DESCRIPTION

The AL573 is an 8-bit D-type transparent latch with 3-state outputs. The device features latch enables (LE) and output enable ($\overline{OE}$) inputs. When LE is high, data at the inputs enter the latches. In this condition the latches are transparent, a latch output will change each time its corresponding D-input changes. When LE is low the latches store the information that was present at the inputs a set-up time preceding the high-to-low transition of LE.

The AL573 is available in SOP20 and TSSOP20 packages.

ORDERING INFORMATION

Package Type	Part Number	
SOP20 SPQ: 1,500pcs/Reel	M20	AL573M20R
		AL573M20VR
TSSOP20 SPQ: 4,000pcs/Reel	TMX20	AL573TMX20R
		AL573TMX20VR
Note	V: Halogen Free Package R: Tape & Reel	
AiT provides all RoHS products		

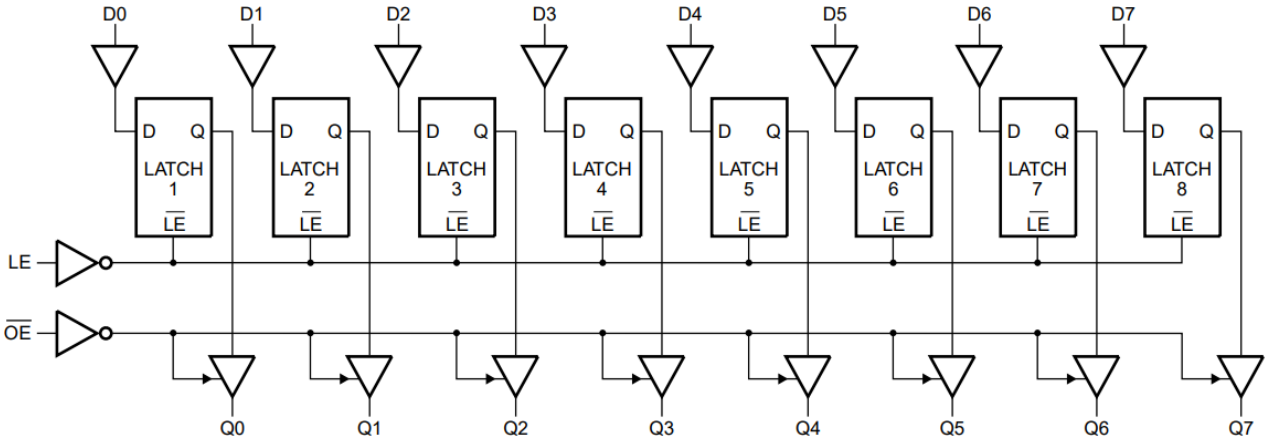
FEATURES

- Wide Power-Supply Range:1.65V to 5.5V
- Common 3-state Output Enable Input
- Balanced Propagation Delays
- Overvoltage Tolerant Inputs to 5.5V
- CMOS Low Power Consumption: 8μA(Max.)
- Low Input Current: 1μA(Max.)
- Extended Temperature: -40°C to +125°C

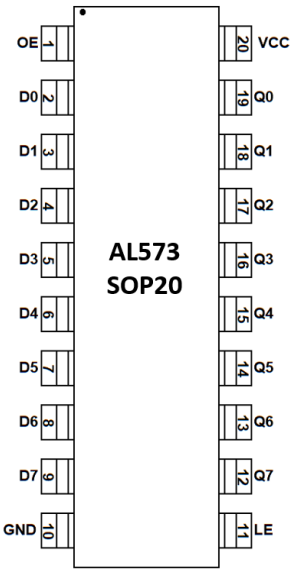
APPLICATION

- Power Sub-Station Controls
- Industrial
  Personal Electronics
- Test and Measurement Solutions
- Patient Monitoring

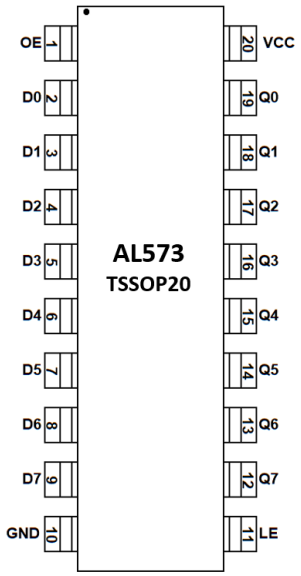
FUNCTIONAL DIAGRAM



PIN DESCIPTION



SOP20, M20
Top View



TSSOP20, TMX20
Top View

Pin #		Symbol	I/O Type*	Description
SOP20	TSSOP20			
1		$\overline{OE}$	I	3-State output enable input (Active Low)
2		D0	I	Data input
3		D1	I	Data input
4		D2	I	Data input
5		D3	I	Data input
6		D4	I	Data input
7		D5	I	Data input
8		D6	I	Data input
9		D7	I	Data input
10		GND	G	Ground.
11		LE	I	Latch enable input (Active High)
12		Q7	O	Data output
13		Q6	O	Data output
14		Q5	O	Data output
15		Q4	O	Data output
16		Q3	O	Data output
17		Q2	O	Data output
18		Q1	O	Data output
19		Q0	O	Data output
20		V_{CC}	P	Supply voltage

* I=Input, O=Output, P=Power.

FUNCTION TABLE

H = HIGH voltage level; h = HIGH voltage level one set-up time prior to the HIGH-to-LOW LE transition
L = LOW voltage level; l = LOW voltage level one set-up time prior to the HIGH-to-LOW LE transition
Z = high-impedance OFF-state

Inputs			Internal Latch	Output
$\overline{OE}$	LE	Dn		Qn
L	H	L	L	L
		H	H	H
L	L	l	L	L
		H	H	H
H	L	l	L	Z
		H	H	Z

ABSOLUTE MAXIMUM RATINGS

V_{CC}, Supply Voltage Range		-0.5V~+7V
I_{IK}, Input Clamp Current	V_I < 0	±50mA
I_{OK}, Output Clamp Current	V_O < 0	±50mA
I_O, Continuous Output Current	V_O= 0 to V_{CC}	±50mA
Continuous Current Through V_{CC} or GND		±100mA
θ_{JA}, Package Thermal Impedance (1)	SOP20	40℃/W
	TSSOP20	40℃/W
T_J, Junction Temperature (2)		-40℃ ~ +150℃
T_{STG}, Storage Temperature		-65℃ ~ +150℃
ESD Ratings		
$V_{(ESD)}$, Electrostatic Discharge	Human-Body Model (HBM)	±2000V
	Charged-Device Model (CDM)	±1000V
	Machine Model (MM)	±200V

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 is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

(1) The package thermal impedance is calculated in accordance with JESD-51.

(2) The maximum power dissipation is a function of $T_{J(MAX)}$, $R_{\theta JA}$, and T_A. The maximum allowable power dissipation at any ambient temperature is PD = ($T_{J(MAX)}$ - T_A) / $R_{\theta JA}$. All numbers apply for packages soldered directly onto a PCB.

RECOMMENDED OPERATING CONDITIONS

Voltages are referenced to GND (ground = 0 V) (1)(2)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}	-	1.65	-	5.5	V
High-Level Input Voltage (3)	V_{IH}	1.65V~1.95V	V_{CCI}x0.65	-	-	V
		2.3V~2.7V	1.70	-	-	
		3V~3.6V	2.00	-	-	
		4.5V~5.5V	V_{CCI}x0.70	-	-	
Low-level Input Voltage (3)	V_{IL}	1.65V~1.95V	-	-	V_{CCI}x0.35	V
		2.3V~2.7V	-	-	0.70	
		3V~3.6V	-	-	0.80	
		4.5V~5.5V	-	-	V_{CCI}x0.30	
Input Voltage	V_I	-	0	-	5.50	V
Output Voltage	V_O	-	0	-	V_{CC}	V
High-Level Output Current	I_{OH}	1.65V~1.95V	-	-	-4	mA
		2.3V~2.7V	-	-	-8	
		3V~3.6V	-	-	-24	
		4.5V~5.5V	-	-	-32	
Low-Level Output Current	I_{OL}	1.65V~1.95V	-	-	4	mA
		2.3V~2.7V	-	-	8	
		3V~3.6V	-	-	24	
		4.5V~5.5V	-	-	32	
Input Transition Rise or Fall Rate(Δt/Δv)	-	1.65V~1.95V	-	-	20	ns/V
		2.3V~2.7V	-	-	20	
		3V~3.6V	-	-	10	
		4.5V~5.5V	-	-	5	
Operating Free-Air Temperature	T_A	-	-40	-	125	°C

(1) All unused or driven (floating) data inputs (I/Os) of the device must be held at logic HIGH or LOW (preferably V_{CC} or GND) to ensure proper device operation and minimize power.

(2) All unused control inputs must be held at V_{CC} or GND to ensure proper device operation and minimize power consumption.

(3) For V_{CC} values not specified in the data sheet, V_{IH} min = V_{CC} × 0.7 V, V_{IL} max = V_{CC} × 0.3 V.

ELECTRICAL CHARACTERISTICS

At recommended operating conditions; voltages are referenced to GND (ground = 0 V)

Parameter	Conditions	V_{CC}	Temp	Min. (1)	Typ. (2)	Max.(1)	Unit
V_{OH}	I_{OH} = –100μA,V_I=V_{IH}	1.65V~4.5V	+25℃	V_{CC}-0.1	-	-	V
	I_{OH} = –4mA, V_I=V_{IH}	1.65V		1.2	-	-	
	I_{OH} = –8mA, V_I=V_{IH}	2.5V		1.9	-	-	
	I_{OH} = –24mA, V_I=V_{IH}	3.3V		2.4	-	-	
	I_{OH} = –32mA, V_I=V_{IH}	4.5V		3.8	-	-	
V_{OL}	I_{OL} = 100μA, V_I =V_{IL}	1.65V~4.5V		-	-	0.10	V
	I_{OL} = 4mA, V_I =V_{IL}	1.65V		-	-	0.45	
	I_{OL} = 8mA, V_I =V_{IL}	2.5V		-	-	0.30	
	I_{OL} = 24mA, V_I =V_{IL}	3.3V		-	-	0.55	
	I_{OL} = 32mA, V_I =V_{IL}	4.5V		-	-	0.55	
I_I	V_I = 5.5V or GND	0V~5.5V	+25℃	-	±0.1	±1	μA
			Full	-	-	±5	
I_{OFF}	V_I or V_O= 5.5V	0V	+25℃	-	±0.1	±1	μA
			Full	-	-	±10	
I_{OZ} (3)	V_O = V_{CC} or GND	1.65V~5.5V	+25℃	-	±0.1	±1	μA
			Full	-	-	±10	
I_{CC}	V_I = V_{CC} or GND (4) I_O = 0	1.65V~5.5V	+25℃	-	0.1	8	μA
			Full	-	-	80	
C_I	f=1MHz	1.65V~5.5V	+25℃	-	3	-	pF
C_{PD}	f=1MHz	No Load	+25℃	-	13	-	pF

(1) Limits are 100% production tested at 25°C. Limits over the operating temperature range are ensured through correlations using statistical quality control (SQC) method.

(2) Typical values represent the most likely parametric norm as determined at the time of characterization. Actual typical values may vary over time and will also depend on the application and configuration.

(3) For I/O ports, the parameter I_{OZ} includes the input leakage current.

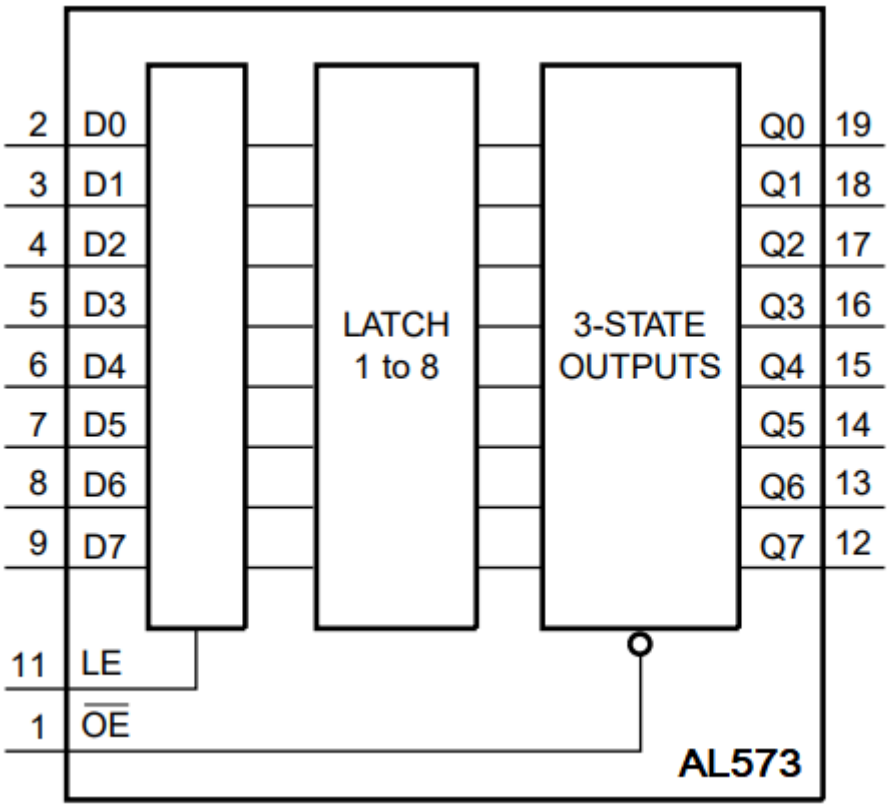
(4) Hold all unused data inputs of the device at V_{CCI} or GND to assure proper device operation.

SWITCHING CHARACTERISTICS

Voltages are referenced to GND (ground = 0 V); CL = 50 pF unless otherwise specified

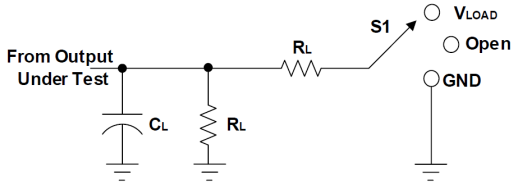
Parameter	V_{CC}=1.8V±0.15V			V_{CC}=2.5V±0.2V			V_{CC}=3.3V±0.3V			V_{CC}=5V±0.5V			Unit
	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
t_{pd}, C_L=50pF, from D (input) to Q (output)	-	25	-	-	12	-	-	10	-	-	8	-	ns
t_{pd}, C_L=50pF, from LE (input) to Q (output)	-	37	-	-	23	-	-	18	-	-	14	-	ns
t_{en}, C_L=50pF, from $\overline{OE}$ (input) to Q (output)	-	27	-	-	17	-	-	14	-	-	10	-	ns
t_{dis}, C_L=50pF, from $\overline{OE}$ (input) to Q (output)	-	22	-	-	14	-	-	12	-	-	9	-	ns
t_t, C_L=50pF to any Q (output)	-	20	-	-	10	-	-	8	-	-	7	-	ns
t_{pd}, C_L=150pF, from D (input) to Q (output)	-	35	-	-	17	-	-	16	-	-	14	-	ns
t_{pd}, C_L=150pF, from LE (input) to Q (output)	-	46	-	-	26	-	-	21	-	-	17	-	ns
t_{en}, C_L=150pF, from $\overline{OE}$ (input) to Q (output)	-	36	-	-	21	-	-	17	-	-	12	-	ns
t_{dis}, C_L=150pF, from $\overline{OE}$ (input) to Q (output)	-	33	-	-	23	-	-	21	-	-	20	-	ns
t_t, C_L=150pF to any Q (output)	-	56	-	-	21	-	-	16	-	-	15	-	ns
t_w, Pulse duration, LE high	-	75	-	-	65	-	-	60	-	-	30	-	ns
t_{su}, Setup time, data before LE↓	-	16	-	-	16	-	-	16	-	-	16	-	ns
t_h, Hold time, data after LE↓	-	19	-	-	17	-	-	16	-	-	16	-	ns

BLOCK DIAGRAM



DETAILED INFORMATION

Parameter Measurement Information



TEST	S1
t_{pd}	Open
t_{PLZ} / t_{PZL}	V_{LOAD}
t_{PHZ}/t_{PZH}	GND

V_{CC}	Inputs		V_M	V_{LOAD}	C_L	R_L	V_Δ
	V_I	t_r/t_f					
1.8V±0.15V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	50pF or 150pF	2kΩ	0.15V
2.5V±0.2V	V_{CC}	≤2ns	$V_{CC}/2$	2 x V_{CC}	50pF or 150pF	2kΩ	0.15V
3.3V±0.3V	3V	≤2.5ns	1.5V	6V	50pF or 150pF	2kΩ	0.3V
5V±0.5V	V_{CC}	≤2.5ns	$V_{CC}/2$	2 x V_{CC}	50pF or 150pF	2kΩ	0.3V

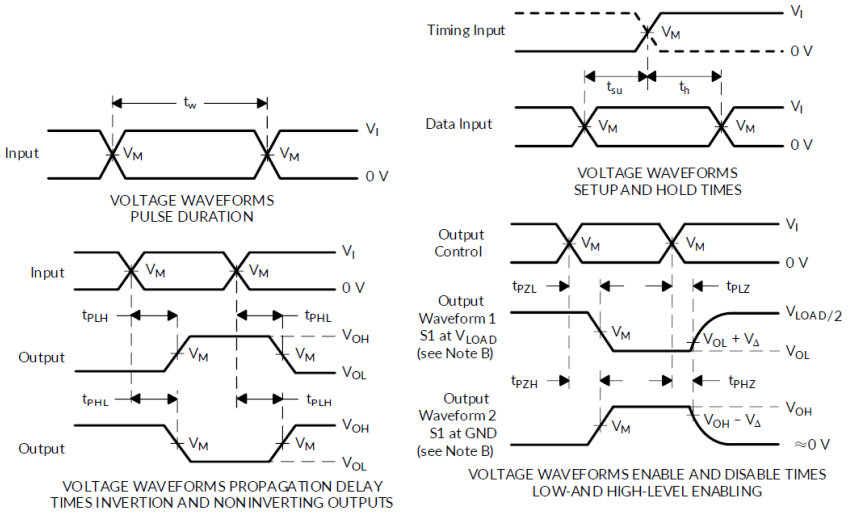
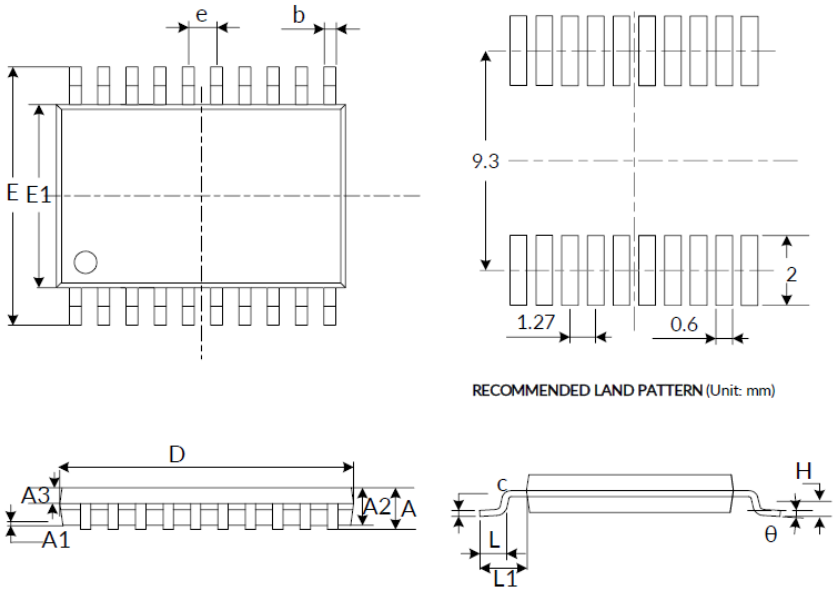


Figure 1. Load Circuit and Voltage Waveforms

(A) CL includes probe and jig capacitance.
(B) Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control.
(C) All input pulses are supplied by generators having the following characteristics: PRR ≤ 10 MHz, Z_O = 50Ω.
(D) The outputs are measured one at a time, with one transition per measurement.
(E) t_{PLZ} and t_{PHZ} are the same as t_{dis}.
(F) t_{PZL} and t_{PZH} are the same as t_{en}.
(G) t_{PLH} and t_{PHL} are the same as t_{pd}.
(H) All parameters and waveforms are not applicable to all devices.

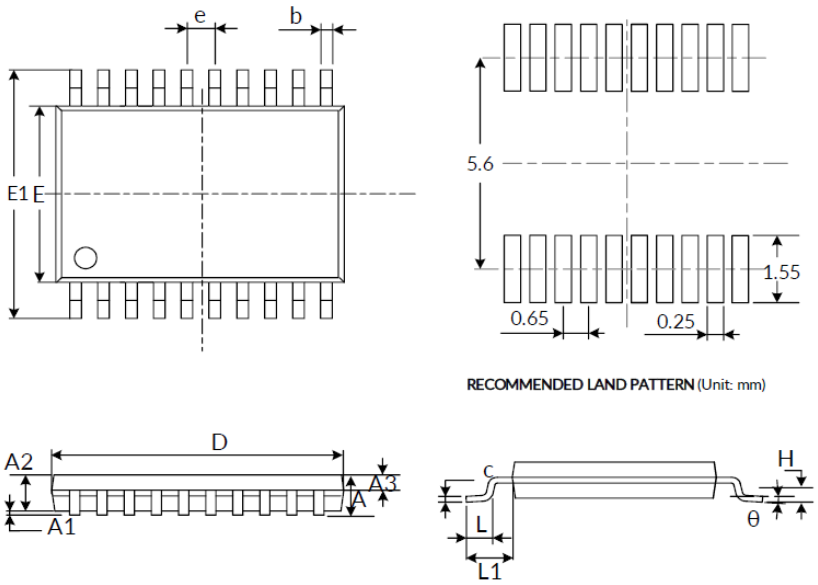
PACKAGE INFORMATION

Dimension in SOP20 (Unit: mm)



Symbol	Min.	Max.
A	-	2.650
A1	0.100	0.300
A2	2.250	2.350
A3	0.970	1.070
b	0.390	0.470
c	0.250	0.290
D	12.700	12.900
E	10.100	10.500
E1	7.400	7.600
e	1.270 BSC	
L	0.700	1.000
L1	1.400 REF	
H	0.250 TYP	
θ	0°	8°

Dimension in TSSOP20 Package (Unit: mm)



Symbol	Min.	Max.
A	-	1.200
A1	0.050	0.150
A2	0.800	1.050
A3	0.390	0.490
b	0.200	0.290
c	0.130	0.170
D	6.400	6.600
E	4.300	4.500
E1	6.200	6.600
e	0.650 BSC	
L	0.450	0.750
L1	1.000 REF	
H	0.250 TYP	
θ	0°	8°

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