SY20714

3.3V/50mA, 30V Input, LDO Regulator

General Description

The SY20714 is a fixed 3.3V output precise LDO capable of delivering 50mA load current. The device works under a wide input voltage range of 3.6V to 30V. The ultra low drop out voltage, wide input voltage range and low ground current make it suitable for USB and portable electronics applications with different inputs. Other features include the operation stability with low ESR ceramic capacitors due to the internal compensation, logic enable control, thermal shutdown, current limit, reverse leakage current protection.

The SY20714 is available in SOT23-5 package.

Ordering Information

SY20714□(□□)□
- Temperature Code
- Package Code
- Optional Spec Code

Ordering Number	Package type	Output Voltage
SY20714AAC	SOT23-5 RoHS-Compliant and Halogen-Free	3.3V

Features

- Wide Input Voltage Range: 3.6V to 30V
- 3.3V Fixed Output Voltage
- Low Dropout Voltage(100mV @ 50mA)
- Low Ground Current
- Ultra Low Shutdown Current
- ±2% Output Voltage Accuracy
- Stable with Small Ceramic Capacitors
- Excellent Load and Line Regulation
- 50mA Output Current Capability
- Output Current Limitation
- Reverse Leakage Current Protection
- Reverse Input Voltage Protection
- TTL Logic Enable Input
- Thermal Shutdown
- Compact SOT23-5 Package

Applications

- Battery powered applications
- Consumer and portable products
- Notebook
- Smart phones
- SMPS post-regulator/ DC-DC modules

Typical Application

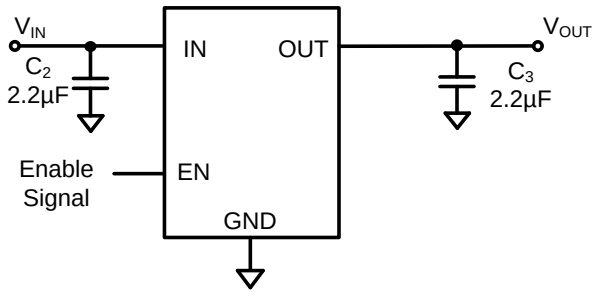


Figure 1. Schematic Diagram

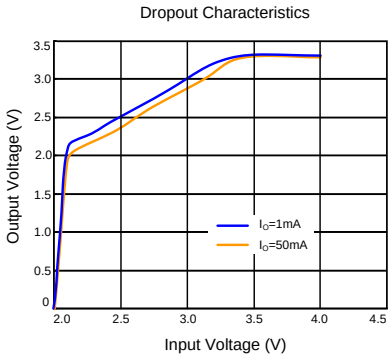
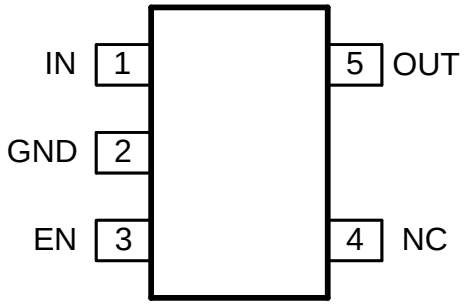


Figure 2. Dropout Characteristics

Pinout (top view)

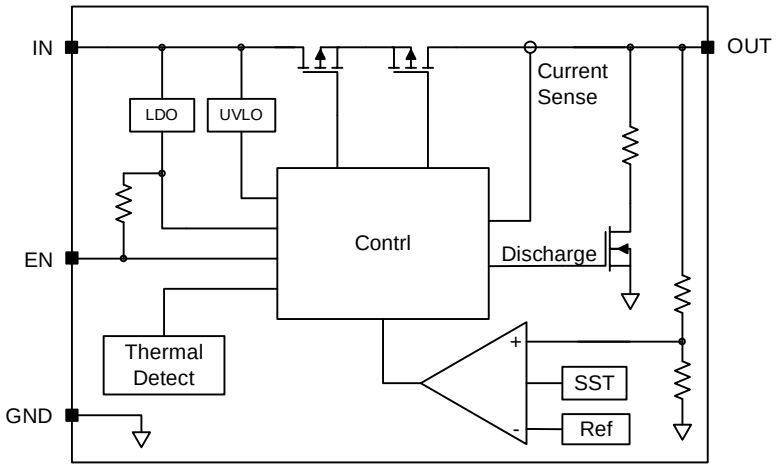


(SOT23-5)

Top mark: **ZC*xyz*** (Device code: ZC, ***x=year code, y=week code, z= lot number code***)

Pin Name	SOT23-5	Pin Description
IN	1	Supply input pin. Decouple this pin to GND with a 1uF MLCC
GND	2	Ground pin.
OUT	5	LDO output pin.
EN	3	Enable pin. Pull it low to shutdown or leave it floating to enable.
NC	4	No connection

Function Block



Absolute Maximum Ratings (Note 1)

Supply Input Voltage ---------- -20V to 36V
Output Voltage ---------- 0.3V+VIN
EN Voltage ---------- -0.3V to 0.3V+VIN
Power Dissipation, P_D @ T_A = 25°C SOT23-5 ---------- 0.6W
Package Thermal Resistance (Note 2)
θ_{JA} ---------- 170°C/W
θ_{JC} ---------- 130°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)

Supply Input Voltage ---------- 3.6V to 30V
Output Voltage ---------- 0.3V+V_{IN}
EN Voltage ---------- 0V to 0.3V+V_{IN}
Junction Temperature (T_J) ---------- -40°C to +125°C

Electrical Characteristics

(V_{IN} =5V, TA = 25°C unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typical	Max	Unit
Input Voltage	V_{IN}		3.6		30	V
Output Voltage	V_{OUT}	I_O=100uA	3.234	3.3	3.366	V
Line Regulation	ΔV_{LNR}	I_O=100uA		0.04		%
Load Regulation	ΔV_{LDR}	I_O=0.1mA to 50mA		0.25	1	%
Dropout Voltage	V_{IN}-V_{OUT}	I_O=10mA		20		mV
		I_O=50mA		100		mV
Shutdown Current	I_{SHDN}	V_{EN}=0V, V_{IN}=24V		1		μA
Quiescent Current	I_Q	I_O=0.1mA		18	30	μA
		I_O=50mA		110		μA
Current Limit	I_{LIM}	V_{OUT}=0.9×V_{OUT}(normal)		70		mA
Reverse Leakage Current Limit	I_{RLK}	V_{IN}= -15V, Load=500ohms		-0.1		μA
Power-supply Rejection Ratio	PSRR	f=1kHz, C_{OUT}=10μF		50		dB
Input UVLO Threshold	V_{UVLO}	V_{IN} rising			2.25	V
UVLO Hysteresis	$V_{UVLO,TH}$			100		mV
Shutdown discharge Resistor	R_{DIS}			500		Ω
Enable Input logic-High Voltage	V_{EN_H}		1.5			V
Enable Input logic-Low Voltage	V_{EN_L}				0.6	V
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.

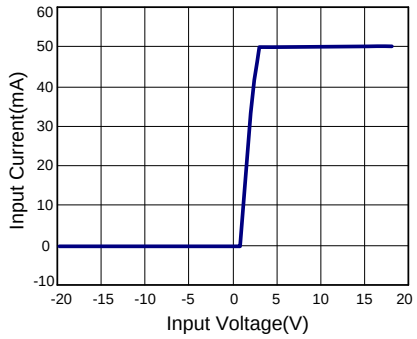
Note 2: θ_{JA} is measured in the natural convection at TA = 25°C on a low effective two layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

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

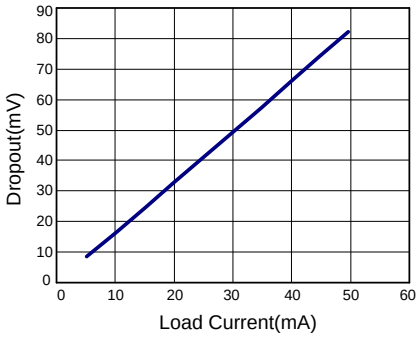
Typical Operating Characteristics

Input Current vs. Input Voltage

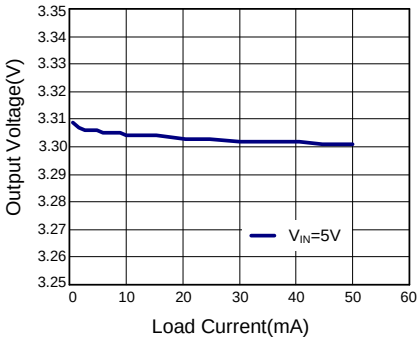
(V_{IN}=5V, V_{OUT}=3.3V, R_L=66Ω)



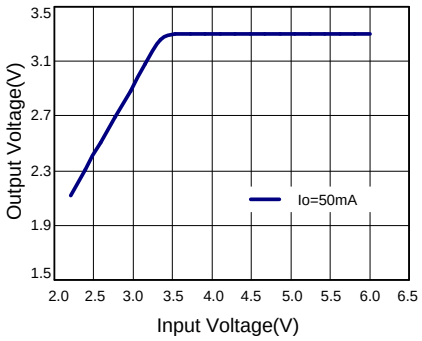
Dropout Voltage vs. Load Current



Load Regulation

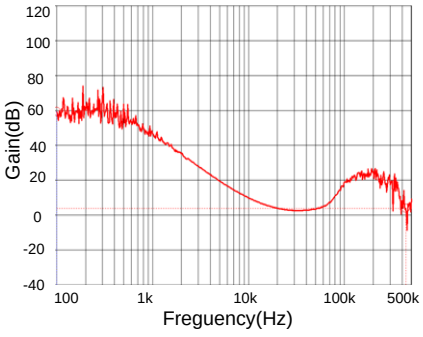


Line Regulation



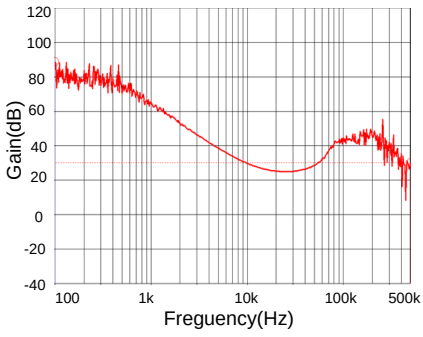
PSRR

(Vin=5V,Vout=3.3V,Iout=50mA)



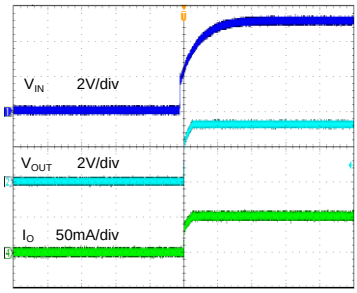
PSRR

(Vin=9V,Vout=3.3V,Iout=50mA)



Startup From V_{IN}

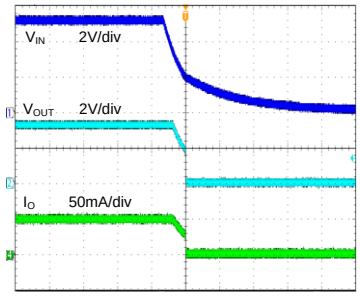
(V_{IN}=5.0V, V_{OUT}=3.3V, I_O=50mA)



Time (4ms/div)

Shutdown From V_{IN}

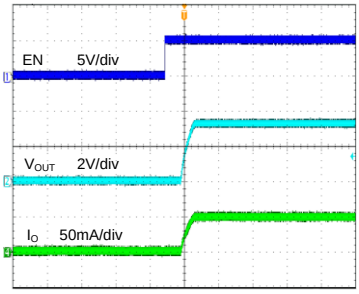
(V_{IN}=5.0V, V_{OUT}=3.3V, I_O=50mA)



Time (20ms/div)

Startup From Enable

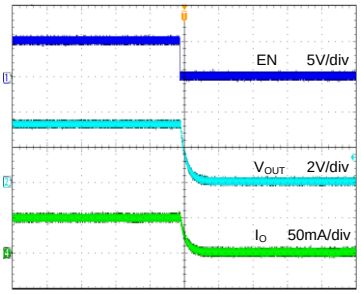
(V_{IN}=5.0V, V_{OUT}=3.3V, I_O=50mA)



Time (400μs/div)

Shutdown From Enable

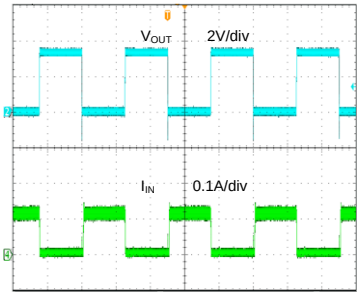
(V_{IN}=5.0V, V_{OUT}=3.3V, I_O=50mA)



Time (800μs/div)

Hard Short Protection

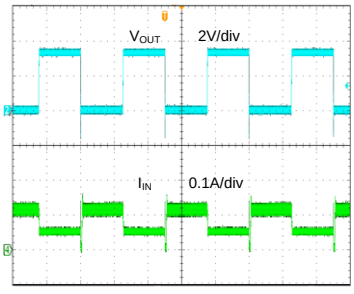
(V_{IN}=5.0V, V_{OUT}=3.3V, Null load to short)



Time (4ms/div)

Hard Short Protection

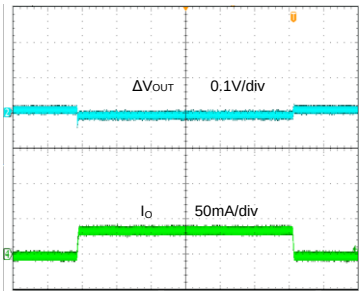
(V_{IN}=5.0V, V_{OUT}=3.3V, 50mA to short)



Time (4ms/div)

Load Transient

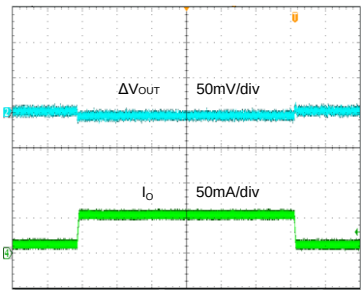
(V_{IN}=5.0V, V_{OUT}=3.3V, I_O=0~35mA)



Time (800μs/div)

Load Transient

(V_{IN}=5.0V, V_{OUT}=3.3V, I_O=10~50mA)



Time (800μs/div)

Application information

The SY20714 is a 50mA linear regulator with extra low dropout voltage. Like any other LDO regulator, SY20714 requires input and output decoupling capacitors.

Input capacitor C_{IN}:

A typical X5R or better grade ceramic capacitor with 1uF capacitance is recommended in this application. This input capacitor must be located close to the device to minimize the input noise.

Output capacitor C_{OUT}:

SY20714 is capable of working with small output capacitors. A 2.2uF output capacitance can be used in this application. Higher capacitance values help to improve transient.

Dropout Voltage:

SY20714 has a very low dropout voltage due to its extra low $R_{DS(ON)}$ of the main PMOS which determines the lowest usable supply .

$V_{DROPOUT}=V_{IN}-V_{OUT}=R_{DS(ON)}\times I_{OUT}$

Over Current and Short Circuit Protection:

The device includes over current and short circuit protection. The current limitation circuit regulates the output current to its limitation threshold to protect IC from damage. Under over current or short circuit condition, the power loss of the IC is relative high, which may trigger the thermal protection.

Thermal Considerations:

The SY20714 can deliver up to 50mA load current over the full operating junction temperature range. However, the maximum output current must be de-rated at higher ambient temperature to ensure the junction temperature does not exceed 125℃. With all possible conditions, the junction temperature must be within the range specified under operating conditions. Power dissipation can be calculated based on the output current and the voltage drop across regulator.

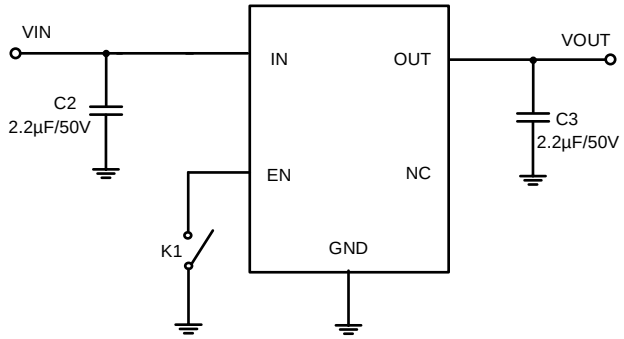
$P_D=(V_{IN}-V_{OUT})\times I_{OUT}+V_{IN}\times I_{GND}$

The final operating junction temperature for any set of condition can be estimated by the following thermal equation:

$P_{D(MAX)}=(T_{J(MAX)}-T_A)/\theta_{JA}$

Where $T_{J(MAX)}$ is the maximum junction temperature of die (125℃) and T_A is the maximum ambient temperature.

Schematic



BOM List

Reference Designator	Description	Part Number	Manufacturer
U1	24V, 50mA	SY20714AAC	Silergy
C2, C3	CHIP CAP X7R 2.2μF ±10% 50V 1206	C3216X7R1H225K	TDK

Layout Design:

PCB layout is very important for reliable operation of the IC. The input and output capacitors, C_{IN} and C_{OUT}, should be put close to IC and connect to IN and OUT pins with short and thick traces. The loop formed by C_{IN}, IN and GND should be minimized. It is desired to connect the GND pin to a ground plane to maximize the power dissipation.

Following is an example of PCB layout,

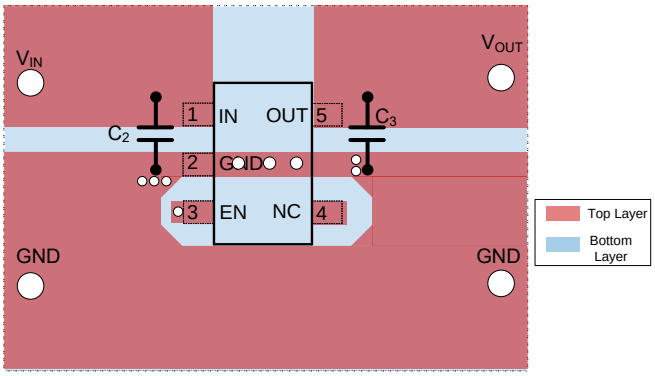
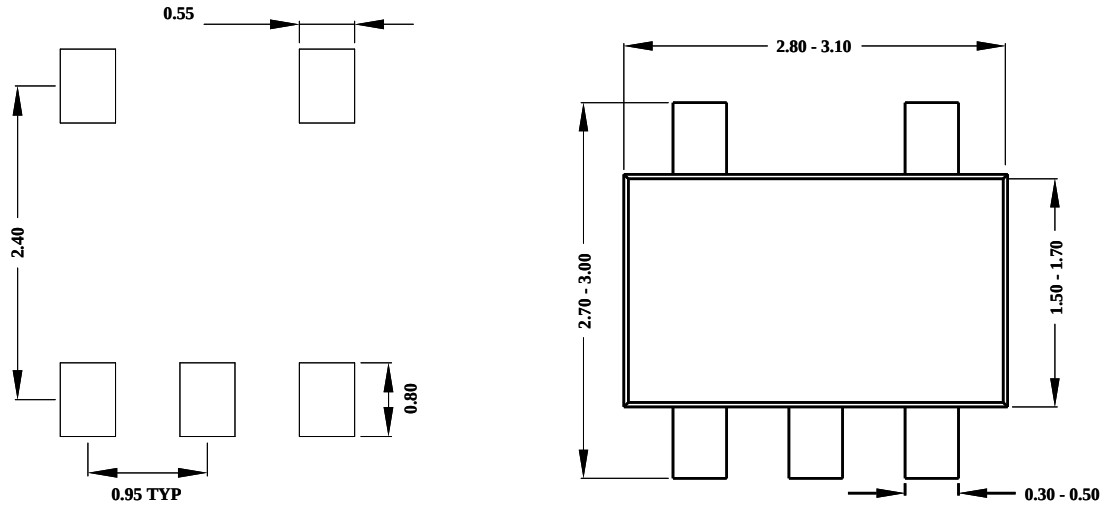
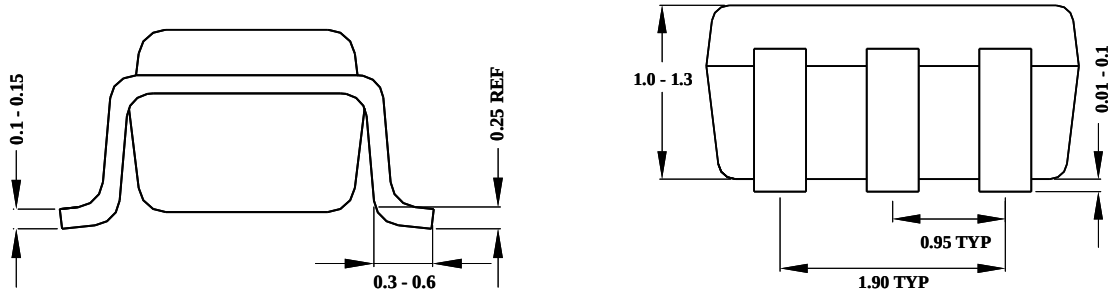


Figure 3. PCB Layout Suggestion

SOT23-5 Package outline & PCB layout design



Recommended Pad Layout

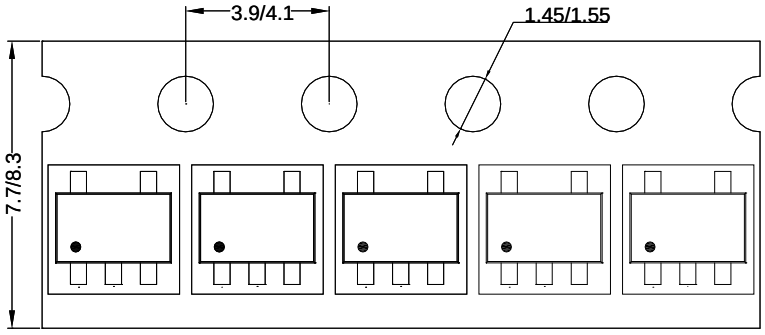


Notes: All dimensions are in millimeters.
All dimensions don't include mold flash & metal burr.

Taping & Reel Specification

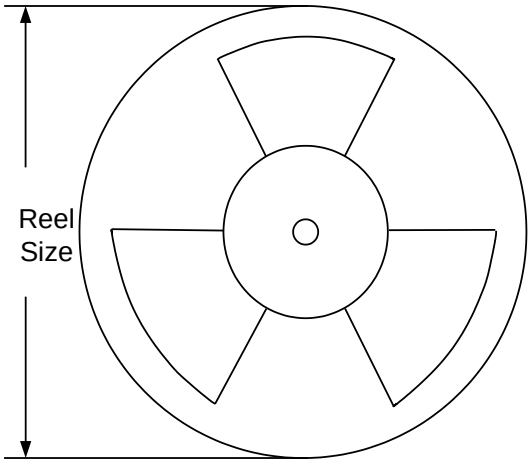
1. Taping orientation

SOT23-5



Feeding direction ⟶

2. 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
SOT23-5	8	4	7"	280	160	3000

3. Others: NA

Revision History

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

Date	Revision	Change
Mar.22, 2024	Revision 1.0	Language improvements for clarity
July 22, 2014	Revision 0.9	Initial Release

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