TS861
TS862
TS864

RAIL TO RAIL
MICROPOWER BICMOS COMPARATORS

- ULTRA LOW CURRENT CONSUMPTION **(6µA/comp at Vcc=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 6µA 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 microcontroler without additionnal pull-up resistor.

APPLICATION

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

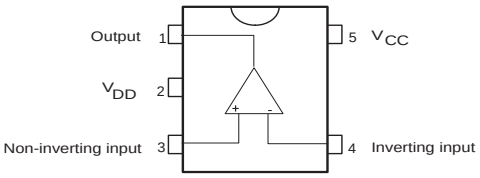
ORDER CODE

Part Number	Temperature Range	Package				SOT23 Marking
		N	D	P	L	
TS861I TS861AI	-40, +85°C	• •	• •		• •	K501 K502
TS862I TS862AI	-40, +85°C	• •	• •	• •		
TS864I TS864AI	-40, +85°C	• •	• •	• •		

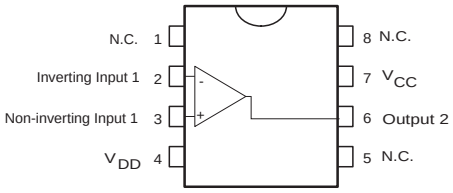
N = Dual in Line Package (DIP)
D = Small Outline Package (SO) - also available in Tape & Reel (DT)
P = Thin Shrink Small Outline Package (TSSOP) - only available in Tape & Reel (PT)
L = Tiny Package (SOT23-5) - only available in Tape & Reel (LT)

PIN CONNECTIONS (top view)

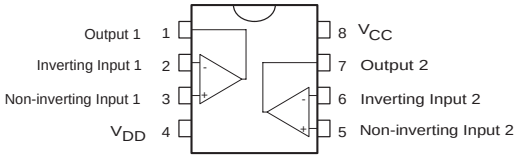
TS861ILT



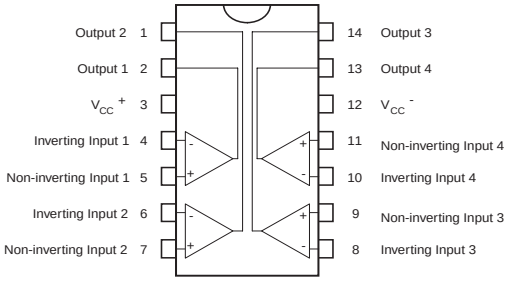
TS861ID-TS861IDT



TS862IN-TS862ID-TS862IDT-TS862IPT



TS864IN-TS864ID-TS864IDT-TS864IPT



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage [1]	12	V
V_{id}	Differential Input Voltage [2]	±12	V
V_{in}	Input Voltage Range [3]	-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[4] SOT23-5 DIP8 DIP14 SO8 SO14 TSSOP8 TSSOP14	 500 1250 1560 710 830 625 710	mW
ESD	Human Body Model Machine Model	2 200	kV 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°C, T_j = +150°C and

R_{thja} = 250°C/W for SOT23-5 package
=100°C/W for DIP8 package
= 80°C/W for DIP14 package
=175°C/W for SO8 package
=150°C/W for SO14 package
= 200°C/W for TSSOP8 package
=175°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°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TS861/2/4 Tmin<T<Tmax TS861/2/4A Tmin<T<Tmax		3 3 	15 18 7 10	mV
ΔV_{io}	Input Offset Voltage Drift		6		µV/°C
I_{io}	Input Offset Current [1] Tmin<T<Tmax		1	150 300	pA
I_{ib}	Input Bias Current [1] Tmin<T<Tmax		1	300 600	pA
V_{OH}	High Level Output Voltage Isource=2.5mA Tmin<T<Tmax	2.35 2.15	2.45		V
V_{OL}	Low Level Output Voltage Isink=2.5mA Tmin<T<Tmax		0.2	0.35 0.45	V
A_{vd}	Large Signal Voltage Gain [2]		240		dB
CMR	Common Mode Rejection Ratio 0 < V_{ICM} < 2.7V		65		dB
SVR	Supply Voltage Rejection Ratio 0 < Vcc < 10V		80		dB
I_{CC}	Supply current per comparator no load, output low no load, output high		6 8	12 14	µA
Tplh	Propagation delay from output low to output high V_{ICM}=1.35V, f=10kHz, C_L=50pF overdrive = 10mV overdrive = 100mV		1.5 0.6		µs
Tphl	Propagation delay from output high to output low V_{ICM}=1.35V, f=10kHz, C_L=50pF overdrive = 10mV overdrive = 100mV		1.5 0.5		µs
Tf	Fall time f=10kHz, C_L=50pF, overdrive=100mV		20		ns
Tr	Rise time f=10kHz, C_L=50pF, overdrive=100mV		20		ns

1. Maximum values including unavoidable inaccurates 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°C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage TS861/2/4 Tmin<T<Tmax TS861/2/4A Tmin<T<Tmax		3 3	15 18 7 10	mV
ΔV_{io}	Input Offset Voltage Drift		6		µV/°C
I_{io}	Input Offset Current [1] Tmin<T<Tmax		1	150 300	pA
I_{ib}	Input Bias Current [1] Tmin<T<Tmax		1	300 600	pA
V_{OH}	High Level Output Voltage Isource=5mA Tmin<T<Tmax	4.6 4.45	4.8		V
V_{OL}	Low Level Output Voltage Isink=5mA Tmin<T<Tmax		0.2	0.4 0.55	V
A_{vd}	Large Signal Voltage Gain [2]		240		dB
CMR	Common Mode Rejection Ratio $0 < V_{ICM} < 5V$		70		dB
SVR	Supply Voltage Rejection Ratio 2.7 < Vcc < 10V		80		dB
I_{CC}	Supply current per comparator no load, output low no load, output high		6 8	12 14	µA
Tplh	Propagation delay from output low to output high V_{ICM}=2.5V, f=10kHz, C_L=50pF overdrive = 10mV overdrive = 100mV		 2 0.5		µs
Tphl	Propagation delay from output high to output low V_{ICM}=2.5V, f=10kHz, C_L=50pF overdrive = 10mV overdrive = 100mV		 2 0.4		µs
Tf	Fall time f=10kHz, C_L=50pF, overdrive=100mV		20		ns
Tr	Rise time f=10kHz, C_L=50pF, overdrive=100mV		20		ns

1. Maximum values including unavoidable inaccurates of the industrial test..
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ELECTRICAL CHARACTERISTICS

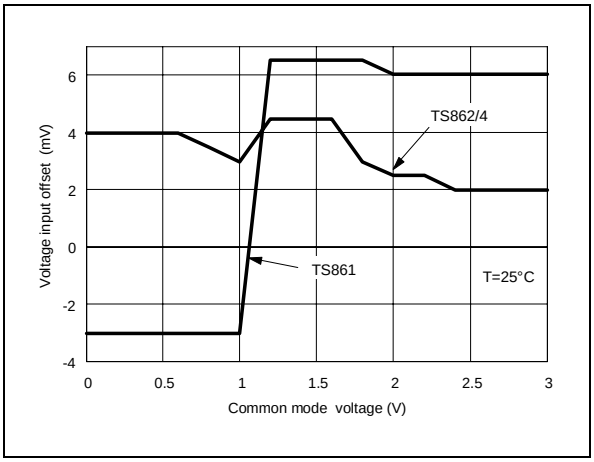
V_{CC} = +10V

T_{amb} = 25°C (unless otherwise specified)

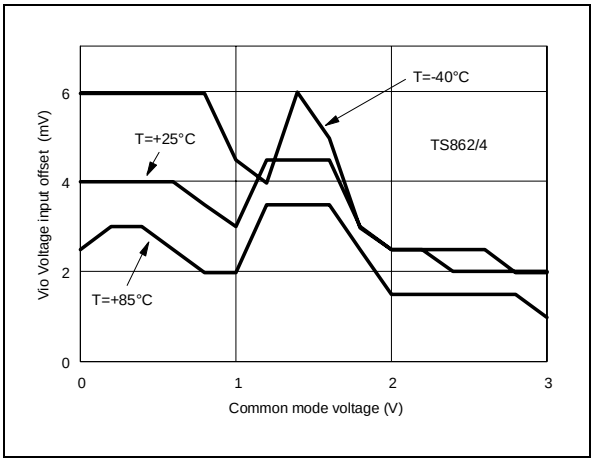
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage (V_{ICM} = V_{CC} / 2) TS861/2/4 Tmin<T<Tmax		3	15 18	mV
ΔV_{io}	Input Offset Voltage Drift		6		µV/°C
I_{io}	Input Offset Current [1] Tmin<T<Tmax		1	150 300	pA
I_{ib}	Input Bias Current [1] Tmin<T<Tmax		1	300 600	pA
V_{OH}	High Level Output Voltage Isource=5mA Tmin<T<Tmax	9.6 9.45	9.8		V
V_{OL}	Low Level Output Voltage Isink=5mA Tmin<T<Tmax		0.2	0.4 0.55	V
A_{vd}	Large Signal Voltage Gain [2]		240		dB
CMR	Common Mode Rejection Ratio 0 < V_{ICM} < 10V		75		dB
SVR	Supply Voltage Rejection Ratio 2.7 < Vcc < 10V		80		dB
I_{CC}	Supply current per comparator no load, output low no load, output high		7 10	14 16	µA
Tplh	Propagation delay from output low to output high V_{ICM}=5V, f=10kHz, C_L=50pF overdrive = 10mV overdrive = 100mV		3 0.5		µs
Tphl	Propagation delay from output high to output low V_{ICM}=5V, f=10kHz, C_L=50pF overdrive = 10mV overdrive = 100mV		2.6 0.4		µs
Tf	Fall time f=10kHz, C_L=50pF, overdrive=100mV		20		ns
Tr	Rise time f=10kHz, C_L=50pF, overdrive=100mV		20		ns

1. Maximum values including unavoidable inaccurates 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.

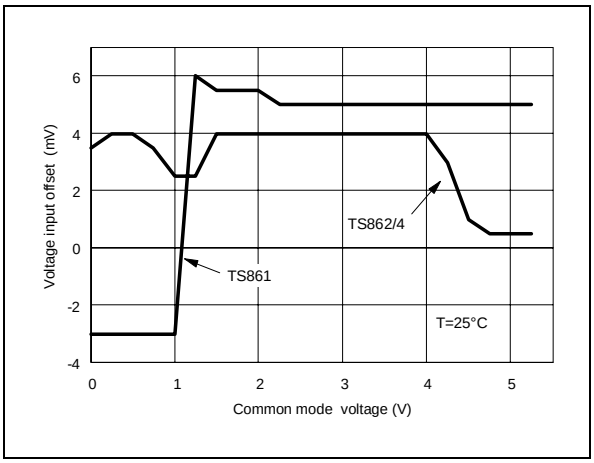
V_{IO} versus V_{ICM} at V_{CC}= 2.7V



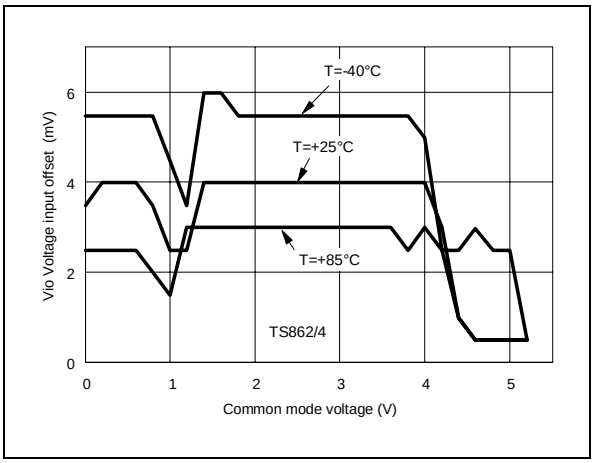
V_{IO} versus V_{ICM} and temperature at V_{CC}= 2.7V



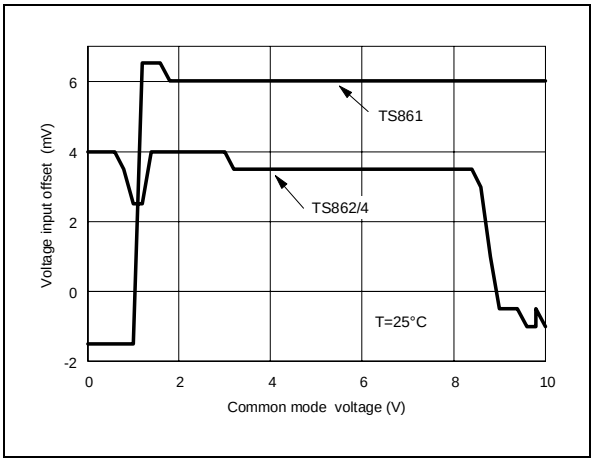
V_{IO} versus V_{ICM} at V_{CC}= 5V



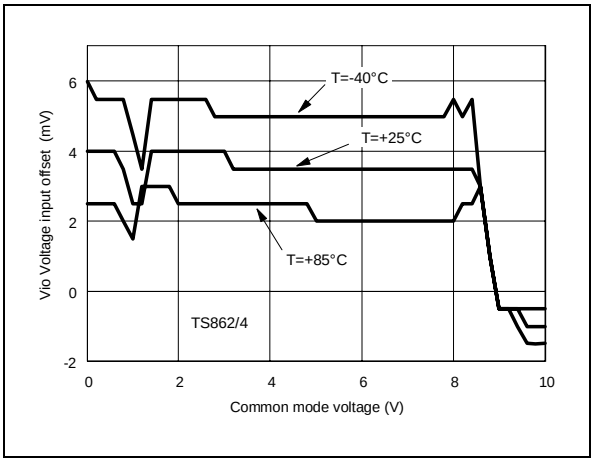
V_{IO} versus V_{ICM} and temperature at V_{CC}= 5V



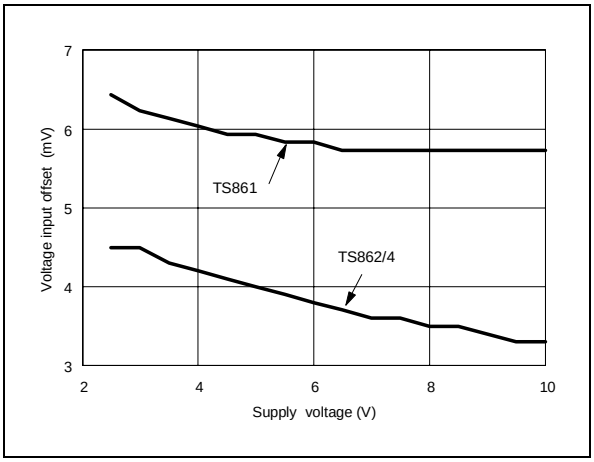
V_{IO} versus V_{ICM} at V_{CC}= 10V



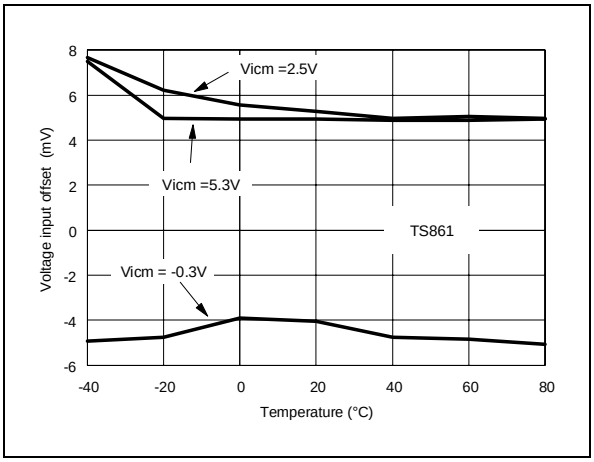
V_{IO} versus V_{ICM} and temperature at V_{CC}= 10V



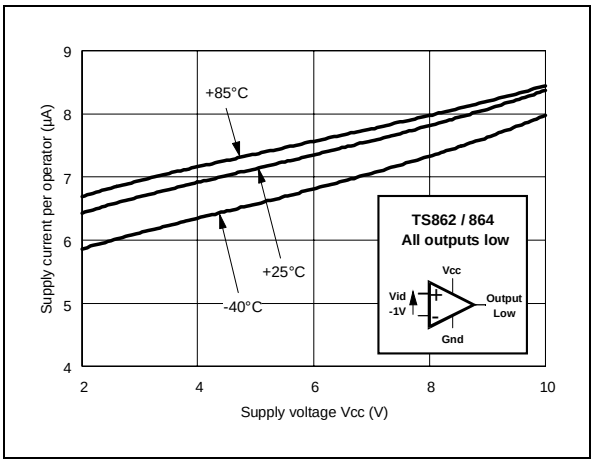
V_{IO} versus V_{CC} at $V_{ICM} = V_{CC} / 2$



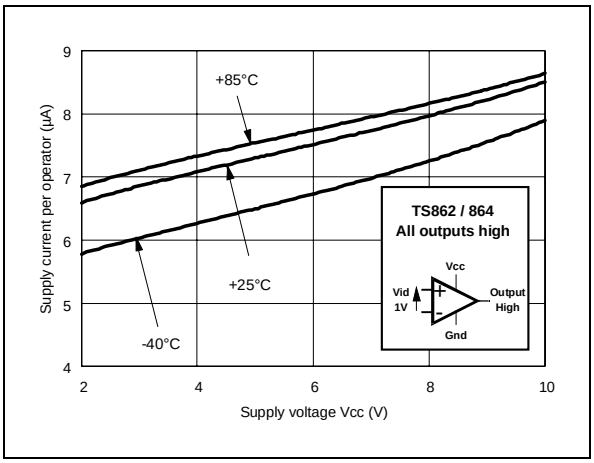
V_{IO} versus temperature at V_{CC} =5V



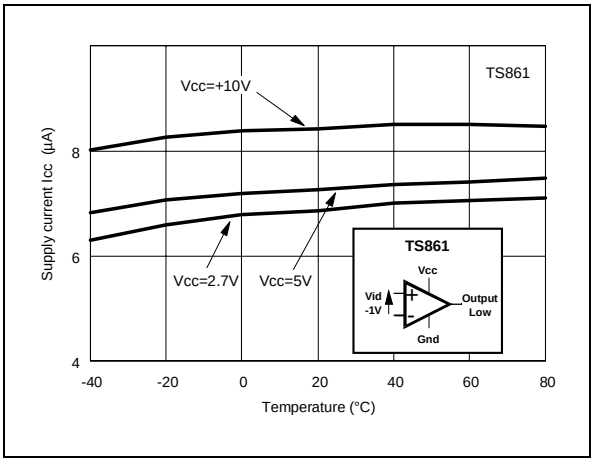
Supply Current (I_{CC}) vs Supply Voltage (V_{CC})



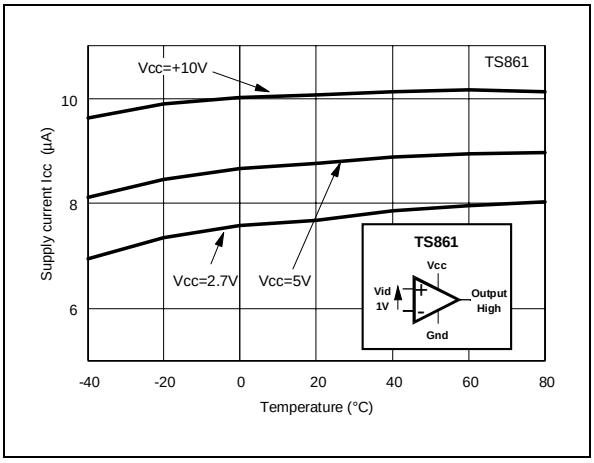
Supply Current (I_{CC}) vs Supply Voltage (V_{CC})



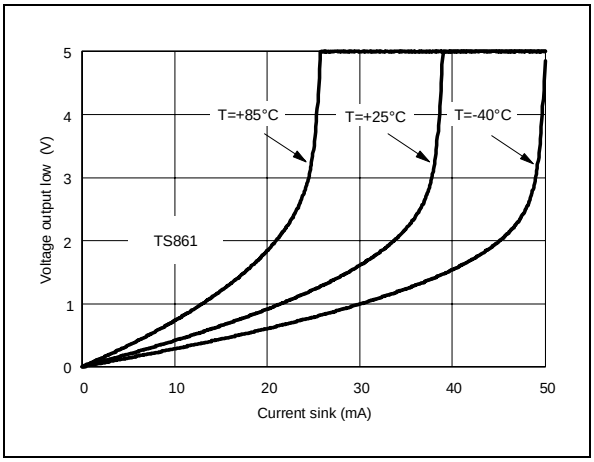
Supply Current (I_{CC}) vs Temperature



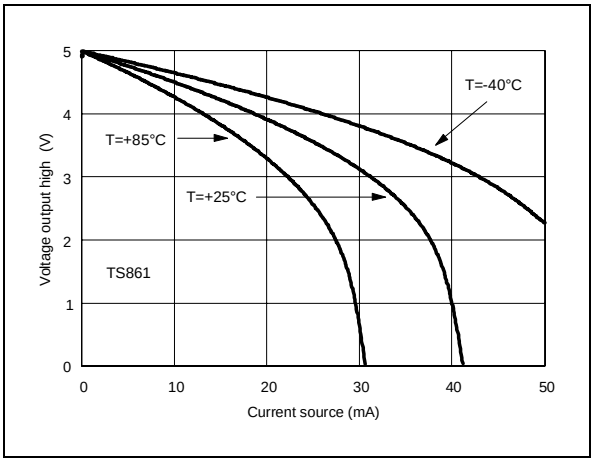
Supply Current (I_{CC}) vs Temperature



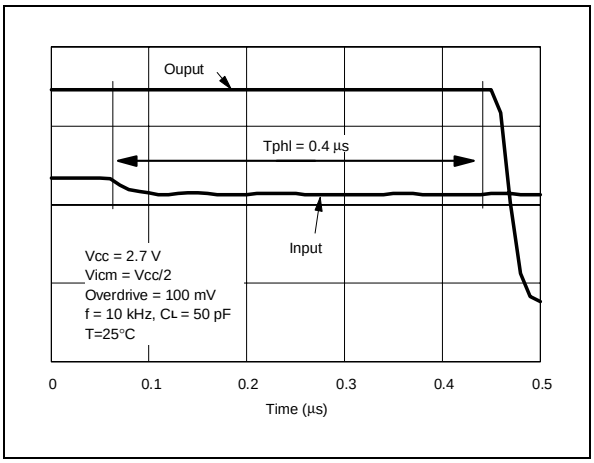
V_{OL} versus I_{SINK} and temperature at V_{CC}=5V



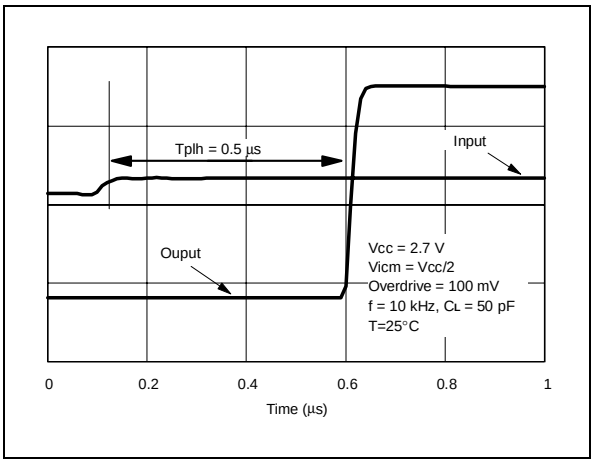
V_{OH} vs I_{SOURCE} and temperature at V_{CC}=5V



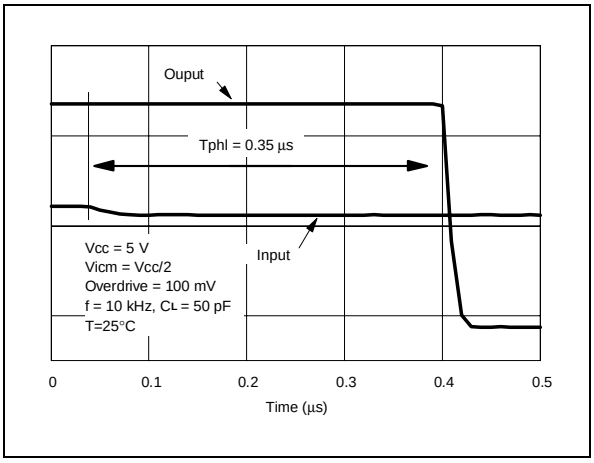
Response time T_{PHL} at V_{CC}= 2.7V



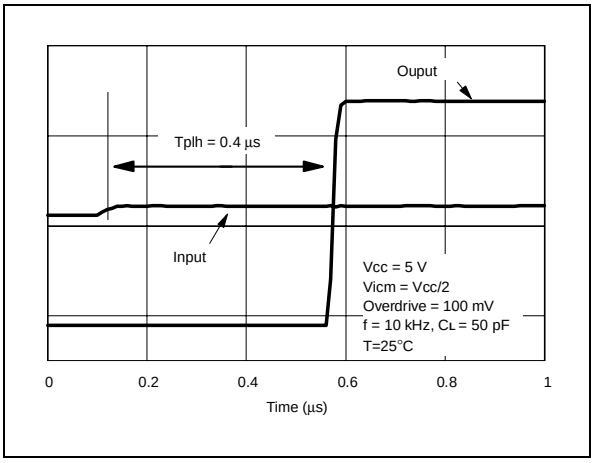
Response time T_{PLH} at V_{CC}= 2.7V



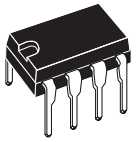
Response time T_{PHL} at V_{CC}= 5V



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

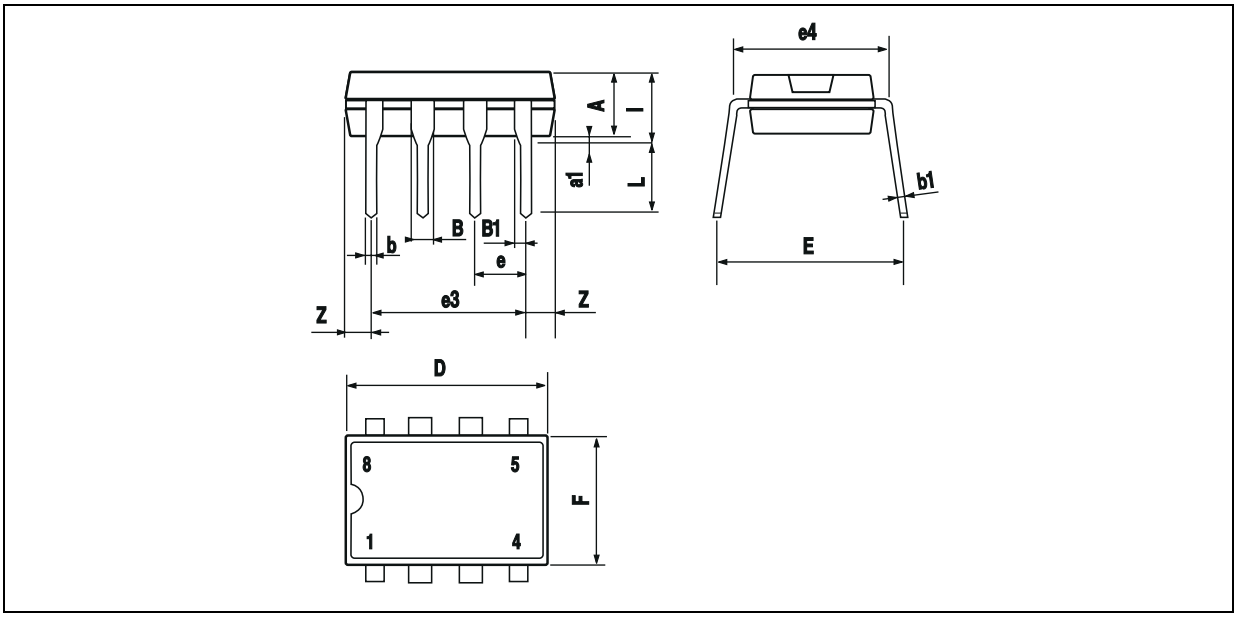


TS861IN - TS862IN



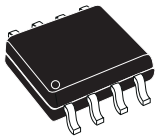
PACKAGE MECHANICAL DATA

8 PINS - PLASTIC PACKAGE



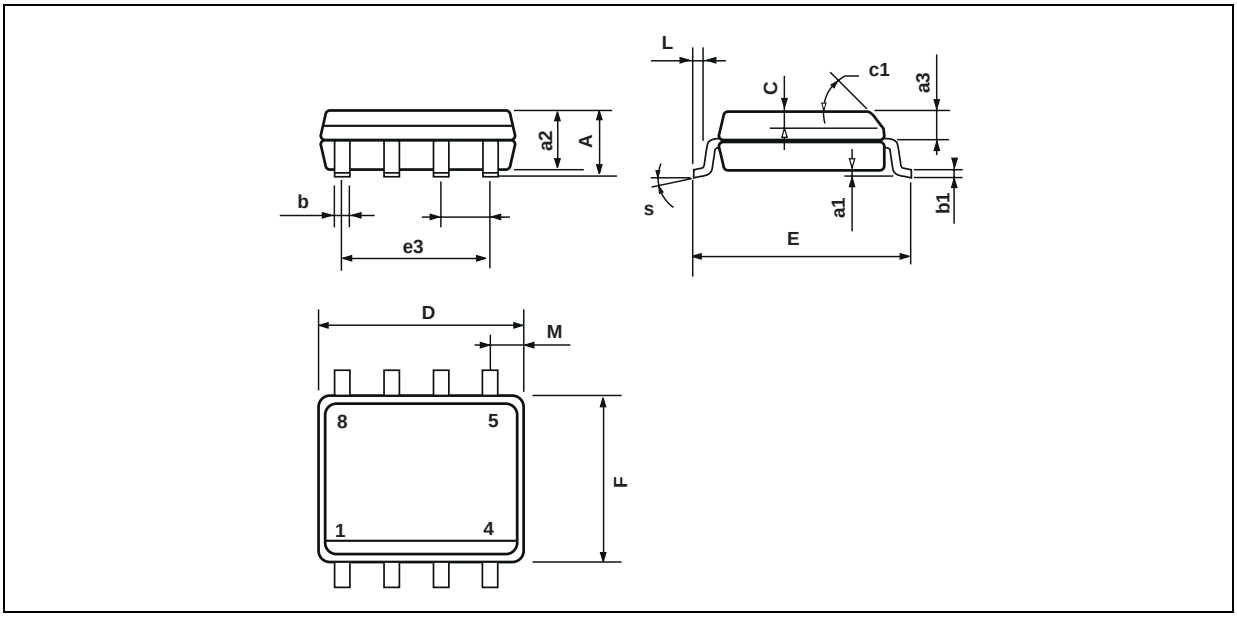
Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

TS861ID - TS862ID



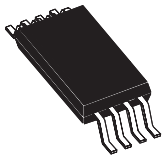
PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



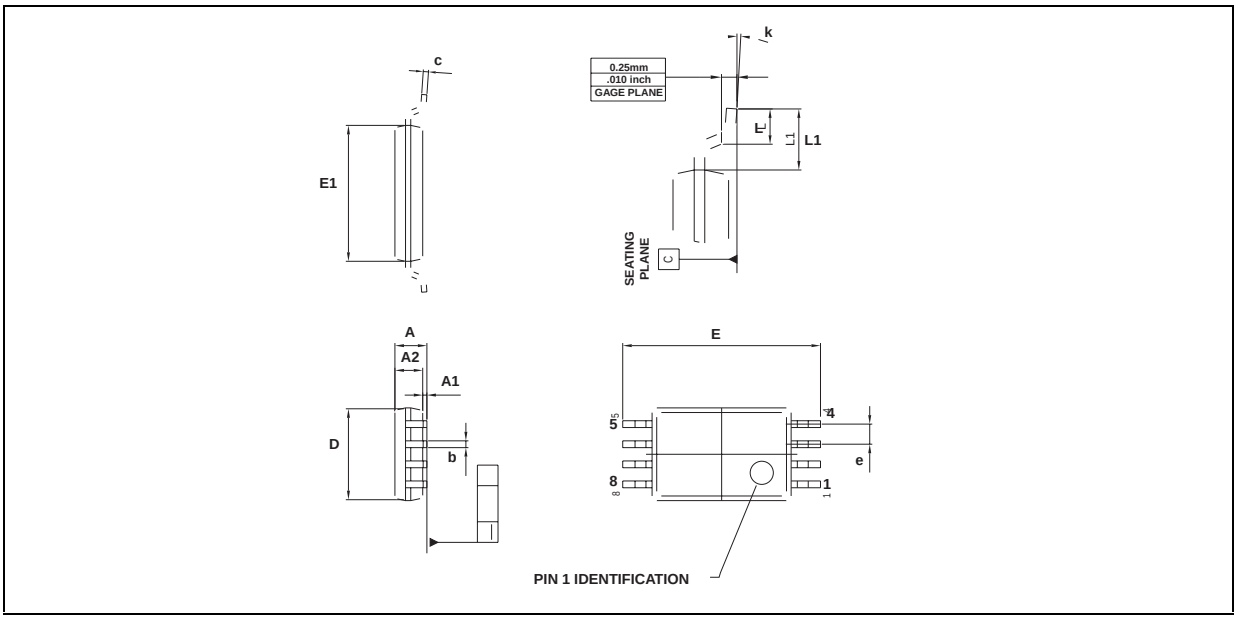
Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		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



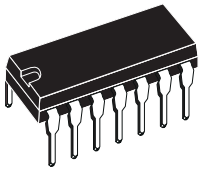
PACKAGE MECHANICAL DATA

8 PINS - THIN SHRINK SMALL OUTLINE PACKAGE



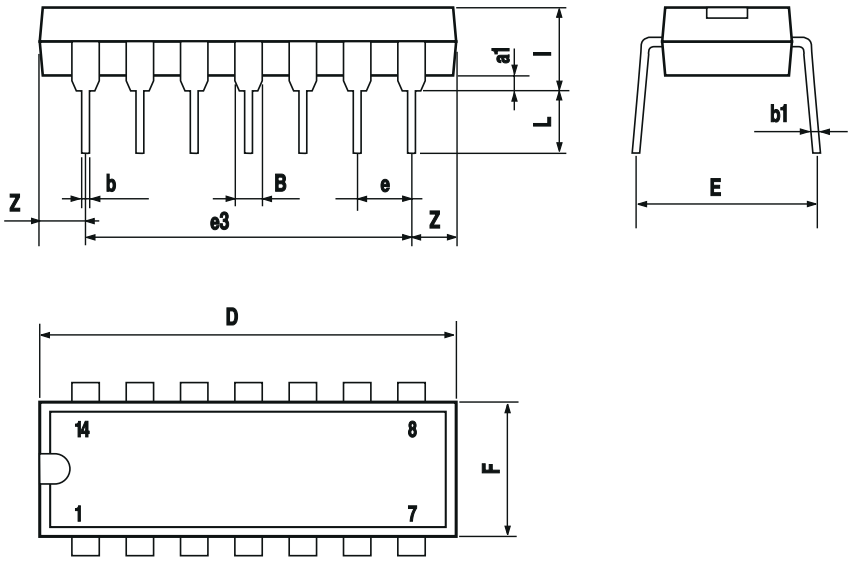
Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	2.90	3.00	3.10	0.114	0.118	0.122
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	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



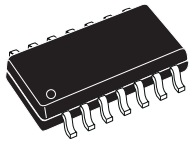
PACKAGE MECHANICAL DATA

14 PINS - PLASTIC PACKAGE

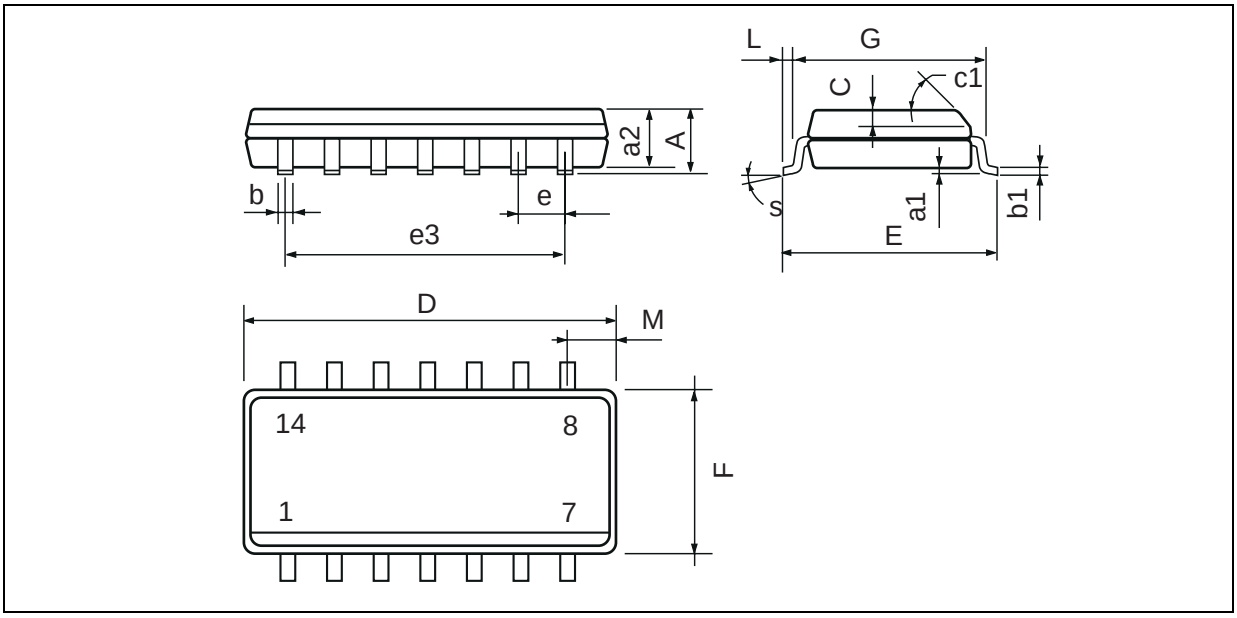


Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
a1	0.51			0.020		
B	1.39		1.65	0.055		0.065
b		0.5			0.020	
b1		0.25			0.010	
D			20			0.787
E		8.5			0.335	
e		2.54			0.100	
e3		15.24			0.600	
F			7.1			0.280
i			5.1			0.201
L		3.3			0.130	
Z	1.27		2.54	0.050		0.100

TS864ID



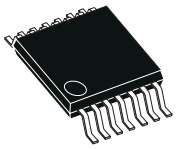
PACKAGE MECHANICAL DATA
14 PINS - PLASTIC MICROPACKAGE (SO)



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.)					

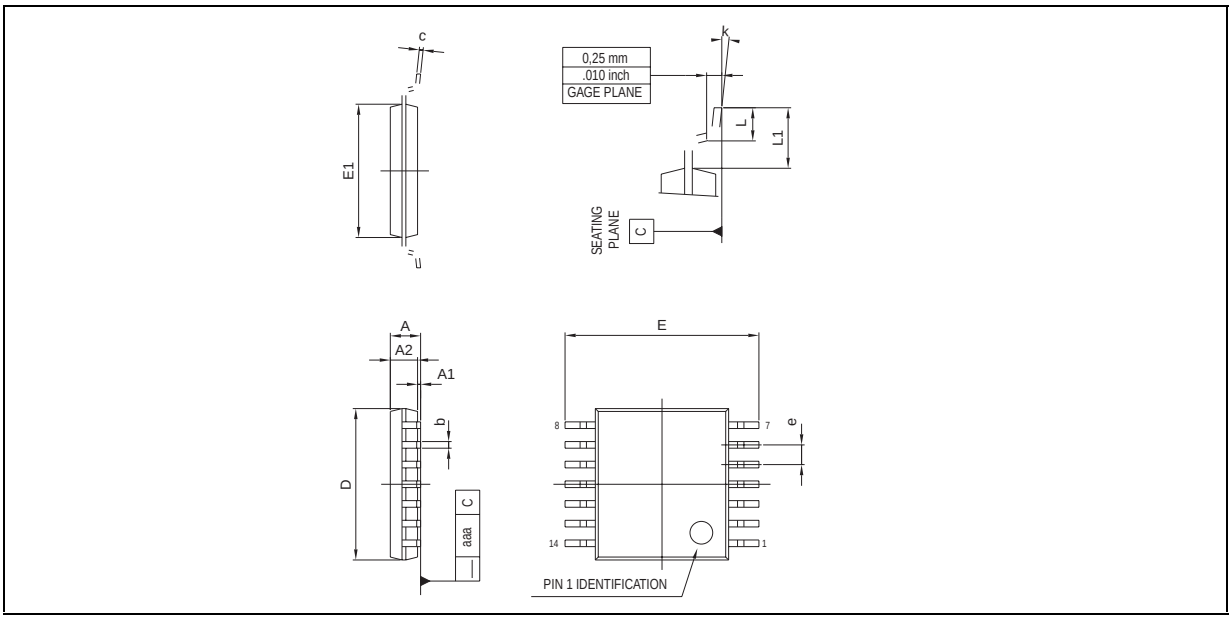
Note : (1) D and F do not include mold flash or protrusions - Mold flash or protrusions shall not exceed 0.15mm (.066 inc) ONLY FOR DATA BOOK.

TS864IPT



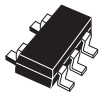
PACKAGE MECHANICAL DATA

14 PINS - THIN SHRINK SMALL OUTLINE PACKAGE



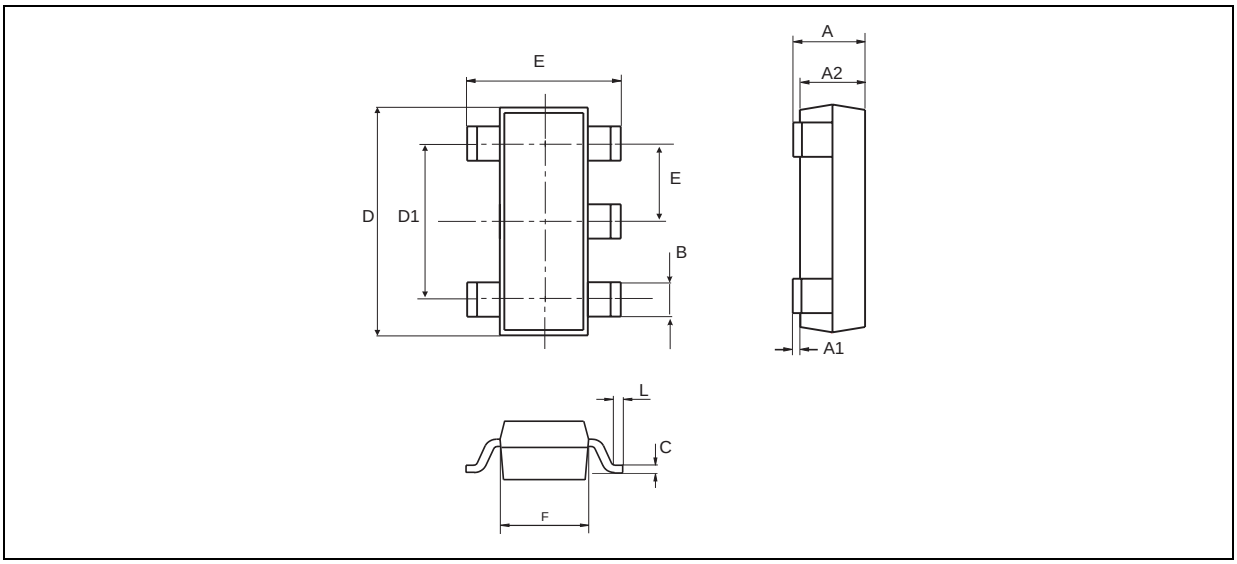
Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	4.90	5.00	5.10	0.192	0.196	0.20
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0°		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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