

August 1998

54ACTQ543

Quiet Series Octal Registered Transceiver with TRI-STATE® Outputs

General Description

The ACTQ543 is a non-inverting octal transceiver containing two sets of D-type registers for temporary storage of data flowing in either direction. Separate Latch Enable and Output Enable inputs are provided for each register to permit independent input and output control in either direction of data flow.

The ACTQ utilizes NSC Quiet Series technology to guarantee quiet output switching and improved dynamic threshold performance. FACT Quiet Series™ features GTO™ output control and undershoot corrector in addition to a split ground bus for superior performance.

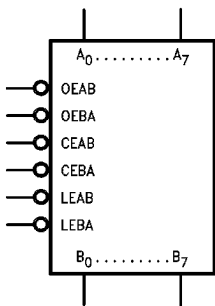
Features

- Guaranteed simultaneous switching noise level and dynamic threshold performance
- 8-bit octal latched transceiver
- Separate controls for data flow in each direction
- Back-to-back registers for storage
- Outputs source/sink 24 mA
- 4 kV minimum ESD immunity

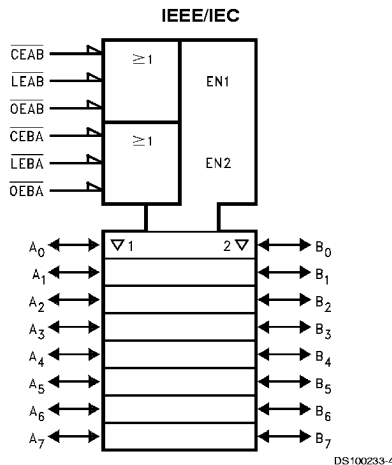
Ordering Code

Military	Package Number	Package Description
54ACTQ543DMQB	J24A	24-Lead Ceramic Dual-In-Line
54ACTQ543FMQB	W24C	24-Lead Cerpack
54ACTQ543LMQB	E28A	24-Lead Ceramic Leadless Chip Carrier, Type C

Logic Symbols



DS100233-1

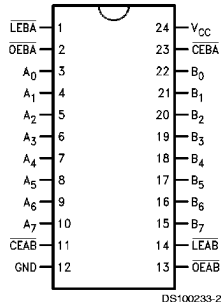


DS100233-4

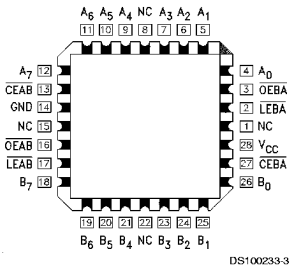
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TRI-STATE® is a registered trademark of National Semiconductor Corporation.
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FACT Quiet Series™ is a trademark of Fairchild Semiconductor Corporation.

Connection Diagrams

Pin Assignment for
DIP and Flatpak



Pin Assignment
for LCC



Pin Names	Description
$\overline{OEAB}$	A-to-B Output Enable Input (Active LOW)
$\overline{OEBA}$	B-to-A Output Enable Input (Active LOW)
$\overline{CEAB}$	A-to-B Enable Input (Active LOW)
$\overline{CEBA}$	B-to-A Enable Input (Active LOW)
$\overline{LEAB}$	A-to-B Latch Enable Input (Active LOW)
$\overline{LEBA}$	B-to-A Latch Enable Input (Active LOW)
A_0-A_7	A-to-B Data Inputs or B-to-A TRI-STATE Outputs
B_0-B_7	B-to-A Data Inputs or A-to-B TRI-STATE Outputs

Functional Description

The ACTQ543 contains two sets of eight D-type latches, with separate input and output controls for each set. For data flow from A to B, for example, the A-to-B Enable ($\overline{CEAB}$) input must be LOW in order to enter data from A_0-A_7 or take data from B_0-B_7 , as indicated in the Data I/O Control Table. With $\overline{CEAB}$ LOW, a LOW signal on the A-to-B Latch Enable ($\overline{LEAB}$) input makes the A-to-B latches transparent; a subsequent LOW-to-HIGH transition of the $\overline{LEAB}$ signal puts the A latches in the storage mode and their outputs no longer change with the A inputs. With $\overline{CEAB}$ and $\overline{OEAB}$ both LOW, the TRI-STATE B output buffers are active and reflect the data present at the output of the A latches. Control of data flow from B to A is similar, but using the $\overline{CEBA}$, $\overline{LEBA}$ and $\overline{OEBA}$ inputs.

Data I/O Control Table

Inputs			Latch Status	Output Buffers
$\overline{CEAB}$	$\overline{LEAB}$	$\overline{OEAB}$		
H	X	X	Latched	High Z
X	H	X	Latched	—
L	L	X	Transparent	—
X	X	H	—	High Z
L	X	L	—	Driving

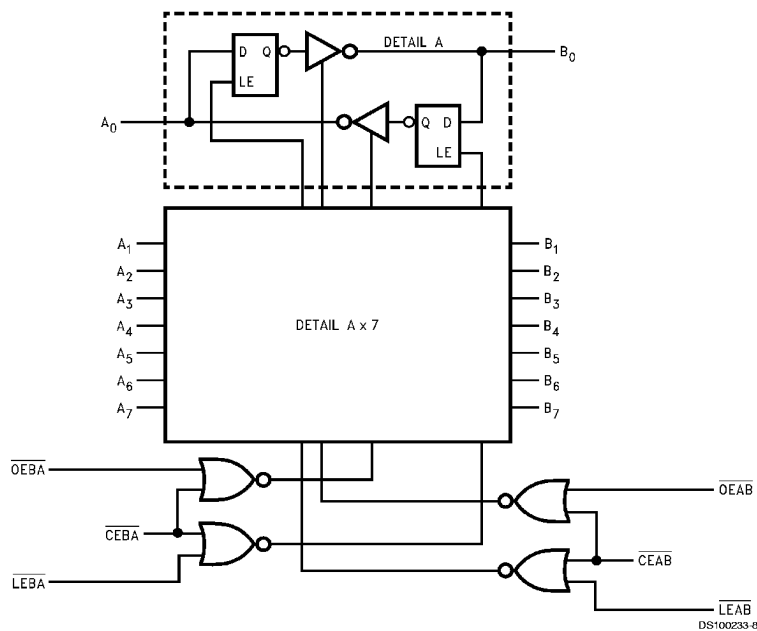
H = HIGH Voltage Level

L = LOW Voltage Level

X = Immaterial

A-to-B data flow shown; B-to-A flow control is the same, except using $\overline{CEBA}$, $\overline{LEBA}$ and $\overline{OEBA}$

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

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 Diode Current (I_{IK})	
$V_I = -0.5V$	-20 mA
$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage (V_I)	-0.5V to $V_{CC} + 0.5V$
DC Output Diode Current (I_{OK})	
$V_O = -0.5V$	-20 mA
$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage (V_O)	-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current (I_O)	±50 mA
DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND})	±50 mA
Storage Temperature (T_{STG})	-65°C to +150°C

DC Latch-up Source or

Sink Current	±300 mA
Junction Temperature (T_J)	
CDIP	175°C

Recommended Operating Conditions

Supply Voltage V_{CC}	
'ACTQ	4.5V to 5.5V
Input Voltage (V_I)	0V to V_{CC}
Output Voltage (V_O)	0V to V_{CC}
Operating Temperature (T_A) (Note 2)	
54ACTQ	-55°C to +125°C
Minimum Input Edge Rate $\Delta V/\Delta t$	
'ACTQ Devices	
V_{IN} from 0.8V to 2.0V	
V_{CC} @ 4.5V, 5.5V	125 mV/ns

Note 1: Absolute maximum ratings are those values beyond which damage to the device may occur. 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 of FACT® circuits outside databook specifications.

Note 2: All commercial packaging is not recommended for applications requiring greater than 2000 temperature cycles from -40°C to +125°C.

DC Characteristics for 'ACTQ Family Devices

Symbol	Parameter	V_{CC} (V)	54ACTQ	Units	Conditions
			$T_A =$ -55°C to +125°C		
			Guaranteed Limits		
V_{IH}	Minimum High Level Input Voltage	4.5	2.0	V	$V_{OUT} = 0.1V$
		5.5	2.0		or $V_{CC} - 0.1V$
V_{IL}	Maximum Low Level Input Voltage	4.5	0.8	V	$V_{OUT} = 0.1V$
		5.5	0.8		or $V_{CC} - 0.1V$
V_{OH}	Minimum High Level Output Voltage	4.5	4.4	V	$I_{OUT} = -50 \mu A$
		5.5	5.4		
		4.5	3.70	V	(Note 3) $V_{IN} = V_{IL}$ or V_{IH} $I_{OH} = -24 \text{ mA}$
		5.5	4.70		$I_{OH} = -24 \text{ mA}$
V_{OL}	Maximum Low Level Output Voltage	4.5	0.1	V	$I_{OUT} = 50 \mu A$
		5.5	0.1		
		4.5	0.50	V	(Note 3) $V_{IN} = V_{IL}$ or V_{IH} $I_{OL} = 24 \text{ mA}$
		5.5	0.50		$I_{OL} = 24 \text{ mA}$
I_{IN}	Maximum Input Leakage Current	5.5	±1.0	μA	$V_I = V_{CC}, \text{ GND}$
I_{OZT}	Maximum I/O Leakage Current	5.5	±10	μA	$V_{(OE)} = V_{IL}, V_{IH}$ $V_O = V_{CC}, \text{ GND}$
I_{OCT}	Maximum I_{CC}/Input	5.5	1.6	mA	$V_I = V_{CC} - 2.1V$
I_{OLD}	Minimum Dynamic Output Current (Note 4)	5.5		mA	$V_{OLD} = 1.65V \text{ Max}$
I_{OHD}		5.5	-50	mA	$V_{OHD} = 3.85V \text{ Min}$
I_{CC}	Maximum Quiescent Supply Current	5.5	160.0	μA	$V_{IN} = V_{CC}$ or GND (Note 5)

DC Characteristics for 'ACTQ Family Devices (Continued)					
Symbol	Parameter	V _{CC} (V)	54ACTQ	Units	Conditions
			T _A = –55°C to +125°C		
			Guaranteed Limits		
V _{OLP}	Quiet Output Maximum Dynamic V _{OL}	5.0	1.5	V	(Notes 6, 7)
V _{OLV}	Quiet Output Minimum Dynamic V _{OL}	5.0	–1.2	V	(Notes 6, 7)

Note 3: Maximum of 8 outputs loaded; thresholds on input associated with output under test.

Note 4: Maximum test duration 2.0 ms, one output loaded at a time.

Note 5: I_{CC} for 54ACTQ @ 25°C is identical to 74ACTQ@ 25°C.

Note 6: Plastic DIP package.

Note 7: Max number of outputs defined as (n). (n–1) Data Inputs are driven 0V to 3V, one output @ GND.

Note 8: Max number of Data Inputs (n) switching. (n–1) Inputs switching 0V to 3V ('ACTQ). Input-under-test switching: 3V to threshold (V_{ILD}), 0V to threshold (V_{IHD}). f = 1 MHz.

AC Electrical Characteristics						
Symbol	Parameter	V _{CC} (V) (Note 9)	54ACTQ		Units	Fig. No.
			T _A = –55°C to +125°C C _L = 50 pF			
			Min	Max		
t _{PLH} t _{PHL}	Propagation Delay Transparent Mode A _n to B _n or B _n to A _n	5.0	2.0	9.5	ns	Figure 4
t _{PLH} t _{PHL}	Propagation Delay LEBA, LEAB to A _n , B _n	5.0	2.0	11.0	ns	Figure 4
t _{PZH} t _{PZL}	Output Enable Time OEBA or OEAB to A _n or B _n CEBA or CEAB to A _n or B _n	5.0	1.5	13.0	ns	Figure 6
t _{PHZ} t _{PLZ}	Output Disable Time OEBA or OEAB to A _n or B _n CEBA or CEAB to A _n or B _n	5.0	1.5	9.0	ns	Figure 6

Note 9: Voltage Range 5.0 is 5.0V ±0.5V

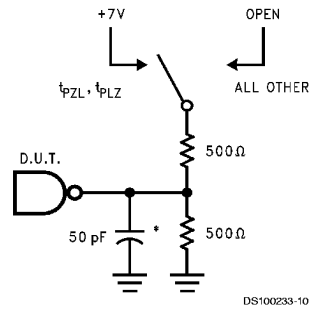
AC Operating Requirements						
Symbol	Parameter	V _{CC} (V) (Note 10)	54ACTQ		Units	Fig. No.
			T _A = –55°C to +125°C C _L = 50 pF			
			Guaranteed Minimum			
t _s	Setup Time, HIGH or LOW A _n or B _n to LEBA or LEAB	5.0	3.0		ns	Figure 7
t _h	Hold Time, HIGH or LOW A _n or B _n to LEBA or LEAB	5.0	1.5		ns	Figure 7
t _w	Latch Enable Pulse Width, LOW	5.0	4.0		ns	Figure 5

Note 10: Voltage Range 5.0 is 5.0V ±0.5V

Capacitance

Symbol	Parameter	Typ	Units	Conditions
C_{IN}	Input Capacitance	4.5	pF	$V_{CC} = OPEN$
C_{PD}	Power Dissipation Capacitance	70.0	pF	$V_{CC} = 5.0V$

AC Loading



*Includes jig and probe capacitance

FIGURE 1. Standard AC Test Load

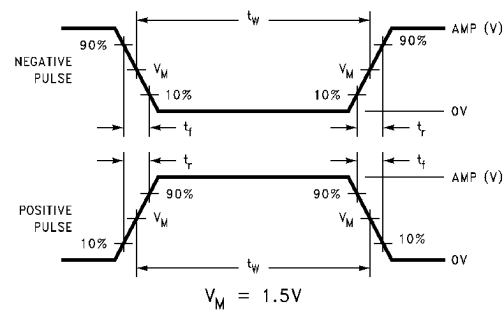


FIGURE 2. Test Input Signal Levels

Amplitude	Rep. Rate	t_w	t_r	t_f
3.0V	1 MHz	500 ns	2.5 ns	2.5 ns

FIGURE 3. Test Input Signal Requirements

AC Waveforms

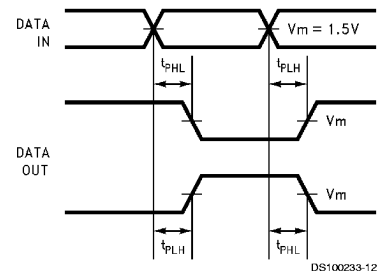


FIGURE 4. Propagation Delay Waveforms for Inverting and Non-Inverting Functions

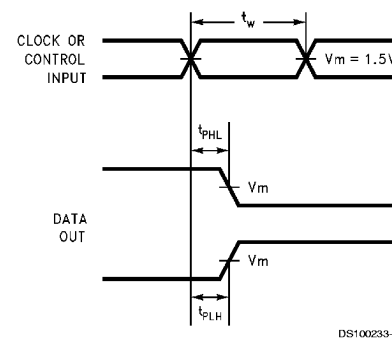


FIGURE 5. Propagation Delay, Pulse Width Waveforms

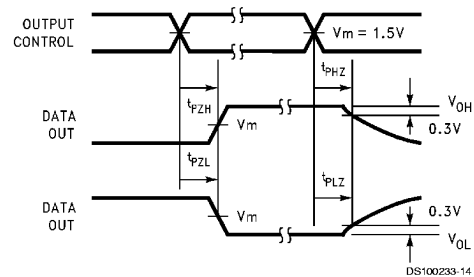


FIGURE 6. TRI-STATE Output High and Low Enable and Disable Time

AC Waveforms (Continued)

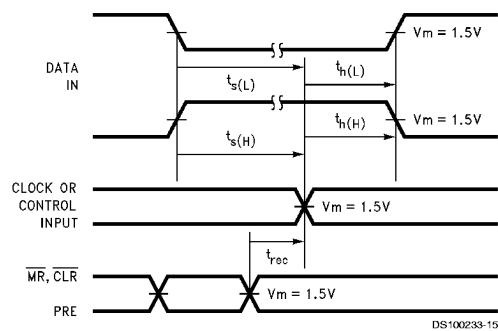
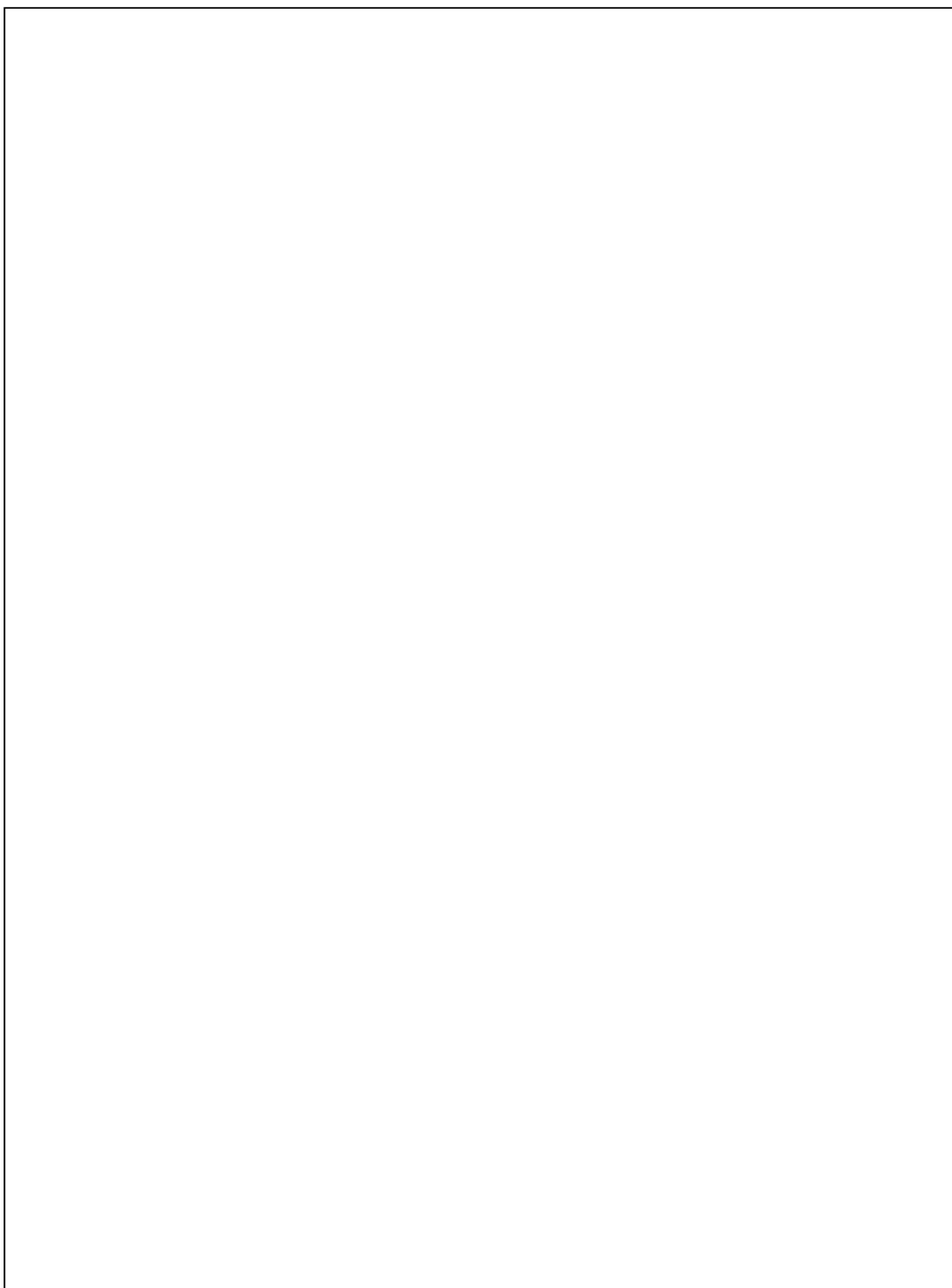
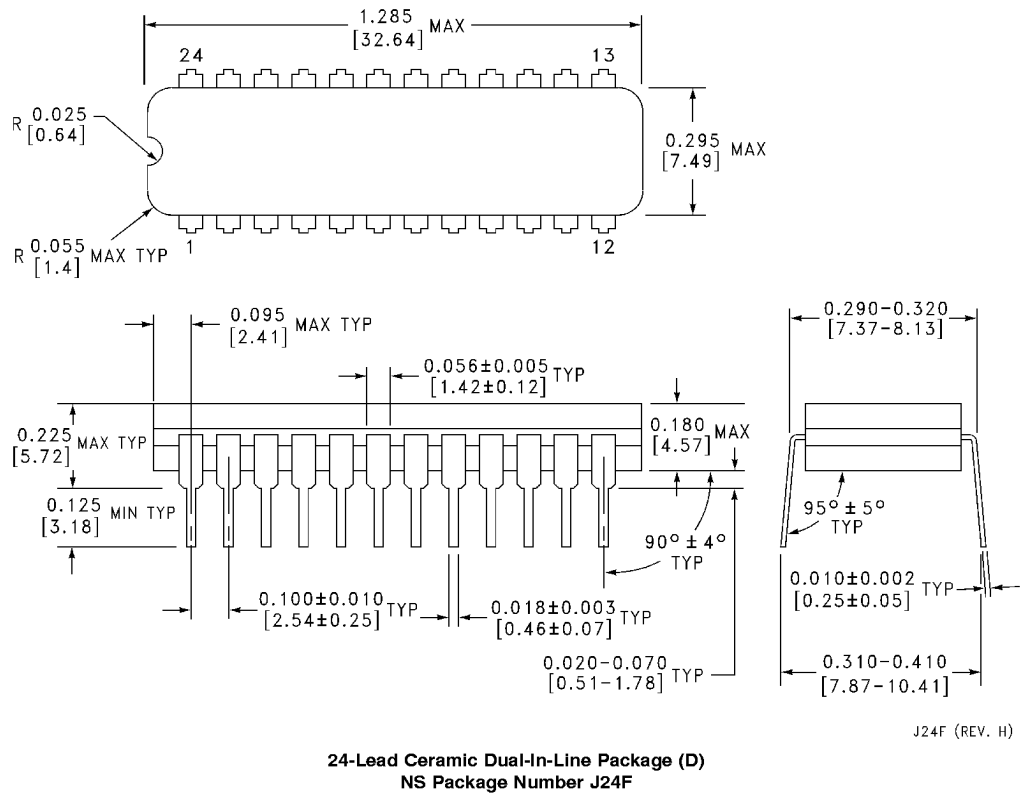
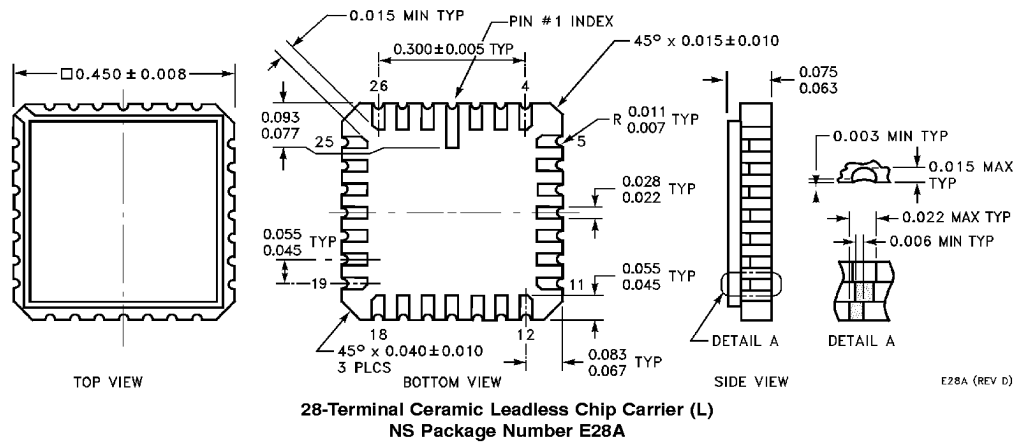


FIGURE 7. Setup Time, Hold Time and Recovery Time Waveforms

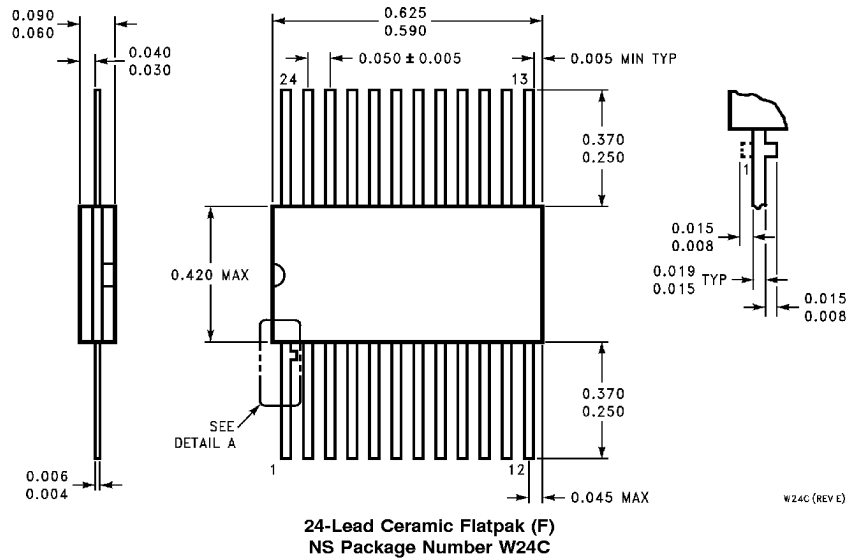
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Physical Dimensions inches (millimeters) unless otherwise noted



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



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