



# SGM3760/SGM3760A

## 2-Channel, 40V High Efficiency Boost White LED Drivers with Flash Mode

### GENERAL DESCRIPTION

The SGM3760 and SGM3760A are 2-channel screen flash white LED drivers with high efficiency boost regulator. With an internal 40V/3.6A power MOSFET, they are well suited for smart phone backlight applications powered by 1-cell Li-Ion battery. The supply voltage operates from 2.7V to 5.5V.

The boost output has an adaptive voltage regulation with enough low headroom voltage. The SGM3760/A are capable of driving up to 10S2P white LEDs while achieving high efficiency.

The SGM3760/A are designed for smart phone image capture using display device as a screen flash mode light source, as they are capable of driving up to 80mA/60mA current per channel at 32V for 330ms when the strobe signal is active.

The backlight mode default white LED current is programmed by an external  $R_{SET}$  resistor. During the operation, the LED current can be controlled by applying a PWM signal to the PWM pin.

When the device is in operation and the STRB pin is pulled up, the SGM3760/A will enter flash mode within 50 $\mu$ s. The output current is regulated to 4 $\times$  for SGM3760 and 3 $\times$  for SGM3760A of the backlight mode voltage that is determined by the PWM signal duty cycle. When the STRB pin is pulled down or the strobe signal remains high for longer than the 330ms timer, the SGM3760/A will enter backlight mode within 50 $\mu$ s.

The SGM3760/A includes various protections such as built-in soft-start, over-voltage protection, over-current protection, and thermal shutdown.

The SGM3760/A are available in a Green WLCSP -1.32 $\times$ 1.32-9B package and operate over the -40 $^{\circ}$ C to +85 $^{\circ}$ C temperature range.

### FEATURES

- **Input Voltage Range: 2.7V to 5.5V**
- **Integrated 40V/3.6A Switch**
- **Up to 90% Efficiency**
- **Adaptive Boost Regulator**
- **Switching Frequency: 1.15MHz**
- **Optimized Rise Time and Fall Time to Reduce EMI on SW Pin**
- **Dual Current Sinks**
  - ◆ **Up to 30mA Current Each in Backlight Mode**
  - ◆ **SGM3760: 4 $\times$  Output Current in Screen Flash Mode for 330ms Timeout**
  - ◆ **SGM3760A: 3 $\times$  Output Current in Screen Flash Mode for 330ms Timeout**
- **1% Regulated LED Current Matching and Accuracy**
- **Very Low Headroom Voltage: 150mV**
- **PWM Dimming Interface**
- **Dimming Stable in More than 1:500 PWM Range**
- **PFM Mode at Light Load**
- **Automatic Soft-Start for Reducing Inrush Current**
- **Protection Features**
  - ◆ **41.5V Over-Voltage Protection**
  - ◆ **LED Open or Short Protection**
  - ◆ **Thermal Shutdown**
- **-40 $^{\circ}$ C to +85 $^{\circ}$ C Operating Temperature Range**
- **Available in a Green WLCSP-1.32 $\times$ 1.32-9B Package**

### APPLICATIONS

PDAs, Handheld Computers

Backlight for Media Form Factor LCD Displays with 1-Cell Battery Input

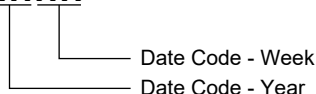
**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3760	WLCSP-1.32×1.32-9B	-40°C to +85°C	SGM3760YG/TR	XXXX ME6	Tape and Reel, 3000
SGM3760A	WLCSP-1.32×1.32-9B	-40°C to +85°C	SGM3760AYG/TR	XXXX C04	Tape and Reel, 3000

**MARKING INFORMATION**

NOTE: XXXX = Date Code.

**XXXX**



Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

**ABSOLUTE MAXIMUM RATINGS**

VIN.....	0.3V to 6V
STRB, PWM to GND .....	-0.3V to 6V
COMP, ISET to GND .....	-0.3V to 3V
SW, IFB1, IFB2 to GND .....	-0.3V to 40V
Package Thermal Resistance	
WLCSP-1.32×1.32-9B, $\theta_{JA}$ .....	100°C/W
Junction Temperature .....	+150°C
Storage Temperature Range .....	-65°C to +150°C
Lead Temperature (Soldering, 10s) .....	+260°C
ESD Susceptibility	
HBM .....	4000V
MM .....	300V
CDM .....	1000V

**RECOMMENDED OPERATING CONDITIONS**

Supply Voltage Range .....	2.7V to 5.5V
Operating Temperature Range .....	-40°C to +85°C
Operating Junction Temperature Range, $T_J$	
.....	-40°C to +125°C

**OVERSTRESS CAUTION**

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

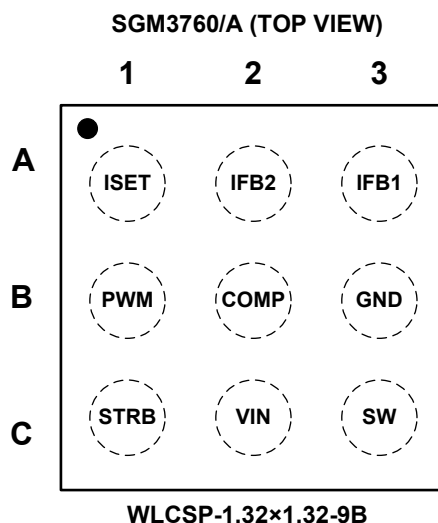
**ESD SENSITIVITY CAUTION**

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

**DISCLAIMER**

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

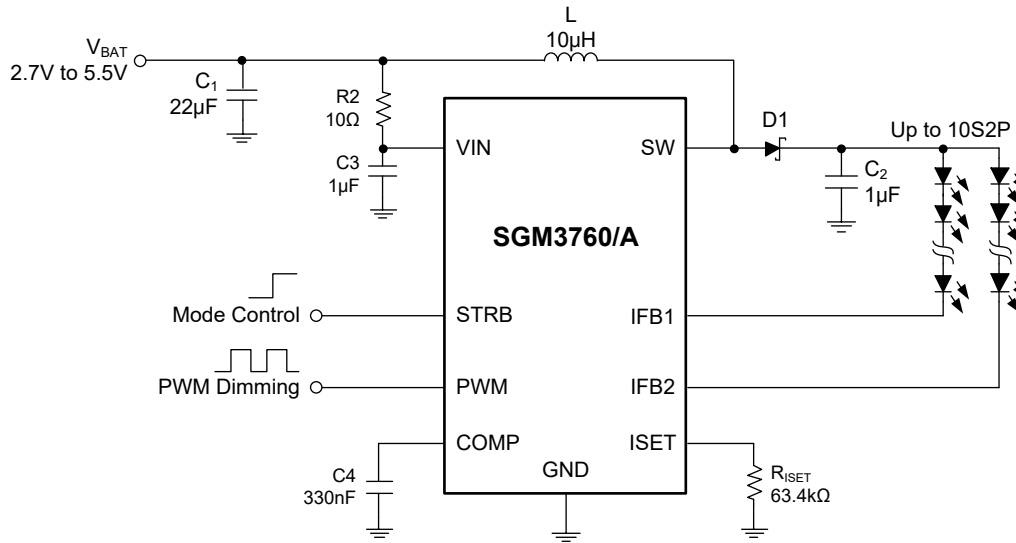
PIN CONFIGURATION



PIN DESCRIPTION

PIN	NAME	I/O	FUNCTION
A1	ISET	I	Current Setting Pin. Connect an external resistor from this pin to ground to set the maximum LED current.
A2	IFB2	I	Regulated Current Sink 2.
A3	IFB1	I	Regulated Current Sink 1.
B1	PWM	I	PWM Dimming Input.
B2	COMP	O	Transconductance Error Amplifier Output. Connect an external capacitor from COMP to ground to compensate the converter.
B3	GND	O	Ground Pin.
C1	STRB	I	Strobe Signal Input Pin. STRB synchronizes the flash pulse to the image capture. Generally, this signal is directly generated from the image sensor.
C2	VIN	I	Input Supply Pin.
C3	SW	I	Drain Connection for Internal Low-side N-Channel MOSFET.

**TYPICAL APPLICATION**



**Figure 1. Typical Application Circuit**

**NOTES:**

1. Backlight Mode: The SGM3760/A are capable of driving 10S2P LEDs with 30mA per channel.
2. Flash Mode: The SGM3760 is capable of driving 8S2P LEDs with 80mA per channel for 330ms.  
The SGM3760/A are capable of driving 10S2P LEDs with 60mA per channel for 330ms.

**ELECTRICAL CHARACTERISTICS**

( $V_{IN} = 3.6V$ , PWM = high, STRB = low,  $I_{FB} = 20mA$ , Full =  $-40^{\circ}C$  to  $+85^{\circ}C$ , typical values are at  $T_A = +25^{\circ}C$ , unless otherwise specified.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
<b>Power Supply</b>							
Input Voltage Range	$V_{IN}$		+25°C	2.7		5.5	V
Operating Quiescent Current into VIN	$I_Q$	Device enable, $V_{IN} = 3.6V$ , switching 1.15MHz and no load	+25°C		1.7	2.1	mA
Shutdown Current	$I_{SD}$	PWM = low	+25°C		0.01	1	μA
Under-Voltage Lockout Threshold	UVLO	$V_{IN}$ falling	+25°C		2.25		V
		$V_{IN}$ rising	+25°C		2.35	2.45	
Under-Voltage Lockout Hysteresis	$V_{HYS}$		+25°C		100		mV
<b>STRB and PWM</b>							
STRB/PWM Threshold	Logic High Voltage	$V_{IH}$		Full	1.65		V
	Logic Low Voltage	$V_{IL}$		Full		0.50	V
PWM Pin Internal Pull-Down Resistor	$R_{PD1}$		+25°C		900		kΩ
PWM Logic High Time to Backlight Mode	$t_{RP1}$		+25°C		55		ms
PWM Logic Low Time to Shutdown	$t_{SD1}$	CTRL high to low	+25°C	2.5			ms
STRB Pin Internal Pull-Down Resistor	$R_{PD2}$		+25°C		55		kΩ
STRB Logic High Time to Flash Mode	$t_{RP2}$		+25°C		50		μs
STRB Logic Low Time to Backlight Mode	$t_{SD2}$		+25°C		50		μs
Flash Mode Timer	$t_P$		+25°C	280	330	380	ms
PWM Dimming Signal Frequency	$f_{PWM}$		+25°C	10		100	kHz
Minimum PWM On-Time	$t_{PWM\_ON(MIN)}$		+25°C	30			ns
<b>Regulation</b>							
ISET Pin Voltage	$V_{ISET\_FULL}$	Backlight mode full brightness	Full	1.184	1.220	1.256	V
Backlight Mode Current Multiplier	$K_{ISET\_BL}$	Backlight mode Full brightness	+25°C		1050		
Flash Mode Current Multiplier	$K_{ISET\_FL}$	Flash mode full brightness (SGM3760)	+25°C		4200		
		Flash mode full brightness (SGM3760A)	+25°C		3150		
Current Accuracy	$I_{FB\_AVG}$	$I_{SET} = 20\mu A$ , $D = 100\%$	+25°C	-5		5	%
$(I_{MAX} - I_{AVG}) / I_{AVG}$	$K_M$	$D = 100\%$	+25°C			2.5	%
Backlight Mode Current Sink Maximum Output Current	$I_{FB\_MAXBL}$	$I_{SET} = 30\mu A$ , each IFBx pin	+25°C		30		mA
Flash Mode Current Sink Maximum Output Current	$I_{FB\_MAXFL}$	$I_{SET} = 30\mu A$ , each IFBx pin (SGM3760)	+25°C		120		mA
		$I_{SET} = 30\mu A$ , each IFBx pin (SGM3760A)	+25°C		90		
<b>Power Switch</b>							
Switch MOSFET On-Resistance	$R_{DS(ON)}$	$V_{IN} = 3.6V$	+25°C		0.18		Ω
		$V_{IN} = 3V$	+25°C		0.2		
<b>Oscillator</b>							
Oscillator Frequency	$f_S$		Full	950	1150	1350	kHz
Maximum Duty Cycle	$D_{MAX}$	Measured on the drive signal of switch MOSFET	+25°C		96		%

# 2-Channel 40V High Efficiency Boost White LED Drivers with Flash Mode

## SGM3760/SGM3760A

### ELECTRICAL CHARACTERISTICS (continued)

( $V_{IN} = 3.6V$ , PWM = high, STRB = low,  $I_{FB} = 20mA$ , Full =  $-40^{\circ}C$  to  $+85^{\circ}C$ , typical values are at  $T_A = +25^{\circ}C$ , unless otherwise specified.)

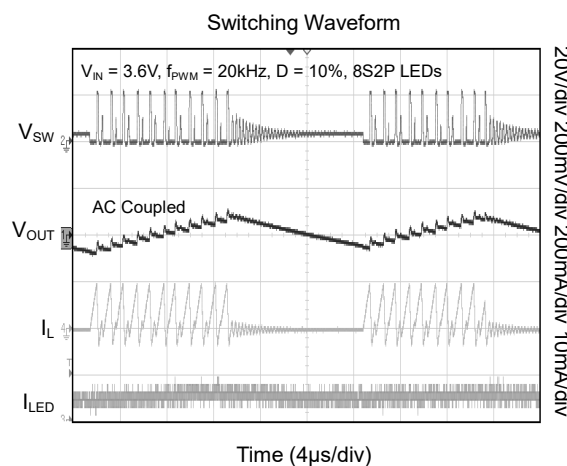
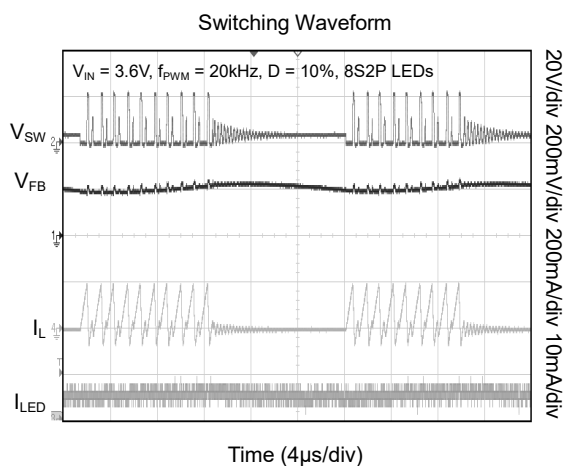
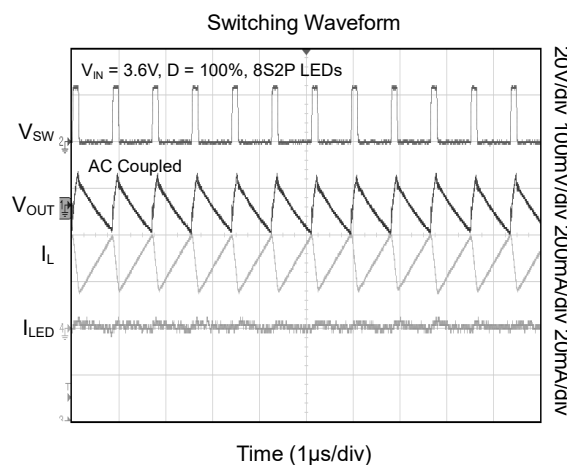
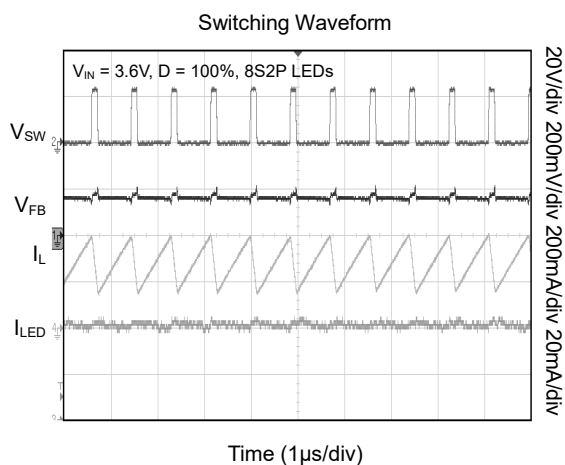
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
<b>Boost Voltage Control</b>							
Backlight Mode IFBx Feedback Regulation Voltage	$V_{IFB\_REGB}$	$I_{IFBx} = 20mA$ , measured on IFBx pin which has a lower voltage	$+25^{\circ}C$		150		mV
Flash Mode IFBx Feedback Regulation Voltage	$V_{IFB\_REGF}$	$I_{IFBx} = 80mA$ , measured on IFBx pin which has a lower voltage	$+25^{\circ}C$		450		mV
<b>Protection</b>							
Flash Mode Switch MOSFET Current Limit	$I_{LIMFL}$	$D = D_{MAX}$	$+25^{\circ}C$		3.6		A
Backlight Mode Switch MOSFET Current Limit	$I_{LIMBL}$	$D = D_{MAX}$	$+25^{\circ}C$	1.35	1.70	2.10	A
Switch MOSFET Start Up Current Limit	$I_{LIM\_START}$	$D = D_{MAX}$	$+25^{\circ}C$		0.6		A
Time Window for Half Current Limit	$t_{HALF\_LIM}$		$+25^{\circ}C$		6		ms
SW Pin Over-Voltage Threshold	$V_{OVP\_SW}$		Full	40.0	41.5	43.0	V
IFBx Pin Over-Voltage Threshold	$V_{OVP\_IFB}$	Measured on IFBx pin	$+25^{\circ}C$		4.5		V
<b>Thermal Shutdown</b>							
Thermal Shutdown Threshold	$T_{SHDN}$				150		$^{\circ}C$
Thermal Shutdown Hysteresis	$T_{HYS}$				15		$^{\circ}C$

**RECOMMENDED COMPONENTS OF TEST CIRCUITS**

	Component		Component
Inductor	10 $\mu$ H/CD75NP-100KC	Capacitor	1 $\mu$ F/C2012X7R1H105JT
Diode	MBR0540		

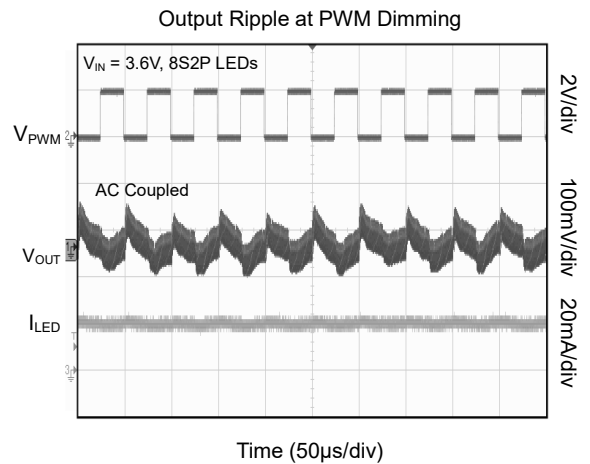
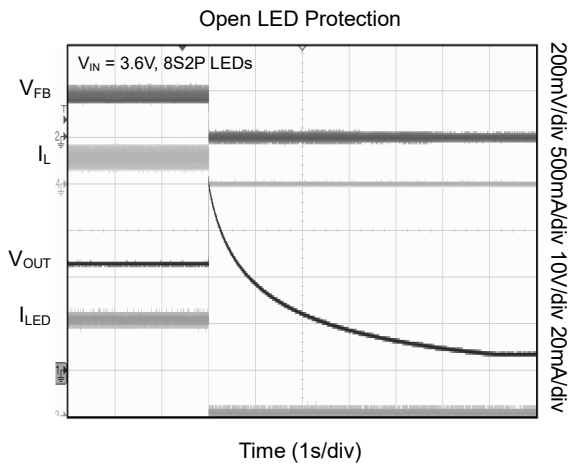
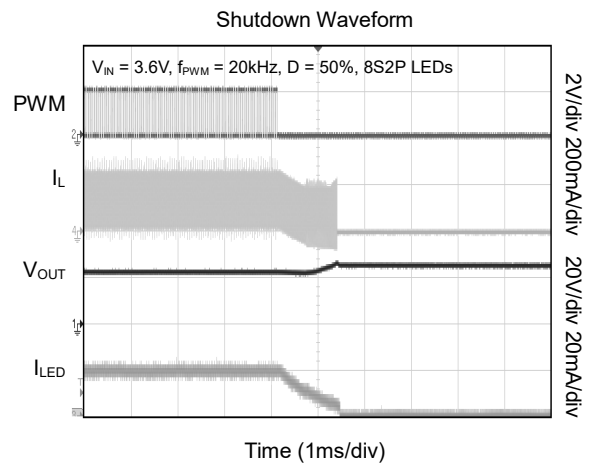
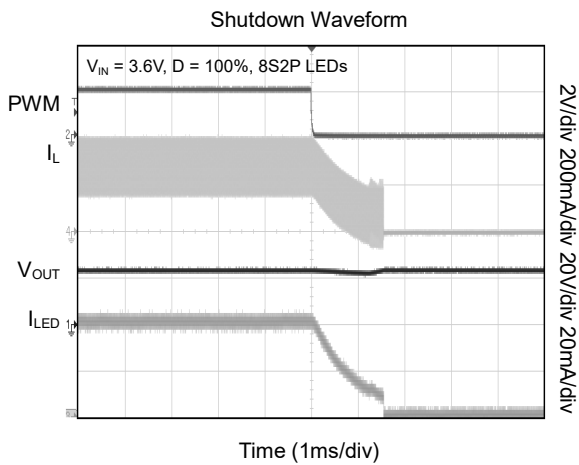
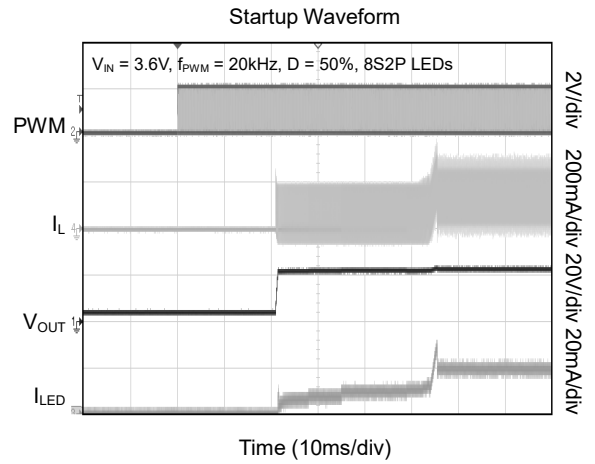
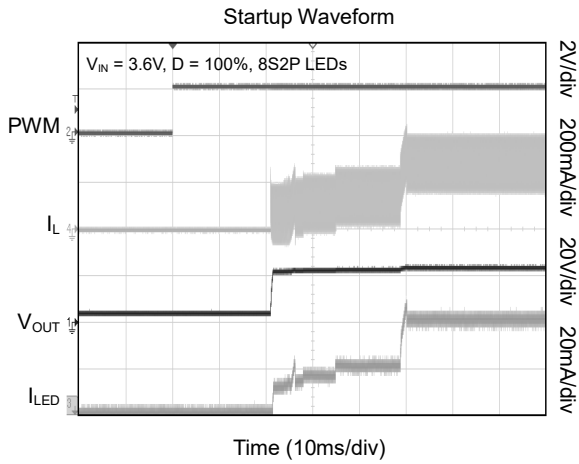
**TYPICAL PERFORMANCE CHARACTERISTICS**

T<sub>A</sub> = +25°C, L = 10 $\mu$ H, C<sub>IN</sub> = 1 $\mu$ F, C<sub>OUT</sub> = 1 $\mu$ F, unless otherwise noted.



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

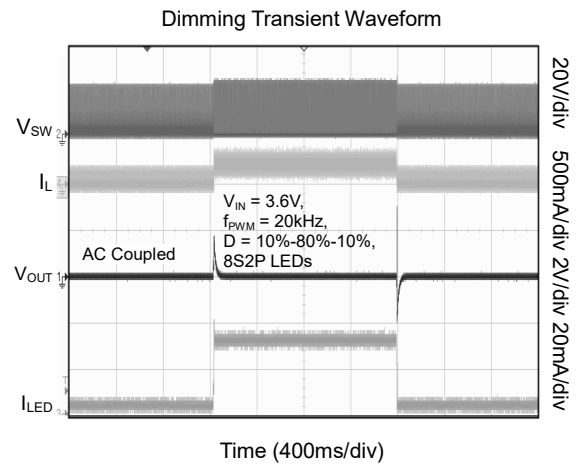
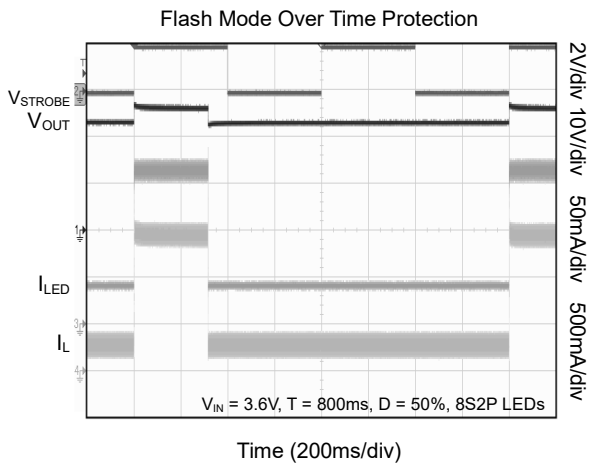
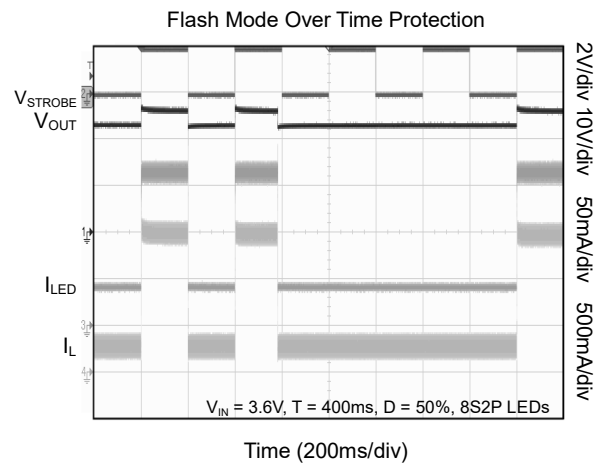
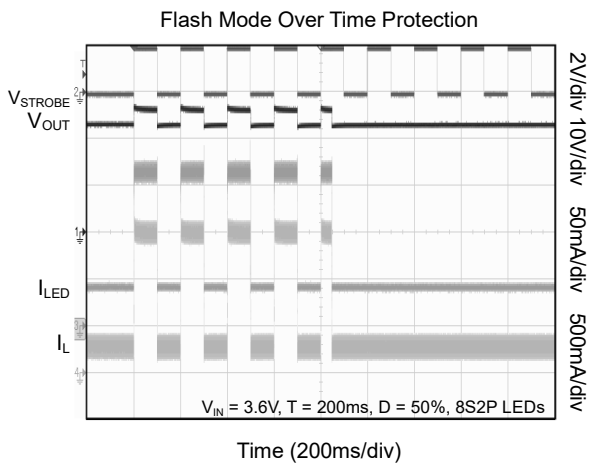
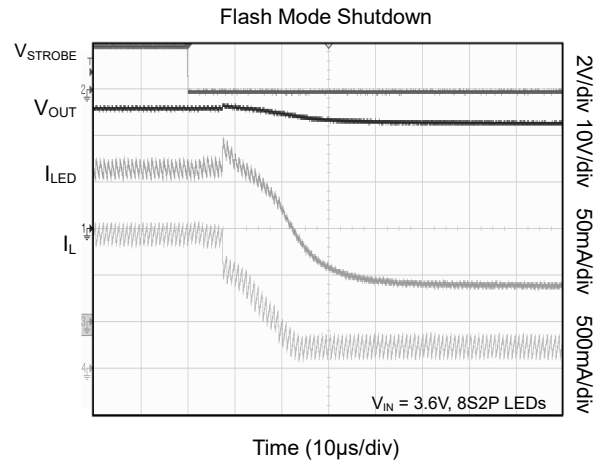
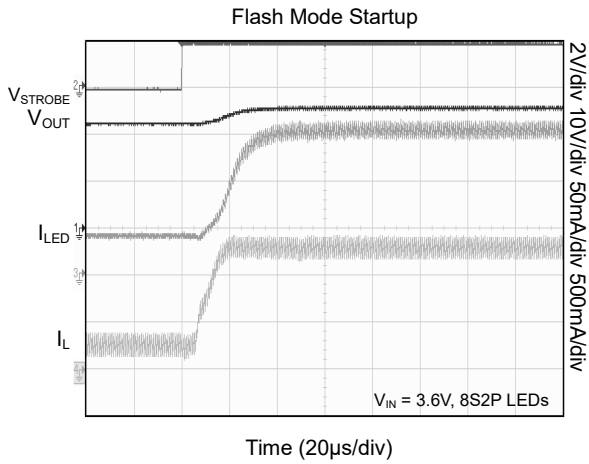
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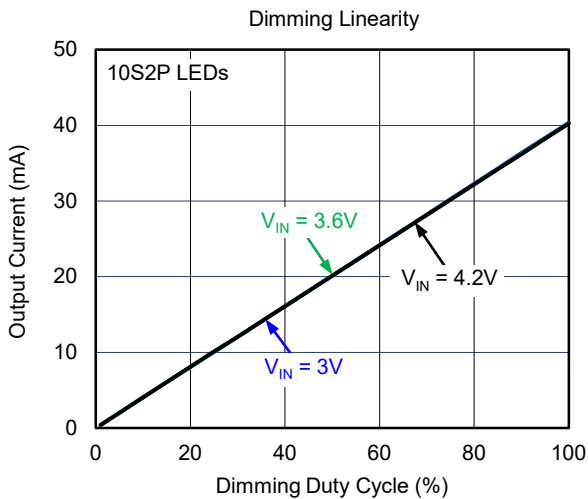
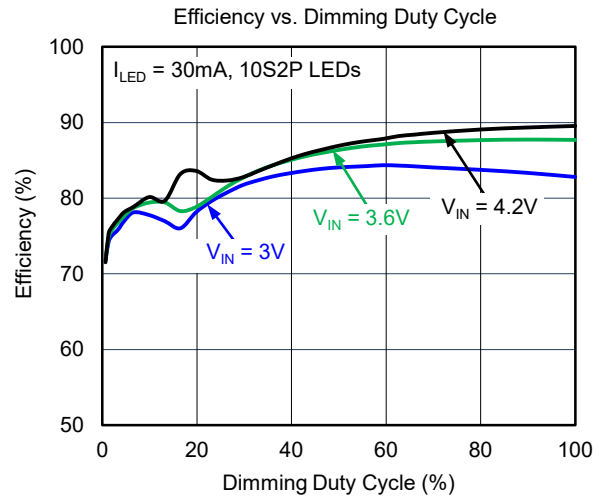
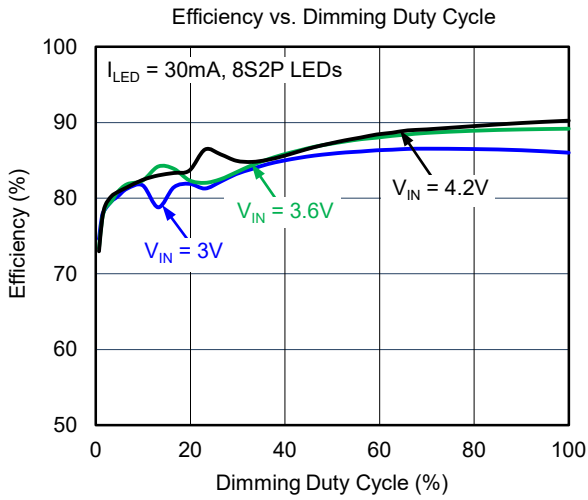
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T<sub>A</sub> = +25°C, L = 10μH, C<sub>IN</sub> = 1μF, C<sub>OUT</sub> = 1μF, unless otherwise noted.



**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**

T<sub>A</sub> = +25°C, L = 10µH, C<sub>IN</sub> = 1µF, C<sub>OUT</sub> = 1µF, unless otherwise noted.



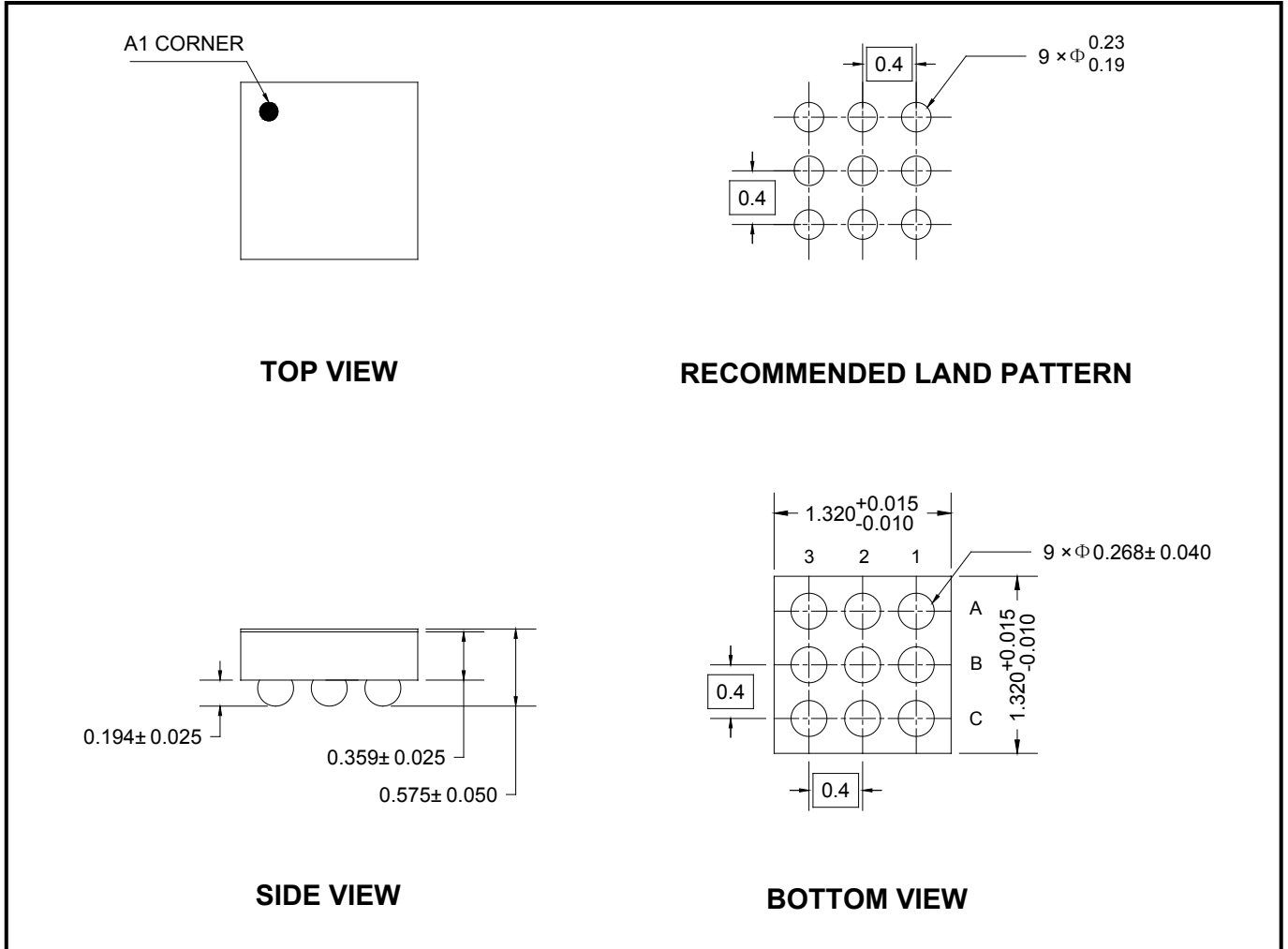
**REVISION HISTORY**

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (MARCH 2019) to REV.A	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

WLCSP-1.32×1.32-9B



NOTE: All linear dimensions are in millimeters.

# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
WLCSP-1.32×1.32-9B	7"	9.5	1.38	1.38	0.70	4.0	4.0	2.0	8.0	Q1

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# PACKAGE INFORMATION

## CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

## KEY PARAMETER LIST OF CARTON BOX

Reel Type	Length (mm)	Width (mm)	Height (mm)	Pizza/Carton
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002