FAIRCHILD SEMICONDUCTOR™

March 1998

100371
Low Power Triple 4-Input Multiplexer with Enable

General Description

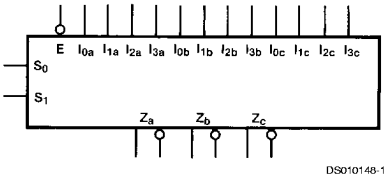
The 100371 contains three 4-input multiplexers which share a common decoder (inputs S_0 and S_1). Output buffer gates provide true and complement outputs. A HIGH on the Enable input ($\overline{E}$) forces all true outputs LOW (see Truth Table). All inputs have 50 kΩ pull-down resistors.

Features

- 35% power reduction of the 100171
- 2000V ESD protection
- Pin/function compatible with 100171
- Voltage compensated operating range = −4.2V to −5.7V
- Available to industrial grade temperature range

Ordering Code:

Logic Symbol



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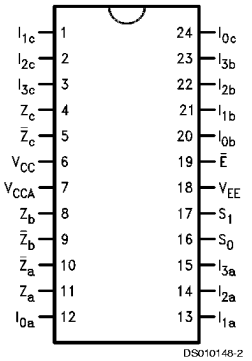
Pin Names	Description
I_{0x}–I_{3x}	Data Inputs
S_0, S_1	Select Inputs
$\overline{E}$	Enable Input (Active LOW)
Z_a–Z_c	Data Outputs
$\overline{Z}_a$–$\overline{Z}_c$	Complementary Data Outputs

Connection Diagrams

24-Pin DIP/SOIC



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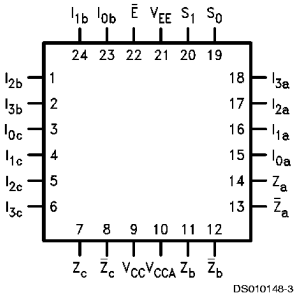
24-Pin Quad Cerpak



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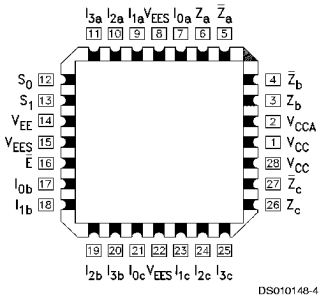
28-Pin PCC



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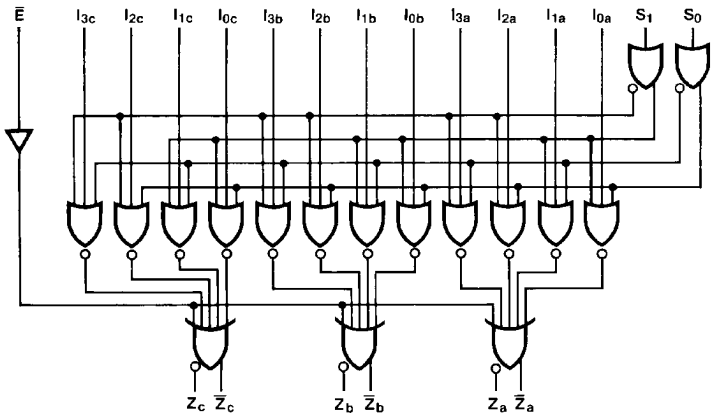
Logic Diagram



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Truth Table

Inputs			Outputs
$\overline{E}$	S_0	S_1	Z_n
L	L	L	I_{0x}
L	H	L	I_{1x}
L	L	H	I_{2x}
L	H	H	I_{3x}
H	X	X	L

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care

Absolute Maximum Ratings (Note 1)

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°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)	Loading with
V_{OL}	Output LOW Voltage	−1830	−1705	−1620	mV	or V_{IL} (Min)	50Ω to −2.0V
V_{OHC}	Output HIGH Voltage	−1035			mV	V_{IN} = V_{IH} (Min)	Loading with
V_{OLC}	Output LOW Voltage			−1610	mV	or V_{IL} (Max)	50Ω to −2.0V
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						
	I_{0X}–I_{3X}			340	μA	V_{IN} = V_{IH} (Max)	
	S_0, S_1, $\overline{E}$			300			
I_{EE}	Power Supply Current	−75		−39	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.

Commercial Version DIP 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}	Propagation Delay	0.45	1.50	0.45	1.50	0.45	1.60	ns	
t_{PHL}	I_{0x}–I_{3x} to Output								
t_{PLH}	Propagation Delay	0.90	2.40	0.90	2.40	1.00	2.60	ns	*Figures 1, 2*
t_{PHL}	S_0, S_1 to Output								(Note 4)
t_{PLH}	Propagation Delay	0.65	2.30	0.65	2.30	0.75	2.40	ns	
t_{PHL}	$\overline{E}$ 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 300 ps with multiple outputs switching.

Commercial Version
SOIC, 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_{0x}–I_{3x} to Output	0.45	1.30	0.45	1.30	0.45	1.40	ns	
t_{PLH} t_{PHL}	Propagation Delay S_0, S_1 to Output	0.90	2.20	0.90	2.20	1.00	2.40	ns	*Figures 1, 2* (Note 6)
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to Output	0.65	2.10	0.65	2.10	0.75	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	*Figures 1, 2*
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		400		400		400	ps	PCC only (Note 5)
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		490		490		490	ps	PCC only (Note 5)
t_{OST}	Maximum Skew Opposite Edge Output-to-Output Variation Data to Output Path		490		490		490	ps	PCC only (Note 5)
t_{PS}	Maximum Skew Pin (Signal) Transition Variation Data to Output Path		430		430		430	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_{OSHL}), or LOW to HIGH (t_{OSLH}), 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 300 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°C to +85°C (Note 7)

Symbol	Parameter	T_C = −40°C		T_C = 0°C to +85°C		Units	Conditions	
		Min	Max	Min	Max			
V_{OH}	Output HIGH Voltage	−1085	−870	−1025	−870	mV	V_{IN} =V_{IH} (Max)	Loading with
V_{OL}	Output LOW Voltage	−1830	−1575	−1830	−1620	mV	or V_{IL}(Min)	50Ω to −2.0V
V_{OHC}	Output HIGH Voltage	−1095		−1035		mV	V_{IN} = V_{IH} (Min)	Loading with
V_{OLC}	Output LOW Voltage		−1565		−1610	mV	or V_{IL}(Max)	50Ω to −2.0V
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 I_{0X}–I_{3X} S_0, S_1, $\overline{E}$		340 300		340 300	µA	V_{IN} = V_{IH} (Max)	
I_{EE}	Power Supply Current	−75	−35	−75	−39	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.

Industrial Version
PCC AC Electrical Characteristics

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

Symbol	Parameter	T_C = –40°C		T_C = +25°C		T_C = +85°C		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay I_{0x}–I_{3x} to Output	0.40	1.30	0.45	1.30	0.45	1.40	ns	
t_{PLH} t_{PHL}	Propagation Delay S_0, S_1 to Output	0.70	2.20	0.90	2.20	1.00	2.40	ns	*Figures 1, 2* (Note 8)
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to Output	0.65	2.10	0.65	2.10	0.75	2.20	ns	
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.20	1.60	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 300 ps with multiple outputs switching.

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 (Max) or $V_{IL\ (Min)}$	Loading with 50Ω to –2.0V	(Notes 9, 10, 11)
		–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	(Notes 9, 10, 11)
		–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		(Notes 9, 10, 11, 12)
V_{IL}	Input LOW Voltage	–1830	–1475	mV	–55°C to +125°C	Guaranteed LOW Signal for All Inputs		(Notes 9, 10, 11, 12)
I_{IL}	Input LOW Current	0.50		µA	–55°C to +125°C	V_{EE} = –4.2V V_{IN} = V_{IL} (Min)		(Notes 9, 10, 11)
I_{IH}	Input HIGH Current I_{0X}–I_{3X} S_0, S_1, $\overline{E}$		340 300	µA	0°C to +125°C	V_{EE} = –5.7V V_{IN} = V_{IH} (Max)		(Notes 9, 10, 11)
	I_{0X}–I_{3X} S_0, S_1, $\overline{E}$		490 450	µA	–55°C			
I_{EE}	Power Supply Current	–80	–30	mA	–55°C to +125°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°C), then testing immediately without allowing for the junction temperature to stabilize due to heat dissapation 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°C, +25°C, and +125°C, Subgroups 1, 2, 3, 7, and 8.

Note 11: Sample tested (Method 5005, Table I) on each manufactured lot at –55°C, +25°C, and +125°C, Subgroups 1, 2, 3, 7, and 8.

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

Military Version—Preliminary
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_{0x}–I_{3x} to Output	0.30	1.90	0.40	1.70	0.30	2.00	ns	*Figures 1, 2*	(Notes 13, 14, 15, 17)
t_{PLH} t_{PHL}	Propagation Delay S_0, $S_1$to Output	0.40	2.70	0.60	2.40	0.50	2.90	ns		
t_{PLH} t_{PHL}	Propagation Delay $\overline{E}$ to Output	0.50	2.70	0.60	2.40	0.50	2.90	ns		
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.20	1.60	0.30	1.50	0.20	1.60	ns		(Note 16)

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

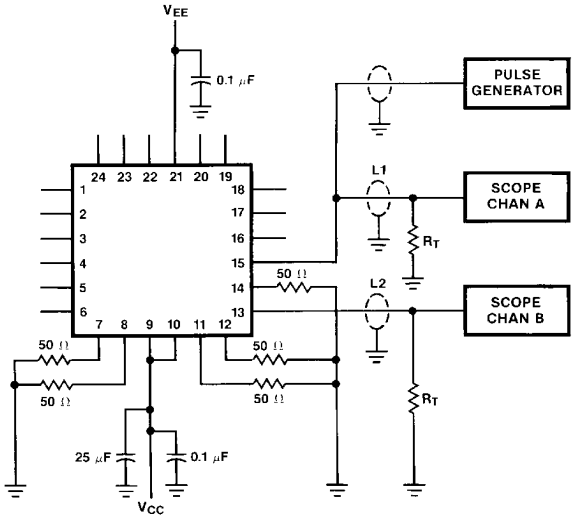
Note 14: Screen tested 100% on each device at +25°C temperature only, Subgroup A9.

Note 15: Sample tested (Method 5005, Table I) on each mfg. lot at +25°C, Subgroup A9, and at +125°C and −55°C temperatures, Subgroups A10 and A11.

Note 16: Not tested at +25°C, +125°C and −55°C temperature (design characterization data).

Note 17: The propagation delay specified is for single output switching. Delays may vary up to 300 ps with multiple outputs switching.

Test Circuitry



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

FIGURE 1. AC Test Circuit

Switching Waveforms

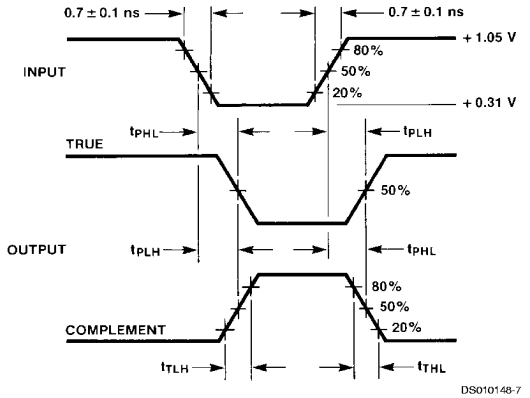
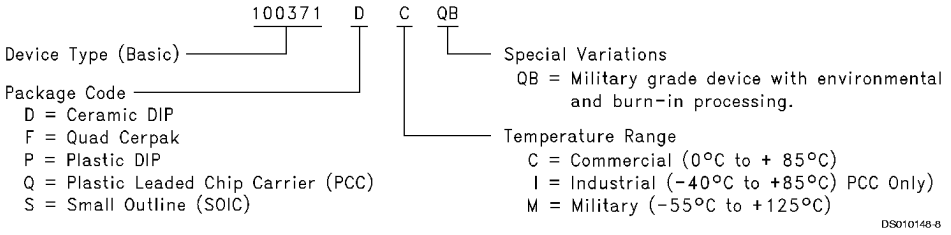


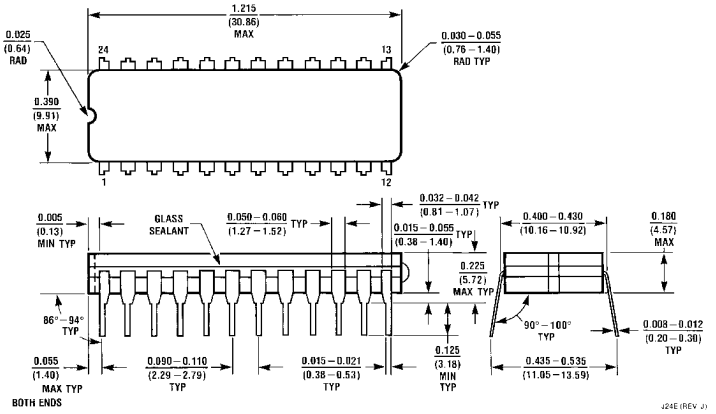
FIGURE 2. Propagation Delay and Transition Times

Ordering Information

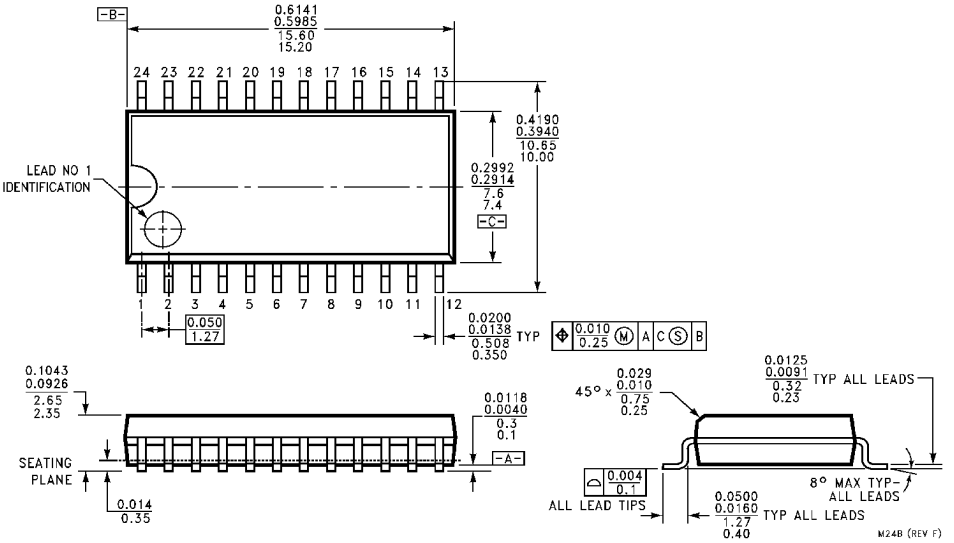
The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



Physical Dimensions inches (millimeters) unless otherwise noted

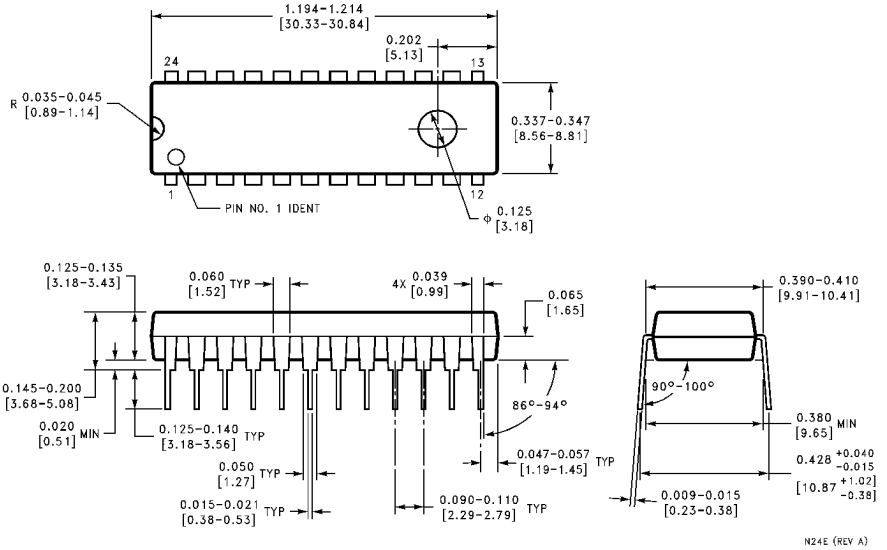


24-Lead Ceramic Dual-In-Line Package (D)
Package Number J24E



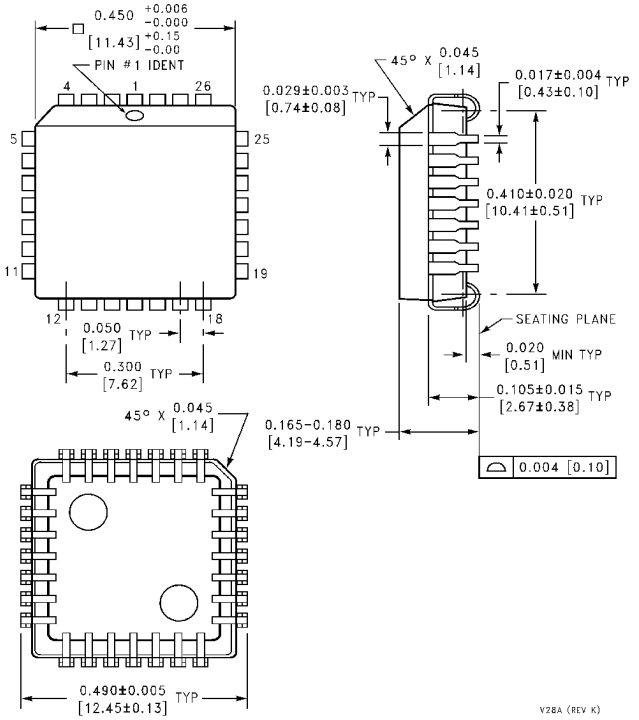
24-Lead Molded Package (0.300" Wide) (S)
Package Number M24B

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



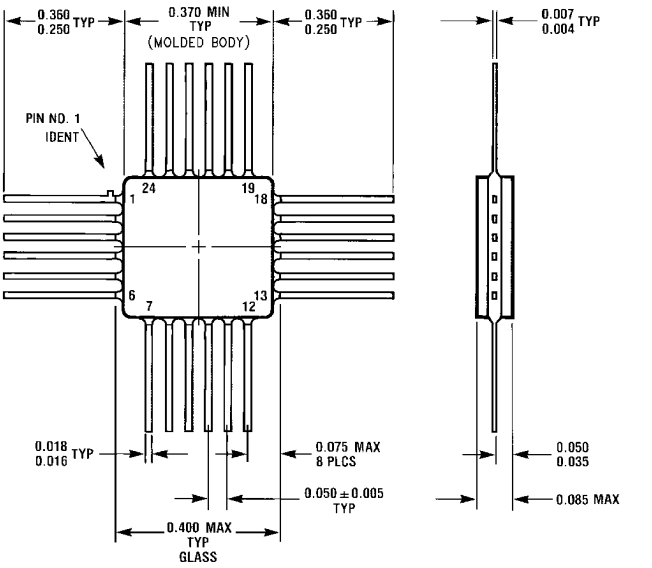
24-Lead Plastic Dual-In-Line Package (P)
Package Number N24E

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



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

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



24-Lead Ceramic Flatpak (F)
Package Number W24B

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2. A critical component in 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.

Fairchild Semiconductor Corporation
Americas
Customer Response Center
Tel: 1-888-522-5372

Fairchild Semiconductor Europe
Fax: +49 (0) 1 80-530 85 86
Email: europe.support@nsc.com
Deutsch Tel: +49 (0) 8 141-35-0
English Tel: +44 (0) 1 793-85-68-56
Italy Tel: +39 (0) 2 57 5631

Fairchild Semiconductor Hong Kong Ltd.
13th Floor, Straight Block,
Ocean Centre, 5 Canton Rd.
Tsimshatsui, Kowloon
Hong Kong
Tel: +852 2737-7200
Fax: +852 2314-0061

National Semiconductor Japan Ltd.
Tel: 81-3-5620-6175
Fax: 81-3-5620-6179

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