MBM250H33E3

Silicon N-channel IGBT 3300V E3 version

FEATURES

- Soft switching behavior & low conduction loss:
  Soft low-injection punch-through High conductivity IGBT.
- Low driving power due to low input capacitance MOS gate.
- Low noise recovery: Ultra soft fast recovery diode.

ABSOLUTE MAXIMUM RATINGS (Tc=25ºC)

Item		Symbol	Unit	MBM250H33E3
Collector Emitter Voltage		V_{CES}	V	3,300
Gate Emitter Voltage		V_{GES}	V	±20
Collector Current	DC	I_C	A	250 (Tc=95 ºC)
	1ms	I_{Cp}		500
Forward Current	DC	I_F	A	250
	1ms	I_{FM}		500
Peak Forward Surge Current		IFSM	Ap	2000
Total Power Dissipation		Ptot	W	2500 (Tc=25ºC per IGBT)
Junction Temperature		T_j	ºC	-40 ~ +150
Junction Operating Temperature		Tjop	ºC	-40 ~ +125
Case Temperature		Tc	ºC	-40 ~ +125
Storage Temperature		T_{stg}	ºC	-50 ~ +125
Isolation Voltage		V_{ISO}	V_{RMS}	7,700 (AC 1 minute)
Screw Torque	Mounting (M6)	-	N·m	6 (1)

Notes: (1) Recommended Value 5.5±0.5N·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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ELECTRICAL CHARACTERISTICS (IGBT)

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions	
Collector Emitter Cut-Off Current		I_{CES}	mA	-	-	2	Tj=25ºC	V_{CE}=3,300V, V_{GE}=0V
				-	4	10	Tj=125ºC	
Gate Emitter Leakage Current		I_{GES}	nA	-500	-	+500	V_{GE}=±20V, V_{CE}=0V, Tj=25ºC	
Collector Emitter Saturation Voltage		$V_{CE(sat)}$	V	-	2.65	-	Tj=25ºC	I_C=250A, V_{GE}=15V
				2.70	3.40	3.90	Tj=125ºC	
				-	3.60	-	Tj=150ºC	
Gate Emitter Threshold Voltage		$V_{GE(TO)}$	V	5.5	6.3	7.5	V_{CE}=10V, I_C=250mA, Tj=25ºC	
Gate Charge		Qg	µC	-	2.8	-	V_{CC}=2800V, Ic=250A, V_{GE}=+/-15V	
Input Capacitance		C_{ies}	nF	-	33	-	V_{CE}=10V,V_{GE}=0V, f=100kHz, Tj=25ºC	
Output Capacitance		C_{oes}	nF	-	3.3	-		
Reverse transfer capacitance		C_{res}	nF	-	2.3	-		
Internal Gate Resistance		Rge	Ω	-	5.4	-	V_{CE}=10V,V_{GE}=0V, f=100kHz, Tj=25ºC	
Switching Times	Rise Time	t_r	µs	-	1.5	-	Tj=25ºC	V_{CC}=1,800V, Ic=250A, Ls=400nH, R_G=15Ω (2), V_{GE}=+/-15V
				-	1.8	2.5	Tj=125ºC	
				-	1.9	-	Tj=150ºC	
	Turn On Time	t_{on}		-	2.1	-	Tj=25ºC	
				-	2.5	3.3	Tj=125ºC	
				-	2.5	-	Tj=150ºC	
	Fall Time	t_f		-	1.6	-	Tj=25ºC	
				-	1.9	3.2	Tj=125ºC	
				-	1.9	-	Tj=150ºC	
	Turn Off Time	t_{off}		-	3.6	-	Tj=25ºC	
				-	4.0	5.2	Tj=125ºC	
				-	4.0	-	Tj=150ºC	
Turn On Loss		$E_{on(full)}$	J/p	-	0.35	-	Tj=25ºC	V_{CC}=1800V, Ic=250A, Ls=400nH R_G= 15Ω (2) V_{GE}=+/-15V
		$E_{on(10\%)}$		-	0.43	0.58	Tj=125ºC	
		$E_{on(full)}$		-	0.48	-	Tj=125ºC	
		$E_{on(full)}$		-	0.50	-	Tj=150ºC	
Turn Off Loss		$E_{off(full)}$		-	0.40	-	Tj=25ºC	
		$E_{off(10\%)}$		-	0.37	0.50	Tj=125ºC	
		$E_{off(full)}$		-	0.48	-	Tj=125ºC	
		$E_{off(full)}$		-	0.49	-	Tj=150ºC	

Notes:(2) 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.

ELECTRICAL CHARACTERISTICS (DIODE)

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions	
Peak Forward Voltage Drop	V_{FM}	V	-	2.70	-	Tj=25ºC	IF=250A, V_{GE}=0V
			2.30	2.90	3.30	Tj=125ºC	
			-	2.80	-	Tj=150ºC	
Reverse Recovery Time	t_{rr}	µs	-	0.50	-	Tj=25ºC	V_{CC}=1800V,IF=250A, Ls=400nH, R_G= 15Ω (3)
			-	0.70	1.2	Tj=125ºC	
			-	0.80	-	Tj=150ºC	
Reverse Recovery Current	I_{rr}	A	-	270	-	Tj=25ºC	
			-	330	-	Tj=125ºC	
			-	330	-	Tj=150ºC	
Recovery charge	Qrr	µC	-	70	-	Tj=25ºC	
			-	120	-	Tj=125ºC	
			-	120	-	Tj=150ºC	
Reverse Recovery Loss	$E_{rr(full)}$	J/ p	-	0.21	-	Tj=25ºC	V_{CC}=1800V,IF=250A, Ls=400nH, R_G= 15Ω (3)
	$E_{rr(10\%)}$		-	0.31	0.41	Tj=125ºC	
	$E_{rr(full)}$		-	0.40	-	Tj=125ºC	
	$E_{rr(full)}$		-	0.45	-	Tj=150ºC	

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.

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THERMAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Thermal Impedance	IGBT	Rth(j-c)	K/W	-	-	0.050	Junction to case
	FWD	Rth(j-c)		-	-	0.100	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.032	-	Case to fin (λgrease=1W/(m·K), heat-sink flatness ≤50um)

MODULE MECHANICAL CHARACTERISTICS

Item		Unit	Characteristics	Conditions
Weight		g	840	
Creepage Distance	Between terminal	mm	54	Collector-sense to Emitter-main
	Terminal-Base	mm	64	
Clearance Distance	Between terminal	mm	19	Collector-sense to Emitter-main
	Terminal-Base	mm	35	
Stray inductance in module	LS(CM-EM)	nH	140	Between C1- E2
Resistance, Terminal-chip	$R_{CC'+EE'}$	mΩ	1.5	Terminal to chip
Comparative Tracking Index (CTI)			600	
Module base plate Material			Cu	
Baseplate Thickness		mm	5	
Insulation plate Material			AlN	
Terminal Surface treatment			Ni plating	
Case Material			Poly-Phenilene Sulfide	

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DEFINITION OF TEST CIRCUIT

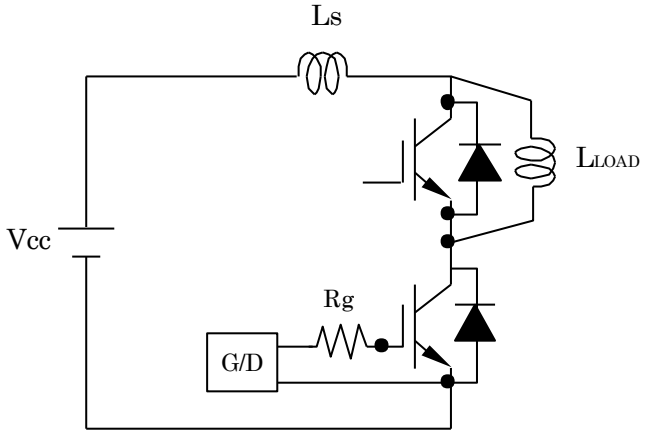
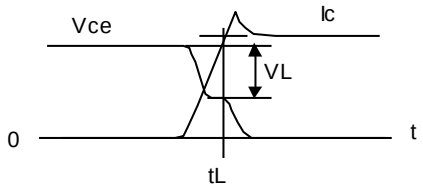
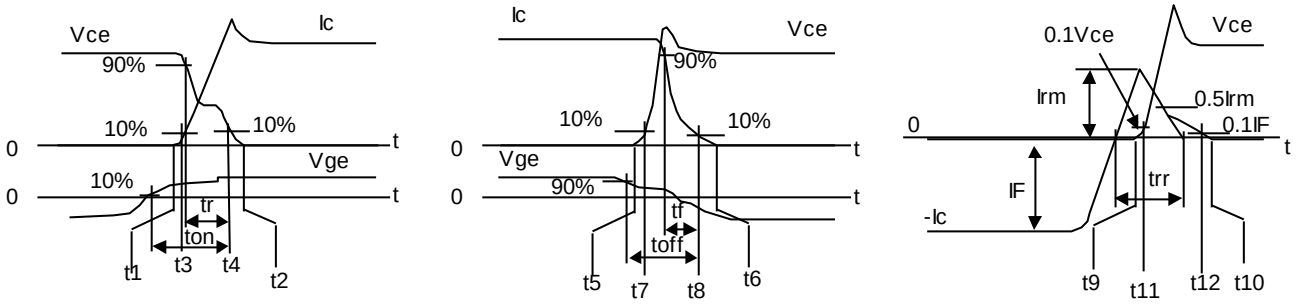


Fig.1 Switching test circuit



$$Ls = \frac{VL}{\left(\frac{dIc}{dt}\right)_{t=tL}}$$

Fig.2 Definition of Ls



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

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

Fig.3 Definition of switching loss

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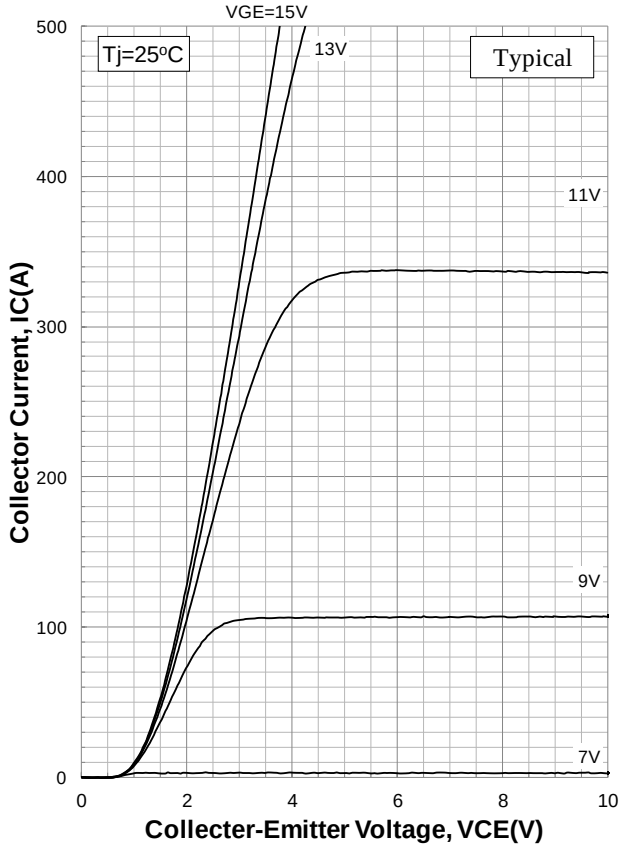
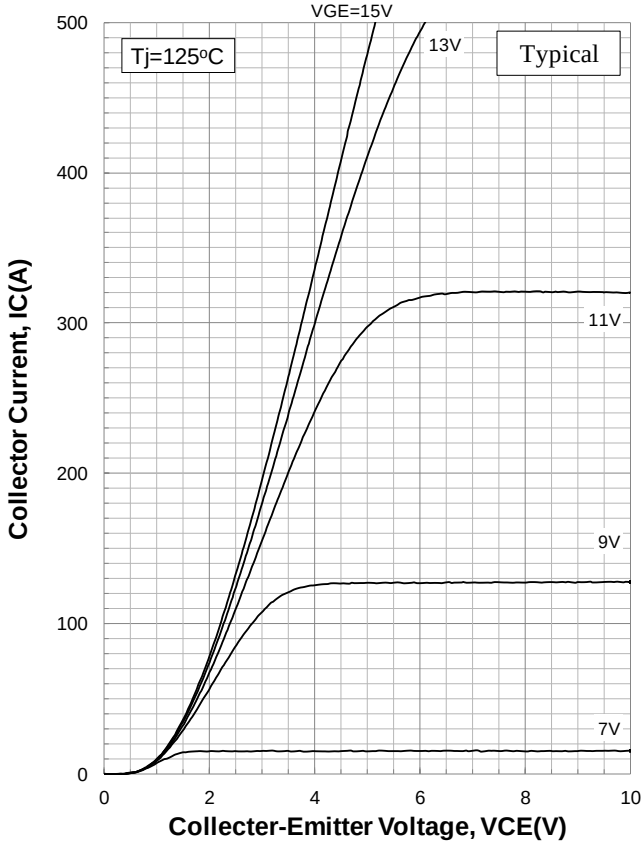
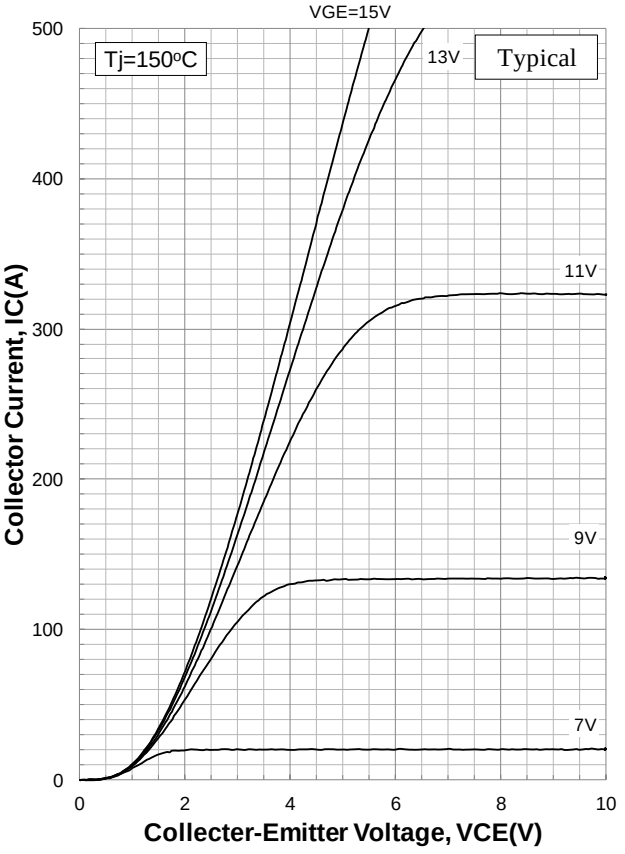
STATIC CHARACTERISTICS



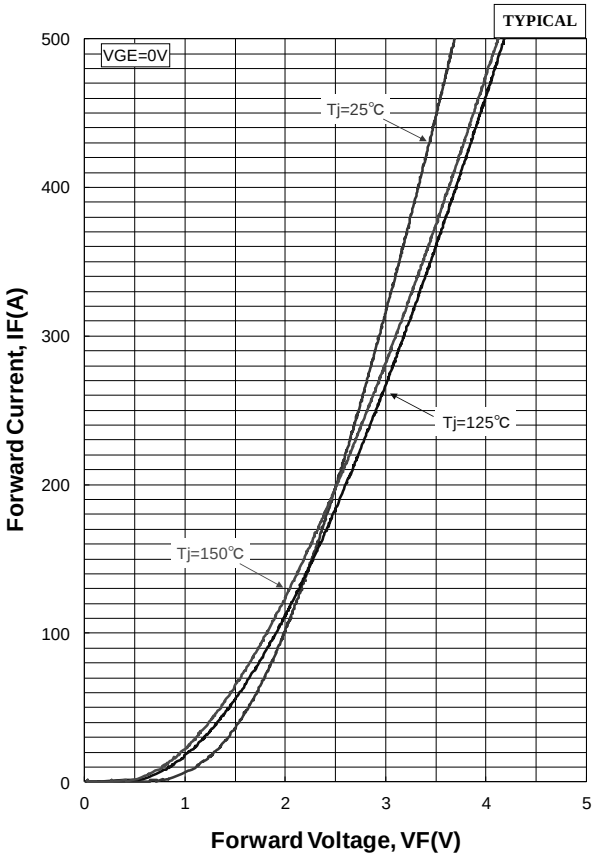
Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



Forward Voltage of free-wheeling diode

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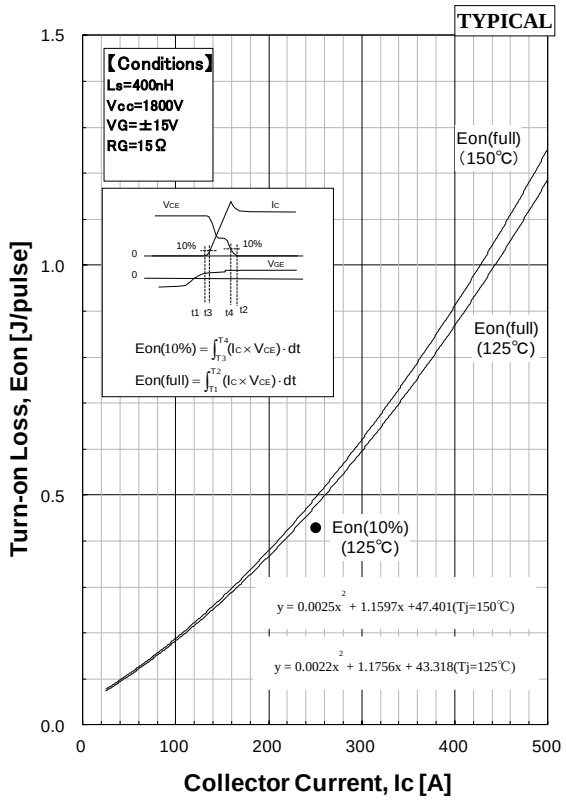
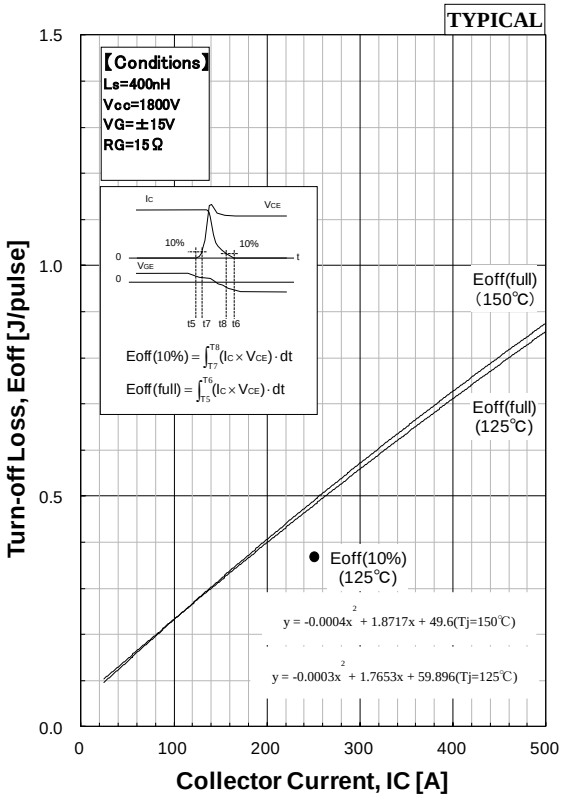
DYNAMIC CHARACTERISTICS

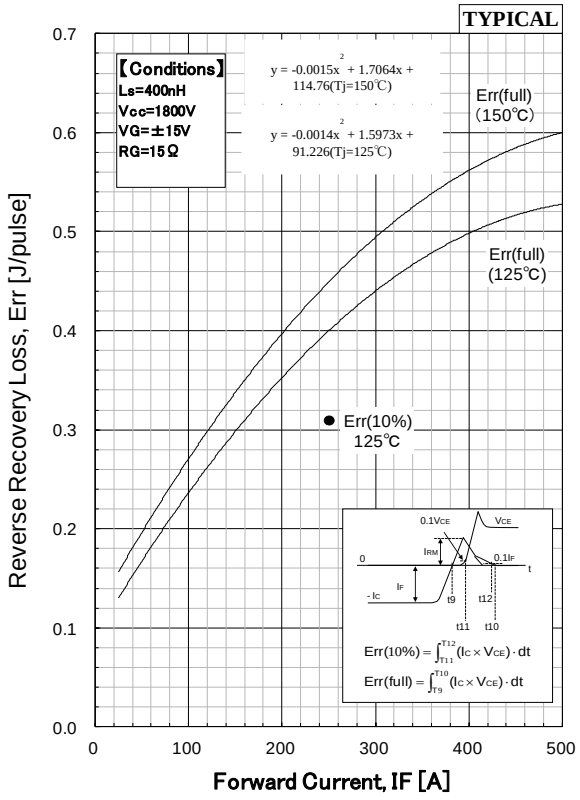
DEPENDENCE OF CURRENT



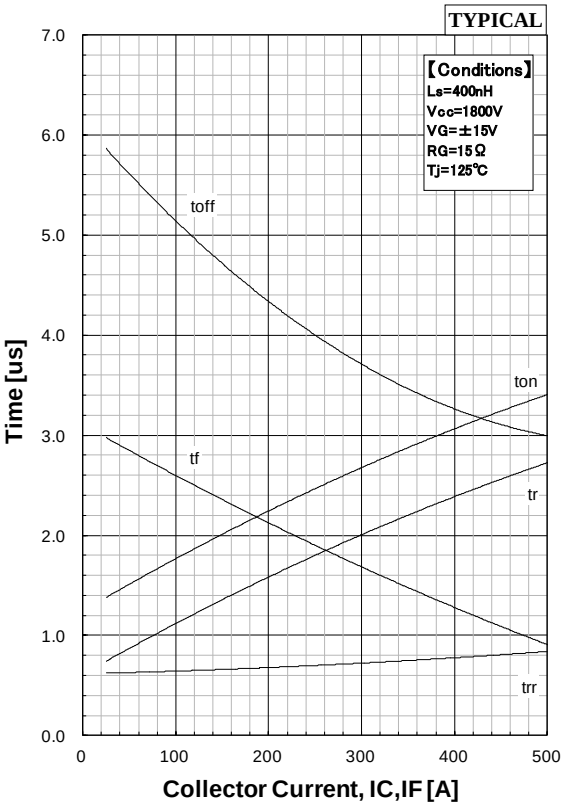
Turn-on Loss vs. Collector current



Turn-off Loss vs. Collector current



Recovery loss vs. Forward current



Switching time vs. Collector current

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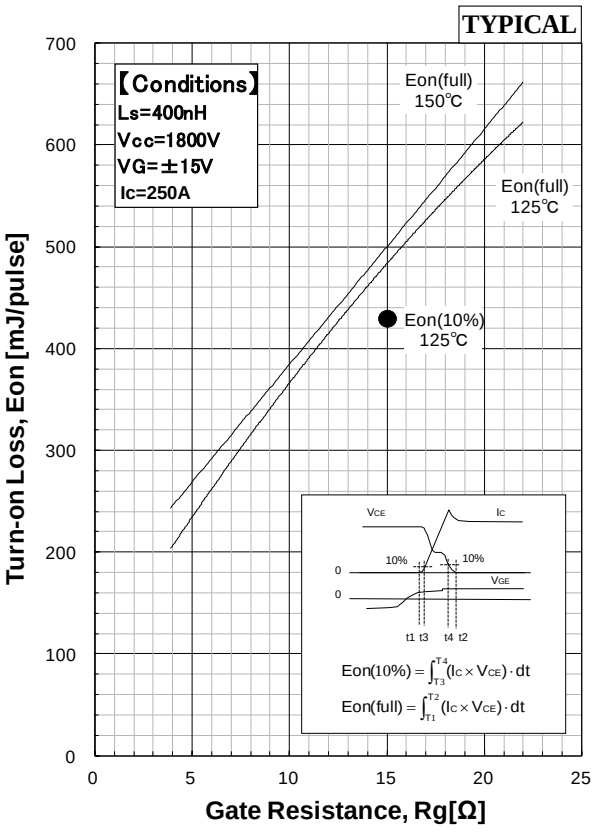
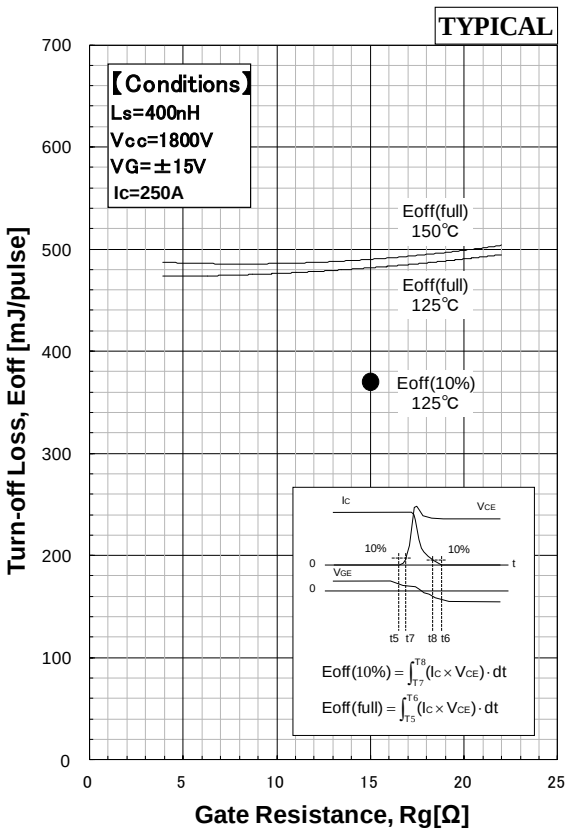
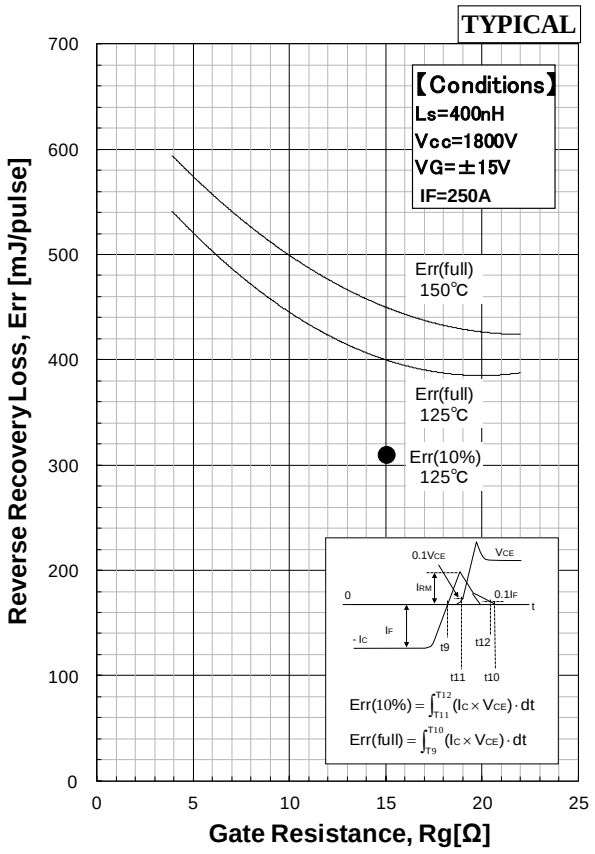
DEPENDENCE OF RG



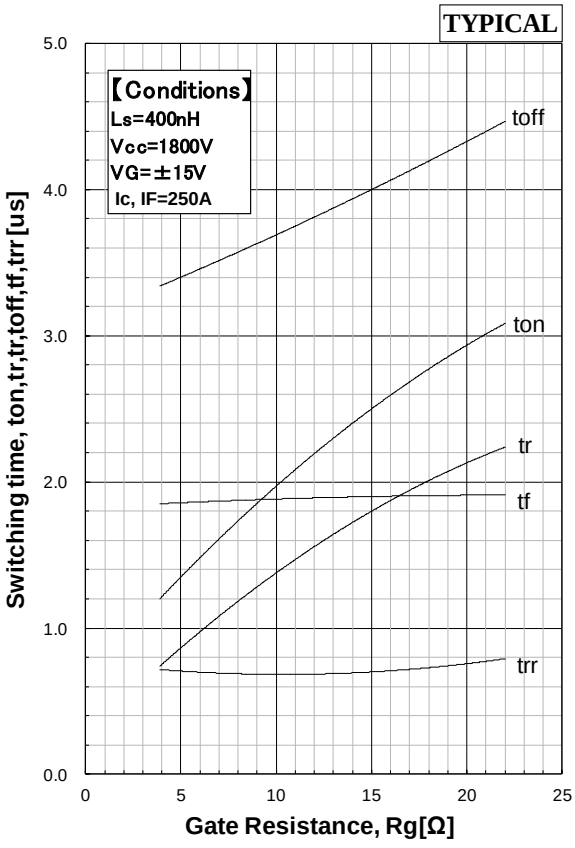
Turn-on Loss vs Gate Resistance



Turn-off Loss vs Gate Resistance



Recovery Loss vs Gate Resistance



Switching time vs Gate Resistance

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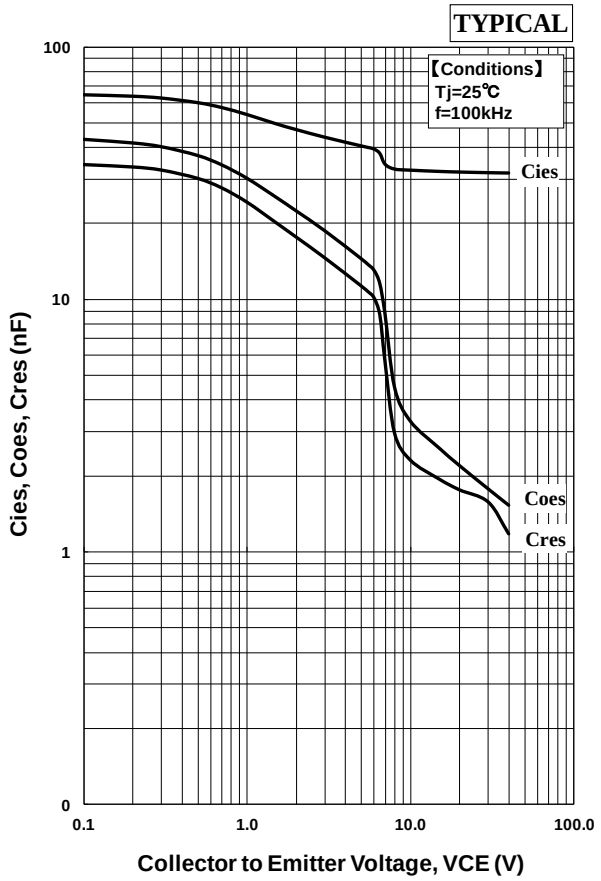
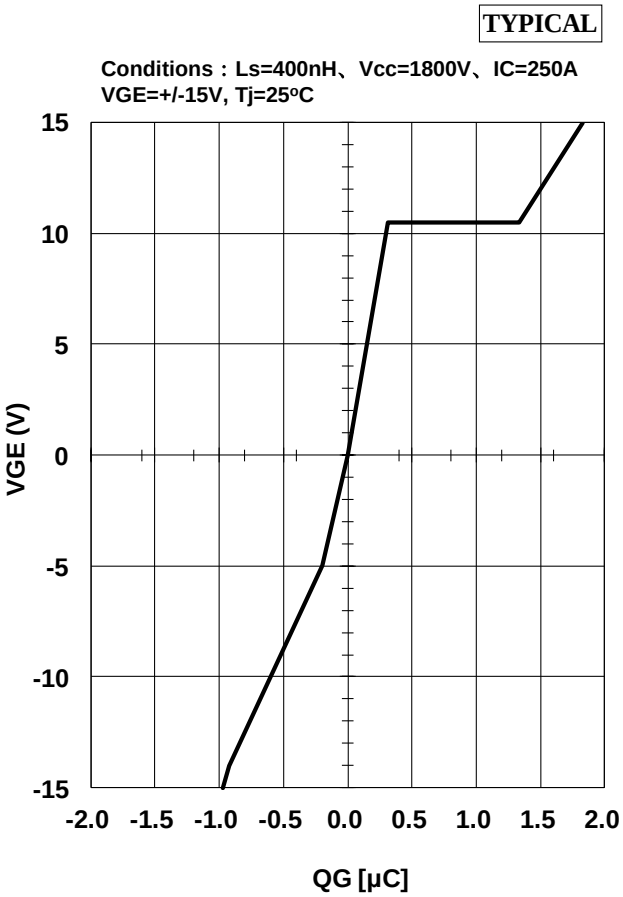
Cies,Coes,Cres-VCE, QG-VG

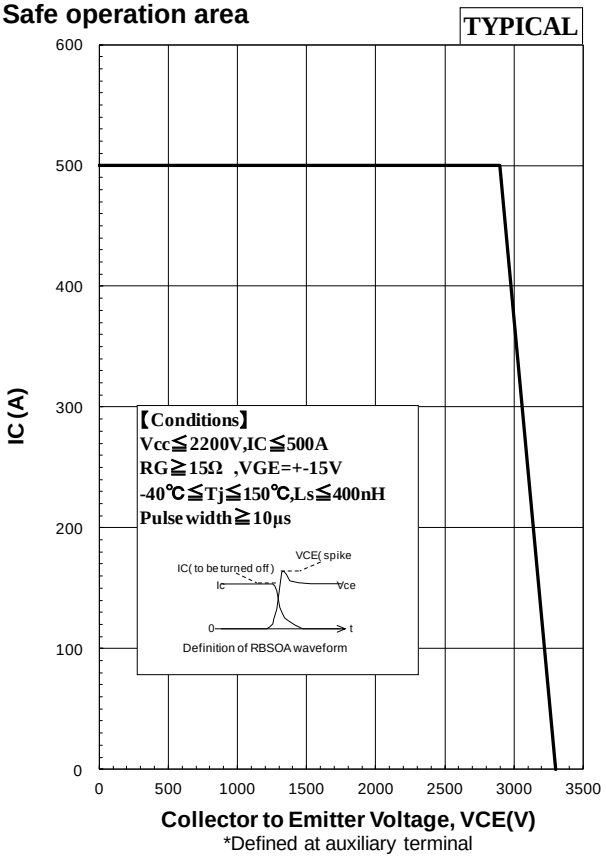


Cies,Coes,Cres-VCE

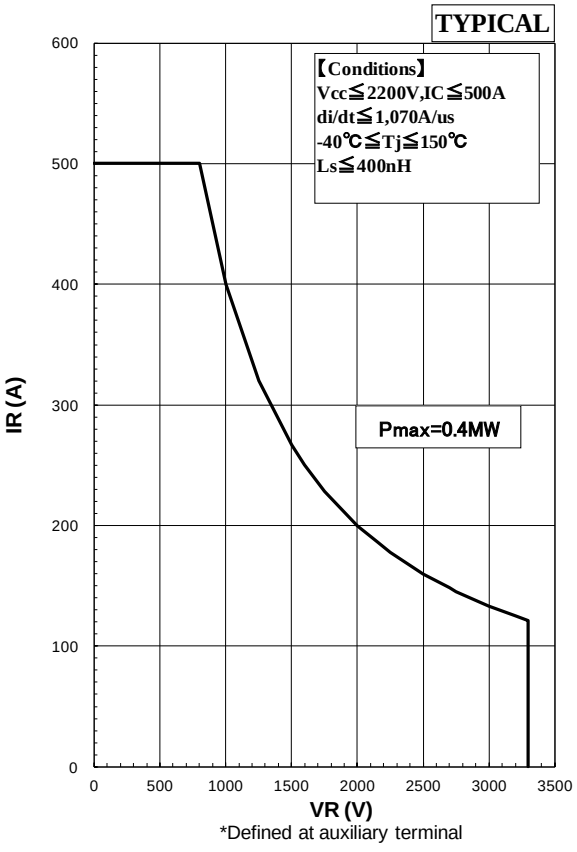


QG-VGE Curve

Safe operation area



Reverse bias Safe operation area (RBSOA)



Reverse Recovery Safe operation area (RecSOA)

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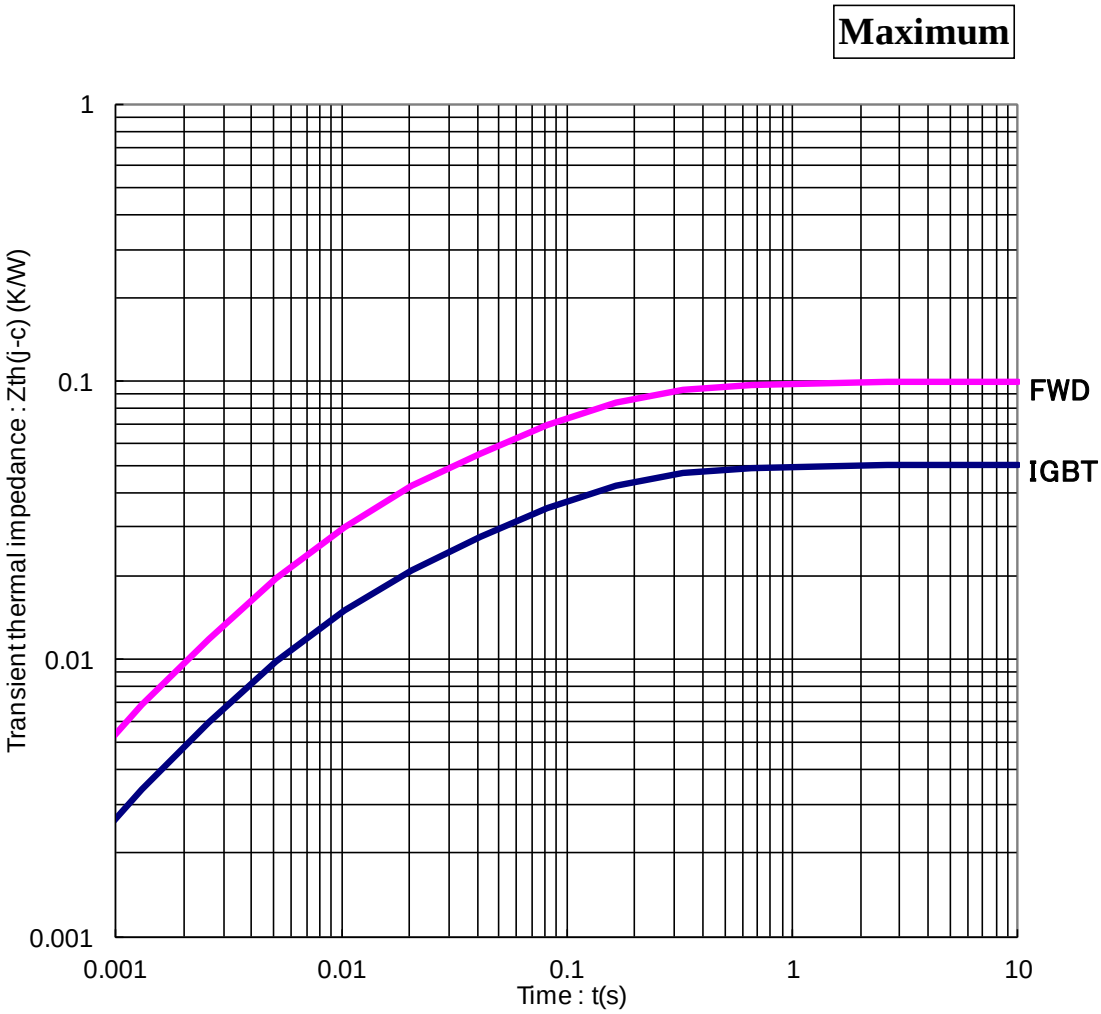
TRANSIENT THERMAL IMPEDANCE



Transient Thermal Impedance Curve

Curve approximation model
Zth = Σ rth[n]*(1-exp(-t/τth[n]))

n	1	2	3	4	Unit
τ th[n]	2.73E-01	7.21E-02	8.98E-03	2.02E-03	sec
rth[n,IGBT]	9.27E-03	2.52E-02	1.32E-02	2.35E-03	K/W
rth[n,Diode]	1.83E-02	5.07E-02	2.61E-02	4.89E-03	K/W

Material Declaration

Please note the following material is contained in the product in order to keep product characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder

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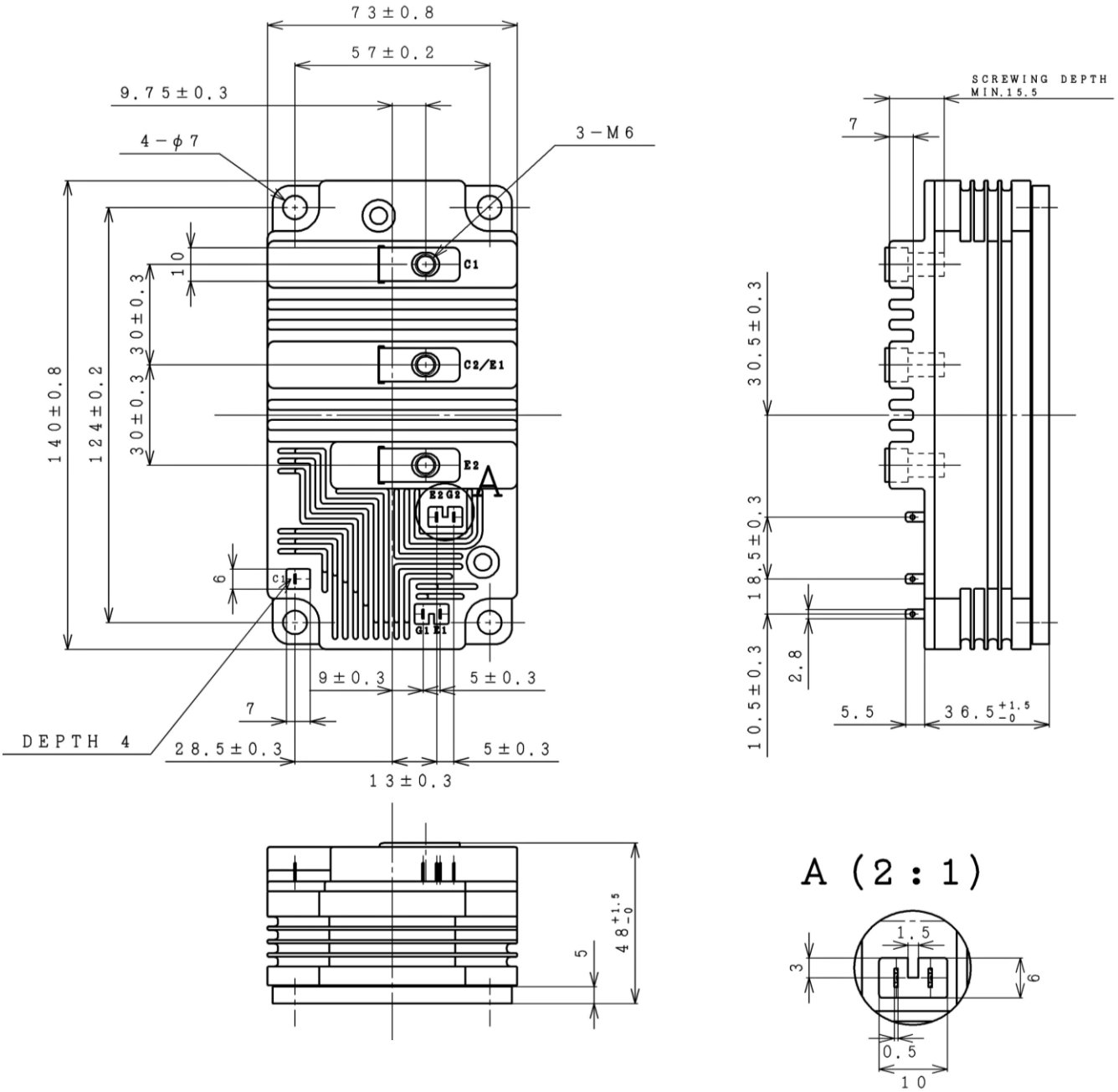
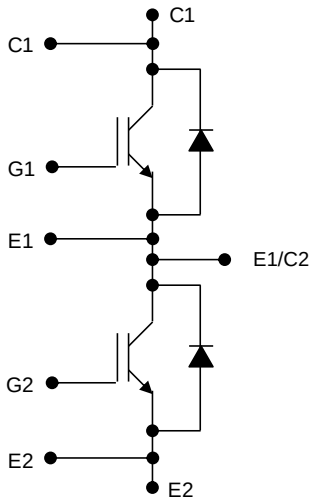
Module Outline Drawing

Unit: mm



CIRCUIT DIAGRAM



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HITACHI POWER SEMICONDUCTORS

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