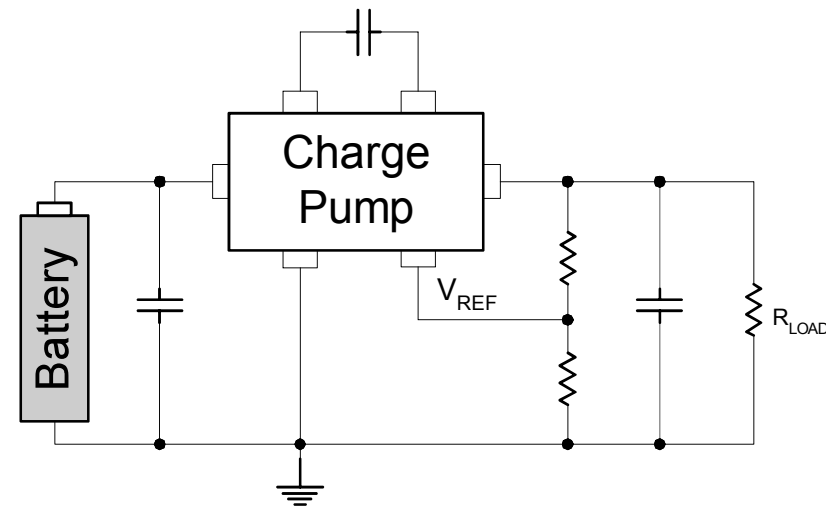


LED Drive Techniques

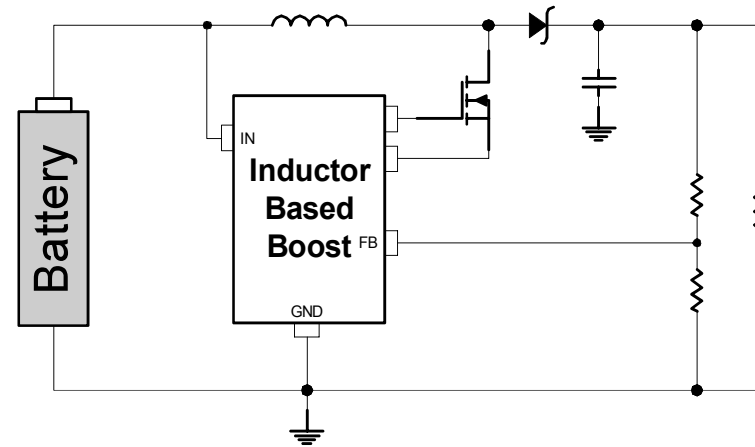
Charge Pump/Voltage Doubler

- Uses A Capacitor To Transfer Charge
- Advantages
 - Simple Implementation
 - Cheap
 - Few Components
- Disadvantages
 - Can Have Poor Efficiency
- Applications
 - Cell Phone, Few PDAs
- Number of LEDs driven dependant on output current.



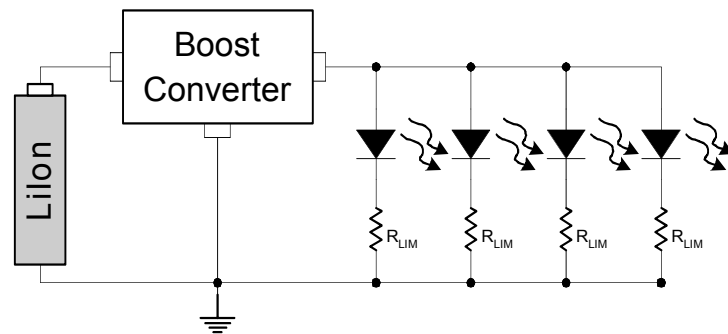
Inductor Based Boost Converter

- Uses Faraday Principle To Boost Output Voltage
- Advantages
 - Capable of Large Output Voltages
 - Efficient Conversion
- Disadvantages
 - Component Count
 - EMI/RFI
 - Cost
- Applications
 - PDA
- Number of LEDs driven dependant on output power capability.

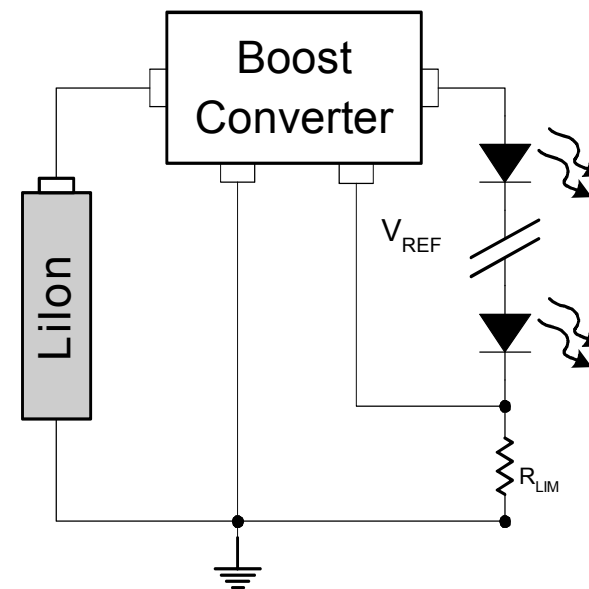


Two Drive Configurations

- Parallel Drive



- Series Drive

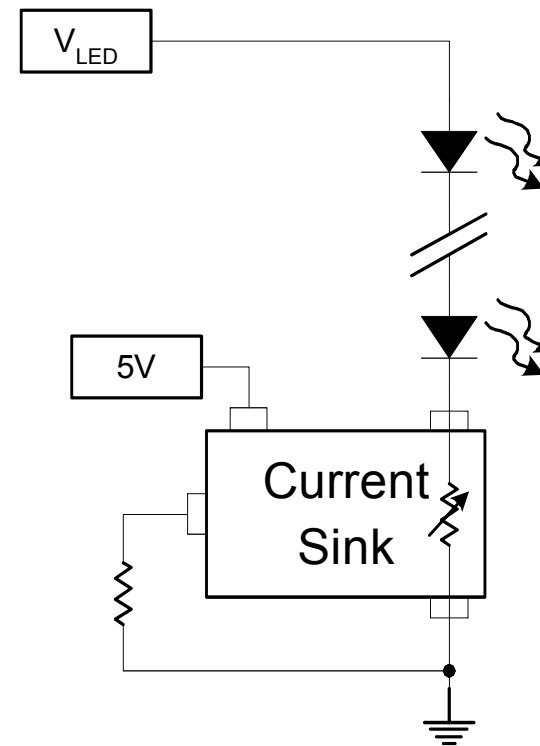


Pros/Cons of Configurations

- Parallel Drive
 - Less expensive
 - Less switching noise
 - Easier design
 - No Inductor/Lower Profile
 - Poor light output matching
 - Lower efficiency (25% less than series)
- Series Drive
 - Higher Efficiency
 - Perfect light output matching
 - Requires inductor
 - Slightly more expensive
 - Inductor dictates cost penalty

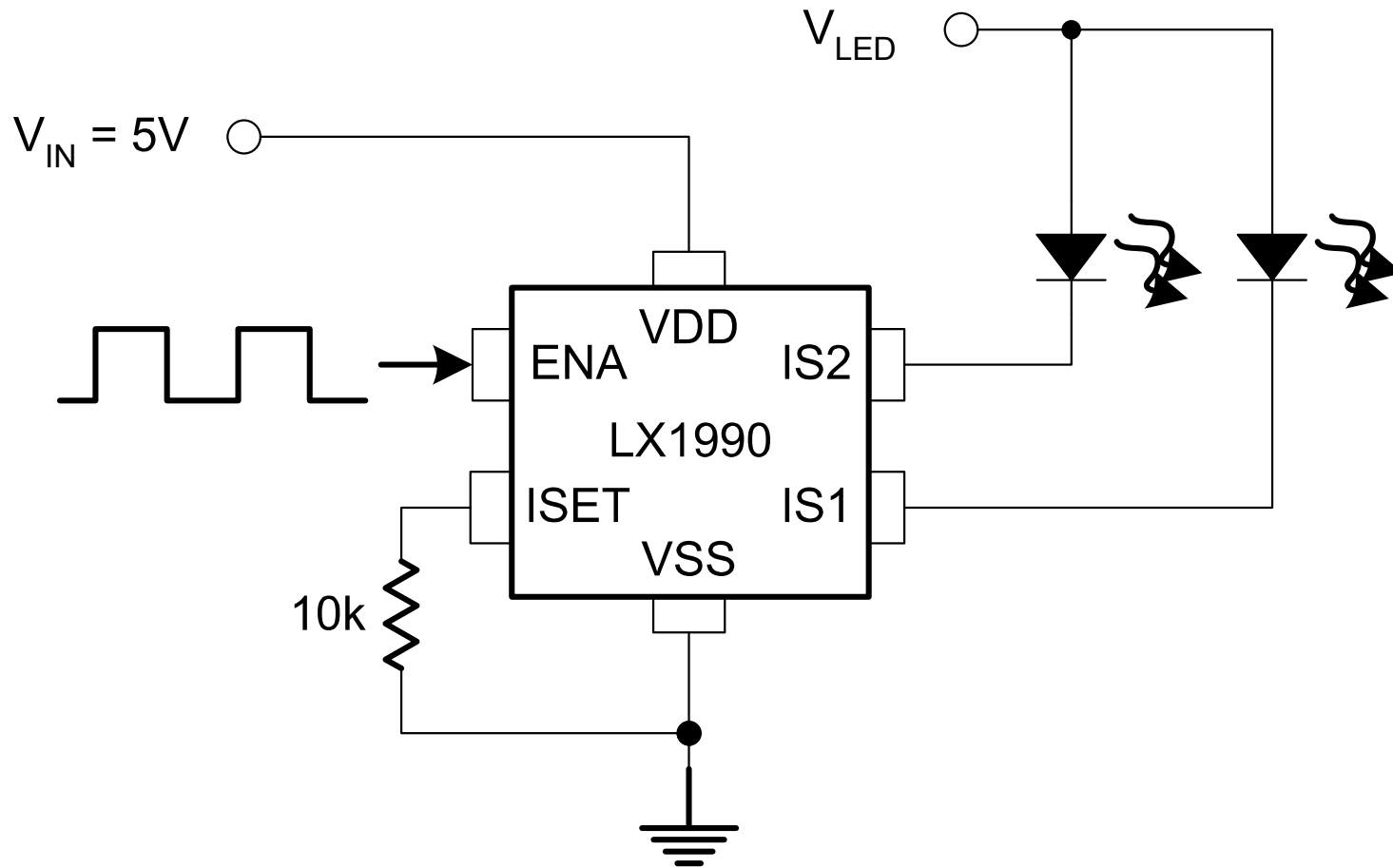
Current Sink/Regulator

- Adjusts Resistance To Maintain Set Current
- Advantages
 - Simple Implementation
 - Cheap
 - Few Components
- Disadvantages
 - Must have voltage supply already available.
- Applications
 - Cell phone, Signage, Auto, Anything



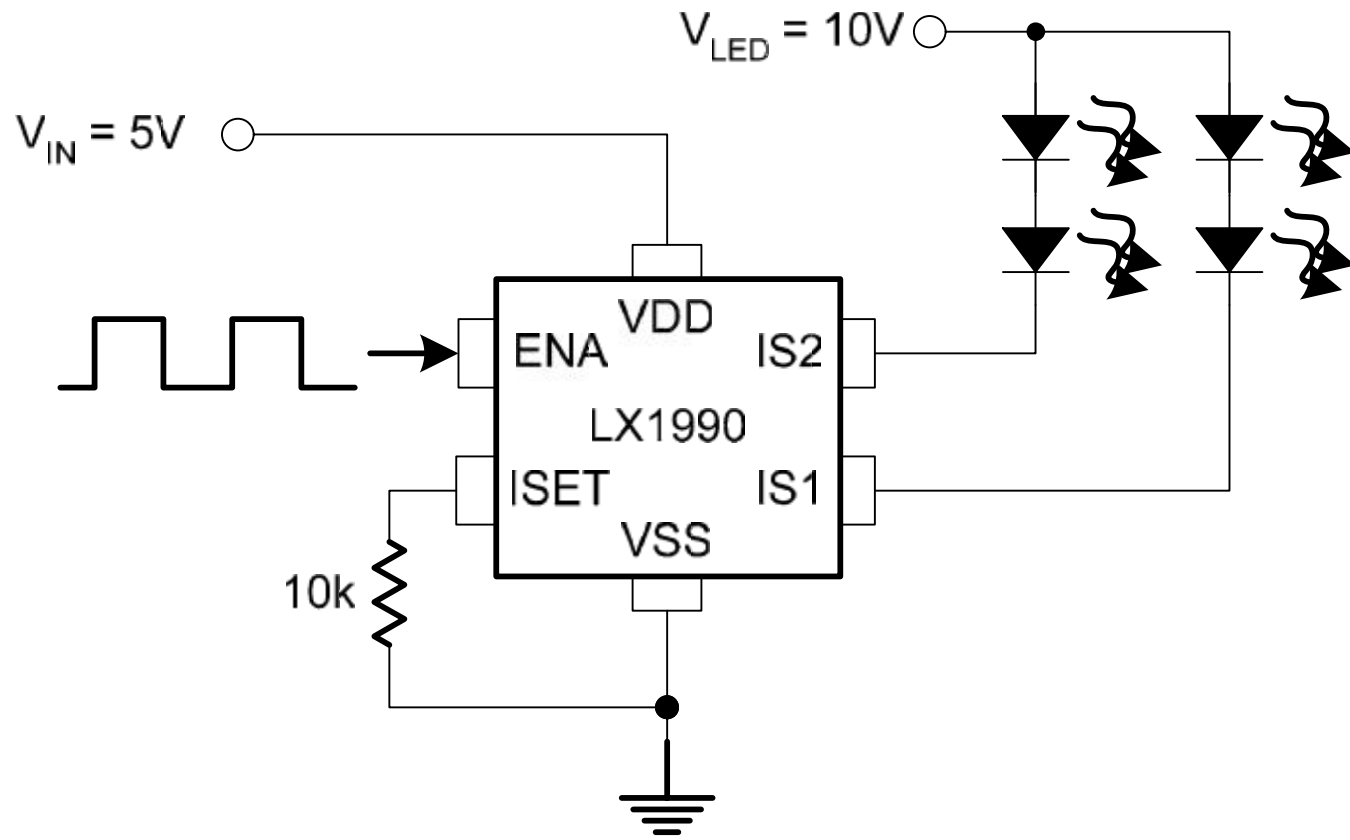


How Many LEDs Can The 1990 Drive?

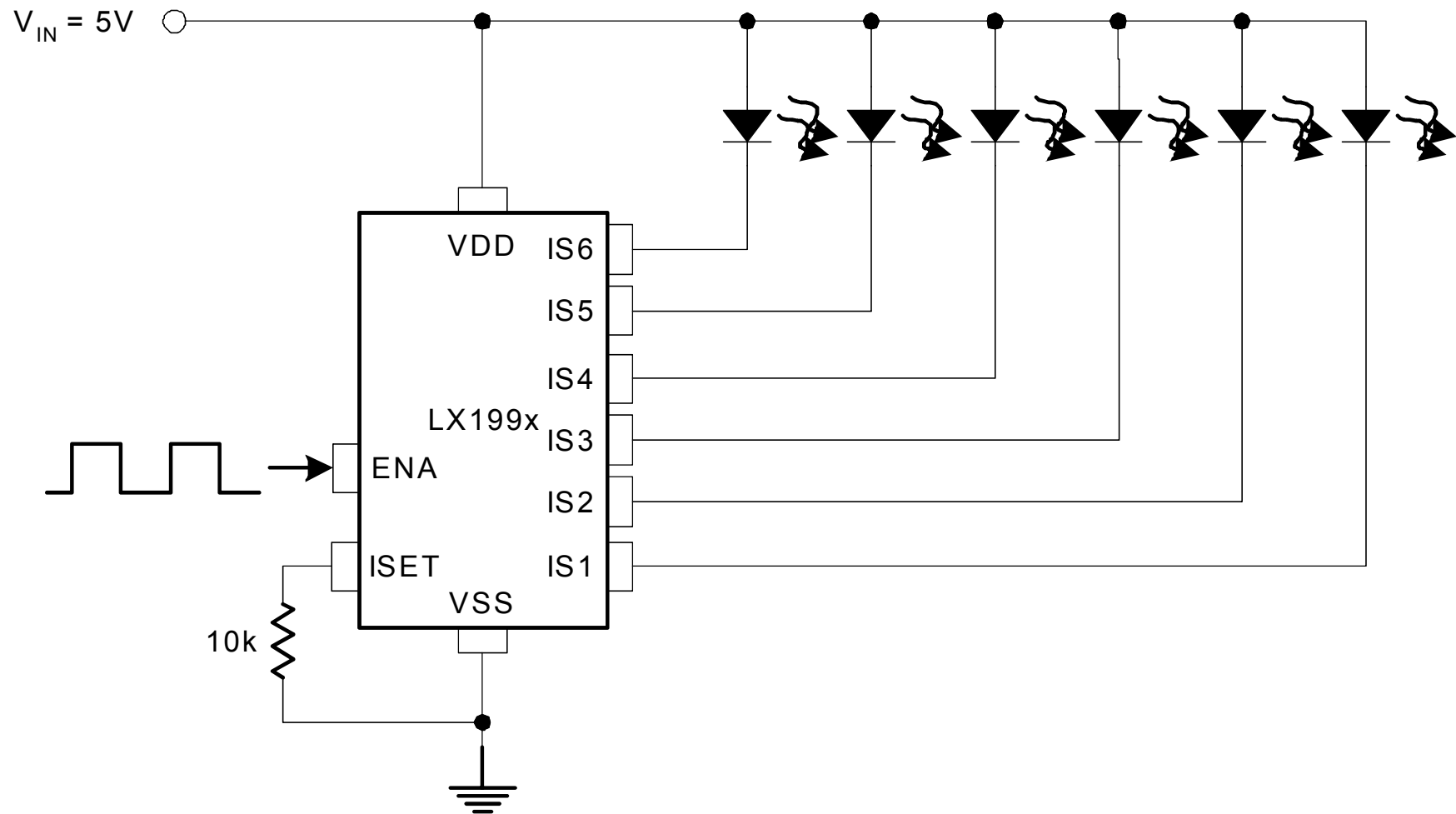




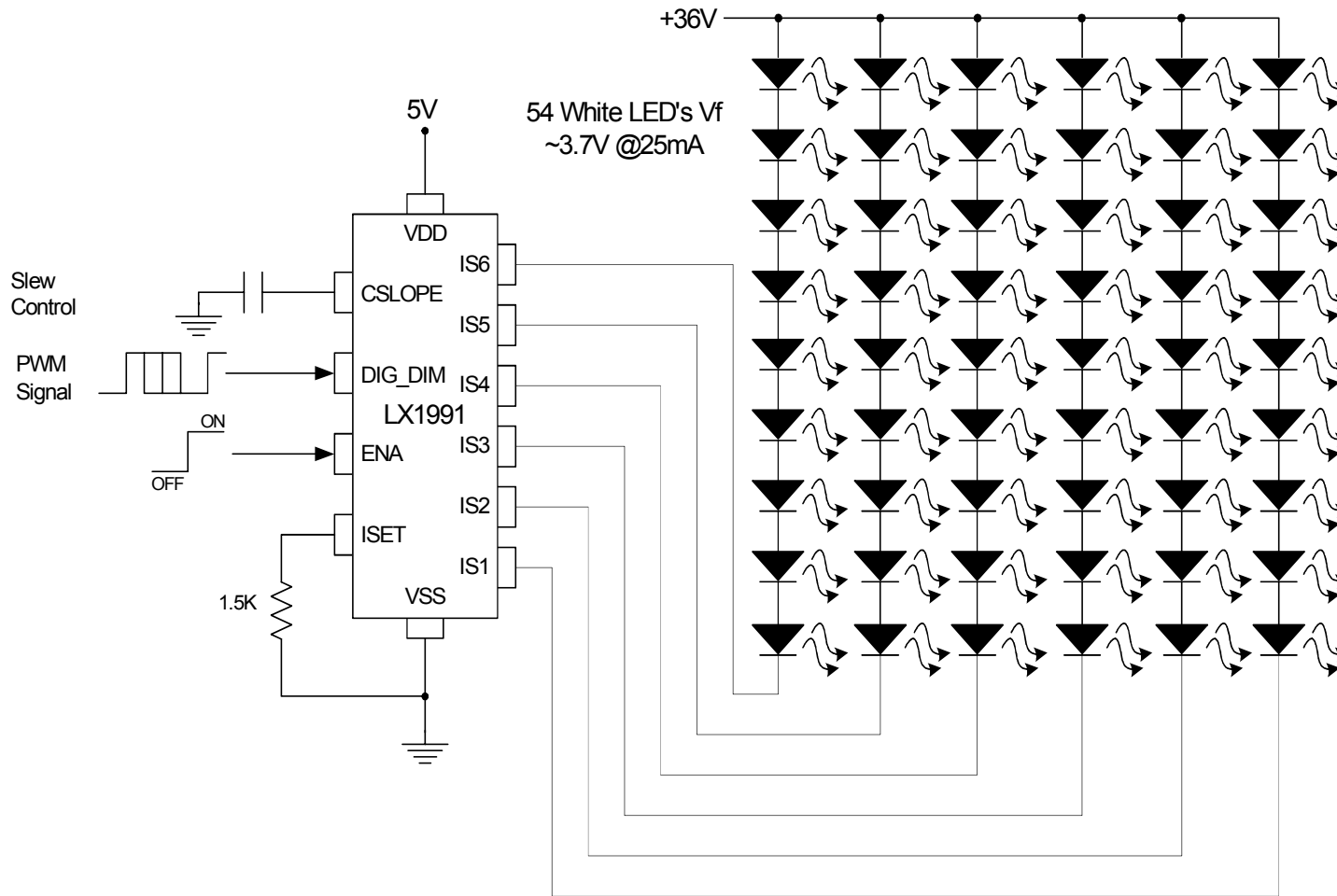
How Many LEDs Can The 1990 Drive?



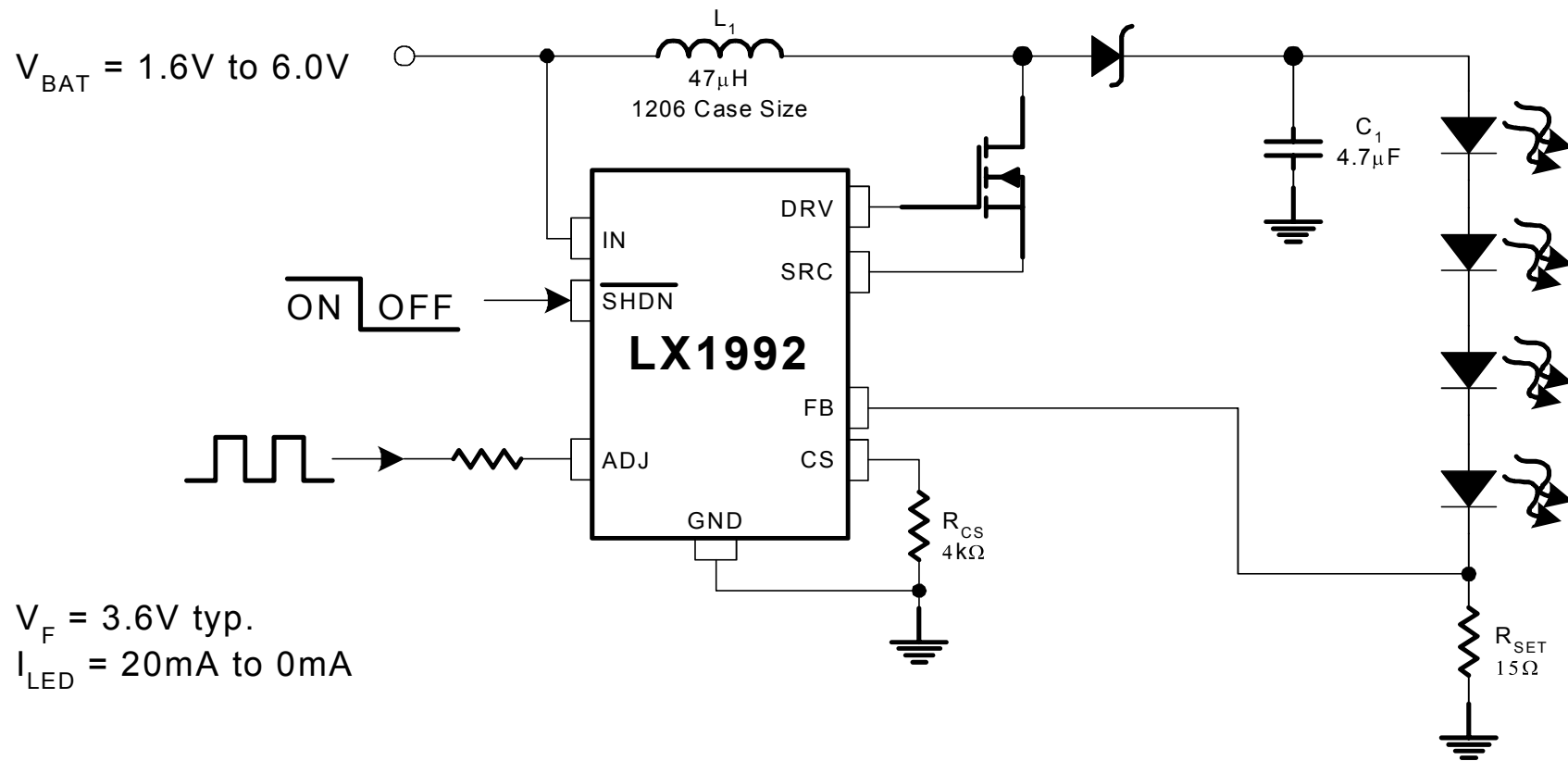
LX1991



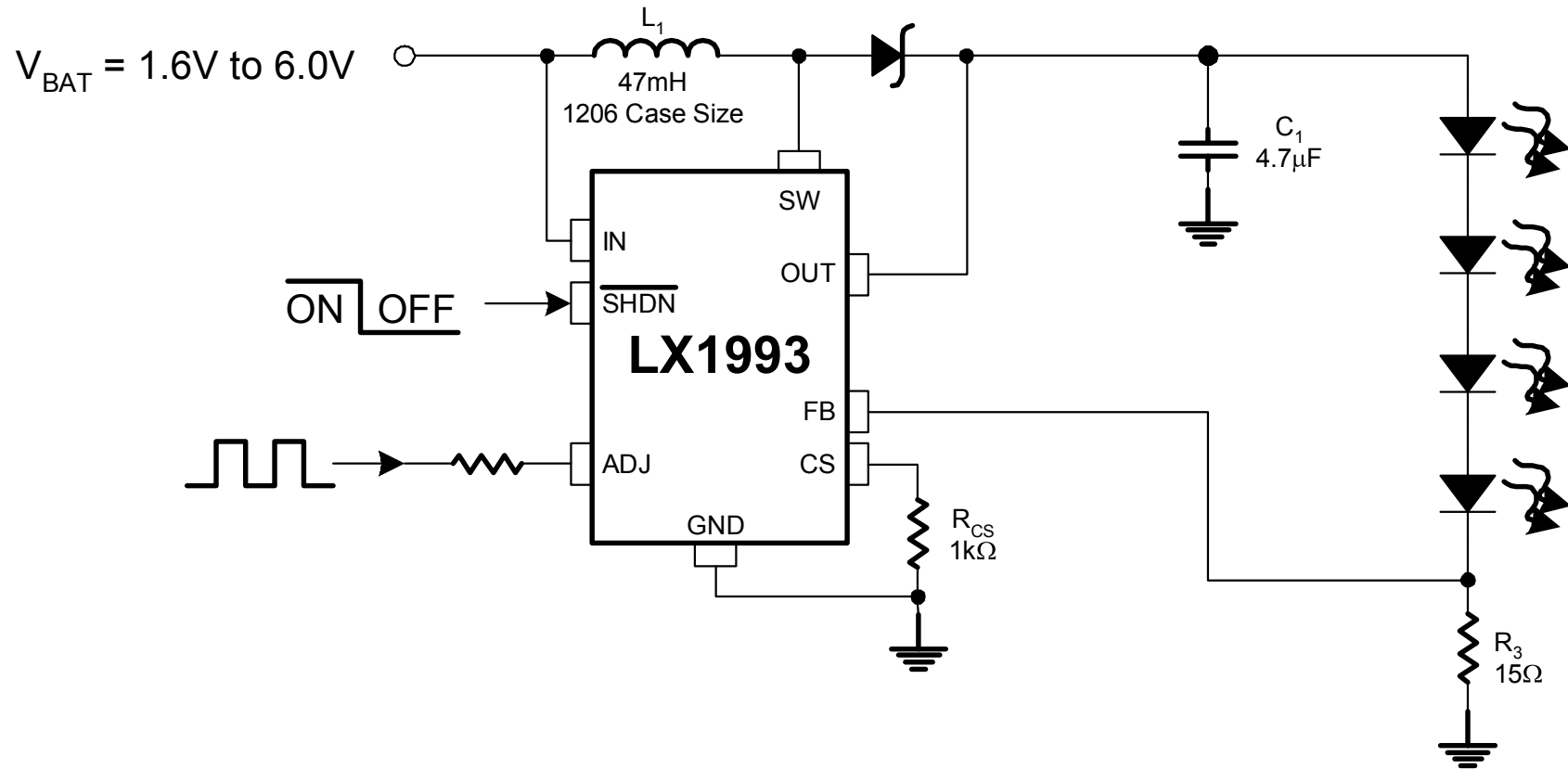
LX1991



LX1992



LX1993



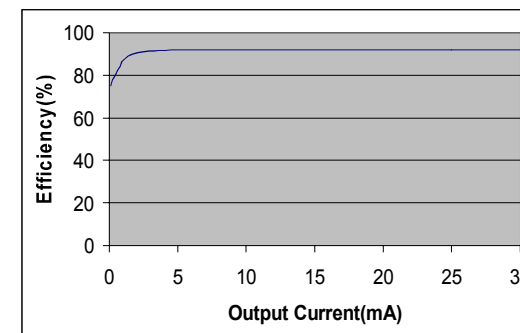
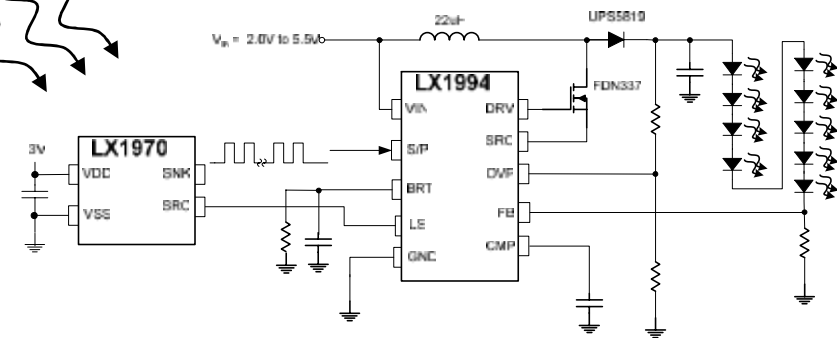
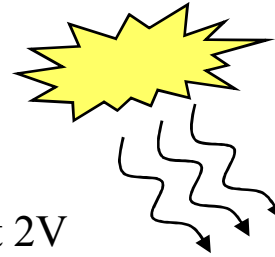
LX1994 – High efficiency LED Driver

- FEATURES

- Efficiency >92%
- Light sensor interface
- Vin range 2.7 V to 6V. Start up at 2V
- NEW !!! Dual Mode PFM architecture
- >1W drive at high efficiency
- Ext. N-MOSFET for >35V outputs
- OVP protection open string
- Logic Controlled Shutdown
- Typical $I_q < 180\mu\text{A}$
- Shutdown I_q current $< 1\mu\text{A}$
- Dual dimming options (DC or PWM)
- No external Zener clamp diode requires
- Tiny 10-Pin MLP or MSOP Package

- APPLICATIONS

- Pagers, PDAs
- Wireless Phones
- Handheld Displays



LX1995-x Small size

- FEATURES

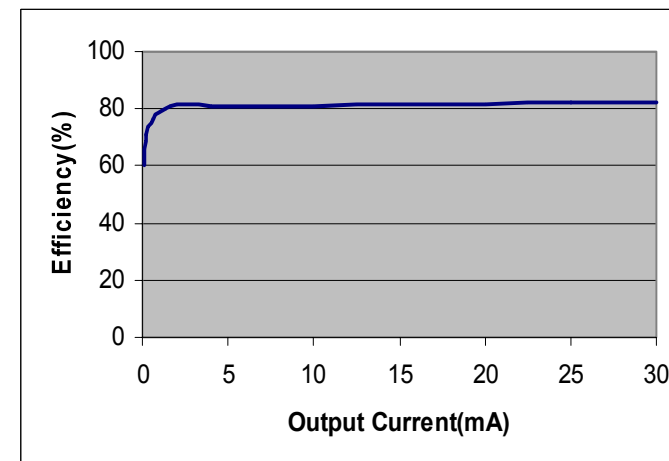
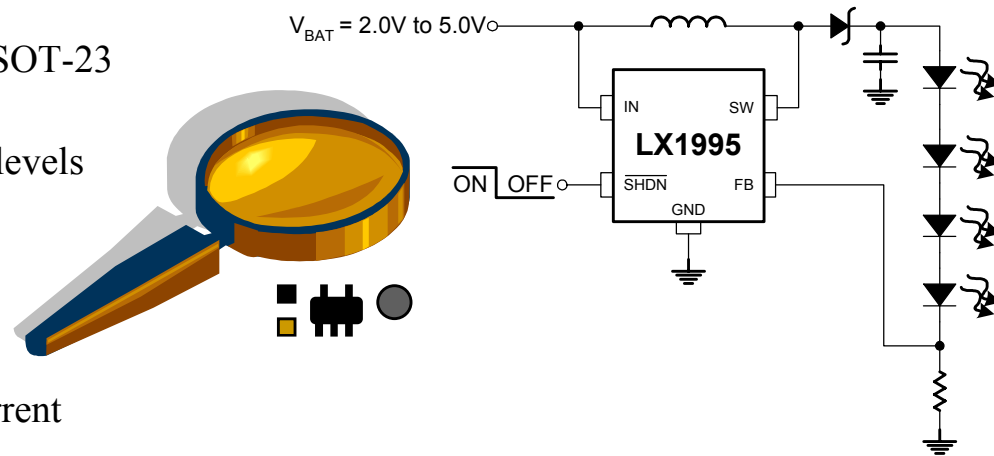
- Tiny 5-Pin TSOT Package or 5-Pin SOT-23
- Smallest L and C
- Efficient even at low output current levels
- Internal N-MOSFET
- Logic Controlled Shutdown
 - $< 1\mu\text{A}$ Shutdown Current
- $> 85\%$ Maximum Efficiency
- $70\mu\text{A}$ Typical Quiescent Supply Current
- Dimming options: PWM or DC
- Switching Frequency up to 2MHz
- LX1995-1 drives up to 6 LEDs
- LX1995-2 drive up to 10 LEDs

- APPLICATIONS

- Pagers, PDAs, GPS Receivers
- Wireless Phones, LED Driver
- Digital Camera Displays

- Availability

- Production - NOW





The Position - LED Drivers

- We have the highest efficiency down to the lowest cost.
- Automotive LED driver has EMI adjustment (LX1991)
- LX1995 is pin-compatible with LT1937
- Target
 - Every PDA/Handheld, Cell Phone, Automotive Display/Inst Cluster, Signage (Anyone interested in LEDs)