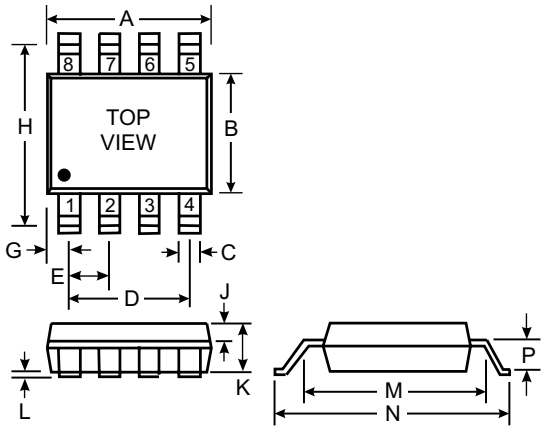
# DI9400

## SINGLE P-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR

## Features

- High Cell Density DMOS Technology
- Lower On-State Resistance
- High Power and Current Capability
- Fast Switching Speed
- High Transient Tolerance




| SO-8 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 3.94 | 4.19 |
| **B** | 3.20 | 3.40 |
| **C** | 0.381 | 0.495 |
| **D** | 2.67 | 3.05 |
| **E** | 0.89 | 1.02 |
| **G** | 0.527 | 0.679 |
| **J** | 0.41 Nominal | |
| **K** | 0.94 | 1.09 |
| **L** | 0.025 | 0.152 |
| **M** | 4.37 | 4.62 |
| **N** | 4.39 | 4.70 |
| **P** | 0.939 Nominal | |
| **All Dimensions in mm** | | |

## Mechanical Data

- SO-8 Plastic Case
- Terminal Connections: See Outline Drawing and Internal Circuit Diagram above

## Maximum Ratings

25°C unless otherwise specified

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | -30 | V |
| Gate-Source Voltage | | $V_{GSS}$ | ±20 | V |
| Drain Current | Note 1a Continuous<br>Pulsed | $I_D$ | ±3.4<br>±10 | A |
| Maximum Power Dissipation | Note 1a<br>Note 1b<br>Note 1c | $P_d$ | 2.5<br>1.2<br>1.0 | W |
| Operating and Storage Temperature Range | | $T_j$, $T_{STG}$ | -55 to +150 | °C |

## Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Thermal Resistance, Junction-to-Ambient | Note 1a | $R_{\Theta JA}$ | 50 | °C/W |
| Thermal Resistance, Junction-to-Case | Note 1 | $R_{\Theta JC}$ | 25 | °C/W |

Notes: 1. $R_{\Theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance ($R_{\Theta JC}$ + $R_{\Theta CA}$) where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\Theta JC}$ in this instance is 25°C/W but is dependent on the specific circuit board thermal design.

1a. With 1 in² of 2 oz. copper mounting pad $R_{\Theta JA}$ = 50°C\W.

1b. With 0.04 in² of 2 oz. copper mounting pad $R_{\Theta JA}$ = 105°C\W.

1c. With 0.006 in² of 2 oz. copper mounting pad $R_{\Theta JA}$ = 125°C\W.

## Electrical Characteristics

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<br>$T_j$ = 55°C | $I_{DSS}$ | — | — | -2.0<br>-25 | µA | VDS = -24V, $V_{GS}$ = 0V |
| Gate-Body Leakage, Forward | $I_{GSSF}$ | — | — | 100 | nA | $V_{GS}$ = 20V, $V_{DS}$ = 0V |
| Gate-Body Leakage, Reverse | $I_{GSSR}$ | — | — | -100 | nA | $V_{GS}$ = -20V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 2)** | | | | | | |
| Gate Threshold Voltage<br>$T_j$ = 125°C | $V_{GS(th)}$ | -1.0<br>-0.85 | -1.60<br>-1.25 | -2.8<br>-2.5 | V | VDS = $V_{GS}$, $I_D$ = -250µA |
| Static Drain-Source On-Resistance<br>$T_j$ = 125°C | $R_{DS\ (ON)}$ | — | 0.11<br>0.15<br>0.17<br>0.24 | 0.13<br>0.21<br>0.20<br>0.32 | Ω | $V_{GS}$ = -10V, $I_D$ = -1.0A<br>$V_{GS}$ = -10V, $I_D$ = -1.0A<br>$V_{GS}$ = -4.5V, $I_D$ = -0.5A<br>$V_{GS}$ = -4.5V, $I_D$ = -0.5A |
| On-State Drain Current | $I_{D(ON)}$ | -10 | — | — | A | $V_{GS}$ = -10V, $V_{DS}$ = -5V |
| Forward Transconductance | $g_{FS}$ | — | 4.0 | — | m | $V_{DS}$ = -15V, $I_D$ = -3.4A |
| **DYNAMIC CHARACTERISTICS** | | | | | | |
| Input Capacitance | $C_{ISS}$ | — | 350 | — | pF | $V_{DS}$ = -10V, $V_{GS}$ = 0V<br>f = 1.0MHz |
| Output Capacitance | $C_{OSS}$ | — | 260 | — | pF | |
| Reverse Transfer Capacitance | $C_{RSS}$ | — | 100 | — | pF | |
| **SWITCHING CHARACTERISTICS (Note 2)** | | | | | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 9.0 | 40 | ns | $V_{DD}$ = -10V, $I_D$ = -1.0A<br>$V_{GEN}$ = -10V, $R_{GEN}$ = 6.0Ω |
| Turn-On Rise Time | $t_r$ | — | 21 | 40 | ns | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 21 | 90 | ns | |
| Turn-Off Fall Time | $t_f$ | — | 8.0 | 50 | ns | |
| Total Gate Charge | $Q_g$ | — | 10 | 25 | nC | $V_{DS}$ = -10V. $I_D$ = -3.4A.<br>$V_{GS}$ = -10V |
| Gate-Source Charge | $Q_{gs}$ | — | 1.6 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 3.4 | — | nC | |
| **DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS** | | | | | | |
| Max Continuous Drain-Source Diode Forward Current | $I_S$ | — | — | -1.9 | A | |
| Drain-Source Diode Forward Voltage | $V_{SD}$ | — | -0.8 | -1.3 | V | $V_{GS}$ = 0V, $I_S$ = -1.25A<br>(Note 2) |
| Reverse Recovery Time | $t_{rr}$ | — | — | 100 | ns | $V_{GS}$ = 0V, $I_F$ = -2.0A,<br>$dI_F/dt$ = 100A/µs |
| Reverse Recovery Current | $I_{rr}$ | — | 1.9 | — | A | |

Notes: 2. Pulse Test: Pulse width ≤ 300µs, duty cycle ≤ 2.0%.

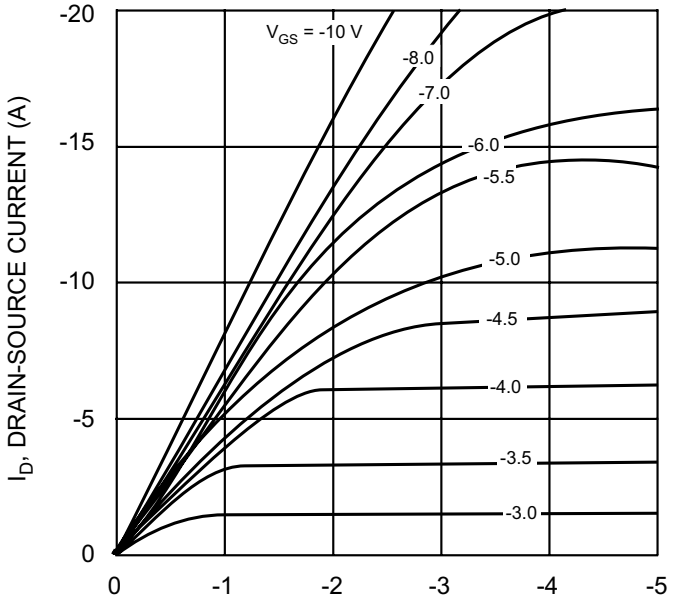



Fig. 1 On-Region Characteristics

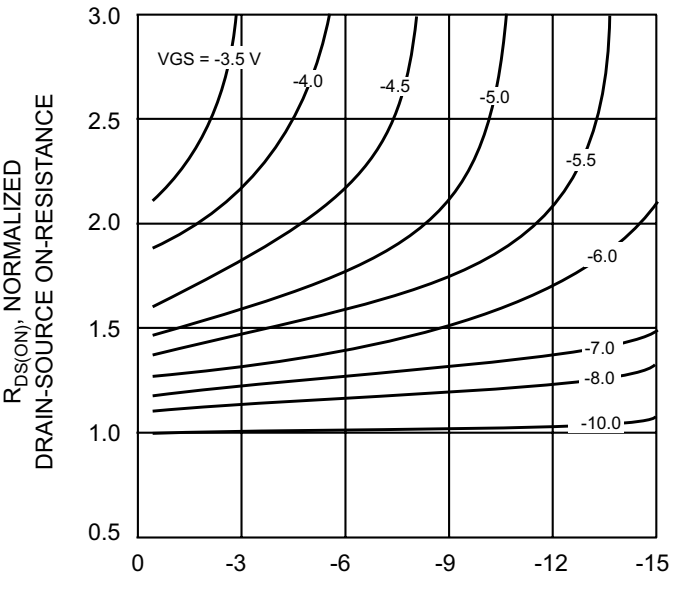



Fig. 2 On-Resistance vs Gate Voltage & Drain Current

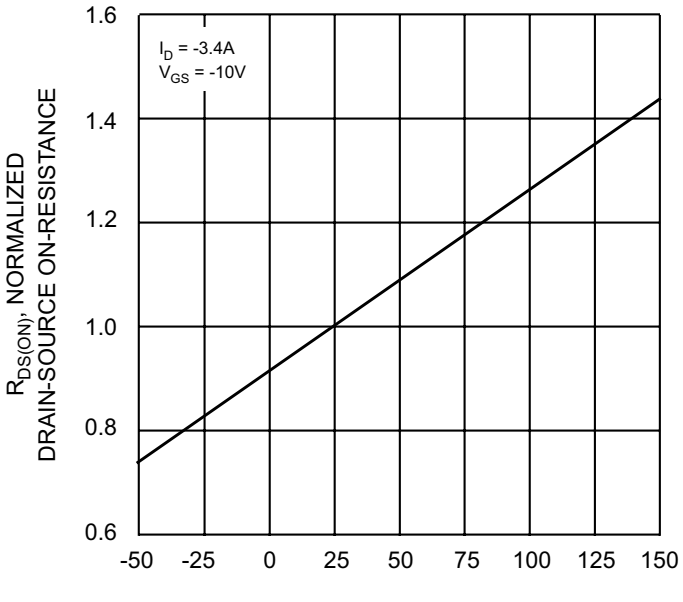



Fig. 3 On-Resistance vs Junction Temperature

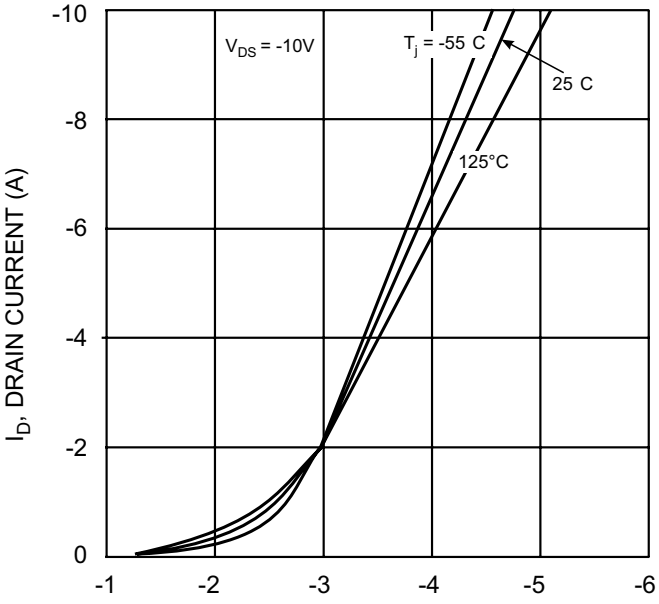



Fig. 4 Transfer Characteristics

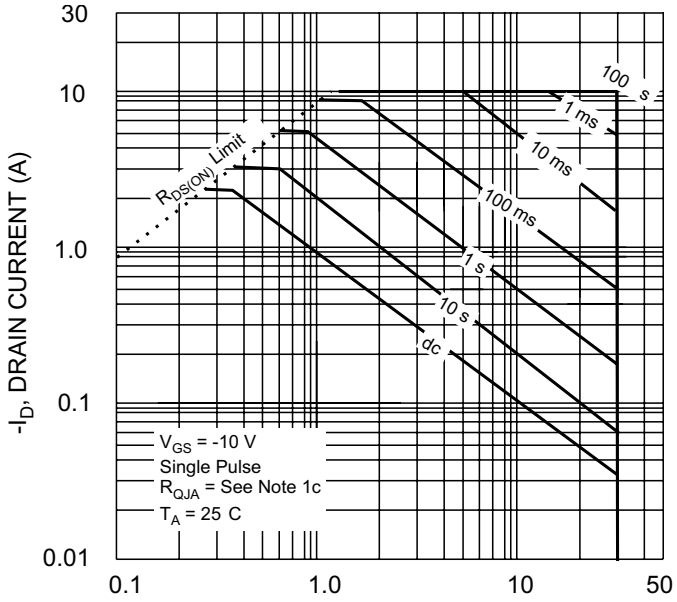



Fig. 5, Maximum Safe Operating Area

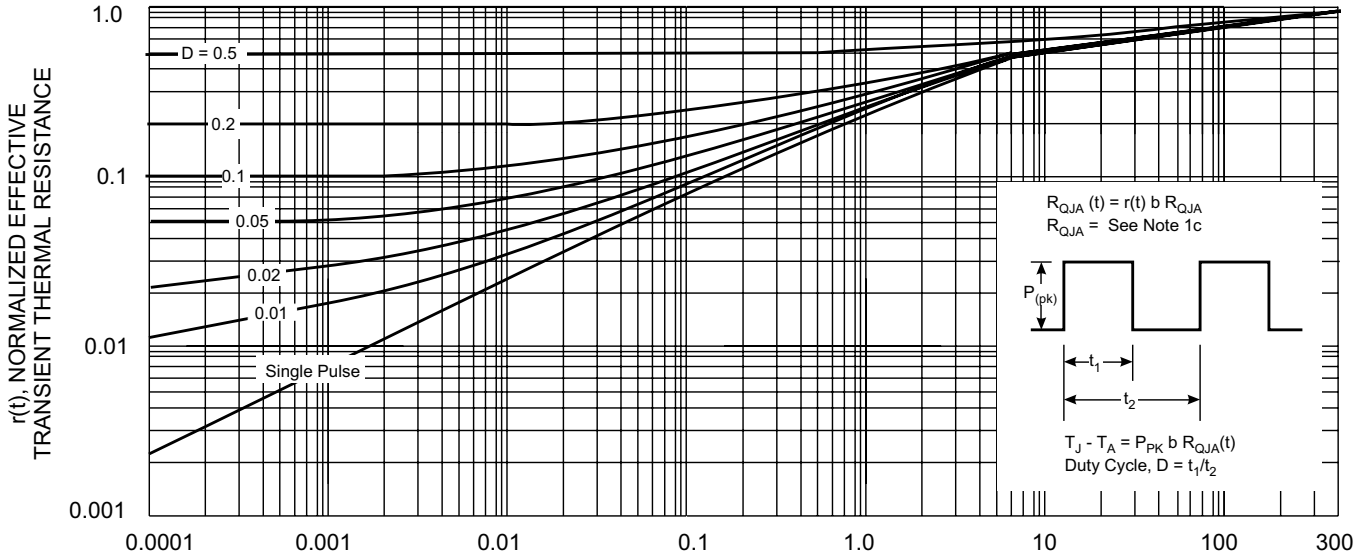



Fig. 6 Typical Normalized Transient Thermal Impedance Curves

Remark: Thermal characterization performed under conditions of Note 1c. Better thermal design such as shown in Notes 1a and 1b or 1d will offer lower $R_{\Theta JA}$ values and allow junction to reach thermal equilibrium sooner.