## Product Summary

| Device | $V_{(BR)DSS}$ | $R_{DS(on)\ max}$ | $I_D$ $T_A$ = +25°C |
|---|---|---|---|
| Q1 | 60V | 13.5Ω @ $V_{GS}$ = 10V | 115mA |
| Q2 | -50V | 10Ω @ $V_{GS}$ = -5V | -130mA |

## 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

- General Purpose Interfacing Switch
- Power Management Functions
- Analog Switch

## Features and Benefits

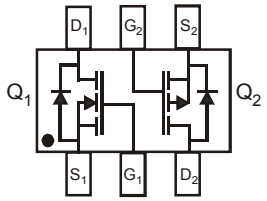
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Complementary Pair
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

- Case: SOT363
- Case Material: Molded Plastic. "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish annealed over Alloy 42 leadframe (Lead Free Plating). Solderable per MIL-STD-202, Method 208 (e3)
- Terminal Connections: See Diagram
- Weight: 0.006 grams (approximate)

SOT363

Top View



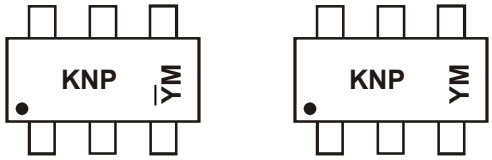

Top View
Internal Schematic

## Ordering Information (Note 4)

| Part Number | Compliance | Case | Packaging |
|---|---|---|---|
| BSS8402DW-7-F | Standard | SOT363 | 3,000/Tape & Reel |
| BSS8402DW-13-F | Standard | SOT363 | 10,000/Tape & Reel |
| BSS8402DWQ-7 | Automotive | SOT363 | 3,000/Tape & Reel |
| BSS8402DWQ-13 | Automotive | SOT363 | 10,000/Tape & Reel |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html 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 http://www.diodes.com/products/packages.html

## Marking Information




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

Date Code Key

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | P | R | S | T | U | V | W | X | Y | Z | A | B | C | D |

| 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 – Total Device (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Value | Units |
|---|---|---|---|
| Power Dissipation (Note 5) | $P_D$ | 200 | mW |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 625 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## Maximum Ratings N-CHANNEL – $Q_1$, 2N7002 Section (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 60 | V |
| Drain-Gate Voltage $R_{GS} \leq 1.0M\Omega$ | | $V_{DGR}$ | 60 | V |
| Gate-Source Voltage | Continuous<br>Pulsed | $V_{GSS}$ | ±20<br>±40 | V |
| Drain Current (Note 5) | Continuous<br>Continuous @ +100°C<br>Pulsed | $I_D$ | 115<br>73<br>800 | mA |

## Maximum Ratings P-CHANNEL – $Q_2$, BSS84 Section (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | -50 | V |
| Drain-Gate Voltage $R_{GS} \leq 20K\Omega$ | | $V_{DGR}$ | -50 | V |
| Gate-Source Voltage | Continuous | $V_{GSS}$ | ±20 | V |
| Drain Current (Note 5) | Continuous | $I_D$ | -130 | mA |

Note: 5. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch; pad layout as shown on Diodes Inc. suggested pad layout document AP02001, which can be found on our website at http://www.diodes.com.

## Electrical Characteristics N-CHANNEL – $Q_1$, 2N7002 Section (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 6)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 60 | 70 | — | V | $V_{GS}$ = 0V, $I_D$ = 10μA |
| Zero Gate Voltage Drain Current @ $T_C$ = +25°C<br>@ $T_C$ = +125°C | $I_{DSS}$ | — | — | 1.0<br>500 | μA | $V_{DS}$ = 60V, $V_{GS}$ = 0V |
| Gate-Body Leakage | $I_{GSS}$ | — | — | ±10 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 6)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1.0 | — | 2.5 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| Static Drain-Source On-Resistance @ $T_J$ = +25°C | $R_{DS(on)}$ | — | 3.2 | 7.5 | Ω | $V_{GS}$ = 5.0V, $I_D$ = 0.05A |
| @ $T_J$ = +125°C | | | 4.4 | 13.5 | | $V_{GS}$ = 10V, $I_D$ = 0.5A |
| On-State Drain Current | $I_{D(on)}$ | 0.5 | 1.0 | — | A | $V_{GS}$ = 10V, $V_{DS}$ = 7.5V |
| Forward Transconductance | $g_{FS}$ | 80 | — | — | mS | $V_{DS}$ =10V, $I_D$ = 0.2A |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 22 | 50 | pF | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 11 | 25 | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 2.0 | 5.0 | pF | |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 7.0 | 20 | ns | $V_{DD}$ = 30V, $I_D$ = 0.2A, |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 11 | 20 | ns | $R_L$ = 150Ω, $V_{GEN}$ = 10V, $R_{GEN}$ = 25Ω |

## Electrical Characteristics P-CHANNEL – $Q_2$, BSS84 Section (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 6)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -50 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -250μA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -1 | μA | $V_{DS}$ = -50V, $V_{GS}$ = 0V, $T_J$ = 25°C |
| | | — | — | -2 | μA | $V_{DS}$ = -50V, $V_{GS}$ = 0V, $T_J$ = 125°C |
| | | — | — | -100 | nA | $V_{DS}$ = -25V, $V_{GS}$ = 0V, $T_J$ = 25°C |
| Gate-Body Leakage | $I_{GSS}$ | — | — | ±10 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 6)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -0.8 | — | -2.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -1mA |
| Static Drain-Source On-Resistance | $R_{DS\ (on)}$ | — | — | 10 | Ω | $V_{GS}$ = -5V, $I_D$ = -0.100A |
| Forward Transconductance | $g_{FS}$ | .05 | — | — | S | $V_{DS}$ = -25V, $I_D$ = -0.1A |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | — | 45 | pF | $V_{DS}$ = -25V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | — | 25 | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | — | 12 | pF | |
| **SWITCHING CHARACTERISTICS** | | | | | | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 10 | — | ns | $V_{DD}$ = -30V, $I_D$ = -0.27A, |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 18 | — | ns | $R_{GEN}$ = 50Ω, $V_{GS}$ = -10V |

Note: 6. Short duration pulse test used to minimize self-heating effect.

## N-CHANNEL – 2N7002 Section

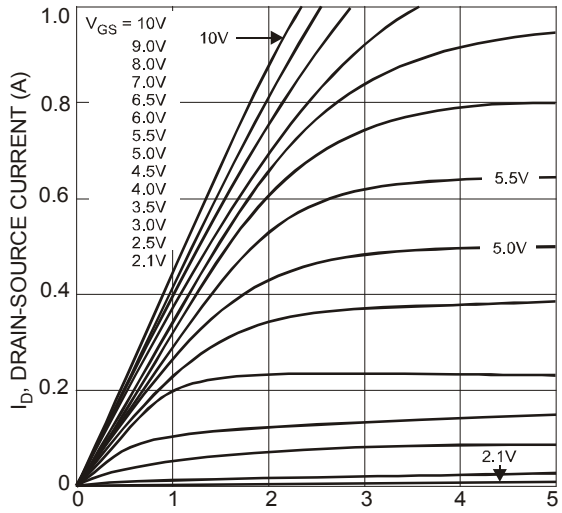



Figure 1 On-Region Characteristics

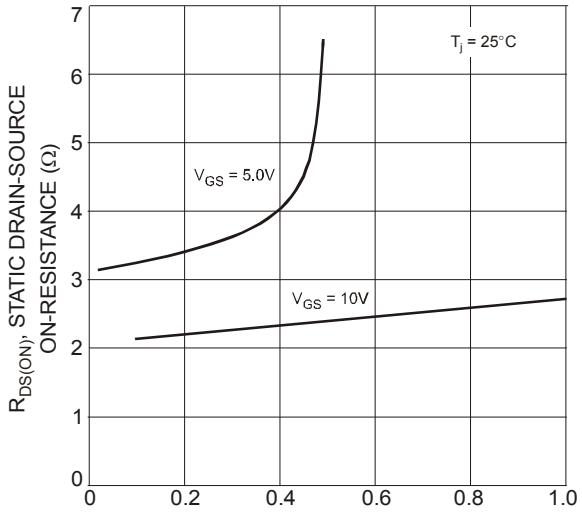



Figure 2 On-Resistance vs. Drain Current

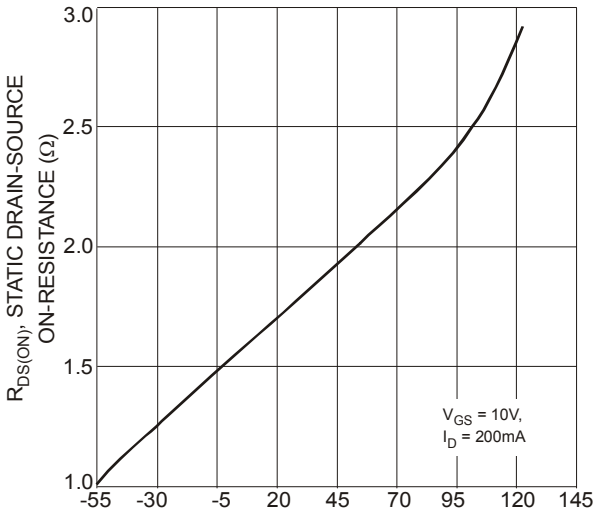



Figure 3 On-Resistance vs. Junction Temperature

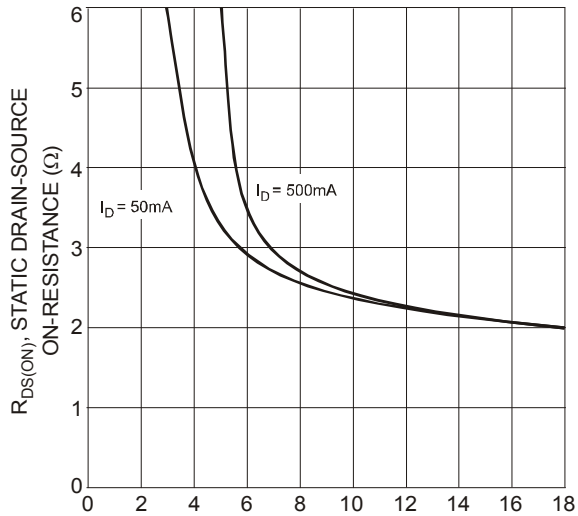



Figure 4 On-Resistance vs. Gate-Source Voltage

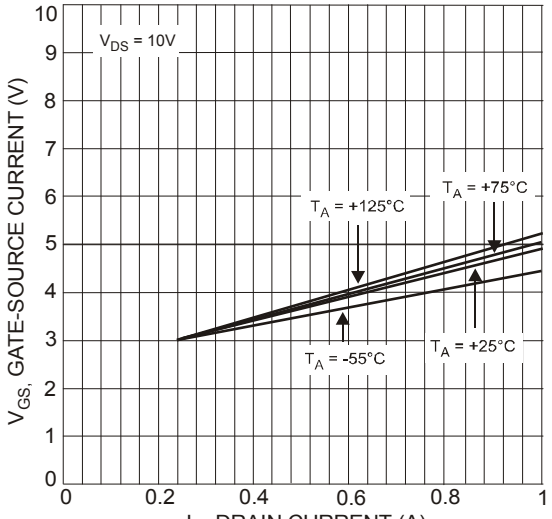



Figure 5 Typical Transfer Characteristics

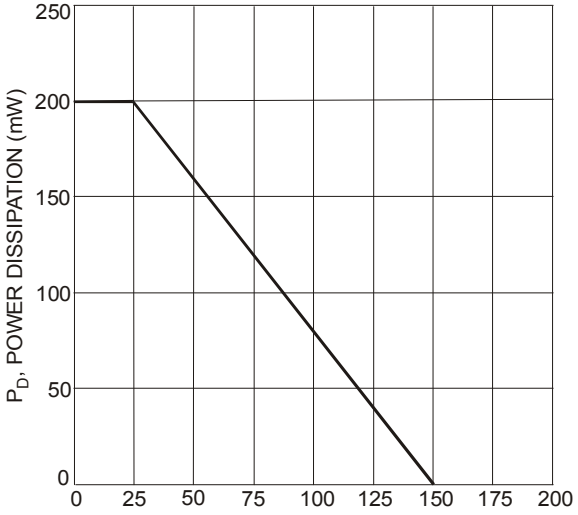



Figure 6 Max Power Dissipation vs. Ambient Temperature

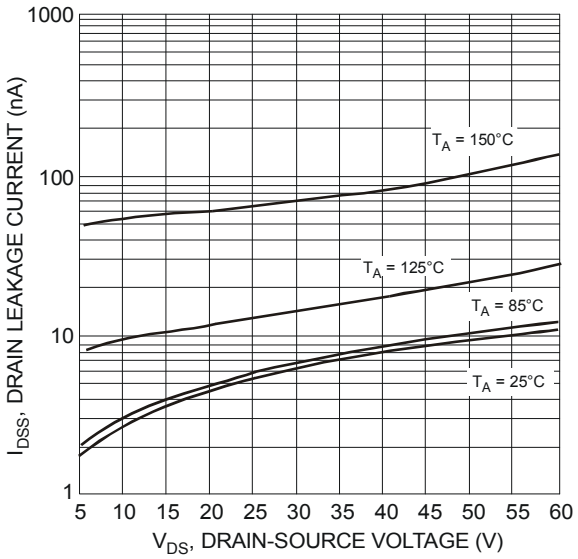



Figure 7 Typical Drain-Source Leakage Current vs. Voltage

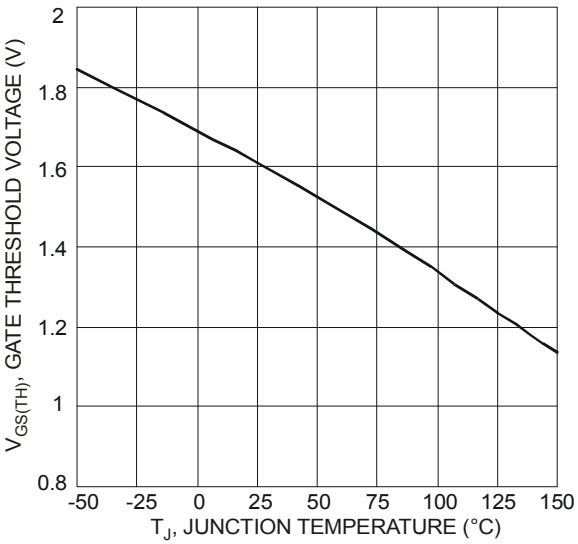



Figure 8 Gate Threshold Variation vs. Ambient Temperaure

## P-CHANNEL – BSS84 Section

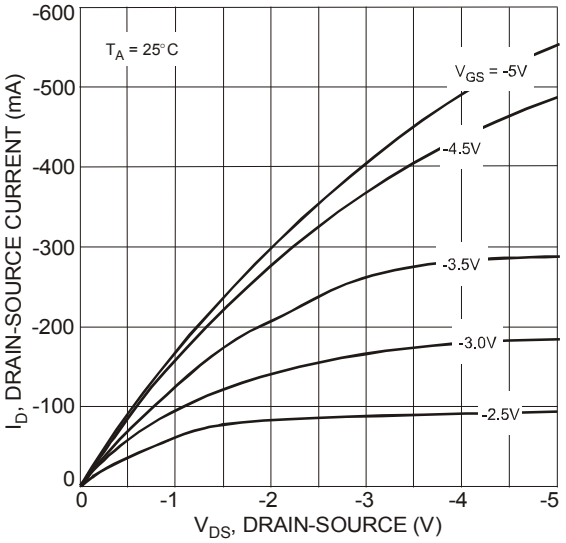



Figure 9 Drain-Source Current vs. Drain-Source Voltage

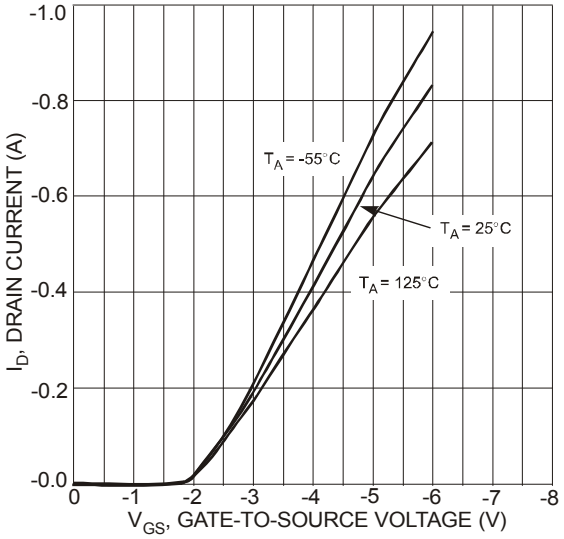



Figure 10 Drain Current vs. Gate-Source Voltage

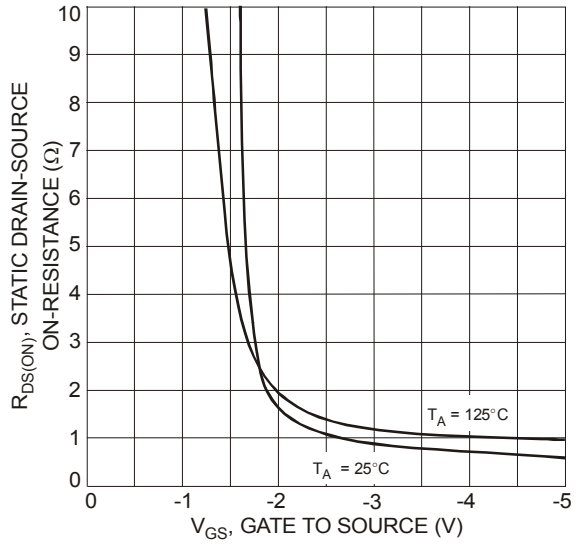



Figure 11 On-Resistance vs. Gate-Source Voltage

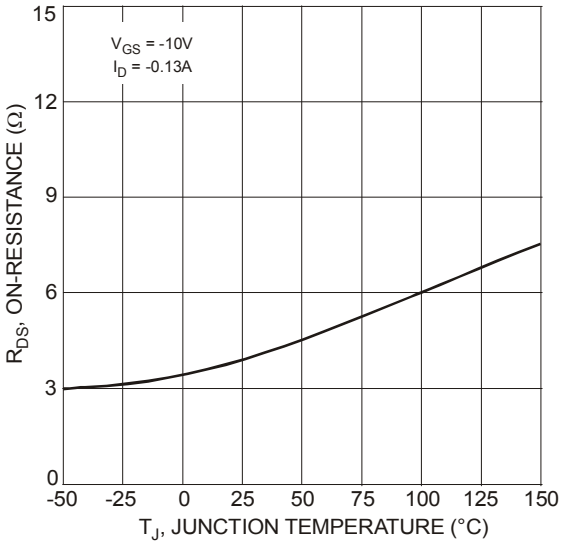



Figure 12 On-Resistance vs. Junction Temperature

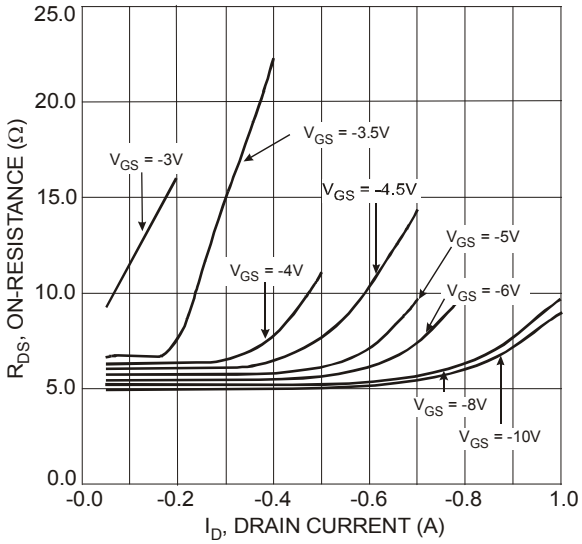



Figure 13 On-Resistance vs. Drain Current

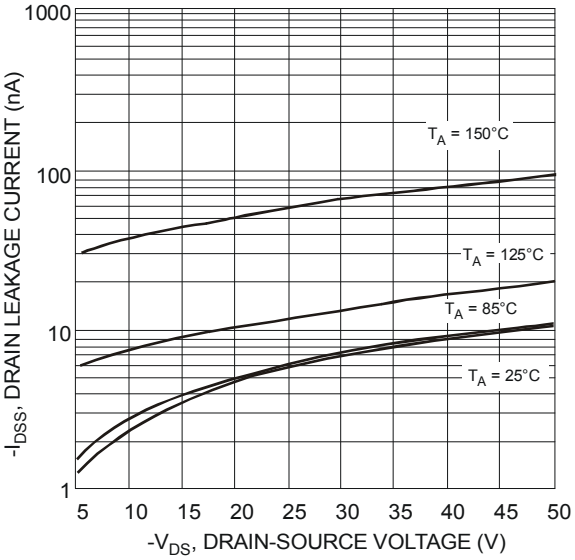



Figure 14 Typical Drain-Source Leakage Current vs. Voltage

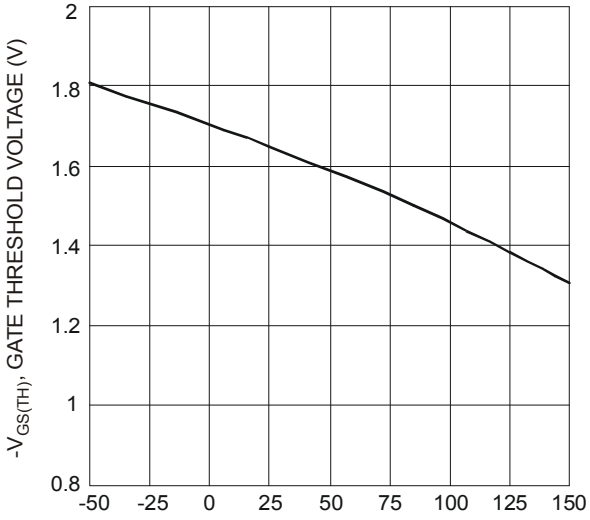
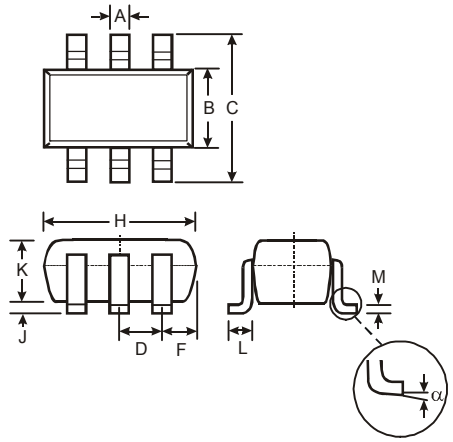



Figure 15 Gate Threshold Variation vs. Ambient Temperaure

## Package Outline Dimensions

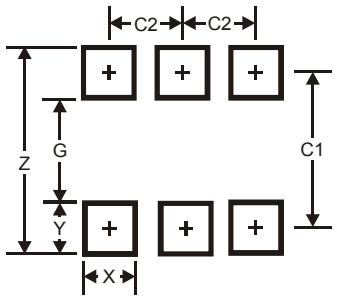
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.




| SOT363 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.10 | 0.30 | 0.25 |
| **B** | 1.15 | 1.35 | 1.30 |
| **C** | 2.00 | 2.20 | 2.10 |
| **D** | 0.65 Typ | | |
| **F** | 0.40 | 0.45 | 0.425 |
| **H** | 1.80 | 2.20 | 2.15 |
| **J** | 0 | 0.10 | 0.05 |
| **K** | 0.90 | 1.00 | 1.00 |
| **L** | 0.25 | 0.40 | 0.30 |
| **M** | 0.10 | 0.22 | 0.11 |
| **α** | 0° | 8° | - |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.




| Dimensions | Value (in mm) |
|---|---|
| Z | 2.5 |
| G | 1.3 |
| X | 0.42 |
| Y | 0.6 |
| C1 | 1.9 |
| C2 | 0.65 |