MMBF4391LT1, MMBF4392LT1, MMBF4393LT1

JFET Switching Transistors

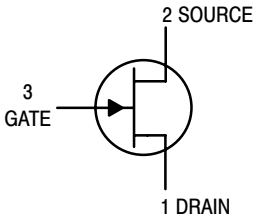
N−Channel

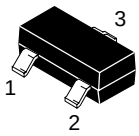
ON Semiconductor®

http://onsemi.com

Features

- Pb−Free Packages are Available





SOT−23
CASE 318
STYLE 10

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

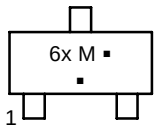
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation FR−5 Board (Note 1) T_A = 25°C Derate above 25°C	P_D	225 1.8	mW mW/°C
Thermal Resistance, Junction−to−Ambient	$R_{\theta JA}$	556	°C/W
Junction and Storage Temperature Range	T_J, T_{stg}	−55 to +150	°C

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. FR−5 = 1.0 × 0.75 × 0.062 in.

MARKING DIAGRAM



6x = Specific Device Code
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 2 of this data sheet.

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

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)		$V_{(BR)GSS}$	30	−	Vdc
Gate Reverse Current		I_{GSS}			
(V_{GS} = 15 Vdc, V_{DS} = 0, T_A = 25°C)			−	1.0	nAdc
(V_{GS} = 15 Vdc, V_{DS} = 0, T_A = 100°C)			−	0.20	μAdc
Gate−Source Cutoff Voltage		$V_{GS(off)}$			Vdc
(V_{DS} = 15 Vdc, I_D = 10 nAdc)	MMBF4391LT1		−4.0	−10	
	MMBF4392LT1		−2.0	−5.0	
	MMBF4393LT1		−0.5	−3.0	
Off−State Drain Current		$I_{D(off)}$			
(V_{DS} = 15 Vdc, V_{GS} = −12 Vdc)			−	1.0	nAdc
(V_{DS} = 15 Vdc, V_{GS} = −12 Vdc, T_A = 100°C)			−	1.0	μAdc
ON CHARACTERISTICS					
Zero−Gate−Voltage Drain Current		I_{DSS}			mAdc
(V_{DS} = 15 Vdc, V_{GS} = 0)	MMBF4391LT1		50	150	
	MMBF4392LT1		25	75	
	MMBF4393LT1		5.0	30	
Drain−Source On−Voltage		$V_{DS(on)}$			Vdc
(I_D = 12 mAdc, V_{GS} = 0)	MMBF4391LT1		−	0.4	
(I_D = 6.0 mAdc, V_{GS} = 0)	MMBF4392LT1		−	0.4	
(I_D = 3.0 mAdc, V_{GS} = 0)	MMBF4393LT1		−	0.4	
Static Drain−Source On−Resistance		$r_{DS(on)}$			Ω
(I_D = 1.0 mAdc, V_{GS} = 0)	MMBF4391LT1		−	30	
	MMBF4392LT1		−	60	
	MMBF4393LT1		−	100	
SMALL−SIGNAL CHARACTERISTICS					
Input Capacitance (V_{DS} = 15 Vdc, V_{GS} = 0, f = 1.0 MHz)		C_{iss}	−	14	pF
Reverse Transfer Capacitance (V_{DS} = 0, V_{GS} = 12 Vdc, f = 1.0 MHz)		C_{rss}	−	3.5	pF

ORDERING INFORMATION

Device	Marking	Package	Shipping†
MMBF4391LT1	6J	SOT−23	3000 / Tape & Reel
MMBF4391LT1G	6J	SOT−23 (Pb−Free)	
MMBF4392LT1	6K	SOT−23	
MMBF4392LT1G	6K	SOT−23 (Pb−Free)	
MMBF4393LT1	6G	SOT−23	
MMBF4393LT1G	6G	SOT−23 (Pb−Free)	

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

TYPICAL CHARACTERISTICS

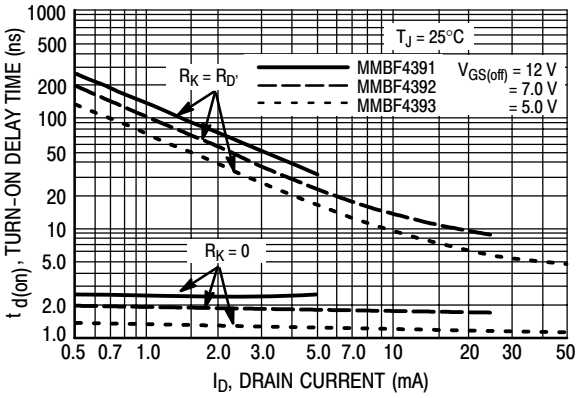


Figure 1. Turn−On Delay Time

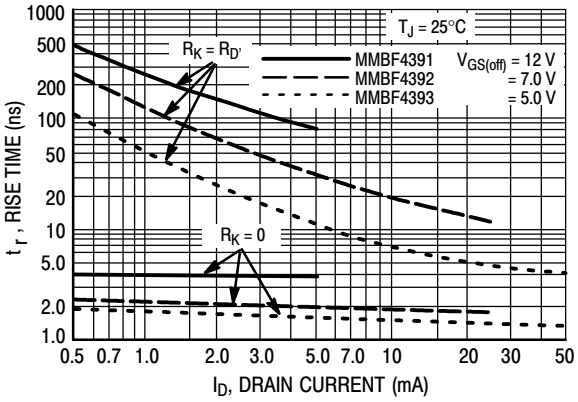


Figure 2. Rise Time

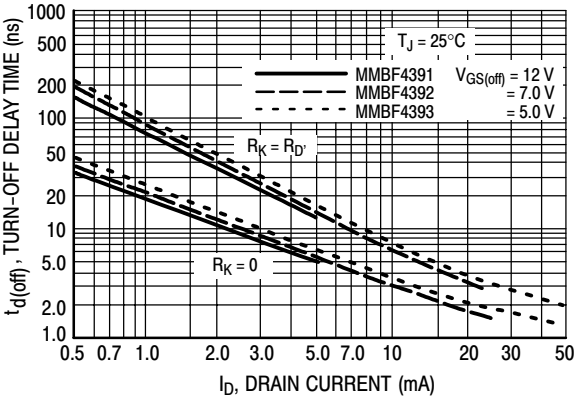


Figure 3. Turn−Off Delay Time

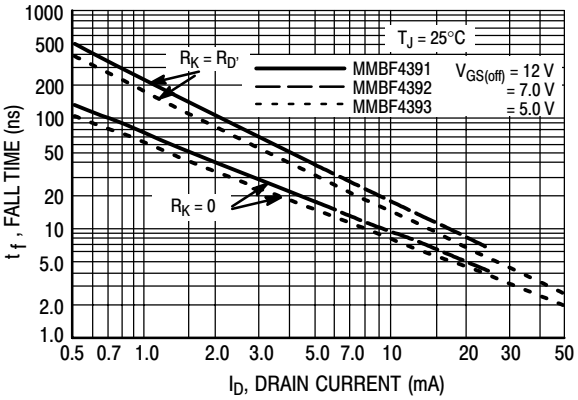


Figure 4. Fall Time

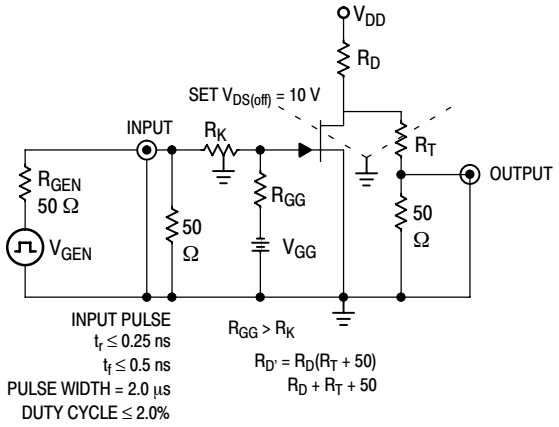


Figure 5. Switching Time Test Circuit

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}) of 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.

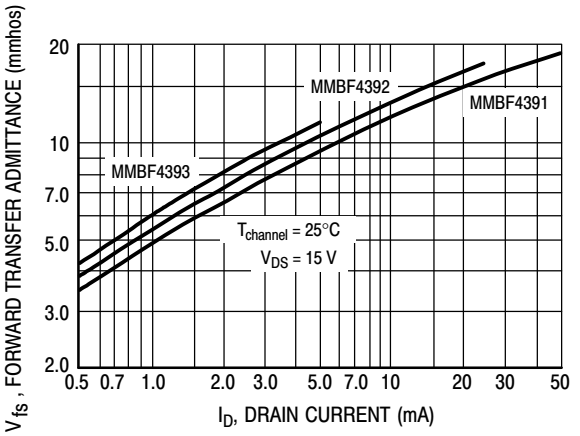


Figure 6. Typical Forward Transfer Admittance

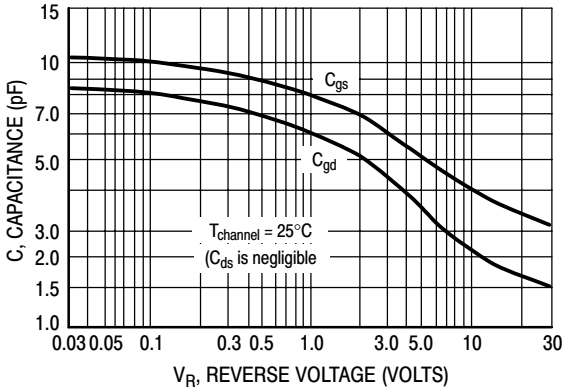


Figure 7. Typical Capacitance

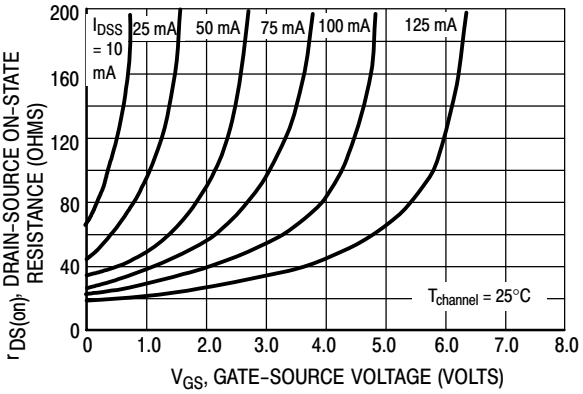


Figure 8. Effect of Gate−Source Voltage on Drain−Source Resistance

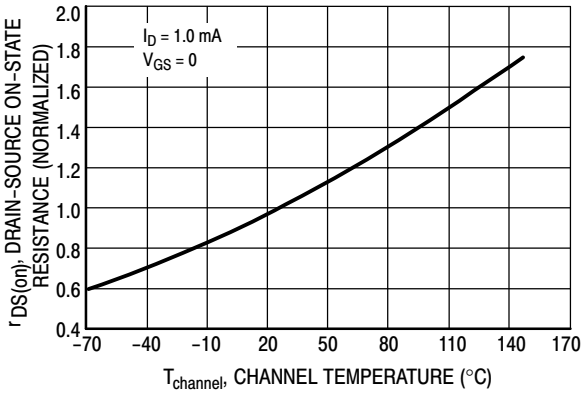


Figure 9. Effect of Temperature on Drain−Source On−State Resistance

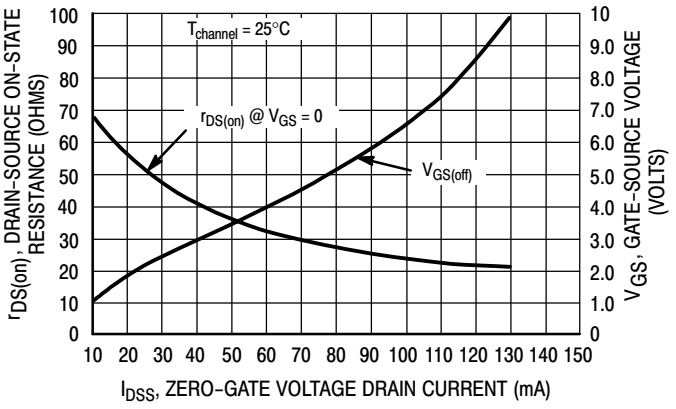


Figure 10. Effect of I_{DSS} on Drain−Source Resistance and Gate−Source Voltage

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:

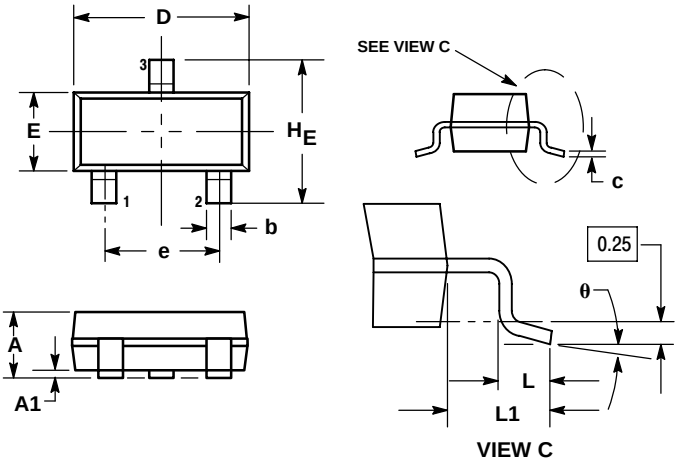
Unknown

$r_{DS(on)}$ and V_{GS} range for an MMBF4392

The electrical characteristics table indicates that an MMBF4392 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

SOT−23 (TO−236)
CASE 318−08
ISSUE AN

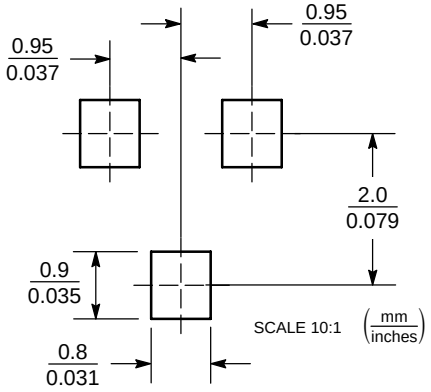


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318−01 THRU −07 AND −09 OBSOLETE, NEW STANDARD 318−08.

	MILLIMETERS			INCHES		
DIM	MIN	NOM	MAX	MIN	NOM	MAX
A	0.89	1.00	1.11	0.035	0.040	0.044
A1	0.01	0.06	0.10	0.001	0.002	0.004
b	0.37	0.44	0.50	0.015	0.018	0.020
c	0.09	0.13	0.18	0.003	0.005	0.007
D	2.80	2.90	3.04	0.110	0.114	0.120
E	1.20	1.30	1.40	0.047	0.051	0.055
e	1.78	1.90	2.04	0.070	0.075	0.081
L	0.10	0.20	0.30	0.004	0.008	0.012
L1	0.35	0.54	0.69	0.014	0.021	0.029
H_E	2.10	2.40	2.64	0.083	0.094	0.104

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

SOLDERING FOOTPRINT*



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

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
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Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
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Japan: ON Semiconductor, Japan Customer Focus Center
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Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

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