7MBR50XRKD120-50

IGBT Modules

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

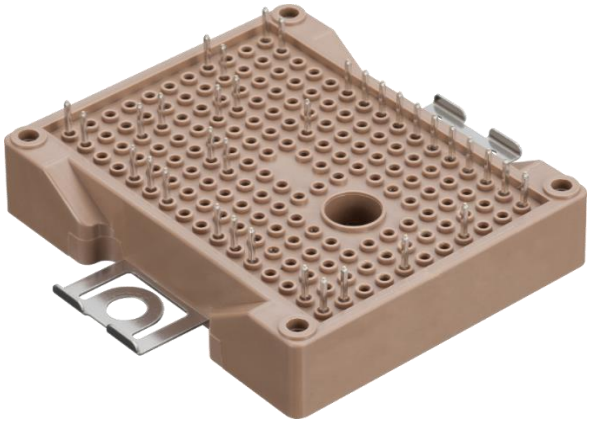
■ Feactures

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

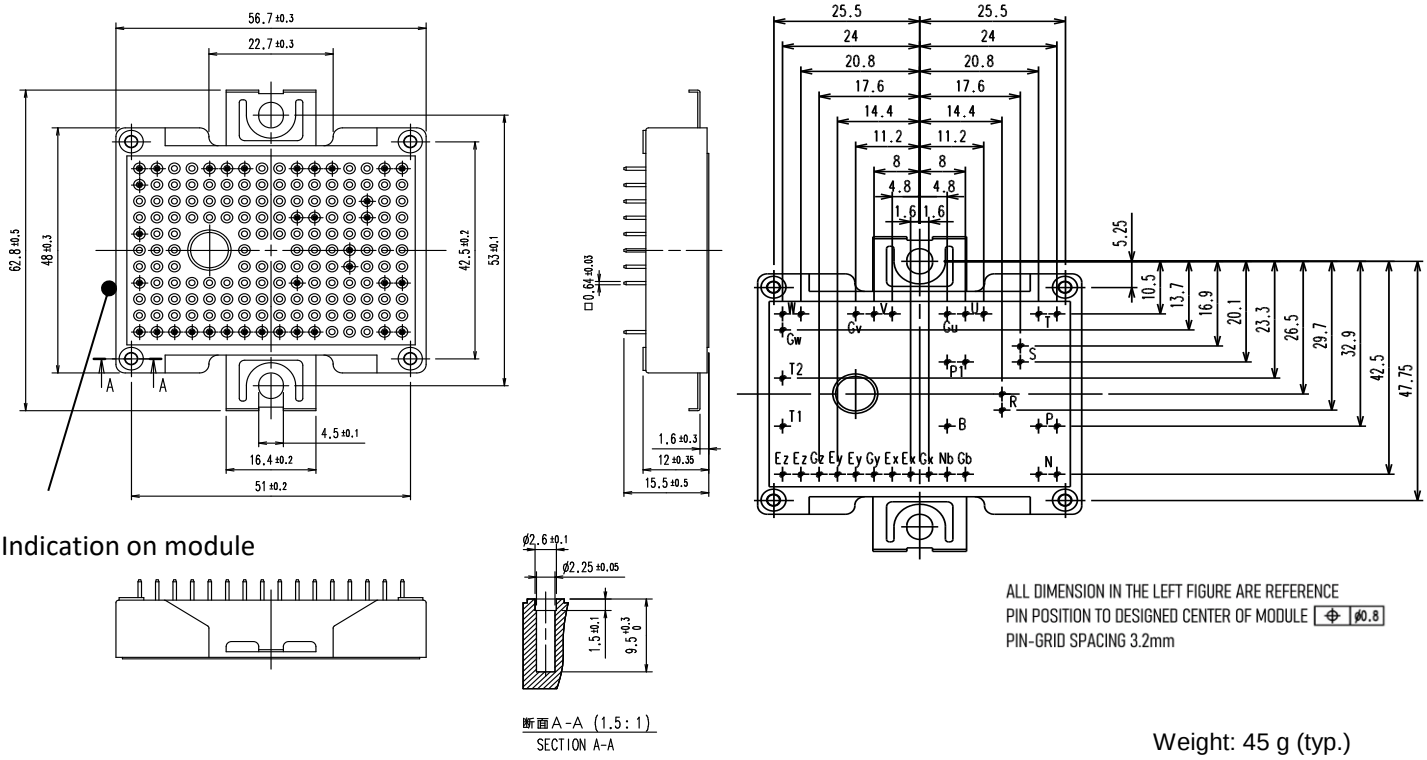
■ Applications

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

■ Typical appearance



■ Outline drawing (Unit : mm)



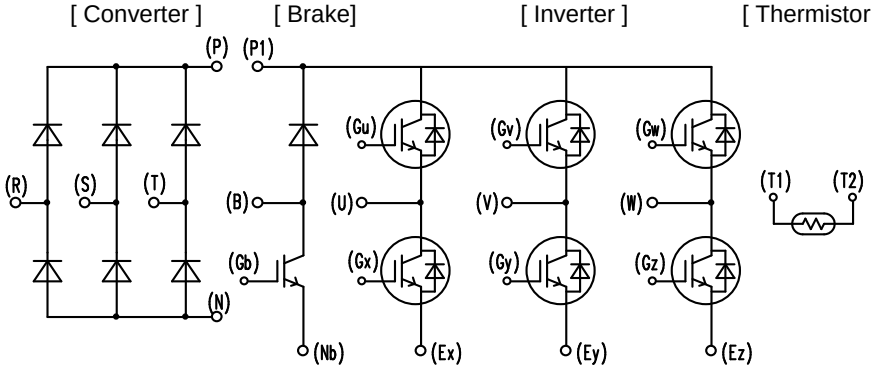
Indication on module

断面A-A (1.5 : 1)
SECTION A-A

ALL DIMENSION IN THE LEFT FIGURE ARE REFERENCE
PIN POSITION TO DESIGNED CENTER OF MODULE ⌖ φ0.8
PIN-GRID SPACING 3.2mm

Weight: 45 g (typ.)

■ Equivalent circuit



7MBR50XRKD120-50

■ **Maximum ratings (at T_c = 25°C unless otherwise specified)**

	Items	Symbols	Conditions		Maximum ratings	Units
Inverter	Collector-Emitter voltage, Gate-Emitter short-circuited	V_{CES}			1200	V
	Gate-Emitter voltage, Collector-Emitter short-circuited	V_{GES}			±20	V
	Collector current	I_C	Continuous	T_c=100°C	50	A
	Repetitive peak collector current	I_{CRM}	1ms		100	
	Reverse-Conducting current	I_{RC}	Continuous		50	
	Repetitive peak reverse-conducting current	I_{RCRM}	1ms		100	
	Total power dissipation	P_{tot}	1 device		500	W
Brake IGBT	Collector-Emitter voltage, Gate-Emitter short-circuited	V_{CES}			1200	V
	Gate-Emitter voltage, Collector-Emitter short-circuited	V_{GES}			±20	V
	Collector current	I_C	Continuous	T_c=100°C	35	A
	Repetitive peak collector current	I_{CRM}	1ms		70	
	Total power dissipation	P_{tot}	1 device		255	W
Brake FWD	Forward current	I_F	Continuous		10	A
	Repetitive peak forward current	I_{FRM}	1ms		20	
	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 forward current (Non-Repetitive) (*1)	I_{FSM}	t=10ms, Half sine wave form	T_{vj}=25°C	470	A
				T_{vj}=150°C	385	
	I^2t (Non-Repetitive) (*1)	I^2t		T_{vj}=25°C	1105	A^2s
				T_{vj}=150°C	750	
Virtual junction temperature		T_{vj}	Inverter, Brake		175	°C
			Converter		150	
Operating virtual 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)					
Mounting torque for screws to heat sink(*4)		M_s	M4		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.

(*4) Recommendable value : Mounting 1.3 ~ 1.7 N·m (M4)

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

	Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Collector-Emitter cut-off current , Gate-Emitter short-circuited	I_{CES}	V_{GE} = 0V V_{CE} = 1200V		-	-	50	μA
	Gate leakage current , Collector-Emitter short-circuited	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	-	2.00	2.50	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.80	2.25	
				T_{vj}=125°C	-	2.25	-	
				T_{vj}=150°C	-	2.30	-	
				T_{vj}=175°C	-	2.45	-	
	Internal gate resistance	r_g	-		-	0	-	Ω
	Input capacitance	C_{ies}	V_{CE} = 10V, V_{GE} =0V, f = 1MHz		-	5.7	-	nF
	Output capacitance	C_{oes}			-	0.26	-	
	Reverse transfer capacitance	C_{res}			-	0.06	-	
	Gate charge	Q_G	V_{CC} = 600V V_{GE}=-15 → +15V I_C = 50A		-	420	-	nC
	Reverse-conducting voltage	V_{RC}(terminal)	I_{RC} = 50A	T_{vj}=25°C	-	2.05	2.55	V
		V_{RC} (chip)		T_{vj}=25°C	-	1.85	2.30	
				T_{vj}=125°C	-	2.15	-	
				T_{vj}=150°C	-	2.15	-	
				T_{vj}=175°C	-	2.10	-	
	Turn-on delay time(*1)	$t_{d(on)}$	V_{CC} = 600V I_C,I_{RC} = 50A L_s = 30nH V_{GE} = +15/-15V R_G = 10 Ω	T_{vj}=25°C	-	0.07	-	μs
				T_{vj}=125°C	-	0.07	-	
				T_{vj}=150°C	-	0.07	-	
				T_{vj}=175°C	-	0.07	-	
	Rise time	t_r	V_{CC} = 600V I_C,I_{RC} = 50A L_s = 30nH V_{GE} = +15/-15V R_G = 10 Ω	T_{vj}=25°C	-	0.03	-	
				T_{vj}=125°C	-	0.04	-	
				T_{vj}=150°C	-	0.04	-	
				T_{vj}=175°C	-	0.04	-	
	Turn-off delay time(*2)	$t_{d(off)}$	V_{CC} = 600V I_C,I_{RC} = 50A L_s = 30nH V_{GE} = +15/-15V R_G = 10 Ω	T_{vj}=25°C	-	0.17	-	
				T_{vj}=125°C	-	0.20	-	
				T_{vj}=150°C	-	0.21	-	
				T_{vj}=175°C	-	0.22	-	
	Fall time	t_f	V_{CC} = 600V I_C,I_{RC} = 50A L_s = 30nH V_{GE} = +15/-15V R_G = 10 Ω	T_{vj}=25°C	-	0.05	-	
				T_{vj}=125°C	-	0.10	-	
				T_{vj}=150°C	-	0.12	-	
				T_{vj}=175°C	-	0.14	-	
	Forward recovery time	t_{fr}	V_{CC} = 600V I_C,I_{RC}= 50A L_s = 30nH V_{GE} = +15/-15V R_G = 10 Ω	T_{vj}=25°C	-	0.14	-	
				T_{vj}=125°C	-	0.20	-	
				T_{vj}=150°C	-	0.21	-	
				T_{vj}=175°C	-	0.23	-	

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

(*2) Turn off time (t_{off}) = $t_{d(off)}$ + t_f

	Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Turn-on energy (per puls)	E_{on}	V_{CC} = 600V, I_C,I_{RC} = 50A, L_s = 30nH, V_{GE} = +15/-15V, R_G = 10 Ω	T_{vj}=25°C	-	4.29	-	mJ
				T_{vj}=125°C	-	5.98	-	
				T_{vj}=150°C	-	6.54	-	
				T_{vj}=175°C	-	7.06	-	
	Turn-off energy (per puls)	E_{off}	V_{CC} = 600V, I_C,I_{RC} = 50A, L_s = 30nH, V_{GE} = +15/-15V, R_G = 10 Ω	T_{vj}=25°C	-	1.91	-	
				T_{vj}=125°C	-	2.70	-	
				T_{vj}=150°C	-	2.95	-	
				T_{vj}=175°C	-	3.20	-	
	Forward recovery energy (per puls)	E_{fr}	V_{CC} = 600V, I_C,I_{RC} = 50A, L_s = 30nH, V_{GE} = +15/-15V, R_G = 10 Ω	T_{vj}=25°C	-	1.66	-	
				T_{vj}=125°C	-	2.95	-	
				T_{vj}=150°C	-	3.24	-	
				T_{vj}=175°C	-	3.50	-	
Brake	Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	V_{GE} = 0V, V_{CE} = 1200V		-	-	50	μA
	Gate leakage current, Collecter-Emitter short-circuited	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
	Turn-on dalay time(*1)	$t_{d(on)}$	V_{CC} = 600V, I_C = 35A, L_s = 30nH, V_{GE} = +15/-15V, R_G = 12 Ω	T_{vj}=25°C	-	0.04	-	μs
				T_{vj}=125°C	-	0.04	-	
				T_{vj}=150°C	-	0.04	-	
				T_{vj}=175°C	-	0.04	-	
	Rise time	t_r	V_{CC} = 600V, I_C = 35A, L_s = 30nH, V_{GE} = +15/-15V, R_G = 12 Ω	T_{vj}=25°C	-	0.02	-	
				T_{vj}=125°C	-	0.02	-	
				T_{vj}=150°C	-	0.02	-	
				T_{vj}=175°C	-	0.02	-	
	Turn-off dalay time(*2)	$t_{d(off)}$	V_{CC} = 600V, I_C = 35A, L_s = 30nH, V_{GE} = +15/-15V, R_G = 12 Ω	T_{vj}=25°C	-	0.20	-	
				T_{vj}=125°C	-	0.23	-	
				T_{vj}=150°C	-	0.23	-	
				T_{vj}=175°C	-	0.23	-	
	Fall time	t_f	V_{CC} = 600V, I_C = 35A, L_s = 30nH, V_{GE} = +15/-15V, R_G = 12 Ω	T_{vj}=25°C	-	0.12	-	
				T_{vj}=125°C	-	0.16	-	
				T_{vj}=150°C	-	0.20	-	
				T_{vj}=175°C	-	0.22	-	
	Reverse current	I_R	V_R = 1200V		-	-	50	μA
	Forward voltage	V_F (terminal)	I_F = 10A	T_{vj}=25°C	-	2.05	2.50	V
		V_F (chip)	I_F = 10A	T_{vj}=25°C	-	1.90	2.35	
				T_{vj}=125°C	-	1.95	-	
				T_{vj}=150°C	-	1.90	-	
				T_{vj}=175°C	-	1.85	-	
Converter	Reverse current	I_R	V_R = 1600V		-	-	50	μA
	Continuous(direct)forward voltage	V_F	I_F = 50A	terminal	-	1.30	1.80	V
				chip	-	1.10	1.55	
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 (*2) Turn off time (t_{off}) = $t_{d(off)}$ + t_f

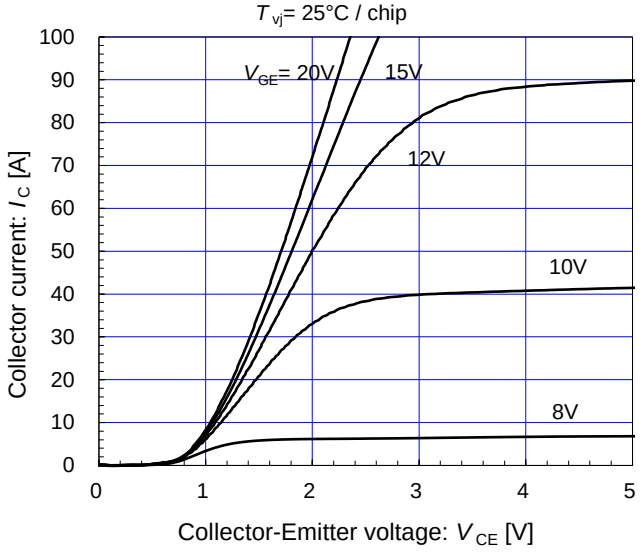
NOTICE:
The external gate resistance (R_G) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment. We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches design criteria, for example, switching loss, EMC/EMI, spike voltage, surge current and no unexpected oscillation and so on.

■Thermal resistance characteristics

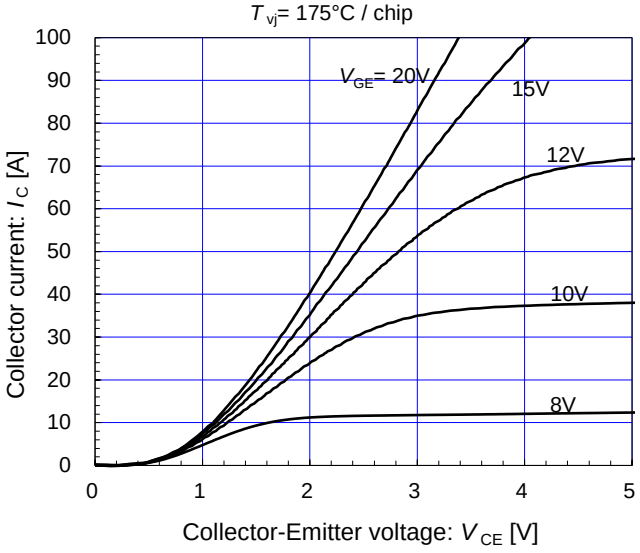
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case(1device)	$R_{th(j-c)}$	Inverter RC-IGBT	-	-	0.30	K/W
		Brake IGBT	-	-	0.58	
		Brake FWD	-	-	1.75	
		Converter Diode	-	-	0.73	
Thermal resistance case to heat sink(*1) (1device)	$R_{th(c-s)}$	Inverter RC-IGBT	-	0.55	-	
		Brake IGBT	-	0.61	-	
		Brake FWD	-	0.71	-	
		Converter Diode	-	0.68	-	

(*1) This is the value which is defined mounting on the additional heat sink with 1w/(m・k) thermal grease.

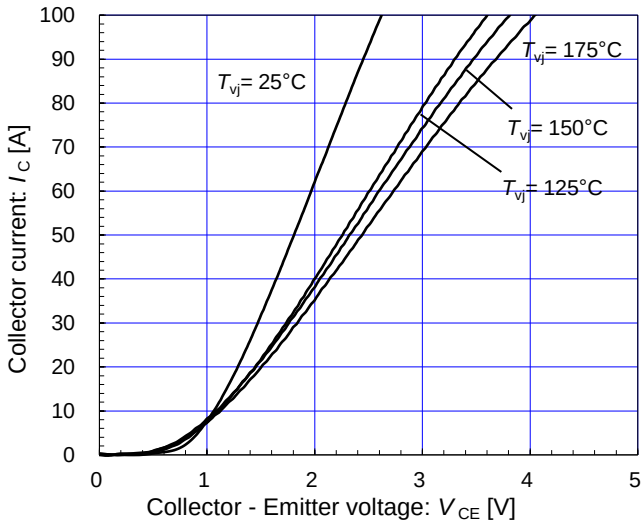
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}= 25°C / chip



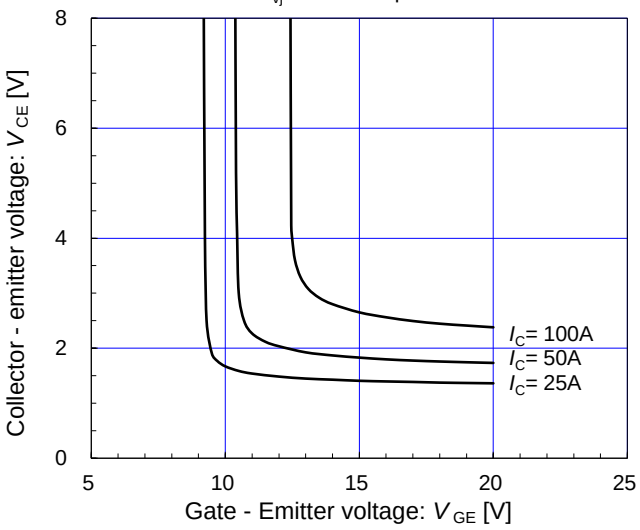
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj}= 175°C / chip



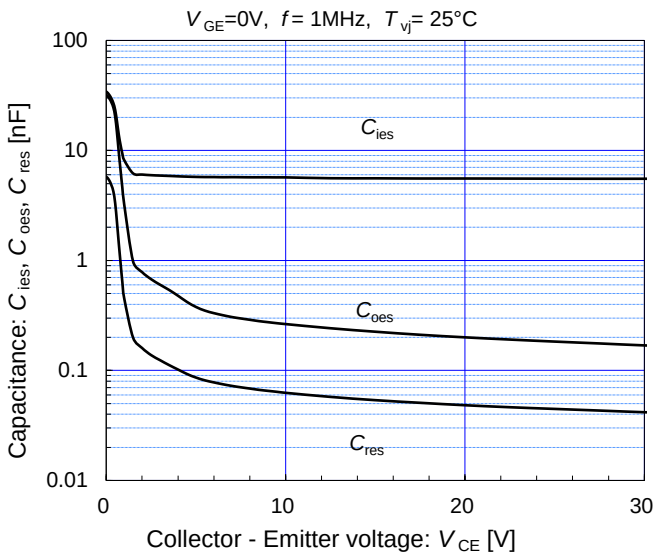
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE}=15V / chip



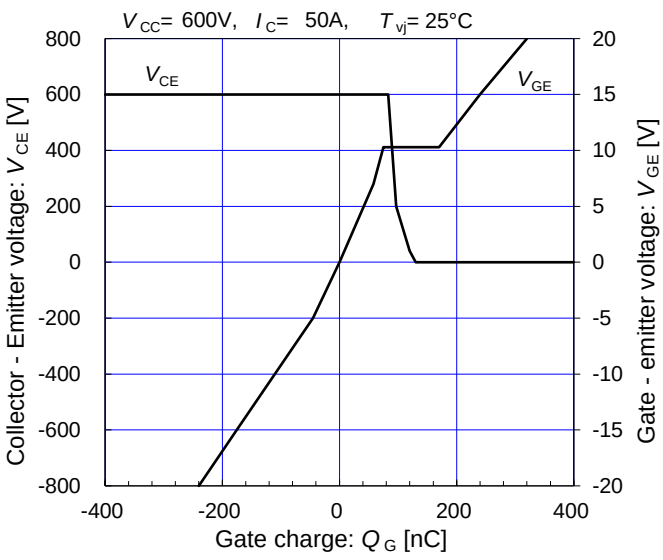
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj}= 25°C / chip



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



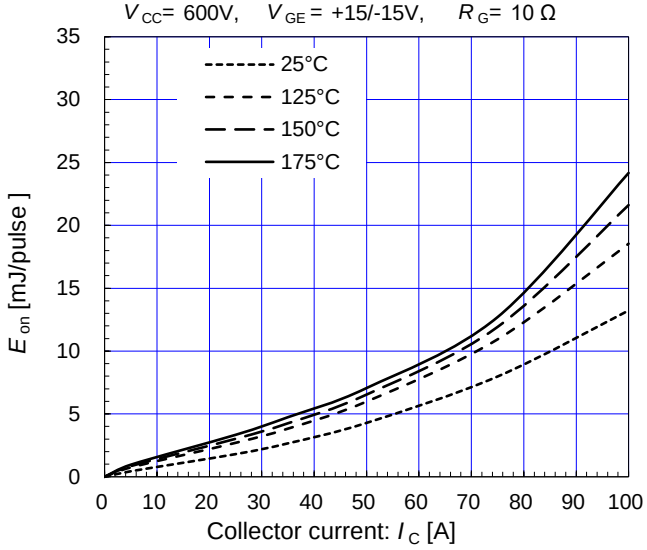
[Inverter]
Dynamic gate charge (typ.)
V_{CC}= 600V, I_C= 50A, T_{vj}= 25°C



[Inverter]

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

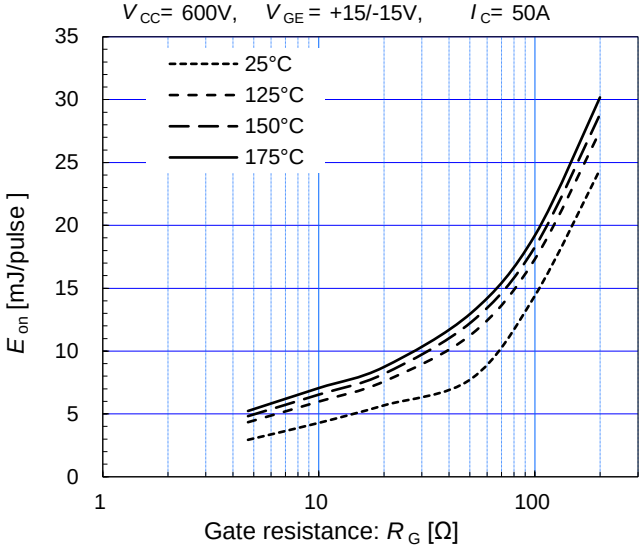
V_{CC}= 600V, V_{GE} = +15/-15V, R_G= 10 Ω



[Inverter]

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

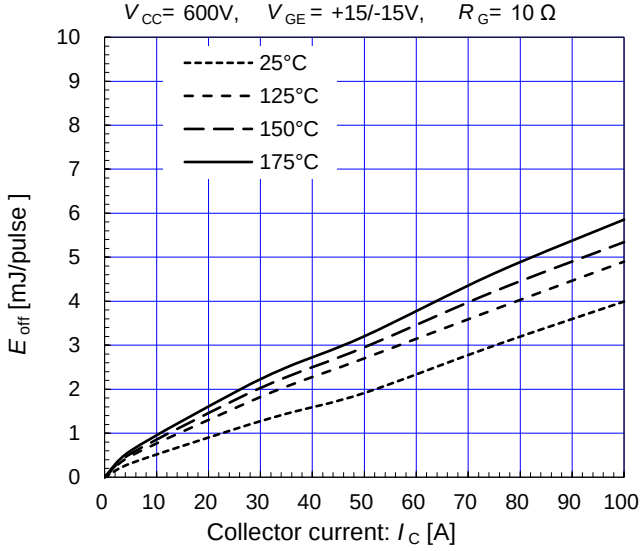
V_{CC}= 600V, V_{GE} = +15/-15V, I_C= 50A



[Inverter]

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

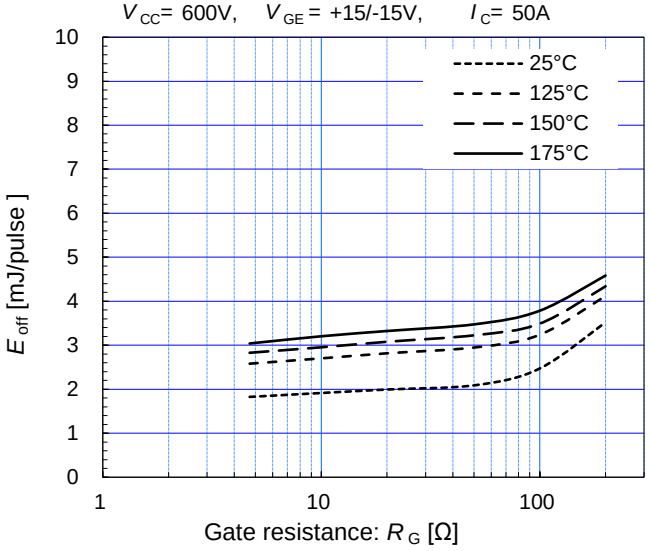
V_{CC}= 600V, V_{GE} = +15/-15V, R_G= 10 Ω



[Inverter]

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

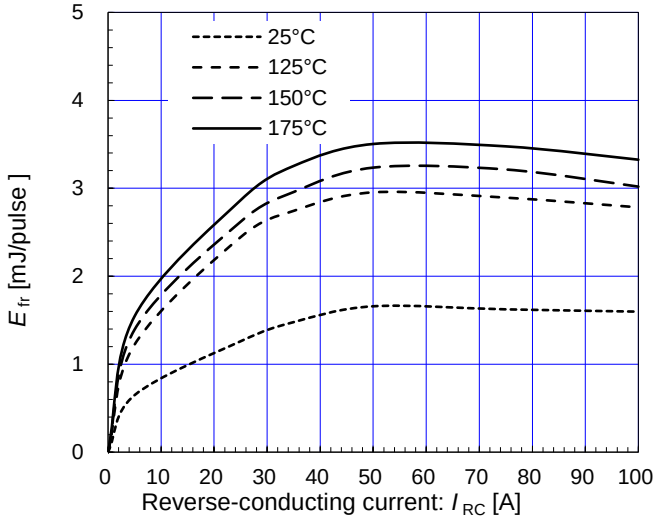
V_{CC}= 600V, V_{GE} = +15/-15V, I_C= 50A



[Inverter]

E_{fr} vs. Reverse-conducting current (typ.)

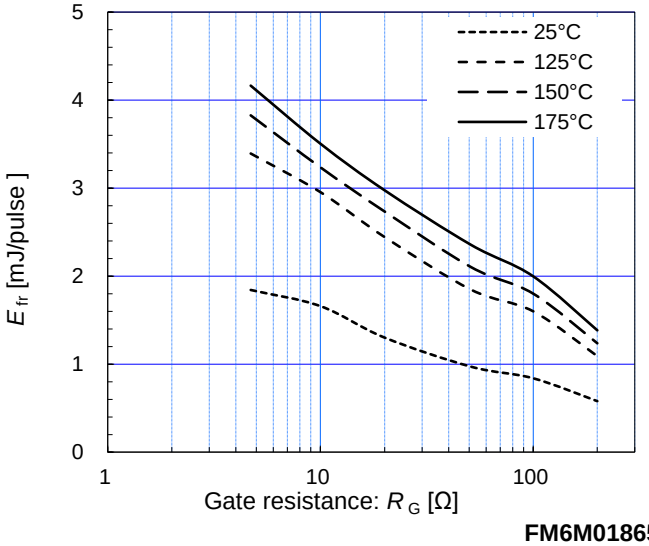
V_{CC}= 600V, V_{GE} = +15/-15V, R_G= 10 Ω



[Inverter]

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

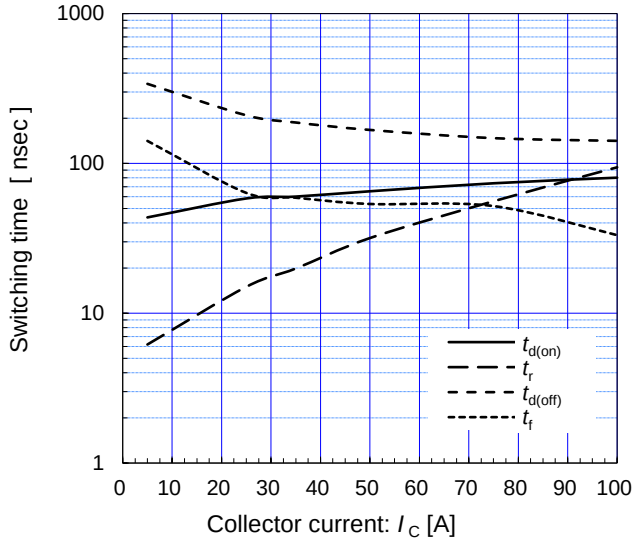
V_{CC}= 600V, V_{GE} = +15/-15V, I_{RC}= 50A



[Inverter]

Switching time vs. Collector current (typ.)

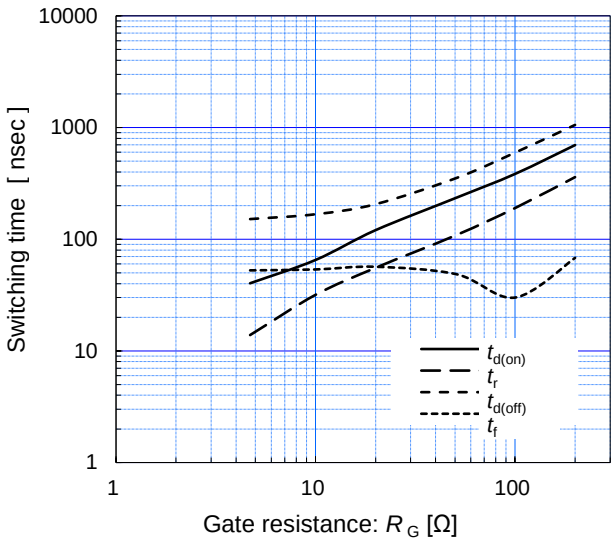
V_{CC}= 600V, R_G= 10Ω V_{GE}= +15/-15V, T_{vj}= 25°C



[Inverter]

Switching time vs. Gate resistance (typ.)

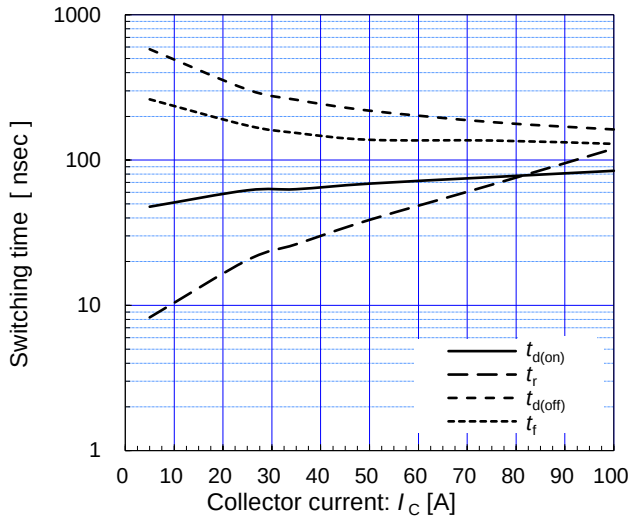
V_{CC}= 600V, I_C= 50A, V_{GE}= +15/-15V, T_{vj}= 25°C



[Inverter]

Switching time vs. Collector current (typ.)

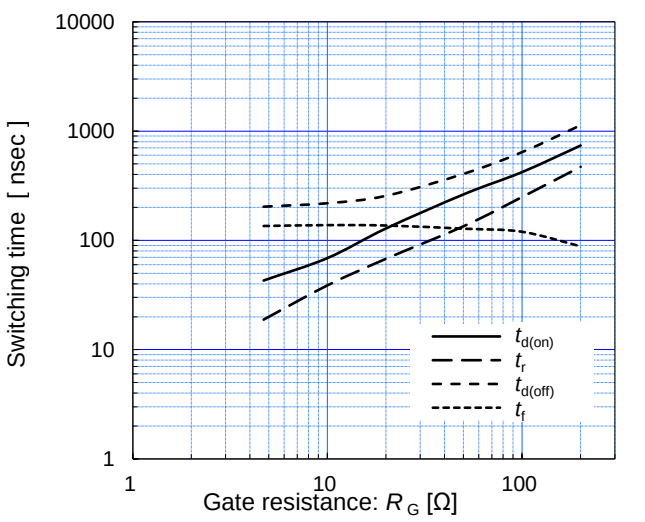
V_{CC}= 600V, R_G= 10Ω V_{GE}= +15/-15V, T_{vj}= 175°C



[Inverter]

Switching time vs. Gate resistance (typ.)

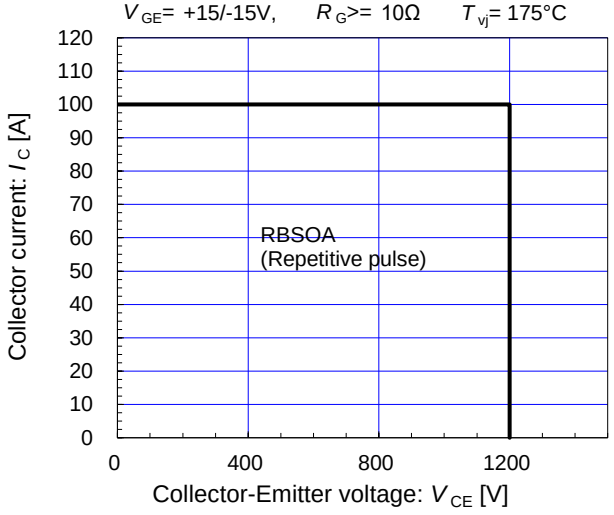
V_{CC}= 600V, I_C= 50A, V_{GE}= +15/-15V, T_{vj}= 175°C



[Inverter]

Reverse bias safe operating area (max.)

V_{GE}= +15/-15V, R_G>= 10Ω T_{vj}= 175°C

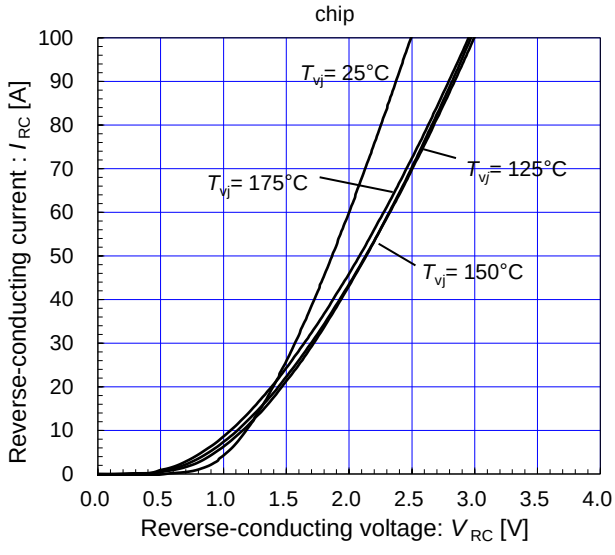


(Main terminals)

[Inverter]

Reverse-conducting current vs. Reverse-conducting voltage (typ.)

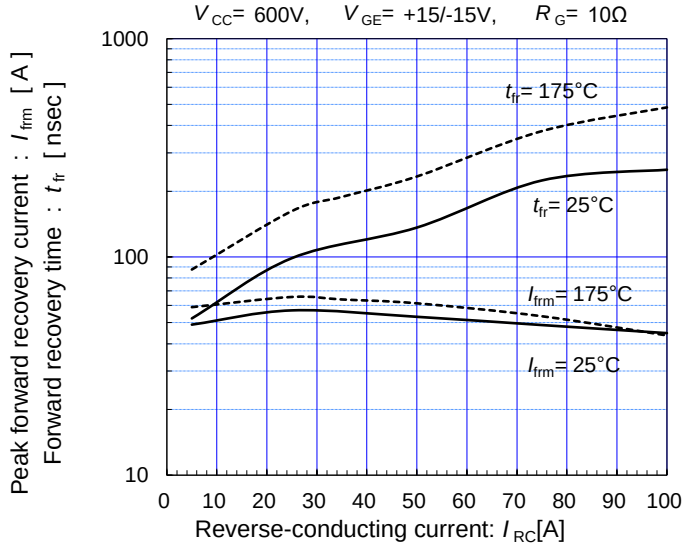
chip



[Inverter]

Forward recovery characteristics (typ.)

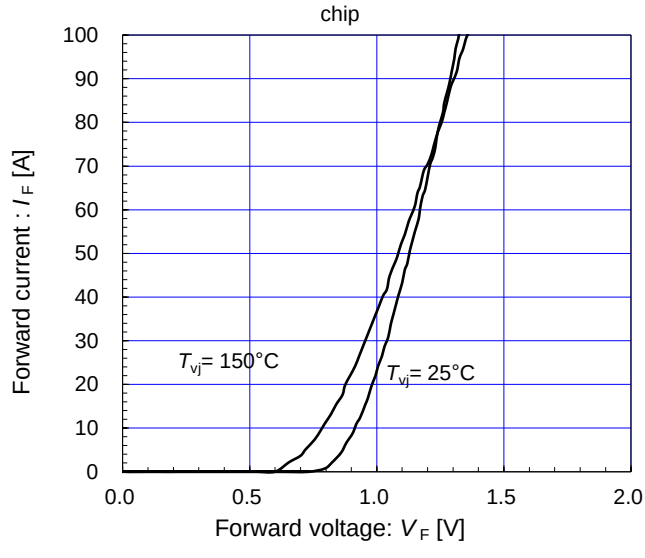
V_{CC}= 600V, V_{GE}= +15/-15V, R_G= 10Ω



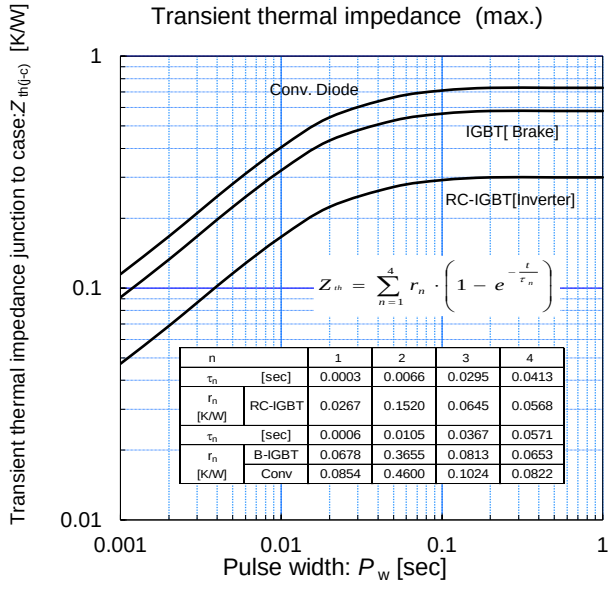
[Converter]

Forward current vs. Forward voltage (typ.)

chip



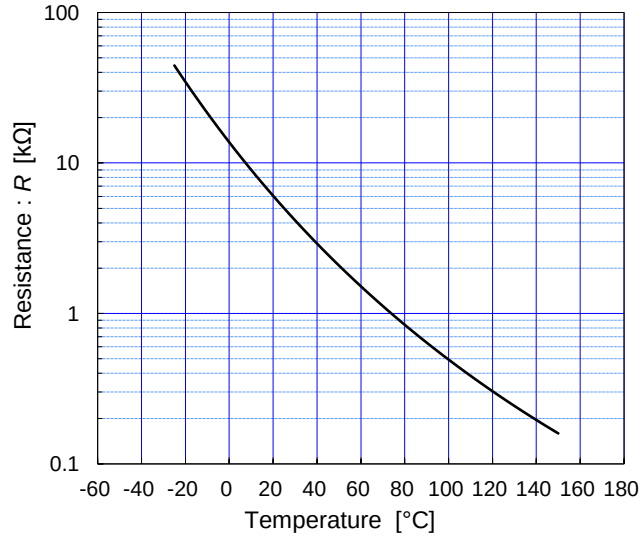
Transient thermal impedance (max.)



n		1	2	3	4
τ_n	[sec]	0.0003	0.0066	0.0295	0.0413
r_n [K/W]	RC-IGBT	0.0267	0.1520	0.0645	0.0568
τ_n	[sec]	0.0006	0.0105	0.0367	0.0571
r_n [K/W]	B-IGBT	0.0678	0.3655	0.0813	0.0653
	Conv	0.0854	0.4600	0.1024	0.0822

[Thermistor]

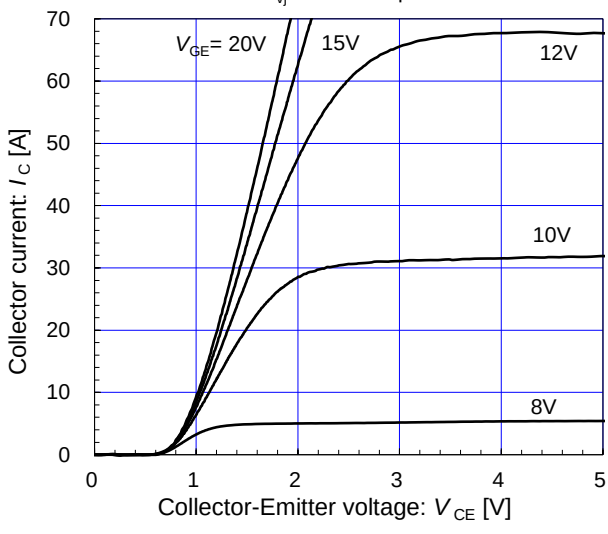
Temperature characteristic (typ.)



[Brake]

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

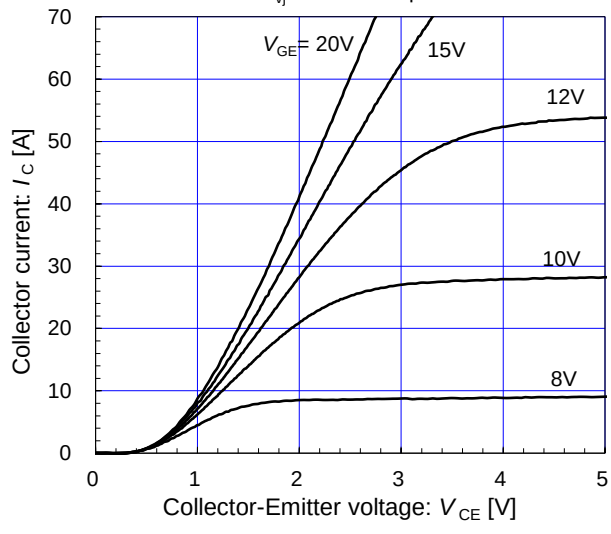
T_{vj}= 25°C / chip



[Brake]

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

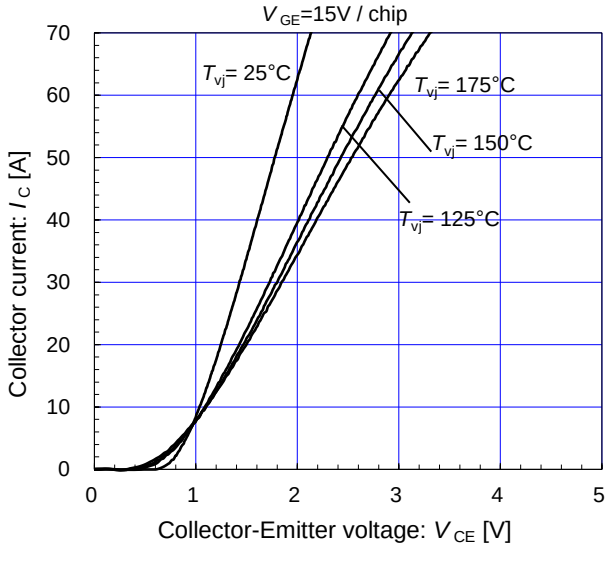
T_{vj}= 175°C / chip



[Brake]

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

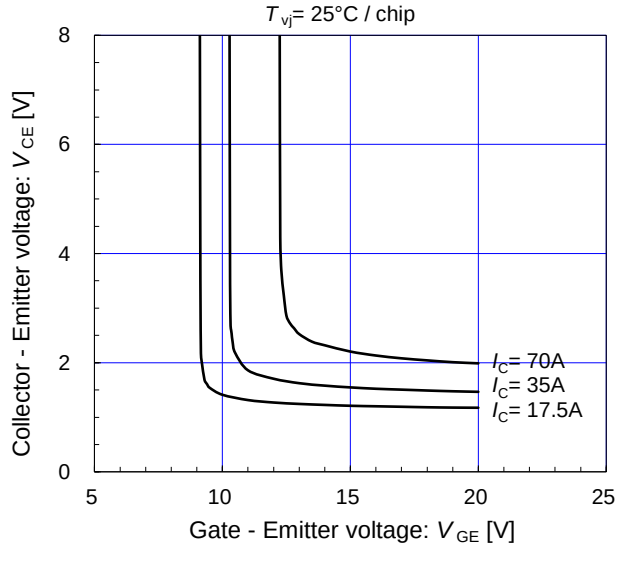
V_{GE}=15V / chip



[Brake]

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

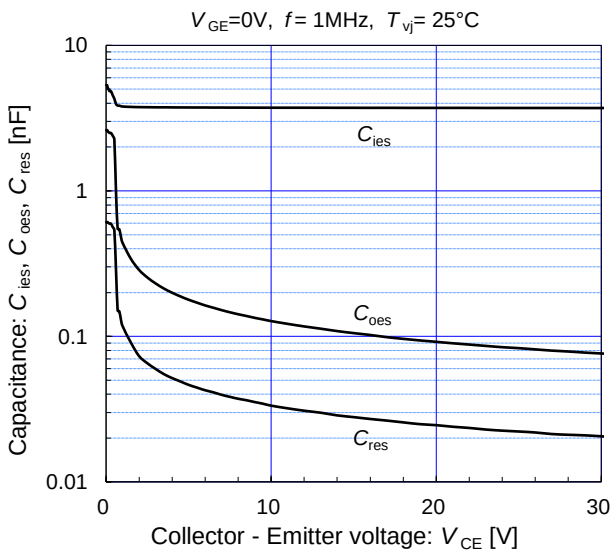
T_{vj}= 25°C / chip



[Brake]

Capacitance vs. Collector-Emitter voltage (typ.)

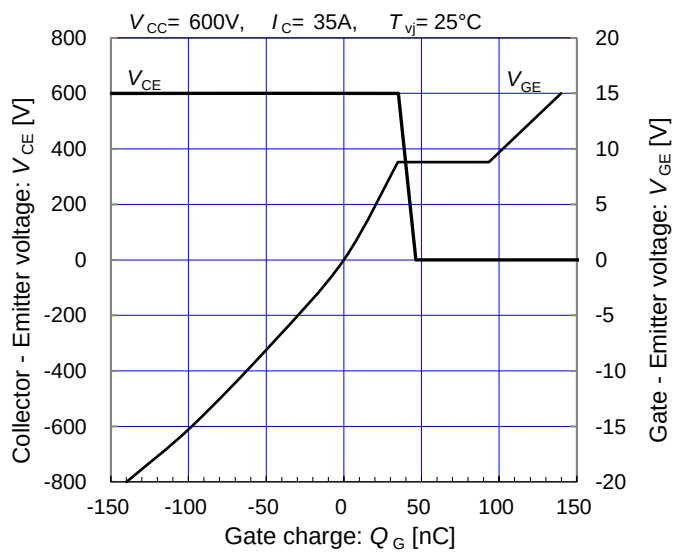
V_{GE}=0V, f= 1MHz, T_{vj}= 25°C



[Brake]

Dynamic gate charge (typ.)

V_{CC}= 600V, I_C= 35A, T_{vj}= 25°C



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4. The products introduced in this Catalog are intended for use in the following electronic and electrical equipment which has normal reliability requirements.
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7.

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