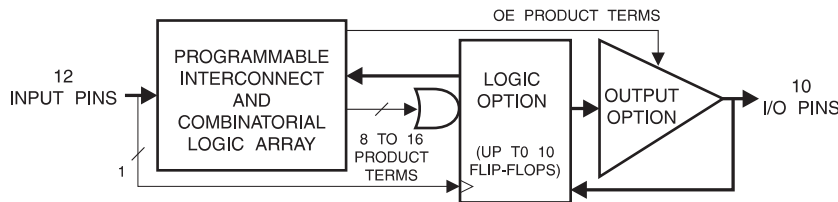


Features

- 3.0V to 5.5V Operating Range
- Advanced Low-voltage, Zero-power, Electrically Erasable Programmable Logic Device
- Edge-sensing “Zero” Power
- Low-voltage Equivalent of ATF22V10CZ
- “Zero” Standby Power (25 μ A Maximum) (Input Transition Detection)
- Ideal for Battery Powered Systems
- CMOS- and TTL-compatible Inputs and Outputs
- Latch Feature Hold Inputs to Previous Logic States
- Advanced EE 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
- Commercial and Industrial Temperature Ranges
- Dual Inline and Surface Mount Standard Pinouts
- Inputs are 5V Tolerant

Block Diagram

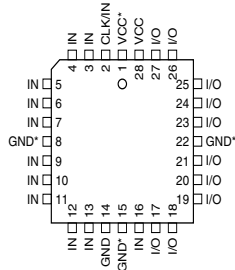


Pin Configurations

All Pinouts Top View

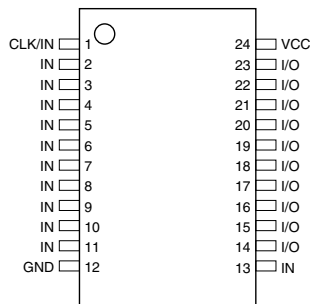
Pin Name	Function
CLK	Clock
IN	Logic Inputs
I/O	Bi-directional Buffers
GND	Ground
VCC	(3 to 5.5V) Supply

PLCC



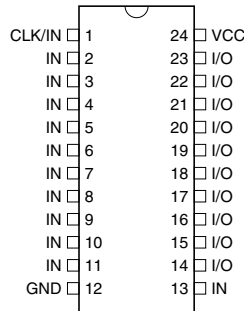
Note: For PLCC, pins 1, 8, 15, and 22 can be left unconnected. For superior performance, connect VCC to pin 1 and GND to pins 8, 15, and 22.

TSSOP



Note: TSSOP is the smallest package of SPLD offering.

DIP/SOIC



Rev. 0779J-11/00



High-performance
EE PLD

ATF22LV10CZ
ATF22LV10CQZ





Description

The ATF22LV10CZ/CQZ is a high-performance CMOS (electrically erasable) programmable logic device (PLD) that utilizes Atmel's proven electrically erasable Flash memory technology and provides 25 ns speed with standby current of 25 μ A maximum. All speed ranges are specified over the 3.0V to 5.5V range for industrial and commercial temperature ranges.

The ATF22LV10CZ/CQZ provides a low-voltage and edge-sensing "zero" power CMOS PLD solution with "zero" standby power (5 μ A typical). The ATF22LV10CZ/CQZ powers down automatically to the zero power mode through Atmel's patented Input Transition Detection (ITD) circuitry when the device is idle. The ATF22LV10CZ/CQZ is capable of operating at supply voltages down to 3.0V.

Pin "keeper" circuits on input and output pins hold pins to their previous logic levels when idle, which eliminate static power consumed by pull-up resistors. The "CQZ" combines this low high-frequency I_{CC} of the "Q" design with the "Z" feature.

The ATF22LV10CZ/CQZ macrocell incorporates a variable product term architecture. Each output is allocated from 8 to 16 product terms which allows highly complex logic functions to be realized. Two additional product terms are included to provide synchronous reset and asynchronous reset. These additional product terms are common to all 10 registers and are automatically cleared upon power-up. Register Preload simplifies testing. A security fuse prevents unauthorized copying of programmed fuse patterns.

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	3.0V - 5.5V	3.0V - 5.5V

Functional Logic Diagram Description

The Functional Logic Diagram describes the ATF22LV10CZ/CQZ architecture.

The ATF22LV10CZ/CQZ has 12 inputs and 10 I/O macrocells. Each macrocell can be configured into one of four output configurations: active high/low or registered/combinatorial. The universal architecture of the ATF22LV10CZ/CQZ can be programmed to emulate most 24-pin PAL devices.

Unused product terms are automatically disabled by the compiler to decrease power consumption. A security fuse, when programmed, protects the contents of the ATF22LV10CZ/CQZ. Eight bytes (64 fuses) of User Signature are accessible to the user for purposes such as storing project name, part number, revision or date. The User Signature is accessible regardless of the state of the security fuse.

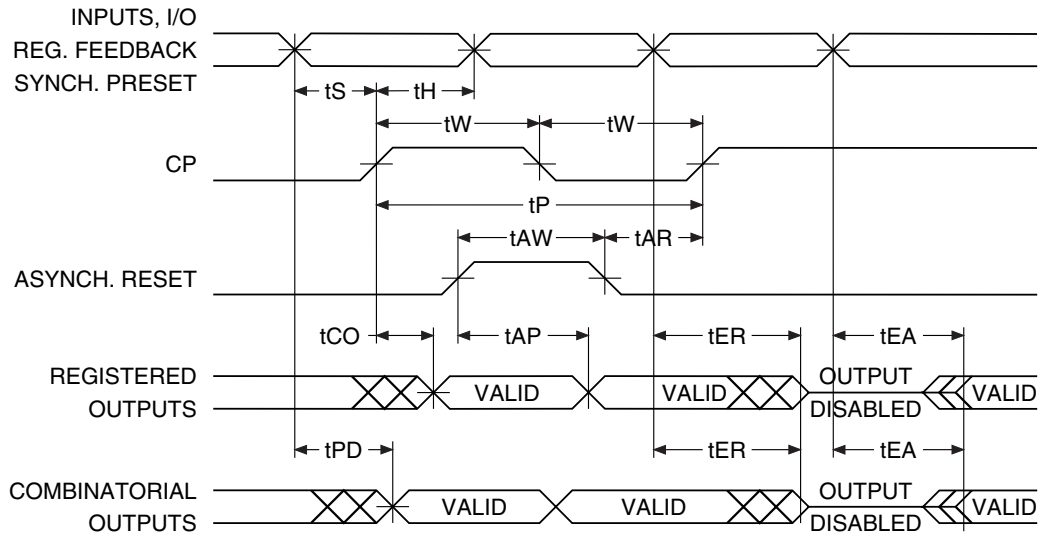
DC Characteristics

Symbol	Parameter	Condition ⁽²⁾	Min	Typ	Max	Units	
I_{IL}	Input or I/O Low Leakage Current	$0 \leq V_{IN} \leq V_{IL} (Max)$			-10.0	μA	
I_{IH}	Input or I/O High Leakage Current	$(V_{CC} - 0.2)V \leq V_{IN} \leq V_{CC}$			10.0	μA	
I_{CC}	Clocked Power Supply Current	$V_{CC} = Max$ Outputs Open, $f = 15 MHz$	CZ-25	Com.	50.0	85.0	mA
			CZ-25	Ind.	55.0	90.0	mA
			CQZ-25	Com.	18.0	50.0	mA
			CQZ-25	Ind.	19.0	60.0	mA
I_{SB}	Power Supply Current, Standby	$V_{CC} = Max$ $V_{IN} = Max$ Outputs Open	CZ-25	Com.	3.0	25.0	μA
			CZ-25	Ind.	4.0	50.0	μA
			CQZ-25	Com.	3.0	25.0	μA
			CQZ-25	Ind.	4.0	50.0	μA
$I_{OS}^{(1)}$	Output Short Circuit Current	$V_{OUT} = 0.5V$			-130.0	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	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{CC} = Min$, $I_{OL} = 16 mA$	Com.		0.5	V	
			Ind.				
V_{OH}	Output High Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{CCIO} = Min$, $I_{OH} = -2.0 mA$	2.4			V	
V_{OH}	Output High Voltage	$I_{OH} = -100 \mu A$	$V_{CC} - 0.2V$			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. For DC characterization, the test condition of $V_{CC} = Max$ corresponds to 3.6V.



AC Waveforms

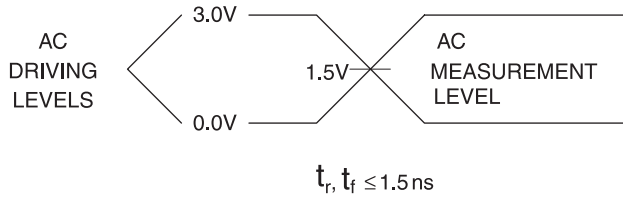


AC Characteristics⁽¹⁾

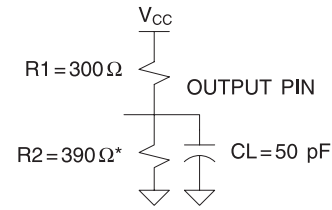
Symbol	Parameter	-25		-30		Units
		Min	Max	Min	Max	
t_{PD}	Input or Feedback to Non-registered Output	3.0	25.0	10.0	30.0	ns
t_{CF}	Clock to Feedback		13.0	10.0	15.0	ns
t_{CO}	Clock to Output	2.0	15.0	4.0	20.0	ns
t_S	Input or Feedback Setup Time	15.0		18.0		ns
t_H	Input Hold Time	0		0		ns
t_P	Clock Period	25.0		30.0		ns
t_W	Clock Width	12.5		15.0		ns
f_{MAX}	External Feedback $1/(t_S + t_{CO})$	33.3			25.0	MHz
	Internal Feedback $1/(t_S + t_{CF})$	35.7			30.0	MHz
	No Feedback $1/(t_P)$	40.0			33.3	MHz
t_{EA}	Input to Output Enable	3.0	25.0	10.0	30.0	ns
t_{ER}	Input to Output Disable	3.0	25.0	10.0	30.0	ns
t_{AP}	Input or I/O to Asynchronous Reset of Register	3.0	25.0	10.0	3.0	ns
t_{SP}	Setup Time, Synchronous Preset	15.0		20.0		ns
t_{AW}	Asynchronous Reset Width	25.0		30.0		ns
t_{AR}	Asynchronous Reset Recovery Time	25.0		30.0		ns
t_{SPR}	Synchronous Preset to Clock Recovery Time	15.0		20.0		ns

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

Input Test Waveforms and Measurement Levels



Output Test Loads



Note: Similar competitors devices are specified with slightly different loads. These load differences may affect output signals' delay and slew rate. Atmel devices are tested with sufficient margins to meet compatible device specification conditions.

Pin Capacitance

f = 1 MHz, T = 25°C⁽¹⁾

	Typ	Max	Units	Conditions
C _{IN}	5	8	pF	V _{IN} = 0V
C _{I/O}	6	8	pF	V _{OUT} = 0V

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

Power-up Reset

The registers in the ATF22LV10CZ/CQZ 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 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 start below 0.7V.
2. The clock must remain stable during T_{PR}.
3. After T_{PR}, all input and feedback setup times must be met before driving the clock pin high.

Preload of Register Outputs

The ATF22LV10CZ/CQZ'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.

Security Fuse Usage

A single fuse is provided to prevent unauthorized copying of the ATF22LV10CZ/CQZ 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.

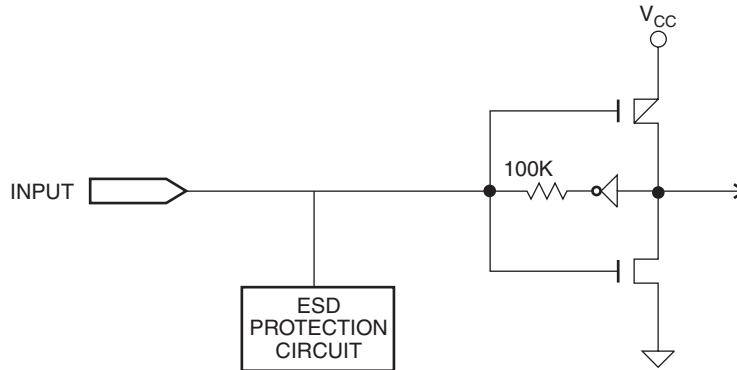
Parameter	Description	Typ	Max	Units
T _{PR}	Power-up Reset Time	600	1000	ns
V _{RST}	Power-up Reset Voltage	2.3	2.7	V

Input and I/O Pin Keepers

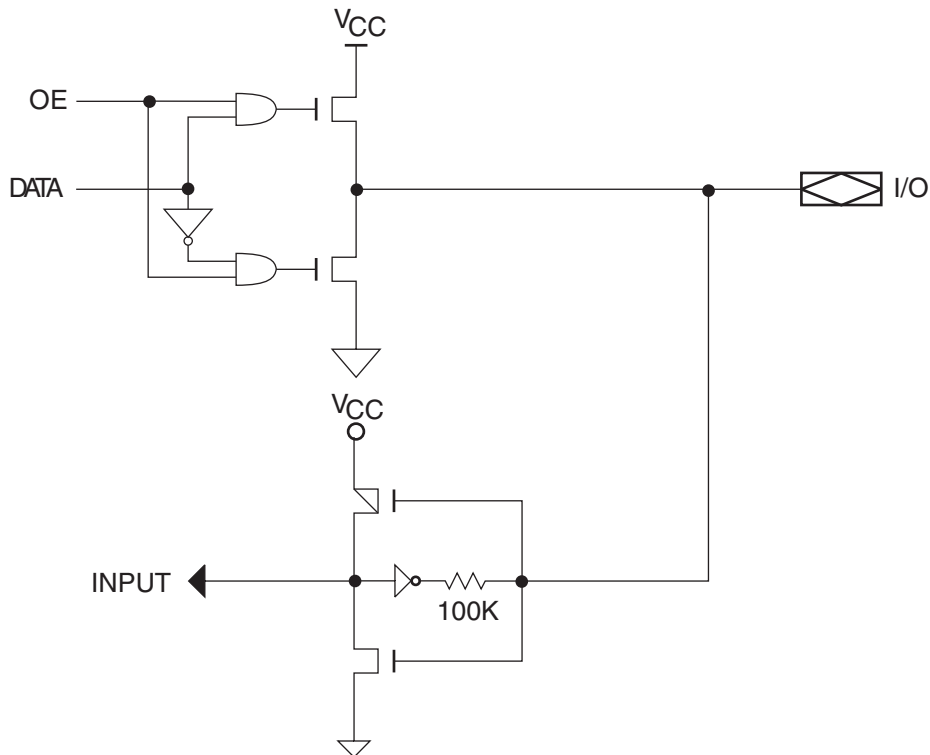
All ATF22LV10CZ/CQZ family members have internal input and I/O pin-keeper circuits. Therefore, whenever inputs or I/Os are not being driven externally, they will maintain their last driven state. This ensures that all logic array inputs and

device outputs are at known states. These are relatively weak active circuits that can be easily overridden by TTL-compatible drivers (see input and I/O diagrams below).

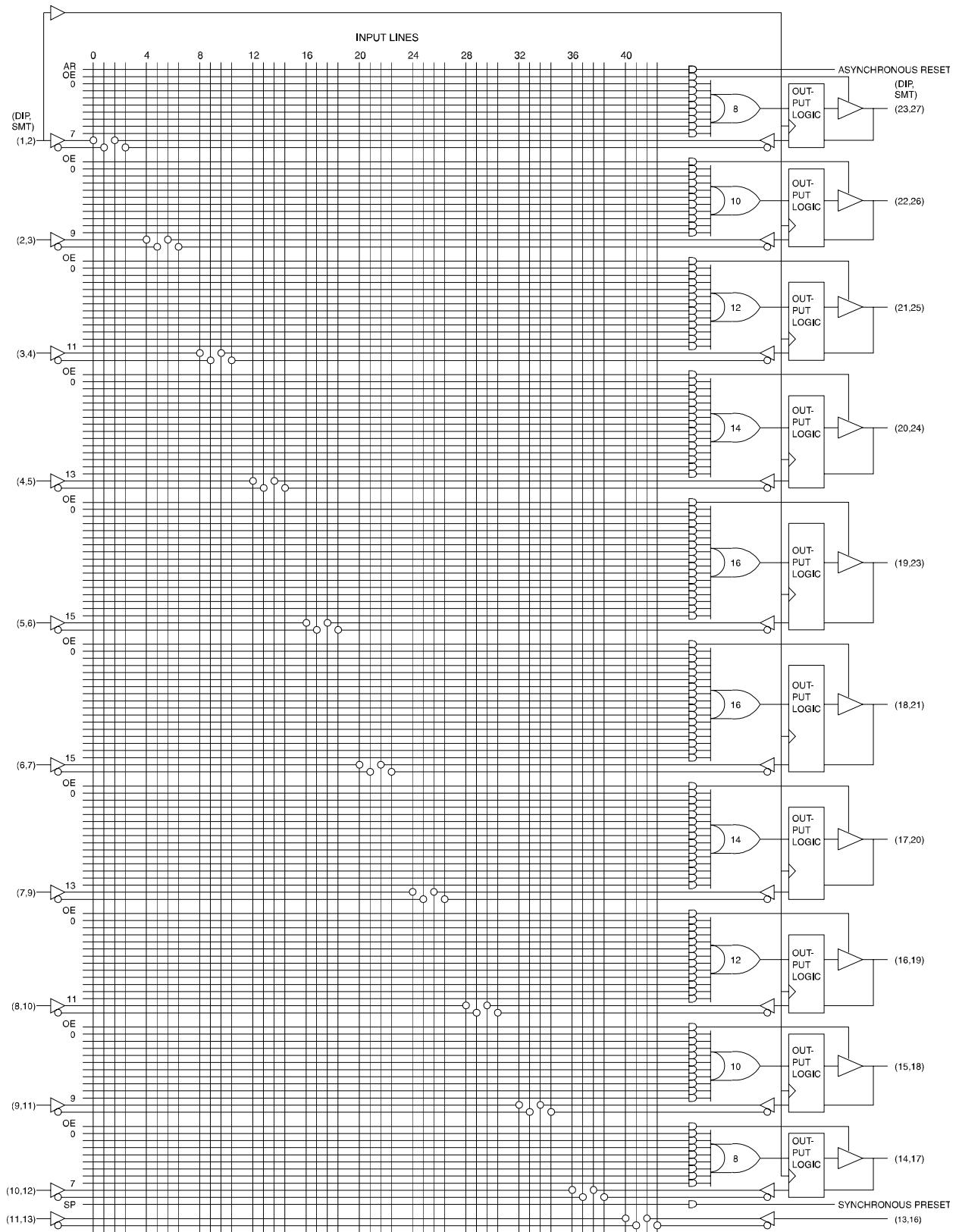
Input Diagram



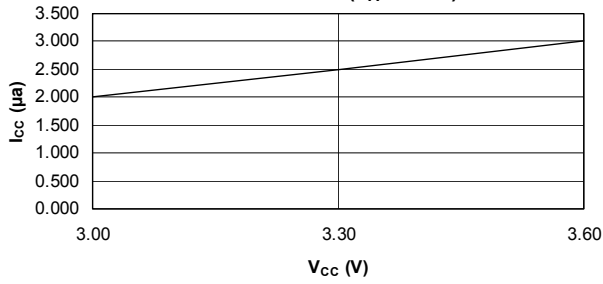
I/O Diagram



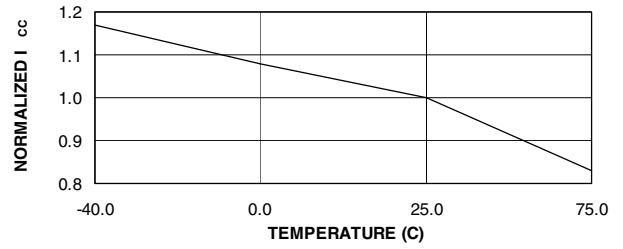
Functional Logic Diagram ATF22LV10CZ/CQZ



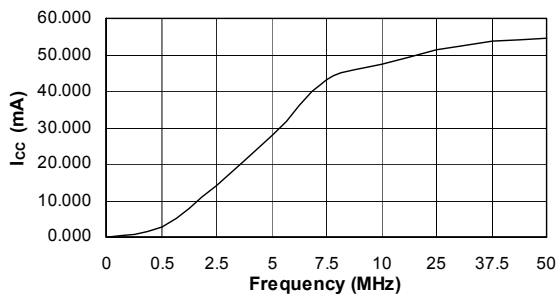
ATF22LV10CZ/CQZ STANDBY CURRENT VS. SUPPLY VOLTAGE ($T_A = 25^\circ\text{C}$)



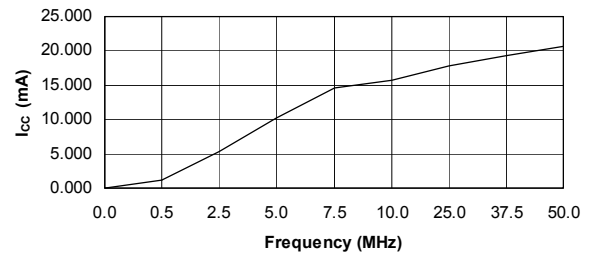
NORMALIZED I_{cc} VS. TEMP



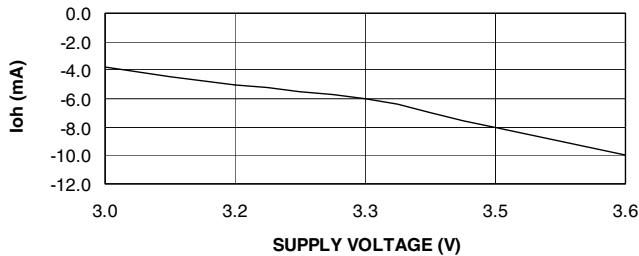
ATF22LV10CZ SUPPLY CURRENT VS. INPUT FREQUENCY ($V_{CC} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$)



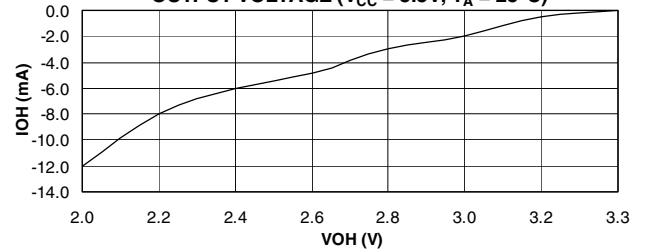
ATF22LV10CQZ SUPPLY CURRENT VS. INPUT FREQUENCY ($V_{CC} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$)



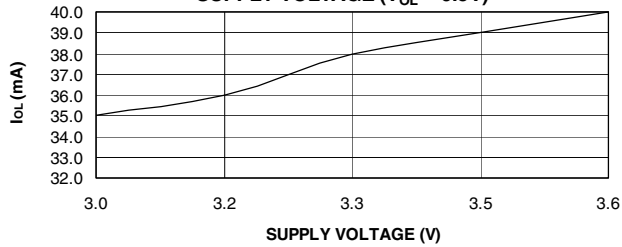
ATF22LV10CZ/CQZ SOURCE CURRENT VS. SUPPLY VOLTAGE ($V_{OH} = 2.4\text{V}$)



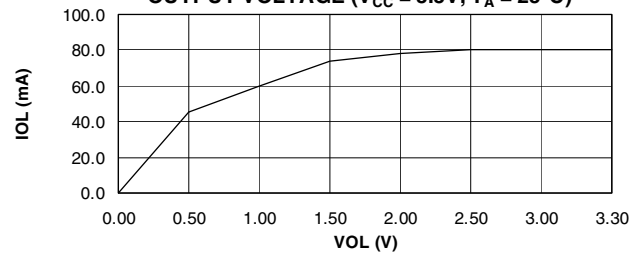
ATF22LV10C/CZ OUTPUT SOURCE CURRENT VS. OUTPUT VOLTAGE ($V_{CC} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$)



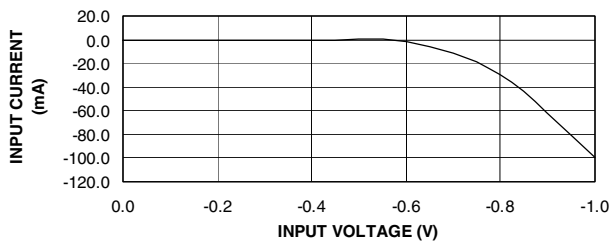
ATF22LV10CZ/CQZ OUTPUT SINK CURRENT VS. SUPPLY VOLTAGE ($V_{OL} = 0.5\text{V}$)



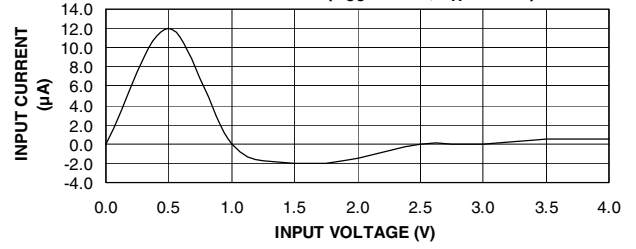
ATF22LV10CZ/CQZ OUTPUT SINK CURRENT VS. OUTPUT VOLTAGE ($V_{CC} = 3.3\text{V}$, $T_A = 25^\circ\text{C}$)



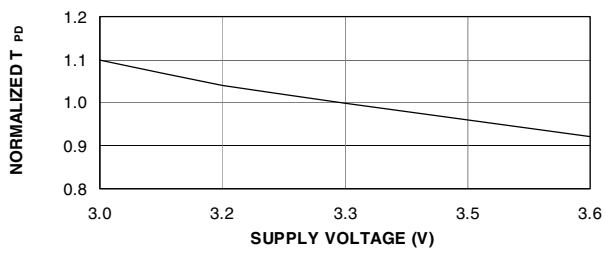
ATF22LV10CZ/CQZ INPUT CLAMP CURRENT VS. INPUT VOLTAGE ($V_{CC} = 3.3V, T_A = 25^\circ C$)



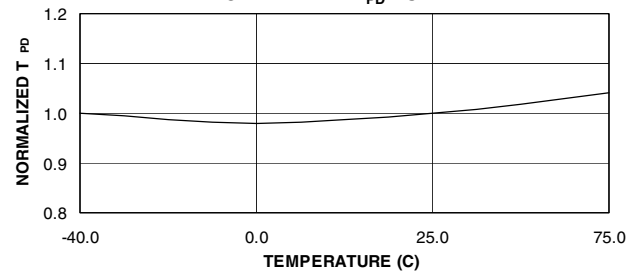
ATF22LV10CZ/CQZ INPUT CURRENT VS. INPUT VOLTAGE ($V_{CC} = 3.3V, T_A = 25^\circ C$)



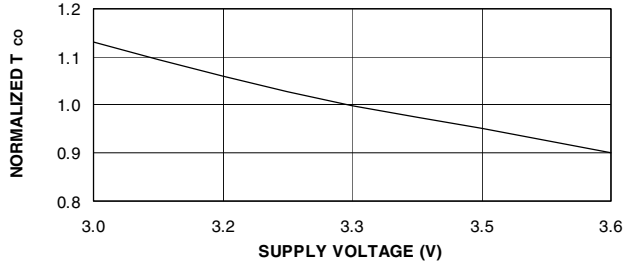
NORMALIZED T_{PD} VS. V_{CC}



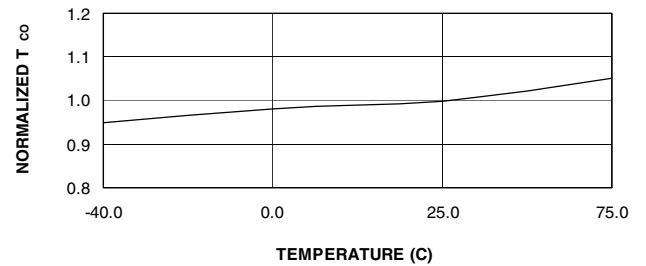
NORMALIZED T_{PD} VS. TEMP



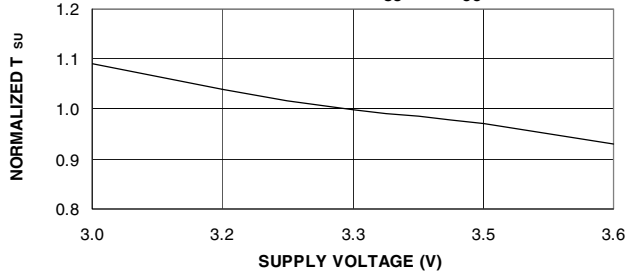
NORMALIZED T_{CO} VS. V_{CC}



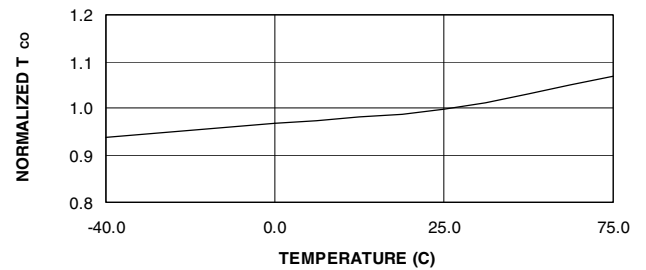
NORMALIZED T_{CO} VS. TEMP



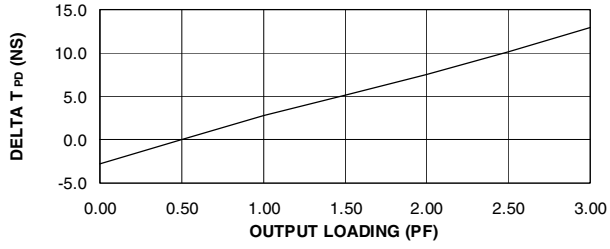
NORMALIZED T_{SU} VS. V_{CC}



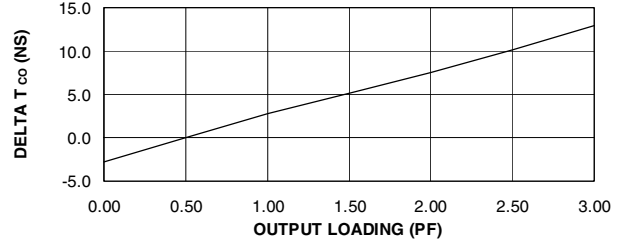
NORMALIZED T_{SU} VS. TEMP



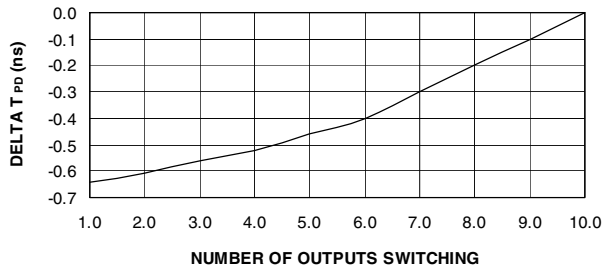
22LV10CZ/CQZ DELTA T_{PD} VS. OUTPUT LOADING



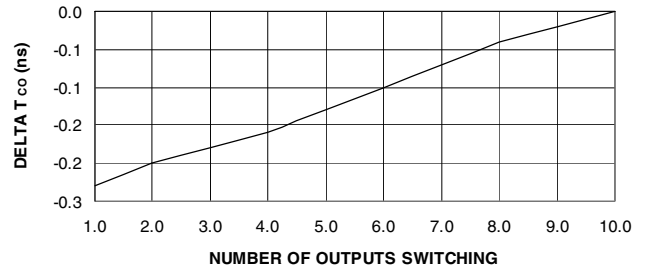
22LV10CZ/CQZ DELTA T_{CO} VS. OUTPUT LOADING



DELTA T_{PD} VS. # OF OUTPUT SWITCHING



DELTA T_{CO} VS. # OF OUTPUT SWITCHING



Ordering Information

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
25	15	15	ATF22LV10CZ-25JC	28J	Commercial (0°C to 70°C)
			ATF22LV10CZ-25PC	24P3	
			ATF22LV10CZ-25SC	24S	
			ATF22LV10CZ-25XC	24X	
			ATF22LV10CZ-25JI	28J	Industrial (-40°C to +85°C)
			ATF22LV10CZ-25PI	24P3	
			ATF22LV10CZ-25SI	24S	
			ATF22LV10CZ-25XI	24X	
			ATF22LV10CQZ-30JC	28J	Commercial (0°C to 70°C)
			ATF22LV10CQZ-30PC	24P3	
			ATF22LV10CQZ-30SC	24S	
			ATF22LV10CQZ-30XC	24X	
			ATF22LV10CQZ-30JI	28J	Industrial (-40°C to +85°C)
			ATF22LV10CQZ-30PI	24P3	
			ATF22LV10CQZ-30SI	24S	
			ATF22LV10CQZ-30XI	24X	

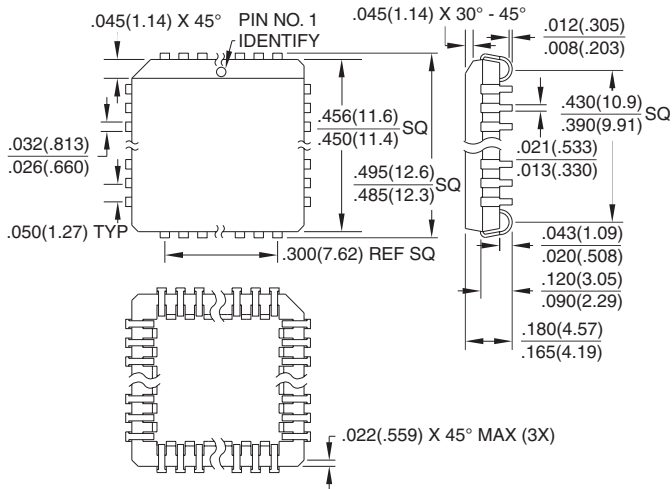
Using “C” Product for Industrial

To use commercial product for industrial temperature ranges, simply de-rate I_{CC} by 15% on the “C” device. No speed de-rating is necessary.

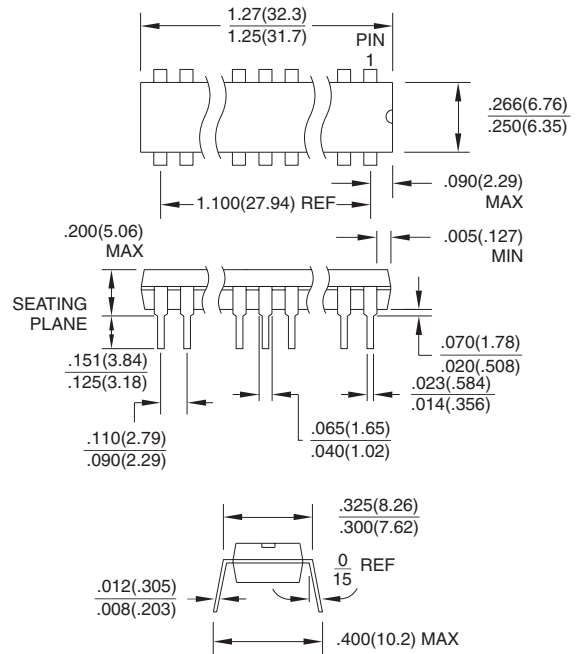
Package Type	
28J	28-lead, Plastic J-leaded Chip Carrier (PLCC)
24P3	24-pin, 0.300" Wide, Plastic Dual Inline Package (PDIP)
24S	24-lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC)
24X	24-lead, 4.4 mm Wide, Plastic Thin Shrink Small Outline (TSSOP)

Packaging Information

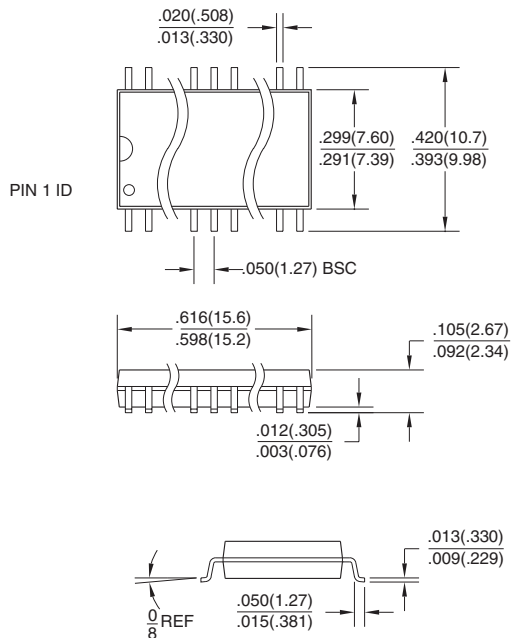
28J, 28-lead, Plastic J-leaded Chip Carrier (PLCC)
 Dimensions in Inches and (Millimeters)
 JEDEC STANDARD MS-018 AB



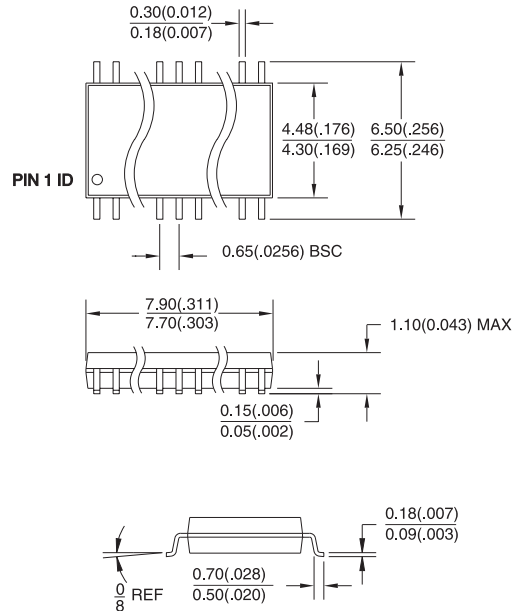
24P3, 24-pin, 0.300" Wide, Plastic Dual In Line Package (PDIP)
 Dimensions in Inches and (Millimeters)
 JEDEC STANDARD MS-001 AF



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)*



*Controlling dimension: millimeters



Atmel Headquarters

Corporate Headquarters
2325 Orchard Parkway
San Jose, CA 95131
TEL (408) 441-0311
FAX (408) 487-2600

Europe

Atmel SarL
Route des Arsenaux 41
Casa Postale 80
CH-1705 Fribourg
Switzerland
TEL (41) 26-426-5555
FAX (41) 26-426-5500

Asia

Atmel Asia, Ltd.
Room 1219
Chinachem Golden Plaza
77 Mody Road Tsimhatsui
East Kowloon
Hong Kong
TEL (852) 2721-9778
FAX (852) 2722-1369

Japan

Atmel Japan K.K.
9F, Tonetsu Shinkawa Bldg.
1-24-8 Shinkawa
Chuo-ku, Tokyo 104-0033
Japan
TEL (81) 3-3523-3551
FAX (81) 3-3523-7581

Atmel Operations

Atmel Colorado Springs
1150 E. Cheyenne Mtn. Blvd.
Colorado Springs, CO 80906
TEL (719) 576-3300
FAX (719) 540-1759

Atmel Rousset
Zone Industrielle
13106 Rousset Cedex
France
TEL (33) 4-4253-6000
FAX (33) 4-4253-6001

Atmel Smart Card ICs
Scottish Enterprise Technology Park
East Kilbride, Scotland G75 0QR
TEL (44) 1355-803-000
FAX (44) 1355-242-743

Atmel Grenoble
Avenue de Rochepleine
BP 123
38521 Saint-Egreve Cedex
France
TEL (33) 4-7658-3000
FAX (33) 4-7658-3480

Fax-on-Demand

North America:
1-(800) 292-8635
International:
1-(408) 441-0732

e-mail
literature@atmel.com

Web Site
<http://www.atmel.com>

BBS
1-(408) 436-4309

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