

7MBR25XKC120-50

IGBT Modules

Power Module(X series)
1200V / 25A / PIM

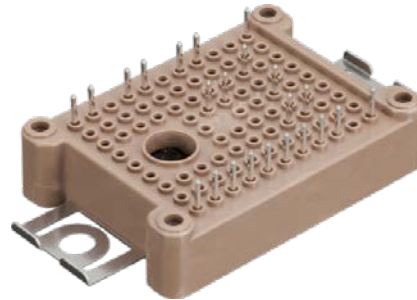
□ Features

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

□ Applications

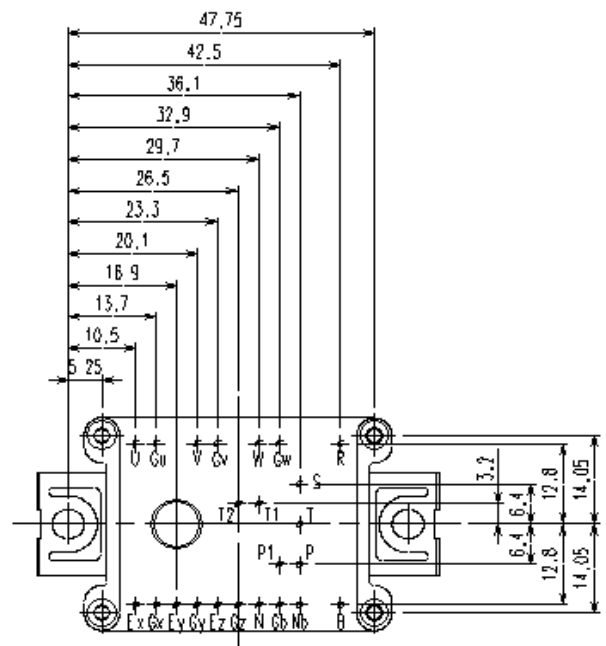
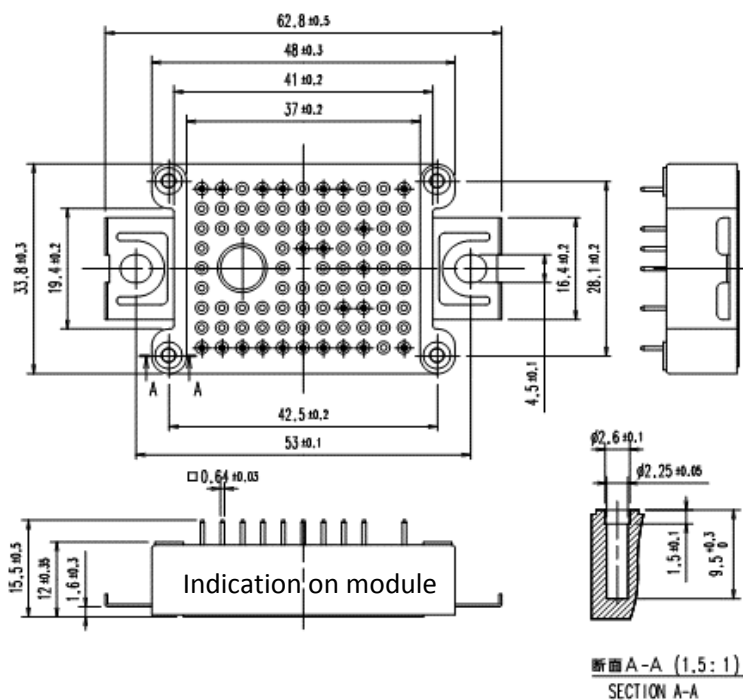
Inverter for Motor Drive
AC and DC Servo Drive Amplifier
Uninterruptible Power Supply

□ Typical appearance



□ Outline drawing (Unit : mm)

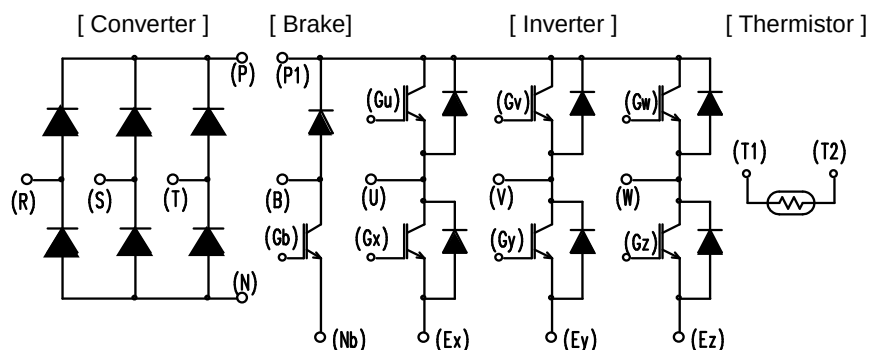
shows theoretical dimension.
() shows reference dimension.



Weight: 25 g (typ.)

PIN POSITIONS WITH TOLERANCE ± 0.4

□ Equivalent circuit



7MBR25XKC120-50

IGBT Modules

□ 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	$T_c=100^{\circ}\text{C}$	25	A	
		I_C pulse	1ms		40		
	Forward current	I_F	Continuous		25		
		I_F pulse	1ms		40		
Collector power dissipation		P_C	1 device		155	W	
Brake IGBT	Collector-Emitter voltage	V_{CES}			1200	V	
	Gate-Emitter voltage	V_{GES}			±20	V	
	Collector current	I_C	Continuous	$T_c=100^{\circ}\text{C}$	25	A	
		I_C pulse	1ms		40		
	Collector power dissipation		P_C	1 device		155	W
Brake FWD	Forward current	I_F	Continuous		10	A	
		I_{FRM}	1ms		20		
	Repetitive peak reverse voltage		V_{RRM}			1200	V
	Repetitive peak reverse voltage		V_{RRM}			1600	V
Converter	Average output current	I_O	Three-phase full wave rectified	$T_c=80^{\circ}\text{C}$	25	A	
	Surge current (Non-Repetitive) (*1)	I_{FSM}	$t=10\text{ms}$, Half sine wave form	$T_{vj}=25^{\circ}\text{C}$	350	A	
				$T_{vj}=150^{\circ}\text{C}$	300		
	I^2t (Non-Repetitive) (*1)	I^2t		$T_{vj}=25^{\circ}\text{C}$	615	A ² s	
				$T_{vj}=150^{\circ}\text{C}$	450		
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)

7MBR25XKC120-50

IGBT Modules

□ 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}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	50	μA
	Gate-Emitter leakage current	I_{GES}	$V_{CE} = 0V \quad V_{GE} = +20/-20V$		-	-	100	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	$V_{CE} = 20V$ $I_C = 25mA$		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	$V_{GE} = 15V$ $I_C = 25A$	$T_{vj}=25^{\circ}C$	-	1.85	2.30	V
		$V_{CE(sat)}$ (chip)		$T_{vj}=25^{\circ}C$	-	1.70	2.15	
				$T_{vj}=125^{\circ}C$	-	2.20	-	
				$T_{vj}=150^{\circ}C$	-	2.30	-	
				$T_{vj}=175^{\circ}C$	-	2.40	-	
	Internal Gate resistance	r_g	-		-	0	-	Ω
	Capacitance	C_{ies}	$V_{CE} = 10V, V_{GE} = 0V, f = 1MHz$		-	2.0	-	nF
		C_{oes}			-	0.07	-	
		C_{res}			-	0.02	-	
	Gate charge	Q_G	$V_{CC} = 600V \quad V_{GE} = -15 \rightarrow +15V$ $I_C = 25A$		-	130	-	nC
	Forward voltage	V_F (terminal)	$I_F = 25A$	$T_{vj}=25^{\circ}C$	-	2.85	3.30	V
		V_F (chip)		$T_{vj}=25^{\circ}C$	-	2.70	3.15	
				$T_{vj}=125^{\circ}C$	-	2.95	-	
				$T_{vj}=150^{\circ}C$	-	2.90	-	
				$T_{vj}=175^{\circ}C$	-	2.90	-	
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$ $I_C, I_F = 25A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 20 \Omega$	$T_{vj}=25^{\circ}C$	-	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		$V_{CC} = 600V$ $I_C, I_F = 25A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 20 \Omega$	$T_{vj}=25^{\circ}C$	-	0.02	-		
			$T_{vj}=125^{\circ}C$	-	0.03	-		
			$T_{vj}=150^{\circ}C$	-	0.03	-		
			$T_{vj}=175^{\circ}C$	-	0.03	-		
$t_{d(off)}$		$V_{CC} = 600V$ $I_C, I_F = 25A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 20 \Omega$	$T_{vj}=25^{\circ}C$	-	0.15	-		
			$T_{vj}=125^{\circ}C$	-	0.19	-		
			$T_{vj}=150^{\circ}C$	-	0.20	-		
			$T_{vj}=175^{\circ}C$	-	0.20	-		
t_f		$V_{CC} = 600V$ $I_C, I_F = 25A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 20 \Omega$	$T_{vj}=25^{\circ}C$	-	0.15	-		
			$T_{vj}=125^{\circ}C$	-	0.17	-		
			$T_{vj}=150^{\circ}C$	-	0.20	-		
			$T_{vj}=175^{\circ}C$	-	0.21	-		
Reverse recovery time	t_{rr}	$V_{CC} = 600V$ $I_C, I_F = 25A \quad L_s = 30nH$ $V_{GE} = +15/-15 V$ $R_G = 20 \Omega$	$T_{vj}=25^{\circ}C$	-	0.06	-		
			$T_{vj}=125^{\circ}C$	-	0.11	-		
			$T_{vj}=150^{\circ}C$	-	0.13	-		
			$T_{vj}=175^{\circ}C$	-	0.16	-		

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

7MBR25XKC120-50

IGBT Modules

Items		Symbols	Conditions		Characteristics			Units
					min.	typ.	max.	
Inverter	Switching loss (per pulse)	E_{on}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	1.51	-	mJ
			$I_C,I_F = 25A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	1.95	-	
			$V_{GE} = +15/-15 \text{ V}$	$T_{vj}=150^{\circ}C$	-	2.07	-	
			$R_G = 20 \Omega$	$T_{vj}=175^{\circ}C$	-	2.19	-	
		E_{off}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	1.79	-	
			$I_C,I_F = 25A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	2.30	-	
			$V_{GE} = +15/-15 \text{ V}$	$T_{vj}=150^{\circ}C$	-	2.43	-	
			$R_G = 20 \Omega$	$T_{vj}=175^{\circ}C$	-	2.54	-	
		E_{rr}	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	1.00	-	
			$I_C,I_F = 25A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	1.27	-	
			$V_{GE} = +15/-15 \text{ V}$	$T_{vj}=150^{\circ}C$	-	1.47	-	
			$R_G = 20 \Omega$	$T_{vj}=175^{\circ}C$	-	1.66	-	
Brake	Zero Gate voltage collector current	I_{CES}	$V_{GE} = 0V$ $V_{CE} = 1200V$		-	-	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)	$V_{GE} = 15V$ $I_C = 25A$	$T_{vj}=25^{\circ}C$	-	1.85	2.30	V
		$V_{CE(sat)}$ (chip)	$T_{vj}=25^{\circ}C$	-	1.70	2.15		
			$T_{vj}=125^{\circ}C$	-	2.20	-		
			$T_{vj}=150^{\circ}C$	-	2.30	-		
	$T_{vj}=175^{\circ}C$	-	2.40	-				
	Internal Gate resistance	r_g	-		-	0	-	Ω
	Switching time (*1)	$t_{d(on)}$	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.04	-	μs
			$I_C = 25A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.04	-	
			$V_{GE} = +15/-15 \text{ V}$	$T_{vj}=150^{\circ}C$	-	0.04	-	
			$R_G = 20 \Omega$	$T_{vj}=175^{\circ}C$	-	0.04	-	
t_r		$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.02	-		
		$I_C = 25A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.03	-		
		$V_{GE} = +15/-15 \text{ V}$	$T_{vj}=150^{\circ}C$	-	0.03	-		
		$R_G = 20 \Omega$	$T_{vj}=175^{\circ}C$	-	0.03	-		
$t_{d(off)}$		$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.15	-		
		$I_C = 25A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.19	-		
		$V_{GE} = +15/-15 \text{ V}$	$T_{vj}=150^{\circ}C$	-	0.20	-		
		$R_G = 20 \Omega$	$T_{vj}=175^{\circ}C$	-	0.20	-		
t_f	$V_{CC} = 600V$	$T_{vj}=25^{\circ}C$	-	0.15	-			
	$I_C = 25A \quad L_s = 30nH$	$T_{vj}=125^{\circ}C$	-	0.17	-			
	$V_{GE} = +15/-15 \text{ V}$	$T_{vj}=150^{\circ}C$	-	0.20	-			
	$R_G = 20 \Omega$	$T_{vj}=175^{\circ}C$	-	0.21	-			
Reverse current	I_{RRM}	$V_R = 1200V$		-	-	50	μA	
Forward voltage	V_F (terminal)	$I_F = 10A$	$T_{vj}=25^{\circ}C$	-	2.05	2.50	V	
	V_F (chip)	$I_F = 10A$	$T_{vj}=25^{\circ}C$	-	1.90	2.35		
		$T_{vj}=125^{\circ}C$	-	1.95	-			
		$T_{vj}=150^{\circ}C$	-	1.90	-			
$T_{vj}=175^{\circ}C$	-	1.85	-					
Converter	Reverse current	I_{RRM}	$V_R = 1600V$		-	-	50	μA
	Forward voltage	V_{FM}	$I_F = 25A$	terminal	-	1.20	1.65	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}) = $t_{d(off)} + t_f$

FM6M01725

7MBR25XKC120-50

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 (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.94	°C/W
		Inverter FWD	-	-	1.75	
		Brake IGBT	-	-	0.94	
		Brake FWD	-	-	1.75	
		Converter Diode	-	-	0.97	
Contact thermal resistance(*1) (1device)	$R_{th(c-f)}$	Inverter IGBT	-	0.74	-	
		Inverter FWD	-	0.92	-	
		Brake IGBT	-	0.78	-	
		Brake FWD	-	0.75	-	
		Converter Diode	-	0.78	-	

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

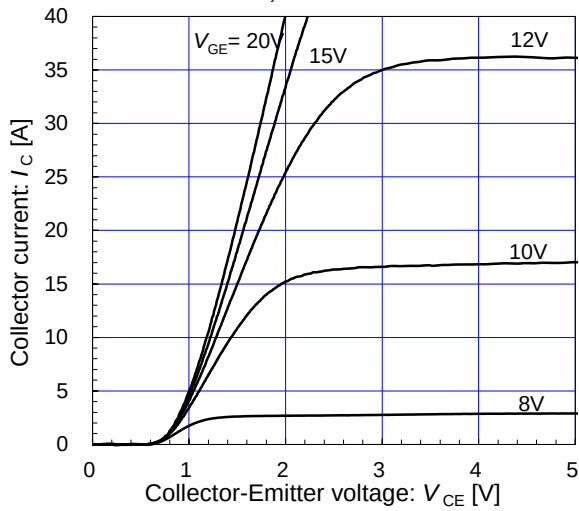
7MBR25XKC120-50

IGBT Modules

[Inverter]

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

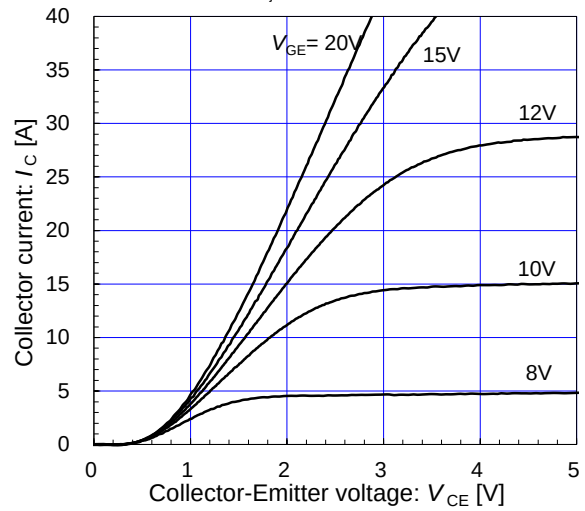
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

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

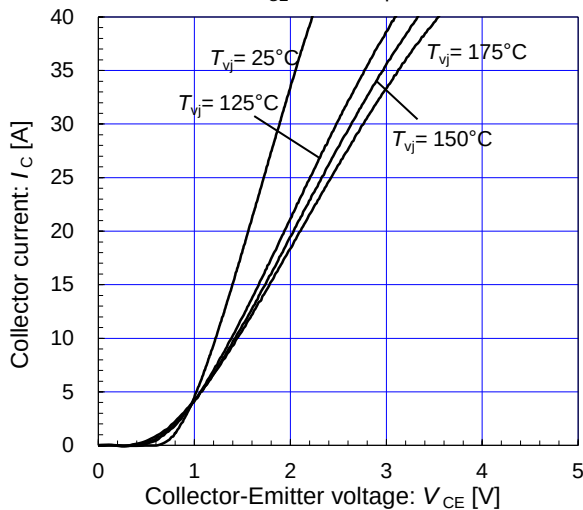
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Inverter]

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

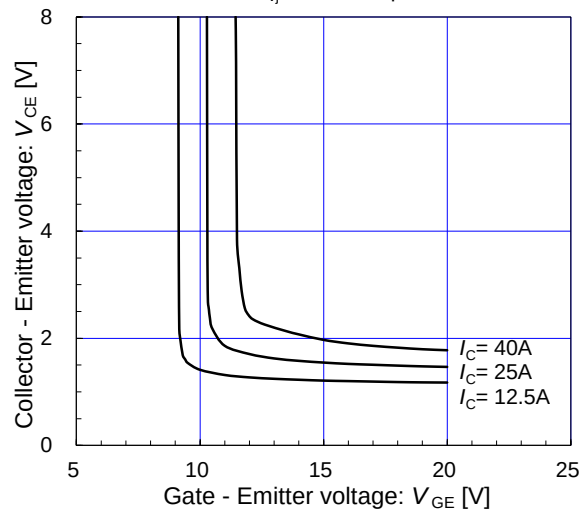
$V_{GE} = 15\text{V}$ / chip



[Inverter]

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

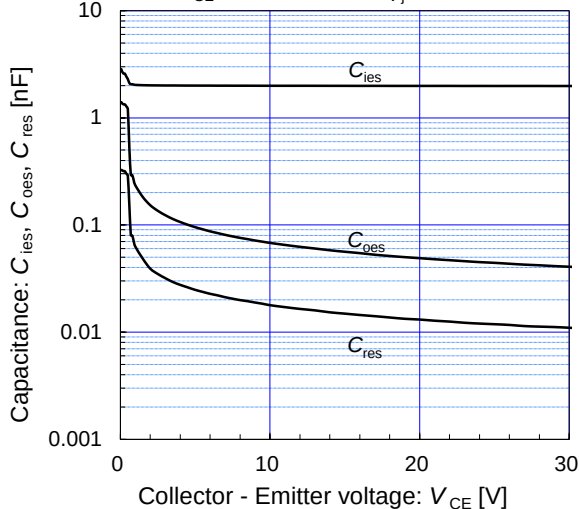
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Inverter]

Capacitance vs. Collector-Emitter voltage (typ.)

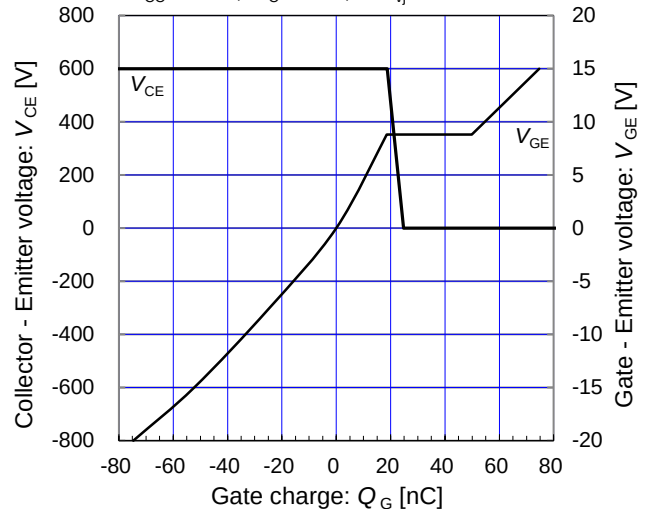
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Inverter]

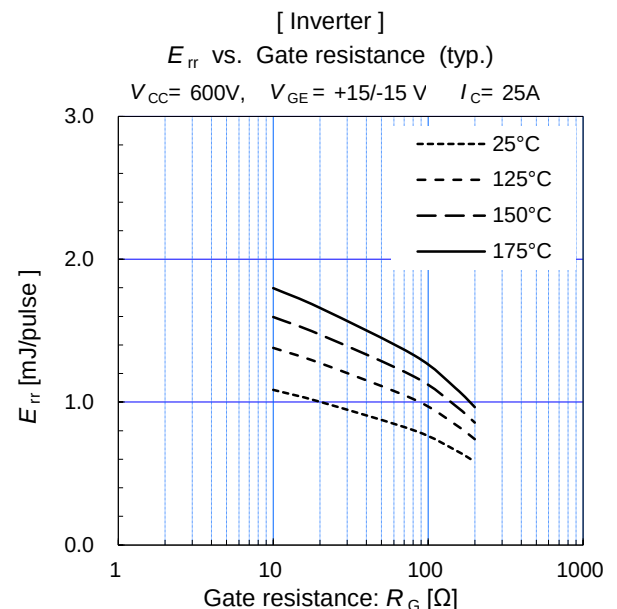
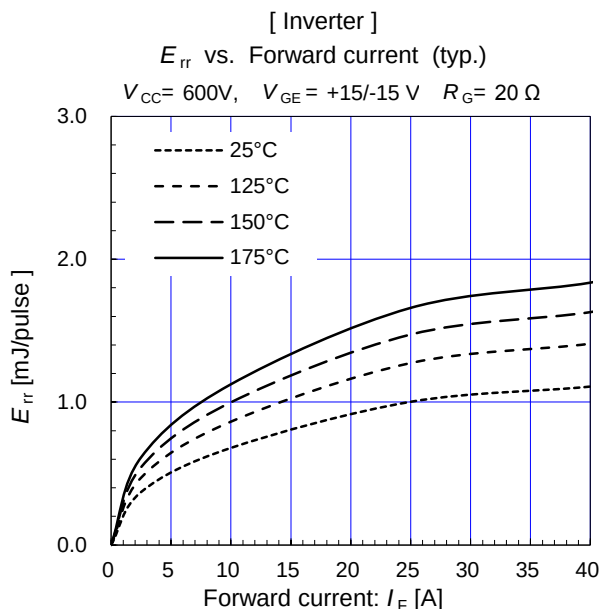
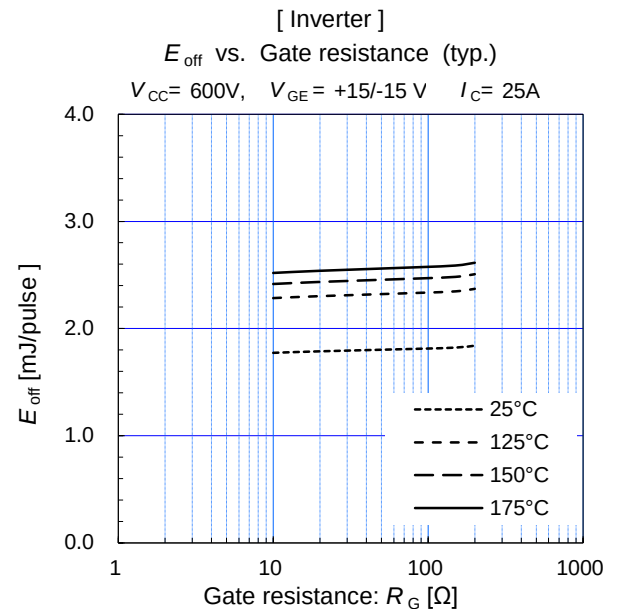
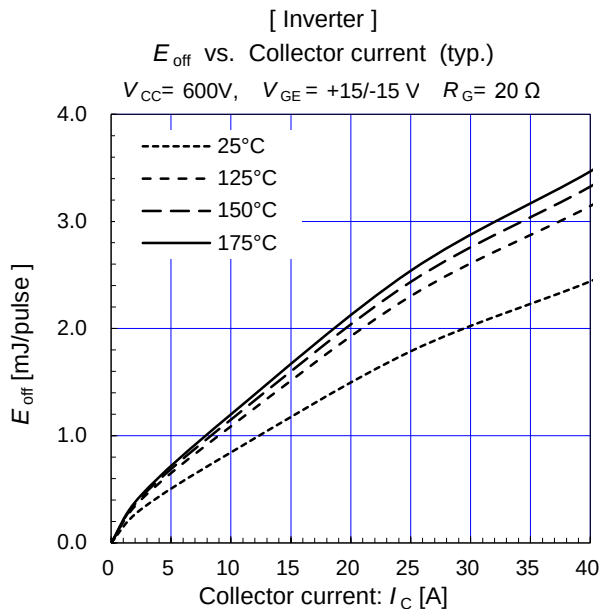
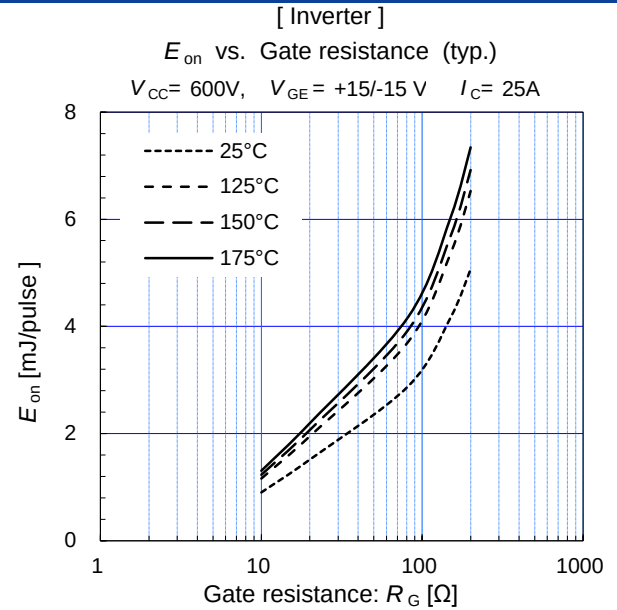
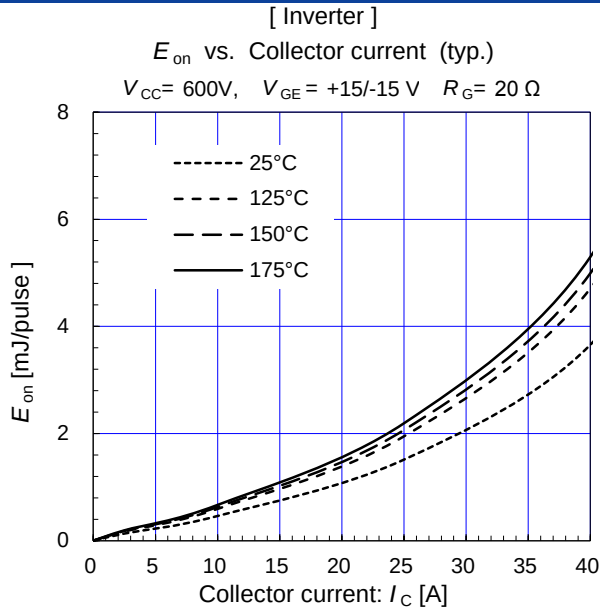
Dynamic Gate charge (typ.)

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



7MBR25XKC120-50

IGBT Modules



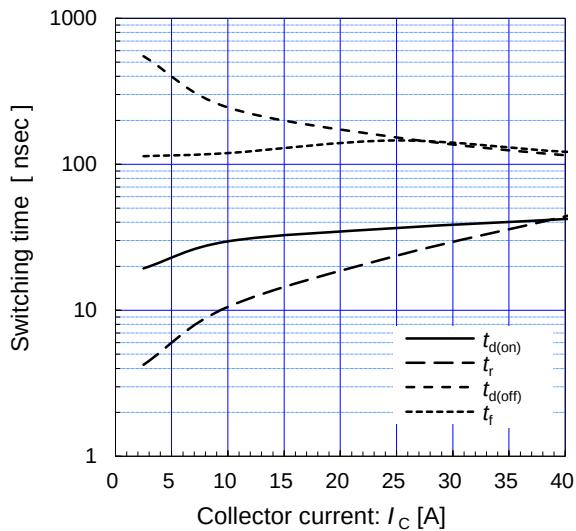
7MBR25XKC120-50

IGBT Modules

[Inverter]

Switching time vs. Collector current (typ.)

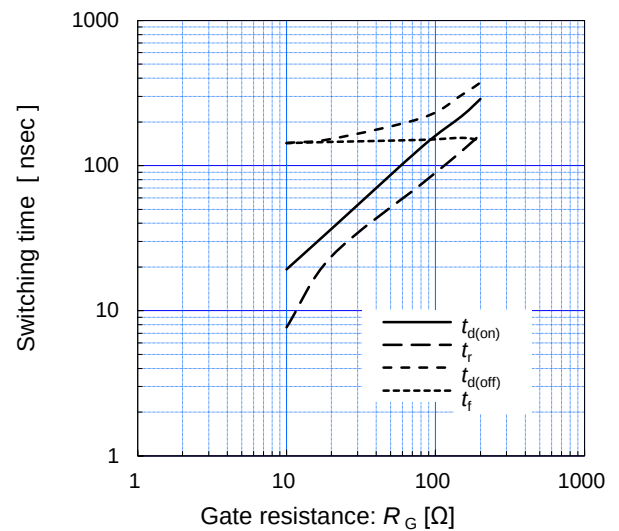
$V_{CC} = 600V$, $R_G = 20\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

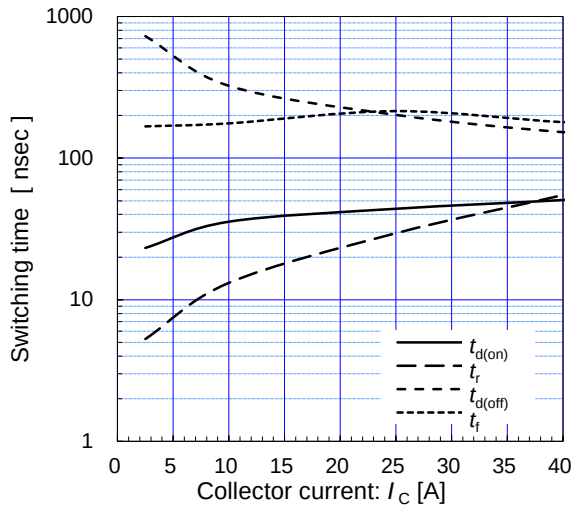
$V_{CC} = 600V$, $I_C = 25A$, $V_{GE} = +15/-15V$, $T_{vj} = 25^\circ C$



[Inverter]

Switching time vs. Collector current (typ.)

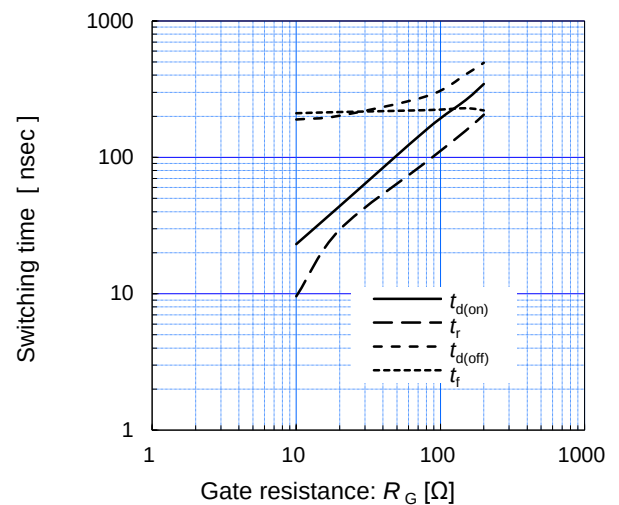
$V_{CC} = 600V$, $R_G = 20\Omega$ $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Switching time vs. Gate resistance (typ.)

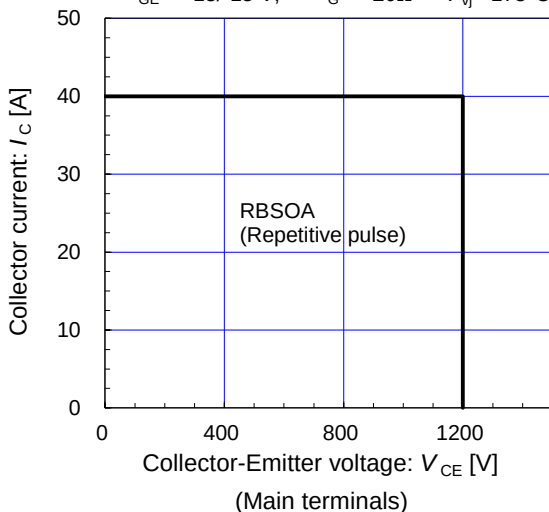
$V_{CC} = 600V$, $I_C = 25A$, $V_{GE} = +15/-15V$, $T_{vj} = 175^\circ C$



[Inverter]

Reverse bias safe operating area (max.)

$V_{GE} = +15/-15V$, $R_G \geq 20\Omega$ $T_{vj} = 175^\circ C$

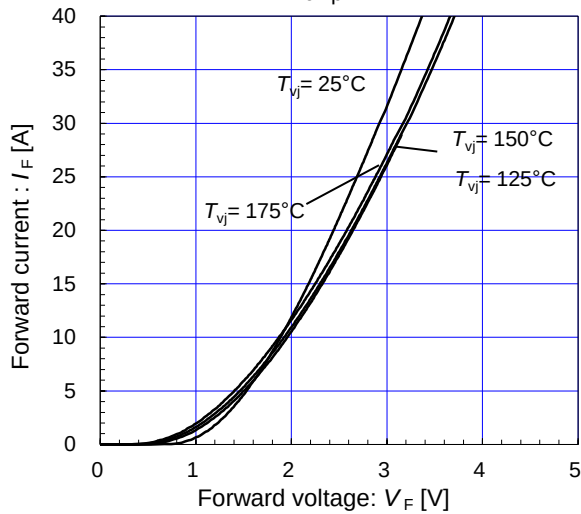


7MBR25XKC120-50

IGBT Modules

[Inverter]

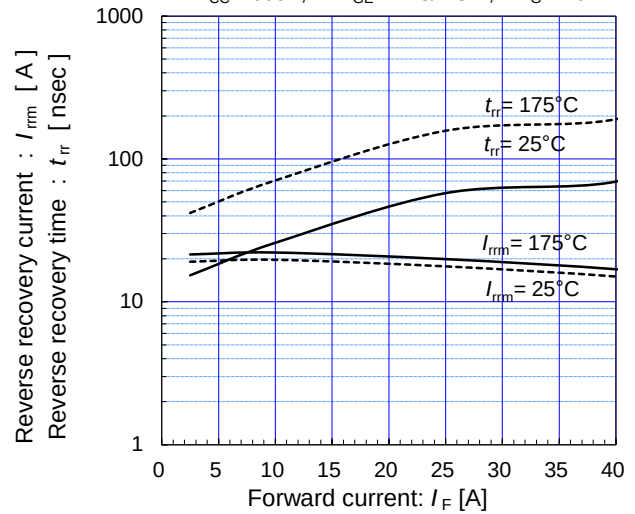
Forward current vs. Forward voltage (typ.)
chip



[Inverter]

Reverse recovery characteristics (typ.)

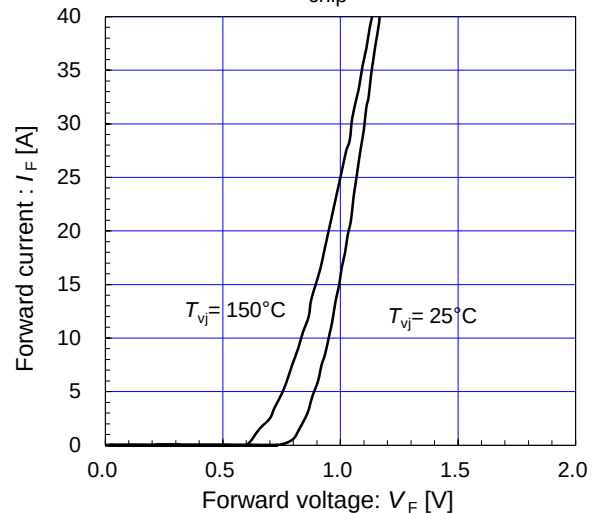
$V_{CC} = 600V$, $V_{GE} = +15/-15V$, $R_G = 20\Omega$



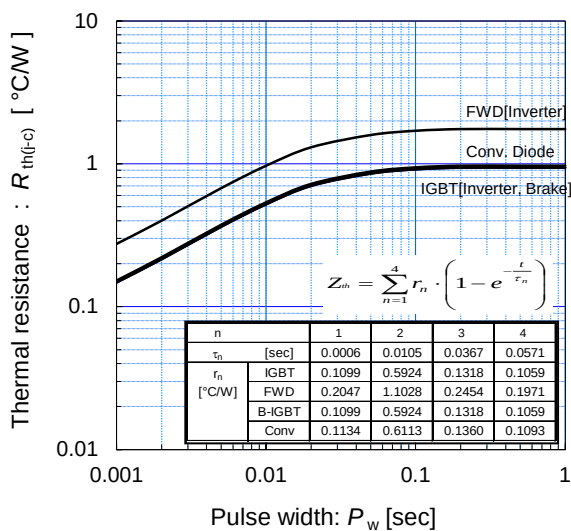
[Converter]

Forward current vs. Forward voltage (typ.)

chip

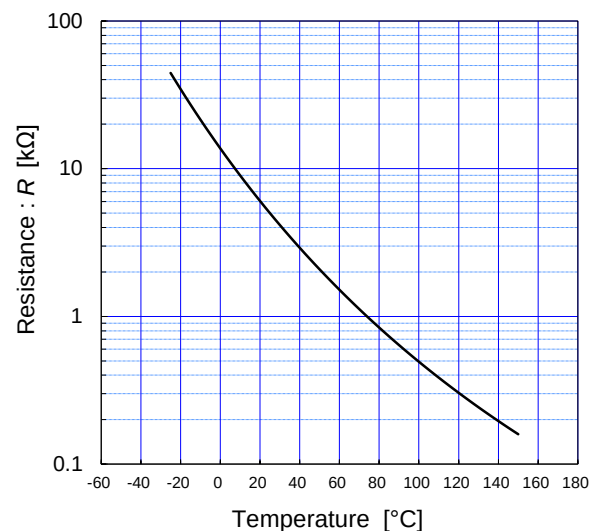


Transient thermal resistance (max.)



[Thermistor]

Temperature characteristic (typ.)



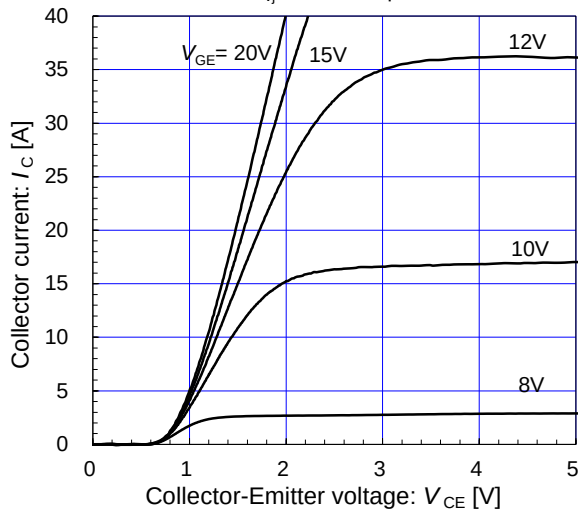
7MBR25XKC120-50

IGBT Modules

[Brake]

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

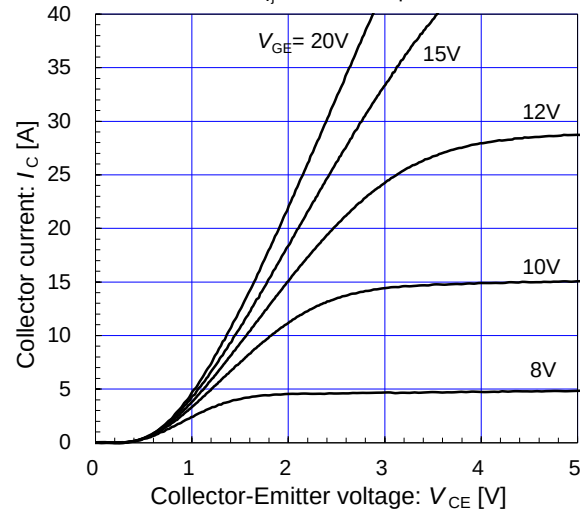
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

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

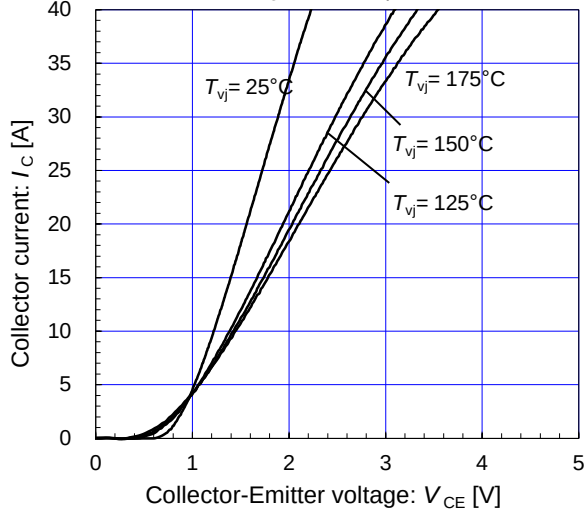
$T_{vj} = 175^{\circ}\text{C}$ / chip



[Brake]

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

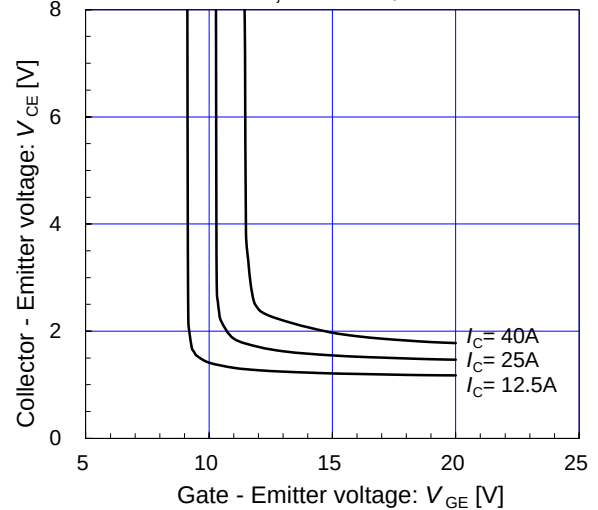
$V_{GE} = 15\text{V}$ / chip



[Brake]

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

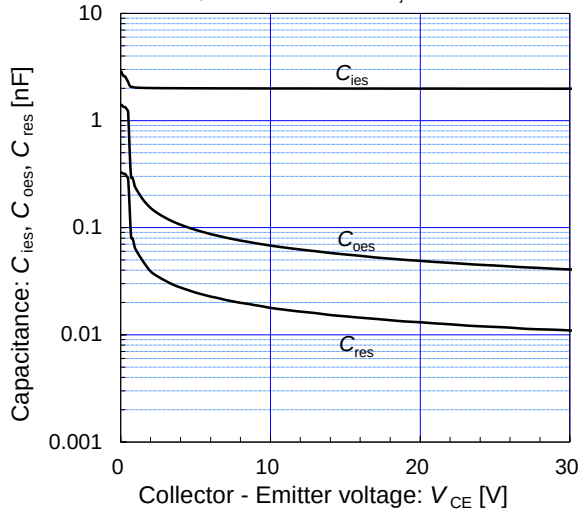
$T_{vj} = 25^{\circ}\text{C}$ / chip



[Brake]

Capacitance vs. Collector-Emmitter voltage (typ.)

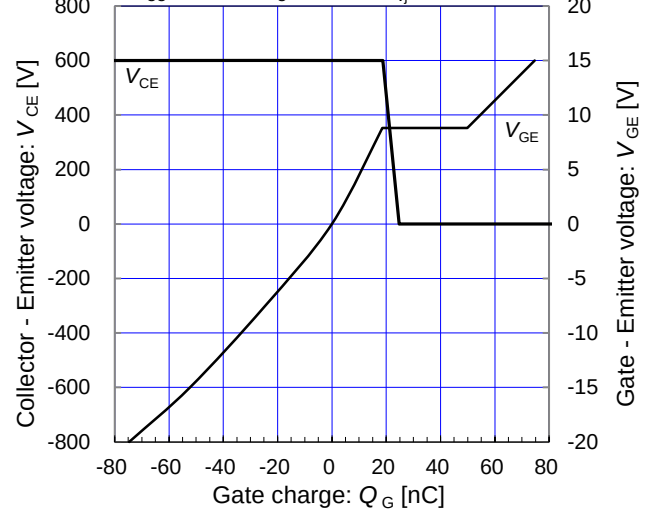
$V_{GE} = 0\text{V}$, $f = 1\text{MHz}$, $T_{vj} = 25^{\circ}\text{C}$



[Brake]

Dynamic Gate charge (typ.)

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



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