

### GENERAL DESCRIPTION

The SGM66055B is an internally compensated, 2.2MHz switching frequency, current mode, synchronous Boost switching converter. The SGM66055B supports up to 800mA load current from a battery as low as 2.65V, and the output voltage is fixed at 5.0V. This device turns into power-save mode to maintain high efficiency at light load currents. Its output is disconnected by the rectifier circuit during shutdown with no input to output leakage.

The SGM66055B has built-in protection features such as short-circuit protection, over-current protection and thermal shutdown.

The SGM66055B is available in a Green WLCSP-1.21×1.21-9B package.

### FEATURES

- 2.5V to 4.85V Operating Input Voltage Range
- 5.0V Fixed Output Voltage
- $I_{OUT} \geq 1A$  at  $V_{OUT} = 5V$ ,  $V_{IN} \geq 2.7V$
- Up to 97% Efficiency
- Device Quiescent Current: 24 $\mu$ A (TYP)
- Shutdown Current: 1 $\mu$ A (MAX)
- Improved Light Load Efficiency with Power-Save Mode (PSM)
- Low Reverse Leakage Current when  $V_{OUT} > V_{IN}$
- Load Disconnect during Shutdown
- Thermal Shutdown
- -40°C to +85°C Operating Temperature Range
- Available in a Green WLCSP-1.21×1.21-9B Package

### APPLICATIONS

USB OTG  
Single-Cell Li-Ion Battery Power Supply  
Smart Phones and Tablets  
Portable and Wearable Devices

### TYPICAL APPLICATION

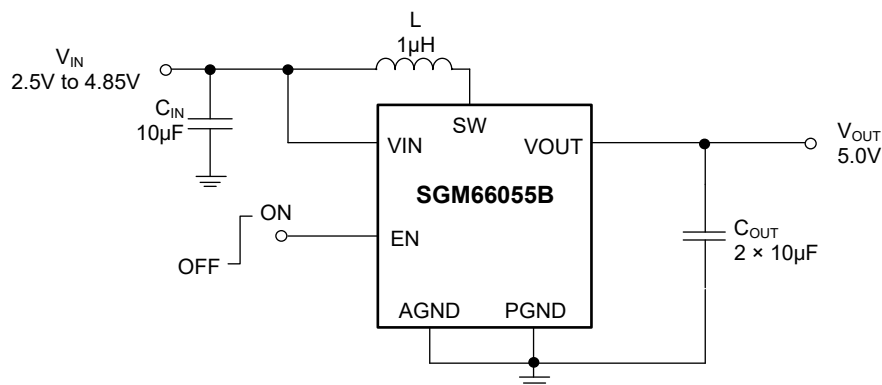


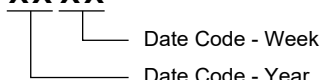
Figure 1. Typical Application Circuit

## PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM66055B-5.0	WLCSP-1.21×1.21-9B	-40°C to +85°C	SGM66055B-5.0YG/TR	R9F XXXX	Tape and Reel, 3000

## MARKING INFORMATION

NOTE: XXXX = Date Code.

**YYY** — Serial Number  
**XXXX**  

 Date Code - Week  
 Date Code - Year

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 Voltage..... -0.3V to 5.5V  
 VOUT and EN Voltages..... -0.3V to 6V  
 SW Node (DC)..... -0.3V to 6V  
 SW Node (Transient: 10ns, 3MHz)..... -1V to 8V  
 Voltage on Other Pins..... -0.3V to 6V  
 Package Thermal Resistance  
 WLCSP-1.21×1.21-9B,  $\theta_{JA}$  ..... 106°C/W  
 Junction Temperature..... +150°C  
 Storage Temperature Range..... -65°C to +150°C  
 Lead Temperature (Soldering, 10s)..... +260°C  
 ESD Susceptibility  
 HBM..... 4000V  
 CDM ..... 1000V

## RECOMMENDED OPERATING CONDITIONS

Operating Junction Temperature Range..... -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.

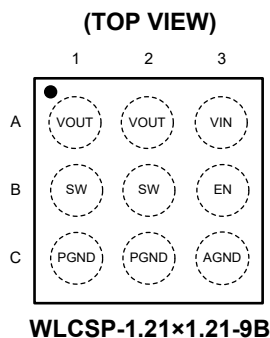
## ESD SENSITIVITY CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. 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 very small parametric changes could cause the device not to meet its 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	FUNCTION
A1, A2	VOUT	Boost Converter Output.
A3	VIN	Power Supply Input.
B1, B2	SW	Switch Node. Drain connection of low-side power MOSFET.
B3	EN	Device Enable Node. Pulling this pin logic high enables the device and pulling it logic low disables the device.
C1, C2	PGND	Power Ground.
C3	AGND	Analog Ground.

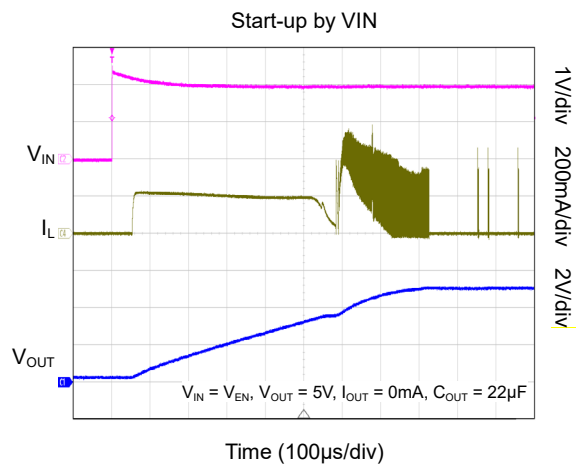
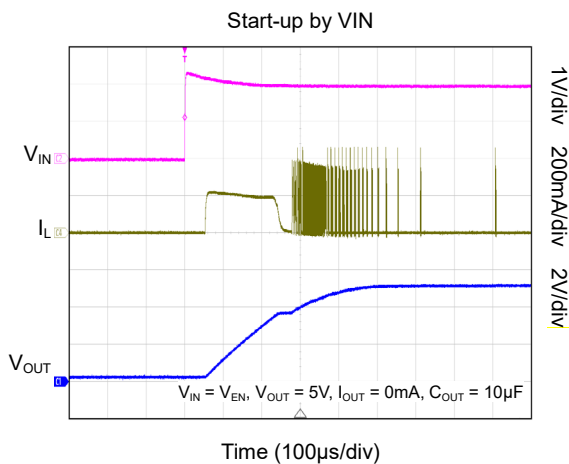
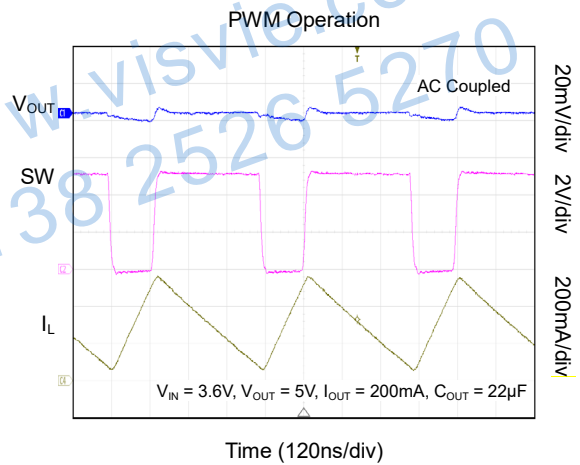
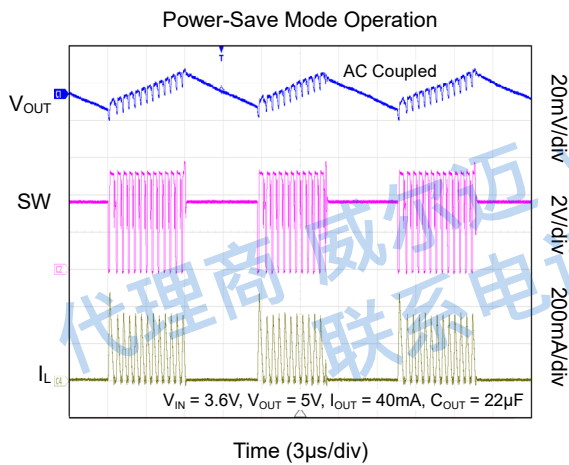
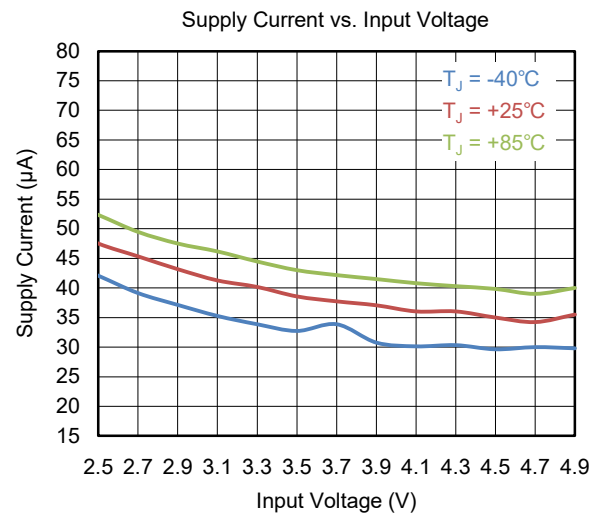
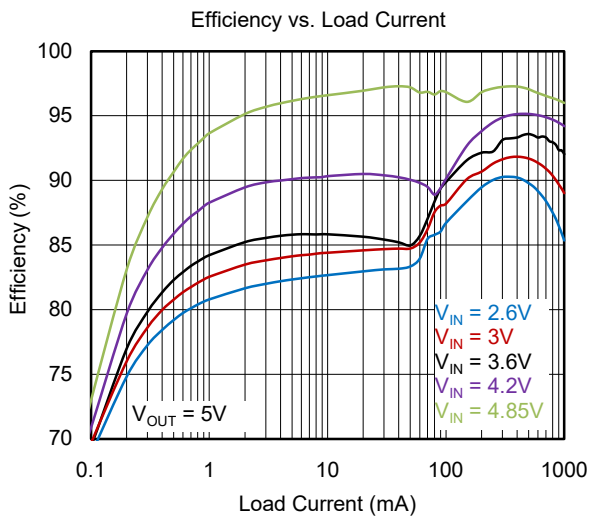
## ELECTRICAL CHARACTERISTICS

(V<sub>IN</sub> = 3.6V, T<sub>J</sub> = -40°C to +85°C, typical values are at T<sub>J</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>DC/DC Stage</b>						
Input Voltage	V <sub>IN</sub>	T <sub>J</sub> = +25°C	2.5		4.85	V
Output Voltage	V <sub>OUT</sub>		4.89	5.04	5.19	V
UVLO Rising Threshold	V <sub>UVLO_R</sub>	T <sub>J</sub> = +25°C	1.87	2.2	2.50	V
UVLO Falling Threshold	V <sub>UVLO_F</sub>	T <sub>J</sub> = +25°C	1.77	2.1	2.40	V
UVLO Hysteresis Voltage	V <sub>UVLO_HYS</sub>			100		mV
Switching Frequency	f <sub>SW</sub>		1.71	2.2	2.54	MHz
Switch Current Limit	I <sub>L</sub>	T <sub>J</sub> = +25°C	1.80	2.4	2.85	A
Boost Switch On-Resistance	R <sub>DS(on)</sub>	V <sub>OUT</sub> = 5.0V, T <sub>J</sub> = +25°C		60	95	mΩ
Rectifying Switch On-Resistance	R <sub>DS(on)</sub>	V <sub>OUT</sub> = 5.0V, T <sub>J</sub> = +25°C		80	105	mΩ
Quiescent Current	I <sub>Q</sub>	V <sub>EN</sub> = V <sub>IN</sub> = 3.6V, no switching, T <sub>J</sub> = +25°C		24	35	μA
Shutdown Current	I <sub>SD</sub>	V <sub>EN</sub> = 0V, V <sub>IN</sub> = 3.6V, T <sub>J</sub> = +25°C		0.01	1	μA
<b>Control Stage</b>						
EN Input Low Voltage	V <sub>IL</sub>				0.4	V
EN Input High Voltage	V <sub>IH</sub>		1.3			V
EN Input Current	I <sub>EN</sub>	Clamped to AGND or VIN		0.1		μA
Thermal Shutdown	T <sub>SD</sub>			150		°C
Thermal Shutdown Hysteresis	T <sub>SD_HYS</sub>			20		°C

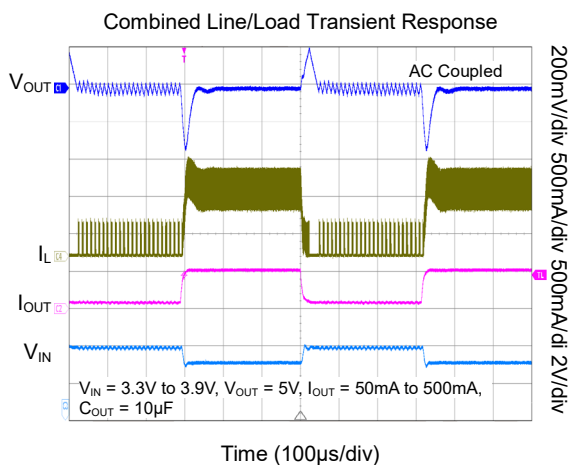
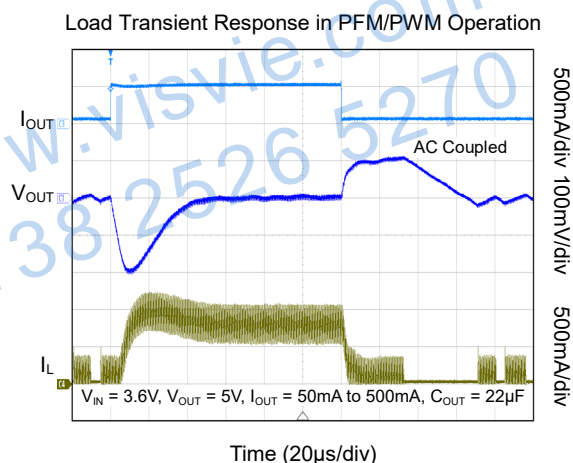
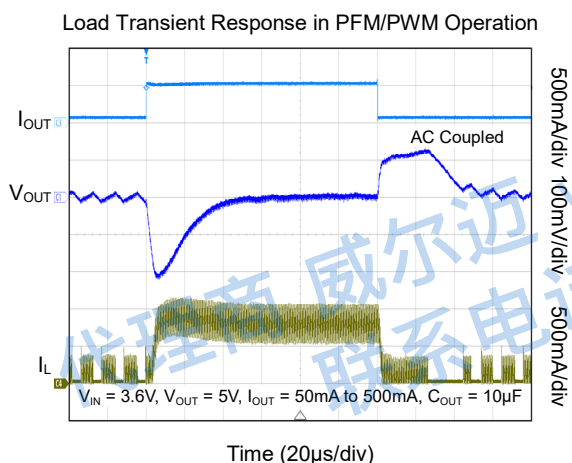
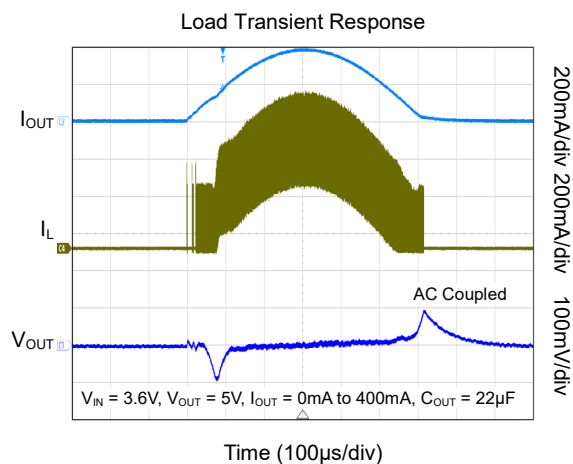
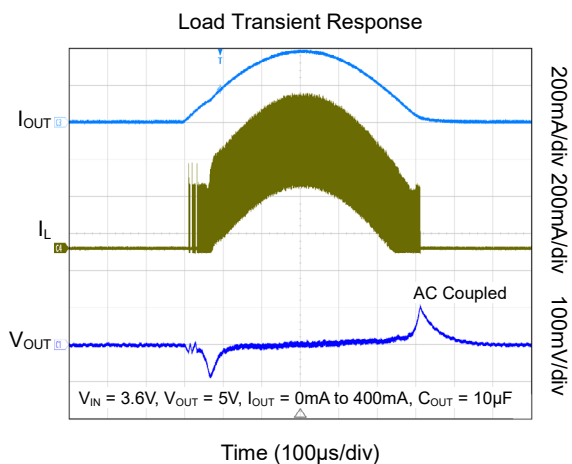
## TYPICAL PERFORMANCE CHARACTERISTICS

At  $T_J = +25^\circ\text{C}$ ,  $V_{IN} = 3.6\text{V}$ ,  $C_{IN} = 10\mu\text{F}$  and  $C_{OUT} = 20\mu\text{F}$ , unless otherwise noted.

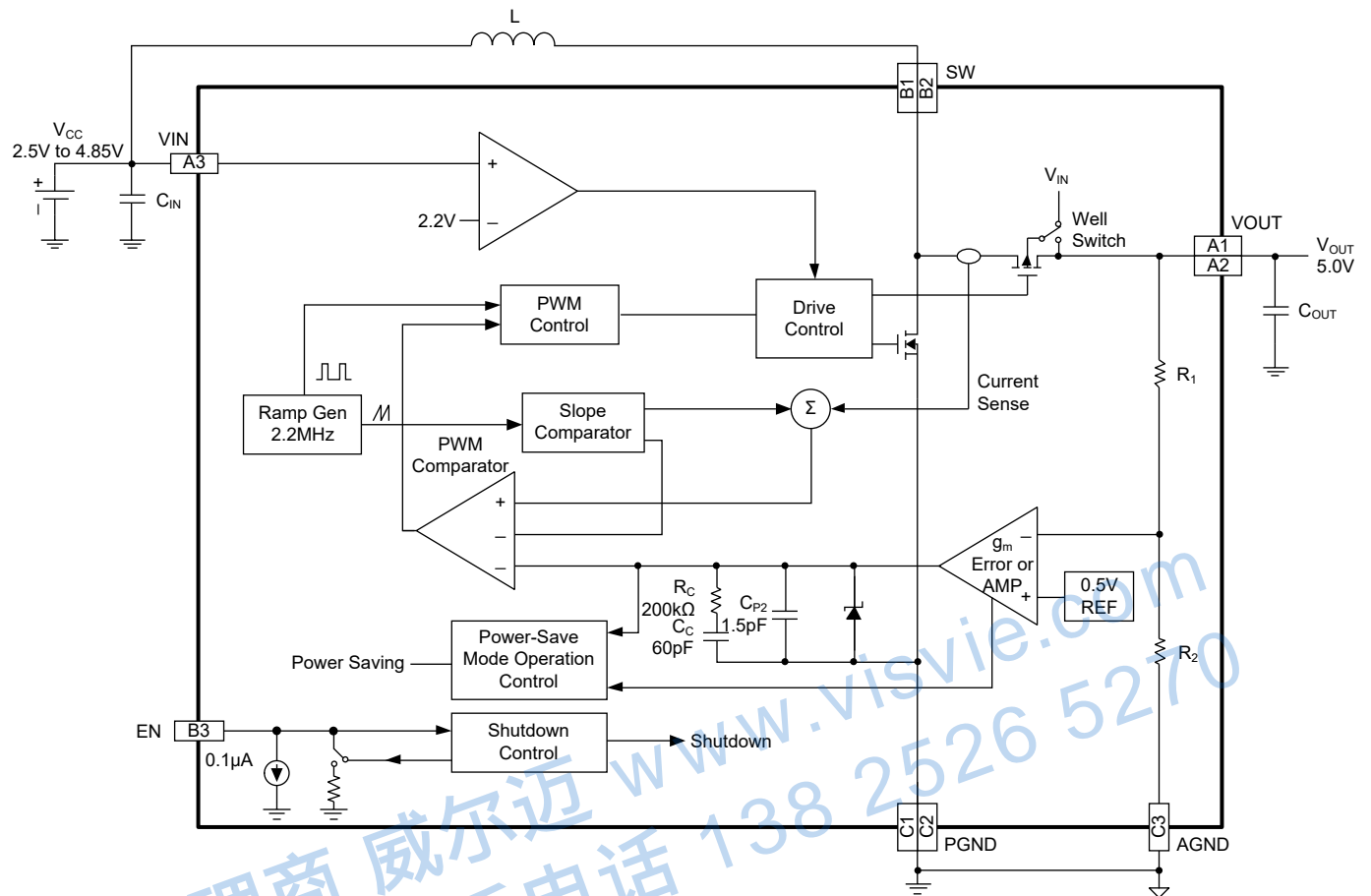


## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At  $T_J = +25^\circ\text{C}$ ,  $V_{IN} = 3.6\text{V}$ ,  $C_{IN} = 10\mu\text{F}$  and  $C_{OUT} = 20\mu\text{F}$ , unless otherwise noted.



**FUNCTIONAL BLOCK DIAGRAM**



**Figure 2. SGM66055B Block Diagram**

## APPLICATION INFORMATION

The SGM66055B is a fully-integrated synchronous Boost DC/DC converter. The recommended input supply voltage for full performance is 2.5V to 4.85V. Operating input voltage above 4.85V is possible with SGM66055B, however, the full performance is not guaranteed beyond the 4.85V operation. When the input supply voltage is larger than 5.3V, the device is shut down. An inductor, an output storage capacitor and an input decoupling capacitor should be selected to ensure the proper performance desired in a specific application circuit.

### Start-up and Enable

The SGM66055B implements the enable input to control the turn-on and turn-off of the device. A logic signal above 1.3V applied on EN pin turns on the device, and a logic signal below 0.4V turns off the device.

The SGM66055B has built-in 600 $\mu$ s (TYP) soft-start time. After enabling, the SGM66055B enters linear pre-charge phase with a limited current of 200mA. As the output voltage reaches the input voltage, the pre-charge phase terminates. The SGM66055B starts switching and boosts the output voltage to the 5.0V fixed output. This start-up sequence effectively reduces the inrush current during start-up.

The SGM66055B has a built-in 0.1 $\mu$ A (TYP) pull-down current when the EN pin is programmed to logic low. In addition to this pull-down current, there is an additional 300k $\Omega$  pull-down resistor when EN pin is logic low. When EN pin is programmed to logic high, the 300k $\Omega$  pull-down resistor is switched off and only the 0.1 $\mu$ A (TYP) pull-down current remains.

### Current Limit and Short-Circuit

The SGM66055B has a built-in 2.4A (TYP) current limit. As load current continues to rise and exceeds the current limit, output voltage will fall to maintain a constant power operation. As output voltage drops below the input voltage, current limit is reduced to 200mA (TYP) to minimize excessive power dissipation within the IC.

When an output short to ground event occurs, the SGM66055B reduces the current limit to 200mA (TYP) to prevent damage to the device. The SGM66055B resumes operation and goes through the start-up sequence once the short-circuit condition is removed.

### Inductor Selection

Inductor is an essential element for current DC/DC switch mode power supplies regardless of topology. Inductor serves as the energy storage element for power conversion. Inductance and saturation current of inductor are two most important criteria for inductor selection. For general design guidance, the selected inductance should provide a peak to peak ripple current that is around 30% of the average inductor current at full load and nominal input voltage. The average inductor current for a Boost converter is the input current. Equation 1 shows the calculation of inductance selection, where  $f_{SW}$  is the switching frequency and  $\Delta I_L$  is the inductor ripple current.

$$L = \frac{V_{IN} \times (V_{OUT} - V_{IN})}{\Delta I_L \times f_{SW} \times V_{OUT}} \quad (1)$$

The selected inductor should have a saturation current rating higher than the 2.4A (TYP) current limit of SGM66055B.

The inductor also affects the close loop response of the DC/DC converter. The SGM66055B is an internally compensated device; the loop response is optimized for inductor in the range of 0.7 $\mu$ H to 2.9 $\mu$ H.

### Input Capacitor

Boost converter's input capacitor has continuous current throughout the entire switching cycle, a 10 $\mu$ F ceramic capacitor is recommended to place as close as possible between the VCC pin and GND pin of the device. For applications where the SGM66055B is located far away from the input source, a 47 $\mu$ F or higher capacitance capacitor is recommended to damp the wiring harness inductance.

**APPLICATION INFORMATION (continued)****Output Capacitor**

The output capacitors of Boost converter dictate the output voltage ripple and load transient response. Equation 2 is used to estimate the necessary capacitance to achieve desired output voltage ripple, where  $\Delta V$  is the maximum allowed ripple.

$$C_{\text{MIN}} = \frac{I_{\text{OUT}} \times (V_{\text{OUT}} - V_{\text{IN}})}{f_{\text{SW}} \times \Delta V \times V_{\text{OUT}}} \quad (2)$$

Since SGM66055B is an internally compensated device, the loop response is optimized for capacitor in the range of 10 $\mu$ F to 47 $\mu$ F. Due to the DC bias nature of ceramic capacitors, care should be taken by verifying manufacture's datasheet to ensure enough effective capacitance at desired output voltage.

**Layout Considerations**

In addition to component selection, layout is a critical step to ensure the performance of any switch mode power supplies. Poor layout could result in system instability, EMI failure, and device damage. Thus, place the inductor, input and output capacitors as close to the IC as possible, and use wide and short traces for current carrying traces to minimize PCB inductance.

For Boost converter, the current loop of the output capacitor from VOUT pin back to the PGND pin of the device should be as small as possible.

**REVISION HISTORY**

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

**MAY 2022 – REV.A to REV.A.1****Page**

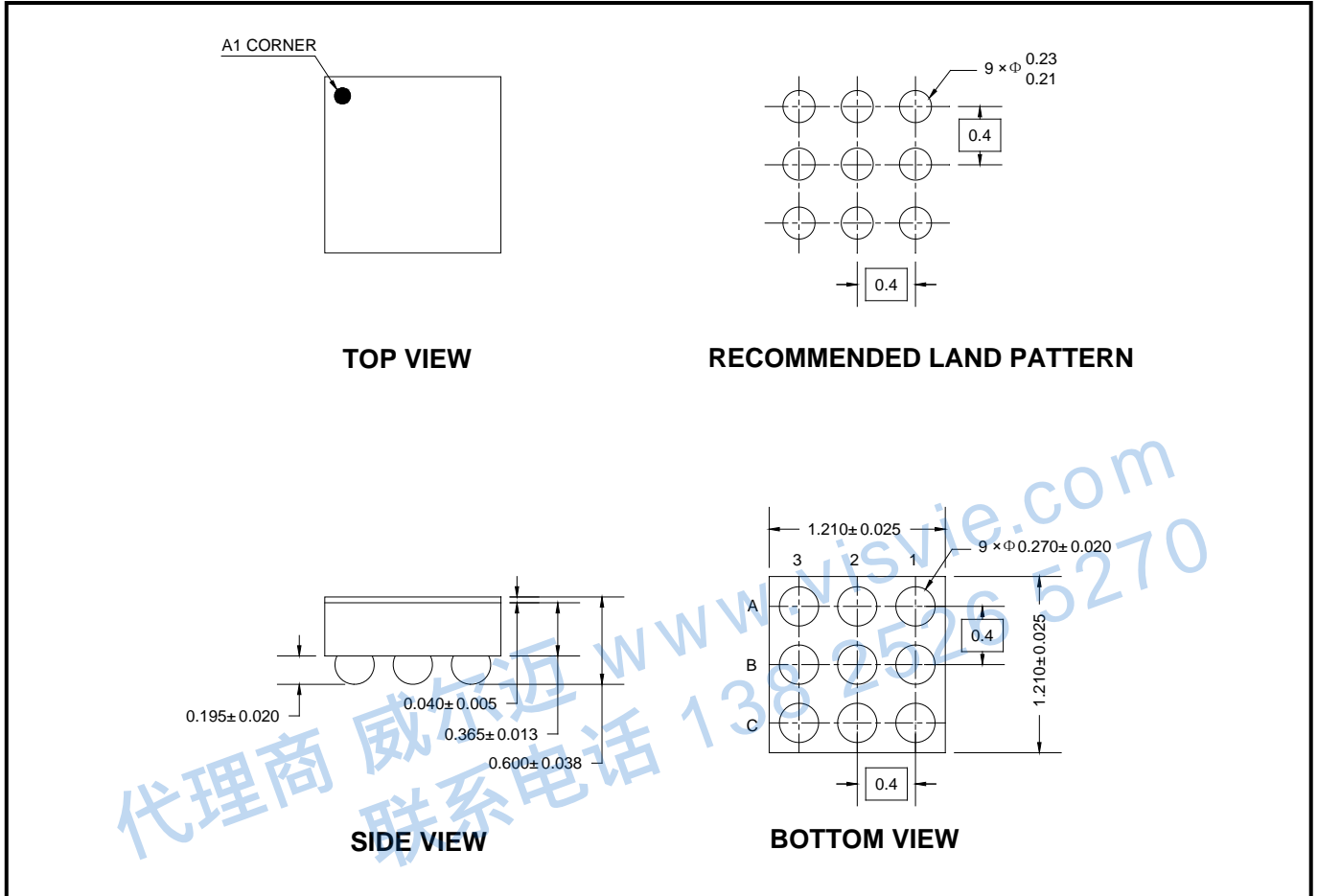
Updated Features section.....	1
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**Changes from Original (APRIL 2022) to REV.A****Page**

Changed from product preview to production data.....	All
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## PACKAGE OUTLINE DIMENSIONS

### WLCSP-1.21×1.21-9B



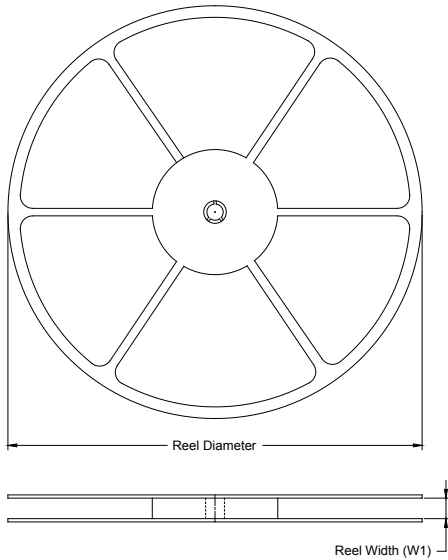
#### NOTES:

1. All linear dimensions are in millimeters.
2. This drawing is subject to change without notice.

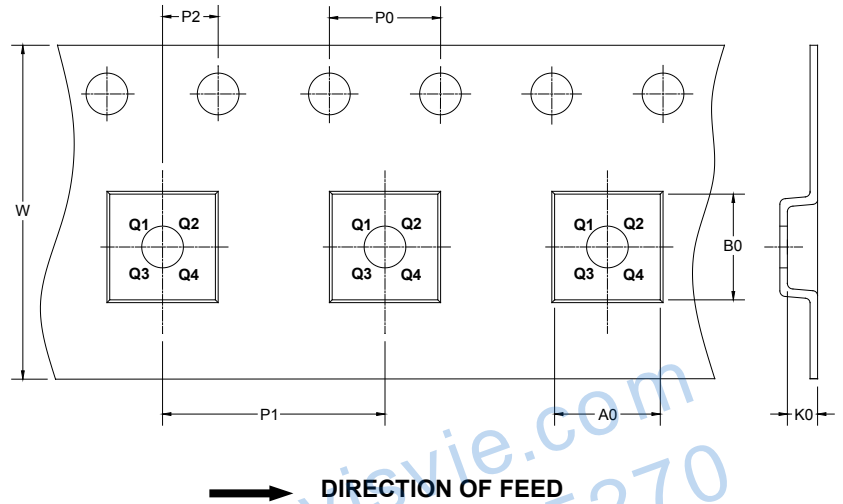
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



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

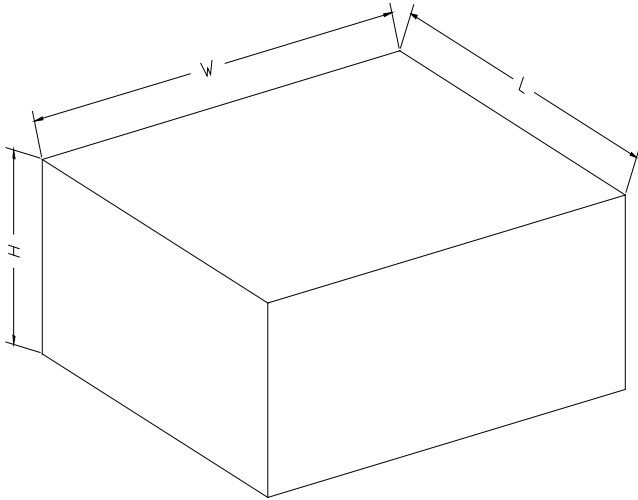
### KEY PARAMETER LIST OF TAPE AND REEL

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-1.21×1.21-9B	7"	9.2	1.33	1.33	0.74	4.0	4.0	2.0	8.0	Q1

DD00001

## 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