Atmel ATPL00B

FSK Power Line Communications SoC

SUMMARY DATASHEET

Features

- Core
  - ADD8051C3A enhanced 8051 core
  - Speedups up to x5 vs. standard 8051 microcontroller
- 128Kbytes internal SRAM
- In-circuit serial flash programming
- Auto boot-loading program from serial flash
- Media Access Control
  - Convolutional and block (FEC) channel coding, Viterbi decoding
  - Hardware CRC error detection and FEC error correction
  - By-pass mode to support earlier no-MAC FSK modem software
- Modem
  - Power Line Carrier Modem for 50 and 60 Hz mains
  - Carrier Frequency: 132.5KHz
  - Baud rate Selectable: 600 to 4800 bps
  - Half Duplex communication
  - Receiver Sensitivity: Up to 44dBµVrms
- Peripherals
  - Three 2-wire UARTs
  - Two SPI. SPI to serial flash and External RTC. Buffered SPI to external metering IC
  - Programmable Watchdog
  - Quad dimmer in/out
  - Up to 20 I/O lines
- Package
  - 144-lead LQFP, 16 x 16 mm, pitch 0.4 mm
  - Pb-free and RoHS compliant
- Typical Applications
  - Automated Meter Reading (AMR) & Advanced Meter Management (AMM)
  - Street lighting
  - Home Automation

Description

The ATPL00B is a Power Line Communications System on Chip. It implements a full PLC node using FSK modulations and includes a hardwired Medium Access Controller (ADD1210). It has been developed to reduce the CPU computational load in PLC systems. Thus, the microcontroller is free to be used in the applications tasks.

MAC functional capabilities of ATPL00B (performed in ADD1210 Medium Access Controller) involve the construction of message packets, adding convolutional or FEC (Forward Error Correction) codes to bytes and FCS (Frame Check Sequence) to packets. In reception, the MAC provides frame detection and Viterbi decoding or FCS and FEC correction.

ATPL00B MAC design is versatile and allows users to create a wide range of datagram structures. The MAC can be set in a bypass mode allowing direct connection between the microcontroller and the modem to support old FSK software that doesn't include the MAC.

ATPL00B PLC modem (ADD1310) is based on a Frequency-shift keying (FSK) Modulation Scheme supporting Minimum Shift Frequency (MSK) in the C-Band with carrier frequency of 132,5KHz. It can work using a single power supply of 3.3V and a few external components, supporting several Analog Front End (AFE) configurations suitable for Home Automation purposes. It can replace the traditional analog PLC modem and can use the same software libraries or a simplified version if the hardwired MAC is used. The PLC modem fits CENELEC C-band and EN50065-1 access rules, and has receiver sensitivity up to 44dBµVrms (158 µVrms).

ATPL00B core (ADD8051C3A) includes all features of the standard 8051, with an average speed up x5 and some additional features.

The microcontroller includes some specific peripherals as a 4 input / 4 output dimmer for power regulation (phase angle control), also being able to generate a PWM (Pulse-Width Modulation) control.

A flash program loader allows to store the microcontroller program in a standard SPI serial flash memory and to execute it from internal SRAM. In the start-up process the program is uploaded from serial flash to the internal 128Kbytes of SRAM before start execution, after start-up the free space in the serial flash can be used to store application data. ATPL00B includes an encryption engine for code protection. Using a larger flash, several programs can be stored at the same time and the microcontroller can switch from one program to another, this feature could be used to reprogram the SoC using PLC downloading.
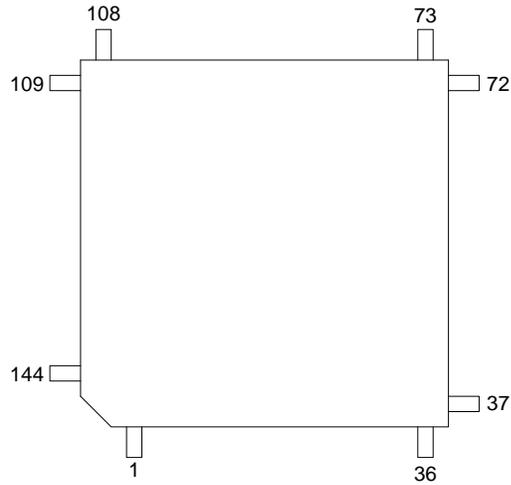
1. Block Diagram

Figure 1-1. ATPL00B 144-pin Block Diagram
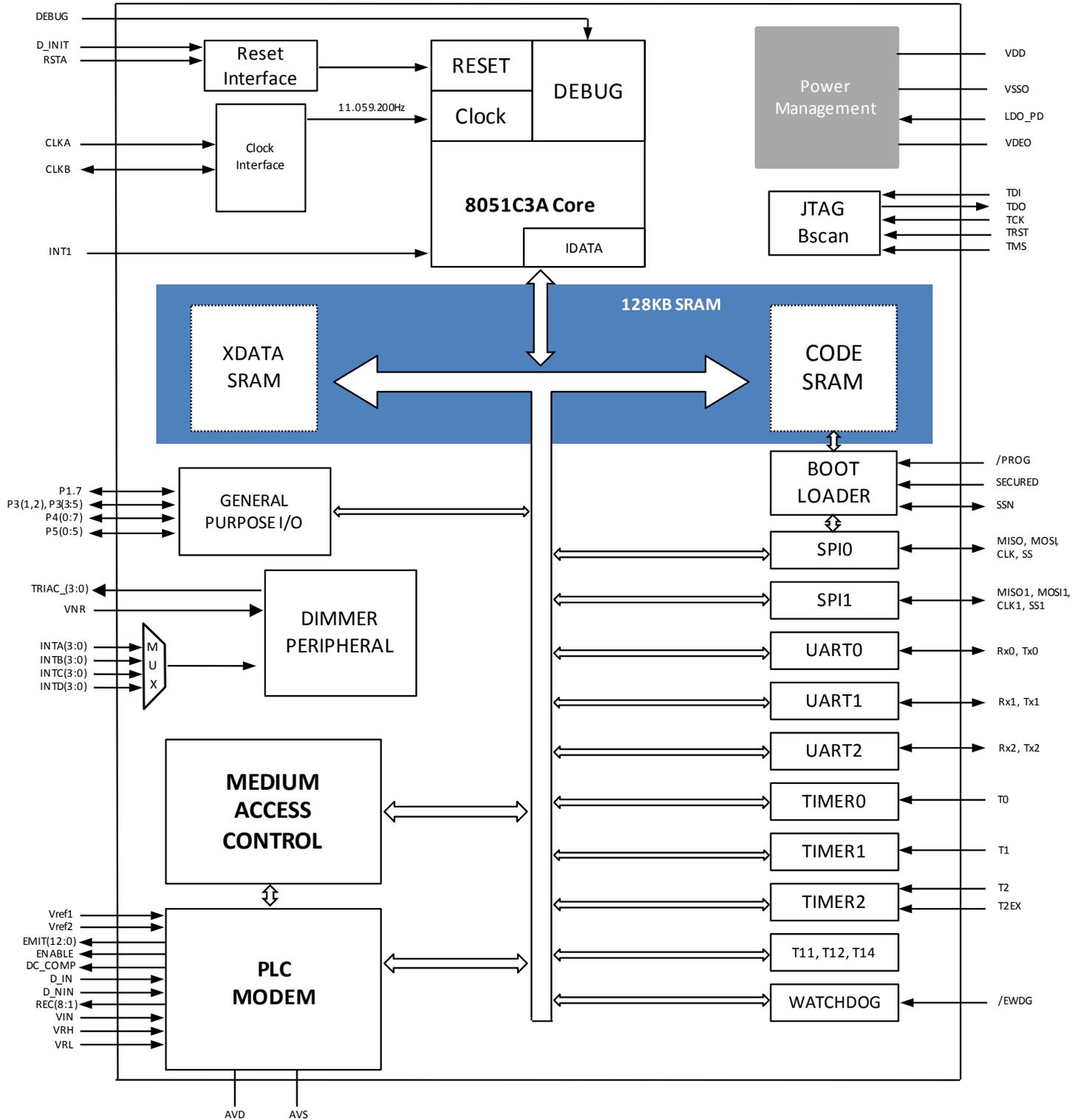
2. Package and Pinout

2.1 144-Lead LQFP Package Outline

Figure 2-1. Orientation of the 144-Lead Package

2.2 144-Lead LQFP Pinout

Table 2-1. ATPL00B 144-Lead LQFP pinout

1	P3.3/INT1	37	TRIAC_0	73	P4.0/RXD2	109	NC
2	VCC	38	P5.5/TXD1/INTA1	74	VCC	110	NC
3	GND	39	P5.4/RXD1/INTA0	75	GND	111	NC
4	GND	40	P4.7/T2EX/INTA3	76	INTC3	112	NC
5	GND	41	P4.6/T2/INTA2	77	INTC2	113	GND
6	TDI	42	P1.7/SSN	78	INTC1	114	DC_COMP
7	TDO	43	VCC	79	INTC0	115	VCC
8	TCK	44	GND	80	NC	116	ENABLE
9	TMS	45	EMIT.0	81	NC	117	GND
10	TRST	46	EMIT.1	82	NC	118	DNIN
11	D_INIT	47	EMIT.2	83	NC	119	DIN
12	RSTA	48	VCC	84	NC	120	REC_1
13	/PROG	49	GND	85	NC	121	REC_2
14	SECURED	50	EMIT.3	86	NC	122	REC_3
15	/EWDG	51	EMIT.4	87	NC	123	REC_4
16	DEBUG	52	EMIT.5	88	NC	124	REC_5
17	VCC	53	EMIT.6	89	VDD	125	REC_6
18	CLKEB	54	VCC	90	VCC	126	REC_7
19	VSS	55	GND	91	GND	127	REC_8
20	CLKEA	56	EMIT.7	92	NC	128	VCC
21	VCC	57	EMIT.8	93	NC	129	GND
22	GND	58	EMIT.9	94	NC	130	VRL
23	GND	59	EMIT.10	95	NC	131	VIN
24	VDEO	60	VCC	96	NC	132	VRH
25	VDEO	61	GND	97	NC	133	AVD1
26	VSSO	62	EMIT.11	98	NC	134	AVS1
27	LDO_PD	63	EMIT.12	99	NC	135	AVD2
28	VDD	64	VCC	100	NC	136	AVS2
29	GND	65	GND	101	NC	137	VCC
30	VCC	66	P3.1/TXD0	102	NC	138	GND
31	Vref1	67	P3.0/RXD0	103	VCC	139	P5.3/MISO0
32	Vref2	68	P4.5/MISO1/INTB3	104	GND	140	P5.2/MOSI0
33	VNR	69	P4.4/MOSI1/INTB2	105	INTD3	141	P5.1/SPICLK0
34	TRIAC_3	70	P4.3/SPICLK1/INTB1	106	INTD2	142	P5.0/SS0
35	TRIAC_2	71	P4.2/SS1/INTB0	107	INTD1	143	P3.5/T1
36	TRIAC_1	72	P4.1/TXD2	108	INTD0	144	P3.4/T0

3. Mechanical Characteristics
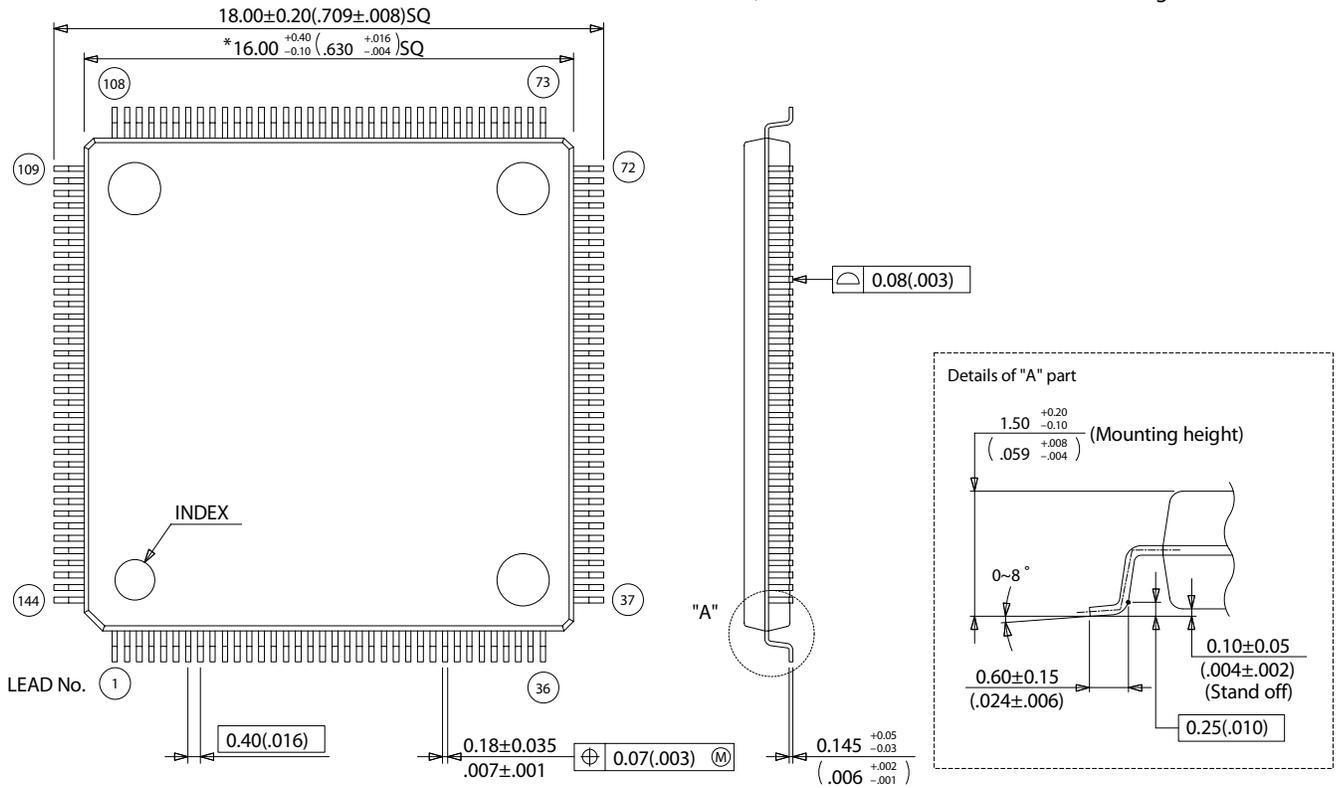
Figure 3-1.   144-lead LQFP Package Mechanical Drawing
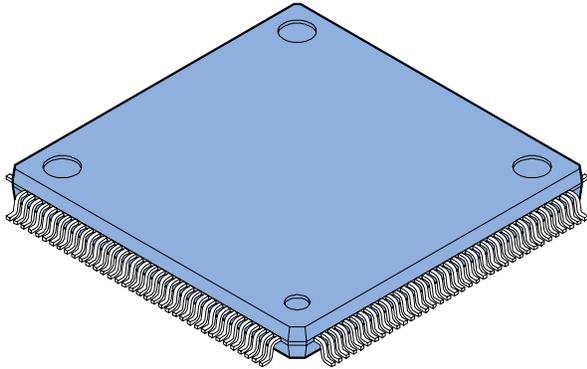
Lead pitch	0.40 mm
Package width · package length	16.0 · 16.0 mm
Lead shape	Gullwing
Sealing method	Plastic mold
Mounting height	1.70 mm MAX
Weight	0.88 g

Note 1) * : These dimensions include resin protrusion.
Resin protrusion is +0.25(.010)Max(each side).
Note 2) Pins width and pins thickness include plating thickness.
Note 3) Pins width do not include tie bar cutting remainder.

18.00±0.20(.709±.008)SQ

$*16.00\,^{+0.40}_{-0.10}\left(.630\,^{+.016}_{-.004}\right)$SQ

108   73
109   72
144   37
LEAD No. 1   36

INDEX

0.40(.016)

0.18±0.035
.007±.001

0.07(.003) (M)

0.08(.003)

"A"

$0.145\,^{+0.05}_{-0.03}$
$\left(.006\,^{+.002}_{-.001}\right)$

Details of "A" part

$1.50\,^{+0.20}_{-0.10}$ (Mounting height)
$\left(.059\,^{+.008}_{-.004}\right)$

0~8°

0.60±0.15
(.024±.006)

0.10±0.05
(.004±.002)
(Stand off)

0.25(.010)

Dimensions in mm (inches).
Note: The values in parentheses are reference values.

4. Recommended mounting conditions

4.1 Conditions of Standard Reflow

Table 4-1. Conditions of standard Reflow

Items	Contents	
Method	IR(Infrared Reflow)/Convection	
Times	2	
Floor Life	Before unpacking	Please use within 2 years after production
	From unpacking to second reflow	Within 8 days
	In case over period of floor life	Baking with 125ºC +/- 3ºC for 24hrs +2hrs/-0hrs is required. Then please use within 8 days. (please remember baking is up to 2 times)
Floor Life Condition	Between 5ºC and 30ºC and also below 70%RH required. (It is preferred lower humidity in the required temp range.)	

Figure 4-1. Temperature Profile
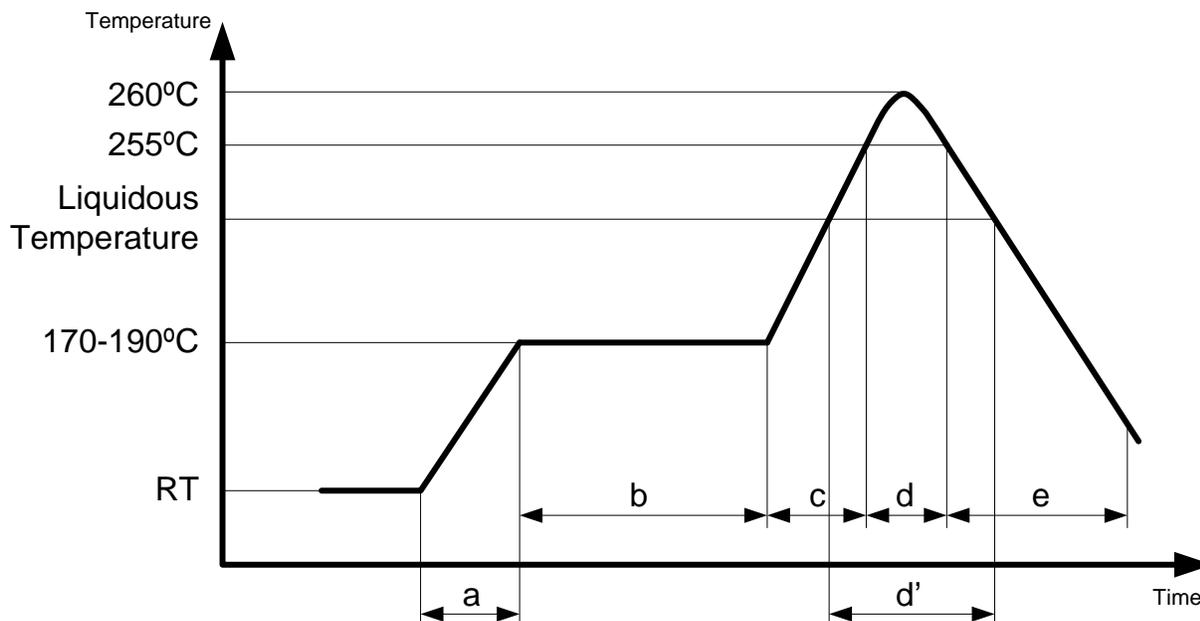
Note: H rank: 260ºC Max

    a: Average ramp-up rate: 1ºC/s to 4ºC/s

    b: Preheat & Soak: 170ºC to 190ºC, 60s to 180s

    c: Average ramp-up rate: 1ºC/s to 4ºC

    d: Peak temperature: 260ºC Max, up to 255ºC within 10s

    d': Liquidous temperature: Up to 230ºC within 40s or

    Up to 225ºC within 60s or

    Up to 220ºC within 80s

    e: Cooling: Natural cooling or forced cooling

5. Ordering Information

Table 5-1.   Atmel ATPL00B Ordering Codes

Atmel Ordering Code	Package	Package Type	Temperature Range
ATPL00B-AZU-Y	144 LQFP	Pb-Free	Industrial (-40ºC to 85º)

<div align="center">

A T P L 0 0 B - A Z U - Y x x

</div>

Atmel Designator
AT=Atmel

Product Family
PL=Power Line Communications

Device Designator

Device Revision

Customer marking

Shipping Carrier Option
Y =   Tray

Package Device Grade or Wafer/Die Thickness
U = Lead free (Pb-free)
        Industrial temperature range
        (-40°C to +85°C)

Package Option
AZ   = 144LQFP
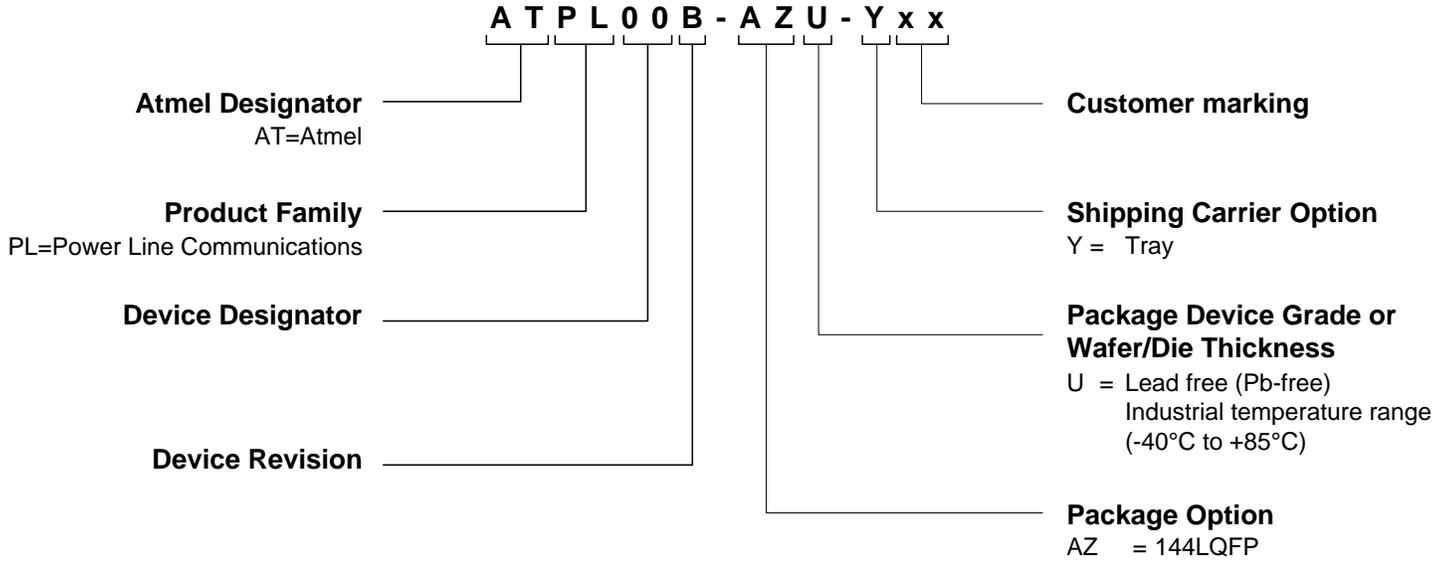
6. Revision History

Doc. Rev.	Date	Comments
1.00	30/03/2012	Initial release

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