

## General Description

The GreenMOS<sup>®</sup> high voltage MOSFET utilizes charge balance technology to achieve outstanding low on-resistance and lower gate charge. It is engineered to minimize conduction loss, provide superior switching performance and robust avalanche capability.

The GreenMOS<sup>®</sup> Z series is integrated with fast recovery diode (FRD) to minimize reverse recovery time. It is suitable for resonant switching topologies to reach higher efficiency, higher reliability and smaller form factor.

## Features

- Low  $R_{DS(ON)}$  & FOM
- Extremely low switching loss
- Excellent stability and uniformity
- Ultra-fast and robust body diode




## Applications

- PC power
- Telecom power
- Server power
- EV Charger
- Motor driver

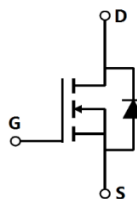
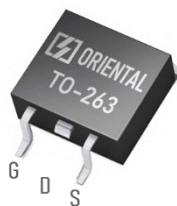
## Key Performance Parameters

Parameter	Value	Unit
$V_{DS}$	600	V
$I_{D, pulse}$	84	A
$R_{DS(ON), max} @ V_{GS}=10V$	99	m $\Omega$
$Q_g$	49	nC
PD	178	W

## Marking Information

Product Name	Package	Marking
OSG60R099KT4ZF	TO263	OSG60R099KT4Z

## Package & Pin Information



**Absolute Maximum Ratings** at  $T_j=25^{\circ}\text{C}$  unless otherwise noted

Parameter	Symbol	Value	Unit
Drain-source voltage	$V_{DS}$	600	V
Gate-source voltage (static)	$V_{GS}$	$\pm 20$	V
Gate-source voltage (dynamic)		$\pm 30$	V
Continuous drain current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$	$I_D$	28	A
Continuous drain current <sup>1)</sup> , $T_C=100^{\circ}\text{C}$		17.7	
Pulsed drain current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$	$I_{D, pulse}$	84	A
Continuous diode forward current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$	$I_S$	28	A
Diode pulsed current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$	$I_{S, pulse}$	84	A
Power dissipation <sup>3)</sup> , $T_C=25^{\circ}\text{C}$	$P_D$	178	W
Single pulsed avalanche energy <sup>5)</sup>	$E_{AS}$	290	mJ
MOSFET dv/dt ruggedness, $V_{DS}=0\dots 400\text{ V}$	dv/dt	100	V/ns
Reverse diode dv/dt, $V_{DS}=0\dots 400\text{ V}$ , $I_{SD}\leq I_D$	dv/dt	50	V/ns
Operation and storage temperature	$T_{stg}, T_j$	-55 to 150	$^{\circ}\text{C}$

**Thermal Characteristics**

Parameter	Symbol	Value	Unit
Thermal resistance, junction-case	$R_{\theta JC}$	0.7	$^{\circ}\text{C/W}$
Thermal resistance, junction-ambient <sup>4)</sup>	$R_{\theta JA}$	62	$^{\circ}\text{C/W}$

**Electrical Characteristics** at  $T_j=25^{\circ}\text{C}$  unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Drain-source breakdown voltage	$BV_{DSS}$	600			V	$V_{GS}=0\text{ V}$ , $I_D=1\text{ mA}$
Gate threshold voltage	$V_{GS(th)}$	3.5		5.5	V	$V_{DS}=V_{GS}$ , $I_D=1\text{ mA}$
Drain-source on-state resistance	$R_{DS(ON)}$		75	99	m $\Omega$	$V_{GS}=10\text{ V}$ , $I_D=13\text{ A}$
			177			$V_{GS}=10\text{ V}$ , $I_D=13\text{ A}$ , $T_j=150^{\circ}\text{C}$
Gate-source leakage current	$I_{GSS}$			100	nA	$V_{GS}=20\text{ V}$
				-100		$V_{GS}=-20\text{ V}$
Drain-source leakage current	$I_{DSS}$			10	$\mu\text{A}$	$V_{DS}=600\text{ V}$ , $V_{GS}=0\text{ V}$
Gate resistance	$R_G$		10		$\Omega$	$f=1\text{ MHz}$ , Open drain

### Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	$C_{iss}$		2225		pF	$V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=100\text{ kHz}$
Output capacitance	$C_{oss}$		127		pF	
Reverse transfer capacitance	$C_{rss}$		2.5		pF	
Effective output capacitance, energy related	$C_{o(er)}$		82		pF	$V_{GS}=0\text{ V}$ , $V_{DS}=0\text{ V-400 V}$
Effective output capacitance, time related	$C_{o(tr)}$		487		pF	
Turn-on delay time	$t_{d(on)}$		26		ns	$V_{GS}=10\text{ V}$ , $V_{DS}=400\text{ V}$ , $R_G=2\ \Omega$ , $I_D=13\text{ A}$
Rise time	$t_r$		35		ns	
Turn-off delay time	$t_{d(off)}$		74		ns	
Fall time	$t_f$		5.2		ns	

### Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	$Q_g$		49		nC	$V_{GS}=10\text{ V}$ , $V_{DS}=400\text{ V}$ , $I_D=13\text{ A}$
Gate-source charge	$Q_{gs}$		15		nC	
Gate-drain charge	$Q_{gd}$		22		nC	
Gate plateau voltage	$V_{plateau}$		7.2		V	

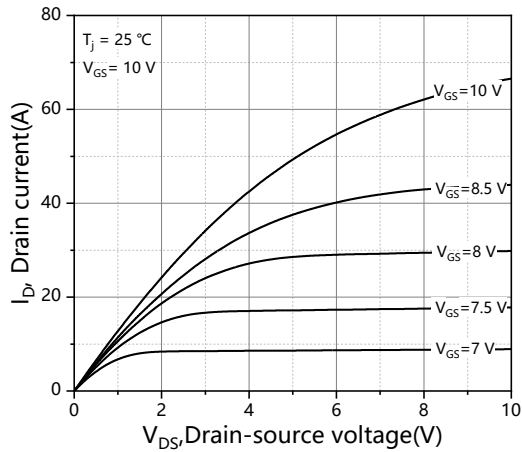
### Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	$V_{SD}$			1.3	V	$I_S=26\text{ A}$ , $V_{GS}=0\text{ V}$
Reverse recovery time	$t_{rr}$		129		ns	$V_R=400\text{ V}$ , $I_S=13\text{ A}$ , $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		0.65		$\mu\text{C}$	
Peak reverse recovery current	$I_{rrm}$		9		A	

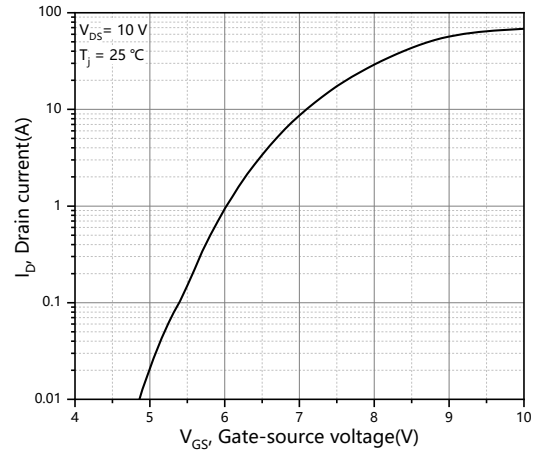
### Note

- 1) Calculated continuous current based on maximum allowable junction temperature.
- 2) Repetitive rating; pulse width limited by max. junction temperature.
- 3)  $P_d$  is based on max. junction temperature, using junction-case thermal resistance.
- 4) The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_a=25\text{ }^\circ\text{C}$ .
- 5)  $V_{DD}=100\text{ V}$ ,  $V_{GS}=10\text{ V}$ ,  $L=80\text{ mH}$ , starting  $T_j=25\text{ }^\circ\text{C}$ .

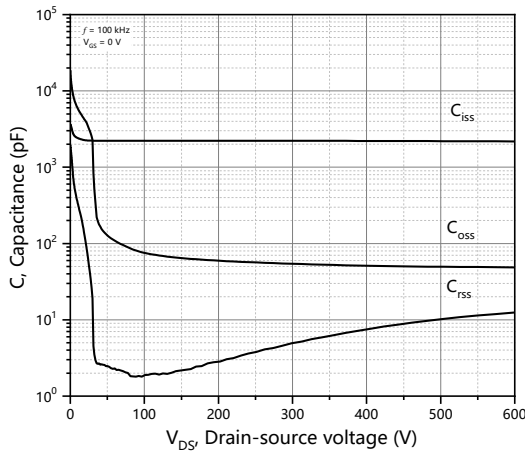
**Electrical Characteristics Diagrams**



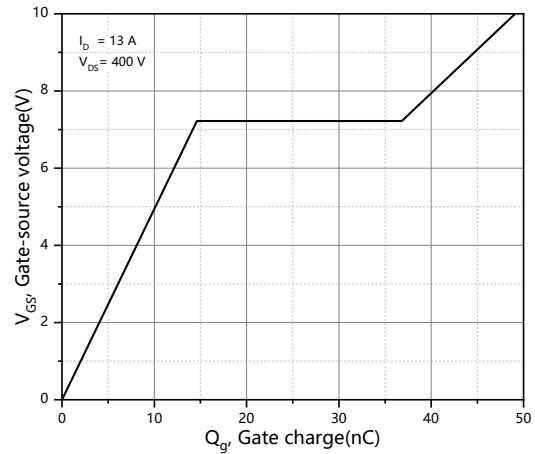
**Figure 1. Typ. output characteristics  $T_j=25^\circ\text{C}$**



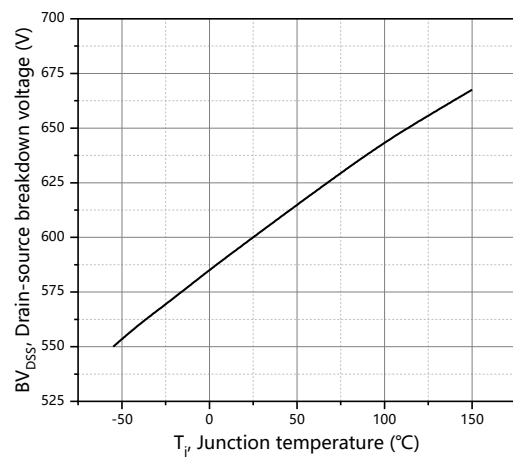
**Figure 2. Typ. transfer characteristics**



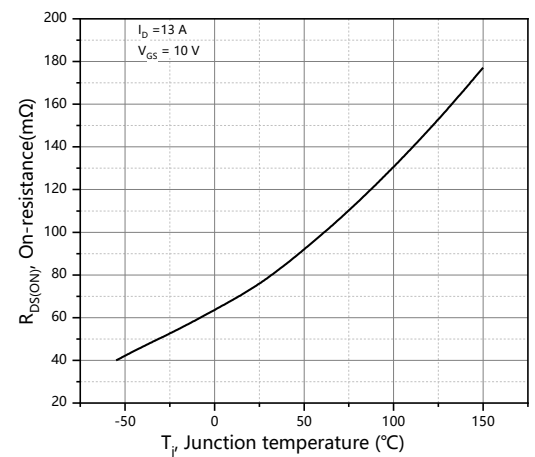
**Figure 3. Typ. capacitances**



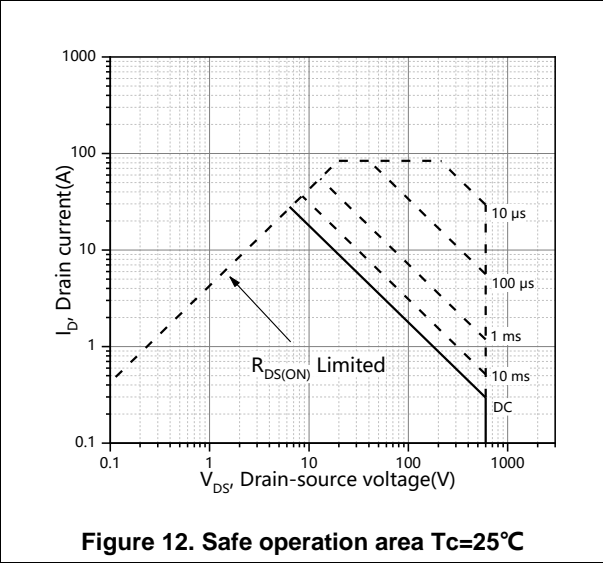
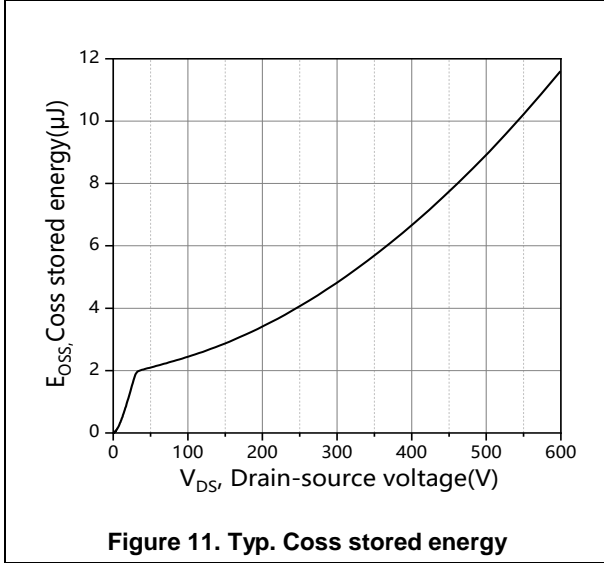
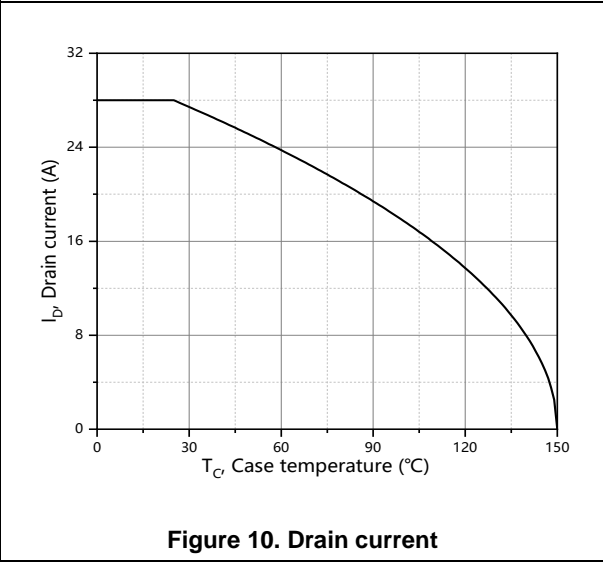
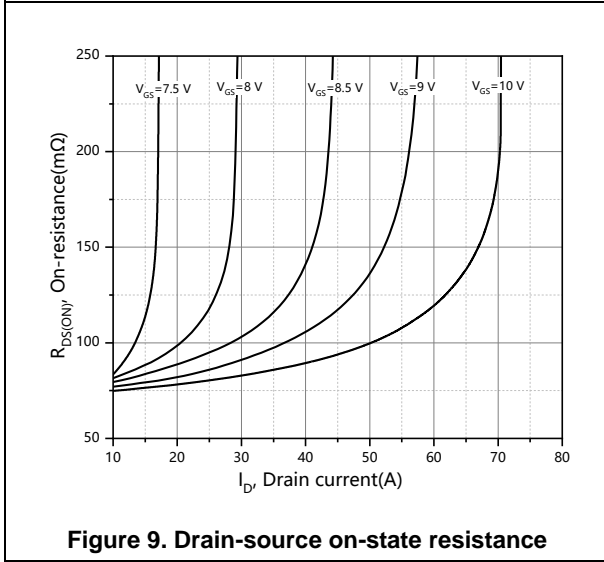
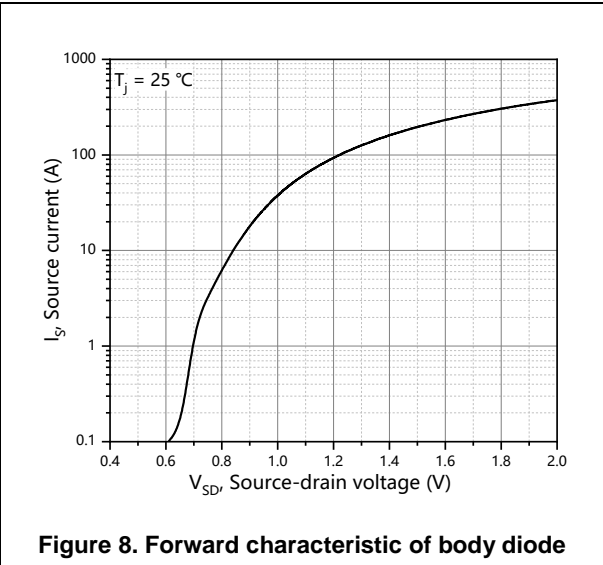
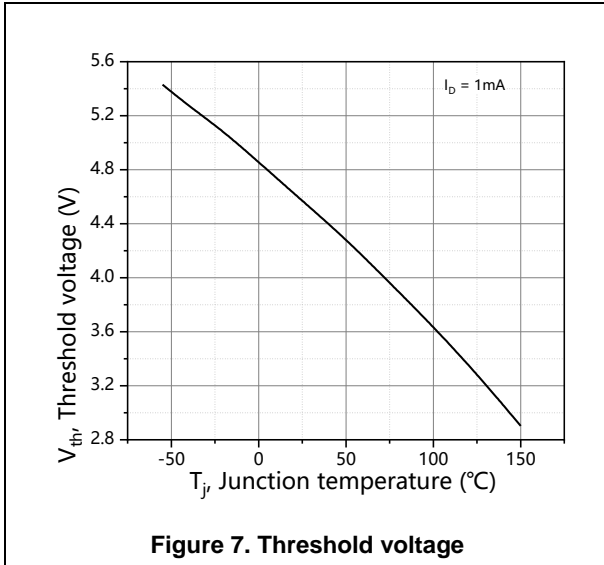
**Figure 4. Typ. gate charge**

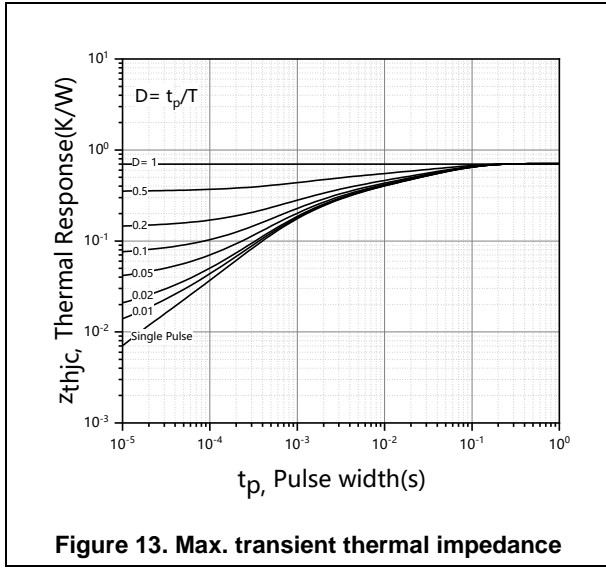


**Figure 5. Drain-source breakdown voltage**

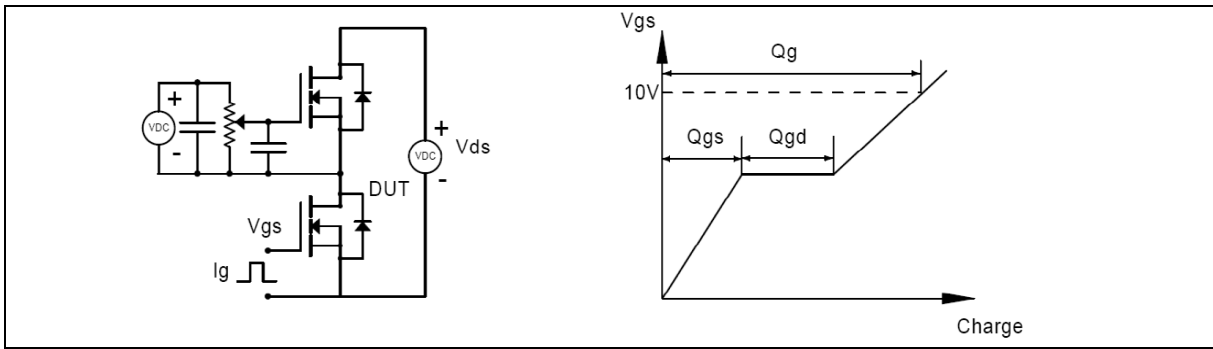


**Figure 6. Drain-source on-state resistance**

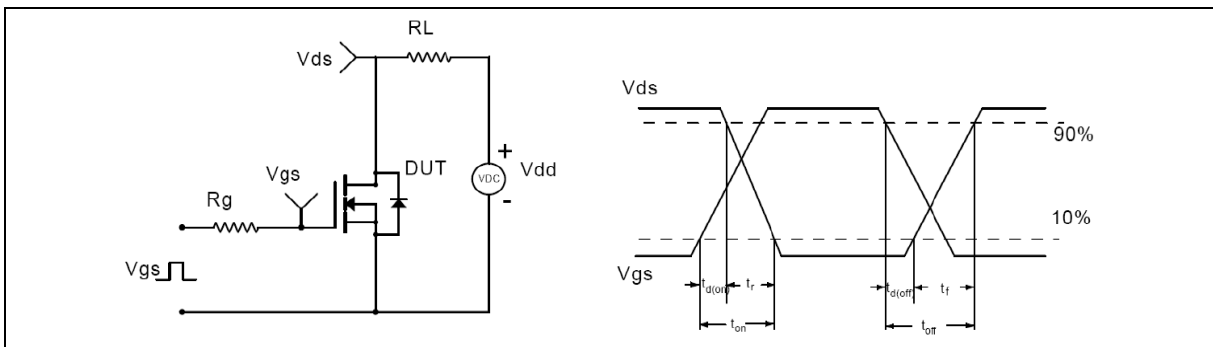




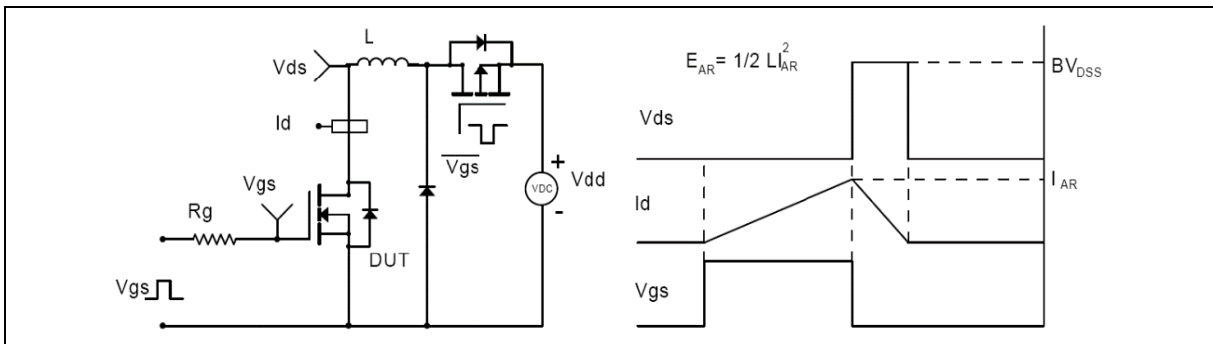
**Test circuits and waveforms**



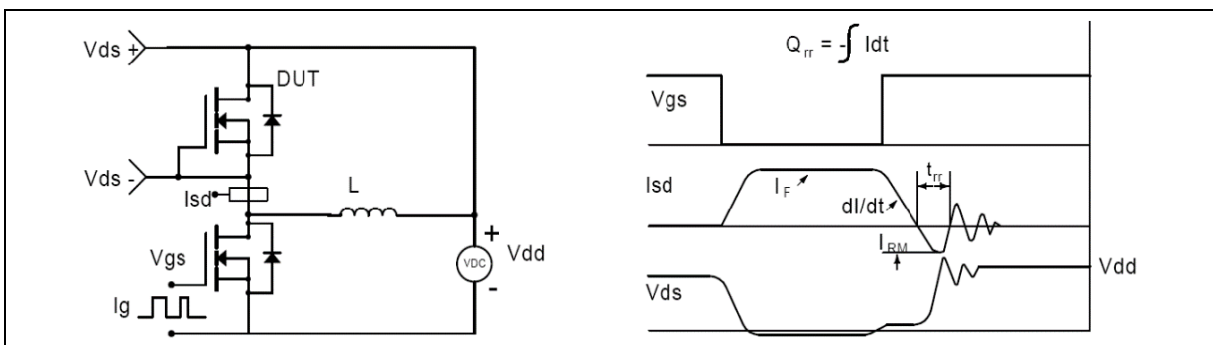
**Figure 1. Gate charge test circuit & waveform**



**Figure 2. Switching time test circuit & waveforms**

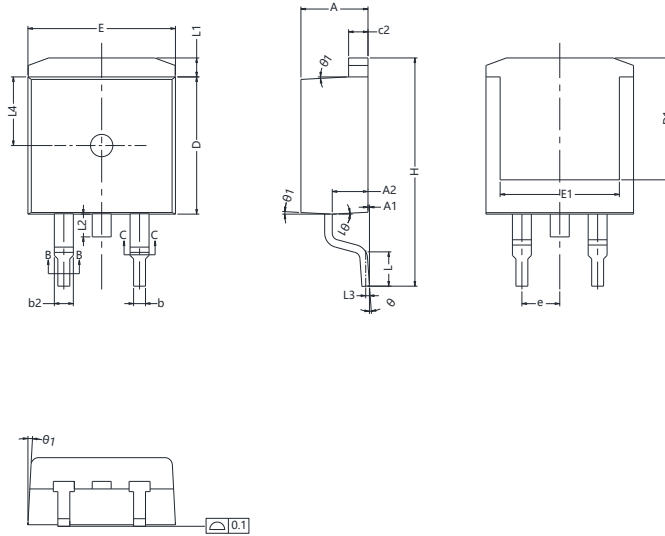


**Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms**



**Figure 4. Diode reverse recovery test circuit & waveforms**

**Package Information**



Symbol	mm		
	Min	Nom	Max
A	4.40	4.50	4.60
A1	0.00	0.10	0.25
A2	2.20	2.40	2.60
b	0.76	-	0.89
b2	1.23	-	1.37
c	0.47	-	0.60
c1	0.46	0.51	0.56
c2	1.25	1.30	1.35
D	9.10	9.20	9.30
D1	8.00	-	-
E	9.80	9.90	10.00
E1	7.80	-	-
e	2.54BSC		
H	14.90	15.30	15.70
L	2.00	2.30	2.30
L1	1.17	1.27	1.40
L2	-	-	1.75
L3	0.25BSC		
L4	4.60 REF		
theta	0°	-	8°
theta1	1°	3°	5°

Version: TO263-J package outline dimension



### Ordering Information

Package Type	Units/ Reel	Reels/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO263-J	800	1	800	10	8000

### Product Information

Product	Package	Pb Free	RoHS	Halogen Free
OSG60R099KT4ZF	TO263	yes	yes	yes

### Legal Disclaimer

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