

MMBF4391LT1G, MMBF4392LT1G, MMBF4393LT1G

JFET Switching Transistors N-Channel

Features

- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

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) $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D | 225 1.8 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 556 | $^\circ\text{C}/\text{W}$ |
| Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

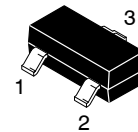
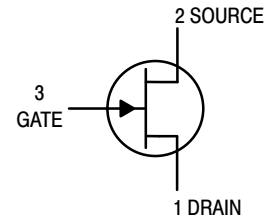
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

1. FR-5 = $1.0 \times 0.75 \times 0.062$ in.



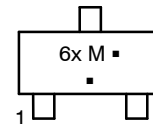
ON Semiconductor®

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SOT-23
CASE 318
STYLE 10

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.

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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 (V _{GS} = 15 Vdc, V _{DS} = 0, T _A = 25°C) (V _{GS} = 15 Vdc, V _{DS} = 0, T _A = 100°C) | I _{GSS} | – – | 1.0 0.20 | nAdc μAdc |
| Gate–Source Cutoff Voltage (V _{DS} = 15 Vdc, I _D = 10 nAdc) | V _{GS(off)} | –4.0 –2.0 –0.5 | –10 –5.0 –3.0 | Vdc |
| Off–State Drain 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 |
| ON CHARACTERISTICS | | | | |
| Zero–Gate–Voltage Drain Current (V _{DS} = 15 Vdc, V _{GS} = 0) | I _{DSS} | 50 25 5.0 | 150 75 30 | mAdc |
| Drain–Source On–Voltage (I _D = 12 mAdc, V _{GS} = 0) (I _D = 6.0 mAdc, V _{GS} = 0) (I _D = 3.0 mAdc, V _{GS} = 0) | V _{DS(on)} | – – – | 0.4 0.4 0.4 | Vdc |
| Static Drain–Source On–Resistance (I _D = 1.0 mAdc, V _{GS} = 0) | r _{DS(on)} | – – – | 30 60 100 | Ω |
| SMALL–SIGNAL CHARACTERISTICS | | | | |
| Input Capacitance (V _{DS} = 0 Vdc, V _{GS} = –15 Vdc, f = 1.0 MHz) | C _{iss} | – | 14 | pF |
| Reverse Transfer Capacitance (V _{DS} = 0 Vdc, V _{GS} = –12 Vdc, f = 1.0 MHz) | C _{rss} | – | 3.5 | pF |

ORDERING INFORMATION

| Device | Marking | Package | Shipping [†] |
|--------------|---------|---------------------|-----------------------|
| MMBF4391LT1G | 6J | SOT–23 (Pb–Free) | 3000 / Tape & Reel |
| MMBF4392LT1G | 6K | SOT–23 (Pb–Free) | |
| 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.

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TYPICAL CHARACTERISTICS

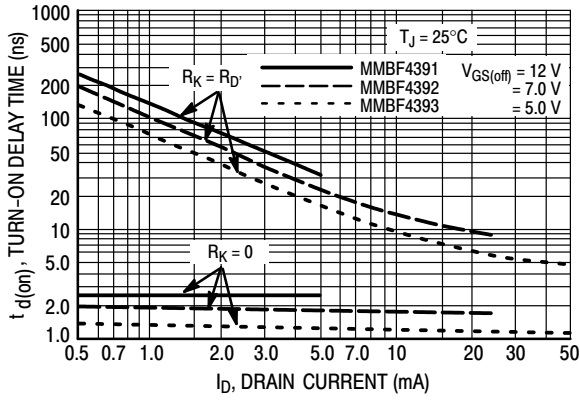


Figure 1. Turn-On Delay Time

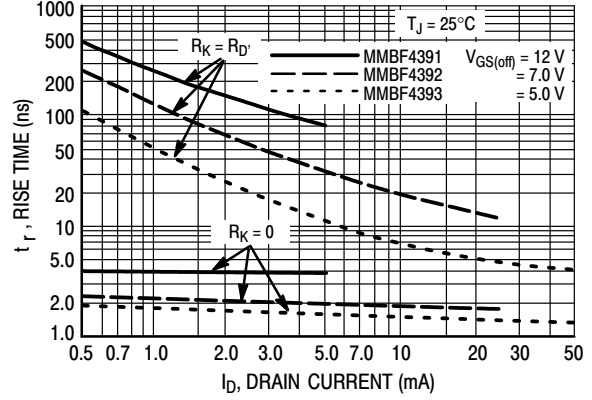


Figure 2. Rise Time

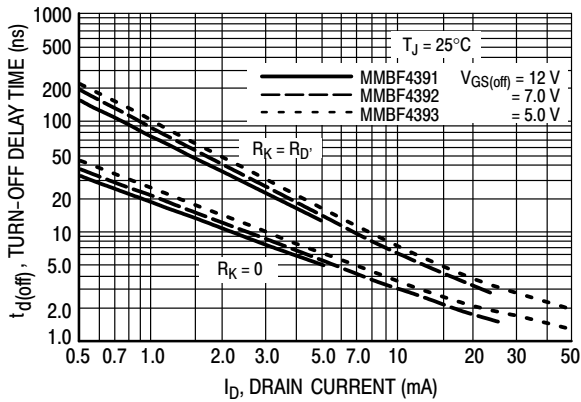


Figure 3. Turn-Off Delay Time

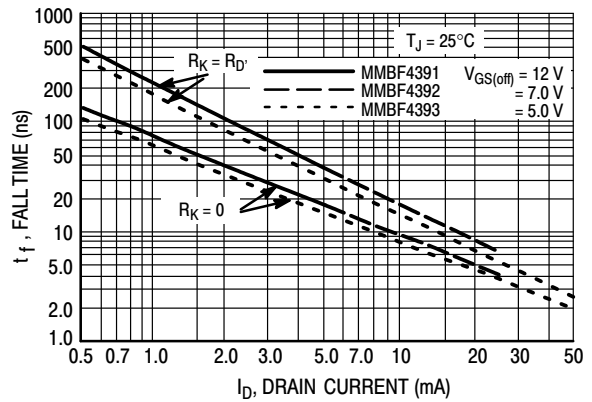


Figure 4. Fall Time

NOTE 1

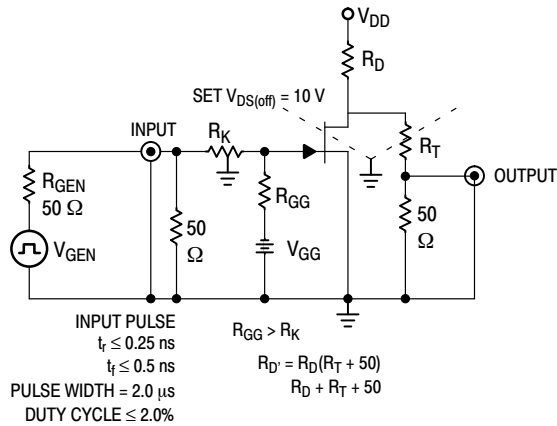


Figure 5. Switching Time Test Circuit

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.

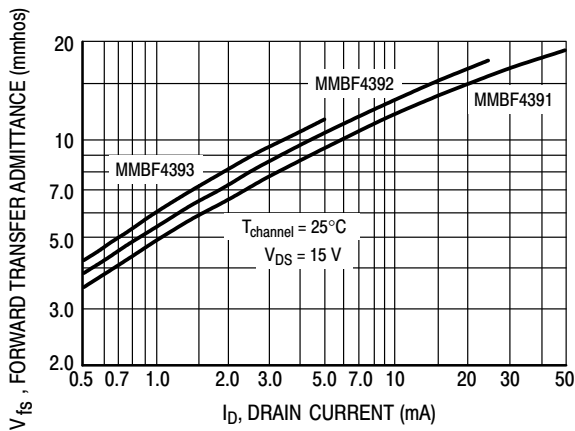


Figure 6. Typical Forward Transfer Admittance

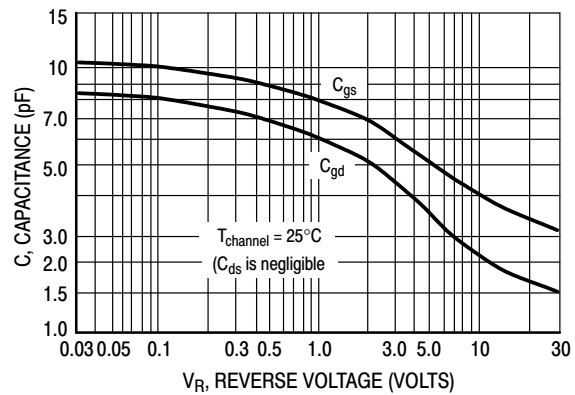


Figure 7. Typical Capacitance

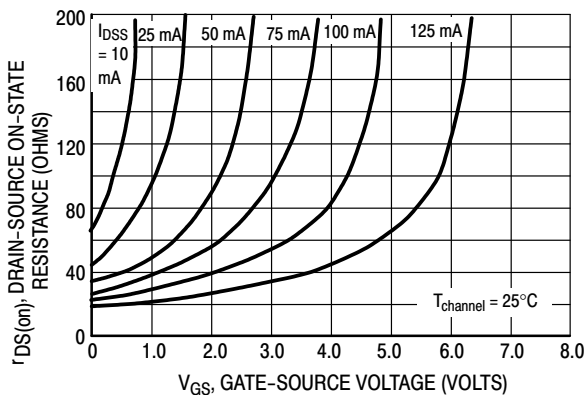


Figure 8. Effect of Gate-Source Voltage on Drain-Source Resistance

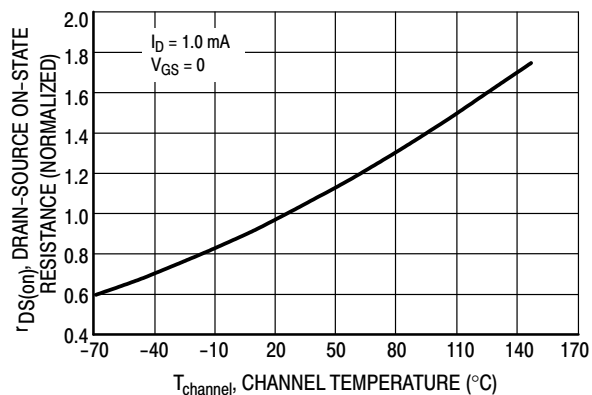


Figure 9. Effect of Temperature on Drain-Source On-State Resistance

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 MMBF4392

The electrical characteristics table indicates that an MMBF4392 has an I_{DSS} range of 25 to 75 mA. Figure 10 shows $r_{DS(on)} = 52 \Omega$ for $I_{DSS} = 25$ mA and 30Ω for $I_{DSS} = 75$ mA. The corresponding V_{GS} values are 2.2 V and 4.8 V.

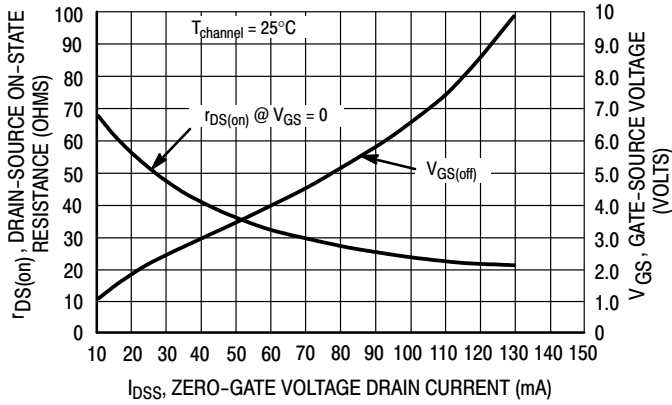
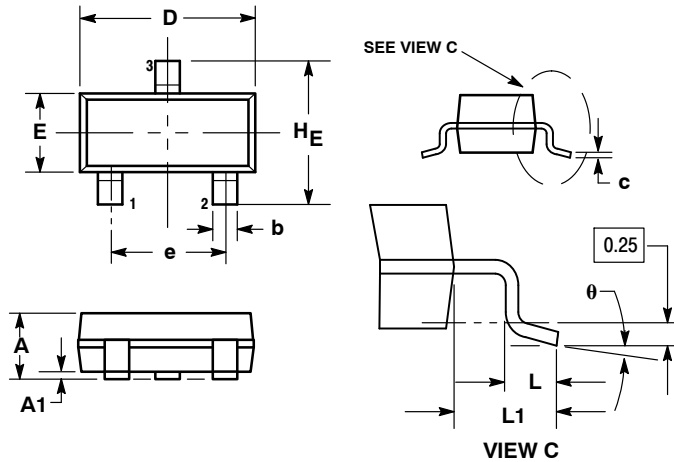


Figure 10. Effect of I_{DSS} on Drain-Source Resistance and Gate-Source Voltage

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PACKAGE DIMENSIONS SOT-23 (TO-236) CASE 318-08 ISSUE AN

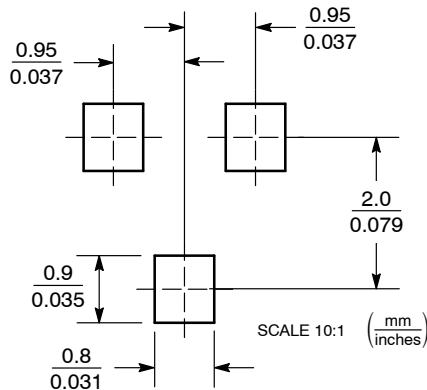


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.
 3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
 4. 318-01 THRU -07 AND -09 OBSOLETE, NEW STANDARD 318-08.

| DIM | MILLIMETERS | | | INCHES | | |
|-----|-------------|------|------|--------|-------|-------|
| | 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 |
| HE | 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.

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