LENS DRIVERS

A New Family of Lens Drivers for Camera Devices of all kinds...
Camera Phone Forecast by Resolution

Camera Phones become “real” Cameras:

- MegaPixels
- Auto-Focus
Generic Block Diagram – Camera Device

Image Sensor
CCD / CMOS

Analog Front End

ISP / DSP

LENS DRIVER

Drivers
Power Management
Control

Signal Conditioning & Conversion

Focus
Zoom

Image Stabilization

Lens

Motor(s)
Voice Coil
Piezo
Stepper
DC Motor

Shutter
NDF
Iris/exposure
Lens Cover

Lens position, Light, Temperature

Gyro / Accelerometers

Flash
## Motor comparison

<table>
<thead>
<tr>
<th></th>
<th>Piezo motor</th>
<th>Voice Coil Motor (VCM)</th>
<th>Stepper motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy [mJ]</td>
<td>0.7</td>
<td>2.4</td>
<td>21</td>
</tr>
<tr>
<td>Speed, auto-focus [ms]</td>
<td>3</td>
<td>10</td>
<td>100</td>
</tr>
<tr>
<td>Volume [mm³]</td>
<td>15</td>
<td>100</td>
<td>54</td>
</tr>
<tr>
<td>Cost (motor + driver + other electronics)</td>
<td>2.2</td>
<td>2.1</td>
<td>4.0</td>
</tr>
</tbody>
</table>


Assumptions: Auto-Focus, single full scale travel, 0.3mm travel, 1% resolution of travel, 3V supply (8V for piezo)
Lens Driver Solutions for Camera Modules and Camera Phones

**AD5398** VCM driver for Auto-Focus
- Small: 1.5 x 1.7 mm
- Complete: no other components required
- No Noise: all DC (no PWM)
- High resolution: 10 bits
- High current: 120mA
- Low voltage: 2.5~5.5V

**AD5801** 8+1.5ch Piezo motor driver for AF, Zoom, etc
- Small: 3 x 3 mm
- Complete: fully integrated Power, Signal & Control
- Optimized for Piezo Motors
- Low voltage: 2.8~4.5V
- High performance: 0.5 ohm
- Complex: waveform generation, position control Focus, Zoom, Shutter and Iris outputs
Auto-Focus Application Circuit

Battery

ISP (DSP) as ISP, MMP, or in DBB

AD5398

VCM
AD5398 Programmable 120mA Current Sink

1st part in 1st generation of Lens Drivers

- 120mA Current Sink
- Fully integrated:
  - Current Sensing Resistor (3.3ohms)
  - Reference
  - Power-On Reset
- Low Voltage Battery operation:
  - 2.5V – 5.5V
  - (unregulated)
- Inductive Fly-back Protection diodes
- 10-bit control
- 8-lead LFCSP: 3x3mm
- Power Down: 80nA
- I2C interface – SPI TBD...

Designed for Voice Coil Motors with Spring-return controlling Focus (AF)
AD5800 Piezo/PWM Lens Driver for Auto-Focus and Optical Zoom

- Battery
- I2C
- Step-Up Converter
- Serial Interface & Digital
- ADC + sensor supply
- Piezo/PWM Drive
- Piezo/PWM Drive
- sensors
- ZOOM
- FOCUS
AD5800 Complex but Complete Solution

- **Lowest power**
  - IC and Motor/Actuator
  - Power management
- **System solution**
  - optimal system solution
  - Complete - has everything you need
- **Complex inside BUT easy-to-use**
  - evaluation boards, driver software, application notes available
  - Integrated control, temperature correction, travel optimization, compensation
- **Flexible**
  - pattern generator, voltage control, memory, register based
- **Maximum efficiency**