

MOS FIELD EFFECT TRANSISTOR 2SK3642

SWITCHING N-CHANNEL POWER MOS FET

DESCRIPTION

The 2SK3642 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
2SK3642-ZK	TO-252 (MP-3ZK)

FEATURES

· Low on-state resistance

 $R_{DS(on)1}$ = 9.5 m Ω MAX. (Vgs = 10 V, ID = 32 A) $R_{DS(on)2}$ = 16 m Ω MAX. (Vgs = 4.5 V, ID = 18 A)

- Low Ciss: Ciss = 1100 pF TYP.
- · Built-in gate protection diode

(TO-252)



ABSOLUTE MAXIMUM RATINGS (TA = 25°C)

Drain to Source Voltage (VGS = 0 V)	VDSS	30	V	
Gate to Source Voltage (Vps = 0 V)	Vgss	±20	V	
Drain Current (DC) (Tc = 25°C)	I _{D(DC)}	±64	Α	
Drain Current (pulse) Note1	ID(pulse)	±190	Α	
Total Power Dissipation (Tc = 25°C)	P _{T1}	36	W	
Total Power Dissipation	P _{T2}	1.0	W	
Channel Temperature	T_ch	150	°C	
Storage Temperature	T_{stg}	-55 to + 150	°C	
Single Avalanche Current Note2	las	25	Α	
Single Avalanche Energy Note2	Eas	62	mJ	

Notes 1. PW \leq 10 μ s, Duty Cycle \leq 1%

2. Starting T_{ch} = 25°C, V_{DD} = 15 V, R_G = 25 Ω , L = 100 μ H, V_{GS} = 20 \rightarrow 0 V

The information in this document is subject to change without notice. Before using this document, please confirm that this is the latest version. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.

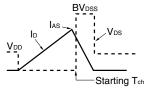


ELECTRICAL CHARACTERISTICS (TA = 25°C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	IDSS	V _{DS} = 30 V, V _{GS} = 0 V			10	μΑ
Gate Leakage Current	Igss	V _{GS} = ±20 V, V _{DS} = 0 V			±10	μΑ
Gate Cut-off Voltage	V _{GS(off)}	V _{DS} = 10 V, I _D = 1 mA	1.5		2.5	V
Forward Transfer Admittance Note	yfs	V _{DS} = 10 V, I _D = 32 A	13	26		S
Drain to Source On-state Resistance Note	RDS(on)1	V _{GS} = 10 V, I _D = 32 A		7.6	9.5	mΩ
	RDS(on)2	V _{GS} = 4.5 V, I _D = 18 A		10.8	16	mΩ
Input Capacitance	Ciss	V _{DS} = 10 V		1100		pF
Output Capacitance	Coss	V _{GS} = 0 V		410		pF
Reverse Transfer Capacitance	Crss	f = 1 MHz		150		pF
Turn-on Delay Time	t _{d(on)}	V _{DD} = 15 V, I _D = 32 A		9.6		ns
Rise Time	tr	V _{GS} = 10 V		5.1		ns
Turn-off Delay Time	t _{d(off)}	$R_G = 10 \Omega$		38		ns
Fall Time	t f			10		ns
Total Gate Charge	QG	V _{DD} = 24 V		23		nC
Gate to Source Charge	Qgs	V _{GS} = 10 V		4.3		nC
Gate to Drain Charge	Q _{GD}	I _D = 64 A		6		nC
Body Diode Forward Voltage Note	V _{F(S-D)}	I _F = 64 A, V _{GS} = 0 V		1.0		V
Reverse Recovery Time	trr	I _F = 64 A, V _{GS} = 0 V		31		ns
Reverse Recovery Charge	Qrr	di/dt = 100 A/μs		25		nC

Note Pulsed: PW \leq 350 μ s, Duty Cycle \leq 2%

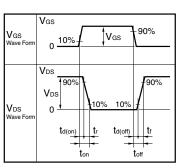
TEST CIRCUIT 1 AVALANCHE CAPABILITY



PG. RG RG VDD

TEST CIRCUIT 2 SWITCHING TIME





TEST CIRCUIT 3 GATE CHARGE

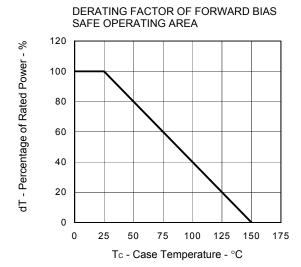
$$\begin{array}{c|c} D.U.T. \\ I_G = 2 \text{ mA} \\ \hline \end{array}$$

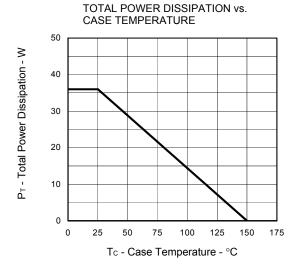
$$\begin{array}{c|c} PG. & \begin{array}{c} \\ \\ \\ \end{array} \end{array} \begin{array}{c} SD.U.T. \\ \hline \end{array}$$

$$\begin{array}{c|c} \\ \\ \end{array} \begin{array}{c} \\$$

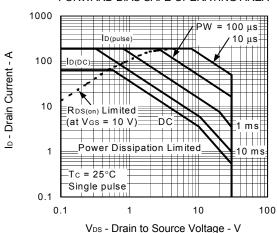


TYPICAL CHARACTERISTICS (TA = 25°C)

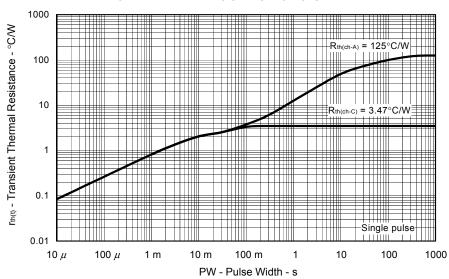




FORWARD BIAS SAFE OPERATING AREA







3



0

0

Pulsed

250

Pulsed

150

Vgs = 10 V

4.5 V

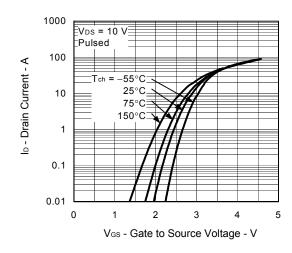
2

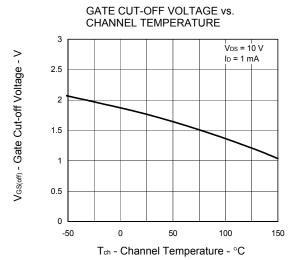
VDS - Drain to Source Voltage - V

3

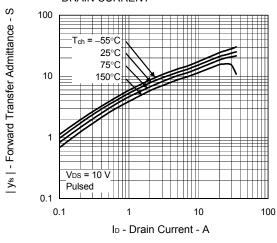
DRAIN CURRENT vs.

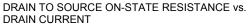
FORWARD TRANSFER CHARACTERISTICS

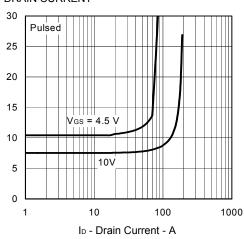




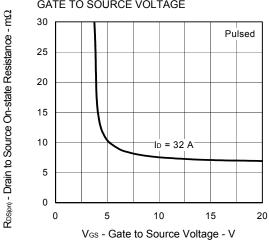
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT





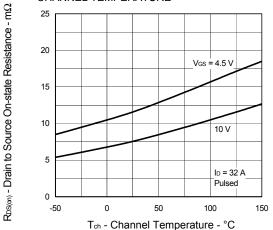


DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

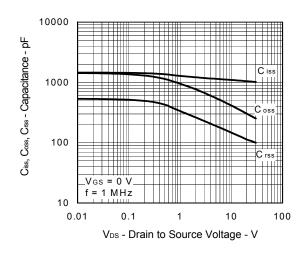


R_{DS(on)} - Drain to Source On-state Resistance - mΩ

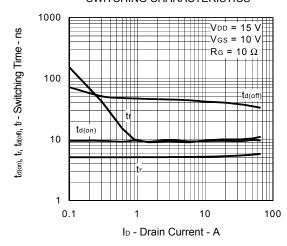
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



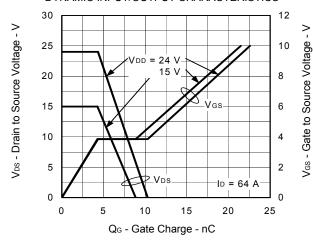
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



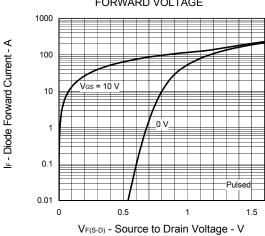
SWITCHING CHARACTERISTICS



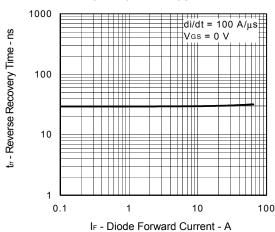
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



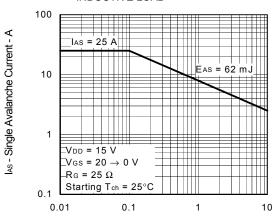
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

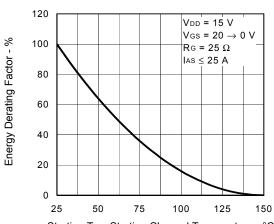


SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



L - Inductive Load - mH

SINGLE AVALANCHE ENERGY DERATING FACTOR

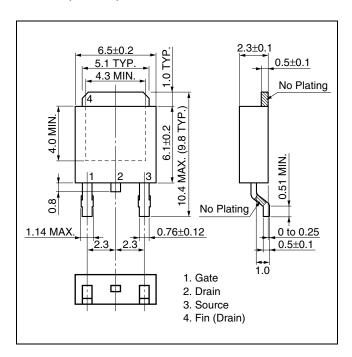


Starting Tch - Starting Channel Temperature - °C

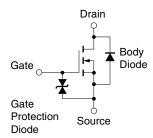


★ PACKAGE DRAWING (Unit: mm)

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.

Data Sheet D15970EJ4V0DS 7

- The information in this document is current as of January, 2005. The information is subject to change without notice. For actual design-in, refer to the latest publications of NEC Electronics data sheets or data books, etc., for the most up-to-date specifications of NEC Electronics products. Not all products and/or types are available in every country. Please check with an NEC Electronics sales representative for availability and additional information.
- No part of this document may be copied or reproduced in any form or by any means without the prior
 written consent of NEC Electronics. NEC Electronics assumes no responsibility for any errors that may
 appear in this document.
- NEC Electronics does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from the use of NEC Electronics products listed in this document or any other liability arising from the use of such products. No license, express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Electronics or others.
- Descriptions of circuits, software and other related information in this document are provided for illustrative
 purposes in semiconductor product operation and application examples. The incorporation of these
 circuits, software and information in the design of a customer's equipment shall be done under the full
 responsibility of the customer. NEC Electronics assumes no responsibility for any losses incurred by
 customers or third parties arising from the use of these circuits, software and information.
- While NEC Electronics endeavors to enhance the quality, reliability and safety of NEC Electronics products, customers agree and acknowledge that the possibility of defects thereof cannot be eliminated entirely. To minimize risks of damage to property or injury (including death) to persons arising from defects in NEC Electronics products, customers must incorporate sufficient safety measures in their design, such as redundancy, fire-containment and anti-failure features.
- NEC Electronics products are classified into the following three quality grades: "Standard", "Special" and "Specific".

The "Specific" quality grade applies only to NEC Electronics products developed based on a customer-designated "quality assurance program" for a specific application. The recommended applications of an NEC Electronics product depend on its quality grade, as indicated below. Customers must check the quality grade of each NEC Electronics product before using it in a particular application.

- "Standard": Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots.
- "Special": Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support).
- "Specific": Aircraft, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems and medical equipment for life support, etc.

The quality grade of NEC Electronics products is "Standard" unless otherwise expressly specified in NEC Electronics data sheets or data books, etc. If customers wish to use NEC Electronics products in applications not intended by NEC Electronics, they must contact an NEC Electronics sales representative in advance to determine NEC Electronics' willingness to support a given application.

(Note)

- (1) "NEC Electronics" as used in this statement means NEC Electronics Corporation and also includes its majority-owned subsidiaries.
- (2) "NEC Electronics products" means any product developed or manufactured by or for NEC Electronics (as defined above).