



**THE DATASHEET OF  
74ACT74MTCX**



# 74AC74, 74ACT74

## Dual D-Type Positive Edge-Triggered Flip-Flop

### Features

- $I_{CC}$  reduced by 50%
- Output source/sink 24mA
- ACT74 has TTL-compatible inputs

### General Description

The AC/ACT74 is a dual D-type flip-flop with Asynchronous Clear and Set inputs and complementary (Q,  $\bar{Q}$ ) outputs. Information at the input is transferred to the outputs on the positive edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. After the Clock Pulse input threshold voltage has been passed, the Data input is locked out and information present will not be transferred to the outputs until the next rising edge of the Clock Pulse input.


Asynchronous Inputs:

- LOW input to  $\bar{S}_D$  (Set) sets Q to HIGH level
- LOW input to  $\bar{C}_D$  (Clear) sets Q to LOW level
- Clear and Set are independent of clock
- Simultaneous LOW on  $\bar{C}_D$  and  $\bar{S}_D$  makes both Q and  $\bar{Q}$  HIGH

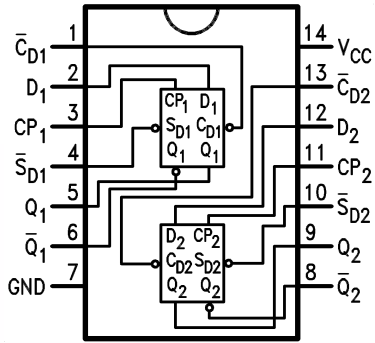
### Ordering Information

Order Number	Package Number	Package Description
74AC74SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74AC74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC74PC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT74SC	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74ACT74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT74PC	N14A	14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

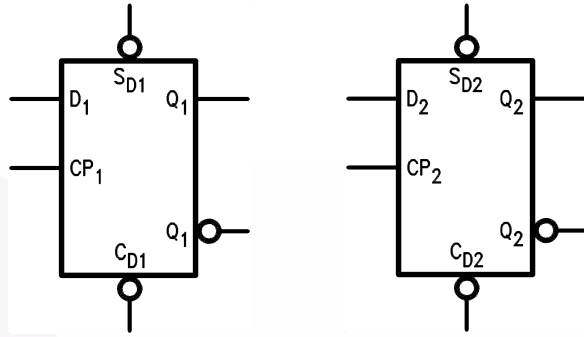
Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.

 All packages are lead free per JEDEC: J-STD-020B standard.

### Connection Diagram



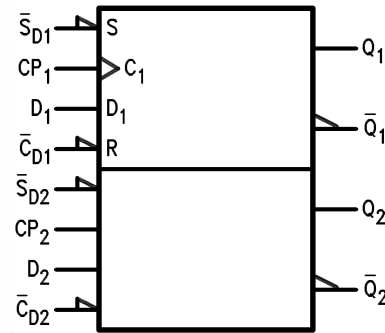
### Logic Symbols



### Pin Descriptions

Pin Names	Description
$D_1, D_2$	Data Inputs
$CP_1, CP_2$	Clock Pulse Inputs
$\bar{C}_{D1}, \bar{C}_{D2}$	Direct Clear Inputs
$\bar{S}_{D1}, \bar{S}_{D2}$	Direct Set Inputs
$Q_1, \bar{Q}_1, Q_2, \bar{Q}_2$	Outputs

### IEEE/IEC



### Truth Table

(Each Half)

Inputs				Outputs	
$\bar{S}_D$	$\bar{C}_D$	CP	D	Q	$\bar{Q}$
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H	H
H	H	↗	H	H	L
H	H	↗	L	L	H
H	H	L	X	$Q_0$	$\bar{Q}_0$

H = HIGH Voltage Level

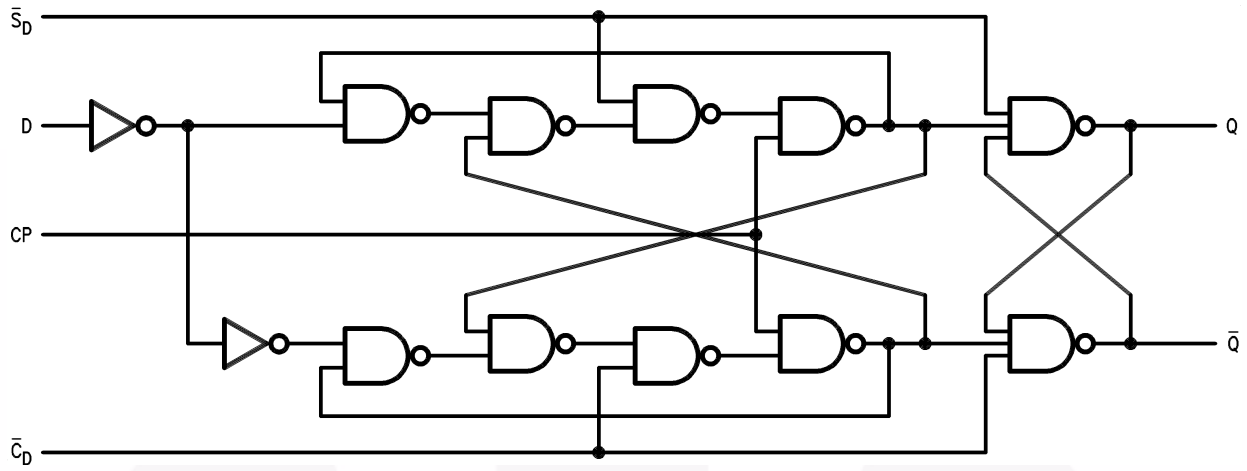
L = LOW Voltage Level

X = Immaterial

↗ = LOW-to-HIGH Clock Transition

$Q_0 (\bar{Q}_0)$  = Previous Q ( $\bar{Q}$ ) before LOW-to-HIGH Transition of Clock

**Logic Diagram**



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage	-0.5V to +7.0V
$I_{IK}$	DC Input Diode Current $V_I = -0.5V$	-20mA
	$V_I = V_{CC} + 0.5$	+20mA
$V_I$	DC Input Voltage	-0.5V to $V_{CC} + 0.5V$
$I_{OK}$	DC Output Diode Current $V_O = -0.5V$	-20mA
	$V_O = V_{CC} + 0.5V$	+20mA
$V_O$	DC Output Voltage	-0.5V to $V_{CC} + 0.5V$
$I_O$	DC Output Source or Sink Current	$\pm 50mA$
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current per Output Pin	$\pm 50mA$
$T_{STG}$	Storage Temperature	-65°C to +150°C
$T_J$	Junction Temperature	140°C

## Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
$V_{CC}$	Supply Voltage AC	2.0V to 6.0V
	ACT	4.5V to 5.5V
$V_I$	Input Voltage	0V to $V_{CC}$
$V_O$	Output Voltage	0V to $V_{CC}$
$T_A$	Operating Temperature	-40°C to +85°C
$\Delta V / \Delta t$	Minimum Input Edge Rate, AC Devices: $V_{IN}$ from 30% to 70% of $V_{CC}$ , $V_{CC}$ @ 3.3V, 4.5V, 5.5V	125mV/ns
$\Delta V / \Delta t$	Minimum Input Edge Rate, ACT Devices: $V_{IN}$ from 0.8V to 2.0V, $V_{CC}$ @ 4.5V, 5.5V	125mV/ns

## DC Electrical Characteristics for AC

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		Units	
				Typ.	Guaranteed Limits				
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	3.0	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	1.5	2.1	2.1		V	
		4.5		2.25	3.15				
		5.5		2.75	3.85				
V <sub>IL</sub>	Maximum LOW Level Input Voltage	3.0	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	1.5	0.9	0.9		V	
		4.5		2.25	1.35				
		5.5		2.75	1.65				
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	3.0	I <sub>OUT</sub> = -50μA	2.99	2.9	2.9		V	
		4.5		4.49	4.4				
		5.5		5.49	5.4				
		3.0	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -12mA		2.56	2.46			
		4.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA		3.86	3.76		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>(1)</sup>		4.86	4.76		
V <sub>OL</sub>	Maximum LOW Level Output Voltage	3.0	I <sub>OUT</sub> = 50μA	0.002	0.1	0.1		V	
		4.5		0.001	0.1				
		5.5		0.001	0.1				
		3.0	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 12mA		0.36	0.44			
		4.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA		0.36	0.44		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>(1)</sup>		0.36	0.44		
I <sub>IN</sub> <sup>(3)</sup>	Maximum Input Leakage Current	5.5	V <sub>I</sub> = V <sub>CC</sub> , GND		±0.1	±1.0		μA	
I <sub>OLD</sub>	Minimum Dynamic Output Current <sup>(2)</sup>	5.5	V <sub>OLD</sub> = 1.65V Max.			75		mA	
I <sub>OHD</sub>		5.5	V <sub>OHD</sub> = 3.85V Min.			-75		mA	
I <sub>CC</sub> <sup>(3)</sup>	Maximum Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND		2.0	20.0		μA	

**Notes:**

- All outputs loaded; thresholds on input associated with output under test.
- Maximum test duration 2.0ms, one output loaded at a time.
- I<sub>IN</sub> and I<sub>CC</sub> @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V<sub>CC</sub>.

## DC Electrical Characteristics for ACT

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C		Units
				Typ.	Guaranteed Limits			
V <sub>IH</sub>	Minimum HIGH Level Input Voltage	4.5	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	1.5	2.0	2.0		V
		5.5		1.5	2.0	2.0		
V <sub>IL</sub>	Maximum LOW Level Input Voltage	4.5	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	1.5	0.8	0.8		V
		5.5		1.5	0.8	0.8		
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	4.5	I <sub>OUT</sub> = -50μA	4.49	4.4	4.4		V
		5.5		5.49	5.4	5.4		
		4.5	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA		3.86	3.76		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OH</sub> = -24mA <sup>(4)</sup>		4.86	4.76	
V <sub>OL</sub>	Maximum LOW Level Output Voltage	4.5	I <sub>OUT</sub> = 50μA	0.001	0.1	0.1		V
		5.5		0.001	0.1	0.1		
		4.5	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA		0.36	0.44		
		5.5		V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> , I <sub>OL</sub> = 24mA <sup>(4)</sup>		0.36	0.44	
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	V <sub>I</sub> = V <sub>CC</sub> , GND		±0.1	±1.0		μA
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5	V <sub>I</sub> = V <sub>CC</sub> - 2.1V	0.6		1.5		mA
I <sub>OLD</sub>	Minimum Dynamic Output Current <sup>(5)</sup>	5.5	V <sub>OLD</sub> = 1.65V Max.			75		mA
		5.5	V <sub>OHD</sub> = 3.85V Min.			-75		mA
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND		2.0	20.0		μA

**Notes:**

4. All outputs loaded; thresholds on input associated with output under test.

## AC Electrical Characteristics for AC

Symbol	Parameter	$V_{CC}$ (V) <sup>(6)</sup>	$T_A = +25^\circ\text{C}$ , $C_L = 50\text{pF}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$ , $C_L = 50\text{pF}$		Units
			Min.	Typ.	Max.	Min.	Max.	
$f_{MAX}$	Maximum Clock Frequency	3.3	100	125		95		MHz
		5.0	140	160		125		
$t_{PLH}$	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to $Q_n$ or $\overline{Q}_n$	3.3	3.5	8.0	12.0	2.5	13.0	ns
		5.0	2.5	6.0	9.0	2.0	10.0	
$t_{PHL}$	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to $Q_n$ or $\overline{Q}_n$	3.3	4.0	10.5	12.0	3.5	13.5	ns
		5.0	3.0	8.0	9.5	2.5	10.5	
$t_{PLH}$	Propagation Delay, $CP_n$ to $Q_n$ or $\overline{Q}_n$	3.3	4.5	8.0	13.5	4.0	16.0	ns
		5.0	3.5	6.0	10.0	3.0	10.5	
$t_{PHL}$	Propagation Delay, $CP_n$ to $Q_n$ or $\overline{Q}_n$	3.3	3.5	8.0	14.0	3.5	14.5	ns
		5.0	2.5	6.0	10.0	2.5	10.5	

**Note:**

5. Voltage range 3.3 is  $3.3\text{V} \pm 0.3\text{V}$ . Voltage range 5.0 is  $5.0\text{V} \pm 0.5\text{V}$ .

## AC Operating Requirements for AC

Symbol	Parameter	$V_{CC}$ (V) <sup>(7)</sup>	$T_A = +25^\circ\text{C}$ , $C_L = 50\text{pF}$		$T_A = -40^\circ\text{C to } +85^\circ\text{C}$ , $C_L = 50\text{pF}$		Units
			Typ.	Guaranteed Minimum			
$t_S$	Set-up Time, HIGH or LOW, $D_n$ to $CP_n$	3.3	1.5	4.0	4.5		ns
		5.0	1.0	3.0	3.0		
$t_H$	Hold Time, HIGH or LOW, $D_n$ to $CP_n$	3.3	-2.0	0.5	0.5		ns
		5.0	-1.5	0.5	0.5		
$t_W$	$CP_n$ or $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ Pulse Width	3.3	3.0	5.5	7.0		ns
		5.0	2.5	4.5	5.0		
$t_{rec}$	Recovery Time, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to CP	3.3	-2.5	0	0		ns
		5.0	-2.0	0	0		

**Note:**

6. Voltage range 3.3 is  $3.3\text{V} \pm 0.3\text{V}$ . Voltage range 5.0 is  $5.0\text{V} \pm 0.5\text{V}$ .

## AC Electrical Characteristics for ACT

Symbol	Parameter	V <sub>CC</sub> (V) <sup>(8)</sup>	T <sub>A</sub> = +25°C, C <sub>L</sub> = 50pF			T <sub>A</sub> = -40°C to +85°C, C <sub>L</sub> = 50pF		Units
			Min.	Typ.	Max.	Min.	Max.	
f <sub>MAX</sub>	Maximum Clock Frequency	5.0	145	210		125		MHz
t <sub>PLH</sub>	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q <sub>n</sub> or $\overline{Q}_n$	5.0	3.0	5.5	9.5	2.5	10.5	ns
t <sub>PHL</sub>	Propagation Delay, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to Q <sub>n</sub> or $\overline{Q}_n$	5.0	3.0	6.0	10.0	3.0	11.5	ns
t <sub>PLH</sub>	Propagation Delay, CP <sub>n</sub> to Q <sub>n</sub> or $\overline{Q}_n$	5.0	4.0	7.5	11.0	4.0	13.0	ns
t <sub>PHL</sub>	Propagation Delay, CP <sub>n</sub> to Q <sub>n</sub> or $\overline{Q}_n$	5.0	3.5	6.0	10.0	3.0	11.5	ns

**Note:**

7. Voltage range 5.0 is 5.0V ± 0.5V.

## AC Operating Requirements for ACT

Symbol	Parameter	V <sub>CC</sub> (V) <sup>(9)</sup>	T <sub>A</sub> = +25°C, C <sub>L</sub> = 50pF		T <sub>A</sub> = -40°C to +85°C, C <sub>L</sub> = 50pF		Units
			Typ.	Guaranteed Minimum			
t <sub>S</sub>	Set-up Time, HIGH or LOW, D <sub>n</sub> to CP <sub>n</sub>	5.0	1.0	3.0	3.5		ns
t <sub>H</sub>	Hold Time, HIGH or LOW, D <sub>n</sub> to CP <sub>n</sub>	5.0	-0.5	1.0	1.0		ns
t <sub>W</sub>	CP <sub>n</sub> or $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ Pulse Width	5.0	3.0	5.0	6.0		ns
t <sub>rec</sub>	Recovery Time, $\overline{C}_{Dn}$ or $\overline{S}_{Dn}$ to CP	5.0	-2.5	0	0		ns

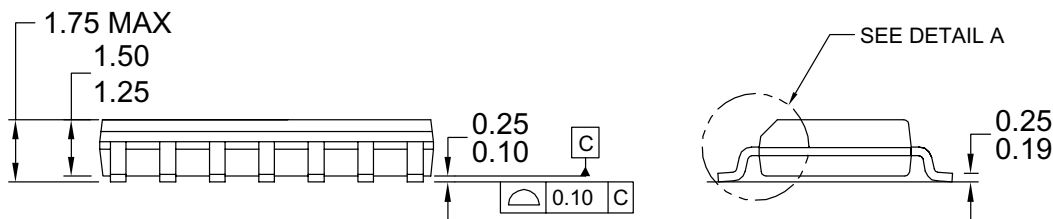
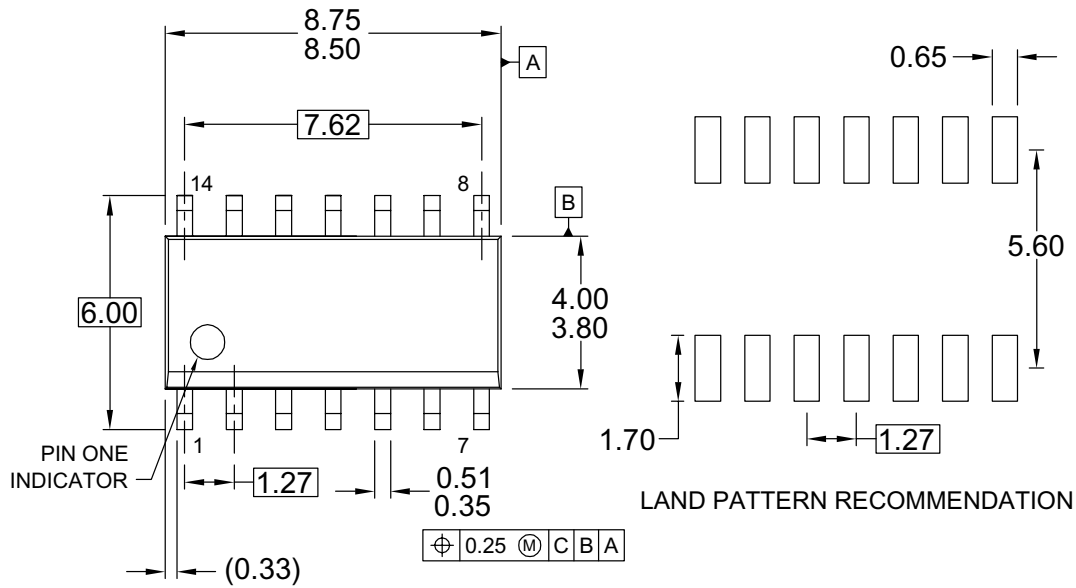
**Note:**

8. Voltage range 5.0 is 5.0V ± 0.5V.

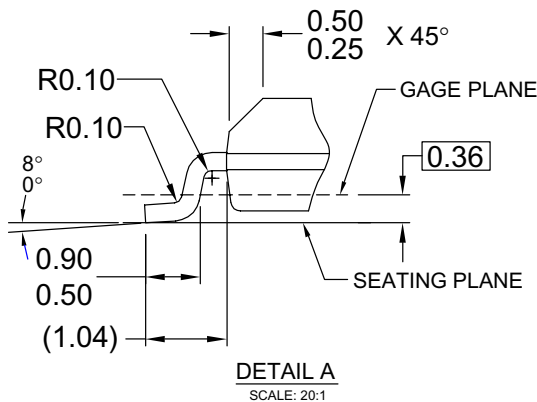
## Capacitance

Symbol	Parameter	Conditions	Typ.	Units
C <sub>IN</sub>	Input Capacitance	V <sub>CC</sub> = OPEN	4.5	pF
C <sub>PD</sub>	Power Dissipation Capacitance	V <sub>CC</sub> = 5.0V	35.0	pF

### Physical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED



- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C,
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X145-14M
- E) DRAWING CONFORMS TO ASME Y14.5M-1994
- F) DRAWING FILE NAME: M14AREV13

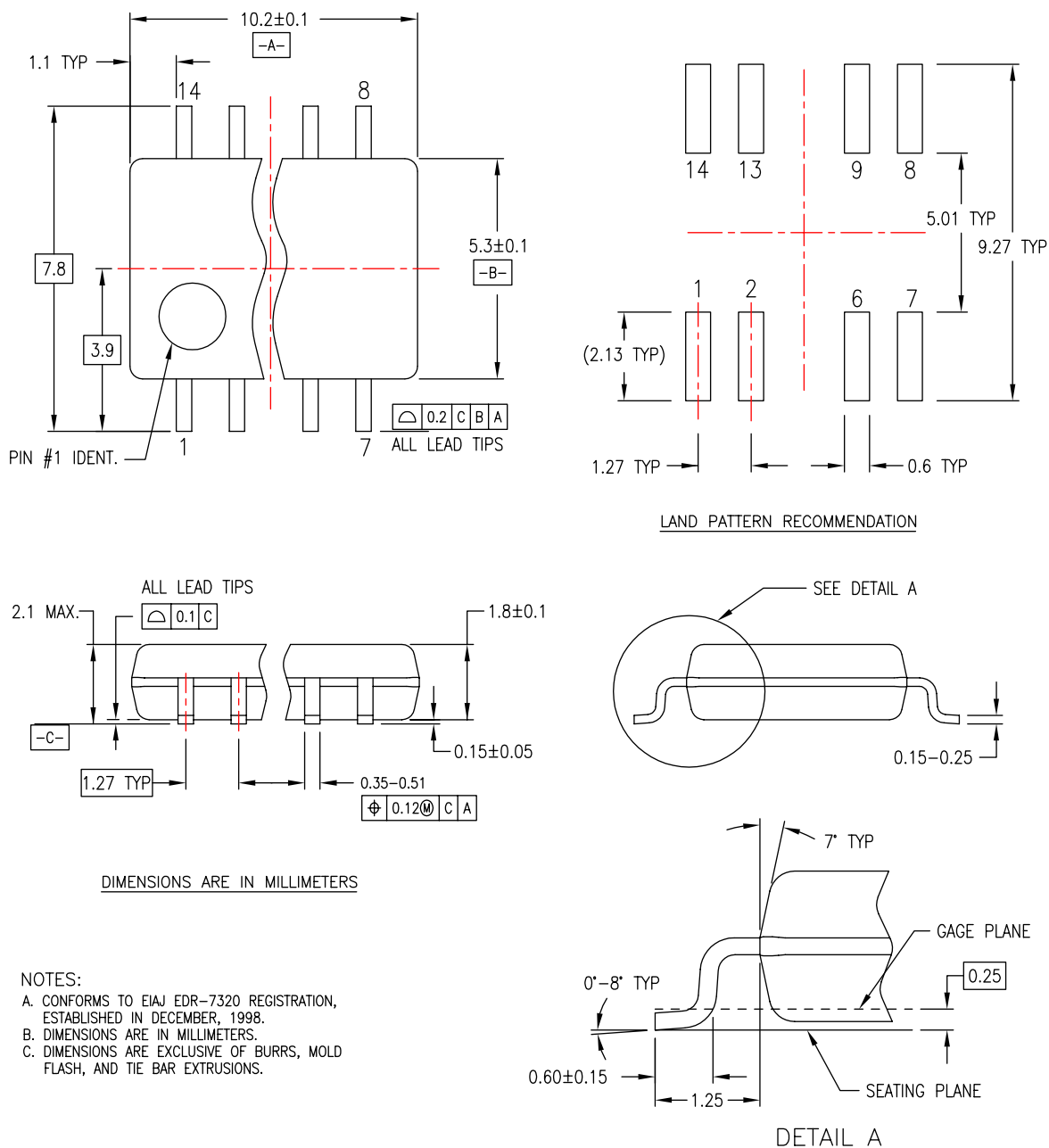
**Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow**

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**Physical Dimensions (Continued)**



M14DREVC

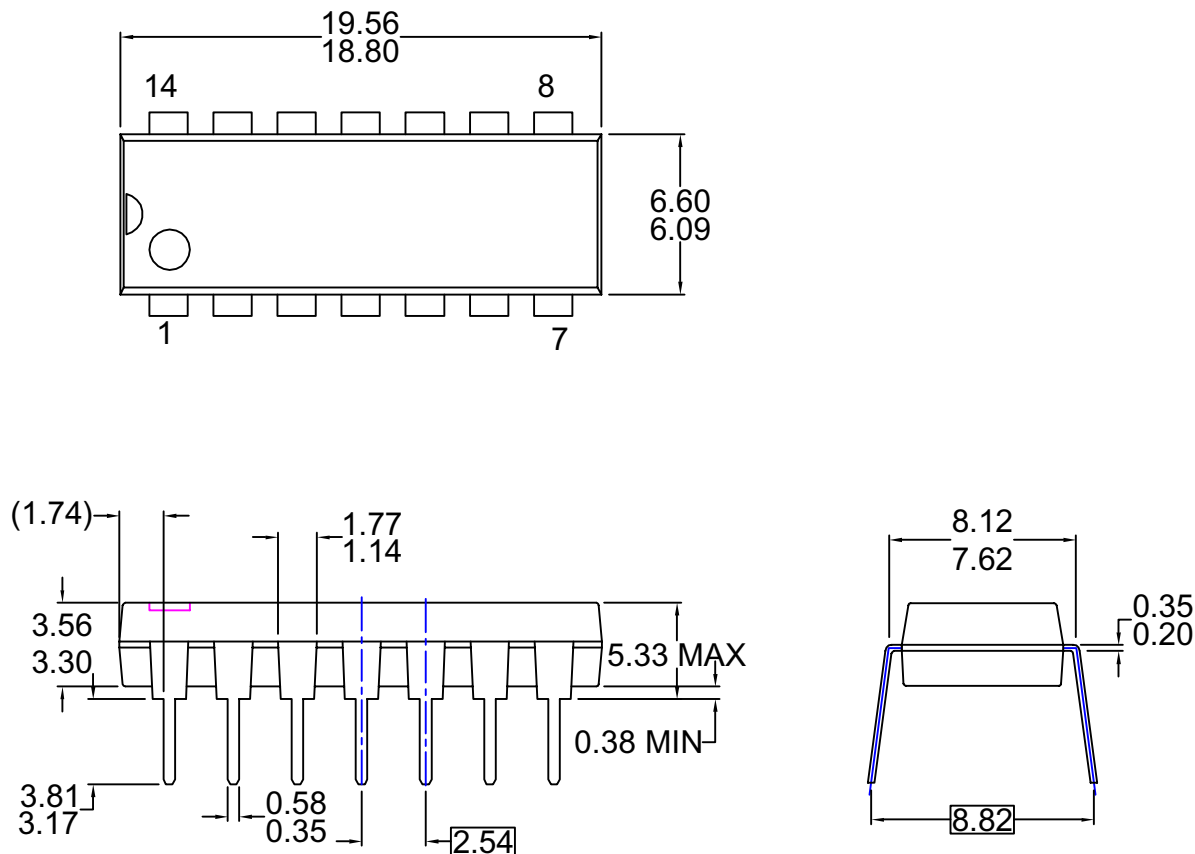
**Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide**

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**Physical Dimensions** (Continued)

- NOTES: UNLESS OTHERWISE SPECIFIED**
- THIS PACKAGE CONFORMS TO
  - A) JEDEC MS-001 VARIATION BA
  - B) ALL DIMENSIONS ARE IN MILLIMETERS.
  - C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
  - D) DIMENSIONS AND TOLERANCES PER ASME Y14.5-1994
  - E) DRAWING FILE NAME: MKT-N14AREV7

**Figure 4. 14-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide**

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| ACEx <sup>®</sup>   | FPST <sup>™</sup>                            | PDP-SPM <sup>™</sup>                   | SyncFET <sup>™</sup>             |
| Build it Now <sup>™</sup>   | FRFET <sup>®</sup>                           | Power220 <sup>®</sup>                  | SYSTEM GENERAL <sup>®</sup>      |
| CorePLUS <sup>™</sup>   | Global Power Resource <sup>SM</sup>          | Power247 <sup>®</sup>                  | The Power Franchise <sup>®</sup> |
| CROSSVOLT <sup>™</sup>  | Green FPS <sup>™</sup>                       | POWEREDGE <sup>®</sup>                 | the power <sup>™</sup>           |
| CTL <sup>™</sup>  | Green FPS <sup>™</sup> e-Series <sup>™</sup> | Power-SPM <sup>™</sup>                 | franchise                        |
| Current Transfer Logic <sup>™</sup>   | GTO <sup>™</sup>                             | PowerTrench <sup>®</sup>               | TinyBoost <sup>™</sup>           |
| EcoSPARK <sup>®</sup>   | i-Lo <sup>™</sup>                            | Programmable Active Droop <sup>™</sup> | TinyBuck <sup>™</sup>            |
| EZSWITCH <sup>™</sup> *   | IntelliMAX <sup>™</sup>                      | QFET <sup>®</sup>                      | TinyLogic <sup>®</sup>           |
|  ™ | ISOPLANAR <sup>™</sup>                       | QST <sup>™</sup>                       | TINYOPTO <sup>™</sup>            |
|  ™ | MegaBuck <sup>™</sup>                        | QT Optoelectronics <sup>™</sup>        | TinyPower <sup>™</sup>           |
| Fairchild <sup>®</sup>  | MICROCOUPLER <sup>™</sup>                    | Quiet Series <sup>™</sup>              | TinyPWM <sup>™</sup>             |
| Fairchild Semiconductor <sup>®</sup>  | MicroFET <sup>™</sup>                        | RapidConfigure <sup>™</sup>            | TinyWire <sup>™</sup>            |
| FACT Quiet Series <sup>™</sup>  | MicroPak <sup>™</sup>                        | SMART START <sup>™</sup>               | μSerDes <sup>™</sup>             |
| FACT <sup>®</sup>   | MillerDrive <sup>™</sup>                     | SPM <sup>®</sup>                       | UHC <sup>®</sup>                 |
| FAST <sup>®</sup>   | Motion-SPM <sup>™</sup>                      | STEALTH <sup>™</sup>                   | Ultra FRFET <sup>™</sup>         |
| FastvCore <sup>™</sup>  | OPTOLOGIC <sup>®</sup>                       | SuperFET <sup>™</sup>                  | UniFET <sup>™</sup>              |
| FlashWriter <sup>®</sup> *  | OPTOPLANAR <sup>®</sup>                      | SuperSOT <sup>™</sup> -3               | VCX <sup>™</sup>                 |
|   |  | SuperSOT <sup>™</sup> -6               |                                  |
|   |  | SuperSOT <sup>™</sup> -8               |                                  |

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