



## Description

The HRQ5C025TPTL uses advanced trench technology to provide excellent  $R_{DS(ON)}$ . This device is suitable for use as a load switch or in PWM applications.

## General Features

$V_{DS} = -20V, I_D = -3A$

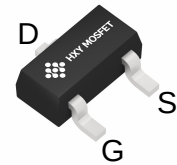
$R_{DS(ON)} < 80m\Omega @ V_{GS} = -4.5V$

## Application

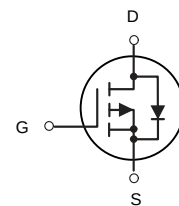
Battery protection

Load switch

Uninterruptible power supply



SOT-23



P-Channel MOSFET

## Ordering Information

| Product ID   | Pack   | Marking | Qty(PCS) |
|--------------|--------|---------|----------|
| HRQ5C025TPTL | SOT-23 | A1SHB   | 3000     |

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

| Symbol          | Parameter                                        | Limit      | Unit |
|-----------------|--------------------------------------------------|------------|------|
| $V_{DS}$        | Drain-Source Voltage                             | -20        | V    |
| $V_{GS}$        | Gate-Source Voltage                              | ±12        | V    |
| $I_D$           | Drain Current-Continuous                         | -3         | A    |
| $I_{DM}$        | Drain Current-Pulsed (Note 1)                    | -10        | A    |
| $P_D$           | Maximum Power Dissipation                        | 1          | W    |
| $T_J, T_{STG}$  | Operating Junction and Storage Temperature Range | -55 To 150 | ℃    |
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient (Note 2) | 125        | ℃/W  |



**Electrical Characteristics (TA=25°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  | -24  | -    | V    |
| Zero Gate Voltage Drain Current                   | I <sub>DSS</sub>    | V <sub>DS</sub> =-20V,V <sub>GS</sub> =0V                                              | -    | -    | -1   | μA   |
| Parameter                                         | Symbol              | Condition                                                                              | Min  | Typ  | Max  | Unit |
| Gate-Body Leakage Current                         | I <sub>GSS</sub>    | V <sub>GS</sub> =±12V,V <sub>DS</sub> =0V                                              | -    | -    | ±100 | nA   |
| On Characteristics <small>(Note 3)</small>        |                     |                                                                                        |      |      |      |      |
| Gate Threshold Voltage                            | V <sub>GS(th)</sub> | V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =-250μA                               | -0.4 | -0.7 | -1   | V    |
| Drain-Source On-State Resistance                  | R <sub>DS(ON)</sub> | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A                                            | -    | 60   | 80   | mΩ   |
|                                                   |                     | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-2A                                            | -    | 85   | 103  | mΩ   |
| Forward Transconductance                          | g <sub>FS</sub>     | V <sub>DS</sub> =-5V,I <sub>D</sub> =-2A                                               | 5    | -    | -    | S    |
| Dynamic Characteristics <small>(Note4)</small>    |                     |                                                                                        |      |      |      |      |
| Input Capacitance                                 | C <sub>iss</sub>    | V <sub>DS</sub> =-10V,V <sub>GS</sub> =0V,<br>F=1.0MHz                                 | -    | 405  | -    | PF   |
| Output Capacitance                                | C <sub>oss</sub>    |                                                                                        | -    | 75   | -    | PF   |
| Reverse Transfer Capacitance                      | C <sub>rss</sub>    |                                                                                        | -    | 55   | -    | PF   |
| Switching Characteristics <small>(Note 4)</small> |                     |                                                                                        |      |      |      |      |
| Turn-on Delay Time                                | t <sub>d(on)</sub>  | V <sub>DD</sub> =-10V,I <sub>D</sub> =-1A V <sub>GS</sub> =-4.5V,R <sub>GEN</sub> =10Ω | -    | 11   | -    | 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> =-10V,I <sub>D</sub> =-3A,<br>V <sub>GS</sub> =-2.5V                   | -    | 3.3  | 12   | nC   |
| Gate-Source Charge                                | Q <sub>gs</sub>     |                                                                                        | -    | 0.7  | -    | nC   |
| Gate-Drain Charge                                 | Q <sub>gd</sub>     |                                                                                        | -    | 1.3  | -    | nC   |
| Drain-Source Diode Characteristics                |                     |                                                                                        |      |      |      |      |
| Diode Forward Voltage <small>(Note 3)</small>     | V <sub>SD</sub>     | V <sub>GS</sub> =0V,I <sub>S</sub> =1.3A                                               | -    | -    | -1.2 | V    |
| Diode Forward Current <small>(Note 2)</small>     | I <sub>S</sub>      |                                                                                        | -    | -    | -3   | A    |

**Notes:**

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



## Typical Electrical and Thermal Characteristics

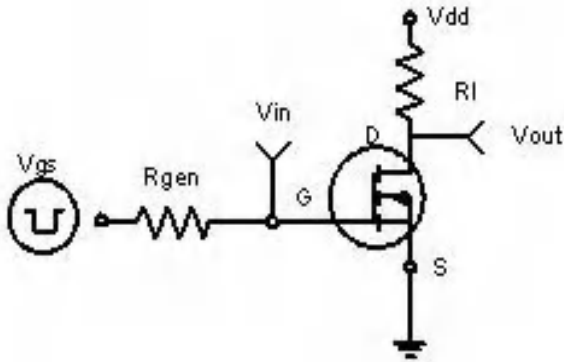


Figure 1: Switching Test Circuit

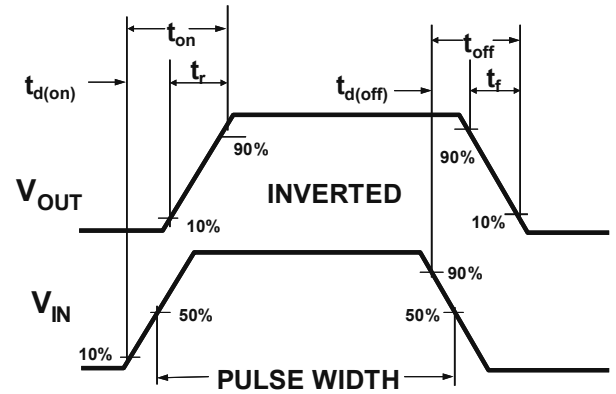
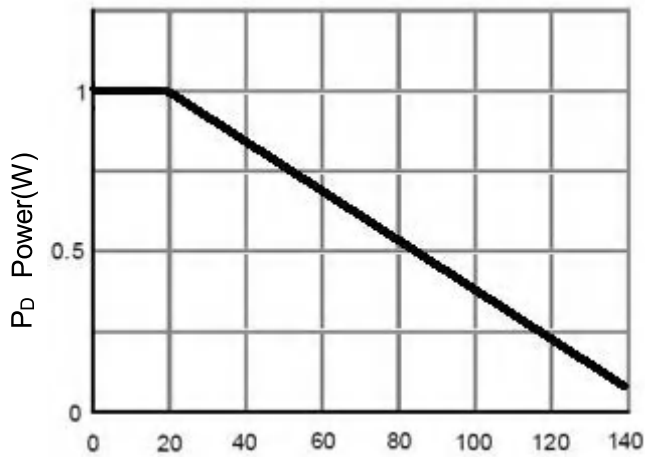
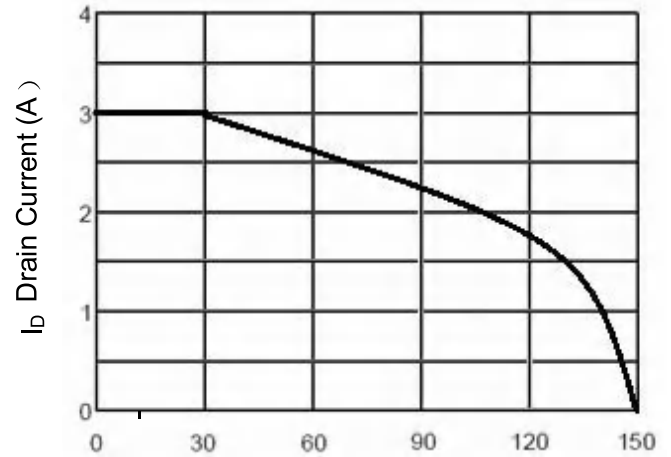


Figure 2: Switching Waveforms



T<sub>J</sub>-Junction Temperature(°C)

Figure 3 Power Dissipation



T<sub>J</sub>-Junction Temperature(°C)

Figure 4 Drain Current

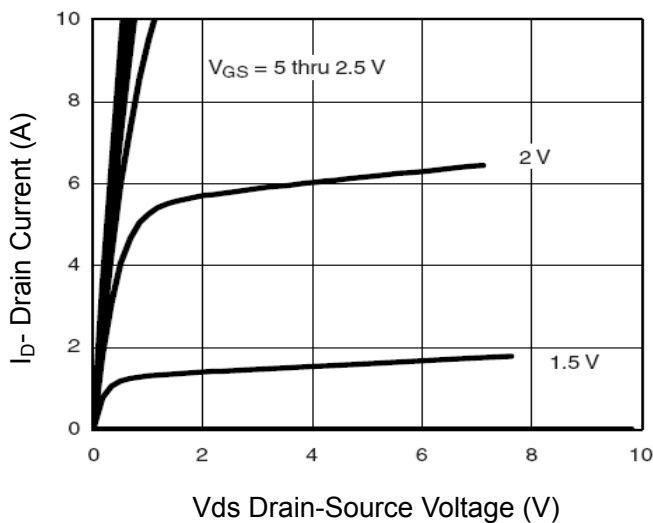


Figure 5 Output Characteristics

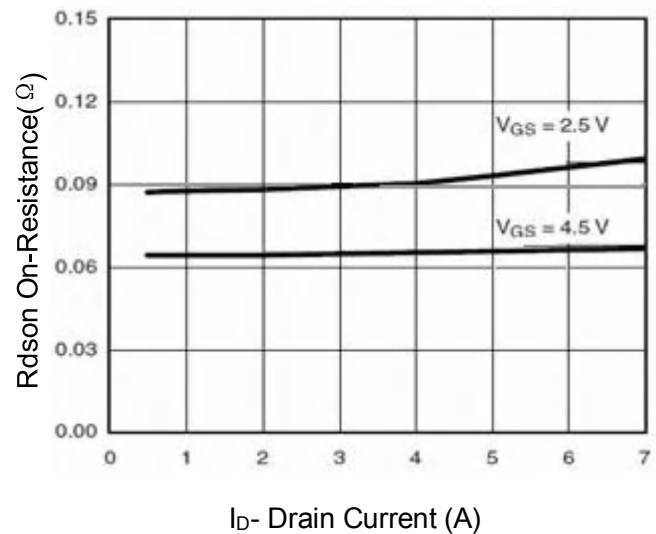
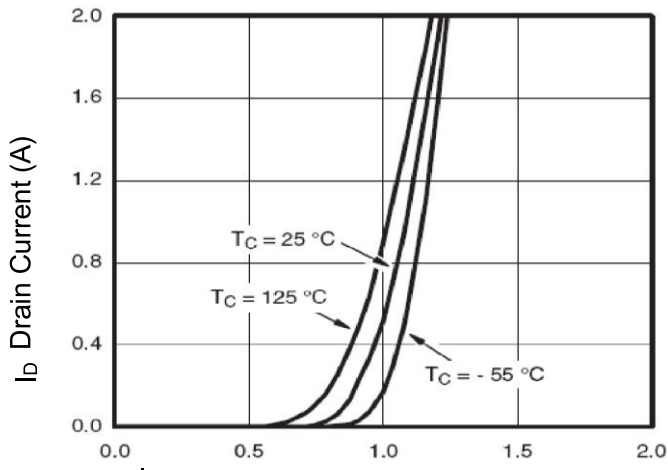
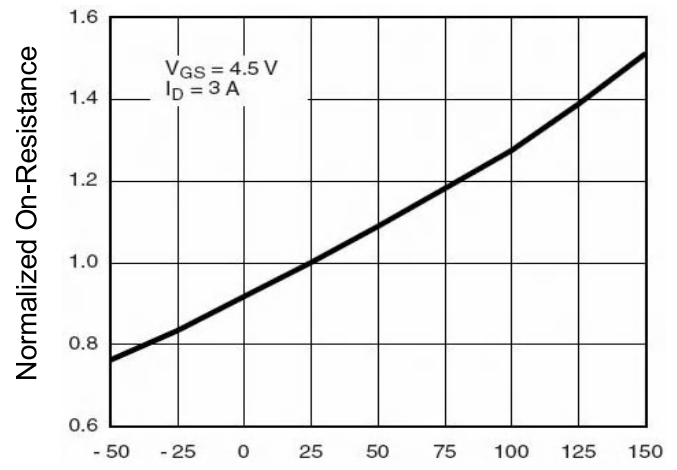


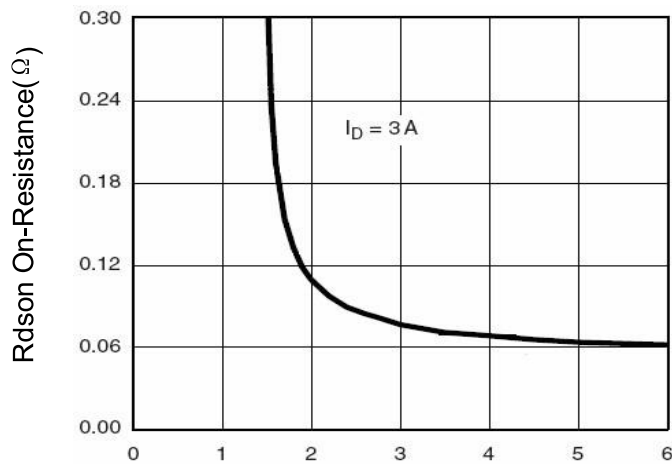
Figure 6 Drain-Source On-Resistance



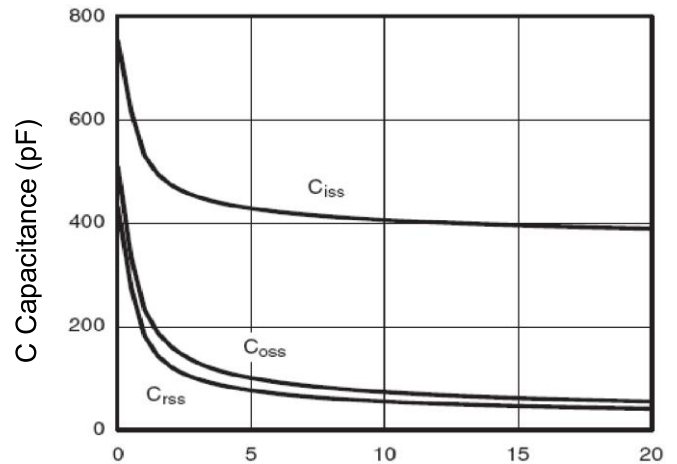
V<sub>GS</sub> Gate-Source Voltage (V)  
**Figure 7 Transfer Characteristics**



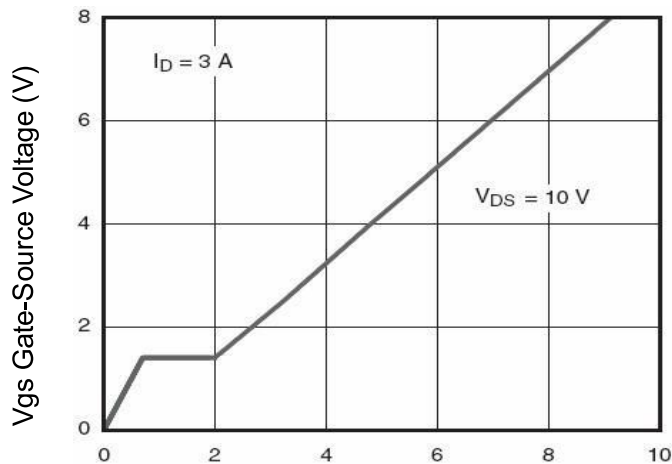
T<sub>J</sub>-Junction Temperature( $^{\circ}\text{C}$ )  
**Figure 8 Drain-Source On-Resistance**



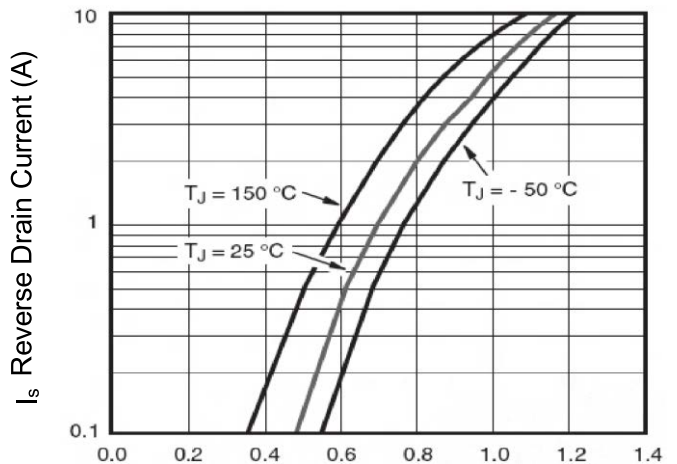
V<sub>GS</sub> Gate-Source Voltage (V)  
**Figure 9 Rdson vs Vgs**



V<sub>DS</sub> Drain-Source Voltage (V)  
**Figure 10 Capacitance vs Vds**



Q<sub>g</sub> Gate Charge (nC)  
**Figure 11 Gate Charge**



V<sub>SD</sub> Source-Drain Voltage (V)  
**Figure 12 Source- Drain Diode Forward**

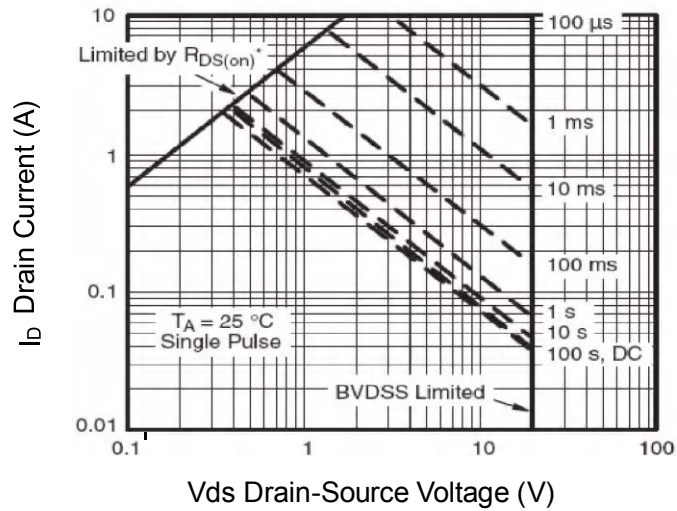


Figure 13 Safe Operation Area

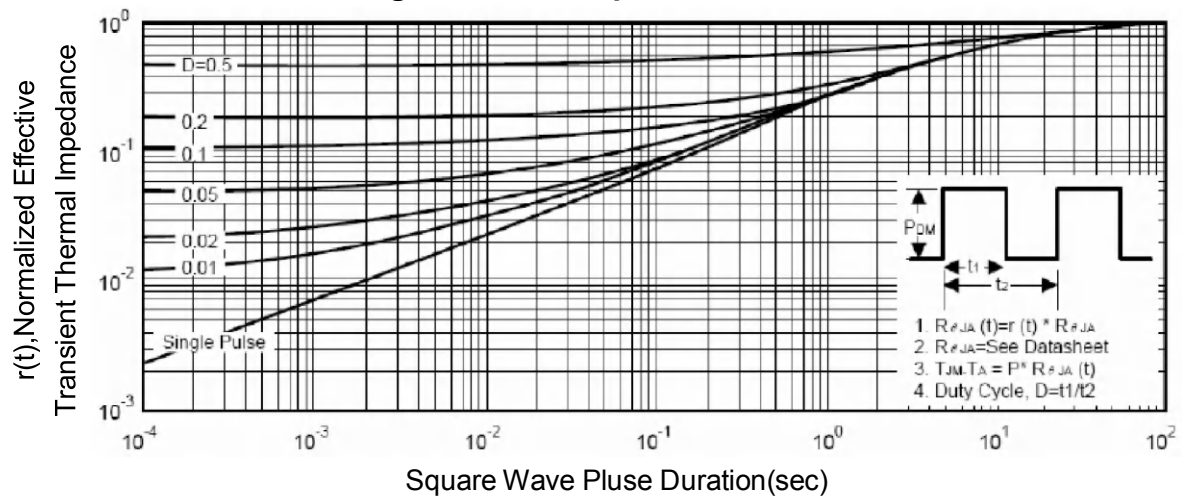
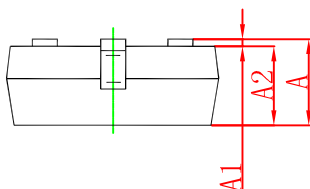
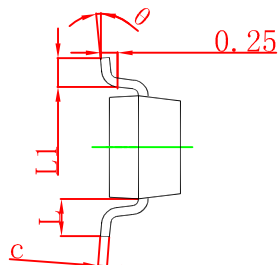
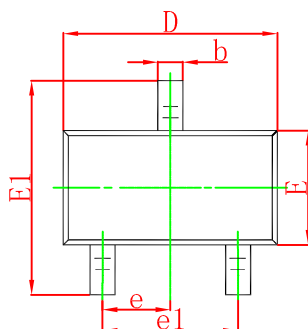


Figure 14 Normalized Maximum Transient Thermal Impedance

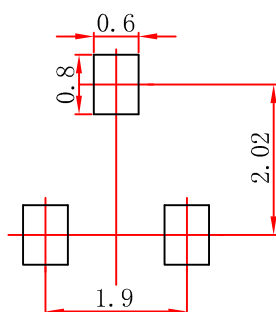


## SOT-23 Package Outline Dimensions



| 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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