

### GENERAL DESCRIPTION

The SGM2578S/SGM2578SD family is a single load switch with reverse current protection function. The device can operate from 1.2V to 5.5V single supply and has the ability to drive up to 2A continuous current.

The device contains a 20mΩ low  $R_{DS(ON)}$  N-MOSFET controlled by the ON pin. During power-up, a smart pull-down resistor is used to avoid the ON pin floating. Once the ON pin reaches a high voltage ( $> V_{IH}$ ), the smart pull-down resistor is disconnected, which reduces the standby current and power loss. The small package and low  $R_{DS(ON)}$  make the device very suitable for space limited, battery powered applications.

The device supports a wide input voltage range, which is suitable for different voltage rails. The rise time is used to avoid inrush current. The SGM2578SD offers the quick output discharge function in disabled status.

The SGM2578S and SGM2578SD are available in a Green WLCSP-0.9×0.9-4B-D package.

### FEATURES

- Input Voltage Range: 1.2V to 5.5V
- Low On-Resistance: 20mΩ (TYP)
- Low Shutdown Current: 0.15μA (TYP)
- Low Quiescent Current: 0.24μA (TYP)
- Maximum Continuous Current: 2A
- Reverse Current Protection When Disabled
- Low Threshold 1.2V GPIO Control Input
- Smart ON
- Controlled Slew Rate
- Quick Output Discharge (SGM2578SD Only)
- Available in a Green WLCSP-0.9×0.9-4B-D Package

### APPLICATIONS

Mobile Phone  
 Ultrabook  
 Tablet PC  
 Digital Camera  
 Wearable Technology  
 Solid State Drive

### TYPICAL APPLICATION

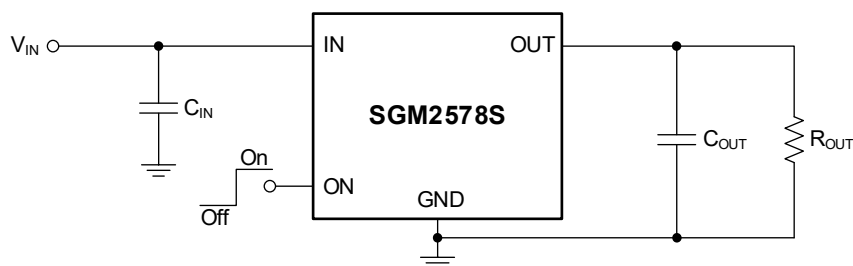



Figure 1. Typical Application Circuit

## PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM2578S	WLCSP-0.9×0.9-4B-D	-40°C to +125°C	SGM2578SYG/TR	03 XX	Tape and Reel, 3000
SGM2578SD	WLCSP-0.9×0.9-4B-D	-40°C to +125°C	SGM2578SDYG/TR	00 XX	Tape and Reel, 3000

## MARKING INFORMATION

NOTE: XX = Date Code.

**YY** — Serial Number  
**XX**  

 Date Code - Week  
 Date Code - Year

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 Range, V<sub>IN</sub>..... -0.3V to 6V  
 Output Voltage Range, V<sub>OUT</sub>..... -0.3V to 6V  
 ON Pin Voltage Range, V<sub>ON</sub>..... -0.3V to 6V  
 Maximum Continuous Switch Current, I<sub>MAX</sub>..... 2A  
 Package Thermal Resistance  
   WLCSP-0.9×0.9-4B-D, θ<sub>JA</sub>..... 211.3°C/W  
   WLCSP-0.9×0.9-4B-D, θ<sub>JB</sub>..... 79.5°C/W  
   WLCSP-0.9×0.9-4B-D, θ<sub>JC</sub>..... 70.8°C/W  
 Junction Temperature ..... +150°C  
 Storage Temperature Range..... -65°C to +150°C  
 Lead Temperature (Soldering, 10s) ..... +260°C  
 ESD Susceptibility <sup>(1) (2)</sup>  
   HBM..... ±3000V  
   CDM ..... ±1000V

### NOTES:

1. For human body model (HBM), all pins comply with ANSI/ESDA/JEDEC JS-001 specifications.
2. For charged device model (CDM), all pins comply with ANSI/ESDA/JEDEC JS-002 specifications.

## RECOMMENDED OPERATING CONDITIONS

Input Voltage Range, V<sub>IN</sub>..... 1.2V to 5.5V  
 Output Voltage Range, V<sub>OUT</sub>..... 0V to 5.5V  
 ON Pin Input High Voltage, V<sub>IH</sub>..... 0.71V to 5.5V  
 ON Pin Input Low Voltage, V<sub>IL</sub>..... 0V to 0.3V  
 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

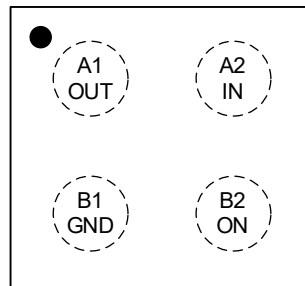
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

(TOP VIEW)

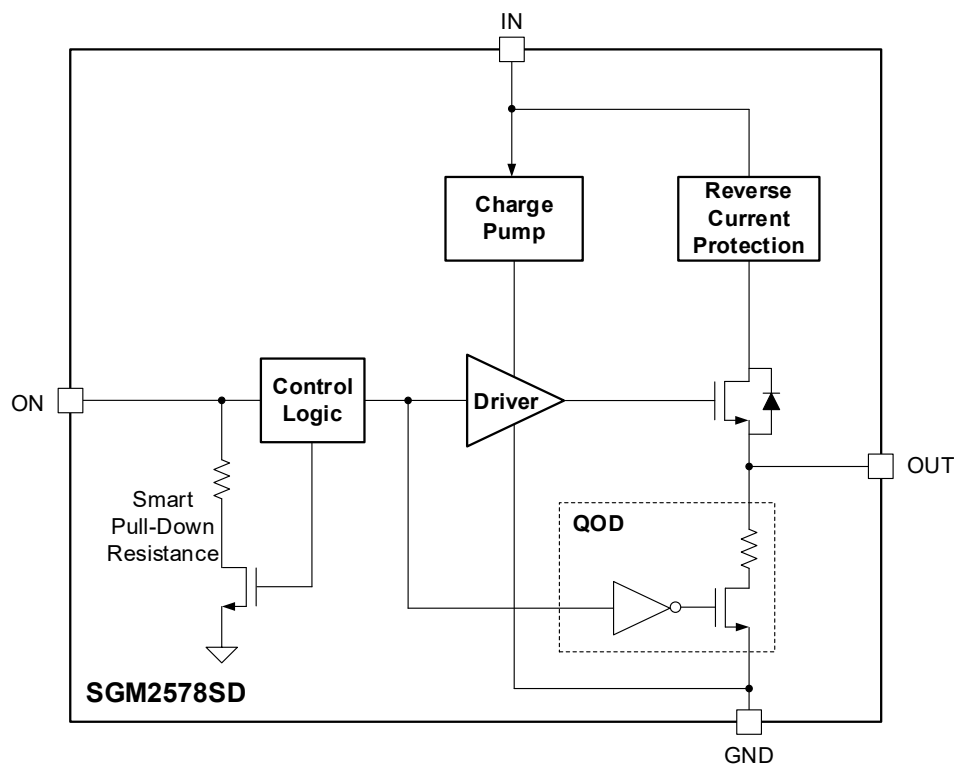


WLCSP-0.9×0.9-4B-D

## PIN DESCRIPTION

PIN	NAME	FUNCTION
A1	OUT	Switch Output.
A2	IN	Switch Input. It is recommended to use a bypass capacitor (ceramic) to ground.
B1	GND	Ground.
B2	ON	Switch Control Input. Setting the ON pin to a high logic level enables the device, and setting it to a low logic level disables the device.

## FUNCTIONAL BLOCK DIAGRAM



## ELECTRICAL CHARACTERISTICS

(For SGM2578SD only, T<sub>J</sub> = -40°C to +125°C, V<sub>IN</sub> = 1.2V to 5.5V, C<sub>IN</sub> = 1μF, C<sub>OUT</sub> = 0.1μF, typical values are at T<sub>J</sub> = +25°C, unless otherwise noted.)

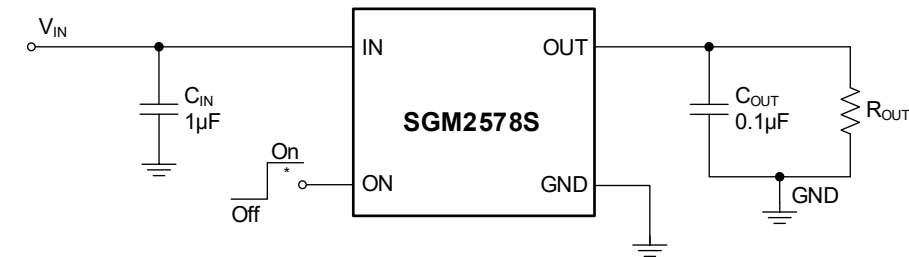
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range	V <sub>IN</sub>		1.2		5.5	V
UVLO Threshold, Rising	V <sub>UVLO_R</sub>			0.9	1.15	V
UVLO Hysteresis	V <sub>UVLO_HYS</sub>			70		mV
Quiescent Current	I <sub>Q</sub>	V <sub>IN</sub> = 5.5V, V <sub>ON</sub> = 1.2V, I <sub>OUT</sub> = 0mA		0.59	1.9	μA
		V <sub>IN</sub> = 3.3V, V <sub>ON</sub> = 1.2V, I <sub>OUT</sub> = 0mA		0.39	1.3	
		V <sub>IN</sub> = 1.2V, V <sub>ON</sub> = 1.2V, I <sub>OUT</sub> = 0mA		0.24	0.85	
Shutdown Current	I <sub>SD</sub>	V <sub>IN</sub> = 5.5V, V <sub>ON</sub> = 0V	T <sub>J</sub> = -40°C to +85°C	0.15	0.6	μA
			T <sub>J</sub> = -40°C to +125°C	0.15	1.9	
Supply Leakage Current in Shutdown Mode	I <sub>LEAKAGE</sub>	V <sub>IN</sub> = 5.5V, V <sub>ON</sub> = 0V, V <sub>OUT</sub> = 0V	T <sub>J</sub> = -40°C to +85°C	0.15	0.6	μA
			T <sub>J</sub> = -40°C to +125°C	0.15	1.9	
On-Resistance	R <sub>DS(on)</sub>	V <sub>IN</sub> = 5.5V, V <sub>ON</sub> = 1.2V, I <sub>OUT</sub> = -200mA		20	44	mΩ
		V <sub>IN</sub> = 3.3V, V <sub>ON</sub> = 1.2V, I <sub>OUT</sub> = -200mA		20	44	
		V <sub>IN</sub> = 1.2V, V <sub>ON</sub> = 1.2V, I <sub>OUT</sub> = -200mA		25		
ON Pin Leakage Current	I <sub>ON</sub>	V <sub>ON</sub> = 3.3V		10	900	nA
Reverse Current When Disabled	I <sub>RC</sub>	V <sub>IN</sub> = V <sub>ON</sub> = 0V, V <sub>OUT</sub> = 5V		10	1400	nA
Output Pull-Down Resistance	R <sub>PD</sub>	V <sub>IN</sub> = 3.3V, V <sub>ON</sub> = 0V, I <sub>OUT</sub> = 1mA		230	300	Ω
Smart Pull-Down Resistance	R <sub>PD_ON</sub>	Disabled		1		MΩ
ON Pin Input High Voltage	V <sub>IH</sub>		0.71			V
ON Pin Input Low Voltage	V <sub>IL</sub>				0.3	V
<b>True Reverse Current Blocking</b>						
RCB Protection Trip Point	V <sub>T_RCB</sub>	V <sub>OUT</sub> - V <sub>IN</sub>	6	24	50	mV
RCB Hysteresis	V <sub>RCB_HYS</sub>			30		mV

SWITCHING CHARACTERISTICS

(For SGM2578SD only, T<sub>J</sub> = -40°C to +125°C, V<sub>IN</sub> = 1.2V to 5.5V, C<sub>IN</sub> = 1μF, C<sub>OUT</sub> = 0.1μF, typical values are at T<sub>J</sub> = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	TEST CONDITION	MIN	TYP	MAX	UNITS
Turn-On Time	t <sub>ON</sub>	V <sub>IN</sub> = 3.3V		620	1600	μs
Turn-Off Time	t <sub>OFF</sub>	V <sub>IN</sub> = 3.3V		6		μs
V <sub>OUT</sub> Rise Time	t <sub>R</sub>	V <sub>IN</sub> = 3.3V		440	800	μs
V <sub>OUT</sub> Fall Time	t <sub>F</sub>	V <sub>IN</sub> = 3.3V		2		μs
Delay Time	t <sub>D</sub>	V <sub>IN</sub> = 3.3V		480	1300	μs

PARAMETER MEASUREMENT INFORMATION



\*: Rise and fall times of the control signal are 100ns.

Figure 2. Test Circuit

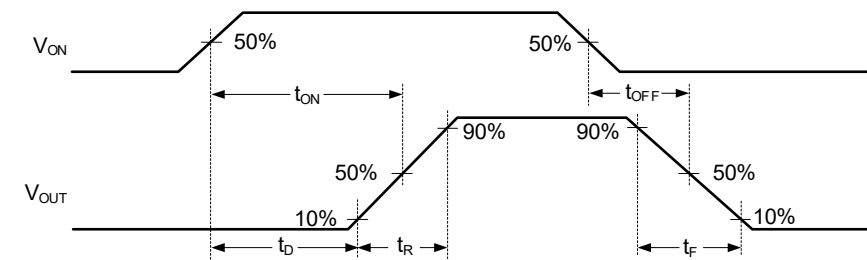
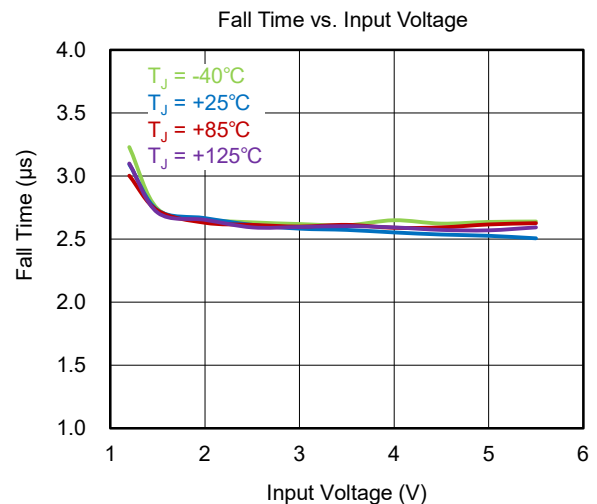
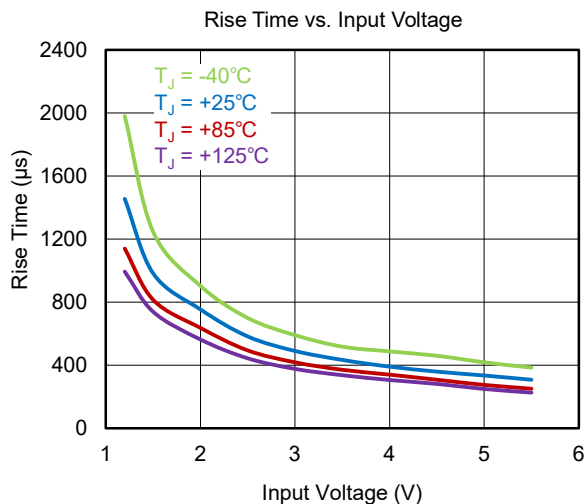
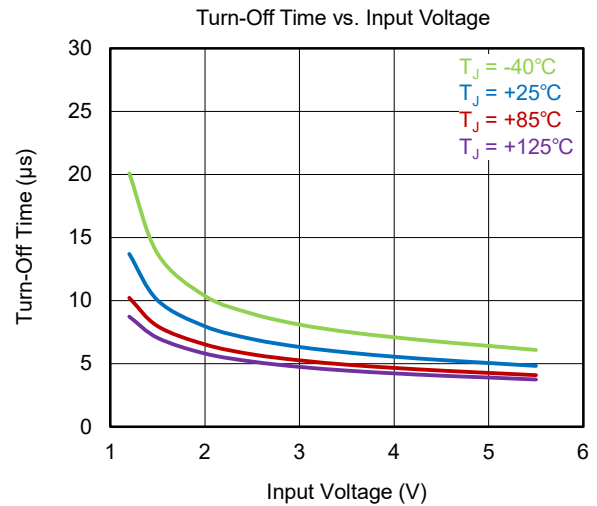
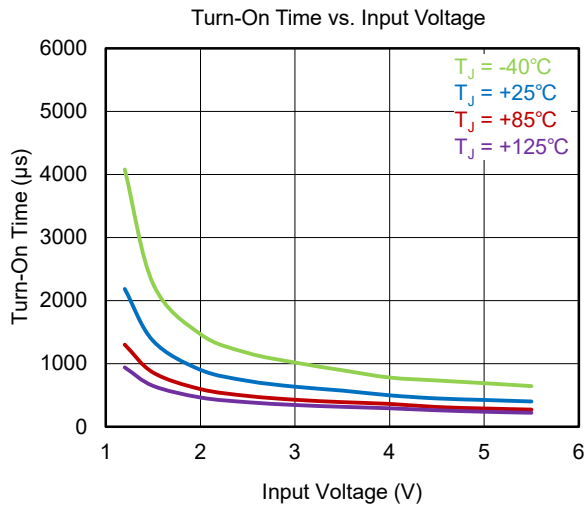
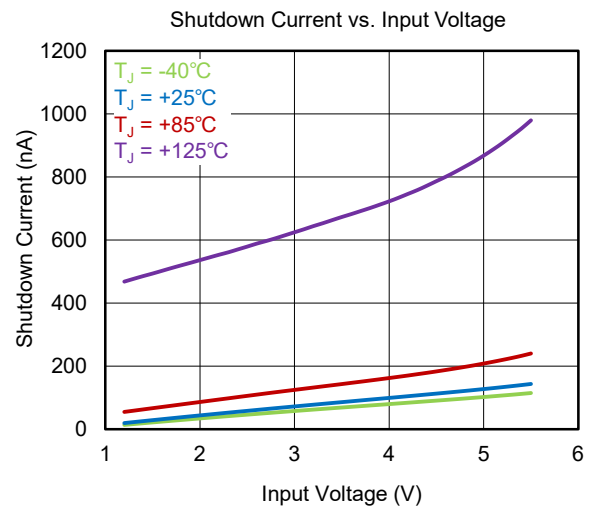
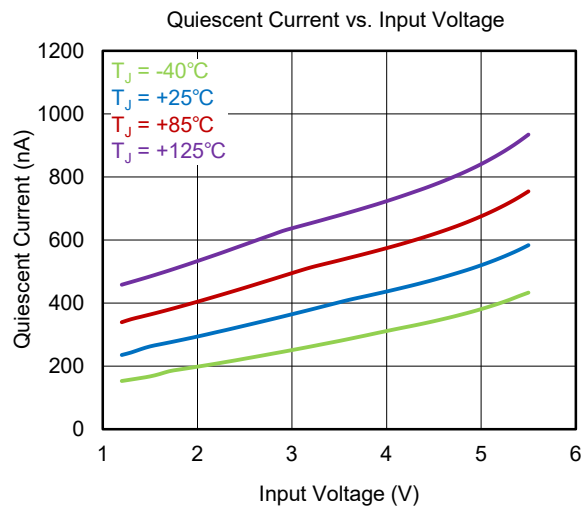


Figure 3. Timing Waveforms

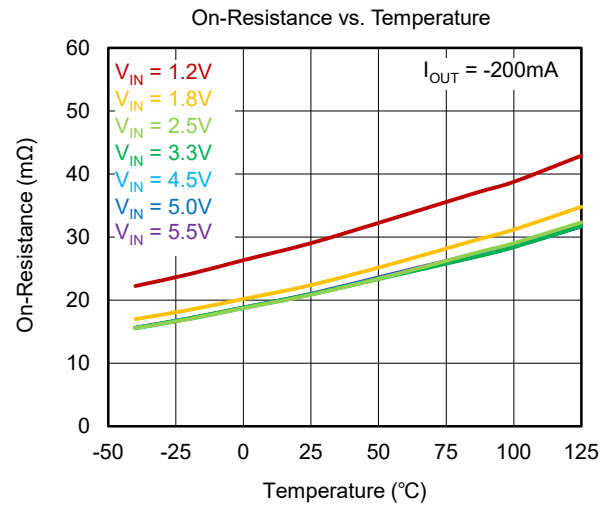
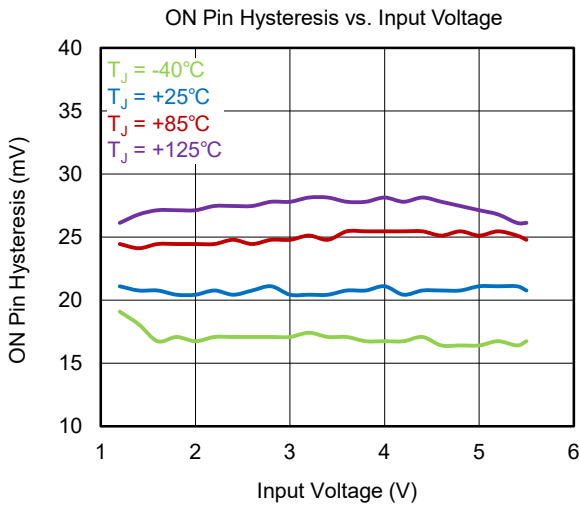
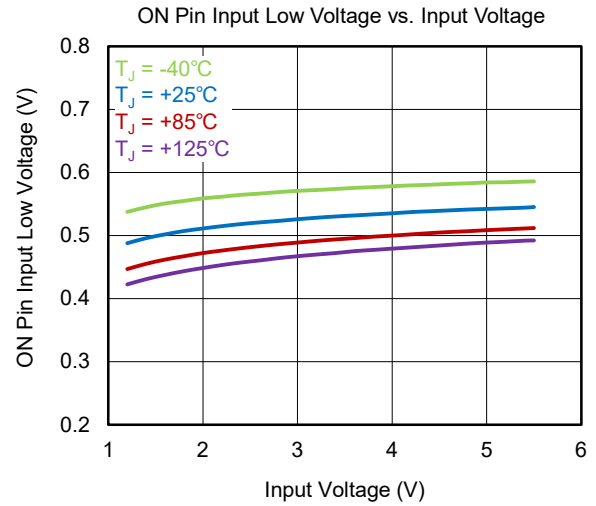
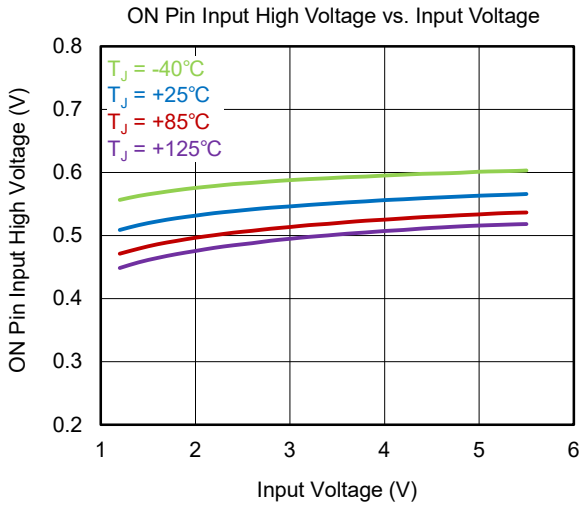
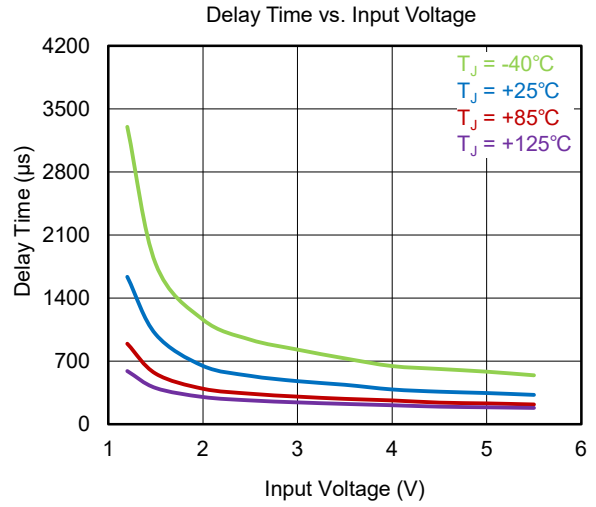
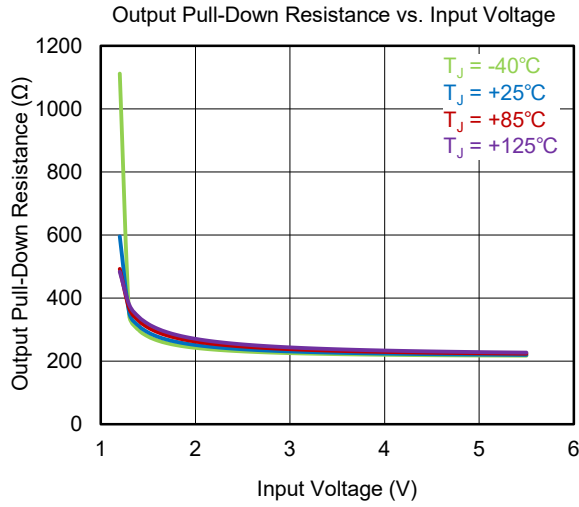
## TYPICAL PERFORMANCE CHARACTERISTICS

$T_J = +25^\circ\text{C}$ , unless otherwise noted.



## TYPICAL PERFORMANCE CHARACTERISTICS (continued)

$T_J = +25^\circ\text{C}$ , unless otherwise noted.



## DETAILED DESCRIPTION

The SGM2578S/SGM2578SD family is a single, 4-ball, 2A load switch. A low on-resistance N-MOSFET is integrated, which makes a low voltage drop across the device. To choose suitable rise time is always used to avoid inrush current.

### Quick Output Discharge (SGM2578SD Only)

The quick output discharge feature is available for SGM2578SD. If the ON pin is pulled low, a discharge resistor of 230Ω (TYP) is connected between OUT and GND pins to prevent the output from floating when the switch is disabled.

### Control Pin

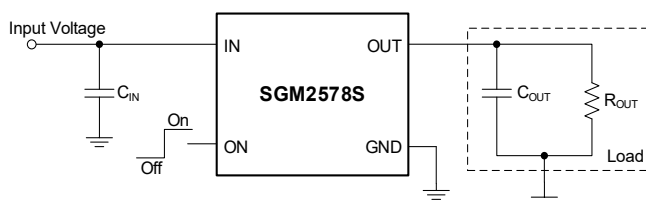
The ON pin can control the device. Setting the ON pin to a high logic level enables the device, and setting it to a low logic level disables the device. It has the ability to interface with low-voltage GPIO. It can support with 1.2V, 1.8V, 2.5V, 3.3V GPIOs.

**Table 1. Smart ON Functional Modes**

ON	ON Pin
Below $V_{IL}$	Pull-Down Active
Above $V_{IH}$	No Pull-Down

## APPLICATION INFORMATION

The SGM2578S/SGM2578SD family is a single, up to 2A current capability load switch with low on-resistance. The device has a wide input range, which can be used in different terminal equipment to set power sequence, reduce inrush current and maintain low standby leakage current. The typical application circuit of SGM2578S is shown in Figure 4.



**Figure 4. Typical Application Circuit**

### Input Capacitor

A 1μF input capacitor ( $C_{IN}$ ) is recommended to use between IN and GND close to the device pins. It can limit the voltage drop on the input supply. Larger  $C_{IN}$  can reduce voltage dip in high current applications.

### Output Capacitor

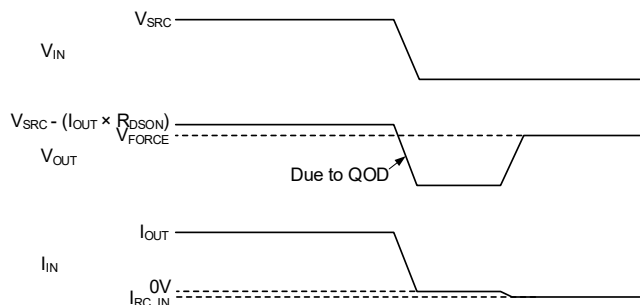
A 1μF output capacitor ( $C_{OUT}$ ) should be placed between OUT and GND as close to the device pins as possible. This capacitor will prevent parasitic board inductances from forcing  $V_{OUT}$  below GND when the switch is shutdown.



## APPLICATION INFORMATION (continued)

### Reverse Current Protection

The reverse current protection function is activated when  $V_{OUT}$  is higher than  $V_{IN}$  by  $V_{T_{RCB}}$ . The reverse current protection is enabled whether the ON pin is high or low. This function prevents the current flowing from OUT to IN, and is very useful when SGM2578S/SGM2578SD is disabled and the output needs to be driven by another voltage source.



NOTE:  $V_{SRC}$  is the input power supply to the equipment.  $V_{FORCE}$  is the external power source forced at OUT pin.  $I_{IN}$  is the current of IN pin.  $I_{OUT}$  is output load current.

**Figure 5. Reverse Current Protection**

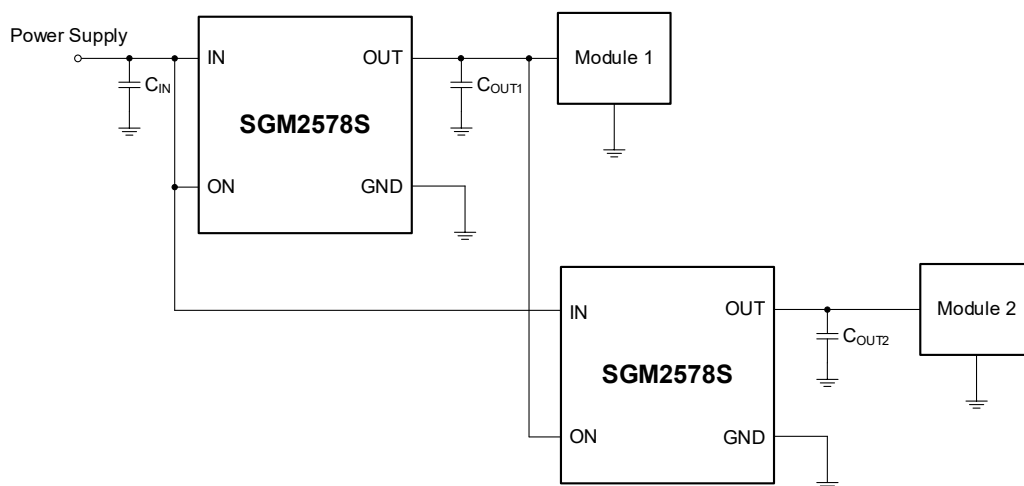
Figure 5 shows how the reverse current protection circuit is activated in SGM2578S. When  $V_{IN}$  is turned off, the device is shut down and an external voltage ( $V_{FORCE}$ ) is forced to OUT pin, the reverse current is tested very small given by  $I_{RC\_IN}$ . This will prevent any large extra current flowing from the  $V_{FORCE}$  (added on  $V_{OUT}$ ) to  $V_{IN}$ .

### Power Supply Recommendations

The SGM2578S/SGM2578SD is designed for a wide operate input voltage range of 1.2V to 5.5V. Place a 1μF input bypass capacitor close to the device terminal is recommended.

### Power Supply Sequencing without a GPIO Input

In many terminal devices, each module needs to be powered up in a pre-determined manner. SGM2578S/SGM2578SD can set a power sequence by the  $t_{DELAY}$  without extra GPIO, and may reduce inrush current. Figure 6 shows the sequence that the ON pin of first load switch is connected to the IN, and the second load switch ON pin is connected to the OUT of first load switch. The second load switch is powered up when the first load switch is turned on, this is the fixed sequence and the delay time set by default  $t_{DELAY}$ .



**Figure 6. Power Supply Sequencing without a GPIO Input**

## REVISION HISTORY

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

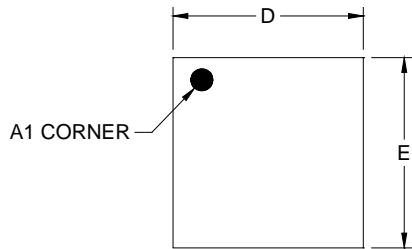
### Changes from Original to REV.A (JUNE 2025)

Changes from Original to REV.A (JUNE 2025)	Page
Changed from product preview to production data.....	All

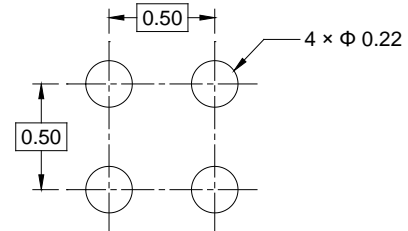
## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

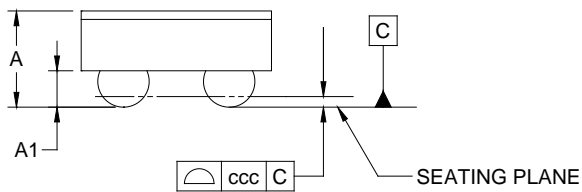
#### WLCSP-0.9×0.9-4B-D



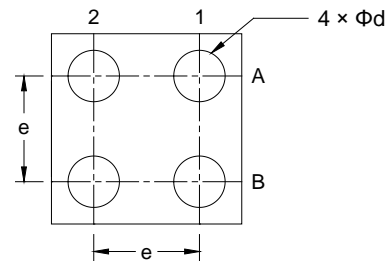
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



BOTTOM VIEW

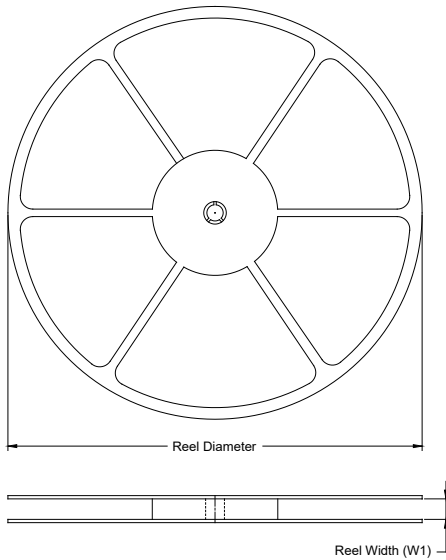
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	0.493
A1	0.152	-	0.192
D	0.870	-	0.930
E	0.870	-	0.930
d	0.213	-	0.273
e	0.500 BSC		
ccc	0.050		

NOTE: This drawing is subject to change without notice.

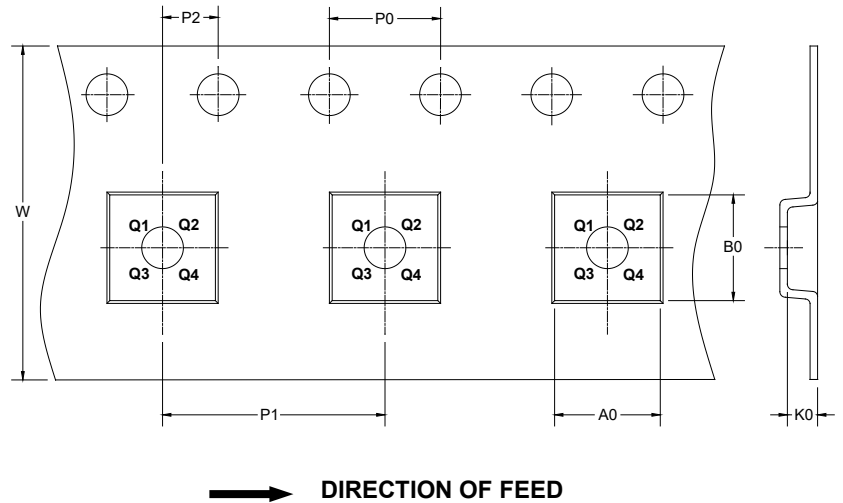
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



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

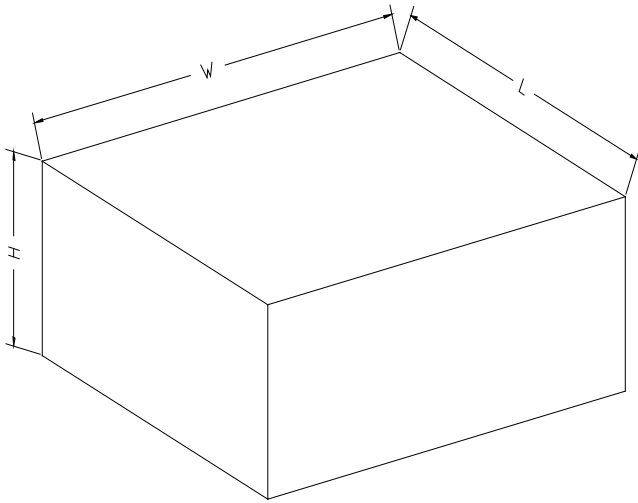
### KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
WLCSP-0.9×0.9-4B-D	7"	9.0	0.99	0.99	0.59	4.0	4.0	2.0	8.0	Q1

DD00001

## 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