

# MBM500E33E2-R

Silicon N-channel IGBT 3300V E2 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.
- \* High thermal fatigue durability:  
( $\Delta T_c=70K$ ,  $N>30,000$ cycles)  
AlSiC base-plate/AlN substrate

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

Item	Symbol	Unit	MBM500E33E2-R
Collector Emitter Voltage	$V_{CES}$	V	3,300
Gate Emitter Voltage	$V_{GES}$	V	$\pm 20$
Collector Current	DC	$I_c$	500 ( $T_c=95^\circ C$ )
	1ms	$I_{cp}$	1,000
Forward Current	DC	$I_F$	500
	1ms	$I_{FM}$	1,000
Operating Junction Temperature	$T_{vj,op}$	$^\circ C$	-50 ~ +150
Maximum Junction Temperature	$T_{vj,max}$	$^\circ C$	175 (1)
Storage Temperature	$T_{stg}$	$^\circ C$	-55 ~ +125
Isolation Voltage	$V_{ISO}$	$V_{RMS}$	6,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	2/15 (2)
	Mounting (M6)	-	6 (3)

Notes: (1) Only static operation is applicable. Please refer to LD-ES-130737.

(2) Recommended Value  $1.8 \pm 0.2/15^{+0.3} N \cdot m$ (3) Recommended Value  $5.5 \pm 0.5 N \cdot m$ 

## ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	$I_{CES}$	mA	-	-	4	$V_{CE}=3,300V, V_{GE}=0V, T_j=25^\circ C$
			-	7	20	$V_{CE}=3,300V, V_{GE}=0V, T_j=125^\circ C$
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	2.5	2.95	3.5	$I_c=500A, V_{GE}=15V, T_j=125^\circ C$
			-	3.1	-	$I_c=500A, V_{GE}=15V, T_j=150^\circ C$
Gate Emitter Threshold Voltage	$V_{GE(To)}$	V	5.5	6.5	7.5	$V_{CE}=10V, I_c=500mA, T_j=25^\circ C$
Input Capacitance	$C_{ies}$	nF	-	65	-	$V_{CE}=10V, V_{GE}=0V, f=100kHz, T_j=25^\circ C$
Internal Gate Resistance	$R_{ge}$	$\Omega$	-	2.1	-	$V_{CE}=10V, V_{GE}=0V, f=100kHz, T_j=25^\circ C$
Switching Times	Rise Time	$t_r$	0.8	1.3	1.8	$V_{CC}=1,650V, I_c=500A$
	Turn On Time	$t_{on}$	0.7	1.7	2.1	$L_s=150nH$
	Fall Time	$t_f$	0.9	1.7	2.6	$R_G(on/off)=5.6\Omega/8.2\Omega$ (4)
	Turn Off Time	$t_{off}$	2.1	3.8	4.9	$V_{GE}=\pm 15V, T_j=125^\circ C$
Peak Forward Voltage Drop	$V_{FM}$	V	2.2	2.5	3.0	$I_F=500A, V_{GE}=0V, T_j=125^\circ C$
			-	2.5	-	$I_F=500A, V_{GE}=0V, T_j=150^\circ C$
Reverse Recovery Time	$t_{rr}$	$\mu s$	-	0.60	0.87	$V_{CC}=1,650V, I_F=500A, L_s=150nH$ $T_j=125^\circ C, R_G(on)=5.6\Omega, V_{GE}=\pm 15V$
Short Circuit Pulse Width	$t_{sc}$	$\mu s$	10	-	-	$V_{CC}=2200V, L_s=130nH$ $R_G(on/off)=5.6/8.2\Omega, V_{GE}=\pm 15V, T_j=150^\circ C$
Turn On Loss	$E_{on(10\%)}$	J/P	-	0.65	0.95	$T_j=125^\circ C$
	$E_{on(full)}$		-	0.70	-	$T_j=150^\circ C$
Turn Off Loss	$E_{off(10\%)}$	J/P	-	0.72	0.86	$T_j=125^\circ C$
	$E_{off(full)}$		-	0.79	-	$T_j=150^\circ C$
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	0.66	0.80	$T_j=125^\circ C$
	$E_{rr(full)}$		-	0.78	-	$T_j=150^\circ C$

Notes:(4)  $R_G$  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.

\* 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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## THERMAL CHARACTERISTICS

Item		Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Thermal Impedance	IGBT	Rth(j-c)	K/W	-	-	0.024	Junction to case
	FWD	Rth(j-c)		-	-	0.049	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.008	-	Case to fin ( $\lambda_{grease}=1W/(m \cdot K)$ , heat-sink flatness $\leq 50\mu m$ )

## MODULE MECHANICAL CHARACTERISTICS

Item		Unit	Characteristics	Conditions
Weight		g	900	
Creepage Distance	Between terminal	mm	>34	E2aux-C2aux
	Terminal-Base	mm	>32	Base-E1aux
Clearance Distance	Between terminal	mm	>19	C1main-E1aux
	Terminal-Base	mm	>28	Base-E1aux
Stray inductance in module		nH	36	Collector-main to Emitter-main
Comparative Tracking Index (CTI)			600	
Module base plate Material			Al-SiC	
Baseplate Thickness		mm	5	
Insulation plate Material			AlN	
Terminal Surface treatment			Ni plating	
Case Material			Poly-Phenylene Sulfide	
Fire and Smoke Category			I2 / F3	NFF 16-102

# MBM500E33E2-R

## DEFINITION OF TEST CIRCUIT

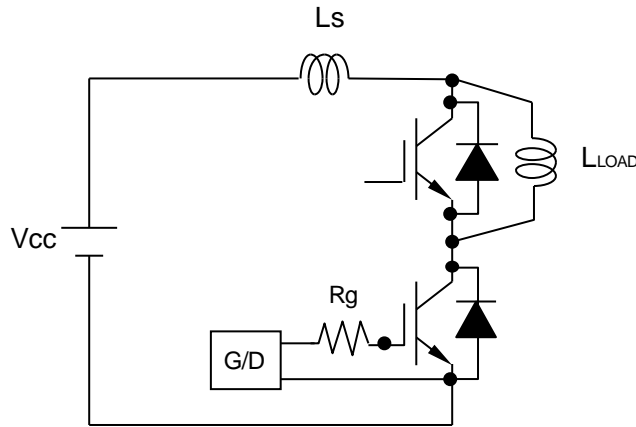


Fig.1 Switching test circuit

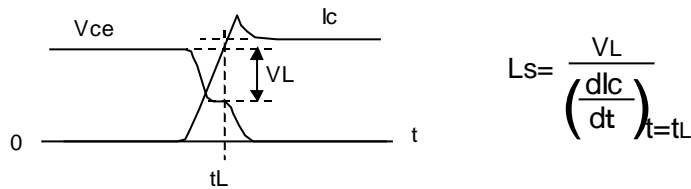


Fig.2 Definition of stray inductance

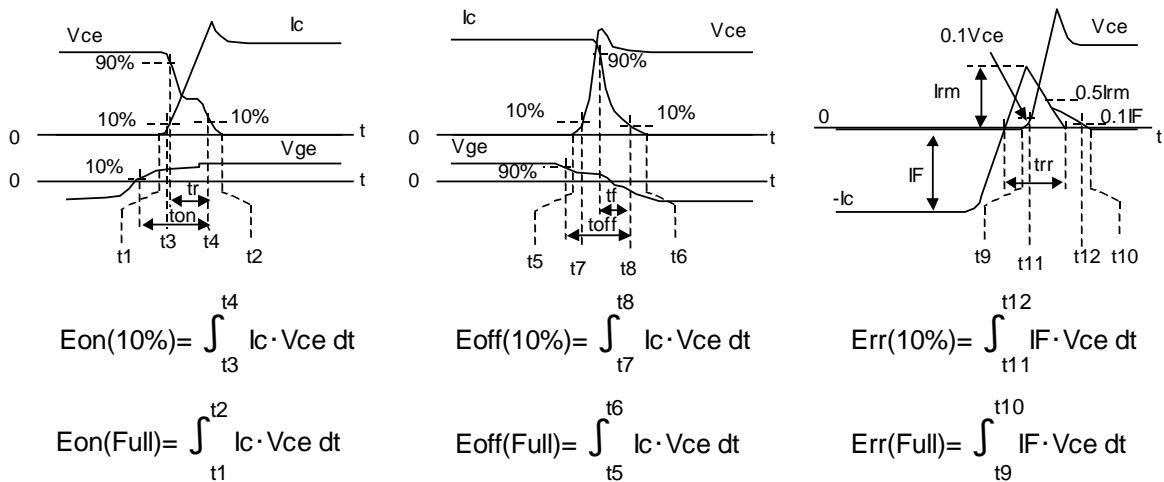
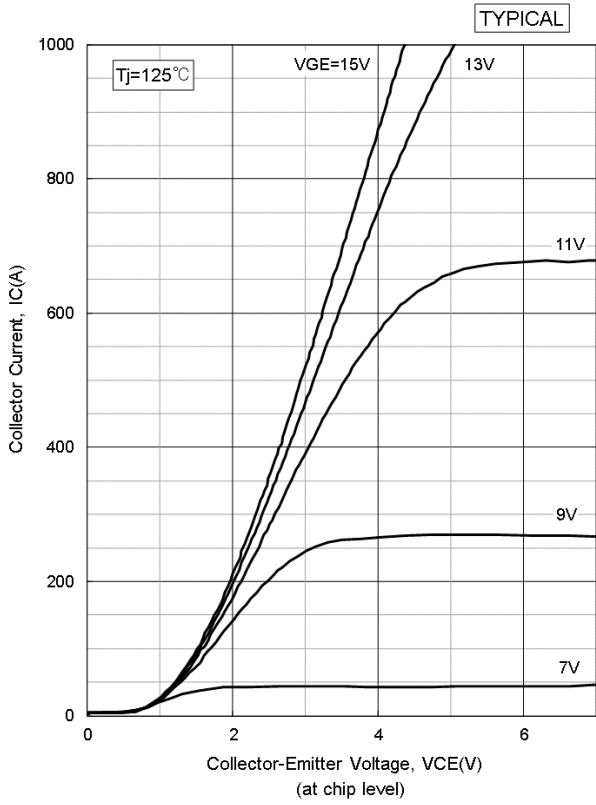


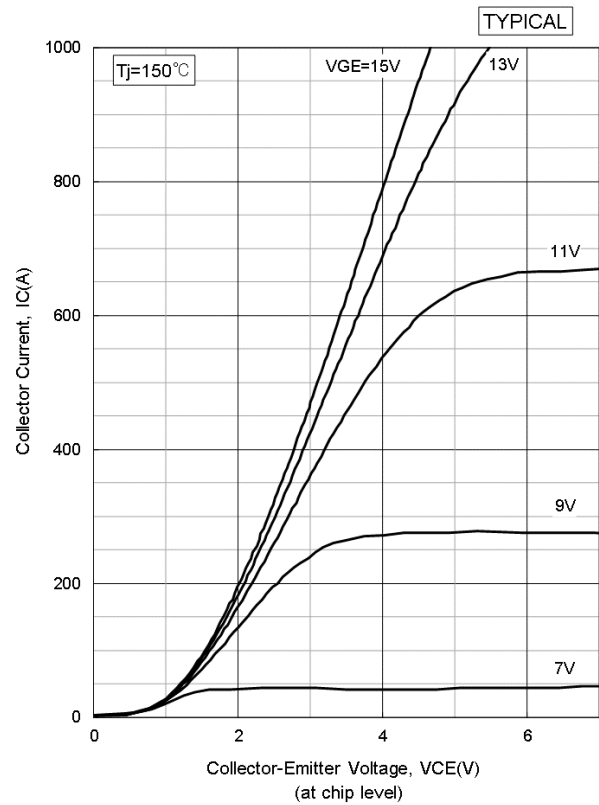
Fig.3 Definition of switching loss

# MBM500E33E2-R

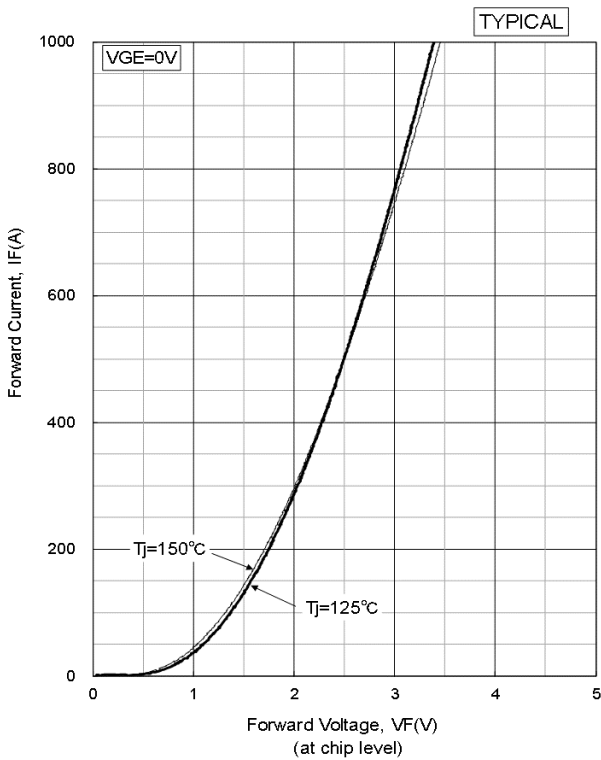
## STATIC CHARACTERISTICS



IC vs. VCE



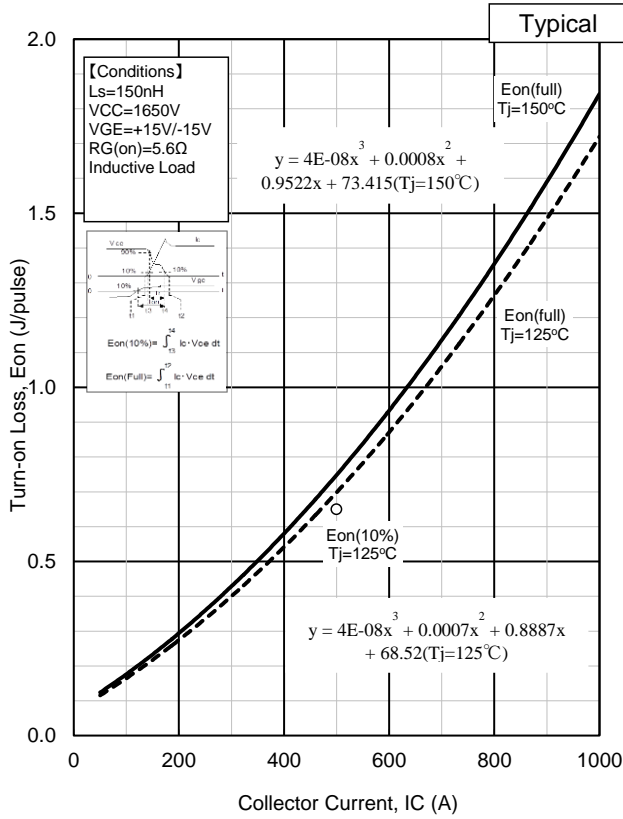
IC vs. VCE



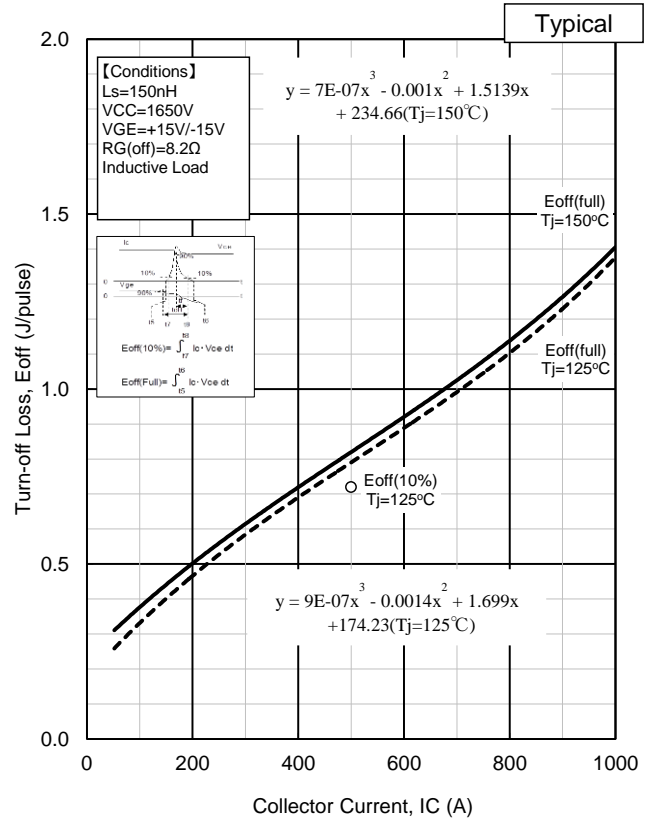
IF vs. VF

# MBM500E33E2-R

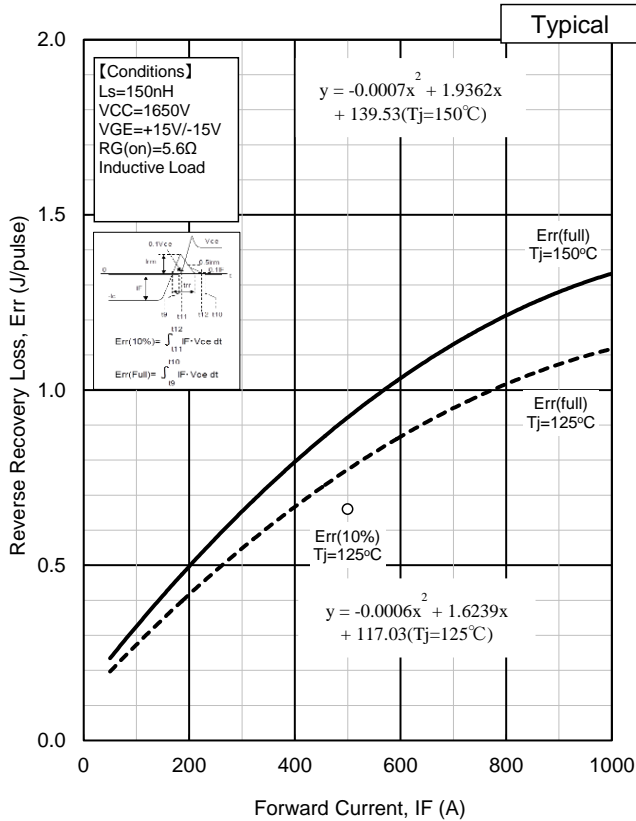
## DYNAMIC CHARACTERISTICS



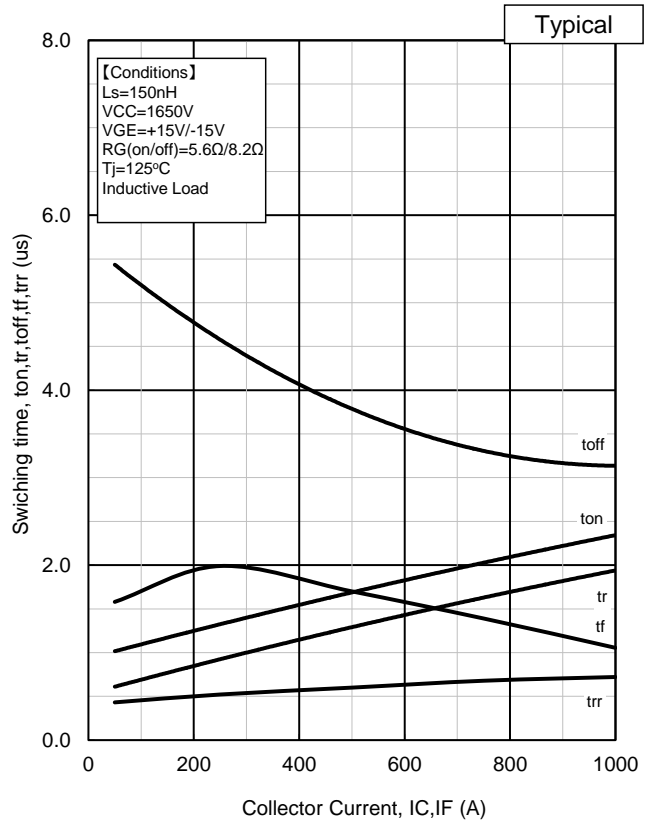
Turn-on loss vs. Collector current



Turn-off loss vs. Collector current

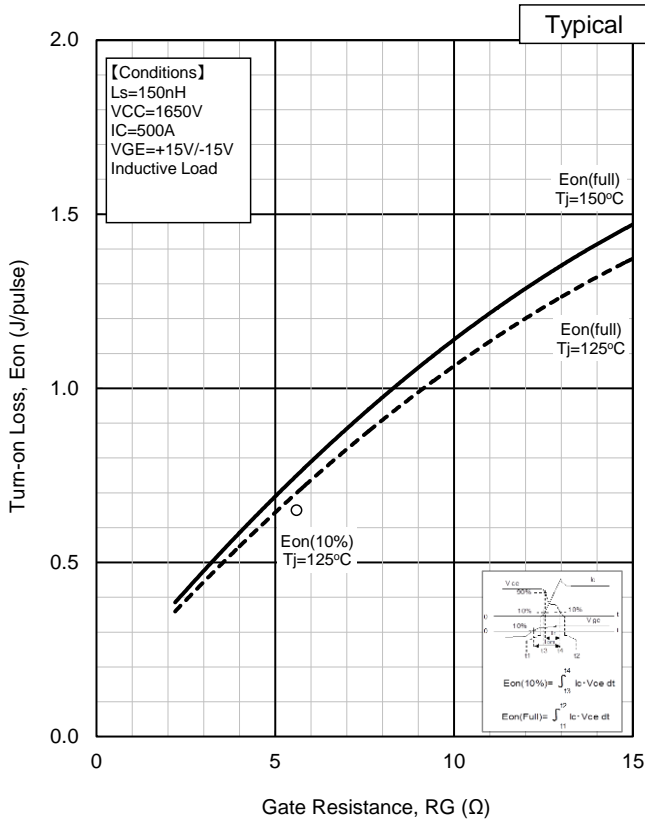


Recovery loss vs. Forward current

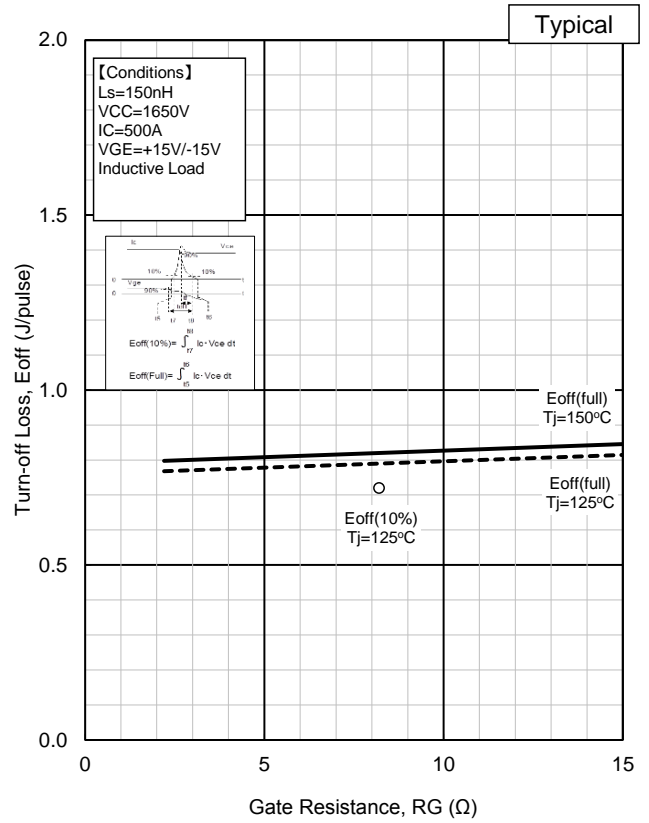


Switching time vs. Collector current

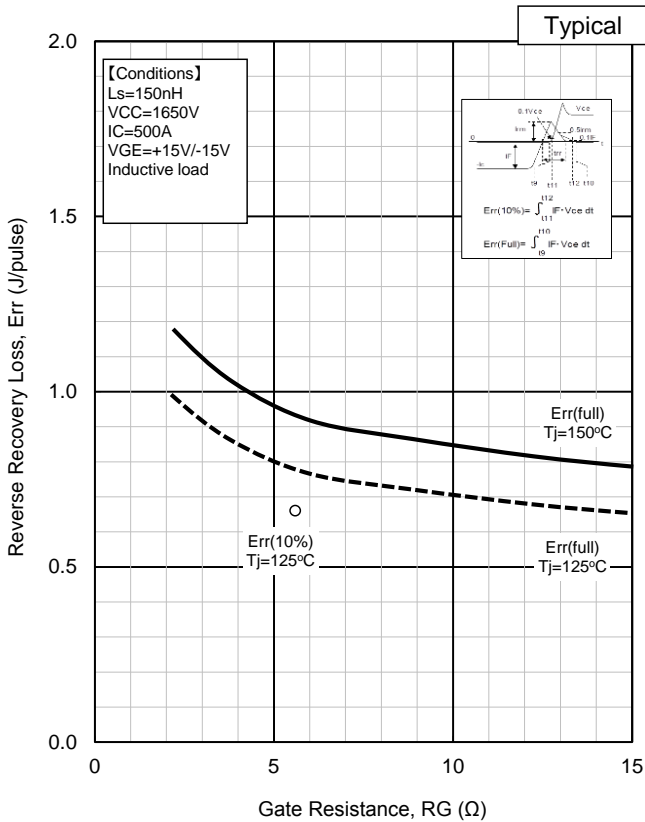
# MBM500E33E2-R



Turn-on loss vs. Gate Resistance



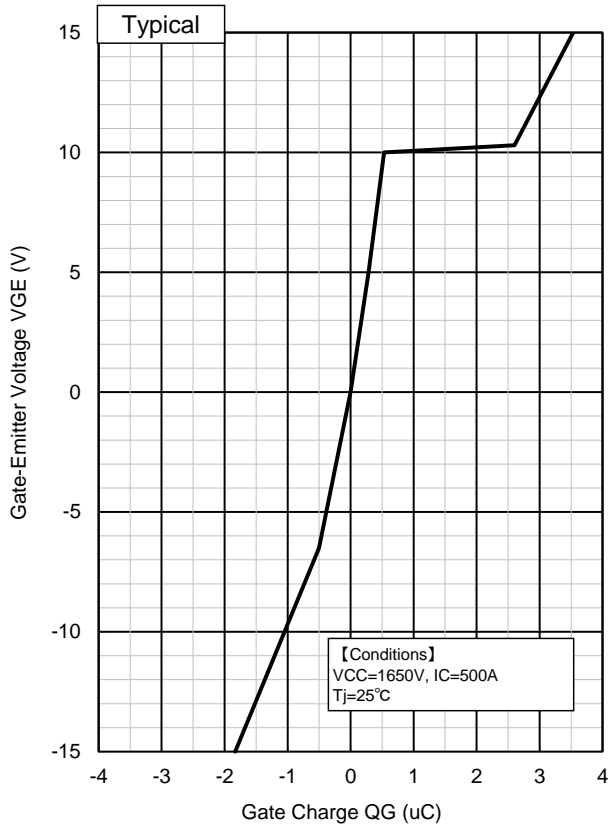
Turn-off loss vs. Gate Resistance



Recovery loss vs. Gate Resistance

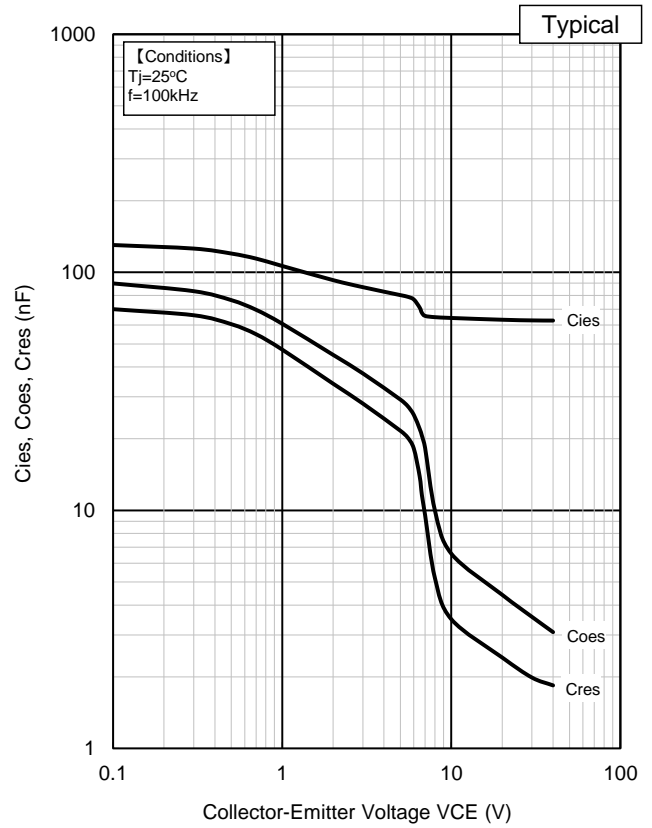
# MBM500E33E2-R

QG-VG Curve



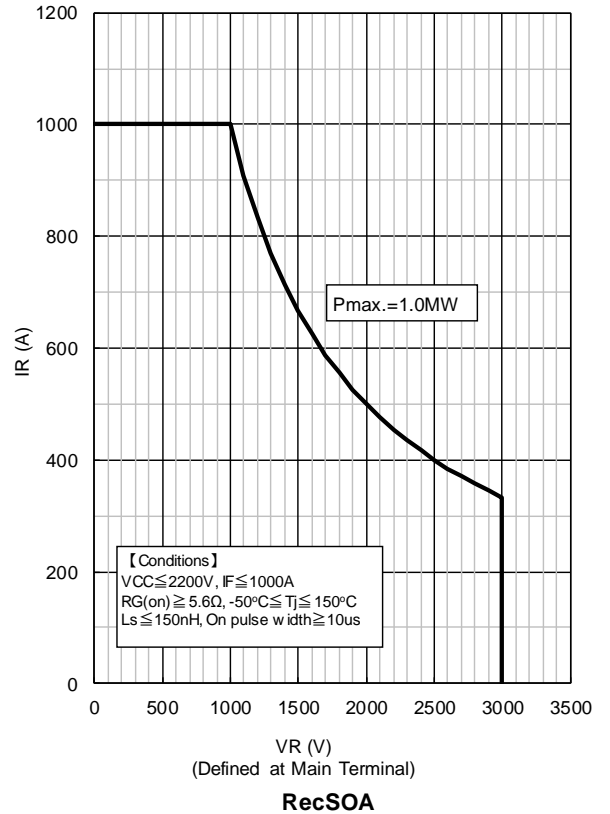
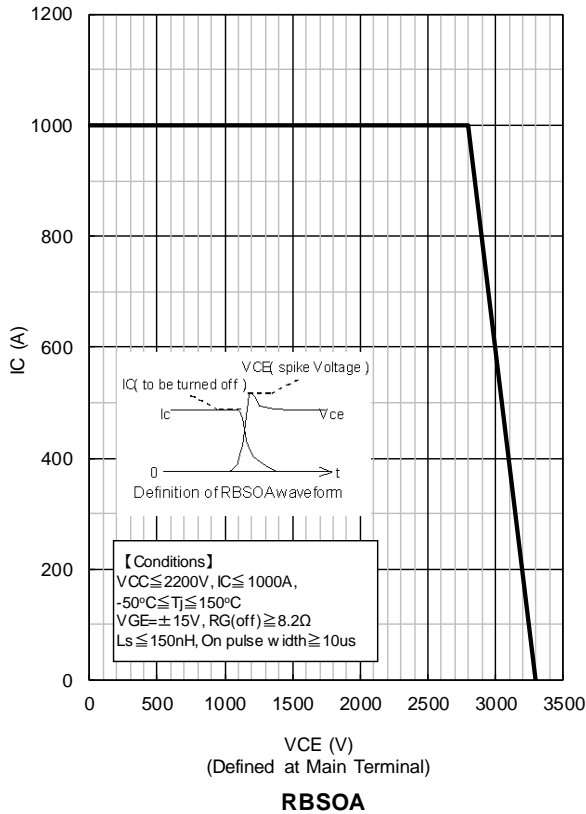
QG vs. VGE

Cies, Coes, Cres curve



Cies, Coes, Cres vs. VCE

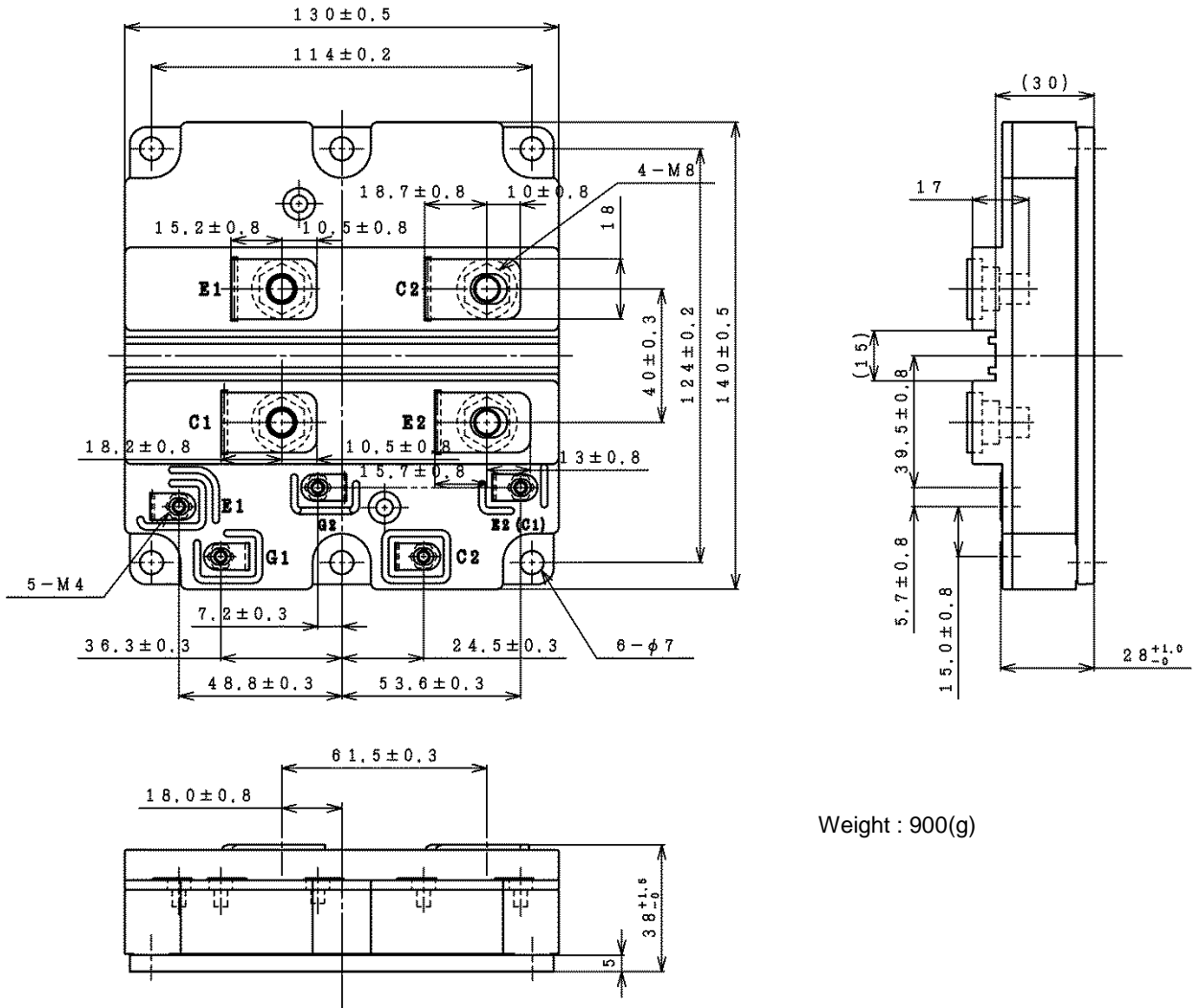
Safe Operation Area



# MBM500E33E2-R

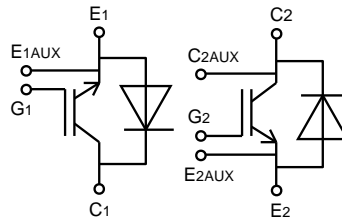
## OUTLINE DRAWINGS

Unit in mm



Weight : 900(g)

## CIRCUIT DIAGRAM



## Material declaration

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

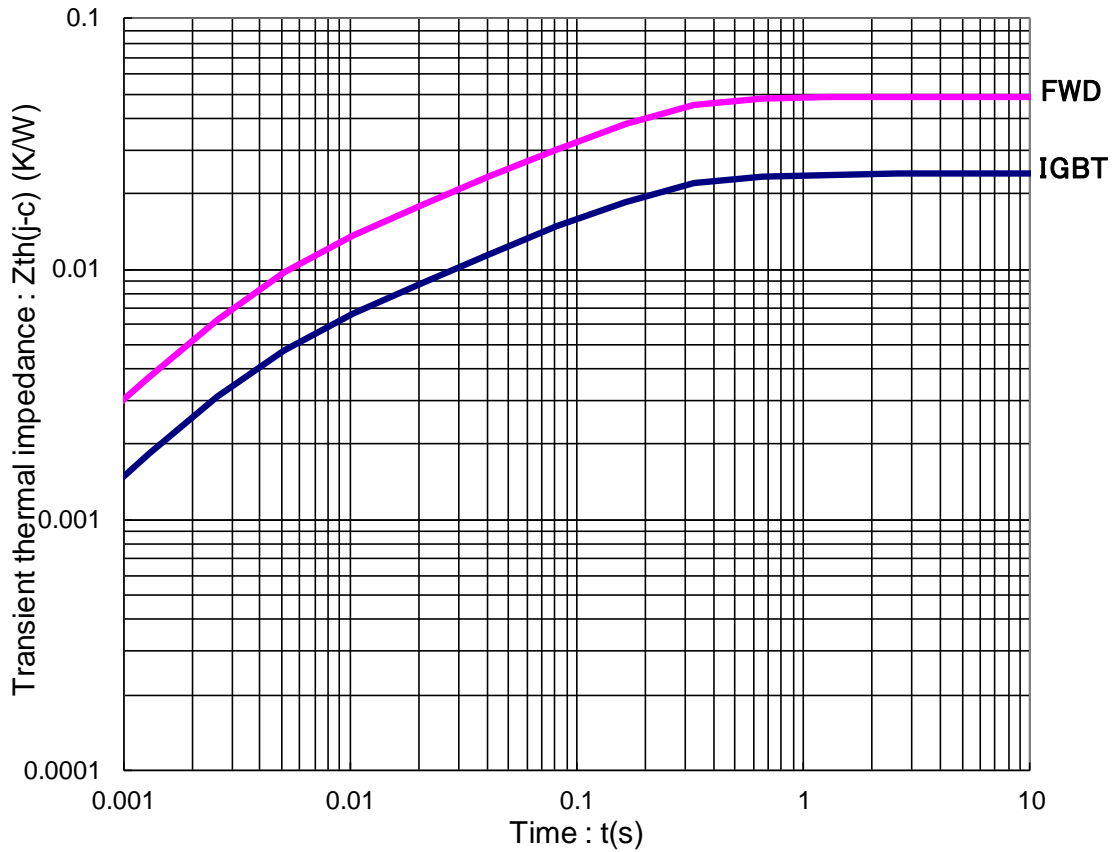
Material	Contained part
Lead (Pb) and its compounds	Solder



# MBM500E33E2-R

TRANSIENT THERMAL IMPEDANCE

**Maximum**



**Transient Thermal Impedance Curve**

Curve approximation model

$$(\sum R_{th}[n] * (1 - \exp(-t/\tau_{th}[n])))$$

n	1	2	3	4	Unit
$\tau_{th}[n]$	1.60E-01	2.77E-02	4.10E-03	8.07E-04	sec
$R_{th}[n,IGBT]$	1.49E-02	4.33E-03	4.28E-03	5.03E-04	K/W
$R_{th}[n,Diode]$	3.02E-02	9.24E-03	8.50E-03	1.06E-03	K/W

# MBM500E33E2-R

## HITACHI POWER SEMICONDUCTORS

### Notices

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