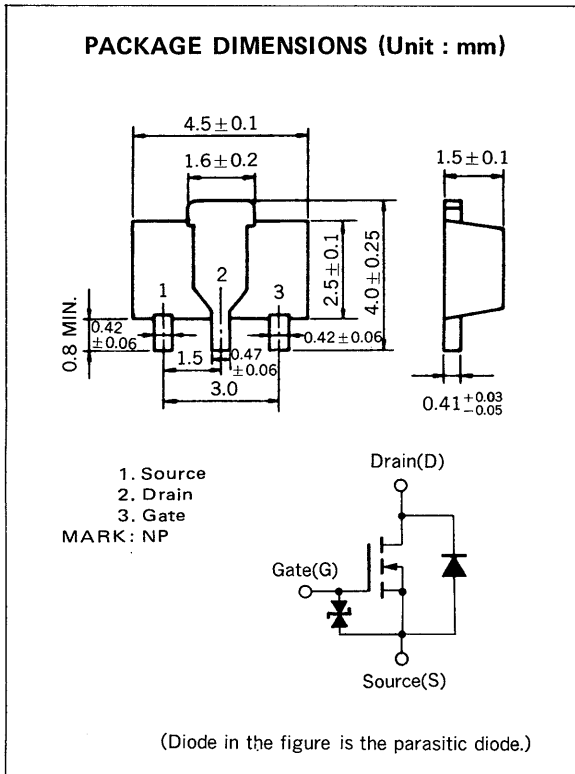


# MOS FIELD EFFECT TRANSISTOR 2SK1593

## N-CHANNEL MOS FET FOR SWITCHING



The 2SK1593, N-channel vertical type MOS FET, is a switching device which can be driven directly by the output of ICs having a 5 V power source.

As the MOS FET has low on-state resistance and excellent switching characteristics, it is suitable for driving actuators such as motors, relays, and solenoids.

### FEATURES

- Directly driven by ICs having a 5 V power source.
  - Has low on-state resistance.
- $R_{DS(on)1} = 6.0 \Omega \text{ MAX. @ } V_{GS} = 4.0 \text{ V, } I_D = 0.3 \text{ A}$   
 $R_{DS(on)2} = 5.0 \Omega \text{ MAX. @ } V_{GS} = 10 \text{ V, } I_D = 0.3 \text{ A}$

### QUALITY GRADE

Standard

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

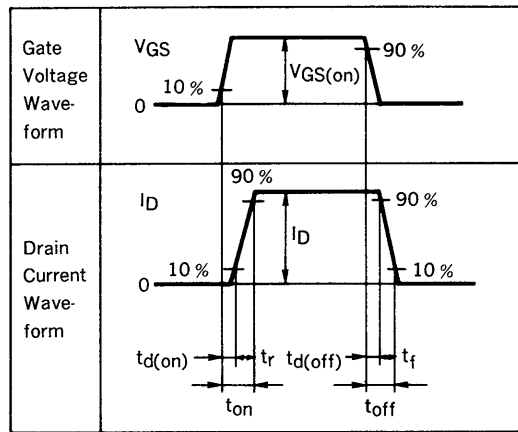
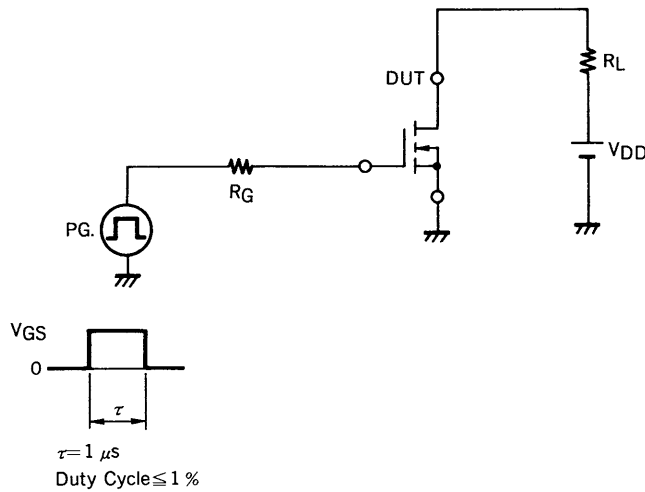
### ABSOLUTE MAXIMUM RATINGS ( $T_a = 25^\circ\text{C}$ )

PARAMETER	SYMBOL	RATINGS	UNIT	TEST CONDITIONS
Drain to Source Voltage	$V_{DSS}$	100	V	$V_{GS} = 0$
Gate to Source Voltage	$V_{GSS}$	$\pm 20$	V	$V_{DS} = 0$
Drain Current	$I_D(\text{DC})$	$\pm 500$	mA	
Drain Current	$I_D(\text{pulse})$	$\pm 1.0$	A	$PW \leq 10 \text{ ms, Duty Cycle} \leq 50 \%$
Total Power Dissipation	$P_T$	2.0	W	When using ceramic board of $16 \text{ cm}^2 \times 0.7 \text{ mm}$
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$	
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$	

ELECTRICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )

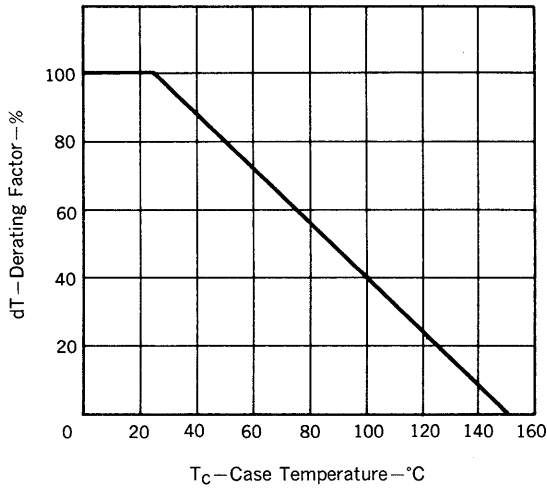
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Drain Cut-off Current	$I_{DSS}$			10	$\mu\text{A}$	$V_{DS} = 100\text{ V}, V_{GS} = 0$
Gate Leakage Current	$I_{GSS}$			$\pm 10$	$\mu\text{A}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0$
Gate Cut-off Voltage	$V_{GS(off)}$	0.8	1.3	2.0	V	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$
Forward Transfer Admittance	$ y_{fs} $	0.4	0.5		S	$V_{DS} = 10\text{ V}, I_D = 0.5\text{ A}$
Drain to Source On-State Resistance	$R_{DS(on)1}$		4.0	6.0	$\Omega$	$V_{GS} = 4.0\text{ V}, I_D = 0.3\text{ A}$
Drain to Source On-State Resistance	$R_{DS(on)2}$		3.4	5.0	$\Omega$	$V_{GS} = 10\text{ V}, I_D = 0.3\text{ A}$
Input Capacitance	$C_{iss}$		55		pF	$V_{DS} = 10\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$
Output Capacitance	$C_{oss}$		25		pF	
Feedback Capacitance	$C_{rss}$		4.5		pF	
Turn-On Delay Time	$t_{d(on)}$		60		ns	$V_{DD} = 10\text{ V}, I_D = 0.3\text{ A}$ $V_{GS(on)} = 4\text{ V}, R_G = 10\ \Omega$ $R_L = 33\ \Omega$
Rise Time	$t_r$		140		ns	
Turn-Off Delay Time	$t_{d(off)}$		140		ns	
Fall Time	$t_f$		90		ns	

SWITCHING TIME MEASUREMENT CIRCUIT AND CONDITIONS

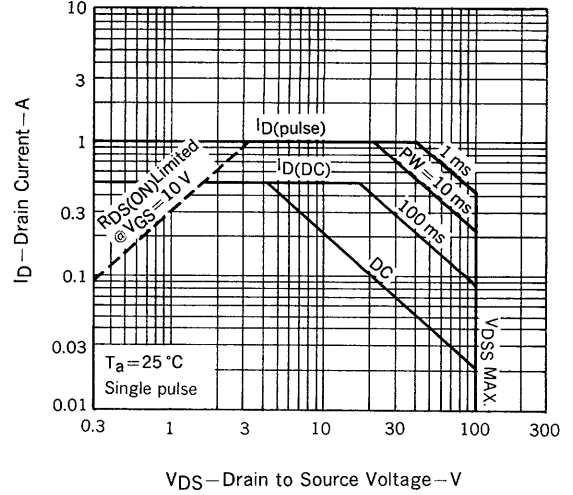


TYPICAL CHARACTERISTICS ( $T_a = 25^\circ\text{C}$ )

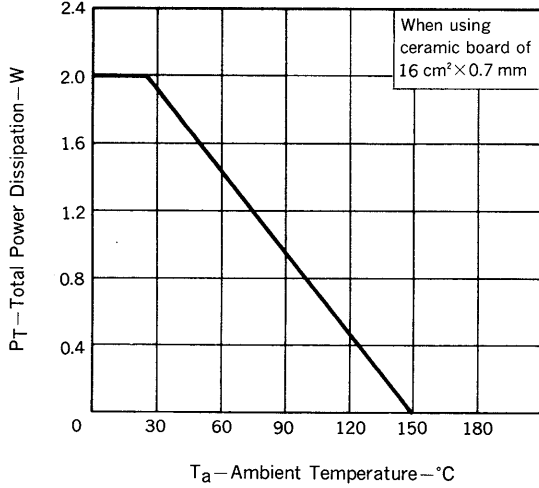
DERATING FACTOR OF FORWARD BIAS SAFE OPERATION AREA



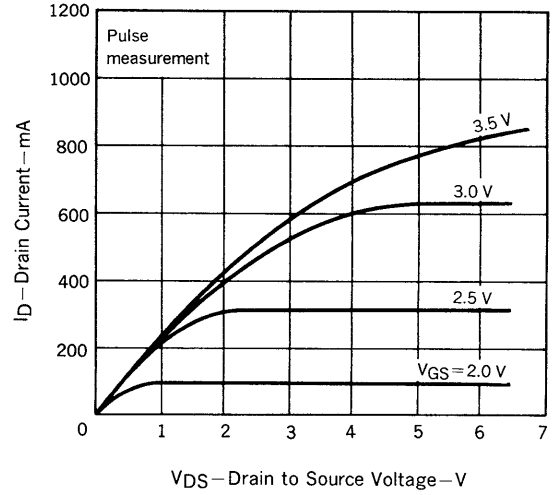
FORWARD BIAS SAFE OPERATING AREA



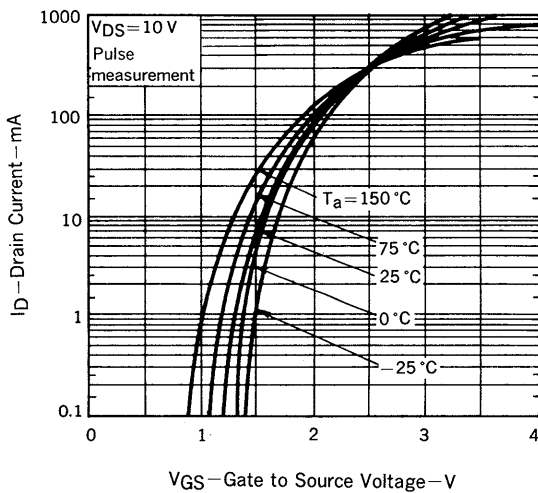
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



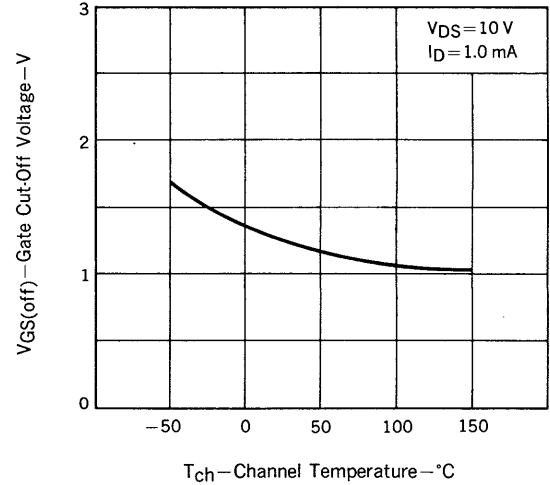
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



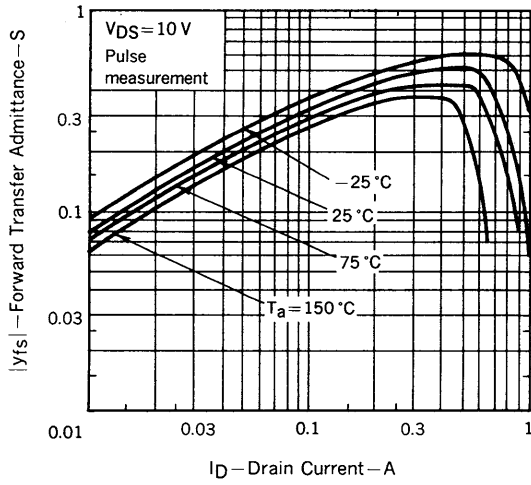
TRANSFER CHARACTERISTICS



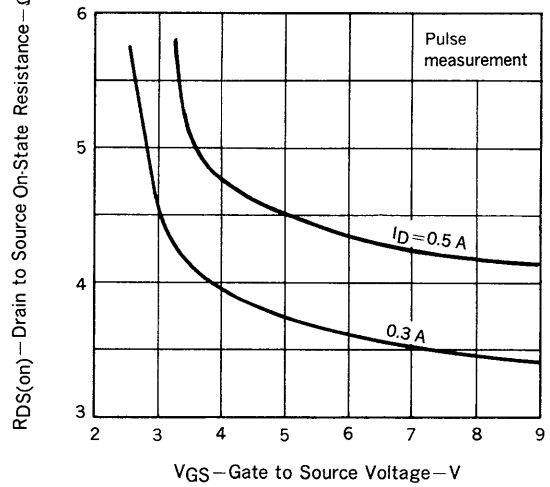
GATE TO SOURCE CUTOFF VOLTAGE vs. CHANNEL TEMPERATURE



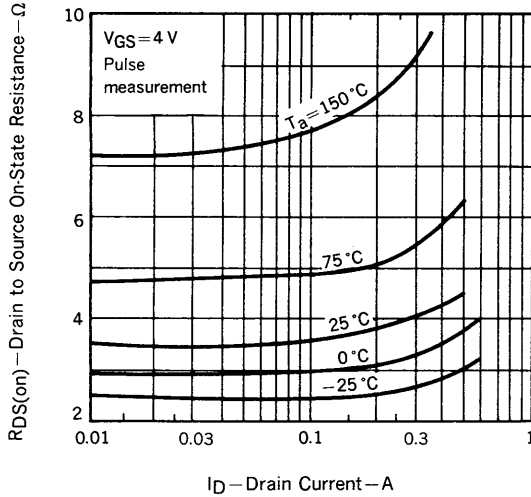
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



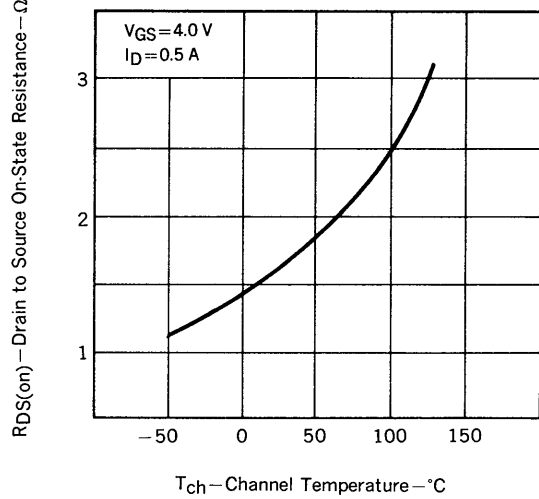
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



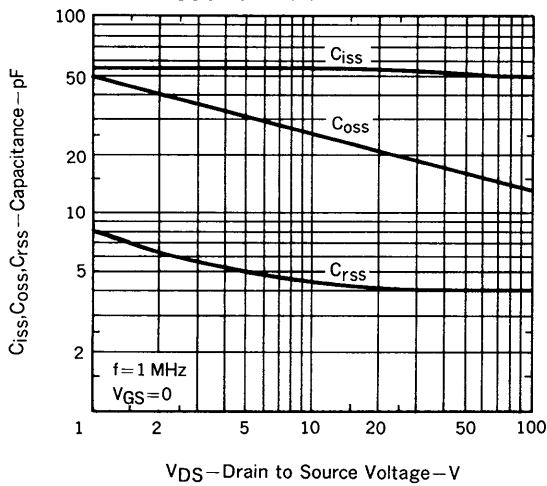
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



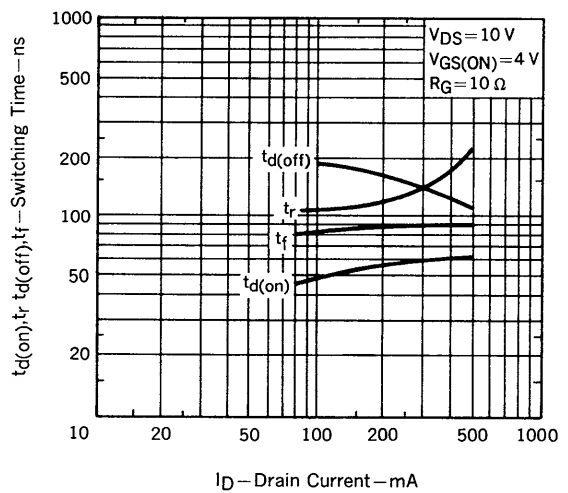
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

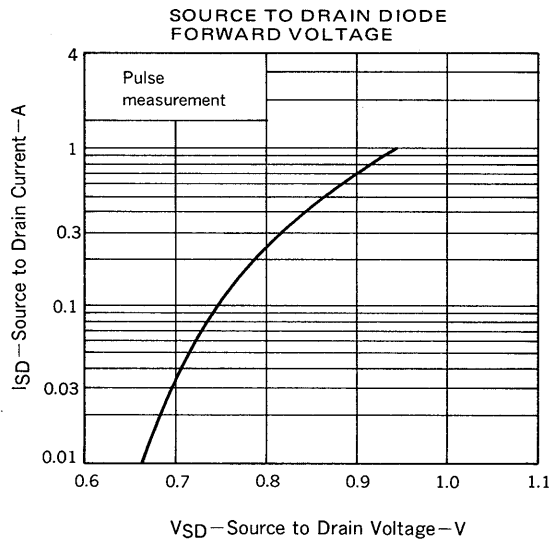


CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



SWITCHING CHARACTERISTICS





**RECOMMENDED SOLDERING CONDITIONS**

Mouning of this product by soldering should be done under the following conditions.  
Please consult our representatives about soldering methods and conditions other than these.

**SURFACE MOUNT TYPE**

For details of the recommended soldering conditions, see the information document "SMT MANUAL" (IEI-1207).

Soldering Method	Soldering Conditions	Symbol for Recommended Conditions
Infrared Reflow	Package peak temp.: 230 °C Soldering time: within 30 sec (above 210 °C) Soldering times: 1, Days limitation: none*	IR30-00
Vapor Phase Soldering	Package peak temp.: 215 °C Soldering time: within 40 sec (above 200 °C) Soldering times: 1, Days limitation: none*	VP15-00
Wave Soldering	Soldering bath temp.: below 260 °C Soldering time: within 10 sec Soldering times: 1, Days limitation: none*	WS60-00

\*: Stored days under storage conditions at 25 °C and below 65 % R.H. after the dry-pack has been opened.

**Note 1** Combination of soldering methods should be avoided.

REFERENCE

Document Name	Document No.
NEC semiconductor device reliability/quality control system.	TEI-1202
Quality grade on NEC semiconductor devices.	IEI-1209
Semiconductor device mounting technology manual.	IEI-1207
Semiconductor device package manual.	IEI-1213
Guide to quality assurance for semiconductor devices.	MEI-1202
Semiconductor selection guide.	MF-1134

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