FAIRCHILD SEMICONDUCTOR™

March 1998

100353
Low Power 8-Bit Register

General Description

The 100353 contains eight D-type edge triggered, master/slave flip-flops with individual inputs (D_n), true outputs (Q_n), a clock input (CP), and a common clock enable pin ($\overline{CEN}$). Data enters the master when CP is LOW and transfers to the slave when CP goes HIGH. When the $\overline{CEN}$ input goes HIGH it overrides all other inputs, disables the clock, and the Q outputs maintain the last state.

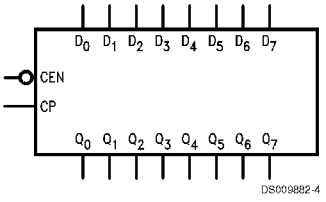
The 100353 output drivers are designed to drive 50Ω termination to –2.0V. All inputs have 50 kΩ pull-down resistors.

Features

- Low power operation
- 2000V ESD protection
- Voltage compensated operating range = –4.2V to –5.7V
- Available to industrial grade temperature range

Ordering Code:

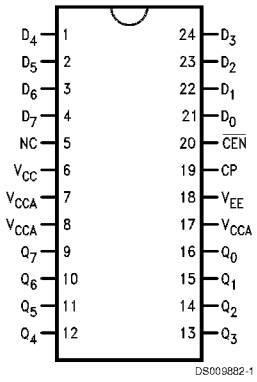
Logic Symbol



Pin Names	Description
D_0–D_7	Data Inputs
$\overline{CEN}$	Clock Enable Input
CP	Clock Input (Active Rising Edge)
Q_0–Q_7	Data Outputs
NC	No Connect

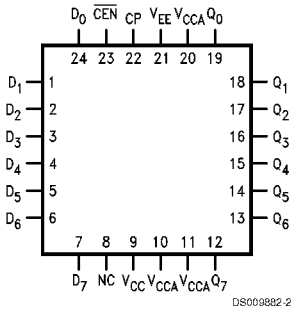
Connection Diagrams

24-Pin DIP



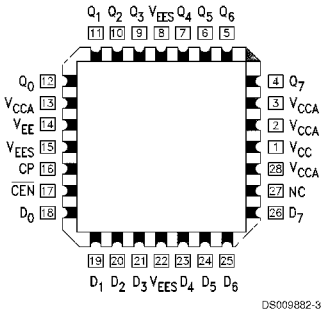
DS009882-1

24-Pin Quad Cerpak



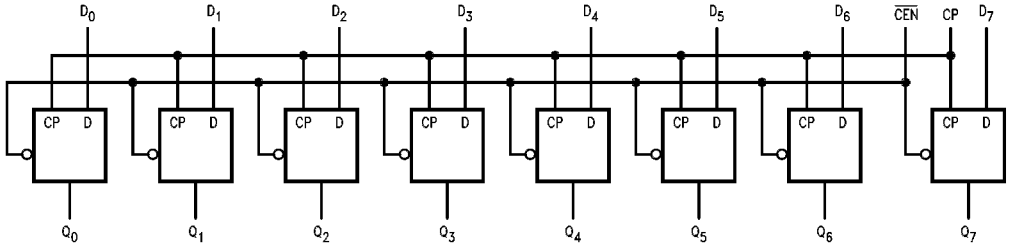
DS009882-2

28-Pin PCC



DS009882-3

Logic Diagram



DS009882-5

Truth Table

Inputs			Outputs
D_n	$\overline{CEN}$	CP	Q_n
L	L	⌐	L
H	L	⌐	H
X	X	L	NC
X	X	H	NC
X	H	X	NC

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
NC = No Change
⌐ = LOW to HIGH Transition

Absolute Maximum Ratings (Note 1)

Above which the useful life may be impared

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

Commercial Version

DC Electrical Characteristics (Note 3)

V_{EE} = −4.2V to −5.7V, V_{CC} = V_{CCA} = GND, T_C = 0°C to +85°C

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			240	µA	V_{IN} = V_{IH} (Max)	
I_{EE}	Power Supply Current					Inputs Open	
		−119		−61	mA	V_{EE} = −4.2V to −4.8V	
		−122		−61		V_{EE} = −4.2V to −5.7V	

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 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_{max}	Toggle Frequency	425		425		425		MHz	*Figures 1, 2*
t_{PLH}	Propagation Delay	1.40	3.00	1.40	3.00	1.50	3.10	ns	*Figures 1, 2*
t_{PHL}	CP to Output								(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%								
t_s	Setup Time								
	D_n	1.10		1.10		1.10			
	$\overline{CEN}$ (Disable Time)	0.40		0.40		0.40		ns	*Figures 1, 3*
	$\overline{CEN}$ (Release Time)	1.10		1.10		1.10			
t_h	Hold Time								
	D_n	0.10		0.10		0.10		ns	*Figures 1, 4*
t_{pw}(H)	Pulse Width HIGH								
	CP	2.00		2.00		2.00		ns	*Figures 1, 2*

Note 4: The propagation delay specified is for single output switching. Delays may vary up to 300 ps with multiple outputs switching.

PCC and Cerpack 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_{max}	Toggle Frequency	425		425		425		MHz	*Figures 1, 2*
t_{PLH}	Propagation Delay	1.40	2.80	1.40	2.80	1.50	2.90	ns	*Figures 1, 2*
t_{PHL}	CP to Output								(Note 6)
t_{TLH}	Transition Time	0.45	1.90	0.45	1.90	0.45	1.90	ns	*Figures 1, 2*
t_{THL}	20% to 80%, 80% to 20%								
t_s	Setup Time								
	D_n	1.00		1.00		1.00			
	$\overline{CEN}$ (Disable Time)	0.30		0.30		0.30		ns	*Figures 1, 3*
	$\overline{CEN}$ (Release Time)	1.00		1.00		1.00			
t_h	Hold Time D_n	0		0		0		ns	*Figures 1, 4*
t_{pw}(H)	Pulse Width HIGH CP	2.00		2.00		2.00		ns	*Figures 1, 2*
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		200		200		200	ps	PCC Only (Note 5)
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		200		200		200	ps	PCC Only (Note 5)
t_{OST}	Maximum Skew Opposite Edge Output-to-Output Variation Data to Output Path		260		260		260	ps	PCC Only (Note 5)
t_{PS}	Maximum Skew Pin (Signal) Transition Variation Data to Output Path		280		280		280	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

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		240		240	µA	V_{IN} = V_{IH} (Max)	
I_{EE}	Power Supply Current						Inputs Open	
		−119	−61	−119	−61	mA	V_{EE} = −4.2V to −4.8V	
		−122	−61	−122	−61		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		
f_{max}	Toggle Frequency	425		425		425		MHz	*Figures 1, 2*
t_{PLH} t_{PHL}	Propagation Delay CP to Output	1.40	2.80	1.40	2.80	1.50	2.90	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*
t_s	Setup Time								
	D_n	0.60		1.00		1.00			
	$\overline{CEN}$ (Disable Time)	0.90		0.30		0.30		ns	*Figures 1, 3*
	$\overline{CEN}$ (Release Time)	1.40		1.00		1.00			
t_h	Hold Time D_n	0.30		0		0		ns	*Figures 1, 4*
t_{pw}(H)	Pulse Width HIGH CP	2.00		2.00		2.00		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			
		−1085	−870	mV	−55°C	V_{IN} = V_{IH} (Max) or V_{IL} (Min)	Loading with 50Ω to −2.0V	(Notes 9, 10, 11)
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			
		−1085		mV	−55°C	V_{IN} = V_{IH} (Min) or V_{IL} (Max)	Loading with 50Ω to −2.0V	(Notes 9, 10, 11)
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		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	Inputs Open		
		−125	−50	mA	+125°C	V_{EE} = −4.2V to −4.8V		(Notes 9, 10, 11)
		−130				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			
f_{max}	Toggle Frequency	400		400		400		MHz	*Figures 1, 2*	(Note 16)
t_{PLH}	Propagation Delay	0.70	3.30	0.80	3.10	0.80	3.80	ns	*Figures 1, 2*	(Notes 13,
t_{PHL}	CP to Output									14, 15, 17)
t_{TLH}	Transition Time	0.40	2.50	0.40	2.40	0.40	2.70	ns		(Note 16)
t_{THL}	20% to 80%, 80% to 20%									
t_s	Setup Time									
	D_n	0.60		0.60		0.60				
	$\overline{CEN}$ (Disable Time)	0.90		0.70		0.90		ns	*Figures 1, 3*	(Note 16)
	$\overline{CEN}$ (Release Time)	1.40		1.40		2.10				
t_h	Hold Time D_n	0.30		0.30		0.30		ns	*Figures 1, 4*	(Note 16)
t_{pw}(H)	Pulse Width HIGH CP	2.00		2.00		2.00		ns	*Figures 1, 2*	(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.

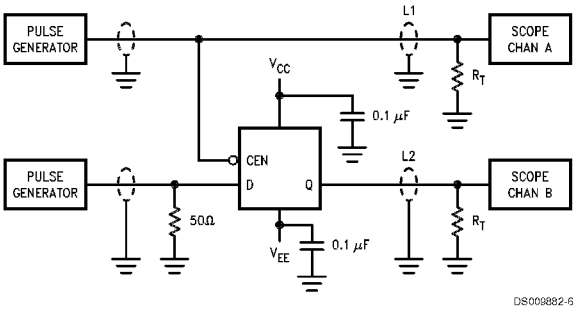
Note 14: Screen tested 100% on each device at +25°C temperature only, Subgroup A9.

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).

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

FIGURE 1. AC, Toggle Frequency Test Circuit

Switching Waveforms

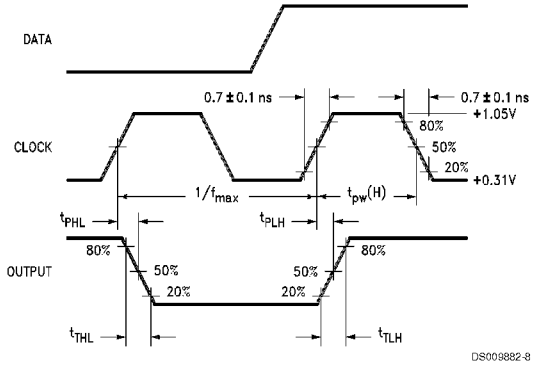


FIGURE 2. Propagation Delay (Clock) and Transition Times

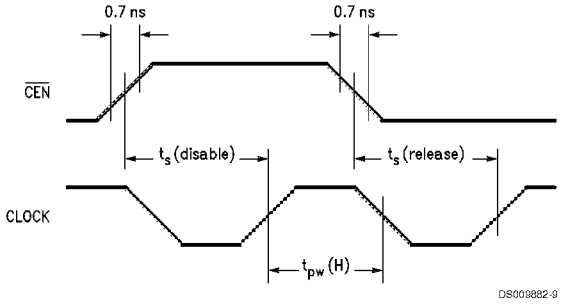
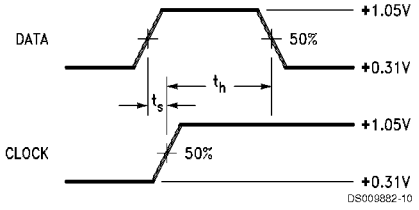


FIGURE 3. Setup and Pulse Width Times



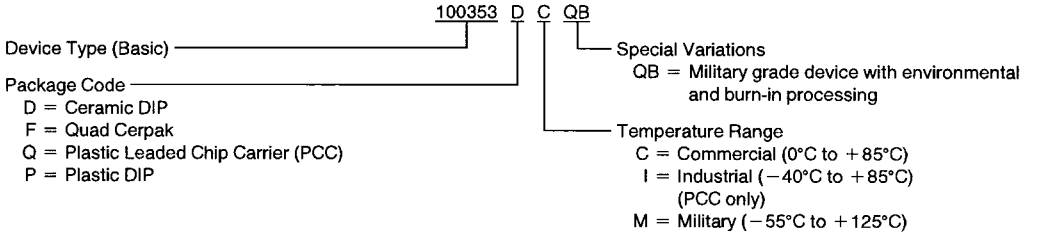
Note 18: t_s is the minimum time before the transition of the clock that information must be present at the data input.

Note 19: t_h is the minimum time after the transition of the clock that information must remain unchanged at the data input.

FIGURE 4. Data Setup and Hold Time

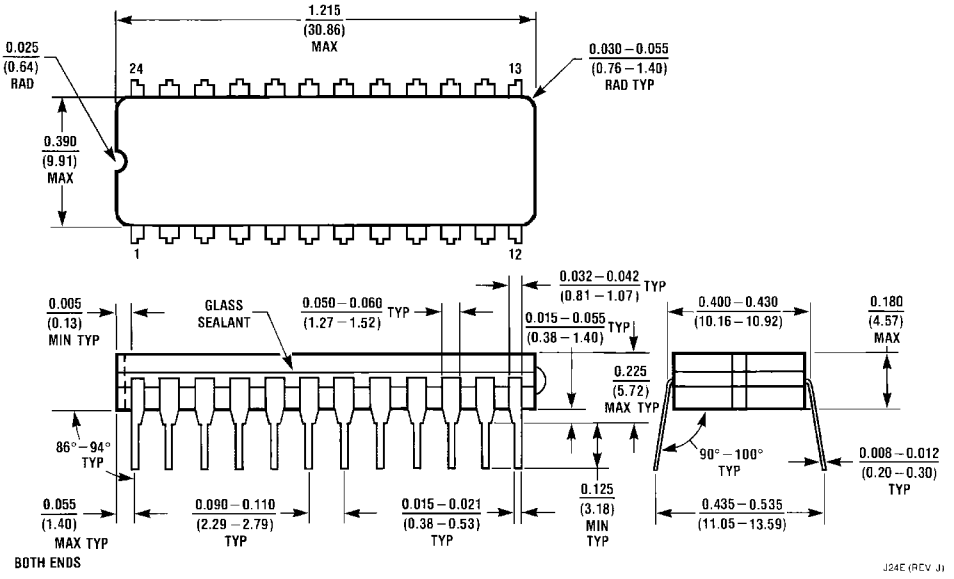
Ordering Information

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

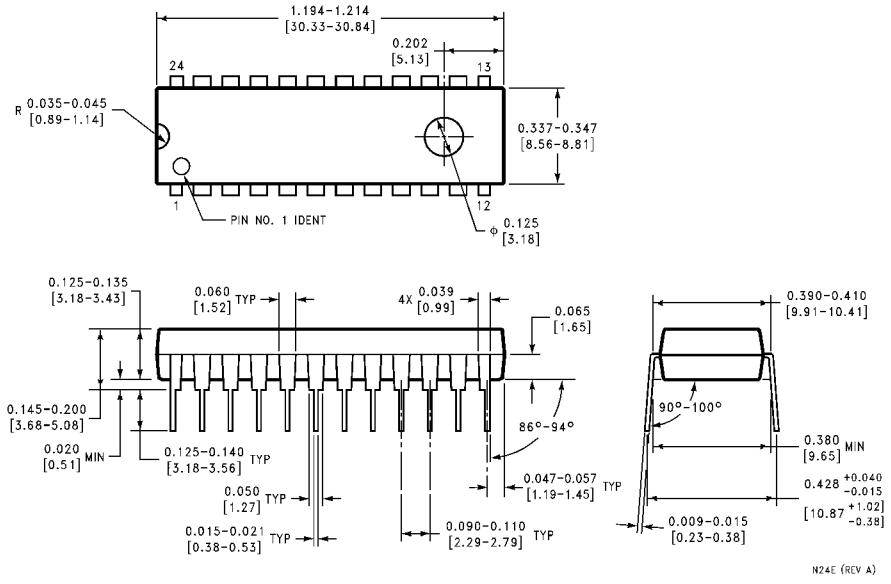


DS009882-11

Physical Dimensions inches (millimeters) unless otherwise noted

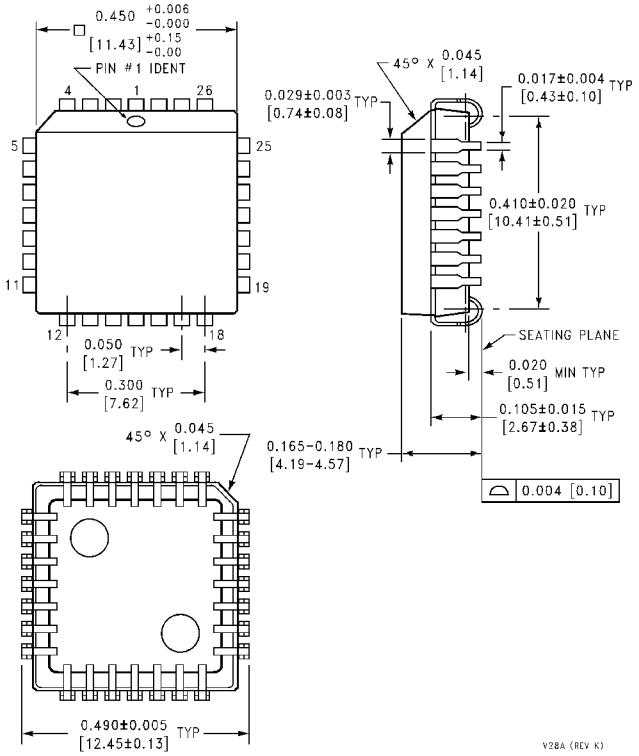


24-Lead Ceramic Dual-In-Line Package (0.400" Wide) (D)
Package Number J24E



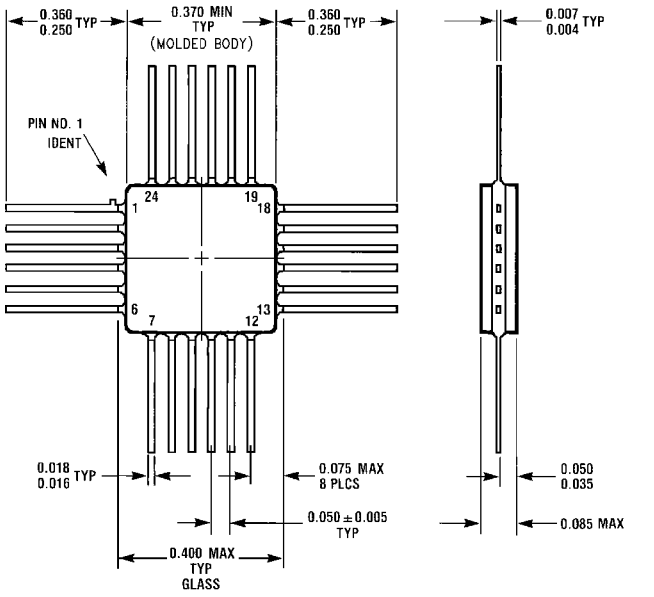
24-Lead Plastic Dual-In-Line Package (P)
Package Number N24E

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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