



**TS861  
TS862  
TS864**

## RAIL TO RAIL MICROPOWER BICMOS COMPARATORS

- ULTRA LOW CURRENT CONSUMPTION (**6 $\mu$ A/comp at V<sub>CC</sub>=2.7V**)
- RAIL TO RAIL CMOS INPUTS
- PUSH PULL OUTPUTS
- SUPPLY OPERATION FROM **2.7V TO 10V**
- LOW PROPAGATION DELAY
- LOW FALL AND RISE TIME: 20ns
- ESD PROTECTION (**2kV**)
- LATCH-UP IMMUNITY (**Class A**)
- AVAILABLE IN **SOT23-5 MICROPACKAGE**

### DESCRIPTION

The TS86x (Single, Dual & Quad) is a Rail to Rail comparator characterized for 2.7V to 10V operation over -40°C to +85°C temperature range. It exhibits an excellent speed to power ratio, featuring a current consumption of 6 $\mu$ A per comparator and a response time of 500ns at 2.7V for 100mV overdrive.

Due to its ultra low power consumption and its availability in tiny package, the TS86x comparator family is perfectly suited to battery powered systems. The output stage is designed with a push pull structure allowing a direct connection to microcontroller without additional pull-up resistor.

### APPLICATION

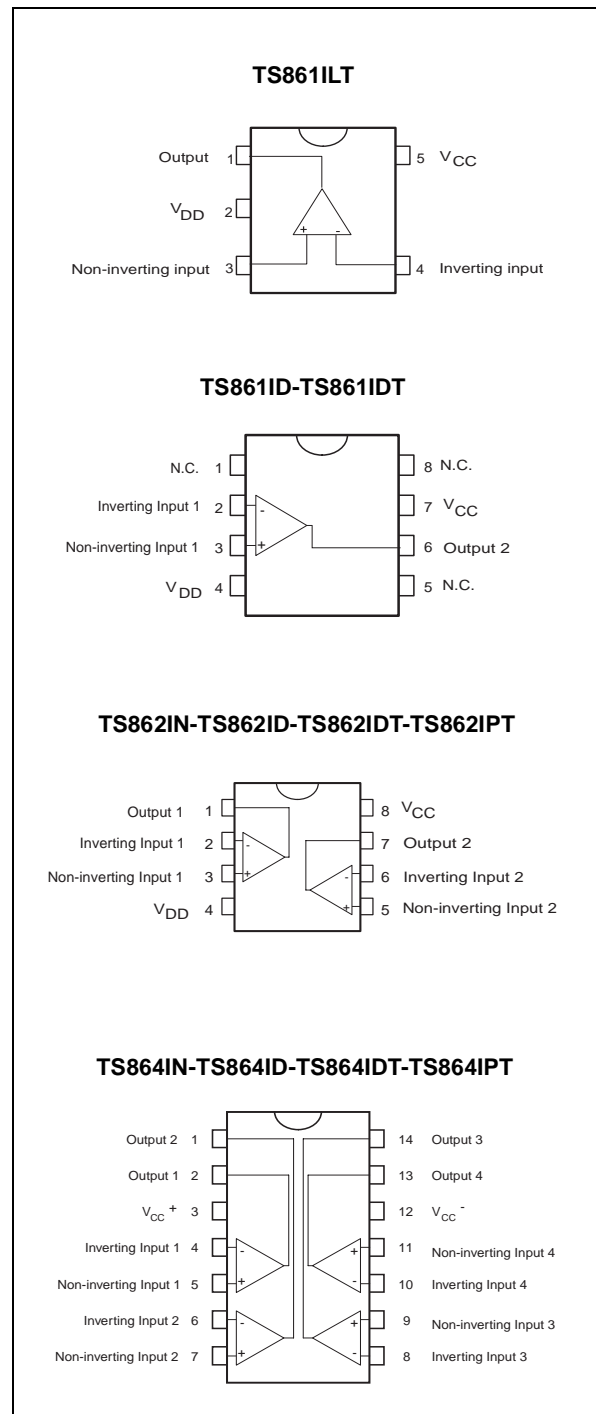
- Battery-powered systems (eg: Alarm)
- Portable communication systems
- Smoke/gas/fire detectors
- Portable computers

### ORDER CODE

| Part Number       | Temperature Range | Package |   |   |   | SOT23 Marking |
|-------------------|-------------------|---------|---|---|---|---------------|
|                   |                   | N       | D | P | L |               |
| TS861I<br>TS861AI | -40, +85°C        | •       | • |   | • | K501<br>K502  |
| TS862I<br>TS862AI | -40, +85°C        | •       | • | • |   |               |
| TS864I<br>TS864AI | -40, +85°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)  
**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 <sup>1)</sup>             | 12           | V    |
| $V_{id}$  | Differential Input Voltage <sup>2)</sup> | $\pm 12$     | V    |
| $V_{in}$  | Input Voltage Range <sup>3)</sup>        | -0.3 to 12.3 | V    |
| $T_{std}$ | Storage Temperature Range                | -65 to +150  | °C   |
| $T_j$     | Maximum Junction Temperature             | 150          | °C   |
| $P_D$     | Power dissipation <sup>4)</sup>          |              | mW   |
|           | SOT23-5                                  | 500          |      |
|           | DIP8                                     | 1250         |      |
|           | DIP14                                    | 1560         |      |
|           | SO8                                      | 710          |      |
|           | SO14                                     | 830          |      |
|           | TSSOP8                                   | 625          |      |
| TSSOP14   | 710                                      |              |      |
| ESD       | Human Body Model                         | 2            | kV   |
|           | Machine Model                            | 200          | V    |
|           | Latch-up Immunity                        | Class A      |      |
|           | Lead Temperature (soldering, 10 sec)     | 250          | °C   |

1. All voltages values, except differential voltage are with respect to network 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.  $P_D$  is calculated with  $T_{amb} = +25^\circ C$ ,  $T_j = +150^\circ C$  and  
 $R_{thja} = 250^\circ C/W$  for SOT23-5 package  
 $= 100^\circ C/W$  for DIP8 package  
 $= 80^\circ C/W$  for DIP14 package  
 $= 175^\circ C/W$  for SO8 package  
 $= 150^\circ C/W$  for SO14 package  
 $= 200^\circ C/W$  for TSSOP8 package  
 $= 175^\circ C/W$  for TSSOP14 package

**OPERATING CONDITIONS**

| Symbol     | Parameter                            | Value                                | Unit |
|------------|--------------------------------------|--------------------------------------|------|
| $V_{CC}$   | Supply Voltage                       | 2.7 to 10                            | V    |
| $V_{icm}$  | Common Mode Input Voltage Range      | $V_{CC}^- - 0.3$ to $V_{CC}^+ + 0.3$ | V    |
| $T_{oper}$ | Operating Free Air Temperature Range | -40 to + 85                          | °C   |

**ELECTRICAL CHARACTERISTICS** $V_{CC} = +2.7V$  $T_{amb} = 25^{\circ}C$  (unless otherwise specified)

| Symbol          | Parameter   | Min.         | Typ.       | Max.         | Unit              |
|-----------------|---|--------------|------------|--------------|-------------------|
| $V_{io}$        | Input Offset Voltage<br>TS861/2/4<br>$T_{min} < T < T_{max}$  |              | 3          | 15<br>18     | mV                |
|                 | TS861/2/4A<br>$T_{min} < T < T_{max}$   |              | 3          | 7<br>10      |                   |
| $\Delta V_{io}$ | Input Offset Voltage Drift  |              | 6          |              | $\mu V/^{\circ}C$ |
| $I_{io}$        | Input Offset Current <sup>1)</sup><br>$T_{min} < T < T_{max}$   |              | 1          | 150<br>300   | pA                |
| $I_{ib}$        | Input Bias Current <sup>1)</sup><br>$T_{min} < T < T_{max}$   |              | 1          | 300<br>600   | pA                |
| $V_{OH}$        | High Level Output Voltage<br>$I_{source} = 2.5mA$<br>$T_{min} < T < T_{max}$  | 2.35<br>2.15 | 2.45       |              | V                 |
| $V_{OL}$        | Low Level Output Voltage<br>$I_{sink} = 2.5mA$<br>$T_{min} < T < T_{max}$   |              | 0.2        | 0.35<br>0.45 | V                 |
| $A_{vd}$        | Large Signal Voltage Gain <sup>2)</sup>   |              | 240        |              | dB                |
| CMR             | Common Mode Rejection Ratio<br>$0 < V_{ICM} < 2.7V$   |              | 65         |              | dB                |
| SVR             | Supply Voltage Rejection Ratio<br>$0 < V_{CC} < 10V$  |              | 80         |              | dB                |
| $I_{CC}$        | Supply current per comparator<br>no load, output low<br>no load, output high  |              | 6<br>8     | 12<br>14     | $\mu A$           |
| $T_{plh}$       | Propagation delay from output low to output high<br>$V_{ICM} = 1.35V$ , $f = 10kHz$ , $C_L = 50pF$<br>overdrive = 10mV<br>overdrive = 100mV |              | 1.5<br>0.6 |              | $\mu s$           |
| $T_{phl}$       | Propagation delay from output high to output low<br>$V_{ICM} = 1.35V$ , $f = 10kHz$ , $C_L = 50pF$<br>overdrive = 10mV<br>overdrive = 100mV |              | 1.5<br>0.5 |              | $\mu s$           |
| $T_f$           | Fall time<br>$f = 10kHz$ , $C_L = 50pF$ , overdrive = 100mV   |              | 20         |              | ns                |
| $T_r$           | Rise time<br>$f = 10kHz$ , $C_L = 50pF$ , overdrive = 100mV   |              | 20         |              | ns                |

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

2. Design evaluation

3. Limits are 100% production tested at 25°C. Limits over temperature are guaranteed through correlation and by design.

**ELECTRICAL CHARACTERISTICS**

$V_{CC} = +5V$

$T_{amb} = 25^{\circ}C$  (unless otherwise specified)

| Symbol          | Parameter  | Min.        | Typ.     | Max.        | Unit              |
|-----------------|--|-------------|----------|-------------|-------------------|
| $V_{io}$        | Input Offset Voltage<br>TS861/2/4<br>$T_{min} < T < T_{max}$   |             | 3        | 15<br>18    | mV                |
|                 | TS861/2/4A<br>$T_{min} < T < T_{max}$  |             | 3        | 7<br>10     |                   |
| $\Delta V_{io}$ | Input Offset Voltage Drift   |             | 6        |             | $\mu V/^{\circ}C$ |
| $I_{io}$        | Input Offset Current <sup>1)</sup><br>$T_{min} < T < T_{max}$  |             | 1        | 150<br>300  | pA                |
| $I_{ib}$        | Input Bias Current <sup>1)</sup><br>$T_{min} < T < T_{max}$  |             | 1        | 300<br>600  | pA                |
| $V_{OH}$        | High Level Output Voltage<br>$I_{source} = 5mA$<br>$T_{min} < T < T_{max}$   | 4.6<br>4.45 | 4.8      |             | V                 |
| $V_{OL}$        | Low Level Output Voltage<br>$I_{sink} = 5mA$<br>$T_{min} < T < T_{max}$  |             | 0.2      | 0.4<br>0.55 | V                 |
| $A_{vd}$        | Large Signal Voltage Gain <sup>2)</sup>  |             | 240      |             | dB                |
| CMR             | Common Mode Rejection Ratio<br>$0 < V_{ICM} < 5V$  |             | 70       |             | dB                |
| SVR             | Supply Voltage Rejection Ratio<br>$2.7 < V_{CC} < 10V$   |             | 80       |             | dB                |
| $I_{CC}$        | Supply current per comparator<br>no load, output low<br>no load, output high   |             | 6<br>8   | 12<br>14    | $\mu A$           |
| $T_{plh}$       | Propagation delay from output low to output high<br>$V_{ICM} = 2.5V, f = 10kHz, C_L = 50pF$<br>overdrive = 10mV<br>overdrive = 100mV |             | 2<br>0.5 |             | $\mu s$           |
| $T_{phl}$       | Propagation delay from output high to output low<br>$V_{ICM} = 2.5V, f = 10kHz, C_L = 50pF$<br>overdrive = 10mV<br>overdrive = 100mV |             | 2<br>0.4 |             | $\mu s$           |
| $T_f$           | Fall time<br>$f = 10kHz, C_L = 50pF, overdrive = 100mV$  |             | 20       |             | ns                |
| $T_r$           | Rise time<br>$f = 10kHz, C_L = 50pF, overdrive = 100mV$  |             | 20       |             | ns                |

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

2. Design evaluation

3. Limits are 100% production tested at 25°C. Limits over temperature are guaranteed through correlation and by design

**ELECTRICAL CHARACTERISTICS****V<sub>CC</sub> = +10V**T<sub>amb</sub> = 25°C (unless otherwise specified)

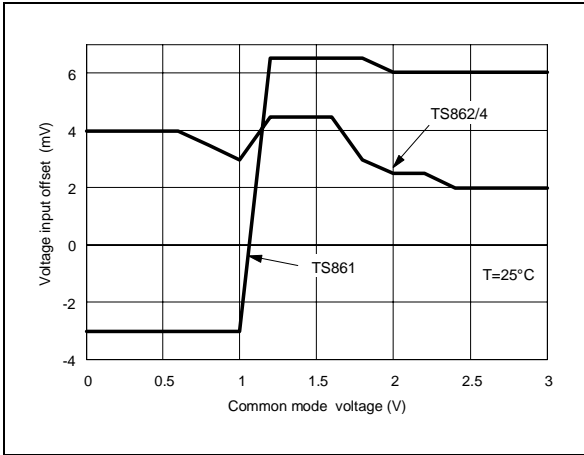
| Symbol           | Parameter  | Min.        | Typ.       | Max.        | Unit  |
|------------------|--|-------------|------------|-------------|-------|
| V <sub>io</sub>  | Input Offset Voltage (V <sub>ICM</sub> = V <sub>CC</sub> / 2 )<br>TS861/2/4<br>Tmin<T<Tmax   |             | 3          | 15<br>18    | mV    |
| ΔV <sub>io</sub> | Input Offset Voltage Drift   |             | 6          |             | μV/°C |
| I <sub>io</sub>  | Input Offset Current <sup>1)</sup><br>Tmin<T<Tmax  |             | 1          | 150<br>300  | pA    |
| I <sub>ib</sub>  | Input Bias Current <sup>1)</sup><br>Tmin<T<Tmax  |             | 1          | 300<br>600  | pA    |
| V <sub>OH</sub>  | High Level Output Voltage<br>I <sub>source</sub> =5mA<br>Tmin<T<Tmax   | 9.6<br>9.45 | 9.8        |             | V     |
| V <sub>OL</sub>  | Low Level Output Voltage<br>I <sub>sink</sub> =5mA<br>Tmin<T<Tmax  |             | 0.2        | 0.4<br>0.55 | V     |
| A <sub>vd</sub>  | Large Signal Voltage Gain <sup>2)</sup>  |             | 240        |             | dB    |
| CMR              | Common Mode Rejection Ratio<br>0 < V <sub>ICM</sub> < 10V  |             | 75         |             | dB    |
| SVR              | Supply Voltage Rejection Ratio<br>2.7 < V <sub>CC</sub> < 10V  |             | 80         |             | dB    |
| I <sub>CC</sub>  | Supply current per comparator<br>no load, output low<br>no load, output high   |             | 7<br>10    | 14<br>16    | μA    |
| T <sub>plh</sub> | Propagation delay from output low to output high<br>V <sub>ICM</sub> =5V, f=10kHz, C <sub>L</sub> =50pF<br>overdrive = 10mV<br>overdrive = 100mV |             | 3<br>0.5   |             | μs    |
| T <sub>phl</sub> | Propagation delay from output high to output low<br>V <sub>ICM</sub> =5V, f=10kHz, C <sub>L</sub> =50pF<br>overdrive = 10mV<br>overdrive = 100mV |             | 2.6<br>0.4 |             | μs    |
| T <sub>f</sub>   | Fall time<br>f=10kHz, C <sub>L</sub> =50pF, overdrive=100mV  |             | 20         |             | ns    |
| T <sub>r</sub>   | Rise time<br>f=10kHz, C <sub>L</sub> =50pF, overdrive=100mV  |             | 20         |             | ns    |

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

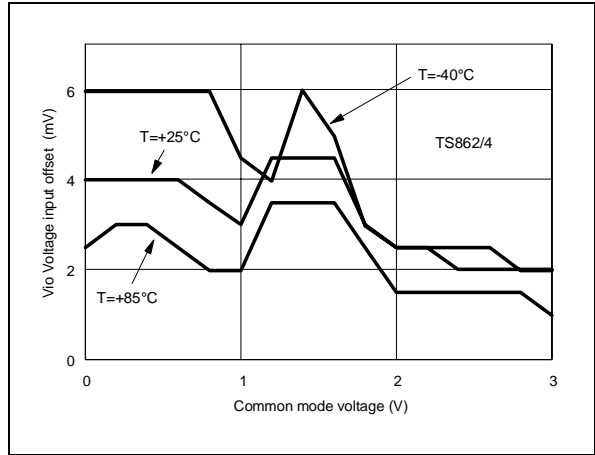
2. Design evaluation

3. Limits are 100% production tested at 25°C. Limits over temperature are guaranteed through correlation and by design.

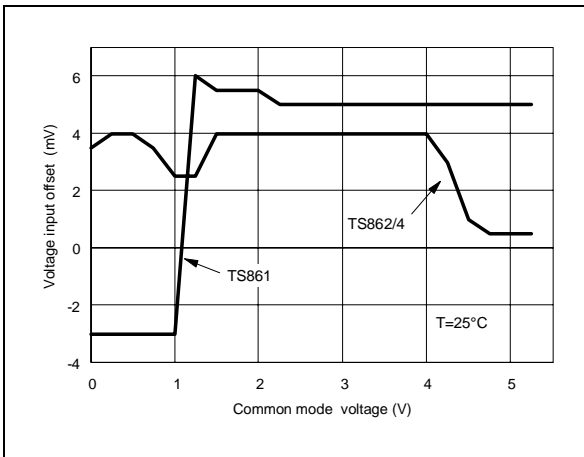
$V_{IO}$  versus  $V_{ICM}$  at  $V_{CC}= 2.7V$



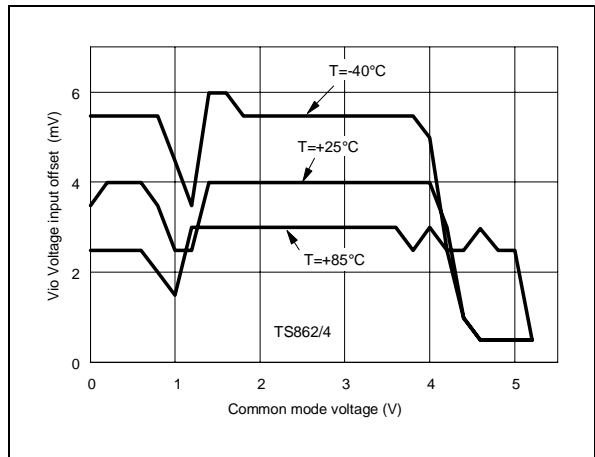
$V_{IO}$  versus  $V_{ICM}$  and temperature at  $V_{CC}= 2.7V$



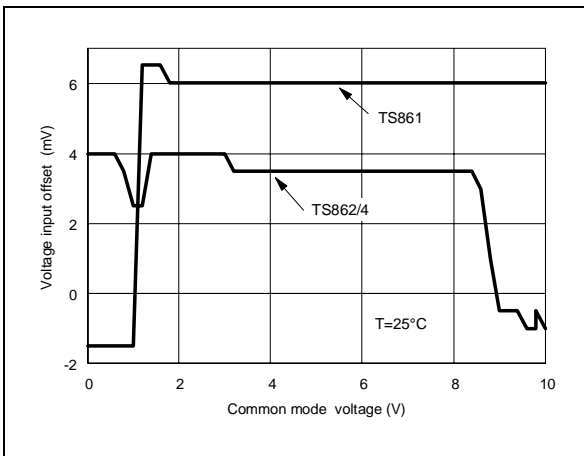
$V_{IO}$  versus  $V_{ICM}$  at  $V_{CC}= 5V$



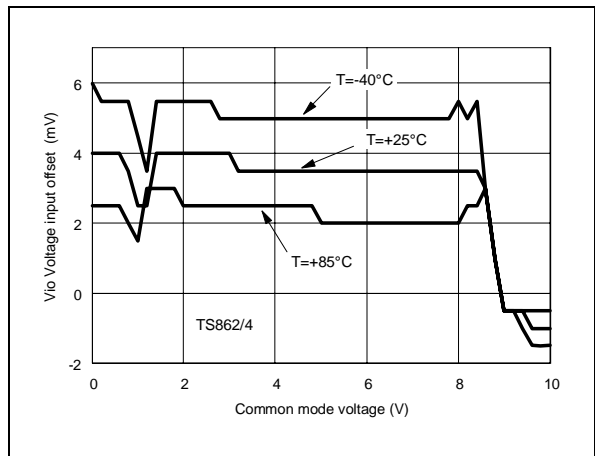
$V_{IO}$  versus  $V_{ICM}$  and temperature at  $V_{CC}= 5V$



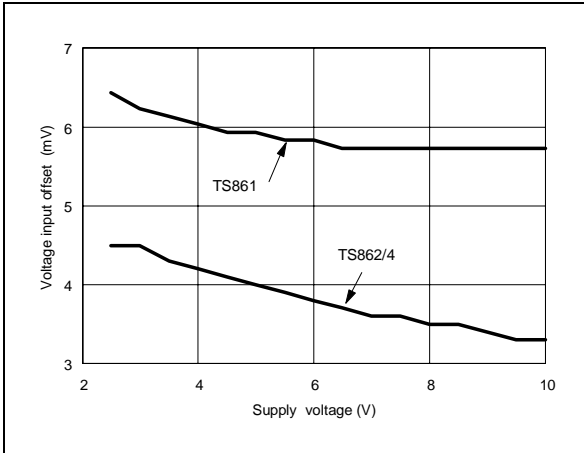
$V_{IO}$  versus  $V_{ICM}$  at  $V_{CC}= 10V$



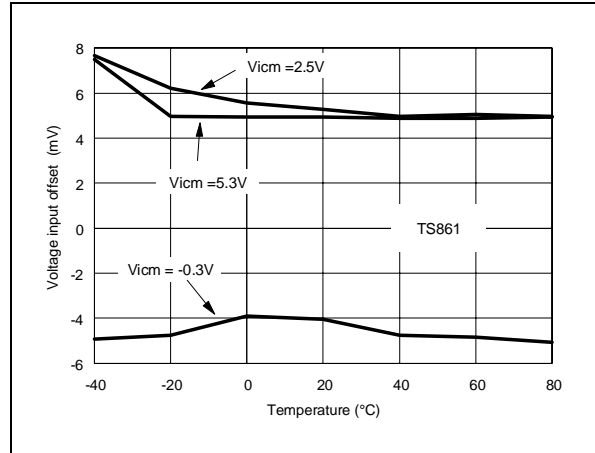
$V_{IO}$  versus  $V_{ICM}$  and temperature at  $V_{CC}= 10V$



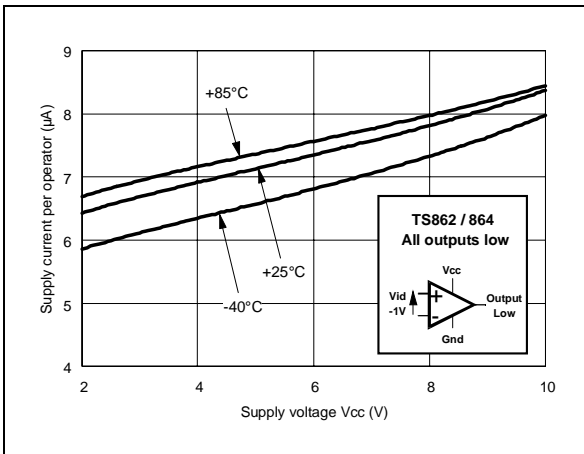
$V_{IO}$  versus  $V_{CC}$  at  $V_{ICM} = V_{CC} / 2$



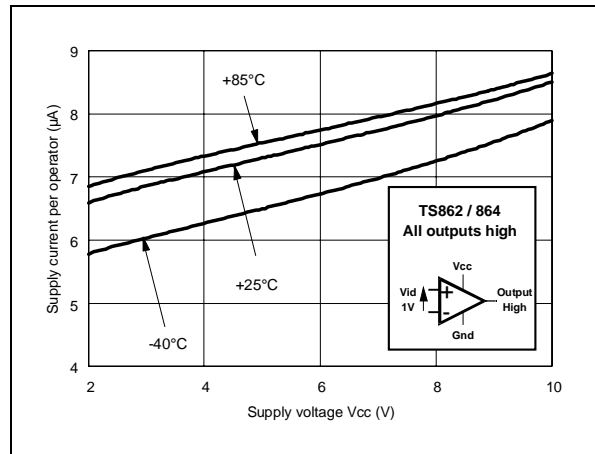
$V_{IO}$  versus temperature at  $V_{CC} = 5V$



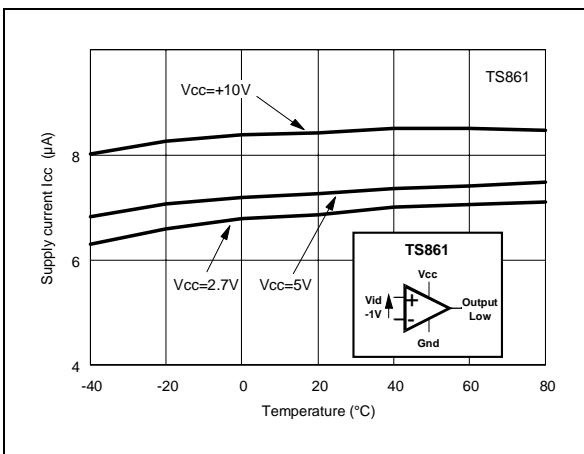
Supply Current ( $I_{CC}$ ) vs Supply Voltage ( $V_{CC}$ )



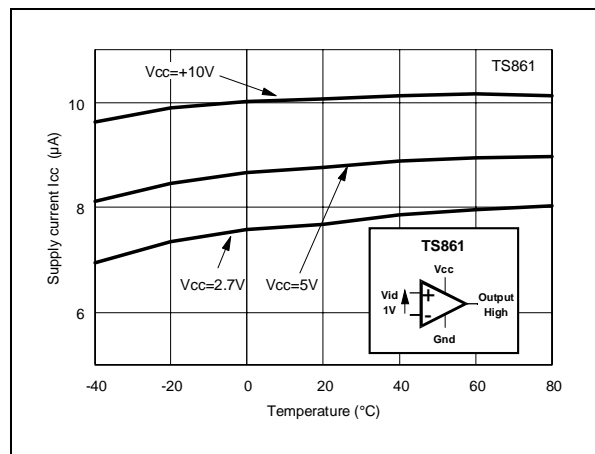
Supply Current ( $I_{CC}$ ) vs Supply Voltage ( $V_{CC}$ )



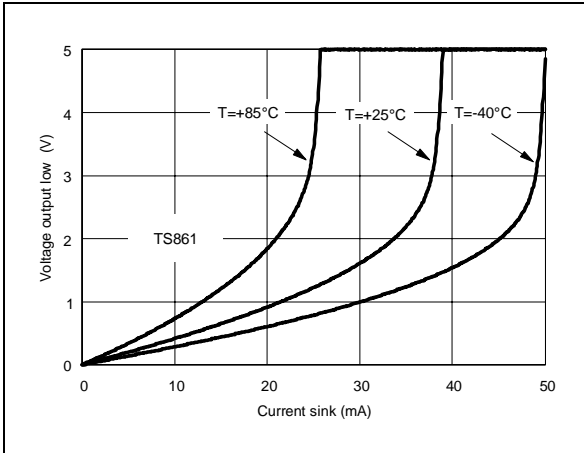
Supply Current ( $I_{CC}$ ) vs Temperature



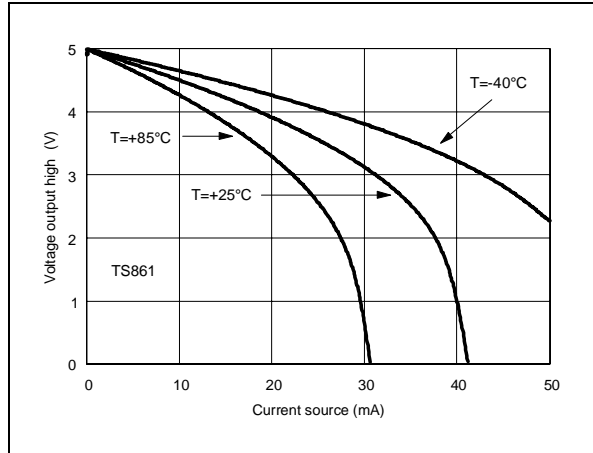
Supply Current ( $I_{CC}$ ) vs Temperature



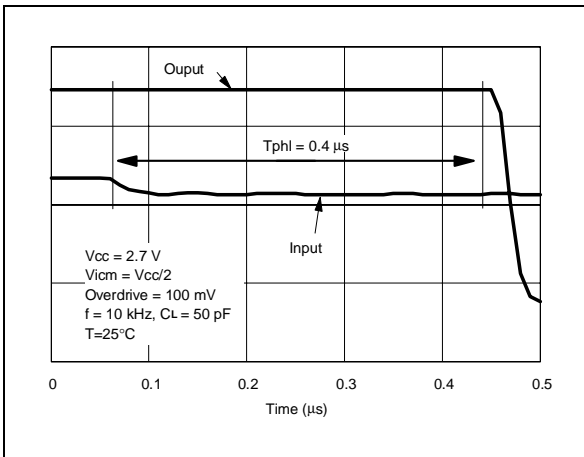
$V_{OL}$  versus  $I_{SINK}$  and temperature at  $V_{CC}=5V$



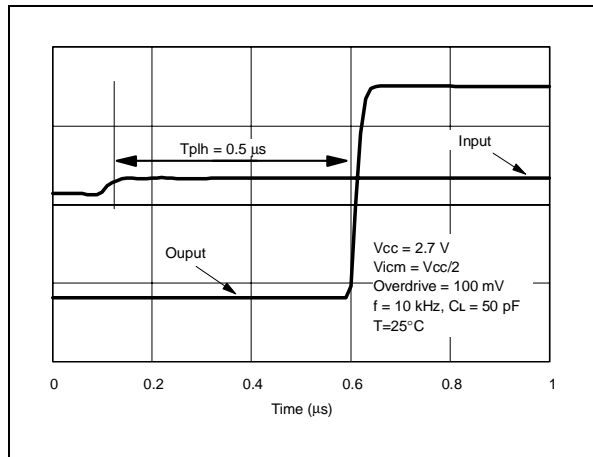
$V_{OH}$  vs  $I_{SOURCE}$  and temperature at  $V_{CC}=5V$



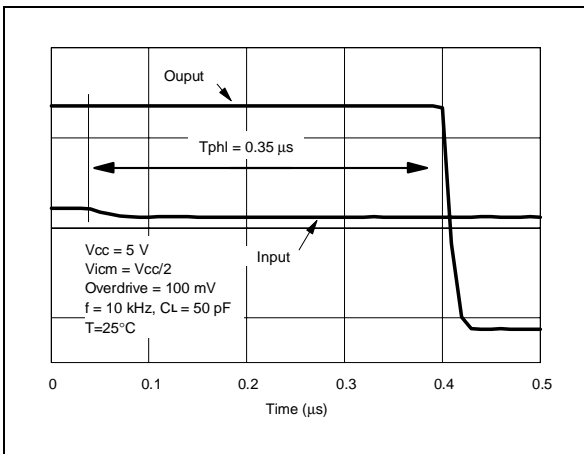
Response time  $T_{PHL}$  at  $V_{CC}= 2.7V$



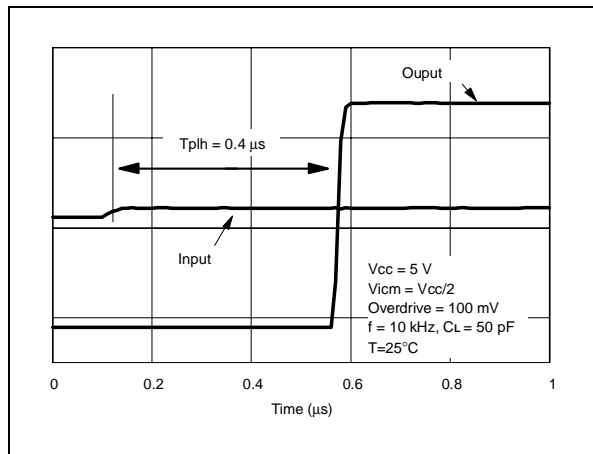
Response time  $T_{PLH}$  at  $V_{CC}= 2.7V$



Response time  $T_{PHL}$  at  $V_{CC}= 5V$

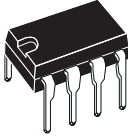


Response time  $T_{PLH}$  at  $V_{CC}= 5V$

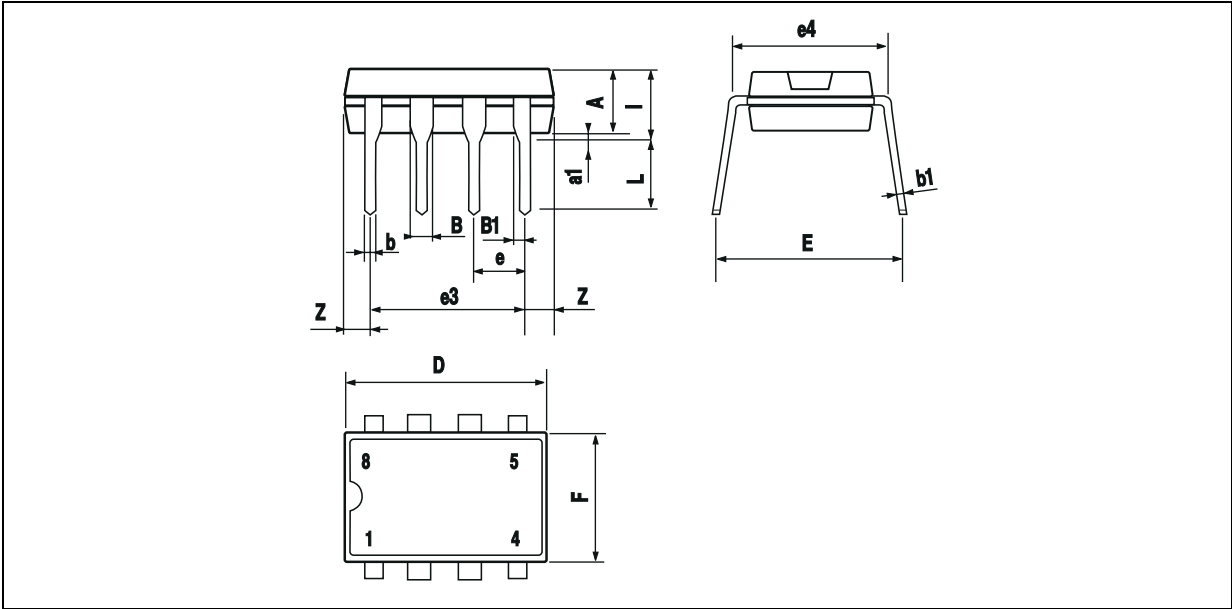




TS861IN - TS862IN

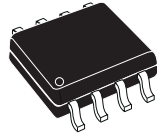


**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC PACKAGE

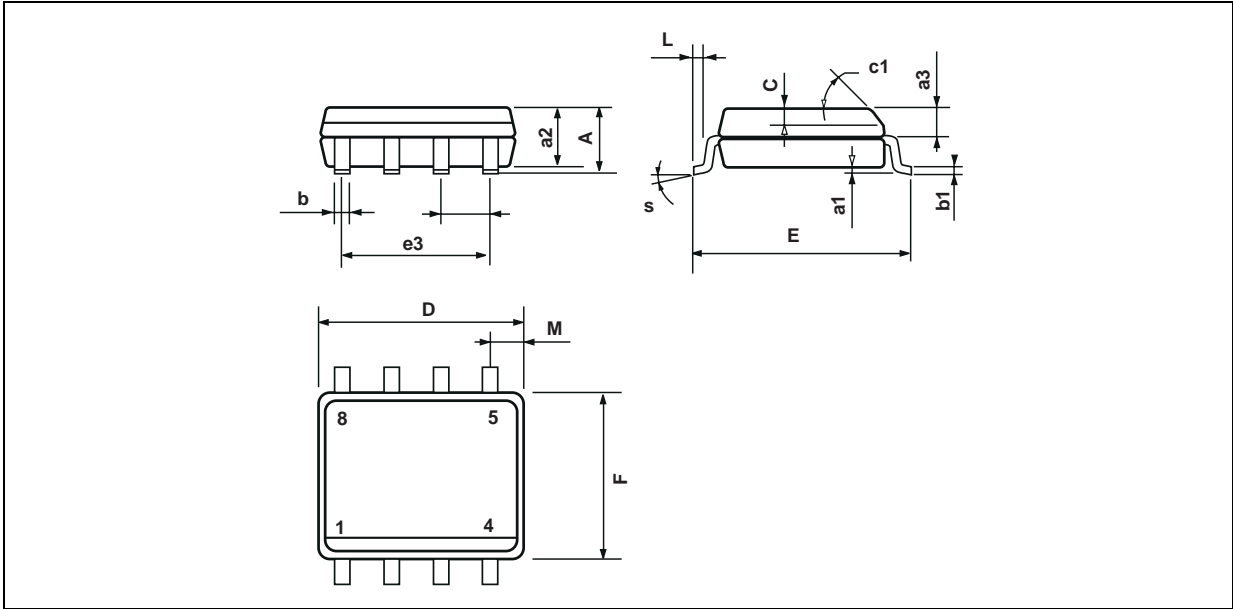


| Dimensions | Millimeters |      |       | Inches |       |       |
|------------|-------------|------|-------|--------|-------|-------|
|            | Min.        | Typ. | Max.  | Min.   | Typ.  | Max.  |
| A          |             | 3.32 |       |        | 0.131 |       |
| a1         | 0.51        |      |       | 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 |

TS861ID - TS862ID

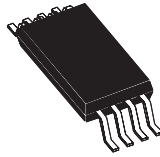


**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC MICROPACKAGE (SO)

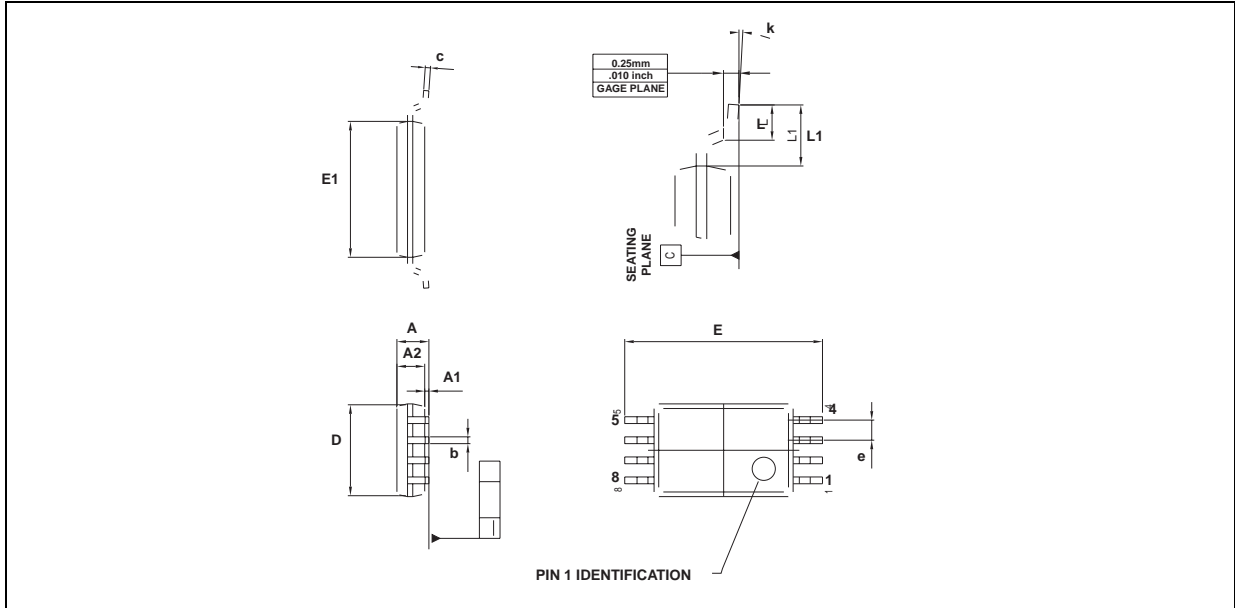


| Dimensions | Millimeters |      |      | Inches |       |       |
|------------|-------------|------|------|--------|-------|-------|
|            | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A          |             |      | 1.75 |        |       | 0.069 |
| a1         | 0.1         |      | 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.)   |      |      |        |       |       |

TS862IPT

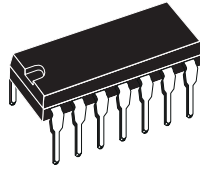


**PACKAGE MECHANICAL DATA**  
8 PINS - THIN SHRINK SMALL OUTLINE PACKAGE



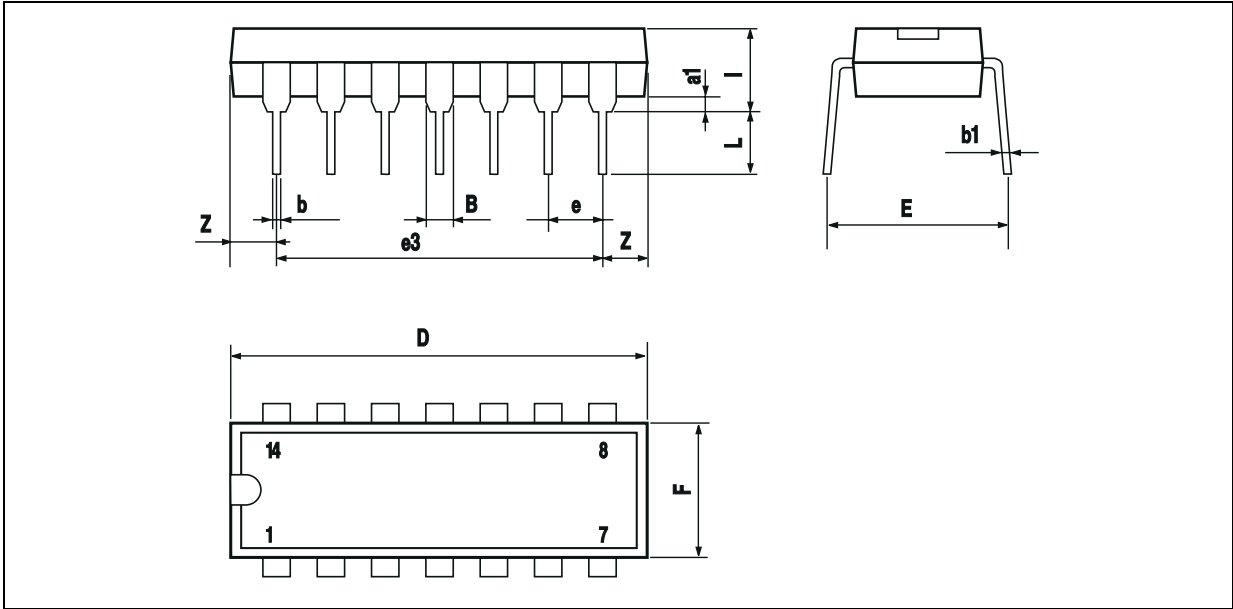
| Dimensions | Millimeters |       |      | Inches |        |       |
|------------|-------------|-------|------|--------|--------|-------|
|            | Min.        | Typ.  | Max. | Min.   | Typ.   | Max.  |
| A          |             |       | 1.20 |        |        | 0.05  |
| A1         | 0.05        |       | 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  |       |

TS864IN



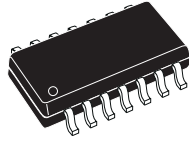
**PACKAGE MECHANICAL DATA**

14 PINS - PLASTIC PACKAGE

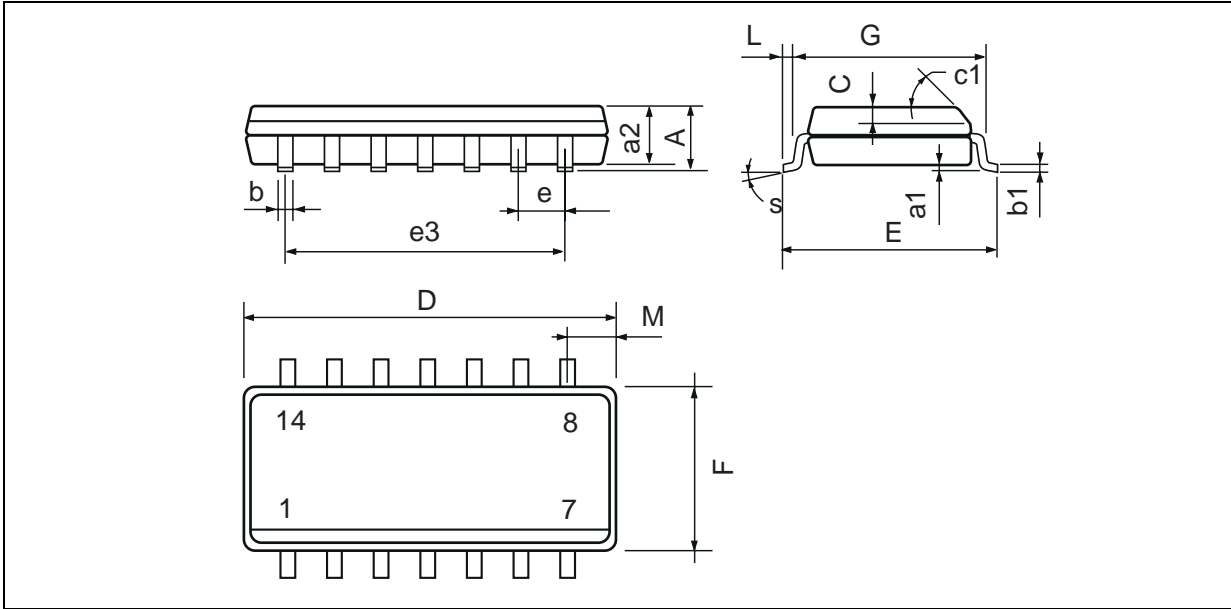


| Dimensions | Millimeters |       |      | Inches |       |       |
|------------|-------------|-------|------|--------|-------|-------|
|            | Min.        | Typ.  | Max. | Min.   | Typ.  | Max.  |
| a1         | 0.51        |       |      | 0.020  |       |       |
| B          | 1.39        |       | 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 |

TS864ID



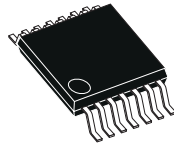
**PACKAGE MECHANICAL DATA**  
14 PINS - PLASTIC MICROPACKAGE (SO)



| 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 (1)      | 8.55        |      | 8.75 | 0.336  |       | 0.344 |
| E          | 5.8         |      | 6.2  | 0.228  |       | 0.244 |
| e          |             | 1.27 |      |        | 0.050 |       |
| e3         |             | 7.62 |      |        | 0.300 |       |
| F (1)      | 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.)   |      |      |        |       |       |

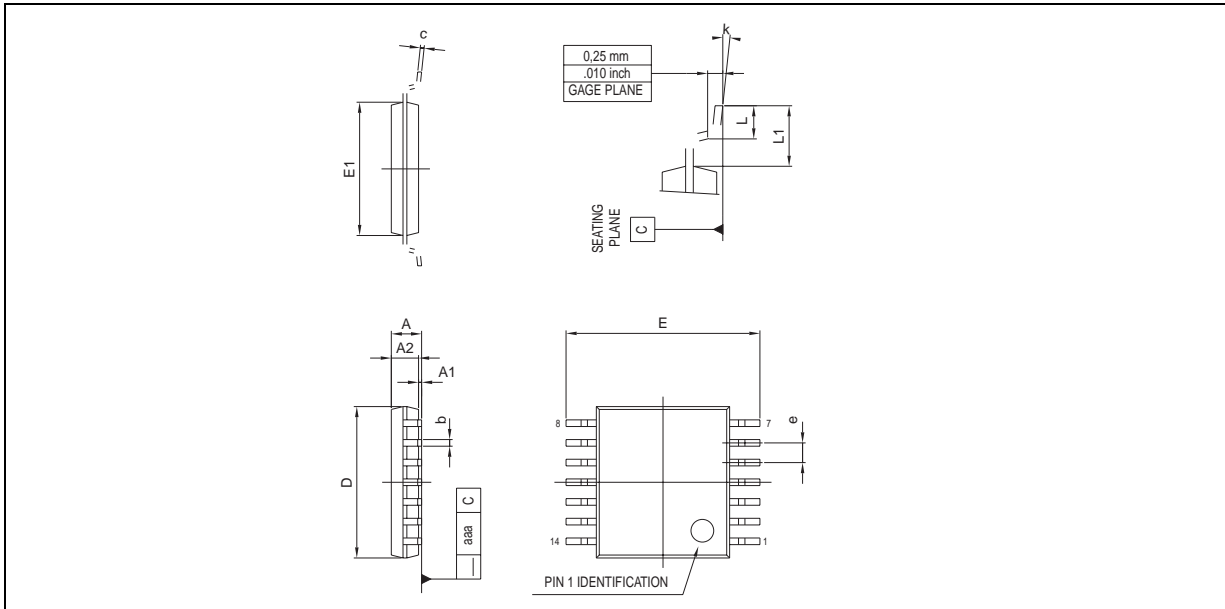
Note : (1) D and F do not include mold flash or protrusions - Mold flash or protrusions shall not exceed 0.15mm (.066 inc) ONLY FOR DATA BOOK.

TS864IPT



**PACKAGE MECHANICAL DATA**

14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE

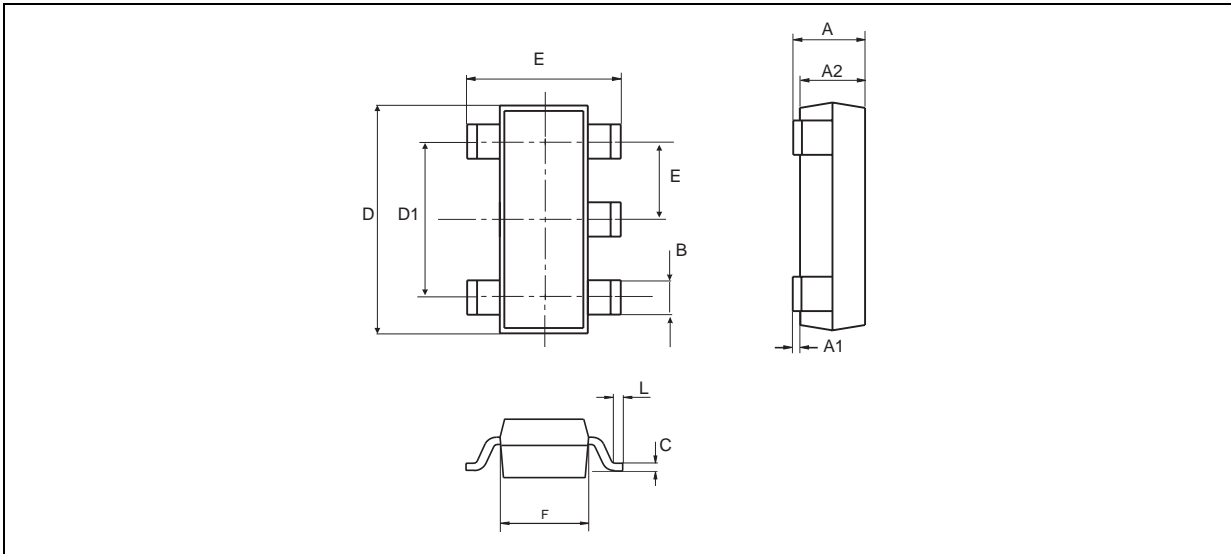


| Dimensions | Millimeters |       |       | Inches |       |       |
|------------|-------------|-------|-------|--------|-------|-------|
|            | Min.        | Typ.  | Max.  | Min.   | Typ.  | Max.  |
| A          |             |       | 1.20  |        |       | 0.05  |
| A1         | 0.05        |       | 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          | 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          | 0.450       | 0.600 | 0.750 | 0.018  | 0.024 | 0.030 |
| L1         |             | 1.00  |       |        | 0.039 |       |
| aaa        |             |       | 0.100 |        |       | 0.004 |

TS861ILT



**PACKAGE MECHANICAL DATA**  
5 PINS - TINY PACKAGE (SOT23)



| Dimensions | Millimeters |      |      | Inches |       |       |
|------------|-------------|------|------|--------|-------|-------|
|            | Min.        | Typ. | Max. | Min.   | Typ.  | Max.  |
| A          | 0.90        | 1.20 | 1.45 | 0.035  | 0.047 | 0.057 |
| A1         | 0           |      | 0.15 |        |       | 0.006 |
| A2         | 0.90        | 1.05 | 1.30 | 0.035  | 0.041 | 0.051 |
| B          | 0.35        | 0.40 | 0.50 | 0.014  | 0.016 | 0.020 |
| C          | 0.09        | 0.15 | 0.20 | 0.004  | 0.006 | 0.008 |
| D          | 2.80        | 2.90 | 3.00 | 0.110  | 0.114 | 0.118 |
| D1         |             | 1.90 |      |        | 0.075 |       |
| e          |             | 0.95 |      |        | 0.037 |       |
| E          | 2.60        | 2.80 | 3.00 | 0.102  | 0.110 | 0.118 |
| F          | 1.50        | 1.60 | 1.75 | 0.059  | 0.063 | 0.069 |
| L          | 0.3         | 0.5  | 0.60 | 0.012  | 0.014 | 0.024 |
| K          | 0d          |      | 10d  | 0d     |       | 10d   |

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