MBN1500FH45F

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	MBN1500FH45F
Collector Emitter Voltage		V_{CES}	V	4,500
Gate Emitter Voltage		V_{GES}	V	±20
Collector Current	DC	I_C	A	1,500
	1ms	I_{CRM}		3,000
Forward Current	DC	I_F	A	1,500
	1ms	I_{FRM}		3,000
Junction Temperature		$T_{vj\ op}$	ºC	-50 ~ +150
Storage Temperature		T_{stg}	ºC	-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	-	-	6	V_{CE}=4,500V, V_{GE}=0V, T_{vj}=25°C
				-	60	180	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=1,500A, 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=1,500mA, T_{vj}=25°C
Input Capacitance		C_{ies}	nF	-	83	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, T_{vj}=25°C
Internal Gate Resistance		$R_{G(int)}$	Ω	-	2.6	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, T_{vj}=25ºC
Turn On Delay Time		$t_{d(on)}$	µs	-	0.5	-	V_{CC}=2,800V, I_C=1,500A
Rise Time		t_r		-	0.25	-	L_S=165nH
Turn Off Delay Time		$t_{d(off)}$		-	2.8	-	R_G(on/off)=3.3/3.3Ω (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=1,500A, V_{GE}=0V, T_{vj}=150°C
Reverse Recovery Time		t_{rr}	µs	-	1.3	-	V_{CC}=2,800V, I_F=1,500A, L_S=165nH T_{vj}=150°C
Turn On Loss		E_{on}	J/P	-	4.8	-	V_{CC}=2,800V, I_C=1,500A, L_S=165nH
Turn Off Loss		E_{off}	J/P	-	8.0	-	R_G(on/off)=3.3/3.3Ω (3)
Reverse Recovery Loss		E_{rr}	J/P	-	6.3	-	V_{GE}=±15V, T_{vj}=150°C
Short Circuit Pulse Width		t_{sc}	µs	10	-	-	V_{CC}=3,000V, Ls=165nH R_G(on/off)=3.3/33Ω,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	-	10	-	
Thermal Impedance	IGBT	$R_{th(j-c)}$	K/W	-	-	0.0085	Junction to case
	FWD	$R_{th(j-c)}$		-	-	0.0115	
Contact Thermal Impedance		$R_{th(c-f)}$	K/W	-	0.005	-	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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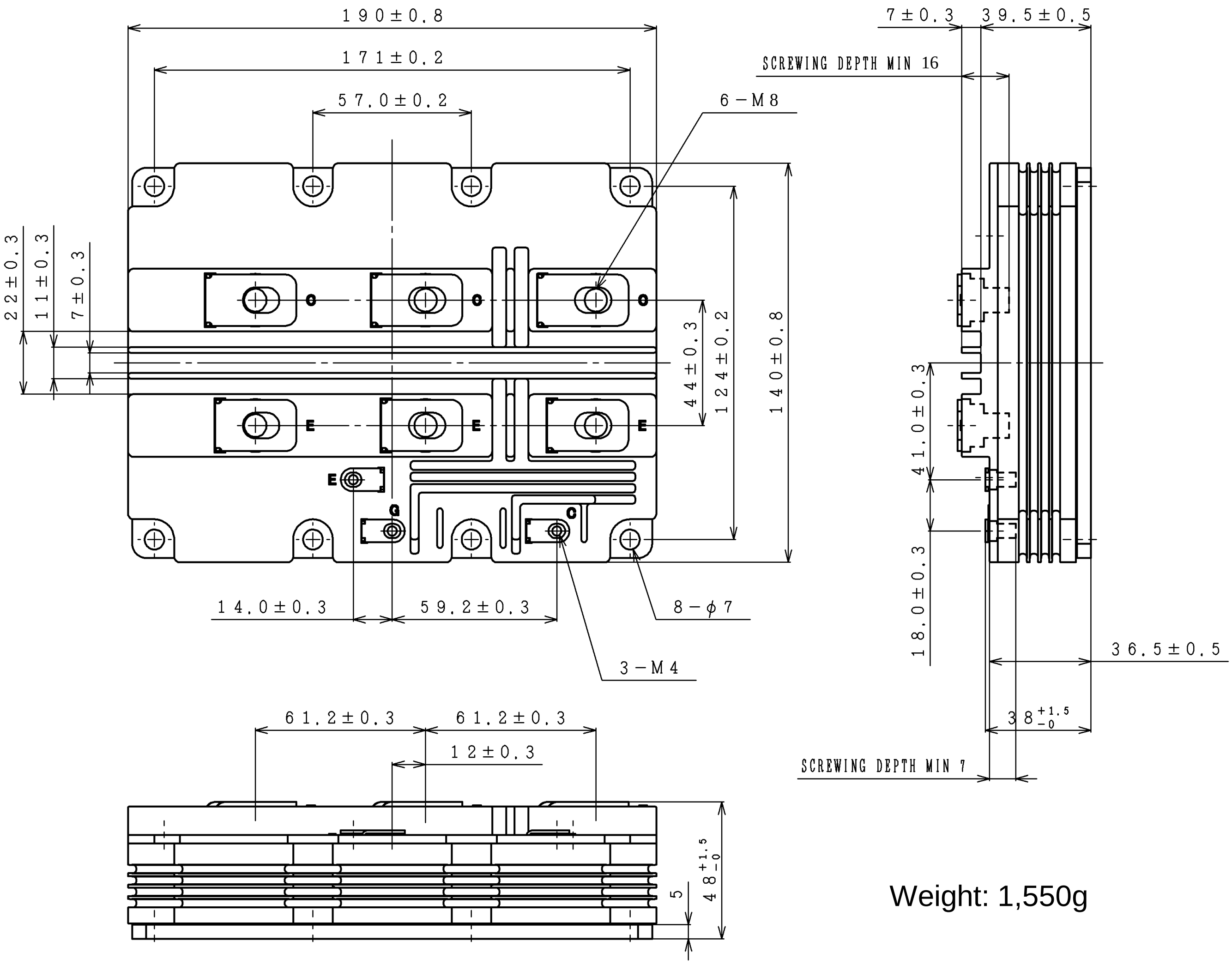
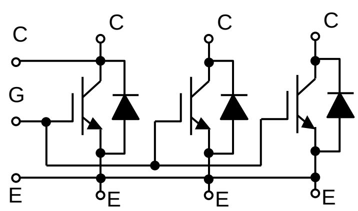
OUTLINE DRAWING

Unit in mm



Weight: 1,550g

CIRCUIT DIAGRAM



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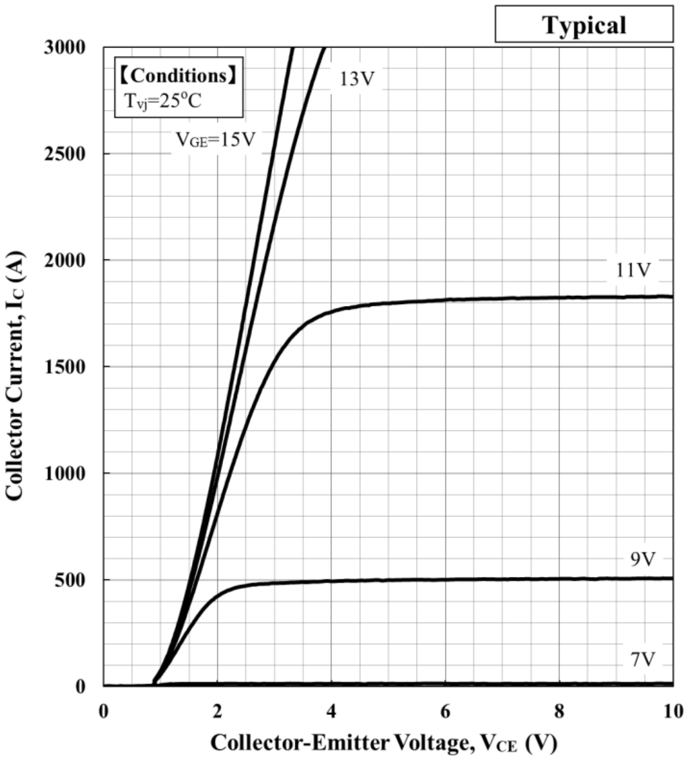
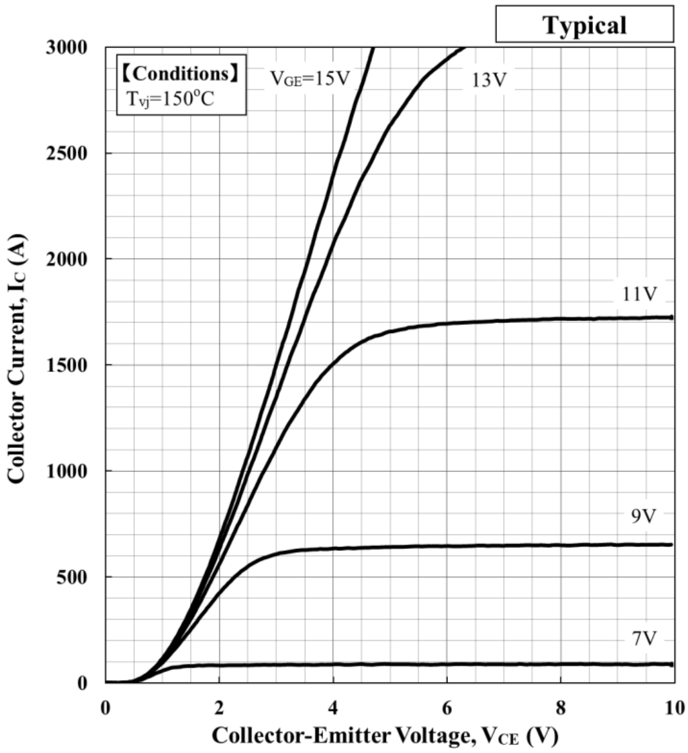


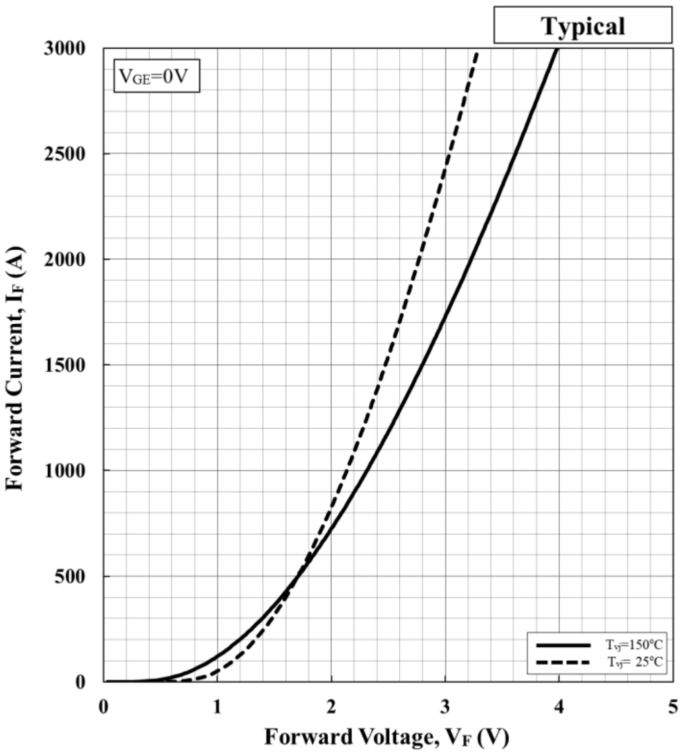
$V_{CE}(sat)[V] = a_3 \cdot \lvert I_c\rvert^3 + a_2 \cdot \lvert I_c\rvert^2 + a_1 \cdot \lvert I_c\rvert + a_0$					
Temp.[°C]	V_{GE}[V]	a_3	a_2	a_1	a_0
25	15	3.92E-11	-2.39E-07	1.14E-03	9.98E-01

Collector Current vs. Collector Emitter Voltage



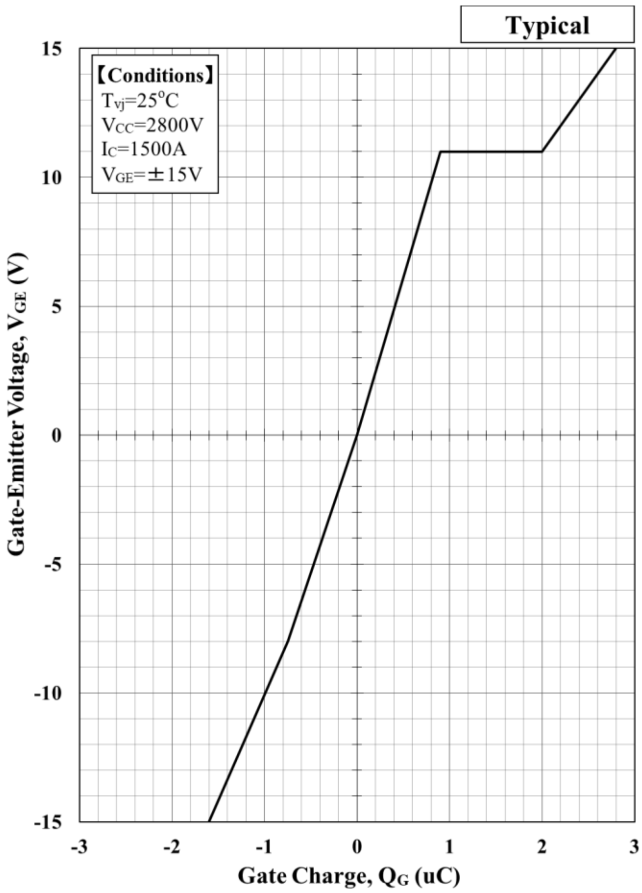
$V_{CE}(sat)[V] = a_3 \cdot \lvert I_c\rvert^3 + a_2 \cdot \lvert I_c\rvert^2 + a_1 \cdot \lvert I_c\rvert + a_0$					
Temp.[°C]	V_{GE}[V]	a_3	a_2	a_1	a_0
150	15	6.37E-11	-3.80E-07	1.84E-03	8.92E-01

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	5.30E-11	-3.63E-07	1.35E-03	1.10E+00
150	6.59E-11	-4.62E-07	1.83E-03	8.75E-01

Forward Voltage of free-wheeling diode



V_{GE}-Q_G curve

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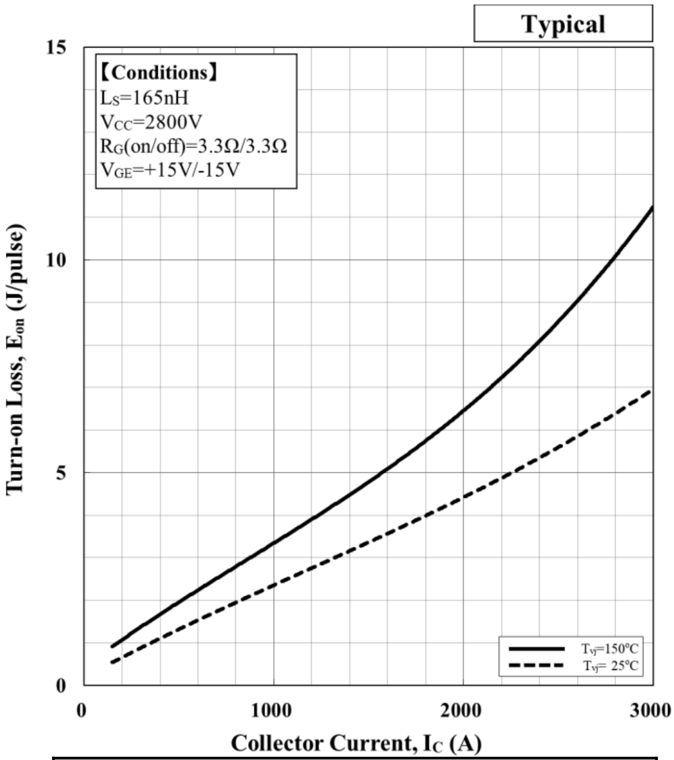
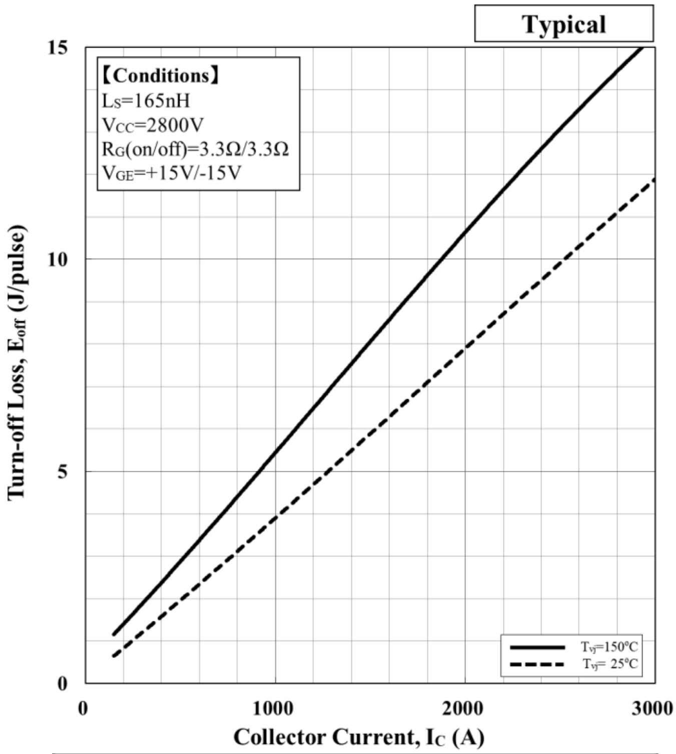


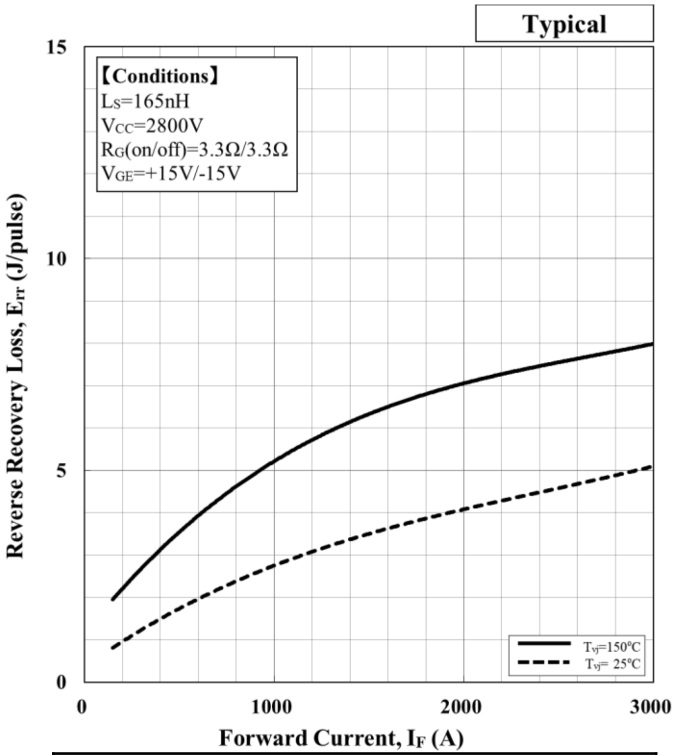
$E\,[J] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	9.68E-11	-3.41E-07	2.41E-03	1.90E-01
150	2.47E-10	-6.38E-07	3.30E-03	4.38E-01

Turn-on loss vs. Collector current



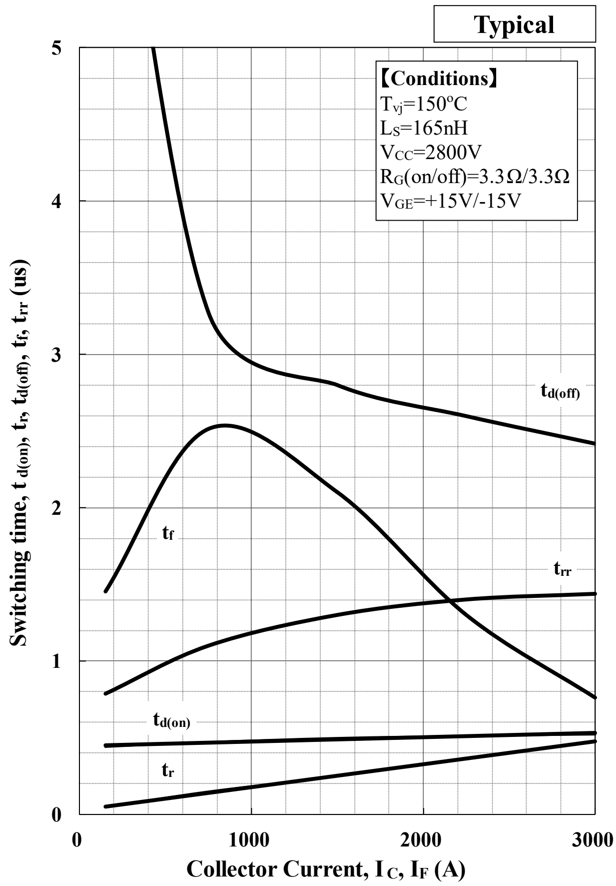
$E\,[J] = a_3 \cdot \lvert I_c \rvert^3 + a_2 \cdot \lvert I_c \rvert^2 + a_1 \cdot \lvert I_c \rvert + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	-3.59E-11	2.07E-07	3.63E-03	1.02E-01
150	-1.26E-10	4.82E-07	4.63E-03	4.59E-01

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	1.26E-10	-9.11E-07	3.18E-03	3.56E-01
150	2.20E-10	-1.77E-06	5.61E-03	1.15E+00

Recovery loss vs. Forward current



Switching time vs. Collector Current

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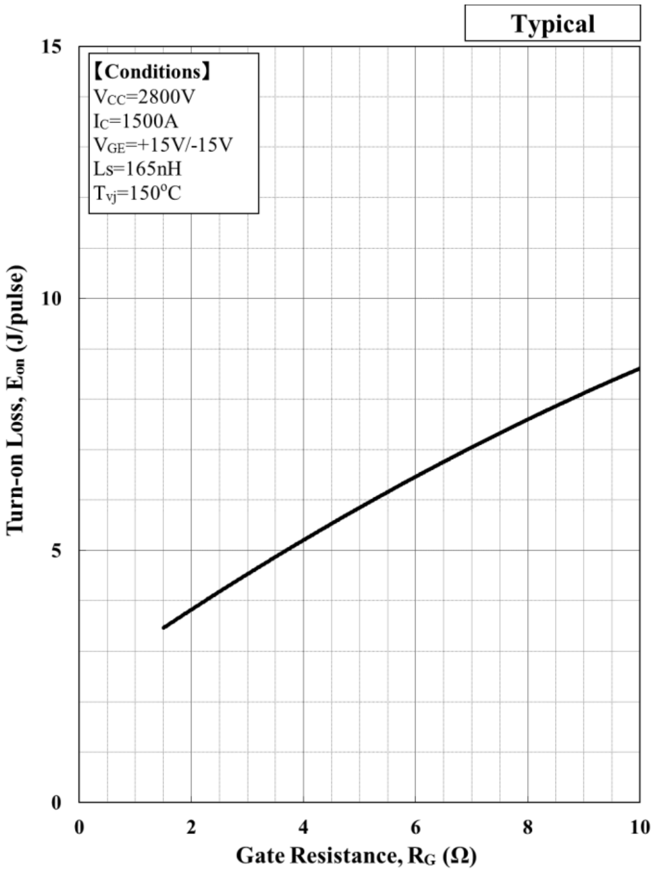
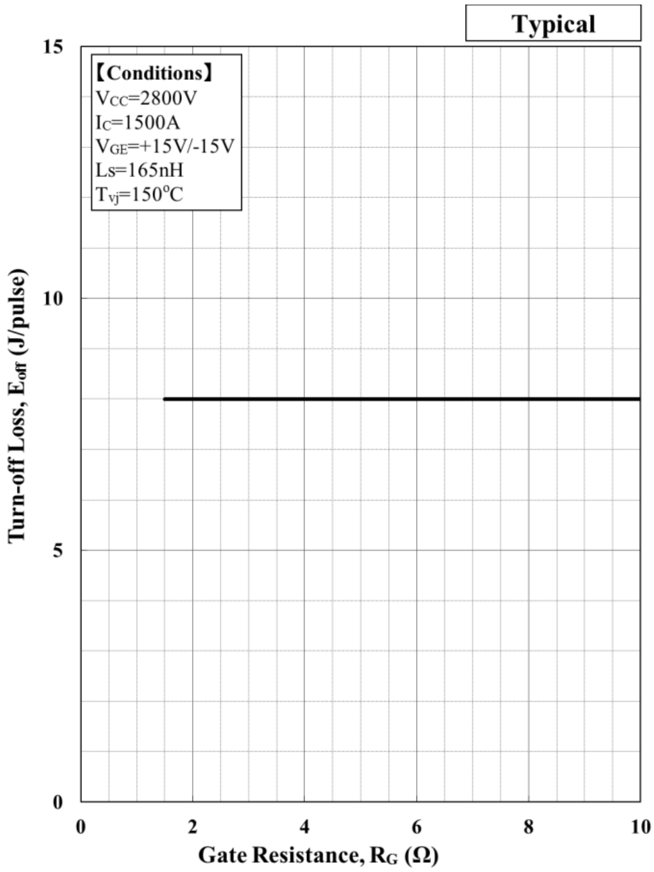
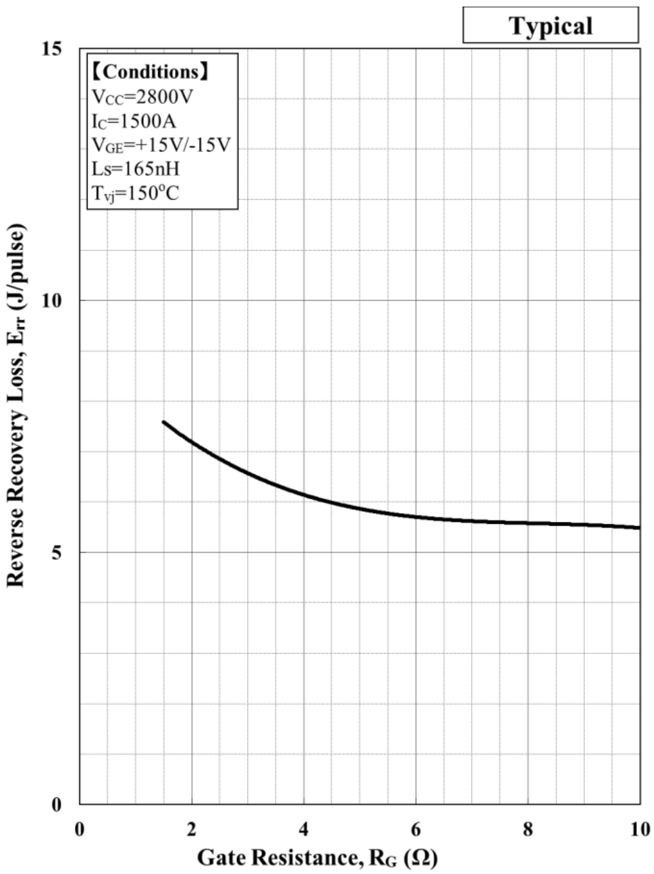


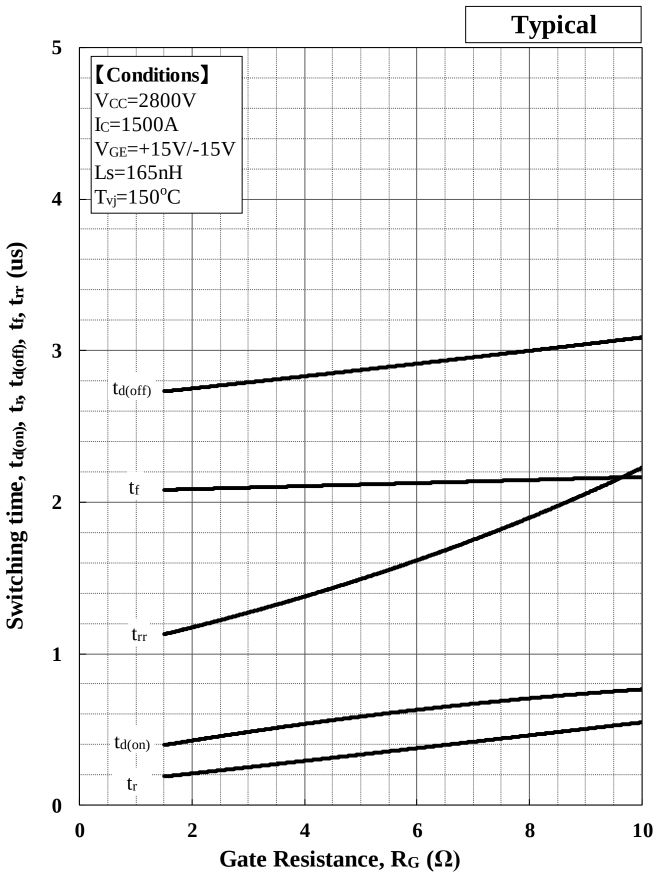
Turn-on loss vs. Gate Resistance



Turn-off loss vs. Gate Resistance



Recovery loss vs. Gate Resistance



Switching time vs. Gate Resistance

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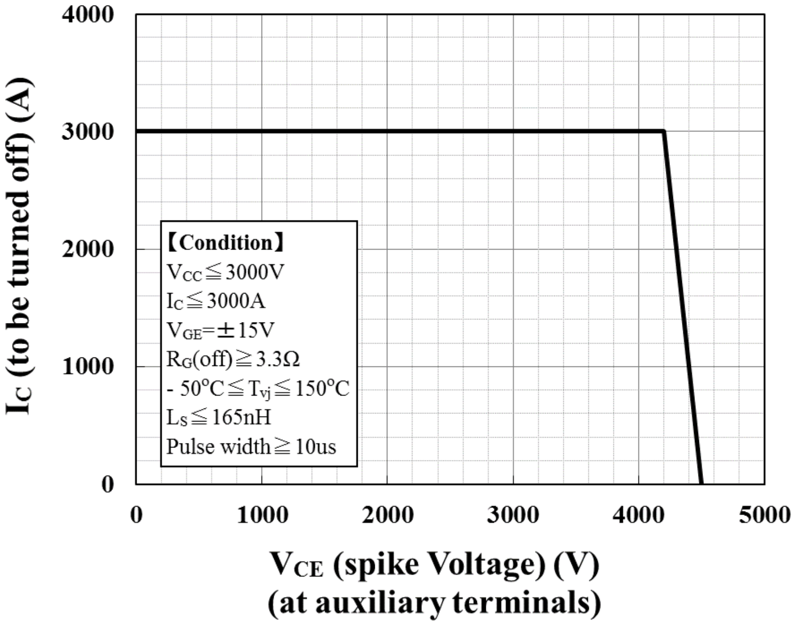
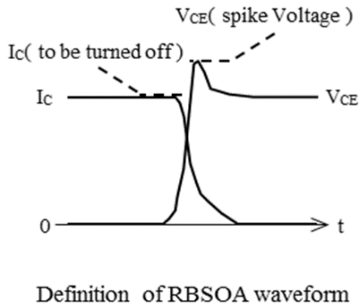
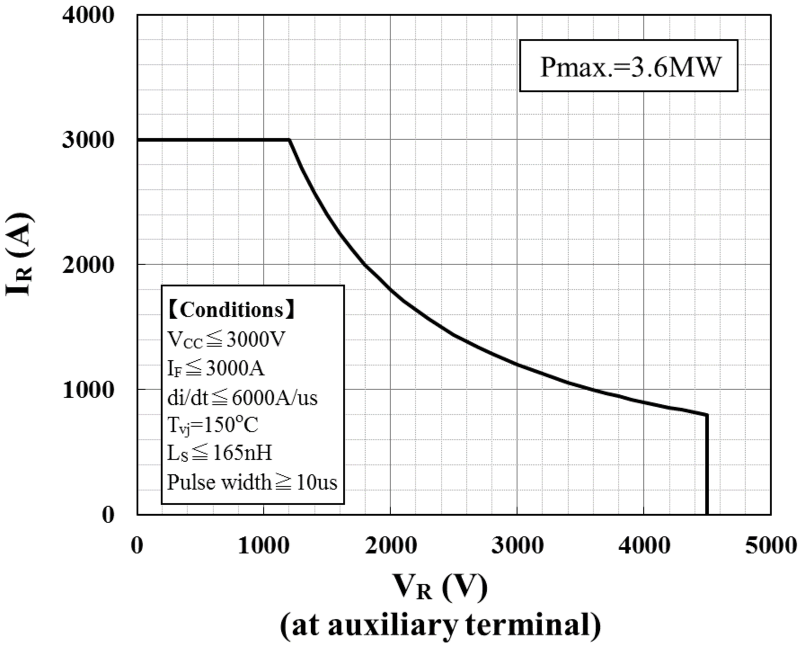
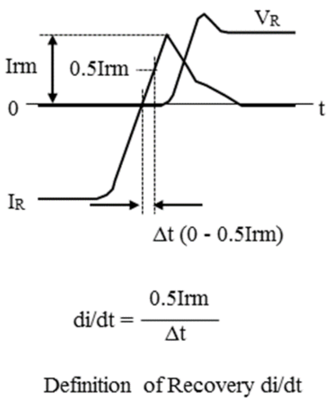




Reverse bias safe operation area (RBSOA)





Reverse recovery safe operation area(RRSOA)

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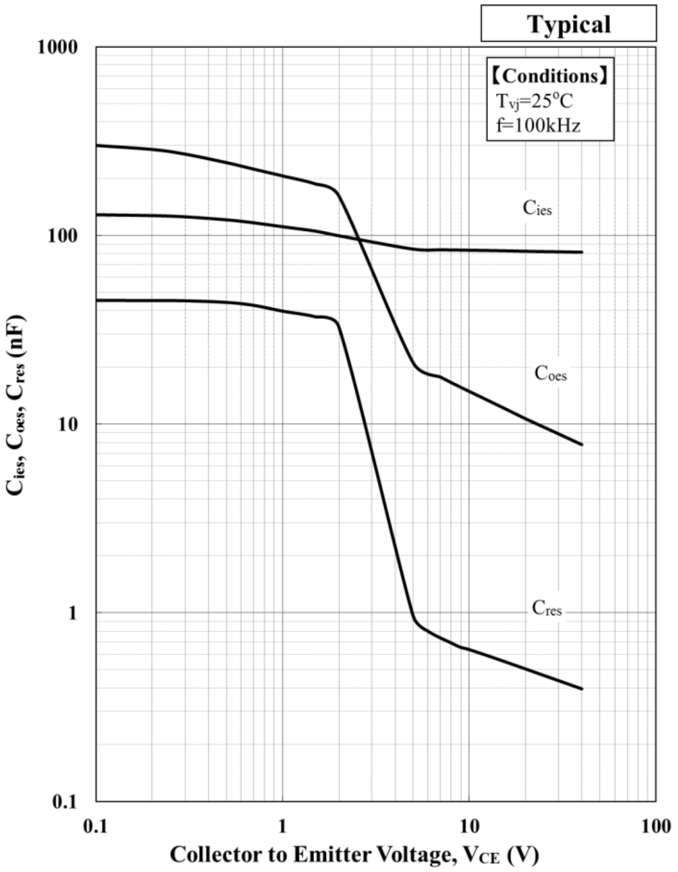
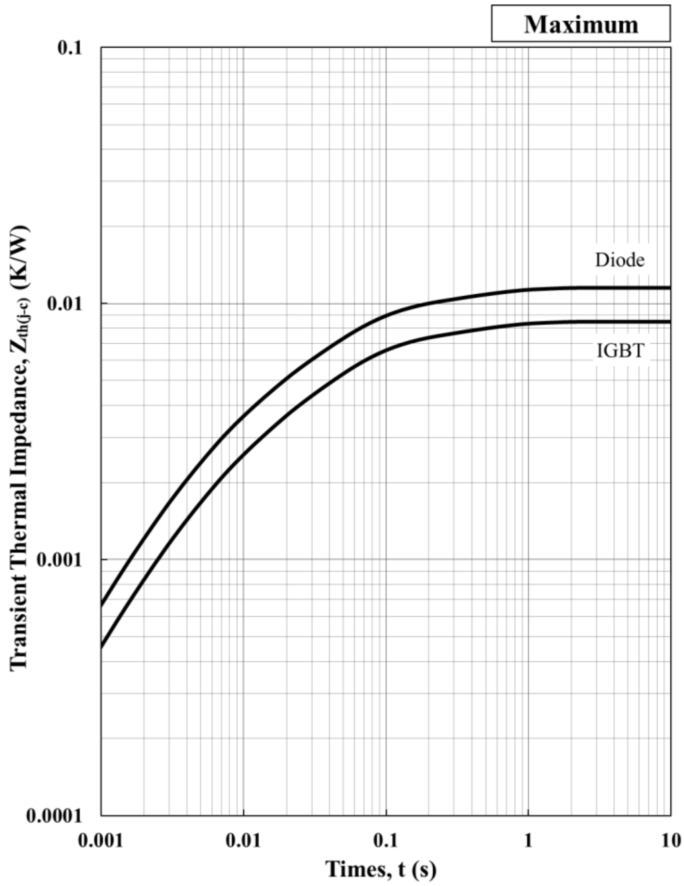


Capacitance vs. Collector to Emitter Voltage



Transient Thermal Impedance Curve

Foster model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	1.76E-03	4.75E-03	1.63E-03	3.62E-04	[K/W]
C th, IGBT [n]	2.26E+02	9.79E+00	4.18E+00	6.17E+00	[J/K]
R th, Diode [n]	2.34E-03	6.25E-03	2.33E-03	5.78E-04	[K/W]
C th, Diode [n]	1.70E+02	7.43E+00	2.93E+00	3.86E+00	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	2.35E-03	1.74E-03	3.11E-03	1.30E-03	[K/W]
C th, IGBT [n]	1.97E+00	3.35E+00	8.89E+00	2.90E+02	[J/K]
R th, Diode [n]	3.25E-03	2.39E-03	4.14E-03	1.73E-03	[K/W]
C th, Diode [n]	1.35E+00	2.49E+00	6.92E+00	2.18E+02	[J/K]

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8. For handling other than described in this manual, follow the handling instructions (IGBT-HI-00002).

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