

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_{DSON} 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_{DSON} 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

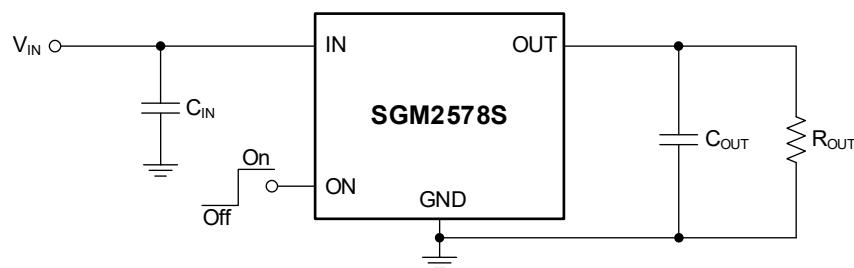


Figure 1. Typical Application Circuit

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 _{IN} | -0.3V to 6V |
| Output Voltage Range, V _{OUT} | -0.3V to 6V |
| ON Pin Voltage Range, V _{ON} | -0.3V to 6V |
| Maximum Continuous Switch Current, I _{MAX} | 2A |
| Package Thermal Resistance | |
| WLCSP-0.9×0.9-4B-D, θ _{JA} | 211.3°C/W |
| WLCSP-0.9×0.9-4B-D, θ _{JB} | 79.5°C/W |
| WLCSP-0.9×0.9-4B-D, θ _{JC} | 70.8°C/W |
| Junction Temperature | +150°C |
| Storage Temperature Range..... | -65°C to +150°C |
| Lead Temperature (Soldering, 10s) | +260°C |
| ESD Susceptibility ⁽¹⁾⁽²⁾ | |
| HBM..... | ±4000V |
| 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 _{IN} | 1.2V to 5.5V |
| Output Voltage Range, V _{OUT} | 0V to 5.5V |
| ON Pin Input High Voltage, V _{IH} | 0.71V to 5.5V |
| ON Pin Input Low Voltage, V _{IL} | 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

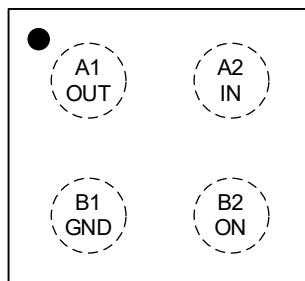
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

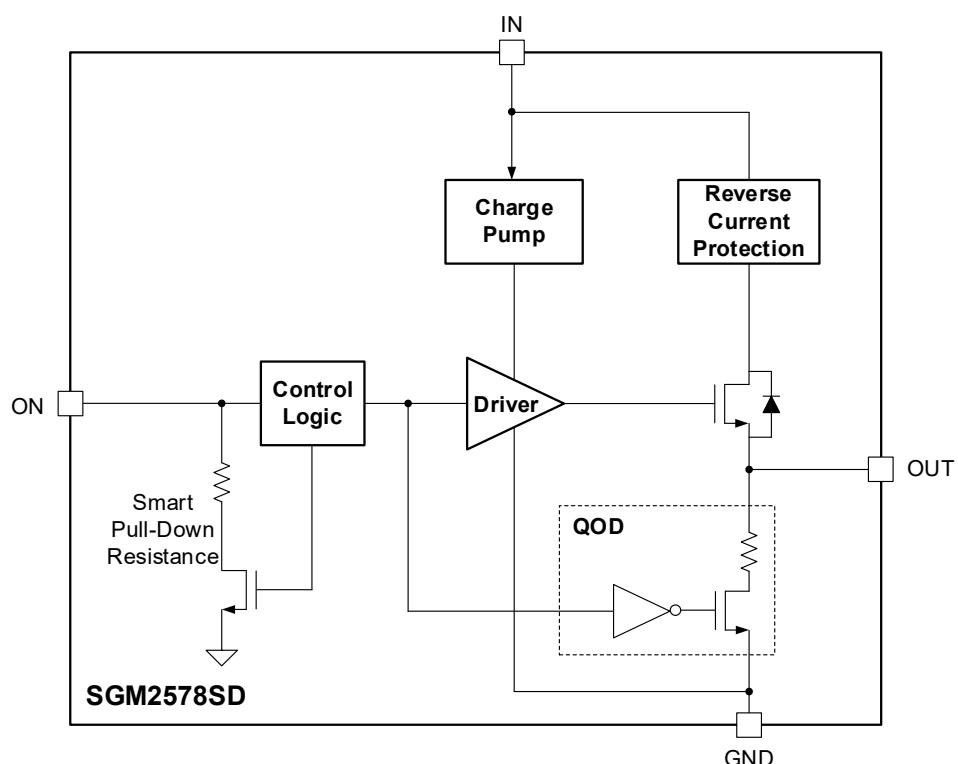


WLCSP-0.9x0.9-4B-D

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_J = -40°C to +125°C, V_{IN} = 1.2V to 5.5V, C_{IN} = 1μF, C_{OUT} = 0.1μF, typical values are at T_J = +25°C, unless otherwise noted.)

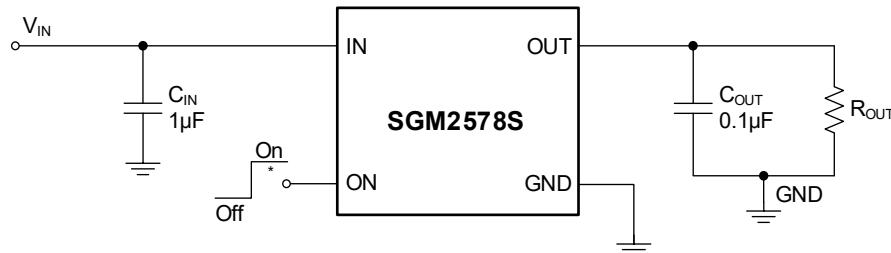
| PARAMETER | SYMBOL | CONDITIONS | | MIN | TYP | MAX | UNITS |
|---|-----------------------|---|----------------------------------|------|------|------|-------|
| Input Voltage Range | V _{IN} | | | 1.2 | | 5.5 | V |
| UVLO Threshold, Rising | V _{UVLO_R} | | | | 0.9 | 1.15 | V |
| UVLO Hysteresis | V _{UVLO_HYS} | | | 70 | | | mV |
| Quiescent Current | I _Q | V _{IN} = 5.5V, V _{ON} = 1.2V, I _{OUT} = 0mA | | 0.59 | 1.9 | | μA |
| | | V _{IN} = 3.3V, V _{ON} = 1.2V, I _{OUT} = 0mA | | 0.39 | 1.3 | | |
| | | V _{IN} = 1.2V, V _{ON} = 1.2V, I _{OUT} = 0mA | | 0.24 | 0.85 | | |
| Shutdown Current | I _{SD} | V _{IN} = 5.5V, V _{ON} = 0V | T _J = -40°C to +85°C | | 0.15 | 0.6 | μA |
| | | | T _J = -40°C to +125°C | | 0.15 | 1.9 | |
| Supply Leakage Current in Shutdown Mode | I _{LEAKAGE} | V _{IN} = 5.5V, V _{ON} = 0V, V _{OUT} = 0V | T _J = -40°C to +85°C | | 0.15 | 0.6 | μA |
| | | | T _J = -40°C to +125°C | | 0.15 | 1.9 | |
| On-Resistance | R _{DS} ON | V _{IN} = 5.5V, V _{ON} = 1.2V, I _{OUT} = -200mA | | 20 | 44 | | mΩ |
| | | V _{IN} = 3.3V, V _{ON} = 1.2V, I _{OUT} = -200mA | | 20 | 44 | | |
| | | V _{IN} = 1.2V, V _{ON} = 1.2V, I _{OUT} = -200mA | | 25 | | | |
| ON Pin Leakage Current | I _{ON} | V _{ON} = 5.5V | | 10 | 670 | nA | |
| Reverse Current When Disabled | I _{RC} | V _{IN} = V _{ON} = 0V, V _{OUT} = 5V | | 10 | 1400 | nA | |
| Output Pull-Down Resistance | R _{PD} | V _{IN} = 3.3V, V _{ON} = 0V, I _{OUT} = 1mA | | 230 | 300 | Ω | |
| Smart Pull-Down Resistance | R _{PD_ON} | Disabled | | 1 | | | MΩ |
| ON Pin Input High Voltage | V _{IH} | | | 0.71 | | | V |
| ON Pin Input Low Voltage | V _{IL} | | | | | 0.3 | V |
| True Reverse Current Blocking | | | | | | | |
| RCB Protection Trip Point | V _{T_RCB} | V _{OUT} - V _{IN} | | 6 | 24 | 50 | mV |
| RCB Hysteresis | V _{RCB_HYS} | | | | 30 | | mV |

SWITCHING CHARACTERISTICS

(For SGM2578SD only, $T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$, $V_{IN} = 1.2\text{V}$ to 5.5V , $C_{IN} = 1\mu\text{F}$, $C_{OUT} = 0.1\mu\text{F}$, typical values are at $T_J = +25^\circ\text{C}$, unless otherwise noted.)

| PARAMETER | SYMBOL | TEST CONDITION | MIN | TYP | MAX | UNITS |
|---------------------|-----------|------------------------|-----|-----|------|---------------|
| Turn-On Time | t_{ON} | $V_{IN} = 3.3\text{V}$ | | 620 | 1600 | μs |
| Turn-Off Time | t_{OFF} | $V_{IN} = 3.3\text{V}$ | | 6 | | μs |
| V_{OUT} Rise Time | t_R | $V_{IN} = 3.3\text{V}$ | | 440 | 800 | μs |
| V_{OUT} Fall Time | t_F | $V_{IN} = 3.3\text{V}$ | | 2 | | μs |
| Delay Time | t_D | $V_{IN} = 3.3\text{V}$ | | 480 | 1300 | μs |

PARAMETER MEASUREMENT INFORMATION



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

Figure 2. Test Circuit

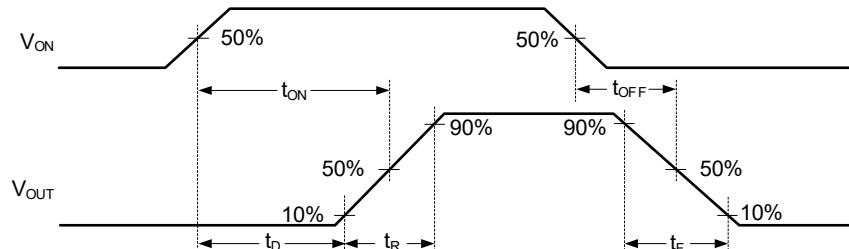
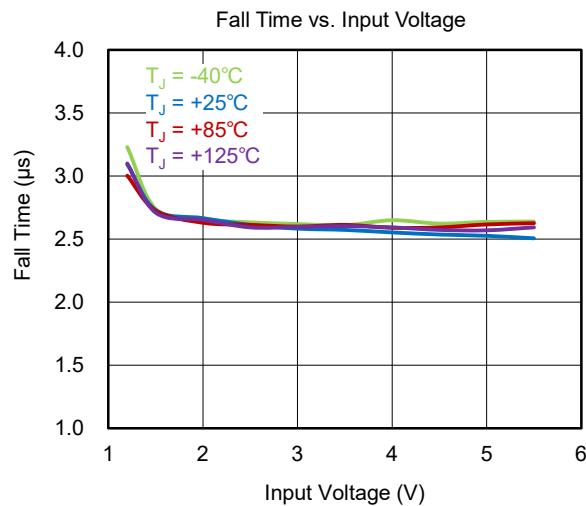
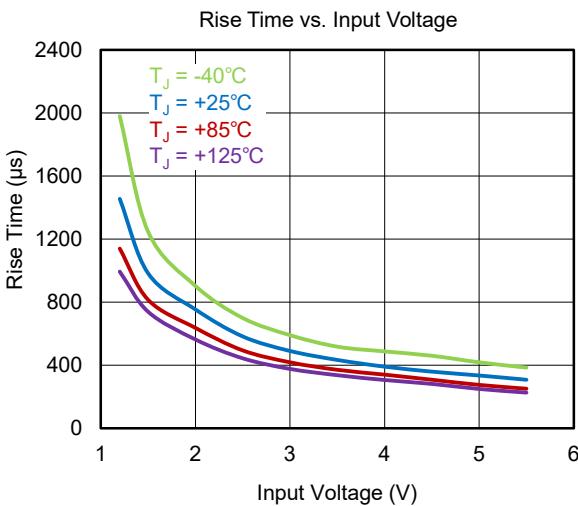
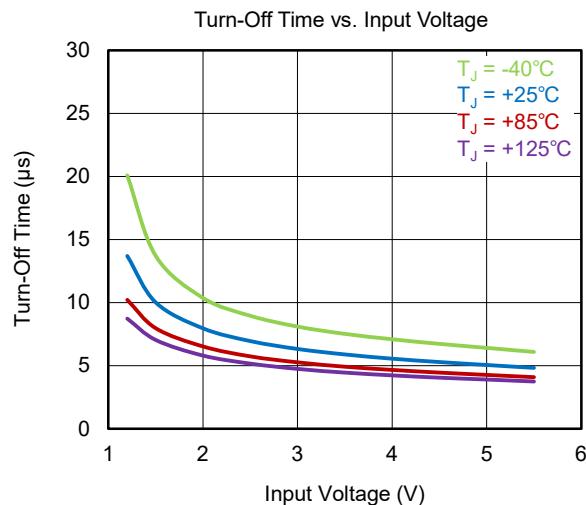
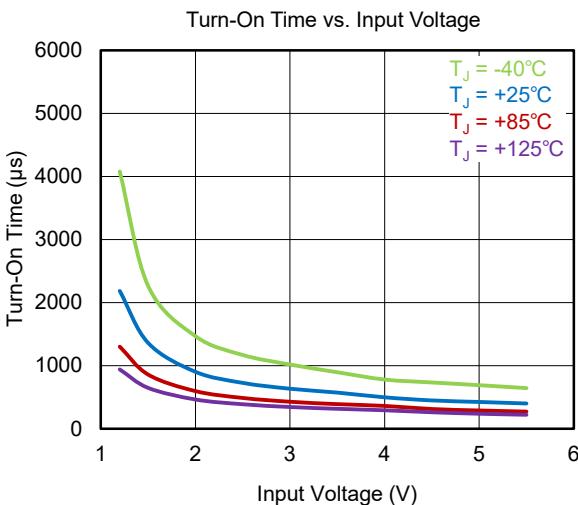
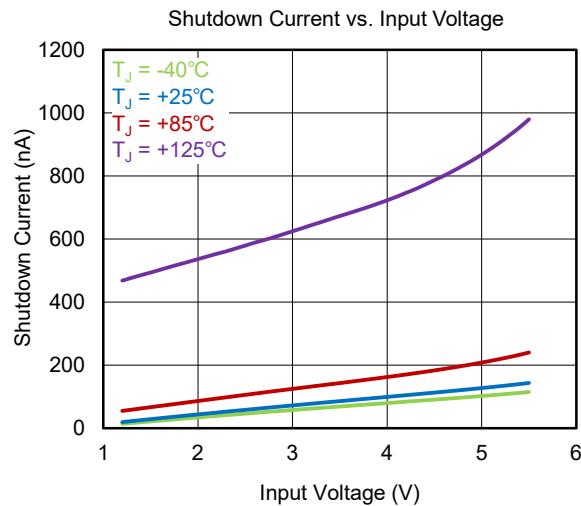
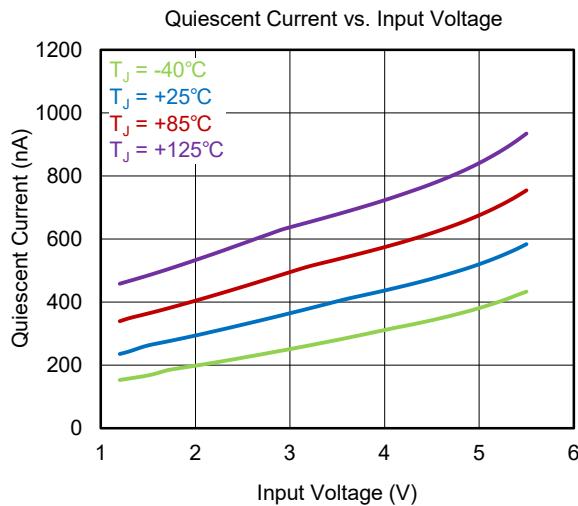


Figure 3. Timing Waveforms

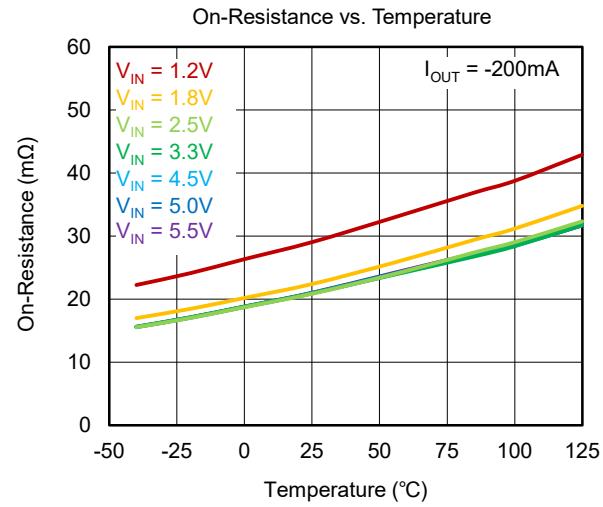
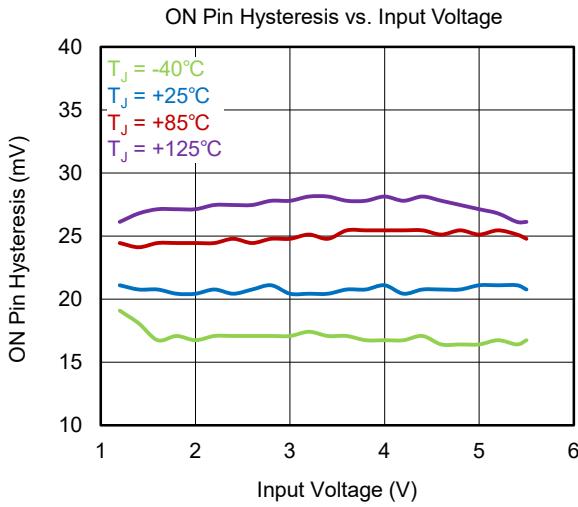
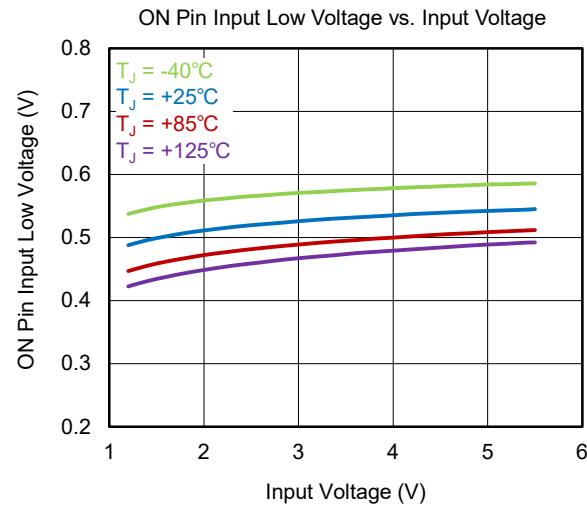
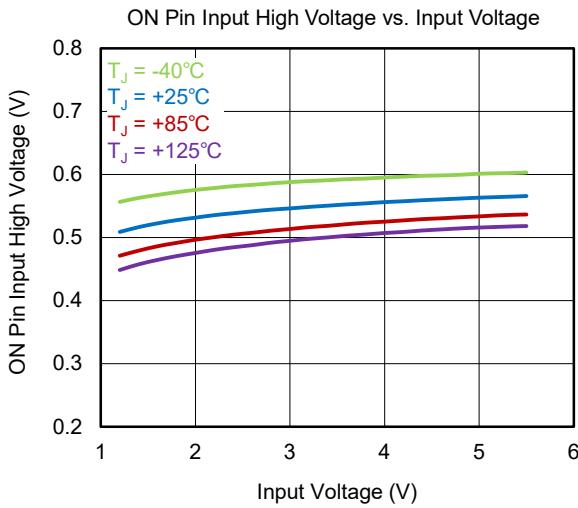
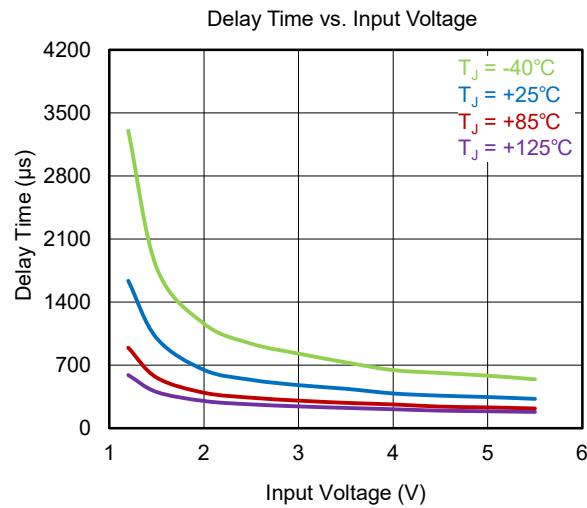
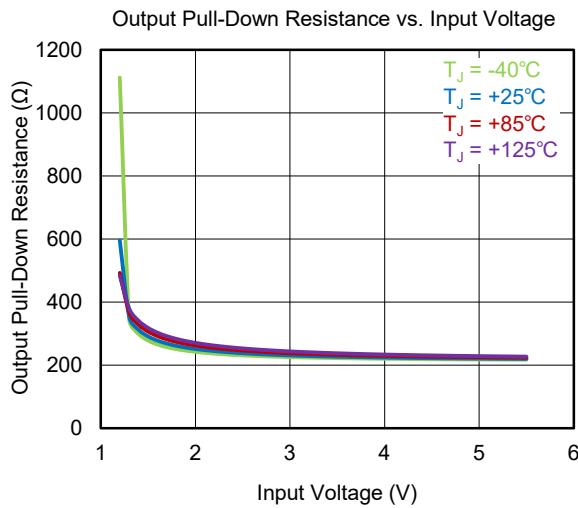
TYPICAL PERFORMANCE CHARACTERISTICS

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

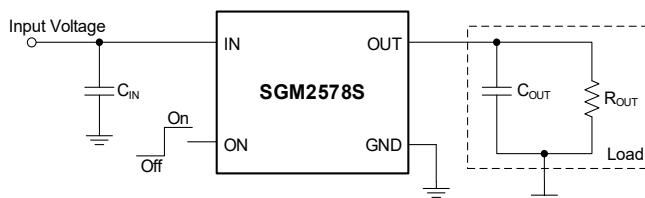


Figure 4. Typical Application Circuit

Input Capacitor

A $1\mu\text{F}$ 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.

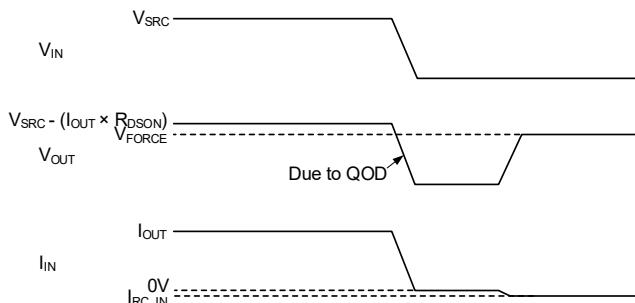
Output Capacitor

A $1\mu\text{F}$ 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} .

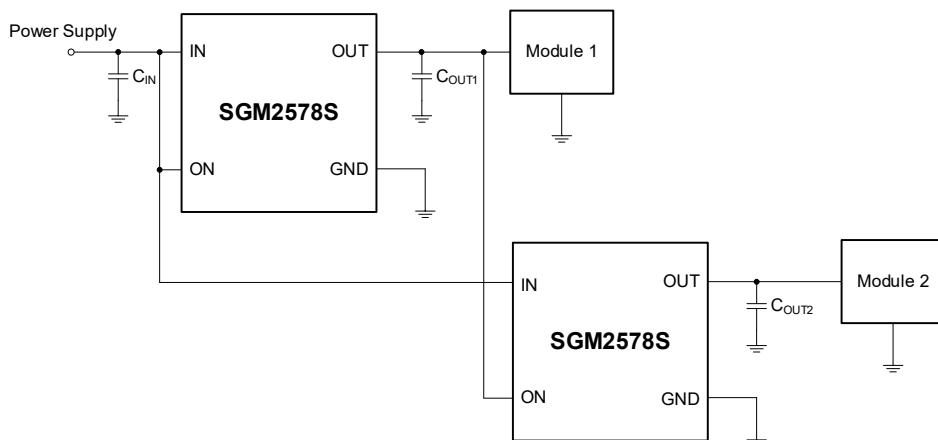


Figure 6. Power Supply Sequencing without a GPIO Input

REVISION HISTORY

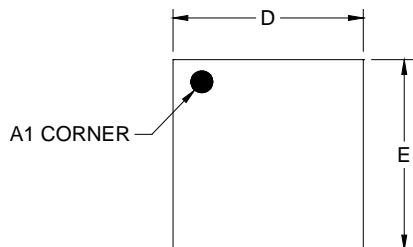
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

| | Page |
|---|------|
| JANUARY 2026 – REV.A.1 to REV.A.2 | |
| Updated ESD Susceptibility | 2 |
| JULY 2025 – REV.A to REV.A.1 | |
| Updated Electrical Characteristics section | 4 |
| Changes from Original to REV.A (JUNE 2025) | |
| Changed from product preview to production data | All |

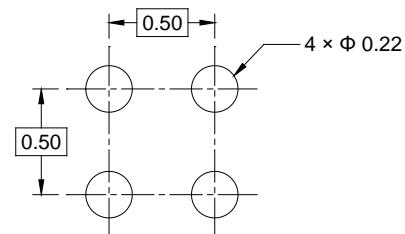
PACKAGE INFORMATION

PACKAGE OUTLINE DIMENSIONS

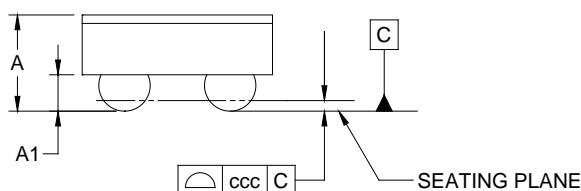
WLCSP-0.9x0.9-4B-D



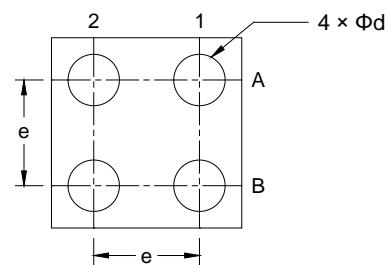
TOP VIEW



RECOMMENDED LAND PATTERN (Unit: mm)



SIDE VIEW



BOTTOM VIEW

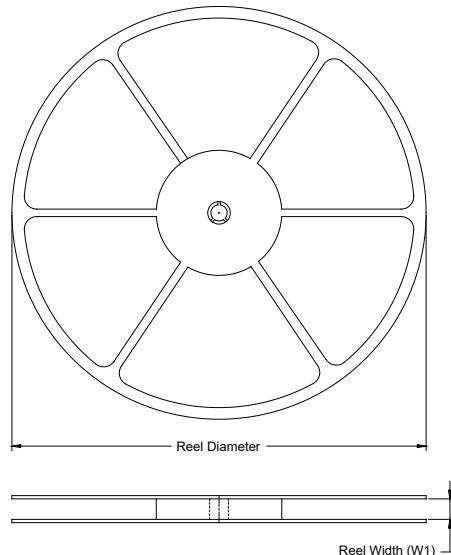
| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|-----|-------|
| | MIN | NOM | MAX |
| A | - | - | 0.493 |
| A1 | 0.152 | - | 0.192 |
| D | 0.870 | - | 0.930 |
| E | 0.870 | - | 0.930 |
| d | 0.213 | - | 0.273 |
| e | 0.500 BSC | | |
| ccc | 0.050 | | |

NOTE: This drawing is subject to change without notice.

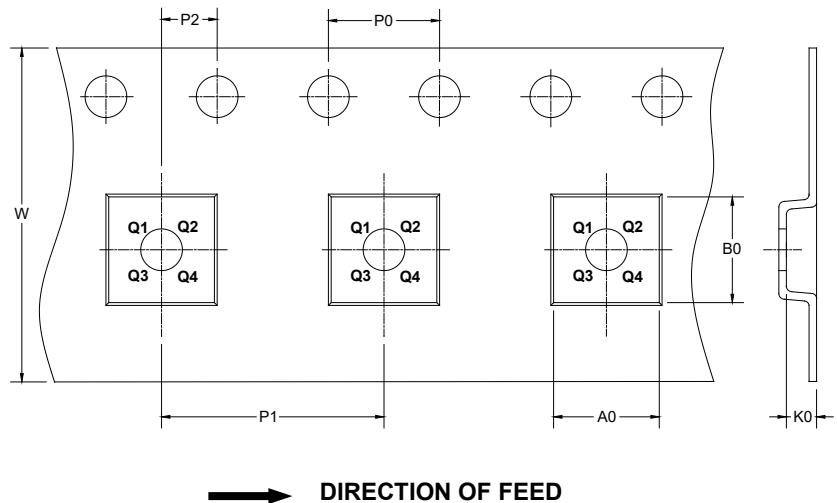
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



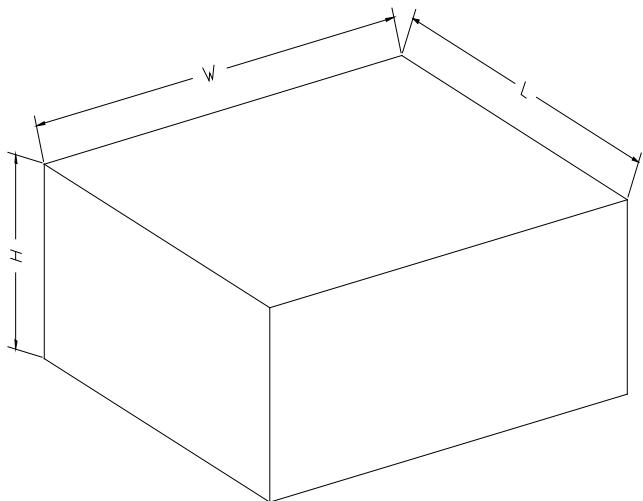
NOTE: The picture is only for reference. Please make the object as the standard.

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 |

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 |

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