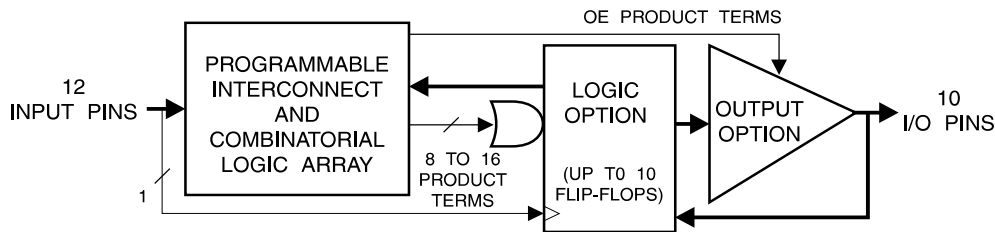


Features

- Industry-standard Architecture
 - Low-cost, Easy-to-use Software Tools
- High-speed, Electrically-erasable Programmable Logic Devices
 - 5 ns Maximum Pin-to-pin Delay
- CMOS- and TTL-compatible Inputs and Outputs
 - Latch Feature Holds Inputs to Previous Logic States
- Pin-controlled Standby Power (10 μ A Typical)
- Advanced Flash Technology
 - Reprogrammable
 - 100% Tested
- High-reliability CMOS Process
 - 20-year Data Retention
 - 100 Erase/Write Cycles
 - 2,000V ESD Protection
 - 200 mA Latch-up Immunity
- Dual Inline and Surface Mount Packages in Standard Pinouts
- PCI-compliant

Logic Diagram

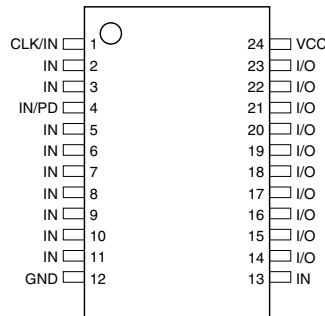


Pin Configurations

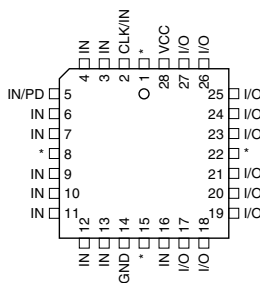
All Pinouts Top View

Pin Name	Function
CLK	Clock
IN	Logic Inputs
I/O	Bi-directional Buffers
*	No Internal Connection
VCC	+5V Supply
PD	Power-down

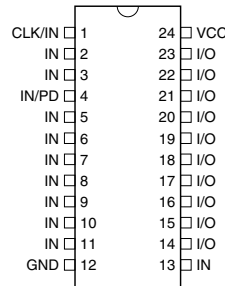
TSSOP



PLCC



DIP/SOIC



Note: For PLCC, pins 1, 8, 15 and 22 can be left unconnected. For superior performance, connect VCC to pin 1 and GND to 8, 15, 22.



High-performance
EE PLD

ATF22V10C
ATF22V10CQ
ATF22V10CQZ





Description

The ATF22V10C is a high-performance CMOS (electrically-erasable) programmable logic device (PLD) that utilizes Atmel's proven electrically-erasable Flash memory technology. Speeds down to 5 ns and power dissipation as low as 100 μ A are offered. All speed ranges are specified over the full $5V \pm 10\%$ range for industrial

temperature ranges, and $5V \pm 5\%$ for commercial temperature ranges.

Several low-power options allow selection of the best solution for various types of power-limited applications. Each of these options significantly reduces total system power and enhances system reliability.

Absolute Maximum Ratings*

Temperature under Bias	-40°C to +85°C
Storage Temperature	-65°C to +150°C
Voltage on Any Pin with Respect to Ground	-2.0V to +7.0V ⁽¹⁾
Voltage on Input Pins with Respect to Ground During Programming.....	-2.0V to +14.0V ⁽¹⁾
Programming Voltage with Respect to Ground	-2.0V to +14.0V ⁽¹⁾

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Note: 1. Minimum voltage is -0.6V DC, which may undershoot to -2.0V for pulses of less than 20 ns. Maximum output pin voltage is $V_{CC} + 0.75V$ DC, which may overshoot to 7.0V for pulses of less than 20 ns.

DC and AC Operating Conditions

	Commercial	Industrial
Operating Temperature (Ambient)	0°C - 70°C	-40°C - 85°C
V_{CC} Power Supply	$5V \pm 5\%$	$5V \pm 10\%$

Compiler Mode Selection

	PAL Mode (5828 Fuses)	GAL Mode (5892 Fuses)	Power-down Mode ⁽¹⁾ (5893 Fuses)
Synario	ATF22V10C (DIP) ATF22V10C (PLCC)	ATTF22V10C DIP (UES) ATF22C10C PLCC (UES)	ATF22V10C DIP (PWD) ATF22V10C PLCC (PWD)
WINCUPPL	P22V10 P22V10LCC	G22V10 G22V10LCC	G22V10CP G22V10CPLCC

Note: 1. These device types will create a JEDEC file which when programmed in ATF22V10C devices will enable the power-down mode feature. All other device types have the feature disabled.

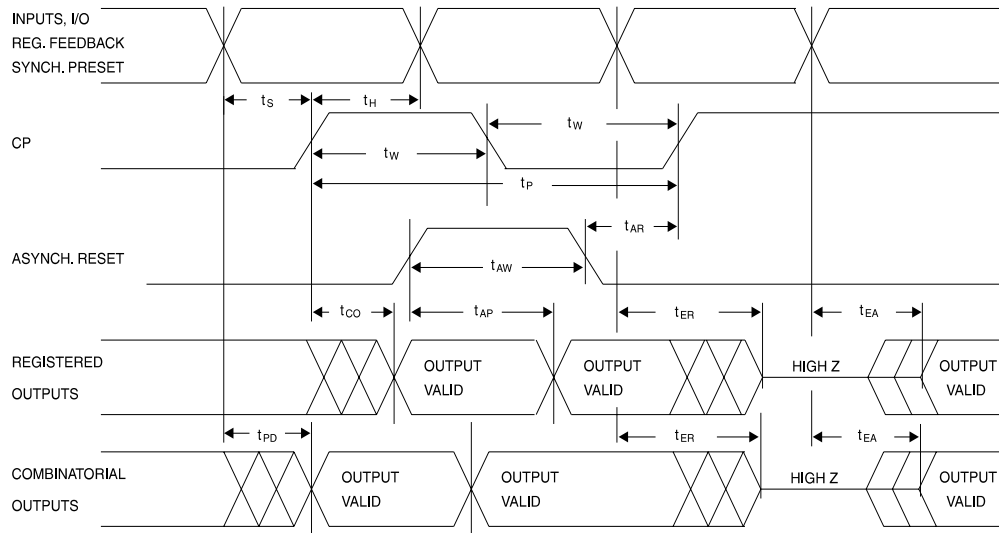
DC Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Units	
I_{IL}	Input or I/O Low Leakage Current	$0 \leq V_{IN} \leq V_{IL} \text{ (Max)}$		-35	-10	μA	
I_{IH}	Input or I/O High Leakage Current	$3.5 \leq V_{IN} \leq V_{CC}$			10	μA	
I_{CC}	Power Supply Current, Standby	$V_{CC} = \text{Max},$ $V_{IN} = \text{Max},$ Outputs Open	C-5, 7, 10	Com.	85	130	mA
			C-10	Ind.	90	140	mA
			C-15	Com.	65	90	mA
			C-15	Ind.	65	115	mA
			CQ-15	Com.	35	55	mA
			CQ-15	Ind.	35	70	mA
			CQZ-20	Com.	5	25	μA
			CQZ-20	Ind.	5	50	μA
I_{CC2}	Clocked Power Supply Current	$V_{CC} = \text{Max},$ Outputs Open, $f = 15 \text{ MHz}$	C-5, 7, 10	Com.		150	mA
			C-10	Ind.		160	mA
			C-15	Com.	70	90	mA
			C-15	Ind.	70	90	mA
			CQ-15	Com.	40	60	mA
			CQ-15	Ind.	40	80	mA
			CQZ-20	Com.	20	50	mA
			CQZ-20	Ind.	20	70	mA
I_{PD}	Power Supply Current, PD Mode	$V_{CC} = \text{Max}$	Com.	10	100	μA	
		$V_{IN} = 0, \text{ Max}$	Ind.	10	100	μA	
$I_{OS}^{(1)}$	Output Short Circuit Current	$V_{OUT} = 0.5\text{V}$			-130	mA	
V_{IL}	Input Low Voltage		-0.5		0.8	V	
V_{IH}	Input High Voltage		2.0		$V_{CC}+0.75$	V	
V_{OL}	Output Low Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL},$ $V_{CC} = \text{Min}$	$I_{OL} = 16 \text{ mA}$	Com., Ind.		0.5	V
			$I_{OL} = 12 \text{ mA}$	Mil.		0.5	V
V_{OH}	Output High Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL},$ $V_{CC} = \text{Min}$	$I_{OH} = -4.0 \text{ mA}$		2.4		V

- Notes: 1. Not more than one output at a time should be shorted. Duration of short circuit test should not exceed 30 sec.
2. Shaded area indicates preliminary data.



AC Waveforms⁽¹⁾



Note: 1. Timing measurement reference is 1.5V. Input AC driving levels are 0.0V and 3.0V, unless otherwise specified.

AC Characteristics⁽¹⁾

Symbol	Parameter	-5		-7		-10		-15		-20		Units
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t_{PD}	Input or Feedback to Combinatorial Output	1	5	3	7.5	3	10	3	15	3	20	ns
t_{CO}	Clock to Output	1	4	2	4.5 ⁽²⁾	2	6.5	2	8	2	12	ns
t_{CF}	Clock to Feedback		2.5		2.5		2.5		2.5		8	ns
t_S	Input or Feedback Setup Time	3		3.5		4.5		10			14	ns
t_H	Hold Time	0		0		0		0		0		ns
f_{MAX}	External Feedback $1/(t_S + t_{CO})$		142		125 ⁽³⁾		90		55.5		38.5	MHz
	Internal Feedback $1/(t_S + t_{CF})$		166		142		117		80		45.5	MHz
	No Feedback $1/(t_{WH} + t_{WL})$		166		166		125		83.3		50	MHz
t_W	Clock Width (t_{WL} and t_{WH})	3		3		3		6		10		ns
t_{EA}	Input or I/O to Output Enable	2	6	3	7.5	3	10	3	15	3	20	ns
t_{ER}	Input or I/O to Output Disable	2	5	3	7.5	3	9	3	15	3	20	ns
t_{AP}	Input or I/O to Asynchronous Reset of Register	3	7	3	10	3	12	3	20	3	22	ns
t_{AW}	Asynchronous Reset Width	5.5		7		8			15	20		ns
t_{AR}	Asynchronous Reset Recovery Time	4		5		6			10	20		ns
t_{SP}	Setup Time, Synchronous Preset	4		4.5		6			10	14		ns
t_{SPR}	Synchronous Preset to Clock Recovery Time	4		5		8			10	14		ns

Notes: 1. See ordering information for valid part numbers.

2. 2.5 ns for DIP package devices.

3. 3.111 MHz for DIP package devices.

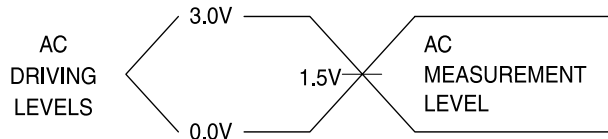
4. Shaded area indicates preliminary data.

Power-down AC Characteristics⁽¹⁾⁽²⁾⁽³⁾

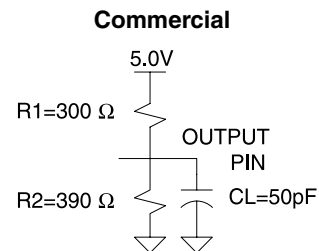
Symbol	Parameter	-5		-7		-10		-15		-20		Units
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t_{IVDH}	Valid Input before PD High	5		7.5		10		15		20		ns
t_{GVDH}	Valid \overline{OE} before PD High	0		0		0		0		0		ns
t_{CVDH}	Valid Clock before PD High	0		0		0						ns
t_{DHIX}	Input Don't Care after PD High		5		7		10		15		20	ns
t_{DHGX}	\overline{OE} Don't Care after PD High		5		7		10		15		20	ns
t_{DHGX}	Clock Don't Care after PD High		5		7		10		15		20	ns
t_{DLIV}	PD Low to Valid Input		5		7.5		10		15		20	ns
t_{DLGV}	PD Low to Valid \overline{OE}		15		20		25		30		35	ns
t_{DLCV}	PD Low to Valid Clock		15		20		25		30		35	ns
t_{DLOV}	PD Low to Valid Output		20		25		30		35		40	ns

- Notes:
1. Output data is latched and held.
 2. High-Z outputs remain high-Z.
 3. Clock and input transitions are ignored.
 4. Shaded area indicates preliminary data.

Input Test Waveforms and Measurement Levels



Output Test Loads



Pin Capacitance

$f = 1 \text{ MHz}$, $T = 25^\circ\text{C}^{(1)}$

	Typ	Max	Units	Conditions
C_{IN}	5	8	pF	$V_{IN} = 0V$
C_{OUT}	6	8	pF	$V_{OUT} = 0V$

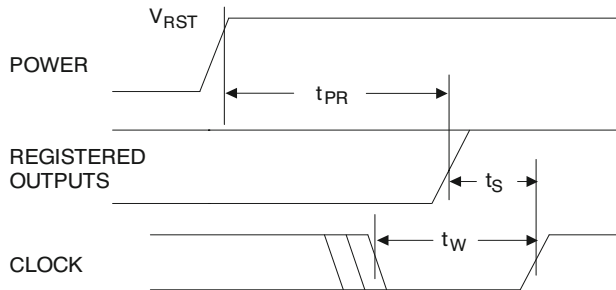
- Note:
1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

Power-up Reset

The registers in the ATF22V10Cs are designed to reset during power-up. At a point delayed slightly from V_{CC} crossing V_{RST} , all registers will be reset to the low state. The output state will depend on the polarity of the output buffer.

This feature is critical for state machine initialization. However, due to the asynchronous nature of reset and the uncertainty of how V_{CC} actually rises in the system, the following conditions are required:

1. The V_{CC} rise must be monotonic, and starts below 0.7V,
2. After reset occurs, all input and feedback setup times must be met before driving the clock pin high, and
3. The clock must remain stable during t_{PR} .



Preload of Registered Outputs

The ATF22V10C's registers are provided with circuitry to allow loading of each register with either a high or a low. This feature will simplify testing since any state can be forced into the registers to control test sequencing. A JEDEC file with preload is generated when a source file with vectors is compiled. Once downloaded, the JEDEC file preload sequence will be done automatically by most of the approved programmers after the programming.

Electronic Signature Word

There are 64 bits of programmable memory that are always available to the user, even if the device is secured. These bits can be used for user-specific data.

Parameter	Description	Typ	Max	Units
t_{PR}	Power-up Reset Time	600	1,000	ns
V_{RST}	Power-up Reset Voltage	3.8	4.5	V

Security Fuse Usage

A single fuse is provided to prevent unauthorized copying of the ATF22V10C fuse patterns. Once programmed, fuse verify and preload are inhibited. However, the 64-bit User Signature remains accessible.

The security fuse should be programmed last, as its effect is immediate.

Programming/Erasing

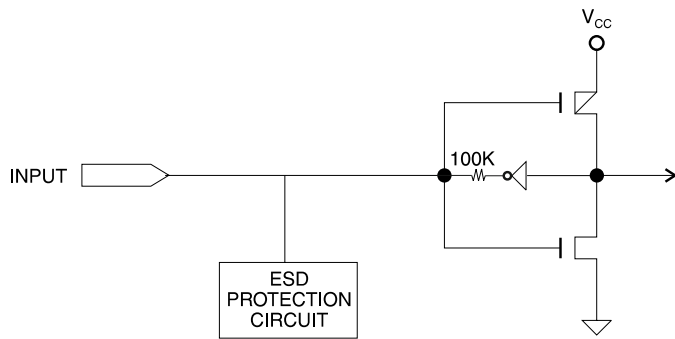
Programming/erasing is performed using standard PLD programmers. See "CMOS PLD Programming Hardware & Software Support" for information on software/programming.

Input and I/O Pin-keeper Circuits

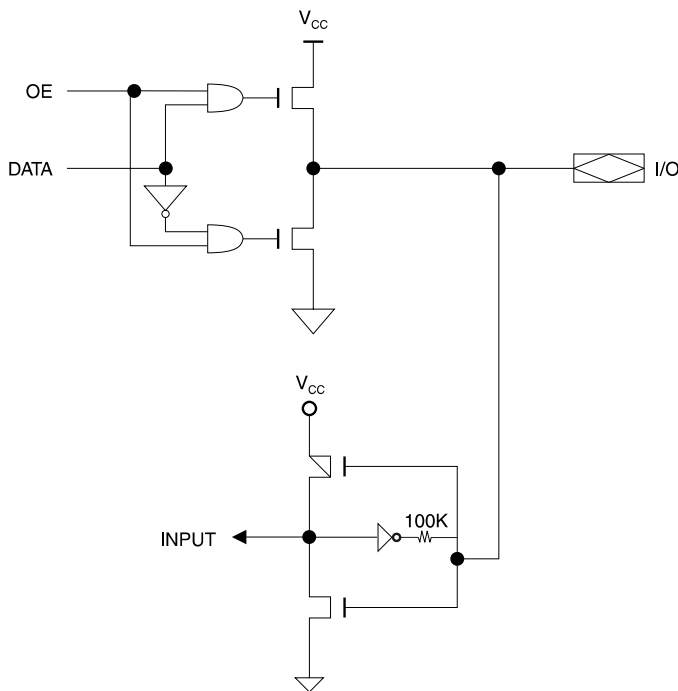
The ATF22V10C contains internal input and I/O pin-keeper circuits. These circuits allow each ATF22V10C pin to hold its previous value even when it is not being driven by an external source or by the device's output buffer. This helps to ensure that all logic array inputs are at known valid logic levels. This reduces system power by preventing pins from floating to indeterminate levels. By using pin-keeper circuits rather than pull-up resistors, there is no DC current required to hold the pins in either logic state (high or low).

These pin-keeper circuits are implemented as weak feedback inverters, as shown in the Input Diagram below. These keeper circuits can easily be overdriven by standard TTL- or CMOS-compatible drivers. The typical overdrive current required is 40 μ A.

Input Diagram



I/O Diagram



Power-down Mode

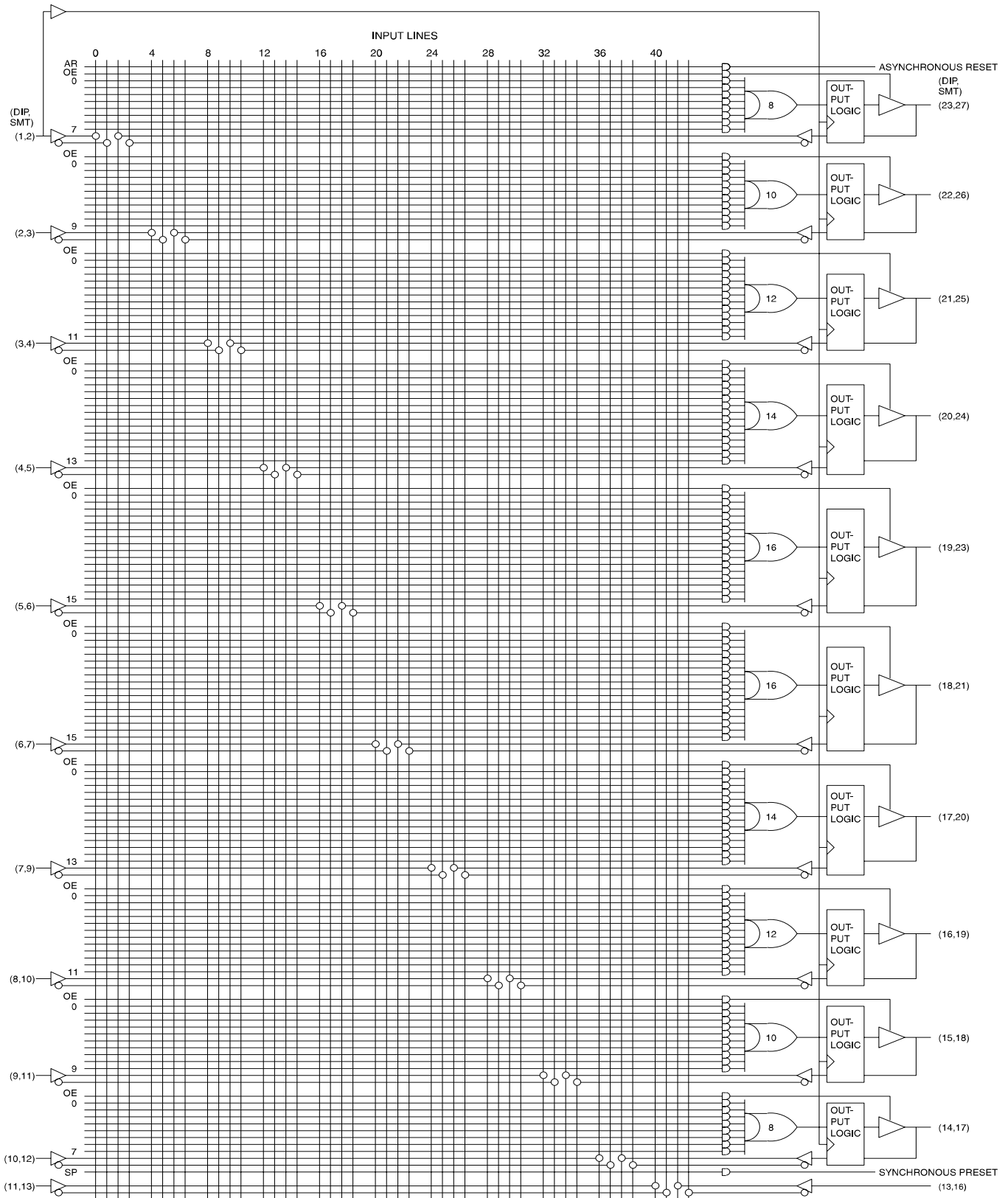
The ATF22V10C includes an optional pin-controlled power-down feature. When this mode is enabled, the PD pin acts as the power-down pin (Pin 4 on the DIP/SOIC packages and Pin 5 on the PLCC package). When the PD pin is high, the device supply current is reduced to less than 100 mA. During power-down, all output data and internal logic states are latched and held. Therefore, all registered and combinatorial output data remain valid. Any outputs that were in an undetermined state at the onset of power-down will remain at the same state. During power-down, all input signals except the power-down pin are blocked. Input and I/O hold latches remain active to ensure that pins do not float to indeterminate levels, further reducing system power. The power-down pin feature is enabled in the logic design file. Designs using the power-down pin may not use the PD pin logic array input. However, all other PD pin macrocell resources may still be used, including the buried feedback and foldback product term array inputs.

PD pin configuration is controlled by the design file, and appears as a separate fuse bit in the JEDEC file. When the power-down feature is not specified in the design file, the IN/PD pin will be configured as a regular logic input.

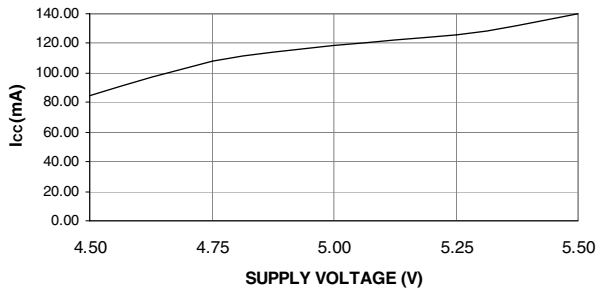
Note: Some programmers list the 22V10 JEDEC compatible 22V10C (no PD used) separately from the non-22V10 JEDEC compatible 22V10CEX (with PD used).



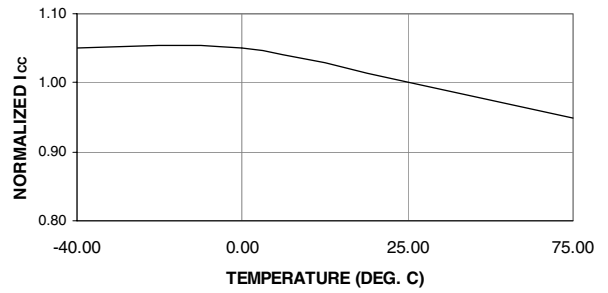
Functional Logic Diagram ATF22V10C



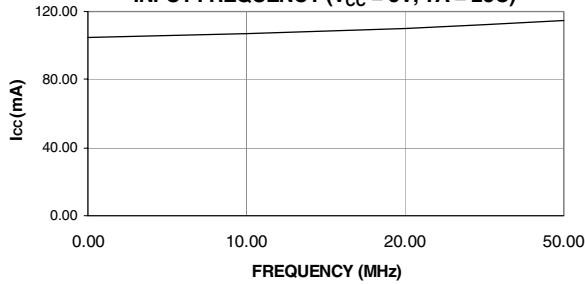
ATF22V10C SUPPLY CURRENT VS. SUPPLY VOLTAGE (TA = 25C)



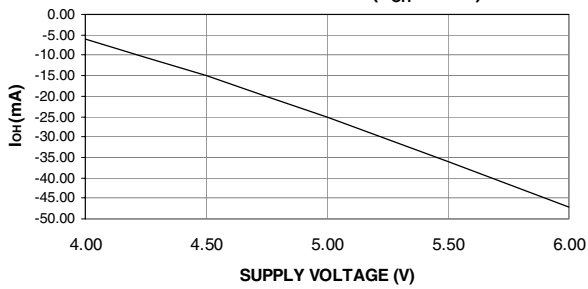
ATF22V10C NORMALIZED I_{CC} VS. TEMP.



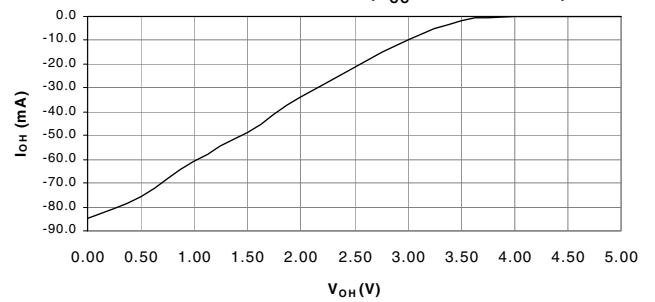
ATF22V10C SUPPLY CURRENT VS. INPUT FREQUENCY (V_{CC} = 5V, TA = 25C)



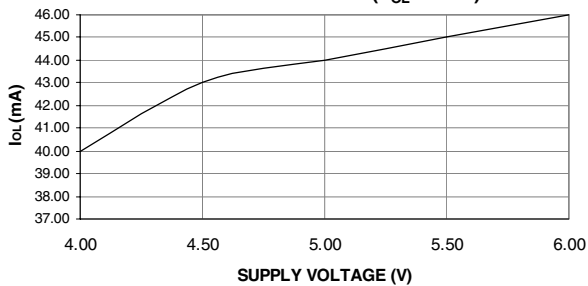
ATF22V10C OUTPUT SOURCE CURRENT VS. SUPPLY VOLTAGE (V_{OH} = 2.4V)



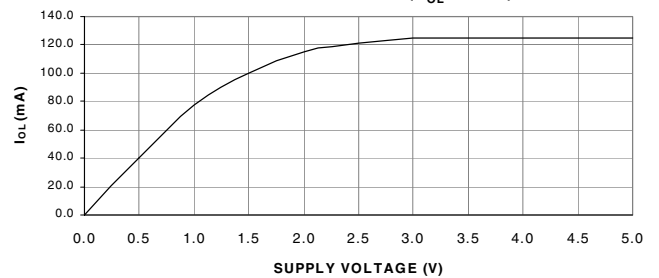
ATF22V10C OUTPUT SOURCE CURRENT VS. OUTPUT VOLTAGE (V_{CC} = 5V, TA = 25C)



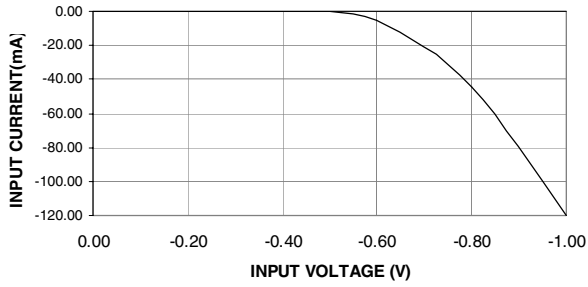
ATF22V10C OUTPUT SINK CURRENT VS. SUPPLY VOLTAGE (V_{OL} = 0.5V)



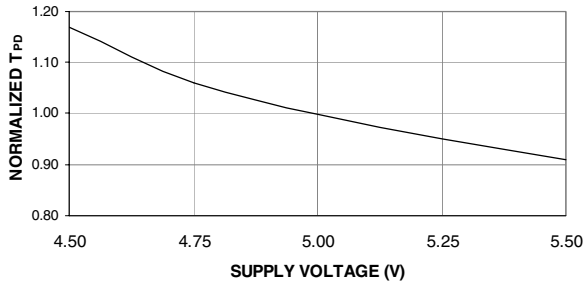
ATF22V10C OUTPUT SINK CURRENT VS. SUPPLY VOLTAGE (V_{OL} = 0.5V)



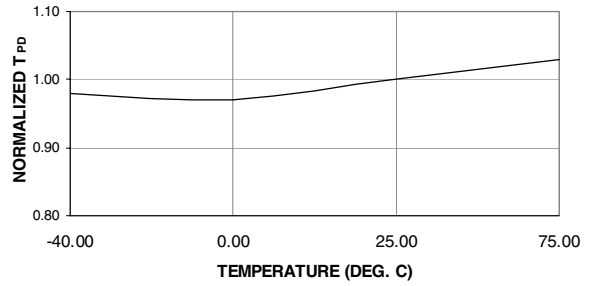
ATF22V10C INPUT CLAMP CURRENT VS. INPUT VOLTAGE ($V_{CC} = 5V, T_A = 35C$)



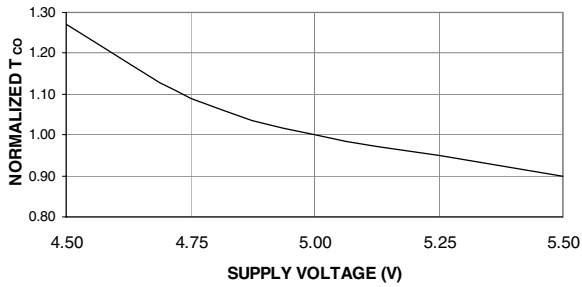
ATF22V10C NORMALIZED T_{PD} VS. V_{CC}



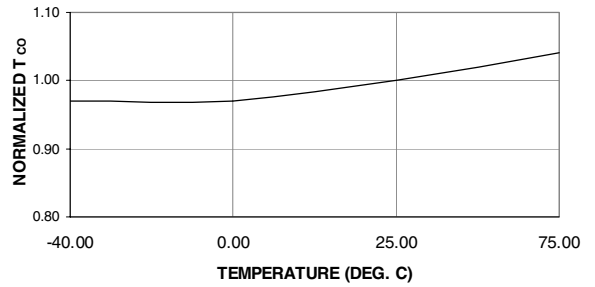
ATF22V10C NORMALIZED T_{PD} VS. Temperature



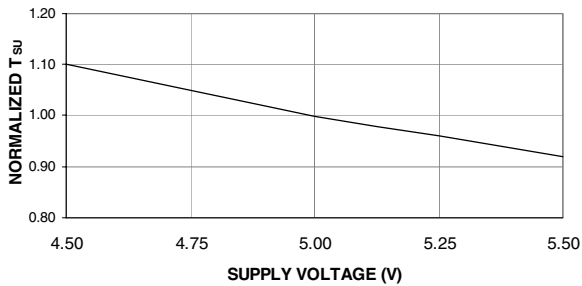
ATF22V10C NORMALIZED T_{CO} VS. V_{CC}



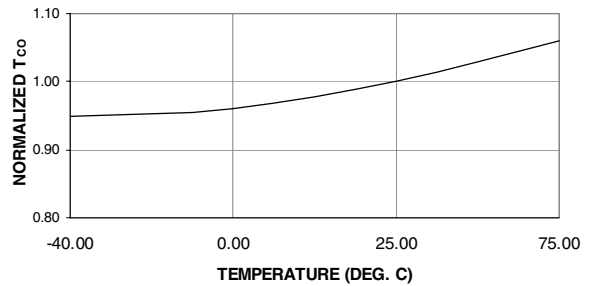
ATF22V10C NORMALIZED T_{CO} VS. Temperature



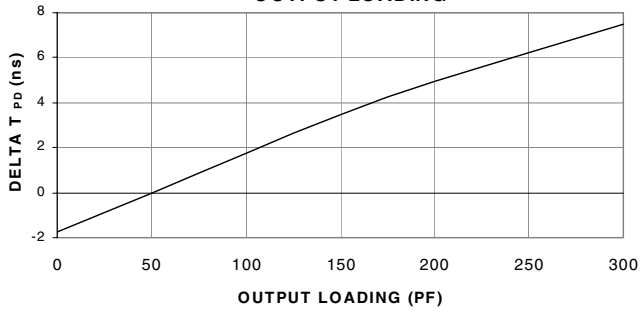
ATF22V10C NORMALIZED T_{SU} VS. V_{CC}



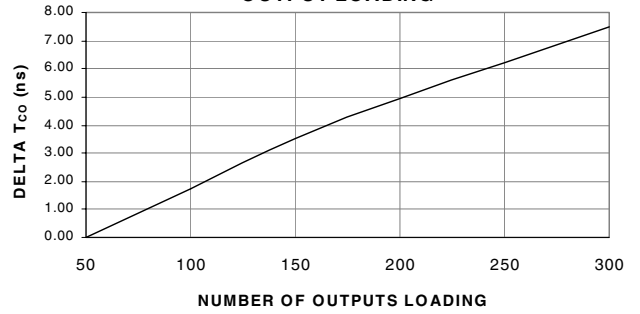
ATF22V10C NORMALIZED T_{SU} VS. Temperature



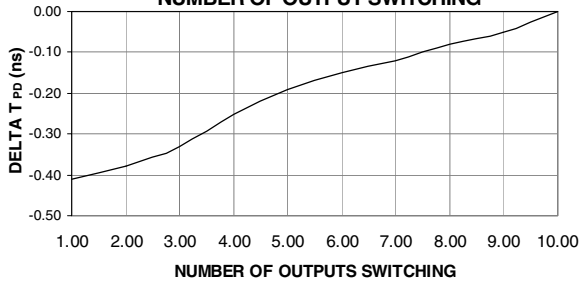
ATF22V10C DELTA T_{PD} VS. OUTPUT LOADING



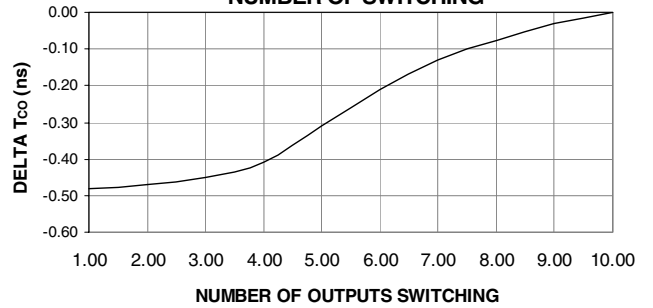
ATF22V10C DELTA T_{CO} VS. OUTPUT LOADING



ATF22V10C DELTA T_{PD} VS. NUMBER OF OUTPUT SWITCHING



ATF22V10C DELTA T_{CO} VS. NUMBER OF SWITCHING





ATF22V10C Ordering Information

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
5	3	4	ATF22V10C-5JC	28J	Commercial (0°C to 70°C)
7.5	3.5	4.5	ATF22V10C-7JC	28J	Commercial (0°C to 70°C)
			ATF22V10C-7PC	24P3	
			ATF22V10C-7SC	24S	
			ATF22V10C-7XC	24X	
10	4.5	6.5	ATF22V10C-10JC	28J	Commercial (0°C to 70°C)
			ATF22V10C-10PC	24P3	
			ATF22V10C-10SC	24S	
			ATF22V10C-10XC	24X	
			ATF22V10C-10JI	28J	Industrial (-40°C to 85°C)
			ATF22V10C-10PI	24P3	
			ATF22V10C-10SI	24S	
			ATF22V10C-10XI	24X	
15	10	8	ATF22V10C-15JC	28J	Commercial (0°C to 70°C)
			ATF22V10C-15PC	24P3	
			ATF22V10C-15SC	24S	
			ATF22V10C-15XC	24X	
			ATF22V10C-15JI	28J	Industrial (-40°C to 85°C)
			ATF22V10C-15PI	24P3	
			ATF22V10C-15SI	24S	
			ATF22V10C-15XI	24X	

Using “C” Product for Industrial

To use commercial product for Industrial temperature ranges, down-grade one speed grade from the “I” to the “C” device (7 ns “C” = 10 ns “I”) and de-rate power by 30%.

Package Type	
28J	28-lead, Plastic J-leded Chip Carrier (PLCC)
24P3	24-pin, 0.300" Wide, Plastic Dual Inline Package (PDIP)
24S	24-lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC)
24X	24-lead, 4.4 mm Wide, Plastic Thin Shrink Small Outline (TSSOP)

ATF22V10C(Q) Ordering Information

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
15	10	8	ATF22V10CQ-15JC	28J	Commercial (0°C to 70°C)
			ATF22V10CQ-15PC	24P3	
			ATF22V10CQ-15SC	24S	
			ATF22V10CQ-15XC	24X	
			ATF22V10CQ-15JI	28J	Industrial (-40°C to 85°C)
			ATF22V10CQ-15PI	24P3	
			ATF22V10CQ-15SI	24S	
			ATF22V10CQ-15XI	24X	
20	14	12	ATF22V10CQZ-20JC	28J	Commercial (0°C to 70°C)
			ATF22V10CQZ-20PC	24P3	
			ATF22V10CQZ-20SC	24S	
			ATF22V10CQZ-20XC	24X	
			ATF22V10CQZ-20JI	28J	Industrial (-40°C to 85°C)
			ATF22V10CQZ-20PI	24P3	
			ATF22V10CQZ-20SI	24S	
			ATF22V10CQZ-20XI	24X	

Note: Shaded area indicates preliminary data.

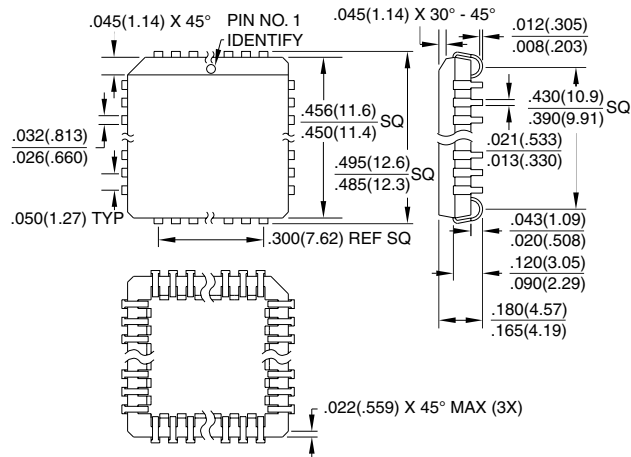
Using “C” Product for Industrial

To use commercial product for Industrial temperature ranges, down-grade one speed grade from the “I” to the “C” device (7 ns “C” = 10 ns “I”) and de-rate power by 30%.

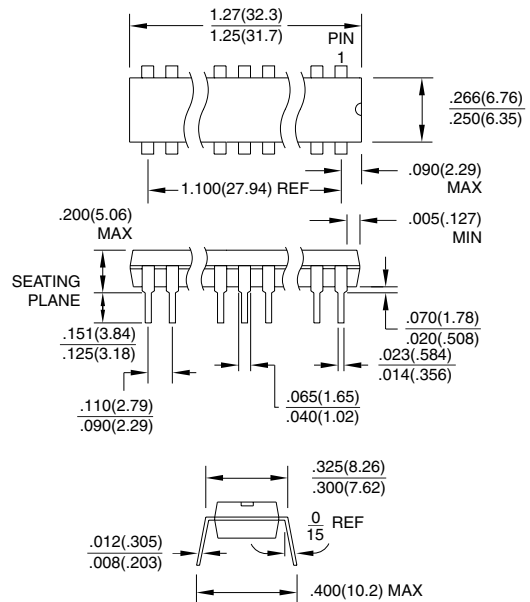
Package Type	
28J	28-lead, Plastic J-leaded Chip Carrier (PLCC)
24P3	24-pin, 0.300" Wide, Plastic Dual Inline Package (PDIP)
24S	24-lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC)
24X	24-lead, 4.4 mm Wide, Plastic Thin Shrink Small Outline (TSSOP)

Packaging Information

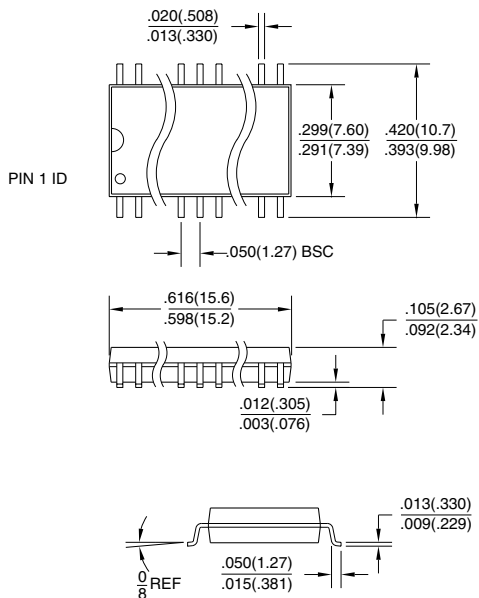
28J, 28-lead, Plastic J-leaded Chip Carrier (PLCC)
 Dimensions in Inches and (Millimeters)
 JEDEC STANDARD MS-018 AB



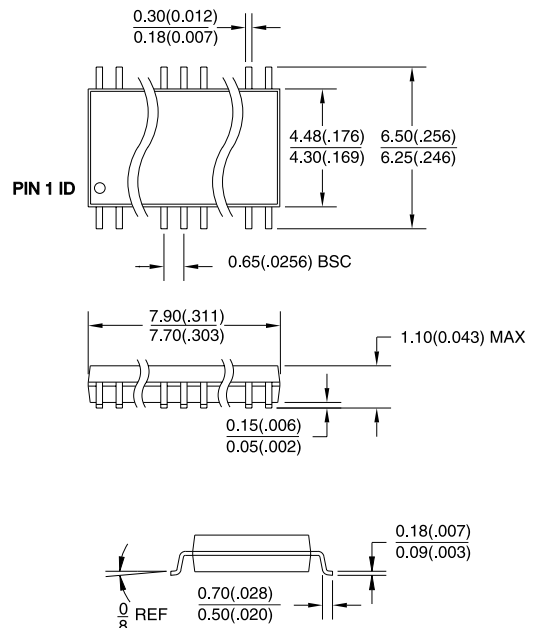
24P3, 24-pin, 0.300" Wide, Plastic Dual In Line Package (PDIP)
 Dimensions in Inches and (Millimeters)
 JEDEC STANDARD MS-001 AF



24S, 24-lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC)
 Dimensions in Inches and (Millimeters)



24X, 24-lead, 4.4 mm Wide, Plastic Thin Shrink Small Outline (TSSOP)
 Dimensions in Millimeters and (Inches)





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