



**TS461
TS462
TS464**

OUTPUT RAIL TO RAIL OPERATIONAL AMPLIFIERS

- HIGH DYNAMIC FEATURES
- LARGE **OUTPUT SWING**
($\pm 2.4V$ @ $V_{CC} = \pm 2.5V$)
- LOW NOISE LEVEL : $4nV/\sqrt{Hz}$
- LOW DISTORTION : **0.003%**
- OPERATING RANGE : **2.7V to 12V**
- AVAILABLE IN **SOT23-5 MICROPACKAGE**

DESCRIPTION

The TS46x is operational amplifiers able to operate with voltages as low as $\pm 1.35V$ and to reach a minimum of $\pm 2V_{pp}$ of output swing when supplied with $\pm 2.5V$.

This device is well suited for every kind of portable and battery-supplied equipment where low noise and low distortion are key.

The TS461/2/4 are a cost-attractive access to the range of the Rail to Rail Op-Amps from STMicroelectronics.

APPLICATIONS

- Sound cards
- PDA
- CD players
- Recording equipments
- Multimedia
- Microphone preamplifier

ORDER CODES

| Part Number | Temperature Range | Package | | | | SOT23 Marking |
|-------------|-------------------|---------|---|---|---|---------------|
| | | N | D | P | L | |
| TS461C | -20, +70°C | | • | | • | K105 |
| TS462C | -20, +70°C | • | • | • | | |
| TS464C | -20, +70°C | • | • | • | | |

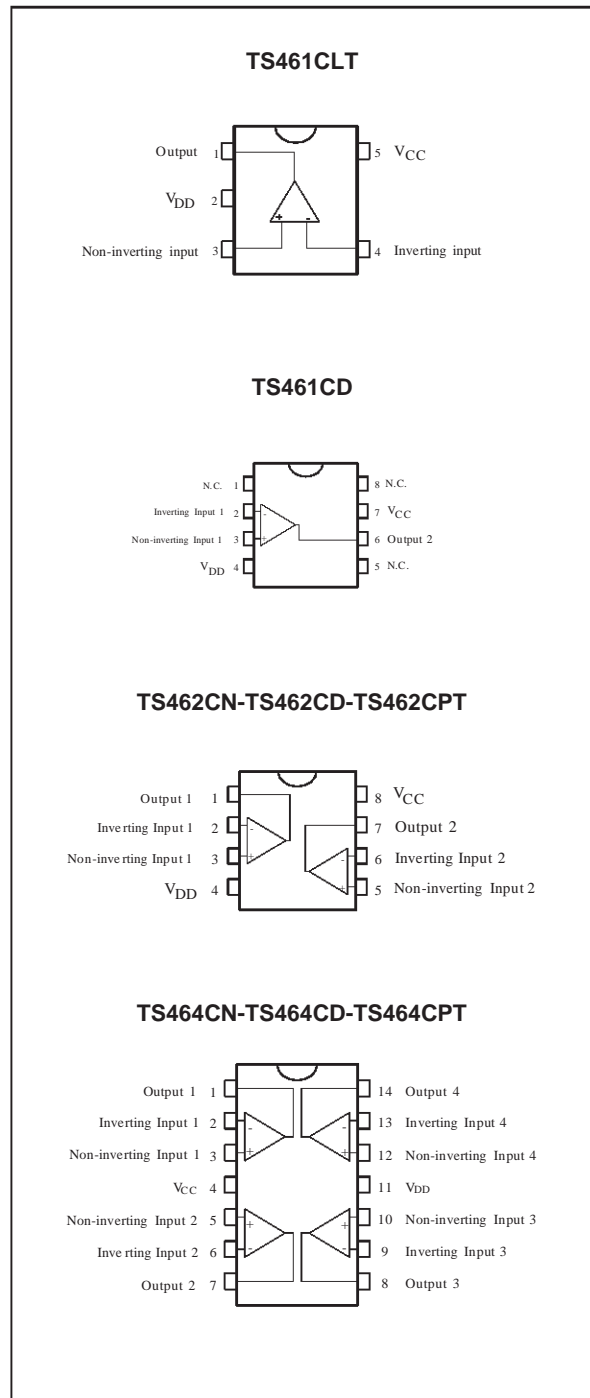
N = Dual in Line Package (DIP)

D = Small Outline Package (SO) - also available in Tape & Reel

P = Thin Shrink Small Outline Package (TSSOP) - only available in Tape & Reel (PT)

L = Tiny Package (SOT23-5) - only available in Tape & Reel (LT)

PIN CONNECTIONS (top view)



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|------------|---|----------------------------|------|
| V_{CC} | Supply Voltage - note 1 | 12 | V |
| V_{id} | Differential Input Voltage - note 2 | $\pm V_{CC}$ | V |
| V_{in} | Input Voltage Range - note 3 | -0.3 to 12.3 | V |
| T_{oper} | Operating Free Air Temperature Range | -20 to +70 | °C |
| T_{stg} | Storage Temperature | -65 to +150 | °C |
| T_j | Maximum Junction Temperature | 150 | °C |
| R_{thjc} | Thermal Resistance Junction to Case - note 4 SOT23-5 SO8 SO14 TSSOP8 TSSOP14 | 81 28 22 26 21 | °C/W |
| R_{thja} | Thermal Resistance Junction to Ambient (SOT23-5) | 256 | °C/W |
| ESD | Human Body Model | 2 | kV |
| | Lead Temperature (soldering, 10sec) | 260 | °C |

- Notes :**
1. All voltages values, except differential voltage are with respect to network ground terminal.
 2. Differential voltages are non-inverting input terminal with respect to the inverting input terminal.
 3. The magnitude of input and output voltages must never exceed $V_{CC} + 0.3V$.
 4. Short-circuits can cause excessive heating and destructive dissipation.

OPERATING CONDITIONS

| Symbol | Parameter | Value | Unit |
|-----------|---------------------------------|------------------------------------|------|
| V_{CC} | Supply Voltage Range | 2.7 to 10 | V |
| V_{icm} | Common Mode Input Voltage Range | $V_{DD} + 1.15$ to $V_{CC} - 1.15$ | V |

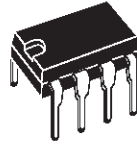
ELECTRICAL CHARACTERISTICS

$V_{CC} = 2.5V$, $V_{DD} = -2.5V$, $T_{amb} = 25^{\circ}C$ (unless otherwise specified)

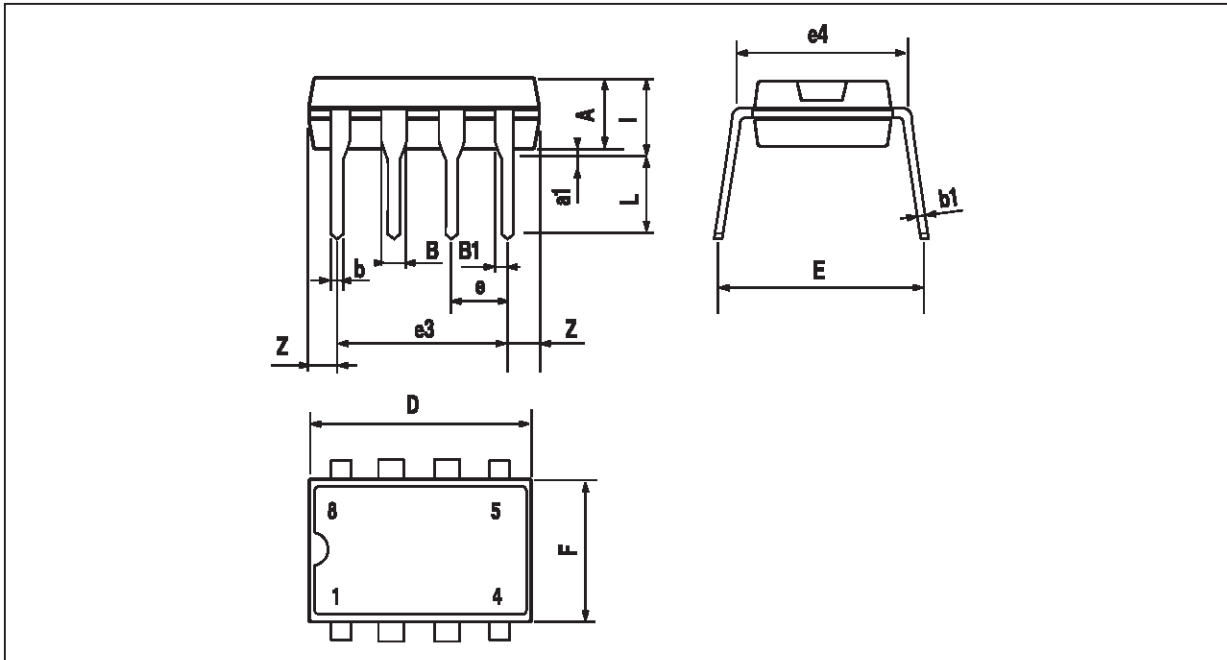
| Symbol | Parameter | Min. | Typ. | Max. | Unit |
|-----------|--|-------|------------|-------------|------------------------|
| V_{io} | Input Offset Voltage $T_{min.} < T_{amb} < T_{max.}$ | | 1 | 5 | mV |
| DV_{io} | Input Offset Voltage Drift $V_{icm} = 0V$, $V_o = 0V$ | | 5 | | $\mu V/^{\circ}C$ |
| I_{io} | Input Offset Current $V_{icm} = 0V$, $V_o = 0V$ $T_{min.} < T_{amb} < T_{max.}$ | | 10 | 150 200 | nA |
| I_{ib} | Input Bias Current $V_{icm} = 0V$, $V_o = 0V$ $T_{min.} < T_{amb} < T_{max.}$ | | 200 200 | 750 1000 | nA |
| V_{icm} | Common Mode Input Voltage Range | -1.35 | ± 1.5 | 1.35 | V |
| CMR | Common Mode Rejection Ratio $V_{icm} = \pm 1.35V$ | 60 | 85 | | dB |
| SVR | Supply Voltage Rejection Ratio $V_{CC} = \pm 2V$ to $\pm 3V$ | 60 | 70 | | dB |
| A_{vd} | Large Signal Voltage Gain $R_L = 2k\Omega$ | 70 | 80 | | dB |
| V_{OH} | High Level Output Voltage $R_L = 2k\Omega$ | 2 | 2.4 | | V |
| V_{OL} | Low Level Output Voltage $R_L = 2k\Omega$ | | -2.4 | -2 | V |
| I_{CC} | Supply Current, per amplifier Unity gain - no load | | 2 | 2.8 | mA |
| GBP | Gain Bandwidth Product $f = 100kHz$ $R_L = 2k\Omega$, $C_L = 100pF$ | 8.5 | 10 | | MHz |
| SR | Slew Rate $A_V = 1$, $V_{in} = \pm 1V$ | 2.8 | 4 | | V/ μs |
| e_n | Equivalent Input Noise Voltage $f = 100kHz$ | | 4 | | $\frac{nV}{\sqrt{Hz}}$ |
| THD | Total Harmonic Distortion $f = 1kHz$, $A_V = -1$ $R_L = 10k\Omega$ | | 0.003 | | % |

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TS462CN

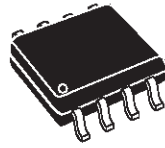


PACKAGE MECHANICAL DATA
8 PINS - PLASTIC DIP

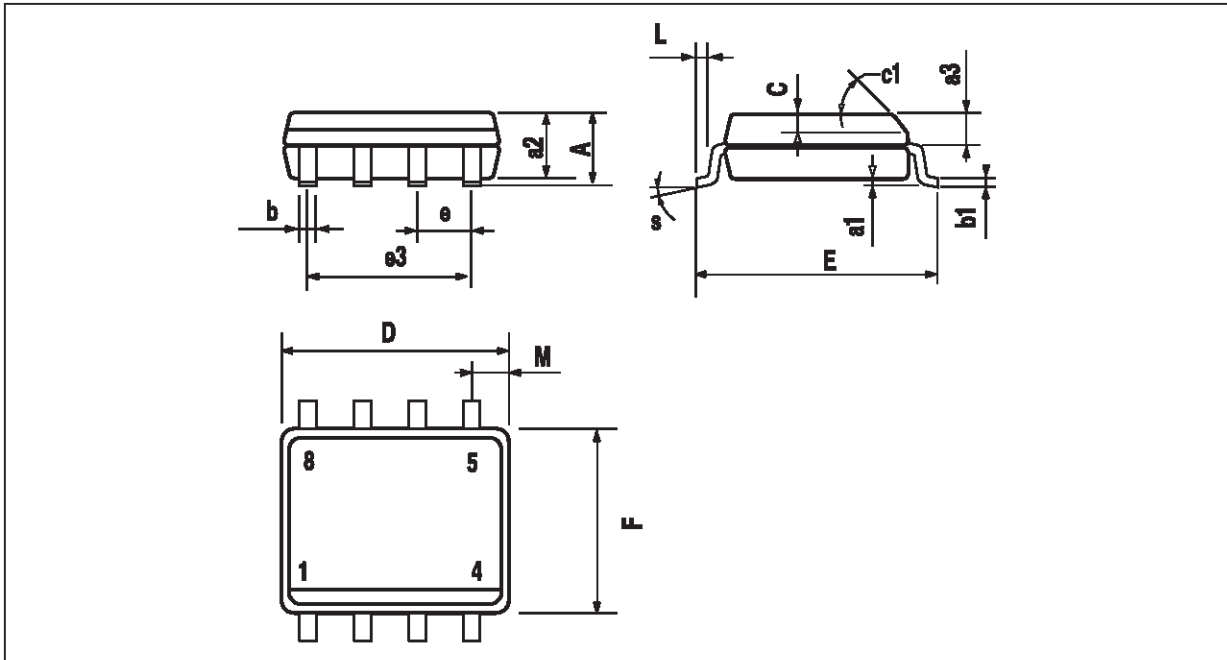


| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|------|-------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | 3.32 | | | 0.131 | |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.15 | | 1.65 | 0.045 | | 0.065 |
| b | 0.356 | | 0.55 | 0.014 | | 0.022 |
| 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 |

TS461CD-TS462CD

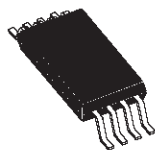


PACKAGE MECHANICAL DATA
8 PINS - PLASTIC MICROPACKAGE (SO)



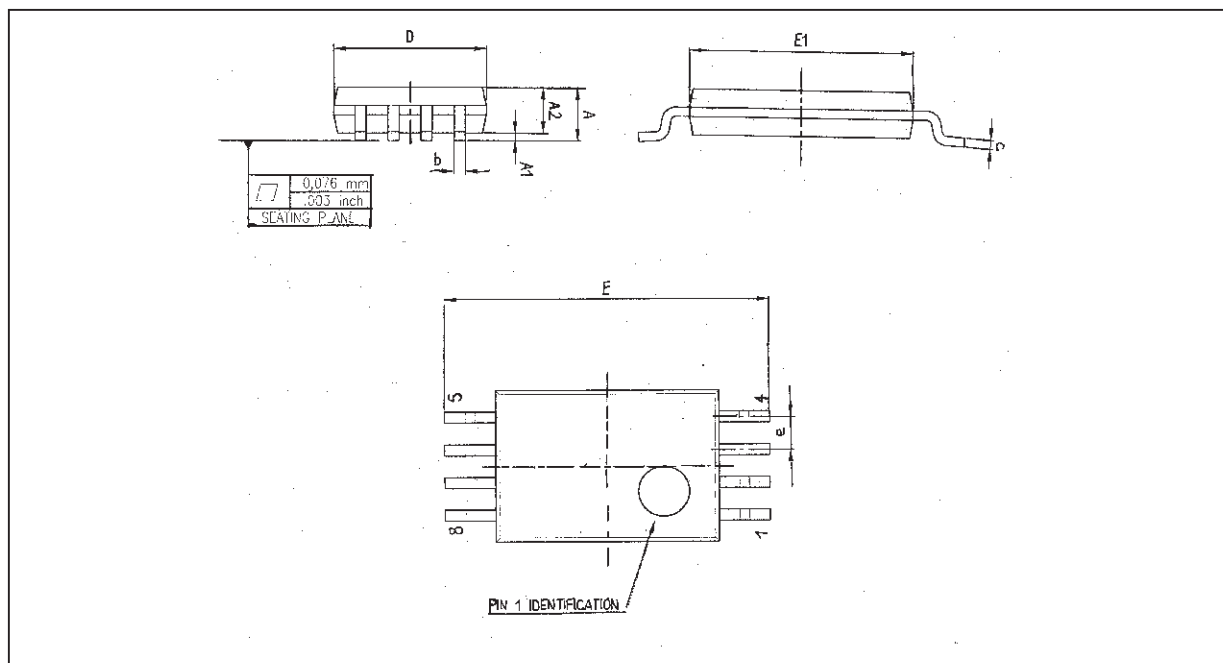
| Dimensions | Millimeters | | | Inches | | |
|------------|-------------|------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 |
| a2 | | | 1.65 | | | 0.065 |
| a3 | 0.65 | | 0.85 | 0.026 | | 0.033 |
| 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.) | | | | | |

TS462CPT



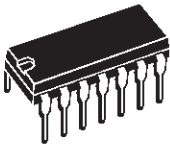
PACKAGE MECHANICAL DATA

8 PINS - THIN SHRINK SMALL OUTLINE PACKAGE (TSSOP)

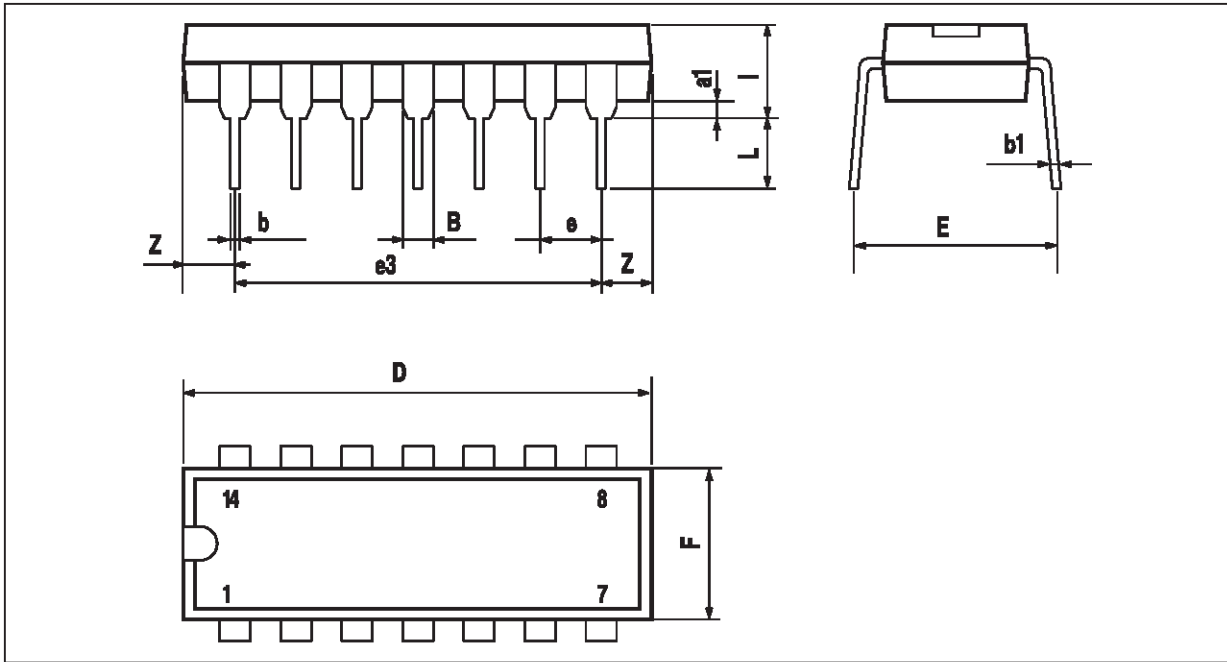


| Dim. | Millimeters | | | Inches | | |
|------|-------------|------|------|--------|--------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.20 | | | 0.05 |
| A1 | 0.05 | | 0.15 | 0.01 | | 0.006 |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 0.15 |
| c | 0.09 | | 0.20 | 0.003 | | 0.012 |
| D | 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 |

TS464CN



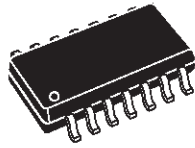
PACKAGE MECHANICAL DATA
14 PINS - PLASTIC DIP



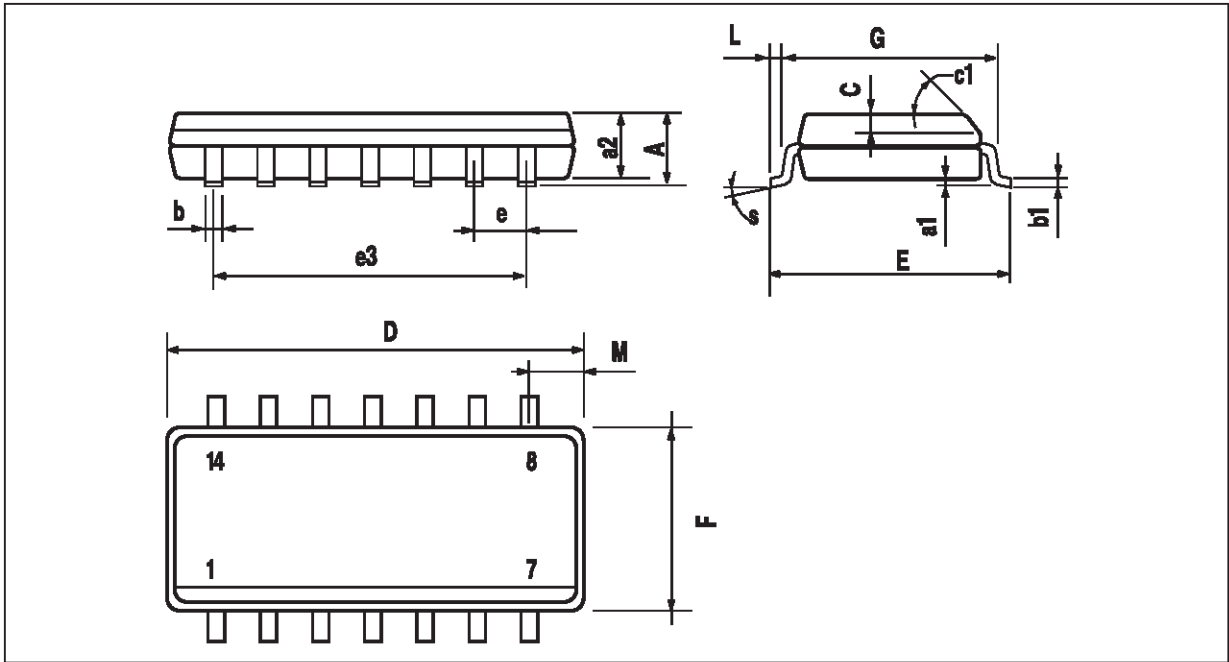
| Dim. | Millimeters | | | Inches | | |
|------|-------------|-------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| a1 | 0.51 | | | 0.020 | | |
| B | 1.39 | | 1.65 | 0.055 | | 0.065 |
| b | | 0.5 | | | 0.020 | |
| b1 | | 0.25 | | | 0.010 | |
| D | | | 20 | | | 0.787 |
| 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 |

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TS464CD

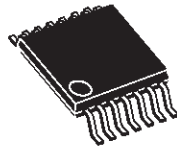


PACKAGE MECHANICAL DATA
14 PINS - PLASTIC MICROPACKAGE (SO)

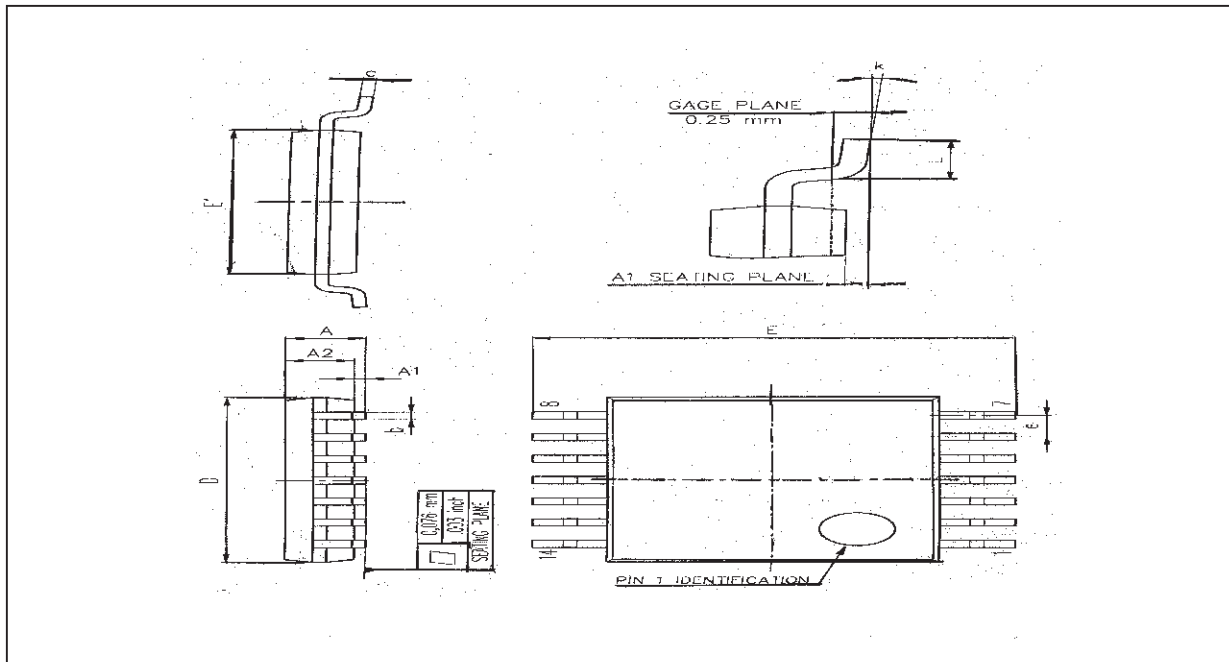


| Dim. | Millimeters | | | Inches | | |
|------|-------------|------|------|--------|-------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.75 | | | 0.069 |
| a1 | 0.1 | | 0.2 | 0.004 | | 0.008 |
| a2 | | | 1.6 | | | 0.063 |
| b | 0.35 | | 0.46 | 0.014 | | 0.018 |
| b1 | 0.19 | | 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.) | | | | | |

TS464CPT

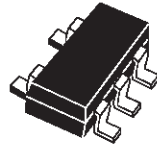


PACKAGE MECHANICAL DATA
14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE (TSSOP)

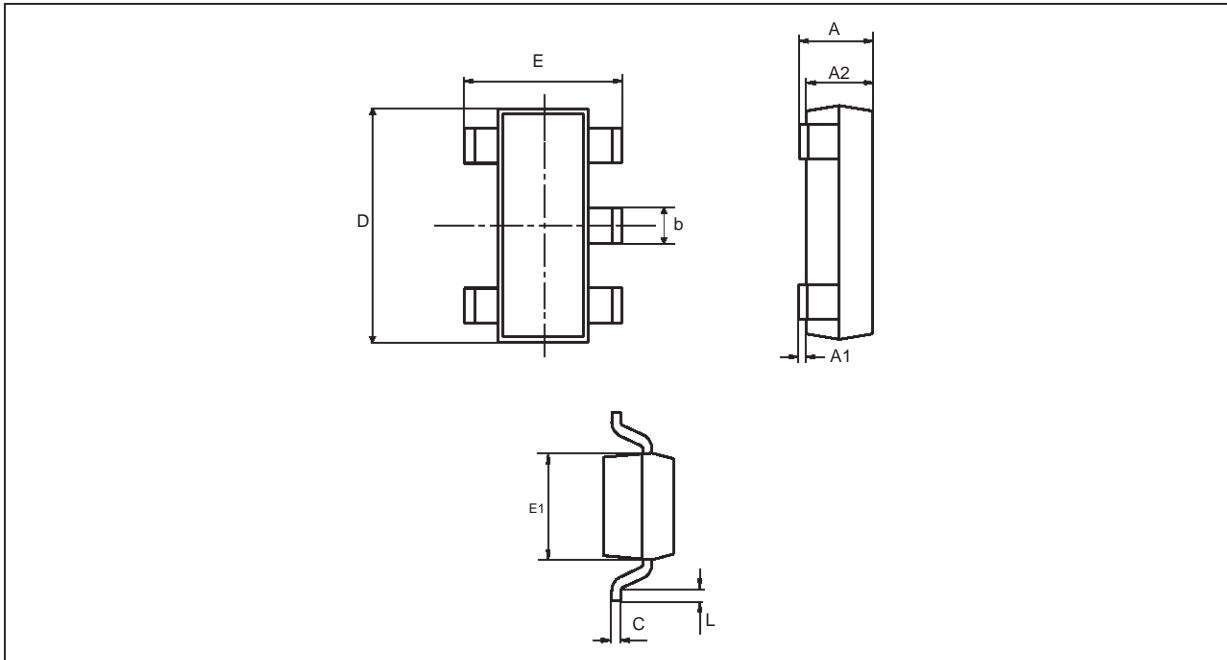


| Dim. | Millimeters | | | Inches | | |
|------|-------------|------|------|--------|--------|-------|
| | Min. | Typ. | Max. | Min. | Typ. | Max. |
| A | | | 1.20 | | | 0.05 |
| A1 | 0.05 | | 0.15 | 0.01 | | 0.006 |
| A2 | 0.80 | 1.00 | 1.05 | 0.031 | 0.039 | 0.041 |
| b | 0.19 | | 0.30 | 0.007 | | 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 |

TS461CLT



PACKAGE MECHANICAL DATA
5 PINS -TINY PACKAGE (SOT23)



| Dim. | Millimeters | | Inches | |
|------|-------------|------|--------|-------|
| | Min. | Max. | Min. | Max. |
| A | 0.90 | 1.45 | 0.034 | 0.057 |
| A1 | 0 | 0.15 | | 0.006 |
| A2 | 0.90 | 1.30 | 0.034 | 0.051 |
| b | 0.35 | 0.50 | 0.013 | 0.020 |
| C | 0.09 | 0.20 | 0.003 | 0.008 |
| D | 2.80 | 3.00 | 0.110 | 0.118 |
| E | 2.60 | 3.00 | 0.102 | 0.118 |
| E1 | 1.50 | 1.75 | 0.059 | 0.069 |
| L | 0.10 | 0.60 | 0.003 | 0.024 |

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