



## N-Channel JFETs

|               |               |                |
|---------------|---------------|----------------|
| <b>2N4391</b> | <b>PN4391</b> | <b>SST4391</b> |
| <b>2N4392</b> | <b>PN4392</b> | <b>SST4392</b> |
| <b>2N4393</b> | <b>PN4393</b> | <b>SST4393</b> |

| PRODUCT SUMMARY |                          |                             |                              |                          |
|-----------------|--------------------------|-----------------------------|------------------------------|--------------------------|
| Part Number     | V <sub>GS(off)</sub> (V) | r <sub>DS(on)</sub> Max (Ω) | I <sub>D(off)</sub> Typ (pA) | t <sub>ON</sub> Typ (ns) |
| 2N/PN/SST4391   | -4 to -10                | 30                          | 5                            | 4                        |
| 2N/PN/SST4392   | -2 to -5                 | 60                          | 5                            | 4                        |
| 2N/PN/SST4393   | -0.5 to -3               | 100                         | 5                            | 4                        |

### FEATURES

- Low On-Resistance: 4391 < 30 Ω
- Fast Switching—t<sub>ON</sub>: 4 ns
- High Off-Isolation: I<sub>D(off)</sub> with Low Leakage
- Low Capacitance: < 3.5 pF
- Low Insertion Loss

### BENEFITS

- Low Error Voltage
- High-Speed Analog Circuit Performance
- Negligible “Off-Error,” Excellent Accuracy
- Good Frequency Response, Low Glitches
- Eliminates Additional Buffering

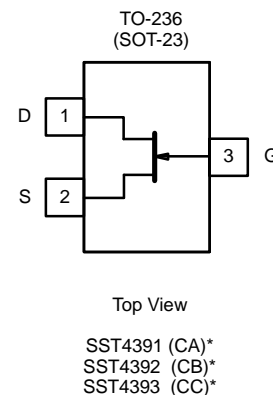
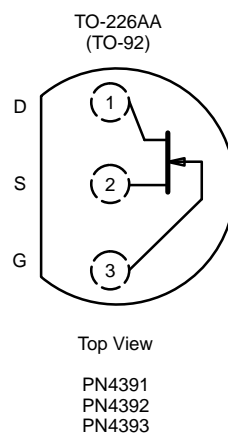
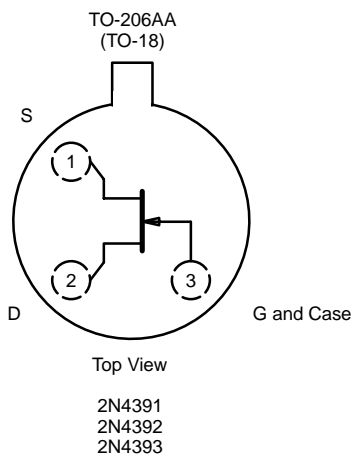
### APPLICATIONS

- Analog Switches
- Choppers
- Sample-and-Hold
- Normally “On” Switches
- Current Limiters
- Commutators

### DESCRIPTION

The 2N/PN/SST4391 series features many of the superior characteristics of JFETs which make it a good choice for demanding analog switching applications and for specialized amplifier circuits.

The 2N series hermetically-sealed TO-206AA (TO-18) can be available with processing per MIL-S-19500 (see Military Information). Both the PN, TO-226AA (TO-92), and SST, TO-236 (SOT-23), series are available in tape-and-reel for automated assembly (see Packaging Information). For similar dual products, see the 2N5564/5565/5566 data sheet.



\*Marking Code for TO-236

For applications information see AN104 and AN106



### ABSOLUTE MAXIMUM RATINGS

|                                  |                                 |
|----------------------------------|---------------------------------|
| Gate-Drain, Gate-Source Voltage: |                                 |
| (2N/PN Prefixes)                 | −40 V                           |
| (SST Prefix)                     | −35 V                           |
| Gate Current                     | 50 mA                           |
| Lead Temperature                 | 300 °C                          |
| Storage Temperature :            | (2N Prefix) −65 to 200 °C       |
|                                  | (PN/SST Prefixes) −55 to 150 °C |

|                                  |   |
|----------------------------------|---|
| Operating Junction Temperature : |   |
| (2N Prefix)                      | −55 to 200 °C   |
| (PN/SST Prefixes)                | −55 to 150 °C   |
| Power Dissipation :              | (2N Prefix) <sup>a</sup> (T <sub>C</sub> = 25 °C) 1800 mW |
|                                  | (PN/SST Prefixes) <sup>b</sup> 350 mW                     |

- Notes
- Derate 10 mW/°C above 25 °C
  - Derate 2.8 mW/°C above 25 °C

| SPECIFICATIONS (T <sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED) |                              |   |                              |        |       |      |       |      |       |      |    |
|--|------------------------------|---|------------------------------|--------|-------|------|-------|------|-------|------|----|
| Parameter  | Symbol                       | Test Conditions                                     | Typ <sup>a</sup>             | Limits |       |      |       |      |       | Unit |    |
|  |                              |   |                              | 4391   |       | 4392 |       | 4393 |       |      |    |
|  |                              |   |                              | Min    | Max   | Min  | Max   | Min  | Max   |      |    |
| <b>Static</b>  |                              |   |                              |        |       |      |       |      |       |      |    |
| Gate-Source Breakdown Voltage                                  | V <sub>(BR)GSS</sub>         | I <sub>G</sub> = −1 μA, V <sub>DS</sub> = 0 V       | −55                          | −40    |       | −40  |       | −40  |       | V    |    |
| Gate-Source Cutoff Voltage                                     | V <sub>GS(off)</sub>         | V <sub>DS</sub> = 20 V                              | 2N/PN: I <sub>D</sub> = 1 nA | −4     | −10   | −2   | −5    | −0.5 | −3    | V    |    |
|  |                              | V <sub>DS</sub> = 15 V                              | SST: I <sub>D</sub> = 10 nA  |        |       |      |       |      |       |      |    |
| Saturation Drain Current <sup>b</sup>                          | I <sub>DSS</sub>             | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V       | 2N                           | 50     | 150   | 25   | 75    | 5    | 30    | mA   |    |
|  |                              |   | PN                           | 50     | 150   | 25   | 100   | 5    | 60    |      |    |
|  |                              |   | SST                          | 50     |       | 25   |       | 5    |       |      |    |
| Gate Reverse Current   | I <sub>GSS</sub>             | V <sub>GS</sub> = −20 V<br>V <sub>DS</sub> = 0 V    | 2N/SST                       | −5     | −100  |      | −100  |      | −100  | pA   |    |
|  |                              |   | PN                           | −5     | −1000 |      | −1000 |      | −1000 |      |    |
|  |                              |   | 2N: T <sub>A</sub> = 150 °C  | −13    | −200  |      | −200  |      | −200  | nA   |    |
|  |                              |   | PN: T <sub>A</sub> = 100 °C  | −1     | −200  |      | −200  |      | −200  |      |    |
| SST: T <sub>A</sub> = 125 °C                                   | −3                           |   |                              |        |       |      |       |      |       |      |    |
| Gate Operating Current   | I <sub>G</sub>               | V <sub>DG</sub> = 15 V, I <sub>D</sub> = 10 mA      | −5                           |        |       |      |       |      |       |      |    |
| Drain Cutoff Current   | I <sub>D(off)</sub>          | V <sub>DS</sub> = 20 V                              | 2N: V <sub>GS</sub> = −5 V   | 5      |       |      |       |      | 100   | pA   |    |
|  |                              |   | 2N: V <sub>GS</sub> = −7 V   | 5      |       |      | 100   |      |       |      |    |
|  |                              |   | 2N: V <sub>GS</sub> = −12 V  | 5      |       | 100  |       |      |       |      |    |
|  |                              |   | PN: V <sub>GS</sub> = −5 V   | 0.005  |       |      |       |      | 1     | nA   |    |
|  |                              |   | PN: V <sub>GS</sub> = −7 V   | 0.005  |       |      |       | 1    |       |      |    |
|  |                              |   | PN: V <sub>GS</sub> = −12 V  | 0.005  |       | 1    |       |      |       |      |    |
|  |                              | SST V <sub>DS</sub> = 10 V, V <sub>GS</sub> = −10 V | 5                            |        | 100   |      | 100   |      | 100   | pA   |    |
|  |                              | V <sub>DS</sub> = 20 V<br>T <sub>A</sub> = 150 °C   | 2N: V <sub>GS</sub> = −5 V   | 13     |       |      |       |      |       | 200  | nA |
|  |                              |   | 2N: V <sub>GS</sub> = −7 V   | 13     |       |      |       | 200  |       |      |    |
|  |                              |   | 2N: V <sub>GS</sub> = −12 V  | 13     |       | 200  |       |      |       |      |    |
| V <sub>DS</sub> = 20 V<br>T <sub>A</sub> = 100 °C              | PN: V <sub>GS</sub> = −5 V   | 1   |                              |        |       |      |       | 200  |       |      |    |
|  | PN: V <sub>GS</sub> = −7 V   | 1   |                              |        |       | 200  |       |      |       |      |    |
|  | PN: V <sub>GS</sub> = −12 V  | 1   |                              | 200    |       |      |       |      |       |      |    |
| V <sub>DS</sub> = 10 V<br>T <sub>A</sub> = 125 °C              | SST: V <sub>GS</sub> = −10 V | 3   |                              |        |       |      |       |      |       |      |    |
| Drain-Source On-Voltage  | V <sub>DS(on)</sub>          | V <sub>GS</sub> = 0 V                               | I <sub>D</sub> = 3 mA        | 0.25   |       |      |       |      | 0.4   | V    |    |
|  |                              |   | I <sub>D</sub> = 6 mA        | 0.3    |       |      |       | 0.4  |       |      |    |
|  |                              |   | I <sub>D</sub> = 12 mA       | 0.35   |       | 0.4  |       |      |       |      |    |
| Drain-Source On-Resistance                                     | r <sub>DS(on)</sub>          | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA        |                              |        | 30    |      | 60    |      | 100   | Ω    |    |
| Gate-Source Forward Voltage                                    | V <sub>GS(F)</sub>           | I <sub>G</sub> = 1 mA<br>V <sub>DS</sub> = 0 V      | 2N                           | 0.7    |       | 1    |       | 1    |       | 1    | V  |
|  |                              |   | PN/SST                       | 0.7    |       |      |       |      |       |      |    |



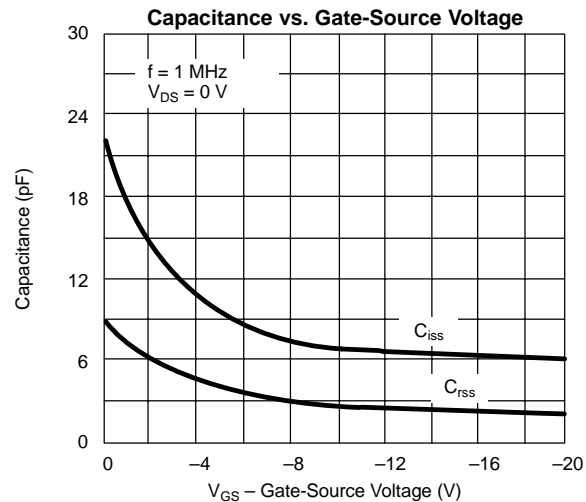
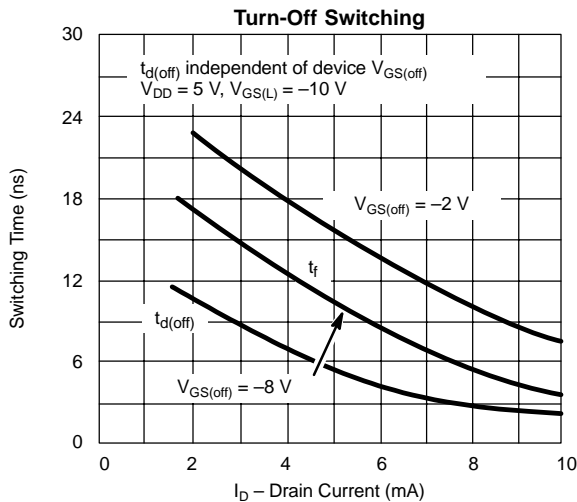
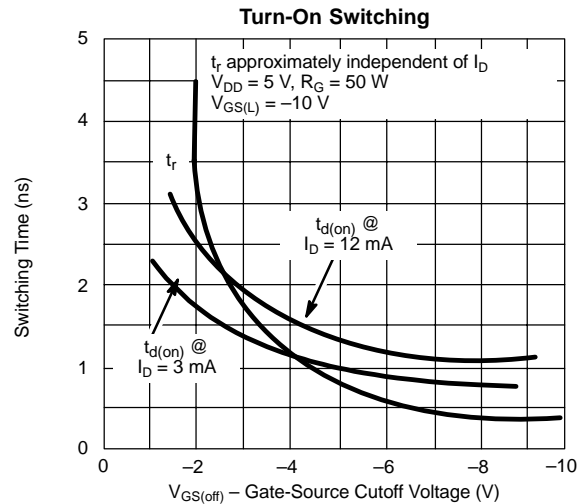
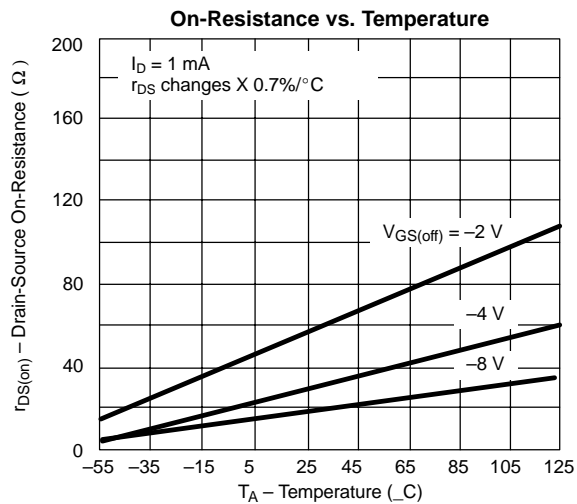
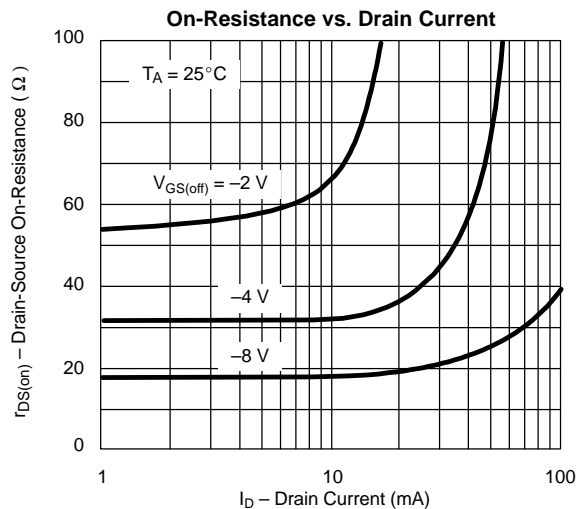
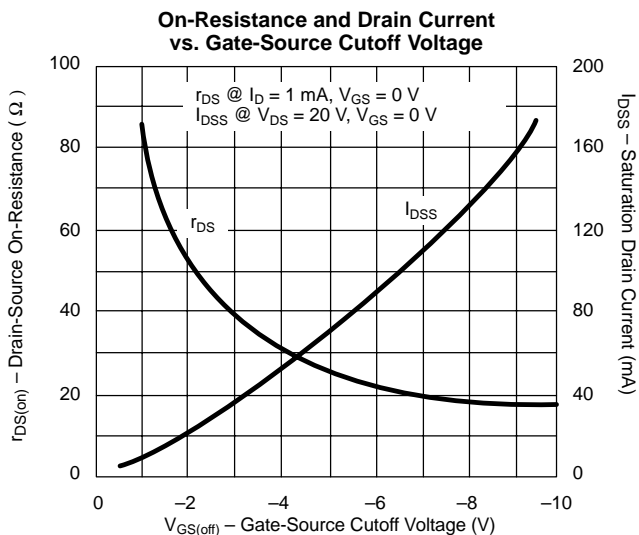
| SPECIFICATIONS (T <sub>A</sub> = 25 °C UNLESS OTHERWISE NOTED) |                     |   |                             |        |     |      |     |      |     |            |    |
|--|---------------------|---|-----------------------------|--------|-----|------|-----|------|-----|------------|----|
| Parameter  | Symbol              | Test Conditions   | Typ <sup>a</sup>            | Limits |     |      |     |      |     | Unit       |    |
|  |                     |   |                             | 4391   |     | 4392 |     | 4393 |     |            |    |
|  |                     |   |                             | Min    | Max | Min  | Max | Min  | Max |            |    |
| <b>Dynamic</b>   |                     |   |                             |        |     |      |     |      |     |            |    |
| Common-Source Forward Transconductance                         | g <sub>fs</sub>     | V <sub>DS</sub> = 20 V, I <sub>D</sub> = 1 mA, f = 1 kHz                    | 6                           |        |     |      |     |      |     | mS         |    |
| Common-Source Output Conductance                               | g <sub>os</sub>     |   | 25                          |        |     |      |     |      |     | μS         |    |
| Drain-Source On-Resistance                                     | r <sub>DS(on)</sub> | V <sub>GS</sub> = 0 V, I <sub>D</sub> = 0 mA, f = 1 kHz                     |                             |        | 30  |      | 60  |      | 100 | Ω          |    |
| Common-Source Input Capacitance                                | C <sub>iss</sub>    | V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V<br>f = 1 MHz                  | 2N                          | 12     |     | 14   |     | 14   |     | 14         |    |
|  |                     |   | PN                          | 12     |     | 16   |     | 16   |     | 16         |    |
|  |                     |   | SST                         | 13     |     |      |     |      |     |            |    |
| Common-Source Reverse Transfer Capacitance                     | C <sub>rss</sub>    | V <sub>DS</sub> = 0 V<br>f = 1 MHz  | 2N: V <sub>GS</sub> = -5 V  | 3.3    |     |      |     |      |     | 3.5        | pF |
|  |                     |   | 2N: V <sub>GS</sub> = -7 V  | 3.2    |     |      |     | 3.5  |     |            |    |
|  |                     |   | 2N: V <sub>GS</sub> = -12 V | 2.8    |     | 3.5  |     |      |     |            |    |
|  |                     |   | PN: V <sub>GS</sub> = -5 V  | 3.5    |     |      |     |      |     | 5          |    |
|  |                     |   | PN: V <sub>GS</sub> = -7 V  | 3.4    |     |      |     | 5    |     |            |    |
|  |                     |   | PN: V <sub>GS</sub> = -12 V | 3.0    |     | 5    |     |      |     |            |    |
|  |                     |   | SST: V <sub>GS</sub> = -5 V | 3.6    |     |      |     |      |     |            |    |
|  |                     |   | SST: V <sub>GS</sub> = -7 V | 3.5    |     |      |     |      |     |            |    |
| SST: V <sub>GS</sub> = -12 V                                   | 3.1                 |   |                             |        |     |      |     |      |     |            |    |
| Equivalent Input Noise Voltage                                 | e <sub>n</sub>      | V <sub>DS</sub> = 10 V, I <sub>D</sub> = 10 mA<br>f = 1 kHz                 | 3                           |        |     |      |     |      |     | nV/<br>√Hz |    |
| <b>Switching</b>   |                     |   |                             |        |     |      |     |      |     |            |    |
| Turn-On Time   | t <sub>d(on)</sub>  | V <sub>DD</sub> = 10 V<br>V <sub>GS(H)</sub> = 0 V<br>See Switching Circuit | 2N/PN                       | 2      |     | 15   |     | 15   |     | 15         | ns |
|  | t <sub>r</sub>      |   | SST                         | 2      |     |      |     |      |     |            |    |
| Turn-Off Time  | t <sub>d(off)</sub> |   | 2N/PN                       | 2      |     | 5    |     | 5    |     | 5          |    |
|  |                     |   | SST                         | 2      |     |      |     |      |     |            |    |
|  | t <sub>f</sub>      |   | 2N/PN                       | 6      |     | 20   |     | 35   |     | 50         |    |
|  |                     |   | SST                         | 6      |     |      |     |      |     |            |    |
|  |                     | 2N/PN   | 13                          |        | 15  |      | 20  |      | 30  |            |    |
|  |                     | SST   | 13                          |        |     |      |     |      |     |            |    |

Notes

- a. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- b. Pulse test: PW ≤ 300 μs duty cycle ≤ 3%.

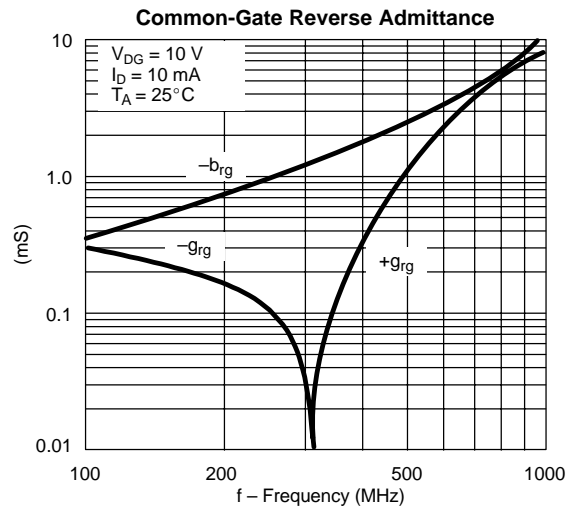
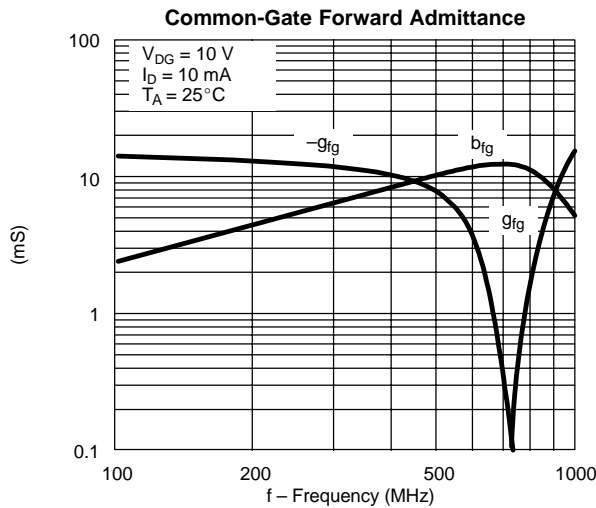
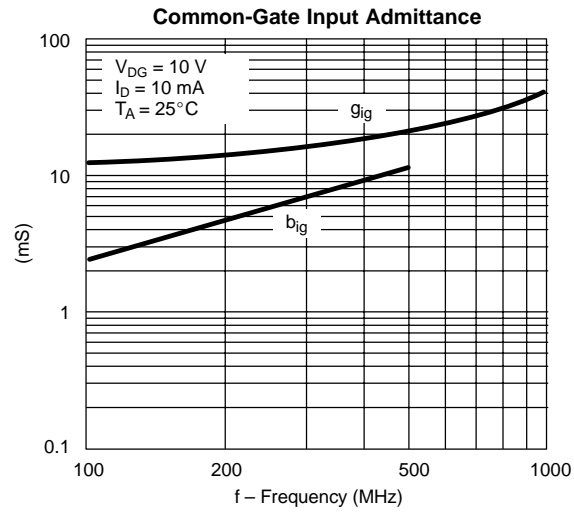
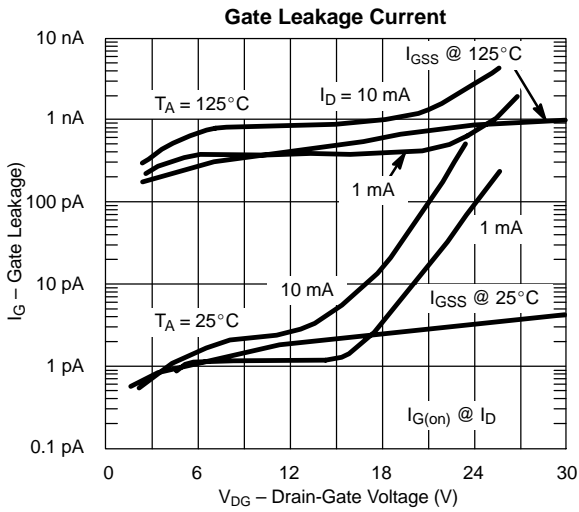
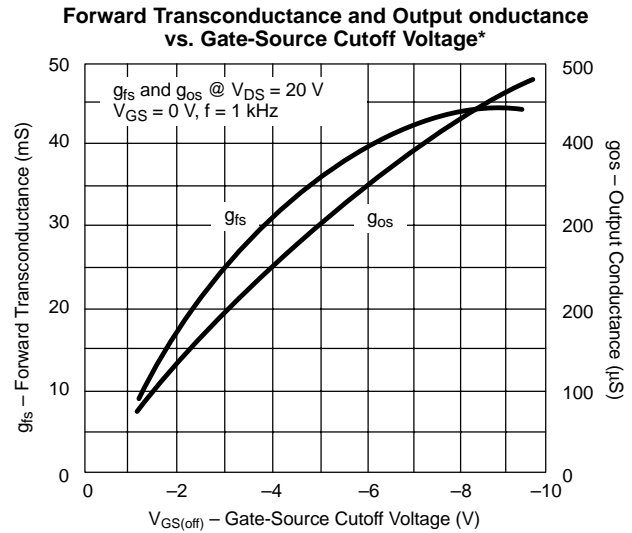
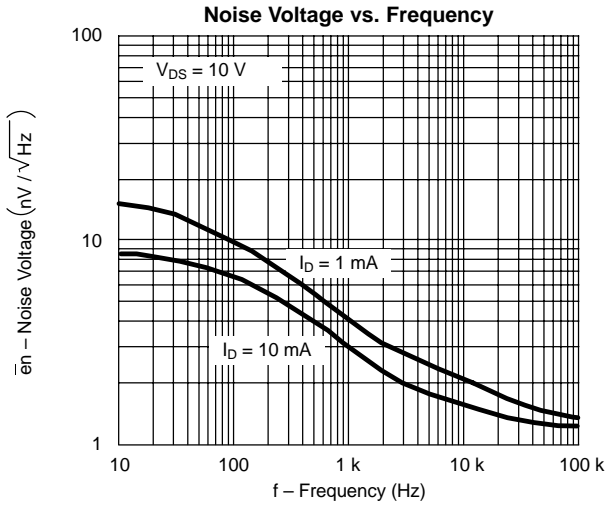
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### TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)

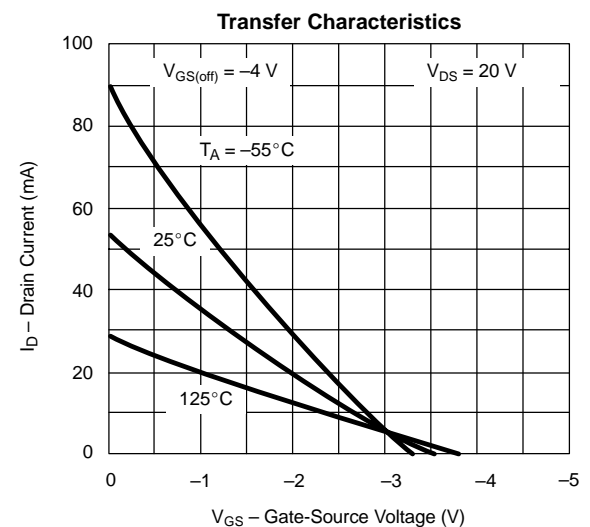
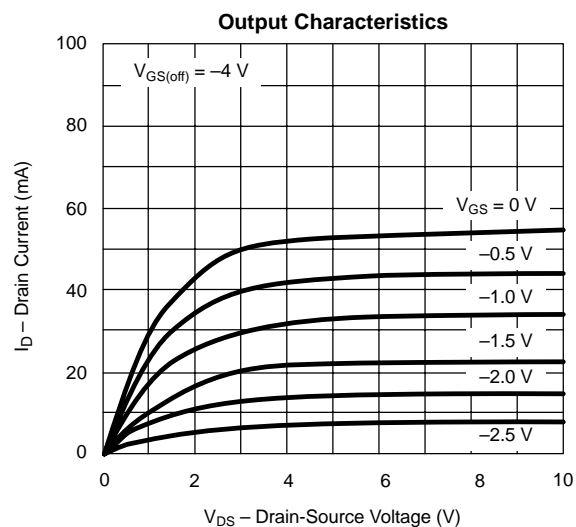
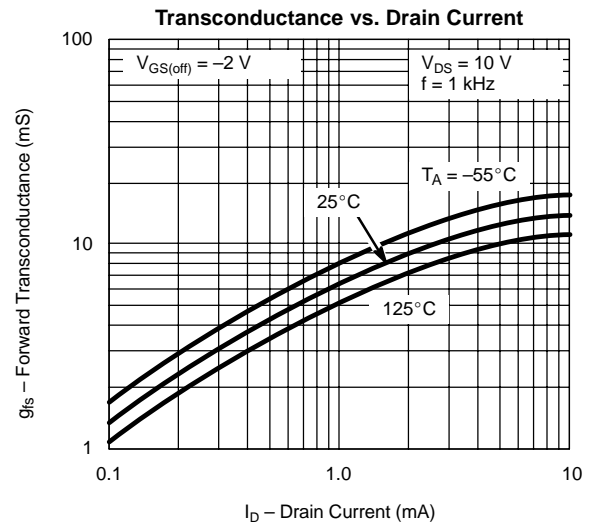
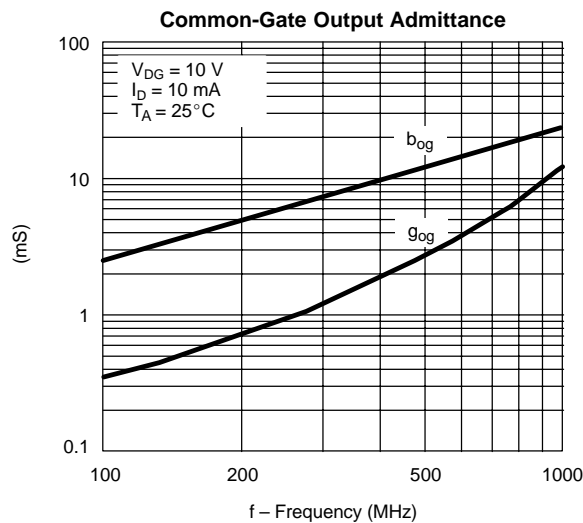




**TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$  UNLESS OTHERWISE NOTED)**



### TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE NOTED)



| SWITCHING TIME TEST CIRCUIT |              |               |               |
|-----------------------------|--------------|---------------|---------------|
|                             | 4391         | 4392          | 4393          |
| $V_{GS(L)}$                 | -12 V        | -7 V          | -5 V          |
| $R_L^*$                     | 800 $\Omega$ | 1600 $\Omega$ | 3000 $\Omega$ |
| $I_{D(on)}$                 | 12 mA        | 6 mA          | 3 mA          |

\*Non-inductive

#### INPUT PULSE

Rise Time < 1 ns  
Fall Time < 1 ns  
Pulse Width 100 ns  
PRF 1 MHz

#### SAMPLING SCOPE

Rise Time 0.4 ns  
Input Resistance 10 M $\Omega$   
Input Capacitance 1.5 pF

See Typical Characteristics curves for changes.

