# NTND31225CZ

# MOSFET – Small Signal, Complementary, XLLGAS6, 0.65mm x 0.90mm x 0.4mm

## 20 V

**ON Semiconductor®**

www.onsemi.com

### Features

- Advanced Trench Complementary MOSFET
- Offers a Low $R_{DS(ON)}$ Solution in the Ultra Small 0.65 mm × 0.90 mm Package
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

### Applications

- Small Signal Load Switch with Level Shift
- Analog Switch
- High Speed Interfacing
- Optimized for Power Management in Ultra Portable Products

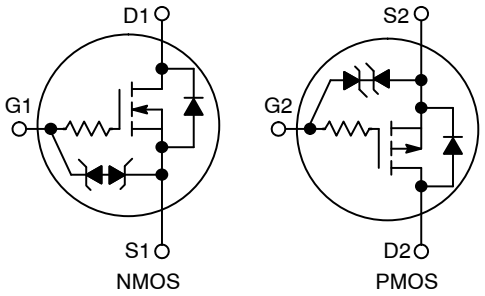
| $V_{(BR)DSS}$ | $R_{DS(ON)}$ MAX | $I_D$ Max |
|---|---|---|
| N−Channel 20 V | 1.5 Ω @ 4.5 V | 220 mA |
| | 2.0 Ω @ 2.5 V | |
| | 3.0 Ω @ 1.8 V | |
| | 4.5 Ω @ 1.5 V | |
| P−Channel −20 V | 5.0 Ω @ −4.5 V | −127 mA |
| | 6.0 Ω @ −2.5 V | |
| | 7.0 Ω @ −1.8 V | |
| | 10.0 Ω @ −1.5 V | |

**MAXIMUM RATINGS** ($T_J$ = 25°C unless otherwise specified)

| Parameter | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-to-Source Voltage | | NMOS | $V_{DSS}$ | 20 | V |
| | | PMOS | | −20 | |
| Gate-to-Source Voltage | | NMOS | $V_{GSS}$ | ±8 | V |
| | | PMOS | | ±8 | |
| N−Channel Continuous Drain Current (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | 220 | mA |
| | | $T_A$ = 85°C | | 158 | |
| | t ≤ 5 s | $T_A$ = 25°C | | 253 | |
| P−Channel Continuous Drain Current (Note 1) | Steady State | $T_A$ = 25°C | $I_D$ | −127 | mA |
| | | $T_A$ = 85°C | | −91 | |
| | t ≤ 5 s | $T_A$ = 25°C | | −146 | |
| Power Dissipation (Note 1) | Steady State | $T_A$ = 25°C | $P_D$ | 125 | mW |
| | t ≤ 5 s | | | 166 | |
| Pulsed Drain Current | NMOS | $t_p$ = 10 μs | $I_{DM}$ | 846 | mA |
| | PMOS | | | −488 | |
| Source Current (Body Diode) | | | $I_S$ | 200 | mA |
| | | | | −200 | |
| Operating Junction and Storage Temperature | | | $T_J$, $T_{STG}$ | −55 to 150 | °C |
| Lead Temperature for Soldering Purposes (1/8″ from case for 10 s) | | | $T_L$ | 260 | °C |

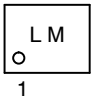
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**DEVICE SYMBOL**



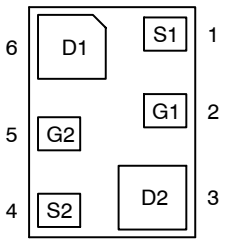

**XLLGA6**
**Case 713AC**

**MARKING DIAGRAM**




L = Specific Device Code
M = Date Code

**PINOUT DIAGRAM**




(Bottom View)

**ORDERING INFORMATION**

See detailed ordering and shipping information on page 4 of this data sheet.

1. Surface-mounted on FR4 board using the minimum recommended pad size, 1 oz Cu.

## THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Max | Unit |
|---|---|---|---|
| Junction-to-Ambient (Note 2)<br>Steady State<br>t ≤ 5 s | $R_{\theta JA}$ | <br>998<br>751 | °C/W |

2. Surface−mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq), 1 oz copper

## ELECTRICAL CHARACTERISTICS ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | FET | Test Condition | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | | | |
| Drain-to-Source Breakdown Voltage | $V_{(BR)DSS}$ | N | $V_{GS}$ = 0 V, $I_D$ = 250 μA | | 20 | | | V |
| | | P | $V_{GS}$ = 0 V, $I_D$ = −250 μA | | −20 | | | |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | N | $V_{GS}$ = 0 V, $V_{DS}$ = 5 V | $T_J$ = 25°C | | | 50 | nA |
| | | | | $T_J$ = 85°C | | | 200 | |
| | | | $V_{GS}$ = 0 V, $V_{DS}$ = 16 V | $T_J$ = 25°C | | | 100 | |
| | | P | $V_{GS}$ = 0 V, $V_{DS}$ = −5 V | $T_J$ = 25°C | | | −50 | |
| | | | | $T_J$ = 85°C | | | −200 | |
| | | | $V_{GS}$ = 0 V, $V_{DS}$ = −16 V | $T_J$ = 25°C | | | −100 | |
| Gate-to-Source Leakage Current | $I_{GSS}$ | N | $V_{GS}$ = 0 V, $V_{DS}$ = ±5 V | | | | ±100 | nA |
| | | P | $V_{GS}$ = 0 V, $V_{DS}$ = ±5 V | | | | ±100 | |
| **ON CHARACTERISTICS** | | | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | N | $V_{GS}$ = $V_{DS}$, $I_D$ = 250 μA | | 0.4 | | 1.0 | V |
| | | P | $V_{GS}$ = $V_{DS}$, $I_D$ = −250 μA | | −0.4 | | −1.0 | |
| Drain-to-Source On Resistance | $R_{DS(ON)}$ | N | $V_{GS}$ = 4.5 V, $I_D$ = 100 mA | | | 0.8 | 1.5 | Ω |
| | | | $V_{GS}$ = 2.5 V, $I_D$ = 50 mA | | | 1.1 | 2.0 | |
| | | | $V_{GS}$ = 1.8 V, $I_D$ = 20 mA | | | 1.4 | 3.0 | |
| | | | $V_{GS}$ = 1.5 V, $I_D$ = 10 mA | | | 1.8 | 4.5 | |
| | | P | $V_{GS}$ = −4.5 V, $I_D$ = −100 mA | | | 2.1 | 5.0 | |
| | | | $V_{GS}$ = −2.5 V, $I_D$ = −50 mA | | | 2.7 | 6.0 | |
| | | | $V_{GS}$ = −1.8 V, $I_D$ = −20 mA | | | 3.6 | 7.0 | |
| | | | $V_{GS}$ = −1.5 V, $I_D$ = −10 mA | | | 4.2 | 10.0 | |
| Forward Transconductance | $g_{FS}$ | N | $V_{DS}$ = 5 V, $I_D$ = 125 mA | | | 0.48 | | S |
| | | P | $V_{DS}$ = −5 V, $I_D$ = −125 mA | | | 0.35 | | |
| Forward Diode Voltage | $V_{SD}$ | N | $V_{GS}$ = 0 V, $I_S$ = 10 mA | | | 0.6 | 1.0 | V |
| | | P | $V_{GS}$ = 0 V, $I_S$ = −10 mA | | | −0.6 | −1.0 | |

3. Switching characteristics are independent of operating junction temperatures.
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.

**ELECTRICAL CHARACTERISTICS** ($T_J$ = 25°C unless otherwise specified)

| Parameter | Symbol | FET | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **CAPACITANCES** | | | | | | | |
| Input Capacitance | $C_{ISS}$ | N | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = 15 V | | 12.3 | | pF |
| Output Capacitance | $C_{OSS}$ | | | | 3.4 | | |
| Reverse Capacitance | $C_{RSS}$ | | | | 2.5 | | |
| Input Capacitance | $C_{ISS}$ | P | $V_{GS}$ = 0 V, f = 1 MHz, $V_{DS}$ = −15 V | | 12.8 | | |
| Output Capacitance | $C_{OSS}$ | | | | 2.8 | | |
| Reverse Capacitance | $C_{RSS}$ | | | | 2.0 | | |
| **SWITCHING CHARACTERISTICS, $V_{GS}$ = 4.5 V** | | | | | | | |
| Turn-On Delay Time | $t_{d(ON)}$ | N | $V_{GS}$ = 4.5 V, $V_{DS}$ = 15 V, $I_D$ = 200 mA, $R_G$ = 2 Ω | | 16.5 | | ns |
| Rise Time | $t_r$ | | | | 25.5 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | | 142 | | |
| Fall Time | $t_f$ | | | | 80 | | |
| Turn-On Delay Time | $t_{d(ON)}$ | P | $V_{GS}$ = −4.5 V, $V_{DS}$ = −15 V, $I_D$ = −200 mA, $R_G$ = 2 Ω | | 37 | | |
| Rise Time | $t_r$ | | | | 71 | | |
| Turn-Off Delay Time | $t_{d(OFF)}$ | | | | 280 | | |
| Fall Time | $t_f$ | | | | 171 | | |

3. Switching characteristics are independent of operating junction temperatures.

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.

## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NTND31225CZTAG | XLLGA6 (Pb−Free) | 8000 / Tape & Reel |

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

## TYPICAL CHARACTERISTICS – P–CHANNEL

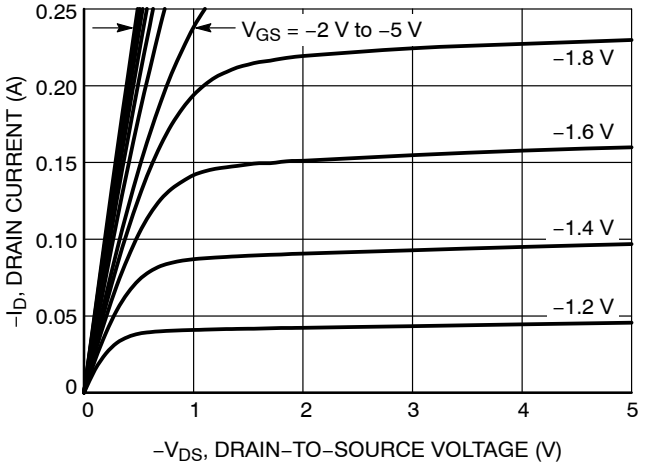



**Figure 1. On−Region Characteristics**

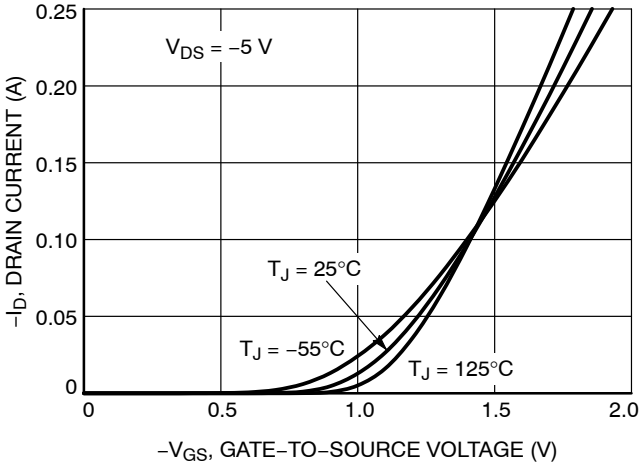



**Figure 2. Transfer Characteristics**

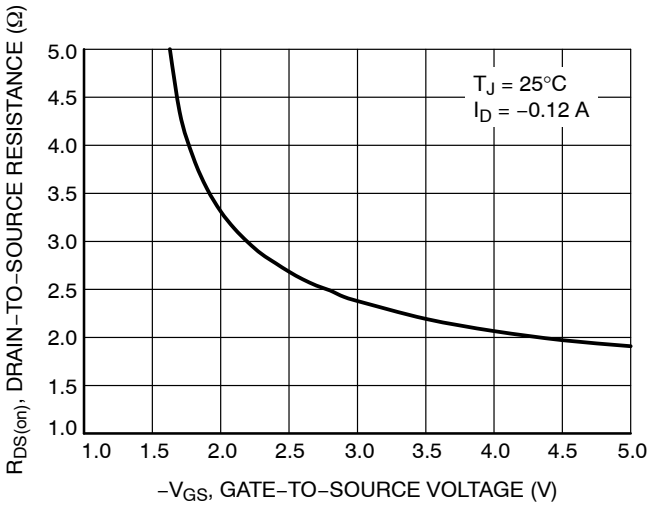



**Figure 3. On−Resistance vs. Gate−to−Source Voltage**

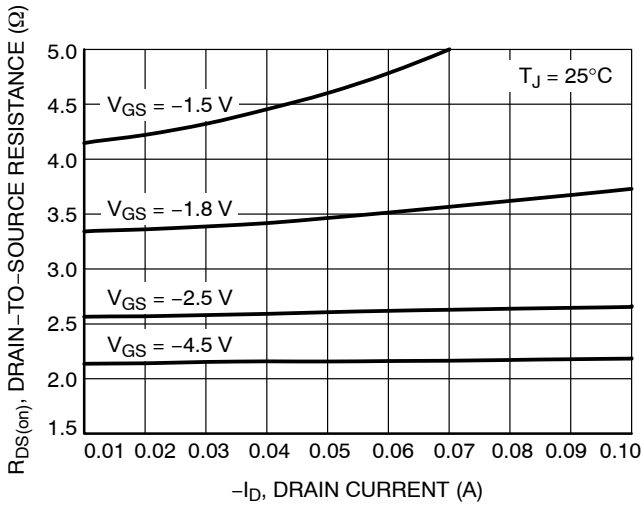



**Figure 4. On−Resistance vs. Drain Current and Gate Voltage**

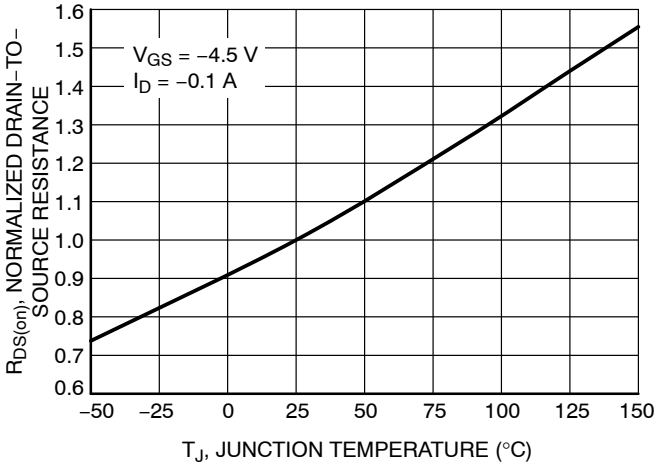



**Figure 5. On−Resistance Variation with Temperature**

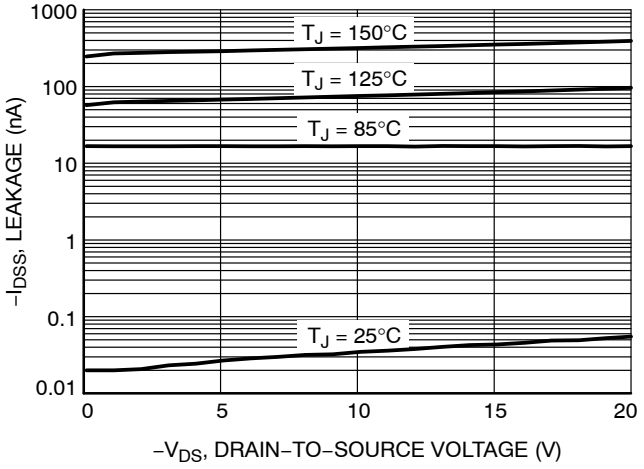



**Figure 6. Drain−to−Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS – P–CHANNEL

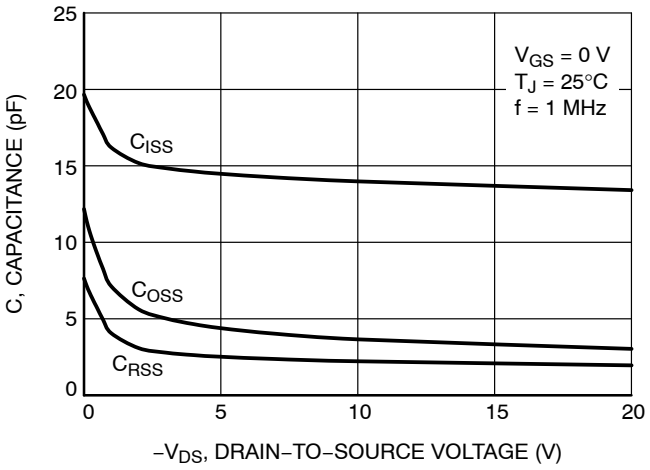



**Figure 7. Capacitance Variation**

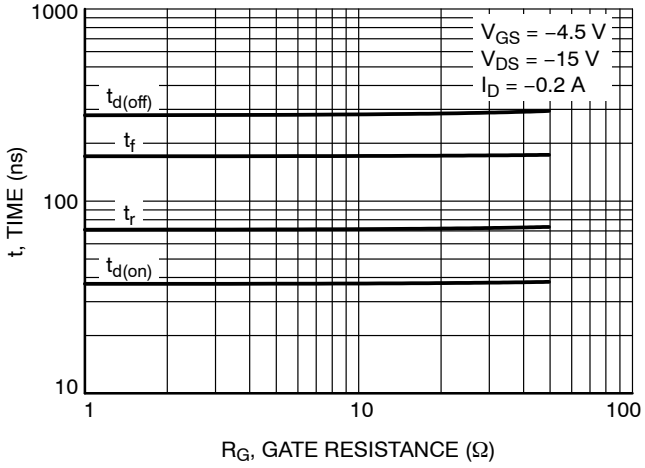



**Figure 8. Resistive Switching Time Variation vs. Gate Resistance**

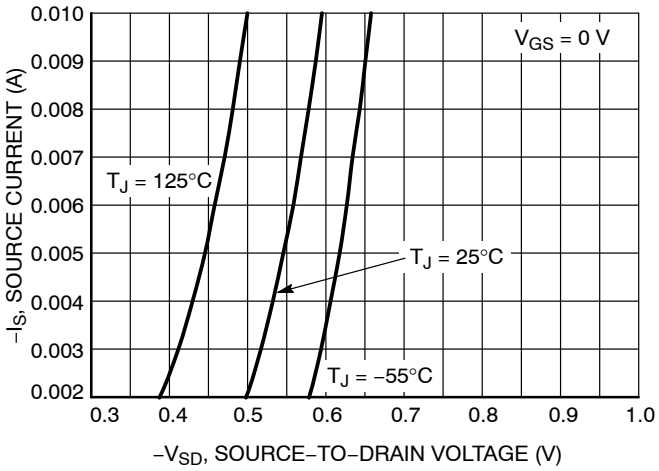



**Figure 9. Diode Forward Voltage vs. Current**

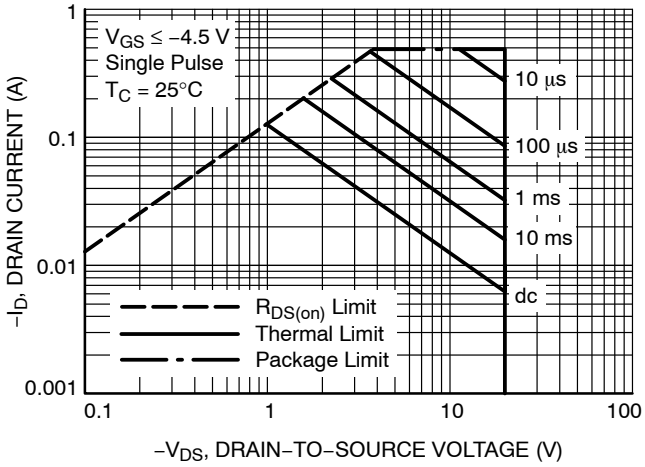



**Figure 10. Maximum Rated Forward Biased Safe Operating Area**

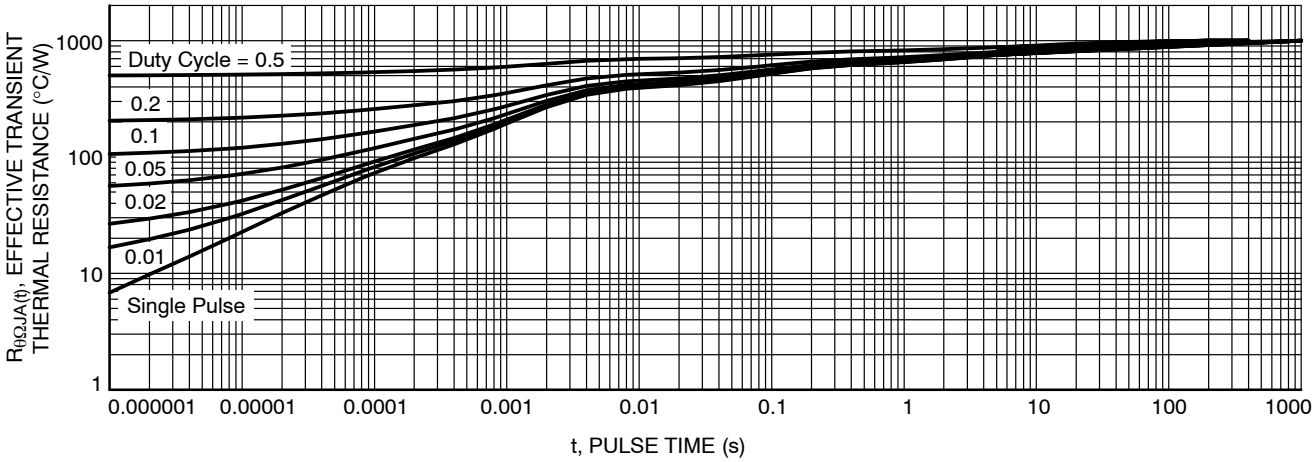



**Figure 11. Thermal Response**

## TYPICAL CHARACTERISTICS – N–CHANNEL

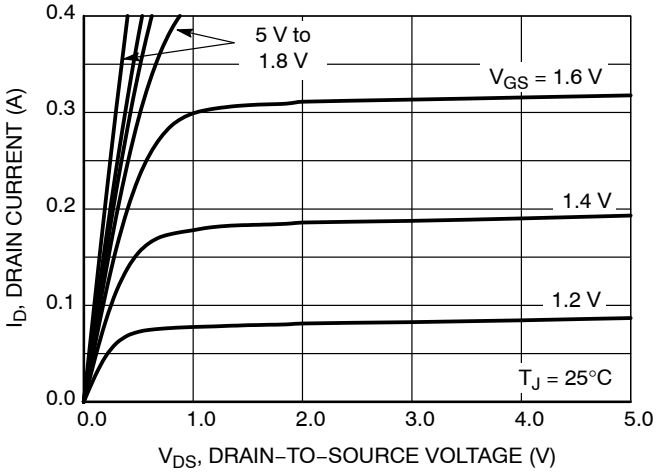



**Figure 12. On–Region Characteristics**

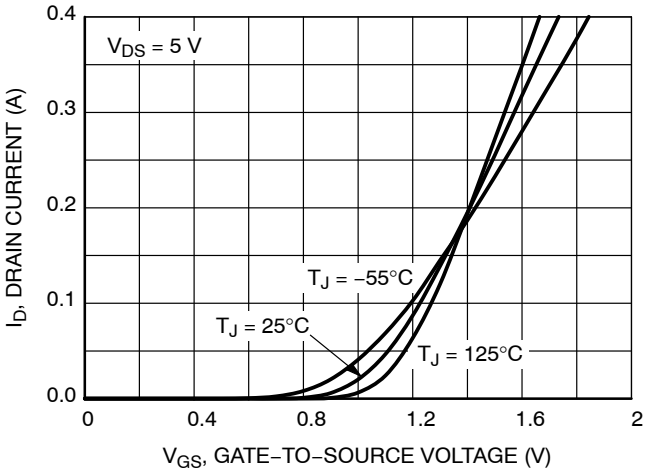



**Figure 13. Transfer Characteristics**

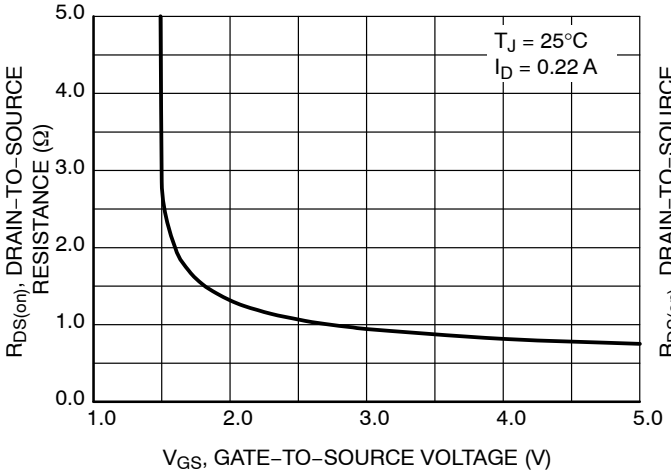



**Figure 14. On–Resistance vs. Gate–to–Source Voltage**

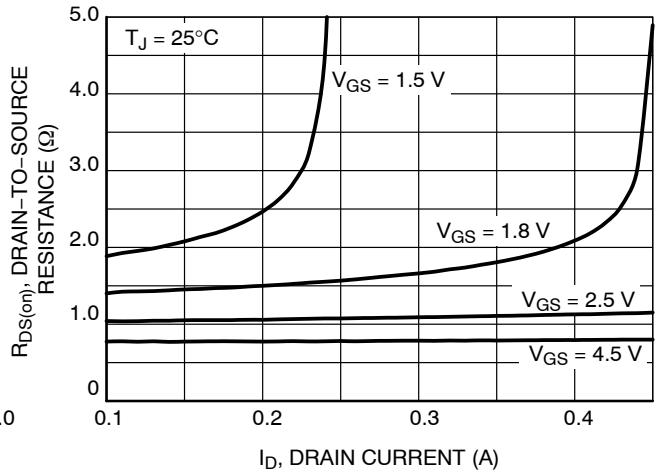



**Figure 15. On–Resistance vs. Drain Current and Gate Voltage**

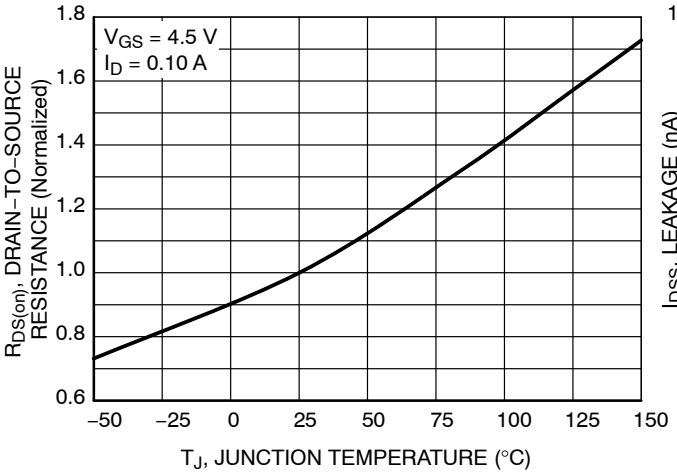



**Figure 16. On–Resistance Variation with Temperature**

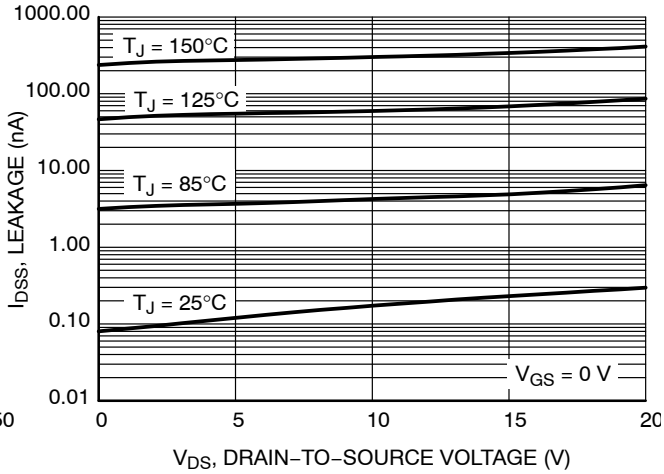



**Figure 17. Drain–to–Source Leakage Current vs. Voltage**

## TYPICAL CHARACTERISTICS – N–CHANNEL

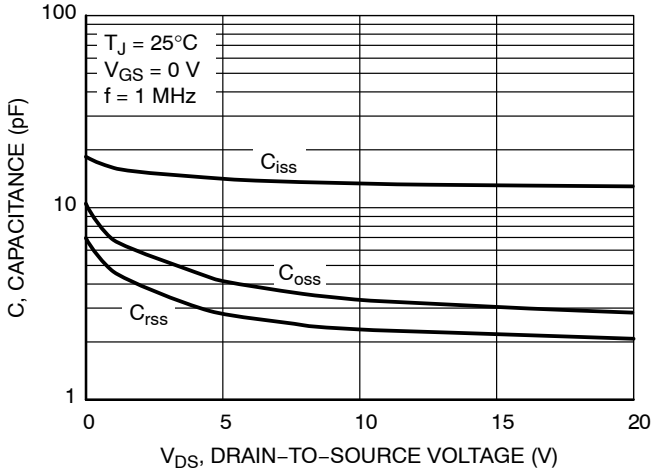



**Figure 18. Capacitance Variation**

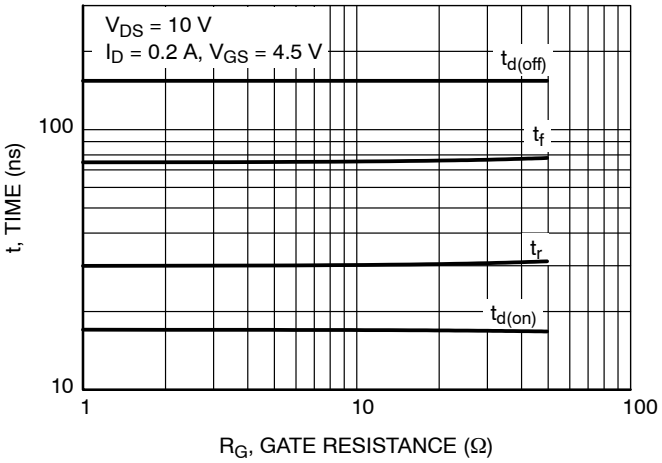



**Figure 19. Resistive Switching Time Variation vs. Gate Resistance**

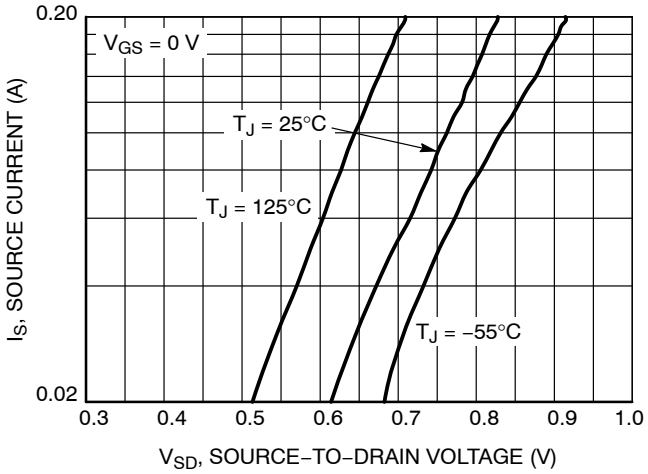



**Figure 20. Diode Forward Voltage vs. Current**

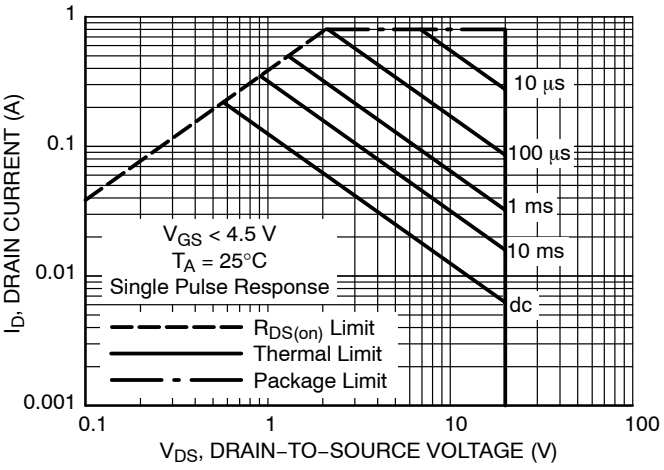



**Figure 21. Maximum Rated Forward Biased Safe Operating Area**

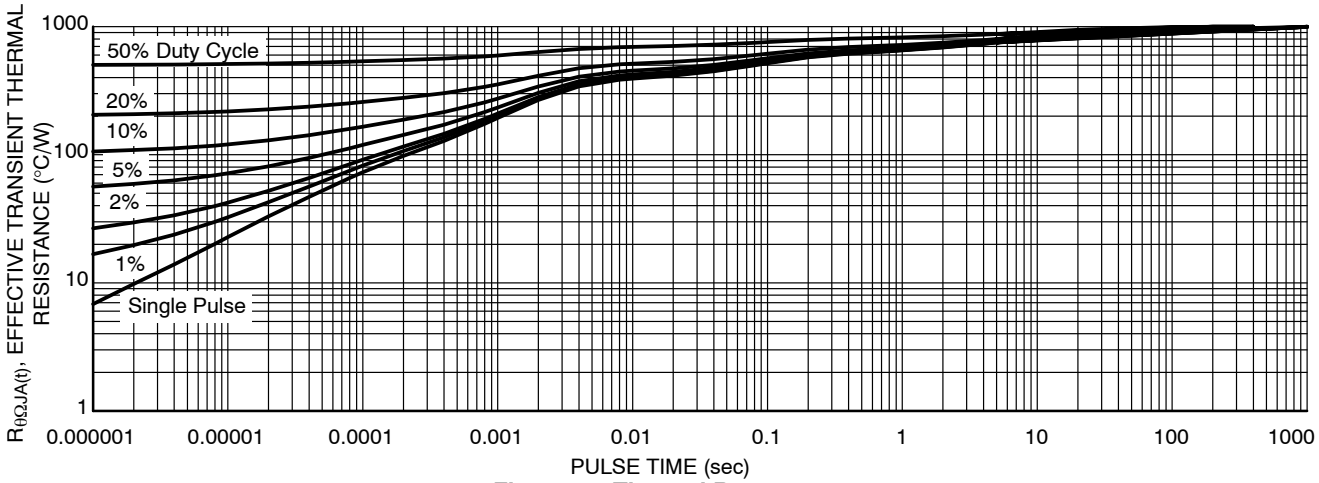



**Figure 22. Thermal Response**

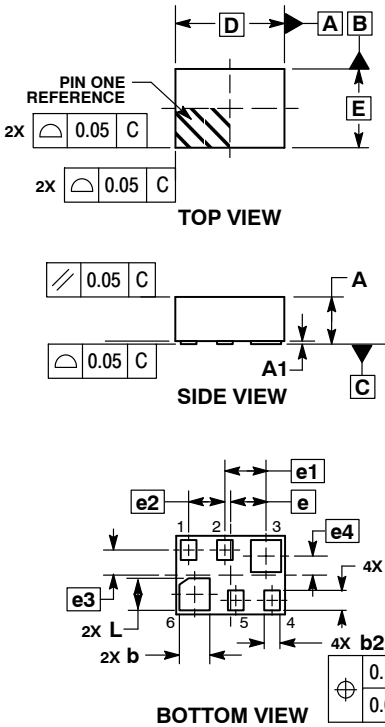
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS

ON Semiconductor®

**XLLGA6 0.90x0.65**
CASE 713AC
ISSUE O

DATE 19 JUN 2014

SCALE 8:1




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
2. CONTROLLING DIMENSION: MILLIMETERS.
3. POSITIONAL TOERANCE APPLIES TO ALL SIX LEADS.

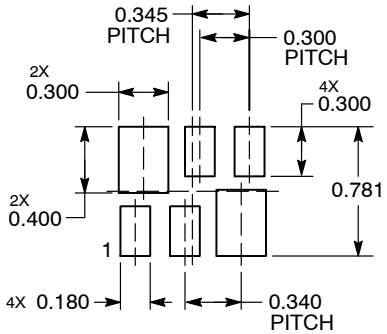
| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | 0.340 | 0.440 |
| A1 | 0.000 | 0.050 |
| b | 0.200 | 0.300 |
| b2 | 0.080 | 0.180 |
| D | 0.900 BSC | |
| E | 0.650 BSC | |
| e | 0.295 BSC | |
| e1 | 0.340 BSC | |
| e2 | 0.300 BSC | |
| e3 | 0.208 BSC | |
| e4 | 0.158 BSC | |
| L | 0.215 | 0.315 |
| L2 | 0.115 | 0.215 |

### GENERIC MARKING DIAGRAM*


X = Specific Device Code
M = Date Code

*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.

### RECOMMENDED SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

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

| | | | |
|---|---|---|---|
| DOCUMENT NUMBER: | 98AON86873F | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. | |
| DESCRIPTION: | XLLGA6 0.90X0.65 | | PAGE 1 OF 1 |

## 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