7MBR15XKD120-50

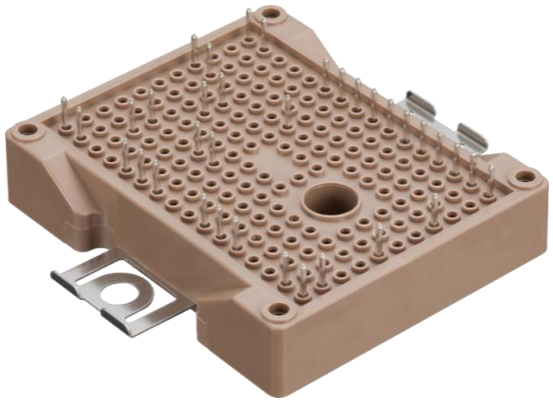
IGBT Modules

Power Module(X series)
1200V / 15A / PIM

■ Feactures

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

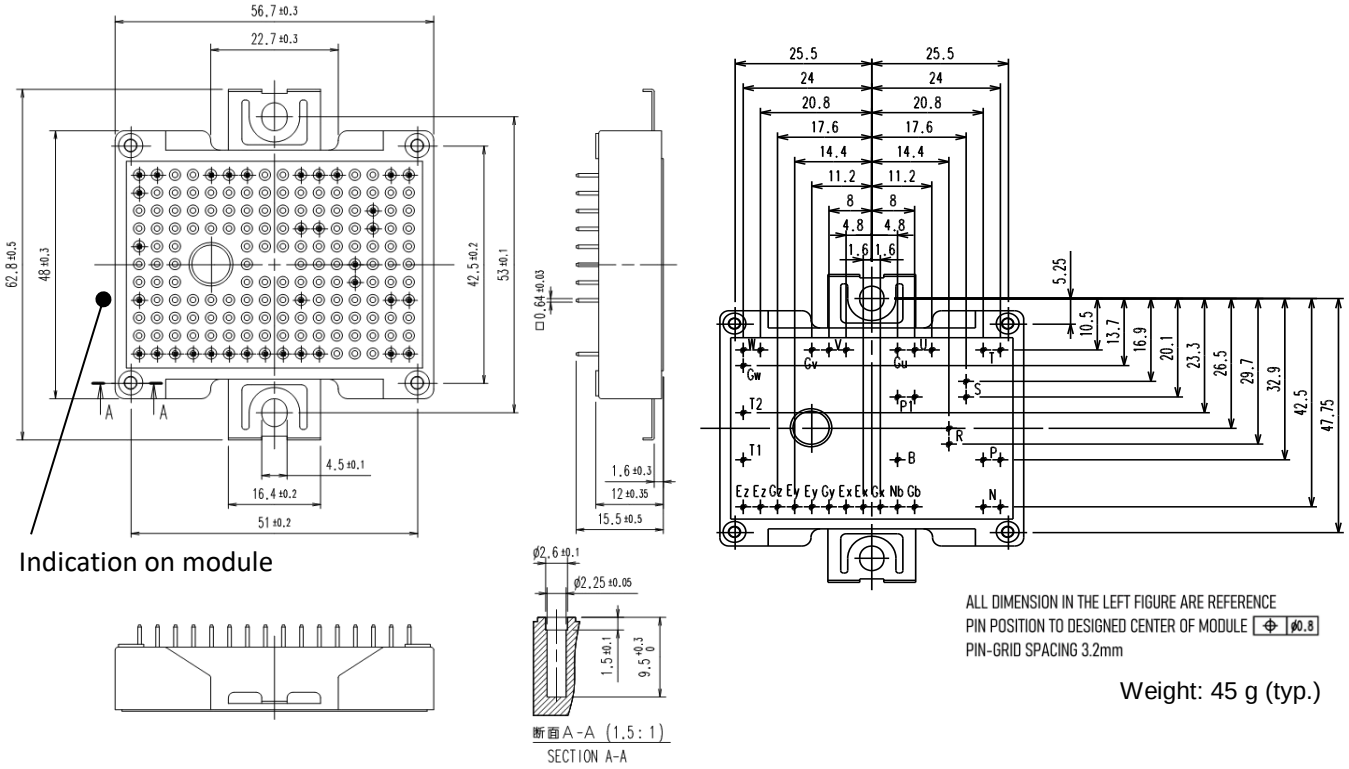
■ Typical appearance



■Applications

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

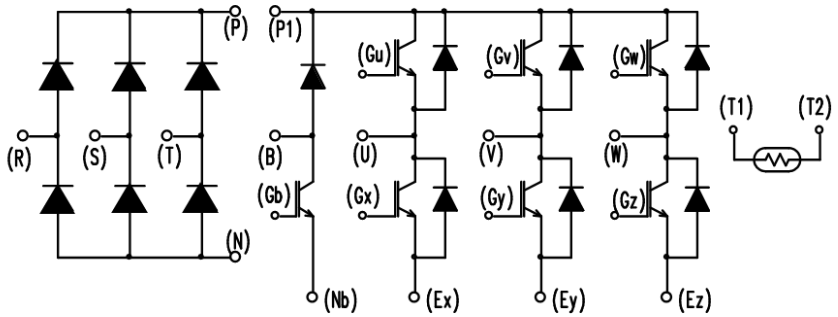
■ Outline drawing (Unit : mm)



Weight: 45 g (typ.)

■ Equivalent circuit

[Converter] [Brake] [Inverter] [Thermistor]



■ **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, Collecter-Emitter short-circuited		V_{GES}			±20	V
	Collector current		I_C	Continuous	T_c=100°C	15	A
	Repetitve peak collector current		I_{CRM}	1ms		30	
	Forward current		I_F	Continuous		15	
	Repetitive peak forward current		I_{FRM}	1ms		30	
	Total power dissipation		P_{tot}	1 device		135	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	15	A
	Repetitive peak collector current		I_{CRM}	1ms		30	
	Total power dissipation		P_{tot}	1 device		135	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	T_c=80°C	15	A
	Surge 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 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 torque of screws to heat sink	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 = ####		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C = 15A	T_{vj}=25°C	-	1.60	2.05	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		-	1.6	-	nF
		C_{oes}			-	0.05	-	
		C_{res}			-	0.01	-	
	Gate charge	Q_G	V_{CC} = 600V V_{GE}=-15 → +15V I_C = 15A		-	100	-	nC
	Forward voltage	V_F (terminal)	I_F = 15A	T_{vj}=25°C	-	1.90	2.35	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 = 15A L_s = 30nH V_{GE} = +15/-15 V R_G = 39 Ω	T_{vj}=25°C	-	0.05	-	μs
				T_{vj}=125°C	-	0.06	-	
				T_{vj}=150°C	-	0.06	-	
				T_{vj}=175°C	-	0.06	-	
		t_r	V_{CC} = 600V I_C,I_F = 15A L_s = 30nH V_{GE} = +15/-15 V R_G = 39 Ω	T_{vj}=25°C	-	0.03	-	
				T_{vj}=125°C	-	0.03	-	
				T_{vj}=150°C	-	0.03	-	
				T_{vj}=175°C	-	0.03	-	
		$t_{d(off)}$	V_{CC} = 600V I_C,I_F = 15A L_s = 30nH V_{GE} = +15/-15 V R_G = 39 Ω	T_{vj}=25°C	-	0.21	-	
				T_{vj}=125°C	-	0.24	-	
				T_{vj}=150°C	-	0.25	-	
				T_{vj}=175°C	-	0.26	-	
		t_f	V_{CC} = 600V I_C,I_F = 15A L_s = 30nH V_{GE} = +15/-15 V R_G = 39 Ω	T_{vj}=25°C	-	0.10	-	
				T_{vj}=125°C	-	0.18	-	
				T_{vj}=150°C	-	0.19	-	
				T_{vj}=175°C	-	0.20	-	
	Reverse recovery time	t_{rr}	V_{CC} = 600V I_C,I_F = 15A L_s = 30nH V_{GE} = +15/-15 V R_G = 39 Ω	T_{vj}=25°C	-	0.07	-	
				T_{vj}=125°C	-	0.13	-	
				T_{vj}=150°C	-	0.17	-	
				T_{vj}=175°C	-	0.20	-	

(*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 = 15A, L_s = 30nH, V_{GE} = +15/-15 V, R_G = 39 Ω	T_{vj}=25°C	-	1.18	-	mJ
				T_{vj}=125°C	-	1.57	-	
				T_{vj}=150°C	-	1.68	-	
				T_{vj}=175°C	-	1.79	-	
		E_{off}	V_{CC} = 600V, I_C,I_F = 15A, L_s = 30nH, V_{GE} = +15/-15 V, R_G = 39 Ω	T_{vj}=25°C	-	1.12	-	
				T_{vj}=125°C	-	1.41	-	
				T_{vj}=150°C	-	1.49	-	
				T_{vj}=175°C	-	1.56	-	
		E_{rr}	V_{CC} = 600V, I_C,I_F = 15A, L_s = 30nH, V_{GE} = +15/-15 V, R_G = 39 Ω	T_{vj}=25°C	-	0.72	-	
				T_{vj}=125°C	-	1.06	-	
				T_{vj}=150°C	-	1.26	-	
				T_{vj}=175°C	-	1.41	-	
Brake	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
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V, I_C = 15A	T_{vj}=25°C	-	1.60	2.05	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 = 15A, L_s = 30nH, V_{GE} = +15/-15 V, R_G = 39 Ω	T_{vj}=25°C	-	0.05	-	μs
				T_{vj}=125°C	-	0.06	-	
				T_{vj}=150°C	-	0.06	-	
				T_{vj}=175°C	-	0.06	-	
		t_r	V_{CC} = 600V, I_C = 15A, L_s = 30nH, V_{GE} = +15/-15 V, R_G = 39 Ω	T_{vj}=25°C	-	0.03	-	
				T_{vj}=125°C	-	0.03	-	
				T_{vj}=150°C	-	0.03	-	
				T_{vj}=175°C	-	0.03	-	
		$t_{d(off)}$	V_{CC} = 600V, I_C = 15A, L_s = 30nH, V_{GE} = +15/-15 V, R_G = 39 Ω	T_{vj}=25°C	-	0.21	-	
				T_{vj}=125°C	-	0.24	-	
				T_{vj}=150°C	-	0.25	-	
				T_{vj}=175°C	-	0.26	-	
		t_f	V_{CC} = 600V, I_C = 15A, L_s = 30nH, V_{GE} = +15/-15 V, R_G = 39 Ω	T_{vj}=25°C	-	0.10	-	
				T_{vj}=125°C	-	0.18	-	
				T_{vj}=150°C	-	0.19	-	
				T_{vj}=175°C	-	0.20	-	
	Reverse current	I_{RRM}	V_R = 1200V		-	-	50	μA
	Forward voltage	V_F (terminal)	I_F = 10A	T_{vj}=25°C	-	2.00	2.45	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_{RRM}	V_R = 1600V		-	-	50	μA
	Forward voltage	V_{FM}	I_F = 15A	terminal	-	1.05	1.50	V
				chip	-	0.95	1.40	
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

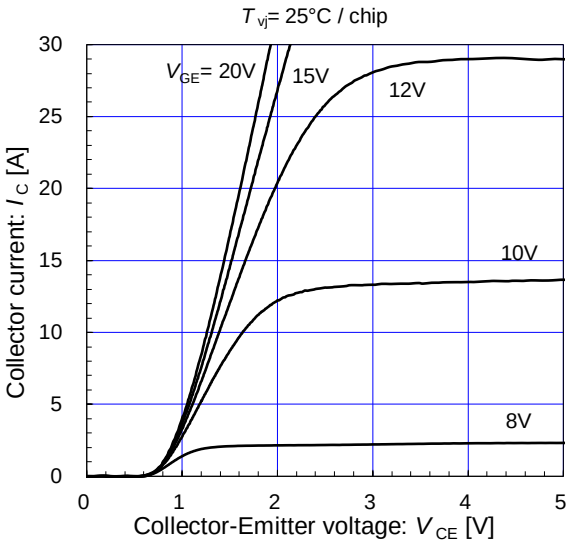
NOTICE:
The external gate resistance (R_G) shown above is one of our recommended value for the purpose of minimum switching loss. However the optimum R_G depends on circuit configuration and/or environment. We recommend that the R_G has to be carefully chosen based on consideration if IGBT module matches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

■Thermal resistance characteristics

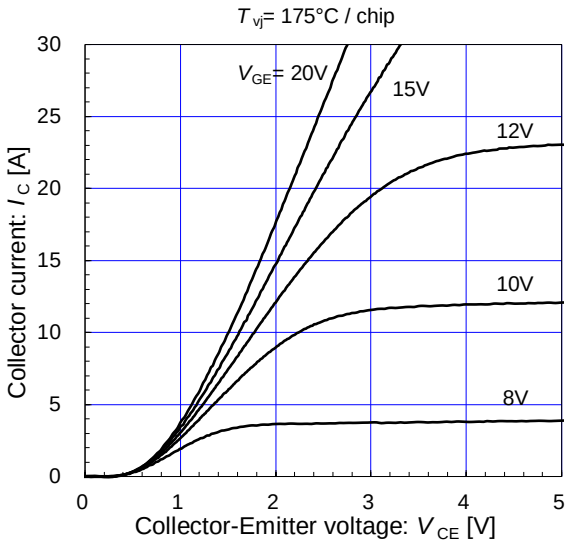
Items	Symbols	Conditions	Characteristics			Units
			min.	typ.	max.	
Thermal resistance junction to case (1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	1.09	K/W
		Inverter FWD	-	-	1.30	
		Brake IGBT	-	-	1.09	
		Brake FWD	-	-	1.75	
		Converter Diode	-	-	0.73	
Thermal resistance case to heat sink(*1) (1 device)	$R_{th(c-f)}$	Inverter IGBT	-	0.64	-	
		Inverter FWD	-	0.69	-	
		Brake IGBT	-	0.70	-	
		Brake FWD	-	0.71	-	
		Converter Diode	-	0.68	-	

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

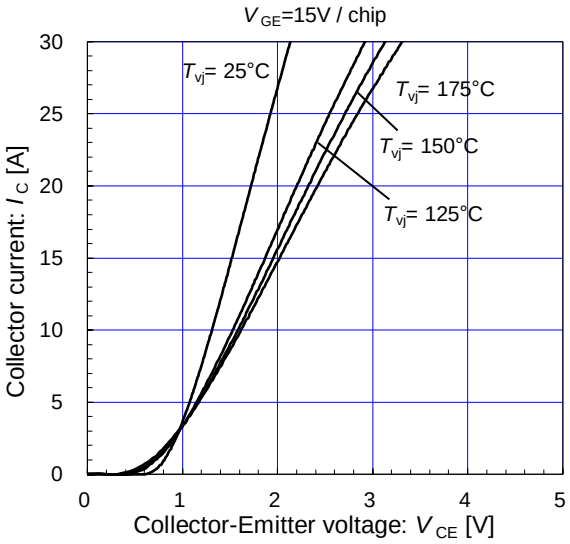
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)



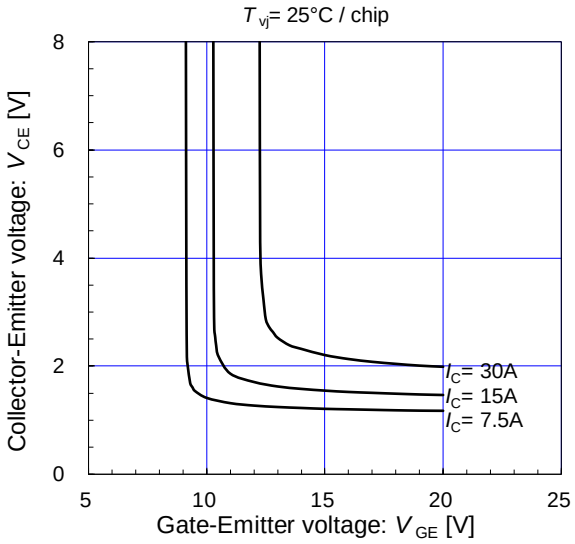
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)



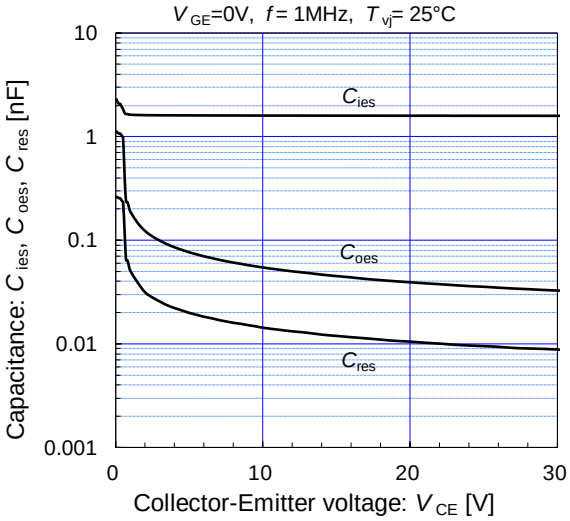
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)



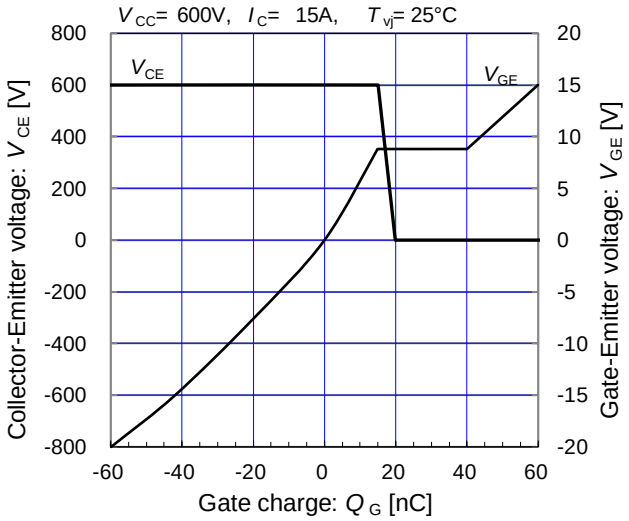
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)



[Inverter]
Capacitance vs. Collector-Emitter voltage (typ.)



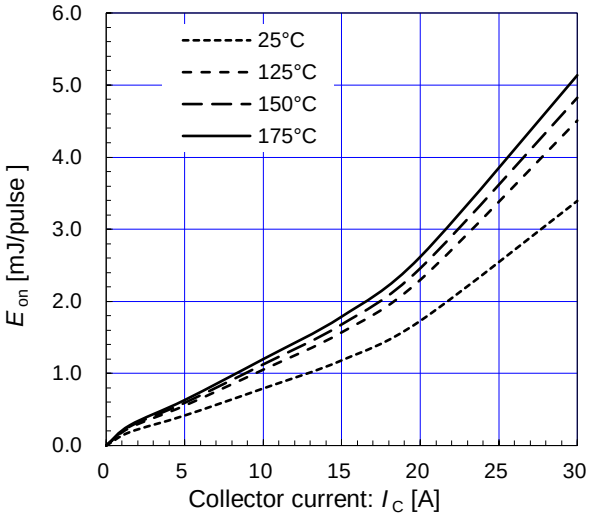
[Inverter]
Dynamic gate charge (typ.)



[Inverter]

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

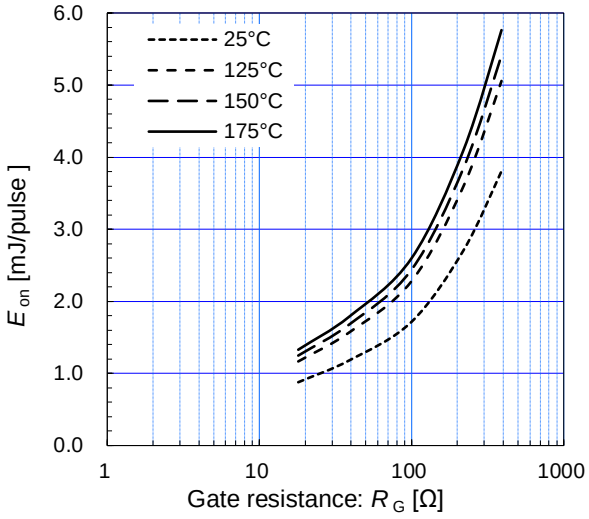
V_{CC}= 600V, V_{GE} = +15/-15 V R_G= 39 Ω



[Inverter]

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

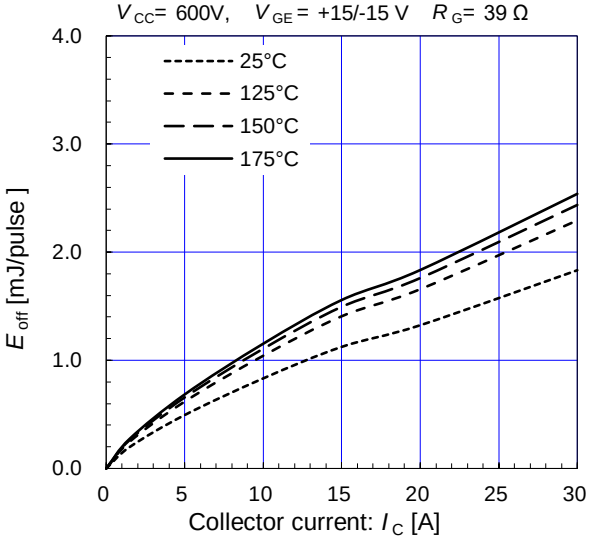
V_{CC}= 600V, V_{GE} = +15/-15 V I_C= 15A



[Inverter]

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

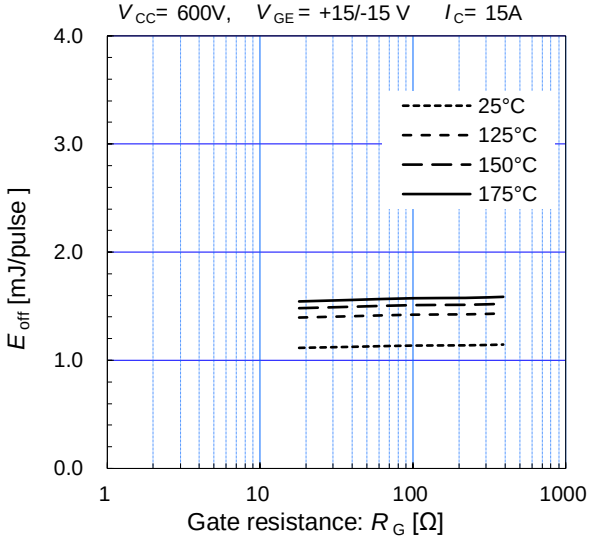
V_{CC}= 600V, V_{GE} = +15/-15 V R_G= 39 Ω



[Inverter]

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

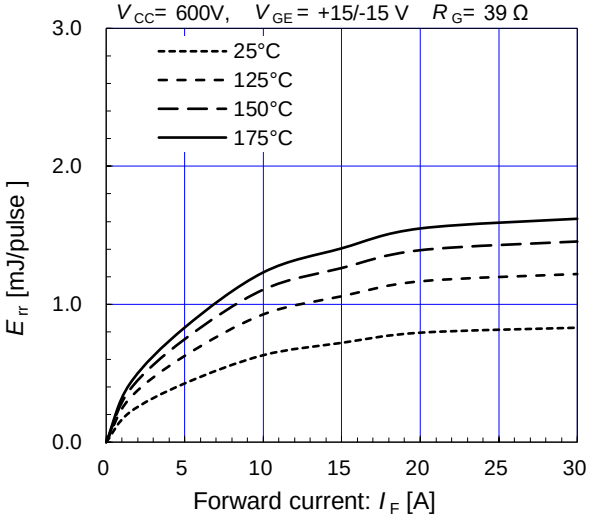
V_{CC}= 600V, V_{GE} = +15/-15 V I_C= 15A



[Inverter]

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

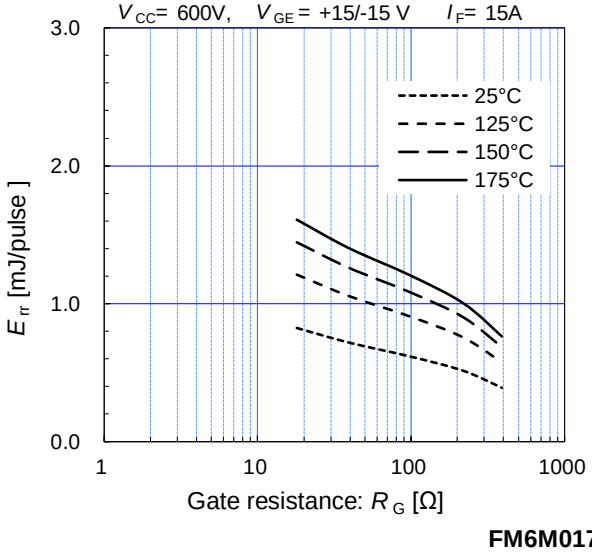
V_{CC}= 600V, V_{GE} = +15/-15 V R_G= 39 Ω



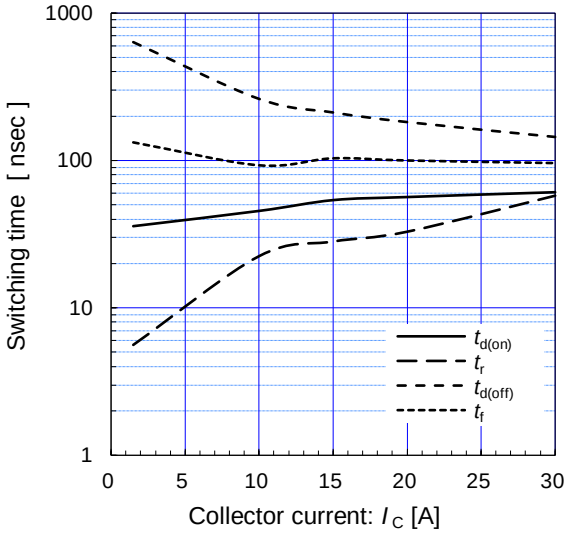
[Inverter]

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

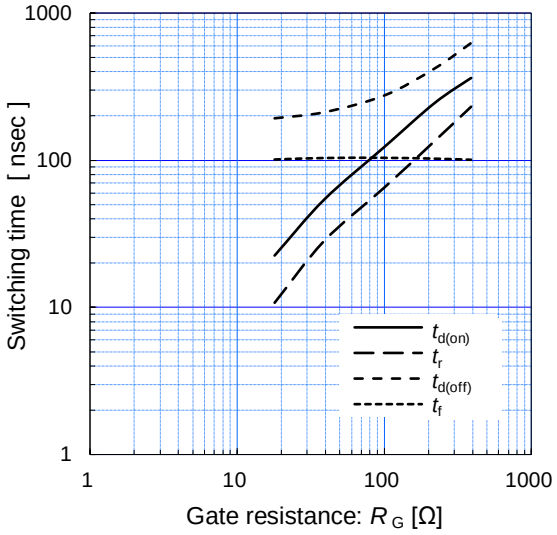
V_{CC}= 600V, V_{GE} = +15/-15 V I_F= 15A



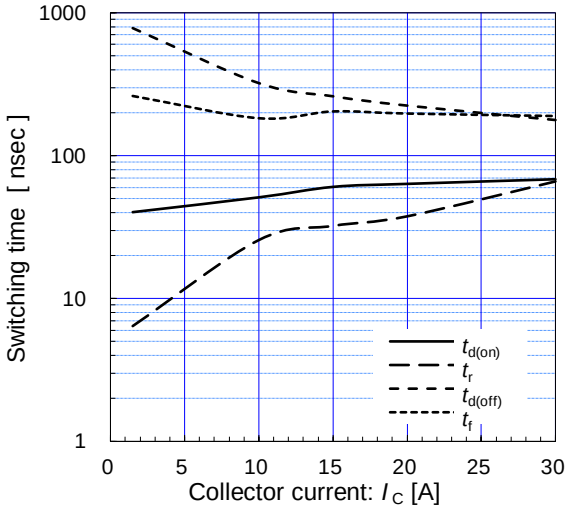
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC}= 600V, R_G= 39Ω V_{GE}= +15/-15 V, T_{vj}= 25°C



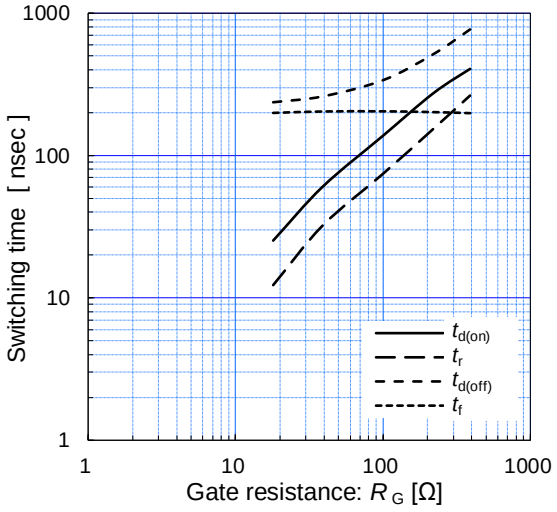
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC}= 600V, I_C= 15A, V_{GE}= +15/-15 V, T_{vj}= 25°C



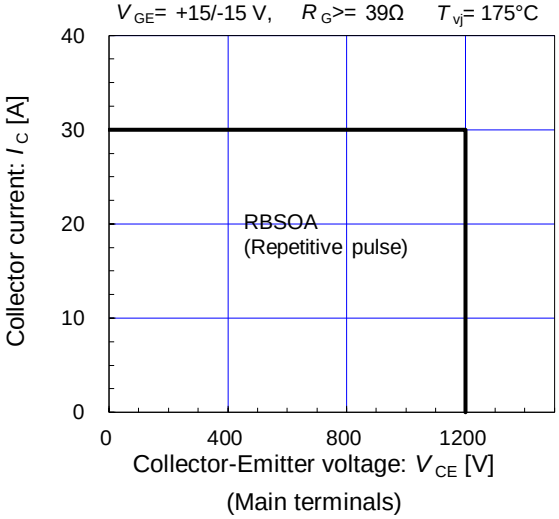
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC}= 600V, R_G= 39Ω V_{GE}= +15/-15 V, T_{vj}= 175°C



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



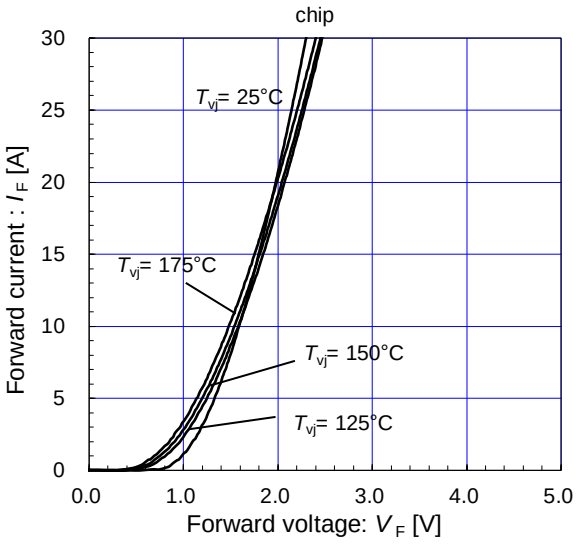
[Inverter]
Reverse bias safe operating area (max.)
V_{GE}= +15/-15 V, R_G>= 39Ω T_{vj}= 175°C



(Main terminals)

[Inverter]

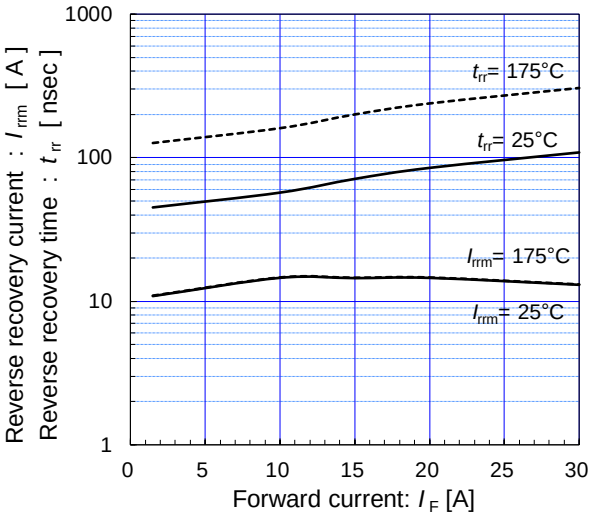
Forward current vs. Forward voltage (typ.)



[Inverter]

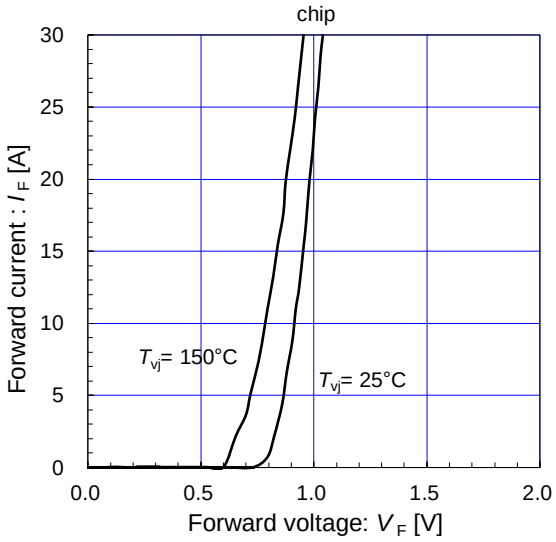
Reverse recovery characteristics (typ.)

V_{CC}= 600V, V_{GE}= +15/-15 V, R_G= 39Ω

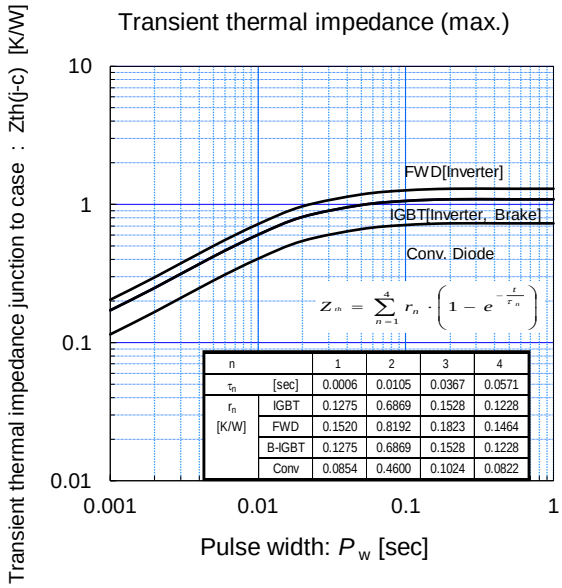


[Converter]

Forward current vs. Forward voltage (typ.)



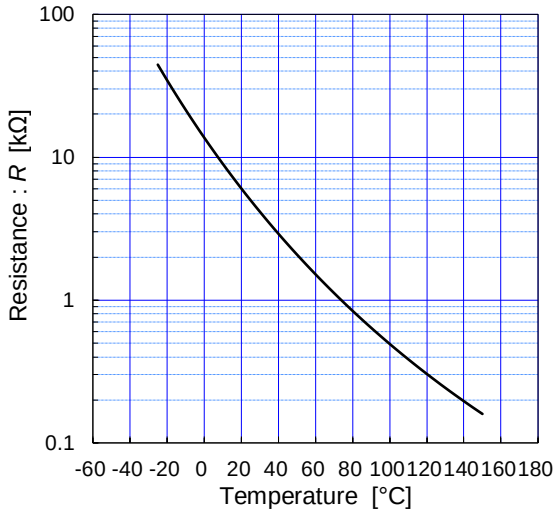
Transient thermal impedance (max.)



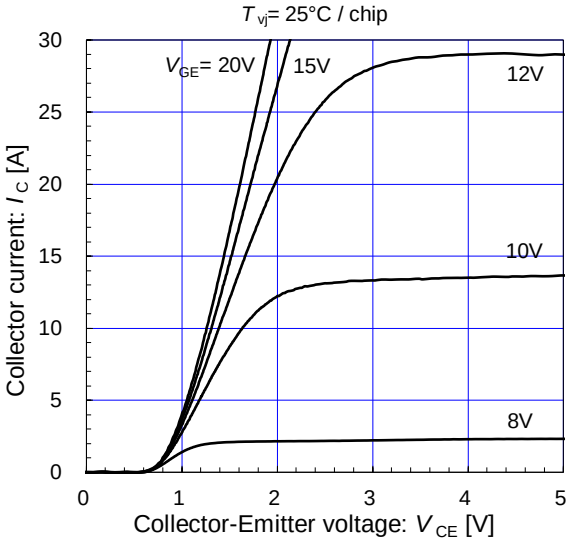
n		1	2	3	4
τ_n	[sec]	0.0006	0.0105	0.0367	0.0571
r_n [K/W]	IGBT	0.1275	0.6869	0.1528	0.1228
	FWD	0.1520	0.8192	0.1823	0.1464
	B-IGBT	0.1275	0.6869	0.1528	0.1228
	Conv	0.0854	0.4600	0.1024	0.0822

[Thermistor]

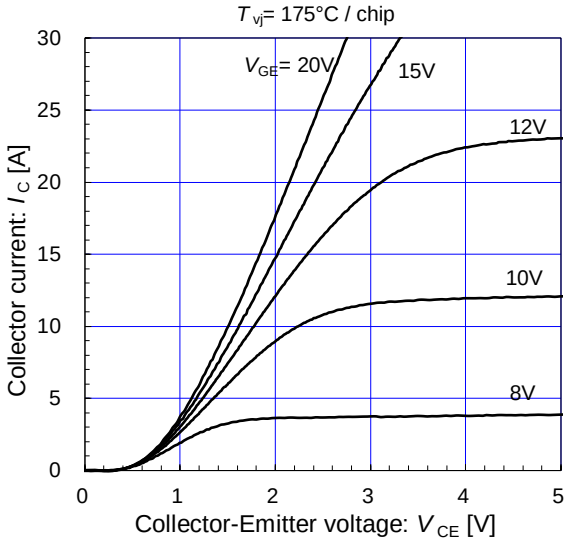
Temperature characteristic (typ.)



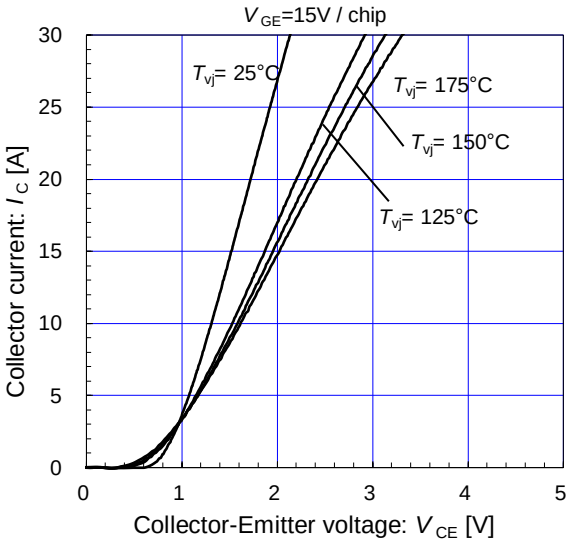
[Brake]
Collector current vs. Collector-Emitter voltage (typ.)



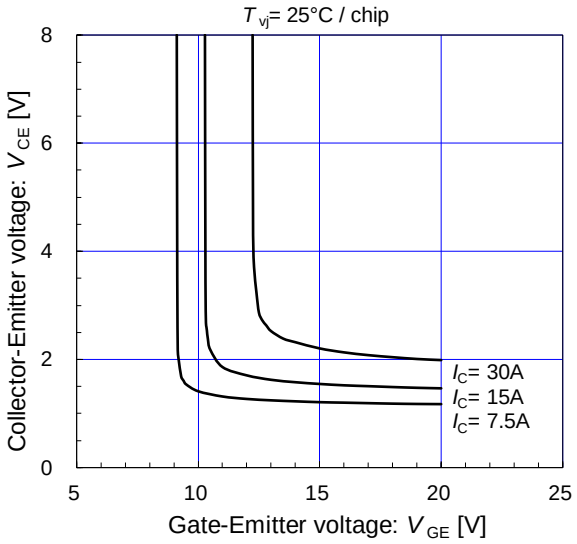
[Brake]
Collector current vs. Collector-Emitter voltage (typ.)



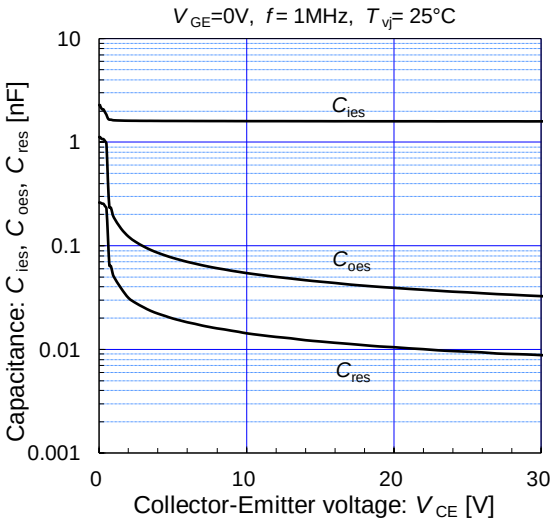
[Brake]
Collector current vs. Collector-Emitter voltage (typ.)



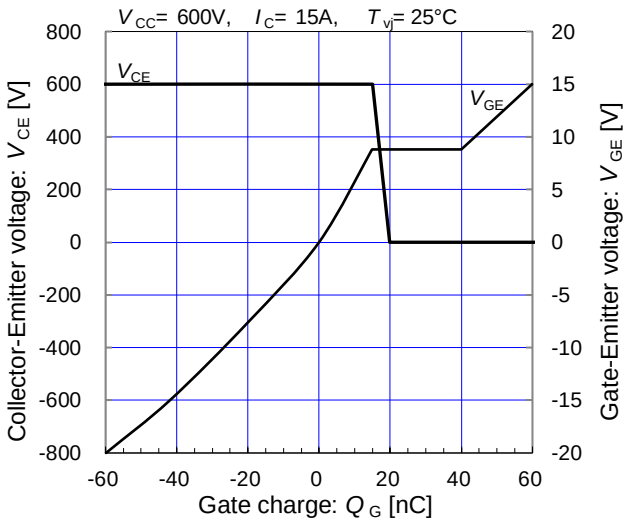
[Brake]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)



[Brake]
Capacitance vs. Collector-Emitter voltage (typ.)



[Brake]
Dynamic gate charge (typ.)



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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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・Machine tools ・Audiovisual equipment ・Electrical home appliances ・Personal equipment ・Industrial robots etc.

5. If you need to use a product in this Catalog for equipment requiring higher reliability than normal, such as for the equipment listed below, it is imperative to contact Fuji Electric Co., Ltd. to obtain prior approval. When using these products for such equipment, take adequate measures such as a backup system to prevent the equipment from malfunctioning even if a Fuji's product incorporated in the equipment becomes faulty.
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・Traffic-signal control equipment ・Gas leakage detectors with an auto-shut-off feature
・Emergency equipment for responding to disasters and anti-burglary devices ・Safety devices ・Medical equipment

6. Do not use products in this Catalog for the equipment requiring strict reliability such as the following and equivalents to strategic equipment (without limitation).
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7.

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