Power LED Driver the Smallest and Low Profile, Constant Current Source 0 - 2.0A, 2.5V to 7V, with 450W/in^3 Power Density and High Efficiency

FEATURES

- Fully integrated Power LED driver
- High efficiency over large load range
- 100% duty cycle
- Power density - more than 450W/inch^3
- 1uA shutdown current
- Variable input voltage 2.5V to 6V (1Li+ or 3-cell NiCd or NiMH cells)
- Controlled output current
- Programmable PWM/$\overline{\text{PSM}}$ controls
- Low output ripple
- BGA construction
- Temperature range: - 40°C to + 85°C
- No external components required
- Output power 15W
- Maximum current 2.5A
- Short circuit protection
- Low profile

The Power LED Driver is dedicated for optimum performance to drive Power LED's. FX5959 is a complete system solution for all Power LED's with high current for e.g. > 300 mA. The driver provides a constant current without exceeding the applicable LED voltage to ensure the specified LED load life time. The integrated Current Source provides flexibility of utilizing various battery configurations and chemistries such as NiCd, NiMH, or Li+ with input voltage range of 2.5v to 6v. An additional flexibility is provided by using external resistors to adapt to various voltage input levels and LED configurations. For ultra-high efficiency, the Power LED Driver is designed to operate in synchronous rectified PWM mode under full load while transforming into externally controlled pulse-skipping mode (PSM) under light load (for e.g. LED's with 20 to 200 mA).

The FX5959 Current Source is available in 25-ports BGA package. In order to satisfy the stringent ambient temperature requirements, the Current Source is designed to handle the industrial temperature range of –40°C to 85°C.

APPLICATIONS

- Bike lamps
- Headlights and flashlights
- Medical instrumentation
- General and emergency/alarm lighting
- Design and architectural lighting
- Interior and runway lights
- Outdoor accent lighting
- Household appliances

ORDERING INFORMATION

FX	5959	G701	ADJ	□□

FUNCTION

SIZE

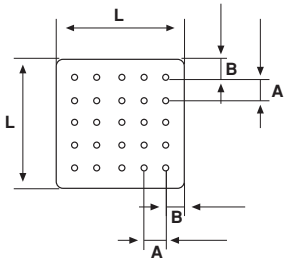
CIRCUIT IDENTIFIER

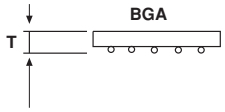
OUTPUT VOLTAGE - ADJ for adjustable version - self selectable output voltage. (see note below)

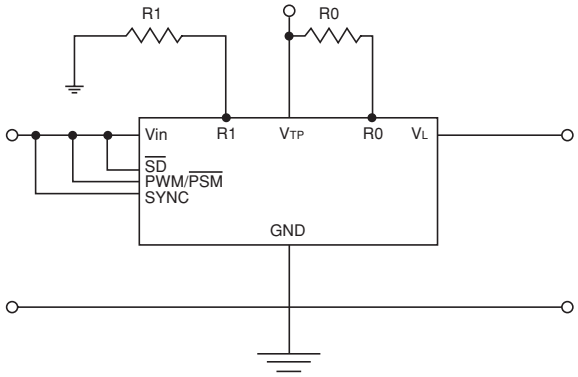
PACKAGING - B1 = 10pcs in bulk; B5 = 50pcs in bulk; T5 = 500pcs in 13" reel.

* Note: for fixed output current please contact Function PAK@vishay.com

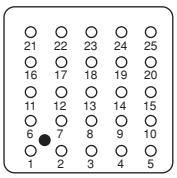
DIMENSIONS in inches [millimeters]	
L	0.59 ± 0.01 [15 ± 0.25]
A	0.1 ± 0.01 [2.54 ± 0.25]
B	0.95 ± 0.01 [2.42 ± 0.25]
T	0.126 max [3.2 max]







UPPER SIDE

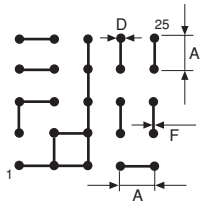


Note:

*must be connected to Vin.

PIN CONFIGURATION	
PIN	**CONNECTION**
4, 5	Vin
9, 14	$\overline{SD}$*
10, 15	PWM/$\overline{PSM}$*
20, 25	SYNC*
1-3, 7, 8, 13, 18, 23	GND
19, 24	$R1_{ext}$
21, 22	V_{TP}
16, 17	$R0_{ext}$
6, 11, 12	Load

RECOMMENDED PAD PATTERN in inches [millimeters]		
A	**D**	**F**
0.1 ± 0.01 [2.54 ± 0.25]	0.03 ± 0.001 [0.8 ± 0.02]	0.02 ± 0.001 [0.5 ± 0.02]

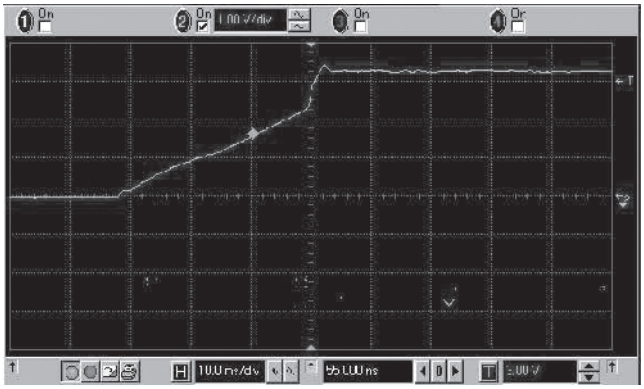


STANDARD ELECTRICAL SPECIFICATIONS

PARAMETER	UNIT	CONDITION	MINIMUM	TYPICAL	MAXIMUM
Input					
Voltage Range	V_{DC}		2.5		6.0
Quiescent Current	µA	$\overline{\text{PSM}}$ mode		200	
Soft Start Time	ms	T_{SS} for Vout = 6.0V		22	
	ms	T_{SS} for Vout = 5.0V		22	
	ms	T_{SS} for Vout = 3.3V		19	
SD, PWM/$\overline{\text{PSM}}$, SYNC					
Logic High	V	V_H	2.4		
Logic Low	V	V_L			0.8
Normal Mode	µA	I_{DD}			750
$\overline{\text{PSM}}$ Mode	µA	I_{DD}			250
Shutdown Mode	µA	I_{DD}			1
Shutdown Time	ms	T_{SS} for Vout = 6.0V		15	
	ms	T_{SS} for Vout = 5.0V		14	
	ms	T_{SS} for Vout = 3.3V		14	
Insulation					
Test Voltage	V_{AC}	60Hz 60sec	750		
Resistance	Ω	V_{ISO} = 500V_{DC}	1 x 10^{11}		
Leakage Current	nA	V_{ISO} = 500V_{DC}			5
Output					
(V_{TP} -V_L) I_{OUT}	W				1.5
Power	W			15	
Voltage	V_{DC}				7
Current Tolerance	%	at 25°C ambient temperature		± 10	
Temp. Coefficient	%/°C				0.03
Ripple and Noise	mVpp	DC to 20MHz		45	
General					
Package Weight	gr.				1.65
Oscillator					
Frequency	KHz			670	
SYNC Range		F_{SYNC}/F_{OSC}	1.2		1.5
Temperature					
Operation	°C		- 40		+ 85
Storage	°C		- 55		+ 125
Operating Junction Temp.	°C	Tj		150	
Thermal Impedance	°C/W_D*	θ_{JA}		82	

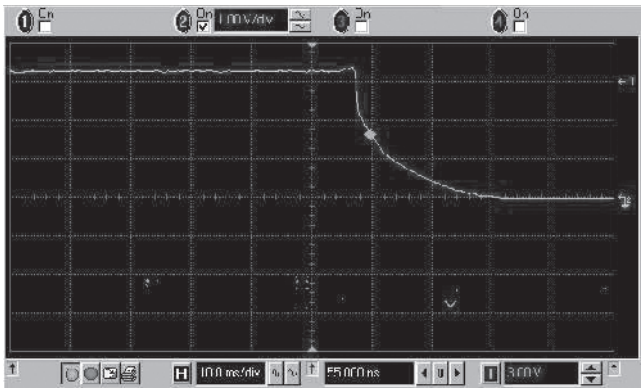
Note:
*W_D = Power Dissipated

Rise Time



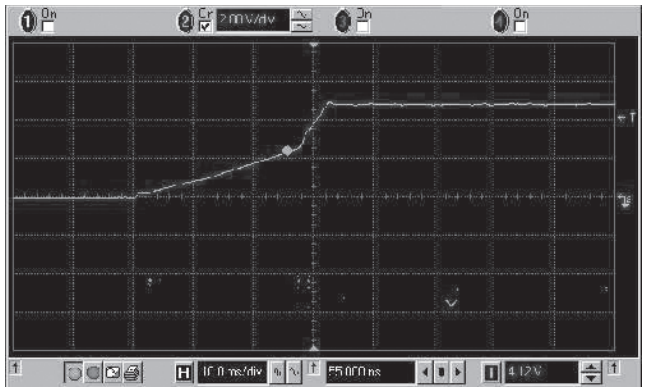
Rise Time (PWM mode): Vin = 3V; V_{TP} = 3.3V; Iout = 2.5A

Fall Time

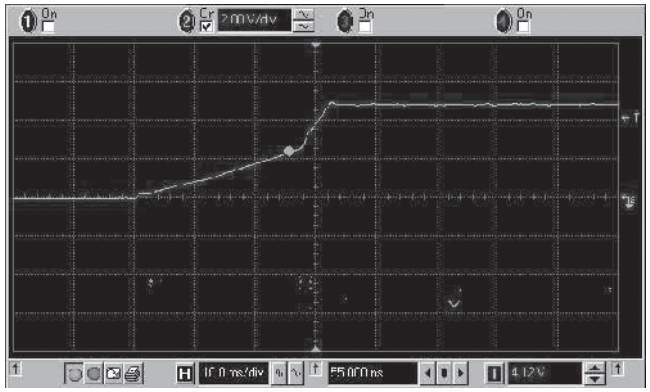


Fall Time (PWM mode): Vin = 3V; V_{TP} = 3.3V; Iout = 2.5A

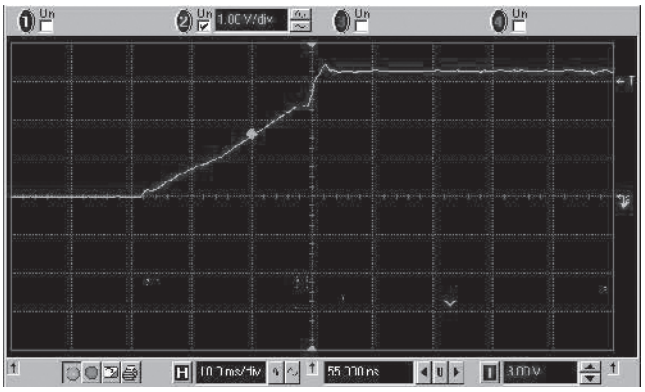
Rise Time



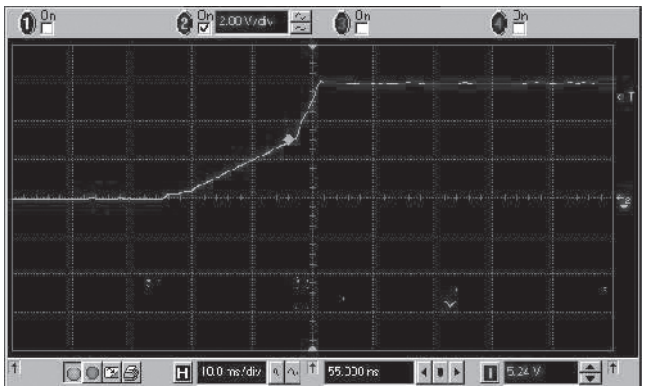
Rise Time (PWM mode): Vin = 4.5V; V_{TP} = 5V; Iout = 2A



Rise Time (PWM mode): Vin = 3.5V; V_{TP} = 5V; Iout = 2A

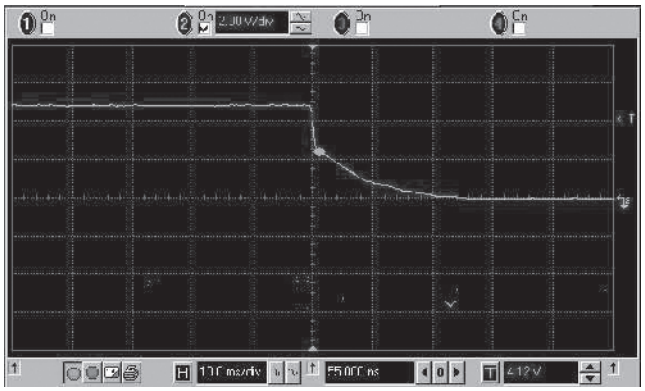


RIse Time (PWM mode): Vin = 3V; V_{TP} = 3.3V; Iout = 2A

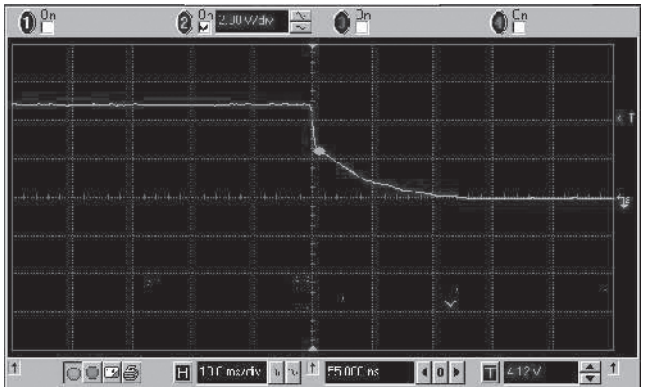


Rise Time (PWM mode): Vin = 5V; V_{TP} = 6V; Iout = 1A

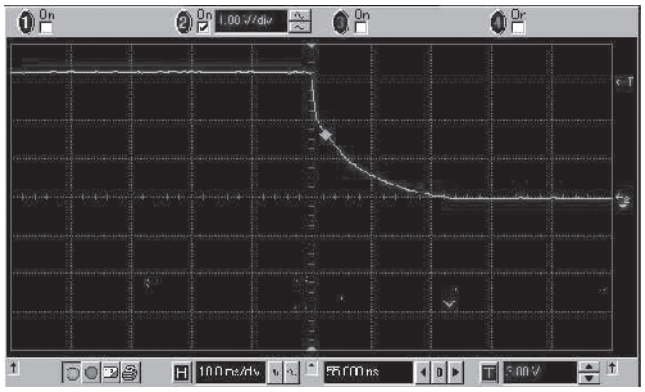
Fall Time



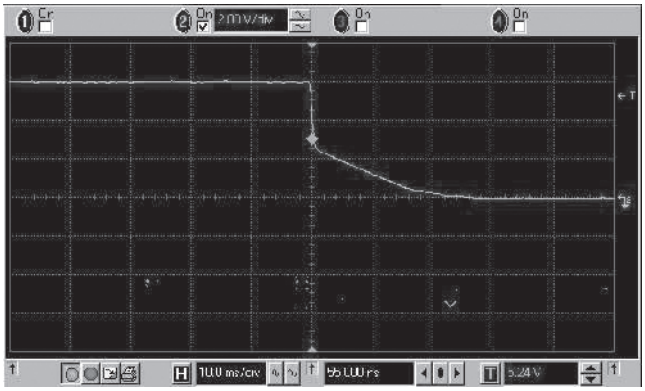
Fall Time (PWM mode): Vin = 4.5V; V_{TP} = 5V; Iout = 2A



Fall Time (PWM mode): Vin = 3.5V; V_{TP} = 5V; Iout = 2A



Fall Time (PWM mode): Vin = 3V; V_{TP} = 3.3V; Iout = 2A



Fall Time (PWM mode): Vin = 5V; V_{TP} = 6V; Iout = 1A

For technical questions, contact FunctionPAK@vishay.com
For marketing questions, contact FunctionPAK.marketing@vishay.com

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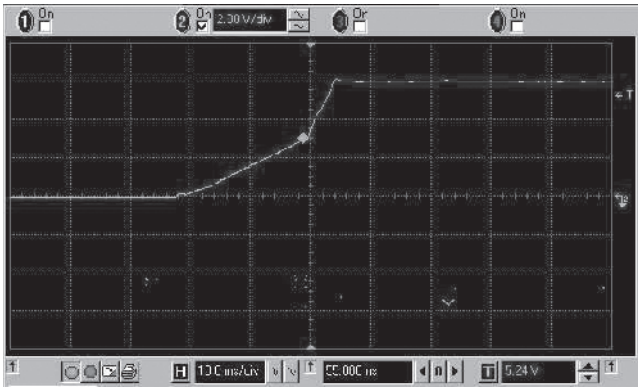
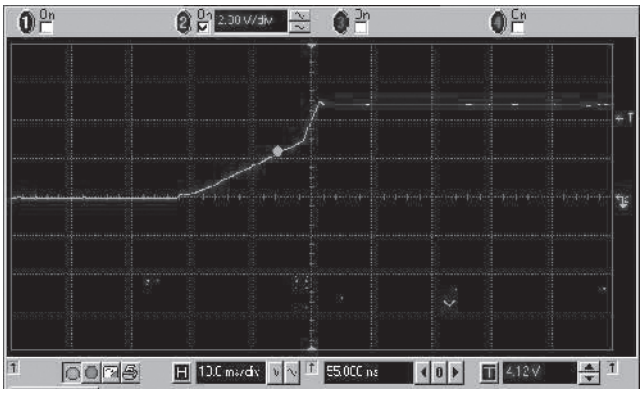
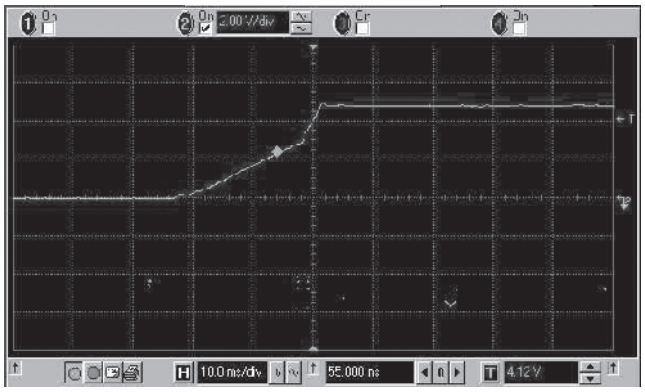
Rise Time



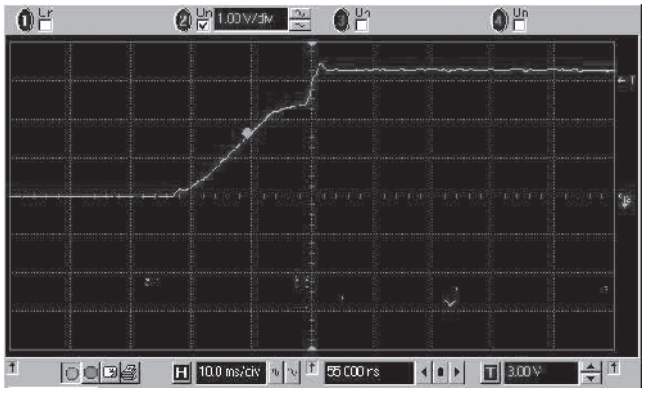
Rise Time (PWM mode): Vin = 4V; V_{TP} = 6V; Iout = 1A



Rise Time (PWM mode): Vin = 4.5V; V_{TP} = 5V; Iout = 1A

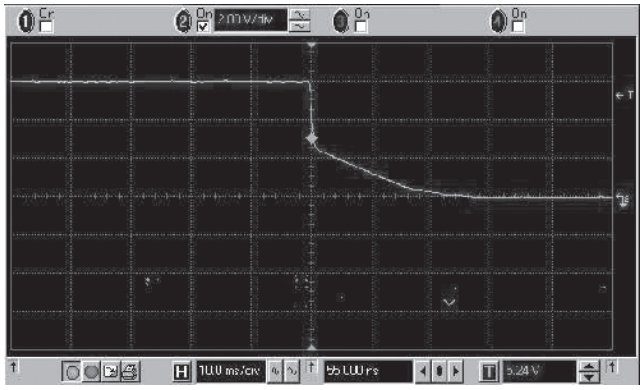


Rise Time (PWM mode): Vin = 3.5V; V_{TP} = 5V; Iout = 1A

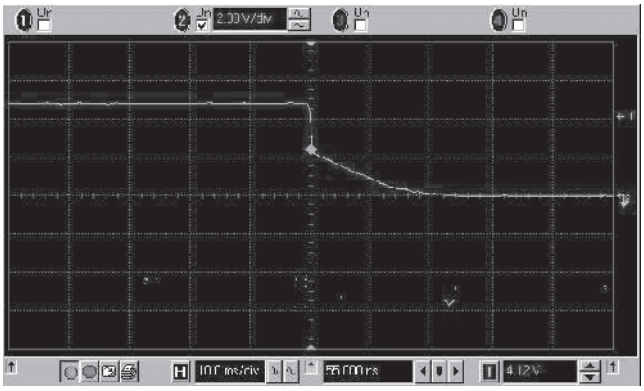


Rise Time (PWM mode): Vin = 3V; V_{TP} = 3.3V; Iout = 1A

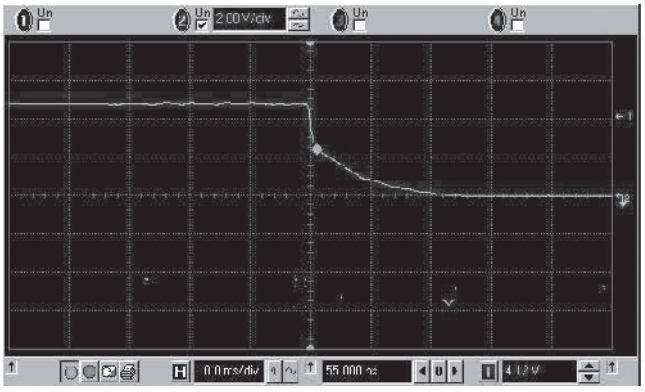
Fall Time



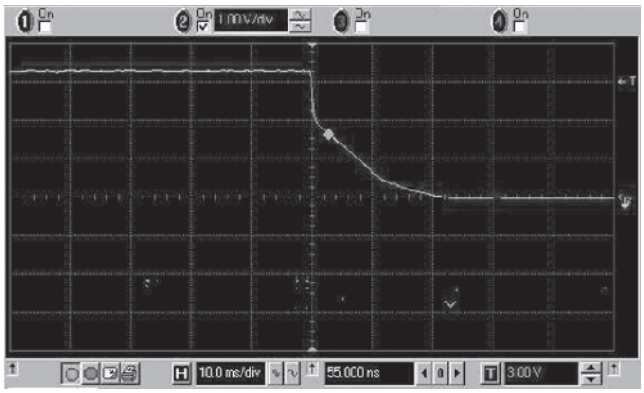
Fall Time (PWM mode): Vin = 4V; V_{TP} = 6V; Iout = 1A



Fall Time (PWM mode): Vin = 4.5V; V_{TP} = 5V; Iout = 1A



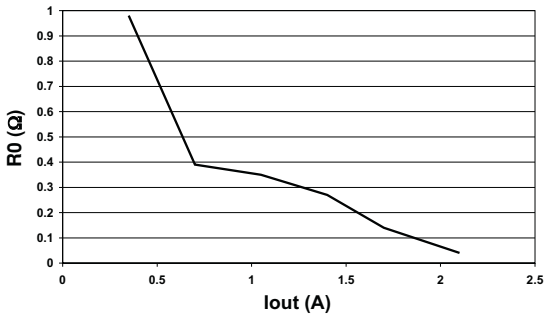
Fall Time (PWM mode): Vin = 3.5V; V_{TP} = 5V; Iout = 1A



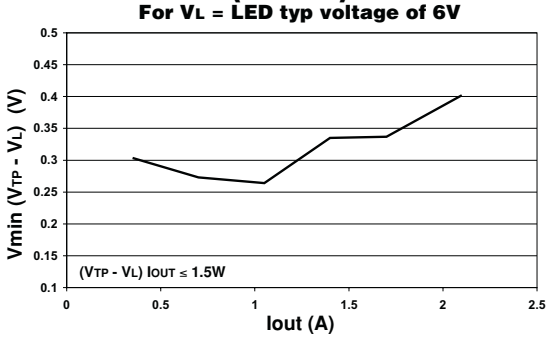
Fall Time (PWM mode): Vin = 3V; V_{TP} = 3.3V; Iout = 1A

PWM MODE FOR 6V LED

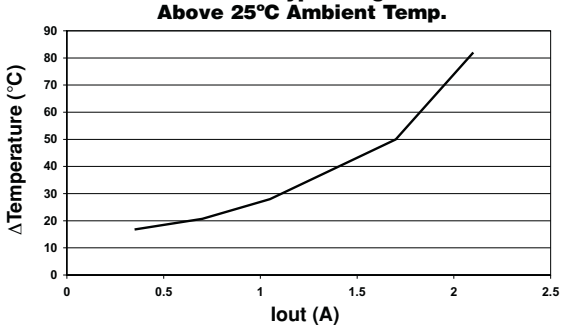
R0 vs. Iout
For V_L = LED typ voltage of 6V



ΔVmin (V_{TP} - V_L) vs. Iout
For V_L = LED typ voltage of 6V

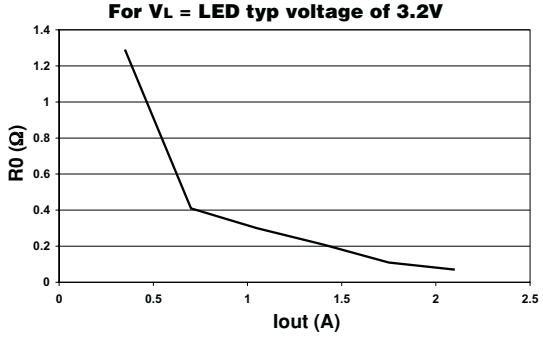


ΔTemp vs. Iout
For V_L = LED typ voltage of 6V
Above 25°C Ambient Temp.

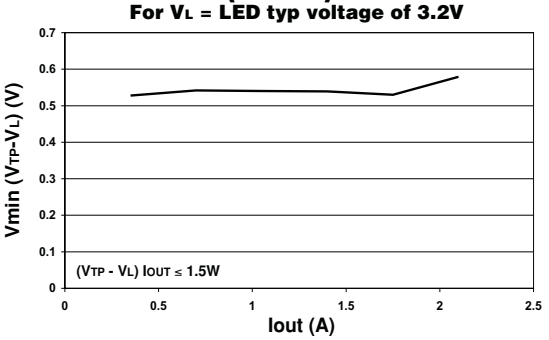


PWM MODE FOR 3.2V LED

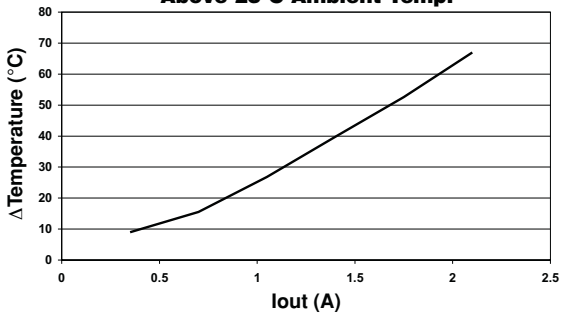
R0 vs. Iout
For V_L = LED typ voltage of 3.2V



ΔVmin (V_{TP} -V_L) vs. Iout
For V_L = LED typ voltage of 3.2V



ΔTemp. vs. Iout
For V_L =LED typ voltage of 3.2V
Above 25°C Ambient Temp.



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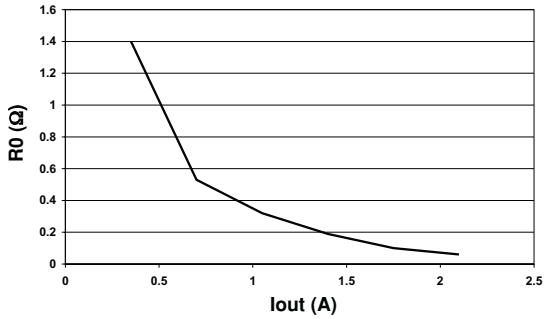
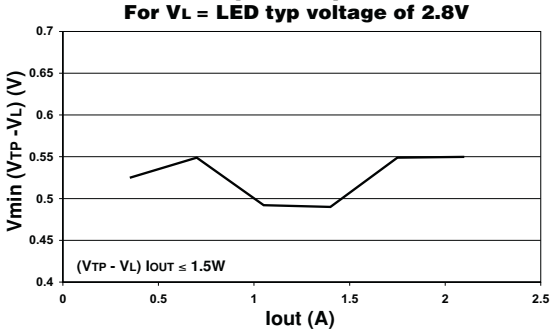
PWM MODE FOR 2.8V LED

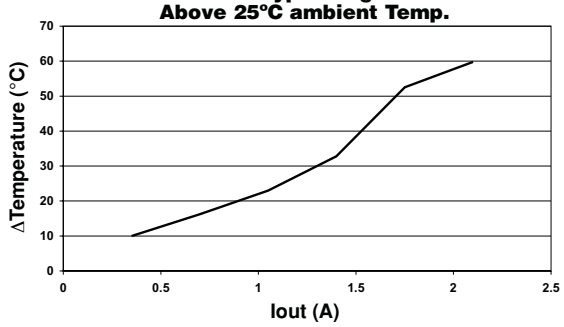
R0 vs. Iout
For V_L = LED typ voltage of 2.8V



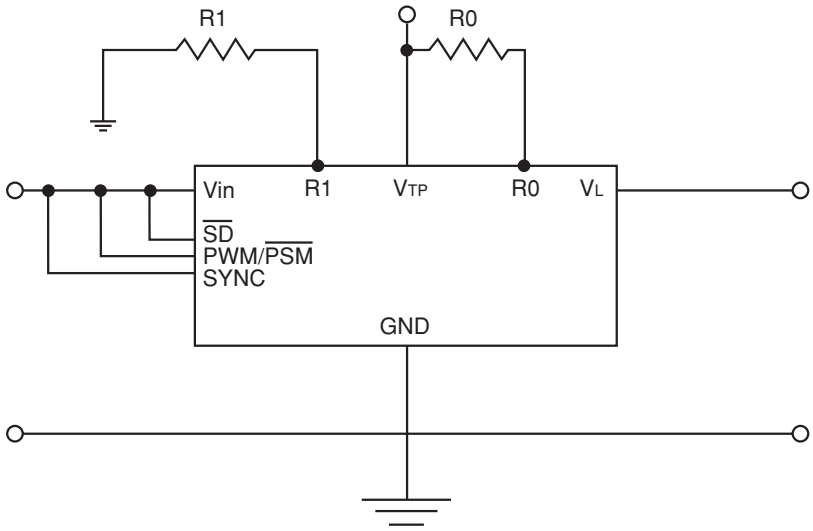
ΔVmin (V_{TP} -V_L) vs. Iout
For V_L = LED typ voltage of 2.8V



ΔTemp. vs. Iout
For V_L = LED typ voltage of 2.8V
Above 25°C ambient Temp.



PIN DESCRIPTION



PIN	DESCRIPTION
SD	Logic low on SD pin shuts down the Current Source completely and decreases current consumption to less than 1uA
PWM/$\overline{PSM}$	Logic high=PWM mode, logic low=PSM mode. In PSM mode synchronous rectification is disabled.
SYNC	Externally controlled synchronization signal. Logic high to low transition forces the clock synchronization. If not used must be connected to Vin or logic high.
Vin	Input supply voltage
GND	Ground
R1	Included inside the package for fixed voltage. To be added externally for all self selected voltage.
V_{TP}	Voltage test point. To test the minimum gap above VL.
R0	To be added externally for self selected output current.
V_L	Output current. LED connection

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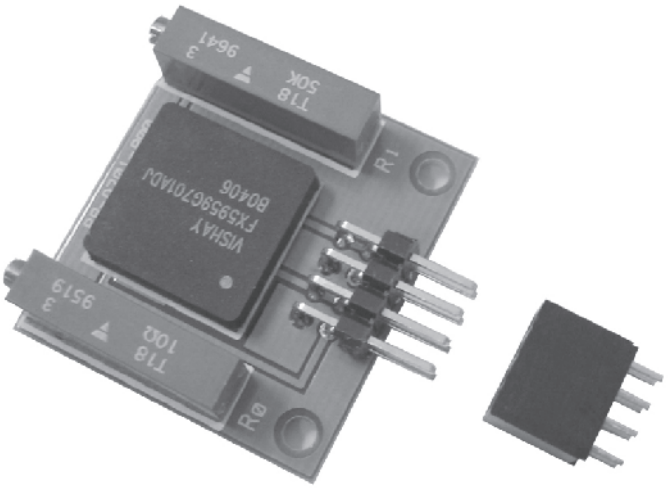
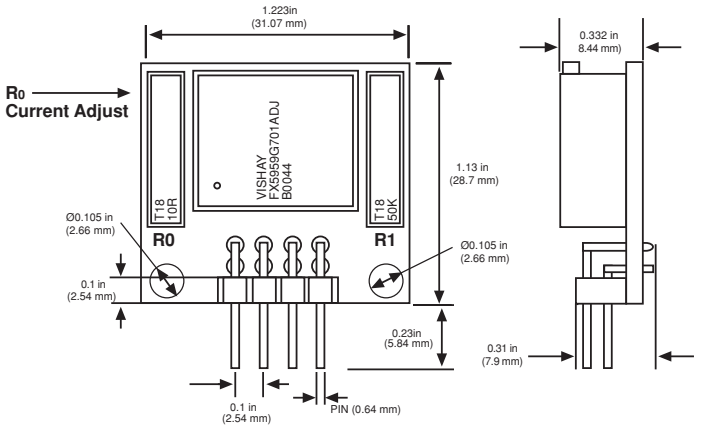
DEMONSTRATION BOARD

TEST SET-UP AND OPERATION

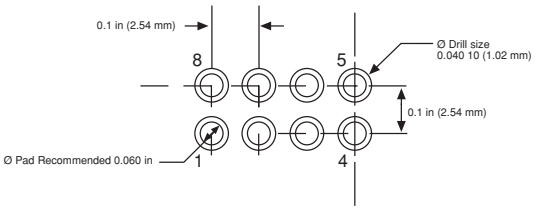
Pins SD (Shut Down), PWM and SYNC (Synchronization) are internally connected on the demo board to Vin.

1. Connect the DB according to the circuit drawing below without connecting the LED
2. Use DC power supply, with current capability of twice the output current.
3. Adjust V_{TP} with R1 trimmer to a typical voltage of 0.6v above the V_L (LED voltage).
4. Connect the LED or equivalent resistor value according to the circuit drawing below and adjust R0 trimmer to the required current.
5. Input voltage can be adjusted between 2.5V to V_{TP}.



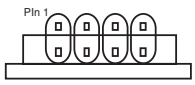


RECOMMENDED BOARD LAYOUT

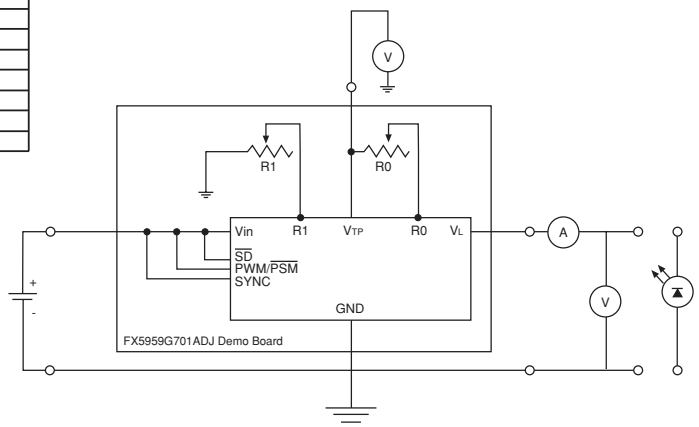


Standard Strip 0.1" (2.54 mm) Centers,
Double Row
All Positions Filled

View from bottom side



PIN No:	Description
1	GND
2	V_L
3	GND
4	Vin
5	Vin
6	GND
7	V_L
8	TP



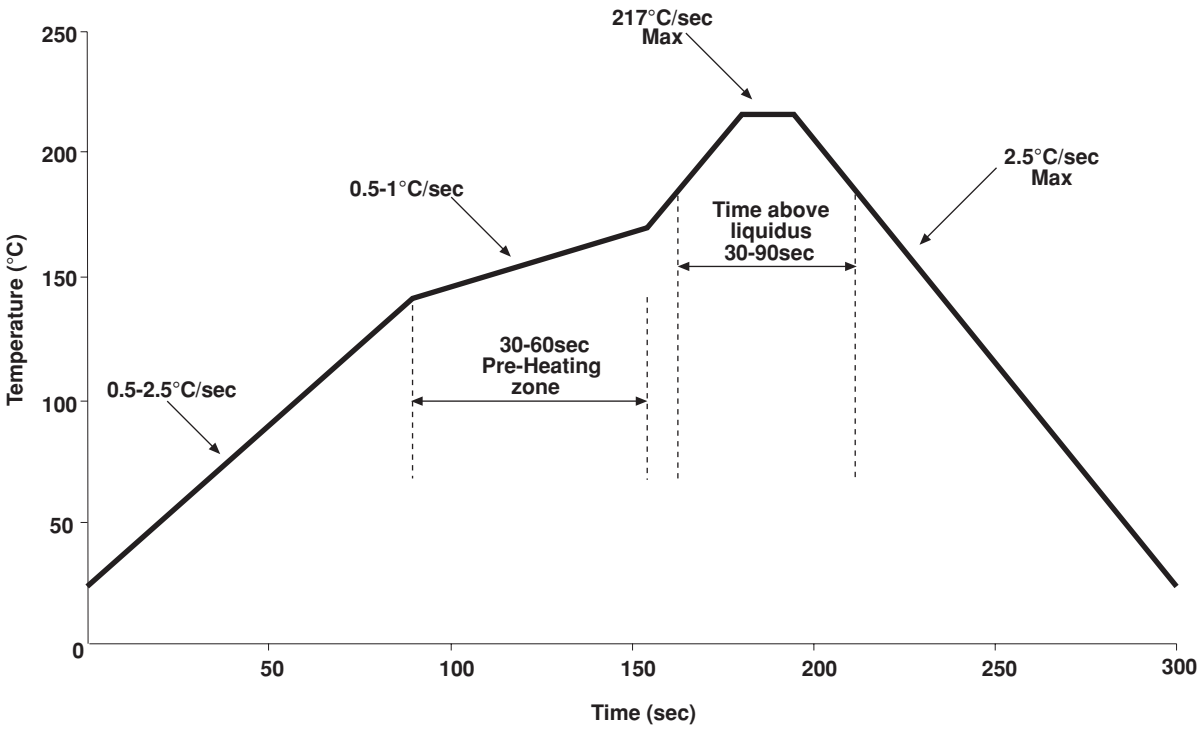
SOLDERING PROFILE

All of the components must be dried prior to assembly as follows:

1. Samples and package type B1 and B5, bulk components - the recommended drying process is to be done at 125°C for 48 hours.
2. For package type T5 - per JEDEC J-STD-033 level 5.

For taped components the recommended drying process is to be done at maximum 70°C.

RECOMMENDED SOLDERING PROFILE



For technical questions, contact FunctionPAK@vishay.com
For marketing questions, contact FunctionPAK.marketing@vishay.com

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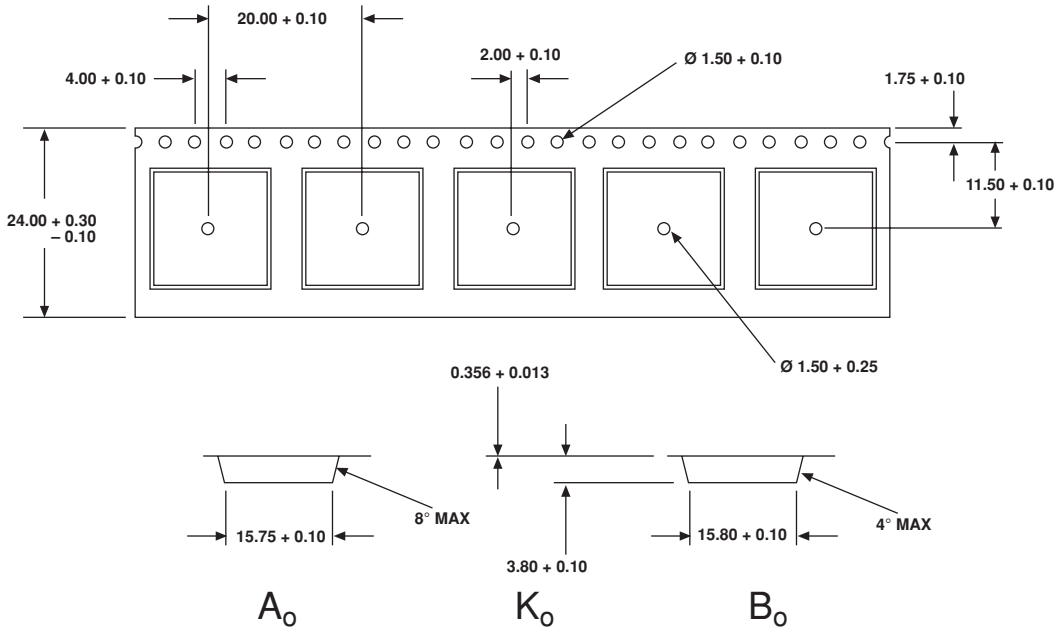
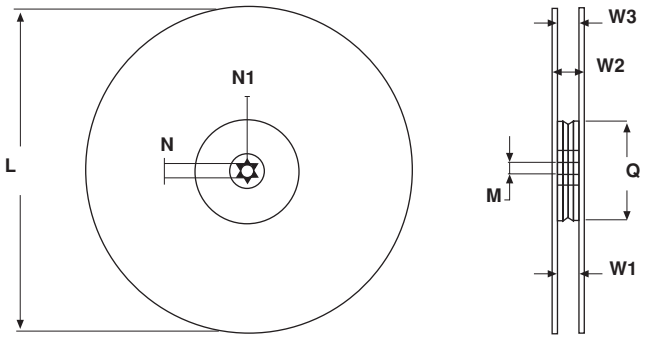
TAPE AND REEL INFORMATION

PER STANDARD EIA-481-2-A
(REVISION OF 481-2 AND INCLUSION OF EIA-481-3)





T5 - 13" REEL DIMENSIONS

DIMENSION	MIN	MAX
L		330
M	12.8	13.2
N	20.2	
N1	1.5	
Q	100	
W1	24.4	26.4
W2		30.4
W3		27.4

*Dimensions are in millimeter