

N-Channel Enhancement Mode Power MOSFET

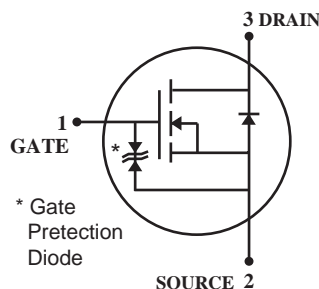
(Pb) Lead(Pb)-Free

Features:

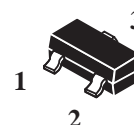
- * Low Gate Voltage Threshold $V_{GS(th)}$ to Facilitate Drive Circuit Design.
- * Low Gate Charge for Fast Switching.
- * ESD Protected Gate.
- * Minimum Breakdown Voltage Rating of 30V.

Application:

- * Level Shifters
- * Level Switches
- * Low Side Load Switches
- * Portable Applications



DRAIN CURRENT
0.5 AMPERES
DRAIN SOURCE VOLTAGE
30 VOLTAGE



SOT-23

Maximum Ratings ($T_A=25^\circ\text{C}$ Unless Otherwise Specified)

| Rating | Symbol | Value | Unit |
|--|-----------------|----------|--------------------|
| Drain-Source Voltage | V_{DS} | 30 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | |
| Continuous Drain Current ¹ , Steady State ($T_A=25^\circ\text{C}$) ($T_A=85^\circ\text{C}$) | I_D | 0.5 | A |
| | | 0.37 | |
| Power Dissipation ¹ , Steady State | P_D | 0.69 | W |
| Continuous Drain Current ¹ , $t < 10s$ ($T_A=25^\circ\text{C}$) ($T_A=85^\circ\text{C}$) | I_D | 0.56 | A |
| | | 0.40 | |
| Power Dissipation ¹ , $t < 5s$ | P_D | 0.83 | W |
| Pulsed Drain Current | I_{DM} | 1.7 | A |
| Maximum Junction-ambient , Steady State ¹ , $t < 10s$ ¹ , Steady State ² | $R_{\theta JA}$ | 180 | $^\circ\text{C/W}$ |
| | | 150 | |
| | | 300 | |
| Operating Junction Temperature Range | T_J | +150 | $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | -55~+150 | $^\circ\text{C}$ |
| Source Current (Body Diode) | I_S | 1.0 | A |
| Lead Temperature for Soldering Purposes (1/8" from case 10s) | T_L | 260 | $^\circ\text{C}$ |

Note: 1. Surface-mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).

2. Surface-mounted on FR4 board using the minimum recommended pad size.

Device Marking

2N4003K = TR8

Electrical Characteristics (T_A=25°C Unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

Static

| | | | | | |
|---|----------------------|--------|------------|------------|----|
| Drain-Source Breakdown Voltage V _{GS} =0, I _D =100μA | V _{(BR)DSS} | 30 | - | - | V |
| Gate-Source Threshold Voltage ³ V _{DS} =V _{GS} , I _D =250μA | V _{GS(Th)} | 0.8 | - | 1.6 | |
| Gate-Source Leakage Current V _{GS} =±10V | I _{GSS} | - | - | ±1.0 | μA |
| Zero Gate Voltage Drain Current (T _J =25°C) V _{DS} =30V, V _{GS} =0 | I _{DSS} | - | - | 1 | μA |
| Drain-Source On-Resistance ³ V _{GS} =2.5V, I _D =10mA V _{GS} =4.0V, I _D =10mA | R _{DS(on)} | - - | 1.5 1.0 | 2.0 1.5 | Ω |
| Forward Transconductance ³ V _{DS} =3.0V, I _D =10mA | g _{fs} | - | 0.33 | - | S |

Dynamic

| | | | | | |
|--|------------------|---|------|---|----|
| Input Capacitance V _{GS} =0V, V _{DS} =5.0V, f=1.0MHz | C _{iss} | - | 21 | - | pF |
| Output Capacitance V _{GS} =0V, V _{DS} =5.0V, f=1.0MHz | C _{oss} | - | 19.7 | - | |
| Reverse Transfer Capacitance V _{GS} =0V, V _{DS} =5.0V, f=1.0MHz | C _{rss} | - | 8.1 | - | |

Switching

| | | | | | |
|--|--------------|---|------|---|----|
| Turn-on Delay Time ⁴ $V_{GS}=4.5V, V_{DD}=5.0V, I_D=0.1A, R_G=50\Omega$ | $t_{d(on)}$ | - | 16.7 | - | ns |
| Rise Time ⁴ $V_{GS}=4.5V, V_{DD}=5.0V, I_D=0.1A, R_G=50\Omega$ | t_r | - | 47.9 | - | |
| Turn-off Delay Time ⁴ $V_{GS}=4.5V, V_{DD}=5.0V, I_D=0.1A, R_G=50\Omega$ | $t_{d(off)}$ | - | 65.1 | - | |
| Fall Time ⁴ $V_{GS}=4.5V, V_{DD}=5.0V, I_D=0.1A, R_G=50\Omega$ | t_f | - | 64.2 | - | |
| Total Gate Charge $V_{GS}=5.0V, V_{DS}=24V, I_D=0.1A$ | Q_g | - | 1.15 | - | nC |
| Threshold Gate Charge $V_{GS}=5.0V, V_{DS}=24V, I_D=0.1A$ | $Q_{g(TH)}$ | - | 0.15 | - | |
| Gate-Source Charge $V_{GS}=5.0V, V_{DS}=24V, I_D=0.1A$ | Q_{gs} | - | 0.32 | - | |
| Gate-Drain Charge $V_{GS}=5.0V, V_{DS}=24V, I_D=0.1A$ | Q_{gd} | - | 0.23 | - | |

Source-Drain Diode Characteristics

| | | | | | |
|--|----------|---|--------------|----------|----|
| Forward On Voltage $V_{GS}=0V, I_S=10mA$ $T_J=25^\circ C$ $T_J=125^\circ C$ | V_{SD} | - | 0.65 0.45 | 0.7 - | V |
| Reverse Recovery Time $V_{GS}=0V, I_S=10mA, dI_S/dt=8A/\mu s$ | t_{rr} | - | 14 | - | nS |

Note : 3. Pulse Test: pulse width $\leq 300 \mu s$, duty cycle $\leq 2\%$.

4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES ($T_J = 25^\circ\text{C}$ unless otherwise noted)

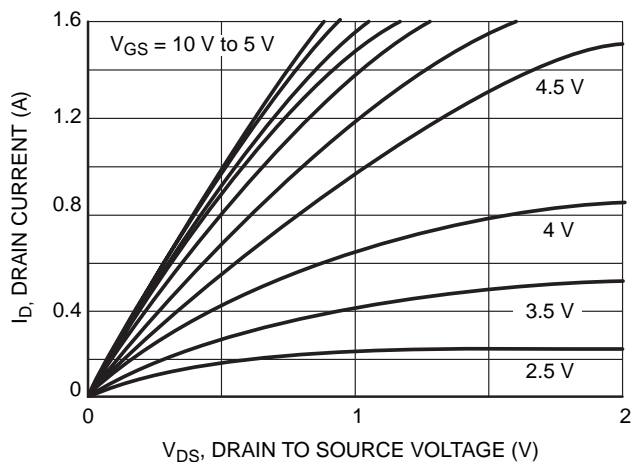


Figure 1. On Region Characteristics

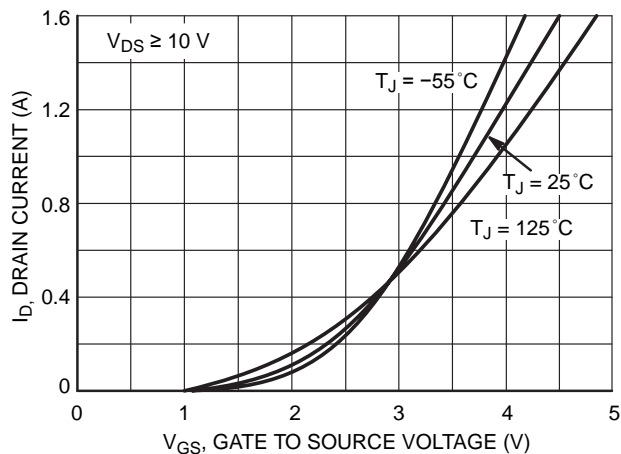


Figure 2. Transfer Characteristics

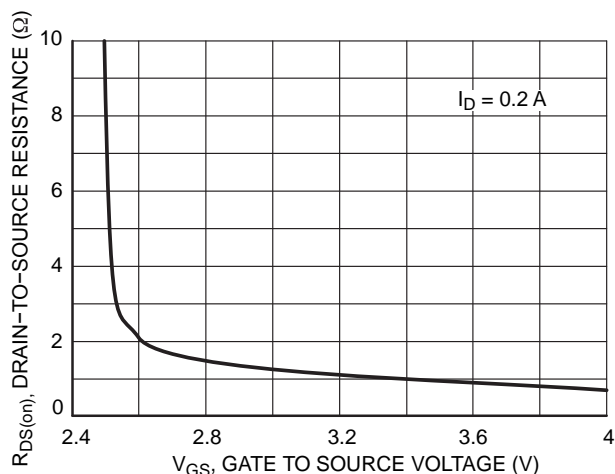


Figure 3. On Resistance vs. Gate to Source Voltage

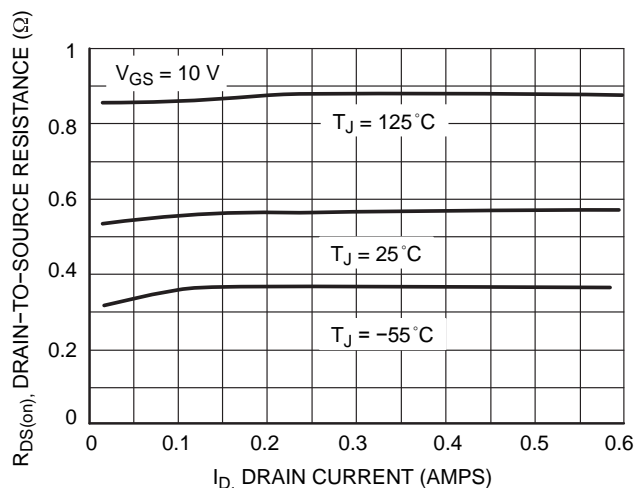


Figure 4. On Resistance vs. Drain Current and Temperature

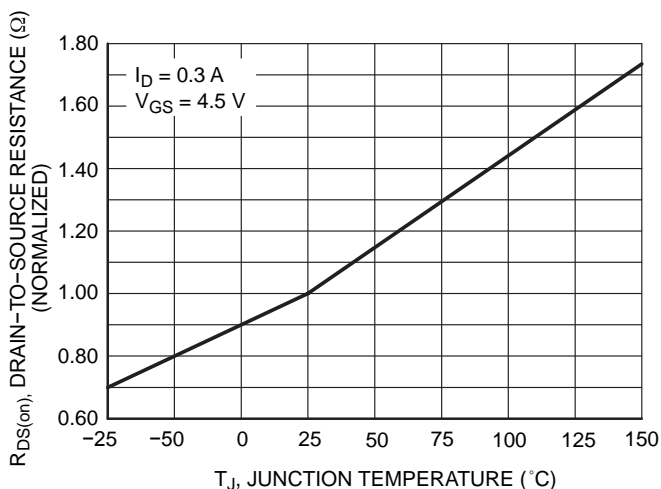


Figure 5. On Resistance Variation with Temperature

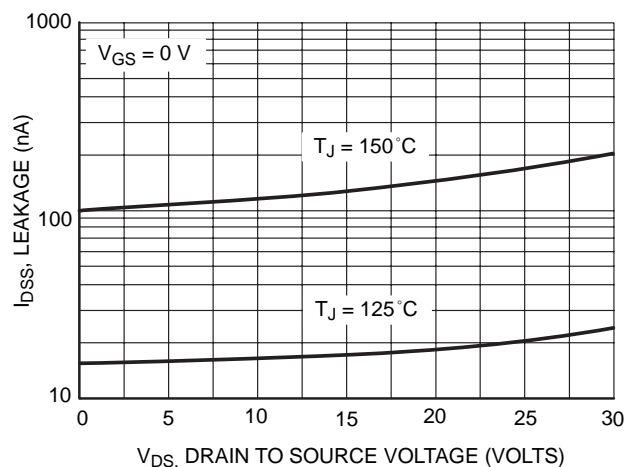


Figure 6. Drain to Source Leakage Current vs. Voltage

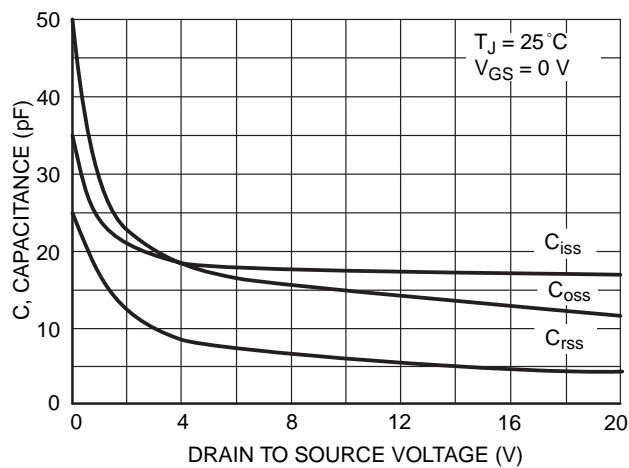


Figure 7. Capacitance Variation

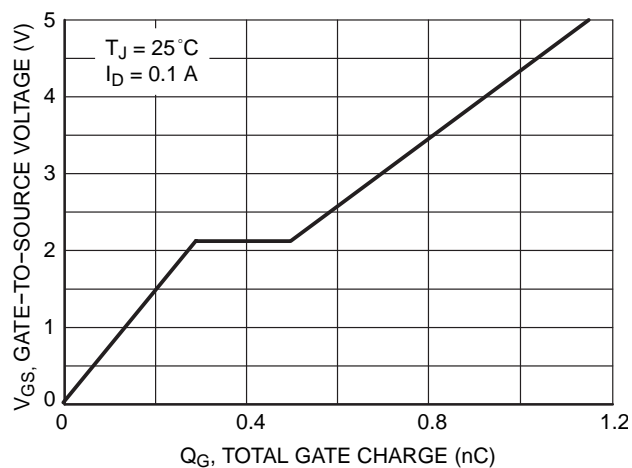


Figure 8. Gate to Source & Drain to Source Voltage vs. Total Charge

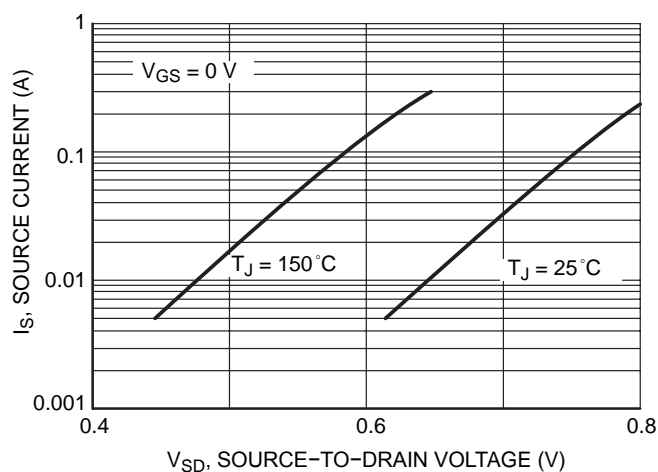
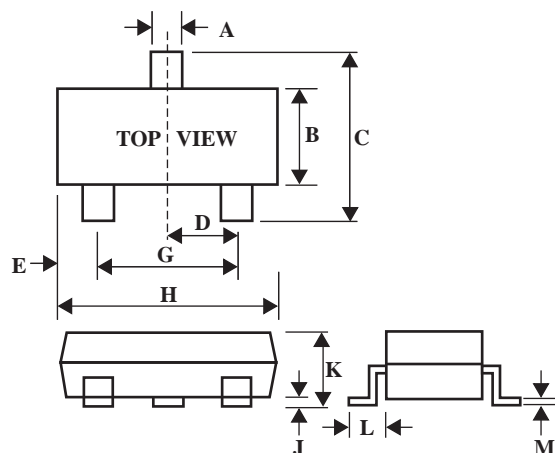


Figure 9. Diode Forward Voltage vs. Current

SOT-23 Outline Dimension

Unit:mm



| SOT-23 | | |
|----------|-------|------|
| Dim | Min | Max |
| A | 0.35 | 0.51 |
| B | 1.19 | 1.40 |
| C | 2.10 | 3.00 |
| D | 0.85 | 1.05 |
| E | 0.46 | 1.00 |
| G | 1.70 | 2.10 |
| H | 2.70 | 3.10 |
| J | 0.01 | 0.13 |
| K | 0.89 | 1.10 |
| L | 0.30 | 0.61 |
| M | 0.076 | 0.25 |