

## MOS FIELD EFFECT TRANSISTOR

2SK3510

## SWITCHING N-CHANNEL POWER MOS FET

#### **DESCRIPTION**

The 2SK3510 is N-channel MOS Field Effect Transistor designed for high current switching applications.

#### **FEATURES**

• Super low on-state resistance:

 $R_{DS(on)} = 8.5 \, m\Omega \, MAX. \, (V_{GS} = 10 \, V, \, I_{D} = 42 \, A)$ 

- Low Ciss: Ciss = 8500 pF TYP.
- Built-in gate protection diode

#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3510	TO-220AB
2SK3510-S	TO-262
2SK3510-ZJ	TO-263
2SK3510-Z	TO-220SMD <sup>Note</sup>

**Note** TO-220SMD package is produced only in Japan.

(TO-220AB)

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

Drain to Source Voltage (Vgs = 0 V)	VDSS	75	V
Gate to Source Voltage (Vbs = 0 V)	Vgss	±20	V
Drain Current (DC) (Tc = 25°C)	ID(DC)	±83	Α
Drain Current (pulse) Note1	ID(pulse)	±332	Α
Total Power Dissipation (Tc = 25°C)	P <sub>T1</sub>	125	W
Total Power Dissipation (T <sub>A</sub> = 25°C)	P <sub>T2</sub>	1.5	W
Channel Temperature	$T_ch$	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C
Single Avalanche Current Note2	las	69	Α
Single Avalanche Energy Note2	Eas	450	mJ

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

2. Starting Tch = 25°C, VdD = 35 V, Rg = 25  $\Omega$ , Vgs = 20  $\rightarrow$  0 V



(TO-262)



(TO-263, TO-220SMD)



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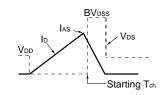


## **ELECTRICAL CHARACTERISTICS (TA = 25°C)**

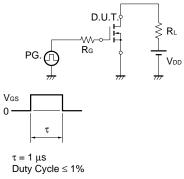
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CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	Ipss	V <sub>DS</sub> = 75 V, V <sub>GS</sub> = 0 V			10	μΑ
Gate Leakage Current	Igss	$V_{GS} = \pm 20 \text{ V}, V_{DS} = 0 \text{ V}$			±10	μΑ
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.0	3.0	4.0	V
Forward Transfer Admittance	yfs	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 42 A	30	60		S
Drain to Source On-state Resistance	RDS(on)	Vgs = 10 V, ID = 42 A		6.5	8.5	mΩ
Input Capacitance	Ciss	V <sub>DS</sub> = 10 V		8500		pF
Output Capacitance	Coss	Vgs = 0 V		1300		pF
Reverse Transfer Capacitance	Crss	f = 1 MHz		650		pF
Turn-on Delay Time	td(on)	V <sub>DD</sub> = 38 V, I <sub>D</sub> = 42 A		35		ns
Rise Time	tr	Vgs = 10 V		28		ns
Turn-off Delay Time	td(off)	$R_G = 0 \Omega$		105		ns
Fall Time	tf			16		ns
Total Gate Charge	QG	VDD = 60 V		150		nC
Gate to Source Charge	Qgs	V <sub>G</sub> S = 10 V		30		nC
Gate to Drain Charge	Q <sub>GD</sub>	ID = 83 A		52		nC
Body Diode Forward Voltage	V <sub>F</sub> (S-D)	IF = 83 A, VGS = 0 V		1.0		V
Reverse Recovery Time	trr	IF = 83 A, VGS = 0 V		80		ns
Reverse Recovery Charge	Qrr	di/dt = 100 A/ μs		240		nC

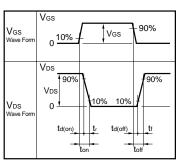
#### **TEST CIRCUIT 1 AVALANCHE CAPABILITY**

# $V_{GS} = 20 \rightarrow 0 \text{ V}$



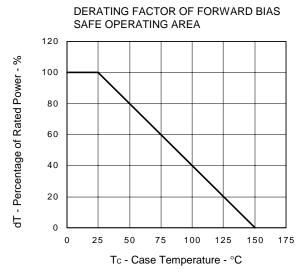
## TEST CIRCUIT 2 SWITCHING TIME

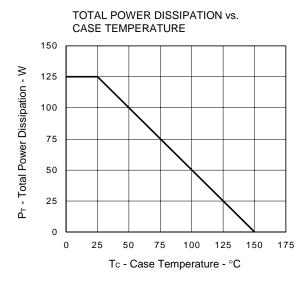


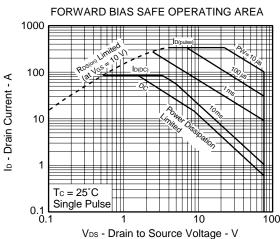


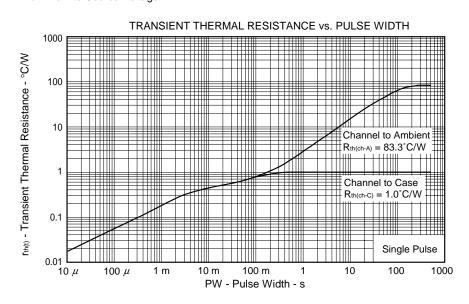
## **TEST CIRCUIT 3 GATE CHARGE**

## TYPICAL CHARACTERISTICS (TA = 25°C)

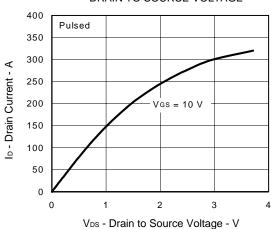




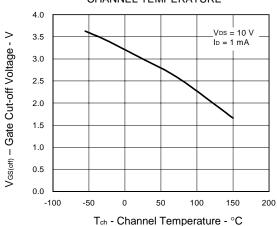




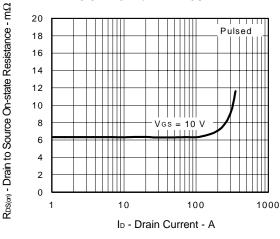
## DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



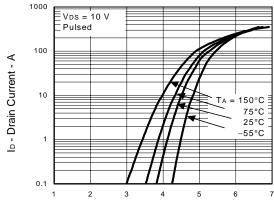
## GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



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

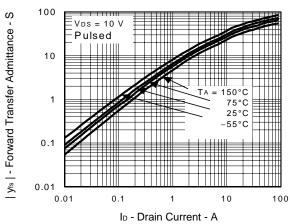


#### FORWARD TRANSFER CHARACTERISTICS

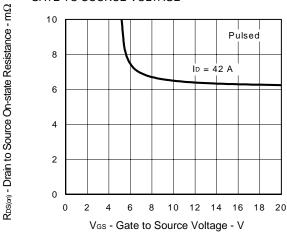


Vgs - Gate to Source Voltage - V

## FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



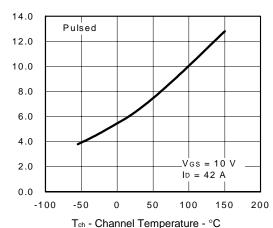
## DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



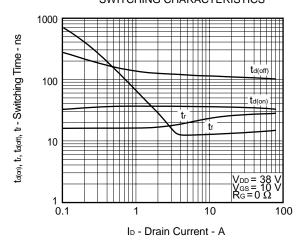


R<sub>DS(m)</sub> - Drain to Source On-state Resistance - mΩ

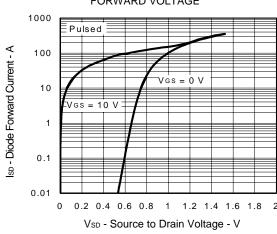




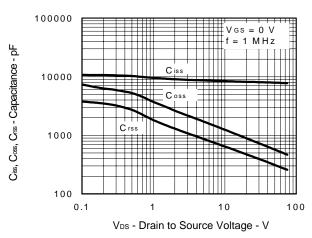
## SWITCHING CHARACTERISTICS



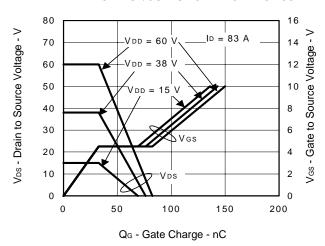
## SOURCE TO DRAIN DIODE FORWARD VOLTAGE



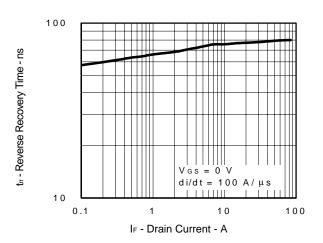
## CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



#### DYNAMIC INPUT/OUTPUT CHARACTERISTICS

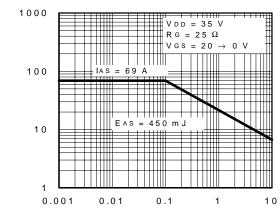


#### REVERSE RECOVERY TIME vs. DRAIN CURRENT



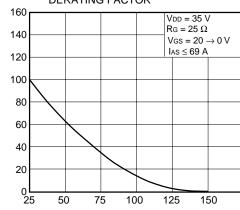
IAS - Single Avalanche Current - A

## SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



L - Inductive Load - mH

## SINGLE AVALANCHE ENERGY DERATING FACTOR



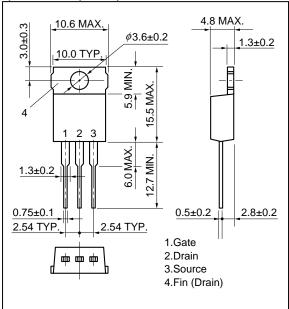
Energy Derating Factor - %

Starting Tch - Starting Channel Temperature - °C

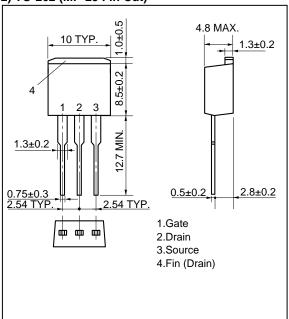


## **PACKAGE DRAWINGS (Unit: mm)**

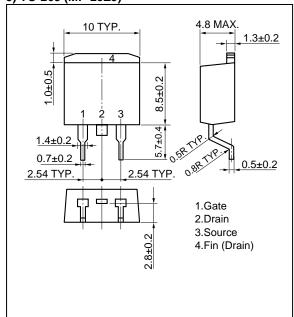
#### 1) TO-220AB (MP-25)



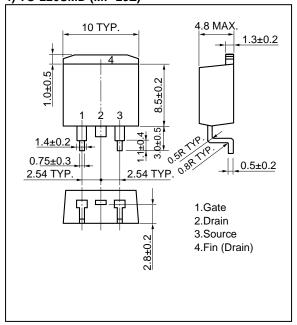
### 2) TO-262 (MP-25 Fin Cut)



#### 3) TO-263 (MP-25ZJ)

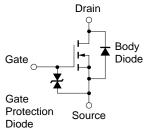


## 4) TO-220SMD (MP-25Z)<sup>Note</sup>



Note This package is produced only in Japan.

#### **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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