TC35097P 8 BIT 2-CH SERIAL I/O ANALOG TO DIGITAL CONVERTER

GENERAL DESCRIPTION

The TC35097P is a monolithic CMOS 8 bit successive approximation A/D converter with serial I/O and 2 channel multiplex inputs.

Conversion start when $\overline{CS}$ is set low and start bit ("L" level) and channel select bit are given to serial input DI.

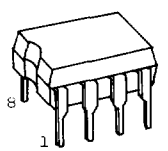
As soon as conversion starts a start bit ("L" level) appears at serial output DO and 8 bit conversion data (MSB first) and a stop bit ("H" level) follow continuously.

The device requires no external zero and full scale adjustments.

The TC35097P has features of high speed, high accuracy and microprocessor compatible I/O which make the device well suited to a broad application field such as process and machine control, automotive equipment and consumer apparatus.

FEATURES

- High accuracy ..... $\pm\frac{3}{4}$ LSB MAX
- High speed conversion ..... 30μsec MAX @f_{cp}=400KHz
- Single power supply ..... 5V±10%
- Low power consumption ..... 17.5mW MAX @T_a=25°C
- Serial I/O
- 2 channel analog multiplex input
- Easy interface to all microprocessors
- 3-state output
- Zero or full scale adjustment free

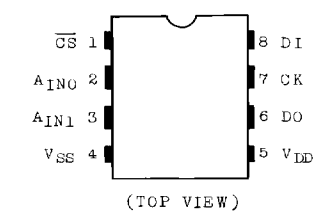


DIP8 (DIP8-P-300)

MAXIMUM RATINGS

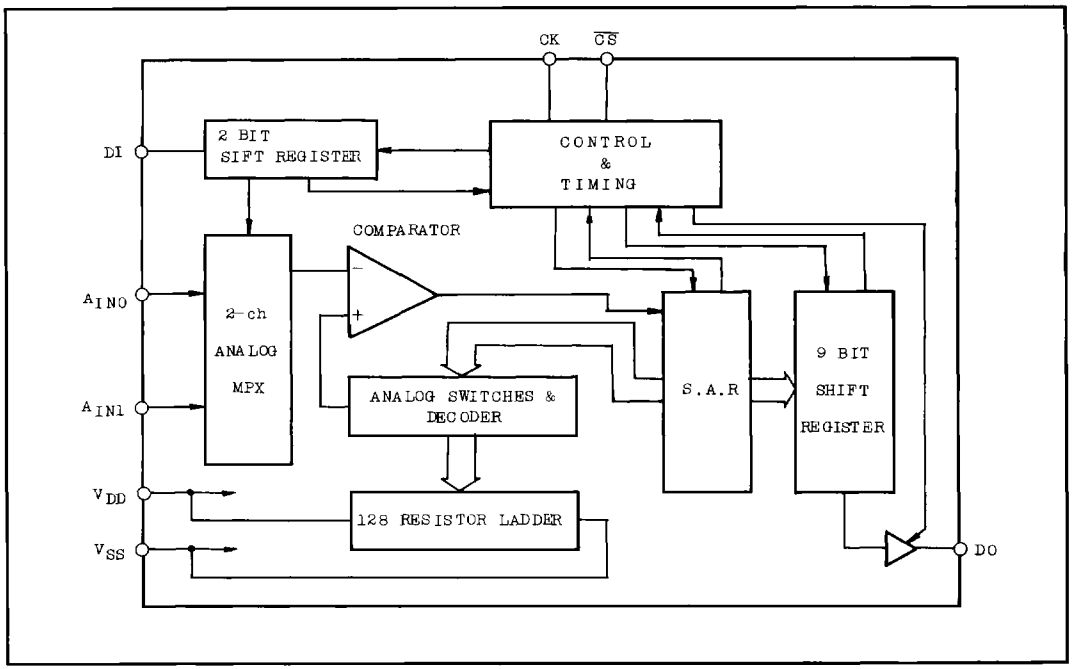
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage Range	V_{DD}	V_{SS}-0.5∿V_{SS}+7	V
DC Input Voltage	V_{IN}	V_{SS}-0.5∿V_{DD}+0.5	V
DC Output Voltage	V_{OUT}	V_{SS}-0.5∿V_{DD}+0.5	V
DC Input Current	I_{IN}	±10	mA
Power Dissipation	P_D	300	mW
Storage Temperature	T_{stg}	-65∿150	°C
Lead Temperature 10sec.	T_L	300	°C

PIN ASSIGNMENT

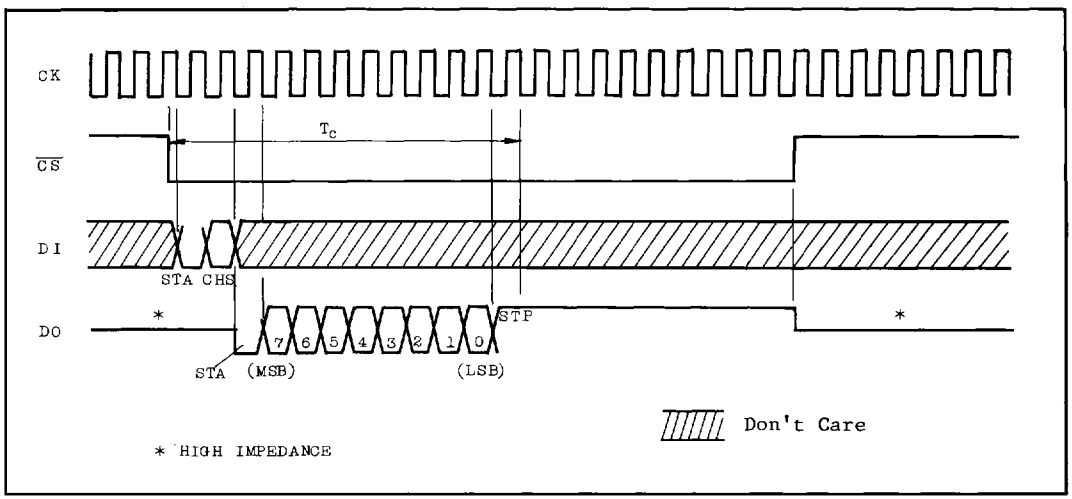


(TOP VIEW)

BLOCK DIAGRAM



TIMING CHART



PIN & FUNCTION

PIN NO.	SYMBOL	NAME & FUNCTION
1	$\overline{CS}$	[CHIP SELECT] At the falling edge of $\overline{CS}$, the device is set stand-by for conversion. When $\overline{CS}$ is "H" the device is reset and all outputs become high impedance.
2	A_{IN0}	[ANALOG INPUT] A_{IN0} or A_{IN1} is selected according to the channel select bit applied on DI input. Full range of input signal is to be from V_{SS} to V_{DD}. ON Channel / DI Data CHS: A_{IN0} → L; A_{IN1} → H
3	A_{IN1}	
4	V_{SS}	[GROUND] V_{SS} is connected internally to 128 resistor ladder as an analog ground.
5	V_{DD}	[POWER SUPPLY] V_{DD} is connected internally to 128 resistor ladder as a reference voltage 5V ± 10%
6	DO	[DATA OUTPUT] A start bit ("L" level), 8 bit conversion data (MSB first) and a stop bit ("H" level) are sent out in series.
7	CK	[CLOCK INPUT] Basic system clock Duty cycle is to be 50%.
8	DI	[DATA INPUT] For starting conversion, a start bit ("L" level) and channel select bit (CHS) are to be applied.

SYSTEM CHARACTERISTICS (Ta=-40 ∿ 85°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Zero Point Error	E_{ZR}	V_{DD}=5.000V f_{cp}=400kHz Duty=50%	-	±1/4	±1/2	LSB
Full Scale Error	E_{FS}		-	±1/4	±1/2	
Nonlinearity Error	E_{LI}		-	±1/4	-	
Total Error	E_T		-	±1/4	±3/4	
Conversion Time	T_C	f_{cp}=400kHz		30	31.5	μS

$$Tc=\frac{12}{fcp}\pm\alpha \qquad 0<\alpha<\frac{1}{2fcp}$$

RECOMMENDED OPERATING CONDITIONS (V_{SS}=0V)

CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{DD}		4.5	5.0	5.5	V
Input Voltage	V_{IN}		0	-	V_{DD}	V
Clock Frequency	f_{cp}	V_{DD}=5V±10%			400	kHz
Clock Pulse Width	$t_{w(H)}$ $t_{w(L)}$	V_{DD}=5V±10%	1.00	1.25	-	μS
Operating Temperature	T_{opr}		-40	-	+85	°C

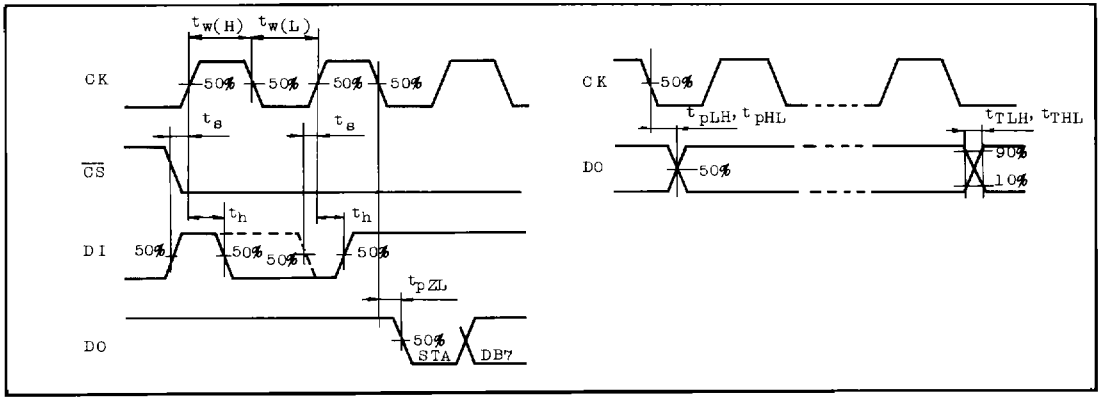
DC ELECTRICAL CHARACTERISTICS (V_{DD}=5V ±10%, V_{ss}=0V)

CHARACTERISTIC	SYMBOL	TEST CONDITION	25°C			-40 ∿85°C		UNIT
			MIN.	TYP.	MAX.	MIN.	MAX.	
High Level Output Voltage	V_{OH}	$\|I_{OUT}\|$<1μA $V_{IN}=V_{SS}, V_{DD}$	V_{DD}-0.05	V_{DD}	-	V_{DD}-0.05	-	V
Low Level Output Voltage	V_{OL}	$\|I_{OUT}\|$<1μA $V_{IN}=V_{SS}, V_{DD}$	-	0.00	0.05	-	0.05	V
High Level Output Current	I_{OH}	$V_{OH}=V_{DD}$-0.4V $V_{IN}=V_{SS}, V_{DD}$	-0.44	-	-	-0.36	-	mA
Low Level Output Current	I_{OL}	V_{OL}=0.4V $V_{IN}=V_{SS}, V_{DD}$	2.0	-	-	1.6	-	mA
High Level Input Voltage	V_{IH}	$\|I_{OUT}\|$<1μA V_{OUT}=0.5V, V_{DD}-0.5V	0.7 ×V_{DD}	-	-	0.7 ×V_{DD}	-	V
Low Level Input Voltage	V_{IL}	$\|I_{OUT}\|$<1μA V_{OUT}=0.5V, V_{DD}-0.5V		-	0.3 ×V_{DD}	-	0.3 ×V_{DD}	V
3-State Output Disable Current	I_{DH} I_{DL}	$V_{OH}=V_{DD}$ or V_{OL}=0.0V		-	±0.5	-	±1	μA
Digital Input Current	I_{IH} I_{IL}	$V_{IH}=V_{DD}$ or V_{IL}=0.0V		-	±0.3	-	±1	μA
ON Channel Input Current	I_{ON}	$V_{IH}=V_{REF}$ or V_{IL}=0.0V f_{cp}=400kHz	-	-	±5	-	±7	μA
OFF Channel Input Current	I_{OFF}	$V_{IH}=V_{DD}$ or V_{IL}=0.0V	-	-	±0.2	-	±1	μA
Operating Current	I_{DD}	f_{cp}=400kHz	-	-	3.9	-	4.3	mA
Quiescent Supply Current	I_{DDS}	$\overline{CK}=V_{DD}$, V_{SS} $\overline{CS}=V_{DD}$	-	-	3.0	-	3.5	mA

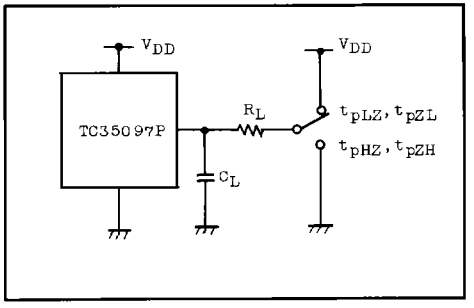
SWITCHING CHARACTERISTICS (V_{DD}=5V±10%, V_{SS}=0V, Ta=25°C)

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}	C_L=50pF	-	30	100	nS
Propagation Delay Time (CK-Data)	tpLH tpHL	C_L=50pF	-	80	250	
3-State Output Enable Time (CK-Data)	tpZL	C_L=50pF R_L=1kΩ	-	30	200	
3-State Output Disable Time ($\overline{CS}$-Data)	tpHZ tpLZ		-	60	200	
Minimum Pulse Width ($\overline{CS}$)	$t_{w(H)}$	C_L=50pF	-	30	100	
Minimum Set-up Time ($\overline{CS}$, DI)	t_s	C_L=50pF	-	-10	150	
Minimum Hold Time (DI)	t_h	C_L=50pF	-	10	50	
Input Capacitance	C_{IN1}	Digital Input	-	5	-	pF
Input Capacitance	C_{IN2}	Analog In (ON)	-	5	-	
Input Capacitance	C_{IN3}	Analog In (OFF)	-	5	-	
Output Capacitance	C_{OUT}	3-State Out	-	10	-	

SWITCHING CHARACTERISTICS TEST WAVEFORM



3-STATE OUTPUT TEST CIRCUIT



APPLICATION CIRCUIT (EXAMPLE)