



SGM3138

6-Channel Charge Pump White LED Driver with Low Dropout Current Source

GENERAL DESCRIPTION

The SGM3138 is a current-regulated white LED driver with integrated low dropout current sources and a high efficiency charge pump. The charge pump has automatically selectable 1×/1.5× fractional operation modes. The SGM3138 is well suited for white LED applications powered by a Li-Ion battery due to small equivalent open-loop resistance in 1× mode.

The supply voltage operates from 2.7V to 5.5V. The SGM3138 supports up to 6 LEDs for total maximum 120mA current. The LED reference current is set through an internal resistor. The SGM3138 contains a 4-bit digital-to-analog converter for 16-step LED current control. The LED current can be set between 1.25mA and 20mA by a serial pulse input signal into the EN/SET pin.

The SGM3138 provides less than 1μA shutdown current and soft-start function. Built-in soft-start circuitry avoids excessive inrush current during startup and mode transition.

The SGM3138 is available in a Green TQFN-3×3-16L package. It operates over an ambient temperature range of -40°C to +85°C.

FEATURES

- **Input Voltage Range: 2.7V to 5.5V**
- **Support to 6 LEDs at 20mA Each**
- **16-Step Brightness Control Through One-Wire Interface**
- **1× and 1.5× Charge Pump for High Conversion Efficiency**
- **Switching Frequency: 1MHz**
- **±5% Regulated LED Current Matching**
- **Built-in Soft-Start for Reducing Inrush Current**
- **Low Input Ripple and Low EMI**
- **Protection Features**
 - ◊ **Over-Current Protection**
 - ◊ **Under-Voltage Lockout**
 - ◊ **Thermal Shutdown**
- **Operating Temperature Range: -40°C to +85°C**
- **Available in a Green TQFN-3×3-16L Package**

APPLICATIONS

White LED Backlighting
Mobile Phones, MP3s
Digital Still Cameras
LCD Displays

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM3138	TQFN-3×3-16L	-40°C to +85°C	SGM3138YTQ16G/TR	3138TQ XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.

XXXXX



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

V _{IN} to GND.....	-0.3V to 6V
The Other Pins to GND.....	-0.3V to V _{IN}
Power Dissipation, P _D @ T _A = +25°C	
TQFN-3×3-16L.....	1.47W
Operating Temperature Range.....	-40°C to +85°C
Junction Temperature.....	+150°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 10s).....	+260°C
ESD Susceptibility	
HBM.....	2000V
MM.....	200V

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.

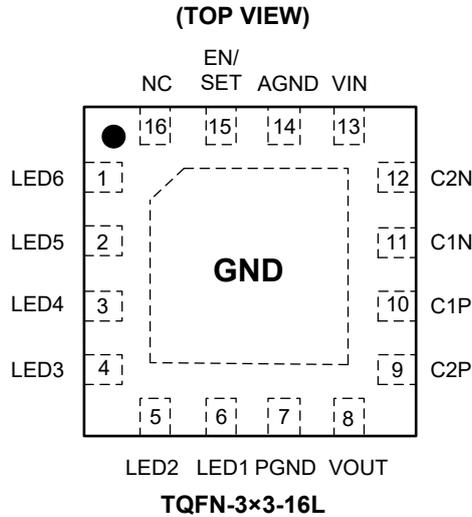
ESD SENSITIVITY CAUTION

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



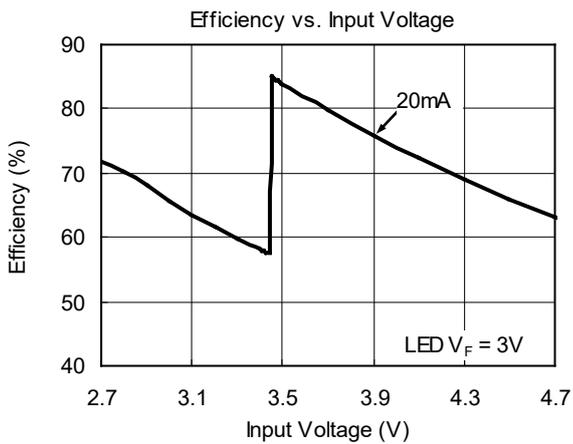
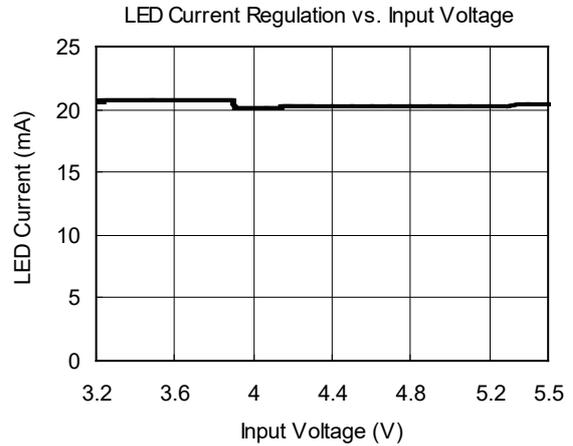
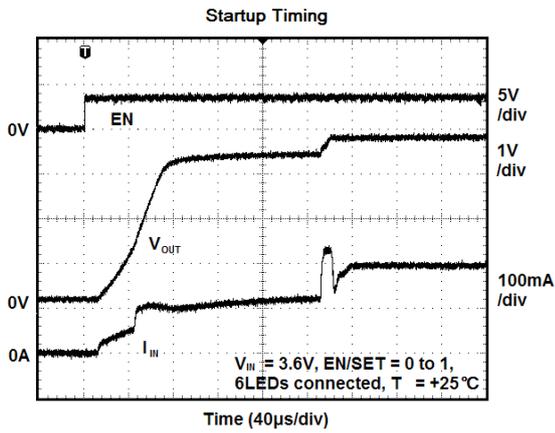
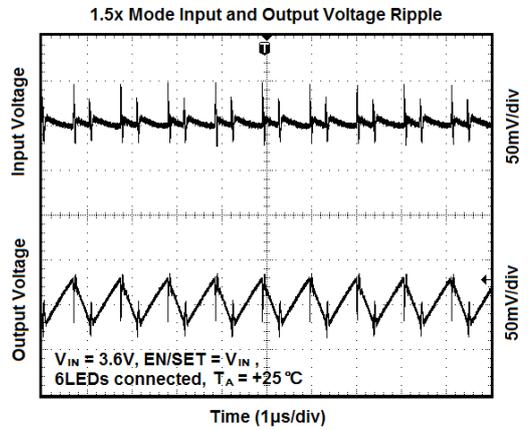
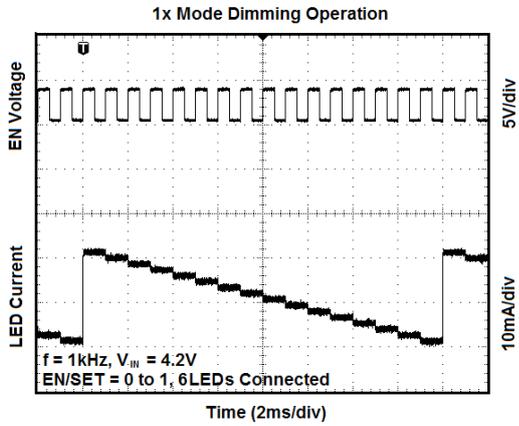
PIN DESCRIPTION

PIN	NAME	I/O	FUNCTION
1 - 6	LED6 - LED1	I	Current Sink Input. Connect to the cathode of the corresponding LED.
7	PGND	-	Power Ground Pin.
8	VOUT	O	Connect to the output capacitor and the anodes of the LEDs.
9	C2P	-	Positive Terminal of the Flying Capacitor 2.
10	C1P	-	Positive Terminal of the Flying Capacitor 1.
11	C1N	-	Negative Terminal of the Flying Capacitor 1.
12	C2N	-	Negative Terminal of the Flying Capacitor 2.
13	VIN	I	Input Supply Pin.
14	AGND	-	Analog Ground Pin.
15	EN/SET	I	Active-High LED Enable Pin and Dimming Control. Connect to the GPIO pin of MCU.
16	NC	-	No Connection.
Exposed Pad	GND	-	Exposed Pad. It should be soldered to PCB board and connected to GND.

ELECTRICAL CHARACTERISTICS(V_{IN} = 3.6V, EN/SET = V_{IN}, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage and Current						
Input Voltage Range	V _{IN}		2.7		5.5	V
Quiescent Power Supply Current	I _Q	V _{IN} = 4.2V, 1× Mode, I _{LEDx} = 1.25mA		210		μA
	I _Q	I _{OUT} = 0mA, 1.5× Mode		2		mA
Shutdown Supply Current	I _{SHDN}	EN/SET = GND		0.1	1	μA
Charge Pump Stage						
Over-Voltage Limit	V _{OUT}	LEDx unconnected, V _{IN} = 4.2V		5.8		V
Start-Up Time		C _{OUT} = 1μF, I _{LEDx} ≥ 0.9 × I _{LEDx-set}		235		μs
Soft-Start Duration				190		μs
Switching Frequency	f		0.6	1	1.4	MHz
Efficiency	η	V _{IN} = 3.45V, V _{LEDx} = 3V		85		%
Shutdown Temperature		Temperature rising		150		°C
Shutdown Temperature Hysteresis				15		°C
Input Current Limit		EN/SET = 1		300		mA
Current Sinks						
Recommended Maximum Current per Current Sink	I _{LEDx}	3.2V ≤ V _{IN} ≤ 5.5V	18	20	22.5	mA
Current Matching between Any Two Outputs		V _{LEDx} = 3.2V, I _{LEDx} = 20mA	-5	1	5	%
Line Regulation		3.3V < V _{IN} < 5.5V, V _{LEDx} = 3.2V, EN/SET = 1		3		%
Voltage at LED _x to GND	V _{SOURCE}	V _{IN} = 4.2V, EN/SET = 1		400		mV
EN/SET Logic						
Low Time for Shutdown	t _{SHDN}		3			ms
Low Time for Dimming	t _{LO}		0.5		500	μs
High Time for Dimming	t _{HI}		0.5			μs
Threshold	Logic-High Voltage	V _{IH}	1.2			V
	Logic-Low Voltage	V _{IL}			0.6	V

TYPICAL PERFORMANCE CHARACTERISTICS



TYPICAL APPLICATION

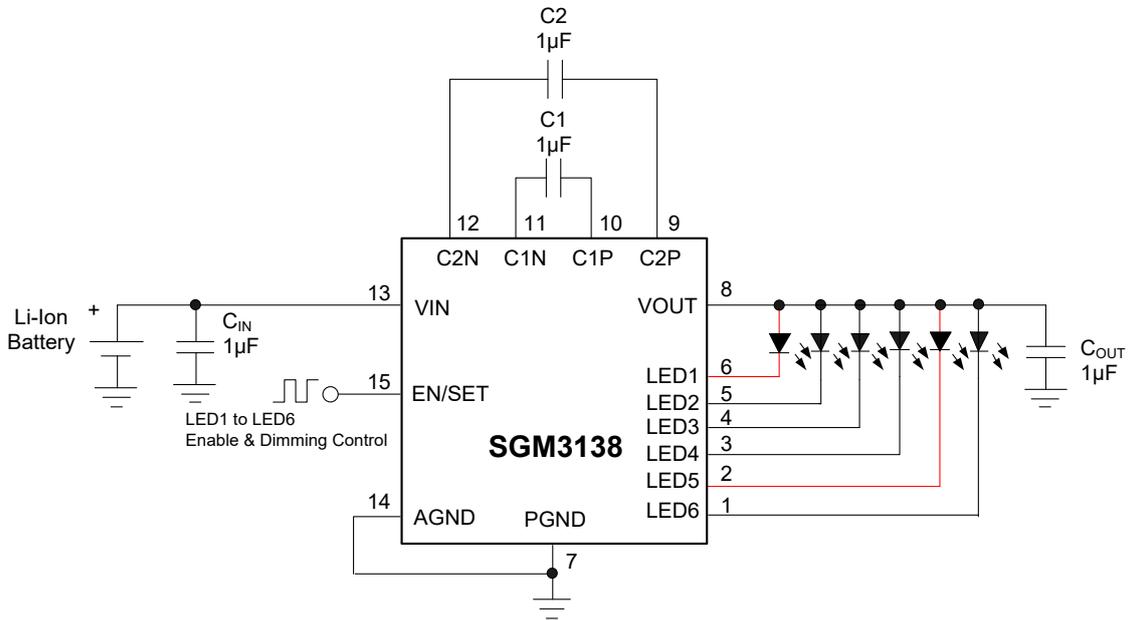


Figure 1. Typical Application Circuit

REVISION HISTORY

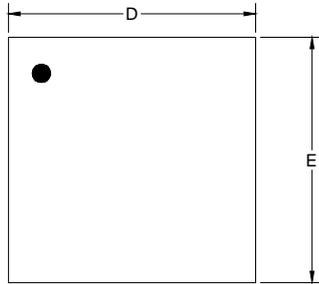
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

APRIL 2014 – REV.A.3 to REV.A.4	Page
Changed Absolute Maximum Ratings section	4
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JANUARY 2013 – REV.A.2 to REV.A.3	Page
Added Recommended Land Pattern section	9
Added Tape and Reel Information section	10, 11
<hr/>	
MAY 2011 – REV.A.1 to REV.A.2	Page
Changed Package Description	All
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JANUARY 2011 – REV.A to REV.A.1	Page
Added Application Information section	8
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Changes from Original (APRIL 2010) to REV.A	Page
Changed from product preview to production data	All

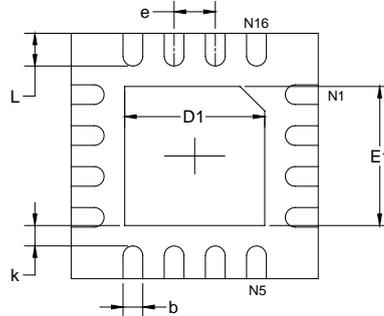
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

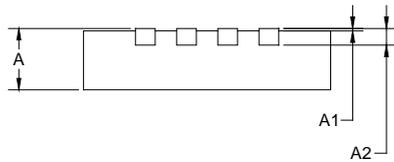
TQFN-3x3-16L



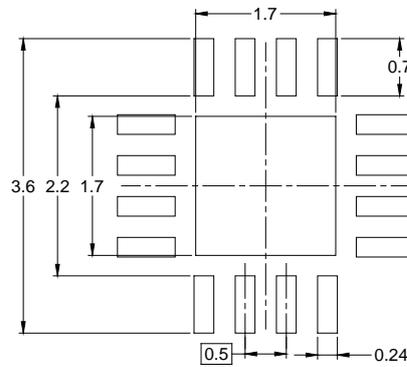
TOP VIEW



BOTTOM VIEW



SIDE VIEW



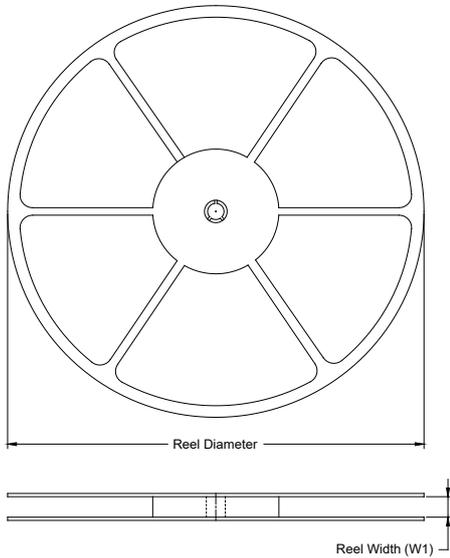
RECOMMENDED LAND PATTERN (Unit: mm)

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	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E	2.900	3.100	0.114	0.122
E1	1.600	1.800	0.063	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

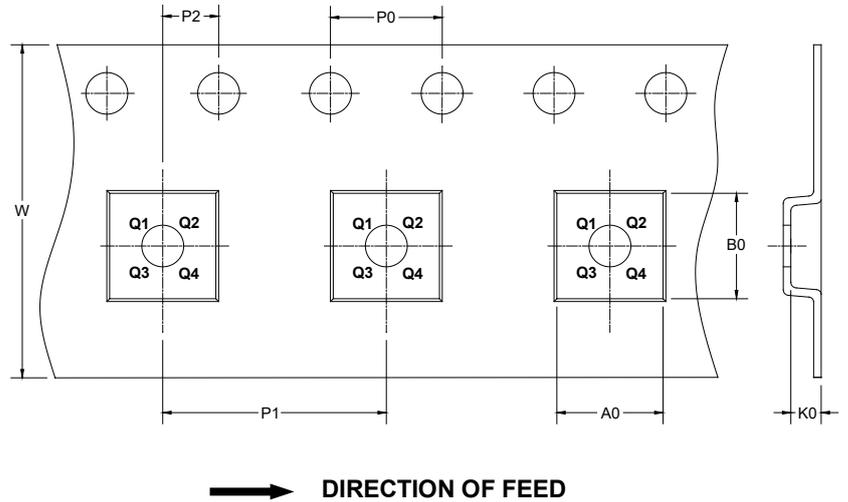
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

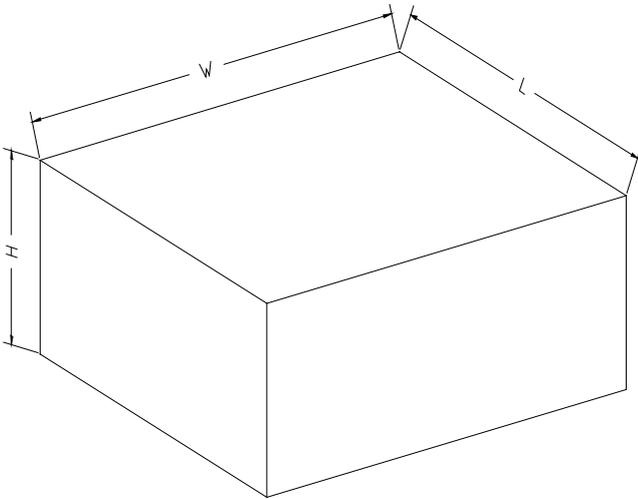
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
TQFN-3×3-16L	13"	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	Q1

DD0001

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
13"	386	280	370	5

DD0002