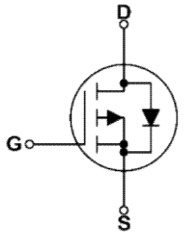
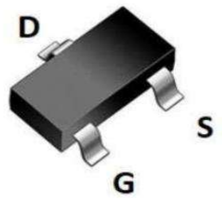
## P-Channel Trench Mode MOSFET -20V/3.4A

| Parameter | Value | Unit |
|---|---|---|
| $V_{DS}$ | -20 | V |
| $R_{DS(on)}$, typ @$V_{GS}$ = -4.5V | 36 | mΩ |
| $I_D$ @Continuous ($T_C$ = 25℃) | -3.4 | A |
| $V_{GSS}$ typ | ±12 | V |





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## Features

- Si P-channel trench MOSFET
- Very Low On-resistance $R_{DS(ON)}$
- Low $C_{rss}$
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

## Applications

- PWM applications
- Load Switch
- Power Management

## MAXIMUM RATINGS (Ta=25°Cunless otherwise noted)

| Symbol | Parameter | | Value | Units |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-Source Voltage | | -20 | V |
| $I_D$ | Drain Current | -Continuous ($T_C$ = 25℃) | -3.4 | A |
| | | -Continuous ($T_C$ = 100℃) | -2.1 | A |
| $I_{DM}$ | Drain Current | - Pulsed (Note 1) | -14 | A |
| $V_{GSS}$ | Gate-Source Voltage | | ±12 | V |
| $P_D$ | Power Dissipation ($T_A$ = 25℃) | | 1 | W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Case | | 125 | ℃/W |
| $T_J$, $T_{STG}$ | Operating and Storage Temperature Range | | -55 to +150 | ℃ |
| $T_L$ | Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds | | 300 | ℃ |

Note:

1. Drain current limited by maximum junction temperature.

## ELECTRICAL CHARACTERISTICS($T_A$=25°C unless otherwise noted)

### Off Characteristics

| Symbol | Parameter | Test condition | Values | | | Unit |
|---|---|---|---|---|---|---|
| | | | Min. | Typ. | Max. | |
| $B_{VDSS}$ | Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = -250uA | -20 | -- | -- | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current | $V_{DS}$ = -20V, $V_{GS}$ = 0V | -- | -- | -1 | uA |
| $I_{GSSF}$ | Gate-Body Leakage Current, Forward | $V_{GS}$ = -12V, $V_{DS}$ = 0V | -- | -- | -100 | nA |
| $I_{GSSR}$ | Gate-Body Leakage Current, Reverse | $V_{GS}$ = 12V, $V_{DS}$ = 0V | -- | -- | 100 | nA |

### On Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{DS}$ = $V_{GS}$ , $I_D$ = -250uA | -0.45 | -0.50 | -0.55 | V |
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $V_{GS}$ = -4.5V, $I_D$ = -3.4A | -- | 43 | 58 | mΩ |
| | | $V_{GS}$ = -2.5V, $I_D$ = -2.5A | -- | 55 | 78 | |

### Dynamic Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = -10V, $V_{GS}$ = 0V, f = 1.0MHz | -- | 610 | - | pF |
| $C_{oss}$ | Output Capacitance | | -- | 78 | - | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | -- | 75 | - | pF |

### Switching Characteristics

| | | | | | | |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{GS}$= -4.5V, $V_{DS}$= -10V, $R_G$ = 10Ω ,$R_L$ = 2.9Ω (Note 3) | -- | 12 | -- | ns |
| $t_r$ | Turn-On Rise Time | | -- | 36 | -- | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | -- | 31 | -- | ns |
| $t_f$ | Turn-Off Fall Time | | -- | 12 | -- | ns |
| $Q_g$ | Total Gate Charge | $V_{DS}$ = -10V, $I_D$ = -2.5A, $V_{GS}$ = -4.5V (Note 3) | -- | 9 | -- | nC |
| $Q_{gs}$ | Gate-Source Charge | | -- | 0.8 | -- | nC |
| $Q_{gd}$ | Gate-Drain Charge | | -- | 1.7 | -- | nC |
| $R_G$ | Gate Resistance | f = 1MHz | -- | 6.3 | -- | Ω |

### Drain-Source Diode Characteristics and Maximum Ratings

| | | | | | |
|---|---|---|---|---|---|
| $I_S$ | Maximum Continuous Drain-Source Diode Forward Current | -- | -- | -3.4 | A |
| $I_{SM}$ | Maximum Pulsed Drain-Source Diode Forward Current | -- | -- | -14 | A |
| $V_{SD}$ | Drain to Source Diode Forward Voltage,$V_{GS}$ = 0V, $I_{SD}$ = -3A,$T_J$ = 25℃ | -- | -- | -1.2 | V |

Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. Device mounted on FR-4 PCB, 1inch x 0.85inch x 0.062 inch
3. Pulse Test: Pulse Width≤300μs, Duty Cycle≤0.5%.

## Typical Performance Characteristics

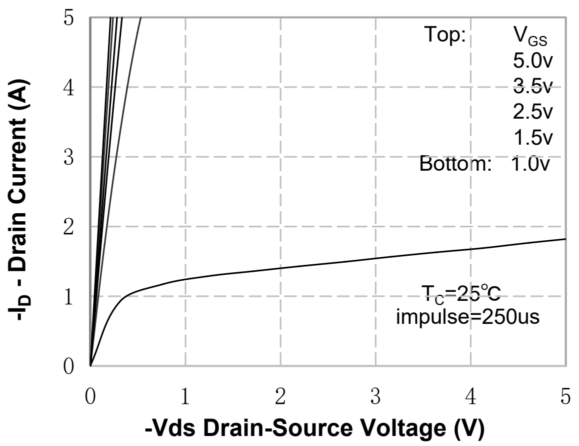


Figure 1. On-Region Characteristics

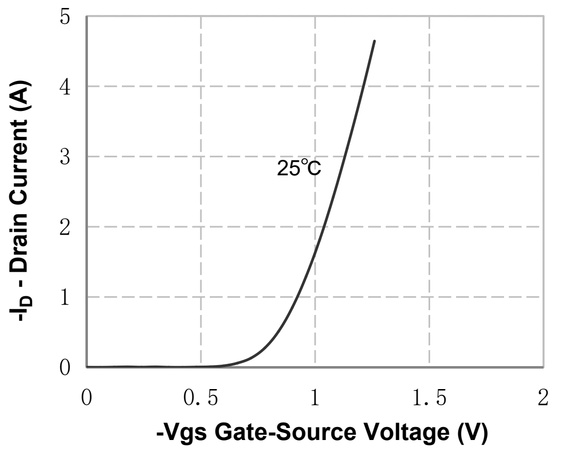


Figure 2. Transfer Characteristics

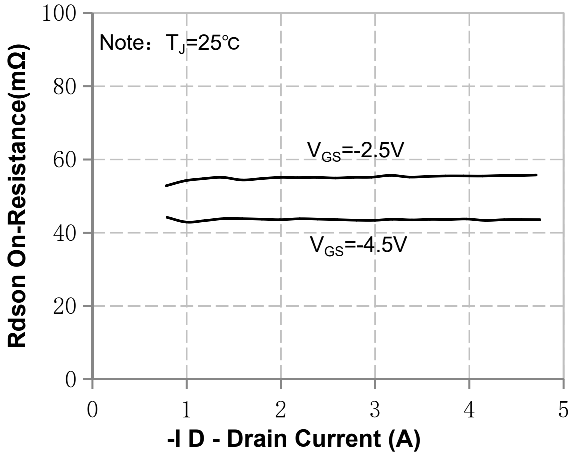


Figure 3. On-Resistance Variation vs Drain Current and Gate Voltage

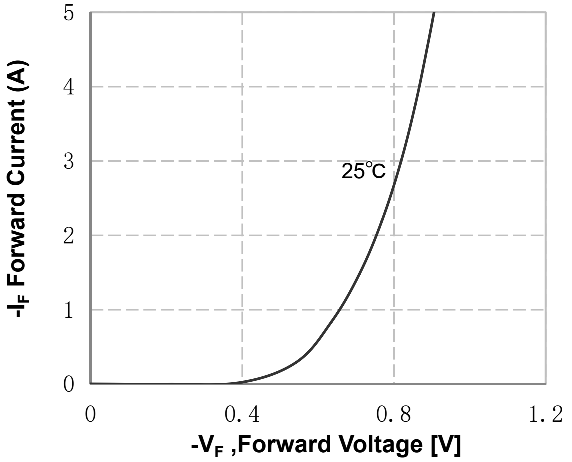


Figure 4. Body Diode Forward Voltage Variation with Source Current

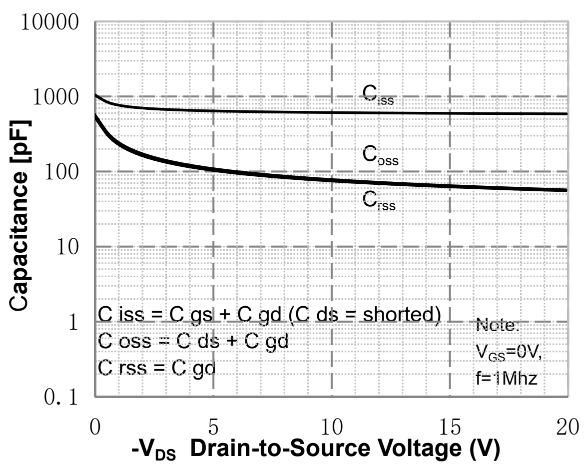


Figure 5. Capacitance Characteristics

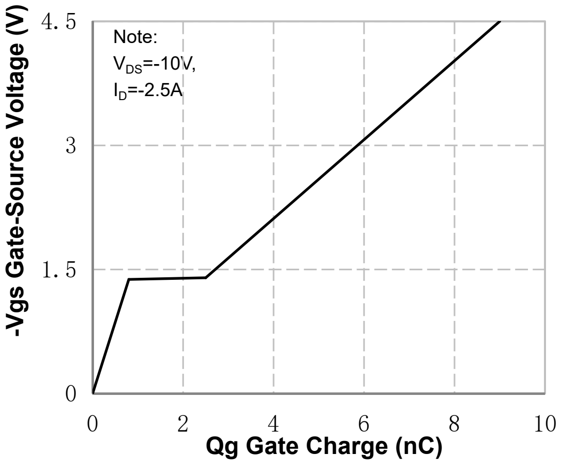


Figure 6. Gate Charge Characteristics

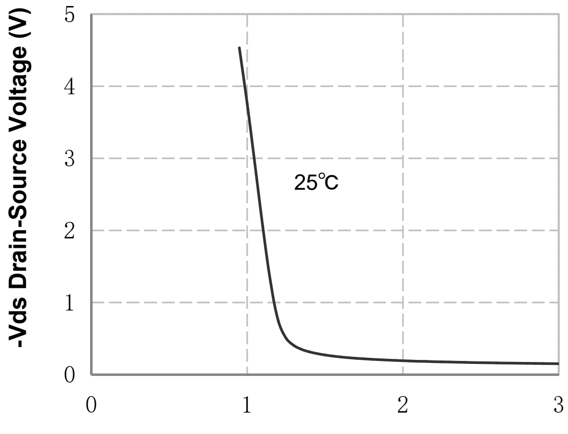


Figure 7. Vds Drain-Source Voltage vs Gate Voltage

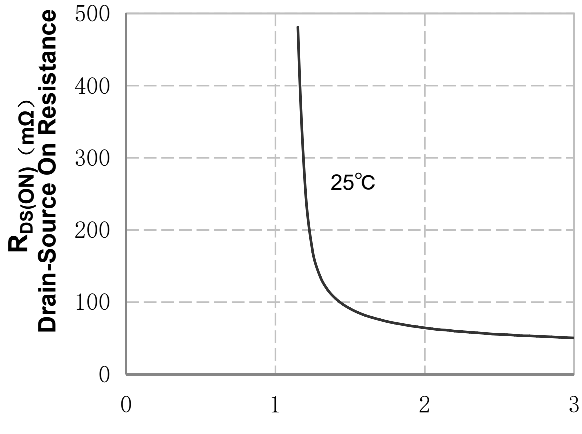


Figure 8. On-Resistance vs Gate Voltage

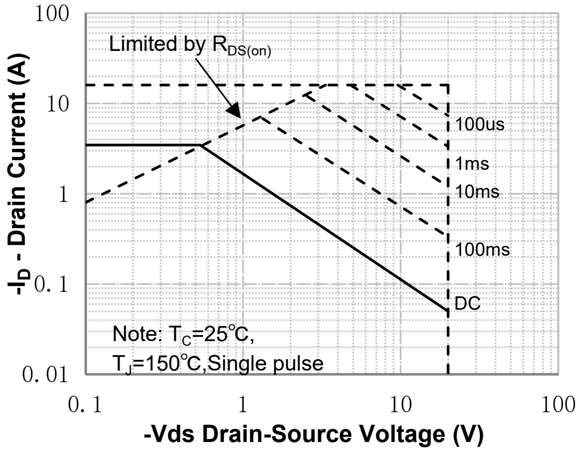


Figure 9. Maximum Safe Operating Area

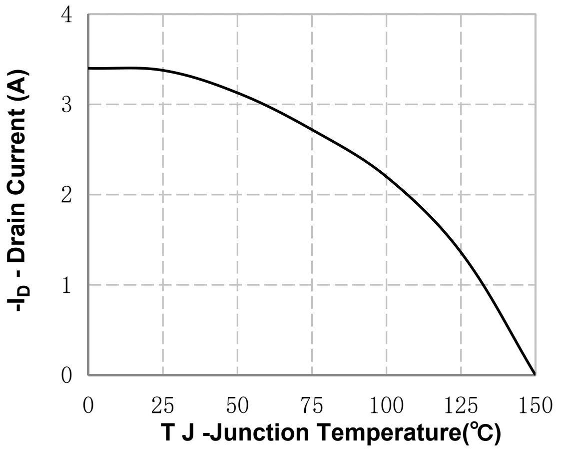


Figure 10. Maximum Continuous Drain Current vs Temperature

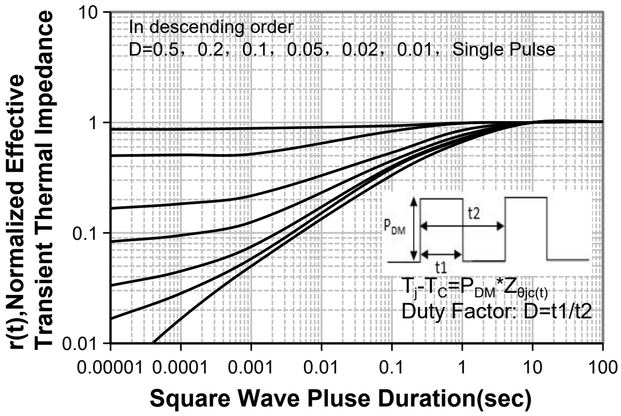
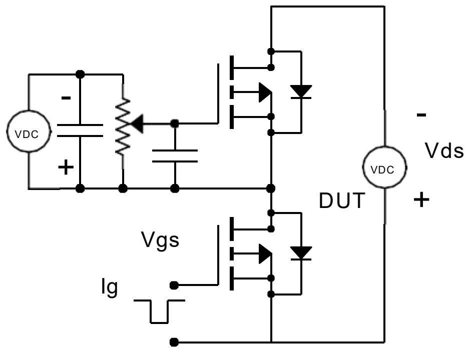
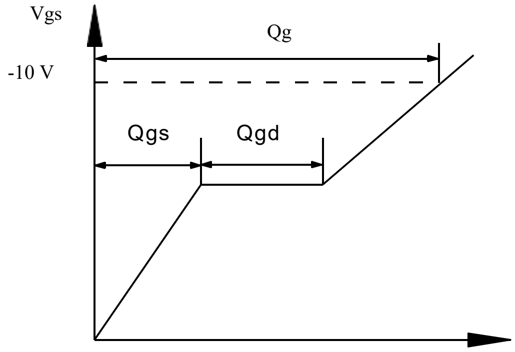


Figure 11. Transient Thermal Response Curve

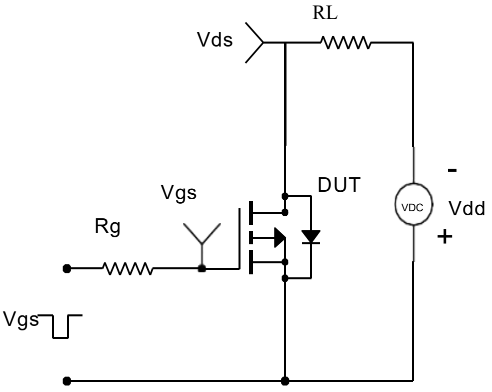
## TEST CIRCUITS AND WAVEFORMS

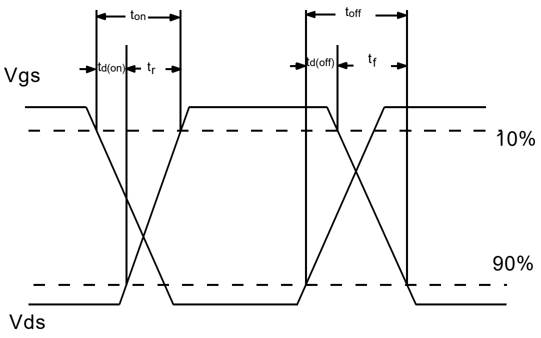
### Gate Charge Test Circuit & Waveform



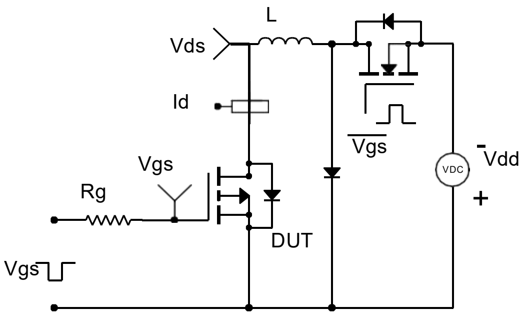


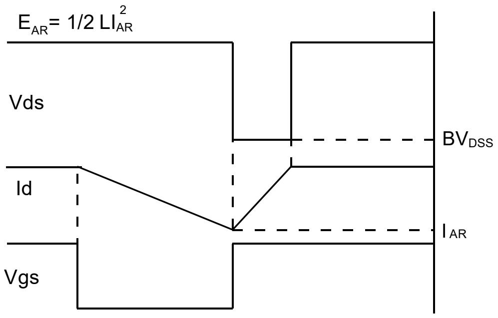
### Resistive Switching Test Circuit & Waveforms



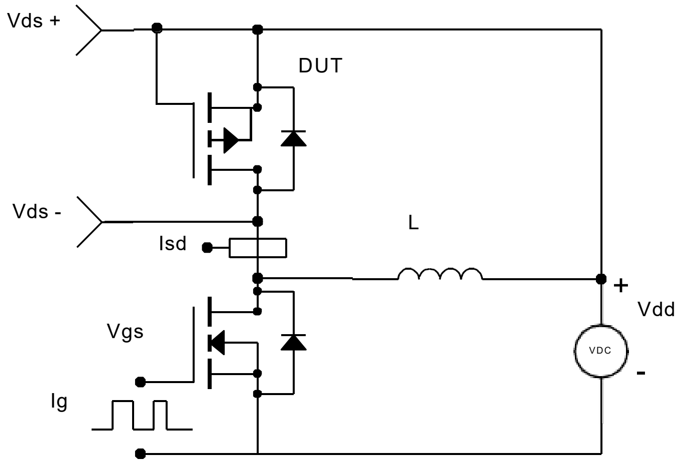


### Unclamped Inductive Switching Test Circuit & Waveforms

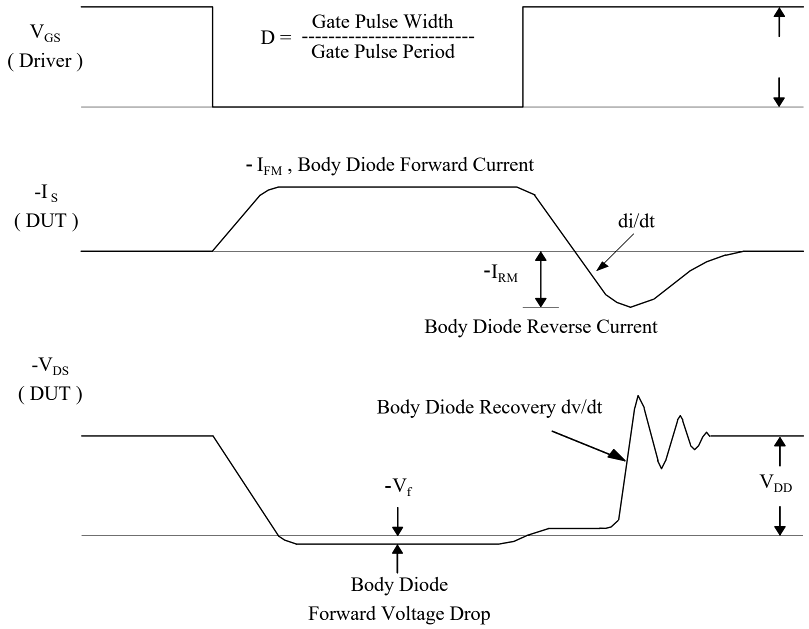




## Peak Diode Recovery dv/dt Test Circuit & Waveforms

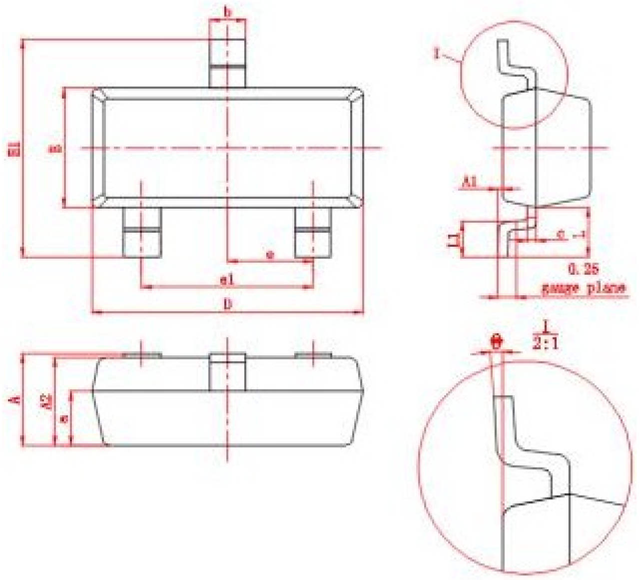


- dv/dt controlled by $R_G$
- $I_{SD}$ controlled by pulse period



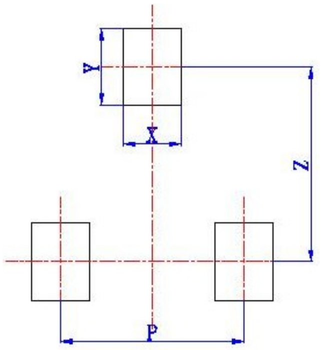
## PACKAGE OUTLINES (unit:mm)

Plastic surface mounted package(SOT-23)



| Symbol | Dimension in Millimeters | |
|---|---|---|
| | Min. | Max. |
| A | 0.9 | 1.15 |
| A1 | 0 | 0.1 |
| A2 | 0.9 | 1.05 |
| a | (0.6) | |
| D | 2.8 | 3.0 |
| E | 1.2 | 1.4 |
| E1 | 2.25 | 2.55 |
| e | (0.95) | |
| e1 | 1.8 | 2.0 |
| b | 0.3 | 0.5 |
| c | 0.08 | 0.15 |
| L | (0.55) | |

The recommended mounting pad size



| Symbol | Dimension in Millimeters |
|---|---|
| | typ |
| X | (0.6) |
| Y | (0.8) |
| Z | (2.02) |
| P | (1.9) |

****Important Usage Information and Disclaimer**

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