

NTR2101P

MOSFET – Single P-Channel, Small Signal, SOT-23

-8.0 V, -3.7 A

Features

- Leading Trench Technology for Low $R_{DS(on)}$
- -1.8 V Rated for Low Voltage Gate Drive
- SOT-23 Surface Mount for Small Footprint (3 x 3 mm)
- This is a Pb-Free Device

Applications

- High Side Load Switch
- DC-DC Conversion
- Cell Phone, Notebook, PDAs, etc.

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

| Parameter | Symbol | Value | Unit | |
|---|------------------------|--------------------------|------------------|---|
| Drain-to-Source Voltage | V_{DSS} | -8.0 | V | |
| Gate-to-Source Voltage | V_{GS} | ± 8.0 | V | |
| Continuous Drain Current (Note 1) | $t \leq 5 \text{ s}$ | $T_A = 25^\circ\text{C}$ | -3.7 | A |
| | | $T_A = 70^\circ\text{C}$ | -3.0 | A |
| Power Dissipation (Note 1) | $t \leq 5 \text{ s}$ | P_D | 0.96 | W |
| Pulsed Drain Current | $t_p = 10 \mu\text{s}$ | I_{DM} | -11 | A |
| Operating Junction and Storage Temperature | T_J, T_{STG} | -55 to 150 | $^\circ\text{C}$ | |
| Source Current (Body Diode) | I_S | -1.2 | A | |
| Lead Temperature for Soldering Purposes (1/8" from case for 10 s) | T_L | 260 | $^\circ\text{C}$ | |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|--|-----------------|-----|--------------------|
| Junction-to-Ambient – Steady State | $R_{\theta JA}$ | 160 | $^\circ\text{C/W}$ |
| Junction-to-Ambient – $t \leq 5 \text{ s}$ | $R_{\theta JA}$ | 130 | |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

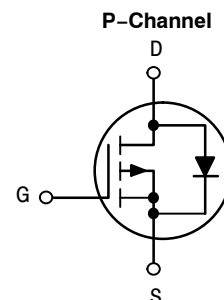
1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).



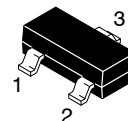
ON Semiconductor®

www.onsemi.com

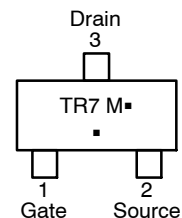
| $V_{(BR)DSS}$ | $R_{DS(on)}$ Typ | I_D Max |
|---------------|------------------------|-----------|
| -8.0 V | 39 m Ω @ -4.5 V | -3.7 A |
| | 52 m Ω @ -2.5 V | |
| | 79 m Ω @ -1.8 V | |



MARKING DIAGRAM & PIN ASSIGNMENT



SOT-23
CASE 318
STYLE 21



TR7 = Specific Device Code
M = Date Code*
▪ = Pb-Free Package

(Note: Microdot may be in either location)
*Date Code orientation may vary depending upon manufacturing location.

ORDERING INFORMATION

| Device | Package | Shipping† |
|-------------|------------------|------------------|
| NTR2101PT1G | SOT-23 (Pb-Free) | 3000/Tape & Reel |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

NTR2101P

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

| Parameter | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|-------------------|--|---------------------------|-----|-----------|---------------|
| OFF CHARACTERISTICS | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS} = 0\text{ V}, I_D = -250\ \mu\text{A}$ | -8.0 | | | V |
| Drain-to-Source Breakdown Voltage Temperature Coefficient | $V_{(BR)DSS}/T_J$ | | | 10 | | mV/°C |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{GS} = 0\text{ V}, V_{DS} = -6.4\text{ V}$ | $T_J = 25^\circ\text{C}$ | | -1.0 | μA |
| | | | $T_J = 125^\circ\text{C}$ | | -100 | |
| Gate-to-Source Leakage Current | I_{GSS} | $V_{DS} = 0\text{ V}, V_{GS} = \pm 8.0\text{ V}$ | | | ± 100 | nA |

ON CHARACTERISTICS (Note 2)

| | | | | | | |
|--|------------------|---|-------|-----|------|------------|
| Gate Threshold Voltage | $V_{GS(TH)}$ | $V_{GS} = V_{DS}, I_D = -250\ \mu\text{A}$ | -0.40 | | -1.0 | V |
| Negative Threshold Temperature Coefficient | $V_{GS(TH)}/T_J$ | | | 2.7 | | mV/°C |
| Drain-to-Source On Resistance | $R_{DS(on)}$ | $V_{GS} = -4.5\text{ V}, I_D = -3.5\text{ A}$ | | 39 | 52 | m Ω |
| | | $V_{GS} = -2.5\text{ V}, I_D = -3.0\text{ A}$ | | 52 | 72 | |
| | | $V_{GS} = -1.8\text{ V}, I_D = -2.0\text{ A}$ | | 79 | 120 | |
| Forward Transconductance | g_{FS} | $V_{GS} = -5.0\text{ V}, I_D = -3.5\text{ A}$ | | 9.0 | | S |

CHARGES AND CAPACITANCES

| | | | | | | |
|------------------------------|--------------|---|--|------|----|----|
| Input Capacitance | C_{ISS} | $V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}, V_{DS} = -4.0\text{ V}$ | | 1173 | | pF |
| Output Capacitance | C_{OSS} | | | 289 | | |
| Reverse Transfer Capacitance | C_{RSS} | | | 218 | | |
| Total Gate Charge | $Q_{G(TOT)}$ | $V_{GS} = -4.5\text{ V}, V_{DS} = -4.0\text{ V}, I_D = -3.5\text{ A}$ | | 12 | 15 | nC |
| Gate-to-Source Charge | Q_{GS} | | | 3.8 | | |
| Gate-to-Drain Charge | Q_{GD} | | | 2.5 | | |

SWITCHING CHARACTERISTICS (Note 3)

| | | | | | | |
|---------------------|--------------|--|--|-------|----|----|
| Turn-On Delay Time | $t_{d(on)}$ | $V_{GS} = -4.5\text{ V}, V_{DD} = -4.0\text{ V}, I_D = -1.2\text{ A}, R_G = 6.0\ \Omega$ | | 7.4 | 15 | ns |
| Rise Time | t_r | | | 15.75 | 25 | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 38 | 58 | |
| Fall Time | t_f | | | 31 | 51 | |

DRAIN-SOURCE DIODE CHARACTERISTICS

| | | | | | | | |
|-----------------------|----------|--|--------------------------|--|-------|------|---|
| Forward Diode Voltage | V_{SD} | $V_{GS} = 0\text{ V}, I_S = -1.2\text{ A}$ | $T_J = 25^\circ\text{C}$ | | -0.73 | -1.2 | V |
|-----------------------|----------|--|--------------------------|--|-------|------|---|

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Pulse Test: pulse width $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$.

3. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

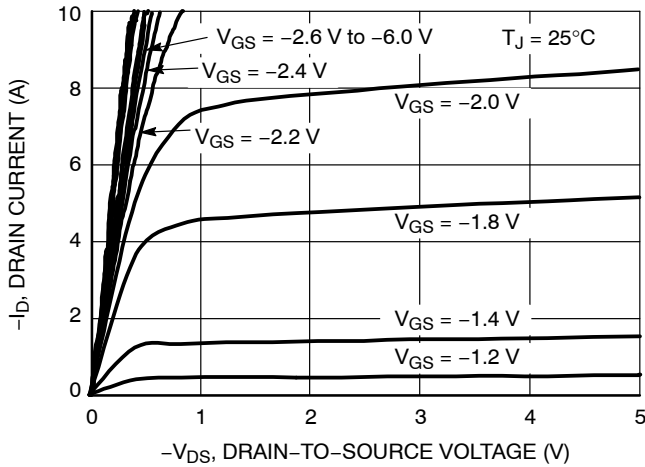


Figure 1. On-Region Characteristics

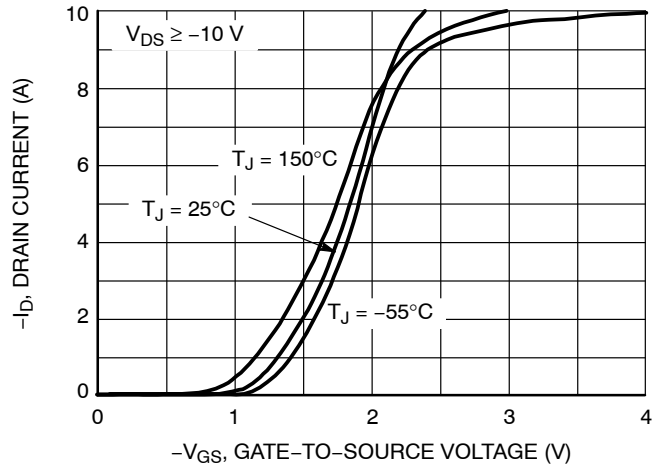


Figure 2. Transfer Characteristics

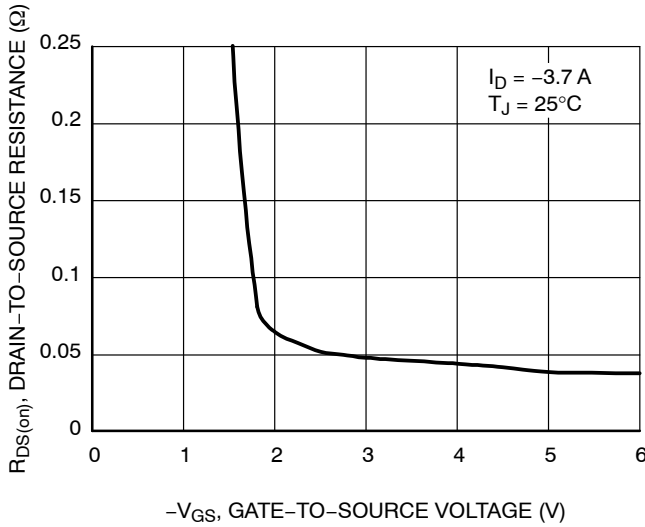


Figure 3. On-Resistance versus Gate-to-Source Voltage

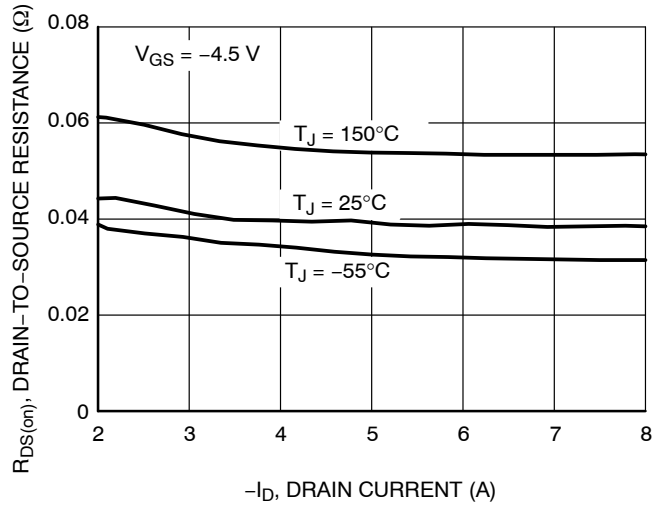


Figure 4. On-Resistance versus Drain Current and Gate Voltage

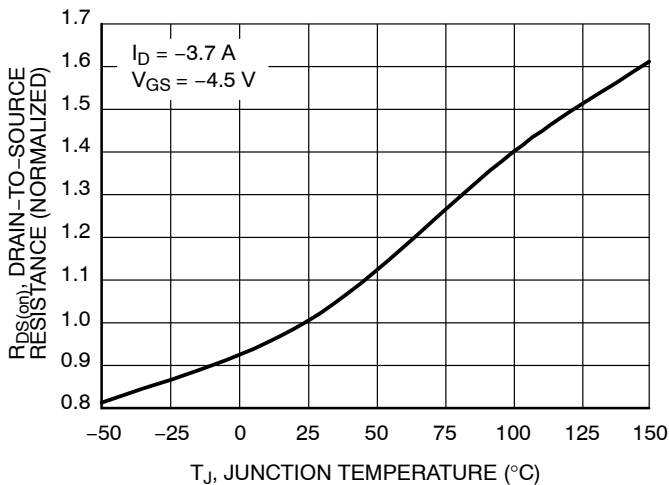


Figure 5. On-Resistance Variation with Temperature

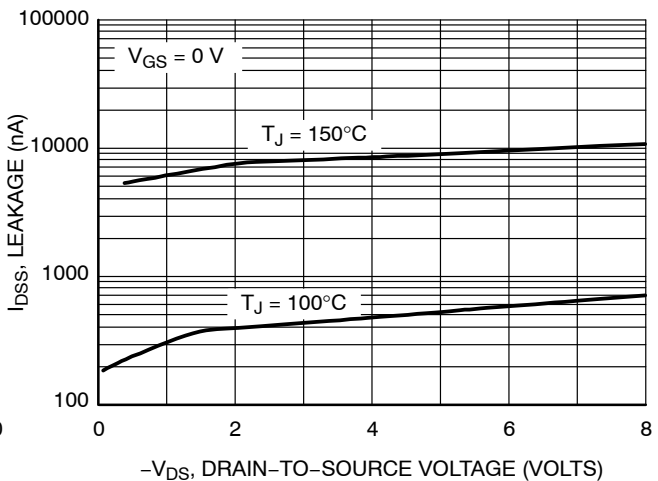


Figure 6. Drain-to-Source Leakage Current versus Voltage

NTR2101P

TYPICAL CHARACTERISTICS

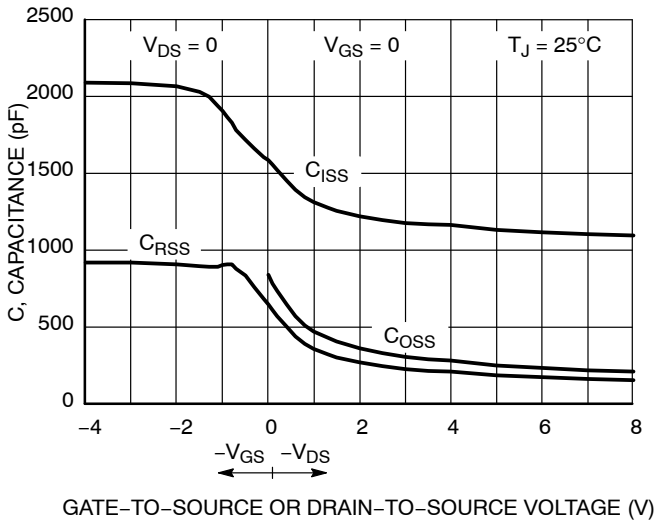


Figure 7. Capacitance Variation

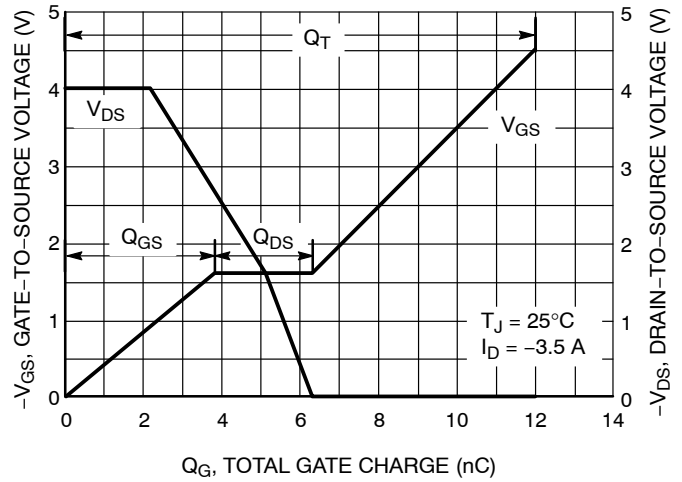


Figure 8. Gate-to-Source and Drain-to-Source Voltage versus Total Charge

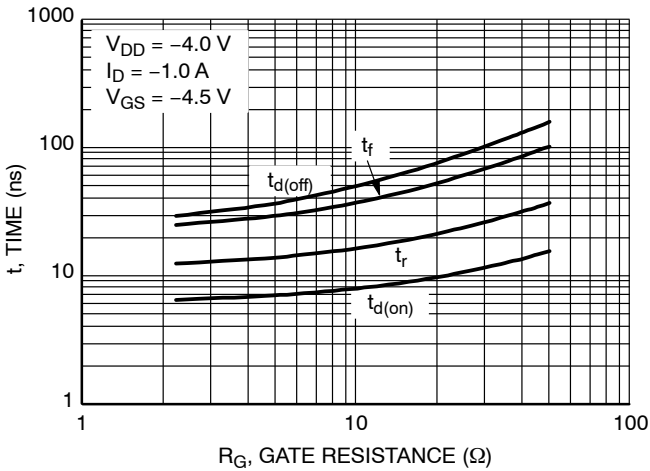


Figure 9. Resistive Switching Time Variation versus Gate Resistance

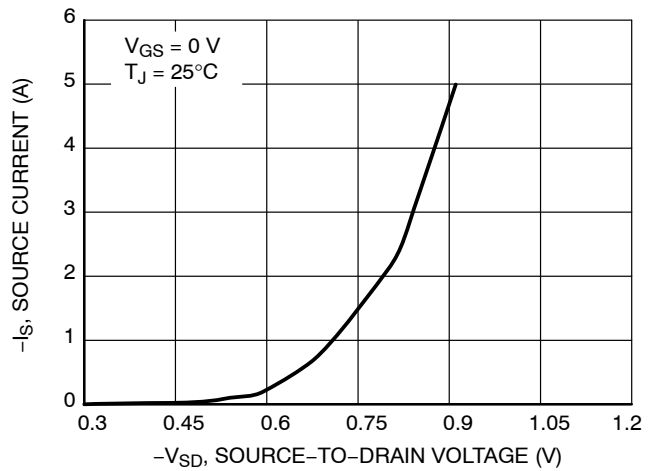


Figure 10. Diode Forward Voltage versus Current

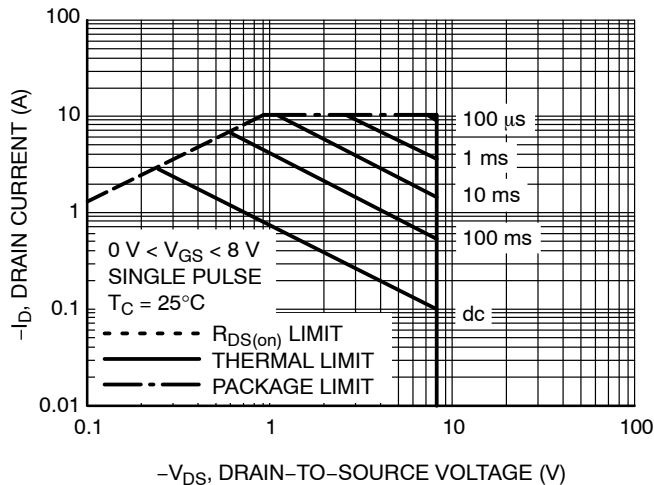


Figure 11. Maximum Rated Forward Biased Safe Operating Area

NTR2101P

TYPICAL CHARACTERISTICS

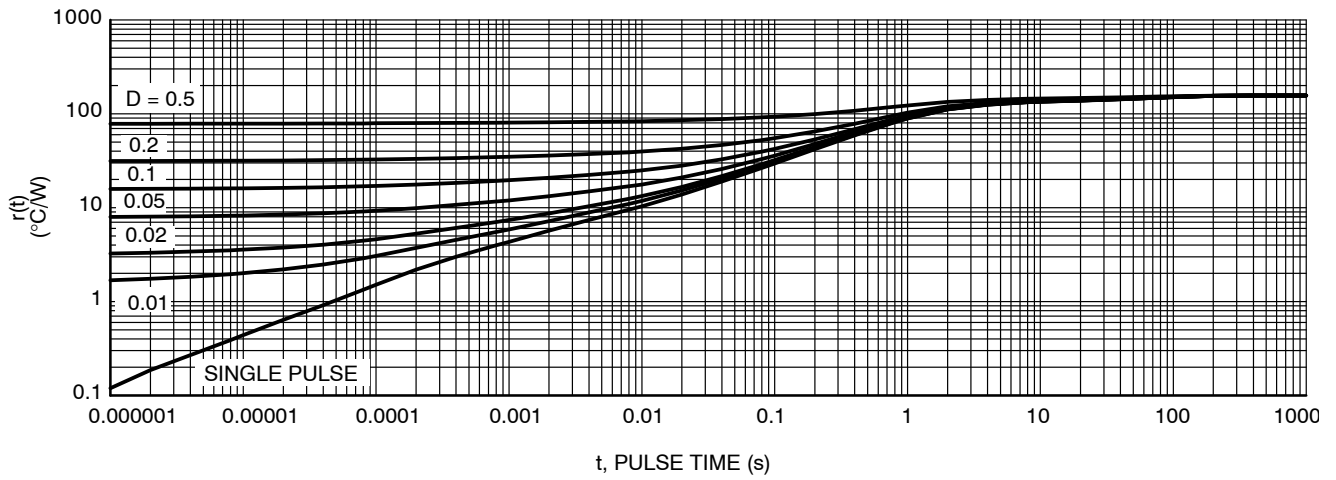
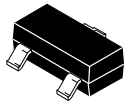


Figure 12. Thermal Response

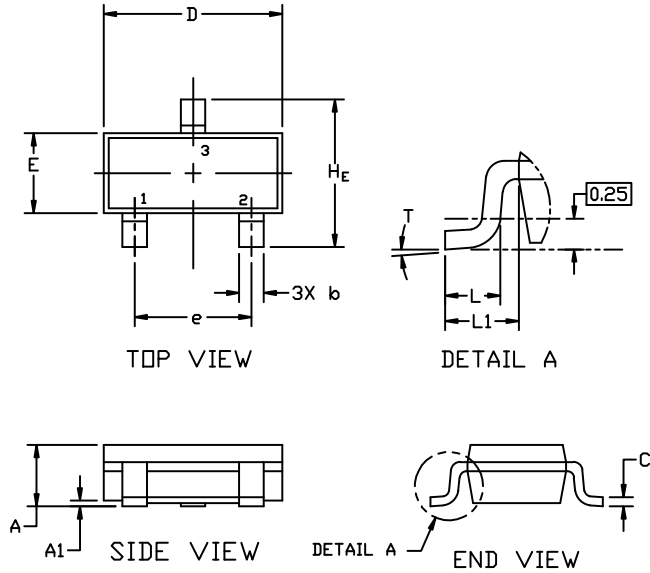
MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



SOT-23 (TO-236)
CASE 318
ISSUE AT

DATE 01 MAR 2023

SCALE 4:1



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

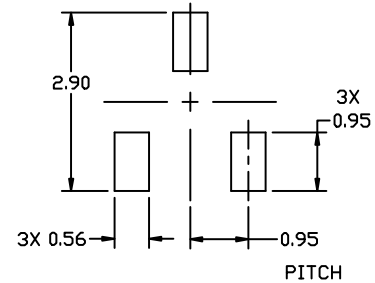
| DIM | MILLIMETERS | | | INCHES | | |
|----------------|-------------|------|------|--------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| D | 2.80 | 2.90 | 3.04 | 0.110 | 0.114 | 0.120 |
| E | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e | 1.78 | 1.90 | 2.04 | 0.070 | 0.075 | 0.080 |
| L | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| H _E | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | --- | 10° | 0° | --- | 10° |

GENERIC MARKING DIAGRAM*



- XXX = Specific Device Code
- M = Date Code
- = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.



RECOMMENDED MOUNTING FOOTPRINT

* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

STYLES ON PAGE 2

| | | |
|-------------------------|------------------------|--|
| DOCUMENT NUMBER: | 98ASB42226B | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | SOT-23 (TO-236) | PAGE 1 OF 2 |

onsemi and ONSEMI are trademarks of Semiconductor Components Industries, LLC dba onsemi or its subsidiaries in the United States and/or other countries. onsemi reserves the right to make changes without further notice to any products herein. onsemi makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does onsemi assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. onsemi does not convey any license under its patent rights nor the rights of others.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS



SOT-23 (TO-236)
CASE 318
ISSUE AT

DATE 01 MAR 2023

STYLE 1 THRU 5:
 CANCELLED

STYLE 6:
 PIN 1. BASE
 2. EMITTER
 3. COLLECTOR

STYLE 7:
 PIN 1. EMITTER
 2. BASE
 3. COLLECTOR

STYLE 8:
 PIN 1. ANODE
 2. NO CONNECTION
 3. CATHODE

STYLE 9:
 PIN 1. ANODE
 2. ANODE
 3. CATHODE

STYLE 10:
 PIN 1. DRAIN
 2. SOURCE
 3. GATE

STYLE 11:
 PIN 1. ANODE
 2. CATHODE
 3. CATHODE-ANODE

STYLE 12:
 PIN 1. CATHODE
 2. CATHODE
 3. ANODE

STYLE 13:
 PIN 1. SOURCE
 2. DRAIN
 3. GATE

STYLE 14:
 PIN 1. CATHODE
 2. GATE
 3. ANODE

STYLE 15:
 PIN 1. GATE
 2. CATHODE
 3. ANODE

STYLE 16:
 PIN 1. ANODE
 2. CATHODE
 3. CATHODE

STYLE 17:
 PIN 1. NO CONNECTION
 2. ANODE
 3. CATHODE

STYLE 18:
 PIN 1. NO CONNECTION
 2. CATHODE
 3. ANODE

STYLE 19:
 PIN 1. CATHODE
 2. ANODE
 3. CATHODE-ANODE

STYLE 20:
 PIN 1. CATHODE
 2. ANODE
 3. GATE

STYLE 21:
 PIN 1. GATE
 2. SOURCE
 3. DRAIN

STYLE 22:
 PIN 1. RETURN
 2. OUTPUT
 3. INPUT

STYLE 23:
 PIN 1. ANODE
 2. ANODE
 3. CATHODE

STYLE 24:
 PIN 1. GATE
 2. DRAIN
 3. SOURCE

STYLE 25:
 PIN 1. ANODE
 2. CATHODE
 3. GATE

STYLE 26:
 PIN 1. CATHODE
 2. ANODE
 3. NO CONNECTION

STYLE 27:
 PIN 1. CATHODE
 2. CATHODE
 3. CATHODE

STYLE 28:
 PIN 1. ANODE
 2. ANODE
 3. ANODE

| | | |
|-------------------------|------------------------|---|
| DOCUMENT NUMBER: | 98ASB42226B | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | SOT-23 (TO-236) | PAGE 2 OF 2 |

onsemi and **ONSEMI** are trademarks of Semiconductor Components Industries, LLC dba **onsemi** or its subsidiaries in the United States and/or other countries. **onsemi** reserves the right to make changes without further notice to any products herein. **onsemi** makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. **onsemi** does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales