

60V N-CHANNEL MOSFET

GENERAL DESCRIPTION

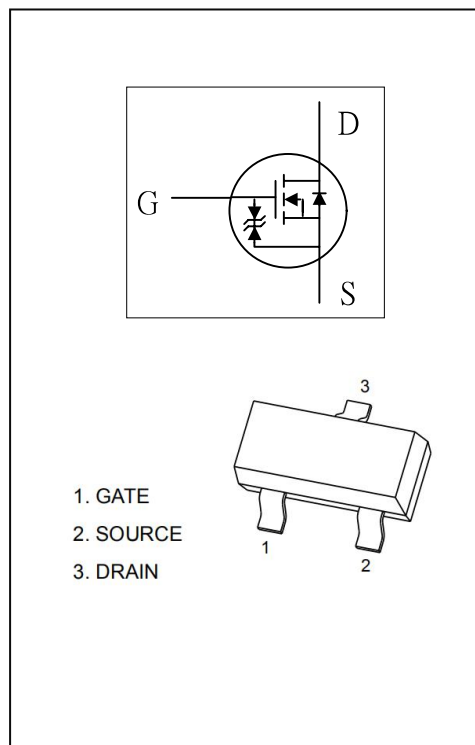
These N-Channel enhancement mode power field effect transistors are produced using Hi-semicon's proprietary, planar stripe, DMOS technology.

Features

- ◆ VDS(V)=60V, ID=500mA
- ◆ R<sub>DS(ON)</sub>  
TYP:1.6 @VGS=10V

Applications

- ◆ High density cell design for low R<sub>DS(on)</sub>
- ◆ Voltage controlled small signal switch
- ◆ Rugged and reliable
- ◆ High saturation current capability



ORDERING INFORMATION

| Part No.  | Package | Marking | Material | Packing |
|-----------|---------|---------|----------|---------|
| SFS2N7002 | SOT23   | 2N7002  | Pb Free  | Reel    |

ABSOLUTE MAXIMUM RATINGS (T<sub>J</sub>=25°C unless otherwise noted)

| Characteristics   | Symbol           | Ratings               | Unit |
|---|------------------|-----------------------|------|
| Drain-Source Voltage  | V <sub>DS</sub>  | 60                    | V    |
| Gate-Source Voltage   | V <sub>GS</sub>  | ±20                   | V    |
| Drain Current   | I <sub>D</sub>   | T <sub>C</sub> = 25°C | 500  |
|   |                  | T <sub>C</sub> = 70°C | 350  |
| Drain Current Pulsed (Note 1)   | I <sub>DM</sub>  | 1200                  | mA   |
| Power Dissipation(T <sub>C</sub> =25°C)<br>-Derate above 25°C                 | P <sub>D</sub>   | 0.7                   | W    |
|   |                  | 0.005                 | W/°C |
| Operation Junction Temperature Range  | T <sub>J</sub>   | -55~+150              | °C   |
| Storage Temperature Range   | T <sub>stg</sub> | -55~+150              | °C   |
| Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | TL               | 300                   | °C   |

## THERMAL CHARACTERISTICS

| Characteristics                         | Symbol          | MAX  | Unit          |
|---|-----------------|------|---------------|
| Thermal Resistance, Junction-to-Case    | $R_{\theta JC}$ | 180  | $^{\circ}C/W$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ | 62.5 | $^{\circ}C/W$ |

## ELECTRICAL CHARACTERISTICS

| Characteristics                          | Symbol       | Test conditions  | Min. | Typ. | Max. | Unit     |
|--|--------------|--|------|------|------|----------|
| <b>Off Characteristics</b>               |              |  |      |      |      |          |
| Drain -Source Breakdown Voltage          | $B_{VDSS}$   | $V_{GS}=0V, I_D=250\mu A$  | 60   | 72   | --   | V        |
| Drain-Source Leakage Current             | $I_{DSS}$    | $V_{DS}60V, V_{GS}=0V$   | --   | --   | 1.0  | $\mu A$  |
| Gate-Source Leakage Current              | $I_{GSS}$    | $V_{GS}=20V, V_{DS}=0V$  | --   | --   | 10   | $\mu A$  |
| Gate-Source Leakage Current              | $I_{GSS}$    | $V_{GS}=-20V, V_{DS}=0V$   | --   | --   | -10  | $\mu A$  |
| <b>On Characteristics</b>                |              |  |      |      |      |          |
| Gate Threshold Voltage                   | $V_{GS(th)}$ | $V_{GS}=V_{DS}, I_D=250\mu A$  | 1.0  | 1.7  | 2.5  | V        |
| Static Drain- Source On State Resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=500mA$  | --   | 1.6  | 2.5  | $\Omega$ |
|  |              | $V_{GS}=4.5V, I_D=200mA$   | --   | 2.0  | 3.2  |          |
| <b>Dynamic Characteristics</b>           |              |  |      |      |      |          |
| Input Capacitance                        | $C_{iss}$    | $V_{DS}=25V$<br>$V_{GS}=0V$<br>$f=1.0MHz$                            | --   | 28.1 | --   | pF       |
| Output Capacitance                       | $C_{oss}$    |  | --   | 10.5 | --   |          |
| Reverse Transfer Capacitance             | $C_{rss}$    |  | --   | 3.8  | --   |          |
| <b>Switching Characteristics</b>         |              |  |      |      |      |          |
| Turn-on Delay Time                       | $t_{d(on)}$  | $V_{DD}=30V; V_{GS}=10V$<br>$R_G=3.3\Omega; I_D=500mA$<br>(Note 2.3) | --   | 13.1 | --   | ns       |
| Turn-on Rise Time                        | $t_r$        |  | --   | 9.8  | --   |          |
| Turn-off Delay Time                      | $t_{d(off)}$ |  | --   | 43.7 | --   |          |
| Turn-off Fall Time                       | $t_f$        |  | --   | 30.4 | --   |          |
| Total Gate Charge                        | $Q_g$        | $V_{DS}=50V, I_D=500mA$<br>$V_{GS}=4.5V$<br>(Note 2.3)               | --   | 1.1  | 1.6  | nC       |
| Gate-Source Charge                       | $Q_{gs}$     |  | --   | 0.4  | --   |          |
| Gate-Drain Charge                        | $Q_{gd}$     |  | --   | 0.6  | --   |          |

## SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS

|                       |          |                        |    |    |     |   |
|-----------------------|----------|------------------------|----|----|-----|---|
| Diode Forward Voltage | $V_{SD}$ | $I_S=500mA, V_{GS}=0V$ | -- | -- | 1.2 | V |
|-----------------------|----------|------------------------|----|----|-----|---|

- 1.Pulse width limited by maximum junction temperature
- 2.Pulse Test: Pulse width  $\leq 300\mu s$ , Duty cycle  $\leq 2\%$
- 3.Essentially independent of operating temperature

Typical Performance Characteristics

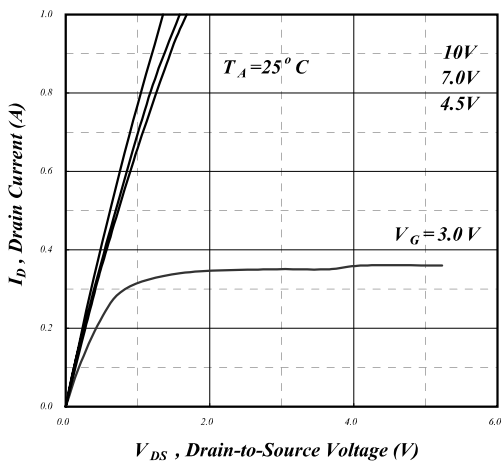


Fig 1. Typical Output Characteristics

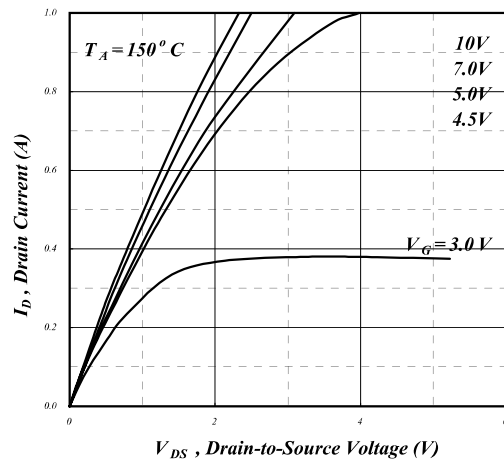


Fig 2. Typical Output Characteristics

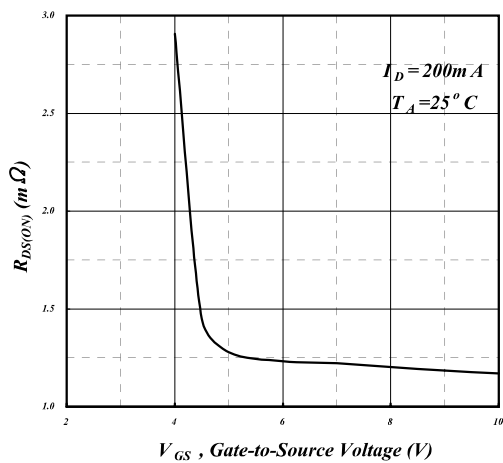


Fig 3. On-Resistance v.s. Gate Voltage

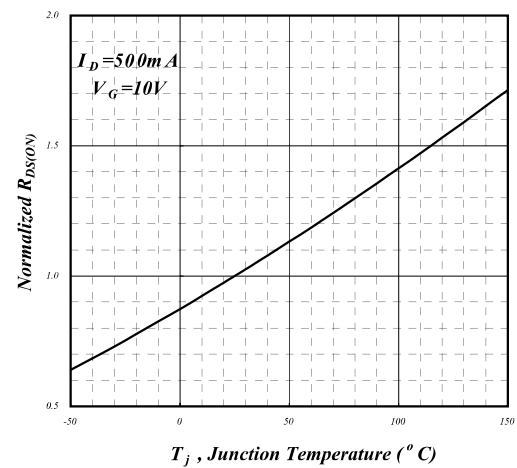


Fig 4. Normalized On-Resistance v.s. Junction Temperature

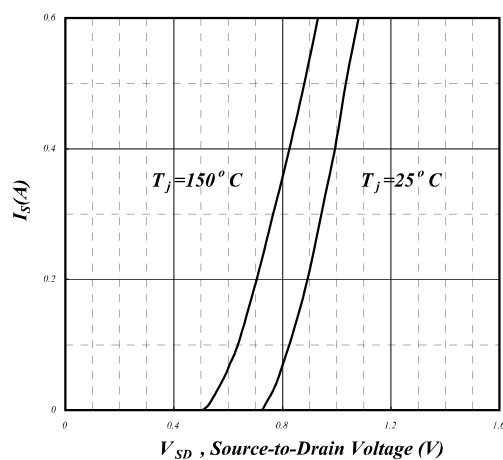


Fig 5. Forward Characteristic of Reverse Diode

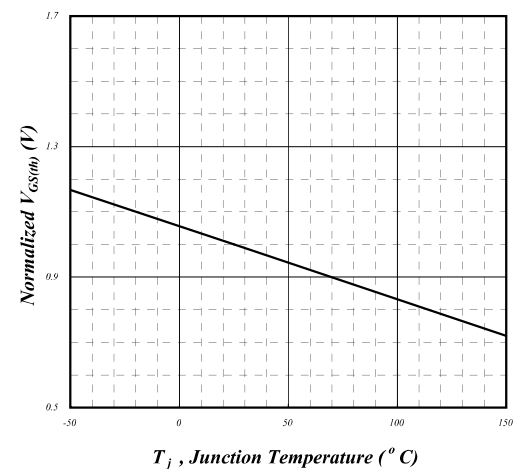


Fig 6. Gate Threshold Voltage v.s. Junction Temperature

Typical Performance Characteristics

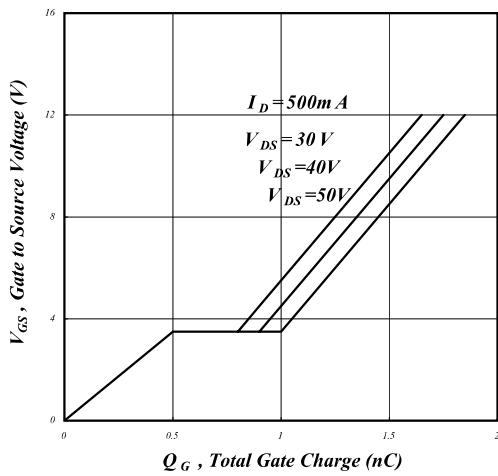


Fig 7. Gate Charge Characteristics

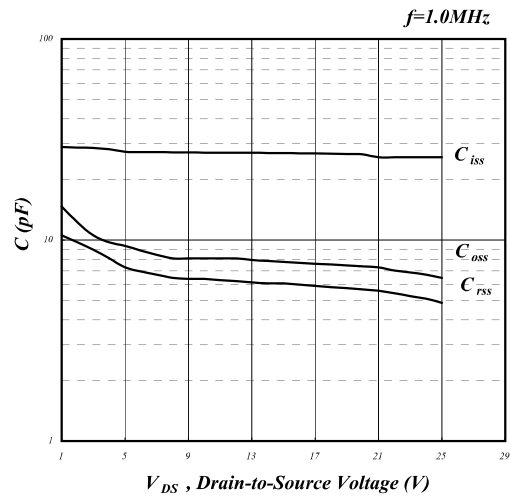


Fig 8. Typical Capacitance Characteristics

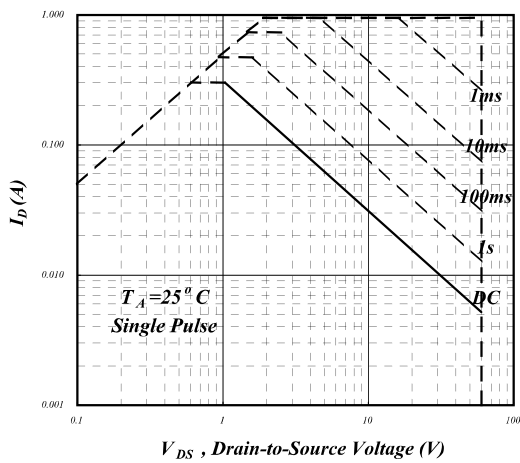


Fig 9. Maximum Safe Operating Area

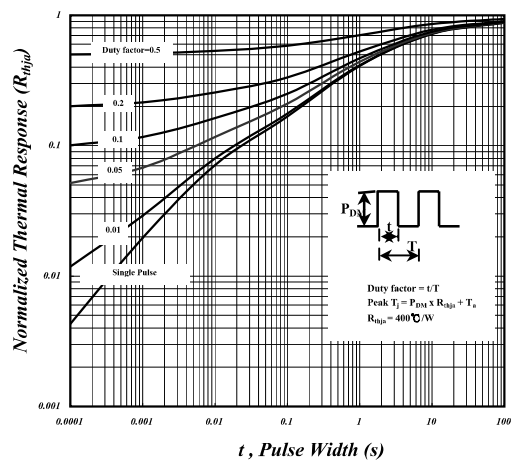


Fig 10. Effective Transient Thermal Impedance

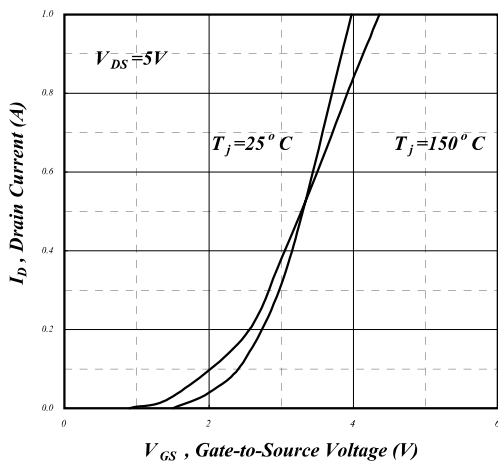


Fig 11. Transfer Characteristics

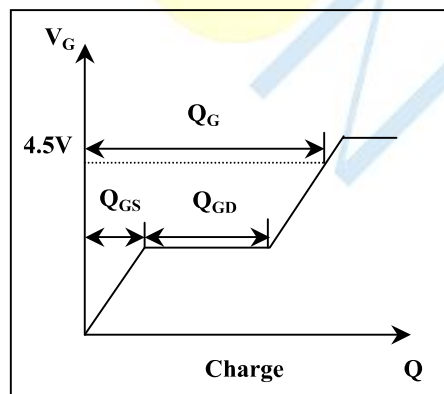
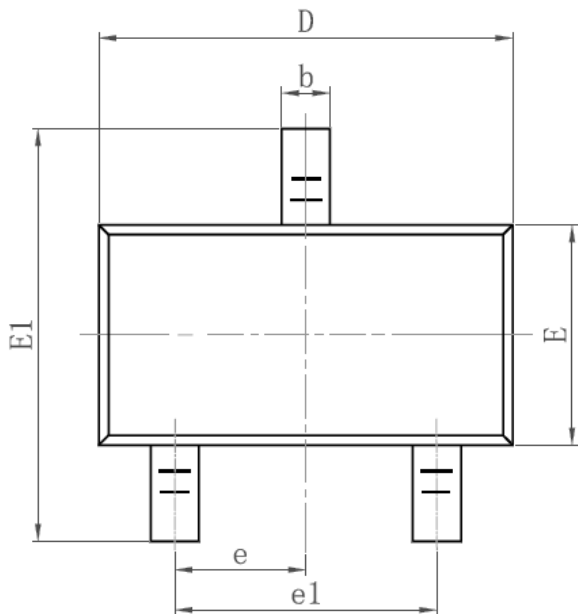
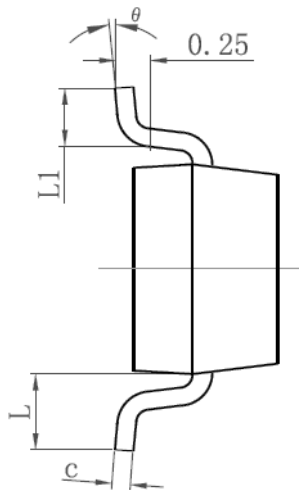
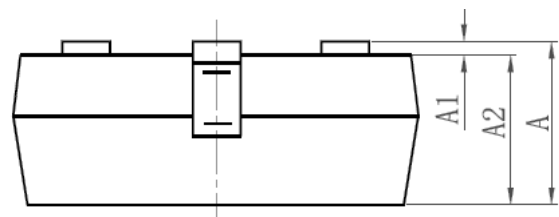


Fig 12. Gate Charge Waveform

Package Dimensions of SOT23



Unit:mm



| Symbol   | Dimensions in Millimeters |       |
|----------|---------------------------|-------|
|          | MIN.                      | MAX.  |
| A        | 0.900                     | 1.150 |
| A1       | 0.000                     | 0.100 |
| A2       | 0.900                     | 1.050 |
| b        | 0.300                     | 0.500 |
| c        | 0.080                     | 0.150 |
| D        | 2.800                     | 3.000 |
| E        | 1.200                     | 1.400 |
| E1       | 2.250                     | 2.550 |
| e        | 0.950TYP                  |       |
| e1       | 1.800                     | 2.000 |
| L        | 0.550REF                  |       |
| L1       | 0.300                     | 0.500 |
| $\theta$ | 0°                        | 8°    |

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