National Semiconductor

October 1990

F100364
Low Power 16-Input Multiplexer

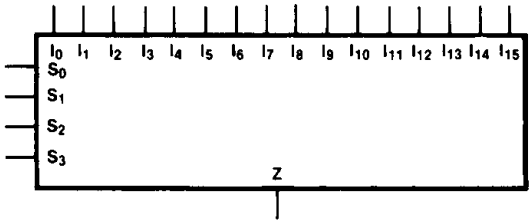
General Description

The F100364 is a 16-input multiplexer. Data paths are controlled by four Select lines (S_0–S_3). Their decoding is shown in the truth table. Output data polarity is the same as the seleted input data. All inputs have 50 kΩ pulldown resistors.

Features

- 35% power reduction of the F100164
- 2000V ESD protection
- Pin/function compatible with F100164
- Voltage compensated operating range = −4.2V to −5.7V

Logic Symbol



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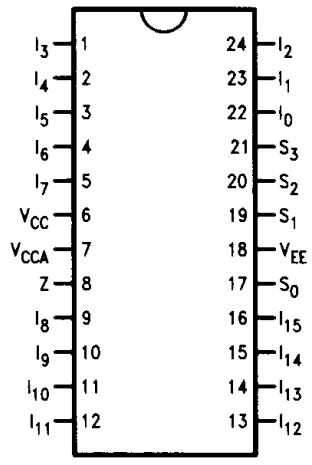
Pin Names	Description
I_0–I_{15}	Data Inputs
S_0–S_3	Select Inputs
Z	Data Output

Connection Diagrams

24-Pin DIP



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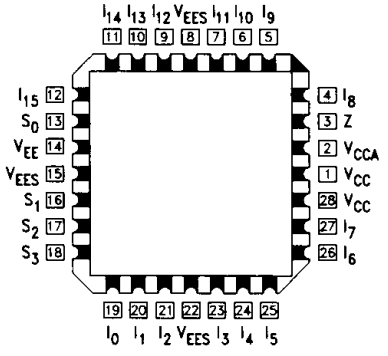
28-Pin PCC



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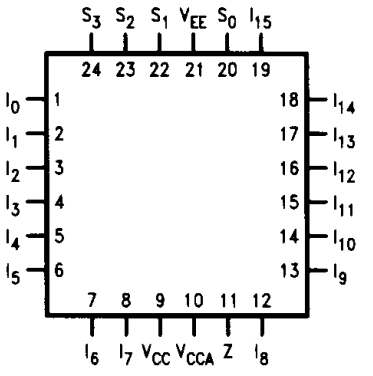
24-Pin Quad Cerpak



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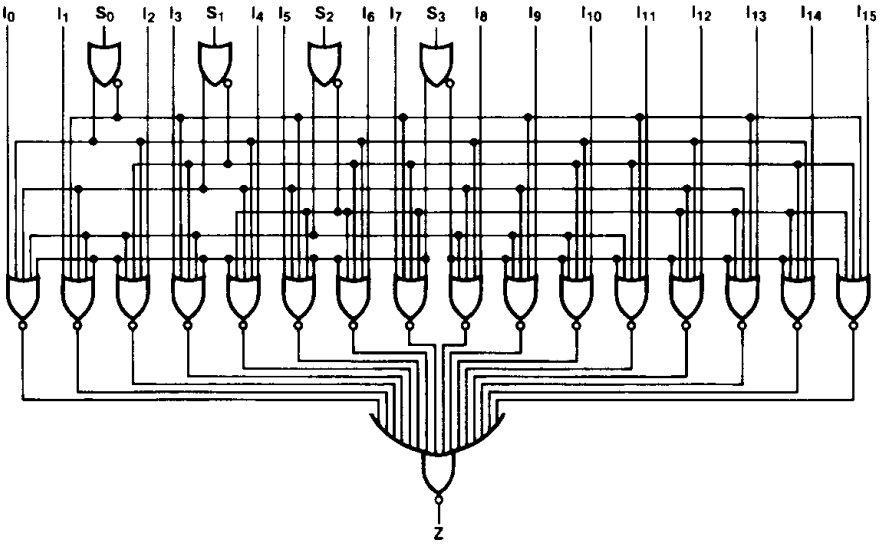
Logic Diagram



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Truth Table

Select Inputs				Output
S_0	S_1	S_2	S_3	Z
L	L	L	L	I_0
H	L	L	L	I_1
L	H	L	L	I_2
H	H	L	L	I_3
L	L	H	L	I_4
H	L	H	L	I_5
L	H	H	L	I_6
H	H	H	L	I_7
L	L	L	H	I_8
H	L	L	H	I_9
L	H	L	H	I_{10}
H	H	L	H	I_{11}
L	L	H	H	I_{12}
H	L	H	H	I_{13}
L	H	H	H	I_{14}
H	H	H	H	I_{15}

H = HIGH Voltage Level
L = LOW Voltage Level

Absolute Maximum Ratings

Above which the useful life may be impaired (Note 1)

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

Storage Temperature (T_{STG})	−65°C to +150°C
Maximum Junction Temperature (T_J)	
Ceramic	+175°C
Plastic	+150°C
Pin Potential to Ground Pin (V_{EE})	−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
Military	−55°C to +125°C
Supply Voltage (V_{EE})	
Commercial	−5.7V to −4.2V
Military	−5.7V to −4.2V

Commercial Version

DC Electrical Characteristics

V_{EE} = −4.2V to −5.7V, V_{CC} = V_{CCA} = GND, T_C = 0°C to +85°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	0.5			μA	V_{IN} = V_{IL} (Min)	
I_{IH}	Input HIGH Current			300	μA	V_{IN} = V_{IH} (Max)	
I_{EE}	Power Supply Current	−89		−45	mA	Inputs Open	

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.

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 operate under "worst case" conditions.

Ceramic Dual-In-Line Package AC Electrical Characteristics

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

Symbol	Parameter	T_C = 0°C		T_C = +25°C		T_C = +85°C		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay I_0–I_{15} to Output	0.90	2.00	0.90	2.00	0.90	2.10	ns	*Figures 1, 2*
t_{PLH} t_{PHL}	Propagation Delay S_0, S_1 to Output	1.40	2.80	1.40	2.80	1.50	2.90	ns	
t_{PLH} t_{PHL}	Propagation Delay S_2, S_3 to Output	1.00	2.20	1.00	2.20	1.10	2.40	ns	
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.35	1.20	0.35	1.20	0.35	1.20	ns	

Commercial Version (Continued)

PCC and Cerpak AC Electrical Characteristics

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

Symbol	Parameter	T_C = 0°C		T_C = +25°C		T_C = +85°C		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay I_0–I_{15} to Output	0.90	1.80	0.90	1.80	0.90	1.90	ns	*Figures 1, 2*
t_{PLH} t_{PHL}	Propagation Delay S_0, S_1 to Output	1.40	2.60	1.40	2.60	1.50	2.70	ns	
t_{PLH} t_{PHL}	Propagation Delay S_2, S_3 to Output	1.00	2.00	1.00	2.00	1.10	2.20	ns	
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.35	1.10	0.35	1.10	0.35	1.10	ns	
$t_{S\,G-G}$	Skew Gate to Gate		TBD		TBD		TBD	PS	PCC Only (Note 1)

Note 1: Gate to gate skew is defined as the difference in propagation delays beween each of the outputs.

Military Version—Preliminary

DC Electrical Characteristics

V_{EE} = −4.2V to −5.7V, V_{CC} = V_{CCA} = GND, T_C = −55°C to +125°C

Symbol	Parameter	Min	Max	Units	T_C	Conditions		Notes
V_{OH}	Output HIGH Voltage	−1025	−870	mV	0°C to +125°C	V_{IN} = V_{IH} (Max) or V_{IL} (Min)	Loading with 50Ω to −2.0V	1, 2, 3
		−1085	−870	mV	−55°C			
V_{OL}	Output LOW Voltage	−1830	−1620	mV	0°C to +125°C			
		−1830	−1555	mV	−55°C			
V_{OHC}	Output HIGH Voltage	−1035		mV	0°C to +125°C	V_{IN} = V_{IH} (Min) or V_{IL} (Max)	Loading with 50Ω to −2.0V	1, 2, 3
		−1085		mV	−55°C			
V_{OLC}	Output LOW Voltage		−1610	mV	0°C to +125°C			
			−1555	mV	−55°C			
V_{IH}	Input HIGH Voltage	−1165	−870	mV	−55°C to +125°C	Guaranteed HIGH Signal for All Inputs		1, 2, 3, 4
V_{IL}	Input LOW Voltage	−1830	−1475	mV	−55°C to +125°C	Guaranteed LOW Signal for All Inputs		1, 2, 3, 4
I_{IL}	Input LOW Current	0.50		μA	−55°C to +125°C	V_{EE} = −4.2V V_{IN} = V_{IL} (Min)		1, 2, 3

Military Version—Preliminary (Continued)

DC Electrical Characteristics

V_{EE} = −4.2V to −5.7V, V_{CC} = V_{CCA} = GND, T_C = −55°C to +125°C

Symbol	Parameter	Min	Max	Units	T_C	Conditions	Notes
I_{IH}	Input HIGH Current		300	μA	0°C to +125°C	V_{EE} = −5.7V V_{IN} = V_{IH} (Max)	1, 2, 3
			450	μA	−55°C		
I_{EE}	Power Supply Current	−95	−35	mA	−55°C to +125°C	Inputs Open	1, 2, 3

Note 1: F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals −55°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 2: Screen tested 100% on each device at −55°C, +25°C, and +125°C, Subgroups, 1, 2, 3, 7 and 8.

Note 3: Sampled tested (Method 5005, Table I) on each manufactured lot at −55°C, +25°C, and +125°C, Subgroups A1, 2, 3, 7 and 8.

Note 4: Guaranteed by applying specified input condition and testing V_{OH}/V_{OL}.

Ceramic Dual-In-Line Package AC Electrical Characteristics

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

Symbol	Parameter	T_C = −55°C		T_C = 25°C		T_C = +125°C		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
t_{PLH} t_{PHL}	Propagation Delay I_0–I_{15} to Output	0.50	2.60	0.60	2.40	0.60	2.80	ns	*Figures 1, 2*	1, 2, 3
t_{PLH} t_{PHL}	Propagation Delay S_0, S_1 to Output	0.70	3.30	0.90	3.10	1.00	3.50	ns		
t_{PLH} t_{PHL}	Propagation Delay S_2, S_3 to Output	0.50	2.90	0.70	2.60	0.60	3.00	ns		
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.20	1.20	0.20	1.20	0.20	1.20	ns		4

Cerpak AC Electrical Characteristics

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

Symbol	Parameter	T_C = −55°C		T_C = +25°C		T_C = +125°C		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
t_{PLH} t_{PHL}	Propagation Delay I_0–I_{15} to Output	0.50	2.60	0.60	2.40	0.60	2.80	ns	*Figures 1, 2*	1, 2, 3
t_{PLH} t_{PHL}	Propagation Delay S_0, S_1 to Output	0.70	3.30	0.90	3.10	1.00	3.50	ns		
t_{PLH} t_{PHL}	Propagation Delay S_2, S_3 to Output	0.50	2.90	0.70	2.60	0.60	3.00	ns		
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.20	1.20	0.20	1.20	0.20	1.20	ns		4

Note 1: F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals −55°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 2: Screen tested 100% on each device at +25°C, temperature only, Subgroup A9.

Note 3: Sample tested (Method 5005, Table I) on each Mfg. lot at +25°C, Subgroup A9, and at +125°C, and −55°C temp., Subgroups A10 and A11.

Note 4: Not tested at +25°C, +125°C and −55°C temperature (design characterization data).

Test Circuit

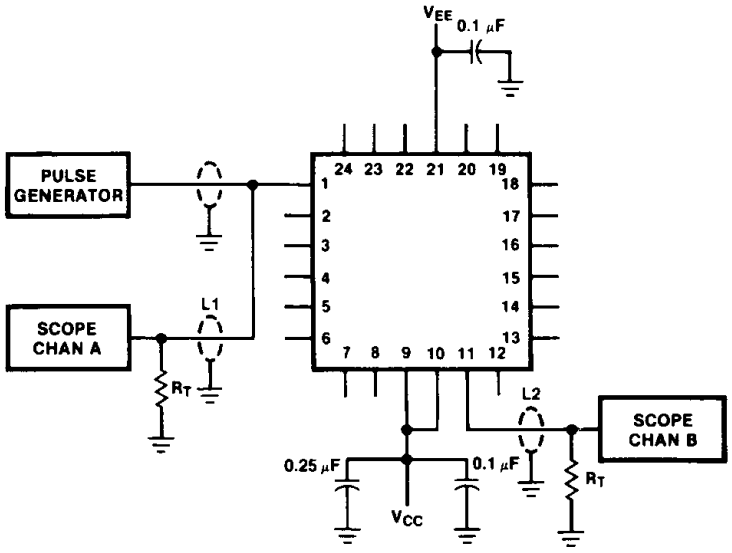

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FIGURE 1. AC Test Circuit

Switching Waveforms

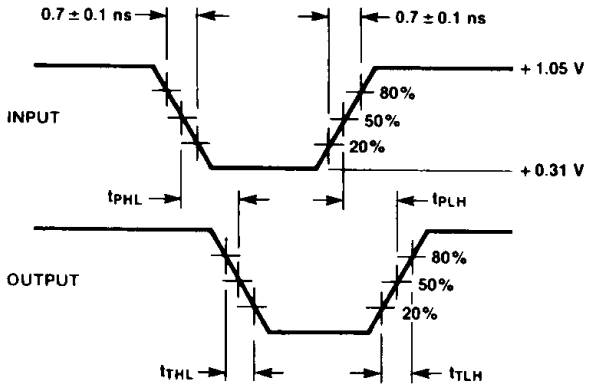

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FIGURE 2. Propagation Delay and Transition Times

Notes:

V_{CC}, V_{CCA} = +2V, V_{EE} = −2.5V

L1 and L2 = Equal length 50Ω impedance lines

R_T = 50Ω terminator internal to scope

Decoupling 0.1 μF from GND to V_{CC} and V_{EE}

All unused outputs are loaded with 50Ω to GND

C_L = Fixture and stray capacitance ≤ 3 pF

Pin numbers shown are for flatpak; for DIP see logic symbol

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:

100364 D C QR

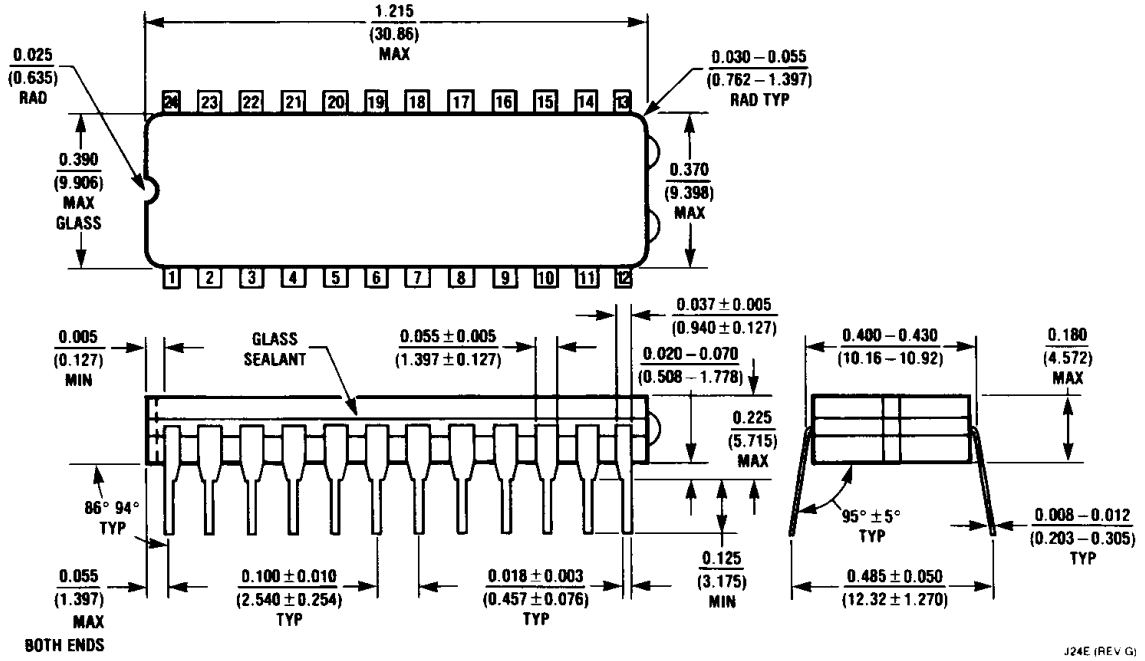
Device Type (Basic)

Package Code
- D = Ceramic DIP
- F = Quad Cerpak
- Q = Plastic Leaded Chip Carrier (PCC)

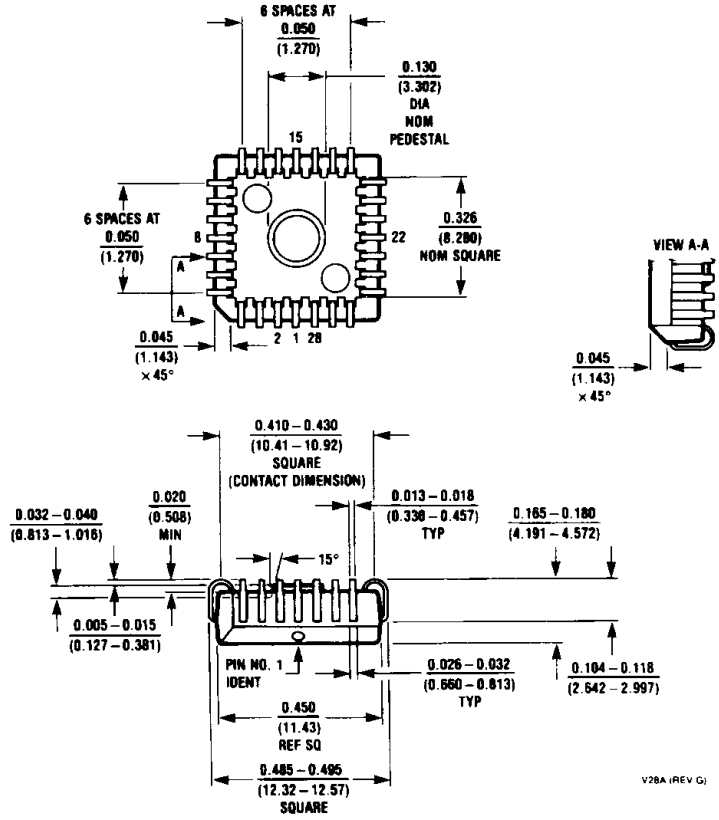
Temperature Range
- C = Commercial (0°C to +85°C)
- M = Military (−55°C to +125°C)

Special Variations
- QR = Commercial grade device with burn-in
- QB = Military grade device with environmental and burn-in processing

Physical Dimensions inches (millimeters)



24-Lead Ceramic Dual-In-Line Package (0.400" Wide) (D)
NS Package Number J24E

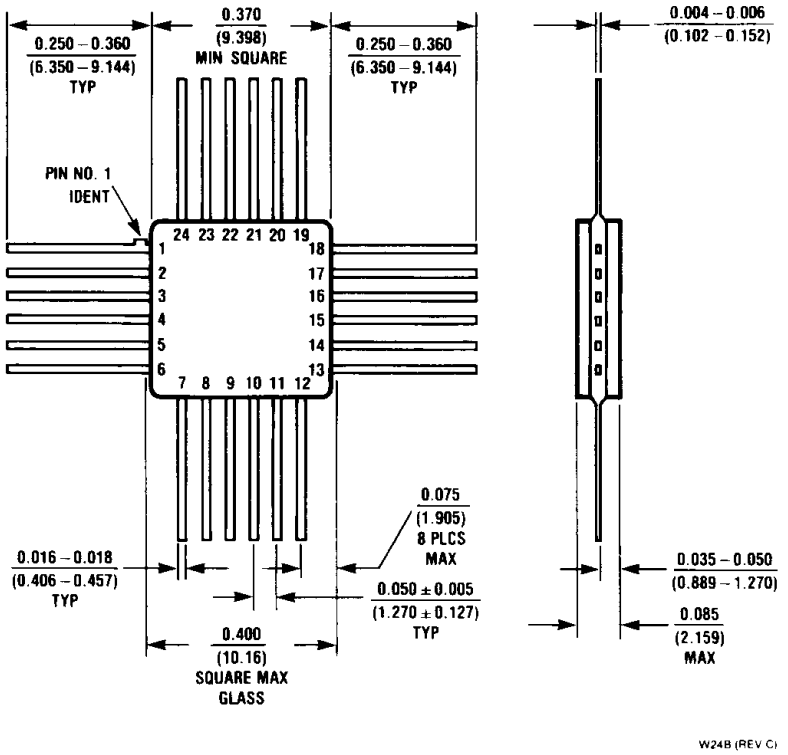


28-Lead Plastic Chip Carrier (Q)
NS Package Number V28A

Note: Pedestal as shown on base is not available for F100K ECL products.

Physical Dimensions inches (millimeters) (Continued)

Lit.# 114925



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

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