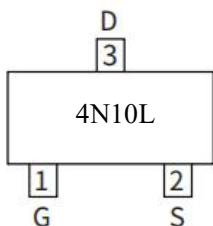




|                                                                                                                                                                                                                           |                                                                                                                                                      |              |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| <b>Features</b> <ul style="list-style-type: none"><li>➤ Super Low Gate Charge</li><li>➤ Green Device Available</li><li>➤ Excellent Cdv/dt effect decline</li><li>➤ Advanced high cell density Trench technology</li></ul> | <b>Bvdss</b>                                                                                                                                         | <b>Rdson</b> | <b>ID</b> |
|                                                                                                                                                                                                                           | <b>100V</b>                                                                                                                                          | <b>120mΩ</b> | <b>4A</b> |
|                                                                                                                                                                                                                           | <b>Application</b> <ul style="list-style-type: none"><li>➤ Battery protection</li><li>➤ Load Switch</li><li>➤ Uninterruptible power supply</li></ul> |              |           |



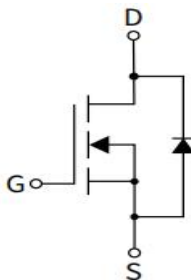
|                |
|----------------|
| <b>Package</b> |
|----------------|



Marking and pin assignment



SOT23-3L top view



Schematic diagram

### Package Marking and Ordering Information

| Device Marking | Device | Device Package | Quantity |
|----------------|--------|----------------|----------|
| 4N10L          | 4N10L  | SOT23-3L       | 3000     |

### Absolute Maximum Ratings (T<sub>C</sub>=25°C unless otherwise specified)

| Parameter                                                   | Symbol                                | Value      | Unit |
|-------------------------------------------------------------|---------------------------------------|------------|------|
| Drain-Source Voltage                                        | V <sub>DS</sub>                       | 100        | V    |
| Gate-Source Voltage                                         | V <sub>GS</sub>                       | ±20        | V    |
| Continuous Drain Current, V <sub>GS</sub> @10V <sup>1</sup> | I <sub>D</sub> @T <sub>A</sub> =25°C  | 4          | A    |
| Continuous Drain Current, V <sub>GS</sub> @10V <sup>1</sup> | I <sub>D</sub> @T <sub>A</sub> =100°C | 2          | A    |
| Pulsed Drain Current <sup>2</sup>                           | I <sub>DM</sub>                       | 16         | A    |
| Single Pulse Avalanche Energy <sup>3</sup>                  | E <sub>AS</sub>                       | 12         | mJ   |
| Avalanche Current                                           | I <sub>AS</sub>                       | 7          | A    |
| Total Power Dissipation <sup>4</sup>                        | P <sub>D</sub> @T <sub>A</sub> =25°C  | 26.6       | W    |
| Storage Temperature Range                                   | T <sub>STG</sub>                      | -55 to 150 | °C   |
| Operating Junction Temperature Range                        | T <sub>J</sub>                        | -55 to 150 | °C   |

### Thermal Resistance Ratings

| Parameter                                        | Symbol           | Typ. | Max. | Unit |
|--------------------------------------------------|------------------|------|------|------|
| Thermal Resistance Junction-ambient <sup>1</sup> | R <sub>θJA</sub> | --   | --   | °C/W |
| Thermal Resistance Junction-Case <sup>1</sup>    | R <sub>θJC</sub> | --   | 4.7  | °C/W |



## Ordering Information

| Ordering Number | Package  | Pin Assignment |   |   | Packing   |
|-----------------|----------|----------------|---|---|-----------|
| Halogen Free    |          | G              | S | D |           |
| HL4N10L         | SOT23-3L | 1              | 2 | 3 | Tape Reel |

Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise specified)

| Parameter                                                               | Symbol                              | Condition                                                                             | Min | Typ  | Max  | Unit |
|-------------------------------------------------------------------------|-------------------------------------|---------------------------------------------------------------------------------------|-----|------|------|------|
| Static Characteristics                                                  |                                     |                                                                                       |     |      |      |      |
| Drain-Source Breakdown Voltage                                          | V <sub>DSS</sub>                    | V <sub>GS</sub> =0V I <sub>D</sub> =250μA                                             | 100 | -    | -    | V    |
| BV <sub>DSS</sub> Temperature Coefficient                               | △BV <sub>DSS</sub> /△T <sub>J</sub> | Reference to 25℃ , I <sub>D</sub> =1mA                                                | -   | -    | -    | V/℃  |
| Drain-Source Leakage Current                                            | I <sub>DSS</sub>                    | V <sub>DS</sub> =100V , V <sub>GS</sub> =0V ,<br>T <sub>J</sub> =25℃                  | -   | -    | 1    | μA   |
| Drain-Source Leakage Current                                            | I <sub>DSS</sub>                    | V <sub>DS</sub> =100V, V <sub>GS</sub> =0V ,<br>T <sub>J</sub> =100℃                  | -   | -    | -    |      |
| Gate- Source Forward Leakage                                            | I <sub>GSS</sub> (F)                | V <sub>GS</sub> =+20V,V <sub>DS</sub> =0V                                             | -   | -    | 100  | nA   |
| Gate- Source Reverse Leakage                                            | I <sub>GSS</sub> (R)                | V <sub>GS</sub> =-10V,V <sub>DS</sub> =0V                                             | -   | -    | -100 | nA   |
| Gate Threshold Voltage                                                  | V <sub>GS(th)</sub>                 | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA                               | 1   | 2    | 2.5  | V    |
| V <sub>GS(th)</sub> Temperature Coefficient                             | △V <sub>GS(th)</sub>                |                                                                                       | -   | -    | -    | mV/℃ |
| Drain-Source On-State Resistance <sup>2</sup>                           | R <sub>DS(ON)</sub>                 | V <sub>GS</sub> =10V, I <sub>D</sub> =2A                                              | -   | 120  | 156  | mΩ   |
|                                                                         |                                     | V <sub>GS</sub> =4.5V, I <sub>D</sub> =1.2A                                           | -   | 126  | 164  |      |
| Gate Resistance                                                         | R <sub>g</sub>                      | V <sub>DS</sub> =0V , V <sub>GS</sub> =0V , f=1MHz                                    | -   | -    | -    | Ω    |
| Dynamic Characteristics                                                 |                                     |                                                                                       |     |      |      |      |
| Input Capacitance                                                       | C <sub>iss</sub>                    | V <sub>DS</sub> =25V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -   | 655  | -    | pF   |
| Output Capacitance                                                      | C <sub>oss</sub>                    |                                                                                       | -   | 31   | -    | pF   |
| Reverse Transfer Capacitance                                            | C <sub>rss</sub>                    |                                                                                       | -   | 24   | -    | pF   |
| Forward Transconductance                                                | g <sub>fs</sub>                     | V <sub>DS</sub> =50V,I <sub>D</sub> =0.8A                                             | -   | -    | -    | S    |
| Resistive Switching Characteristics                                     |                                     |                                                                                       |     |      |      |      |
| Turn-on Delay Time                                                      | T <sub>d(on)</sub>                  | V <sub>GS</sub> =10V,V <sub>DD</sub> =50V,<br>R <sub>G</sub> =3Ω,I <sub>D</sub> =1.2A | -   | 12   | -    | nS   |
| Turn-on Rise Time                                                       | t <sub>r</sub>                      |                                                                                       | -   | 7.6  | -    | nS   |
| Turn-Off Delay Time                                                     | T <sub>d(off)</sub>                 |                                                                                       | -   | 36   | -    | nS   |
| Turn-Off Fall Time                                                      | T <sub>f</sub>                      |                                                                                       | -   | 9.2  | -    | nS   |
| Total Gate Charge                                                       | Q <sub>g</sub>                      | V <sub>DS</sub> =50V,I <sub>D</sub> =1.2A,<br>V <sub>GS</sub> =0 to 10V               | -   | 14.8 | -    | nC   |
| Gate-Source Charge                                                      | Q <sub>gs</sub>                     |                                                                                       | -   | 3    | -    | nC   |
| Gate-Drain Charge                                                       | Q <sub>gd</sub>                     |                                                                                       | -   | 4.4  | -    | nC   |
| Source-Drain Diode Characteristics                                      |                                     |                                                                                       |     |      |      |      |
| Diode Forward Voltage <sup>2</sup>                                      | V <sub>SD</sub>                     | V <sub>GS</sub> =0V,I <sub>S</sub> =4A , T <sub>J</sub> =25℃                          | -   | -    | 1.2  | V    |
| Maximum Continuous Drain to Source Diode Forward Current <sup>1,5</sup> | I <sub>S</sub>                      | V <sub>G</sub> =V <sub>D</sub> =0V,Force Current                                      | -   | -    | 4    | A    |

Note :

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature.
- 2.EAS condition: Starting  $T_J=25^{\circ}\text{C}$ ,  $V_{DD}=50\text{V}$ ,  $V_G=10\text{V}$ ,  $R_G=25\Omega$ ,  $L=0.5\text{mH}$ ,  $I_{AS}=7\text{A}$
- 3.Pulse Test: Pulse Width $\leq 300\mu\text{s}$ , Duty Cycle $\leq 0.5\%$ .

## Typical Characteristics

Figure 1. Output Characteristics

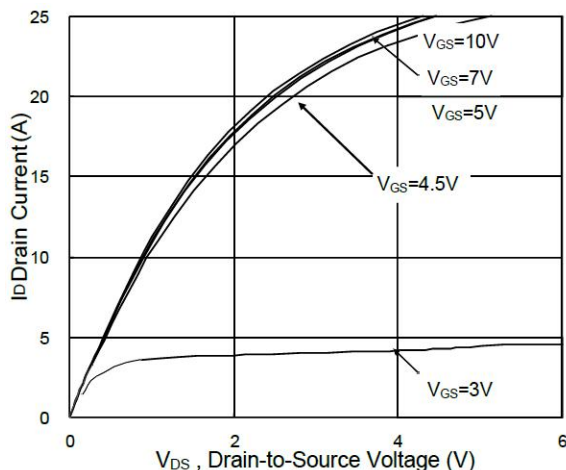


Figure 2. On-Resistance vs. Gate-Source

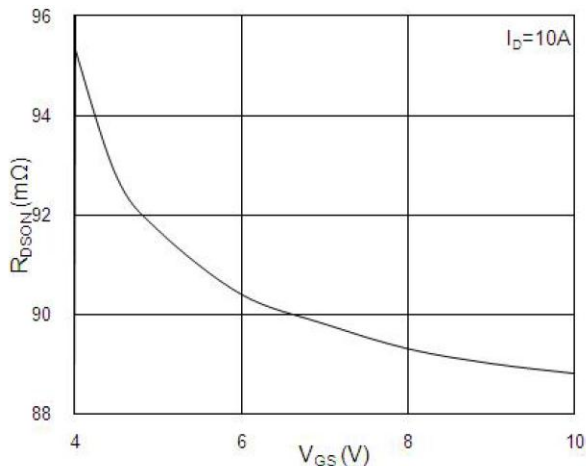


Figure 3. Forward Characteristics of Reverse

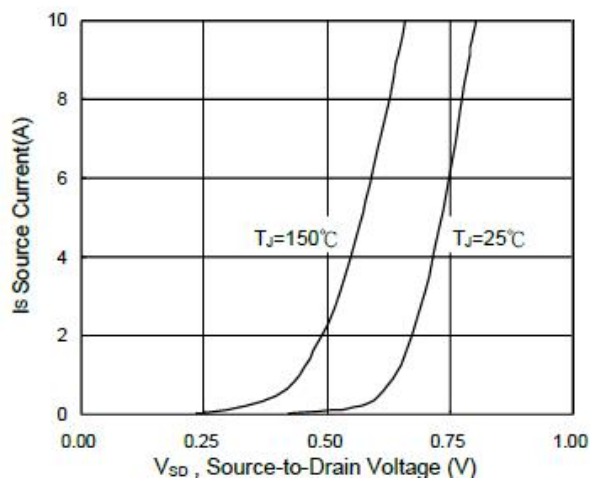


Figure 4. Gate-Charge Characteristics

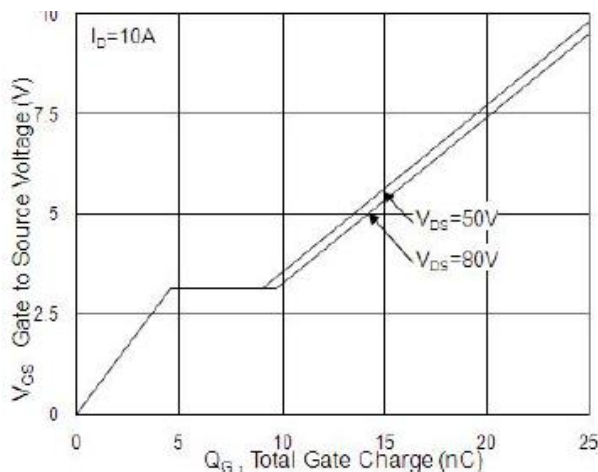


Figure 5: Normalized  $V_{GS(th)}$  vs.  $T_J$

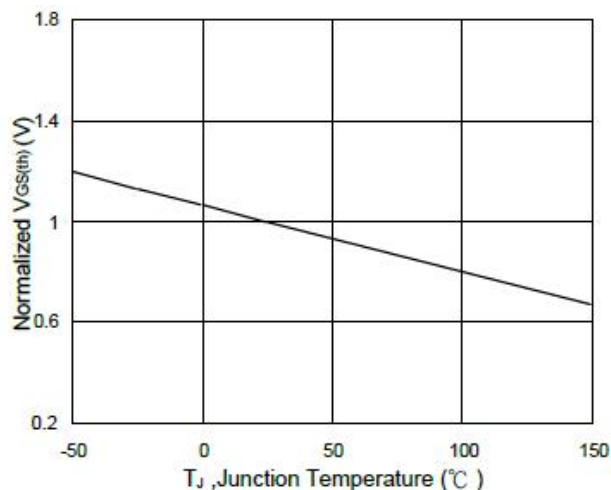


Figure 6: Normalized  $R_{DS(on)}$  vs.  $T_J$

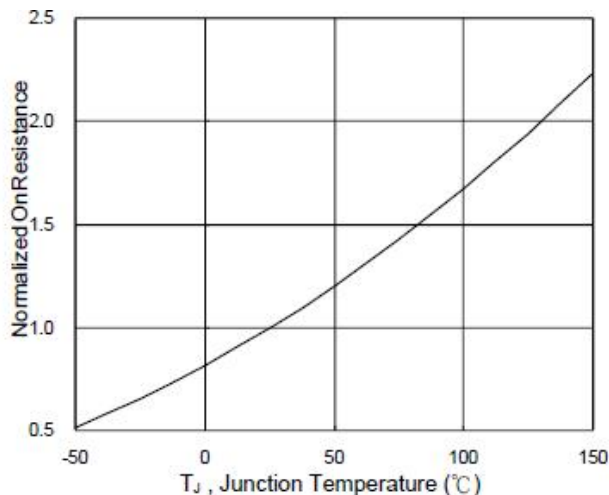


Figure 7: Capacitance

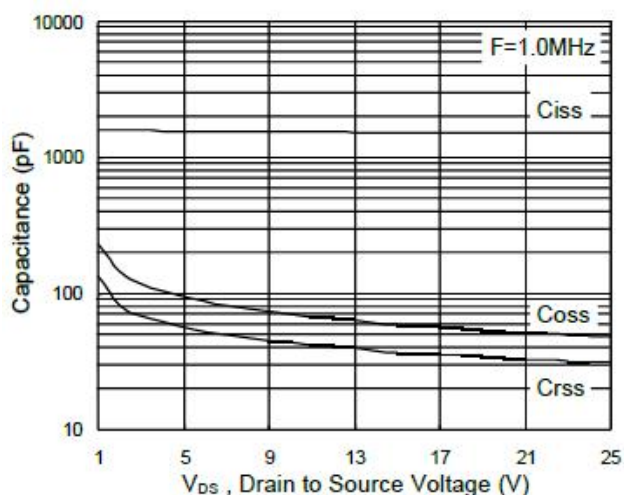


Figure 8: Safe Operating Area

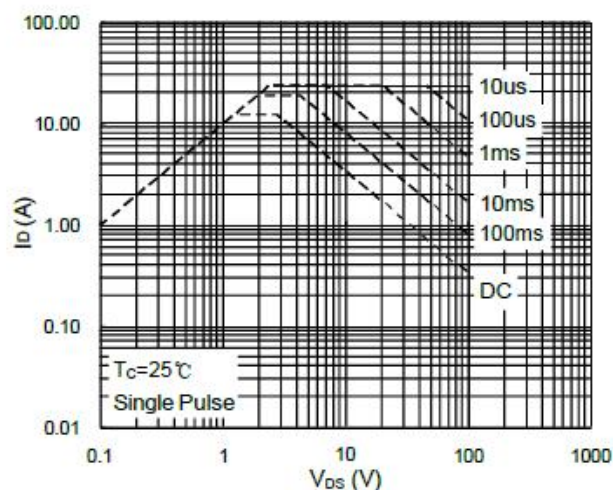


Figure 9: Normalized Maximum Transient Thermal Impedance

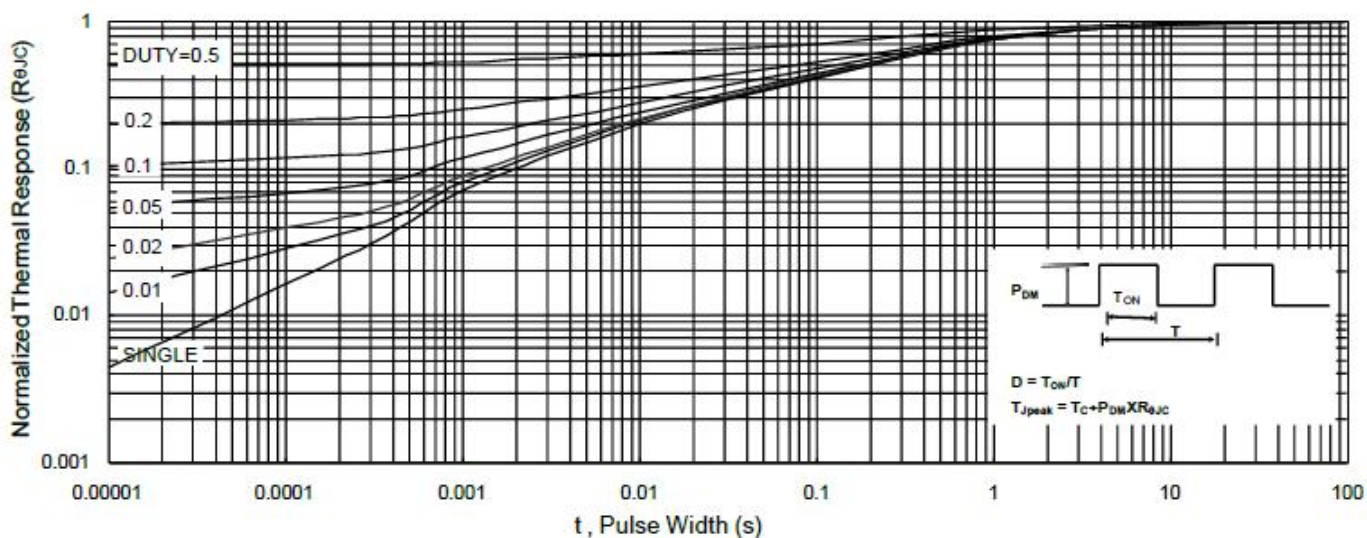


Figure 10: Switching Time Waveform

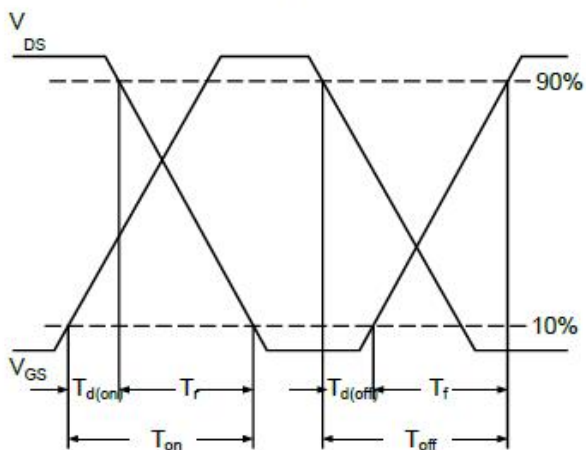
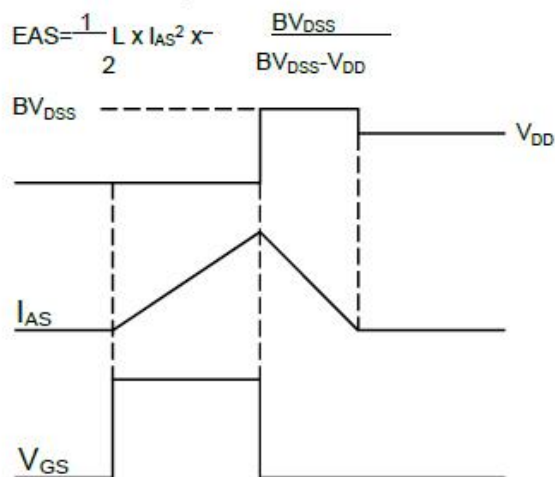
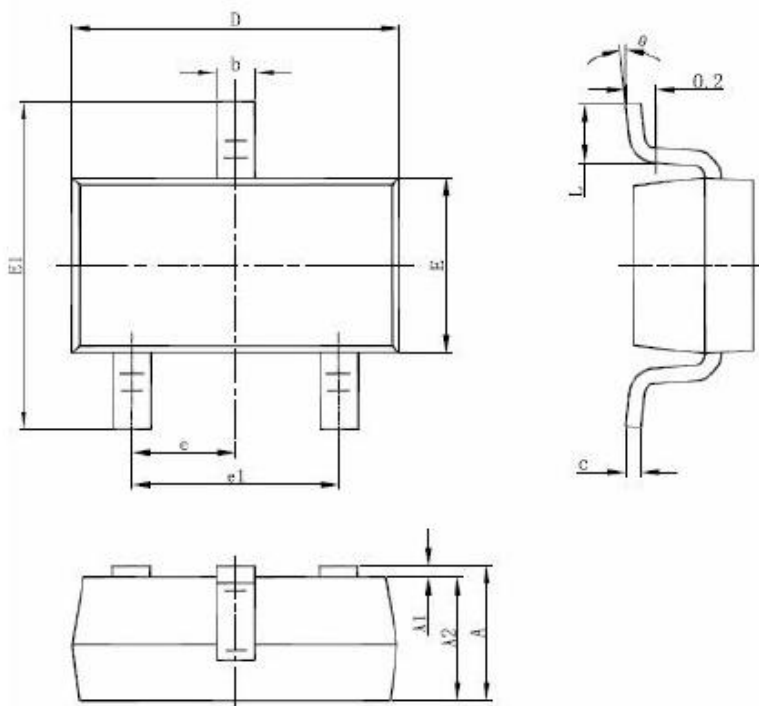


Figure 11: Unclamped Inductive Switching Waveform



**Package Dimensions SOT23-3L**


| 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 |
| E      | 1.500                     | 1.700 | 0.059                | 0.067 |
| E1     | 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°    |



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