SGM48017C/SGM48018C/SGM48019C Power MOSFET and IGBT Gate Drivers with Comprehensive Protections

GENERAL DESCRIPTION

The SGM48017C/18C/19C 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 SGM48017C/18C/19C provide a set of comprehensive protection features such as thermal shutdown protection and under-voltage lockout. They operate with a wide supply range of 4.5V to 20V.

The SGM48017C/18C/19C are available in a Green SOT-23-5 package. They operate over a temperature range of -40℃ to +125℃.

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)
- **Protection Features**
  - **Thermal Shutdown Protection**
  - **Under-Voltage Lockout**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in a Green SOT-23-5 Package**

TYPICAL APPLICATIONS

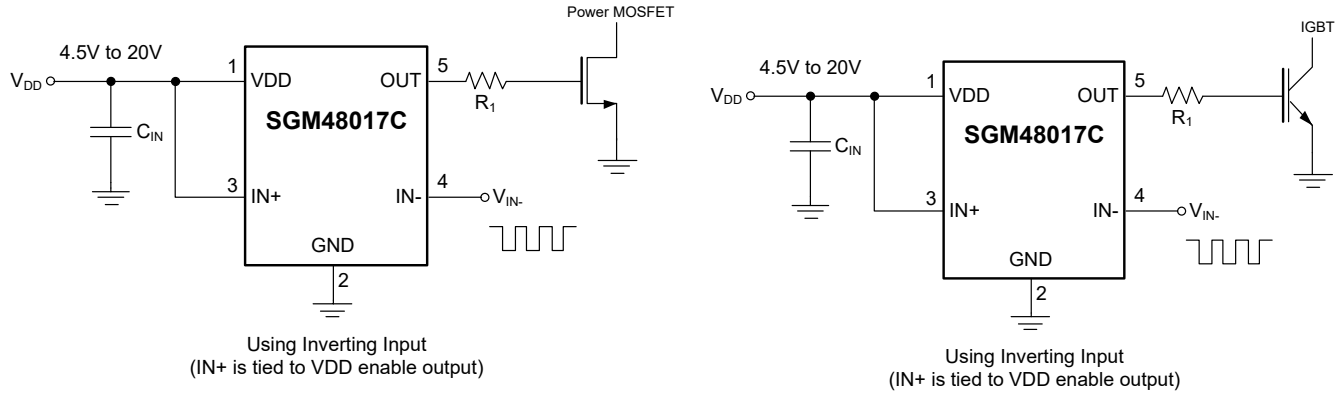


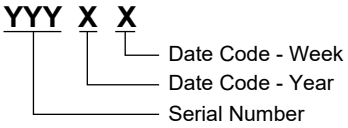
Figure 1. Typical Application Circuits

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM48017C	SOT-23-5	-40℃ to +125℃	SGM48017CXN5G/TR	03JXX	Tape and Reel, 3000
SGM48018C	SOT-23-5	-40℃ to +125℃	SGM48018CXN5G/TR	03KXX	Tape and Reel, 3000
SGM48019C	SOT-23-5	-40℃ to +125℃	SGM48019CXN5G/TR	03LXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date 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

VDD ..... -0.3V to 22V
Continuous INx, when (V_{DD} - V_{INx}) ≤ 22V
..... -10V to V_{DD} + 0.3V
Continuous EN, when (V_{DD} - V_{EN}) ≤ 22V
..... -10V to V_{DD} + 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℃
SOT-23-5 ..... 0.67W
Package Thermal Resistance
SOT-23-5, θ_{JA} ..... 185℃/W
Junction Temperature .....+150℃
Storage Temperature Range.....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....+260℃
ESD Susceptibility
HBM.....8000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range .....4.5V to 20V
Operating Junction Temperature Range..... -40℃ to +125℃

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

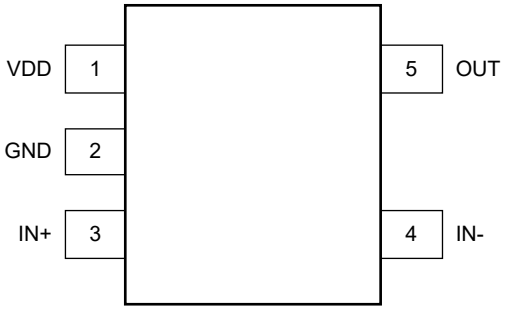
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

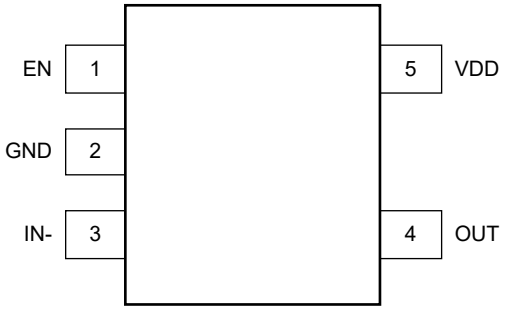
PIN CONFIGURATIONS

SGM48017C (TOP VIEW)



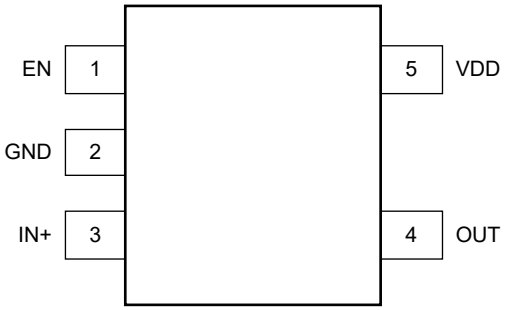
SOT-23-5

SGM48018C (TOP VIEW)



SOT-23-5

SGM48019C (TOP VIEW)



SOT-23-5

PIN DESCRIPTION

PIN			NAME	I/O	FUNCTION
SGM48017C	SGM48018C	SGM48019C			
1	5	5	VDD	P	Supply Input. Place a 4.7μF 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+	I	Non-Inverting Input. OUT is held low if IN+ is floating. For the SGM48017C, 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 SGM48017C, when the driver is used in non-inverting configuration, pull IN- low in order to enable output.
5	4	4	OUT	O	Source/Sink Current Output of Driver.
—	1	1	EN	I	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℃, T_J = -40℃ to +125℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Power Supplies						
VDD Operating Supply Voltage	V_{DD}		4.5		20	V
VDD Operating Supply Current	I_{VDD}	INx, EN floating, T_J = +25℃		90	120	μA
		V_{IN+} = 5V, V_{IN-} = 0V, SGM48017C only, T_J = +25℃		750	960	
		V_{EN} = 5V, V_{IN-} = 0V, SGM48018C only, T_J = +25℃		815	1040	
		V_{EN} = 5V, V_{IN+} = 5V, SGM48019C only, T_J = +25℃		775	990	
VDD Under-Voltage Lockout Voltage	V_{UVLO}	V_{DD} rising	3.8	4.1	4.4	V
VDD Under-Voltage Lockout Voltage Hysteresis	V_{HYS}			200		mV
Inputs (INx, EN)						
Input Low Voltage	V_{IL}				0.7	V
Input High Voltage	V_{IH}		2.5			V
Input Low Current	I_{IL}	Inverting input current, V_{INx} = 0V, T_J = +25℃		110	140	μA
		Non-inverting input current, V_{INx} = 0V, T_J = +25℃		0.1	1	
Input High Current	I_{IH}	Inverting input current, V_{INx} = 20V, T_J = +25℃		0.2	2	μA
		Non-inverting input current, V_{INx} = 20V, T_J = +25℃		115	150	
EN Low Current	I_{ENL}	V_{EN} = 0V, T_J = +25℃		110	145	μA
EN High Current	I_{ENH}	V_{EN} = 20V, T_J = +25℃		0.2	2	μA
Outputs						
Pull-Up Resistance (1)	R_{OH}	V_{DD} = 12V, I_{OUT_SOURCE} = 50mA		4.7	7.4	Ω
		V_{DD} = 4.5V, I_{OUT_SOURCE} = 50mA		5.3	8.3	
Pull-Down Resistance	R_{OL}	V_{DD} = 12V, I_{OUT_SINK} = -50mA		255	440	mΩ
		V_{DD} = 4.5V, I_{OUT_SINK} = -50mA		265	460	
Peak Output Current	I_{PK_SOURCE}	V_{DD} = 20V, C_L = 0.22μF, f_{SW} = 1kHz		8		A
	I_{PK_SINK}			13		A
Switching Characteristics						
Rise Time	t_R	C_L = 2.2nF, see Figure 2 through Figure 9		7		ns
Fall Time	t_F			8		ns
Propagation Delay (IN+) to OUT	t_{D1}	C_L = 2.2nF, 3V input pulse, see Figure 2, Figure 4 and Figure 8		26		ns
	t_{D2}			30		ns
Propagation Delay (IN-) to OUT	t_{D3}	C_L = 2.2nF, 3V input pulse, see Figure 3, Figure 5 and Figure 6		30		ns
	t_{D4}			26		ns
Propagation Delay (EN) to OUT	t_{D5}	C_L = 2.2nF, 3V input pulse, see Figure 7 and Figure 9		26		ns
	t_{D6}			30		ns
Protection Circuits						
Thermal Shutdown Temperature	T_{TSD}			165		℃
Thermal Shutdown Temperature Hysteresis	T_{HYS}			30		℃

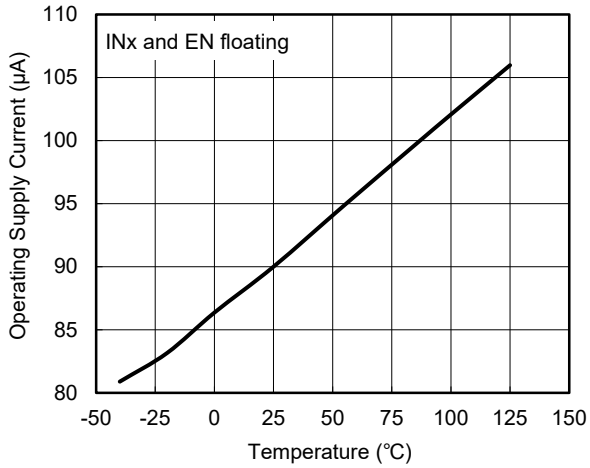
NOTE:

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} = 565mΩ (TYP).

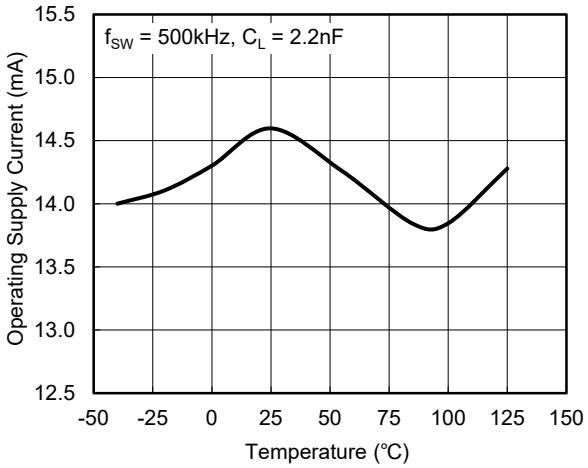
TYPICAL PERFORMANCE CHARACTERISTICS

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

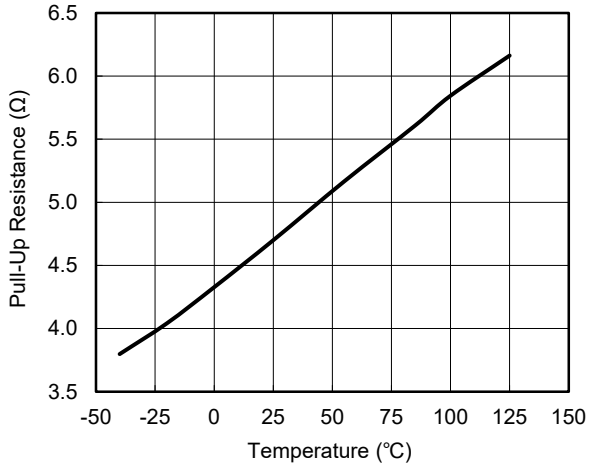
Operating Supply Current vs. Temperature



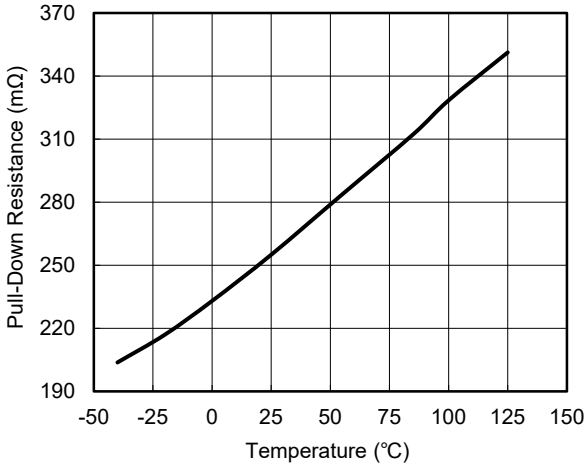
Operating Supply Current vs. Temperature (Output Switching)



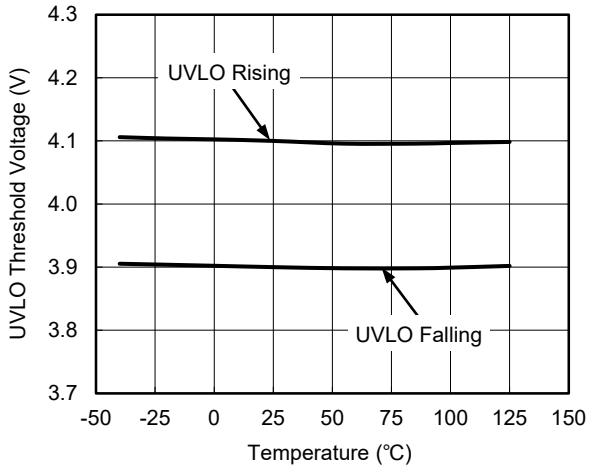
Pull-Up Resistance vs. Temperature



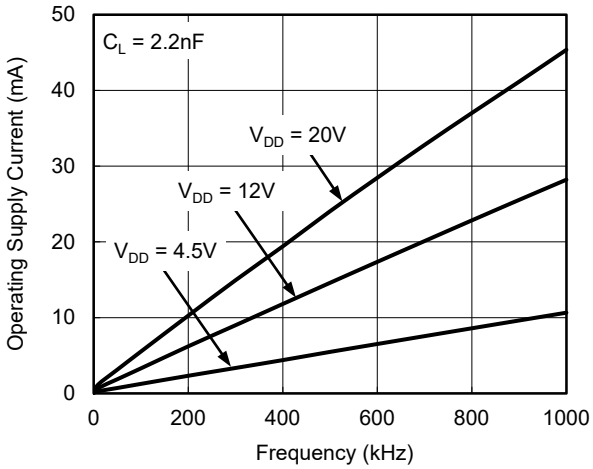
Pull-Down Resistance vs. Temperature



UVLO Threshold Voltage vs. Temperature



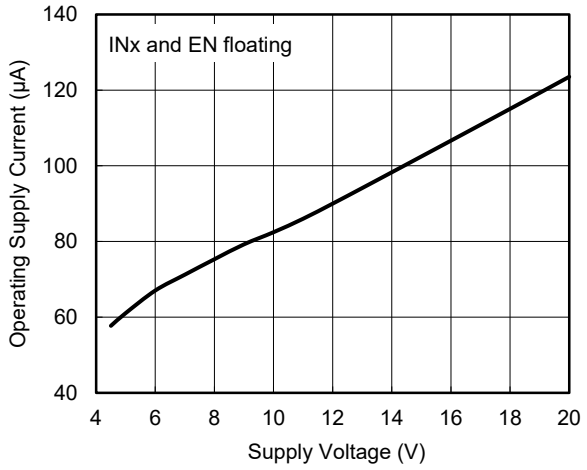
Operating Supply Current vs. Frequency (Output Switching)



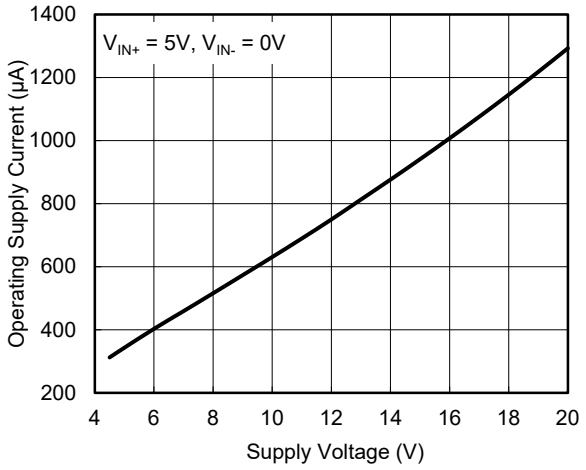
TYPICAL PERFORMANCE CHARACTERISTICS (continued)

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

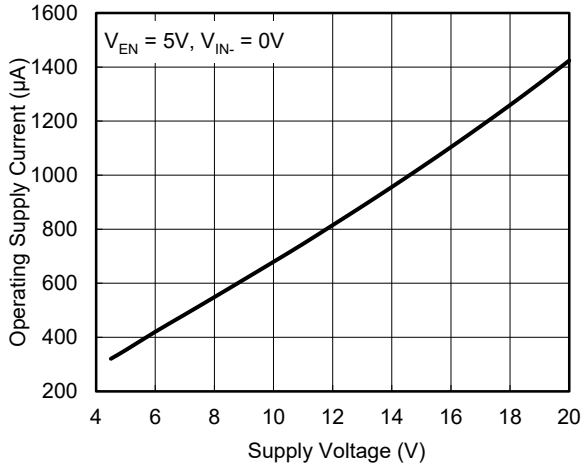
Operating Supply Current vs. Supply Voltage



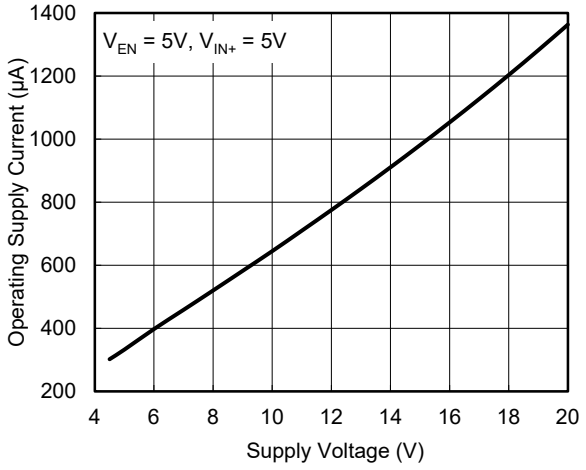
Operating Supply Current vs. Supply Voltage (SGM48017C Only)



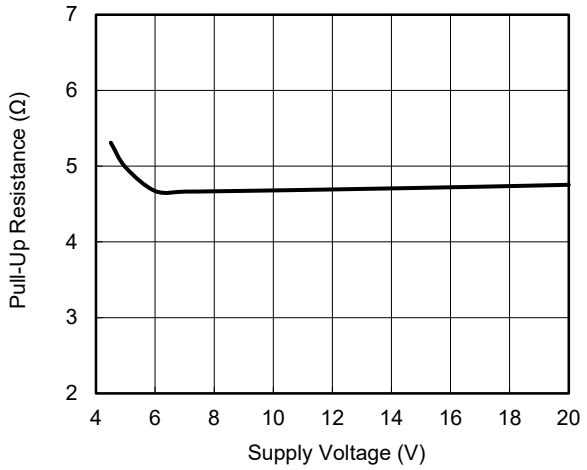
Operating Supply Current vs. Supply Voltage (SGM48018C Only)



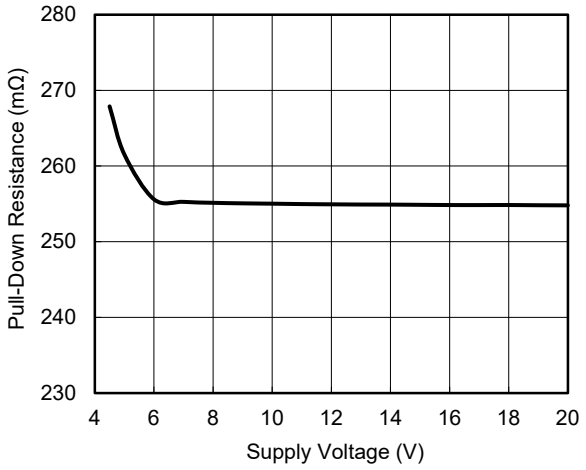
Operating Supply Current vs. Supply Voltage (SGM48019C Only)



Pull-Up Resistance vs. Supply Voltage



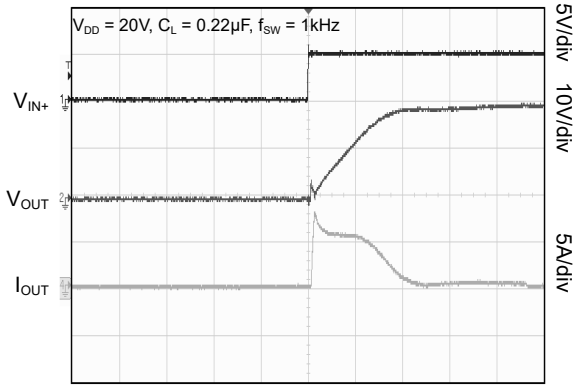
Pull-Down Resistance vs. Supply Voltage



TYPICAL PERFORMANCE CHARACTERISTICS (continued)

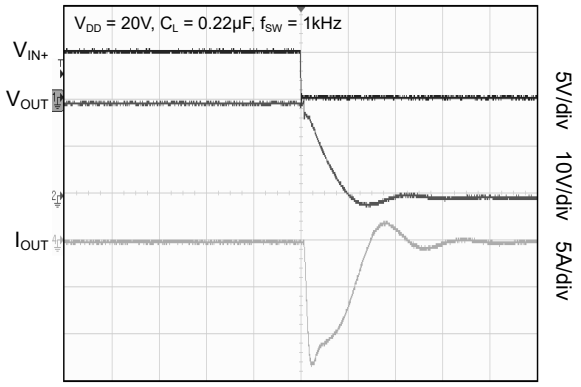
At T_J = +25℃, V_{DD} = 12V, C_{IN} = 4.7μF, unless otherwise noted.

Quasi-Static Source Current



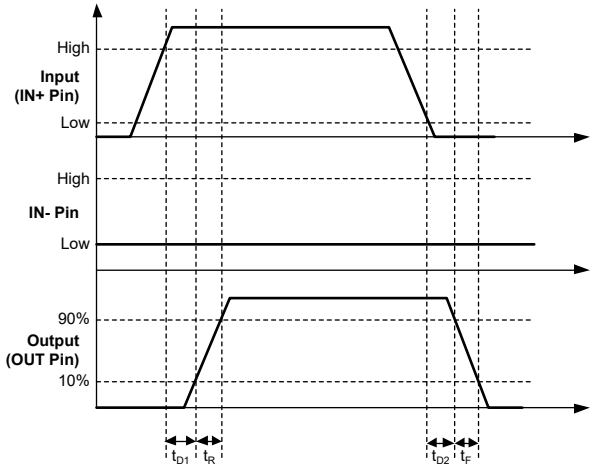
Time (500ns/div)

Quasi-Static Sink Current



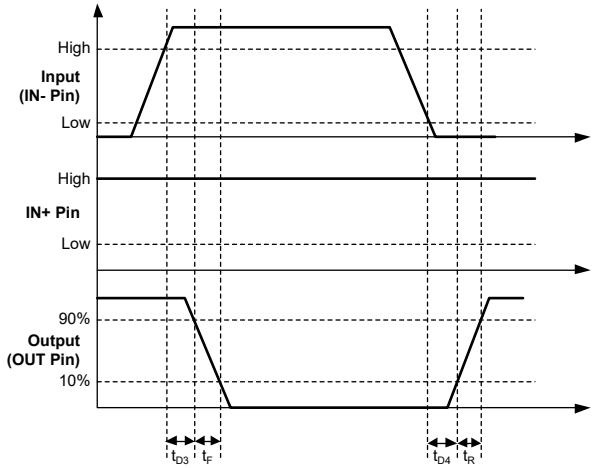
Time (500ns/div)

TIMING DIAGRAMS



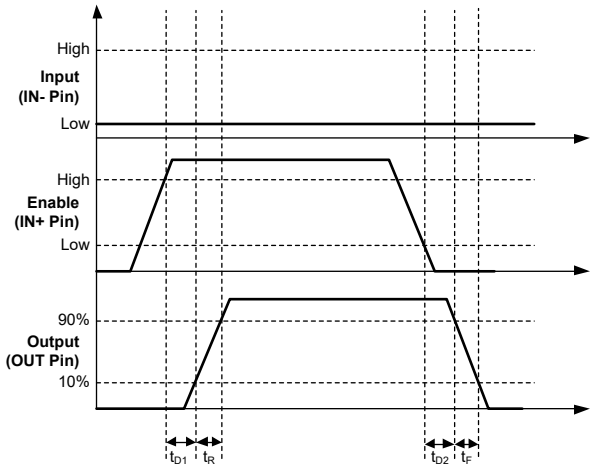
(PWM Input to IN+ Pin (IN- Pin Tied Low), SGM48017C)

Figure 2. Non-Inverting Configuration



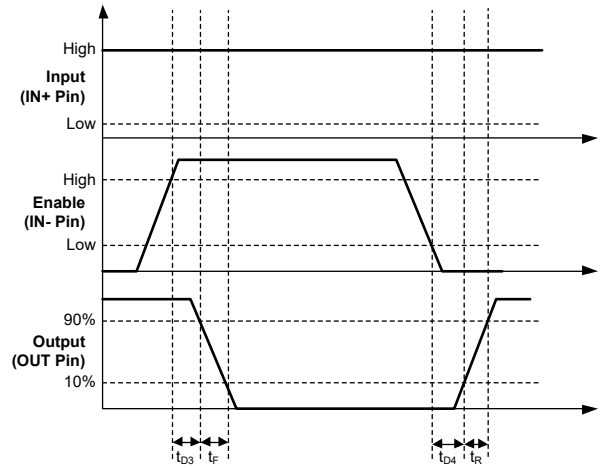
(PWM Input to IN- Pin (IN+ Pin Tied High), SGM48017C)

Figure 3. Inverting Configuration



(Enable Signal Applied to IN+ Pin, PWM Input to IN- Pin, SGM48017C)

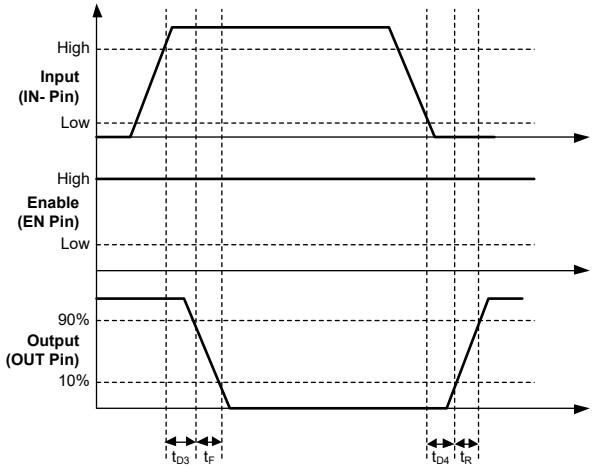
Figure 4. Enable and Disable Functions Using IN+ Pin



(Enable Signal Applied to IN- Pin, PWM Input to IN+ Pin, SGM48017C)

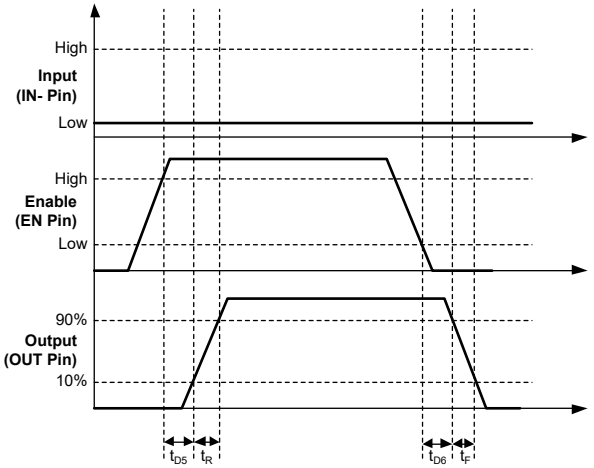
Figure 5. Enable and Disable Functions Using IN- Pin

TIMING DIAGRAMS (continued)



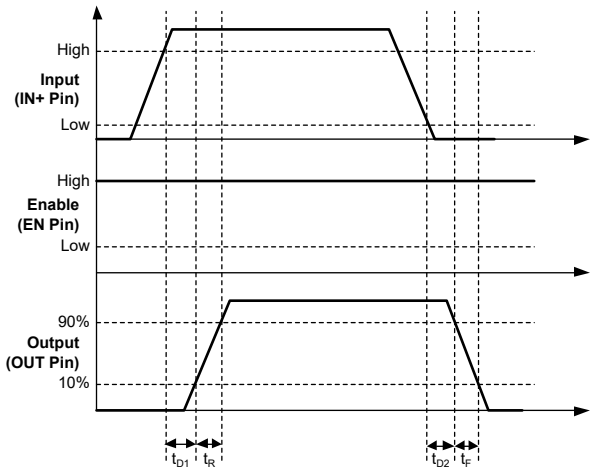
(PWM Input to IN- Pin (EN Pin Tied High), SGM48018C)

Figure 6. Inverting Configuration



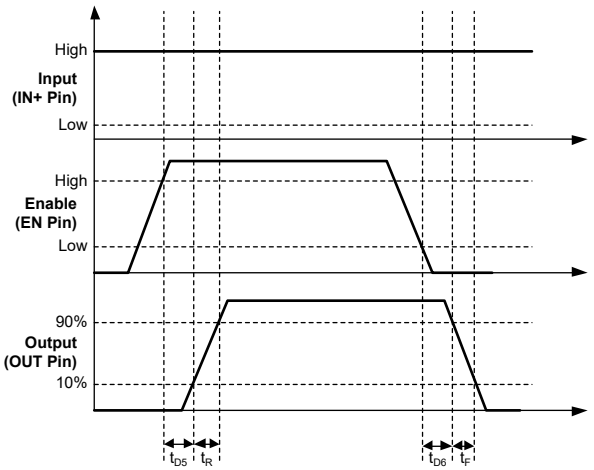
(Enable Signal Applied to EN Pin, PWM Input to IN- Pin, SGM48018C)

Figure 7. Enable and Disable Functions Using EN Pin



(PWM Input to IN+ Pin (EN Pin Tied High), SGM48019C)

Figure 8. Non-Inverting Configuration



(Enable Signal Applied to EN Pin, PWM Input to IN+ Pin, SGM48019C)

Figure 9. Enable and Disable Functions Using EN Pin

FUNCTION TABLE

SGM48017C			SGM48018C			SGM48019C		
IN+	IN-	OUT	EN	IN-	OUT	EN	IN+	OUT
L	L	L	L	L	L	L	L	L
L	H	L	L	H	L	L	H	L
H	L	H	H	L	H	H	L	L
H	H	L	H	H	L	H	H	H
–	Floating	L	Floating	L	H	Floating	L	L
Floating	–	L	Floating	H	L	Floating	H	H
–	–	–	–	Floating	L	–	Floating	L

FUNCTIONAL BLOCK DIAGRAMS

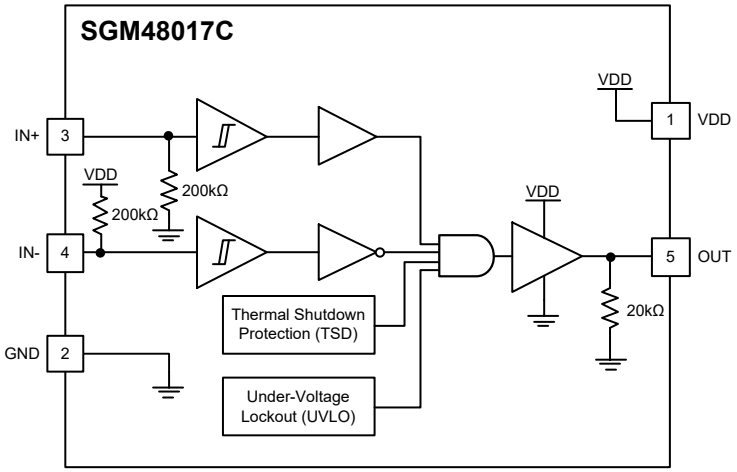


Figure 10. SGM48017C Block Diagram

FUNCTIONAL BLOCK DIAGRAMS (continued)

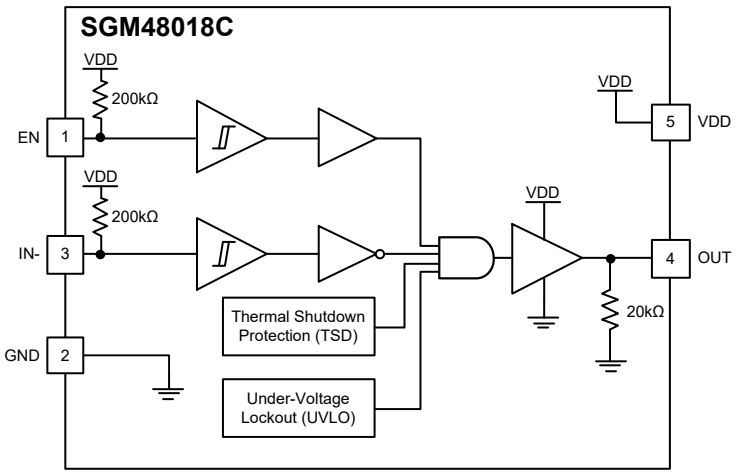


Figure 11. SGM48018C Block Diagram

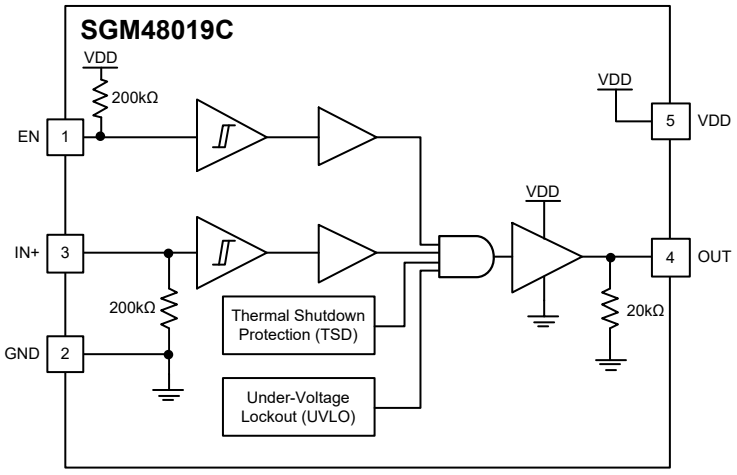


Figure 12. SGM48019C Block Diagram

DETAILED DESCRIPTION

The SGM48017C/18C/19C are reliable and high-speed gate drivers for power MOSFETs and IGBTs with a comprehensive set of protection features such as thermal shutdown protection (TSD) and under-voltage lockout (UVLO). Both TSD and UVLO are active. The output will be forced low when any threshold of the above two protections is reached and held low during hysteresis range. Only if both TSD and UVLO are released, the output follows the input again.

The SGM48017C/18C/19C offer a unique output stage design. It can effectively suppress the output voltage ringing and the overshoot/undershoot on the outputs.

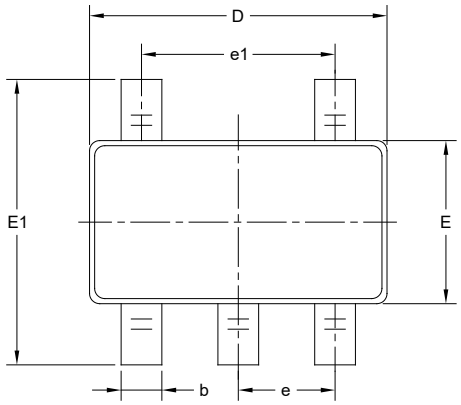
REVISION HISTORY

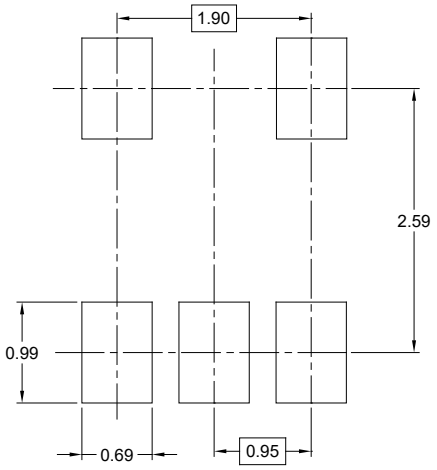
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (MARCH 2023) to REV.A	Page
Changed from product preview to production data	All

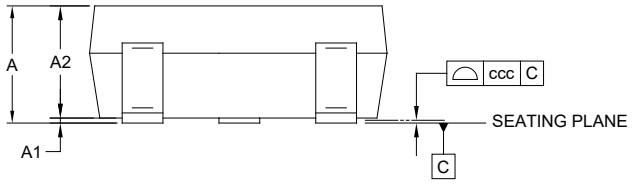
PACKAGE OUTLINE DIMENSIONS

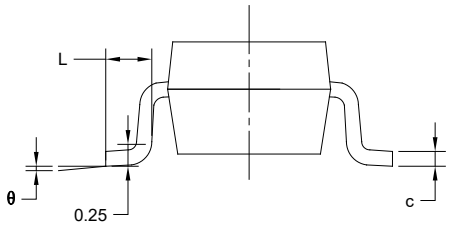
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)



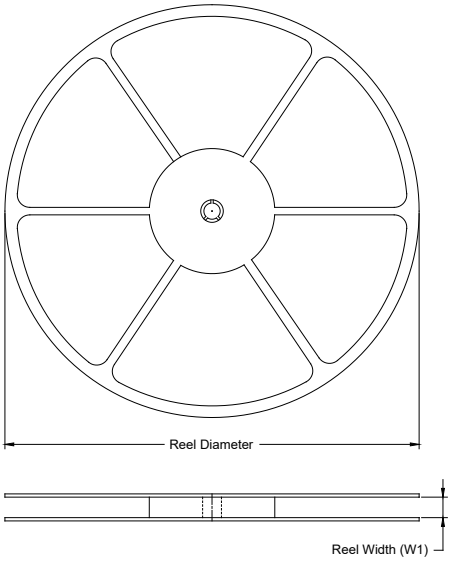


Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

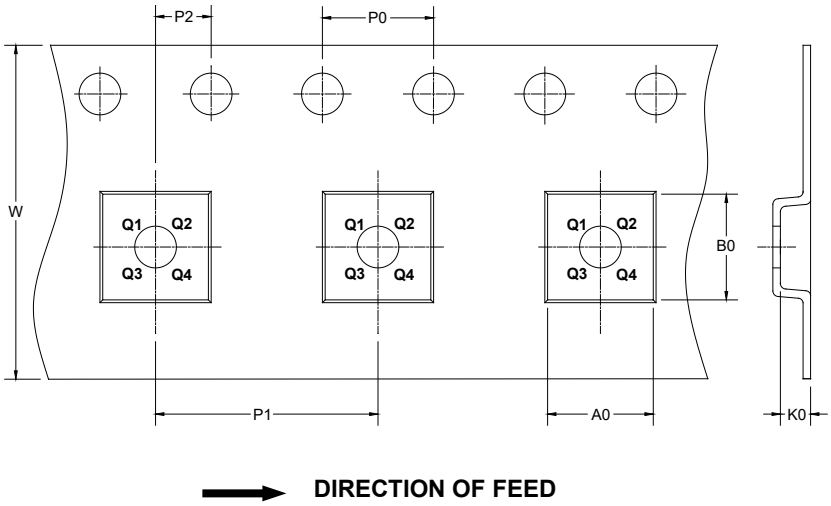
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



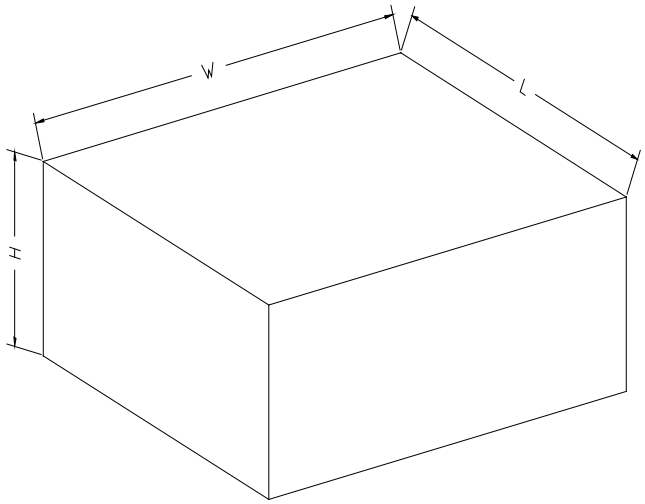
NOTE: The picture is only for reference. Please make the object as the standard.

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-23-5	7″	9.5	3.20	3.20	1.40	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