SGM3758
38V High Efficiency, Boost White LED Driver with Strobe Interface for Flash Mode

GENERAL DESCRIPTION

The SGM3758 is a high efficiency white LED driver with a 1.2MHz boost converter. With the fixed switching frequency and an internal 40V/3A switch FET, the SGM3758 is designed for powering single or parallel LED strings for various size panel backlighting and ideal for smart phone image capture using display device as a flash mode light source, as it is capable of driving up to 200mA current at 30V for 320ms when the strobe signal is active.

The FB feedback voltage is regulated at 200mV typically. The backlight mode default 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 CTRL pin. The feedback voltage depends on the PWM signal duty cycle. For PWM dimming control, there are no audible noises on the output capacitor.

The SGM3758 integrates LED open protection. It prevents the device from damaging due to the over-voltage during LED open conditions.

When the device is in operation and the STROBE pin is pulled up, the SGM3758 will enter flash mode within 100μs. The feedback voltage is regulated to 5× of the backlight mode voltage that is determined by the PWM signal duty cycle. When the STROBE pin is pulled down or the strobe signal remains high for longer than the 320ms timer, the SGM3758 will enter backlight mode within 100μs.

The SGM3758 is available in a Green TDFN-2×2-6L package. It operates over an ambient temperature range of -40℃ to +85℃.

FEATURES

- **Input Voltage Range: 2.7V to 5.5V**
- **Integrated 40V/3A Switch**
- **Up to 200mA Output Current at 30V**
- **Accumulated 320ms Flash Timer Control**
- **Switching Frequency: 1.2MHz**
- **PWM Dimming Control**
- **PWM Dimming Frequency: 20kHz to 100kHz**
- **Strobe Interface for Image Capture Mode**
- **Up to 87% Efficiency for 7S2P LEDs**
- **Up to 92% Efficiency for 3S20P LEDs**
- **Dimming Stable in 1:500 Range**
- **Feedback Voltage**
  - **Backlight Mode: 200mV**
  - **Flash Mode: 1000mV**
- **Flash Mode Under-Voltage Lockout**
- **Automatic Soft-Start for Reducing Inrush Current**
- **PFM Mode at Light Load**
- **Protection Features**
  - **38V Over-Voltage Protection**
  - **LED Open or Short Protection**
  - **Thermal Shutdown**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in a Green TDFN-2×2-6L Package**

APPLICATIONS

PDAs, Handheld Computers

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

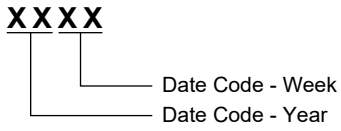
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3758	TDFN-2×2-6L	-40℃ to +85℃	SGM3758YTDI6G/TR	3758 XXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXX = Date Code.

TDFN-2×2-6L



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

Voltages on VIN, CTRL, STROBE, FB ..... -0.3V to 6V
Package Thermal Resistance
TDFN-2×2-6L, θ_{JA} ..... 120℃/W
Voltage on SW ..... -0.3V to 40V
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 3000V
MM 200V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Input Voltage Range ..... 2.7V to 5.5V
Output Voltage Range ..... V_{IN} to 38V
Inductor ..... 4.7μH to 22μH
Input Capacitor ..... 1μF (MIN)
Output Capacitor ..... 1μF to 10μF
Operating Temperature Range ..... -40℃ to +85℃

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.

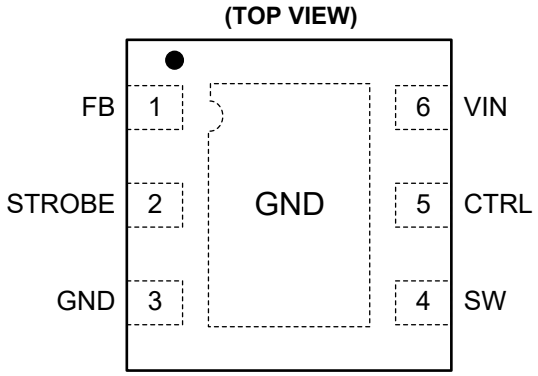
ESD SENSITIVITY CAUTION

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



TDFN-2×2-6L

PIN DESCRIPTION

PIN	NAME	I/O	FUNCTION
1	FB	I	Feedback Input for Current. Connect the sense resistor from FB to GND.
2	STROBE	I	Strobe Signal Input Pin. STROBE synchronizes the flash pulse to the image capture. Generally, this signal is directly generated from the image sensor.
3	GND	O	Ground Pin.
4	SW	I	Boost Switching Node. The device monitors the output voltage on this pin for LED open protection. Connect an inductor between the VIN and SW pins.
5	CTRL	I	Boost Regulator Control Pin. It is used for enable control and PWM dimming control.
6	VIN	I	Input Supply Pin.
Exposed Pad	GND	—	Exposed Pad. It should be soldered to the analog ground plane. If possible, use thermal via connection to ground plane for enhanced power dissipation.

TYPICAL APPLICATION

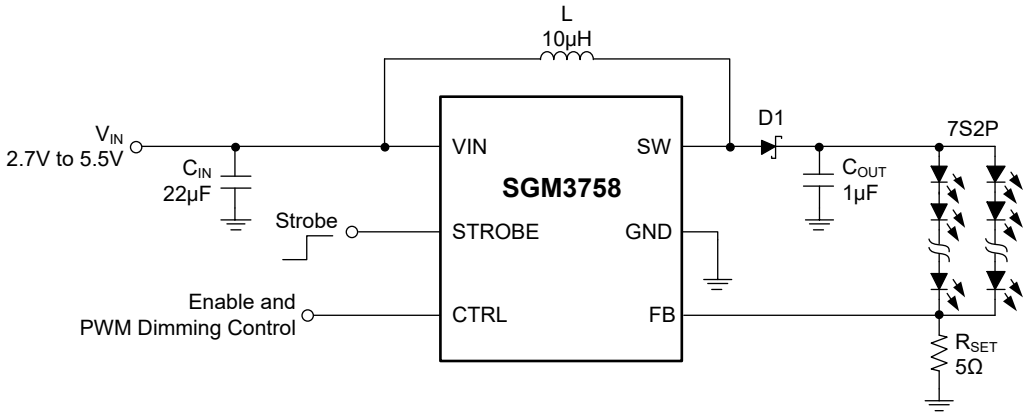


Figure 1. Typical Application Circuit

ELECTRICAL CHARACTERISTICS

(V_{IN} = 3.6V, CTRL = V_{IN}, C_{IN} = 22μF, Full = -40℃ to +85℃, typical values are at T_A = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Power Supply							
Input Voltage Range	V_{IN}		Full	2.7		5.5	V
Under-Voltage Lockout Threshold	UVLO	V_{IN} falling	+25℃		2.2		V
		V_{IN} rising	+25℃		2.3	2.5	V
UVLO Hysteresis	V_{HYS}		+25℃		100		mV
Operating Quiescent Current into V_{IN}	I_Q	V_{FB} = 300mV, no switching	+25℃		0.2	0.35	mA
Shutdown Current	I_{SD}	CTRL = GND	+25℃			1	μA
Boost Converter							
Backlight Mode Feedback Regulation Voltage	$V_{FB(BL)}$	PWM duty cycle 100%	+25℃	193.5	200	205.3	mV
		PWM duty cycle 10%	+25℃	18	20	22	mV
		PWM duty cycle 1%	+25℃	1.4	2.2	3	mV
		PWM duty cycle 0.2%	+25℃		0.65		mV
Flash Mode Feedback Regulation Voltage	$V_{FB(FL)}$	PWM duty cycle 100%	+25℃	950	1000	1050	mV
		PWM duty cycle 67%	+25℃	630	670	710	mV
		PWM duty cycle 33%	+25℃	300	330	360	mV
FB Pin Bias Current	I_{FB}	V_{FB} = 100mV	+25℃		0.6	1	μA
V_{REF} Filter Time Constant	t_{REF}		+25℃		0.1		ms
N-Channel MOSFET On-Resistance	$R_{DS(ON)}$		+25℃		0.2	0.3	Ω
Switching Frequency	f_{SW}		Full	0.9	1.2	1.35	MHz
Switching MOSFET Current Limit for Backlight Mode	I_{LIMBL}		+25℃	1.15	1.5	1.85	A
Switching MOSFET Current Limit for Flash Mode	I_{LIMFL}		+25℃		3		A
Output Voltage Over-Voltage Threshold	V_{OVP_SW}		Full	36	38	39.5	V
Control							
CTRL Logic High Voltage	V_{CTRLH}		Full	1.6			V
CTRL Logic Low Voltage	V_{CTRLL}		Full			0.4	V
CTRL Pin internal Pull-Down Resistor	R_{CTRLPD}		+25℃		580		kΩ
CTRL Logic High Time to Backlight Mode	t_{RP1}		+25℃		6		ms
CTRL Logic Low Time to Shutdown	t_{SD1}	CTRL high to low	+25℃	2.5			ms
STROBE Logic High Voltage	$V_{STROBEH}$		Full	1.6			V
STROBE Logic Low Voltage	$V_{STROBEL}$		Full			0.4	V
STROBE Pin internal Pull-Down Resistor	$R_{STROBEPD}$		+25℃		180		kΩ
STROBE Logic High Time to Flash Mode	t_{RP2}		+25℃		50		μs
STROBE Logic Low Time to Backlight Mode	t_{SD2}		+25℃		50		μs
Flash Mode Under-Voltage Lockout Threshold	$UVLO_{FL}$		+25℃	3.2	3.3	3.45	V
Flash Mode UVLO Hysteresis	V_{HYSFL}		+25℃		100		mV
Flash Mode Timer	t_P		+25℃	280	320	380	ms
PWM Dimming Frequency Range	DFR		+25℃	20		100	kHz
Minimum PWM On-Time			+25℃	40			ns
PWM Duty Cycle Changing Time to Output	DCCTO	Duty cycle from100% to 50%	+25℃		2		ms
Stable Dimming Range	DR		+25℃	0.2		100	%
Thermal Shutdown							
Thermal Shutdown Threshold	$T_{SHUTDOWN}$				160		℃
Thermal Shutdown Hysteresis	T_{HYS}				20		℃

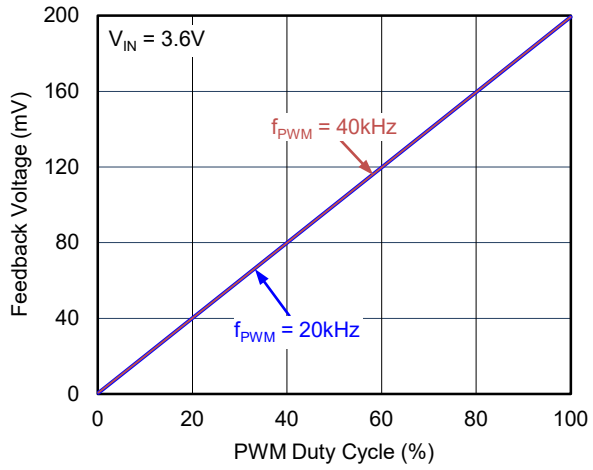
RECOMMENDED COMPONENTS OF TEST CIRCUITS

	Component		Component
Inductor	10μH/ETQP3M100KVP	**Capacitor**	1μF/C2012X7R1H105JT
Diode	PMEG4030ER		22μF/C2012X7R1H226JT

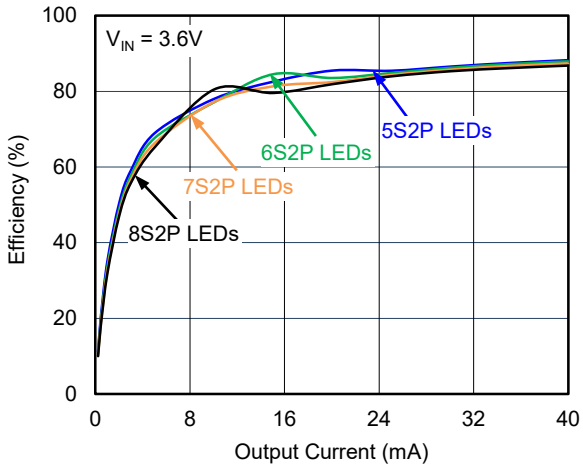
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = +25℃, L = 10μH, C_{IN} = 22μF, C_{OUT} = 1μF, unless otherwise noted.

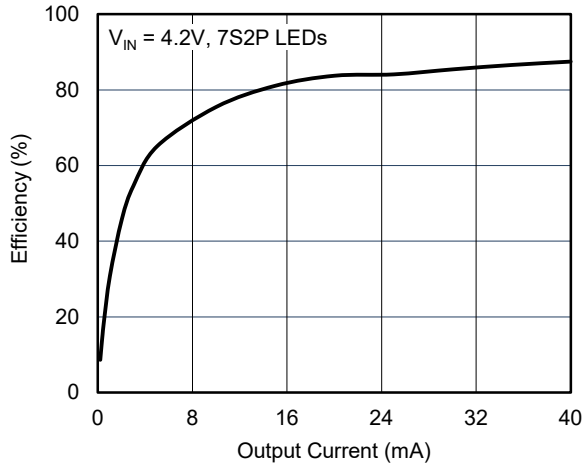
Feedback Voltage vs. PWM Duty Cycle



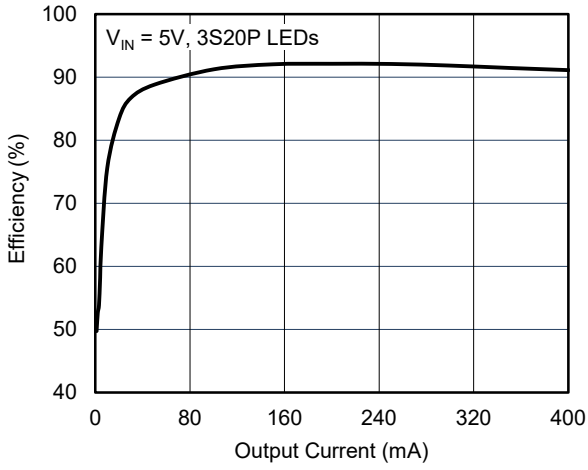
Efficiency vs. Output Current



Efficiency vs. Output Current



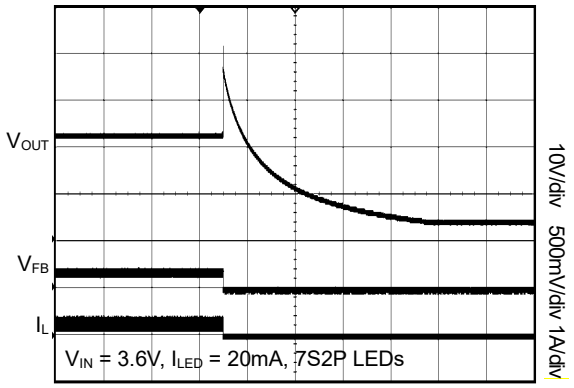
Efficiency vs. Output Current



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

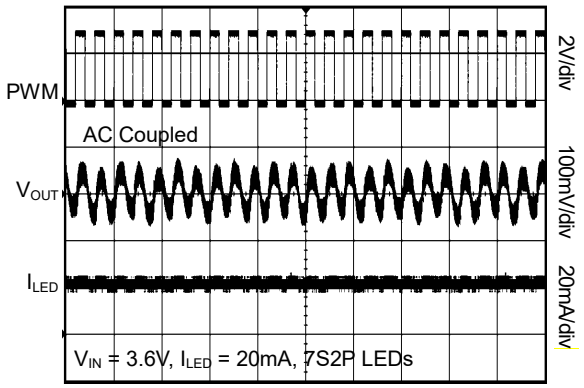
T_A = +25℃, L = 10μH, C_{IN} = 22μF, C_{OUT} = 1μF, unless otherwise noted.

Open LED Protection



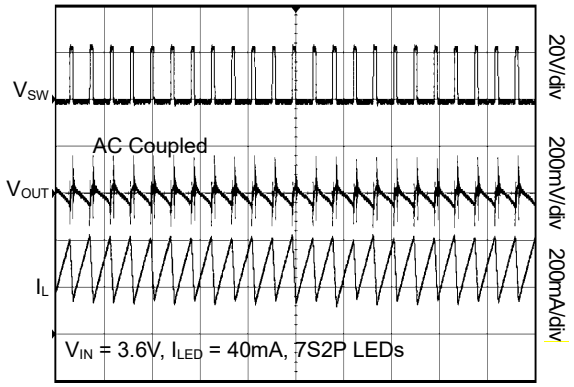
Time (2s/div)

Output Ripple at PWM Dimming



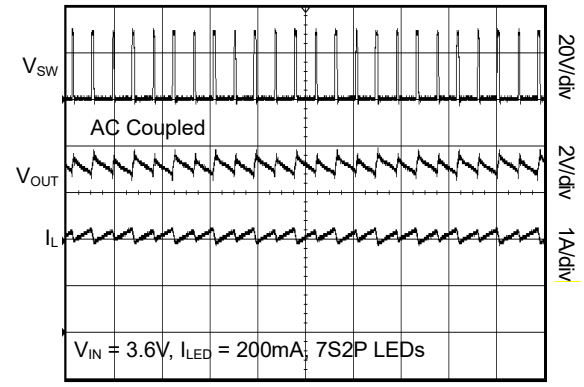
Time (50μs/div)

Switching Waveform



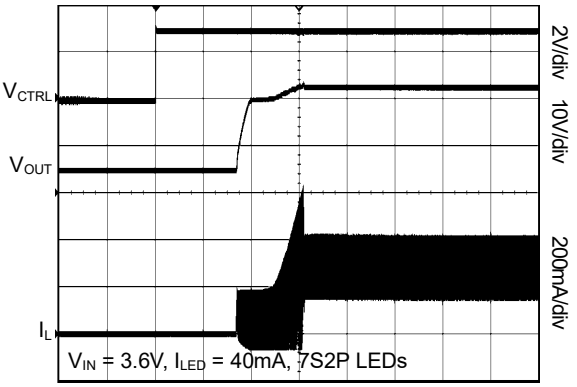
Time (2μs/div)

Switching Waveform



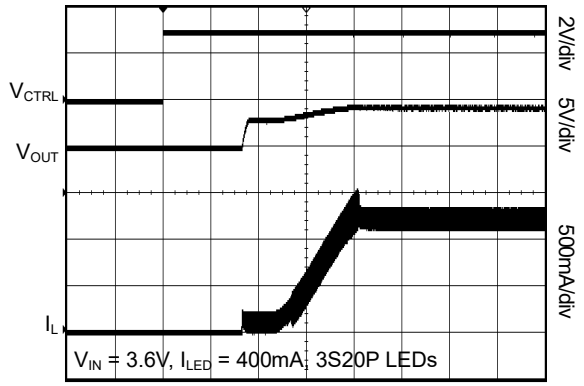
Time (2μs/div)

Start-Up



Time (2ms/div)

Start-Up

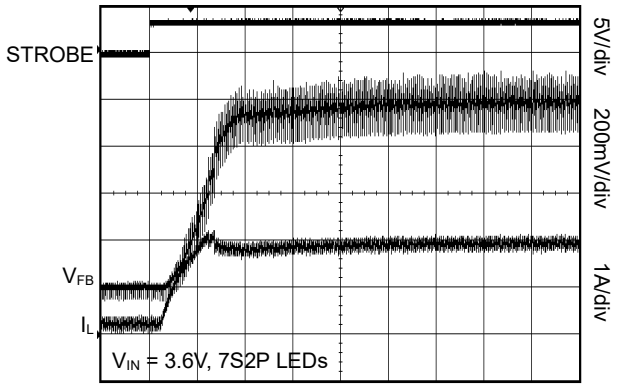


Time (2ms/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

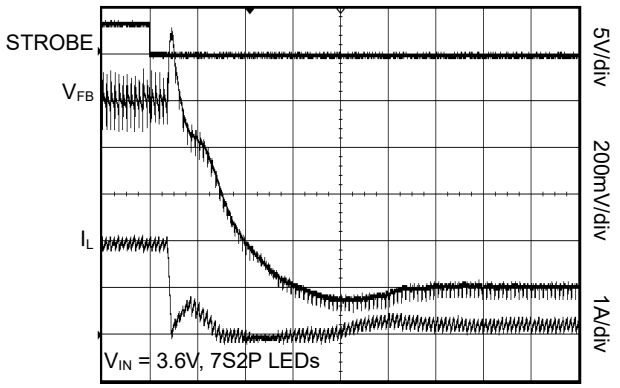
T_A = +25℃, L = 10μH, C_{IN} = 22μF, C_{OUT} = 1μF, unless otherwise noted.

Flash Mode Start-Up



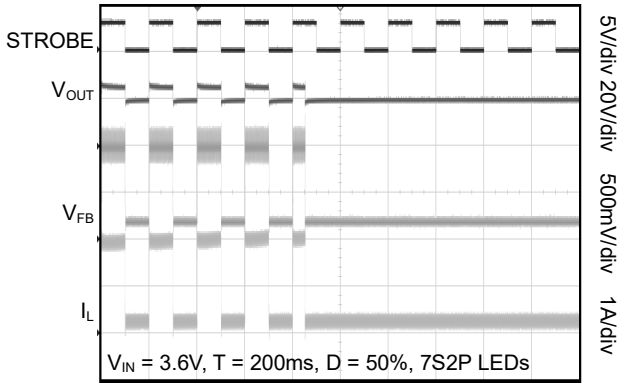
Time (20μs/div)

Flash Mode Shut-Down



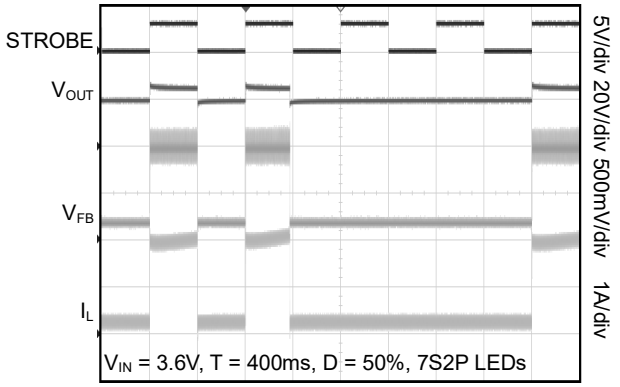
Time (10μs/div)

Flash Mode Over Time Protection



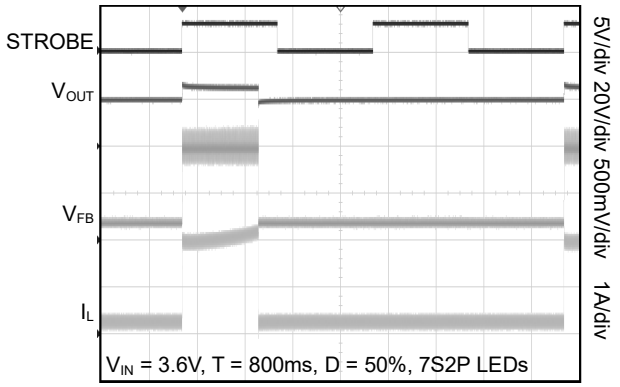
Time (200ms/div)

Flash Mode Over Time Protection



Time (200ms/div)

Flash Mode Over Time Protection



Time (200ms/div)

ADDITIONAL TYPICAL APPLICATION

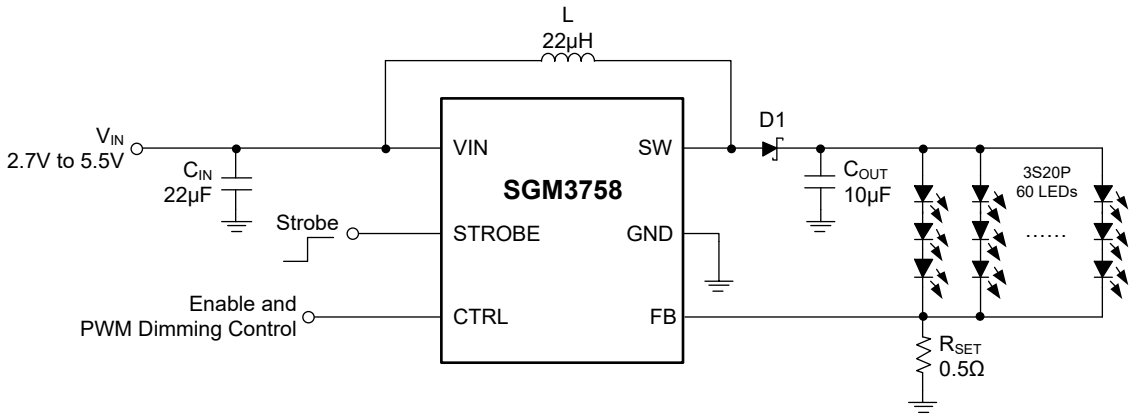


Figure 2. Drive 60 LEDs for Media Form Factor Display

REVISION HISTORY

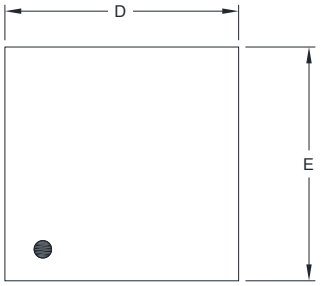
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (NOVEMBER 2017) to REV.A

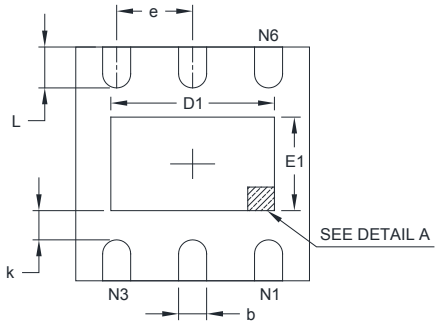
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

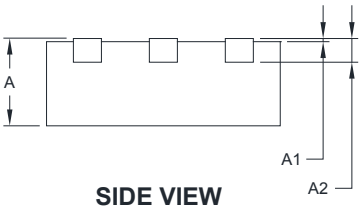
TDFN-2×2-6L



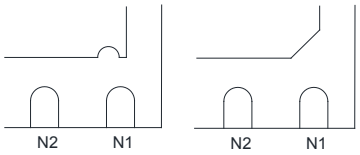
TOP VIEW



BOTTOM VIEW



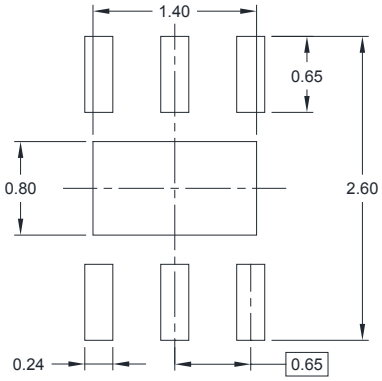
SIDE VIEW



DETAIL A

Pin #1 ID and Tie Bar Mark Options

NOTE: The configuration of the Pin #1 identifier is optional, but must be located within the zone indicated.

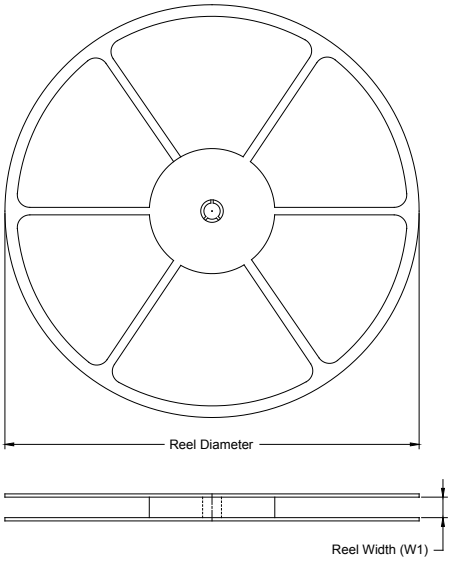


RECOMMENDED LAND PATTERN (Unit: mm)

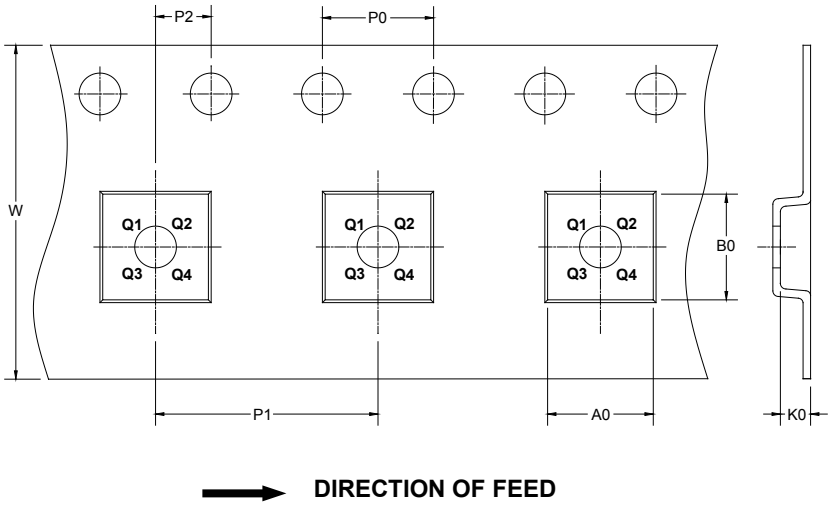
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	1.900	2.100	0.075	0.083
D1	1.100	1.450	0.043	0.057
E	1.900	2.100	0.075	0.083
E1	0.600	0.850	0.024	0.034
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.650 TYP		0.026 TYP	
L	0.250	0.450	0.010	0.018

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



DIRECTION OF FEED

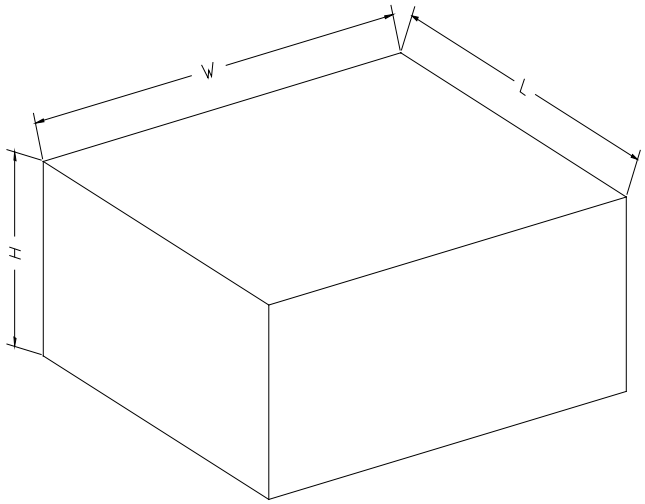
NOTE: The picture is only for reference. Please make the object as the standard.

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
TDFN-2×2-6L	7″	9.5	2.30	2.30	1.10	4.0	4.0	2.0	8.0	Q1

DD0001

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