2MBI600XNE120-50

IGBT Modules

Power Module (X series)
1200V / 600A / 2-in-1 package



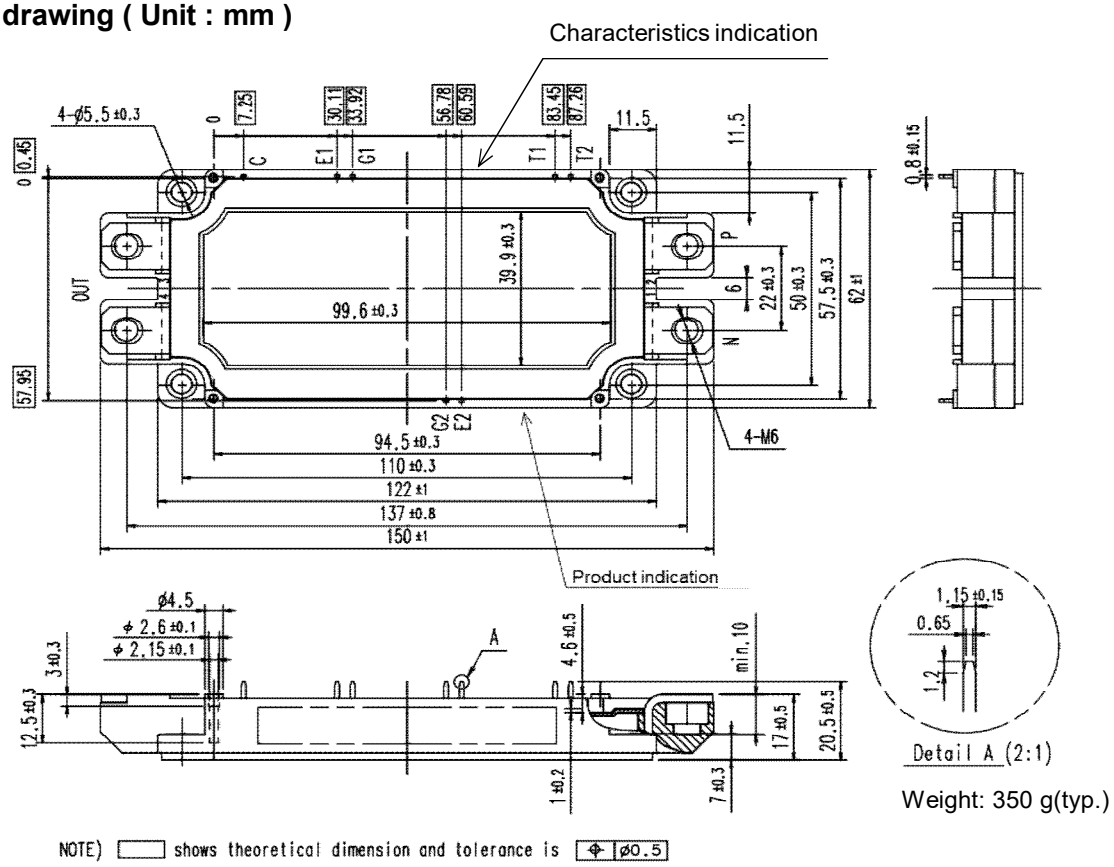
■ Features

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

■ Applications

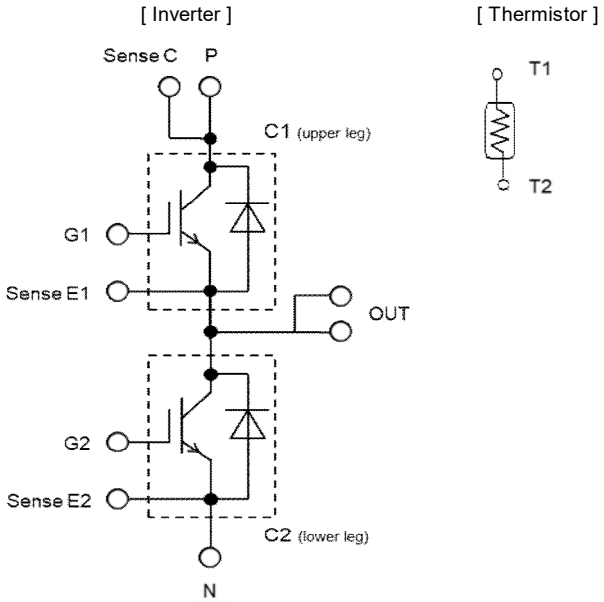
Inverter for Motor Drives, AC and DC Servo Drives
Uninterruptible Power Supply Systems, Wind Turbines, PV Power Conditioning Systems

■ Outline drawing (Unit : mm)



Weight: 350 g(typ.)

■ Equivalent circuit



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

Items		Symbols	Conditions		Maximrum 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	600	A
	Repetitive peak collector current	I_{CRM}	1ms		1200	
	Forward current	I_F			600	
	Repetitive peak forward current	I_{FRM}	1ms		1200	
	Total power dissipation	P_{tot}	1 device		3125	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.		4000	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
Inverter	Collector-Emitter cut-off current, Gate-Emitter short-circuited	I_{CES}	V_{GE} = 0V V_{CE} = 1200V		-	-	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 = 600mA		6.0	6.5	7.0	V
	Collector-Emitter saturation voltage	$V_{CE(sat)}$ (terminal)	V_{GE} = 15V I_C= 600A	T_{vj}=25°C	-	2.20	2.65	V
		$V_{CE(sat)}$ (chip)		T_{vj}=25°C	-	1.45	1.90	
				T_{vj}=125°C	-	1.80	-	
				T_{vj}=150°C	-	1.90	-	
				T_{vj}=175°C	-	1.95	-	
	Internal gate resistance	r_g	-		-	1.67	-	Ω
	Capacitance	C_{ies}	V_{CE}=10V, V_{GE}=0V, f=1MHz		-	64	-	nF
		C_{oes}			-	2.2	-	
		C_{res}			-	0.57	-	
	Gate charge	Q_G	V_{CC} = 600V, I_C = 600A V_{GE} = -15 → +15V		-	4.2	-	μC
	Forward voltage	V_F (terminal)	V_{GE} = 0V I_F= 600A	T_{vj}=25°C	-	2.35	2.80	V
		V_F (chip)		T_{vj}=25°C	-	1.60	2.05	
				T_{vj}=125°C	-	1.65	-	
				T_{vj}=150°C	-	1.60	-	
				T_{vj}=175°C	-	1.60	-	
	Switching time (*1)	$t_{d(on)}$	V_{CC} = 600V I_C, I_F = 600A V_{GE} = +15/ -15V R_G = ±0.56Ω L_S = 35 nH	T_{vj}=25°C	-	0.42	-	μs
				T_{vj}=125°C	-	0.46	-	
				T_{vj}=150°C	-	0.48	-	
				T_{vj}=175°C	-	0.49	-	
		t_r		T_{vj}=25°C	-	0.09	-	
				T_{vj}=125°C	-	0.11	-	
				T_{vj}=150°C	-	0.11	-	
				T_{vj}=175°C	-	0.12	-	
		$t_{d(off)}$		T_{vj}=25°C	-	0.42	-	
				T_{vj}=125°C	-	0.47	-	
				T_{vj}=150°C	-	0.48	-	
				T_{vj}=175°C	-	0.49	-	
		t_f		T_{vj}=25°C	-	0.07	-	
				T_{vj}=125°C	-	0.09	-	
				T_{vj}=150°C	-	0.10	-	
				T_{vj}=175°C	-	0.10	-	
	Reverse recovery time	t_{rr}		T_{vj}=25°C	-	0.14	-	
				T_{vj}=125°C	-	0.26	-	
				T_{vj}=150°C	-	0.28	-	
				T_{vj}=175°C	-	0.31	-	

(*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
Inverter	Switching loss (per pulse)	E_{on}	V_{CC} = 600V, I_C, I_F = 600A, V_{GE} = +15/ -15V, R_G = ±0.56Ω, L_S = 35 nH	T_{vj}= 25°C	-	38.7	-	mJ
				T_{vj}=125°C	-	59.5	-	
				T_{vj}=150°C	-	63.4	-	
				T_{vj}=175°C	-	73.2	-	
		E_{off}		T_{vj}= 25°C	-	54.2	-	
				T_{vj}=125°C	-	63.1	-	
				T_{vj}=150°C	-	66.0	-	
				T_{vj}=175°C	-	70.7	-	
		E_{rr}		T_{vj}= 25°C	-	20.2	-	
				T_{vj}=125°C	-	41.3	-	
				T_{vj}=150°C	-	49.5	-	
				T_{vj}=175°C	-	53.0	-	
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.

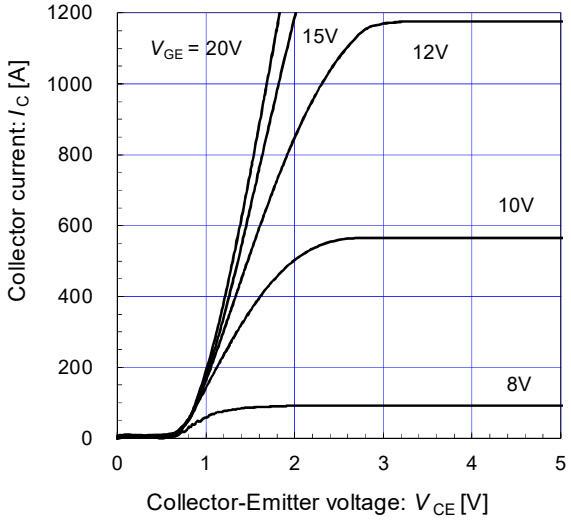
■Thermal resistance characteristics

Items	Symbols	Conditions	Characteristics min.	Characteristics typ.	Characteristics max.	Units
Thermal resistance junction to case(1 device)	$R_{th(j-c)}$	Inverter IGBT	-	-	0.048	K/W
		Inverter FWD	-	-	0.057	
Thermal resistance case to heatsink(1 IGBT+1 FWD) (*1)	$R_{th(c-s)}$	with 1 W/(m·°C) thermal grease	-	0.0167	-	

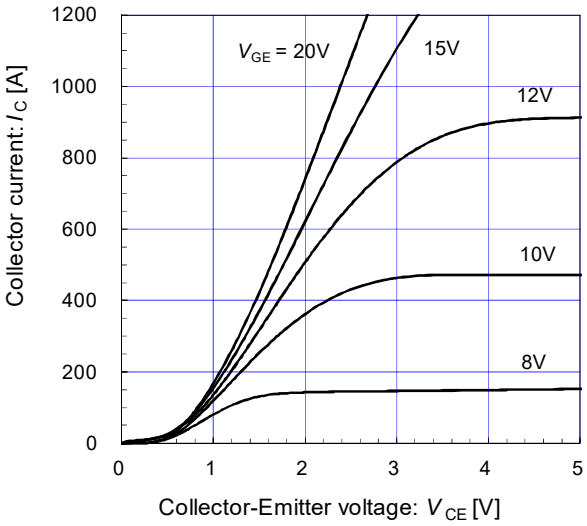
(*1) This is the value which is defined mounting on the additional heatsink with thermal grease.

2MBI600XNE120-50

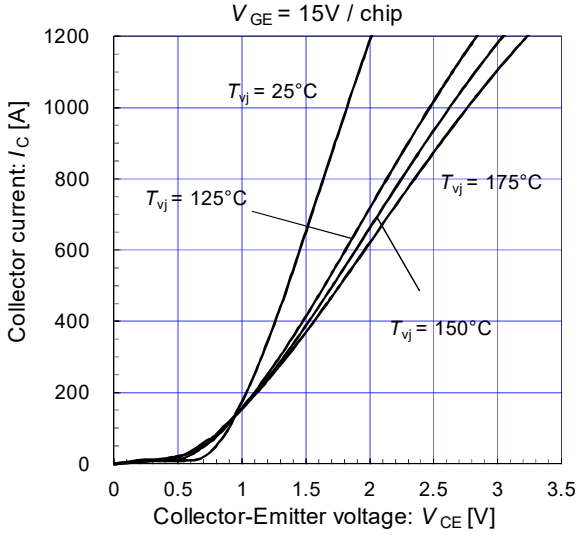
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{vj} = 25°C / chip



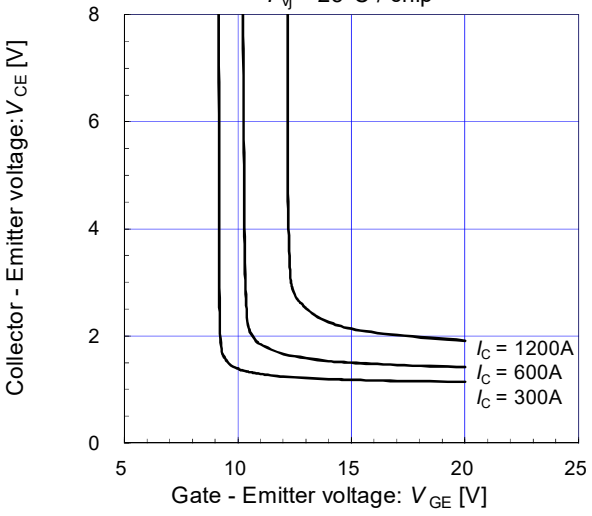
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
T_{Vj} = 175°C / chip



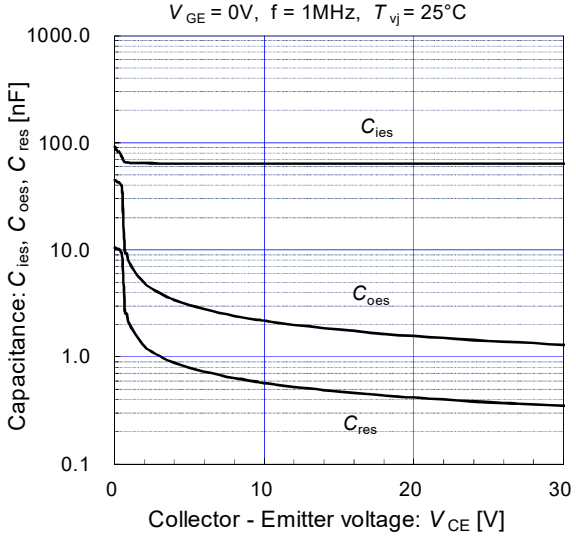
[Inverter]
Collector current vs. Collector-Emitter voltage (typ.)
V_{GE} = 15V / chip



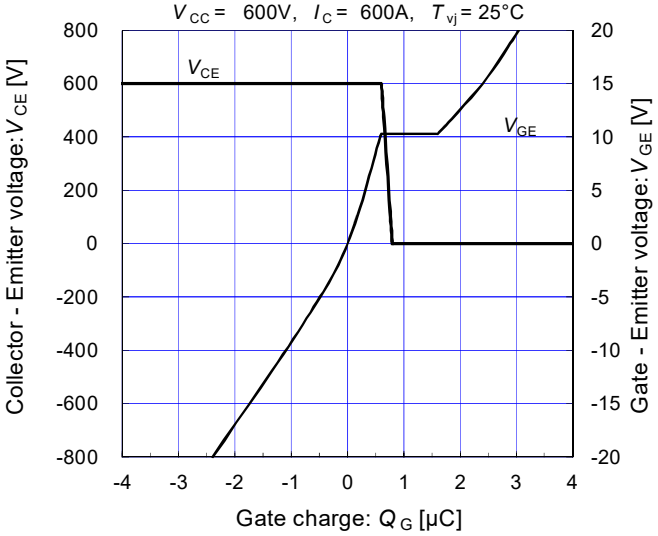
[Inverter]
Collector-Emitter voltage vs. Gate-Emitter voltage (typ.)
T_{vj} = 25°C / chip



[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 = 600A, T_{vj} = 25°C



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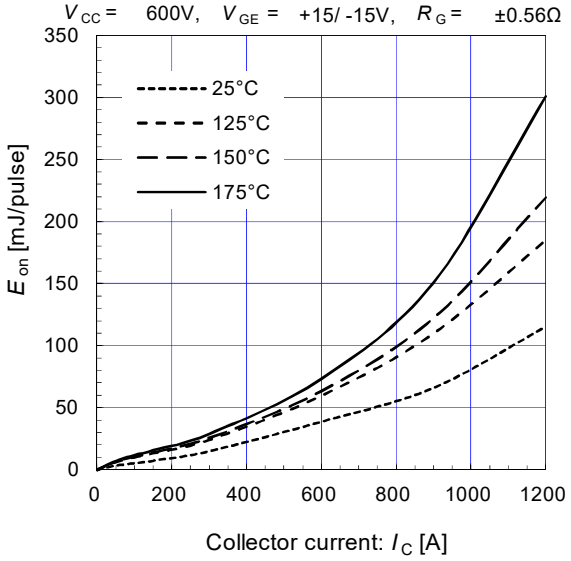
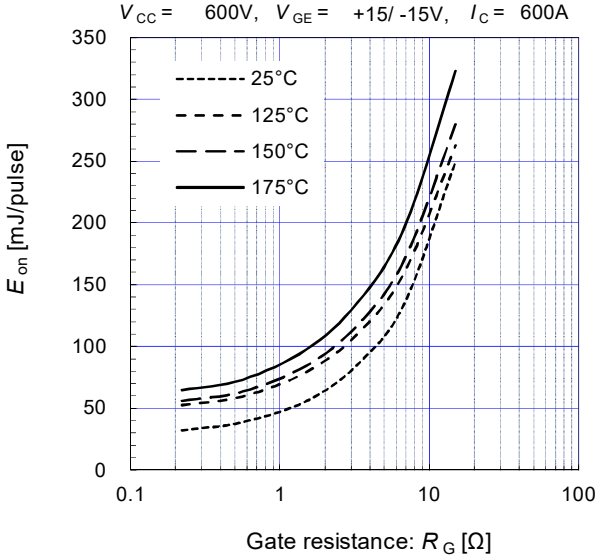
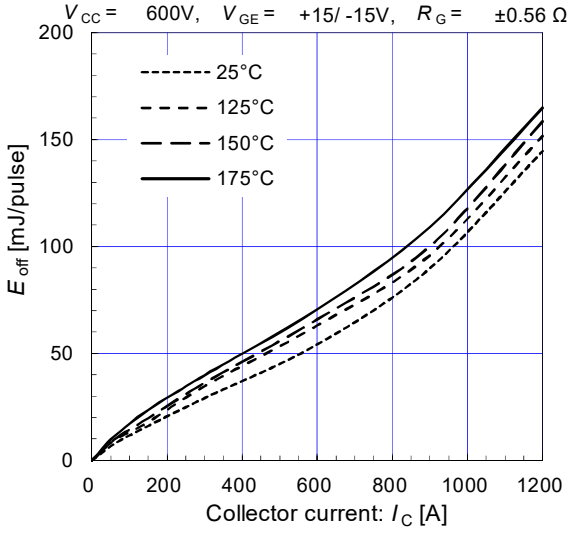
[Inverter]
E_{on} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = ±0.56Ω



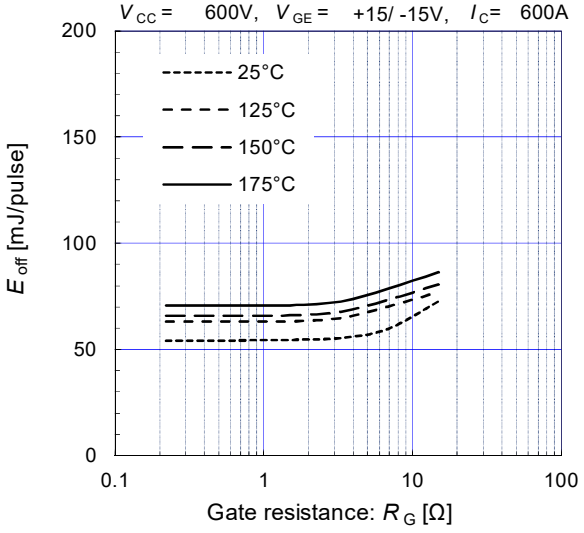
[Inverter]
E_{on} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A



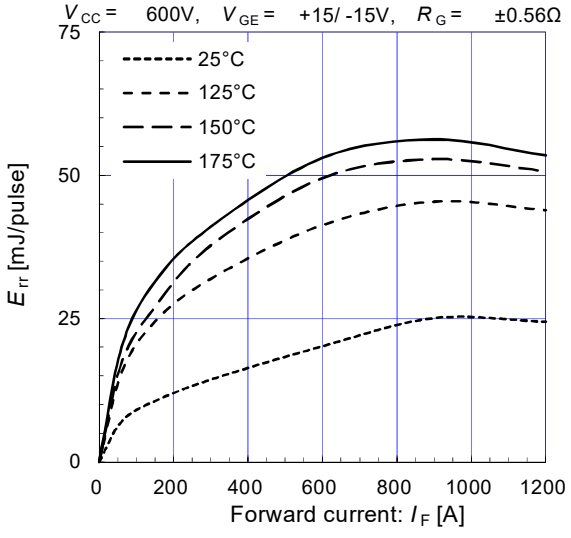
[Inverter]
E_{off} vs. Collector current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = ±0.56 Ω



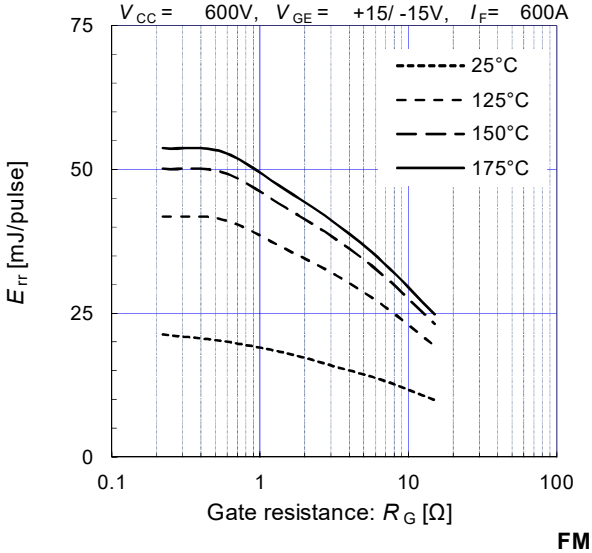
[Inverter]
E_{off} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_C = 600A



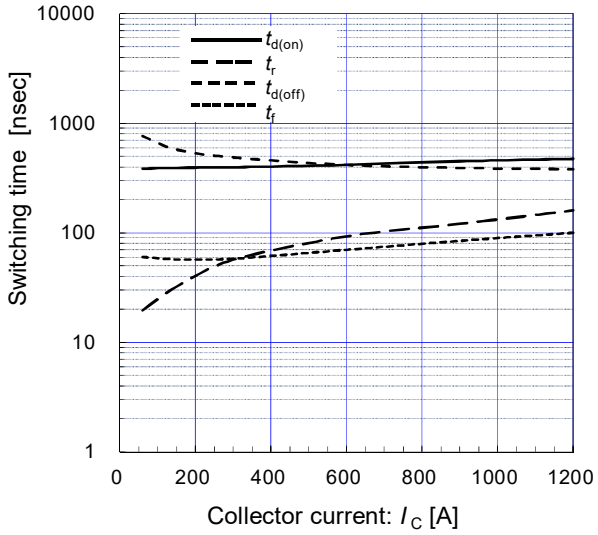
[Inverter]
E_{rr} vs. Forward current (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = ±0.56Ω



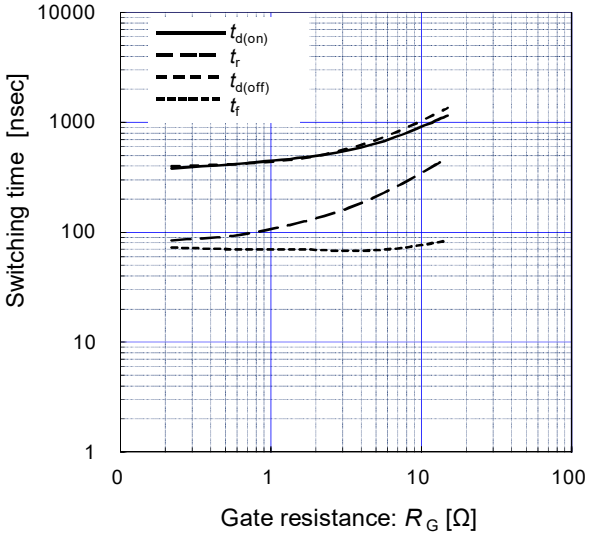
[Inverter]
E_{rr} vs. Gate resistance (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, I_F = 600A



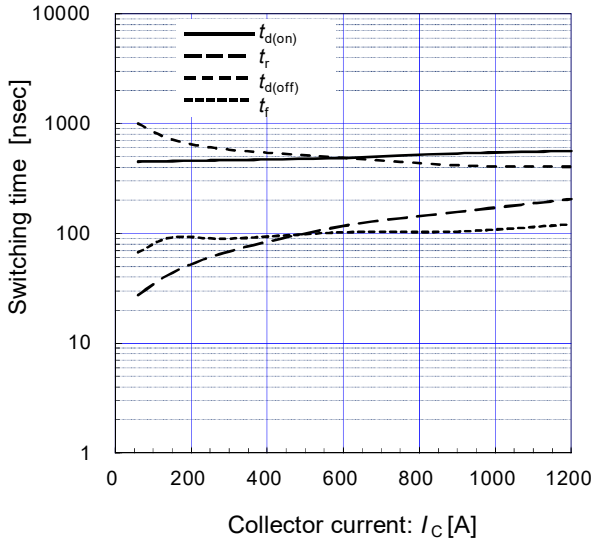
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = ±0.56Ω, V_{GE} = +15/ -15V, T_{vj} = 25°C



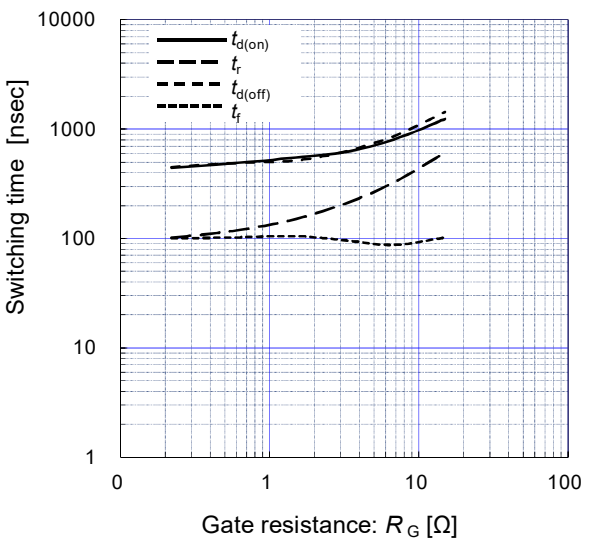
[Inverter]
Switching time vs. Gate resistance (typ.)
V_{CC} = 600V, I_C = 600A, V_{GE} = +15/ -15V, T_{vj} = 25°C



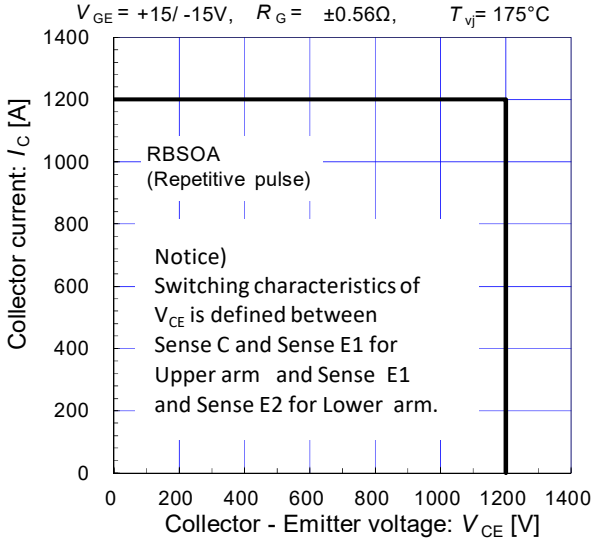
[Inverter]
Switching time vs. Collector current (typ.)
V_{CC} = 600V, R_G = ±0.56Ω, V_{GE} = +15/ -15V, T_{vj} = 175°C



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



[Inverter]
Reverse bias safe operating area (max.)
V_{GE} = +15/ -15V, R_G = ±0.56Ω, T_{vj} = 175°C



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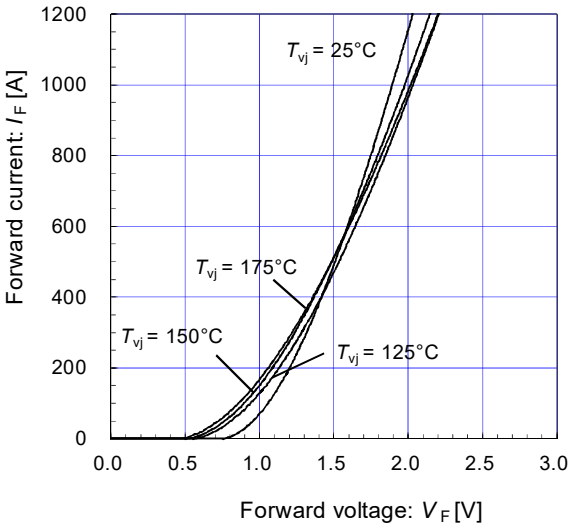
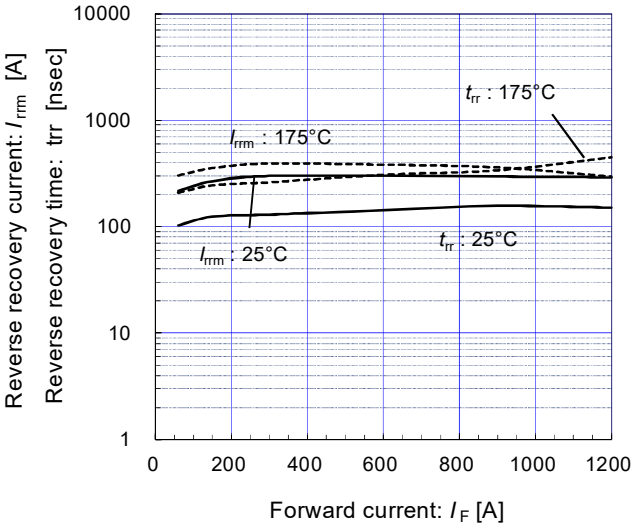
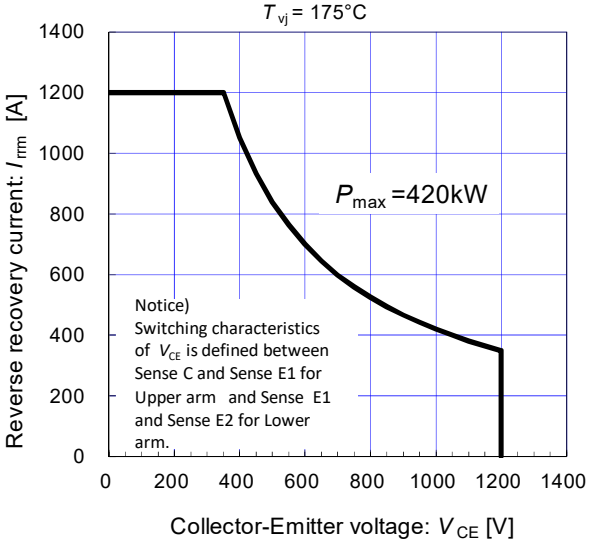
[Inverter]
Forward current vs. Forward voltage (typ.)
chip



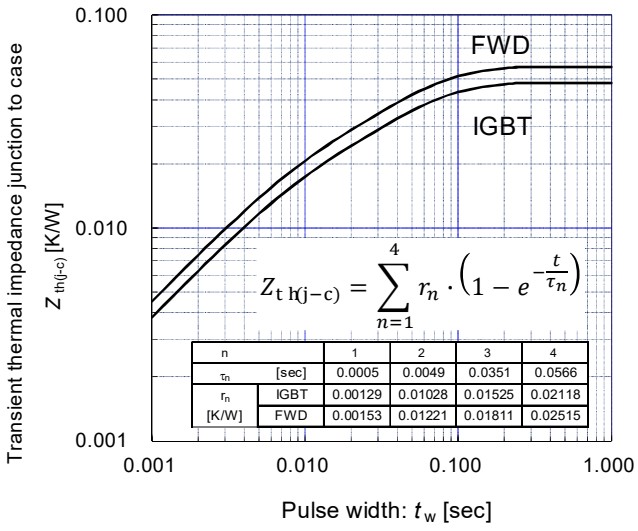
[Inverter]
Reverse recovery characteristics (typ.)
V_{CC} = 600V, V_{GE} = +15/ -15V, R_G = ±0.56Ω



[Inverter]
Reverse recovery characteristics (typ.)
T_{vj} = 175°C

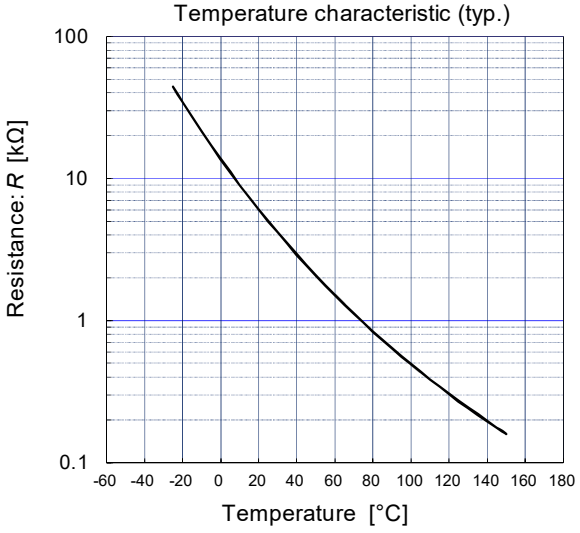


[Inverter]
Transient thermal resistance (max.)



n		1	2	3	4
τ_n	[sec]	0.0005	0.0049	0.0351	0.0566
r_n [K/W]	IGBT	0.00129	0.01028	0.01525	0.02118
	FWD	0.00153	0.01221	0.01811	0.02515

[Thermistor]
Temperature characteristic (typ.)



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・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/
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