

MBN1200E17E

Silicon N-channel IGBT 1700V E version

1. FEATURES

- * Soft switching behavior & low conduction loss: Soft low-injection punch-through with trench gate IGBT.
- * Low driving power: Low input capacitance advanced trench gate.
- * Low noise recovery: Ultra soft fast recovery diode.
- * High thermal fatigue durability:($\Delta T_c=70K$, $N>30,000$ cycles)
- * AlSiC base-plate/AlN substrate.

2. ABSOLUTE MAXIMUM RATINGS (Tc=25°C)

Item		Symbol	Unit	MBN1200E17E
Collector Emitter Voltage		V_{CES}	V	1,700
Gate Emitter Voltage		V_{GES}	V	± 20
Collector Current	DC	I_C	A	1,200
	1ms	I_{CP}		2,400
Forward Current	DC	I_F	A	1,200
	1ms	I_{FM}		2,400
Total Power dissipation		P_{tot}	kW	5.5
Junction Temperature		T_j	°C	-40 ~ +125
Storage Temperature		T_{stg}	°C	-40 ~ +125
Isolation Voltage		V_{ISO}	V_{RMS}	4,000 (AC 1 minute)
Screw Torque	Terminals	(M4)	N·m	2 ⁽¹⁾
		(M8)		15 ⁽¹⁾
	Mounting	(M6)		5 ⁽²⁾

Notes: (1) Recommended Value $2.0^{+0.1}_{-0.2} / 15^{+0}_{-3}$ N·m
 (2) Recommended Value 5.0 ± 1 N·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	$V_{CE}=1,700V, V_{GE}=0V, T_j=25^{\circ}C$
			-	14	35	$V_{CE}=1,700V, V_{GE}=0V, T_j=125^{\circ}C$
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	-	$I_C=1,200A, V_{GE}=15V, T_j=25^{\circ}C$
			1.7	2.2	2.7	$I_C=1,200A, V_{GE}=15V, T_j=125^{\circ}C$
Gate Emitter Threshold Voltage	$V_{GE(TO)}$	V	5.0	6.5	8.0	$V_{CE}=10V, I_C=120mA, T_j=25^{\circ}C$
Input Capacitance	C_{ies}	nF	-	100	-	$V_{CE}=10V, V_{GE}=0V$ $f=100kHz, T_j=25^{\circ}C$
Reverse transfer Capacitance	C_{res}	nF	-	6	-	
Output Capacitance	C_{oes}	nF	-	11	-	
Total Gate Charge	Q_G	μC	-	7	-	$V_{GE}=\pm 15V, V_{CC}=900V, I_C=1,200A$
Turn-on Gate Charge	QG(on)	μC	-	3.3	-	$V_{GE}=-15V \rightarrow 0V, V_{CC}=900V, I_C=1,200A$
			-	4.3	-	$V_{GE}=-15V \rightarrow 8V, V_{CC}=900V, I_C=1,200A$
Internal Gate Resistance (Tentative)	$R_{ge(int)}$	Ω	-	2.0	-	$V_{CE}=10V, V_{GE}=0V, f=100kHz, T_j=25^{\circ}C$
Switching Times	Rise Time	t_r	0.5	1.1	2.2	$V_{CC}=900V, I_C=1,200A, L=100nH$ $R_G(on/off)=6.8/1.5\Omega^{(3)}$ $V_{GE}=\pm 15V, T_j=125^{\circ}C$
	Turn On Time	t_{on}	1.0	2.0	4.0	
	Fall Time	t_f	0.5	1.0	2.0	
	Turn Off Time	t_{off}	1.0	2.1	4.2	
Peak Forward Voltage Drop	V_{FM}	V	-	1.8	-	$I_F=1,200A, V_{GE}=0V, T_j=25^{\circ}C$
			1.4	1.9	2.5	$I_F=1,200A, V_{GE}=0V, T_j=125^{\circ}C$
Reverse Recovery Time	t_{rr}	μs	0.3	0.7	1.4	$V_{CC}=900V, I_C=1,200A$ $L=100nH$ $R_G(on/off)=6.8/1.5\Omega^{(3)}$ $V_{GE}=\pm 15V, T_j=125^{\circ}C$
Turn On Loss	$E_{on(10\%)}$	J/P	-	0.28	0.42	
	$E_{on(Full)}$	J/P	-	0.36	(0.54)	
Turn Off Loss	$E_{off(10\%)}$	J/P	-	0.8	1.2	
	$E_{off(Full)}$	J/P	-	0.9	(1.35)	
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	0.4	0.6	
	$E_{rr(Full)}$	J/P	-	0.5	(0.75)	
Reverse Recovery Peak Current	I_{RRM}	A	-	1000	-	
RBSOA	I_C	A	2400	-	-	$V_{CC}=1100V, L=100nH, R_G(on/off)=6.8/1.5\Omega^{(3)}$
Recovery SOA	I_F	A	2400	-	-	$V_{GE}=\pm 15V, T_j=125^{\circ}C$
I^2t value	I^2t	kA^2s	-	450	-	$T_{I,start}=125^{\circ}C, 10ms, V_R=0V$
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

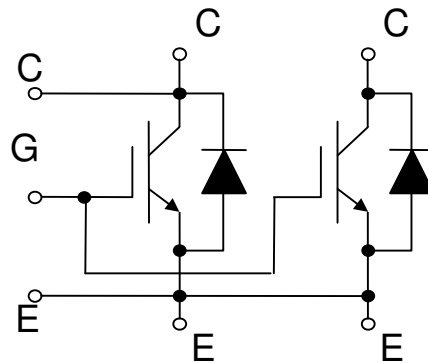
Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions	
Thermal Resistance	IGBT	$R_{th(j-c)}$	K/W	-	-	0.018	Junction to case
	FWD	$R_{th(j-c)}$		-	-	0.023	
Contact Thermal Impedance	$R_{th(c-f)}$	K/W	-	0.008	-	Case to fin. Thermal grease applied. Thickness 100 μm , Thermal conductivity of grease: 1W/mK	

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5. MODULE MECHANICAL CHARACTERISTICS

Item	Unit	Characteristics	Conditions	
Weight	g	900		
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	18	Collector-main to Emitter-main
	LS (E S - E M)		5.7	Emitter-sense to Emitter-main
	LS (C M - C S)		9.6	Collector-main to Collector sense
Terminal Resistance	R_{Terminal}	m Ω	0.14	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

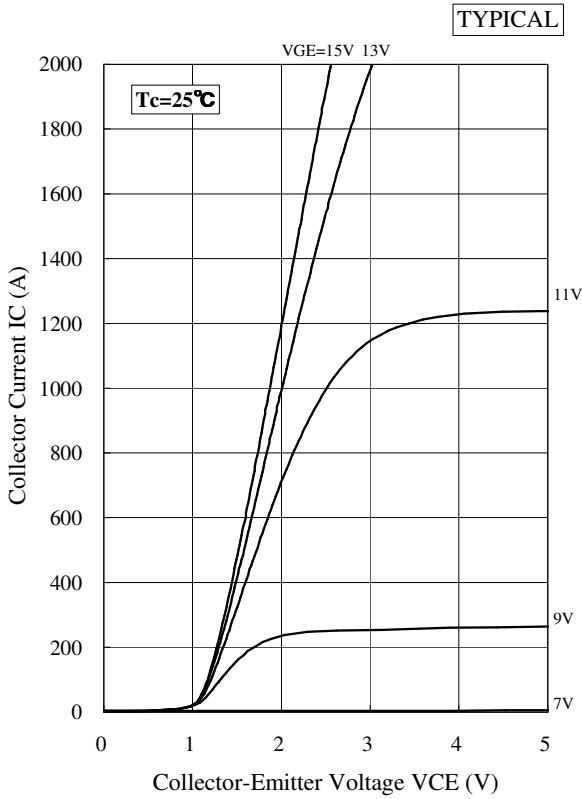


CIRCUIT DIAGRAM

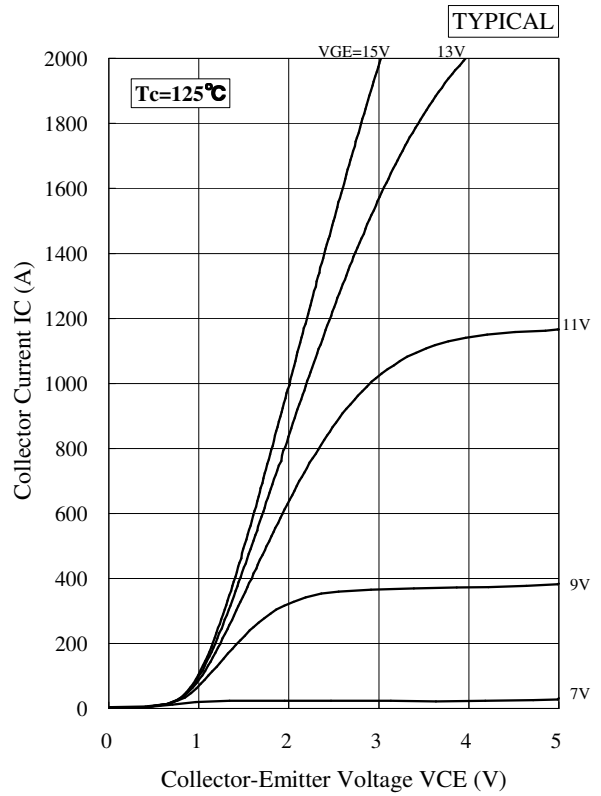
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7. CHARACTERISTICS CURVE

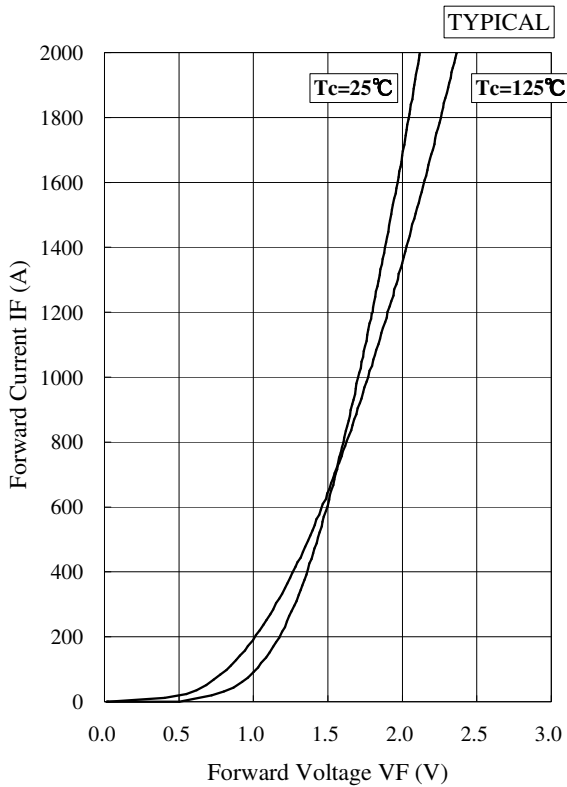
7.1 STATIC CHARACTERISTICS



Collector Current vs. Collector to Emittor Voltage

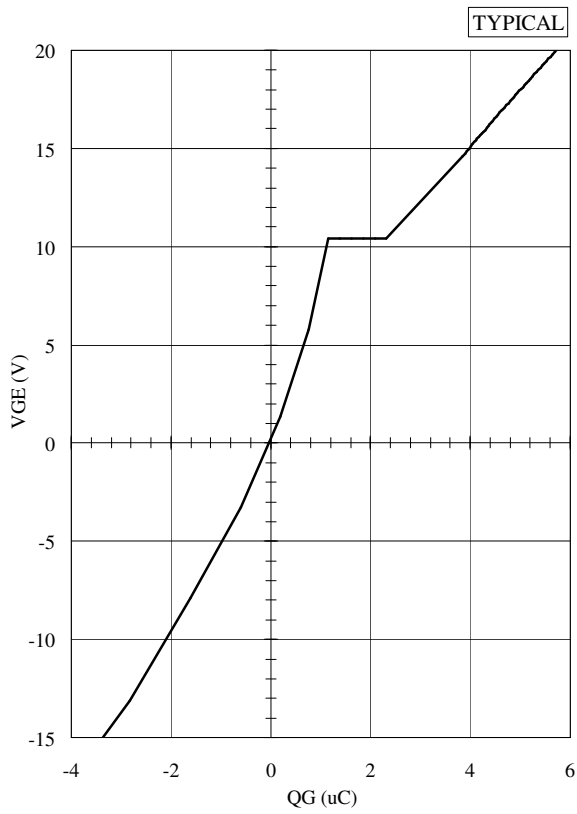


Collector Current vs. Collector to Emittor Voltage

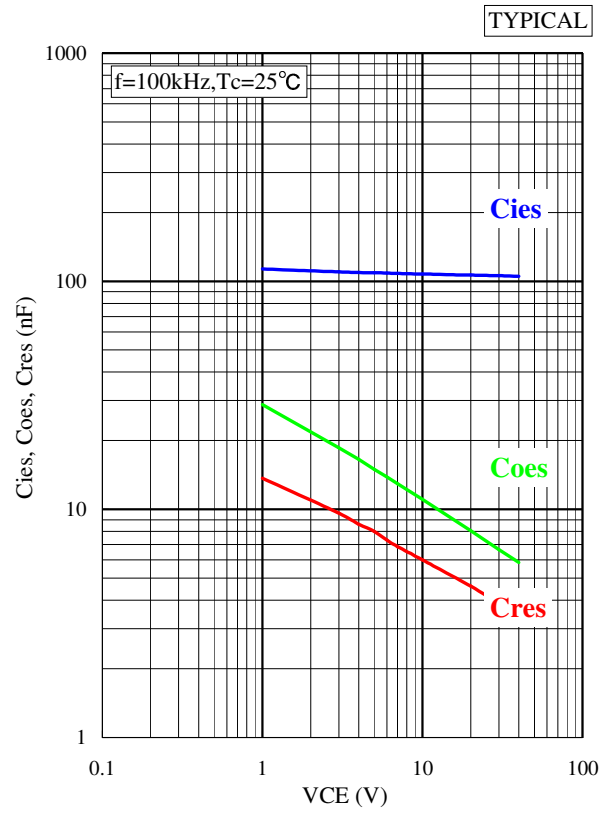


Forward Voltage of free-wheeling diode

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QG-VGE curve

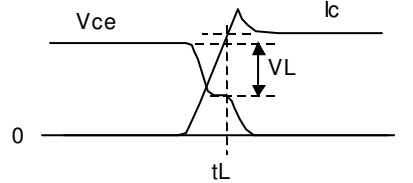
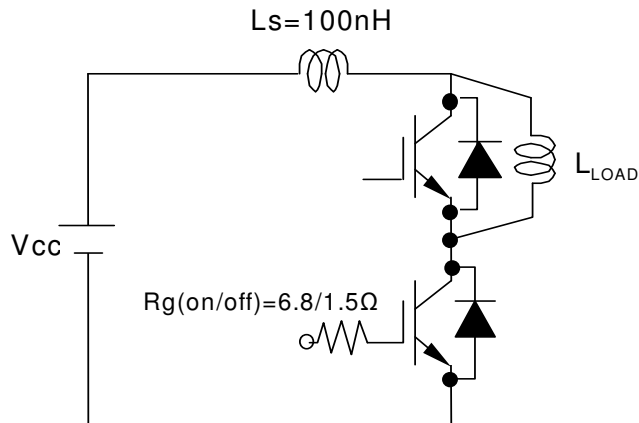


Cies, Coes, Cres vs. Vce

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7.2 DYNAMIC CHARACTERISTICS

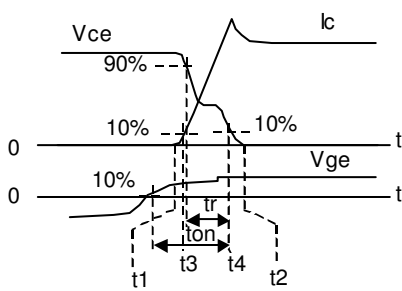
7.2.1 CIRCUIT



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

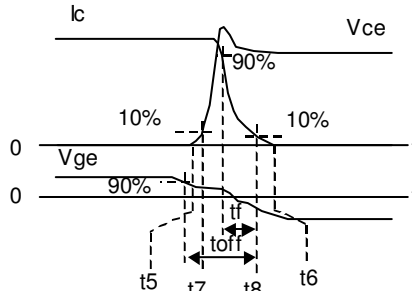
Definition of L_s

7.2.2 WAVEFORM DEFINITION



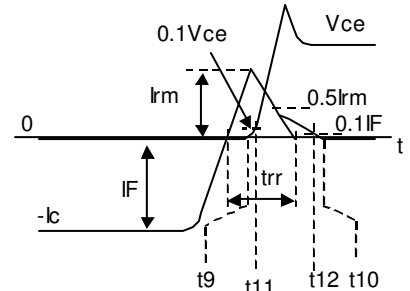
$$E_{on}(10\%) = \int_{t_3}^{t_4} I_c \cdot V_{ce} dt$$

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



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

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



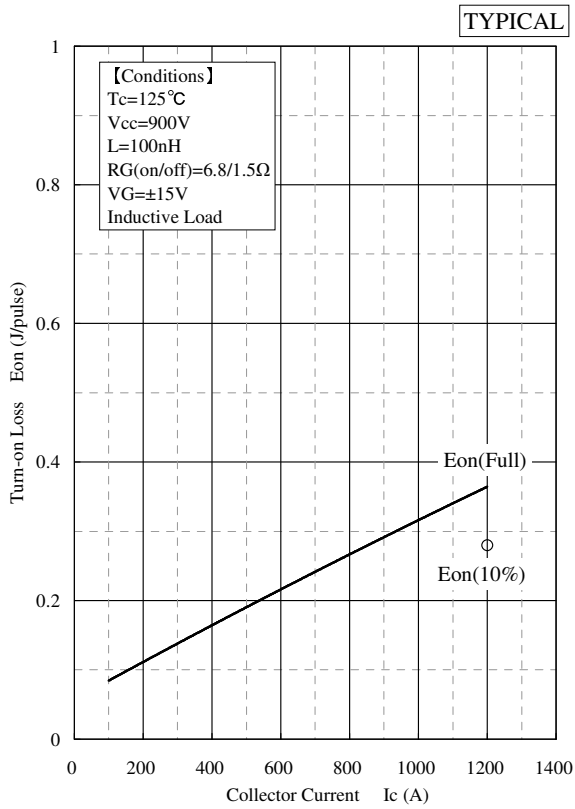
$$E_{rr}(10\%) = \int_{t_{11}}^{t_{12}} I_F \cdot V_{ce} dt$$

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

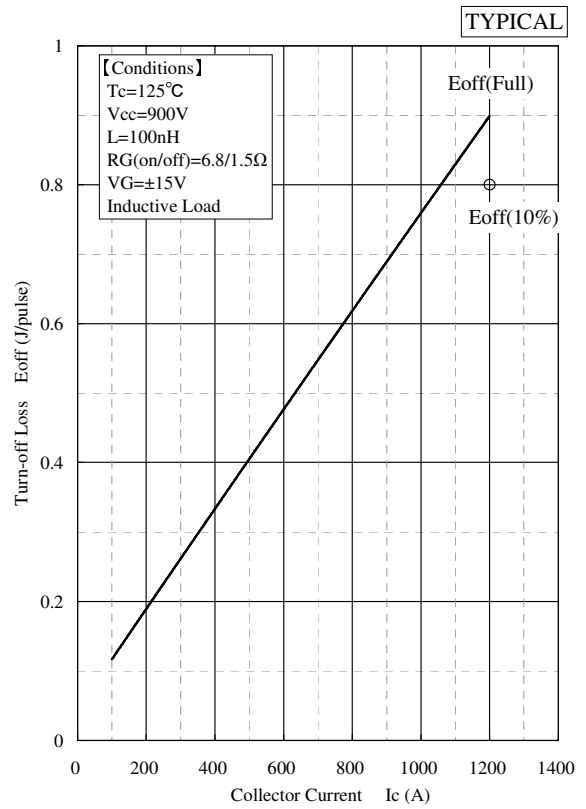
Definition of switching loss

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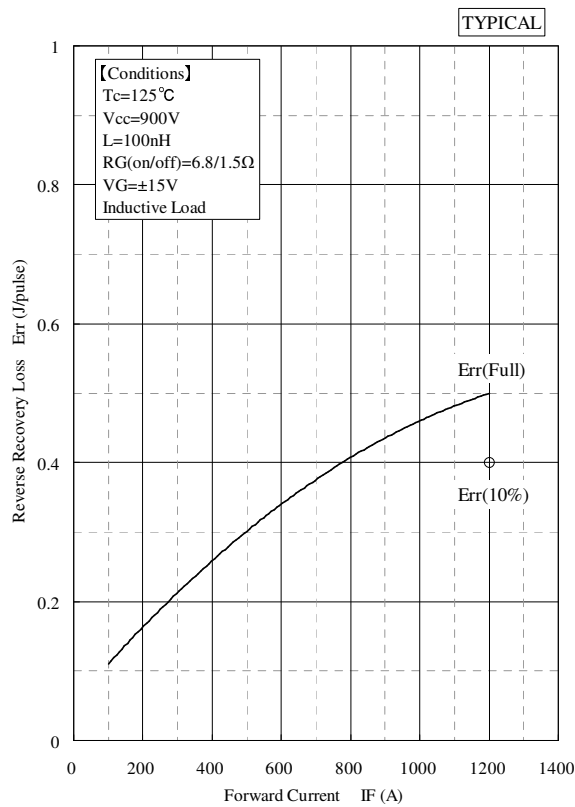
7.2.3 DEPENDENCE OF CURRENT



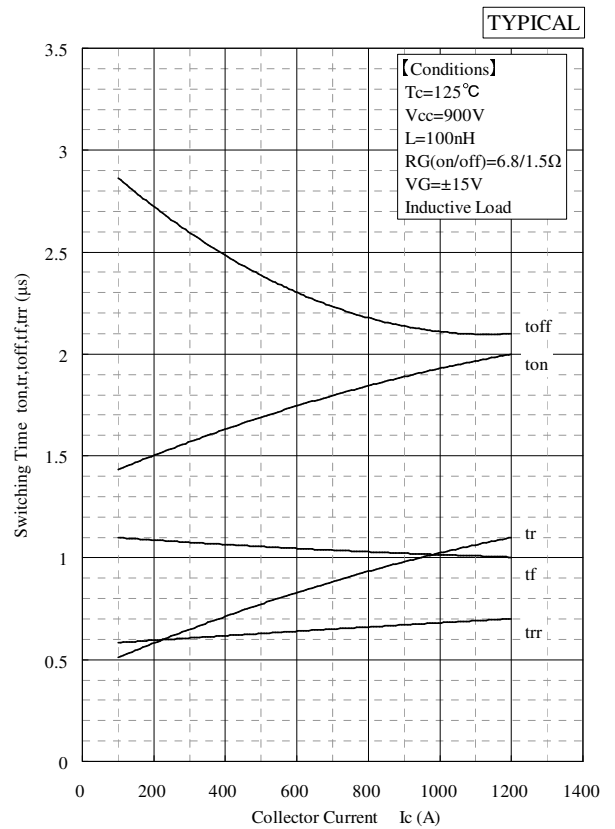
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current



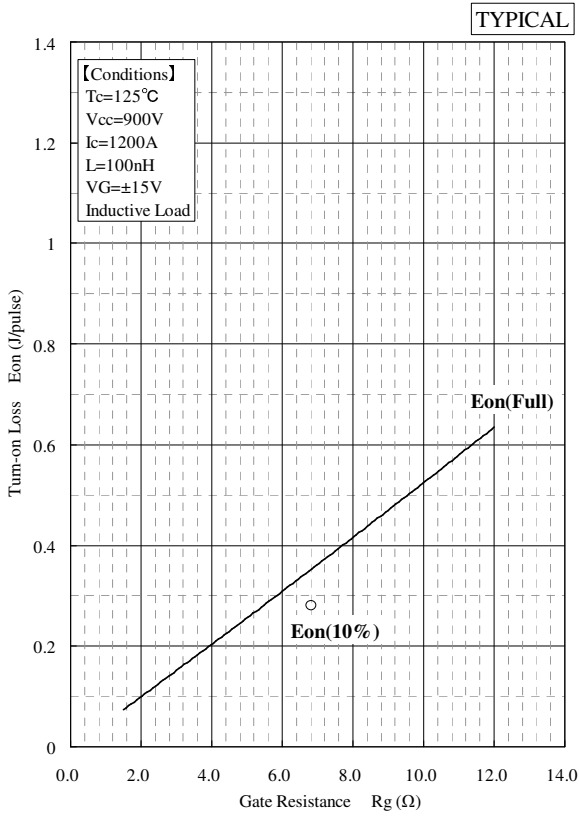
Reverse Recovery Loss vs. Forward Current



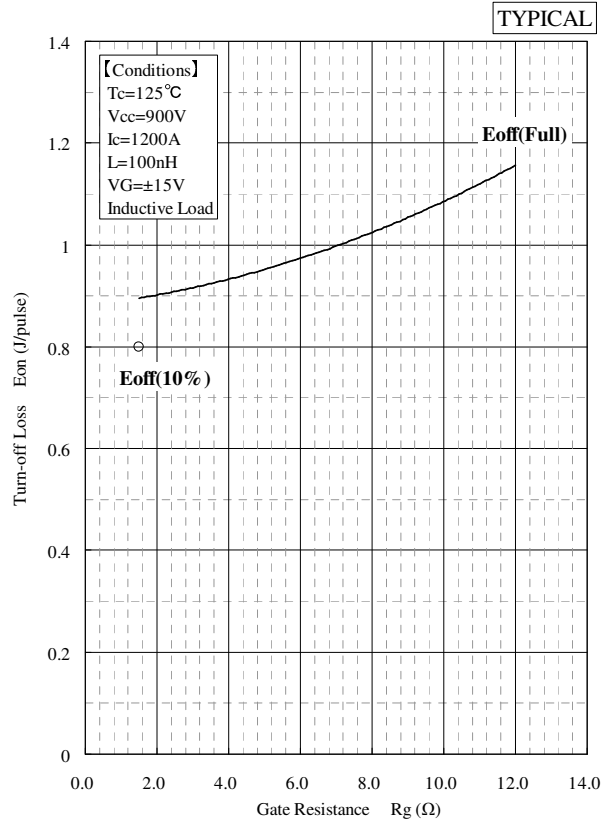
Switching Time vs. Collector Current

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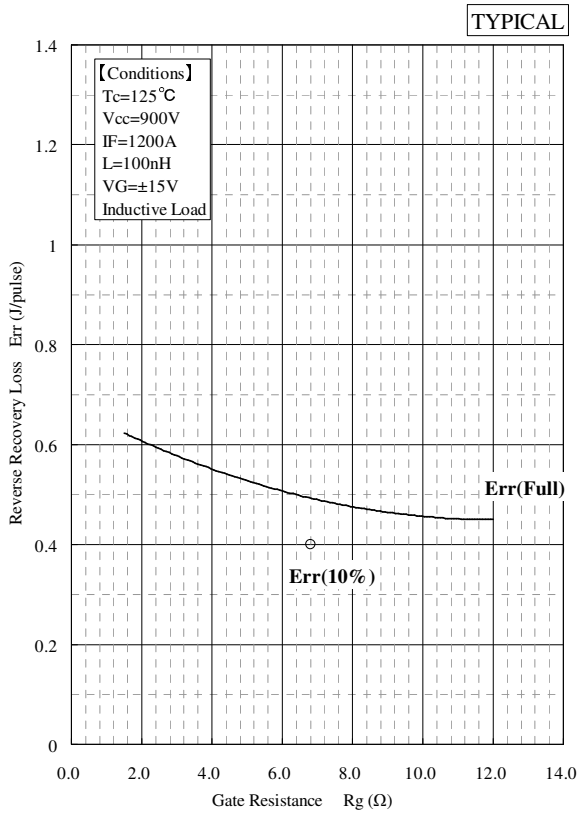
7.2.4 DEPENDENCE OF RG



Turn-on Loss vs. Gate Resistance



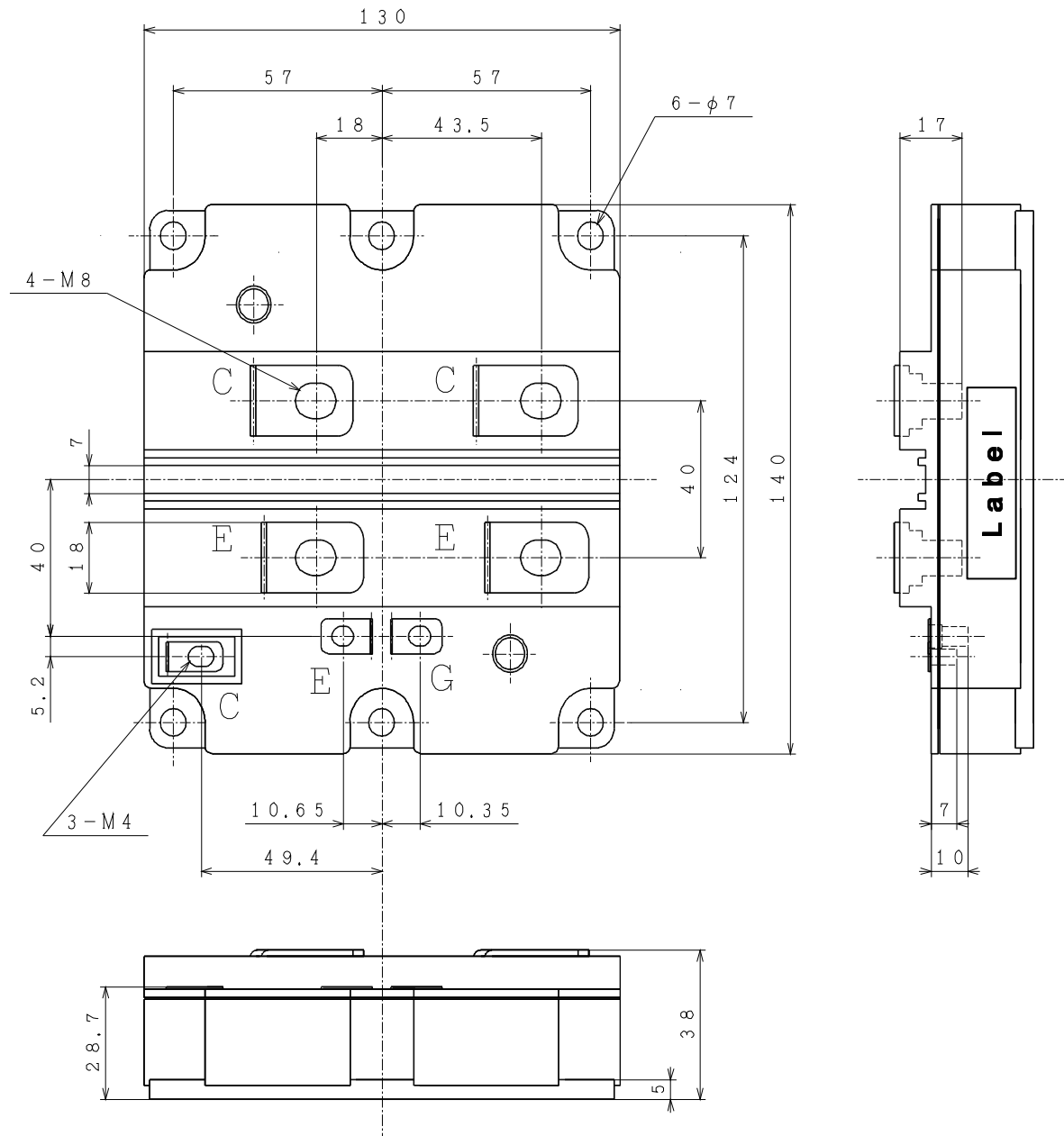
Turn-off Loss vs. Gate Resistance



Reverse Recovery Loss vs. Gate Resistance

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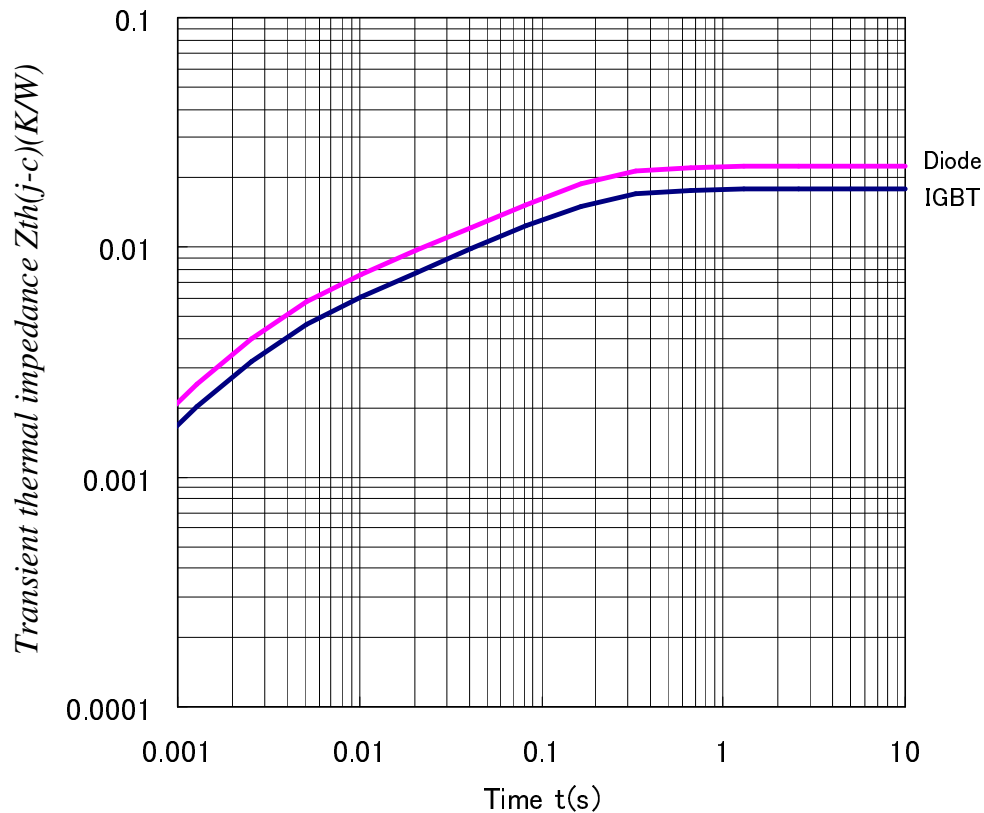
8. PACKAGE OUTLINE DRAWING



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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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