



TS7221

SINGLE BiCMOS RAIL TO RAIL μPOWER COMPARATOR

- RAIL TO RAIL INPUTS
- OPEN DRAIN OUTPUT
- SUPPLY OPERATION FROM 2.7V TO 10V
- TYPICAL SUPPLY CURRENT: 6μA @ 5V
- RESPONSE TIME OF 0.5μs AT 5V
- LOW INPUT CURRENT
- ESD PROTECTION : 2KV (HBM) 200V (MM)
- AVAILABLE IN TINY SOT23-5 PACKAGE

DESCRIPTION

The TS7221 is a micropower comparator featuring rail to rail input performance in a tiny SOT23-5 package. This comparator is ideally suited to space and weight critical applications. It is fully specified at 2.7V, 5V and 10V operations over the industrial temperature range (-40/+85°C).

The TS7221 features an open drain output stage. The speed to power ratio makes this device ultra versatile for a wide range of applications.

APPLICATIONS

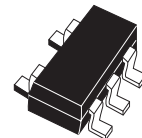
- Battery powered systems
- Notebooks and PDAs
- PCMCIA cards
- Cellulare and mobile communication
- Alarm and security systems
- Replacement of amplifiers used in comparator configuration with better performances

ORDER CODE

Part Number	Temperature Range	Package	SOT23-5 Marking
		L	
TS7221AI	-40°C, +85°C	•	K518
TS7221BI		•	K519
Example : TS7221AILT			

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

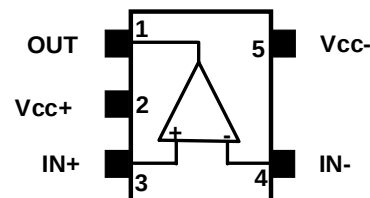
December 2002



L
SOT23-5L
(Tiny Package)

PIN CONNECTIONS (top view)

TS7221 Open drain output



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
ESD	Human body model (HBM)	2000	V
	Machine model (MM)	200	
V_{ID}	Differential Input Voltage	$(V_{CC}^-) - 0.3$ to $(V_{CC}^+) + 0.3$	V
V_{IN}	Input Voltage ¹⁾	$(V_{CC}^-) - 0.3$ to $(V_{CC}^+) + 0.3$	V
V_{OUT}	Output Voltage	12	V
V_{CC}	Supply voltage	12	V
I_{IN}	Current at input pins	± 5	mA
I_{OUT}	Current at output pin	± 30	mA
T_{Lead}	Lead temperature (soldering 10 seconds)	250	°C
T_{STG}	Storage Temperature	-65 to +150	°C
T_J	Junction Temperature	150	°C
P_D	Power dissipation ²⁾ SOT23-5	500	mW

1. The magnitude of input voltages must never exceed 0.3V beyond the supply voltage.

2. $T_J = 150^\circ\text{C}$, $T_{AMB} = 25^\circ\text{C}$ with $R_{TH-JA} = 250^\circ\text{C/W}$ for SOT23-5 package

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2.7 to 10	V
T_{AMB}	Ambient Temperature	-40 to +85	°C
V_{ICM}	Common mode input voltage range	$(V_{CC}^-) - 0.3$ to $(V_{CC}^+) + 0.3$	V

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 (Full common mode range) TS7221A $T_{MIN} \leq T_{AMB} \leq T_{MAX}$ TS7221B $T_{MIN} \leq T_{AMB} \leq T_{MAX}$			7 10 15 18	mV
ΔV_{IO}	Input Offset Voltage Drift with temperature		6		$\mu V/^{\circ}C$
I_{IB}	Input Bias Current ¹⁾ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		1	300 600	pA
I_{IO}	Input Offset Current ¹⁾ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		1	150 300	pA
CMRR	Common-mode Rejection Ratio ($0 < V_{icm} < 2.7V$)		65		dB
PSRR	Power Supply Rejection Ratio ($2.7 < V_{CC} < 10V$)		80		dB
A_{VD}	Voltage Gain ²⁾		240		dB
V_{ICM}	Input Common Mode Voltage Range (upper rail) $T_{MIN} \leq T_{AMB} \leq T_{MAX}$	3 2.7			V
	Input Common Mode Voltage Range (lower rail) $T_{MIN} \leq T_{AMB} \leq T_{MAX}$	-0.3 0.0			
I_{OH}	High Level Output Voltage ($IN^{+}=0.5V$, $IN^{-}=0V$ & $OUT=10V$)		0.1	500	nA
V_{OL}	Low Level Output Voltage - $I_{sink} = 2.5mA$ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		0.2	0.35 0.45	V
I_{CC}	Supply Current Output low		6	12	μA
	Output high		8	14	
T_{PLH}	Response Time Low to High ($V_{ic} = 1.35V$, $C_L = 50pF$, $R_L=10k\Omega$) Overdrive = 10mV Overdrive = 100mV		1.5 0.6		μs
T_{PHL}	Response Time High to Low ($V_{ic} = 1.35V$, $C_L = 50pF$, $R_L=10k\Omega$) Overdrive = 10mV Overdrive = 100mV		1.5 0.5		μs
T_F	Fall Time ($C_L = 50pF$, $R_L=5k\Omega$) Overdrive = 10mV		0.3		μs
T_R	Rise Time ($C_L = 50pF$, $R_L=5k\Omega$) Overdrive = 10mV		0.3		μs

1) Maximum values include unavoidable inaccuracies of the industrial test.

2) Design evaluation.

3) Limits are 100% production tested at $+25^{\circ}C$. 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 (Full common mode range) TS7221A $T_{MIN} \leq T_{AMB} \leq T_{MAX}$ TS7221B $T_{MIN} \leq T_{AMB} \leq T_{MAX}$			7 10 15 18	mV
ΔV_{IO}	Input Offset Voltage Drift with temperature		6		$\mu V/^\circ C$
I_{IB}	Input Bias Current ¹⁾ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		1	300 600	pA
I_{IO}	Input Offset Current ¹⁾ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		1	150 300	pA
CMRR	Common-mode Rejection Ratio ($0 < V_{icm} < 5V$)		70		dB
PSRR	Power Supply Rejection Ratio ($2.7 < V_{CC} < 10V$)		80		dB
A_{VD}	Voltage Gain ²⁾		240		dB
V_{ICM}	Input Common Mode Voltage Range (upper rail) $T_{MIN} \leq T_{AMB} \leq T_{MAX}$	5.3 5.0			V
	Input Common Mode Voltage Range (lower rail) $T_{MIN} \leq T_{AMB} \leq T_{MAX}$	-0.3 0.0			
I_{OH}	High Level Output Voltage ($IN^+ = 0.5V$, $IN^- = 0V$ & $OUT = 10V$)		0.1	500	nA
V_{OL}	Low Level Output Voltage - $I_{sink} = 5mA$ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		0.2	0.40 0.55	V
I_{CC}	Supply Current Output low		6	12	μA
	Output high		8	14	
T_{PLH}	Response Time Low to High ($V_{IC} = 2.5V$, $C_L = 50pF$, $R_L = 10k\Omega$) Overdrive = 10mV Overdrive = 100mV		2 0.5		μs
T_{PHL}	Response Time High to Low ($V_{ic} = 2.5V$, $C_L = 50pF$, $R_L = 10k\Omega$) Overdrive = 10mV Overdrive = 100mV		2 0.4		μs
T_F	Fall Time ($C_L = 50pF$, $R_L = 5k\Omega$) Overdrive = 10mV		0.3		μs
T_R	Rise Time ($C_L = 50pF$, $R_L = 5k\Omega$) Overdrive = 10mV		0.3		μs

1) Maximum values include unavoidable inaccuracies of the industrial test.

2) Design evaluation.

3) Limits are 100% production tested at $+25^\circ C$. Limits over temperature are guaranteed through correlation and by design.

ELECTRICAL CHARACTERISTICS $V_{CC}^+ = 10V$, $T_{AMB} = 25^\circ C$ (unless otherwise specified)

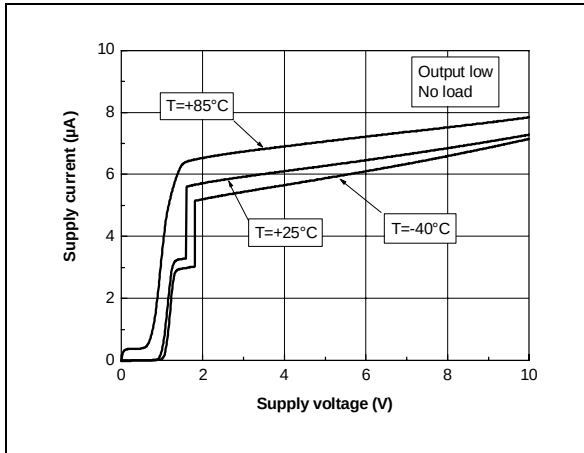
Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{IO}	Input Offset Voltage (Full common mode range) TS7221A $T_{MIN} \leq T_{AMB} \leq T_{MAX}$ TS7221B $T_{MIN} \leq T_{AMB} \leq T_{MAX}$			7 10 15 18	mV
ΔV_{IO}	Input Offset Voltage Drift with temperature		6		$\mu V/^\circ C$
I_{IB}	Input Bias Current ¹⁾ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		1	300 600	pA
I_{IO}	Input Offset Current ¹⁾ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		1	150 300	pA
CMRR	Common-mode Rejection Ratio ($0 < V_{icm} < 10V$)		75		dB
PSRR	Power Supply Rejection Ratio ($2.7 < V_{CC} < 10V$)		80		dB
A_{VD}	Voltage Gain ²⁾		240		dB
V_{ICM}	Input Common Mode Voltage Range (upper rail) $T_{MIN} \leq T_{AMB} \leq T_{MAX}$	10.3 10.0			V
	Input Common Mode Voltage Range (lower rail) $T_{MIN} \leq T_{AMB} \leq T_{MAX}$	-0.3 0.0			
I_{OH}	High Level Output Voltage ($IN^+ = 0.5V$, $IN^- = 0V$ & $OUT = 10V$)		0.1	500	nA
V_{OL}	Low Level Output Voltage - $I_{sink} = 5mA$ $T_{MIN} \leq T_{AMB} \leq T_{MAX}$		0.2	0.40 0.55	V
I_{CC}	Supply Current				
	Output low Output high		7 10	14 16	μA
T_{PLH}	Response Time Low to High ($V_{ic} = 5V$, $C_L = 50pF$, $R_L = 10k\Omega$) Overdrive = 10mV Overdrive = 100mV		3 0.5		μs
T_{PHL}	Response Time High to Low ($V_{ic} = 5V$, $C_L = 50pF$, $R_L = 10k\Omega$) Overdrive = 10mV Overdrive = 100mV		4 0.4		μs
T_F	Fall Time ($C_L = 50pF$, $R_L = 5k\Omega$) Overdrive = 10mV		0.3		μs
T_R	Rise Time ($C_L = 50pF$, $R_L = 5k\Omega$) Overdrive = 10mV		0.3		μs

1) Maximum values include unavoidable inaccuracies of the industrial test.

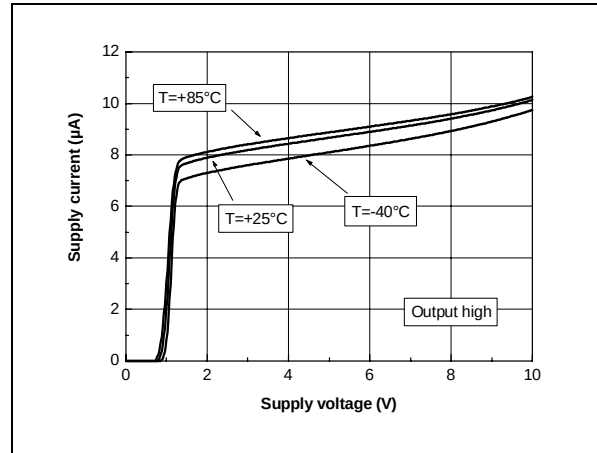
2) Design evaluation.

3) Limits are 100% production tested at $+25^\circ C$. Limits over temperature are guaranteed through correlation and by design.

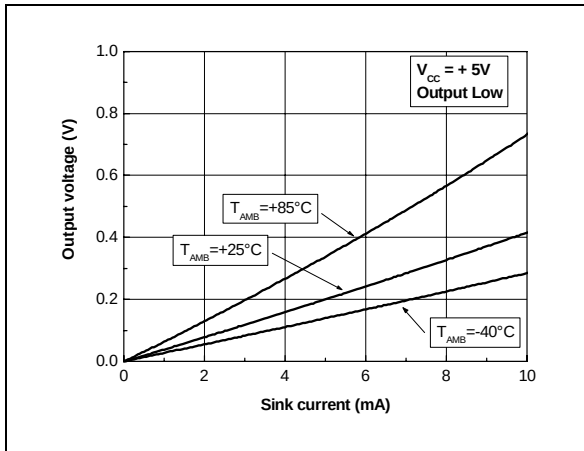
Supply current versus supply voltage
(Output low)



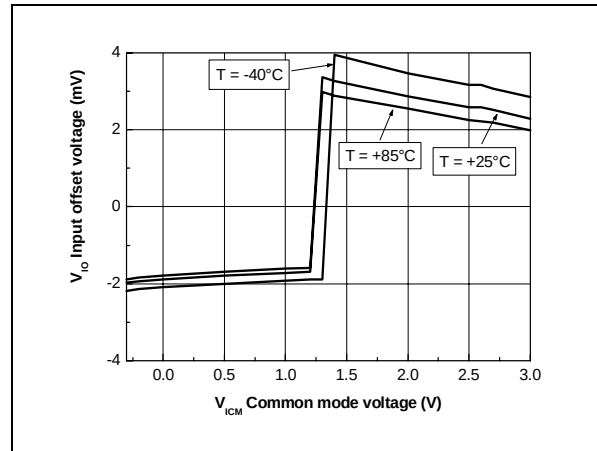
Supply current versus supply voltage
(Output high)



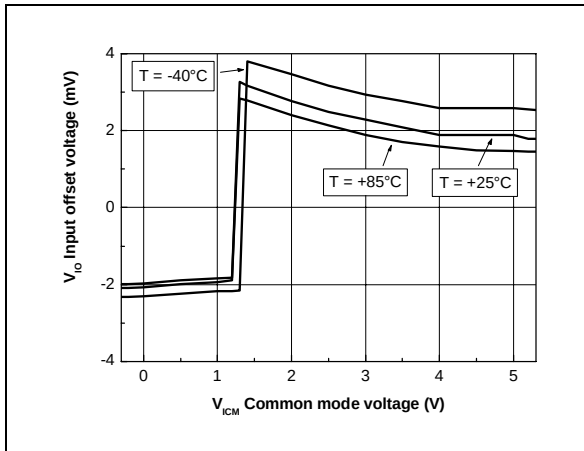
Output sinking current vs Output voltage @
 $V_{CC} = +2.7\text{V}$ and $V_{CC} = +5\text{V}$



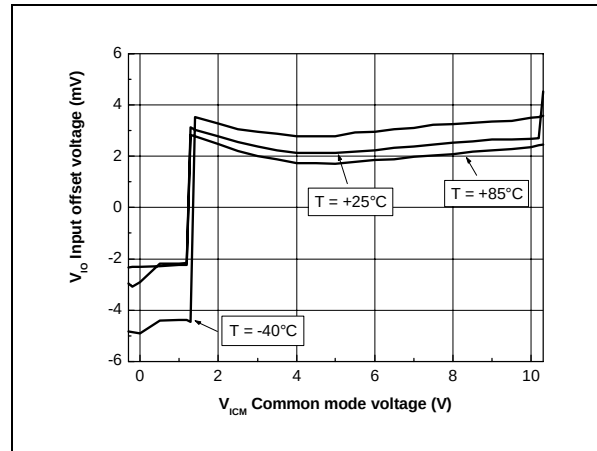
V_{IO} vs V_{ICM} & Temperature @ $V_{CC}=2.7\text{V}$

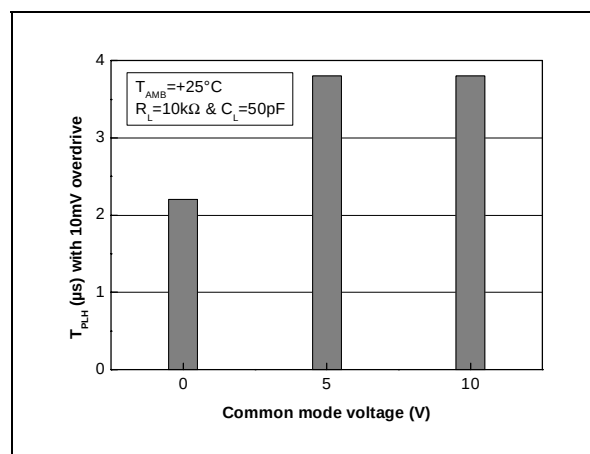
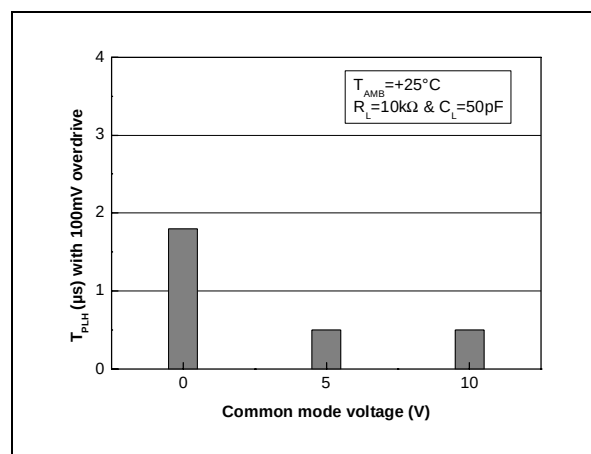
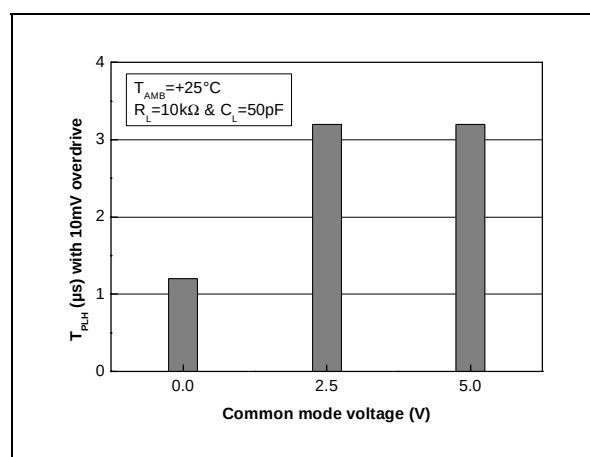
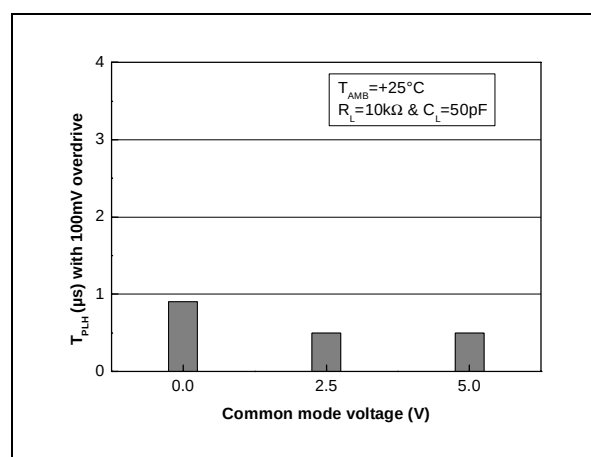
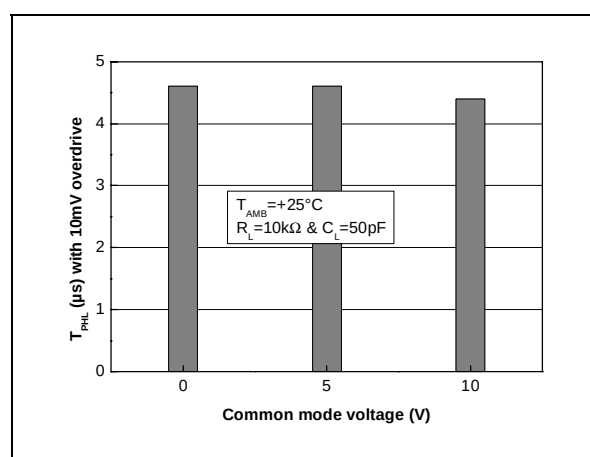
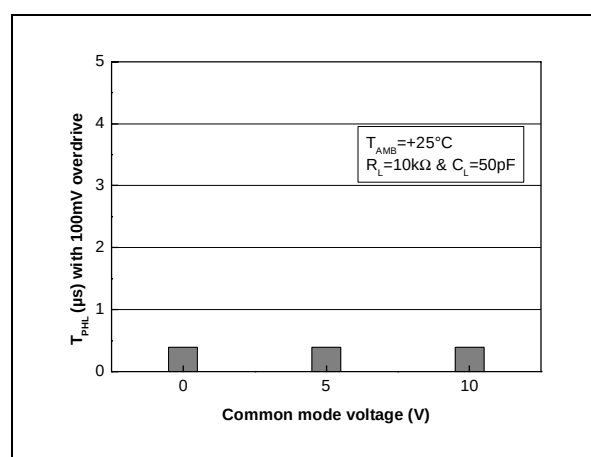


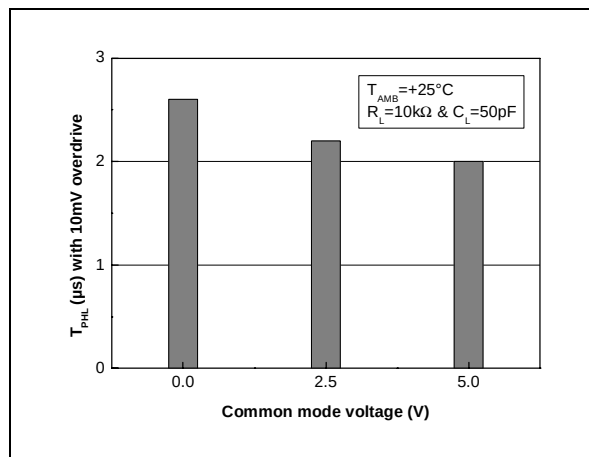
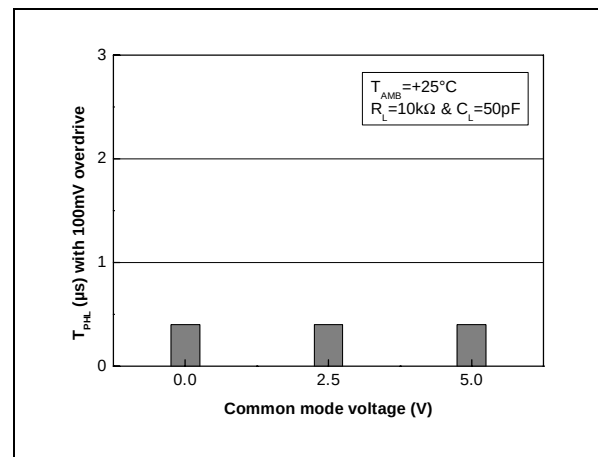
V_{IO} vs V_{ICM} & Temperature @ $V_{CC}=5\text{V}$



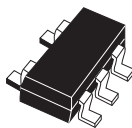
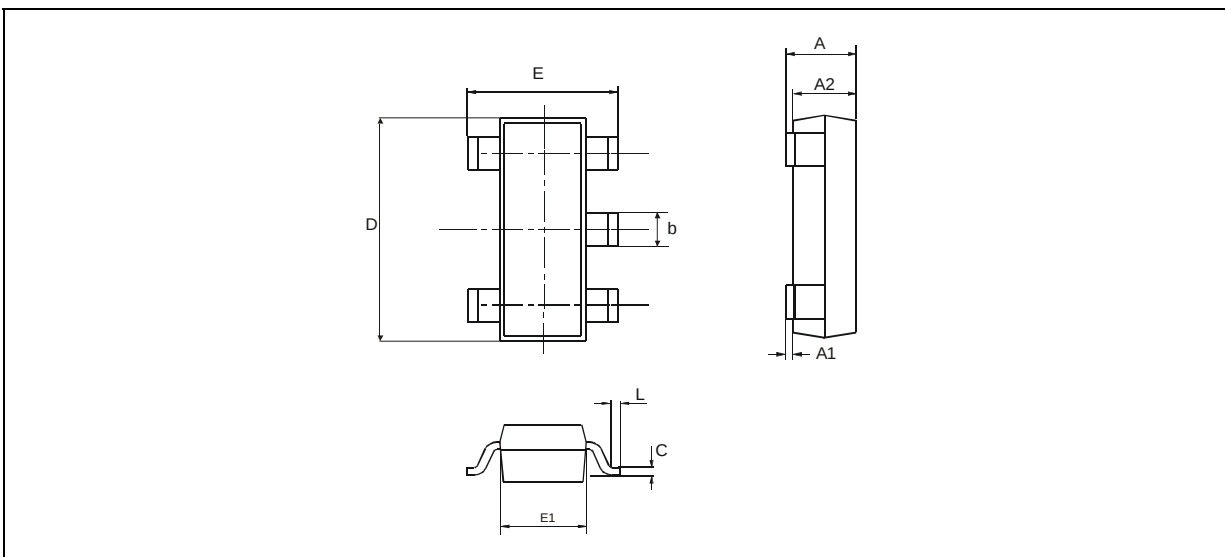
V_{IO} vs V_{ICM} & Temperature @ $V_{CC}=10\text{V}$



T_{PLH} vs V_{ICM} @ $V_{CC}=10V$ and 10mV overdrive **T_{PLH} vs V_{ICM} @ $V_{CC}=10V$ and 100mV overdrive** **T_{PLH} vs V_{ICM} @ $V_{CC}=5V$ and 10mV overdrive** **T_{PLH} vs V_{ICM} @ $V_{CC}=5V$ and 100mV overdrive** **T_{PHL} vs V_{ICM} @ $V_{CC}=10V$ and 10mV overdrive** **T_{PHL} vs V_{ICM} @ $V_{CC}=10V$ and 100mV overdrive**

T_{PHL} vs V_{ICM} @ $V_{CC}=5V$ and 10mV overdrive T_{PHL} vs V_{ICM} @ $V_{CC}=5V$ and 100mV overdrive

TS7221ILT


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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