



FEATURES:

- Step Down DC/DC LED driver
- Constant current output
- Wide (4:1) input voltage range
- High efficiency up to 95%
- Operating Temperature range -40°C to +85°C
- Open and Short LED Protection
- PWM/Digital and Analog Voltage dimming
- Remote ON/OFF Control



Models
Single output

| Model | Input Voltage (V) | Output Voltage (V) | Output Current (mA) | Efficiency (%) | Package Type |
|--------------|-------------------|--------------------|---------------------|----------------|--------------|
| AMLDL-3030Z | 7-30 | 2-28 | 300 | 95 | DIP14 |
| AMLDL-3035Z | 7-30 | 2-28 | 350 | 95 | DIP14 |
| AMLDL-3050Z | 7-30 | 2-28 | 500 | 95 | DIP16 |
| AMLDL-3060Z | 7-30 | 2-28 | 600 | 95 | DIP16 |
| AMLDL-3070Z | 7-30 | 2-28 | 700 | 95 | DIP16 |
| AMLDL-30100Z | 7-30 | 2-28 | 1000 | 95 | DIP16 |

NOTE: All specifications in this datasheet are measured at an ambient temperature of 25°C, humidity<75%, nominal input voltage and at rated output load unless otherwise specified.

Input Specifications

| Parameters | Nominal | Typical | Maximum | Units |
|--|---|----------|---------|-------|
| Voltage range | 24 | 7-30 | | VDC |
| Filter | Capacitor | | | |
| Absolute Maximum Rating | | | 40 | VDC |
| Peak Input Voltage time | | | 500 | ms |
| DC/DC ON (Leave open if not used) | ON –Open or 0.3V<Vadj<1.25 | | | |
| DC/DC OFF | OFF(shutdown) – Vadj<0.15 | | | |
| Maximum Remote pin drive current | Vadj = 1.25V | | 1 | mA |
| Quiescent Current in Shutdown mode | Vin = 30V, Vadj <0.15 | | 0.25 | mA |
| On/Off Control (Digital Control) | Max PWM Frequency 1KHz | | | |
| Minimum Switch ON/OFF time | | 200 | | ns |
| On/Off Control (Analog Dimming Control) (Leave open if not used) | Input voltage range | 0.3-1.25 | | VDC |
| Drive with DC Voltage | 0.3V < VADJ<1.25V to adjust output current from 25% to 100% | | | |
| Output current adjustment* | Vin-Vout<20 | | | % |
| Control Voltage Range limits | ON – 0.2 – 0.3V (Vadj rise) | | | |
| | OFF – 0.15-0.25V (Vadj fall) | | | |
| Maximum Analog pin drive current | Vadj = 1.25V | 25-100 | 1 | mA |

Output Specifications

| Parameters | Conditions | Typical | Maximum | Units |
|---------------------------|---|---------|---------|--------|
| Current accuracy | | ±6 | | % |
| Output Voltage range | V input = 30V | 2-28 | | VDC |
| Output current | Vin – Vout >1.5V to 3V | | 300 | mA |
| Short Circuit protection | Regulated at the rated current for each model | | | |
| Output no load Protection | Continuously | | | |
| Max load capacitance | | | 47 | µF |
| Temperature coefficient | Ta = -40 to +85°C | ±0.05 | | %/°C |
| Ripple & Noise | 20MHz Bandwidth | 250 | | mV p-p |

General Specifications

| Parameters | Conditions | Typical | Maximum | Units |
|-----------------------|------------|-------------|---------|-------|
| Switching frequency | 100% load | 40 - 380 | | KHz |
| Operating temperature | | -40 to +85 | | °C |
| Storage temperature | | -40 to +125 | | °C |

General Specifications (continued)

| Parameters | Conditions | Typical | Maximum | Units |
|-------------------------------|--|---------------------------|--------------------------|-------|
| Maximum case temperature | | | 100 | °C |
| Thermal Impedance | Free air convection | +40 | | °C/W |
| Cooling | | Free air convection | | |
| Humidity | | | 95 | % RH |
| Case material | Non-Conductive Black Plastic (UL94-V0 rated) | | | |
| Weight | | 2.6 (DIP14) | | g |
| | | 6.2 (DIP 16) | | |
| Dimensions (L x W x H) | DIP 14 | 0.80 x 0.40 x 0.27 inches | 20.32 x 10.16 x 6.88 mm | |
| | DIP 16 | 0.80 x 0.40 x 0.40 inches | 23.37 x 13.97 x 10.16 mm | |
| MTBF | > 500 000hrs (MIL-HDBK-217 F at +25 °C) | | | |
| Maximum Soldering Temperature | 1.5mm from case for 10sec. | | 260 | °C |

NOTES:

- 1.Reversed polarity at the input power will damage the driver. The input ground must not be connected to the negative output.
- 2.Leave the pin VADJ opened if not used , grounding VADJ will shut the driver off, connecting VADJ to +Vin will damage the driver.
- 3.Maximum output open voltage is equal to input voltage

Safety Specifications

| Parameters | |
|------------------|--|
| Agency approvals | CE |
| Standards | EN 55015 (CISPR22) IEC 61000-4-2 (Perf. Criteria A) IEC 61000-4-3 (Perf. Criteria A) IEC 61000-4-4 (Perf. Criteria A) IEC 61000-4-6 (Perf. Criteria A) IEC 61000-4-8 (Perf. Criteria A) |

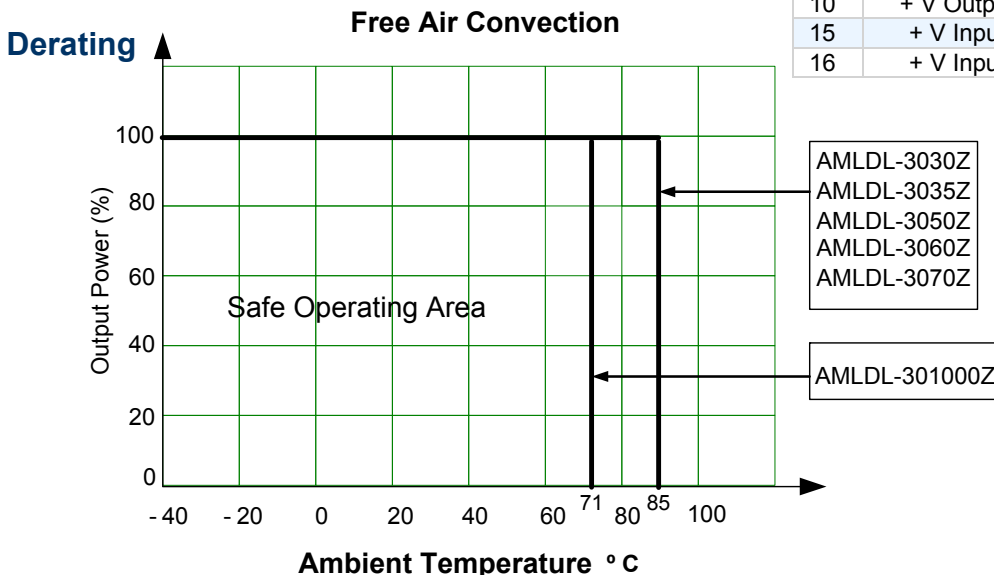
Pin Out Specifications

DIP 14

| Pin | Single | |
|-----|------------|------------------------|
| 1 | - V Input | - DC Supply |
| 2 | Vadj | PWM/ON/OFF or not used |
| 7 | - V Output | LED Cathode connection |
| 8 | + V Output | LED Anode connection |
| 14 | + V Input | + DC Supply |

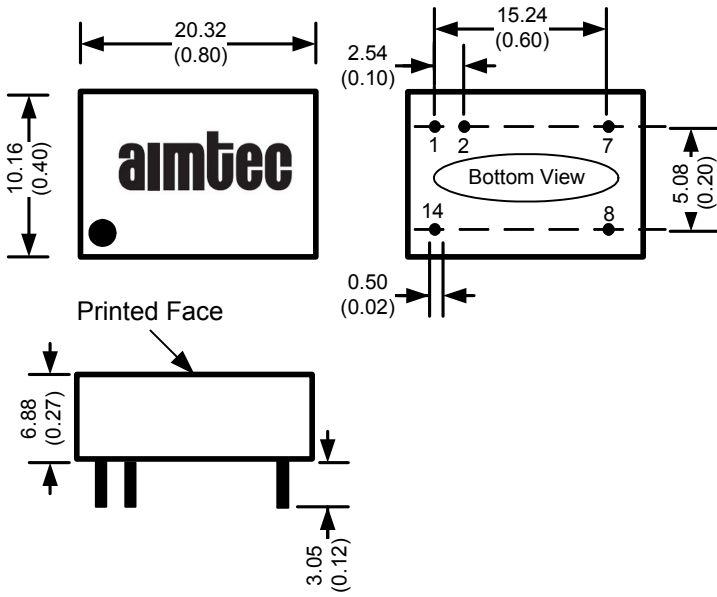
DIP 16

| Pin | Single | |
|-----|------------|------------------------|
| 1 | - V Input | - DC Supply |
| 2 | - V Input | - DC Supply |
| 3 | Vadj | PWM/ON/OFF or not used |
| 7 | - V Output | LED Cathode connection |
| 8 | - V Output | LED Cathode connection |
| 9 | + V Output | LED Anode connection |
| 10 | + V Output | LED Anode connection |
| 15 | + V Input | + DC Supply |
| 16 | + V Input | + DC Supply |

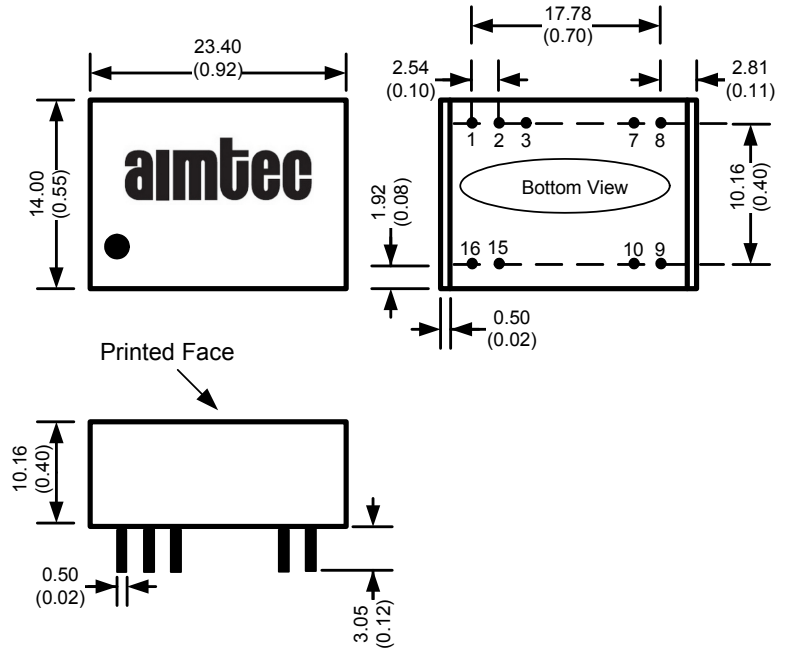


Dimensions

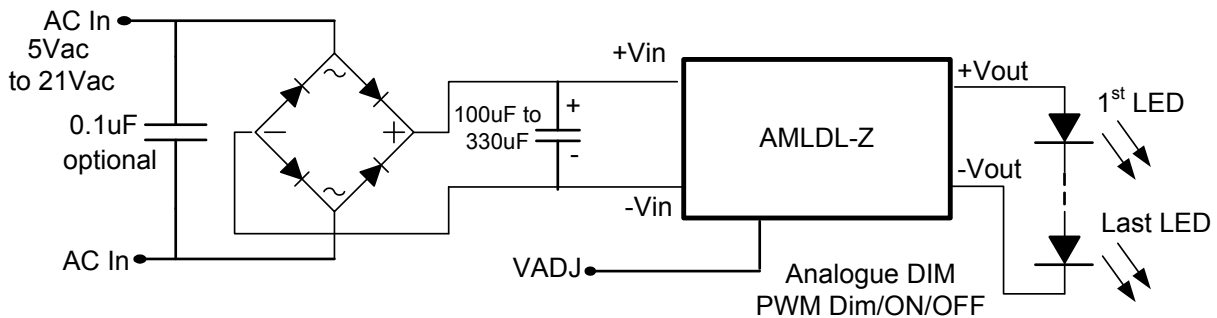
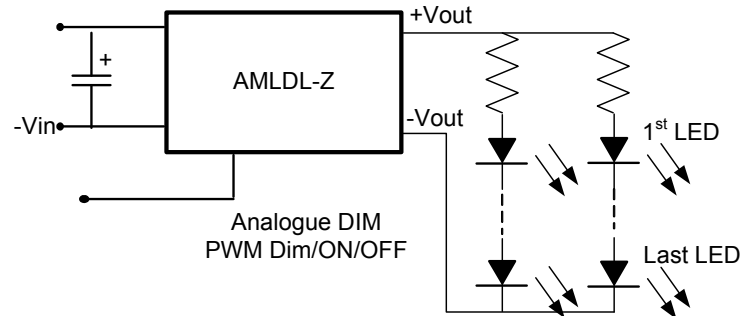
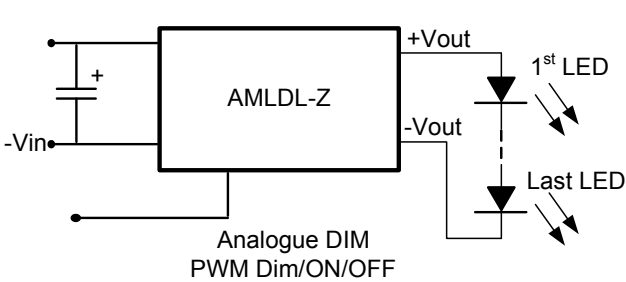
DIP 14: AMLDL-3030Z & AMLDL3035Z



DIP 16: AMLDL-3050Z, AMLDL-3060Z, AMLDL-3070Z, AMLDL-30100Z



Application circuit examples:

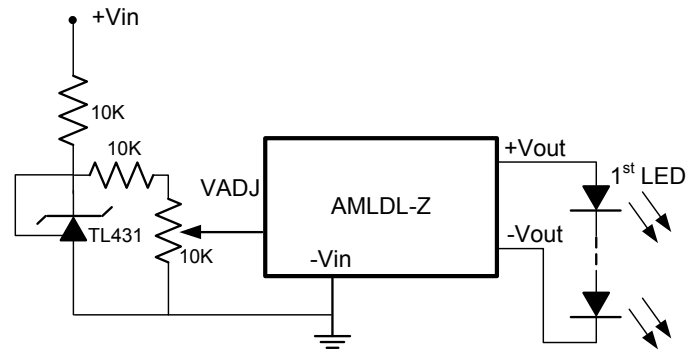
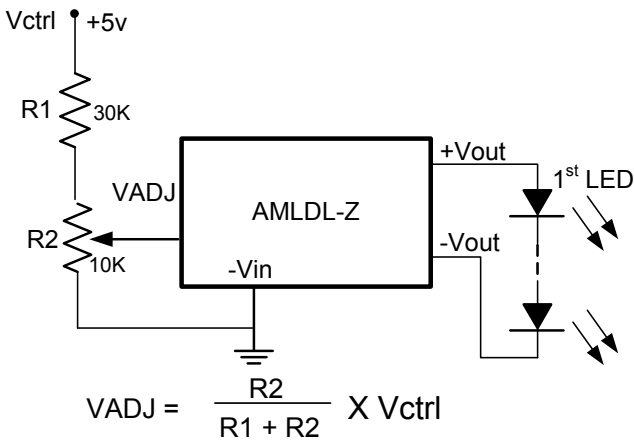
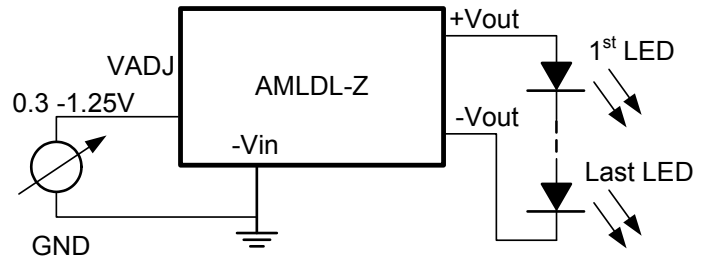


Output Current Adjustment by External DC Control Voltage:

The nominal output current is given by:

$$I_{out} \sim \frac{0.08 \times V_{adj}}{X}$$

| Model Number | X |
|--------------|--------|
| AMLDL-3030Z | 0.327 |
| AMLDL-3035Z | 0.280 |
| AMLDL-3050Z | 0.197 |
| AMLDL-3060Z | 0.165 |
| AMLDL-3070Z | 0.1388 |
| AMLDL-30100Z | 0.095 |



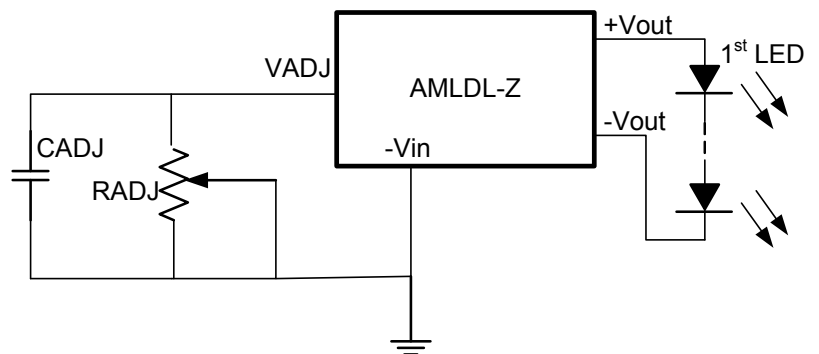
Resistive Dimming Control

A simplified dimming control can be achieved using a variable resistor connected between VADJ and GND. Capacitor CADJ is optional, it is installed to limit AC mains interference and high frequency noise. The recommended value of CADJ is 0.22µF.

The nominal output current is given by:

$$I_{outnom} = \frac{I_{out} \times R_{adj}}{R_{adj} + 200K}$$

NOTE: Typical error is ±10% with resistive dimming control



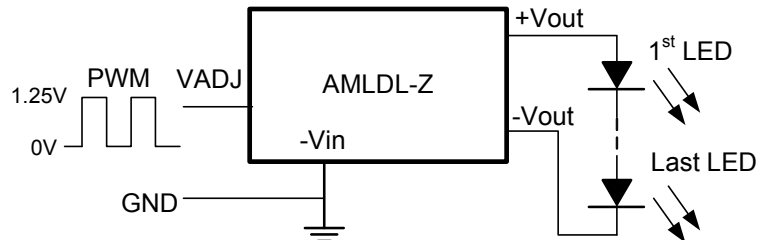
Output Current Adjustment by PWM Control: Driving VADJ Directly

A Pulse Width Modulated (PWM) signal with a duty cycle of DPWM can be applied directly to VADJ pin as shown below.

The output current is given by:

$$I_{out} \sim \frac{0.1 \times DPWM}{X} \quad [\text{for } 0 < DPWM < 1]$$

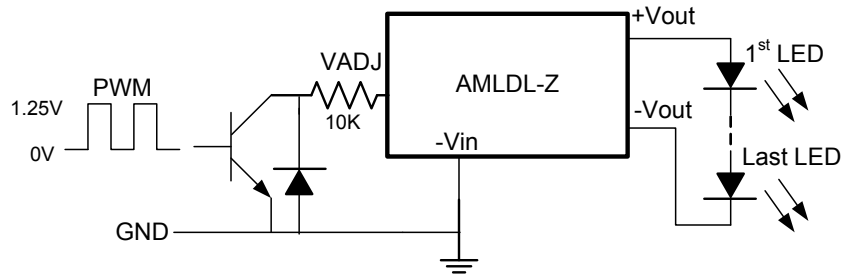
| Model Number | X |
|--------------|--------|
| AMLDL-3030Z | 0.327 |
| AMLDL-3035Z | 0.280 |
| AMLDL-3050Z | 0.197 |
| AMLDL-3060Z | 0.165 |
| AMLDL-3070Z | 0.1388 |
| AMLDL-30100Z | 0.095 |



Driving VADJ Via Open Collector Transistor

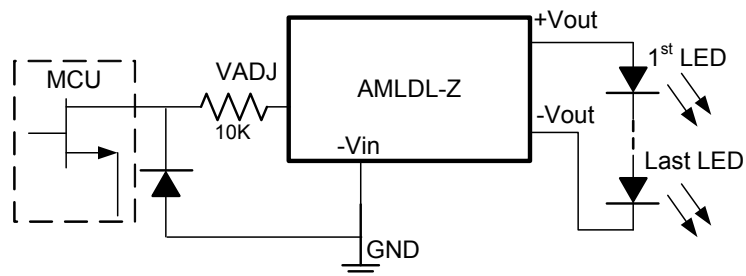
The VADJ can also be driven via an open collector transistor as shown below.

The diode and resistor serve to suppress any possible high amplitude negative voltage spikes to the VADJ input resulting from the collector to emitter capacitance of the transistor. Any negative voltage spikes will cause errors in output current and/or unstable driver operation.



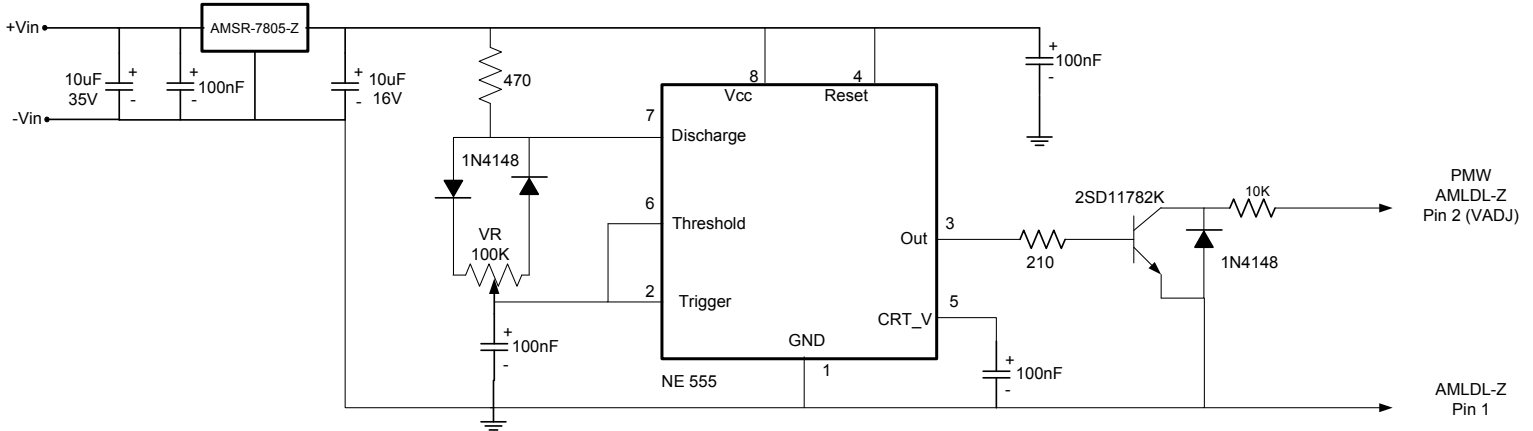
Driving the VADJ from a Microcontroller

The VADJ can be driven from an open drain output of a microcontroller as shown below. The diode and resistor serve to suppress any possible high amplitude negative voltage spikes to the VADJ input resulting from the drain to source capacitance of the FET. Any negative voltage spikes will cause errors in output current and/or unstable driver operation.

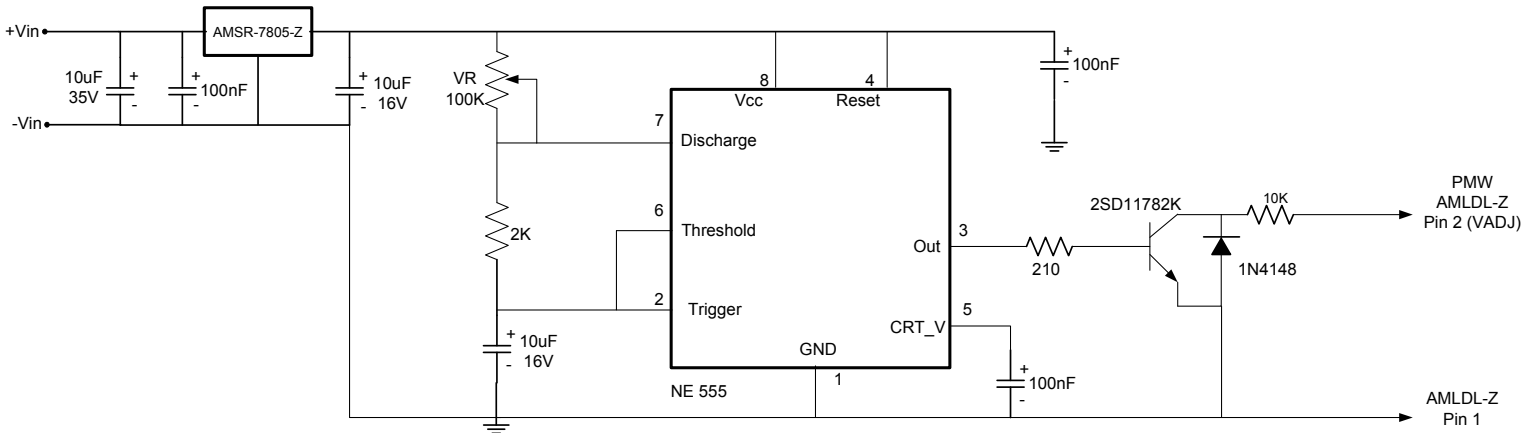


Output Current Adjustment by PWM Control (Dimming):

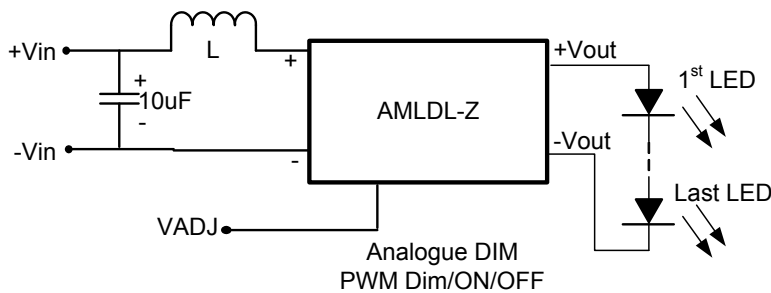
A PWM signal must have a frequency of greater than 100Hz to prevent any visible flicker.



Output Current Adjustment by PWM Control (Flash):

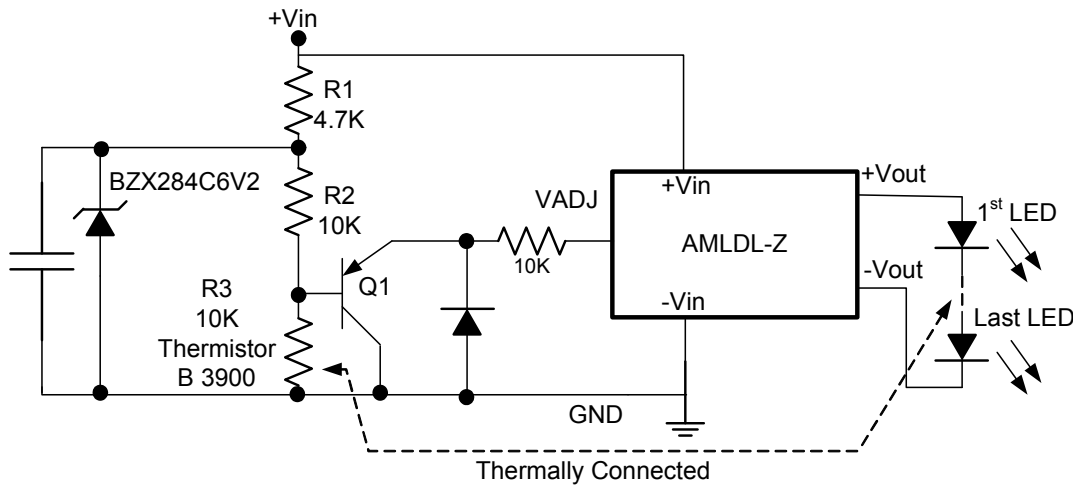


Recommended Class B EMI Filter:



| Model Number | Inductor Value (µH) |
|--------------|---------------------|
| AMLDL-3030Z | 68 |
| AMLDL-3035Z | 68 |
| AMLDL-3050Z | 27 |
| AMLDL-3060Z | 27 |
| AMLDL-3070Z | 27 |
| AMLDL-30100Z | 27 |

Thermal Feedback Circuit



The selection of components for the thermal feedback circuit is depends on the choice of R2 and R3 and the effectiveness of the LED heatsink. To optimize the LED brightness control at high temperatures, the LEDs must have a sufficient thermal extraction path, if not the reduction in drive current will not be optimal.

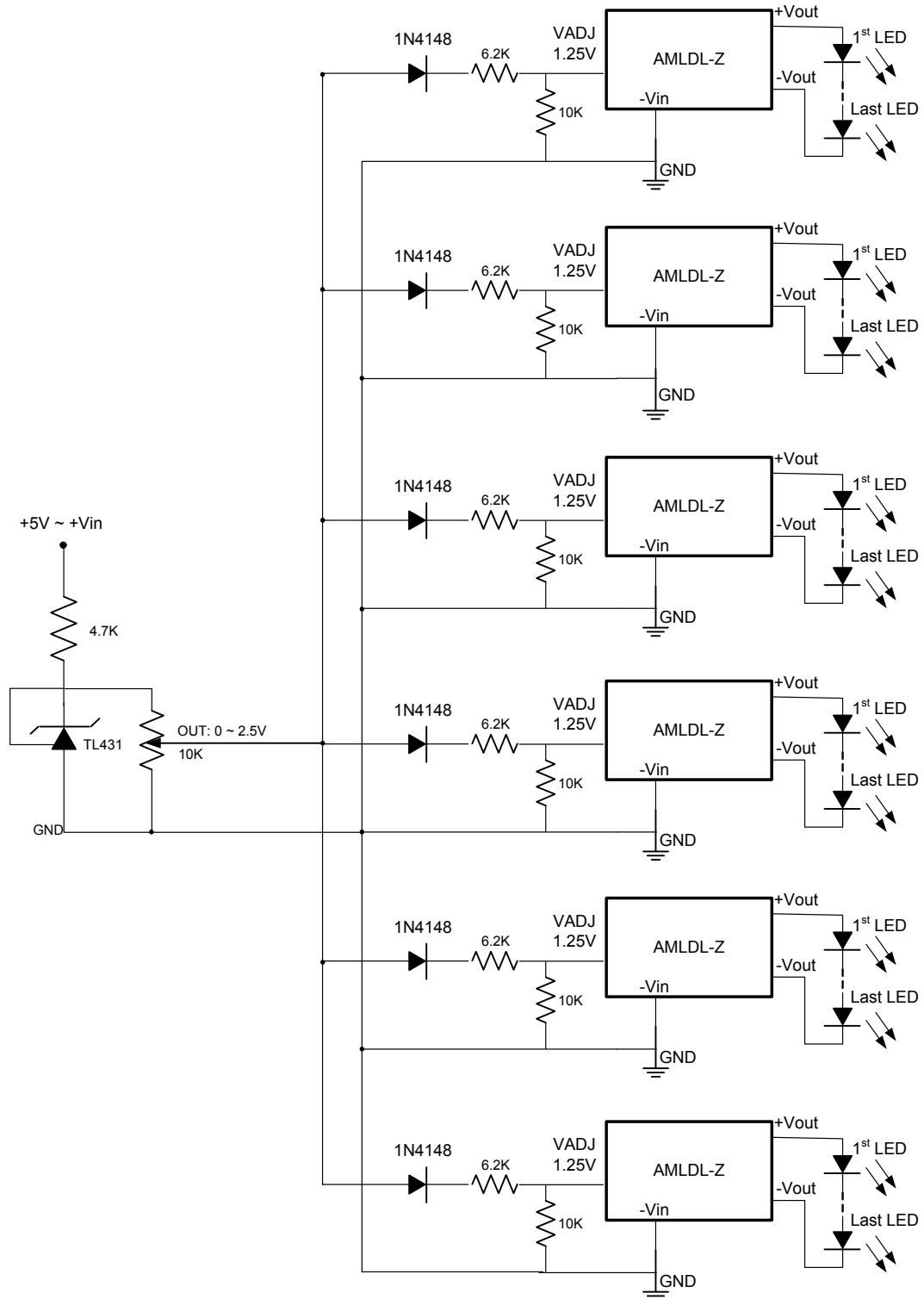
The thermal control threshold points are set by adjusting R2. Three values (33K, 22K, and 10K) were tested. These values were chosen to provide thermal break points of approximately 25°C, 40°C, and 60°C.

Note, that the LED drive current will not continually dim to zero – the thermal controls applying DC control to that VADJ pin has a dimming ratio from maximum current of approximately 5:1.

Once the reduced DC level drops below the shutdown threshold of around 200mV, the LED drive current will fall to zero and the LEDs will be off.

The slope of the current reduction is determined by the beta value of the thermistor. The larger the Beta value the sharper will be the resultant current control response. The slope of the current reduction is also affected by Q1's base emitter voltage variation with temperature.

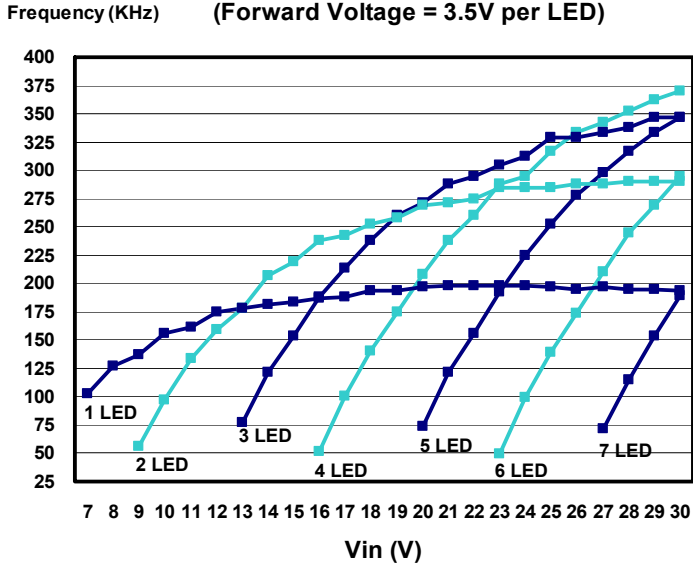
Output Current Adjustment By External DC Control Voltage:



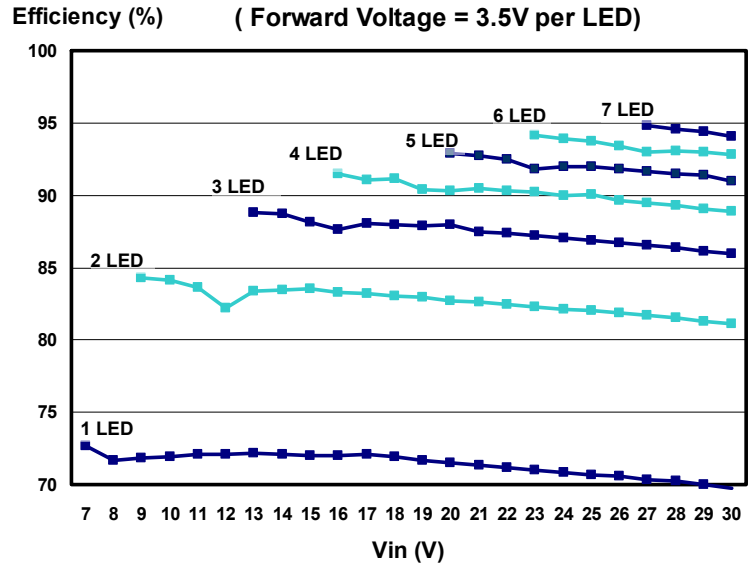
Typical Characteristics:

AMLDL-3030Z

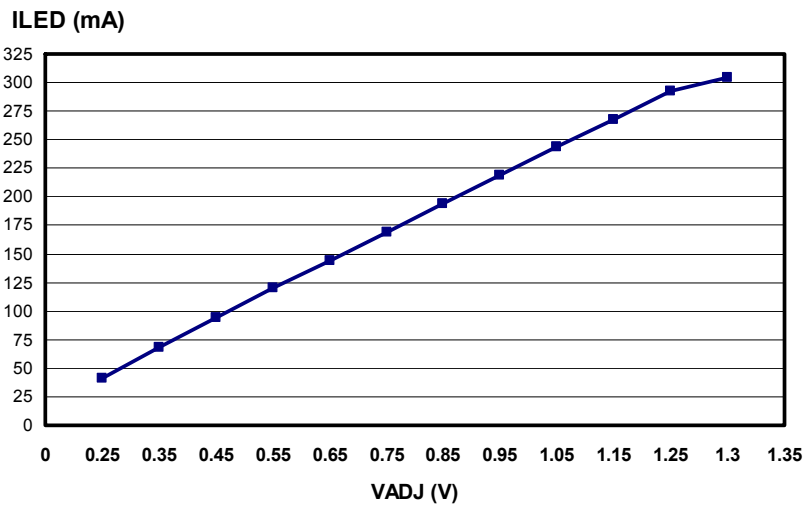
Operating Frequency vs Input Voltage
(Forward Voltage = 3.5V per LED)



Efficiency vs Vin
(Forward Voltage = 3.5V per LED)

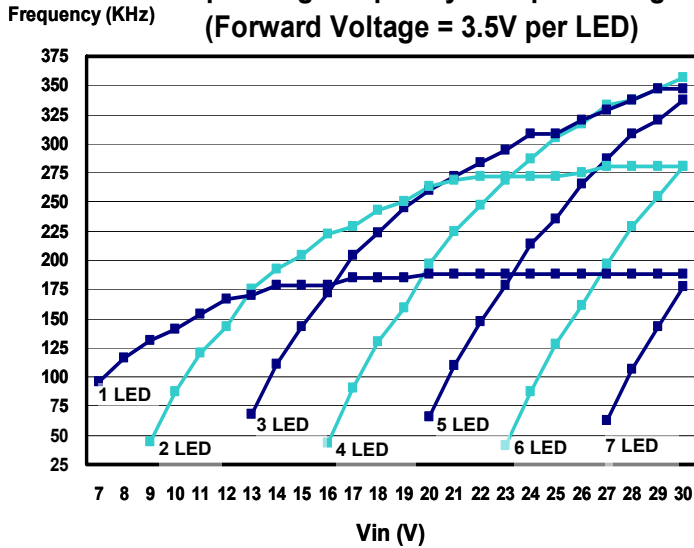


Output Current Vs V_{ADJ}

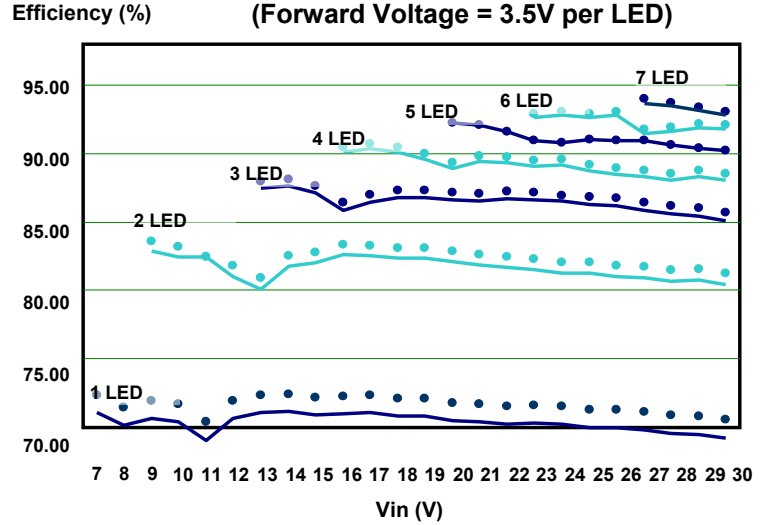


Typical Characteristics: AMLDL-3035Z

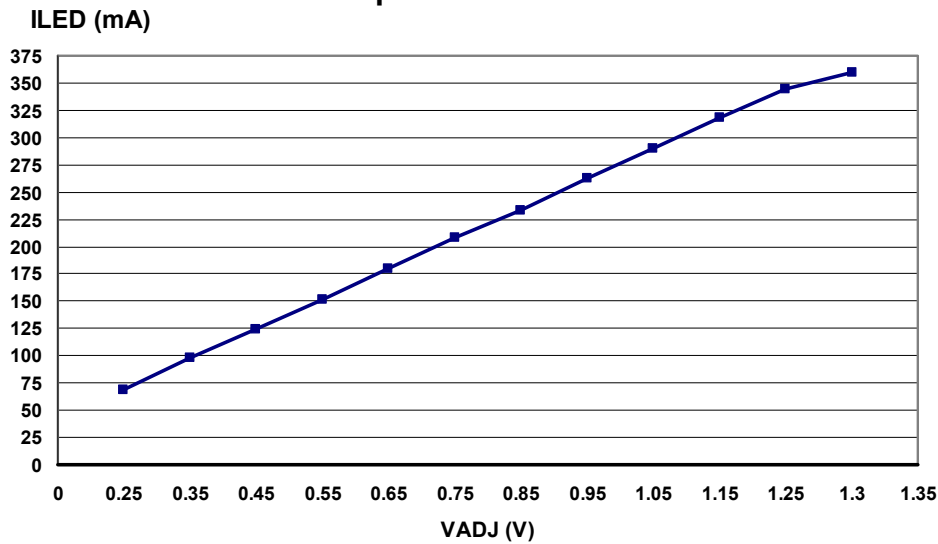
Operating Frequency vs Input Voltage
(Forward Voltage = 3.5V per LED)



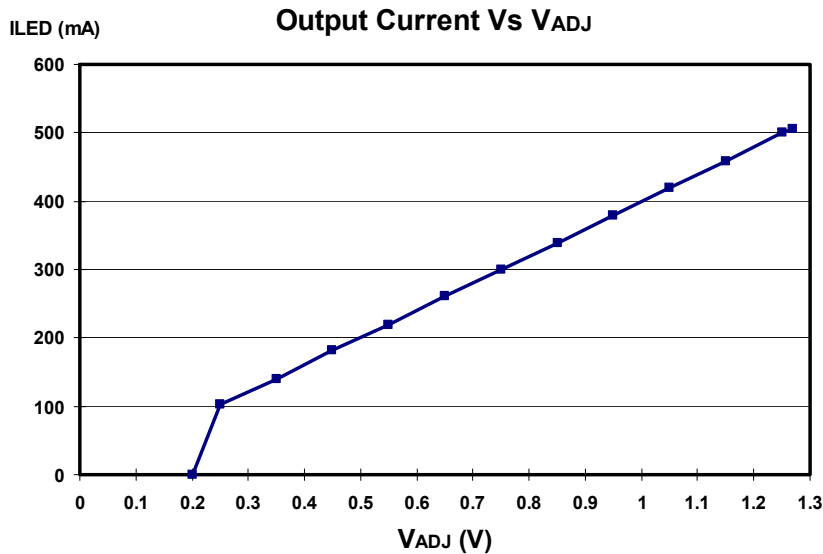
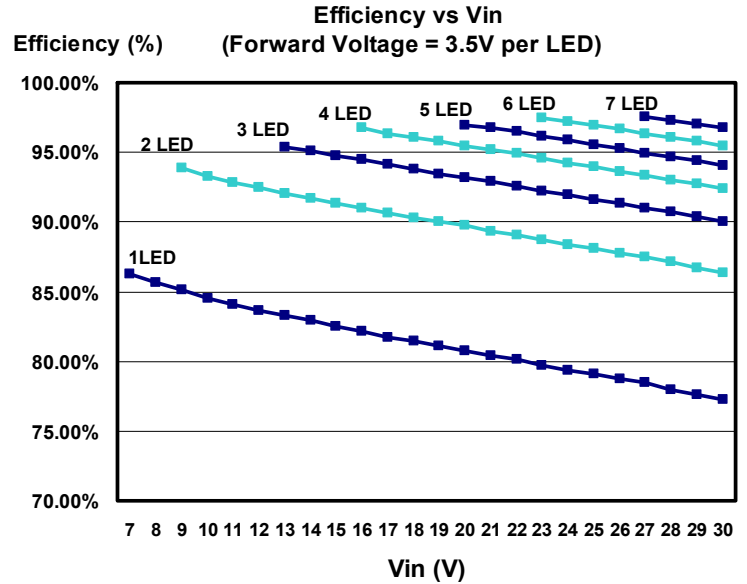
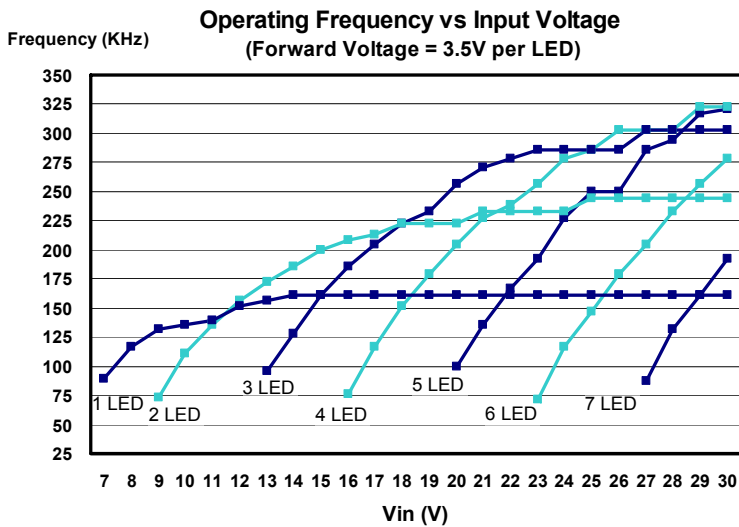
Efficiency vs Vin
(Forward Voltage = 3.5V per LED)



Output Current Vs VADJ

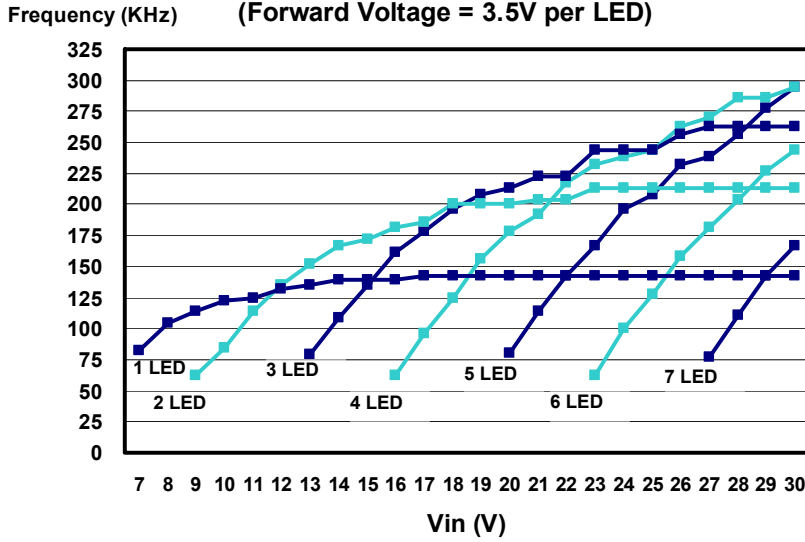


Typical Characteristics: AMLDL-3050Z

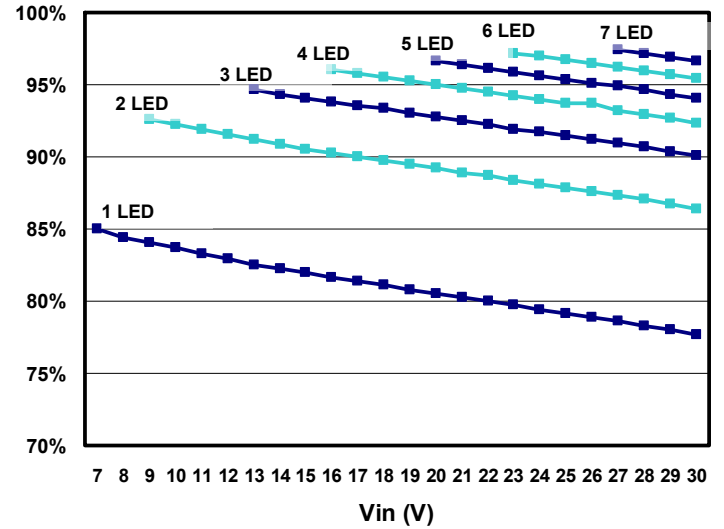


Typical Characteristics: AMLDL-3060Z

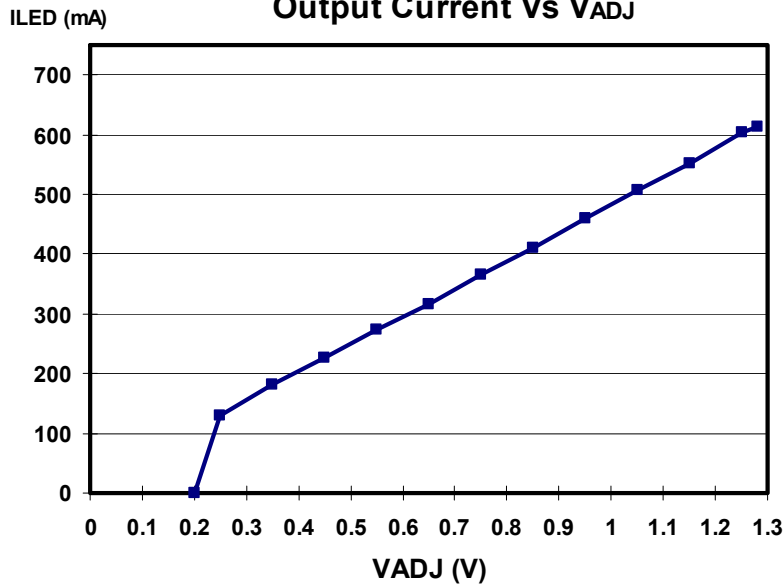
Operating Frequency vs Input Voltage
(Forward Voltage = 3.5V per LED)



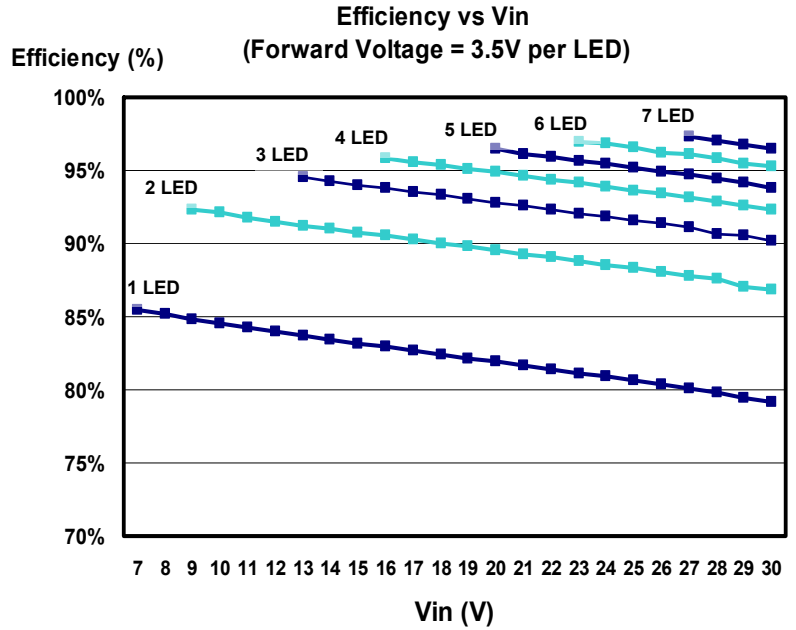
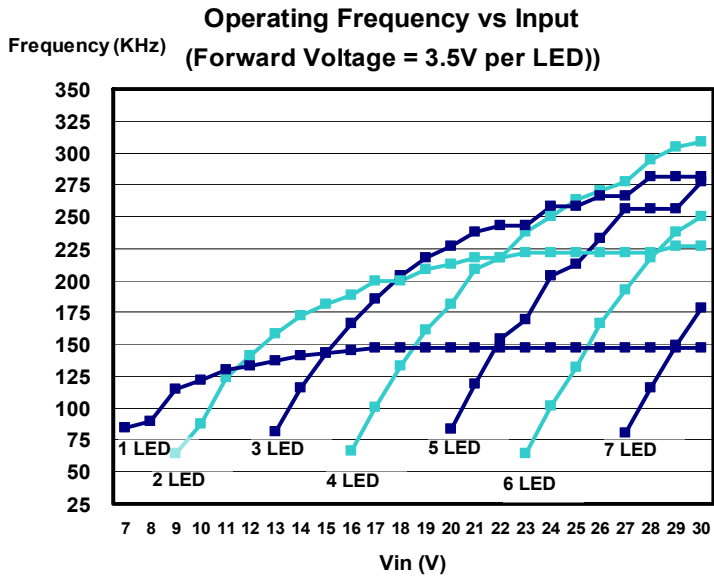
Efficiency vs Vin
(Forward Voltage = 3.5V per LED)



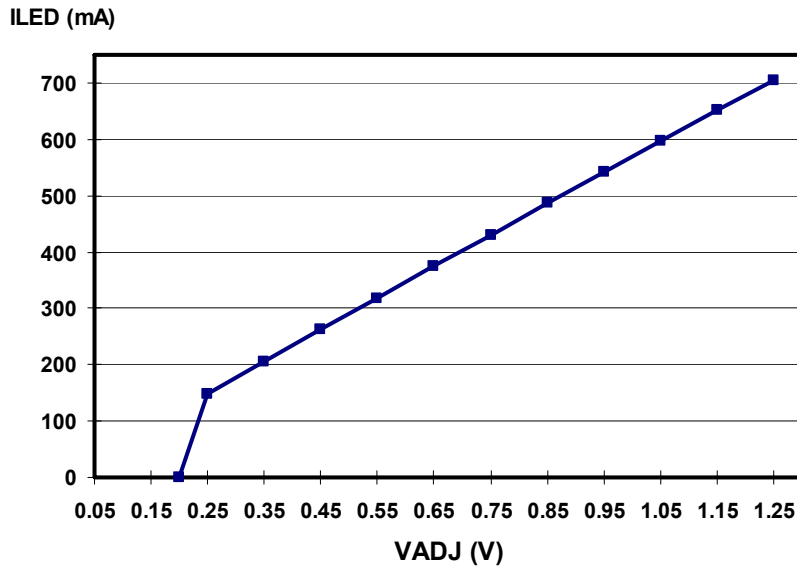
Output Current Vs VADJ



Typical Characteristics: AMLDL-3070Z

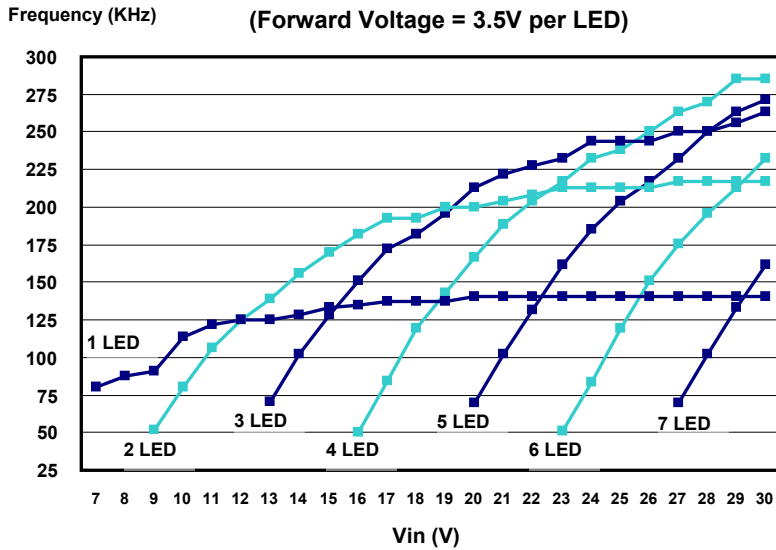


Output Current Vs V_{ADJ}

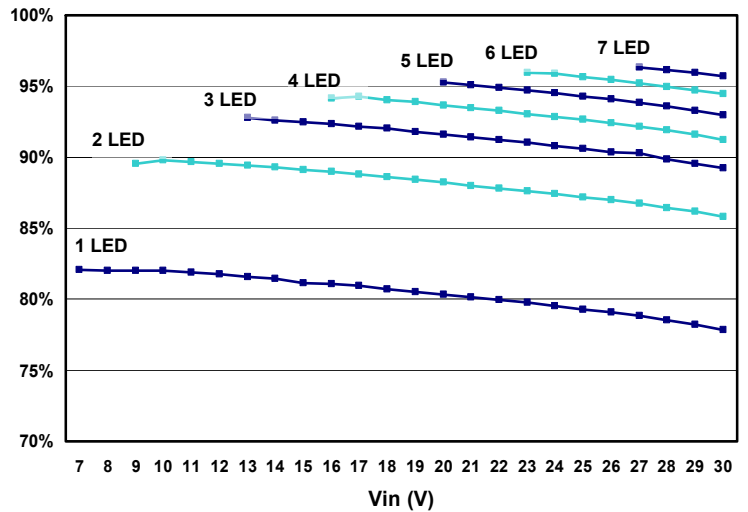


Typical Characteristics: AMLD-30100Z

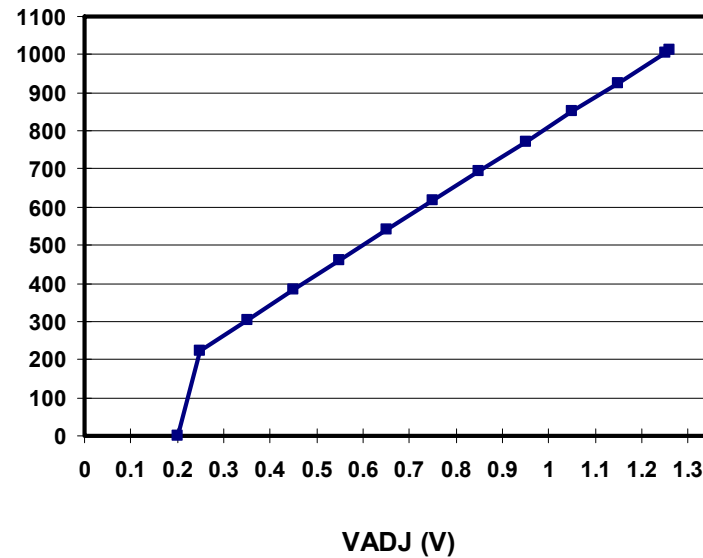
Operating Frequency vs Input Voltage
(Forward Voltage = 3.5V per LED)



Efficiency vs Vin
(Forward Voltage = 3.5V per LED)



Output Current vs V_{ADJ}



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