# Nano-Power, RRIO, 2.5V, Push-Pull Output Comparator with Voltage Reference

## 1 FEATURES

- **Low Supply Current:3.5μA(TYP) at Vs=2.5V**
- **Supply Range: +2.5V to +5.5V**
- **Integrated Voltage Reference:1.2V**
- **Low Input Offset Voltage: Vos(max) = 3.5mV at Vs=5V**
- **Rail-to-Rail Input**
- **Push-Pull Output**
- **Operating Temperature Range: -40°C to +125°C**
- **Micro SIZE PACKAGES: SOT23-6、DFN1.6×1.6-6L**

## 2 APPLICATIONS

- **RC TIMERS**
- **MULTIVIBRATORS**
- **WINDOW DETECTORS**
- **SYSTEM MONITORING**
- **SENSOR SYSTEMS: Smoke Detectors, Light Sensors, Alarms**

## 3 DESCRIPTIONS

The RS8912 is a push-pull output comparator. It features an uncommitted on-chip voltage reference and have low quiescent current, input common-mode range 100mV beyond the supply rails, and single-supply operation from 2.5V to 5.5V. The integrated 1.2V series voltage reference offers low 60μV/°C drift, is stable with up to 10nF capacitive load, and can provide up to 310uA (TYP) of output current.

Featuring a push-pull output stage, the RS8912 allows for operation with absolute minimum power consumption when driving any capacitive or resistive load.

The RS8912 is available in Green SOT23-6 and DFN1.6×1.6-6L package, it is specified at the full temperature range of −40°C to +125°C.

**Device Information (1)**

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|---|---|---|
| RS8912 | SOT23-6 | 1.60mm×2.92mm |
| | DFN1.6×1.6-6L | 1.60mm×1.60mm |

(1) For all available packages, see the orderable addendum at the end of the data sheet.

# Table of Contents

# 4 Revision History

Note: Page numbers for previous revisions may different from page numbers in the current version.

| VERSION | Change Date | Change Item |
|---|---|---|
| A.3 | 2022/01/25 | 1. Delete the second remark in the Absolute Maximum Ratings in Page 4@A.2 Version.<br>2. Added TAPE AND REEL INFORMATION |
| A.4 | 2022/07/04 | 1. Update Operating Temperature Range: -40°C to +125°C<br>2. Update ELECTRICAL CHARACTERISTICS and TYPICAL CHARACTERISTICS<br>3. Update Supply Range: +2.5V to +5.5V |

# 5 PACKAGE/ORDERING INFORMATION (1)

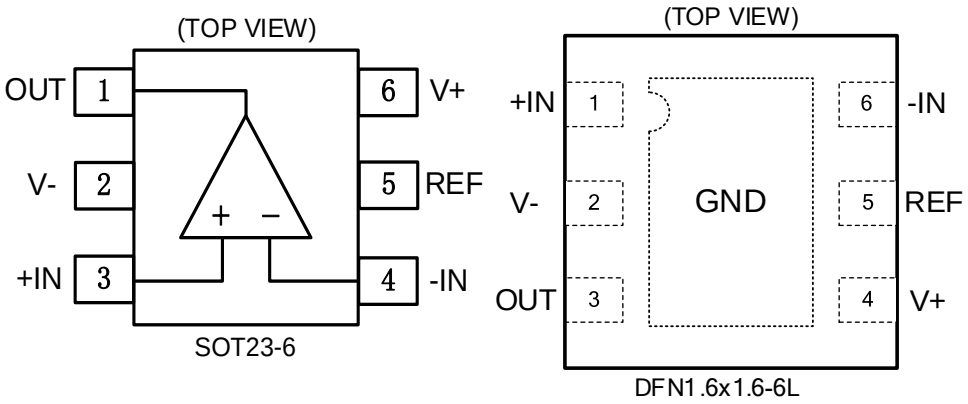
| Orderable Device | Package Type | Pin | Channel | Op Temp(°C) | Device Marking (2) | Package Qty |
|---|---|---|---|---|---|---|
| RS8912XH | SOT23-6 | 6 | 1 | -40°C ~125°C | 8912 | Tape and Reel,3000 |
| RS8912XUTDL6 | DFN1.6×1.6-6L | 6 | 1 | -40°C ~125°C | 8912 | Tape and Reel,3000 |

NOTE:

(1) This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the right-hand navigation.

(2) There may be additional marking, which relates to the lot trace code information(data code and vendor code)，the logo or the environmental category on the device.

## 6 Pin Configuration and Functions (Top View)




### Pin Description

| NAME | PIN | | I/O (1) | DESCRIPTION |
|---|---|---|---|---|
| | SOT23-6 | DFN1.6x1.6-6L | | |
| OUT | 1 | 3 | O | Output |
| V- | 2 | 2 | P | Negative (lowest) power supply |
| +IN | 3 | 1 | I | Noninverting input |
| -IN | 4 | 6 | I | Inverting input |
| REF | 5 | 5 | O | Voltage Reference |
| V+ | 6 | 4 | P | Positive (highest) power supply |

(1) I=Input, O=Output, P=Power

# 7 SPECIFICATIONS

## 7.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted) (1)

| | | MIN | MAX | UNIT |
|---|---|---|---|---|
| Voltage | Supply, Vs=(V+) - (V-) | | 7 | V |
| | Input pin (IN+, IN-) (2) | (V-)-0.5 | (V+) +0.5 | |
| | Signal output pin (3) | (V-)-0.5 | (V+) +0.5 | |
| Current | Signal input pin (IN+, IN-) (2) | -10 | 10 | mA |
| | Signal output pin (3) | -10 | 10 | mA |
| | Output short-circuit (4) | Continuous | | |
| Temperature | Operating range, $T_A$ | -40 | 125 | °C |
| | Junction, $T_J$ (5) | -40 | 150 | |
| | Storage, $T_{stg}$ | -65 | 150 | |

(1) Stresses above these ratings may cause permanent damage. Exposure to absolute maximum conditions for extended periods may degrade device reliability. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those specified is not implied.
(2) Input terminals are diode-clamped to the power-supply rails. Input signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±10mA or less.
(3) Output terminals are diode-clamped to the power-supply rails. Output signals that can swing more than 0.5V beyond the supply rails should be current-limited to ±10mA or less.
(4) Short-circuit to ground, one amplifier per package.
(5) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and $T_A$. The maximum allowable power dissipation at any ambient temperature is $P_D = (T_{J(MAX)} - T_A) / R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

## 7.2 ESD Ratings

The following ESD information is provided for handling of ESD-sensitive devices in an ESD protected area only.

| | | | VALUE | UNIT |
|---|---|---|---|---|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM), per ANSI/ESDA/JEDEC JS-001(1) | ±3000 | V |
| | | Machine Model (MM) | ±200 | |

(1) JEDEC document JEP155 states that 500 V HBM allows safe manufacturing with a standard ESD control process.

**ESD SENSITIVITY CAUTION**

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

## 7.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

| | | MIN | NOM | MAX | UNIT |
|---|---|---|---|---|---|
| Supply voltage, Vs= (V+) - (V-) | Single-supply | 2.5 | | 5.5 | V |
| | Dual-supply | ±1.25 | | ±2.75 | |

## 7.4 Thermal Information:RS8912

| THERMAL METRIC (1) | | RS8912 6PINS SOT23-6 | UNIT |
|---|---|---|---|
| $R_{\Theta JA}$ | Junction-to-ambient thermal resistance | 214.7 | °C/W |
| $R_{\Theta JC(top)}$ | Junction-to-case(top) thermal resistance | 127.1 | °C/W |
| $R_{\Theta JB}$ | Junction-to-board thermal resistance | 60.0 | °C/W |
| $\Psi_{JT}$ | Junction-to-top characterization parameter | 33.4 | °C/W |
| $\Psi_{JB}$ | Junction-to-board characterization parameter | 59.8 | °C/W |
| $R_{\Theta JC(bot)}$ | Junction-to-case(bottom) thermal resistance | N/A | °C/W |

(1) Thermal resistance varies with operating conditions.

## 7.5 ELECTRICAL CHARACTERISTICS：$V_S$=2.5V

(At $T_A$ = +25°C, V+=2.5V, V-=0V, $V_{CM}$=Vs/2, unless otherwise noted.)

| PARAMETER | | CONDITIONS | RS8912 | | | UINTS |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | |
| **POWER SUPPLY** | | | | | | |
| Vs | Operating Voltage Range | | 2.5 | | 5.5 | V |
| $I_Q$ | Quiescent Current | | | 3.5 | 8 | μA |
| PSRR | Power-Supply Rejection Ratio | Vs=2.5V to 5.5V, $V_{CM}$=(V)+0.5V | | 70 | | dB |
| **INPUT** | | | | | | |
| Vos | Input Offset Voltage | $V_{CM}$ =0V | | 1 | 5 | mV |
| | | $V_{CM}$ =2.5V | | 1 | 5 | |
| ΔVos/ΔT | Input Offset Voltage Drift | $V_{CM}$ =Vs/2, -40°C ≤ $T_A$ ≤125°C | | 2 | | μV/°C |
| IB | Input Bias Current | | | 1 | 10 | pA |
| $V_{CM}$ | Common-Mode Voltage Range | $T_A$ = –40°C to 125°C | (V-)-0.1 | | (V+)+0.1 | V |
| CMRR | Common-Mode Rejection Ratio | $V_{CM}$ =-0.1V to 2.6V | | 70 | | dB |
| **OUTPUT** | | | | | | |
| $V_{OH}$ | Output Swing From Upper Rail | Io=25uA | 2.410 | 2.440 | | V |
| | | Io=95uA | 2.186 | 2.277 | | |
| $V_{OL}$ | Output Swing From Lower Rail | Io=25uA | | 55 | 80 | mV |
| | | Io=95uA | | 215 | 289 | |
| $I_{SC}$ | Short Circuit Sink Current | $V_S$=±1.25V, $V_{OUT}$=0V | | -0.6 | -0.3 | mA |
| | Short Circuit Source Current | $V_S$=±1.25V, $V_{OUT}$=0V | 0.3 | 0.6 | | mA |
| **SWITCHING** | | | | | | |
| $T_{PHL}$ | Propagation Delay H To L | Overdrive = 20 mV | | 45 | | μs |
| | | Overdrive = 100 mV | | 15 | | |
| $T_{PLH}$ | Propagation Delay L To H | Overdrive = 20 mV | | 40 | | |
| | | Overdrive = 100 mV | | 20 | | |
| $T_R$ | Rise Time | Overdrive = 100 mV | | 30 | | us |
| $T_F$ | Fall Time | Overdrive = 100 mV | | 30 | | us |
| | Noise of $V_{REF}$ | f=0.1Hz to 10Hz | | 20 | | $uV_{RMS}$ |
| **VOLTAGE REFERENCE** | | | | | | |
| $V_{REF}$ | Reference Voltage | $I_{REF}$=0mA | 1.176 | 1.200 | 1.224 | V |
| | Reference Voltage Drift | | | 60 | | μV/°C |
| | Reference Output Current (Source) | | 80 | 110 | | uA |

## 7.6 ELECTRICAL CHARACTERISTICS：$V_S$=5V

(At $T_A$ = +25°C, V+=5V, V-=0V, $V_{CM}$=Vs/2, unless otherwise noted.)

| PARAMETER | | CONDITIONS | RS8912 | | | UINTS |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | |
| **POWER SUPPLY** | | | | | | |
| Vs | Operating Voltage Range | | 2.5 | | 5.5 | V |
| $I_Q$ | Quiescent Current | | | 4.85 | 10 | μA |
| PSRR | Power-Supply Rejection Ratio | Vs=2.5V to 5.5V, $V_{CM}$=(V)+0.5V | | 70 | | dB |
| **INPUT** | | | | | | |
| Vos | Input Offset Voltage | $V_{CM}$ =0V | | 1 | 3.5 | mV |
| | | $V_{CM}$ =5V | | 1 | 3.5 | |
| ΔVos/ΔT | Input Offset Voltage Drift | $V_{CM}$ =Vs/2, -40°C ≤ $T_A$ ≤125°C | | 2 | | μV/°C |
| IB | Input Bias Current | | | 1 | 10 | pA |
| $V_{CM}$ | Common-Mode Voltage Range | $T_A$ = –40°C to 125°C | (V-)-0.1 | | (V+)+0.1 | V |
| CMRR | Common-Mode Rejection Ratio | $V_{CM}$ =-0.1V to 5.1V | | 70 | | dB |
| **OUTPUT** | | | | | | |
| $V_{OH}$ | Output Swing From Upper Rail | Io=25uA | 4.915 | 4.935 | | V |
| | | Io=95uA | 4.720 | 4.785 | | |
| $V_{OL}$ | Output Swing From Lower Rail | Io=25uA | | 55 | 72 | mV |
| | | Io=95uA | | 215 | 280 | |
| $I_{SC}$ | Short Circuit Sink Current | $V_S$=±2.5V, $V_{OUT}$=0V | | -1.1 | -0.9 | mA |
| | Short Circuit Source Current | $V_S$=±2.5V, $V_{OUT}$=0V | 0.9 | 1.1 | | mA |
| **SWITCHING** | | | | | | |
| $T_{PHL}$ | Propagation Delay H To L | Overdrive = 20 mV | | 25 | | μs |
| | | Overdrive = 100 mV | | 10 | | |
| $T_{PLH}$ | Propagation Delay L To H | Overdrive = 20 mV | | 20 | | |
| | | Overdrive = 100 mV | | 10 | | |
| $T_R$ | Rise Time | Overdrive = 100 mV | | 12 | | us |
| $T_F$ | Fall Time | Overdrive = 100 mV | | 12 | | us |
| | Noise of $V_{REF}$ | f=0.1Hz to 10Hz | | 20 | | $uV_{RMS}$ |
| **VOLTAGE REFERENCE** | | | | | | |
| $V_{REF}$ | Reference Voltage | $I_{REF}$=0mA | 1.176 | 1.200 | 1.224 | V |
| | Reference Voltage Drift | | | 50 | | μV/°C |
| | Reference Output Current (Source) | | 200 | 310 | | uA |

## 7.7 TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At $T_A$ = +25°C, Vs=5V, $V_{CM}$ = $V_S$/2, $C_L$=15pF unless otherwise noted.

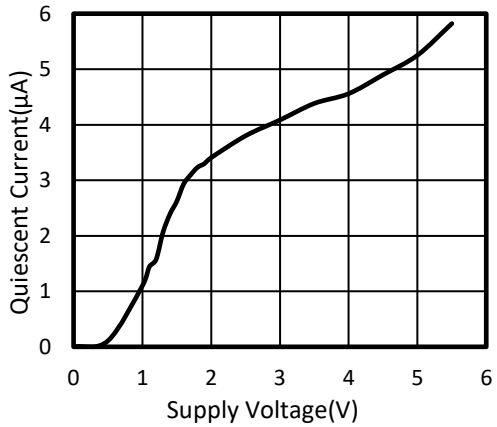



**Figure 1. Supply Voltage vs Quiescent Current**

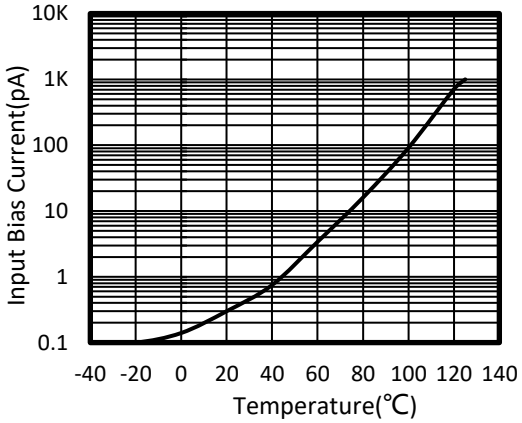



**Figure 2. INPUT BIAS CURRENT vs TEMPERATURE**

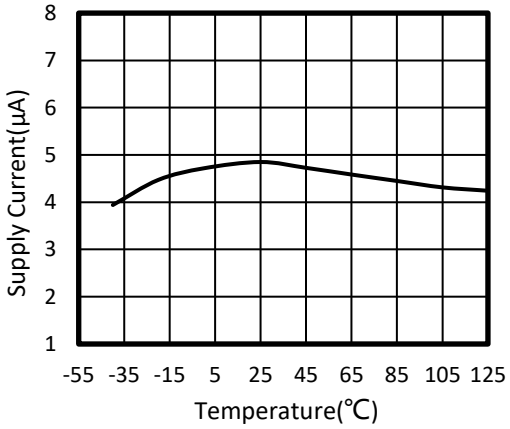



**Figure 3. Supply Current vs Temperature**

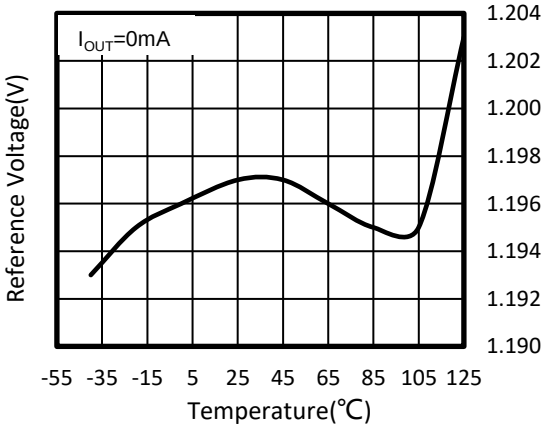



**Figure 4. Reference Voltage vs Temperature**

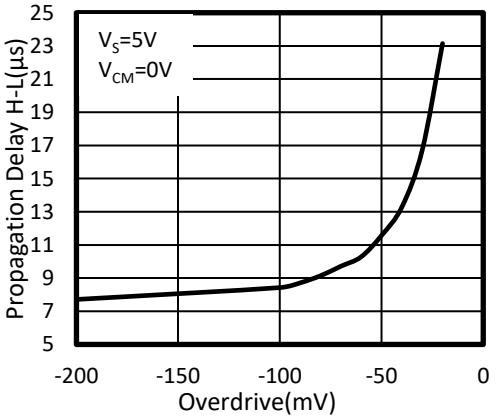



**Figure 5. Propagation Delay vs Overdrive**

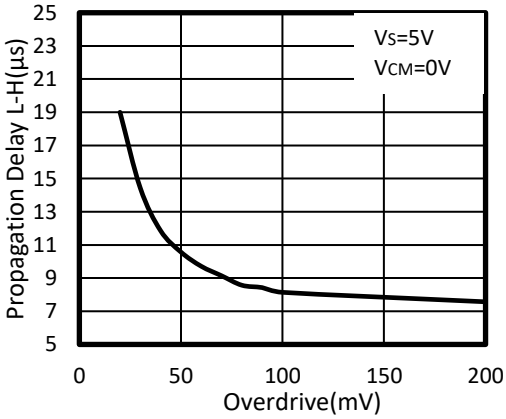



**Figure 6. Propagation Delay vs Overdrive**

# TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At $T_A$ = +25°C, Vs=5V, $V_{CM}$ = $V_S$/2, $C_L$=15pF unless otherwise noted.

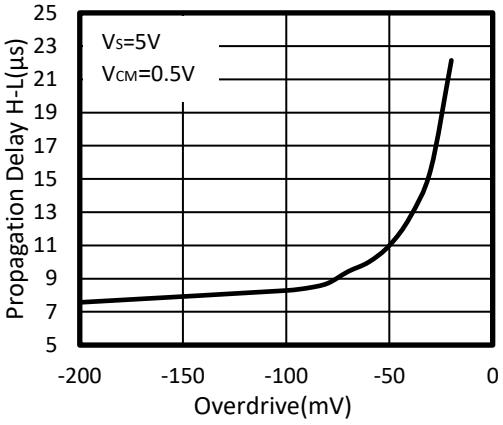



**Figure 7. Propagation Delay vs Overdrive**

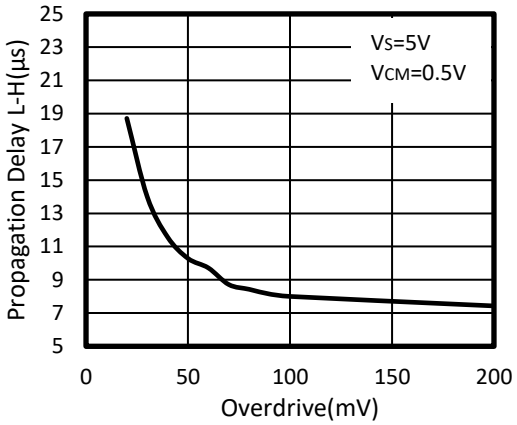



**Figure 8. Propagation Delay vs Overdrive**

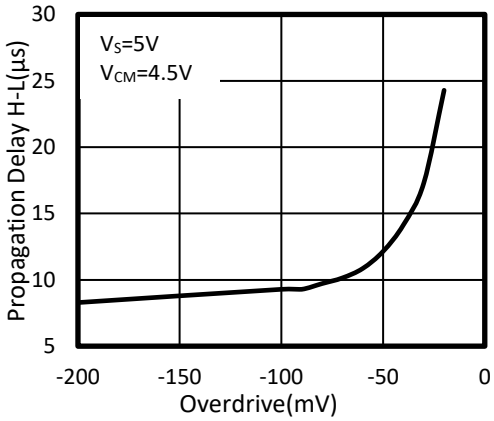



**Figure 9. Propagation Delay vs Overdrive**

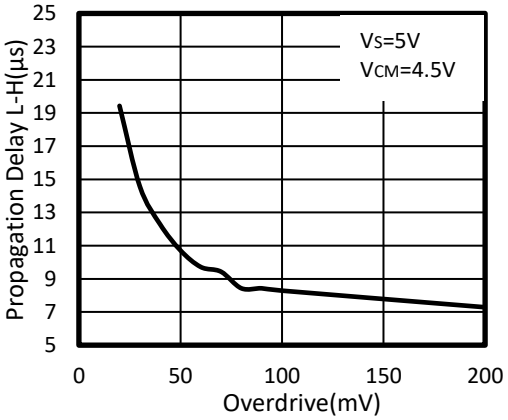



**Figure 10. Propagation Delay vs Overdrive**

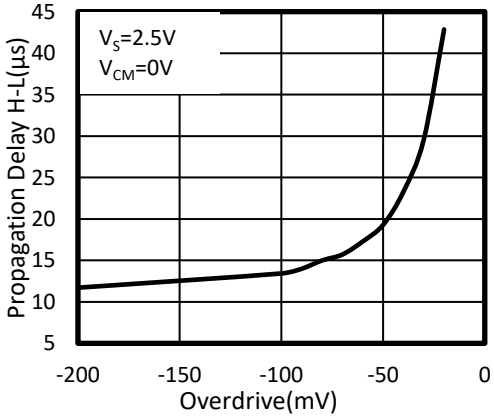



**Figure 11. Propagation Delay vs Overdrive**

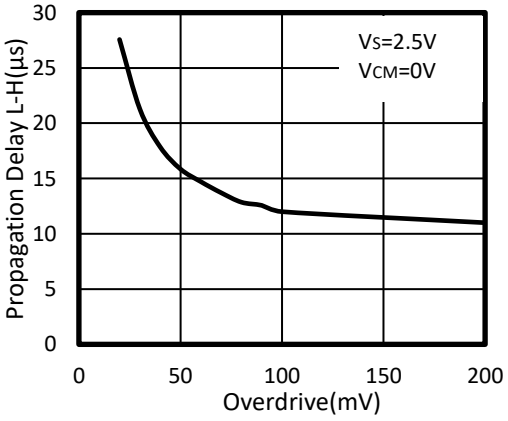



**Figure 12. Propagation Delay vs Overdrive**

# TYPICAL CHARACTERISTICS

NOTE: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only.

At $T_A$ = +25°C, Vs=5V, $V_{CM}$ = $V_S$/2, $C_L$=15pF unless otherwise noted.

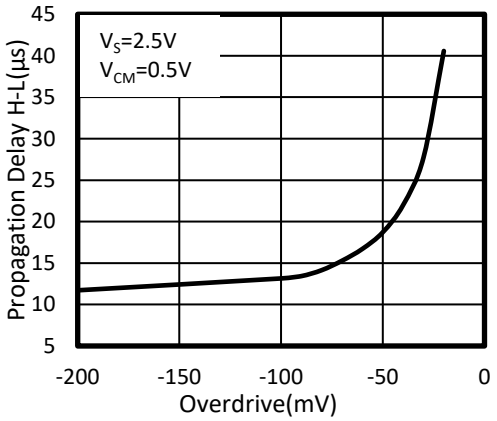



**Figure 13. Propagation Delay vs Overdrive**

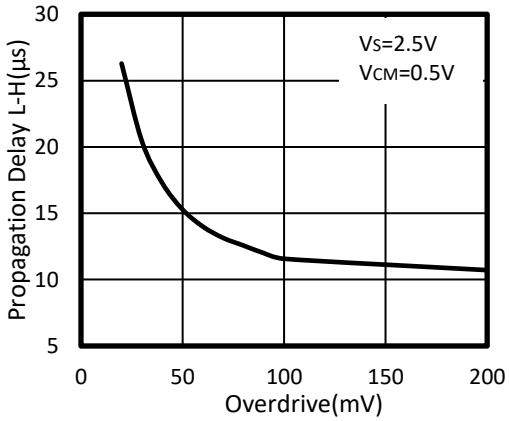



**Figure 14. Propagation Delay vs Overdrive**

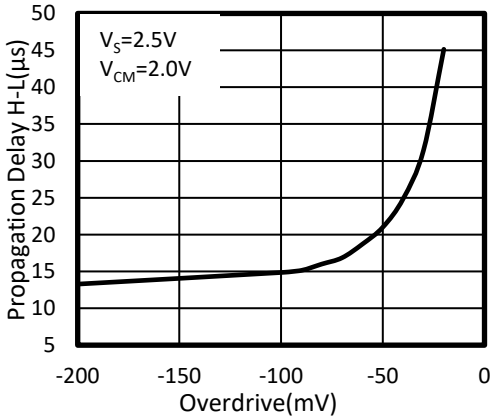



**Figure 15. Propagation Delay vs Overdrive**

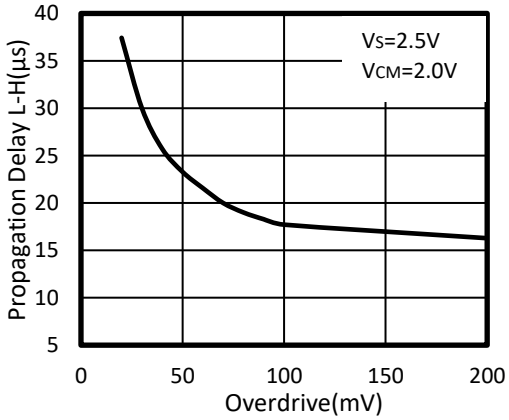
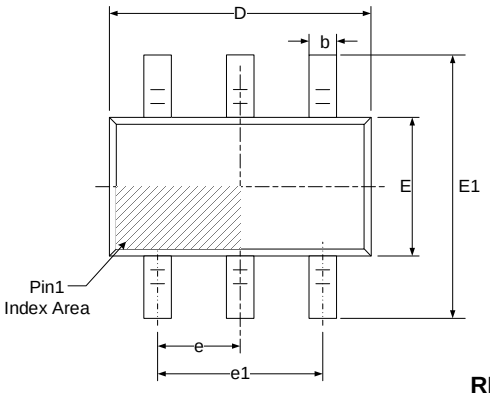
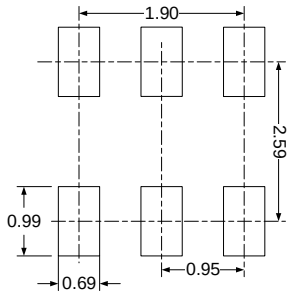



**Figure 16. Propagation Delay vs Overdrive**

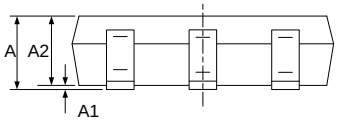
# 8 PACKAGE OUTLINE DIMENSIONS

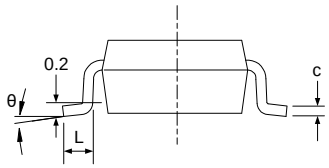
## SOT23-6



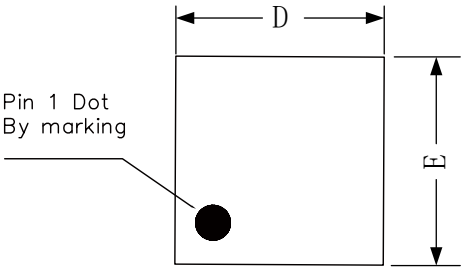

**RECOMMENDED LAND PATTERN (Unit: mm)**



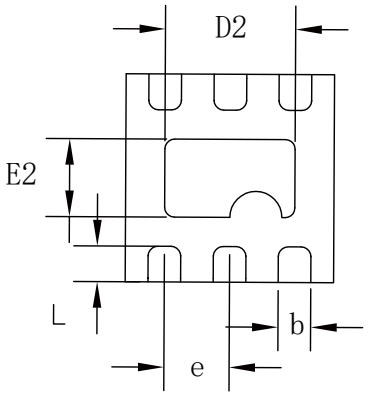




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 1.050 | 1.250 | 0.041 | 0.049 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 1.050 | 1.150 | 0.041 | 0.045 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.100 | 0.200 | 0.004 | 0.008 |
| 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° |

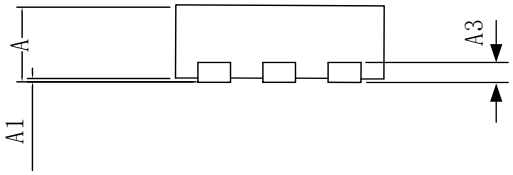
## DFN1.6x1.6-6L




TOP VIEW




BOTTOM VIEW




SIDE VIEW

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.500 | 0.600 | 0.020 | 0.024 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A3 | 0.150 REF | | 0.006 REF | |
| D | 1.550 | 1.650 | 0.061 | 0.065 |
| E | 1.550 | 1.650 | 0.061 | 0.065 |
| D2 | 0.900 | 1.050 | 0.035 | 0.041 |
| E2 | 0.500 | 0.650 | 0.020 | 0.025 |
| L | 0.200 | 0.300 | 0.008 | 0.012 |
| b | 0.200 | 0.300 | 0.008 | 0.012 |
| e | 0.500 BSC | | 0.020 BSC | |

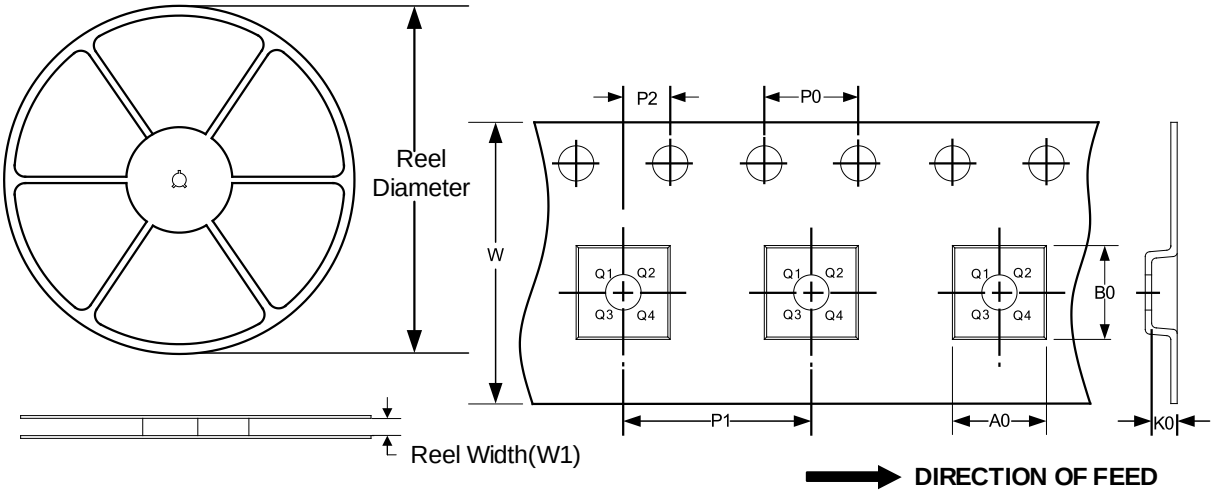
NOTE:

A. All linear dimension is in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. BSC: Basic Dimension. Theoretically exact value shown without tolerances.
E. REF: Reference Dimension, usually without tolerance, for information purposes only.

# 9 TAPE AND REEL INFORMATION

### REEL DIMENSIONS

### TAPE DIMENSION




NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width(mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|---|---|---|---|---|---|---|---|---|---|---|
| SOT23-6 | 7'' | 9.5 | 3.17 | 3.23 | 1.37 | 4.0 | 4.0 | 2.0 | 8.0 | Q3 |
| DFN1.6×1.6-6L | 7'' | 9.5 | 1.86 | 1.90 | 0.88 | 4.0 | 4.0 | 2.0 | 8.0 | Q1 |

NOTE:
1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.

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