

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: 22m Ω at $V_{IN}=5V$
- 3A Continuous Load Current Capability
- Operating Current $I_q = 4 \mu A$ (typ.)
- Shutdown Current $I_{SHDN} = 1 \mu A$ (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

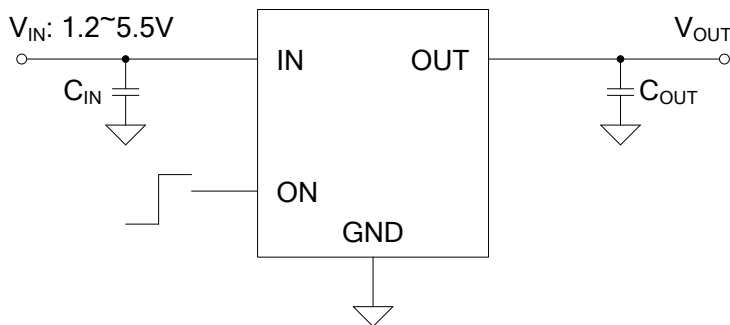


Figure 1. Schematic Diagram

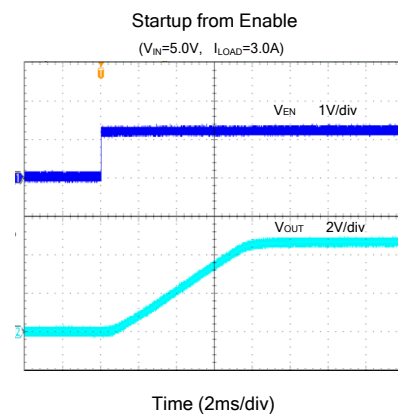


Figure 2. Startup Figure

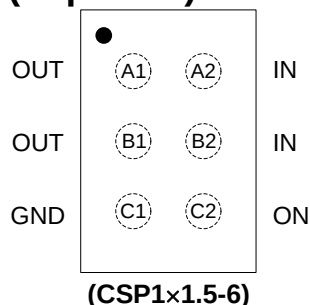
Ordering Information

Ordering Number	Package Type	Top Mark
SY20813PEC	6 ball CSP	THxyz
SY20813APEC	6 ball CSP	WVxyz

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

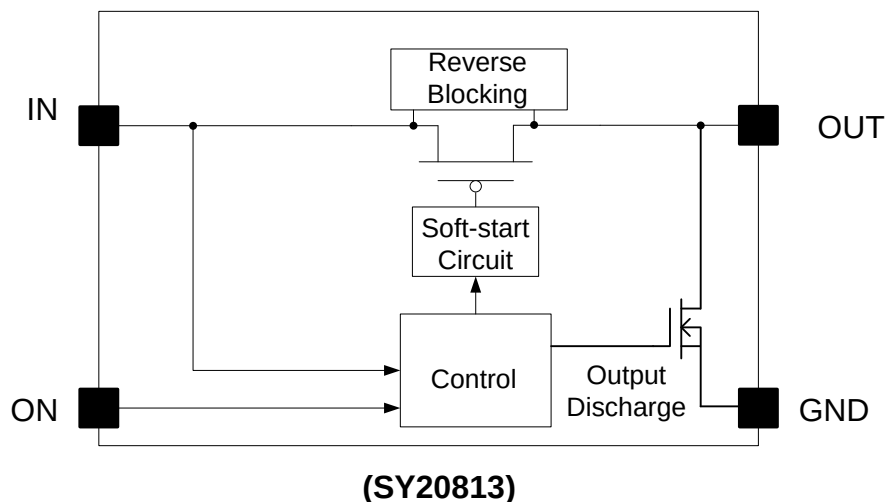
Device code: WV, *x=year code*, *y=week code*,
z=lot number code

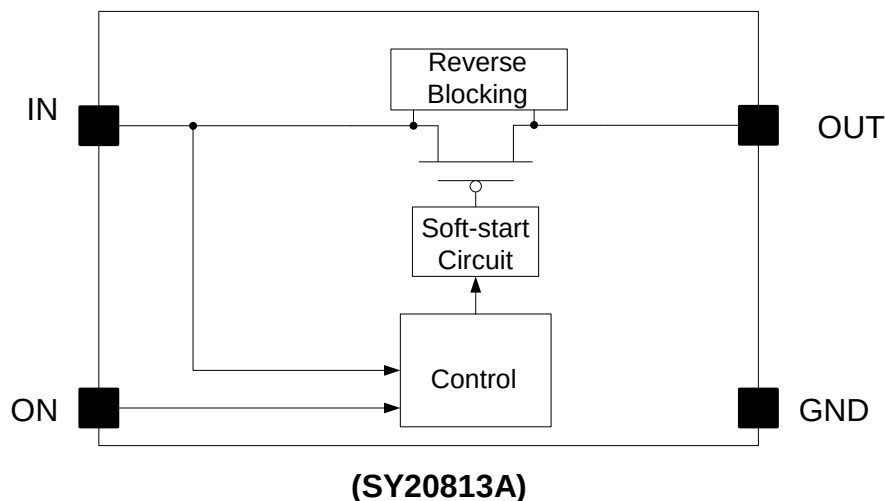
Pinout (Top View)



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





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 $T_A = 25^\circ\text{C}$	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	



SY20813/SY20813A

Electrical Characteristics

($V_{IN} = 5.0V$, $T_A = 25^{\circ}C$ unless otherwise specified)

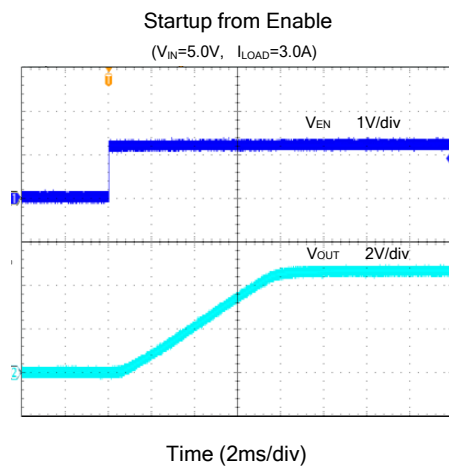
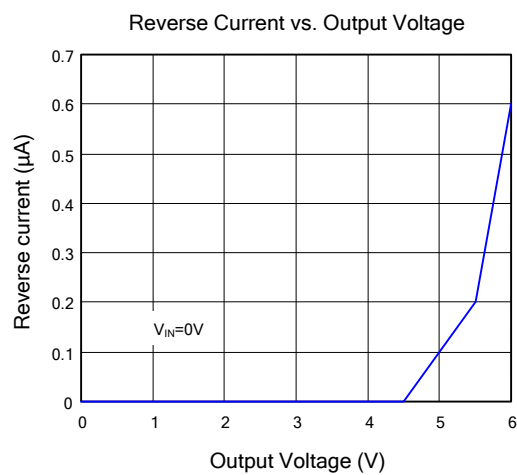
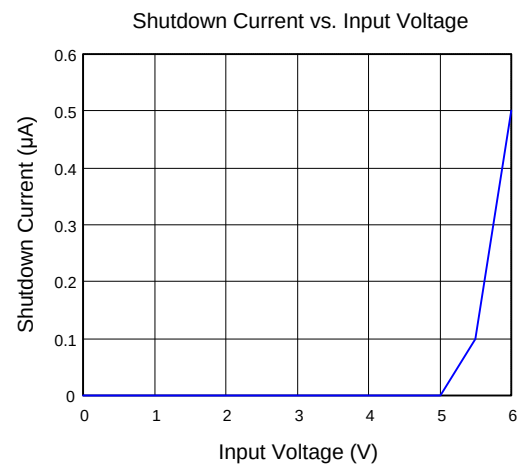
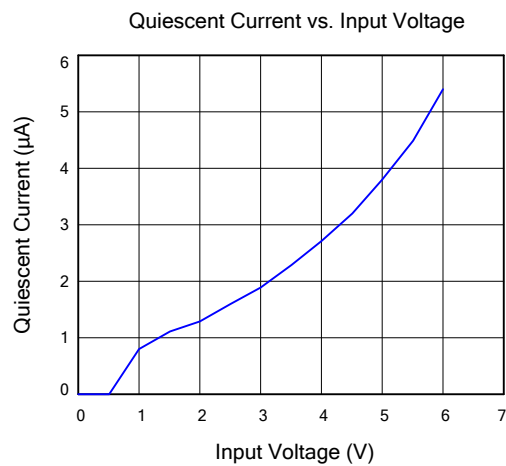
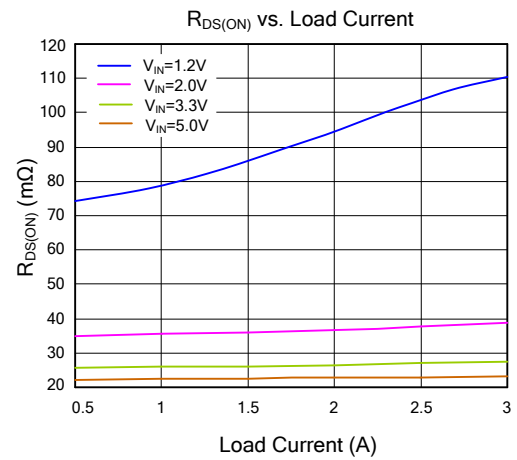
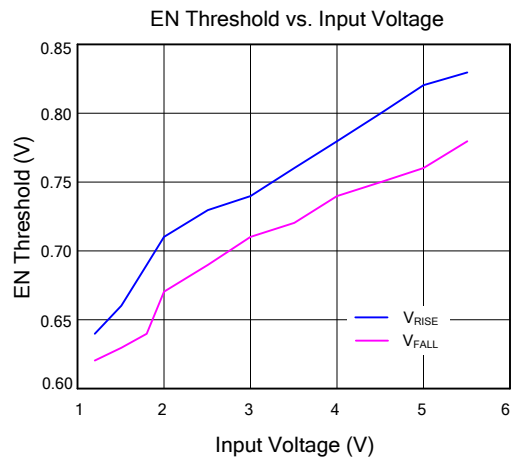
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range	V_{IN}		1.2		5.5	V
Shutdown Current	I_{SHDN2}	ON=Low, $V_{OUT}=GND$			1	μA
Quiescent Current	I_Q	$I_{OUT}=0$		4	8	μA
MOSFET R_{ON}	$R_{DS(ON)}$			22	30	m Ω
ON Input Logic High	V_{IH}		1			V
ON Input Logic Low	V_{IL}				0.4	V
Turn On Rise Time	t_{RISE}	$C_{OUT}=1\mu F$, 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 $T_A = 25^{\circ}C$ on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

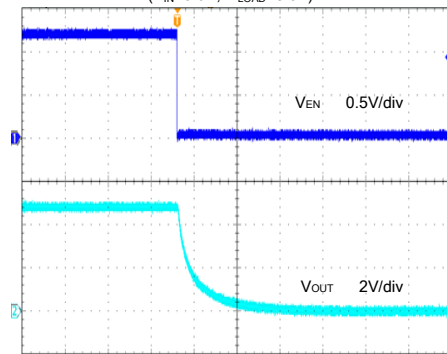
Note 3. The device is not guaranteed to function outside its operating conditions

Typical Performance Characteristics



Shutdown from Enable

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



Time (20μs/div)

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 $1\mu\text{F}$ 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 $1\mu\text{F}$ ceramic output cap is recommended to prevent parasitic board inductance from forcing V_{OUT} 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.

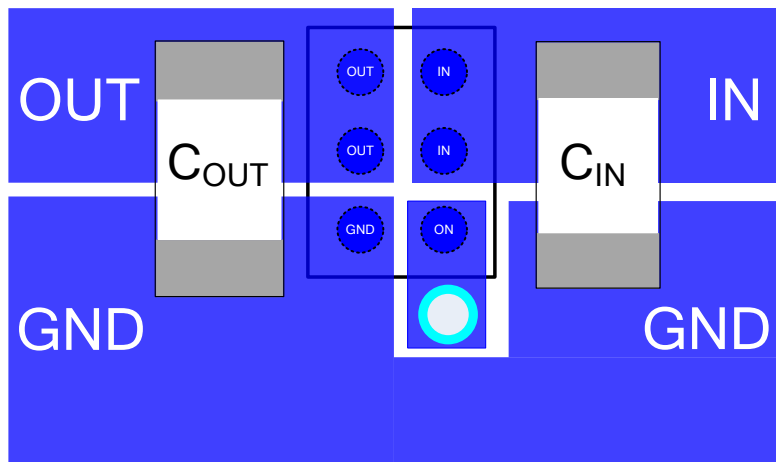
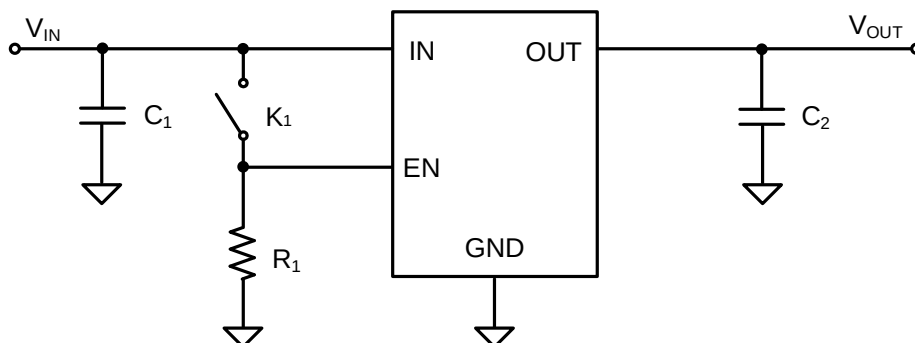


Figure 3. PCB Layout Example

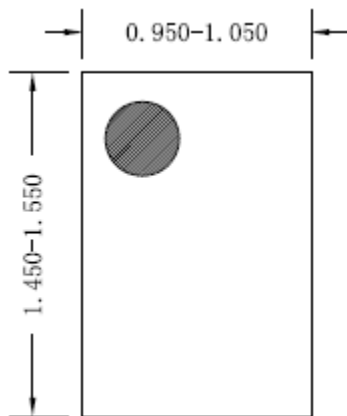
Application Schematic



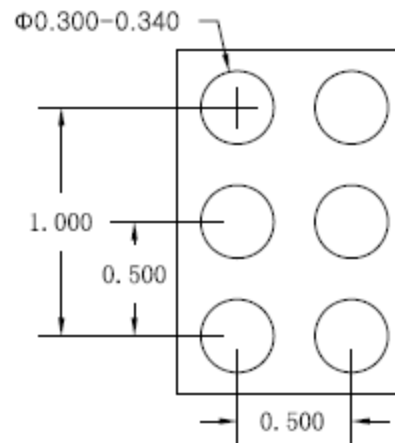
BOM List

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		

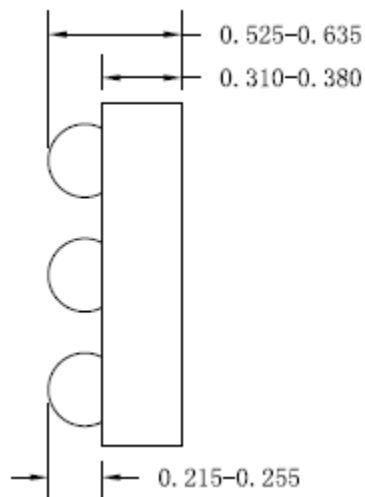
CSP1.0×1.5-6 Outline Drawings



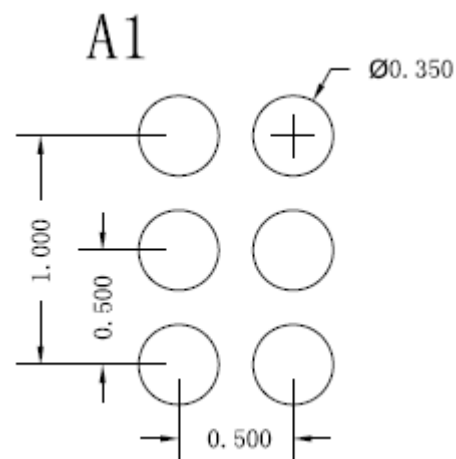
Top View



Bottom View



Side View

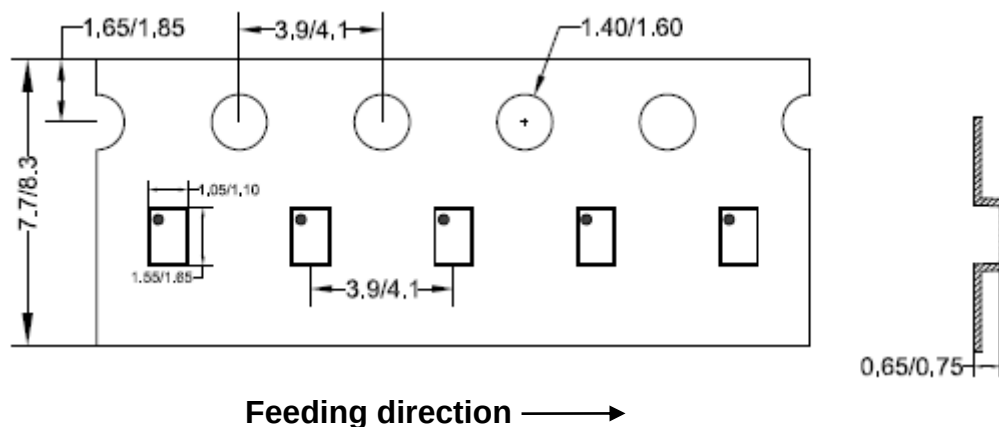


**Recommended PCB Layout
(Reference Only)**

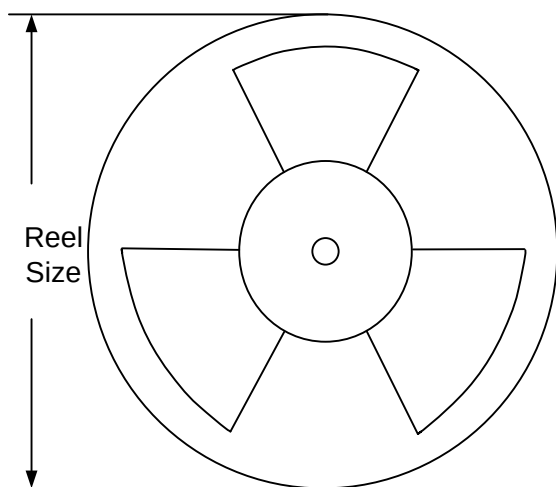
Note: All dimensions are in millimeters and exclude mold flash and metal burr.

Taping & Reel Specification

CSP1.0×1.5 Taping Orientation



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



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