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**Status of Li-Ion Polymer Battery  
Manufacturing in China**

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**Manufacturing Director. William Chen**  
(Amperex Technology Limited)



# Status of Li-Ion Polymer Battery Manufacturing in China

Prepared By: William Chen

Amperex Technology Limited

- ATL

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## Categories of secondary Li-Ion batteries

Package / Assembly	Hard (Metal-casing)	Soft (Al-foil)
Winding	Liquid	ALB
Stacking	Large cell (Liquid or Polymer)	Bellcore & Hybrid

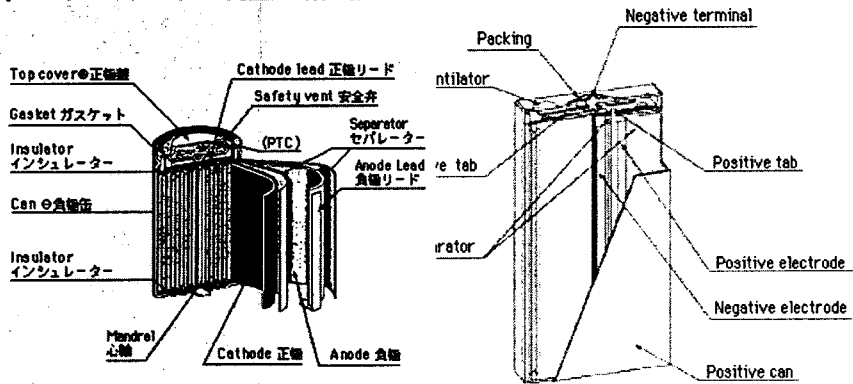
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# Winding LiB and LIP



Square-type aluminum can drawing (sample)

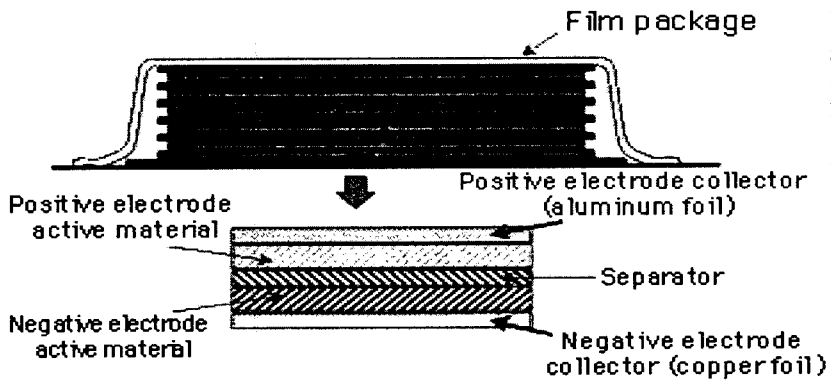
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# Stacking type LIP



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## Major LIP Players in China (alphabetic order)

- ATL
- BYD
- Coslight
- LiShen
- Others (TCL, AE energy, HiCell, GuoGuang)

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## LIP Manufacturing Technology in China

Company	Product	Assembly	Cell format
ATL	LIP	Stacking	L/M/S
BYD	LIB,LIP	Winding	M/S
Coslight	LIB,LIP	Winding	M
Lishen	LIB,LIP	Winding	M/S
TCL	LIB,LIP	Stacking, Winding	L/M/S
AE energy	LIP	Winding	L/M/S

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## Strong in converting Technology to manufacturing and marketing

- Investment in Intellectual properties
  - Patented technologies and licensed technologies
- Optimized manufacturing cost
  - Reasonable mechanization, automation plus manual operation, low capital entry barrier
  - Competitive price vs. quality, reasonable profit
- Flexible design and customized made
  - Build to order, build to design
  - Quick response and low inventories risk

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## China LIP manufacturers aggressively...

- Not only making cells
  - Capacity expansion for 2003 and 2004 aggressively
  - Shipping volume doubles and doubles
  - World wide delivery
  - OEM qualification for volume shipment
- Safety improvement
  - UL1642
  - IEC
  - Protection circuitry
- Manufacturing Improvement
  - QS 9000 management system
  - SPC, FMEA and etc..

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## China LIP manufacturer aggressively...

### Also focus on:

- Alliance with material research organizations and firms
- Established Basic energy material technologies
- Infrastructures for future development
- Enterprise or government funded in research
- Driving force for raw material manufacturing in China
  - Couples anode and cathode material factories shipped millions tons, domestically and worldwide
  - Mature electrolyte solvent and salt manufacturing
  - Separator technology is progressing

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## LIP product from China

### Flexible formats

- Small format for Bluetooth
- Medium format for cell phone
- Large format for portable devices

Flexible applications – emerging and customized design

**ATL is dominating LIP manufacturing in China since 2002**

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## ATL stacking vs. winding

		Footprint		
		Small	Medium	Large
T h i c k n e s s	Thin (<2.0mm)	Strong	Strong	Strong
	Medium	Strong	Even	Strong
	Thick (>7mm)	Even	WEAK	Strong

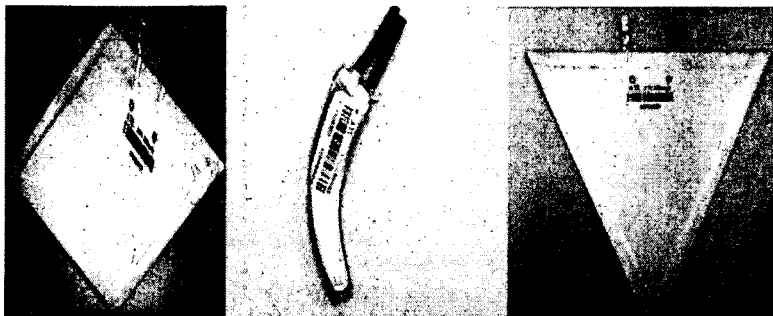
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Sheppards Avenue East, Scarborough, Ontario M1S 5T6, Canada

## Flexible LIP from ATL



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## LIP from ATL for various applications



**Applications: From Bluetooth device to Large professional camcorder**

**Capacity: from 20 mAh to 6000 mAh**

**Dimension: From 10x20 mm to 150 x 200 mm**

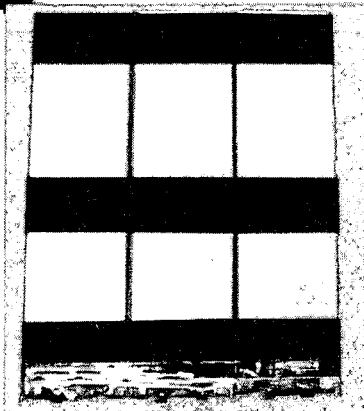
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## ATL LIP in modules



Module cells with 30Ah, 3.7v



Module cells 3S vs. 3S3P cylindrical 18650,

thickness < 10 mm

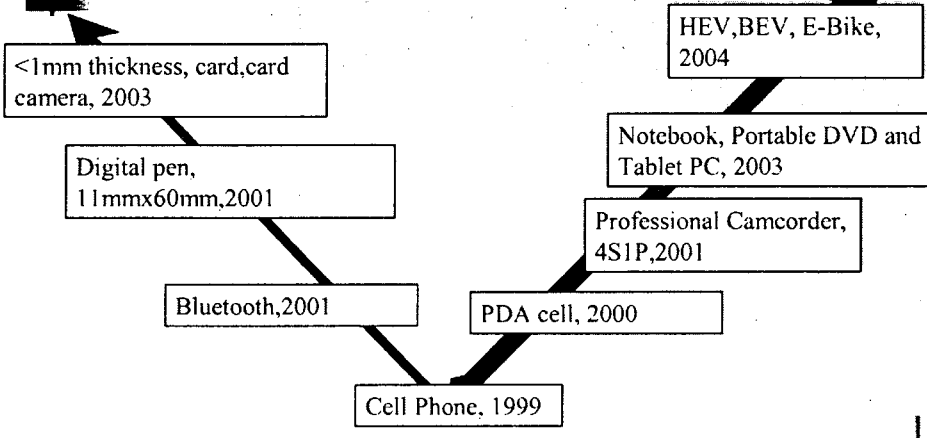
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# ATL LIP product family



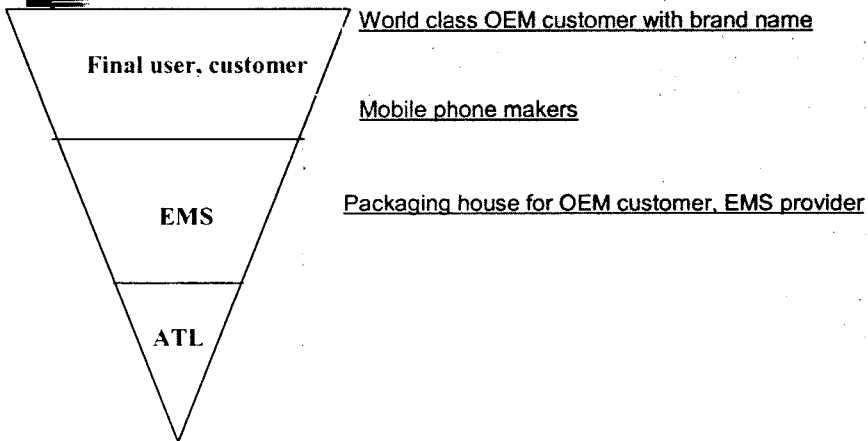
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Singapore

# ATL 's LIP customers



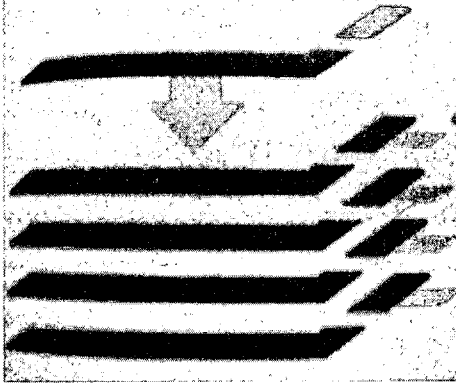
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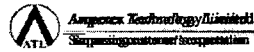
# ATL LIP cell structure



- Laminated electrodes and separators
- Stacked single cells or bi-cells

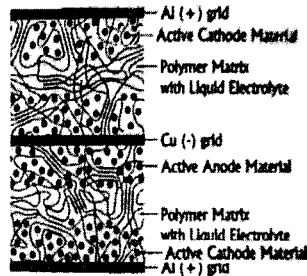
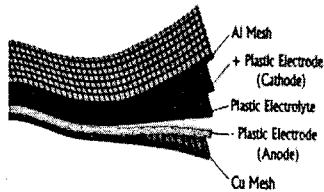
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# Cross-section

## Schematic of LIP Battery Structure



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# ATL LIP's features

Stack pressure



Electrodes  
and  
separators

Stack pressure,  
laminated interface



low impedance  
long cycle-life

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# LIP manufacturing Control

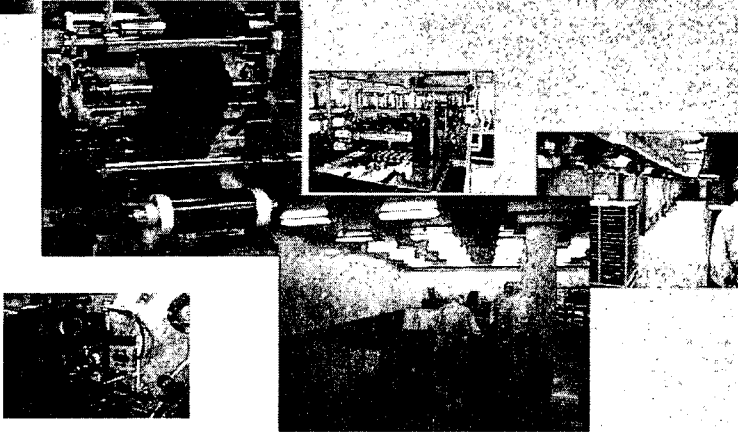
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# ATL manufacturing control 4M, 1E



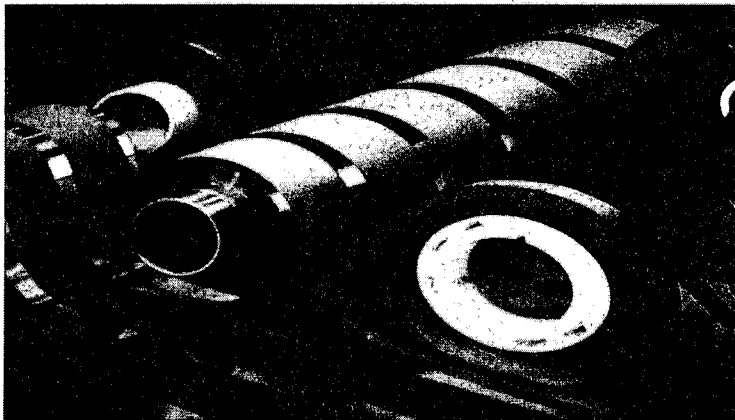
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# Manufacturing Process for LIP



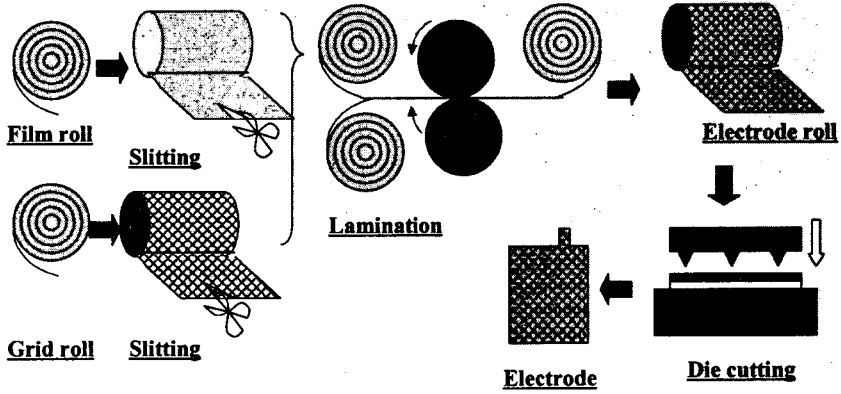
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# ATL LIP—1



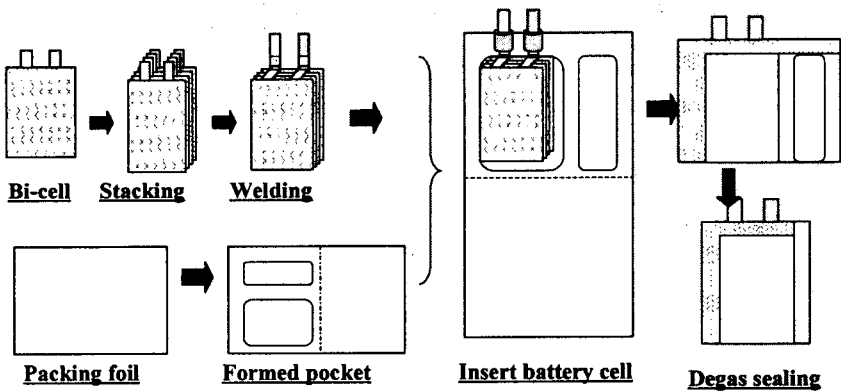
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# ATL LIP—2



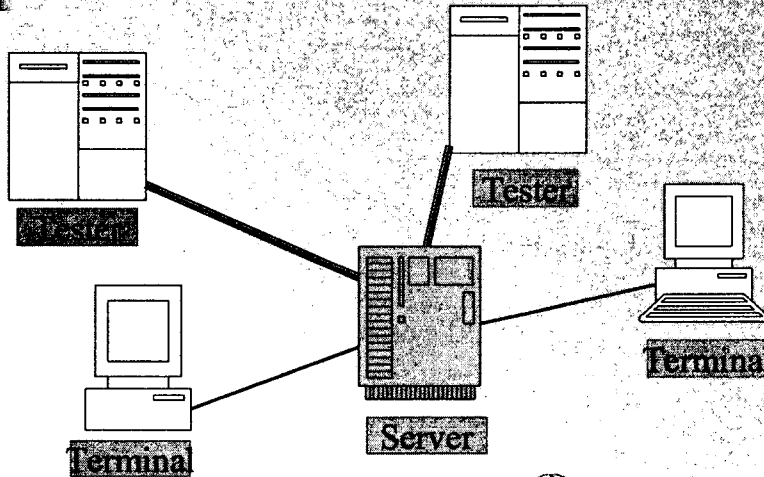
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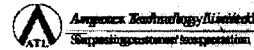
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# On Line Data Base



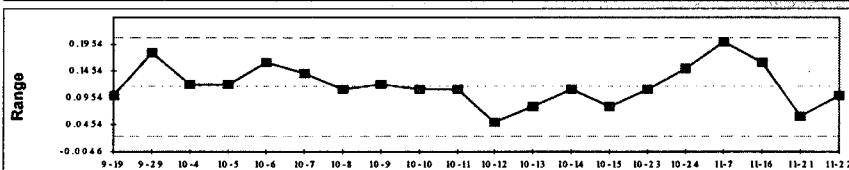
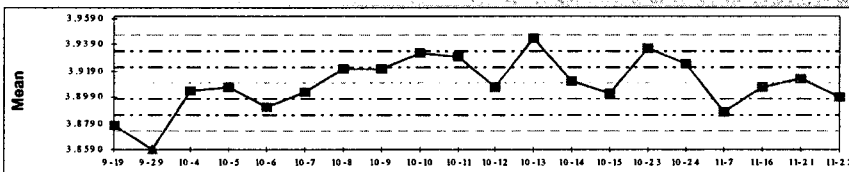
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# X-R Chart

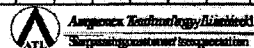
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 Group :  
 Level : BBP  
 Operation : DTMES - Dimension check thickness  
 P/N : 001-001-01  
 Shift : M  
 M/C : LINE 2  
 Mark : 123  
 Unit : mm  
 Sample : 30  
 Date : 01-27-01  
 To : 11-26-01



Super : \* \* \* \* \*  
 Remark : \* \* \* \* \*

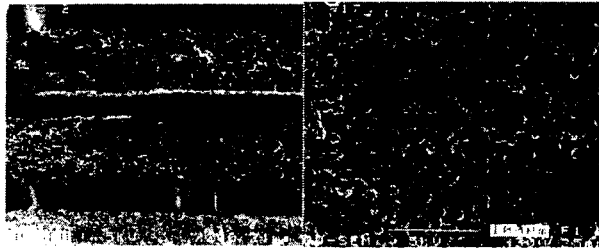
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# Process monitoring and FA

- AFM
- TOF-SIMS
- Auger
- GC-MS
- SEM

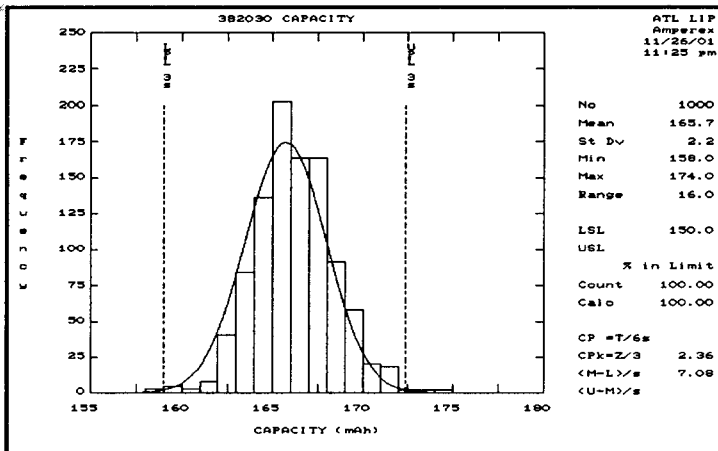


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# Product Uniformity – CpK control



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## Product Design – Customized

- Design to the format
- Design to structure
- Design to performance
- Design to cost
- Integrated customized made and volume production

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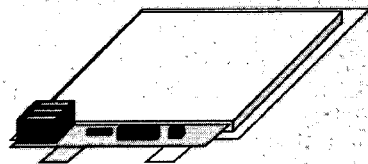
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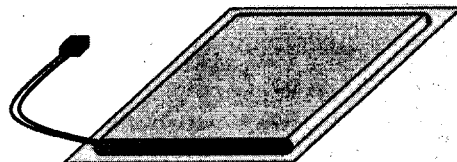
## Customized design for room saving

Battery Case



■ **External Pack: PCM layout to sealing edge to utilize more space**

■ **Internal pack: shrink-wrap, user replaceable**



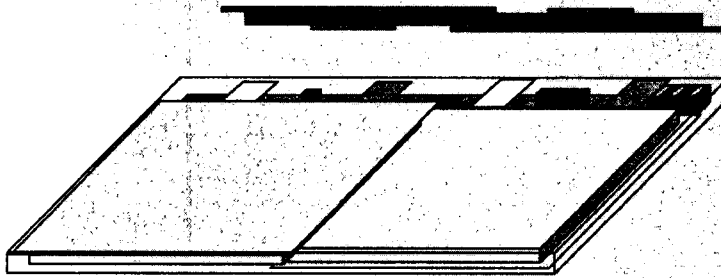
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## Module cells design



- Overlapped dummy edge to achieve higher volume density

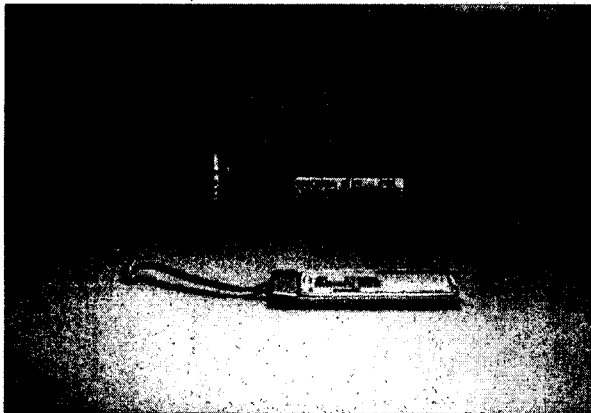
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## ATL LIP in Digital Pen



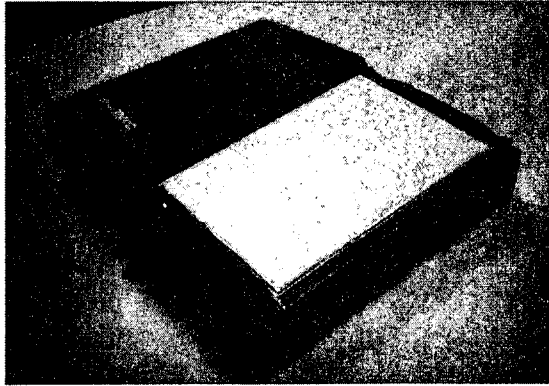
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## ATL LIPs modules in Video Camera



4S1P, 14.8V, 5Ah

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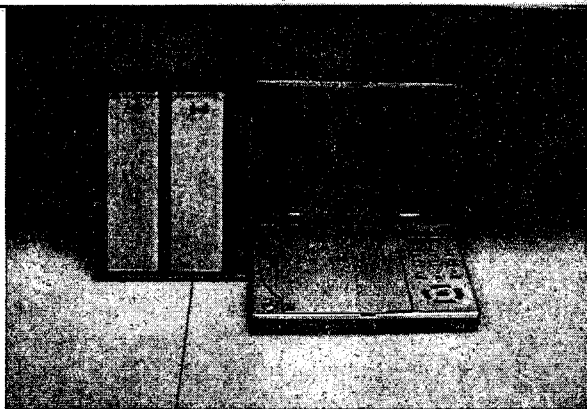
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Šarunų gatvė 10, Vilnius, Lietuva



## ATL LIPs in Portable DVD



2S1P, 7.2V, 3.5Ah

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# Thank You

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