# COMPLEMENTARY 30V ENHANCEMENT MODE MOSFET H-BRIDGE

## Product Summary

| Device | $BV_{DSS}$ | $R_{DS(ON)}$ max | $I_D$ max $T_A$ = +25°C |
|---|---|---|---|
| N-Channel | 30V | 0.12Ω @ $V_{GS}$ = 10V | 3.1A |
| P-Channel | -30V | 0.21Ω @ $V_{GS}$ = -10V | -2.3A |

## Description

This new generation of trench MOSFETs from Zetex utilizes a unique structure that combines the benefits of low on-resistance with fast switching speed. This makes them ideal for high efficiency, low voltage, power management applications.

## Applications

- Single Phase DC Fan Motor Drive

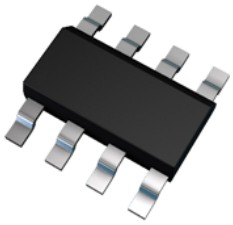
## Features

- Low On-Resistance
- Fast Switching Speed
- Low Threshold
- Low Gate Drive
- Single SM-8 Surface Mount Package
- **Lead-Free Finish; RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

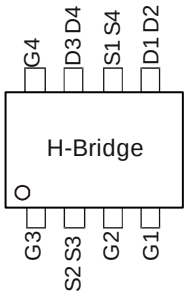
## Mechanical Data

- Case: SM-8 (8 LEAD SOT223)
- 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: 0.117 grams (Approximate)

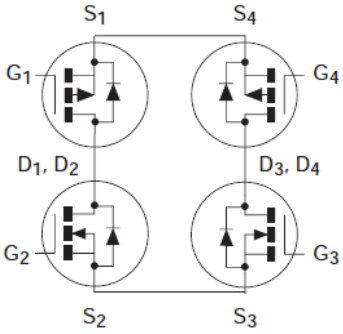
SM-8



Top View




Top View
Pin Configuration




Internal Schematic

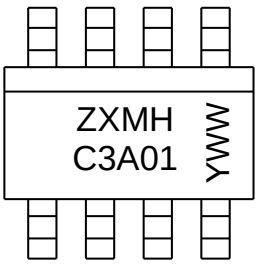
## Ordering Information (Note 4)

| Part Number | REEL SIZE | TAPE WIDTH | QUANTITY PER REEL |
|---|---|---|---|
| ZXMHC3A01T8TA | 7" | 12mm | 1,000 units |

Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. All applicable RoHS exemptions applied.
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

SM-8




ZXMHC3A01 = Product Type Marking Code
YWW = Date Code Marking
Y or $\overline{Y}$ = Last Digit of Year (ex: 5= 2015)
WW or $\overline{WW}$ = Week Code (01~53)

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

| Characteristic | | | Symbol | N-channel | P-channel | Units |
|---|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 30 | -30 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±20 | ±20 | V |
| Continuous Drain Current, $V_{GS}$ = 10V (Note 8) | Steady State | $T_A$ = +25°C (Note 6 & 8)<br>$T_A$ = +70°C (Note 6 & 8)<br>$T_A$ = +25°C (Note 5 & 8) | $I_D$ | 3.1<br>2.5<br>2.7 | -2.3<br>-1.8<br>-2.0 | A |
| Continuous Source Current (body diode) (Note 6) | | | $I_S$ | 2.3 | -2.2 | A |
| Pulsed Drain Current (Note 7) | | | $I_{DM}$ | 14.3 | -10.8 | A |
| Pulsed Source Current (Note 7) | | | $I_{SM}$ | 14.5 | -10.8 | A |

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

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Total Power Dissipation (Note 8)<br>Linear Derating Factor | $T_A$ = +25°C (Note 5) | $P_D$ | 1.3<br>10.4 | W<br>mW/°C |
| Total Power Dissipation (Note 8)<br>Linear Derating Factor | $T_A$ = +25°C (Note 6) | $P_D$ | 1.7<br>13.6 | W<br>mW/°C |
| Thermal Resistance, Junction to Ambient (Note 8) | Steady State (Note 5) | $R_{\theta JA}$ | 96 | °C/W |
| | Steady State (Note 6) | | 73 | °C/W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes:
5. For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions..
6. For a device surface mounted on FR4 PCB measured at t ≤10 seconds.
7. Repetitive rating 50mm x 50mm x 1.6mm FR4 PCB, D = 0.02, pulse width 300µs - pulse width limited by maximum junction temperature. Refer to transient thermal Impedance graph.
8. For device with one active die.

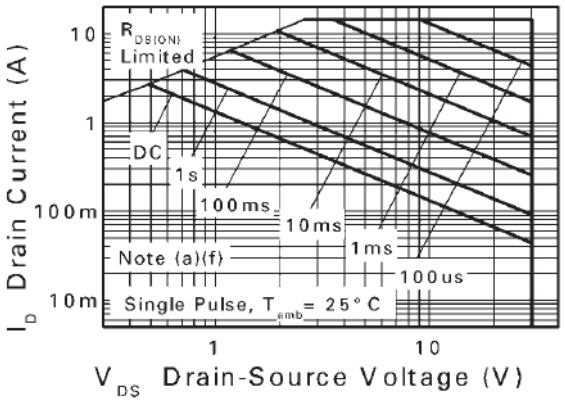
## Electrical Characteristics N-CHANNEL (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | 1.0 | μA | $V_{DS}$ = 30V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | 100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1.0 | — | 3.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250μA |
| Static Drain-Source On-Resistance (Note 9) | $R_{DS\ (ON)}$ | — | — | 0.12 | Ω | $V_{GS}$ = 10V, $I_D$ = 2.5A |
| | | — | — | 0.18 | | $V_{GS}$ = 4.5V, $I_D$ = 2.0A |
| Forward Transfer Admittance (Notes 9 & 11) | $g_{fs}$ | — | 3.5 | — | S | $V_{DS}$ = 4.5V, $I_D$ = 2.5A |
| Diode Forward Voltage (Note 9) | $V_{SD}$ | — | — | 0.95 | V | $V_{GS}$ = 0V, $I_S$ = 1.7A |
| **DYNAMIC CHARACTERISTICS (Note 11)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 190 | — | pF | $V_{DS}$ = 25V, $V_{GS}$ = 0V, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 38 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 20 | — | | |
| Total Gate Charge (Note 10) | $Q_g$ | — | 3.9 | — | nC | $V_{DS}$ = 15V, $I_D$ = 2.5A, $V_{GS}$ = 10V |
| Gate-Source Charge (Note 10) | $Q_{gs}$ | — | 0.6 | — | | |
| Gate-Drain Charge (Note 10) | $Q_{gd}$ | — | 0.9 | — | | |
| Turn-On Delay Time (Note 10) | $t_{D(on)}$ | — | 1.7 | — | ns | $V_{DD}$ = 15V, $V_{GS}$ = 10V, $I_D$ = 2.5A, $R_G \cong 6.0\Omega$, |
| Turn-On Rise Time (Note 10) | $t_r$ | — | 2.3 | — | | |
| Turn-Off Delay Time (Note 10) | $t_{D(off)}$ | — | 6.6 | — | | |
| Turn-Off Fall Time | $t_f$ | — | 2.9 | — | | |
| Reverse Recovery Time | $t_{rr}$ | — | 17.7 | — | ns | $I_S$ = 1.8A, di/dt = 100A/μs |
| Reverse Recovery Charge | $Q_{rr}$ | — | 13 | — | nC | |

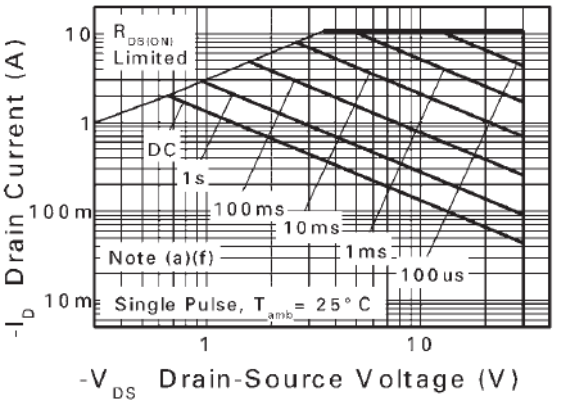
## Electrical Characteristics P-CHANNEL (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -30 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -250μA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | — | — | -1.0 | μA | $V_{DS}$ = -30V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | 100 | nA | $V_{GS}$ = ±20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -1.0 | — | -3.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA |
| Static Drain-Source On-Resistance (Note 9) | $R_{DS\ (ON)}$ | — | — | 0.21 | Ω | $V_{GS}$ = -10V, $I_D$ = -1.4A |
| | | — | — | 0.33 | | $V_{GS}$ = -4.5V, $I_D$ = -1.1A |
| Forward Transfer Admittance (Notes 9 & 11) | $g_{fs}$ | — | 2.5 | — | S | $V_{DS}$ = -15V, $I_D$ = -1.4A |
| Diode Forward Voltage (Note 9) | $V_{SD}$ | — | -0.85 | -0.95 | V | $V_{GS}$ = 0V, $I_S$ = -1.1A |
| **DYNAMIC CHARACTERISTICS (Note 11)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 204 | — | pF | $V_{DS}$ = -15V, $V_{GS}$ = 0V, f = 1MHz |
| Output Capacitance | $C_{oss}$ | — | 39.8 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 25.8 | — | pF | |
| Gate Charge ($V_{GS}$ = -5.0V) (Note 10) | $Q_g$ | — | 2.6 | — | nC | $V_{DS}$ = -15V, $I_D$ = -1.4A, |
| Total Gate Charge ($V_{GS}$ = -10V) (Note 10) | $Q_g$ | — | 5.2 | — | nC | |
| Gate-Source Charge (Note 10) | $Q_{gs}$ | — | 0.7 | — | nC | |
| Gate-Drain Charge (Note 10) | $Q_{gd}$ | — | 0.9 | — | nC | |
| Turn-On Delay Time (Note 10) | $t_{D(on)}$ | — | 1.2 | — | ns | $V_{DD}$ = -15V, $V_{GS}$ = -10V, $R_G \cong 6.0\Omega$, $I_D$ = -1.0A |
| Turn-On Rise Time (Note 10) | $t_r$ | — | 2.3 | — | ns | |
| Turn-Off Delay Time (Note 10) | $t_{D(off)}$ | — | 12.1 | — | ns | |
| Turn-Off Fall Time | $t_f$ | — | 7.5 | — | ns | |
| Reverse Recovery Time | $t_{rr}$ | — | 19 | — | ns | $I_S$ = -0.95A, di/dt = 100A/μs |
| Reverse Recovery Charge | $Q_{rr}$ | — | 15 | — | nC | |

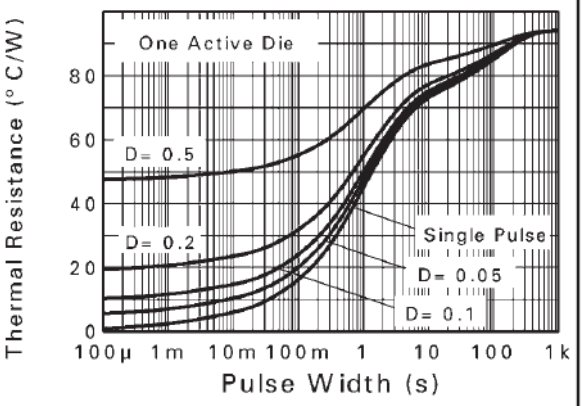
Notes: 9. Measured under pulsed conditions. Width≤300μs. Duty cycle ≤ 2%.
10. Switching characteristics are independent of operating junction temperature.
11. For design aid only, not subject to production testing.



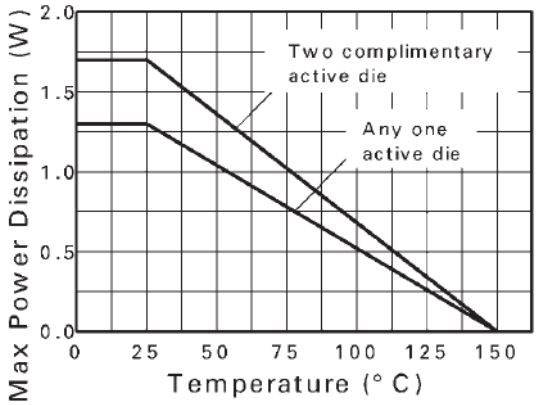

**N-channel Safe Operating Area**



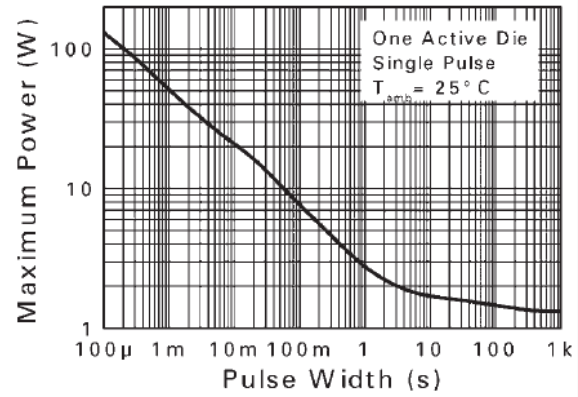

**P-channel Safe Operating Area**




**Transient Thermal Impedance**

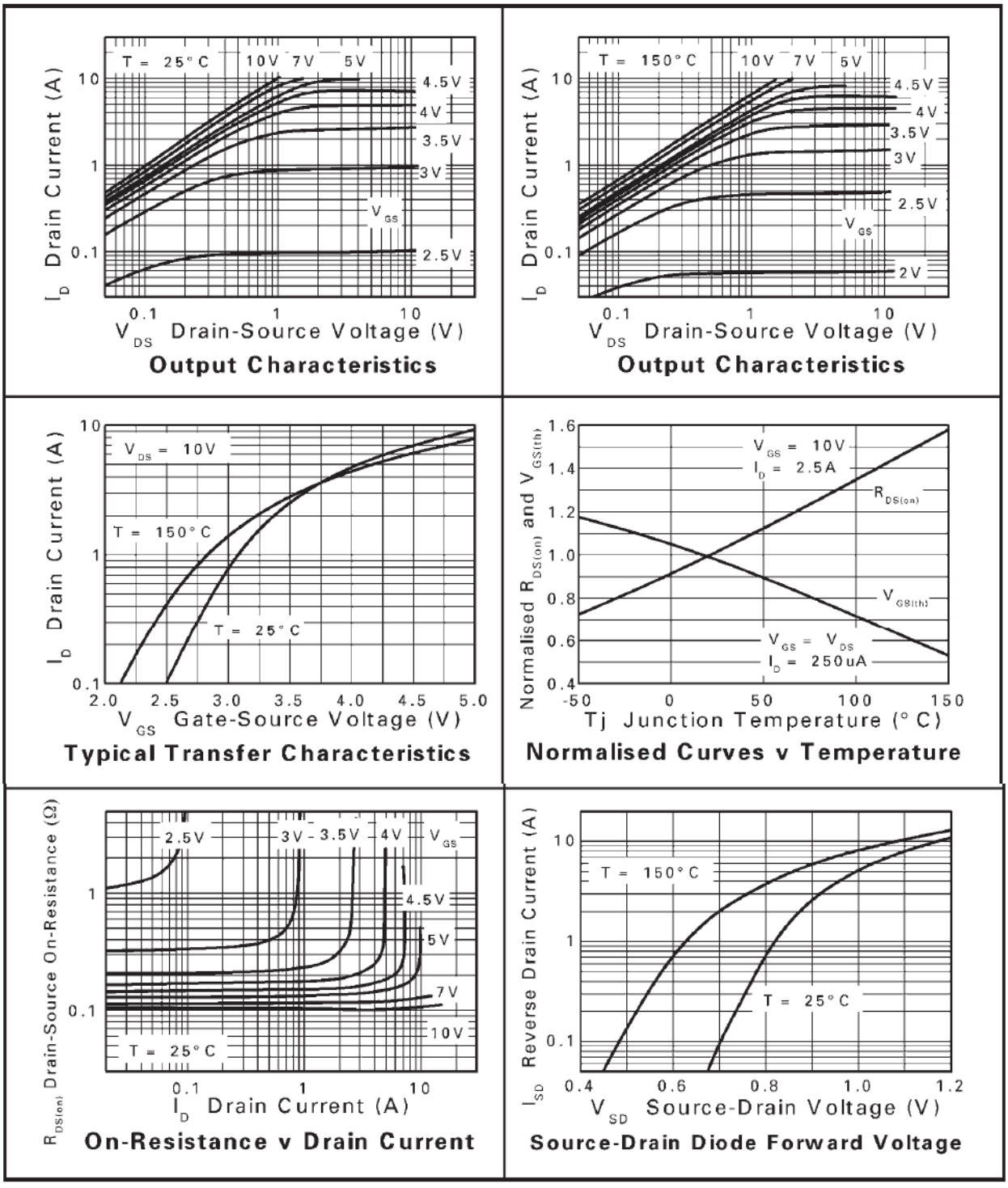



**Derating Curve**

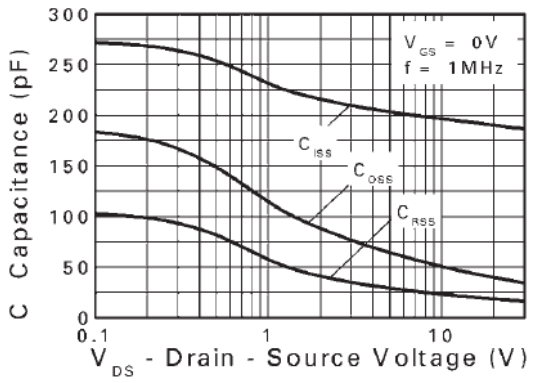



**Pulse Power Dissipation**

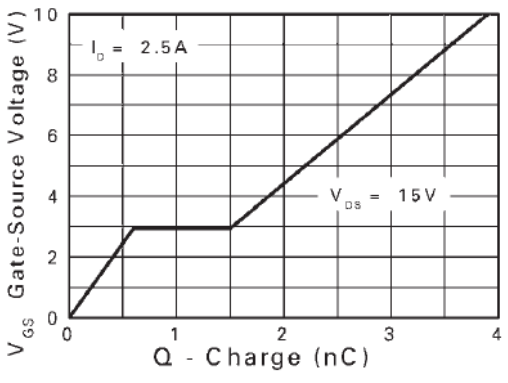
## Typical Characteristics N-CHANNEL



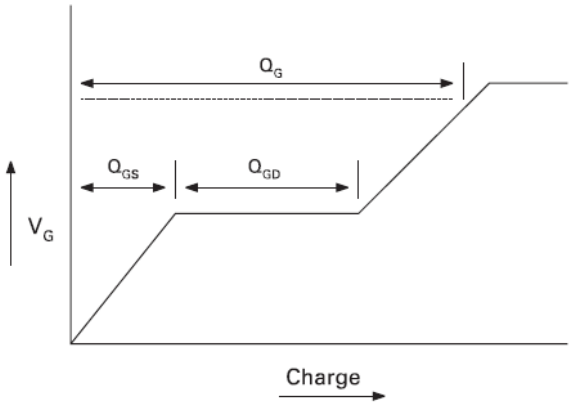
## Typical Characteristics N-CHANNEL



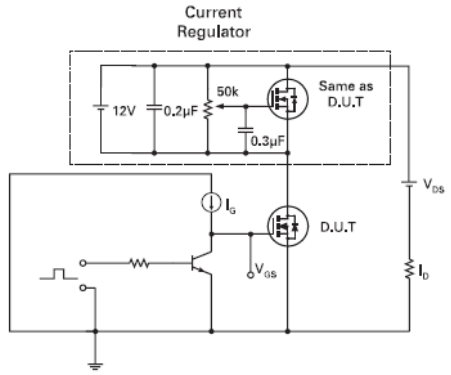

**Capacitance v Drain-Source Voltage**



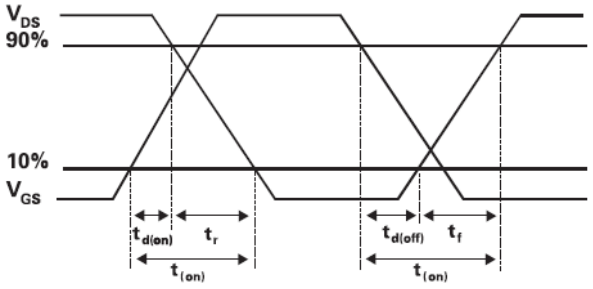

**Gate-Source Voltage v Gate Charge**



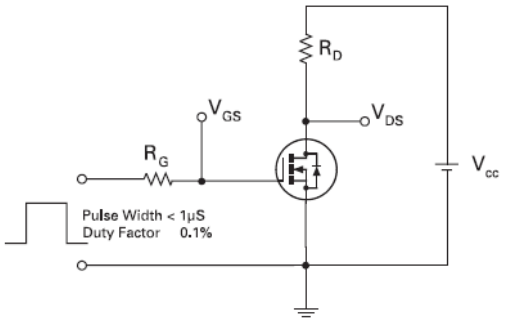

**Basic Gate Charge Waveform**




**Gate Charge Test Circuit**

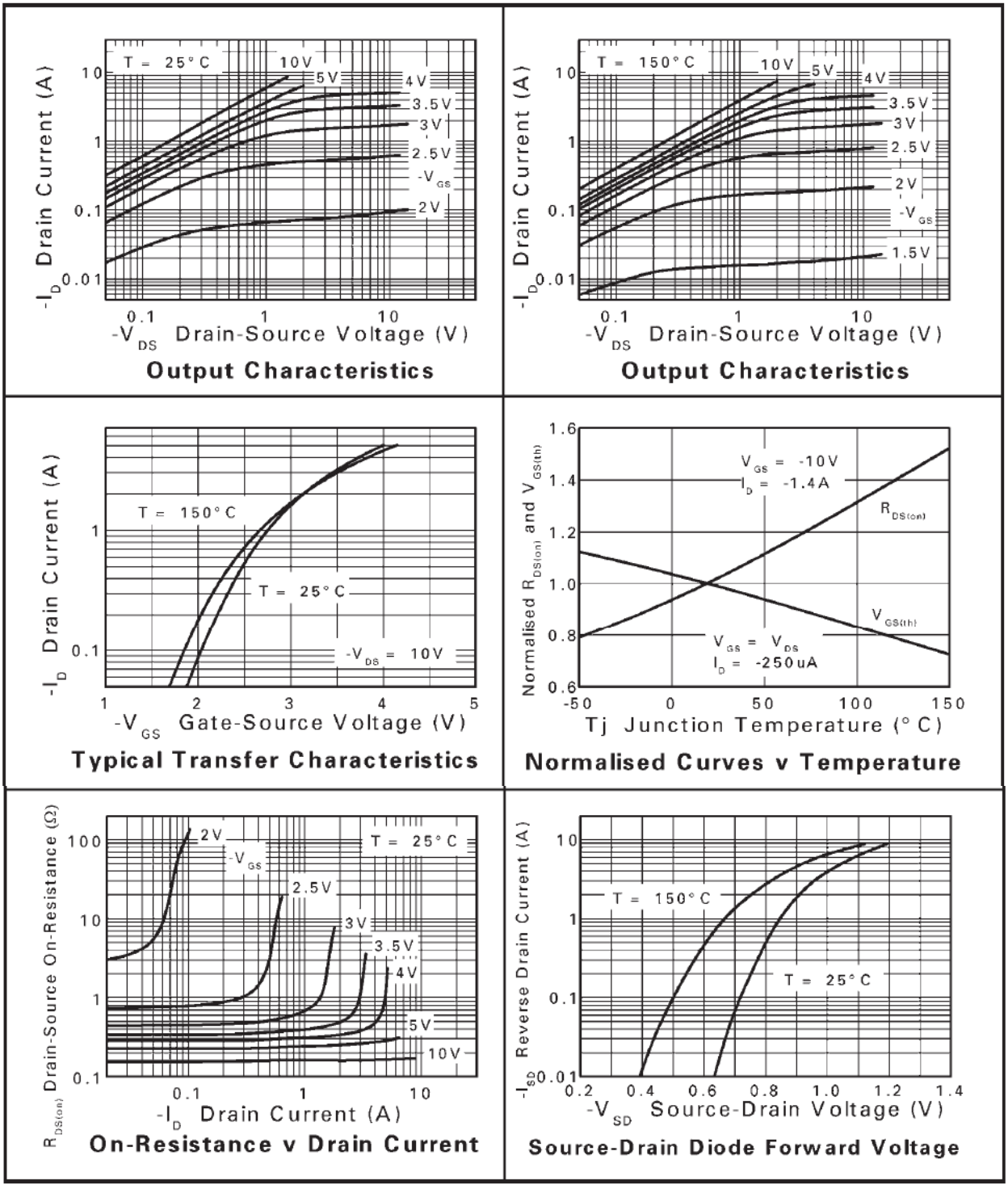



**Switching Time Waveforms**

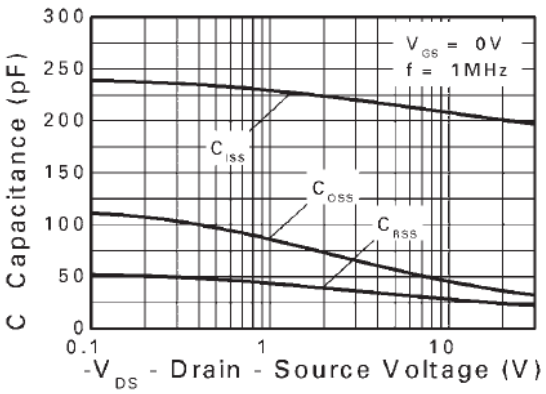



**Switching Time Test Circuit**

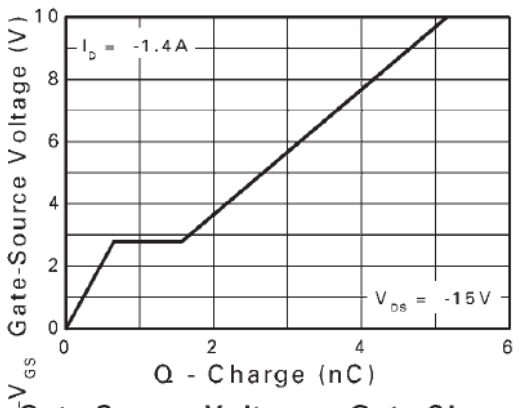
## Typical Characteristics P-CHANNEL



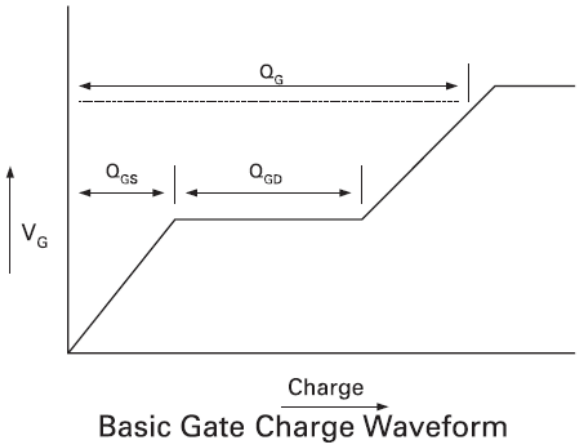
## Typical Characteristics P-CHANNEL



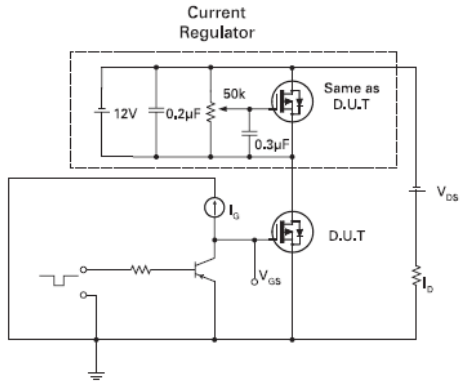

**Capacitance v Drain-Source Voltage**



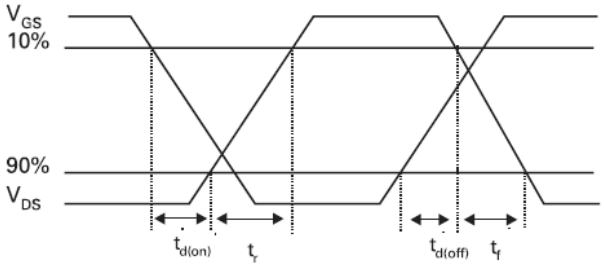

**Gate-Source Voltage v Gate Charge**



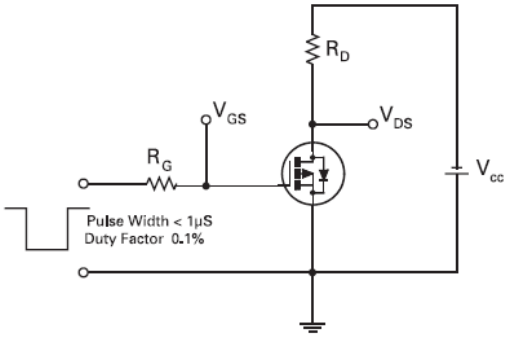

**Basic Gate Charge Waveform**




**Gate Charge Test Circuit**



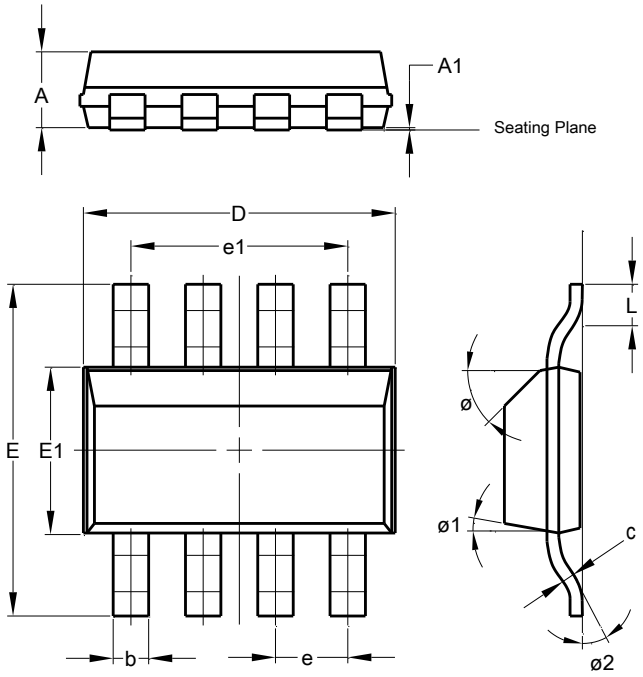

**Switching Time Waveforms**




**Switching Time Test Circuit**

## Package Outline Dimensions

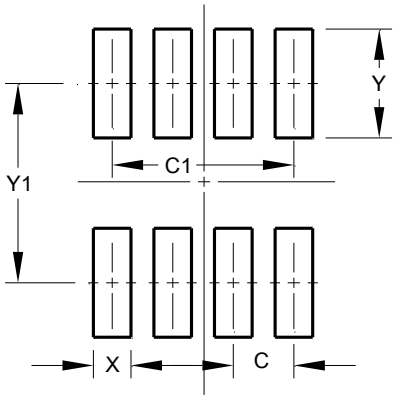
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.




| SM-8 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | -- | 1.70 | 1.60 |
| **A1** | 0.02 | 0.10 | 0.04 |
| **b** | 0.70 | 0.90 | 0.80 |
| **c** | 0.24 | 0.32 | 0.28 |
| **D** | 6.30 | 6.70 | 6.60 |
| **e** | 1.53 REF | | |
| **e1** | 4.59 REF | | |
| **E** | 6.70 | 7.30 | 7.00 |
| **E1** | 3.30 | 3.70 | 3.50 |
| **L** | 0.75 | 1.00 | 0.90 |
| **Ø** | -- | -- | 45° |
| **Ø1** | -- | 15° | -- |
| **Ø2** | -- | -- | 10° |
| **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) |
|---|---|
| **C** | 1.52 |
| **C1** | 4.60 |
| **X** | 0.95 |
| **Y** | 2.80 |
| **Y1** | 6.80 |

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