

# 74VHCT74A

## Dual D-Type Flip-Flop with Preset and Clear

### Features

- High speed:  $f_{MAX} = 160\text{MHz}$  (Typ.) at  $T_A = 25^\circ\text{C}$
- High noise immunity:  $V_{IH} = 2.0\text{V}$ ,  $V_{IL} = 0.8\text{V}$
- Power down protection is provided on all inputs and outputs
- Low power dissipation:  $I_{CC} = 2\mu\text{A}$  (Max.) at  $T_A = 25^\circ\text{C}$
- Pin and function compatible with 74HCT74

### General Description

The VHCT74A is an advanced high speed CMOS Dual D-Type Flip-Flop fabricated with silicon gate CMOS technology. It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation. The signal level applied to the D INPUT is transferred to the Q OUTPUT during the positive going transition of the CK pulse. CLR and PR are independent of the CK and are accomplished by setting the appropriate input LOW.

Protection circuits ensure that 0V to 7V can be applied to the input pins without regard to the supply voltage and to the output pins with  $V_{CC} = 0\text{V}$ . These circuits prevent device destruction due to mismatched supply and input/output voltages. This device can be used to interface 3V to 5V systems and two supply systems such as battery backup.

### Ordering Information

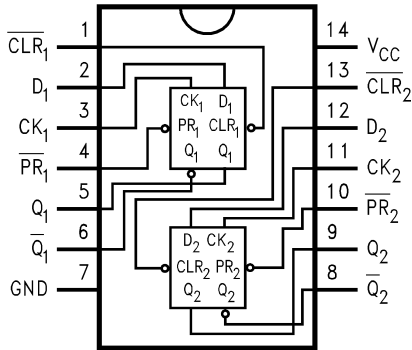
Order Number	Package Number	Package Description
74VHCT74AM	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHCT74AMX_NL <sup>(1)</sup>	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
74VHCT74ASJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74VHCT74AMTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74VHCT74AMTCX_NL <sup>(1)</sup>	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Surface mount packages are also available on Tape and Reel. Specify by appending the suffix letter "X" to the ordering number. Pb-Free package per JEDEC J-STD-020B.

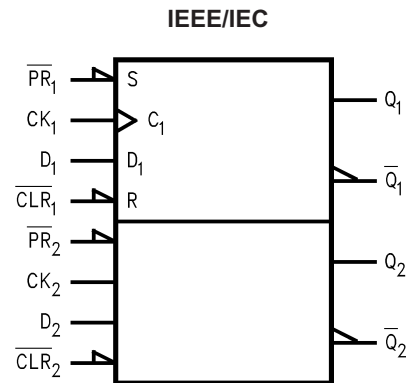
#### Note:

1. Device available in Tape and Reel only.

### Connection Diagram



### Logic Symbol



### Pin Description

Pin Names	Description
D <sub>1</sub> , D <sub>2</sub>	Data Inputs
CK <sub>1</sub> , CK <sub>2</sub>	Clock Pulse Inputs
$\overline{\text{CLR}}_1$ , $\overline{\text{CLR}}_2$	Direct Clear Inputs
$\overline{\text{PR}}_1$ , $\overline{\text{PR}}_2$	Direct Preset Inputs
Q <sub>1</sub> , $\overline{\text{Q}}_1$ , Q <sub>2</sub> , $\overline{\text{Q}}_2$	Outputs

### Truth Table

Inputs				Outputs		Function
CLR	$\overline{\text{PR}}$	D	CK	Q	$\overline{\text{Q}}$	
L	H	X	X	L	H	Clear
H	L	X	X	H	L	Preset
L	L	X	X	H	H	
H	H	L	↗	L	H	
H	H	H	↘	H	L	
H	H	X	↔	Q <sub>n</sub>	$\overline{\text{Q}}_n$	No Change

## 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
$V_{IN}$	DC Input Voltage	-0.5V to +7.0V
$V_{OUT}$	DC Output Voltage Note 2 Note 3	-0.5V to $V_{CC} + 0.5V$ -0.5V to 7.0V
$I_{IK}$	Input Diode Current	-20mA
$I_{OK}$	Output Diode Current <sup>(4)</sup>	±20mA
$I_{OUT}$	DC Output Current	±25mA
$I_{CC}$	DC $V_{CC}$ / GND Current	±50mA
$T_{STG}$	Storage Temperature	-65°C to +150°C
$T_L$	Lead Temperature (Soldering, 10 seconds)	260°C

## Recommended Operating Conditions<sup>(5)</sup>

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	4.5V to +5.5V
$V_{IN}$	Input Voltage	0V to +5.5V
$V_{OUT}$	Output Voltage Note 2 Note 3	0V to $V_{CC}$ 0V to 5.5V
$T_{OPR}$	Operating Temperature	-40°C to +85°C
$t_r, t_f$	Input Rise and Fall Time $V_{CC} = 5.0V \pm 0.5V$	0ns/V ~ 20ns/V

### Notes:

- HIGH or LOW state.  $I_{OUT}$  absolute maximum rating must be observed.
- $V_{CC} = 0V$ .
- $V_{OUT} < GND, V_{OUT} > V_{CC}$  (Outputs Active).
- Unused inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	HIGH Level Input Voltage	4.5		2.0			2.0		V
		5.5		2.0			2.0		
V <sub>IL</sub>	LOW Level Input Voltage	4.5				0.8		0.8	V
		5.5				0.8		0.8	
V <sub>OH</sub>	HIGH Level Output Voltage	4.5	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50μA	4.40	4.50		4.40	V
		4.5		I <sub>OH</sub> = -8mA	3.94			3.80	
V <sub>OL</sub>	LOW Level Output Voltage	4.5	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50μA		0.0	0.1	0.1	V
		4.5		I <sub>OL</sub> = 8mA			0.36	0.44	
I <sub>IN</sub>	Input Leakage Current	0-5.5	V <sub>IN</sub> = 5.5V or GND				±0.1	±1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	5.5	V <sub>IN</sub> = V <sub>CC</sub> or GND				2.0	20.0	μA
I <sub>CC(T)</sub>	Maximum I <sub>CC</sub> /Input	5.5	V <sub>IN</sub> = 3.4V, Other Inputs = V <sub>CC</sub> or GND				1.35	1.50	mA
I <sub>OFF</sub>	Output Leakage Current (Power Down State)	0.0	V <sub>OUT</sub> = 5.5V				+0.5	+5.0	μA

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V) <sup>(6)</sup>	Conditions	T <sub>A</sub> = 25°C			T <sub>A</sub> = -40°C to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
f <sub>MAX</sub>	Maximum Clock Frequency	5.0	C <sub>L</sub> = 15pF	100	160		80		MHz
		5.0	C <sub>L</sub> = 50pF	80	140		65		
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time (CK-Q, $\bar{Q}$ )	5.0	C <sub>L</sub> = 15pF		5.8	7.8	1.0	9.0	ns
		5.0	C <sub>L</sub> = 50pF		6.3	8.8	1.0	10.0	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Time ( $\overline{\text{CLR}}$ , $\overline{\text{PR-Q}}$ , $\bar{Q}$ )	5.0	C <sub>L</sub> = 15pF		7.6	10.4	1.0	12.0	ns
		5.0	C <sub>L</sub> = 50pF		8.1	11.4	1.0	13.0	
C <sub>IN</sub>	Input Capacitance		V <sub>CC</sub> = Open		4	10		10	pF
C <sub>PD</sub>	Power Dissipation Capacitance		<sup>(7)</sup>		24				pF

## Notes:

6. V<sub>CC</sub> is 5.0 ± 0.5V

7. C<sub>PD</sub> is defined as the value of internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation:

$$I_{CC}(\text{Opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 2 \text{ (per flip-flop).}$$

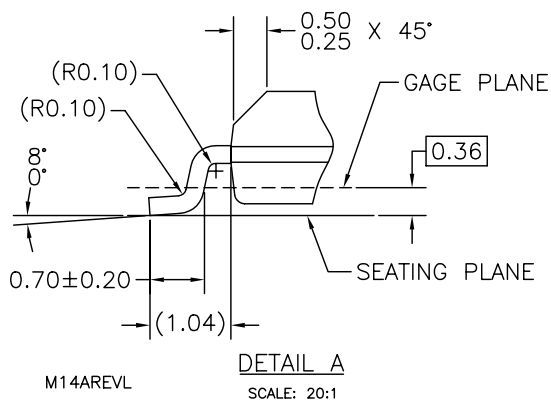
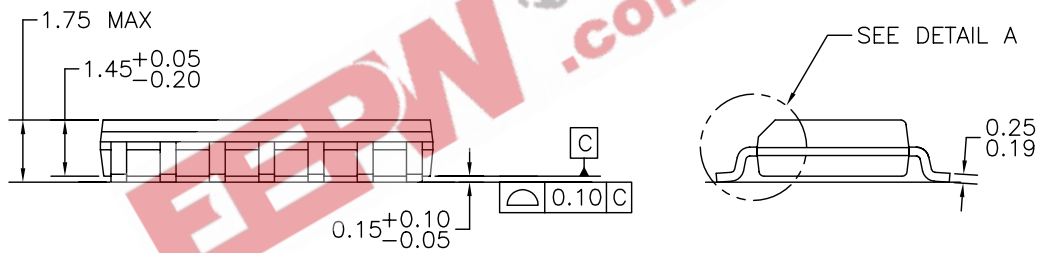
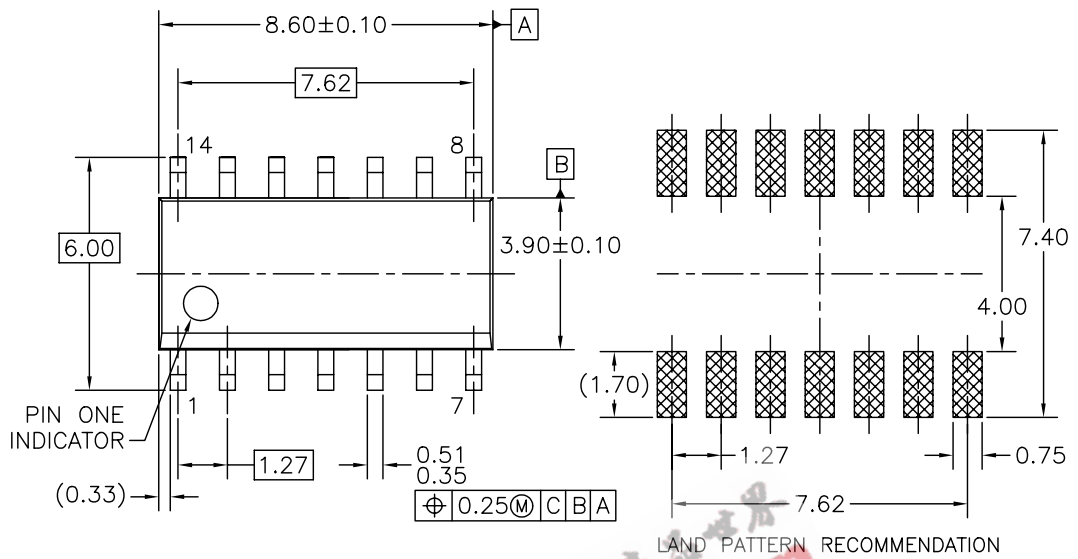
## AC Operating Requirements

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = 25°C		T <sub>A</sub> = -40°C to +85°C		Units
			Typ.	Guaranteed Minimum			
t <sub>W(L)</sub> , t <sub>W(H)</sub>	Minimum Pulse Width (CK)	5.0 ± 0.5		5.0	5.0		ns
t <sub>W(L)</sub>	Minimum Pulse Width ( $\overline{\text{CLR}}$ , $\overline{\text{PR}}$ )	5.0 ± 0.5		5.0	5.0		ns
t <sub>S</sub>	Minimum Setup Time	5.0 ± 0.5		5.0	5.0		ns
t <sub>H</sub>	Minimum Hold Time	5.0 ± 0.5		0	0		ns
t <sub>REM</sub>	Minimum Removal Time ( $\overline{\text{CLR}}$ , $\overline{\text{PR}}$ )	5.0 ± 0.5		3.5	3.5		ns

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### Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



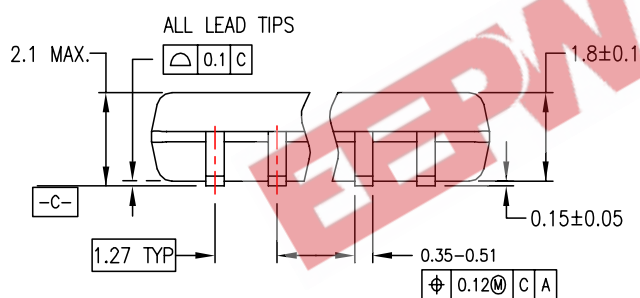
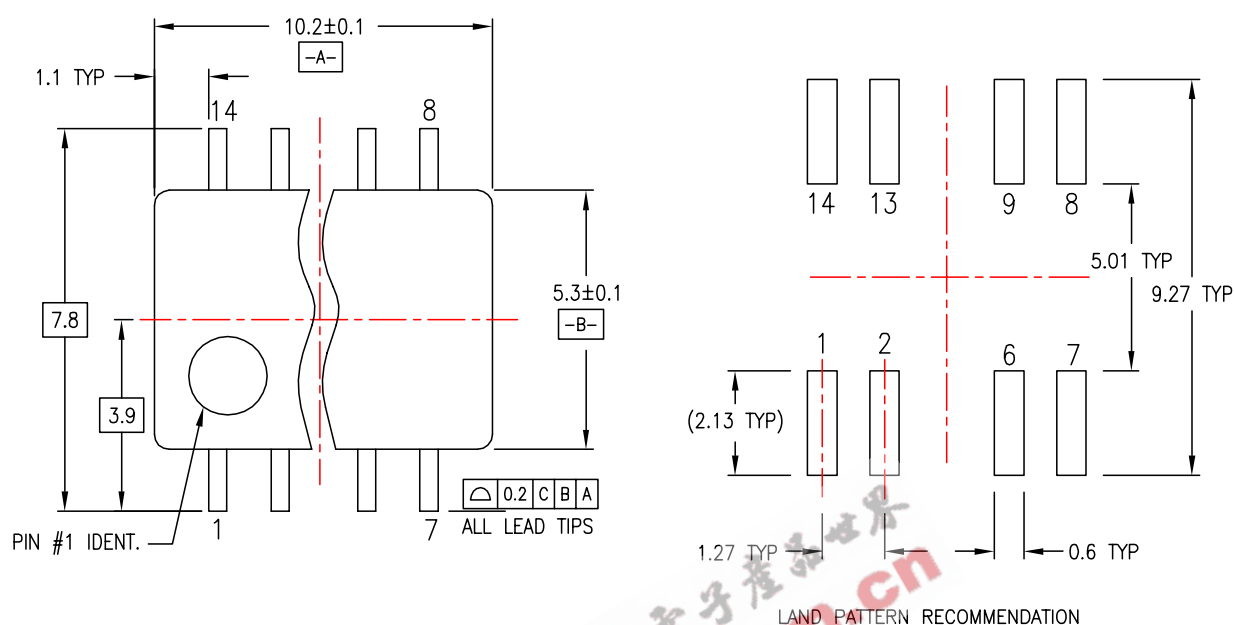
NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AB, ISSUE C, DATED MAY 1990.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.

Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow Package Number M14A

### Physical Dimensions (Continued)

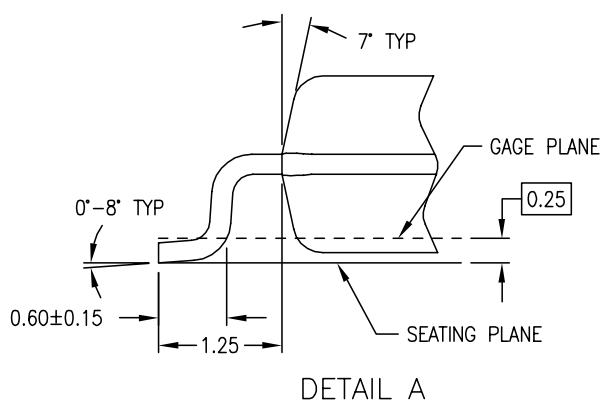
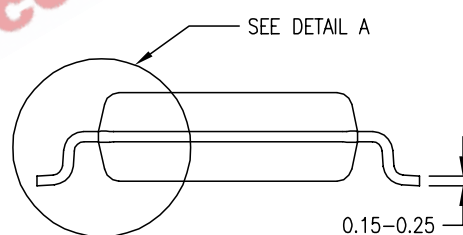
Dimensions are in millimeters unless otherwise noted.



DIMENSIONS ARE IN MILLIMETERS

#### NOTES:

- A. CONFORMS TO EIAJ EDR-7320 REGISTRATION, ESTABLISHED IN DECEMBER, 1998.
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.

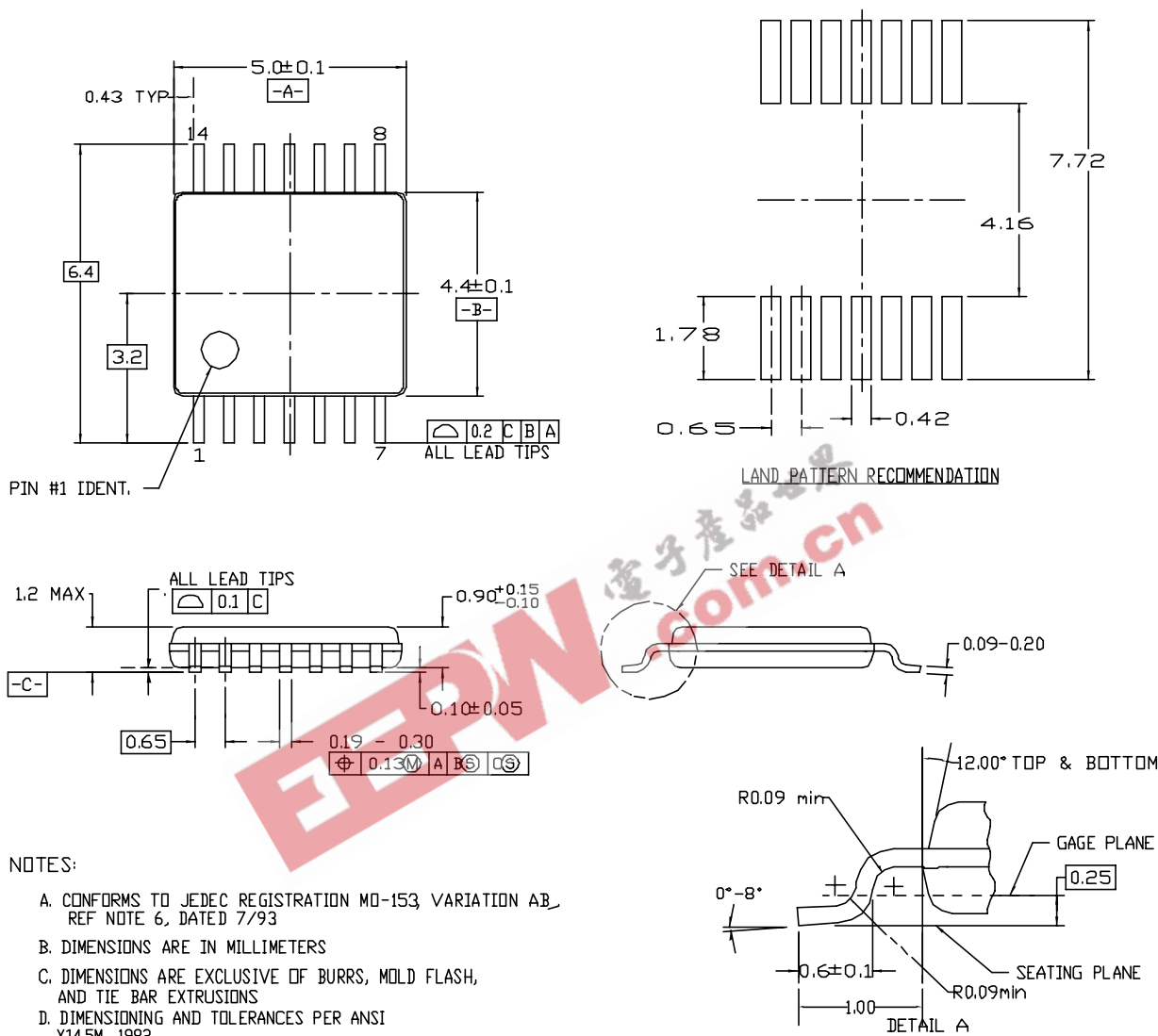


M14DREVC

Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide Package Number M14D

### Physical Dimensions (Continued)

Dimensions are in millimeters unless otherwise noted.



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AB, REF NOTE 6, DATED 7/93
- B. DIMENSIONS ARE IN MILLIMETERS
- C. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982

MTC14revD

Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide Package Number MTC14





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Rev. I27