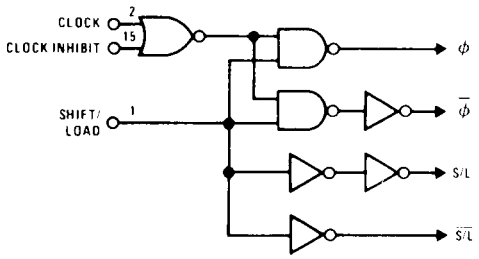
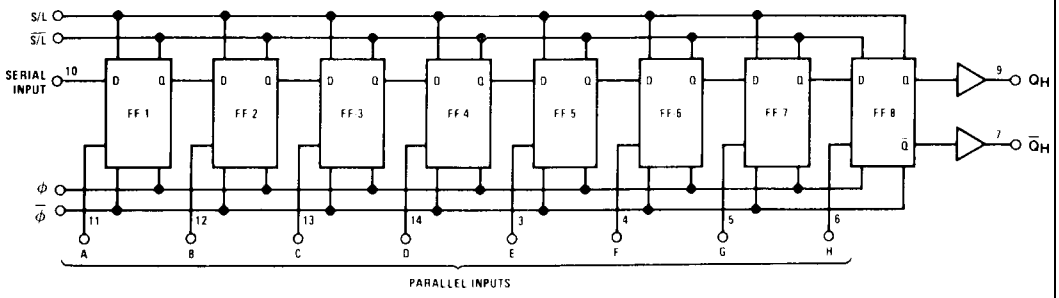
Logic Diagrams





Absolute Maximum Ratings (Note 1)

(Note 2)

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

Recommended Operating Conditions

	Min	Max	Units
Supply Voltage (V_{CC})	2	6	V
DC Input or Output Voltage			
(V_{IN}, V_{OUT})	0	V_{CC}	V
Operating Temperature Range (T_A)	−40	+85	°C
Input Rise or Fall Times			
(t_r, t_f) V_{CC} = 2.0V		1000	ns
V_{CC} = 4.5V		500	ns
V_{CC} = 6.0V		400	ns

Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur.

Note 2: Unless otherwise specified all voltages are referenced to ground.

Note 3: Power Dissipation temperature derating — plastic "N" package: −12 mW/°C from 65°C to 85°C.

DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	V_{CC}	T_A = 25°C	T_A = −40 to 85°C	T_A = −55 to 125°C	Units
				Typ	Guaranteed Limits		
V_{IH}	Minimum HIGH Level Input Voltage		2.0V		1.5	1.5	1.5	V
			4.5V		3.15	3.15	3.15	V
			6.0V		4.2	4.2	4.2	V
V_{IL}	Maximum LOW Level Input Voltage		2.0V		0.5	0.5	0.5	V
			4.5V		1.35	1.35	1.35	V
			6.0V		1.8	1.8	1.8	V
V_{OH}	Minimum HIGH Level Output Voltage	V_{IN} = V_{IH} or V_{IL}						
		$\|I_{OUT}\| \le 20$ μA	2.0V	2.0	1.9	1.9	1.9	V
			4.5V	4.5	4.4	4.4	4.4	V
			6.0V	6.0	5.9	5.9	5.9	V
		V_{IN} = V_{IH} or V_{IL}						
		$\|I_{OUT}\| \le 4.0$ mA	4.5V	4.2	3.98	3.84	3.7	V
		$\|I_{OUT}\| \le 5.2$ mA	6.0V	5.7	5.48	5.34	5.2	V
V_{OL}	Maximum LOW Level Output Voltage	V_{IN} = V_{IH} or V_{IL}						
		$\|I_{OUT}\| \le 20$ μA	2.0V	0	0.1	0.1	0.1	V
			4.5V	0	0.1	0.1	0.1	V
			6.0V	0	0.1	0.1	0.1	V
		V_{IN} = V_{IH} or V_{IL}						
		$\|I_{OUT}\| \le 4.0$ mA	4.5V	0.2	0.26	0.33	0.4	V
		$\|I_{OUT}\| \le 5.2$ mA	6.0V	0.2	0.26	0.33	0.4	V
I_{IN}	Maximum Input Current	V_{IN} = V_{CC} or GND	6.0V		±0.1	±1.0	±1.0	μA
		V_{CC} = 2–6V						
I_{CC}	Maximum Quiescent Supply Current	V_{IN} = V_{CC} or GND	6.0V		8.0	80	160	μA
		I_{OUT} = 0 μA						
		V_{CC} = 2–6V						

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

AC Electrical Characteristics

V_{CC} = 5V, T_A = 25°C, C_L = 15 pF, $t_r = t_f$ = 6 ns

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
f_{MAX}	Maximum Operating Frequency		50	30	MHz
t_{PHL}, t_{PLH}	Maximum Propagation Delay H to Q_H or $\overline{Q}_H$		15	25	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay Serial Shift/Parallel Load to Q_H		13	25	ns
t_{PHL}, t_{PLH}	Maximum Propagation Delay Clock to Output		15	25	ns
t_S	Minimum Setup Time Serial Input to Clock, Parallel or Data to Shift/Load		10	20	ns
t_S	Minimum Setup Time Shift/Load to Clock		11	20	ns
t_S	Minimum Setup Time Clock Inhibit to Clock		10	20	ns
t_H	Minimum Hold Time Serial Input to Clock or Parallel Data to Shift/Load			0	ns
t_W	Minimum Pulse Width Clock			16	ns

AC Electrical Characteristics

C_L = 50 pF, $t_r = t_f$ = 6 ns (unless otherwise specified)

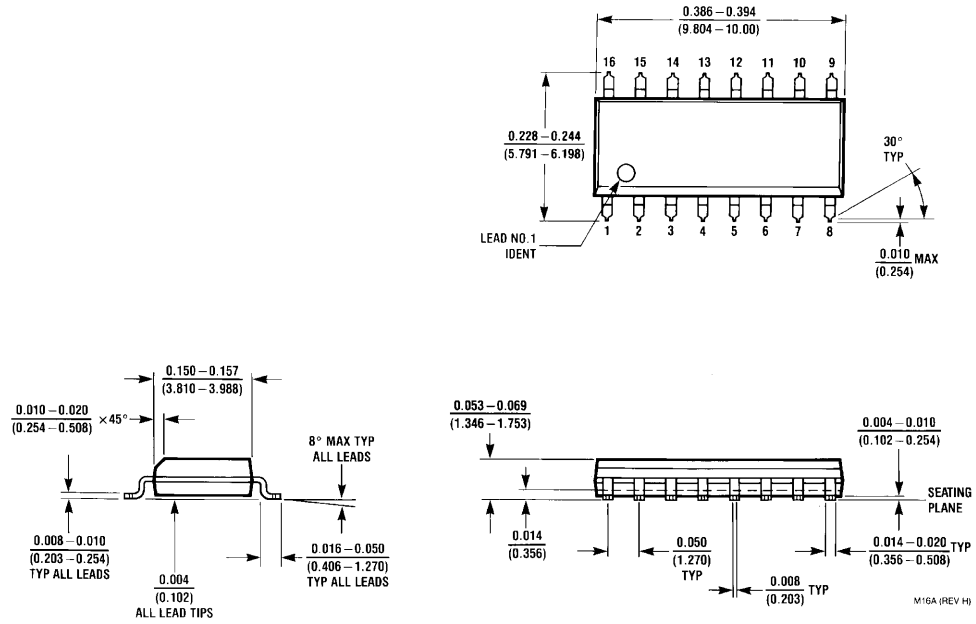
Symbol	Parameter	Conditions	V_{CC}	T_A = 25°C	T_A = −40 to 85°C	T_A = −55 to 125°C	Units
				Typ	Guaranteed Limits		
f_{MAX}	Maximum Operating		2.0V	10	5	4	4	MHz
	Frequency		4.5V	45	27	21	18	MHz
			6.0V	50	32	25	21	MHz
t_{PHL}, t_{PLH}	Maximum Propagation		2.0V	70	150	189	225	ns
	Delay H to Q_H or $\overline{Q}_H$		4.5V	21	30	38	45	ns
			6.0V	18	26	33	39	ns
t_{PHL}, t_{PLH}	Maximum Propagation		2.0V	70	175	220	260	ns
	Delay Serial Shift/		4.5V	21	35	44	52	ns
	Parallel Load to Q_H		6.0V	18	30	37	44	ns
t_{PHL}, t_{PLH}	Maximum Propagation		2.0V	70	150	189	225	ns
	Delay Clock to Output		4.5V	21	30	38	45	ns
			6.0V	18	26	33	39	ns
t_S	Minimum Setup Time		2.0V	35	100	125	150	ns
	Serial Input to Clock,		4.5V	11	20	25	30	ns
	or Parallel Data to Shift/Load		6.0V	9	17	21	25	ns
t_S	Minimum Setup Time		2.0V	38	100	125	150	ns
	Shift/Load to Clock		4.5V	12	20	25	30	ns
			6.0V	9	17	21	25	ns
t_S	Minimum Setup Time		2.0V	35	100	125	150	ns
	Clock Inhibit to Clock		4.5V	11	20	25	30	ns
			6.0V	9	17	21	25	ns
t_H	Minimum Hold Time Serial		2.0V		0	0	0	ns
	Input to Clock or		4.5V		0	0	0	ns
	Parallel Data to Shift/Load		6.0V		0	0	0	ns
t_W	Minimum Pulse Width,		2.0V	30	80	100	120	ns
	Clock		4.5V	9	16	20	24	ns
			6.0V	8	14	18	20	ns
t_{THL}, t_{TLH}	Maximum Output		2.0V	30	75	95	110	ns
	Rise and Fall Time		4.5V	9	15	19	22	ns
			6.0V	8	13	16	19	ns
t_r, t_f	Maximum Input Rise and		2.0V		1000	1000	1000	ns
	Fall Time		4.5V		500	500	500	ns
			6.0V		400	400	400	ns

AC Electrical Characteristics (Continued)

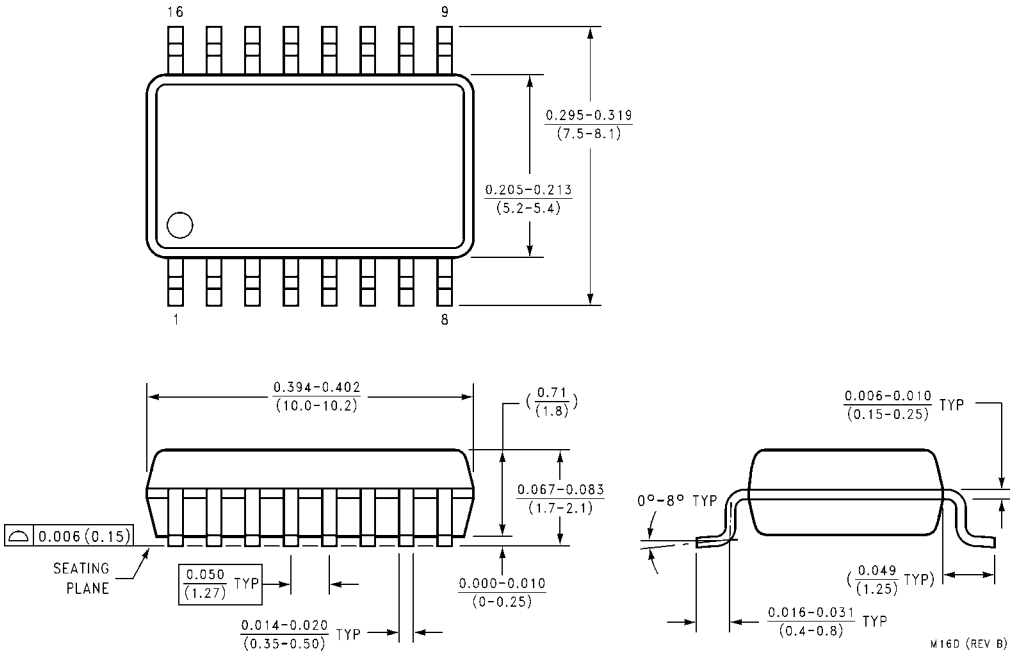
Symbol	Parameter	Conditions	V_{CC}	$T_A = 25°C$	$T_A = -40$ to $85°C$		$T_A = -55$ to $125°C$	Units
				Typ	Guaranteed Limits			
C_{PD}	Power Dissipation Capacitance (Note 5)	(per package)		100				pF
C_{IN}	Maximum Input Capacitance			5	10	10	10	pF

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, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Physical Dimensions inches (millimeters) unless otherwise noted

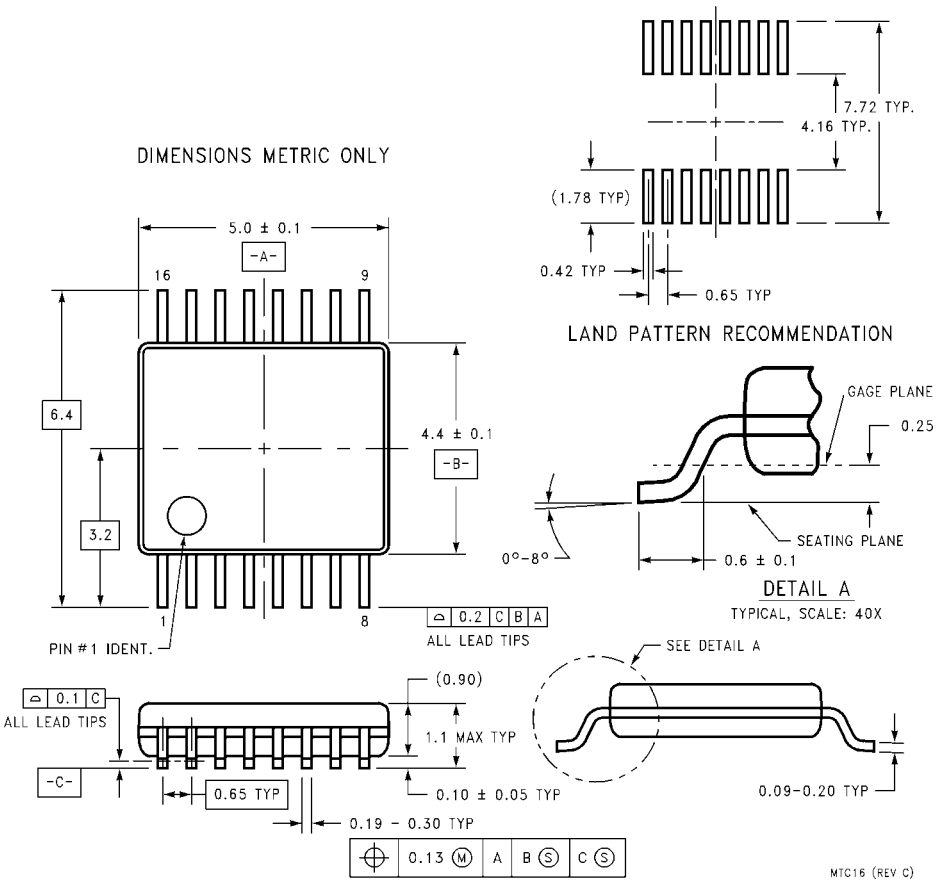


16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow
Package Number M16A



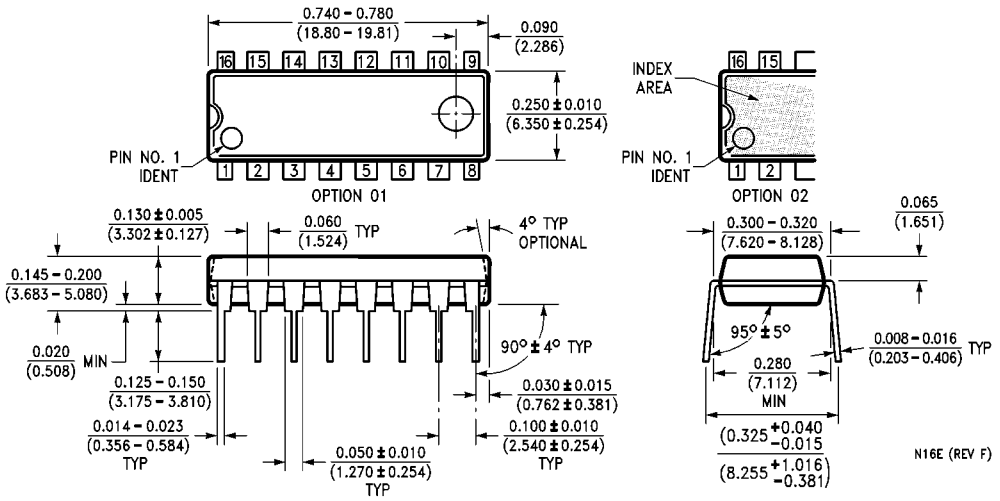
16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
Package Number M16D

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



16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
Package Number MTC16

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



16-Lead Plastic Dual-In-Line Package (PDIP), MS-001, 0.300" Wide
Package N16E

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