		Brake IGBT	-	-	1.31	
		Brake FWD	-	-	1.92	
		Converter Diode	-	-	0.75	
Contact thermal resistance(*1) (1device)	$R_{th(c-f)}$	Inverter IGBT	-	0.81	-	
		Inverter FWD	-	0.92	-	
		Brake IGBT	-	0.84	-	
		Brake FWD	-	0.80	-	
		Converter Diode	-	0.79	-	

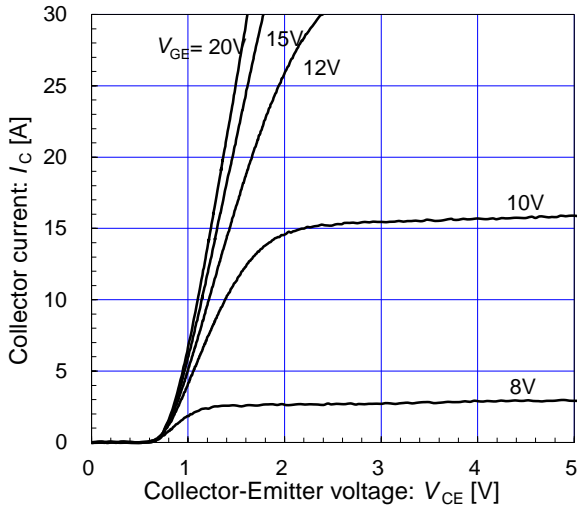
(*1) This is the value which is defined mounting on the additional cooling fin with 1 W/(m·K) thermal grease.

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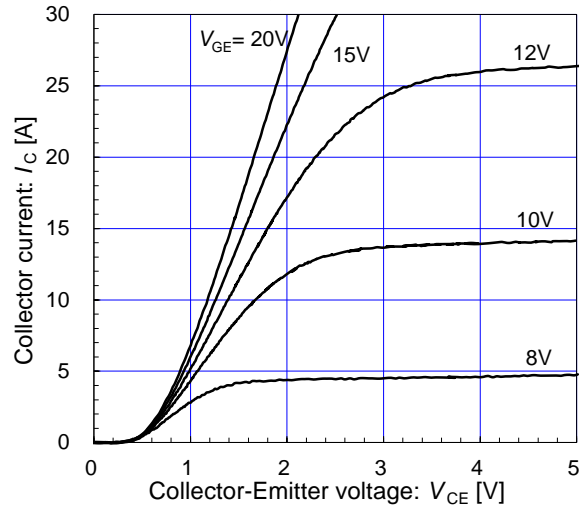
[Inverter]

Collector current vs. Collector-Emitter voltage (typ.)
 $T_{vj} = 25^\circ\text{C} / \text{chip}$



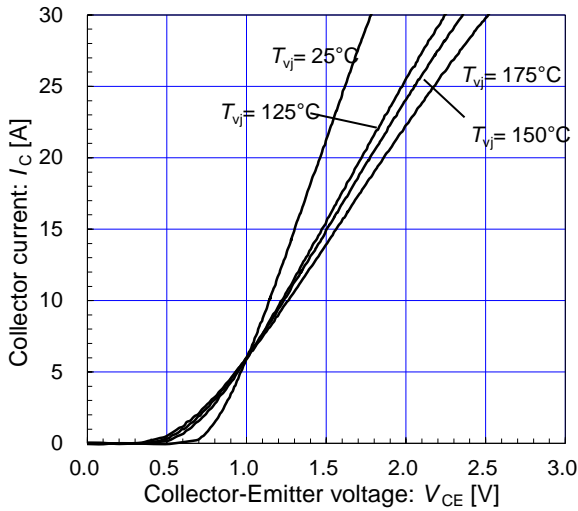
[Inverter]

Collector current vs. Collector-Emitter voltage (typ.)
 $T_{vj} = 175^\circ\text{C} / \text{chip}$



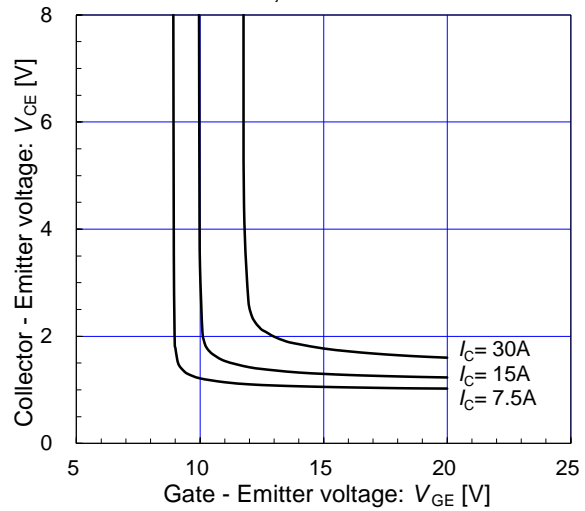
[Inverter]

Collector current vs. Collector-Emitter voltage (typ.)
 $V_{GE} = 15\text{V} / \text{chip}$



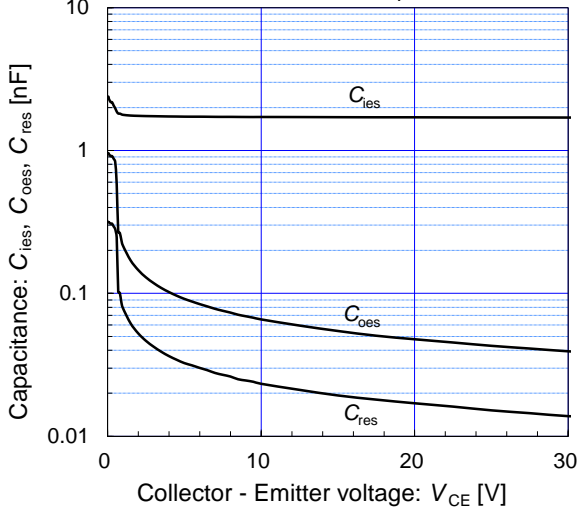
[Inverter]

Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
 $T_{vj} = 25^\circ\text{C} / \text{chip}$



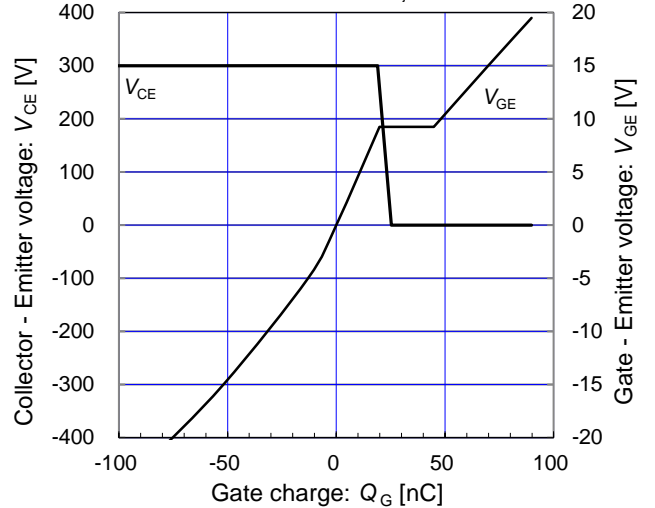
[Inverter]

Capacitance vs. Collector-Emitter voltage (typ.)
 $V_{GE} = 0\text{V}, f = 1\text{MHz}, T_{vj} = 25^\circ\text{C}$



[Inverter]

Dynamic Gate charge (typ.)
 $V_{CC} = 300\text{V}, I_c = 15\text{A}, T_{vj} = 25^\circ\text{C}$

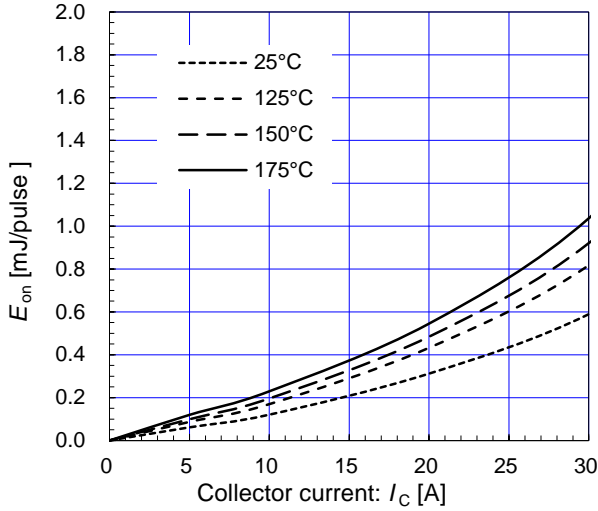


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[Inverter]

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

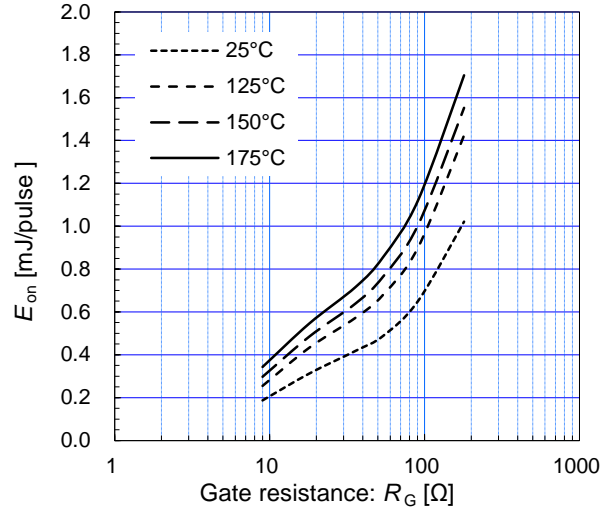
$V_{CC}=300V, V_{GE}=+15/-15V, R_G=24\Omega$



[Inverter]

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

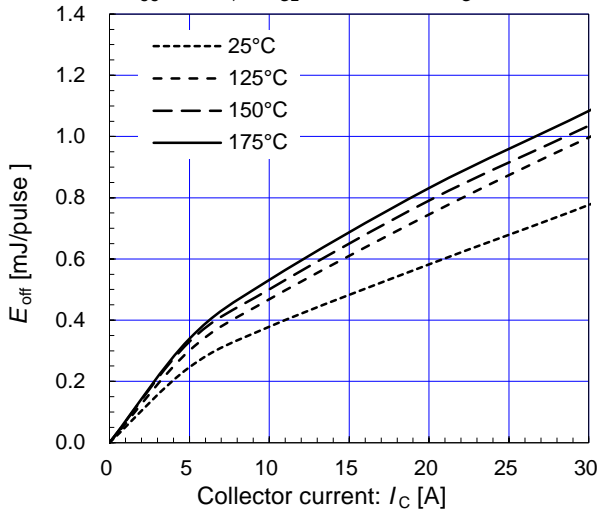
$V_{CC}=300V, V_{GE}=+15/-15V, I_C=15A$



[Inverter]

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

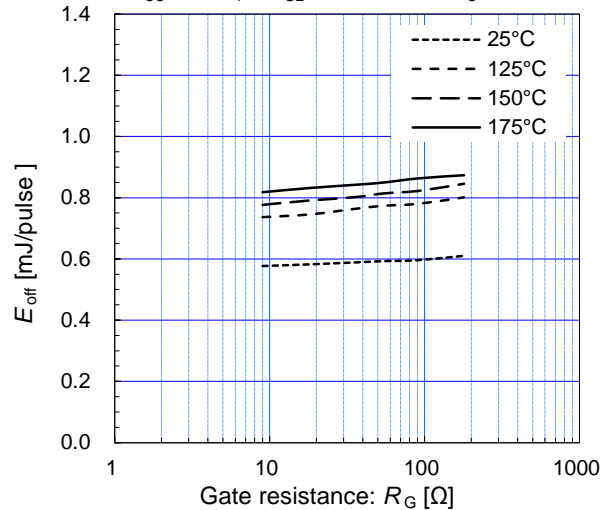
$V_{CC}=300V, V_{GE}=+15/-15V, R_G=24\Omega$



[Inverter]

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

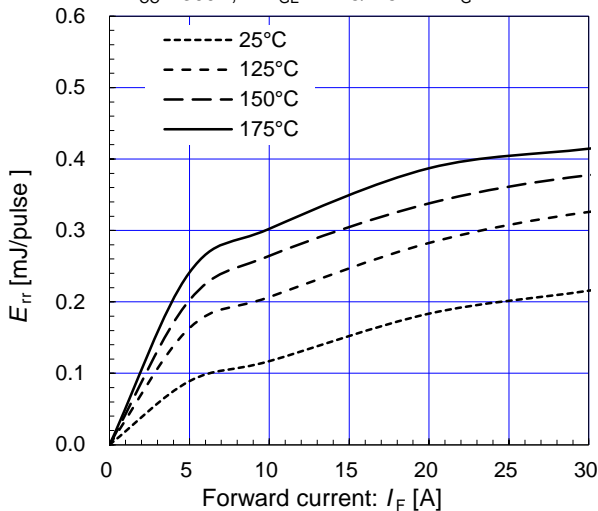
$V_{CC}=300V, V_{GE}=+15/-15V, I_C=15A$



[Inverter]

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

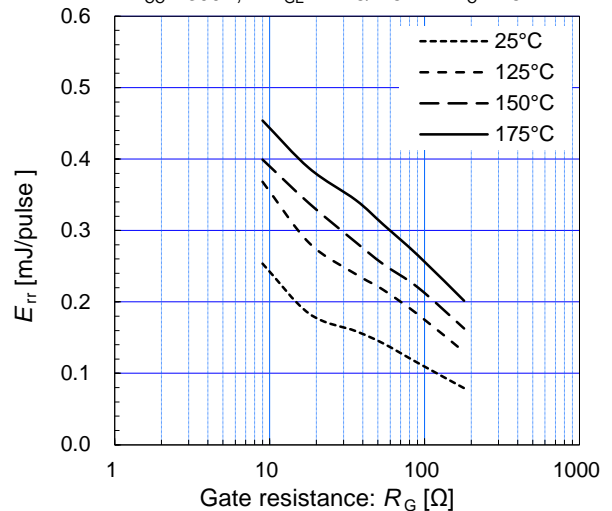
$V_{CC}=300V, V_{GE}=+15/-15V, R_G=24\Omega$



[Inverter]

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

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



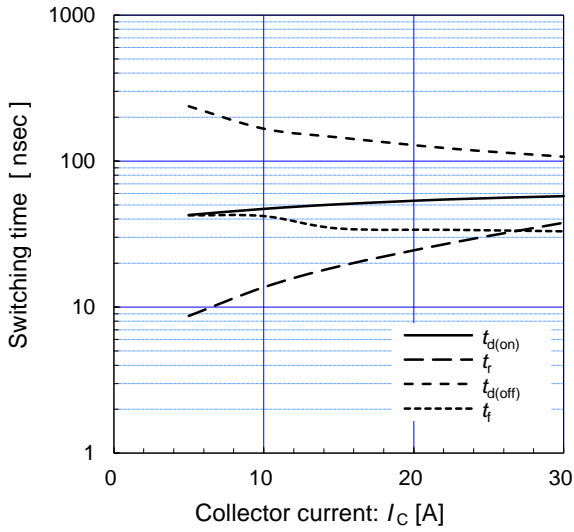
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[Inverter]

Switching time vs. Collector current (typ.)

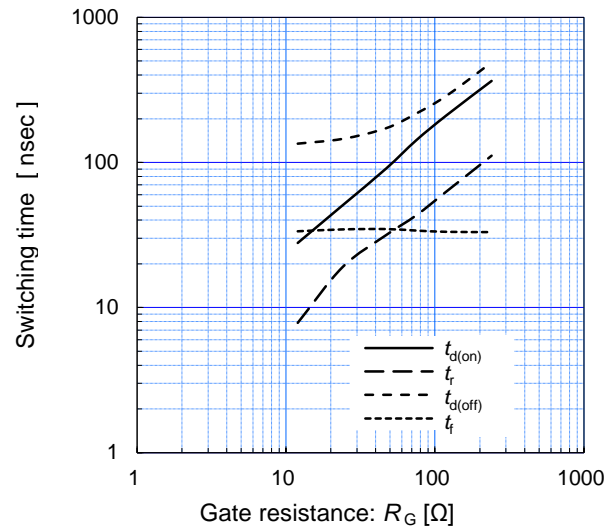
$V_{CC}=300V, R_G=24\Omega, V_{GE}=+15/-15V, T_{vj}=25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

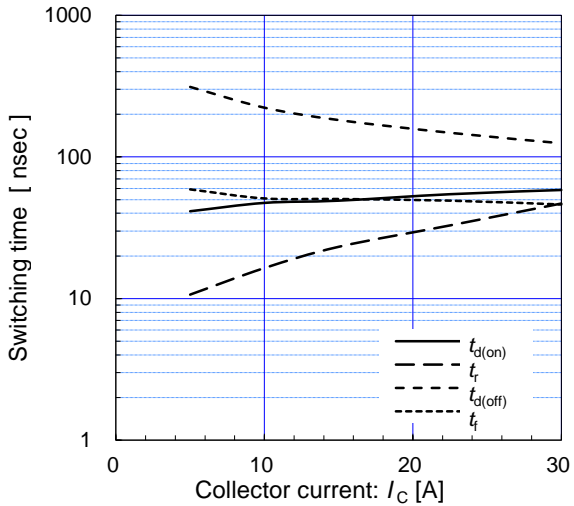
$V_{CC}=300V, I_C=15A, V_{GE}=+15/-15V, T_{vj}=25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

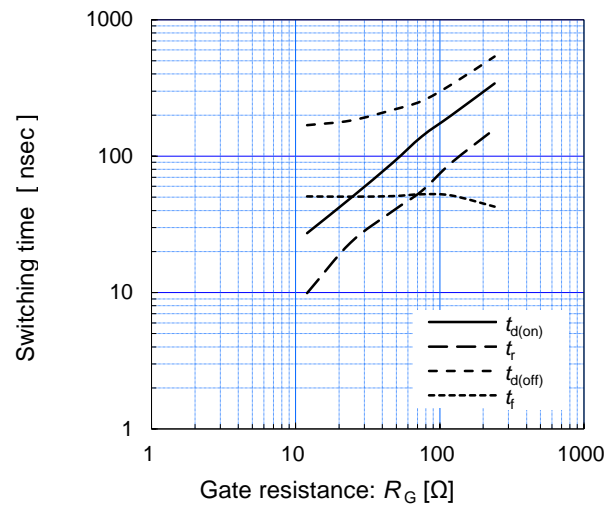
$V_{CC}=300V, R_G=24\Omega, V_{GE}=+15/-15V, T_{vj}=175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

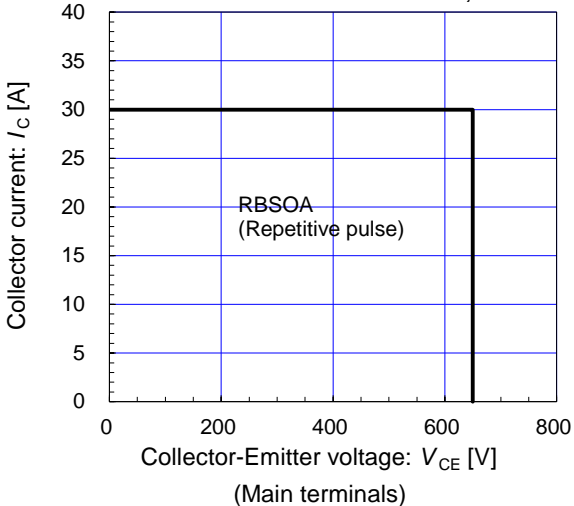
$V_{CC}=300V, I_C=15A, V_{GE}=+15/-15V, T_{vj}=175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

$V_{GE}=+15/-15V, R_G \geq 24\Omega, T_{vj}=175^\circ C$

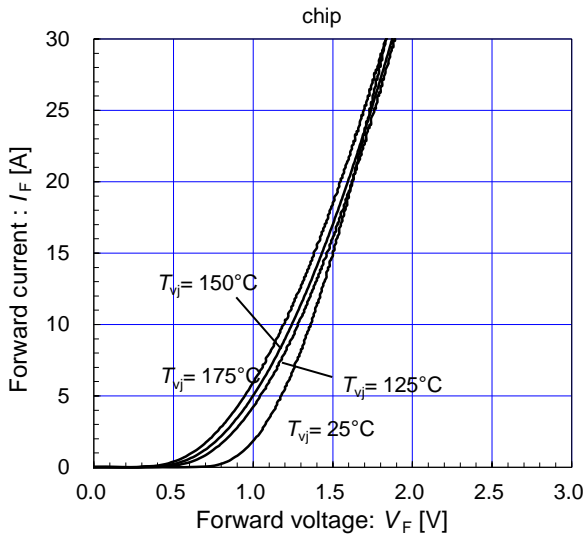


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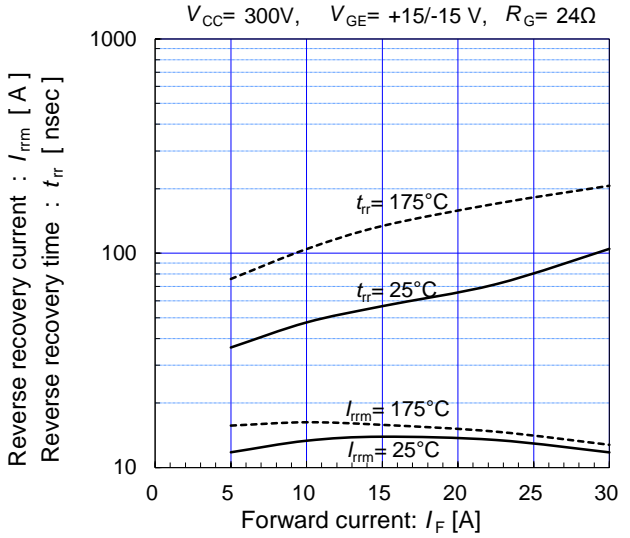
[Inverter]

Forward current vs. Forward voltage (typ.)



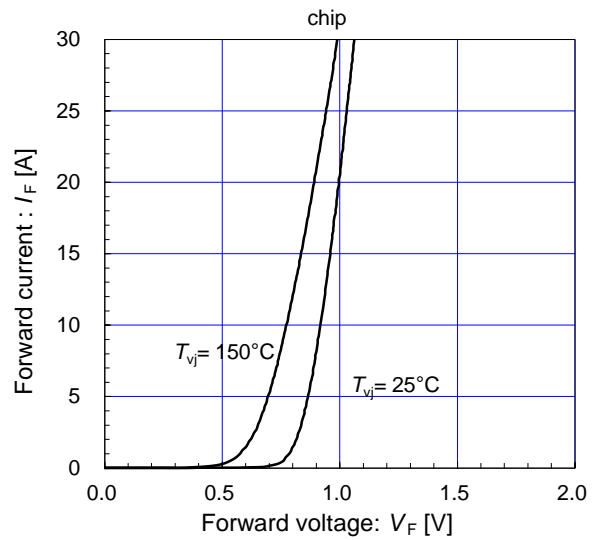
[Inverter]

Reverse recovery characteristics (typ.)

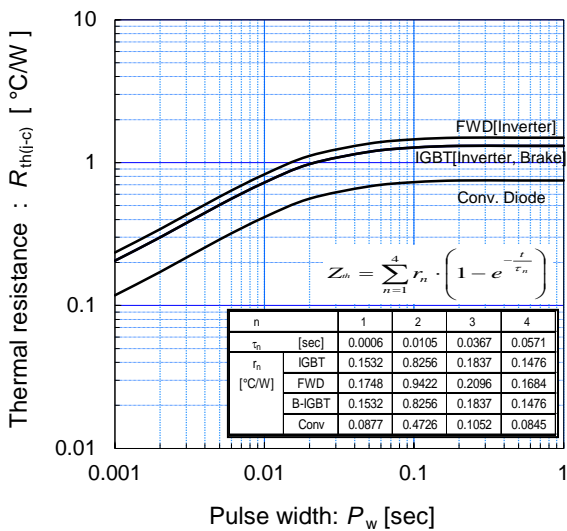


[Converter]

Forward current vs. Forward voltage (typ.)

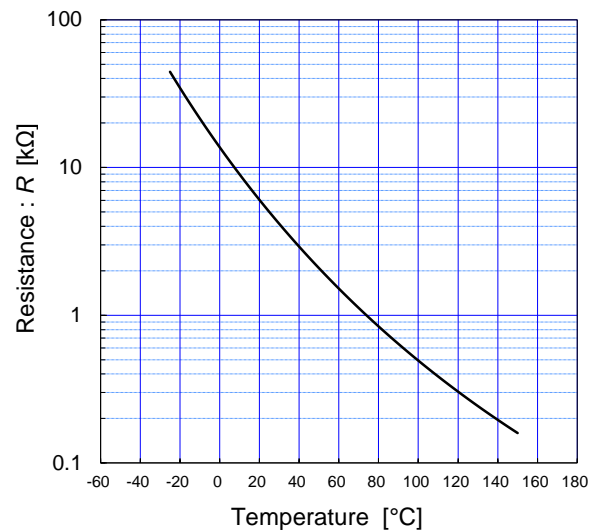


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



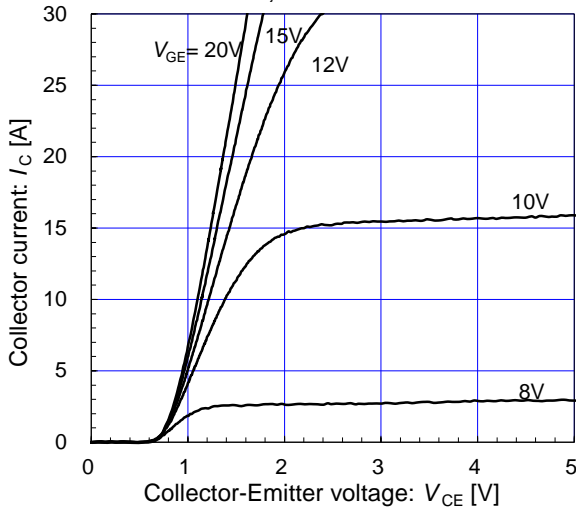
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[Brake]

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

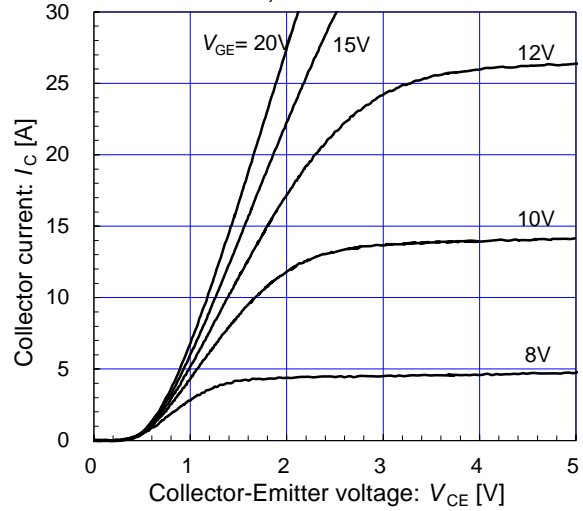
$T_{vj} = 25^{\circ}\text{C} / \text{chip}$



[Brake]

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

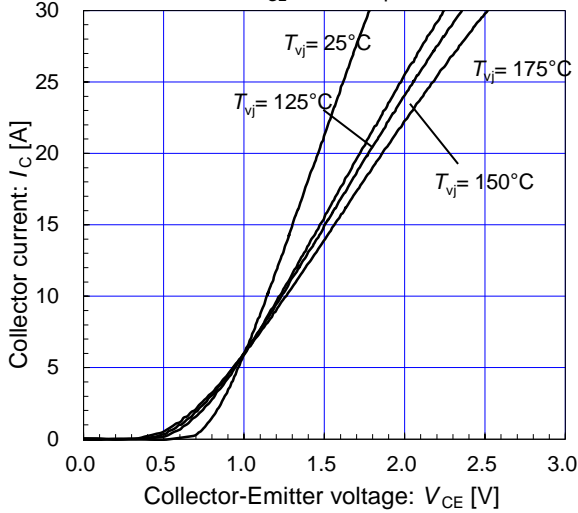
$T_{vj} = 175^{\circ}\text{C} / \text{chip}$



[Brake]

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

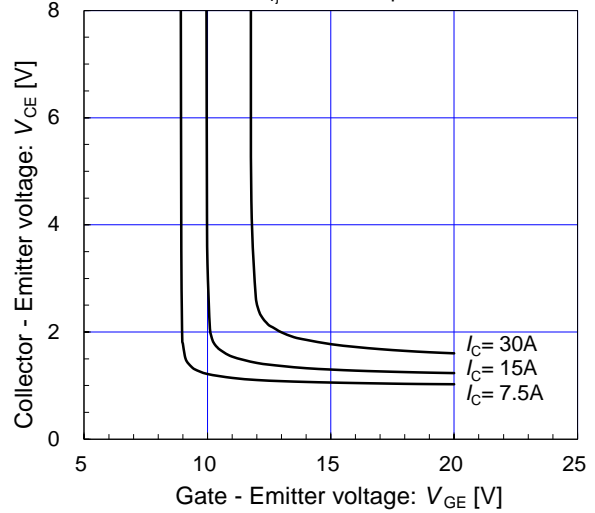
$V_{GE} = 15\text{V} / \text{chip}$



[Brake]

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

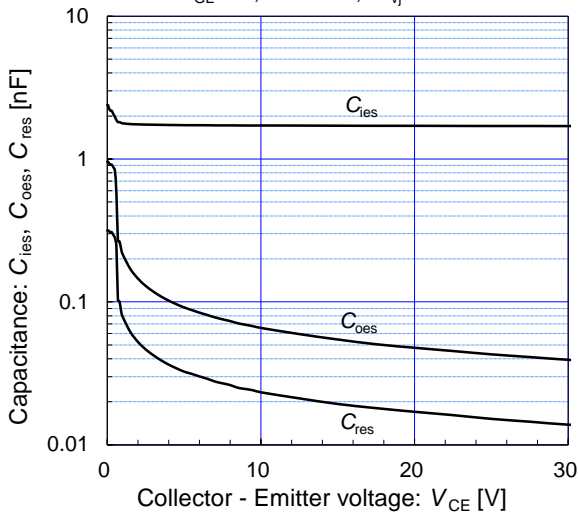
$T_{vj} = 25^{\circ}\text{C} / \text{chip}$



[Brake]

Capacitance vs. Collector-Emittor voltage (typ.)

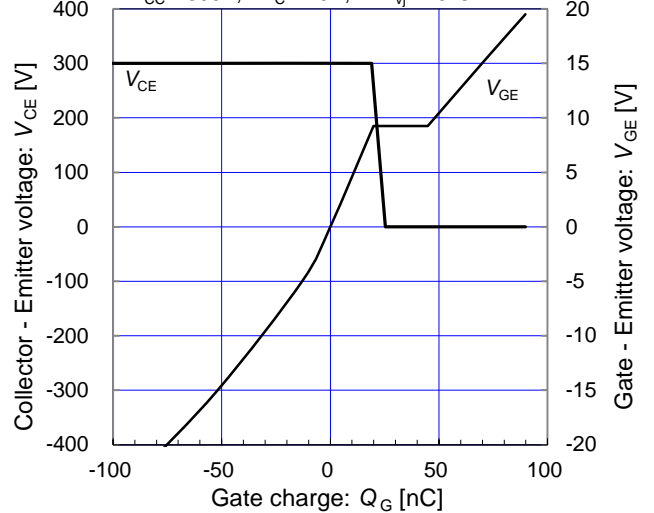
$V_{GE} = 0\text{V}, f = 1\text{MHz}, T_{vj} = 25^{\circ}\text{C}$



[Brake]

Dynamic Gate charge (typ.)

$V_{CC} = 300\text{V}, I_C = 15\text{A}, T_{vj} = 25^{\circ}\text{C}$



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