

MBN1800F33F

Silicon N-channel IGBT 3300V 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
- * High thermal fatigue durability: ($\Delta T_c=70K$, $N>30,000$ cycles)

ABSOLUTE MAXIMUM RATINGS ($T_c=25^\circ\text{C}$)

Item	Symbol	Unit	MBN1800F33F
Collector Emitter Voltage	V_{CES}	V	3,300
Gate Emitter Voltage	V_{GES}	V	± 20
Collector Current	DC	A	1,800
	1ms		3,600
Forward Current	DC	A	1,800
	1ms		3,600
Junction Temperature	$T_{vj op}$	$^\circ\text{C}$	-50 ~ +150
Storage Temperature	T_{stg}	$^\circ\text{C}$	-55 ~ +150
Isolation Voltage	V_{ISO}	V_{RMS}	6,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	2/15 (1)
	Mounting (M6)	-	6 (2)

Notes: (1) Recommended Value $1.8 \pm 0.2/15^{+0}_{-3} \text{N}\cdot\text{m}$ (2) Recommended Value $5.5 \pm 0.5 \text{N}\cdot\text{m}$

ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	I_{CES}	mA	-	-	0.6	$V_{CE}=3,300\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=25^\circ\text{C}$
			-	40	100	$V_{CE}=3,300\text{V}$, $V_{GE}=0\text{V}$, $T_{vj}=150^\circ\text{C}$
Gate Emitter Leakage Current	I_{GES}	nA	-500	-	+500	$V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_{vj}=25^\circ\text{C}$
Collector Emitter Saturation Voltage	V_{CEsat}	V	2.5	2.85	3.5	$I_C=1,800\text{A}$, $V_{GE}=15\text{V}$, $T_{vj}=150^\circ\text{C}$
Gate Emitter Threshold Voltage	$V_{GE(th)}$	V	5.5	6.5	7.5	$V_{CE}=10\text{V}$, $I_C=1,800\text{mA}$, $T_{vj}=25^\circ\text{C}$
Input Capacitance	C_{ies}	nF	-	132	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^\circ\text{C}$
Internal Gate Resistance	$R_{G(int)}$	Ω	-	1.3	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_{vj}=25^\circ\text{C}$
Turn On Delay Time	$t_{d(on)}$	μs	-	0.8	-	$V_{CC}=1,800\text{V}$, $I_C=1,800\text{A}$
Rise Time	t_r		-	0.3	-	$L_S=80\text{nH}$
Turn Off Delay Time	$t_{d(off)}$		-	2.2	-	$R_{G(on/off)}=4.7\Omega/5.6\Omega$ (3)
Fall Time	t_f		-	1.8	-	$V_{GE}=\pm 15\text{V}$, $T_{vj}=150^\circ\text{C}$
Forward Voltage Drop	V_F	V	2.2	2.6	2.9	$I_F=1,800\text{A}$, $V_{GE}=0\text{V}$, $T_{vj}=150^\circ\text{C}$
Reverse Recovery Time	t_{rr}	μs	-	0.7	-	$V_{CC}=1,800\text{V}$, $I_F=1,800\text{A}$, $L_S=80\text{nH}$ $T_{vj}=150^\circ\text{C}$
Turn On Loss	E_{on}	J/P	-	3.7	-	$V_{CC}=1,800\text{V}$, $I_C=1,800\text{A}$, $L_S=80\text{nH}$
Turn Off Loss	E_{off}	J/P	-	3.3	-	$R_{G(on/off)}=4.7\Omega/5.6\Omega$ (3)
Reverse Recovery Loss	E_{rr}	J/P	-	2.4	-	$V_{GE}=\pm 15\text{V}$, $T_{vj}=150^\circ\text{C}$
Short Circuit Pulse Width	t_{sc}	μs	10	-	-	$V_{CC}=2,000\text{V}$, $L_S=80\text{nH}$ $R_{G(on/off)}=4.7/56\Omega$, $V_{GE}=\pm 15\text{V}$, $T_{vj}=150^\circ\text{C}$
Stray inductance module	L_{SCE}	nH	-	7	-	
Thermal Impedance	IGBT	$R_{th(j-c)}$	K/W	-	-	Junction to case
	FWD	$R_{th(j-c)}$		-	-	
Contact Thermal Impedance		$R_{th(c-f)}$	K/W	-	0.005	Case to fin

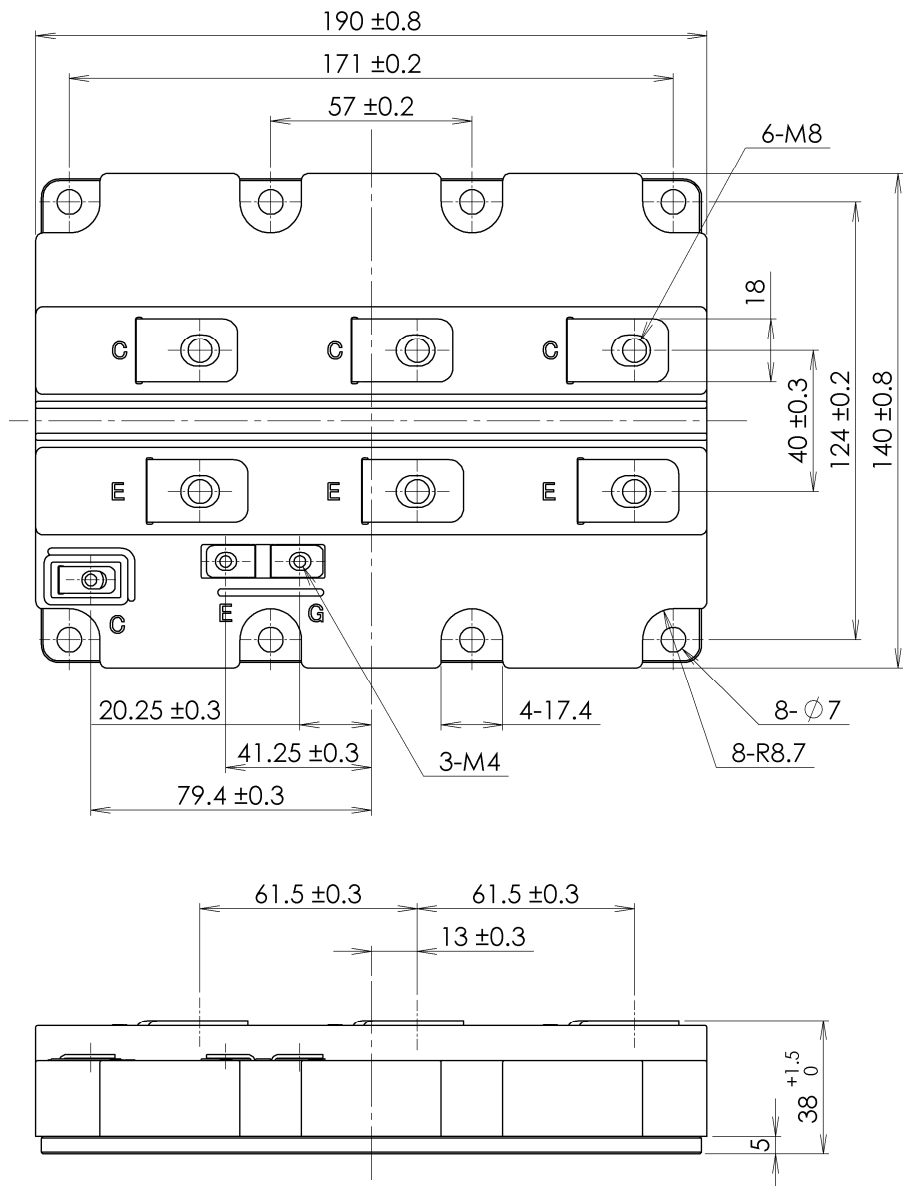
Notes: (3) R_G value is a test condition value for evaluation, not recommended value.

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.

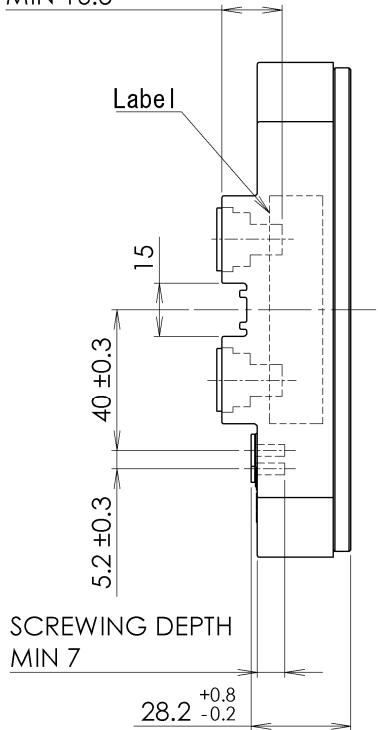
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OUTLINE DRAWING



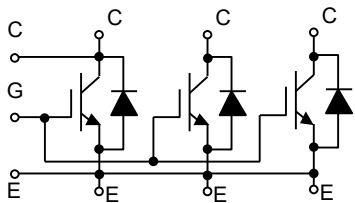
Unit in mm

SCREWING DEPTH
MIN 16.5

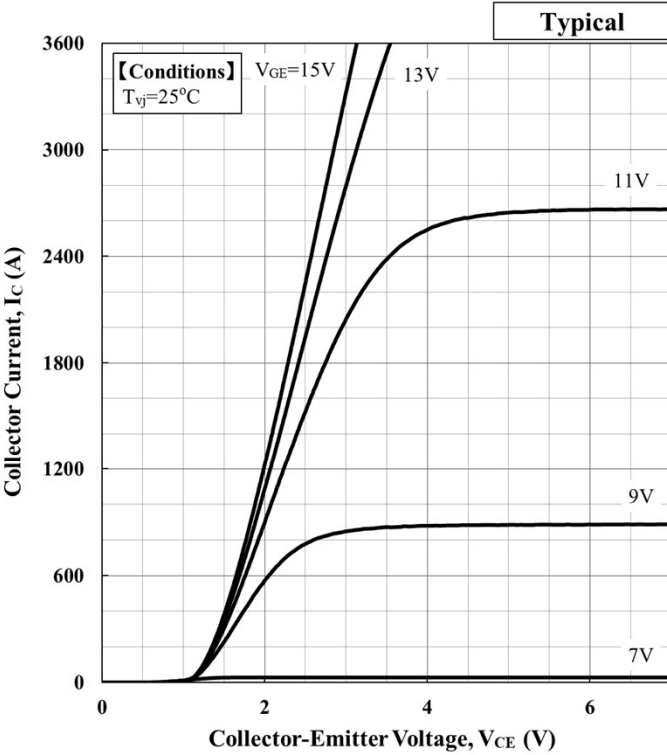


Weight: 1,300g

CIRCUIT DIAGRAM

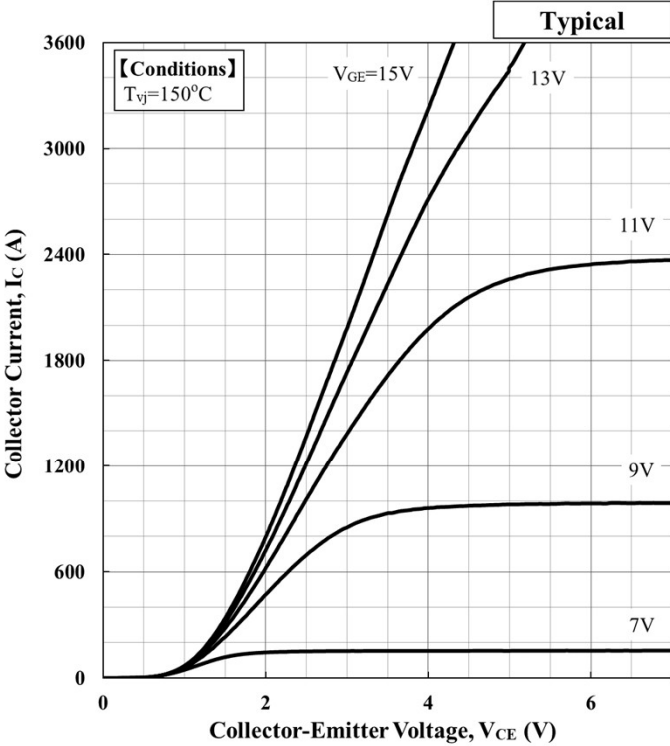


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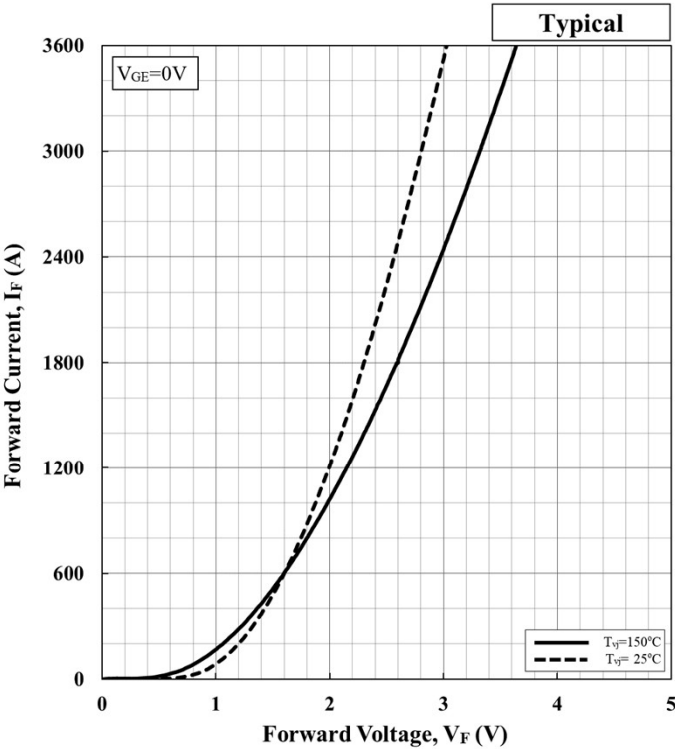
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
25	15	1.58.E-11	-1.20.E-07	7.57.E-04	1.23.E+00

Collector Current vs. Collector Emitter Voltage



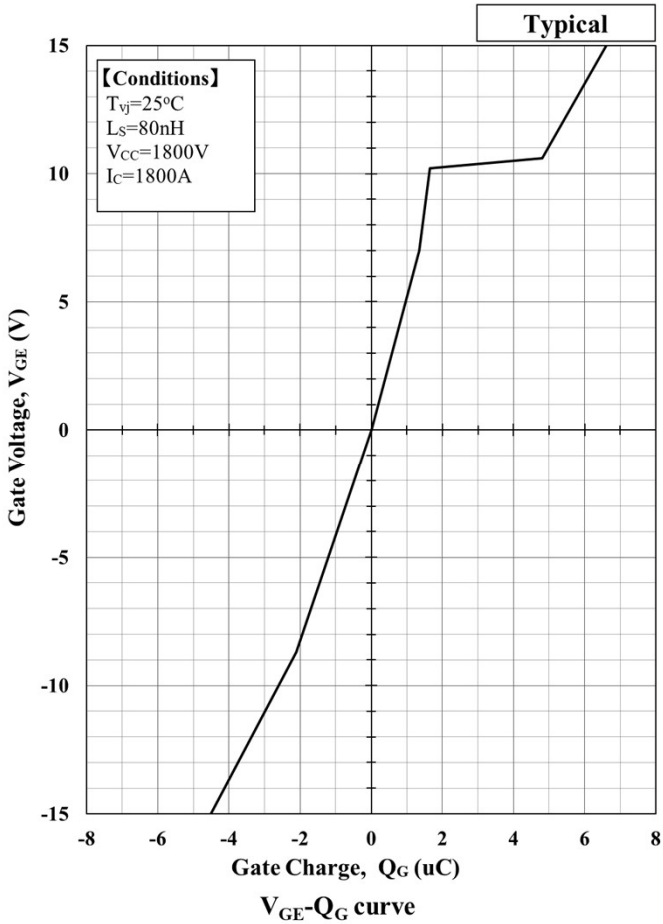
$V_{CE}(sat)[V] = a_3 \cdot I_c ^3 + a_2 \cdot I_c ^2 + a_1 \cdot I_c + a_0$					
Temp.[°C]	$V_{GE}[V]$	a_3	a_2	a_1	a_0
150	15	3.35.E-11	-2.27.E-07	1.28.E-03	1.09.E+00

Collector Current vs. Collector Emitter Voltage

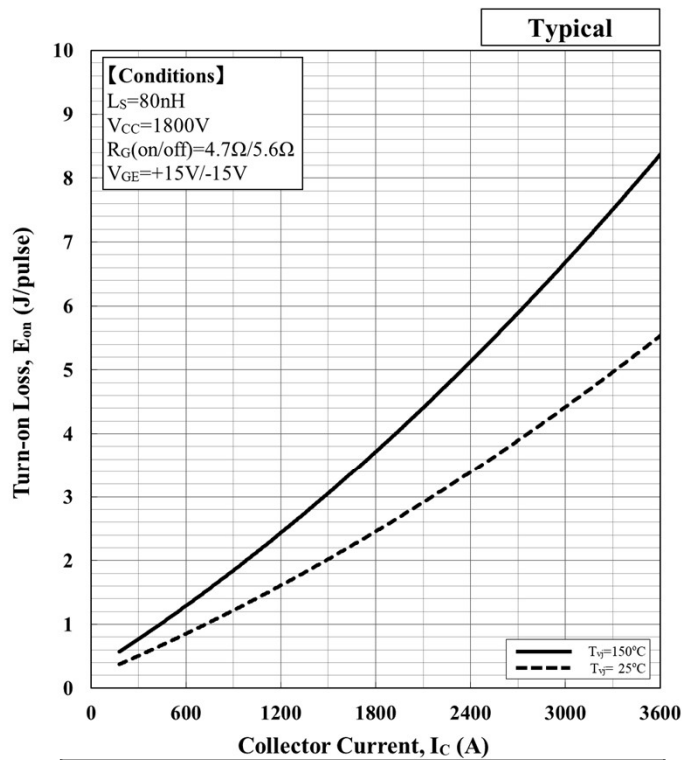


$V_F[V] = a_3 \cdot I_F ^3 + a_2 \cdot I_F ^2 + a_1 \cdot I_F + a_0$				
Temp.[°C]	a_3	a_2	a_1	a_0
25	2.77.E-11	-2.33.E-07	1.03.E-03	1.04.E+00
150	3.40.E-11	-2.93.E-07	1.40.E-03	8.36.E-01

Forward Voltage of free-wheeling diode



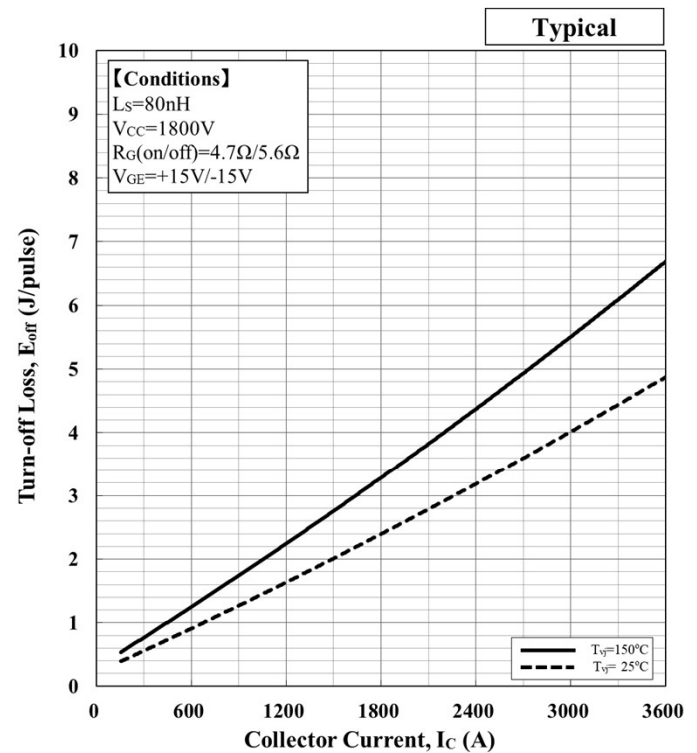
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$$E [J] = a_3 \cdot |I_C|^3 + a_2 \cdot |I_C|^2 + a_1 \cdot |I_C| + a_0$$

Temp.[°C]	a_3	a_2	a_1	a_0
25	-	1.24E-07	1.04E-03	1.87E-01
150	-	1.88E-07	1.57E-03	2.82E-01

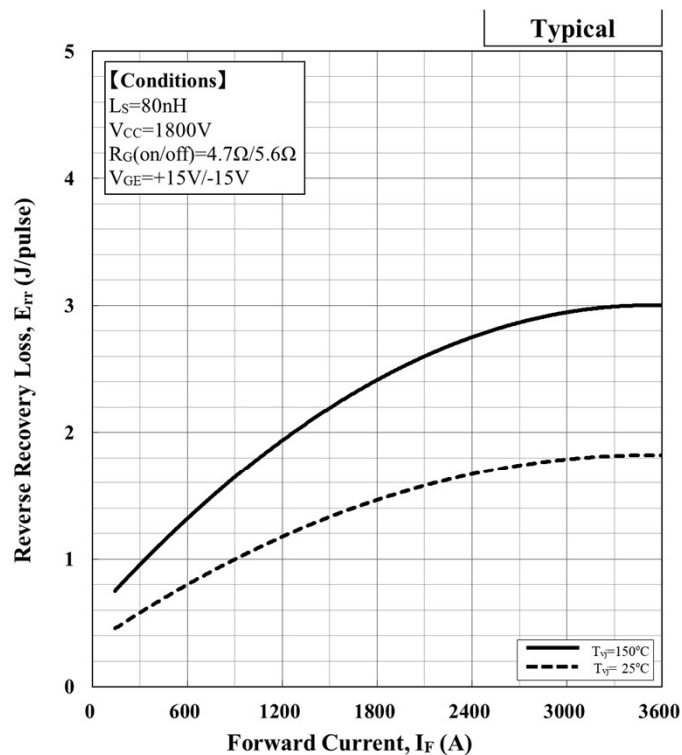
Turn-on loss vs. Collector current



$$E [J] = a_3 \cdot |I_C|^3 + a_2 \cdot |I_C|^2 + a_1 \cdot |I_C| + a_0$$

Temp.[°C]	a_3	a_2	a_1	a_0
25	-	4.68E-08	1.13E-03	2.18E-01
150	-	6.42E-08	1.54E-03	2.99E-01

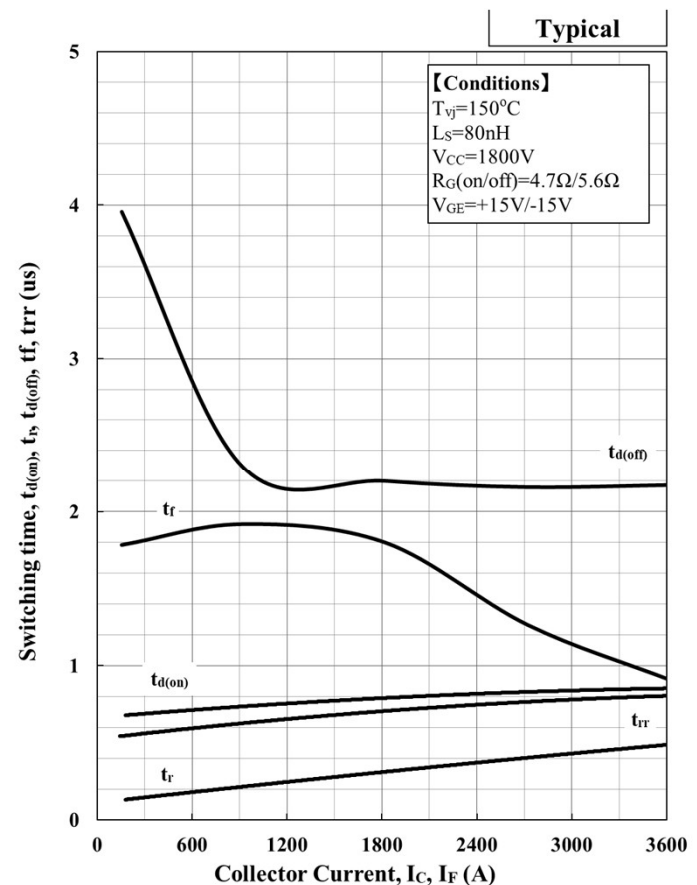
Turn-off loss vs. Collector current



$$E [J] = a_3 \cdot |I_F|^3 + a_2 \cdot |I_F|^2 + a_1 \cdot |I_F| + a_0$$

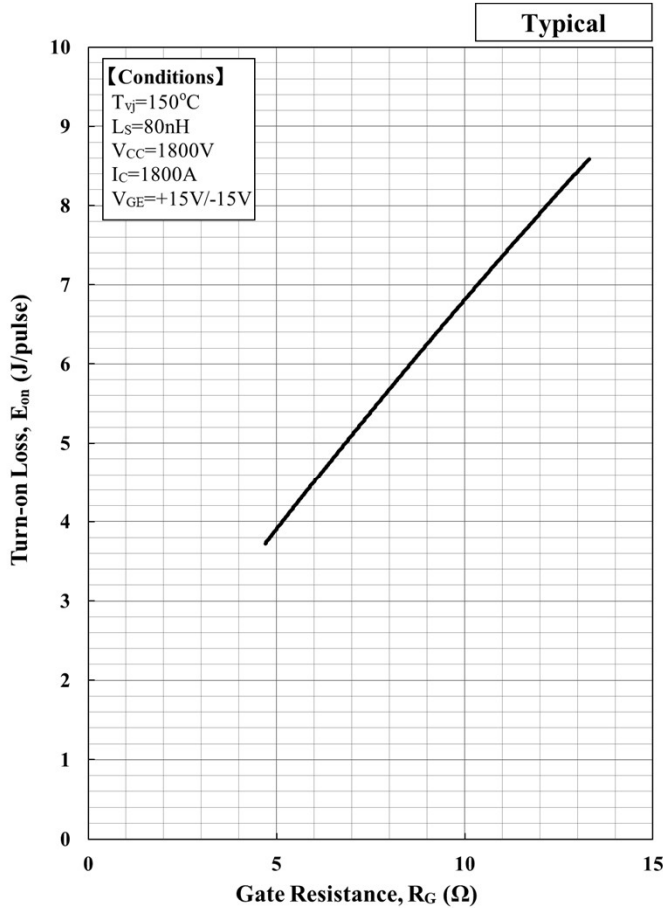
Temp.[°C]	a_3	a_2	a_1	a_0
25	-	-1.19E-07	8.40E-04	3.39E-01
150	-	-1.96E-07	1.38E-03	5.58E-01

Recovery loss vs. Forward current

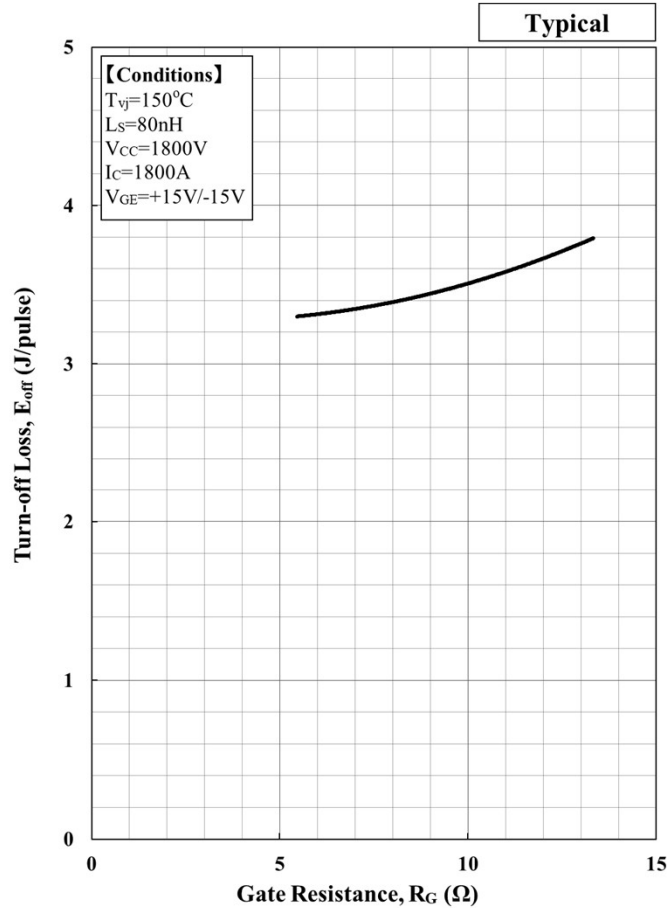


Switching time vs. Collector Current

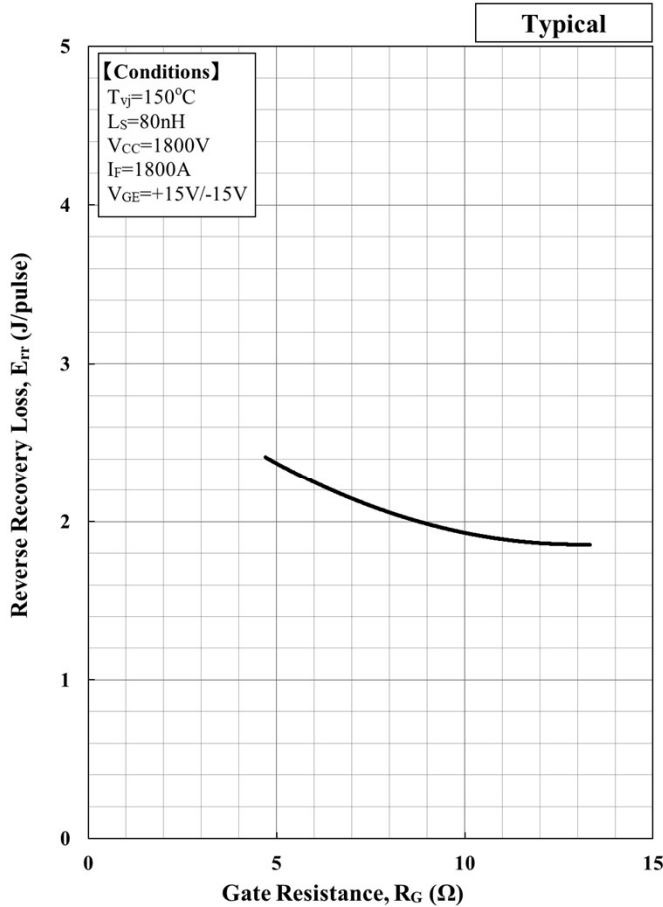
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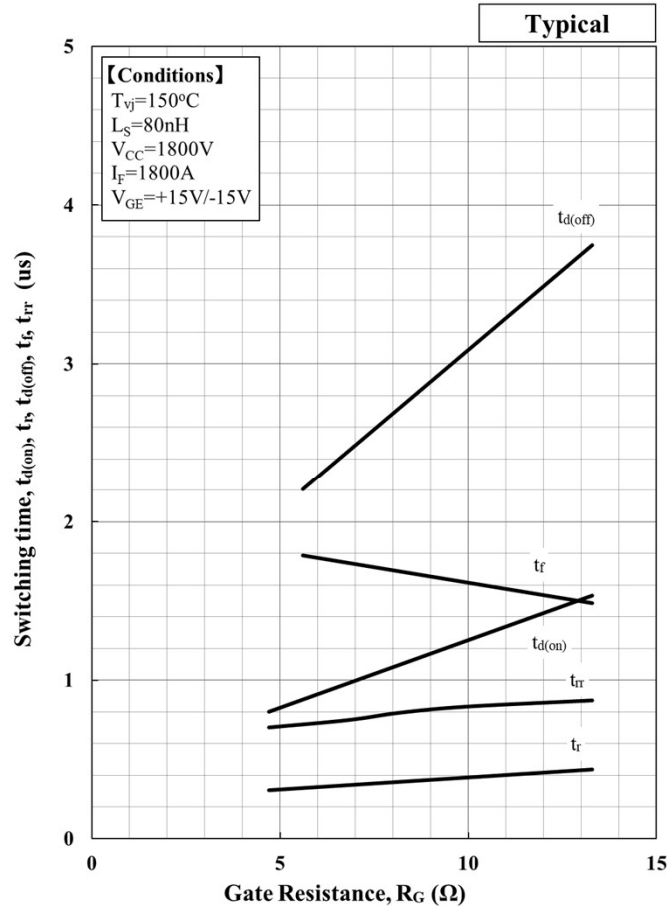
Turn-on loss vs. Gate Resistance



Turn-off loss vs. Gate Resistance

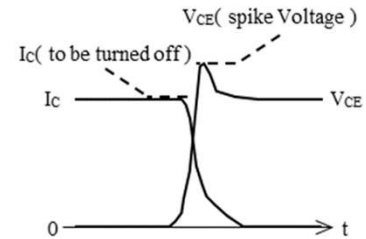
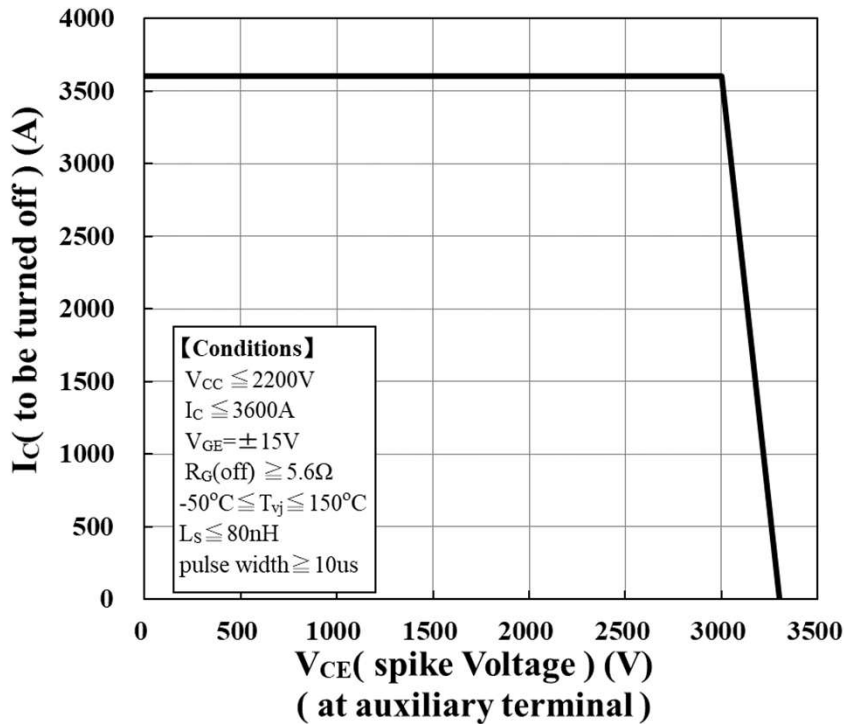


Recovery loss vs. Gate Resistance



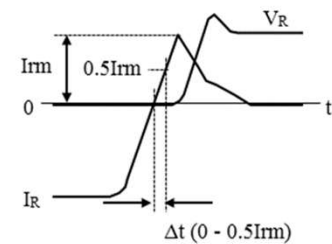
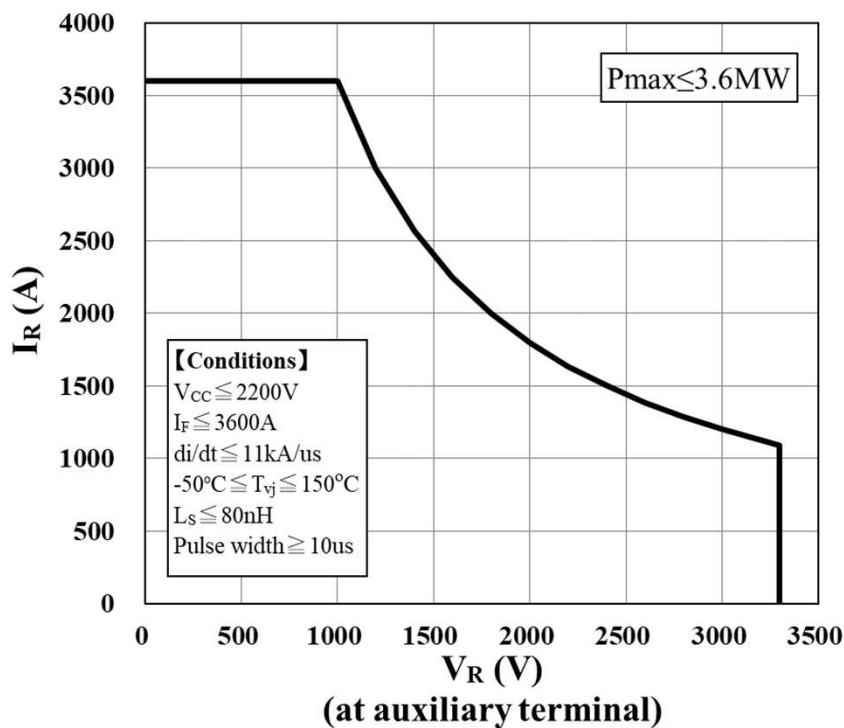
Switching time vs. Gate Resistance

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Definition of RBSOA waveform

Reverse Bias Safe Operation Area (RBSOA)

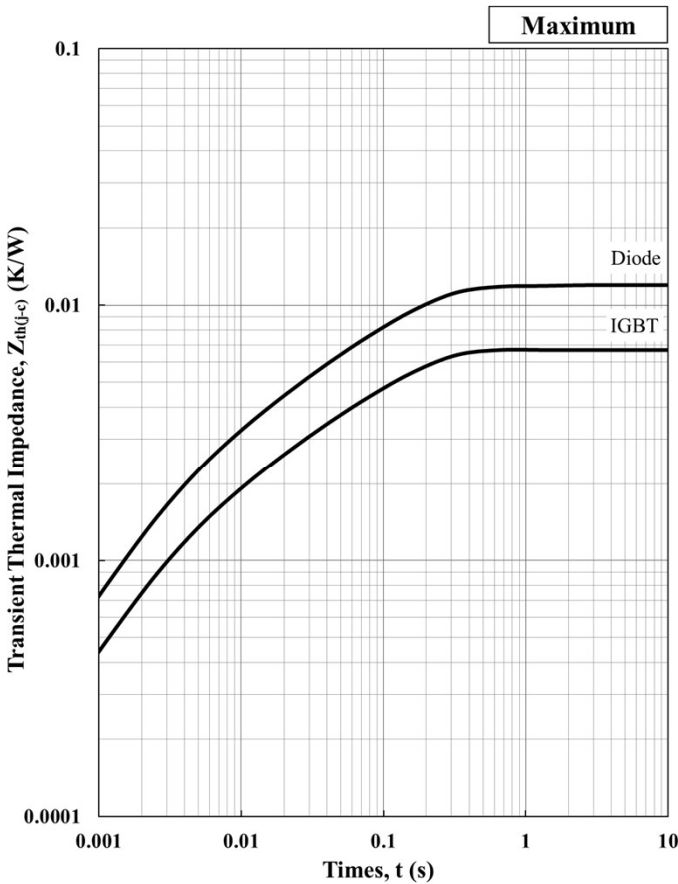
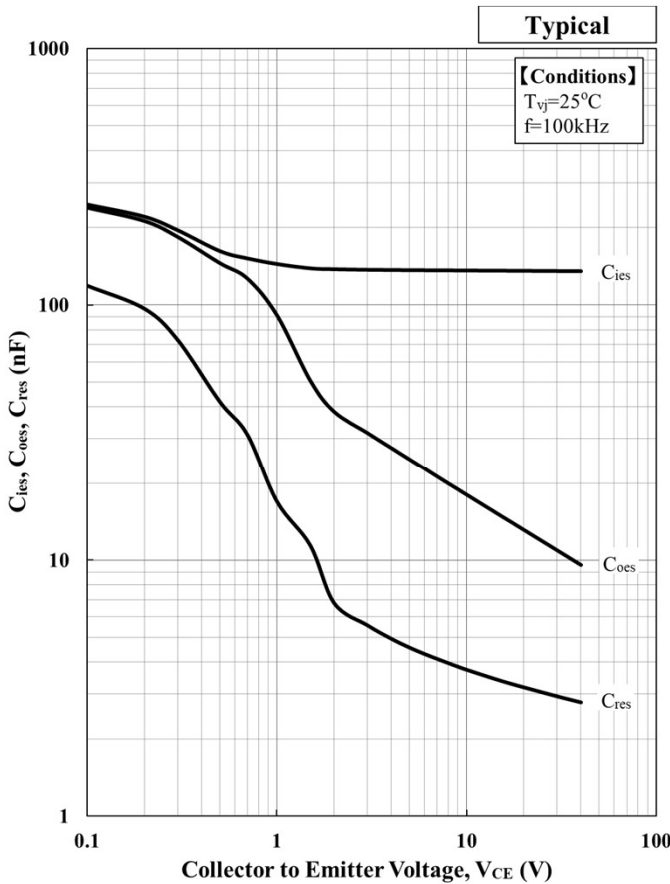


$$di/dt = \frac{0.5I_{rm}}{\Delta t}$$

Definition of Recovery di/dt

Reverse Recovery Safe Operation Area (RRSOA)

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Foster model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	4.32E-03	1.45E-03	8.73E-04	5.10E-05	[K/W]
C th, IGBT [n]	2.93E+01	1.07E+01	3.14E+00	6.21E+00	[J/K]
R th, Diode [n]	7.78E-03	2.84E-03	1.28E-03	1.00E-04	[K/W]
C th, Diode [n]	1.63E+01	5.45E+00	2.15E+00	3.16E+00	[J/K]

Cauer model lumped circuit constant

n	1	2	3	4	Unit
R th, IGBT [n]	5.84E-04	1.17E-03	1.97E-03	2.98E-03	[K/W]
C th, IGBT [n]	1.64E+00	1.09E+00	8.05E+00	2.95E+01	[J/K]
R th, Diode [n]	8.92E-04	2.14E-03	3.59E-03	5.38E-03	[K/W]
C th, Diode [n]	9.74E-01	7.11E-01	4.00E+00	1.67E+01	[J/K]

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