## REVISIONS

| Letter | ECO No. | Description | Checked | Approved | Date |
|---|---|---|---|---|---|
| A | 36-271 | INITIAL RELEASE | | RFG | 5/22/95 |
| B | 36-323 | ADD VENDOR PAGE 7-40 AND REFERENCES | BK | RFG | 7/31/95 |
| | | | | | |

| NAME | DATE |
|---|---|
| Drawn: BRIAN KLATT | 5/21/95 |
| Checked: | |
| Approved: R. F. Goeke | 5/22/95 |
| Released: D. Gage | 5/22/95 |

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CENTER FOR SPACE RESEARCH

# TRANSISTOR, FIELD EFFECT (FET), U309, DICE, SILICON

| Size | Code Identification No. | Drawing No. | Rev. |
|---|---|---|---|
| T | 80230 | 36-02309 | B |

Scale: NONE

## 1.0 SCOPE

1.1 Introduction This drawing describes device requirements for Field Effect Transistors (FETs) used in flight hardware for a space experiment on the AXAF CCD Imaging Spectrometer (ACIS) Instrument. The part described herein is a Siliconix die, part type U309, unpackaged.

1.2 Part Number The complete MIT part number shall be 36-02309

1.3 Absolute maximum ratings Absolute maximum ratings are in accordance with pages 7-38 through 7-40 of Siliconix Low-Power Discrete Data book, 1994

## 2.0 APPLICABLE DRAWINGS

2.1 Government Specifications and Standards Unless otherwise specified, the following specifications and standards, of the latest released issue, form a part of this drawing, to the extent specified herein.

SPECIFICATIONS

MILITARY

| | |
|---|---|
| MIL-S-19500 | Semiconductor Devices, General Specification for |

INDUSTRY

| | |
|---|---|
| Siliconix | Low-Power Discrete Data book, 1994 |

NOTE: Pages 7-38, 7-39, and 7-40 of Siliconix Low-Power Discrete Data book, 1994, are included herein for convenience.

2.2 Order of precedence In the event of conflict between the text of this drawing and the references cited herein, the text of this drawing shall govern.

## 3.0 REQUIREMENTS

3.1 General Requirements

3.1.1 Item Requirements The microcircuits described herein shall, in all respects, meet all the requirements of this specification and the intent of MIL-S-19500, Appendix H, as specified herein. These FETs shall be tested using production and test facilities and a Reliability and Quality Assurance program adequate to assure successful compliance with this specification.

3.1.2 Procuring Activity For the purposes of this specification and documents referenced herein, the procuring activity is the Massachusetts Institute of Technology (MIT), Center for Space Research (CSR).

3.1.3 Product Changes The supplier shall notify MIT of proposed changes to FETs, including changes in design, materials, fabrication methods, or processes, and changes which may affect the quality or intended end use.

3.3 Electrical performance characteristics Unless otherwise specified, the electrical performance characteristics are as specified on pages 7-38 through 7-40 of Siliconix Low-Power Discrete Data book, 1994 for U309, and apply over the full operating temperature range.

## 4.0 QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection Unless otherwise specified herein, the supplier is responsible for the performance of all examinations and tests as specified herein.

4.2 Screening All FET dice (100%) shall be subjected to and pass the screen tests and examinations defined in paragraph 50.2, Appendix H, of MIL-S-19500. DC electrical tests shall be per pages 7-38 through 7-40 of Siliconix Low-Power Discrete Data book, 1994 for U309.

4.3 Qualification Qualification will be performed on packaged parts, from the same wafer, in accordance with the following;

Sample size shall be seventy-seven (77) pieces

Initial DC electrical tests shall be per pages 7-38 through 7-40 of Siliconix Low-Power Discrete Data book, 1994 for U309

Life Test shall be High Temperature Reverse Bias (HTRB) at 150°C for 1000 hours

Post life test electrical tests shall be DC electrical tests per pages 7-38 through 7-40 of Siliconix Low-Power Discrete Data book, 1994 for U309, and performed at -55°C, +25°C, and +125°C.

Parametric delta limits for $I_{GSS}$ apply at +25°C from initial electrical tests to post life test electrical tests. The delta limit is 10% (15pA).

4.4 Inspection and Test Records The supplier shall maintain inspection and test records for 36 months after hardware delivery to MIT. Test data for all electrical tests, and Qualification shall be submitted to MIT.

4.5 Government Source Inspection (GSI) The government has the right to inspect any or all of the work included in this order at the supplier's facility.

## 5.0 PACKAGING

5.1 Packaging requirements Packaging shall be in accordance with paragraph 60. of Appendix H, of MIL-S-19500.

## 6.0 NOTES

6.1 Approved Source of Supply

Chip Supply
7725 N. Orange Blossom Trail
Orlando, Florida 32810-2696
Cage Code: 57300

# J/SST/U308 Series



## N-Channel JFETs

**J308 SST308 U309**
**J309 SST309 U310**
**J310 SST310**

## Product Summary

| Part Number | $V_{GS(off)}$ (V) | $V_{(BR)GSS}$ Min (V) | $g_{fs}$ Min (mS) | $I_{DSS}$ Min (mA) |
|---|---|---|---|---|
| J308 | −1 to −6.5 | −25 | 8 | 12 |
| J309 | −1 to −4 | −25 | 10 | 12 |
| J310 | −2 to −6.5 | −25 | 8 | 24 |
| SST308 | −1 to −6.5 | −25 | 8 | 12 |
| SST309 | −1 to −4 | −25 | 10 | 12 |
| SST310 | −2 to −6.5 | −25 | 8 | 24 |
| U309 | −1 to −4 | −25 | 10 | 12 |
| U310 | −2.5 to −6 | −25 | 10 | 24 |

*U310, For applications information see AN104, page 12-21.*

## Features

- Excellent High Frequency Gain: Gps 11.5 dB @ 450 MHz
- Very Low Noise: 2.7 dB @ 450 MHz
- Very Low Distortion
- High ac/dc Switch Off-Isolation

## Benefits

- Wideband High Gain
- Very High System Sensitivity
- High Quality of Amplification
- High-Speed Switching Capability
- High Low-Level Signal Amplification

## Applications

- High-Frequency Amplifier/Mixer
- Oscillator
- Sample-and-Hold
- Very Low Capacitance Switches

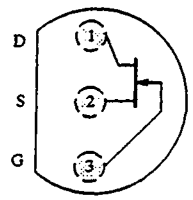
## Description

The J/SST/U308 series offers superb amplification characteristics. Of special interest is its high-frequency performance. Even at 450 MHz, this series offers high power gain at low noise.

Low-cost J series TO-226AA (TO-92) packaging supports automated assembly with tape-and-reel options. The SST series TO-236 (SOT-23) package provides surface-mount capabilities and is available with tape-and-reel options. The U series hermetically-scaled TO-206AC (TO-52) package supports full military processing. (See Military and Packaging Information for further details.)

For similar dual products packaged in the TO-78, see the U430/431 data sheet.

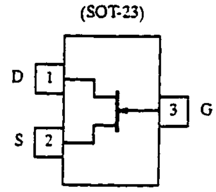
TO-226AA
(TO-92)




Top View

J308
J309
J310

TO-236
(SOT-23)

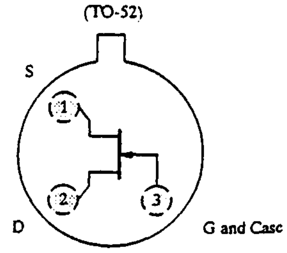



Top View

SST308 (Z8)*
SST309 (Z9)*
SST310 (Z0)*

*Marking Code for TO-236

TO-206AC
(TO-52)




Top View

U309
U310



P-37514—Rev. E (07/25/94)

TEMIC

Siliconix

# J/SST/U308 Series

## Absolute Maximum Ratings

Gate-Drain, Gate-Source Voltage ........................ −25 V
Gate Current : (J/SST Prefixes) ........................ 10 mA
(U Prefix) ........................ 20 mA
Lead Temperature (1/16" from case for 10 sec.) ............ 300°C
Storage Temperature : (J/SST Prefixes) .......... −55 to 150°C
(U Prefix) ................ −65 to 175°C

Operating Junction Temperature .................. −55 to 150°C
Power Dissipation : (J/SST Prefixes)[a] ................ 350 mW
(U Prefix)[b] ...................... 500 mW

Notes
a. Derate 2.8 mW/°C above 25°C
b. Derate 4 mW/°C above 25°C

## Specifications[a] for J/SST308, J/SST309 and J/SST310

| Parameter | Symbol | Test Conditions | | Typ[b] | J/SST308 Min | J/SST308 Max | J/SST309 Min | J/SST309 Max | J/SST310 Min | J/SST310 Max | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Static** | | | | | | | | | | | |
| Gate-Source Breakdown Voltage | $V_{(BR)GSS}$ | $I_G = -1\ \mu A$, $V_{DS} = 0$ V | | −35 | −25 | | −25 | | −25 | | V |
| Gate-Source Cutoff Voltage | $V_{GS(off)}$ | $V_{DS} = 10$ V, $I_D = 1$ nA | | | −1 | −6.5 | −1 | −4 | −2 | −6.5 | V |
| Saturation Drain Current[c] | $I_{DSS}$ | $V_{DS} = 10$ V, $V_{GS} = 0$ V | | | 12 | 60 | 12 | 30 | 24 | 60 | mA |
| Gate Reverse Current | $I_{GSS}$ | $V_{GS} = -15$ V, $V_{DS} = 0$ V | | −0.002 | | −1 | | −1 | | −1 | nA |
| | | | $T_A = 125°C$ | −0.001 | | −1 | | −1 | | −1 | µA |
| Gate Operating Current | $I_G$ | $V_{DG} = 9$ V, $I_D = 10$ mA | | −15 | | | | | | | pA |
| Drain-Source On-Resistance | $r_{DS(on)}$ | $V_{GS} = 0$ V, $I_D = 1$ mA | | 35 | | | | | | | Ω |
| Gate-Source Forward Voltage | $V_{GS(F)}$ | $I_G = 10$ mA, $V_{DS} = 0$ V | J | 0.7 | | 1 | | 1 | | 1 | V |
| **Dynamic** | | | | | | | | | | | |
| Common-Source Forward Transconductance | $g_{fs}$ | $V_{DS} = 10$ V, $I_D = 10$ mA, f = 1 kHz | | 14 | 8 | | 10 | | 8 | | mS |
| Common-Source Output Conductance | $g_{os}$ | $V_{DS} = 10$ V, $I_D = 10$ mA, f = 1 kHz | | 110 | | 250 | | 250 | | 250 | µS |
| Common-Source Input Capacitance | $C_{iss}$ | $V_{DS} = 10$ V, $V_{GS} = -10$ V, f = 1 MHz | J | 4 | | 5 | | 5 | | 5 | pF |
| | | | SST | 4 | | | | | | | pF |
| Common-Source Reverse Transfer Capacitance | $C_{rss}$ | $V_{DS} = 10$ V, $V_{GS} = -10$ V, f = 1 MHz | J | 1.9 | | 2.5 | | 2.5 | | 2.5 | pF |
| | | | SST | 1.9 | | | | | | | pF |
| Equivalent Input Noise Voltage | $\bar{e}_n$ | $V_{DS} = 10$ V, $I_D = 10$ mA, f = 100 Hz | | 6 | | | | | | | nV/√Hz |
| **High Frequency** | | | | | | | | | | | |
| Common-Gate Forward Transconductance | $g_{fg}$ | $V_{DS} = 10$ V, $I_D = 10$ mA | f = 105 MHz | 15 | | | | | | | mS |
| | | | f = 450 MHz | 13 | | | | | | | mS |
| Common-Gate Output Conductance | $g_{og}$ | $V_{DS} = 10$ V, $I_D = 10$ mA | f = 105 MHz | 0.16 | | | | | | | mS |
| | | | f = 450 MHz | 0.55 | | | | | | | mS |
| Common-Gate Power Gain[d] | $G_{pg}$ | $V_{DS} = 10$ V, $I_D = 10$ mA | f = 105 MHz | 16 | | | | | | | dB |
| | | | f = 450 MHz | 11.5 | | | | | | | dB |
| Noise Figure | NF | $V_{DS} = 10$ V, $I_D = 10$ mA | f = 105 MHz | 1.5 | | | | | | | dB |
| | | | f = 450 MHz | 2.7 | | | | | | | dB |

Notes
a. $T_A = 25°C$ unless otherwise noted.
b. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
c. Pulse test: PW ≤ 300 µs duty cycle ≤ 3%.
d. Gain ($G_{pg}$) measured at optimum input noise match.

NZB



7 N-Channel JFETs

Page 7-40 of Siliconix Low-Power Discrete Data book, 1994



## Specifications[a] for U309 and U310

| Parameter | Symbol | Test Conditions | Typ[b] | 309 Min | 309 Max | 310 Min | 310 Max | Unit |
|---|---|---|---|---|---|---|---|---|
| **Static** | | | | | | | | |
| Gate-Source Breakdown Voltage | $V_{(BR)GSS}$ | $I_G = -1\ \mu A$, $V_{DS} = 0\ V$ | -35 | -25 | | -25 | | V |
| Gate-Source Cutoff Voltage | $V_{GS(off)}$ | $V_{DS} = 10\ V$, $I_D = 1\ nA$ | | -1 | -4 | -2.5 | -6 | V |
| Saturation Drain Current[c] | $I_{DSS}$ | $V_{DS} = 10\ V$, $V_{GS} = 0\ V$ | | 12 | 30 | 24 | 60 | mA |
| Gate Reverse Current | $I_{GSS}$ | $V_{GS} = -15\ V$, $V_{DS} = 0\ V$ | -0.002 | | -0.15 | | -0.15 | nA |
| | | $T_A = 125°C$ | -0.001 | | -0.15 | | -0.15 | µA |
| Gate Operating Current | $I_G$ | $V_{DG} = 9\ V$, $I_D = 10\ mA$ | 15 | | | | | pA |
| Drain-Source On-Resistance | $r_{DS(on)}$ | $V_{GS} = 0\ V$, $I_D = 1\ mA$ | 35 | | | | | Ω |
| Gate-Source Forward Voltage | $V_{GS(F)}$ | $I_G = 10\ mA$, $V_{DS} = 0\ V$ | 0.7 | | 1 | | 1 | V |
| **Dynamic** | | | | | | | | |
| Common-Source Forward Transconductance | $g_{fs}$ | $V_{DS} = 10\ V$, $I_D = 10\ mA$, $f = 1\ kHz$ | 14 | 10 | | 10 | | mS |
| Common-Source Output Conductance | $g_{os}$ | $V_{DS} = 10\ V$, $I_D = 10\ mA$, $f = 1\ kHz$ | 110 | | 250 | | 250 | µS |
| Common-Source Input Capacitance | $C_{iss}$ | $V_{DS} = 10\ V$, $V_{GS} = -10\ V$, $f = 1\ MHz$ | 4 | | 5 | | 5 | pF |
| Common-Source Reverse Transfer Capacitance | $C_{rss}$ | $V_{DS} = 10\ V$, $V_{GS} = -10\ V$, $f = 1\ MHz$ | 1.9 | | 2.5 | | 2.5 | pF |
| Equivalent Input Noise Voltage | $\bar{e}_n$ | $V_{DS} = 10\ V$, $I_D = 10\ mA$, $f = 100\ Hz$ | 6 | | | | | nV/√Hz |
| **High Frequency** | | | | | | | | |
| Common-Gate Forward Transconductance | $g_{fg}$ | $V_{DS} = 10\ V$, $I_D = 10\ mA$; $f = 105\ MHz$ | 15 | | | | | mS |
| | | $f = 450\ MHz$ | 13 | | | | | mS |
| Common-Gate Output Conductance | $g_{og}$ | $f = 105\ MHz$ | 0.16 | | | | | mS |
| | | $f = 450\ MHz$ | 0.55 | | | | | mS |
| Common-Gate Power Gain[d] | $G_{pg}$ | $f = 105\ MHz$ | 16 | 14 | | 14 | | dB |
| | | $f = 450\ MHz$ | 11.5 | 10 | | 10 | | dB |
| Noise Figure | NF | $f = 105\ MHz$ | 1.5 | | 2 | | 2 | dB |
| | | $f = 450\ MHz$ | 2.7 | | 3.5 | | 3.5 | dB |

Notes
a. $T_A = 25°C$ unless otherwise noted.
b. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
c. Pulse test: PW ≤300 µs duty cycle ≤3%.
d. Gain ($G_{pg}$) measured at optimum input noise match.

NZ