

SGM48017/SGM48018/SGM48019 Power MOSFET and IGBT Gate Drivers with Comprehensive Protections

GENERAL DESCRIPTION

The SGM48017/8/9 are high-speed gate drivers capable of effectively driving MOSFET and IGBT power switches. They allow for up to 8A source and 13A sink peak currents at V_{DD} = 20V. The SGM48017/8/9 provide a set of comprehensive protection features such as thermal shutdown protection, under-voltage lockout and short-circuit protection. They operate with a wide supply range of 4.5V to 20V.

The SGM48017/8/9 are available in a Green SOT-23-5 package. They operate over a temperature range of -40° C to $+125^{\circ}$ C.

APPLICATIONS

Power MOSFETs IGBT Driving for Power Supplies Motor Drivers

FEATURES

- Simple and Reliable
- 8A Source and 13A Sink Peak Currents
- Wide Supply Voltage Range: 4.5V to 20V
- Fast Propagation Delay: 30ns (TYP)
- Fast Rise Time: 7ns (TYP)
- Fast Fall Time: 8ns (TYP)
- Ringing Suppression
- Negative Voltage Capability on INx Pin: -10V when (V_{DD} - V_{INx}) ≤ 22V
- Negative Voltage Capability on EN Pin: -10V when (V_{DD} - V_{EN}) ≤ 22V
- Negative Voltage Capability on OUT Pin: -5V (Pulse < 500ns)
- Comprehensive Protection Features
 - Thermal Shutdown Protection
 - Under-Voltage Lockout
 - Short-Circuit Protection
- -40°C to +125°C Operating Temperature Range
- Available in a Green SOT-23-5 Package

TYPICAL APPLICATIONS





PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM48017	SOT-23-5	-40°C to +125°C	SGM48017XN5G/TR	CLFXX	Tape and Reel, 3000
SGM48018	SOT-23-5	-40°C to +125°C	SGM48018XN5G/TR	R74XX	Tape and Reel, 3000
SGM48019	SOT-23-5	-40°C to +125°C	SGM48019XN5G/TR	CM0XX	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.

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ABSOLUTE MAXIMUM RATINGS

VDD0.3V to	22V
Continuous INx, when $(V_{DD} - V_{INx}) \le 22V$	
	0.3V
Continuous EN, when $(V_{DD} - V_{EN}) \le 22V$	
	0.3V
Continuous OUT (DC)0.3V to V _{DD} +	0.3V
Pulse OUT (Pulse < 500ns)5V to V_{DD} +	0.3V
Power Dissipation, $P_D @ T_A = +25^{\circ}C$	
SOT-23-50.	67W
Package Thermal Resistance	
SOT-23-5, θ _{JA}	°C/W
Junction Temperature+1	50°C
Storage Temperature Range65°C to +1	50°C
Lead Temperature (Soldering, 10s)+2	60°C
ESD Susceptibility	
HBM80	700C
CDM	700C

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range4.5V to 20V	/
Operating Junction Temperature Range40°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	I/O	FUNCTION		
SGM48017	SGM48018	SGM48019			TONOTION	
1	5	5	VDD		Supply Input. Place a $4.7\mu F$ decoupling capacitor between this pin and GND pin close to the device.	
2	2	2	GND	G	Ground. All signals are referenced to this pin.	
3	_	3	IN+	Ι	Non-Inverting Input. OUT is held low if IN+ is floating. For the SGM48017, when the driver is used in inverting configuration, pull IN+ high in order to enable output.	
4	3	_	IN-	I	Inverting Input. OUT is held low if IN- is floating. For the SGM48017, when the driver is used in non-inverting configuration, pull IN- low in order to enable output.	
5	4	4	OUT	0	Source/Sink Current Output of Driver.	
_	1	1	EN		Enable Input. EN is biased low to disable output regardless of input state. EN is biased high or left floating to enable output. EN is allowed to float.	

NOTE:

P: power supply, I: input, O: output, G: ground.



ELECTRICAL CHARACTERISTICS

(V_{DD} = 12V, C_{IN} = 4.7µF, typical values are at T_J = +25°C, Full = -40°C to +125°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	TEMP	MIN	TYP	MAX	UNITS	
Power Supplies								
VDD Operating Supply Voltage	V _{DD}		Full	4.5		20	V	
		INx, EN floating	+25°C		90	120		
		V _{IN+} = 5V, V _{IN-} = 0V, SGM48017 only	+25°C		750	960	1	
VDD Operating Supply Current	I _{VDD}	$V_{EN} = 5V, V_{IN-} = 0V, SGM48018 only$	+25°C		815	1040	μA	
		$V_{EN} = 5V, V_{IN+} = 5V, SGM48019 \text{ only}$	+25°C		775	990		
VDD Under-Voltage Lockout Voltage	V _{UVLO}	V _{DD} rising	Full	3.8	4.1	4.4	V	
VDD Under-Voltage Lockout Voltage Hysteresis	V _{HYS}		+25°C		200		mV	
Inputs (INx, EN)		•			•	•	•	
Input Low Voltage	V _{IL}		Full			0.7	V	
Input High Voltage	VIH		Full	2.5			V	
land have Queen t		Inverting input current, V _{INx} = 0V	+25°C		110	140		
Input Low Current	lι∟	Non-inverting input current, $V_{INx} = 0V$	+25°C Full Full Full 2.5 t current, $V_{INx} = 0V$ +25°C input current, $V_{INx} = 20V$ +25°C t current, $V_{INx} = 50V$ +25°C t current, $V_{INx} = 50MA$ Full ut_source = 50mA Full t_SINK = -50mA	0.1	1	μA		
In must I link Command		Inverting input current, V _{INx} = 20V	+25°C		0.2	2	μA	
Input High Current	I _{IH}	Non-inverting input current, V _{INx} = 20V	+25°C		115	150		
EN Low Current	I _{ENL}	V _{EN} = 0V			110	145	μA	
EN High Current	I _{ENH}	V _{EN} = 20V			0.2	2	μA	
Outputs								
	R _{OH}	V_{DD} = 12V, I_{OUT_SOURCE} = 50mA	Full		4.7	7.4		
Pull-Up Resistance ⁽¹⁾		V_{DD} = 4.5V, I_{OUT_SOURCE} = 50mA	Full		5.3	8.3	Ω	
		V_{DD} = 12V, I_{OUT_SINK} = -50mA	Full		255	440		
Pull-Down Resistance	R _{ol}	V_{DD} = 4.5V, I_{OUT_SINK} = -50mA	Full		265	460	mΩ	
Pook Output Current	I _{PK_SOURCE}	$V_{1} = 20V_{1}C_{2} = 0.22uE_{1}f_{1} = 1kH_{7}$	+25°C		8		Α	
Peak Output Current	I _{PK_SINK}	$V_{DD} = 200, C_L = 0.22 \mu r, I_{SW} = 1 \text{ KHz}$	+25°C		13		Α	
Switching Characteristics								
Rise Time	t _R		+25°C		7		ns	
Fall Time	t _F	C_L = 2.2nF, see Figure 2 through Figure 9	+25°C		8		ns	
Propagation Doloy (IN) to OUT	t _{D1}	C _L = 2.2nF, 3V input pulse,	+25°C		26		ns	
Propagation Delay (IN+) to OUT	t _{D2}	see Figure 2, Figure 4 and Figure 8	+25°C		30		ns	
	t _{D3}	C _L = 2.2nF, 3V input pulse,	+25°C		30		ns	
Propagation Delay (IN-) to OUT	t _{D4}	see Figure 3, Figure 5 and Figure 6	+25°C		26		ns	
Propagation Doloy (EN) to OUT	t _{D5}	C _L = 2.2nF, 3V input pulse,	+25°C		26		ns	
Propagation Delay (EN) to OUT	t _{D6}	see Figure 7 and Figure 9	+25°C		30		ns	
Protection Circuits								
Thermal Shutdown Temperature	T _{TSD}				165		°C	
Thermal Shutdown Temperature Hysteresis	T _{HYS}				30		°C	

NOTE:

1. R_{OH} represents constant pull-up resistance only. Pull-up resistance R_{OH_PULSE} operates in pulse mode during the output rising stage, R_{OH_PULSE} = 565m Ω (TYP).

TYPICAL PERFORMANCE CHARACTERISTICS

At T_J = +25°C, V_{DD} = 12V, C_{IN} = 4.7 μ F, unless otherwise noted.



25 50 75 100 125 150 Temperature (°C) Pull-Down Resistance vs. Temperature







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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_J = +25°C, V_{DD} = 12V, C_{IN} = 4.7 μ F, unless otherwise noted.



Operating Supply Current vs. Supply Voltage (SGM48018 Only)







1400 V_{IN+} = 5V, V_{IN-} = 0V Operating Supply Current (µA) 008 000 009 000 009 000 200 8 10 12 20 6 14 16 18 4 Supply Voltage (V)

Operating Supply Current vs. Supply Voltage (SGM48017 Only)

Operating Supply Current vs. Supply Voltage (SGM48019 Only)





Pull-Down Resistance vs. Supply Voltage



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TYPICAL PERFORMANCE CHARACTERISTICS (continued)

At T_J = +25°C, V_{DD} = 12V, C_{IN} = 4.7µF, unless otherwise noted.





SGM48017/SGM48018/SGM48019 with Com

Power MOSFET and IGBT Gate Drivers with Comprehensive Protections

TIMING DIAGRAMS



Figure 4. Enable and Disable Functions Using IN+ Pin



Figure 5. Enable and Disable Functions Using IN- Pin



TIMING DIAGRAMS (continued)



Figure 8. Non-Inverting Configuration



Figure 7. Enable and Disable Functions Using EN Pin



Figure 9. Enable and Disable Functions Using EN Pin



Power MOSFET and IGBT Gate Drivers SGM48017/SGM48018/SGM48019 with Comprehensive Protections

FUNCTION TABLE

SGM48017				SGM48018		SGM48019			
IN+	IN-	OUT	EN	IN-	OUT	EN	IN+	OUT	
L	L	L	L	L	L	L	L	L	
L	Н	L	L	н	L	L	Н	L	
Н	L	Н	Н	L	Н	Н	L	L	
Н	Н	L	Н	н	L	Н	Н	Н	
_	Floating	L	Floating	L	Н	Floating	L	L	
Floating	-	L	Floating	Н	L	Floating	Н	Н	
-	-	_	-	Floating	L	_	Floating	L	

FUNCTIONAL BLOCK DIAGRAMS



Figure 10. SGM48017 Block Diagram



FUNCTIONAL BLOCK DIAGRAMS (continued)



Figure 11. SGM48018 Block Diagram



Figure 12. SGM48019 Block Diagram

DETAILED DESCRIPTION

The SGM48017/8/9 are reliable and high-speed gate drivers for power MOSFETs and IGBTs with a comprehensive set of protection features such as thermal shutdown protection, under-voltage lockout and short-circuit protection. The outputs are forced low immediately if any of the above mentioned conditions occurs, except short-circuit protection. When short-circuit protection occurs, the outputs enter into high impedance, and the driver will be re-enabled after the protection period (16ms, TYP) expires.

The SGM48017/8/9 offer a unique output stage design. It can effectively suppress the output voltage ringing and the overshoot/undershoot on the outputs.



REVISION HISTORY

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

Changes from Original (SEPTEMBER 2020) to REV.A

Changed from product preview to production data	. All



Page

PACKAGE OUTLINE DIMENSIONS

SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	-	nsions meters	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		
С	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		
е	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



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-23-5	7″	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3

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	00002

