



# SGM2053

## 500mA, Ultra-Low Dropout, Low Power, RF Linear Regulator

### GENERAL DESCRIPTION

The SGM2053 is a low power, low noise, ultra-low dropout CMOS linear voltage regulator with excellent line and ultrafast load transient performance and that operates from a 1.5V to 5.5V input voltage. It is the perfect choice for low voltage and low power applications. Low ground current makes this part attractive for battery operated power systems. The SGM2053 also offers ultra-low dropout voltage to prolong battery life in portable electronics. Systems requiring a quiet voltage source, such as RF applications, will benefit from the SGM2053's low output noise ( $20\mu\text{V}_{\text{RMS}}$ ) and high PSRR with an external noise bypass capacitor connected to the device's BP pin.

Other features include a 30nA logic-controlled shutdown mode, output current limit and thermal shutdown protection.

The SGM2053 is available in a Green SOT-23-6 package. It operates over an operating temperature range of  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

### FEATURES

- **Fixed Output Voltages:**  
1.0V, 1.05V, 1.1V, 1.8V, 2.8V, 3.0V and 3.3V
- **Adjustable Output from 0.8V to 5.0V**
- **500mA Guaranteed Output Current**
- **Ultra-Low Dropout Voltage:**  
110mV (TYP) at  $V_{\text{OUT}} = 5.0\text{V}$
- **Turn-On Time: 70 $\mu\text{s}$  (TYP)**
- **Low Output Noise**
- **Ultrafast Line and Load Transient Performance**
- **Thermal Shutdown Protection**
- **Output Current Limit**
- **High PSRR: 93dB at 1kHz**
- **Pull-Down Current at EN Pin**
- **Output Auto-Discharge in Shutdown**
- **$-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  Operating Temperature Range**
- **Available in a Green SOT-23-6 Package**

### APPLICATIONS

Cellular Telephones  
Cordless Telephones  
Hand-Held Instruments  
Palmtop Computers  
Electronic Planners  
Portable/Battery-Powered Equipment

### TYPICAL APPLICATION

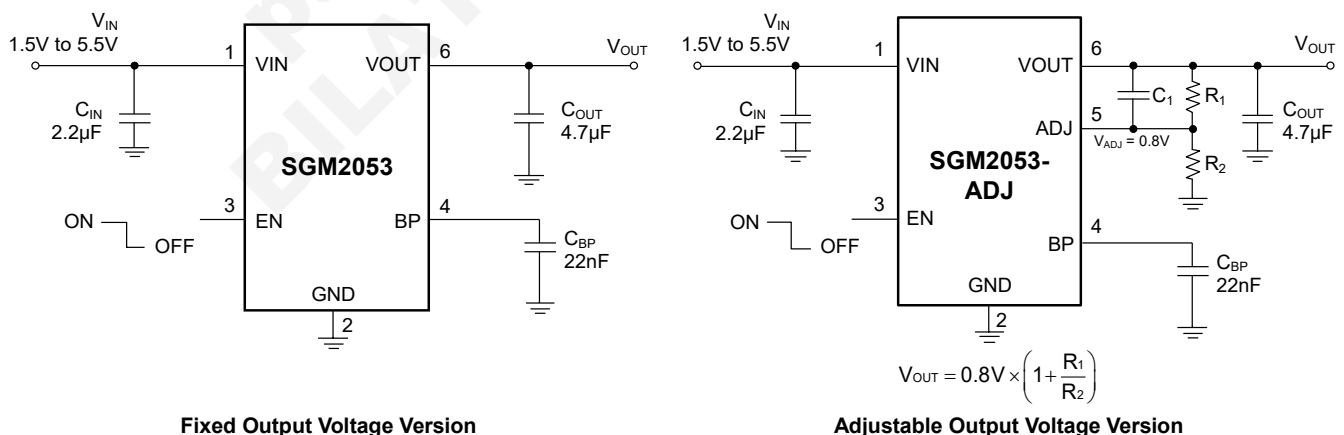


Figure 1. Typical Application Circuits

## PACKAGE/ORDERING INFORMATION

MODEL	V <sub>OUT</sub> (V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2053-1.0	1.0	SOT-23-6	-40°C to +125°C	SGM2053-1.0XN6G/TR	CYAXX	Tape and Reel, 3000
SGM2053-1.05	1.05	SOT-23-6	-40°C to +125°C	SGM2053-1.05XN6G/TR	CY8XX	Tape and Reel, 3000
SGM2053-1.1	1.1	SOT-23-6	-40°C to +125°C	SGM2053-1.1XN6G/TR	CYCXX	Tape and Reel, 3000
SGM2053-1.8	1.8	SOT-23-6	-40°C to +125°C	SGM2053-1.8XN6G/TR	CYDXX	Tape and Reel, 3000
SGM2053-2.8	2.8	SOT-23-6	-40°C to +125°C	SGM2053-2.8XN6G/TR	CYEXX	Tape and Reel, 3000
SGM2053-3.0	3.0	SOT-23-6	-40°C to +125°C	SGM2053-3.0XN6G/TR	CYFXX	Tape and Reel, 3000
SGM2053-3.3	3.3	SOT-23-6	-40°C to +125°C	SGM2053-3.3XN6G/TR	CZ0XX	Tape and Reel, 3000
SGM2053-ADJ	ADJ	SOT-23-6	-40°C to +125°C	SGM2053-ADJXN6G/TR	CZ1XX	Tape and Reel, 3000

## MARKING INFORMATION

NOTE: XX = Date Code.

YYY X X

Date Code - Week

Date Code - Year

Serial Number

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 to GND	-0.3V to 6.0V
EN to GND	-0.3V to 6.0V
VOUT, BP, ADJ to GND	-0.3V to (VIN + 0.3V)
Package Thermal Resistance	
SOT-23-6, $\theta_{JA}$	196°C/W
SOT-23-6, $\theta_{JB}$	61°C/W
SOT-23-6, $\theta_{JC}$	81°C/W
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility	
HBM	8000V
CDM	1000V

## RECOMMENDED OPERATING CONDITIONS

Input Voltage Range	1.5V to 5.5V
Input Effective Capacitance, C <sub>IN</sub>	1.5 $\mu$ F (MIN)
Output Effective Capacitance, C <sub>OUT</sub>	1 $\mu$ F to 10 $\mu$ F
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.

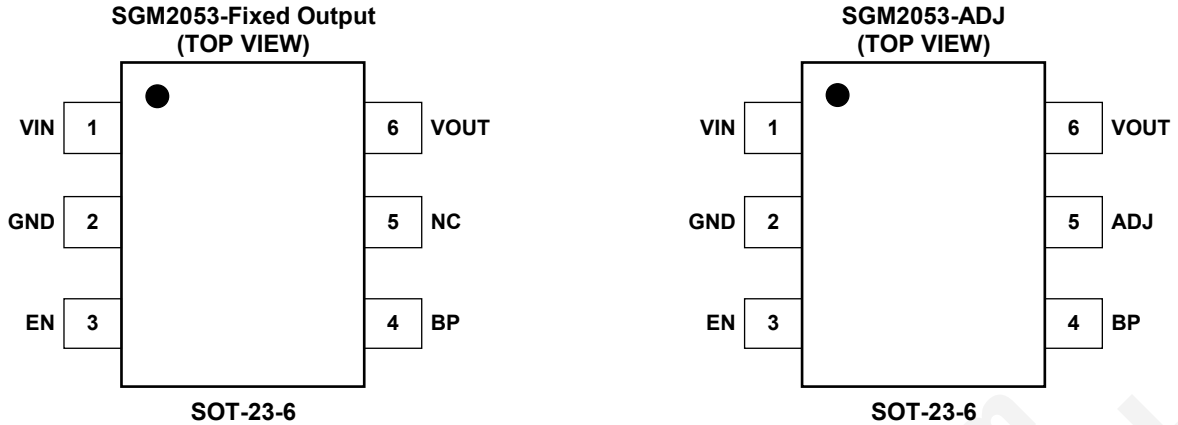
## ESD SENSITIVITY CAUTION

This integrated circuit can be damaged 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 CONFIGURATIONS



PIN DESCRIPTION

PIN	NAME	FUNCTION
1	VIN	Regulator Input. Supply voltage can range from 1.5V to 5.5V. Bypass with a 2.2μF capacitor to GND.
2	GND	Ground.
3	EN	Enable Pin. Driving EN high to turn on the regulator. Driving EN low to turn off the regulator. For automatic start-up, connect EN pin to VIN pin.
4	BP	Reference-Noise Bypass. Bypass with a low-leakage 22nF ceramic capacitor for reduced noise at the output.
5	NC	Not Connected (fixed voltage version only).
	ADJ	Adjustable Input (adjustable voltage version only). An external resistor divider sets the output voltage.
6	VOUT	Regulator Output. It is recommended to use output capacitor with effective capacitance in the range of 1μF to 10μF.

## ELECTRICAL CHARACTERISTICS

( $V_{IN} = (V_{OUT(NOM)} + 0.5V)$  or 1.5V, whichever is greater. For SGM2053-ADJ,  $V_{OUT} = 0.8V$ ,  $V_{ADJ} = V_{OUT}$ ,  $C_{IN} = 2.2\mu F$ ,  $C_{OUT} = 1\mu F$  and  $C_{BP} = 22nF$ , typical values are at  $T_J = +25^\circ C$ , unless otherwise noted.)

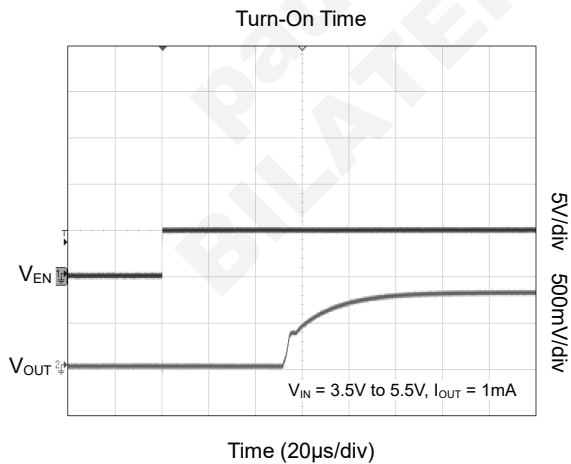
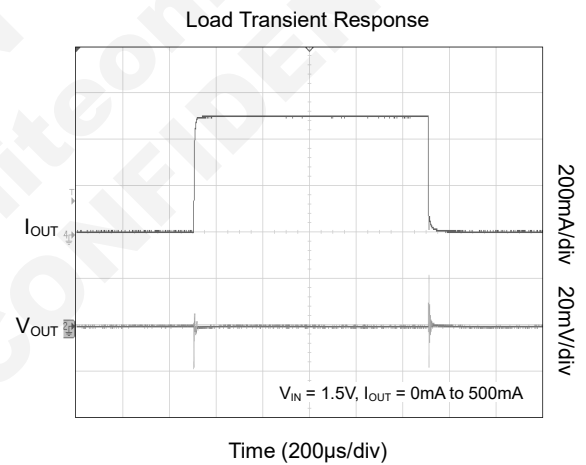
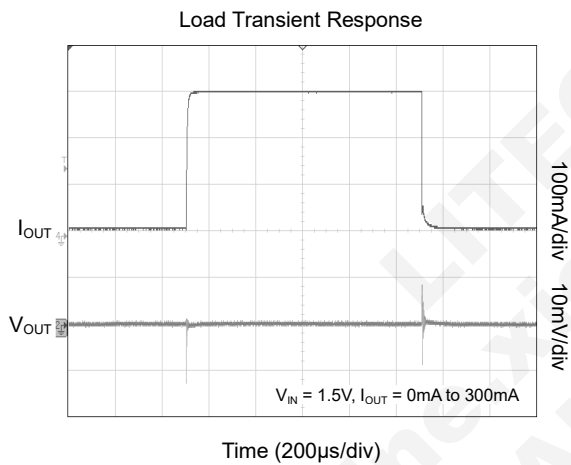
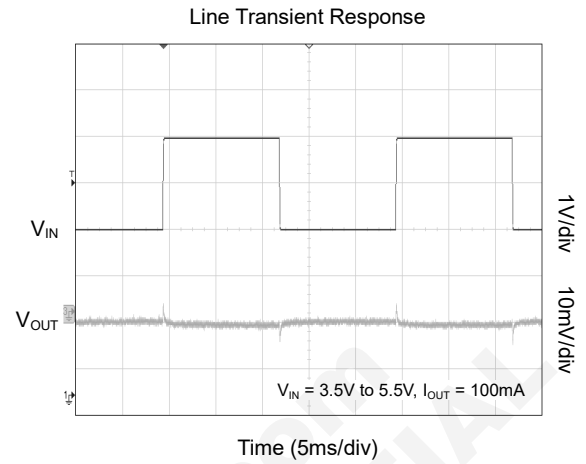
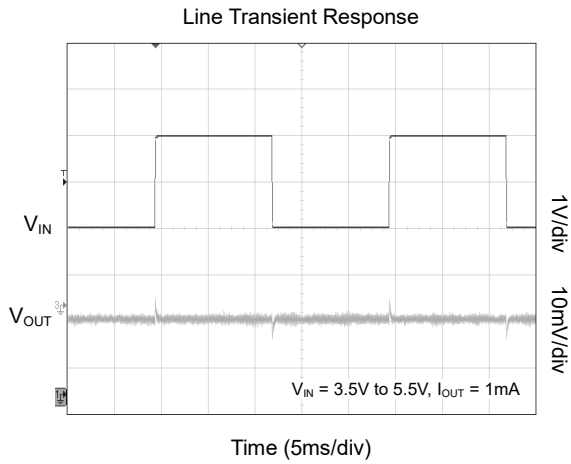
PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS
Input Voltage Range	$V_{IN}$		+25°C	1.5		5.5	V
ADJ Pin Input Bias Current	$I_{ADJ}$	$V_{OUT} = 0.9V$	+25°C		0.05		nA
Output Current Limit	$I_{LIMIT}$	$V_{OUT} = 0.9 \times V_{OUT(NOM)}$ , $V_{OUT(NOM)} = 5.0V$	+25°C		1		A
Short Circuit Current	$I_{SC}$	$V_{OUT} = 0V$	+25°C		530		mA
Ground Pin Current	$I_Q$	No load, $V_{EN} = V_{IN}$	+25°C		17		$\mu A$
Line Regulation	$\Delta V_{LNR}$	$V_{IN} = (V_{OUT(NOM)} + 0.5V)$ to 5.5V, $I_{OUT} = 0.1mA$	+25°C		0.2		mV
Load Regulation	$\Delta V_{LDR}$	$I_{OUT} = 0.1mA$ to 500mA	+25°C		1		mV
Dropout Voltage <sup>(1)</sup>	$V_{DROPO}$	$I_{OUT} = 500mA$	$V_{OUT(NOM)} = 1.8V$	+25°C		180	mV
			$V_{OUT(NOM)} = 5.0V$	+25°C		110	
Output Voltage Noise	$e_n$	$I_{OUT} = 50mA$ , $f = 10Hz$ to 100kHz	+25°C		20		$\mu V_{RMS}$
Power Supply Rejection Ratio	PSRR	$V_{IN} = V_{OUT(NOM)} + 1.0V$ , $I_{OUT} = 50mA$	$f = 217Hz$	+25°C		92	dB
			$f = 1kHz$	+25°C		93	dB
			$f = 10kHz$	+25°C		89	dB
<b>Shutdown</b>							
EN Input Threshold	$V_{IH}$	$V_{IN} = 1.5V$ to 5.5V	+25°C	1			V
	$V_{IL}$		+25°C			0.3	
EN Input Bias Current	$I_{ENH}$	$V_{EN} = 5.5V$ , $V_{IN} = 5.5V$	+25°C		30		nA
	$I_{ENL}$	$V_{EN} = 0V$ , $V_{IN} = 5.5V$	+25°C		0.5		
Shutdown Supply Current	$I_{SHDN}$	$V_{EN} = 0V$ , $V_{IN} = 5.5V$	+25°C		0.03		$\mu A$
Turn-On Time	$t_{ON}$	From EN rising from 0V to $V_{IN}$ to $0.9 \times V_{OUT}$ , $C_{BP} = 22nF$ , no load	+25°C		70		$\mu s$
Discharge Resistor	$R_{DIS}$	$V_{EN} = 0V$ , $V_{OUT} = 0.5V$ , $V_{IN} = 1.5V$	+25°C		60		$\Omega$
<b>Thermal Protection</b>							
Thermal Shutdown Temperature	$T_{SHDN}$				160		°C
Thermal Shutdown Hysteresis	$\Delta T_{SHDN}$				20		°C

## NOTE:

1. The dropout voltage is defined as  $V_{IN} - V_{OUT}$ , when  $V_{OUT}$  is 50mV below the value of  $V_{OUT}$  for  $V_{IN} = V_{OUT(NOM)} + 0.5V$  or 1.5V.

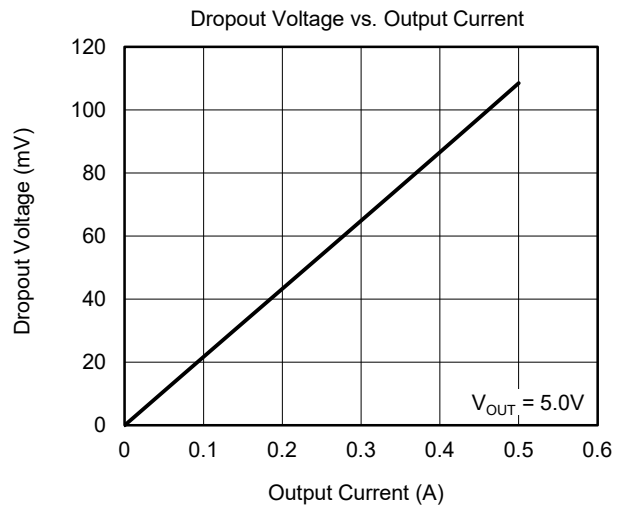
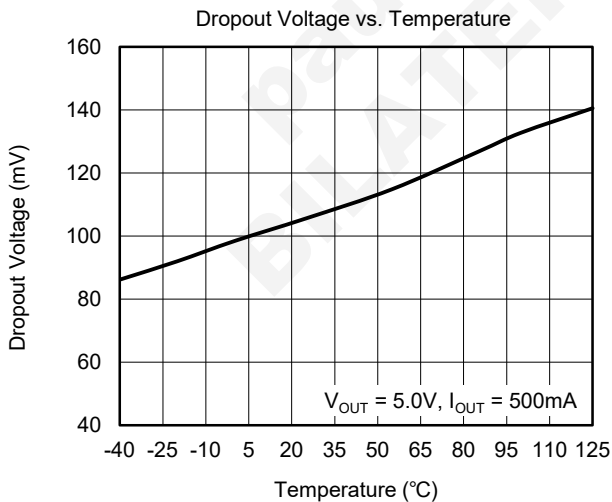
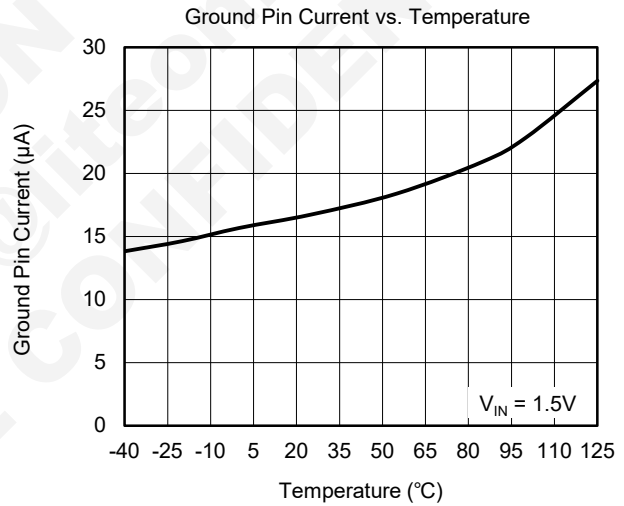
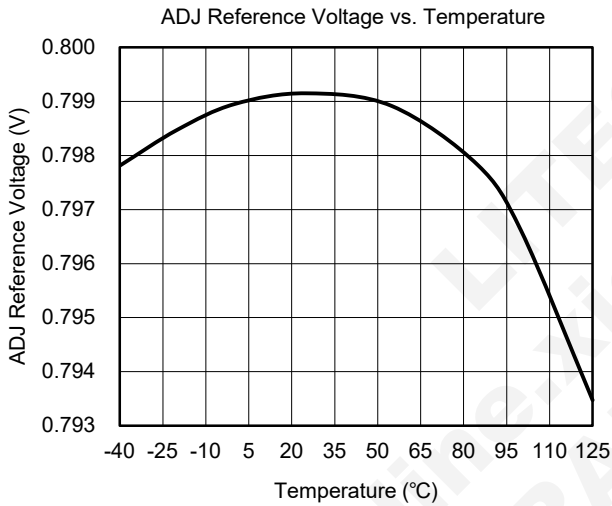
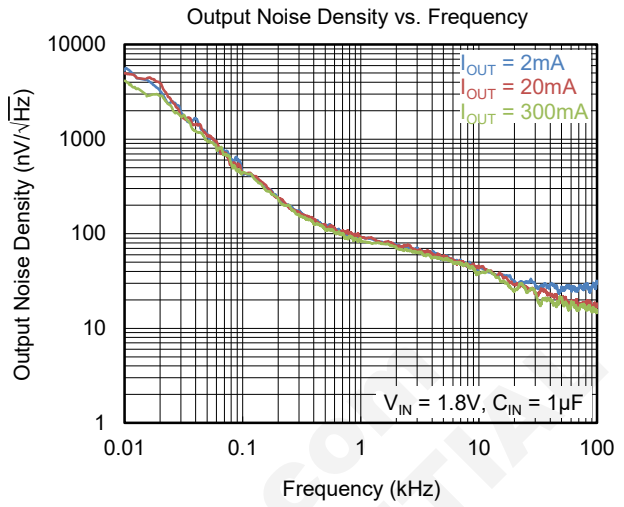
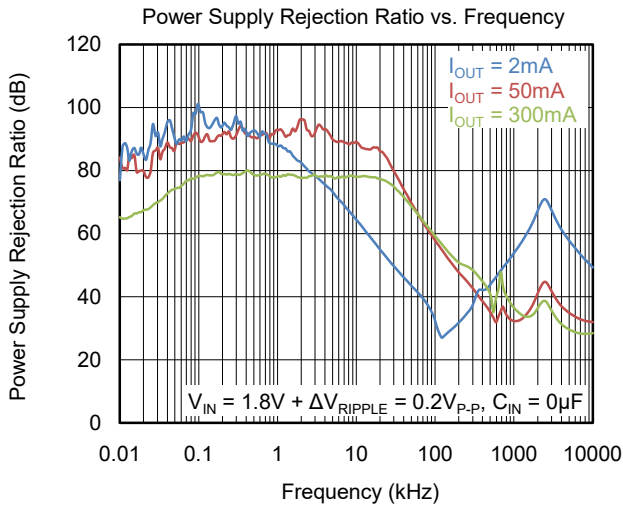
TYPICAL PERFORMANCE CHARACTERISTICS

$T_J = +25^\circ\text{C}$ ,  $V_{IN} = V_{OUT(NOM)} + 1\text{V}$ ,  $V_{OUT} = 0.8\text{V}$ ,  $V_{ADJ} = V_{OUT}$ ,  $C_{IN} = 2.2\mu\text{F}$ ,  $C_{OUT} = 1\mu\text{F}$  and  $C_{BP} = 22\text{nF}$ , unless otherwise noted.



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J = +25^\circ\text{C}$ ,  $V_{IN} = V_{OUT(NOM)} + 1\text{V}$ ,  $V_{OUT} = 0.8\text{V}$ ,  $V_{ADJ} = V_{OUT}$ ,  $C_{IN} = 2.2\mu\text{F}$ ,  $C_{OUT} = 1\mu\text{F}$  and  $C_{BP} = 22\text{nF}$ , unless otherwise noted.



APPLICATION NOTE

When LDO is used in handheld products, attention must be paid to voltage spikes which could damage the SGM2053. In such applications, voltage spikes will be generated at charger interface and  $V_{BUS}$  pin of USB interface when charger adapters and USB equipments are hot-plugged. Besides this, handheld products will be tested on the production line without battery. Test engineer will apply power from the connector pin which connects with positive pole of the battery. When external power supply is turned on suddenly, the voltage spikes will be generated at the battery connector. The voltage spikes will be very high and it always exceeds the absolute maximum input voltage (6.0V) of LDO. In order to get robust design, design engineer needs to clear up this voltage spike. Zener diode is a cheap and effective solution to eliminate such voltage spike. For example, BZM55B5V6 is a 5.6V small package Zener diode which can be used to remove voltage spikes in cell phone designs. The schematic is shown below.

For the SGM2053-ADJ, set the output voltage by using a resistor divider as shown in Figure 3. Capacitance  $C_1 = 10nF$  can be added to improve stability and reduce noise. Choose  $R_2 = 40k\Omega$  to maintain a  $20\mu A$  minimum load. Calculate the value for  $R_1$  using the following equation:

$$R_1 = R_2 \times \left( \frac{V_{OUT}}{0.8V} - 1 \right)$$

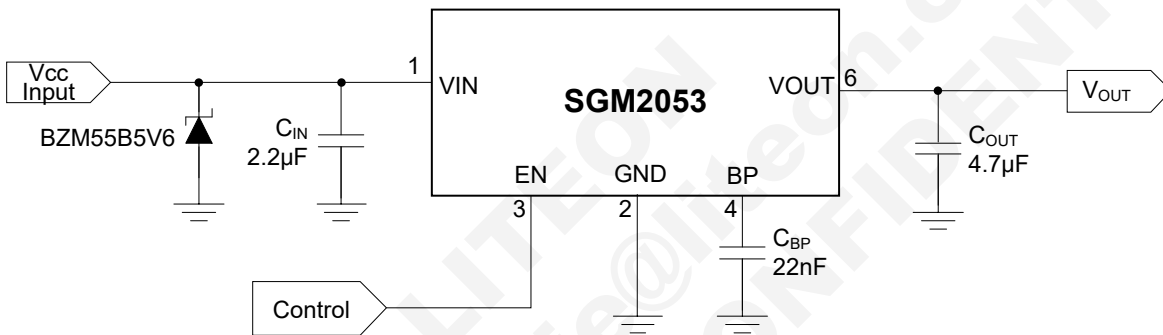


Figure 2. Fixed Output Voltage Version

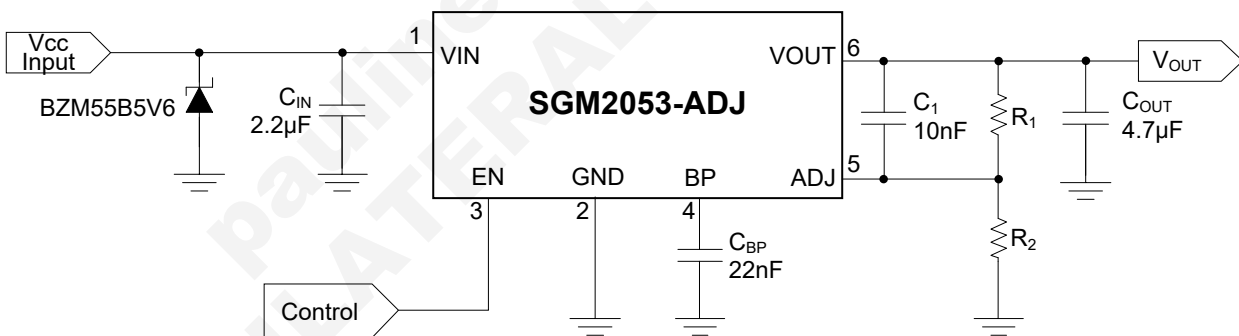
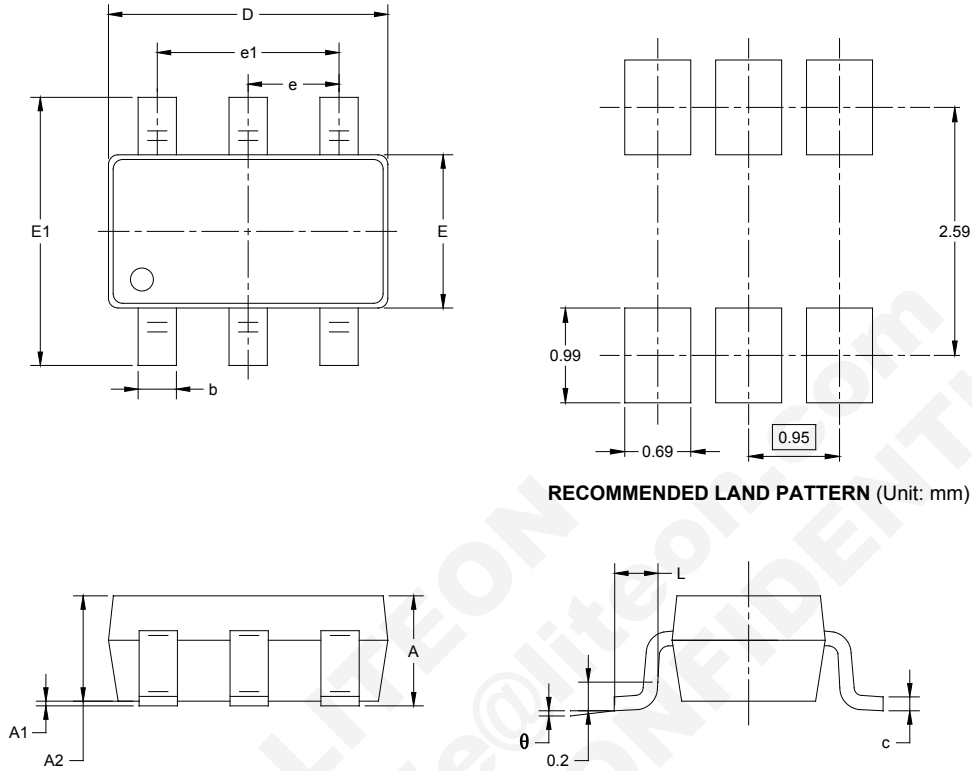


Figure 3. Adjustable Output Voltage Version

PACKAGE OUTLINE DIMENSIONS

SOT-23-6



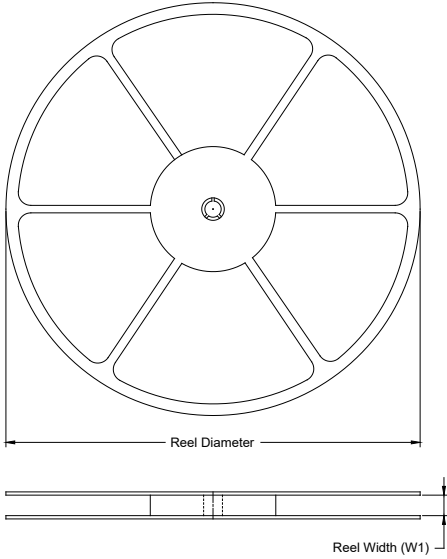
RECOMMENDED LAND PATTERN (Unit: mm)

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

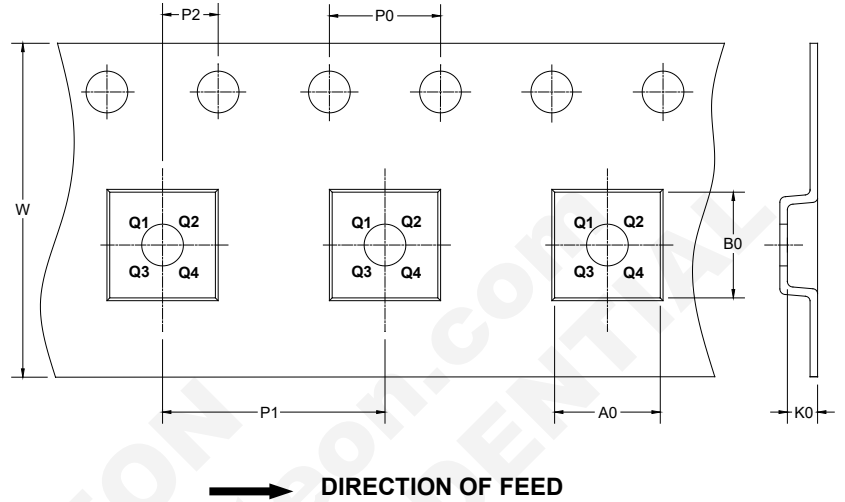


TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



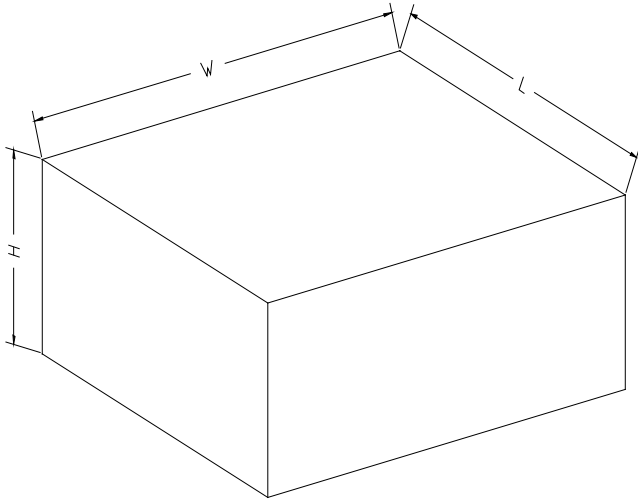
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOT-23-6	7"	9.5	3.17	3.23	1.37	4.0	4.0	2.0	8.0	Q3

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