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℃, and the output MOSFET remains off until the die temperature drops to +140℃.

The SGM2596 and SGM2596D are both available in a Green TDFN-3×2-14AL package. They are rated over the -40℃ to +105℃ 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} = 16mΩ (TYP) at V_{INx} = 3.3V, V_{BIAS} = 5V**
  - **R_{ON} = 16.1mΩ (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℃ to +105℃ Operating Temperature Range**
- **Available in a Green TDFN-3×2-14AL Package**

APPLICATIONS

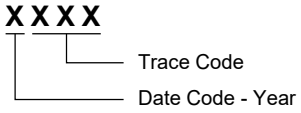
Portable Medical Equipment
Portable Media Players
Motherboard USB Power Switch
USB Device Power Switch

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2596	TDFN-3×2-14AL	-40℃ to +105℃	SGM2596GTES14G/TR	2596 XXXX	Tape and Reel, 3000
SGM2596D	TDFN-3×2-14AL	-40℃ to +105℃	SGM2596DGTES14G/TR	2596D XXXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XXXX = Date Code and Trace 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 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℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃

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℃ ..... 1.05V to 5.7V
V_{BIAS} = 2.5V to 5.7V, T_A < +105℃ ..... 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℃ to +105℃

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

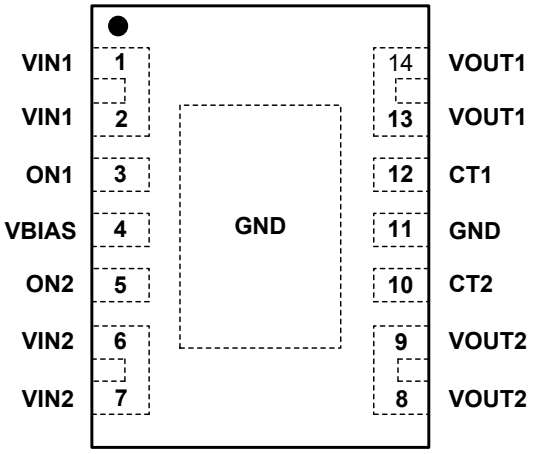
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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-3×2-14AL

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_{BIAS} = 5V, typical values are at T_J = +25℃, unless otherwise noted.)

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

ELECTRICAL CHARACTERISTICS (continued)

(V_{BIAS} = 2.5V, typical values are at T_J = +25℃, unless otherwise noted.)

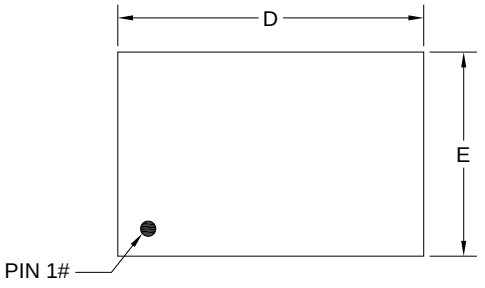
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Power Supplies and Currents							
VBIAS Quiescent Current (Both Channels)	I_{Q_VBIAS}	I_{OUTx} = 0mA, V_{INx} = V_{ONx} = 2.5V			16		μA
VBIAS Quiescent Current (Single Channel)		I_{OUTx} = 0mA, V_{ON2} = 0V, V_{INx} = V_{ON1} = 2.5V			16.5		μA
VBIAS Shutdown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

SWITCHING CHARACTERISTICS

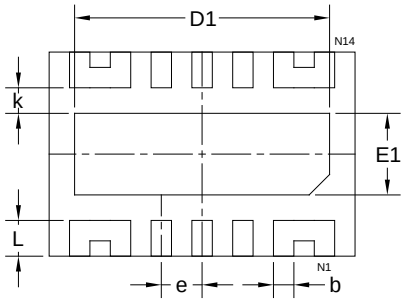
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
V_{INx} = V_{ONx} = V_{BIAS} = 5V, T_A = +25℃, unless otherwise noted.						
Turn-On Time	t_{ON}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		1540		μs
Turn-Off Time	t_{OFF}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		16		
V_{OUT} Rise Time	t_R	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		2550		
V_{OUT} Fall Time	t_F	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		7		
On Delay Time	t_D	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		260		
V_{INx} = 0.6V, V_{ONx} = V_{BIAS} = 5V, T_A = +25℃, unless otherwise noted.						
Turn-On Time	t_{ON}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		510		μs
Turn-Off Time	t_{OFF}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		25		
V_{OUT} Rise Time	t_R	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		360		
V_{OUT} Fall Time	t_F	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		7		
On Delay Time	t_D	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		330		
V_{INx} = 2.5V, V_{ONx} = 5V, V_{BIAS} = 2.5V, T_A = +25℃, unless otherwise noted.						
Turn-On Time	t_{ON}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		1020		μs
Turn-Off Time	t_{OFF}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		45		
V_{OUT} Rise Time	t_R	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		1160		
V_{OUT} Fall Time	t_F	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		10		
On Delay Time	t_D	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		430		
V_{INx} = 0.6V, V_{ONx} = 5V, V_{BIAS} = 2.5V, T_A = +25℃, unless otherwise noted.						
Turn-On Time	t_{ON}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		530		μs
Turn-Off Time	t_{OFF}	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		45		
V_{OUT} Rise Time	t_R	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		355		
V_{OUT} Fall Time	t_F	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		8		
On Delay Time	t_D	R_L = 10Ω, C_L = 0.1μF, C_T = 1000pF		360		

PACKAGE OUTLINE DIMENSIONS

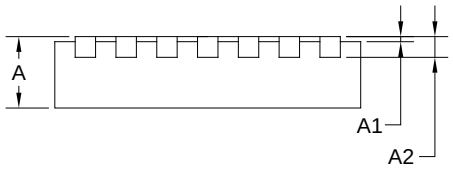
TDFN-3×2-14AL



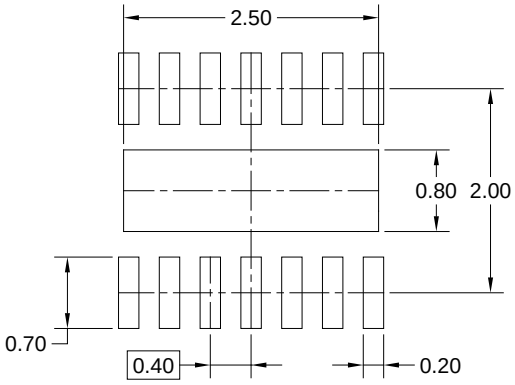
TOP VIEW



BOTTOM VIEW



SIDE VIEW



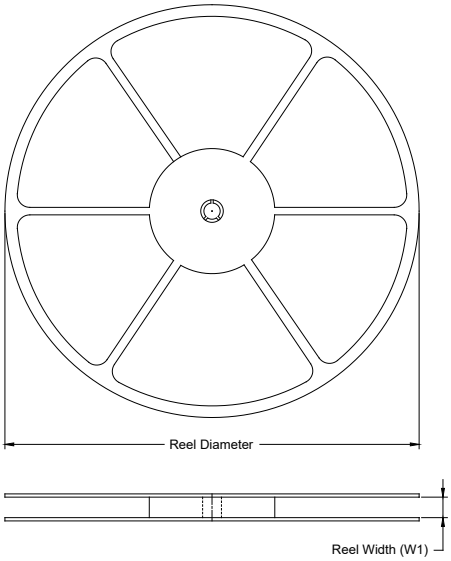
RECOMMENDED LAND PATTERN (Unit: mm)

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		

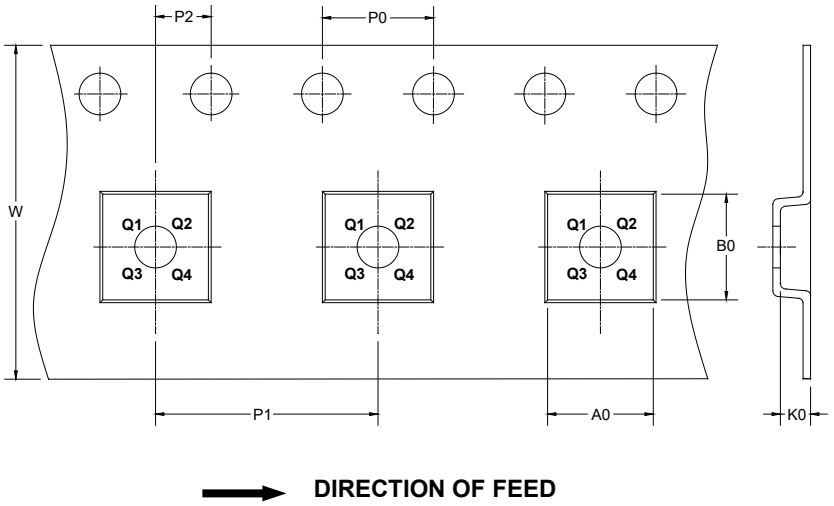
NOTE: This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



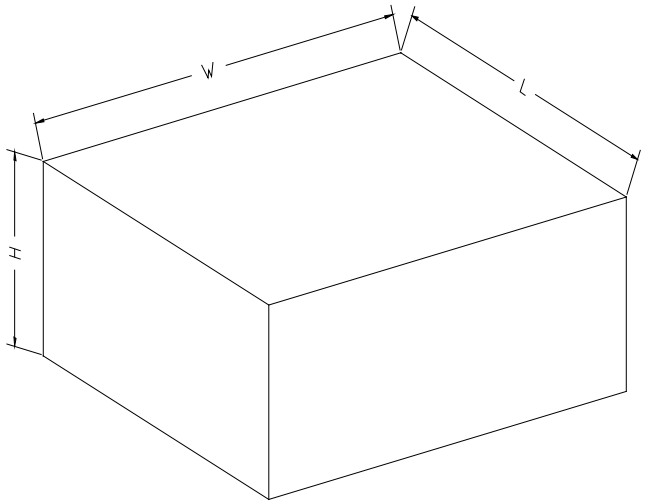
NOTE: The picture is only for reference. Please make the object as the standard.

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

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