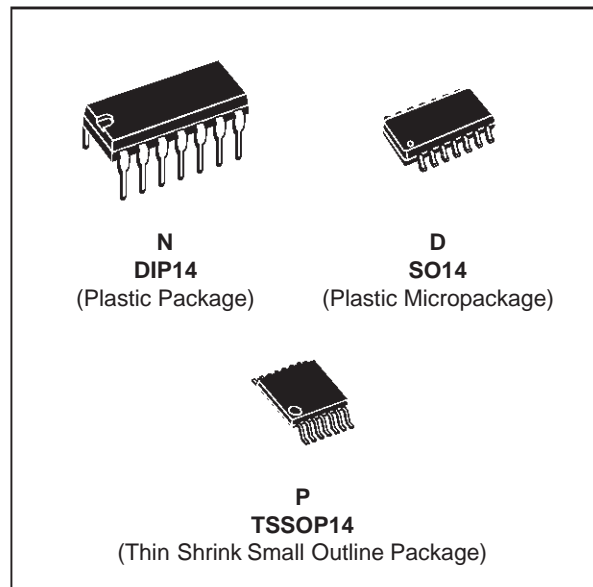




# TS339C,I,M

## MICROPOWER QUAD CMOS VOLTAGE COMPARATORS

- EXTREMELY LOW SUPPLY CURRENT :  
9 $\mu$ A TYP / COMPARATOR
- WIDE SINGLE SUPPLY RANGE (3V TO 16V)  
OR DUAL SUPPLIES ( $\pm$ 1.5V TO  $\pm$ 8V)
- EXTREMELY LOW INPUT BIAS CURRENT :  
1pA TYP
- EXTREMELY LOW INPUT OFFSET  
CURRENT : 1pA TYP
- INPUT COMMON-MODE VOLTAGE RANGE  
INCLUDES GND
- HIGH INPUT IMPEDANCE : 10<sup>12</sup> $\Omega$  TYP
- FAST RESPONSE TIME : 1.5 $\mu$ s TYP FOR  
5mV OVERDRIVE
- PIN-TO-PIN AND FUNCTIONALLY  
COMPATIBLE WITH BIPOLAR LM339



### DESCRIPTION

The TS339 is a micropower CMOS quad voltage comparator with extremely low consumption of 9 $\mu$ A typ / comparator (20 times less than bipolar LM339). Similar performances are offered by the quad micropower comparator TS3704 with a push-pull CMOS output.

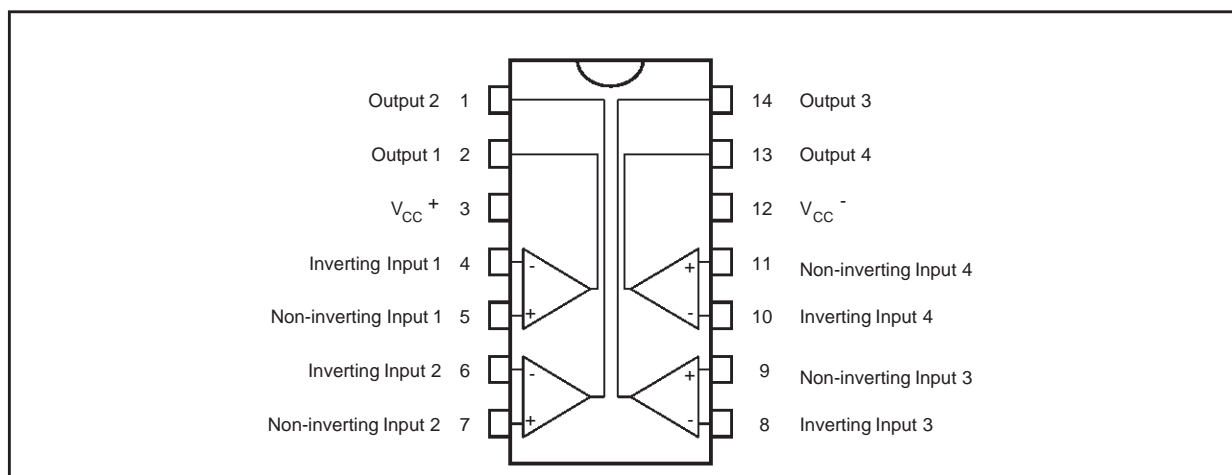
Thus response times remain similar to the LM339.

### ORDER CODES

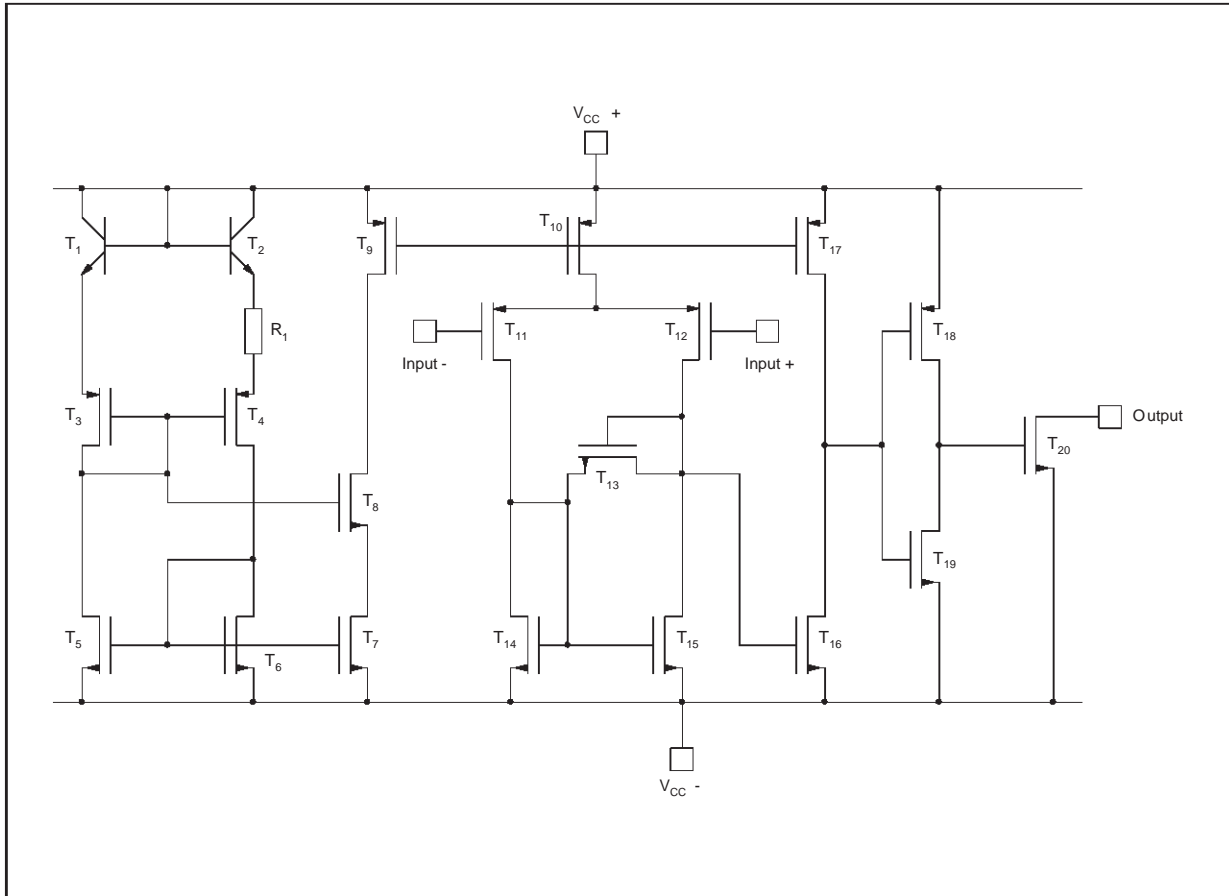
| Part Number | Temperature Range | Package |   |   |
|-------------|-------------------|---------|---|---|
|             |                   | N       | D | P |
| TS339C      | 0°C, +70°C        | ●       | ● | ● |
| TS339I      | -40°C, +125°C     | ●       | ● | ● |
| TS339M      | -55°C, +125°C     | ●       | ● | ● |

**Example :** TS339CN

### PIN CONNECTIONS (top view)



**SCHEMATIC DIAGRAM** (for 1/4 TS339)



**MAXIMUM RATINGS**

| Symbol     | Parameter                             | Value                                                                | Unit        |
|------------|---------------------------------------|----------------------------------------------------------------------|-------------|
| $V_{CC}^+$ | Supply Voltage - (note 1)             | 18                                                                   | V           |
| $V_{id}$   | Differential Input Voltage - (note 2) | $\pm 18$                                                             | V           |
| $V_i$      | Input Voltage - (note 3)              | 18                                                                   | V           |
| $V_o$      | Output Voltage                        | 18                                                                   | V           |
| $I_o$      | Output Current                        | 20                                                                   | mA          |
| $T_{oper}$ | Operating Free-Air Temperature Range  | TS339C<br>TS339I<br>TS339M<br>0 to +70<br>-40 to +125<br>-55 to +125 | $^{\circ}C$ |
| $T_{stg}$  | Storage Temperature Range             | -65 to +150                                                          | $^{\circ}C$ |

- Notes :**
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. Short circuit from outputs to  $V_{CC}^+$  can cause excessive heating and eventual destruction.

**OPERATING CONDITIONS**

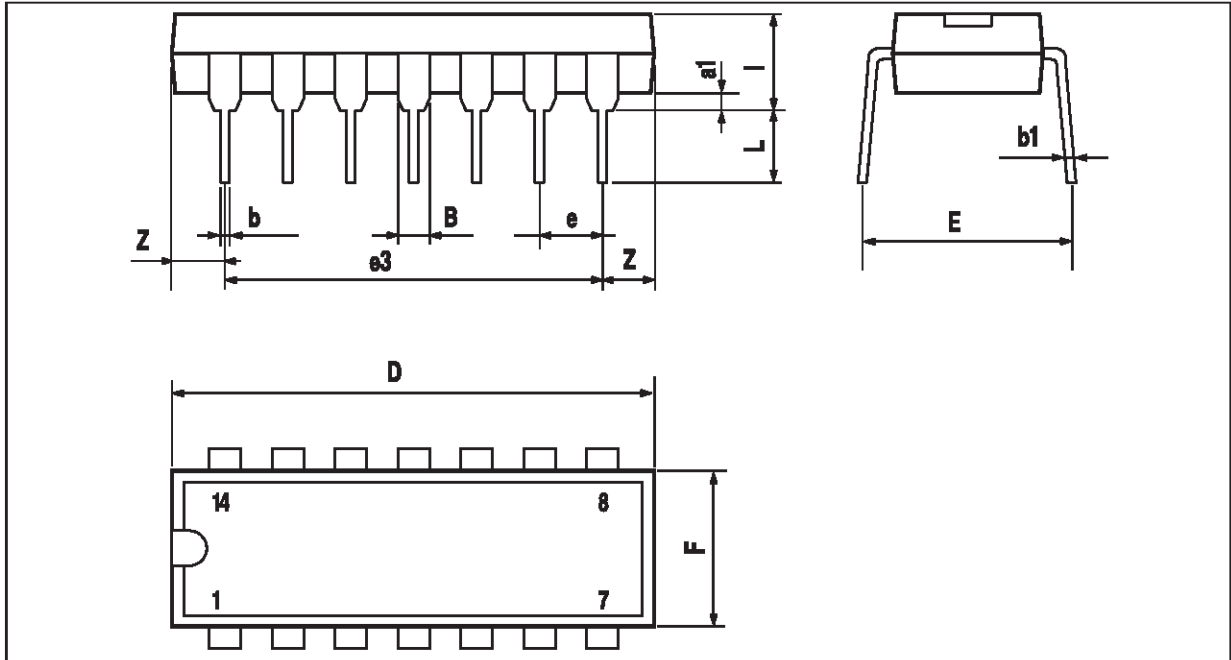
| Symbol     | Parameter                       | Value                                    | Unit |
|------------|---------------------------------|------------------------------------------|------|
| $V_{CC}^+$ | Supply Voltage                  | TS339C,I<br>TS339M<br>3 to 16<br>4 to 16 | V    |
| $V_{icm}$  | Common Mode Input Voltage Range | 0 to $V_{CC}^+ - 1.5$                    | V    |

**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 - (note 1)<br>$V_{ic} = V_{icm\ min.}, V_{CC}^+ = 5V\ to\ 10V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                  |                                                | 1.4                              | 5<br>6.5   | mV      |
| $I_{io}$  | Input Offset Current - (note 2)<br>$V_{ic} = 2.5\ V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                                                 |                                                | 1                                | 300        | pA      |
| $I_{ib}$  | Input Bias Current - (note 2)<br>$V_{ic} = 2.5\ V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                                                   |                                                | 1                                | 600        | pA      |
| $V_{icm}$ | Input Common Mode Voltage Range<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                                                                      | 0 to $V_{CC}^+ - 1.2$<br>0 to $V_{CC}^+ - 1.5$ |                                  |            | V       |
| CMR       | Common-mode Rejection Ratio<br>$V_{ic} = V_{icm\ min.}$                                                                                                                       |                                                | 75                               |            | dB      |
| SVR       | Supply Voltage Rejection Ratio<br>$V_{CC}^+ = +5V\ to\ +10V$                                                                                                                  |                                                | 85                               |            | dB      |
| $I_{OH}$  | High Level Output Current<br>$V_{id} = 1V, V_{OH} = +5V$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                                             |                                                | 2                                | 40<br>1000 | nA      |
| $V_{OL}$  | Low Level Output Voltage<br>$V_{id} = -1V, I_{OL} = 6mA$<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                                             |                                                | 350                              | 400<br>650 | mV      |
| $I_{CC}$  | Supply Current (4 comparators)<br>No load - Outputs low<br>$T_{min.} \leq T_{amb} \leq T_{max.}$                                                                              |                                                | 36                               | 80<br>100  | $\mu A$ |
| $t_{PLH}$ | Response Time Low to High<br>$V_{ic} = 0V, f = 10kHz, R_L = 5.1k\Omega, C_L = 15pF,$ Overdrive = 5mV<br>Overdrive = 10mV<br>Overdrive = 20mV<br>Overdrive = 40mV<br>TTL Input |                                                | 1.5<br>1.2<br>1.1<br>0.9<br>0.8  |            | $\mu s$ |
| $t_{PHL}$ | Response Time High to Low<br>$V_{ic} = 0V, f = 10kHz, R_L = 5.1k\Omega, C_L = 15pF,$ Overdrive = 5mV<br>Overdrive = 10mV<br>Overdrive = 20mV<br>Overdrive = 40mV<br>TTL Input |                                                | 2.5<br>1.9<br>1.2<br>0.8<br>0.08 |            | $\mu s$ |
| $t_f$     | Fall Time<br>$f = 10kHz, C_L = 15pF, R_L = 5.1k\Omega, Overdrive\ 50mV$                                                                                                       |                                                | 25                               |            | ns      |

**Note :** 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**  
14 PINS - PLASTIC DIP

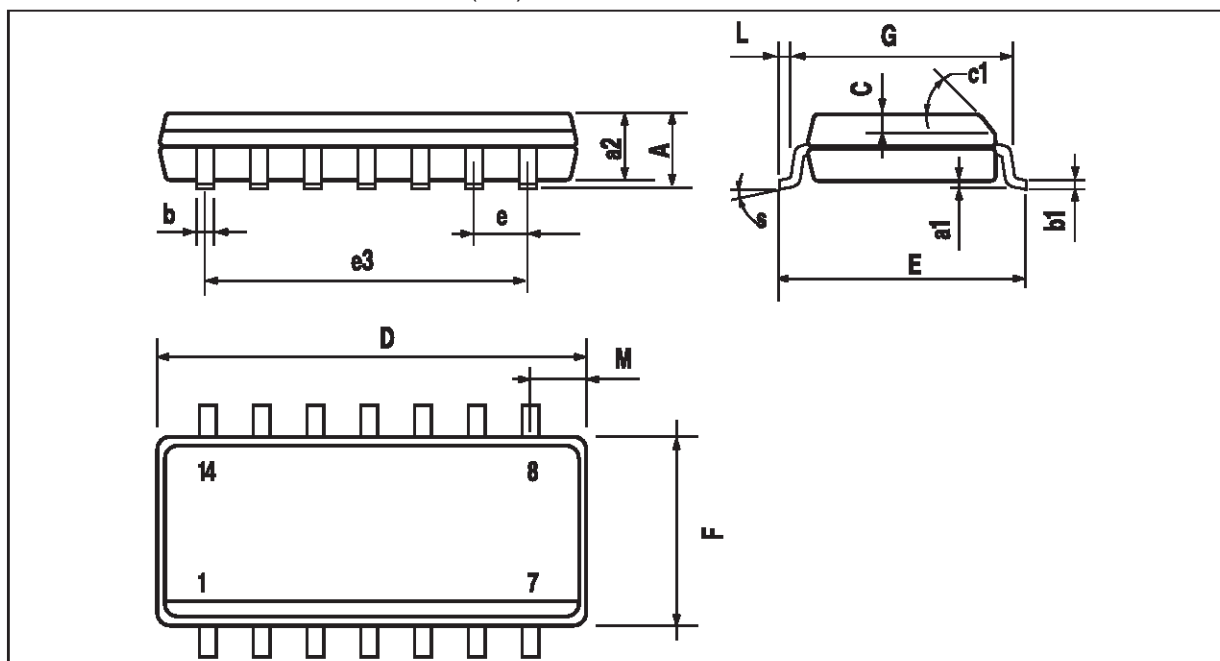


PM-DIP14,EP5

| Dimensions | Millimeters |       |      | Inches |       |       |
|------------|-------------|-------|------|--------|-------|-------|
|            | Min.        | Typ.  | Max. | Min.   | Typ.  | Max.  |
| a1         | 0.51        |       |      | 0.020  |       |       |
| B          | 1.39        |       | 1.65 | 0.055  |       | 0.065 |
| b          |             | 0.5   |      |        | 0.020 |       |
| b1         |             | 0.25  |      |        | 0.010 |       |
| D          |             |       | 20   |        |       | 0.787 |
| E          |             | 8.5   |      |        | 0.335 |       |
| e          |             | 2.54  |      |        | 0.100 |       |
| e3         |             | 15.24 |      |        | 0.600 |       |
| F          |             |       | 7.1  |        |       | 0.280 |
| i          |             |       | 5.1  |        |       | 0.201 |
| L          |             | 3.3   |      |        | 0.130 |       |
| Z          | 1.27        |       | 2.54 | 0.050  |       | 0.100 |

DIP14,TEL

**PACKAGE MECHANICAL DATA**  
 14 PINS - PLASTIC MICROPACKAGE (SO)

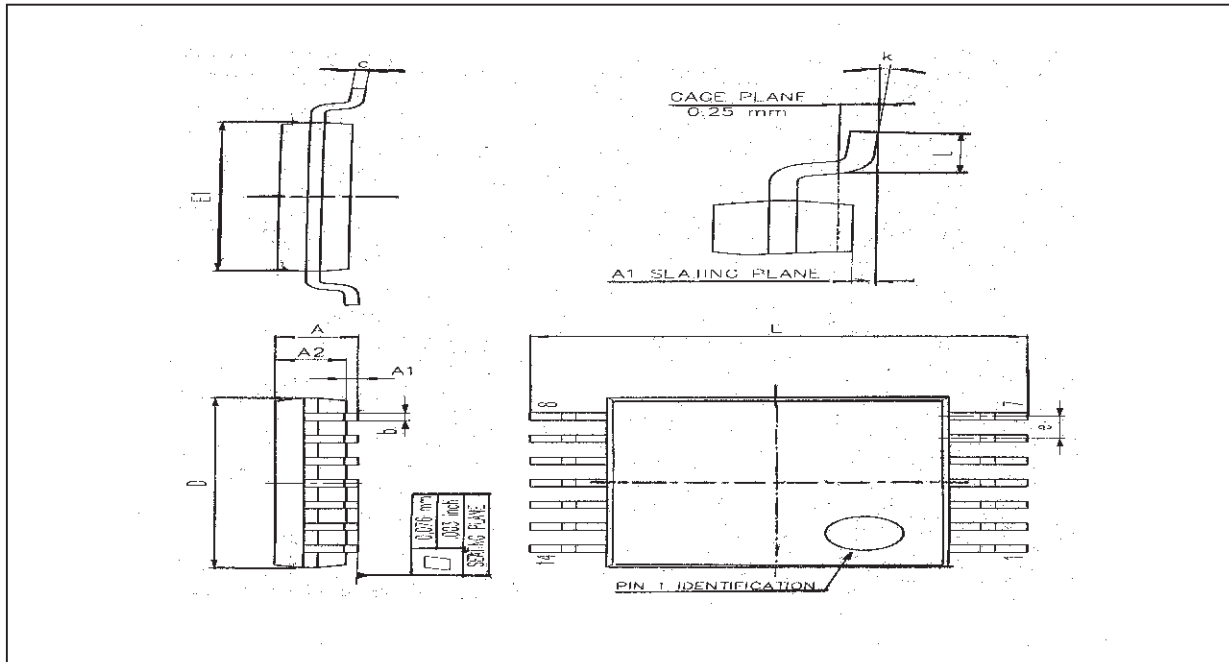


PM-S014EPS

| Dimensions | Millimeters |      |      | Inches |       |       |
|------------|-------------|------|------|--------|-------|-------|
|            | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A          |             |      | 1.75 |        |       | 0.069 |
| a1         | 0.1         |      | 0.2  | 0.004  |       | 0.008 |
| a2         |             |      | 1.6  |        |       | 0.063 |
| b          | 0.35        |      | 0.46 | 0.014  |       | 0.018 |
| b1         | 0.19        |      | 0.25 | 0.007  |       | 0.010 |
| C          |             | 0.5  |      |        | 0.020 |       |
| c1         | 45° (typ.)  |      |      |        |       |       |
| D          | 8.55        |      | 8.75 | 0.336  |       | 0.334 |
| E          | 5.8         |      | 6.2  | 0.228  |       | 0.244 |
| e          |             | 1.27 |      |        | 0.050 |       |
| e3         |             | 7.62 |      |        | 0.300 |       |
| F          | 3.8         |      | 4.0  | 0.150  |       | 0.157 |
| G          | 4.6         |      | 5.3  | 0.181  |       | 0.208 |
| L          | 0.5         |      | 1.27 | 0.020  |       | 0.050 |
| M          |             |      | 0.68 |        |       | 0.027 |
| S          | 8° (max.)   |      |      |        |       |       |

S014.TBL

**PACKAGE MECHANICAL DATA**  
 14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE



| Dim. | 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    | 4.90        | 5.00 | 5.10 | 0.192  | 0.196  | 0.20  |
| 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 |

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