FAIRCHILD SEMICONDUCTOR™

March 1998

100314
Low Power Quint Differential Line Receiver

General Description

The 100314 is a monolithic quint differential line receiver with emitter-follower outputs. An internal reference supply (V_{BB}) is available for single-ended reception. When used in single-ended operation the apparent input threshold of the true inputs is 25 mV to 30 mV higher (positive) than the threshold of the complementary inputs. Unlike other F100K ECL devices, the inputs do not have input pull-down resistors.

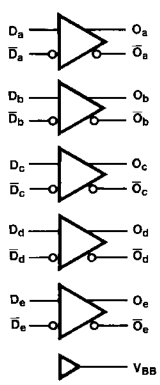
Active current sources provide common-mode rejection of 1.0V in either the positive or negative direction. A defined output state exists if both inverting and non-inverting inputs are at the same potential between V_{EE} and V_{CC}. The defined state is logic HIGH on the $\overline{O}_a$–$\overline{O}_e$ outputs.

Features

- 35% power reduction of the 100114
- 2000V ESD protection
- Pin/function compatible with 100114
- Voltage compensated operating range = −4.2V to −5.7V
- Available to MIL-STD-883
- Available to industrial grade temperature range

Ordering Code:

Logic Symbol



Pin Names	Description
D_a–D_e	Data Inputs
$\overline{D}_a$–$\overline{D}_e$	Inverting Data Inputs
O_a–O_e	Data Outputs
$\overline{O}_a$–$\overline{O}_e$	Complementary Data Outputs

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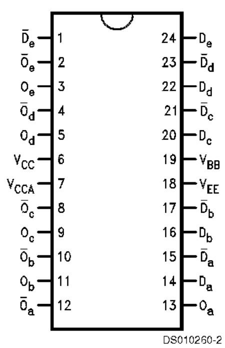
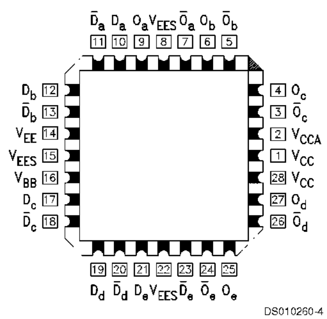
Connection Diagrams

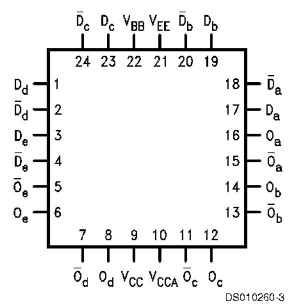
24-Pin DIP/SOIC



28-Pin PCC



24-Pin Quad Cerpak



Absolute Maximum Ratings (Note 1)

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

Storage Temperature (T_{STG})	−65°C to +150°C
Maximum Junction Temperture (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
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}	Loading with
V_{OLC}	Output LOW Voltage			−1610	mV	or V_{IL} (Max)	50Ω to −2.0V
V_{BB}	Output Reference Voltage	−1380	−1320	−1260	mV	I_{VBB} = −250 μA	
V_{DIFF}	Input Voltage Differential	150			mV	Required for Full Output Swing	
V_{CM}	Common Mode Voltage	V_{CC} − 2.0		V_{CC} − 0.5	V		
V_{IH}	Single-Ended Input High Voltage	−1110		−870	mV	Guaranteed HIGH Signal for All Inputs (with one input tied to V_{BB}) V_{BB} (Max) + V_{DIFF}	
V_{IL}	Single-Ended Input Low Voltage	−1830		−1530	mV	Guaranteed LOW Signal for All Inputs (with one input tied to V_{BB}) V_{BB} (Min) − V_{DIFF}	
I_{IL}	Input LOW Current	0.50			μA	V_{IN} = V_{IL} (Min)	
I_{IH}	Input HIGH Current			240	μA	V_{IN} = $V_{IH\ (Max)}$, D_a–D_e = V_{BB}, $\overline{D}_a$–$\overline{D}_e$ = $V_{IL(Min)}$	
I_{CBO}	Input Leakage Current	−10			μA	V_{IN} = V_{EE}, D_a–D_e = V_{BB}, $\overline{D}_a$–$\overline{D}_e$ = $V_{IL\ (Min)}$	
I_{EE}	Power Supply Current	−60		−30	mA	D_a–D_e = V_{BB}, $\overline{D}_a$–$\overline{D}_e$ = $V_{IL\ (Min)}$	

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		
f_{MAXFS}	Toggle Frequency (Full Swing)	250		250		250		MHz	(Note 2)
f_{MAXRS}	Toggle Frequency (Reduced Swing)	700		700		700		MHz	(Note 3)
t_{PLH} t_{PHL}	Propagation Delay Data to Output	0.65	1.90	0.65	2.00	0.70	2.00	ns	*Figures 1, 2*
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	

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		
f_{MAXFS}	Toggle Frequency (Full Swing)	250		250		250		MHz	(Note 5)
f_{MAXRS}	Toggle Frequency (Reduced Swing)	700		700		700		MHz	(Note 6)
t_{PLH} t_{PHL}	Propagation Delay Data to Output	0.65	1.70	0.65	1.80	0.70	1.80	ns	*Figures 1, 2*
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_{PLH} t_{PHL}	Propagation Delay Data to Output	0.70	1.50	0.80	1.60	0.90	1.80	ns	PCC only
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		280		280		280	ps	PCC only (Notes 4, 7)
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		330		330		330	ps	PCC only (Notes 4, 7)
t_{OST}	Maximum Skew Opposite Edge Output-to-Output Variation Data to Output Path		330		330		330	ps	PCC only (Notes 4, 7)
t_{PS}	Maximum Skew Pin (Signal) Transition Variation Data to Output Path		320		320		320	ps	PCC only (Notes 4, 7)

Note 4: 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 5: Maximum toggle frequency at which V_{OH} and V_{OL} DC specifications are maintained.

Note 6: Maximum toggle frequency at which outputs maintain 150 mV swing.

Note 7: All skews calculated using input crossing point to output crossing point propagation delays.

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 8)

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}	Loading with
V_{OLC}	Output LOW Voltage		–1565		–1610	mV	or V_{IL} (Min)	50Ω to –2.0V
V_{BB}	Output Reference Voltage	–1395	–1255	–1380	–1260	mV	I_{VBB} = –250 µA	
V_{DIFF}	Input Voltage Differential	150		150		mV	Required for Full Output Swing	
V_{CM}	Common Mode Voltage	V_{CC} – 2.0	V_{CC} – 0.5	V_{CC} – 2.0	V_{CC} – 0.5	V		
V_{IH}	Single-Ended Input High Voltage	–1115	–870	–1110	–870	mV	Guaranteed HIGH Signal for All Inputs (with one input tied to V_{BB}) V_{BB} (Max) + V_{DIFF}	
V_{IL}	Single-Ended Input Low Voltage	–1830	–1535	–1830	–1530	mV	Guaranteed LOW Signal for All Inputs (with one input tied to V_{BB}) V_{BB} (Min) – V_{DIFF}	
I_{IL}	Input LOW Current	0.50		0.50		µA	V_{IN} = $V_{IL\ (Min)}$	
I_{IH}	Input HIGH Current		240		240	µA	V_{IN} = $V_{IH\ (Max)}$, D_a–D_e = V_{BB}, $\overline{D}_a$–$\overline{D}_e$ = $V_{IL\ (Min)}$	
I_{CBO}	Input Leakage Current	–10		–10		µA	V_{IN} = V_{EE}, D_a–D_e = V_{BB} $\overline{D}_a$–$\overline{D}_e$ = $V_{IL\ (Min)}$	
I_{EE}	Power Supply Current	–60	–30	–60	–30	mA	D_a–D_e = V_{BB}, $\overline{D}_a$–$\overline{D}_e$ = $V_{IL\ (Min)}$	

Note 8: 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		
f_{MAXFS}	Toggle Frequency (Full Swing)	250		250		250		MHz	(Note 5)
f_{MAXRS}	Toggle Frequency (Reduced Swing)	700		700		700		MHz	(Note 6)
t_{PLH} t_{PHL}	Propagation Delay Data to Output	0.65	1.70	0.65	1.80	0.70	1.80	ns	*Figures 1, 2*
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.20	1.40	0.35	1.10	0.35	1.10	ns	

Military Version
DC Electrical Characteristics

V_{EE} = –4.2V to –5.7V, V_{CC} = V_{CCA} = GND, T_C = –55°C to +125°C (Note 11)

Symbol	Parameter	Min	Typ	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	(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} (Max) or V_{IL} (Min)	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_{BB}	Output Reference Voltage			–1260	mV	0°C to +125°C	I_{VBB} = 0 µA, V_{EE} = 4.2V		(Notes 9, 10, 11)
		–1380		–1260	mV	0°C to +125°C	I_{VBB} = –250 µA, V_{EE} = –5.7V		(Notes 9, 10, 11)
		–1396			mV	–55°C	I_{VBB} = –350 µA, V_{EE} = –5.7V		
V_{DIFF}	Input Voltage Differential	150			mV	–55°C to +125°C	Required for Full Output Swing		(Notes 9, 10, 11)
V_{CM}	Common Mode Voltage	V_{CC} – 2.0		V_{CC} – 0.5	V	–55°C to +125°C			(Notes 9, 10, 11)
V_{IH}	Single-Ended Input High Voltage	–1165		–870	mV	–55°C to +125°C	Guaranteed HIGH Signal for All Inputs (with $\overline{D_n}$ tied to V_{BB})		(Notes 9, 10, 11, 12)
V_{IL}	Single-Ended Input Low Voltage	–1830		–1475	mV	–55°C to +125°C	Guaranteed LOW Signal for All Inputs (with $\overline{D_n}$ tied to V_{BB})		(Notes 9, 10, 11, 12)
I_{IH}	Input HIGH Current			50	µA	0°C to +125°C	V_{IN} = $V_{IH\ (Max)}$, D_a–D_e = V_{BB}, $\overline{D_a}$–$\overline{D_e}$ = $V_{IL\ (Min)}$		(Notes 9, 10, 11)
				70	µA	–55°C			
I_{CBO}	Input Leakage Current	–10			µA	–55°C to +125°C	V_{IN} = V_{EE}, D_a–D_e = V_{BB}, $\overline{D_a}$–$\overline{D_e}$ = $V_{IL\ (Min)}$		(Notes 9, 10, 11)
I_{EE}	Power Supply Current	–65		–25	mA	–55°C to +125°C	D_a–D_e = V_{BB}, $\overline{D_a}$–$\overline{D_e}$ = $V_{IL\ (Min)}$		(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 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 Data to Output	0.40	2.30	0.60	2.20	0.60	2.70	ns	*Figures 1, 2*	(Notes 13, 14, 15)
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.20	1.40	0.20	1.40	0.20	1.40	ns		(Note 16)

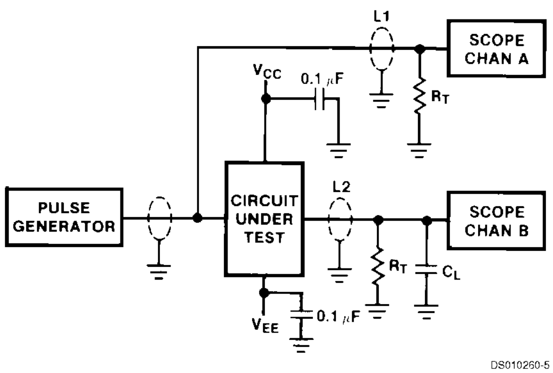
Note 13: F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals −55°C), then testing immediately after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

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 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).

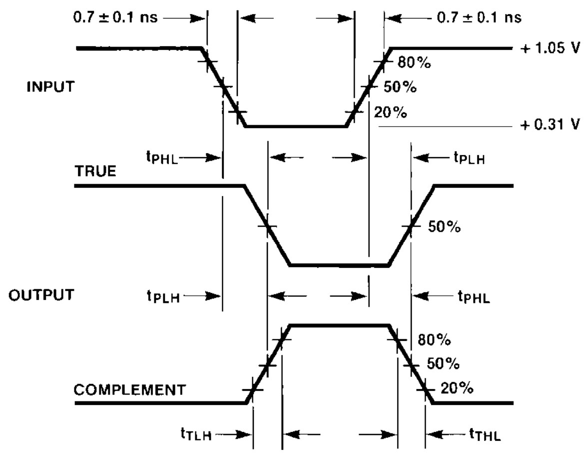
Test Circuit



Note: 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

FIGURE 1. AC Test Circuit

Switching Waveforms



DS010260-6

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:

100314 D C QB

Device Type (Basic)

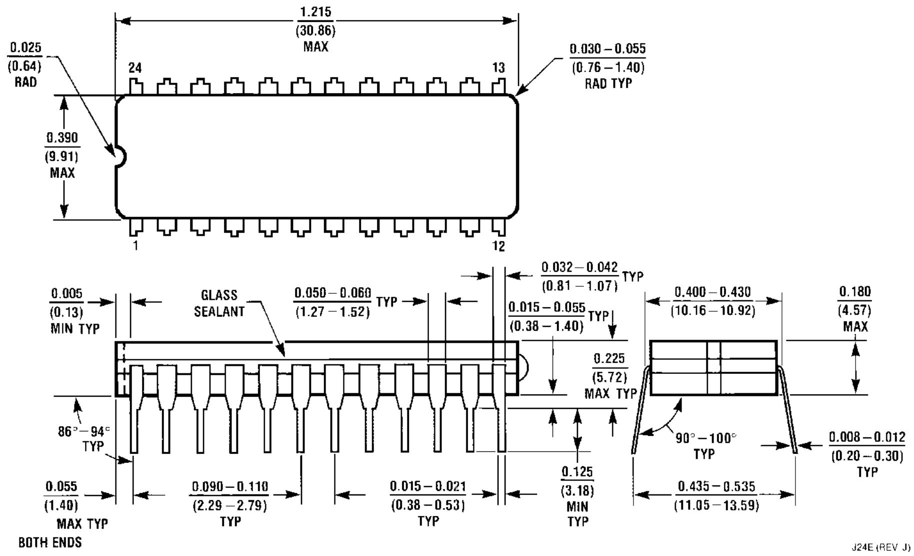
Package Code
- D = Ceramic DIP
- F = Quad Cerpak
- Q = Plastic Leaded Chip Carrier (PCC)
- P = Plastic DIP
- S = Small Outline (SOIC)

Special Variation
- QB = Military grade device with environmental and burn-in processing

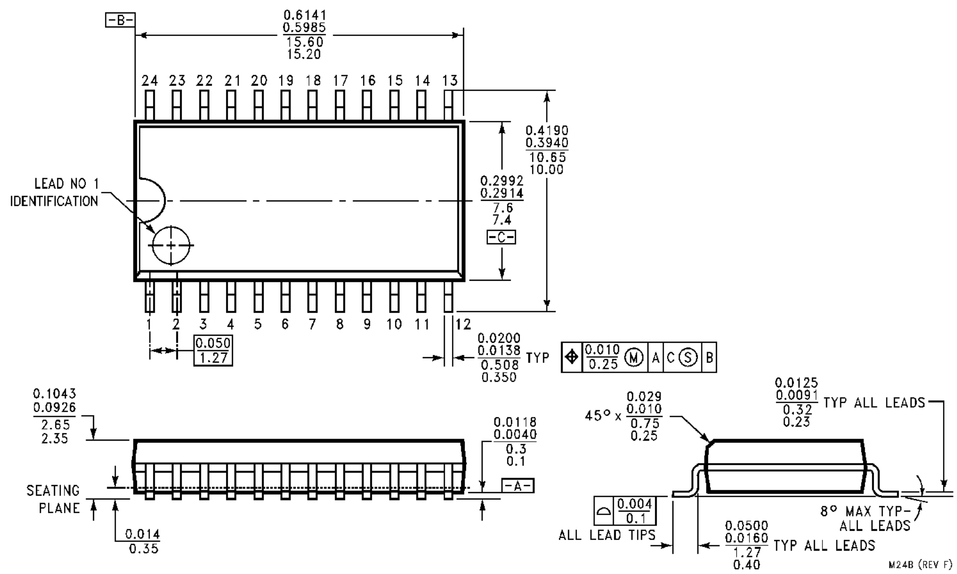
Temperature Range
- C = Commercial (0°C to +85°C)
- I = Industrial (−40°C to +85°C) (PCC only)
- M = Military (−55°C to +125°C)

DS010260-7

Physical Dimensions inches (millimeters) unless otherwise noted

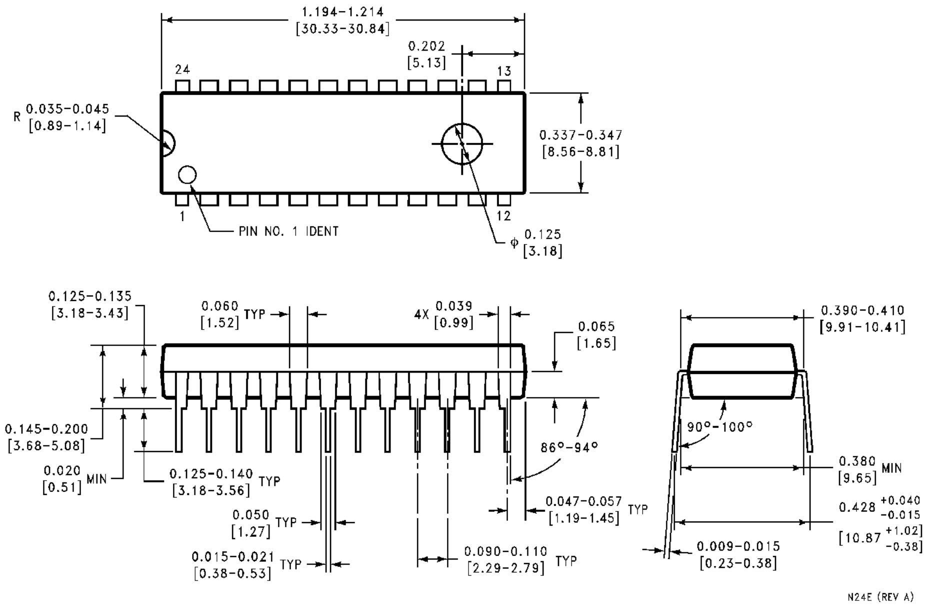


24-Lead Ceramic Dual-In-Line Package (0.400" Wide) (D)
Package Number J24E



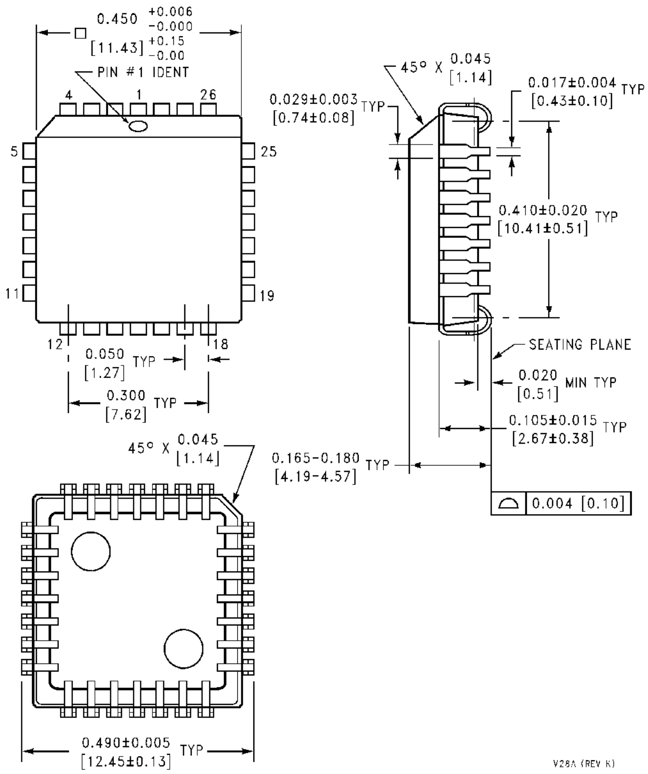
24-Lead Molded Package (0.300") Wide (S)
Package Number M24B

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



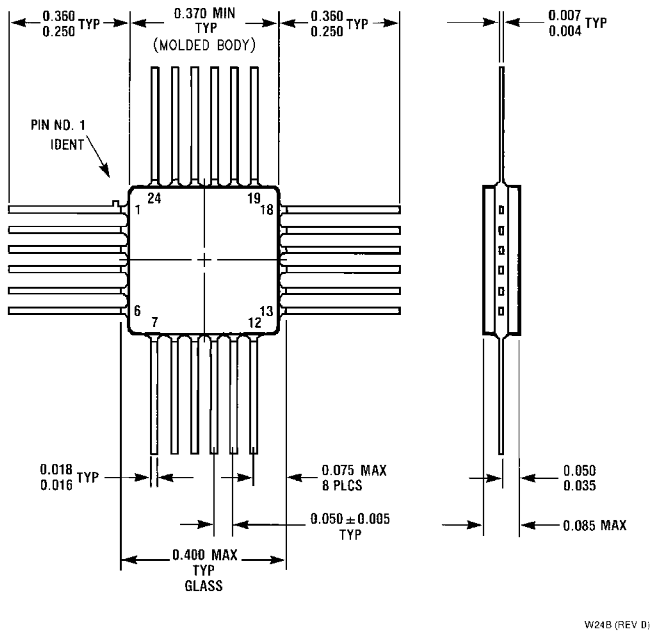
24-Lead Plastic Dual-In-Line Package (P)
Package Number N24E

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 Quad Cerpak (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.

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