NEW PRODUCT

Lead-free Green

**2N7002E**

## N-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR

Please click here to visit our online spice models database.

## Features

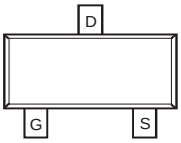
- Low On-Resistance: $R_{DS(ON)}$
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **Lead, Halogen and Antimony Free, RoHS Compliant "Green" Device (Notes 2 and 4)**

## Mechanical Data

- Case: SOT-23
- Case Material: UL Flammability Classification Rating 94V-0
- Moisture sensitivity: Level 1 per J-STD-020D
- Terminals: Solderable per MIL-STD-202, Method 208
- Lead Free Plating (Matte Tin Finish annealed over Alloy 42 leadframe).
- Terminal Connections: See Diagram
- Marking Information: See Page 3
- Ordering Information: See Page 3
- Weight: 0.008 grams (approximate)

SOT-23

TOP VIEW




TOP VIEW
Pin Out Configuration

## Maximum Ratings @$T_A$ = 25°C unless otherwise specified

| Characteristic | | Symbol | Value | Units |
|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DSS}$ | 60 | V |
| Drain-Gate Voltage $R_{GS} \le 1.0M\Omega$ | | $V_{DGR}$ | 60 | V |
| Gate-Source Voltage | Continuous<br>Pulsed | $V_{GSS}$ | ±20<br>±40 | V |
| Drain Current | Continuous | $I_D$ | 240 | mA |

## Thermal Characteristics @$T_A$ = 25°C unless otherwise specified

| Characteristic | Symbol | Value | Units |
|---|---|---|---|
| Total Power Dissipation (Note 1) | $P_D$ | 300 | mW |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 417 | °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 3)** | | | | | | | |
| 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 | $V_{GS}$ = ±15V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 3)** | | | | | | | |
| 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 | $R_{DS\ (ON)}$ | —<br>— | 1.6<br>2.0 | 3<br>4 | Ω | $V_{GS}$ = 10V, $I_D$ = 250mA<br>$V_{GS}$ = 4.5V, $I_D$ = 200mA |
| On-State Drain Current | | $I_{D(ON)}$ | 0.8 | 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 |

Notes:
1. 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/datasheets/ap02001.pdf.
2. No purposefully added lead. Halogen and Antimony Free.
3. Short duration pulse test used to minimize self-heating effect.
4. Product manufactured with Data Code V9 (week 33, 2008) and newer are built with Green Molding Compound. Product manufactured prior to Date Code V9 are built with Non-Green Molding Compound and may contain Halogens or Sb203 Fire Retardants.

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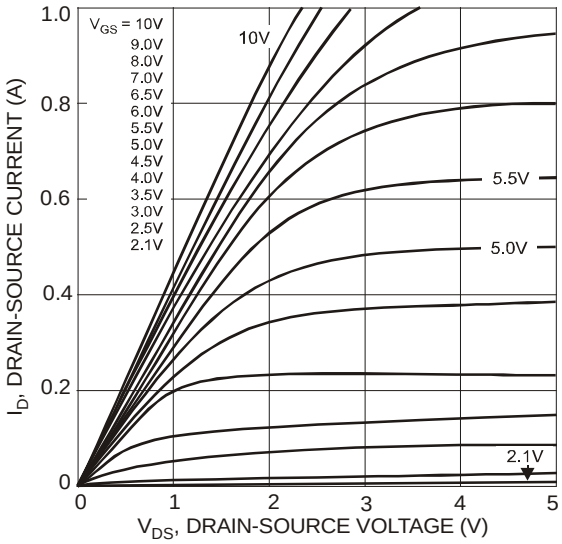



Fig. 1 On-Region Characteristics

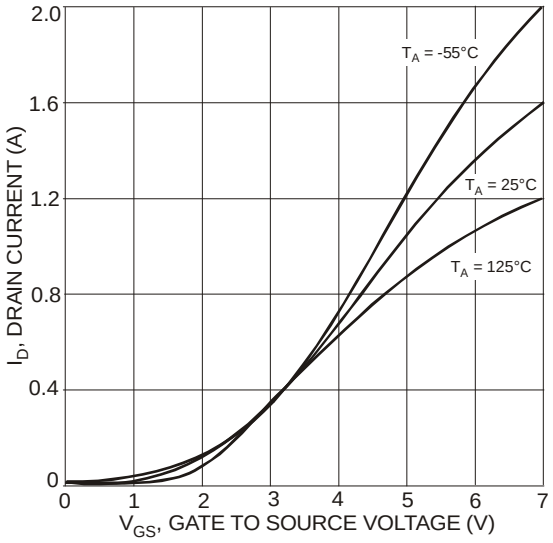



Fig. 2 Drain Current vs. Gate-Source Voltage

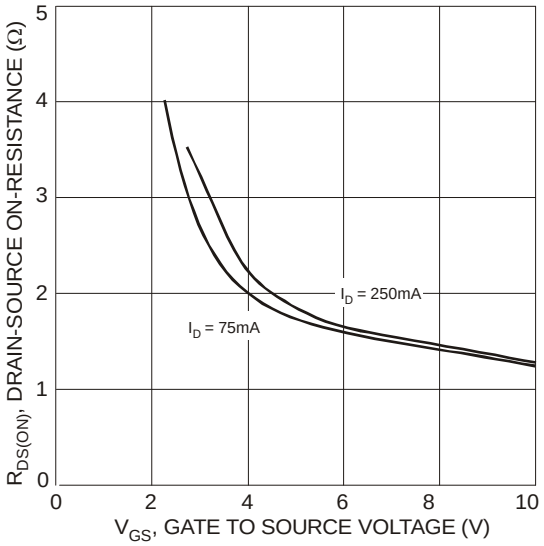



Fig. 3 On Resistance vs. Gate-Source Voltage

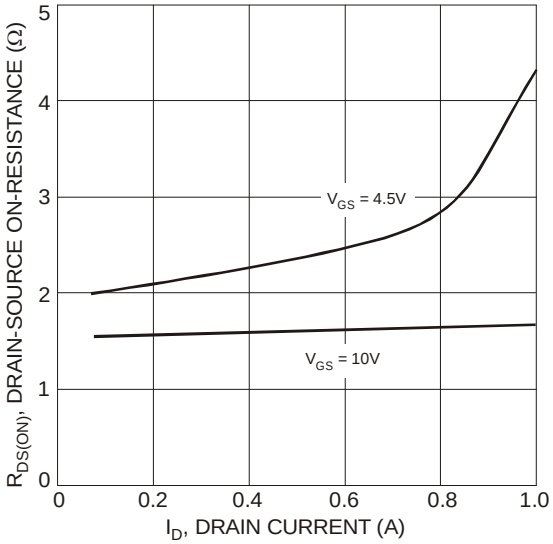



Fig. 4 On Resistance vs. Drain Current

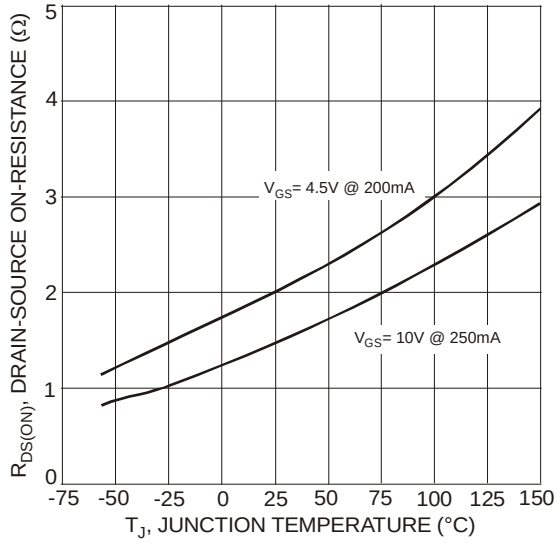



Fig. 5 On-Resistance vs. Junction Temperature

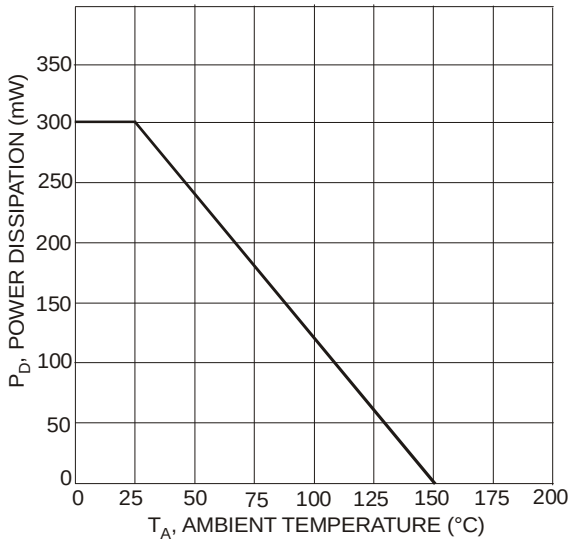



Fig. 6 Max Power Dissipation vs. Ambient Temperature

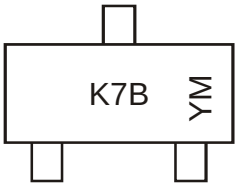
NEW PRODUCT

## Ordering Information (Note 5)

| Part Number | Case | Packaging |
|---|---|---|
| 2N7002E-7-F | SOT-23 | 3000/Tape & Reel |

Notes: 5. For packaging details, go to our website at http://www.diodes.com/datasheets/ap02007.pdf.

## Marking Information



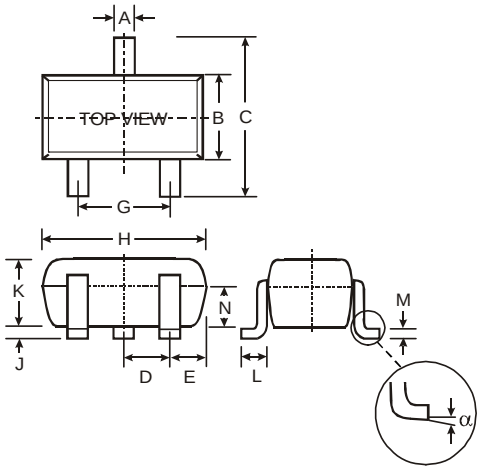

K7B = Product Type Marking Code
YM = Date Code Marking
Y = Year ex: P = 2003
M = Month ex: 9 = September

Date Code Key

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|
| Code | P | R | S | T | U | V | W | X | Y | Z |

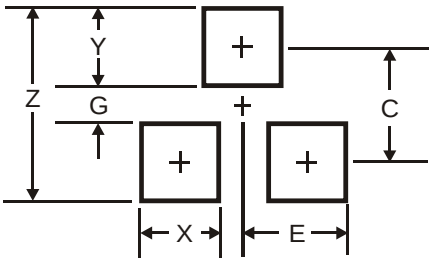
| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |

## Package Outline Dimensions




| SOT-23 | | |
|---|---|---|
| Dim | Min | Max |
| A | 0.37 | 0.51 |
| B | 1.20 | 1.40 |
| C | 2.30 | 2.50 |
| D | 0.89 | 1.03 |
| E | 0.45 | 0.60 |
| G | 1.78 | 2.05 |
| H | 2.80 | 3.00 |
| J | 0.013 | 0.10 |
| K | 0.903 | 1.10 |
| L | 0.45 | 0.61 |
| M | 0.085 | 0.180 |
| N | — | — |
| α | 0° | 8° |
| All Dimensions in mm | | |

## Suggested Pad Layout




| Dimensions | Value (in mm) |
|---|---|
| Z | 3.4 |
| G | 0.7 |
| X | 0.9 |
| Y | 1.4 |
| C | 2.0 |
| E | 0.9 |