

Nano-Power, RRIO, 2.3V, Push-Pull Output Comparator with Voltage Reference

FEATURES

- **Low supply current:** 3.5 μ A (TYP) at $V_s=2.3V$
- **Supply Range:** +2.3V to +5.5V
- **Integrated Voltage Reference:** 1.2V
- **Low input offset voltage:** $V_{os(max)} = 3.5mV$
- **Rail-to-Rail Input**
- **Push-Pull Output**
- **Operating Temperature Range:** -40°C to +85°C
- **Micro SIZE PACKAGES:** SOT23-6

APPLICATIONS

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

DESCRIPTION

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 200mV beyond the supply rails, and single-supply operation from 2.3V to 5.5V. The integrated 1.2V series voltage reference offers low 42 μ V/°C drift, is stable with up to 10nF capacitive load, and can provide up to 350 μ A (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.

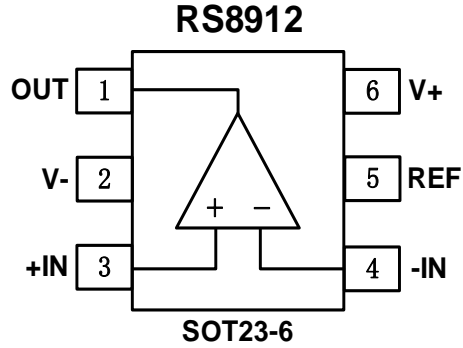
The RS8912 is available in Green SOT23-6 package and is specified at the full temperature range of -40°C to +85°C.

Device Information ⁽¹⁾

| PART NUMBER | PACKAGE | BODY SIZE (NOM) |
|-------------|---------|------------------------|
| RS8912 | SOT23-6 | 1.60mm \times 2.92mm |

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

Pin Configuration and Functions (Top View)



Pin Description

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

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

SPECIFICATIONS

Absolute Maximum Ratings

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

| | | MIN | MAX | UNIT |
|-------------|--|------------|-----------|------|
| Voltage | Supply, $V_S=(V+) - (V-)$ | | 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 | 85 | °C |
| | Junction, T_J | | 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 ± 10 mA or less.

(4) Short-circuit to ground, one amplifier per package.

ESD Ratings

| | | | VALUE | UNIT |
|-------------|-------------------------|------------------------|-------|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human-body model (HBM) | 3000 | V |
| | | Machine Model (MM) | 200 | |

Recommended Operating Conditions

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

| | | MIN | NOM | MAX | UNIT |
|-----------------------------------|---------------|------------|-----|------------|------|
| Supply voltage, $V_S=(V+) - (V-)$ | Single-supply | 2.3 | | 5.5 | V |
| | Dual-supply | ± 1.15 | | ± 2.75 | |

Thermal Information:RS8912

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

PACKAGE/ORDERING INFORMATION

| Orderable Device | Package Type | Pin | Channel | Op Temp(°C) | Device Marking | Package Qty |
|------------------|--------------|-----|---------|-------------|----------------|--------------------|
| RS8912XH | SOT23-6 | 6 | 1 | -40°C~85°C | 8912 XXXX | Tape and Reel,3000 |

NOTE: XXXX = Date Code and Vendor Code.

ELECTRICAL CHARACTERISTICS: $V_S=2.3V$

 (At $T_A = +25^\circ C$, $V_+ = 2.3V$, $V_- = 0V$, $V_{CM} = V_S/2$, unless otherwise noted.)

| PARAMETER | | CONDITIONS | RS8912 | | | UNITS |
|--------------------------|-----------------------------------|---|-----------------------|-------|-----------------------|------------------|
| | | | MIN | TYP | MAX | |
| POWER SUPPLY | | | | | | |
| V_S | Operating Voltage Range | | 2.3 | | 5.5 | V |
| I_Q | Quiescent Current | | | 3.5 | 8 | μA |
| PSRR | Power-Supply Rejection Ratio | $V_S = 2.3V$ to $5.5V$, $V_{CM} = (V_+) + 0.5V$ | | 70 | | dB |
| INPUT | | | | | | |
| V_{OS} | Input Offset Voltage | $V_{CM} = 0V$ | | 1 | 5 | mV |
| | | $V_{CM} = 2.3V$ | | 1 | 5 | |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift | $V_{CM} = V_S/2$, $-40^\circ C \leq T_A \leq 85^\circ C$ | | 2 | | $\mu V/^\circ C$ |
| I_B | Input Bias Current | | | 1 | 10 | pA |
| V_{CM} | Common-Mode Voltage Range | $T_A = -40^\circ C$ to $85^\circ C$ | (V ₋)-0.1 | | (V ₊)+0.1 | V |
| CMRR | Power-Supply Rejection Ratio | $V_{CM} = 0V$ to $2.3V$ | | 70 | | dB |
| OUTPUT | | | | | | |
| V_{OH} | Output Swing From Upper Rail | $I_O = 25\mu A$ | 2.208 | 2.237 | | V |
| | | $I_O = 95\mu A$ | 2.011 | 2.095 | | |
| V_{OL} | Output Swing From Lower Rail | $I_O = 25\mu A$ | | 55 | 80 | mV |
| | | $I_O = 95\mu A$ | | 205 | 289 | |
| I_{SC} | Short Circuit Sink Current | $V_S = 2.3V$ | | -1 | -0.62 | mA |
| | Short Circuit Source Current | $V_S = 2.3V$ | 0.57 | 1 | | mA |
| SWITCHING | | | | | | |
| T_{PHL} | Propagation Delay H To L | Overdrive = 10 mV | | 135 | | μs |
| | | Overdrive = 100 mV | | 21 | | |
| T_{PLH} | Propagation Delay L To H | Overdrive = 10 mV | | 123 | | μs |
| | | Overdrive = 100 mV | | 40 | | |
| 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 | | μV_{RMS} |
| VOLTAGE REFERENCE | | | | | | |
| V_{REF} | Reference Voltage | $I_{REF} = 0mA$ | 1.176 | 1.200 | 1.224 | V |
| | Reference Voltage Drift | | | 42 | | $\mu V/^\circ C$ |
| | Reference Output Current (Source) | | 60 | 80 | | μA |

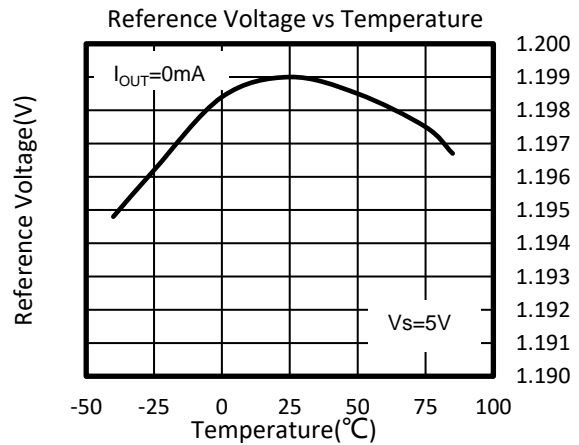
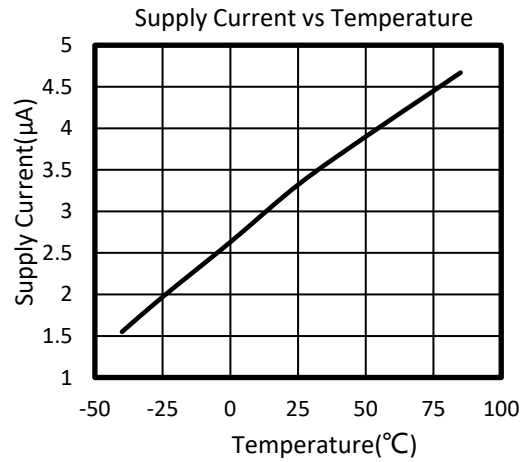
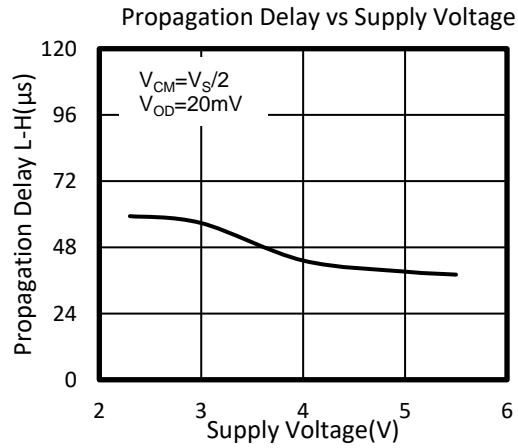
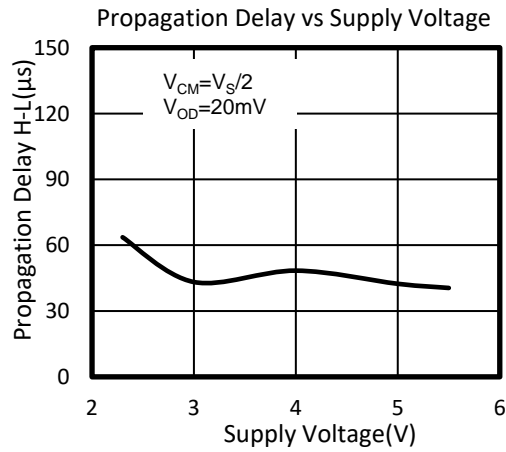
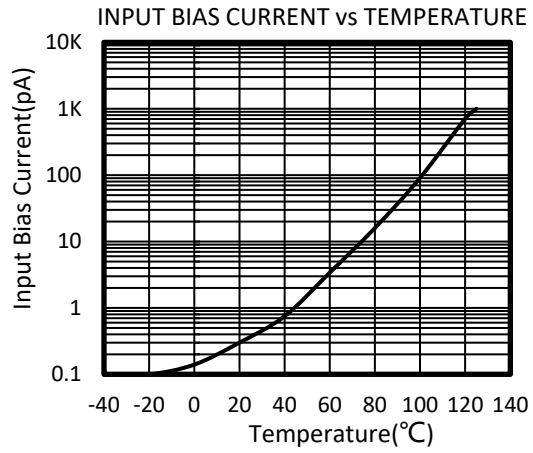
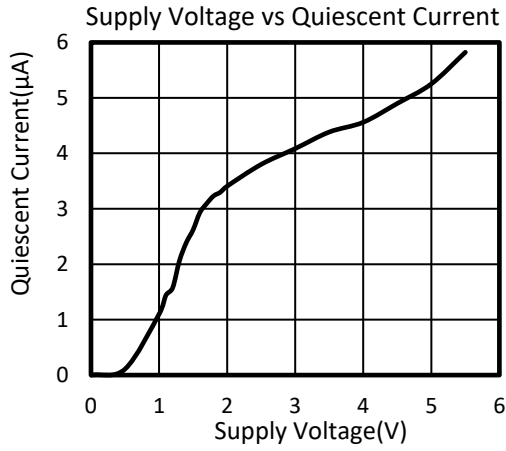
ELECTRICAL CHARACTERISTICS: $V_S=5V$

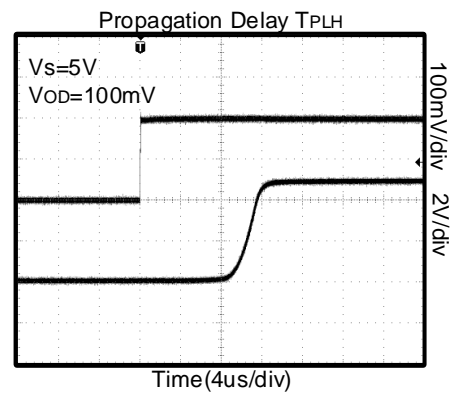
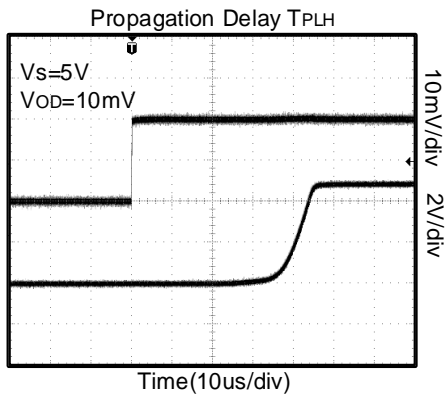
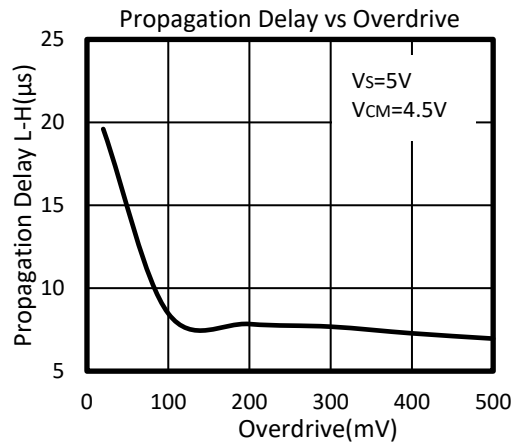
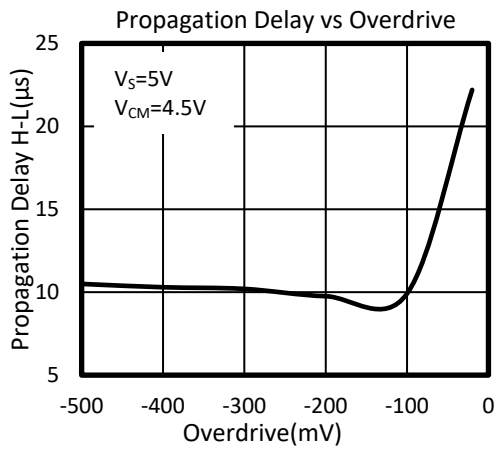
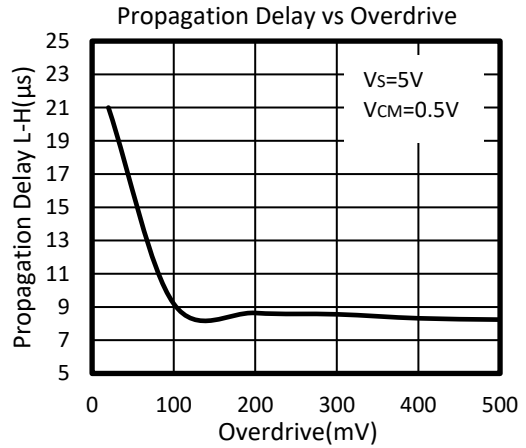
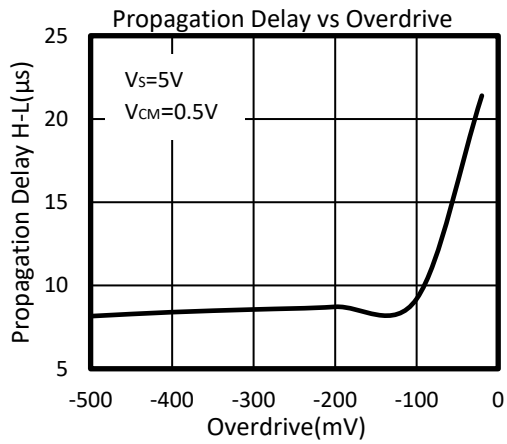
 (At $T_A = +25^\circ C$, $V_+ = 5V$, $V_- = 0V$, $V_{CM} = V_S/2$, unless otherwise noted.)

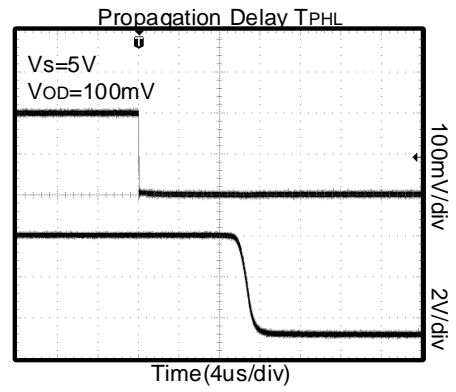
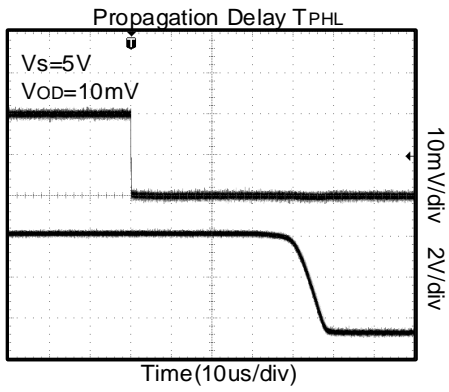
| PARAMETER | | CONDITIONS | RS8912 | | | UNITS |
|--------------------------|-----------------------------------|---|---------------|-------|---------------|------------------|
| | | | MIN | TYP | MAX | |
| POWER SUPPLY | | | | | | |
| V_S | Operating Voltage Range | | 2.3 | | 5.5 | V |
| I_Q | Quiescent Current | | | 4.85 | 10 | μA |
| PSRR | Power-Supply Rejection Ratio | $V_S = 2.3V$ to $5.5V$, $V_{CM} = (V_+) + 0.5V$ | | 70 | | dB |
| INPUT | | | | | | |
| V_{OS} | Input Offset Voltage | $V_{CM} = 0V$ | | 1 | 3.5 | mV |
| | | $V_{CM} = 5V$ | | 1 | 3.5 | |
| $\Delta V_{OS}/\Delta T$ | Input Offset Voltage Drift | $V_{CM} = V_S/2$, $-40^\circ C \leq T_A \leq 85^\circ C$ | | 2 | | $\mu V/^\circ C$ |
| I_B | Input Bias Current | | | 1 | 10 | pA |
| V_{CM} | Common-Mode Voltage Range | $T_A = -40^\circ C$ to $85^\circ C$ | (V_-)-0.1 | | (V_+)+0.1 | V |
| CMRR | Power-Supply Rejection Ratio | $V_{CM} = 0V$ to $5V$ | | 70 | | dB |
| OUTPUT | | | | | | |
| V_{OH} | Output Swing From Upper Rail | $I_O = 25\mu A$ | 4.915 | 4.935 | | V |
| | | $I_O = 95\mu A$ | 4.720 | 4.785 | | |
| V_{OL} | Output Swing From Lower Rail | $I_O = 25\mu A$ | | 55 | 72 | mV |
| | | $I_O = 95\mu A$ | | 215 | 280 | |
| I_{SC} | Short Circuit Sink Current | $V_S = 5V$ | | -2.25 | -2.2 | mA |
| | Short Circuit Source Current | $V_S = 5V$ | 2.15 | 2.23 | | mA |
| SWITCHING | | | | | | |
| T_{PHL} | Propagation Delay H To L | Overdrive = 10 mV | | 67 | | μs |
| | | Overdrive = 100 mV | | 12 | | |
| T_{PLH} | Propagation Delay L To H | Overdrive = 10 mV | | 68 | | |
| | | Overdrive = 100 mV | | 12 | | |
| 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 | | μV_{RMS} |
| VOLTAGE REFERENCE | | | | | | |
| V_{REF} | Reference Voltage | $I_{REF} = 0mA$ | 1.176 | 1.200 | 1.224 | V |
| | Reference Voltage Drift | | | 42 | | $\mu V/^\circ C$ |
| | Reference Output Current (Source) | | 200 | 350 | | μA |

TYPICAL CHARACTERISTICS

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

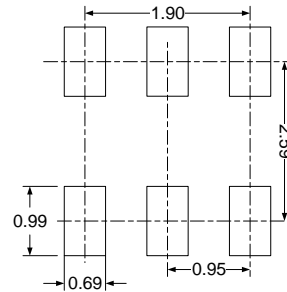
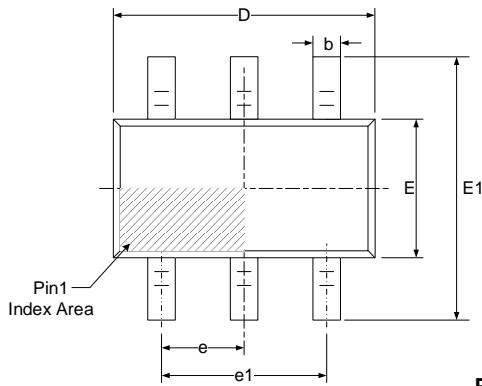
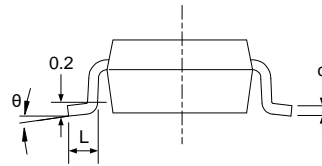
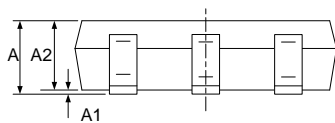






PACKAGE OUTLINE DIMENSIONS

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° |