DESCRIPTION

The AL273 is an octal positive-edge-triggered D-type flip-flop. It features clock (CP) and master reset (MR) inputs.

On the LOW-to-HIGH transition of the clock (CP), the outputs (Qn) assume the logic state of the corresponding data inputs (Dn), provided that the setup and hold time requirements are satisfied.

A LOW level applied to the master reset (MR) input forces all outputs LOW, independent of the clock and data inputs.

The inputs are equipped with clamp diodes, allowing the use of current-limiting resistors to interface with input voltages exceeding VCC..

AL273 is available in SOP20, TSSOP20 and DIP20 packages.

FEATURES

- Integrated 8-bit D Flip-Flop with shared clock and reset control
- Positive edge-triggered design for reliable data latching
- Wide operating temperature range (−40°C to +125°C), suitable for industrial applications
- Multiple package options for flexible PCB design (SOP, TSSOP & DIP)

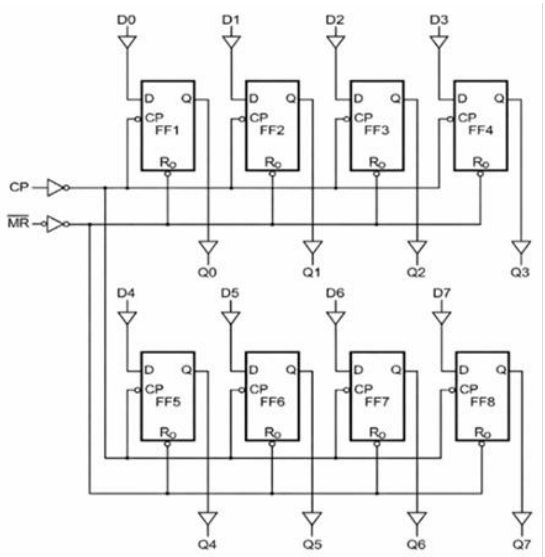
APPLICATION

- Buffer/Storage Registers
- Shift Registers
- Pattern Generators

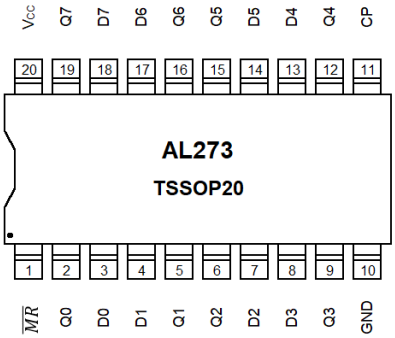
ORDERING INFORMATION

Package Type	Part Number	
SOP20 SPQ: 2,000pcs/Reel	M20	AL273M20R
		AL273M20VR
TSSOP20 SPQ: 2,000pcs/Reel	TMX20	AL273TMX20R
		AL273TMX20VR
DIP20 SPQ: 18pcs/Tube 720pcs/Box	P20	AL273P20U
		AL273P20VU
Note	V: Halogen free Package R: Tape & Reel U: Tube Package	
AiT provides all RoHS products		

LOGIC SYMBOL

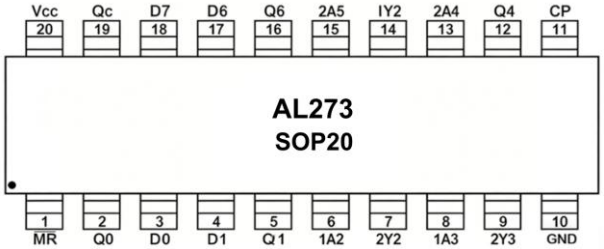


PIN DESCRIPTION



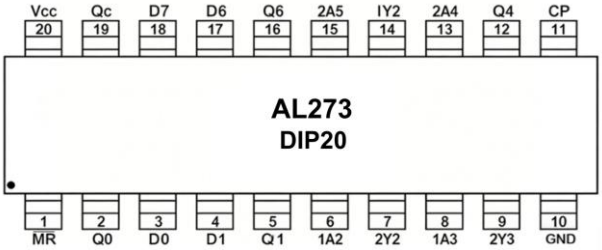
TSSOP20, TMX20

Top View



SOP20, M20

Top View



DIP20, P20

Top View

PIN#	Symbol	Function
1	$\overline{MR}$	Master reset input (active LOW)
2	Q0	Flip-flop Output
3	D0	Data Input
4	D1	Data Input
5	Q1	Flip-flop Output
6	Q2	Flip-flop Output
7	D2	Data Input
8	D3	Data Input
9	Q3	Flip-flop Output
10	GND	Ground (0V)
11	CP	Clock Input (LOW-to-HIGH, edge-triggered)
12	Q4	Flip-flop Output
13	D4	Data Input
14	D5	Data Input
15	Q5	Flip-flop Output
16	Q6	Flip-flop Output
17	D6	Data Input
18	D7	Data Input
19	Q7	Flip-flop Output
20	VCC	Supply Voltage

FUNCTION TABLE

Operating Modes	INPUT			OUTPUT
	$\overline{MR}$	CP	Dn	Qn
Read (Clear)	L	X	X	L
Load "1"	H	↑	h	H
Load "0"	H	↑	l	L

H: High Voltage Level
L: Low Voltage Level
X: Don't care

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range (unless otherwise noted) (1) (2)

V_{CC}, Supply Voltage		-0.5V ~ + 7V
I_{IK}, Input Clamping Current	V_I < 0.5V or V_I > V_{CC} +0.5V	±20mA
I_{OK}, Output Clamping Current	V_O < 0.5V or V_O > V_{CC} +0.5V	±20mA
I_O, Output Current	-0.5V < V_O < V_{CC} +0.5V	±25mA
I_{CC}, Supply Current		50mA
I_{GND}, Ground Current		-50mA
T_L, Soldering Temperature	DIP	245℃
	SOP / TSSOP	260℃
T_{STG}, Storage Temperature		-65℃ ~ +150℃
P_{tot}, Total Power Dissipation		500mW

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

T_A=25°C

Parameter	Symbol	Conditions	Min	Typ.	Max	Unit
Supply Voltage	V_{CC}	-	2	5	6	V
Input Voltage	V_I	-	0	-	V_{CC}	V
Output Voltage	V_O	-	0	-	V_{CC}	V
Input Transition Rise and Fall Rise	Δt/ΔV	V_{CC}=2V	-	-	625	ns/V
		V_{CC}=4.5V	-	1.67	1.39	
		V_{CC}=6V	-	-	83	
Ambient Temperature	T_{amb}	-	-40	-	85	℃

DC CHARACTERISTICS 1

T_{amb}=25°C, Voltage are Referenced to GND (Ground=0V), unless otherwise noted.

Parameter		Conditions		Min	Typ.	Max	Unit
V_{OH}	High-Level Output Voltage	I_O = -20uA, V_{CC}=2.0V	V_I = V_{IH} or V_{IL}	1.90	2.00	-	V
		I_O = -20uA, V_{CC}=4.5V		4.40	4.50	-	
		I_O = -20uA, V_{CC}=6.0V		5.90	6.00	-	
		I_O = -4mA, V_{CC}=4.5V		3.98	4.32	-	
		I_O= -5.2mA, V_{CC}=6.0V		5.48	5.81	-	
V_{OL}	Low-Level Output Voltage	I_O = 20uA, V_{CC}=2.0V	V_I = V_{IH} or V_{IL}	-	0	0.10	V
		I_O = 20uA, V_{CC}=4.5V		-	0	0.10	
		I_O = 20uA, V_{CC}=6.0V		-	0	0.10	
		I_O = 4.0mA, V_{CC}=4.5V		-	0.15	0.26	
		I_O = 5.2mA, V_{CC}=6.0V		-	0.16	0.26	
V_{IH}	High-Level Input Voltage	V_{CC}=2.0V		1.50	1.20	-	V
		V_{CC}=4.5V		3.15	2.40	-	
		V_{CC}=6.0V		4.20	3.20	-	
V_{IL}	Low-Level Input Voltage	V_{CC}=2.0V		-	0.80	0.50	V
		V_{CC}=4.5V		-	2.10	1.35	
		V_{CC}=6.0V		-	2.80	1.80	
I_I	Input Leakage Current	V_I = V_{CC} or GND, V_{CC}=6V		-	-	±1	uA
I_{CC}	Supply Current	V_I = V_{CC} or GND, V_{CC}=6V I_O=0A		-	-	8	uA
Ci	Input Capacitance	-		-	3.50	-	pF

DC CHARACTERISTICS 2

T_{amb}=-40°C ~ +85°C, Voltage are Referenced to GND (Ground=0V), unless otherwise noted.

Parameter		Conditions		Min	Typ.	Max	Unit
V_{OH}	High-Level Output Voltage	I_O = -20uA, V_{CC}=2.0V	V_I = V_{IH} or V_{IL}	1.90	-	-	V
		I_O = -20uA, V_{CC}=4.5V		4.40	-	-	
		I_O = -20uA, V_{CC}=6.0V		5.90	-	-	
		I_O = -4mA, V_{CC}=4.5V		3.84	-	-	
		I_O = -5.2mA, V_{CC}=6.0V		5.34	-	-	
V_{OL}	Low-Level Output Voltage	I_O = 20uA, V_{CC}=2.0V	V_I = V_{IH} or V_{IL}	-	-	0.10	V
		I_O = 20uA, V_{CC}=4.5V		-	-	0.10	
		I_O = 20uA, V_{CC}=6.0V		-	-	0.10	
		I_O = 4.0mA, V_{CC}=4.5V		-	-	0.33	
		I_O = 5.2mA, V_{CC}=6.0V		-	-	0.33	
V_{IH}	High-Level Input Voltage	V_{CC}=2.0V		1.50	-	-	V
		V_{CC}=4.5V		3.15	-	-	
		V_{CC}=6V		4.20	-	-	
V_{IL}	Low-Level Input Voltage	V_{CC}=2.0V		-	-	0.50	V
		V_{CC}=4.5V		-	-	1.35	
		V_{CC}=6V		-	-	1.80	
I_I	Input Leakage Current	V_I = V_{CC} or GND, V_{CC}=6V		-	-	±1	uA
I_{CC}	Supply Current	V_I = V_{CC} or GND, V_{CC}=6V I_O=0A		-	-	8	uA

DC CHARACTERISTICS 3

T_{amb}=-40°C ~ +125°C, Voltage are Referenced to GND (Ground=0V), unless otherwise noted.

Parameter		Conditions		Min	Typ.	Max	Unit
V_{OH}	High-Level Output Voltage	I_O = -20uA, V_{CC}=2.0V	V_I = V_{IH} or V_{IL}	1.90	-	-	V
		I_O = -20uA, V_{CC}=4.5V		4.40	-	-	
		I_O = -20uA, V_{CC}=6.0V		5.90	-	-	
		I_O = -4mA, V_{CC}=4.5V		3.70	-	-	
		I_O = -5.2mA, V_{CC}=6.0V		5.20	-	-	
V_{OL}	Low-Level Output Voltage	I_O = 20uA, V_{CC}=2.0V	V_I = V_{IH} or V_{IL}	-	-	0.10	V
		I_O = 20uA, V_{CC}=4.5V		-	-	0.10	
		I_O = 20uA, V_{CC}=6.0V		-	-	0.10	
		I_O = 4.0mA, V_{CC}=4.5V		-	-	0.40	
		I_O = 5.2mA, V_{CC}=6.0V		-	-	0.40	
V_{IH}	High-Level Input Voltage	V_{CC}=2.0V		1.50	-	-	V
		V_{CC}=4.5V		3.15	-	-	
		V_{CC}=6V		4.20	-	-	
V_{IL}	Low-Level Input Voltage	V_{CC}=2.0V		-	-	0.50	V
		V_{CC}=4.5V		-	-	1.35	
		V_{CC}=6V		-	-	1.80	
I_I	Input Leakage Current	V_I = V_{CC} or GND, V_{CC}=6V		-	-	±1	uA
I_{CC}	Supply Current	V_I = V_{CC} or GND, V_{CC}=6V I_O=0A		-	-	160	uA

AC CHARACTERISTICS 1

T_{amb}=25°C, GND=0V, C_L=50pF, unless otherwise noted.

Parameter		Conditions		Min.	Typ.	Max.	Unit
t_{pd}	CP to Qn Propagation Delay	V_{CC} = 2V	See Fig 2	-	41	150	ns
		V_{CC} = 4.5V		-	15	30	
		V_{CC} = 5V, C_L=15pF		-	15	-	
		V_{CC} = 6V		-	13	26	
t_{PHL}	$\overline{MR}$ to Qn High to Low Propagation Delay	V_{CC} = 2V	See Fig 3	-	44	150	ns
		V_{CC} = 4.5V		-	16	30	
		V_{CC} = 5V, C_L=15pF		-	15	-	
		V_{CC} = 6V		-	14	26	
t_t	Transition Time	V_{CC} = 2.0V	Qn Output, See Fig 2	-	19	75	
		V_{CC} = 4.5V		-	7	15	
		V_{CC} = 6V		-	6	13	
t_W	Pulse Width	V_{CC} = 2V	CP Input Hig or Low, See Fig 2	80	14	-	ns
		V_{CC} = 4.5V		16	5	-	
		V_{CC} = 6V		14	4	-	
		V_{CC} = 2V	$\overline{MR}$ Input Low, See Fig 3	60	17	-	
		V_{CC} = 4.5V		12	6	-	
		V_{CC} = 6V		10	5	-	
t_{rec}	Recovery Time	V_{CC} = 2V	$\overline{MR}$ to CP, See Fig 3	50	-6	-	ns
		V_{CC} = 4.5V		10	-2	-	
		V_{CC} = 6V		9	-2	-	
t_{su}	Set-Up Time	V_{CC} = 2V	Dn to CP, See Fig 4	60	11	-	ns
		V_{CC} = 4.5V		12	4	-	
		V_{CC} = 6V		10	3	-	
t_h	Hold Time	V_{CC} = 2V	Dn to CP, See Fig 4	3	-6	-	ns
		V_{CC} = 4.5V		3	-2	-	
		V_{CC} = 6V		3	-2	-	
f_{max}	Maximum Frequency	V_{CC} = 2V	CP Input, See Fig 2	6	20.6	-	MHz
		V_{CC} = 4.5V		30	103	-	
		V_{CC} = 5V, C_L=15pF		-	66	-	
		V_{CC} = 6V		35	122	-	
C_{PD}	Power Dissipation Capacitance	Per Package, V_I=GND ~ V_{CC}		-	20	-	pF

AC CHARACTERISTICS 2

T_{amb}= -40°C ~ +85°C, GND=0V, C_L=50pF, unless otherwise noted.

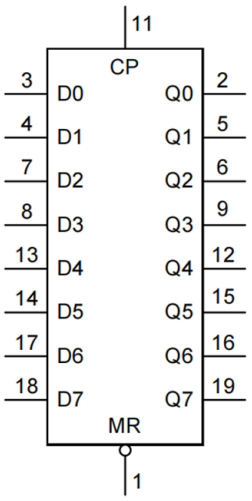
Parameter		Conditions		Min.	Typ.	Max.	Unit
t_{pd}	CP to Qn Propagation Delay	V_{CC} = 2V	See Fig 2	-	-	185	ns
		V_{CC} = 4.5V		-	-	37	
		V_{CC} = 6V		-	-	31	
t_{PHL}	$\overline{MR}$ to Qn High to Low Propagation Delay	V_{CC} = 2V	See Fig 3	-	-	185	ns
		V_{CC} = 4.5V		-	-	37	
		V_{CC} = 6V		-	-	31	
t_t	Transition Time	V_{CC} = 2.0V	Qn Output, See Fig 2	-	-	95	
		V_{CC} = 4.5V		-	-	19	
		V_{CC} = 6V		-	-	15	
t_W	Pulse Width	V_{CC} = 2V	CP Input Hig or Low, See Fig 2	100	-	-	ns
		V_{CC} = 4.5V		20	-	-	
		V_{CC} = 6V		17	-	-	
		V_{CC} = 2V	$\overline{MR}$ Input Low, See Fig 3	75	-	-	
		V_{CC} = 4.5V		15	-	-	
		V_{CC} = 6V		13	-	-	
t_{rec}	Recovery Time	V_{CC} = 2V	$\overline{MR}$ to CP, See Fig 3	65	-	-	ns
		V_{CC} = 4.5V		13	-	-	
		V_{CC} = 6V		11	-	-	
t_{su}	Set-Up Time	V_{CC} = 2V	Dn to CP, See Fig 4	75	-	-	ns
		V_{CC} = 4.5V		15	-	-	
		V_{CC} = 6V		73	-	-	
t_h	Hold Time	V_{CC} = 2V	Dn to CP, See Fig 4	3	-		ns
		V_{CC} = 4.5V		3	-		
		V_{CC} = 6V		3	-		
f_{max}	Maximum Frequency	V_{CC} = 2V	CP Input, See Fig 2	4.8	-		MHz
		V_{CC} = 4.5V		24	-		
		V_{CC} = 6V		28	-		

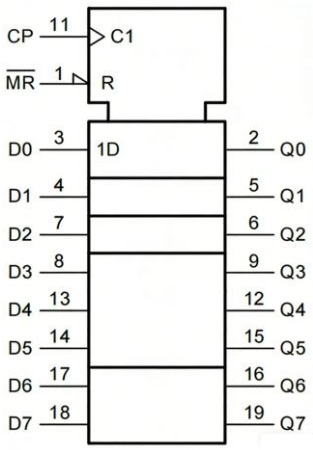
AC CHARACTERISTICS 3

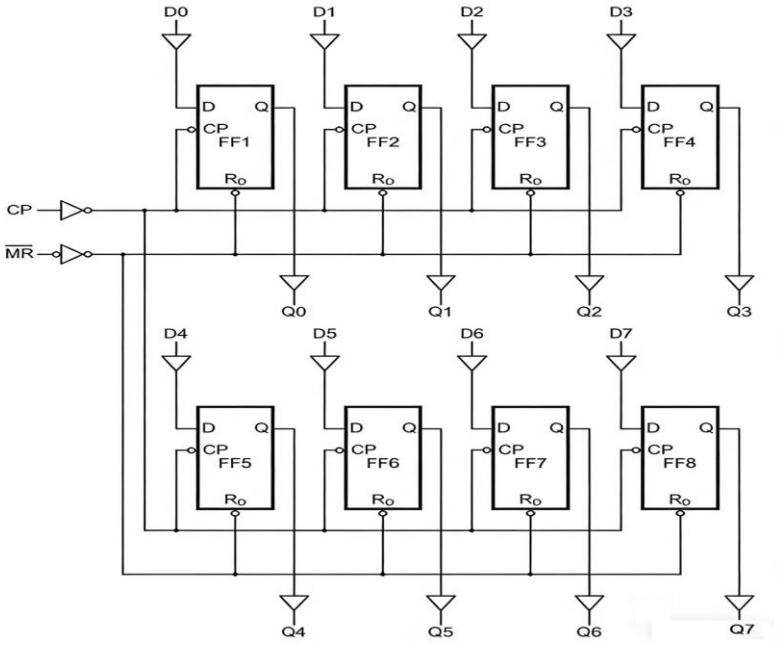
T_{amb}= -40°C ~ +125°C, GND=0V, C_L=50pF, unless otherwise noted.

Parameter		Conditions		Min.	Typ.	Max.	Unit
t_{pd}	CP to Qn Propagation Delay	V_{CC} = 2V	See Fig 2	-	-	225	ns
		V_{CC} = 4.5V		-	-	45	
		V_{CC} = 6V		-	-	38	
t_{PHL}	$\overline{MR}$ to Qn High to Low Propagation Delay	V_{CC} = 2V	See Fig 3	-	-	225	ns
		V_{CC} = 4.5V		-	-	45	
		V_{CC} = 6V		-	-	38	
t_t	Transition Time	V_{CC} = 2.0V	Qn Output, See Fig 2	-	-	110	
		V_{CC} = 4.5V		-	-	22	
		V_{CC} = 6V		-	-	19	
t_W	Pulse Width	V_{CC} = 2V	CP Input Hig or Low, See Fig 2	120	-	-	ns
		V_{CC} = 4.5V		24	-	-	
		V_{CC} = 6V		20	-	-	
		V_{CC} = 2V	$\overline{MR}$ Input Low, See Fig 3	90	-	-	
		V_{CC} = 4.5V		18	-	-	
		V_{CC} = 6V		15	-	-	
t_{rec}	Recovery Time	V_{CC} = 2V	$\overline{MR}$ to CP, See Fig 3	75	-	-	ns
		V_{CC} = 4.5V		15	-	-	
		V_{CC} = 6V		13	-	-	
t_{su}	Set-Up Time	V_{CC} = 2V	Dn to CP, See Fig 4	90	-	-	ns
		V_{CC} = 4.5V		18	-	-	
		V_{CC} = 6V		15	-	-	
t_h	Hold Time	V_{CC} = 2V	Dn to CP, See Fig 4	3	-		ns
		V_{CC} = 4.5V		3	-		
		V_{CC} = 6V		3	-		
f_{max}	Maximum Frequency	V_{CC} = 2V	CP Input, See Fig 2	4	-		MHz
		V_{CC} = 4.5V		20	-		
		V_{CC} = 6V		24	-		

BLOCK DIAGRAM



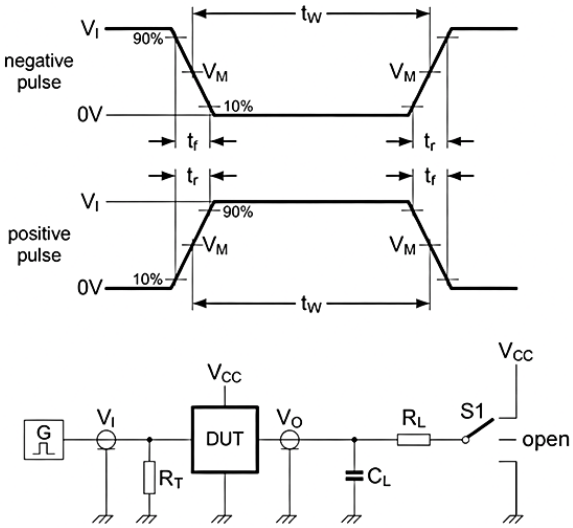




TEST CIRCUIT

AC Testing Circuit

Fig 1. Test Circuit for Measuring Switching Times



Definitions for test circuit: R_L=Load resistance.

C_L=Load capacitance including jig and probe capacitance.

R_T=Termination resistance should be equal to the output impedance Z_O of the pulse generator.

S1=Test selection switch.

Fig 2. Propagation delay clock input (CP) to output (Qn), clock (CP) pulse width, output transition time and the maximum clock pulse frequency

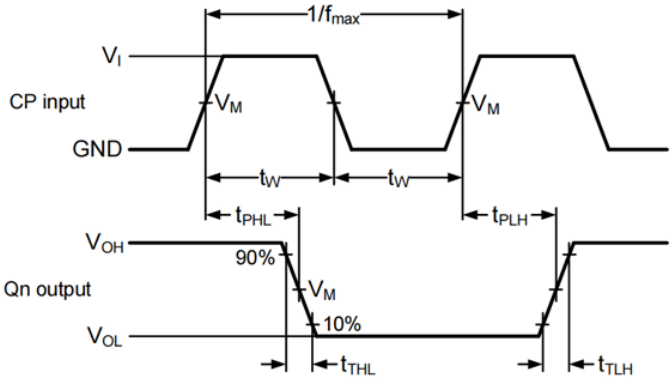


Figure 3. Propagation delay master reset ($\overline{MR}$) to output (Qn), pulse width master reset ($\overline{MR}$) and recovery time master reset ($\overline{MR}$) to clock (CP)

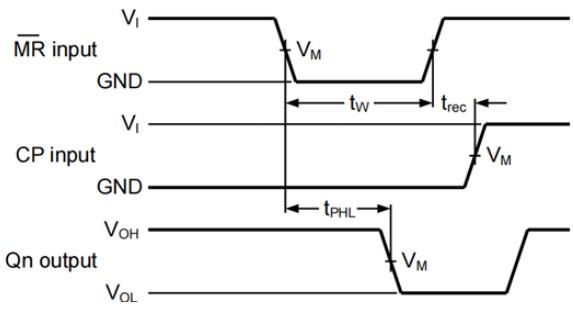
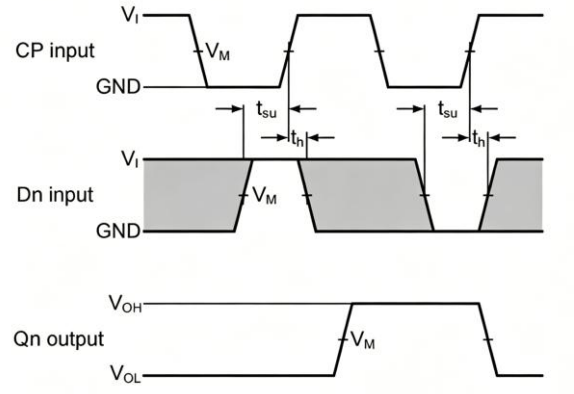


Fig 4. Data Set-up and Hold Times Data Input (Dn)



MEASUREMENT POINTS

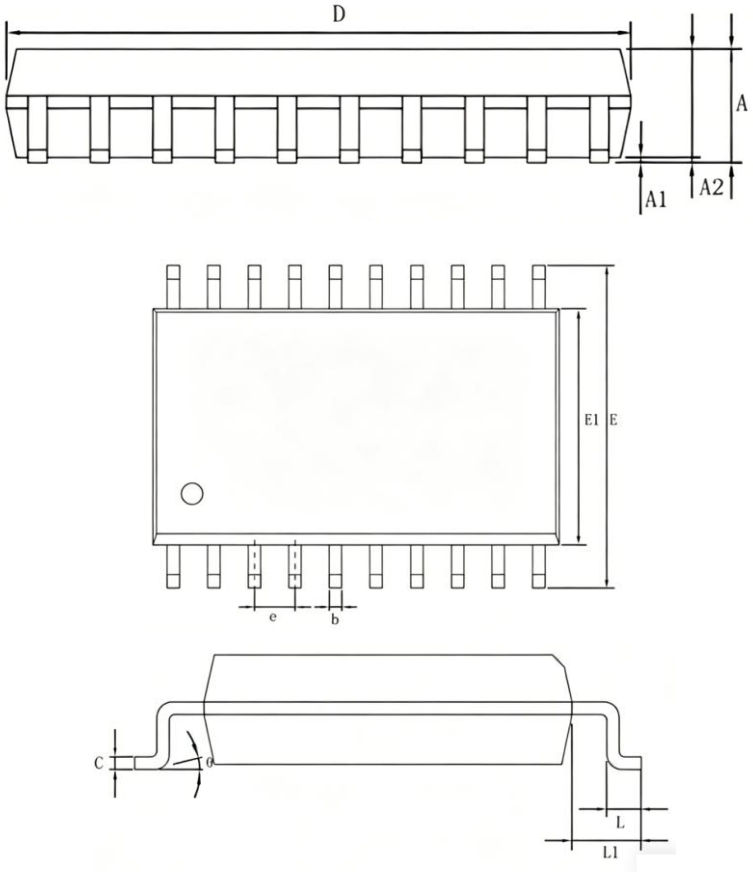
TYPE	INPUT		OUTPUT
AL273	V_I	V_M	V_M
	V_{CC}	0.5 x V_{CC}	0.5 x V_{CC}

TEST DATA

TYPE	INPUT		LOAD		S1 POSITION
AL273	V_I	t_r, t_f	C_L	R_L	t_{PHL}, t_{PLH}
	V_{CC}	6ns	15pF, 50pF	1kΩ	0.5 x VCC

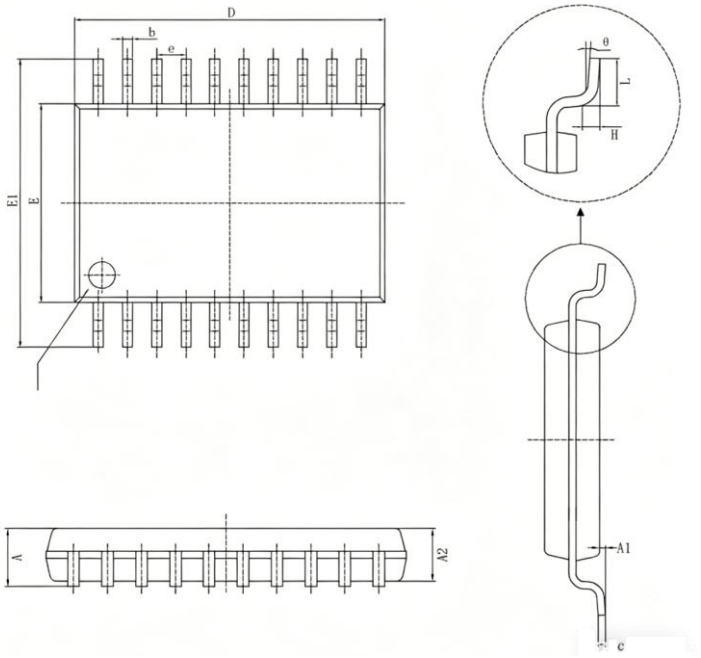
PACKAGE INFORMATION

Dimension in SOP20 (Unit: mm)



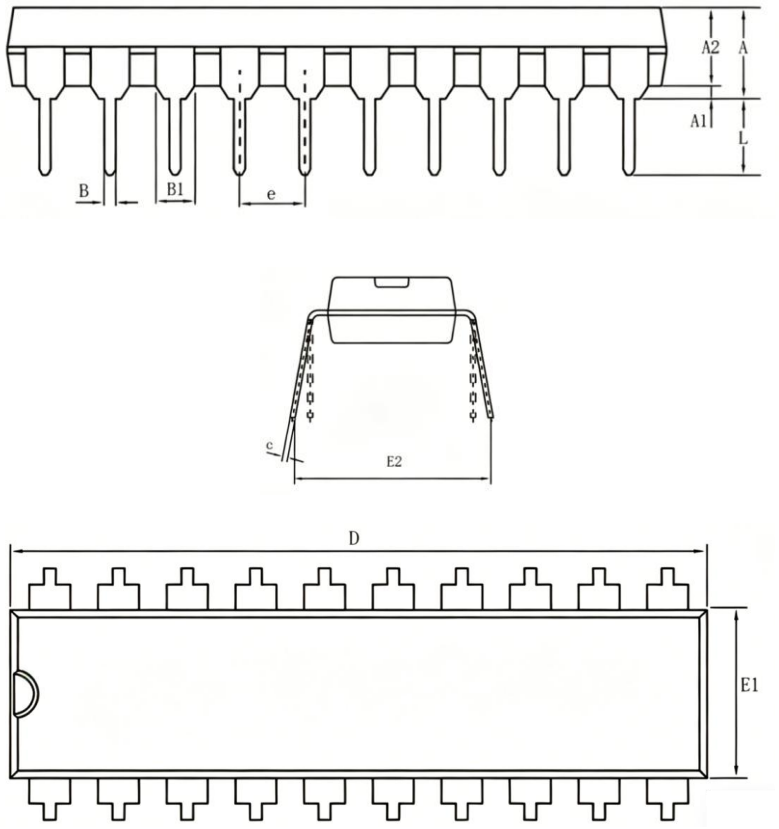
Symbol	Millimeters	
	Min	Max
A	2.470	2.650
A1	0.050	0.300
A2	2.200	2.440
b	0.350	0.500
c	0.150	0.300
D	12.540	12.940
E	10.000	10.600
E1	7.300	7.700
e	1.270 BSC.	
L	0.400	1.050
L1	1.300	1.500
θ	0°	8°

Dimension in TSSOP20 (Unit: mm)



Symbol	Millimeters	
	Min	Max
A	-	1.200
A1	0.050	0.150
A2	0.800	1.000
b	0.190	0.300
c	0.090	0.200
D	6.400	6.600
E	4.300	4.500
E1	6.250	6.550
e	0.650 BSC.	
L	0.500	0.700
H	0.250 TYP.	
θ	1°	7°

Dimension in DIP-20 (Unit: mm)



Symbol	Millimeters	
	Min	Max
A	3.600	5.330
A1	0.510	-
A2	3.200	3.600
B	0.360	0.530
B1	1.520 (BSC).	
c	0.204	0.360
D	25.700	26.540
E1	6.200	6.750
E2	7.620	9.300
e	2.540 (BSC).	
L	3.000	3.600

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