



## 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 +71°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)	Maximum Rated Current (mA)	Max Capacitive Load (uF)	Efficiency (%)	Package Type
AMLDL-3050-RZ	7-30	2-28	500	47	95	DIP14
AMLDL-3060-RZ	7-30	2-28	600	47	95	DIP14
AMLDL-3070-RZ	7-30	2-28	700	47	95	DIP14

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 $0.3V < V_{adj} < 1.25$			
DC/DC OFF	OFF (shutdown) – $V_{adj} < 0.15$			
Quiescent Current in Shutdown mode	$V_{in} = 30V, V_{adj} < 0.15$		25	$\mu A$
PWM dimming	Max PWM Frequency 1KHz, adjust output current from 0% to 100%			
Analog dimming	$0.3V < V_{ADJ} < 1.25V$ to adjust output current from 25% to 100%			
V <sub>adj</sub> pin input voltage range	Input voltage range	0-1.25		VDC
V <sub>adj</sub> pin drive current	$V_{adj} = 1.25V$		1	mA

### Output Specifications

Parameters	Conditions	Typical	Maximum	Units
Current accuracy			±10	%
Output Voltage range	$V_{input} = 30V$	2-28		VDC
Output current	$V_{in} - V_{out} > 2$ to 3V	See model table above		
Short Circuit protection	Regulated at the rated current for each model			
Output no load Protection	Continuously			
Max load capacitance			47	$\mu F$
Temperature coefficient	$T_a = -40$ to $+85^\circ C$		±0.05	%/°C
Ripple & Noise	20MHz Bandwidth		450	mV p-p

### General Specifications

Parameters	Conditions	Typical	Maximum	Units
Switching frequency	100% load	70 - 450		KHz
Operating temperature		-40 to +71		°C
Storage temperature		-40 to +125		°C
Maximum case temperature			105	°C
Cooling	Free air convection			
Humidity			95	% RH
Case material	Non-Conductive Black Plastic (UL94-V0 rated)			
Weight		2.6		g
Dimensions (L x W x H)	0.80 x 0.40 x 0.27 inches	20.32 x 10.16 x 6.88 mm		
MTBF	>1, 600,000 hrs (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

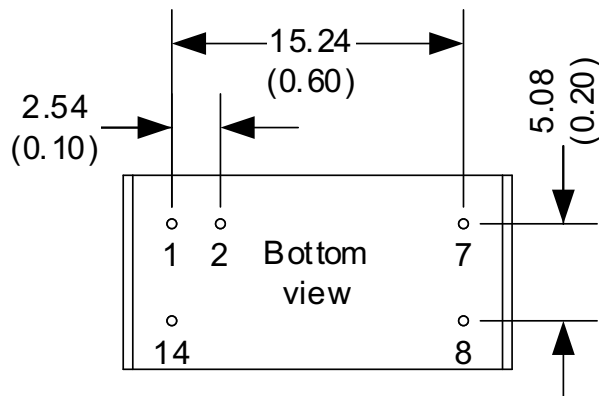
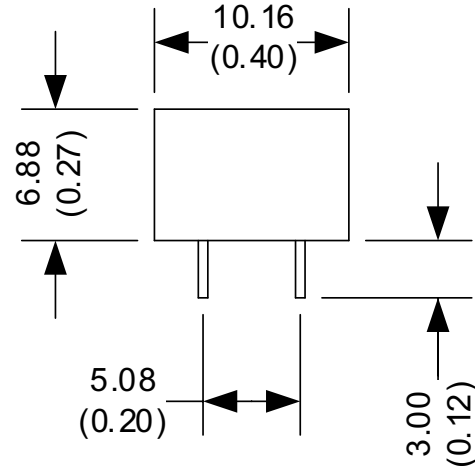
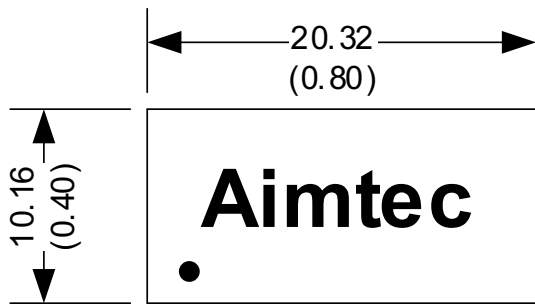
**Safety Specifications**

Parameters		
Agency approvals	CE	
Standards	EMI	EN 55015 (CISPR22) with recommended EMC circuit
	EMC immunity	EN 61547
	Electrostatic Discharge Immunity	IEC 61000-4-2
	RF, Electromagnetic Field Immunity	IEC 61000-4-3
	Electrical Fast Transient/Burst Immunity	IEC 61000-4-4
	Surge Immunity	IEC 61000-4-5, with a TVS at the input ( $V_C @ I_{PP} \leq 40V$ )
	RF, Conducted Disturbance Immunity	IEC 61000-4-6
	Power frequency Magnetic Field Immunity	IEC 61000-4-8

**Pin Out Specifications**

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

**Dimensions**



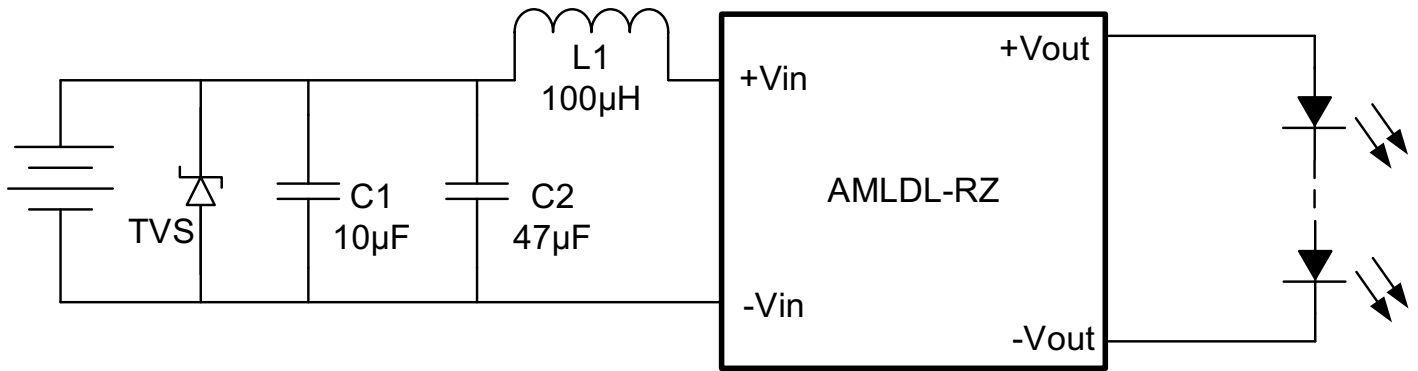
Unit: mm(inch)

Case tolerance:  $\pm 0.5(0.02)$

Pin diameter:  $0.5 \pm 0.05(0.02 \pm 0.002)$

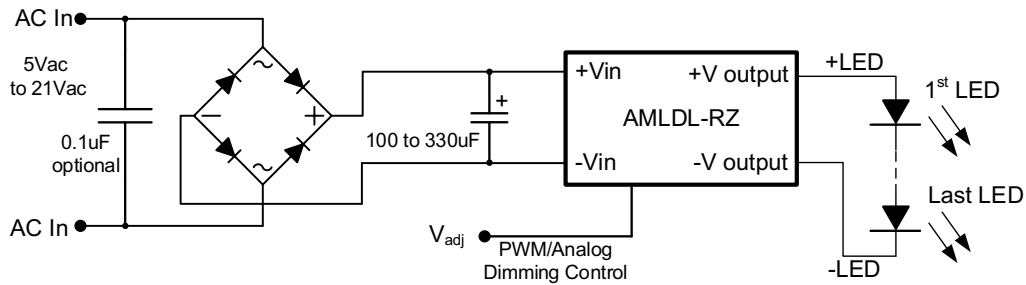
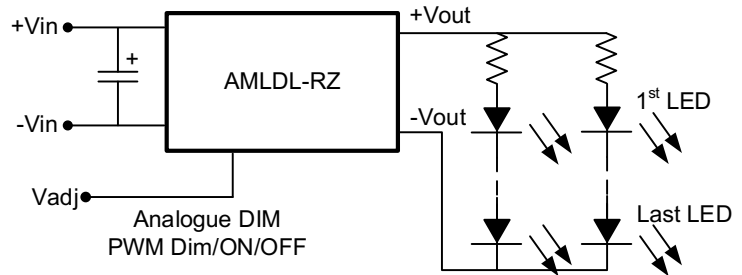
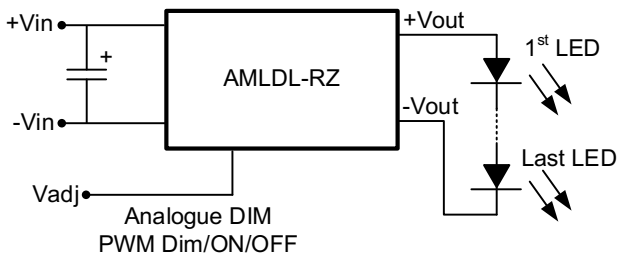
Pin pitch and length tolerance :  $\pm 0.35(0.014)$

**Recommended EMI Filter:**



TVS
$V_C @ I_{PP} \leq 40V$

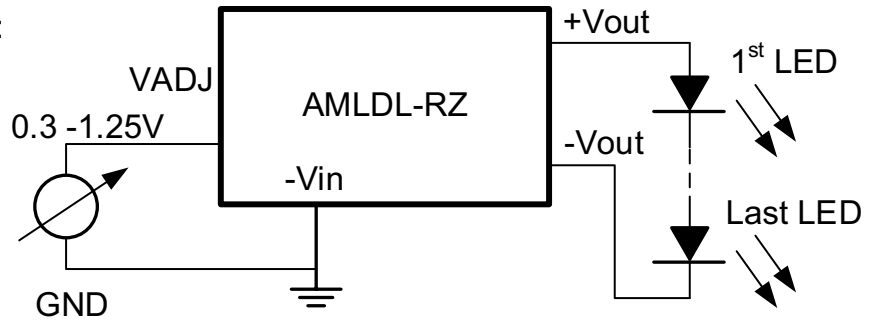
**Application circuit examples:**



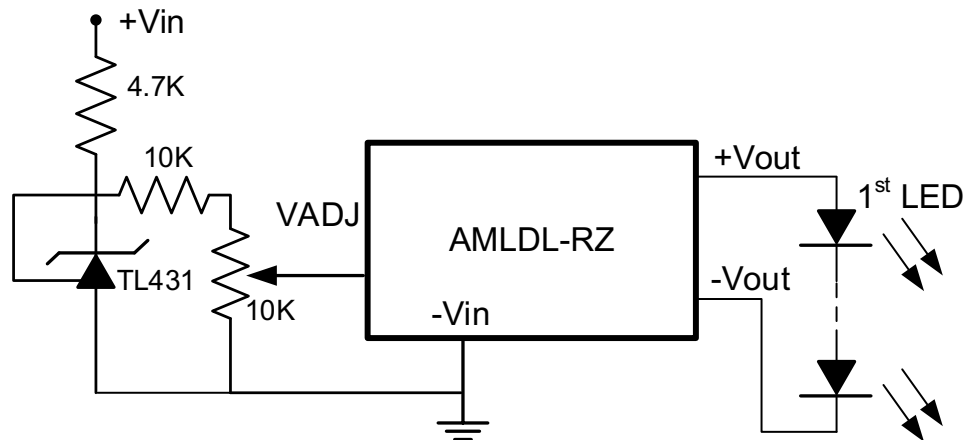
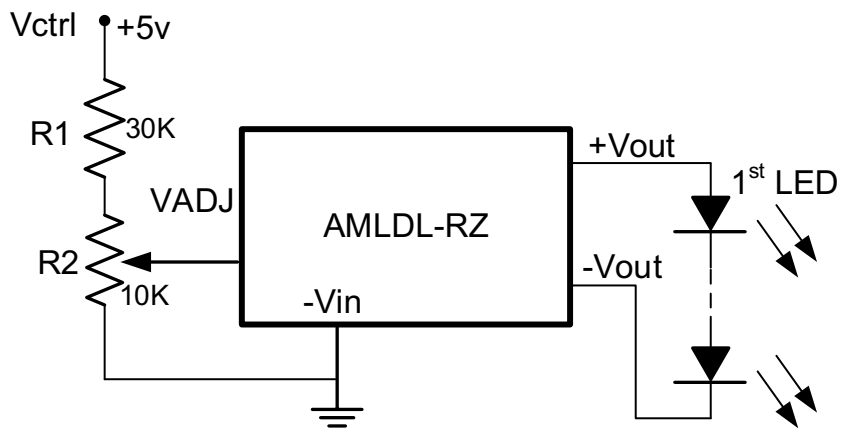
**Output Current Adjustment by External DC Control Voltage:**

The nominal output current is given by:

$$I_{outnom} = I_{out} \frac{V_{adj}}{1.25}$$



$$V_{ADJ} = \frac{R_2}{R_1 + R_2} \times V_{ctrl}$$

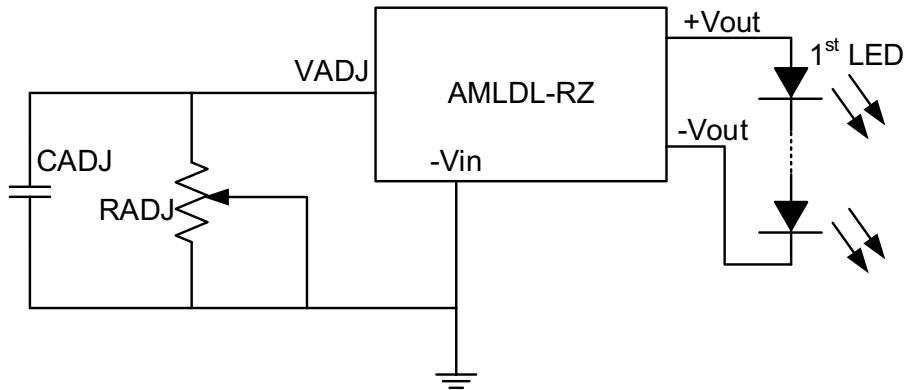


### Resistive Dimming Control

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

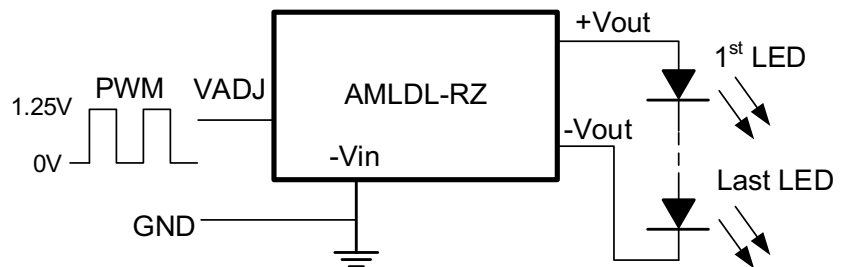
If the value of R<sub>adj</sub> is between 0 to 2MΩ, the maximum adjustment range will be 25% to 90%, (for V<sub>in</sub> - V<sub>out</sub> < 20VDC)

### 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:

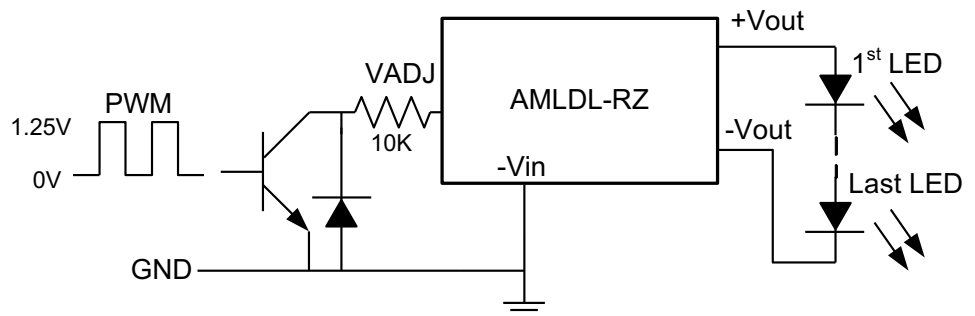
$$I_{outnom} = I_{out} \times DPWM \quad [for \ 0.01 < DPWM < 1]$$



### Driving VADJ Via Open Collector Transistor

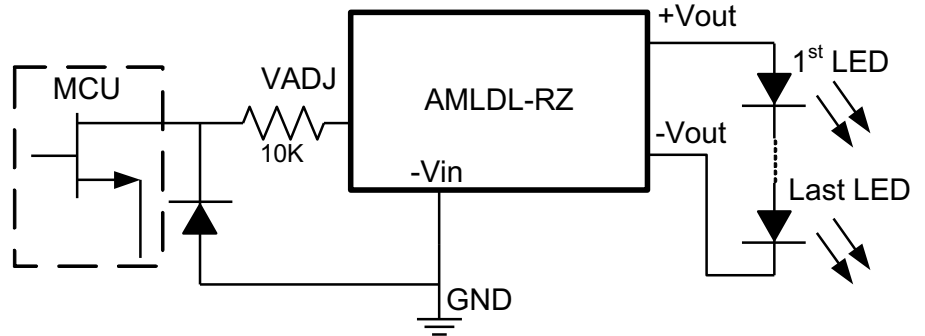
The VADJ can also be driven via an open collector transistor as shown below.

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.



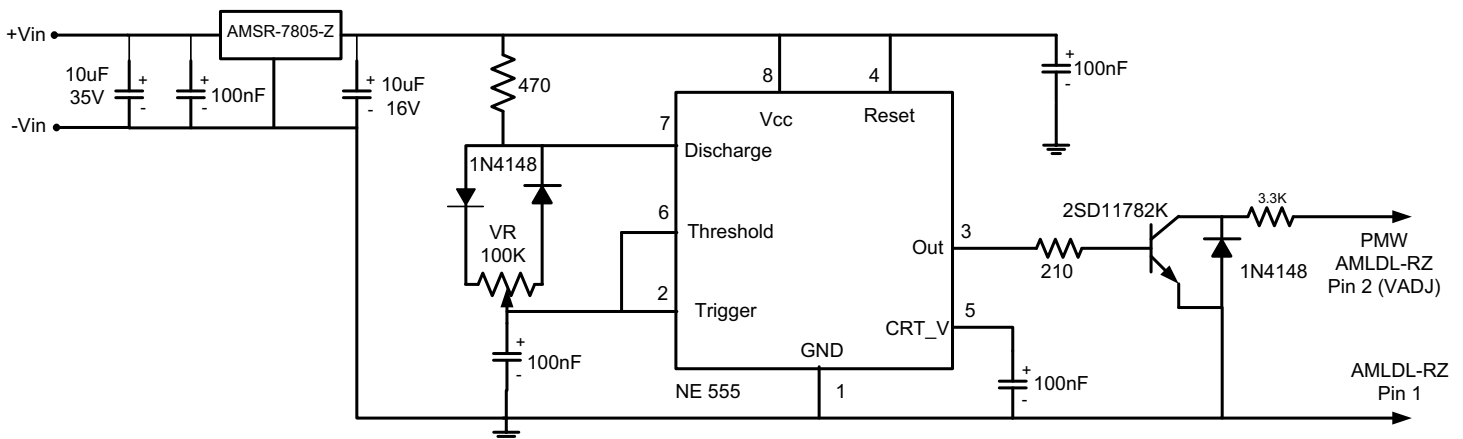
### Driving the VADJ from a Microcontroller

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.

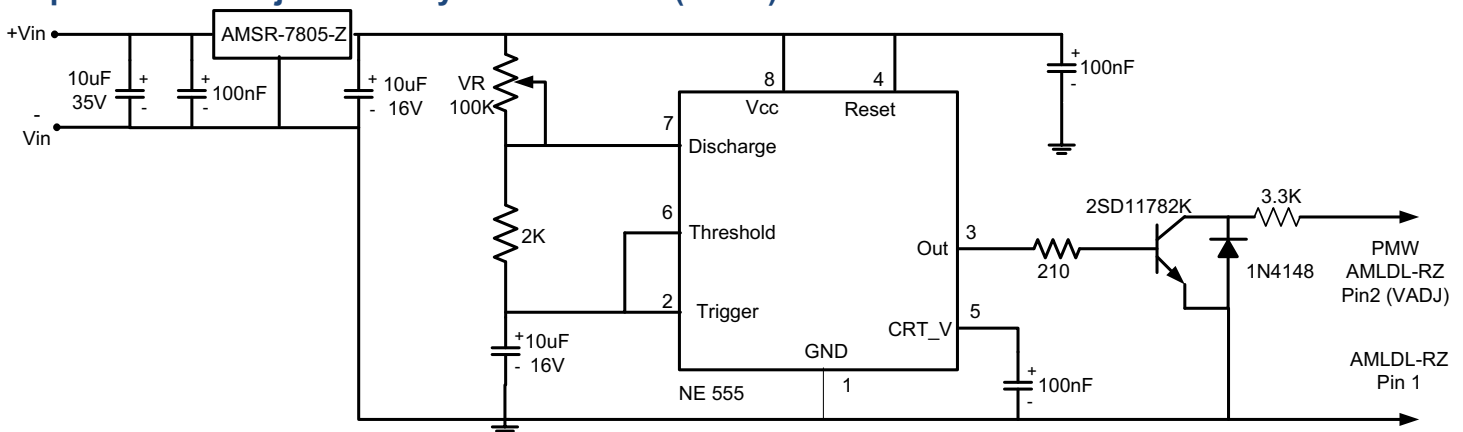


### Output Current Adjustment by PWM Control (Dimming):

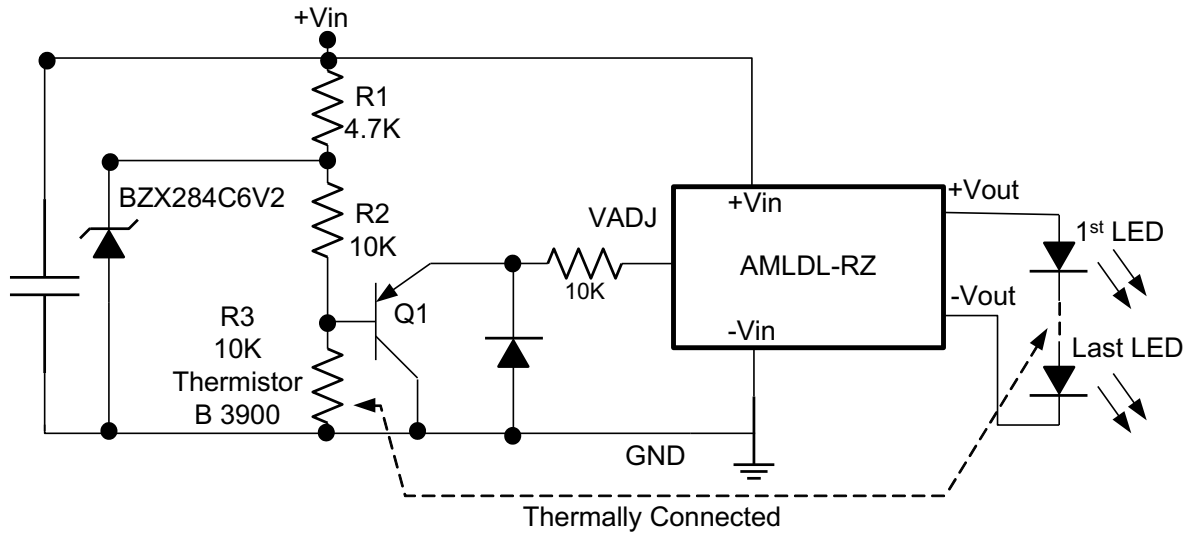
A PWM signal must have a frequency of greater than 100Hz to prevent any visible flicker.



### Output Current Adjustment by PWM Control (Flash):



## 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.

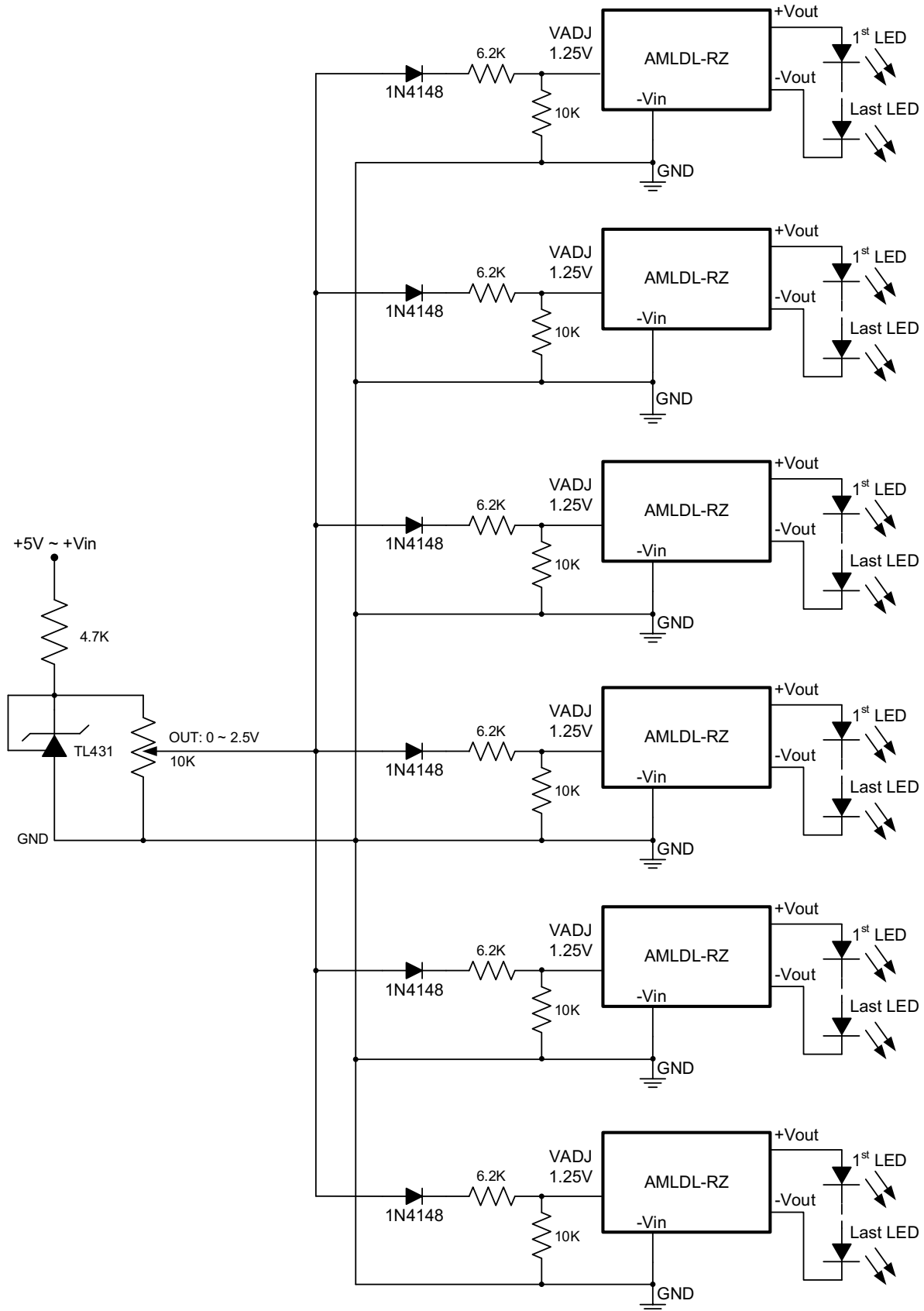
The thermal control threshold points are set by adjusting R2. Three values (33K, 22K, and 10K) were tested. These values were chosen to provide thermal break points of approximately 25°C, 40°C, and 60°C.

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:**

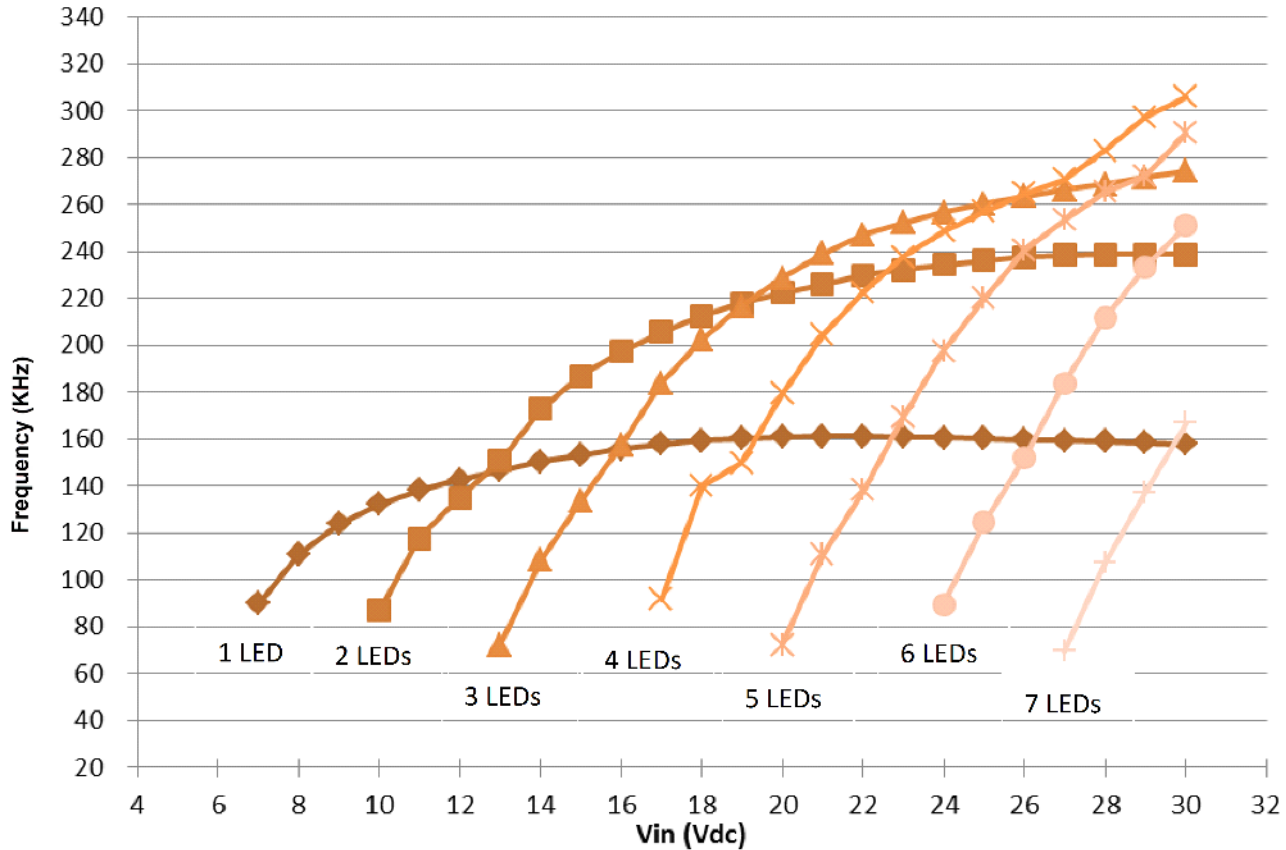




**Typical Characteristics: AMLDL-3050-RZ**

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

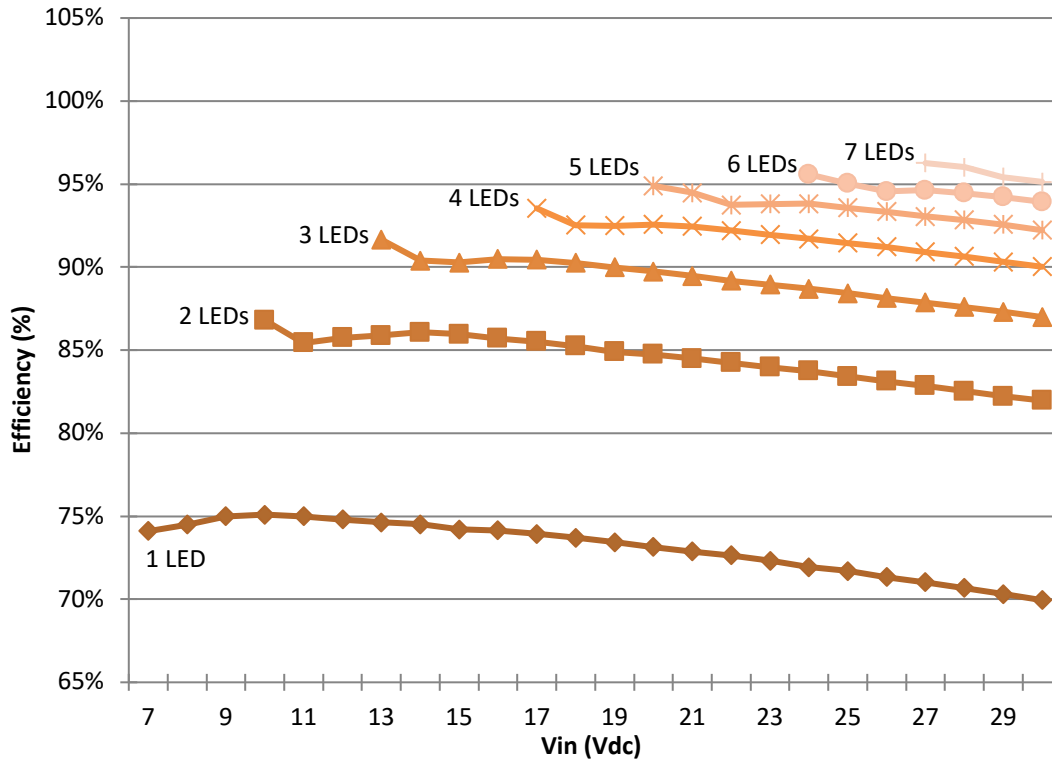
**Operating Frequency vs. Input Voltage**



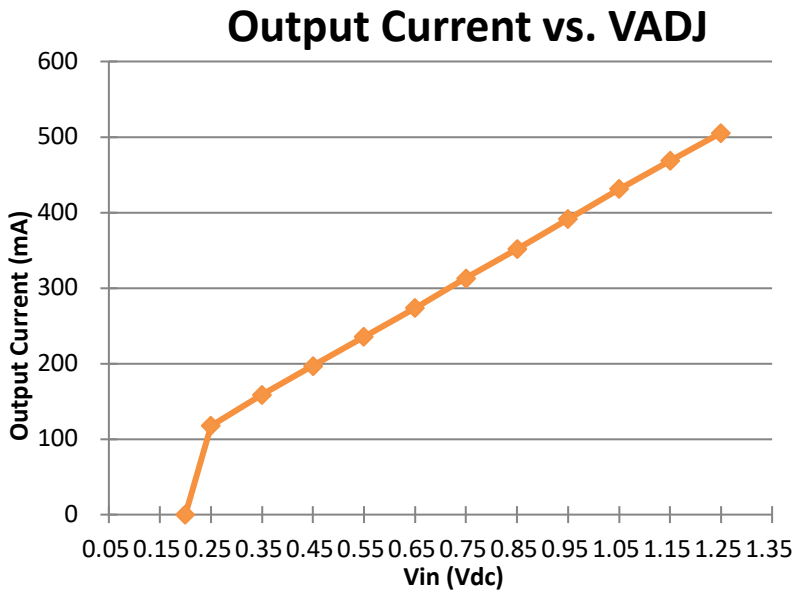
**AMLDL-3050-RZ**

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

**Efficiency vs Input Voltage**



**AMLDL-3050-RZ**  
Output Current Vs  $V_{ADJ}$

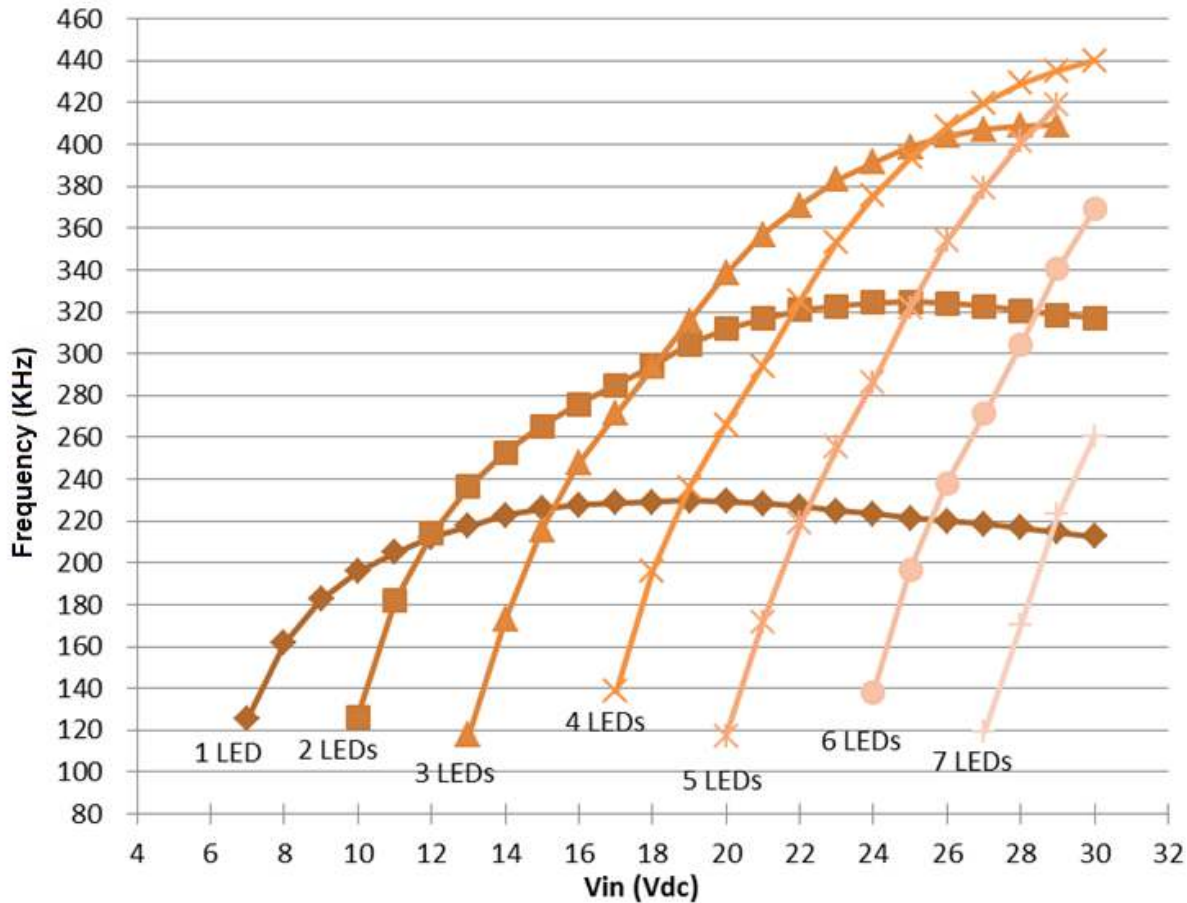


**Typical Characteristics: AMLDL-3060Z**

Operating Frequency vs Input Voltage

(Forward Voltage = 3.5V per LED)

**Operating Frequency vs. Input Voltage**

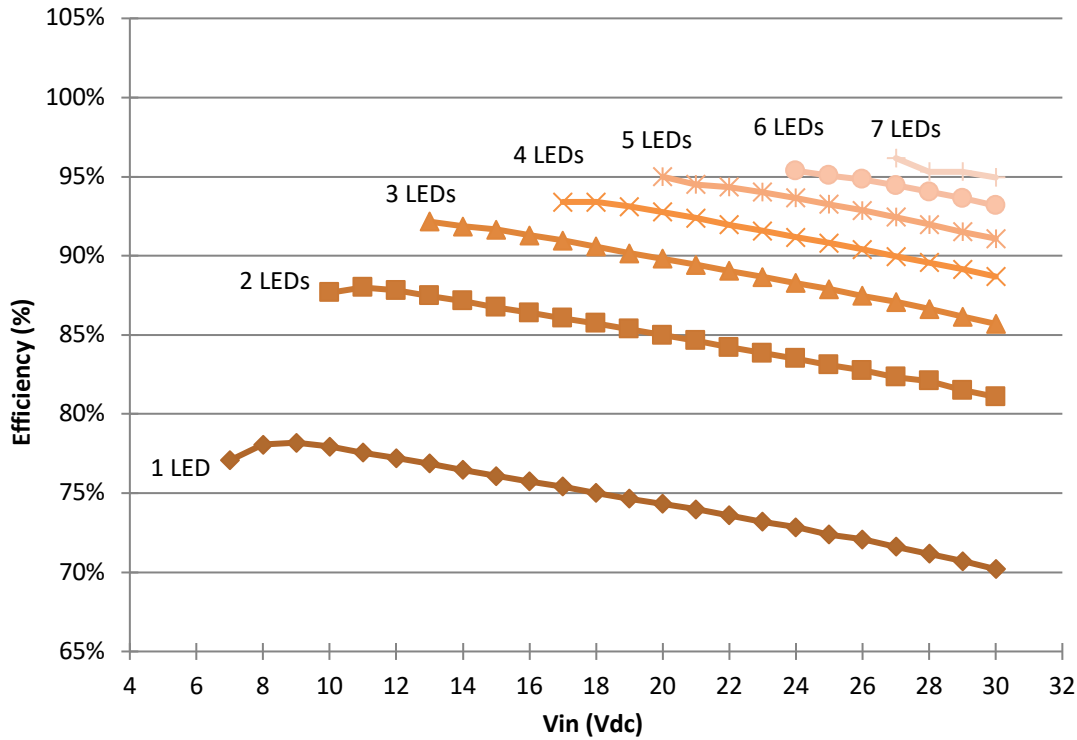


**AMLDL-3060Z**

Efficiency vs Vin

(Forward Voltage = 3.5V per LED)

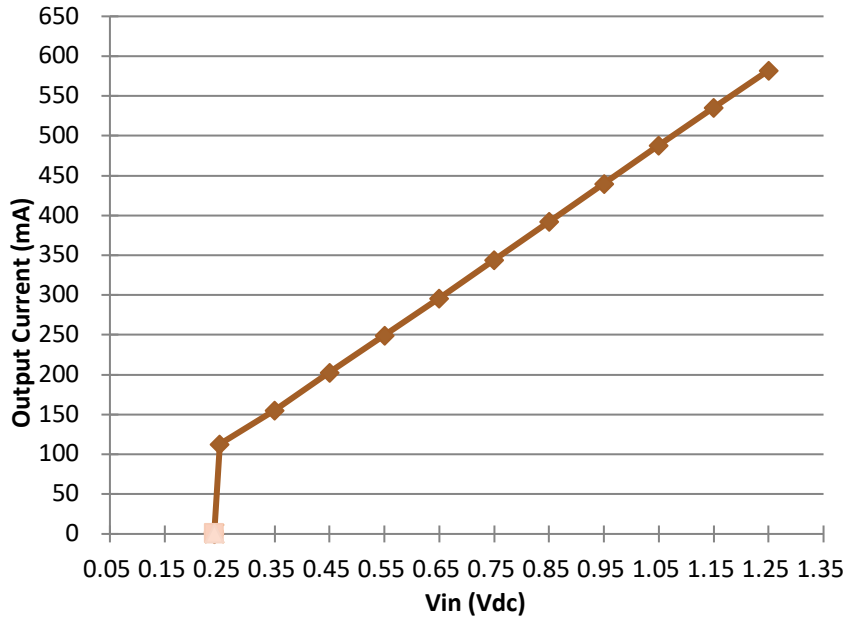
**Efficiency vs. Input Voltage**



**AMLDL-3060Z**

Output Current Vs  $V_{ADJ}$

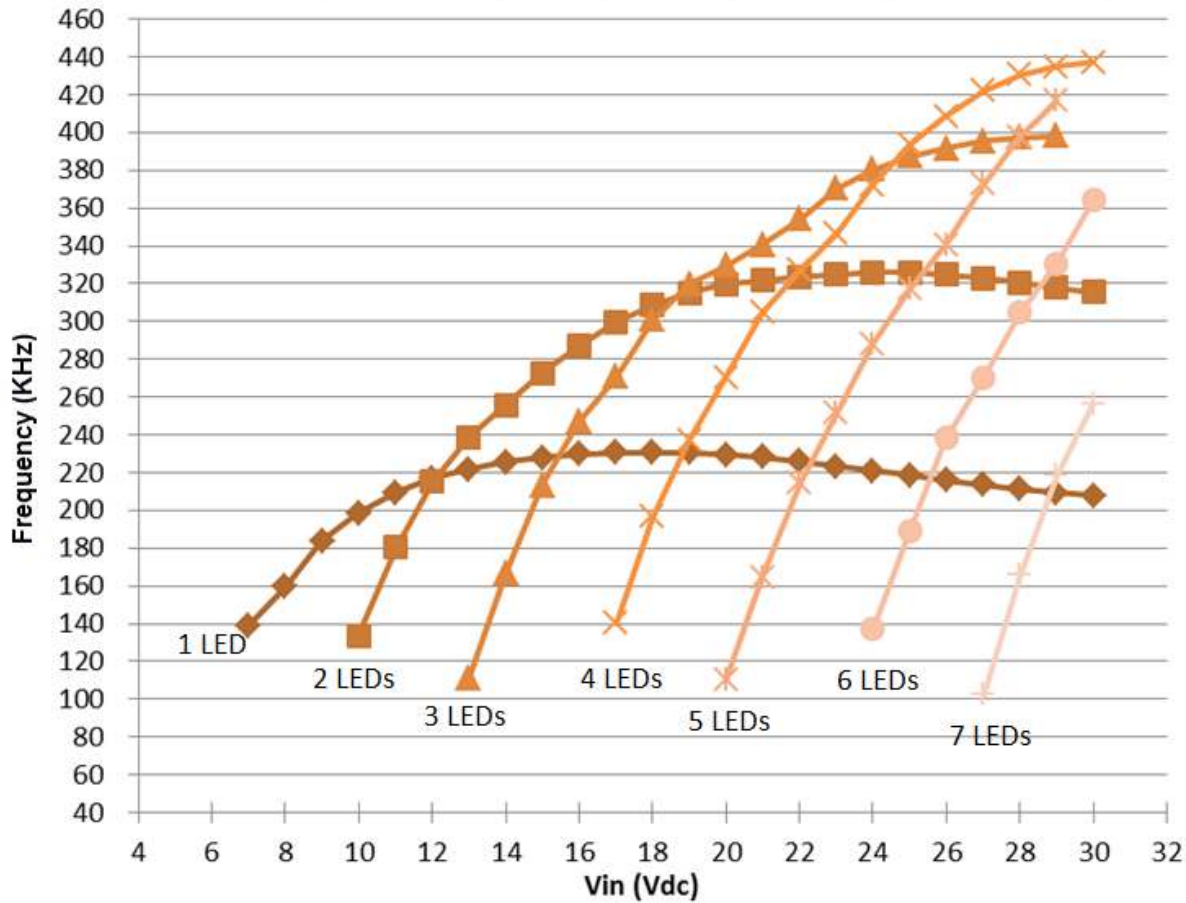
**Output Current vs.  $V_{ADJ}$**



**Typical Characteristics: AMLDL-3070Z**

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

**Operating Frequency vs. Input Voltage**

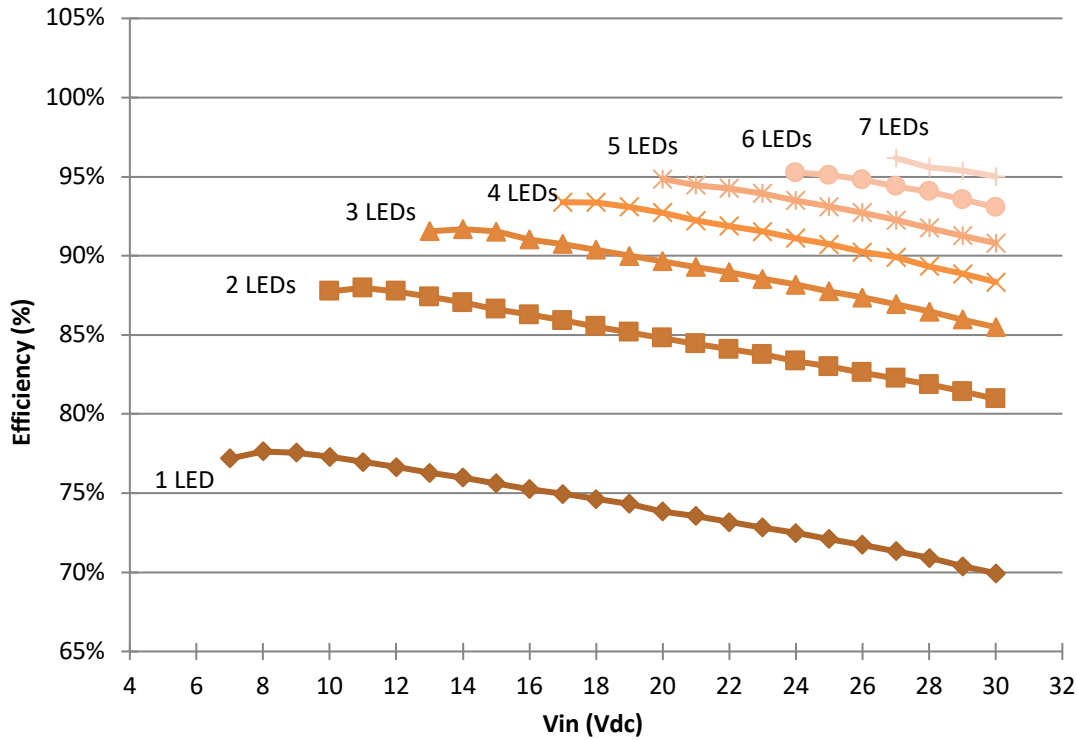


**AMLDL-3070Z**

Efficiency vs Vin

(Forward Voltage = 3.5V per LED)

**Efficiency vs. Input Voltage**

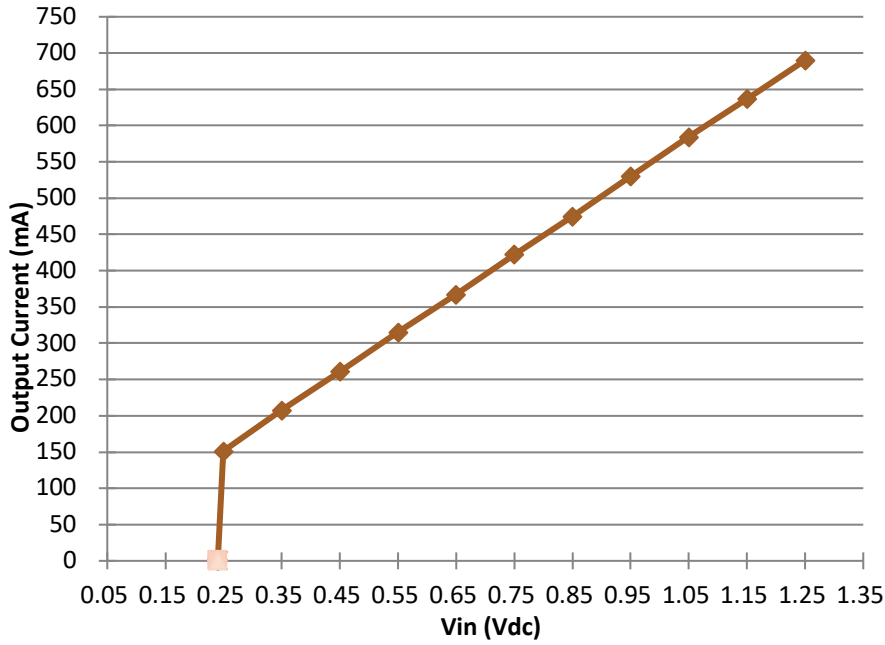




**AMLDL-3070Z**

Output Current Vs V<sub>ADJ</sub>

**Output Current vs. V<sub>ADJ</sub>**



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