

General Description

The GreenMOS[®] 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[®] 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

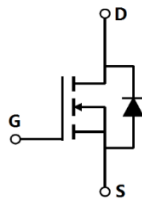
Key Performance Parameters

Parameter	Value	Unit
V_{DS}	650	V
I_D , pulse	24	A
$R_{DS(ON), max}$ @ $V_{GS}=10V$	650	m Ω
Q_g	11.9	nC

Marking Information

Product Name	Package	Marking
OSG65R650FZF	TO220F	OSG65R650FZ

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}	± 30	V
Continuous drain current ¹⁾ , $T_C=25^\circ\text{C}$	I_D	8	A
Continuous drain current ¹⁾ , $T_C=100^\circ\text{C}$		5.1	
Pulsed drain current ²⁾ , $T_C=25^\circ\text{C}$	$I_{D, pulse}$	24	A
Continuous diode forward current ¹⁾ , $T_C=25^\circ\text{C}$	I_S	8	A
Diode pulsed current ²⁾ , $T_C=25^\circ\text{C}$	$I_{S, pulse}$	24	A
Power dissipation ³⁾ , $T_C=25^\circ\text{C}$	P_D	28	W
Single pulsed avalanche energy ⁴⁾	E_{AS}	117	mJ
MOSFET dv/dt ruggedness, $V_{DS}=0\dots 480\text{ V}$	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS}=0\dots 480\text{ V}$, $I_{SD}\leq I_D$	dv/dt	50	V/ns
Maximum diode commutation speed di/dt, $V_{DS}=0\dots 480\text{ V}$, $I_{SD}\leq I_D$	di/dt	500	A/ μs
Operation and storage temperature	T_{stg}, T_j	-55 to 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, junction-case	$R_{\theta JC}$	4.46	$^\circ\text{C/W}$
Thermal resistance, junction-ambient	$R_{\theta JA}$	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	$V_{GS}=0\text{ V}$, $I_D=250\ \mu\text{A}$
Gate threshold voltage	$V_{GS(th)}$	3.0		4.5	V	$V_{DS}=V_{GS}$, $I_D=250\ \mu\text{A}$
Drain-source on-state resistance	$R_{DS(ON)}$		0.55	0.65	Ω	$V_{GS}=10\text{ V}$, $I_D=4\text{ A}$
			1.5			$V_{GS}=10\text{ V}$, $I_D=4\text{ A}$, $T_j=150^\circ\text{C}$
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	μA	$V_{DS}=650\text{ V}$, $V_{GS}=0\text{ V}$

Dynamic Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Input capacitance	C_{iss}		633		pF	$V_{GS}=0\text{ V}$, $V_{DS}=100\text{ V}$, $f=100\text{ kHz}$
Output capacitance	C_{oss}		36.9		pF	
Reverse transfer capacitance	C_{rss}		2.4		pF	
Turn-on delay time	$t_{d(on)}$		38.6		ns	$V_{GS}=10\text{ V}$, $V_{DS}=400\text{ V}$, $R_G=2\ \Omega$, $I_D=4\text{ A}$
Rise time	t_r		33.9		ns	
Turn-off delay time	$t_{d(off)}$		66.8		ns	
Fall time	t_f		14		ns	

Gate Charge Characteristics

Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Total gate charge	Q_g		11.9		nC	$V_{GS}=10\text{ V}$, $V_{DS}=400\text{ V}$, $I_D=4\text{ A}$
Gate-source charge	Q_{gs}		4.2		nC	
Gate-drain charge	Q_{gd}		4.5		nC	
Gate plateau voltage	$V_{plateau}$		6.9		V	

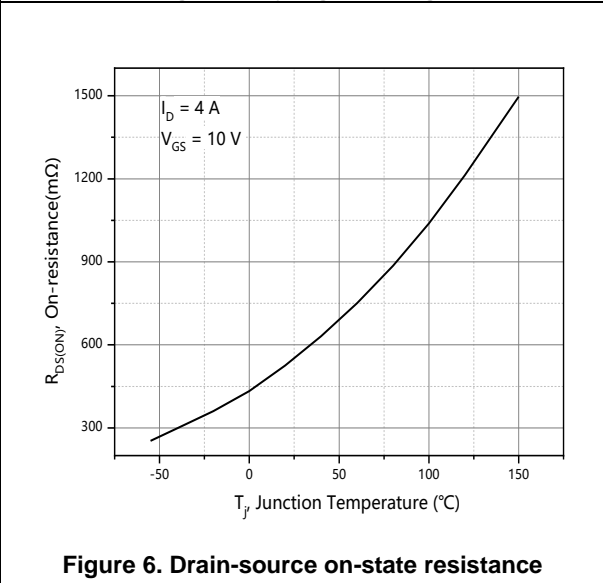
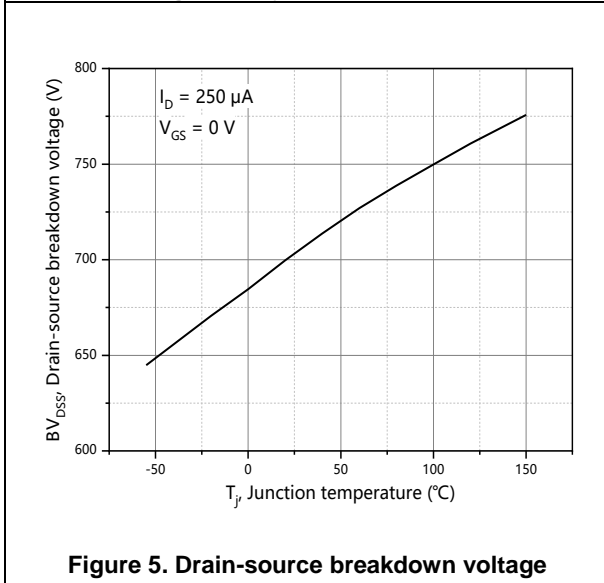
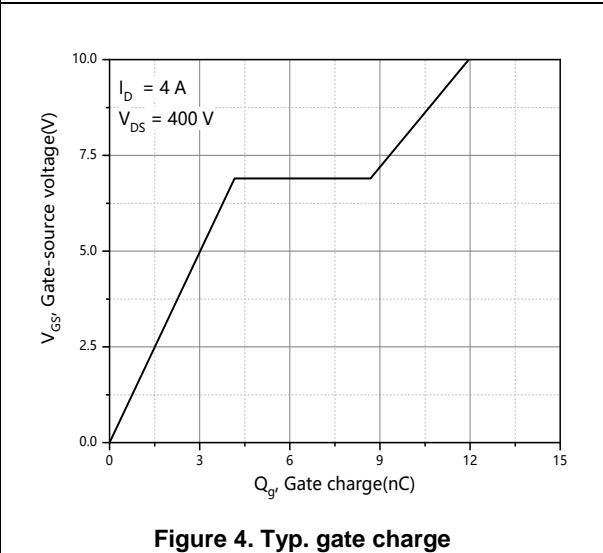
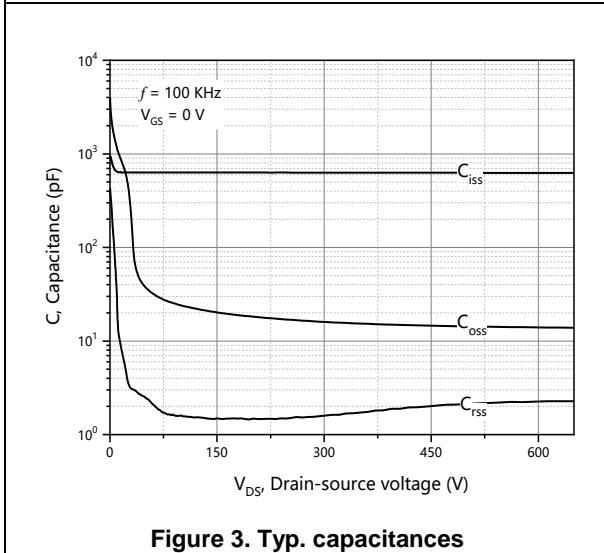
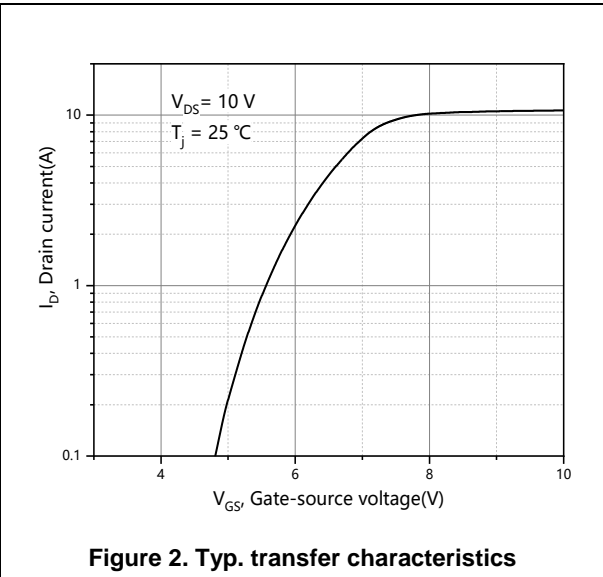
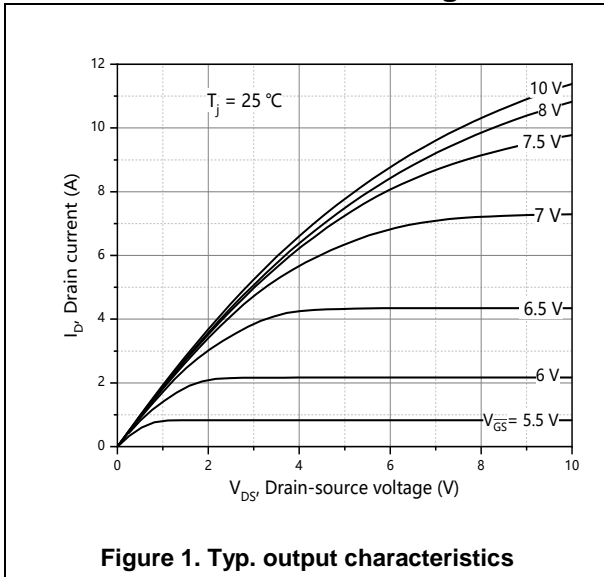
Body Diode Characteristics

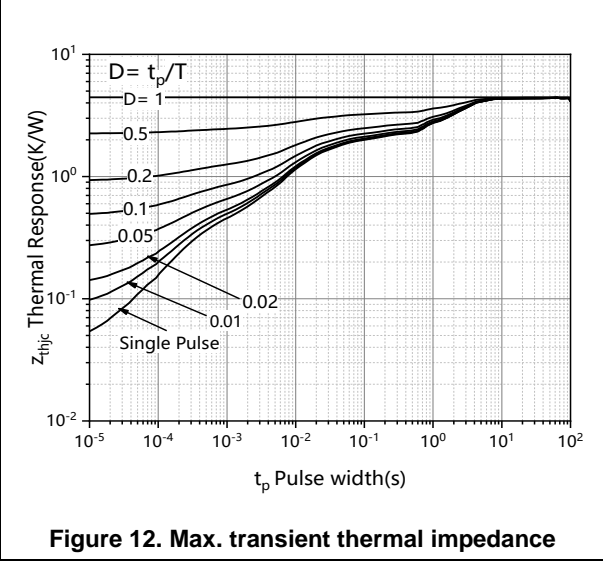
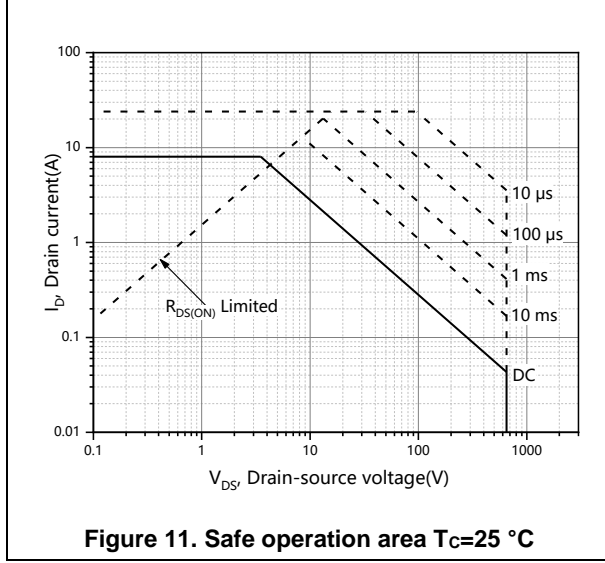
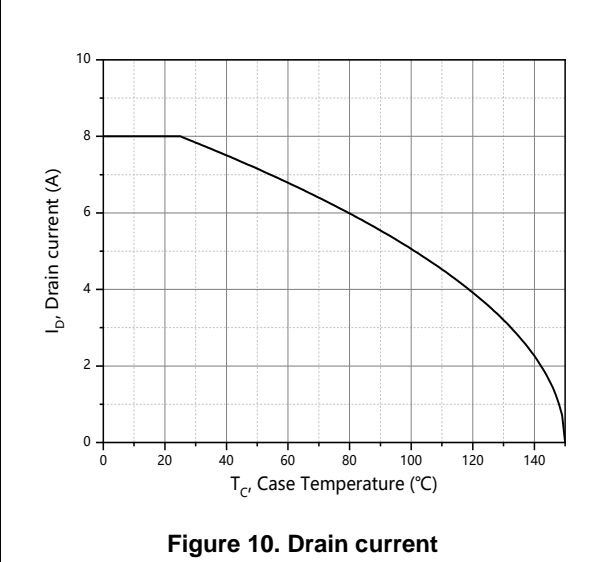
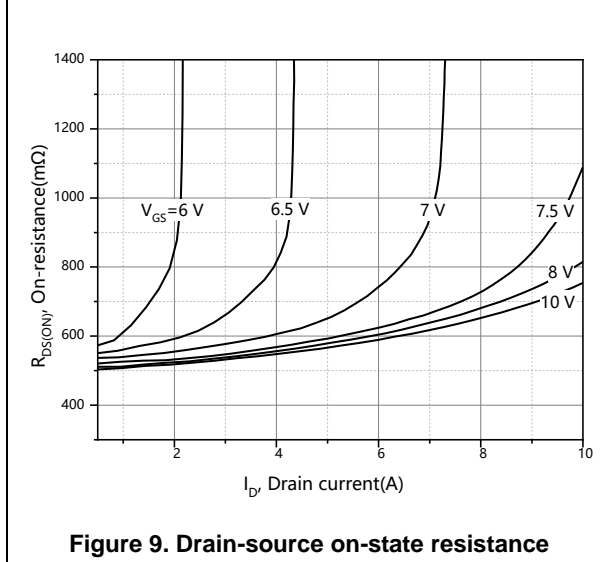
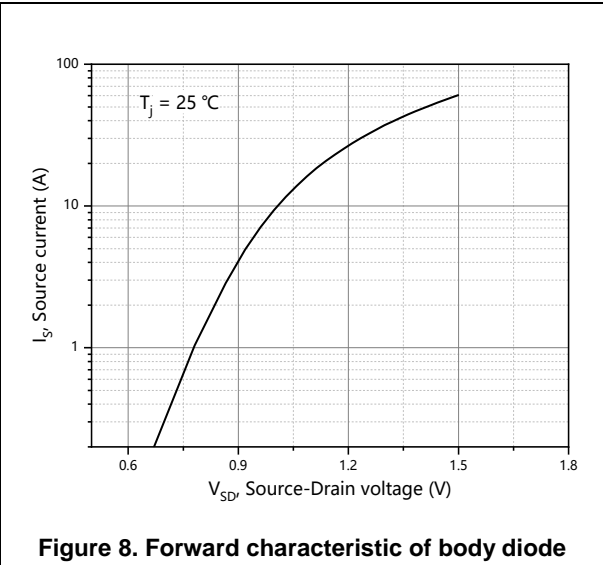
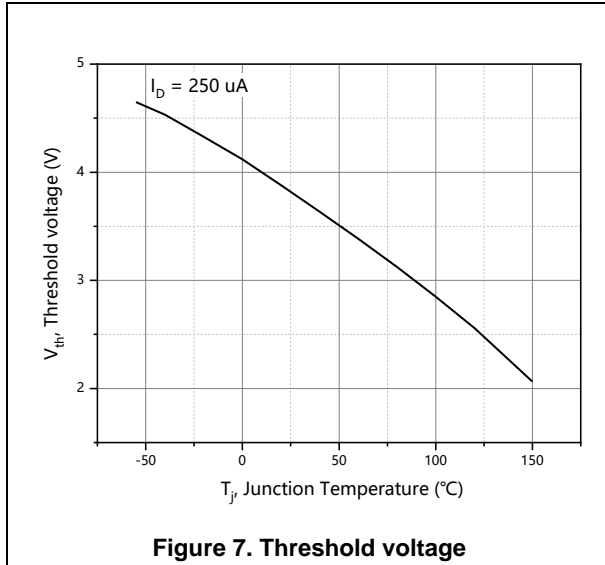
Parameter	Symbol	Min.	Typ.	Max.	Unit	Test condition
Diode forward voltage	V_{SD}			1.4	V	$I_S=8\text{ A}$, $V_{GS}=0\text{ V}$
Reverse recovery time	t_{rr}		87		ns	$V_R=400\text{ V}$, $I_S=4\text{ A}$, $di/dt=100\text{ A}/\mu\text{s}$
Reverse recovery charge	Q_{rr}		316.1		nC	
Peak reverse recovery current	I_{rrm}		6.9		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) $V_{DD}=100\text{ V}$, $V_{GS}=10\text{ V}$, $L=60\text{ mH}$, starting $T_j=25\text{ }^\circ\text{C}$.

Electrical Characteristics Diagrams





Test circuits and waveforms



Figure 1. Gate charge test circuit & waveform



Figure 2. Switching time test circuit & waveforms

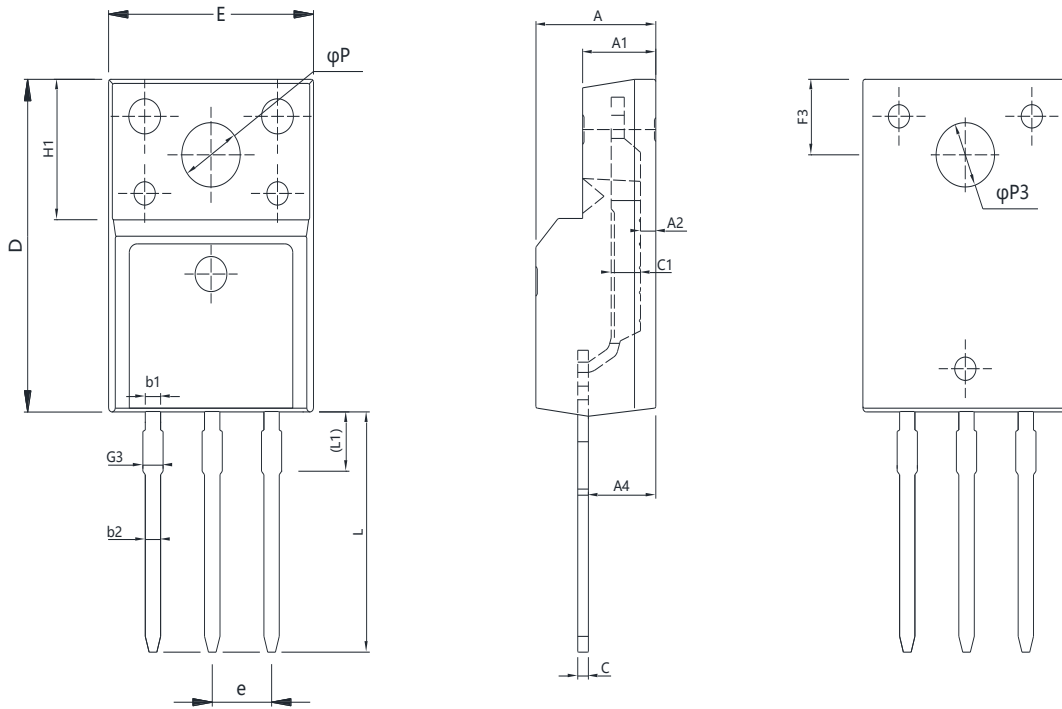


Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms



Figure 4. Diode reverse recovery test circuit & waveforms

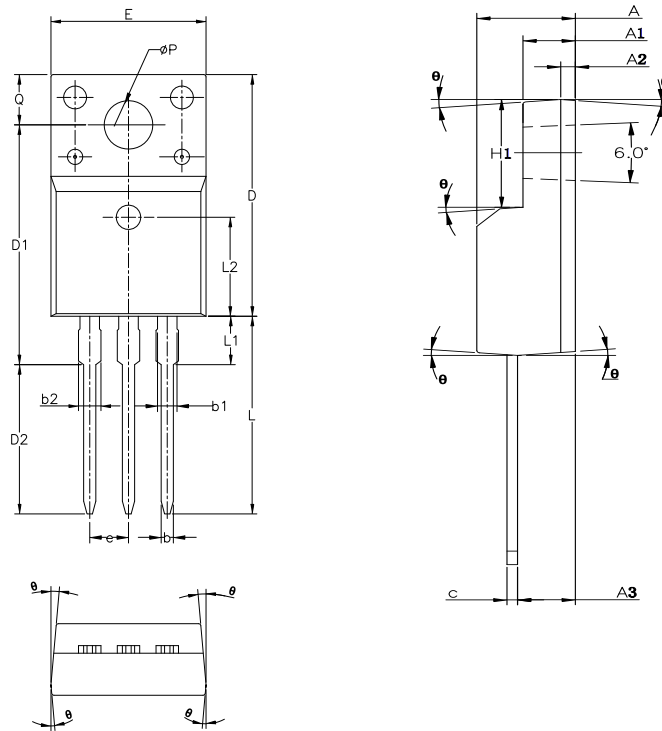
Package Information



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	6.70REF		
e	2.54BSC		
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

Version 1: TO220F-P package outline dimension

Package Information



Symbol	mm		
	Min	Nom	Max
A	4.50	4.70	4.83
A1	2.34	2.54	2.74
A2	0.70 REF		
A3	2.56	2.76	2.93
b	0.70	-	0.90
b1	1.18	-	1.38
b2	-	-	1.47
c	0.45	0.50	0.60
D	15.67	15.87	16.07
D1	15.55	15.75	15.95
D2	9.60	9.80	10.00
E	9.96	10.16	10.36
e	2.54 BSC		
H1	6.48	6.68	6.88
L	12.68	12.98	13.28
L1	-	-	3.50
L2	6.50 REF		
phi P	3.08	3.18	3.28
Q	3.20	-	3.40
theta	1°	3°	5°

Version 2: TO220F-J package outline dimension

Ordering Information

Package Type	Units/ Tube	Tubes/ Inner Box	Units/ Inner Box	Inner Boxes/ Carton Box	Units/ Carton Box
TO220F-P	50	20	1000	6	6000
TO220F-J	50	20	1000	5	5000

Product Information

Product	Package	Pb Free	RoHS	Halogen Free
OSG65R650FZF	TO220F	yes	yes	yes

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