SY20813/SY20813A

5V 3A Ultra-Low Loss Reverse Blocking Load Switch

General Description

The SY20813 and the SY20813A are ultra-low $R_{DS\ (ON)}$ load switches with reverse current blocking functions. The controlled ramp-up speed avoids the inrush current during turn-on. The devices operate over an input voltage range of 1.2V to 5.5V.

The SY20813 offers an output discharge resistor to ensure the capacitance existing in the systems is discharged when the part is disabled.

Both devices are available in a small 1.0 mm x 1.5 mm 6-pin CSP package.

Features

- Input Voltage Range: 1.2V to 5.5V
- Low $R_{DS(ON)}$ for Internal Pass Switch: 22mΩ at V_{IN}=5V
- 3A Continuous Load Current Capability
- Operating Current Iq = 4 μA (typ.)
- Shutdown Current I_{SHDN} = 1μA (max.)
- Reverse Blocking (No Body Diode)
- ON/OFF Control Input
- Controlled Turn-On Slew Rate
- Auto Output Capacitor Discharge Function:
  - SY20813: Auto Output Capacitor Discharge Function
  - SY20813A: No Output Capacitor Discharge Function
- RoHS Compliant and Halogen Free
- Compact CSP-6 Package: 1.0mm×1.5mm, 0.5mm Pitch, 0.5mm Height

Applications

- Smartphones
- Storage, DSLR, and Portable Devices
- Battery operated devices

Typical Application

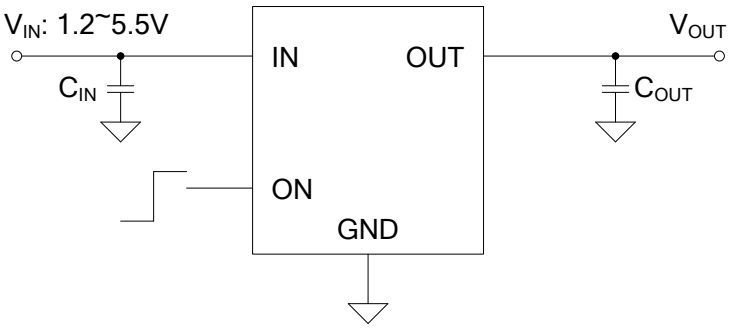


Figure 1. Schematic Diagram

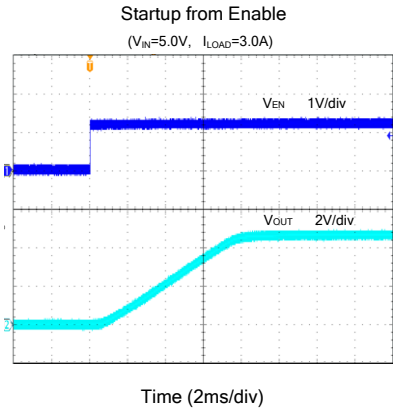


Figure 2. Startup Figure

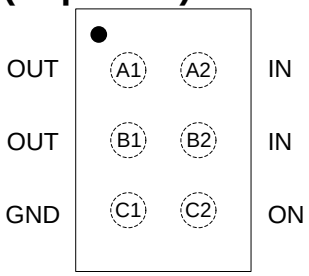
© 2020 Silergy Corp. All Rights Reserved.

Ordering Information

Ordering Number	Package Type	Top Mark
SY20813PEC	6 ball CSP	**TH*xyz***
SY20813APEC	6 ball CSP	**WV*xyz***

Device code: TH, ***x=year code, y=week code, z= lot number code***
Device code: WV, ***x=year code, y=week code, z= lot number code***

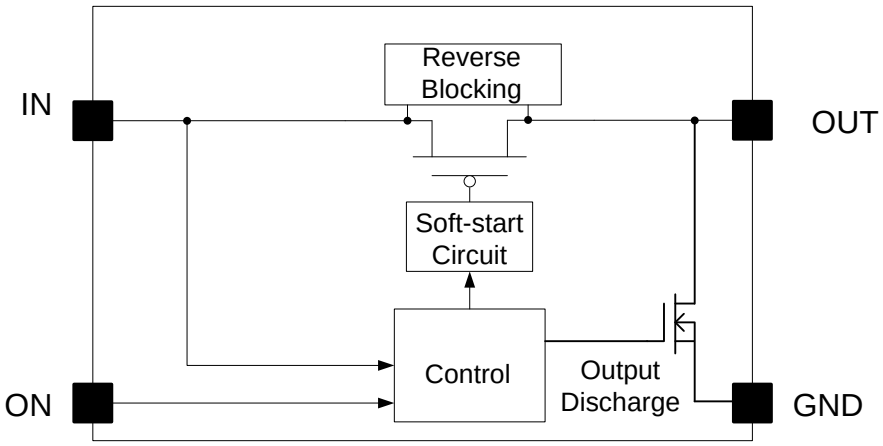
Pinout (Top View)



(CSP1×1.5-6)

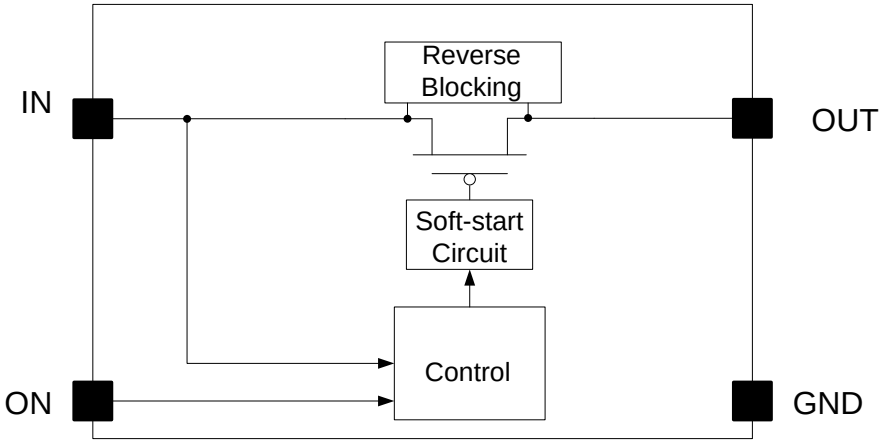
Pin Name	Pin Number	Pin Description
IN	A2, B2	Input pin.
OUT	A1, B1	Output pin.
GND	C1	Ground pin.
ON	C2	ON/OFF control. Active high. Do not leave it floating.

Block Diagrams



(SY20813)

© 2020 Silergy Corp. All Rights Reserved.



(SY20813A)

Absolute Maximum Ratings

Parameter (Note 1)	Min	Max	Unit
IN, OUT, ON		6	V
Lead Temperature (Soldering, 10s)		260	°C
Junction Temperature, Operating	-40	150	
Storage Temperature	-65	150	

Thermal Information

Parameter (Note 2)	Typ	Unit
θ_{JA} Junction-to-Ambient Thermal Resistance	123	°C/W
θ_{JC} Junction-to-Case Thermal Resistance	17	
P_D Power Dissipation T_A = 25°C	1	W

Recommended Operating Conditions

Parameter (Note 3)	Min	Max	Unit
IN, OUT	1.2	5.5	V
ON	-0.3	V_{IN}+0.3	
Junction Temperature, Operating	-40	125	°C
Ambient Temperature	-40	105	

© 2020 Silergy Corp. All Rights Reserved.

Electrical Characteristics

(V_{IN} = 5.0V, T_A = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		1.2		5.5	V
Shutdown Current	I_{SHDN2}	ON=Low, V_{OUT}=GND			1	μA
Quiescent Current	I_Q	I_{OUT}=0		4	8	μA
MOSFET R_{ON}	$R_{DS(ON)}$			22	30	mΩ
ON Input Logic High	V_{IH}		1			V
ON Input Logic Low	V_{IL}				0.4	V
Turn On Rise Time	t_{RISE}	C_{OUT}=1μF, Open Load	3	6	9	ms
Output Discharge Resistor	R_{DSC}		35	50	70	Ω

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.

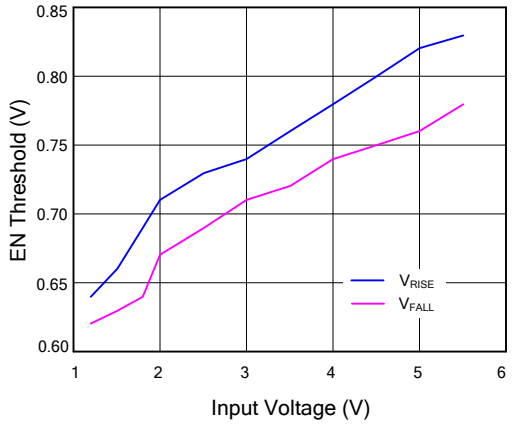
Note 2: θ_{JA} is measured in the natural convection at T_A = 25°C on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

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

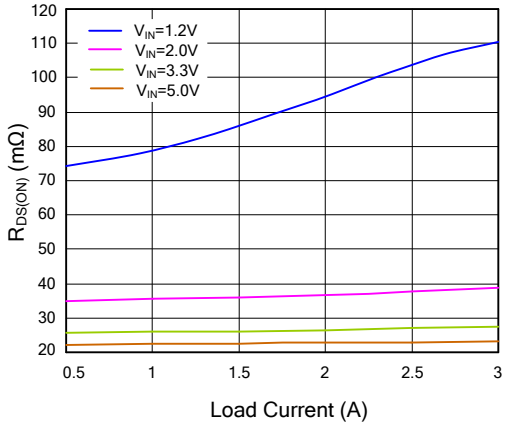
© 2020 Silergy Corp. All Rights Reserved.

Typical Performance Characteristics

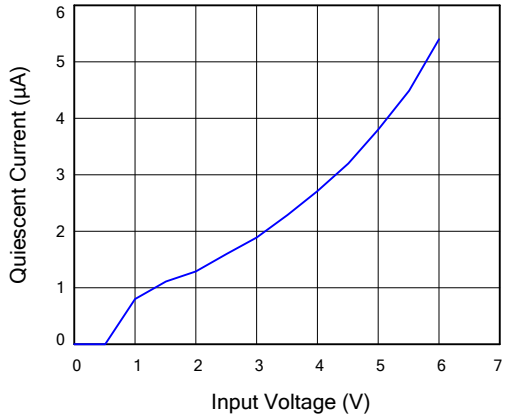
EN Threshold vs. Input Voltage



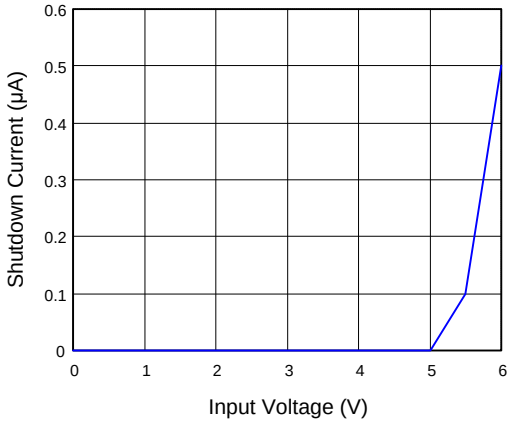
$R_{DS(ON)}$ vs. Load Current



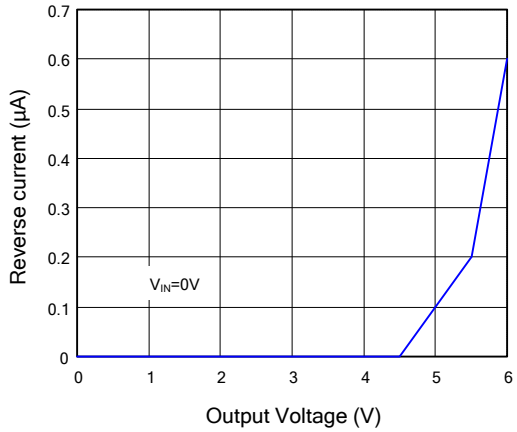
Quiescent Current vs. Input Voltage



Shutdown Current vs. Input Voltage

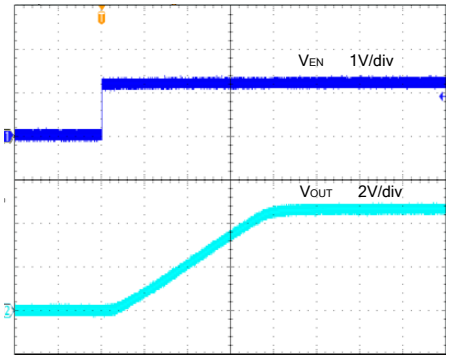


Reverse Current vs. Output Voltage



Startup from Enable

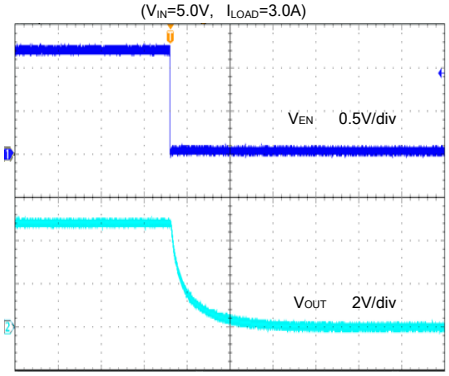
(V_{IN}=5.0V, I_{LOAD}=3.0A)



© 2020 Silergy Corp. All Rights Reserved.

Shutdown from Enable

(V_{IN}=5.0V, I_{LOAD}=3.0A)



Time (20μs/div)

© 2020 Silergy Corp. All Rights Reserved.

Application Information

The SY20813 and the SY20813A are ultra-low $R_{DS\ (ON)}$ load switches with reverse current blocking functions. The controlled ramp-up speed avoids the inrush current during turn-on. The devices operate from a wide input voltage range of 1.2V to 5.5V.

Input Capacitor:

To reduce device inrush current, a 1μF ceramic capacitor, C_{IN}, is recommended. A higher value of C_{IN} can be used to reduce the voltage drop experienced as the switch is turned on into large capacitive load. C_{IN} should be placed close to the IN and GND pins.

Output Capacitor:

A 1μF ceramic output cap is recommended to prevent parasitic board inductance from forcing VOUT below GND when switching off.

Output Discharge:

The SY20813 integrates a 50Ω pull-down resistor for quick output discharge. The resistor is activated when the switch is turned off.

PCB Layout Guide:

For best performance of the SY20813/A, the following guidelines must be strictly followed:

1. Keep all power traces as short and wide as possible and use at least 2-ounce copper for all power traces.
2. Place a ground plane under all circuitry to lower both resistance and inductance and improve DC and transient performance.
3. Place the output capacitors as close to the connectors as possible to lower the impedance (mainly inductance) between the port and the capacitor and improve transient performance.
4. Input and output capacitors should be placed close to the IC and connected to the ground plane to reduce noise coupling.

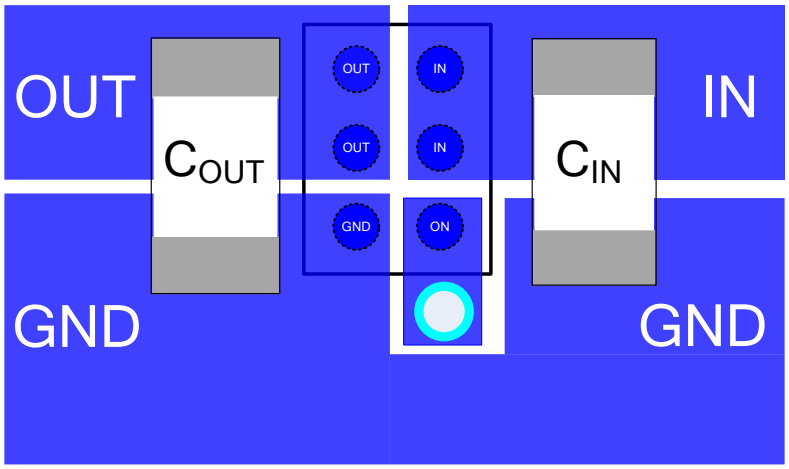
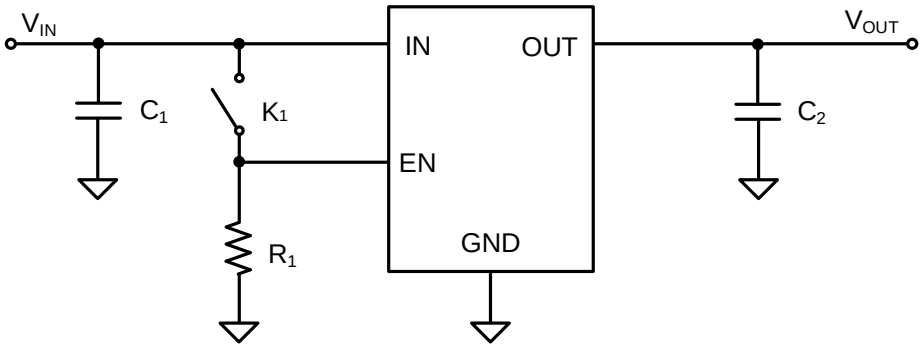


Figure 3. PCB Layout Example

© 2020 Silergy Corp. All Rights Reserved.

Application Schematic

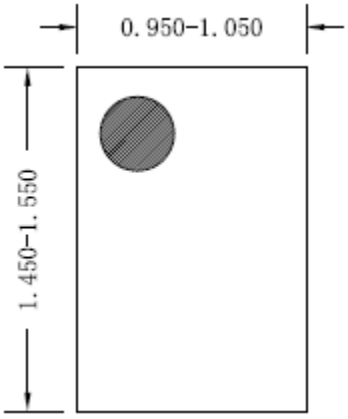


BOM List

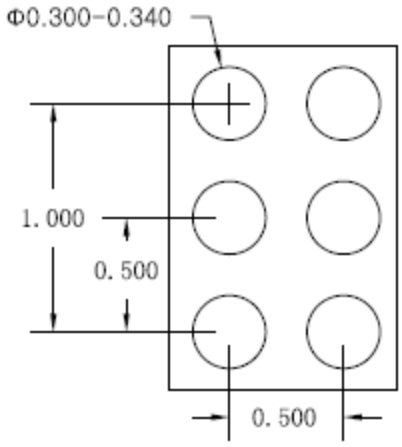
Designator	Description	Part Number	Manufacturer
C_1	1μF/25V, 0603, X5R	C1608X5R1E105K	TDK
C_2	1μF/25V, 0603, X5R	C1608X5R1E105K	TDK
R_1	100kΩ, 1%, 0603		

© 2020 Silergy Corp. All Rights Reserved.

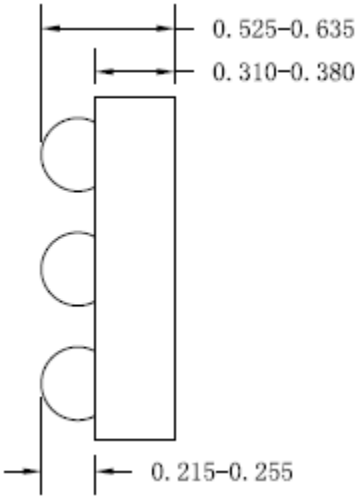
CSP1.0×1.5-6 Outline Drawings



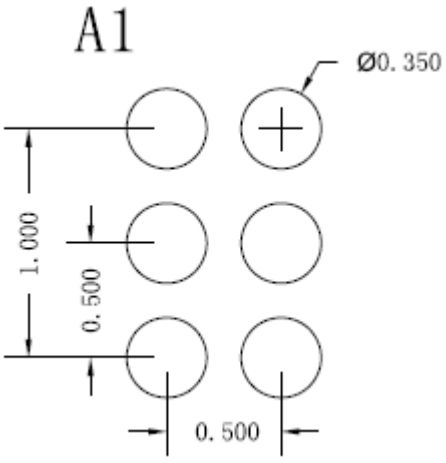
Top View



Bottom View



Side View



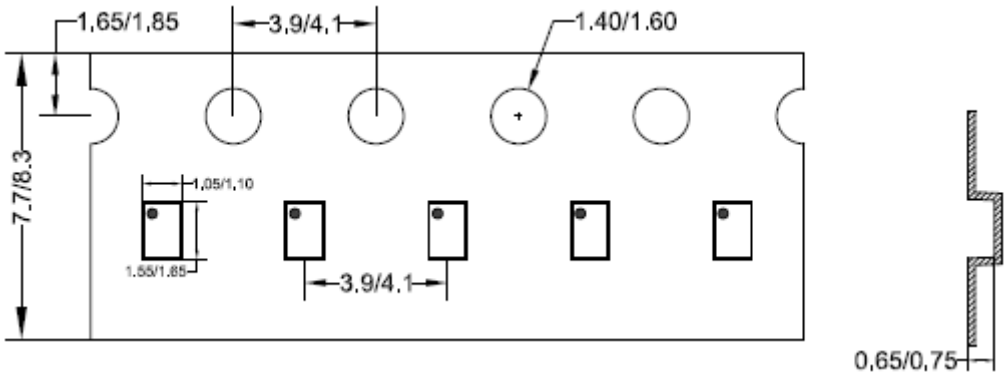
Recommended PCB Layout (Reference Only)

Note: All dimensions are in millimeters and exclude mold flash and metal burr.

© 2020 Silergy Corp. All Rights Reserved.

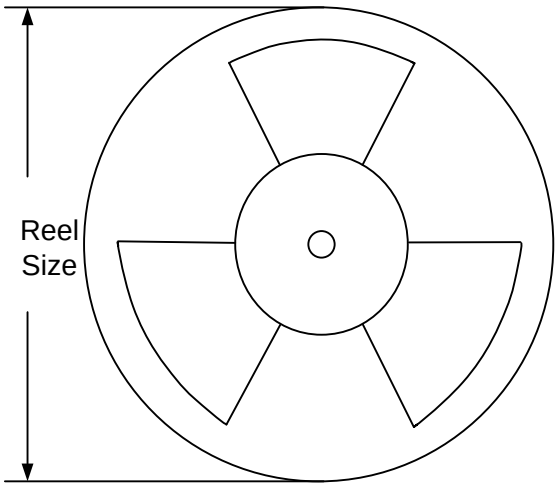
Taping & Reel Specification

CSP1.0×1.5 Taping Orientation



Feeding direction ⟶

Carrier Tape & Reel Specification for Packages



Package types	Tape width (mm)	Pocket pitch (mm)	Reel size (Inch)	Trailer length (mm)	Leader length (mm)	Qty per reel
CSP1.5×1.0	8	4	7"	400	400	3000

© 2020 Silergy Corp. All Rights Reserved.

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 a 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

© 2020 Silergy Corp. **All Rights Reserved.**

© 2020 Silergy Corp. All Rights Reserved.