# DUAL N-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)}$ max | $I_D$ max $T_A$ = 25°C |
|---|---|---|
| 60V | 7.5Ω @ $V_{GS}$ = 5V | 0.23A |

## 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

- Motor control
- Power Management Functions

## Features

- Dual N-Channel MOSFET
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Ultra-Small Surface Mount Package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Notes 3 & 4)**
- **Qualified to AEC-Q101 Standards for High Reliability**

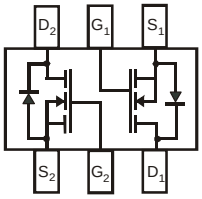
## Mechanical Data

- 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



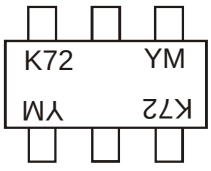

Top View
Internal Schematic

## Ordering Information (Note 5)

| Part Number | Qualification | Case | Packaging |
|---|---|---|---|
| 2N7002DW-7-F | Commercial | SOT363 | 3,000/Tape & Reel |
| 2N7002DWQ-7-F | Automotive | SOT363 | 3,000/Tape & Reel |
| 2N7002DW-13-F | Commercial | SOT363 | 10,000/Tape & Reel |
| 2N7002DWQ-13-F | 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 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. Product manufactured with Date Code UO (week 40, 2007) and newer are built with Green Molding Compound. Product manufactured prior to Date Code UO are built with Non-Green Molding Compound and may contain Halogens or $Sb_2O_3$ Fire Retardants.
5. For packaging details, go to our website at http://www.diodes.com.

## Marking Information




K72 = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: N = 2002)
M = Month (ex: 9 = September)

Date Code Key

| Year | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | … | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | J | K | L | M | N | P | R | … | Y | Z | A | B | C | D | E |

| 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 |


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## Maximum Ratings (@$T_A$ = +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 | $V_{GSS}$ | ±20 | V |
| | | Pulsed | $V_{GSS}$ | ±40 | V |
| Continuous Drain Current (Note 7) $V_{GS}$ = 5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C<br>$T_A$ = +100°C | $I_D$ | 0.23<br>0.18<br>0.14 | A |
| Maximum Continuous Body Diode Forward Current (Note 7) | | | $I_S$ | 0.53 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | $I_{DM}$ | 0.8 | A |

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

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Total Power Dissipation (Note 6) | $T_A$ = +25°C | $P_D$ | 0.31 | W |
| | $T_A$ = +70°C | | 0.2 | |
| | $T_A$ = +100°C | | 0.12 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady state | $R_{\theta JA}$ | 410 | °C/W |
| Total Power Dissipation (Note 7) | $T_A$ = +25°C | $P_D$ | 0.4 | W |
| | $T_A$ = +70°C | | 0.25 | |
| | $T_A$ = +100°C | | 0.15 | |
| Thermal Resistance, Junction to Ambient (Note 7) | Steady state | $R_{\theta JA}$ | 318 | °C/W |
| Thermal Resistance, Junction to Case (Note 7) | Steady state | $R_{\theta JC}$ | 135 | °C/W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 8)** | | | | | | |
| 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 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 1.0 | — | 2.0 | 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 |
| Diode Forward Voltage | $V_{SD}$ | — | 0.78 | 1.5 | V | $V_{GS}$ = 0V, $I_S$ = 115mA |
| **DYNAMIC CHARACTERISTICS (Note 9)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 22 | 50 | pF | $V_{DS}$ = 25V, $V_{GS}$ = 0V<br>f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 11 | 25 | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 2.0 | 5.0 | pF | |
| **SWITCHING CHARACTERISTICS (Note 9)** | | | | | | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 7.0 | 20 | ns | $V_{DD}$ = 30V, $I_D$ = 0.2A,<br>$R_L$ = 150Ω, $V_{GEN}$ = 10V,<br>$R_{GEN}$ = 25Ω |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 11.0 | 20 | | |

Notes: 6. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout
7. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal vias to bottom layer 1inch square copper plate
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.


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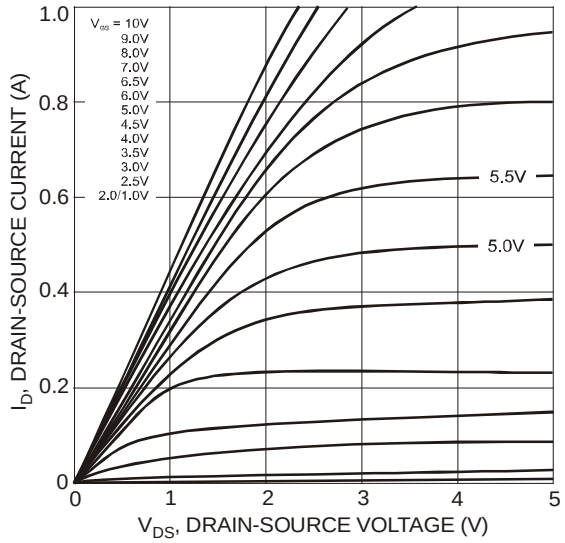



Fig. 1 On-Region Characteristics

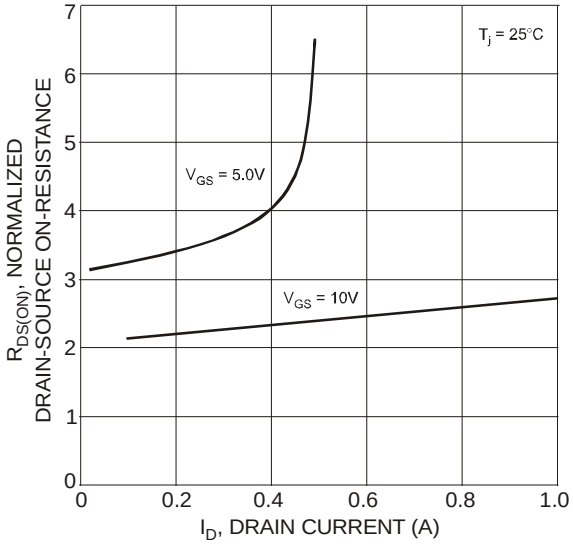



Fig. 2 On-Resistance vs. Drain Current

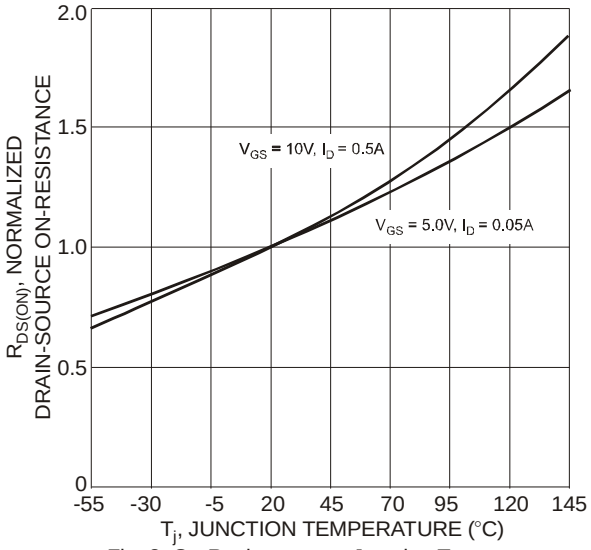



Fig. 3 On-Resistance vs. Junction Temperature

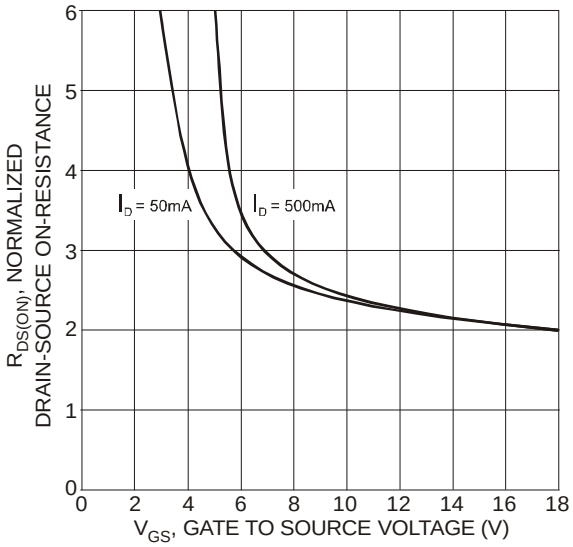
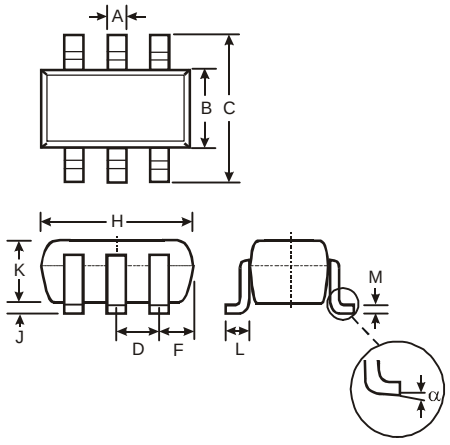



Fig. 4 On-Resistance vs. Gate-Source Voltage

## Package Outline Dimensions

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

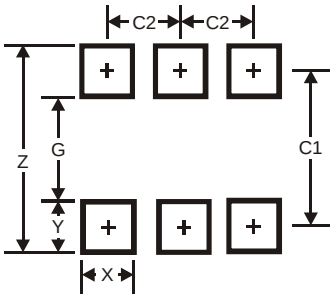



| SOT363 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 0.10 | 0.30 |
| **B** | 1.15 | 1.35 |
| **C** | 2.00 | 2.20 |
| **D** | 0.65 Typ | |
| **F** | 0.40 | 0.45 |
| **H** | 1.80 | 2.20 |
| **J** | 0 | 0.10 |
| **K** | 0.90 | 1.00 |
| **L** | 0.25 | 0.40 |
| **M** | 0.10 | 0.22 |
| **α**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


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## 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 |

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