

## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(ON)} \text{ max}$ | $I_D \text{ max}$<br>$T_A = +25^\circ\text{C}$ |
|---------------|--------------------------|------------------------------------------------|
| 60V           | $3\Omega @ V_{GS} = 10V$ | 300mA                                          |

## Description

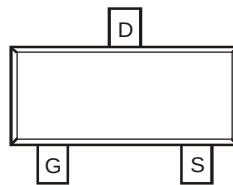
This MOSFET has been designed to minimize the on-state resistance ( $R_{DS(ON)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

## Applications

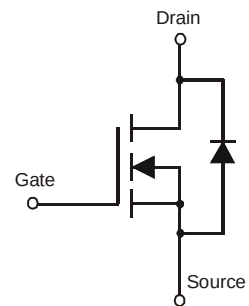
- Motor Control
- Power Management Functions



Top View



Top View  
Pin Out Configuration



Equivalent Circuit

## Features and Benefits

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Small Surface Mount Package
- **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**

## Mechanical Data

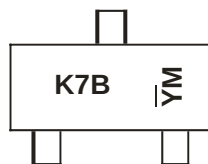
- Case: SOT23
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish annealed over Alloy 42 leadframe (Lead Free Plating). Solderable per MIL-STD-202, Method 208 **e3**
- Weight: 0.008 grams (approximate)

## Ordering Information (Note 4)

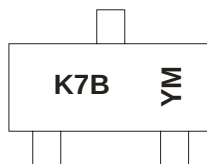
| Part Number  | Case  | Packaging          |
|--------------|-------|--------------------|
| 2N7002E-7-F  | SOT23 | 3,000/Tape & Reel  |
| 2N7002E-13-F | SOT23 | 10,000/Tape & Reel |

- 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/quality/lead\\_free.html](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



Chengdu A/T Site



Shanghai A/T Site

K7B = Product Type Marking Code  
 YM = Date Code Marking for SAT (Shanghai Assembly/ Test site)  
 YM = Date Code Marking for CAT (Chengdu Assembly/ Test site)  
 Y or Y= Year (ex: A = 2013)  
 M = Month (ex: 9 = September)

### Date Code Key

| Year | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | P    | R    | S    | T    | U    | V    | W    | X    | 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   |

## Maximum Ratings (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                          |              |                                                  | Symbol           | Value      | Units |
|---------------------------------------------------------|--------------|--------------------------------------------------|------------------|------------|-------|
| Drain-Source Voltage                                    |              |                                                  | V <sub>DSS</sub> | 60         | V     |
| Drain-Gate Voltage R <sub>GS</sub> ≤ 1.0MΩ              |              |                                                  | V <sub>DGR</sub> | 60         | V     |
| Gate-Source Voltage                                     |              |                                                  | V <sub>GSS</sub> | ±20        | V     |
| Continuous Pulsed                                       |              |                                                  |                  | ±40        |       |
| Continuous Drain Current (Note 5) V <sub>GS</sub> = 10V | Steady State | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | 250<br>200 | mA    |
| Continuous Drain Current (Note 6) V <sub>GS</sub> = 10V | Steady State | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | 300<br>240 | mA    |
| Maximum Body Diode Forward Current (Note 6)             |              |                                                  | I <sub>S</sub>   | 500        | mA    |
| Pulsed Drain Current (10μs pulse, duty cycle = 1%)      |              |                                                  | I <sub>DM</sub>  | 800        | mA    |

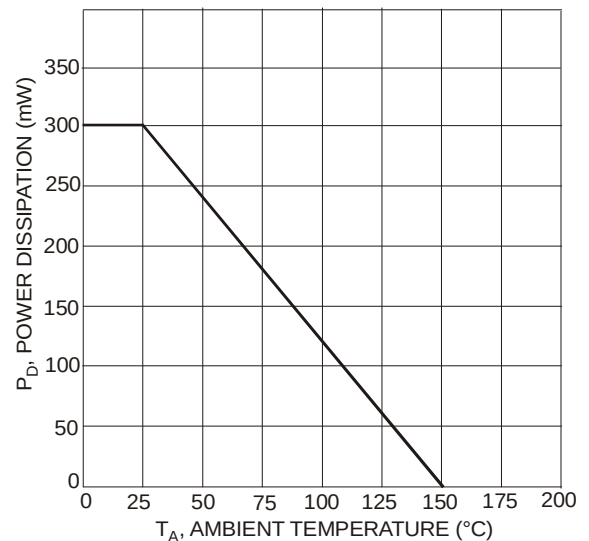
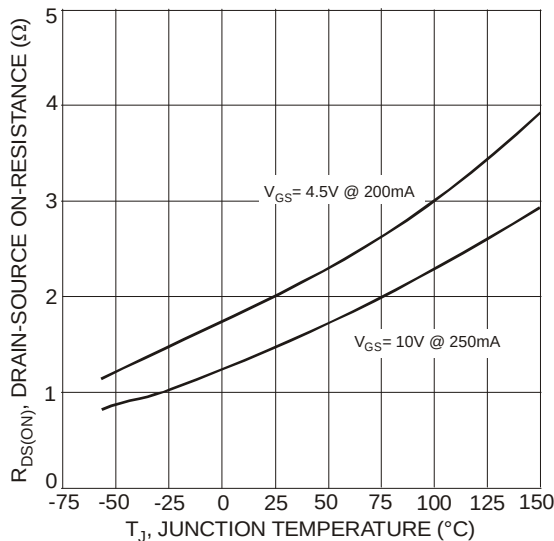
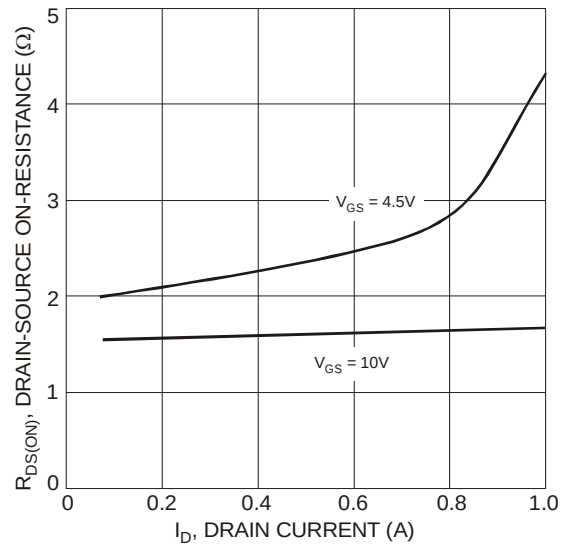
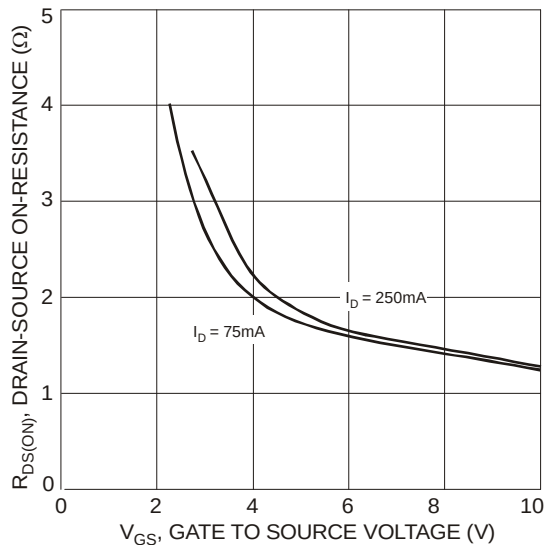
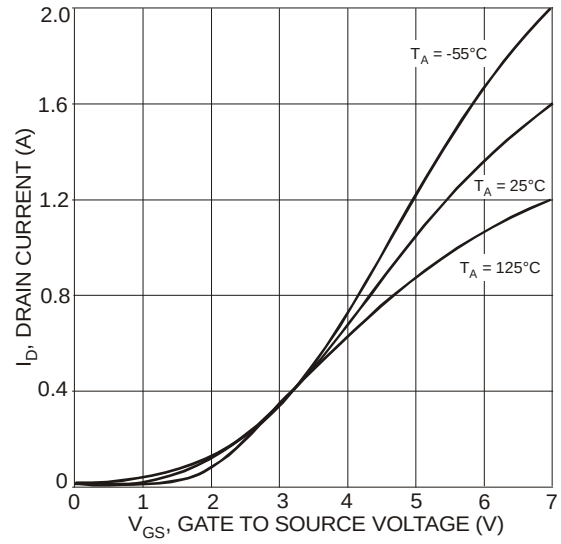
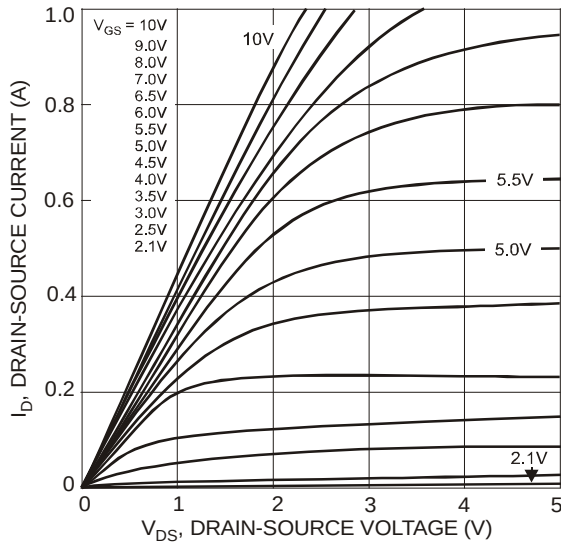
## Thermal Characteristics (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                          |          | Symbol                            | Value      | Units |
|-----------------------------------------|----------|-----------------------------------|------------|-------|
| Total Power Dissipation                 | (Note 5) | P <sub>D</sub>                    | 370        | mW    |
|                                         | (Note 6) |                                   | 540        |       |
| Thermal Resistance, Junction to Ambient | (Note 5) | R <sub>θJA</sub>                  | 348        | °C/W  |
|                                         | (Note 6) |                                   | 241        |       |
| Thermal Resistance, Junction to Case    | (Note 6) | R <sub>θJC</sub>                  | 91         |       |
| Operating and Storage Temperature Range |          | T <sub>J</sub> , T <sub>STG</sub> | -55 to 150 | °C    |

## Electrical Characteristics (@T<sub>A</sub> = +25°C, unless otherwise specified.)

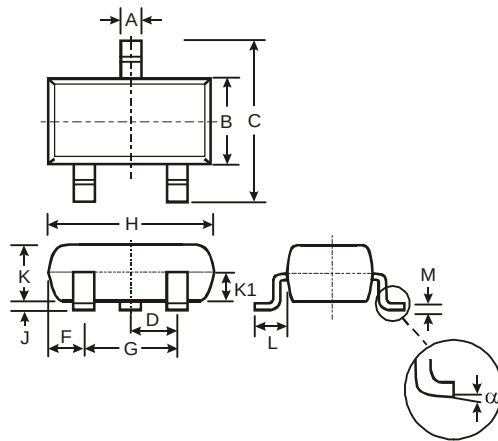
| Characteristic                                                                           | Symbol              | Min    | Typ        | Max        | Unit | Test Condition                                                                                                         |
|------------------------------------------------------------------------------------------|---------------------|--------|------------|------------|------|------------------------------------------------------------------------------------------------------------------------|
| OFF CHARACTERISTICS (Note 7)                                                             |                     |        |            |            |      |                                                                                                                        |
| Drain-Source Breakdown Voltage                                                           | BV <sub>DSS</sub>   | 60     | 70         | —          | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = 10μA                                                                            |
| Zero Gate Voltage Drain Current<br>@ T <sub>C</sub> = +25°C<br>@ T <sub>C</sub> = +125°C | I <sub>DSS</sub>    | —      | —          | 1.0<br>500 | μA   | V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V                                                                            |
| Gate-Body Leakage                                                                        | I <sub>GSS</sub>    | —      | —          | ±10        | nA   | V <sub>GS</sub> = ±15V, V <sub>DS</sub> = 0V                                                                           |
| ON CHARACTERISTICS (Note 7)                                                              |                     |        |            |            |      |                                                                                                                        |
| Gate Threshold Voltage                                                                   | V <sub>GS(th)</sub> | 1.0    | —          | 2.5        | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA                                                             |
| Static Drain-Source On-Resistance<br>@ T <sub>J</sub> = +25°C                            | R <sub>DS(ON)</sub> | —<br>— | 1.6<br>2.0 | 3<br>4     | Ω    | V <sub>GS</sub> = 10V, I <sub>D</sub> = 250mA<br>V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 200mA                        |
| On-State Drain Current                                                                   | I <sub>D(ON)</sub>  | 0.8    | 1.0        | —          | A    | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 7.5V                                                                          |
| Forward Transconductance                                                                 | g <sub>FS</sub>     | 80     | —          | —          | mS   | V <sub>DS</sub> =10V, I <sub>D</sub> = 0.2A                                                                            |
| DYNAMIC CHARACTERISTICS (Note 8)                                                         |                     |        |            |            |      |                                                                                                                        |
| Input Capacitance                                                                        | C <sub>iSS</sub>    | —      | 22         | 50         | pF   | V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz                                                                |
| Output Capacitance                                                                       | C <sub>oSS</sub>    | —      | 11         | 25         | pF   |                                                                                                                        |
| Reverse Transfer Capacitance                                                             | C <sub>rSS</sub>    | —      | 2.0        | 5.0        | pF   |                                                                                                                        |
| Gate resistance                                                                          | R <sub>g</sub>      | —      | 120        | —          | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz                                                                 |
| Total Gate Charge (V <sub>GS</sub> = 4.5V)                                               | Q <sub>g</sub>      | —      | 223        | —          | pC   | V <sub>DS</sub> = 10V, I <sub>D</sub> = 250mA                                                                          |
| Gate-Source Charge                                                                       | Q <sub>gs</sub>     | —      | 82         | —          | pC   |                                                                                                                        |
| Gate-Drain Charge                                                                        | Q <sub>gd</sub>     | —      | 178        | —          | pC   |                                                                                                                        |
| SWITCHING CHARACTERISTICS (Note 8)                                                       |                     |        |            |            |      |                                                                                                                        |
| Turn-On Delay Time                                                                       | t <sub>D(ON)</sub>  | —      | 7.0        | 20         | ns   | V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.2A,<br>R <sub>L</sub> = 150Ω, V <sub>GEN</sub> = 10V, R <sub>GEN</sub> = 25Ω |
| Turn-Off Delay Time                                                                      | t <sub>D(OFF)</sub> | —      | 11         | 20         | ns   |                                                                                                                        |

- Notes:
5. Device mounted on FR-4 PCB, with minimum recommended pad layout.
  6. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.
  7. Short duration pulse test used to minimize self-heating effect.
  8. Guaranteed by design. Not subject to product testing.



## Package Outline Dimensions

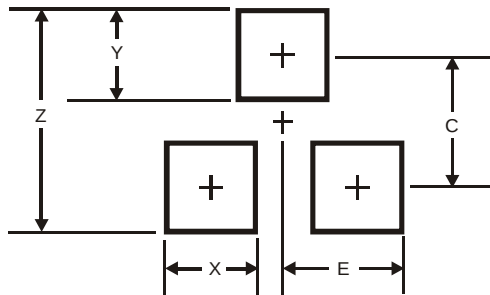
Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



| SOT23                |       |      |       |
|----------------------|-------|------|-------|
| Dim                  | Min   | Max  | Typ   |
| A                    | 0.37  | 0.51 | 0.40  |
| B                    | 1.20  | 1.40 | 1.30  |
| C                    | 2.30  | 2.50 | 2.40  |
| D                    | 0.89  | 1.03 | 0.915 |
| F                    | 0.45  | 0.60 | 0.535 |
| G                    | 1.78  | 2.05 | 1.83  |
| H                    | 2.80  | 3.00 | 2.90  |
| J                    | 0.013 | 0.10 | 0.05  |
| K                    | 0.903 | 1.10 | 1.00  |
| K1                   | -     | -    | 0.400 |
| L                    | 0.45  | 0.61 | 0.55  |
| M                    | 0.085 | 0.18 | 0.11  |
| $\alpha$             | 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) |
|------------|---------------|
| Z          | 2.9           |
| X          | 0.8           |
| Y          | 0.9           |
| C          | 2.0           |
| E          | 1.35          |

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