



## N-Channel Super Junction Power MOSFET II

### General Description

The series of devices use advanced super junction technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. This super junction MOSFET fits the industry's AC-DC SMPS requirements for PFC, AC/DC power conversion, and industrial power applications.

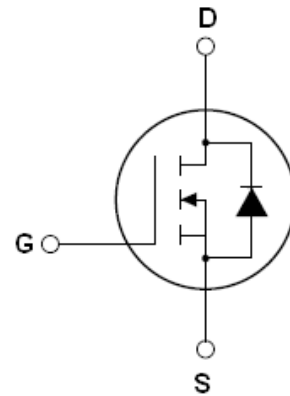
### Features

- New technology for high voltage device
- Low on-resistance and low conduction losses
- Small package
- Ultra Low Gate Charge cause lower driving requirements
- 100% Avalanche Tested
- ROHS compliant

### Application

- Power factor correction (PFC)
- Switched mode power supplies(SMPS)
- Uninterruptible Power Supply (UPS)

$V_{DS}$	650	V
$R_{DS(ON) MAX}$	1200	m $\Omega$
$I_D$	4	A



Schematic diagram

### Package Marking And Ordering Information

Device	Device Package	Marking
TGD65R1K2Z	TO-92	TGD65R1K2Z



TO-92

Table 1. Absolute Maximum Ratings ( $T_c=25^\circ\text{C}$ )

Parameter	Symbol	Value	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	650	V
Gate-Source Voltage ( $V_{DS}=0V$ )	$V_{GS}$	$\pm 30$	V
Continuous Drain Current at $T_c=25^\circ\text{C}$	$I_{D(DC)}$	4	A
Continuous Drain Current at $T_c=100^\circ\text{C}$	$I_{D(DC)}$	2.5	A
Pulsed drain current (Note 1)	$I_{DM(pluse)}$	12	A
Maximum Power Dissipation( $T_c=25^\circ\text{C}$ )	$P_D$	4	W
Derate above $25^\circ\text{C}$		0.03	W/ $^\circ\text{C}$
Single pulse avalanche energy (Note2)	$E_{AS}$	130	mJ
Avalanche current (Note 1)	$I_{AR}$	2	A
Repetitive Avalanche energy , $t_{AR}$ limited by $T_{jmax}$ (Note 1)	$E_{AR}$	0.2	mJ



Parameter	Symbol	Value	Unit
Drain Source voltage slope, $V_{DS} \leq 480V$ ,	dv/dt	50	V/ns
Reverse diode dv/dt, $V_{DS} \leq 480V, I_{SD} < I_D$	dv/dt	15	V/ns
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55...+150	°C

**Table 2. Thermal Characteristic**

Parameter	Symbol	Value	Unit
Thermal Resistance, Junction-to-Case (Maximum)	$R_{thJC}$	31	°C /W
Thermal Resistance, Junction-to-Ambient (Maximum)	$R_{thJA}$	180	°C /W

**Table 3. Electrical Characteristics (TA=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
On/off states						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	650			V
Zero Gate Voltage Drain Current(Tc=25℃)	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V			1	μA
Zero Gate Voltage Drain Current(Tc=125℃)	I <sub>DSS</sub>	V <sub>DS</sub> =650V, V <sub>GS</sub> =0V			50	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V			±100	nA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	2.5	3	3.5	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =2A		1000	1200	mΩ
Dynamic Characteristics						
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 20V, I <sub>D</sub> = 2.5A		4		S
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =50V, V <sub>GS</sub> =0V, F=1.0MHz		280		PF
Output Capacitance	C <sub>oss</sub>			26		PF
Reverse Transfer Capacitance	C <sub>rss</sub>			2.3		PF
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =480V, I <sub>D</sub> =4A, V <sub>GS</sub> =10V		6.5	10	nC
Gate-Source Charge	Q <sub>gs</sub>			1.3		nC
Gate-Drain Charge	Q <sub>gd</sub>			2.5		nC
Intrinsic gate resistance	R <sub>G</sub>	f = 1 MHz open drain		2.5		Ω
Switching times						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =380V, I <sub>D</sub> =2.5A, R <sub>G</sub> =20Ω, V <sub>GS</sub> =10V		6		nS
Turn-on Rise Time	t <sub>r</sub>			3		nS
Turn-Off Delay Time	t <sub>d(off)</sub>			48	60	nS
Turn-Off Fall Time	t <sub>f</sub>			8	15	nS
Source- Drain Diode Characteristics						
Source-drain current(Body Diode)	I <sub>SD</sub>	T <sub>C</sub> =25℃			4	A
Pulsed Source-drain current(Body Diode)	I <sub>SDM</sub>				12	A
Forward On Voltage	V <sub>SD</sub>	T <sub>j</sub> =25℃, I <sub>SD</sub> =4A, V <sub>GS</sub> =0V		1	1.3	V
Reverse Recovery Time	t <sub>rr</sub>	T <sub>j</sub> =25℃, I <sub>F</sub> =4A, di/dt=100A/μs		150		nS
Reverse Recovery Charge	Q <sub>rr</sub>			0.85		uC
Peak reverse recovery current	I <sub>rrm</sub>			11		A

Notes: 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.  $T_J=25^\circ C, V_{DD}=50V, V_G=10V, R_G=25\Omega$

## TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS (curves)

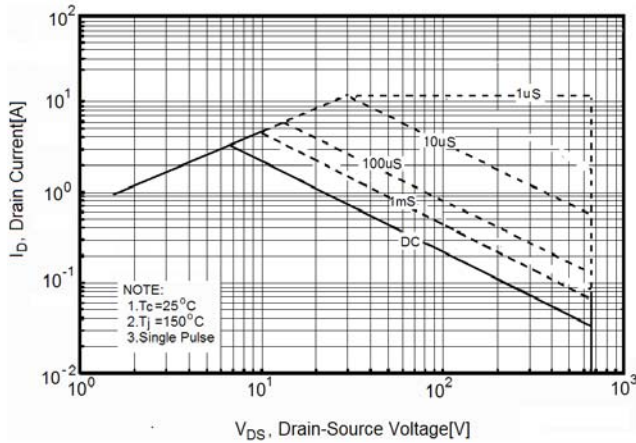
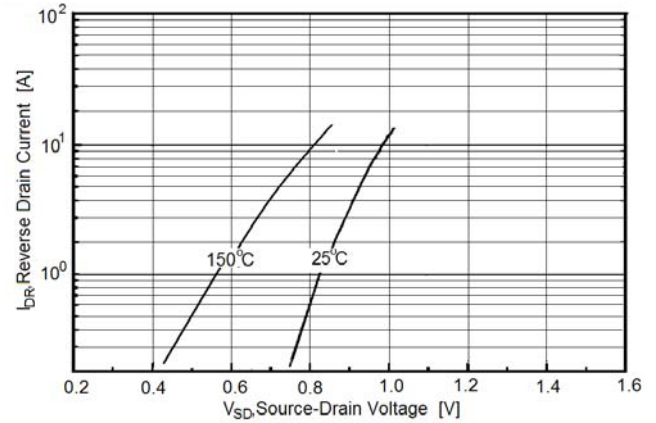
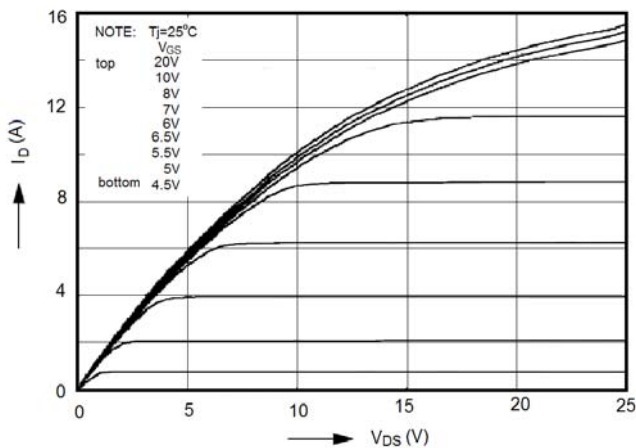
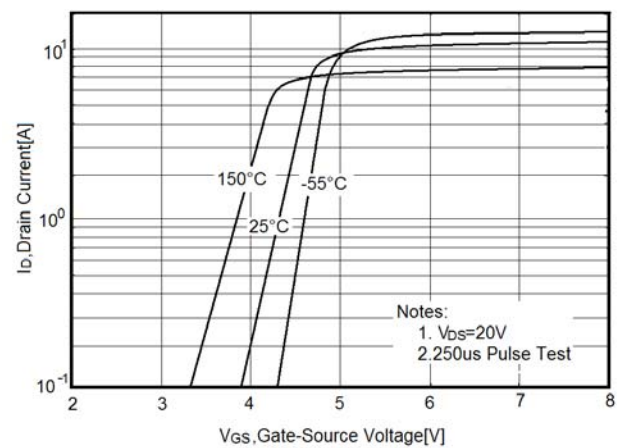
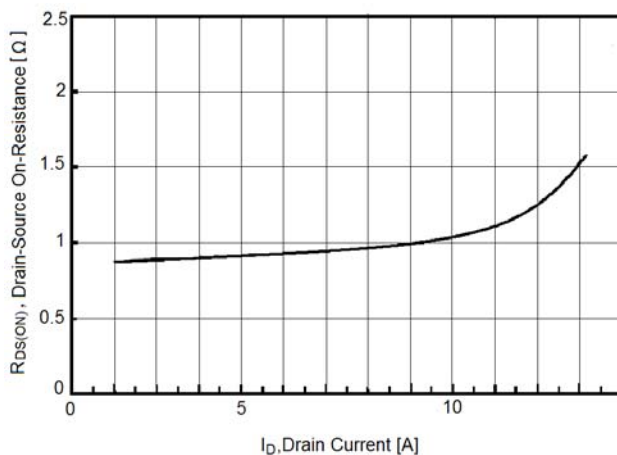
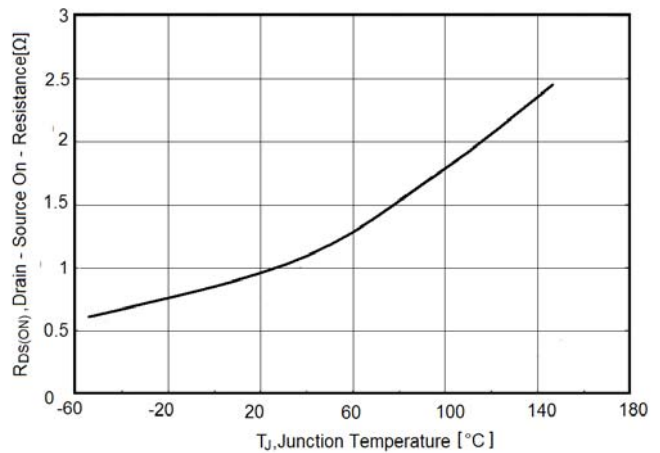
**Figure1. Safe operating area**

**Figure2. Source-Drain Diode Forward Voltage**

**Figure3. Output characteristics**

**Figure4. Transfer characteristics**

**Figure5. Static drain-source on resistance**

**Figure6.  $R_{DS(ON)}$  vs Junction Temperature**


Figure7.  $BV_{DSS}$  vs Junction Temperature

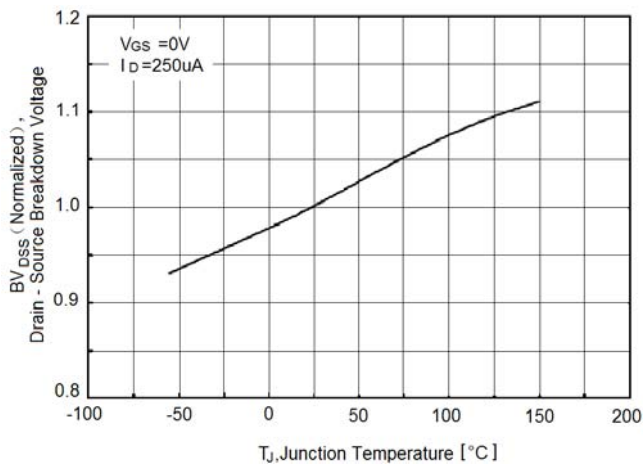


Figure8. Maximum  $I_D$  vs Junction Temperature

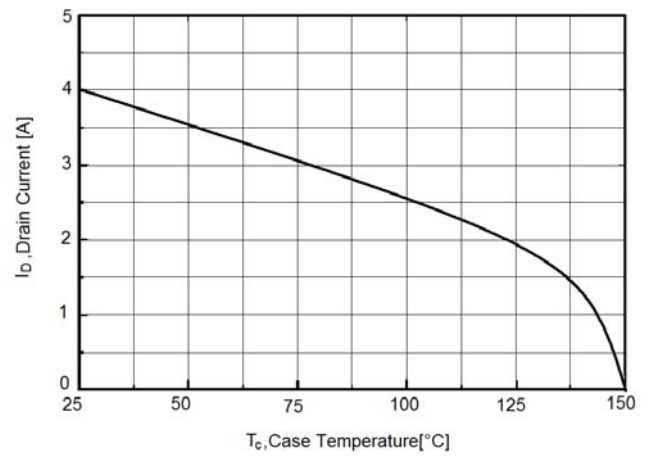


Figure9. Gate charge waveforms

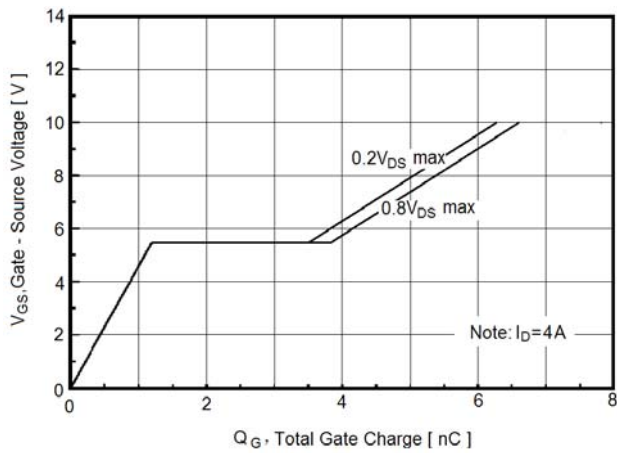
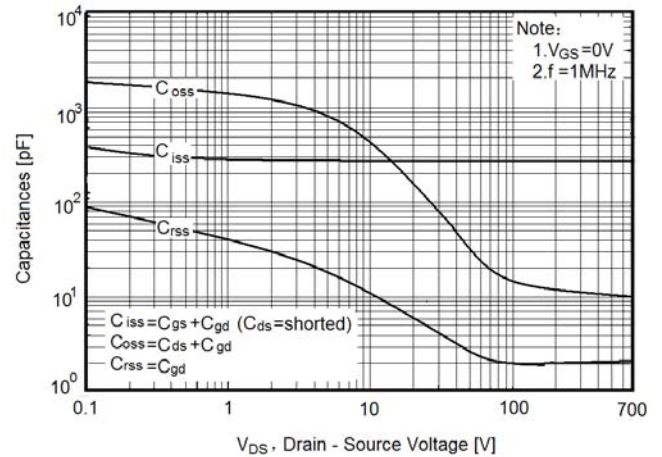
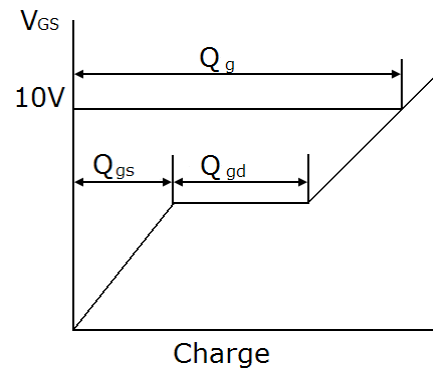
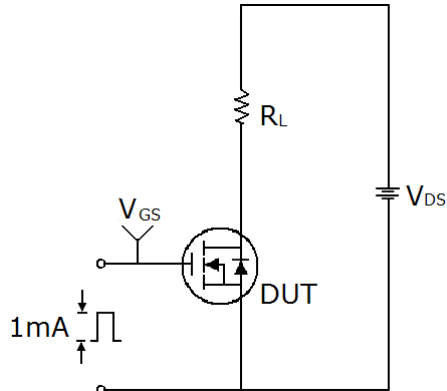


Figure10. Capacitance

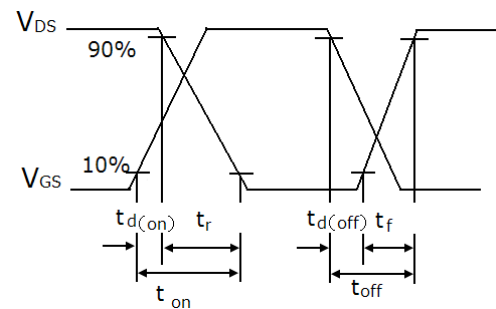
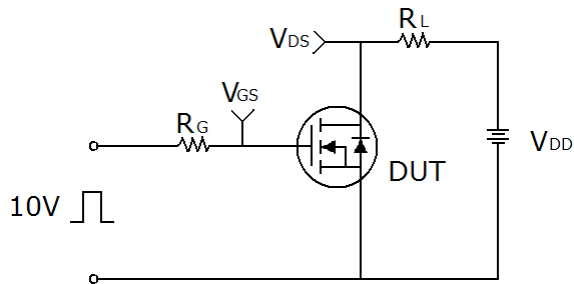


## Test circuit

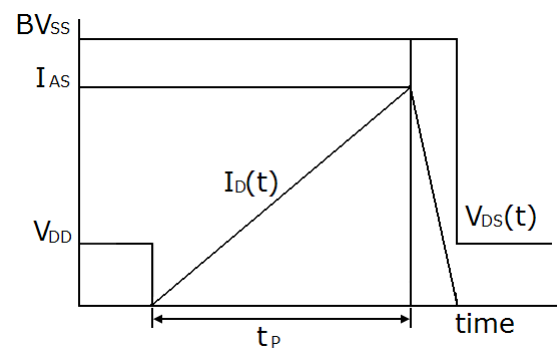
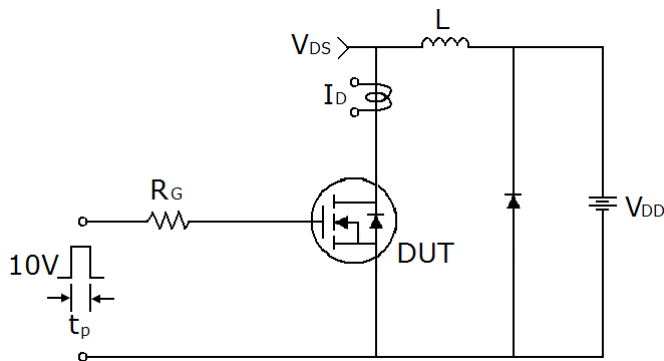
### 1) Gate charge test circuit & Waveform



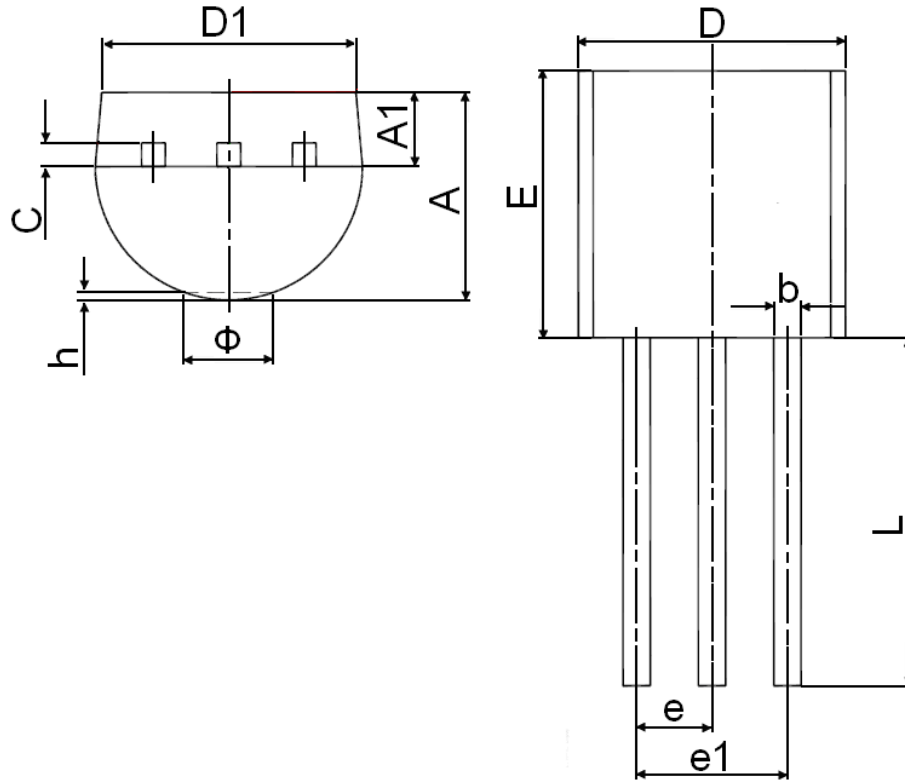
### 2) Switch Time Test Circuit:



### 3) Unclamped Inductive Switching Test Circuit & Waveforms



## TO-251 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.460	0.580	0.018	0.023
D	4.400	4.700	0.173	0.185
D1	3.430		0.135	
E	4.300	4.700	0.169	0.185
e	1.270TYP		0.050TYP	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571
$\Phi$		1.600		0.063
h	0.000	0.380	0.000	0.015