

## MM74HC174 — Hex D-Type Flip-Flops with Clear

### Features


- Typical Propagation Delay: 16ns
- Wide Operating Voltage Range: 2V–6V
- Low Input Current: 1μA maximum
- Low Quiescent Current: 80μA (74HC Series)
- Output Drive: 10 LSTTL Loads


### Description

The MM74HC174 edge-triggered flip-flops utilize silicon-gate CMOS technology to implement D-type flip-flops. They possess high noise immunity, low-power, and speeds comparable to low-power Schottky TTL circuits. This device contains six master-slave flip-flops with a common clock and common clear. Data on the D input with the specified setup and hold times is transferred to the Q output on the LOW-to-HIGH transition of the CLOCK input. When LOW, the input sets all outputs to a LOW state.

Each output can drive ten low-power Schottky TTL equivalent loads. The MM74HC174 is functionally and pin comparable to the 74LS174. All inputs are protected from damage due to static discharge by diodes to  $V_{CC}$  and ground.

### Ordering Information

Part Number	Operating Temperature Range	 Eco Status	Package	Packing Method
MM74HC174M	-40 to +85°C	RoHS	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Inch Narrow	Tubes
MM74HC174MX	-40 to +85°C			Tape and Reel
MM74HC174MTC	-40 to +85°C	RoHS	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide	Tubes
MM74HC174MTCX	-40 to +85°C			Tape and Reel
MM74HC174N	-40 to +85°C	RoHS	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Inch Wide	Tubes

 For Fairchild's definition of "green" Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

### Pin Configuration

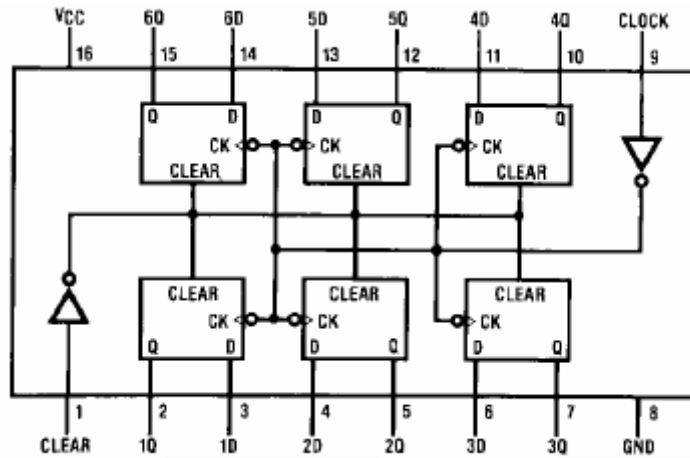


Figure 1. Pin Configuration (Top View)

### Truth Table (Each Flip-Flop)

Inputs			Output
Clear	Clock	D	Q
LOW	Don't Care	Don't Care	LOW
HIGH	↑ <sup>(1)</sup>	HIGH	HIGH
HIGH	↑ <sup>(1)</sup>	LOW	LOW
HIGH	LOW	Don't Care	Q <sub>0</sub> <sup>(2)</sup>

**Notes:**

1. Transition from LOW to HIGH level.
2. The level of Q before the indicated steady-state input conditions were established.

### Logic Diagram

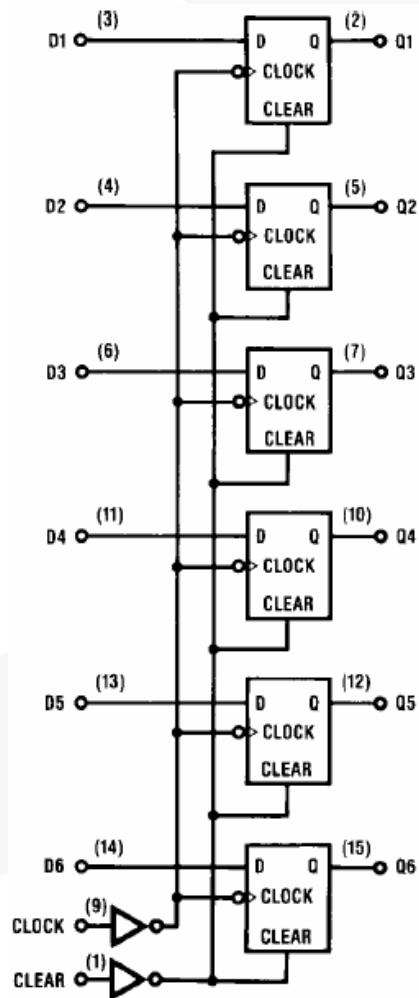


Figure 2. Logic Diagram

## 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. Unless otherwise noted, all voltages are referenced to ground.

Symbol	Parameter	Min.	Max.	Unit
$V_{CC}$	Supply Voltage	-0.5	+7.0	V
$V_{IN}$	DC Input Voltage	-1.5 to $V_{CC}$	+1.5	V
$V_{OUT}$	DC Output Voltage	-0.5 to $V_{CC}$	+0.5	V
$I_{IK}, I_{OK}$	Clamp Diode Current		$\pm 20$	mA
$I_{OUT}$	DC Output Current, per Pin		$\pm 25$	mA
$I_{CC}$	DC $V_{CC}$ or GND Current, per Pin		$\pm 50$	mA
$T_{STG}$	Storage Temperature Range	-65	+150	$^{\circ}\text{C}$
$P_D$	Power Dissipation <sup>(3)</sup>	TSSOP, PDIP	600	mW
		SOIC	500	
$T_L$	Lead Temperature, Soldering 10 Seconds		260	$^{\circ}\text{C}$

### Notes:

- Power dissipation temperature derating— plastic “N” package: 12mW/ $^{\circ}\text{C}$  from 65 $^{\circ}$  to 85 $^{\circ}\text{C}$ .

## 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	Conditions	Min.	Max.	Unit
$V_{CC}$	Supply Voltage		2	6	V
$V_{IN}, V_{OUT}$	DC Input or Output Voltage		0	$V_{CC}$	V
$T_A$	Operating Temperature Range		-40	+85	$^{\circ}\text{C}$
$t_r, t_f$	Input Rise and Fall Times	$V_{CC}=2.0\text{V}$		1000	ns
		$V_{CC}=4.5\text{V}$		500	ns
		$V_{CC}=6.0\text{V}$		400	ns

DC Electrical Characteristics<sup>(4)</sup>

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> =25°C	T <sub>A</sub> =-40 to+85°C	T <sub>A</sub> =-55 to +125°C	Units	
				Typ.	Guaranteed Limits			
V <sub>IH</sub>	Minimum HIGH Level Input		2.0		1.5	1.5	1.5	V
			4.5		3.15	3.15	3.15	
			6.0		4.2	4.2	4.2	
V <sub>IL</sub>	Minimum LOW Level Input		2.0		0.5	0.5	0.5	V
			4.5		1.35	1.35	1.35	
			6.0		1.8	1.8	1.8	
V <sub>OH</sub>	Minimum HIGH Level Output Voltage	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 20μA	2.0	2.0	1.9	1.9	1.9	V
			4.5	4.5	4.4	4.4	4.4	
			6.0	6.0	5.9	5.9	5.9	
V <sub>OL</sub>	Minimum LOW Level Output Voltage	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 4.0mA	4.5	4.20	3.98	3.84	3.70	V
			6.0	5.70	5.48	5.34	5.20	
			V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 5.2mA	6.0	5.70	5.48	5.34	
V <sub>OL</sub>	Minimum LOW Level Output Voltage	V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 20μA	2.0	0	0.1	0.1	0.1	V
			4.5	0	0.1	0.1	0.1	
			6.0	0	0.1	0.1	0.1	
		V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 4.0mA	4.5	0.2	0.26	0.33	0.40	
		V <sub>IN</sub> =V <sub>IH</sub> or V <sub>IL</sub> ,  I <sub>OUT</sub>   ≤ 5.2mA	6.0	0.20	0.26	0.33	0.40	
I <sub>IN</sub>	Maximum Input Current	V <sub>IN</sub> =V <sub>CC</sub> or GND	6.0		±0.1	±1.0	±1.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	V <sub>IN</sub> =V <sub>CC</sub> or GND, I <sub>OUT</sub> =0μA	6.0		8	80	160	μA

**Note:**

4. For a power supply of 5V ±10%, the worst-case output voltages (V<sub>OH</sub> and V<sub>OL</sub>) occur for HC at 4.5V. The 4.5V values should be used when designing with this supply. Worst-case V<sub>IH</sub> and V<sub>IL</sub> occur at V<sub>CC</sub> = 5.5V and 4.5V, respectively. (The V<sub>IH</sub> value at 5.5V is 3.85V.) The worst-case leakage current (I<sub>IN</sub>, I<sub>CC</sub>, and I<sub>OZ</sub>) occurs for CMOS at the higher voltage, so the 6.0V values should be used.

**AC Electrical Characteristics**

$V_{CC} = 5V$ ,  $T_A = 25^\circ C$  and  $C_L = 15pF$ ,  $t_r = t_f = 6ns$ .

Symbol	Parameter	Typ.	Guaranteed Limit	Unit
$f_{MAX}$	Maximum Operating Frequency	50	30	MHz
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Clock, or Clear to Output	16	30	ns
$t_{REM}$	Minimum Removal Time, Clear to Clock	-2	5	ns
$t_S$	Minimum Setup Time, Data to Clock	10	20	ns
$t_H$	Minimum Hold Time, Clock to Data	0	5	ns
$t_W$	Minimum Pulsewidth, Clock or Clear	10	16	ns

**AC Electrical Characteristics<sup>(5)</sup>**

$C_L = 50pF$ ,  $t_r = t_f = 6ns$  unless otherwise noted.

Symbol	Parameter	$V_{CC}$ (V)	$T_A = 25^\circ C$		$T_A = -40$	$T_A = -55$ to	Units
			Typ.	Guaranteed Limits			
$f_{MAX}$	Maximum Operating Frequency	2.0		5	4	3	MHz
		4.5		27	21	18	
		6.0		31	24	20	
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Clock, or Clear to Output	2.0	55	165	206	248	ns
		4.5	18	33	41	49	
		6.0	16	28	35	42	
$t_{REM}$	Minimum Setup Time, Data to Clock	2.0	1	5	5	5	ns
		4.5	1	5	5	5	
		6.0	1	5	5	5	
$t_S$	Minimum Setup Time, Data to Clock	2.0	42	100	125	150	ns
		4.5	12	20	25	30	
		6.0	10	17	21	25	
$t_H$	Minimum Hold Time, Clock to Data	2.0	1	5	5	5	ns
		4.5	1	5	5	5	
		6.0	1	5	5	5	
$t_W$	Minimum Pulse Width, Clock or Clear	2.0	35	80	106	120	ns
		4.5	10	16	20	24	
		6.0	8	14	18	20	
$t_{TLH}, t_{THL}$	Maximum Output Rise and Fall Time	2.0	30	75	95	110	ns
		4.5	8	15	19	22	
		6.0	7	13	16	19	
$t_r, t_f$	Maximum Input Rise and Fall Time	2.0		1000	1000	1000	ns
		4.5		500	500	500	
		6.0		400	400	400	
$C_{PD}$	Power Dissipation Capacitance <sup>(5)</sup> (per Package)		136				pF
$C_{IN}$	Maximum Input Capacitance		5	10	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,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

AC Waveforms

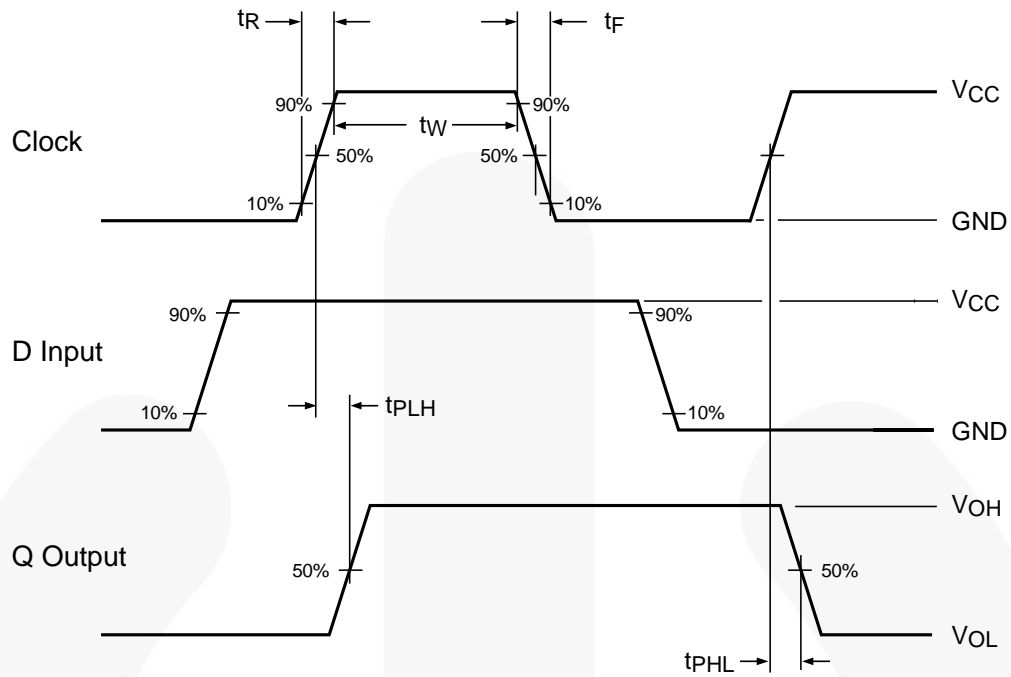


Figure 3. AC Waveform

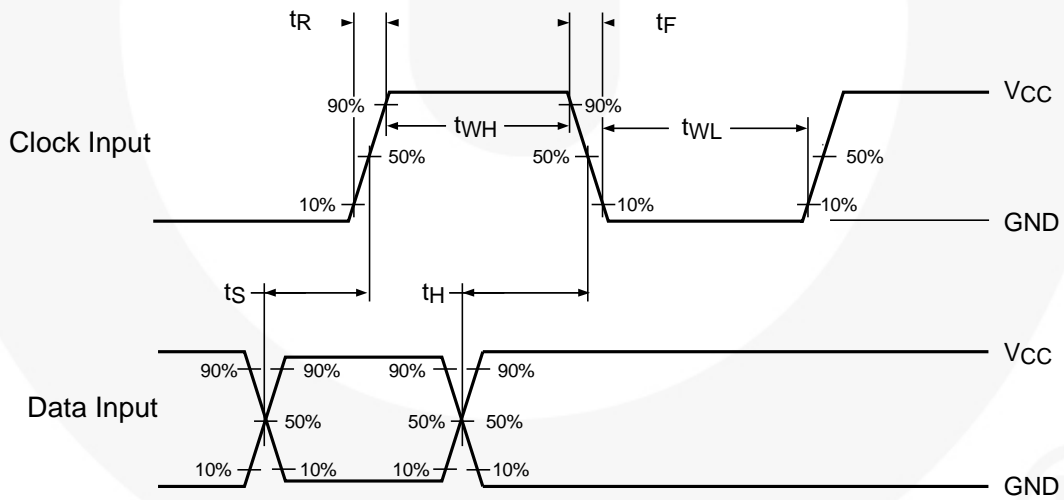


Figure 4. AC Waveform

Physical Dimensions

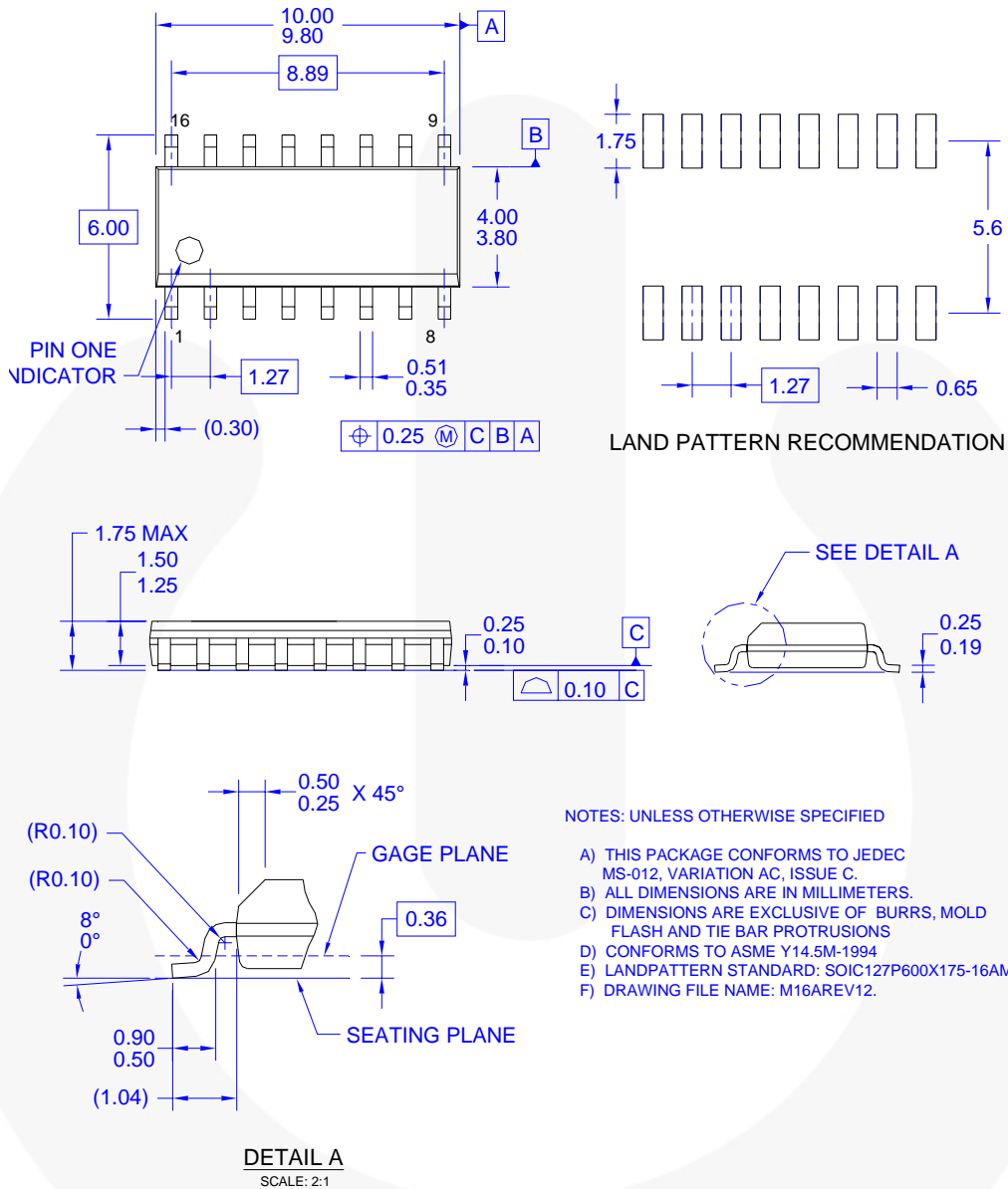
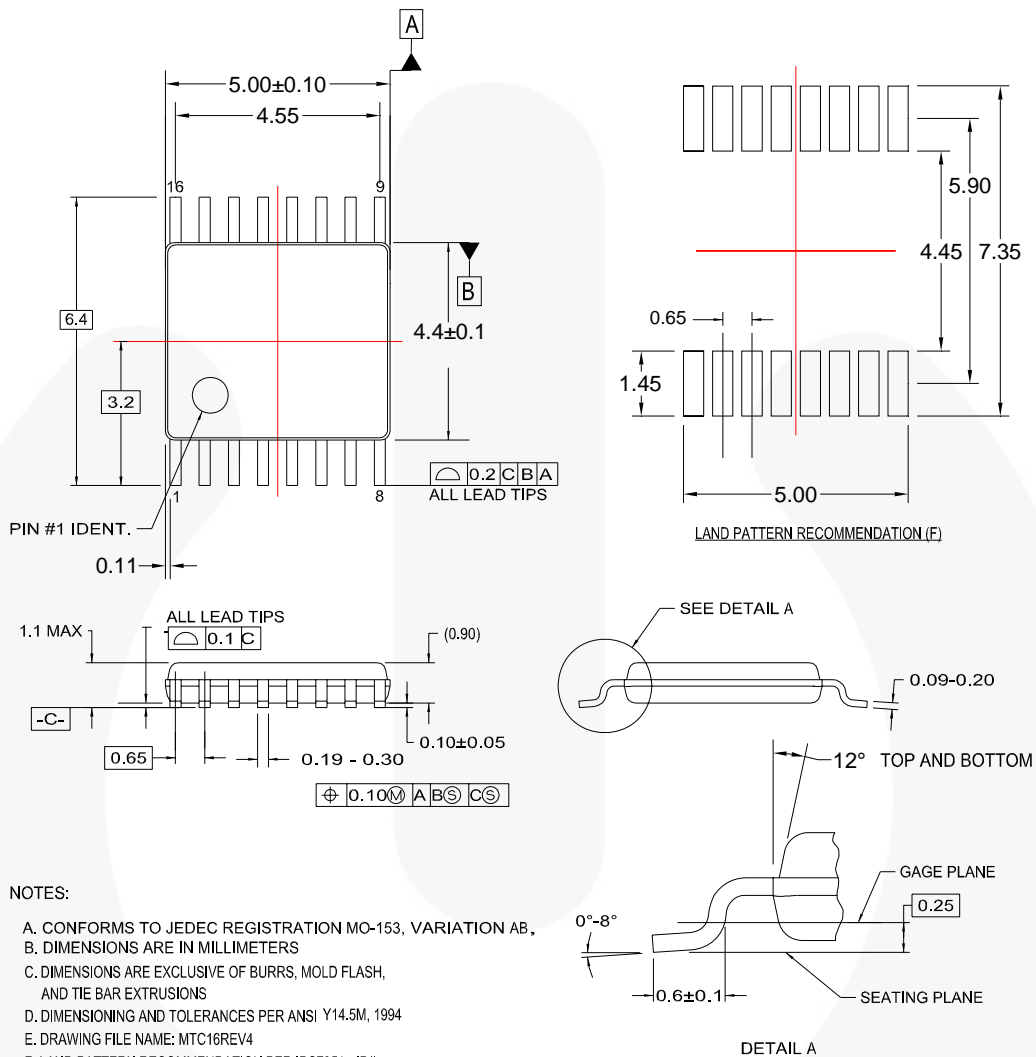


Figure 5. 16-Lead, Small Outline Integrated Circuit (SOIC)

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  - D. DIMENSIONING AND TOLERANCES PER ANSI Y14.5M, 1994
  - E. DRAWING FILE NAME: MTC16REV4
  - F. LAND PATTERN RECOMMENDATION PER IPC7351 - ID# TSOP65P640X110-16N

MTC16rev4

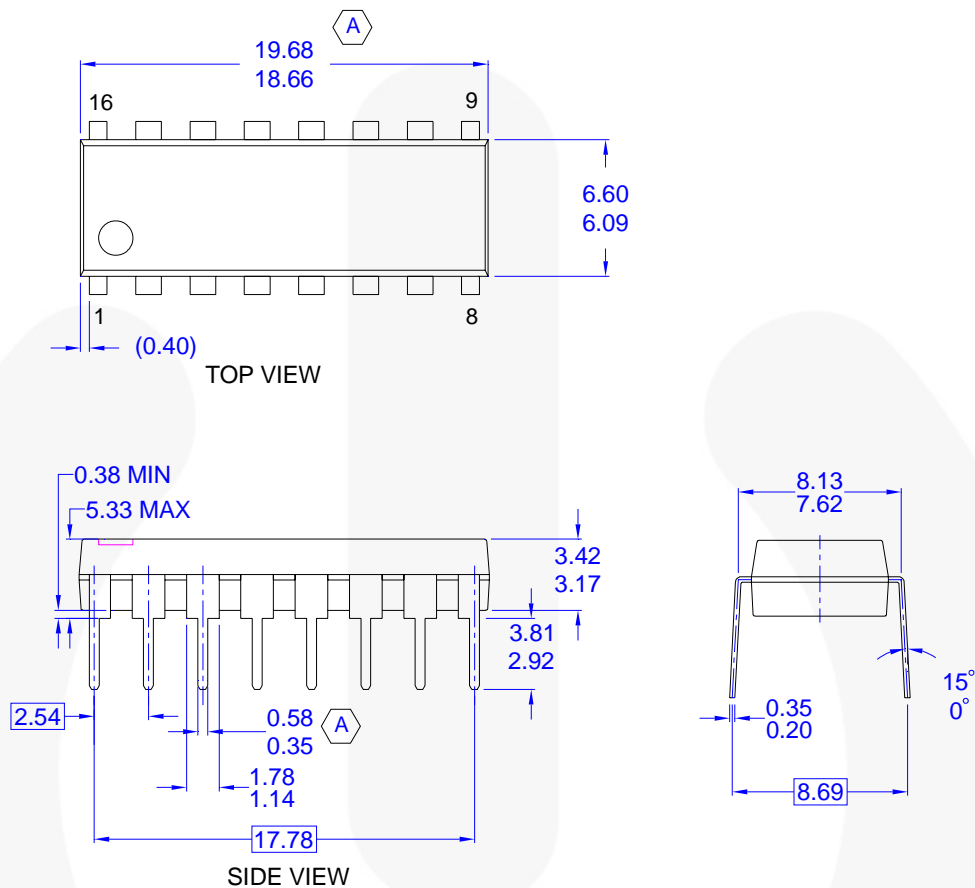
Figure 6. 16-Lead Thin Shrink Small Outline Package (TSSOP)

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Figure 7. 16-Lead Plastic Dual-In-Line Package (PDIP)

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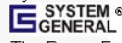


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