SGS-THOMSON MICROELECTRONICS

TSM221

DUAL CMOS RAIL TO RAIL OPERATIONAL AMPLIFIER AND DUAL CMOS COMPARATOR

- SINGLE SUPPLY OPERATION FROM **2.7V TO 16V**
- LOW SUPPLY CURRENT: 500µA (V_{CC} = 5V)
- LATCH - UP IMMUNITY

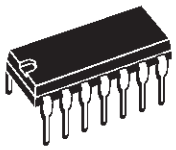
OPERATIONAL AMPLIFIERS

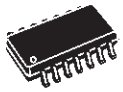
- RAIL TO RAIL INPUT AND OUTPUT
- EXTREMELY LOW INPUT BIAS CURRENT : 1pA typ.
- 1MHz TYPICAL GAIN BANDWIDTH PRODUCT
- SPECIFIED FOR 600Ω OUTPUT LOAD

COMPARATORS

- PUSH-PULL OUTPUT (no external pull-up resistor required)
- EXTREMELY LOW INPUT BIAS CURRENT : 1pA typ.
- EXTREMELY LOW INPUT OFFSET CURRENT : 1pA typ.
- INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GROUND
- HIGH INPUT IMPEDANCE : 10^{12} typ.
- FAST RESPONSE TIME : 2µs TYP. FOR 5mV OVERDRIVE

- SPICE **MACROMODEL** INCLUDED IN THIS SPECIFICATION





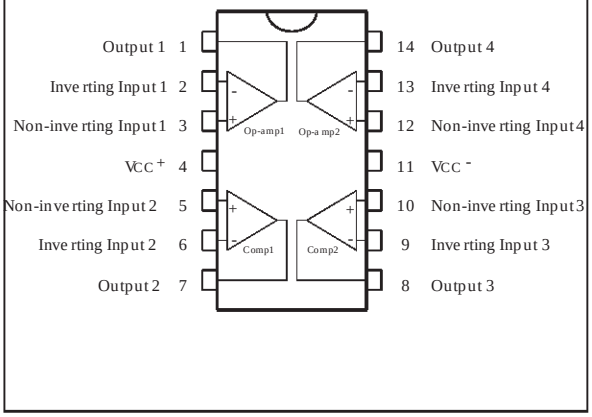
N
DIP14
(Plastic Package)

D
SO14
(Plastic Micropackage)

ORDER CODES

Part Number	Temperature Range	Package	
		N	D
TSM221I	-40, +125°C	•	•

PIN CONNECTIONS (top view)



DESCRIPTION

The TSM221 is a space-saving monolithic IC which includes a dual Rail to Rail op-amp and a micropower dual comparator, using a CMOS process. This mixed circuit is a general purpose analog block for Telecom or Industrial applications, offering an integrated high performances solution.

ABSOLUTE MAXIMUM RATINGS (OPERATIONAL AMPLIFIERS)

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage - (note 1)	18	V
V_{id}	Differential Input Voltage - (note 2)	±18	V
V_i	Input Voltage - (note 3)	-0.3 to 18	V
I_{in}	Current on Inputs (Op-Amps)	±50	mA
I_o	Current on Outputs (Op-Amps)	±130	mA
T_{oper}	Operating Free Air Temperature Range	-40 to +125	°C
T_{stg}	Storage Temperature	-65 to +125	°C

ABSOLUTE MAXIMUM RATINGS (COMPARATORS)

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage - (note 1)	18	V
V_{id}	Differential Input Voltage - (note 2)	±18	V
V_i	Input Voltage - (note 4)	-0.3 to 18	V
V_O	Output Voltage	18	V
I_o	Output Current (Comparators)	20	mA
T_{oper}	Operating Free Air Temperature Range	-40 to +125	°C
T_{stg}	Storage Temperature	-65 to +125	°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. The magnitude of input and output voltages must never exceed the magnitude of the positive supply voltage.

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2.7 to 16	V
V_{icm}	Common Mode Input Voltage Range (Op-Amps)	V_{dd} -0.2 to V_{CC} +0.2	V
V_{icm}	Common Mode Input Voltage Range (Comparators)	0 to V_{CC}^+ -1.5	V

OPERATIONAL AMPLIFIERS

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = 5V$, $V_{CC}^- = 0V$, R_L,C_L connected to $V_{CC}/2$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage	$T_{min.} \le T_{amb} \le T_{max.}$			10 12	mV
DV_{io}	Input Offset Voltage Drift			5		$\mu V/^oC$
I_{io}	Input Offset Current - (note 1)	$T_{min.} \le T_{amb} \le T_{max.}$		1	100 200	pA
I_{ib}	Input Bias Current - (note 1)	$T_{min.} \le T_{amb} \le T_{max.}$		1	150 300	pA
A_{vd}	Large Signal Voltage Gain	$R_L = 10k\Omega$, $V_O = 1.5V$ to $3.5V$ $T_{min.} \le T_{amb} \le T_{max.}$	10 7	50		V/mV
I_{CC}	Total Supply Current- (note 2)	No load		500	800	µA
CMR	Common Mode Rejection Ratio	$V_{ic} = 1.5$ to $3.5V$, $V_o = 2.5V$	60	85		dB
SVR	Supply Voltage Rejection Ratio	$V_{CC}^+ = 3V$ to $5V$, $V_O = V_{CC}/2$	55	80		dB
V_{OH}	High Level Output Voltage R1 connected to $V_{CC/2}$	$R_L = 10k$ $R_L = 600\Omega$ $R_L = 100\Omega$	4.90 4.25	4.95 4.55 3.7		V
V_{OL}	Low Level Output Voltage R1 connected to $V_{CC/2}$	$R_L = 10k$ $R_L = 600\Omega$ $R_L = 100\Omega$		40 350 1400	100 500	mV
I_o	Output Short Circuit Current	$V_o = V_{CC}^-$	45	65		mA
I_{sink}	Output Sink Current	$V_o = V_{CC}^+$	45	65		mA
GBP	Gain Bandwidth Product	$A_{VCL} = 100$, $R_L = 10k$, $C_L = 100pF$, $f = 100kHz$		1		MHz
SR	Slew Rate	$A_{VCL} = 1$, $R_L = 10k$, $C_L = 100pF$, $V_i = 1V$ to $4V$		0.7		V/µs
∅m	Phase Margin			30		Degrees
e_n	Equivalent Input Noise Voltage	$R_s = 100\Omega$, $f = 1kHz$		30		$\frac{nV}{\sqrt{Hz}}$
C_s	Channel Separation	$f = 1kHz$		120		dB

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

Note 2 : Op-amps and comparators

OPERATIONAL AMPLIFIERS

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = 3V$, $V_{CC}^- = 0V$, R_L,C_L connected to $V_{CC}/2$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage	$T_{min.} \le T_{amb} \le T_{max.}$			10 12	mV
DV_{io}	Input Offset Voltage Drift			5		µV/°C
I_{io}	Input Offset Current - (note 1)	$T_{min.} \le T_{amb} \le T_{max.}$		1	100 200	pA
I_{ib}	Input Bias Current - (note 1)	$T_{min.} \le T_{amb} \le T_{max.}$		1	150 300	pA
A_{vd}	Large Signal Voltage Gain	R_L = 10kΩ, V_O = 1.5V to 3.5V $T_{min.} \le T_{amb} \le T_{max.}$	3 2	10		V/mV
I_{CC}	Total Supply Current- (note 2)	No load		415	600	µA
CMR	Common Mode Rejection Ratio	V_{ic} = 0 to 3V, V_o = 1.5V		70		dB
SVR	Supply Voltage Rejection Ratio	V_{CC}^+ = 2.7V to 3.3V, $V_O = V_{CC}/2$	50	80		dB
V_{OH}	High Level Output Voltage R1 connected to $V_{CC/2}$	R_L = 10k R_L = 600Ω R_L = 100Ω	2.90 2.30	2.96 2.60 2		V
V_{OL}	Low Level Output Voltage R1 connected to $V_{CC/2}$	R_L = 10k R_L = 600Ω R_L = 100Ω		30 300 900	70 400	mV
I_o	Output Short Circuit Current	$V_o = V_{CC}^-$	20	40		mA
I_{sink}	Output Sink Current	$V_o = V_{CC}^+$	20	40		mA
GBP	Gain Bandwidth Product	A_{VCL} = 100, R_L = 10k, C_L = 100pF, f = 100kHz		0.8		MHz
SR	Slew Rate	A_{VCL} = 1, R_L = 10k, C_L = 100pF, V_i = 1.3V to 1.7V		0.3		V/µs
∅m	Phase Margin			30		Degrees
e_n	Equivalent Input Noise Voltage	R_S = 100Ω, f = 1kHz		30		$\frac{nV}{\sqrt{Hz}}$
C_s	Channel Separation	f = 1kHz		120		dB

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

Note 2 : Op-amps and comparators

MACROMODEL FOR OP-AMPS (V_{CC} = 3V)
Applies to : TSM221

```
** Standard Linear Ics Macromodels, 1993.
** CONNECTIONS :
* 1 INVERTING INPUT
* 2 NON-INVERTING INPUT
* 3 OUTPUT
* 4 POSITIVE POWER SUPPLY
* 5 NEGATIVE POWER SUPPLY
.SUBCKT TSM2213V 1 3 2 4 5 (analog)
*******************************************************
.MODEL MDTH D IS=1E-8 KF=6.564344E-14 CJO=10F
* INPUT STAGE
CIP 2 5 1.000000E-12
CIN 1 5 1.000000E-12
EIP 10 5 2 5 1
EIN 16 5 1 5 1
RIP 10 11 6.500000E+00
RIN 15 16 6.500000E+00
RIS 11 15 1.271505E+01
DIP 11 12 MDTH 400E-12
DIN 15 14 MDTH 400E-12
VOFP 12 13 DC 0.000000E+00
VOFN 13 14 DC 0
IPOL 13 5 4.000000E-05
CPS 11 15 2.125860E-08
DINN 17 13 MDTH 400E-12
VIN 17 5 0.000000e+00
DINR 15 18 MDTH 400E-12
VIP 4 18 0.000000E+00
FCP 4 5 VOFP 5.000000E+00
FCN 5 4 VOFN 5.000000E+00
* AMPLIFYING STAGE
FIP 5 19 VOFP 2.750000E+02
FIN 5 19 VOFN 2.750000E+02
RG1 19 5 1.916825E+05
RG2 19 4 1.916825E+05
CC 19 29 2.200000E-08
HZTP 30 29 VOFP 1.3E+03
HZTN  5 30 VOFN 1.3E+03
DOPM 19 22 MDTH 400E-12
DONM 21 19 MDTH 400E-12
HOPM 22 28 VOUT 3800
VIPM 28 4 150
HONM 21 27 VOUT 3800
VINM 5 27 150
EOUT 26 23 19 5 1
VOUT 23 5 0
ROUT 26 3 75
COUT 3 5 1.000000E-12
DOP 19 68 MDTH 400E-12
VOP 4 25 1.724
HSCP 68 25 VSCP1 0.8E8
DON 69 19 MDTH 400E-12
VON 24 5 1.7419107
HSCN 24 69 VSCN1 0.8E+08
VSCTHP 60 61 0.0875
** VSCTHP = le seuil au dessus de vio * 500
** c.a.d 275U-000U dus a l'offset
DSCP1 61 63 MDTH 400E-12
VSCP1 63 64 0
ISCP 64 0 1.000000E-8
DSCP2 0 64 MDTH 400E-12
DSCN2 0 74 MDTH 400E-12
ISCN 74 0 1.000000E-8
VSCN1 73 74 0
DSCN1 71 73 MDTH 400E-12
VSCTHN 71 70 -0.55
** VSCTHN = le seuil au dessous de vio * 2000
** c.a.d -375U-000U dus a l'offset
ESCP 60 0 2 1 500
ESCN 70 0 2 1 -2000
.ENDS
```

ELECTRICAL CHARACTERISTICS V_{CC}^+ **=** 3V**,** V_{CC}^- **=** 0V, R_L,C_L connected to $V_{CC}/2$, T_{amb} = 25°C, unless otherwise specified

Symbol	Conditions	Value	Unit
V_{io}		0	mV
A_{vd}	R_L = 10kΩ	10	V/mV
I_{CC}	No load	415	µA
V_{icm}		-0.2 to 3.2	V
V_{OH}	R_L = 10kΩ	2.96	V
V_{OL}	R_L = 10kΩ	30	mV
I_{sink}	V_O = 3V	40	mA
I_{source}	V_O = 0V	40	mA
GBP	R_L = 10kΩ, C_L = 100pF	0.8	MHz
SR	R_L = 10kΩ, C_L = 100pF	0.3	V/µs

MACROMODEL FOR OP-AMPS (V_{CC} = 5V)
Applies to : TSM221

```
** Standard Linear Ics Macromodels, 1993.
** CONNECTIONS :
* 1 INVERTING INPUT
* 2 NON-INVERTING INPUT
* 3 OUTPUT
* 4 POSITIVE POWER SUPPLY
* 5 NEGATIVE POWER SUPPLY
* 6 STANDBY
.SUBCKT TSM2215V 1 3 2 4 5 (analog)
**********************************************************
.MODEL MDTH D IS=1E-8 KF=6.564344E-14 CJO=10F
* INPUT STAGE
CIP 2 5 1.000000E-12
CIN 1 5 1.000000E-12
EIP 10 5 2 5 1
EIN 16 5 1 5 1
RIP 10 11 6.500000E+00
RIN 15 16 6.500000E+00
RIS 11 15 7.322092E+00
DIP 11 12 MDTH 400E-12
DIN 15 14 MDTH 400E-12
VOFP 12 13 DC 0.000000E+00
VOFN 13 14 DC 0
IPOL 13 5 4.000000E-05
CPS 11 15 2.498970E-08
DINN 17 13 MDTH 400E-12
VIN 17 5 0.000000e+00
DINR 15 18 MDTH 400E-12
VIP 4 18 0.000000E+00
FCP 4 5 VOFP 5.750000E+00
FCN 5 4 VOFN 5.750000E+00
ISTB0 5 4 500N
* AMPLIFYING STAGE
FIP 5 19 VOFP 4.400000E+02
FIN 5 19 VOFN 4.400000E+02
RG1 19 5 4.904961E+05
RG2 19 4 4.904961E+05
CC 19 29 2.200000E-08
HZTP 30 29 VOFP 1.8E+03
HZTN  5 30 VOFN 1.8E+03
DOPM 19 22 MDTH 400E-12
DONM 21 19 MDTH 400E-12
HOPM 22 28 VOUT 3800
VIPM 28 4 230
HONM 21 27 VOUT 3800
VINM 5 27 230
EOUT 26 23 19 5 1
VOUT 23 5 0
ROUT 26 3 82
COUT 3 5 1.000000E-12
DOP 19 68 MDTH 400E-12
VOP 4 25 1.724
HSCP 68 25 VSCP1 0.8E+08
DON 69 19 MDTH 400E-12
VON 24 5 1.7419107
HSCN 24 69 VSCN1 0.8E+08
VSCTHP 60 61 0.0875
** VSCTHP = le seuil au dessus de vio * 500
** c.a.d 275U-000U dus a l'offset
DSCP1 61 63 MDTH 400E-12
VSCP1 63 64 0
ISCP 64 0 1.000000E-8
DSCP2 0 64 MDTH 400E-12
DSCN2 0 74 MDTH 400E-12
ISCN 74 0 1.000000E-8
VSCN1 73 74 0
DSCN1 71 73 MDTH 400E-12
VSCTHN 71 70 -0.55
** VSCTHN = le seuil au dessous de vio * 2000
** c.a.d -375U-000U dus a l'offset
ESCP 60 0 2 1 500
ESCN 70 0 2 1 -2000
.ENDS
```

ELECTRICAL CHARACTERISTICS V_{CC}^+ = 5V, V_{CC}^- = 0V, R_L,C_L connected to $V_{CC}/2$, T_{amb} = 25°C, unless otherwise specified

Symbol	Conditions	Value	Unit
V_{io}		0	mV
A_{vd}	R_L = 10kΩ	50	V/mV
I_{CC}	No load	500	µA
V_{icm}		-0.2 to 5.2	V
V_{OH}	R_L = 10kΩ	4.95	V
V_{OL}	R_L = 10kΩ	40	mV
I_{sink}	V_O = 5V	65	mA
I_{source}	V_O = 0V	65	mA
GBP	R_L = 10kΩ, C_L = 100pF	1	MHz
SR	R_L = 10kΩ, C_L = 100pF	0.7	V/µs

COMPARATORS

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = 5V$, $V_{CC}^- = 0V$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage - (note 1) $T_{min.} \le T_{amb} \le T_{max.}$	$V_{ic} = V_{icm\ min.}$ $V_{CC}^+ = 5V$ to $10V$			5 6.5	mV
I_{io}	Input Offset Current - (note 2) $T_{min.} \le T_{amb} \le T_{max.}$			1	 300	pA
I_{ib}	Input Bias Current - (note 2) $T_{min.} \le T_{amb} \le T_{max.}$			1	 600	pA
V_{OH}	High Level Output Voltage $T_{min.} \le T_{amb} \le T_{max.}$	$V_{id} = 1V$, $I_{oh} = -4mA$	4.5 4.3	4.7		V
V_{OL}	Low Level Output Voltage $T_{min.} \le T_{amb} \le T_{max.}$	$V_{id} = -1V$, $I_{oh} = 4mA$		220	300 375	mV
V_{icm}	Input Common Mode Voltage $T_{min.} \le T_{amb} \le T_{max.}$		0 to V_{CC}^+ -1.2 0 to V_{CC}^+ -1.5			
CMR	Common Mode Rejection Ratio	$V_{ic} = V_{icm\ min.}$		82		dB
SVR	Supply Voltage Rejection Ratio	$V_{CC}^+ = 5V$ to $10V$		90		dB
T_{plh}	Response Time Low to High Overdrive = 5mV Overdrive = 10mV Overdrive = 20mV Overdrive = 40mV TTL input	$V_{ic} = 0V$, f = 10kHz, $C_L = 50pF$	 1.5 1.1 0.9 0.7 0.6			µs
T_{ph1}	Response Time High to Low Overdrive = 5mV Overdrive = 10mV Overdrive = 20mV Overdrive = 40mV TTL input	$V_{ic} = 0V$, f = 10kHz, $C_L = 50pF$	 2.2 1.6 1.1 0.75 0.17			µs
T_f	Fall Time	f = 10kHz, $C_L = 50pF$, overdrive 50mV		30		ns
T_R	Rise Time	f = 10kHz, CL = 50pF, overdrive 50mV		30		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.

Note 2 : Maximum values including unavoidable inaccuracies of the industrial test.

COMPARATORS

ELECTRICAL CHARACTERISTICS

$V_{CC}^+ = 3V$, $V_{CC}^- = 0V$, $T_{amb} = 25^oC$ (unless otherwise specified)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_{io}	Input Offset Voltage - (note 1) $T_{min.} \le T_{amb} \le T_{max.}$	V_{ic} = 1.5V			5 6.5	mV
I_{io}	Input Offset Current - (note 2) $T_{min.} \le T_{amb} \le T_{max.}$			1	 300	pA
I_{ib}	Input Bias Current - (note 2) $T_{min.} \le T_{amb} \le T_{max.}$			1	 600	pA
V_{OH}	High Level Output Voltage $T_{min.} \le T_{amb} \le T_{max.}$	V_{id} = 1V, I_{oh} = -4mA	2 1.8	2.4		V
V_{OL}	Low Level Output Voltage $T_{min.} \le T_{amb} \le T_{max.}$	V_{id} = -1V, I_{oh} = 4mA		300	400 450	mV
V_{icm}	Input Common Mode Voltage $T_{min.} \le T_{amb} \le T_{max.}$		0 to V_{CC}^+ -1.2 0 to V_{CC}^+ -1.5			
CMR	Common Mode Rejection Ratio	$V_{ic} = V_{icm\ min.}$		80		dB
SVR	Supply Voltage Rejection Ratio	V_{CC}^+ = 5V to 10V		75		dB
T_{plh}	Response Time Low to High Overdrive = 5mV TTL input	V_{ic} = 0V, f = 10kHz, C_L = 50pF	 1.5 0.7			µs
T_{phl}	Response Time High to Low Overdrive = 5mV TTL input	V_{ic} = 0V, f = 10kHz, C_L = 50pF	 2.2 0.15			µs
T_f	Fall Time	f = 10kHz, C_L = 50pF, overdrive 50mV		30		ns
T_R	Rise Time	f = 10kHz, CL = 50pF, overdrive 50mV		30		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.

Note 2 : Maximum values including unavoidable inaccuracies of the industrial test.

MACROMODEL FOR COMPARTORS (V_{CC} = 3V)
Applies to : TSM221

```
** Standard Linear Ics Macromodels, 1993.
** CONNECTIONS :
* 1 INVERTING INPUT
* 2 NON-INVERTING INPUT
* 3 OUTPUT
* 4 POSITIVE POWER SUPPLY
* 5 NEGATIVE POWER SUPPLY
.SUBCKT TSM221C 1 3 2 4 5
 ************************************************************
 ************************ RVAR ************************
.SUBCKT RVAR 20 10 IN OUT
VSENS0 IN 1 0V
R0 1 OUT 125
F0 1 OUT POLY(2) VSENS0 VSENS2 0 0 0 0 1E+08
VSENS2 20 3 0V
R2 3 10 1E+09
.ENDS RVAR
********************** COMPARATOR **********************
.MODEL MDTH D IS=1E-11 KF=1.050321E-32
CJO=10F
* INPUT STAGE
CIP 2 5 1.000000E-12
CIN 1 5 1.000000E-12
EIP 10 0 2 0 1
EIN 16 0 1 0 1
RIP 10 11 6.500000E+01
RIN 15 16 6.500000E+01
RIS 11 15 1.939046E+02
DIP 11 12 MDTH 400E-12
DIN 15 14 MDTH 400E-12
VOFP 12 13 DC 0.000000E+00
VOFN 13 14 DC 0
IPOL 13 0 100E-06
CPS 11 15 8.16E-09
DINN 17 13 MDTH 400E-12
VIN 17 5 0.000000e+00
DINR 15 18 MDTH 400E-12
VIP 4 18 1.200000E+00
FCP 4 5 VOFP 0.02
FCN 5 4 VOFN 0.02
FIBP 2 0 VOFN 2.000000E-08
FIBN 0 1 VOFP 2.000000E-08
* AMPLIFYING STAGE
RG1 5 19 2.8E+05
RG2 4 19 2.8E+05
DOPM 19 22 MDTH 400E-12
DONM 21 19 MDTH 400E-12
HOPM 22 28 VOUT 3000
VIPM0 28 40 -87
EIPM 40 4 4 5 42
**VIPM 28 4 150
HONM 21 27 VOUT 3000
VINM0 50 27 -114
EINM 5 50 4 5 54
**VINM 5 27 150
DOP 19 25 MDTH 400E-12
VOP 4 25 1.097
DON 24 19 MDTH 400E-12
VON 24 5 1.097
FIP 0 19 VOFP 104
FIN 0 19 VOFN 104
EOUT 26 23 19 5 1
VOUT 23 5 0V
XOUT 4 5 26 3 RVAR
*ROUT 26 3 62.5
.ENDS
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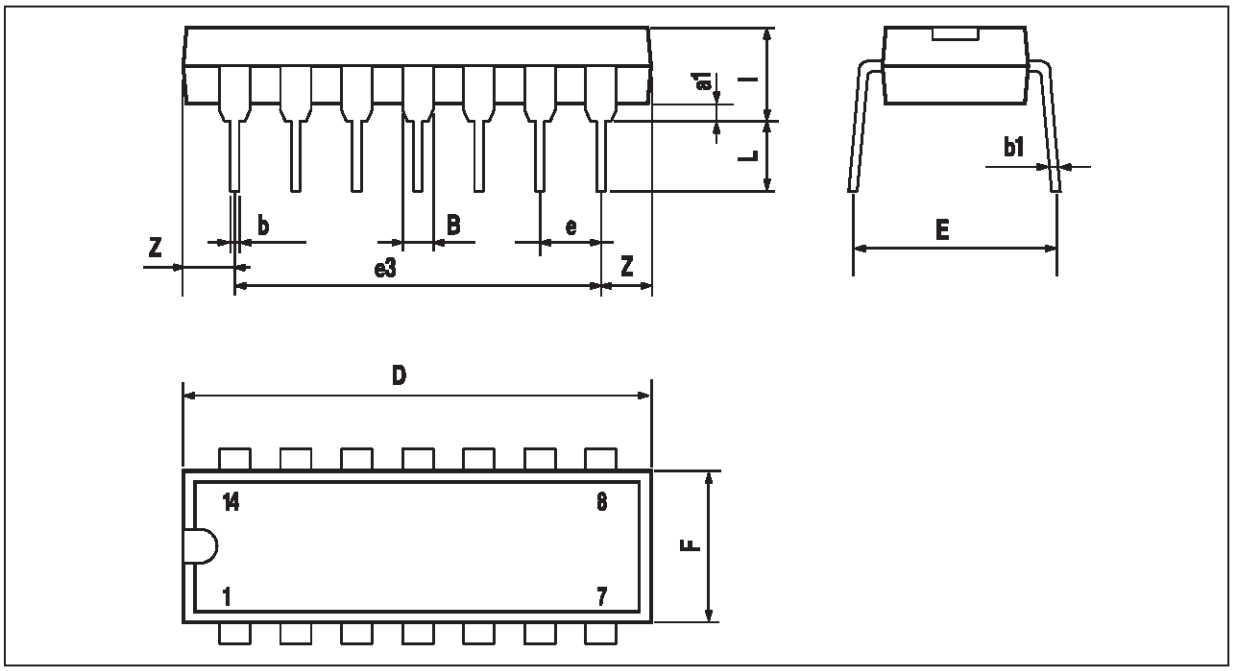
ELECTRICAL CHARACTERISTICS V_{CC}^+ = 3V, V_{CC}^- = 0V, T_{amb} = 25°C, unless otherwise specified

Symbol	Conditions	Value	Unit
V_{io}	V_{ic} = 1.5V	0	mV
I_{CC}	No load, per operator	7	µA
V_{icm}		0 to 1.8V	V
V_{OH}	V_{id} = 1V, I_{OH} = -4mA	2.4	V
V_{OL}	V_{id} = 1V, I_{OH} = -4mA	300	mV
t_{PLH}	Overdrive = 5mV	1.5	µs
t_{PHL}	Overdrive = 5mV	2.2	µs

PACKAGE MECHANICAL DATA

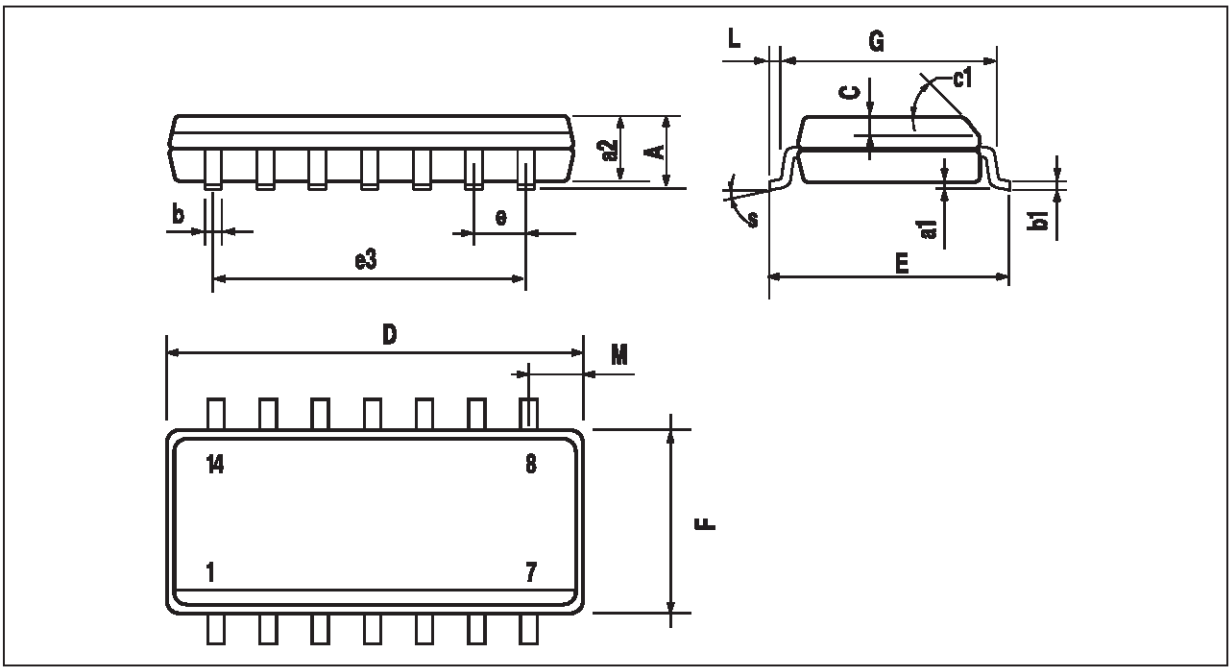
14 PINS - PLASTIC DIP



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

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.)					

ORDER CODE :

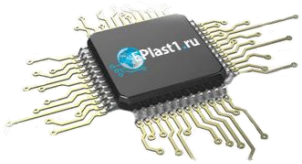
Компания «ЭлектроПласт» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов;
- Поставка более 17-ти миллионов наименований электронных компонентов;
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- Лицензия ФСБ на осуществление работ с использованием сведений, составляющих государственную тайну;
- Поставка специализированных компонентов (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Aeroflex, Peregrine, Syfer, Eurofarad, Texas Instrument, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits,General Dynamics и др.);

Помимо этого, одним из направлений компании «ЭлектроПласт» является направление «Источники питания». Мы предлагаем Вам помощь Конструкторского отдела:

- Подбор оптимального решения, техническое обоснование при выборе компонента;
- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



Как с нами связаться

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