

## 2N3821, 2N3822

## N-Channel Silicon Junction Field-Effect Transistor

- VHF Amplifiers
- Small Signal Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 50 V

Continuous Forward Gate Current

10 mA

Continuous Device Power Dissipation

300 mW

Power Derating

2mW/°C

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N3821 |       | 2N3822 |       | Process NJ32  |                                                        |                           |
|-----------------------------------|---------------|--------|-------|--------|-------|---------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Unit          | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 50   |       | – 50   |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 |        | – 0.1 | nA            | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |        | – 0.1 |        | – 0.1 | $\mu\text{A}$ | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 150^\circ\text{C}$ |
| Gate Source Voltage               | $V_{GS}$      | – 0.5  | – 2   |        |       | V             | $V_{DS} = 15\text{V}$ , $I_D = 50\ \mu\text{A}$        |                           |
|                                   |               |        |       | – 1    | – 4   | V             | $V_{DS} = 15\text{V}$ , $I_D = 200\ \mu\text{A}$       |                           |
|                                   |               |        |       |        |       | V             | $V_{DS} = 15\text{V}$ , $I_D = 400\ \mu\text{A}$       |                           |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ |        | – 4   |        | – 6   | V             | $V_{DS} = 15\text{V}$ , $I_D = 0.5\ \text{nA}$         |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 0.5    | 2.5   | 2      | 10    | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        |       |        |       | nA            | $V_{DS} = 15\text{V}$ , $V_{GS} = -8\text{V}$          |                           |
|                                   |               |        |       |        |       | $\mu\text{A}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = -8\text{V}$          | $T_A = 150^\circ\text{C}$ |

## Dynamic Electrical Characteristics

|                                              |              |      |      |      |      |                        |                                                                                   |                       |
|----------------------------------------------|--------------|------|------|------|------|------------------------|-----------------------------------------------------------------------------------|-----------------------|
| Drain Source ON Resistance                   | $r_{ds(on)}$ |      |      |      |      | $\Omega$               | $V_{GS} = \emptyset\text{V}$ , $I_D = \emptyset\text{V}$                          | $f = 1\ \text{kHz}$   |
| Common Source Forward Transconductance       | $g_{fs}$     | 1500 | 4500 | 3000 | 6500 | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              | $f = 1\ \text{kHz}$   |
| Common Source Forward Transmittance          | $ Y_{fs} $   | 1500 |      | 3000 |      | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              | $f = 100\ \text{MHz}$ |
| Common Source Output Conductance             | $g_{os}$     |      | 10   |      | 20   | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              | $f = 1\ \text{kHz}$   |
| Common Source Input Capacitance              | $C_{iss}$    |      | 6    |      | 6    | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              | $f = 1\ \text{MHz}$   |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$    |      | 2    |      | 2    | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              | $f = 1\ \text{MHz}$   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$  |      | 200  |      | 200  | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              | $f = 10\ \text{Hz}$   |
| Noise Figure                                 | NF           |      | 5    |      | 5    | dB                     | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$<br>$R_G = 1\ \text{M}\Omega$ | $f = 10\ \text{Hz}$   |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



InterFET Corporation

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## 2N3823, 2N3824

## N-Channel Silicon Junction Field-Effect Transistor

- VHF Amplifiers
- Small Signal Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source & Reverse Gate Drain Voltage  
 Continuous Forward Gate Current  
 Continuous Device Power Dissipation  
 Power Derating

– 50 V  
 10 mA  
 300 mW  
 2 mW/°C

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N3823 |       | 2N3824 |       | Process NJ32  |                                                                            |
|-----------------------------------|---------------|--------|-------|--------|-------|---------------|----------------------------------------------------------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Unit          | Test Conditions                                                            |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 30   |       | – 50   |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$                             |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.5 |        | – 0.1 | nA            | $V_{GS} = -30\text{V}$ , $V_{DS} = 0\text{V}$                              |
|                                   |               |        | – 0.5 |        | – 0.1 | $\mu\text{A}$ | $V_{GS} = -30\text{V}$ , $V_{DS} = 0\text{V}$<br>$T_A = 150^\circ\text{C}$ |
| Gate Source Voltage               | $V_{GS}$      | – 1    | – 7.5 |        |       | V             | $V_{DS} = 15\text{V}$ , $I_D = 400\ \mu\text{A}$                           |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ |        | – 8   |        |       | V             | $V_{DS} = 15\text{V}$ , $I_D = 0.5\ \text{nA}$                             |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 4      | 20    |        |       | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                               |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        |       |        | 0.1   | nA            | $V_{DS} = 15\text{V}$ , $V_{GS} = -8\text{V}$                              |
|                                   |               |        |       |        | 0.1   | $\mu\text{A}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = -8\text{V}$<br>$T_A = 150^\circ\text{C}$ |

## Dynamic Electrical Characteristics

|                                              |              |      |      |  |     |                        |                                                                           |                       |
|----------------------------------------------|--------------|------|------|--|-----|------------------------|---------------------------------------------------------------------------|-----------------------|
| Drain Source ON Resistance                   | $r_{ds(on)}$ |      |      |  | 250 | $\Omega$               | $V_{GS} = 0\text{V}$ , $I_D = 0\text{V}$                                  | $f = 1\ \text{kHz}$   |
| Common Source Forward Transconductance       | $g_{fs}$     | 3500 | 6500 |  |     | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              | $f = 1\ \text{kHz}$   |
| Common Source Forward Transmittance          | $ Y_{fs} $   | 3200 |      |  |     | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              | $f = 100\ \text{MHz}$ |
| Common Source Output Conductance             | $g_{os}$     |      | 35   |  |     | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              | $f = 1\ \text{kHz}$   |
| Common Source Input Capacitance              | $C_{iss}$    |      | 6    |  | 6   | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              | $f = 1\ \text{MHz}$   |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$    |      | 2    |  | 3   | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              | $f = 1\ \text{MHz}$   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$  |      | 200  |  |     | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              | $f = 10\ \text{Hz}$   |
| Noise Figure                                 | NF           |      | 6    |  |     | dB                     | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$<br>$R_G = 1\ \text{M}\Omega$ | $f = 10\ \text{Hz}$   |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



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## 2N3954, 2N3955, 2N3956

## N-Channel Dual Silicon Junction Field-Effect Transistor

- Low and Medium Frequency Differential Amplifiers
- High Input Impedance Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 50 V

Gate Current

50 mA

Total Device Power Dissipation (each side)

250 mW

@  $85^\circ\text{C}$  Case Temperature (both sides)

500 mW

Power Derating (both sides)

4.3 mW/ $^\circ\text{C}$ At  $25^\circ\text{C}$  free air temperature:  
Static Electrical Characteristics

|                                   |               | 2N3954 |       | 2N3955 |       | 2N3956 |       | Process NJ16 |                                                       |                           |
|-----------------------------------|---------------|--------|-------|--------|-------|--------|-------|--------------|-------------------------------------------------------|---------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Min    | Max   | Unit         | Test Conditions                                       |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 50   |       | – 50   |       | – 50   |       | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |                           |
| Gate Reverse Current              | $I_{GSS}$     |        | – 100 |        | – 100 |        | – 100 | pA           | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$ |                           |
|                                   |               |        | – 500 |        | – 500 |        | – 500 | nA           | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$ | $T_A = 125^\circ\text{C}$ |
| Gate Operating Current            | $I_G$         |        | – 50  |        | – 50  |        | – 50  | pA           | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$        |                           |
|                                   |               |        | – 250 |        | – 250 |        | – 250 | nA           | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$        | $T_A = 125^\circ\text{C}$ |
| Gate Source Voltage               | $V_{GS}$      |        | – 4.2 |        | – 4.2 |        | – 4.2 | V            | $V_{DS} = 20\text{V}$ , $I_D = 50\mu\text{A}$         |                           |
|                                   |               | – 0.5  | – 4   | – 0.5  | – 4   | – 0.5  | – 4   | V            | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$        |                           |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 1    | – 4.5 | – 1    | – 4.5 | – 1    | – 4.5 | V            | $V_{DS} = -20\text{V}$ , $I_G = 1\text{nA}$           |                           |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |        | 2     |        | 2     |        | 2     | V            | $V_{DS} = \emptyset\text{V}$ , $I_G = 1\text{mA}$     |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 0.5    | 5     | 0.5    | 5     | 0.5    | 5     | mA           | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$  |                           |

## Dynamic Electrical Characteristics

|                                                   |                                             |      |      |      |      |      |      |                      |                                                                                 |                                                     |
|---------------------------------------------------|---------------------------------------------|------|------|------|------|------|------|----------------------|---------------------------------------------------------------------------------|-----------------------------------------------------|
| Common Source Forward Transconductance            | $g_{fs}$                                    | 1000 | 3000 | 1000 | 3000 | 1000 | 3000 | $\mu\text{S}$        | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                            | $f = 1\text{kHz}$                                   |
|                                                   |                                             | 1000 |      | 1000 |      | 1000 |      | $\mu\text{S}$        | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                            | $f = 200\text{MHz}$                                 |
| Common Source Output Capacitance                  | $g_{os}$                                    |      | 35   |      | 35   |      | 35   | $\mu\text{S}$        | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                            | $f = 1\text{kHz}$                                   |
| Common Source Input Capacitance                   | $C_{iss}$                                   |      | 4    |      | 4    |      | 4    | pF                   | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                            | $f = 1\text{MHz}$                                   |
| Drain Gate Capacitance                            | $C_{dgo}$                                   |      | 1.5  |      | 1.5  |      | 1.5  | pF                   | $V_{dg} = 10\text{V}$ , $I_S = \emptyset\text{A}$                               | $f = 1\text{MHz}$                                   |
| Common Source Reverse Transfer Capacitance        | $C_{rss}$                                   |      | 1.2  |      | 1.2  |      | 1.2  | pF                   | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                            | $f = 1\text{MHz}$                                   |
| Noise Figure                                      | NF                                          |      | 0.5  |      | 0.5  |      | 0.5  | dB                   | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ , $R_g = 10\text{M}\Omega$ | $f = 100\text{Hz}$                                  |
| Differential Gate Current                         | $ I_{G1} - I_{G2} $                         |      | 10   |      | 10   |      | 10   | nA                   | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$                                  | $T_A = 125^\circ\text{C}$                           |
| Saturation Drain Current Ratio                    | $I_{DSS1}/I_{DSS2}$                         | 0.95 | 1    | 0.95 | 1    | 0.95 | 1    |                      | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                            |                                                     |
| Differential Gate Source Voltage                  | $ V_{GS1} - V_{GS2} $                       |      | 5    |      | 10   |      | 15   | mV                   | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$                                  |                                                     |
| Differential Gate Source Voltage with Temperature | $\frac{\Delta V_{GS1} - V_{GS2}}{\Delta T}$ |      | 0.8  |      | 2    |      | 4    | mV/ $^\circ\text{C}$ | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$                                  | $T_A = 25^\circ\text{C}$<br>to $-55^\circ\text{C}$  |
|                                                   |                                             |      | 1    |      | 2.5  |      | 5    | mV/ $^\circ\text{C}$ | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$                                  | $T_A = 25^\circ\text{C}$<br>to $+125^\circ\text{C}$ |
| Transconductance Ratio                            | $g_{fs1}/g_{fs2}$                           | 0.97 | 1    | 0.97 | 1    | 0.97 | 1    |                      | $V_{DS} = 20\text{V}$ , $I_D = 200\mu\text{A}$                                  | $f = 1\text{kHz}$                                   |

## TO-71 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source, 2 Drain, 3 Gate,  
5 Source, 6 Drain, 7 Gate

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## 2N3957, 2N3958

## N-Channel Dual Silicon Junction Field-Effect Transistor

- Low and Medium Frequency Differential Amplifiers
- High Input Impedance Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 50 V

Gate Current

50 mA

Total Device Power Dissipation (each side)

250 mW

@  $85^\circ\text{C}$  Case Temperature (both sides)

500 mW

Power Derating (both sides)

4.3 mW/ $^\circ\text{C}$ At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N3957 |       | 2N3958 |       | Process NJ16 |                                                        |                           |
|-----------------------------------|---------------|--------|-------|--------|-------|--------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Unit         | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 50   |       | – 50   |       | V            | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |        | – 100 |        | – 100 | pA           | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |        | – 500 |        | – 500 | nA           | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 125^\circ\text{C}$ |
| Gate Operating Current            | $I_G$         |        | – 50  |        | – 50  | pA           | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$       |                           |
|                                   |               |        | – 250 |        | – 250 | nA           | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$       | $T_A = 125^\circ\text{C}$ |
| Gate Source Voltage               | $V_{GS}$      |        | – 4.2 |        | – 4.2 | V            | $V_{DS} = 20\text{V}$ , $I_D = 50\ \mu\text{A}$        |                           |
|                                   |               | – 0.5  | – 4   | – 0.5  | – 4   | V            | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$       |                           |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 1    | – 4.5 | – 1    | – 4.5 | V            | $V_{DS} = 20\text{V}$ , $I_D = 1\ \text{nA}$           |                           |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |        | 2     |        | 2     | V            | $V_{DS} = \emptyset$ , $I_G = 1\ \text{mA}$            |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 0.5    | 5     | 0.5    | 5     | mA           | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |

## Dynamic Electrical Characteristics

|                                                   |                                             |      |      |      |      |               |                                                                                    |                                                    |
|---------------------------------------------------|---------------------------------------------|------|------|------|------|---------------|------------------------------------------------------------------------------------|----------------------------------------------------|
| Common Source Forward Transconductance            | $g_{fs}$                                    | 1000 | 3000 | 1000 | 3000 | $\mu\text{S}$ | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                               | $f = 1\ \text{kHz}$                                |
|                                                   |                                             | 1000 |      | 1000 |      | $\mu\text{S}$ | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                               | $f = 200\ \text{MHz}$                              |
| Common Source Output Conductance                  | $g_{os}$                                    |      | 35   |      | 35   | $\mu\text{S}$ | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                               | $f = 1\ \text{kHz}$                                |
| Common Source Input Capacitance                   | $C_{iss}$                                   |      | 4    |      | 4    | pF            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                               | $f = 1\ \text{MHz}$                                |
| Drain Gate Capacitance                            | $C_{dgo}$                                   |      | 1.5  |      | 1.5  | pF            | $V_{DS} = 10\text{V}$ , $I_S = \emptyset\text{A}$                                  | $f = 1\ \text{MHz}$                                |
| Common Source Reverse Transfer Capacitance        | $C_{rss}$                                   |      | 1.2  |      | 1.2  | pF            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                               | $f = 1\ \text{MHz}$                                |
| Noise Figure                                      | NF                                          |      | 0.5  |      | 0.5  | dB            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$<br>$R_G = 10\ \text{M}\Omega$ | $f = 100\ \text{Hz}$                               |
| Differential Gate Current                         | $ I_{G1} - I_{G2} $                         |      | 10   |      | 10   | nA            | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$                                   | $T_A = 125^\circ\text{C}$                          |
| Saturation Drain Current Ratio                    | $I_{DSS1} / I_{DSS2}$                       | 0.9  | 1    | 0.85 | 1    |               | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                               |                                                    |
| Differential Gate Source Voltage                  | $ V_{GS1} - V_{GS2} $                       |      | 20   |      | 25   | mV            | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$                                   |                                                    |
| Differential Gate Source Voltage with Temperature | $\frac{\Delta V_{GS1} - V_{GS2}}{\Delta T}$ |      | 6    |      | 8    | mV            | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$                                   | $T_A = 25^\circ\text{C}$<br>to $-55^\circ\text{C}$ |
|                                                   |                                             |      | 7.5  |      | 10   | mV            | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$                                   | $T_A = 25^\circ\text{C}$<br>to $125^\circ\text{C}$ |
| Transconductance Ratio                            | $g_{fs1} / g_{fs2}$                         | 0.9  | 1    | 0.85 | 1    |               | $V_{DS} = 20\text{V}$ , $I_D = 200\ \mu\text{A}$                                   | $f = 1\ \text{kHz}$                                |

## TO-71 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 5 Source,  
6 Drain, 7 Gate

## 2N3993, 2N3993A

## P-Channel Silicon Junction Field-Effect Transistor

- Choppers
- High Speed Commutators

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

25 V

Continuous Forward Gate Current

– 10 mA

Continuous Device Power Dissipation

300 mW

Power Derating

2.4 mW/°C

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N3993 |       | 2N3993A |       | Process PJ99  |                                                       |                           |
|-----------------------------------|---------------|--------|-------|---------|-------|---------------|-------------------------------------------------------|---------------------------|
|                                   |               | Min    | Max   | Min     | Max   | Unit          | Test Conditions                                       |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 25     |       | 25      |       | V             | $I_G = 1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 4      | 9.5   | 4       | 9.5   | V             | $V_{DS} = -10\text{V}$ , $I_D = -1\ \mu\text{A}$      |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 10   |       | – 10    |       | mA            | $V_{DS} = -10\text{V}$ , $V_{GS} = \emptyset\text{V}$ |                           |
| Drain Reverse Current             | $I_{DGO}$     |        | – 1.2 |         | – 1.2 | nA            | $V_{DG} = -15\text{V}$ , $I_S = \emptyset\text{A}$    |                           |
|                                   |               |        | – 1.2 |         | – 1.2 | $\mu\text{A}$ | $V_{DG} = -15\text{V}$ , $I_S = \emptyset\text{A}$    | $T_A = 150^\circ\text{C}$ |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        | – 1.2 |         | – 1.2 | nA            | $V_{DS} = -10\text{V}$ , $V_{GS} = 10\text{V}$        |                           |
|                                   |               |        | – 1   |         | – 1   | $\mu\text{A}$ | $V_{DS} = -10\text{V}$ , $V_{GS} = 10\text{V}$        | $T_A = 150^\circ\text{C}$ |

## Dynamic Electrical Characteristics

|                                            |              |   |     |   |     |          |                                                          |                    |
|--------------------------------------------|--------------|---|-----|---|-----|----------|----------------------------------------------------------|--------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |   | 150 |   | 150 | $\Omega$ | $V_{GS} = \emptyset\text{V}$ , $I_D = \emptyset\text{A}$ | $f = 1\text{ kHz}$ |
| Common Source Forward Transmittance        | $ Y_{fs} $   | 6 | 12  | 7 | 12  | mS       | $V_{DS} = -10\text{V}$ , $V_{GS} = \emptyset\text{V}$    | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |   | 16  |   | 12  | pF       | $V_{DS} = -10\text{V}$ , $V_{GS} = \emptyset\text{V}$    | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |   | 4.5 |   | 3   | pF       | $V_{DS} = \emptyset$ , $V_{GS} = 10\text{V}$             | $f = 1\text{ MHz}$ |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Gate, 3 Drain, 4 Case



## 2N3994, 2N3994A

## P-Channel Silicon Junction Field-Effect Transistor

- Choppers
- High Speed Commutators

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                     |           |
|-------------------------------------|-----------|
| Reverse Gate Source Voltage         | 25 V      |
| Reverse Gate Drain Voltage          | 25 V      |
| Continuous Forward Gate Current     | – 10 mA   |
| Continuous Device Power Dissipation | 300 mW    |
| Power Derating                      | 2.4 mW/°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N3994 |       | 2N3994A |       | Process PJ99  |                                                       |                           |
|-----------------------------------|---------------|--------|-------|---------|-------|---------------|-------------------------------------------------------|---------------------------|
|                                   |               | Min    | Max   | Min     | Max   | Unit          | Test Conditions                                       |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 25     |       | 25      |       | V             | $I_G = 1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 1      | 5.5   | 1       | 5.5   | V             | $V_{DS} = -10\text{V}$ , $I_D = -1\ \mu\text{A}$      |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 2    |       | – 2     |       | mA            | $V_{DS} = -10\text{V}$ , $V_{GS} = \emptyset\text{V}$ |                           |
| Drain Reverse Current             | $I_{DGO}$     |        | – 1.2 |         | – 1.2 | nA            | $V_{DG} = -15\text{V}$ , $I_S = \emptyset\text{A}$    |                           |
|                                   |               |        | – 1.2 |         | – 1.2 | $\mu\text{A}$ | $V_{DG} = -15\text{V}$ , $I_S = \emptyset\text{A}$    | $T_A = 150^\circ\text{C}$ |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        | – 1.2 |         | – 1.2 | nA            | $V_{DS} = -10\text{V}$ , $V_{GS} = 10\text{V}$        |                           |
|                                   |               |        | – 1   |         | – 1   | $\mu\text{A}$ | $V_{DS} = -10\text{V}$ , $V_{GS} = 10\text{V}$        | $T_A = 150^\circ\text{C}$ |

## Dynamic Electrical Characteristics

|                                            |              |   |     |   |     |          |                                                          |                    |
|--------------------------------------------|--------------|---|-----|---|-----|----------|----------------------------------------------------------|--------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |   | 300 |   | 300 | $\Omega$ | $V_{GS} = \emptyset\text{V}$ , $I_D = \emptyset\text{A}$ | $f = 1\text{ kHz}$ |
| Common Source Forward Transmittance        | $ Y_{fs} $   | 4 | 10  | 5 | 10  | mS       | $V_{DS} = -10\text{V}$ , $V_{GS} = \emptyset\text{V}$    | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |   | 16  |   | 12  | pF       | $V_{DS} = -10\text{V}$ , $V_{GS} = \emptyset\text{V}$    | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |   | 5   |   | 3.5 | pF       | $V_{DS} = \emptyset$ , $V_{GS} = 10\text{V}$             | $f = 1\text{ MHz}$ |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Gate, 3 Drain, 4 Case

# 2N4117, 2N4117A, 2N4118, 2N4118A, 2N4119, 2N4119A

## N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- Ultra-High Input Impedance Amplifiers

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 40 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

300 mW

Power Derating (to  $175^\circ\text{C}$ )2 mW/ $^\circ\text{C}$ 

### At $25^\circ\text{C}$ free air temperature:

#### Static Electrical Characteristics

|                                                                                          |               | 2N4117<br>2N4117A |       | 2N4118<br>2N4118A |      | 2N4119<br>2N4119A |      | Process NJ01 |                                                       |
|------------------------------------------------------------------------------------------|---------------|-------------------|-------|-------------------|------|-------------------|------|--------------|-------------------------------------------------------|
|                                                                                          |               | Min               | Max   | Min               | Max  | Min               | Max  | Unit         | Test Conditions                                       |
| Gate Source Breakdown Voltage                                                            | $V_{(BR)GSS}$ | – 40              |       | – 40              |      | – 40              |      | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |
| Gate Reverse Current<br>2N4117, 2N4118, 2N4119<br>2N4117A, 2N4118A, 2N4119A              | $I_{GSS}$     |                   | – 10  |                   | – 10 |                   | – 10 | pA           | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ |
|                                                                                          |               |                   | – 1   |                   | – 1  |                   | – 1  | pA           | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ |
| Gate Source Cutoff Voltage                                                               | $V_{GS(OFF)}$ | – 0.6             | – 1.8 | – 1               | – 3  | – 2               | – 6  | V            | $V_{DS} = 10\text{V}$ , $I_D = 1\text{nA}$            |
| Drain Saturation Current (Pulsed)<br>2N4117, 2N4118, 2N4119<br>2N4117A, 2N4118A, 2N4119A | $I_{GSS}$     | 0.03              | 0.09  | 0.08              | 0.24 | 0.2               | 0.6  | mA           | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$  |
|                                                                                          |               | 0.015             | 0.09  | 0.08              | 0.24 | 0.2               | 0.6  | mA           | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$  |

#### Dynamic Electrical Characteristics

|                                            |           |    |     |    |     |     |     |               |                                                      |                    |
|--------------------------------------------|-----------|----|-----|----|-----|-----|-----|---------------|------------------------------------------------------|--------------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 70 | 210 | 80 | 250 | 100 | 330 | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance           | $g_{os}$  |    | 3   |    | 5   |     | 10  | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |    | 3   |    | 3   |     | 3   | pF            | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |    | 1.5 |    | 1.5 |     | 1.5 | pF            | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |

### TO-72 Package

Dimensions in Inches (mm)

### Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



# 2N4220, 2N4220A, 2N4221, 2N4221A, 2N4222, 2N4222A

## N-Channel Silicon Junction Field-Effect Transistor

- Mixers
- Oscillators
- VHF Amplifiers
- Small Signal Amplifiers

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                                  |         |
|--------------------------------------------------|---------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 30 V  |
| Continuous Forward Gate Current                  | 10 mA   |
| Continuous Device Power Dissipation              | 300 mW  |
| Power Derating (to 150 °C)                       | 2 mW/°C |

### At 25°C free air temperature:

#### Static Electrical Characteristics

|                                   |               | 2N4220<br>2N4220A |               | 2N4221<br>2N4221A |              | 2N4222<br>2N4222A |              |                    |                                                                                   |
|-----------------------------------|---------------|-------------------|---------------|-------------------|--------------|-------------------|--------------|--------------------|-----------------------------------------------------------------------------------|
|                                   |               | NJ16              |               | NJ16              |              | NJ32              |              | Process            |                                                                                   |
|                                   |               | Min               | Max           | Min               | Max          | Min               | Max          | Unit               | Test Conditions                                                                   |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 30              |               | – 30              |              | – 30              |              | V                  | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$                              |
| Gate Reverse Current              | $I_{GSS}$     |                   | – 0.1         |                   | – 0.1        |                   | – 0.1        | nA                 | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |                   | – 0.1         |                   | – 0.1        |                   | – 0.1        | $\mu\text{A}$      | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Voltage               | $V_{GS}$      | – 0.5<br>(50)     | – 2.5<br>(50) | – 1<br>(200)      | – 5<br>(200) | – 2<br>(500)      | – 6<br>(500) | V<br>$\mu\text{A}$ | $V_{DS} = 15\text{V}$ , $I_D = ( )$                                               |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ |                   | – 4           |                   | – 6          |                   | – 8          | V                  | $V_{DS} = 15\text{V}$ , $I_D = 0.1\text{ nA}$                                     |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 0.5               | 3             | 2                 | 6            | 5                 | 15           | mA                 | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              |

#### Dynamic Electrical Characteristics

|                                            |            |      |      |      |      |      |      |               |                                                                                  |                      |
|--------------------------------------------|------------|------|------|------|------|------|------|---------------|----------------------------------------------------------------------------------|----------------------|
| Common Source Forward Transconductance     | $g_{fs}$   | 1000 | 4000 | 2000 | 5000 | 2500 | 6000 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                             | $f = 1\text{ kHz}$   |
| Common Source Forward Transmittance        | $ Y_{fs} $ | 750  |      | 750  |      | 750  |      | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                             | $f = 100\text{ MHz}$ |
| Common Source Output Conductance           | $g_{os}$   |      | 10   |      | 20   |      | 40   | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                             | $f = 1\text{ kHz}$   |
| Common Source Input Capacitance            | $C_{iss}$  |      | 6    |      | 6    |      | 6    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                             | $f = 1\text{ MHz}$   |
| Common Source Reverse Transfer Capacitance | $C_{rss}$  |      | 2    |      | 2    |      | 2    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                             | $f = 1\text{ MHz}$   |
| Noise Figure<br>2N4220A, 2N4221A, 2N4222A  | NF         |      | 2.5  |      | 2.5  |      | 2.5  | dB            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$<br>$R_G = 1\text{ M}\Omega$ | $f = 100\text{ MHz}$ |

### TO-72 Package

Dimensions in Inches (mm)

### Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



## 2N4338, 2N4339

## N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- Small Signal Amplifiers
- Voltage-Controlled Resistors
- Current Limiters & Regulators

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 50 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

300 mW

Power Derating (to  $175^\circ\text{C}$ )2mW/ $^\circ\text{C}$ At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N4339 |               | 2N4339 |               | Process NJ16 |                                                                           |
|-----------------------------------|---------------|--------|---------------|--------|---------------|--------------|---------------------------------------------------------------------------|
|                                   |               | Min    | Max           | Min    | Max           | Unit         | Test Conditions                                                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 50   |               | – 50   |               | V            | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$                            |
| Gate Reverse Current              | $I_{GSS}$     |        | – 100         |        | – 100         | pA           | $V_{GS} = -30\text{V}$ , $V_{DS} = 0\text{V}$                             |
|                                   |               |        | – 100         |        | – 100         | nA           | $V_{GS} = -30\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.3  | – 1           | – 0.6  | – 1.8         | V            | $V_{DS} = 15\text{V}$ , $I_D = 0.1\ \mu\text{A}$                          |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 0.2    | 0.6           | 0.5    | 1.5           | mA           | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        | 0.05<br>(– 5) |        | 0.05<br>(– 5) | nA<br>V      | $V_{DS} = 15\text{V}$ , $V_{GS} = ( )$                                    |

## Dynamic Electrical Characteristics

|                                            |              |     |      |     |      |               |                                                                                        |                    |
|--------------------------------------------|--------------|-----|------|-----|------|---------------|----------------------------------------------------------------------------------------|--------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |     | 2500 |     | 1700 | $\Omega$      | $V_{GS} = 0\text{V}$ , $I_D = 0\text{A}$                                               | $f = 1\text{ kHz}$ |
| Common Source Forward Transconductance     | $g_{fs}$     | 600 | 1800 | 800 | 2400 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ kHz}$ |
| Common Source Output Conductance           | $g_{os}$     |     | 5    |     | 15   | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |     | 7    |     | 7    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |     | 3    |     | 3    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ MHz}$ |
| Noise Figure                               | NF           |     | 1    |     | 1    | dB            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$<br>$R_G = 1\text{ M}\Omega$ , BW = 200 Hz | $f = 1\text{ kHz}$ |

## TO-18 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case



## 2N4340, 2N4341

## N-Channel Silicon Junction Field-Effect Transistor

- Small Signal Amplifiers
- Current Regulators
- Voltage-Controlled Resistors

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source & Reverse Gate Drain Voltage  
 Continuous Forward Gate Current  
 Continuous Device Power Dissipation  
 Power Derating (to  $175^\circ\text{C}$ )

– 50 V  
 50 mA  
 300 mW  
 2mW/ $^\circ\text{C}$

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N4340 |               | 2N4341 |                | Process NJ16 |                                                  |                           |
|-----------------------------------|---------------|--------|---------------|--------|----------------|--------------|--------------------------------------------------|---------------------------|
|                                   |               | Min    | Max           | Min    | Max            | Unit         | Test Conditions                                  |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 50   |               | – 50   |                | V            | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$   |                           |
| Gate Reverse Current              | $I_{GSS}$     |        | – 100         |        | – 100          | pA           | $V_{GS} = -30\text{V}$ , $V_{DS} = 0\text{V}$    |                           |
|                                   |               |        | – 100         |        | – 100          | nA           | $V_{GS} = -30\text{V}$ , $V_{DS} = 0\text{V}$    | $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 1    | – 3           | – 2    | – 6            | V            | $V_{DS} = 15\text{V}$ , $I_D = 0.1\ \mu\text{A}$ |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 1.2    | 3.6           | 3      | 9              | mA           | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$     |                           |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        | 0.05<br>(– 5) |        | 0.07<br>(– 10) | nA<br>V      | $V_{DS} = 15\text{V}$ , $V_{GS} = ( )$           |                           |

## Dynamic Electrical Characteristics

|                                            |              |      |      |      |      |               |                                                                                        |                    |
|--------------------------------------------|--------------|------|------|------|------|---------------|----------------------------------------------------------------------------------------|--------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |      | 1500 |      | 800  | $\Omega$      | $V_{GS} = 0\text{V}$ , $I_D = 0\text{A}$                                               | $f = 1\text{ kHz}$ |
| Common Source Forward Transconductance     | $g_{fs}$     | 1300 | 3000 | 2000 | 4000 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ kHz}$ |
| Common Source Output Conductance           | $g_{os}$     |      | 30   |      | 60   | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |      | 7    |      | 7    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |      | 3    |      | 3    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                                           | $f = 1\text{ MHz}$ |
| Noise Figure                               | NF           |      | 1    |      | 1    | dB            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$<br>$R_G = 1\text{ M}\Omega$ , BW = 200 Hz | $f = 1\text{ kHz}$ |

## TO-18 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case

## Surface Mount

SMP4340, SMP4341



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[www.interfet.com](http://www.interfet.com)

## 2N4391, 2N4392, 2N4393

## N-Channel Silicon Junction Field-Effect Transistor

- Low On Resistance Analog Switches
- Choppers
- Commutators

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 40 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

1.8 W

Power Derating

12 mW/°C

At 25°C free air temperature  
Static Electrical Characteristics

|                                   |               | 2N4391 |       | 2N4392 |       | 2N4393 |       | Process NJ132 |                                                       |                           |
|-----------------------------------|---------------|--------|-------|--------|-------|--------|-------|---------------|-------------------------------------------------------|---------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Min    | Max   | Unit          | Test Conditions                                       |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 40   |       | – 40   |       | – 40   |       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |                           |
| Gate Reverse Current              | $I_{GSS}$     |        | – 100 |        | – 100 |        | – 100 | pA            | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ |                           |
|                                   |               |        | – 200 |        | – 200 |        | – 200 | nA            | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ | $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 4    | – 10  | – 2    | – 5   | – 0.5  | – 3   | V             | $V_{DS} = -20\text{V}$ , $I_D = 1\text{nA}$           |                           |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |        | 1     |        | 1     |        | 1     | V             | $I_G = 1\text{mA}$ , $V_{DS} = \emptyset\text{V}$     |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 50     | 150   | 25     | 75    | 5      | 30    | mA            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$  |                           |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        |       |        |       |        | 100   | pA            | $V_{DS} = 20\text{V}$ , $V_{GS} = -5\text{V}$         |                           |
|                                   |               |        |       |        |       |        | 200   | nA            | $V_{DS} = 20\text{V}$ , $V_{GS} = -5\text{V}$         | $T_A = 150^\circ\text{C}$ |
|                                   |               |        |       |        | 100   |        |       | pA            | $V_{DS} = 20\text{V}$ , $V_{GS} = -7\text{V}$         |                           |
|                                   |               |        |       |        | 200   |        |       | nA            | $V_{DS} = 20\text{V}$ , $V_{GS} = -7\text{V}$         | $T_A = 150^\circ\text{C}$ |
|                                   |               |        | 100   |        |       |        |       | pA            | $V_{DS} = 20\text{V}$ , $V_{GS} = -12\text{V}$        |                           |
|                                   |               |        | 200   |        |       |        |       | nA            | $V_{DS} = 20\text{V}$ , $V_{GS} = -12\text{V}$        | $T_A = 150^\circ\text{C}$ |
| Drain Source ON Voltage           | $V_{DS(ON)}$  |        |       |        |       |        | 0.4   | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = 3\text{mA}$     |                           |
|                                   |               |        |       |        | 0.4   |        |       | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = 6\text{mA}$     |                           |
|                                   |               |        | 0.4   |        |       |        |       | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = 12\text{mA}$    |                           |
| Static Drain Source ON Resistance | $r_{DS(ON)}$  |        | 30    |        | 60    |        | 100   | $\Omega$      | $V_{GS} = \emptyset\text{V}$ , $I_D = 1\text{mA}$     |                           |

## Dynamic Electrical Characteristics

|                                            |              |  |     |  |     |  |     |          |                                                          |                   |
|--------------------------------------------|--------------|--|-----|--|-----|--|-----|----------|----------------------------------------------------------|-------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |  | 30  |  | 60  |  | 100 | $\Omega$ | $V_{GS} = \emptyset\text{V}$ , $I_D = \emptyset\text{A}$ | $f = 1\text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |  | 14  |  | 14  |  | 14  | pF       | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$     | $f = 1\text{kHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |  |     |  |     |  | 3.5 | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -5\text{V}$     | $f = 1\text{kHz}$ |
|                                            |              |  |     |  | 3.5 |  |     | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -7\text{V}$     | $f = 1\text{kHz}$ |
|                                            |              |  | 3.5 |  |     |  |     | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -12\text{V}$    | $f = 1\text{kHz}$ |

## Switching Characteristics

|                     |              |  |    |  |    |  |    |    |                                                                                                                                                                              |
|---------------------|--------------|--|----|--|----|--|----|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  |  | 15 |  | 15 |  | 15 | ns | $V_{DD} = 10\text{V}$ , $V_{GS(ON)} = \emptyset\text{V}$<br><b>2N4391 2N4392 2N4393</b><br>$I_{D(ON)}$ 12       6       3    mA<br>$V_{GS(OFF)}$ – 12      – 7      – 5    V |
| Rise Time           | $t_r$        |  | 5  |  | 5  |  | 5  | ns |                                                                                                                                                                              |
| Turn OFF Delay Time | $t_{d(off)}$ |  | 20 |  | 35 |  | 50 | ns |                                                                                                                                                                              |
| Fall Time           | $t_f$        |  | 15 |  | 20 |  | 30 | ns |                                                                                                                                                                              |

## TO-18 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case

## Surface Mount

SMP4391, SMP4392, SMP4393



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## 2N4416, 2N4416A

## N-Channel Silicon Junction Field-Effect Transistor

- Mixers
- VHF Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |        |         |         |         |
|--------------------------------------------------|--------|---------|---------|---------|
| Reverse Gate Source & Reverse Gate Drain Voltage | 2N4416 | – 30 V  | 2N4416A | – 35 V  |
| Gate Current                                     |        | 10 mA   |         | 10 mA   |
| Continuous Device Dissipation                    |        | 300 mW  |         | 300 mW  |
| Power Derating                                   |        | 2 mW/°C |         | 2 mW/°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N4416 |       | 2N4416A |       | Process NJ26  |                                                                           |
|-----------------------------------|---------------|--------|-------|---------|-------|---------------|---------------------------------------------------------------------------|
|                                   |               | Min    | Max   | Min     | Max   | Unit          | Test Conditions                                                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 30   |       | – 35    |       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$                              |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 |         | – 0.1 | nA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$                             |
|                                   |               |        | – 0.1 |         | – 0.1 | $\mu\text{A}$ | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ |        | – 6   | – 2.5   | – 6   | V             | $V_{DS} = 15\text{V}$ , $I_D = 1\text{nA}$                                |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      | 15    | 5       | 15    | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                              |

## Dynamic Electrical Characteristics

|                                            |           |      |       |      |       |               |                                              |                      |
|--------------------------------------------|-----------|------|-------|------|-------|---------------|----------------------------------------------|----------------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 4500 | 7500  | 4500 | 7500  | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ kHz}$   |
|                                            |           | 4000 |       | 4000 |       | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Output Conductance           | $g_{os}$  |      | 50    |      | 50    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ kHz}$   |
|                                            |           |      | 75    |      | 75    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 100   |      | 100   | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |      | 4     |      | 4     | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$   |
| Common Source Output Capacitance           | $C_{oss}$ |      | 2     |      | 2     | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$   |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |      | 0.8   |      | 0.8   | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$   |
| Common Source Input Conductance            | $g_{is}$  |      | 100   |      | 100   | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 1000  |      | 1000  | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Input Susceptance            | $b_{is}$  |      | 2500  |      | 2500  | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 10000 |      | 10000 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Output Susceptance           | $b_{os}$  |      | 1000  |      | 1000  | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 4000  |      | 4000  | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Power Gain                   | $G_{ps}$  | 18   |       | 18   |       | dB            | $V_{DS} = 15\text{V}$ , $I_D = 5\text{mA}$   | $f = 100\text{ MHz}$ |
|                                            |           | 10   |       | 10   |       | dB            | $V_{DS} = 15\text{V}$ , $I_D = 5\text{mA}$   | $f = 400\text{ MHz}$ |
| Noise Figure                               | NF        |      | 2     |      | 2     | dB            | $V_{DS} = 15\text{V}$ , $I_D = 5\text{mA}$   | $f = 100\text{ MHz}$ |
|                                            |           |      | 4     |      | 4     | dB            | $R_G = 1\text{k}\Omega$                      | $f = 400\text{ MHz}$ |

## TO-72 Package

See Section G for Outline Dimensions

## Surface Mount

SMP4416, SMP4416A

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case

Note: rf parameters guaranteed, but not 100% tested.



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# 2N4856, 2N4857, 2N4858, 2N4859, 2N4860, 2N4861

## N-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Commutators
- Analog Switches

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                 | 2N4856, 2N4857, 2N4858 | 2N4859, 2N4860, 2N4861 |
|---------------------------------|------------------------|------------------------|
| Reverse Gate Source Voltage     | – 40 V                 | – 30 V                 |
| Reverse Gate Drain Voltage      | – 40 V                 | – 30 V                 |
| Continuous Device Dissipation   | 1.8 W                  | 1.8 W                  |
| Power Derating                  | 10 mW/°C               | 10 mW/°C               |
| Continuous Forward Gate Current | 50 mA                  | 50 mA                  |

### At 25°C free air temperature:

#### Static Electrical Characteristics

|                                                                                   |               | 2N4856<br>2N4859 |              | 2N4857<br>2N4860 |             | 2N4858<br>2N4861 |            | Process NJ132 |                                                                            |
|-----------------------------------------------------------------------------------|---------------|------------------|--------------|------------------|-------------|------------------|------------|---------------|----------------------------------------------------------------------------|
|                                                                                   |               | Min              | Max          | Min              | Max         | Min              | Max        | Unit          | Test Conditions                                                            |
| Gate Source Breakdown Voltage<br>2N4856, 2N4857, 2N4858<br>2N4859, 2N4860, 2N4861 | $V_{(BR)GSS}$ |                  | – 40         |                  | – 40        |                  | – 40       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$                               |
|                                                                                   |               |                  | – 30         |                  | – 30        |                  | – 30       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$                               |
| Gate Reverse Current<br>2N4856, 2N4857, 2N4858                                    | $I_{GSS}$     |                  | – 250        |                  | – 250       |                  | – 250      | pA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$                              |
|                                                                                   |               |                  | – 500        |                  | – 500       |                  | – 500      | nA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 150^\circ\text{C}$  |
| Gate Reverse Current<br>2N4859, 2N4860, 2N4861                                    | $I_{GSS}$     |                  | – 250        |                  | – 250       |                  | – 250      | pA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$                              |
|                                                                                   |               |                  | – 500        |                  | – 500       |                  | – 500      | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 150^\circ\text{C}$  |
| Gate Source Cutoff Voltage                                                        | $V_{GS(OFF)}$ | – 4              | – 10         | – 2              | – 6         | – 0.8            | – 4        | V             | $V_{DS} = 15\text{V}$ , $I_D = 0.5\text{ nA}$                              |
| Drain Saturation Current (Pulsed)                                                 | $I_{DSS}$     | 50               |              | 20               | 100         | 8                | 80         | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                               |
| Drain Cutoff Current                                                              | $I_{D(OFF)}$  |                  | 250          |                  | 250         |                  | 250        | pA            | $V_{DS} = 15\text{V}$ , $V_{GS} = -10\text{V}$                             |
|                                                                                   |               |                  | 500          |                  | 500         |                  | 500        | nA            | $V_{DS} = 15\text{V}$ , $V_{GS} = -10\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Drain Source ON Voltage                                                           | $V_{DS(ON)}$  |                  | 0.75<br>(20) |                  | 0.5<br>(10) |                  | 0.5<br>(5) | V<br>(mA)     | $V_{GS} = 0\text{V}$ , $I_D = ( )$                                         |

#### Dynamic Electrical Characteristics

|                                            |              |  |    |  |    |  |    |          |                                               |                    |
|--------------------------------------------|--------------|--|----|--|----|--|----|----------|-----------------------------------------------|--------------------|
| Common Source ON Resistance                | $r_{ds(on)}$ |  | 25 |  | 40 |  | 60 | $\Omega$ | $V_{GS} = 0\text{V}$ , $I_D = 0\text{A}$      | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |  | 18 |  | 18 |  | 18 | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |  | 8  |  | 8  |  | 8  | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |

#### Switching Characteristics

|                     |              |  |                     |  |                     |  |                     |                   |                                                                                                                                                                                                                                  |
|---------------------|--------------|--|---------------------|--|---------------------|--|---------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  |  | 6<br>(20)<br>[–10]  |  | 6<br>(10)<br>[– 6]  |  | 10<br>(5)<br>[– 4]  | ns<br>(mA)<br>[V] | $V_{DD} = 10\text{V}$ , $V_{GS} = 0\text{V}$<br>$I_{D(ON)} = ( )$<br>$V_{GS(OFF)} = [ ]$<br><b>(2N4856, 2N4859)</b> $R_L = 465\Omega$<br><b>(2N4857, 2N4860)</b> $R_L = 953\Omega$<br><b>(2N4858, 2N4861)</b> $R_L = 1910\Omega$ |
| Rise Time           | $t_r$        |  | 3<br>(20)<br>[–10]  |  | 4<br>(10)<br>[– 6]  |  | 10<br>(5)<br>[– 4]  | ns<br>(mA)<br>[V] |                                                                                                                                                                                                                                  |
| Turn OFF Delay Time | $t_{d(off)}$ |  | 25<br>(20)<br>[–10] |  | 50<br>(10)<br>[– 6] |  | 100<br>(5)<br>[– 4] | ns<br>(mA)<br>[V] |                                                                                                                                                                                                                                  |

#### TO-18 Package

See Section G for Outline Dimensions

#### Pin Configuration

1 Source, 2 Drain, 3 Gate & Case

#### Surface Mount

SMP4856, SMP4857, SMP4858,  
SMP4859, SMP4860, SMP4861



# 2N4856A, 2N4857A, 2N4858A, 2N4859A, 2N4860A, 2N4861A

## N-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Commutators
- Analog Switches

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                 | 2N4856A, 2N4857A, 2N4858A | 2N4859A, 2N4860A, 2N4861A |
|---------------------------------|---------------------------|---------------------------|
| Reverse Gate Source Voltage     | – 40 V                    | – 30 V                    |
| Reverse Gate Drain Voltage      | – 40 V                    | – 30 V                    |
| Continuous Device Dissipation   | 1.8 W                     | 1.8 W                     |
| Continuous Forward Gate Current | 50 mA                     | 50 mA                     |
| Power Derating                  | 10 mW/°C                  | 10 mW/°C                  |

### At $25^\circ\text{C}$ free air temperature:

#### Static Electrical Characteristics

|                                                            |               | 2N4856A<br>2N4859A |              | 2N4857A<br>2N4860A |             | 2N4858A<br>2N4861A |            | Process NJ132 |                                                                            |
|------------------------------------------------------------|---------------|--------------------|--------------|--------------------|-------------|--------------------|------------|---------------|----------------------------------------------------------------------------|
|                                                            |               | Min                | Max          | Min                | Max         | Min                | Max        | Unit          | Test Conditions                                                            |
| Gate Source Breakdown Voltage<br>2N4856A, 2N4857A, 2N4858A | $V_{(BR)GSS}$ |                    | – 40         |                    | – 40        |                    | – 40       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$                               |
| Gate Source Breakdown Voltage<br>2N4859A, 2N4860A, 2N4861A | $V_{(BR)GSS}$ |                    | – 30         |                    | – 30        |                    | – 30       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$                               |
| Gate Reverse Current<br>2N4856A, 2N4857A, 2N4858A          | $I_{GSS}$     |                    | – 250        |                    | – 250       |                    | – 250      | pA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$                              |
|                                                            |               |                    | – 500        |                    | – 500       |                    | – 500      | nA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 150^\circ\text{C}$  |
| Gate Reverse Current<br>2N4859A, 2N4860A, 2N4861A          | $I_{GSS}$     |                    | – 250        |                    | – 250       |                    | – 250      | pA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$                              |
|                                                            |               |                    | – 500        |                    | – 500       |                    | – 500      | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 150^\circ\text{C}$  |
| Gate Source Cutoff Voltage                                 | $V_{GS(OFF)}$ | – 4                | – 10         | – 2                | – 6         | – 0.8              | – 4        | V             | $V_{DS} = 15\text{V}$ , $I_D = 0.5\text{ nA}$                              |
| Drain Saturation Current (Pulsed)                          | $I_{DSS}$     | 50                 |              | 20                 | 100         | 8                  | 80         | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                               |
| Drain Cutoff Current                                       | $I_{D(OFF)}$  |                    | 250          |                    | 250         |                    | 250        | pA            | $V_{DS} = 15\text{V}$ , $V_{GS} = -10\text{V}$                             |
|                                                            |               |                    | 500          |                    | 500         |                    | 500        | nA            | $V_{DS} = 15\text{V}$ , $V_{GS} = -10\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Drain Source ON Voltage                                    | $V_{DS(ON)}$  |                    | 0.75<br>(20) |                    | 0.5<br>(10) |                    | 0.5<br>(5) | V<br>(mA)     | $V_{GS} = 0\text{V}$ , $I_D = ( )$                                         |

#### Dynamic Electrical Characteristics

|                                            |              |  |    |  |     |  |     |          |                                               |                    |
|--------------------------------------------|--------------|--|----|--|-----|--|-----|----------|-----------------------------------------------|--------------------|
| Common Source ON Resistance                | $r_{ds(on)}$ |  | 25 |  | 40  |  | 60  | $\Omega$ | $V_{GS} = 0\text{V}$ , $I_D = 0\text{A}$      | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |  | 10 |  | 10  |  | 10  | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |  | 4  |  | 3.5 |  | 3.5 | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |

#### Switching Characteristics

|                     |              |  |                     |  |                     |  |                    |                   |                                                                                                                                                                                                                                        |
|---------------------|--------------|--|---------------------|--|---------------------|--|--------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  |  | 5<br>(20)<br>[–10]  |  | 6<br>(10)<br>[– 6]  |  | 8<br>(5)<br>[– 4]  | ns<br>(mA)<br>[V] | $V_{DD} = 10\text{V}$ , $V_{GS} = 0\text{V}$<br>$I_{D(ON)} = ( )$<br>$V_{GS(OFF)} = [ ]$<br><b>(2N4856A, 2N4859A)</b> $R_L = 464\Omega$<br><b>(2N4857A, 2N4860A)</b> $R_L = 953\Omega$<br><b>(2N4858A, 2N4861A)</b> $R_L = 1910\Omega$ |
| Rise Time           | $t_r$        |  | 3<br>(20)<br>[–10]  |  | 4<br>(10)<br>[– 6]  |  | 8<br>(5)<br>[– 4]  | ns<br>(mA)<br>[V] |                                                                                                                                                                                                                                        |
| Turn OFF Delay Time | $t_{d(off)}$ |  | 25<br>(20)<br>[–10] |  | 40<br>(10)<br>[– 6] |  | 80<br>(5)<br>[– 4] | ns<br>(mA)<br>[V] |                                                                                                                                                                                                                                        |

#### TO-18 Package

See Section G for Outline Dimensions

#### Pin Configuration

1 Source, 2 Drain, 3 Gate & Case

#### Surface Mount

SMP4856A, SMP4857A, SMP4858A,  
SMP4859A, SMP4860A, SMP4861A



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# 2N4867, 2N4867A, 2N4868, 2N4868A, 2N4869, 2N4869A

## N-Channel Silicon Junction Field-Effect Transistor

### • Audio Amplifiers

#### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                                  |                   |
|--------------------------------------------------|-------------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 40 V            |
| Gate Current                                     | 50 mA             |
| Continuous Device Power Dissipation              | 300mW             |
| Power Derating                                   | 1.7 mW/°C         |
| Storage Temperature Range                        | – 65°C to + 200°C |

#### At 25°C free air temperature:

##### Static Electrical Characteristics

|                                   |               | 2N4867<br>2N4867A |        | 2N4868<br>2N4868A |        | 2N4869<br>2N4869A |        | Process NJ16  |                                                       |                           |
|-----------------------------------|---------------|-------------------|--------|-------------------|--------|-------------------|--------|---------------|-------------------------------------------------------|---------------------------|
|                                   |               | Min               | Max    | Min               | Max    | Min               | Max    | Unit          | Test Conditions                                       |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 40              |        | – 40              |        | – 40              |        | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |                           |
| Gate Reverse Current              | $I_{GSS}$     |                   | – 0.25 |                   | – 0.25 |                   | – 0.25 | nA            | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$ |                           |
|                                   |               |                   | – 0.25 |                   | – 0.25 |                   | – 0.25 | $\mu\text{A}$ | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$ | $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.7             | – 2    | – 1               | – 3    | – 1.8             | – 5    | V             | $V_{DS} = 20\text{V}$ , $I_D = 1\mu\text{A}$          |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 0.4               | 1.2    | 1                 | 3      | 2.5               | 7.5    | mA            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$  |                           |

##### Dynamic Electrical Characteristics

|                                              |             |     |      |      |      |      |      |                        |                                                                                            |                    |
|----------------------------------------------|-------------|-----|------|------|------|------|------|------------------------|--------------------------------------------------------------------------------------------|--------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 700 | 2000 | 1000 | 3000 | 1300 | 4000 | $\mu\text{S}$          | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                                       | $f = 1\text{ kHz}$ |
| Common Source Output Conductance             | $g_{os}$    |     | 1.5  |      | 4    |      | 10   | $\mu\text{S}$          | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                                       | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |     | 25   |      | 25   |      | 25   | pF                     | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                                       | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |     | 5    |      | 5    |      | 5    | pF                     | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                                       | $f = 1\text{ MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |     | 20   |      | 20   |      | 20   | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$                                       | $f = 10\text{ Hz}$ |
|                                              |             |     | 10   |      | 10   |      | 10   | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$                                       | $f = 1\text{ kHz}$ |
| Noise Figure                                 | NF          |     | 1    |      | 1    |      | 1    | dB                     | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$                                       | $f = 1\text{ kHz}$ |
|                                              |             |     |      |      |      |      |      |                        | (2N4867, 68, 69) $R_G = 20\text{ k}\Omega$<br>(2N4867A, 68A, 69A) $R_G = 5\text{ k}\Omega$ |                    |

#### TO-72 Package

Dimensions in Inches (mm)

#### Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case

#### Surface Mount

SMP4867, SMP4867A, SMP4868,  
SMP4868A, SMP4869, SMP4869A



## 2N5020, 2N5021

## P-Channel Silicon Junction Field-Effect Transistor

## • Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                   |
|--------------------------------------------------|-------------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 50 V            |
| Continuous Forward Gate Current                  | 50 mA             |
| Continuous Device Power Dissipation              | 500 mW            |
| Power Derating                                   | 4 mW/°C           |
| Storage Temperature Range                        | – 65°C to + 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N5020 |       | 2N5021 |       | Process PJ32 |                                                       |  |
|-----------------------------------|---------------|--------|-------|--------|-------|--------------|-------------------------------------------------------|--|
|                                   |               | Min    | Max   | Min    | Max   | Unit         | Test Conditions                                       |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GDO}$ | 25     |       | 25     |       | V            | $I_G = 1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$   |  |
| Gate Reverse Current              | $I_{GSS}$     |        | 1     |        | 1     | nA           | $V_{GS} = 15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 0.3    | 1.5   | 0.5    | 2.5   | V            | $V_{DS} = -15\text{V}$ , $I_D = 1\text{nA}$           |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 0.3  | – 1.2 | – 1    | – 3.5 | mA           | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$ |  |

## Dynamic Electrical Characteristics

|                                            |           |   |     |     |    |               |                                                       |           |
|--------------------------------------------|-----------|---|-----|-----|----|---------------|-------------------------------------------------------|-----------|
| Common Source Forward Transconductance     | $g_{fs}$  | 1 | 3.5 | 1.5 | 6  | mS            | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$ |           |
| Common Source Output Conductance           | $g_{os}$  |   | 20  |     | 20 | $\mu\text{S}$ | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$ |           |
| Common Source Input Capacitance            | $C_{iss}$ |   | 25  |     | 25 | pF            | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 1 MHz |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |   | 7   |     | 7  | pF            | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 1 MHz |

## TO-18 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source 1, 2 Gate &amp; Case, 3 Drain

## Surface Mount

SMP5020, SMP5021



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## 2N5114, 2N5115, 2N5116

## P-Channel Silicon Junction Field-Effect Transistor

## • Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                   |
|--------------------------------------------------|-------------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 40 V            |
| Gate Current                                     | 50 mA             |
| Continuous Device Power Dissipation              | 500mW             |
| Power Derating                                   | 3 mW/°C           |
| Storage Temperature Range                        | – 65°C to + 200°C |

At 25°C free air temperature:  
Static Electrical Characteristics

|                                   |               | 2N5114 |       | 2N5115 |       | 2N5116 |       | Process PJ99  |                                                                                  |
|-----------------------------------|---------------|--------|-------|--------|-------|--------|-------|---------------|----------------------------------------------------------------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Min    | Max   | Unit          | Test Conditions                                                                  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 30     |       | 30     |       | 30     |       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$                             |
| Gate Reverse Current              | $I_{GSS}$     |        | 500   |        | 500   |        | 500   | pA            | $V_{GS} = 20\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |        | 1     |        | 1     |        | 1     | $\mu\text{A}$ | $V_{GS} = 20\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 5      | 10    | 3      | 6     | 1      | 4     | V             | $V_{DS} = -15\text{V}$ , $I_G = -1\text{nA}$                                     |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |        | – 1   |        | – 1   |        | – 1   | V             | $V_{DS} = \emptyset\text{V}$ , $I_G = -1\text{mA}$                               |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 30   | – 90  |        |       |        |       | mA            | $V_{GS} = \emptyset\text{V}$ , $V_{DS} = -18\text{V}$                            |
|                                   |               |        |       | – 15   | – 60  | – 5    | – 25  | mA            | $V_{GS} = \emptyset\text{V}$ , $V_{DS} = -15\text{V}$                            |
| Drain Cutoff Current              | $I_{D(OFF)}$  |        | – 500 |        |       |        |       | pA            | $V_{DS} = -15\text{V}$ , $V_{GS} = 12\text{V}$                                   |
|                                   |               |        | – 1   |        |       |        |       | $\mu\text{A}$ | $V_{DS} = -15\text{V}$ , $V_{GS} = 12\text{V}$ , $T_A = 150^\circ\text{C}$       |
|                                   |               |        |       |        | – 500 |        |       | pA            | $V_{DS} = -15\text{V}$ , $V_{GS} = 7\text{V}$                                    |
|                                   |               |        |       |        | – 1   |        |       | $\mu\text{A}$ | $V_{DS} = -15\text{V}$ , $V_{GS} = 7\text{V}$ , $T_A = 150^\circ\text{C}$        |
|                                   |               |        |       |        |       |        | – 500 | pA            | $V_{DS} = -15\text{V}$ , $V_{GS} = 5\text{V}$                                    |
|                                   |               |        |       |        |       |        | – 1   | $\mu\text{A}$ | $V_{DS} = -15\text{V}$ , $V_{GS} = 5\text{V}$ , $T_A = 150^\circ\text{C}$        |
| Drain Source ON Voltage           | $V_{DS(ON)}$  |        | – 1.3 |        |       |        |       | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = -15\text{mA}$                              |
|                                   |               |        |       |        | – 0.8 |        |       | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = -7\text{mA}$                               |
|                                   |               |        |       |        |       | – 0.6  |       | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = -3\text{mA}$                               |
| Static Drain Source ON Resistance | $r_{DS(ON)}$  |        | 75    |        | 100   |        | 150   | $\Omega$      | $V_{GS} = \emptyset\text{V}$ , $I_D = -1\text{mA}$                               |

## Dynamic Electrical Characteristics

|                                            |              |  |    |  |     |  |     |          |                                                          |                   |
|--------------------------------------------|--------------|--|----|--|-----|--|-----|----------|----------------------------------------------------------|-------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |  | 75 |  | 100 |  | 150 | $\Omega$ | $V_{GS} = \emptyset\text{V}$ , $I_D = \emptyset\text{A}$ | $f = 1\text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |  | 25 |  | 25  |  | 27  | pF       | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$    | $f = 1\text{MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |  | 7  |  |     |  |     | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 12\text{V}$     | $f = 1\text{MHz}$ |
|                                            |              |  |    |  | 7   |  |     | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 7\text{V}$      | $f = 1\text{MHz}$ |
|                                            |              |  |    |  |     |  | 7   | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 5\text{V}$      | $f = 1\text{MHz}$ |

## Switching Characteristics

|                     |              | 2N5114      | 2N5115 | 2N5116 |      |  |    |          |
|---------------------|--------------|-------------|--------|--------|------|--|----|----------|
| Turn ON Delay Time  | $t_{d(on)}$  |             | 6      |        | 10   |  | 25 | ns       |
| Rise Time           | $t_r$        |             | 10     |        | 20   |  | 35 | ns       |
| Turn OFF Delay Time | $t_{d(off)}$ |             | 6      |        | 8    |  | 20 | ns       |
| Fall Time           | $t_f$        |             | 15     |        | 30   |  | 60 | ns       |
|                     |              | $V_{DD}$    | – 10   | – 6    | – 6  |  |    | V        |
|                     |              | $V_{GG}$    | 20     | 12     | 8    |  |    | V        |
|                     |              | $R_L$       | 130    | 910    | 2000 |  |    | $\Omega$ |
|                     |              | $R_G$       | 100    | 220    | 390  |  |    | $\Omega$ |
|                     |              | $I_{D(ON)}$ | – 15   | – 7    | – 3  |  |    | mA       |

## TO-18 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source 1, 2 Gate &amp; Case, 3 Drain



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## 2N5397, 2N5398

## N-Channel Silicon Junction Field-Effect Transistor

- Low-Noise
- High Power Gain
- High Transconductance
- Mixers
- Oscillators
- VHF Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |           |
|--------------------------------------------------|-----------|
| Reverse Gate Source & Reverse Gate Drain Voltage | - 25 V    |
| Drain Source Voltage                             | 25 V      |
| Continuous Forward Gate Current                  | 10 mA     |
| Continuous Device Power Dissipation              | 300 mW    |
| Power Derating                                   | 1.7 mW/°C |

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N5397 |       | 2N5398 |       | Process NJ26L |                                                                                   |
|-----------------------------------|---------------|--------|-------|--------|-------|---------------|-----------------------------------------------------------------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Unit          | Test Conditions                                                                   |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | - 25   |       | - 25   |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$                            |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |        | 1     |        | 1     | V             | $I_G = 1\ \text{mA}$ , $V_{DS} = \emptyset\text{V}$                               |
| Gate Reverse Current              | $I_{GSS}$     |        | - 0.1 |        | - 0.1 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |        | - 0.1 |        | - 0.1 | $\mu\text{A}$ | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | - 1    | - 6   | - 1    | - 6   | V             | $V_{DS} = 10\text{V}$ , $I_D = 1\ \text{nA}$                                      |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 10     | 30    | 5      | 40    | mA            | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$                              |

## Dynamic Electrical Characteristics

|                                            |            |     |     |     |     |    |                                                      |                       |
|--------------------------------------------|------------|-----|-----|-----|-----|----|------------------------------------------------------|-----------------------|
| Common Source Forward Transconductance     | $g_{fs}$   | 5.5 | 9   | 5   | 10  | mS | $V_{DG} = 10\text{V}$ , $I_D = 10\ \text{mA}$        | $f = 450\ \text{MHz}$ |
| Common Source Forward Transfer Admittance  | $ Y_{fs} $ | 6   | 10  | 5.5 | 10  | mS | $V_{DS} = 10\text{V}$ , $I_D = 10\ \text{mA}$        | $f = 1\ \text{kHz}$   |
| Common Source Output Conductance           | $ g_{os} $ |     | 0.4 |     | 0.5 | mS | $V_{DG} = 10\text{V}$ , $I_D = 10\ \text{mA}$        | $f = 450\ \text{MHz}$ |
| Common Source Input Admittance             | $ Y_{os} $ |     | 0.2 |     | 0.4 | mS | $V_{DS} = 10\text{V}$ , $I_D = 10\ \text{mA}$        | $f = 1\ \text{kHz}$   |
| Common Source Input Conductance            | $g_{is}$   |     | 2   |     | 3   | mS | $V_{DG} = 10\text{V}$ , $I_D = 10\ \text{mA}$        | $f = 450\ \text{MHz}$ |
| Common Source Input Capacitance            | $C_{iss}$  |     | 5   |     | 5.5 | pF | $V_{DG} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$   |
| Common Source Reverse Transfer Capacitance | $C_{rss}$  |     | 1.2 |     | 1.3 | pF | $V_{DG} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$   |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case

## Surface Mount

SMP5397, SMP5398



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## 2N5460, 2N5461, 2N5462

## P-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- General Purpose Amplifiers

## Absolute maximum ratings at 25 °C

Reverse Gate Source & Reverse Gate Drain Voltage  
 Continuous Forward Gate Current  
 Continuous Device Power Dissipation  
 Power Derating

40 V  
 – 10 mA  
 310 mW  
 2.8 mW/°C

At 25°C free air temperature:  
 Static Electrical Characteristics

|                                   |               | 2N5460 |     | 2N5461 |     | 2N5462 |      | Process PJ32 |                                                                |
|-----------------------------------|---------------|--------|-----|--------|-----|--------|------|--------------|----------------------------------------------------------------|
|                                   |               | Min    | Max | Min    | Max | Min    | Max  | Unit         | Test Conditions                                                |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 40     |     | 40     |     | 40     |      | V            | $I_G = 10 \mu A$ , $V_{DS} = \emptyset V$                      |
| Gate Reverse Current              | $I_{GSS}$     |        | 5   |        | 5   |        | 5    | nA           | $V_{GS} = 20 V$ , $V_{DS} = \emptyset V$                       |
|                                   |               |        | 1   |        | 1   |        | 1    | $\mu A$      | $V_{GS} = 20 V$ , $V_{DS} = \emptyset V$ , $T_A = 100^\circ C$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 0.75   | 6   | 1      | 7.5 | 1.8    | 9    | V            | $V_{DS} = -15 V$ , $I_D = -1 \mu A$                            |
| Gate Source Voltage               | $V_{GS}$      | 0.8    | 4.5 |        |     |        |      | V            | $V_{DS} = -15 V$ , $I_D = -100 \mu A$                          |
|                                   |               |        |     | 0.8    | 4.5 |        |      | V            | $V_{DS} = -15 V$ , $I_D = -200 \mu A$                          |
|                                   |               |        |     |        |     | 1.5    | 6    | V            | $V_{DS} = -15 V$ , $I_D = -400 \mu A$                          |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 1    | – 5 | – 2    | – 9 | – 4    | – 16 | mA           | $V_{DS} = -15 V$ , $V_{GS} = \emptyset V$                      |

## Dynamic Electrical Characteristics

|                                              |              |   |     |     |     |   |     |                 |                                                               |                       |
|----------------------------------------------|--------------|---|-----|-----|-----|---|-----|-----------------|---------------------------------------------------------------|-----------------------|
| Drain Source ON Resistance                   | $r_{ds(on)}$ |   | 2   |     | 0.8 |   | 0.4 | k $\Omega$      | $V_{GS} = \emptyset V$ , $I_D = \emptyset A$                  | f = 1 kHz             |
| Common Source Forward Transadmittance        | $ Y_{fs} $   | 1 | 4   | 1.5 | 5   | 2 | 6   | mS              | $V_{DS} = -15 V$ , $V_{GS} = \emptyset V$                     | f = 1 kHz             |
| Common Source Output Admittance              | $ Y_{os} $   |   | 75  |     | 75  |   | 75  | $\mu S$         | $V_{DS} = -15 V$ , $V_{GS} = \emptyset V$                     | f = 1 kHz             |
| Common Source Input Capacitance              | $C_{iss}$    |   | 7   |     | 7   |   | 7   | pF              | $V_{DS} = -15 V$ , $V_{GS} = \emptyset V$                     | f = 1 MHz             |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$    |   | 2   |     | 2   |   | 2   | pF              | $V_{DS} = -15 V$ , $V_{GS} = \emptyset V$                     | f = 1 MHz             |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$  |   | 2.5 |     | 2.5 |   | 2.5 | dB              | $V_{DS} = -15 V$ , $V_{GS} = \emptyset V$                     | f = 100 Hz, BW = 1 Hz |
| Noise Figure                                 | NF           |   | 115 |     | 115 |   | 115 | nV/ $\sqrt{Hz}$ | $V_{DS} = -15 V$ , $V_{GS} = \emptyset V$ , $R_G = 1 M\Omega$ | f = 100 Hz            |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMP5460, SMP5461, SMP5462



# 2N5484, 2N5485, 2N5486

## N-Channel Silicon Junction Field-Effect Transistor

### • VHF/UHF Amplifiers

#### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                     |            |
|-------------------------------------|------------|
| Reverse Gate Source Voltage         | – 25 V     |
| Reverse Gate Drain Voltage          | – 25 V     |
| Continuous Device Power Dissipation | 360 mW     |
| Power Derating                      | 3.27 mW/°C |

#### At 25°C free air temperature: Static Electrical Characteristics

|                                   |               | 2N5484 |       | 2N5485 |       | 2N5486 |       | Process NJ26  |                                                                                   |
|-----------------------------------|---------------|--------|-------|--------|-------|--------|-------|---------------|-----------------------------------------------------------------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Min    | Max   | Unit          | Test Conditions                                                                   |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25   |       | – 25   |       | – 25   |       | V             | $I_G = 1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$                               |
| Gate Reverse Current              | $I_{GSS}$     |        | – 1   |        | – 1   |        | – 1   | nA            | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |        | – 0.2 |        | – 0.2 |        | – 0.2 | $\mu\text{A}$ | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 100^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.3  | – 3   | – 0.5  | – 4   | – 2    | – 6   | V             | $V_{DS} = 15\text{V}$ , $I_D = 10\text{ nA}$                                      |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 1      | 5     | 4      | 10    | 8      | 20    | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                              |

#### Dynamic Electrical Characteristics

|                                            |               |      |      |      |      |      |      |               |                                                      |             |
|--------------------------------------------|---------------|------|------|------|------|------|------|---------------|------------------------------------------------------|-------------|
| Forward Transconductance                   | $R_e(Y_{fs})$ | 2500 |      |      |      |      |      | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 100 MHz |
|                                            |               |      |      | 3000 |      | 3500 |      | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 400 MHz |
| Common Source Forward Transadmittance      | $Y_{fs}$      | 3000 | 6000 | 3500 | 7000 | 4000 | 8000 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 1 kHz   |
| Input Admittance                           | $R_e(Y_{is})$ |      | 100  |      |      |      |      | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 100 MHz |
|                                            |               |      |      |      | 1000 |      | 1000 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 400 MHz |
| Output Conductance                         | $R_e(Y_{os})$ |      | 75   |      |      |      |      | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 100 MHz |
|                                            |               |      |      |      | 100  |      | 100  | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 400 MHz |
| Common Source Output Admittance            | $Y_{os}$      |      | 50   |      | 60   |      | 75   | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 1 MHz   |
| Common Source Input Capacitance            | $C_{iss}$     |      | 5    |      | 5    |      | 5    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 1 MHz   |
| Common Source Reverse Transfer Capacitance | $C_{rss}$     |      | 1    |      | 1    |      | 1    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 1 MHz   |
| Output Capacitance                         | $C_{oss}$     |      | 2    |      | 2    |      | 2    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | f = 1 MHz   |

#### TO-226AA Package

Dimensions in Inches (mm)

#### Pin Configuration

1 Drain, 2 Source, 3 Gate

#### Surface Mount

SMP5484, SMP5485, SMP5486



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## 2N5911, 2N5912

## Dual N-Channel Silicon Junction Field-Effect Transistor

### • Wideband Differential Amplifiers

#### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                 |                  |
|---------------------------------|------------------|
| Continuous Forward Gate Current | 50 mA            |
| Total Device Power Dissipation  | 500 mW           |
| Power Derating                  | 4 mW/°C          |
| Storage Temperature Range       | -65°C to + 200°C |

#### At 25°C free air temperature:

##### Static Electrical Characteristics

|                                   |               | 2N5911 |       | 2N5912 |       | Process NJ30L or NJ36D |                                                        |                           |
|-----------------------------------|---------------|--------|-------|--------|-------|------------------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Unit                   | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | - 25   |       | - 25   |       | V                      | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |        | - 100 |        | - 100 | pA                     | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |        | - 250 |        | - 250 | nA                     | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 150^\circ\text{C}$ |
| Gate Operating Current            | $I_G$         |        | - 100 |        | - 100 | pA                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$             |                           |
|                                   |               |        | - 100 |        | - 100 | nA                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$             | $T_A = 125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | - 1    | - 5   | - 1    | - 5   | V                      | $V_{DS} = 10\text{V}$ , $I_D = 1\text{nA}$             |                           |
| Gate Source Voltage               | $V_{GS}$      | - 0.3  | - 4   | - 0.3  | - 4   | V                      | $V_{DS} = 10\text{V}$ , $I_D = 5\text{mA}$             |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 7      | 40    | 7      | 40    | mA                     | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |

##### Dynamic Electrical Characteristics

|                                              |                                          |      |       |      |       |                        |                                                                         |                                                         |
|----------------------------------------------|------------------------------------------|------|-------|------|-------|------------------------|-------------------------------------------------------------------------|---------------------------------------------------------|
| Common Source Forward Transconductance       | $g_{fs}$                                 | 5000 | 10000 | 5000 | 10000 | $\mu\text{S}$          | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 1\text{kHz}$                                       |
|                                              |                                          | 5000 | 10000 | 5000 | 10000 | $\mu\text{S}$          | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 100\text{MHz}$                                     |
| Common Source Output Conductance             | $g_{os}$                                 |      | 100   |      | 100   | $\mu\text{S}$          | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 1\text{kHz}$                                       |
|                                              |                                          |      | 150   |      | 150   | $\mu\text{S}$          | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 100\text{MHz}$                                     |
| Common Source Input Capacitance              | $C_{iss}$                                |      | 5     |      | 5     | pF                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 1\text{MHz}$                                       |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$                                |      | 1.2   |      | 1.2   | pF                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 1\text{MHz}$                                       |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$                              |      | 20    |      | 20    | nV/ $\sqrt{\text{Hz}}$ | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 10\text{kHz}$                                      |
| Noise Figure                                 | NF                                       |      | 1     |      | 1     | dB                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$<br>$R_G = 100\text{K}\Omega$ | $f = 10\text{kHz}$                                      |
| Differential Gate Current                    | $I_{G1} - I_{G2}$                        |      | 20    |      | 20    | nA                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $T_A = 125^\circ\text{C}$                               |
| Saturation Drain Current Ratio               | $I_{DSS1} / I_{DSS2}$                    | 0.95 | 1     | 0.95 | 1     |                        | $V_{DG} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$                    |                                                         |
| Differential Gate Source Voltage             | $ V_{GS1} - V_{GS2} $                    |      | 10    |      | 15    | mV                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              |                                                         |
| Gate Source Voltage Differential Drift       | $\Delta V_{GS1} - V_{GS2}$<br>$\Delta T$ |      | 20    |      | 40    | mV                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $T_A = 25^\circ\text{C}$ ,<br>$T_B = 125^\circ\text{C}$ |
|                                              |                                          |      | 20    |      | 40    | mV                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $T_A = -55^\circ\text{C}$ ,<br>$T_B = 25^\circ\text{C}$ |
| Transconductance Ratio                       | $g_{fs1} / g_{fs2}$                      | 0.9  | 1     | 0.85 | 1     |                        | $V_{DG} = 10\text{V}$ , $I_D = 5\text{mA}$                              | $f = 1\text{kHz}$                                       |

#### SOIC-8 Package

See Section G for Outline Dimensions

#### Pin Configuration

1 Source 1, 2 Drain 1, 3 Gate 1, 4 N/C,  
5 Source 2, 6 Drain 2, 7 Gate 2, 8 Omitted

#### TO-78 Package

See Section G for Outline Dimensions

#### Pin Configuration

1 Source 1, 2 Drain 1, 3 Gate 1,  
4 Case, 5 Source 2, 6 Drain 2,  
7 Gate 2, 8 Omitted

#### Surface Mount

SMP5911, SMP5912



## 2N6449, 2N6450

## N-Channel Silicon Junction Field-Effect Transistor

## • High Voltage

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                     | 2N6449    | 2N6450    |
|-------------------------------------|-----------|-----------|
| Reverse Gate Source Voltage         | – 300 V   | – 200 V   |
| Reverse Gate Drain Voltage          | – 300 V   | – 200 V   |
| Continuous Forward Gate Current     | 10 mA     | 10 mA     |
| Continuous Device Power Dissipation | 800 mW    | 800 mW    |
| Power Derating                      | 6.4 mW/°C | 6.4 mW/°C |

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N6449 |       | 2N6450 |       | Process NJ42  |                                                                                    |
|-----------------------------------|---------------|--------|-------|--------|-------|---------------|------------------------------------------------------------------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Unit          | Test Conditions                                                                    |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 300  |       | – 200  |       | V             | $I_G = -10\text{ }\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$                      |
| Gate Reverse Current              | $I_{GSS}$     |        | – 100 |        |       | nA            | $V_{GS} = -150\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |        |       |        | – 100 | nA            | $V_{GS} = -100\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |        | – 100 |        |       | $\mu\text{A}$ | $V_{GS} = -150\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 150^\circ\text{C}$ |
|                                   |               |        |       |        | – 100 | $\mu\text{A}$ | $V_{GS} = -100\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 2    | – 15  | – 2    | – 15  | V             | $V_{DS} = 30\text{V}$ , $I_D = 4\text{ nA}$                                        |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 2      | 10    | 2      | 10    | mA            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$                               |

## Dynamic Electrical Characteristics

|                                            |           |     |     |     |     |               |                                                      |                    |
|--------------------------------------------|-----------|-----|-----|-----|-----|---------------|------------------------------------------------------|--------------------|
| Common Source Forward Transfer Admittance  | $Y_{fs}$  | 0.5 | 3   | 0.5 | 3   | mS            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance           | $Y_{os}$  |     | 100 |     | 100 | $\mu\text{S}$ | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |     | 20  |     | 20  | pF            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |     | 2.5 |     | 2.5 | pF            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |

## TO-39 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case

## 2N6451, 2N6452

## N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- Low-Noise, High Gain Amplifiers
- Low-Noise Preamplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                     | 2N6451     | 2N6452     |
|-------------------------------------|------------|------------|
| Reverse Gate Source Voltage         | – 20 V     | – 25 V     |
| Reverse Gate Drain Voltage          | – 20 V     | – 25 V     |
| Continuous Forward Gate Current     | 10 mA      | 10 mA      |
| Continuous Device Power Dissipation | 360 mW     | 360 mW     |
| Power Derating                      | 2.88 mW/°C | 2.88 mW/°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N6451 |       | 2N6452 |       | Process NJ132L |                                                                                   |
|-----------------------------------|---------------|--------|-------|--------|-------|----------------|-----------------------------------------------------------------------------------|
|                                   |               | Min    | Max   | Min    | Max   | Unit           | Test Conditions                                                                   |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | – 25   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$                            |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 |        |       | nA             | $V_{GS} = -10\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |        |       |        | – 0.5 | nA             | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |        | – 0.2 |        |       | $\mu\text{A}$  | $V_{GS} = -10\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 125^\circ\text{C}$ |
|                                   |               |        |       |        | – 1   | $\mu\text{A}$  | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.5  | – 3.5 | – 0.5  | – 3.5 | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.5\ \text{nA}$                                    |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      | 20    | 5      | 20    | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$                              |

## Dynamic Electrical Characteristics

|                                              |             |    |     |    |     |                        |                                                                            |                      |
|----------------------------------------------|-------------|----|-----|----|-----|------------------------|----------------------------------------------------------------------------|----------------------|
| Common Source Forward Transmittance          | $ Y_{fs} $  | 15 | 30  | 15 | 30  | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$                               | $f = 1\ \text{kHz}$  |
|                                              |             |    |     |    |     | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 15\ \text{mA}$                              | $f = 1\ \text{kHz}$  |
| Common Source Output Conductance             | $ Y_{os} $  |    | 50  |    | 50  | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$                               | $f = 1\ \text{kHz}$  |
|                                              |             |    |     |    |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 15\ \text{mA}$                              | $f = 1\ \text{kHz}$  |
| Common Source Input Capacitance              | $C_{iss}$   |    | 25  |    | 25  | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$                               | $f = 1\ \text{kHz}$  |
|                                              |             |    |     |    |     | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 15\ \text{mA}$                              | $f = 1\ \text{kHz}$  |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |    | 5   |    | 5   | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$                               | $f = 1\ \text{kHz}$  |
|                                              |             |    |     |    |     | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 15\ \text{mA}$                              | $f = 1\ \text{kHz}$  |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |    | 5   |    | 10  | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$                               | $f = 10\ \text{kHz}$ |
|                                              |             |    | 3   |    | 8   | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$                               | $f = 1\ \text{kHz}$  |
| Noise Figure                                 | NF          |    | 1.5 |    | 2.5 | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$<br>$R_G = 10\ \text{k}\Omega$ | $f = 10\ \text{Hz}$  |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



## 2N6453, 2N6454

## N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- Low-Noise, High Gain Amplifiers
- Low-Noise Preamplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                     | 2N6453     | 2N6454     |
|-------------------------------------|------------|------------|
| Reverse Gate Source Voltage         | -20 V      | -25 V      |
| Reverse Gate Drain Voltage          | -20 V      | -25 V      |
| Continuous Forward Gate Current     | 10 mA      | 10 mA      |
| Continuous Device Power Dissipation | 360 mW     | 360 mW     |
| Power Derating                      | 2.88 mW/°C | 2.88 mW/°C |

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | 2N6453 |      | 2N6454 |      | Process NJ132L |                                                                           |
|-----------------------------------|---------------|--------|------|--------|------|----------------|---------------------------------------------------------------------------|
|                                   |               | Min    | Max  | Min    | Max  | Unit           | Test Conditions                                                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | -20    |      | -25    |      | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$                            |
| Gate Reverse Current              | $I_{GSS}$     |        | -0.1 |        |      | nA             | $V_{GS} = -10\text{V}$ , $V_{DS} = 0\text{V}$                             |
|                                   |               |        |      |        | -0.5 | nA             | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$                             |
|                                   |               |        | -0.2 |        |      | $\mu\text{A}$  | $V_{GS} = -10\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 125^\circ\text{C}$ |
|                                   |               |        |      |        | -1   | $\mu\text{A}$  | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = 125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | -0.75  | -5   | -0.75  | -5   | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.5\text{ nA}$                             |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 15     | 50   | 15     | 50   | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                              |

## Dynamic Electrical Characteristics

|                                              |             |    |     |    |     |                        |                                                                          |                     |
|----------------------------------------------|-------------|----|-----|----|-----|------------------------|--------------------------------------------------------------------------|---------------------|
| Common Source Forward Transmittance          | $ Y_{fs} $  |    |     |    |     | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$                              | $f = 1\text{ kHz}$  |
|                                              |             | 20 | 40  | 20 | 40  | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 15\text{ mA}$                             | $f = 1\text{ kHz}$  |
| Common Source Output Conductance             | $ Y_{os} $  |    |     |    |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$                              | $f = 1\text{ kHz}$  |
|                                              |             |    | 100 |    | 100 | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 15\text{ mA}$                             | $f = 1\text{ kHz}$  |
| Common Source Input Capacitance              | $C_{iss}$   |    |     |    |     | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$                              | $f = 1\text{ kHz}$  |
|                                              |             |    | 25  |    | 25  | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 15\text{ mA}$                             | $f = 1\text{ kHz}$  |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |    |     |    |     | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$                              | $f = 1\text{ kHz}$  |
|                                              |             |    | 5   |    | 5   | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 15\text{ mA}$                             | $f = 1\text{ kHz}$  |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |    | 5   |    | 10  | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$                              | $f = 10\text{ kHz}$ |
|                                              |             |    | 3   |    | 8   | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$                              | $f = 1\text{ kHz}$  |
| Noise Figure                                 | NF          |    | 1.5 |    | 2.5 | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$<br>$R_G = 10\text{ k}\Omega$ | $f = 10\text{ Hz}$  |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



## 2N6550

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                  |
|--------------------------------------------------|------------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V           |
| Continuous Forward Gate Current                  | 50 mA            |
| Continuous Device Power Dissipation              | 400 mW           |
| Power Derating                                   | 2.3 mW/°C        |
| Junction Temperature (Operating & Storage)       | – 65°C to +200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                          |               | 2N6550 |     |       | Process NJ450L |                                                        |                          |
|------------------------------------------|---------------|--------|-----|-------|----------------|--------------------------------------------------------|--------------------------|
|                                          |               | Min    | Typ | Max   | Unit           | Test Conditions                                        |                          |
| Gate Source Breakdown Voltage            | $V_{(BR)GSS}$ | – 20   |     |       | V              | $I_G = 10\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                          |
| Gate Leakage Current                     | $I_{GSS}$     |        |     | – 3   | nA             | $V_{GS} = -10\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                          |
|                                          |               |        |     | – 0.1 | $\mu\text{A}$  | $V_{GS} = -10\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 85^\circ\text{C}$ |
| Zero Gate Voltage Drain Current (Pulsed) | $I_{DSS}$     | 10     | 100 | 250   | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                          |
| Gate Source Cutoff Voltage               | $V_{GS(OFF)}$ | – 0.3  |     | – 3   | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.1\text{ mA}$          |                          |

## Dynamic Electrical Characteristics

|                                              |                   |    |     |     |                        |                                                      |                                        |
|----------------------------------------------|-------------------|----|-----|-----|------------------------|------------------------------------------------------|----------------------------------------|
| Transconductance                             | $g_{fs}$          | 25 |     | 150 | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$         | $f = 1\text{ kHz}$                     |
| Common Source Output Conductance             | $ Y_{os} $        |    |     | 150 | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$         | $f = 1\text{ kHz}$                     |
| Common Source Input Capacitance              | $C_{iss}$         |    | 30  | 35  | pF                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$         | $f = 140\text{ kHz}$                   |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$         |    | 10  | 20  | pF                     | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 140\text{ kHz}$                   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$       |    | 1.4 | 2   | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 5\text{V}$ , $I_D = 10\text{ mA}$          | $f = 1\text{ kHz}$                     |
|                                              |                   |    | 6   | 10  | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 5\text{V}$ , $I_D = 10\text{ mA}$          | $f = 10\text{ Hz}$                     |
|                                              | $\bar{e}_N$ Total |    | 0.4 | 0.6 | $\mu\text{Vrms}$       | $V_{DS} = 5\text{V}$ , $I_D = 10\text{ mA}$          | $f = 10\text{ kHz}$ to $20\text{ kHz}$ |
| Equivalent Open Circuit Input Noise Current  | $\bar{i}_N$       |    | 0.1 |     | pA/ $\sqrt{\text{Hz}}$ | $R_S < 100\text{ K}\Omega$                           | $f = 1\text{ kHz}$                     |

## TO-46 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate &amp; Case



## IF140, IF140A

## N-Channel Silicon Junction Field-Effect Transistor

• Low-Noise, High Gain Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 375 mW          |
| Power Derating                                   | 3 mW/°C         |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF140 |       | IF140A |       | Process NJ14AL |                                                                         |
|-----------------------------------|---------------|-------|-------|--------|-------|----------------|-------------------------------------------------------------------------|
|                                   |               | Min   | Max   | Min    | Max   | Unit           | Test Conditions                                                         |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20  |       | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$                          |
| Gate Reverse Current              | $I_{GSS}$     |       | – 0.1 |        | – 0.1 | nA             | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$                           |
|                                   |               |       | – 0.2 |        | – 0.2 | nA             | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$ $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ |       | – 6   |        | – 6   | V              | $V_{DS} = 15\text{V}$ , $I_D = 5\text{ nA}$                             |
| Gate Source Voltage               | $V_{GS}$      |       | – 5   | – 2.5  | – 6   | V              | $V_{DS} = 15\text{V}$ , $I_D = 50\ \mu\text{A}$                         |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |       | 1     |        | 1     | V              | $V_{DS} = 0$ , $I_G = 1\text{ mA}$                                      |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5     | 15    | 5      | 15    | mA             | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$                            |

## Dynamic Electrical Characteristics

|                                            |           |     |      |     |      |               |                                              |                    |
|--------------------------------------------|-----------|-----|------|-----|------|---------------|----------------------------------------------|--------------------|
| Common Source Forward Transmittance        | $Y_{fs}$  | 4.5 |      | 4.5 |      | mS            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance           | $Y_{os}$  |     | 0.05 |     | 0.05 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |     | 3    |     | 3    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |     | 0.6  |     | 0.6  | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$ |

Typ

Typ

|                                              |             |   |   |                        |                                              |                    |
|----------------------------------------------|-------------|---|---|------------------------|----------------------------------------------|--------------------|
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 4 | 4 | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 12\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 10\text{ Hz}$ |
|----------------------------------------------|-------------|---|---|------------------------|----------------------------------------------|--------------------|

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case

# N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 375 mW          |
| Power Derating                                   | 3 mW/°C         |
| Storage Temperature Range                        | – 65°C to 200°C |

### At 25°C free air temperature:

#### Static Electrical Characteristics

|                                   |               | IF142 |       | Process NJ14AL |                                                        |                           |
|-----------------------------------|---------------|-------|-------|----------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min   | Max   | Unit           | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25  |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |       | – 0.1 | nA             | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |       | – 0.2 | nA             | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ |       | – 6   | V              | $V_{DS} = 15\text{V}$ , $I_D = 5\text{ nA}$            |                           |
| Gate Source Voltage               | $V_{GS}$      |       | – 5   | V              | $V_{DS} = 15\text{V}$ , $I_D = 50\ \mu\text{A}$        |                           |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |       | 1     | V              | $V_{DS} = \emptyset$ , $I_G = 1\text{ mA}$             |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5     | 15    | mA             | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |

#### Dynamic Electrical Characteristics

|                                            |           |     |      |               |                                                      |                    |
|--------------------------------------------|-----------|-----|------|---------------|------------------------------------------------------|--------------------|
| Common Source Forward Transmittance        | $Y_{fs}$  | 3.5 |      | mS            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance           | $Y_{os}$  |     | 0.05 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |     | 3    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |     | 0.6  | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |

#### Typ

|                                              |             |   |                        |                                                      |                    |
|----------------------------------------------|-------------|---|------------------------|------------------------------------------------------|--------------------|
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 4 | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 12\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 10\text{ Hz}$ |
|----------------------------------------------|-------------|---|------------------------|------------------------------------------------------|--------------------|

**TO-236AB Package**  
Dimensions in Inches (mm)

**Pin Configuration**  
1 Drain, 2 Source, 3 Gate



## IF1320

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 225 mW          |
| Power Derating                                   | 1.8 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF1320 |       | Process NJ132L |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 1.5 | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      | 20    | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                               |           |    |    |    |                                              |                     |
|-----------------------------------------------|-----------|----|----|----|----------------------------------------------|---------------------|
| Common Source<br>Forward Transconductance     | $g_{fs}$  | 15 |    | mS | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance               | $C_{iss}$ |    | 20 | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |
| Common Source<br>Reverse Transfer Capacitance | $C_{rss}$ |    | 5  | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |

## Typ

|                                                 |             |     |        |                                              |                     |
|-------------------------------------------------|-------------|-----|--------|----------------------------------------------|---------------------|
| Equivalent Short Circuit<br>Input Noise Voltage | $\bar{e}_N$ | 2.5 | nV/√Hz | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
|-------------------------------------------------|-------------|-----|--------|----------------------------------------------|---------------------|

## TO-236AB Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate



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## IF1330

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 225 mW          |
| Power Derating                                   | 1.8 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF1330 |       | Process NJ132H |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 1.5 | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      | 20    | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                            |           |    |    |    |                                              |                     |
|--------------------------------------------|-----------|----|----|----|----------------------------------------------|---------------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 10 |    | mS | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |    | 20 | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |    | 5  | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |

## Typ

|                                              |             |     |  |                        |                                              |                     |
|----------------------------------------------|-------------|-----|--|------------------------|----------------------------------------------|---------------------|
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 2.5 |  | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
|----------------------------------------------|-------------|-----|--|------------------------|----------------------------------------------|---------------------|

TO-236AB Package  
Dimensions in Inches (mm)

Pin Configuration  
1 Drain, 2 Source, 3 Gate

## IF1331

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 225 mW          |
| Power Derating                                   | 1.8 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF1331 |       | Process NJ132H |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 1.5 | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      | 20    | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                               |           |    |    |    |                                              |                     |
|-----------------------------------------------|-----------|----|----|----|----------------------------------------------|---------------------|
| Common Source<br>Forward Transconductance     | $g_{fs}$  | 10 |    | mS | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance               | $C_{iss}$ |    | 20 | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |
| Common Source<br>Reverse Transfer Capacitance | $C_{rss}$ |    | 5  | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |

## Typ

|                                                 |             |     |        |                                              |                     |
|-------------------------------------------------|-------------|-----|--------|----------------------------------------------|---------------------|
| Equivalent Short Circuit<br>Input Noise Voltage | $\bar{e}_N$ | 2.5 | nV/√Hz | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
|-------------------------------------------------|-------------|-----|--------|----------------------------------------------|---------------------|

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



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## IF1801

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings =  $T_A$  at 25 °C

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source Voltage & Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 300 mW          |
| Power Derating                                   | 2 mW/°C         |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF1801 |       | Process NJ1800DL |                                           |  |
|-----------------------------------|---------------|--------|-------|------------------|-------------------------------------------|--|
|                                   |               | Min    | Max   | Unit             | Test Conditions                           |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V                | $I_G = -1 \mu A$ , $V_{DS} = \emptyset V$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA               | $V_{GS} = -10 V$ , $V_{DS} = \emptyset V$ |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 2   | V                | $V_{DS} = 10 V$ , $I_D = 0.5 nA$          |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 30     |       | mA               | $V_{DS} = 10 V$ , $V_{GS} = \emptyset V$  |  |

## Dynamic Electrical Characteristics

|                                            |           |    |     |    |                                |             |
|--------------------------------------------|-----------|----|-----|----|--------------------------------|-------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 50 |     | mS | $V_{DS} = 10 V$ , $I_D = 5 mA$ | $f = 1 kHz$ |
| Common Source Input Capacitance            | $C_{iss}$ |    | 100 | pF | $V_{DS} = 10 V$ , $I_D = 5 mA$ | $f = 1 MHz$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |    | 50  | pF | $V_{DS} = 10 V$ , $I_D = 5 mA$ | $f = 1 MHz$ |

## Typ

|                                              |             |     |  |                 |                               |             |
|----------------------------------------------|-------------|-----|--|-----------------|-------------------------------|-------------|
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 0.5 |  | nV/ $\sqrt{Hz}$ | $V_{DG} = 4 V$ , $I_D = 5 mA$ | $f = 1 kHz$ |
|----------------------------------------------|-------------|-----|--|-----------------|-------------------------------|-------------|

## TO-52 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case



## IF3601

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings =  $T_A$  at 25°C

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source Voltage & Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 300 mW          |
| Power Derating                                   | 2 mW/°C         |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF3601 |       | Process NJ3600L |                                           |  |
|-----------------------------------|---------------|--------|-------|-----------------|-------------------------------------------|--|
|                                   |               | Min    | Max   | Unit            | Test Conditions                           |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V               | $I_G = -1 \mu A$ , $V_{DS} = \emptyset V$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA              | $V_{GS} = -10 V$ , $V_{DS} = \emptyset V$ |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 2   | V               | $V_{DS} = 10 V$ , $I_D = 0.5 nA$          |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 30     |       | mA              | $V_{DS} = 10 V$ , $V_{GS} = \emptyset V$  |  |

## Dynamic Electrical Characteristics

## Typ

|                                              |             |     |                 |                                          |              |
|----------------------------------------------|-------------|-----|-----------------|------------------------------------------|--------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 750 | mS              | $V_{DS} = 10 V$ , $V_{GS} = \emptyset V$ | $f = 1 kHz$  |
| Common Source Input Capacitance              | $C_{iss}$   | 300 | pF              | $V_{DS} = \emptyset V$ , $V_{GS} = -4 V$ | $f = 1 MHz$  |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   | 200 | pF              | $V_{DS} = \emptyset V$ , $V_{GS} = -4 V$ | $f = 1 MHz$  |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 0.3 | nV/ $\sqrt{Hz}$ | $V_{DG} = 3 V$ , $I_D = 5 mA$            | $f = 100 Hz$ |

## TO-39 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case



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## Dual N-Channel Silicon Junction Field-Effect Transistor

### • Low-Noise, High Gain Amplifier

#### Absolute maximum ratings = $T_A$ at 25 °C

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source Voltage & Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 300 mW          |
| Power Derating                                   | 4 mW/°C         |
| Storage Temperature Range                        | – 65°C to 200°C |

#### At 25°C free air temperature:

##### Static Electrical Characteristics

|                                   |               | IF3602 |       | Process NJ3600L |                                        |  |
|-----------------------------------|---------------|--------|-------|-----------------|----------------------------------------|--|
|                                   |               | Min    | Max   | Unit            | Test Conditions                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V               | $I_G = -1 \mu A, V_{DS} = \emptyset V$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.5 | nA              | $V_{GS} = -10 V, V_{DS} = \emptyset V$ |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 3   | V               | $V_{DS} = 10 V, I_D = 0.5 nA$          |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 30     |       | mA              | $V_{DS} = 10 V, V_{GS} = \emptyset V$  |  |

##### Dynamic Electrical Characteristics

##### Typ

|                                              |             |     |                        |                                       |                      |
|----------------------------------------------|-------------|-----|------------------------|---------------------------------------|----------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 750 | mS                     | $V_{DS} = 10 V, V_{GS} = \emptyset V$ | $f = 1 \text{ kHz}$  |
| Common Source Input Capacitance              | $C_{iss}$   | 300 | pF                     | $V_{DS} = \emptyset V, V_{GS} = -4 V$ | $f = 1 \text{ MHz}$  |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   | 200 | pF                     | $V_{DS} = \emptyset V, V_{GS} = -4 V$ | $f = 1 \text{ MHz}$  |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 0.3 | nV/ $\sqrt{\text{Hz}}$ | $V_{DG} = 3 V, I_D = 5 \text{ mA}$    | $f = 100 \text{ Hz}$ |

##### Max

|                                  |                       |     |    |                                       |  |
|----------------------------------|-----------------------|-----|----|---------------------------------------|--|
| Differential Gate Source Voltage | $ V_{GS1} - V_{GS2} $ | 100 | mV | $V_{DS} = 10 V, V_{GS} = \emptyset V$ |  |
|----------------------------------|-----------------------|-----|----|---------------------------------------|--|

#### TO-78 Package

Dimensions in Inches (mm)

#### Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Omitted,  
5 Source, 6 Drain, 7 Gate, 8 Omitted



## IF4500

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 225 mW          |
| Power Derating                                   | 1.8 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF4500 |       | Process NJ450L |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 1.5 | V              | $V_{DS} = 15\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      |       | mA             | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                               |           |    |    |    |                                                      |                     |
|-----------------------------------------------|-----------|----|----|----|------------------------------------------------------|---------------------|
| Common Source<br>Forward Transconductance     | $g_{fs}$  | 15 |    | mS | $V_{DS} = 15\text{V}$ , $I_D = 5\ \text{mA}$         | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance               | $C_{iss}$ |    | 35 | pF | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |
| Common Source<br>Reverse Transfer Capacitance | $C_{rss}$ |    | 8  | pF | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |

## Typ

|                                                 |             |     |  |        |                                                      |                     |
|-------------------------------------------------|-------------|-----|--|--------|------------------------------------------------------|---------------------|
| Equivalent Short Circuit<br>Input Noise Voltage | $\bar{e}_N$ | 1.5 |  | nV/√Hz | $V_{DS} = 12\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$ |
|-------------------------------------------------|-------------|-----|--|--------|------------------------------------------------------|---------------------|

## TO-236AB Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate



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## IF4501

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 300 mW          |
| Power Derating                                   | 2.4 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF4501 |       | Process NJ450L |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{GS} = -10\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 1.5 | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      |       | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                            |           |    |    |    |                                              |                     |
|--------------------------------------------|-----------|----|----|----|----------------------------------------------|---------------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 15 |    | mS | $V_{DS} = 15\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |    | 35 | pF | $V_{DS} = 15\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |    | 9  | pF | $V_{DS} = 15\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{MHz}$ |

## Typ

|                                              |             |     |  |                        |                                              |                     |
|----------------------------------------------|-------------|-----|--|------------------------|----------------------------------------------|---------------------|
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 1.5 |  | nV/ $\sqrt{\text{Hz}}$ | $V_{DG} = 12\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
|----------------------------------------------|-------------|-----|--|------------------------|----------------------------------------------|---------------------|

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



## IF4510

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 300 mW          |
| Power Derating                                   | 1.8 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF4510 |       | Process NJ450H |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 1.5 | V              | $V_{DS} = 15\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      |       | mA             | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                               |           |    |    |    |                                                      |                     |
|-----------------------------------------------|-----------|----|----|----|------------------------------------------------------|---------------------|
| Common Source<br>Forward Transconductance     | $g_{fs}$  | 15 |    | mS | $V_{DS} = 15\text{V}$ , $I_D = 5\ \text{mA}$         | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance               | $C_{iss}$ |    | 35 | pF | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |
| Common Source<br>Reverse Transfer Capacitance | $C_{rss}$ |    | 8  | pF | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |

## Typ

|                                                 |             |     |  |        |                                                      |                     |
|-------------------------------------------------|-------------|-----|--|--------|------------------------------------------------------|---------------------|
| Equivalent Short Circuit<br>Input Noise Voltage | $\bar{e}_N$ | 1.5 |  | nV/√Hz | $V_{DG} = 12\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$ |
|-------------------------------------------------|-------------|-----|--|--------|------------------------------------------------------|---------------------|

## TO-236AB Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate



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## IF4511

## N-Channel Silicon Junction Field-Effect Transistor

## • Audio Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 300 mW          |
| Power Derating                                   | 1.8 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF4511 |       | Process NJ450H |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 1.5 | V              | $V_{DS} = 15\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5      |       | mA             | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                            |           |    |    |    |                                                      |                     |
|--------------------------------------------|-----------|----|----|----|------------------------------------------------------|---------------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 15 |    | mS | $V_{DS} = 15\text{V}$ , $I_D = 5\ \text{mA}$         | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |    | 35 | pF | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |    | 8  | pF | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |

## Typ

|                                              |             |     |  |        |                                                      |                     |
|----------------------------------------------|-------------|-----|--|--------|------------------------------------------------------|---------------------|
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 1.5 |  | nV/√Hz | $V_{DG} = 12\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$ |
|----------------------------------------------|-------------|-----|--|--------|------------------------------------------------------|---------------------|

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



## IF9030

## N-Channel Silicon Junction Field-Effect Transistor

## • Low-Noise, High Gain Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 10 mA           |
| Continuous Device Power Dissipation              | 300 mW          |
| Power Derating                                   | 2.4 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IF9030 |       | Process NJ903L |                                                        |  |
|-----------------------------------|---------------|--------|-------|----------------|--------------------------------------------------------|--|
|                                   |               | Min    | Max   | Unit           | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 20   |       | V              | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |        | – 0.1 | nA             | $V_{GS} = -10\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.35 | – 2   | V              | $V_{DS} = 10\text{V}$ , $I_D = 0.5\ \text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 30     | 300   | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

## Dynamic Electrical Characteristics

|                                            |           |    |    |    |                                                      |                     |
|--------------------------------------------|-----------|----|----|----|------------------------------------------------------|---------------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 80 |    | mS | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$ |    | 60 | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$         | $f = 1\ \text{MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |    | 20 | pF | $V_{DS} = 10\text{V}$ , $I_D = 5\ \text{mA}$         | $f = 1\ \text{MHz}$ |

## Typ

|                                              |             |     |        |                                             |                     |
|----------------------------------------------|-------------|-----|--------|---------------------------------------------|---------------------|
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ | 0.5 | nV/√Hz | $V_{DG} = 4\text{V}$ , $I_D = 5\ \text{mA}$ | $f = 1\ \text{kHz}$ |
|----------------------------------------------|-------------|-----|--------|---------------------------------------------|---------------------|

## TO-52 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case

# IFN421, IFN422, IFN423

## Dual N-Channel Silicon Junction Field-Effect Transistor

- Very High Input Impedance Differential Amplifiers
- Electrometers

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                                    |                 |
|----------------------------------------------------|-----------------|
| Device Dissipation (Derate 3.2 mW/°C to 50°C)      | 400 mW          |
| Total Device Dissipation (Derate 6 mW/°C to 150°C) | 750 mW          |
| Storage Temperature Range                          | – 65°C to 200°C |

### At 25°C free air temperature:

#### Static Electrical Characteristics

|                                   |               | IFN421, IFN422, IFN423 |      |        | Process NJ01  |                                                                 |                            |
|-----------------------------------|---------------|------------------------|------|--------|---------------|-----------------------------------------------------------------|----------------------------|
|                                   |               | Min                    | Typ  | Max    | Unit          | Test Conditions                                                 |                            |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 40                   | – 60 |        | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$                  |                            |
| Gate to Gate Breakdown Voltage    | $BV_{G1G2}$   | $\pm 40$               |      |        | V             | $I_G = -1\ \mu\text{A}$ , $I_D = 0\text{A}$ , $I_S = 0\text{A}$ |                            |
| Gate Reverse Current              | $I_{GSS}$     |                        |      | – 1    | pA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$                   |                            |
|                                   |               |                        |      | – 1    | nA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$                   | $T_A = +125^\circ\text{C}$ |
| Gate Operating Current            | $I_G$         |                        |      | – 0.25 | pA            | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                 |                            |
|                                   |               |                        |      | – 250  | pA            | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                 | $T_A = +125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.4                  |      | – 2    | V             | $V_{DS} = 10\text{V}$ , $I_D = 1\ \text{nA}$                    |                            |
| Gate Source Voltage               | $V_{GS}$      |                        |      | – 1.8  | V             | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                 |                            |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 60                     |      | 1000   | $\mu\text{A}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                    |                            |

#### Dynamic Electrical Characteristics

|                                            |             |     |    |      |                        |                                                                               |                     |
|--------------------------------------------|-------------|-----|----|------|------------------------|-------------------------------------------------------------------------------|---------------------|
| Common Source Forward Transconductance     | $g_{fs}$    | 100 |    | 1500 | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                                  | $f = 1\ \text{kHz}$ |
| Common Source Output Conductance           | $g_{os}$    |     |    | 3    | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                               | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$   |     |    | 3    | pF                     | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                                  | $f = 1\ \text{MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$   |     |    | 1.5  | pF                     | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                                  | $f = 1\ \text{MHz}$ |
| Equivalent Circuit Input Noise Voltage     | $\bar{e}_N$ |     | 20 | 70   | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                               | $f = 10\ \text{Hz}$ |
| Noise Figure                               | NF          |     |    | 1    | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$<br>$R_G = 10\ \text{M}\Omega$ | $f = 10\ \text{Hz}$ |

#### Max - IFN421 IFN422 IFN423

|                                                   |                                        |    |    |    |                              |                                                 |                                                                                    |
|---------------------------------------------------|----------------------------------------|----|----|----|------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------|
| Differential Gate Source Voltage                  | $ V_{GS1} - V_{GS2} $                  | 10 | 15 | 25 | mV                           | $V_{DG} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$ |                                                                                    |
| Differential Gate Source Voltage With Temperature | $\frac{ V_{GS1} - V_{GS2} }{\Delta T}$ | 10 | 25 | 40 | $\mu\text{V}/^\circ\text{C}$ | $V_{DG} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$ | $T_A = -55^\circ\text{C}$<br>$T_B = 25^\circ\text{C}$<br>$T_C = 125^\circ\text{C}$ |

#### Min - IFN421 IFN422 IFN423

|                             |      |    |    |    |    |                                                                |  |
|-----------------------------|------|----|----|----|----|----------------------------------------------------------------|--|
| Common Mode Rejection Ratio | CMRR | 90 | 80 | 80 | dB | $V_{DG} = 10\text{V to } 20\text{V}$ , $I_D = 30\ \mu\text{A}$ |  |
|-----------------------------|------|----|----|----|----|----------------------------------------------------------------|--|

### TO-78 Package

See Section G for Outline Dimensions

### Pin Configuration

1 Source 1, 2 Drain 1, 3 Gate 1, 4 Case,  
5 Source 2, 6 Drain 2, 7 Gate 2,  
8 Omitted



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# IFN424, IFN425, IFN426

## Dual N-Channel Silicon Junction Field-Effect Transistor

- Very High Impedance Differential Amplifiers
- Electrometers

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                                     |                   |
|-----------------------------------------------------|-------------------|
| Device Dissipation (Derate 3.2 mW/°C to 50°C)       | 400 mW            |
| Total Device Dissipation (Derate 6 mW/°C to 150 °C) | 750 mW            |
| Storage Temperature Range                           | - 60 °C to 200 °C |

### At 25°C free air temperature:

#### Static Electrical Characteristics

|                                   |               | IFN424, IFN425, IFN426 |      |       | Process NJ01  |                                                                 |  |
|-----------------------------------|---------------|------------------------|------|-------|---------------|-----------------------------------------------------------------|--|
|                                   |               | Min                    | Typ  | Max   | Unit          | Test Conditions                                                 |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | - 40                   | - 60 |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$                  |  |
| Gate to Gate Breakdown Voltage    | $BV_{G1G2}$   | $\pm 40$               |      |       | V             | $I_G = -1\ \mu\text{A}$ , $I_D = 0\text{A}$ , $I_S = 0\text{A}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |                        |      | - 3   | pA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$                   |  |
|                                   |               |                        |      | - 3   | nA            | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$                   |  |
| Gate Operating Current            | $I_G$         |                        |      | - 0.5 | pA            | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                 |  |
|                                   |               |                        |      | - 500 | pA            | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                 |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | - 0.4                  |      | - 3   | V             | $V_{DS} = 10\text{V}$ , $I_D = 1\ \text{nA}$                    |  |
| Gate Source Voltage               | $V_{GS}$      |                        |      | - 2.9 | V             | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                 |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 60                     | 1800 |       | $\mu\text{A}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                    |  |

#### Dynamic Electrical Characteristics

|                                              |             |     |    |      |               |                                                                              |                     |
|----------------------------------------------|-------------|-----|----|------|---------------|------------------------------------------------------------------------------|---------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 100 |    | 1500 | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                                 | $f = 1\ \text{kHz}$ |
| Common Source Output Conductance             | $g_{os}$    |     |    | 3    | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                              | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |     |    | 3    | pF            | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                                 | $f = 1\ \text{MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |     |    | 1.5  | pF            | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                                 | $f = 1\ \text{MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |     | 20 | 70   | nV/√Hz        | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$                              | $f = 10\ \text{Hz}$ |
| Noise Figure                                 | NF          |     |    | 1    | dB            | $V_{DS} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$<br>$R_G = 1\ \text{M}\Omega$ | $f = 10\ \text{Hz}$ |

#### Max - IFN424 IFN425 IFN426

|                                                   |                                        |    |    |    |                              |                                                 |                                                                                    |
|---------------------------------------------------|----------------------------------------|----|----|----|------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------|
| Differential Gate Source Voltage                  | $ V_{GS1} - V_{GS2} $                  | 10 | 15 | 25 | mV                           | $V_{DG} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$ |                                                                                    |
| Differential Gate Source Voltage With Temperature | $\frac{ V_{GS1} - V_{GS2} }{\Delta T}$ | 10 | 25 | 40 | $\mu\text{V}/^\circ\text{C}$ | $V_{DG} = 10\text{V}$ , $I_D = 30\ \mu\text{A}$ | $T_A = -55^\circ\text{C}$<br>$T_B = 25^\circ\text{C}$<br>$T_C = 125^\circ\text{C}$ |

#### Min - IFN424 IFN425 IFN426

|                             |      |    |    |    |    |                                                                |  |
|-----------------------------|------|----|----|----|----|----------------------------------------------------------------|--|
| Common Mode Rejection Ratio | CMRR | 90 | 80 | 80 | dB | $V_{DG} = 10\text{V to } 20\text{V}$ , $I_D = 30\ \mu\text{A}$ |  |
|-----------------------------|------|----|----|----|----|----------------------------------------------------------------|--|

### TO-78 Package

See Section G for Outline Dimensions

### Pin Configuration

1 Source 1, 2 Drain 1, 3 Gate 1, 4 Case,  
5 Source 2, 6 Drain 2, 7 Gate 2,  
8 Omitted



## IFN860

## Dual N-Channel Silicon Junction Field-Effect Transistor

- Low-Noise Audio Amplifier
- Equivalent to Crystallonics CD860

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 20 V          |
| Continuous Forward Gate Current                  | 50 mA           |
| Continuous Device Power Dissipation              | 400 mW          |
| Power Derating                                   | 2.3 mW/°C       |
| Storage Temperature Range                        | – 65°C to 200°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |                       | IFN860 |     |     | Process NJ450L |                                                              |  |
|-----------------------------------|-----------------------|--------|-----|-----|----------------|--------------------------------------------------------------|--|
|                                   |                       | Min    | Typ | Max | Unit           | Test Conditions                                              |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$         | – 20   |     |     | V              | $I_G = -1\text{ }\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Leakage Voltage      | $I_{GSS}$             |        |     | 3   | nA             | $V_{GS} = -10\text{V}$ , $V_{DS} = \emptyset\text{V}$        |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$         | – 0.3  |     | – 3 | V              | $V_{DS} = 10\text{V}$ , $I_D = 100\text{ }\mu\text{A}$       |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$             | 10     |     |     | mA             | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$         |  |
| Differential Gate Source Voltage  | $ V_{GS1} - V_{GS2} $ |        |     | 25  | mV             | $V_{DS} = 10\text{V}$ , $I_D = 100\text{ }\mu\text{A}$       |  |

## Dynamic Electrical Characteristics

|                                              |             |    |    |    |                        |                                               |                    |
|----------------------------------------------|-------------|----|----|----|------------------------|-----------------------------------------------|--------------------|
| Transconductance                             | $g_m$       | 25 | 40 |    | mS                     | $V_{DS} = 10\text{V}$ , $I_D = -10\text{ mA}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |    | 30 | 35 | pF                     | $V_{DS} = 10\text{V}$ , $I_D = -10\text{ mA}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |    | 17 | 20 | pF                     | $V_{DS} = 10\text{V}$ , $I_D = -10\text{ mA}$ | $f = 1\text{ MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |    |    | 2  | nV/ $\sqrt{\text{Hz}}$ | $V_{DG} = 3\text{V}$ , $I_D = 10\text{ mA}$   | $f = 1\text{ kHz}$ |

## TO-71 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 5 Source,  
6 Drain, 7 Gate

## IFN5114, IFN5115, IFN5116

## P-Channel Silicon Junction Field-Effect Transistor

## • Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 50 V          |
| Continuous Forward Gate Current                  | 50 mA           |
| Continuous Device Power Dissipation              | 500 mW          |
| Power Derating                                   | 4 mW/°C         |
| Storage Temperature Range                        | – 65°C to 200°C |

At 25°C free air temperature:  
Static Electrical Characteristics

|                                   |               | IFN5114 |       | IFN5115 |       | IFN5116 |      | Process PJ99  |                                                                                    |
|-----------------------------------|---------------|---------|-------|---------|-------|---------|------|---------------|------------------------------------------------------------------------------------|
|                                   |               | Min     | Max   | Min     | Max   | Min     | Max  | Unit          | Test Conditions                                                                    |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 30      |       | 30      |       | 30      |      | V             | $I_G = -1\text{ mA}$ , $V_{DS} = \emptyset\text{ V}$                               |
| Gate Reverse Current              | $I_{GSS}$     |         | 2     |         | 2     |         | 2    | nA            | $V_{GS} = 20\text{ V}$ , $V_{DS} = \emptyset\text{ V}$                             |
|                                   |               |         | 10    |         | 10    |         | 10   | $\mu\text{A}$ | $V_{GS} = 20\text{ V}$ , $V_{DS} = \emptyset\text{ V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 5       | 10    | 3       | 6     | 1       | 4    | V             | $V_{DS} = -15\text{ V}$ , $I_G = -1\text{ nA}$                                     |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |         | – 1   |         | – 1   |         | – 1  | V             | $V_{DS} = \emptyset\text{ V}$ , $I_G = -1\text{ mA}$                               |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 30    | – 90  |         |       |         |      | mA            | $V_{DS} = -15\text{ V}$ , $V_{GS} = 18\text{ V}$                                   |
|                                   |               |         |       | – 15    | – 60  | – 5     | – 25 | mA            | $V_{DS} = -15\text{ V}$ , $V_{GS} = 15\text{ V}$                                   |
| Drain Cutoff Current              | $I_{D(OFF)}$  |         | – 2   |         | – 2   |         | – 2  | nA            | $V_{DS} = -15\text{ V}$ , $V_{GS} = 12\text{ V}$                                   |
|                                   |               |         | – 10  |         | – 10  |         | – 10 | $\mu\text{A}$ | $V_{DS} = -15\text{ V}$ , $V_{GS} = 7\text{ V}$ , $T_A = 150^\circ\text{C}$        |
| Drain Source ON Voltage           | $V_{DS(ON)}$  |         | – 1.3 |         |       |         |      | V             | $V_{GS} = \emptyset\text{ V}$ , $I_D = -15\text{ mA}$                              |
|                                   |               |         |       |         | – 0.8 |         |      | V             | $V_{GS} = \emptyset\text{ V}$ , $I_D = -7\text{ mA}$                               |
|                                   |               |         |       |         |       | – 0.6   |      | V             | $V_{GS} = \emptyset\text{ V}$ , $I_D = -3\text{ mA}$                               |
| Static Drain Source ON Resistance | $r_{DS(ON)}$  |         | 75    |         | 100   |         | 150  | $\Omega$      | $V_{GS} = \emptyset\text{ V}$ , $I_D = -1\text{ mA}$                               |

## Dynamic Electrical Characteristics

|                                            |              |  |    |  |     |  |     |          |                                                            |                    |
|--------------------------------------------|--------------|--|----|--|-----|--|-----|----------|------------------------------------------------------------|--------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |  | 75 |  | 100 |  | 150 | $\Omega$ | $V_{GS} = \emptyset\text{ V}$ , $I_D = \emptyset\text{ A}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |  | 25 |  | 25  |  | 27  | pF       | $V_{DS} = -15\text{ V}$ , $V_{GS} = \emptyset\text{ V}$    | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |  | 7  |  |     |  |     | pF       | $V_{DS} = -10\text{ V}$ , $V_{GS} = 12\text{ V}$           | $f = 1\text{ MHz}$ |
|                                            |              |  |    |  | 7   |  |     | pF       | $V_{DS} = -10\text{ V}$ , $V_{GS} = 7\text{ V}$            | $f = 1\text{ MHz}$ |
|                                            |              |  |    |  |     |  | 7   | pF       | $V_{DS} = -10\text{ V}$ , $V_{GS} = 5\text{ V}$            | $f = 1\text{ MHz}$ |

## Switching Characteristics

|                     |              | IFN5114 |    | IFN5115 |    | IFN5116 |    |    |                                                                                |
|---------------------|--------------|---------|----|---------|----|---------|----|----|--------------------------------------------------------------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  |         | 6  |         | 10 |         | 25 | ns | $V_{DD} = -10$ , $V_{GG} = 20$ , $R_L = 130$ , $R_G = 100$ , $I_{D(ON)} = -15$ |
| Rise Time           | $t_r$        |         | 10 |         | 20 |         | 35 | ns | $V_{GG} = 20$ , $R_L = 130$ , $R_G = 100$ , $I_{D(ON)} = -15$                  |
| Turn OFF Delay Time | $t_{d(off)}$ |         | 6  |         | 8  |         | 20 | ns | $V_{GG} = 20$ , $R_L = 130$ , $R_G = 100$ , $I_{D(ON)} = -15$                  |
| Fall Time           | $t_f$        |         | 15 |         | 30 |         | 60 | ns | $V_{GG} = 20$ , $R_L = 130$ , $R_G = 100$ , $I_{D(ON)} = -15$                  |

## TO-18 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source 1, 2 Gate &amp; Case, 3 Drain

## Surface Mount

SMP5114, SMP5115, SMP5116



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## IFN5432, IFN5433, IFN5434

## N-Channel Silicon Junction Field-Effect Transistor

- Analog Low On Resistance Switches
- Choppers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 25 V

Continuous Forward Gate Current

100 mA

Continuous Device Power Dissipation

300 mW

Power Derating

2.4 mW/°C

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | IFN5432 |       | IFN5433 |       | IFN5434 |       | Process NJ903 |                                                       |                           |
|-----------------------------------|---------------|---------|-------|---------|-------|---------|-------|---------------|-------------------------------------------------------|---------------------------|
|                                   |               | Min     | Max   | Min     | Max   | Min     | Max   | Unit          | Test Conditions                                       |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25    |       | – 25    |       | – 25    |       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |                           |
| Gate Reverse Current              | $I_{GSS}$     |         | – 200 |         | – 200 |         | – 200 | pA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$ |                           |
|                                   |               |         | – 200 |         | – 200 |         | – 200 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$ | $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 4     | – 10  | – 3     | – 9   | – 1     | – 4   | V             | $V_{DS} = 5\text{V}$ , $I_G = 3\text{nA}$             |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 150     |       | 100     |       | 30      |       | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$  |                           |
| Drain Cutoff Current              | $I_{D(OFF)}$  |         | 200   |         | 200   |         | 200   | pA            | $V_{DS} = 5\text{V}$ , $V_{GS} = -10\text{V}$         |                           |
|                                   |               |         | 200   |         | 200   |         | 200   | nA            | $V_{DS} = 5\text{V}$ , $V_{GS} = -10\text{V}$         | $T_A = 150^\circ\text{C}$ |
| Drain Source ON Voltage           | $V_{DS}$      |         | 50    |         | 70    |         | 100   | mV            | $V_{GS} = \emptyset\text{V}$ , $I_D = 10\text{mA}$    |                           |
| Static Drain Source ON Resistance | $r_{DS(ON)}$  | 2       | 5     |         | 7     |         | 10    | $\Omega$      | $V_{DS} = \emptyset\text{V}$ , $I_D = 10\text{mA}$    |                           |

## Dynamic Electrical Characteristics

|                                            |              |  |    |  |    |  |    |          |                                                          |                   |
|--------------------------------------------|--------------|--|----|--|----|--|----|----------|----------------------------------------------------------|-------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |  | 5  |  | 7  |  | 10 | $\Omega$ | $V_{GS} = \emptyset\text{V}$ , $I_D = \emptyset\text{A}$ | $f = 1\text{kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |  | 60 |  | 60 |  | 60 | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$    | $f = 1\text{MHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |  | 20 |  | 20 |  | 20 | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$    | $f = 1\text{MHz}$ |

## Switching Characteristics

|                     |              |  |    |  |    |  |    |    |                                                                                                                                                                                                                                              |
|---------------------|--------------|--|----|--|----|--|----|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  |  | 4  |  | 4  |  | 4  | ns | $V_{DD} = 1.5\text{V}$ , $V_{GS(ON)} = \emptyset\text{V}$<br>$V_{GS(OFF)} = -12\text{V}$ , $I_{D(ON)} = 10\text{mA}$<br><b>(IFN5432)</b> $R_L = 145\ \Omega$<br><b>(IFN5433)</b> $R_L = 143\ \Omega$<br><b>(IFN5434)</b> $R_L = 140\ \Omega$ |
| Rise Time           | $t_r$        |  | 1  |  | 1  |  | 1  | ns |                                                                                                                                                                                                                                              |
| Turn OFF Delay Time | $t_{d(off)}$ |  | 6  |  | 6  |  | 6  | ns |                                                                                                                                                                                                                                              |
| Fall Time           | $t_f$        |  | 30 |  | 30 |  | 30 | ns |                                                                                                                                                                                                                                              |

## TO-52 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case



## IFN5564, IFN5565, IFN5566

## N-Channel Dual Silicon Junction Field-Effect Transistor

- Wide Band Differential Amplifier
- Commutators

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ .

Reverse Gate Source & Reverse Gate Drain Voltage  
 Continuous Forward Gate Current  
 Continuous Device Power Dissipation  
 Power Derating

– 40 V  
 50 mA  
 650 mW  
 3.3 mW/°C

At  $25^\circ\text{C}$  free air temperature:  
 Static Electrical Characteristics

|                                   |               | IFN5564 |       | IFN5565 |       | IFN5566 |       | Process NJ72 |                                                       |
|-----------------------------------|---------------|---------|-------|---------|-------|---------|-------|--------------|-------------------------------------------------------|
|                                   |               | Min     | Max   | Min     | Max   | Min     | Max   | Unit         | Test Conditions                                       |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 40    |       | – 40    |       | – 40    |       | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |
| Gate Leakage Voltage              | $I_{GSS}$     |         | – 100 |         | – 100 |         | – 100 | pA           | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ |
|                                   |               |         | – 200 |         | – 200 |         | – 200 | nA           | $T_A = 150^\circ\text{C}$                             |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.5   | – 3   | – 0.5   | – 3   | – 0.5   | – 3   | V            | $V_{DS} = 15\text{V}$ , $I_D = 1\text{nA}$            |
| Gate Source Voltage               | $V_{GS(f)}$   |         | 1     |         | 1     |         | 1     | V            | $V_{DS} = \emptyset\text{V}$ , $I_G = 2\text{mA}$     |
| Saturation Current (Pulsed)       | $I_{DSS}$     | 5       | 30    | 5       | 30    | 5       | 30    | mA           | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$  |
| Static Drain Source ON Resistance | $r_{DS(ON)}$  |         | 100   |         | 100   |         | 100   | $\Omega$     | $I_D = 1\text{mA}$ , $V_{GS} = \emptyset\text{V}$     |

## Dynamic Electrical Characteristics

|                                              |             |      |       |      |       |      |       |                        |                                                                       |                     |
|----------------------------------------------|-------------|------|-------|------|-------|------|-------|------------------------|-----------------------------------------------------------------------|---------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 7000 | 12500 | 7000 | 12500 | 7000 | 12500 | $\mu\text{hmo}$        | $V_{DG} = 15\text{V}$ , $I_D = 2\text{mA}$                            | $f = 1\text{kHz}$   |
|                                              |             | 7000 |       | 7000 |       | 7000 |       | $\mu\text{hmo}$        |                                                                       | $f = 100\text{MHz}$ |
| Common Source Output Transconductance        | $g_{os}$    |      | 45    |      | 45    |      | 45    | $\mu\text{hmo}$        | $V_{DS} = 15\text{V}$ , $I_D = 2\text{mA}$                            | $f = 1\text{kHz}$   |
| Common Source Input Capacitance              | $C_{iss}$   |      | 12    |      | 12    |      | 12    | pF                     | $V_{DS} = 15\text{V}$ , $I_D = 2\text{mA}$                            | $f = 1\text{MHz}$   |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |      | 3     |      | 3     |      | 3     | pF                     | $V_{DS} = 15\text{V}$ , $I_D = 2\text{mA}$                            | $f = 1\text{MHz}$   |
| Noise Figure                                 | NF          |      | 1     |      | 1     |      | 1     | dB                     | $V_{DS} = 15\text{V}$ , $I_D = 2\text{mA}$<br>$R_G = 1\text{M}\Omega$ | $f = 10\text{Hz}$   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |      | 50    |      | 50    |      | 50    | nV/ $\sqrt{\text{Hz}}$ | $V_{DG} = 15\text{V}$ , $I_D = 2\text{mA}$                            | $f = 10\text{Hz}$   |

## Characteristics

|                                         |                                                  |      |    |      |    |      |    |                              |                                                                              |  |
|-----------------------------------------|--------------------------------------------------|------|----|------|----|------|----|------------------------------|------------------------------------------------------------------------------|--|
| Saturation Drain Current Ratio (Pulsed) | $\frac{I_{DSS1}}{I_{DSS2}}$                      | 0.95 | 1  | 0.95 | 1  | 0.95 | 1  | –<br>–                       | $V_{DG} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$                         |  |
| Differential Gate Source Voltage        | $ V_{GS(1)} - V_{GS(2)} $                        |      | 5  |      | 10 |      | 20 | mV                           | $V_{DS} = 15\text{V}$ , $I_D = 2\text{mA}$                                   |  |
| Gate Source Voltage Differential Drift  | $\frac{\Delta V_{GS(f)} - V_{GS(f)} }{\Delta T}$ |      | 10 |      | 25 |      | 50 | $\mu\text{V}/^\circ\text{C}$ | $V_{DS} = 15\text{V}$ , $T_A = 25^\circ\text{C}$ , $T_B = 125^\circ\text{C}$ |  |
|                                         |                                                  |      | 10 |      | 25 |      | 50 | $\mu\text{V}/^\circ\text{C}$ | $I_D = 2\text{mA}$ , $T_A = 55^\circ\text{C}$ , $T_B = 25^\circ\text{C}$     |  |
| Transconductance Ratio (Pulsed)         | $\frac{g_{fs(1)}}{g_{fs(2)}}$                    | 0.95 | 1  | 0.9  | 1  | 0.9  | 1  | –<br>–                       | $V_{DS} = 15\text{V}$ , $I_D = 2\text{mA}$                                   |  |

## TO-71 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Omitted,  
 5 Source, 6 Drain, 7 Gate, 8 Omitted

## IFN5911, IFN5912

## N-Channel Dual Silicon Junction Field-Effect Transistor

- VHF Amplifiers
- Wideband Differential Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                     |                                            |
|-------------------------------------|--------------------------------------------|
| Continuous Forward Gate Current     | 50 mA                                      |
| Continuous Device Power Dissipation | 500 mW                                     |
| Power Derating                      | 4 mW/ $^\circ\text{C}$                     |
| Storage Temperature Range           | $-65^\circ\text{C}$ to $200^\circ\text{C}$ |

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | IFN5911 |      | IFN5912 |      | Process NJ30L or NJ36D |                                                        |                           |
|-----------------------------------|---------------|---------|------|---------|------|------------------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min     | Max  | Min     | Max  | Unit                   | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | -25     |      | -25     |      | V                      | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |         | -100 |         | -100 | pA                     | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |         | -250 |         | -250 | nA                     | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 150^\circ\text{C}$ |
| Gate Operating Current            | $I_G$         |         | -100 |         | -100 | pA                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$            |                           |
|                                   |               |         | -100 |         | -100 | nA                     | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$            | $T_A = 125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | -1      | -5   | -1      | -5   | V                      | $V_{DS} = 10\text{V}$ , $I_D = 1\text{ nA}$            |                           |
| Gate Source Voltage               | $V_{GS}$      | -0.3    | -4   | -0.3    | -4   | V                      | $V_{DS} = 10\text{V}$ , $I_D = 5\text{ mA}$            |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 7       | 40   | 7       | 40   | mA                     | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |

## Dynamic Electrical Characteristics

|                                              |                                             |      |       |      |       |                              |                                                                           |                                                       |
|----------------------------------------------|---------------------------------------------|------|-------|------|-------|------------------------------|---------------------------------------------------------------------------|-------------------------------------------------------|
| Common Source Forward Transconductance       | $g_{fs}$                                    | 3000 | 10000 | 3000 | 10000 | $\mu\text{S}$                | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 1\text{ kHz}$                                    |
|                                              |                                             | 3000 | 10000 | 3000 | 10000 | $\mu\text{S}$                | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 100\text{ MHz}$                                  |
| Common Source Output Conductance             | $g_{os}$                                    |      | 100   |      | 100   | $\mu\text{S}$                | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 1\text{ kHz}$                                    |
|                                              |                                             |      | 150   |      | 150   | $\mu\text{S}$                | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 100\text{ MHz}$                                  |
| Common Source Input Capacitance              | $C_{iss}$                                   |      | 5     |      | 5     | pF                           | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 1\text{ MHz}$                                    |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$                                   |      | 1.2   |      | 1.2   | pF                           | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 1\text{ MHz}$                                    |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$                                 |      | 20    |      | 20    | nV/ $\sqrt{\text{Hz}}$       | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 10\text{ kHz}$                                   |
| Noise Figure                                 | NF                                          |      | 1     |      | 1     | dB                           | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$<br>$R_G = 100\text{ K}\Omega$ | $f = 10\text{ Hz}$                                    |
| Differential Gate Current                    | $ I_{G1}  -  I_{G2} $                       |      | 20    |      | 20    | nA                           | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $T_A = 125^\circ\text{C}$                             |
| Saturation Drain Current Ratio               | $I_{DSS1}/I_{DSS2}$                         | 0.95 | 1     | 0.95 | 1     |                              | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$                      |                                                       |
| Differential Gate Source Voltage             | $V_{GS1} - V_{GS2}$                         |      | 10    |      | 15    | mV                           | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               |                                                       |
| Gate Source Voltage Differential Drift       | $\frac{\Delta V_{GS1} - V_{GS2}}{\Delta T}$ |      | 20    |      | 40    | $\mu\text{V}/^\circ\text{C}$ | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $T_A = 25^\circ\text{C}$<br>$T_B = 125^\circ\text{C}$ |
|                                              | $\frac{\Delta V_{GS1} - V_{GS2}}{\Delta T}$ |      | 20    |      | 40    | $\mu\text{V}/^\circ\text{C}$ | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $T_A = -55^\circ\text{C}$<br>$T_B = 25^\circ\text{C}$ |
| Transconductance Ratio                       | $g_{fs1}/g_{fs2}$                           | 0.95 | 1     | 0.95 | 1     |                              | $V_{DG} = 10\text{V}$ , $I_D = 5\text{ mA}$                               | $f = 1\text{ kHz}$                                    |

## TO-78 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case,  
5 Source, 6 Drain, 7 Gate, 8 Omitted

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## IFN6449, IFN6450

## N-Channel Silicon Junction Field-Effect Transistor

## • High Voltage

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                     | IFN6449   | IFN6450   |
|-------------------------------------|-----------|-----------|
| Reverse Gate Source Voltage         | – 100 V   | – 100 V   |
| Reverse Gate Drain Voltage          | – 300 V   | – 200 V   |
| Continuous Forward Gate Current     | 10 mA     | 10 mA     |
| Continuous Device Power Dissipation | 800 mW    | 800 mW    |
| Power Derating                      | 6.4 mW/°C | 6.4 mW/°C |

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | IFN6449 |      | IFN6450 |       | Process NJ42  |                                                                                    |
|-----------------------------------|---------------|---------|------|---------|-------|---------------|------------------------------------------------------------------------------------|
|                                   |               | Min     | Max  | Min     | Max   | Unit          | Test Conditions                                                                    |
| Gate Drain Breakdown Voltage      | $V_{(BR)GDO}$ | – 300   |      | – 200   |       | V             | $I_G = -10\ \mu\text{A}$ , $I_S = \emptyset\text{A}$                               |
| Gate Source Breakdown Voltage     | $V_{(BR)GSO}$ | – 100   |      | – 100   |       | V             | $I_G = -10\ \mu\text{A}$ , $I_D = \emptyset\text{A}$                               |
| Gate Reverse Current              | $I_{GSS}$     |         |      |         | – 100 | nA            | $V_{GS} = -80\text{V}$ , $V_{DS} = \emptyset\text{V}$                              |
|                                   |               |         |      |         | – 100 | $\mu\text{A}$ | $V_{GS} = -80\text{V}$ , $V_{DS} = \emptyset\text{V}$<br>$T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 2     | – 15 | – 2     | – 15  | V             | $V_{DS} = 30\text{V}$ , $I_D = 4\ \text{nA}$                                       |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 2       | 10   | 2       | 10    | mA            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$                               |

## Dynamic Electrical Characteristics

|                                              |            |     |     |     |     |               |                                                      |                     |
|----------------------------------------------|------------|-----|-----|-----|-----|---------------|------------------------------------------------------|---------------------|
| Common Source Forward Transfer Transmittance | $ Y_{fs} $ | 0.5 | 3   | 0.5 | 3   | mS            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$ |
| Common Source Output Conductance             | $g_{os}$   |     | 100 |     | 100 | $\mu\text{S}$ | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$  |     | 10  |     | 10  | pF            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$  |     | 5   |     | 5   | pF            | $V_{DS} = 30\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |

## TO-39 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case



InterFET Corporation

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## J108, J109

## N-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Commutators
- Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 25 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

360 mW

Power Derating

3.27 mW/°C

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | J108 |      | J109 |     | Process NJ450 |                                                        |  |
|-----------------------------------|---------------|------|------|------|-----|---------------|--------------------------------------------------------|--|
|                                   |               | Min  | Max  | Min  | Max | Unit          | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |      | – 25 |     | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |      | – 3  |      | – 3 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 3  | – 10 | – 2  | – 6 | V             | $V_{DS} = 5\text{V}$ , $I_D = 1\ \mu\text{A}$          |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 80   |      | 40   |     | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |
| Drain Cutoff Current              | $I_{D(OFF)}$  |      | 3    |      | 3   | nA            | $V_{DS} = 5\text{V}$ , $V_{GS} = -10\text{V}$          |  |

## Dynamic Electrical Characteristics

|                                      |                   |  |    |  |    |          |                                                       |                    |
|--------------------------------------|-------------------|--|----|--|----|----------|-------------------------------------------------------|--------------------|
| Drain Source ON Resistance           | $r_{ds(on)}$      |  | 8  |  | 12 | $\Omega$ | $V_{GS} = \emptyset$ , $V_{DS} \leq 0.1\text{V}$      | $f = 1\text{ kHz}$ |
| Drain Gate Capacitance               | $C_{gd}$          |  | 15 |  | 15 | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Source Gate Capacitance              | $C_{gs}$          |  | 15 |  | 15 | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Drain Gate + Source Gate Capacitance | $C_{gd} + C_{gs}$ |  | 85 |  | 85 | pF       | $V_{DS} = V_{GS} = \emptyset\text{V}$                 | $f = 1\text{ MHz}$ |

## Switching Characteristics

|                     |              | Typ |    | Typ |  |                                                          |               |          |
|---------------------|--------------|-----|----|-----|--|----------------------------------------------------------|---------------|----------|
| Turn ON Delay Time  | $t_{d(on)}$  | 3   | 3  | ns  |  | <div> <div></div> <div>J108</div> <div>J109</div> </div> |               |          |
| Rise Time           | $t_r$        | 1   | 1  | ns  |  |                                                          | $V_{DD}$      | 1.5      |
| Turn OFF Delay Time | $t_{d(off)}$ | 4   | 4  | ns  |  |                                                          | $V_{GS(OFF)}$ | – 12     |
| Fall Time           | $t_f$        | 18  | 18 | ns  |  |                                                          | $R_L$         | 150      |
|                     |              |     |    |     |  |                                                          |               | 1.5      |
|                     |              |     |    |     |  |                                                          |               | – 7      |
|                     |              |     |    |     |  |                                                          |               | 150      |
|                     |              |     |    |     |  |                                                          |               | $\Omega$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ108, SMPJ109



## J110, J110A

## N-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Commutators
- Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |            |
|--------------------------------------------------|------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 25 V     |
| Continuous Forward Gate Current                  | 50 mA      |
| Continuous Device Power Dissipation              | 360 mW     |
| Power Derating                                   | 3.27 mW/°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | J110  |     | J110A |     | Process NJ450 |                                                |
|-----------------------------------|---------------|-------|-----|-------|-----|---------------|------------------------------------------------|
|                                   |               | Min   | Max | Min   | Max | Unit          | Test Conditions                                |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25  |     | – 25  |     | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$ |
| Gate Reverse Current              | $I_{GSS}$     |       | – 3 |       | – 3 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.5 | – 4 | – 0.5 | – 4 | V             | $V_{DS} = 5\text{V}$ , $I_D = 1\ \mu\text{A}$  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 10    |     | 10    |     | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$   |
| Drain Cutoff Current              | $I_{D(OFF)}$  |       | 3   |       | 3   | nA            | $V_{DS} = 5\text{V}$ , $V_{GS} = -10\text{V}$  |

## Dynamic Electrical Characteristics

|                                      |                   |  |    |  |    |          |                                               |                    |
|--------------------------------------|-------------------|--|----|--|----|----------|-----------------------------------------------|--------------------|
| Drain Source ON Resistance           | $r_{ds(on)}$      |  | 18 |  | 25 | $\Omega$ | $V_{GS} = 0$ , $V_{DS} \leq 0.1\text{V}$      | $f = 1\text{ kHz}$ |
| Drain Gate Capacitance               | $C_{gd}$          |  | 15 |  | 15 | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Source Gate Capacitance              | $C_{gs}$          |  | 15 |  | 15 | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Drain Gate + Source Gate Capacitance | $C_{gd} + C_{gs}$ |  | 85 |  | 85 | pF       | $V_{DS} = V_{GS} = 0\text{V}$                 | $f = 1\text{ MHz}$ |

## Switching Characteristics

|                     |              | Typ |  | Typ |  |    |               |                  |
|---------------------|--------------|-----|--|-----|--|----|---------------|------------------|
| Turn ON Delay Time  | $t_{d(on)}$  | 4   |  | 4   |  | ns | J110          | J110A            |
| Rise Time           | $t_r$        | 1   |  | 1   |  | ns | $V_{DD}$      | 1.5 1.5 V        |
| Turn OFF Delay Time | $t_{d(off)}$ | 6   |  | 6   |  | ns | $V_{GS(OFF)}$ | – 5 – 5 V        |
| Fall Time           | $t_f$        | 30  |  | 30  |  | ns | $R_L$         | 150 150 $\Omega$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ110, SMPJ110A



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## J111, J112, J113

## N-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Commutators
- Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 35 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

360 mW

Power Derating

3.27 mW/°C

At 25°C free air temperature  
Static Electrical Characteristics

|                                   |               | J111 |      | J112 |     | J113 |     | Process NJ132 |                                                |  |
|-----------------------------------|---------------|------|------|------|-----|------|-----|---------------|------------------------------------------------|--|
|                                   |               | Min  | Max  | Min  | Max | Min  | Max | Unit          | Test Conditions                                |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 35 |      | – 35 |     | – 35 |     | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$   |  |
| Gate Reverse Current              | $I_{GSS}$     |      | – 1  |      | – 1 |      | – 1 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 3  | – 10 | – 1  | – 5 |      | – 3 | V             | $V_{DS} = 5\text{V}$ , $I_D = 1\mu\text{A}$    |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 20   |      | 5    |     | 2    |     | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$   |  |
| Drain Cutoff Current              | $I_{D(OFF)}$  |      | – 1  |      | – 1 |      | – 1 | nA            | $V_{DS} = 15\text{V}$ , $V_{GS} = -10\text{V}$ |  |

## Dynamic Electrical Characteristics

|                                      |                   |  |    |  |    |  |     |          |                                               |                    |
|--------------------------------------|-------------------|--|----|--|----|--|-----|----------|-----------------------------------------------|--------------------|
| Drain Source ON Resistance           | $r_{ds(on)}$      |  | 30 |  | 50 |  | 100 | $\Omega$ | $V_{GS} = 0\text{V}$ , $V_{DS} = 0.1\text{V}$ | $f = 1\text{ kHz}$ |
| Drain Gate Capacitance               | $C_{dg}$          |  | 5  |  | 5  |  | 5   | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Source Gate Capacitance              | $C_{gs}$          |  | 5  |  | 5  |  | 5   | pF       | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$ |
| Drain Gate + Source Gate Capacitance | $C_{gd} + C_{gs}$ |  | 28 |  | 28 |  | 28  | pF       | $V_{DS} = V_{GS} = 0\text{V}$                 | $f = 1\text{ MHz}$ |

## Switching Characteristics

|                     |              | Typ |  | Typ |  | Typ |    |               |      |      |          |
|---------------------|--------------|-----|--|-----|--|-----|----|---------------|------|------|----------|
| Turn ON Delay Time  | $t_{d(on)}$  | 7   |  | 7   |  | 7   | ns |               | J111 | J112 | J113     |
| Rise Time           | $t_r$        | 6   |  | 6   |  | 2   | ns | $V_{DD}$      | 10   | 10   | 10       |
| Turn OFF Delay Time | $t_{d(off)}$ | 20  |  | 20  |  | 20  | ns | $V_{GS(OFF)}$ | – 12 | – 7  | – 5      |
| Fall Time           | $t_f$        | 15  |  | 15  |  | 15  | ns | $R_L$         | 800  | 1600 | 3200     |
|                     |              |     |  |     |  |     |    |               |      |      | $\Omega$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ111, SMPJ112, SMPJ113



## J174, J175

## P-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Commutators
- Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |            |
|--------------------------------------------------|------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 30 V     |
| Continuous Forward Gate Current                  | 50 mA      |
| Continuous Device Power Dissipation              | 360 mW     |
| Power Derating                                   | 3.27 mW/°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | J174 |       | J175 |      | Process PJ99 |                                                       |  |
|-----------------------------------|---------------|------|-------|------|------|--------------|-------------------------------------------------------|--|
|                                   |               | Min  | Max   | Min  | Max  | Unit         | Test Conditions                                       |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 30   |       | 30   |      | V            | $I_G = 1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |      | 1     |      | 1    | nA           | $V_{GS} = 20\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 5    | 10    | 3    | 6    | V            | $V_{DS} = -15\text{V}$ , $I_D = -10\text{ nA}$        |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 20 | – 125 | – 7  | – 70 | mA           | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$ |  |
| Drain Cutoff Current              | $I_{D(OFF)}$  |      | – 1   |      | – 1  | nA           | $V_{DS} = -15\text{V}$ , $V_{GS} = 10\text{V}$        |  |

## Dynamic Electrical Characteristics

|                            |              | Max |  | Max |  |          |                                                  |                    |
|----------------------------|--------------|-----|--|-----|--|----------|--------------------------------------------------|--------------------|
| Drain Source ON Resistance | $r_{ds(on)}$ | 85  |  | 85  |  | $\Omega$ | $V_{GS} = \emptyset$ , $V_{DS} \leq 0.1\text{V}$ | $f = 1\text{ kHz}$ |

## Dynamic Electrical Characteristics

|                                      |                   | Typ |  | Typ |  |    |                                                      |                    |
|--------------------------------------|-------------------|-----|--|-----|--|----|------------------------------------------------------|--------------------|
| Drain Gate Capacitance               | $C_{gd}$          | 5.5 |  | 5.5 |  | pF | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 10\text{V}$ | $f = 1\text{ MHz}$ |
| Source Gate Capacitance              | $C_{gs}$          | 5.5 |  | 5.5 |  | pF | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 10\text{V}$ | $f = 1\text{ MHz}$ |
| Drain Gate + Source Gate Capacitance | $C_{gd} + C_{gs}$ | 32  |  | 32  |  | pF | $V_{DS} = V_{GS} = \emptyset\text{V}$                | $f = 1\text{ MHz}$ |

## Switching Characteristics

|                     |              |    |    |    |                                                                                                    |                                                 |                                                |                         |
|---------------------|--------------|----|----|----|----------------------------------------------------------------------------------------------------|-------------------------------------------------|------------------------------------------------|-------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  | 2  | 5  | ns | <div> <math>V_{DD}</math> <math>V_{GS(OFF)}</math> <math>R_L</math> <math>V_{GS(ON)}</math> </div> | <b>J174</b><br>– 10<br>12<br>560<br>$\emptyset$ | <b>J175</b><br>– 6<br>8<br>1.2k<br>$\emptyset$ | V<br>V<br>$\Omega$<br>V |
| Rise Time           | $t_r$        | 5  | 10 | ns |                                                                                                    |                                                 |                                                |                         |
| Turn OFF Delay Time | $t_{d(off)}$ | 5  | 10 | ns |                                                                                                    |                                                 |                                                |                         |
| Fall Time           | $t_f$        | 10 | 20 | ns |                                                                                                    |                                                 |                                                |                         |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Gate, 3 Source

## Surface Mount

SMPJ174, SMPJ175



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## J176, J177

## P-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Commutators
- Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 30 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

360 mW

Power Derating

3.27 mW/°C

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | J176 |      | J177  |      | Process PJ99 |                                                       |  |
|-----------------------------------|---------------|------|------|-------|------|--------------|-------------------------------------------------------|--|
|                                   |               | Min  | Max  | Min   | Max  | Unit         | Test Conditions                                       |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 30   |      | 30    |      | V            | $I_G = 1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |      | 1    |       | 1    | nA           | $V_{GS} = 20\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | 1    | 4    | 0.8   | 2.25 | V            | $V_{DS} = -15\text{V}$ , $I_D = -10\text{nA}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | – 2  | – 35 | – 1.5 | – 20 | mA           | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$ |  |
| Drain Cutoff Current              | $I_{D(OFF)}$  |      | – 1  |       | – 1  | nA           | $V_{DS} = -15\text{V}$ , $V_{GS} = 10\text{V}$        |  |

## Dynamic Electrical Characteristics

Max

Max

|                            |              |     |     |          |                                                  |                    |
|----------------------------|--------------|-----|-----|----------|--------------------------------------------------|--------------------|
| Drain Source ON Resistance | $r_{ds(on)}$ | 250 | 300 | $\Omega$ | $V_{GS} = \emptyset$ , $V_{DS} \leq 0.1\text{V}$ | $f = 1\text{ kHz}$ |
|----------------------------|--------------|-----|-----|----------|--------------------------------------------------|--------------------|

## Dynamic Electrical Characteristics

Typ

Typ

|                                      |                   |     |     |    |                                                      |                    |
|--------------------------------------|-------------------|-----|-----|----|------------------------------------------------------|--------------------|
| Drain Gate Capacitance               | $C_{gd}$          | 5.5 | 5.5 | pF | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 10\text{V}$ | $f = 1\text{ MHz}$ |
| Source Gate Capacitance              | $C_{gs}$          | 5.5 | 5.5 | pF | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 10\text{V}$ | $f = 1\text{ MHz}$ |
| Drain Gate + Source Gate Capacitance | $C_{gd} + C_{gs}$ | 32  | 32  | pF | $V_{DS} = V_{GS} = \emptyset\text{V}$                | $f = 1\text{ MHz}$ |

## Switching Characteristics

|                     |              |    |    |    |                                                            |                     |
|---------------------|--------------|----|----|----|------------------------------------------------------------|---------------------|
| Turn ON Delay Time  | $t_{d(on)}$  | 15 | 20 | ns | <div> <div><b>J176</b></div> <div><b>J177</b></div> </div> |                     |
| Rise Time           | $t_r$        | 20 | 25 | ns |                                                            | $V_{DD}$ – 6 V      |
| Turn OFF Delay Time | $t_{d(off)}$ | 15 | 20 | ns |                                                            | $V_{GS(OFF)}$ 6 V   |
| Fall Time           | $t_f$        | 20 | 25 | ns |                                                            | $R_L$ 5.6k $\Omega$ |
|                     |              |    |    |    | $V_{GS(ON)}$ $\emptyset$                                   | $\emptyset$ V       |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Gate, 3 Source

## Surface Mount

SMPJ176, SMPJ177



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## J201, J202

## N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- General Purpose Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |            |
|--------------------------------------------------|------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 40 V     |
| Continuous Forward Gate Current                  | 50 mA      |
| Continuous Device Power Dissipation              | 360 mW     |
| Power Derating                                   | 3.27 mW/°C |

At  $25^\circ\text{C}$  free air temperature:  
Static Electrical Characteristics

|                                   |                      | J201  |      |       | J202  |      |       | Process NJ16 |                                                       |
|-----------------------------------|----------------------|-------|------|-------|-------|------|-------|--------------|-------------------------------------------------------|
|                                   |                      | Min   | Typ  | Max   | Min   | Typ  | Max   | Unit         | Test Conditions                                       |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$        | – 40  |      |       | – 40  |      |       | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |
| Gate Reverse Current              | $I_{GSS}$            |       |      | – 100 |       |      | – 100 | pA           | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ |
| Gate Operating Current            | $I_G$                |       | – 10 |       |       | – 10 |       | pA           | $V_{DG} = 20\text{V}$ , $I_D = I_{DSS(\text{min})}$   |
| Gate Source Cutoff Voltage        | $V_{GS(\text{OFF})}$ | – 0.3 |      | – 1.5 | – 0.8 |      | – 4   | V            | $V_{DS} = 20\text{V}$ , $I_D = 10\text{ nA}$          |
| Drain Saturation Current (Pulsed) | $I_{DSS}$            | 0.2   |      | 1     | 0.9   |      | 4.5   | mA           | $V_{DSS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ |

## Dynamic Electrical Characteristics

|                                              |             |     |   |  |      |     |  |                        |                                                      |                    |
|----------------------------------------------|-------------|-----|---|--|------|-----|--|------------------------|------------------------------------------------------|--------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 500 |   |  | 1000 |     |  | $\mu\text{S}$          | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance             | $g_{os}$    |     | 1 |  |      | 3.5 |  | $\mu\text{S}$          | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |     | 4 |  |      | 4   |  | pF                     | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |     | 1 |  |      | 1   |  | pF                     | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |     | 5 |  |      | 5   |  | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ201, SMPJ202



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## J203, J204

## N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- General Purpose Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 40 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

360 mW

Power Derating

3.27 mW/°C

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |                      | J203 |      |       | J204  |      |       | Process NJ16 |                                                       |
|-----------------------------------|----------------------|------|------|-------|-------|------|-------|--------------|-------------------------------------------------------|
|                                   |                      | Min  | Typ  | Max   | Min   | Typ  | Max   | Unit         | Test Conditions                                       |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$        | – 40 |      |       | – 25  |      |       | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |
| Gate Reverse Current              | $I_{GSS}$            |      |      | – 100 |       |      | – 100 | pA           | $V_{GS} = -20\text{V}$ , $V_{DS} = \emptyset\text{V}$ |
| Gate Operating Current            | $I_G$                |      | – 10 |       |       | – 10 |       | pA           | $V_{DG} = 20\text{V}$ , $I_D = I_{DSS(\text{min})}$   |
| Gate Source Cutoff Voltage        | $V_{GS(\text{OFF})}$ | – 2  |      | – 10  | – 0.3 |      | – 2   | V            | $V_{DS} = 20\text{V}$ , $I_D = 10\text{ nA}$          |
| Drain Saturation Current (Pulsed) | $I_{DSS}$            | 4    |      | 20    | 0.2   | 1.2  | 3     | mA           | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$  |

## Dynamic Electrical Characteristics

|                                              |             |      |    |  |     |      |  |                        |                                                      |                    |
|----------------------------------------------|-------------|------|----|--|-----|------|--|------------------------|------------------------------------------------------|--------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 1500 |    |  | 500 | 1500 |  | $\mu\text{S}$          | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance             | $g_{os}$    |      | 10 |  |     | 2.5  |  | $\mu\text{S}$          | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |      | 4  |  |     | 4    |  | pF                     | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |      | 1  |  |     | 1    |  | pF                     | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |      | 5  |  |     | 10   |  | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ203, SMPJ204



InterFET Corporation

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## J210, J211

## N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifiers
- General Purpose Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |            |
|--------------------------------------------------|------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 25 V     |
| Continuous Forward Gate Current                  | 10 mA      |
| Continuous Device Power Dissipation              | 360 mW     |
| Power Derating                                   | 3.27 mW/°C |

At  $25^\circ\text{C}$  free air temperature:  
Static Electrical Characteristics

|                                   |               | J210 |      |       | J211  |      |       | Process NJ26L |                                               |
|-----------------------------------|---------------|------|------|-------|-------|------|-------|---------------|-----------------------------------------------|
|                                   |               | Min  | Typ  | Max   | Min   | Typ  | Max   | Unit          | Test Conditions                               |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |      |       | – 25  |      |       | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$  |
| Gate Reverse Current              | $I_{GSS}$     |      |      | – 100 |       |      | – 100 | pA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$ |
| Gate Operating Current            | $I_G$         |      | – 10 |       |       | – 10 |       | pA            | $V_{DS} = 20\text{V}$ , $I_D = 1\text{mA}$    |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 1  |      | – 3   | – 2.5 |      | – 4.5 | V             | $V_{DS} = 15\text{V}$ , $I_D = 1\text{nA}$    |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 2    |      | 15    | 7     |      | 20    | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$  |

## Dynamic Electrical Characteristics

|                                              |             |      |    |       |      |    |       |                        |                                              |                   |
|----------------------------------------------|-------------|------|----|-------|------|----|-------|------------------------|----------------------------------------------|-------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 4000 |    | 12000 | 6000 |    | 12000 | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{kHz}$ |
| Common Source Output Conductance             | $g_{os}$    |      |    | 150   |      |    | 200   | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |      | 4  |       |      | 4  |       | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |      | 1  |       |      | 1  |       | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |      | 10 |       |      | 10 |       | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{kHz}$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ210, SMPJ211



InterFET Corporation

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# N-Channel Silicon Junction Field-Effect Transistor

- Audio Amplifier
- General Purpose Amplifier

## Absolute maximum ratings at $T_A = 25^\circ\text{C}$

|                                                  |            |
|--------------------------------------------------|------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 25 V     |
| Continuous Forward Gate Current                  | 10 mA      |
| Continuous Device Power Dissipation              | 360 mW     |
| Power Derating                                   | 3.27 mW/°C |

### At 25°C free air temperature:

#### Static Electrical Characteristics

|                                   |               | J212 |      |       | Process NJ26L |                                                        |  |
|-----------------------------------|---------------|------|------|-------|---------------|--------------------------------------------------------|--|
|                                   |               | Min  | Typ  | Max   | Unit          | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |      |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |      |      | – 100 | pA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Operating Current            | $I_G$         |      | – 10 |       | pA            | $V_{DS} = 20\text{V}$ , $I_D = 1\text{mA}$             |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 4  |      | – 6   | V             | $V_{DS} = 15\text{V}$ , $I_D = 1\text{nA}$             |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 15   |      | 40    | mA            | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

#### Dynamic Electrical Characteristics

|                                              |             |      |    |       |                        |                                                      |                   |
|----------------------------------------------|-------------|------|----|-------|------------------------|------------------------------------------------------|-------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 7000 |    | 12000 | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{kHz}$ |
| Common Source Output Conductance             | $g_{os}$    |      |    | 200   | $\mu\text{S}$          | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |      | 4  |       | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |      | 1  |       | pF                     | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |      | 10 |       | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{kHz}$ |

### TO-226AA Package

Dimensions in Inches (mm)

### Pin Configuration

1 Drain, 2 Source, 3 Gate

### Surface Mount

SMPJ212



## J230, J231

## N-Channel Silicon Junction Field-Effect Transistor

## • Audio Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |            |
|--------------------------------------------------|------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 40 V     |
| Continuous Forward Gate Current                  | 50 mA      |
| Continuous Device Power Dissipation              | 360 mW     |
| Power Derating                                   | 3.27 mW/°C |

At 25°C free air temperature:  
Static Electrical Characteristics

|                                   |               | J230  |     |       | J231  |     |       | Process NJ16 |                                                       |
|-----------------------------------|---------------|-------|-----|-------|-------|-----|-------|--------------|-------------------------------------------------------|
|                                   |               | Min   | Typ | Max   | Min   | Typ | Max   | Unit         | Test Conditions                                       |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 40  |     |       | – 40  |     |       | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$  |
| Gate Reverse Current              | $I_{GSS}$     |       |     | – 250 |       |     | – 250 | pA           | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$ |
| Gate Operating Current            | $I_G$         |       | – 2 |       |       | – 2 |       | pA           | $V_{DS} = 20\text{V}$ , $I_D = \emptyset\text{V}$     |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 0.5 |     | – 3   | – 1.5 |     | – 5   | V            | $V_{DS} = 20\text{V}$ , $I_D = 1\mu\text{A}$          |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 0.7   |     | 3     | 2     |     | 6     | mA           | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$  |

## Dynamic Electrical Characteristics

|                                              |             |      |     |      |      |   |      |               |                                                      |                    |
|----------------------------------------------|-------------|------|-----|------|------|---|------|---------------|------------------------------------------------------|--------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 1000 |     | 3500 | 1500 |   | 4000 | $\mu\text{S}$ | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance             | $g_{OS}$    |      | 1.5 |      |      | 3 |      | $\mu\text{S}$ | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |      | 4   |      |      | 4 |      | pF            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |      | 1   |      |      | 1 |      | pF            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |      | 8   | 30   |      | 8 | 30   | nV/√Hz        | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 10\text{ Hz}$ |
|                                              |             |      | 2   |      |      | 2 |      | nV/√Hz        | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ230, SMPJ231



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# N-Channel Silicon Junction Field-Effect Transistor

## • Audio Amplifier

### Absolute maximum ratings at $T_A = 25^\circ\text{C}$

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 40 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

360 mW

Power Derating

3.27 mW/°C

### At 25°C free air temperature:

#### Static Electrical Characteristics

|                                   |               | J232 |     |       | Process NJ16 |                                                        |  |
|-----------------------------------|---------------|------|-----|-------|--------------|--------------------------------------------------------|--|
|                                   |               | Min  | Typ | Max   | Unit         | Test Conditions                                        |  |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 40 |     |       | V            | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |  |
| Gate Reverse Current              | $I_{GSS}$     |      |     | – 250 | pA           | $V_{GS} = -30\text{V}$ , $V_{DS} = \emptyset\text{V}$  |  |
| Gate Operating Current            | $I_G$         |      | – 2 |       | pA           | $V_{DS} = 20\text{V}$ , $I_D = \emptyset\text{V}$      |  |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 3  |     | – 6   | V            | $V_{DS} = 20\text{V}$ , $I_D = 1\ \mu\text{A}$         |  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5    |     | 10    | mA           | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$   |  |

#### Dynamic Electrical Characteristics

|                                              |             |      |    |      |               |                                                      |                    |
|----------------------------------------------|-------------|------|----|------|---------------|------------------------------------------------------|--------------------|
| Common Source Forward Transconductance       | $g_{fs}$    | 2500 |    | 5000 | $\mu\text{S}$ | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Output Conductance             | $g_{os}$    |      | 5  |      | $\mu\text{S}$ | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance              | $C_{iss}$   |      | 4  |      | pF            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Common Source Reverse Transfer Capacitance   | $C_{rss}$   |      | 1  |      | pF            | $V_{DS} = 20\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ MHz}$ |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |      | 20 | 30   | nV/√Hz        | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 10\text{ Hz}$ |
|                                              |             |      | 6  |      | nV/√Hz        | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\text{ kHz}$ |

### TO-226AA Package

Dimensions in Inches (mm)

### Pin Configuration

1 Drain, 2 Source, 3 Gate

### Surface Mount

SMPJ232



## J304, J305

## N-Channel Silicon Junction Field-Effect Transistor

- Mixers
- Oscillators
- VHF/UHF Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                                  |            |
|--------------------------------------------------|------------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 30 V     |
| Continuous Forward Gate Current                  | 10 mA      |
| Continuous Device Power Dissipation              | 360 mW     |
| Power Derating                                   | 3.27 mW/°C |

At  $25^\circ\text{C}$  free air temperature:  
Static Electrical Characteristics

|                                   |               | J304 |     |       | J305  |     |       | Process NJ26 |                                               |
|-----------------------------------|---------------|------|-----|-------|-------|-----|-------|--------------|-----------------------------------------------|
|                                   |               | Min  | Typ | Max   | Min   | Typ | Max   | Unit         | Test Conditions                               |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 30 |     |       | – 30  |     |       | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$  |
| Gate Reverse Current              | $I_{GSS}$     |      |     | – 100 |       |     | – 100 | pA           | $V_{GS} = -20\text{V}$ , $V_{DS} = 0\text{V}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 2  |     | – 6   | – 0.5 |     | – 3   | V            | $V_{DS} = 15\text{V}$ , $I_D = 1\text{nA}$    |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 5    |     | 15    | 1     |     | 8     | mA           | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$  |

## Dynamic Electrical Characteristics

|                                            |           |      |      |      |      |      |    |               |                                              |                      |
|--------------------------------------------|-----------|------|------|------|------|------|----|---------------|----------------------------------------------|----------------------|
| Common Source Forward Transconductance     | $g_{fs}$  | 4500 |      | 7500 | 3000 |      |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ kHz}$   |
|                                            |           |      |      |      |      | 3000 |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 4200 |      |      |      |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Output Conductance           | $g_{os}$  |      |      | 50   |      |      | 50 | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ kHz}$   |
| Common Source Input Capacitance            | $C_{iss}$ |      | 3    |      |      | 3    |    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$   |
| Common Source Reverse Transfer Capacitance | $C_{rss}$ |      | 0.85 |      |      | 0.85 |    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$   |
| Common Source Output Capacitance           | $C_{oss}$ |      | 1    |      |      | 1    |    | pF            | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 1\text{ MHz}$   |
| Common Source Output Conductance           | $g_{os}$  |      | 60   |      |      | 60   |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 80   |      |      |      |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Output Susceptance           | $b_{os}$  |      | 800  |      |      | 800  |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 3600 |      |      |      |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Input Conductance            | $g_{is}$  |      | 80   |      |      | 80   |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 800  |      |      |      |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Input Susceptance            | $b_{is}$  |      | 2000 |      |      | 2000 |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 100\text{ MHz}$ |
|                                            |           |      | 7500 |      |      |      |    | $\mu\text{S}$ | $V_{DS} = 15\text{V}$ , $V_{GS} = 0\text{V}$ | $f = 400\text{ MHz}$ |
| Common Source Power Gain                   | $G_{ps}$  |      | 20   |      |      |      |    | dB            | $V_{DS} = 15\text{V}$ , $I_D = 5\text{ mA}$  | $f = 100\text{ MHz}$ |
|                                            |           |      | 11   |      |      |      |    | dB            | $V_{DS} = 15\text{V}$ , $I_D = 5\text{ mA}$  | $f = 400\text{ MHz}$ |
| Noise Figure                               | NF        |      | 1.7  |      |      |      |    | dB            | $V_{DS} = 15\text{V}$ , $I_D = 5\text{ mA}$  | $f = 100\text{ MHz}$ |
|                                            |           |      | 3.8  |      |      |      |    | dB            | $R_G = 1\ \Omega$                            | $f = 400\text{ MHz}$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ304, SMPJ305



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## J308, J309

## N-Channel Silicon Junction Field-Effect Transistor

- Mixers
- Oscillators
- VHF/UHF Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 25 V

Continuous Forward Gate Current

10 mA

Continuous Device Power Dissipation

360 mW

Power Derating

3.27 mW/°C

At 25°C free air temperature:  
Static Electrical Characteristics

|                                   |               | J308 |     |       | J309 |     |     | Process NJ72  |                                                                            |
|-----------------------------------|---------------|------|-----|-------|------|-----|-----|---------------|----------------------------------------------------------------------------|
|                                   |               | Min  | Typ | Max   | Min  | Typ | Max | Unit          | Test Conditions                                                            |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |     |       | – 25 |     |     | V             | $I_G = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$                               |
| Gate Reverse Current              | $I_{GSS}$     |      |     | – 1   |      |     | – 1 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$                              |
|                                   |               |      |     | – 1   |      |     | – 1 | $\mu\text{A}$ | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = +125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 1  |     | – 6.5 | – 1  |     | – 4 | V             | $V_{DS} = 10\text{V}$ , $I_D = 1\text{nA}$                                 |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |      |     | 1     |      |     | 1   | V             | $V_{DS} = 0\text{V}$ , $I_G = 1\text{mA}$                                  |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 12   |     | 60    | 12   |     | 30  | mA            | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                               |

## Dynamic Electrical Characteristics

|                                              |                 |      |       |     |       |       |     |               |                                               |                     |
|----------------------------------------------|-----------------|------|-------|-----|-------|-------|-----|---------------|-----------------------------------------------|---------------------|
| Common Source Forward Transconductance       | $g_{fs}$        | 8000 | 17000 |     | 10000 | 17000 |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 1\text{kHz}$   |
| Common Source Output Conductance             | $g_{os}$        |      |       | 250 |       |       | 250 | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 1\text{kHz}$   |
| Common Gate Forward Transconductance         | $g_{fg}$        |      | 13000 |     |       | 13000 |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 1\text{kHz}$   |
| Common Gate Output Transconductance          | $g_{og}$        |      | 150   |     |       | 100   |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 1\text{kHz}$   |
| Gate Drain Capacitance                       | $C_{dg}$        |      | 1.8   | 2.5 |       | 1.8   | 2.5 | pF            | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{MHz}$   |
| Gate Source Capacitance                      | $C_{gs}$        |      | 4     | 5   |       | 4     | 5   | pF            | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{MHz}$   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$     |      | 10    |     |       | 10    |     | nV/√Hz        | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 100\text{kHz}$ |
| Common Source Forward Transconductance       | $Re_{(Y_{fs})}$ |      | 12    |     |       | 12    |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 105\text{MHz}$ |
| Common Gate Input Conductance                | $Re_{(Y_{ig})}$ |      | 14    |     |       | 14    |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 105\text{MHz}$ |
| Common Source Input Conductance              | $Re_{(Y_{is})}$ |      | 0.4   |     |       | 0.4   |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 105\text{MHz}$ |
| Common Source Output Conductance             | $Re_{(G_{os})}$ |      | 0.15  |     |       | 0.15  |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 105\text{MHz}$ |
| Common Gate Power Gain at Noise Match        | $G_{pg}$        |      | 16    |     |       | 16    |     | dB            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 105\text{MHz}$ |
|                                              |                 |      | 11    |     |       | 11    |     | dB            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$   | $f = 450\text{MHz}$ |
| Noise Figure                                 | NF              |      | 1.5   |     |       | 1.5   |     | dB            | $V_{DS} = 15\text{V}$ , $I_D = 10\text{mA}$   | $f = 105\text{MHz}$ |
|                                              |                 |      | 2.7   |     |       | 2.7   |     | dB            | $V_{DS} = 15\text{V}$ , $I_D = 10\text{mA}$   | $f = 450\text{MHz}$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ308, SMPJ309



InterFET Corporation

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## J310

## N-Channel Silicon Junction Field-Effect Transistor

- Mixer
- Oscillator
- VHF/UHF Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

|                                     |        |
|-------------------------------------|--------|
| Reverse Gate Source Voltage         | – 25 V |
| Reverse Gate Drain Voltage          | – 25 V |
| Continuous Forward Gate Current     | 10 mA  |
| Continuous Device Power Dissipation | 360 mW |

At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | J310 |     |       | Process NJ72  |                                                |                            |
|-----------------------------------|---------------|------|-----|-------|---------------|------------------------------------------------|----------------------------|
|                                   |               | Min  | Typ | Max   | Unit          | Test Conditions                                |                            |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |     |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = 0\text{V}$ |                            |
| Gate Reverse Current              | $I_{GSS}$     |      |     | – 1   | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$  |                            |
|                                   |               |      |     | – 1   | $\mu\text{A}$ | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$  | $T_A = +125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 2  |     | – 6.5 | V             | $V_{DS} = 10\text{V}$ , $I_D = 1\text{ nA}$    |                            |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |      |     | 1     | V             | $V_{DS} = 0\text{V}$ , $I_G = 1\text{ mA}$     |                            |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 24   |     | 60    | mA            | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$   |                            |

## Dynamic Electrical Characteristics

|                                              |                     |      |       |     |                        |                                               |                      |
|----------------------------------------------|---------------------|------|-------|-----|------------------------|-----------------------------------------------|----------------------|
| Common Source Forward Transconductance       | $g_{fs}$            | 8000 | 17000 |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 1\text{ kHz}$   |
| Common Source Output Conductance             | $g_{os}$            |      |       | 250 | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 1\text{ kHz}$   |
| Common Gate Forward Transconductance         | $g_{fg}$            |      | 1200  |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 1\text{ kHz}$   |
| Common Gate Output Transconductance          | $g_{og}$            |      | 150   |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 1\text{ kHz}$   |
| Gate Drain Capacitance                       | $C_{dg}$            |      | 1.8   | 2.5 | pF                     | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$   |
| Gate Source Capacitance                      | $C_{gs}$            |      | 4     | 5   | pF                     | $V_{DS} = 0\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$         |      | 10    |     | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 100\text{ Hz}$  |
| Common Source Forward Transconductance       | $\text{Re}(Y_{fs})$ |      | 12    |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 105\text{ MHz}$ |
| Common Gate Input Conductance                | $\text{Re}(Y_{ig})$ |      | 14    |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 105\text{ MHz}$ |
| Common Source Input Conductance              | $\text{Re}(Y_{is})$ |      | 0.4   |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 105\text{ MHz}$ |
| Common Source Output Conductance             | $\text{Re}(g_{os})$ |      | 0.15  |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 105\text{ MHz}$ |
| Common Gate Power Gain at Noise Match        | $G_{pg}$            |      | 16    |     | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 105\text{ MHz}$ |
|                                              |                     |      | 11    |     | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$  | $f = 450\text{ MHz}$ |
| Noise Figure                                 | NF                  |      | 1.5   |     | dB                     | $V_{DS} = 15\text{V}$ , $I_D = 10\text{ mA}$  | $f = 105\text{ MHz}$ |
|                                              |                     |      | 2.7   |     | dB                     | $V_{DS} = 15\text{V}$ , $I_D = 10\text{ mA}$  | $f = 450\text{ MHz}$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Drain, 2 Source, 3 Gate

## Surface Mount

SMPJ310



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## P1086, P1087

## P-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Analog Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

30 V

Continuous Forward Gate Current

50 mA

Continuous Device Power Dissipation

360 mW

Power Derating

3.27 mW/ $^\circ\text{C}$ At  $25^\circ\text{C}$  free air temperature:

## Static Electrical Characteristics

|                                   |               | P1086 |      | P1087 |      | Process PJ99  |                                                            |                          |
|-----------------------------------|---------------|-------|------|-------|------|---------------|------------------------------------------------------------|--------------------------|
|                                   |               | Min   | Max  | Min   | Max  | Unit          | Test Conditions                                            |                          |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | 30    |      | 30    |      | V             | $I_G = 1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$      |                          |
| Gate Reverse Current              | $I_{GSS}$     |       | 2    |       | 2    | nA            | $V_{GS} = 15\text{V}$ , $V_{DS} = \emptyset\text{V}$       |                          |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ |       | 10   |       | 5    | V             | $V_{DS} = -15\text{V}$ , $I_D = -1\ \mu\text{A}$           |                          |
| Saturation Drain Current (Pulsed) | $I_{DSS}$     | -10   |      | -5.0  |      | mA            | $V_{DS} = -20\text{V}$ , $V_{GS} = \emptyset\text{V}$      |                          |
| Drain Cutoff Current              | $I_{D(OFF)}$  |       | -10  |       | -10  | nA            | $V_{DS} = -15\text{V}$ , $V_{GS} = 12\text{V}$ (P1086)     | $T_A = 85^\circ\text{C}$ |
|                                   |               |       | -0.5 |       | -0.5 | $\mu\text{A}$ | $V_{GS} = 7\text{V}$ (P1087)                               |                          |
| Drain Reverse Current             | $I_{DGO}$     |       | 2    |       | 2    | nA            | $V_{DG} = -15\text{V}$ , $I_S = \emptyset\text{A}$         | $T_A = 85^\circ\text{C}$ |
|                                   |               |       | 0.1  |       | 0.1  | $\mu\text{A}$ | $V_{DG} = -15\text{V}$ , $I_S = \emptyset\text{A}$         |                          |
| Drain Source ON Voltage           | $V_{DS(ON)}$  |       | -0.5 |       | -0.5 | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = -6\text{mA}$ (P1086) |                          |
|                                   |               |       | -0.5 |       | -0.5 | V             | $V_{GS} = \emptyset\text{V}$ , $I_D = -3\text{mA}$ (P1087) |                          |
| Static Drain Source ON Resistance | $r_{DS(ON)}$  |       | 75   |       | 150  | $\Omega$      | $I_D = -1\text{mA}$ , $V_{GS} = \emptyset\text{V}$         |                          |

## Dynamic Electrical Characteristics

|                                            |              |  |    |  |     |          |                                                              |                    |
|--------------------------------------------|--------------|--|----|--|-----|----------|--------------------------------------------------------------|--------------------|
| Drain Source ON Resistance                 | $r_{ds(on)}$ |  | 75 |  | 150 | $\Omega$ | $I_D = \emptyset$ , $V_{GS} = \emptyset\text{V}$             | $f = 1\text{ kHz}$ |
| Common Source Input Capacitance            | $C_{iss}$    |  | 45 |  | 45  | pF       | $V_{DS} = -15\text{V}$ , $V_{GS} = \emptyset\text{V}$        | $f = 1\text{ kHz}$ |
| Common Source Reverse Transfer Capacitance | $C_{rss}$    |  | 10 |  | 10  | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 12\text{V}$ (P1086) | $f = 1\text{ MHz}$ |
|                                            |              |  | 10 |  | 10  | pF       | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = 7\text{V}$ (P1087)  |                    |

## Switching Characteristics

|                     |              |  |    |  |     |    |                                                                                                            |
|---------------------|--------------|--|----|--|-----|----|------------------------------------------------------------------------------------------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  |  | 15 |  | 15  | ns | $V_{DD} = -6\text{V}$ , $V_{GS(ON)} = \emptyset\text{V}$<br><div> <div>P1086</div> <div>P1087</div> </div> |
| Rise Time           | $t_r$        |  | 20 |  | 75  | ns |                                                                                                            |
| Turn OFF Delay Time | $t_{d(off)}$ |  | 15 |  | 25  | ns |                                                                                                            |
| Fall Time           | $t_f$        |  | 50 |  | 100 | ns |                                                                                                            |

|               |     |      |          |
|---------------|-----|------|----------|
| $V_{GS(OFF)}$ | 12  | 7    | V        |
| $V_{D(ON)}$   | -6  | -3   | MA       |
| $R_L$         | 910 | 1.8K | $\Omega$ |

## TO-226AA Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate

## Surface Mount

SMPP1086, SMPP1087



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## SMP5911, SMP5912

## Dual N-Channel Silicon Junction Field-Effect Transistor

- Wideband Differential Amplifiers

At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | SMP5911 |       | SMP5912 |       | Process NJ30L |                                                               |
|-----------------------------------|---------------|---------|-------|---------|-------|---------------|---------------------------------------------------------------|
|                                   |               | Min     | Max   | Min     | Max   | Unit          | Test Conditions                                               |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | - 25    |       | - 25    |       | V             | $I_G = -1 \mu A, V_{DS} = \emptyset V$                        |
| Gate Reverse Current              | $I_{GSS}$     |         | - 100 |         | - 100 | pA            | $V_{GS} = -15 V, V_{DS} = \emptyset V$                        |
|                                   |               |         | - 250 |         | - 250 | nA            | $V_{GS} = -15 V, V_{DS} = \emptyset V$<br>$T_A = 150^\circ C$ |
| Gate Operating Current            | $I_G$         |         | - 100 |         | - 100 | pA            | $V_{DG} = 10 V, I_D = 5 mA$                                   |
|                                   |               |         | - 100 |         | - 100 | nA            | $V_{DG} = 10 V, I_D = 5 mA$<br>$T_A = 125^\circ C$            |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | - 1.0   | - 5   | - 1.0   | - 5   | V             | $V_{DS} = 15 V, I_D = 5 nA$                                   |
| Gate Source Voltage               | $V_{GS}$      | - 0.3   | - 4   | - 0.3   | - 4   | V             | $V_{DS} = 15 V, I_D = 5 mA$                                   |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 7       | 40    | 7       | 40    | mA            | $V_{DS} = 10 V, V_{GS} = \emptyset V$                         |

## Dynamic Electrical Characteristics

|                                                   |                                       |      |       |      |       |                  |                                                    |                     |
|---------------------------------------------------|---------------------------------------|------|-------|------|-------|------------------|----------------------------------------------------|---------------------|
| Common Source Forward Transconductance            | $g_{fs}$                              | 3000 | 10000 | 3000 | 10000 | $\mu S$          | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 1 kHz$         |
|                                                   |                                       | 3000 | 10000 | 3000 | 10000 | $\mu S$          | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 100 MHz$       |
| Common Source Output Conductance                  | $g_{os}$                              |      | 100   |      | 100   | $\mu S$          | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 1 kHz$         |
|                                                   |                                       |      | 150   |      | 150   | $\mu S$          | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 100 MHz$       |
| Common Source Input Capacitance                   | $C_{iss}$                             |      | 5     |      | 5     | pF               | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 1 MHz$         |
| Common Source Reverse Transfer Capacitance        | $C_{rss}$                             |      | 1.2   |      | 1.2   | pF               | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 1 MHz$         |
| Equivalent Short Circuit Input Noise Voltage      | $\bar{e}_N$                           |      | 20    |      | 20    | nV/ $\sqrt{Hz}$  | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 10 kHz$        |
| Noise Figure                                      | NF                                    |      | 1     |      | 1     | dB               | $V_{DG} = 10 V, I_D = 5 mA$<br>$R_G = 100 K\Omega$ | $f = 10 kHz$        |
| Gate Source Differential Voltage                  | $V_{GS1} - V_{GS2}$                   |      | 10    |      | 15    | mV               | $V_{DG} = 10 V, I_D = 5 mA$                        |                     |
| Gate Differential Current                         | $I_{G1} - I_{G2}$                     |      | 20    |      | 20    | nA               | $V_{DG} = 10 V, I_D = 5 mA$                        | $T_A = 125^\circ C$ |
| Drain Saturation Current Ratio                    | $I_{DSS1} / I_{DSS2}$                 | 0.95 | 1     | 0.95 | 1     |                  | $V_{DG} = 10 V, V_{GS} = \emptyset V$              |                     |
| Transconductance Ratio                            | $g_{fs1} / g_{fs2}$                   | 0.95 | 1     | 0.95 | 1     |                  | $V_{DG} = 10 V, I_D = 5 mA$                        | $f = 1 kHz$         |
| Gate Source Differential Voltage With Temperature | $\Delta V_{GS1} - V_{GS2} / \Delta T$ |      | 20    |      | 40    | $\mu V/^\circ C$ | $V_{DG} = 10 V, I_D = 5 mA$                        | $T_A = 25^\circ C$  |
|                                                   |                                       |      | 20    |      | 40    | $\mu V/^\circ C$ | $V_{DG} = 10 V, I_D = 5 mA$                        | $T_B = 125^\circ C$ |
|                                                   |                                       |      | 20    |      | 40    | $\mu V/^\circ C$ | $V_{DG} = 10 V, I_D = 5 mA$                        | $T_A = 35^\circ C$  |
|                                                   |                                       |      | 20    |      | 40    | $\mu V/^\circ C$ | $V_{DG} = 10 V, I_D = 5 mA$                        | $T_B = 25^\circ C$  |

## SOIC-8 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source 1, 2 Drain 1, 3 Gate 1, 4 N/C,  
5 Source 2, 6 Drain 2, 7 Gate 2,  
8 Omitted



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## U290, U291

## N-Channel Silicon Junction Field-Effect Transistor

- Choppers
- Low On Resistance Switches

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ 

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 30 V

Continuous Forward Gate Current

100 mA

Continuous Device Power Dissipation

500 mW

Power Derating

4 mW/°C

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | U290 |      | U291  |       | Process NJ1800D |                                                        |                           |
|-----------------------------------|---------------|------|------|-------|-------|-----------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min  | Max  | Min   | Max   | Unit            | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 30 |      | – 30  |       | V               | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |      | – 1  |       | – 1   | nA              | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{A}$  |                           |
|                                   |               |      | – 1  |       | – 1   | $\mu\text{A}$   | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{A}$  | $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 4  | – 10 | – 1.5 | – 4.5 | V               | $V_{DS} = 15\text{V}$ , $I_D = 3\ \text{nA}$           |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 500  |      | 200   |       | mA              | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |
| Drain Cutoff Current              | $I_{D(OFF)}$  |      | 1    |       | 1     | nA              | $V_{DS} = 5\text{V}$ , $V_{GS} = -10\text{V}$          |                           |
|                                   |               |      | 1    |       | 1     | $\mu\text{A}$   | $V_{DS} = 5\text{V}$ , $V_{GS} = -10\text{V}$          | $T_A = 150^\circ\text{C}$ |
| Drain Source ON Voltage           | $V_{DS(ON)}$  |      | 30   |       | 70    | mV              | $V_{GS} = \emptyset\text{V}$ , $I_D = 10\ \text{mA}$   |                           |
| Static Drain Source ON Resistance | $r_{DS(ON)}$  | 1    | 3    | 2     | 7     | $\Omega$        | $V_{GS} = \emptyset\text{V}$ , $I_D = 10\ \text{mA}$   |                           |

## Dynamic Electrical Characteristics

|                             |              |   |     |   |     |          |                                                             |                     |
|-----------------------------|--------------|---|-----|---|-----|----------|-------------------------------------------------------------|---------------------|
| Drain Source ON Resistance  | $r_{ds(on)}$ | 1 | 3   | 2 | 7   | $\Omega$ | $V_{GS} = \emptyset\text{V}$ , $I_D = \emptyset$            | $f = 1\ \text{kHz}$ |
| Drain Gate OFF Capacitance  | $C_{dgo}$    |   | 30  |   | 30  | pF       | $V_{DG} = 15\text{V}$ , $I_S = \emptyset\text{V}$           | $f = 1\ \text{MHz}$ |
| Source Gate OFF Capacitance | $C_{sgo}$    |   | 30  |   | 30  | pF       | $V_{DG} = 15\text{V}$ , $I_S = \emptyset\text{V}$           | $f = 1\ \text{MHz}$ |
| Source Gate Plus Drain Gate | $C_{iss}$    |   | 160 |   | 160 | pF       | $V_{DG} = \emptyset\text{V}$ , $V_{GS} = \emptyset\text{V}$ | $f = 1\ \text{MHz}$ |

## Switching Characteristics

|                     |              |  |    |  |    |    |                                                                                                                                                                                                         |
|---------------------|--------------|--|----|--|----|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Turn ON Delay Time  | $t_{d(on)}$  |  | 15 |  | 15 | ns | $V_{DD} = 1.5\text{V}$ , $I_{D(ON)} = 30\ \text{mA}$<br>$R_L = 50\ \Omega$<br>$V_{GS(ON)} = \emptyset\text{V}$<br><b>(U290)</b> $V_{GS(OFF)} = -12\text{V}$<br><b>(U291)</b> $V_{GS(OFF)} = -7\text{V}$ |
| Rise Time           | $t_r$        |  | 20 |  | 20 | ns |                                                                                                                                                                                                         |
| Turn OFF Delay Time | $t_{d(off)}$ |  | 15 |  | 15 | ns |                                                                                                                                                                                                         |
| Fall Time           | $t_f$        |  | 20 |  | 20 | ns |                                                                                                                                                                                                         |

## TO-52 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case



## U308, U309

## N-Channel Silicon Junction Field-Effect Transistor

- Mixers
- Oscillators
- VHF/UHF Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ .

|                                                  |         |
|--------------------------------------------------|---------|
| Reverse Gate Source & Reverse Gate Drain Voltage | – 25 V  |
| Continuous Forward Gate Current                  | 20 mA   |
| Continuous Device Power Dissipation              | 500 mW  |
| Power Derating                                   | 4 mW/°C |

At 25°C free air temperature:  
Static Electrical Characteristics

|                                   |               | U308 |     |       | U309 |     |       | Process NJ72 |                                                                            |
|-----------------------------------|---------------|------|-----|-------|------|-----|-------|--------------|----------------------------------------------------------------------------|
|                                   |               | Min  | Typ | Max   | Min  | Typ | Max   | Unit         | Test Conditions                                                            |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |     |       | – 25 |     |       | V            | $V_{GS} = -1\mu\text{A}$ , $V_{DS} = 0\text{V}$                            |
| Gate Reverse Current              | $I_{GSS}$     |      |     | – 150 |      |     | – 150 | pA           | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$                              |
|                                   |               |      |     | – 150 |      |     | – 150 | nA           | $V_{GS} = -15\text{V}$ , $V_{DS} = 0\text{V}$ , $T_A = +125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 1  |     | – 6   | – 1  |     | – 4   | V            | $V_{DS} = 10\text{V}$ , $I_D = 1\text{nA}$                                 |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |      |     | 1     |      |     | 1     | V            | $V_{DS} = 0\text{V}$ , $I_G = 10\text{mA}$                                 |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 12   |     | 60    | 12   |     | 30    | mA           | $V_{DS} = 10\text{V}$ , $V_{GS} = 0\text{V}$                               |

## Dynamic Electrical Characteristics

|                                              |             |    |      |     |    |      |     |                        |                                                |             |
|----------------------------------------------|-------------|----|------|-----|----|------|-----|------------------------|------------------------------------------------|-------------|
| Common Gate Forward Transconductance         | $G_{fs}$    | 10 | 17   |     | 10 | 17   |     | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 1 kHz   |
|                                              |             |    | 15   |     |    | 15   |     | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 105 MHz |
|                                              |             |    | 14   |     |    | 14   |     | mS                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 450 MHz |
| Common Gate Output Conductance               | $G_{og}$    |    |      | 250 |    |      | 250 | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 1 kHz   |
|                                              |             |    | 0.18 |     |    | 0.18 |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 105 MHz |
|                                              |             |    | 0.32 |     |    | 0.32 |     | $\mu\text{S}$          | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 450 MHz |
| Drain Gate Capacitance                       | $C_{dg}$    |    |      | 2.5 |    |      | 2.5 | pF                     | $V_{DS} = 10\text{V}$ , $V_{GS} = -10\text{V}$ | f = 1 MHz   |
| Gate Source Capacitance                      | $C_{gs}$    |    |      | 5   |    | 5    |     | pF                     | $V_{DS} = 10\text{V}$ , $V_{GS} = -10\text{V}$ | f = 1 MHz   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |    | 10   |     |    | 10   |     | nV/ $\sqrt{\text{Hz}}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 100 kHz |
| Common Gate Power Gain                       | $G_{pg}$    | 14 | 16   |     | 14 | 16   |     | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 105 MHz |
|                                              |             | 10 | 11   |     | 10 | 11   |     | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 450 MHz |
| Noise Figure                                 | NF          |    | 1.5  | 2   |    | 1.5  | 2   | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 105 MHz |
|                                              |             |    | 2.7  | 3.5 |    | 2.7  | 3.5 | dB                     | $V_{DS} = 10\text{V}$ , $I_D = 10\text{mA}$    | f = 450 MHz |

## TO-52 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case

## Surface Mount

SMPJ308/J309



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# N-Channel Silicon Junction Field-Effect Transistor

- Mixer
- Oscillator
- VHF/UHF Amplifier

## Absolute maximum ratings at $T_A = 25^\circ\text{C}$ .

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 25 V

Continuous Forward Gate Current

20 mA

Continuous Device Power Dissipation

500 mW

Power Derating

4 mW/°C

## At 25°C free air temperature:

### Static Electrical Characteristics

|                                   |               | U310  |     |       | Process NJ72L |                                                        |                           |
|-----------------------------------|---------------|-------|-----|-------|---------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min   | Typ | Max   | Unit          | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25  |     |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |       |     | – 150 | pA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |       |     | – 150 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 2.5 |     | – 6   | V             | $V_{DS} = 10\text{V}$ , $I_D = 1\text{ nA}$            |                           |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |       |     | 1     | V             | $V_{DS} = \emptyset\text{V}$ , $I_G = 10\text{ mA}$    |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 24    |     | 60    | mA            | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |

### Dynamic Electrical Characteristics

|                                              |             |    |      |     |               |                                                |                      |
|----------------------------------------------|-------------|----|------|-----|---------------|------------------------------------------------|----------------------|
| Common Gate Forward Transconductance         |             | 10 | 17   |     | mS            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 1\text{ kHz}$   |
|                                              | $g_{fg}$    |    | 15   |     | mS            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 105\text{ MHz}$ |
|                                              |             |    | 14   |     | mS            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 450\text{ MHz}$ |
| Common Gate Output Conductance               |             |    |      | 250 | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 1\text{ kHz}$   |
|                                              | $g_{og}$    |    | 0.18 |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 105\text{ MHz}$ |
|                                              |             |    | 0.32 |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 450\text{ MHz}$ |
| Drain Gate Capacitance                       | $C_{dg}$    |    |      | 2.5 | pF            | $V_{DS} = 10\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$   |
| Gate Source Capacitance                      | $C_{gs}$    |    |      | 5   | pF            | $V_{DS} = 10\text{V}$ , $V_{GS} = -10\text{V}$ | $f = 1\text{ MHz}$   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$ |    | 10   |     | nV/√Hz        | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 100\text{ Hz}$  |
| Common Gate Power Gain                       | $G_{pg}$    | 14 | 16   |     | dB            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 105\text{ MHz}$ |
|                                              |             | 10 | 11   |     | dB            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 450\text{ MHz}$ |
| Noise Figure                                 | NF          |    | 1.5  | 2   | dB            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 105\text{ MHz}$ |
|                                              |             |    | 2.7  | 3.5 | dB            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$   | $f = 450\text{ MHz}$ |

## TO-52 Package

See Section G for Outline Dimensions

## Pin Configuration

1 Source, 2 Drain, 3 Gate &amp; Case

## Surface Mount

SMPJ310



## U311

## N-Channel Silicon Junction Field-Effect Transistor

- Mixer
- Oscillator
- VHF/UHF Amplifier

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ .

|                                                  |           |
|--------------------------------------------------|-----------|
| Reverse Gate Source & Reverse Gate Drain Voltage | - 25 V    |
| Continuous Forward Gate Current                  | 10 mA     |
| Continuous Device Power Dissipation              | 300 mW    |
| Power Derating                                   | 2.4 mW/°C |

## At 25°C free air temperature:

## Static Electrical Characteristics

|                                   |               | U311 |     |       | Process NJ72L |                                                        |                           |
|-----------------------------------|---------------|------|-----|-------|---------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min  | Typ | Max   | Unit          | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | - 25 |     |       | V             | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |      |     | - 150 | pA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |      |     | - 150 | nA            | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | - 1  |     | - 6   | V             | $V_{DS} = 10\text{V}$ , $I_D = 1\text{ nA}$            |                           |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |      |     | 1     | V             | $V_{DS} = \emptyset\text{V}$ , $I_G = 1\text{ mA}$     |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 20   |     | 60    | mA            | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |

## Dynamic Electrical Characteristics

|                                      |          |      |       |     |               |                                              |                    |
|--------------------------------------|----------|------|-------|-----|---------------|----------------------------------------------|--------------------|
| Common Gate Forward Transconductance | $g_{fg}$ | 1000 | 17000 |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$ | $f = 1\text{ kHz}$ |
| Common Gate Output Conductance       | $g_{og}$ |      |       | 250 | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$ | $f = 1\text{ kHz}$ |
| Gate Drain Capacitance               | $C_{dg}$ |      |       | 2.5 | pF            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$ | $f = 1\text{ MHz}$ |
| Gate Source Capacitance              | $C_{gs}$ |      |       | 5   | pF            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$ | $f = 1\text{ MHz}$ |

## TO-72 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source, 2 Drain, 3 Gate, 4 Case



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# Hybrid Quad Silicon Junction Field-Effect Transistor Array

- Analog Multiplier
- VHF Double-Balanced Mixer

## Absolute maximum ratings at $T_A = 25^\circ\text{C}$ .

Reverse Gate Source &amp; Reverse Gate Drain Voltage

– 25 V

Gate Current

25 mA

Continuous Device Power Dissipation

400 mW

Power Derating

3.2 mW/°C

## At 25°C free air temperature:

### Static Electrical Characteristics

|                                   |               | U350 |     |     | Four Matched Process NJ72L |                                                        |                           |
|-----------------------------------|---------------|------|-----|-----|----------------------------|--------------------------------------------------------|---------------------------|
|                                   |               | Min  | Typ | Max | Unit                       | Test Conditions                                        |                           |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |     |     | V                          | $I_G = -1\ \mu\text{A}$ , $V_{DS} = \emptyset\text{V}$ |                           |
| Gate Reverse Current              | $I_{GSS}$     |      |     | – 1 | nA                         | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  |                           |
|                                   |               |      |     | – 1 | $\mu\text{A}$              | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$  | $T_A = 125^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 2  |     | – 6 | V                          | $V_{DS} = 10\text{V}$ , $I_D = 1\text{ nA}$            |                           |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |      |     | 1   | V                          | $V_{DS} = \emptyset\text{V}$ , $I_G = 1\text{ mA}$     |                           |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 24   |     | 60  | mA                         | $V_{DS} = 15\text{V}$ , $V_{GS} = \emptyset\text{V}$   |                           |

### Dynamic Electrical Characteristics

|                                        |                             |     |    |     |               |                                                                             |                      |
|----------------------------------------|-----------------------------|-----|----|-----|---------------|-----------------------------------------------------------------------------|----------------------|
| Drain Source ON Resistance             | $r_{ds(on)}$                |     | 50 | 90  | $\Omega$      | $V_{GS} = \emptyset\text{V}$ , $I_D = \text{mA}$                            | $f = 1\text{ kHz}$   |
| Common Source Forward Transconductance | $g_{fs}$                    | 10  |    | 18  | mS            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                | $f = 1\text{ kHz}$   |
| Common Source Output Conductance       | $g_{os}$                    |     |    | 150 | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                | $f = 1\text{ kHz}$   |
| Drain Gate Capacitance                 | $C_{dgo}$                   |     |    | 2.5 | pF            | $V_{GD} = -10\text{V}$ , $I_S = \emptyset\text{V}$                          | $f = 1\text{ MHz}$   |
| Gate Source Capacitance                | $C_{sgo}$                   |     |    | 5   | pF            | $V_{GS} = -10\text{V}$ , $I_D = \emptyset\text{V}$                          | $f = 1\text{ MHz}$   |
| (Conversion Gain)                      | $G_c$                       |     | 4  |     | dB            | $V_{DS} = 20\text{V}$ , $V_{GS} = 1/2 V_{GS(OFF)}$<br>$R_D = 1,700\ \Omega$ | $f = 100\text{ MHz}$ |
| Noise Figure                           | NF                          |     | 7  |     | dB            | $V_{DS} = 20\text{V}$ , $V_{GS} = 1/2 V_{GS(OFF)}$<br>$R_D = 1,700\ \Omega$ | $f = 100\text{ MHz}$ |
| Saturation Drain Current Ratio         | $I_{DSS} / I_{DSS}$         | 0.9 |    | 1   |               | $V_{DS} = 15\text{V}$ , $V_{DS} = \emptyset\text{V}$                        |                      |
| Gate Source Cutoff Voltage Ratio       | $V_{GS(OFF)} / V_{GS(OFF)}$ | 0.9 |    | 1   |               | $V_{DS} = 15\text{V}$ , $I_D = 1\text{ nA}$                                 |                      |
| Common Source Forward Transconductance | $g_{fs} / g_{fs}$           | 0.9 |    | 1   |               | $V_{DS} = 15\text{V}$ , $I_D = 10\text{ mA}$                                | $f = 1\text{ kHz}$   |
| Differential Output Conductance        | $Y_{os} / Y_{os}$           | 0.9 |    | 1   |               | $V_{DS} = 15\text{V}$ , $I_D = 10\text{ mA}$                                | $f = 1\text{ kHz}$   |

## TO-78 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Gate 1 & 3, 2 Drain 1 & 4,  
3 Source 1 & 2, 4 Ground & Case,  
5 Source 3 & 4, 6 Drain 2 & 3,  
7 Gate 2 & 4, 8 Omitted



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## U430, U431

## Dual N-Channel Silicon Junction Field-Effect Transistor

- Balanced Mixers
- Differential Amplifiers

Absolute maximum ratings at  $T_A = 25^\circ\text{C}$ .

Total Device Dissipation (Derate 4 mW/°C to 150°C)

500 mW

Storage Temperature Range

– 65°C to +150°C

Lead Temperature

300°C

At 25°C free air temperature:  
Static Electrical Characteristics

|                                   |               | U430 |     |       | U431 |     |       | Process NJ72 |                                                                                   |
|-----------------------------------|---------------|------|-----|-------|------|-----|-------|--------------|-----------------------------------------------------------------------------------|
|                                   |               | Min  | Typ | Max   | Min  | Typ | Max   | Unit         | Test Conditions                                                                   |
| Gate Source Breakdown Voltage     | $V_{(BR)GSS}$ | – 25 |     |       | – 25 |     |       | V            | $I_G = -1\mu\text{A}$ , $V_{DS} = \emptyset\text{V}$                              |
| Gate Reverse Current              | $I_{GSS}$     |      |     | – 150 |      |     | – 150 | pA           | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$                             |
|                                   |               |      |     | – 150 |      |     | – 150 | nA           | $V_{GS} = -15\text{V}$ , $V_{DS} = \emptyset\text{V}$ , $T_A = 150^\circ\text{C}$ |
| Gate Source Cutoff Voltage        | $V_{GS(OFF)}$ | – 1  |     | – 4   | – 2  |     | – 6   | V            | $V_{DS} = 10\text{V}$ , $I_D = 1\text{ nA}$                                       |
| Gate Source Forward Voltage       | $V_{GS(F)}$   |      |     | 1     |      |     | 1     | V            | $V_{DS} = \emptyset\text{V}$ , $I_G = 10\text{ mA}$                               |
| Drain Saturation Current (Pulsed) | $I_{DSS}$     | 12   |     | 30    | 24   |     | 60    | mA           | $V_{DS} = 10\text{V}$ , $V_{GS} = \emptyset\text{V}$                              |

## Dynamic Electrical Characteristics

|                                              |                                     |     |      |     |     |      |     |               |                                                                               |                      |
|----------------------------------------------|-------------------------------------|-----|------|-----|-----|------|-----|---------------|-------------------------------------------------------------------------------|----------------------|
| Common Source Forward Transconductance       | $G_{fs}$                            | 10  | 17   |     | 10  | 17   |     | mS            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                  | $f = 1\text{ kHz}$   |
|                                              |                                     |     | 12   |     |     | 12   |     | mS            | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                  | $f = 100\text{ MHz}$ |
| Common Source Output Conductance             | $G_{os}$                            |     |      | 250 |     |      | 250 | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                  | $f = 1\text{ kHz}$   |
|                                              |                                     |     | 0.15 |     |     | 0.15 |     | $\mu\text{S}$ | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                  | $f = 100\text{ MHz}$ |
| Drain Gate Capacitance                       | $C_{dg}$                            |     |      | 5   |     |      | 5   | pF            | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$                         | $f = 1\text{ MHz}$   |
| Source Gate Capacitance                      | $C_{gs}$                            |     |      | 2.5 |     |      | 2.5 | pF            | $V_{DS} = \emptyset\text{V}$ , $V_{GS} = -10\text{V}$                         | $f = 1\text{ MHz}$   |
| Equivalent Short Circuit Input Noise Voltage | $\bar{e}_N$                         |     | 10   |     |     | 10   |     | nV/√Hz        | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                  | $f = 100\text{ kHz}$ |
| Power Match Source Admittance                | $g_{ig}$                            |     | 12   |     |     | 12   |     |               | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                  | $f = 100\text{ MHz}$ |
| Conversion Gain                              | $G_c$                               |     | 3    |     |     | 3    |     | dB            | $V_{DS} = 20\text{V}$ , $R_L = 2\text{ k}\Omega$ , $V_{GS} = 1/2 V_{GS(OFF)}$ | $f = 100\text{ MHz}$ |
| Saturation Drain Current Ratio               | $I_{DSS1}/I_{DSS2}$                 | 0.9 |      | 1   | 0.9 |      | 1   |               | $V_{DS} = 10\text{V}$ , $V_G = \emptyset\text{V}$                             |                      |
| Gate Source Cutoff Voltage Ratio             | $\frac{V_{GS(OFF)1}}{V_{GS(OFF)2}}$ | 0.9 |      | 1   | 0.9 |      | 1   |               | $V_{DS} = 10\text{V}$ , $I_D = 1\text{ nA}$                                   |                      |
| Transconductance Ratio                       | $g_{fs1}/g_{fs2}$                   | 0.9 |      | 1   | 0.9 |      | 1   |               | $V_{DS} = 10\text{V}$ , $I_D = 10\text{ mA}$                                  |                      |

## TO-78 Package

Dimensions in Inches (mm)

## Pin Configuration

1 Source 1, 2 Gate 1, Drain 1,  
4 Case, 5 Drain 2, 6 Gate 2,  
7 Source 2, 8 Omitted