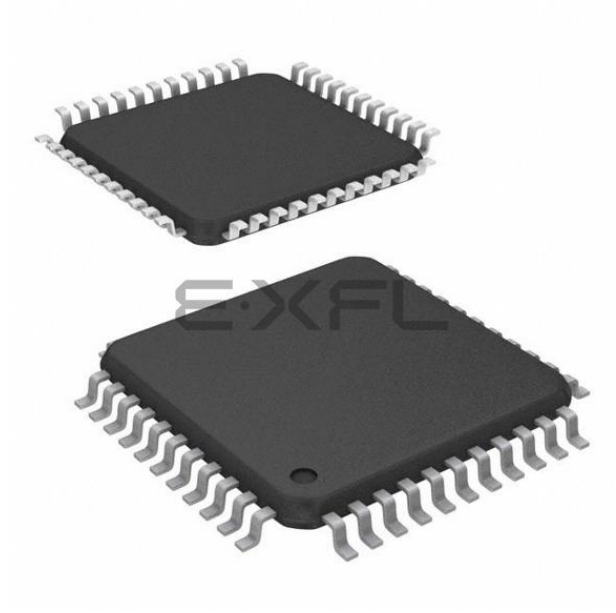


Welcome to E-XFL.COM

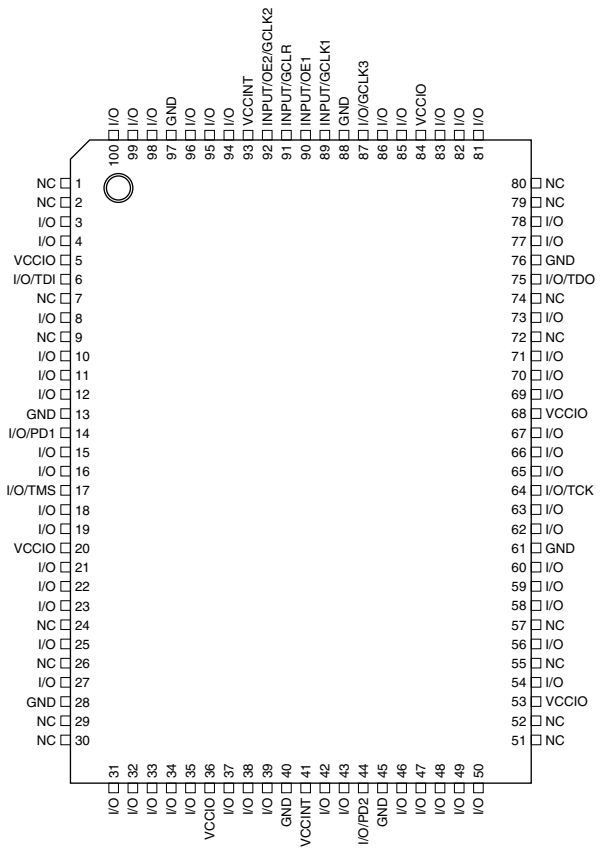
Understanding Embedded - CPLDs (Complex Programmable Logic Devices)

Embedded - CPLDs, or Complex Programmable Logic Devices, are highly versatile digital logic devices used in electronic systems. These programmable components are designed to perform complex logical operations and can be customized for specific applications. Unlike fixed-function ICs, CPLDs offer the flexibility to reprogram their configuration, making them an ideal choice for various embedded systems. They consist of a set of logic gates and programmable interconnects, allowing designers to implement complex logic circuits without needing custom hardware.

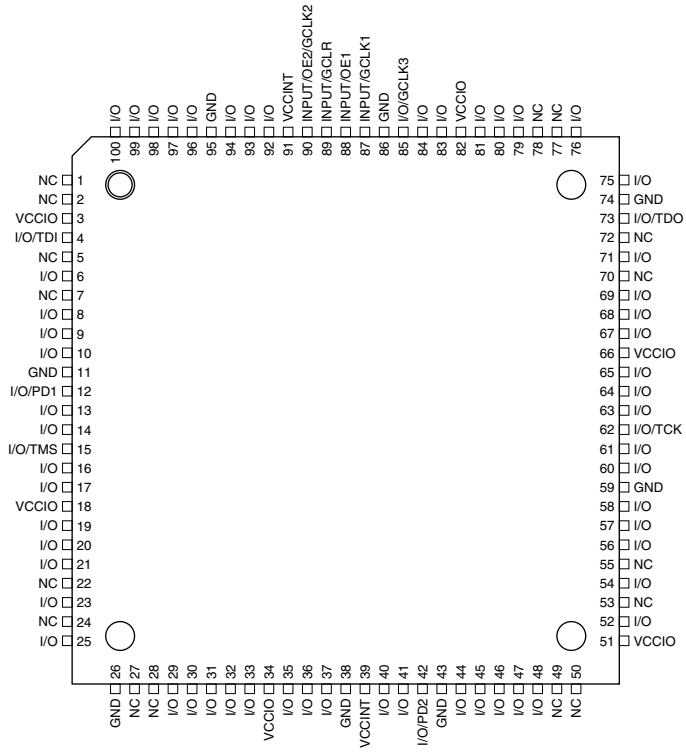
Applications of Embedded - CPLDs

Details	
Product Status	Obsolete
Programmable Type	In System Programmable (min 10K program/erase cycles)
Delay Time tpd(1) Max	20 ns
Voltage Supply - Internal	3V ~ 3.6V
Number of Logic Elements/Blocks	-
Number of Macrocells	64
Number of Gates	-
Number of I/O	32
Operating Temperature	0°C ~ 70°C (TA)
Mounting Type	Surface Mount
Package / Case	44-TQFP
Supplier Device Package	44-TQFP (10x10)
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/atf1504asvl-20ac44

100-lead PQFP
Top View



100-lead TQFP
Top View



Description

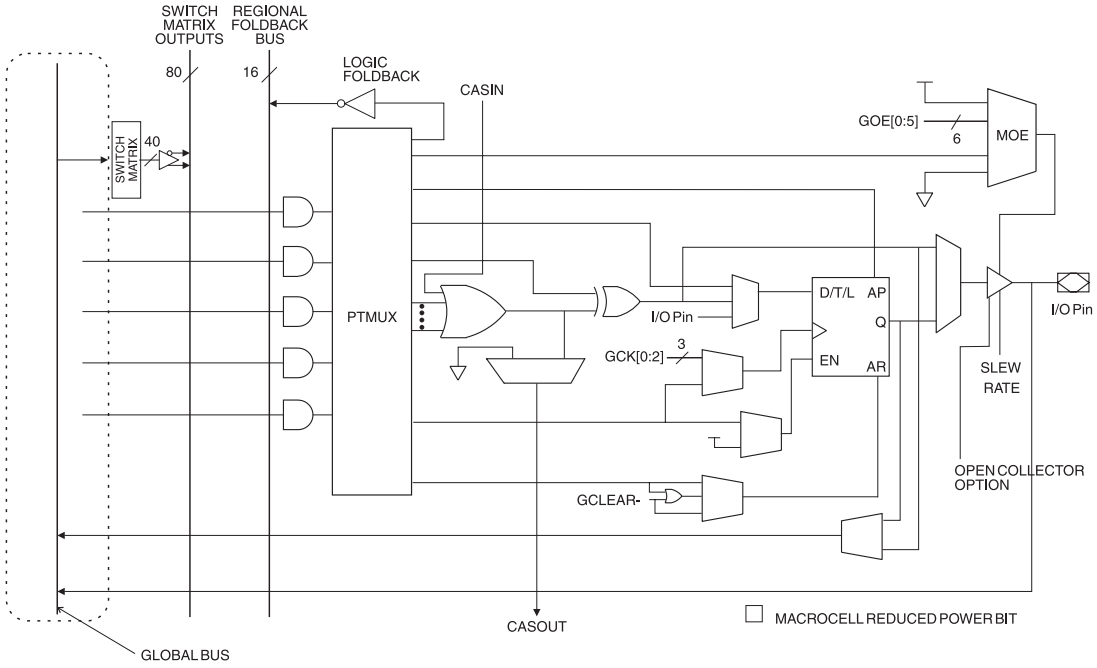
The ATF1504ASV(L) is a high-performance, high-density complex programmable logic device (CPLD) that utilizes Atmel's proven electrically-erasable memory technology. With 64 logic macrocells and up to 68 inputs, it easily integrates logic from several TTL, SSI, MSI, LSI and classic PLDs. The ATF1504ASV(L)'s enhanced routing switch matrices increase usable gate count and the odds of successful pin-locked design modifications.

The ATF1504ASV(L) has up to 68 bi-directional I/O pins and four dedicated input pins, depending on the type of device package selected. Each dedicated pin can also serve as a global control signal, register clock, register reset or output enable. Each of these control signals can be selected for use individually within each macrocell.

Each of the 64 macrocells generates a buried feedback that goes to the global bus. Each input and I/O pin also feeds into the global bus. The switch matrix in each logic block then selects 40 individual signals from the global bus. Each macrocell also generates a foldback logic term that goes to a regional bus. Cascade logic between macrocells in the ATF1504ASV(L) allows fast, efficient generation of complex logic functions. The ATF1504ASV(L) contains four such logic chains, each capable of creating sum term logic with a fan-in of up to 40 product terms.

The ATF1504ASV(L) macrocell, shown in Figure 1, is flexible enough to support highly-complex logic functions operating at high speed. The macrocell consists of five sections: product terms and product term select multiplexer, OR/XOR/CASCADE logic, a flip-flop, output select and enable, and logic array inputs.

Figure 1. ATF1504ASV(L) Macrocell



Programmable Pin-keeper Option for Inputs and I/Os

The ATF1504ASV(L) offers the option of programming all input and I/O pins so that pin keeper circuits can be utilized. When any pin is driven high or low and then subsequently left floating, it will stay at that previous high- or low-level. This circuitry prevents unused input and I/O lines from floating to intermediate voltage levels, which causes unnecessary power consumption and system noise. The keeper circuits eliminate the need for external pull-up resistors and eliminate their DC power consumption.

All power-down AC characteristic parameters are computed from external input or I/O pins, with reduced-power bit turned on. For macrocells in reduced-power mode (reduced-power bit turned on), the reduced-power adder, t_{RPA}, must be added to the AC parameters, which include the data paths t_{LAD}, t_{LAC}, t_{IC}, t_{ACL}, t_{ACH} and t_{SEXP}.

The ATF1504ASV(L) macrocell also has an option whereby the power can be reduced on a per macrocell basis. By enabling this power-down option, macrocells that are not used in an application can be turned down, thereby reducing the overall power consumption of the device.

Each output also has individual slew rate control. This may be used to reduce system noise by slowing down outputs that do not need to operate at maximum speed. Outputs default to slow switching, and may be specified as fast switching in the design file.

Design Software Support

ATF1504ASV(L) designs are supported by several industry standard third party tools. Automated fitters allow logic synthesis using a variety of high-level description languages and formats.

Power-up Reset

The ATF1504ASV is designed with a power-up reset, a feature critical for state machine initialization. At a point delayed slightly from V_{CC} crossing V_{RST}, all registers will be initialized, and the state of each output will depend on the polarity of its buffer. However, due to the asynchronous nature of reset and 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_D.

The ATF1504ASV has two options for the hysteresis about the reset level, V_{RST}, Small and Large. To ensure a robust operating environment in applications where the device is operated near 3.0V, Atmel recommends that during the fitting process users configure the device with the Power-up Reset hysteresis set to Large. For conversions, Atmel POF2JED users should include the flag “-power_reset” on the command line after “filename.POF”. To allow the registers to be properly reinitialized with the Large hysteresis option selected, the following condition is added:

4. If V_{CC} falls below 2.0V, it must shut off completely before the device is turned on again.

When the Large hysteresis option is active, I_{CC} is reduced by several hundred microamps as well.

Security Fuse Usage

A single fuse is provided to prevent unauthorized copying of the ATF1504ASV(L) fuse patterns. Once programmed, fuse verify is inhibited. However, the 16-bit User Signature remains accessible.

Programming

ATF1504ASV(L) devices are in-system programmable (ISP) devices utilizing the 4-pin JTAG protocol. This capability eliminates package handling normally required for programming and facilitates rapid design iterations and field changes.

Atmel provides ISP hardware and software to allow programming of the ATF1504ASV(L) via the PC. ISP is performed by using either a download cable, a comparable board tester or a simple microprocessor interface.

To facilitate ISP programming by the Automated Test Equipment (ATE) vendors. Serial Vector Format (SVF) files can be created by Atmel provided software utilities.

ATF1504ASV(L) devices can also be programmed using standard third-party programmers. With third-party programmer the JTAG ISP port can be disabled thereby allowing four additional I/O pins to be used for logic.

Contact your local Atmel representatives or Atmel PLD applications for details.

ISP Programming Protection

The ATF1504ASV(L) has a special feature that locks the device and prevents the inputs and I/O from driving if the programming process is interrupted for any reason. The inputs and I/O default to high-Z state during such a condition. In addition the pin keeper option preserves the former state during device programming, if this circuit were previously programmed on the device. This prevents disturbing the operation of other circuits in the system while the ATF1504ASV(L) is being programmed via ISP.

All ATF1504ASV(L) devices are initially shipped in the erased state thereby making them ready to use for ISP.

Note: For more information refer to the “Designing for In-System Programmability with Atmel CPLDs” application note.

DC and AC Operating Conditions

	Commercial	Industrial
Operating Temperature (Ambient))	0°C - 70°C	-40°C - 85°C
V_{CC} (3.3V) Power Supply	3.0V - 3.6V	3.0V - 3.6V

DC Characteristics

Symbol	Parameter	Condition			Min	Typ	Max	Units
I_{IL}	Input or I/O Low Leakage Current	$V_{IN} = V_{CC}$				-2	-10	µA
I_{IH}	Input or I/O High Leakage Current					2	10	
I_{OZ}	Tri-State Output Off-State Current	$V_O = V_{CC}$ or GND			-40		40	µA
I_{CC1}	Power Supply Current, Standby	V_{CC} = Max V_{IN} = 0, V_{CC}	Std Mode	Com.		60		mA
				Ind.		75		mA
			"L" Mode	Com.		5		µA
				Ind.		5		µA
I_{CC2}	Power Supply Current, Power-down Mode	V_{CC} = Max V_{IN} = 0, V_{CC}	"PD" Mode			0.1	5	mA
I_{CC3} (2)	Reduced-power Mode Supply Current, Standby	V_{CC} = Max V_{IN} = 0, V_{CC}	Std Power	Com		40		ma
				Ind		55		
V_{IL}	Input Low Voltage				-0.3		0.8	V
V_{IH}	Input High Voltage				1.7		V_{CCIO} + 0.3	V
V_{OL}	Output Low Voltage (TTL)	$V_{IN} = V_{IH}$ or V_{IL} V_{CCIO} = Min, I_{OL} = 8 mA		Com.			0.45	V
				Ind.			0.45	
	Output Low Voltage (CMOS)	$V_{IN} = V_{IH}$ or V_{IL} V_{CC} = Min, I_{OL} = 0.1 mA		Com.			0.2	V
				Ind.			0.2	V
V_{OH}	Output High Voltage - 3.3V (TTL)	$V_{IN} = V_{IH}$ or V_{IL} V_{CCIO} = Min, I_{OH} = -2.0 mA			2.4			V
	Output High Voltage - 3.3V (CMOS)	$V_{IN} = V_{IH}$ or V_{IL} V_{CCIO} = Min, I_{OH} = -0.1 mA			V_{CCIO} - 0.2			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. When microcell reduced-power feature is enabled.

Pin Capacitance

	Typ	Max	Units	Conditions
C_{IN}		8	pF	V_{IN} = 0V; f = 1.0 MHz
$C_{I/O}$		8	pF	V_{OUT} = 0V; f = 1.0 MHz

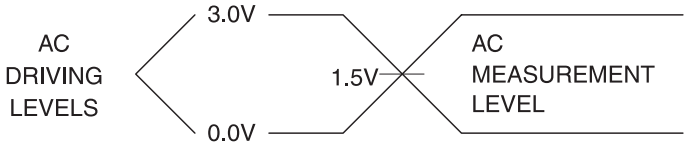
Note: Typical values for nominal supply voltage. This parameter is only sampled and is not 100% tested.
The OGI pin (high-voltage pin during programming) has a maximum capacitance of 12 pF.

AC Characteristics (Continued)

Symbol	Parameter	-15		-20		Units
		Min	Max	Min	Max	
t_{ZX2}	Output Buffer Enable Delay (Slow slew rate = OFF; V_{CCIO} = 3.3V; C_L = 35 pF)		7		9	ns
t_{ZX3}	Output Buffer Enable Delay (Slow slew rate = ON; V_{CCIO} = 5.0V/3.3V; C_L = 35 pF)		10		11	ns
t_{XZ}	Output Buffer Disable Delay (C_L = 5 pF)		6		7	ns
t_{SU}	Register Setup Time	5		6		ns
t_H	Register Hold Time	4		5		ns
t_{FSU}	Register Setup Time of Fast Input	2		2		ns
t_{FH}	Register Hold Time of Fast Input	2		2		ns
t_{RD}	Register Delay		2		2.5	ns
t_{COMB}	Combinatorial Delay		2		3	ns
t_{IC}	Array Clock Delay		6		7	ns
t_{EN}	Register Enable Time		6		7	ns
t_{GLOB}	Global Control Delay		2		3	ns
t_{PRE}	Register Preset Time		4		5	ns
t_{CLR}	Register Clear Time		4		5	ns
t_{UIM}	Switch Matrix Delay		2		2.5	ns
t_{RPA}	Reduced-power Adder[2]		10		13	ns

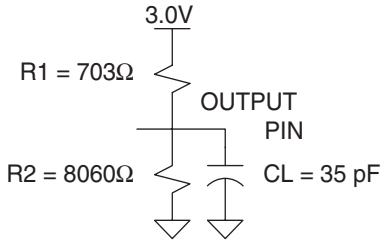
Notes: 1. See ordering information for valid part numbers.
2. The t_{RPA} parameter must be added to the t_{LAD}, t_{LAC},t_{TIC}, t_{ACL}, and t_{SEXP} parameters for macrocells running in the reduced-power mode.
3. See ordering information for valid part numbers.

Input Test Waveforms and Measurement Levels



t_R, t_F = 1.5 ns typical

Output AC Test Loads



Power-down Mode

The ATF1504ASV(L) includes an optional pin-controlled power-down feature. When this mode is enabled, the PD pin acts as the power-down pin. When the PD pin is high, the device supply current is reduced to less than 3 mA. During power down, all output data and internal logic states are latched internally and held. Therefore, all registered and combinatorial output data remain valid. Any outputs that were in a High-Z state at the onset will remain at High-Z. 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 mode feature is enabled in the logic design file or as a fitted or translated s/w option. Designs using the power-down pin may not use the PD pin as a logic array input. However, all other PD pin macrocell resources may still be used, including the buried feedback and foldback product term array inputs.

Power Down AC Characteristics(1)(2)

		-15		-20		
Symbol	**Parameter**	**Min**	**Max**	**Min**	**Max**	**Units**
t_{IVDH}	Valid I, I/O before PD High	15		20		ns
t_{GVDH}	Valid OE(2) before PD High	15		20		ns
t_{CVDH}	Valid Clock(2) before PD High	15		20		ns
t_{DHIX}	I, I/O Don't Care after PD High		25		30	ns
t_{DHGX}	OE(2) Don't Care after PD High		25		30	ns
t_{DHCX}	Clock(2) Don't Care after PD High		25		30	ns
t_{DLIV}	PD Low to Valid I, I/O		1		1	µs
t_{DLGV}	PD Low to Valid OE (Pin or Term)		1		1	µs
t_{DLCV}	PD Low to Valid Clock (Pin or Term)		1		1	µs
t_{DLOV}	PD Low to Valid Output		1		1	µs

Notes: 1. For slow slew outputs, add t_{SSO}.
2. Pin or product term.
3. Includes t_{RPA} for reduced-power bit enabled.

JTAG-BST/ISP Overview

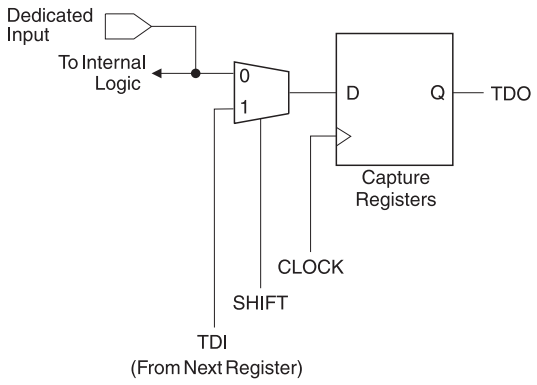
The JTAG boundary-scan testing is controlled by the Test Access Port (TAP) controller in the ATF1504ASV(L). The boundary-scan technique involves the inclusion of a shift-register stage (contained in a boundary-scan cell) adjacent to each component so that signals at component boundaries can be controlled and observed using scan testing principles. Each input pin and I/O pin has its own boundary-scan cell (BSC) in order to support boundary-scan testing. The ATF1504ASV(L) does not currently include a Test Reset (TRST) input pin because the TAP controller is automatically reset at power-up. The five JTAG modes supported include: SAMPLE/PRELOAD, EXTEST, BYPASS, IDCODE and HIGHZ. The ATF1504ASV(L)'s ISP can be fully described using JTAG's BSDL as described in IEEE Standard 1149.1b. This allows ATF1504ASV(L) programming to be described and implemented using any one of the third-party development tools supporting this standard.

The ATF1504ASV(L) has the option of using four JTAG-standard I/O pins for boundary-scan testing (BST) and in-system programming (ISP) purposes. The ATF1504ASV(L) is programmable through the four JTAG pins using the IEEE standard JTAG programming protocol established by IEEE Standard 1149.1 using 5V TTL-level programming signals from the ISP interface for in-system programming. The JTAG feature is a programmable option. If JTAG (BST or ISP) is not needed, then the four JTAG control pins are available as I/O pins.

JTAG Boundary-scan Cell (BSC) Testing

The ATF1504ASV(L) contains up to 68 I/O pins and four input pins, depending on the device type and package type selected. Each input pin and I/O pin has its own boundary-scan cell (BSC) in order to support boundary-scan testing as described in detail by IEEE Standard 1149.1. A typical BSC consists of three capture registers or scan registers and up to two update registers. There are two types of BSCs, one for input or I/O pin, and one for the macrocells. The BSCs in the device are chained together through the capture registers. Input to the capture register chain is fed in from the TDI pin while the output is directed to the TDO pin. Capture registers are used to capture active device data signals, to shift data in and out of the device and to load data into the update registers. Control signals are generated internally by the JTAG TAP controller. The BSC configuration for the input and I/O pins and macrocells are shown below.

BSC Configuration for Input and I/O Pins (Except JTAG TAP Pins)



Note: The ATF1504ASV(L) has pull-up option on TMS and TDI pins. This feature is selected as a design option.

ATF1504ASV Dedicated Pinouts

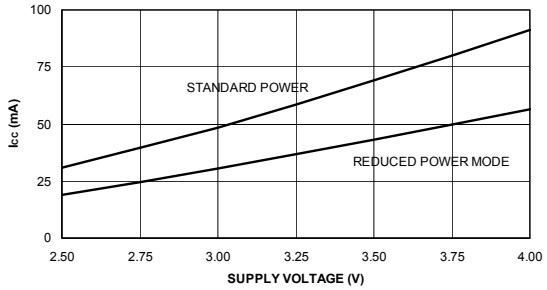
Dedicated Pin	44-lead TQFP	44-lead J-lead	68-lead J-lead	84-lead J-lead	100-lead PQFP	100-lead TQFP
INPUT/OE2/GCLK2	40	2	2	2	92	90
INPUT/GCLR	39	1	1	1	91	89
INPUT/OE1	38	44	68	84	90	88
INPUT/GCLK1	37	43	67	83	89	87
I/O /GCLK3	35	41	65	81	87	85
I/O / PD (1,2)	5, 19	11, 25	17, 37	20, 46	14, 44	12, 42
I/O / TDI (JTAG)	1	7	12	14	6	4
I/O / TMS (JTAG)	7	13	19	23	17	15
I/O / TCK (JTAG)	26	32	50	62	64	62
I/O / TDO (JTAG)	32	38	57	71	75	73
GND	4, 16, 24, 36	10, 22, 30, 42	6, 16, 26, 34, 38, 48, 58, 66	7, 19, 32, 42, 47, 59, 72, 82	13, 28, 40, 45, 61, 76, 88, 97	11, 26, 38, 43, 59, 74, 86, 95
V_{CC}	9, 17, 29, 41	3, 15, 23, 35	3, 11, 21, 31, 35, 43, 53, 63	3,13, 26, 38, 43, 53, 66, 78	5, 20, 36, 41, 53, 68, 84, 93	3, 18, 34, 39, 51, 66, 82, 91
N/C	–	–	–	–	1, 2, 7, 9, 24, 26, 29, 30, 51, 52, 55, 57, 72, 74, 79, 80	1, 2, 5, 7, 22, 24, 27, 28, 49, 50, 53, 55, 70, 72, 77, 78
# of Signal Pins	36	36	52	68	68	68
# User I/O Pins	32	32	48	64	64	64

OE (1, 2)	Global OE pins
GCLR	Global Clear pin
GCLK (1, 2, 3)	Global Clock pins
PD (1, 2)	Power-down pins
TDI, TMS, TCK, TDO	JTAG pins used for boundary-scan testing or in-system programming
GND	Ground pins
VCC	VCC pins for the device

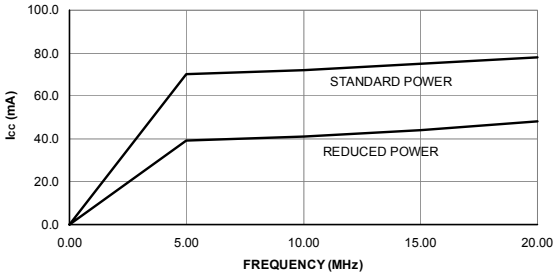
ATF1504ASV I/O Pinouts

MC	PLC	44-lead PLCC	44-lead TQFP	68-lead PLCC	84-lead PLCC	100-lead PQFP	100-lead TQFP	MC	PLC	44-lead PLCC	44-lead TQFP	68-lead PLCC	84-lead PLCC	100-lead PQFP	100-lead TQFP
1	A	12	6	18	22	16	14	33	C	24	18	36	44	42	40
2	A	-	-	-	21	15	13	34	C	-	-	-	45	43	41
3	A/ **PD1**	11	5	17	20	14	12	35	C/ **PD2**	25	19	37	46	44	42
4	A	9	3	15	18	12	10	36	C	26	20	39	48	46	44
5	A	8	2	14	17	11	9	37	C	27	21	40	49	47	45
6	A	-	-	13	16	10	8	38	C	-	-	41	50	48	46
7	A	-	-	-	15	8	6	39	C	-	-	-	51	49	47
8/ **TDI**	A	7	1	12	14	6	4	40	C	28	22	42	52	50	48
9	A	-	-	10	12	4	100	41	C	29	23	44	54	54	52
10	A	-	-	-	11	3	99	42	C	-	-	-	55	56	54
11	A	6	44	9	10	100	98	43	C	-	-	45	56	58	56
12	A	-	-	8	9	99	97	44	C	-	-	46	57	59	57
13	A	-	-	7	8	98	96	45	C	-	-	47	58	60	58
14	A	5	43	5	6	96	94	46	C	31	25	49	60	62	60
15	A	-	-	-	5	95	93	47	C	-	-	-	61	63	61
16	A	4	42	4	4	94	92	48/ **TCK**	C	32	26	50	62	64	62
17	B	21	15	33	41	39	37	49	D	33	27	51	63	65	63
18	B	-	-	-	40	38	36	50	D	-	-	-	64	66	64
19	B	20	14	32	39	37	35	51	D	34	28	52	65	67	65
20	B	19	13	30	37	35	33	52	D	36	30	54	67	69	67
21	B	18	12	29	36	34	32	53	D	37	31	55	68	70	68
22	B	-	-	28	35	33	31	54	D	-	-	56	69	71	69
23	B	-	-	-	34	32	30	55	D	-	-	-	70	73	71
24	B	17	11	27	33	31	29	56/ **TDO**	D	38	32	57	71	75	73
25	B	16	10	25	31	27	25	57	D	39	33	59	73	77	75
26	B	-	-	-	30	25	23	58	D	-	-	-	74	78	76
27	B	-	-	24	29	23	21	59	D	-	-	60	75	81	79
28	B	-	-	23	28	22	20	60	D	-	-	61	76	82	80
29	B	-	-	22	27	21	19	61	D	-	-	62	77	83	81
30	B	14	8	20	25	19	17	62	D	40	34	64	79	85	83
31	B	-	-	-	24	18	16	63	D	-	-	-	80	86	84
32/ **TMS**	B	13	7	19	23	17	15	64	D/ **GCLK3**	41	35	65	81	87	85

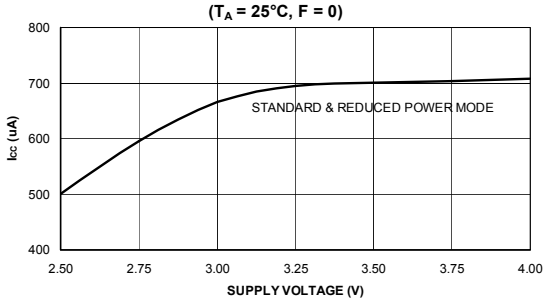
SUPPLY CURRENT VS. SUPPLY VOLTAGE
(T_A = 25°C, F = 0)



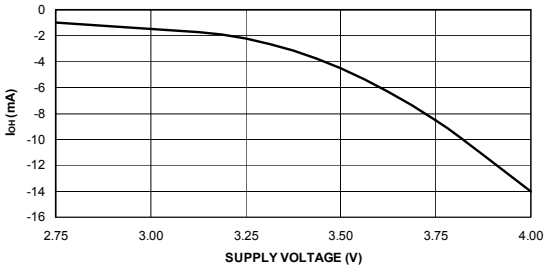
SUPPLY CURRENT VS. FREQUENCY
LOW-POWER ("L") VERSION
(T_A = 25°C)



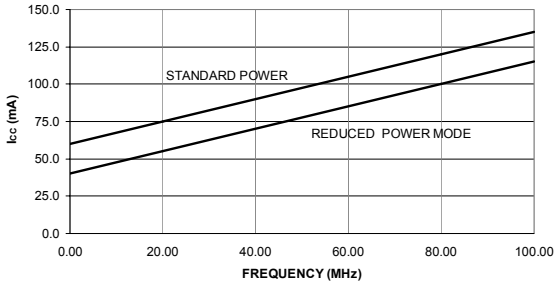
SUPPLY CURRENT VS. SUPPLY VOLTAGE
PIN-CONTROLLED POWER-DOWN MODE
(T_A = 25°C, F = 0)



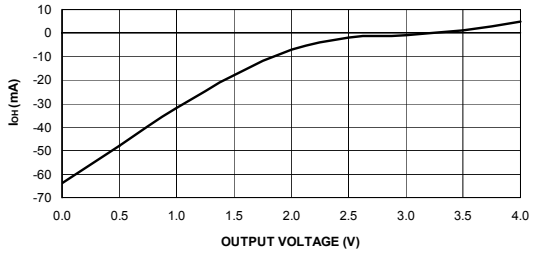
OUTPUT SOURCE CURRENT
VS. SUPPLY VOLTAGE
(V_{OH} = 2.4V, T_A = 25°C)



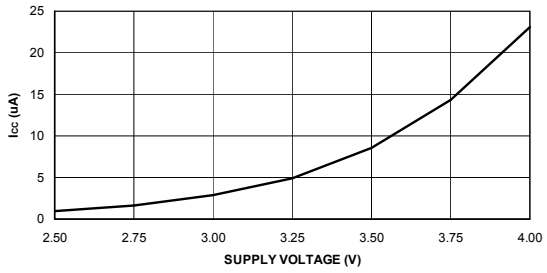
SUPPLY CURRENT VS. FREQUENCY
STANDARD POWER (T_A = 25°C)



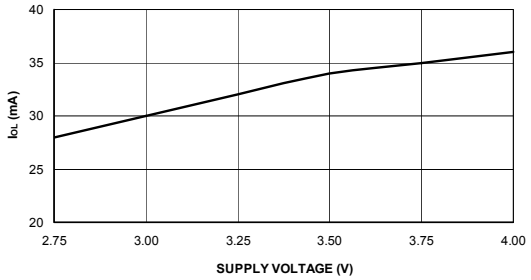
OUTPUT SOURCE CURRENT
VS. OUTPUT VOLTAGE
(V_{CC} = 3.3V, T_A = 25°C)



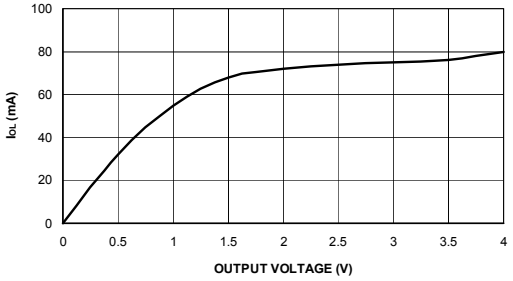
SUPPLY CURRENT VS. SUPPLY VOLTAGE
LOW-POWER ("L") VERSION
(T_A = 25°C, F = 0)



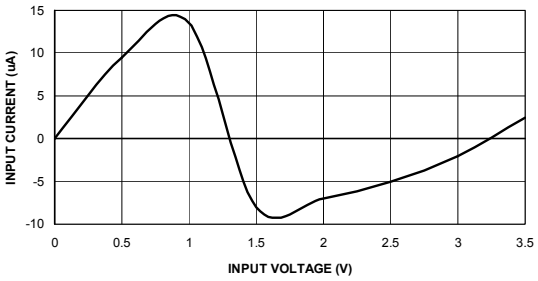
OUTPUT SINK CURRENT VS. SUPPLY VOLTAGE
(V_{OL} = 0.5V, T_A = 25°C)



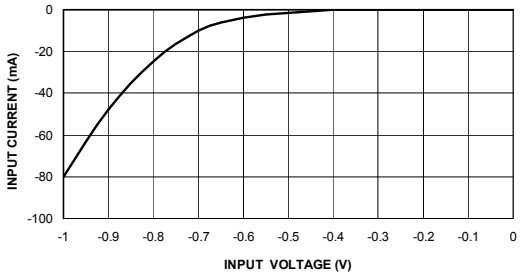
OUTPUT SINK CURRENT VS. OUTPUT VOLTAGE
(V_{CC} = 3.3V, T_A = 25°C)



INPUT CURRENT VS. INPUT VOLTAGE
(V_{CC} = 3.3V, T_A = 25°C)



INPUT CLAMP CURRENT VS. INPUT VOLTAGE
(V_{CC} = 3.3V, T_A = 25°C)



Ordering Information

ATF1504ASV(L) Standard Package Options

t_{PD} (ns)	t_{CO1} (ns)	f_{MAX} (MHz)	Ordering Code	Package	Operation Range
15	8	100	ATF1504ASV-15 AC44	44A	Commercial (0°C to 70°C)
			ATF1504ASV-15 JC44	44J	
			ATF1504ASV-15 JC68[2]	68J	
			ATF1504ASV-15 JC84[3]	84J	
			ATF1504ASV-15 QC100[2]	100Q1	
			ATF1500ASV-15 AC100	100A	
15	8	100	ATF1504ASV-15 AI44	44A	Industrial (-40°C to +85°C)
			ATF1504ASV-15 JI44	44J	
			ATF1504ASV-15 JI68	68J	
			ATF1504ASV-15 JI84	84J	
			ATF1504ASV-15 QI100	100Q1	
			ATF1504ASV-15 AI100	100A	
20	12	83.3	ATF1504ASVL-20 AC44	44A	Commercial (0°C to 70°C)
			ATF1504ASVL-20 JC44	44J	
			ATF1504ASVL-20 JC68[2]	68J	
			ATF1504ASVL-20 JC84[3]	84J	
			ATF1504ASVL-20 QC100[2]	100Q1	
			ATF1504ASVL-20 AC100	100A	
20	12	83.3	ATF1504ASVL-20 AI44	44A	Industrial (-40°C to +85°C)
			ATF1504ASVL-20 JI44	44J	
			ATF1504ASVL-20 JI68	68J	
			ATF1504ASVL-20 JI84	84J	
			ATF1504ASVL-20 QI100	100Q1	
			ATF1504ASVL-20 AI100	100A	

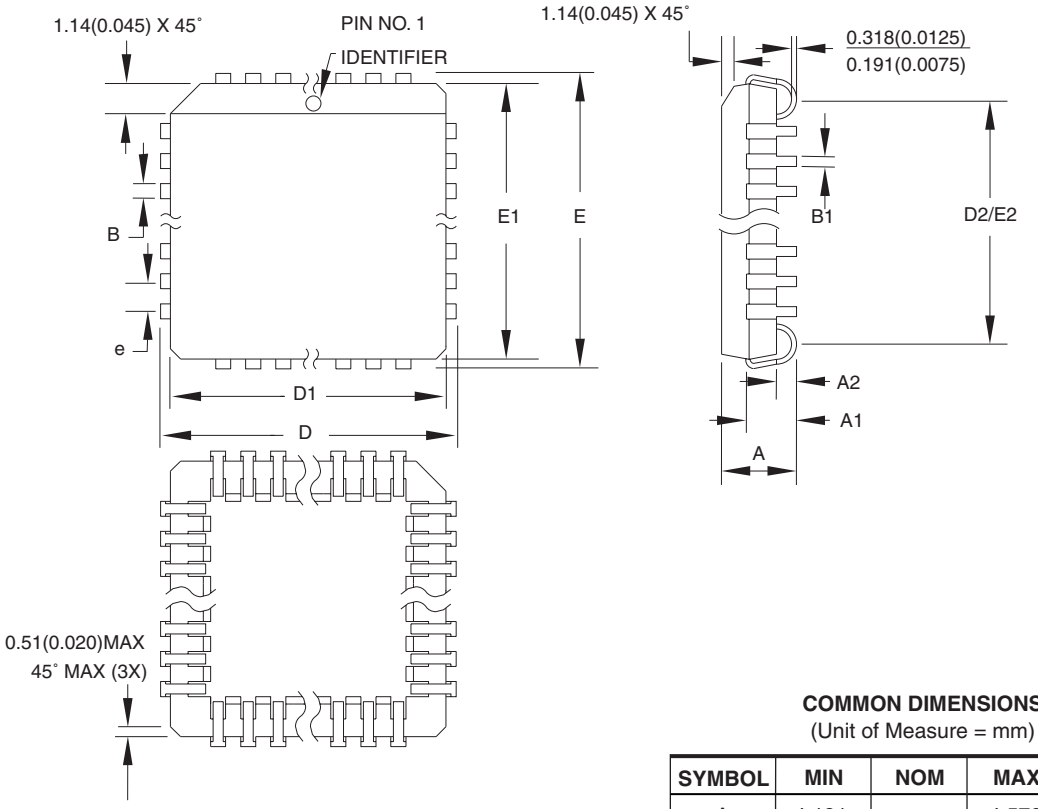
Note: 1. The last time buy is Sept. 30, 2005 for shaded parts.

2. The recommended migration for QC100 or JC68 packages is the AU100 or the smaller JU44 packages.
3. The recommended migration for the JC84 package is the ATF1508ASV-15JU84

Using “C” Product for Industrial

There is very little risk in using “C” devices for industrial applications because the V_{CC} conditions for 3.3V products are the same for commercial and industrial (there is only 15°C difference at the high end of the temperature range). To use commercial product for industrial temperature ranges, de-rate I_{CC} by 15%.

44J – PLCC



COMMON DIMENSIONS
(Unit of Measure = mm)

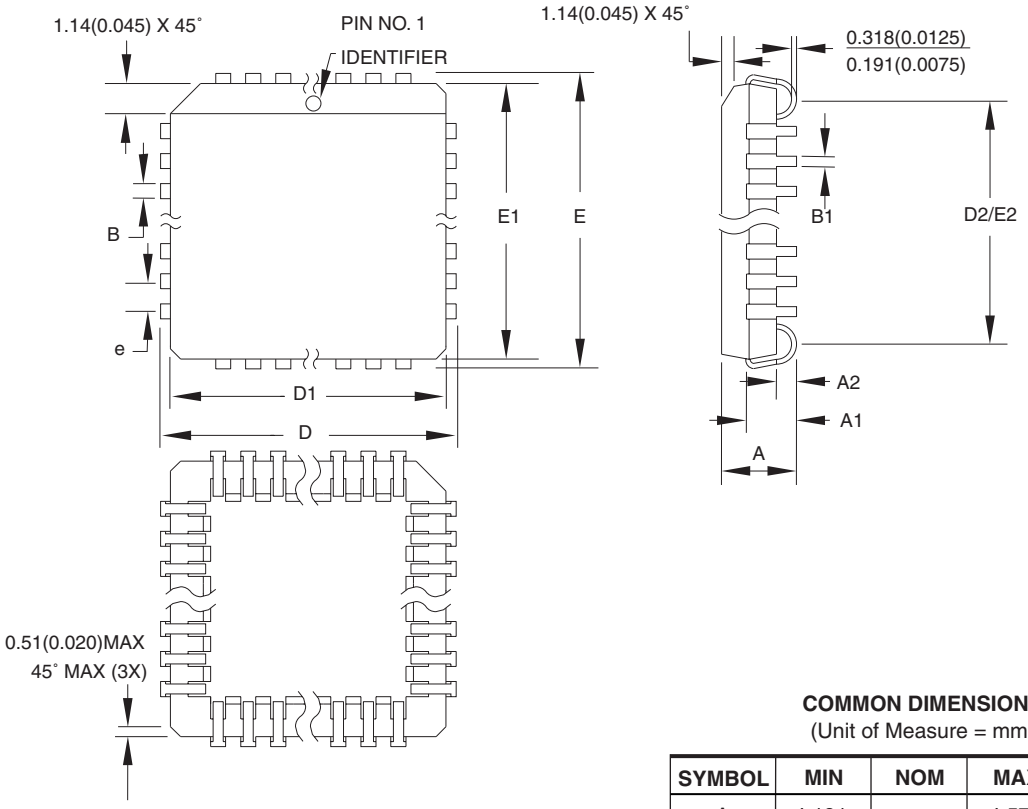
SYMBOL	MIN	NOM	MAX	NOTE
A	4.191	–	4.572	
A1	2.286	–	3.048	
A2	0.508	–	–	
D	17.399	–	17.653	
D1	16.510	–	16.662	Note 2
E	17.399	–	17.653	
E1	16.510	–	16.662	Note 2
D2/E2	14.986	–	16.002	
B	0.660	–	0.813	
B1	0.330	–	0.533	
e	1.270 TYP			

Notes:
1. This package conforms to JEDEC reference MS-018, Variation AC.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is .010"(0.254 mm) per side. Dimension D1 and E1 include mold mismatch and are measured at the extreme material condition at the upper or lower parting line.
3. Lead coplanarity is 0.004" (0.102 mm) maximum.

10/04/01

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**44J**, 44-lead, Plastic J-leaded Chip Carrier (PLCC)	44J	B

68J – PLCC



COMMON DIMENSIONS
(Unit of Measure = mm)

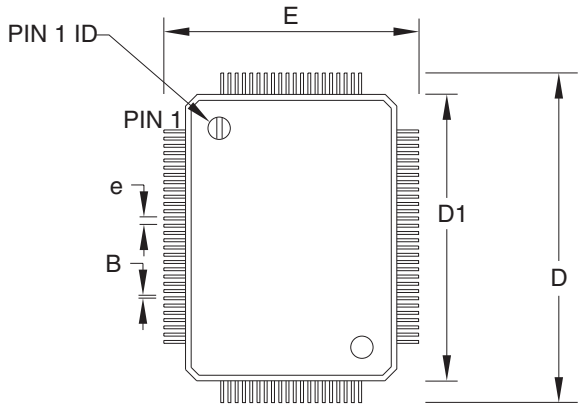
SYMBOL	MIN	NOM	MAX	NOTE
A	4.191	–	4.572	
A1	2.286	–	3.048	
A2	0.508	–	–	
D	25.019	–	25.273	
D1	24.130	–	24.333	Note 2
E	25.019	–	25.273	
E1	24.130	–	24.333	Note 2
D2/E2	22.606	–	23.622	
B	0.660	–	0.813	
B1	0.330	–	0.533	
e	1.270 TYP			

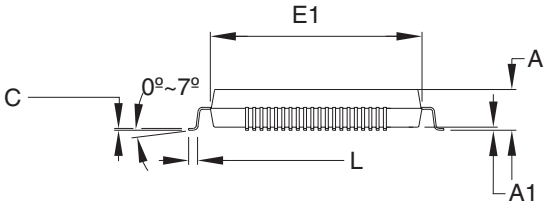
Notes:
1. This package conforms to JEDEC reference MS-018, Variation AE.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is .010"(0.254 mm) per side. Dimension D1 and E1 include mold mismatch and are measured at the extreme material condition at the upper or lower parting line.
3. Lead coplanarity is 0.004" (0.102 mm) maximum.

10/04/01

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**68J**, 68-lead, Plastic J-leaded Chip Carrier (PLCC)	68J	B

100Q1 – PQFP





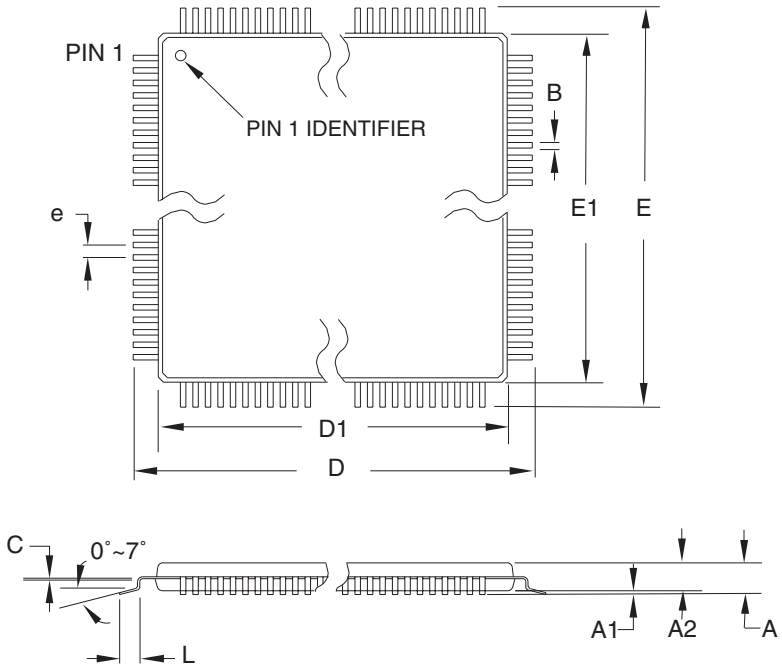
COMMON DIMENSIONS
(Unit of Measure = mm)
JEDEC STANDARD MS-022, GC-1

SYMBOL	MIN	NOM	MAX	NOTE
A	–	3.04	3.4	
A1	0.25	0.33	0.5	
D		23.20 BSC		
E		17.20 BSC		
E1		14.00 BSC		
B	0.22	–	0.40	
D1		20 BSC		
L	0.73	–	1.03	
e		0.65 BSC		

09/10/2002

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**100Q1**, 100-lead, 14 x 20 mm Body, 3.2 mm Footprint, 0.65 mm Pitch, Plastic Quad Flat Package (PQFP)	100Q1	B

100A – TQFP



COMMON DIMENSIONS
(Unit of Measure = mm)

SYMBOL	MIN	NOM	MAX	NOTE
A	–	–	1.20	
A1	0.05	–	0.15	
A2	0.95	1.00	1.05	
D	15.75	16.00	16.25	
D1	13.90	14.00	14.10	Note 2
E	15.75	16.00	16.25	
E1	13.90	14.00	14.10	Note 2
B	0.17	–	0.27	
C	0.09	–	0.20	
L	0.45	–	0.75	
e	0.50 TYP			

Notes:
1. This package conforms to JEDEC reference MS-026, Variation AED.
2. Dimensions D1 and E1 do not include mold protrusion. Allowable protrusion is 0.25 mm per side. Dimensions D1 and E1 are maximum plastic body size dimensions including mold mismatch.
3. Lead coplanarity is 0.08 mm maximum.

10/5/2001

	TITLE	DRAWING NO.	REV.
2325 Orchard Parkway San Jose, CA 95131	**100A,** 100-lead, 14 x 14 mm Body Size, 1.0 mm Body Thickness, 0.5 mm Lead Pitch, Thin Profile Plastic Quad Flat Package (TQFP)	100A	C

Revision History

Revision	Comments
1409J	Green package options added.

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