2MBI1500XZF170-50

IGBT Modules

Power Module (X series)
1700V / 1500A / 2-in-1 package



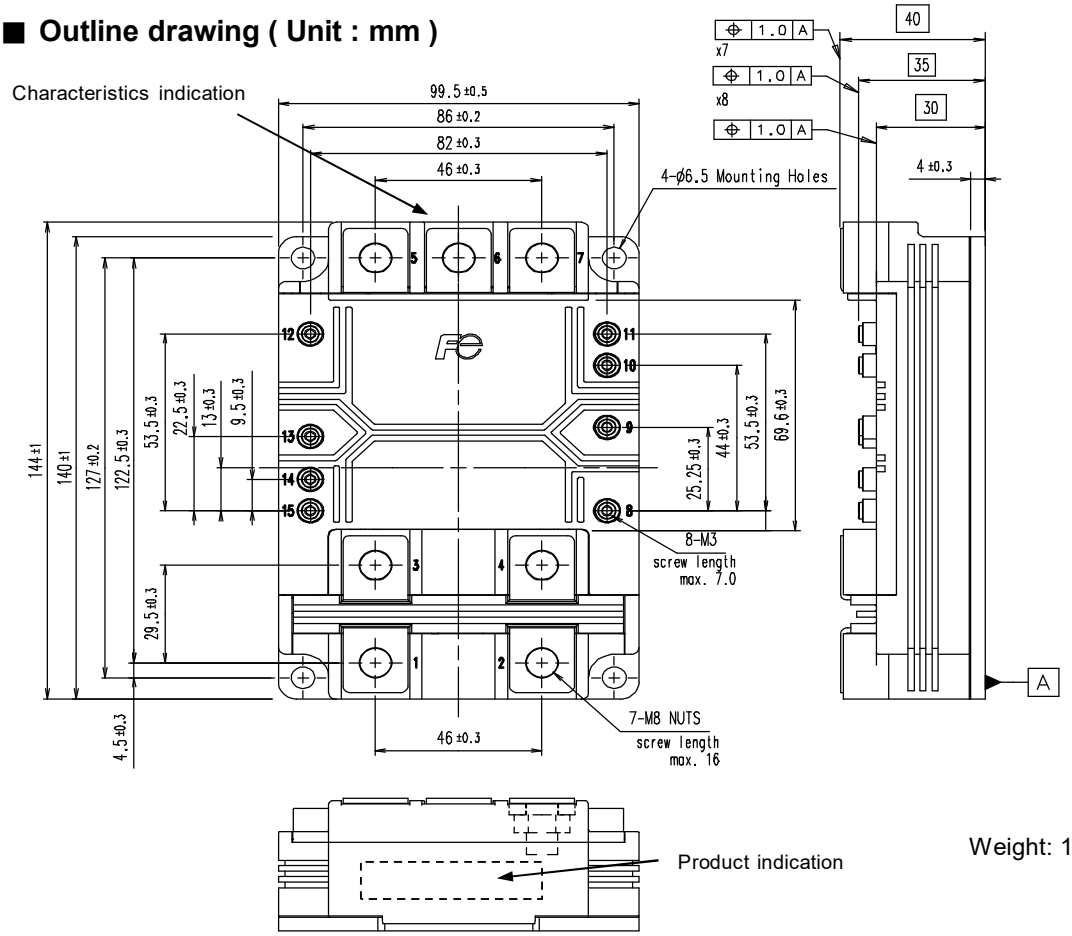
■ Features

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

■ Applications

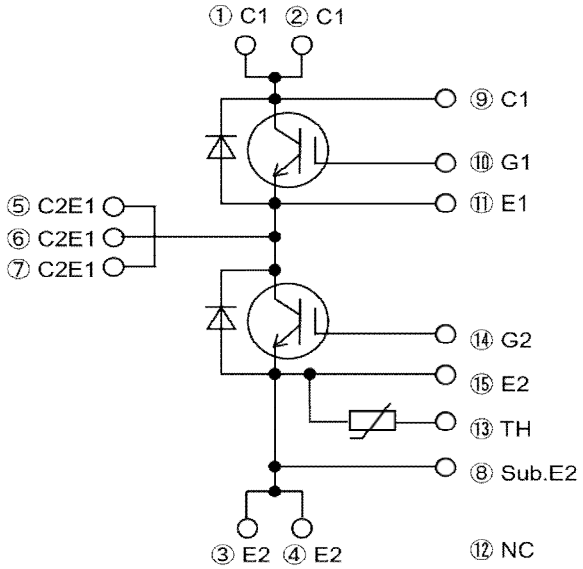
Inverter for Motor Drives, AC and DC Servo Drives
Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems

■ Outline drawing (Unit : mm)



Weight: 1050 g

■ Equivalent circuit



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■ 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}			1700	V
	Gate-Emitter voltage, Collector-Emitter short-circuited	V_{GES}			±20	V
	Collector current	I_C	Continuous	T_c=83°C	1500	A
	Repetitive peak collector current	I_{CRM}	1ms		3000	
	Forward current	I_F			1500	
	Repetitive peak forward current	I_{FRM}	1ms		3000	
	Total power dissipation	P_{tot}	1 device		7.3	kW
	Virtual junction temperature	T_{vj}			175	°C
	Operating virtual junction temperature (under switching conditions)	T_{vjop}			175	
Case temperature		T_c			150	
Storage temperature		T_{stg}			-40 ~ 150	
Isolation voltage	Between terminal and copper base (*1)	V_{isol}	AC: 1min.		4000	Vrms
Mounting torque of screws to heatsink		M_s	M6		3.5 ~ 6.0	N·m
Mounting torque of screws to terminals		M_t	M8		8.0 ~ 10.0	
Mounting torque of screws to sense terminals			M3		0.7 ~ 0.8	

(*1) All terminals should be connected together during the test.

■ **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} = 1700V		-	-	300	μA
	Gate leakage current, Collector-Emitter short-circuited	I_{GES}	V_{CE}=0V, V_{GE}=+20/-20 V		-	-	600	nA
	Gate-Emitter threshold voltage	$V_{GE(th)}$	V_{CE} = 20V, I_C = 1200mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V, I_C= 1500A	T_{vj}=25°C	-	2.40	2.85	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.90	2.35	
				T_{vj}=125°C	-	2.40	-	
				T_{vj}=150°C	-	2.55	-	
				T_{vj}=175°C	-	2.70	-	
	Internal gate resistance	r_g	-		-	2.50	-	Ω
	Capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=100kHz		-	147	-	nF
		C_{oes}			-	4.2	-	
		C_{res}			-	0.9	-	
	Gate charge	Q_G	V_{CC} = 900V, I_C = 1500A, V_{GE} = -15 → +15V		-	8.2	-	μC
	Forward voltage	V_F (terminal) (*1)	V_{GE} = 0V, I_F= 1500A	T_{vj}=25°C	-	2.30	2.90	V
		V_F (chip)		T_{vj}= 25°C	-	1.95	2.40	
				T_{vj}=125°C	-	2.15	-	
				T_{vj}=150°C	-	2.20	-	
				T_{vj}=175°C	-	2.15	-	
	Switching time (*1)	$t_{d(on)}$	V_{CC} = 900V, I_C, I_F = 1500A, V_{GE} = +15/-15 V, $R_{G(on/off)}$ = 0.11/1.0Ω, L_S = 25 nH	T_{vj}= 25°C	-	0.78	-	μs
				T_{vj}=125°C	-	0.81	-	
				T_{vj}=150°C	-	0.82	-	
				T_{vj}=175°C	-	0.83	-	
		t_r		T_{vj}= 25°C	-	0.14	-	
				T_{vj}=125°C	-	0.17	-	
				T_{vj}=150°C	-	0.19	-	
				T_{vj}=175°C	-	0.21	-	
		$t_{d(off)}$		T_{vj}= 25°C	-	0.90	-	
				T_{vj}=125°C	-	0.96	-	
				T_{vj}=150°C	-	0.96	-	
				T_{vj}=175°C	-	0.97	-	
		t_f		T_{vj}= 25°C	-	0.33	-	
				T_{vj}=125°C	-	0.48	-	
				T_{vj}=150°C	-	0.58	-	
				T_{vj}=175°C	-	0.61	-	
	Reverse recovery time	t_{rr}		T_{vj}= 25°C	-	0.31	-	
				T_{vj}=125°C	-	0.47	-	
				T_{vj}=150°C	-	0.49	-	
				T_{vj}=175°C	-	0.54	-	

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

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

Items		Symbols	Conditions		Characteristics min.	Characteristics typ.	Characteristics max.	Units
Inverter	Switching loss (per pulse)	E_{on}	V_{CC} = 900V, I_C, I_F = 1500A, V_{GE} = +15/-15 V, $R_{G(on/off)}$ = 0.11/1.0Ω, L_S = 25 nH	T_{vj}=25°C	-	308	-	mJ
				T_{vj}=125°C	-	451	-	
				T_{vj}=150°C	-	494	-	
				T_{vj}=175°C	-	548	-	
		E_{off}		T_{vj}=25°C	-	377	-	
				T_{vj}=125°C	-	464	-	
				T_{vj}=150°C	-	485	-	
				T_{vj}=175°C	-	500	-	
		E_{rr}		T_{vj}=25°C	-	190	-	
				T_{vj}=125°C	-	308	-	
				T_{vj}=150°C	-	346	-	
				T_{vj}=175°C	-	403	-	
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	-	-	20.5	K/kW
		Inverter FWD	-	-	31.0	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1	$R_{th(c-s)}$	with 1 W/(m·K) thermal grease	-	8.3	-	

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

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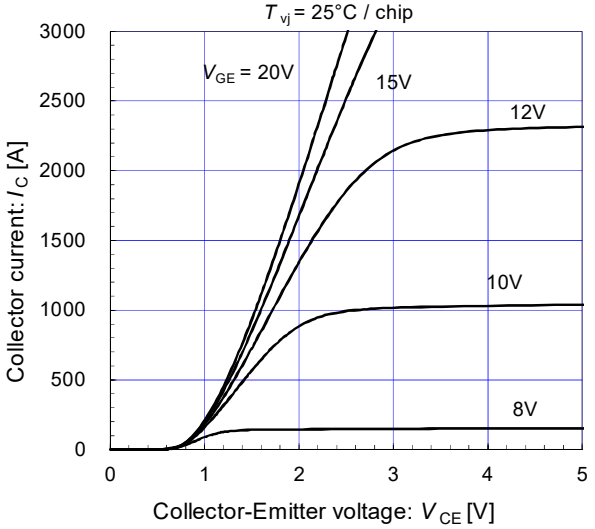
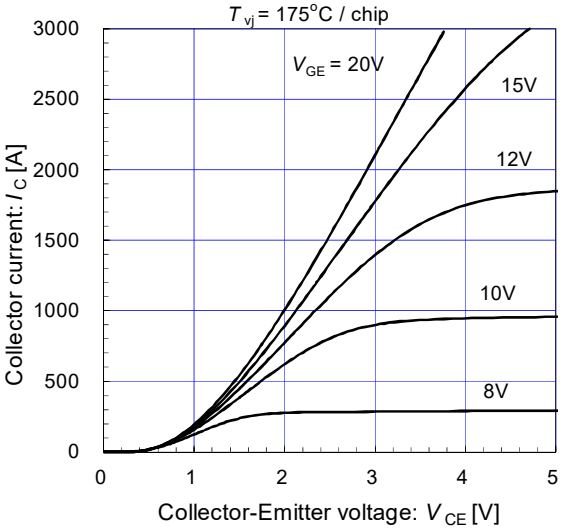
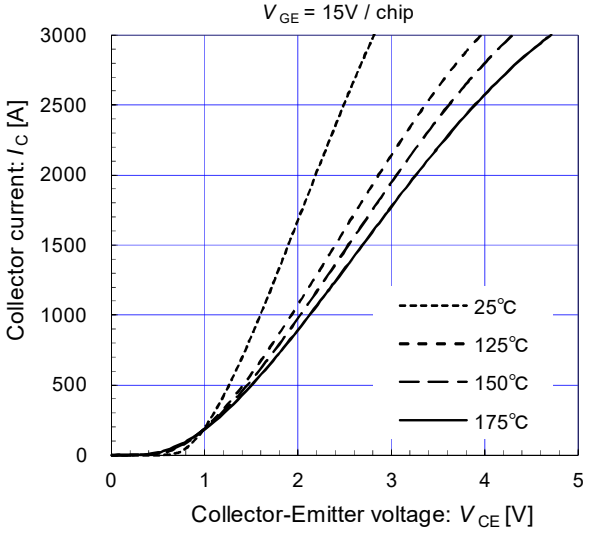
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 25°C / chip



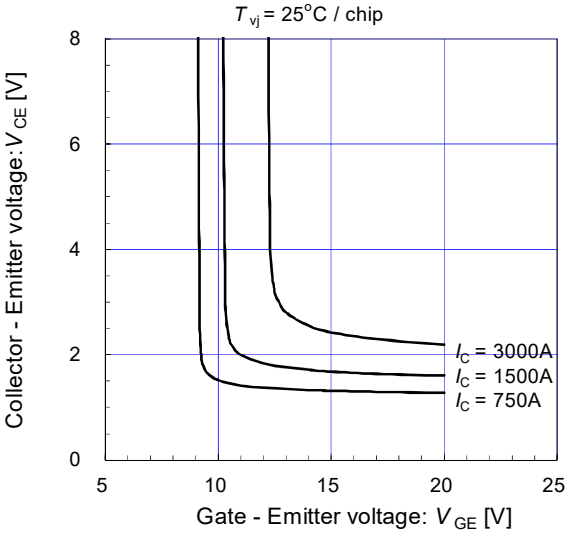
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 175°C / chip



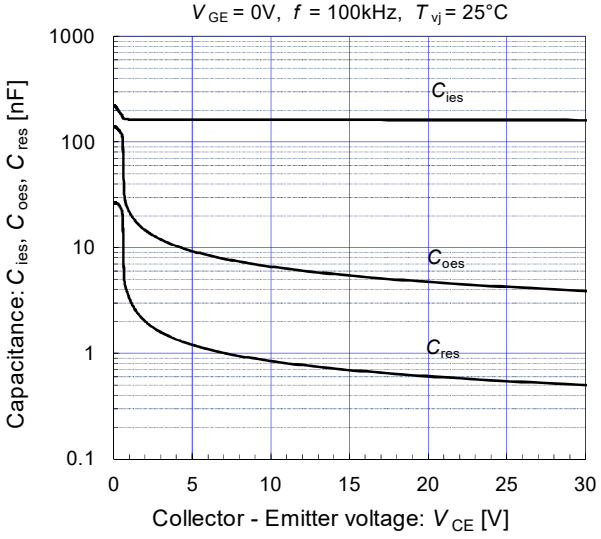
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} = 15V / chip



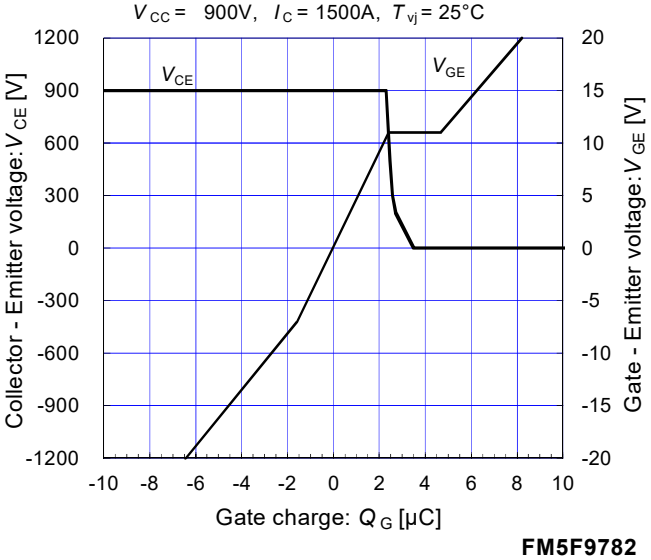
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj} = 25°C / chip



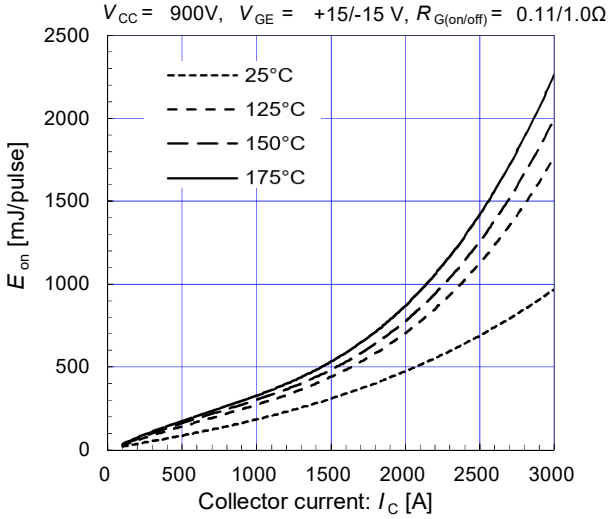
[Inverter]
Capacitance vs. Collector-Emitter voltage (typ.)
V_{GE} = 0V, f = 100kHz, T_{vj} = 25°C



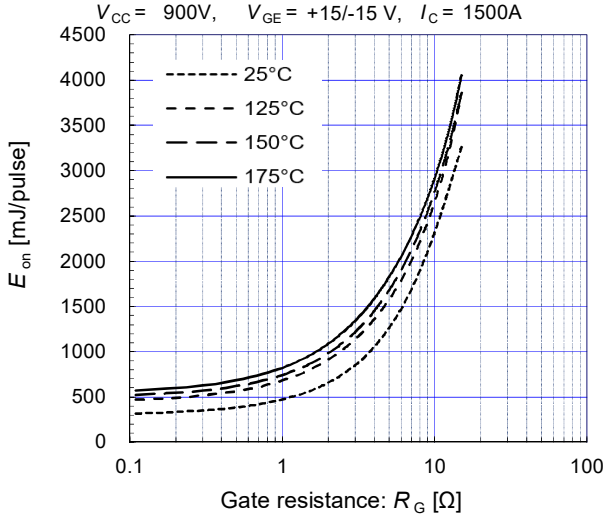
[Inverter]
Dynamic gate charge (typ.)
V_{CC} = 900V, I_C = 1500A, T_{vj} = 25°C



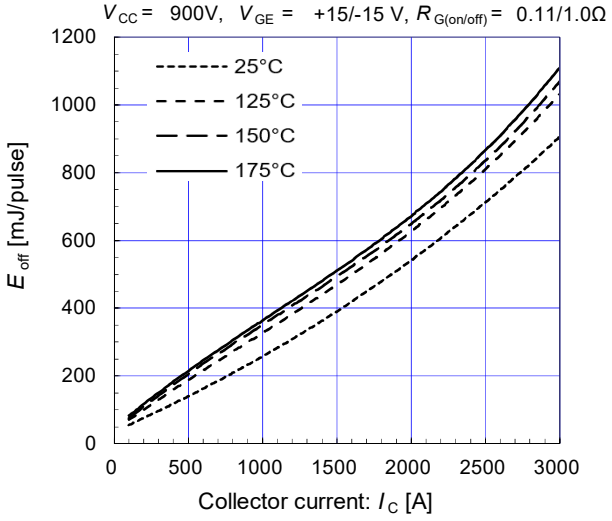
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, $R_{G(on/off)}$ = 0.11/1.0Ω



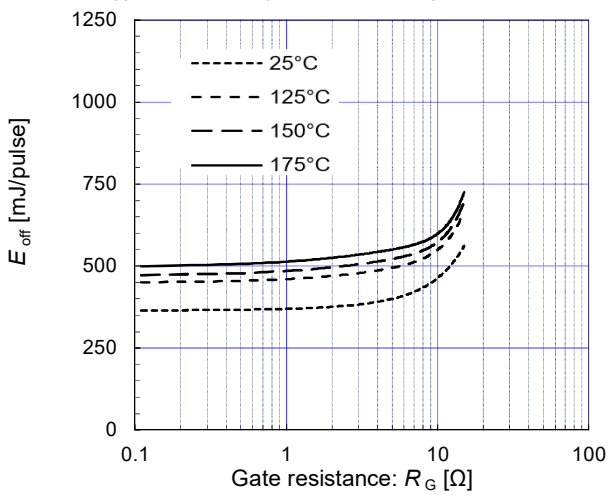
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, I_C = 1500A



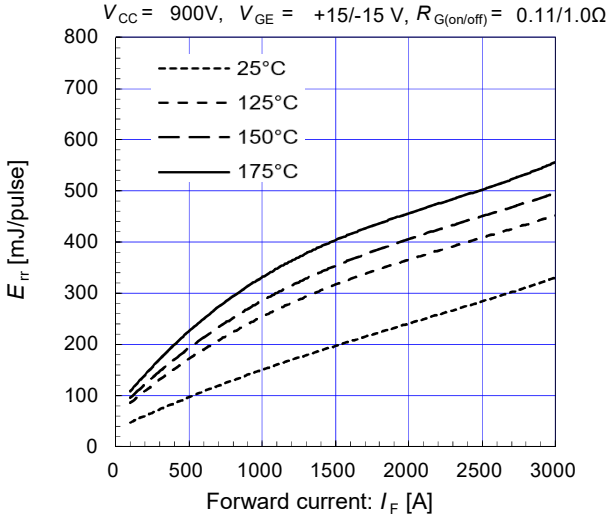
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, $R_{G(on/off)}$ = 0.11/1.0Ω



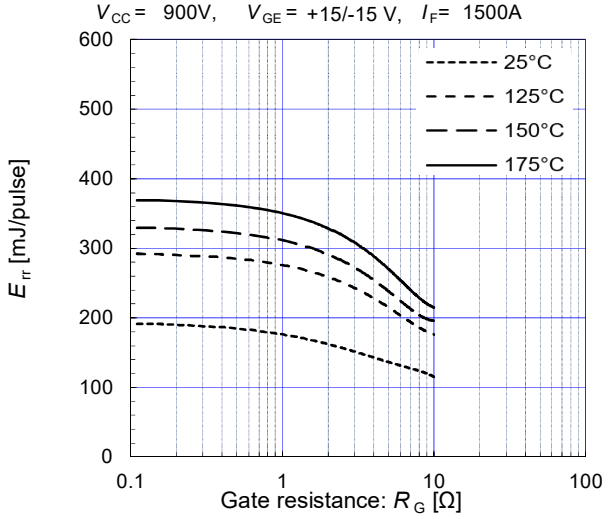
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, I_C = 1500A



[Inverter]
E_{rr} vs. Forward current (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, $R_{G(on/off)}$ = 0.11/1.0Ω



[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, I_F = 1500A



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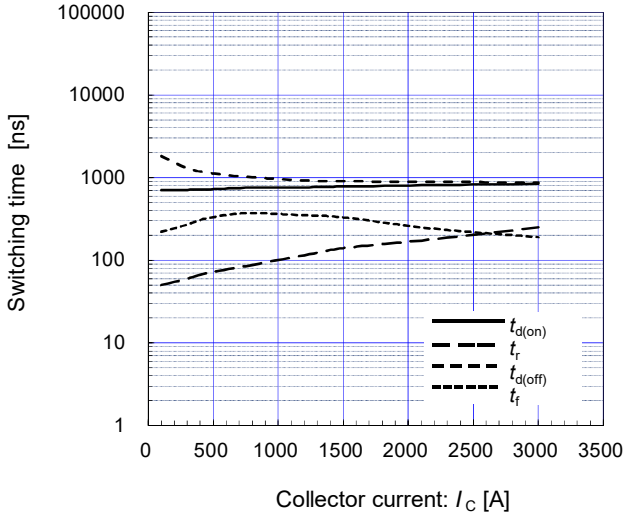
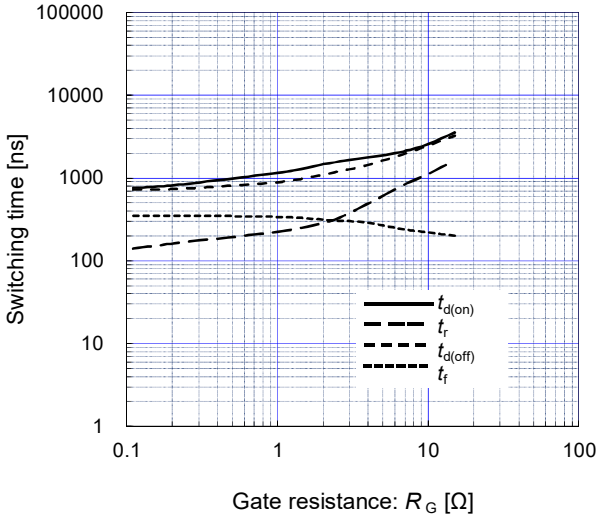
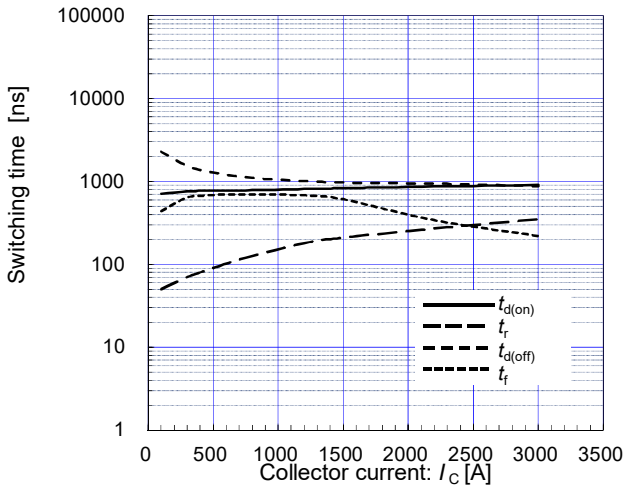
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 900V, $R_{G(on/off)}$ = 0.11/1.0Ω, V_{GE} = +15/-15 V, T_{vj} = 25°C



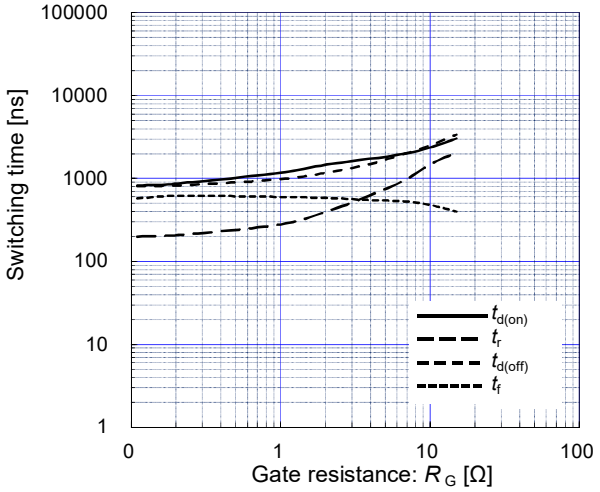
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 900V, I_C = 1500A, V_{GE} = +15/-15 V, T_{vj} = 25°C



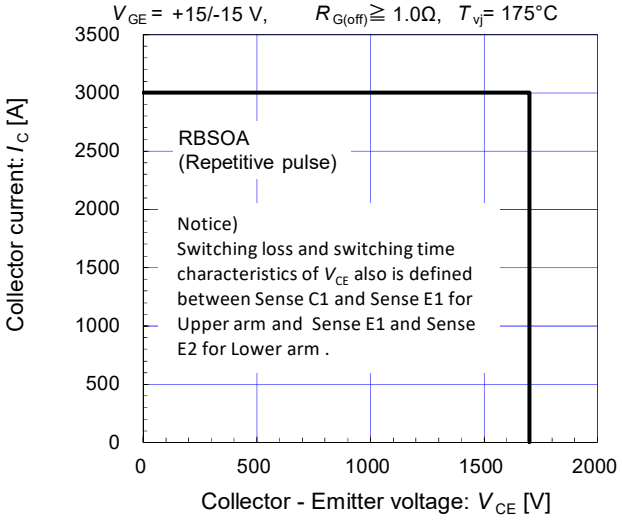
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 900V, $R_{G(on/off)}$ = 0.11/1.0Ω, V_{GE} = +15/-15 V, T_{vj} = 175°C



[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 900V, I_C = 1500A, V_{GE} = +15/-15 V, T_{vj} = 175°C



Reverse bias safe operating area (max.)
V_{GE} = +15/-15 V, $R_{G(off)} \geqq$ 1.0Ω, T_{vj} = 175°C



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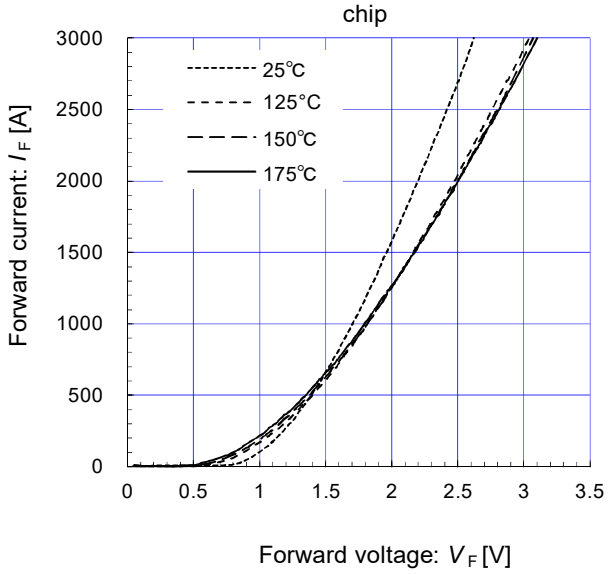
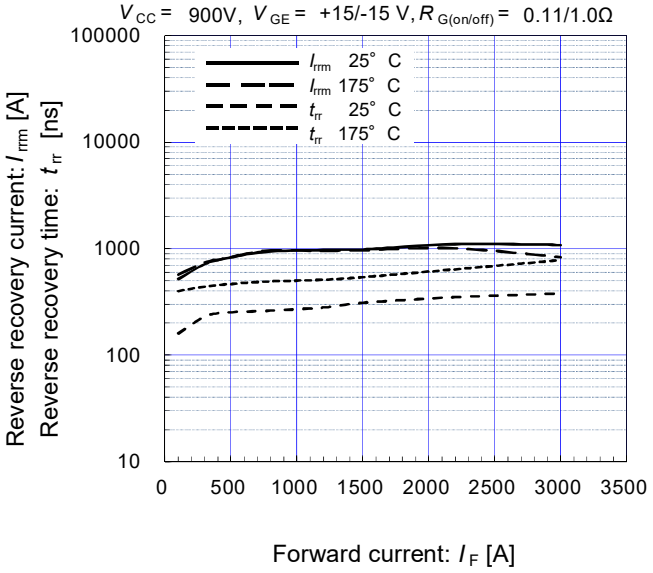
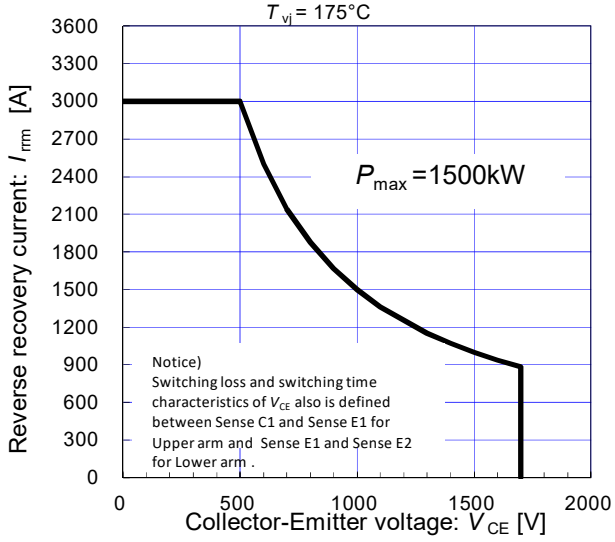
[Inverter]
Forward current vs. Forward voltage (typ.)
chip



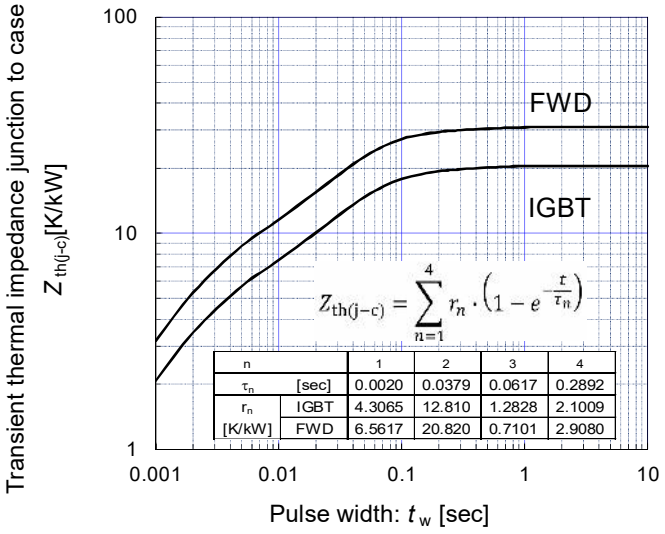
[Inverter]
Reverse recovery characteristics (typ.)
V_{CC} = 900V, V_{GE} = +15/-15 V, $R_{G(on/off)}$ = 0.11/1.0Ω



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

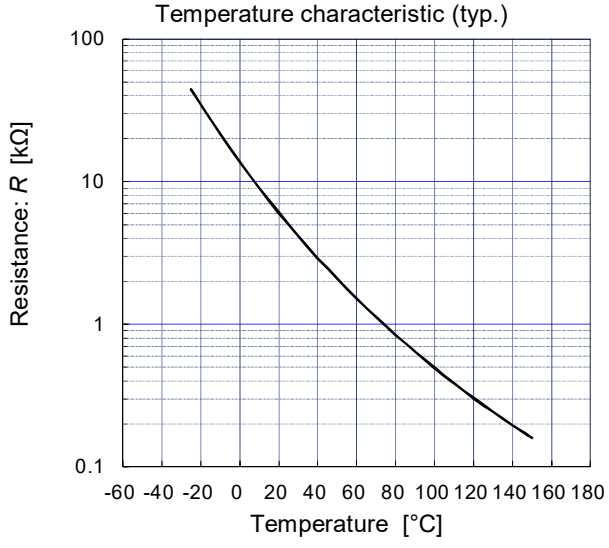


[Inverter]
Transient thermal resistance (max.)



n		1	2	3	4
τ_n	[sec]	0.0020	0.0379	0.0617	0.2892
r_n	IGBT	4.3065	12.810	1.2828	2.1009
[K/kW]	FWD	6.5617	20.820	0.7101	2.9080

[Thermistor]
Temperature characteristic (typ.)



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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
・Emergency equipment for responding to disasters and anti-burglary devices ・Safety devices ・Medical equipment

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IGBT Modules

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6 IGBT Loss Simulation Software	www.fujielectric.com/products/semiconductor/model/igbt/simulation/
7 Fuji Electric Journal	www.fujielectric.com/products/semiconductor/journal/
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