

MGSF2N02EL

Power MOSFET 2.8 Amps, 20 Volts N-Channel SOT-23

These miniature surface mount MOSFETs low $R_{DS(on)}$ assure minimal power loss and conserve energy, making these devices ideal for use in space sensitive power management circuitry.

Features

- Low $R_{DS(on)}$ Provides Higher Efficiency and Extends Battery Life
- Miniature SOT-23 Surface Mount Package Saves Board Space
- I_{DSS} Specified at Elevated Temperature

Applications

- DC-DC Converters
- Power Management in Portable and Battery Powered Products, ie: Computers, Printers, PCMCIA Cards, Cellular and Cordless Telephones

MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|-----------------|------------|---------------------------|
| Drain-to-Source Voltage | V_{DSS} | 20 | Vdc |
| Gate-to-Source Voltage – Continuous | V_{GS} | ± 8.0 | Vdc |
| Drain Current | I_D | 2.8 | A |
| – Continuous @ $T_A = 25^\circ\text{C}$ | I_{DM} | 5.0 | |
| – Single Pulse ($t_p = 10 \mu\text{s}$) | | | |
| Total Power Dissipation @ $T_A = 25^\circ\text{C}$ | P_D | 1.25 | W |
| Operating and Storage Temperature Range | T_J, T_{stg} | -55 to 150 | $^\circ\text{C}$ |
| Thermal Resistance – Junction-to-Ambient (Note 1) | $R_{\theta JA}$ | 100 | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance – Junction-to-Ambient (Note 2) | | 300 | |
| Maximum Lead Temperature for Soldering Purposes, 1/8" from case for 10 seconds | T_L | 260 | $^\circ\text{C}$ |

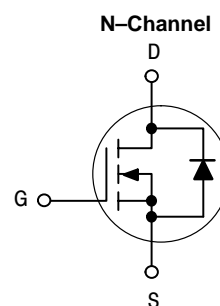
1. 1" Pad, $t < 10$ sec.
2. Min pad, steady state.



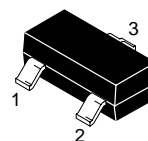
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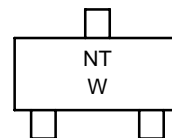
2.8 AMPS
20 VOLTS
 $R_{DS(on)} = 85 \text{ m}\Omega$ (max)



MARKING DIAGRAM

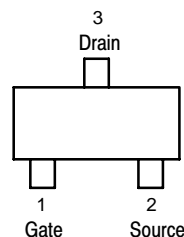


SOT-23
CASE 318
STYLE 21



NT = Device Code
W = Work Week

PIN ASSIGNMENT



ORDERING INFORMATION

| Device | Package | Shipping |
|--------------|---------|--------------------|
| MGSF2N02ELT1 | SOT-23 | 3000 Tape & Reel |
| MGSF2N02ELT3 | SOT-23 | 10,000 Tape & Reel |

This document contains information on a new product. Specifications and information herein are subject to change without notice.

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

MGSF2N02EL

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | |
|---|---------------|---------|---------|-----------|-----------------|
| Drain-to-Source Breakdown Voltage (Note 3) ($V_{GS} = 0\text{ Vdc}$, $I_D = 10\ \mu\text{Adc}$) Temperature Coefficient (Positive) | $V_{(BR)DSS}$ | 20 – | – 22 | – – | Vdc mV/°C |
| Zero Gate Voltage Drain Current ($V_{DS} = 20\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$) ($V_{DS} = 20\text{ Vdc}$, $V_{GS} = 0\text{ Vdc}$, $T_J = 125^\circ\text{C}$) | I_{DSS} | – – | – – | 1.0 10 | μAdc |
| Gate-Source Leakage Current ($V_{GS} = \pm 8.0\text{ Vdc}$, $V_{DS} = 0\text{ Vdc}$) | I_{GSS} | – | – | ± 100 | nA |

ON CHARACTERISTICS (Note 3)

| | | | | | |
|--|--------------|----------|-----------|-----------|--------------|
| Gate-Source Threshold Voltage ($V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{Adc}$) Threshold Temperature Coefficient (Negative) | $V_{GS(th)}$ | 0.5 – | – –2.3 | 1.0 – | Vdc mV/°C |
| Static Drain-to-Source On-Resistance ($V_{GS} = 4.5\text{ Vdc}$, $I_D = 3.6\text{ A}$) ($V_{GS} = 2.5\text{ Vdc}$, $I_D = 3.1\text{ A}$) | $R_{DS(on)}$ | – – | 78 105 | 85 115 | m Ω |

DYNAMIC CHARACTERISTICS

| | | | | | | |
|----------------------|--|-----------|---|-----|---|----|
| Input Capacitance | $(V_{DS} = 5.0\text{ Vdc}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$) | C_{iss} | – | 150 | – | pF |
| Output Capacitance | | C_{oss} | – | 130 | – | |
| Transfer Capacitance | | C_{rss} | – | 45 | – | |

SWITCHING CHARACTERISTICS (Note 4)

| | | | | | | |
|---------------------|---|--------------|---|-----|---|----|
| Turn-On Delay Time | $(V_{DD} = 16\text{ Vdc}$, $I_D = 2.8\text{ Adc}$, $V_{GS} = 4.5\text{ V}$, $R_G = 2.3\ \Omega$) | $t_{d(on)}$ | – | 6.0 | – | ns |
| Rise Time | | t_r | – | 95 | – | |
| Turn-Off Delay Time | | $t_{d(off)}$ | – | 28 | – | |
| Fall Time | | t_f | – | 125 | – | |
| Gate Charge | $(V_{DS} = 16\text{ Vdc}$, $I_D = 1.75\text{ Adc}$, $V_{GS} = 4.0\text{ Vdc}$) (Note 3) | Q_T | – | 3.5 | – | nC |
| | | Q_{gs} | – | 0.6 | – | |
| | | Q_{gd} | – | 1.5 | – | |

SOURCE-DRAIN DIODE CHARACTERISTICS

| | | | | | | |
|--------------------------------|--|--|----------|-----------|----------|---------------|
| Forward Voltage | $(I_S = 1.0\text{ Adc}$, $V_{GS} = 0\text{ Vdc}$) (Note 3) | V_{SD} | – – | 0.76 – | 1.2 – | V |
| Reverse Recovery Time | | $(I_S = 1.0\text{ Adc}$, $V_{GS} = 0\text{ Vdc}$, $di_S/dt = 100\text{ A}/\mu\text{s}$) (Note 3) | t_{rr} | – | 104 | – |
| | t_a | | – | 42 | – | |
| | t_b | | – | 62 | – | |
| Reverse Recovery Stored Charge | | Q_{RR} | – | 0.20 | – | μC |

3. Pulse Test: Pulse Width $\leq 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

4. Switching characteristics are independent of operating junction temperature.

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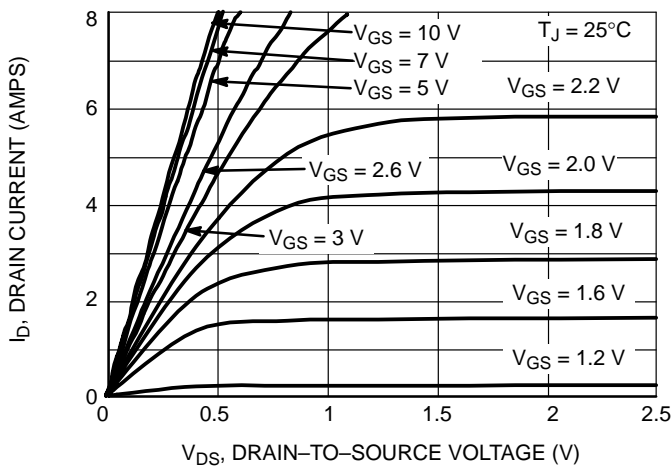


Figure 1. On-Region Characteristics

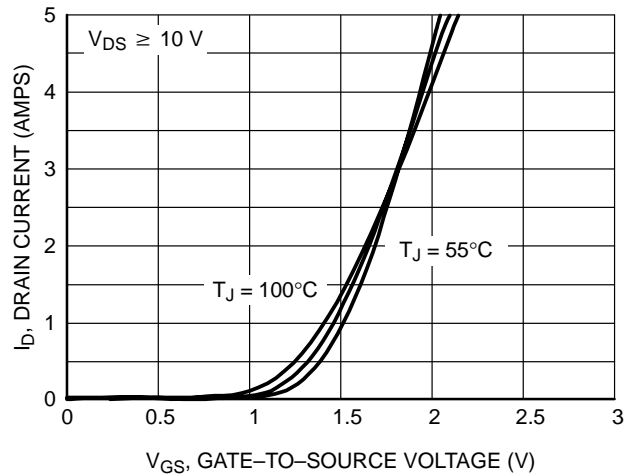


Figure 2. Transfer Characteristics

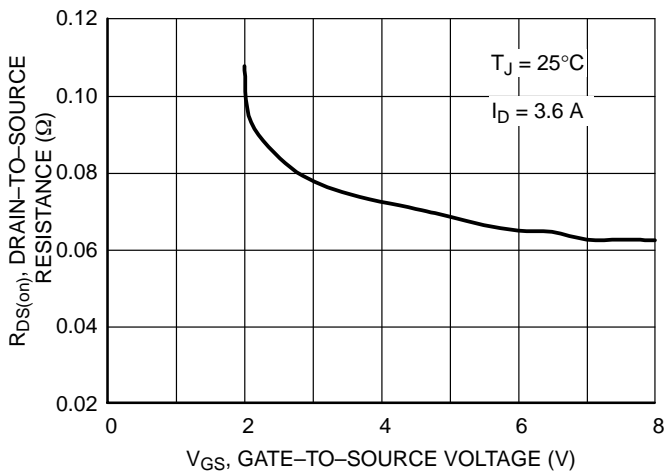


Figure 3. On-Resistance vs. Gate-to-Source Voltage

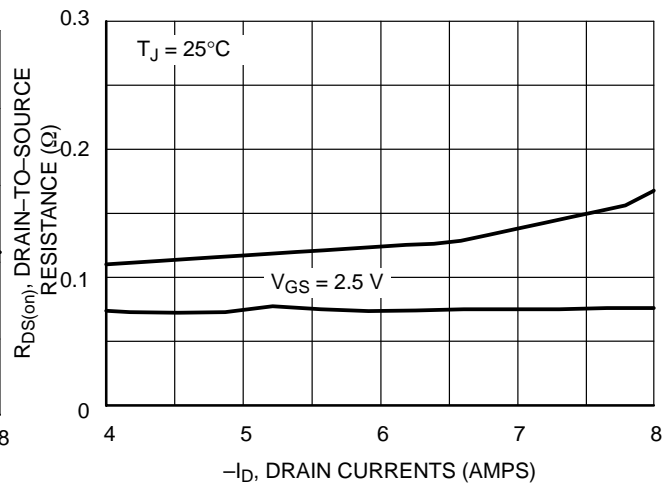


Figure 4. On-Resistance vs. Gate Voltage

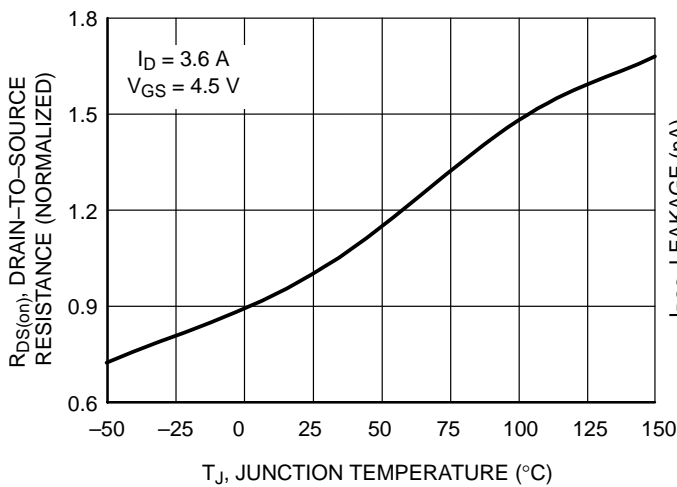


Figure 5. On-Resistance Variation with Temperature

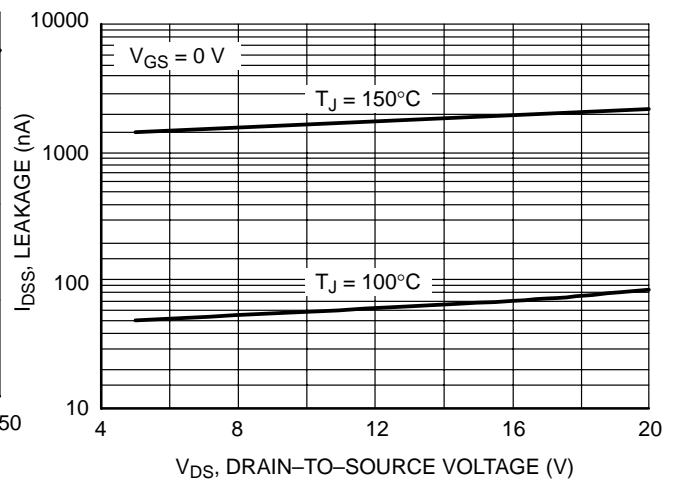


Figure 6. Drain-to-Source Leakage Current vs. Voltage

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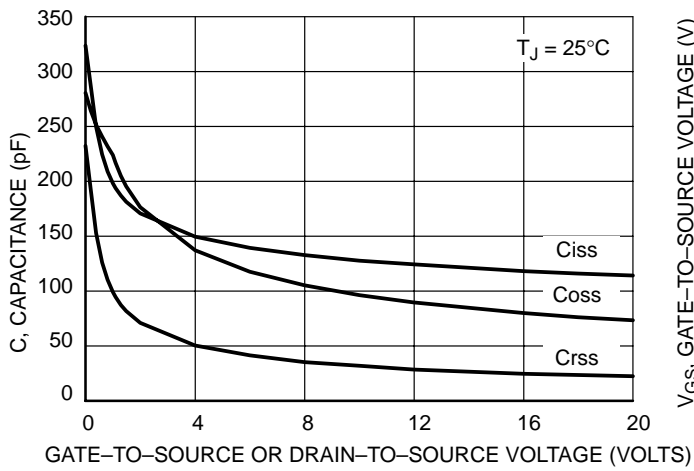


Figure 7. Capacitance Variation

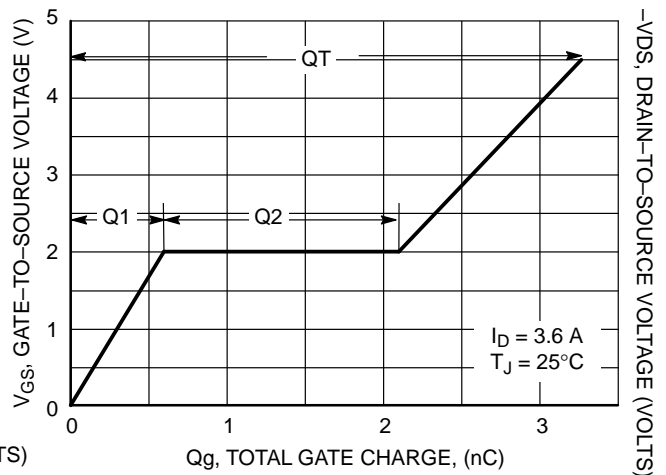


Figure 8. Gate-to-Source Voltage vs. Total Charge

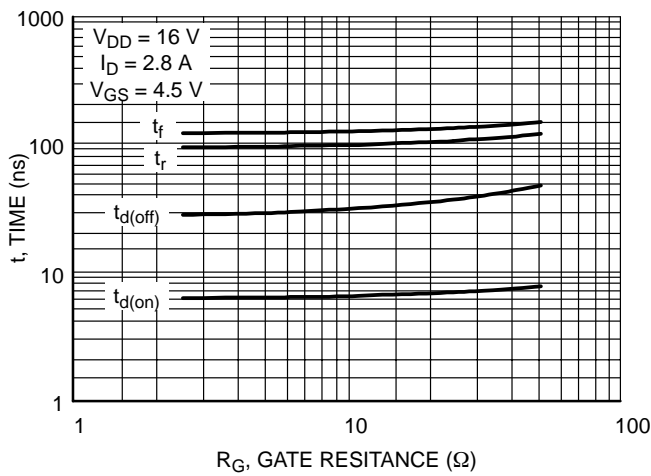


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

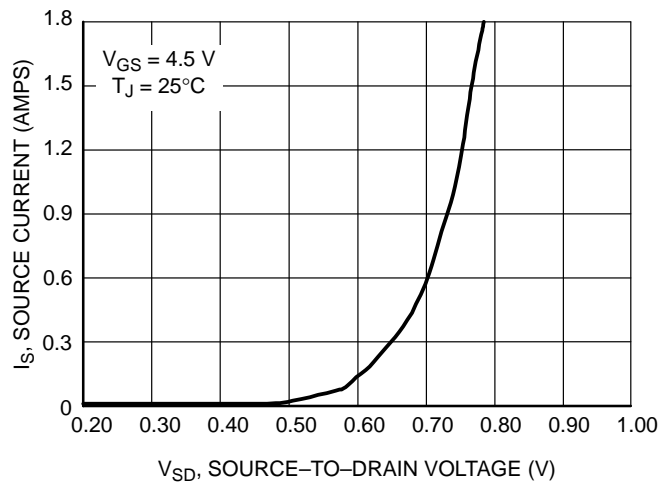


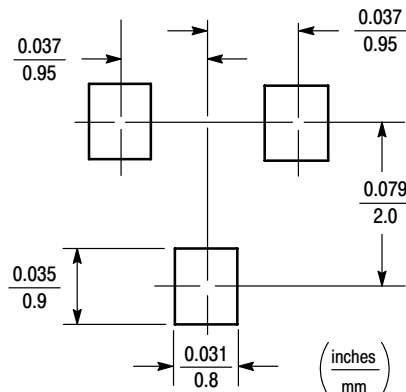
Figure 10. Diode Forward Voltage vs. Current

INFORMATION FOR USING THE SOT-23 SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection

interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



SOLDERING PRECAUTIONS

The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.

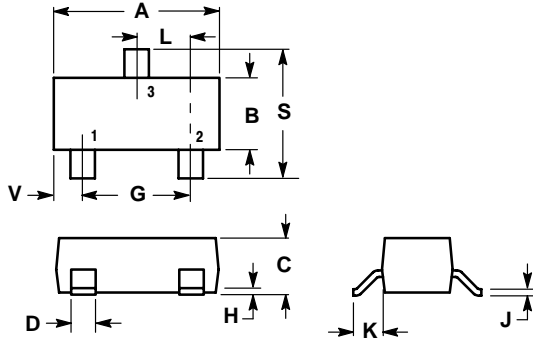
- The soldering temperature and time shall not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

MGSF2N02EL

PACKAGE DIMENSIONS

SOT-23 (TO-236)
CASE 318-08
ISSUE AH



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318-03 AND -07 OBSOLETE, NEW STANDARD 318-08.


| DIM | INCHES | | MILLIMETERS | |
|-----|--------|--------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.1102 | 0.1197 | 2.80 | 3.04 |
| B | 0.0472 | 0.0551 | 1.20 | 1.40 |
| C | 0.0350 | 0.0440 | 0.89 | 1.11 |
| D | 0.0150 | 0.0200 | 0.37 | 0.50 |
| G | 0.0701 | 0.0807 | 1.78 | 2.04 |
| H | 0.0005 | 0.0040 | 0.013 | 0.100 |
| J | 0.0034 | 0.0070 | 0.085 | 0.177 |
| K | 0.0140 | 0.0285 | 0.35 | 0.69 |
| L | 0.0350 | 0.0401 | 0.89 | 1.02 |
| S | 0.0830 | 0.1039 | 2.10 | 2.64 |
| V | 0.0177 | 0.0236 | 0.45 | 0.60 |

STYLE 21:

- PIN 1. GATE
2. SOURCE
3. DRAIN

Notes

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