# 30V COMPLEMENTARY ENHANCEMENT MODE MOSFET H-BRIDGE

## Product Summary

| Device | $V_{(BR)DSS}$ | $R_{DS(ON)}$ max | $I_D$ max $T_A$ = +25°C |
|---|---|---|---|
| N-Channel | 30V | 25mΩ @ $V_{GS}$ = 10V | 6.0 |
| | | 40mΩ @ $V_{GS}$ = 4.5V | 4.6 |
| P-Channel | -30V | 50mΩ @ $V_{GS}$ = -10V | -4.2 |
| | | 80mΩ @ $V_{GS}$ = -4.5V | -3.2 |

## Description and Applications

This new generation complementary MOSFET H-Bridge features 2 N and 2 P channel in an SOIC package. Qualified to AECQ101 the H bridge is ideally suited to driving :

- Solenoids
- DC Motors
- Audio Outputs

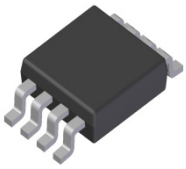
## Features

- 2 x N + 2 x P channels in a SOIC package
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- **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**
- **PPAP Capable (Note 4)**

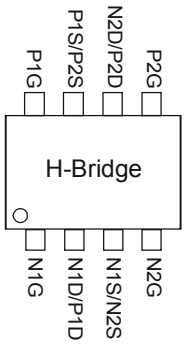
## Mechanical Data

- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections Indicator: See diagram
- Terminals: Finish — Matte Tin annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.074 grams (approximate)

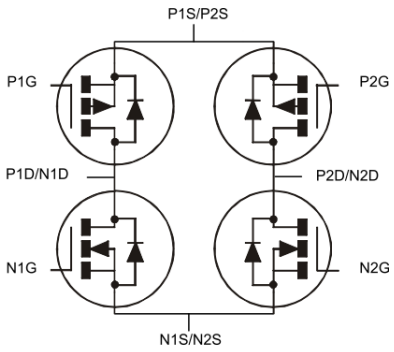
SO-8



Top View




Top View
Pin Configuration



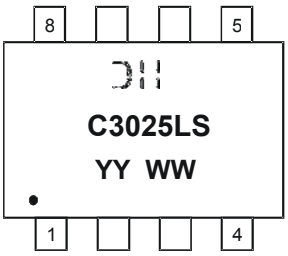

Internal Schematic

## Ordering Information (Note 5)

| Part Number | Compliance | Case | Packaging |
|---|---|---|---|
| DMHC3025LSDQ-13 | Automotive | SO-8 | 2,500/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. Automotive products are AEC-Q101 qualified and are PPAP capable. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to http://www.diodes.com/quality/product_grade_definitions/.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

## Marking Information




= Manufacturer's Marking
C3025LS = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 09 = 2009)
WW = Week (01 - 53)

## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Total Power Dissipation (Note 6) | | $P_D$ | 1.5 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 83 | °C/W |
| | t < 10s | | 50 | |
| Thermal Resistance, Junction to Case | | $R_{\theta JC}$ | 14.5 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |

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

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 30 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = 10V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 6.0<br>4.8 | A |
| | t < 10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 7.8<br>6.1 | A |
| Continuous Drain Current (Note 6) $V_{GS}$ = 4.5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 4.6<br>3.6 | A |
| | t < 10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 6.1<br>4.8 | A |
| Maximum Continuous Body Diode Forward Current (Note 5) | | | $I_S$ | 2.5 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | $I_{DM}$ | 60 | A |

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

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 30 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±20 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = -10V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -4.2<br>-3.3 | A |
| | t < 10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -5.4<br>-4.3 | A |
| Continuous Drain Current (Note 6) $V_{GS}$ = -4.5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -3.2<br>-2.5 | A |
| | t < 10s | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -4.3<br>-3.3 | A |
| Maximum Continuous Body Diode Forward Current (Note 6) | | | $I_S$ | -2.5 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | $I_{DM}$ | -30 | A |

Note: 6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 7)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | 0.5 | μA | $V_{DS}$ = 30V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±1 | μA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1 | — | 2 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| Static Drain-Source On-Resistance | $R_{DS\ (ON)}$ | — | 19 | 25 | mΩ | $V_{GS}$ = 10V, $I_D$ = 5A |
| | | — | 26 | 40 | | $V_{GS}$ = 4.5V, $I_D$ = 4A |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | — | 4 | — | S | $V_{DS}$ = 5V, $I_D$ = 5A |
| Diode Forward Voltage | $V_{SD}$ | — | 0.70 | 1.2 | V | $V_{GS}$ = 0V, $I_S$ = 1.7A |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 590 | — | pF | $V_{DS}$ = 15V, $V_{GS}$ = 0V, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 122 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 58 | — | | |
| Gate resistance | $R_g$ | — | 1.5 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge ($V_{GS}$ = 4.5V) | $Q_g$ | — | 5.4 | — | nC | $V_{DS}$ = 15V, $I_D$ = 7.8A |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_g$ | — | 11.7 | — | | |
| Gate-Source Charge | $Q_{gs}$ | — | 1.8 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 2.1 | — | | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 11.2 | — | ns | $V_{DD}$ = 15V, $V_{GS}$ = 4.5V, $R_L$ = 2.4Ω, $R_G$ = 1Ω, |
| Turn-On Rise Time | $t_r$ | — | 15 | — | | |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 17.5 | — | | |
| Turn-Off Fall Time | $t_f$ | — | 8.7 | — | | |
| Reverse Recovery Time | $t_{rr}$ | — | 18.3 | — | ns | $I_F$ = 12A, di/dt = 500A/μs |
| Reverse Recovery Charge | $Q_{rr}$ | — | 12 | — | nC | |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 7)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -250μA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -0.5 | μA | $V_{DS}$ = -30V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±1 | μA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -1 | — | -2 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA |
| Static Drain-Source On-Resistance | $R_{DS\ (ON)}$ | — | 43 | 50 | mΩ | $V_{GS}$ = -10V, $I_D$ = -5A |
| | | — | 68 | 80 | | $V_{GS}$ = -4.5V, $I_D$ = -4A |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | — | 3.5 | — | S | $V_{DS}$ = -5V, $I_D$ = -5A |
| Diode Forward Voltage | $V_{SD}$ | — | -0.7 | -1.2 | V | $V_{GS}$ = 0V, $I_S$ = -1.7A |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 631 | — | pF | $V_{DS}$ = -15V, $V_{GS}$ = 0V, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 137 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 70 | — | pF | |
| Gate resistance | $R_g$ | — | 10.8 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge ($V_{GS}$ = 4.5V) | $Q_g$ | — | 5.5 | — | nC | $V_{DS}$ = -15V, $I_D$ = -6A |
| Total Gate Charge ($V_{GS}$ = 10V) | $Q_g$ | — | 11.4 | — | nC | |
| Gate-Source Charge | $Q_{gs}$ | — | 1.8 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 2.4 | — | nC | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 7.5 | — | ns | $V_{DD}$ = -15V, $V_{GS}$ = -10V, $R_G$ = 6Ω, $I_D$ = -1A |
| Turn-On Rise Time | $t_r$ | — | 4.9 | — | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 28.2 | — | ns | |
| Turn-Off Fall Time | $t_f$ | — | 13.5 | — | ns | |
| Reverse Recovery Time | $t_{rr}$ | — | 15.1 | — | ns | $I_F$ = 12A, di/dt = 500A/μs |
| Reverse Recovery Charge | $Q_{rr}$ | — | 15.3 | — | nC | |

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

## Typical Characteristics - N-CHANNEL

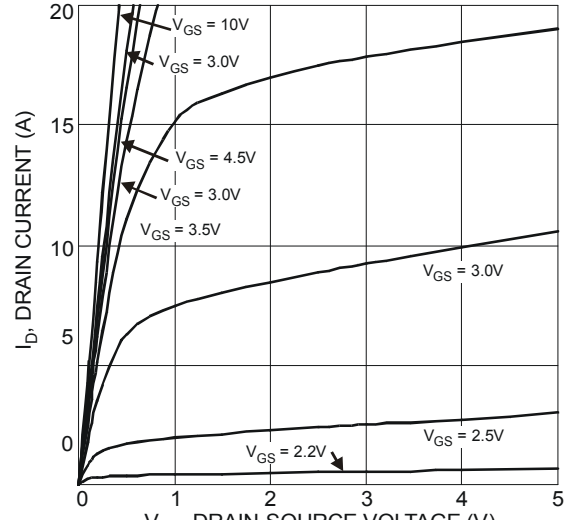



Figure 1 Typical Output Characteristic

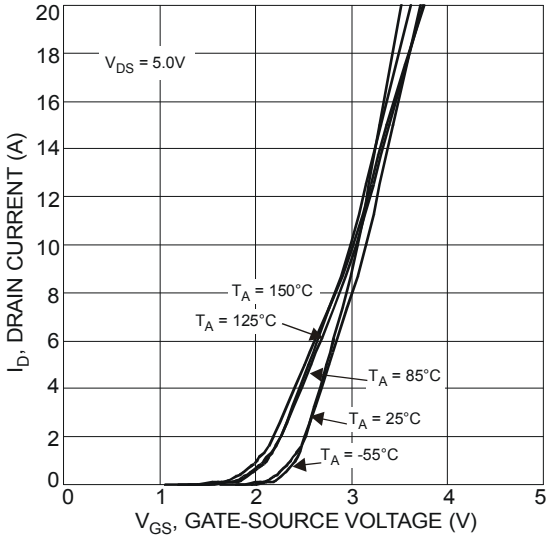



Figure 2 Typical Transfer Characteristics

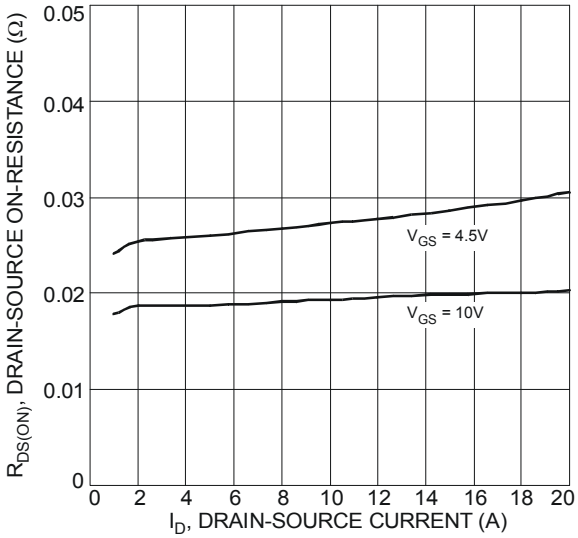



Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

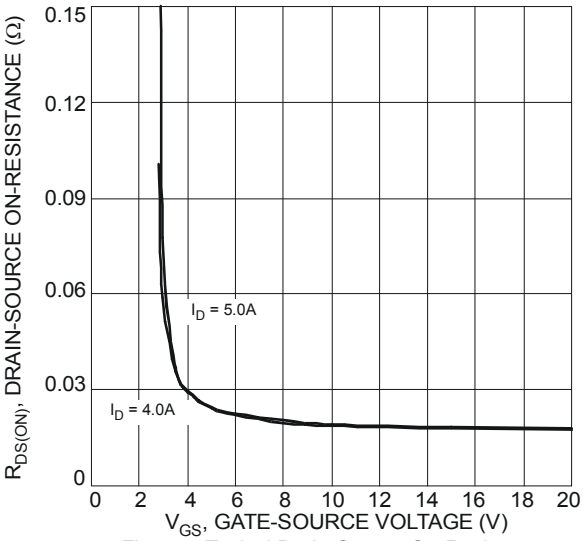



Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

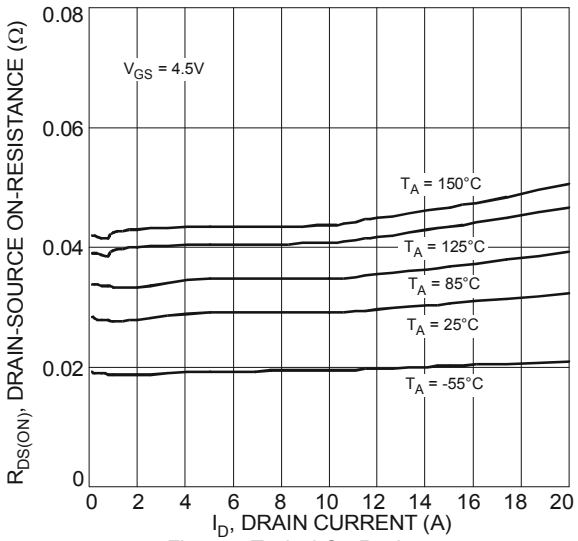



Figure 5 Typical On-Resistance vs. Drain Current and Temperature

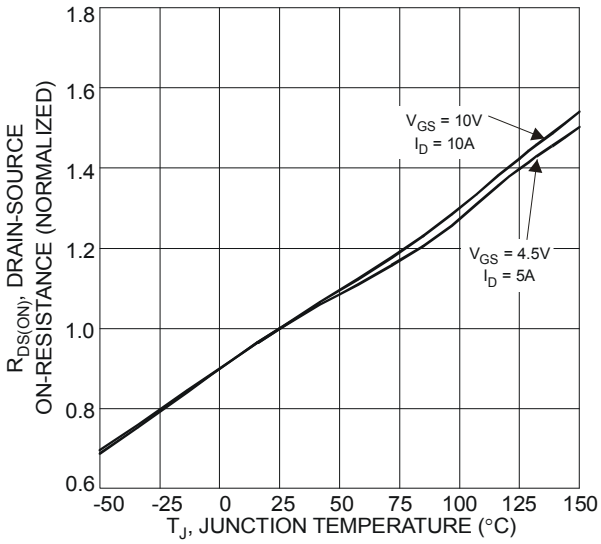



Figure 6 On-Resistance Variation with Temperature

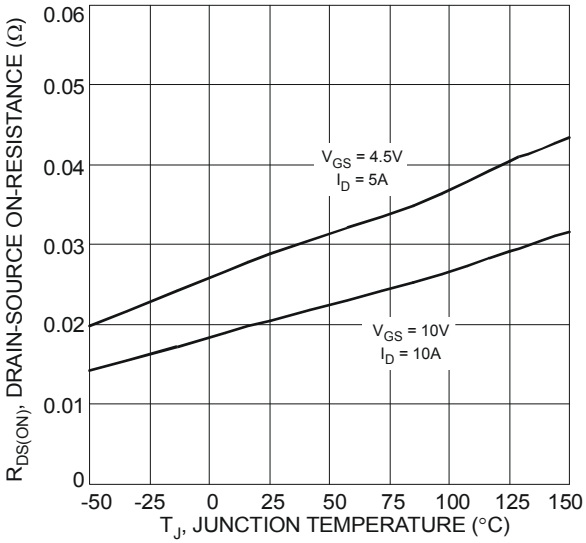



Figure 7 On-Resistance Variation with Temperature

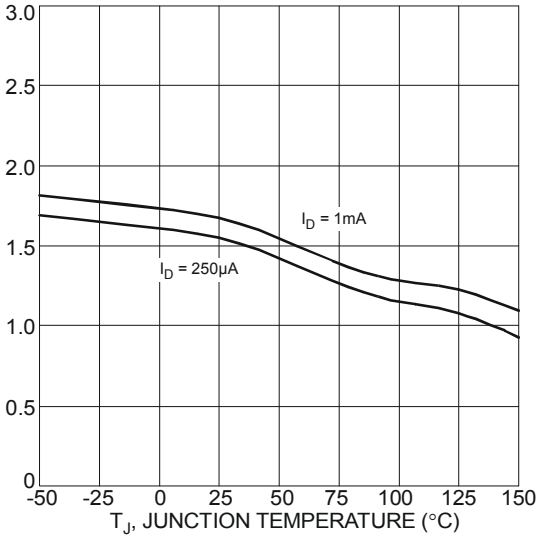



Figure 8 Gate Threshold Variation vs. Ambient Temperature

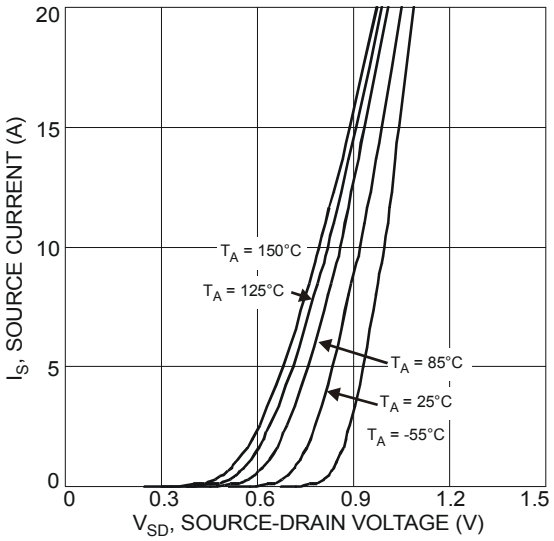



Figure 9 Diode Forward Voltage vs. Current

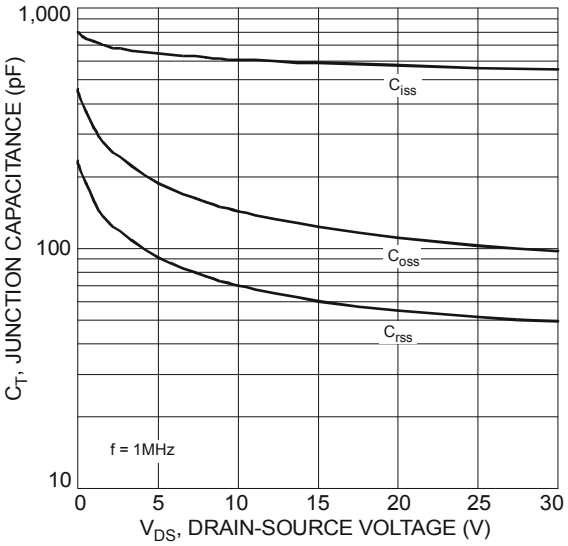



Figure 10 Typical Junction Capacitance

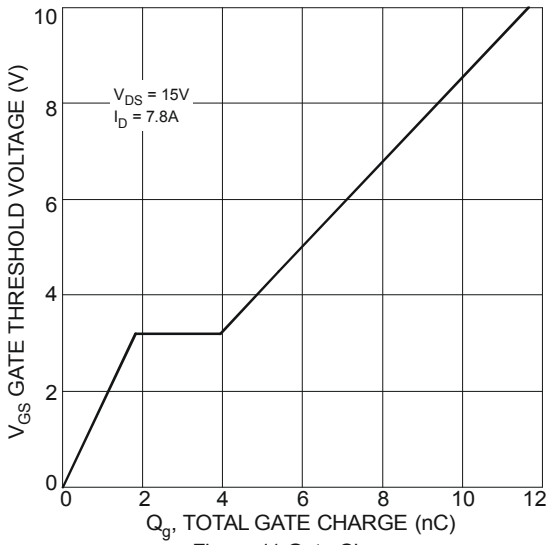



Figure 11 Gate Charge

## Typical Characteristics - P-CHANNEL

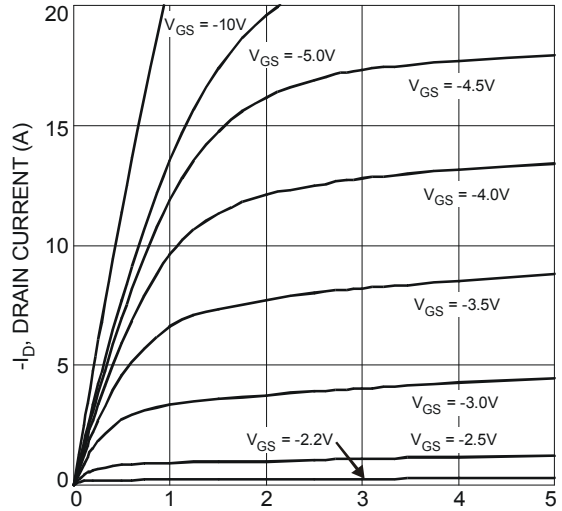


Figure 12 Typical Output Characteristics

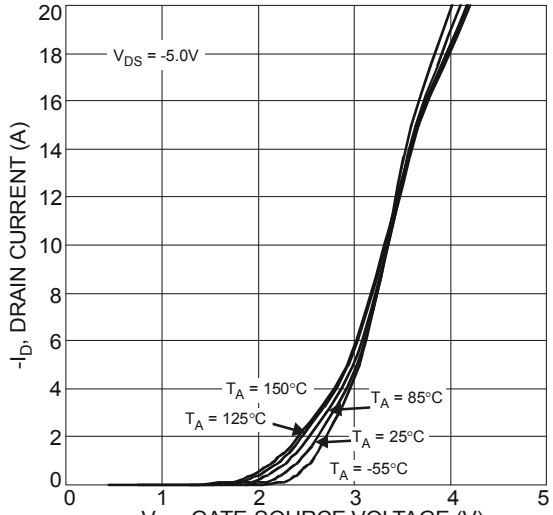


Figure 13 Typical Transfer Characteristics

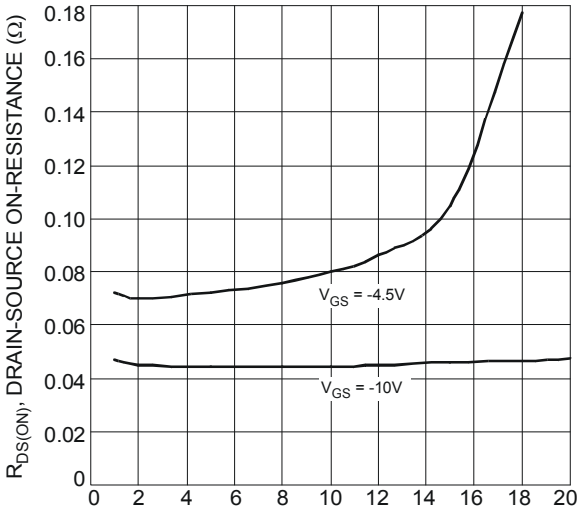


Figure 14 Typical On-Resistance vs. Drain Current and Gate Voltage

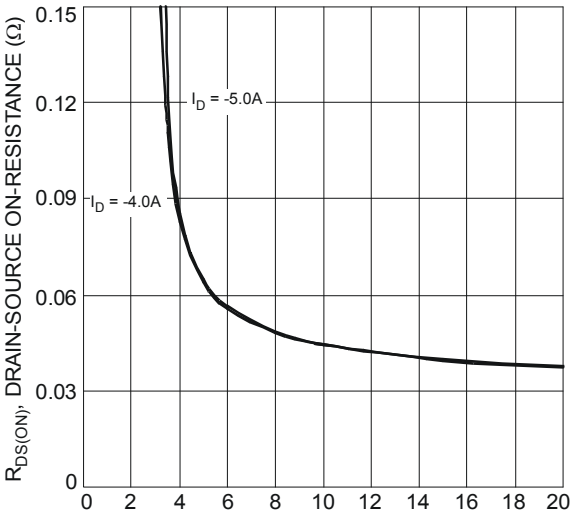


Figure 15 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

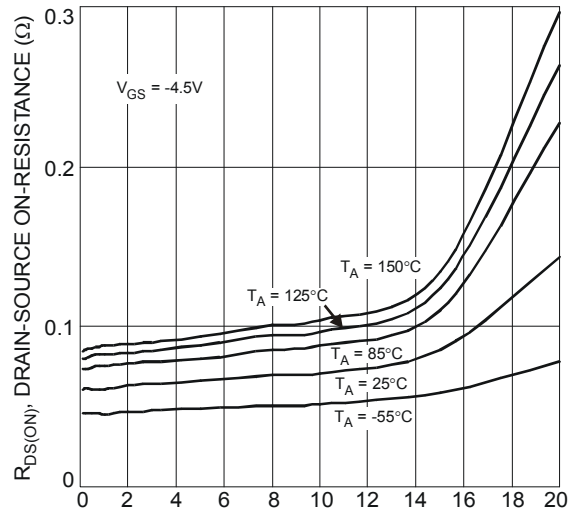


Figure 16 Typical On-Resistance vs. Drain Current and Temperature

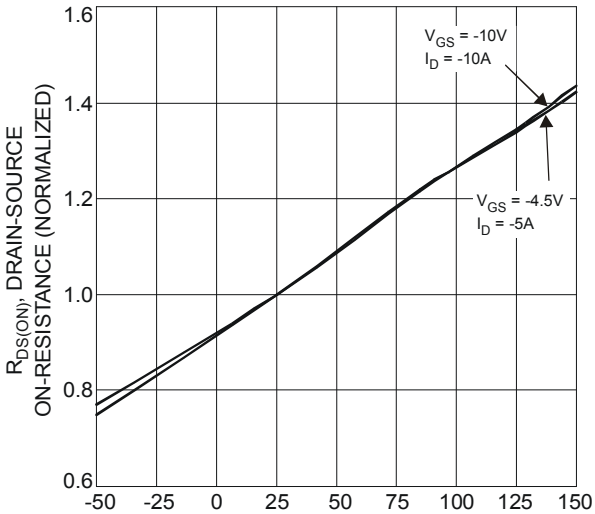


Figure 17 On-Resistance Variation with Temperature

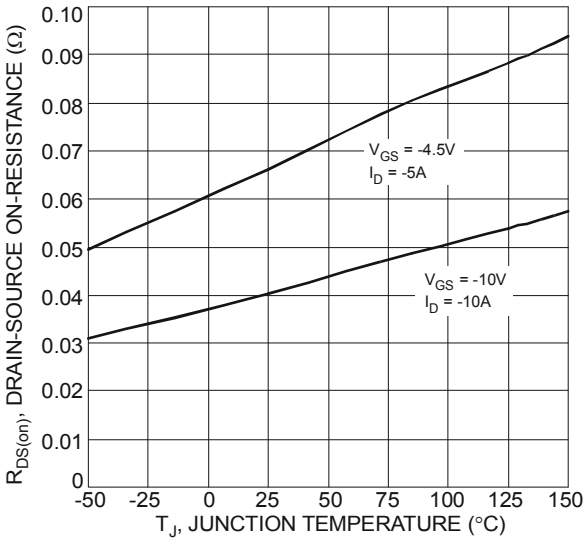



Figure 18 On-Resistance Variation with Temperature

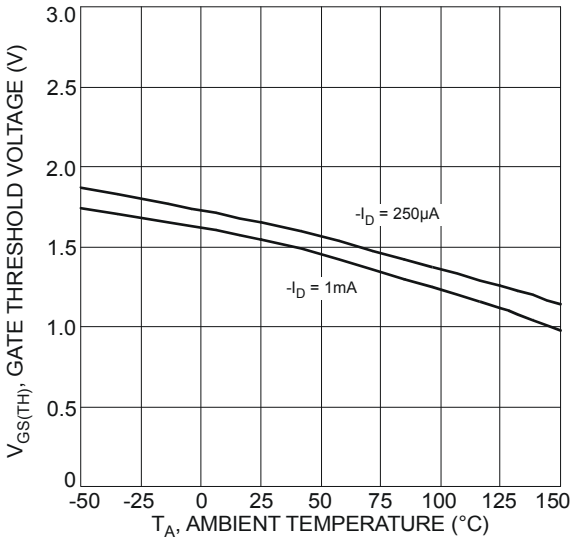



Figure 19 Gate Threshold Variation vs. Ambient Temperature

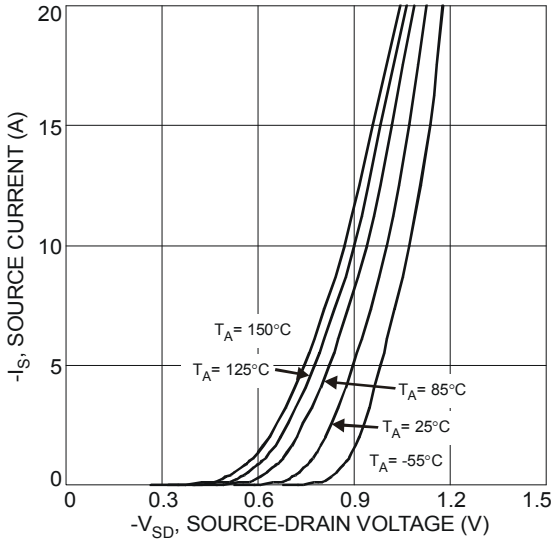



Figure 20 Diode Forward Voltage vs. Current

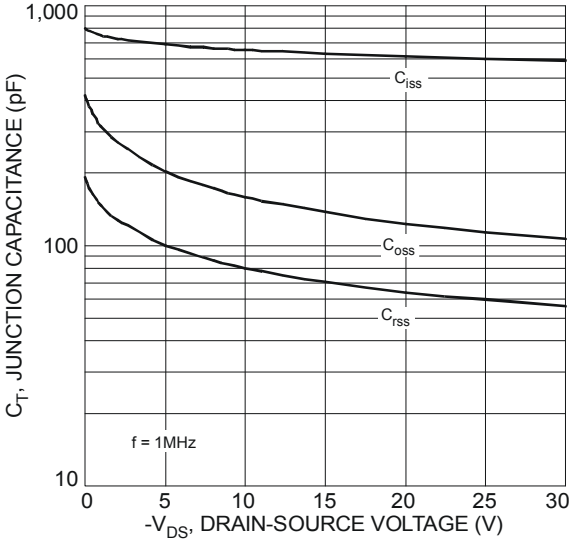



Figure 21 Typical Junction Capacitance

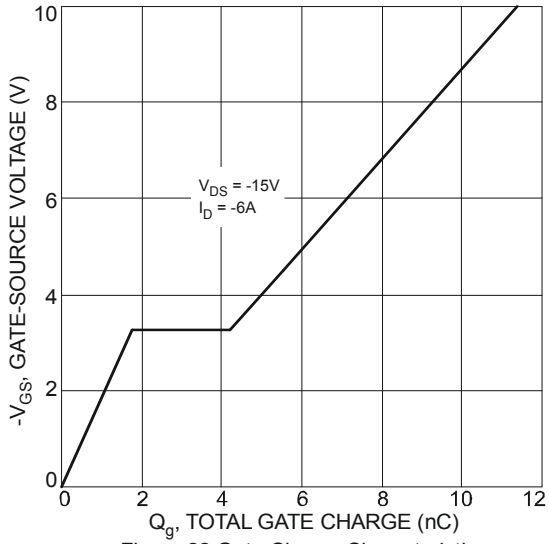
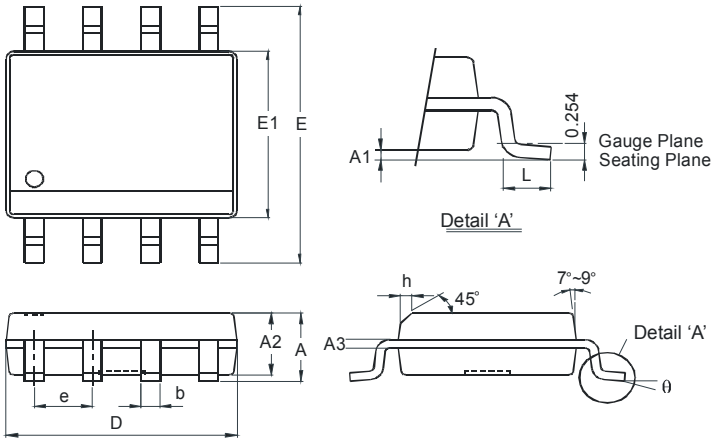



Figure 22 Gate-Charge Characteristics

## Package Outline Dimensions

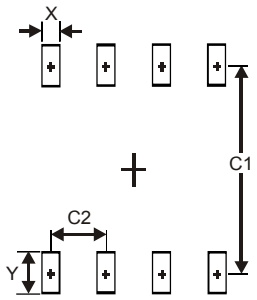
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.




| SO-8 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | - | 1.75 |
| **A1** | 0.10 | 0.20 |
| **A2** | 1.30 | 1.50 |
| **A3** | 0.15 | 0.25 |
| **b** | 0.3 | 0.5 |
| **D** | 4.85 | 4.95 |
| **E** | 5.90 | 6.10 |
| **E1** | 3.85 | 3.95 |
| **e** | 1.27 Typ | |
| **h** | - | 0.35 |
| **L** | 0.62 | 0.82 |
| **θ** | 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) |
|---|---|
| **X** | 0.60 |
| **Y** | 1.55 |
| **C1** | 5.4 |
| **C2** | 1.27 |

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