MBN1000FH45F

Silicon N-channel IGBT 4500V F version

FEATURES

- ∗ Soft switching behavior, low switching loss & low conduction loss :
  - Soft low-injection punch-through
  - Advanced Trench High conductivity IGBT.
- ∗ Low driving power due to low input capacitance with trench MOS gate.
- ∗ Low noise recovery: Ultra soft fast recovery diode.
- ∗ High Current rate Package.
- ∗ Low $R_{th(j-c)}$ & low stray inductance.
- ∗ RoHS

ABSOLUTE MAXIMUM RATINGS (T_C=25°C)

Item		Symbol	Unit	MBN1000FH45F
Collector Emitter Voltage		V_{CES}	V	4,500
Gate Emitter Voltage		V_{GES}	V	±20
Collector Current	DC	I_C	A	1,000
	1ms	I_{CRM}		2,000
Forward Current	DC	I_F	A	1,000
	1ms	I_{FRM}		2,000
Junction Temperature		$T_{vj\ op}$	°C	-50 ~ +150
Storage Temperature		T_{stg}	°C	-50 ~ +150
Isolation Voltage		V_{ISO}	V_{RMS}	10,200(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	N·m	2/10 (1)
	Mounting (M6)	-		6 (2)

Notes: (1) Recommended Value 1.8±0.2/9±1N·m (2) Recommended Value 5.5±0.5N·m

ELECTRICAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current		I_{CES}	mA	-	-	4	V_{CE}=4,500V, V_{GE}=0V, T_{vj}=25°C
				-	40	120	V_{CE}=4,500V, V_{GE}=0V, T_{vj}=150°C
Gate Emitter Leakage Current		I_{GES}	nA	-500	-	+500	V_{GE}=±20V, V_{CE}=0V, T_{vj}=25°C
Collector Emitter Saturation Voltage		V_{CEsat}	V	-	3.0	3.4	I_C=1,000A, V_{GE}=15V, T_{vj}=150°C
Gate Emitter Threshold Voltage		$V_{GE(th)}$	V	6.0	6.5	7.0	V_{CE}=10V, I_C=1,000mA, T_{vj}=25°C
Input Capacitance		C_{ies}	nF	-	55	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, T_{vj}=25°C
Internal Gate Resistance		$R_{G(int)}$	Ω	-	3.9	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, T_{vj}=25°C
Turn On Delay Time		$t_{d(on)}$	µs	-	0.5	-	V_{CC}=2,800V, I_C=1,000A
Rise Time		t_r		-	0.25	-	L_S=180nH
Turn Off Delay Time		$t_{d(off)}$		-	2.8	-	R_G(on/off)=4.7/4.7Ω (3)
Fall Time		t_f		-	2.1	-	V_{GE}=±15V, T_{vj}=150°C
Forward Voltage Drop		V_F	V	-	2.8	3.2	I_F=1,000A, V_{GE}=0V, T_{vj}=150°C
Reverse Recovery Time		t_{rr}	µs	-	1.3	-	V_{CC}=2,800V, I_F=1,000A, L_S=180nH T_{vj}=150°C
Turn On Loss		E_{on}	J/P	-	3.6	-	V_{CC}=2,800V, I_C=1,000A, L_S=180nH
Turn Off Loss		E_{off}	J/P	-	5.3	-	R_G(on/off)=4.7/4.7Ω (3)
Reverse Recovery Loss		E_{rr}	J/P	-	3.6	-	V_{GE}=±15V, T_{vj}=150°C
Short Circuit Pulse Width		t_{sc}	µs	10	-	-	V_{CC}=3,000V,Ls=180nH R_G(on/off)=4.7/47Ω,V_{GE}=±15V, T_{vj}=150°C
Partial discharge extinction voltage		V_e	V_{RMS}	3,500	-	-	f=50Hz, Q_{PD}≤10pC(acc. to IEC 61287)
Stray inductance module		L_{SCE}	nH	-	15	-	
Thermal Impedance	IGBT	$R_{th(j-c)}$	K/W	-	-	0.013	Junction to case
	FWD	$R_{th(j-c)}$		-	-	0.017	
Contact Thermal Impedance		$R_{th(c-f)}$	K/W	-	0.007	-	Case to fin (λ grease = 1W/(m·K) heat-sink flatness ≤ 50µm)

Notes: (3) R_G value is a test condition value for evaluation, not recommended value.
Please, determine the suitable R_G value by measuring switching behaviors.

* Please contact our representatives at order.
* For improvement, specifications are subject to change without notice.
* For actual application, please confirm this spec sheet is the newest revision.
* ELECTRICAL CHARACTERISTIC items shown in above table are according to IEC 60747–2 and IEC 60747–9.

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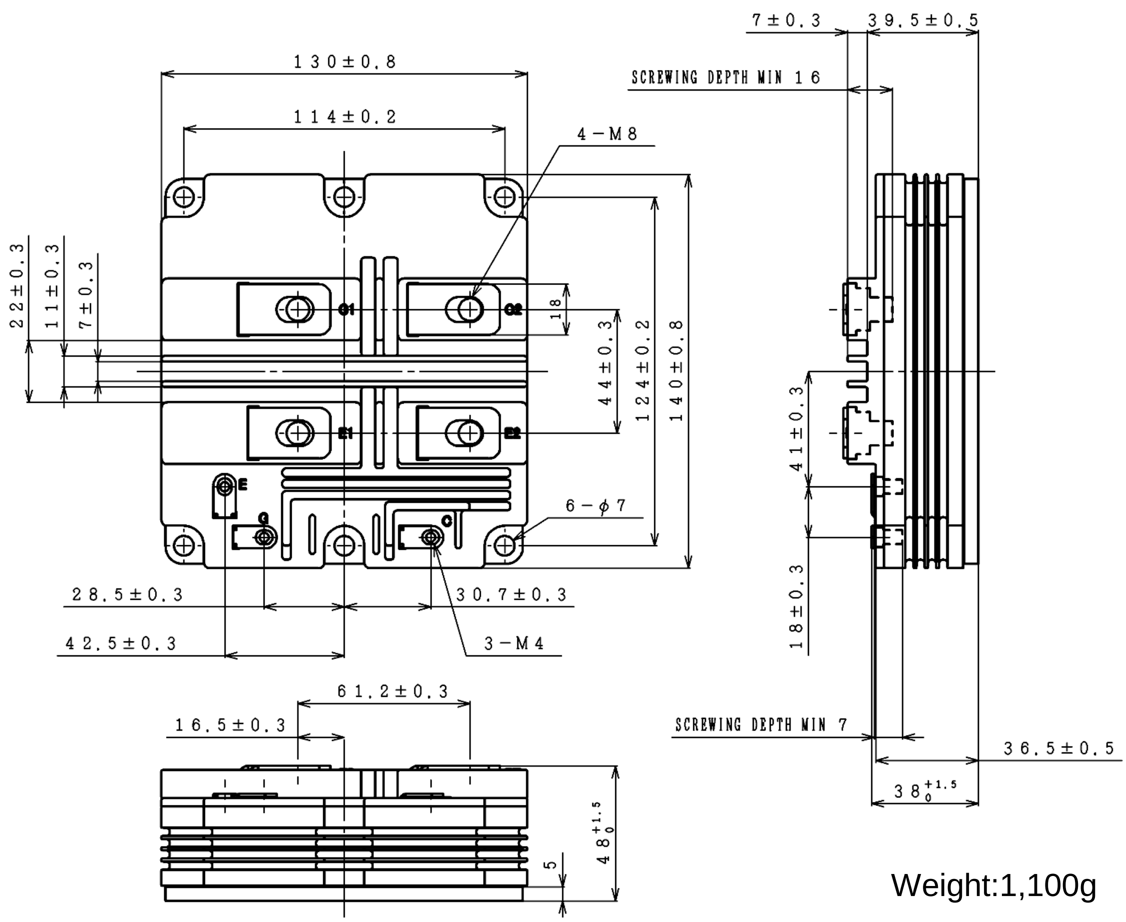
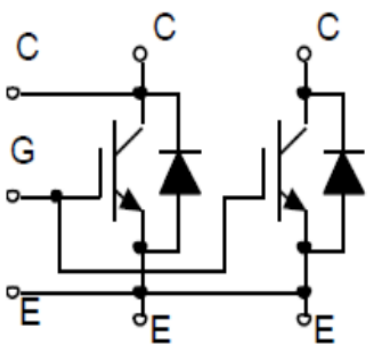
OUTLINE DRAWING

Unit in mm



Weight:1,100g

CIRCUIT DIAGRAM



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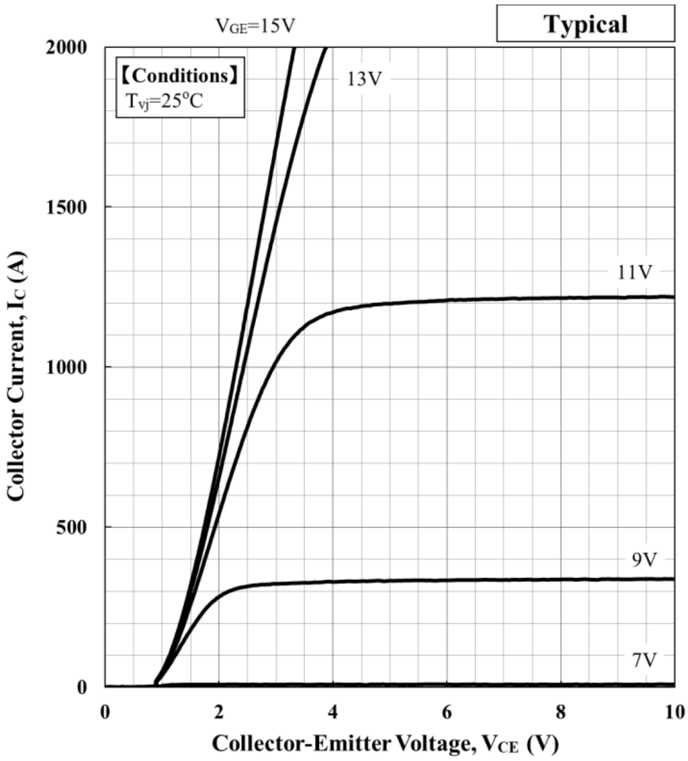
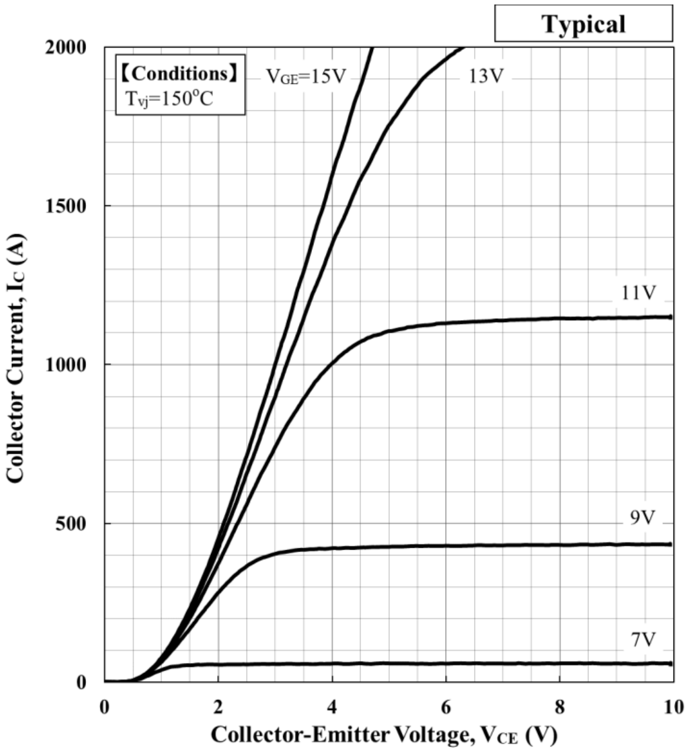


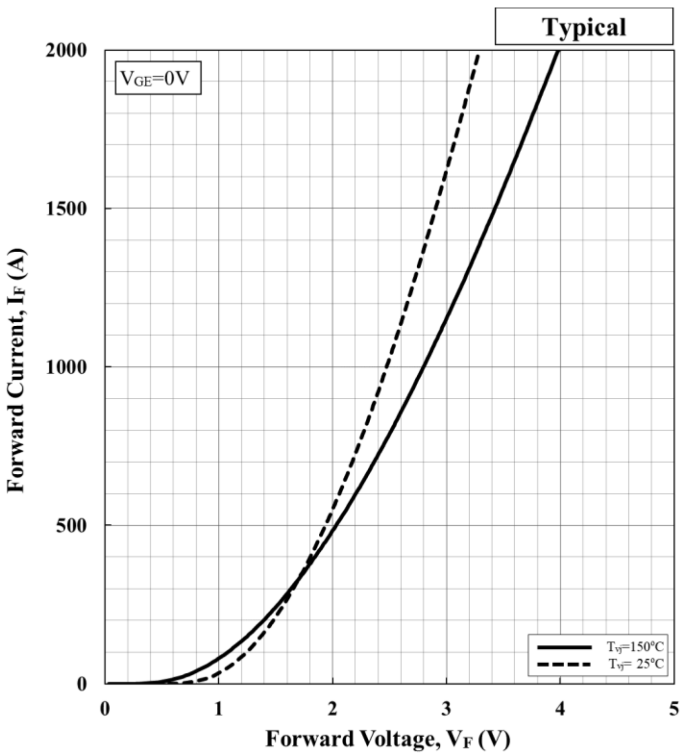
$V_{CE}(sat)[V] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$					
Temp.[°C]	V_{GE}[V]	a_3	a_2	a_1	a_0
25	15	1.32E-10	-5.37E-07	1.71E-03	9.98E-01

Collector Current vs. Collector Emitter Voltage



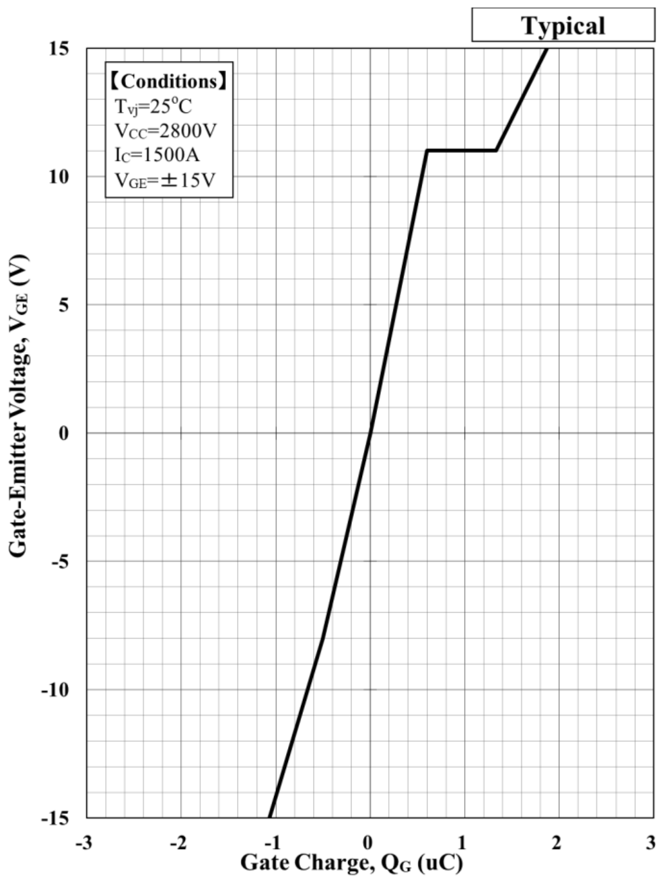
$V_{CE}(sat)[V] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$					
Temp.[°C]	V_{GE}[V]	a_3	a_2	a_1	a_0
150	15	2.15E-10	-8.54E-07	2.76E-03	8.92E-01

Collector Current vs. Collector Emitter Voltage



$V_F[V] = a_3 \cdot \lvert I_F \rvert^3 + a_2 \cdot \lvert I_F \rvert^2 + a_1 \cdot \lvert I_F \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.79E-10	-8.17E-07	2.02E-03	1.10E+00
150	2.23E-10	-1.04E-06	2.75E-03	8.75E-01

Forward Voltage of free-wheeling diode



V_{GE}-Q_G curve

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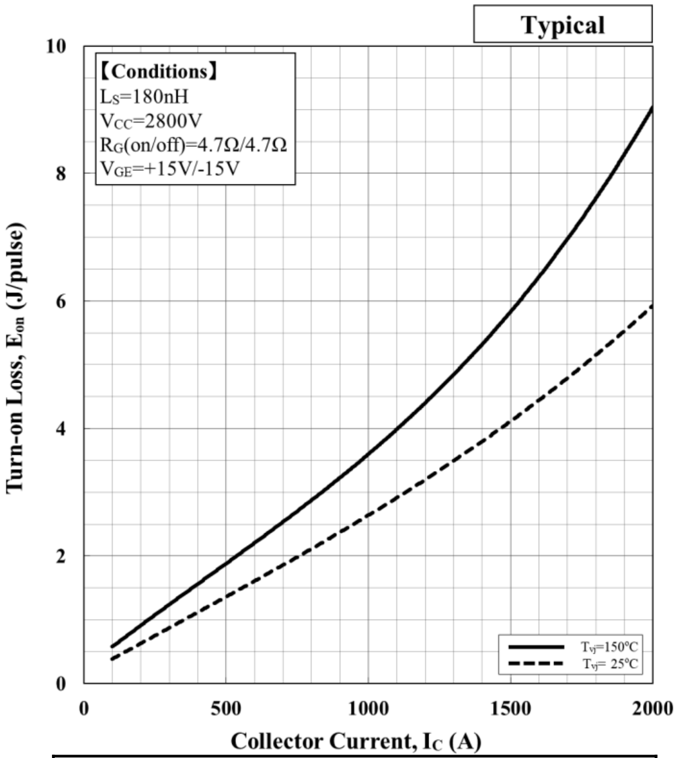
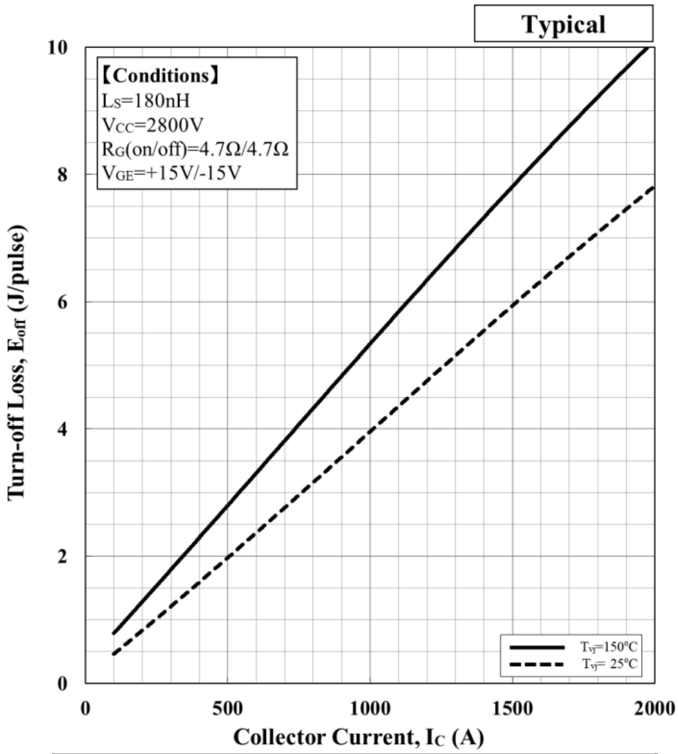


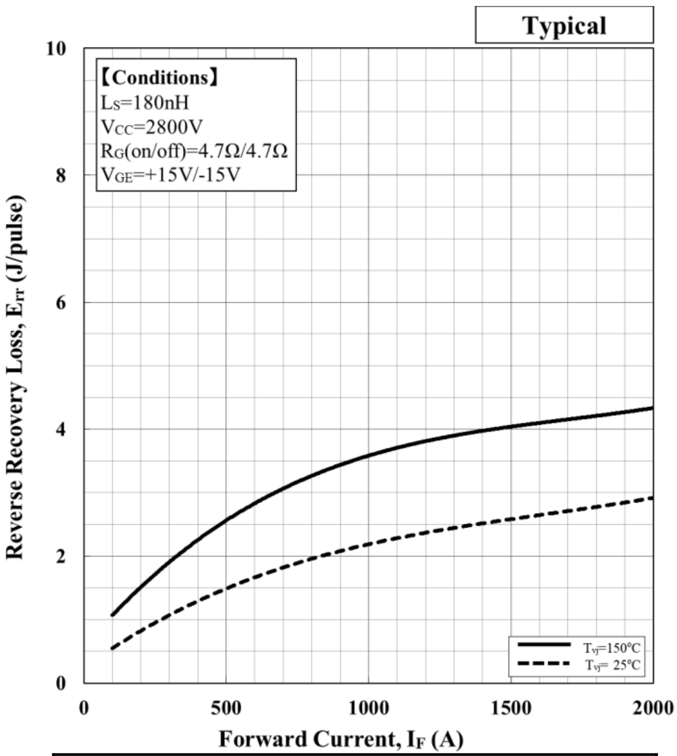
$E\,[J] = a_3 \cdot \lvert I_c\rvert^3 + a_2 \cdot \lvert I_c\rvert^2 + a_1 \cdot \lvert I_c\rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	1.88E-10	-1.73E-07	2.49E-03	1.40E-01
150	6.10E-10	-7.92E-07	3.55E-03	2.31E-01

Turn-on loss vs. Collector current



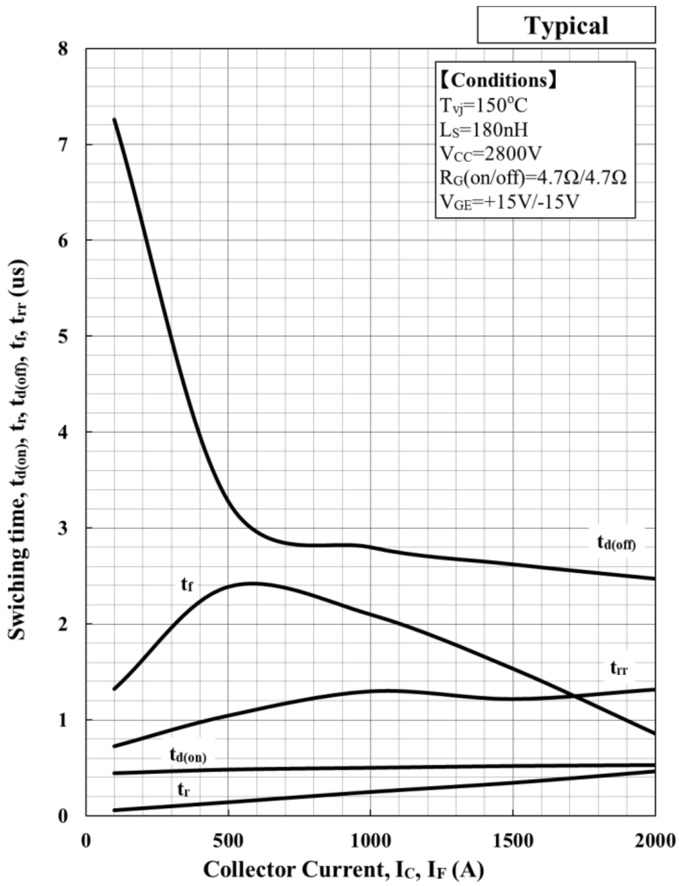
$E\,[J] = a_3 \cdot \lvert I_c\rvert^3 + a_2 \cdot \lvert I_c\rvert^2 + a_1 \cdot \lvert I_c\rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-1.38E-10	4.16E-07	3.58E-03	1.05E-01
150	-1.39E-10	2.83E-07	4.90E-03	2.98E-01

Turn-off loss vs. Collector current



$E\,[J] = a_3 \cdot \lvert I_F\rvert^3 + a_2 \cdot \lvert I_F\rvert^2 + a_1 \cdot \lvert I_F\rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	3.27E-10	-1.59E-06	3.21E-03	2.43E-01
150	5.37E-10	-2.74E-06	5.21E-03	5.77E-01

Recovery loss vs. Forward current



Switching time vs. Collector Current

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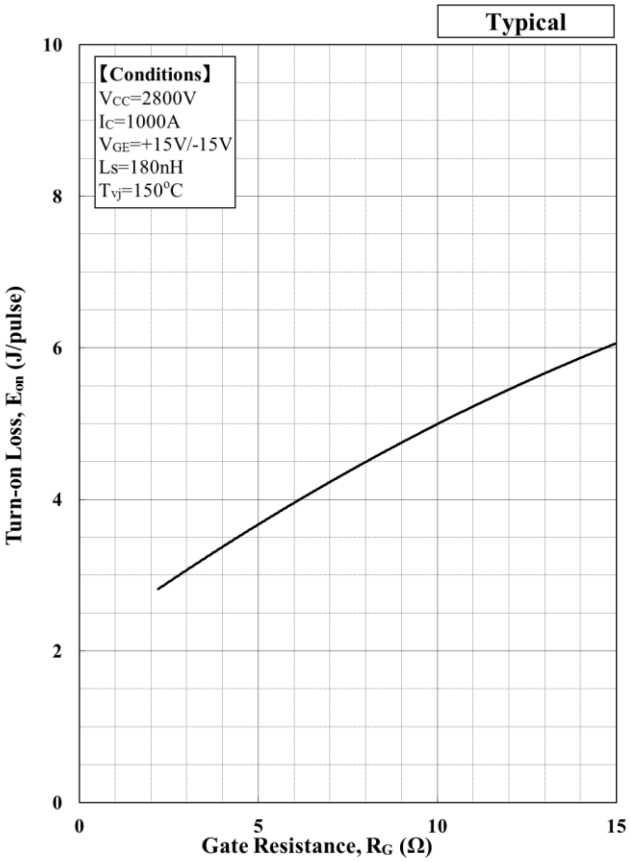
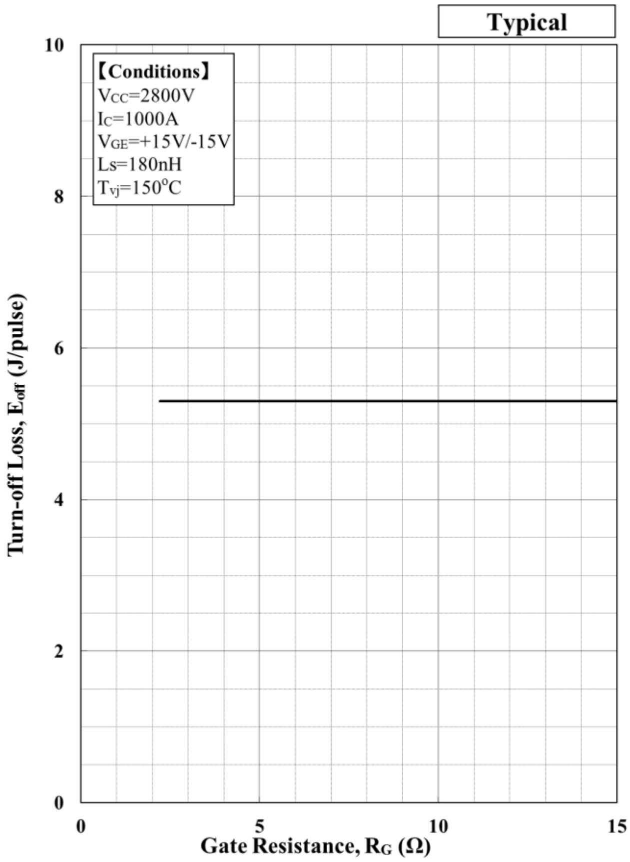
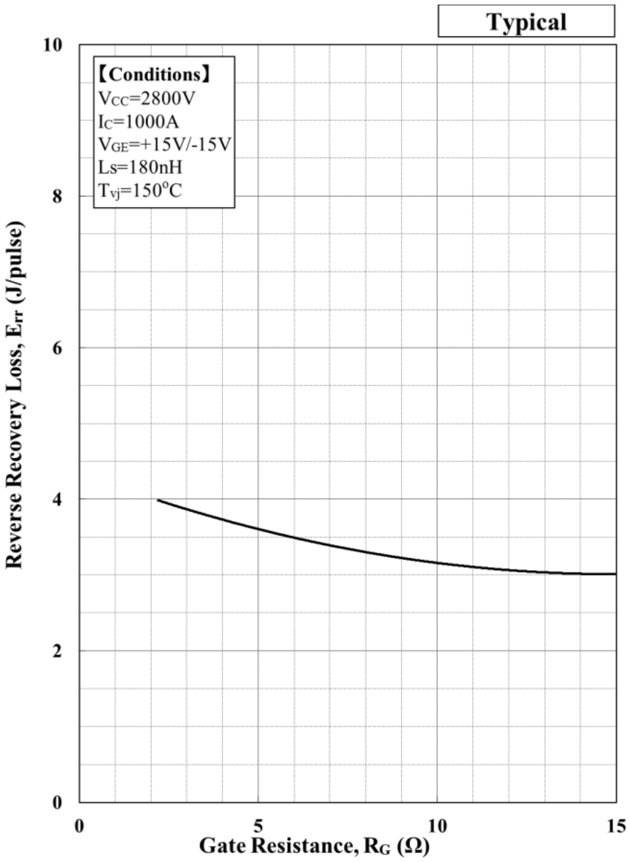


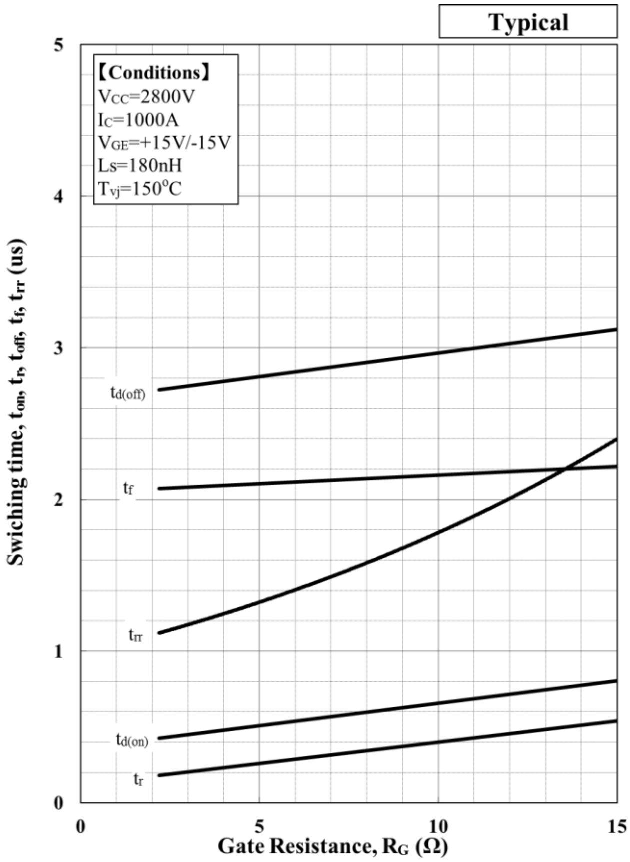
Turn-on loss vs. Gate Resistance



Turn-off loss vs. Gate Resistance



Reverse Recovery loss vs. Gate Resistance



Switching time vs. Gate Resistance

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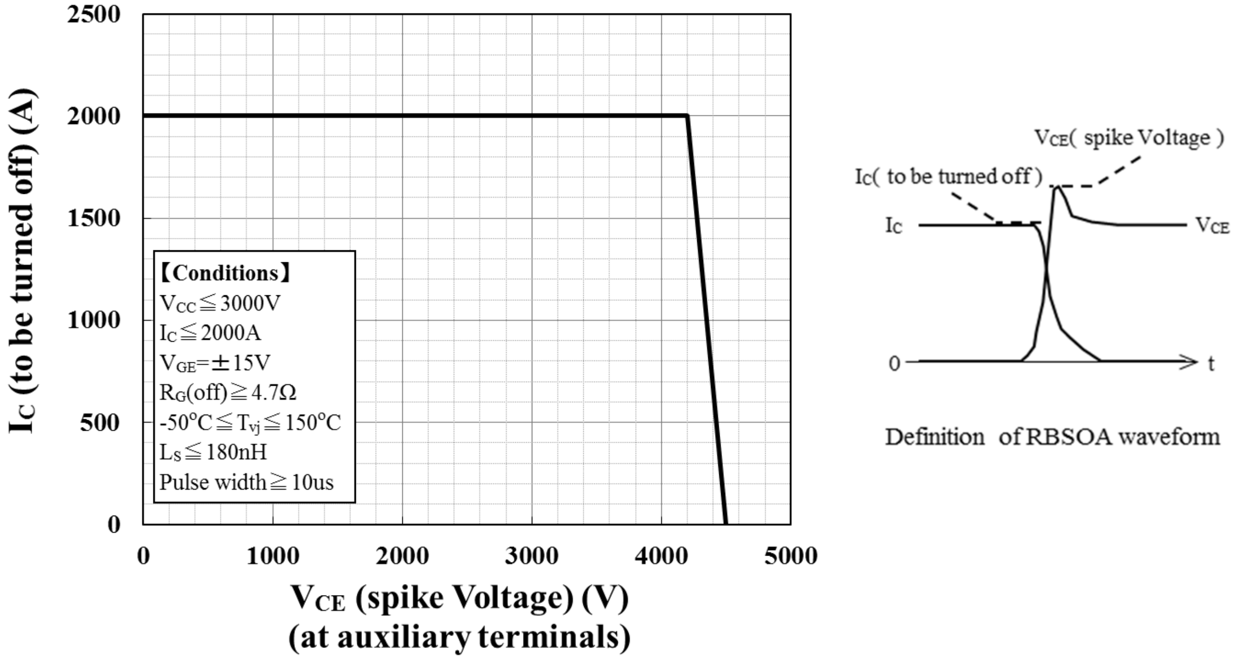
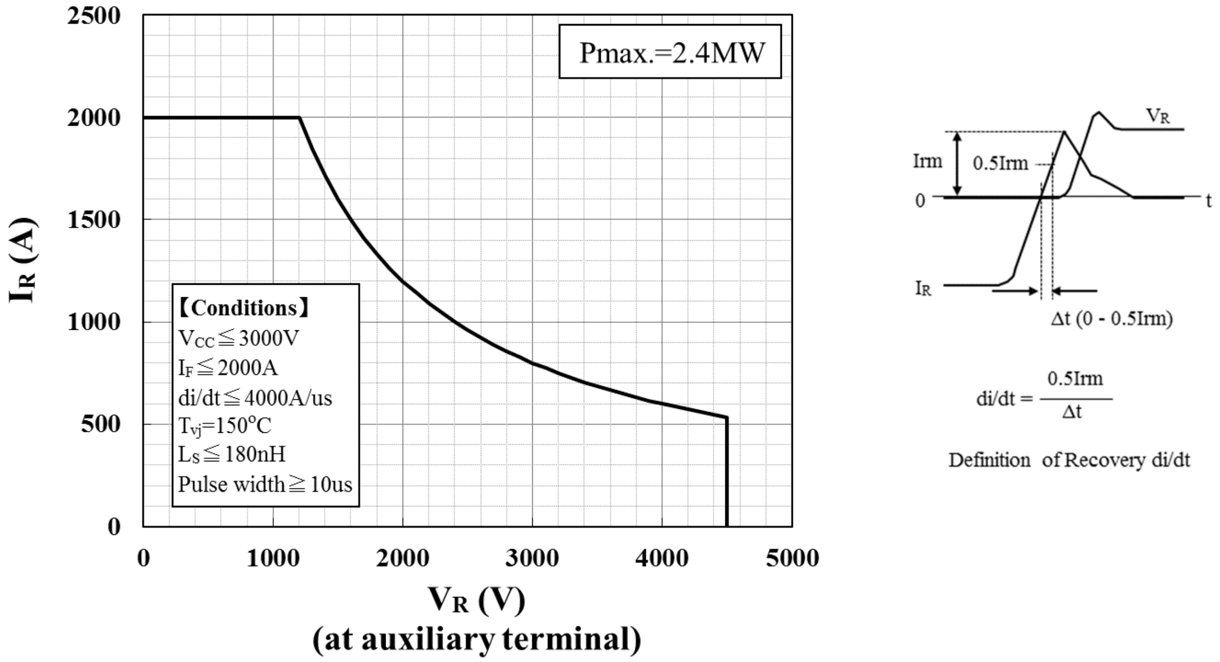


Reverse bias safe operation area (RBSOA)



Reverse recovery safe operation area(RRSOA)

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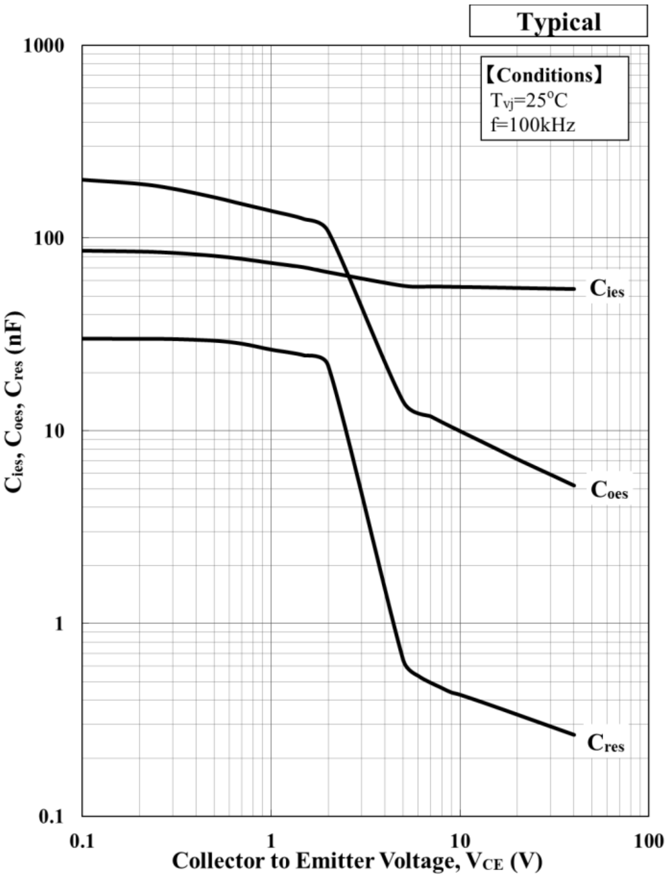
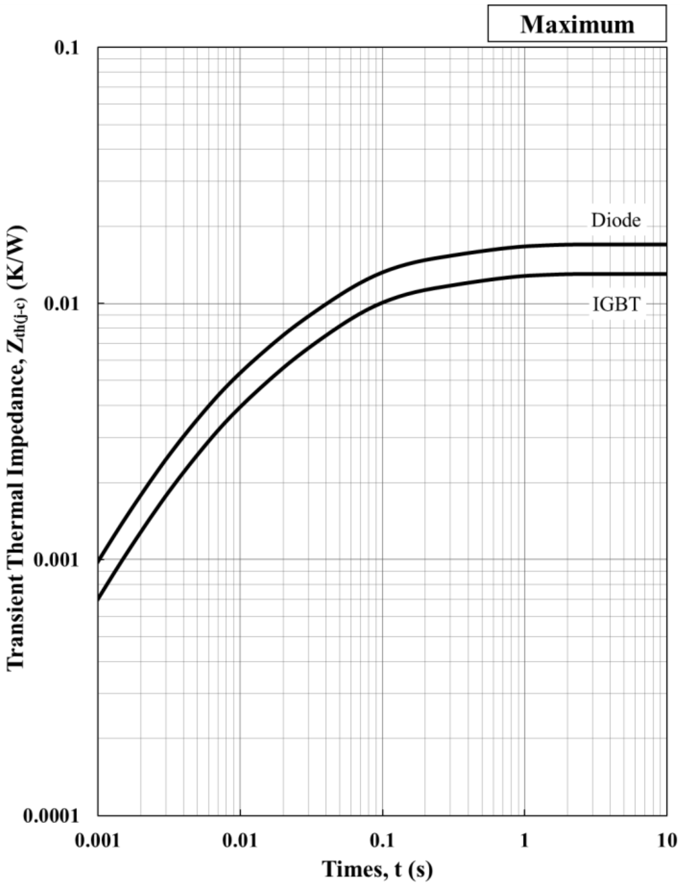


Capacitance vs. Collector to Emitter Voltage



Transient Thermal Ipedance Curve

Foster model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	2.69E-03	7.25E-03	2.44E-03	6.21E-04	[K/W]
C th, IGBT [n]	1.48E+02	6.42E+00	2.86E+00	3.79E+00	[J/K]
R th, Diode [n]	3.44E-03	9.26E-03	3.34E-03	9.61E-04	[K/W]
C th, Diode [n]	1.16E+02	5.03E+00	2.09E+00	2.45E+00	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	3.64E-03	2.73E-03	4.65E-03	1.99E-03	[K/W]
C th, IGBT [n]	1.29E+00	2.33E+00	5.84E+00	1.90E+02	[J/K]
R th, Diode [n]	4.86E-03	3.61E-03	5.99E-03	2.54E-03	[K/W]
C th, Diode [n]	9.13E-01	1.80E+00	4.68E+00	1.48E+02	[J/K]

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