2MBI225XNA170-50

IGBT Modules

Power Module (X series)
1700V / 225A / 2-in-1 package



■ Features

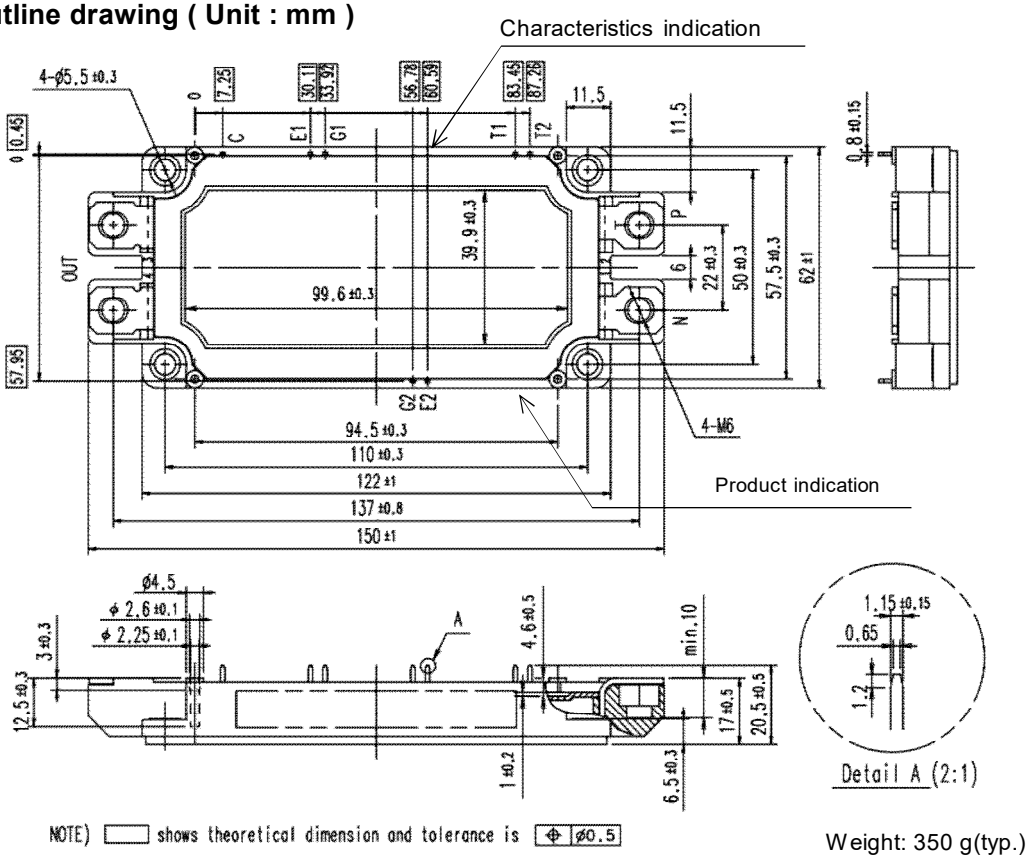
Low $V_{CE(sat)}$
Low Inductance Module structure
Solder pin terminals

■ Applications

Inverter for Motor Drives, AC and DC Servo Drives

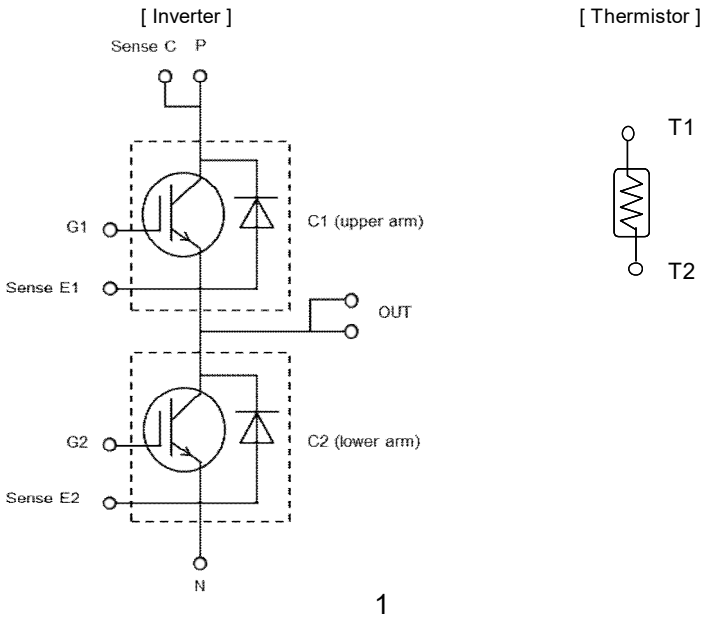
Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems

■ Outline drawing (Unit : mm)



Weight: 350 g(typ.)

■ Equivalent circuit



FM5F9396a
2024/03

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■ Absolute maximum ratings (at T_c= 25°C unless otherwise specified)

Items		Symbols	Conditions		Maximum ratings	Units
Collector-Emitter voltage, Gate-Emitter short-circuited		V_{CES}			1700	V
Gate-Emitter voltage, Collector-Emitter short-circuited		V_{GES}			±20	V
Collector current		I_C	Continuous	T_c=100°C	225	A
Repetitive peak collector current		I_{CRM}	1ms		450	
Forward current		I_F			225	
Repetitive peak forward current		I_{FRM}	1ms		450	
Total power dissipation		P_{tot}	1 device		1470	W
Virtual junction temperature		T_{vj}			175	°C
Operating junction temperature (under switching conditions)		T_{vjop}			175	
Case temperature		T_c			125	
Storage temperature		T_{stg}			-40 ~ 125	
Isolation voltage	Between terminal and copper base (*1)	V_{isol}	AC: 1min.		3400	Vrms
	Between thermistor and others (*2)					
Mounting torque of screws to heatsink		M_s	M5		2.5～6.0	N·m
Mounting torque of screws to terminals		M_t	M6		3.5～6.0	

(*1) All terminals should be connected together during the test.
(*2) Two thermistor terminals should be connected together, other terminals should be connected together and shorted to base plate during the test.

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

Items	Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	V_{GE} = 0V V_{CE} = 1700V		-	-	150	μA
Gate leakage current, Collector-Emitter short-circuited	I_{GES}	V_{CE}=0V, V_{GE}=±20V		-	-	300	nA
Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V I_C = 225mA		6.0	6.5	7.0	V
Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C= 225A	T_{vj}=25°C	-	1.85	2.30	V
	$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.60	2.05	
			T_{vj}=125°C	-	2.00	-	
			T_{vj}=150°C	-	2.10	-	
			T_{vj}=175°C	-	2.20	-	
Internal gate resistance	r_g	-		-	4.17	-	Ω
Capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	31	-	nF
	C_{oes}			-	0.9	-	
	C_{res}			-	0.19	-	
Gate charge	Q_G	V_{CC} = 900V, I_C = 225A V_{GE} = -15 → +15V		-	2.0	-	μC
Forward voltage	V_F (terminal)	V_{GE} = 0V I_F= 225A	T_{vj}=25°C	-	1.95	2.40	V
	V_F (chip)		T_{vj}=25°C	-	1.70	2.15	
			T_{vj}=125°C	-	1.80	-	
			T_{vj}=150°C	-	1.85	-	
			T_{vj}=175°C	-	1.80	-	
Switching time (*1)	$t_{d(on)}$	V_{CC} = 900V I_C, I_F = 225A V_{GE} = +15/-15 V R_G = ±0.82Ω L_S = 35 nH	T_{vj}=25°C	-	0.35	-	μs
			T_{vj}=125°C	-	0.37	-	
			T_{vj}=150°C	-	0.38	-	
			T_{vj}=175°C	-	0.40	-	
	t_r		T_{vj}=25°C	-	0.06	-	
			T_{vj}=125°C	-	0.07	-	
			T_{vj}=150°C	-	0.08	-	
			T_{vj}=175°C	-	0.08	-	
	$t_{d(off)}$		T_{vj}=25°C	-	0.46	-	
			T_{vj}=125°C	-	0.51	-	
			T_{vj}=150°C	-	0.53	-	
			T_{vj}=175°C	-	0.54	-	
	t_f		T_{vj}=25°C	-	0.44	-	
			T_{vj}=125°C	-	0.60	-	
			T_{vj}=150°C	-	0.63	-	
			T_{vj}=175°C	-	0.70	-	
Reverse recovery time	t_{rr}		T_{vj}=25°C	-	0.23	-	
			T_{vj}=125°C	-	0.38	-	
			T_{vj}=150°C	-	0.40	-	
			T_{vj}=175°C	-	0.43	-	

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

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

Items		Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Switching loss (per pulse)		E_{on}	V_{CC} = 900V, I_C, I_F = 225A, V_{GE} = +15/-15 V, R_G = ±0.82Ω, L_S = 35 nH	T_{vj}=25°C	-	49	-	mJ
				T_{vj}=125°C	-	67	-	
				T_{vj}=150°C	-	71	-	
				T_{vj}=175°C	-	76	-	
		E_{off}		T_{vj}=25°C	-	52	-	
				T_{vj}=125°C	-	68	-	
				T_{vj}=150°C	-	70	-	
				T_{vj}=175°C	-	75	-	
		E_{rr}		T_{vj}=25°C	-	34	-	
				T_{vj}=125°C	-	58	-	
				T_{vj}=150°C	-	65	-	
				T_{vj}=175°C	-	72	-	
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

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.

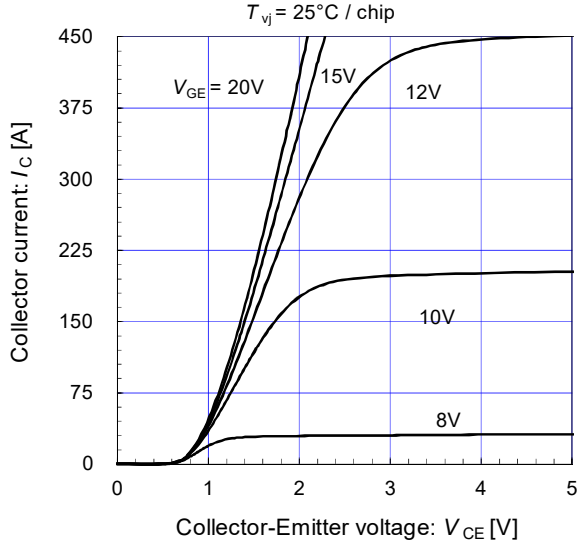
■Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.102	K/W
		Inverter FWD	-	-	0.153	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	0.0167	-	

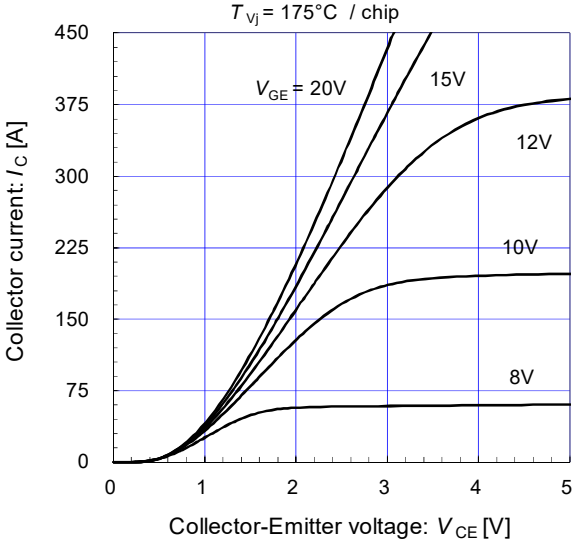
(*1) This is the value which is defined mounting on the additional heatsink with thermal grease.

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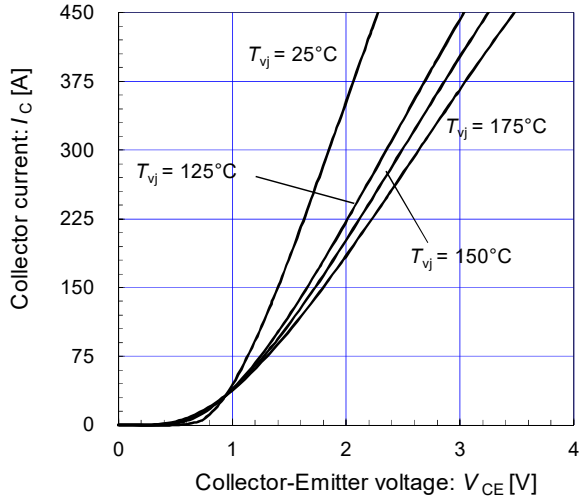
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 25°C / chip



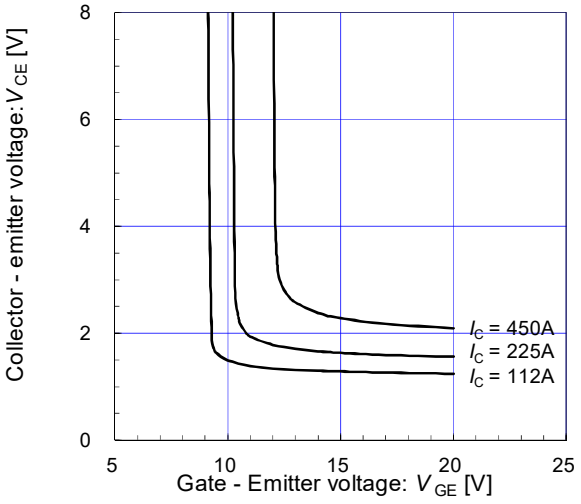
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 175°C / chip



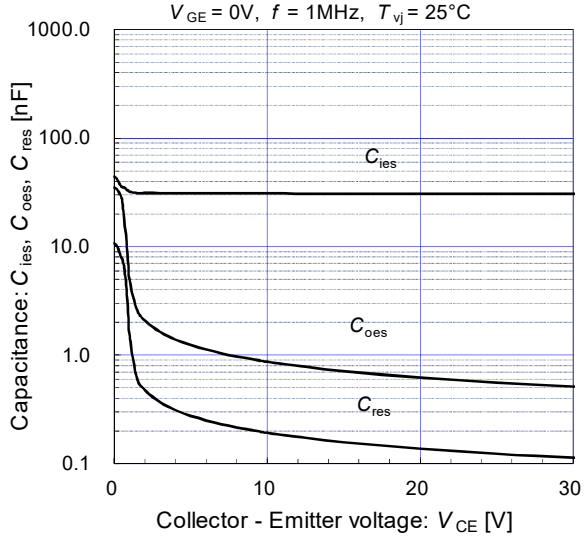
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} = 15V / chip



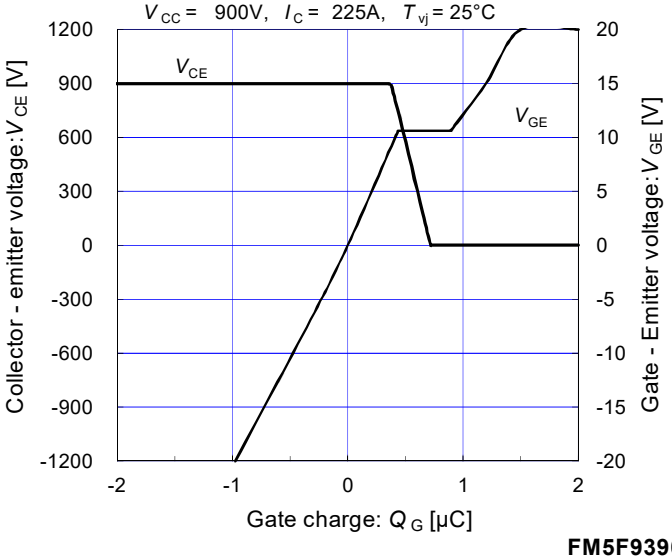
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj} = 25°C / chip



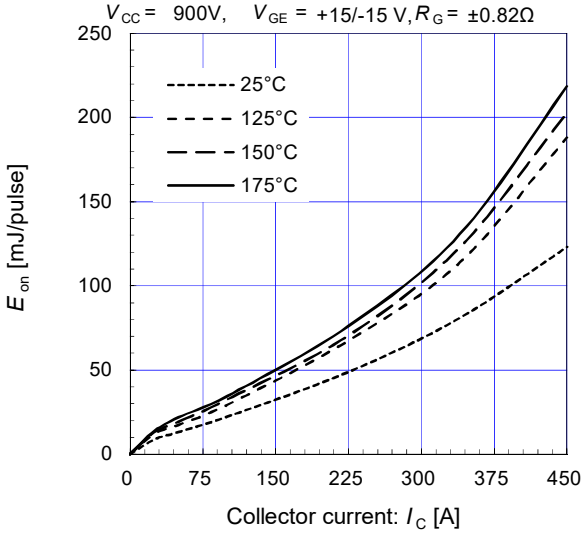
[Inverter]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE} = 0V, f = 1MHz, T_{vj} = 25°C



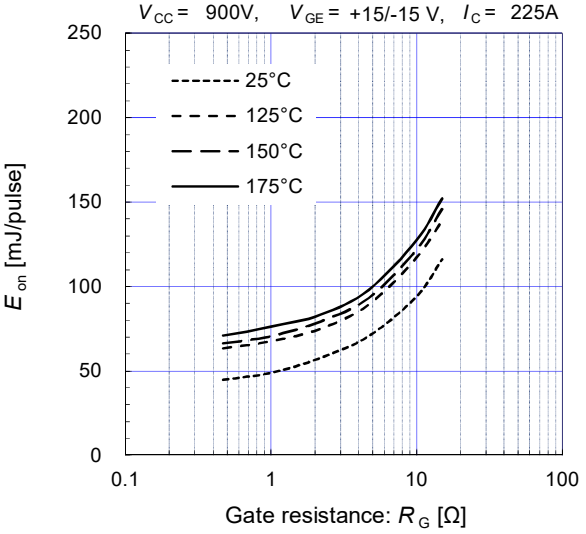
[Inverter]
Dynamic gate charge (typ.)
V_{CC} = 900V, I_C = 225A, T_{vj} = 25°C



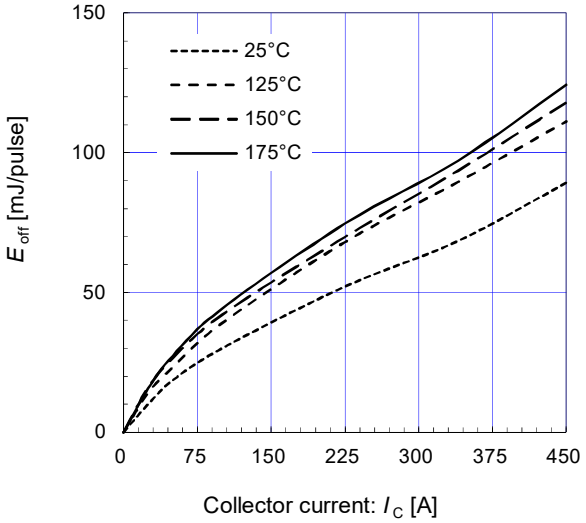
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, R_G = ±0.82Ω



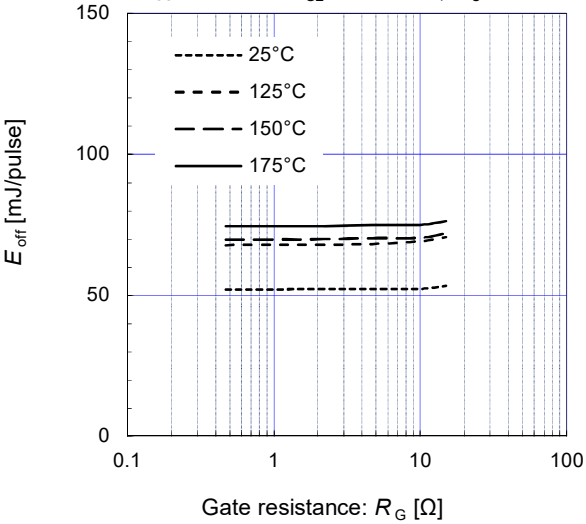
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, I_C = 225A



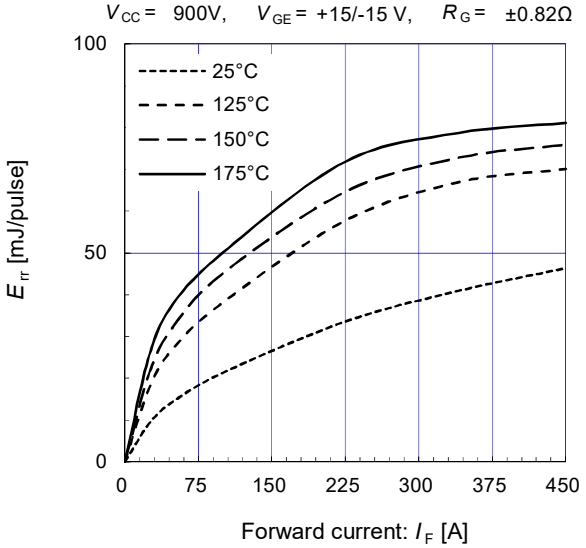
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, R_G = ±0.82 Ω



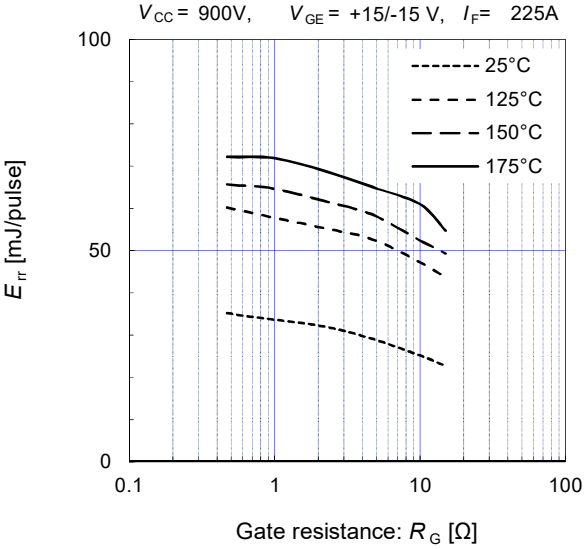
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, I_C = 225A



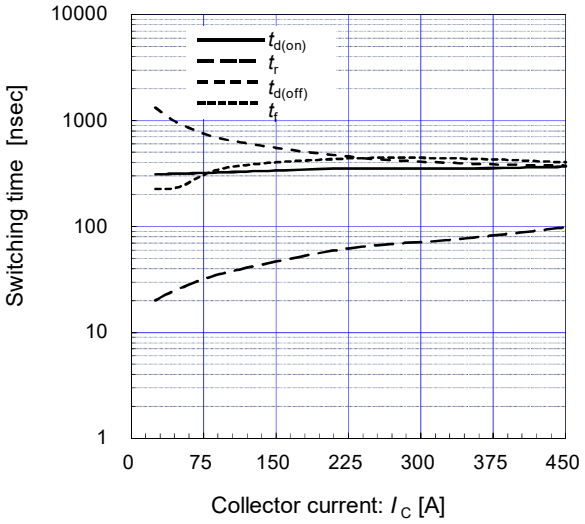
[Inverter]
E_{rr} vs. Forward current (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, R_G = ±0.82Ω



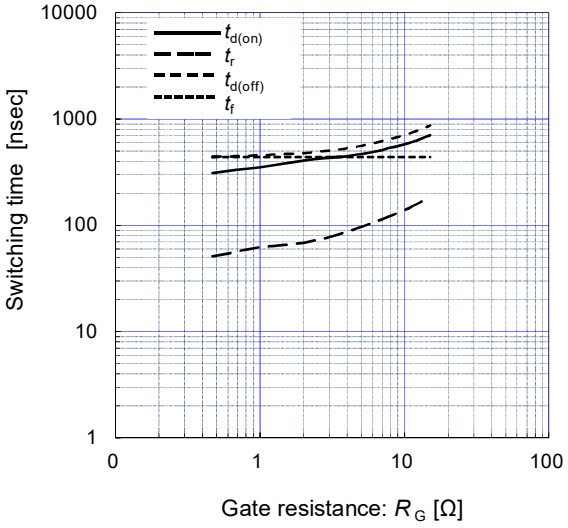
[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, I_F = 225A



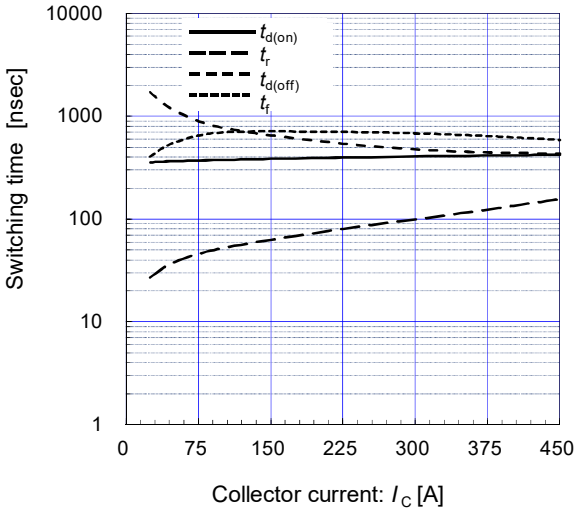
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 900V, R_G = ±0.82Ω, V_{GE} = +15/-15 V, T_{vj} = 25°C



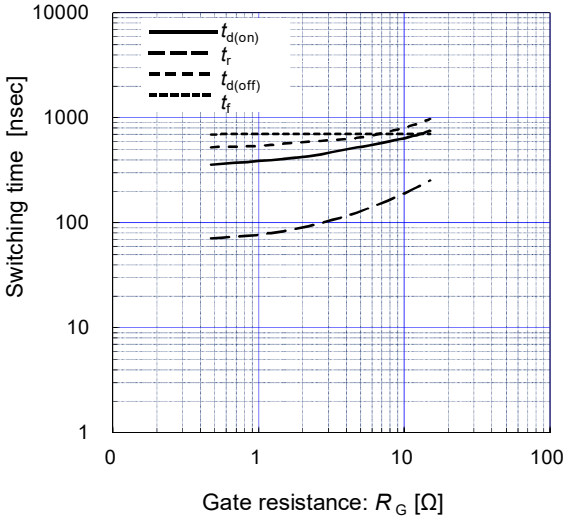
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 900V, I_C = 225A, V_{GE} = +15/-15 V, T_{vj} = 25°C



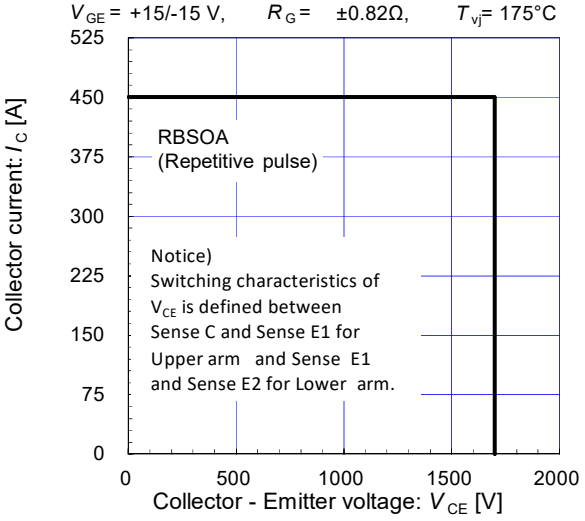
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 900V, R_G = ±0.82Ω, V_{GE} = +15/-15 V, T_{vj} = 175°C



[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 900V, I_C = 225A, V_{GE} = +15/-15 V, T_{vj} = 175°C

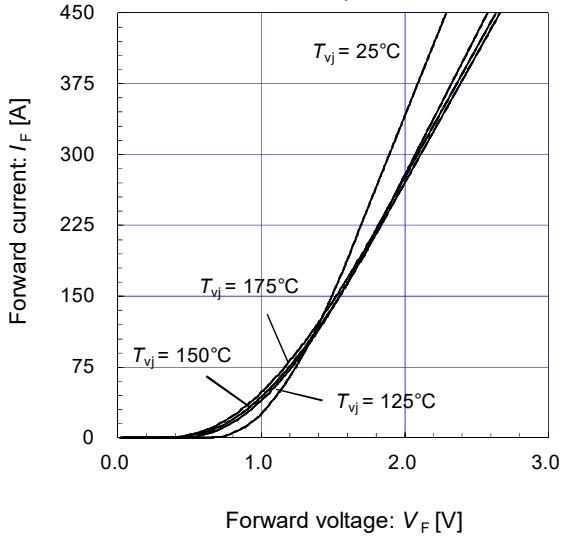


[Inverter]
Reverse bias safe operating area (max.)
V_{GE} = +15/-15 V, R_G = ±0.82Ω, T_{vj} = 175°C

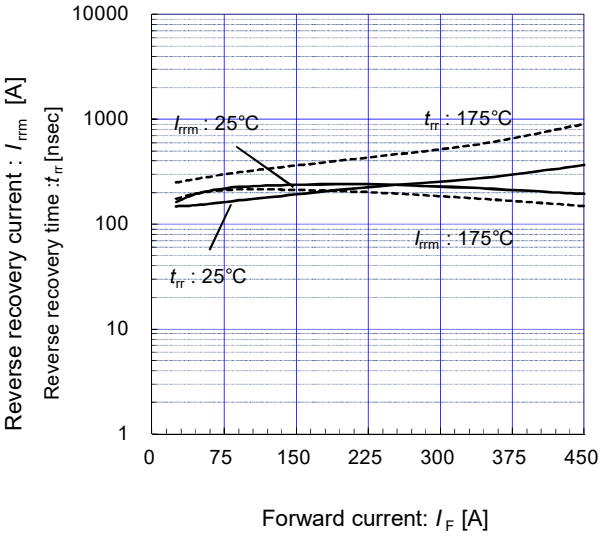


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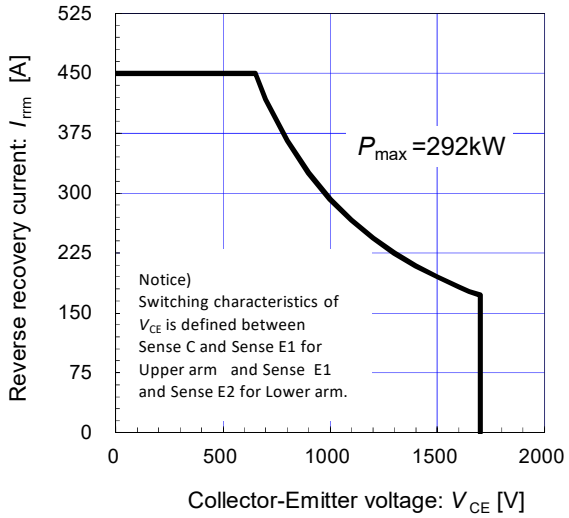
[Inverter]
Forward current vs. Forward voltage (typ.)
chip



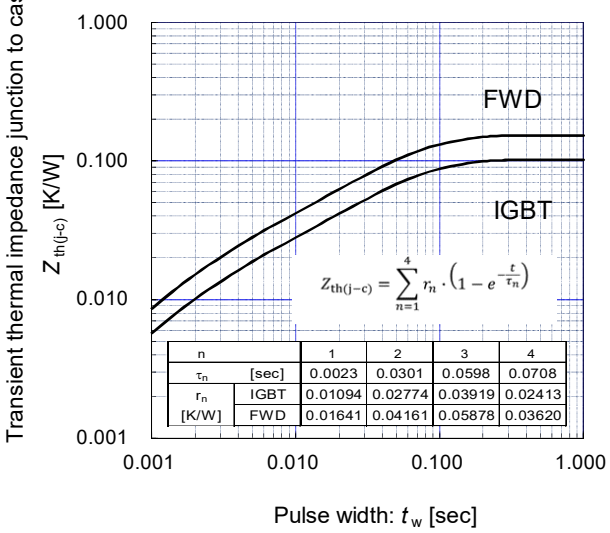
[Inverter]
Reverse recovery characteristics (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, R_G = ±0.82Ω



[Inverter]
FWD safe operation area (max.)
T_{vj} = 175°C

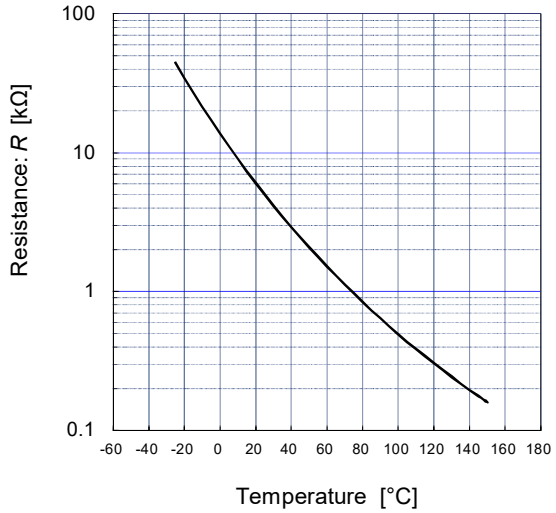


[Inverter]
Transient thermal impedance(max.)



n		1	2	3	4
τ_n	[sec]	0.0023	0.0301	0.0598	0.0708
r_n [K/W]	IGBT	0.01094	0.02774	0.03919	0.02413
	FWD	0.01641	0.04161	0.05878	0.03620

[Thermistor]
Temperature characteristic (typ.)



Warnings

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

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・Traffic-signal control equipment ・Gas leakage detectors with an auto-shut-off feature
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富士電機 Innovating Energy Technology

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IGBT Modules

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6 IGBT Loss Simulation Software	www.fujielectric.com/products/semiconductor/model/igbt/simulation/
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