

Product Summary

| | | |
|---------------|--------------------------|--|
| $V_{(BR)DSS}$ | $R_{DS(ON) \text{ max}}$ | $I_D \text{ max}$ $T_A = +25^\circ\text{C}$ |
| 60V | $6\Omega @ V_{GS} = 5V$ | 200mA |

Description

This MOSFET has been designed to minimize the on-state resistance ($R_{DS(ON)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

Applications

- Motor Control
- Power Management Functions

Features and Benefits

- N-Channel MOSFET
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Small Surface Mount Package
- ESD Protected Gate, 1.2kV HBM
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q101, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q101) for High Reliability.**
- <https://www.diodes.com/quality/product-definitions/>

Mechanical Data

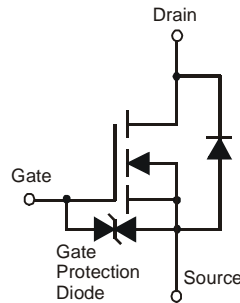
- Case: SOT23
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin annealed over Alloy 42 leadframe. Solderable per MIL-STD-202, Method 208 **e3**
- Terminal Connections: See Diagram
- Weight: 0.008 grams (approximate)



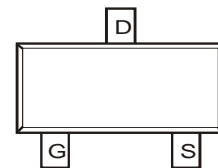
SOT23



Top View



Equivalent Circuit



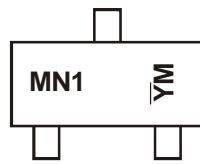
Top View
Pin-Out

Ordering Information (Note 4)

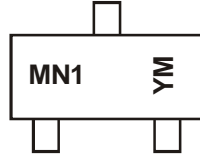
| Part Number | Case | Packaging |
|-------------|-------|--------------------|
| 2N7002A-7 | SOT23 | 3,000/Tape & Reel |
| 2N7002A-13 | SOT23 | 10,000/Tape & Reel |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
 4. For packaging details, go to our website at <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

Marking Information



Chengdu A/T Site



Shanghai A/T Site

MN1 = Product Type Marking Code
 YM = Date Code Marking for SAT (Shanghai Assembly/ Test site)
 $\bar{Y}M$ = Date Code Marking for CAT (Chengdu Assembly/ Test site)
 Y or \bar{Y} = Year (ex: A = 2013)
 M = Month (ex: 9 = September)

Date Code Key

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|------|------|------|------|------|------|------|------|------|
| Code | V | W | X | Y | Z | A | B | C |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |

Maximum Ratings (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

| Characteristic | Symbol | Value | Units |
|--|--------------|----------------------------|-------|
| Drain-Source Voltage | V_{DSS} | 60 | V |
| Gate-Source Voltage | V_{GSS} | ± 20 | V |
| Continuous Drain Current (Note 5) $V_{GS} = 10\text{V}$ | Steady State | $T_A = +25^\circ\text{C}$ | 180 |
| | | $T_A = +85^\circ\text{C}$ | 130 |
| | | $T_A = +100^\circ\text{C}$ | 115 |
| Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$ | Steady State | $T_A = +25^\circ\text{C}$ | 220 |
| | | $T_A = +85^\circ\text{C}$ | 160 |
| | | $T_A = +100^\circ\text{C}$ | 140 |
| Maximum Continuous Body Diode Forward Current (Note 6) | I_S | 0.5 | A |
| Pulsed Drain Current (10 μs pulse, duty cycle = 1%) | I_{DM} | 800 | mA |

Thermal Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

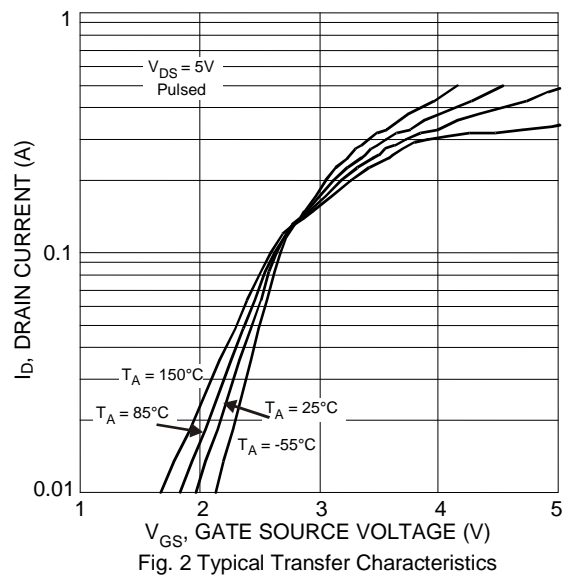
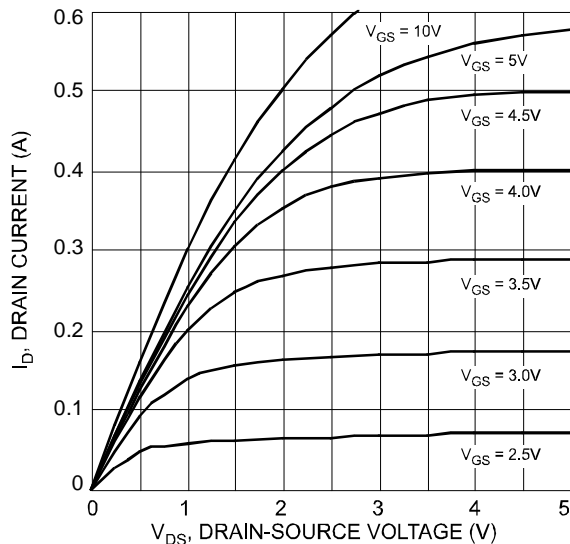
| Characteristic | Symbol | Value | Units |
|---|-----------------|-------------|--------------------|
| Total Power Dissipation | P_D | (Note 5) | 370 |
| | | (Note 6) | 540 |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | (Note 5) | 348 |
| | | (Note 6) | 241 |
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 91 | $^\circ\text{C/W}$ |
| Operating and Storage Temperature Range | T_J, T_{STG} | -55 to +150 | $^\circ\text{C}$ |

Notes: 5. Device mounted on FR-4 PCB, with minimum recommended pad layout
 6. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.

Electrical Characteristics (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|--------------|-----|------------|------------|----------|--|
| OFF CHARACTERISTICS (Note 7) | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | 60 | 70 | — | V | $V_{GS} = 0V, I_D = 10\mu A$ |
| Zero Gate Voltage Drain Current | I_{DSS} | — | — | 1.0 500 | μA | @ $T_C = +25^\circ\text{C}$ @ $T_C = +125^\circ\text{C}$ $V_{DS} = 60V, V_{GS} = 0V$ |
| Gate-Body Leakage | I_{GSS} | — | — | ± 10 | μA | $V_{GS} = \pm 20V, V_{DS} = 0V$ |
| ON CHARACTERISTICS (Note 7) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1.2 | — | 2.0 | V | $V_{DS} = V_{GS}, I_D = 250\mu A$ |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 3.5 3.0 | 6 5 | Ω | @ $T_J = +25^\circ\text{C}$ @ $T_J = +125^\circ\text{C}$ $V_{GS} = 5.0V, I_D = 0.115A$ $V_{GS} = 10V, I_D = 0.115A$ |
| Forward Transconductance | g_{FS} | 80 | — | — | mS | $V_{DS} = 10V, I_D = 0.115A$ |
| DYNAMIC CHARACTERISTICS (Note 8) | | | | | | |
| Input Capacitance | C_{iss} | — | 23 | — | pF | $V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{MHz}$ |
| Output Capacitance | C_{oss} | — | 3.4 | — | pF | |
| Reverse Transfer Capacitance | C_{rss} | — | 1.4 | — | pF | |
| Gate Resistance | R_G | — | 260 | 400 | Ω | $V_{DS} = 0V, V_{GS} = 0V, f = 1.0\text{MHz}$ |
| SWITCHING CHARACTERISTICS (Note 8) | | | | | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 10 | — | ns | $V_{DD} = 30V, I_D = 0.115A, R_L = 150\Omega,$ $V_{GEN} = 10V, R_{GEN} = 25\Omega$ |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 33 | — | ns | |

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.



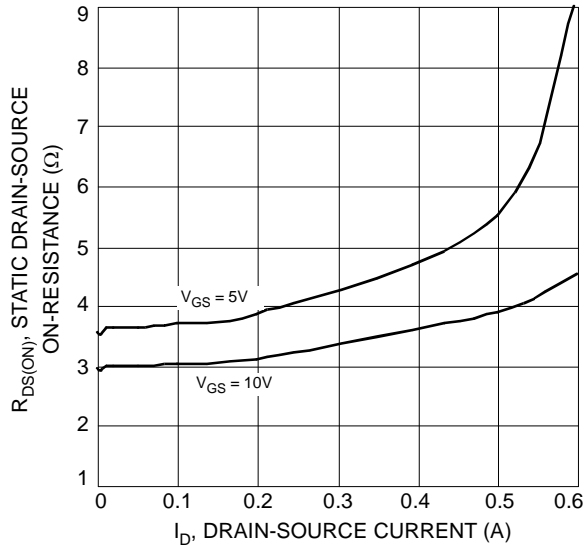


Fig. 3 On-Resistance vs. Drain Current & Gate Voltage

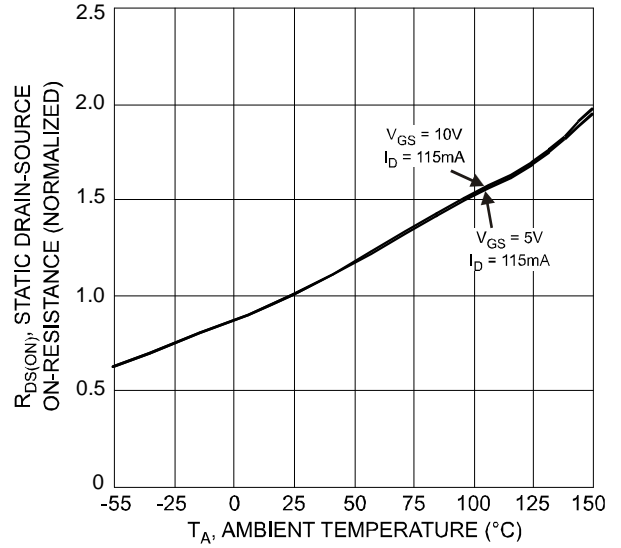


Fig. 4 Normalized Static Drain-Source On-Resistance vs. Ambient Temperature

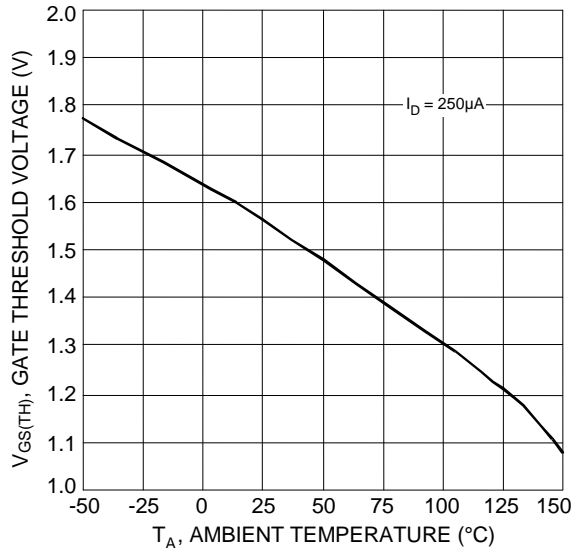


Fig. 5 Gate Threshold Variation vs. Ambient Temperature

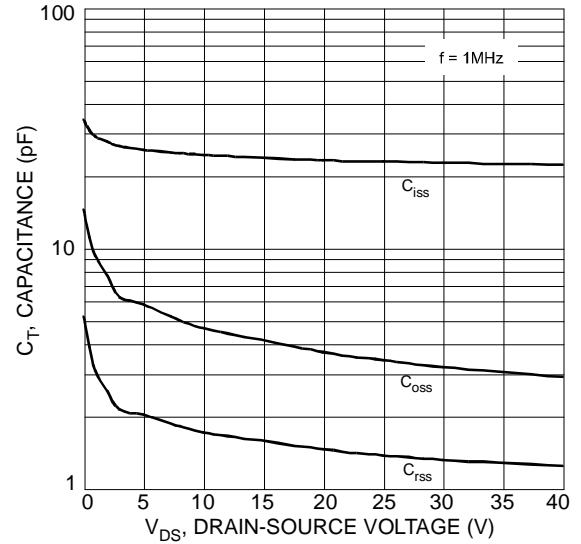


Fig. 6 Typical Total Capacitance

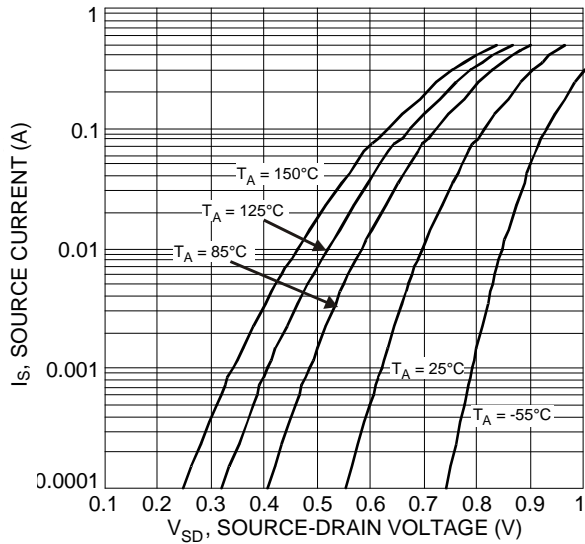
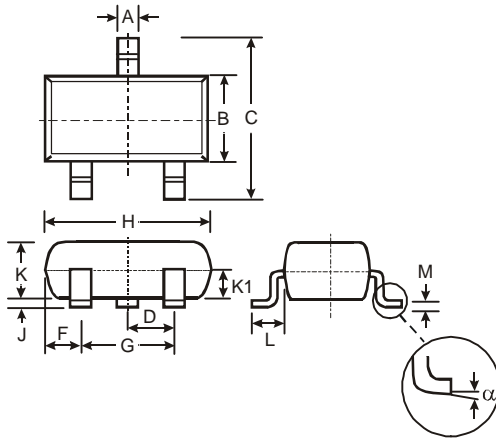


Fig. 7 Reverse Drain Current vs. Source-Drain Voltage

Package Outline Dimensions

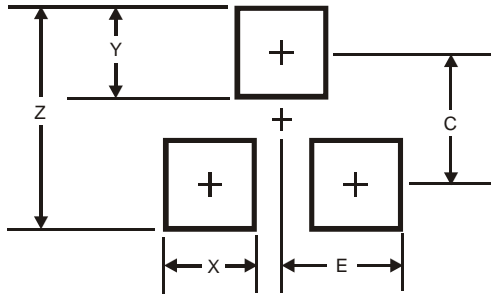
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



| SOT23 | | | |
|----------------------|-------|------|-------|
| Dim | Min | Max | Typ |
| A | 0.37 | 0.51 | 0.40 |
| B | 1.20 | 1.40 | 1.30 |
| C | 2.30 | 2.50 | 2.40 |
| D | 0.89 | 1.03 | 0.915 |
| F | 0.45 | 0.60 | 0.535 |
| G | 1.78 | 2.05 | 1.83 |
| H | 2.80 | 3.00 | 2.90 |
| J | 0.013 | 0.10 | 0.05 |
| K | 0.903 | 1.10 | 1.00 |
| K1 | - | - | 0.400 |
| L | 0.45 | 0.61 | 0.55 |
| M | 0.085 | 0.18 | 0.11 |
| α | 0° | 8° | - |
| All Dimensions in mm | | | |

Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 2.9 |
| X | 0.8 |
| Y | 0.9 |
| C | 2.0 |
| E | 1.35 |

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