

# MOS FIELD EFFECT TRANSISTOR 2SK4075

# SWITCHING N-CHANNEL POWER MOS FET

#### **DESCRIPTION**

The 2SK4075 is N-channel MOS FET designed for high current switching applications.

#### ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
2SK4075-ZK-E1-AY	Pure Sn (Tin)	Tape	TO-252 (MP-3ZK)
2SK4075-ZK-E2-AY		2500 p/reel	typ. 0.27 g

FEATURES (TO-252)

• Low on-state resistance

 $R_{DS(on)1}$  = 6.7 m $\Omega$  MAX. (Vgs = 10 V, ID = 30 A)

 $R_{DS(on)2} = 10 \text{ m}\Omega \text{ MAX}. \text{ (Vgs} = 4.5 \text{ V, I}_D = 15 \text{ A})$ 

• Low Ciss: Ciss = 2900 pF TYP.

Logic level drive type

#### ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

Drain to Source Voltage (V <sub>GS</sub> = 0 V)	VDSS	40	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	Vgss	±20	V
Drain Current (DC) (Tc = 25°C)	I <sub>D(DC)</sub>	±60	Α
Drain Current (pulse) Note1	I <sub>D(pulse)</sub>	±180	Α
Total Power Dissipation (Tc = 25°C)	P <sub>T1</sub>	52	W
Total Power Dissipation (T <sub>A</sub> = 25°C)	P <sub>T2</sub>	1.0	W
Channel Temperature	Tch	150	°C
Storage Temperature	Tstg	-55 to +150	°C
Single Avalanche Current Note2	las	28	Α
Single Avalanche Energy Note2	Eas	78	mJ

**Notes 1.** PW  $\leq$  10  $\mu$ s, Duty Cycle  $\leq$  1%

**2.** Starting T<sub>ch</sub> = 25°C, V<sub>DD</sub> = 20 V, R<sub>G</sub> = 25  $\Omega$ , V<sub>GS</sub> = 20  $\rightarrow$  0 V, L = 100  $\mu$ H

#### THERMAL RESISTANCE

Channel to Case Thermal Resistance	Rth(ch-C)	2.4	°C/W
Channel to Ambient Thermal Resistance	Rth(ch-A)	125	°C/W

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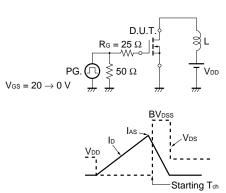
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#### **ELECTRICAL CHARACTERISTICS (TA = 25°C)**

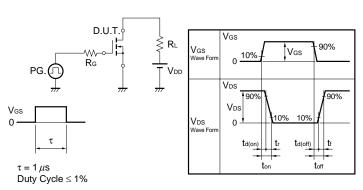
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	Inss	V <sub>DS</sub> = 40 V, V <sub>GS</sub> = 0 V			1	μΑ
Gate Leakage Current	lgss	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±100	nA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	1.5	2.0	2.5	V
Forward Transfer Admittance Note	<b>y</b> fs	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 15 A	9.3			S
Drain to Source On-state Resistance Note	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A		5.2	6.7	mΩ
	RDS(on)2	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A		7.2	10	mΩ
Input Capacitance	Ciss	V <sub>DS</sub> = 10 V		2900		pF
Output Capacitance	Coss	V <sub>GS</sub> = 0 V		450		pF
Reverse Transfer Capacitance	Crss	f = 1 MHz		293		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20 V		18		ns
Rise Time	tr	I <sub>D</sub> = 30 A		16		ns
Turn-off Delay Time	t <sub>d(off)</sub>	V <sub>GS</sub> = 10 V		54		ns
Fall Time	tf	R <sub>G</sub> = 0 Ω		9		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 32 V		54		nC
Gate to Source Charge	Qgs	V <sub>GS</sub> = 10 V		11		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 60 A		15		nC
Body Diode Forward Voltage Note	V <sub>F(S-D)</sub>	I <sub>F</sub> = 60 A, V <sub>GS</sub> = 0 V		0.9	1.5	V
Reverse Recovery Time	trr	I <sub>F</sub> = 60 A, V <sub>GS</sub> = 0 V		33		ns
Reverse Recovery Charge	Qrr	di/dt = 100 A/μs		33		nC

Note Pulsed

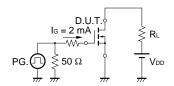
#### TEST CIRCUIT 1 AVALANCHE CAPABILITY



#### TEST CIRCUIT 2 SWITCHING TIME



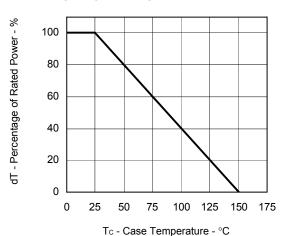
#### **TEST CIRCUIT 3 GATE CHARGE**



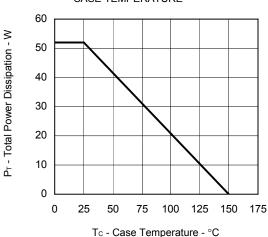
Ip - Drain Current - A

#### TYPICAL CHARACTERISTICS (TA = 25°C)

# DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

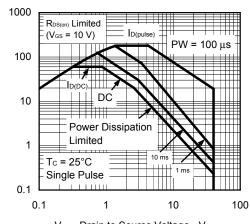


# TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



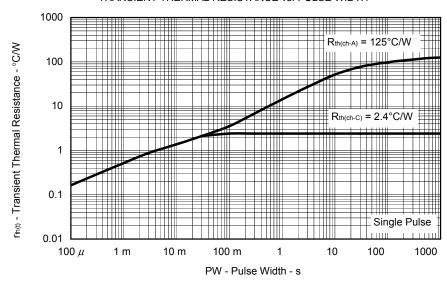
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#### FORWARD BIAS SAFE OPERATING AREA



V<sub>DS</sub> - Drain to Source Voltage - V

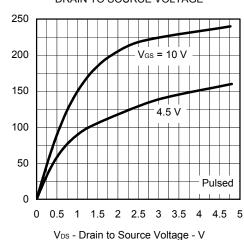
#### TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



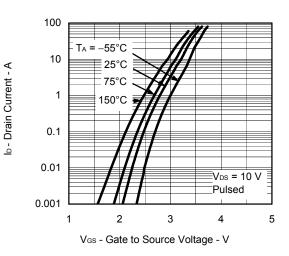
lo - Drain Current - A

VGS(off) - Gate Cut-off Voltage - V

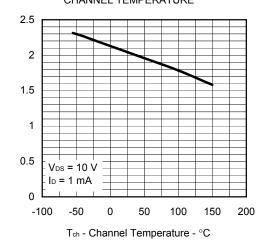
# DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



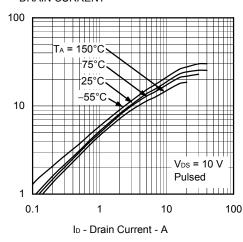
#### FORWARD TRANSFER CHARACTERISTICS



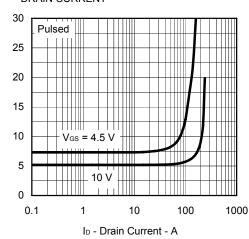
# GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



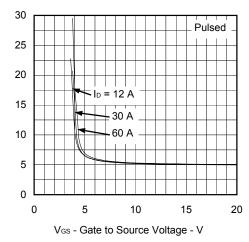
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



# DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



DRAIN TO SOURCE ON-STATERESISTANCE vs. GATE TO SOURCE VOLTAGE



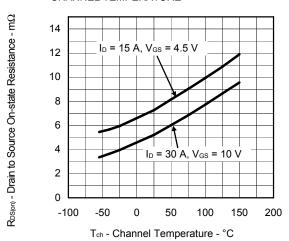
R<sub>DS(m)</sub> - Drain to Source On-state Resistance - mΩ

| y<sub>fs</sub> | - Forward Transfer Admittance - S

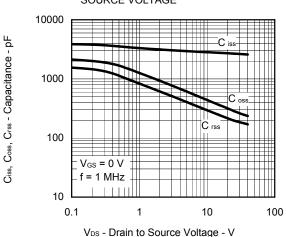
R<sub>DS(cn)</sub> - Drain to Source On-state Resistance - mΩ

ta(on), tr, ta(off), tr - Switching Time - ns

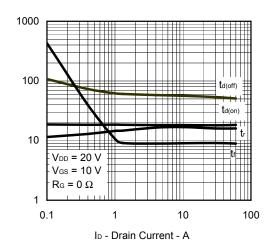
# DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



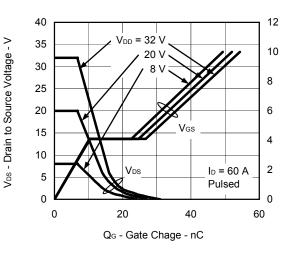
# CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



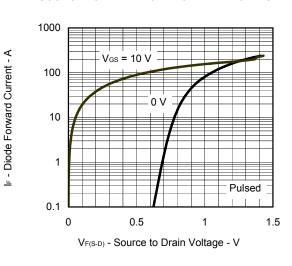
#### SWITCHING CHARACTERISTICS



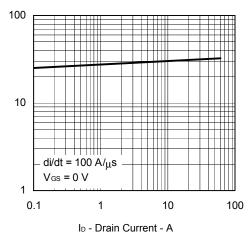
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



#### SOURCE TO DRAIN DIODE FORWARD VOLTAGE



REVERSE RECOVERY TIME vs. DRAIN CURRENT

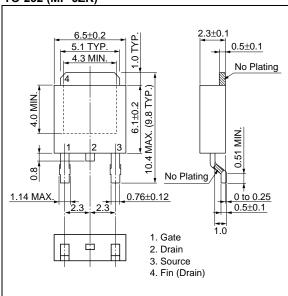


Ves - Gate to Source Voltage - V

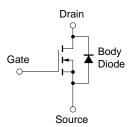
trr - Reverse Recovery Time - ns

#### PACKAGE DRAWING (Unit: mm)

#### TO-252 (MP-3ZK)



#### **EQUIVALENT CIRCUIT**



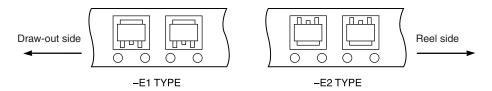
**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD.

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.

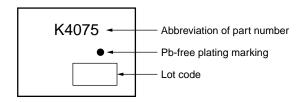


#### TAPE INFORMATION

There are two types (-E1, -E2) of taping depending on the direction of the device.



#### MARKING INFORMATION



#### RECOMMENDED SOLDERING CONDITIONS

The 2SK4075 should be soldered and mounted under the following recommended conditions.

For soldering methods and conditions other than those recommended below, please contact an NEC Electronics sales representative.

For technical information, see the following website.

Semiconductor Device Mount Manual (http://www.necel.com/pkg/en/mount/index.html)

Soldering Method	Soldering Conditions	Recommended Condition Symbol
Infrared reflow	Maximum temperature (Package's surface temperature): 260°C or below	IR60-00-3
	Time at maximum temperature: 10 seconds or less	
	Time of temperature higher than 220°C: 60 seconds or less	
	Preheating time at 160 to 180°C: 60 to 120 seconds	
	Maximum number of reflow processes: 3 times	
	Maximum chlorine content of rosin flux (percentage mass): 0.2% or less	
Partial heating	Maximum temperature (Pin temperature): 350°C or below	P350
	Time (per side of the device): 3 seconds or less	
	Maximum chlorine content of rosin flux: 0.2% (wt.) or less	

Caution Do not use different soldering methods together (except for partial heating).

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