



## Description

The HM6311 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 2.5V. This device is suitable for use as a Battery protection or in other Switching application.

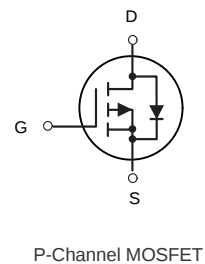
## General Features

$V_{DS} = -30V, I_D = -9.5A$

$R_{DS(ON)} < 20m\Omega @ V_{GS} = -10V$

## Application

High power and current handing capability  
Lead free product is acquired  
Surface mount package  
PWM applications  
Load switch  
Power management



## Package Marking and Ordering Information

| Product ID | Pack      | Marking | Qty(PCS) |
|------------|-----------|---------|----------|
| HM6311     | SOT-23-3L | 30P10   | 3000PCS  |

## Absolute Maximum Ratings ( $T_A = 25^\circ C$ unless otherwise noted)

| Symbol          | Parameter                                       | Max.                | Units        |
|-----------------|-------------------------------------------------|---------------------|--------------|
| $V_{DSS}$       | Drain-Source Voltage                            | -30                 | V            |
| $V_{GSS}$       | Gate-Source Voltage                             | $\pm 20$            | V            |
| $I_D$           | Continuous Drain Current                        | $T_A = 25^\circ C$  | A            |
|                 |                                                 | $T_A = 100^\circ C$ | A            |
| $I_{DM}$        | Pulsed Drain Current <sup>note1</sup>           | -46                 | A            |
| $E_{AS}$        | Single Pulsed Avalanche Energy <sup>note2</sup> | 35                  | mJ           |
| $P_D$           | Power Dissipation $T_A = 25^\circ C$            | 3.0                 | W            |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient         | 48                  | $^\circ C/W$ |
| $T_J, T_{STG}$  | Operating and Storage Temperature Range         | -55 to +150         | $^\circ C$   |



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

| Symbol                                                 | Parameter                                                | Test Condition                                                                                  | Min. | Typ. | Max. | Units |
|--------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------|------|------|------|-------|
| Off Characteristic                                     |                                                          |                                                                                                 |      |      |      |       |
| V <sub>(BR)DSS</sub>                                   | Drain-Source Breakdown Voltage                           | V <sub>GS</sub> =0V, I <sub>D</sub> = -250μA                                                    | -30  | -    | -    | V     |
| I <sub>DSS</sub>                                       | Zero Gate Voltage Drain Current                          | V <sub>DS</sub> = -30V, V <sub>GS</sub> =0V,                                                    | -    | -    | -1   | μA    |
| I <sub>GSS</sub>                                       | Gate to Body Leakage Current                             | V <sub>DS</sub> =0V, V <sub>GS</sub> = ±20V                                                     | -    | -    | ±100 | nA    |
| On Characteristics                                     |                                                          |                                                                                                 |      |      |      |       |
| V <sub>GS(th)</sub>                                    | Gate Threshold Voltage                                   | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> = -250μA                                      | -1.0 | -1.6 | -2.5 | V     |
| R <sub>DS(on)</sub>                                    | Static Drain-Source on-Resistance<br>Note3               | V <sub>GS</sub> = -10V, I <sub>D</sub> = - 5A                                                   | -    | 14   | 20   | mΩ    |
|                                                        |                                                          | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -5A                                                   | -    | 19   | 27   |       |
| Dynamic Characteristics                                |                                                          |                                                                                                 |      |      |      |       |
| C <sub>iss</sub>                                       | Input Capacitance                                        | V <sub>DS</sub> = -15V, V <sub>GS</sub> =0V,<br>f=1.0MHz                                        | -    | 1330 | -    | pF    |
| C <sub>Oss</sub>                                       | Output Capacitance                                       |                                                                                                 | -    | 183  | -    | pF    |
| C <sub>rss</sub>                                       | Reverse Transfer Capacitance                             |                                                                                                 | -    | 156  | -    | pF    |
| Q <sub>g</sub>                                         | Total Gate Charge                                        | V <sub>DS</sub> = -15V, I <sub>D</sub> = -5A,<br>V <sub>GS</sub> = -10V                         | -    | 22   | -    | nC    |
| Q <sub>gs</sub>                                        | Gate-Source Charge                                       |                                                                                                 | -    | 1.0  | -    | nC    |
| Q <sub>gd</sub>                                        | Gate-Drain(“Miller”) Charge                              |                                                                                                 | -    | 1.8  | -    | nC    |
| Switching Characteristics                              |                                                          |                                                                                                 |      |      |      |       |
| t <sub>d(on)</sub>                                     | Turn-on Delay Time                                       | V <sub>DD</sub> = -15V, I <sub>D</sub> = -10A,<br>V <sub>GS</sub> =-10V, R <sub>GEN</sub> =2.5Ω | -    | 9    | -    | ns    |
| t <sub>r</sub>                                         | Turn-on Rise Time                                        |                                                                                                 | -    | 13   | -    | ns    |
| t <sub>d(off)</sub>                                    | Turn-off Delay Time                                      |                                                                                                 | -    | 48   | -    | ns    |
| t <sub>f</sub>                                         | Turn-off Fall Time                                       |                                                                                                 | -    | 20   | -    | ns    |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                          |                                                                                                 |      |      |      |       |
| I <sub>S</sub>                                         | Maximum Continuous Drain to Source Diode Forward Current |                                                                                                 | -    | -    | -9.5 | A     |
| I <sub>SM</sub>                                        | Maximum Pulsed Drain to Source Diode Forward Current     |                                                                                                 | -    | -    | -46  | A     |
| V <sub>SD</sub>                                        | Drain to Source Diode Forward Voltage                    | V <sub>GS</sub> =0V, I <sub>S</sub> = -15A                                                      | -    | -0.8 | -1.2 | V     |
| t <sub>rr</sub>                                        | Reverse Recovery Time                                    | T <sub>J</sub> =25℃,                                                                            | -    | 64   | -    | ns    |
| Q <sub>rr</sub>                                        | Reverse Recovery Charge                                  | V <sub>DD</sub> = -24V, I <sub>F</sub> =-2.8A,<br>dI/dt=-100A/μs                                | -    | 25   | -    | nC    |

Notes:1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature

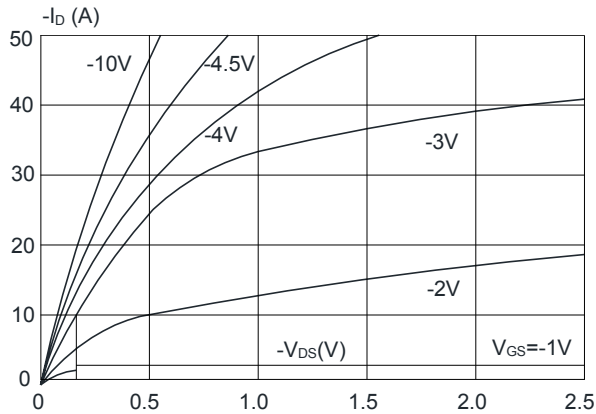
2. EAS condition: T<sub>J</sub>=25°C, V<sub>GS</sub>=10V, R<sub>G</sub>=25Ω, L=0.5mH, I<sub>AS</sub>=-12.7A

3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%

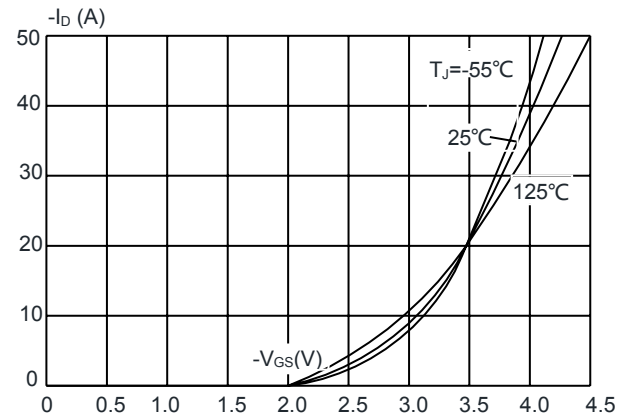


## Typical Performance Characteristics

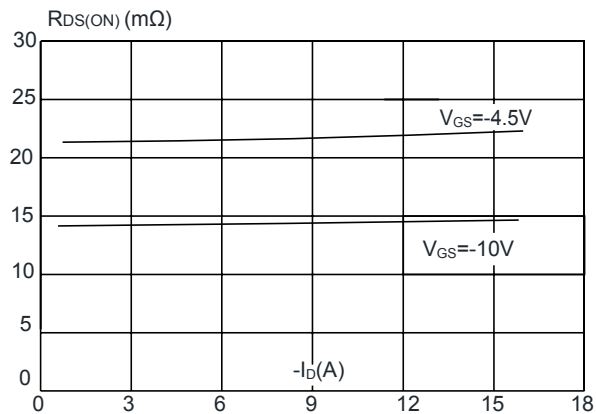
**Figure1: Output Characteristics**



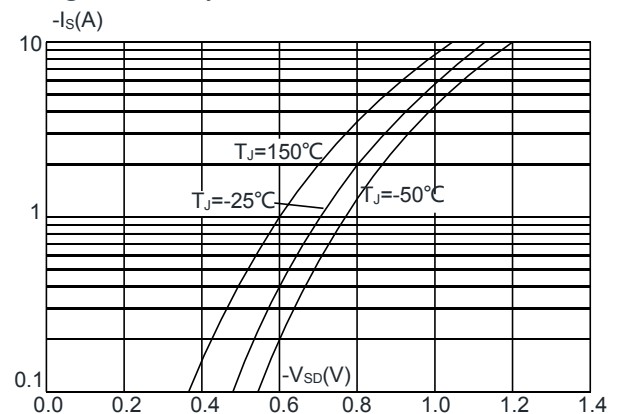
**Figure 2: Typical Transfer Characteristics**



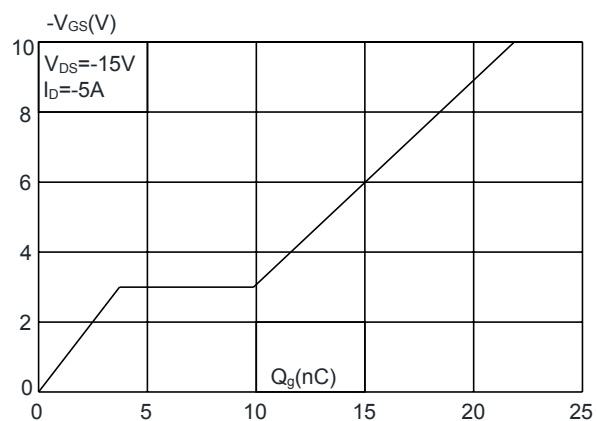
**Figure 3: On-resistance vs. Drain Current**



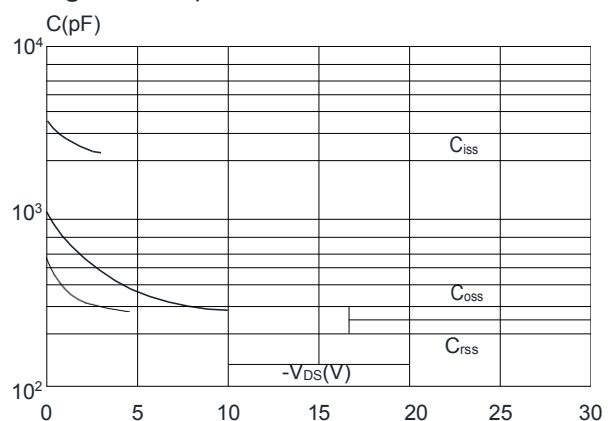
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**

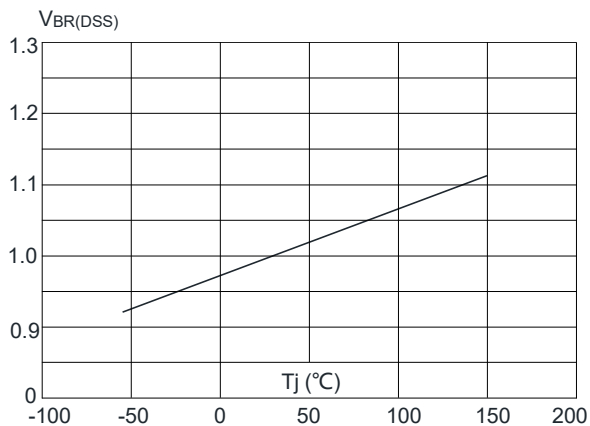


**Figure 6: Capacitance Characteristics**

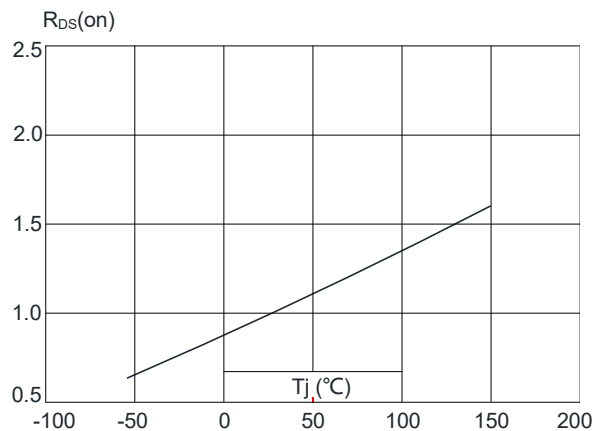




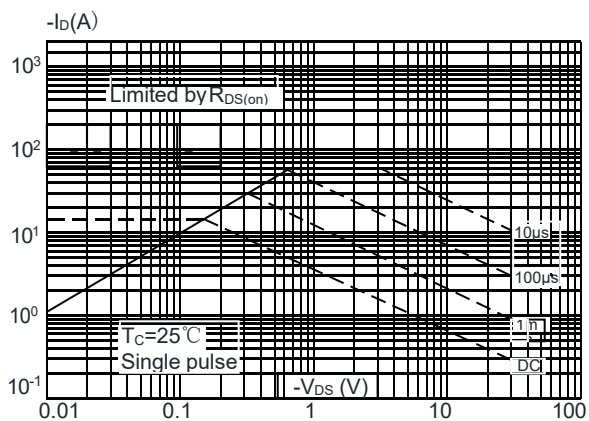
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



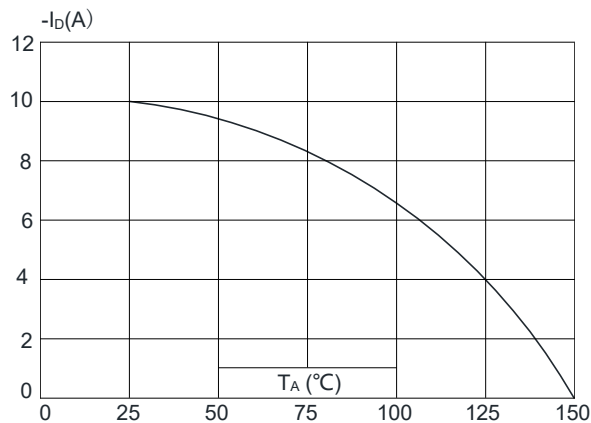
**Figure 8:** Normalized on Resistance vs. Junction Temperature



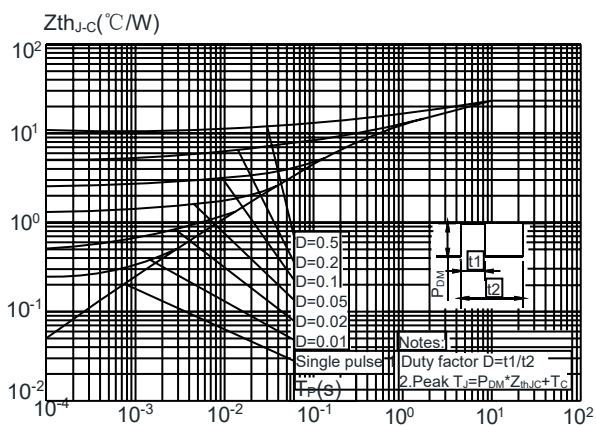
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



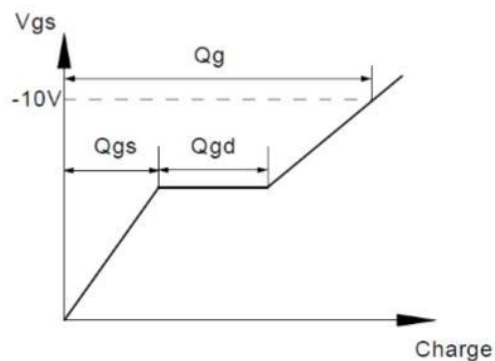
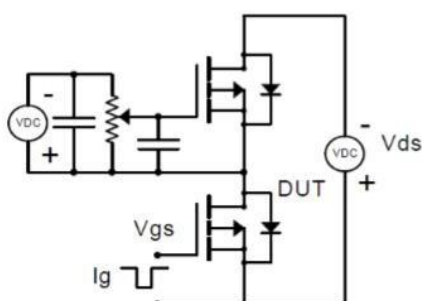
**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case



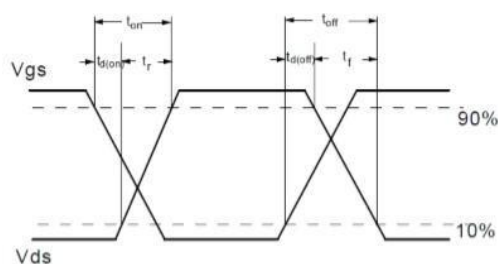
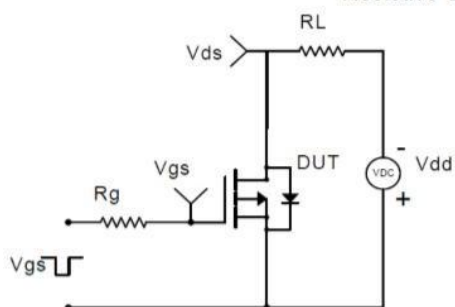


## Test Circuit

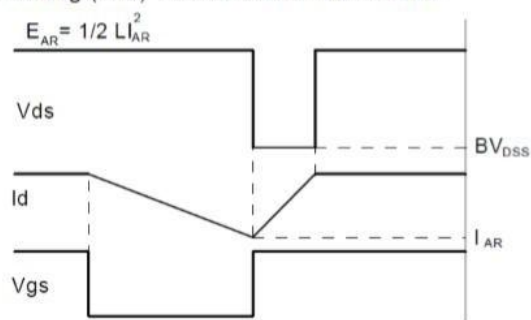
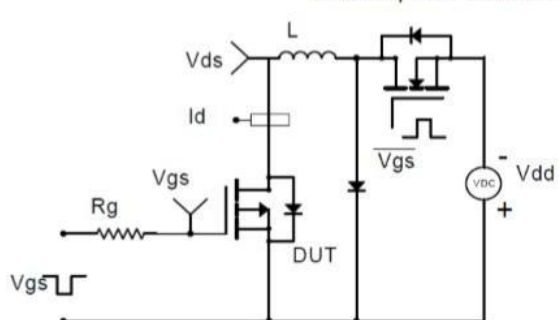
Gate Charge Test Circuit & Waveform



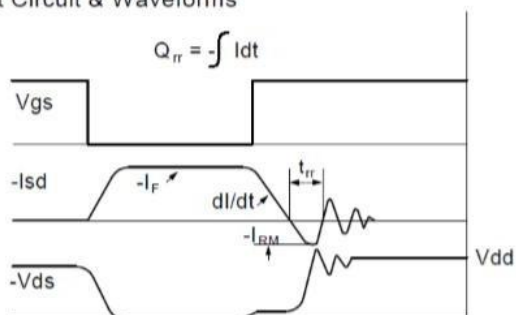
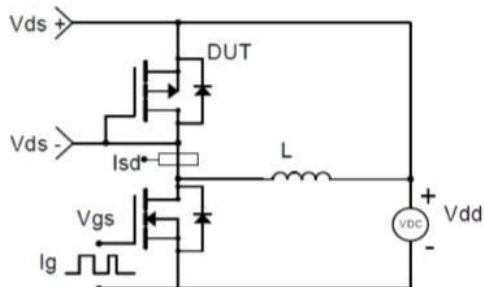
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms





## SOT-23-3L Package Information



| Symbol | Dimensions in Millimeters |       |
|--------|---------------------------|-------|
|        | MIN.                      | MAX.  |
| A      | 1.050                     | 1.250 |
| A1     | 0.000                     | 0.100 |
| A2     | 1.050                     | 1.150 |
| b      | 0.300                     | 0.500 |
| c      | 0.100                     | 0.200 |
| D      | 2.800                     | 3.000 |
| E      | 1.500                     | 1.700 |
| E1     | 2.650                     | 2.950 |
| e      | 0.950TYP                  |       |
| e1     | 1.800                     | 2.000 |
| L      | 0.550REF                  |       |
| L1     | 0.300                     | 0.600 |
| θ      | 0°                        | 8°    |



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