

100321

Low Power 9-Bit Inverter

General Description

The 100321 is a monolithic 9-bit inverter. The device contains nine inverting buffer gates with single input and output. All inputs have 50 kΩ pull-down resistors.

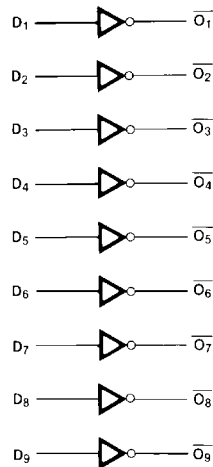
- 2000V ESD protection
- Pin/function compatible with 100121
- Voltage compensated operating range = -4.2V to -5.7V
- Available to industrial grade temperature range
- Available to MIL-STD-883

Features

- 30% power reduction of the 100121

Ordering Code:

Logic Symbol

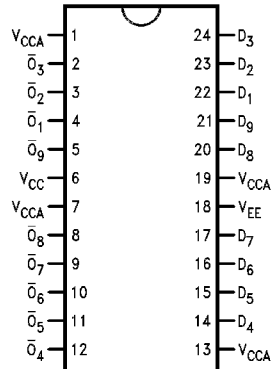


DS010609-1

Pin Names	Description
D ₁ -D ₉	Data Inputs
\overline{O}_1 - \overline{O}_9	Data Outputs

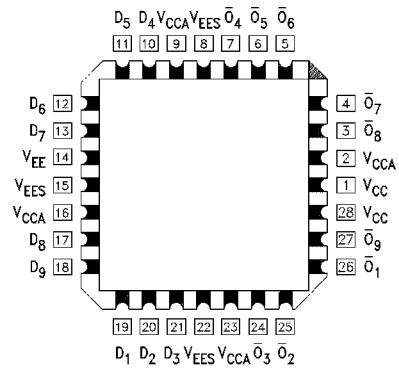
Connection Diagrams

24-Pin DIP



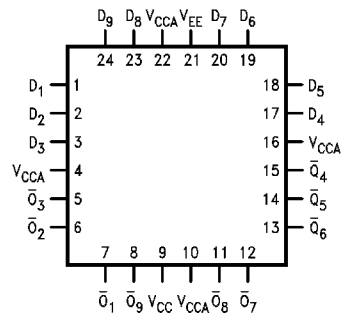
DS010609-2

28-Pin PCC



DS010609-4

24-Pin Quad Cerpak



DS010609-3

Absolute Maximum Ratings (Note 1)

Above which the useful life may be impaired

Storage Temperature (T_{STG})	-65°C to +150°C
Maximum Junction Temperature (T_J)	
Ceramic	+175°C
Plastic	+150°C
V_{EE} Pin Potential to Ground Pin	-7.0V to +0.5V
Input Voltage (DC)	V_{EE} to +0.5V
Output Current (DC Output HIGH)	-50 mA
ESD (Note 2)	≥2000V

Recommended Operating Conditions

Case Temperature (T_C)	
Commercial	0°C to +85°C
Industrial	-40°C to +85°C
Military	-55°C to +125°C
Supply Voltage (V_{EE})	-5.7V to -4.2V

Note 1: Absolute maximum ratings are those values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

Note 2: ESD testing conforms to MIL-STD-883, Method 3015.

Commercial Version

DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$, $T_C = 0^\circ C$ to $+85^\circ C$ (Note 3)

Symbol	Parameter	Min	Typ	Max	Units	Conditions	
V_{OH}	Output HIGH Voltage	-1025	-955	-870	mV	$V_{IN} = V_{IH}$ (Max) or V_{IL} (Min)	Loading with 50Ω to -2.0V
V_{OL}	Output LOW Voltage	-1830	-1705	-1620	mV		
V_{OHC}	Output HIGH Voltage	-1035			mV	$V_{IN} = V_{IH}$ (Min) or V_{IL} (Max)	Loading with 50Ω to -2.0V
V_{OLC}	Output LOW Voltage			-1610	mV		
V_{IH}	Input HIGH Voltage	-1165		-870	mV	Guaranteed HIGH Signal for All Inputs	
V_{IL}	Input LOW Voltage	-1830		-1475	mV	Guaranteed LOW Signal for All Inputs	
I_{IL}	Input LOW Current	0.50			μA	$V_{IN} = V_{IL}$ (Min)	
I_{IH}	Input HIGH Current			240	μA	$V_{IN} = V_{IH}$ (Max)	
I_{EE}	Power Supply Current	-65		-30	mA	Inputs Open	

Note 3: The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

DIP AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH}	Propagation Delay	0.45	1.45	0.45	1.45	0.45	1.55	ns	Figures 1, 2 (Note 4)
t_{PHL}	Data to Output								
t_{TLH}	Transition Time	0.35	1.20	0.35	1.20	0.35	1.20	ns	Figures 1, 2
t_{THL}	20% to 80%, 80% to 20%								

Note 4: The propagation delay specified is for single output switching. Delays may vary up to 200 ps with multiple outputs switching.

PCC and Cerpak AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH}	Propagation Delay	0.45	1.25	0.45	1.25	0.45	1.35	ns	Figures 1, 2 (Note 6)
t_{PHL}	Data to Output								
t_{TLH}	Transition Time	0.35	1.10	0.35	1.10	0.35	1.10	ns	Figures 1, 2
t_{THL}	20% to 80%, 80% to 20%								
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		220		220		220	ps	PCC only (Note 5)

PCC and Cerpak AC Electrical Characteristics (Continued)

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		270		270		270	ps	PCC only (Note 5)
t_{OST}	Maximum Skew Opposite Edge Output-to-Output Variation Data to Output Path		320		320		320	ps	PCC only (Note 5)
t_{PS}	Maximum Skew Pin (Signal) Transition Variation Data to Output Path		230		230		230	ps	PCC only (Note 5)

Note 5: Output-to-Output Skew is defined as the absolute value of the difference between the actual propagation delay for any outputs within the same packaged device. The specifications apply to any outputs switching in the same direction either HIGH to LOW (t_{OSH}), or LOW to HIGH (t_{OLH}), or in opposite directions both HL and LH (t_{OST}). Parameters t_{OST} and t_{PS} guaranteed by design.

Note 6: The propagation delay specified is for single output switching. Delays may vary up to 200 ps with multiple outputs switching.

Industrial Version

PCC DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$, $T_C = -40^\circ C$ to $+85^\circ C$ (Note 7)

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = 0^\circ C$ to $+85^\circ C$		Units	Conditions	
		Min	Max	Min	Max			
V_{OH}	Output HIGH Voltage	-1085	-870	-1025	-870	mV	$V_{IN} = V_{IH}$ (Max) or V_{IL} (Min)	Loading with 50Ω to $-2.0V$
V_{OL}	Output LOW Voltage	-1830	-1575	-1830	-1620	mV		
V_{OHC}	Output HIGH Voltage	-1095		-1035		mV	$V_{IN} = V_{IH}$ (Min) or V_{IL} (Max)	Loading with 50Ω to $-2.0V$
V_{OLC}	Output LOW Voltage		-1565		-1610	mV		
V_{IH}	Input HIGH Voltage	-1170	-870	-1165	-870	mV	Guaranteed HIGH Signal for All Inputs	
V_{IL}	Input LOW Voltage	-1830	-1480	-1830	-1475	mV	Guaranteed LOW Signal for All Inputs	
I_{IL}	Input LOW Current	0.50		0.50		μA	$V_{IN} = V_{IL}$ (Min)	
I_{IH}	Input HIGH Current		300		240	μA	$V_{IN} = V_{IH}$ (Max)	
I_{EE}	Power Supply Current	-65	-30	-65	-30	mA	Inputs Open	

Note 7: The specified limits represent the "worst case" value for the parameter. Since these values normally occur at the temperature extremes, additional noise immunity and guardbanding can be achieved by decreasing the allowable system operating ranges. Conditions for testing shown in the tables are chosen to guarantee operation under "worst case" conditions.

PCC AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH}	Propagation Delay Data to Output	0.45	1.25	0.45	1.25	0.45	1.35	ns	Figures 1, 2 (Note 8)
t_{TLH}	Transition Time 20% to 80%, 80% to 20%	0.30	1.20	0.35	1.10	0.35	1.10	ns	Figures 1, 2

Note 8: The propagation delay specified is for single output switching. Delays may vary up to 200 ps with multiple outputs switching.

Military Version

DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$, $T_C = -55^\circ C$ to $+125^\circ C$

Symbol	Parameter	Min	Max	Units	T_C	Conditions	Notes	
V_{OH}	Output HIGH Voltage	-1025	-870	mV	$0^\circ C$ to $+125^\circ C$	$V_{IN} = V_{IH} (Max)$ or $V_{IL} (Min)$	Loading with 50Ω to $-2.0V$	(Notes 9, 10, 11)
		-1085	-870	mV	$-55^\circ C$			
V_{OL}	Output LOW Voltage	-1830	-1620	mV	$0^\circ C$ to $+125^\circ C$	$V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$	Loading with 50Ω to $-2.0V$	(Notes 9, 10, 11)
		-1830	-1555	mV	$-55^\circ C$			
V_{OHC}	Output HIGH Voltage	-1035		mV	$0^\circ C$ to $+125^\circ C$	$V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$	Loading with 50Ω to $-2.0V$	(Notes 9, 10, 11)
		-1085		mV	$-55^\circ C$			
V_{OLC}	Output LOW Voltage		-1610	mV	$0^\circ C$ to $+125^\circ C$	$V_{IN} = V_{IH} (Min)$ or $V_{IL} (Max)$	Loading with 50Ω to $-2.0V$	(Notes 9, 10, 11)
			-1555	mV	$-55^\circ C$			
V_{IH}	Input HIGH Voltage	-1165	-870	mV	$-55^\circ C$ to $+125^\circ C$	Guaranteed HIGH Signal for All Inputs	(Notes 9, 10, 11, 12)	
V_{IL}	Input LOW Voltage	-1830	-1475	mV	$-55^\circ C$ to $+125^\circ C$	Guaranteed LOW Signal for All Inputs	(Notes 9, 10, 11, 12)	
I_{IL}	Input LOW Current	0.50		μA	$-55^\circ C$ to $+125^\circ C$	$V_{EE} = -4.2V$ $V_{IN} = V_{IL} (Min)$	(Notes 9, 10, 11)	
I_{IH}	Input HIGH Current		240	μA	$0^\circ C$ to $+125^\circ C$	$V_{EE} = -5.7V$ $V_{IN} = V_{IH} (Max)$	(Notes 9, 10, 11)	
			340	μA	$-55^\circ C$			
I_{EE}	Power Supply Current	-70	-25	mA	$-55^\circ C$ to $+125^\circ C$	Inputs Open	(Notes 9, 10, 11)	

Note 9: F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals $-55^\circ C$), then testing immediately without allowing for the junction temperature to stabilize due to heat dissipation after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

Note 10: Screen tested 100% on each device at $-55^\circ C$, $+25^\circ C$, and $+125^\circ C$, Subgroups 1, 2, 3, 7, and 8.

Note 11: Sample tested (Method 5005, Table *NO TARGET FOR table NS0993) on each manufactured lot at $-55^\circ C$, $+25^\circ C$ and $+125^\circ C$, Subgroups A1, 2, 3, 7, and 8.

Note 12: Guaranteed by applying specified input condition and testing V_{OH}/V_{OL} .

AC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$

Symbol	Parameter	$T_C = -55^\circ C$		$T_C = +25^\circ C$		$T_C = +125^\circ C$		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
t_{PLH}	Propagation Delay	0.30	1.80	0.40	1.60	0.40	1.80	ns	Figures 1, 2	(Notes 13, 14, 15, 17)
t_{PHL}	Data to Output									
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.30	1.20	0.30	1.20	0.30	1.20	ns		

Note 13: F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals $-55^\circ C$), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

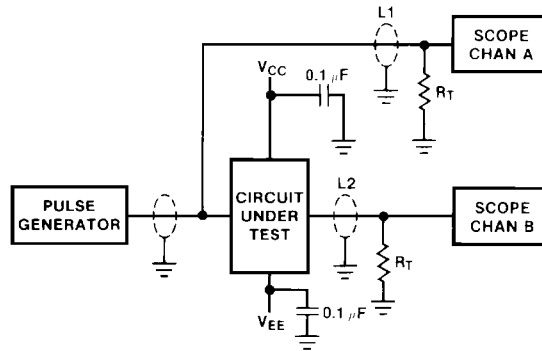
Note 14: Screen tested 100% on each device at $+25^\circ C$ temperature only, Subgroup A9.

Note 15: Sample tested (Method 5005, Table *NO TARGET FOR table NS1082) on each mfg. lot at $+25^\circ C$, Subgroup A9, and at $+125^\circ C$ and $-55^\circ C$ temperatures, Subgroups A10 and A11.

Note 16: Not tested at $+25^\circ C$, $+125^\circ C$, and $-55^\circ C$ temperature (design characterization data).

Note 17: The propagation delay specified is for single output switching. Delays may vary up to 200 ps with multiple outputs switching.

Test Circuitry



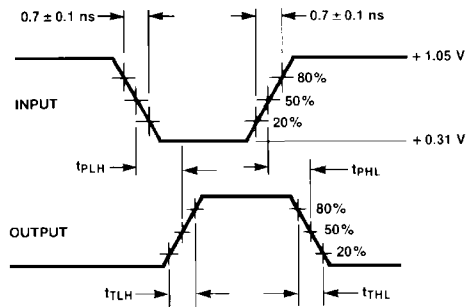
DS010609-5

Notes:

$V_{CC}, V_{CCA} = +2V, V_{EE} = -2.5V$
 $L1$ and $L2$ = equal length 50Ω impedance lines
 $R_T = 50\Omega$ terminator internal to scope
 Decoupling $0.1 \mu F$ from GND to V_{CC} and V_{EE}
 All unused outputs are loaded with 50Ω to GND
 C_L = Fixture and stray capacitance $\leq 3 pF$

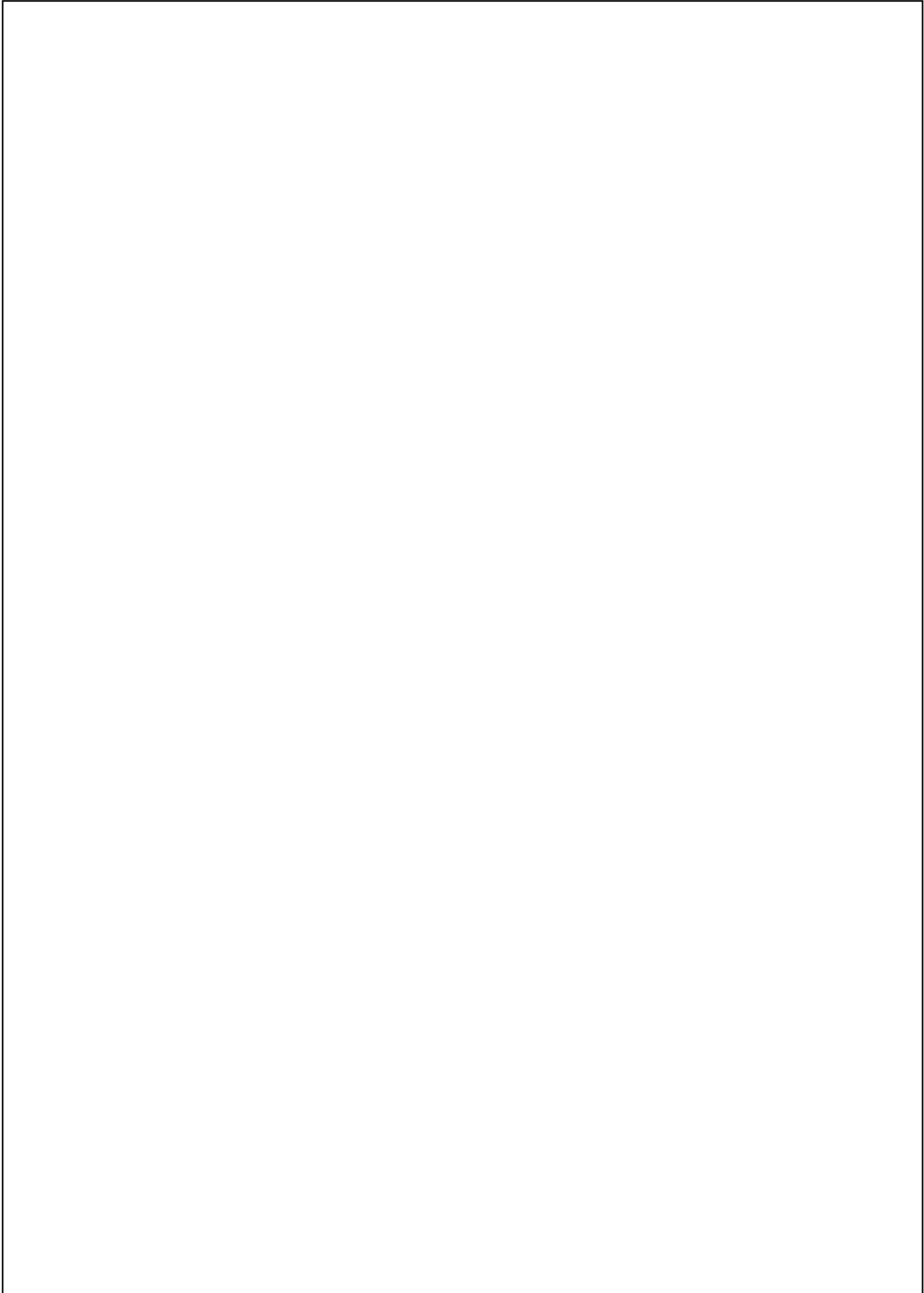
FIGURE 1. AC Test Circuit

Switching Waveforms



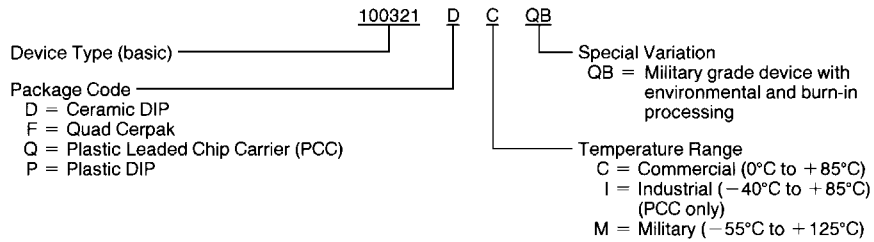
DS010609-6

FIGURE 2. Propagation Delay and Transition Times



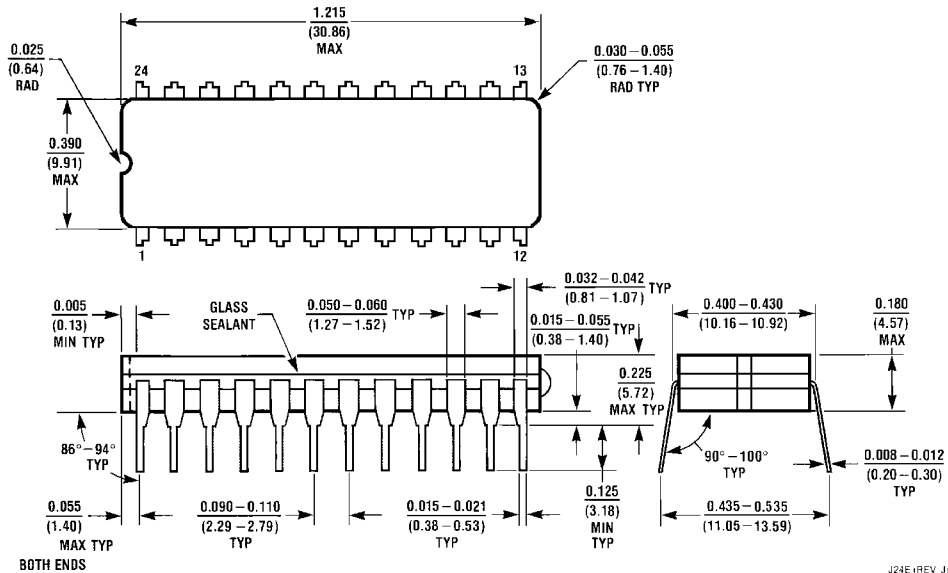
Ordering Information

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



DS010509-7

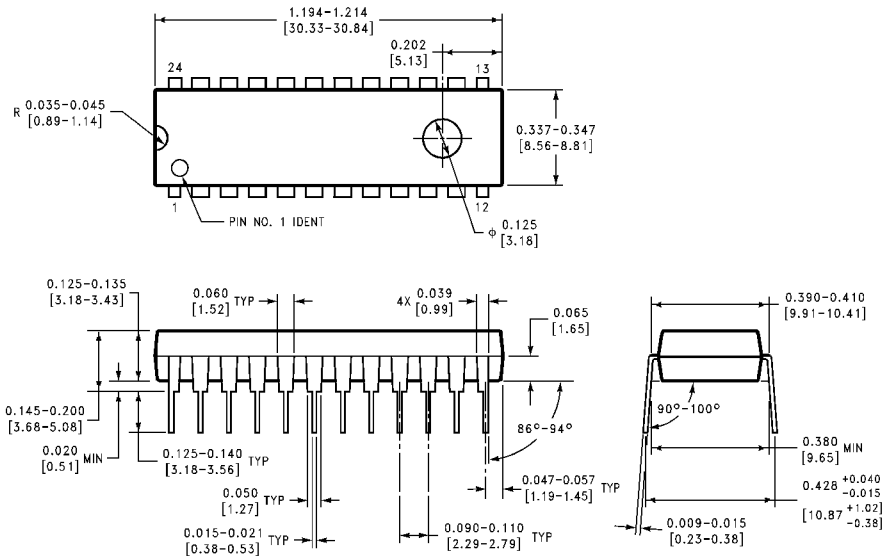
Physical Dimensions inches (millimeters) unless otherwise noted



J24E (REV J)

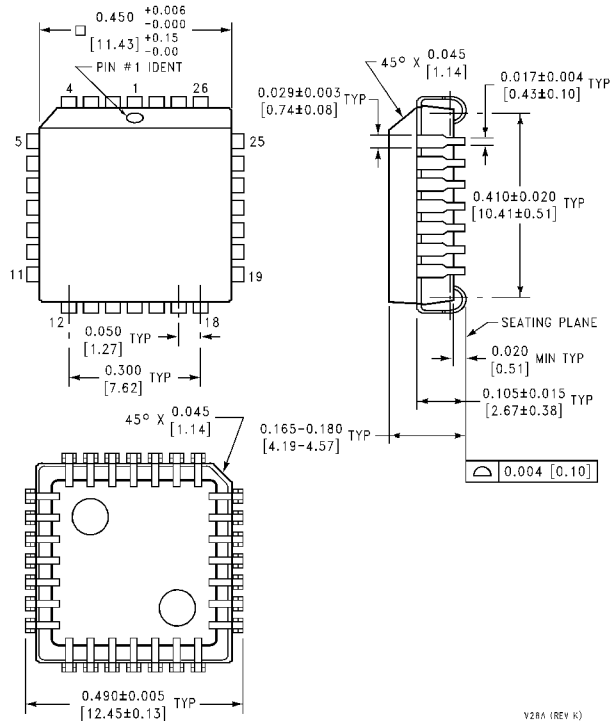
24-Lead Ceramic Dual-In-Line Package (D)
Package Number J24E

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



N24E (REV A)

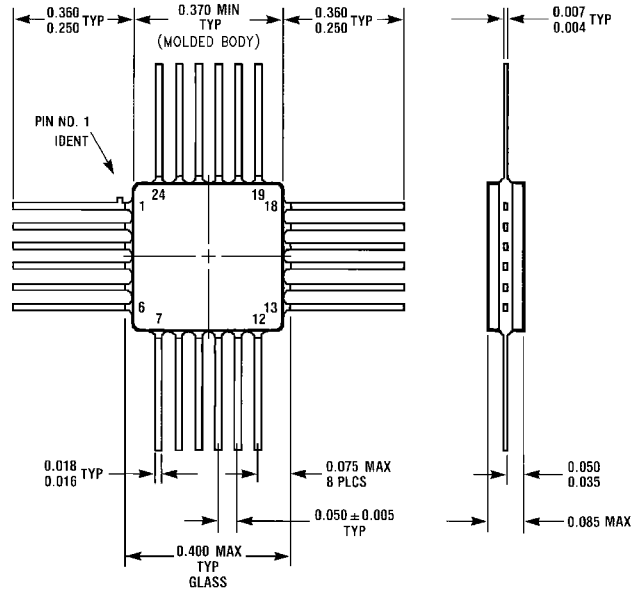
24-Lead Plastic Dual-In-Line Package (P)
Package Number N24E



V28A (REV K)

28-Lead Plastic Chip Carrier (Q)
Package Number V28A

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



W24B (REV D)

**24-Lead Quad Cerpak (F)
Package Number W24B**

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