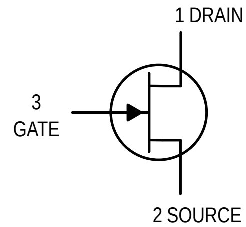
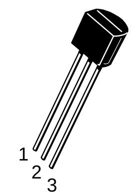
JFETs Switching

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	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	350 2.8	mW mW/°C
Operating and Storage Channel Temperature Range	$T_{channel}$, T_{stg}	–65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Gate–Source Breakdown Voltage (I_G = 1.0 µAdc, V_{DS} = 0)		$V_{(BR)GSS}$	30	—	—	Vdc
Gate Reverse Current (V_{GS} = 15 Vdc, V_{DS} = 0) (V_{GS} = 15 Vdc, V_{DS} = 0, T_A = 100°C)		I_{GSS}	 — —	 — —	 1.0 0.2	 nAdc µAdc
Drain–Cutoff Current (V_{DS} = 15 Vdc, V_{GS} = 12 Vdc) (V_{DS} = 15 Vdc, V_{GS} = 12 Vdc, T_A = 100°C)		$I_{D(off)}$	 — —	 — —	 1.0 0.1	 nAdc µAdc
Gate Source Voltage (V_{DS} = 15 Vdc, I_D = 10 nAdc)	 MPF4392 MPF4393	V_{GS}	 –2.0 –0.5	 — —	 –5.0 –3.0	Vdc
ON CHARACTERISTICS						
Zero–Gate–Voltage Drain Current(1) (V_{DS} = 15 Vdc, V_{GS} = 0)	 MPF4392 MPF4393	I_{DSS}	 25 5.0	 — —	 75 30	mAdc
Drain–Source On–Voltage (I_D = 6.0 mAdc, V_{GS} = 0) (I_D = 3.0 mAdc, V_{GS} = 0)	 MPF4392 MPF4393	$V_{DS(on)}$	 — —	 — —	 0.4 0.4	Vdc
Static Drain–Source On Resistance (I_D = 1.0 mAdc, V_{GS} = 0)	 MPF4392 MPF4393	$r_{DS(on)}$	 — —	 — —	 60 100	Ω
SMALL–SIGNAL CHARACTERISTICS						
Forward Transfer Admittance (V_{DS} = 15 Vdc, I_D = 25 mAdc, f = 1.0 kHz) (V_{DS} = 15 Vdc, I_D = 5.0 mAdc, f = 1.0 kHz)	 MPF4392 MPF4393	$\|y_{fs}\|$	 — —	 17 12	 — —	mmhos

1. Pulse Test: Pulse Width ≤ 300 µs, Duty Cycle ≤ 3.0%.

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

REV 1

MOTOROLA

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted) (Continued)

Characteristic		Symbol	Min	Typ	Max	Unit
SMALL–SIGNAL CHARACTERISTICS (continued)						
Drain–Source "ON" Resistance		$r_{ds(on)}$				Ω
(V_{GS} = 0, I_D = 0, f = 1.0 kHz)	MPF4392		—	—	60	
	MPF4393		—	—	100	
Input Capacitance (V_{GS} = 15 Vdc, V_{DS} = 0, f = 1.0 MHz)		C_{iss}	—	6.0	10	pF
Reverse Transfer Capacitance		C_{rss}				pF
(V_{GS} = 12 Vdc, V_{DS} = 0, f = 1.0 MHz)			—	2.5	3.5	
(V_{DS} = 15 Vdc, I_D = 10 mAdc, f = 1.0 MHz)			—	3.2	—	
SWITCHING CHARACTERISTICS						
Rise Time (See Figure 2)		t_r				ns
($I_{D(on)}$ = 6.0 mAdc)	MPF4392		—	2.0	5.0	
($I_{D(on)}$ = 3.0 mAdc)	MPF4393		—	2.5	5.0	
Fall Time (See Figure 4)		t_f				ns
($V_{GS(off)}$ = 7.0 Vdc)	MPF4392		—	15	20	
($V_{GS(off)}$ = 5.0 Vdc)	MPF4393		—	29	35	
Turn–On Time (See Figures 1 and 2)		t_{on}				ns
($I_{D(on)}$ = 6.0 mAdc)	MPF4392		—	4.0	15	
($I_{D(on)}$ = 3.0 mAdc)	MPF4393		—	6.5	15	
Turn–Off Time (See Figures 3 and 4)		t_{off}				ns
($V_{GS(off)}$ = 7.0 Vdc)	MPF4392		—	20	35	
($V_{GS(off)}$ = 5.0 Vdc)	MPF4393		—	37	55	

TYPICAL SWITCHING CHARACTERISTICS

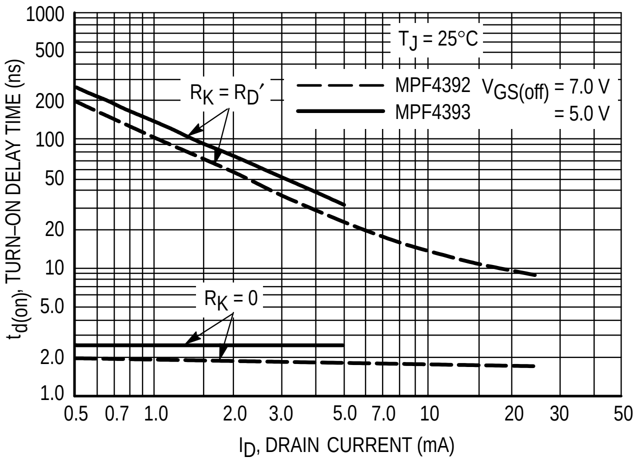


Figure 1. Turn–On Delay Time

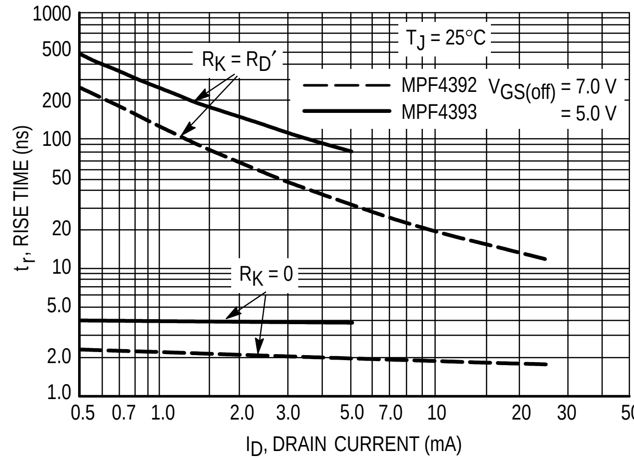


Figure 2. Rise Time

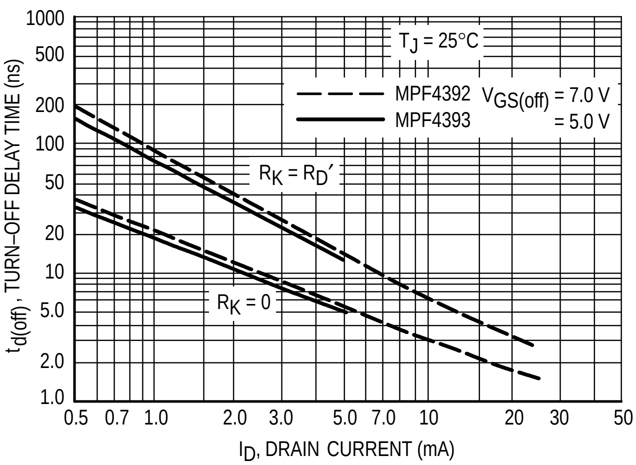


Figure 3. Turn–Off Delay Time

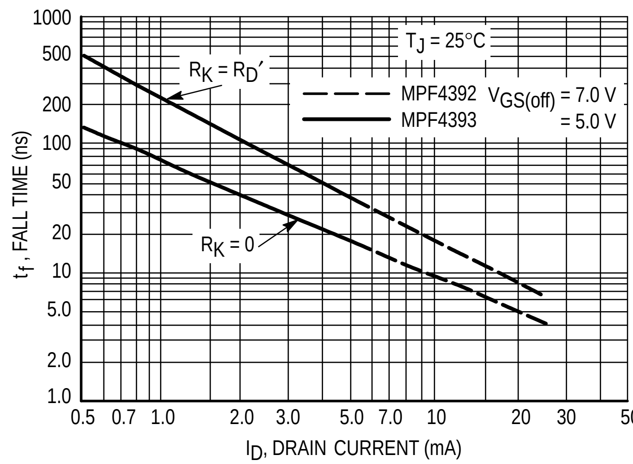


Figure 4. Fall Time

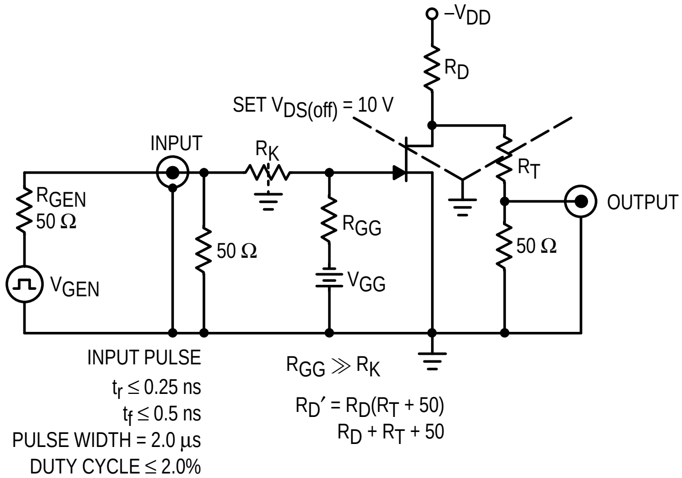


Figure 5. Switching Time Test Circuit

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.

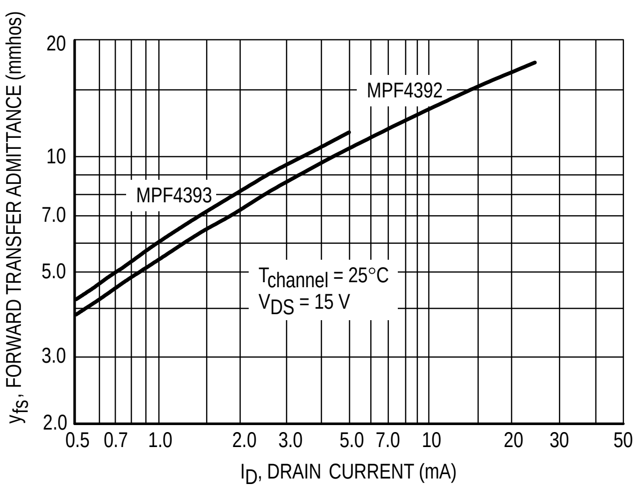


Figure 6. Typical Forward Transfer Admittance

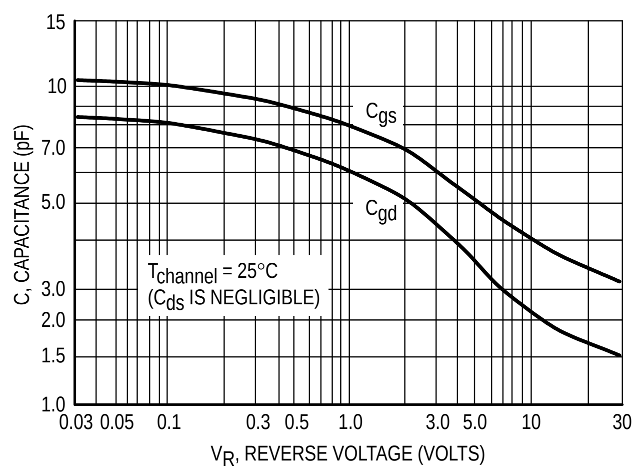


Figure 7. Typical Capacitance

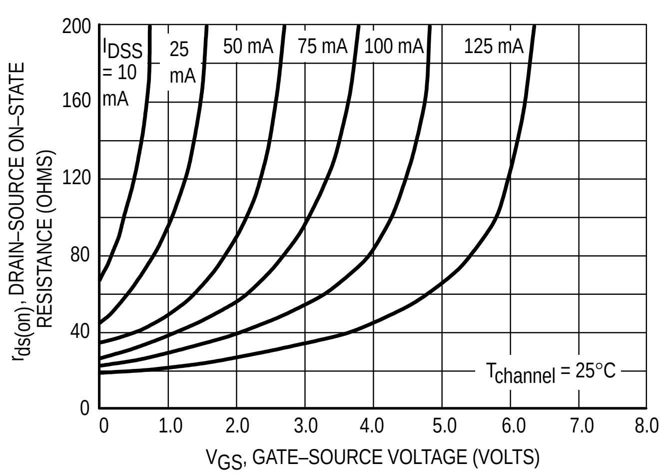


Figure 8. Effect of Gate–Source Voltage On Drain–Source Resistance

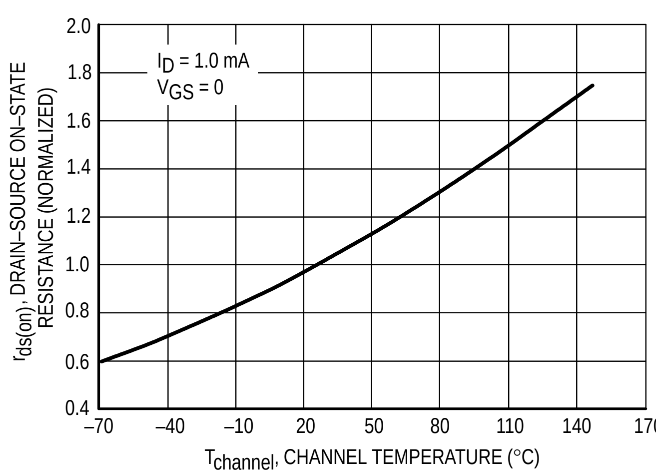


Figure 9. Effect of Temperature On Drain–Source On–State Resistance

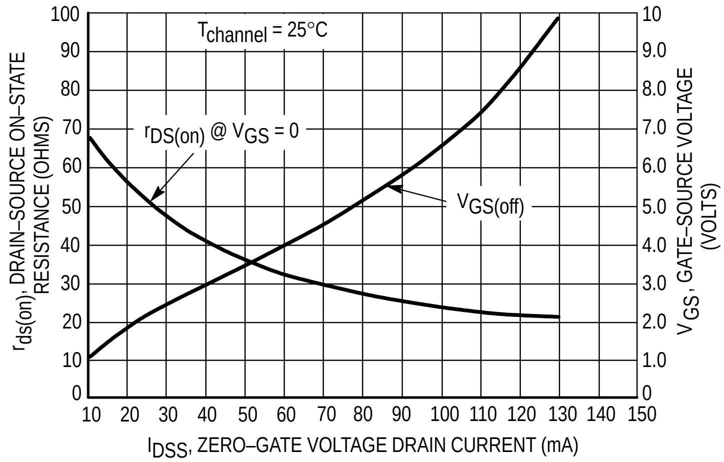


Figure 10. Effect of I_{DSS} On Drain–Source Resistance and Gate–Source Voltage

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 ±10% of the values shown in Figure 10. This data will be useful in predicting the characteristic variations for a given part number.

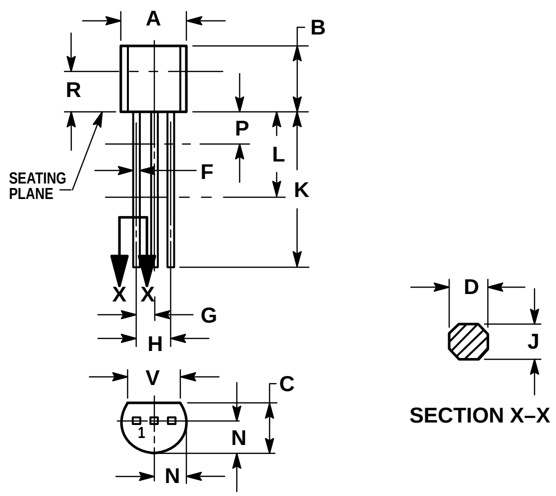
For example:

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.

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. DIMENSION F APPLIES BETWEEN P AND L. DIMENSION D AND J APPLY BETWEEN L AND K MINIMUM. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
B	0.170	0.210	4.32	5.33
C	0.125	0.165	3.18	4.19
D	0.016	0.022	0.41	0.55
F	0.016	0.019	0.41	0.48
G	0.045	0.055	1.15	1.39
H	0.095	0.105	2.42	2.66
J	0.015	0.020	0.39	0.50
K	0.500	—	12.70	—
L	0.250	—	6.35	—
N	0.080	0.105	2.04	2.66
P	—	0.100	—	2.54
R	0.115	—	2.93	—
V	0.135	—	3.43	—

CASE 029–04
(TO–226AA)
ISSUE AD

STYLE 5:
PIN 1. DRAIN
2. SOURCE
3. GATE

How to reach us:
USA / EUROPE / Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 303–675–2140 or 1–800–441–2447

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JAPAN: Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4–32–1,
Nishi–Gotanda, Shinagawa–ku, Tokyo 141, Japan. 81–3–5487–8488

ASIA / PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298