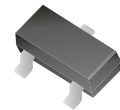


2N7002K-HF

**N-Channel
RoHS Device
Halogen Free**

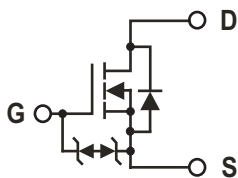


Features

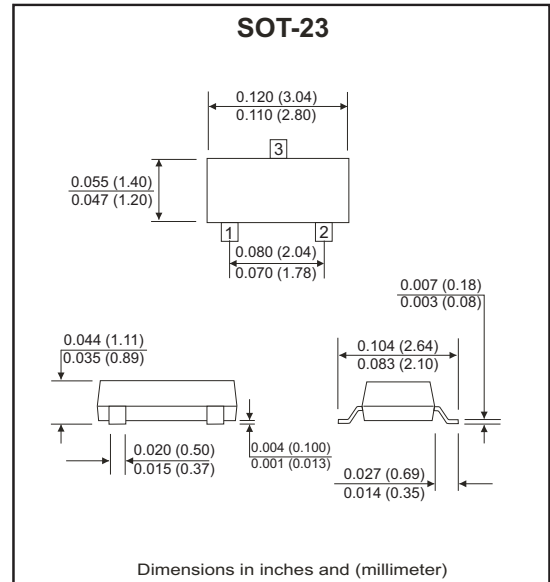
- Small Signal MOSFET.
- ESD protected: 1000V.

Marking: 702

Equivalent Circuit



G : Gate
S : Source
D : Drain



Maximum Ratings (at TA=25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|--|--|-----------|------|
| Drain-Source voltage | V_{DSS} | 60 | Vdc |
| Drain-Gate Voltage ($R_{GS}=1.0\text{ M}\Omega$) | V_{DGR} | 60 | Vdc |
| Drain current | @Continuous $T_c=25^\circ\text{C}$ (Note 1) | ± 115 | mAcd |
| | @Continuous $T_c=100^\circ\text{C}$ (Note 1) | ± 75 | |
| | @Pulsed (Note 2) | ± 800 | |
| Gate-Source voltage | @Continuous | ± 20 | Vdc |
| | @Non-repetitive ($t_p \leq 50\mu\text{s}$) | ± 40 | Vpk |

Thermal Characteristics

| Characteristics | Symbol | Max. Value | Unit |
|---|-----------------|-------------|-------|
| Total Device Dissipation FR-5 Board (Note 3) @TA = 25°C | P_D | 225 | mW |
| | | 1.8 | mW/°C |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 556 | °C/W |
| Total Device Dissipation Alumina Substrate (Note 4) @TA = 25°C | P_D | 300 | mW |
| | | 2.4 | mW/°C |
| Thermal Resistance, Junction to Ambient | $R_{\theta JA}$ | 417 | °C/W |
| Junction and Storage Temperature | T_J, T_{STG} | -55 to +150 | °C |

- Note: 1. The Power Dissipation of the package may result in a lower continuous drain current.
 2. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2.0\%$.
 3. FR-5 = 1.0 x 0.75 x 0.062 in.
 4. Alumina = 0.4 x 0.3 x 0.025 in 99.5% alumina.

Company reserves the right to improve product design , functions and reliability without notice.

REV: A

Electrical Characteristics (at $T_A=25^\circ\text{C}$ unless otherwise noted)

| Characteristics | Conditions | Symbol | Min. | Typ. | Max. | Unit |
|--|--|---------------|------|------|-------|----------|
| Drain-Source Breakdown Voltage | $V_{GS}=0V, I_D=10\mu A$ | $V_{(BR)DSS}$ | 60 | | | V |
| Zero Gate Voltage Drain Current ($V_{GS}=0V, V_{DS}=60V$) | $T_J=25^\circ\text{C}$ | I_{DSS} | | | 1.0 | μA |
| | $T_J=125^\circ\text{C}$ | | | | 500 | |
| Gate-Body Leakage Current, Forward | $V_{GS}=20V$ | I_{GSSF} | | | 1 | μA |
| Gate-Body Leakage Current, Reverse | $V_{GS}=-20V$ | I_{GSSR} | | | -1 | μA |
| ON CHARACTERISTICS (Note 1) | | | | | | |
| Gate Threshold Voltage | $V_{DS}=V_{GS}, I_D=250\mu A$ | $V_{GS(th)}$ | 1 | 1.5 | 2.5 | V |
| On-State Drain Current | $V_{DS}\geq 2.0V_{DS(ON)}, V_{GS}=10V$ | $I_{D(ON)}$ | 500 | | | mA |
| Static Drain-Source On-State Voltage | $V_{GS}=10V, I_D=500mA$ | $V_{DS(ON)}$ | | | 3.75 | V |
| | $V_{GS}=5V, I_D=50mA$ | | | | 0.375 | |
| Static Drain-Source On-State Resistance | $V_{GS}=10V, I_D=500mA @T_C=25^\circ\text{C}$ | $R_{DS(ON)}$ | | 1.4 | 7.5 | Ω |
| | $V_{GS}=10V, I_D=500mA @T_C=125^\circ\text{C}$ | | | | 13.5 | |
| | $V_{GS}=5V, I_D=50mA @T_C=25^\circ\text{C}$ | | | 1.8 | 7.5 | |
| | $V_{GS}=5V, I_D=50mA @T_C=125^\circ\text{C}$ | | | | 13.5 | |
| Forward Transconductance | $V_{DS}\geq 2.0V_{DS(ON)}, I_D=200mA$ | g_{fs} | 80 | | | mS |
| DYNAMIC CHARACTERISTICS | | | | | | |
| Input Capacitance | $V_{DS}=25V, V_{GS}=0V, f=1.0MHz$ | C_{iss} | | 17 | 50 | pF |
| Output Capacitance | | C_{oss} | | 10 | 25 | |
| Reverse Transfer Capacitance | | C_{rss} | | 2.5 | 5.0 | |
| SWITCHING CHARACTERISTICS (Note 1) | | | | | | |
| Turn-On Delay Time | $V_{DD}=25V, I_D=500mA, R_G=25\Omega, R_L=50\Omega, V_{GEN}=10V$ | $t_{d(on)}$ | | 7 | 20 | nS |
| Turn-Off Delay Time | | $t_{d(off)}$ | | 11 | 40 | |
| BODY-DRAIN DIODE RATINGS | | | | | | |
| Diode Forward On-Voltage | $I_S=115mA, V_{GS}=0V$ | V_{SD} | | | -1.5 | V |
| Source Current Continuous | Body Diode | I_S | | | -115 | mA |
| Source Current Pulsed | | I_{SM} | | | -800 | mA |

Note: 1. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2.0\%$.

RATING AND CHARACTERISTIC CURVES (2N7002K-HF)

Fig.1 Ohmic Region

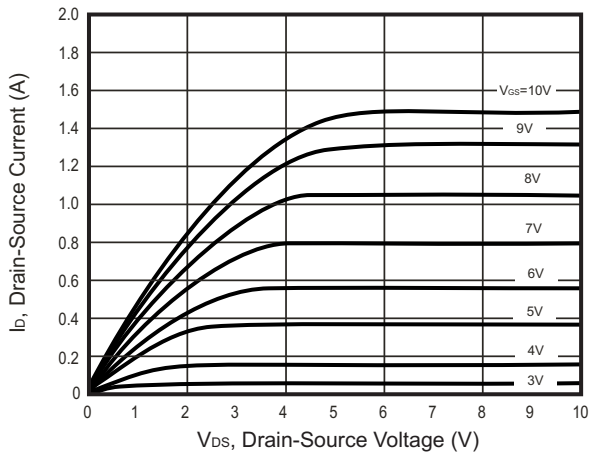


Fig.2 Transfer Characteristics

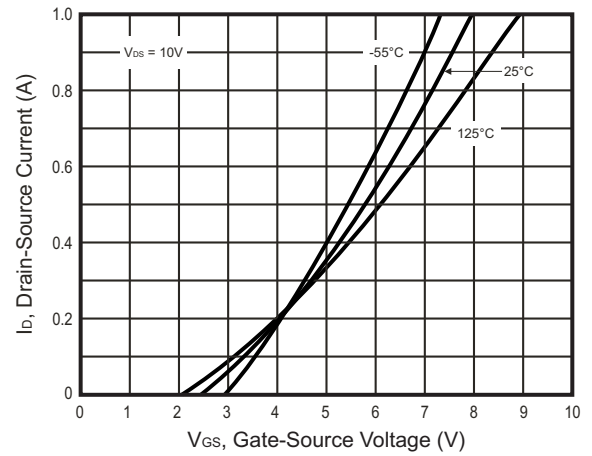


Fig.3 Temperature Versus Static Drain-Source On-Resistance

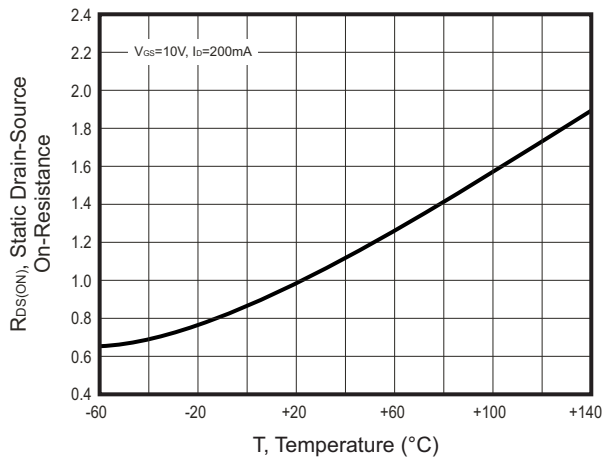
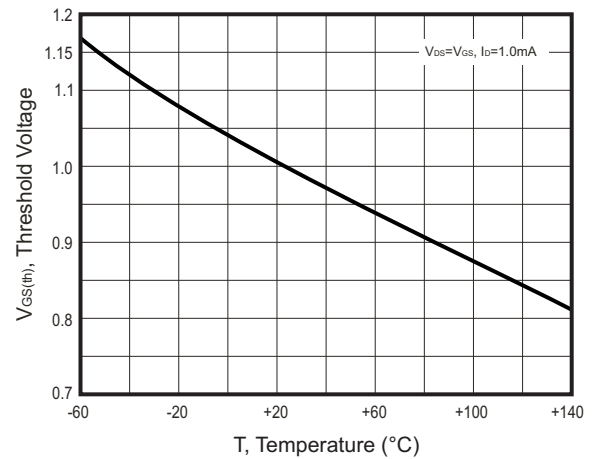
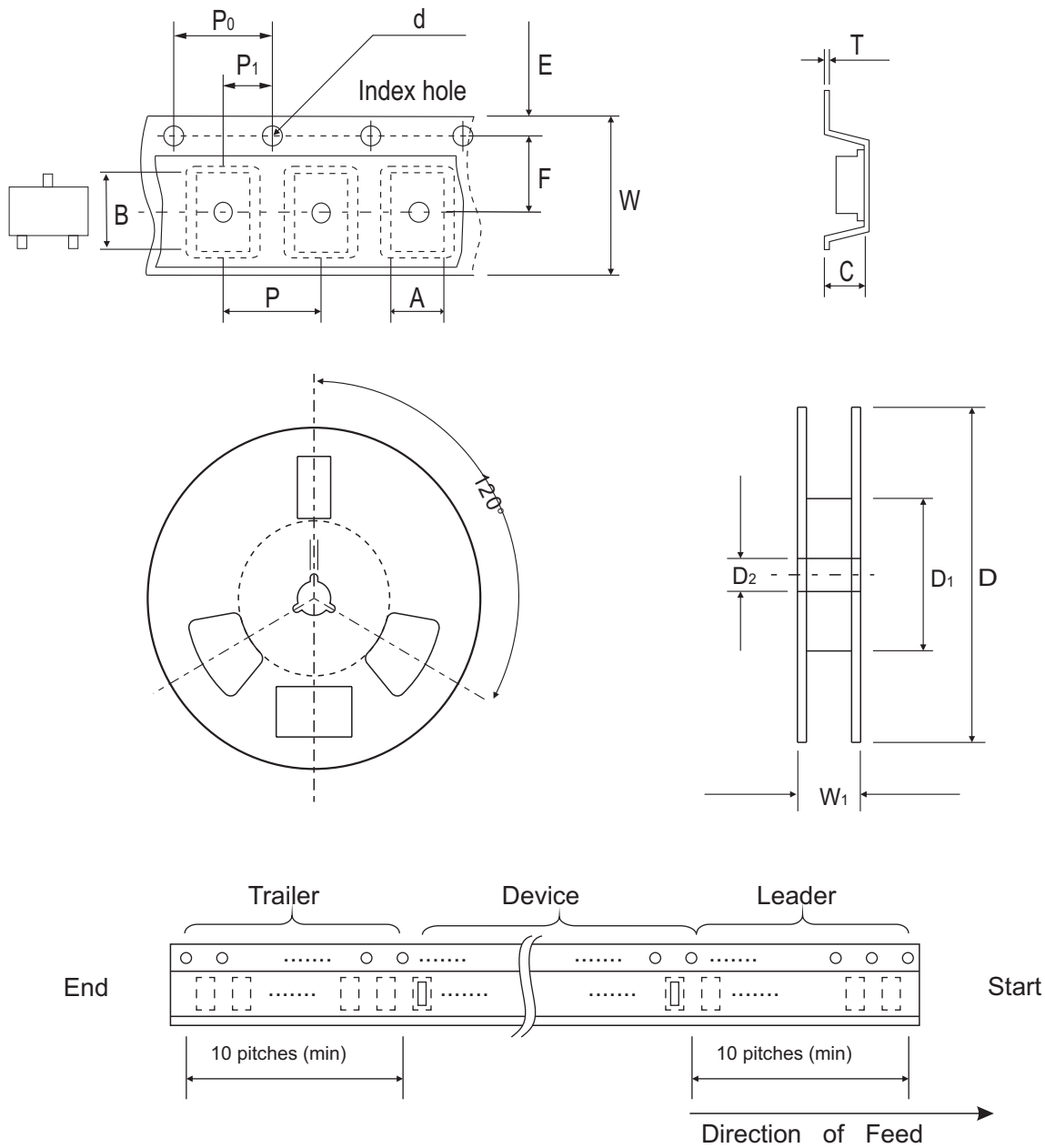


Fig.4 Temperature Versus Gate Threshold Voltage



$V_{GS} = 5V, I_D = 0.05A$

Reel Taping Specification



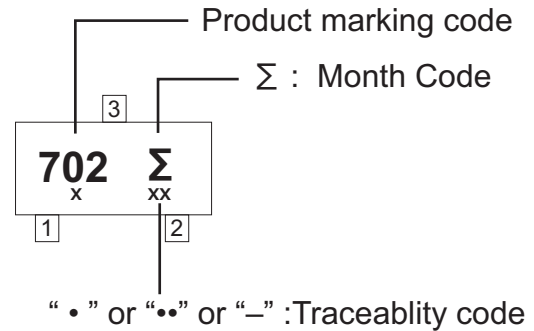
| SOT-23 | SYMBOL | A | B | C | d | D | D ₁ | D ₂ |
|--------|--------|---------------|---------------|---------------|---------------|--------------|----------------|----------------|
| | (mm) | 3.10 ± 0.10 | 2.85 ± 0.10 | 1.40 ± 0.10 | 1.55 ± 0.10 | 178 ± 1 | 50.0 MIN. | 13.0 ± 0.20 |
| | (inch) | 0.122 ± 0.004 | 0.112 ± 0.004 | 0.055 ± 0.004 | 0.061 ± 0.004 | 7.008 ± 0.04 | 1.969 MIN. | 0.512 ± 0.008 |

| SOT-23 | SYMBOL | E | F | P | P ₀ | P ₁ | W | W ₁ |
|--------|--------|---------------|---------------|---------------|----------------|----------------|---------------|----------------|
| | (mm) | 1.75 ± 0.10 | 3.50 ± 0.05 | 4.00 ± 0.10 | 4.00 ± 0.10 | 2.00 ± 0.05 | 8.00 ± 0.30 | 14.4 MAX. |
| | (inch) | 0.069 ± 0.004 | 0.138 ± 0.002 | 0.157 ± 0.004 | 0.157 ± 0.004 | 0.079 ± 0.004 | 0.315 ± 0.008 | 0.567 MAX. |

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Marking Code

| Part Number | Marking Code |
|-------------|--------------|
| 2N7002K-HF | 702 Σ |



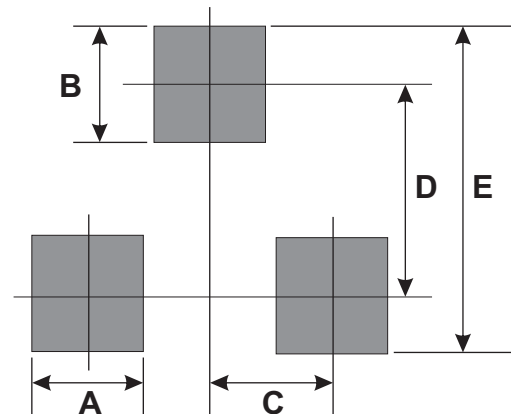
Month Code:

| Month | Odd Year (per A.D.) | Even Year (per A.D.) |
|-------|---------------------|----------------------|
| Jan | 1 | E |
| Feb | 2 | F |
| Wer | 3 | H |
| Apr | 4 | J |
| May | 5 | K |
| Jun | 6 | L |

| Month | Odd Year (per A.D.) | Even Year (per A.D.) |
|-------|---------------------|----------------------|
| Jul | 7 | N |
| Aug | 8 | P |
| Sep | 9 | U |
| Oct | T | X |
| Nov | V | Y |
| Dec | C | Z |

Suggested PAD Layout

| SIZE | SOT-23 | |
|------|--------|--------|
| | (mm) | (inch) |
| A | 0.80 | 0.031 |
| B | 0.90 | 0.035 |
| C | 0.95 | 0.037 |
| D | 2.00 | 0.079 |
| E | 2.90 | 0.114 |



Standard Packaging

| Case Type | REEL PACK | |
|-----------|--------------|------------------|
| | REEL (pcs) | Reel Size (inch) |
| SOT-23 | 3,000 | 7 |

Company reserves the right to improve product design , functions and reliability without notice.