

### 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

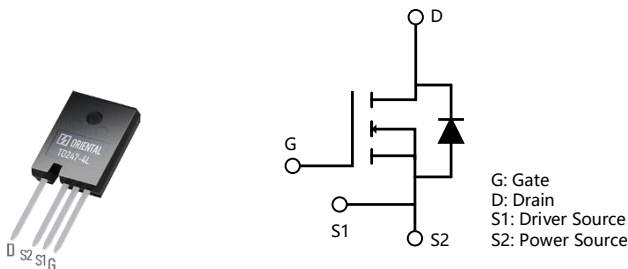
### Key Performance Parameters

Parameter	Value	Unit
$V_{DS, min} @ T_{j(max)}$	700	V
$I_{D, pulse}$	240	A
$R_{DS(ON), max} @ V_{GS}=10V$	38	m $\Omega$
$Q_g$	175	nC

### Marking Information

Product Name	Package	Marking
OSG65R038H4ZF	TO247-4L	OSG65R038H4Z

### Package & Pin Information



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

Parameter	Symbol	Value	Unit
Drain-source voltage	$V_{DS}$	650	V
Gate-source voltage	$V_{GS}$	$\pm 30$	V
Continuous drain current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$	$I_D$	80	A
Continuous drain current <sup>1)</sup> , $T_C=100^{\circ}\text{C}$		50	
Pulsed drain current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$	$I_{D, pulse}$	240	A
Continuous diode forward current <sup>1)</sup> , $T_C=25^{\circ}\text{C}$	$I_S$	80	A
Diode pulsed current <sup>2)</sup> , $T_C=25^{\circ}\text{C}$	$I_{S, pulse}$	240	A
Power dissipation <sup>3)</sup> , $T_C=25^{\circ}\text{C}$	$P_D$	500	W
Single pulsed avalanche energy <sup>5)</sup>	$E_{AS}$	2900	mJ
MOSFET dv/dt ruggedness, $V_{DS}=0\dots 480\text{ V}$	dv/dt	100	V/ns
Reverse diode dv/dt, $V_{DS}=0\dots 480\text{ V}$ , $I_{SD}\leq I_D$	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	$R_{\theta JC}$	0.25	$^{\circ}\text{C/W}$
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	$BV_{DSS}$	650			V	$V_{GS}=0\text{ V}$ , $I_D=2\text{ mA}$
		700	770			$V_{GS}=0\text{ V}$ , $I_D=2\text{ mA}$ , $T_j=150^{\circ}\text{C}$
Gate threshold voltage	$V_{GS(th)}$	3.0		4.0	V	$V_{DS}=V_{GS}$ , $I_D=2\text{ mA}$
Drain-source on-state resistance	$R_{DS(ON)}$		0.032	0.038	$\Omega$	$V_{GS}=10\text{ V}$ , $I_D=40\text{ A}$
			0.083			$V_{GS}=10\text{ V}$ , $I_D=40\text{ A}$ , $T_j=150^{\circ}\text{C}$
Gate-source leakage current	$I_{GSS}$			100	nA	$V_{GS}=30\text{ V}$
				-100		$V_{GS}=-30\text{ V}$
Drain-source leakage current	$I_{DSS}$			10	$\mu\text{A}$	$V_{DS}=650\text{ V}$ , $V_{GS}=0\text{ V}$

### Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	$C_{iss}$		8537.9		pF	$V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=100\text{ kHz}$
Output capacitance	$C_{oss}$		516.1		pF	
Reverse transfer capacitance	$C_{rss}$		13.7		pF	
Turn-on delay time	$t_{d(on)}$		55.9		ns	$V_{GS}=10\text{ V}$ , $V_{DS}=400\text{ V}$ , $R_G=2\ \Omega$ , $I_D=40\text{ A}$
Rise time	$t_r$		121.2		ns	
Turn-off delay time	$t_{d(off)}$		114.2		ns	
Fall time	$t_f$		8.75		ns	

### Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	$Q_g$		175.0		nC	$V_{GS}=10\text{ V}$ , $V_{DS}=400\text{ V}$ , $I_D=40\text{ A}$
Gate-source charge	$Q_{gs}$		40.1		nC	
Gate-drain charge	$Q_{gd}$		76.1		nC	
Gate plateau voltage	$V_{plateau}$		6.4		V	

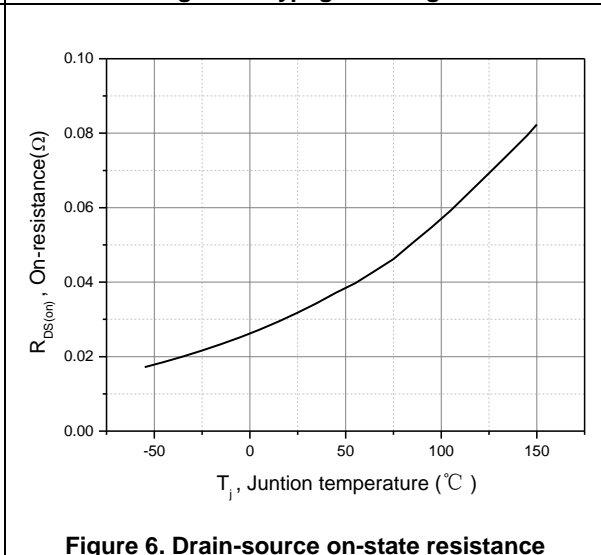
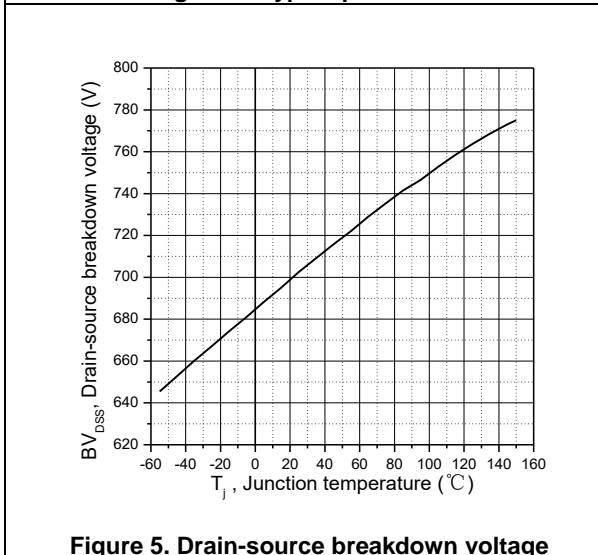
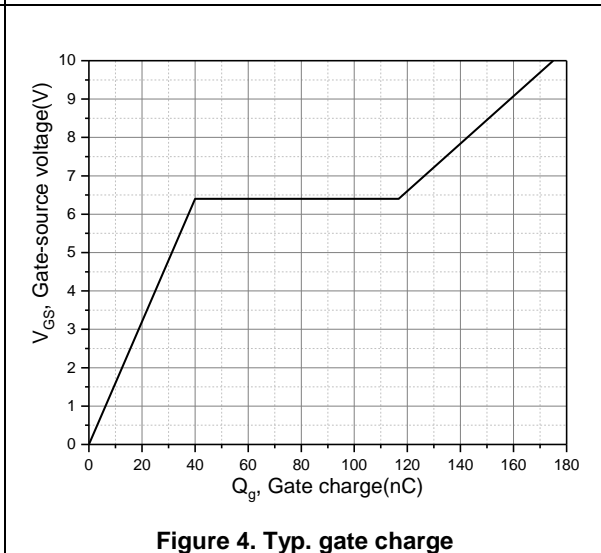
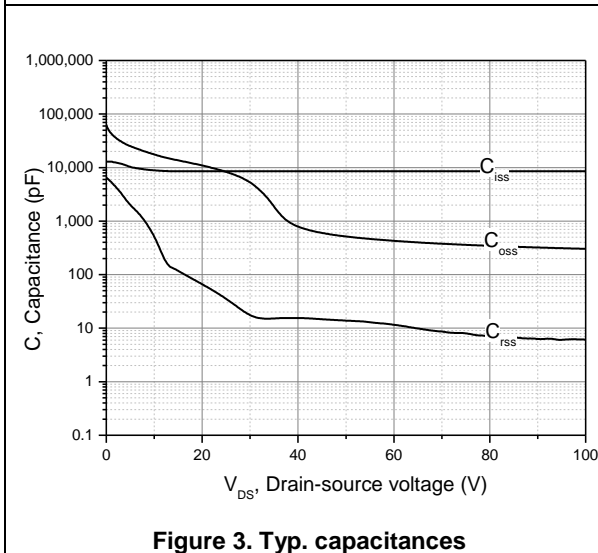
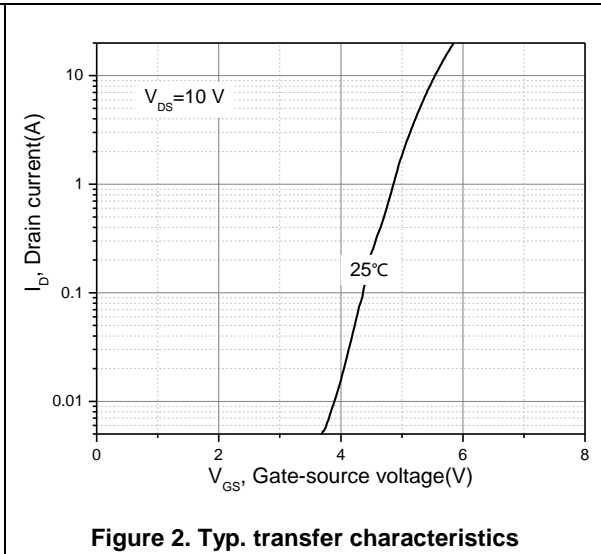
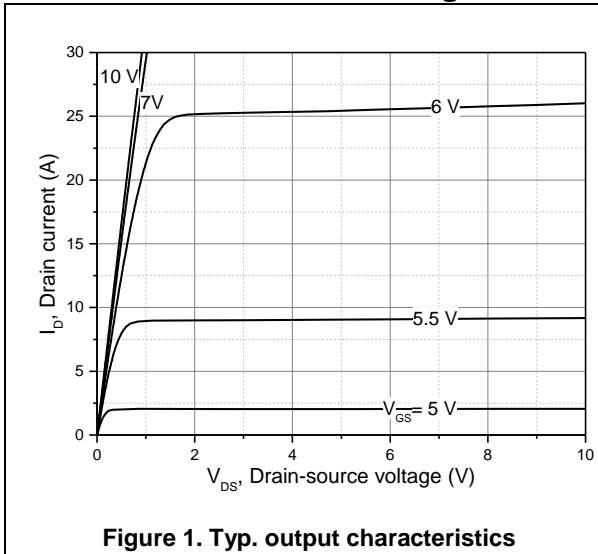
### Body Diode Characteristics

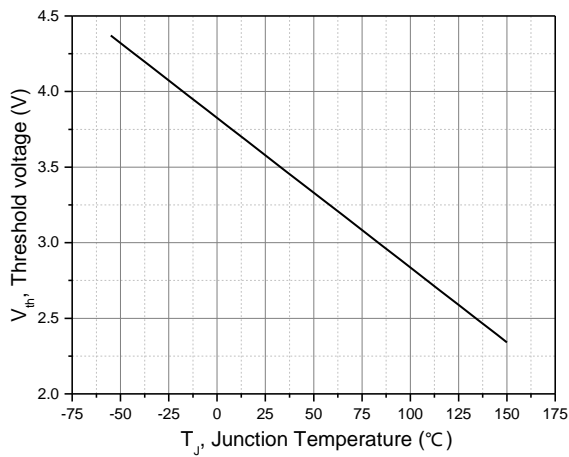
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	$V_{SD}$			1.3	V	$I_S=80\text{ A}$ , $V_{GS}=0\text{ V}$
Reverse recovery time	$t_{rr}$		180		ns	$I_S=30\text{ A}$ , $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		1.5		$\mu\text{C}$	
Peak reverse recovery current	$I_{rrm}$		15.2		A	

### Note

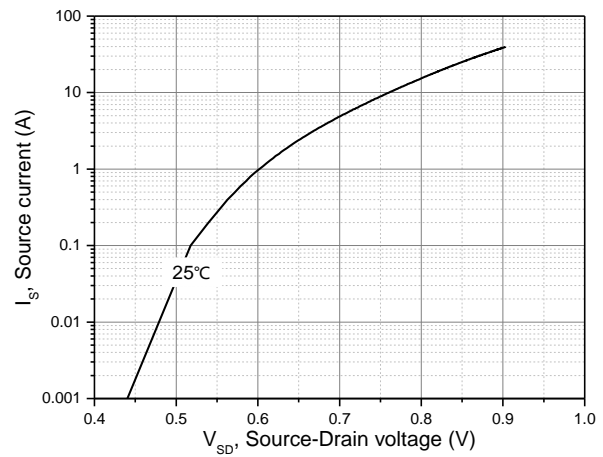
- 1) Calculated continuous current based on maximum allowable junction temperature.
- 2) Repetitive rating; pulse width limited by max. junction temperature.
- 3)  $P_d$  is based on max. junction temperature, using junction-case thermal resistance.
- 4) The value of  $R_{\theta JA}$  is measured with the device mounted on 1 in 2 FR-4 board with 2oz. Copper, in a still air environment with  $T_a=25\text{ }^\circ\text{C}$ .
- 5)  $V_{DD}=300\text{ V}$ ,  $V_{GS}=10\text{ V}$ ,  $L=40\text{ mH}$ , starting  $T_j=25\text{ }^\circ\text{C}$ .

**Electrical Characteristics Diagrams**

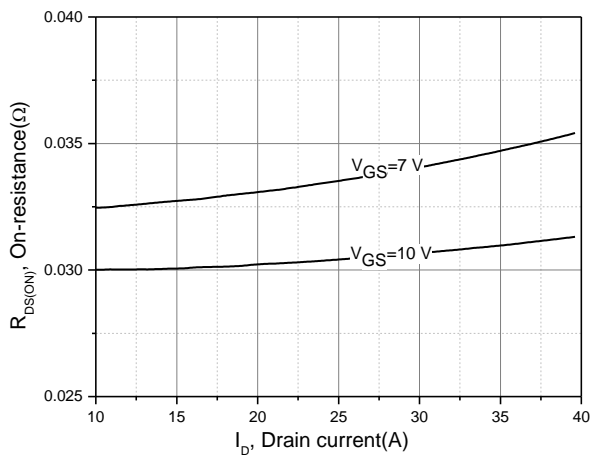




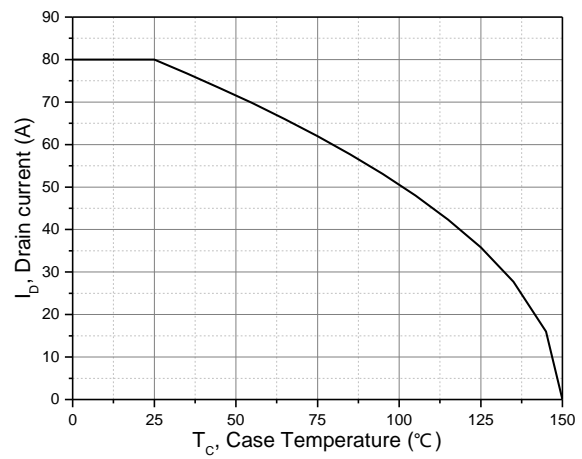
**Figure 7. Threshold voltage**



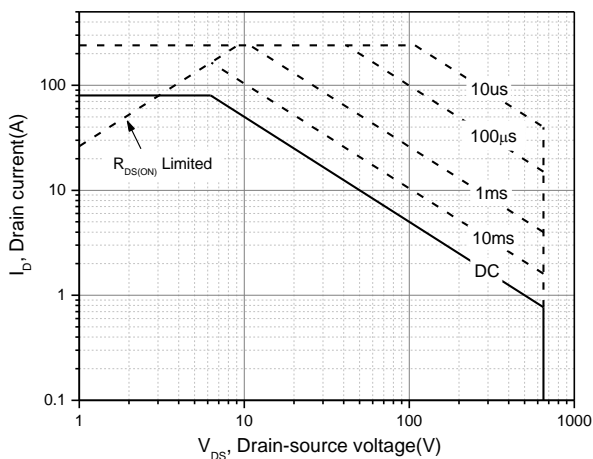
**Figure 8. Forward characteristic of body diode**



**Figure 9. Drain-source on-state resistance**

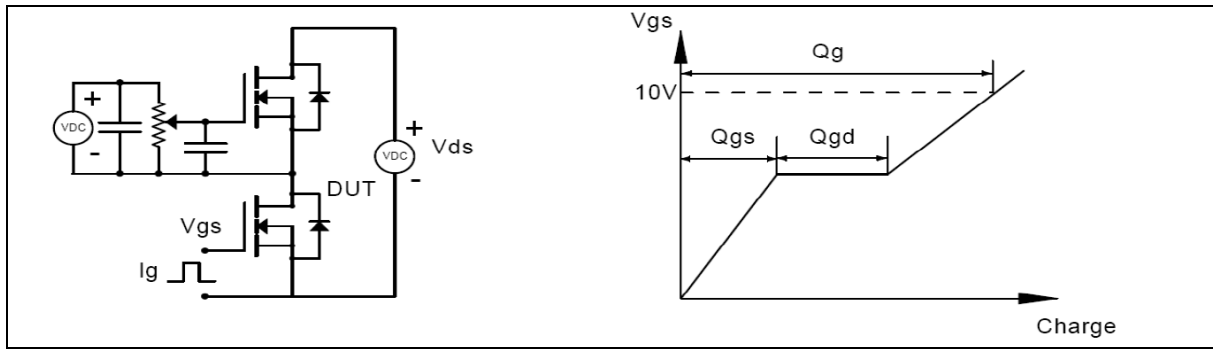


**Figure 10. Drain current**

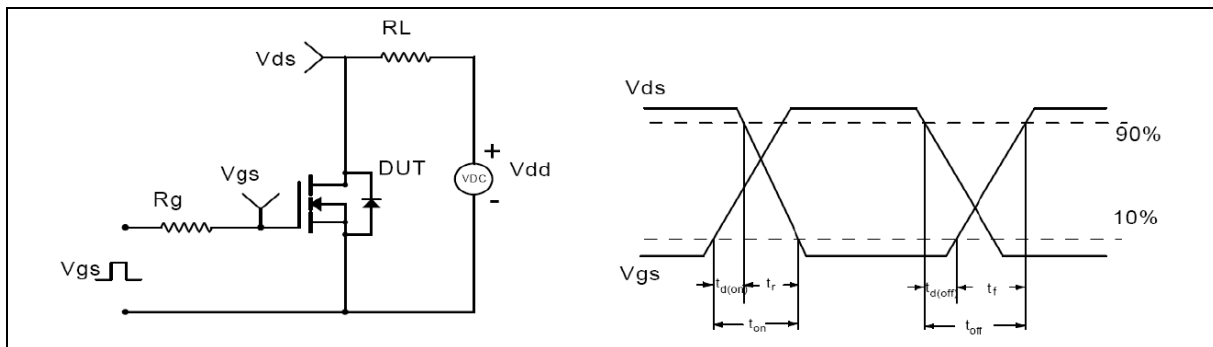


**Figure 11. Safe operation area  $T_C=25^{\circ}C$**

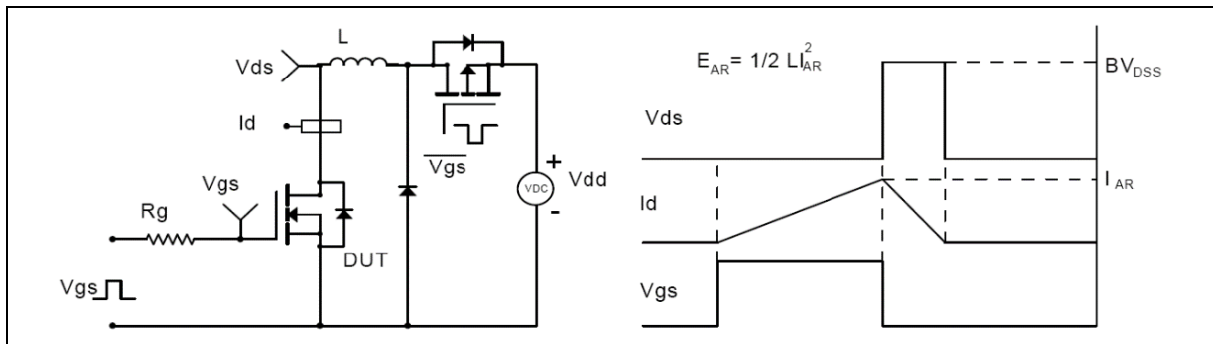
**Test circuits and waveforms**



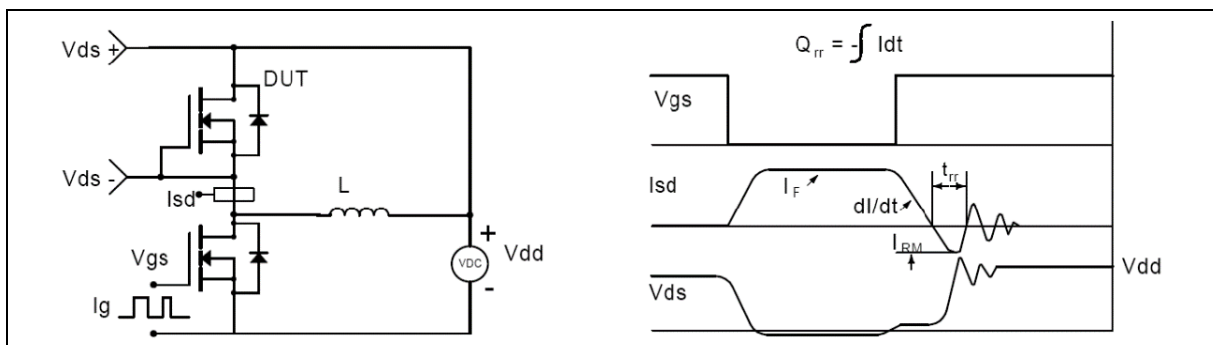
**Figure 1. Gate charge test circuit & waveform**



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

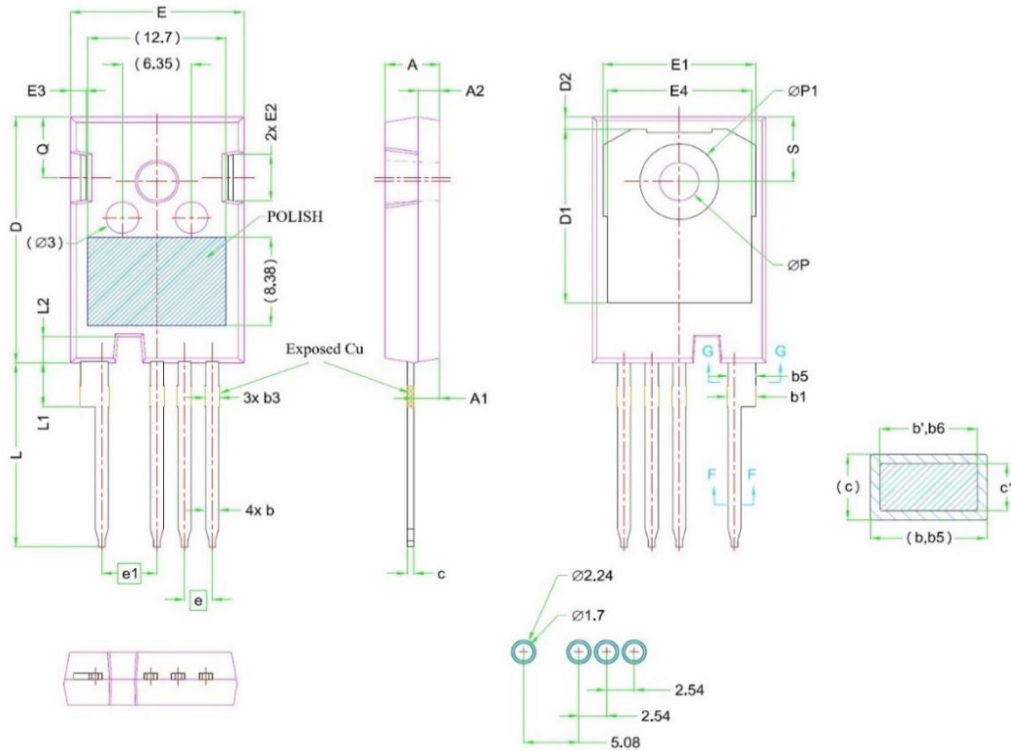


**Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms**



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

**Package Information**



Symbol	mm		
	Min	Nom	Max
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b3	1.07	1.30	1.60
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	0.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ΦP	3.51	3.61	3.65
ΦP1	7.19 REF		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

Version1: TO247-4L-M package outline dimension

## Ordering Information

Package Type	Units/ Tube	Tubes/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO247-4L-M	30	11	330	6	1980

## Product Information

Product	Package	Pb Free	RoHS	Halogen Free
OSG65R038H4ZF	TO247-4L	yes	yes	yes

## Legal Disclaimer

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