

Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage (V_{CC})	-0.5V to +7.0V
DC Input Voltage (V_{IN})	-0.5V to +7.0V
DC Output Voltage (V_{OUT})	
VHC	-0.5V to $V_{CC} + 0.5V$
VHCT*	-0.5V to 7.0V
Input Diode Current (I_{IK})	-20 mA
Output Diode Current (I_{OK})	
VHC	±20 mA
VHCT	-20 mA
DC Output Current (I_{OUT})	±25 mA
DC V_{CC} /GND Current (I_{CC})	±50 mA
Storage Temperature (T_{STG})	-65°C to +150°C
Lead Temperature (T_L)	
Soldering (10 seconds)	300°C

* $V_{OUT} > V_{CC}$ only if output is in H state.

Note 1: Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. National does not recommend operation outside databook specifications.

Recommended Operating Conditions

Supply Voltage (V_{CC})		2.0V to 5.5V
VHC		4.5V to 5.5V
VHCT		
Input Voltage (V_{IN})		0V to +5.5V
Output Voltage (V_{OUT})		0V to V_{CC}
Operating Temperature (T_{OPR})		
54VHC/VHCT		-55°C to +125°C
74VHC/VHCT		-40°C to +85°C
Input Rise and Fall Time (t_r, t_f)		
$V_{CC} = 3.3V \pm 0.3V$ (VHC only)		0 ~ 100 ns/V
$V_{CC} = 5.0V \pm 0.5V$		0 ~ 20 ns/V

DC Characteristics for 'VHC Family Devices

Symbol	Parameter	V_{CC} (V)	74VHC			54VHC		74VHC		Units	Conditions
			$T_A = 25^\circ\text{C}$			$T_A = -55^\circ\text{C}$ to +125°C		$T_A = -40^\circ\text{C}$ to +85°C			
			Min	Typ	Max	Min	Max	Min	Max		
V_{IH}	High Level Input Voltage	2.0 3.0-5.5	1.50			1.50			V		
			0.7 V_{CC}			0.7 V_{CC}					
V_{IL}	Low Level Input Voltage	2.0 3.0-5.5		0.50		0.50		0.50	V		
				0.3 V_{CC}		0.3 V_{CC}		0.3 V_{CC}			
V_{OH}	High Level Output Voltage	2.0	1.9	2.0	1.9		1.9		V	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50 \mu\text{A}$
		3.0	2.9	3.0	2.9		2.9				
		4.5	4.4	4.5	4.4		4.4		V	$I_{OH} = -4 \text{ mA}$ $I_{OH} = -8 \text{ mA}$	
		3.0	2.58		2.40		2.48				
		4.5	3.94		3.70		3.80				
V_{OL}	Low Level Output Voltage	2.0		0.0	0.1		0.1		V	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50 \mu\text{A}$
		3.0		0.0	0.1		0.1				
		4.5		0.0	0.1		0.1		V	$I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$	
		3.0			0.36		0.50				0.44
		4.5			0.36		0.50				
I_{IN}	Input Leakage Current	0-5.5			±0.1		±1.0		μA	$V_{IN} = 5.5V$ or GND	
I_{CC}	Quiescent Supply Current	5.5			2.0		80.0		μA	$V_{IN} = V_{CC}$ or GND	

DC Characteristics for 'VHC Family Devices

Symbol	Parameter	V _{CC} (V)	74VHC		54VHC	74VHC	Units	Conditions
			T _A = 25°C		T _A = -55°C to +125°C	T _A = -40°C to +85°C		
			Typ	Limits	Limits	Limits		
*V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	5.0	0.3	0.8			V	C _L = 50 pF
*V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	5.0	-0.3	-0.8			V	C _L = 50 pF
*V _{IHD}	Minimum High Level Dynamic Input Voltage	5.0		3.5			V	C _L = 50 pF
*V _{ILD}	Maximum Low Level Dynamic Input Voltage	5.0		1.5			V	C _L = 50 pF

*Parameter guaranteed by design.

DC Characteristics for 'VHCT Family Devices

Symbol	Parameter	V _{CC} (V)	74VHCT		54VHCT		74VHCT		Units	Conditions
			T _A = 25°C		T _A = -55°C to +125°C		T _A = -40°C to +85°C			
			Min	Typ Max	Min	Max	Min	Max		
V _{IH}	High Level Input Voltage	4.5	2.0			2.0		V		
		5.5	2.0			2.0				
V _{IL}	Low Level Input Voltage	4.5		0.8			0.8	V		
		5.5		0.8			0.8			
V _{OH}	High Level Output Voltage	4.5	3.15	3.65			3.15	V	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA
		4.5	2.5				2.4			I _{OH} = -8 mA
V _{OL}	Low Level Output Voltage	4.5		0.0	0.1		0.1	V	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA
		4.5			0.36		0.44			I _{OL} = 8 mA
I _{IN}	Input Leakage Current	0-5.5			±0.1			μA	V _{IN} = 5.5V or GND	
I _{CC}	Quiescent Supply Current	5.5			2.0		20.0	μA	V _{IN} = V _{CC} or GND	
I _{CCT}	Maximum I _{CC} /Input	5.5			1.35		1.50	mA	V _{IN} = 3.4V Other Inputs = V _{CC} or GND	
I _{OPD}	Output Leakage Current (Power Down State)	0.0			+0.5		+5.0	μA	V _{OUT} = 5.5V	

DC Characteristics for 'VHCT Family Devices

Symbol	Parameter	V _{CC} (V)	74VHCT		54VHCT	74VHCT		Units	Conditions
			T _A = 25°C		T _A = -55°C to +125°C	T _A = -40°C to +85°C			
			Typ	Limits	Limits	Limits			
*V _{OLP}	Quiet Output Maximum Dynamic V _{OL}							v	C _L = 50 pF
*V _{OLV}	Quiet Output Minimum Dynamic V _{OL}							v	C _L = 50 pF
*V _{IHD}	Minimum High Level Dynamic Input Voltage			2.0				v	C _L = 50 pF
*V _{ILD}	Maximum Low Level Dynamic Input Voltage			0.8				v	C _L = 50 pF

*Parameter guaranteed by design.

AC Electrical Characteristics for 'VHC

Symbol	Parameter	V _{CC} (V)	74VHC			54VHC		74VHC		Units	Conditions
			T _A = 25°C			T _A = -55°C to +125°C		T _A = -40°C to +85°C			
			Min	Typ	Max	Min	Max	Min	Max		
f _{MAX}	Maximum Clock Frequency	3.3 ± 0.3	80	125			70		MHz	C _L = 15 pF	
			50	75			45			C _L = 50 pF	
		5.0 ± 0.5	130	170			110		MHz	C _L = 15 pF	
			90	115			75			C _L = 50 pF	
t _{PLH} , t _{PHL}	Propagation Delay Time (CK-Q, \bar{Q})	3.3 ± 0.3	6.7	11.9			1.0	14.0	ns	C _L = 15 pF	
			9.2	15.4			1.0	17.5		C _L = 50 pF	
		5.0 ± 0.5	4.6	7.3			1.0	8.5	ns	C _L = 15 pF	
			6.1	9.3			1.0	10.5		C _L = 50 pF	
t _{PLH} , t _{PHL}	Propagation Delay Time ($\bar{C}LR$, \overline{PF} -Q, \bar{Q})	3.3 ± 0.3	7.6	12.3			1.0	14.5	ns	C _L = 15 pF	
			10.1	15.8			1.0	18.0		C _L = 50 pF	
		5.0 ± 0.5	4.8	7.7			1.0	9.0	ns	C _L = 15 pF	
			6.3	9.7			1.0	11.0		C _L = 50 pF	
C _{IN}	Input Capacitance		4	10			10	pF	V _{CC} = Open		
C _{PD}	Power Dissipation Capacitance		25					pF	(Note 1)		

Note 1: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained from the equation: I_{CC} (opr.) = C_{PD} * V_{CC} * f_{IN} + I_{CC}/2 (per F/F).

AC Operating Requirements for 'VHC

Symbol	Parameter	*V _{CC} (V)	74VHC	54VHC	74VHC	Units	Conditions		
			T _A = 25°C					T _A = -55°C to +125°C	T _A = -40°C to +85°C
			Typ	Guaranteed Minimum					
t _{W(L)} t _{W(H)}	Minimum Pulse Width (CK)	3.3 5.0	6.0 5.0		7.0 5.0	ns			
t _{W(L)}	Minimum Pulse Width (CLR, PR)	3.3 5.0	6.0 5.0		7.0 5.0	ns			
t _S	Minimum Setup Time	3.3 5.0	6.0 5.0		7.0 5.0	ns			
t _H	Minimum Hold Time	3.3 5.0	0.5 0.5		0.5 0.5	ns			
t _{rem}	Minimum Removal Time (CLR, PR)	3.3 5.0	5.0 3.0		5.0 3.0	ns			

*V_{CC} is 3.3 ± 0.3V or 5.0 ± 0.5V

AC Electrical Characteristics for 'VHCT

Symbol	Parameter	*V _{CC} (V)	74VHCT			54VHCT		74VHCT		Units	Conditions
			T _A = 25°C			T _A = -55°C to +125°C		T _A = -40°C to +85°C			
			Min	Typ	Max	Min	Max	Min	Max		
f _{MAX}	Maximum Clock Frequency	5.0	100	160			80		MHz	C _L = 15 pF	
		5.0	80	140			65			C _L = 50 pF	
t _{PLH} , t _{PHL}	Propagation Delay Time (CK-Q, \bar{Q})	5.0	5.8	7.8			1.0	9.0	ns	C _L = 15 pF	
		5.0	6.3	8.8			1.0	10.0		C _L = 50 pF	
t _{PLH} , t _{PHL}	Propagation Delay Time (CLR, PR-Q, Q)	5.0	7.6	10.4			1.0	12.0	ns	C _L = 15 pF	
		5.0	8.1	11.4			1.0	13.0		C _L = 50 pF	
C _{IN}	Input Capacitance		4	10				10	pF	V _{CC} = Open	
C _{PD}	Power Dissipation Capacitance		24						pF	(Note 1)	

*V_{CC} is 5.0 ± 0.5V

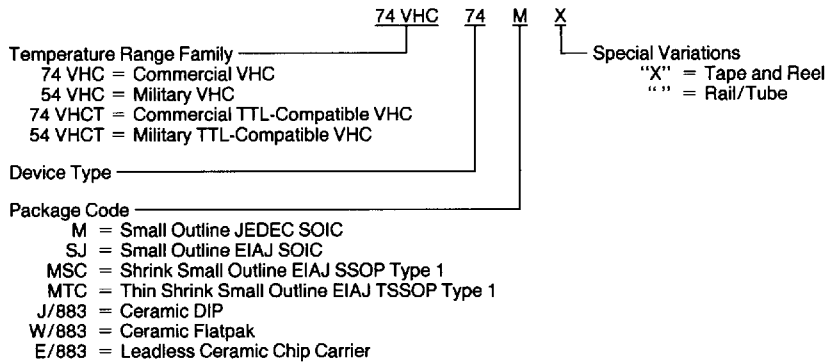
Note 1: C_{PD} is defined as the value of internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I_{CC} (opr) = C_{PD} × V_{CC} × f_{IN} + I_{CC}/2 (per flip-flop).

AC Operating Requirements for 'VHCT

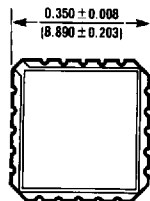
Symbol	Parameter	V _{CC} (V)	74VHCT		54VHCT	74VHCT	Units	Conditions
			T _A = 25°C		T _A = -55°C to +125°C	T _A = -40°C to +85°C		
			Typ	Guaranteed Minimum				
t _{W(L)} t _{W(H)}	Minimum Pulse Width (CK)	5.0 ± 0.5				5.0	ns	
t _{W(L)}	Minimum Pulse Width (\overline{CLR} , \overline{PR})	5.0 ± 0.5		5.0		5.0	ns	
t _S	Minimum Setup Time	5.0 ± 0.5		5.0		5.0	ns	
t _H	Minimum Hold Time	5.0 ± 0.5		0		0	ns	
t _{rem}	Minimum Removal Time (\overline{CLR} , \overline{PR})	5.0 ± 0.5		3.5		3.5	ns	

Ordering Information

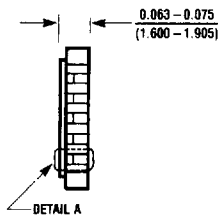
The device number is used to form part of a simplified purchasing code, where the package type and temperature range are defined as follows:



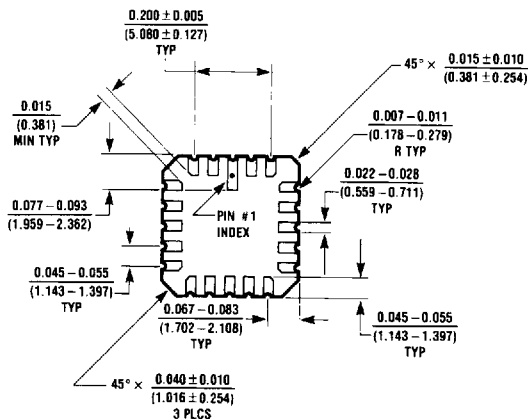
Physical Dimensions inches (millimeters)



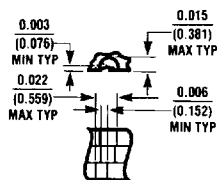
Top View



Side View



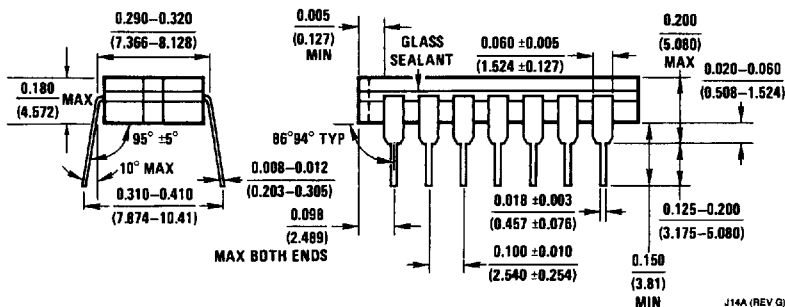
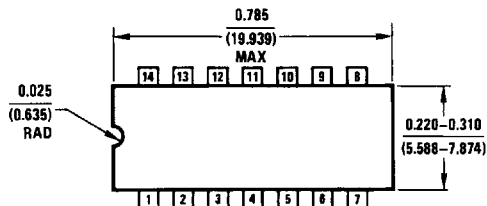
Bottom View



Detail A

20-Lead Ceramic Leadless Chip Carrier, Type C (L) Order Number 54VHC74E/883 or 54VHCT74E/883 NS Package Number E20A

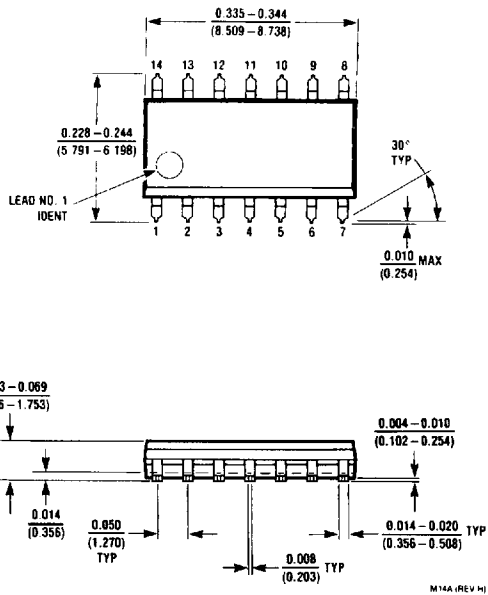
E20A (REV D)



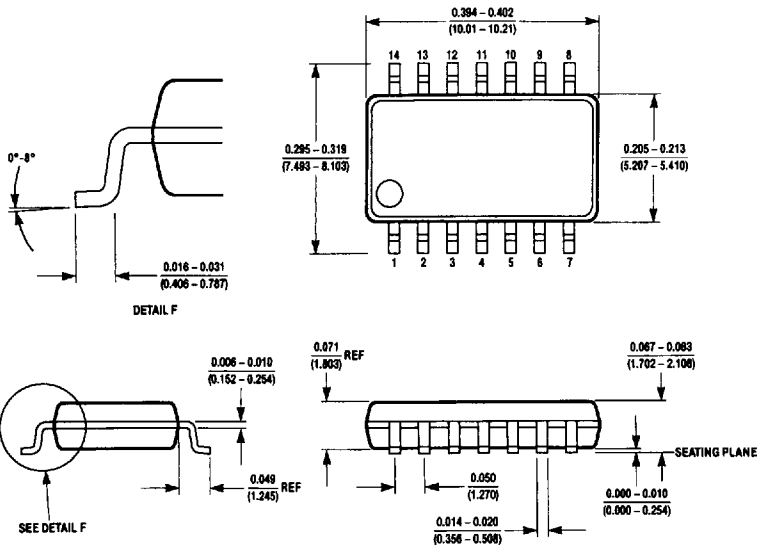
14-Lead Ceramic Dual-In-Line Package (D) Order Number 54VHC74J/883 or 54VHCT74J/883 NS Package Number J14A

J14A (REV G)

Physical Dimensions inches (millimeters) (Continued)

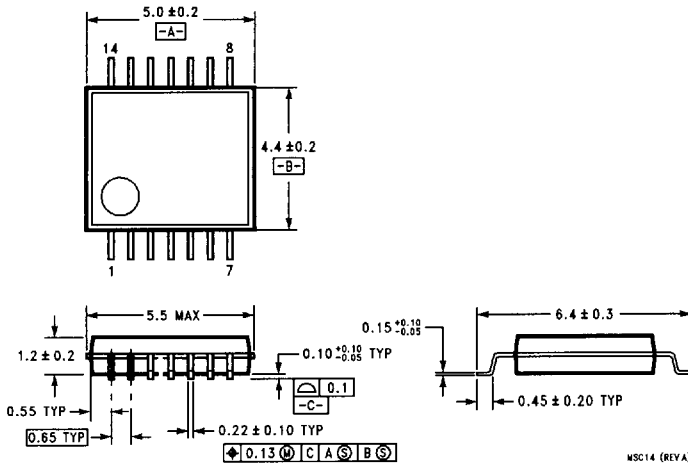


14-Lead Small Outline Integrated Circuit—JEDEC (M)
Order Number 74VHC74M, 74VHC74MX, 74VHCT74M or 74VHCT74MX
NS Package Number M14A

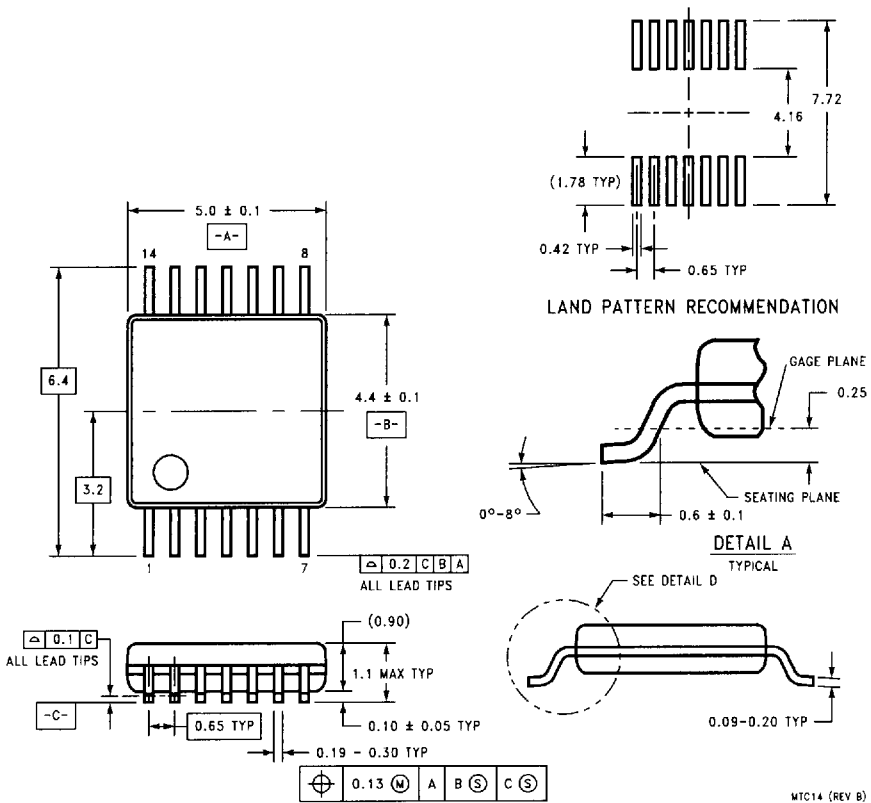


14-Lead Small Outline Package - EIAJ (SJ)
Order Number 74VHC74SJ, 74VHC74SJX, 74VHCT74SJ or 74VHCT74SJX
NS Package Number M14D

Physical Dimensions inches (millimeters) (Continued)



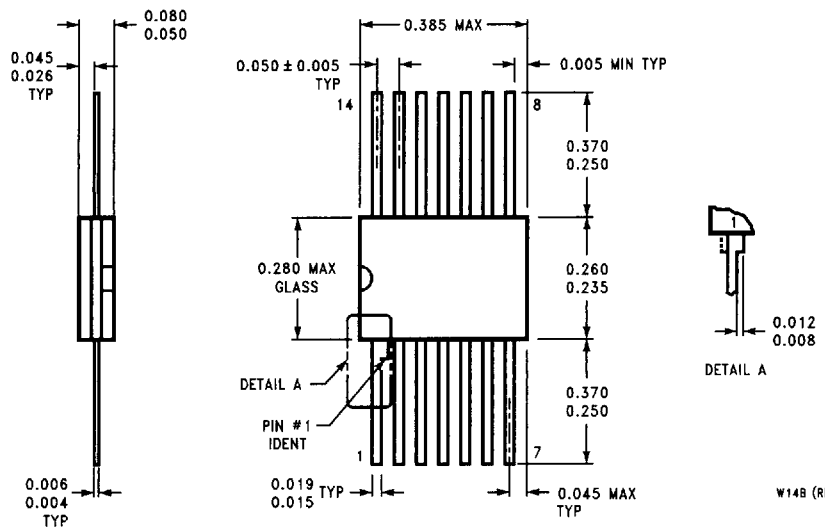
14-Lead Plastic EIAJ SSOP Type 1 (MSC)
Order Number 74VHC74MSCX or 74VHCT74MSCX
NS Package Number MSC14



14-Lead Plastic EIAJ TSSOP Type 1 (MTC)
Order Number 74VHC74MTC, 74VHC74MTCX, 74VHCT74MTC or 74VHCT74MTCX
NS Package Number MTC14

Physical Dimensions inches (millimeters) (Continued)

Lit. # 118050-002



14-Lead Cerpack (F)
Order Number 54VHC74W/883 or 54VHCT74W/883
NS Package Number W14B

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.



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