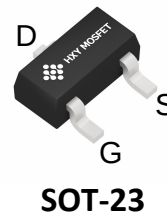




## Description

The HSSM3J331RLF 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 load switch or in PWM applications.

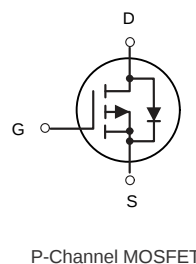


## General Features

$V_{DS} = -20V, I_D = -4.2A$   
 $R_{DS(ON)} < 55m\Omega @ V_{GS} = -4.5V$   
 $R_{DS(ON)} < 75m\Omega @ V_{GS} = -2.5V$

## Application

PWM applications  
Load switch  
Power management



P-Channel MOSFET

## Ordering Information

| Product ID   | Pack   | Marking | Qty(PCS) |
|--------------|--------|---------|----------|
| HSSM3J331RLF | SOT-23 | A5SHB   | 3000     |

## Absolute Maximum Ratings (TA=25°C unless otherwise noted)

| Symbol          | Parameter                                        | Limit      | Unit |
|-----------------|--------------------------------------------------|------------|------|
| $V_{DS}$        | Drain-Source Voltage                             | -20        | V    |
| $V_{GS}$        | Gate-Source Voltage                              | $\pm 12$   | V    |
| $I_D$           | Drain Current-Continuous                         | -4.2       | A    |
| $I_{DM}$        | Drain Current-Pulsed (Note 1)                    | -15        | A    |
| $P_D$           | Maximum Power Dissipation                        | 1.7        | W    |
| $T_J, T_{STG}$  | Operating Junction and Storage Temperature Range | -55 To 150 | °C   |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 2) | 74         | °C/W |



**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

| Parameter                          | Symbol              | Condition                                                                                    | Min   | Typ  | Max  | Unit |
|------------------------------------|---------------------|----------------------------------------------------------------------------------------------|-------|------|------|------|
| Off Characteristics                |                     |                                                                                              |       |      |      |      |
| Drain-Source Breakdown Voltage     | BV <sub>DSS</sub>   | V <sub>GS</sub> =0V I <sub>D</sub> =-250μA                                                   | -20   | -    | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>    | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V                                                   | -     | -    | -1   | μA   |
| Gate-Body Leakage Current          | I <sub>GSS</sub>    | V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V                                                   | -     | -    | ±100 | nA   |
| On Characteristics (Note 3)        |                     |                                                                                              |       |      |      |      |
| Gate Threshold Voltage             | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                    | -0.45 | -0.7 | -1.0 | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-4A                                                  | -     | 48   | 55   | mΩ   |
|                                    |                     | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-3A                                                  | -     | 60   | 75   |      |
| Forward Transconductance           | g <sub>FS</sub>     | V <sub>DS</sub> =-5V, I <sub>D</sub> =-4.2A                                                  | -     | 6    | -    | S    |
| Dynamic Characteristics (Note4)    |                     |                                                                                              |       |      |      |      |
| Input Capacitance                  | C <sub>iss</sub>    | V <sub>DS</sub> =-4V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                       | -     | 740  | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>    |                                                                                              | -     | 290  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>    |                                                                                              | -     | 190  | -    | PF   |
| Switching Characteristics (Note 4) |                     |                                                                                              |       |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>  | V <sub>DD</sub> =-4V, ,R <sub>L</sub> =-1.2Ω,<br>V <sub>GEN</sub> =-4.5V, R <sub>g</sub> =1Ω | -     | 12   | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>      |                                                                                              | -     | 35   | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub> |                                                                                              | -     | 30   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>      |                                                                                              | -     | 10   | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>      | V <sub>DS</sub> =-4V, I <sub>D</sub> =-4.1A, V <sub>GS</sub> =-4.5V                          | -     | 7.8  | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>     |                                                                                              | -     | 1.2  | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>     |                                                                                              | -     | 1.6  | -    | nC   |
| Drain-Source Diode Characteristics |                     |                                                                                              |       |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>     | V <sub>GS</sub> =0V, I <sub>S</sub> =-4.1A                                                   | -     | -    | -1.2 | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>      |                                                                                              | -     | -    | -4.1 | A    |

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production



## Typical Electrical and Thermal Characteristics

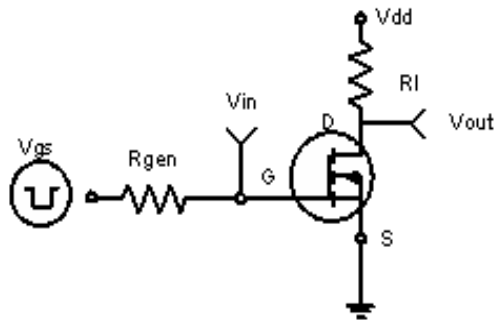


Figure 1: Switching Test Circuit

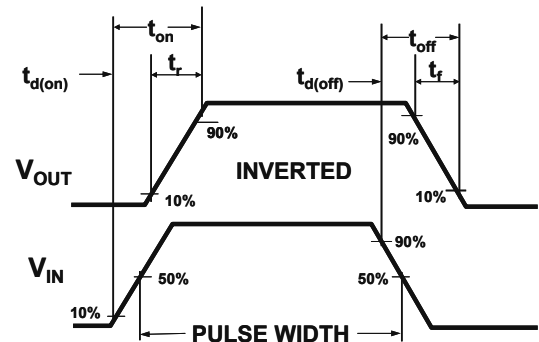
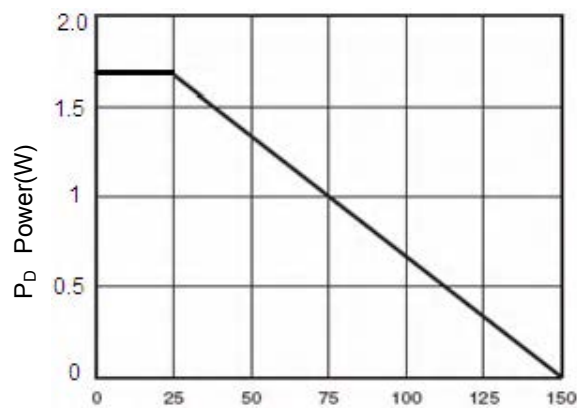
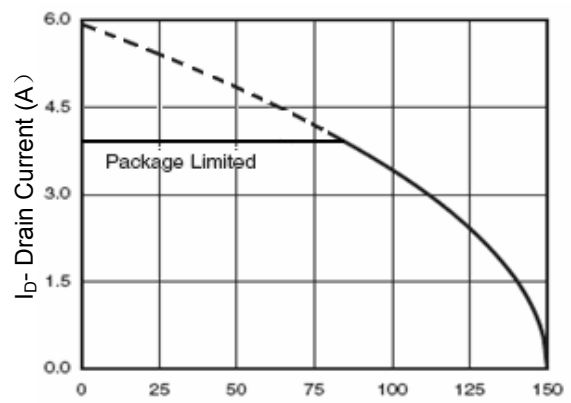


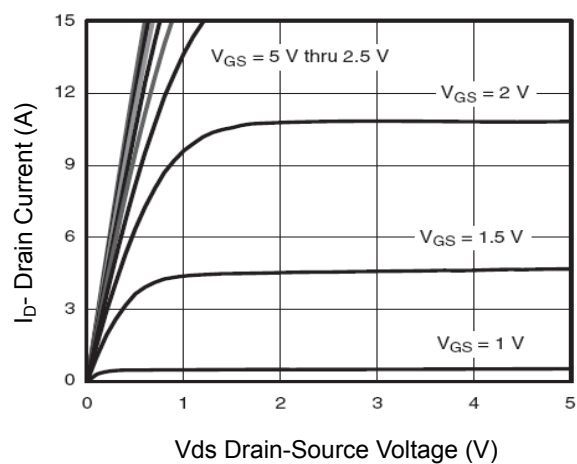
Figure 2: Switching Waveforms



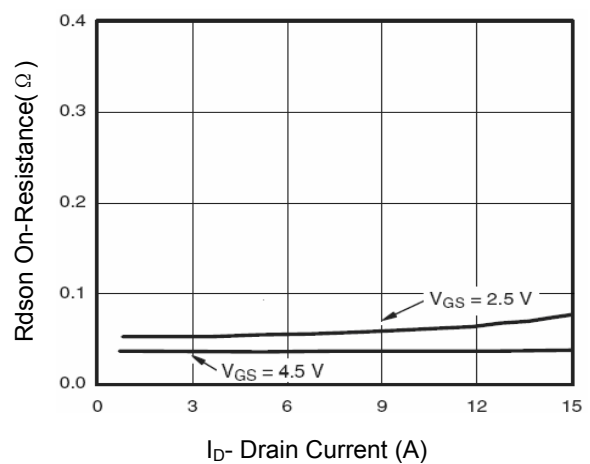
T<sub>J</sub>-Junction Temperature(°C)  
Figure 3 Power Dissipation



T<sub>J</sub>-Junction Temperature(°C)  
Figure 4 Drain Current



V<sub>ds</sub> Drain-Source Voltage (V)  
Figure 5 Output Characteristics



ID- Drain Current (A)  
Figure 6 Drain-Source On-Resistance

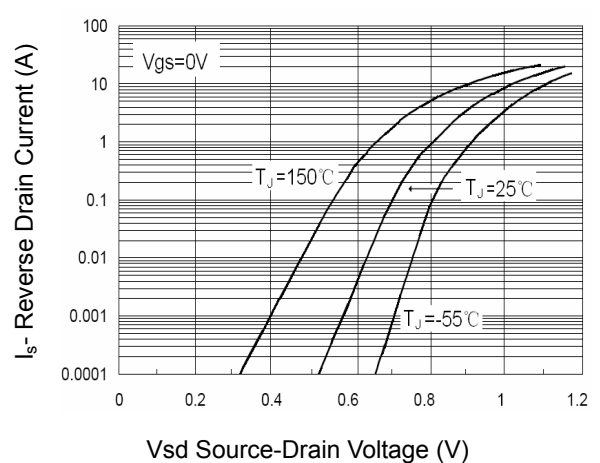
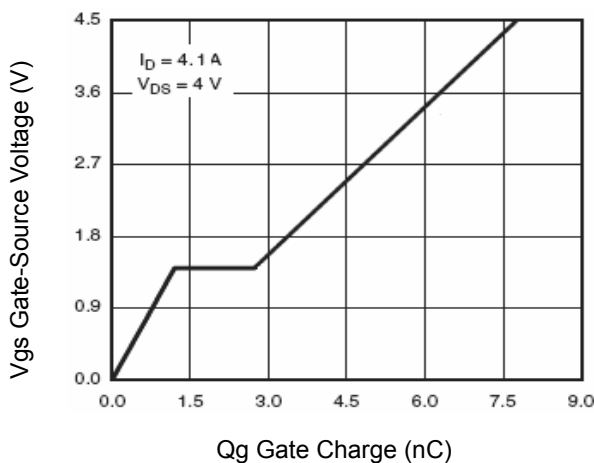
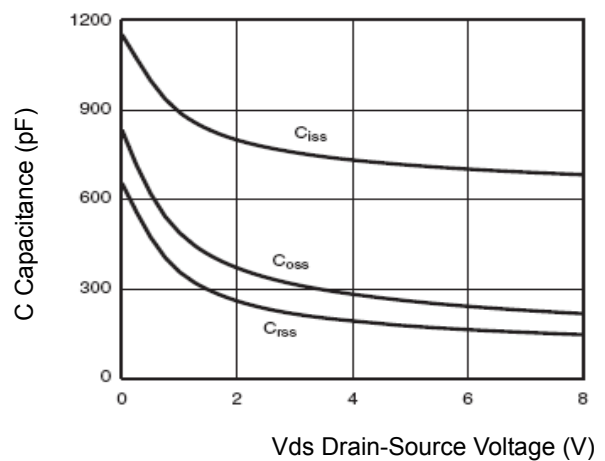
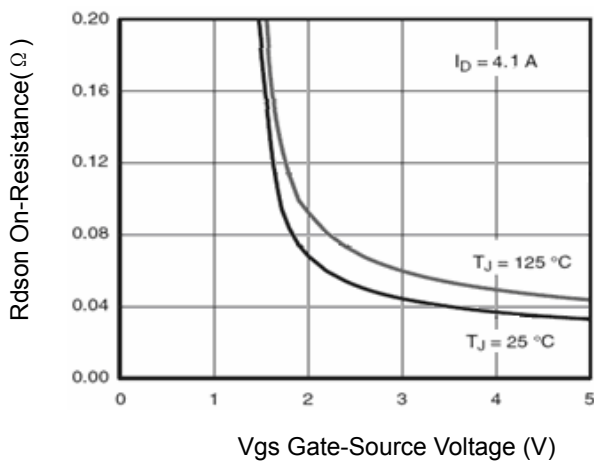
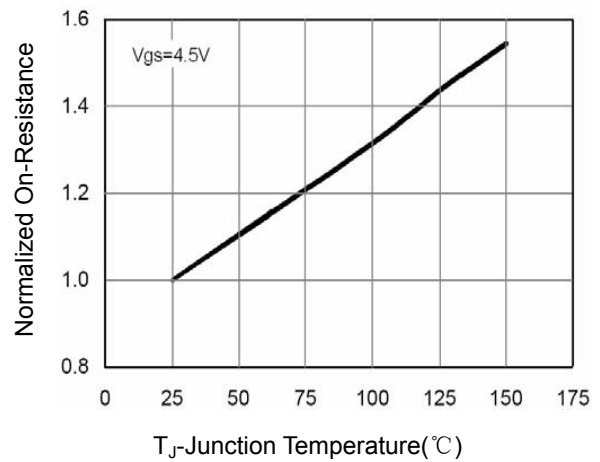




Figure 13 Safe Operation Area

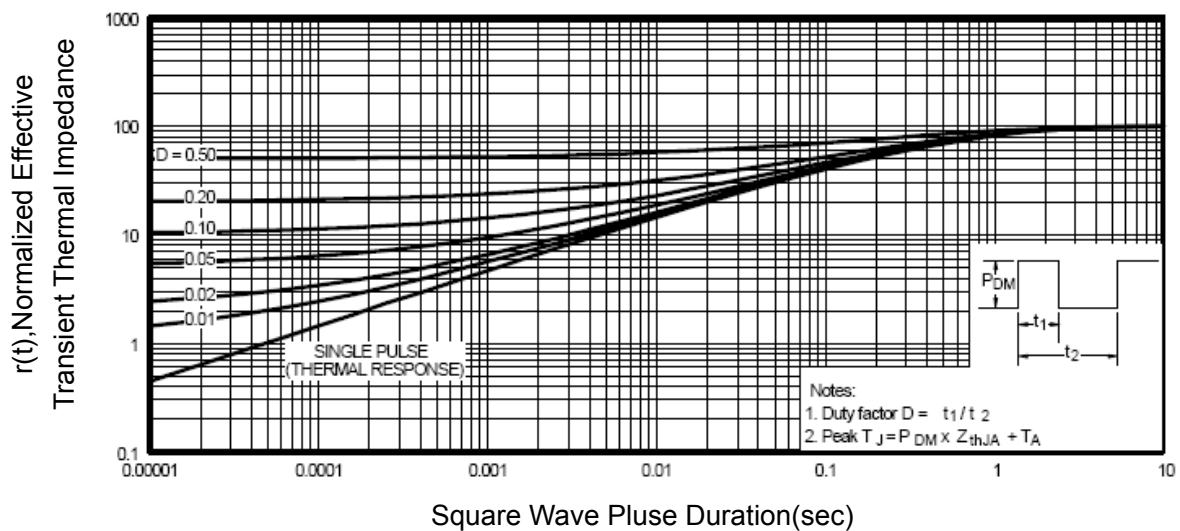
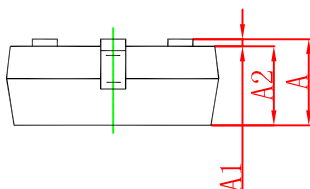
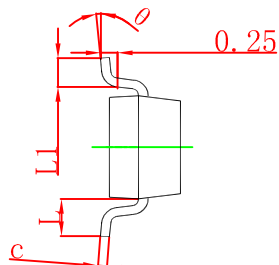
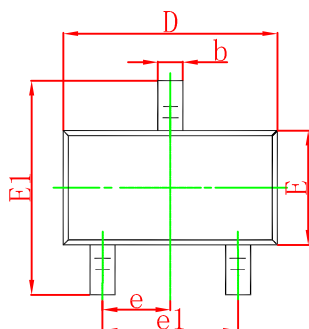


Figure 14 Normalized Maximum Transient Thermal Impedance

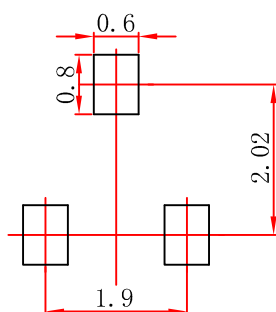


## SOT-23 Package Outline Dimensions



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min                       | Max   | Min                  | Max   |
| A      | 0.900                     | 1.150 | 0.035                | 0.045 |
| A1     | 0.000                     | 0.100 | 0.000                | 0.004 |
| A2     | 0.900                     | 1.050 | 0.035                | 0.041 |
| b      | 0.300                     | 0.500 | 0.012                | 0.020 |
| c      | 0.080                     | 0.150 | 0.003                | 0.006 |
| D      | 2.800                     | 3.000 | 0.110                | 0.118 |
| E      | 1.200                     | 1.400 | 0.047                | 0.055 |
| E1     | 2.250                     | 2.550 | 0.089                | 0.100 |
| e      | 0.950 TYP                 |       | 0.037 TYP            |       |
| e1     | 1.800                     | 2.000 | 0.071                | 0.079 |
| L      | 0.550 REF                 |       | 0.022 REF            |       |
| L1     | 0.300                     | 0.500 | 0.012                | 0.020 |
| θ      | 0°                        | 8°    | 0°                   | 8°    |

## SOT-23 Suggested Pad Layout



Note:  
1. Controlling dimension: in millimeters.  
2. General tolerance:  $\pm 0.05\text{mm}$ .  
3. The pad layout is for reference purposes only.



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