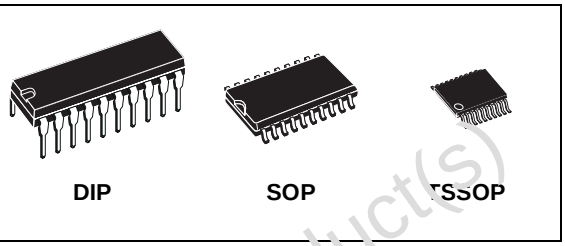
74AC299

8 BIT PIPO SHIFT REGISTER WITH ASYNCHRONOUS CLEAR

- HIGH SPEED:
- f_{MAX} = 240MHz (TYP.) at V_{CC} = 5V
- LOW POWER DISSIPATION: I_{CC} = 8µA(MAX.) at T_A=25°C
- HIGH NOISE IMMUNITY: $V_{NIH} = V_{NIL}$ = 28 % V_{CC} (MIN.)
- 50Ω TRANSMISSION LINE DRIVING CAPABILITY
- SYMMETRICAL OUTPUT IMPEDANCE: $|I_{OH}| = I_{OL}$ = 24mA (MIN)
- BALANCED PROPAGATION DELAYS: $t_{PLH} \cong t_{PHL}$
- OPERATING VOLTAGE RANGE: V_{CC} (OPR) = 2V to 6V
- PIN AND FUNCTION COMPATIBLE WITH 74 SERIES 299
- IMPROVED LATCH-UP IMMUNITY



ORDER CODES

PACKAGE	TUBE	T & R
DIP	74AC299B	
SOP	74AC299M	74AC299MTR
TSSOP		74AC299TTR

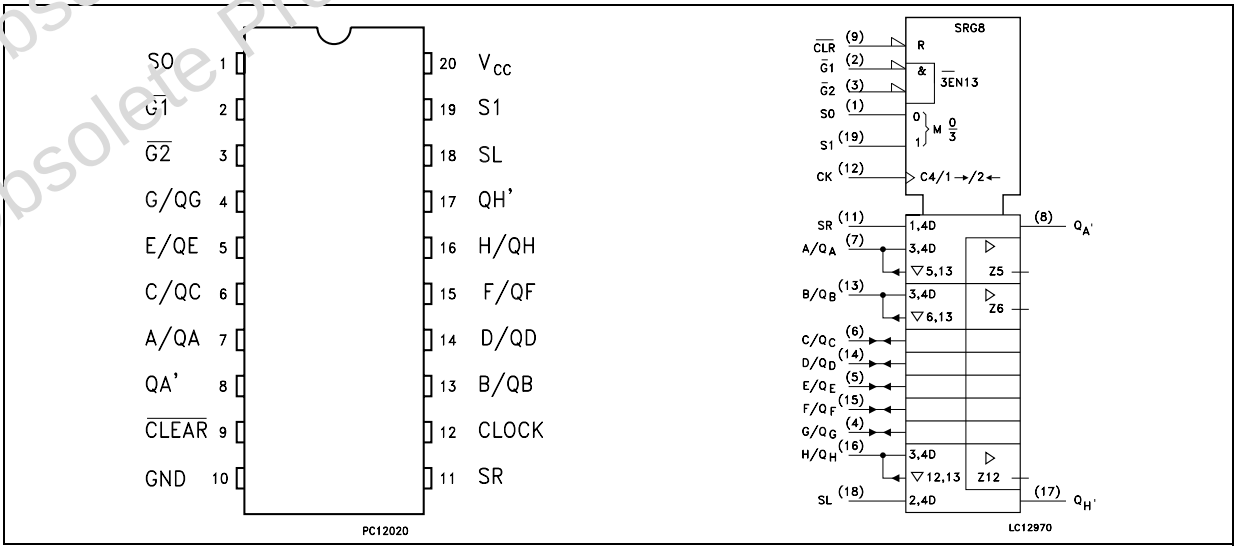
DESCRIPTION

The 74AC299 is an advanced high-speed CMOS 8-BIT PIPO SHIFT REGISTER (3-STATE) fabricated with sub-micron silicon gate and double-layer metal wiring C^2MOS technology.

These devices have four modes (HOLD, SHIFT LEFT, SHIFT RIGHT and LOAD DATA). Each mode is chosen by two function select inputs (S0, S1) as shown in the Truth Table. When one or both enable inputs, ($\overline{G1}$, $\overline{G2}$) are high, the eight input/output terminals are in the high-impedance state; however sequential operation or clearing of the register is not affected. Clear function is asynchronous to clock.

All inputs and outputs are equipped with protection circuits against static discharge, giving them 2KV ESD immunity and transient excess voltage.

PIN CONNECTION AND IEC LOGIC SYMBOLS



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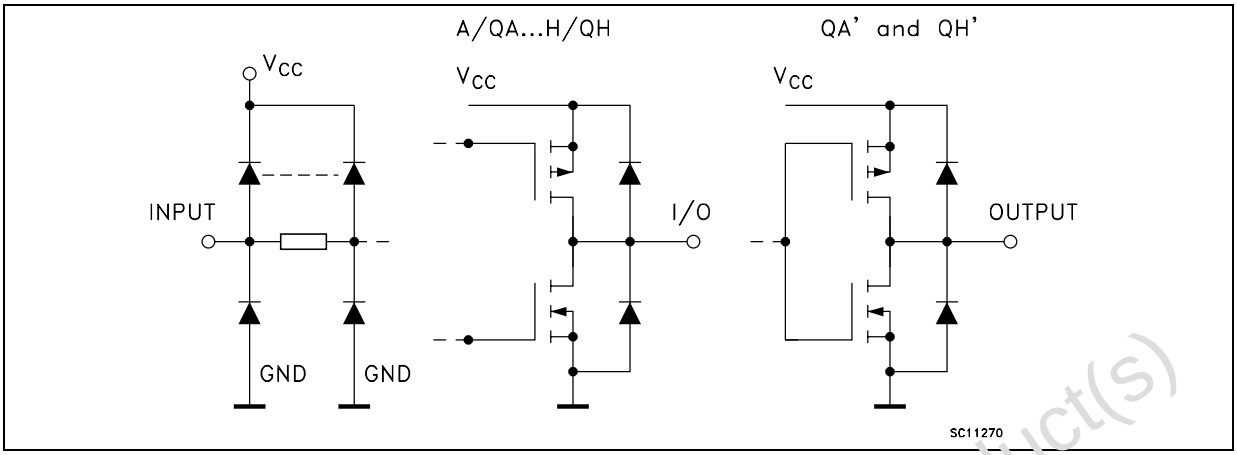
INPUT AND OUTPUT EQUIVALENT CIRCUIT



PIN DESCRIPTION

PIN No	SYMBOL	NAME AND FUNCTION
1, 19	S0, S1	Mode Select Inputs
2, 3	$\overline{G1}$, $\overline{G2}$	3-State Output Enable Inputs (Active LOW)
7, 13, 6, 14, 5, 15, 4, 16	A/QA to H/QH	Parallel Data Inputs or 3-State Parallel Outputs (Bus Driver)
8, 17	QA' to QH'	Serial Outputs (Standard Output)
9	$\overline{CLEAR}$	Asynchronous Master Reset Input (Active LOW)
11	SR	Serial Data Shift Right Input
12	CLOCK	Clock Input (LOW to HIGH, Edge-triggered)
18	SL	Serial Data Shift Left Input
10	GND	Ground (0V)
20	V_{CC}	Positive Supply Voltage

TRUTH TABLE

MODE	INPUTS						INPUTS/OUTPUTS				OUTPUTS	
	$\overline{CLEAR}$	FUNCTION SELECTED		OUTPUT CONTROL		CLOCK	SERIAL		A/QA	H/QH	QA'	QH'
		S1	S0	$\overline{G1}$*	$\overline{G2}$*		SL	SR				
Z	L	H	H	X	X	X	X	X	Z	Z	L	L
CLEAR	L	L	X	L	L	X	X	X	L	L	L	L
	L	X	L	L	L	X	X	X	L	L	L	L
HOLD	H	L	L	L	L	X	X	X	QA0	QH0	QA0	QH0
SHIFT RIGHT	H	L	H	L	L	⎍	X	H	H	QGn	H	QGn
	H	L	H	L	L	⎍	X	L	L	QGn	L	QGn
SHIFT LEFT	H	H	L	L	L	⎍	H	X	QBn	H	QBn	H
	H	H	L	L	L	⎍	L	X	QBn	L	QBn	L
LOAD	H	H	H	X	X	⎍	X	X	a	h	a	h

* When one or both controls are high, the eight input/output terminals are the high impedance state: howewer sequential operation or cleaning of the register is not affected.

Z : High Impedance

Qn0 : The level of An before the indicated steady state input conditions were established.

Qnn : The level of Qn before the most recent active transition indicated by OR

a, h : The level of the steadystate inputs A, H, respectively.

X : Don't Care

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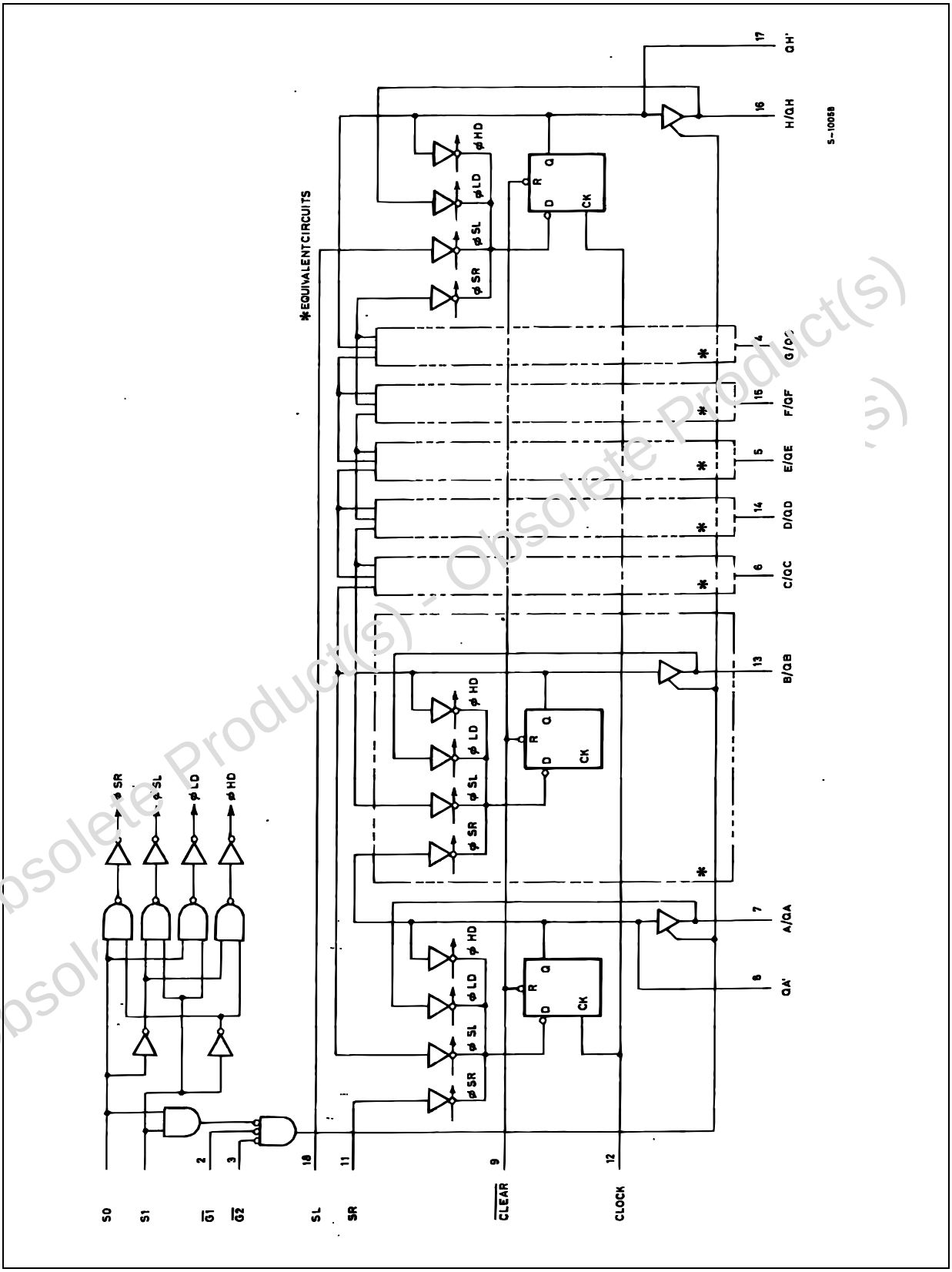
LOGIC DIAGRAM



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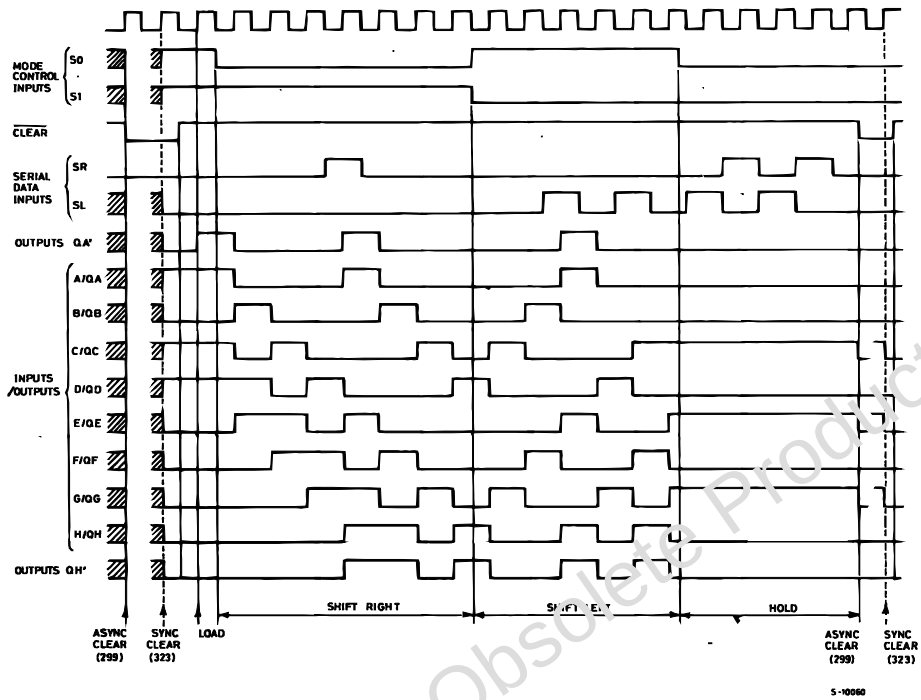
TIMING CHART



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.5 to +7	V
V_I	DC Input Voltage	-0.5 to V_{CC} + 0.5	V
V_O	DC Output Voltage	-0.5 to V_{CC} + 0.5	V
I_{IK}	DC Input Diode Current	± 20	mA
I_{OK}	DC Output Diode Current	± 20	mA
I_O	DC Output Current	± 50	mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current	± 400	mA
T_{stg}	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature (10 sec)	300	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	2 to 6	V
V_I	Input Voltage	0 to V_{CC}	V
V_O	Output Voltage	0 to V_{CC}	V
T_{op}	Operating Temperature	-55 to 125	°C
dt/dv	Input Rise and Fall Time V_{CC} = 3.0, 4.5 or 5.5V (note 1)	8	ns/V

1) V_{IN} from 30% to 70% of V_{CC}

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DC SPECIFICATIONS

Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
V_{IH}	High Level Input Voltage	3.0	V_O = 0.1 V or V_{CC}-0.1V	2.1	1.5		2.1		2.1		V
		4.5		3.15	2.25		3.15		3.15		
		5.5		3.85	2.75		3.85		3.85		
V_{IL}	Low Level Input Voltage	3.0	V_O = 0.1 V or V_{CC}-0.1V		1.5	0.9		0.9		0.9	V
		4.5			2.25	1.35		1.35		1.35	
		5.5			2.75	1.65		1.65		1.65	
V_{OH}	High Level Output Voltage	3.0	I_O=-50 µA	2.9	2.99		2.9		2.9		V
		4.5	I_O=-50 µA	4.4	4.49		4.4		4.4		
		5.5	I_O=-50 µA	5.4	5.49		5.4		5.4		
		3.0	I_O=-12 mA	2.56			2.46		2.4		
		4.5	I_O=-24 mA	3.86			3.76		3.7		
		5.5	I_O=-24 mA	4.86			4.76		4.7		
V_{OL}	Low Level Output Voltage	3.0	I_O=50 µA		0.002	0.1		0.1		0.1	V
		4.5	I_O=50 µA		0.001	0.1		0.1		0.1	
		5.5	I_O=50 µA		0.001	0.1		0.1		0.1	
		3.0	I_O=12 mA			0.36		0.44		0.5	
		4.5	I_O=24 mA			0.36		0.44		0.5	
		5.5	I_O=24 mA			0.36		0.44		0.5	
I_I	Input Leakage Current	5.5	V_I = V_{CC} or GND			± 0.1		± 1		± 1	µA
Ioz	High Impedance Output Leakage Current	5.5	V_I = V_{IH} or V_{IL} V_O = V_{CC} or GND			± 0.5		± 5		±10	µA
I_{CC}	Quiescent Supply Current	5.5	V_I = V_{CC} or GND			8		80		160	µA
I_{OLD}	Dynamic Output Current (note 1, 2)	5.5	V_{OLD} = 1.65 V max					75		50	mA
I_{OHD}			V_{OHD} = 3.85 V min					-75		-50	mA

1) Maximum test duration 2ms, one output loaded at time
2) Incident wave switching is guaranteed on transmission lines with impedances as low as 50Ω

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AC ELECTRICAL CHARACTERISTICS (C_L = 50 pF, R_L = 500 Ω, Input $t_r = t_f$ = 3ns)

Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
t_{PLH} t_{PHL}	Propagation Delay Time CLOCK to Q'_A, Q'_H	3.3(*)			10.6	18.4	1.0	21.0	1.0	21.0	ns
		5.0(**)			6.8	10.5	1.0	12.0	1.0	12.0	
t_{PLH} t_{PHL}	Propagation Delay Time CLOCK to Q_A, Q_H	3.3(*)			10.9	19.3	1.0	22.0	1.0	22.0	ns
		5.0(**)			7.3	10.5	1.0	12.0	1.0	12.0	
t_{PLH} t_{PHL}	Propagation Delay Time $\overline{\text{CLEAR}}$ to Q'_A, Q'_H	3.3(*)			8.1	14.0	1.0	16.0	1.0	16.0	ns
		5.0(**)			6.1	9.2	1.0	10.5	1.0	10.5	
t_{PLH} t_{PHL}	Propagation Delay Time $\overline{\text{CLEAR}}$ to Q_A, Q_H	3.3(*)			9.8	16.7	1.0	19.0	1.0	19.0	ns
		5.0(**)			6.7	10.9	1.0	12.4	1.0	12.4	
t_{PZL} t_{PZH}	Output Enable Time	3.3(*)			9.9	17.5	1.0	20.0	1.0	20.0	ns
		5.0(**)			6.6	9.6	1.0	11.4	1.0	11.4	
t_{PLZ} t_{PHZ}	Output Disable Time	3.3(*)			8.1	14.0	1.0	16.0	1.0	16.0	ns
		5.0(**)			6.4	9.6	1.0	11.0	1.0	11.0	
t_W	$\overline{\text{CLEAR}}$ Pulse Width LOW	3.3(*)				7.0		7.0		7.0	ns
		5.0(**)				5.0		5.0		5.0	
t_W	CLOCK Pulse Width LOW	3.3(*)				8.0		8.0		8.0	ns
		5.0(**)				5.0		5.0		5.0	
t_s	Setup Time HIGH or LOW (S0 or S1 to CLOCK)	3.3(*)				11.9		13.6		13.6	ns
		5.0(**)				7.0		7.0		7.0	
t_h	Hold Time HIGH or LOW (S0 or S1 to CLOCK)	3.3(*)				0.0		0.0		0.0	ns
		5.0(**)				0.0		0.0		0.0	
t_s	Setup Time HIGH or LOW (SR or SL to CLOCK)	3.3(*)				6.0		6.0		6.0	ns
		5.0(**)				4.0		4.0		4.0	
t_h	Hold Time HIGH or LOW (SR or SL to CLOCK)	3.3(*)				1.0		1.0		1.0	ns
		5.0(**)				1.0		1.0		1.0	
t_{REM}	Recovery Time $\overline{\text{CLEAR}}$ to CLOCK	3.3(*)				5.0		5.0		5.0	ns
		5.0(**)				3.0		3.0		3.0	
f_{MAX}	Maximum Clock Frequency	3.3(*)		45	210		45		45		MHz
		5.0(**)		80	240		80		80		

(*) Voltage range is 3.3V ± 0.3V
(**) Voltage range is 5.0V ± 0.5V

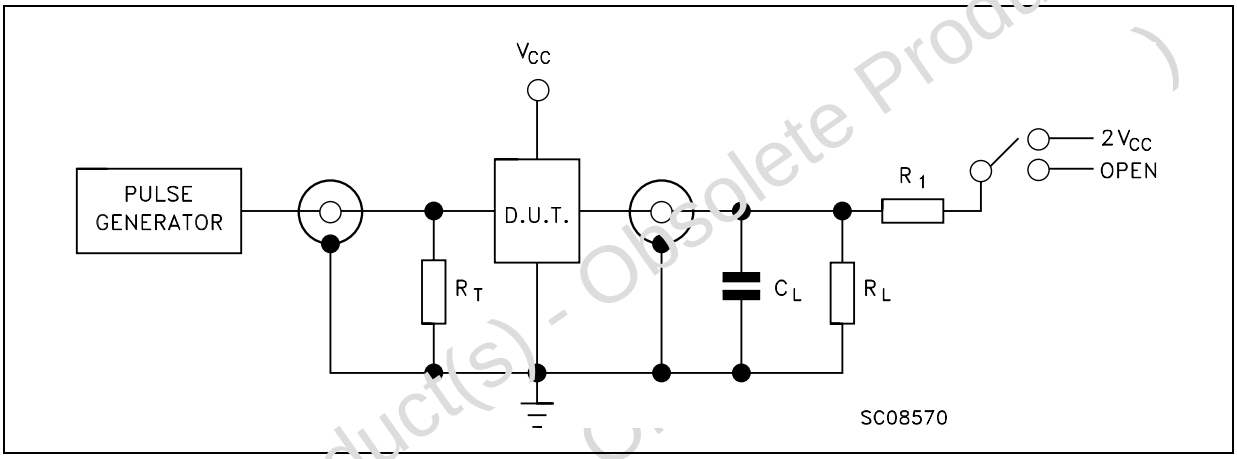
Obsolete Product(s) - Obsolete Product(s) - Obsolete Product(s)

CAPACITIVE CHARACTERISTICS

Symbol	Parameter	Test Condition		Value							Unit
		V_{CC} (V)		T_A = 25°C			-40 to 85°C		-55 to 125°C		
				Min.	Typ.	Max.	Min.	Max.	Min.	Max.	
C_{IN}	Input Capacitance	5.0			5	10		10			pF
$C_{i/O}$	Bus Input Capacitance	5.0			13						pF
C_{PD}	Power Dissipation Capacitance (note 1)	5.0	f_{IN} = 10MHz		120						pF

1) C_{PD} is defined as the value of the IC's internal equivalent capacitance which is calculated from the operating current consumption without load. (Refer to Test Circuit). Average operating current can be obtained by the following equation. $I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}$ n (per circuit)

TEST CIRCUIT

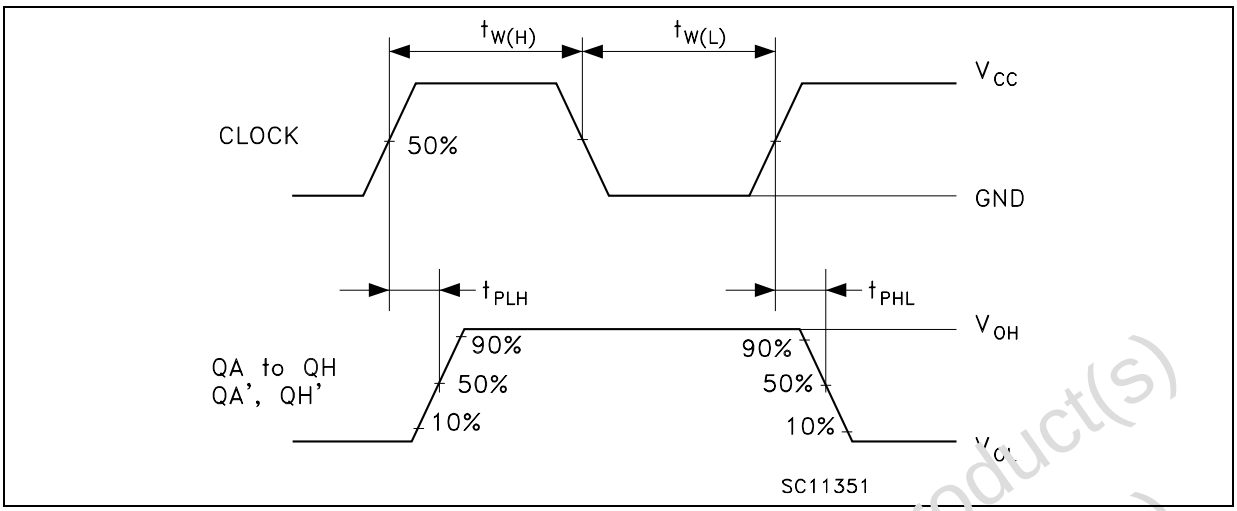


TEST	SWITCH
t_{PLH}, t_{PHL}	Open
t_{PZL}, t_{PLZ}	$2V_{CC}$
t_{PZH}, t_{PHZ}	Open

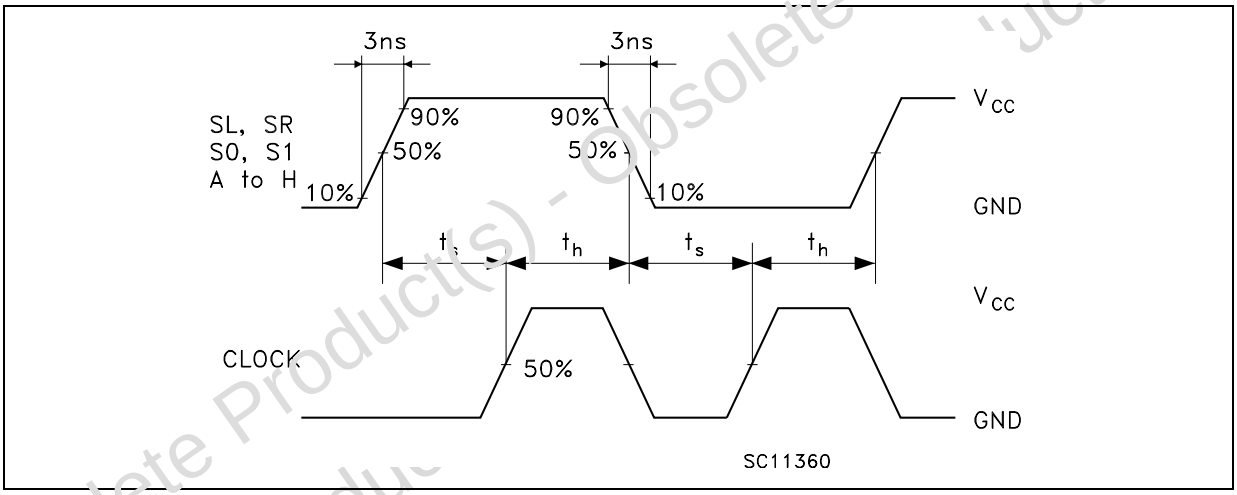
C_L = 50pF or equivalent (includes jig and probe capacitance)
$R_L = R_1$ = 500Ω or equivalent
$R_T = Z_{OUT}$ of pulse generator (typically 50Ω)

Obsolete Product(s) - Obsolete Product(s)

WAVEFORM 1: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)



WAVEFORM 2: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)



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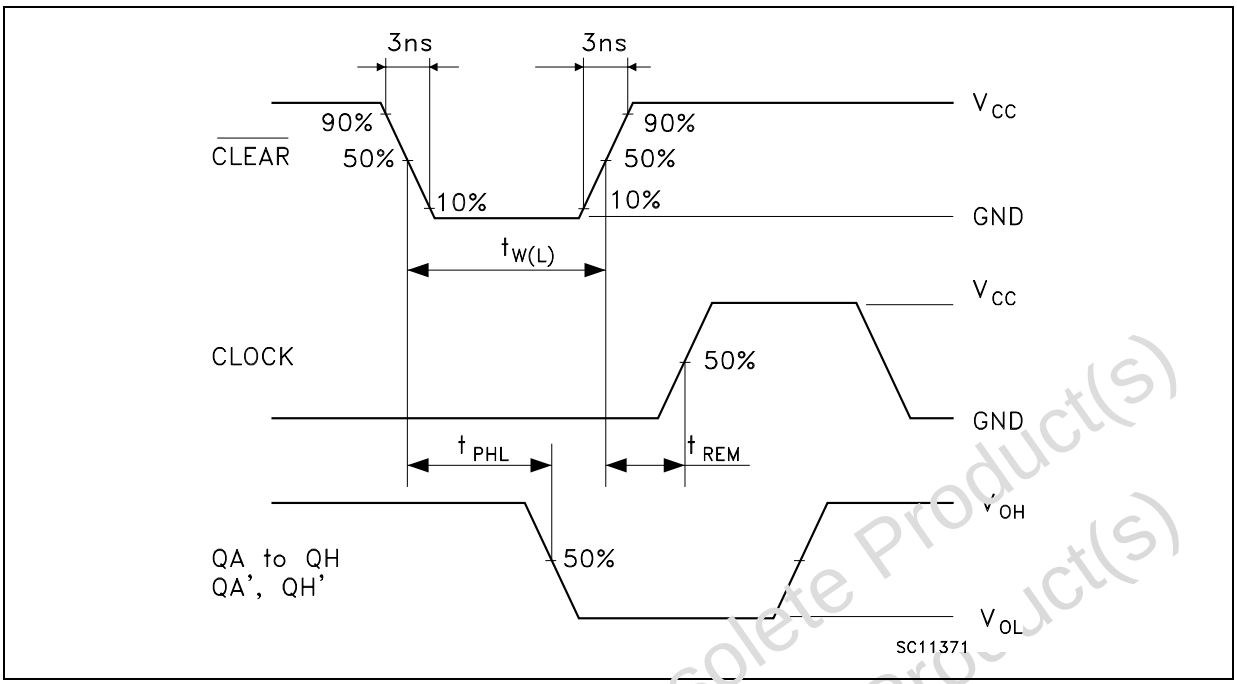
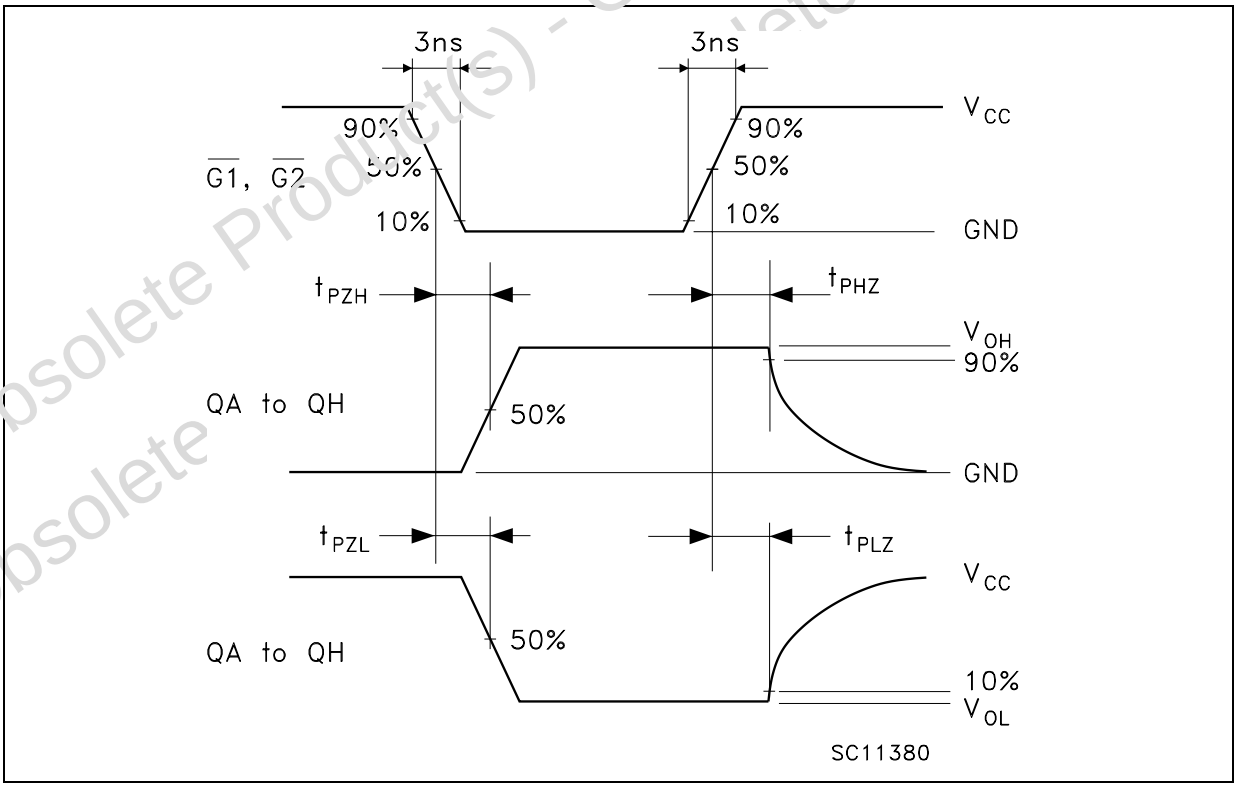
WAVEFORM 3: PROPAGATION DELAYS (f=1MHz; 50% duty cycle)



WAVEFORM 4: PROPAGATION DELAYS (f=1MHz, 50% duty cycle)



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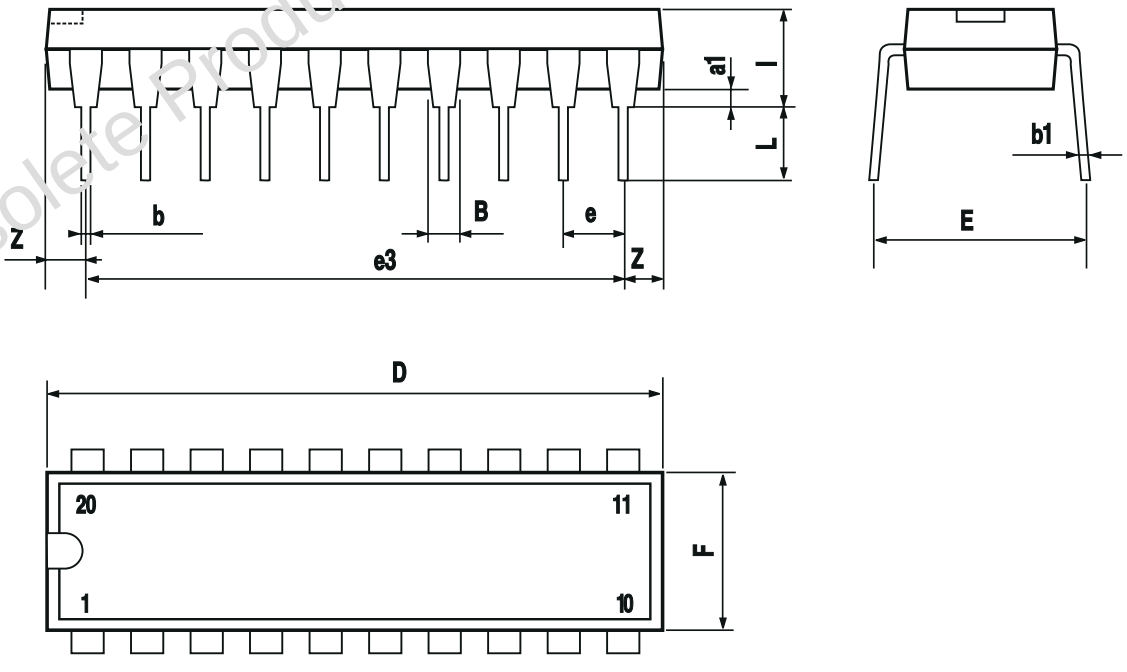
Plastic DIP-20 (0.25) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
a1	0.254			0.010		
B	1.39		1.65	0.055		0.065
b		0.45			0.018	
b1		0.25			0.010	
D			25.4			1.000
E		8.5			0.335	
e		2.54			0.100	
e3		22.86			0.900	
F			7.1			0.280
I			3.93			0.155
L		3.3			0.130	
Z			1.34			0.053



P001J

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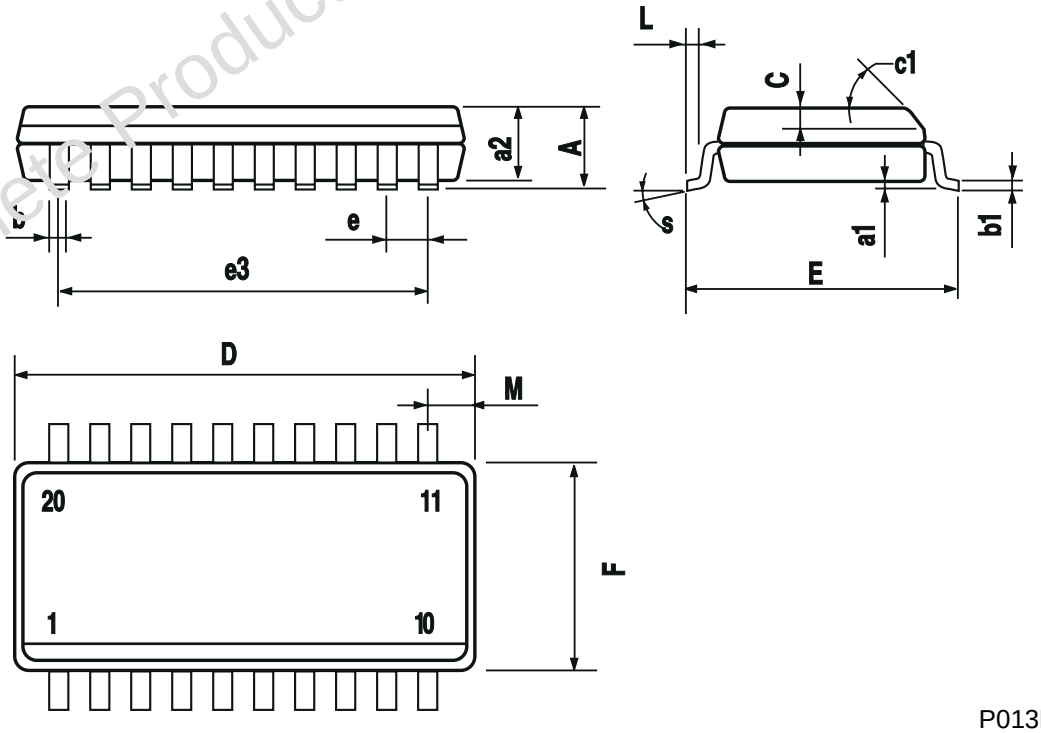
SO-20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.10		0.20	0.004		0.007
a2			2.45			0.096
b	0.35		0.49	0.013		0.019
b1	0.23		0.32	0.009		0.012
C		0.50			0.020	
c1	45 (typ.)					
D	12.60		13.00	0.496		0.512
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		11.43			0.450	
F	7.40		7.60	0.291		0.299
L	0.50		1.27	0.19		0.050
M			0.75			0.029
S	8 (max.)					



P013L

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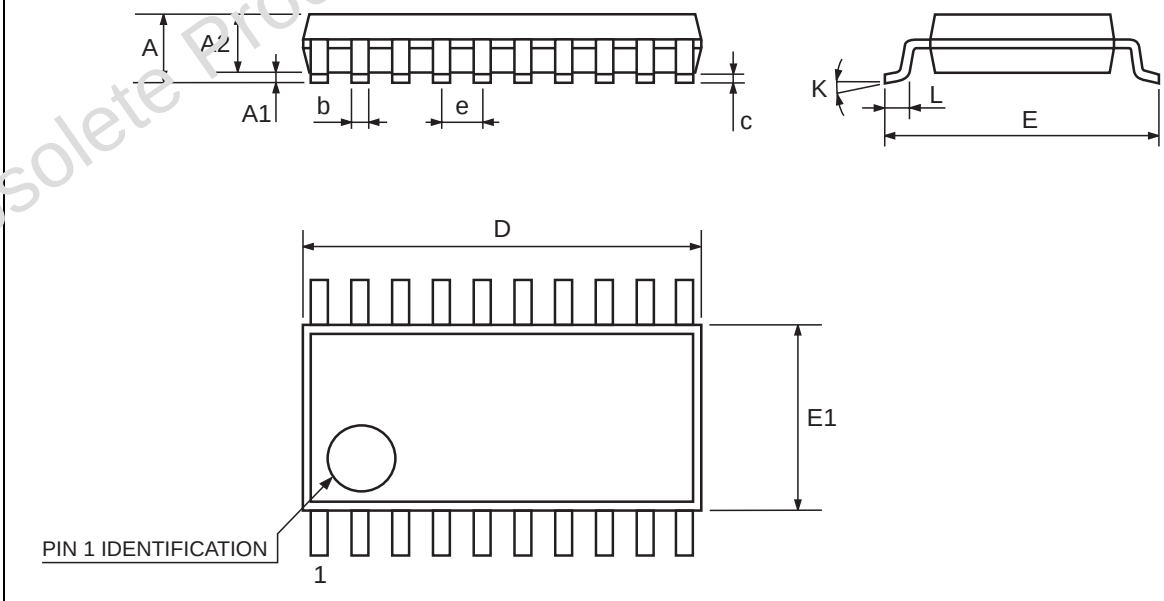
TSSOP20 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.1			0.433
A1	0.05	0.10	0.15	0.002	0.004	0.006
A2	0.85	0.9	0.95	0.335	0.354	0.374
b	0.19		0.30	0.0075		0.0118
c	0.09		0.2	0.0035		0.0079
D	6.4	6.5	6.6	0.252	0.256	0.260
E	6.25	6.4	6.5	0.246	0.252	0.256
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0^o	4^o	8^o	0^o	4^o	8^o
L	0.50	0.60	0.70	0.020	0.024	0.028



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