

## 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

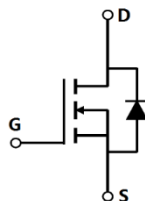
## Key Performance Parameters

Parameter	Value	Unit
$V_{DS, min} @ T_{j(max)}$	700	V
$I_{D, pulse}$	54	A
$R_{DS(ON), max} @ V_{GS}=10V$	220	$m\Omega$
$Q_g$	21.7	nC

## Marking Information

Product Name	Package	Marking
OSG65R220FZF	TO220F	OSG65R220FZ

## 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> , $T_C=25^\circ\text{C}$	$I_D$	18	A
Continuous drain current <sup>1)</sup> , $T_C=100^\circ\text{C}$		11.5	
Pulsed drain current <sup>2)</sup> , $T_C=25^\circ\text{C}$	$I_{D, pulse}$	54	A
Continuous diode forward current <sup>1)</sup> , $T_C=25^\circ\text{C}$	$I_S$	18	A
Diode pulsed current <sup>2)</sup> , $T_C=25^\circ\text{C}$	$I_{S, pulse}$	54	A
Power dissipation <sup>3)</sup> , $T_C=25^\circ\text{C}$	$P_D$	34	W
Single pulsed avalanche energy <sup>5)</sup>	$E_{AS}$	272	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	$R_{\theta JC}$	3.68	$^\circ\text{C/W}$
Thermal resistance, junction-ambient <sup>4)</sup>	$R_{\theta JA}$	62.5	$^\circ\text{C/W}$

**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	$V_{GS}=0\text{ V}$ , $I_D=250\text{ }\mu\text{A}$
		700	770			$V_{GS}=0\text{ V}$ , $I_D=250\text{ }\mu\text{A}$ , $T_j=150^\circ\text{C}$
Gate threshold voltage	$V_{GS(th)}$	3.0		4.5	V	$V_{DS}=V_{GS}$ , $I_D=250\text{ }\mu\text{A}$
Drain-source on-state resistance	$R_{DS(on)}$		0.18	0.22	$\Omega$	$V_{GS}=10\text{ V}$ , $I_D=9\text{ A}$
			0.45			$V_{GS}=10\text{ V}$ , $I_D=9\text{ A}$ , $T_j=150^\circ\text{C}$
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	$C_{iss}$		1493		pF	$V_{GS}=0\text{ V}$ , $V_{DS}=50\text{ V}$ , $f=1\text{ MHz}$
Output capacitance	$C_{oss}$		101		pF	
Reverse transfer capacitance	$C_{rss}$		2.05		pF	
Turn-on delay time	$t_{d(on)}$		45.28		ns	$V_{GS}=10\text{ V}$ , $V_{DS}=400\text{ V}$ , $R_G=20\ \Omega$ , $I_D=18\text{ A}$
Rise time	$t_r$		82.64		ns	
Turn-off delay time	$t_{d(off)}$		42.20		ns	
Fall time	$t_f$		32.56		ns	

### Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	$Q_g$		21.7		nC	$V_{GS}=10\text{ V}$ , $V_{DS}=400\text{ V}$ , $I_D=18\text{ A}$
Gate-source charge	$Q_{gs}$		8.04		nC	
Gate-drain charge	$Q_{gd}$		7.4		nC	
Gate plateau voltage	$V_{plateau}$		7.2		V	

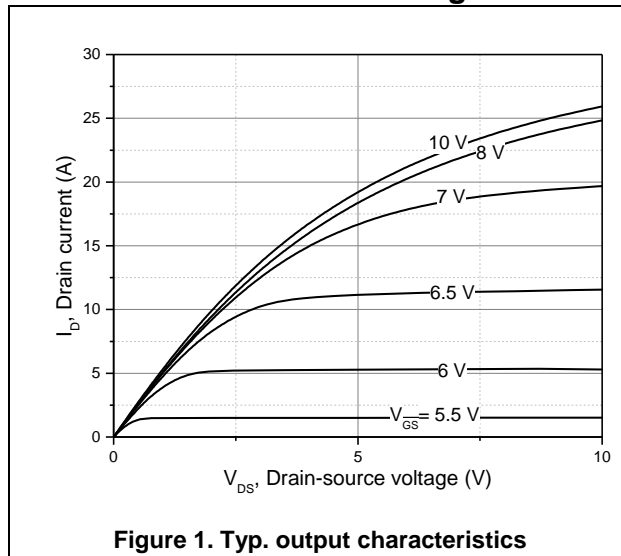
### Body Diode Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	$V_{SD}$			1.2	V	$I_S=18\text{ A}$ , $V_{GS}=0\text{ V}$
Reverse recovery time	$t_{rr}$		143.3		ns	$I_S=18\text{ A}$ , $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	$Q_{rr}$		767		nC	
Peak reverse recovery current	$I_{rrm}$		10.7		A	

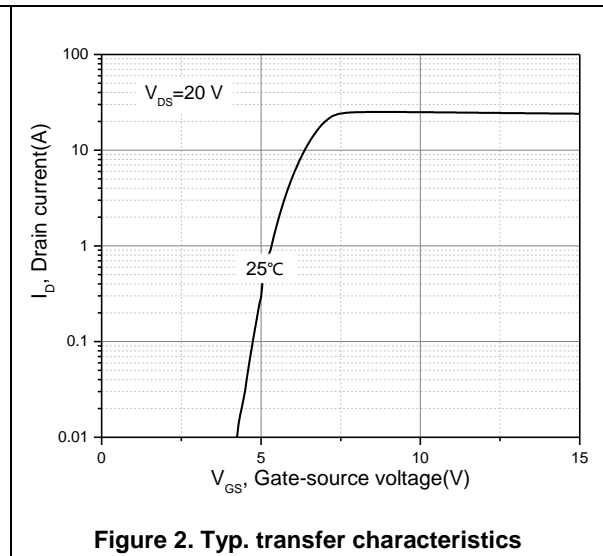
### Note

- 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)  $V_{DD}=100\text{ V}$ ,  $V_{GS}=10\text{ V}$ ,  $L=10\text{ mH}$ , starting  $T_j=25\text{ }^\circ\text{C}$ .

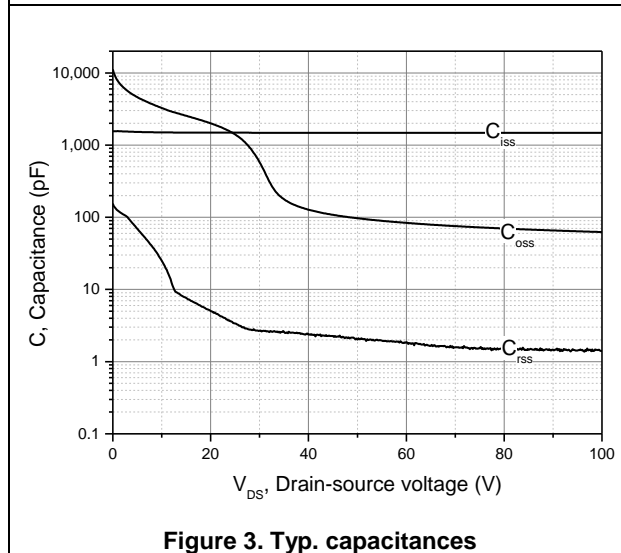
**Electrical Characteristics Diagrams**



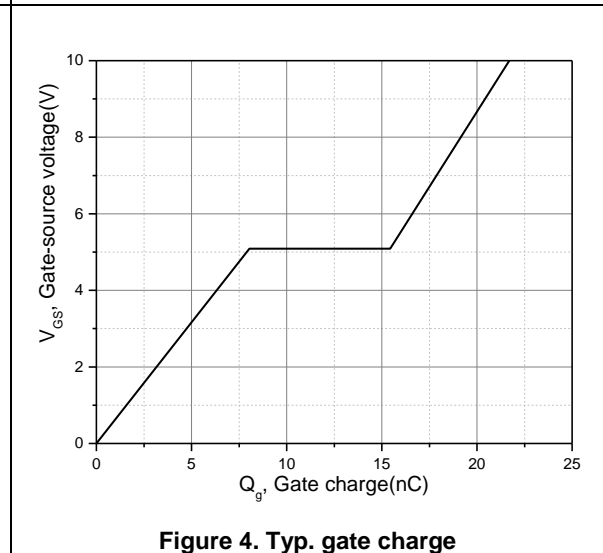
**Figure 1. Typ. output characteristics**



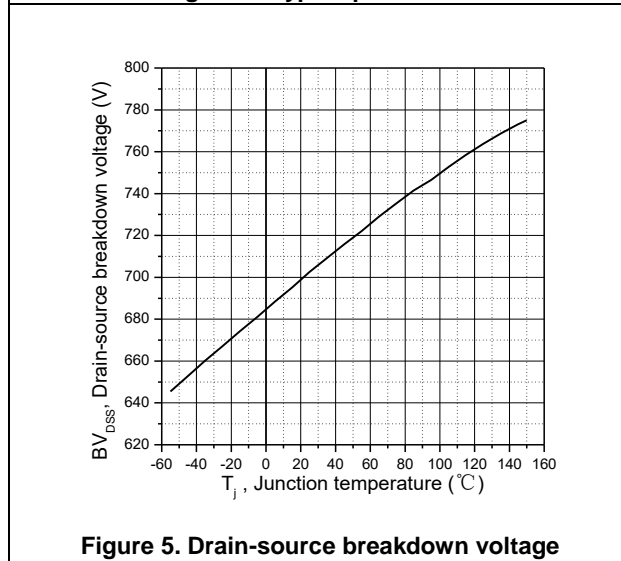
**Figure 2. Typ. transfer characteristics**



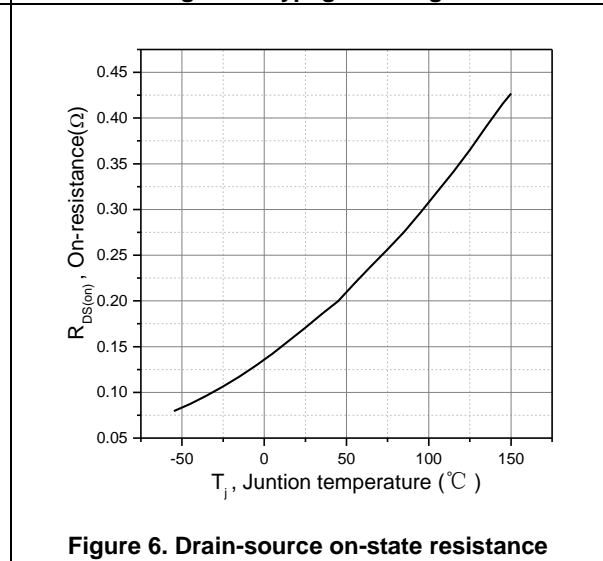
**Figure 3. Typ. capacitances**



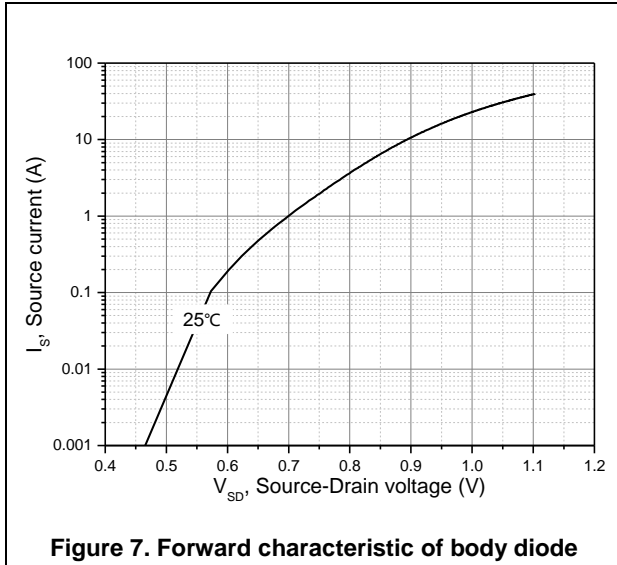
**Figure 4. Typ. gate charge**



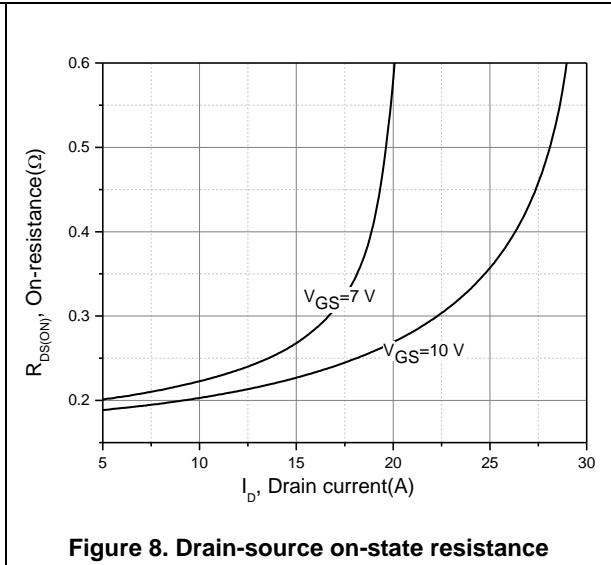
**Figure 5. Drain-source breakdown voltage**



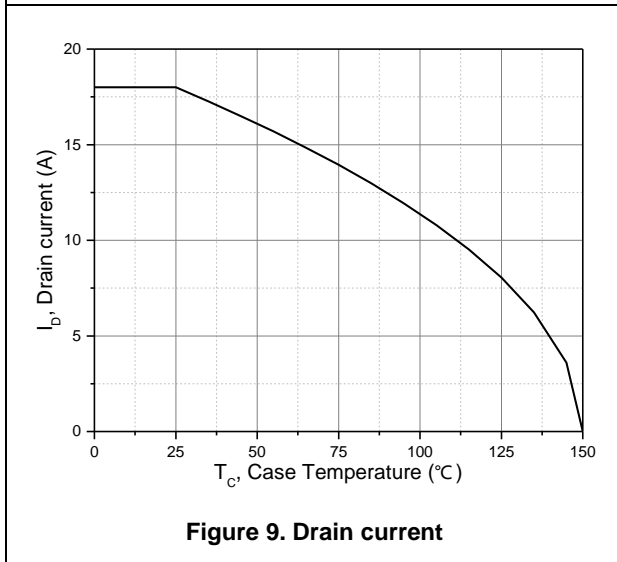
**Figure 6. Drain-source on-state resistance**



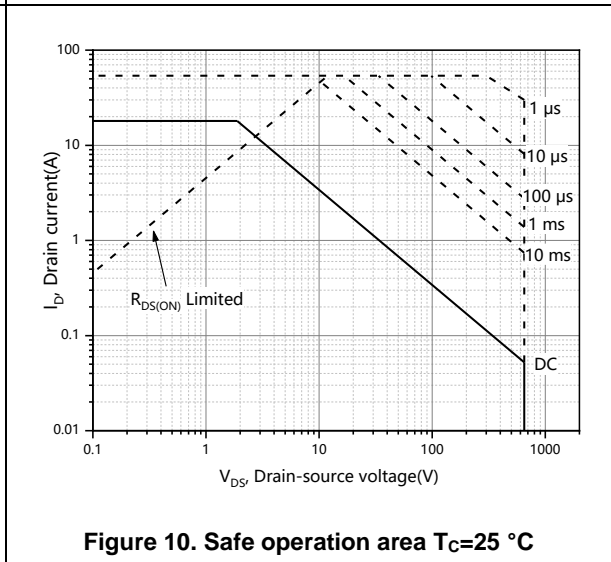
**Figure 7. Forward characteristic of body diode**



**Figure 8. Drain-source on-state resistance**

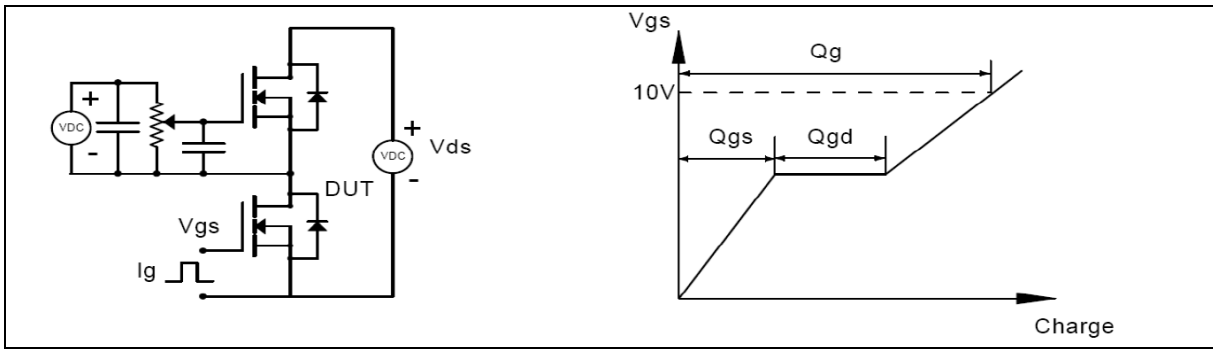


**Figure 9. Drain current**

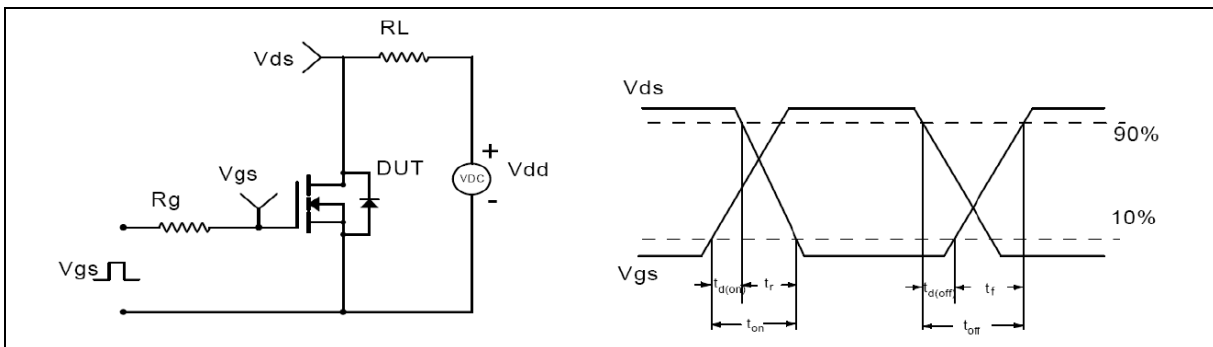


**Figure 10. Safe operation area T<sub>c</sub>=25 °C**

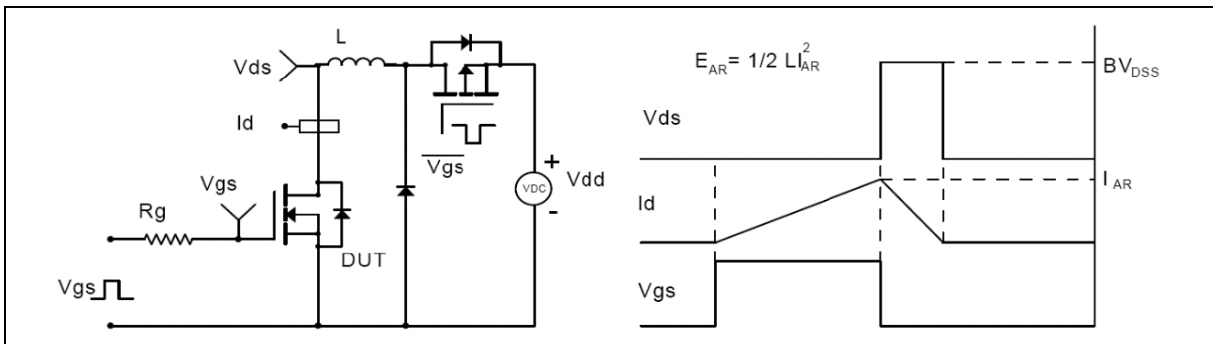
**Test circuits and waveforms**



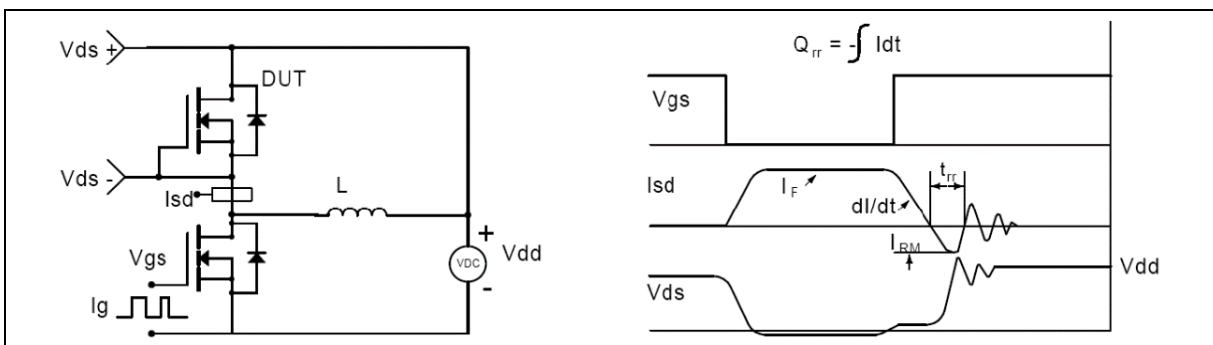
**Figure 1. Gate charge test circuit & waveform**



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

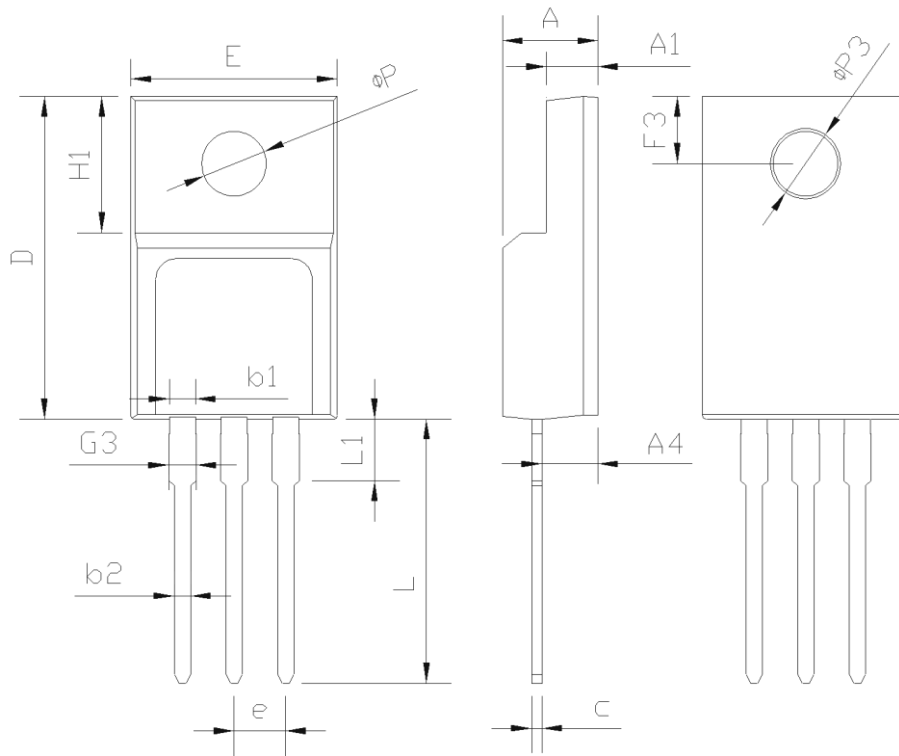


**Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms**



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

**Package Information**



Symbol	mm		
	Min	Nom	Max
E	9.96	10.16	10.36
A	4.50	4.70	4.90
A1	2.34	2.54	2.74
A4	2.56	2.76	2.96
c	0.40	0.50	0.65
D	15.57	15.87	16.17
H1	6.70 REF		
e	2.54 BSC		
L	12.68	12.98	13.28
L1	2.88	3.03	3.18
ΦP	3.03	3.18	3.38
ΦP3	3.15	3.45	3.65
F3	3.15	3.30	3.45
G3	1.25	1.35	1.55
b1	1.18	1.28	1.43
b2	0.70	0.80	0.95

Version1: TO220F-C package outline dimension

## Ordering Information

Package Type	Units/ Tube	Tubes/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO220F-C	50	20	1000	6	6000

## Product Information

Product	Package	Pb Free	RoHS	Halogen Free
OSG65R220FZF	TO220F	yes	yes	yes

## Legal Disclaimer

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