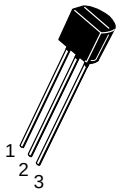
JFET Switching
N–Channel – Depletion

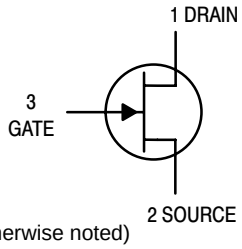
MPF4856

MAXIMUM RATINGS

Rating	Symbol	MPF4856	Unit
Drain–Source Voltage	V_{DS}	+40	Vdc
Drain–Gate Voltage	V_{DG}	+40	Vdc
Reverse Gate–Source Voltage	V_{GSR}	–40	Vdc
Forward Gate Current	I_{GF}	50	mAdc
Total Device Dissipation @ T_A = 25°C Derate above 25°C	P_D	360 2.4	mW mW/°C
Storage Temperature Range	T_{stg}	–65 to +150	°C



CASE 29–11, STYLE 5
TO–92 (TO–226AA)



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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Gate–Source Breakdown Voltage (I_G = 1.0 μAdc, V_{DS} = 0)	$V_{(BR)GSS}$	–40	–	Vdc
Gate Reverse Current (V_{GS} = –20 Vdc, V_{DS} = 0) (V_{GS} = –20 Vdc, V_{DS} = 0, T_A = 150°C)	I_{GSS}	 – –	 0.25 0.5	 nAdc μAdc
Gate Source Cutoff Voltage	$V_{GS(off)}$	–4.0	–10	Vdc
Drain–Cutoff Current (V_{DS} = 15 Vdc, V_{GS} = –10 Vdc) (V_{DS} = 15 Vdc, V_{GS} = –10 Vdc, T_A = 150°C)	$I_{D(off)}$	– –	0.25 0.5	nAdc μAdc
ON CHARACTERISTICS				
Zero–Gate–Voltage Drain Current(1)	I_{DSS}	50	–	mAdc
Drain–Source On–Voltage (I_D = 20 mAdc, V_{GS} = 0)	$V_{DS(on)}$	–	0.75	Vdc
SMALL–SIGNAL CHARACTERISTICS				
Drain–Source “ON” Resistance	$r_{ds(on)}$	–	25	Ω
Input Capacitance (V_{DS} = 0, V_{GS} = –10 Vdc, f = 1.0 MHz)	C_{iss}	–	18	pF
Reverse Transfer Capacitance (V_{DS} = 0, V_{GS} = –10 Vdc, f = 1.0 MHz)	C_{rss}	–	8.0	pF

1. Pulse Test: Pulse Width < 300 μs, Duty Cycle ≤ 2.0%.

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

Characteristic			Symbol	Min	Max	Unit
SWITCHING CHARACTERISTICS						
Turn–On Delay Time	Conditions for MPF4856, MPF4859: (V_{DD} = 10 Vdc, $I_{D(on)}$ = 20 mAdc, $V_{GS(on)}$ = 0, $V_{GS(off)}$ = –10 Vdc)	MPF4856, MPF4859 MPF4857, MPF4860 MPF4861	$t_{d(on)}$	– – –	6.0 6.0 10	ns
Rise Time	Conditions for MPF4857, MPF4860: (V_{DD} = 10 Vdc, $I_{D(on)}$ = 10 mAdc, $V_{GS(on)}$ = 0, $V_{GS(off)}$ = –6.0 Vdc)	MPF4856, MPF4859 MPF4857, MPF4860 MPF4861	t_r	– – –	3.0 4.0 10	ns
Turn–Off Time	Conditions for MPF4858, MPF4861: (V_{DD} = 10 Vdc, $I_{D(on)}$ = 5.0 mAdc, $V_{GS(on)}$ = 0, $V_{GS(off)}$ = –4.0 Vdc)	MPF4856, MPF4859 MPF4857, MPF4860 MPF4861	t_{off}	– – –	25 50 100	ns

TYPICAL SWITCHING CHARACTERISTICS

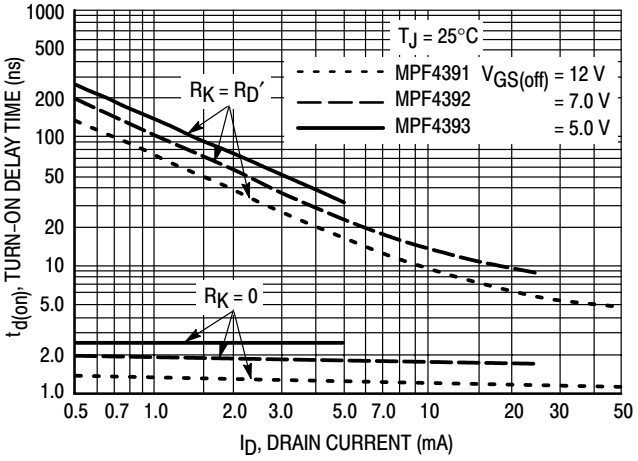


Figure 1. Turn–On Delay Time

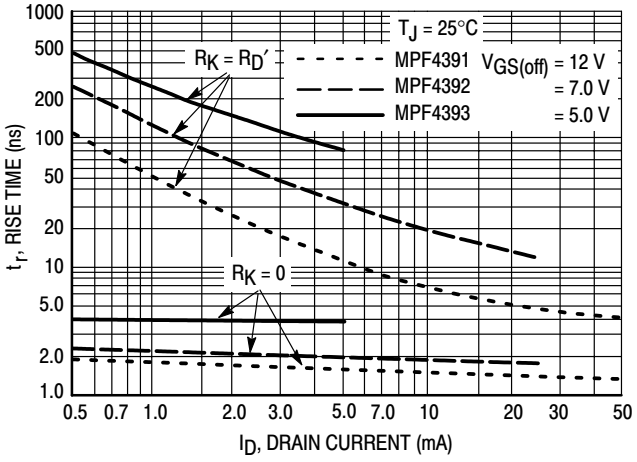


Figure 2. Rise Time

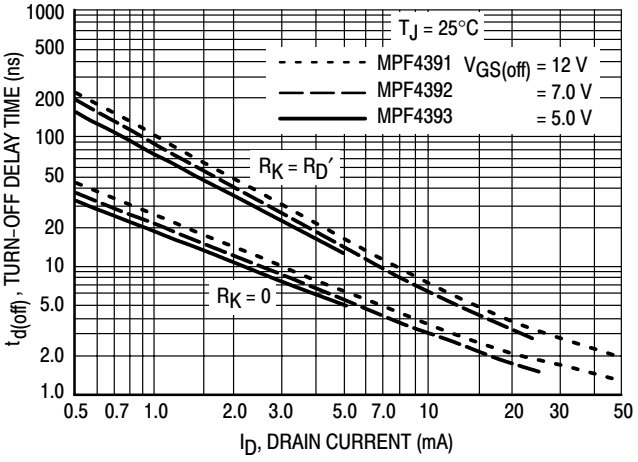


Figure 3. Turn–Off Delay time

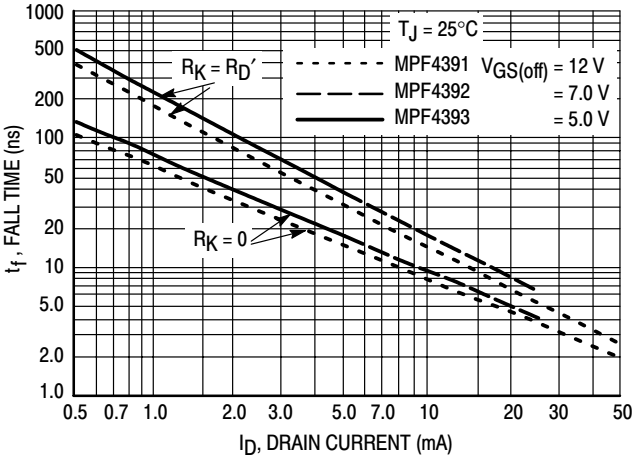


Figure 4. Fall Time

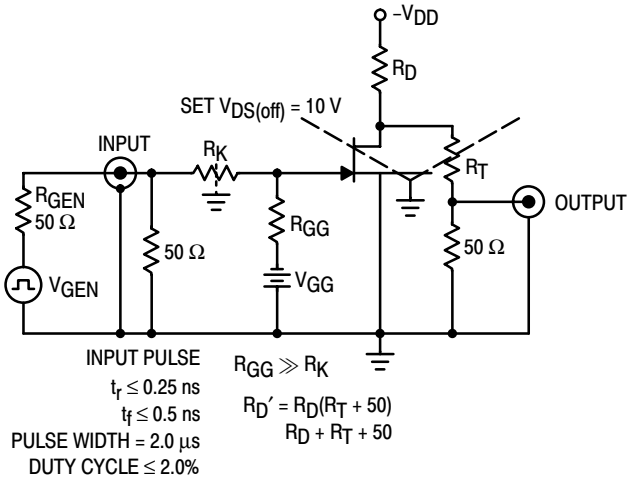


Figure 5. Switching Time Test Circuit

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.

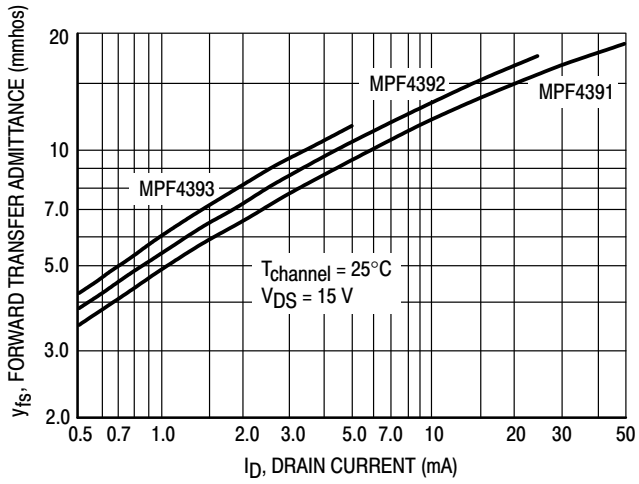


Figure 6. Typical Forward Transfer Admittance

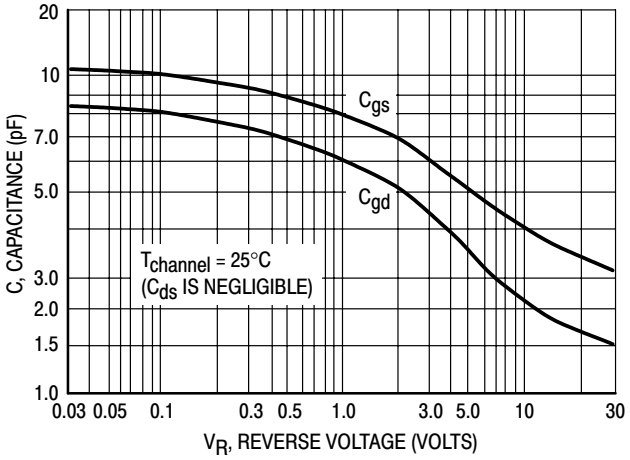


Figure 7. Typical Capacitance

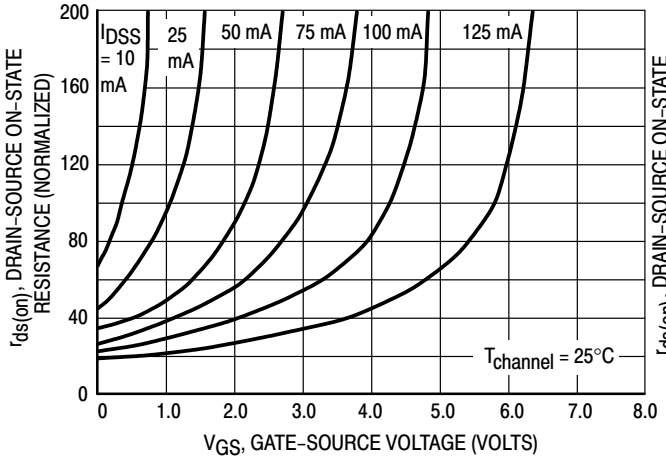


Figure 8. Effect of Gate–Source Voltage On Drain–Source Resistance

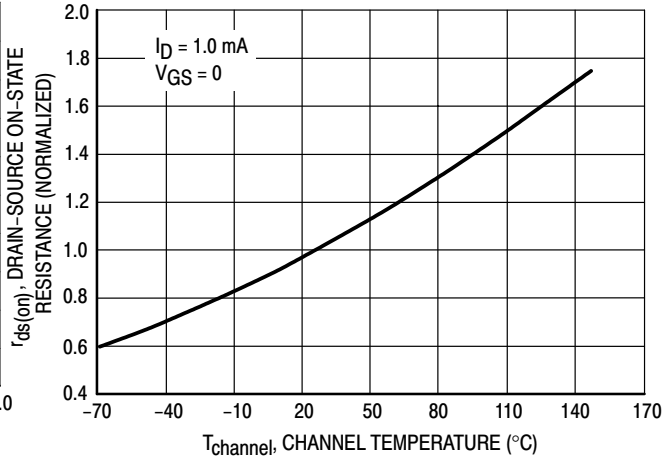


Figure 9. Effect of Temperature On Drain–Source On–State Resistance

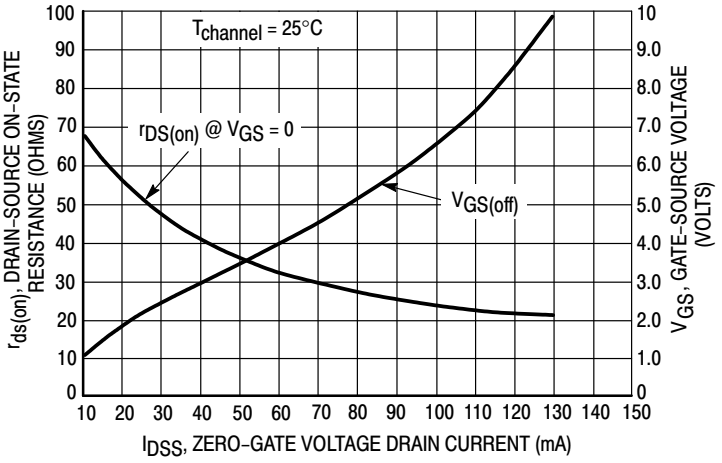


Figure 10. Effect of I_{DSS} On Drain–Source Resistance and Gate–Source Voltage

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:

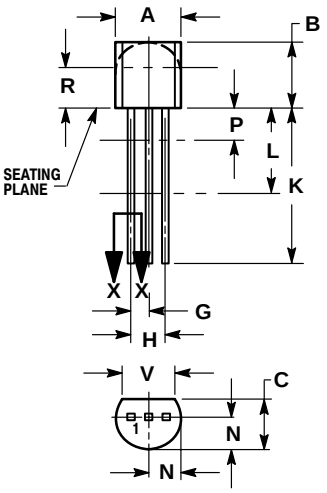
Unknown

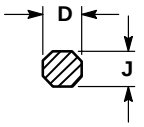
$r_{ds(on)}$ and V_{GS} range for an MPF4392

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

TO–92 (TO–226)
CASE 29–11
ISSUE AL





SECTION X–X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. 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	0.021	0.407	0.533
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	---

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

Notes

Notes

Thermal Clad is a trademark of the Bergquist Company.

PUBLICATION ORDERING INFORMATION

Literature Fulfillment:
Literature Distribution Center for ON Semiconductor
P.O. Box 5163, Denver, Colorado 80217 USA
Phone: 303–675–2175 or 800–344–3860 Toll Free USA/Canada
Fax: 303–675–2176 or 800–344–3867 Toll Free USA/Canada
Email: ONlit@hibbertco.com

N. American Technical Support: 800–282–9855 Toll Free USA/Canada

JAPAN: ON Semiconductor, Japan Customer Focus Center
4–32–1 Nishi–Gotanda, Shinagawa–ku, Tokyo, Japan 141–0031
Phone: 81–3–5740–2700
Email: r14525@onsemi.com

ON Semiconductor Website: http://onsemi.com

For additional information, please contact your local
Sales Representative.