

TSD65R2K3S1/TSU65R2K3S1

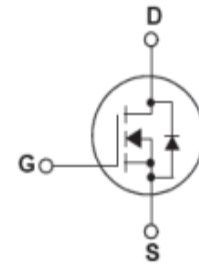
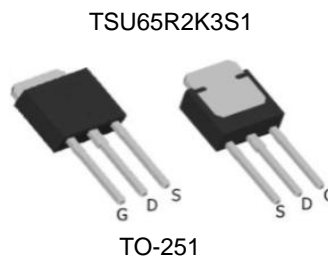
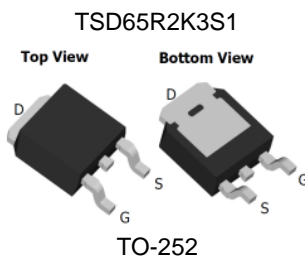
650V 2.1A N-Channel SJ-MOSFET

General Description

Truesemi SJ-FET is new generation of high voltage MOSFET family that is utilizing an advanced charge balance mechanism for outstanding low on-resistance and lower gate charge performance. This advanced technology has been tailored to minimize conduction loss, provide superior switching performance, and withstand extreme dv/dt rate and higher avalanche energy. SJ-FET is suitable for various AC/DC power conversion in switching mode operation for higher efficiency.

Features

- 700V @ $T_J = 150^\circ\text{C}$
- Typ. $R_{DS(on)} = 2.1\Omega$
- Ultra Low gate charge (typ. $Q_g = 7\text{nC}$)
- 100% avalanche tested



Absolute Maximum Ratings

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-Source Voltage	650	V
I_D	Drain Current	-Continuous ($TC = 25^\circ\text{C}$)	2.1
		-Continuous ($TC = 100^\circ\text{C}$)	1.3
I_{DM}	Drain Current – Pulsed (Note 1)	6*	A
V_{GSS}	Gate-Source voltage	± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)	11	mJ
I_{AR}	Avalanche Current (Note 1)	0.4	A
E_{AR}	Repetitive Avalanche Energy (Note 1)	0.06	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	15	V/ns
P_D	Power Dissipation ($TC = 25^\circ\text{C}$)	22.5	W
		0.8	
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds	300	$^\circ\text{C}$

* Drain current limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	5.6	$^\circ\text{C/W}$
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink Typ.	0.5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62	$^\circ\text{C/W}$

Electrical Characteristics TC = 25 °C unless otherwise noted

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} = 0V, I _D = 250μA, T _J = 25 °C	650	--	--	V
		V _{GS} = 0V, I _D = 250μA, T _J = 150 °C	--	700	--	V
ΔBV _{DSS} / ΔT _J	Breakdown Voltage Temperature Coefficient	I _D = 250μA, Referenced to 25 °C	--	0.6	--	V/°C
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} = 650V, V _{GS} = 0V -T _J = 150 °C	--	-- 10	1 --	μA μA
I _{GSSF}	Gate-Body Leakage Current, Forward	V _{GS} = 30V, V _{DS} = 0V	--	--	100	nA
I _{GSSR}	Gate-Body Leakage Current, Reverse	V _{GS} = -30V, V _{DS} = 0V	--	--	-100	nA
On Characteristics						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} = V _{GS} , I _D = 250μA	2.5	--	4.5	V
R _{DS(on)}	Static Drain-Source On-Resistance	V _{GS} = 10V, I _D = 1A	--	2.1	2.3	Ω
g _{FS}	Forward Trans conductance	V _{DS} = 40V, I _D = 1A (Note 4)	--	8	--	S
R _g	Gate resistance	f=1 MHz, open drain	-	3	-	Ω
Dynamic Characteristics						
C _{iss}	Input Capacitance	V _{DS} = 25V, V _{GS} = 0V, f = 1.0MHz	--	130	--	pF
C _{oss}	Output Capacitance		--	40	--	pF
C _{rss}	Reverse Transfer Capacitance		--	3	--	pF
Switching Characteristics						
t _{d(on)}	Turn-On Delay Time	V _{DD} = 400V, I _D = 1A R _G = 20Ω(Note 4, 5)	--	7	--	ns
t _r	Turn-On Rise Time		--	7	--	ns
t _{d(off)}	Turn-Off Delay Time		--	30	--	ns
t _f	Turn-Off Fall Time		--	50	--	ns
Q _g	Total Gate Charge	V _{DS} = 480V, I _D = 1A V _{GS} = 10V (Note 4, 5)	--	8	--	nC
Q _{gs}	Gate-Source Charge		--	0.8	--	nC
Q _{gd}	Gate-Drain Charge		--	3.6	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain-Source Diode Forward Current		--	--	2	A
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	6	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0V, I _F = 1A	--	0.9	1.5	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0V, I _F = 1A di _F /dt = 100A/μs (Note 4)	--	150	--	ns
Q _{rr}	Reverse Recovery Charge		--	1.2	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. I_{AS}=0.4A, V_{DD}=150V, Starting T_J=25 °C
3. I_{SD}≤2.1A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25 °C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

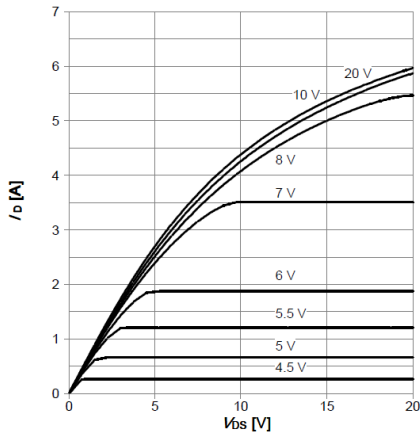


Figure 1: On-Region Characteristics@25°C

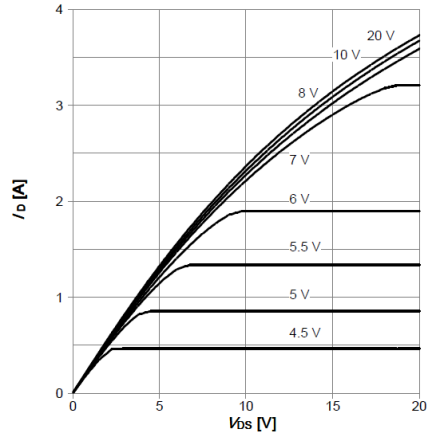


Figure 2: On-Region Characteristics@125°C

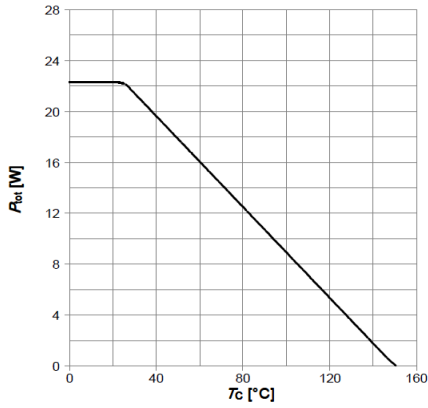


Figure 3: Power Dissipation

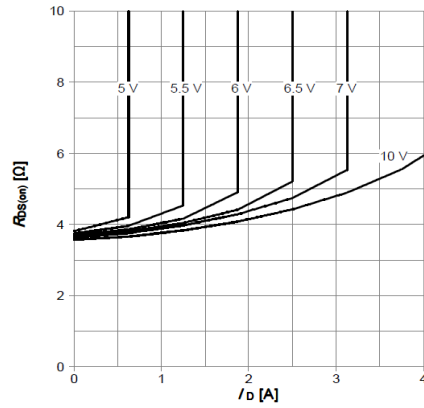


Figure 4: On-Resistance vs. Drain Current and Gate Voltage@125°C

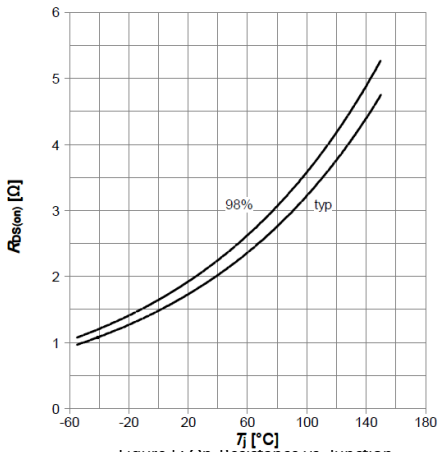
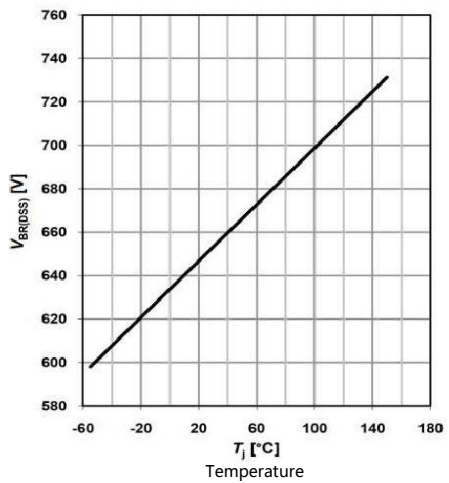


Figure 5: On-Resistance vs. Junction Temperature



Typical Performance Characteristics

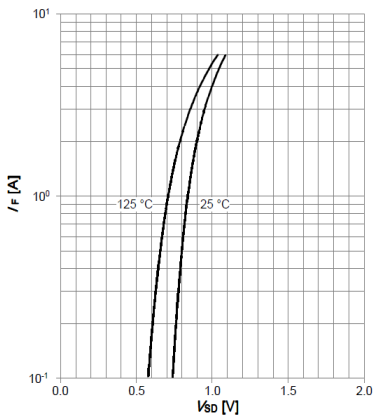


Figure 7: Body-Diode Characteristics

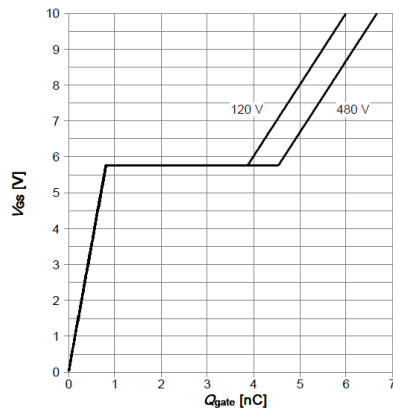


Figure 8: Gate-Charge Characteristics

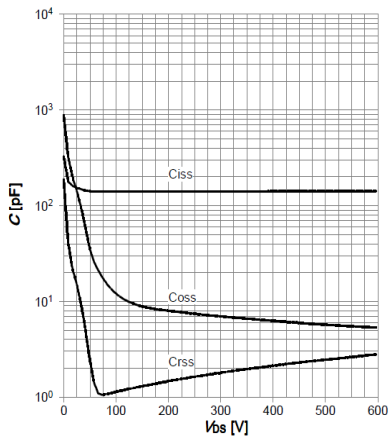


Figure 9: Capacitance Characteristics

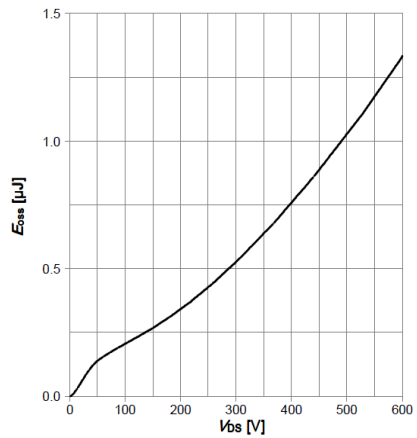


Figure 10: C_{oss} stored Energy

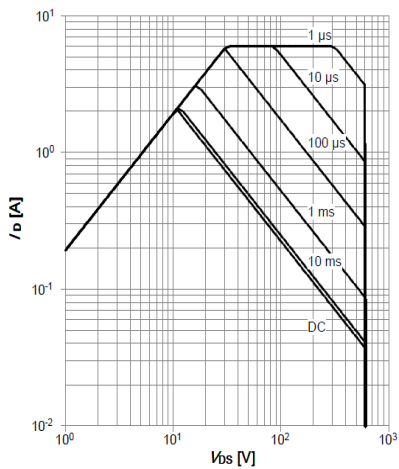


Figure 11: Maximum Forward Biased Safe Operating Area (@25°C)

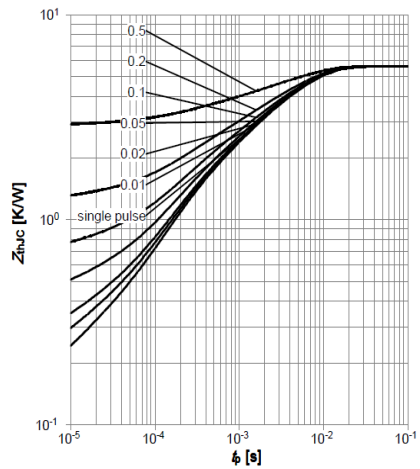


Figure 12: Single Pulse Power Rating Junction-to-Case

Typical Performance Characteristics

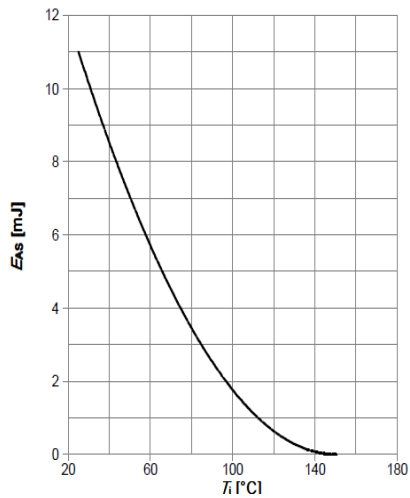


Figure 13: Avalanche energy

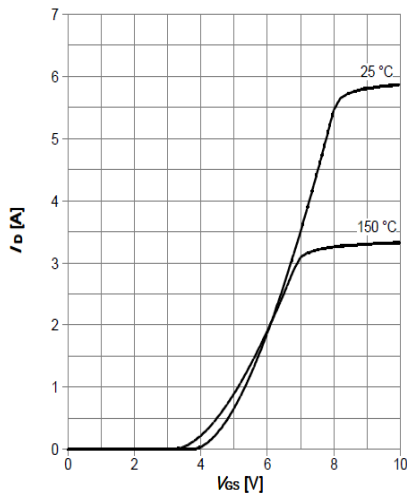
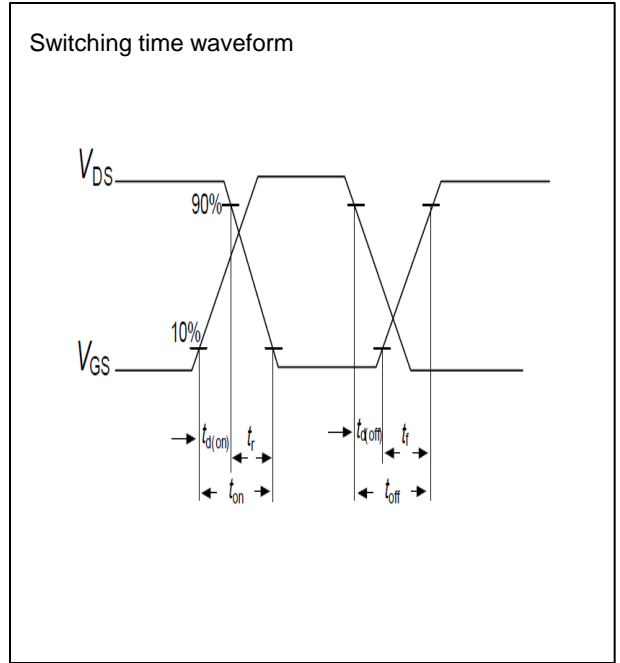
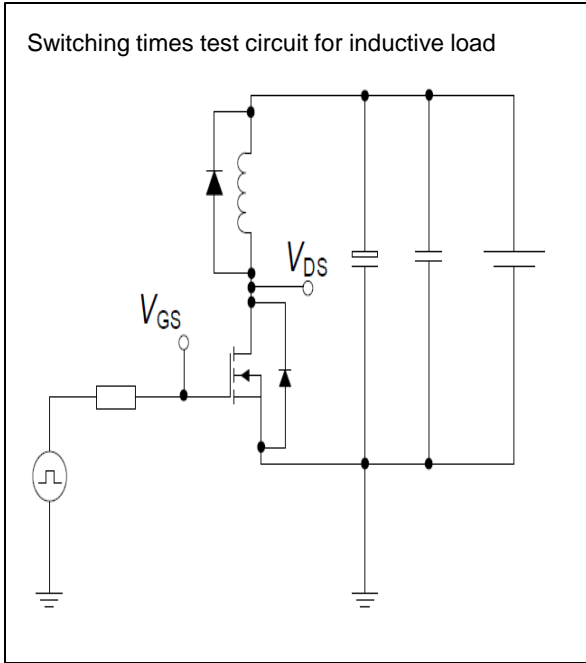


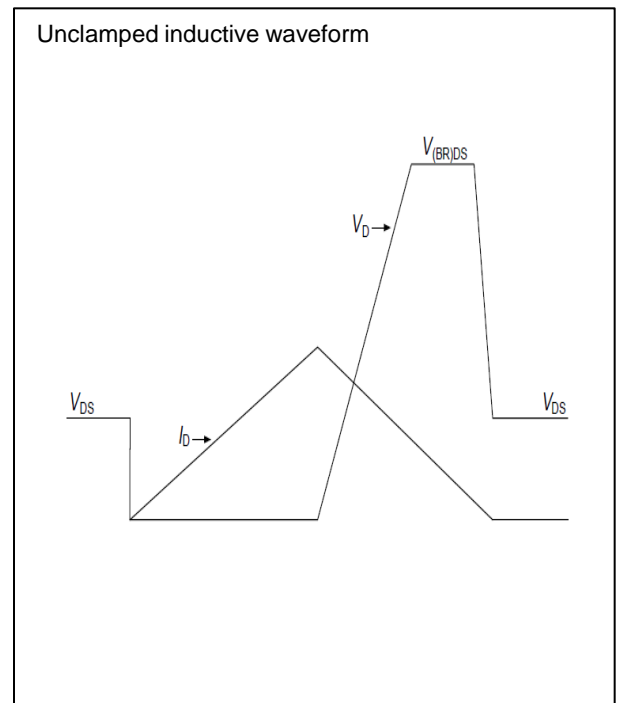
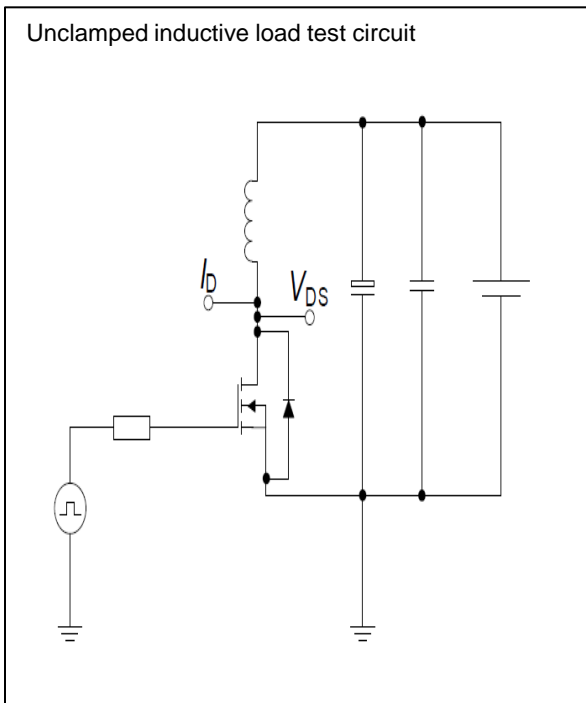
Figure 14: Transfer Characteristics @ $V_{DS}=20V$

Test circuits

Switching times test circuit and waveform for inductive load

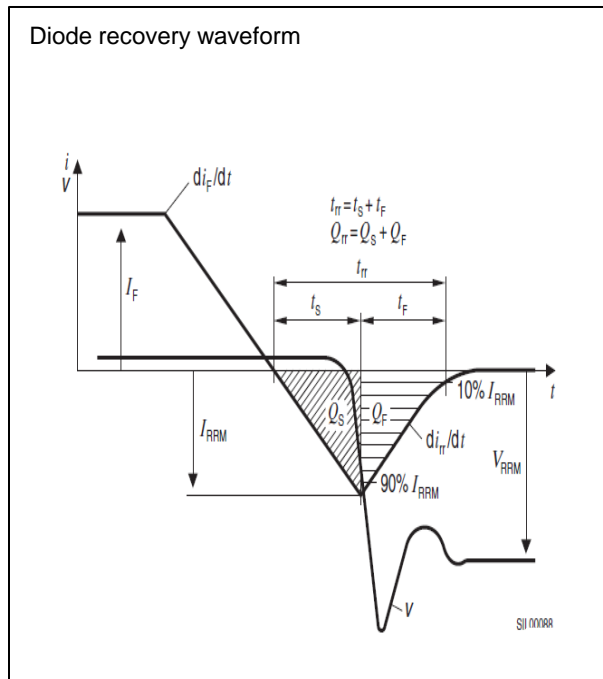
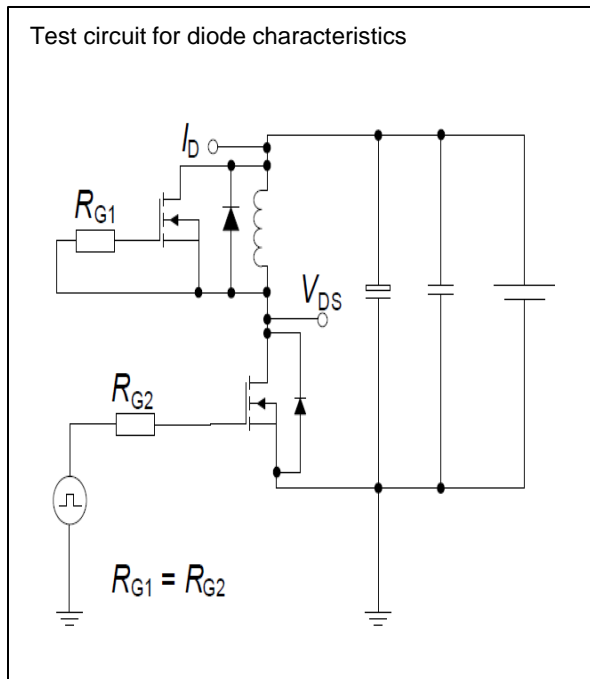


Unclamped inductive load test circuit and waveform



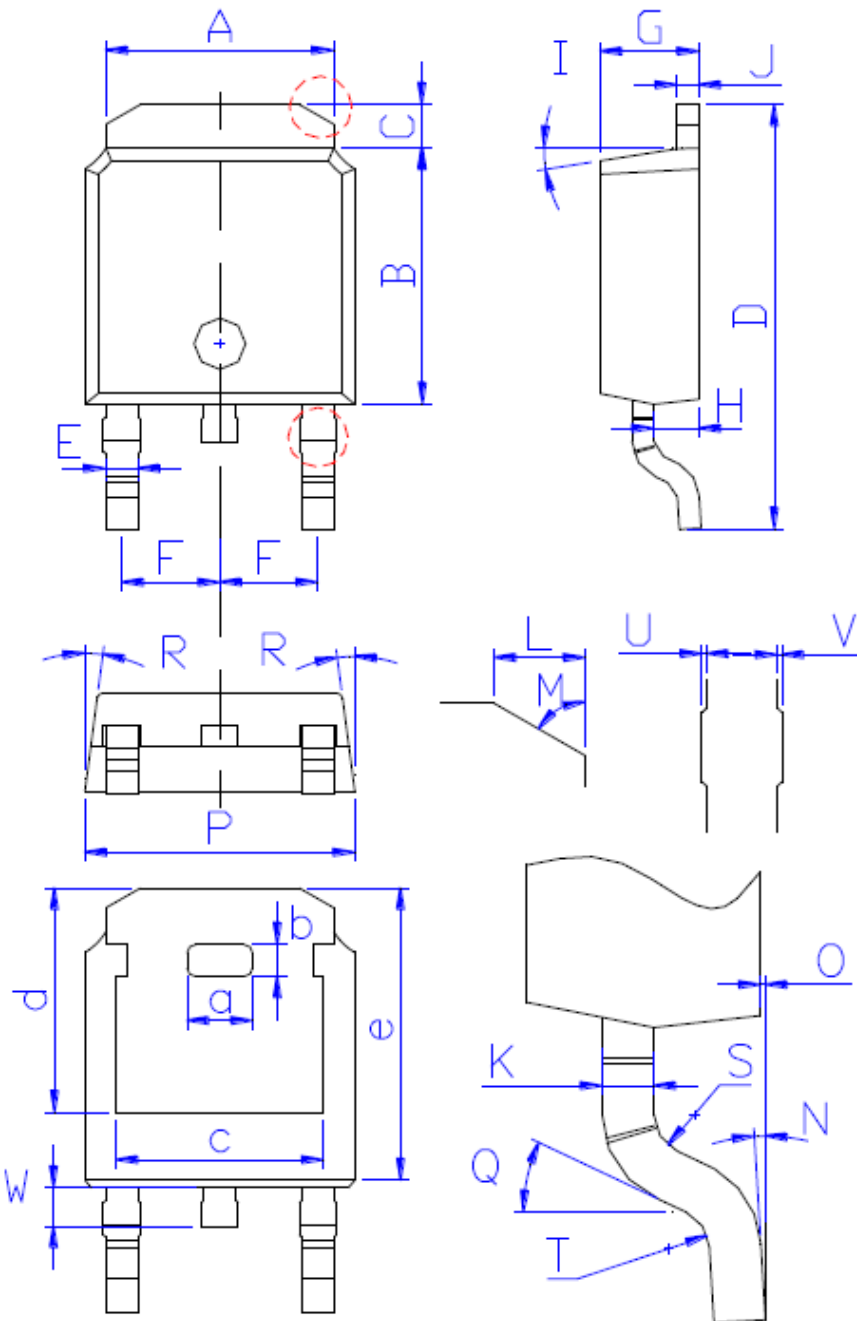
Test circuits

Test circuit and waveform for diode characteristics



Package Outline TO-252

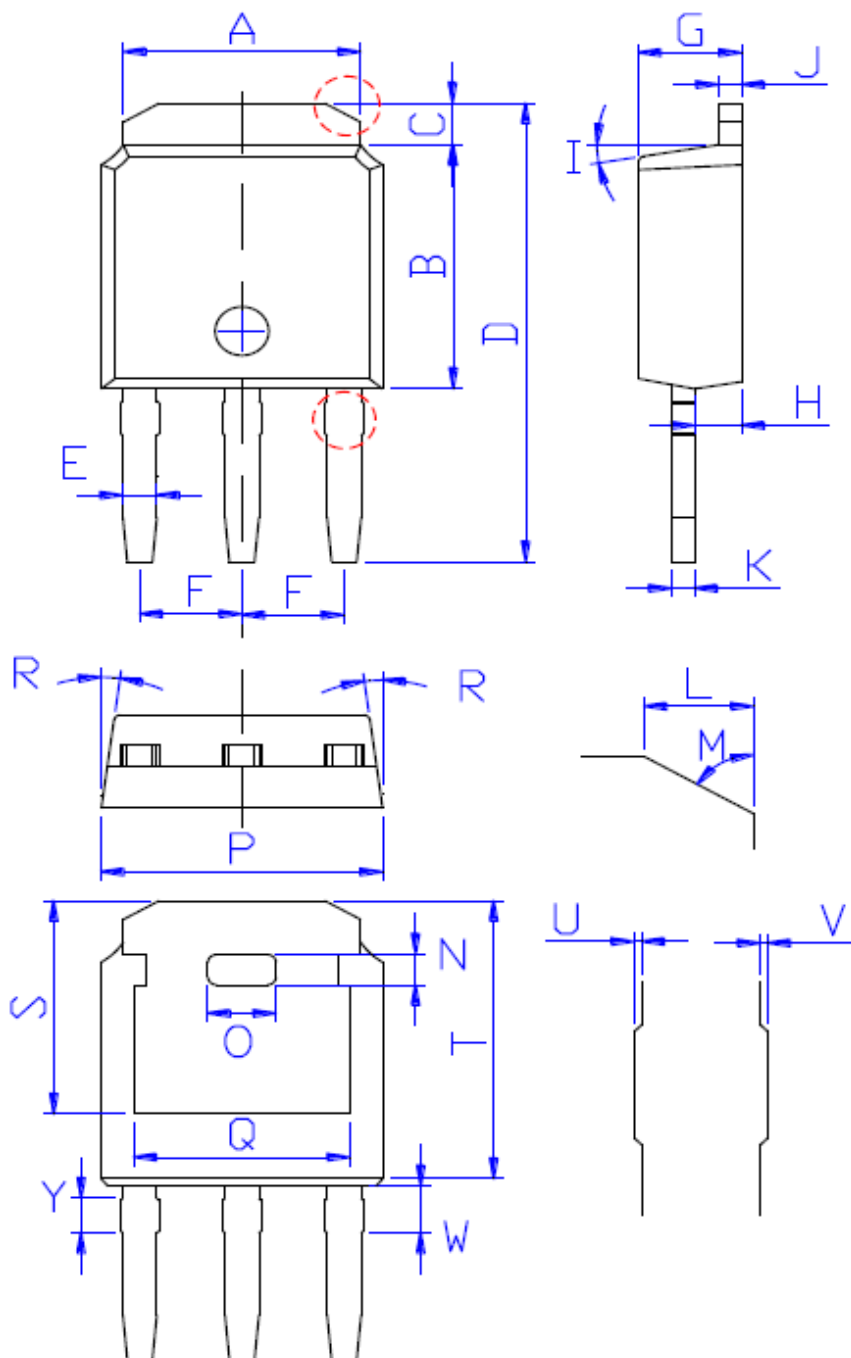
TSD65R2K3S1/TSU65R2K3S1 650V 2.1A N-Channel SJ-MOSFET



DIM	MILLIMETERS
A	5.34 ± 0.30
B	6.00 ± 0.30
C	1.05 ± 0.30
D	9.95 ± 0.30
E	0.76 ± 0.15
F	2.28 ± 0.15
G	2.30 ± 0.30
H	1.06 ± 0.30
I	$(4-10)^\circ$
J	0.51 ± 0.15
K	0.52 ± 0.15
L	0.80 ± 0.30
M	60°
N	$(0-10)^\circ$
O	0.05 ± 0.05
P	6.60 ± 0.30
Q	25°
R	$(4-8.5)^\circ$
S	R0.40
T	R0.40
U	0.05 ± 0.05
V	0.05 ± 0.05
W	0.90 ± 0.30
a	1.80 ± 0.30
b	0.75 ± 0.30
c	4.85 ± 0.30
d	5.30 ± 0.30
e	6.90 ± 0.30

Package Outline TO-251

TSD65R2K3S1/TSU65R2K3S1 650V 2.1A N-Channel SJ-MOSFET



DIM	MILLIMETERS
A	5.34±0.30
B	6.00±0.30
C	1.05±0.30
D	11.31±0.30
E	0.76±0.15
F	2.28±0.15
G	2.30±0.30
H	1.06±0.30
I	(4-10)°
J	0.51±0.15
K	0.52±0.15
L	0.80±0.30
M	60°
N	0.75±0.30
O	1.80±0.30
P	6.60±0.30
Q	4.85±0.30
R	(4-8.5)°
S	5.30±0.30
T	6.90±0.30
U	0.05±0.05
V	0.05±0.05
W	1.15±0.25
Y	0.85±0.25