

100391 Low Power Single Supply Hex TTL-to-ECL Translator

General Description

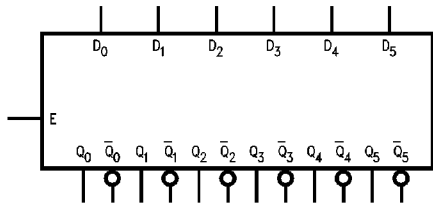
The 100391 is a hex translator for converting TTL logic levels to F100K ECL logic levels. The unique feature of this translator, is the ability to do this translation using only one +5V supply. The differential outputs allow each circuit to be used as an inverting/non-inverting translator, or as a differential line driver. A common enable (E), when low, holds all inverting outputs HIGH and all non-inverting inputs LOW.

The 100391 is ideal for those mixed ECL/TTL applications which only have a +5V supply available. When used in the differential mode, the 100391, due to its high common mode rejection, overcomes voltage gradients between the TTL and ECL ground systems.

Features

- Operates from a single +5V supply
- Differential ECL outputs
- 2000V ESD protection
- Companion chip to 100390 hex ECL-to-TTL translator

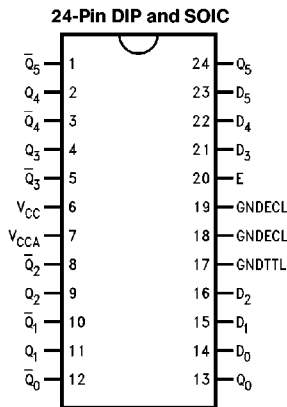
Logic Symbol



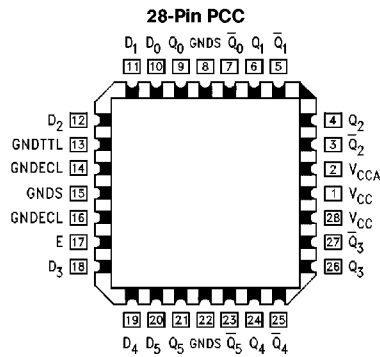
TL/F/10939-1

Pin Names	Description
D ₀ -D ₅	Data Inputs (TTL)
Q ₀ -Q ₅	Data Outputs (PECL)
Q̄ ₀ -Q̄ ₅	Inverting Data Outputs (PECL)
E	Enable Input (TTL)

Connection Diagrams



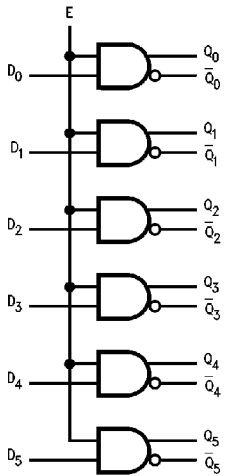
TL/F/10939-2



TL/F/10939-3

100391 Low Power Single Supply Hex TTL-to-ECL Translator

Logic Diagram



TL/F/10939-5

Truth Table

Inputs		Outputs	
D _n	E	Q _n	Q _n [̄]
H	H	H	L
L	H	L	H
H	L	L	H
L	L	L	H

Absolute Maximum Ratings (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
V_{CC} Pin Potential to Ground Pin	-0.5V to +7.0V
ECL Output Current (DC Output HIGH)	-50 mA
TTL Input Voltage (Note 3)	-0.5V to +7.0V
TTL Input Current (Note 3)	-30 mA to +5.0 mA
ESD (Last Passing Voltage) (Min) (Note 2)	2000V

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: Either voltage limit or current limit is sufficient to protect inputs.

Recommended Operating Conditions

Case Temperature (T_C)	
Commercial	0°C to +85°C
Military	-55°C to +125°C
Supply Voltage (V_{CC})	4.5V to 5.5V
Commercial	

Commercial Version

TTL-to-ECL DC Electrical Characteristics $V_{CC} = +5.0V \pm 10\%$, $GND = 0V$

Symbol	Parameter	Min	Typ	Max	Units	Conditions
V_{OH}	Output HIGH Voltage	$V_{CC} - 1025$	$V_{CC} - 955$	$V_{CC} - 870$	mV	$V_{IN} = V_{IH}(\text{max})$ or $V_{IL}(\text{min})$ Loading with 50Ω to $V_{CC} - 2V$
V_{OL}	Output LOW Voltage	$V_{CC} - 1890$	$V_{CC} - 1705$	$V_{CC} - 1620$	mV	
V_{OHC}	Output HIGH Voltage Corner Point High	$V_{CC} - 1035$			mV	$V_{IN} = V_{IH}(\text{min})$ or $V_{IL}(\text{max})$ Loading with 50Ω to $V_{CC} - 2V$
V_{OLC}	Output LOW Voltage Corner Point Low			$V_{CC} - 1610$	mV	
V_{IH}	Input HIGH Voltage	2.0		5.0	V	Over V_{TTL} , V_{EE} , T_C Range
V_{IL}	Input LOW Voltage	0		0.8	V	Over V_{TTL} , V_{EE} , T_C Range
I_{IH}	Input HIGH Current			10	μA	$V_{IN} = +2.7V$
	Breakdown Test			20	μA	$V_{IN} = +5.5V$
I_{IL}	Input LOW Current D_n E	-0.8			mA	$V_{IN} = +0.5V$
		-4.2				
V_{FCD}	Input Clamp Diode Voltage	-1.2			V	$I_{IN} = -18\text{ mA}$
I_{CC}	V_{CC} Supply Current	32		69	mA	Inputs Open

Note 4: 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 Package AC Electrical Characteristics

$V_{CC} = 5.0V \pm 10\%$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay Data to Output	0.30	1.40	0.35	1.30	0.40	1.30	ns	Figures 1, 2
t_{PLH} t_{PHL}	Propagation Delay Enable to Output	0.40	1.50	0.45	1.40	0.50	1.40	ns	Figures 1, 2
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.35	1.70	0.35	1.70	0.35	1.70	ns	Figures 1, 2

SOIC and PCC Package AC Electrical Characteristics

$V_{CC} = 5.0V \pm 10\%$

Symbol	Parameter	$T_C = 0^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay Data to Output	0.30	1.40	0.35	1.30	0.40	1.30	ns	Figures 1 and 2
t_{PLH} t_{PHL}	Propagation Delay Enable to Output	0.40	1.50	0.45	1.40	0.50	1.40	ns	
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.35	1.70	0.35	1.70	0.35	1.70	ns	
t_{OSHL}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		750		750		750	ps	PCC Only (Note 1)
t_{OSLH}	Maximum Skew Common Edge Output-to-Output Variation Data to Output Path		700		700		700	ps	PCC Only (Note 1)
t_{OST}	Maximum Skew Opposite Edge Output-to-Output Variation Data to Output Path		450		450		450	ps	PCC Only (Note 1)
t_{PS}	Maximum Skew Pin (Signal) Transition Variation Data to Output Path		525		525		525	ps	PCC Only (Note 1)

Note 1: 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.

Industrial Version

DC Electrical Characteristics

$V_{CC} = +5.0V \pm 10\%$, $GND = 0V$ (Note 1)

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = 0^\circ C \text{ to } +85^\circ C$		Units	Conditions
		Min	Max	Min	Max		
V_{OH}	Output HIGH Voltage	$V_{CC} - 1085$	$V_{CC} - 870$	$V_{CC} - 1025$	$V_{CC} - 870$	mV	$V_{IN} = V_{IH}(\text{max})$ or $V_{IL}(\text{min})$
V_{OL}	Output LOW Voltage	$V_{CC} - 1890$	$V_{CC} - 1575$	$V_{CC} - 1890$	$V_{CC} - 1620$	mV	Loading with 50Ω to $V_{CC} - 2V$
V_{OHC}	Output HIGH Voltage Corner Point High	$V_{CC} - 1095$		$V_{CC} - 1035$		mV	$V_{IN} = V_{IH}(\text{min})$ or $V_{IL}(\text{max})$ Loading with 50Ω to $V_{CC} - 2V$
V_{OLC}	Output LOW Voltage Corner Point High	$V_{CC} - 1565$		$V_{CC} - 1610$		mV	
V_{IH}	Input HIGH Voltage	2.0	5.0	2.0	5.0	V	
V_{IL}	Input LOW Voltage	0	0.8	0	0.8	V	
I_{IH}	Input HIGH Current	10		10		μA	$V_{IN} = +2.7V$
	Breakdown Test	20		20		μA	$V_{IN} = +5.5V$
I_{IL}	Input LOW Current	D_n E	-0.8	-0.8		mA	$V_{IN} = +0.5V$
			-4.2	-4.2			
V_{FCD}	Input Clamp Diode Voltage	-1.2		-1.2		V	$I_{IN} = -18 \text{ mA}$
I_{CC}	V_{CC} Supply Current	29	69	29	69	mA	Inputs Open

PCC AC Electrical Characteristics

$V_{CC} = +5.0V \pm 10\%$, $GND = 0V$

Symbol	Parameter	$T_C = -40^\circ C$		$T_C = +25^\circ C$		$T_C = +85^\circ C$		Units	Conditions
		Min	Max	Min	Max	Min	Max		
t_{PLH} t_{PHL}	Propagation Delay Data to Output	0.20	1.50	0.35	1.30	0.40	1.30	ns	<i>Figures 1 and 2</i>
t_{PLH} t_{PHL}	Propagation Delay Enable to Output	0.35	1.60	0.45	1.40	0.50	1.40	ns	
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.35	1.70	0.35	1.70	0.35	1.70	ns	

Note 1: 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.

Military Version-Preliminary

TTL-to-ECL DC Electrical Characteristics

$V_{EE} = -4.2V$ to $-5.7V$, $V_{CC} = V_{CCA} = GND$, $T_C = -55^{\circ}C$ to $+125^{\circ}C$, $V_{TTL} = +4.5V$ to $+5.5V$

Symbol	Parameter	Min	Max	Units	T_C	Conditions	Notes	
V_{OH}	Output HIGH Voltage	$V_{CC} - 1025$	$V_{CC} - 870$	mV	$0^{\circ}C$ to $+125^{\circ}C$	$V_{IN} = V_{IH}(\max)$ or $V_{IL}(\min)$	Loading with 50Ω to $V_{CC} - 2.0V$	1, 2, 3
		$V_{CC} - 1085$	$V_{CC} - 870$	mV	$-55^{\circ}C$			
V_{OL}	Output LOW Voltage	$V_{CC} - 1830$	$V_{CC} - 1620$	mV	$0^{\circ}C$ to $+125^{\circ}C$	$V_{IN} = V_{IH}(\min)$ or $V_{IL}(\max)$	Loading with 50Ω to $V_{CC} - 2.0V$	1, 2, 3
		$V_{CC} - 1830$	$V_{CC} - 1555$	mV	$-55^{\circ}C$			
V_{OHC}	Output HIGH Voltage	$V_{CC} - 1035$		mV	$0^{\circ}C$ to $+125^{\circ}C$	$V_{IN} = V_{IH}(\min)$ or $V_{IL}(\max)$	Loading with 50Ω to $V_{CC} - 2.0V$	1, 2, 3
		$V_{CC} - 1085$		mV	$-55^{\circ}C$			
V_{OLC}	Output LOW Voltage		$V_{CC} - 1610$	mV	$0^{\circ}C$ to $+125^{\circ}C$	$V_{IN} = V_{IH}(\min)$ or $V_{IL}(\max)$	Loading with 50Ω to $V_{CC} - 2.0V$	1, 2, 3
			$V_{CC} - 1555$	mV	$-55^{\circ}C$			
V_{IH}	Input HIGH Voltage	2.0		V	$-55^{\circ}C$ to $+125^{\circ}C$		1, 2, 3, 4	
V_{IL}	Input LOW Voltage		0.8	V	$-55^{\circ}C$ to $+125^{\circ}C$		1, 2, 3, 4	
I_{IH}	Input HIGH Current		70	μA	$-55^{\circ}C$ to $+125^{\circ}C$	$V_{IN} = +2.7V$	1, 2, 3	
I_{IL}	Input LOW Current	-1.0		mA	$-55^{\circ}C$ to $+125^{\circ}C$	$V_{IN} = +0.5V$	1, 2, 3	
V_{FCD}	Input Clamp Diode Voltage	-1.2		V	$-55^{\circ}C$ to $+125^{\circ}C$	$I_{IN} = -18$ mA	1, 2, 3	
I_{CC}	V_{CC} Supply Current	20	70	mA	$-55^{\circ}C$ to $+125^{\circ}C$	Inputs Open	1, 2, 3	

AC Electrical Characteristics $V_{CC} = +5.0 \pm 10\%$, $GND = 0V$

Symbol	Parameter	$T = -55^{\circ}C$		$T = +25^{\circ}C$		$T = +125^{\circ}C$		Units	Conditions	Notes
		Min	Max	Min	Max	Min	Max			
t_{PLH} t_{PHL}	Propagation Delay Data and Enable to Output	0.40	2.50	0.50	2.10	0.50	2.10	ns	Figures 1, 2	1, 2, 3
t_{TLH} t_{THL}	Transition Time 20% to 80%, 80% to 20%	0.30	2.00	0.30	2.00	0.30	2.00	ns	Figures 1, 2	1, 2, 3

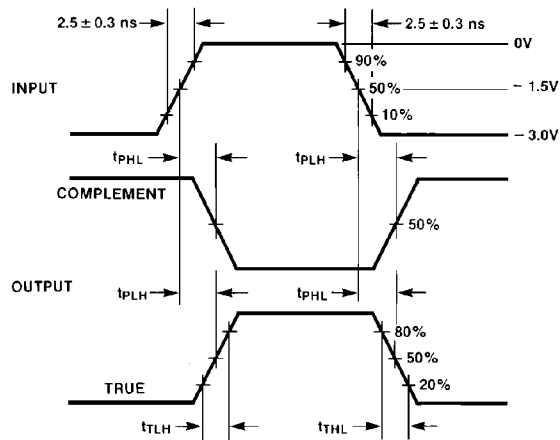
Note 1: F100K 300 Series cold temperature testing is performed by temperature soaking (to guarantee junction temperature equals $-55^{\circ}C$), then testing immediately without allowing for the junction temperature to stabilize due to heat dissipation after power-up. This provides "cold start" specs which can be considered a worst case condition at cold temperatures.

Note 2: Screen tested 100% on each device at $-55^{\circ}C$, $+25^{\circ}C$ and $+125^{\circ}C$, Subgroups 1, 2, 3, 7 and 8.

Note 3: Sample tested (Method 5005, Table I) on each manufactured lot at $-55^{\circ}C$, $+25^{\circ}C$ and $+125^{\circ}C$, Subgroups A1, 2, 3, 7 and 8.

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

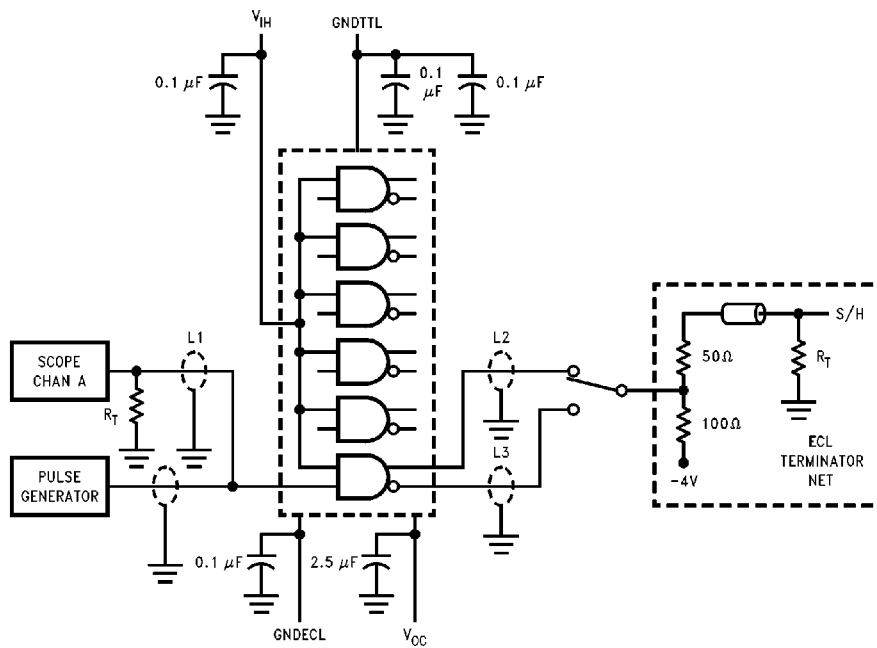
Switching Waveforms



TL/F/10939-6

FIGURE 1. Propagation Delay and Transition Times

Test Circuit



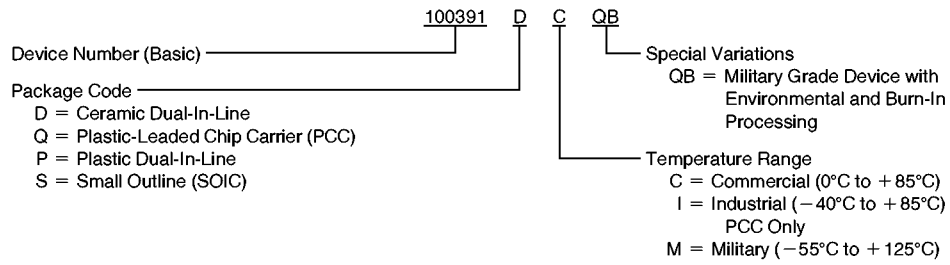
TL/F/10939-7

Notes:

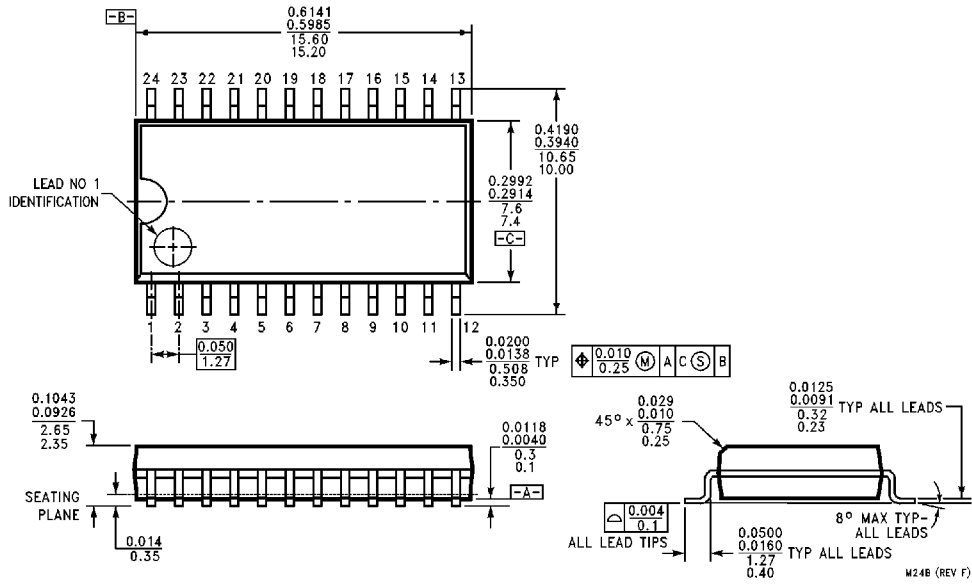
- $V_{CC} = V_{CCA} = +2V$, $GND_{DECL} = GND_{TTL} = 3.0V$
- $V_{IH} = 0V$, $V_{IL} = -3V$
- L1, L2 and L3 = equal length 50Ω impedance lines
- $R_T = 50\Omega$ terminator internal to scope
- Decoupling $0.1\mu F$ from GND to V_{CC} , V_{EE} and V_{TTL}
- All unused outputs are loaded with 50Ω to GND
- C_L = Fixture and stray capacitance $\leq 3\text{ pF}$

Ordering Information

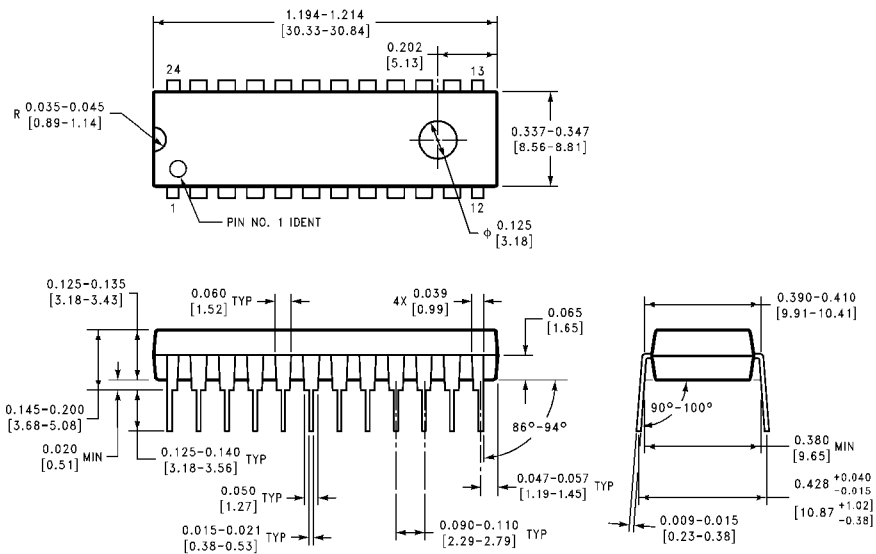
The device number is used to form part of a simplified purchasing code where a package type and temperature range are defined as follows:



Physical Dimensions inches (millimeters)

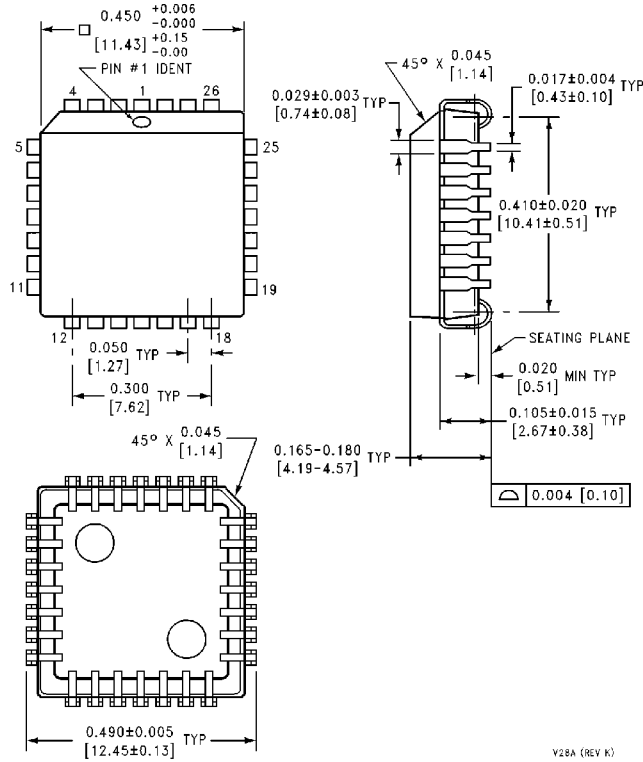


24-Lead Small Outline Integrated Circuit (S)
NS Package Number M24B



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

Physical Dimensions inches (millimeters) (Continued)



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

V28A (REV K)

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