Leiditech®

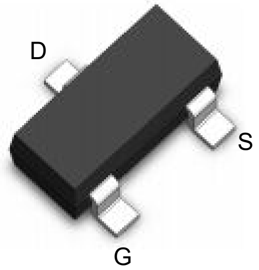
# LM3L5N06

## 60V N-Channel Enhancement Mode MOSFET

## Description

The LM3L5N06 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.

## Dimensions SOT-23-3L

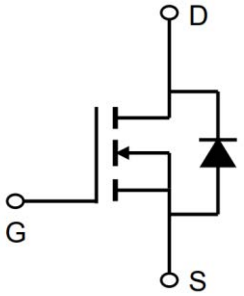


## General Features

$V_{DS}$ = 60V $I_D$ =5A

$R_{DS(ON)}$ < 38mΩ @ $V_{GS}$=10V

## Pin Configuration



## Application

- Battery protection
- Load switch
- Automative lighting

## Package Marking and Ordering Information

| Device | Device Marking | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| LM3L5N06 | NA6-5A | SOT-23-3L | Ø180mm | 8 mm | 3000 units |

## Absolute Maximum Ratings (TC=25℃unless otherwise noted)

| Symbol | Parameter | Rating | Units |
|---|---|---|---|
| $V_{DS}$ | Drain-Source Voltage | 60 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$@$T_A$=25˚C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 5.8 | A |
| $I_D$@$T_A$=70˚C | Continuous Drain Current, $V_{GS}$ @ 10V[1] | 3.5 | A |
| $I_{DM}$ | Pulsed Drain Current[2] | 18 | A |
| EAS | Single Pulse Avalanche Energy[3] | 22 | mJ |
| $I_{AS}$ | Avalanche Current | 21 | A |
| $P_D$@$T_A$=25˚C | Total Power Dissipation[4] | 1.5 | W |
| $T_{STG}$ | Storage Temperature Range | -55 to 150 | ˚C |
| $T_J$ | Operating Junction Temperature Range | -55 to 150 | ˚C |
| $R_{θJA}$ | Thermal Resistance Junction-ambient [1] | 85 | ˚C/W |
| $R_{θJC}$ | Thermal Resistance Junction-Case[1] | 25 | ˚C/W |

## Electrical Characteristics (TJ=25℃, unless otherwise noted)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BVDSS | Drain-Source Breakdown Voltage | $V_{GS}$=0V , $I_D$=250uA | 60 | --- | --- | V |
| △BVDSS/△TJ | BVDSS Temperature Coefficient | Reference to 25℃ , $I_D$=1mA | --- | 0.044 | --- | V/℃ |
| RDS(ON) | Static Drain-Source On-Resistance[2] | $V_{GS}$=10V , $I_D$=4A | --- | 28 | 38 | mΩ |
|  |  | $V_{GS}$=4.5V , $I_D$=2A | --- | 35 | 50 |  |
| VGS(th) | Gate Threshold Voltage | $V_{GS}$=$V_{DS}$ , $I_D$ =250uA | 1.0 | 1.76 | 2.5 | V |
| △$V_{GS(th)}$ | $V_{GS(th)}$ Temperature Coefficient |  | --- | -4.8 | --- | mV/℃ |
| IDSS | Drain-Source Leakage Current | $V_{DS}$=48V , $V_{GS}$=0V , $T_J$=25℃ | --- | --- | 1 | uA |
|  |  | $V_{DS}$=48V , $V_{GS}$=0V , $T_J$=55℃ | --- | --- | 5 |  |
| IGSS | Gate-Source Leakage Current | $V_{GS}$=±20V , $V_{DS}$=0V | --- | --- | ±100 | nA |
| gfs | Forward Transconductance | $V_{DS}$=5V , $I_D$=4A | --- | 28.3 | --- | S |
| $R_g$ | Gate Resistance | $V_{DS}$=0V , $V_{GS}$=0V , f=1MHz | --- | 2.5 | --- | Ω |
| $Q_g$ | Total Gate Charge (10V) | $V_{DS}$=48V , $V_{GS}$=10V , $I_D$=4A | --- | 19 | --- | nC |
| Qgs | Gate-Source Charge |  | --- | 2.6 | --- |  |
| Qgd | Gate-Drain Charge |  | --- | 4.1 | --- |  |
| Td(on) | Turn-On Delay Time | $V_{DD}$=30V , $V_{GS}$=10V , $R_G$=3.3Ω<br>$I_D$=4A | --- | 3 | --- | ns |
| $T_r$ | Rise Time |  | --- | 34 | --- |  |
| Td(off) | Turn-Off Delay Time |  | --- | 23 | --- |  |
| $T_f$ | Fall Time |  | --- | 6 | --- |  |
| Ciss | Input Capacitance | $V_{DS}$=15V , $V_{GS}$=0V , f=1MHz | --- | 1027 | --- | pF |
| Coss | Output Capacitance |  | --- | 65 | --- |  |
| Crss | Reverse Transfer Capacitance |  | --- | 46 | --- |  |
| *IS* | Continuous Source Current[1,5] | $V_G$=$V_D$=0V , Force Current | --- | --- | 4.5 | A |
| *ISM* | Pulsed Source Current[2,5] |  | --- | --- | 18 | A |
| *VSD* | Diode Forward Voltage[2] | $V_{GS}$=0V , $I_S$=1A , $T_J$=25℃ | --- | --- | 1.2 | V |
| trr | Reverse Recovery Time | $I_F$=4A , dI/dt=100A/μs , $T_J$=25℃ | --- | 12.1 | --- | nS |
| $Q_{rr}$ | Reverse Recovery Charge |  | --- | 6.7 | --- | nC |

**Note :**

1、The data tested by surface mounted on a 1 inch2 FR-4 board with 2OZ copper.

2、The data tested by pulsed , pulse width ≦ 300us , duty cycle ≦ 2%

3、The EAS data shows Max. rating . The test condition is VDD=25V,VGS=10V,L=0.1mH,IAS=21A

4、The power dissipation is limited by 150℃ junction temperature

5 、The data is theoretically the same as ID and IDM , in real applications , should be limited by total power dissipation.

## Typical Characteristics

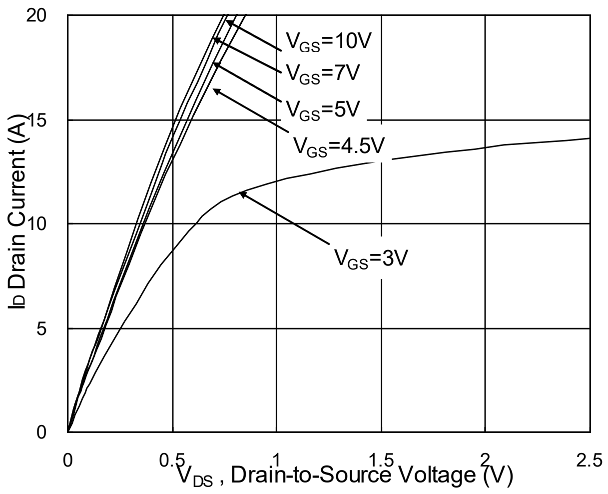


**Fig.1 Typical Output Characteristics**

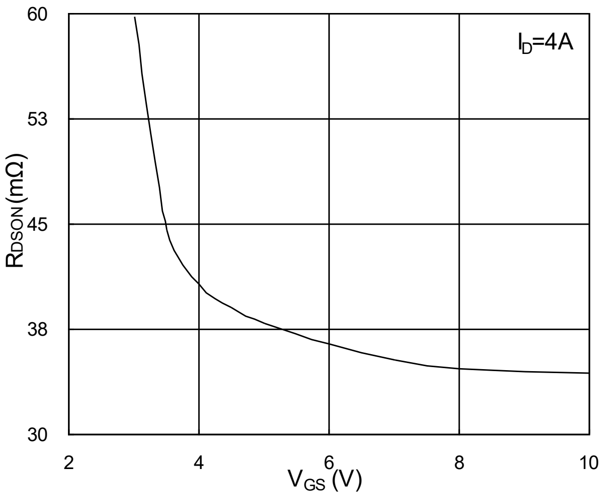


**Fig.2 On-Resistance vs. Gate-Source**

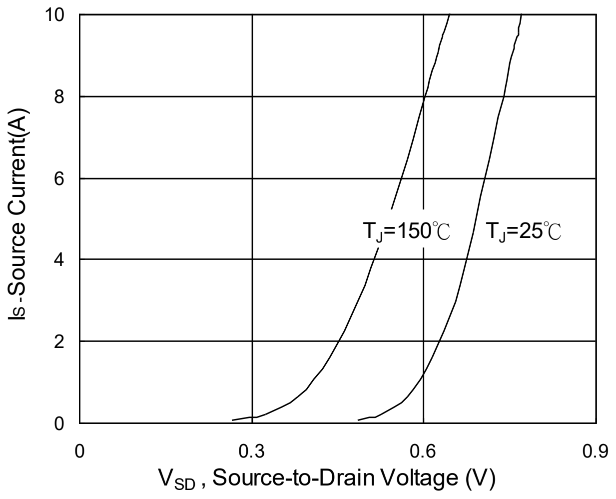


**Fig.3 Forward Characteristics Of Reverse**

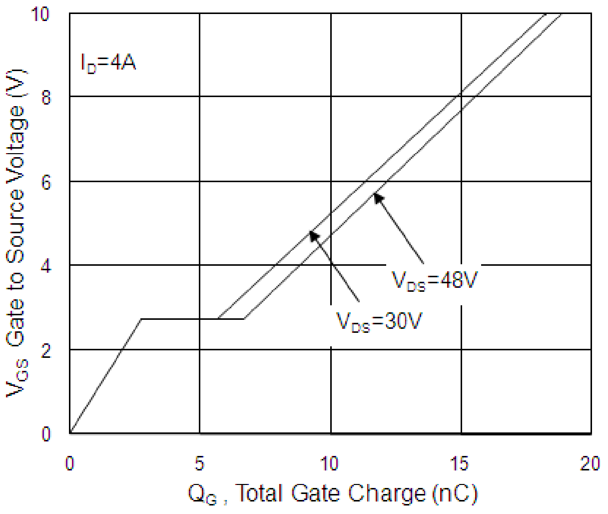


**Fig.4 Gate-Charge Characteristics**

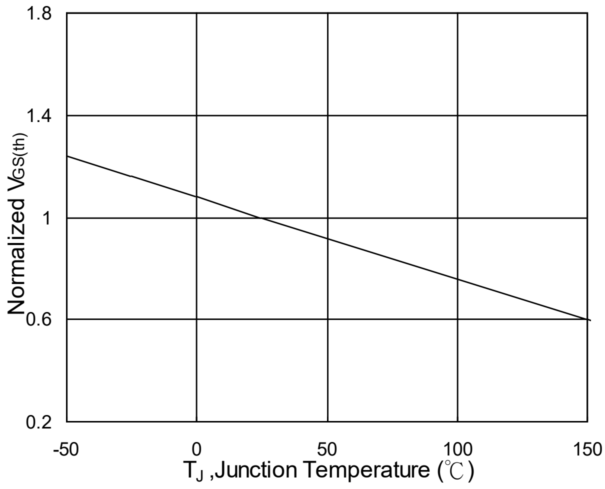


**Fig.5 Normalized $V_{GS(th)}$ vs. $T_J$**

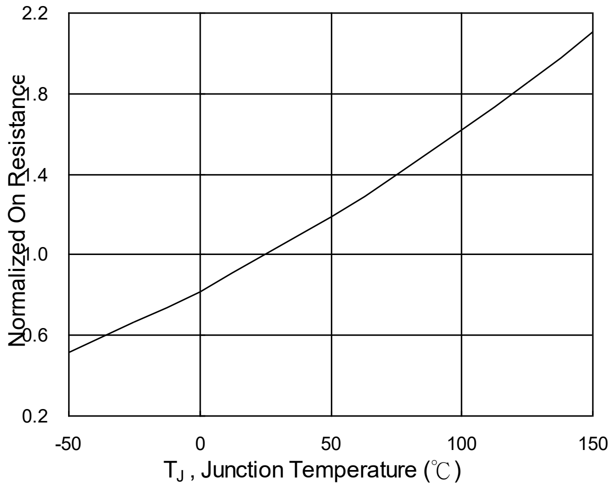


**Fig.6 Normalized $R_{DSON}$ vs. $T_J$**

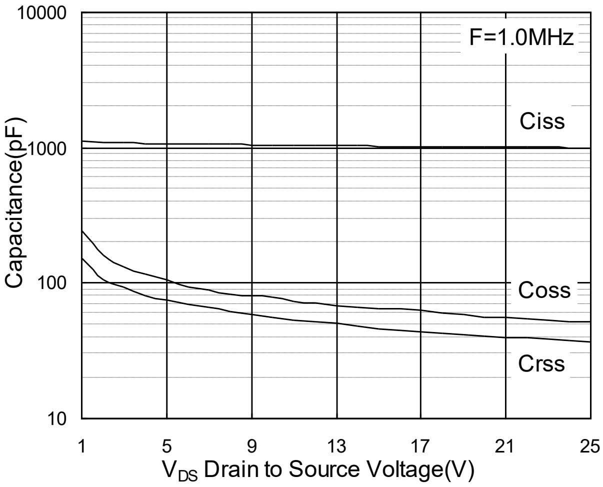


Fig.7 Capacitance

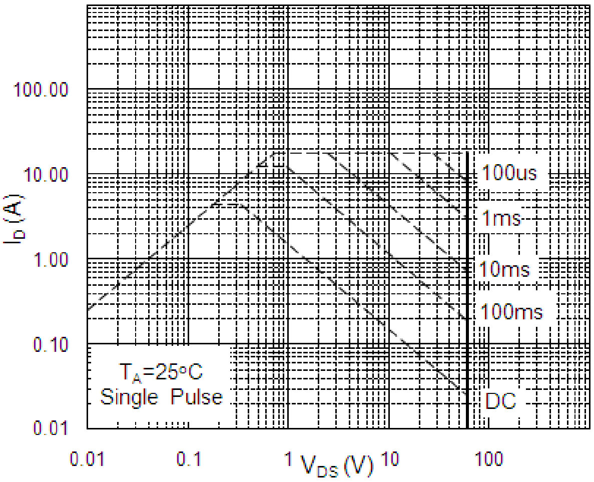


Fig.8 Safe Operating Area

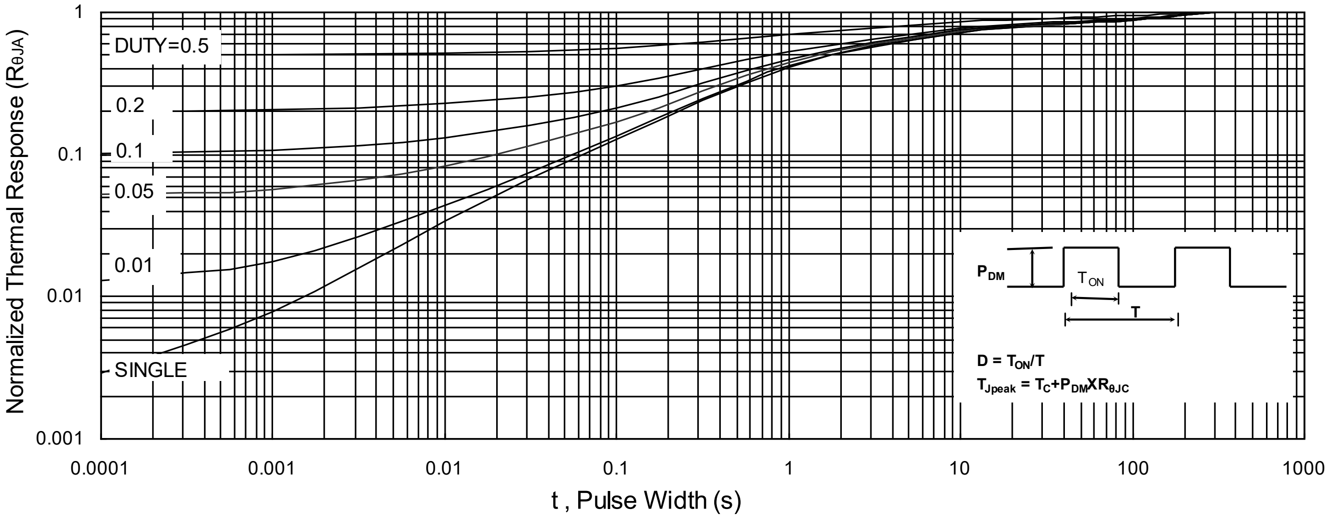


Fig.9 Normalized Maximum Transient Thermal Impedance

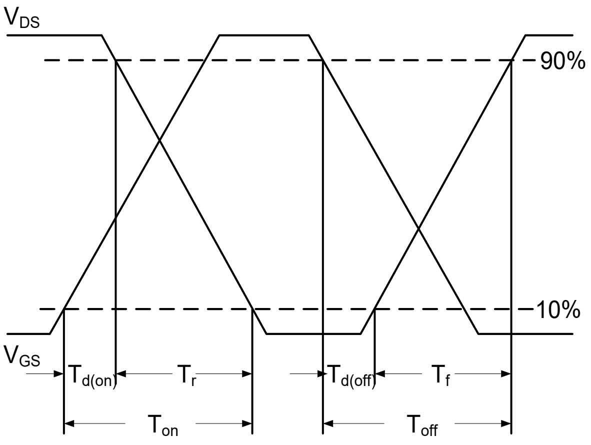


Fig.10 Switching Time Waveform

$$EAS=\frac{1}{2}L \times I_{AS}^2 \times \frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$

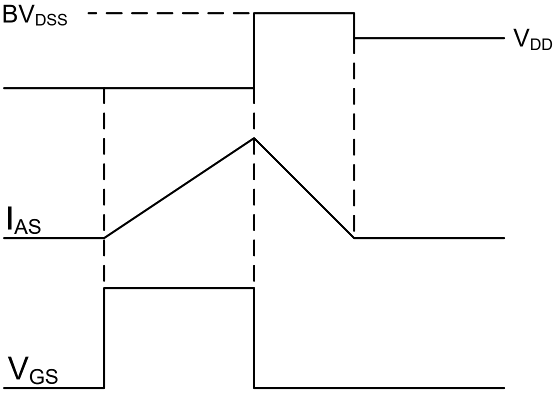
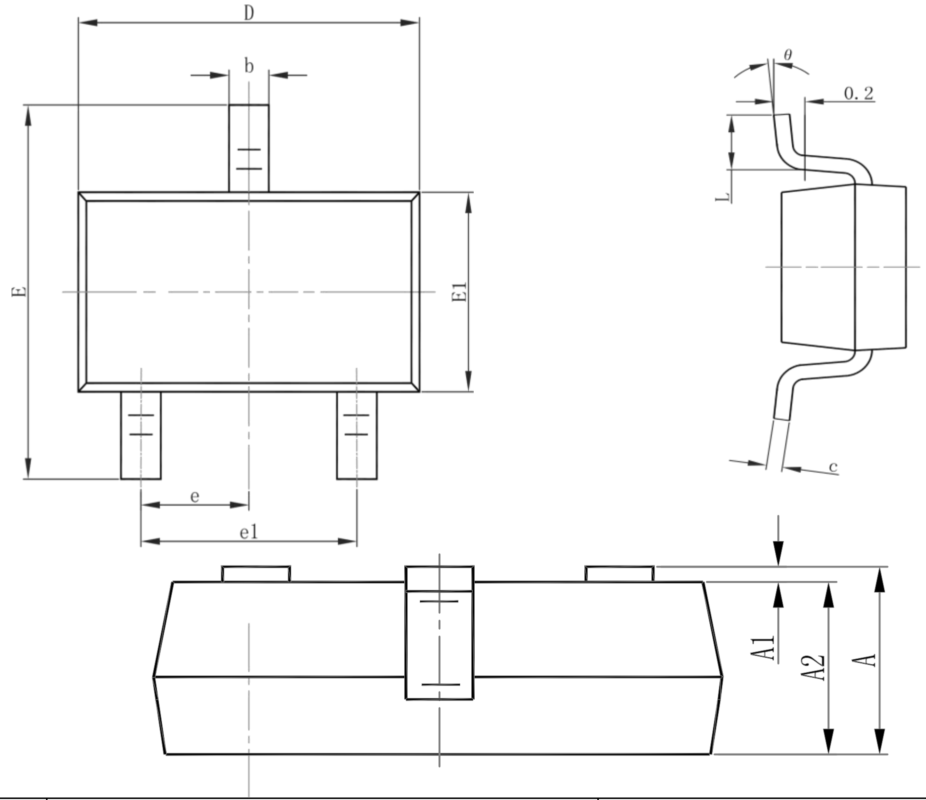


Fig.11 Unclamped Inductive Switching Waveform

## Package Mechanical Data:SOT-23-3L



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| D | 2.820 | 3.020 | 0.111 | 0.119 |
| E1 | 1.500 | 1.700 | 0.059 | 0.067 |
| E | 2.650 | 2.950 | 0.104 | 0.116 |
| e | 0.950(BSC) | | 0.037(BSC) | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.300 | 0.600 | 0.012 | 0.024 |
| θ | 0° | 8° | 0° | 8° |