

MM74HCT74

Dual D-Type Flip-Flop with Preset and Clear

Features

- Typical propagation delay: 20ns
- Low quiescent current: 40µA maximum (74HCT Series)
- Low input current: 1µA maximum
- Fanout of 10 LS-TTL loads
- Meta-stable hardened

General Description

The MM74HCT74 utilizes advanced silicon-gate CMOS technology to achieve operation speeds similar to the equivalent LS-TTL part. It possesses the high noise immunity and low power consumption of standard CMOS integrated circuits, along with the ability to drive 10 LS-TTL loads.

This flip-flop has independent data, preset, clear, and clock inputs and Q and \bar{Q} outputs. The logic level present at the data input is transferred to the output during the positive-going transition of the clock pulse. Preset and clear are independent of the clock and accomplished by a low level at the appropriate input.


The 74HCT logic family is functionally and pin-out compatible with the standard 74LS logic family. All inputs are protected from damage due to static discharge by internal diode clamps to V_{CC} and ground.

MM74HCT devices are intended to interface between TTL and NMOS components and standard CMOS devices. These parts are also plug-in replacements for LS-TTL devices and can be used to reduce power consumption in existing designs.

Ordering Information

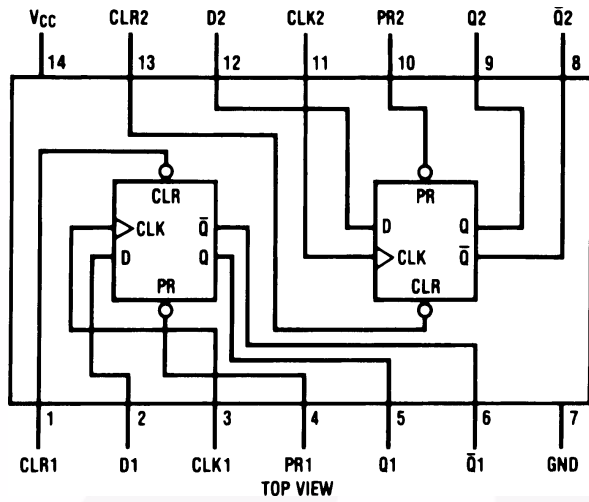
Order Number	Package Number	Package Description
MM74HCT74M	M14A	14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
MM74HCT74SJ	M14D	14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
MM74HCT74MTC	MTC14	14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
MM74HCT74N	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

Pin Assignments for DIP, SOIC, SOP and TSSOP



Truth Table

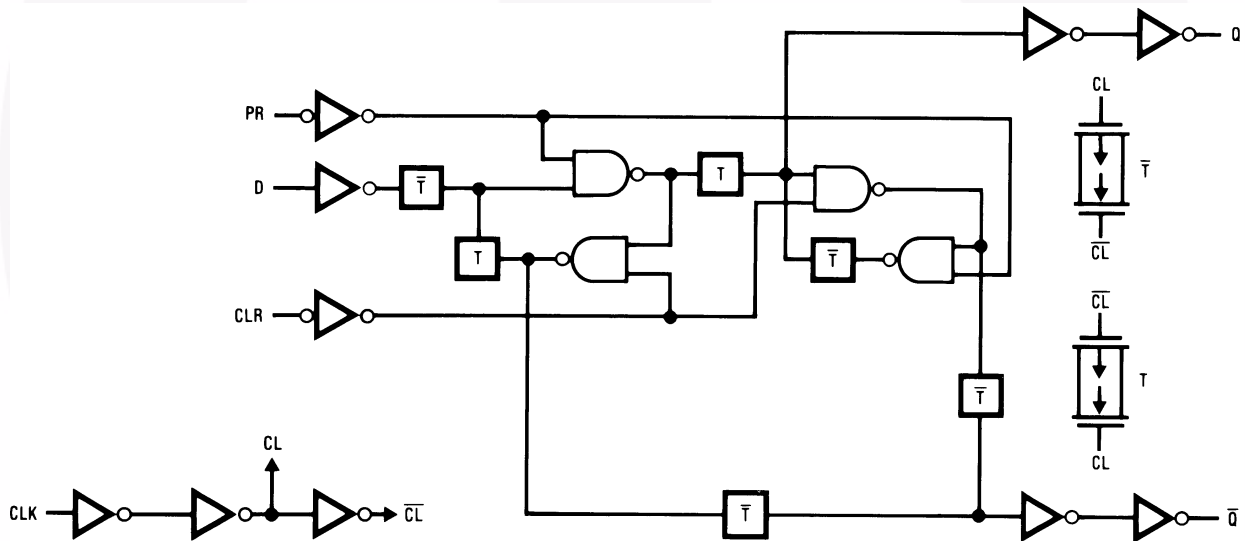
Inputs				Outputs	
PR	CLR	CLK	D	Q	\bar{Q}
L	H	X	X	H	L
H	L	X	X	L	H
L	L	X	X	H ⁽¹⁾	H ⁽¹⁾
H	H	↑	H	H	L
H	H	↑	L	L	H
H	H	L	X	Q0	$\bar{Q}0$

Q0 = the level of Q before the indicated input conditions were established.

Note:

1. This configuration is nonstable; that is, it will not persist when preset and clear inputs return to their inactive (HIGH) level.

Logic Diagram



Absolute Maximum Ratings⁽²⁾

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	-0.5 to +7.0V
V_{IN}	DC Input Voltage	-1.5 to $V_{CC} + 1.5V$
V_{OUT}	DC Output Voltage	-0.5 to $V_{CC} + 0.5V$
I_{IK}, I_{OK}	Clamp Diode Current	$\pm 20mA$
I_{OUT}	DC Output Current, per pin	$\pm 25mA$
I_{CC}	DC V_{CC} or GND Current, per pin	$\pm 50mA$
T_{STG}	Storage Temperature Range	-65°C to +150°C
P_D	Power Dissipation Note 3 S.O. Package only	600mW 500mW
T_L	Lead Temperature (Soldering 10 seconds)	260°C

Notes:

- Unless otherwise specified all voltages are referenced to ground.
- Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°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	Min.	Max.	Units
V_{CC}	Supply Voltage	4.5	5.5	V
V_{IN}, V_{OUT}	DC Input or Output Voltage	0	V_{CC}	V
T_A	Operating Temperature Range	-40	+85	°C
t_r, t_f	Input Rise or Fall Times		500	ns

DC Electrical Characteristics $V_{CC} = 5V \pm 10\%$ (unless otherwise specified).

Symbol	Parameter	Conditions	$T_A =$				Units
			25°C		-40°C to 85°C	-55°C to 125°C	
			Typ.	Guaranteed Limits			
V_{IH}	Minimum HIGH Level Input Voltage			2.0	2.0	2.0	V
V_{IL}	Maximum LOW Level Input Voltage			0.8	0.8	0.8	V
V_{OH}	Minimum HIGH Level Output Voltage	$V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 20\mu A$	V_{CC}	$V_{CC} - 0.1$	$V_{CC} - 0.1$	$V_{CC} - 0.1$	V
		$V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.0mA$, $V_{CC} = 4.5V$	4.2	3.98	3.84	3.7	
		$V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.8mA$, $V_{CC} = 5.5V$	5.2	4.98	4.84	4.7	
V_{OL}	Maximum LOW Level Voltage	$V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 20\mu A$	0	0.1	0.1	0.1	V
		$V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.0mA$, $V_{CC} = 4.5V$	0.2	0.26	0.33	0.4	
		$V_{IN} = V_{IH}$ or V_{IL} , $ I_{OUT} = 4.8mA$, $V_{CC} = 5.5V$	0.2	0.26	0.33	0.4	
I_{IN}	Maximum Input Current	$V_{IN} = V_{CC}$ or GND, V_{IH} or V_{IL}		± 0.5	± 0.5	± 1.0	μA
I_{CC}	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0\mu A$		2.0	20	80	μA
		$V_{IN} = 2.4V$ or $0.5V^{(4)}$		0.3	0.4	0.5	mA

Note:4. This is measured per pin. All other inputs are held at V_{CC} Ground.**AC Electrical Characteristics** $V_{CC} = 5V$, $T_A = 25^\circ C$, $C_L = 15 pF$, $t_r = t_f = 6ns$.

Symbol	Parameter	Conditions	Typ.	Guaranteed Limit	Units
f_{MAX}	Maximum Operating Frequency from Clock to Q or \bar{Q}		50	30	MHz
t_{PHL} , t_{PLH}	Maximum Propagation Delay Clock to Q or \bar{Q}		18	30	ns
t_{PHL} , t_{PLH}	Maximum Propagation Delay from Preset or Clear to Q or \bar{Q}		18	30	ns
t_{REM}	Minimum Removal Time, Preset or Clear to Clock			20	ns
t_S	Minimum Setup Time Data to Clock			20	ns
t_H	Minimum Hold Time Clock to Data		-3	0	ns
t_W	Minimum Pulse Width Clock, Preset or Clear		8	16	ns

AC Electrical Characteristics

$V_{CC} = 5.0V \pm 10\%$, $C_L = 50 \text{ pF}$, $t_r = t_f = 6\text{ns}$ unless otherwise specified.

Symbol	Parameter	Conditions	$T_A = 25^\circ\text{C}$		$T_A = -40^\circ \text{ to } +85^\circ\text{C}$		Units
			Typ.	Guaranteed Limits			
f_{MAX}	Maximum Operating Frequency			27	21		MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay from Clock to Q or \bar{Q}		21	35	44		ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay from Preset or Clear to Q or \bar{Q}		21	35	44		ns
t_{REM}	Minimum Removal Time Preset or Clear to Clock			20	25		ns
t_S	Minimum Setup Time Data to Clock			20	25		ns
t_H	Minimum Hold Time Clock to Data		-3	0	0		ns
t_W	Minimum Pulse Width Clock, Preset or Clear		9	16	20		ns
t_r, t_f	Maximum Clock Input Rise and Fall Time			500	500		ns
t_{THL}, t_{TLH}	Maximum Output Rise and Fall Time			15	19		ns
C_{PD}	Power Dissipation Capacitance ⁽⁵⁾	(per flip-flop)	10				pF
C_{IN}	Maximum Input Capacitance		5	10	10		pF

Note:

5. C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions

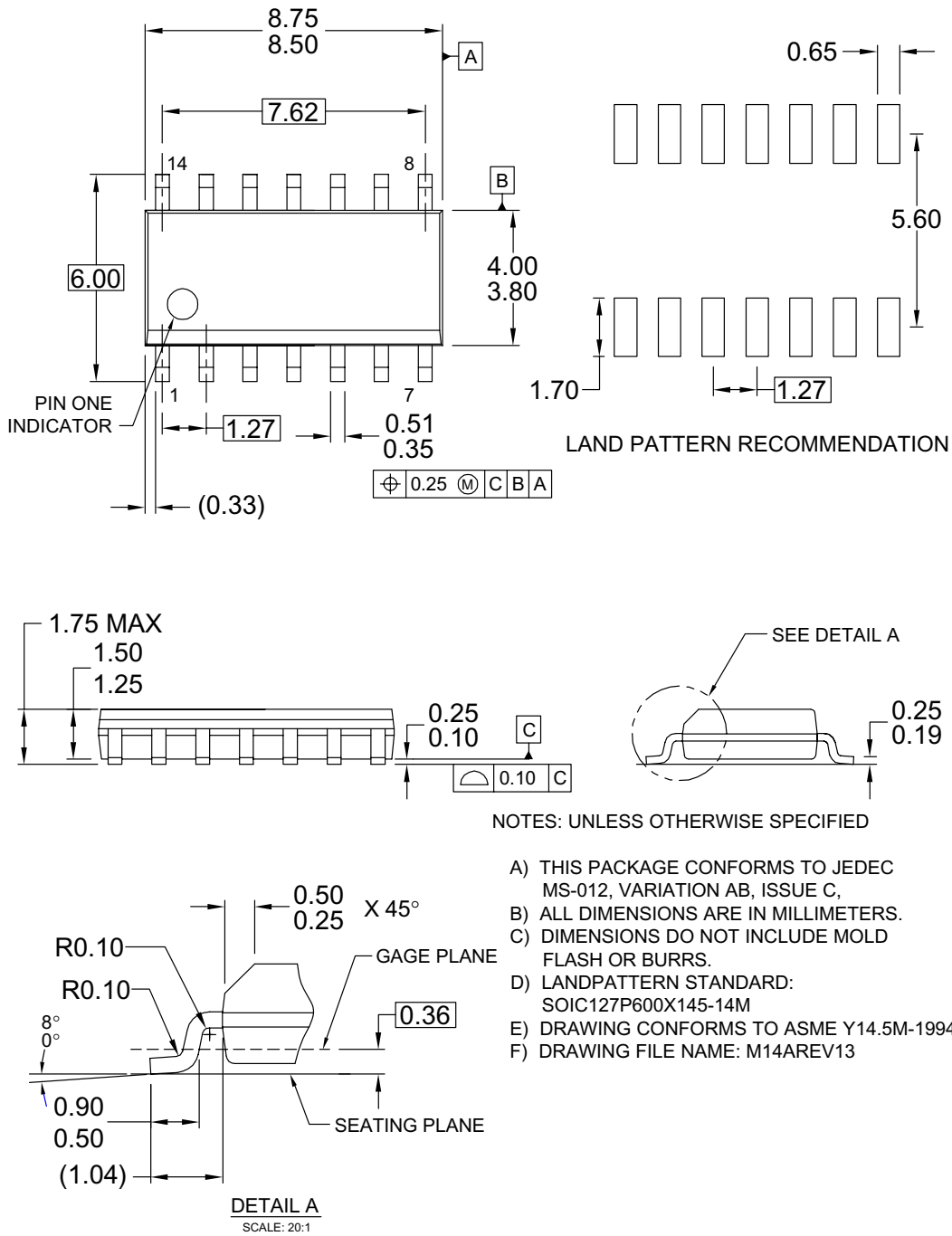


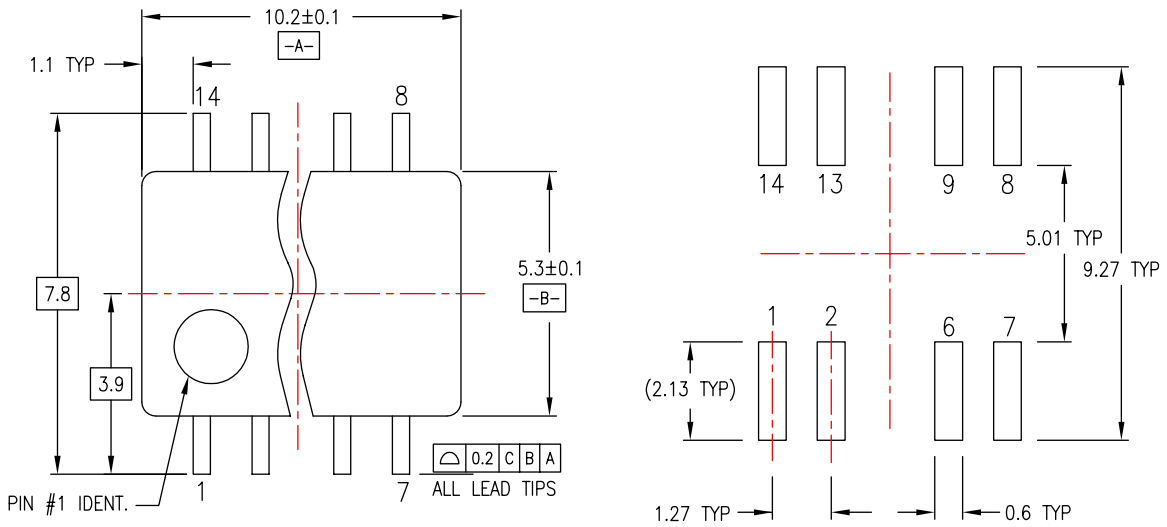
Figure 1. 14-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow

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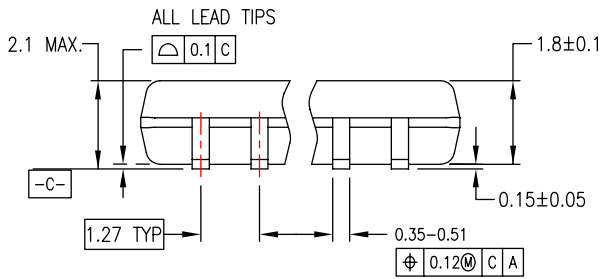
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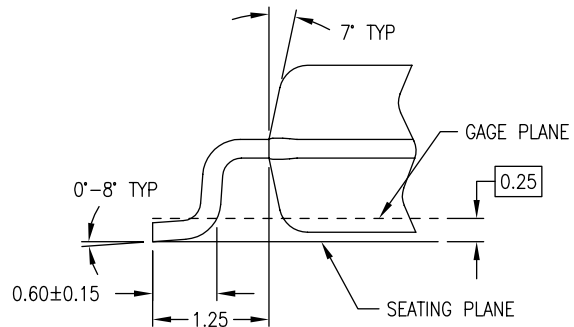
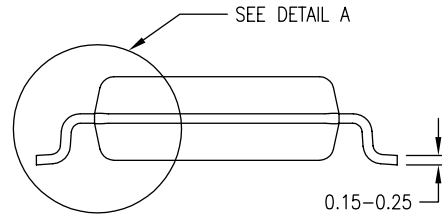
Physical Dimensions (Continued)



LAND PATTERN RECOMMENDATION



DIMENSIONS ARE IN MILLIMETERS



DETAIL A

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

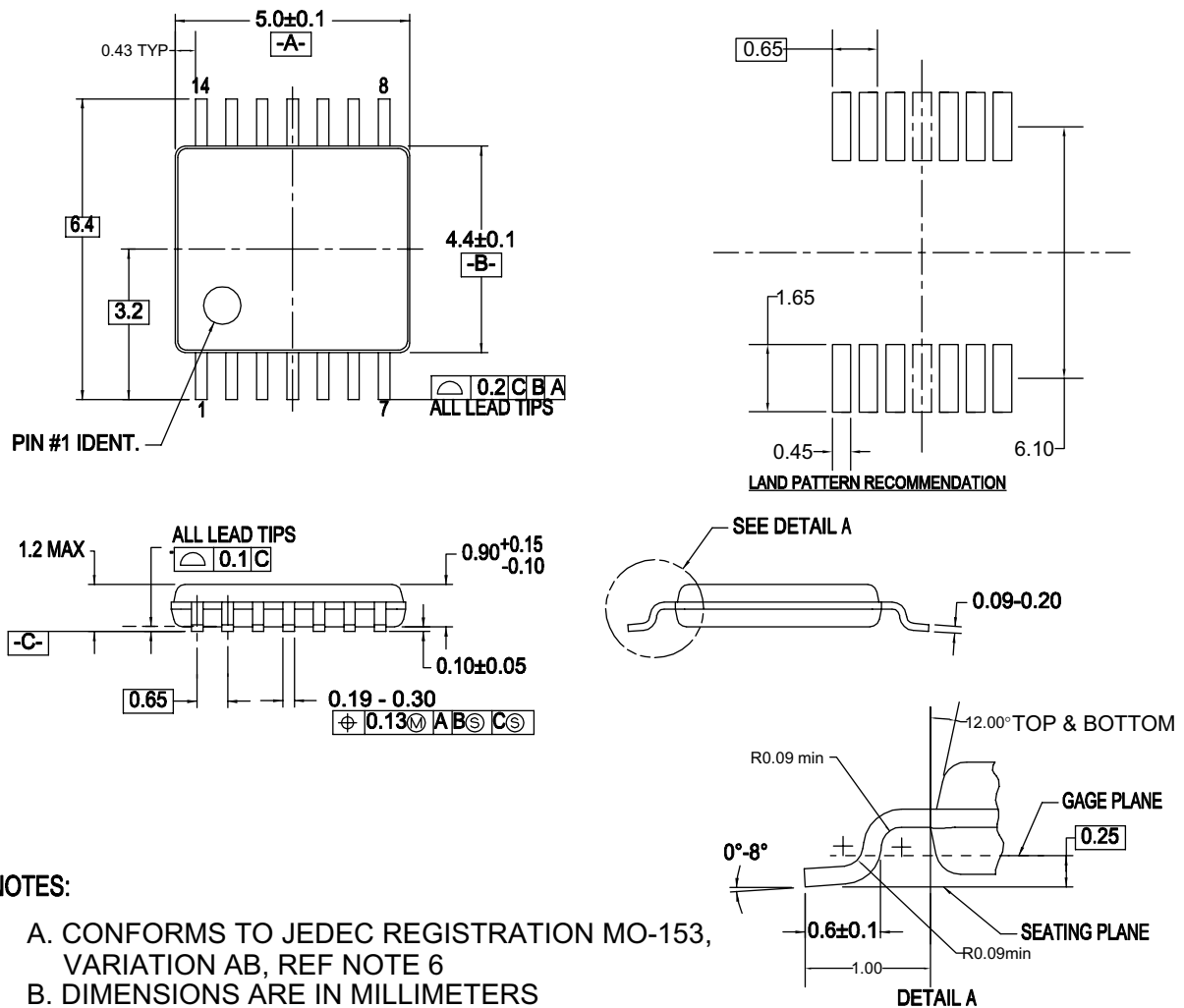
Figure 2. 14-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

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Physical Dimensions (Continued)



NOTES:

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- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS
- DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1982
- LANDPATTERN STANDARD: SOP65P640X110-14M
- DRAWING FILE NAME: MTC14REV6

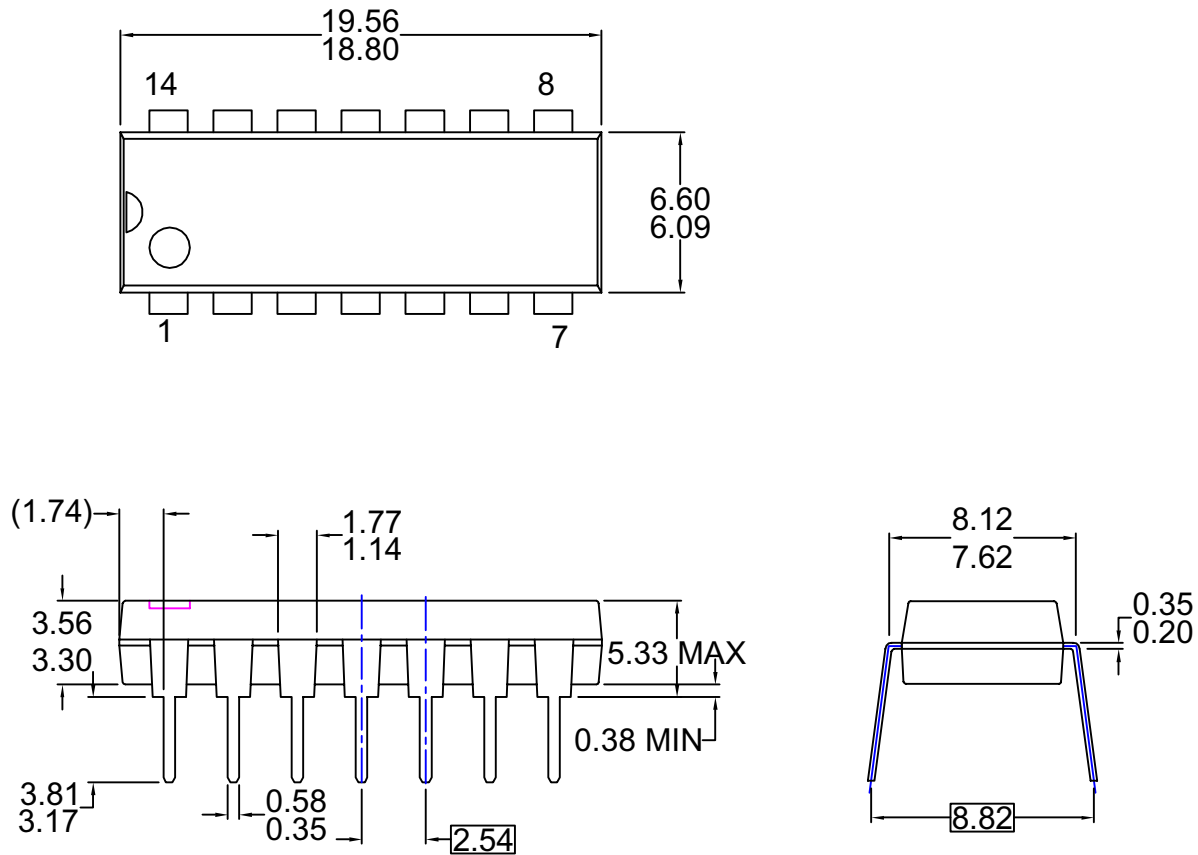
Figure 3. 14-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

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Physical Dimensions (Continued)



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 - 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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