SY6880A/B

Programmable High Current Overvoltage Protection Switch With Integrated Reverse Blocking FET

General Description

The SY6880A/B is a programmable over voltage protection switch with high current capability to prevent damage to the downstream system with low voltage rating. It achieves wide input voltage range from $2.5V_{DC}$ to $28V_{DC}$. Metal option is available for two different default OVP thresholds. Integrated reverse blocking FET prevents the leakage current from the output side to the input side when input power supply is removed. Extremely low power path resistance R_{PWPT} helps to reduce power loss during the normal operation. An open-drain indicator pin is opened to show the operation status of device. It integrates the over-temperature protection shutdown and auto-recovery with hysteresis to protect against over current events. This IC along with small CSP (2.0mmx1.8mm) footprint provides small PCB area application.

Features

- V_{IN}=2.5V to 28V. Absolute Maximum V_{IN}=29V
- Extremely Low Power Path Resistance R_{PWPT}
  - R_{PWPT}=38mΩ typ.
- Programmable Over Voltage Threshold from +4V to +7V
- Metal Option for Different Default OVP Thresholds
  - SY6880A: 6.8V +/-2.9%;
  - SY6880B: 5.825V +/-3%;
- Open-drain Indicator Pin for Operation Status
- Surge Protection up to +80V
- Internal Soft-start to Prevent In-rush Current
- Thermal Shutdown Protection & Auto Recovery
- RoHS Compliant and Halogen Free
- Compact Package: CSP 2.0mm×1.8mm

Ordering Information

SY6880 □(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package type	Note
SY6880APGC	CSP2×1.8-12	----
SY6880BPGC	CSP2×1.8-12	----

Applications

- Smart Phone
- Tablet PCs
- Mobile Device

Typical Applications

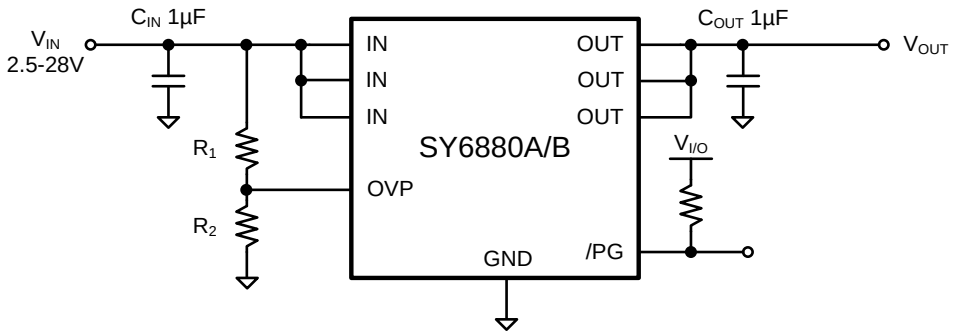
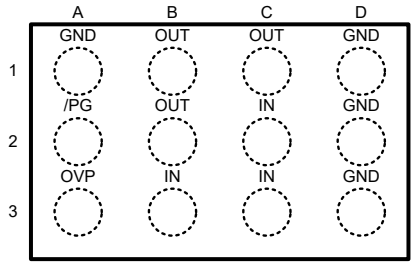


Figure1. Schematic Diagram

Pinout (top view)



(CSP2×1.8-12)

Top mark: **XH*xyz*** for **SY6880A** (Device code: XH, ***x=year code, y=week code, z= lot number code***)
XI*xyz* for **SY6880B** (Device code: XI, ***x=year code, y=week code, z= lot number code***)

Pin Name	Pin Number	Pin Description
IN	B3, C2, C3	Power input pin. Connect the IN pins together. Decouple the high frequency noise by connecting at least a 0.1μF MLCC to the ground.
OUT	B1, B2, C1	Output voltage pin. Source side of the internal FET. Connect the OUT pins together for the normal operation.
OVP	A3	External OVP program pin. Connect the resistor divider to this pin to program the OVP threshold. Make sure V_{OVP} is lower than the internal threshold; otherwise the internal default threshold is active. Pulling down this pin to the ground to disable the external program function.
/PG	A2	Open-drain indicator pin. /PG is pulled down when the input voltage is stable in the normal range between minimum V_{IN} and V_{OVP}. /PG is high impedance when thermal shutdown protection or over voltage protection occurs.
GND	A1, D1, D2, D3	Power ground pin.

Block Diagram

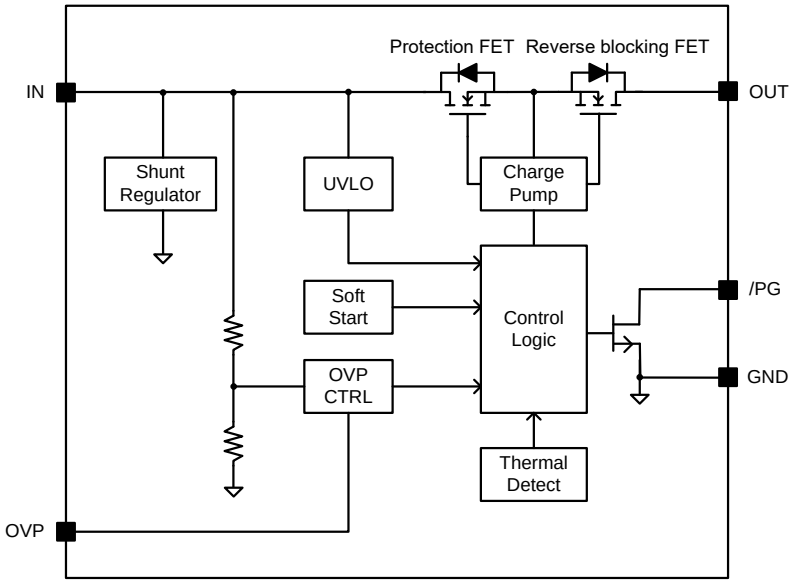


Figure2. Block Diagram

Absolute Maximum Ratings (Note 1)

IN, OVP ---------- 29V
OUT ---------- 7V
/PG ---------- 6V
Continues IN, OUT Current ---------- 5A
Peak IN, OUT Current (10ms) ---------- 8A
Power Dissipation, P_D @ TA = 25°C, CSP ---------- 2.09W
Package Thermal Resistance (Note 2)
θ_{JA} ---------- 59.7°C/W
θ_{JC} ---------- 8.97°C/W
Junction Temperature Range ---------- 150°C
Lead Temperature (Soldering, 10 sec.) ---------- 260°C
Storage Temperature Range ---------- -65°C to 150°C

Recommended Operating Conditions (Note 3)

IN, OVP ---------- less than 29V
OUT ---------- less than 7V
/PG ---------- less than 6V
Continues IN, OUT Current ---------- less than 5A
Peak IN, OUT current (10ms) ---------- less than 8A
Junction Temperature Range ---------- -40°C to 125°C
Ambient Temperature Range ---------- -40°C to 85°C

Electrical Characteristics

(V_{IN} = 2.5V to 28V, C_{IN}=1μF, C_{OUT}=1μF, T_A = 25°C, unless otherwise specified)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Input Voltage Range	V_{IN}			2.5		28	V
Input UVLO Threshold	V_{UVLO}					2.4	V
UVLO Hysteresis	V_{HYS}				0.1		V
Input Clamp Voltage	V_{INCLP}	I_{IN}=10mA			33		V
Bias Current	I_{BIAS}	V_{IN}=5V				100	μA
Internal Default OVP Threshold	V_{OVPD}	Rising	SY6880A	6.6	6.8	7.0	V
			SY6880B	5.65	5.825	6.0	V
		Falling	SY6880A	6.5			V
			SY6880B	5.55			V
OVP Program Threshold	V_{OVPPT}	SY6880A		1.22	1.26	1.30	V
		SY6880B		1.18	1.22	1.26	V
Programmable OVP Range	V_{OVPPR}			4		7	V
Programmable OVP Active Threshold	V_{OVPPA}			0.2		0.3	V
Resistance of Power Path	R_{PWPT}	V_{IN}=5V, I_{OUT}=200mA, from IN to OUT			38	53	mΩ
Output Load Capacitance	C_{OUT}	V_{IN}=5V				1000	μF
OVP Pin Input leakage Current	I_{OVPLK}	V_{OVP}=V_{OVPPT}		-100		100	nA
/PG Low Voltage	V_{PGL}	V_{IO}=3.3V, I_{SINK}=1mA				0.4	V
/PG Leakage Current	V_{PGLK}	V_{IO}=3.3V, /PG high impedance		-1		1	μA
Deglitch Time	t_{DG}	Time from 2.5V<V_{IN}<V_{OVP} to V_{OUT}=10% of V_{IN}			15		ms
Switch Turn-on Time	t_{ON}	V_{IN}=5V, R_L=100, C_{OUT}=100μF; V_{OUT}=10% of V_{IN} to 90% V_{IN}			2		ms
Switch Turn-off Time	t_{OFF}	V_{IN}> V_{OVP} to V_{OUT}=80% V_{IN}, R_L=100, C_{OUT}=100μF; V_{IN} rising lower than 2V/us			2		μs
Thermal Shutdown Temperature	T_{SD}				150		°C
Thermal Shutdown Hysteresis	T_{HYS}				20		°C

Note 1: Stresses beyond the "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

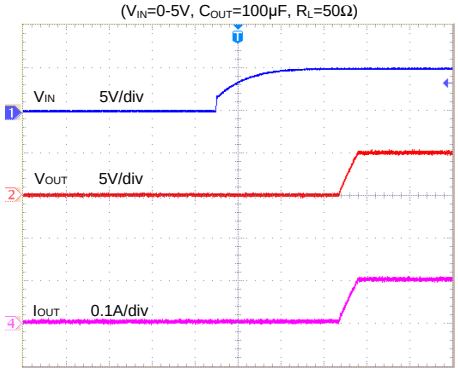
Note 2: θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective four-layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

Note 3: The device is not guaranteed to function outside its operating conditions.

Typical Performance Characteristics

Power-up Response (SY6880A)

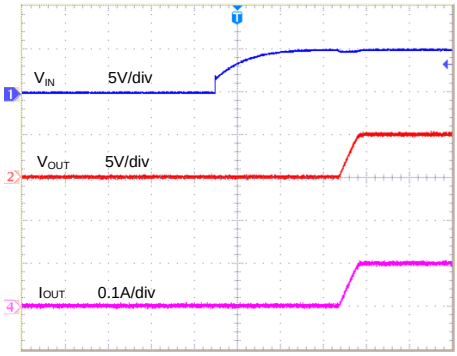
(V_{IN}=0-5V, C_{OUT}=100μF, R_L=50Ω)



Time (4ms/div)

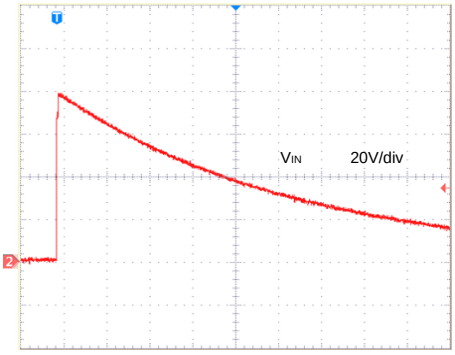
Power-up Response (SY6880A)

(V_{IN}=0- 5V, C_{OUT}=1000μF, R_L=50Ω)



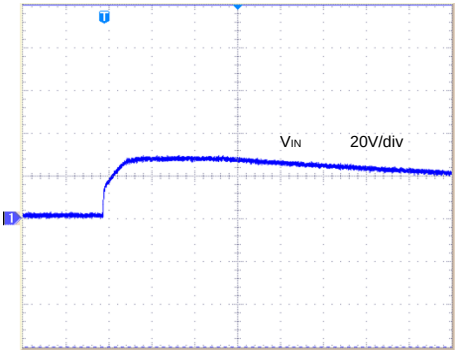
Time (4ms/div)

80V Surge Test Waveform Without SY6880A



Time (10μs/div)

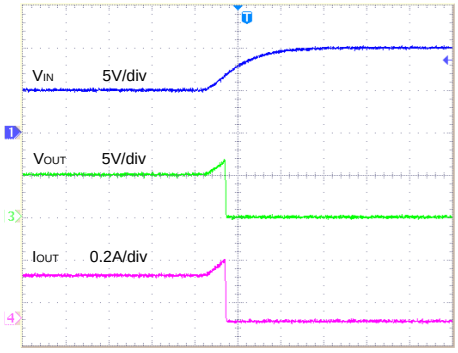
80V Surge Test Waveform With SY6880A



Time (10μs/div)

Over-voltage Fault Response (SY6880A)

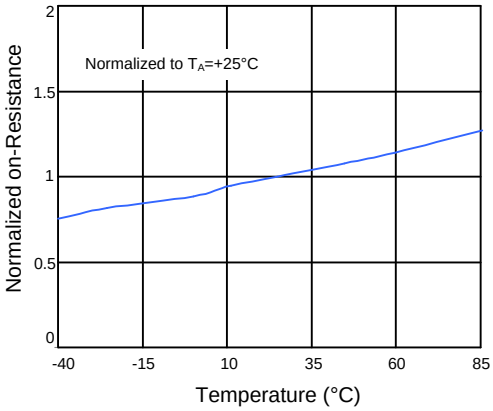
(V_{IN}=5 -10V)



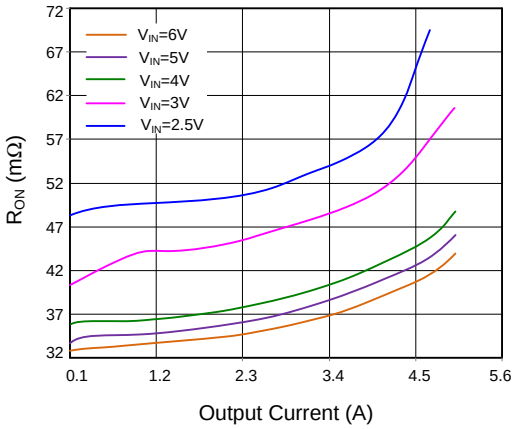
Time (1ms/div)

Normalized R_{ON} vs. Temperature (SY6880A)

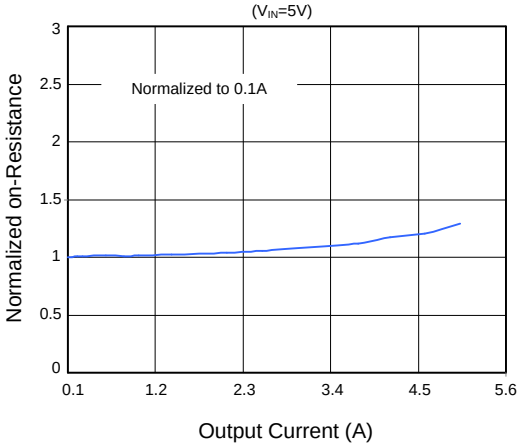
(V_{IN}=5V, R_L=100Ω)



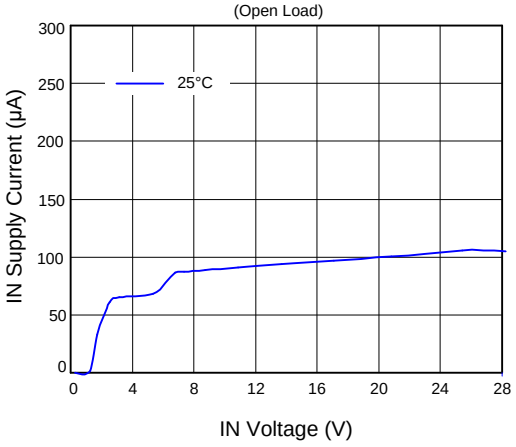
R_{ON} vs. Output Current (SY6880A)



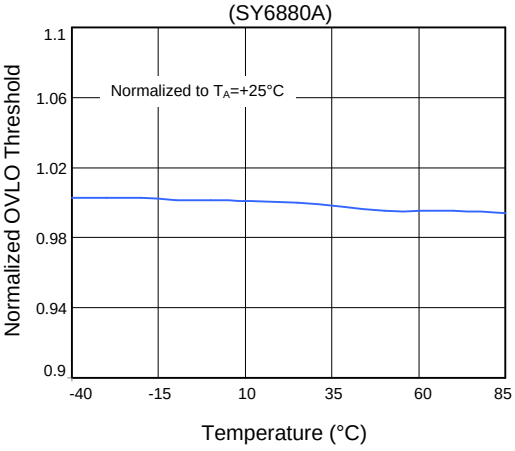
Normalized R_{ON} vs. Output Current (SY6880A)
(V_{IN}=5V)



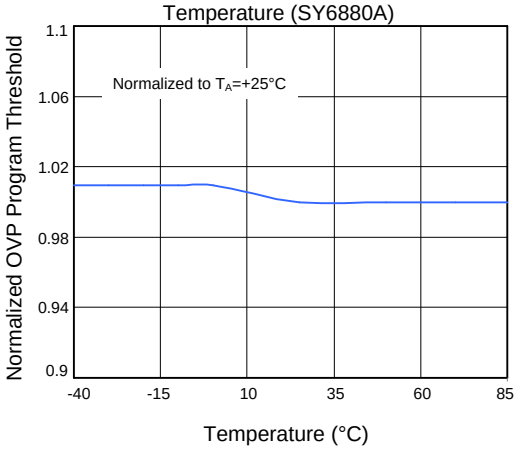
IN Supply Current vs. Supply Voltage (SY6880A)
(Open Load)



Normalized OVLO Threshold vs. Temperature
(SY6880A)



Normalized OVP Program Threshold vs.
Temperature (SY6880A)



Applications Information

IN Bypass Capacitor

For most applications, bypass IN to GND with a 0.1μF ceramic capacitor as close as possible to the device. If the power source has significant inductance due to long lead length, the device clamps the overshoot due to the LC tank circuit.

OUT Output Capacitor

The slow turn-on time provides a soft-start function that allows the SY6880A/B to charge an output capacitor up to 1000μF without turning off due to an over current condition.

Programmable OVP Adjustment Functionality

If OVP is connected to ground, the internal OVP comparator uses the internally set OVP value.

If an external resistor-divider is connected to OVP and the V_{OVP} exceeds the programmable OVP active threshold(V_{OVPPA}), the internal OVP comparator reads the IN fraction fixed by the external resistor divider. R_1 = 1MΩ is a good starting value for minimum current consumption.

Since V_{IN_OVP}, V_{OVPPT} and R_1 are known, R_2 can be calculated from the following formula:

$$V_{IN\_OVP} = V_{OVPPT} \times \left(1 + \frac{R1}{R2}\right)$$

This external resistor-divider is completely independent from the internal resistor-divider.

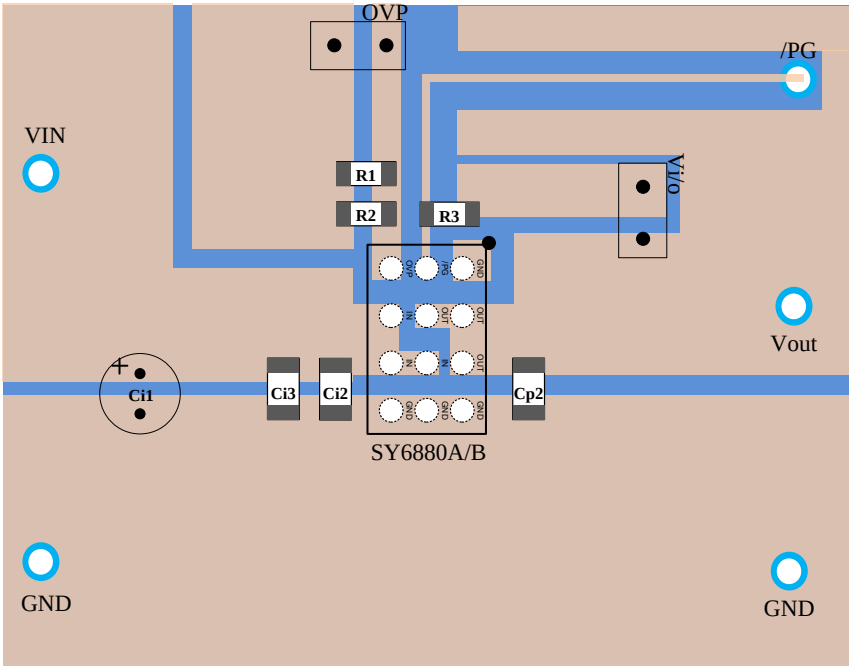
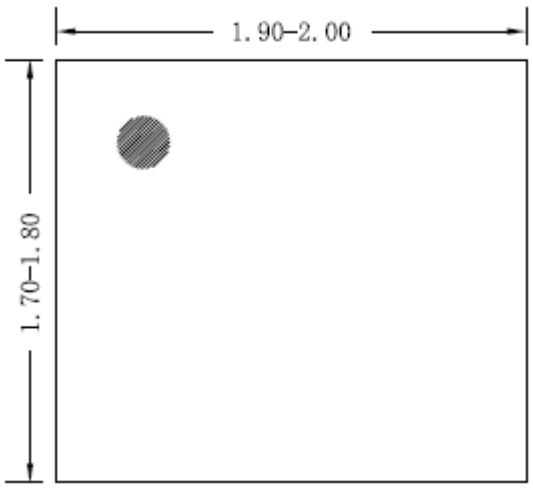
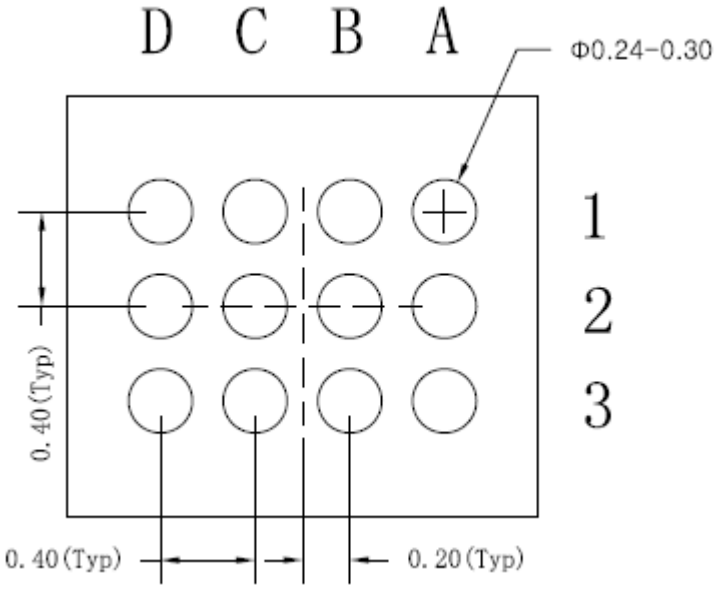


Figure3. PCB Layout Suggestion

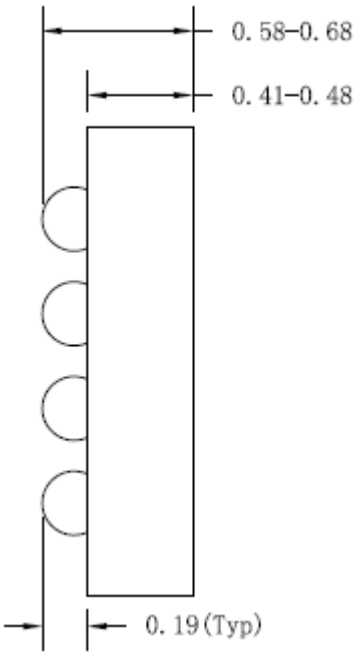
CSP2.0 ×1.8-12 Outline Drawing



Top View



Bottom View

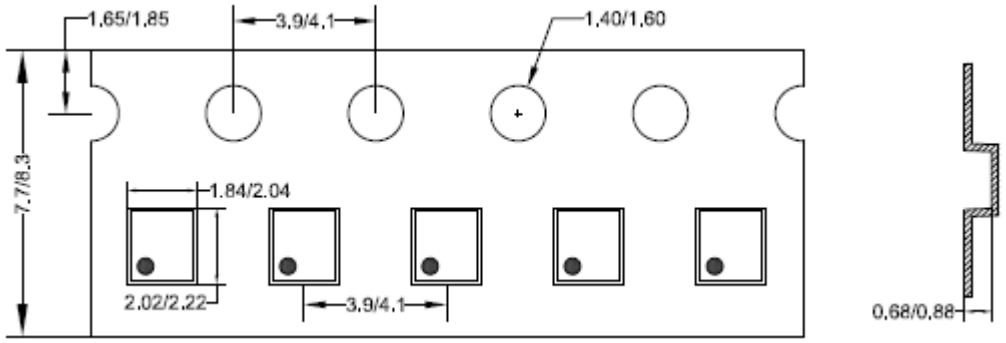


Side View

Notes: **All dimension in millimeter and exclude mold flash & metal burr**

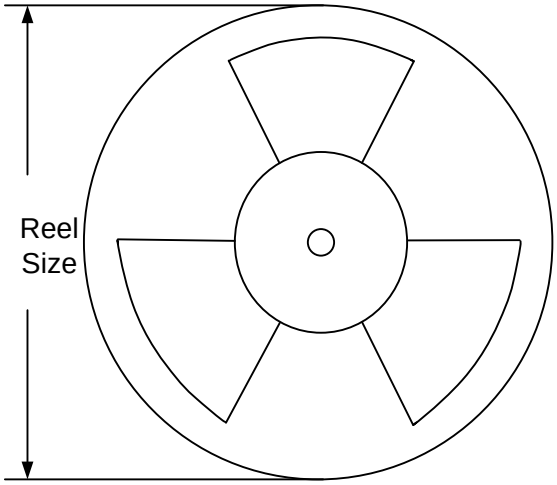
Taping & Reel Specification

1. CSP2×1.8 taping orientation



Feeding direction ⟶

2. Carrier Tape & Reel specification for packages



Package type	Tape width (mm)	Pocket pitch(mm)	Reel size (Inch)	Trailer length(mm)	Leader length (mm)	Qty per reel
CSP2.0×1.8	8	4	7"	400	400	3000

3. Others: NA

IMPORTANT NOTICE

1. **Right to make changes.** Silergy and its subsidiaries (hereafter Silergy) reserve the right to change any information published in this document, including but not limited to circuitry, specification and/or product design, manufacturing or descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products are sold subject to Silergy's standard terms and conditions of sale.

2. Applications. Application examples that are described herein for any of these products are for illustrative purposes only. Silergy makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification. Buyers are responsible for the design and operation of their applications and products using Silergy products. Silergy or its subsidiaries assume no liability for any application assistance or designs of customer products. It is customer's sole responsibility to determine whether the Silergy product is suitable and fit for the customer's applications and products planned. To minimize the risks associated with customer's products and applications, customer should provide adequate design and operating safeguards. Customer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Silergy assumes no liability related to any default, damage, costs or problem in the customer's applications or products, or the application or use by customer's third-party buyers. Customer will fully indemnify Silergy, its subsidiaries, and their representatives against any damages arising out of the use of any Silergy components in safety-critical applications. It is also buyers' sole responsibility to warrant and guarantee that any intellectual property rights of a third party are not infringed upon when integrating Silergy products into any application. Silergy assumes no responsibility for any said applications or for any use of any circuitry other than circuitry entirely embodied in a Silergy product.

3. **Limited warranty and liability.** Information furnished by Silergy in this document is believed to be accurate and reliable. However, Silergy makes no representation or warranty, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. In no event shall Silergy be liable for any indirect, incidental, punitive, special or consequential damages, including but not limited to lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges, whether or not such damages are based on tort or negligence, warranty, breach of contract or any other legal theory. Notwithstanding any damages that customer might incur for any reason whatsoever, Silergy' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Standard Terms and Conditions of Sale of Silergy.

4. **Suitability for use.** Customer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of Silergy components in its applications, notwithstanding any applications-related information or support that may be provided by Silergy. Silergy products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Silergy product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Silergy assumes no liability for inclusion and/or use of Silergy products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

5. **Terms and conditions of commercial sale**. Silergy products are sold subject to the standard terms and conditions of commercial sale, as published at http://www.silergy.com/stdterms, unless otherwise agreed in a valid written individual agreement specifically agreed to in writing by an authorized officer of Silergy. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Silergy hereby expressly objects to and denies the application of any customer's general terms and conditions with regard to the purchase of Silergy products by the customer.

6. **No offer to sell or license**. Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights. Silergy makes no representation or warranty that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right. Information published by Silergy regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from Silergy under the patents or other intellectual property of Silergy.

For more information, please visit: www.silergy.com