



3V MICROPPOWER DUAL CMOS VOLTAGE COMPARATORS

- DEDICATED TO **3.3V** OR **BATTERY SUPPLY** (specified at 3V and 5V)
- PUSH-PULL CMOS OUTPUT (NO EXTERNAL PULL-UP RESISTOR REQUIRED)
- EXTREMELY LOW SUPPLY CURRENT : **7 μ A typ / comparator**
- WIDE SINGLE SUPPLY RANGE **2.7V TO 16V**
- EXTREMELY LOW INPUT CURRENTS : **1pA typ**
- INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GND
- FAST RESPONSE TIME : 2 μ s typ for 5mV overdrive
- PIN-TO-PIN AND FUNCTIONALLY COMPATIBLE WITH BIPOLAR LM393

DESCRIPTION

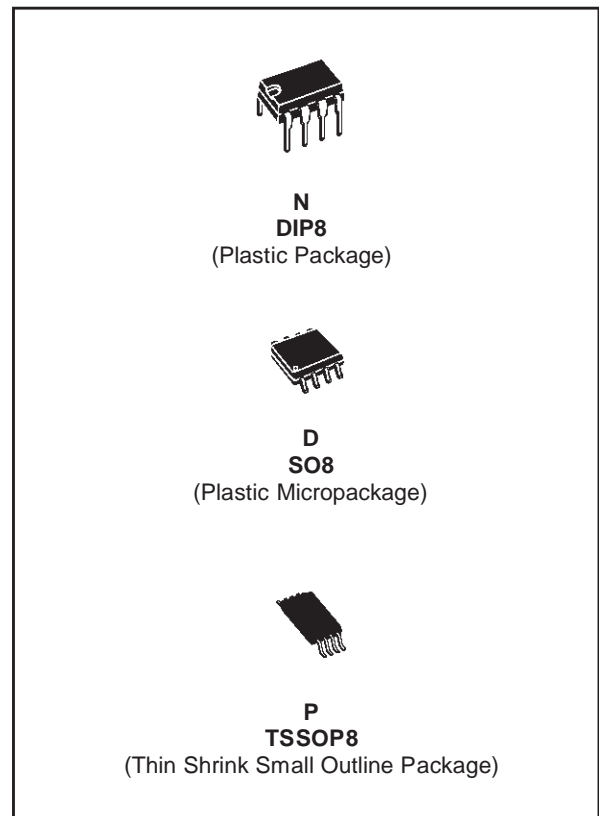
The TS3V3702 is a micropower dual CMOS voltage comparator with extremely low consumption of 7 μ A typ / comparator (20 times less than bipolar LM393). The push-pull CMOS output stage allows power and space saving by eliminating the external pull-up resistor required by usual open-collector output comparators.

Thus response times remain similar to the LM393.

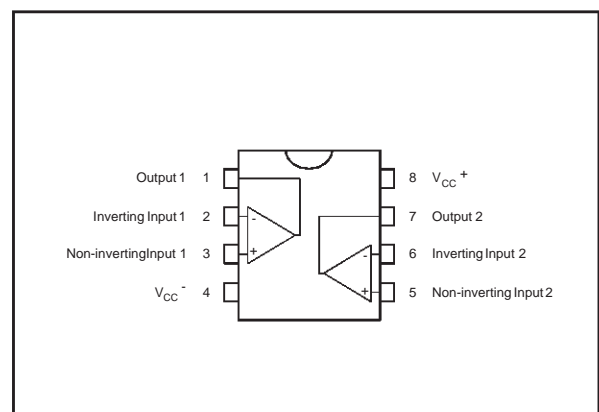
ORDER CODE

| Part Number | Temperature Range | Package | | |
|-------------|-------------------|---------|---|---|
| | | N | D | P |
| TS3V3702I | -40°C, +125°C | • | • | • |

N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)
P = Thin Shrink Small Outline Package (TSSOP) - only available in Tape & Reel (PT)

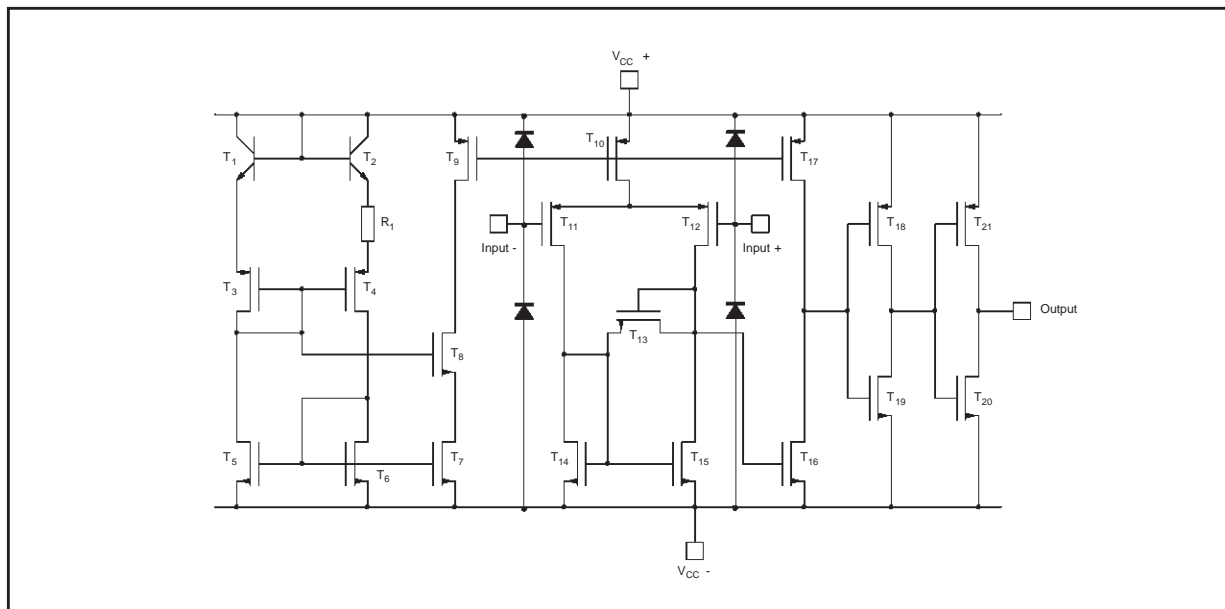


PIN CONNECTIONS (top view)



TS3V3702

SCHEMATIC DIAGRAM (for 1/2 TS3V3702)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|------------|---|-------------|--------------------|
| V_{CC}^+ | Supply Voltage ¹⁾ | 18 | V |
| V_{id} | Differential Input Voltage ²⁾ | ± 18 | V |
| V_i | Input Voltage ³⁾ | 18 | V |
| V_o | Output Voltage | 18 | V |
| I_o | Output Current | 20 | mA |
| I_F | Forward Current in ESD Protection Diodes on Input ⁴⁾ | 50 | mA |
| P_d | Power Dissipation ⁵⁾ | DIP8 | 1250 |
| | | SO8 | 710 |
| | | TSSOP8 | 625 |
| T_{stg} | Storage Temperature Range | -65 to +150 | $^{\circ}\text{C}$ |

1. All voltage values, except differential voltage, are with respect to network ground terminal.

2. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.

3. The magnitude of the input and the output voltages must never exceed the magnitude of the positive supply voltage.

4. Guaranteed by design.

5. P_d is calculated with $T_{amb} = +25^{\circ}\text{C}$, $T_j = +150^{\circ}\text{C}$ and $R_{thja} = 100^{\circ}\text{C/W}$ for DIP8 package
 $= 175^{\circ}\text{C/W}$ for SO8 package
 $= 200^{\circ}\text{C/W}$ for TSSOP8 package

OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|------------|--------------------------------------|-----------------------|-----------------------------------|
| V_{CC}^+ | Supply Voltage | 2.7 to 16 | V |
| V_{icm} | Common Mode Input Voltage Range | 0 to $V_{CC}^+ - 1.5$ | V |
| T_{oper} | Operating Free-Air Temperature range | TS3V3702I | -40 to +125 $^{\circ}\text{C}$ |

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = 3V$, $V_{CC}^- = 0V$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------|---|----------|-------------|--------------------------------------|---------|
| V_{io} | Input Offset Voltage ¹⁾ $V_{ic} = 1.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | | 5 6.5 | mV |
| I_{io} | Input Offset Voltage ²⁾ $V_{ic} = 1.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 300 | pA |
| I_{ib} | Input Bias Current (see note 2) $V_{ic} = 1.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 600 | pA |
| V_{icm} | Input Common Mode Voltage Range $T_{min.} \leq T_{amb} \leq T_{max.}$ | 0 0 | | $V_{CC}^+ - 1.2$ $V_{CC}^+ - 1.5$ | V |
| CMR | Common-mode Rejection Ratio $V_{ic} = V_{icm\ min.}$ | | 80 | | dB |
| SVR | Supply Voltage Rejection Ratio $V_{CC}^+ = 3V$ to $5V$ | | 75 | | dB |
| V_{OH} | High Level Output Voltage $V_{id} = 1V$, $I_{OH} = -4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 2 1.8 | 2.4 | | V |
| V_{OL} | Low Level Output Voltage $V_{id} = -1V$, $I_{OL} = 4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 300 | 400 450 | mV |
| I_{CC} | Supply Current (each comparator) No load - Outputs low $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 7 | 20 25 | μA |
| t_{PLH} | Response Time Low to High $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = 5mV TTL Input | | 1.5 0.7 | | μs |
| t_{PHL} | Response Time High to Low $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = 5mV TTL Input | | 2.2 0.15 | | μs |

1. The specified offset voltage is the maximum value required to drive the output up to 4.5V or down to 0.3V.
2. Maximum values including unavoidable inaccuracies of the industrial test.

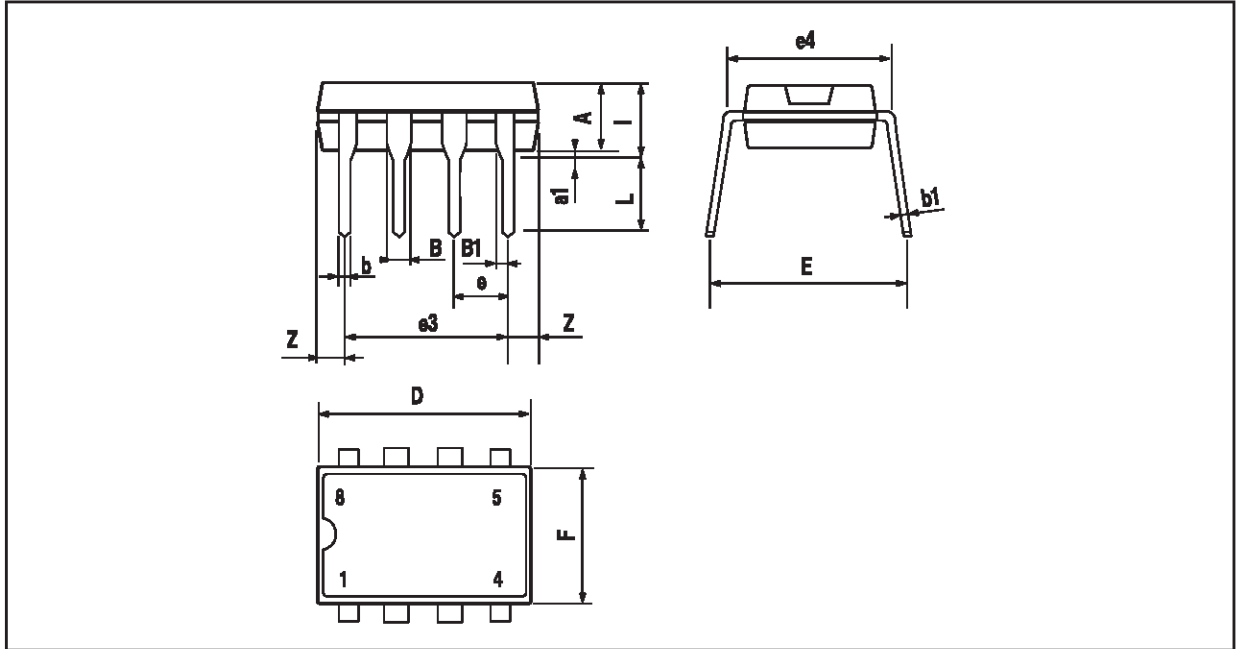
ELECTRICAL CHARACTERISTICS
 $V_{CC}^+ = 5V$, $V_{CC}^- = 0V$, $T_{amb} = 25^\circ C$ (unless otherwise specified)

| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------|---|------------|-----------------------------------|--------------------------------------|---------|
| V_{io} | Input Offset Voltage ¹⁾ $V_{ic} = 2.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1.2 | 5 6.5 | mV |
| I_{io} | Input Offset Voltage ²⁾ $V_{ic} = 2.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 300 | pA |
| I_{ib} | Input Bias Current (see note 2) $V_{ic} = 2.5V$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 1 | 600 | pA |
| V_{icm} | Input Common Mode Voltage Range $T_{min.} \leq T_{amb} \leq T_{max.}$ | 0 0 | | $V_{CC}^+ - 1.2$ $V_{CC}^+ - 1.5$ | V |
| CMR | Common-mode Rejection Ratio $V_{ic} = V_{icm \text{ min.}}$ | | 82 | | dB |
| SVR | Supply Voltage Rejection Ratio $V_{CC}^+ = +5V \text{ to } +10V$ | | 90 | | dB |
| V_{OH} | High Level Output Voltage $V_{id} = 1V$, $I_{OH} = -4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 4.5 4.3 | 4.7 | | V |
| V_{OL} | Low Level Output Voltage $V_{id} = -1V$, $I_{OL} = 4mA$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 200 | 300 375 | mV |
| I_{CC} | Supply Current (each comparator) No load - Outputs low $T_{min.} \leq T_{amb} \leq T_{max.}$ | | 9 | 20 25 | μA |
| t_{PLH} | Response Time Low to High $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = 5mV Overdrive = 10mV Overdrive = 20mV Overdrive = 40mV TTL Input | | 1.5 1.1 0.9 0.7 0.6 | | μs |
| t_{PHL} | Response Time High to Low $V_{ic} = 0V$, $f = 10kHz$, $C_L = 50pF$, Overdrive = 5mV Overdrive = 10mV Overdrive = 20mV Overdrive = 40mV TTL Input | | 2.2 1.6 1.1 0.75 0.17 | | μs |
| t_f | Fall time $f = 10kHz$, $C_L = 50pF$, Overdrive 50mV | | 30 | | ns |

1. The specified offset voltage is the maximum value required to drive the output up to 4.5V or down to 0.3V.

2. Maximum values including unavoidable inaccuracies of the industrial test.

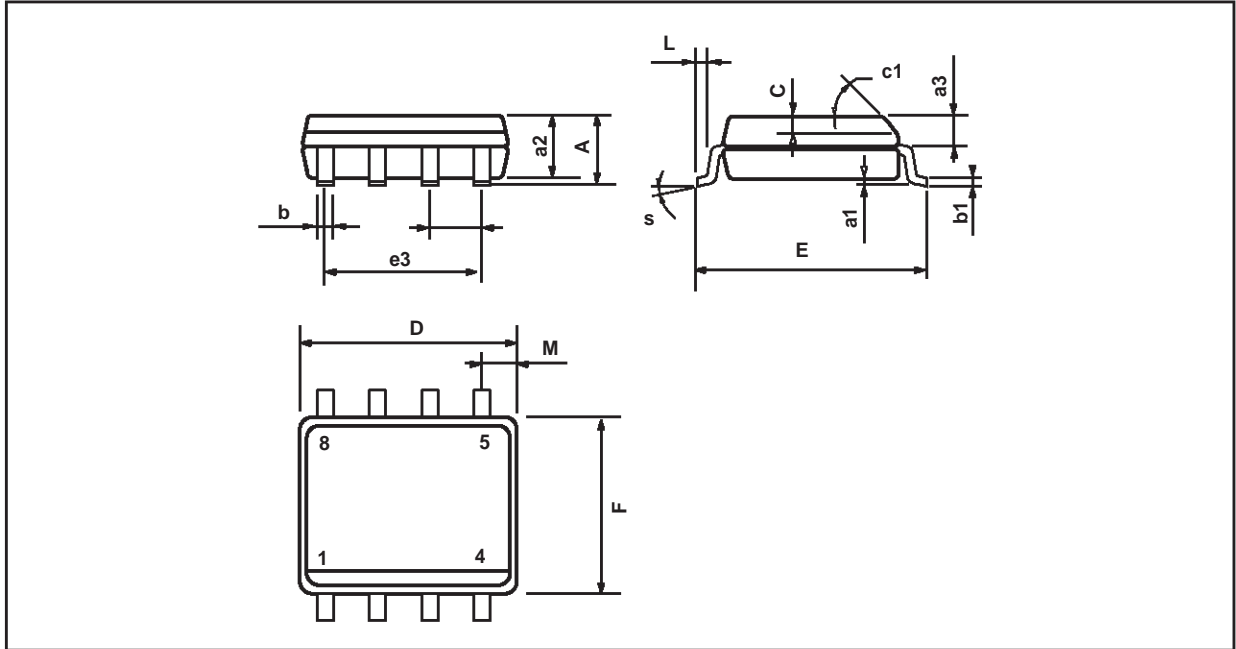
PACKAGE MECHANICAL DATA
8 PINS - PLASTIC DIP



| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|------|-------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | 3.32 | | | 0.131 | |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.15 | | 1.65 | 0.045 | | 0.065 |
| b | 0.356 | | 0.55 | 0.014 | | 0.022 |
| b1 | 0.204 | | 0.304 | 0.008 | | 0.012 |
| D | | | 10.92 | | | 0.430 |
| E | 7.95 | | 9.75 | 0.313 | | 0.384 |
| e | | 2.54 | | | 0.100 | |
| e3 | | 7.62 | | | 0.300 | |
| e4 | | 7.62 | | | 0.300 | |
| F | | | 6.6 | | | 0.260 |
| i | | | 5.08 | | | 0.200 |
| L | 3.18 | | 3.81 | 0.125 | | 0.150 |
| Z | | | 1.52 | | | 0.060 |

TS3V3702

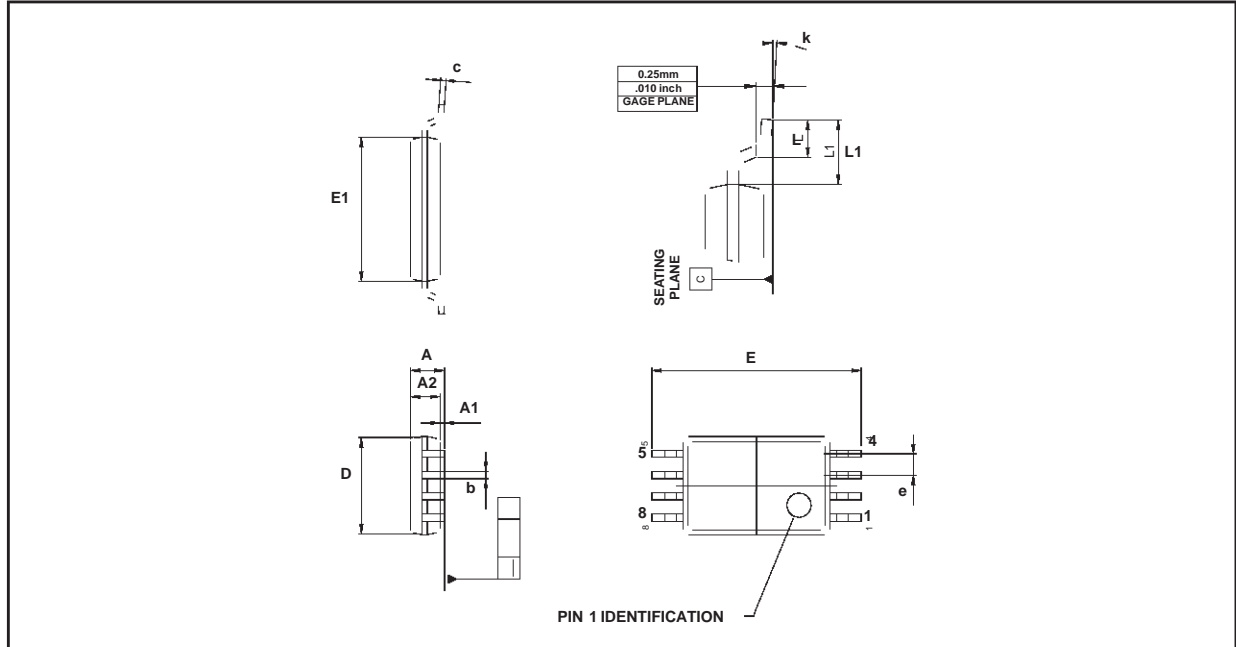
PACKAGE MECHANICAL DATA
8 PINS - PLASTIC MICROPACKAGE (SO)



| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.65 | | | 0.065 |
| a3 | 0.65 | | 0.85 | 0.026 | | 0.033 |
| b | 0.35 | | 0.48 | 0.014 | | 0.019 |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 |
| C | 0.25 | | 0.5 | 0.010 | | 0.020 |
| c1 | 45° (typ.) | | | | | |
| D | 4.8 | | 5.0 | 0.189 | | 0.197 |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 |
| e | | 1.27 | | | 0.050 | |
| e3 | | 3.81 | | | 0.150 | |
| F | 3.8 | | 4.0 | 0.150 | | 0.157 |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 |
| M | | | 0.6 | | | 0.024 |
| S | 8° (max.) | | | | | |

PACKAGE MECHANICAL DATA

8 PINS - THIN SHRINK SMALL OUTLINE PACKAGE (TSSOP)



| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|-------|------|--------|--------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.20 | | | 0.05 |
| A1 | 0.05 | | 0.15 | 0.01 | | 0.006 |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.15 |
| c | 0.09 | | 0.20 | 0.003 | | 0.012 |
| D | 2.90 | 3.00 | 3.10 | 0.114 | 0.118 | 0.122 |
| E | | 6.40 | | | 0.252 | |
| E1 | 4.30 | 4.40 | 4.50 | 0.169 | 0.173 | 0.177 |
| e | | 0.65 | | | 0.025 | |
| k | 0° | | 8° | 0° | | 8° |
| l | 0.50 | 0.60 | 0.75 | 0.09 | 0.0236 | 0.030 |
| L | 0.45 | 0.600 | 0.75 | 0.018 | 0.024 | 0.030 |
| L1 | | 1.000 | | | 0.039 | |

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