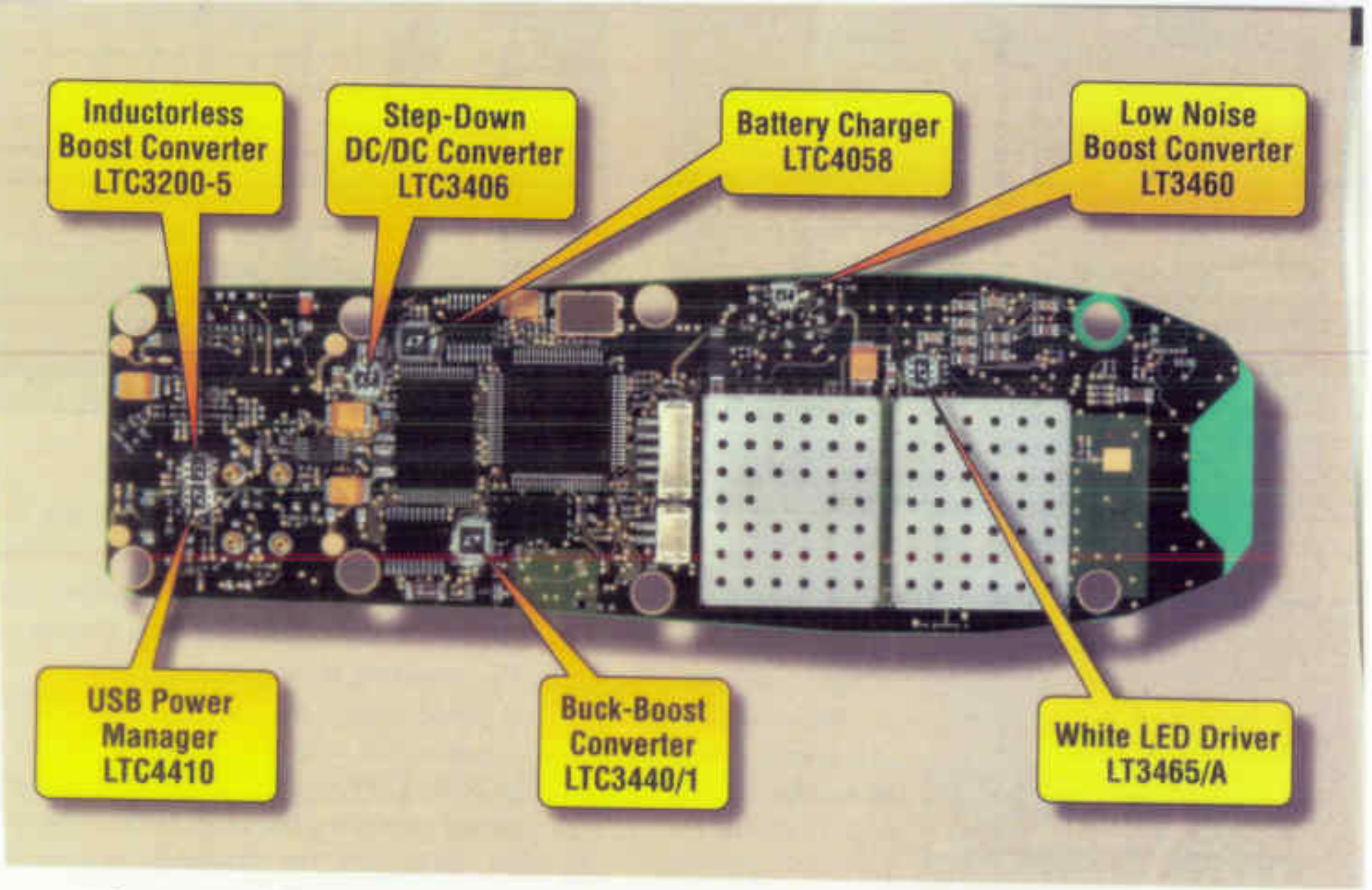
Power Electronics Technology Trend



Tiny & Efficient Power Solutions for Handheld Products

EXAMPLE OF A COMPLETE DIGITAL CAMERA POWER SUPPLY (CAN ALSO BE USED IN PDAs)

INPUT
0.7V TO 5.5V

1 chip
EIGHT OUTPUTS

MAX1800 STEP-UP MASTER
MAX1802 STEP-DOWN MASTER
32-PIN TQFP—5mm x 5mm*
7mm x 7mm x 1mm
(DIMENSION INCLUDES LEADS)

MAX1801 SLAVE CONTROLLER
8-PIN SOT23
2.8mm x 2.9mm

MAXIM
MAX1800
STEP-UP
MASTER

3.3V LOGIC

1.8V CORE

7V CCFL MODULE

15V
-7.5V
CCD BIAS

18V
12V
LCD BIAS

5V ZOOM MOTOR DRIVE (OPTIONAL)

MAXIM
MAX1801
SLAVE CONTROLLER

ADD UP TO FIVE SLAVE CONTROLLERS

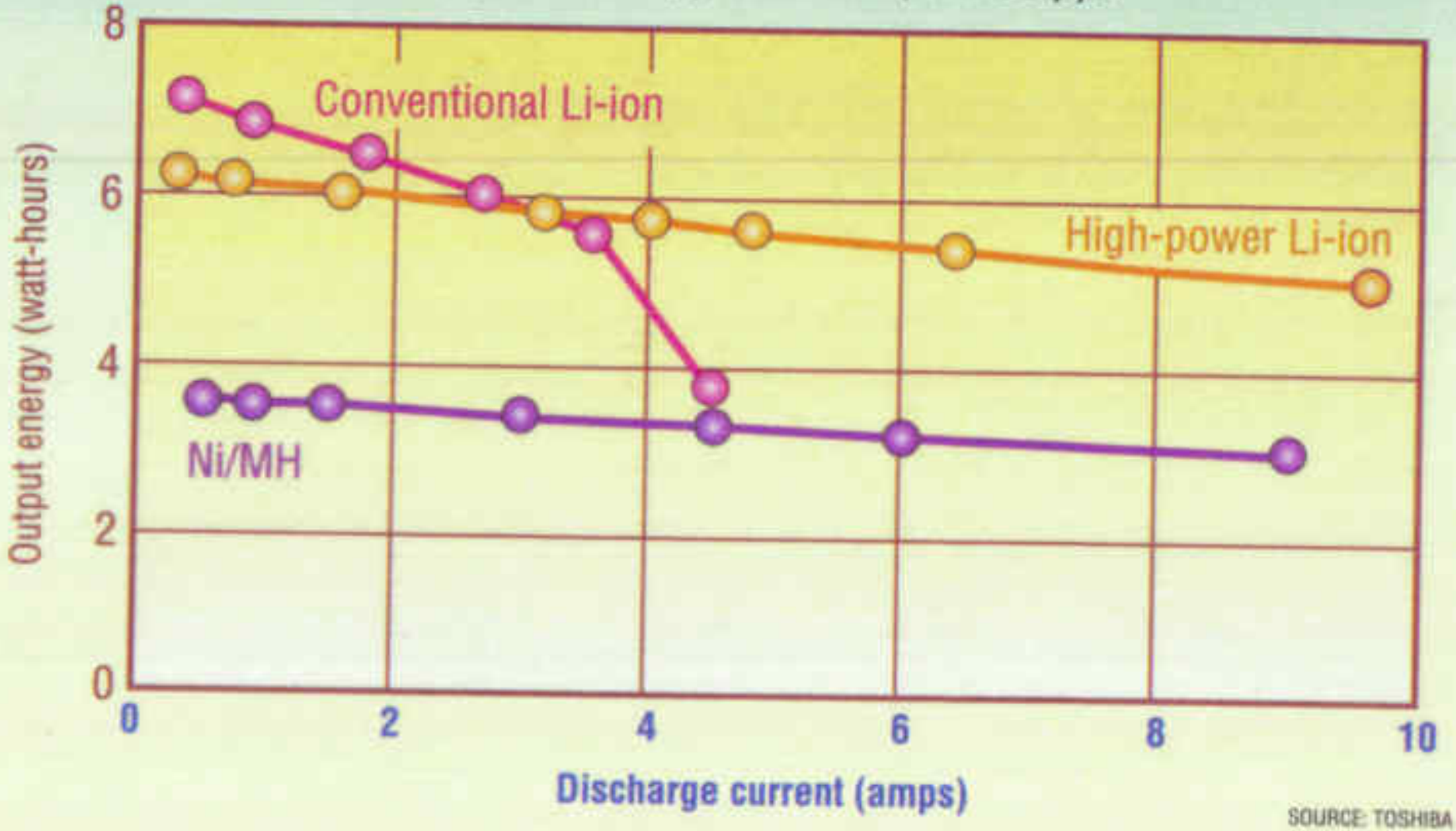
5V LENS COVER DRIVE (OPTIONAL)

1-, 2-, 3-, or 4-Cell Designs

MAX1800	MAX1802
Step-up, step-up/down	Step-down
0.7V to 5.5V input	2.5V to 11V input
One Li+, two or three alkaline	Two Li+, four alkaline
Internal step-up, three step-up controllers, LDO controller	Step-down controller, three step-up controllers, internal step-down

TOSHIBA BATTERY TRIPLES DISCHARGE CURRENT

Cell targets robots, power tools, other apps



SOURCE: TOSHIBA

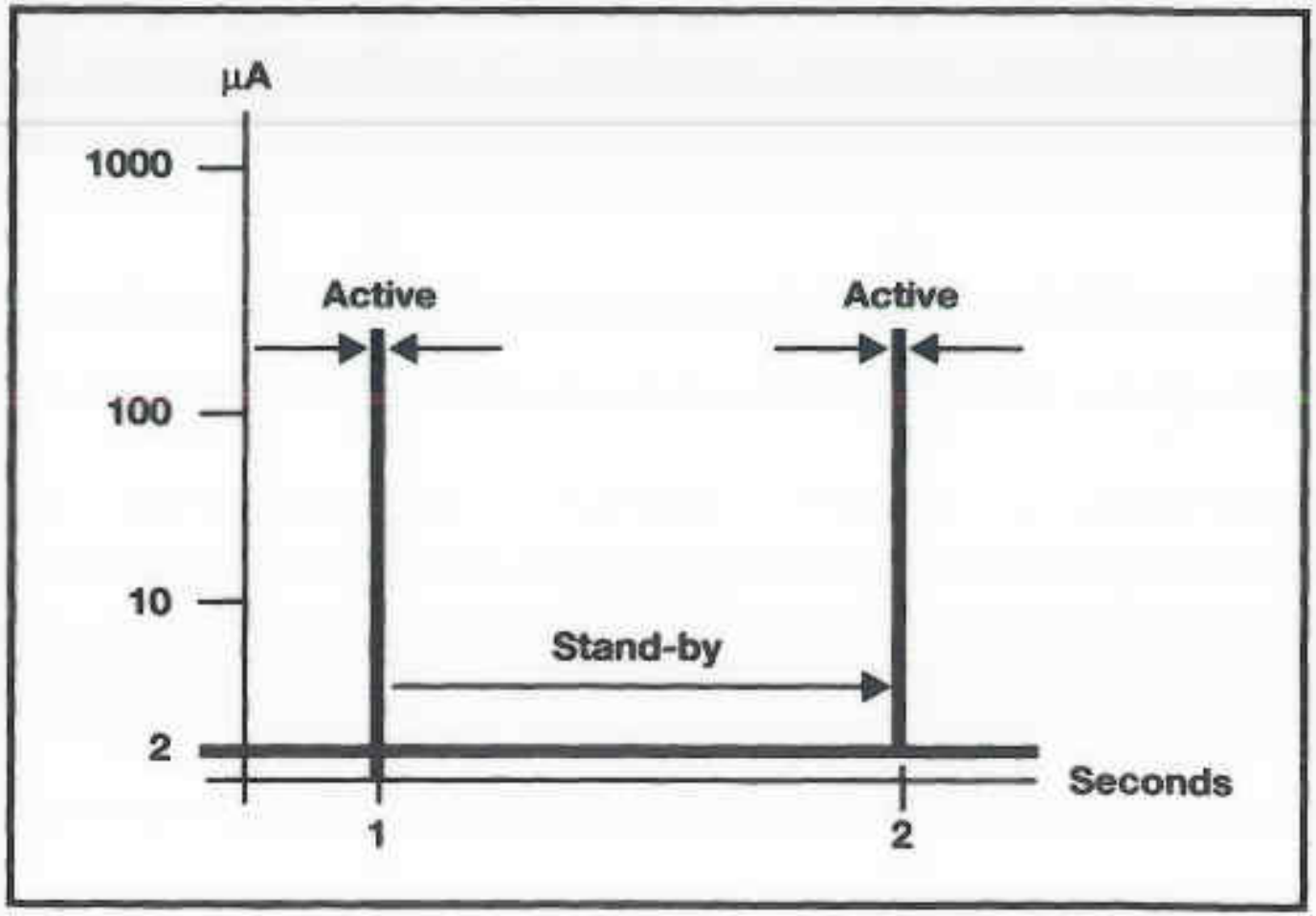


Figure 4: Ultra-low power activity profile maximizes time in standby modes waking the system quickly and only when required.

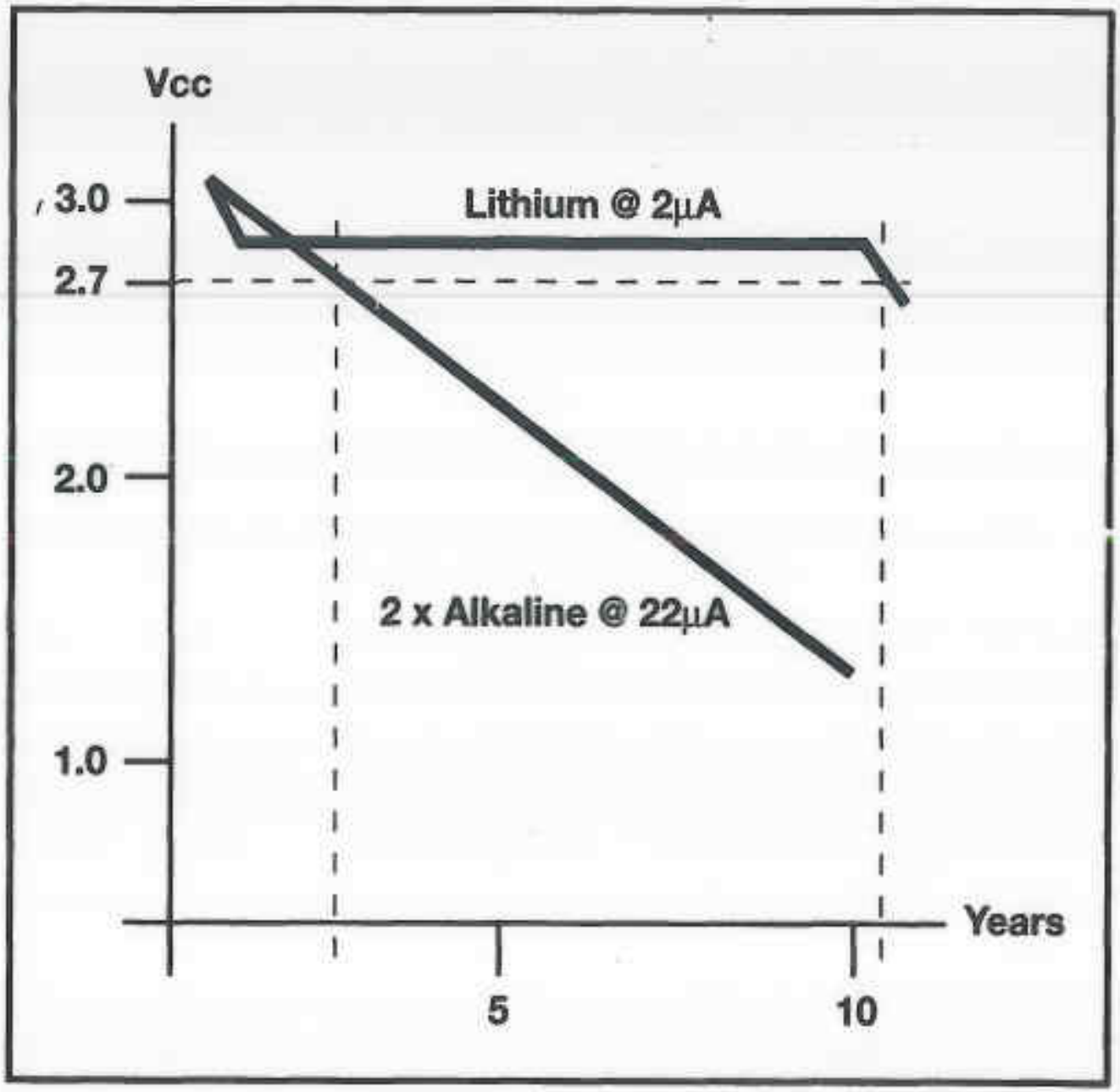


Figure 3: Comparison of alkaline and lithium battery discharge curves.

Paper Switched "C" Converters

C. THREE GENERAL TECHNOLOGIES

1. Linear Regulators

Employed where weight and heat flow are not crucial because design is fast and cost low. Efficiency is only 50 %

2. Pulsewidth modulated(PWM) converters

Employed in portable equipment or where high power flows demands the highest efficiency power conversion of about 95 %

3.RESONANT SWITCHED CONVERTERS

Utilized to achieve small size supplies and still avoid the electronic noise generated by PWM converters.

6 81
564

COMPARISION OF THE BIG THREE

power supply properties	LINEAR	PWM	RESONANT
Size and weight	Large	Small	Small
Electrical Efficiency	50%	85%	95%
Multiple Voltage outputs	Not Possible	Easily done	Easily done
NOISE Generated	Low Noise	High EMI	Medium Noise

We choose between the three approaches based upon the criterion for the system such as the four below:

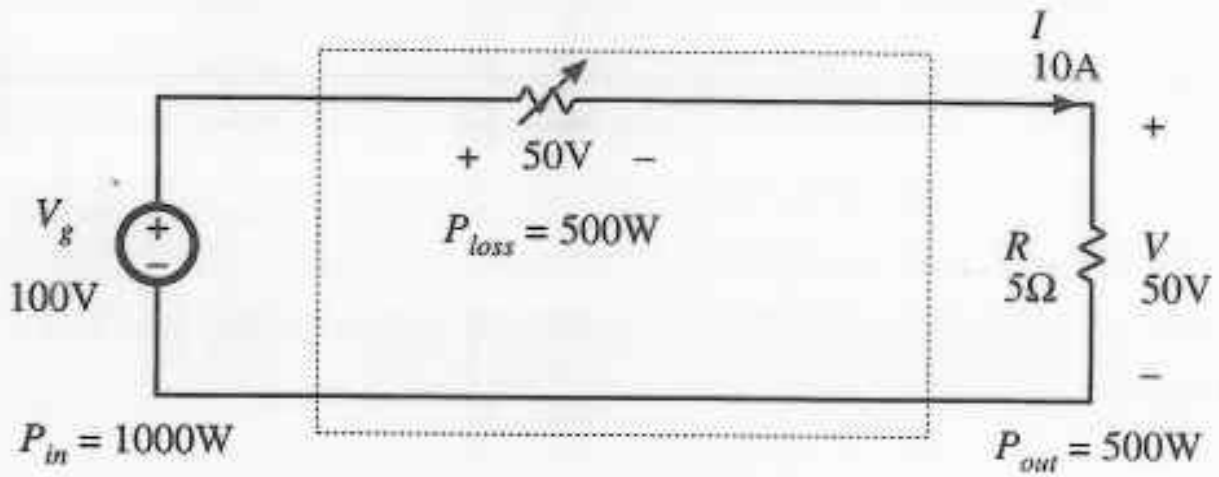
1. Power levels in and out and required operating efficiency to minimize heat generation

% Efficiency = P(out) / P(in)

2. Size and weight lim'ts as well as heat flow limits

Dissipative realization

Resistive voltage divider



High efficiency is essential

Battery

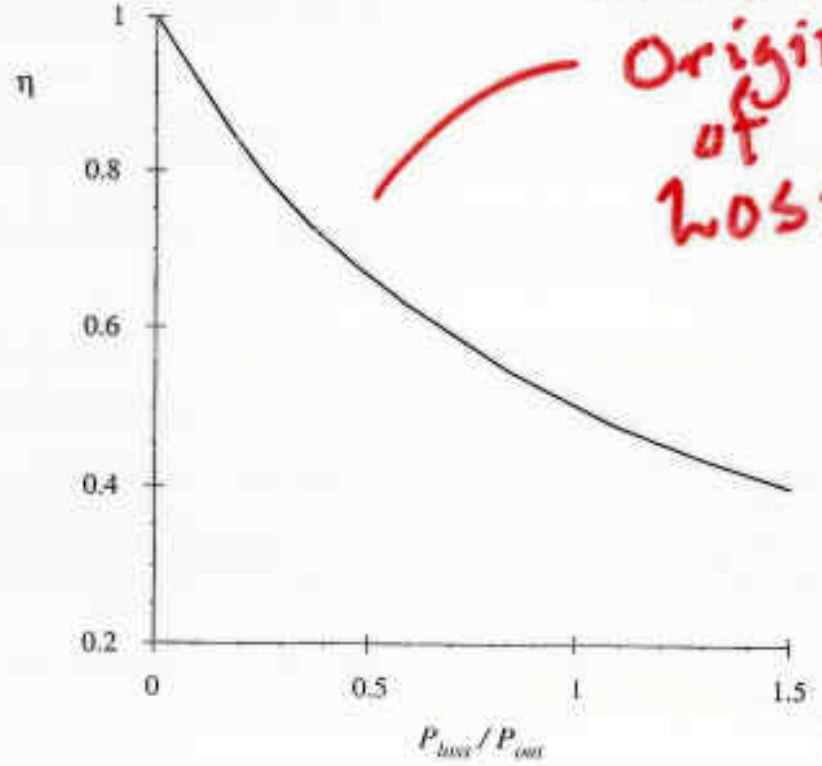
100 Kw

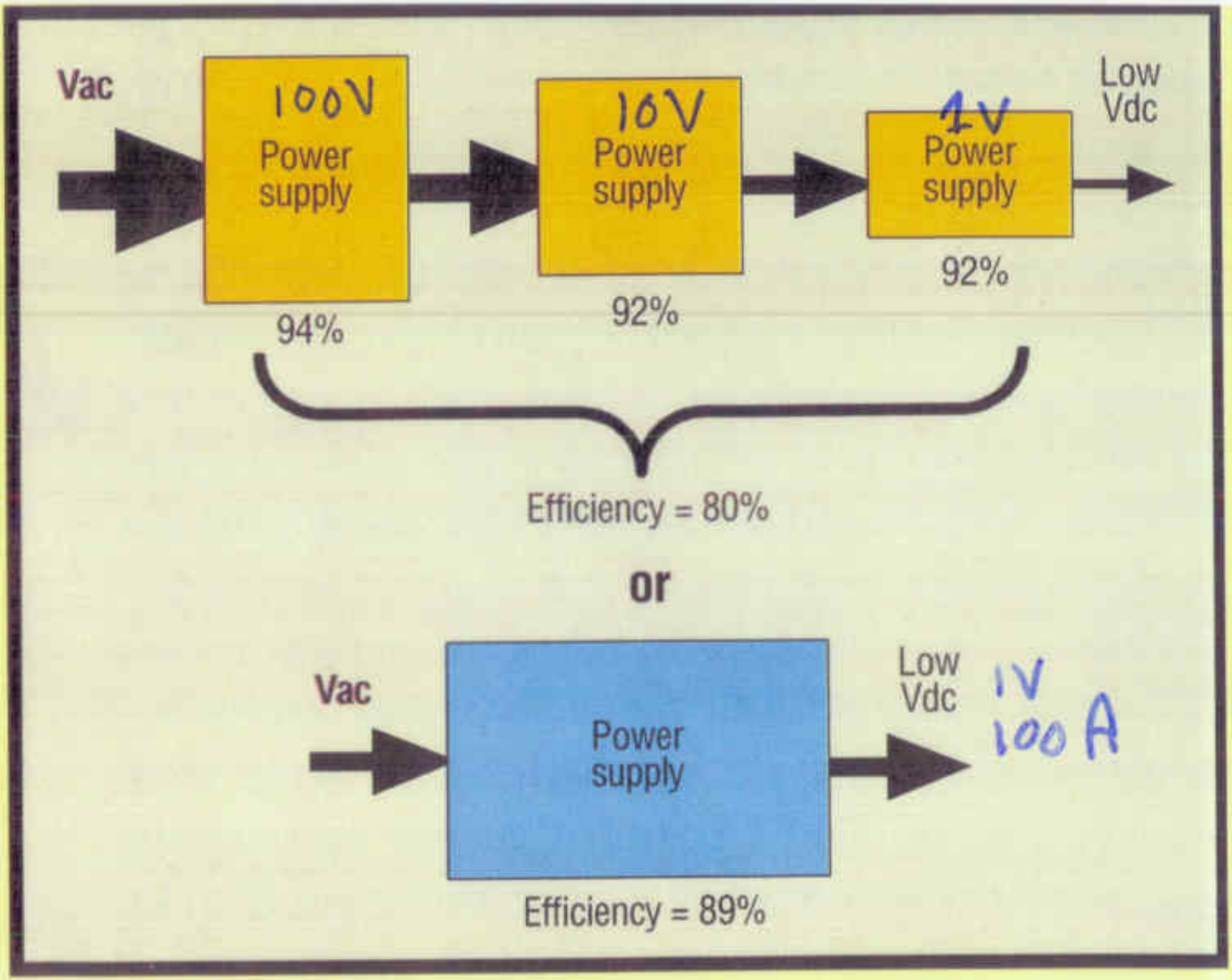
$$\eta = \frac{P_{out}}{P_{in}}$$

$$P_{loss} = P_{in} - P_{out} = P_{out}\left(\frac{1}{\eta} - 1\right)$$

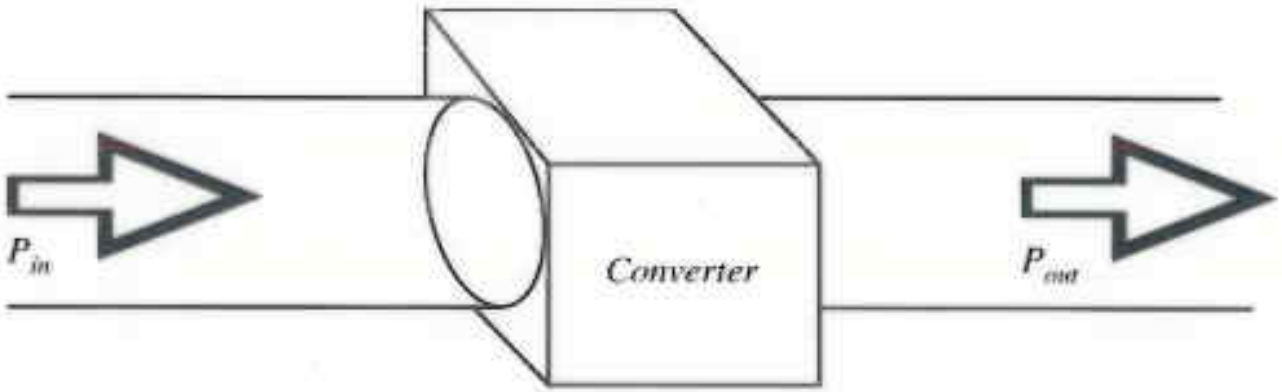
Ch 3 Origins of Loss

- High efficiency leads to low power loss within converter
- Small size and reliable operation is then feasible
- Efficiency is a good measure of converter performance




Vac
100V
Power supply
94%
16V
Power supply
92%
1V
Power supply
92%
Low Vdc
Efficiency = 80%
or
Vac
Power supply
Low Vdc
1V
100A
Efficiency = 89%

A high-efficiency converter



Goal

A goal of current converter technology is to construct converters of small size and weight, which process substantial power at high efficiency

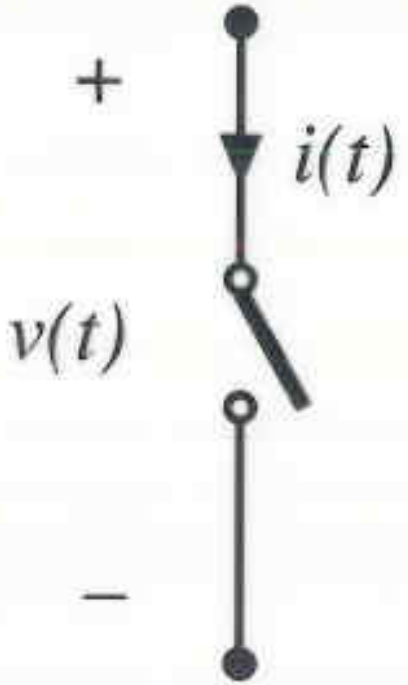
Power loss in an ideal switch

Switch closed: $v(t) = 0$

Switch open: $i(t) = 0$

In either event: $p(t) = v(t)\, i(t) = 0$

Ideal switch consumes zero power



Reality includes more