SGM6011
1.4MHz, 2A, Synchronous Buck Converter

GENERAL DESCRIPTION

The SGM6011 is a high-efficient monolithic synchronous buck converter with a wide input voltage range of 2.5V to 5.5V. The device is available in a 3.3V fixed output and an adjustable voltage versions. This device is targeted at the portable equipment with high current requirements from single-cell Li-Ion batteries. It can operate in the forced continuous pulse width modulation (PWM) mode. The SGM6011 is highly efficient with peak efficiency at 95% when in operation. The device could operate at 100% duty cycle to achieve the lowest dropout and longer battery life.

This device is capable to provide up to 2A output load current and operates at a 1.4MHz constant frequency to achieve the smallest size of external components. The internal slope compensation allows the use of smaller-value inductors to give improved solution size to this device.

The SGM6011 is available in Green TDFN-3×3-10L package and is rated over the -40℃ to +85℃ temperature range.

FEATURES

- **2.5V to 5.5V Input Voltage Range**
- **Forced Continuous PWM Mode Operation**
- **Up to 95% High Efficiency**
- **1.4MHz Constant Frequency Operation**
- **2A Output Current**
- **100% Duty Cycle for Lowest Dropout**
- **Shutdown Current: 2μA (MAX)**
- **135mΩ Low $R_{DS(ON)}$ Internal Switches**
- **Support Ceramic Capacitors**
- **Current Mode Control for Excellent Line and Load Transient Responses**
- **Internal Soft-Start Protection**
- **Short Circuit and Thermal Protection**
- **-40℃ to +85℃ Operating Temperature Range**
- **Available in a Green TDFN-3×3-10L Package**

APPLICATIONS

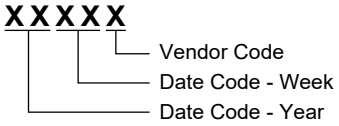
PDA, Pocket PC and Smart Phones
USB Powered Modems
CPUs and DSPs
PC Cards and Notebooks
Mobile Phones
Digital Cameras
DSP Core Supplies
Portable Equipment

PACKAGE/ORDERING INFORMATION

MODEL	V_{OUT} (V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM6011	3.3	TDFN-3×3-10L	-40℃ to +85℃	SGM6011-3.3YD10G/TR	SGM C6011D XXXXX	Tape and Reel, 3000
	Adjustable	TDFN-3×3-10L	-40℃ to +85℃	SGM6011-ADJYD10G/TR	SGM D6011D XXXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXXX = Date Code and Vendor Code.



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

Input Supply Voltage ..... -0.3V to 6V
EN Voltage ..... -0.3V to V_{IN} + 0.3V
FB/OUT, SW Voltages ..... -0.3V to V_{IN} + 0.3V
Power Dissipation, P_D @ T_A = +25℃
TDFN-3×3-10L 2.2W
Package Thermal Resistance
TDFN-3×3-10L, θ_{JA} ..... 45℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 3000V
MM 200V

RECOMMENDED OPERATING CONDITIONS

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

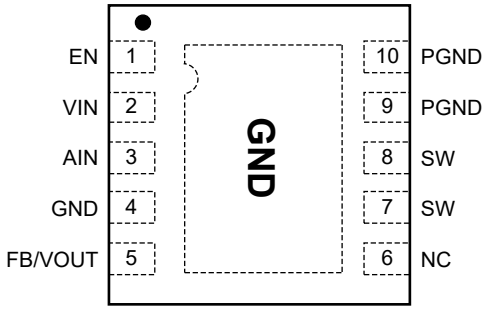
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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

(TOP VIEW)



TDFN-3×3-10L

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	EN	Enable Pin. The IC goes into shutdown mode when this pin is connected to ground. When connect this pin to VIN pin, the device is enabled. Do not leave it floating and must be terminated.
2	VIN	Supply Voltage Input. Strongly recommend to use a 22μF ceramic capacitor or greater to decouple this pin closely to GND.
3	AIN	Analog Supply Input. Provides bias for internal circuitry.
4	GND	Analog Ground.
5	FB	Feedback Pin for Adjustable Version. This pin receives the feedback voltage of an external resistive divider across the output. The internal voltage divider is disabled for adjustable version.
	VOUT	Output Pin for Fixed Version. This pin receives the output voltage which can be connected to the VOUT directly.
6	NC	No Internal Connection.
7, 8	SW	Switching Node Pin. Put an output inductor to these pins.
9, 10	PGND	Power Ground.
Exposed Pad	GND	Analog Ground Exposed Pad. Must be connected to GND plane.

ELECTRICAL CHARACTERISTICS

(V_{IN} = 3.6V, T_A = -40℃ to +85℃, unless otherwise noted.)

PARAMETER		SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		V_{IN}		2.5		5.5	V
Regulated Output Voltage		V_{OUT}		1.2		V_{IN} (1)	V
Input DC Bias Current	PWM Mode	I_Q	V_{FB} = 0.58V		300	450	μA
	Shutdown		V_{IN} = 5.5V, V_{EN} = 0V		0.01	2	
Feedback Input Bias Current		I_{FB}	V_{FB} = 0.65V		0.001	1	μA
Regulated Feedback Voltage		V_{FB}	V_{IN} = 2.5V to 5.5V, T_A = +25℃	0.587	0.6	0.616	V
			V_{IN} = 2.5V to 5.5V, T_A = -40℃ to +85℃	0.583	0.6	0.619	
Line Regulation			V_{IN} = 2.5V to 5.5V, I_{LOAD} = 50mA		0.1	0.6	%/V
Load Regulation			I_{LOAD} = 200mA to 2000mA		0.07		%/A
Output Voltage Accuracy			V_{IN} = 2.5V to 5.5V, I_{LOAD} = 50mA	-3.5		+3.5	%
Oscillator Frequency		f_{OSC}			1.4		MHz
Start-up Time		t_S	From Enable to Output Regulation		500		μs
Over-Temperature Shutdown Threshold		t_{SD}			150		℃
Over-Temperature Shutdown Hysteresis		t_{HYS}			15		℃
Peak Switch Current		I_{PK}			2.7		A
$R_{DS(ON)}$ of P-Channel FET		$R_{DS(ON)}$	V_{IN} = 3.6V		135		mΩ
$R_{DS(ON)}$ of N-Channel FET			V_{IN} = 3.6V		115		
EN Threshold	Logic-High Voltage	V_{EN_H}	V_{EN} Rising	1.5			V
	Logic-Low Voltage	V_{EN_L}	V_{EN} Falling			0.4	
Enable Leakage Current		I_{EN}	V_{EN} = 0V or V_{IN}		0.01	1	μA

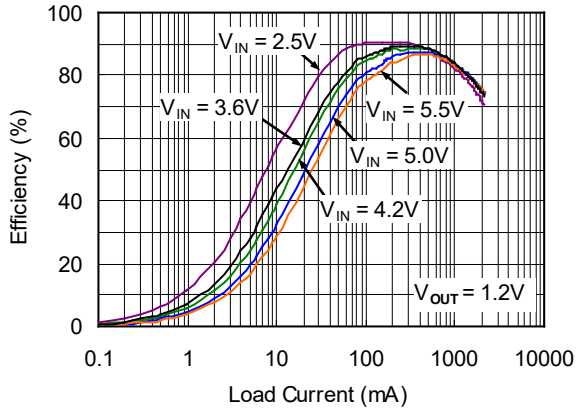
NOTE:

1. The maximum output voltage is 4.4V.

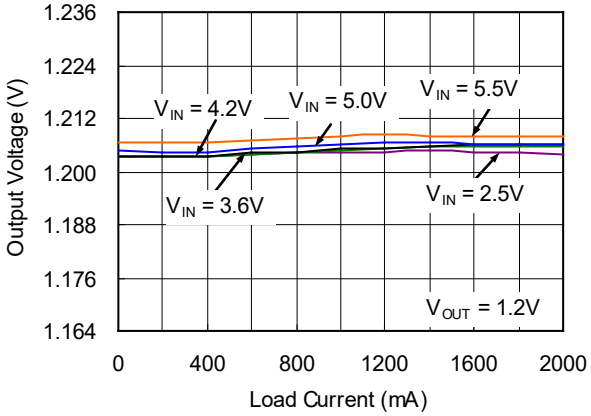
TYPICAL PERFORMANCE CHARACTERISTICS

T_A = 25℃, L = 2.2μH, C_{IN} = C_{OUT} = 22μF, unless otherwise noted.

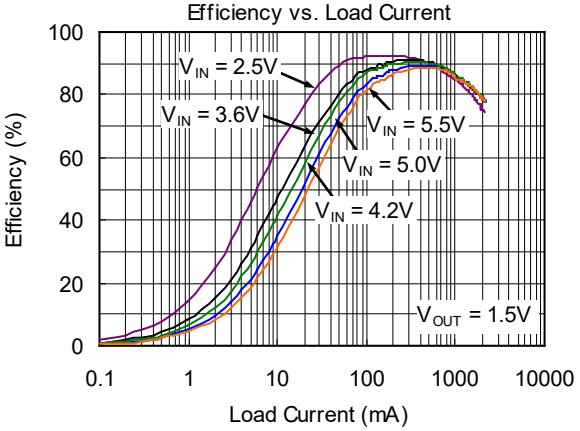
Efficiency vs. Load Current



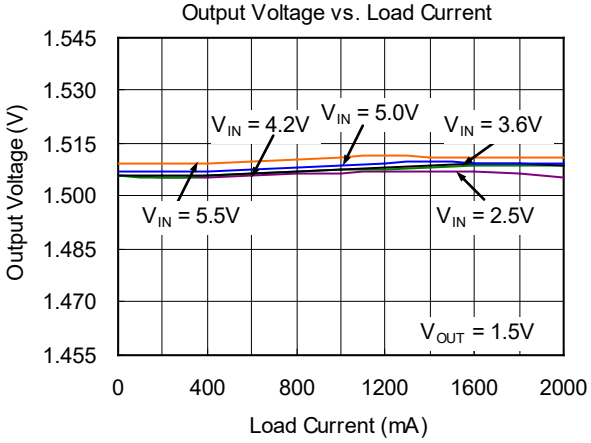
Output Voltage vs. Load Current



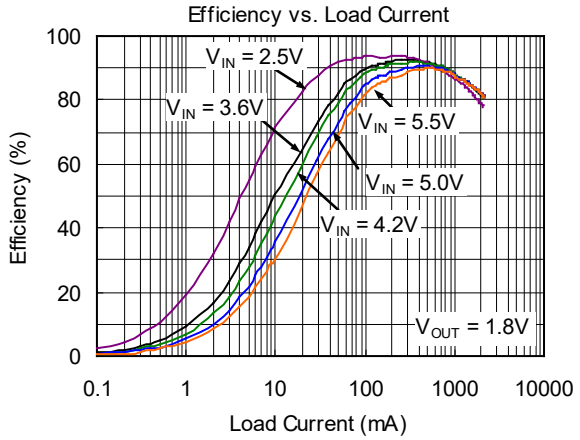
Efficiency vs. Load Current



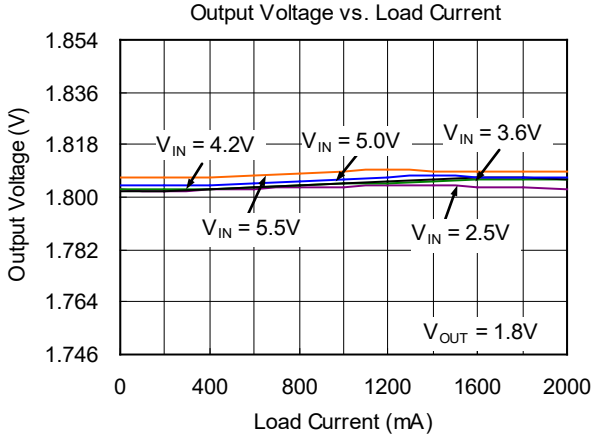
Output Voltage vs. Load Current



Efficiency vs. Load Current



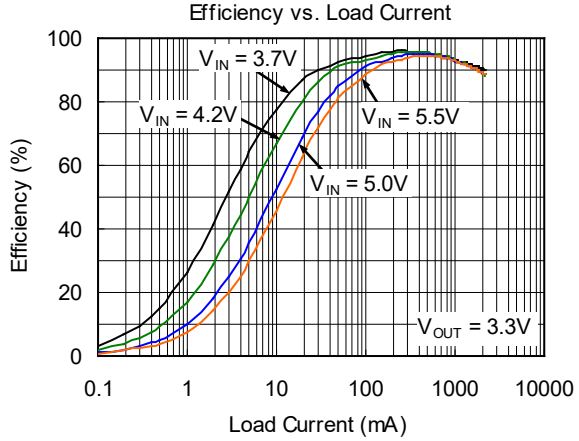
Output Voltage vs. Load Current



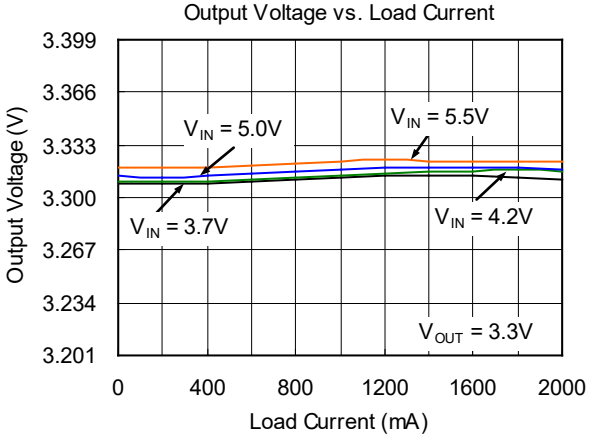
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = 25℃, L = 2.2μH, C_{IN} = C_{OUT} = 22μF, unless otherwise noted.

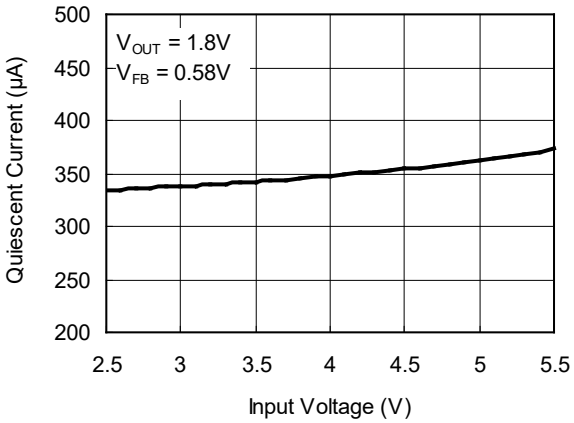
Efficiency vs. Load Current



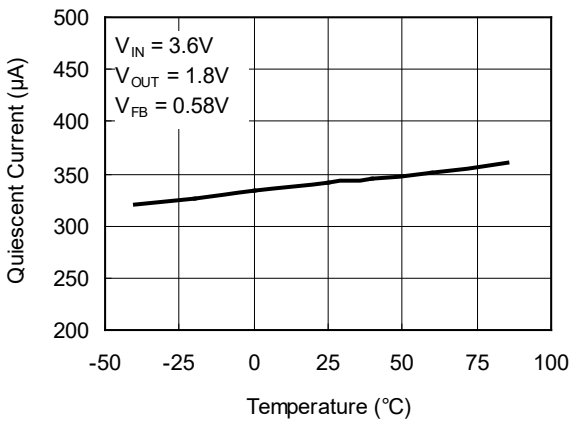
Output Voltage vs. Load Current



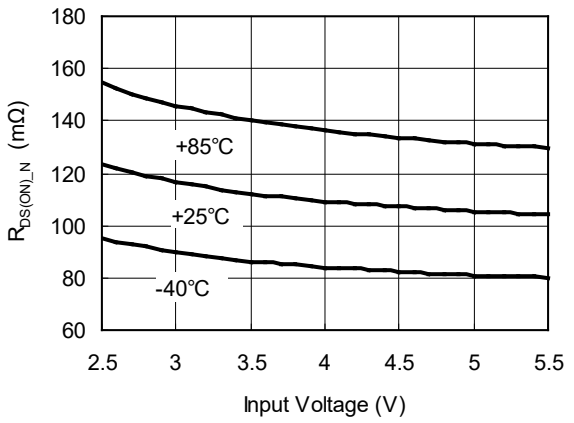
Quiescent Current vs. Input Voltage



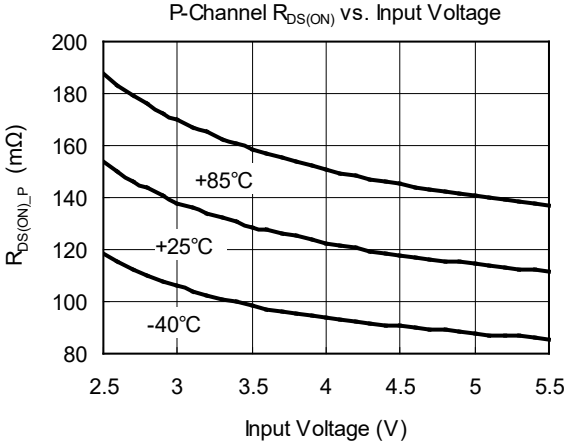
Quiescent Current vs. Temperature



N-Channel $R_{DS(ON)}$ vs. Input Voltage



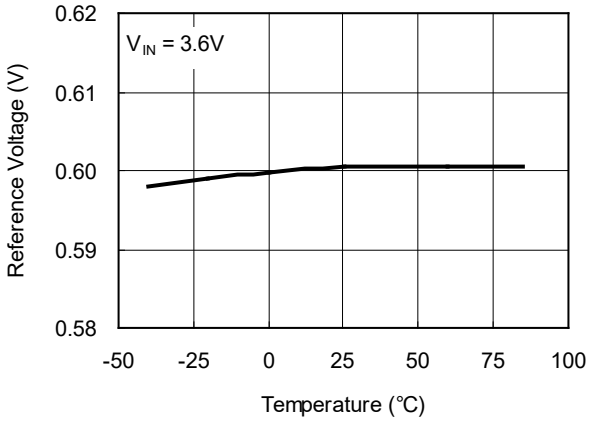
P-Channel $R_{DS(ON)}$ vs. Input Voltage



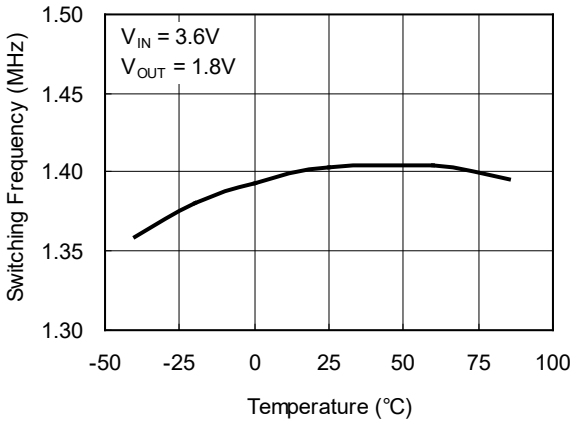
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

T_A = 25℃, L = 2.2μH, C_{IN} = C_{OUT} = 22μF, unless otherwise noted.

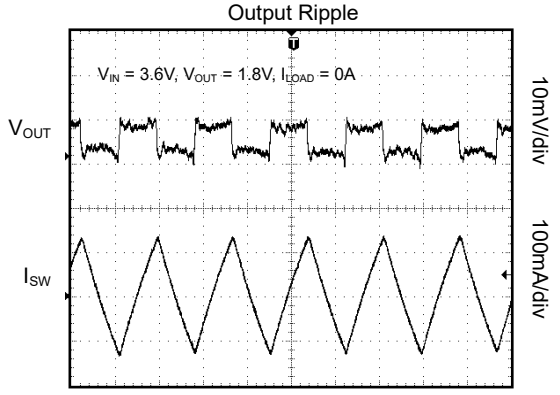
Reference Voltage vs. Temperature



Switching Frequency vs. Temperature

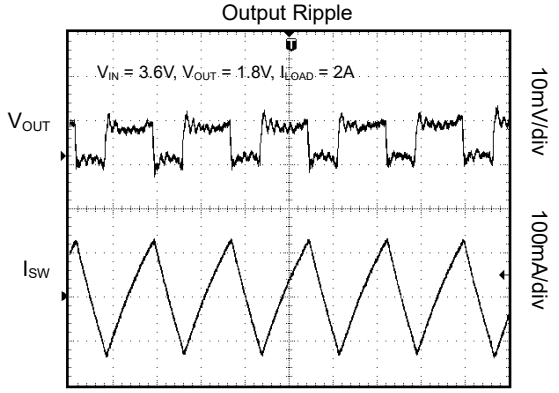


Output Ripple



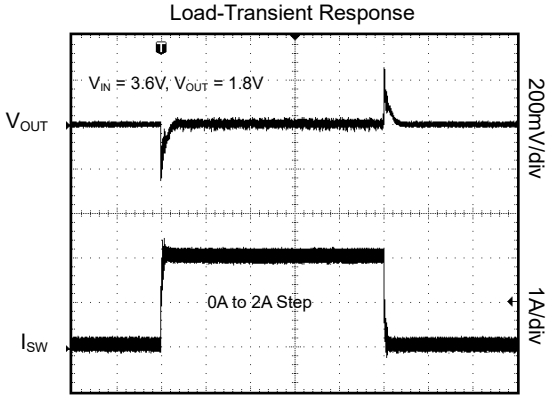
Time (400ns/div)

Output Ripple



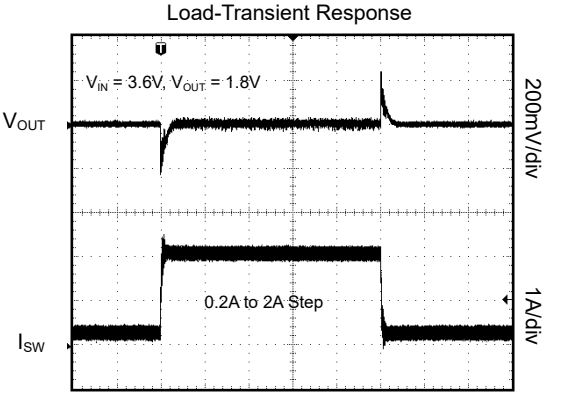
Time (400ns/div)

Load-Transient Response



Time (400μs/div)

Load-Transient Response

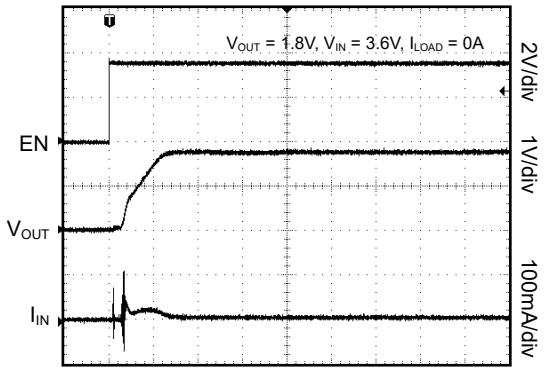


Time (400μs/div)

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

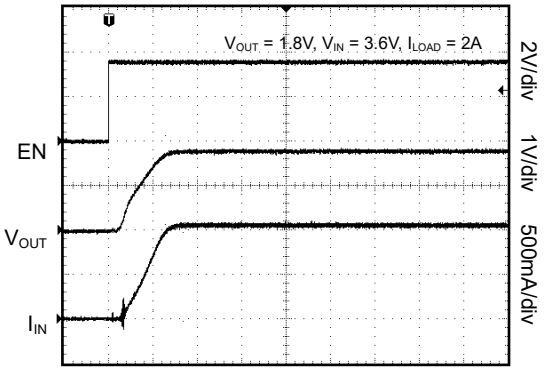
T_A = 25℃, L = 2.2μH, C_{IN} = C_{OUT} = 22μF, unless otherwise noted.

Start-up



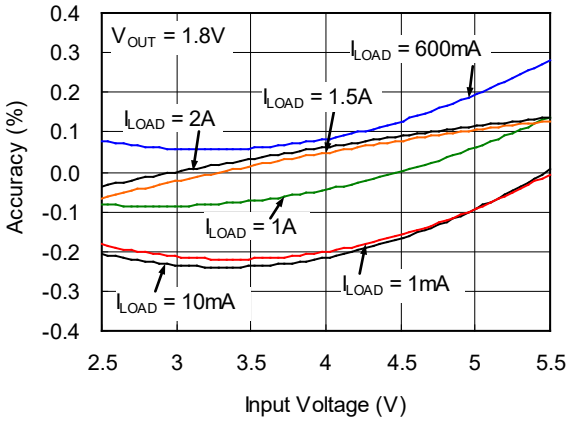
Time (400μs/div)

Start-up



Time (400μs/div)

Line Regulation



TYPICAL APPLICATION CIRCUITS

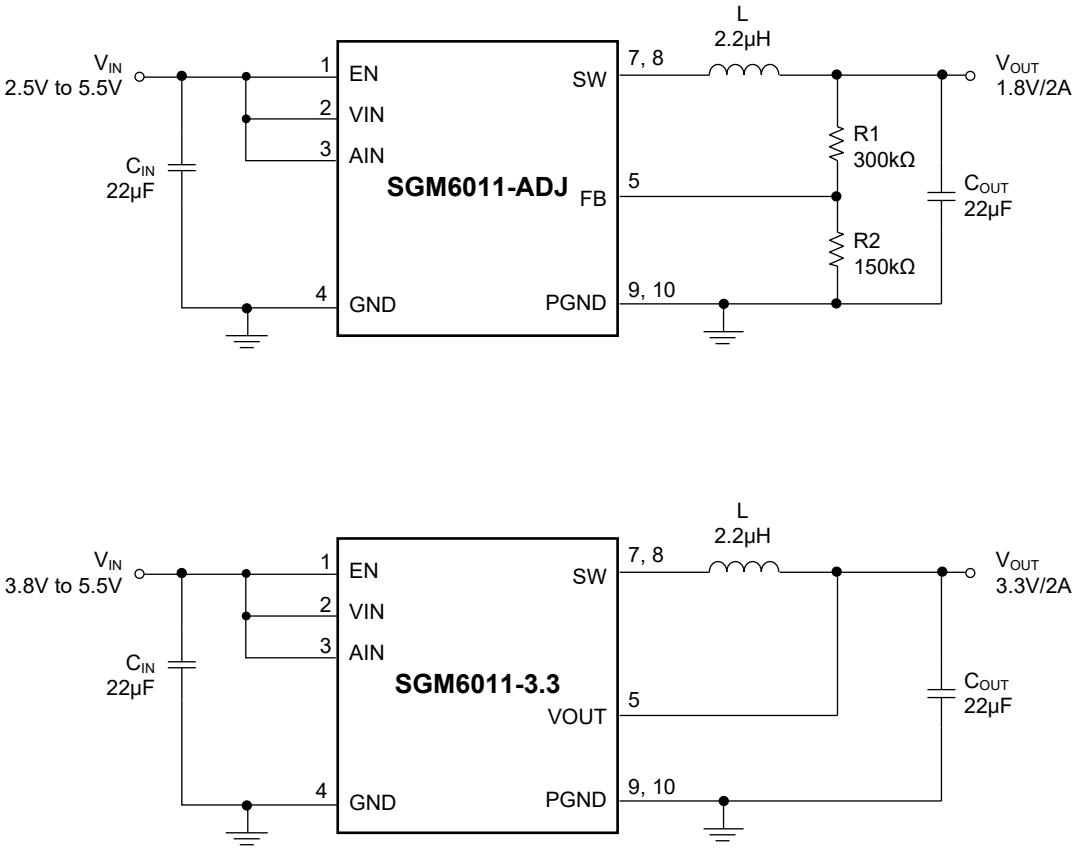


Figure 1. Typical Application Circuits

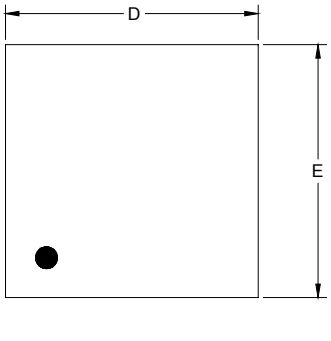
REVISION HISTORY

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

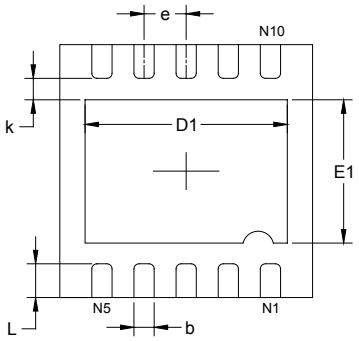
Changes from Original (AUGUST 2015) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

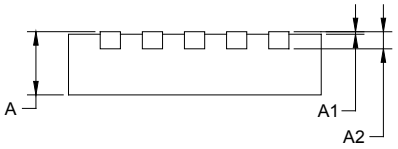
TDFN-3×3-10L



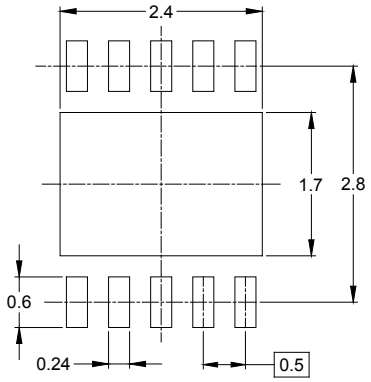
TOP VIEW



BOTTOM VIEW



SIDE VIEW

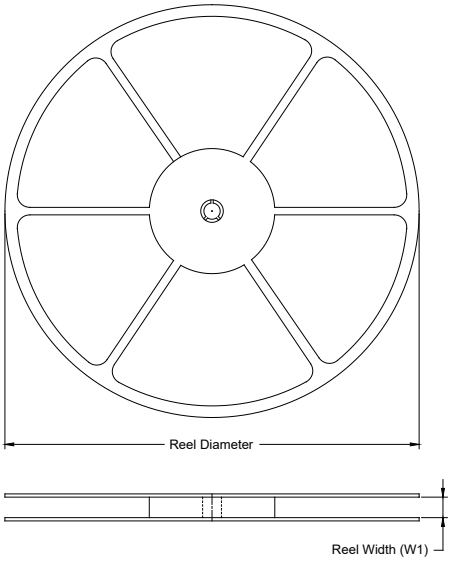


RECOMMENDED LAND PATTERN (Unit: mm)

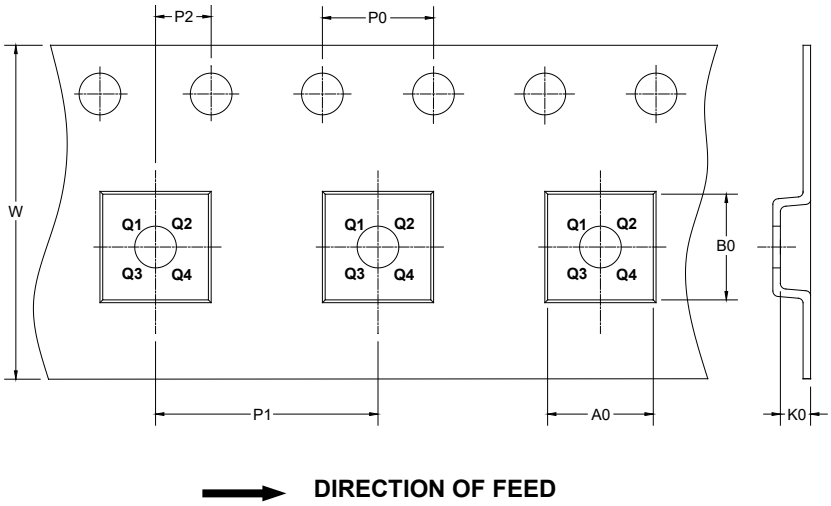
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
D	2.900	3.100	0.114	0.122
D1	2.300	2.600	0.091	0.103
E	2.900	3.100	0.114	0.122
E1	1.500	1.800	0.059	0.071
k	0.200 MIN		0.008 MIN	
b	0.180	0.300	0.007	0.012
e	0.500 TYP		0.020 TYP	
L	0.300	0.500	0.012	0.020

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



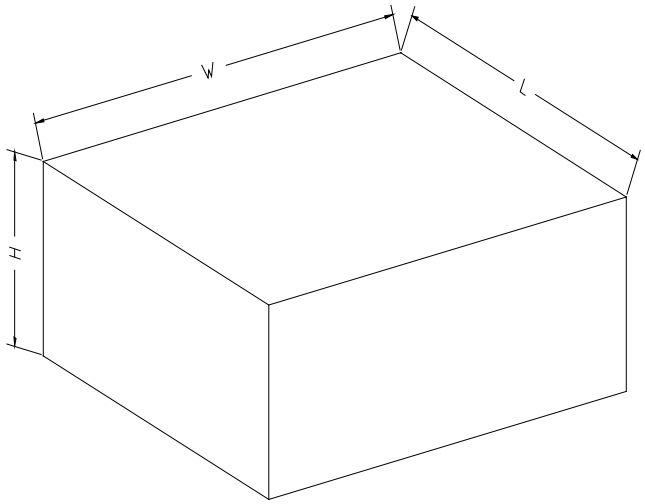
NOTE: The picture is only for reference. Please make the object as the standard.

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
TDFN-3×3-10L	13″	12.4	3.35	3.35	1.13	4.0	8.0	2.0	12.0	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
13″	386	280	370	5

DD0002