SY20806G

1.05V to 5.5V 2A Load Switch

General Description

The SY20806G is a small, low R_{ON}, single channel load switch with controlled slew rate. The device contains an N-channel MOSFET that can operate over an input voltage range of 1.05V to 5.5V and can support a maximum continuous current of 2A.The switch is controlled by an on and off input(Active low), which is capable of interfacing directly with low-voltage control signals.

The small size and low R_{ON} make the device ideal for being used in space constrained, battery powered applications. The wide input voltage range of the switch makes it a versatile solution for many different voltage rails. The controlled rise time of the device greatly reduces inrush current caused by large bulk load capacitances, thereby reducing or eliminating power supply droop.

The SY20806G further reduces the total solution size by integrating a 143Ω pull-down resistor for quick output discharge when the switch is turned off.

The SY20806G is available in a small, space-saving0.78mm×0.78mm, 0.4-mm pitch, 0.5-mmheight 4-pin CSP package. The device is characterized for operation over the free-air temperature range of –40°C to +105°C.

Ordering Information

SY20806 □(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package Type	Note
SY20806GPAC	CSP0.78×0.78– 4	----

Features

- Wide Input Voltage Range: 1.05V to 5.5V
- Ultra-low R_{ON}:
  - 37mΩ(typ)at V_{IN} = 5V
  - 38mΩ(typ)at V_{IN} = 3.3V
  - 43mΩ(typ)at V_{IN} = 1.8V
- 2A Maximum Continuous Switch Current
- Low Quiescent Current: 9.7μA at V_{IN}=3.3V
- Controlled Slew Rate:
  - 1200μs rise time at V_{IN}=3.3V
- Package: CSP0.78mm x 0.78mm – 4

Applications

- Note Book
- Cell Phone

Typical Applications

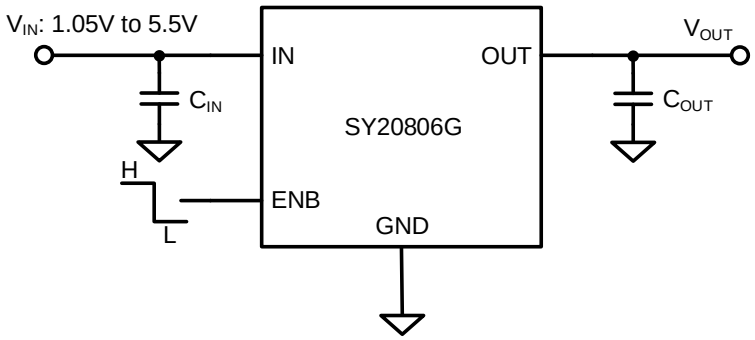
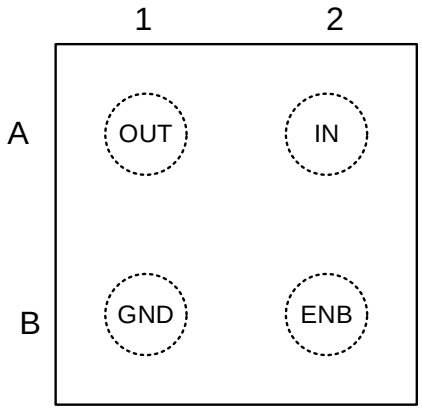


Figure 1. Schematic Diagram

Pinout(Top view)



(CSP0.78×0.78– 4)

Top Mark: **r3*xyz*(**Device code: **r3**; ***x=year code, y=week code, z= lot number code*****)**

Pin Name	Pin number	Pin Description
IN	A2	Input pin, decoupled with at least a 1μF MLCC capacitor to GND.
GND	B1	Ground pin.
OUT	A1	Output pin, decoupled with a2.2μF MLCC capacitor to GND.
ENB	B2	ON/OFF control, active low. Do not leave it floating.

Block Diagram

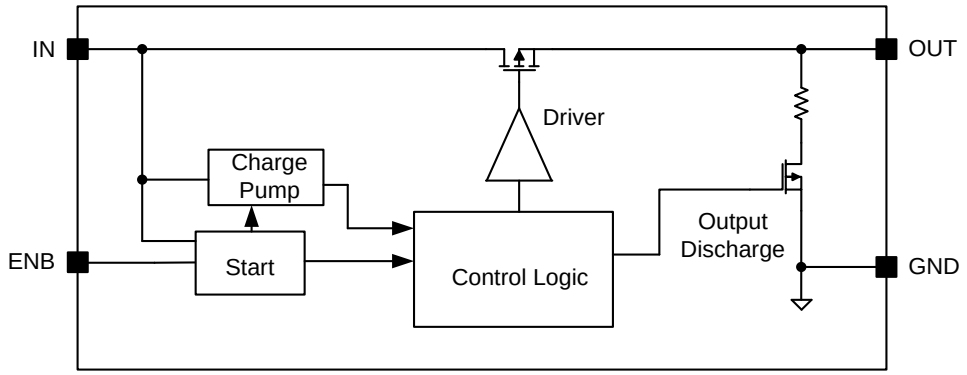


Figure2. Block Diagram

Absolute Maximum Ratings (Note 1)

IN, OUT, ENB to GND ---------- -0.3V to 6V
Power Dissipation, P_D @ T_A = 25°C---------- 0.52W
Package Thermal Resistance (Note 2)
θ_{JA} ---------- 193°C/W
θ_{JC}---------- 2.3°C/W
Junction Temperature---------- -40°C to 150°C
Lead Temperature (Soldering, 10 sec.) ---------- 260°C
Storage Temperature Range ---------- -65°C to 150°C

Recommended Operating Conditions(Note 3)

IN ---------- 1.05V to 5.5V
OUT ---------- 0V to V_{IN}
ENB ---------- 0V to 5.5V
Junction Temperature Range ---------- -40°C to 125°C
Ambient Temperature Range ---------- -40°C to 105°C

Electrical Characteristics

(Unless otherwise noted, the specification in the following table applies over the operating ambient temperature –40˚C≤ T_A≤+105˚C. **Typical values are for T_A = 25°C.)**

Parameter	Symbol	Test Conditions	T_A	Min	Typ	Max	Unit
Quiescent Current	I_Q	V_{IN}=3.3V, V_{ENB}=0V, I_{OUT}=0A	-40˚C to +85˚C		9.7	15	µA
			-40˚C to +105˚C			16	µA
Shutdown Current	I_{SHDN}	V_{IN}=V_{ENB}=3.3V, V_{OUT}=0V	-40˚C to +85˚C		0.5	2	µA
			-40˚C to +105˚C			3	µA
Switch ON Resistance	R_{ON}	V_{IN}=5V, I_{OUT}=200mA	25˚C		37	41	mΩ
			-40˚C to +85˚C			51	mΩ
			-40˚C to +105˚C			57	mΩ
		V_{IN}=3.3V, I_{OUT}=200mA	25˚C		38	41	mΩ
			-40˚C to +85˚C			52	mΩ
			-40˚C to +105˚C			58	mΩ
		V_{IN}=1.8V, I_{OUT}=200mA	25˚C		43	48	mΩ
			-40˚C to +85˚C			59	mΩ
			-40˚C to +105˚C			66	mΩ
		V_{IN}=1.2V, I_{OUT}=200mA	25˚C		52	61	mΩ
			-40˚C to +85˚C			73	mΩ
			-40˚C to +105˚C			85	mΩ
		V_{IN}=1.05V, I_{OUT}=200mA	25˚C		63	96	mΩ
			-40˚C to +85˚C			102	mΩ
			-40˚C to +105˚C			107	mΩ
ENB Input Logic High	V_{IH}	V_{IN}=1.05V to 5.5V	25˚C	1			V
ENB Input Logic Low	V_{IL}	V_{IN}=1.05V to 5.5V	25˚C			0.4	V
ENB Hysteresis	V_{HYS_ENB}	V_{IN}=5.5V	25˚C		102		mV
		V_{IN}=1.05V	25˚C		92		mV
Discharge Resistance	R_{DSG}	V_{IN}=V_{OUT}=V_{ENB}=3.3V	-40˚C to +105˚C		143	200	Ω

Switching Characteristics

Refer to the timing test circuit in Figure 3 (unless otherwise noted) for references to external components used for the test condition in the switching characteristics table. Switching characteristics shown below are only valid for the power-up sequence where V_{IN} is already in steady state condition before the ENB pin is asserted low.

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
V_{IN}=5V, V_{ENB}=0V, T_A=25˚C (Unless otherwise noted)						
Turn ON Time	t_{ON}	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		1300		μs
Turn OFF Time	t_{OFF}	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		2		μs
V_{OUT} Rise Time	t_R	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		1800		μs
V_{OUT} Fall Time	t_F	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		2		μs
Delay Time	t_D	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		663		μs
V_{IN}=3.3V, V_{ENB}=0V, T_A=25˚C (Unless otherwise noted)						
Turn ON Time	t_{ON}	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		1077		μs
Turn OFF Time	t_{OFF}	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		2		μs
V_{OUT} Rise Time	t_R	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		1200		μs
V_{OUT} Fall Time	t_F	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		2		μs
Delay Time	t_D	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		550		μs
V_{IN}=1.05V, V_{ENB}=0V, T_A=25˚C (Unless otherwise noted)						
Turn ON Time	t_{ON}	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		650		μs
Turn OFF Time	t_{OFF}	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		23		μs
V_{OUT} Rise Time	t_R	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		350		μs
V_{OUT} Fall Time	t_F	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		2		μs
Delay Time	t_D	R_L=10Ω, C_{IN}=1μF, C_{OUT}=0.1μF		547		μs

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.

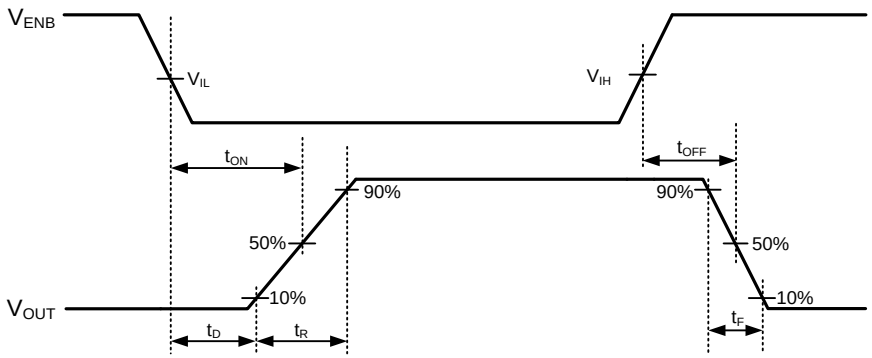
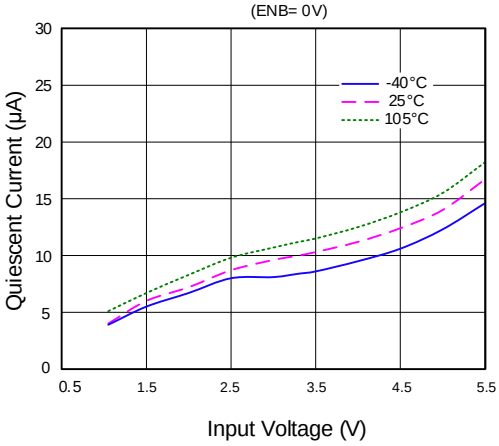


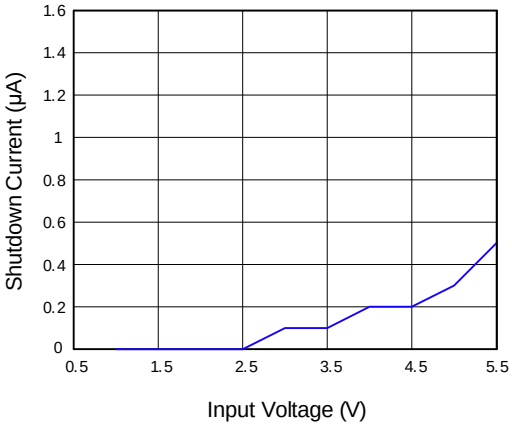
Figure 3 SY20806G Timing Waveform

Typical Operating Characteristics

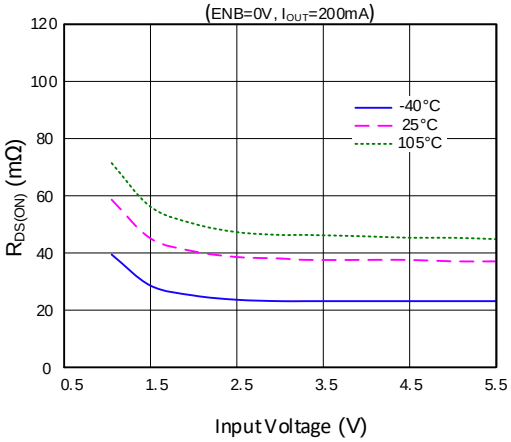
Quiescent Current vs. Input Voltage
(ENB= 0V)



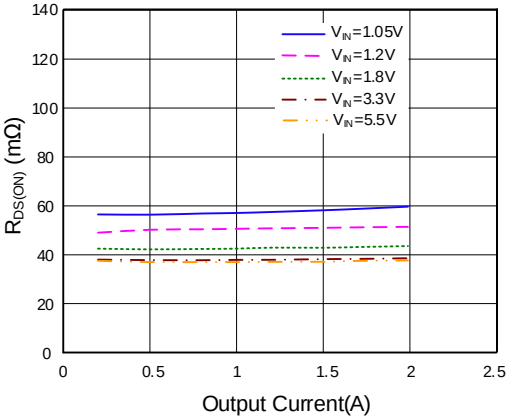
Shutdown Current vs. Input Voltage
(ENB=4V)



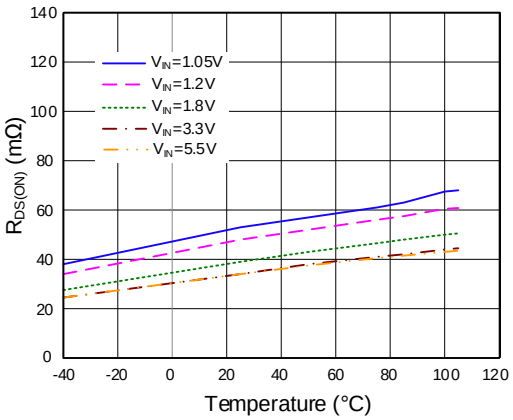
$R_{DS(ON)}$ vs. Input Voltage
(ENB=0V, I_{OUT}=200mA)



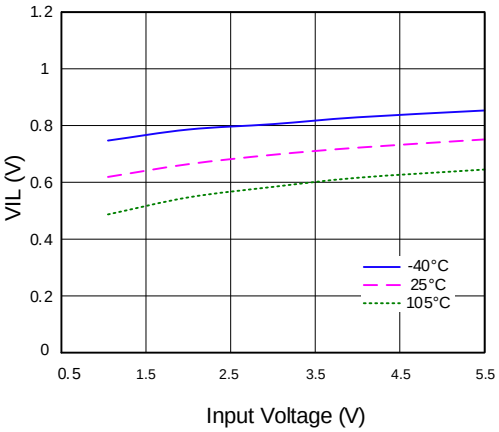
$R_{DS(ON)}$ vs. Output Current
(ENB=0V)



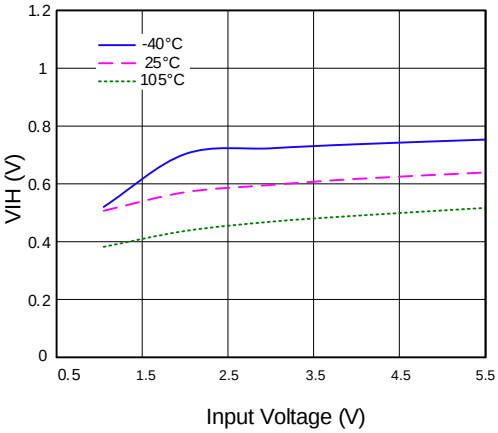
$R_{DS(ON)}$ vs. Temperature
(ENB=0V,I_{OUT}=200mA)



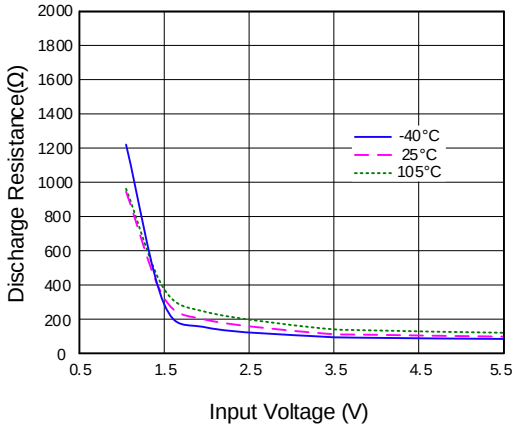
VIL vs. Input Voltage



VIH vs. Input Voltage

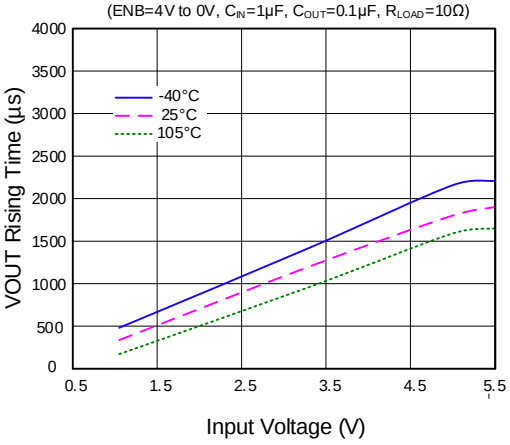


Discharge Resistance vs. Input Voltage



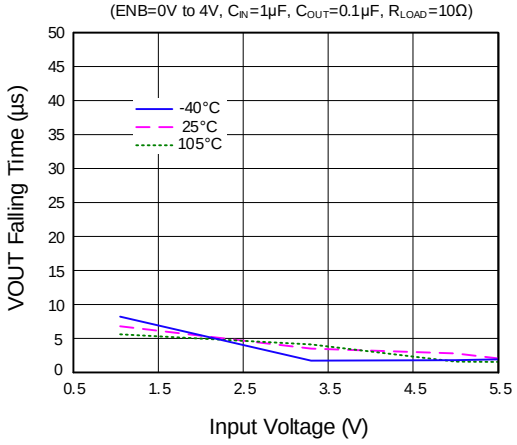
VOUT Rising Time vs. Input Voltage

(ENB=4V to 0V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=10Ω)



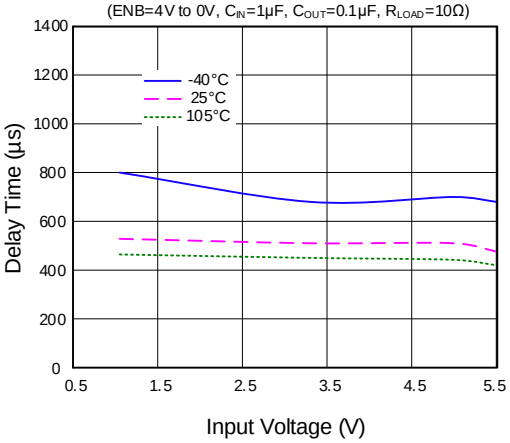
VOUT Falling Time vs. Input Voltage

(ENB=0V to 4V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=10Ω)



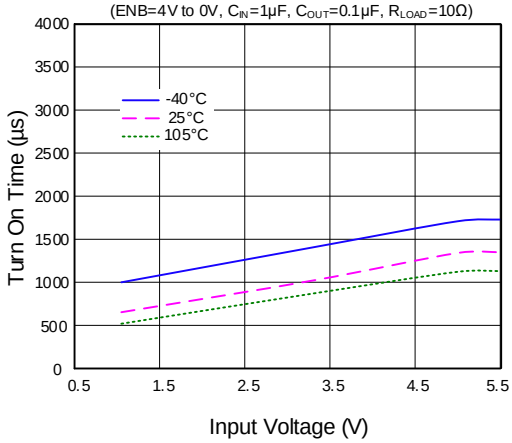
Delay Time vs. Input Voltage

(ENB=4V to 0V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=10Ω)



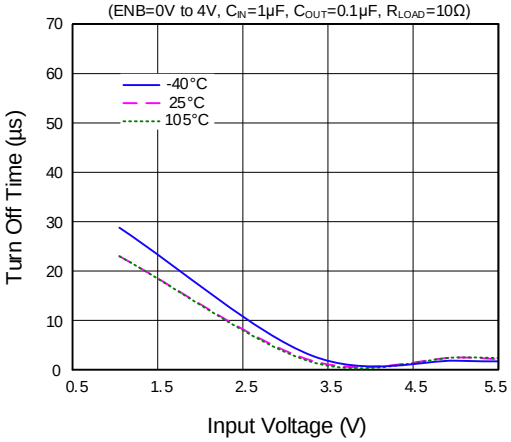
Turn On Time vs. Input Voltage

(ENB=4V to 0V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=10Ω)



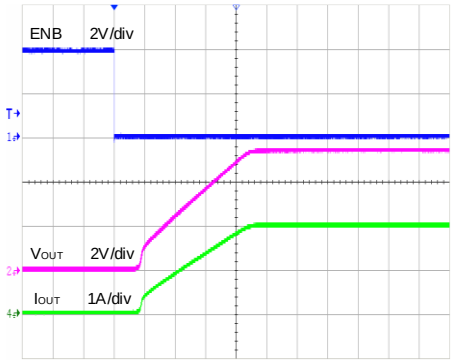
Turn Off Time vs. Input Voltage

(ENB=0V to 4V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=10Ω)



Startup from ENB

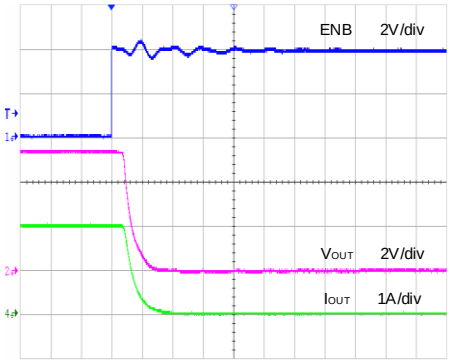
(V_{IN}=5.5V, ENB=4V to 0V, C_{IN}=1μF,C_{OUT}=2.2μF, I_{OUT}=2A)



Time (500μs/div)

Shutdown from ENB

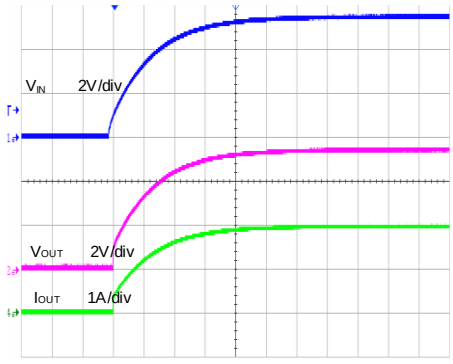
(V_{IN}=5.5V, ENB=0V to 4V, C_{IN}=1μF,C_{OUT}=2.2μF, I_{OUT}=2A)



Time (5μs/div)

Startup from VIN

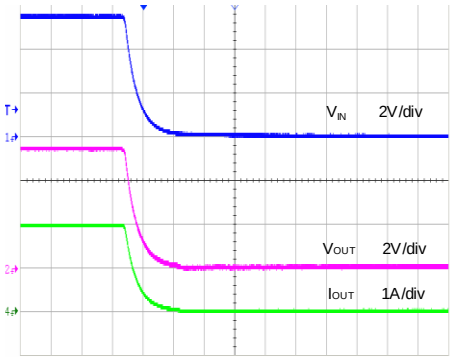
(V_{IN}=0V to 5.5V, ENB=GND, C_{IN}=1μF,C_{OUT}=2.2μF, I_{OUT}=2A)



Time (20ms/div)

Shutdown from VIN

(V_{IN}=5.5V to 0V, ENB=GND, C_{IN}=1μF,C_{OUT}=2.2μF, I_{OUT}=2A)



Time (1ms/div)

Operation

The SY20806G is a small, low R_{ON}, single channel load switch with controlled slew rate. The device contains an N-channel MOSFET that can operate over an input voltage range of 1.05 V to 5.5V and can support a maximum continuous current of 2A.

The switch is controlled by an on and off input (Active Low),which is capable of interfacing directly with low voltage control signals.

Applications Information

Input Capacitor

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

Output Capacitor

A 2.2μF ceramic output cap is recommended to prevent parasitic board inductance from forcing VOUT below GND when switching off

Output Discharge

SY20806G integrate a 143Ω 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 SY20806GPAC, the following guidelines must be strictly followed:

- ✧ Keep all power traces as short and wide as possible and use at least 1-ounce copper for all power traces.
- ✧ Place a ground plane under all circuitry to lower both resistance and inductance and improve DC and transient performance.
- ✧ Locate 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.
- ✧ Input and output capacitors should be placed closed to the IC and connected to ground plane to reduce noise coupling.

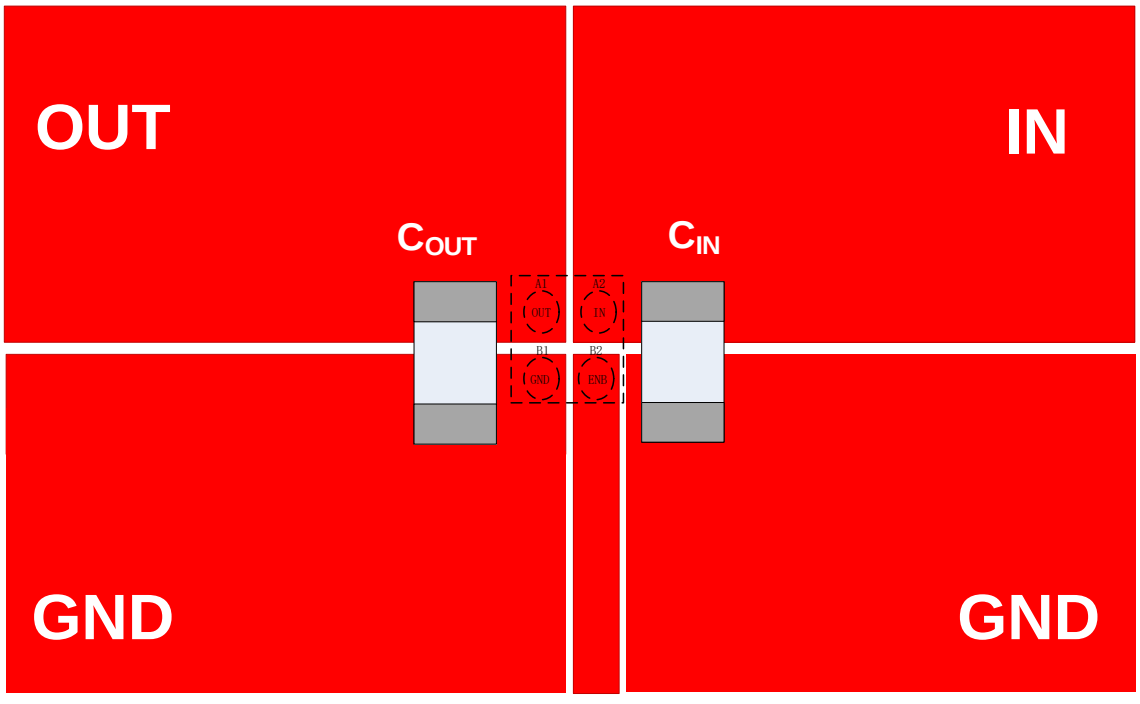
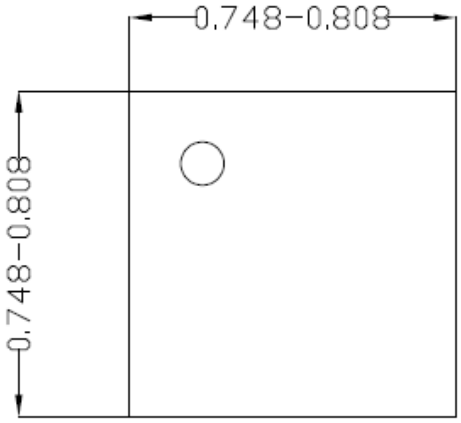
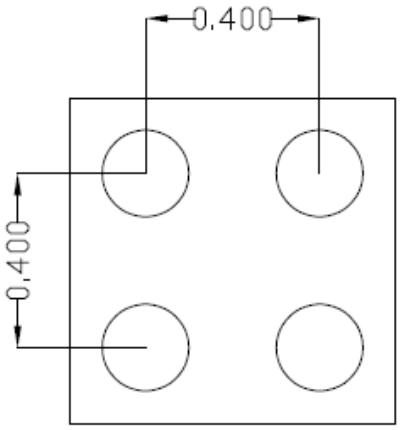


Figure4. PCB Layout Suggestion

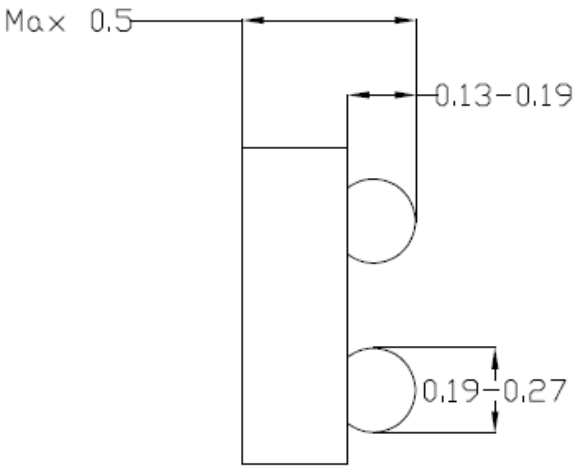
CSP0.78×0.78-4 Package Outline



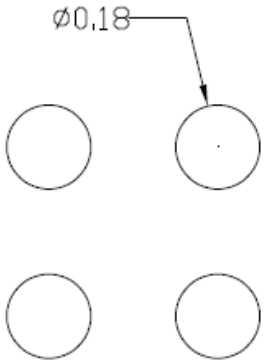
Top View



Bottom View



Side View



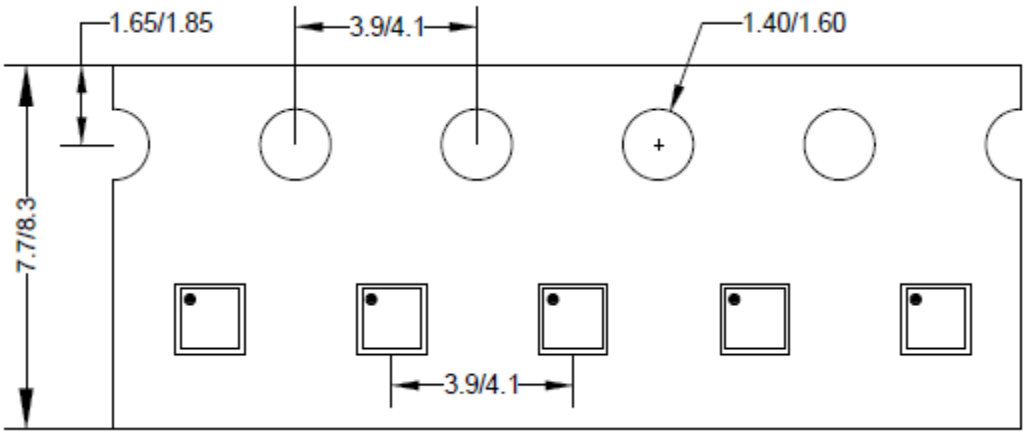
PCB layout (Recommended)

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

Taping & Reel Specification

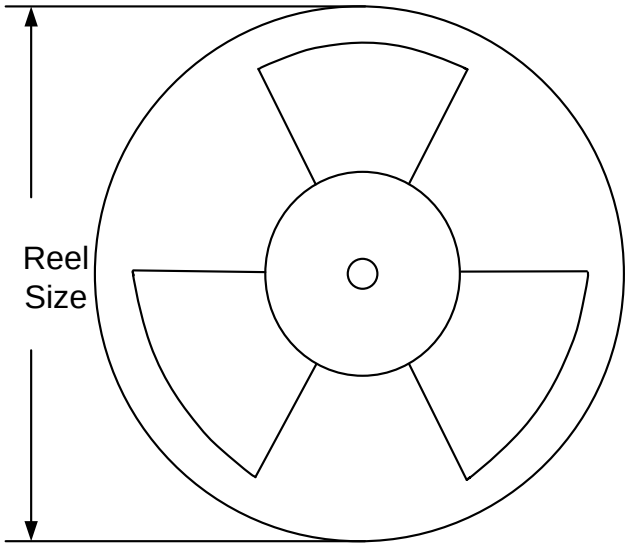
1. Taping orientation

CSP0.78×0.78



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
CSP0.78×0.78	8	4	7"	400	160	5000

3. Others: NA

Revision History

The revision history provided is for informational purpose only and is believed to be accurate, however, not warranted. Please make sure that you have the latest revision.

Date	Revision	Change
Oct.13, 2022	Revision 0.9	Initial Release

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