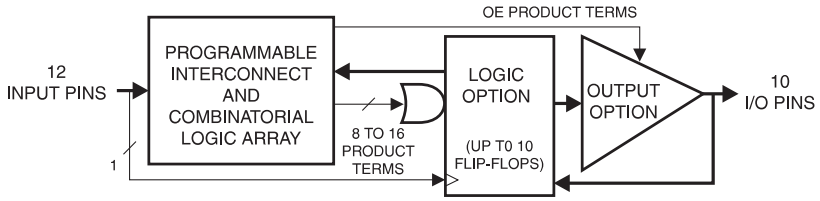
Features

- **Industry Standard Architecture**
  - **Low Cost Easy-to-Use Software Tools**
- **High-Speed, Electrically-Erasable Programmable Logic Devices**
  - **7.5 ns Maximum Pin-to-Pin Delay**
- **Several Power Saving Options**

Device	I_{CC}, Stand-By	I_{CC}, Active
ATF22V10B	85 mA	90 mA
ATF22V10BQ	35 mA	40 mA
ATF22V10BQL	5 mA	20 mA

- **CMOS and TTL Compatible Inputs and Outputs**
  - **Input and I/O Pull-Up Resistors**
- **Advanced Flash Technology**
  - **Reprogrammable**
  - **100% Tested**
- **High Reliability CMOS Process**
  - **20 Year Data Retention**
  - **100 Erase/Write Cycles**
  - **2,000V ESD Protection**
  - **200 mA Latchup Immunity**
- **Full Military, Commercial, and Industrial Temperature Ranges**
- **Dual-in-Line and Surface Mount Packages in Standard Pinouts**

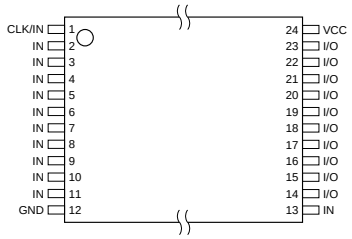
Logic Diagram



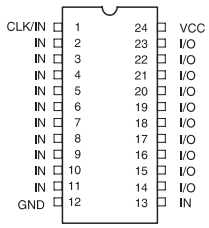
Pin Configurations

Pin Name	Function
CLK	Clock
IN	Logic Inputs
I/O	Bidirectional Buffers
*	No Internal Connection
V_{CC}	+5V Supply

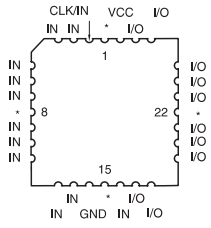
TSSOP Top View



DIP/SOIC



LCC/PLCC



Top View

High-Performance EE PLD

ATF22V10B

Rev. 0250F–05/98

Description

The ATF22V10B is a high performance CMOS (Electrically Erasable) Programmable Logic Device (PLD) which utilizes Atmel's proven electrically erasable Flash memory technology. Speeds down to 7.5 ns and power dissipation as low as 10 mA are offered. All speed ranges are specified over the full 5V ± 10% range for military and industrial temperature ranges, and 5V ± 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	-55°C to +125°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

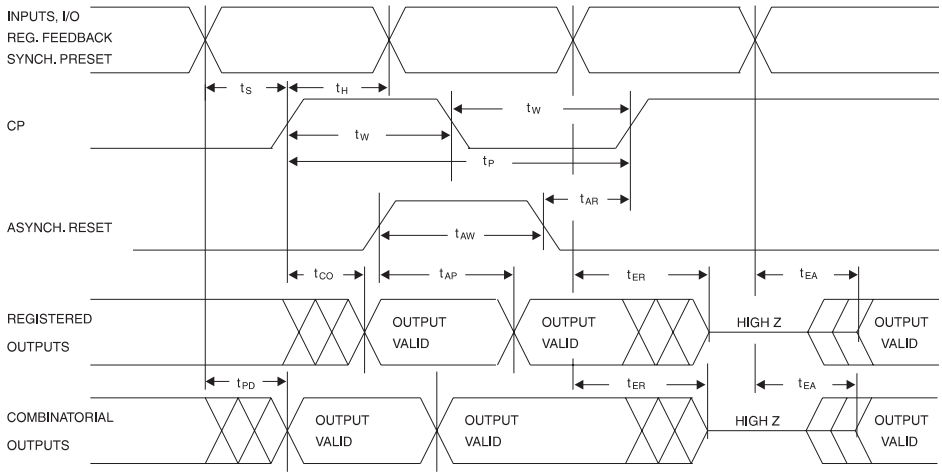
	Commercial	Industrial	Military
Operating Temperature (Case)	0°C - 70°C	-40°C - 85°C	-55°C - 125°C
V_{CC} Power Supply	5V ± 5%	5V ± 10%	5V ± 10%

DC Characteristics

Symbol	Parameter	Condition			Min	Typ	Max	Units
I_{IL}	Input or I/O Low Leakage Current	$0 \le V_{IN} \le V_{IL}$ (MAX)				-35	-100	µA
I_{IH}	Input or I/O High Leakage Current	$3.5 \le V_{IN} \le V_{CC}$					10	µA
I_{CC}	Power Supply Current, Standby	V_{CC} = MAX, V_{IN} = MAX, Outputs Open	B-7, -10	Com.		85	120	mA
				Ind., Mil.		85	140	mA
			B-15, -25	Com.		65	90	mA
				Ind., Mil.		65	115	mA
			BQ-15	Com.		35	55	mA
			BQL-20, -25	Com.		5	10	mA
				Ind., Mil.		5	15	mA
I_{CC2}	Clocked Power Supply Current	V_{CC} = MAX, Outputs Open, f = 15 MHz	B-7, -10	Com.		90	120	mA
				Ind., Mil.		90	145	mA
			B-15, -25	Com.		65	90	mA
				Ind., Mil.		65	120	mA
			BQ-15	Com.		40	60	mA
			BQL-20, -25	Com.		20	50	mA
				Ind., Mil.		20	70	mA
I_{OS}[1]	Output Short Circuit Current	V_{OUT} = 0.5V					-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	$V_{IN} = V_{IH}$ or V_{IL}, V_{CC} = MIN	I_{OL} = 16 mA	Com., Ind.			0.5	V
			I_{OL} = 12 mA	Mil.			0.5	V
V_{OH}	Output High Voltage	$V_{IN} = V_{IH}$ or V_{IL}, V_{CC} = MIN	I_{OH} = -4.0 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.

AC Waveforms(1)



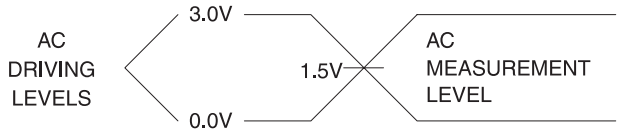
Note: 1. Timing measurement reference is 1.5V. Input AC driving levels are 0.0V and 3.0V, unless otherwise specified.

AC Characteristics(1)

Symbol	Parameter	-7		-10		-15		-20		-25		Units
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
t_{PD}	Input or Feedback to Combinatorial Output	3	7.5	3	10	3	15	3	20	3	25	ns
t_{CO}	Clock to Output	2	4.5(2)	2	6.5	2	8	2	12	2	15	ns
t_{CF}	Clock to Feedback		2.5		2.5		2.5		8		13	ns
t_S	Input or Feedback Setup Time	3.5		4.5		10			14	15		ns
t_H	Hold Time	0		0		0		0		0		ns
F_{MAX}	External Feedback $1/(t_S + t_{CO})$	125(3)		90		55.5		38.5		33.3		MHz
	Internal Feedback $1/(t_S + t_{CF})$	166		142		69		45.5		40		MHz
	No Feedback $1/(t_{WH} + t_{WL})$	166		142		83.3				38.5		MHz
t_W	Clock Width (t_{WL} and t_{WH})	3		3.5		6		10		13		ns
t_{EA}	Input or I/O to Output Enable	3	7.5	3	10	3	15	3	20	3	25	ns
t_{ER}	Input or I/O to Output Disable	3	7.5	3	9	3	15	3	20	3	25	ns
t_{AP}	Input or I/O to Asynchronous Reset of Register	3	10	3	12	3	20	3	22	3	25	ns
t_{AW}	Asynchronous Reset Width	7		8		15		20		25		ns
t_{AR}	Asynchronous Reset Recovery Time	5		6		10		20		25		ns
t_{SP}	Setup Time, Synchronous Preset	4.5		6		10		14		15		ns
t_{SPR}	Synchronous Preset to Clock Recovery Time	5		8		10		14		15		ns

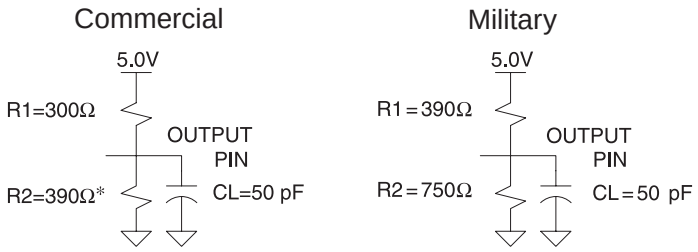
Notes: 1. See ordering information for valid part numbers.
2. 5.5 ns for DIP package devices.
3. 111 MHz for DIP package devices.

Input Test Waveforms and Measurement Levels



t_R, t_F < 3 ns

Outout Test Loads



* All except -7 which is R2 = 300Ω

Pin Capacitance

f = 1 MHz, T = 25°C[1]

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

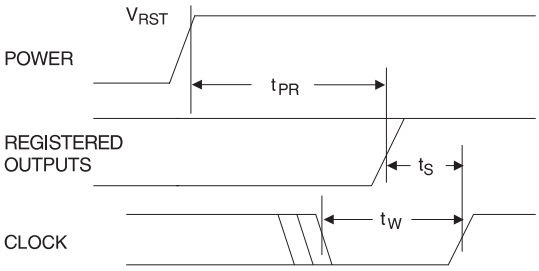
Note: 1. Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.

Power Up Reset

The registers in the ATF22V10Bs 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,
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}.



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

Preload of Registered Outputs

The ATF22V10B'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.

Security Fuse Usage

A single fuse is provided to prevent unauthorized copying of the ATF22V10B 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.

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.

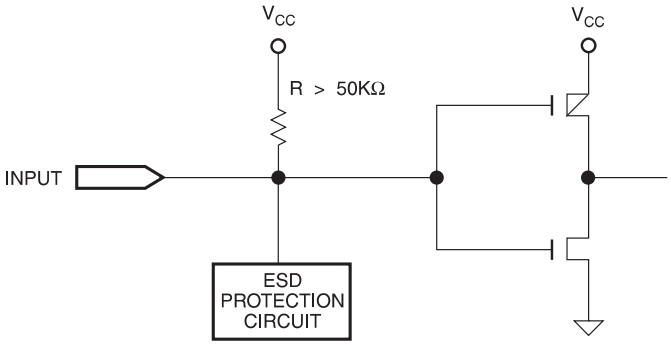
Programming/Erasing

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

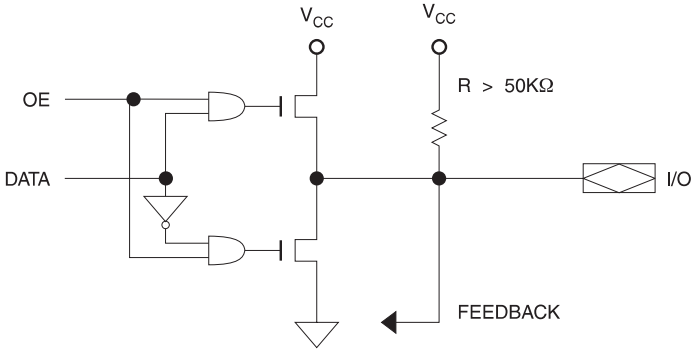
Input and I/O Pull-Ups

All ATF22V10B family members have internal input and I/O pull-up resistors. Therefore, whenever inputs or I/Os are not being driven externally, they will float to V_{CC}. This ensures that all logic array inputs are at known states. These are relatively weak active pull-ups that can easily be overdriven by TTL-compatible drivers (see input and I/O diagrams below).

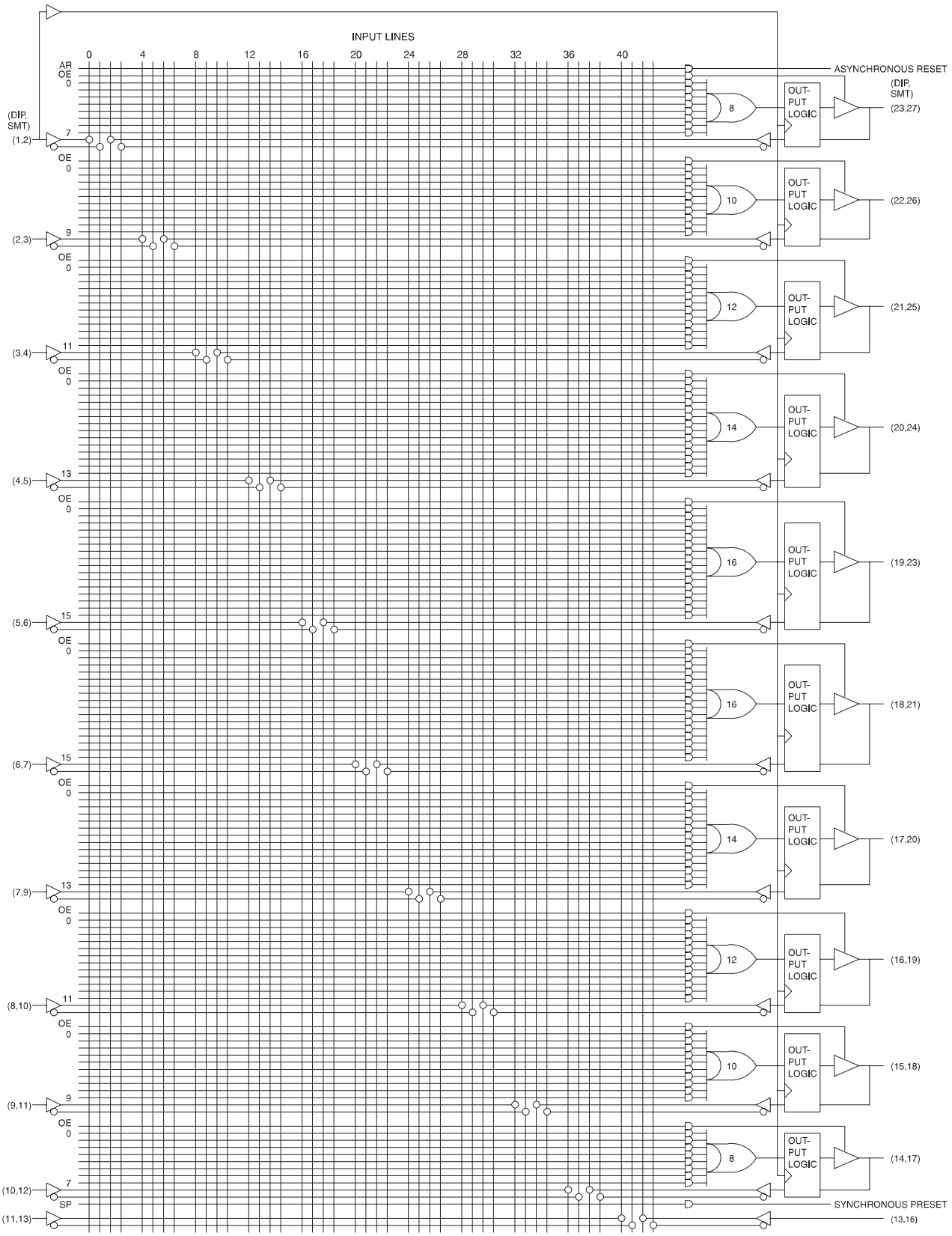
Input Diagram



I/O Diagram

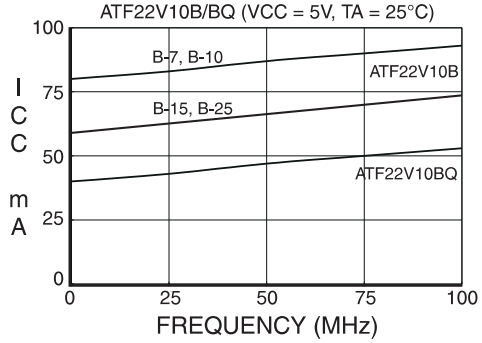


Functional Logic Diagram ATF22V10B



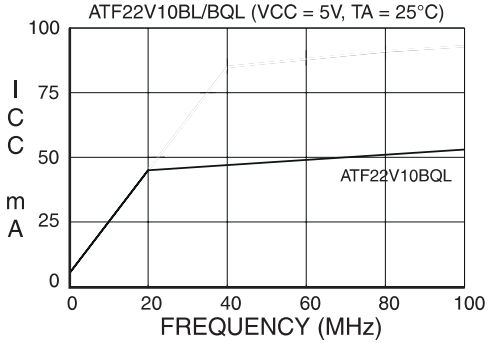
SUPPLY CURRENT vs. INPUT FREQUENCY

ATF22V10B/BQ (VCC = 5V, TA = 25°C)



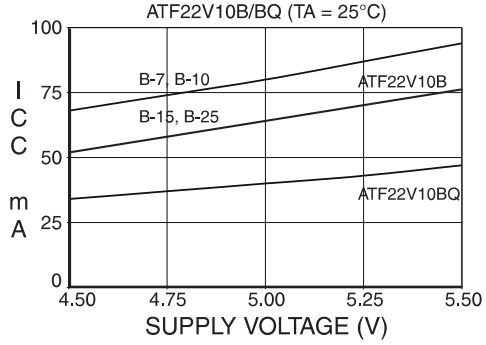
SUPPLY CURRENT vs. INPUT FREQUENCY

ATF22V10BL/BQL (VCC = 5V, TA = 25°C)



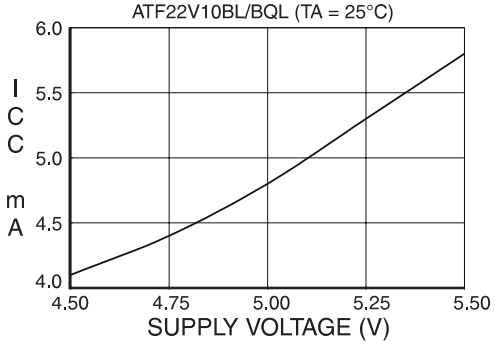
SUPPLY CURRENT vs. SUPPLY VOLTAGE

ATF22V10B/BQ (TA = 25°C)



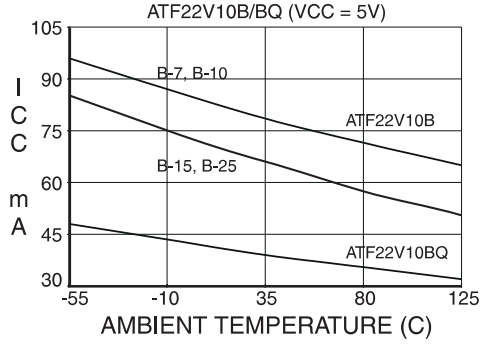
SUPPLY CURRENT vs. SUPPLY VOLTAGE

ATF22V10BL/BQL (TA = 25°C)



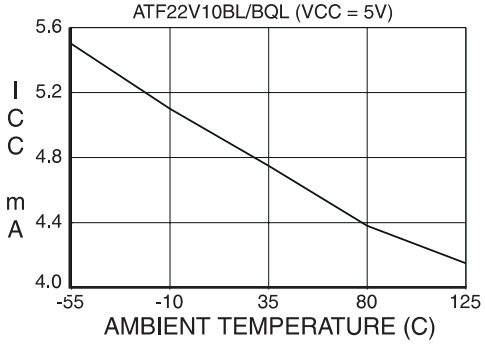
SUPPLY CURRENT vs. AMBIENT TEMPERATURE

ATF22V10B/BQ (VCC = 5V)



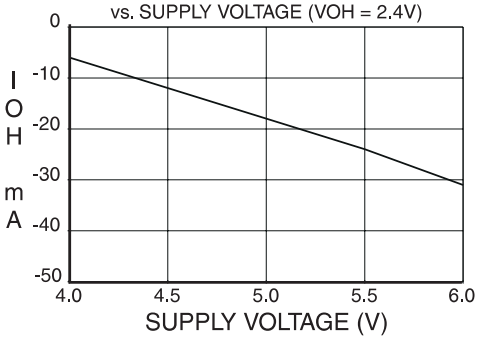
SUPPLY CURRENT vs. AMBIENT TEMPERATURE

ATF22V10BL/BQL (VCC = 5V)



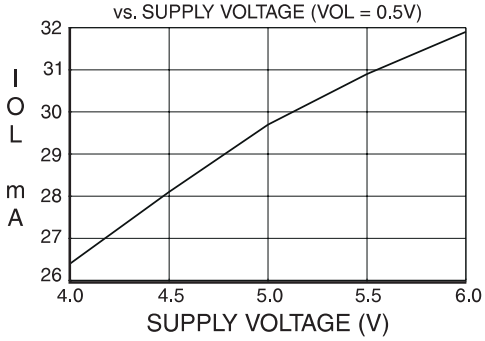
OUTPUT SOURCE CURRENT

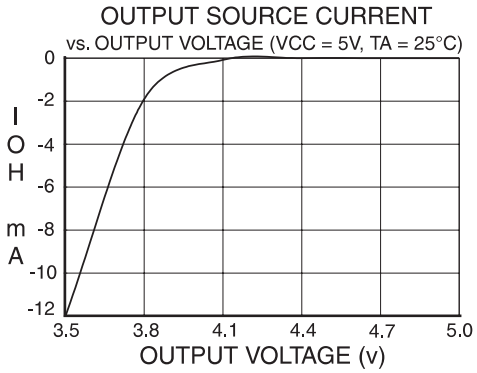
vs. SUPPLY VOLTAGE (VOH = 2.4V)

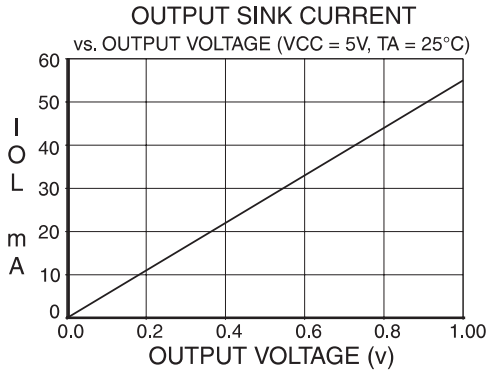


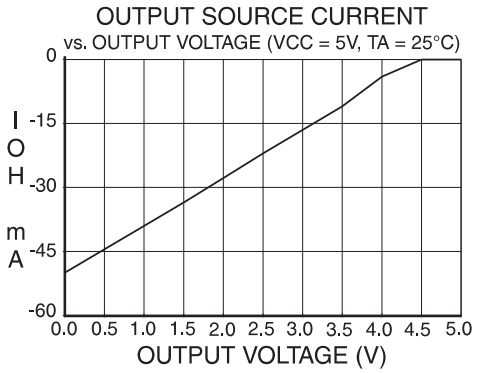
OUTPUT SINK CURRENT

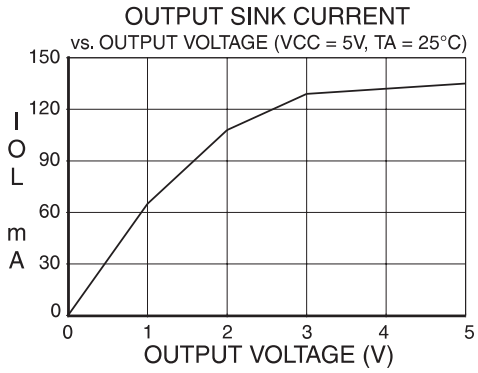
vs. SUPPLY VOLTAGE (VOL = 0.5V)

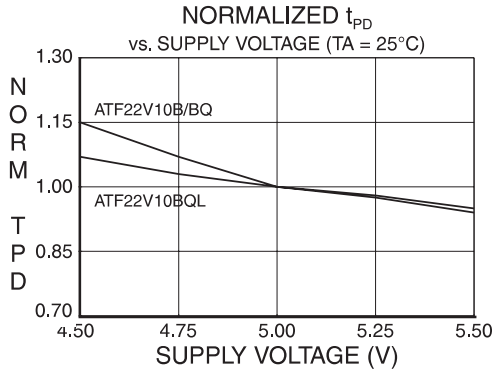


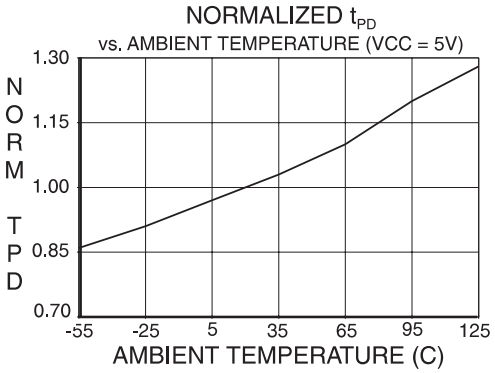

OUTPUT SOURCE CURRENT
vs. OUTPUT VOLTAGE (VCC = 5V, TA = 25°C)
IOH mA
0
-2
-4
-6
-8
-10
-12
3.5
3.8
4.1
4.4
4.7
5.0
OUTPUT VOLTAGE (v)

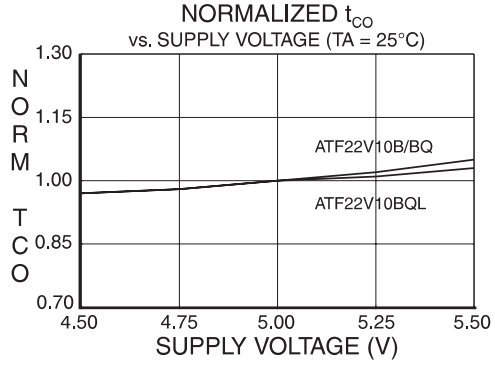

OUTPUT SINK CURRENT
vs. OUTPUT VOLTAGE (VCC = 5V, TA = 25°C)
IOL mA
60
50
40
30
20
10
0
0.0
0.2
0.4
0.6
0.8
1.00
OUTPUT VOLTAGE (v)

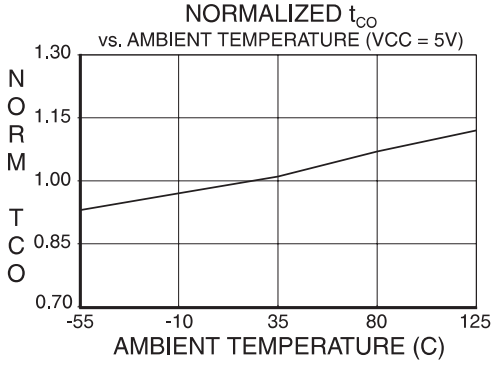

OUTPUT SOURCE CURRENT
vs. OUTPUT VOLTAGE (VCC = 5V, TA = 25°C)
IOH mA
0
-15
-30
-45
-60
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0
OUTPUT VOLTAGE (V)

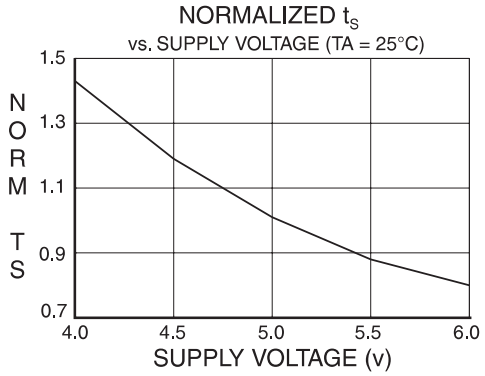

OUTPUT SINK CURRENT
vs. OUTPUT VOLTAGE (VCC = 5V, TA = 25°C)
IOL mA
150
120
90
60
30
0
0
1
2
3
4
5
OUTPUT VOLTAGE (V)

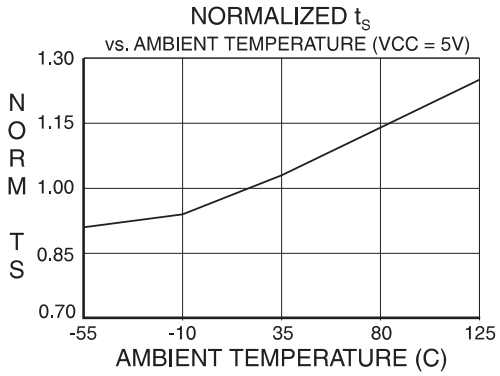

NORMALIZED tPD
vs. SUPPLY VOLTAGE (TA = 25°C)
NORM TPD
1.30
1.15
1.00
0.85
0.70
ATF22V10B/BQ
ATF22V10BQL
4.50
4.75
5.00
5.25
5.50
SUPPLY VOLTAGE (V)

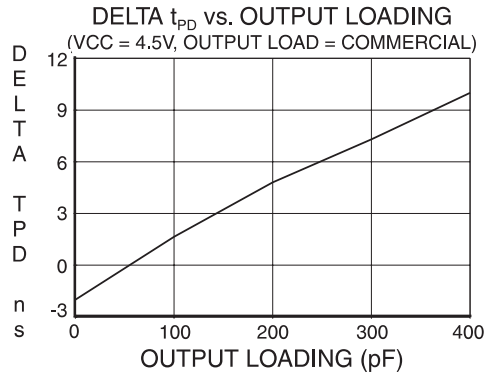

NORMALIZED tPD
vs. AMBIENT TEMPERATURE (VCC = 5V)
NORM TPD
1.30
1.15
1.00
0.85
0.70
-55
-25
5
35
65
95
125
AMBIENT TEMPERATURE (C)

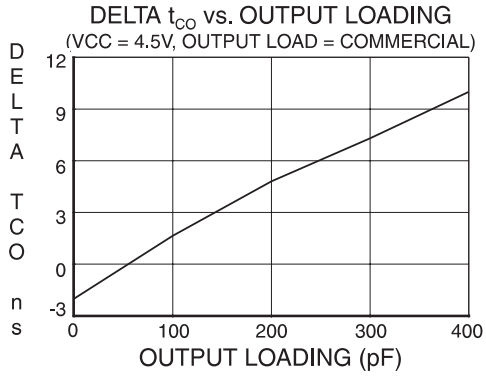

NORMALIZED tCO
vs. SUPPLY VOLTAGE (TA = 25°C)
NORM TCO
1.30
1.15
1.00
0.85
0.70
ATF22V10B/BQ
ATF22V10BQL
4.50
4.75
5.00
5.25
5.50
SUPPLY VOLTAGE (V)

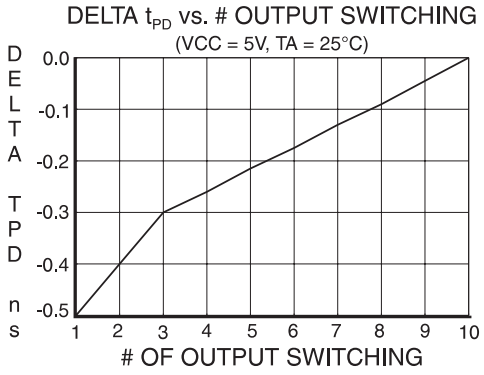

NORMALIZED tCO
vs. AMBIENT TEMPERATURE (VCC = 5V)
NORM TCO
1.30
1.15
1.00
0.85
0.70
-55
-10
35
80
125
AMBIENT TEMPERATURE (C)

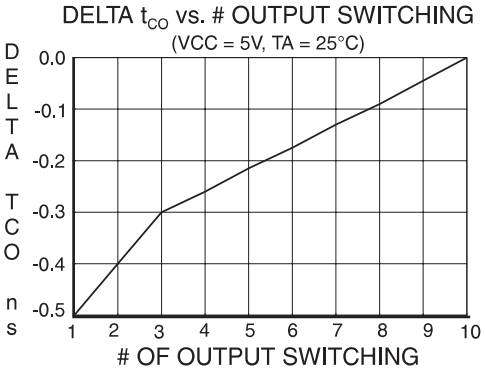

NORMALIZED t_S
vs. SUPPLY VOLTAGE (TA = 25°C)
NORM TS
1.5
1.3
1.1
0.9
0.7
4.0
4.5
5.0
5.5
6.0
SUPPLY VOLTAGE (v)

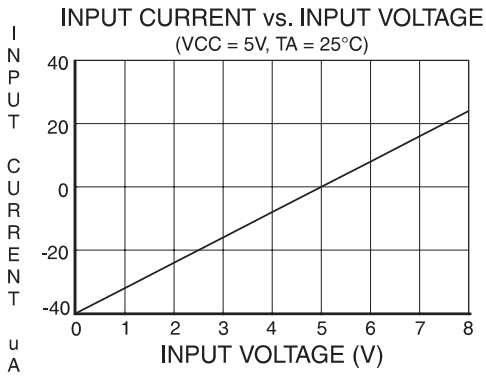

NORMALIZED t_S
vs. AMBIENT TEMPERATURE (VCC = 5V)
NORM TS
1.30
1.15
1.00
0.85
0.70
-55
-10
35
80
125
AMBIENT TEMPERATURE (C)

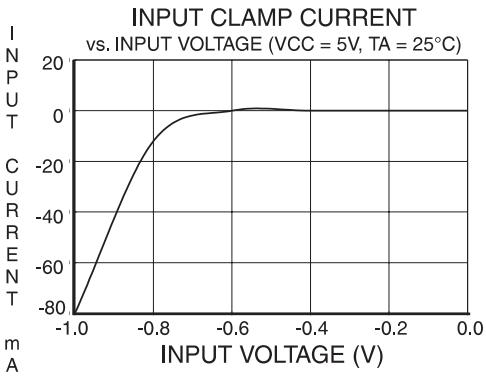

DELTA t_{PD} vs. OUTPUT LOADING
(VCC = 4.5V, OUTPUT LOAD = COMMERCIAL)
DELTA TPD ns
12
9
6
3
0
-3
0
100
200
300
400
OUTPUT LOADING (pF)


DELTA t_{CO} vs. OUTPUT LOADING
(VCC = 4.5V, OUTPUT LOAD = COMMERCIAL)
DELTA TCO ns
12
9
6
3
0
-3
0
100
200
300
400
OUTPUT LOADING (pF)


DELTA t_{PD} vs. # OUTPUT SWITCHING
(VCC = 5V, TA = 25°C)
DELTA TPD ns
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
1
2
3
4
5
6
7
8
9
10
OF OUTPUT SWITCHING


DELTA t_{CO} vs. # OUTPUT SWITCHING
(VCC = 5V, TA = 25°C)
DELTA TCO ns
0.0
-0.1
-0.2
-0.3
-0.4
-0.5
1
2
3
4
5
6
7
8
9
10
OF OUTPUT SWITCHING


INPUT CURRENT vs. INPUT VOLTAGE
(VCC = 5V, TA = 25°C)
INPUT CURRENT uA
40
20
0
-20
-40
0
1
2
3
4
5
6
7
8
INPUT VOLTAGE (V)


INPUT CLAMP CURRENT
vs. INPUT VOLTAGE (VCC = 5V, TA = 25°C)
INPUT CURRENT mA
20
0
-20
-40
-60
-80
-1.0
-0.8
-0.6
-0.4
-0.2
0.0
INPUT VOLTAGE (V)

Ordering Information

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
7.5	3.5	4.5	ATF22V10B-7JC[1] ATF22V10B-7PC[1] ATF22V10B-7SC[1] ATF22V10B-7XC[1]	28J 24P3 24S 24X	Commercial (0°C to 70°C)
10	4.5	6.5	ATF22V10B-10JC[1] ATF22V10B-10PC[1] ATF22V10B-10SC[1] ATF22V10B-10XC[1]	28J 24P3 24S 24X	Commercial (0°C to 70°C)
			ATF22V10B-10JI[1] ATF22V10B-10PI[1] ATF22V10B-10SI[1] ATF22V10B-10XI[1]	28J 24P3 24S 24X	Industrial (-40°C to 85°C)
			ATF22V10B-10GM/883 ATF22V10B-10NM/883	24D3 28L	Military/883C (-55°C to 125°C) Class B, Fully Compliant
15	10	8	ATF22V10B-15JC ATF22V10B-15PC ATF22V10B-15SC ATF22V10B-15XC	28J 24P3 24S 24X	Commercial (0°C to 70°C)
			ATF22V10B-15JI ATF22V10B-15PI ATF22V10B-15SI ATF22V10B-15XI	28J 24P3 24S 24X	Industrial (-40°C to 85°C)
			ATF22V10B-15GM/883 ATF22V10B-15NM/883	24D3 28L	Military/883C (-55°C to 125°C) Class B, Fully Compliant
25	15	15	ATF22V10B-25JC ATF22V10B-25PC ATF22V10B-25SC ATF22V10B-25XC	28J 24P3 24S 24X	Commercial (0°C to 70°C)
			ATF22V10B-25JI ATF22V10B-25PI ATF22V10B-25SI ATF22V10B-25XI	28J 24P3 24S 24X	Industrial (-40°C to 85°C)
10	4.5	6.5	5962-89841 06LA 5962-89841 063X	24D3 28L	Military (-55°C to 125°C) Class B, Fully Compliant
15	10	8	5962-89841 03LA[2] 5962-89841 033X[2] 5962-89841 05LA 5962-89841 053X	24D3 28L 24D3 28L	Military (-55°C to 125°C) Class B, Fully Compliant

Notes: 1. Recommend ATF22V10C versions.

2. Difference between 03 and 05 is that 05 has a relaxed t_{CO} = 12 ns and f_{MAX} (witrh external feedback) = 42 MHz.

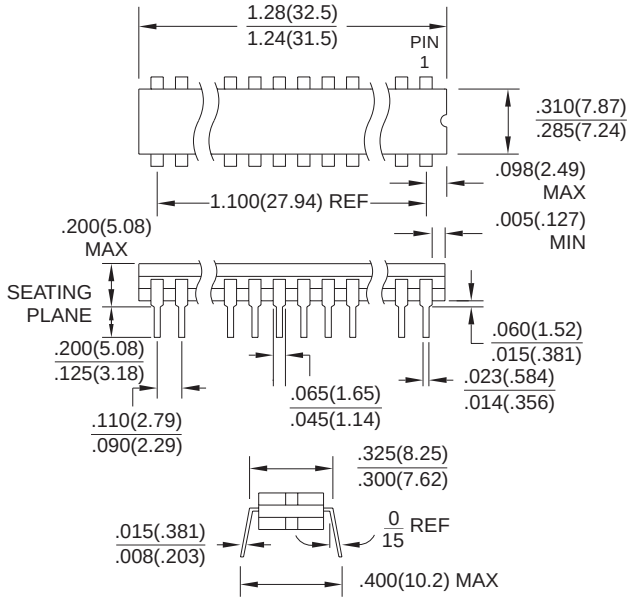
Ordering Information

t_{PD} (ns)	t_S (ns)	t_{CO} (ns)	Ordering Code	Package	Operation Range
15	10	8	ATF22V10BQ-15JC ATF22V10BQ-15PC ATF22V10BQ-15SC ATF22V10BQ-15XC	28J 24P3 24S 24X	Commercial (0°C to 70°C)
20	14	12	ATF22V10BQL-20JC ATF22V10BQL-20PC ATF22V10BQL-20SC ATF22V10BQL-20XC	28J 24P3 24S 24X	Commercial (0°C to 70°C)
			ATF22V10BQL-20JI ATF22V10BQL-20PI ATF22V10BQL-20SI ATF22V10BQL-20XI	28J 24P3 24S 24X	Industrial (-40°C to 85°C)
			ATF22V10BQL-20GM/883 ATF22V10BQL-20GM/883	24D3 28L	Military/883C (-55°C to 125°C) Class B, Fully Compliant
25	15	15	ATF22V10BQL-25JC ATF22V10BQL-25PC ATF22V10BQL-25SC ATF22V10BQL-25XC	28J 24P3 24S 24X	Commercial (0°C to 70°C)
			ATF22V10BQL-25JI ATF22V10BQL-25PI ATF22V10BQL-25SI ATF22V10BQL-25XI	28J 24P3 24S 24X	Industrial (-40°C to 85°C)
			ATF22V10BQL-25GM/883 ATF22V10BQL-25NM/883	24D3 28L	Military/883C (-55°C to 125°C) Class B, Fully Compliant
20	14	12	5962-89841 14 LA 5962-89841 14 3X	24D3 28L	
25	15	15	5962-89841 13 LA 5962-89841 13 3X	24D3 28L	

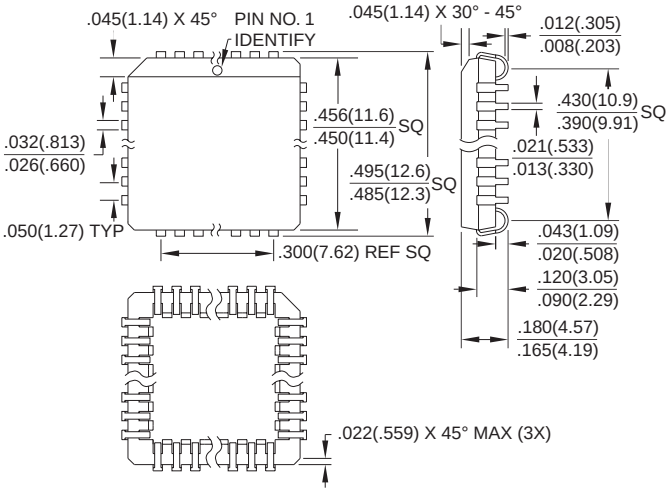
Package Type	
24D3	24-Lead, 0.300" Wide, Ceramic Dual Inline Package (Cerdip)
28J	28-Lead, Plastic J-Leaded Chip Carrier (PLCC)
28L	28-Pad, Ceramic Leadless Chip Carrier (LCC)
24P3	24-Lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
24S	24-Lead, 0.300" Wide, Plastic Gull Wing Small Outline (SOIC)
24X	24-Lead, 4.4 mm Wide, Plastic Thin Shrink Small Outline (TSSOP)

Packaging Information

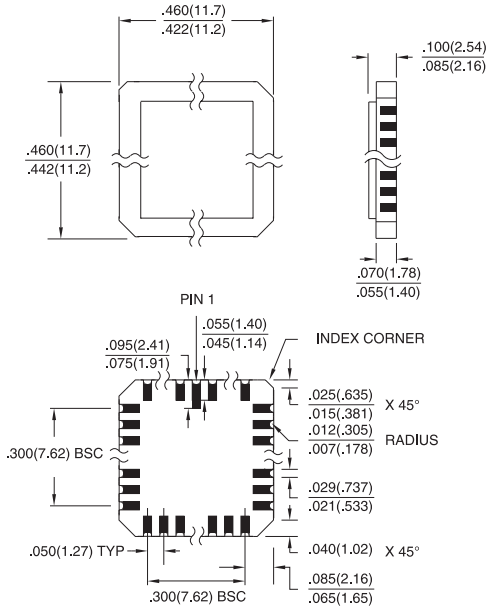
24D3, 24-Lead, 0.300" Wide, Non-Windowed, Ceramic Dual Inline Package (Cerdip)
Dimensions in Inches and (Millimeters)
MIL-STD-1835 D-9 CONFIG A



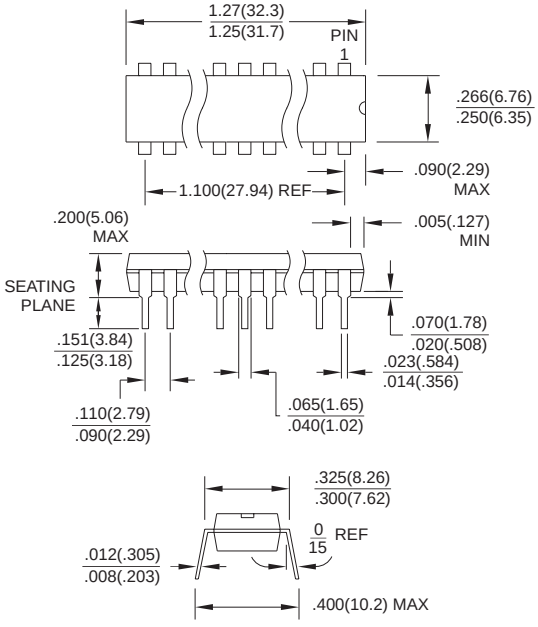
28J, 28-Lead, Plastic J-Leaded Chip Carrier (PLCC)
Dimensions in Inches and (Millimeters)
JEDEC STANDARD MS-018 AB



28L, 28-Pad, Non-Windowed, Ceramic Leadless Chip Carrier (LCC)
Dimensions in Inches and (Millimeters)
MIL-STD-1835 C-4

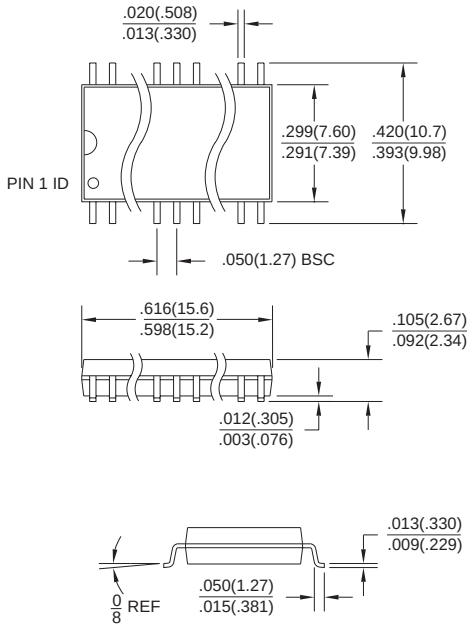


24P3, 24-Lead, 0.300" Wide, Plastic Dual Inline Package (PDIP)
Dimensions in Inches and (Millimeters)
JEDEC STANDARD MS-001 AF



Packaging Information

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)