



# SGM2596/SGM2596D

## 5.7V, 6A, 16mΩ On-Resistance Dual-Channel Load Switches

### GENERAL DESCRIPTION

The SGM2596 and SGM2596D are dual-channel power distribution switches with controlled output ramp-up rate. The switch operates from a wide range of 0.6V to 5.7V supply voltage, and is controlled by the ONx pin (ON1 or ON2). It is capable of supplying up to 6A maximum continuous current.

The small size and quiescent current make the device very suitable for space limited, battery-powered applications. The  $V_{OUT}$  ramp-up rate can be adjusted by setting an additional capacitor to the CTx pin. The SGM2596D has quick output discharge function in disable status. Thermal shutdown shuts off the output MOSFET if the die temperature exceeds +160°C, and the output MOSFET remains off until the die temperature drops to +140°C.

The SGM2596 and SGM2596D are both available in a Green TDFN-3×2-14AL package. They are rated over the -40°C to +105°C temperature range.

### FEATURES

- **Input Voltage Range: 0.6V to  $V_{BIAS}$**
- **$V_{BIAS}$  Voltage Range: 2.5V to 5.7V**
- **Dual-Channel Load Switch**
- **On-Resistance:**
  - $R_{ON} = 16m\Omega$  (TYP) at  $V_{INx} = 3.3V$ ,  $V_{BIAS} = 5V$
  - $R_{ON} = 16.1m\Omega$  (TYP) at  $V_{INx} = 1.2V$ ,  $V_{BIAS} = 2.5V$
- **Continuous Current: 6A (MAX)/Channel**
- **Quiescent Current:**
  - Both Channels: 22.3μA (TYP) at  $V_{INx} = V_{BIAS} = 5V$**
  - Single Channel: 22μA (TYP) at  $V_{INx} = V_{BIAS} = 5V$**
- **Programmable Output Ramp-Up Time**
- **Thermal Shutdown**
- **SGM2596D: Quick Output Discharge (QOD)**
- **-40°C to +105°C Operating Temperature Range**
- **Available in a Green TDFN-3×2-14AL Package**

### APPLICATIONS

Portable Medical Equipment  
 Portable Media Players  
 Motherboard USB Power Switch  
 USB Device Power Switch

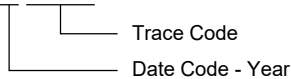
**PACKAGE/ORDERING INFORMATION**

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2596	TDFN-3x2-14AL	-40°C to +105°C	SGM2596GTES14G/TR	2596 XXXX	Tape and Reel, 3000
SGM2596D	TDFN-3x2-14AL	-40°C to +105°C	SGM2596DGTES14G/TR	2596D XXXX	Tape and Reel, 3000

**MARKING INFORMATION**

NOTE: XXXX = Date Code and Trace Code.

**XXXX**



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 Voltage,  $V_{INX}$ ..... -0.3V to 6V
- Output Voltage,  $V_{OUTX}$ ..... -0.3V to 6V
- ON Pin Voltage,  $V_{ONX}$ ..... -0.3V to 6V
- Bias Voltage,  $V_{BIAS}$ ..... -0.3V to 6V
- Maximum Continuous Current per Channel..... 6A
- Maximum Pulsed Switch Current per Channel, Pulse < 300μs, 3% Duty Cycle ..... 8A
- Junction Temperature..... +150°C
- Storage Temperature Range ..... -65°C to +150°C
- Lead Temperature (Soldering, 10s)..... +260°C

**RECOMMENDED OPERATING CONDITIONS**

- Input Voltage,  $V_{INX}$ ..... 0.6V to  $V_{BIAS}$
- Output Voltage,  $V_{OUTX}$ ..... <  $V_{INX}$
- ON Pin Voltage,  $V_{ONX}$ ..... 0V to 5.7V
- Bias Voltage,  $V_{BIAS}$ ..... 2.5V to 5.7V
- High Level Input Voltage,  $V_{IH}$   
 $V_{BIAS} = 2.5V$  to 5V,  $T_A < +85°C$ ..... 1.05V to 5.7V  
 $V_{BIAS} = 2.5V$  to 5.7V,  $T_A < +105°C$ ..... 1.2V to 5.7V
- Low Level Input Voltage,  $V_{IL}$   
 $V_{BIAS} = 2.5V$  to 5.7V ..... 0V to 0.5V
- Input Capacitor,  $C_{IN}$  ..... > 1μF
- Operating Ambient Temperature Range..... -40°C to +105°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.

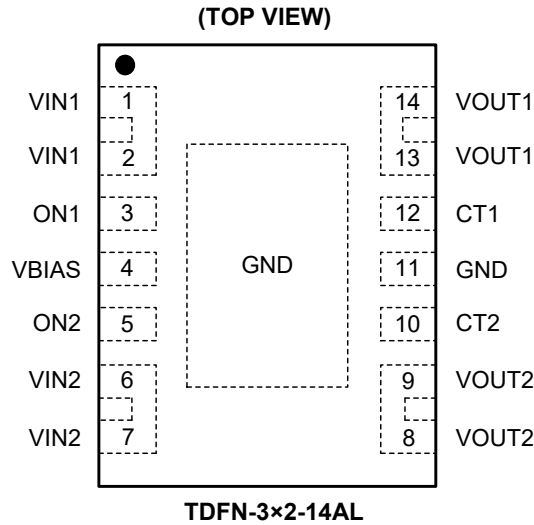
**ESD SENSITIVITY CAUTION**

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 CONFIGURATION**



**PIN DESCRIPTION**

PIN	NAME	TYPE	FUNCTION
1, 2	VIN1	I	Channel 1 Switch Input. It is recommended that place a decoupling capacitor between VIN1 pin to GND.
3	ON1	I	Channel 1 Chip Enable Pin. Do not float this pin.
4	VBIAS	I	Bias Voltage.
5	ON2	I	Channel 2 Chip Enable Pin. Do not float this pin.
6, 7	VIN2	I	Channel 2 Switch Input. It is recommended that place a decoupling capacitor between VIN2 pin to GND.
8, 9	VOUT2	O	Channel 2 Switch Output.
10	CT2	O	Channel 2 Switch Output Ramp-Up Rate Control. Can be left floating. Capacitor used on this pin must be rated at least 25V to achieve the required rise time performance.
11	GND	G	Ground.
12	CT1	O	Channel 1 Switch Output Ramp-Up Rate Control. Can be left floating. Capacitor used on this pin must be rated at least 25V to achieve the required rise time performance.
13, 14	VOUT1	O	Channel 1 Switch Output.
Exposed Pad	GND	G	Ground.

NOTE: I: input, O: output, G: ground.

## ELECTRICAL CHARACTERISTICS

(V<sub>BIAS</sub> = 5V, typical values are at T<sub>J</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Power Supplies and Currents</b>						
VBIAS Quiescent Current (Both Channels)	I <sub>Q_VBIAS</sub>	I <sub>OUTx</sub> = 0mA, V <sub>INx</sub> = V <sub>ONx</sub> = 5V		22.3		μA
VBIAS Quiescent Current (Single Channel)		I <sub>OUTx</sub> = 0mA, V <sub>ON2</sub> = 0V, V <sub>INx</sub> = V <sub>ON1</sub> = 5V		22		μA
VBIAS Shutdown Current	I <sub>SD_VBIAS</sub>	V <sub>ONx</sub> = 0V, V <sub>OUTx</sub> = 0V		0.003		μA
VIN Shutdown Current per Channel	I <sub>SD_VIN</sub>	V <sub>ONx</sub> = 0V, V <sub>OUTx</sub> = 0V	V <sub>INx</sub> = 5V	0.009		μA
			V <sub>INx</sub> = 3.3V	0.009		
			V <sub>INx</sub> = 1.8V	0.006		
			V <sub>INx</sub> = 0.6V	0.002		
ONx Pin Input Leakage Current	I <sub>ON</sub>	V <sub>ONx</sub> = 5.5V		0		μA
<b>Resistance Characteristics</b>						
On-Resistance per Channel	R <sub>ON</sub>	I <sub>OUTx</sub> = -200mA	V <sub>INx</sub> = 5V		16.5	mΩ
			V <sub>INx</sub> = 3.3V		16	
			V <sub>INx</sub> = 1.8V		16	
			V <sub>INx</sub> = 1.2V		16	
			V <sub>INx</sub> = 1.05V		16	
			V <sub>INx</sub> = 0.6V		16	
ONx Pin Hysteresis	V <sub>ON_HYS</sub>	V <sub>INx</sub> = 5V		60		mV
Output Pull-Down Resistance (SGM2596D Only)	R <sub>PD</sub>	V <sub>INx</sub> = V <sub>OUTx</sub> = 5V, V <sub>ONx</sub> = 0V		220		Ω
Thermal Shutdown Temperature	T <sub>SD</sub>	Junction temperature rising		160		°C
Thermal Shutdown Hysteresis	T <sub>HYS</sub>	Junction temperature falling		20		°C

**ELECTRICAL CHARACTERISTICS (continued)**

(V<sub>BIAS</sub> = 2.5V, typical values are at T<sub>J</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>Power Supplies and Currents</b>						
VBIAS Quiescent Current (Both Channels)	I <sub>Q_VBIAS</sub>	I <sub>OUTx</sub> = 0mA, V <sub>INx</sub> = V <sub>ONx</sub> = 2.5V		16		μA
VBIAS Quiescent Current (Single Channel)		I <sub>OUTx</sub> = 0mA, V <sub>ON2</sub> = 0V, V <sub>INx</sub> = V <sub>ON1</sub> = 2.5V		16.5		μA
VBIAS Shutdown Current	I <sub>SD_VBIAS</sub>	V <sub>ONx</sub> = 0V, V <sub>OUTx</sub> = 0V		0.001		μA
VIN Shutdown Current per Channel	I <sub>SD_VIN</sub>	V <sub>ONx</sub> = 0V, V <sub>OUTx</sub> = 0V	V <sub>INx</sub> = 2.5V	0.004		μA
			V <sub>INx</sub> = 1.8V	0.005		
			V <sub>INx</sub> = 1.05V	0.001		
			V <sub>INx</sub> = 0.6V	0.001		
ONx Pin Input Leakage Current	I <sub>ON</sub>	V <sub>ONx</sub> = 5.5V		0		μA
<b>Resistance Characteristics</b>						
On-Resistance per Channel	R <sub>ON</sub>	I <sub>OUTx</sub> = -200mA	V <sub>INx</sub> = 2.5V		16.4	mΩ
			V <sub>INx</sub> = 1.8V		16.3	
			V <sub>INx</sub> = 1.5V		16.2	
			V <sub>INx</sub> = 1.2V		16.1	
			V <sub>INx</sub> = 1.05V		16.1	
			V <sub>INx</sub> = 0.6V		16.1	
ONx Pin Hysteresis	V <sub>ON_HYS</sub>	V <sub>INx</sub> = 2.5V		60		mV
Output Pull-Down Resistance (SGM2596D Only)	R <sub>PD</sub>	V <sub>INx</sub> = V <sub>OUTx</sub> = 2.5V, V <sub>ONx</sub> = 0V		230		Ω
Thermal Shutdown Temperature	T <sub>SD</sub>	Junction temperature rising		160		°C
Thermal Shutdown Hysteresis	T <sub>HYS</sub>	Junction temperature falling		20		°C

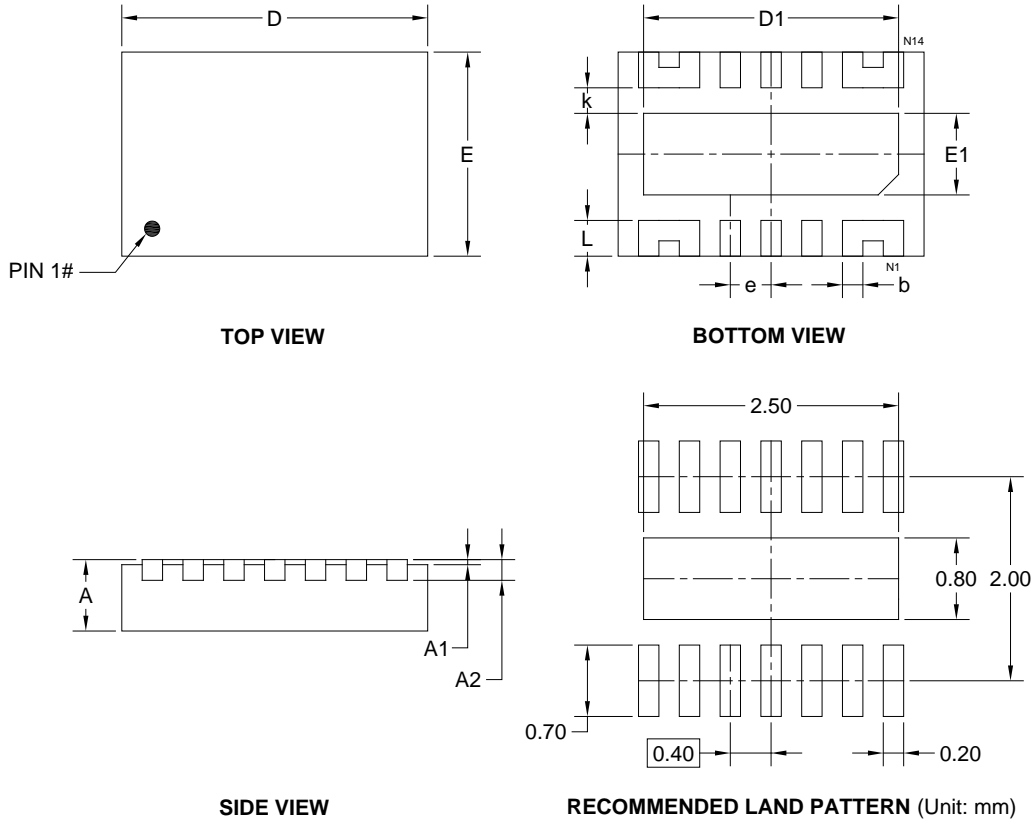
**SWITCHING CHARACTERISTICS**

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>V<sub>INx</sub> = V<sub>ONx</sub> = V<sub>BIAS</sub> = 5V, T<sub>A</sub> = +25°C, unless otherwise noted.</b>						
Turn-On Time	t <sub>ON</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		1540		μs
Turn-Off Time	t <sub>OFF</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		16		
V <sub>OUT</sub> Rise Time	t <sub>R</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		2550		
V <sub>OUT</sub> Fall Time	t <sub>F</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		7		
On Delay Time	t <sub>D</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		260		
<b>V<sub>INx</sub> = 0.6V, V<sub>ONx</sub> = V<sub>BIAS</sub> = 5V, T<sub>A</sub> = +25°C, unless otherwise noted.</b>						
Turn-On Time	t <sub>ON</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		510		μs
Turn-Off Time	t <sub>OFF</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		25		
V <sub>OUT</sub> Rise Time	t <sub>R</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		360		
V <sub>OUT</sub> Fall Time	t <sub>F</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		7		
On Delay Time	t <sub>D</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		330		
<b>V<sub>INx</sub> = 2.5V, V<sub>ONx</sub> = 5V, V<sub>BIAS</sub> = 2.5V, T<sub>A</sub> = +25°C, unless otherwise noted.</b>						
Turn-On Time	t <sub>ON</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		1020		μs
Turn-Off Time	t <sub>OFF</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		45		
V <sub>OUT</sub> Rise Time	t <sub>R</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		1160		
V <sub>OUT</sub> Fall Time	t <sub>F</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		10		
On Delay Time	t <sub>D</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		430		
<b>V<sub>INx</sub> = 0.6V, V<sub>ONx</sub> = 5V, V<sub>BIAS</sub> = 2.5V, T<sub>A</sub> = +25°C, unless otherwise noted.</b>						
Turn-On Time	t <sub>ON</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		530		μs
Turn-Off Time	t <sub>OFF</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		45		
V <sub>OUT</sub> Rise Time	t <sub>R</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		355		
V <sub>OUT</sub> Fall Time	t <sub>F</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		8		
On Delay Time	t <sub>D</sub>	R <sub>L</sub> = 10Ω, C <sub>L</sub> = 0.1μF, C <sub>T</sub> = 1000pF		360		

# PACKAGE INFORMATION

## PACKAGE OUTLINE DIMENSIONS

### TDFN-3x2-14AL



Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.700	0.750	0.800
A1	0.000	-	0.050
A2	0.203 REF		
b	0.130	0.200	0.250
D	3.000 BSC		
D1	2.400	2.500	2.600
E	2.000 BSC		
E1	0.700	0.800	0.900
k	0.250 REF		
L	0.300	0.350	0.400
e	0.400 BSC		

NOTE: 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
TDFN-3×2-14AL	7"	9.5	2.30	3.30	1.10	4.0	4.0	2.0	8.0	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
7" (Option)	368	227	224	8
7"	442	410	224	18

DD0002