# MLSQ4606A

## 30V N-Channel and P-Channel MOSFET

### Features

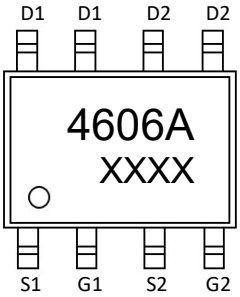
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

### Application

- Battery protection
- Load switch
- Power management

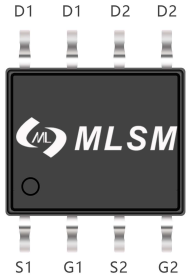
### Product Summary

| $V_{DS}$ | $R_{DS(ON)}$ MAX | $I_D$ MAX |
|---|---|---|
| 30V | 30mΩ@10V | 6.9A |
| | 42mΩ@4.5V | |
| -30V | 50mΩ@-10V | -6.0A |
| | 70mΩ@-4.5V | |

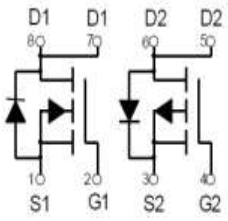



4606A : Device code
XXXX : Code

Marking and pin assignment




SOP-8 top view




Schematic diagram

Pb-Free RoHS Halogen-Free

| Absolute Maximum Ratings (TA=25℃unless otherwise noted) | | | | | |
|---|---|---|---|---|---|
| **Symbol** | **Parameter** | | **N-Channel** | **P-Channel** | **Unit** |
| **Common Ratings (TC=25°C Unless Otherwise Noted)** | | | | | |
| $V_{DS}$ | Drain-Source Breakdown Voltage | | 30 | -30 | V |
| $V_{GS}$ | Gate-Source Voltage | | ±20 | ±20 | V |
| $T_J$ | Maximum Junction Temperature | | 150 | 150 | °C |
| $T_{STG}$ | Storage Temperature Range | | -55 to 150 | -55 to 150 | °C |
| $I_S$ | Diode Continuous Forward Current | Tc=25°C | 6.9 | -6 | A |
| **Mounted on Large Heat Sink** | | | | | |
| $I_{DM}$ | Pulse Drain Current Tested | Tc=25°C | 33 | -28 | A |
| $I_D$ | Continuous Drain Current | Tc=25°C | 6.9 | -6 | A |
| $P_D$ | Maximum Power Dissipation | Tc=25°C | 2 | 2 | W |
| $R_{\theta JA}$ | Thermal Resistance Junction-Ambient | | 50 | 50 | °C/W |

| Ordering Information (Example) | | | | | | |
|---|---|---|---|---|---|---|
| **Type** | **Package** | **Marking** | **Minimum Package(pcs)** | **Inner Box Quantity(pcs)** | **Outer Carton Quantity(pcs)** | **Delivery Mode** |
| MLSQ4606A | SOP-8 | 4606A | 3,000 | 6,000 | 42,000 | 13"reel |

| N-Ch 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 | 30 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=30V, $V_{GS}$=0V | -- | -- | 1 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | -- | -- | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=250μA | 1.2 | 1.5 | 2.4 | V |
| $R_{DS(on)}$ | Drain-Source On-State Resistance | $V_{GS}$=10V, $I_D$=5.6A | -- | 16 | 30 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=5.0A | -- | 20 | 42 | mΩ |
| **Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated)** | | | | | | |
| $C_{ISS}$ | Input Capacitance | $V_{DS}$=15V, $V_{GS}$=0V, f=1MHz | -- | 526 | -- | pF |
| $C_{OSS}$ | Output Capacitance | | -- | 78 | -- | pF |
| $C_{RSS}$ | Reverse Transfer Capacitance | | -- | 69 | -- | pF |
| **Switching Characteristics** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=15V, $I_D$=6A, $V_{GS}$=10V | -- | 17 | -- | nC |
| $Q_{gs}$ | Gate Source Charge | | -- | 2 | -- | nC |
| $Q_{gd}$ | Gate Drain Charge | | -- | 2 | -- | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DS}$=15V, $R_L$=4.1Ω, $V_{GS}$=10V, $R_G$=3Ω | -- | 4.5 | -- | nS |
| $t_r$ | Turn-on Rise Time | | -- | 28.5 | -- | nS |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 16.5 | -- | nS |
| $t_f$ | Turn-Off Fall Time | | -- | 26 | -- | nS |
| **Source- Drain Diode Characteristics** | | | | | | |
| $V_{SD}$ | Forward on voltage | Tj=25℃, Is=6A | -- | -- | 1.2 | V |

| P-Ch 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 | -30 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$=-30V, $V_{GS}$=0V | -- | -- | -1 | μA |
| $I_{GSS}$ | Gate-Body Leakage Current | $V_{GS}$=±20V, $V_{DS}$=0V | -- | -- | ±100 | nA |
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$=$V_{GS}$, $I_D$=-250μA | -1.0 | -1.5 | -2.5 | V |
| $R_{DS(on)}$ | Drain-Source On-State Resistance | $V_{GS}$=-10V, $I_D$=-4.2A | -- | 39 | 50 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-3.5A | -- | 52 | 70 | mΩ |
| **Dynamic Electrical Characteristics @ TJ = 25°C (unless otherwise stated)** | | | | | | |
| $C_{ISS}$ | Input Capacitance | $V_{DS}$=-15V, $V_{GS}$=0V, f=1MHz | -- | 572 | -- | pF |
| $C_{OSS}$ | Output Capacitance | | -- | 82 | -- | pF |
| $C_{RSS}$ | Reverse Transfer Capacitance | | -- | 70 | -- | pF |
| **Switching Characteristics** | | | | | | |
| $Q_g$ | Total Gate Charge | $V_{DS}$=-10V, $I_D$=-4.5A, $V_{GS}$=-15V | -- | 30 | -- | nC |
| $Q_{gs}$ | Gate Source Charge | | -- | 2.7 | -- | nC |
| $Q_{gd}$ | Gate Drain Charge | | -- | 6.9 | -- | nC |
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$=-15V, $I_D$=-4.5A, $V_{GS}$=-10V, $R_G$=2.5Ω | -- | 9 | -- | nS |
| $t_r$ | Turn-on Rise Time | | -- | 16 | -- | nS |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 77 | -- | nS |
| $t_f$ | Turn-Off Fall Time | | -- | 40 | -- | nS |
| **Source- Drain Diode Characteristics** | | | | | | |
| $V_{SD}$ | Forward on voltage | Tj=25℃, Is=-4.5A | -- | -- | -1.2 | V |

## N-Channel Typical Operating Characteristics

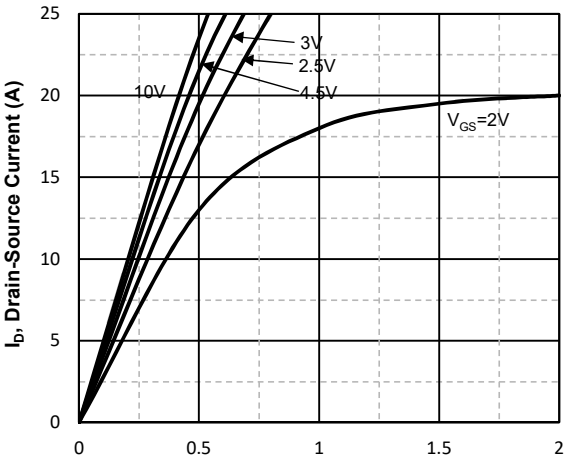



Fig1. Typical Output Characteristics

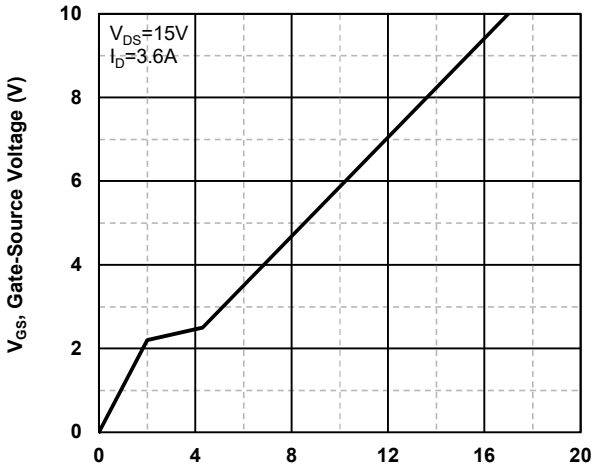



Fig2. Typical Gate Charge Vs.Gate-Source Voltage

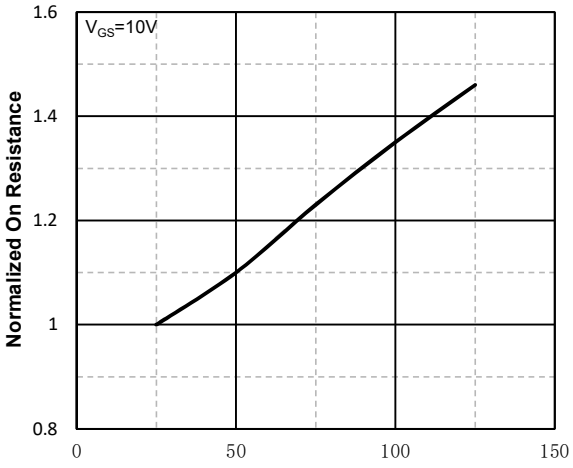



Fig3. Normalized On-Resistance Vs. Temperature

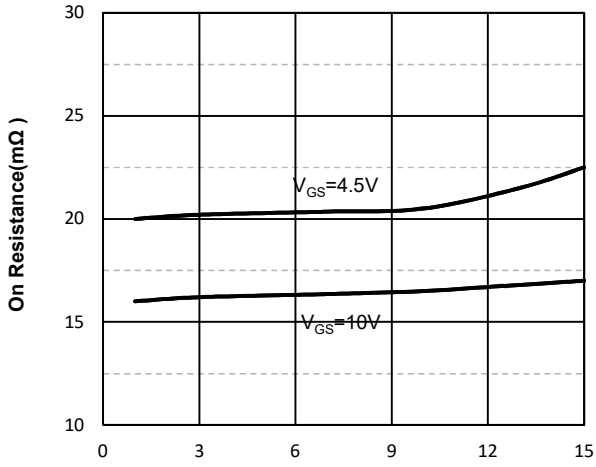



Fig4. On-Resistance Vs. Drain-Source Current

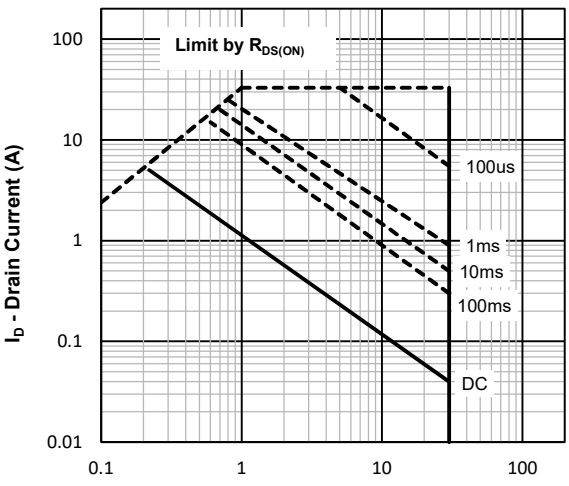



Fig5. Maximum Safe Operating Area

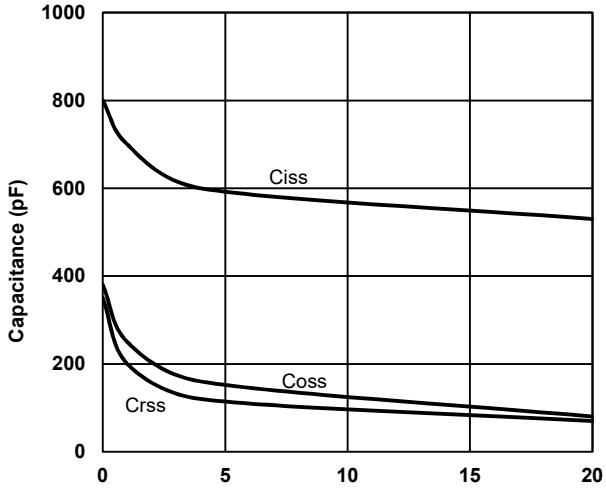



Fig6 Typical Capacitance Vs.Drain-Source Voltage

## P-Channel Typical Operating Characteristics

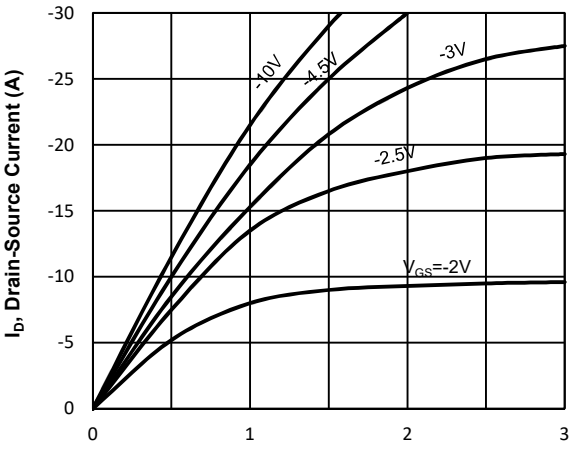



Fig7. Typical Output Characteristics

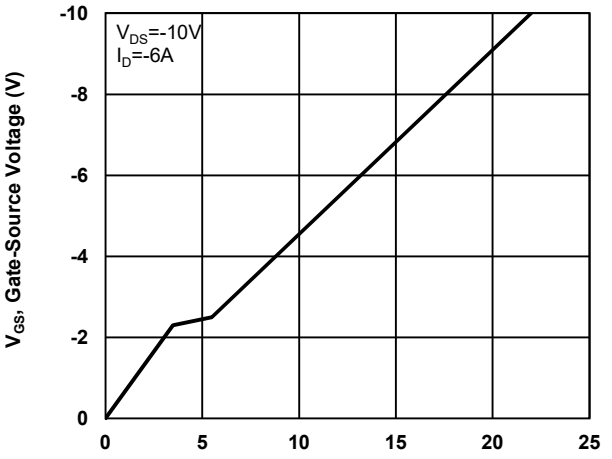



Fig8. Typical Gate Charge Vs.Gate-Source Voltage

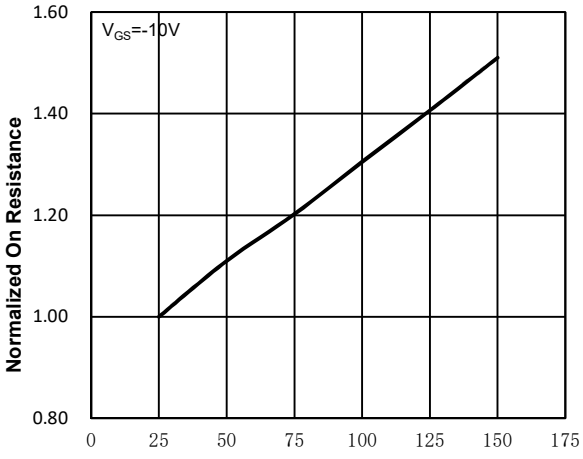



Fig9. Normalized On-Resistance Vs. Temperature

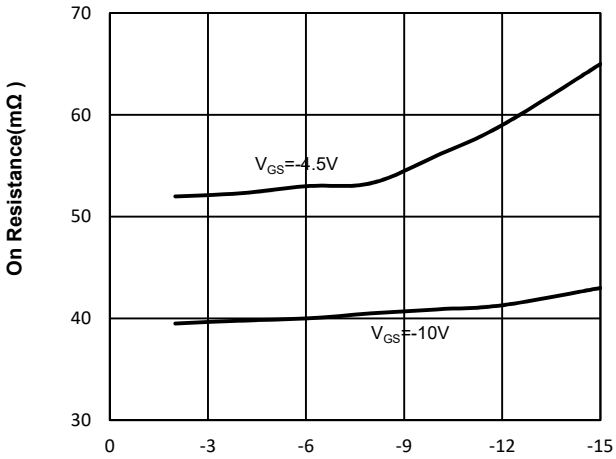



Fig10. On-Resistance Vs. Drain-Source Current

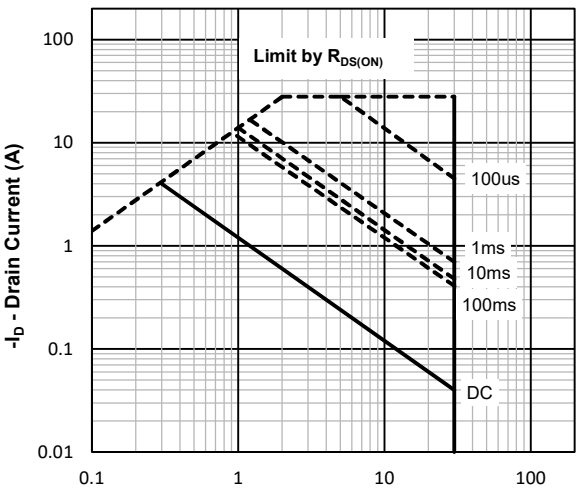



Fig11. Maximum Safe Operating Area

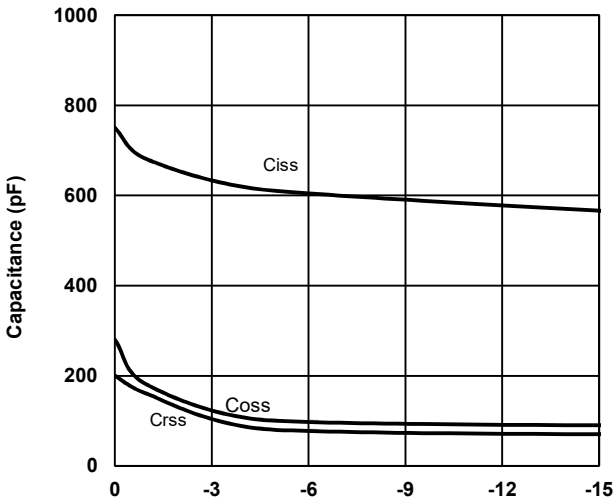
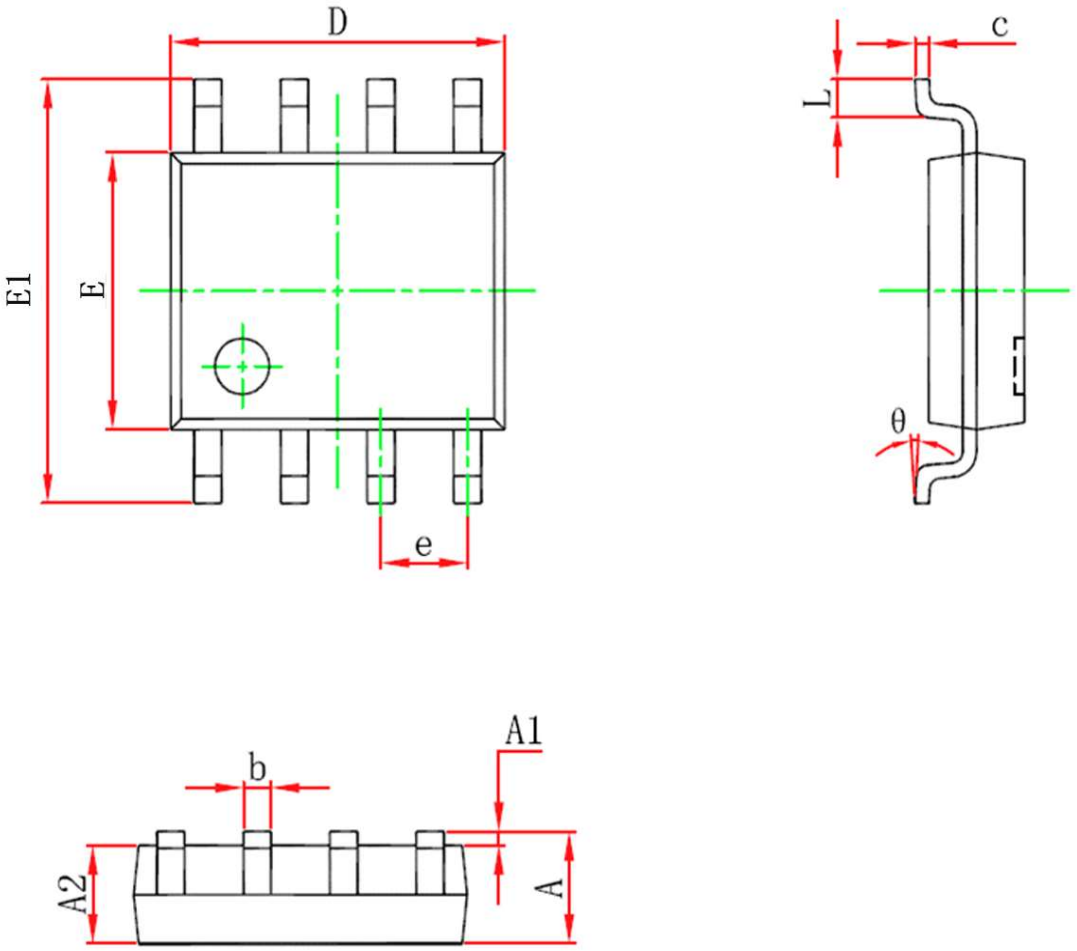



Fig12 Typical Capacitance Vs.Drain-Source Voltage

## SOP-8 Package information




| Symbol | Dimensions in Millimeters(mm) | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.450 | 1.750 | 0.057 | 0.068 |
| A1 | 0.100 | 0.250 | 0.003 | 0.009 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.012 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.009 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| E | 3.800 | 4.000 | 0.149 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| L | 0.400 | 1.270 | 0.015 | 0.050 |
| θ | 0° | 8° | 0° | 8° |