

# MBN1800E17E

Silicon N-channel IGBT

## 1. FEATURES

- \* Low noise, low loss IGBT module due to soft-LiPT Trench Technology
- \* Low noise due to ultra soft fast recovery diode. (U-SFD)
- \* High reverse recovery capability (HiRC)
- \* High thermal fatigue durability. ( $\Delta T_c=70K$ ,  $N>30,000$ cycles)

## 2. ABSOLUTE MAXIMUM RATINGS ( $T_c=25^\circ C$ )

Item		Symbol	Unit	MBN1800E17E
Collector Emitter Voltage		$V_{CES}$	V	1,700
Gate Emitter Voltage		$V_{GES}$	V	$\pm 20$
Collector Current	DC	$I_C$	A	1,800
	1ms	$I_{CP}$		3,600
Forward Current	DC	$I_F$	A	1,800
	1ms	$I_{FM}$		3,600
Total Power dissipation		$P_{tot}$	kW	8.3
Junction Temperature		$T_j$	$^\circ C$	-40 ~ +125
Storage Temperature		$T_{stg}$	$^\circ C$	-40 ~ +125
Isolation Voltage		$V_{ISO}$	$V_{RMS}$	4,000 (AC 1 minute)
Screw Torque	Terminals	(M4)	-	2 <sup>(1)</sup>
		(M8)	-	15 <sup>(1)</sup>
	Mounting	(M6)	-	5 <sup>(2)</sup>

Notes: (1) Recommended Value  $2.0^{+0.1}_{-0.2} / 15^{+0}_{-3} N \cdot m$   
 (2) Recommended Value  $5.0 \pm 1 N \cdot m$

\* 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.

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## 3. ELECTRIC CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	$I_{CES}$	mA	-	-	10	$V_{CE}=1,700V, V_{GE}=0V, T_j=25^\circ C$
			-	15	50	$V_{CE}=1,700V, V_{GE}=0V, T_j=125^\circ C$
Gate Emitter Leakage Current	$I_{GES}$	nA	-500	-	+500	$V_{GE}=\pm 20V, V_{CE}=0V, T_j=25^\circ C$
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	V	-	2.0	-	$I_C=1,800A, V_{GE}=15V, T_j=25^\circ C$
			1.7	2.2	2.8	$I_C=1,800A, V_{GE}=15V, T_j=125^\circ C$
Gate Emitter Threshold Voltage	$V_{GE(TO)}$	V	5.0	6.5	8.0	$V_{CE}=10V, I_C=180mA, T_j=25^\circ C$
Input Capacitance	$C_{ies}$	nF	-	150	-	$V_{CE}=10V, V_{GE}=0V$
Reverse transfer Capacitance	$C_{res}$	nF	-	9	-	
Output Capacitance	$C_{oes}$	nF	-	17	-	$f=100kHz, T_j=25^\circ C$
Total Gate Charge	$Q_G$	$\mu C$	-	11	-	$V_{GE}=\pm 15V, V_{CC}=900V, I_C=1,800A$
Turn-on Gate Charge	QG(on)	$\mu C$	-	5.0	-	$V_{GE}=-15V \rightarrow 0V, V_{CC}=900V, I_C=1,800A$
			-	6.5	-	$V_{GE}=-15V \rightarrow 8V, V_{CC}=900V, I_C=1,800A$
Internal Gate Resistance (Tentative)	$R_{ge(int)}$	$\Omega$	0.9	1.4	2.1	$V_{CE}=10V, V_{GE}=0V, f=100kHz, T_j=25^\circ C$
Switching Times	Turn on delay Time	$t_{d(on)}$	0.5	1.1	2.2	$V_{CC}=900V, I_C=1,800A$
	Rise Time	$t_r$	0.5	1.1	2.2	
	Turn On Time	$t_{on}$	1.0	2.2	4.4	$L=100nH$
	Turn off delay Time	$t_{d(off)}$	0.6	1.3	2.6	$R_G(on/off)=6.8/2.7\Omega$ <sup>(3)</sup>
	Fall Time	$t_f$	0.3	0.9	1.8	$V_{GE}=\pm 15V, T_j=125^\circ C$
Turn Off Time	$t_{off}$	1.0	2.2	4.4		
Peak Forward Voltage Drop	$V_{FM}$	V	-	1.8	-	$I_F=1,800A, V_{GE}=0V, T_j=25^\circ C$
			1.4	1.9	2.5	$I_F=1,800A, V_{GE}=0V, T_j=125^\circ C$
Reverse Recovery Time	$t_{rr}$	$\mu s$	0.2	0.7	1.4	$V_{CC}=900V, I_C=1,800A$ $L=100nH$ $R_G(on/off)=6.8/2.7\Omega$ <sup>(3)</sup> $V_{GE}=\pm 15V, T_j=125^\circ C$
Turn On Loss	$E_{on(10\%)}$	J/P	-	0.45	0.68	
	$E_{on(Full)}$	J/P	-	0.6	(0.9)	
Turn Off Loss	$E_{off(10\%)}$	J/P	-	1.0	1.5	
	$E_{off(Full)}$	J/P	-	1.1	(1.65)	
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	0.6	0.9	
	$E_{rr(Full)}$	J/P	-	0.75	(1.15)	
Reverse Recovery Peak Current	$I_{RRM}$	A	-	1500	-	
RBSOA	$I_C$	A	3600	-	-	$V_{CC}=1100V, L=100nH, R_G(on/off)=6.8/2.7\Omega$ <sup>(3)</sup>
Recovery SOA	$I_F$	A	3600	-	-	$V_{GE}=\pm 15V, T_j=125^\circ C$
$I^2t$ value	$I^2t$	$kA^2s$	-	1000	-	$T_{I,start}=125^\circ C, 10ms, V_R=0V$
Partial Discharge Extinction Voltage	$V_{PDoff}$	$V_{RMS}$	1.3	-	-	$Q=10pC, 50Hz,$

Notes : (3)  $R_G$  value is the test condition's value for evaluation of the switching times, not recommended value.

Please, determine the suitable  $R_G$  value after the measurement of switching waveforms (overshoot voltage, etc.) with appliance mounted.

## 4. THERMAL CHARACTERISTICS

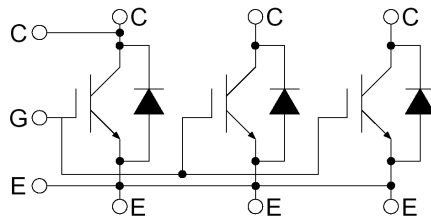
Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions	
Thermal Resistance	IGBT	$R_{th(j-c)}$	K/W	-	-	0.012	Junction to case
	FWD	$R_{th(j-c)}$		-	-	0.015	
Contact Thermal Impedance	$R_{th(c-f)}$	K/W	-	0.006	-	Case to fin. Thermal grease applied. Thickness 100 $\mu m$ , Thermal conductivity of grease: 1W/mK	

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## 5. MODULE MECHANICAL CHARACTERISTICS

Item	Unit	Characteristics	Conditions	
Weight	g	1300		
Creeping Distance	Between terminal	mm	49	
	Terminal-Base	mm	33	
Clearance Distance	Between terminal	mm	22	
	Terminal-Base	mm	25	
Stray inductance in module	LS ( C M - E M )	nH	12	Collector-main to Emitter-main
	LS ( E S - E M )		3.8	Emitter-sense to Emitter-main
	LS ( C M - C S )		6.4	Collector-main to Collector sense
Terminal Resistance	$R_{\text{Terminal}}$	m $\Omega$	0.09	Collector-main to Emitter-main
Comparative Tracking Index (CTI)			600	
Module base plate Material			Al-SiC	
Baseplate Thickness	mm		5	
Insulation Material			Al N	
Terminal Surface treatment			Ni plating	
Case Material			Poly-Phenilene Sulfide	
Fire and Smoke Category			I2 / F3	NFF 16-102

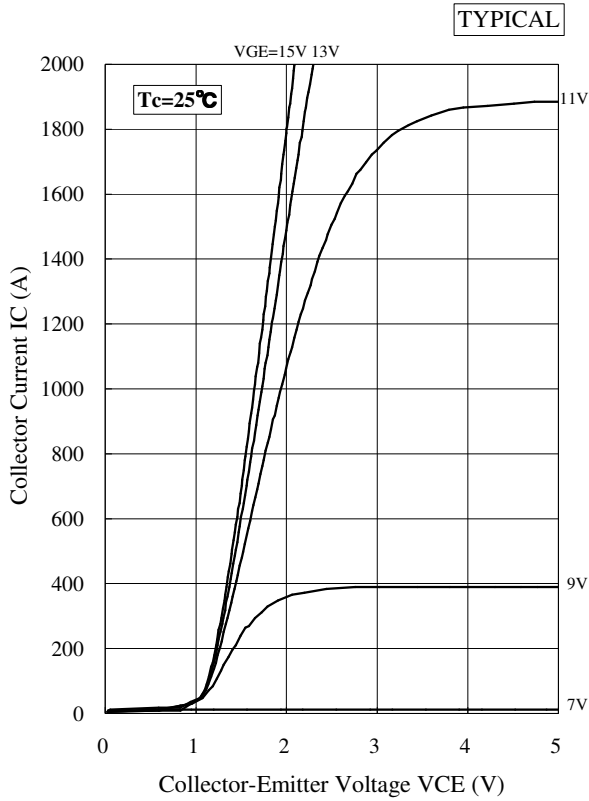
## 6. CIRCUIT DIAGRAM



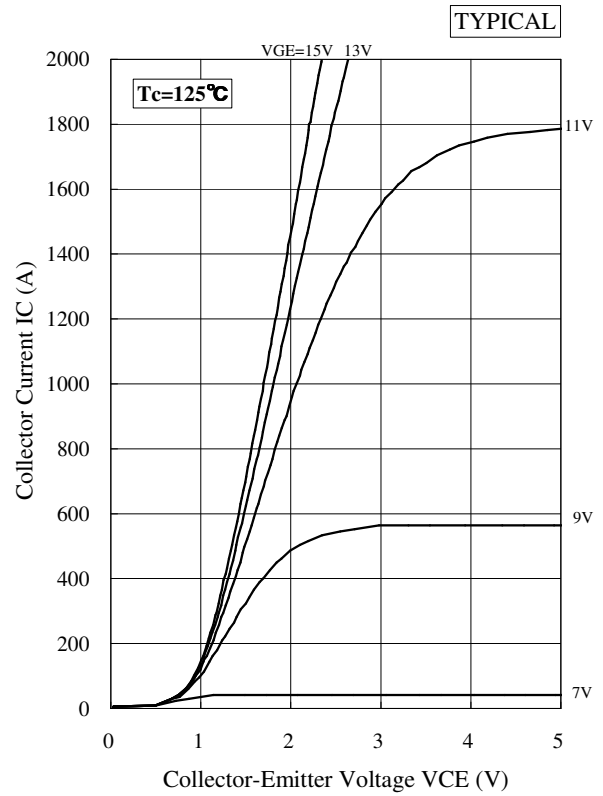
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## 7. CHARACTERISTICS CURVE

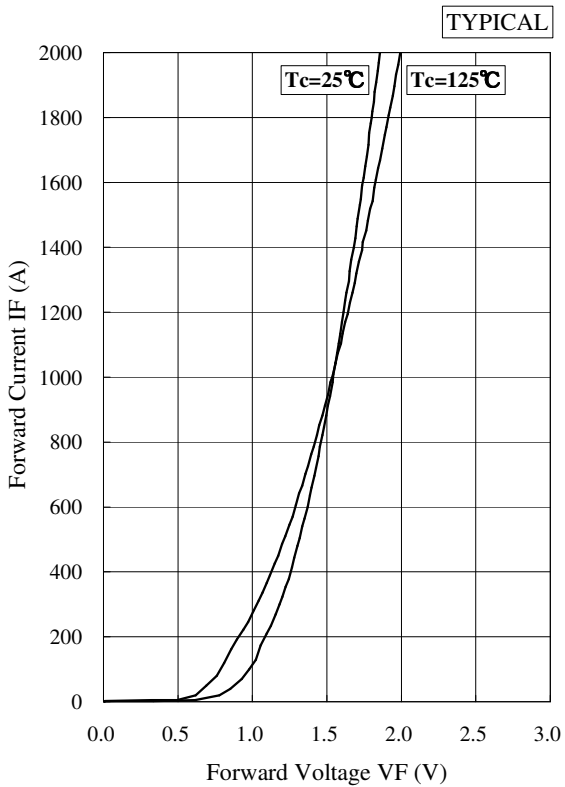
### 7.1 STATIC CHARACTERISTICS



Collector Current vs. Collector to Emitter Voltage

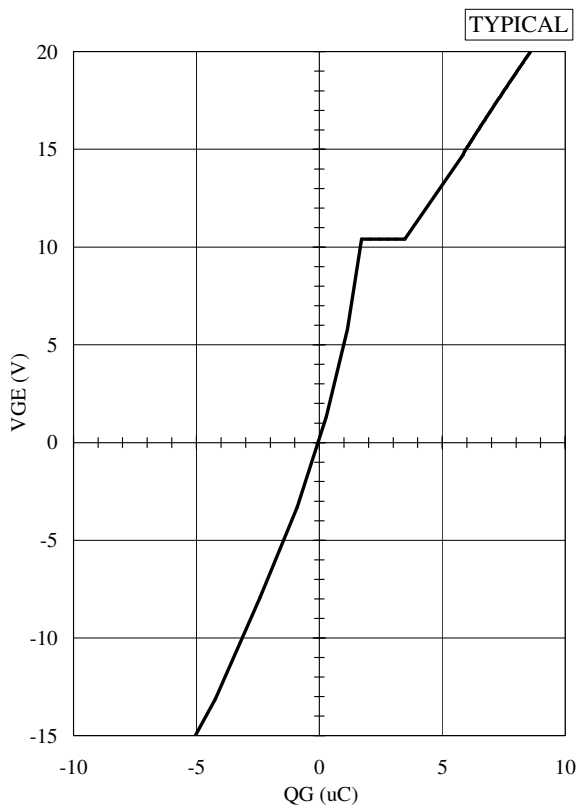


Collector Current vs. Collector to Emitter Voltage

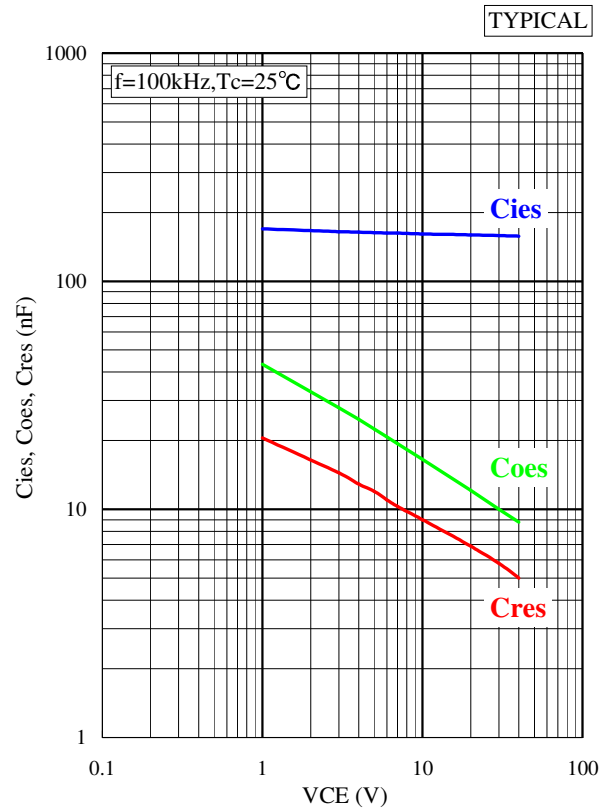


Forward Voltage of free-wheeling diode

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QG-VGE curve

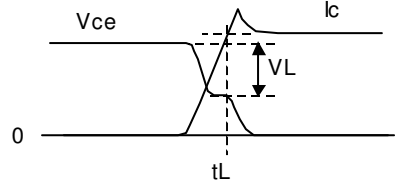
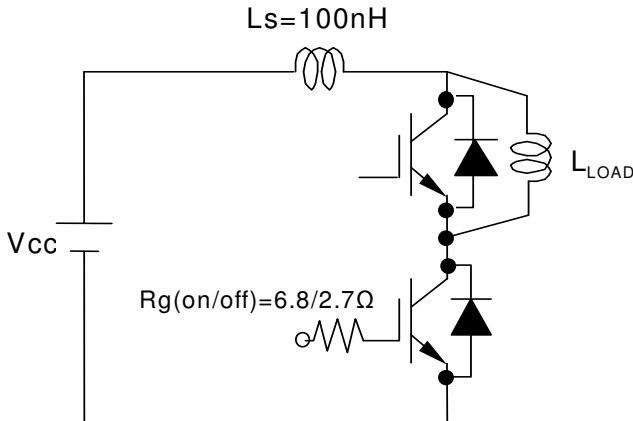


Cies, Coes, Cres vs. Vce

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## 7.2 DYNAMIC CHARACTERISTICS

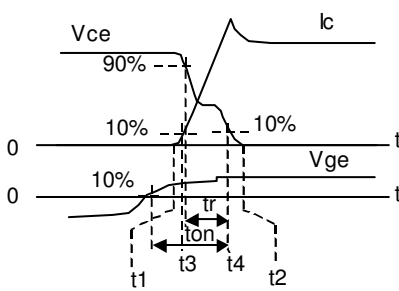
### 7.2.1 CIRCUIT



$$L_s = \frac{V_L}{\left(\frac{dI_c}{dt}\right)_{t=t_L}}$$

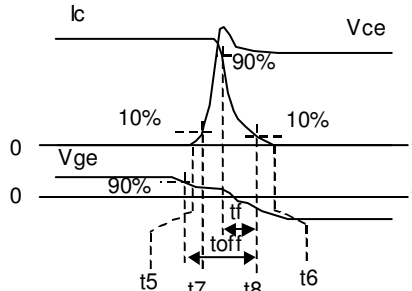
Definition of  $L_s$

### 7.2.2 WAVEFORM DEFINITION



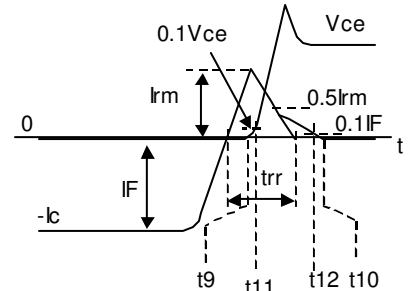
$$E_{on}(10\%) = \int_{t_3}^{t_4} I_c \cdot V_{ce} dt$$

$$E_{on}(Full) = \int_{t_1}^{t_2} I_c \cdot V_{ce} dt$$



$$E_{off}(10\%) = \int_{t_7}^{t_8} I_c \cdot V_{ce} dt$$

$$E_{off}(Full) = \int_{t_5}^{t_6} I_c \cdot V_{ce} dt$$



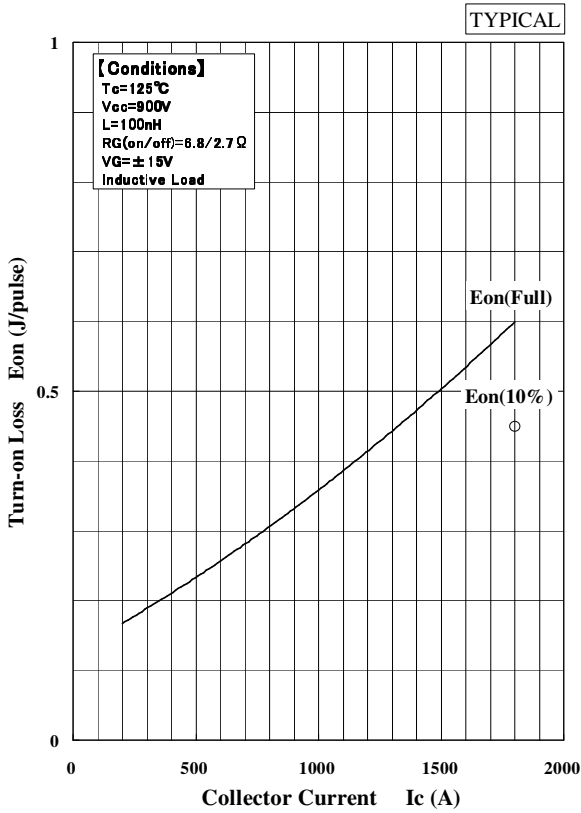
$$Err(10\%) = \int_{t_{11}}^{t_{12}} I_F \cdot V_{ce} dt$$

$$Err(Full) = \int_{t_9}^{t_{10}} I_F \cdot V_{ce} dt$$

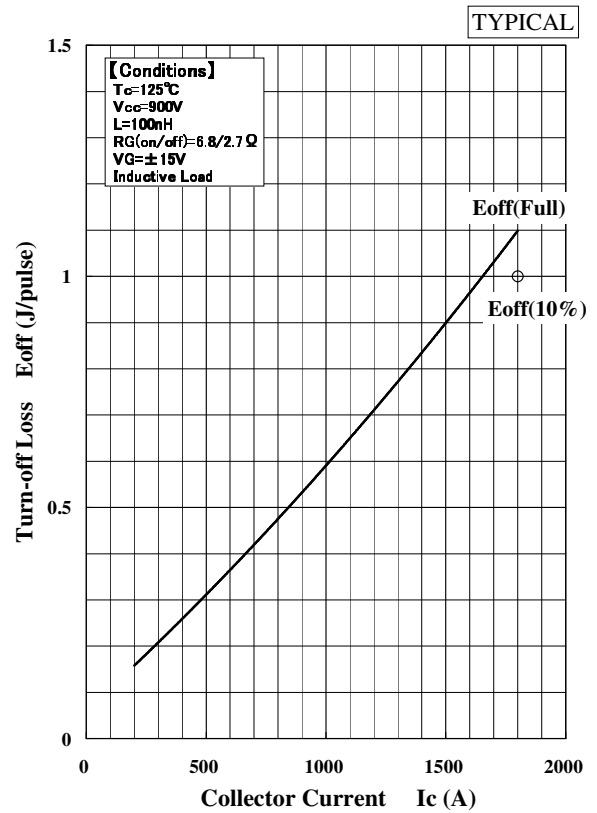
Definition of switching loss

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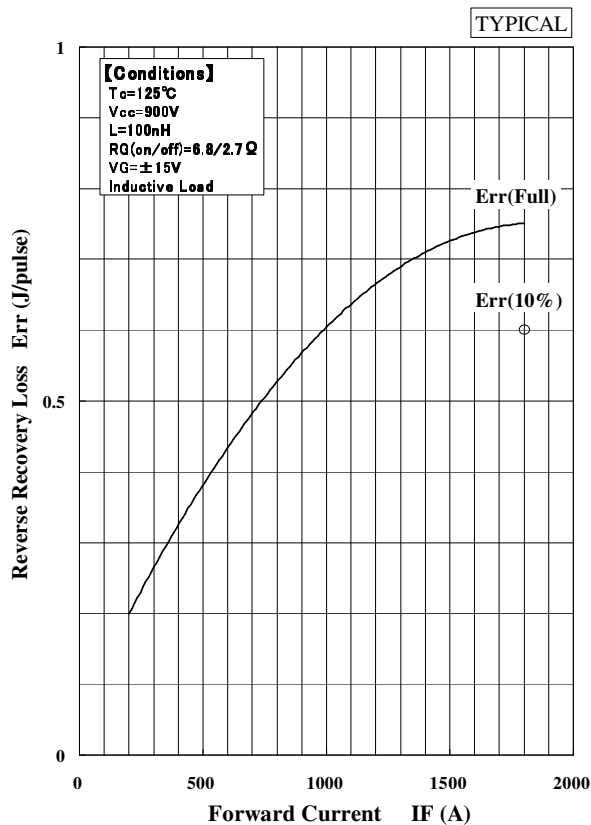
## 7.2.3 DEPENDENCE OF CURRENT



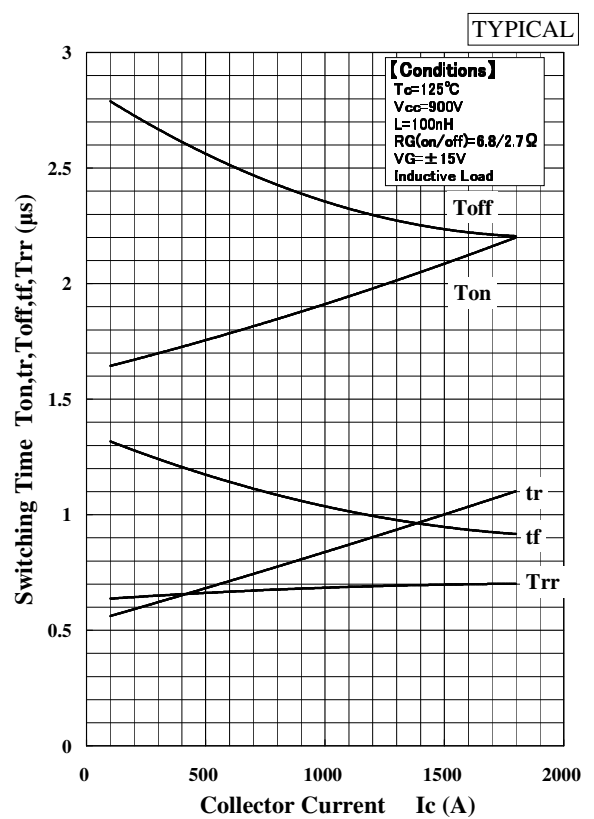
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current



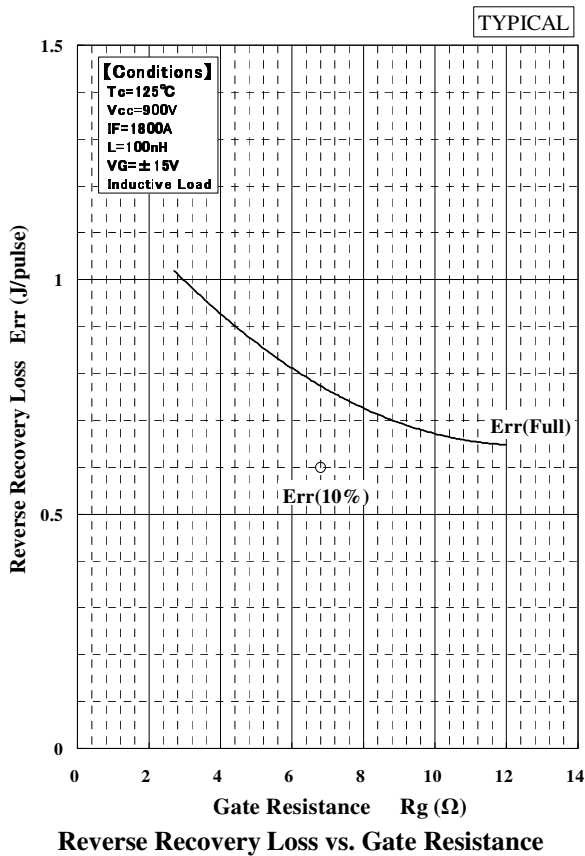
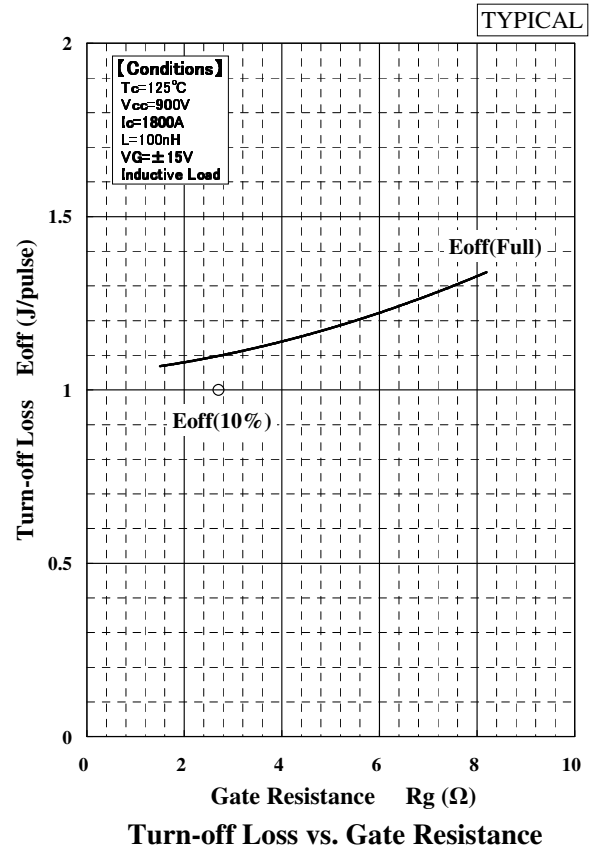
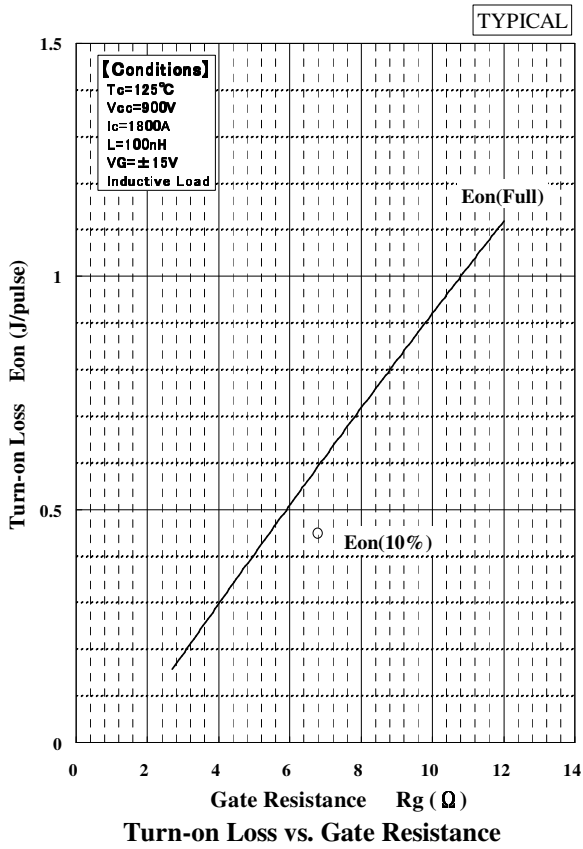
Reverse Recovery Loss vs. Forward Current



Switching Time vs. Collector Current

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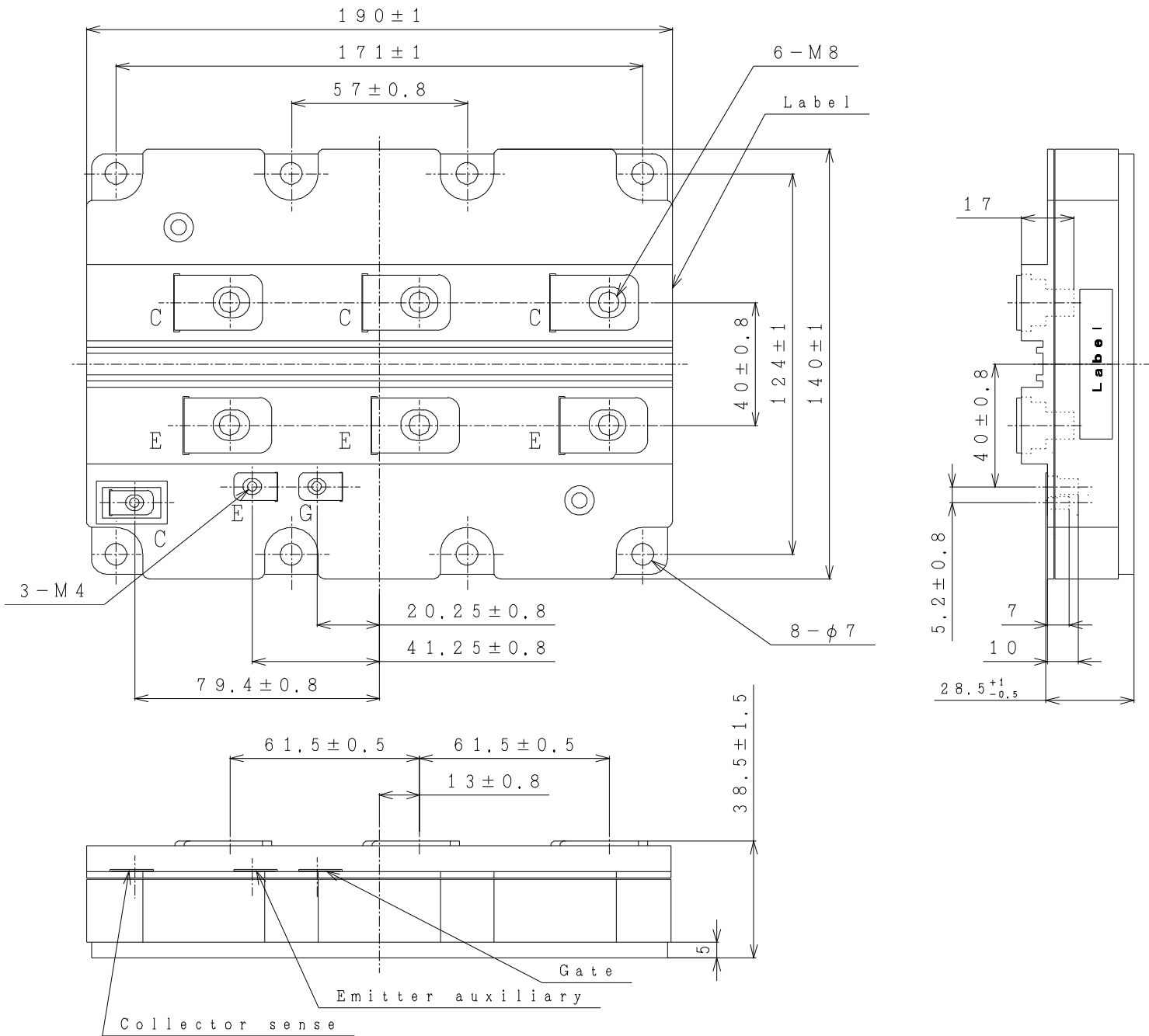
## 7.2.4 DEPENDENCE OF RG





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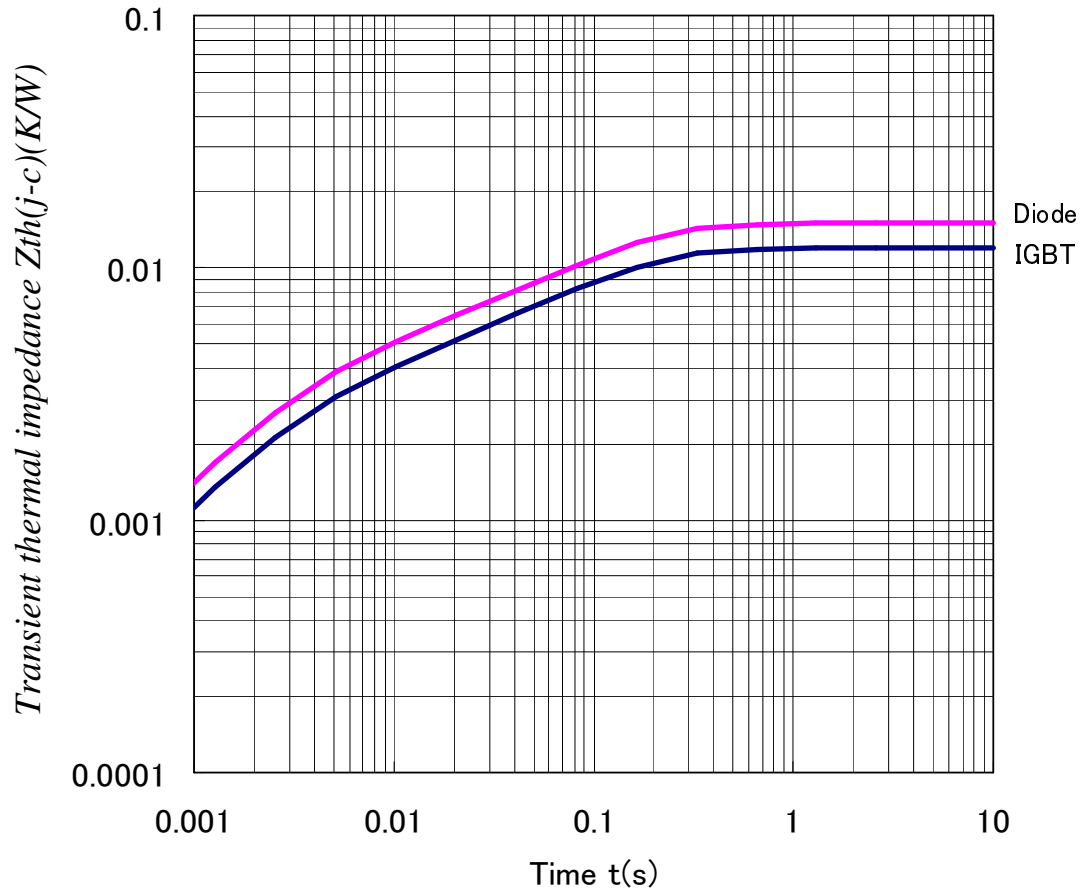
## 8. PACKAGE OUTLINE DRAWING



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## 9. Thermal Impedance

### 9.1 TRANSIENT THERMAL IMPEDANCE



***Transient Thermal Impedance Curve (Maximum Value)***

## 10. Negative environmental impact material

Please note the following materials are contained in the product in order to keep characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder
Arsenic and its compounds	Si chip

# HITACHI POWER SEMICONDUCTORS

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2. Please be sure to read "Precautions for Safe Use and Notices" in the individual brochure before use.
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