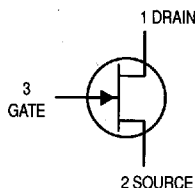


JFETs Switching

N-Channel — Depletion



MPF4392
MPF4393

Motorola Preferred Devices



CASE 29-04, STYLE 5
TO-92 (TO-226AA)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	30	Vdc
Drain-Gate Voltage	V_{DG}	30	Vdc
Gate-Source Voltage	V_{GS}	30	Vdc
Forward Gate Current	$I_{G(f)}$	50	mA
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	350 2.8	mW mW/ $^\circ\text{C}$
Operating and Storage Channel Temperature Range	$T_{\text{channel}}, T_{\text{stg}}$	-65 to +150	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Gate-Source Breakdown Voltage ($I_G = 1.0 \mu\text{A}$, $V_{DS} = 0$)	$V_{(BR)GSS}$	30	—	—	Vdc
Gate Reverse Current ($V_{GS} = 15 \text{ Vdc}$, $V_{DS} = 0$) ($V_{GS} = 15 \text{ Vdc}$, $V_{DS} = 0$, $T_A = 100^\circ\text{C}$)	I_{GSS}	— —	— —	1.0 0.2	nA μA
Drain-Cutoff Current ($V_{DS} = 15 \text{ Vdc}$, $V_{GS} = 12 \text{ Vdc}$) ($V_{DS} = 15 \text{ Vdc}$, $V_{GS} = 12 \text{ Vdc}$, $T_A = 100^\circ\text{C}$)	$I_{D(off)}$	— —	— —	1.0 0.1	nA μA
Gate-Source Voltage ($V_{DS} = 15 \text{ Vdc}$, $I_D = 10 \text{ nA}$)	V_{GS}	-2.0 -0.5	— —	-5.0 -3.0	Vdc

ON CHARACTERISTICS

Zero-Gate-Voltage Drain Current ⁽¹⁾ ($V_{DS} = 15 \text{ Vdc}$, $V_{GS} = 0$)	MPF4392 MPF4393	I_{DSS}	25 5.0	— —	75 30	mA
Drain-Source On-Voltage ($I_D = 6.0 \text{ mA}$, $V_{GS} = 0$) ($I_D = 3.0 \text{ mA}$, $V_{GS} = 0$)	MPF4392 MPF4393	$V_{DS(on)}$	— —	— —	0.4 0.4	Vdc
Static Drain-Source On Resistance ($I_D = 1.0 \text{ mA}$, $V_{GS} = 0$)	MPF4392 MPF4393	$r_{DS(on)}$	— —	— —	60 100	Ω

SMALL-SIGNAL CHARACTERISTICS

Forward Transfer Admittance ($V_{DS} = 15 \text{ Vdc}$, $I_D = 25 \text{ mA}$, $f = 1.0 \text{ kHz}$) ($V_{DS} = 15 \text{ Vdc}$, $I_D = 5.0 \text{ mA}$, $f = 1.0 \text{ kHz}$)	MPF4392 MPF4393	$ y_{fs} $	— —	17 12	—	mmhos
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1. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 3.0\%$.

Preferred devices are Motorola recommended choices for future use and best overall value.

MPF4392 MPF4393

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Typ	Max	Unit
SMALL-SIGNAL CHARACTERISTICS (continued)					
Drain-Source "ON" Resistance ($V_{GS} = 0$, $I_D = 0$, $f = 1.0$ kHz)	$r_{ds(on)}$	—	—	60 100	Ω
Input Capacitance ($V_{GS} = 15$ Vdc, $V_{DS} = 0$, $f = 1.0$ MHz)	C_{iss}	—	6.0	10	pF
Reverse Transfer Capacitance ($V_{GS} = 12$ Vdc, $V_{DS} = 0$, $f = 1.0$ MHz) ($V_{DS} = 15$ Vdc, $I_D = 10$ mAdc, $f = 1.0$ MHz)	C_{rss}	—	2.5 3.2	3.5 —	pF

SWITCHING CHARACTERISTICS

Rise Time (See Figure 2) ($I_{D(on)} = 6.0$ mAdc) ($I_{D(on)} = 3.0$ mAdc)	MPF4392 MPF4393	t_r	— —	2.0 2.5	5.0 5.0	ns
Fall Time (See Figure 4) ($V_{GS(off)} = 7.0$ Vdc) ($V_{GS(off)} = 5.0$ Vdc)	MPF4392 MPF4393	t_f	— —	15 29	20 35	ns
Turn-On Time (See Figures 1 and 2) ($I_{D(on)} = 6.0$ mAdc) ($I_{D(on)} = 3.0$ mAdc)	MPF4392 MPF4393	t_{on}	— —	4.0 6.5	15 15	ns
Turn-Off Time (See Figures 3 and 4) ($V_{GS(off)} = 7.0$ Vdc) ($V_{GS(off)} = 5.0$ Vdc)	MPF4392 MPF4393	t_{off}	— —	20 37	35 55	ns

TYPICAL SWITCHING CHARACTERISTICS

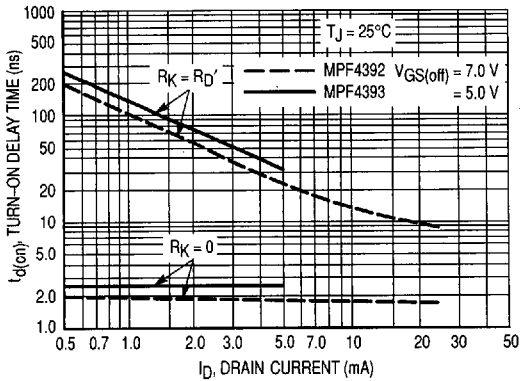


Figure 1. Turn-On Delay Time

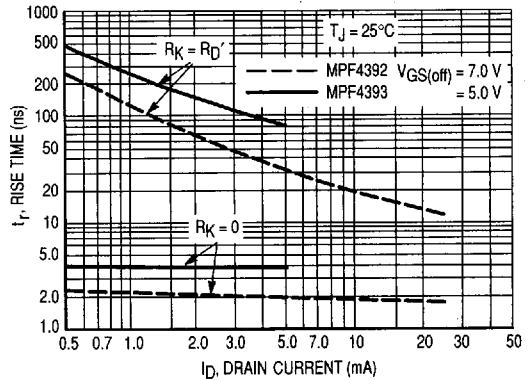


Figure 2. Rise Time

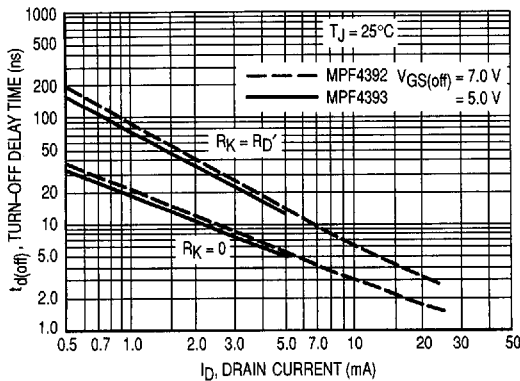


Figure 3. Turn-Off Delay Time

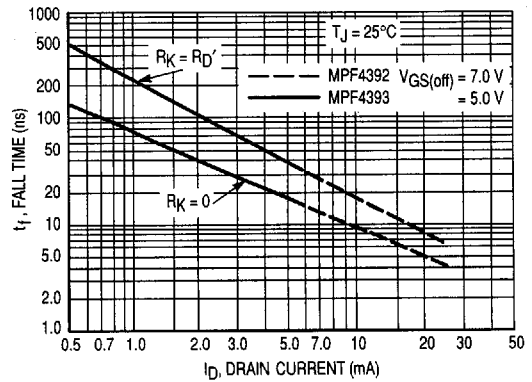


Figure 4. Fall Time

NOTE 1

The switching characteristics shown above were measured using a test circuit similar to Figure 5. At the beginning of the switching interval, the gate voltage is at Gate Supply Voltage ($-V_{GG}$). The Drain-Source Voltage (V_{DS}) is slightly lower than Drain Supply Voltage (V_{DD}) due to the voltage divider. Thus Reverse Transfer Capacitance (C_{rss}) or Gate-Drain Capacitance (C_{gd}) is charged to $V_{GG} + V_{DS}$.

During the turn-on interval, Gate-Source Capacitance (C_{gs}) discharges through the series combination of R_{GEN} and R_K . C_{gd} must discharge to $V_{DS(on)}$ through R_G and R_K in series with the parallel combination of effective load impedance (R'_D) and Drain-Source Resistance (r_{ds}). During the turn-off, this charge flow is reversed.

Predicting turn-on time is somewhat difficult as the channel resistance r_{ds} is a function of the gate-source voltage. While C_{gs} discharges, V_{GS} approaches zero and r_{ds} decreases. Since C_{gd} discharges through r_{ds} , turn-on time is non-linear. During turn-off, the situation is reversed with r_{ds} increasing as C_{gd} charges.

The above switching curves show two impedance conditions: 1) R_K is equal to R'_D which simulates the switching behavior of cascaded stages where the driving source impedance is normally the load impedance of the previous stage, and 2) $R_K = 0$ (low impedance) the driving source impedance is that of the generator.

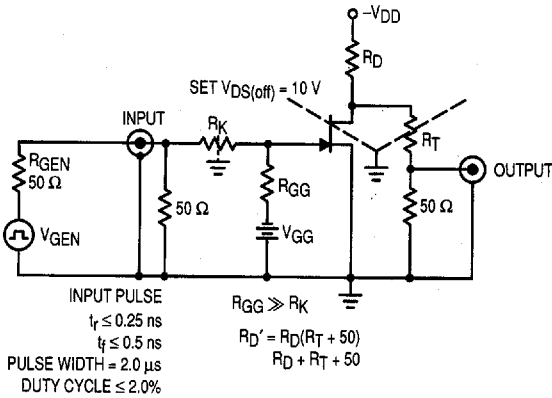


Figure 5. Switching Time Test Circuit

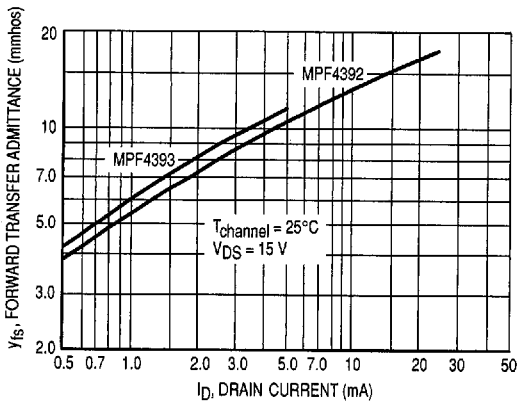


Figure 6. Typical Forward Transfer Admittance

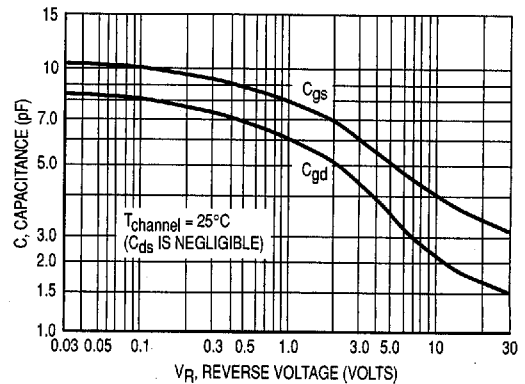


Figure 7. Typical Capacitance

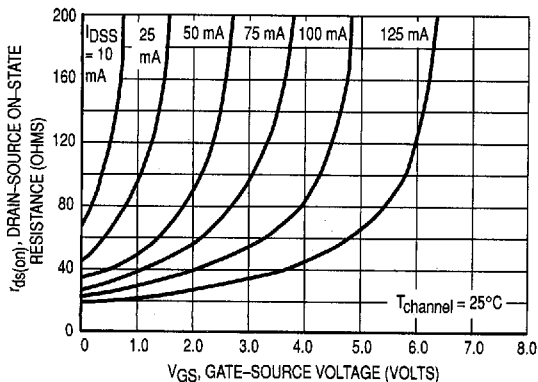


Figure 8. Effect of Gate-Source Voltage On Drain-Source Resistance

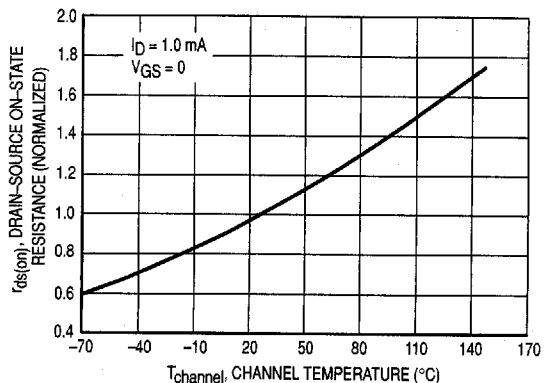


Figure 9. Effect of Temperature On Drain-Source On-State Resistance

6367255 0093865 141

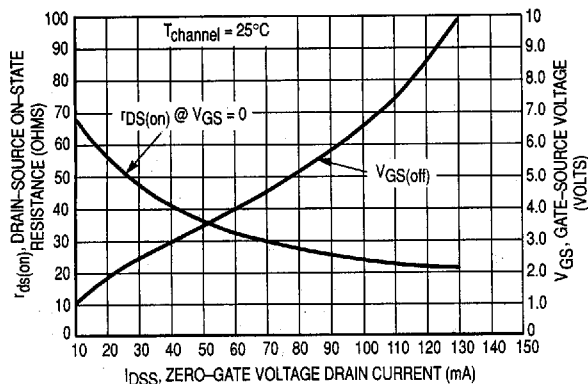


Figure 10. Effect of I_{DSS} On Drain-Source Resistance and Gate-Source Voltage

NOTE 2

The Zero-Gate-Voltage Drain Current (I_{DSS}), is the principle determinant of other J-FET characteristics. Figure 10 shows the relationship of Gate-Source Off Voltage ($V_{GS(off)}$) and Drain-Source On Resistance ($r_{ds(on)}$) to I_{DSS} . Most of the devices will be within $\pm 10\%$ of the values shown in Figure 10. This data will be useful in predicting the characteristic variations for a given part number.

For example:

Unknown

$r_{ds(on)}$ and V_{GS} range for an MPF4392

The electrical characteristics table indicates that an MPF4392 has an I_{DSS} range of 25 to 75 mA. Figure 10 shows $r_{ds(on)} = 52$ Ohms for $I_{DSS} = 25$ mA and 30 Ohms for $I_{DSS} = 75$ mA. The corresponding V_{GS} values are 2.2 volts and 4.8 volts.