

# MOS FIELD EFFECT TRANSISTOR

# 2SK3638

## SWITCHING

### N-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SK3638 is N-channel MOS FET device that features a low on-state resistance and excellent switching characteristics, and designed for low voltage high current applications such as DC/DC converter with synchronous rectifier.

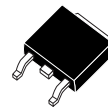
#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3638-ZK	TO-252 (MP-3ZK)

#### FEATURES

- Low on-state resistance  
 $R_{DS(on)1} = 8.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 32 \text{ A)}$   
 $R_{DS(on)2} = 15 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 18 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 1100 \text{ pF TYP.}$
- Built-in gate protection diode

(TO-252)



#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	20	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 64$	A
Drain Current (pulse) <sup>Note</sup>	$I_{D(pulse)}$	$\pm 220$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	36	W
Total Power Dissipation	$P_{T2}$	1.0	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

**Note**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

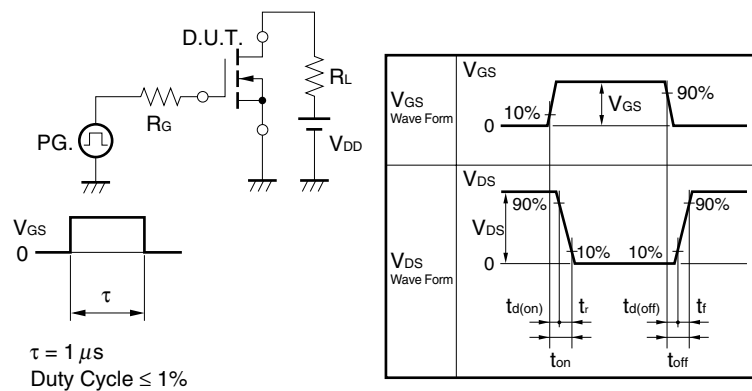
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**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

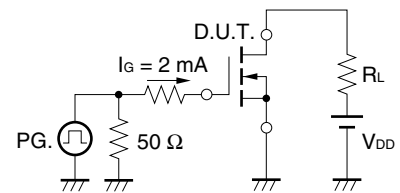
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V			10	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±10	μA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	1.5		2.5	V
Forward Transfer Admittance <b>Note</b>	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 32 A	12	25		S
Drain to Source On-state Resistance <b>Note</b>	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 32 A		6.8	8.5	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 18 A		10	15	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		1100		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		450		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		170		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 10 V, I <sub>D</sub> = 32 A		10		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V		4.3		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		35		ns
Fall Time	t <sub>f</sub>			9.7		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 16 V		22		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		4.3		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 64 A		5.1		nC
Body Diode Forward Voltage <b>Note</b>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 64 A, V <sub>GS</sub> = 0 V		1.0		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 64 A, V <sub>GS</sub> = 0 V		31		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		23		nC

**Note** Pulsed: PW ≤ 350 μs, Duty Cycle ≤ 2%

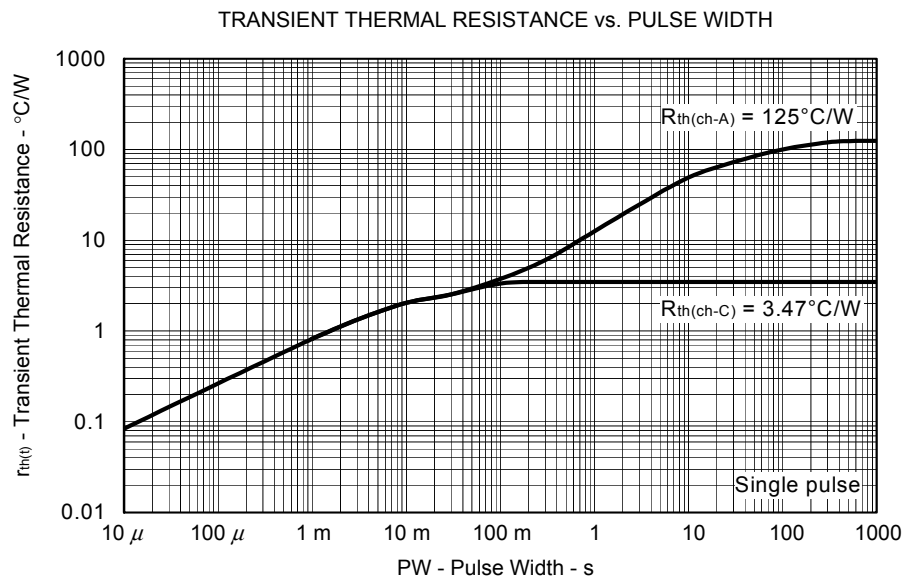
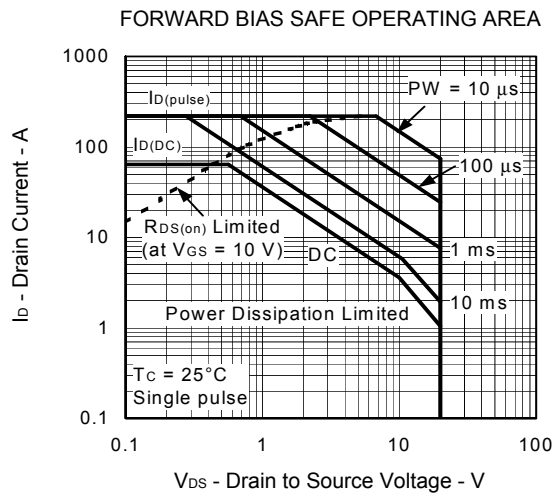
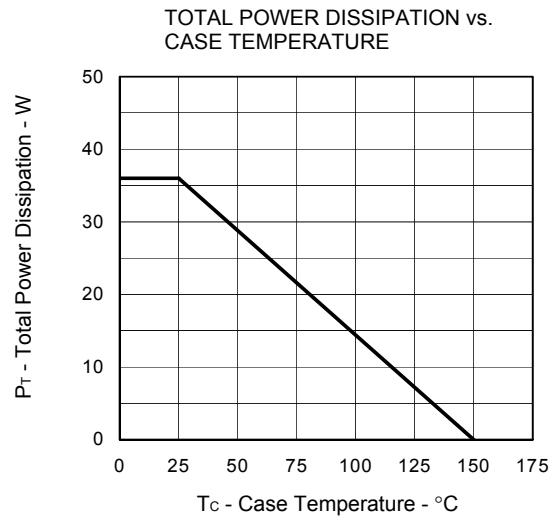
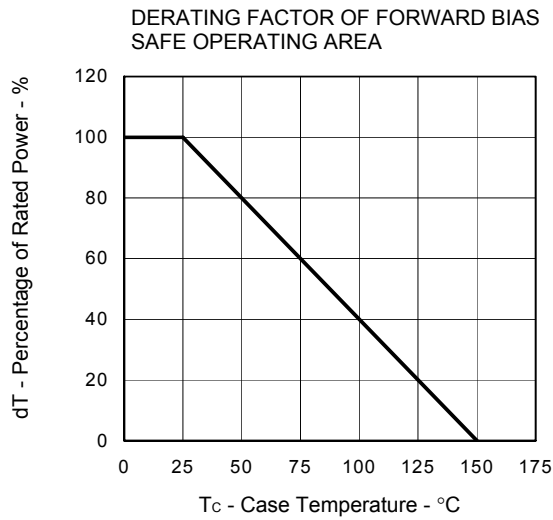
**TEST CIRCUIT 1 SWITCHING TIME**



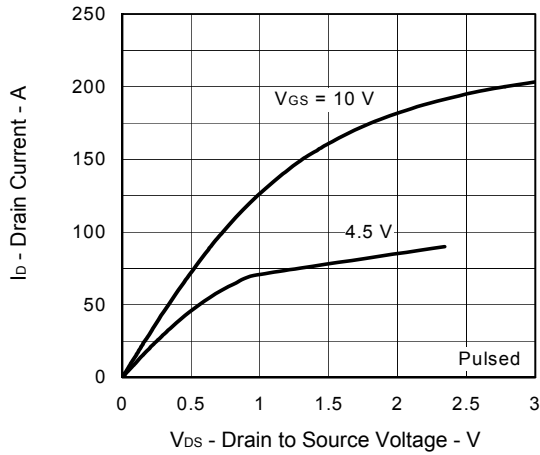
**TEST CIRCUIT 2 GATE CHARGE**



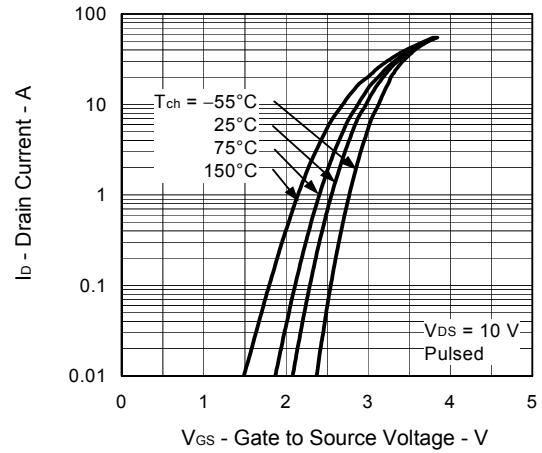
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



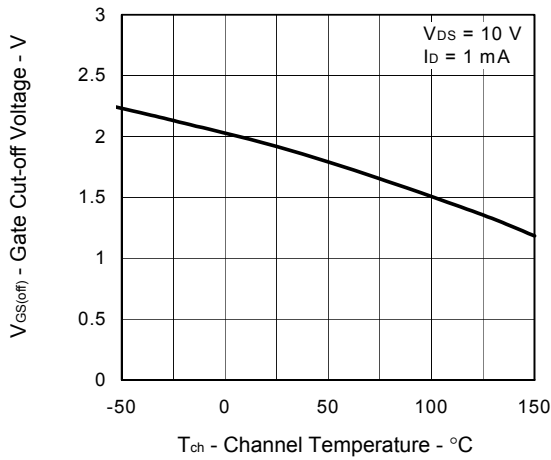
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



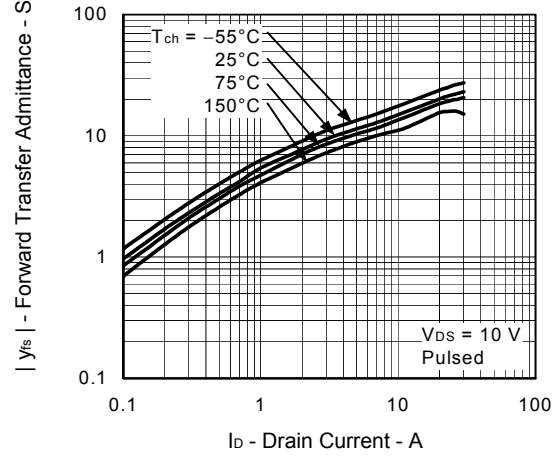
FORWARD TRANSFER CHARACTERISTICS



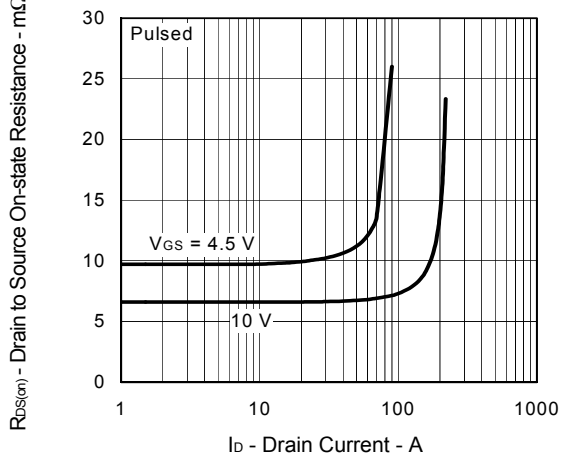
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



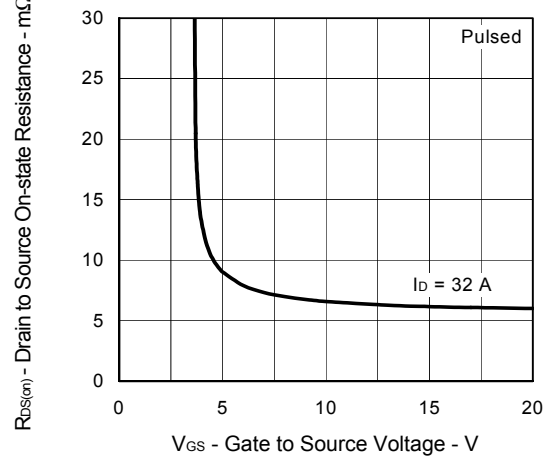
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



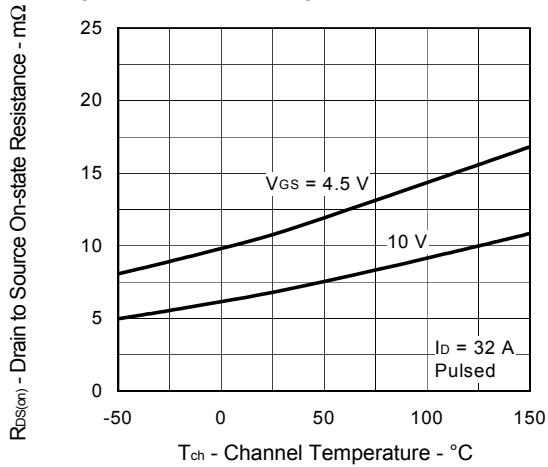
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



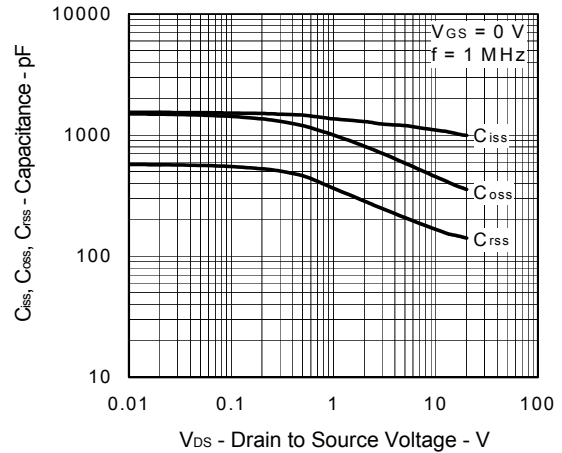
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



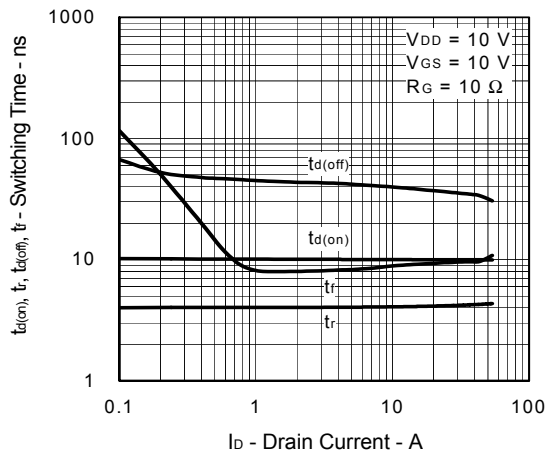
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



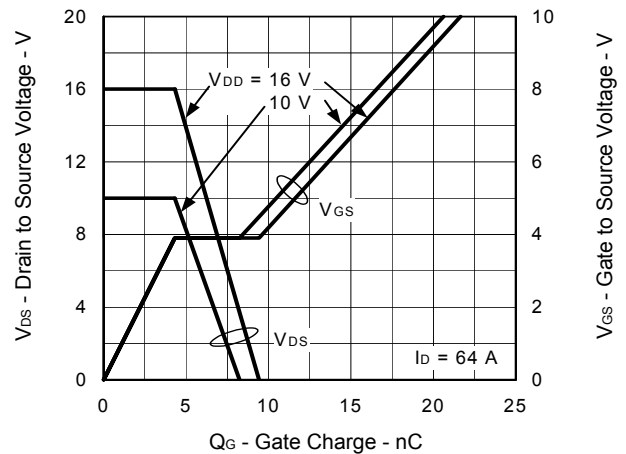
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



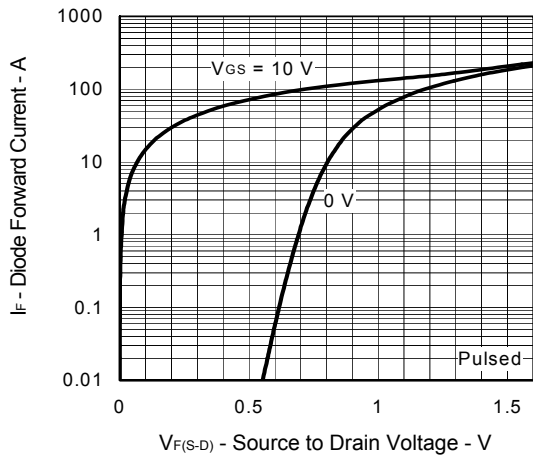
SWITCHING CHARACTERISTICS



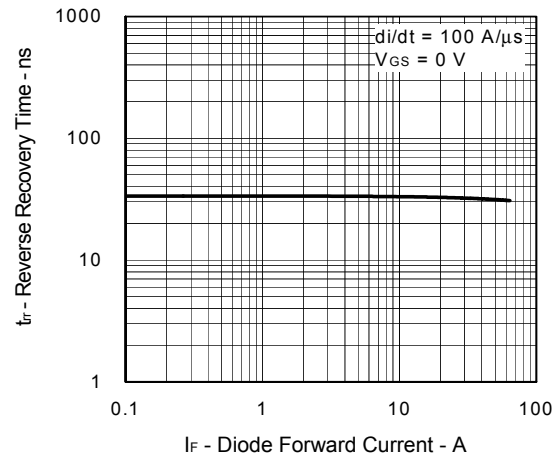
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



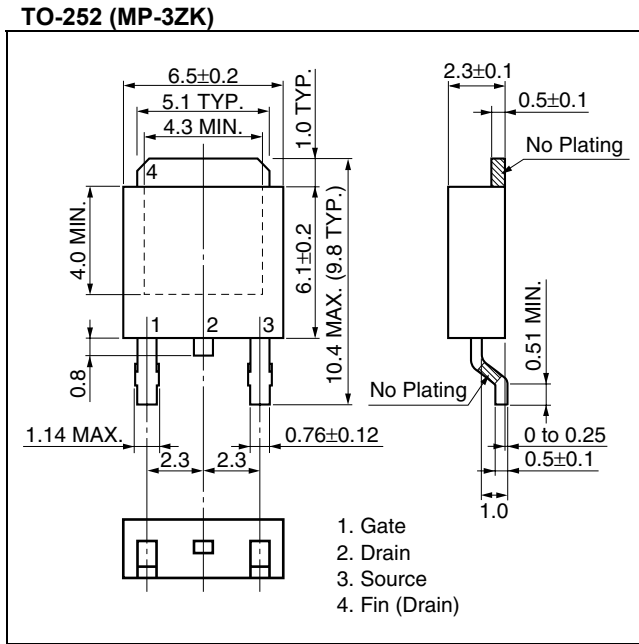
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



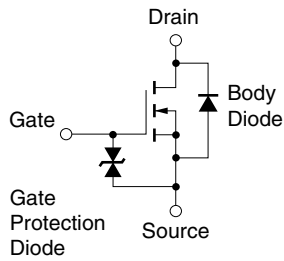
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



★ PACKAGE DRAWING (Unit: mm)



EQUIVALENT CIRCUIT



**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD.  
 When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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