

MBN1500E33E2

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 ($T_c=25^\circ\text{C}$)

Item	Symbol	Unit	MBN1500E33E2
Collector Emitter Voltage	V_{CES}	V	3,300
Gate Emitter Voltage	V_{GES}	V	± 20
Collector Current	DC	I_C	1,500 ($T_c=95^\circ\text{C}$)
	1ms	I_{Cp}	3,000
Forward Current	DC	I_F	1,500
	1ms	I_{FM}	3,000
Junction Temperature	T_j	$^\circ\text{C}$	-40 ~ +150
Storage Temperature	T_{stg}	$^\circ\text{C}$	-50 ~ +125
Isolation Voltage	V_{ISO}	V_{RMS}	6,000(AC 1 minute)
Screw Torque	Terminals (M4/M8)	-	2/15 (1)
	Mounting (M6)	-	6 (2)

Notes: (1) Recommended Value $1.8 \pm 0.2/15^{+0.3} \text{N}\cdot\text{m}$

(2) Recommended Value $5.5 \pm 0.5 \text{N}\cdot\text{m}$

ELECTRICAL CHARACTERISTICS

Item	Symbol	Unit	Min.	Typ.	Max.	Test Conditions
Collector Emitter Cut-Off Current	I_{CES}	mA	-	-	12	$V_{CE}=3,300\text{V}$, $V_{GE}=0\text{V}$, $T_j=25^\circ\text{C}$
Gate Emitter Leakage Current	I_{GES}	nA	-500	-	+500	$V_{CE}=3,300\text{V}$, $V_{GE}=0\text{V}$, $T_j=125^\circ\text{C}$ $V_{GE}=\pm 20\text{V}$, $V_{CE}=0\text{V}$, $T_j=25^\circ\text{C}$
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	V	2.5	2.95	3.5	$I_C=1,500\text{A}$, $V_{GE}=15\text{V}$, $T_j=125^\circ\text{C}$
			-	3.1	-	$I_C=1,500\text{A}$, $V_{GE}=15\text{V}$, $T_j=150^\circ\text{C}$
Gate Emitter Threshold Voltage	$V_{GE(To)}$	V	5.5	6.3	7.5	$V_{CE}=10\text{V}$, $I_C=1,500\text{mA}$, $T_j=25^\circ\text{C}$
Input Capacitance	C_{ies}	nF	-	195	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_j=25^\circ\text{C}$
Internal Gate Resistance	R_{ge}	Ω	-	1.0	-	$V_{CE}=10\text{V}$, $V_{GE}=0\text{V}$, $f=100\text{kHz}$, $T_j=25^\circ\text{C}$
Switching Times	Rise Time	t_r	1.6	2.0	2.6	$V_{CC}=1,650\text{V}$, $I_C=1,500\text{A}$
	Turn On Time	t_{on}	2.0	3.0	3.7	$L_s=100\text{nH}$
	Fall Time	t_f	0.9	1.7	2.6	$R_G=2.7\Omega/2.7\Omega$, $C_{GE}=330\text{nF}$ (3)
	Turn Off Time	t_{off}	2.7	4.4	5.5	$V_{GE}=\pm 15\text{V}$, $T_j=125^\circ\text{C}$
Peak Forward Voltage Drop	V_{FM}	V	2.2	2.6	3.0	$I_F=1,500\text{A}$, $V_{GE}=0\text{V}$, $T_j=125^\circ\text{C}$
			-	2.6	-	$I_F=1,500\text{A}$, $V_{GE}=0\text{V}$, $T_j=150^\circ\text{C}$
Reverse Recovery Time	t_{rr}	μs	0.2	0.8	1.2	$V_{CC}=1,650\text{V}$, $I_F=1,500\text{A}$, $L_s=100\text{nH}$ $T_j=125^\circ\text{C}$
Short Circuit Pulse Width	t_{sc}	μs	10	-	-	$V_{CC}=2000\text{V}$, $L_s=80\text{nH}$ $R_G(\text{on/off})=2.7/27\Omega$, $V_{GE}=\pm 15\text{V}$, $T_j=125^\circ\text{C}$
Turn On Loss	$E_{on(10\%)}$	J/P	-	2.9	3.6	$T_j=125^\circ\text{C}$
	$E_{on(full)}$		-	3.2	-	$T_j=150^\circ\text{C}$
Turn Off Loss	$E_{off(10\%)}$	J/P	-	2.2	2.6	$T_j=125^\circ\text{C}$
	$E_{off(full)}$		-	2.4	-	$T_j=150^\circ\text{C}$
Reverse Recovery Loss	$E_{rr(10\%)}$	J/P	-	1.4	1.9	$T_j=125^\circ\text{C}$
	$E_{rr(full)}$		-	1.7	-	$T_j=150^\circ\text{C}$

Notes:(3) R_G and C_{GE} value are 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.	Conditions
Thermal Impedance	IGBT	Rth(j-c)	K/W	-	-	0.0078	Junction to case
	FWD	Rth(j-c)		-	-	0.0156	
Contact Thermal Impedance		Rth(c-f)	K/W	-	0.005	-	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	1,300	
Stray inductance in module	LS(CM-EM)	nH	12	Collector-main to Emitter-main
	LS(ES-EM)		49	Emitter-sense to Emitter-main
	LS(CM-CS)		56	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

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DEFINITION OF TEST CIRCUIT

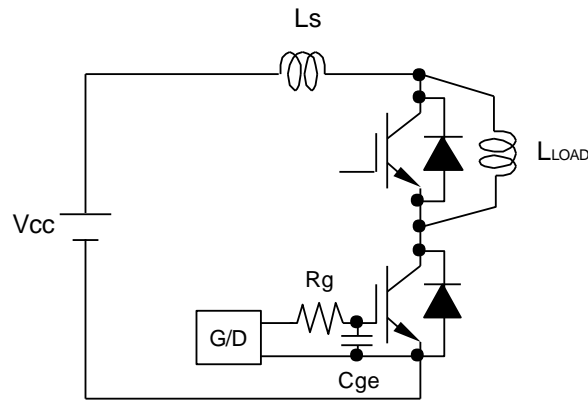


Fig.1 Switching test circuit

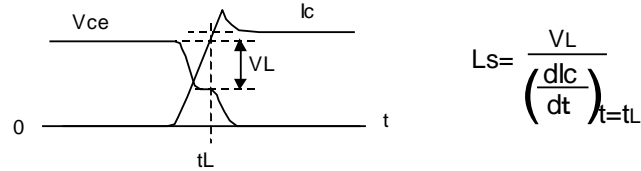


Fig.2 Definition of stray inductance

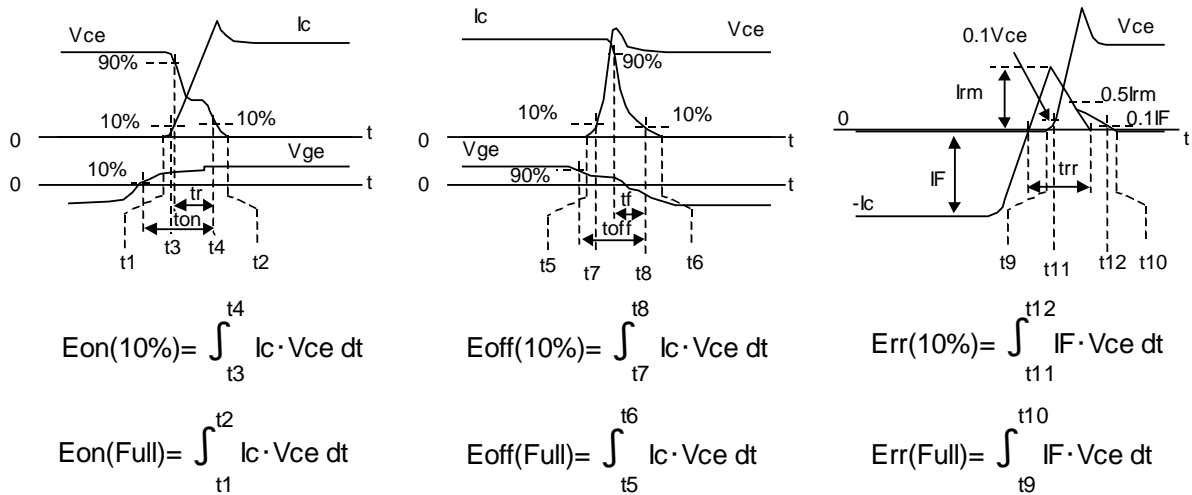
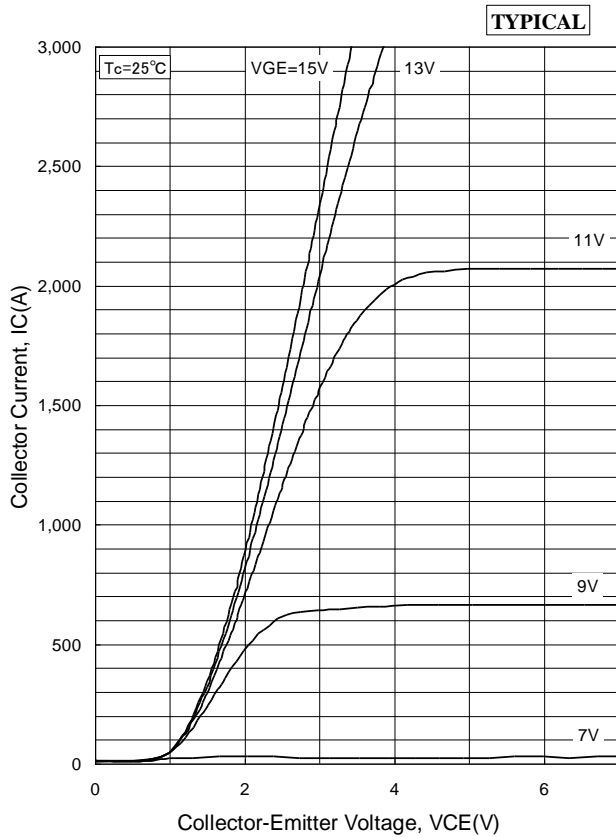


Fig.3 Definition of switching loss

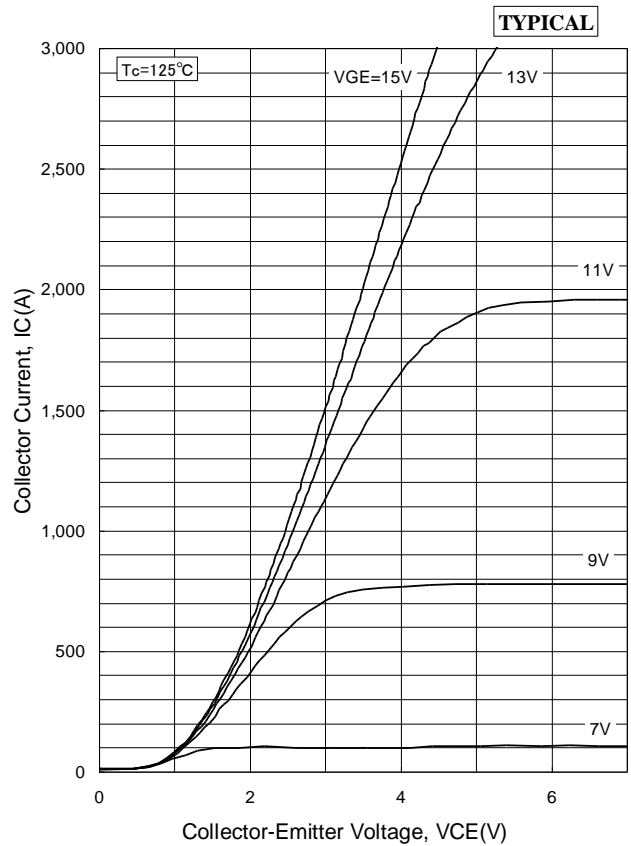
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CHARACTERISTICS CURVE

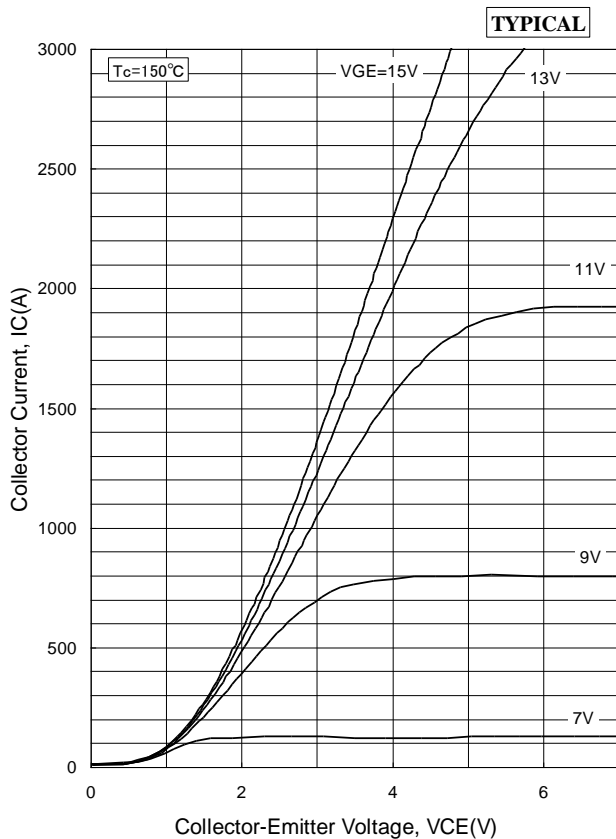
STATIC CHARACTERISTICS



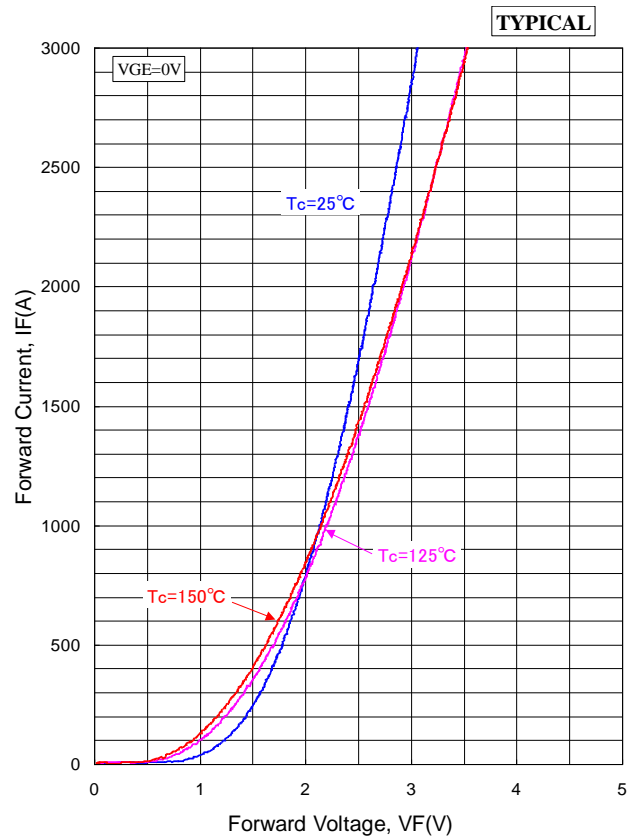
Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage



Collector Current vs. Collector to Emitter Voltage

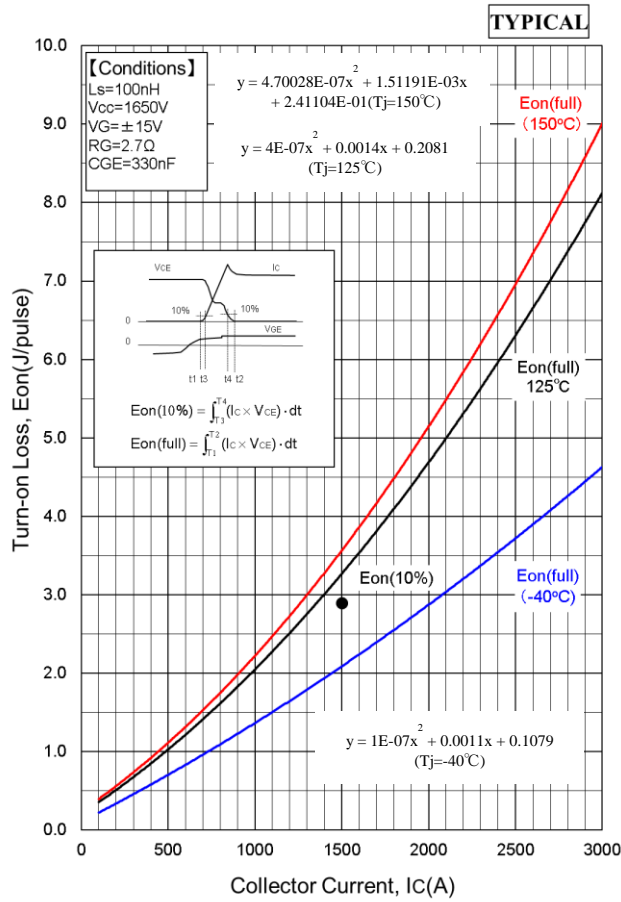


Forward Voltage of free-wheeling diode

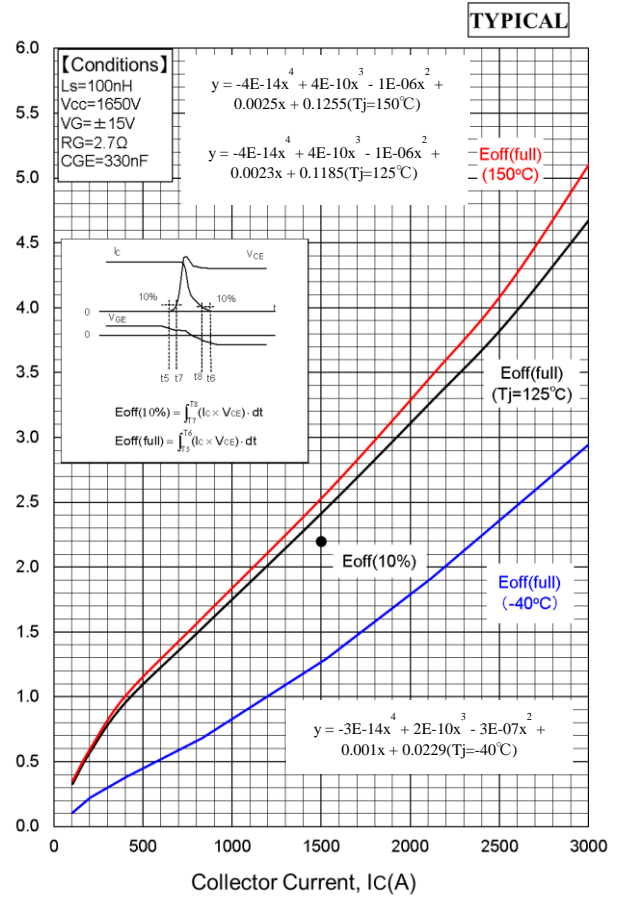
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DYNAMIC CHARACTERISTICS

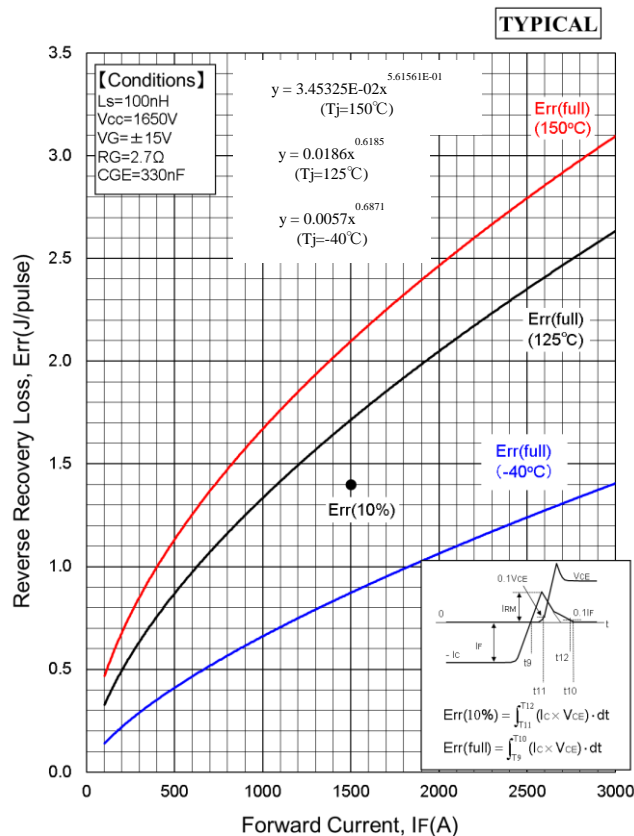
DEPENDENCE OF CURRENT



Turn-on Loss vs. Collector Current

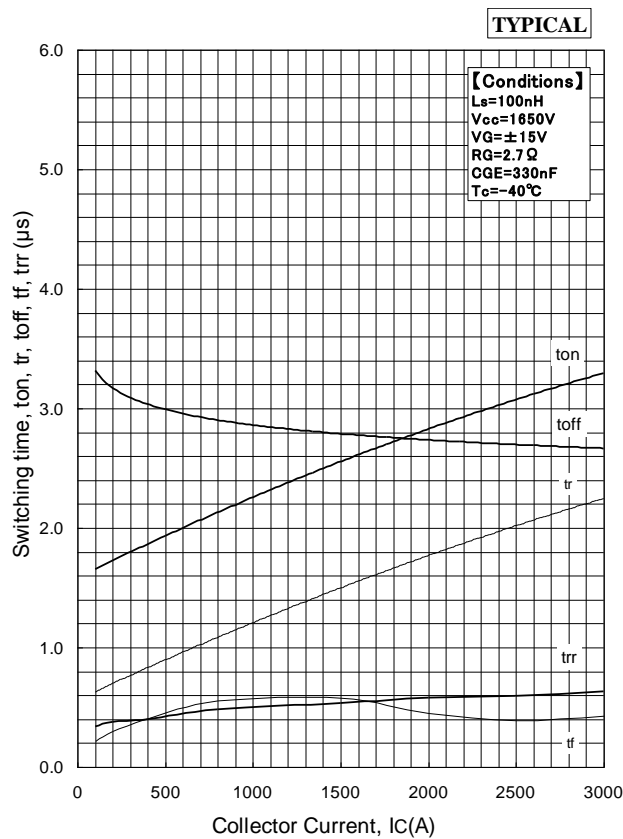
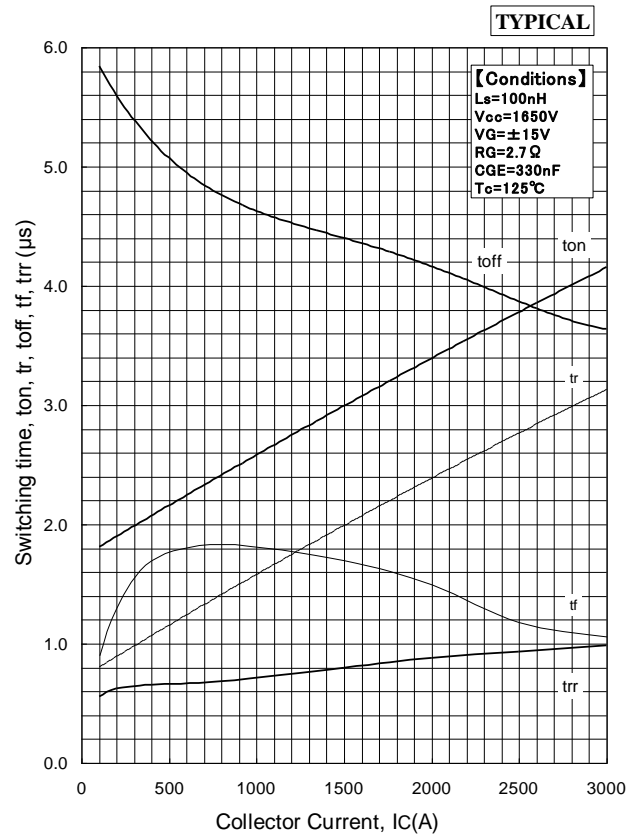
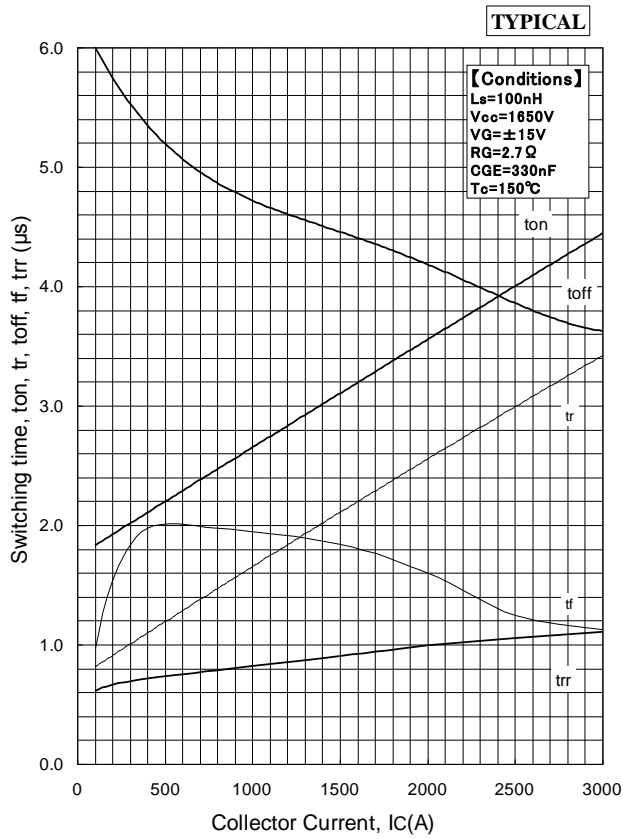


Turn-off Loss vs. Collector Current



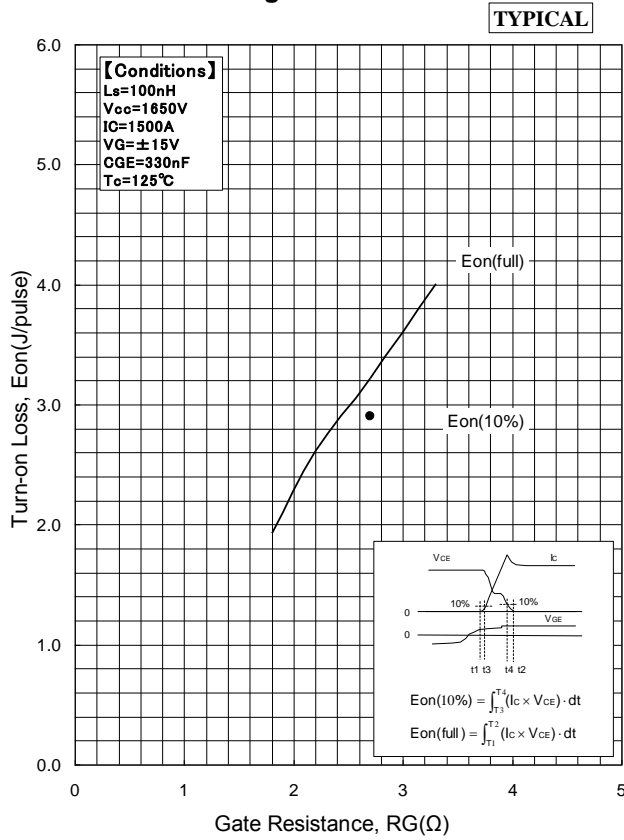
Recovery Loss vs. Forward Current

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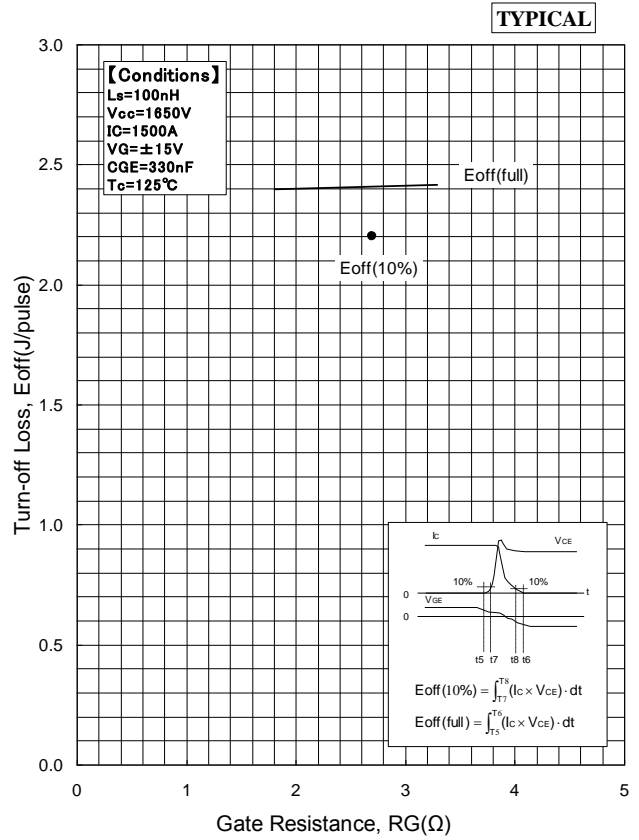


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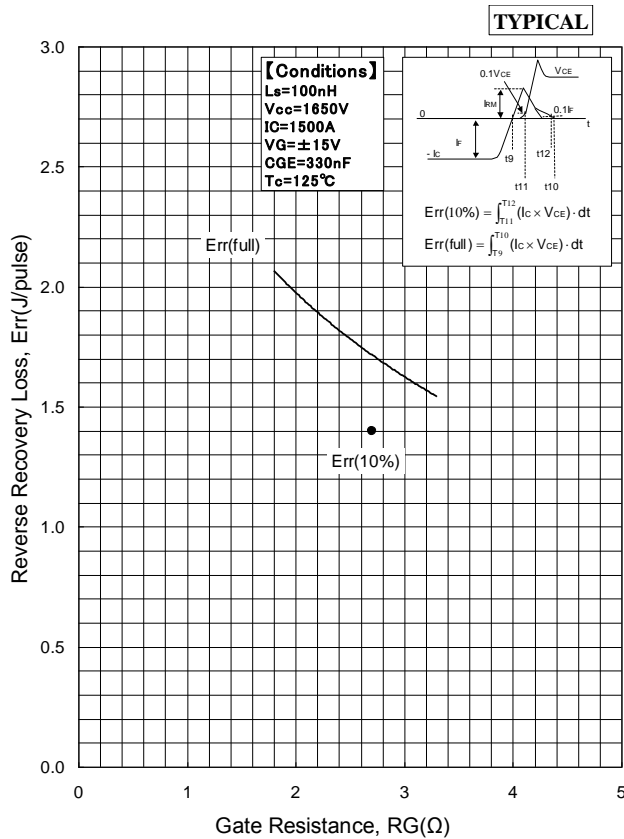
DEPENDENCE OF Rg



Turn-on Loss vs. Gate Resistance



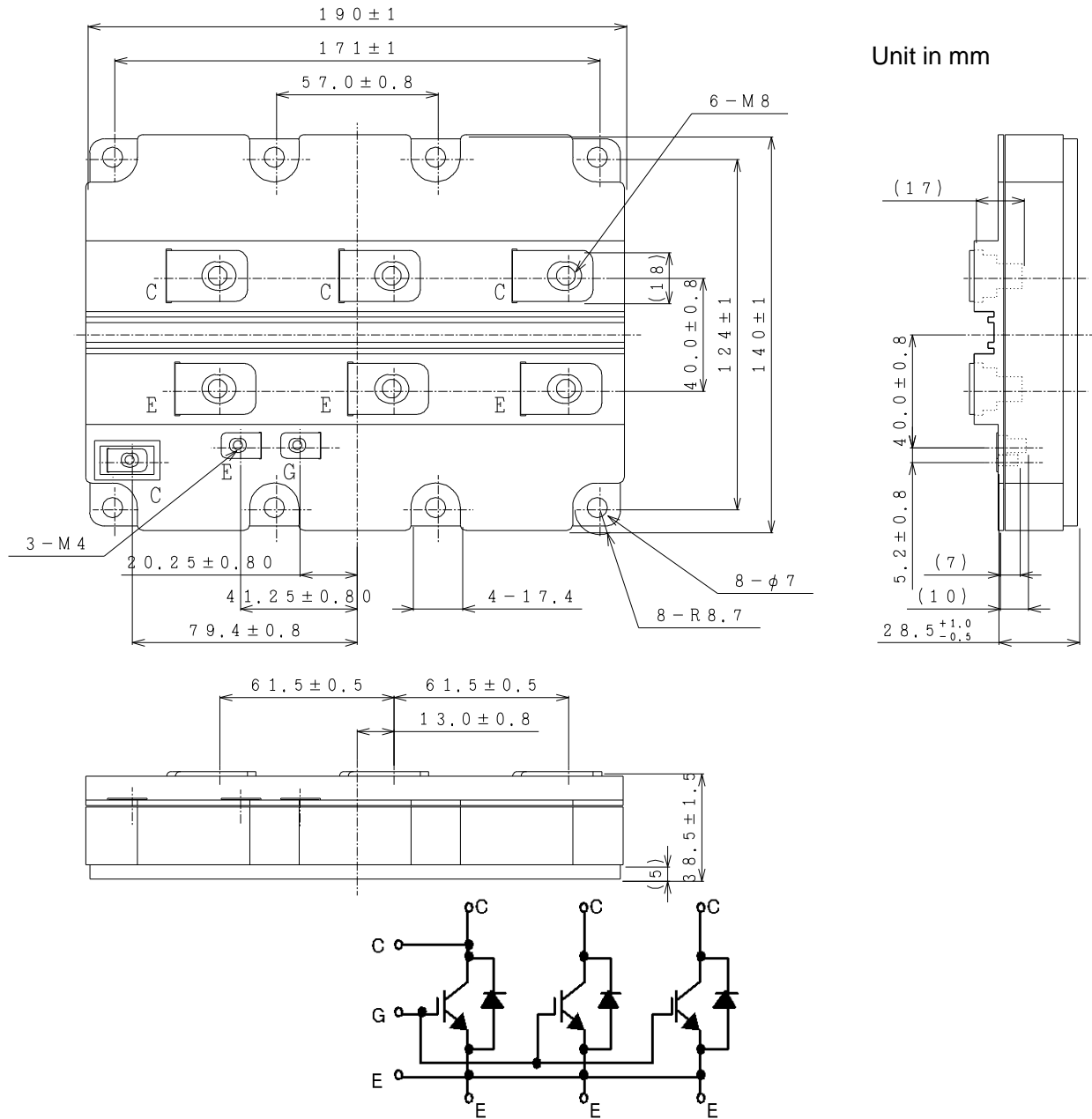
Turn-off Loss vs. Gate Resistance



Recovery Loss vs. Gate Resistance

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OUTLINE DRAWINGS



Unit in mm

Circuit diagram

Material declaration

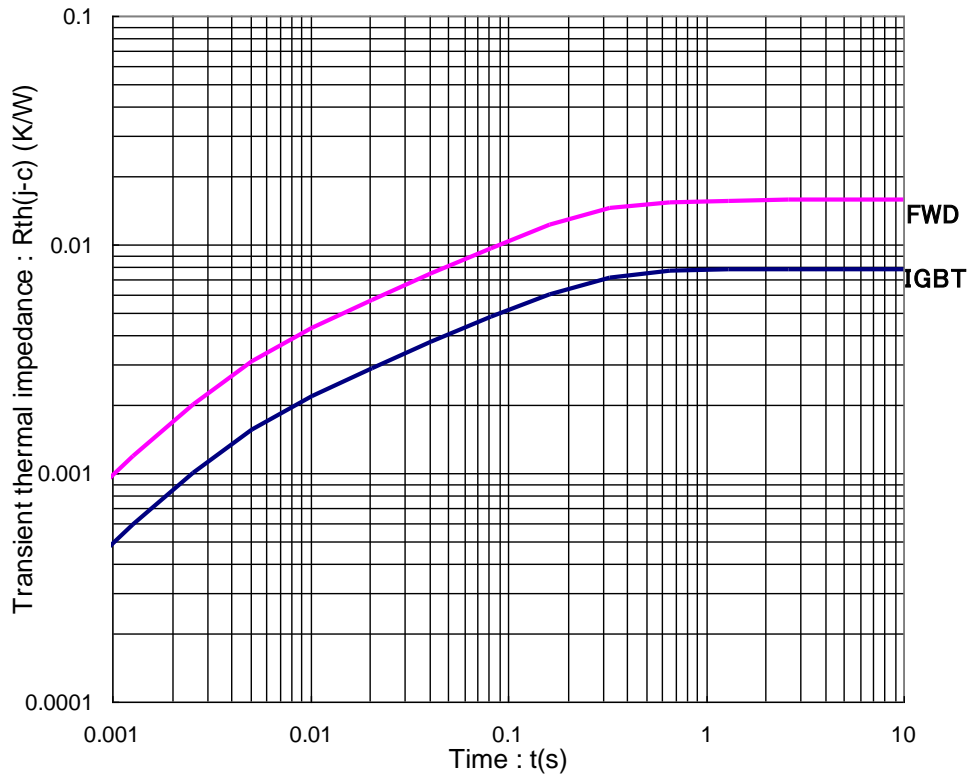
Please note the following materials are contained in the product, in order to keep characteristic and reliability level.

Material	Contained part
Lead (Pb) and its compounds	Solder

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TRANSIENT THERMAL IMPEDANCE

Maximum



Transient Thermal Impedance Curve

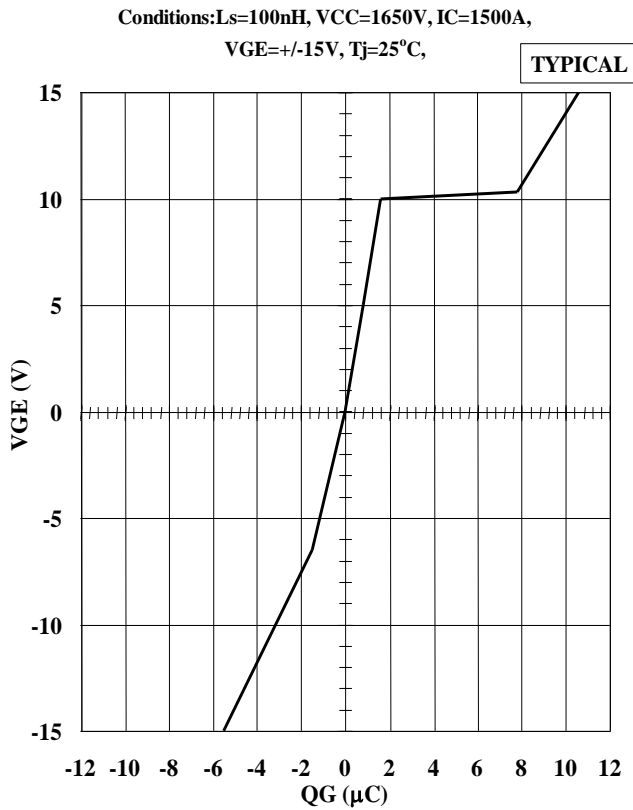
Curve approximation model

$$Z_{th} = \sum r_{th}[n] * (1 - \exp(-t/r_{th}[n]))$$

n	1	2	3	4	Unit
$\tau_{th}[n]$	1.60E-01	2.74E-02	4.04E-03	7.37E-04	sec
$r_{th}[n,IGBT]$	4.83E-03	1.40E-03	1.40E-03	1.43E-04	K/W
$r_{th}[n,Diode]$	9.62E-03	2.90E-03	2.74E-03	2.93E-04	K/W

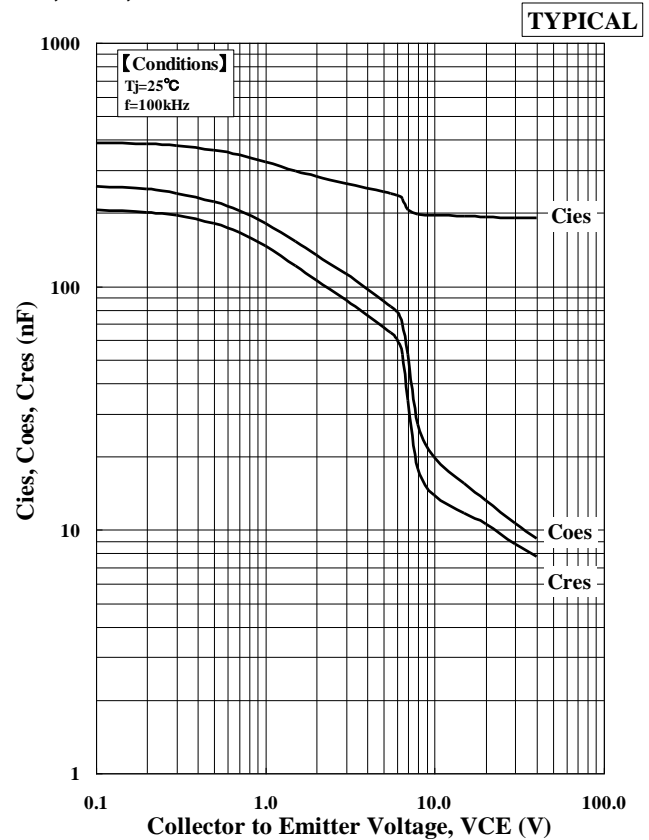
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QG-VG CURVE



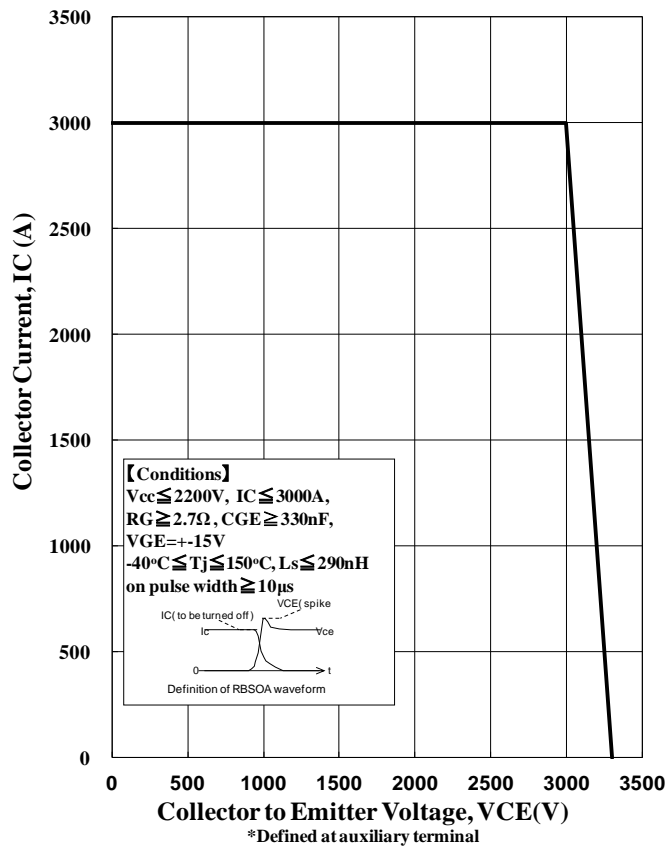
QG-VGE curve

Cies, Coes, Cres Curve

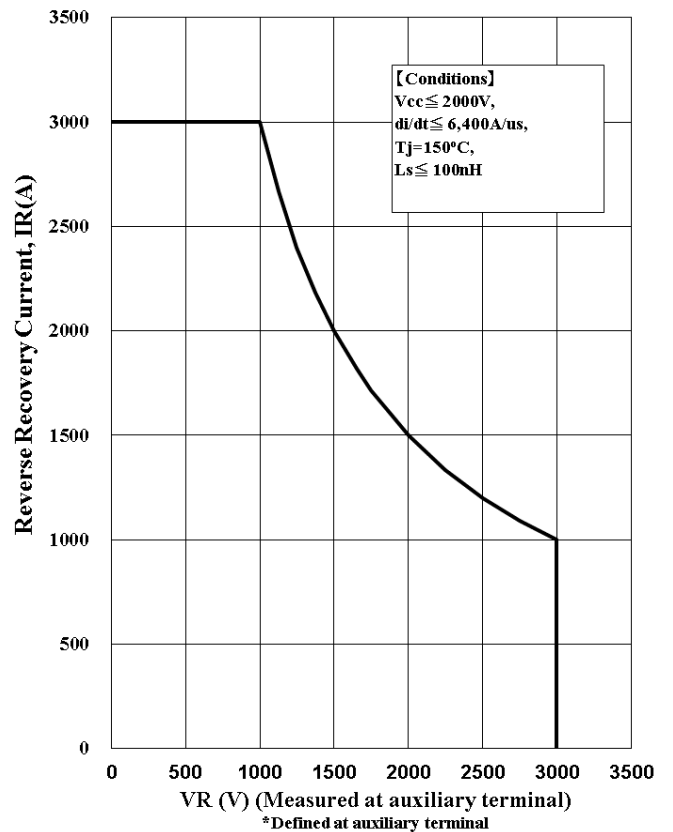


Capacitance vs. Collector to Emitter Voltage

Safe operation area



Reverse bias Safe operation area (RBSOA)



Reverse recovery Safe operation area (RecSOA)

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HITACHI POWER SEMICONDUCTORS

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