# MLS7413KW

## -20V/-1.4A P-Channel MOSFET

### Features

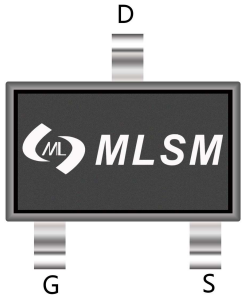
- Trench Power LV MOSFET technology
- High Density Cell Design for Low $R_{DS(ON)}$
- High Speed switching

### Product Summary

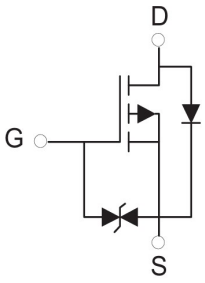
| $V_{DS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| -20V | 113mΩ@-10V | -1.4A |
| | 135mΩ@-4.5V | |

### Application

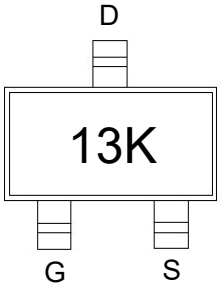
- Battery protection
- Load switch
- Power management



SOT-323 top view



Schematic diagram



13K: Device code

Marking and pin assignment

Pb-Free RoHS Halogen-Free

| Absolute Maximum Ratings (TA=25℃unless otherwise noted) | | | | |
|---|---|---|---|---|
| **Symbol** | **Parameter** | | **Rating** | **Unit** |
| **Common Ratings (TC=25°C Unless Otherwise Noted)** | | | | |
| $V_{DS}$ | Drain-Source Breakdown Voltage | | -20 | V |
| $V_{GS}$ | Gate-Source Voltage | | ±12 | V |
| $T_J$ | Maximum Junction Temperature | | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | °C |
| $I_S$ | Diode Continuous Forward Current | Tc=25°C | -1.4 | A |
| **Mounted on Large Heat Sink** | | | | |
| $I_{DM}$ | Pulse Drain Current Tested | Tc=25°C | -13 | A |
| $I_D$ | Continuous Drain Current | Tc=25°C | -1.4 | A |
| $P_D$ | Maximum Power Dissipation | Tc=25°C | 0.35 | W |
| $R_{\theta JA}$ | Thermal Resistance Junction-to-Ambient | | 350 | °C/W |

| Ordering Information (Example) | | | | | | |
|---|---|---|---|---|---|---|
| **Type** | **Package** | **Marking** | **Minimum Package(pcs)** | **Inner Box Quantity(pcs)** | **Outer Carton Quantity(pcs)** | **Delivery Mode** |
| MLS7413KW | SOT-323 | 13K | 3,000 | 45,000 | 180,000 | 7"reel |

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| Electrical Characteristics (TJ=25℃ unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **Symbol** | **Parameter** | **Condition** | **Min** | **Typ** | **Max** | **Unit** |
| **Static Electrical Characteristics @ TJ = 25°C (unless otherwise stated)** | | | | | | |
| $BV_{(BR)DSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$=0V, $I_D$=-250μA | -20 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=-20V, $V_{GS}$=0V | -- | -- | -1 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$=±12V, $V_{DS}$=0V | -- | -- | ±10 | uA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=-250μA | -0.5 | -0.7 | -1.2 | V |
| $R_{DS(on)}$ | Drain-Source On-State Resistance | $V_{GS}$=-10V, $I_D$=-1.4A | -- | 94 | 113 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-1.3A | -- | 111 | 135 | mΩ |
| **Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated)** | | | | | | |
| $C_{ISS}$ | Input Capacitance | $V_{DS}$=-15V, $V_{GS}$=0V, f=1MHz | -- | 510 | -- | pF |
| $C_{OSS}$ | Output Capacitance | | -- | 55 | -- | pF |
| $C_{RSS}$ | Reverse Transfer Capacitance | | -- | 16 | -- | pF |
| **Switching Characteristics** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=-9V, $I_D$=-1A, $V_{GS}$=-4.5V | -- | 5.5 | -- | nC |
| $Q_{gs}$ | Gate Source Charge | | -- | 1.5 | -- | nC |
| $Q_{gd}$ | Gate Drain Charge | | -- | 1.25 | -- | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DS}$=-6V, $R_L$=6Ω, $V_{GS}$=-4.5V, $R_G$=6Ω | -- | 1350 | -- | nS |
| $t_r$ | Turn-on Rise Time | | -- | 830 | -- | nS |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 5500 | -- | nS |
| $t_f$ | Turn-Off Fall Time | | -- | 1500 | -- | nS |
| **Source- Drain Diode Characteristics** | | | | | | |
| $V_{SD}$ | Forward on voltage | Tj=25℃, Is=-1.4A | -- | -- | -1.2 | V |

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## Typical Operating Characteristics

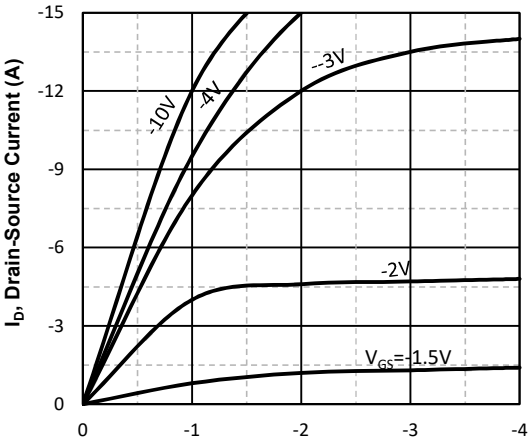


Fig1. Typical Output Characteristics

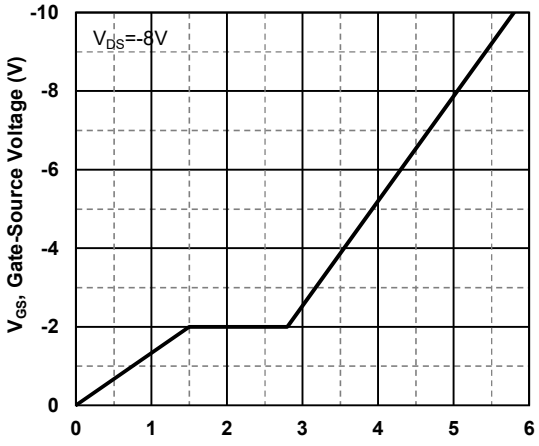


Fig2. Typical Gate Charge Vs.Gate-Source Voltage

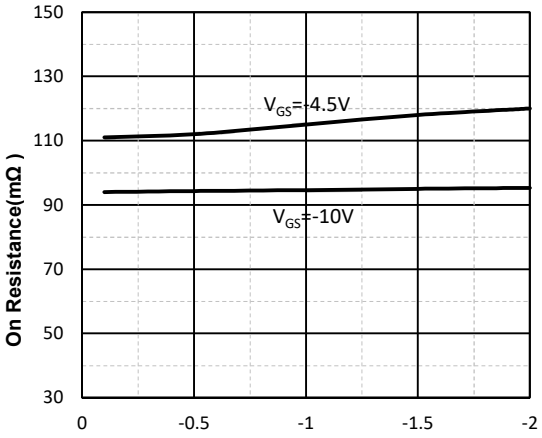


Fig3. Drain-Source on Resistance

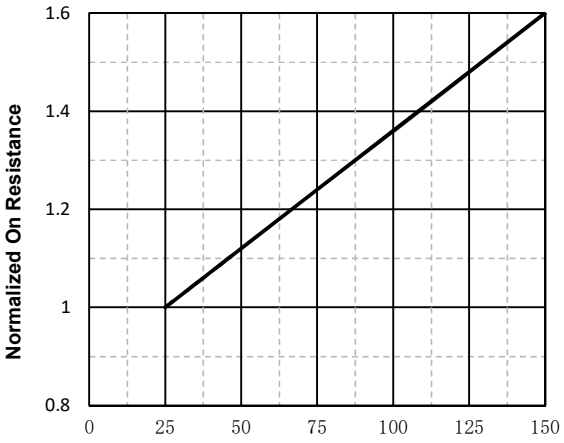


Fig4. Normalized On-Resistance Vs. Temperature

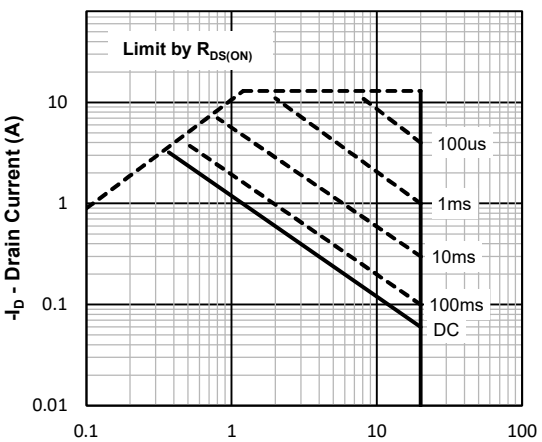


Fig5. Maximum Safe Operating Area

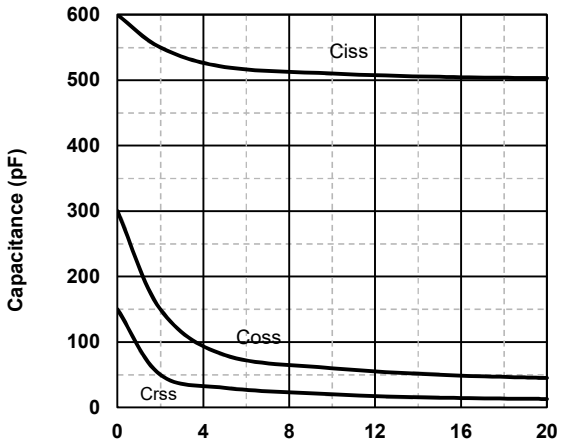


Fig6 Typical Capacitance Vs.Drain-Source Voltage

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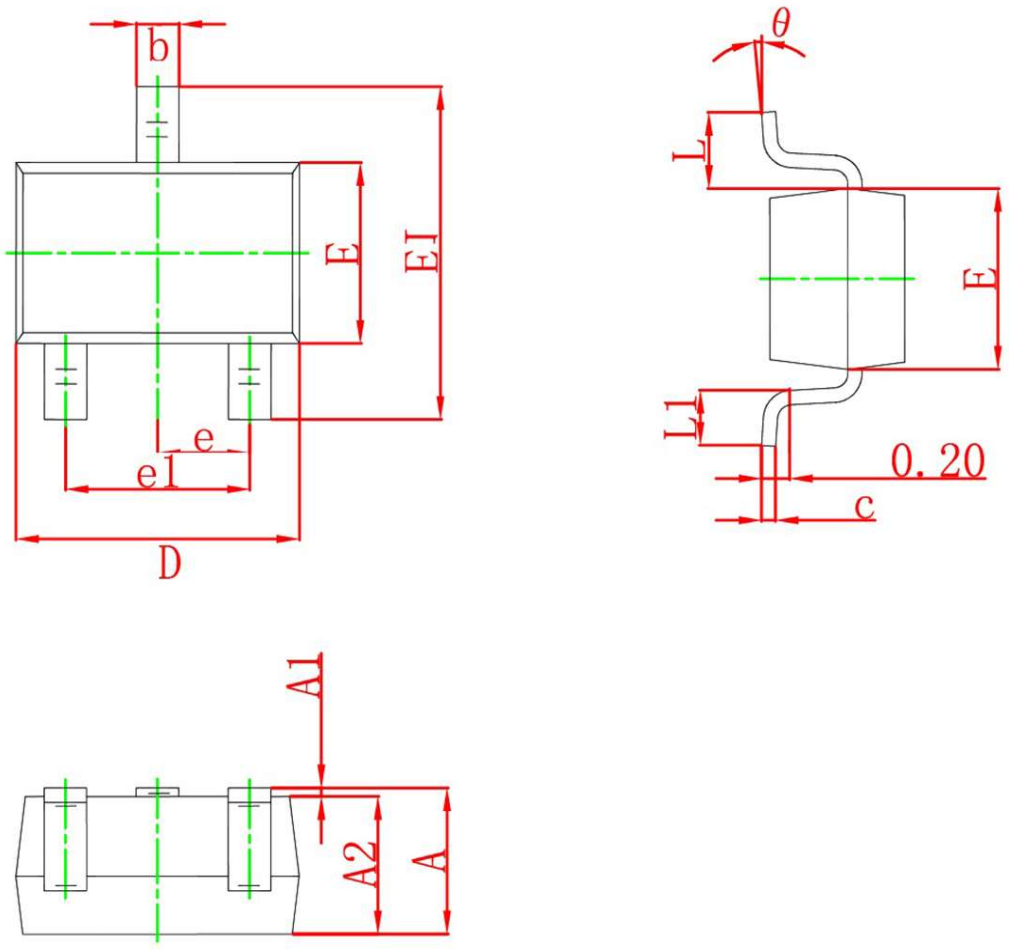
## SOT-323 Package information




| Symbol | Dimensions in Millimeters(mm) | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.900 | 1.100 | 0.035 | 0.043 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.000 | 0.035 | 0.039 |
| b | 0.200 | 0.400 | 0.008 | 0.016 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.000 | 2.200 | 0.079 | 0.087 |
| E | 1.150 | 1.350 | 0.045 | 0.053 |
| E1 | 2.150 | 2.450 | 0.085 | 0.096 |
| e | 0.650TYP | | 0.026TYP | |
| e1 | 1.200 | 1.400 | 0.047 | 0.055 |
| L | 0.525REF | | 0.021REF | |
| L1 | 0.260 | 0.460 | 0.010 | 0.018 |
| θ | 0° | 8° | 0° | 8° |

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