MPF4392, MPF4393

JFET Switching Transistors

N−Channel − Depletion

ON Semiconductor®

Features

- Pb−Free Packages are Available*

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain−Source Voltage	V_{DS}	30	Vdc
Drain−Gate Voltag	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

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.
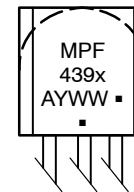
2 SOURCE

3 GATE

1 DRAIN
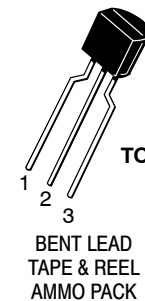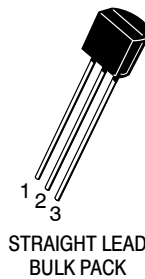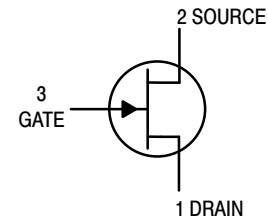
TO−92 (TO−226AA)
CASE 29−11
STYLE 5

STRAIGHT LEAD
BULK PACK

BENT LEAD
TAPE & REEL
AMMO PACK

MARKING DIAGRAM

MPF
439x
AYWW ▪

MPF439x = Device Code
x = 2 or 3
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping[†]
MPF4392	TO−92	1000 Units / Bulk
MPF4392G	TO−92 (Pb−Free)	1000 Units / Bulk
MPF4393	TO−92	1000 Units / Bulk
MPF4393G	TO−92 (Pb−Free)	1000 Units / Bulk
MPF4393RLRP	TO−92	1000 / Ammo Box
MPF4393RLRPG	TO−92 (Pb−Free)	1000 / Ammo Box

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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 1.0	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 (Note 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
Drain–Source "ON" Resistance (V_{GS} = 0, I_D = 0, f = 1.0 kHz)	MPF4392 MPF4393	$r_{ds(on)}$	– –	– –	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

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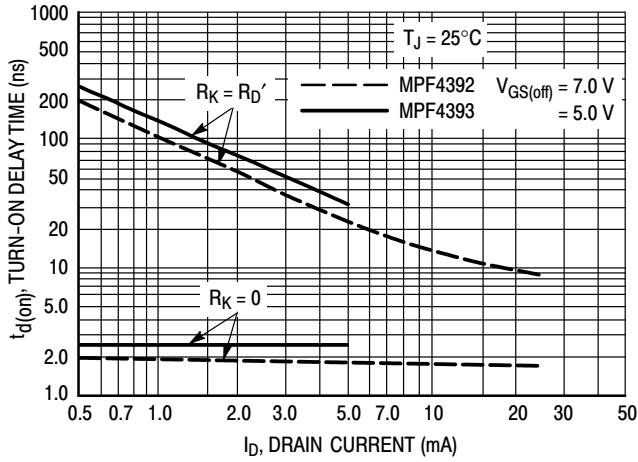
TYPICAL SWITCHING CHARACTERISTICS

Figure 1. Turn−On Delay Time

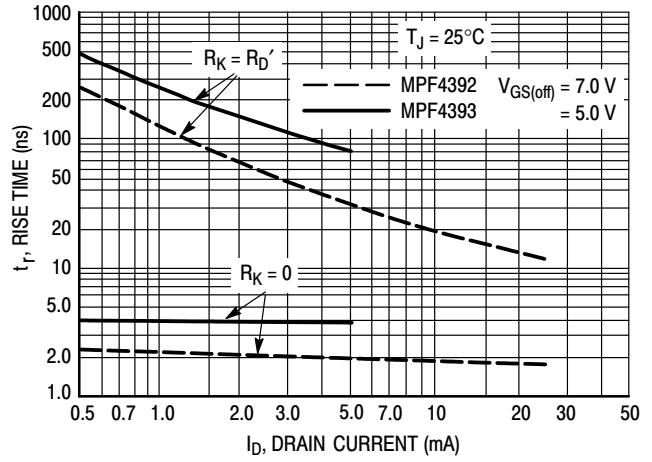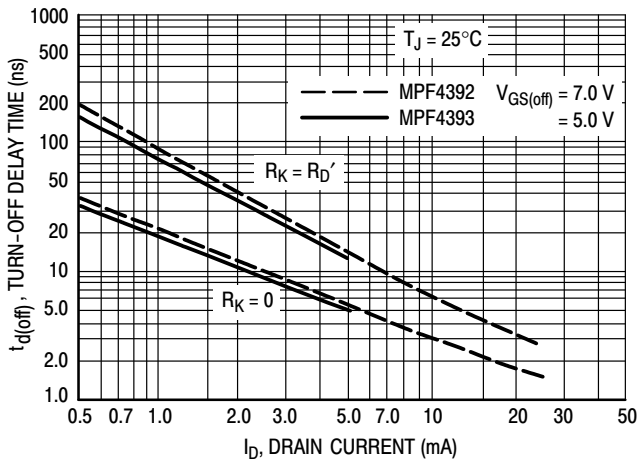**Figure 2. Rise Time**

Figure 3. Turn−Off Delay Time

Figure 4. Fall Time

SET $V_{DS(off)} = 10$ V

INPUT PULSE
$t_r \leq 0.25$ ns
$t_f \leq 0.5$ ns
PULSE WIDTH = 2.0 μs
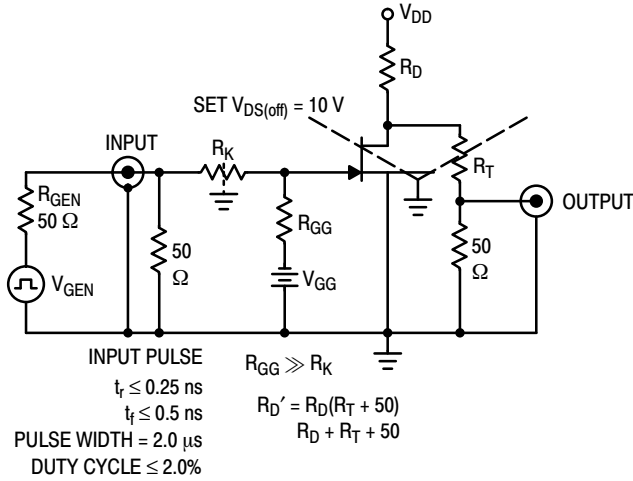DUTY CYCLE $\leq$ 2.0%

$R_{GG} \gg R_K$

$R_D' = \dfrac{R_D(R_T + 50)}{R_D + R_T + 50}$
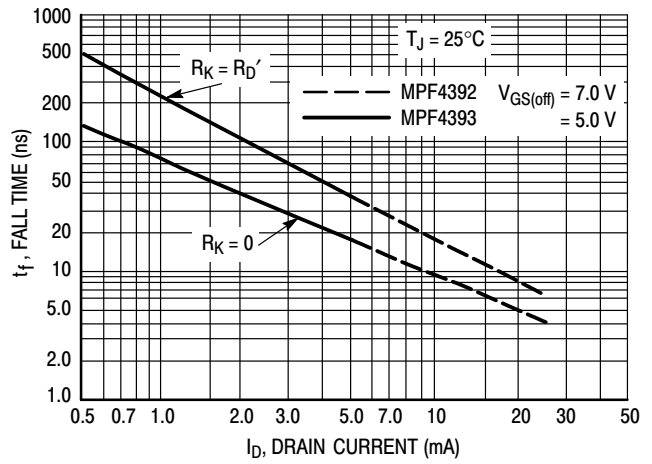
Figure 5. Switching Time Test Circuit

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.
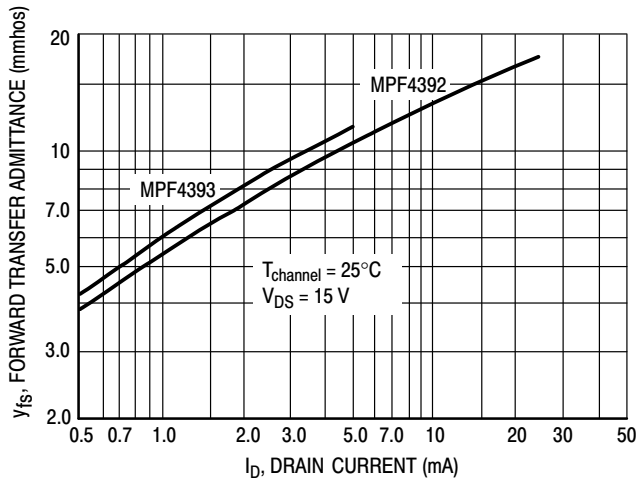

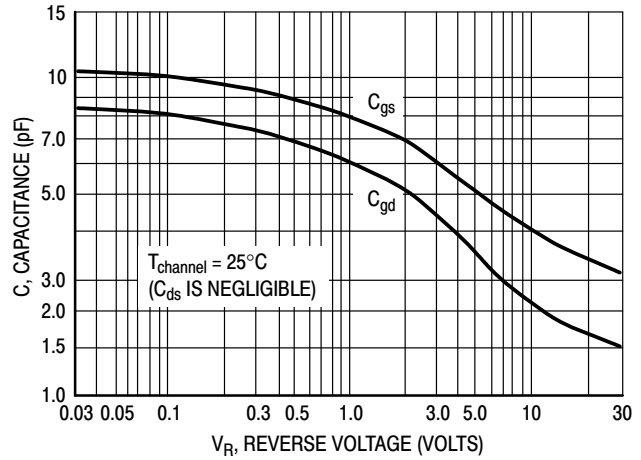**Figure 6. Typical Forward Transfer Admittance**
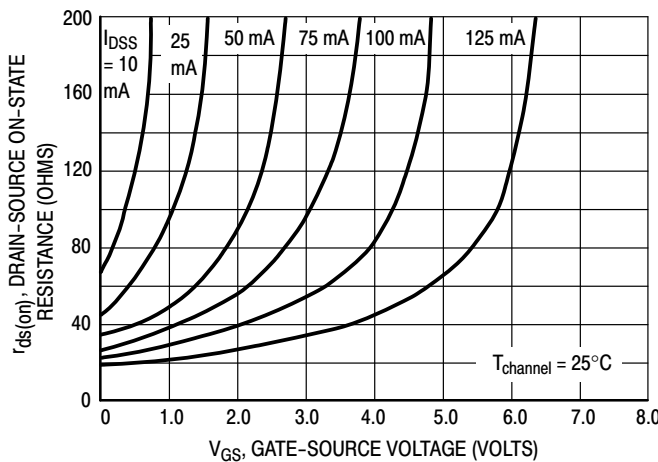

Figure 7. Typical Capacitance

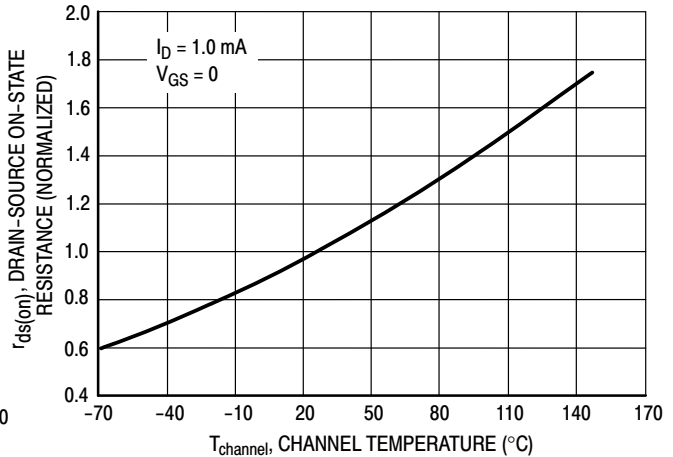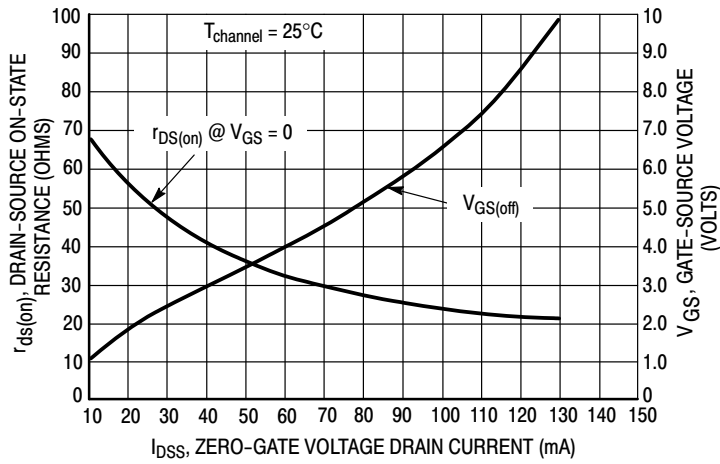**Figure 8. Effect of Gate–Source Voltage On Drain–Source Resistance**

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 Ω for I_{DSS} = 25 mA and 30 Ω for I_{DSS} 75 mA. The corresponding V_{GS} values are 2.2 V and 4.8 V.

PACKAGE DIMENSIONS

TO–92 (TO–226)
CASE 29–11
ISSUE AM
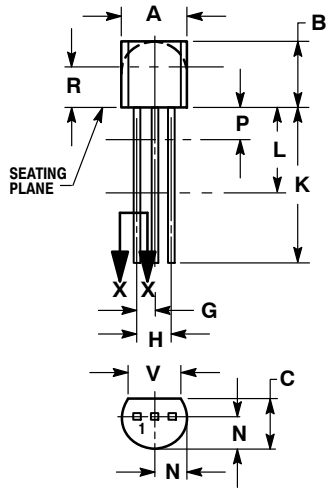
STRAIGHT LEAD
BULK PACK
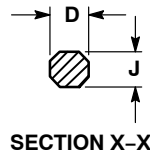
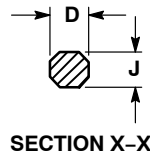**SECTION X–X**

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.

DIM	INCHES		MILLIMETERS	
	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

BENT LEAD
TAPE & REEL
AMMO PACK

SECTION X–X

NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. CONTOUR OF PACKAGE BEYOND DIMENSION R IS UNCONTROLLED.
4. LEAD DIMENSION IS UNCONTROLLED IN P AND BEYOND DIMENSION K MINIMUM.

DIM	MILLIMETERS	
	MIN	MAX
A	4.45	5.20
B	4.32	5.33
C	3.18	4.19
D	0.40	0.54
G	2.40	2.80
J	0.39	0.50
K	12.70	---
N	2.04	2.66
P	1.50	4.00
R	2.93	---
V	3.43	---

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