MBN2400E17D

Silicon N-channel IGBT

1. FEATURES

* High speed, low loss IGBT module due to LiPT Trench Technology
* Low noise due to ultra soft fast recovery diode. (U-SFD)
* High reverse recovery capability (HiRC)
* High thermal fatigue durability. (ΔTc=70K, N>30,000cycles)
* Isolated heat sink (terminal to base).

2. ABSOLUTE MAXIMUM RATINGS (Tc=25^{o}C)

Item			Symbol	Unit	MBN2400E17D
Collector Emitter Voltage			V_{CES}	V	1,700
Gate Emitter Voltage			V_{GES}	V	±20
Collector Current		DC	I_C	A	2,400
		1ms	I_{Cp}		4,800
Forward Current		DC	I_F	A	2,400
		1ms	I_{FM}		4,800
Junction Temperature			T_j	^{o}C	-40 ~ +125
Storage Temperature			Tstg	^{o}C	-40 ~ +125
Isolation Voltage			V_{ISO}	V_{RMS}	4,000 (AC 1 minute)
Screw Torque	Terminals	(M4)	-	N·m	2 (1)
		(M8)	-		10 (1)
	Mounting	(M6)	-		6 (2)

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

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, Tj=25^{o}C
				-	15	50	V_{CE}=1,700V, V_{GE}=0V, Tj=125^{o}C
Gate Emitter Leakage Current		I_{GES}	nA	-500	-	+500	V_{GE}=±20V, V_{CE}=0V, Tj=25^{o}C
Collector Emitter Saturation Voltage		$V_{CE(sat)}$	V	1.7	2.3	2.9	I_C=2,400A, V_{GE}=15V, Tj=25^{o}C
				1.9	2.6	3.3	I_C=2,400A, V_{GE}=15V, Tj=125^{o}C
Gate Emitter Threshold Voltage		$V_{GE(TO)}$	V	5.0	6.5	8.0	V_{CE}=10V, I_C=240mA, Tj=25^{o}C
Input Capacitance		C_{ies}	nF	-	210	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, Tj=25^{o}C
Gate Charge		Q_G	µC	-	15	-	VGE=±15V, Vcc=900V, Ic=2400A
Internal Gate Resistance		$R_{ge(int)}$	Ω	-	0.9	-	V_{CE}=10V, V_{GE}=0V, f=100kHz, Tj=25^{o}C
Switching Times	Rise Time	t_r	µs	-	1.2	2.2	V_{CC}=900V, Ic=2,400A
	Turn On Time	t_{on}		-	1.9	3.4	L=55nH,C_{GE}=220nF (3)
	Fall Time	t_f		-	0.2	0.4	R_G=1.5Ω (3)
	Turn Off Time	t_{off}		-	2.2	3.6	V_{GE}=±15V, Tj=125^{o}C
Peak Forward Voltage Drop		V_{FM}	V	1.1	1.6	2.2	IF=2,400A, V_{GE}=0V, Tj=25^{o}C
				1.2	1.7	2.5	IF=2,400A, V_{GE}=0V, Tj=125^{o}C
Reverse Recovery Time		t_{rr}	µs	-	0.8	1.4	V_{CC}=900V, Ic= IF=2,400A L=55nH,C_{GE}=220nF (3) R_G=1.5Ω (3) V_{GE}=±15V, Tj=125^{o}C
Turn On Loss		$E_{on(10\%)}$	J/P	-	1.0	1.5	
Turn Off Loss		$E_{off(10\%)}$	J/P	-	0.9	1.4	
Reverse Recovery Loss		$E_{rr(10\%)}$	J/P	-	0.7	1.1	
Reverse Recovery Peak Current		IRM	A	-	1900	-	
Stray inductance in module		L_{SCE}	nH		12		
RBSOA		Ic	A	4800	-	-	V_{CC}=1000V, L=55nH,C_{GE}=220nF (3) R_G=1.5Ω (3) V_{GE}=±15V, Tj=125^{o}C
Recovery SOA		I_F	A	4800	-	-	
Partial Discharge Extinction Voltage		V_{PDoff}	V_{RMS}	1.3	-	-	Q=10pC, 50Hz,

Notes : (3) R_G and C_{GE} value is the test condition's value for evaluation of the switching times, not recommended value. Please, determine the suitable R_G and C_{GE} value after the measurement of switching waveforms (overshoot voltage, etc.) with appliance mounted.

* 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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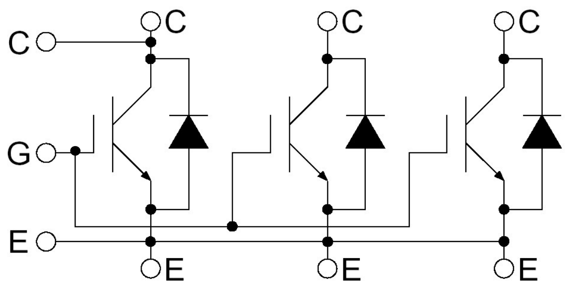
4. THERMAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Thermal Resistance	IGBT	Rth(j-c)	K/W	-	-	0.010	Junction to case
	FWD	Rth(j-c)		-	-	0.015	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.006	-	Case to fin. Thermal grease applied. Thickness 100µm, Thermal conductivity of grease: 1W/mK

5. MODULE MECHANICAL CHARACTERISTICS

Item		Unit	Characteristics	Conditions
Weight		g	1300	
Creepage Distance	Between terminal	mm	35	
	Terminal-Base	mm	35	
Clearance Distance	Between terminal	mm	22	
	Terminal-Base	mm	19.5	
Stray inductance in module	LS(CM-EM)	nH	12	Collector-main to Emitter-main
	LS(ES-EM)		3.8	Emitter-sense to Emitter-main
	LS(CM-CS)		6.4	Collector-main to Collector sense
Terminal Resistance	$R_{Terminal}$	mΩ	0.09	Collector-main to Emitter-main
Comparative Tracking Index (CTI)			600	
Module base plate Material			Al-SiC	
Baseplate Thickness		mm	5	
Insulation plate 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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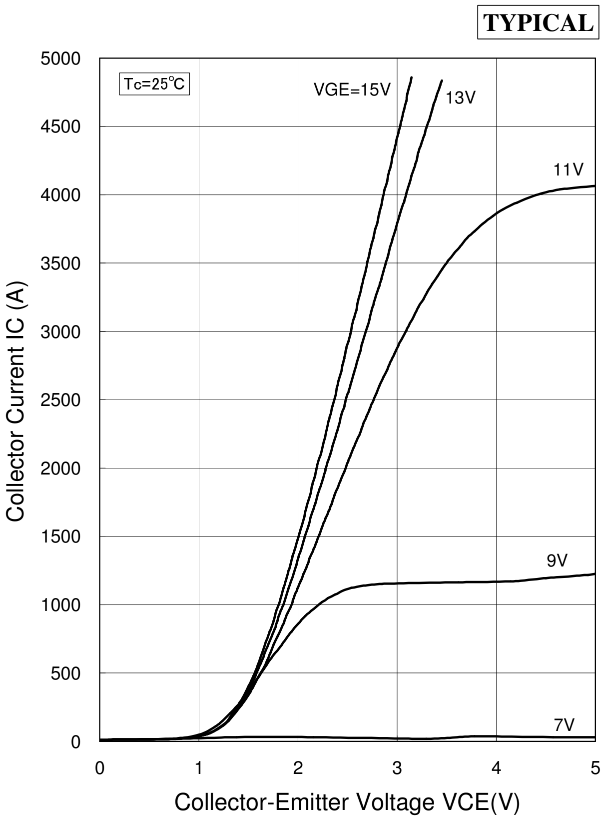
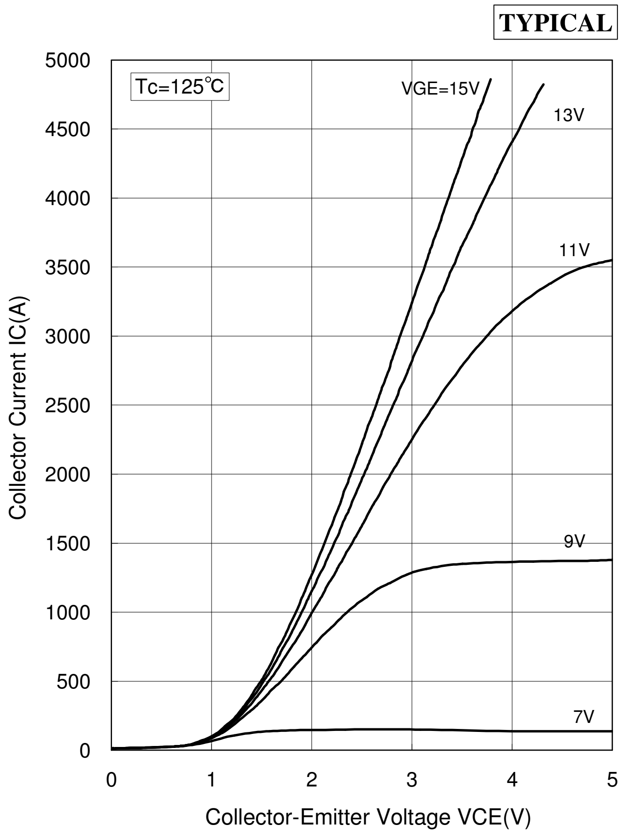
7. CHARACTERISTICS CURVE

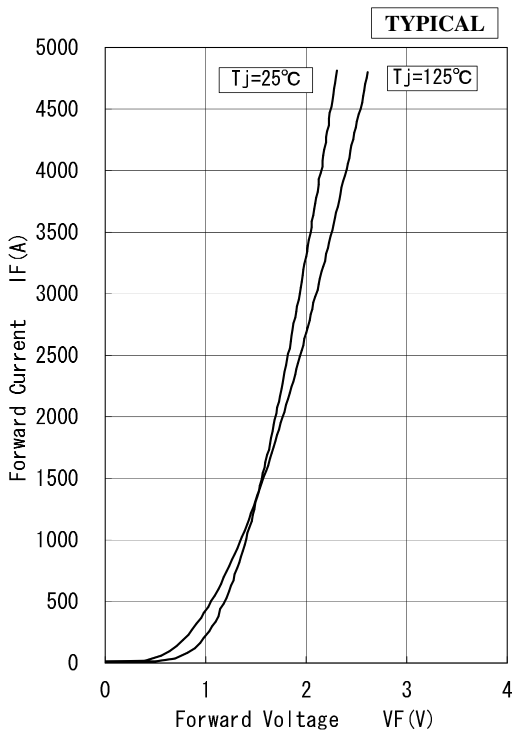
7.1 STATIC CHARACTERISTICS



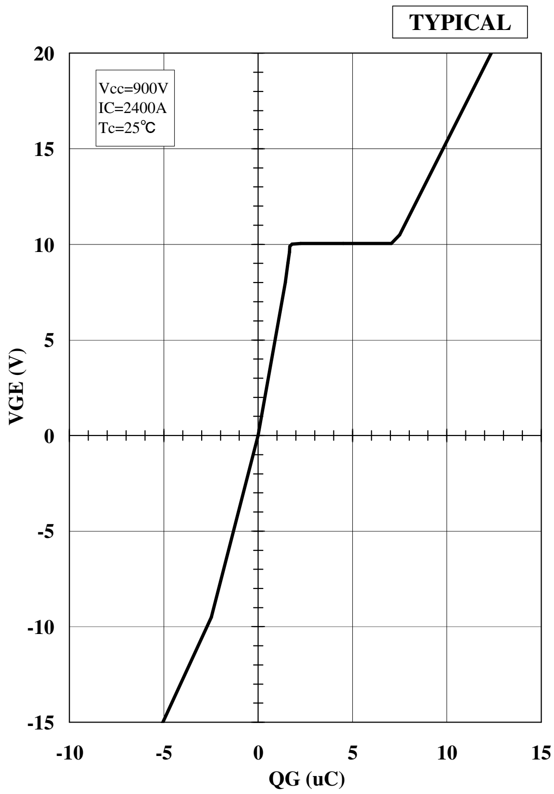
Collector Current vs.Collector to Emitter Voltage



Collector Current vs.Collector to Emitter Voltage



Forward Voltage of free-wheeling diode



QG-VGE curve

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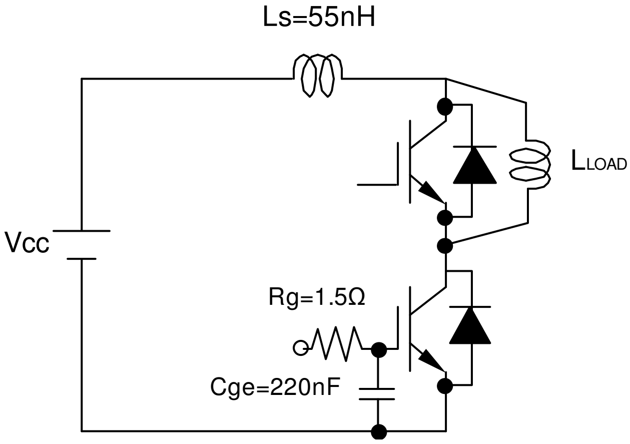
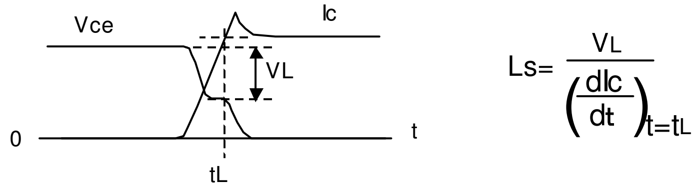
7.2 DYNAMIC CHARACTERISTICS

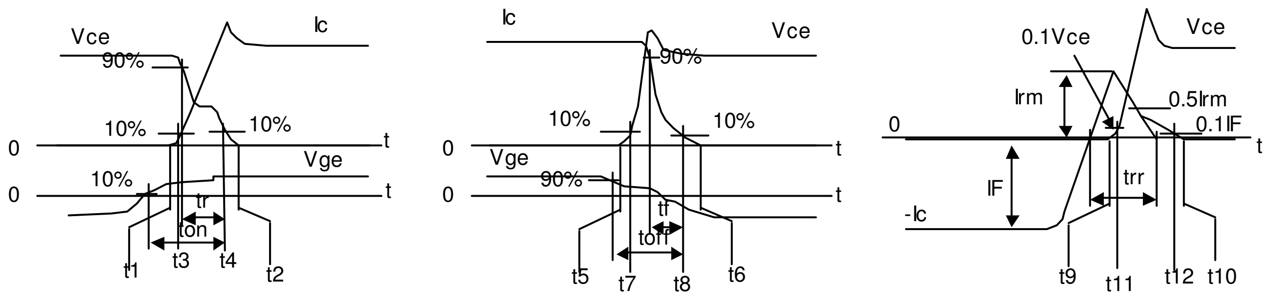
7.2.1 CIRCUIT





Definition of Ls

7.2.2 WAVEFORM DEFINITION



$$Eon(10\%)=\int_{t3}^{t4} Ic\cdot Vce\ dt \qquad Eoff(10\%)=\int_{t7}^{t8} Ic\cdot Vce\ dt \qquad Err(10\%)=\int_{t11}^{t12} IF\cdot Vce\ dt$$

$$Eon(Full)=\int_{t1}^{t2} Ic\cdot Vce\ dt \qquad Eoff(Full)=\int_{t5}^{t6} Ic\cdot Vce\ dt \qquad Err(Full)=\int_{t9}^{t10} IF\cdot Vce\ dt$$

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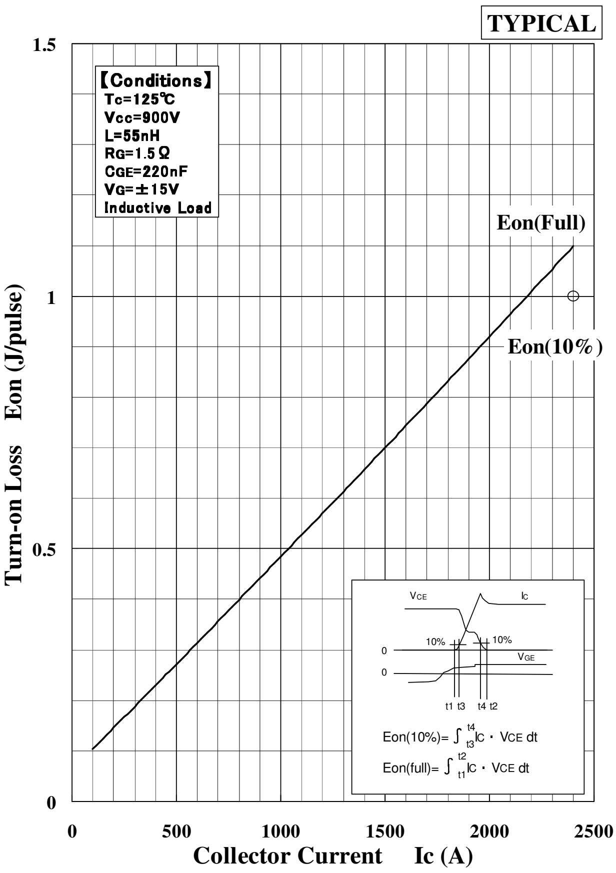
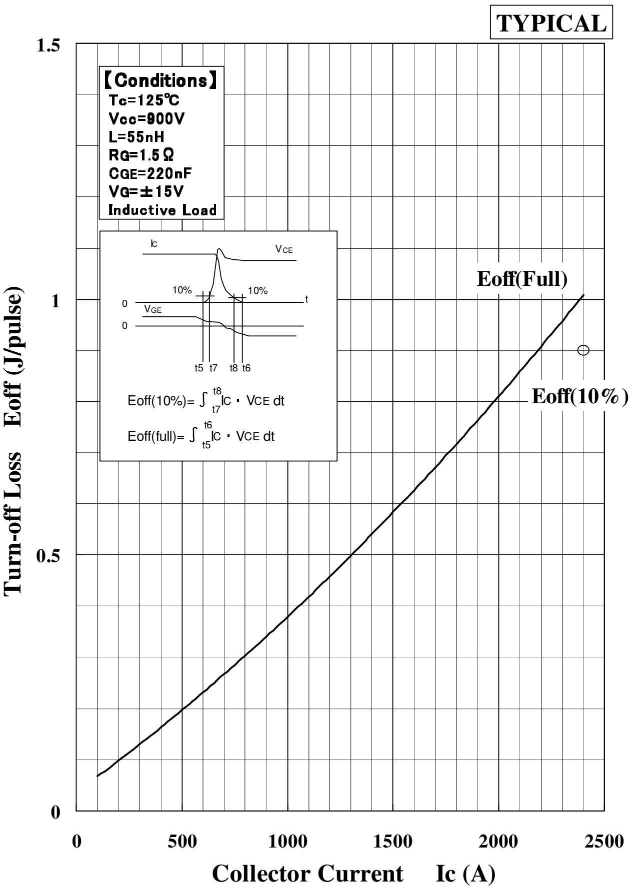
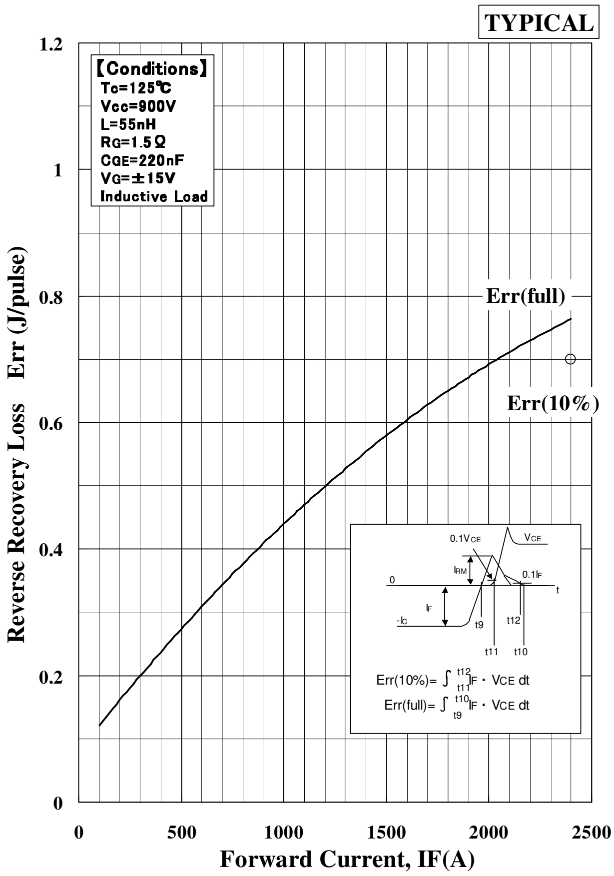
7.2.3 DEPENDENCE OF CURRENT



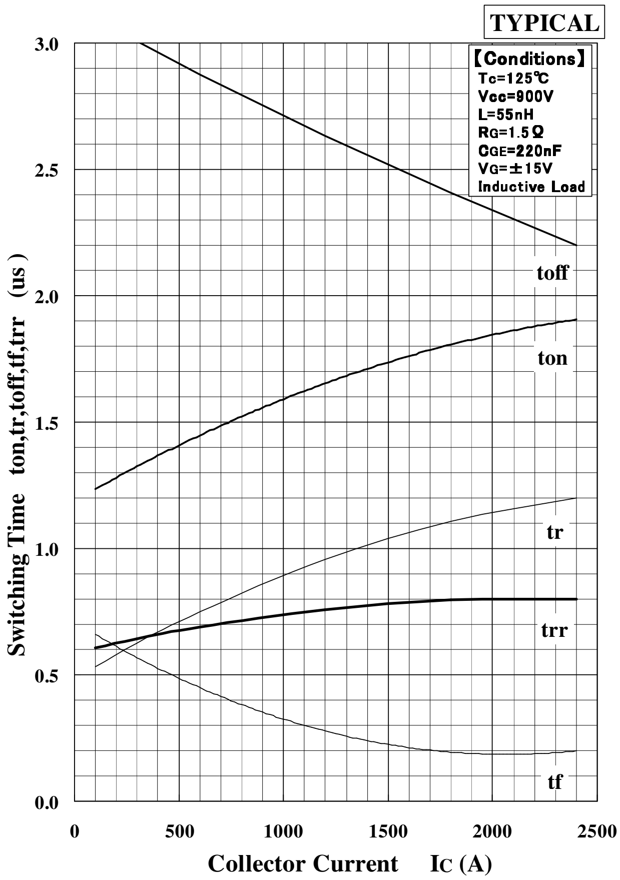
Turn-on Loss vs. Collector Current



Turn-off Loss vs. Collector Current



Recovery Loss vs. Foeward Current



Switching Time vs. Collector Current

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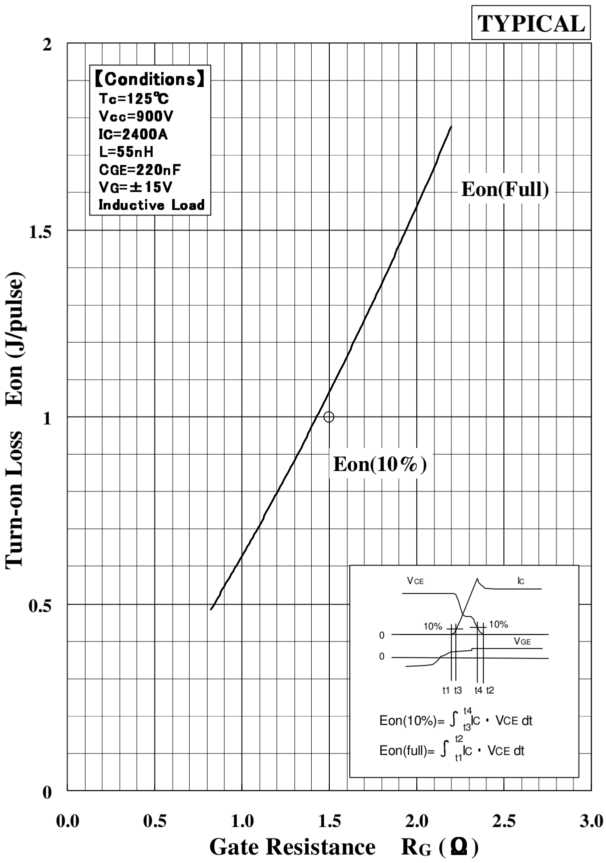
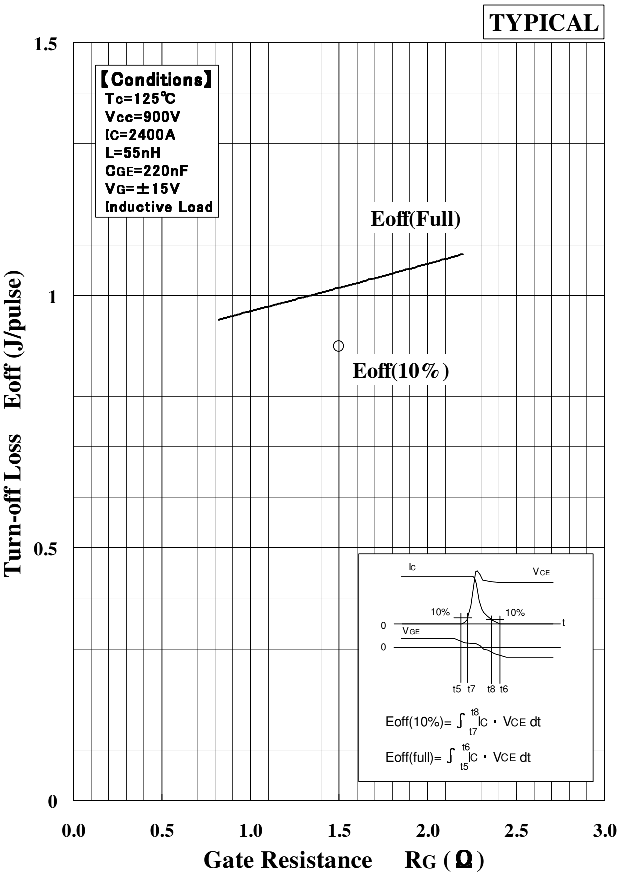
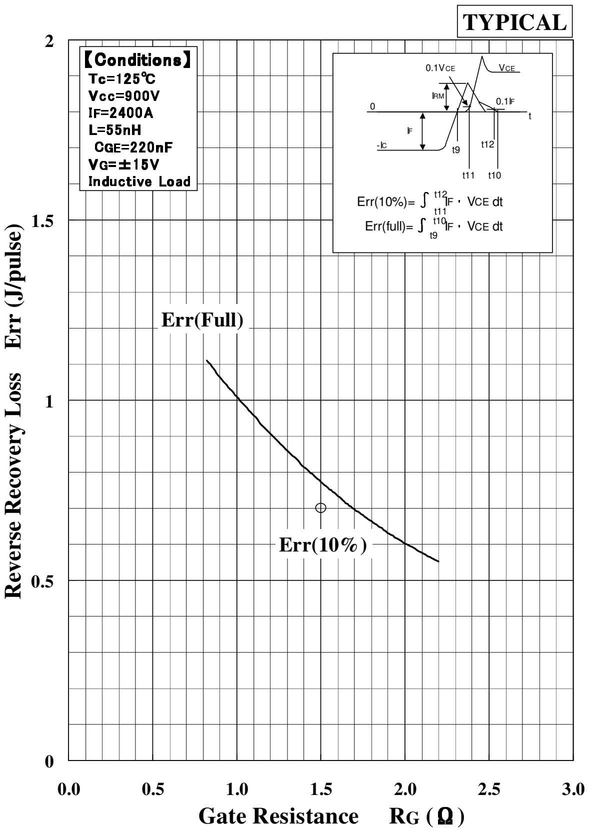
7.2.4 DEPENDENCE OF RG



Turn-on Loss vs. Gate Resistance



Turn-off Loss vs. Gate Resistance



Recovery Loss vs. Gate Resistance

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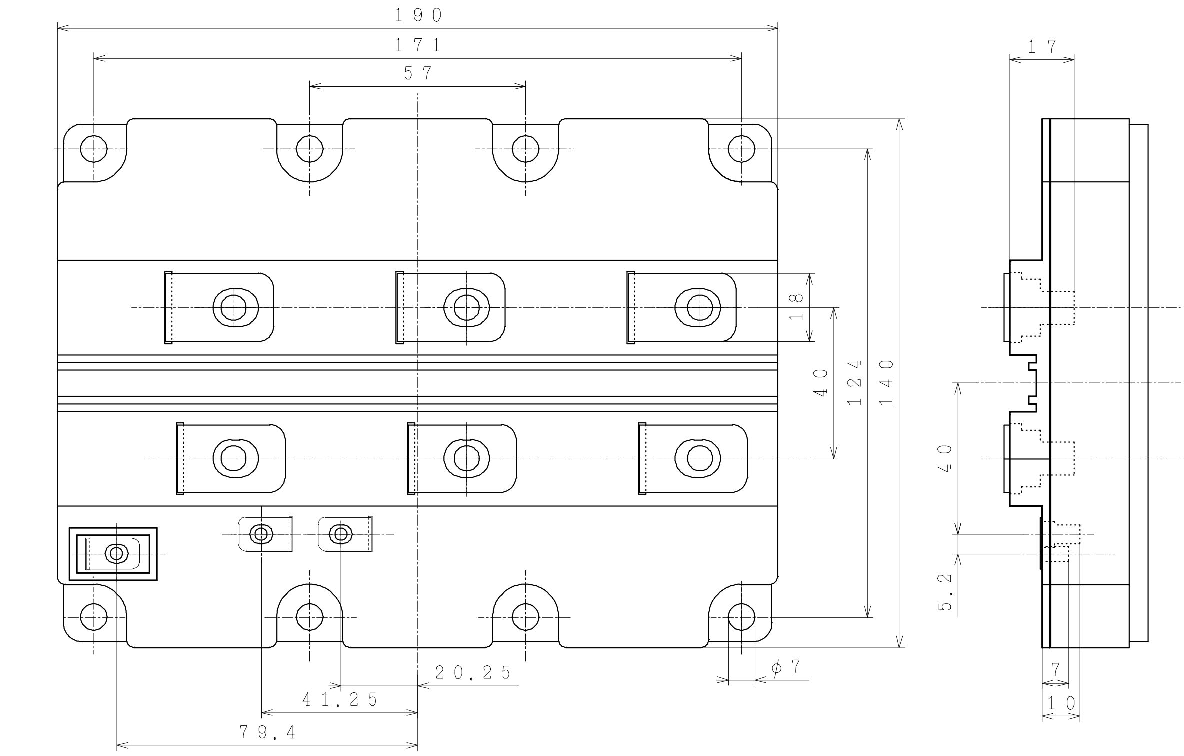
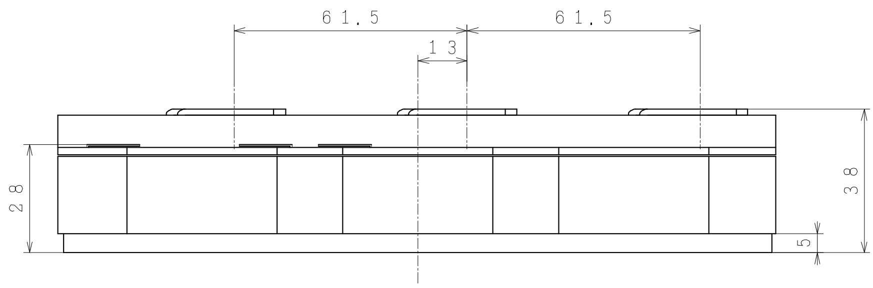
8. PACKAGE OUTLINE DRAWING





Weight: 1300g

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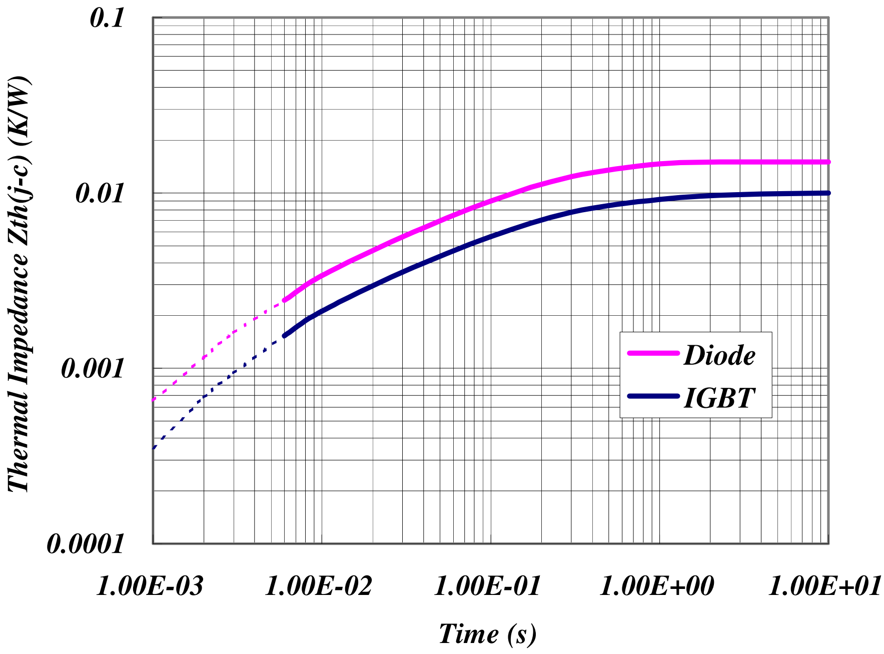
9. Thermal Impedance

9.1 TRANSIENT THERMAL IMPEDANCE



Thermal Impedance Cureve (Maximum Value)

9.2 Curve approximation model

Following expressions approximates the transient thermal impedance curves.

Please note that the expressions are the curve fitted value, and there is no physical meaning in this expression. The expressions are applicable under following condition only.

Condition 1: Time is more than t (1)/e

Condition 2: No heat sink model is considered.

$$Z_{th(j\text{-}c)} = \Sigma\, z_{th(n)} \cdot [1-\exp\{-t/\tau_{th(n)}\}] \qquad (1)$$

n (IGBT)		1	2	3	4	5	6
Zth(n,IGBT)	(K/kW)	0.5	1.3	1.8	2.0	2.4	2.0
τth(n,IGBT)	(s)	0.003	0.01	0.03	0.1	0.3	1
n (Diode)		1	2	3	4	5	6
Zth(n,Diode)	(K/kW)	1.2	1.6	2.0	4.4	4.2	1.6
τth(n,Diode)	(s)	0.003	0.01	0.03	0.1	0.3	1

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10. Negative environmental impact material

Please note the following negative environmental impact materials are contained in the product in order to keep product 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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