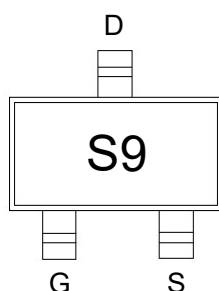


## Features

- Leading trench technology for low  $R_{DS(on)}$
- Low Gate Charge
- Excellent package for good heat dissipation

## Application

- Video monitor
- Power management

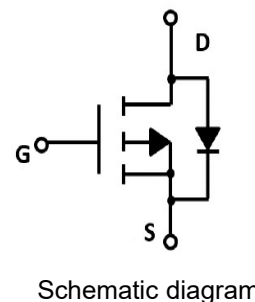
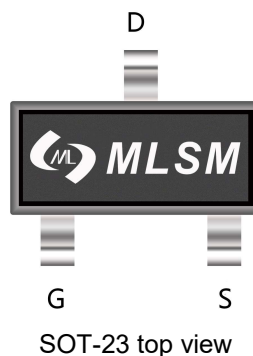


S9: Device code

Marking and pin assignment

## Product Summary

| $V_{DS}$ | $R_{DS(on)}$ MAX | $I_D$ MAX |
|----------|------------------|-----------|
| -60V     | 190mΩ@-10V       | -2A       |
|          | 240mΩ@-4.5V      |           |



Pb-Free



Halogen-Free

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

| Symbol | Parameter | Rating | Unit |
|--------|-----------|--------|------|
|--------|-----------|--------|------|

### Common Ratings (TC=25°C Unless Otherwise Noted)

|           |                                  |                              |    |
|-----------|----------------------------------|------------------------------|----|
| $V_{DS}$  | Drain-Source Breakdown Voltage   | -60                          | V  |
| $V_{GS}$  | Gate-Source Voltage              | ±20                          | V  |
| $T_J$     | Maximum Junction Temperature     | 150                          | °C |
| $T_{STG}$ | Storage Temperature Range        | -55 to 150                   | °C |
| $I_S$     | Diode Continuous Forward Current | $T_c=25^\circ\text{C}$<br>-2 | A  |

### Mounted on Large Heat Sink

|                 |                                        |                                |      |
|-----------------|----------------------------------------|--------------------------------|------|
| $I_{DM}$        | Pulse Drain Current Tested             | $T_c=25^\circ\text{C}$<br>-8   | A    |
| $I_D$           | Continuous Drain Current               | $T_c=25^\circ\text{C}$<br>-2   | A    |
| $P_D$           | Maximum Power Dissipation              | $T_c=25^\circ\text{C}$<br>0.35 | W    |
| $R_{\theta JA}$ | Thermal Resistance Junction-to-Ambient | 357                            | °C/W |

## Ordering Information (Example)

| Type    | Package | Marking | Minimum Package(pcs) | Inner Box Quantity(pcs) | Outer Carton Quantity(pcs) | Delivery Mode |
|---------|---------|---------|----------------------|-------------------------|----------------------------|---------------|
| MLS2309 | SOT-23  | S9      | 3,000                | 45,000                  | 180,000                    | 7"reel        |

| Electrical Characteristics (TJ=25°C unless otherwise noted)              |                                  |                                                                                       |      |      |      |      |
|--------------------------------------------------------------------------|----------------------------------|---------------------------------------------------------------------------------------|------|------|------|------|
| Symbol                                                                   | Parameter                        | Condition                                                                             | Min  | Typ  | Max  | Unit |
| Static Electrical Characteristics @ TJ = 25°C (unless otherwise stated)  |                                  |                                                                                       |      |      |      |      |
| BV <sub>(BR)DSS</sub>                                                    | Drain-Source Breakdown Voltage   | V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA                                           | -60  | --   | --   | V    |
| I <sub>DSS</sub>                                                         | Zero Gate Voltage Drain Current  | V <sub>DS</sub> =-60V, V <sub>GS</sub> =0V                                            | --   | --   | -1   | μA   |
| I <sub>GSS</sub>                                                         | Gate-Body Leakage Current        | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                            | --   | --   | ±100 | nA   |
| V <sub>GS(th)</sub>                                                      | Gate Threshold Voltage           | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                             | -1.2 | -1.7 | -2.5 | V    |
| R <sub>DS(on)</sub>                                                      | Drain-Source On-State Resistance | V <sub>GS</sub> =-10V, I <sub>D</sub> =-2.0A                                          | --   | 130  | 190  | mΩ   |
|                                                                          |                                  | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-1.5A                                         | --   | 160  | 240  | mΩ   |
| Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated) |                                  |                                                                                       |      |      |      |      |
| C <sub>ISS</sub>                                                         | Input Capacitance                | V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, f=1MHz                                    | --   | 445  | --   | pF   |
| C <sub>OSS</sub>                                                         | Output Capacitance               |                                                                                       | --   | 20   | --   | pF   |
| C <sub>RSS</sub>                                                         | Reverse Transfer Capacitance     |                                                                                       | --   | 18   | --   | pF   |
| Switching Characteristics                                                |                                  |                                                                                       |      |      |      |      |
| Q <sub>g</sub>                                                           | Total Gate Charge                | V <sub>DD</sub> =-30V, I <sub>D</sub> =-2A, V <sub>GS</sub> =-10V                     | --   | 11   | --   | nC   |
| Q <sub>gs</sub>                                                          | Gate Source Charge               |                                                                                       | --   | 3    | --   | nC   |
| Q <sub>gd</sub>                                                          | Gate Drain Charge                |                                                                                       | --   | 1.5  | --   | nC   |
| t <sub>d(on)</sub>                                                       | Turn-on Delay Time               | V <sub>DD</sub> =-30V, I <sub>D</sub> =-1A, V <sub>GS</sub> =-10V, R <sub>G</sub> =6Ω | --   | 40   | --   | nS   |
| t <sub>r</sub>                                                           | Turn-on Rise Time                |                                                                                       | --   | 35   | --   | nS   |
| t <sub>d(off)</sub>                                                      | Turn-Off Delay Time              |                                                                                       | --   | 15   | --   | nS   |
| t <sub>f</sub>                                                           | Turn-Off Fall Time               |                                                                                       | --   | 10   | --   | nS   |
| Source- Drain Diode Characteristics                                      |                                  |                                                                                       |      |      |      |      |
| V <sub>SD</sub>                                                          | Forward on voltage               | Tj=25°C, Is=-2A                                                                       | --   | --   | -1.2 | V    |

## Typical Operating Characteristics

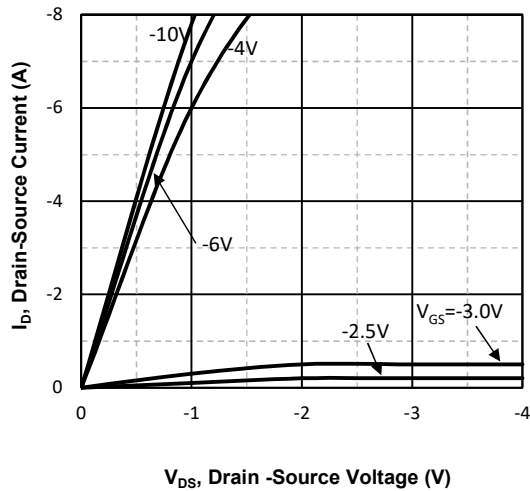


Fig1. Typical Output Characteristics

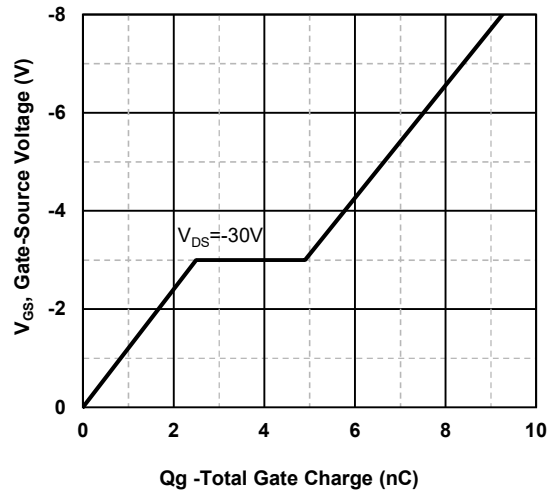


Fig2. Typical Gate Charge Vs. Gate-Source Voltage

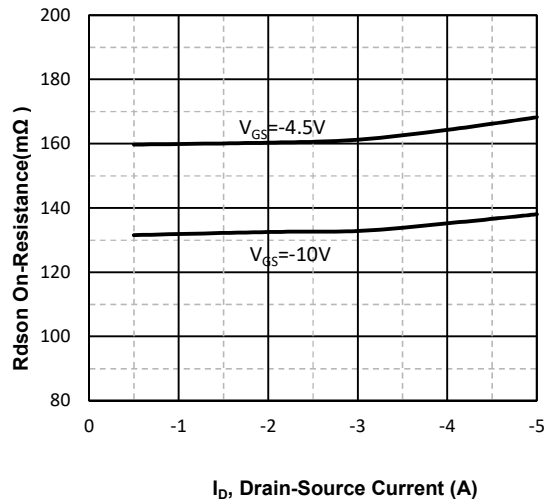


Fig3. Drain-Source on Resistance

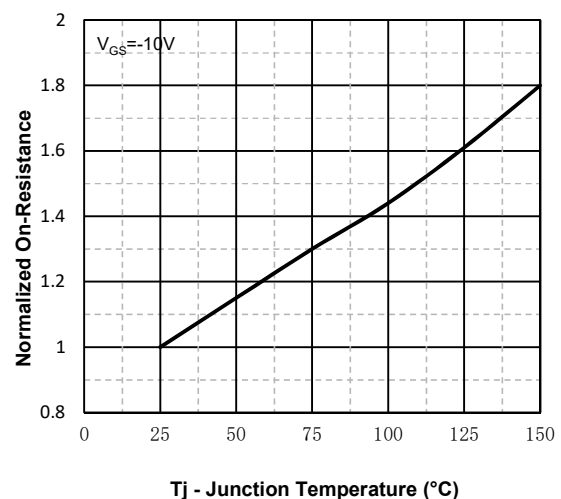


Fig4. Normalized On-Resistance Vs. Temperature

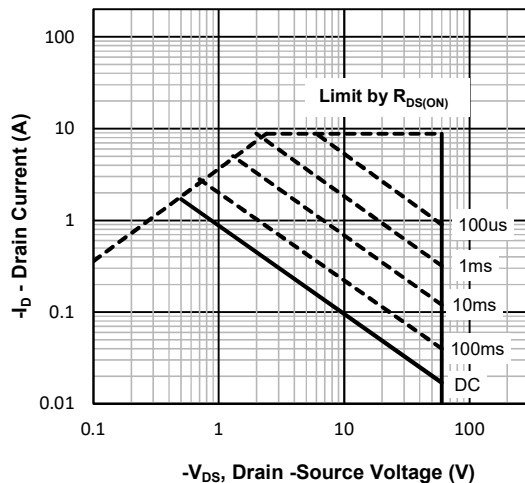


Fig5. Maximum Safe Operating Area

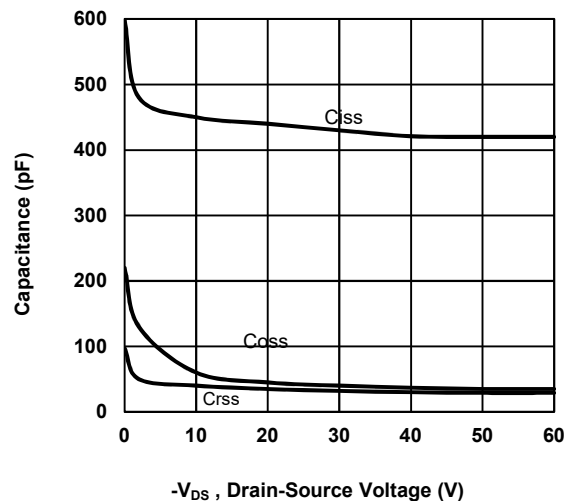
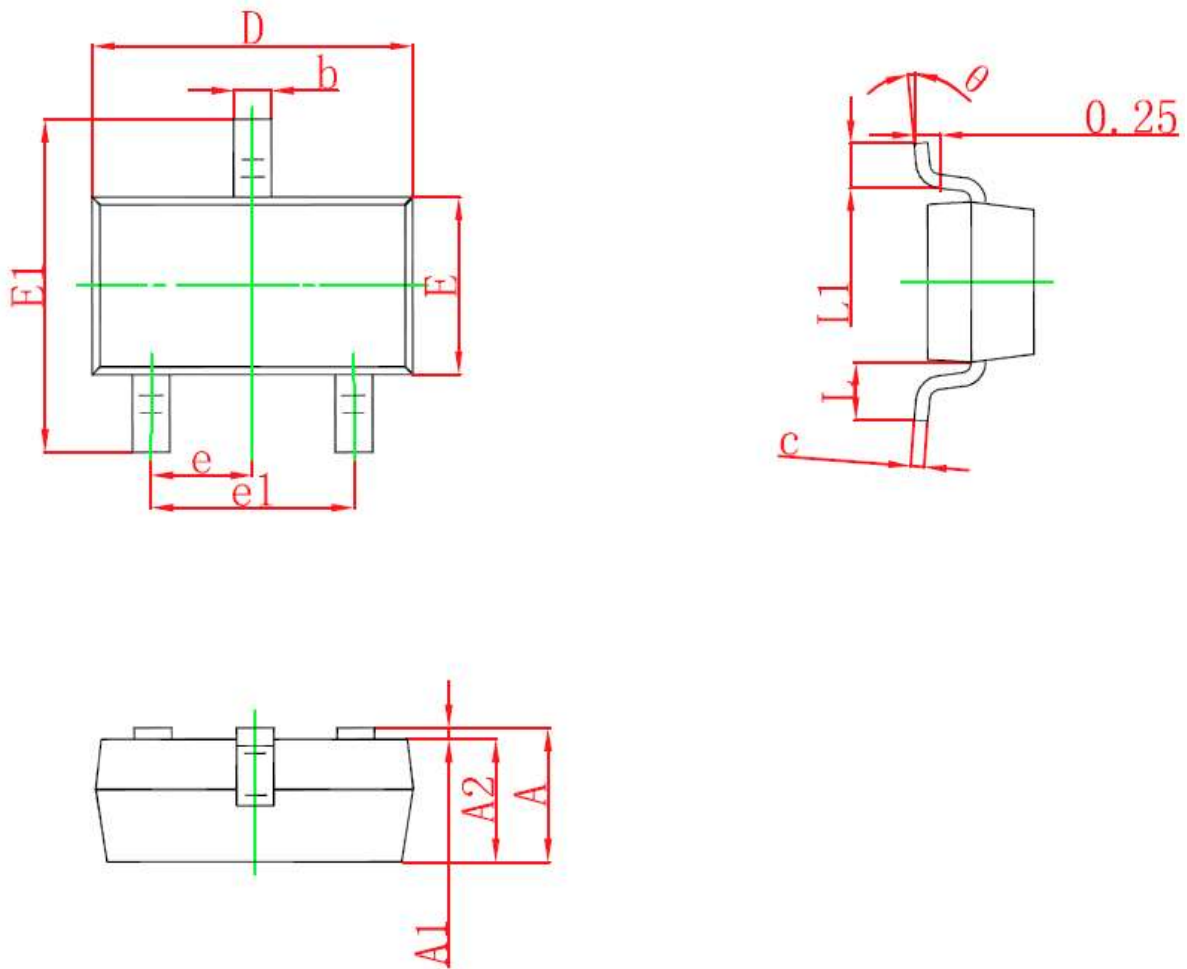


Fig6 Typical Capacitance Vs. Drain-Source Voltage

**SOT-23 Package information**



| Symbol | Dimensions in Millimeters(mm) |       | Dimensions In Inches |       |
|--------|-------------------------------|-------|----------------------|-------|
|        | Min                           | Max   | Min                  | Max   |
| A      | 0.900                         | 1.150 | 0.035                | 0.045 |
| A1     | 0.000                         | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                         | 1.050 | 0.035                | 0.041 |
| b      | 0.300                         | 0.500 | 0.012                | 0.020 |
| c      | 0.080                         | 0.150 | 0.003                | 0.006 |
| D      | 2.800                         | 3.000 | 0.110                | 0.118 |
| E1     | 2.250                         | 2.550 | 0.088                | 0.100 |
| E      | 1.200                         | 1.400 | 0.047                | 0.055 |
| e      | 0.950TYP                      |       | 0.037TYP             |       |
| e1     | 1.800                         | 2.000 | 0.071                | 0.079 |
| L      | 0.550 REF                     |       | 0.022 REF            |       |
| L1     | 0.300                         | 0.500 | 0.012                | 0.020 |
| θ      | 0°                            | 8°    | 0°                   | 8°    |