7MBR50XPA120-50

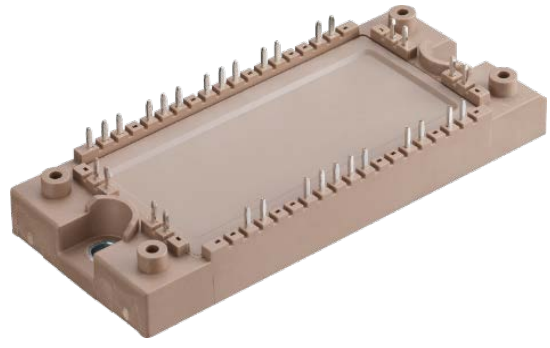
IGBT Modules

Power Module(X series)
1200V / 50A / PIM

□ Feactures

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

□ Typical appearance

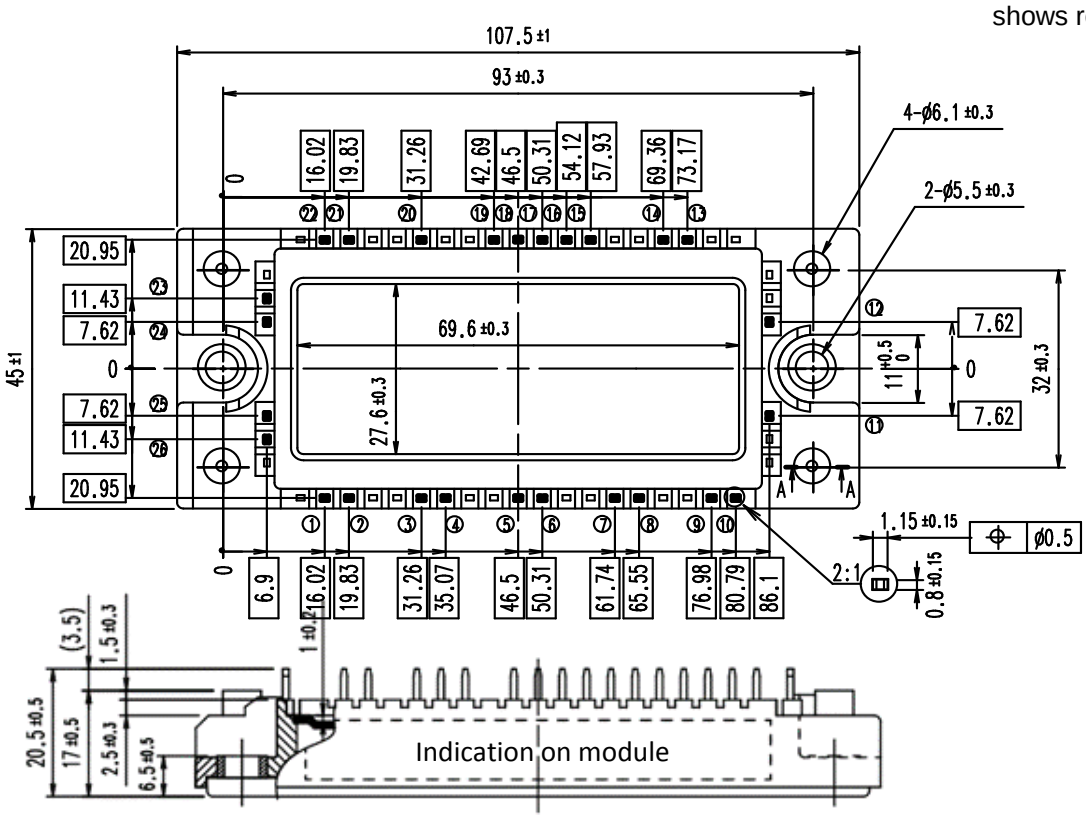


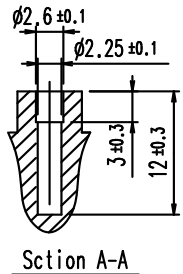
□Applications

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

□ Outline drawing (Unit : mm)

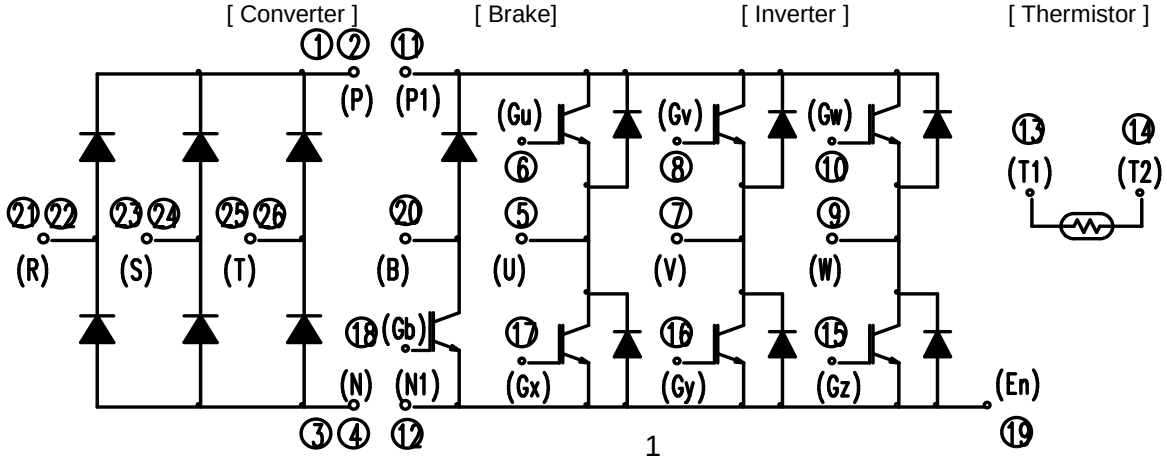
shows theoretical dimension.
shows reference dimension.





Weight: 200 g (typ.)

□ Equivalent circuit



FM6M01718
2017/8

□ Maximum ratings (at T_c = 25°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°C	50	A
			I_C pulse	1ms		100	
	Forward current		I_F	Continuous		50	
			I_F pulse	1ms		100	
	Collector power dissipation		P_C	1 device		250	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°C	35	A
			I_C pulse	1ms		70	
	Collector power dissipation		P_C	1 device		200	W
Brake FWD	Forward current		I_F	Continuous		15	A
			I_{FRM}	1ms		30	
	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°C	50	A
	Surge current (Non-Repetitive) (*1)		I_{FSM}	t=10ms, Half sine wave form	T_{vj}=25°C	630	A
					T_{vj}=150°C	520	
	I^2t (Non-Repetitive) (*1)		I^2t		T_{vj}=25°C	2000	A^2s
					T_{vj}=150°C	1350	
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)

□ Electrical characteristics (at T_{vj} = 25°C unless otherwise specified)

	Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
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 V_{GE} = +20/-20V		-	-	100	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 50mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C = 50A	T_{vj}=25°C	-	1.70	2.20	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.50	1.95	
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.95	-	
				T_{vj}=175°C	-	2.00	-	
	Internal Gate resistance	r_g	-		-	0	-	Ω
	Capacitance	C_{ies}	V_{CE} = 10V, V_{GE} =0V, f = 1MHz		-	5.3	-	nF
		C_{oes}			-	0.18	-	
		C_{res}			-	0.05	-	
	Gate charge	Q_G	V_{CC} = 600V V_{GE}=-15 → +15V I_C = 50A		-	340	-	nC
	Forward voltage	V_F (terminal)	I_F = 50A	T_{vj}=25°C	-	2.00	2.50	V
		V_F (chip)		T_{vj}=25°C	-	1.80	2.25	
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.80	-	
				T_{vj}=175°C	-	1.75	-	
	Switching time (*1)	$t_{d(on)}$	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	0.09	-	μs
				T_{vj}=125°C	-	0.09	-	
				T_{vj}=150°C	-	0.09	-	
				T_{vj}=175°C	-	0.10	-	
		t_r	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	0.04	-	
				T_{vj}=125°C	-	0.04	-	
				T_{vj}=150°C	-	0.04	-	
				T_{vj}=175°C	-	0.04	-	
		$t_{d(off)}$	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	0.24	-	
				T_{vj}=125°C	-	0.27	-	
				T_{vj}=150°C	-	0.27	-	
				T_{vj}=175°C	-	0.28	-	
		t_f	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	0.11	-	
				T_{vj}=125°C	-	0.17	-	
				T_{vj}=150°C	-	0.20	-	
				T_{vj}=175°C	-	0.21	-	
	Reverse recovery time	t_{rr}	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	0.08	-	
				T_{vj}=125°C	-	0.14	-	
				T_{vj}=150°C	-	0.17	-	
				T_{vj}=175°C	-	0.19	-	

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

	Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Switching loss (per pulse)	E_{on}	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	3.78	-	mJ
				T_{vj}=125°C	-	4.90	-	
				T_{vj}=150°C	-	5.46	-	
				T_{vj}=175°C	-	5.83	-	
		E_{off}	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	3.36	-	
				T_{vj}=125°C	-	4.31	-	
				T_{vj}=150°C	-	4.62	-	
				T_{vj}=175°C	-	4.96	-	
		E_{rr}	V_{CC} = 600V I_C,I_F = 50A L_s = 30nH V_{GE} = +15/-15 V R_G = 18 Ω	T_{vj}=25°C	-	1.43	-	
				T_{vj}=125°C	-	2.52	-	
				T_{vj}=150°C	-	3.27	-	
				T_{vj}=175°C	-	3.72	-	
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, V_{GE} = +20/-20V		-	-	100	nA
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C = 35A	T_{vj}=25°C	-	1.65	2.10	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.50	1.95	
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.95	-	
				T_{vj}=175°C	-	2.00	-	
	Internal Gate resistance	r_g	-		-	0	-	Ω
	Switching time (*1)	$t_{d(on)}$	V_{CC} = 600V I_C = 35A L_s = 30nH V_{GE} = +15/-15 V R_G = 30 Ω	T_{vj}=25°C	-	0.10	-	μs
				T_{vj}=125°C	-	0.10	-	
				T_{vj}=150°C	-	0.11	-	
				T_{vj}=175°C	-	0.11	-	
		t_r	V_{CC} = 600V I_C = 35A L_s = 30nH V_{GE} = +15/-15 V R_G = 30 Ω	T_{vj}=25°C	-	0.04	-	
				T_{vj}=125°C	-	0.05	-	
				T_{vj}=150°C	-	0.05	-	
				T_{vj}=175°C	-	0.05	-	
		$t_{d(off)}$	V_{CC} = 600V I_C = 35A L_s = 30nH V_{GE} = +15/-15 V R_G = 30 Ω	T_{vj}=25°C	-	0.23	-	
				T_{vj}=125°C	-	0.27	-	
				T_{vj}=150°C	-	0.27	-	
				T_{vj}=175°C	-	0.27	-	
		t_f	V_{CC} = 600V I_C = 35A L_s = 30nH V_{GE} = +15/-15 V R_G = 30 Ω	T_{vj}=25°C	-	0.12	-	
				T_{vj}=125°C	-	0.18	-	
				T_{vj}=150°C	-	0.20	-	
				T_{vj}=175°C	-	0.21	-	
	Reverse current	I_{RRM}	V_R = 1200V		-	-	50	μA
	Forward voltage	V_F (terminal)	I_F = 15A	T_{vj}=25°C	-	1.95	2.40	V
		V_F (chip)	I_F = 15A	T_{vj}=25°C	-	1.80	2.25	
				T_{vj}=125°C	-	1.85	-	
				T_{vj}=150°C	-	1.80	-	
				T_{vj}=175°C	-	1.75	-	
Converter	Reverse current	I_{RRM}	V_R = 1600V		-	-	50	μA
	Forward voltage	V_{FM}	I_F = 50A	terminal	-	1.25	1.75	V
				chip	-	1.05	1.50	
Thermistor	Resistance	R	T = 25°C		-	5000	-	Ω
			T = 100°C		465	495	520	
	B value	B	T = 25/ 50°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

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

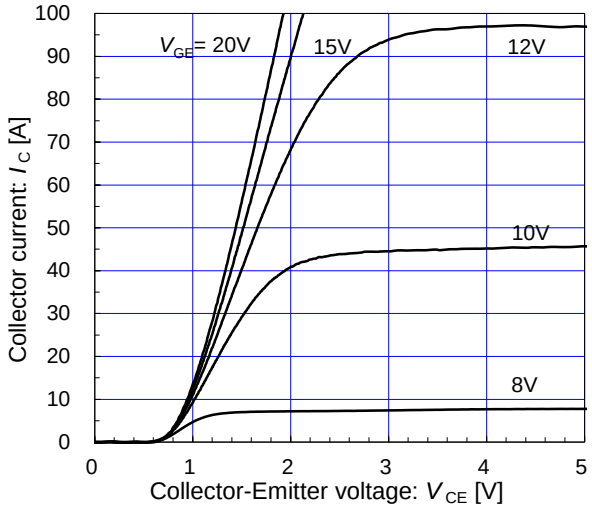
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance (1device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.59	°C/W
		Inverter FWD	-	-	0.71	
		Brake IGBT	-	-	0.74	
		Brake FWD	-	-	1.85	
		Converter Diode	-	-	0.72	
Contact thermal resistance (1 IGBT+1 FWD) (*1)	$R_{th(c-f)}$	with 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.

[Inverter]

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

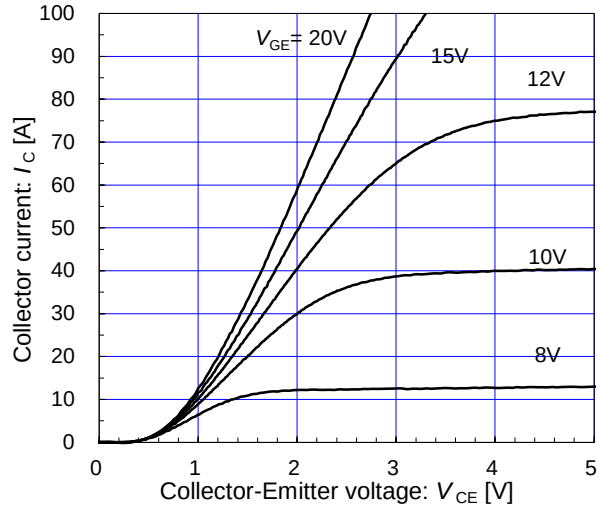
T_{vj}= 25°C / chip



[Inverter]

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

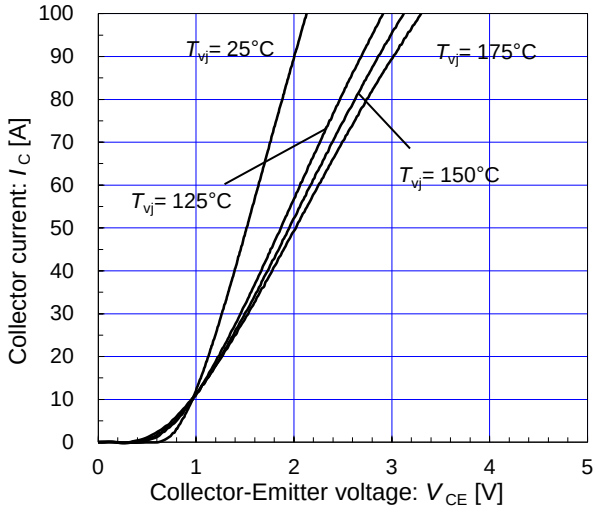
T_{vj}= 175°C / chip



[Inverter]

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

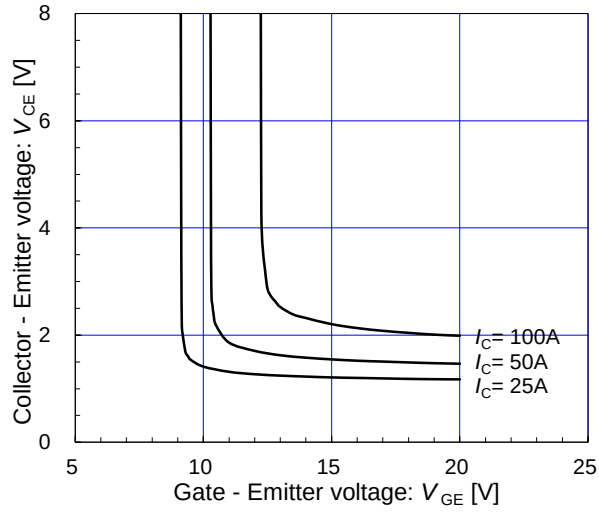
V_{GE}=15V / chip



[Inverter]

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

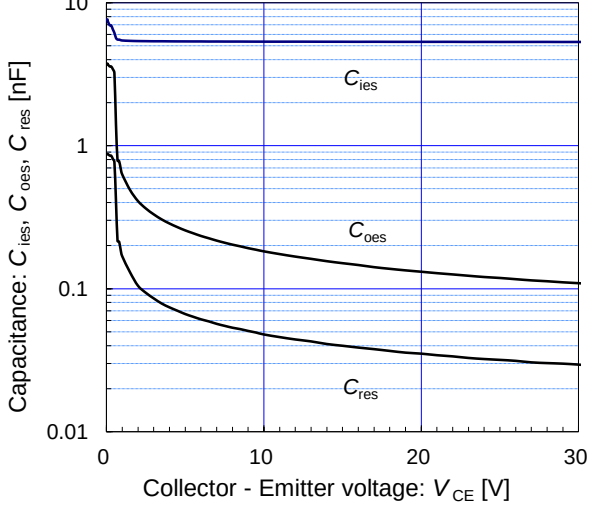
T_{vj}= 25°C / chip



[Inverter]

Capacitance vs. Collector-Emitter voltage (typ.)

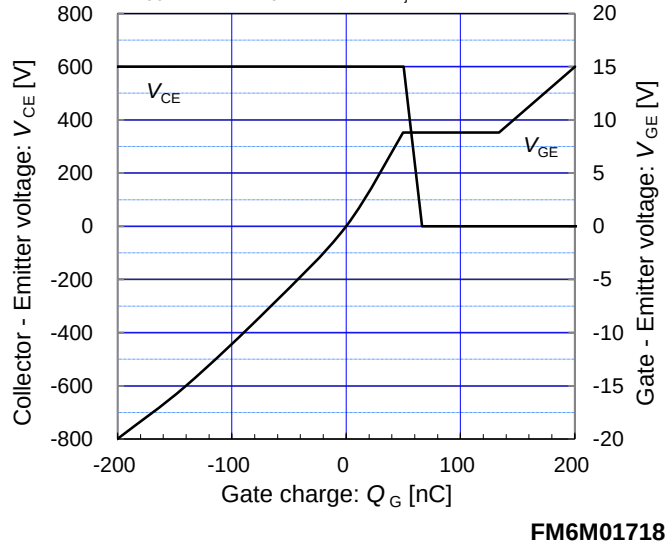
V_{GE}=0V, f= 1MHz, T_{vj}= 25°C



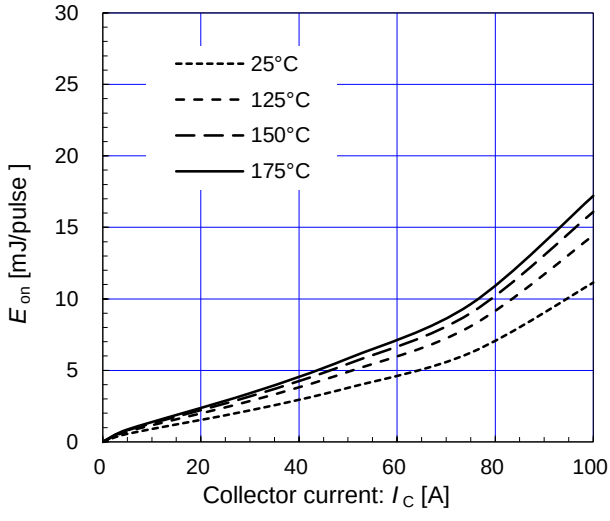
[Inverter]

Dynamic Gate charge (typ.)

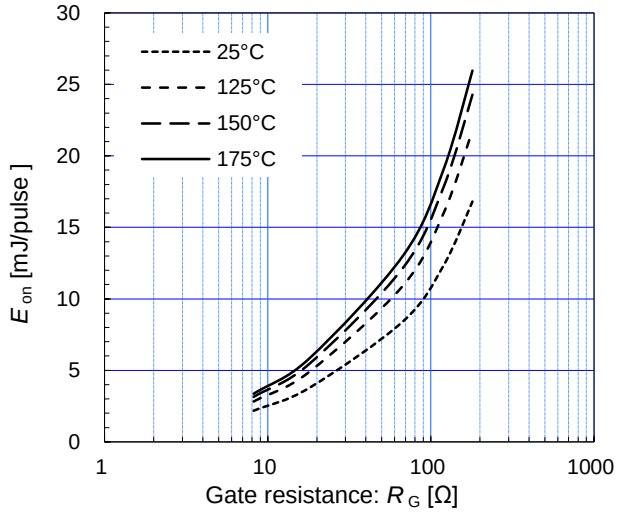
V_{CC}= 600V, I_C= 50A, T_{vj}= 25°C



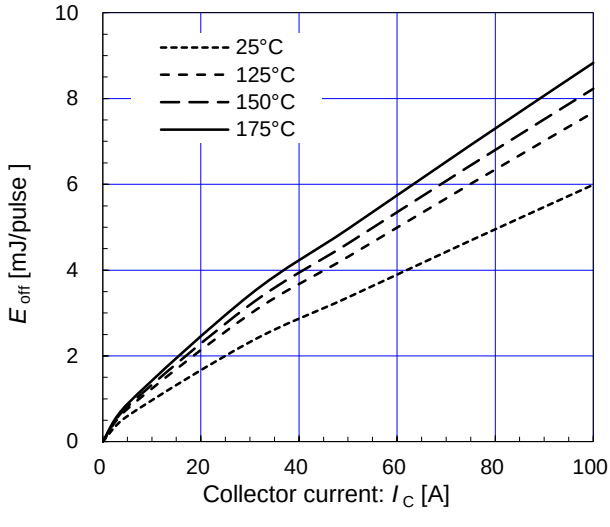
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC}= 600V, V_{GE}= +15/-15 V, R_G= 18 Ω



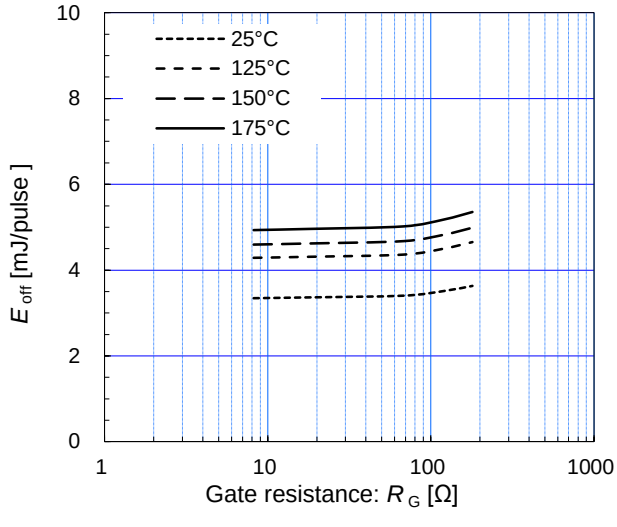
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC}= 600V, V_{GE}= +15/-15 V, I_C= 50A



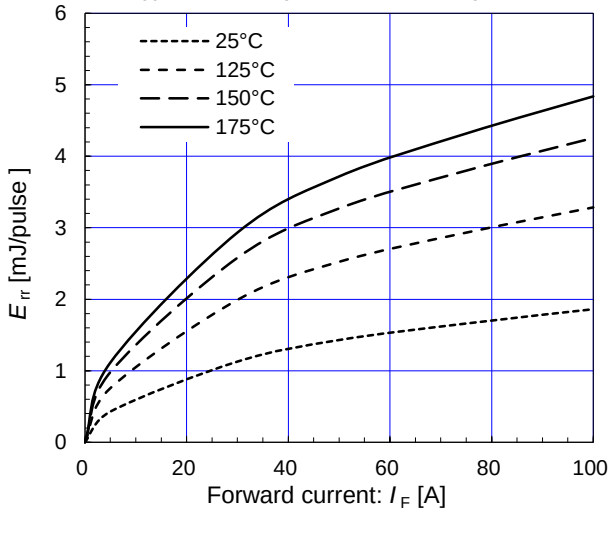
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC}= 600V, V_{GE}= +15/-15 V, R_G= 18 Ω



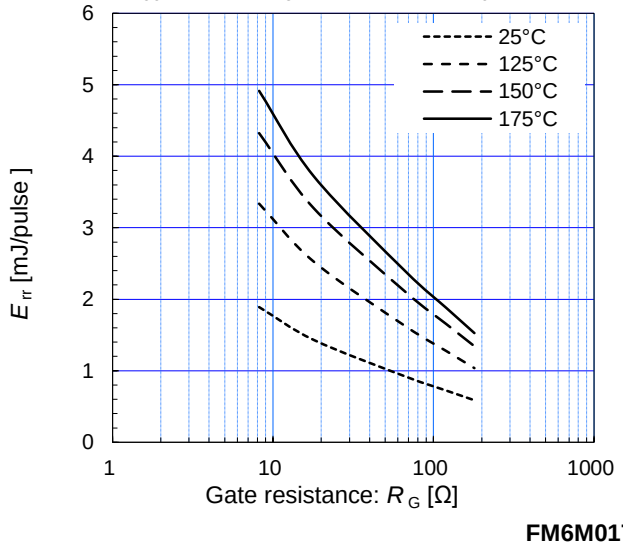
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC}= 600V, V_{GE}= +15/-15 V, I_C= 50A



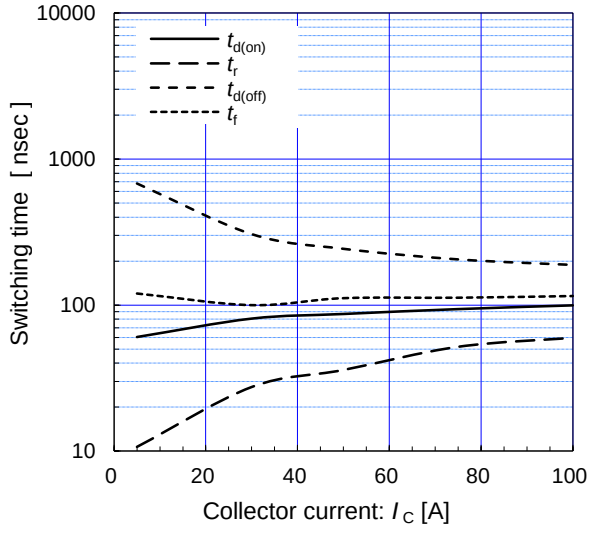
[Inverter]
E_{rr} vs. Forward current (typ.)
V_{CC}= 600V, V_{GE}= +15/-15 V, R_G= 18 Ω



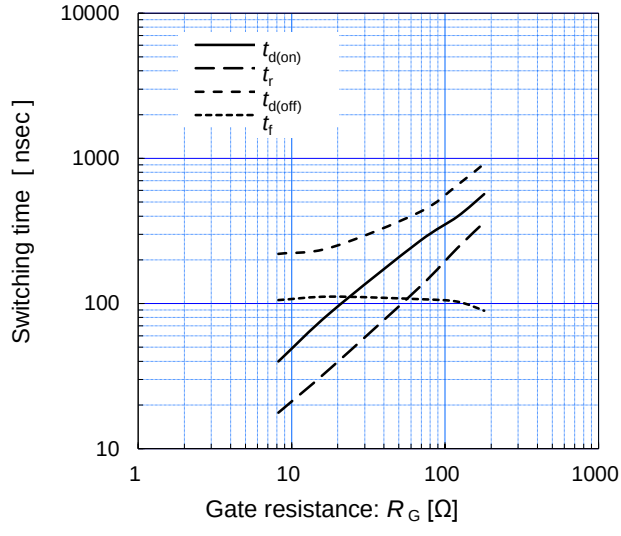
[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC}= 600V, V_{GE}= +15/-15 V, I_C= 50A



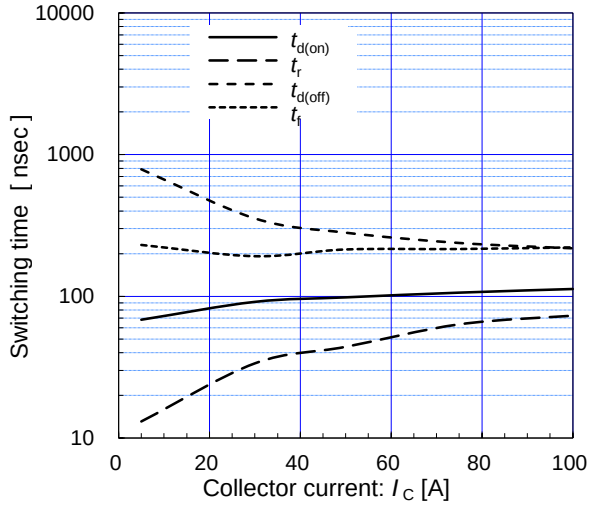
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC}= 600V, R_G= 18Ω V_{GE}= +15/-15 V, T_{vj}= 25°C



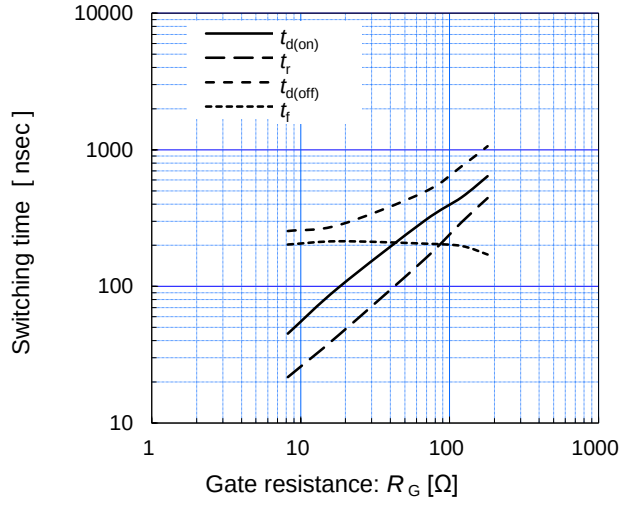
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC}= 600V, I_C= 50A, V_{GE}= +15/-15 V, T_{vj}= 25°C



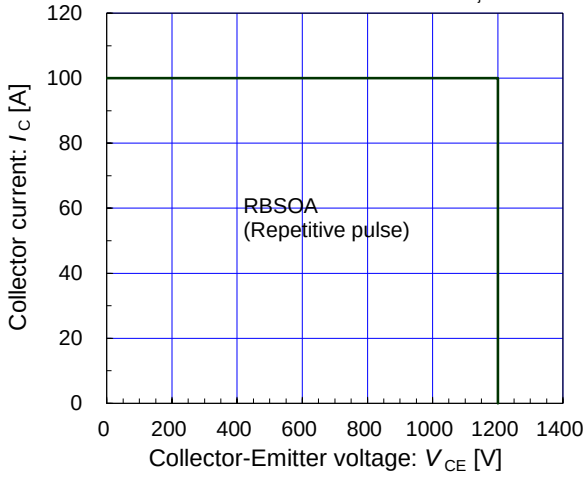
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC}= 600V, R_G= 18Ω V_{GE}= +15/-15 V, T_{vj}= 175°C



[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC}= 600V, I_C= 50A, V_{GE}= +15/-15 V, T_{vj}= 175°C



[Inverter]
Reverse bias safe operating area (max.)
V_{GE}= +15/-15 V, R_G>= 18Ω T_{vj}= 175°C

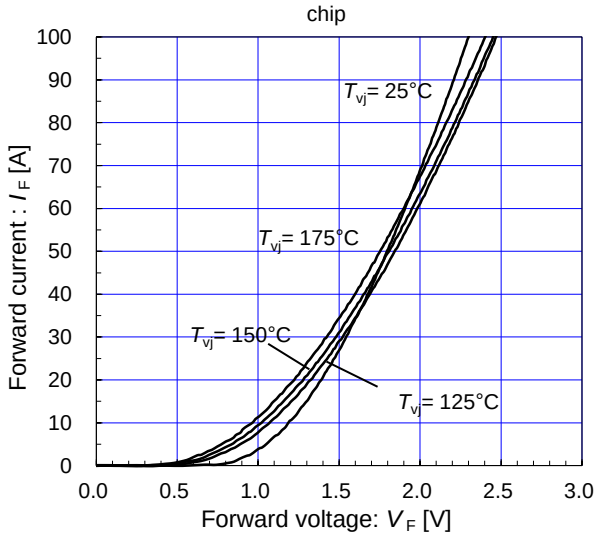


(Main terminals)

[Inverter]

Forward current vs. Forward voltage (typ.)

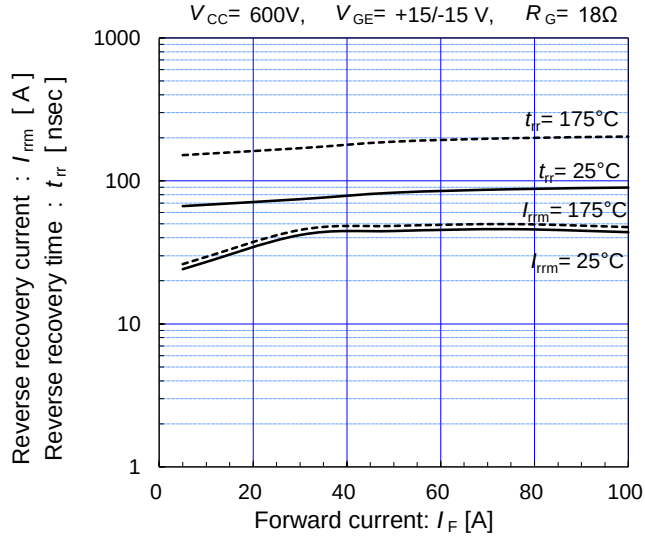
chip



[Inverter]

Reverse recovery characteristics (typ.)

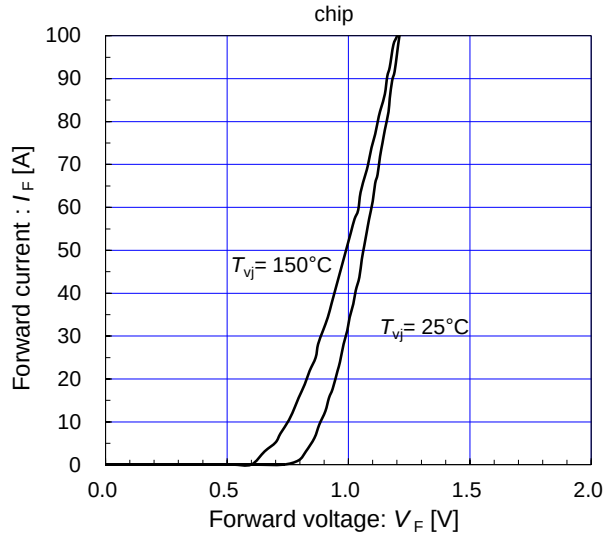
V_{CC}= 600V, V_{GE}= +15/-15 V, R_G= 18Ω



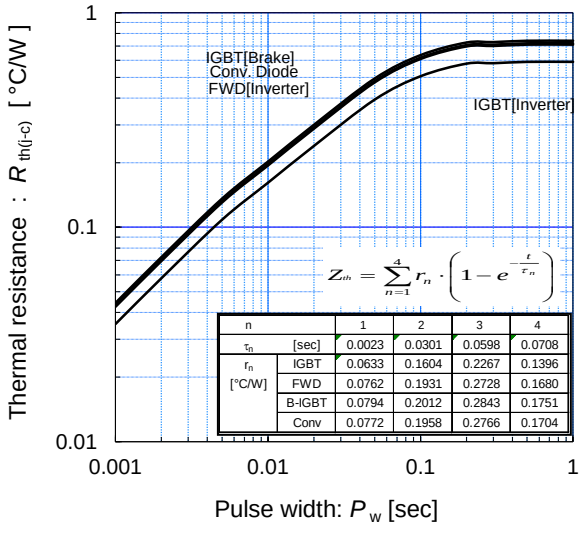
[Converter]

Forward current vs. Forward voltage (typ.)

chip



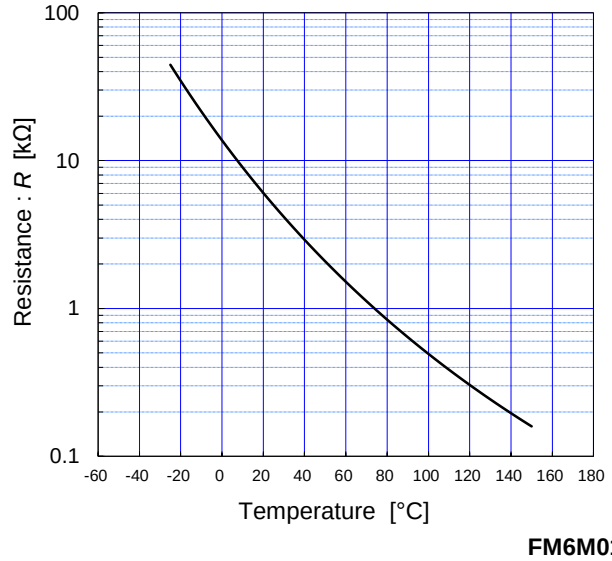
Transient thermal resistance (max.)



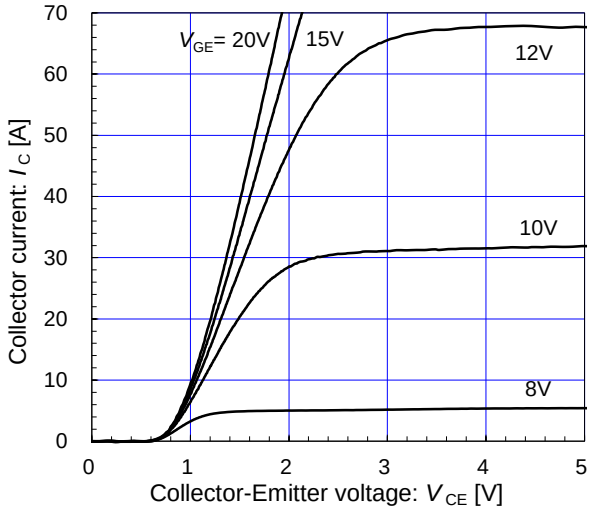
n		1	2	3	4
τ_n	[sec]	0.0023	0.0301	0.0598	0.0708
r_n [°C/W]	IGBT	0.0633	0.1604	0.2267	0.1396
	FWD	0.0762	0.1931	0.2728	0.1680
	B-IGBT	0.0794	0.2012	0.2843	0.1751
	Conv	0.0772	0.1958	0.2766	0.1704

[Thermistor]

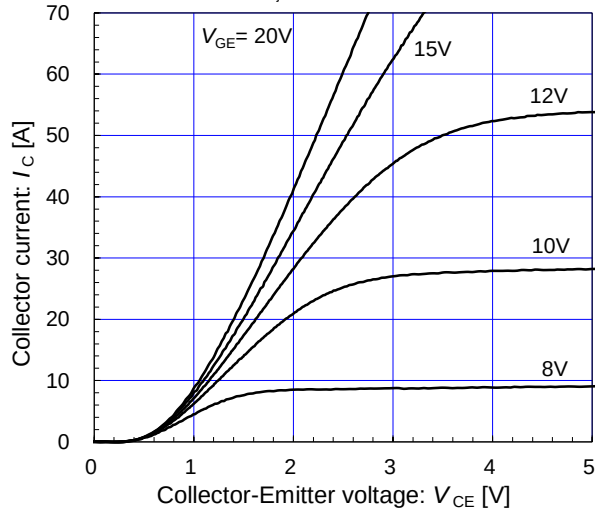
Temperature characteristic (typ.)



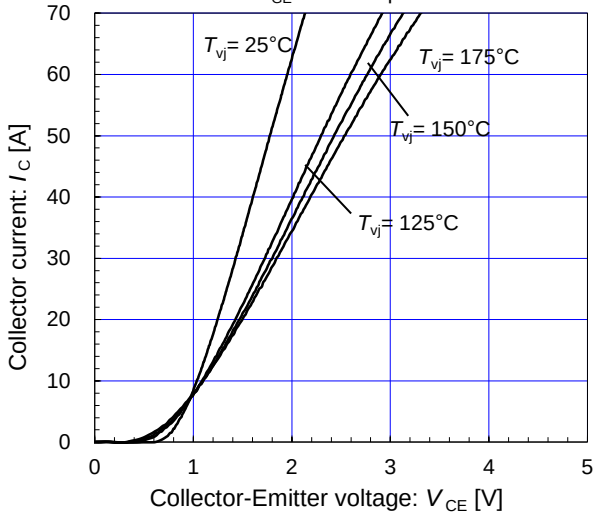
[Brake]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}= 25°C / chip



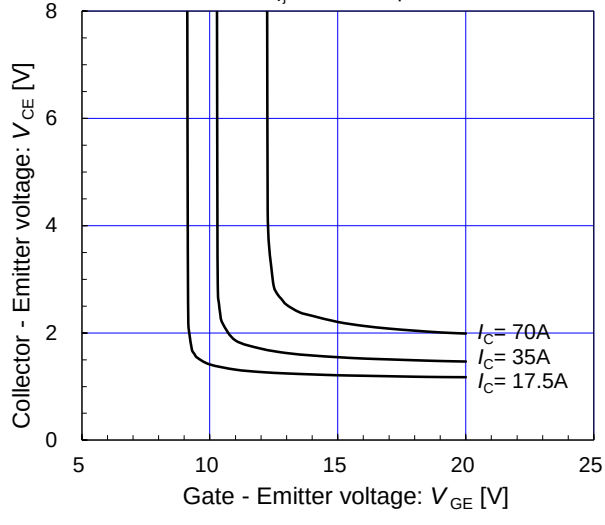
[Brake]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}= 175°C / chip



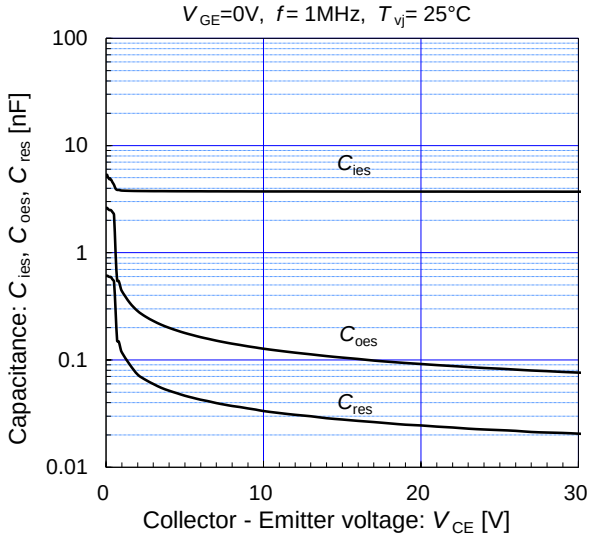
[Brake]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE}=15V / chip



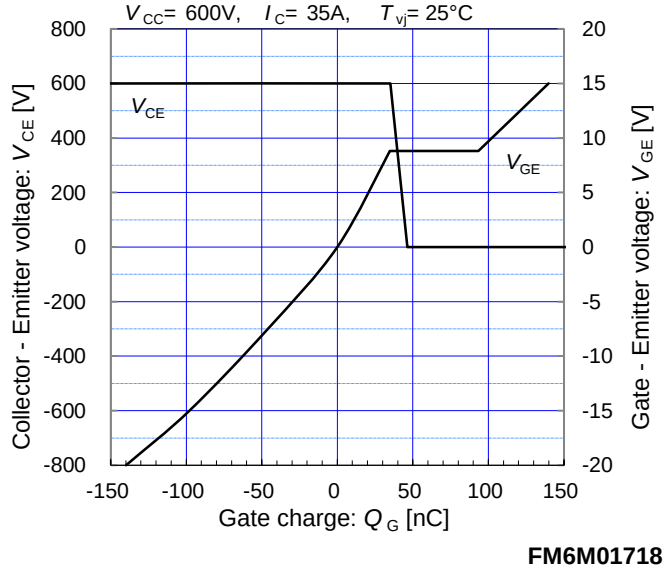
[Brake]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj}= 25°C / chip



[Brake]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE}=0V, f= 1MHz, T_{vj}= 25°C



[Brake]
Dynamic Gate charge (typ.)
V_{CC}= 600V, I_C= 35A, T_{vj}= 25°C



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7.

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