

DATA SHEET

74ALVCH16823

18-bit bus-interface D-type flip-flop
with reset and enable (3-State)

Product specification

1998 Jul 29

IC24 Data Handbook

18-bit D-type flip-flop (3-State)

74ALVCH16823

FEATURES

- Wide supply voltage range of 1.2V to 3.6V
- Complies with JEDEC standard no. 8-1A.
- CMOS low power consumption
- Direct interface with TTL levels
- Current drive ± 24 mA at 3.0 V
- Multibyte™flow-through standard pin-out architecture
- Low inductance multiple V_{CC} and GND pins to minimize noise and ground bounce
- All data inputs have bus hold
- Output drive capability 50 Ω transmission lines @ 85°C

DESCRIPTION

The 74ALVCH16823 is a 18-bit edge-triggered flip-flop featuring separate D-type inputs for each flip-flop and 3-state outputs for bus oriented applications. Incorporates bushold data inputs which eliminate the need for external pull-up resistors to hold unused inputs. The 74ALVCH16823 consists of two sections of nine edge-triggered flip-flops. A clock (CP) input, an output-enable ($\overline{OE}$) input, a Master reset ($\overline{MR}$) input and a clock-enable ($\overline{CE}$) input are provided for each total 9-bit section.

With the clock-enable ($\overline{CE}$) input LOW, the D-type flip-flops will store the state of their individual D-inputs that meet the set-up and hold time requirements on the LOW-to-HIGH CP transition. Taking $\overline{CE}$ HIGH disables the clock buffer, thus latching the outputs. Taking the Master reset ($\overline{MR}$) input LOW causes all the Q outputs to go LOW independently of the clock.

When $\overline{OE}$ is LOW, the contents of the flip-flops are available at the outputs. When the $\overline{OE}$ is HIGH, the outputs go to the high impedance OFF-state. Operation of the $\overline{OE}$ input does not affect the state of flip-flops.

Active bus hold circuitry is provided to hold unused or floating data inputs at a valid logic level.

QUICK REFERENCE DATA

GND = 0V; $T_{amb} = 25^{\circ}\text{C}$; $t_r = t_f \leq 2.5\text{ns}$

SYMBOL	PARAMETER	CONDITIONS		TYPICAL	UNIT
t_{PHL}/t_{PLH}	Propagation delay CP to Qn	$V_{CC} = 2.5\text{V}$, CL = 30pF $V_{CC} = 3.3\text{V}$, CL = 50pF		2.1 2.1	ns
F_{max}	Maximum clock frequency	$V_{CC} = 2.5\text{V}$, CL = 30pF $V_{CC} = 3.3\text{V}$, CL = 50pF		300 350	MHz
C_I	Input capacitance			5.0	pF
C_{PD}	Power dissipation capacitance per latch	$V_I = \text{GND to } V_{CC}^1$	Outputs enabled	16	pF
			Outputs disabled	10	

NOTES:

- C_{PD} is used to determine the dynamic power dissipation (P_D in μW):
 $P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$ where:
 f_i = input frequency in MHz; C_L = output load capacity in pF;
 f_o = output frequency in MHz; V_{CC} = supply voltage in V;
 $\sum (C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

ORDERING INFORMATION

PACKAGES	TEMPERATURE RANGE	OUTSIDE NORTH AMERICA	NORTH AMERICA	DWG NUMBER
56-Pin Plastic SSOP Type II	-40°C to +85°C	74ALVCH16823 DL	ACH16823 DL	SOT371-1
56-Pin Plastic TSSOP Type II	-40°C to +85°C	74ALVCH16823 DGG	ACH16823 DGG	SOT364-1

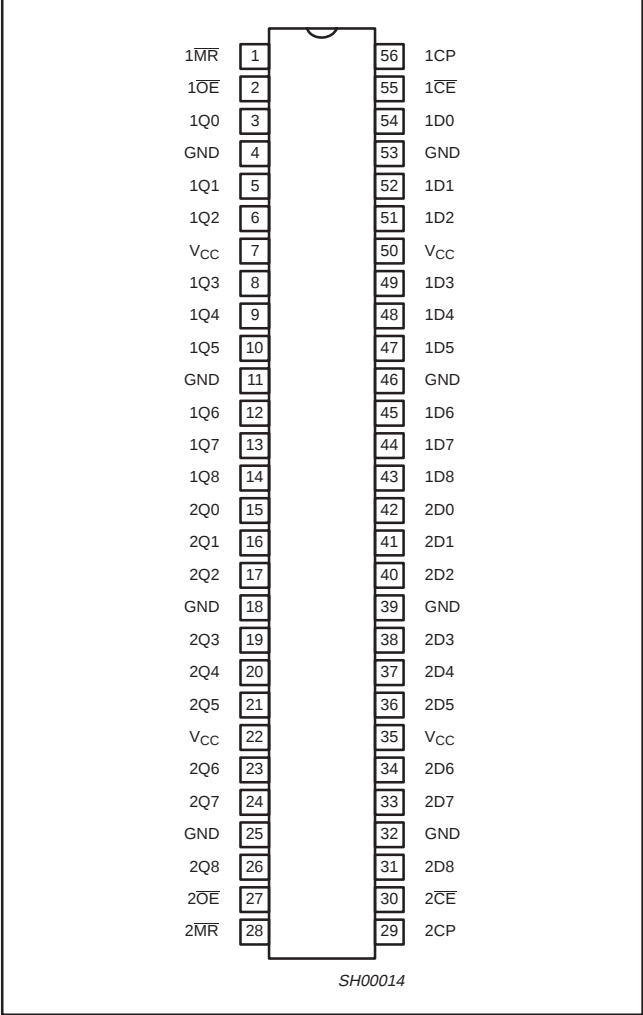
18-bit D-type flip-flop (3-State)

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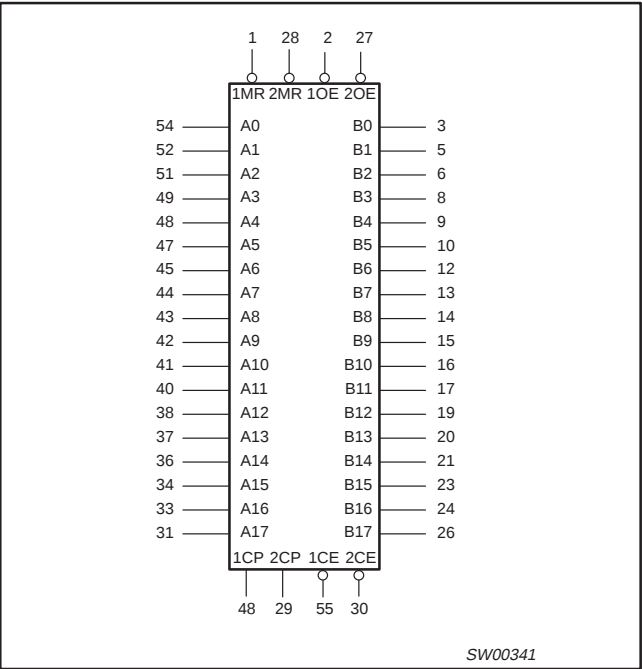
PIN DESCRIPTION

PIN NUMBER	SYMBOL	FUNCTION
2, 27	1OE, 2OE	Output enable input (active-Low)
54, 52, 51, 49, 48, 47, 45, 44, 43 42, 41, 40, 38, 37, 36, 34, 33, 31	1D0-1D8 2D0-2D8	Data inputs
3, 5, 6, 8, 9, 10, 12, 13, 14 15, 16, 17, 19, 20, 21, 23, 24, 26	1Q0-1Q8 2Q0-2Q8	Data outputs
56, 29	1CP, 2CP	Clock pulse input (active rising edge)
55, 30	1CE, 2CE	Clock enable input (active-Low)
1, 28	1MR, 2MR	Master reset input (active-Low)
4, 11, 18, 25, 32, 39, 46, 53	GND	Ground (0V)
7, 22, 35, 50	VCC	Positive supply voltage

PIN CONFIGURATION



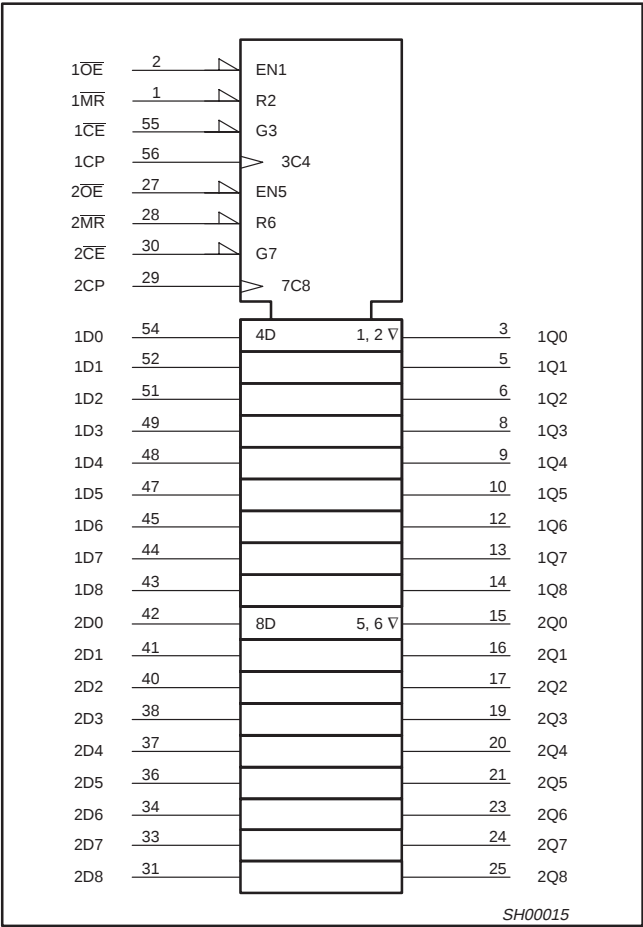
LOGIC SYMBOL



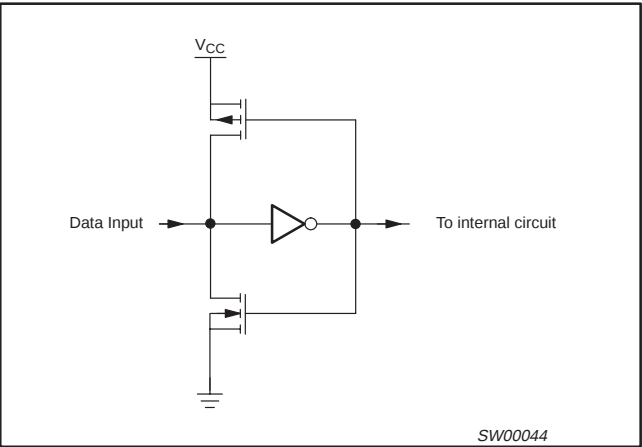
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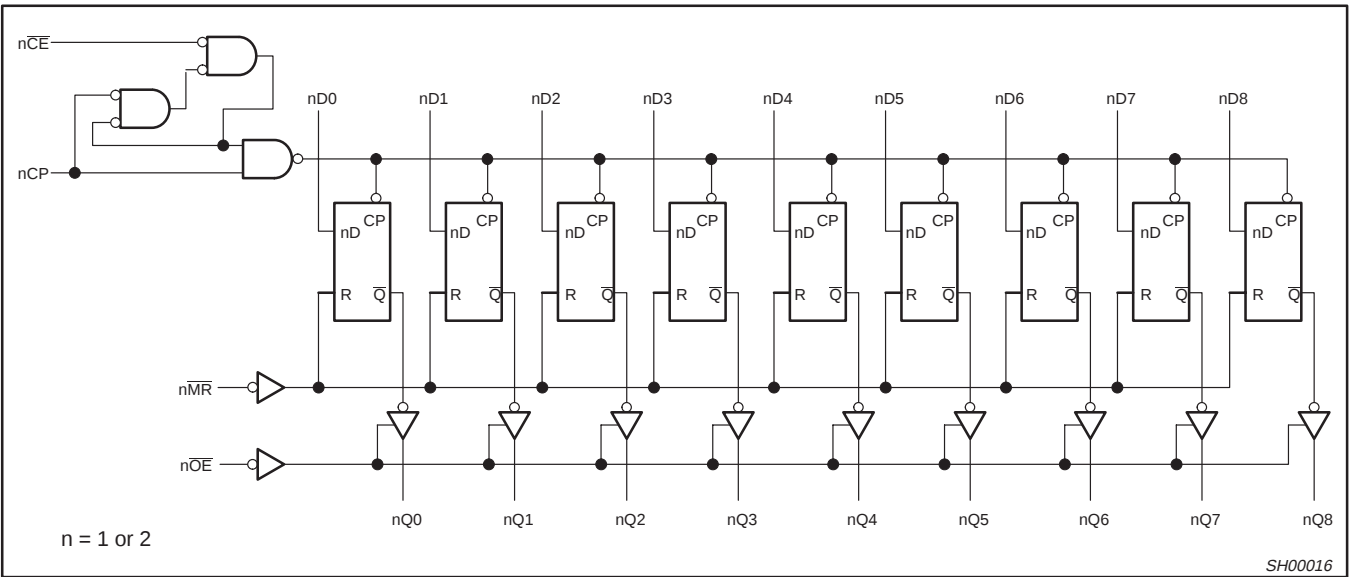
LOGIC SYMBOL (IEEE/IEC)



BUS HOLD CIRCUIT



LOGIC DIAGRAM



18-bit D-type flip-flop (3-State)

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FUNCTION TABLE

INPUTS					OUTPUT	OPERATING MODES
nOE	nMR	nCE	nCP	nDx	nQx	
L	L	X	X	X	L	Clear
L	H	L	↑	h	H	Load and read data
L	H	L	↑	l	L	
L	H	L	L	X	Q ₀	Hold
L	H	H	X	X	Q ₀	
H	X	X	X	X	Z	Disable outputs

H = HIGH voltage level

h = HIGH voltage level one set-up time prior to the Low-to-High clock transition

L = LOW voltage level

l = LOW voltage level one set-up time prior to the Low-to-High clock transition

X = Don't care

Z = HIGH impedance "off" state

↑ = LOW to High clock transition

RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	CONDITIONS	LIMITS		UNIT
			MIN	MAX	
V _{CC}	DC supply voltage 2.5V range (for max. speed performance @ 30 pF output load)		2.3	2.7	V
	DC supply voltage 3.3V range (for max. speed performance @ 50 pF output load)		3.0	3.6	
V _{CC}	DC supply voltage (for low-voltage applications)		1.2	3.6	V
V _I	DC Input voltage range	for data input pins	0	V _{CC}	V
		for control pins	0	5.5	V
V _O	DC output voltage range		0	V _{CC}	V
T _{amb}	Operating free-air temperature range		−40	+85	°C
t _r , t _f	Input rise and fall times	V _{CC} = 2.3 to 3.0V	0	20	ns/V
		V _{CC} = 3.0 to 3.6V	0	10	

ABSOLUTE MAXIMUM RATINGS

In accordance with the Absolute Maximum Rating System (IEC 134). Voltages are referenced to GND (ground = 0V).

SYMBOL	PARAMETER	CONDITIONS	RATING	UNIT
V _{CC}	DC supply voltage		−0.5 to +4.6	V
I _{IK}	DC input diode current	V _I < 0	−50	mA
V _I	DC input voltage	For control pins ¹	−0.5 to +5.5	V
		For data inputs ¹	−0.5 to V _{CC} + 0.5	
I _{OK}	DC output diode current	V _O > V _{CC} or V _O < 0	± 50	mA
V _O	DC output voltage	Note 1	−0.5 to V _{CC} + 0.5	V
I _O	DC output source or sink current	V _O = 0 to V _{CC}	± 50	mA
I _{GND} , I _{CC}	DC V _{CC} or GND current		± 100	mA
T _{stg}	Storage temperature range		−65 to +150	°C
P _{TOT}	Power dissipation per package —plastic medium-shrink (SSOP) —plastic thin-medium-shrink (TSSOP)	For temperature range: −40 to +125 °C above +55°C derate linearly with 11.3 mW/K above +55°C derate linearly with 8 mW/K	850 600	mW

NOTE:

1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

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DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions. Voltage are referenced to GND (ground = 0 V).

SYMBOL	PARAMETER	TEST CONDITIONS	LIMITS			UNIT
			Temp = -40°C to +85°C			
			MIN	TYP ¹	MAX	
V _{IH}	HIGH level Input voltage	V _{CC} = 1.2V	V _{CC}			V
		V _{CC} = 1.8V	0.7*V _{CC}	0.9		
		V _{CC} = 2.3 to 2.7V	1.7	1.2		
		V _{CC} = 2.7 to 3.6V	2.0	1.5		
V _{IL}	LOW level Input voltage	V _{CC} = 1.2V		—	GND	V
		V _{CC} = 1.8V		0.9	0.2*V _{CC}	
		V _{CC} = 2.3 to 2.7V		1.2	0.7	
		V _{CC} = 2.7 to 3.6V		1.5	0.8	
V _{OH}	HIGH level output voltage	V _{CC} = 1.8 to 3.6V; V _I = V _{IH} or V _{IL} ; I _O = -100μA	V _{CC} -0.2	V _{CC}	—	V
		V _{CC} = 1.8V; V _I = V _{IH} or V _{IL} ; I _O = -6mA	V _{CC} -0.4	V _{CC} -0.10	—	
		V _{CC} = 2.3V; V _I = V _{IH} or V _{IL} ; I _O = -6mA	V _{CC} -0.3	V _{CC} -0.08	—	
		V _{CC} = 2.3V; V _I = V _{IH} or V _{IL} ; I _O = -12mA	V _{CC} -0.5	V _{CC} -0.17	—	
		V _{CC} = 2.3V; V _I = V _{IH} or V _{IL} ; I _O = -18mA	V _{CC} -0.6	V _{CC} -0.26	—	
		V _{CC} = 2.7V; V _I = V _{IH} or V _{IL} ; I _O = -12mA	V _{CC} -0.5	V _{CC} -0.14	—	
		V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = -24mA	V _{CC} -1.0	V _{CC} -0.28	—	
V _{OL}	LOW level output voltage	V _{CC} = 1.8 to 3.6V; V _I = V _{IH} or V _{IL} ; I _O = 100μA		GND	0.20	V
		V _{CC} = 1.8V; V _I = V _{IH} or V _{IL} ; I _O = 6mA		0.09	0.30	
		V _{CC} = 2.3V; V _I = V _{IH} or V _{IL} ; I _O = 6mA		0.07	0.20	
		V _{CC} = 2.3V; V _I = V _{IH} or V _{IL} ; I _O = 12mA		0.15	0.40	
		V _{CC} = 2.3V; V _I = V _{IH} or V _{IL} ; I _O = 18mA		0.23	0.60	
		V _{CC} = 2.7V; V _I = V _{IH} or V _{IL} ; I _O = 12mA		0.14	0.40	
		V _{CC} = 3.0V; V _I = V _{IH} or V _{IL} ; I _O = 24mA		0.27	0.55	
I _I	Input leakage current per control pin	V _{CC} = 1.8 to 3.6V; V _I = 5.5V or GND		0.1	5	μA
	Input leakage current per data pin	V _{CC} = 1.8 to 3.6V; V _I = V _{CC} or GND		0.1	5	
I _{IHZ} /I _{ILZ}	Input current for common I/O pins	V _{CC} = 1.8 to 2.7V; V _I = V _{CC} or GND		0.1	10	μA
		V _{CC} = 3.6V; V _I = V _{CC} or GND		0.1	15	
I _{OZ}	3-State output OFF-state current	V _{CC} = 1.8 to 2.7V; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND		0.1	5	μA
		V _{CC} = 2.7 to 3.6V; V _I = V _{IH} or V _{IL} ; V _O = V _{CC} or GND		0.1	10	
ΔI _{CC}	Additional quiescent supply current given per data I/O pin	V _{CC} = 2.7V to 3.6V; V _I = V _{CC} - 0.6V; I _O = 0		150	750	μA
I _{BHL}	Bus hold LOW sustaining current	V _{CC} = 2.3V; V _I = 0.7V ²	45	—		μA
		V _{CC} = 3.0V; V _I = 0.8V ²	75	150		
I _{BHH}	Bus hold HIGH sustaining current	V _{CC} = 2.3V; V _I = 1.7V ²	-45			μA
		V _{CC} = 3.0V; V _I = 2.0V ²	-75	-175		
I _{BHLO}	Bus hold LOW overdrive current	V _{CC} = 2.7V ²	300			μA
		V _{CC} = 3.6V ²	450			
I _{BHHO}	Bus hold HIGH overdrive current	V _{CC} = 2.7V ²	-300			μA
		V _{CC} = 3.6V ²	-450			

NOTES:

1. All typical values are at $T_{amb} = 25^\circ C$.
2. Valid for data inputs of bus hold parts.

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AC CHARACTERISTICS FOR $V_{CC} = 2.3V$ TO $2.7V$ RANGE AND $V_{CC} < 2.3V$ GND = 0V; $t_r = t_f \leq 2.0ns$; $C_L = 30pF$

SYMBOL	PARAMETER	WAVEFORM	LIMITS							UNIT
			$V_{CC} = 2.3$ to $2.7V$			$V_{CC} = 1.8V$			$V_{CC} = 1.2V$	
			MIN	TYP ^{1, 2}	MAX	MIN	TYP1	MAX	TYP ¹	
t_{PLH}/t_{PHL}	Propagation delay nCP to nQ _n	1, 5	1.0	2.8	4.9	1.5	4.5	7.5	10.6	ns
t_{PLH}/t_{PHL}	Propagation delay nMR to nQ _n	2, 5	1.0	2.9	5.0	1.5	4.6	7.4	9.9	ns
t_{PZH}/t_{PZL}	3-State output enable time nOE _n to nQ _n	4, 5	1.0	2.8	5.3	1.5	4.4	7.7	10.4	ns
t_{PHZ}/t_{PLZ}	3-State output disable time nOE _n to nQ _n	4, 5	1.0	2.2	4.1	1.5	3.3	5.5	6.7	ns
t_w	nCP pulse width	1, 5	3.0	1.6		4.0	2.0			ns
	nMR pulse width, LOW	3, 5	3.0	0.4		4.0	0.8			
t_{SU}	Set up time nD _n to nCP	3, 5	1.2	0.2		1.5	0.2			ns
	Set up time nCE to nCP		1.8	-0.2		2.0	-0.2			
t_h	Hold time nD _n to nCP	3, 5	0.8	-0.1		0.6	-0.2			ns
	Hold time nCE to nCP		0.3	0.2		0.3	0.2			
t_{rec}	Recovery time nMR to nCP	2, 5	1.0	0.3		0.8	0.2			ns
F_{max}	Maximum clock pulse frequency	1, 5	150	300		125	250			MHz

NOTE:

1. All typical values are measured at $T_{amb} = 25^\circ C$.
2. Typical value is measured at $V_{CC} = 2.5V$.

AC CHARACTERISTICS FOR $V_{CC} = 3.0V$ TO $3.6V$ RANGE AND $V_{CC} = 2.7V$ GND = 0V; $t_r = t_f \leq 2.5ns$; $C_L = 50pF$

SYMBOL	PARAMETER	WAVEFORM	LIMITS						UNIT
			V _{CC} = 3.0 ± 0.3V			V _{CC} = 2.7V			
			MIN	TYP ^{1, 2}	MAX	MIN	TYP ¹	MAX	
t _{PLH} /t _{PHL}	Propagation delay nCP to nQ _n	1, 5	1.0	2.5	3.7	1.0	2.7	4.3	ns
t _{PLH} /t _{PHL}	Propagation delay nMR to nQ _n	2, 5	1.0	2.6	4.0	1.0	3.1	4.6	ns
t _{PZH} /t _{PZL}	3-State output enable time nOE _n to nQ _n	4, 5	1.0	2.5	4.3	1.0	3.1	5.2	ns
t _{PHZ} /t _{PLZ}	3-State output disable time nOE _n to nQ _n	4, 5	1.0	2.8	3.9	1.0	3.1	4.3	ns
t _w	nCP pulse width HIGH or LOW	1, 5	2.5	1.4		3.0	1.6		ns
	nMR pulse width HIGH or LOW	3, 5	2.5	0.3		3.0	0.6		
t _{su}	Set up time nD _n to nCP	3, 5	1.2	0.2		1.5	0.4		ns
	Set up time nCE to nCP		1.5	−0.1		1.9	−0.1		
t _h	Hold time nD _n to nCP	3, 5	0.8	0.0		0.6	−0.2		ns
	Hold time nCE to nCP		0.5	0.1		0.4	0.1		
t _{rec}	Recovery time nMR to nCP	2, 5	1.0	0.2		0.8	0.1		ns
F _{max}	Maximum clock pulse frequency	1, 5	200	350		150	300		MHz

NOTES:

1. All typical values are measured at $T_{amb} = 25^\circ C$.
2. Typical value is measured at $V_{CC} = 3.3V$.

18-bit D-type flip-flop (3-State)

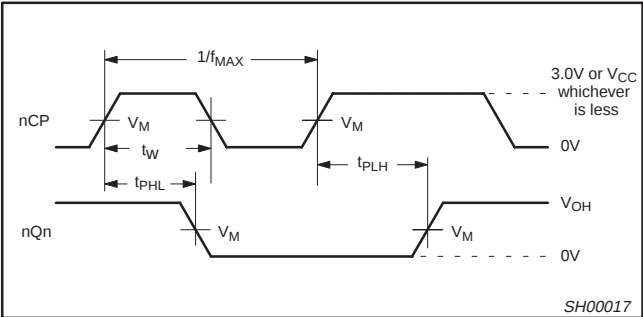
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AC WAVEFORMS FOR $V_{CC} = 2.3V$ TO $2.7V$ AND $V_{CC} < 2.3V$ RANGE

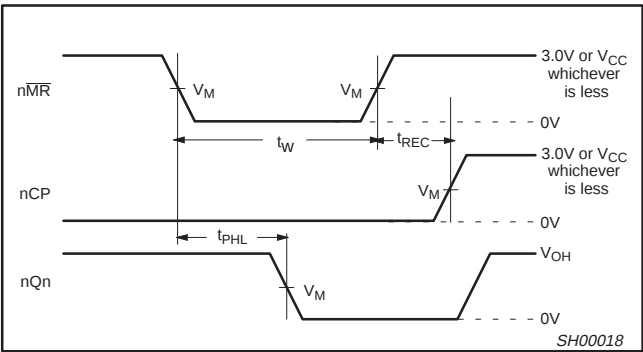
$V_M = 0.5 V_{CC}$
 $V_X = V_{OL} + 0.15V$
 $V_Y = V_{OH} - 0.15V$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
 $V_I = V_{CC}$

AC WAVEFORMS FOR $V_{CC} = 3.0V$ TO $3.6V$ AND $V_{CC} = 2.7V$ RANGE

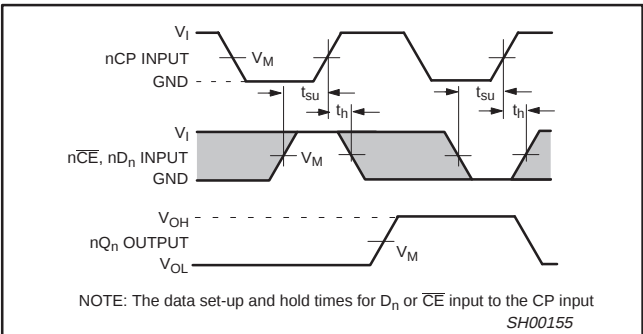
$V_M = 1.5 V$
 $V_X = V_{OL} + 0.3V$
 $V_Y = V_{OH} - 0.3V$
 V_{OL} and V_{OH} are the typical output voltage drop that occur with the output load.
 $V_I = 2.7V$



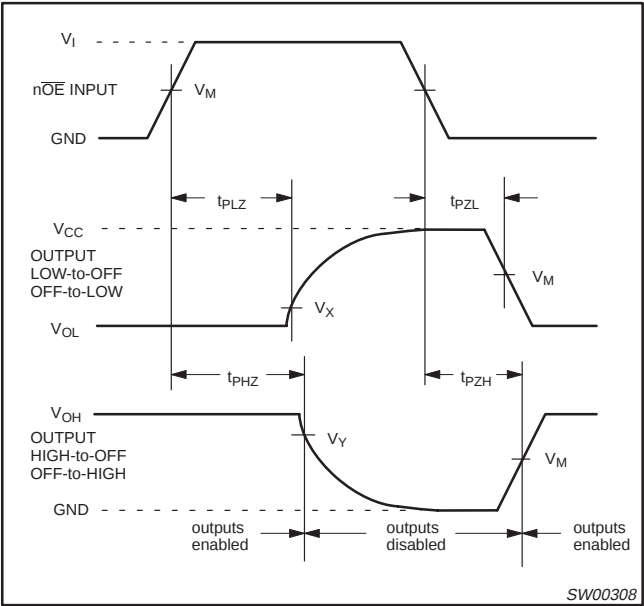
Waveform 1. Clock (nCP) to Output (nQn) Propagation Delays, Clock Pulse Width, and Maximum Clock Pulse Frequency



Waveform 2. Master Reset (MR) Pulse Width, MR to Output propagation Delay and MR to Clock Recovery Time

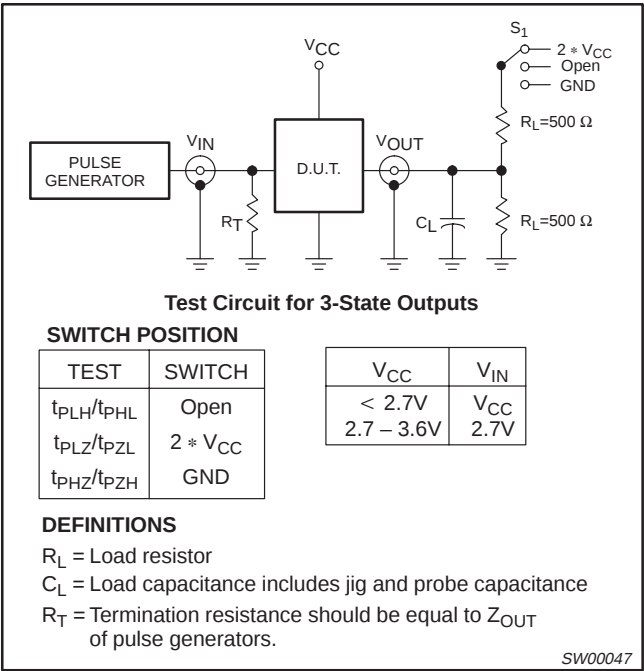


Waveform 3. Data Setup and Hold Times for the D_n or $\overline{CE}$ input to the CP input



Waveform 4. 3-State Enable and Disable Times

TEST CIRCUIT



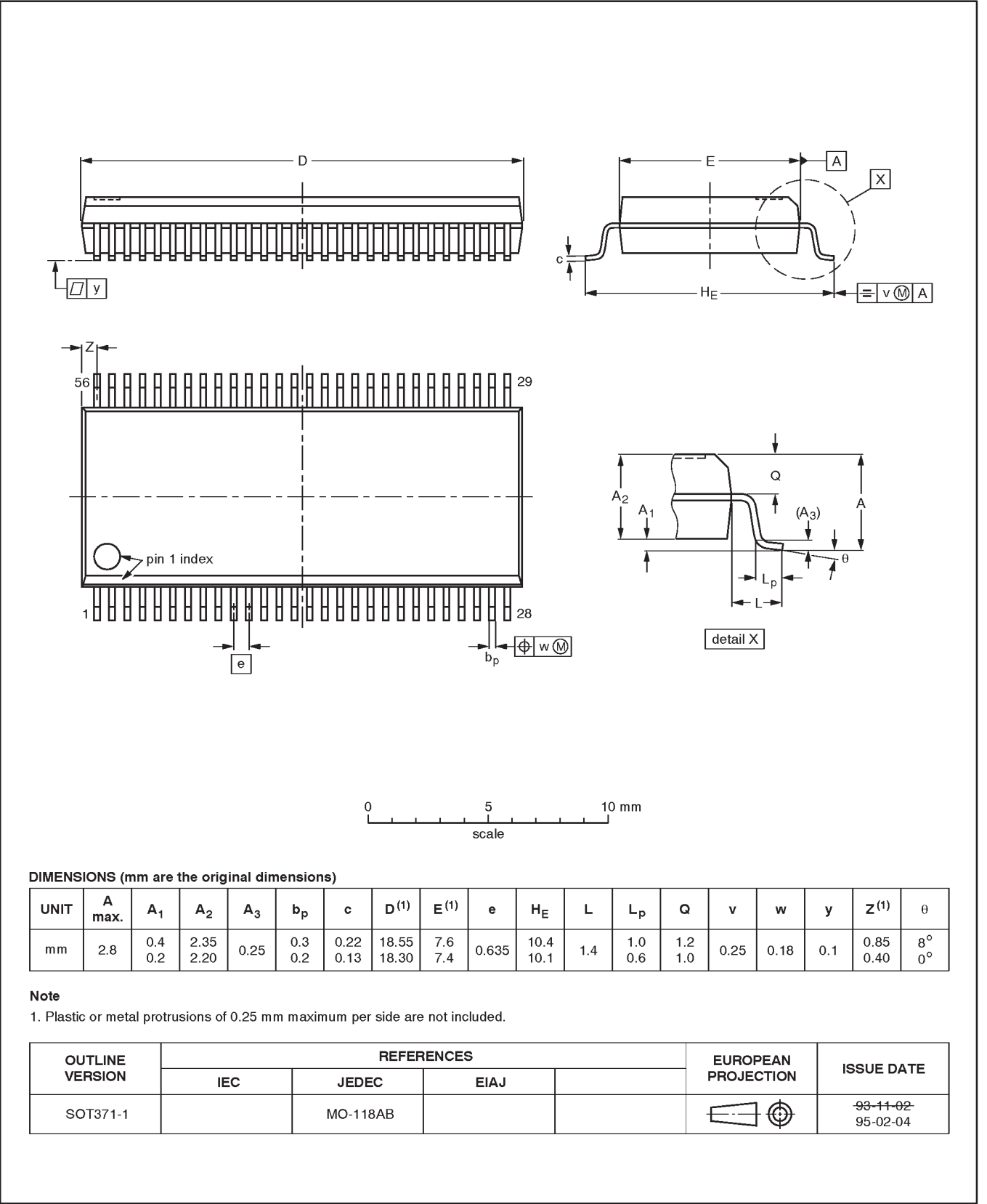
Waveform 5. Load circuitry for switching times

18-bit bus-interface D-type flip-flop
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SSOP56: plastic shrink small outline package; 56 leads; body width 7.5 mm

SOT371-1

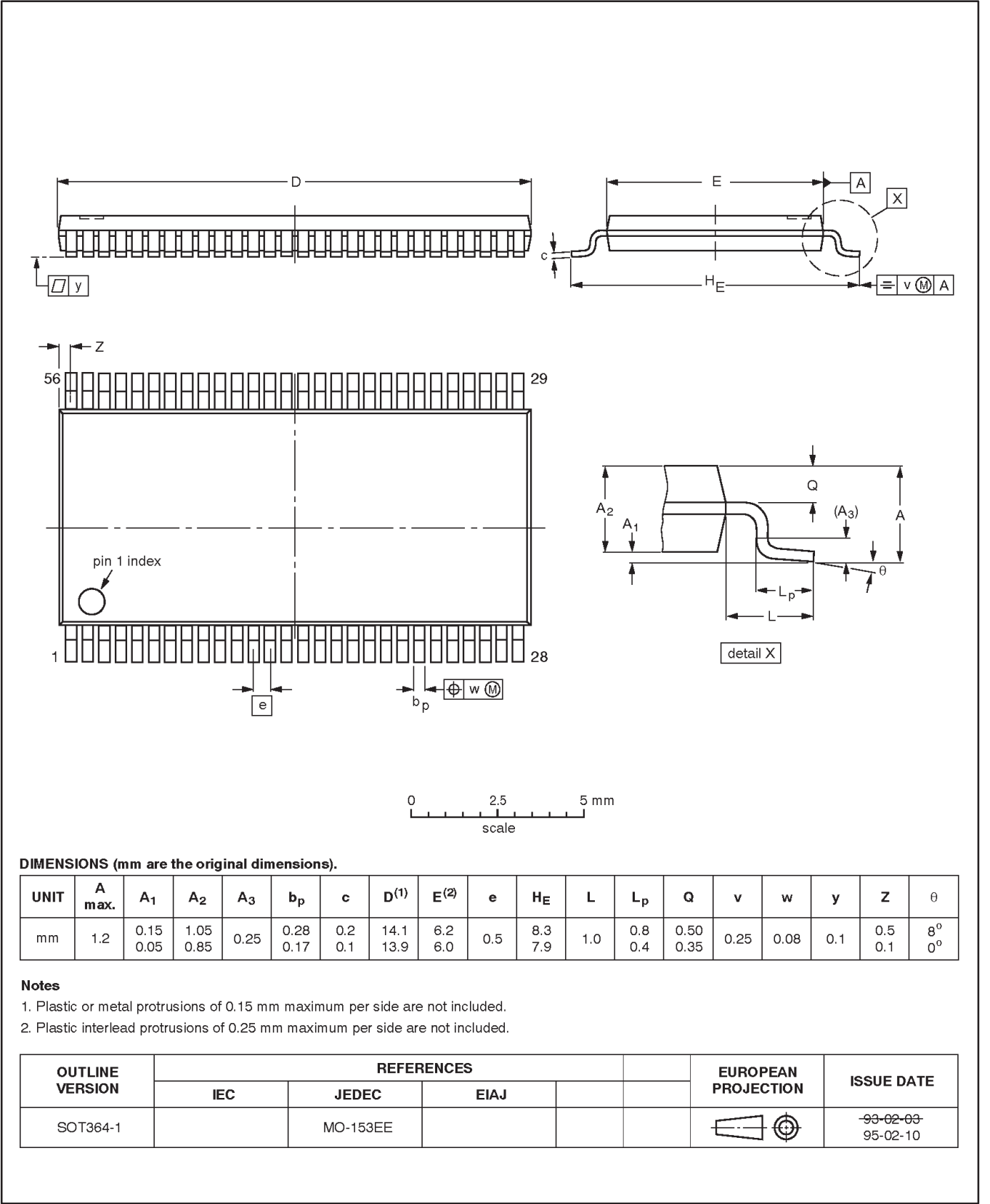


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TSSOP56: plastic thin shrink small outline package; 56 leads; body width 6.1mm

SOT364-1



18-bit bus-interface D-type flip-flop
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NOTES

18-bit bus-interface D-type flip-flop with reset and enable (3-State)

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Data sheet status

Data sheet status	Product status	Definition [1]
Objective specification	Development	This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.
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[1] Please consult the most recently issued datasheet before initiating or completing a design.

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Limiting values definition — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

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