FAIRCHILD SEMICONDUCTOR™

March 1998

100352
Low Power 8-Bit Buffer with Cut-Off Drivers

General Description

The 100352 contains an 8-bit buffer, individual inputs (Dn), outputs (Qn), and a data output enable pin ($\overline{OEN}$). A Q output follows its D input when the $\overline{OEN}$ pin is LOW. A HIGH on $\overline{OEN}$ holds the outputs in a cut-off state. The cut-off state is designed to be more negative than a normal ECL LOW level. This allows the output emitter-followers to turn off when the termination supply is –2.0V, presenting a high impedance to the data bus. This high impedance reduces termination power and prevents loss of low state noise margin when several loads share the bus.

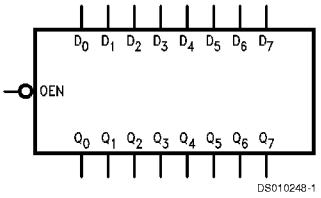
The 100352 outputs are designed to drive a doubly terminated 50Ω transmission line (25Ω load impedance). All inputs have 50 kΩ pull-down resistors.

Features

- Cut-off drivers
- Drives 25Ω load
- Low power operation
- 2000V ESD protection
- Voltage compensated operating range = –4.2V to –5.7V
- Available to industrial grade temperature range
- Available to MIL-STD-883

Ordering Code:

Logic Symbol



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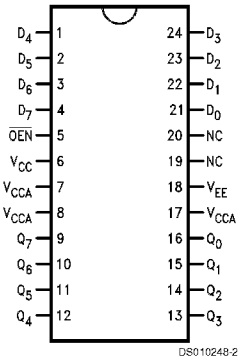
Pin Names	Description
D_0–D_7	Data Inputs
$\overline{OEN}$	Output Enable Input
Q_0–Q_7	Data Outputs
NC	No Connect

Connection Diagrams

24-Pin DIP



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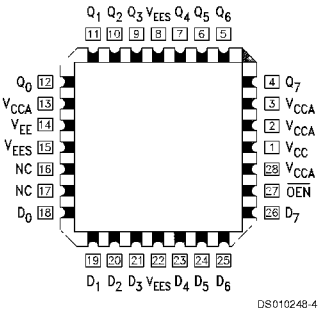
28-Pin PCC



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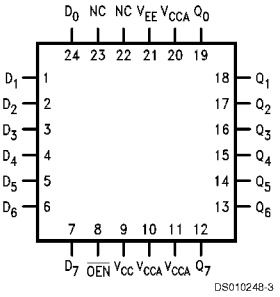
Connection Diagrams (Continued)

24-Pin Quad Cerpak



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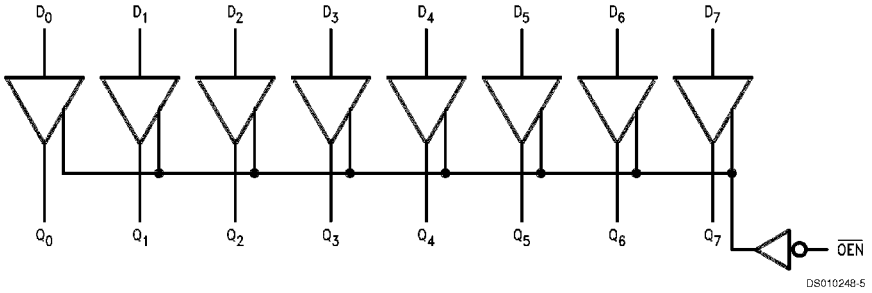
Logic Diagram



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Truth Table

Inputs		Outputs
Dn	$\overline{OEN}$	Qn
L	L	L
H	L	H
X	H	Cutoff

H = HIGH Voltage Level
L = LOW Voltage Level
Cutoff = Lower-than-LOW State
X = Don't Care

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)	−100 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} = $V_{IH\ (Max)}$ or $V_{IL\ (Min)}$	Loading with 25Ω to −2.0V
V_{OL}	Output LOW Voltage	−1830	−1705	−1620			
V_{OHC}	Output HIGH Voltage	−1035			mV	V_{IN} = $V_{IH\ (Min)}$ or $V_{IL\ (Max)}$	Loading with 25Ω to −2.0V
V_{OLC}	Output LOW Voltage			−1610			
V_{OLZ}	Cut-Off LOW Voltage			−1950	mV	V_{IN} = $V_{IH\ (Min)}$ or $V_{IL\ (Max)}$	$\overline{OEN}$ = HIGH
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					Inputs Open	
		−138		−70	mA	V_{EE} = −4.2V to −4.8V	
		−143		−70		V_{EE} = −4.2V to −5.7V	

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°C		T_C = +25°C		T_C = +85°C		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH}	Propagation Delay	0.70	2.00	0.70	2.00	0.70	2.20	ns	*Figures 1, 2*
t_{PHL}	Dn to Output								(Note 4)
t_{PZH}	Propagation Delay	1.60	4.20	1.60	4.20	1.60	4.20	ns	*Figures 1, 2*
t_{PHZ}	$\overline{OEN}$ to Output	1.00	2.70	1.00	2.70	1.00	2.70		(Note 4)
t_{TLH}	Transition Time	0.45	2.00	0.45	2.00	0.45	2.00	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.

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 Dn to Output	0.70	1.80	0.70	1.80	0.70	2.00	ns	*Figures 1, 2* (Note 6)
t_{PZH} t_{PHZ}	Propagation Delay $\overline{OEN}$ to Output	1.60 1.00	4.00 2.50	1.60 1.00	4.00 2.50	1.60 1.00	4.00 2.50	ns	*Figures 1, 2* (Note 6)
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.45	1.90	0.45	1.90	0.45	1.90	ns	*Figures 1, 2*
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		230		230		230	ps	PCC only (Note 5)
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		240		240		240	ps	PCC only (Note 5)
t_{OST}	Maximum Skew Opposite Edge Output-to-Output Variation Data to Output Path		350		350		350	ps	PCC only (Note 5)
t_{PS}	Maximum Skew Pin (Signal) Transition Variation Data to Output Path		350		350		350	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} = $V_{IH(Max)}$ or $V_{IL(Min)}$	Loading with 25Ω to −2.0V
V_{OL}	Output LOW Voltage	−1830	−1575	−1830	−1620			
V_{OHC}	Output HIGH Voltage	−1095		−1035		mV	V_{IN} = $V_{IH(Min)}$ or $V_{IL(Max)}$	Loading with 25Ω to −2.0V
V_{OLC}	Output LOW Voltage		−1565		−1610			
V_{OLZ}	Cut-Off LOW Voltage		−1950		−1950	mV	V_{IN} = $V_{IH(Min)}$ or V_{IL} (Max)	$\overline{OEN}$ =HIGH
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		340		240	µA	V_{IN} = $V_{IH(Max)}$	
I_{EE}	Power Supply Current						Inputs Open	
		−138	−60	−138	−70	mA	V_{EE} = −4.2V to −4.8V	
		−143	−60	−143	−70		V_{EE} = −4.2V to −5.7V	

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°C		T_C = +25°C		T_C = +85°C		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay Dn to Output	0.60	1.80	0.70	1.80	0.70	2.00	ns	*Figures 1, 2* (Note 8)
t_{PZH} t_{PHZ}	Propagation Delay $\overline{OEN}$ to Output	1.40 1.00	4.40 2.50	1.60 1.00	4.00 2.50	1.60 1.00	4.00 2.50	ns	*Figures 1, 2* (Note 8)
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.40	2.50	0.45	1.90	0.45	1.90	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
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 25Ω 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 25Ω 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_{OLZ}	Cut-Off LOW Voltage		−1950	mV	0°C to +125°C	V_{IN} = $V_{IH(Min)}$, or $V_{IL(Max)}$	$\overline{OEN}$ =HIGH	(Notes 9, 10, 11)
			−1850		−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		(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		240	µA	0°C to + 125°C	V_{EE} = −5.7V V_{IN} = $V_{IH(Max)}$		(Notes 9, 10, 11)
			340	µA	−55°C			
I_{EE}	Power Supply Current				−55°C to +125°C	Inputs Open		(Notes 9, 10, 11)
		−145	−55	mA		V_{EE} = −4.2V to −4.8V		
		−150				V_{EE} = −4.2V to −5.7V		

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 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°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 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°C		T_C = +25°C		T_C +125°C		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
t_{PLH} t_{PHL}	Propagation Delay Dn to Output	0.30	2.60	0.50	2.40	0.50	2.70	ns	*Figures 1, 2*	(Notes 13, 14, 16, 17)

AC Electrical Characteristics (Continued)

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_{PZH}	Propagation Delay	1.20	4.40	1.40	4.20	1.20	4.40	ns	*Figures 1, 2*	(Notes 13,
t_{PHZ}	$\overline{OEN}$ to Output	0.70	3.00	0.70	2.80	0.70	3.20			14, 15, 17)
t_{TLH}	Transition Time	0.40	2.50	0.40	2.40	0.40	2.70	ns	*Figures 1, 2*	(Note 16)
t_{THL}	20% to 80%, 80% to 20%									

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.

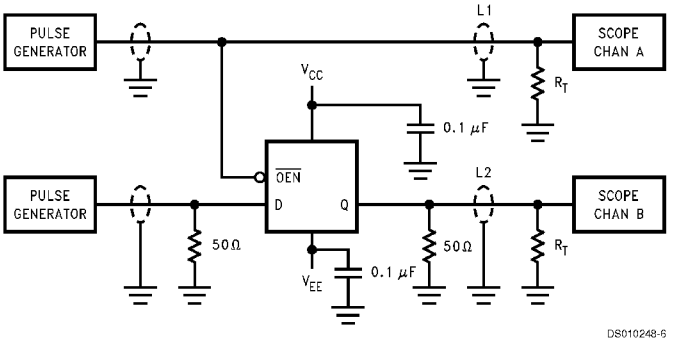
Note 14: Screen tested 100% on each device at +25°C temperature only, Subgroup A9.

Note 15: Sample tested (Method 5005, Table I) on each manufactured 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.

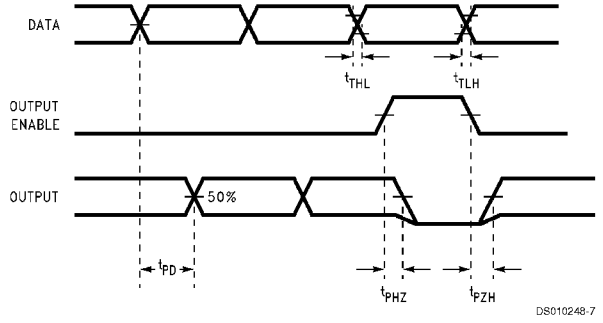
Test Circuitry



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 25Ω to GND
C_L = Fixture and stray capacitance ≤ 3 pF

FIGURE 1. AC Test Circuit

Switching Waveforms

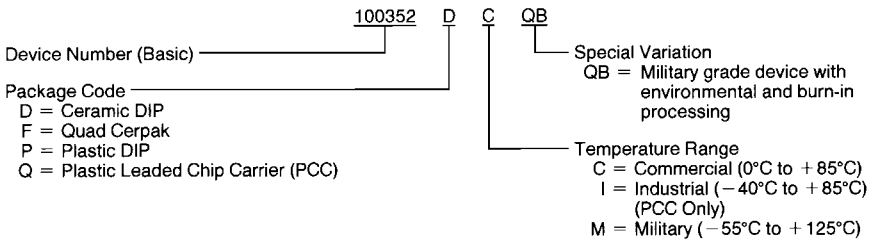


Note:
The output AC measurement point for cut-off propagation delay testing = the 50% voltage point between active V_{OL} and V_{OH}.

FIGURE 2. Propagation Delay, Cut-Off 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:



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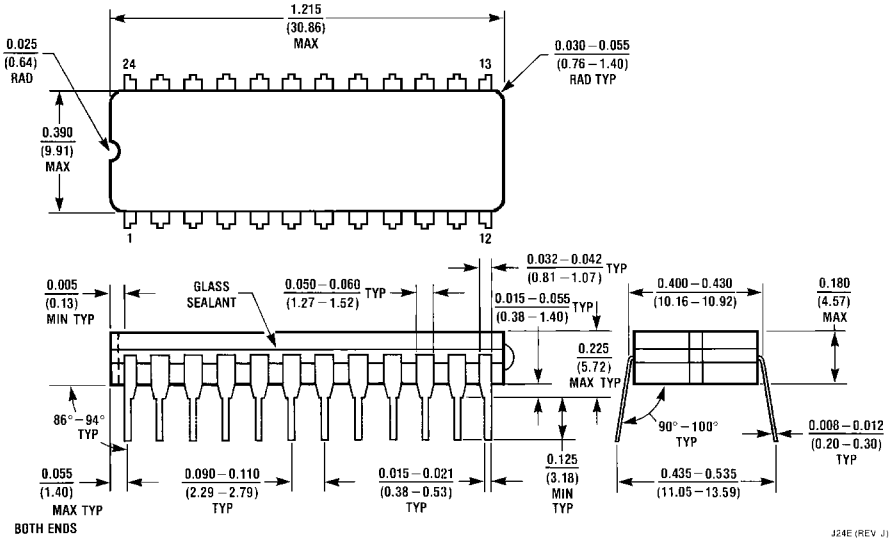
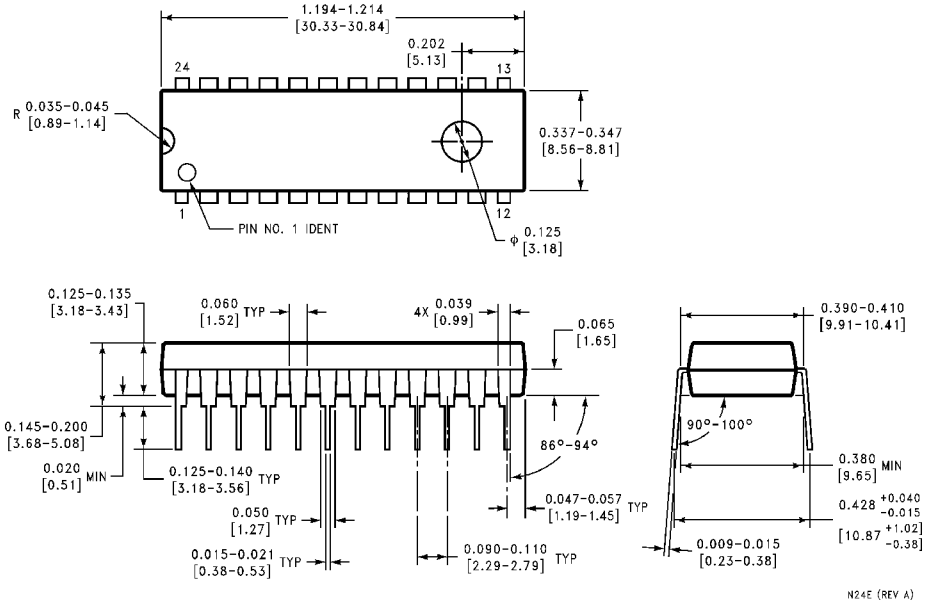
Physical Dimensions inches (millimeters) unless otherwise noted



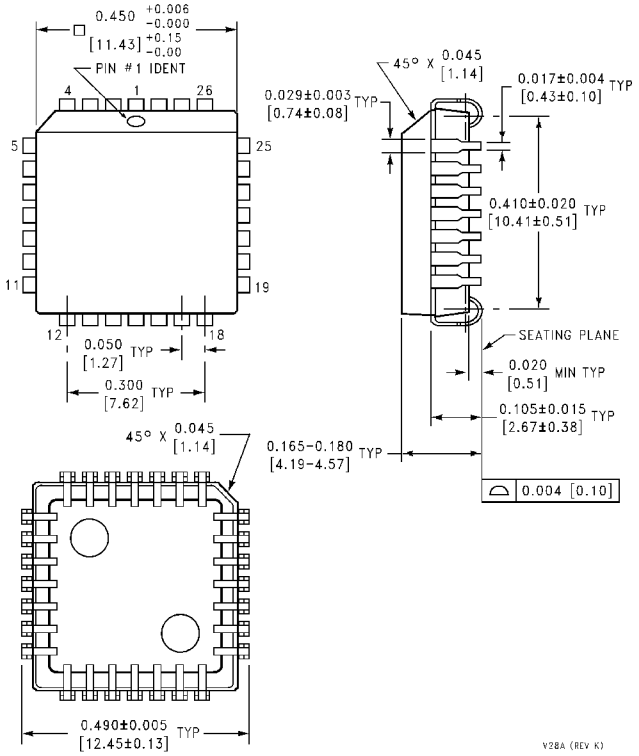
24-Lead Ceramic Dual-In-Line Package (0.400" Wide) (D)
Package Number J24E

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



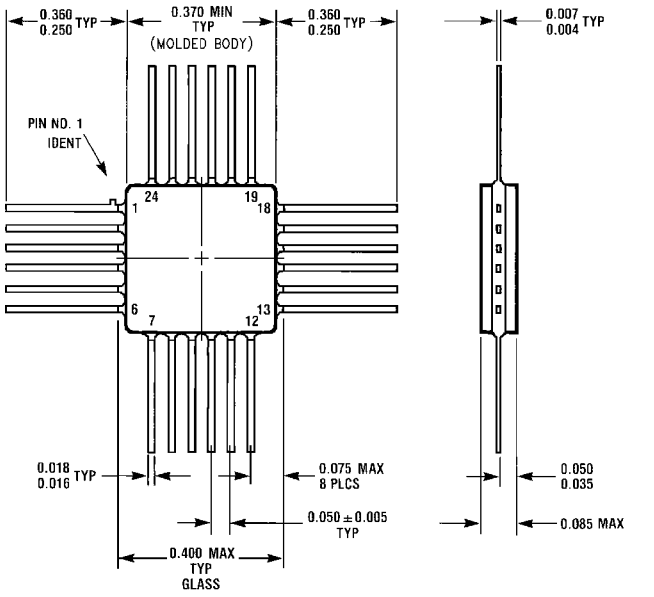
24-Lead Plastic Dual-In-Line Package (P)
Package Number N24E

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 Quad Cerpak (F)
Package Number W24B

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