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### NC7SP74

# TinyLogic® ULP D-Type Flip-Flop with Preset and Clear

### **General Description**

The NC7SP74 is a single D-type CMOS Flip-Flop with preset and clear from Fairchild's Ultra Low Power (ULP) Series of TinyLogic®. Ideal for applications where battery life is critical, this product is designed for ultra low power consumption within the  $V_{CC}$  operating range of 0.9V to 3.6V

The internal circuit is composed of a minimum of inverter stages including the output buffer, to enable ultra low static and dynamic power.

The NC7SP74, for lower drive requirements, is uniquely designed for optimized power and speed, and is fabricated with an advanced CMOS technology to achieve best in class speed operation while maintaining extremely low CMOS power dissipation.

The signal level applied to the D input is transferred to the Q output during the positive going transition of the CLK pulse.

### **Features**

- Space saving US8 surface mount package
- MicroPak™ Pb-Free leadless package
- 0.9V to 3.6V V<sub>CC</sub> supply operation
- 3.6V overvoltage tolerant I/Os at V<sub>CC</sub> from 0.9V to 3.6V
- t<sub>pr</sub>

3.0 ns typ for 3.0V to 3.6V  $\rm V_{\rm CC}$ 

4.0 ns typ for 2.3V to 2.7V  $V_{CC}$ 

5.0 ns typ for 1.65V to 1.95V  $V_{CC}$ 

6.0 ns typ for 1.40V to 1.60V  $V_{CC}$ 

9.0 ns typ for 1.10V to 1.30V  $\ensuremath{V_{CC}}$ 

24.0 ns typ for 0.90V  $V_{\rm CC}$ 

- Power-Off high impedance inputs and outputs
- Static Drive (I<sub>OH</sub>/I<sub>OL</sub>)

±2.6 mA @ 3.00V V<sub>CC</sub>

 $\pm 2.1~\text{mA}$   $\,$  @ 2.30V  $\mathrm{V}_{\mathrm{CC}}$ 

±1.5 mA @ 1.65V V<sub>CC</sub> ±1.0 mA @ 1.40V V<sub>CC</sub>

±0.5 mA @ 1.10V V<sub>CC</sub>

±20 μA @ 0.9V V<sub>CC</sub>

■ Uses patented Quiet Series<sup>™</sup> noise/EMI reduction circuitng

circuitry

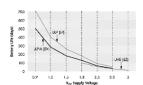
■ Ultra low dynamic power

### **Ordering Code:**

Order Number	Package Number	Product Code Top Mark	Package Description	Supplied As
NC7SP74K8X	MAB08A	P74	8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide	3k Units on Tape and Reel
NC7SP74L8X	MAC08A	X9	Pb-Free 8-Lead MicroPak, 1.6 mm Wide	5k Units on Tape and Reel

Pb-Free package per JEDEC J-STD-020B.

### Battery Life vs. V<sub>CC</sub> Supply Voltage



TinyLogic ULP and ULP-A with up to 50% less power consumption can extend your battery life significantly.

Battery Life =  $(V_{battery} *I_{battery} *.9)/(P_{device})/24hrs/day$ 

Where,  $P_{device} = (I_{CC} * V_{CC}) + (C_{PD} + C_L) * V_{CC}^2 * f$ 

Assumes ideal 3.6V Lithium Ion battery with current rating of 900mAH and derated 90% and device frequency at 10MHz, with  $C_{\rm L}$  = 15 pF load

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# **Pin Descriptions**

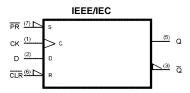
Pin Names	Description
D	Data Input
CK	Clock Pulse Input
CLR	Direct Clear Input
Q, Q	Flip-Flop Output
PR	Direct Preset Input

### **Truth Table**

	Inp	uts		Out	puts	Function		
CLR	PR	D	СК	Q	Q	runction		
L	Н	X	X	L	Н	Clear		
Н	L	Х	Х	Н	L	Preset		
L	L	Х	Х	Н	Н	_		
Н	Н	L	1	L	Н	_		
Н	Н	Н	1	Н	L	_		
Н	Н	X	<b>\</b>	Q <sub>n</sub>	$\overline{Q}_n$	No Change		

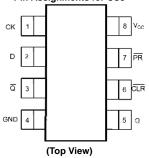
- H = HIGH Logic Level L = LOW Logic Level Q<sub>n</sub> = No change in data
- X = Immaterial
  Z = High Impedance
  ↑ = Rising Edge
  ↓ = Falling edge

# **Logic Symbol**

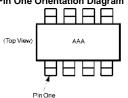


## **Connection Diagrams**

### Pin Assignments for US8



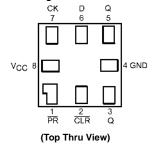
### Pin One Orientation Diagram



AAA represents Product Code Top Mark - see ordering code

**Note:** Orientation of Top Mark determines Pin One location. Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

### Pad Assignments for MicroPak



### **Absolute Maximum Ratings**(Note 1)

Supply Voltage (V<sub>CC</sub>)

# Recommended Operating Conditions (Note 3)

113 0 ( 00)	
DC Input Voltage (V <sub>IN</sub> )	-0.5V to $+4.6V$
DC Output Voltage (V <sub>OUT</sub> )	-0.5V to $+7.0V$
HIGH or LOW State (Note 2)	$-0.5V$ to $V_{CC}$ +0.5V
$V_{CC} = 0V$	-0.5V to 4.6V
DC Input Diode Current ( $I_{IK}$ ) $V_{IN}$ < 0V	±50 mA
DC Output Diode Current (I <sub>OK</sub> )	
Va. = < 0V	_50 m∆

-0.5V to +4.6V

Supply Pin (I $_{CC}$  or Ground)  $\pm 50$  mA Storage Temperature Range (T $_{STG}$ )  $-65^{\circ}$ C to  $+150^{\circ}$ C

 $\begin{tabular}{lll} Power Supply & 0.9V to 3.6V \\ Input Voltage (V_{IN}) & 0V to 3.6V \\ Output Voltage (V_{OUT}) \\ HIGH or LOW State & 0V to <math>V_{CC}$   $V_{CC} = 0V$  & 0V to 3.6V

$$\label{eq:controller} \begin{split} & \text{Output Current in } (I_{OH}/I_{OL}) \\ & \text{$V_{CC} = 3.0$V to $3.6$V} \\ & \text{$V_{CC} = 2.3$V to $2.7$V} \\ & \text{$V_{CC} = 1.65$V to $1.95$V} \\ \end{split} \qquad \qquad \begin{array}{l} \pm 2.6 \text{ mA} \\ \pm 2.1 \text{ mA} \\ \end{array}$$

 $V_{CC} = 1.00 \text{ to } 1.90 \text{ to } 1.50 \text{ mA}$   $V_{CC} = 1.40 \text{ to } 1.60 \text{ V}$   $V_{CC} = 1.10 \text{ to } 1.30 \text{ V}$   $V_{CC} = 0.9 \text{ V}$   $v_{CC} = 0.9 \text{ to } 1.20 \text{ V}$ 

Free Air Operating Temperature (T<sub>A</sub>)  $-40^{\circ}\text{C}$  to +85°C

Minimum Input Edge Rate ( $\Delta t/\Delta V$ )

 $V_{IN} = 0.8V$  to 2.0V,  $V_{CC} = 3.0V$  10 ns/V

Note 1: Absolute Maximum Ratings: are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table will define the conditions for actual device operation.

Note 2:  $I_O$  Absolute Maximum rating must be observed.

Note 3: Unused inputs must be held HIGH or LOW. They may not float.

### **DC Electrical Characteristics**

Symbol	vmbol Parameter		<b>T</b> <sub>A</sub> = -	+25°C	$T_A = -40^{\circ}C \text{ to } +85^{\circ}C$		Units	Conditions
Symbol	raiailletei	(V)	Min	Max	Min	Max	Oilles	Conditions
V <sub>IH</sub>	HIGH Level	0.90	0.65 x V <sub>CC</sub>		0.65 x V <sub>CC</sub>			
	Input Voltage	$1.10 \le V_{CC} \le 1.30$	0.65 x V <sub>CC</sub>		0.65 x V <sub>CC</sub>			
		$1.40 \le V_{CC} \le 1.60$	0.65 x V <sub>CC</sub>		0.65 x V <sub>CC</sub>		V	
		$1.65 \le V_{CC} \le 1.95$	0.65 x V <sub>CC</sub>		0.65 x V <sub>CC</sub>		V	
		$2.30 \le V_{CC} \le 2.70$	1.6		1.6			
		$3.00 \le V_{CC} \le 3.60$	2.1		2.1			
V <sub>IL</sub>	LOW Level	0.90		0.35 x V <sub>CC</sub>		0.35 x V <sub>CC</sub>		
	Input Voltage	$1.10 \le V_{CC} \le 1.30$		$0.35 \times V_{\rm CC}$		$0.35 \times V_{\rm CC}$		
		$1.40 \le V_{CC} \le 1.60$		$0.35 \times V_{\rm CC}$		$0.35 \times V_{CC}$	V	
		$1.65 \le V_{CC} \le 1.95$		$0.35 \times V_{\rm CC}$		$0.35 \times V_{\rm CC}$	V	
		$2.30 \le V_{CC} \le 2.70$		0.7		0.7		
		$3.00 \le V_{CC} \le 3.60$		0.9		0.9		
V <sub>OH</sub>	HIGH Level	0.90	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1			
	Output Voltage	$1.10 \le V_{CC} \le 1.30$	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1			
		$1.40 \le V_{CC} \le 1.60$	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1			I <sub>OH</sub> = -20 μA
		$1.65 \le V_{CC} \le 1.95$	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1			10H = -20 μA
		$2.30 \le V_{CC} \le 2.70$	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1			
		$3.00 \le V_{CC} \le 3.60$	V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		V	
		$1.10 \le V_{CC} \le 1.30$	0.75 x V <sub>CC</sub>		0.70 x V <sub>CC</sub>			$I_{OH} = -0.5 \text{ mA}$
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	1.07		0.99			$I_{OH} = -1.0 \text{ mA}$
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	1.24		1.22			$I_{OH} = -1.5 \text{ mA}$
		$2.30 \le V_{CC} \le 2.70$	1.95		1.87			I <sub>OH</sub> = -2.1 mA
		$3.00 \le V_{CC} \le 3.60$	2.61		2.55			I <sub>OH</sub> = -2.6 mA

# DC Electrical Characteristics (Continued)

Symbol	Parameter	v <sub>cc</sub>	T <sub>A</sub> = -	+25°C	$T_A = -40^{\circ}$	°C to +85°C	Units	Conditions
Oyinboi i arame	(V)	(V)	Min	Max	Min	Max	Onito	Conditions
V <sub>OL</sub>	LOW Level	0.90		0.1		0.1		
	Output Voltage	$1.10 \leq V_{CC} \leq 1.30$		0.1		0.1		
		$1.40 \le V_{CC} \le 1.60$		0.1		0.1		I <sub>OL</sub> = 20 μA
		$1.65 \leq V_{CC} \leq 1.95$		0.1		0.1		I <sub>OL</sub> = 20 μA
		$2.30 \leq V_{CC} \leq 2.70$		0.1		0.1		
		$3.00 \leq V_{CC} \leq 3.60$		0.1		0.1	V	
		$1.10 \le V_{CC} \le 1.30$		0.30 x V <sub>CC</sub>		0.30 x V <sub>CC</sub>		I <sub>OL</sub> = 0.5 mA
		$1.40 \le V_{CC} \le 1.60$		0.31		0.37		I <sub>OL</sub> = 1.0 mA
		$1.65 \le V_{CC} \le 1.95$		0.31		0.35		I <sub>OL</sub> = 1.5 mA
		$2.30 \le V_{CC} \le 2.70$		0.31		0.33		I <sub>OL</sub> = 2.1 mA
		$3.00 \le V_{CC} \le 3.60$		0.31		0.33		I <sub>OL</sub> = 2.6 mA
I <sub>IN</sub>	Input Leakage Current	0.90 to 3.60		±0.1		±0.5	μΑ	$0 \le V_I \le 3.6V$
l <sub>OFF</sub>	Power Off Leakage Current	0		0.5		0.5	μΑ	$0 \le (V_I, V_O) \le 3.6V$
I <sub>CC</sub>	Quiescent Supply Current	0.90 to 3.60		0.9		0.9	μΑ	$V_I = V_{CC}$ or GND

Symbol	Parameter	V <sub>CC</sub>		T <sub>A</sub> = +25°C	;	$T_A = -40^{\circ}$	C to +85°C	Units	Conditions	Figure
Syllibol	Farameter	(V)	Min	Тур	Max	Min	Max	Ullits	Conditions	Number
f <sub>MAX</sub>	Maximum Clock	0.90		40.0						
	Frequency	$1.10 \le V_{CC} \le 1.30$	50			50				
		$1.40 \leq V_{CC} \leq 1.60$	75			75		MHz	$C_L = 10 pF$	Figures
		$1.65 \leq V_{CC} \leq 1.95$	100			100		IVITIZ	$R_D=1\ M\Omega$	1, 5
		$2.30 \leq V_{CC} \leq 2.70$	125			125				
		$3.00 \leq V_{CC} \leq 3.60$	150			150				
t <sub>PLH</sub>	Propagation Delay	0.90		24.0						
t <sub>PHL</sub>	CK to Q, $\overline{Q}$	$1.10 \le V_{CC} \le 1.30$	4.0	15.0	22.0	3.5	31.0			
		$1.40 \le V_{CC} \le 1.60$	2.0	9.0	13.0	1.5	14.0		C <sub>L</sub> = 10 pF	Figures
		$1.65 \le V_{CC} \le 1.95$	1.5	7.0	11.0	1.0	13.0	ns	$R_D = 1 M\Omega$	1, 3
		$2.30 \le V_{CC} \le 2.70$	1.0	5.0	8.0	0.8	9.0			
		$3.00 \le V_{CC} \le 3.60$	1.0	4.0	7.0	0.5	8.0			
t <sub>PLH</sub>	Propagation Delay	0.90		6.5						
t <sub>PHL</sub>	$\overline{\text{CLR}}$ , $\overline{\text{PR}}$ , to Q, $\overline{\text{Q}}$	1.10 ≤ V <sub>CC</sub> ≤ 1.30	4.0	12.0	23.0	4.0	34.0			
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	2.0	9.0	12.0	2.0	14.0		C <sub>L</sub> = 10 pF	Figures
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	1.5	7.0	11.0	1.5	13.0	ns	$R_D = 1 M\Omega$	1, 3
		2.30 ≤ V <sub>CC</sub> ≤ 2.70	1.0	5.0	9.0	1.0	9.0		_	
		3.00 ≤ V <sub>CC</sub> ≤ 3.60	1.0	4.0	7.0	1.0	8.0			
t <sub>S</sub>	Setup Time,	0.90		10.0						1
	CK to D	1.10 ≤ V <sub>CC</sub> ≤ 1.30	7.0			7.0				
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	3.0			3.0			C <sub>L</sub> = 10 pF	Figures
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	2.0			2.0		ns	$R_D = 1 M\Omega$	1, 4
		$2.30 \le V_{CC} \le 2.70$	1.5			1.5				
		$3.00 \le V_{CC} \le 3.60$	1.0			1.0				
t <sub>H</sub>	Hold Time,	0.90		1.0						
	CK to D	1.10 ≤ V <sub>CC</sub> ≤ 1.30	0.5			0.5				
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	0.5			0.5			C <sub>L</sub> = 10 pF	Figures
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	0.5			0.5		ns	$R_D = 1 M\Omega$	1, 4
		$2.30 \le V_{CC} \le 2.70$	0.5			0.5				
		$3.00 \le V_{CC} \le 3.60$	0.5			0.5				
t <sub>W</sub>	Pulse Width,	0.90		5.0						
	CK, PR, CLR	$1.10 \le V_{CC} \le 1.30$	5.0			5.0				
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	3.0			3.0			$C_{L} = 10 \text{ pF}$	Figures
		$1.65 \le V_{CC} \le 1.95$	2.5			2.5		ns	$R_D = 1 M\Omega$	1, 5
		$2.30 \le V_{CC} \le 2.70$	2.5			2.5				
		$3.00 \le V_{CC} \le 3.60$	2.0			2.0				
t <sub>REC</sub>	Recover Time	0.90		12.0		1				
	CLR, PR to CK	1.10 ≤ V <sub>CC</sub> ≤ 1.30	8.5			8.5				
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	3.5			3.5			C <sub>L</sub> = 10 pF	Figures
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	3.0			3.0		ns	$R_D = 1 M\Omega$	1, 4
		2.30 ≤ V <sub>CC</sub> ≤ 2.70	2.5			2.5				
		3.00 ≤ V <sub>CC</sub> ≤ 3.60	2.0			2.0				

### AC Electrical Characteristics (15pF, $1M\Omega$ ) $T_A = +25^{\circ}C$ $T_A = -40^{\circ}C$ to $+85^{\circ}C$ $v_{cc}$ Figure Symbol Parameter Units Conditions Number Min Max (V) Max Тур Maximum Clock 0.90 $f_{MAX}$ Frequency 1.10 ≤ V<sub>CC</sub> ≤ 1.30 150 Figures 1, 5 $1.40 \leq V_{CC} \leq 1.60$ 75 200 $C_L = 15 pF$ MHz $1.65 \leq V_{CC} \leq 1.95$ 100 250 $R_D=1\ M\Omega$ $2.30 \leq V_{CC} \leq 2.70$ 125 175 $3.00 \leq V_{CC} \leq 3.60$ 150 200 Propagation Delay 0.90 27.0 $t_{PLH}$ $1.10 \le V_{CC} \le 1.30$ t<sub>PHL</sub> CK to Q, Q 5.0 16.0 23.0 4.5 34 0 $1.40 \leq V_{CC} \leq 1.60$ $C_L = 15 pF$ 3.0 10.0 2.5 16.0 14.0 Figures $1.65 \le V_{CC} \le 1.95$ 2.0 7.0 11.0 2.0 13.0 $R_D = 1 \ M\Omega$ $2.30 \le V_{CC} \le 2.70$ 1.5 $3.00 \le V_{CC} \le 3.60$ 1.0 4.0 7.0 0.5 8.0 Propagation Delay 0.90 $t_{PLH}$ 27.0 CLR, PR, to Q, Q $t_{\mathsf{PHL}}$ $1.10 \leq V_{CC} \leq 1.30$ 5.0 15.0 24.0 5.0 37.0 $1.40 \leq V_{CC} \leq 1.60$ 10.0 13.0 3.0 16.0 $C_L = 15 \text{ pF}$ 3.0 Figures $1.65 \le V_{CC} \le 1.95$ 2.0 13.0 $R_D = 1 M\Omega$ $2.30 \leq V_{CC} \leq 2.70$ 1.5 5.0 9.0 1.5 9.0 $3.00 \leq V_{CC} \leq 3.60$ 1.0 4.0 1.0 8.0 7.0 0.90 Setup Time, $t_{\rm S}$ $1.10 \le V_{CC} \le 1.30$ 7.0 7.0 $1.40 \le V_{CC} \le 1.60$ 3.0 $C_L = 15 pF$ Figures 1, 4 $1.65 \leq V_{CC} \leq 1.95$ 2.0 2.0 $R_D=1\ M\Omega$ $2.30 \leq V_{CC} \leq 2.70$ 1.5 1.5 $3.00 \leq V_{CC} \leq 3.60$ 1.0 1.0 0.90 $t_{\mathsf{H}}$ CK to D $1.10 \le V_{CC} \le 1.30$ 0.5 $1.40 \le V_{CC} \le 1.60$ 0.5 0.5 $C_L = 15 pF$ Figures 1, 4 $1.65 \leq V_{CC} \leq 1.95$ 0.5 0.5 $R_D = 1 M\Omega$ $2.30 \leq V_{CC} \leq 2.70$ 0.5 0.5 $3.00 \leq V_{CC} \leq 3.60$ 0.5 t<sub>W</sub> Pulse Width, 0.90 5.0 CK, PR, CLR $1.10 \leq V_{CC} \leq 1.30$ 5.0 5.0 $1.40 \leq V_{CC} \leq 1.60$ 3.0 3.0 $C_L = 15 pF$ Figures $1.65 \leq V_{CC} \leq 1.95$ 2.5 2.5 $R_D=1\ M\Omega$ $2.30 \leq V_{CC} \leq 2.70$ 2.5 $3.00 \le V_{CC} \le 3.60$ 2.0 Recover Time 0.90 12.0 $t_{REC}$ CLR, PR to CK $1.10 \le V_{CC} \le 1.30$ 8.5 8.5 C<sub>L</sub> = 15 pF $1.40 \le V_{CC} \le 1.60$ 3.5 3.5 Figures 1, 4 $1.65 \leq V_{CC} \leq 1.95$ 3.0 3.0 $R_D = 1 M\Omega$ $2.30 \leq V_{CC} \leq 2.70$ 2.5 2.5 $3.00 \leq V_{CC} \leq 3.60$ 2.0 2.0

Symbol	Parameter	V <sub>CC</sub>		$T_A = +25^{\circ}C$	;	$T_A = -40^{\circ}$	C to +85°C	Units	Conditions	Figure
Syllibol	Farameter	(V)	Min	Тур	Max	Min	Max	Ullits	Conditions	Number
f <sub>MAX</sub>	Maximum Clock	0.90		40.0						
	Frequency	$1.10 \le V_{CC} \le 1.30$	50			150				
		$1.40 \le V_{CC} \le 1.60$	75			200		MHz	$C_L = 30 pF$	Figures
		$1.65 \leq V_{CC} \leq 1.95$	100			250		IVITZ	$R_D = 1 \ M\Omega$	1, 5
		$2.30 \leq V_{CC} \leq 2.70$	125			175				
		$3.00 \leq V_{CC} \leq 3.60$	150			200				
t <sub>PLH</sub>	Propagation Delay	0.90		34.0						
t <sub>PHL</sub>	CK to Q, Q	$1.10 \le V_{CC} \le 1.30$	6.0	18.0	27.0	5.0	43.0			
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	4.0	11.0	17.0	3.0	18.0		$C_{L} = 30 \text{ pF}$	Figures
		$1.65 \le V_{CC} \le 1.95$	2.0	8.0	13.0	2.0	15.0	ns	$R_D = 1 M\Omega$	1, 3
		$2.30 \le V_{CC} \le 2.70$	1.0	6.0	10.0	1.0	11.0			
		$3.00 \le V_{CC} \le 3.60$	0.8	5.0	8.0	0.5	10.0			
t <sub>PLH</sub>	Propagation Delay	0.90		34.0						
t <sub>PHL</sub>	$\overline{\text{CLR}}$ , $\overline{\text{PR}}$ , to Q, $\overline{\text{Q}}$	1.10 ≤ V <sub>CC</sub> ≤ 1.30	6.0	17.0	28.0	5.5	46.0			
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	4.0	11.0	16.0	3.5	18.0		C <sub>L</sub> = 30 pF	Figures
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	2.0	8.0	13.0	2.5	15.0	ns	$R_D = 1 M\Omega$	1, 3
		2.30 ≤ V <sub>CC</sub> ≤ 2.70	1.0	6.0	9.0	1.5	11.0			
		3.00 ≤ V <sub>CC</sub> ≤ 3.60	0.8	5.0	8.0	1.0	10.0			
t <sub>S</sub>	Setup Time,	0.90		10.0						
	CK to D	1.10 ≤ V <sub>CC</sub> ≤ 1.30	7.0			7.0				
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	3.0			3.0			C <sub>L</sub> = 30 pF	Figures
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	2.0			2.0		ns	$R_D = 1 M\Omega$	1, 4
		$2.30 \le V_{CC} \le 2.70$	1.5			1.5				
		3.00 ≤ V <sub>CC</sub> ≤ 3.60	1.0			1.0				
t <sub>H</sub>	Hold Time,	0.90		1.0						
	CK to D	$1.10 \le V_{CC} \le 1.30$	0.5			0.5				
		$1.40 \le V_{CC} \le 1.60$	0.5			0.5			$C_{L} = 30 \text{ pF}$	Figures
		$1.65 \le V_{CC} \le 1.95$	0.5			0.5		ns	$R_D = 1 M\Omega$	1, 4
		$2.30 \le V_{CC} \le 2.70$	0.5			0.5				
		$3.00 \leq V_{CC} \leq 3.60$	0.5			0.5				
t <sub>W</sub>	Pulse Width,	0.90		5.0						
	CK, PR, CLR	$1.10 \le V_{CC} \le 1.30$	5.0			4.0				
		$1.40 \le V_{CC} \le 1.60$	3.0			3.0		ns	$C_L = 30 pF$	Figures
		$1.65 \le V_{CC} \le 1.95$	2.5			2.0			$R_D = 1 M\Omega$	1, 5
		$2.30 \le V_{CC} \le 2.70$	2.5			3.0				
		$3.00 \le V_{CC} \le 3.60$	2.0			2.0				
t <sub>REC</sub>	Recover Time	0.90		12.0		1				
	CLR, PR to CK	$1.10 \le V_{CC} \le 1.30$	8.5			8.5				
		1.40 ≤ V <sub>CC</sub> ≤ 1.60	3.5			3.5		_	C <sub>L</sub> = 30 pF	Figures
		1.65 ≤ V <sub>CC</sub> ≤ 1.95	3.0			3.0		ns $R_D = 1 M\Omega$		1, 4
		2.30 ≤ V <sub>CC</sub> ≤ 2.70	2.5			2.5				
		3.00 ≤ V <sub>CC</sub> ≤ 3.60	2.0			2.0				

# Capacitance

Symbol	Parameter	Тур	Max	Units	Conditions	Figure Number
C <sub>IN</sub>	Input Capacitance	2.0		pF	V <sub>CC</sub> = 0V	
C <sub>OUT</sub>	Output Capacitance	4.0		pF	$V_{CC} = 0V$	
C <sub>PD</sub>	Power Dissipation Capacitance	8.0		n-	$V_I = 0V \text{ or } V_{CC}$ f = 10  MHz	Figure 2

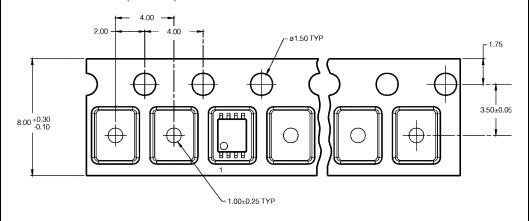
# **AC Loading and Waveforms** Q Output CP Input = AC Waveform; $t_r = t_f = 2.5 \text{ ns}$ ; C<sub>L</sub> includes load and stray capacitance CP Input PRR = 10 MHz; Duty Cycle = 50% Input PRR = 1.0 MHz; $t_w = 500 \text{ ns}$ D Input PRR = 5MHz; Duty Cycle = 50% FIGURE 1. AC Test Circuit FIGURE 2. $I_{CCD}$ Test Circuit $t_{\Gamma}$ = 2.5 ns · V<sub>CC</sub> CP Input GND 90% D Input GND $V_{OH}$ Q Output · V<sub>OL</sub> FIGURE 3. AC Waveforms t<sub>f</sub>= t<sub>r</sub> < 2.5ns V<sub>CC</sub> $V_{CC}$ CK Input 50% CKInput 50% 10% 10% GNE GND ts $\nu_{CC}$ Data Input Data Input - GNE • GND FIGURE 4. AC Waveforms FIGURE 5. AC Waveforms

# **Tape and Reel Specification**

TAPE FORMAT for US8

Package	Tape	Number	Cavity	Cover Tape	
Designator	Section	Cavities	Status	Status	
	Leader (Start End)	125 (typ)	Empty	Sealed	
K8X	Carrier	3000	Filled	Sealed	
	Trailer (Hub End)	75 (typ)	Empty	Sealed	

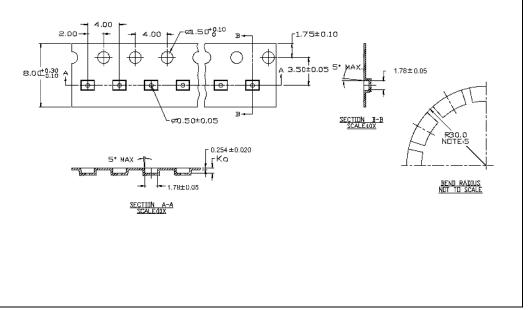
### TAPE DIMENSIONS inches (millimeters)



### TAPE FORMAT for MicroPak

Package	Tape	Number	Cavity	Cover Tape
Designator	Section	Cavities	Status	Status
	Leader (Start End)	125 (typ)	Empty	Sealed
L8X	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed

### TAPE DIMENSIONS inches (millimeters)



### Tape and Reel Specification (Continued) REEL DIMENSIONS inches (millimeters) TAPE SLOT DETAIL X SCALE: 3X DETAIL X Tape Size В С D N W1 W2 W3 7.0 0.059 0.512 0.795 2.165 0.331 + 0.059/-0.000 0.567 W1 + 0.078/-0.039 8 mm (177.8)

(1.50)

(13.00)

(20.20)

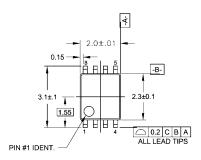
(55.00)

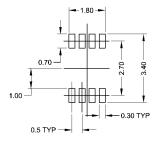
(8.40 + 1.50/-0.00)

(W1 + 2.00/-1.00)

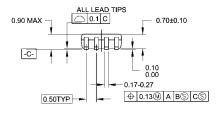
(14.40)

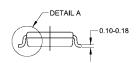
## Physical Dimensions inches (millimeters) unless otherwise noted

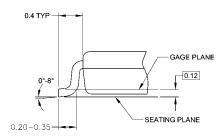




### LAND PATTERN RECOMMENDATION







### NOTES:

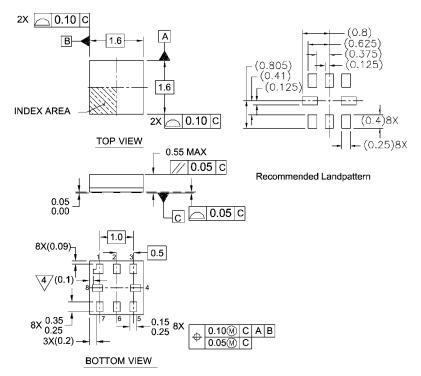
- CONFORMS TO JEDEC REGISTRATION MO-187
   B. DIMENSIONS ARE IN MILLIMETERS.
   C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
   D. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.

**DETAIL A** 

### MAB08AREVC

8-Lead US8, JEDEC MO-187, Variation CA 3.1mm Wide Package Number MAB08A

### Physical Dimensions inches (millimeters) unless otherwise noted (Continued)



### Notes:

- 1. PACKAGE CONFORMS TO JEDEC MO-255 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y.14M-1994

4/PIN 1 FLAG, END OF PACKAGE OFFSET.

MAC08AREVC

Pb-Free 8-Lead MicroPak, 1.6 mm Wide Package Number MAC08A

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