SY2A27317A

1350mA High Accuracy Current Limit Low Dropout Regulator Have fast line and load transient response

General Description

The SY2A27317A is a 1350mA high current capacity linear regulator that provides high output accuracy, fast line and load transient response. The device offers protection features including over current limit, output short protection and over temperature operation.

The SY2A27317A is available in compact with CSP-2.4mm×2.4mm-36 package.

Features

- Input Voltage Range: 1.65V to 3.3V
- Output Current up to 1350mA
- PSRR at 1kHz : 55dB(Typ)
- Adjustable Output FB Voltage Accuracy : ±1% @T_A=25˚C
- Drop Output Voltage : Max=0.4V
- Packages CSP 2.4mm×2.4mm -36
- RoHS Compliant and Halogen Free
- AEC Q100 Grade 2
- -40˚C to +105˚C Ambient Temperature Range

Applications

- Automotive BGA SSD

Typical Application

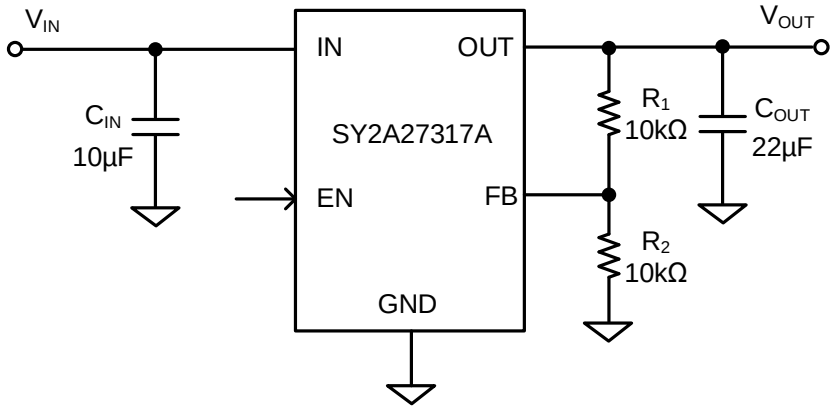


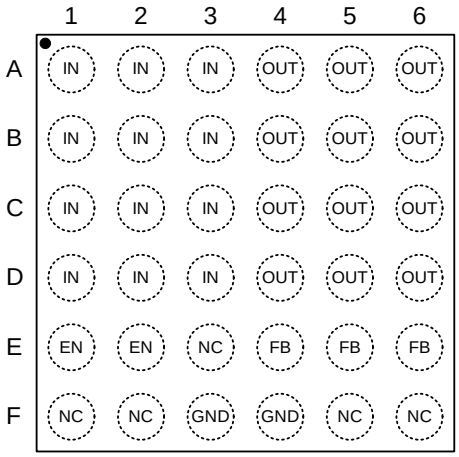
Figure1. Schematic Diagram

Ordering Information

Ordering Part Number	Package Type	Top Mark
SY2A27317AUYS	CSP 2.4×2.4 -36 RoHS Compliant and Halogen Free	**5f*xyz***

x = year code, y = week code, z = lot number code

Pinout (top view)



PIN Name	PIN NO.	Pin Description
IN	A1~A3, B1~B3, C1~C3, D1~D3	Power input pin. Decouple this pin to the GND pin with at least a 10μF ceramic capacitor.
OUT	A4~A6, B4~B6, C4~C6, D4~D6	Output voltage pin. Decouple this pin to the GND pin with at least a 22μF ceramic capacitor.
EN	E1~E2	Enable control pin.
NC	E3, F1~F2, F5~F6	Not connected.
FB	E4~E6	Output voltage adjust pin. Feedback the output voltage through resistor voltage divider network. $V_{OUT} = 0.6V \times (1 + \frac{R_1}{R_2})$
GND	F3, F4	Ground.

Block Diagram

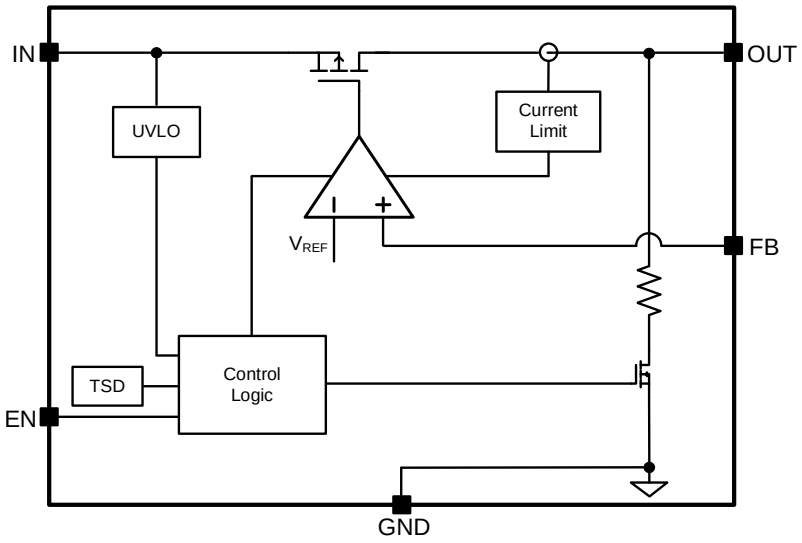


Figure2. Block Diagram

Absolute Maximum Ratings

Parameter (Note 1)	Min	Max	Unit
IN, EN, FB, OUT	-0.3	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	40	°C/W
θ_{JC} Junction-to-Case Thermal Resistance	0.8	
P_D Power Dissipation T_A = 25°C	2.5	W

Recommended Operating Conditions

Parameter (Note 3)	Min	Max	Unit
IN, EN, FB, OUT	1.65	3.3	V
Junction Temperature, Operating	-40	105	°C
Ambient Temperature	-40	105	

Electrical Characteristics

(V_{IN}=1.65V to 3.3V, I_{OUT}=1mA, C_{IN}=10μF, C_{OUT}=22μF, T_A=-40℃ to +105℃. Typical values are at V_{IN}=1.8V, T_A =25°C, unless otherwise specified.)

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
Input Voltage Range	V_{IN}			1.65		3.3	V
UVLO ON Threshold	V_{UVLO_ON}	EN=High		1.1		1.65	V
UVLO Hysteresis	V_{UVLO_HYS}	EN=High			0.05		V
Adjustable Output FB Voltage Accuracy	V_{FB_ACC}	V_{IN}=1.8V, I_{OUT}=1mA to 1350mA	T_A=25℃	594	600	606	mV
			T_A=-40℃ to 105℃	588	600	612	mV
Line Regulation	ΔV_{LINE}	V_{IN}=1.65V to 3.3V, I_{OUT}=1mA, I_{OUT}=100mA		-1		1	%/V
Load Regulation	ΔV_{LOAD}	V_{IN}=1.8V, I_{OUT}=1mA to 1350mA			0.5		%
Dropout Voltage (Note 4)	V_{DROP}	I_{OUT}=1350mA				0.4	V
Quiescent Current	I_Q	EN high, No Load			300		μA
Shutdown Current	I_{SD}	EN low, No Load			0.1	5	μA
Output Current	I_{OUT}				1350		mA
Output Current Protection	I_{OCP}			1500			mA
Fold-back Short Current		V_{OUT} short to ground			750		mA
Power Supply Rejection Ratio (Note 5)	PSRR	V_{IN}=1.8V, I_{OUT}=100mA, f=1kHz			55		dB
EN Input Low Voltage	V_{EN_L}			0		0.4	V
EN Input High Voltage	V_{EN_H}			1.4		3.3	V
EN Input Leakage	I_{EN_L}	V_{IN}=3.3V, V_{EN}=3.3V				1	μA
Output Discharge Resistor	R_{DSC}	V_{IN}=1.8V, V_{OUT}=1.2V, EN=Low			3.8		Ω
Thermal Shutdown Threshold (Note 5)	TSD				150		℃

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Thermal Shutdown Hysteresis (Note 5)	TSD_{HYS}			20		℃
VOUT Rise Time	t_R	C_{OUT}=22μF, Null load, 10% V_{OUT} to 90% V_{OUT}, see figure 3		200		μs
VOUT Fall Time	t_F	C_{OUT}=22μF, Null load, 90% V_{OUT} to 10% V_{OUT}, see figure 3		100		μs
Turn on Delay Time	t_{d_ON}	C_{OUT}=22μF, Null load, 50% EN to 10% V_{OUT}, see figure 3		120		μs
Turn off Delay Time	t_{d_OFF}	C_{OUT}=22μF, Null load, 50% EN to 90% V_{OUT}, see figure 3		10		μs

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

Note 2: θ_{JA} is simulated at T_A=25°C on Silergy’s demo board.

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

Note 4: Dropout voltage is the voltage difference between the input and the output.

Note 5: This specification is guaranteed by design.

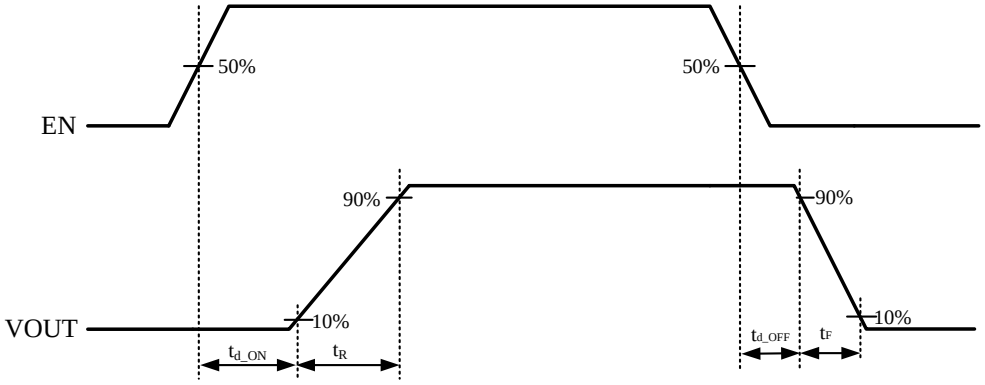
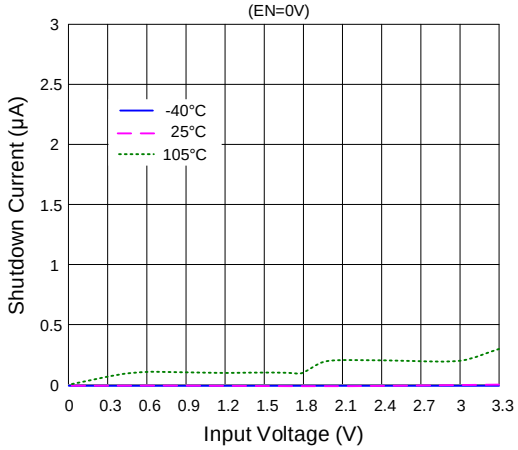


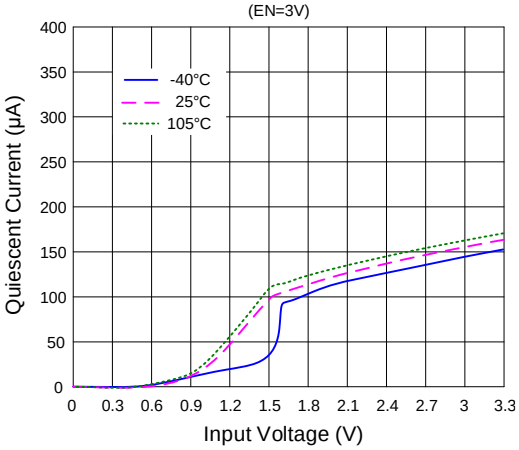
Figure 3. Power ON/OFF Timing Definition

Typical Performance Characteristics

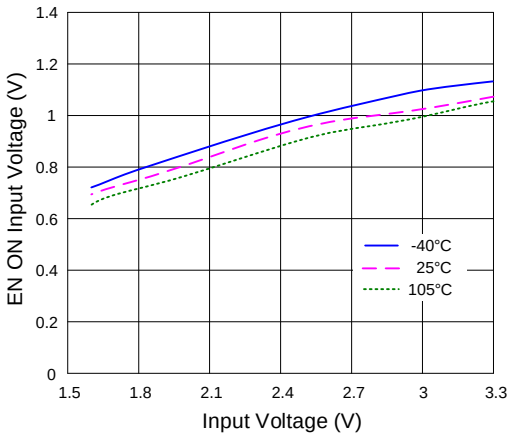
Shutdown Current vs. Input Voltage
(EN=0V)



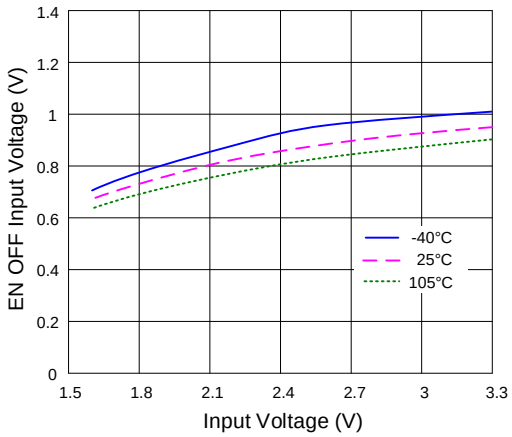
Quiescent Current vs. Input Voltage
(EN=3V)



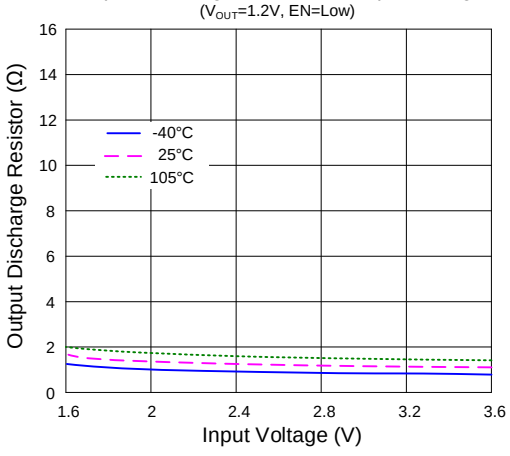
EN ON Input Voltage vs. Input Voltage



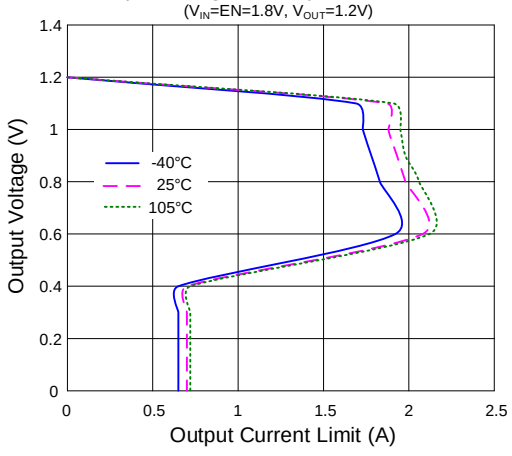
EN OFF Input Voltage vs. Input Voltage



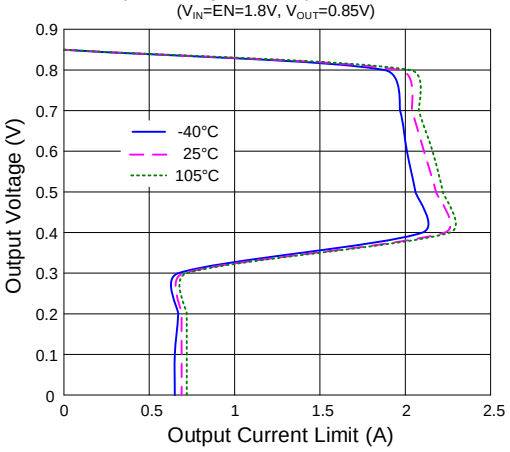
Output Discharge Resistor vs. Input Voltage
(V_{OUT}=1.2V, EN=Low)



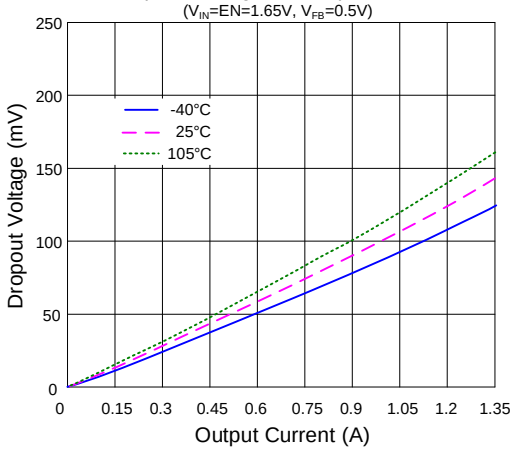
Output Voltage vs. Output Current Limit
(V_{IN}=EN=1.8V, V_{OUT}=1.2V)



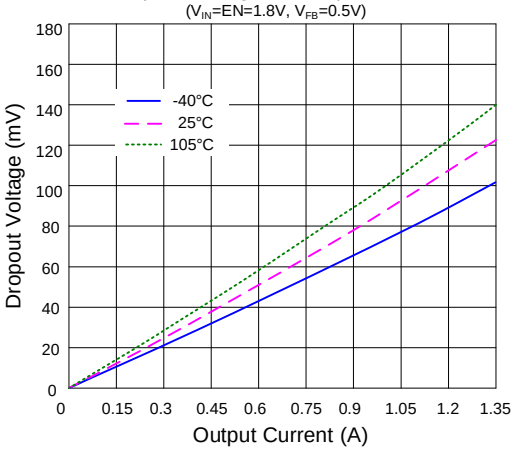
Output Voltage vs. Output Current Limit
(V_{IN}=EN=1.8V, V_{OUT}=0.85V)



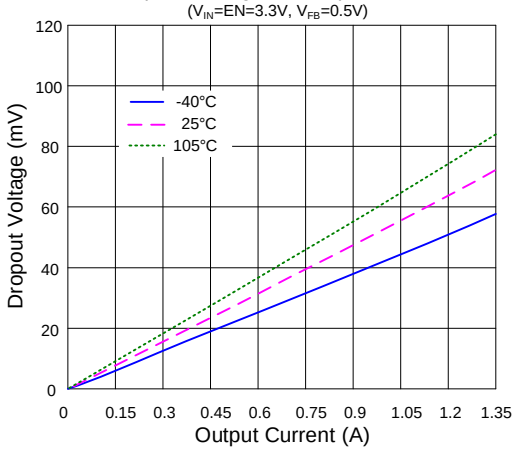
Dropout Voltage vs. Output Current
(V_{IN}=EN=1.65V, V_{FB}=0.5V)



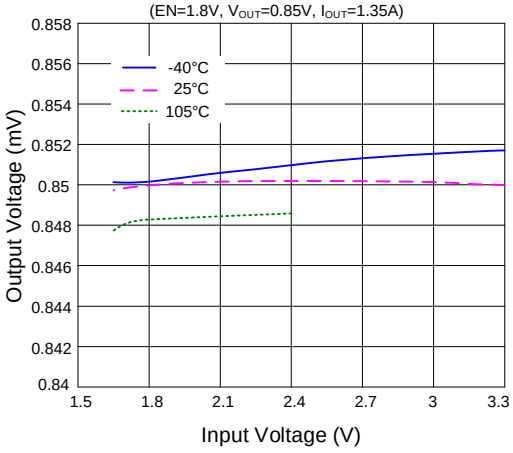
Dropout Voltage vs. Output Current
(V_{IN}=EN=1.8V, V_{FB}=0.5V)



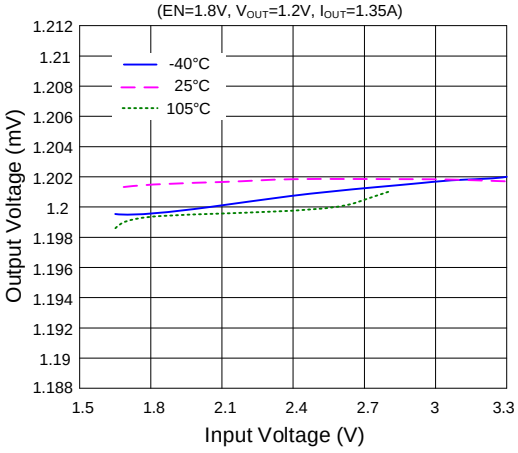
Dropout Voltage vs. Output Current
(V_{IN}=EN=3.3V, V_{FB}=0.5V)



Output Voltage vs. Input Voltage
(EN=1.8V, V_{OUT}=0.85V, I_{OUT}=1.35A)

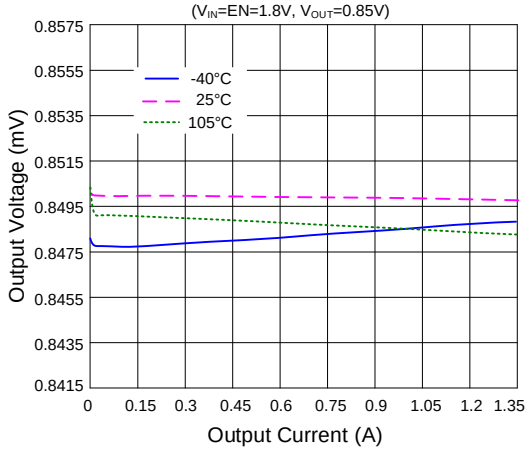


Output Voltage vs. Input Voltage
(EN=1.8V, V_{OUT}=1.2V, I_{OUT}=1.35A)



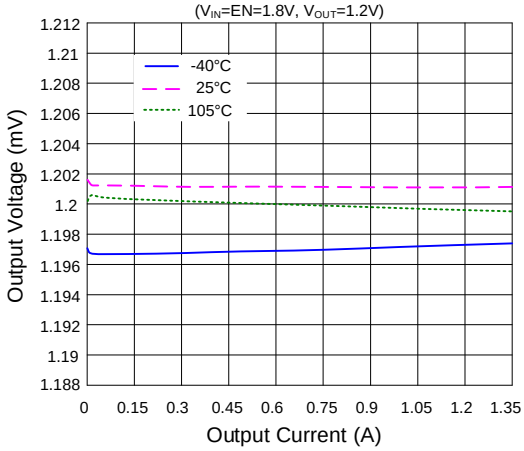
Output Voltage vs. Output Current

(V_{IN}=EN=1.8V, V_{OUT}=0.85V)



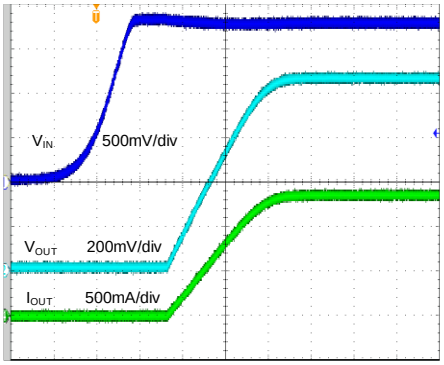
Output Voltage vs. Output Current

(V_{IN}=EN=1.8V, V_{OUT}=1.2V)



Startup from V_{IN}

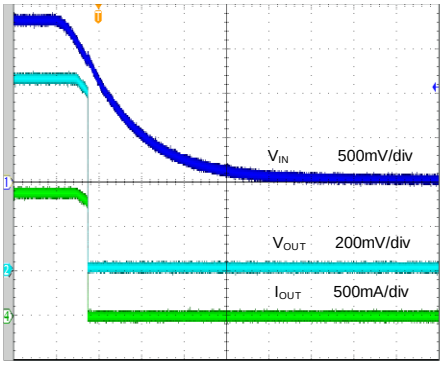
(V_{IN}=1.8V, V_{OUT}=0.85V, I_{OUT}=1.35A)



Time (80µs/div)

Shutdown from V_{IN}

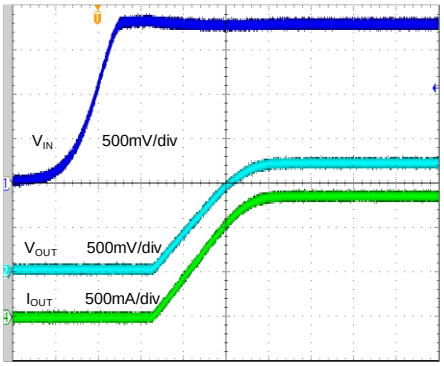
(V_{IN}=1.8V, V_{OUT}=0.85V, I_{OUT}=1.35A)



Time (20ms/div)

Startup from V_{IN}

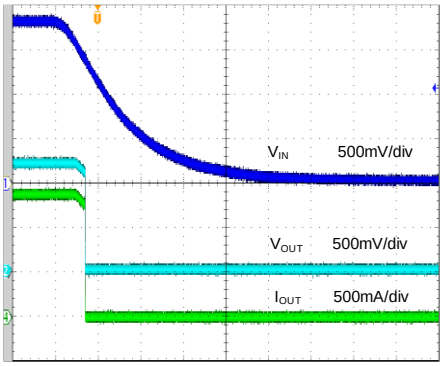
(V_{IN}=1.8V, V_{OUT}=1.2V, I_{OUT}=1.35A)



Time (80µs/div)

Shutdown from V_{IN}

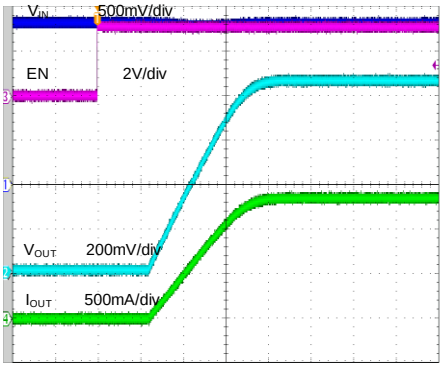
(V_{IN}=1.8V, V_{OUT}=1.2V, I_{OUT}=1.35A)



Time (20ms/div)

Startup from EN

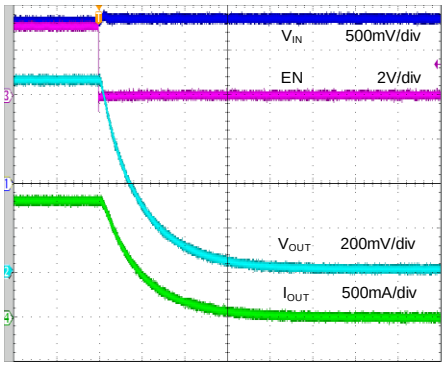
(V_{IN}=1.8V, V_{OUT}=0.85V, I_{OUT}=1.35A)



Time (80µs/div)

Shutdown from EN

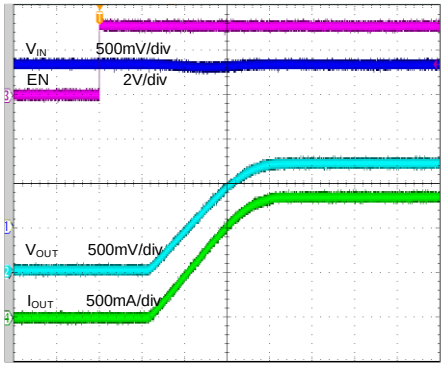
(V_{IN}=1.8V, V_{OUT}=0.85V, I_{OUT}=1.35A)



Time (10µs/div)

Startup from EN

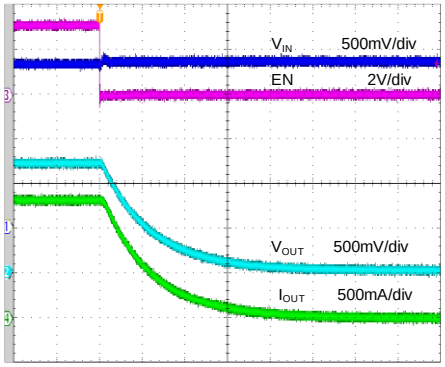
(V_{IN}=1.8V, V_{OUT}=1.2V, I_{OUT}=1.35A)



Time (80µs/div)

Shutdown from EN

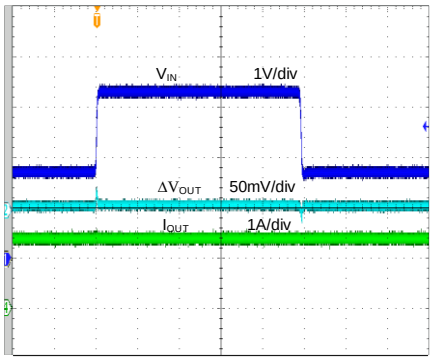
(V_{IN}=1.8V, V_{OUT}=1.2V, I_{OUT}=1.35A)



Time (10µs/div)

Line Transient

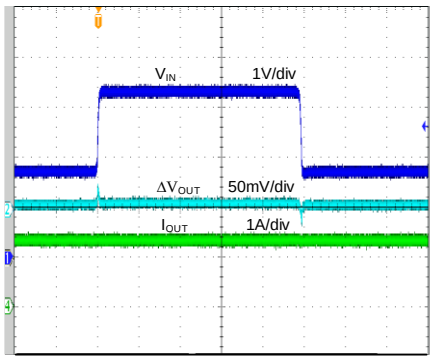
(V_{IN}=EN=1.65V to 3.3V, V_{OUT}=0.85V, I_{OUT}=1.35A)



Time (1ms/div)

Line Transient

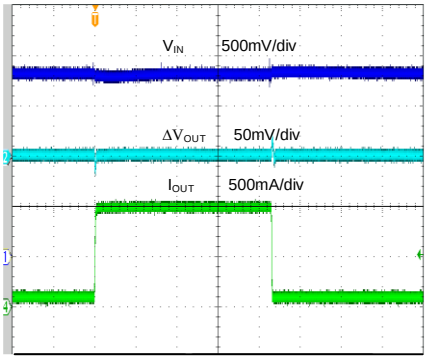
(V_{IN}=EN=1.65V to 3.3V, V_{OUT}=1.2V, I_{OUT}=1.35A)



Time (1ms/div)

Load Transient

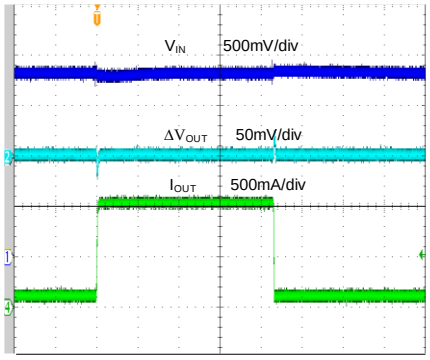
(V_{IN}=EN=1.8V, V_{OUT}=0.85V, I_{OUT}=0.1A to 1A to 0.1A)



Time (80μs/div)

Load Transient

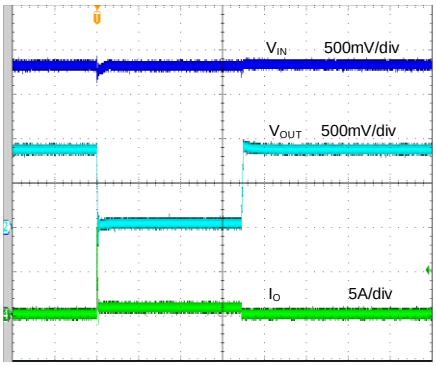
(V_{IN}=EN=1.8V, V_{OUT}=1.2V, I_{OUT}=0.1A to 1A to 0.1A)



Time (80μs/div)

Short Protect

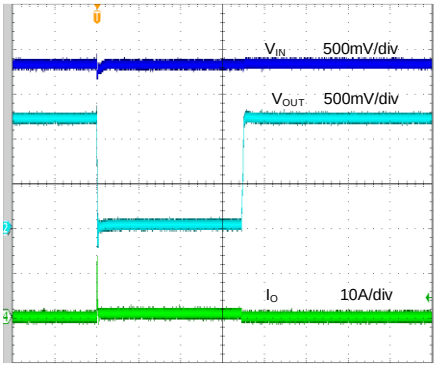
(V_{IN}=1.8V, V_{OUT}=0.85V)



Time (400μs/div)

Short Protect

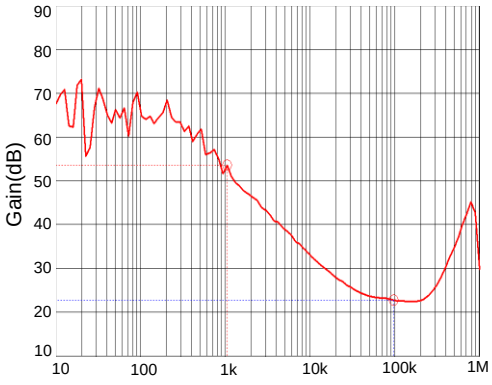
(V_{IN}=1.8V, V_{OUT}=1.2V)



Time (400μs/div)

PSRR

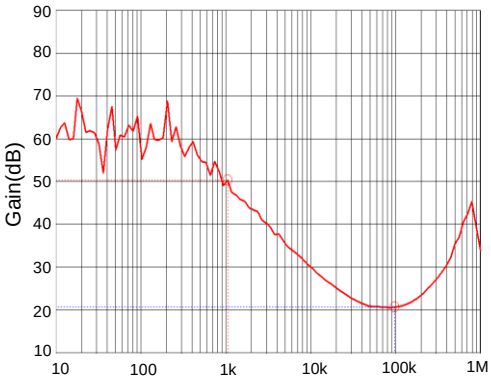
(V_{IN}=1.8V, V_{OUT}=0.85V, I_{OUT}=0.1A)



Frequency(Hz)

PSRR

(V_{IN}=1.8V, V_{OUT}=1.2V, I_{OUT}=0.1A)



Frequency(Hz)

Operation

The SY2A27317A is a 1350mA high current capacity linear regulator, provides high output accuracy, fast line and load transient response. The device with fully protection includes over current limit, output short protection and over temperature operation. The device is available in compact with CSP-2.4mm×2.4mm-36 package.

Applications Information

Input Capacitor C_{IN}

To minimize the potential noise problem and improve power-supply rejection ratio (PSRR) and transient response, place a typical X7R or better grade ceramic capacitor close to the IN and GND pins. Care should be taken to minimize the loop area formed by C_{IN}, and the IN/GND pins. In this case, a 10μF low ESR ceramic capacitor is recommended.

Output Capacitor C_{OUT}

For stable operation over the full temperature range, a 22μF low-ESR ceramic capacitor is recommended. Use 22μF to reduce noise, improve load-transient response and PSRR. Some ceramic dielectrics exhibit large capacitance and ESR variations with temperature.

Feedback Resistor Dividers R_2 and R_3

Choose R_2 and R_3 to program the proper output voltage. To minimize the power consumption under light loads, choose large resistance values (between 1kΩ and 1MΩ) for both resistors. For example, if V_{OUT} is 1.2V, R_3=10kΩ is chosen, then using following equation, R_2 can be calculated to be 10kΩ:

$$R_2 = \frac{0.6V}{V_{OUT} - 0.6V} \times R_3$$

Dropout Voltage

The SY2A27317A has a very low dropout voltage due to its extra low $R_{DS(ON)}$ of the main PMOS determines the lowest usable supply.

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

Short Circuit Protection

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

Enable Protection

The enable pin for the SY2A27317A is active high. The output voltage is enabled when the enable pin voltage is above $V_{IH(EN)}$ and disabled when the enable pin voltage is below $V_{IL(EN)}$. If independent control of the output voltage is not needed, then connect the enable pin to the input.

PCB Layout Guide

For the best performance of the SY2A27317A, the following guidelines must be strictly followed:

1) Keep all Power traces (VIN / OUT / GND) 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) Input and output capacitors should be placed closed to the SY2A27317A and connected to ground plane to reduce noise coupling.

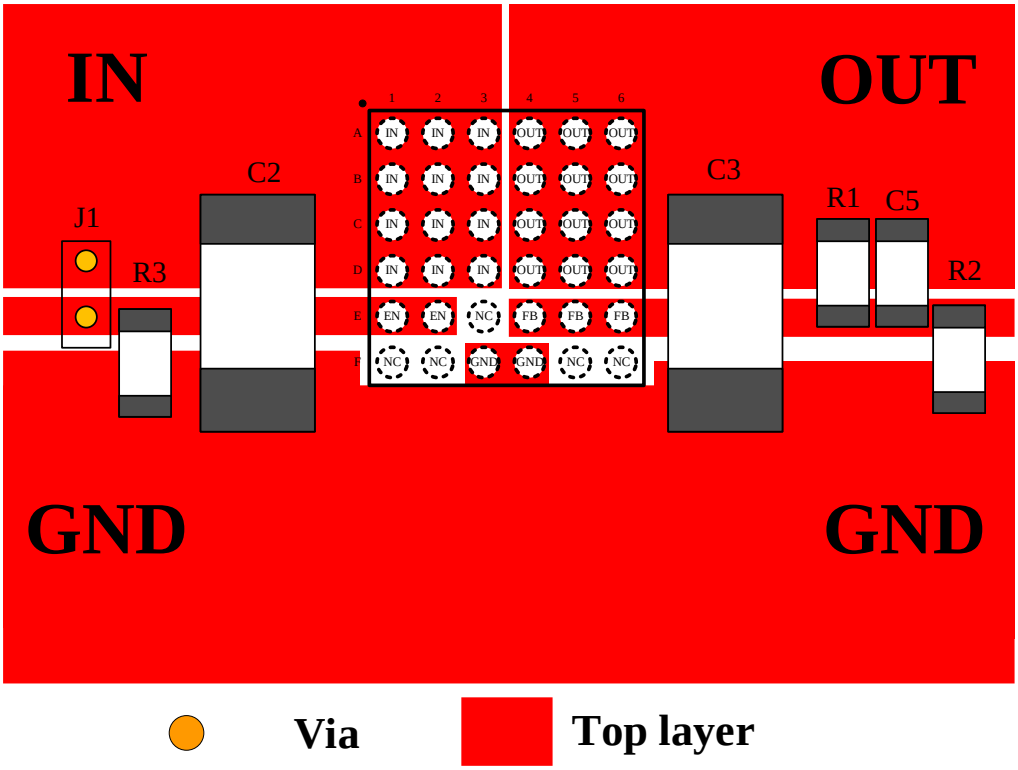
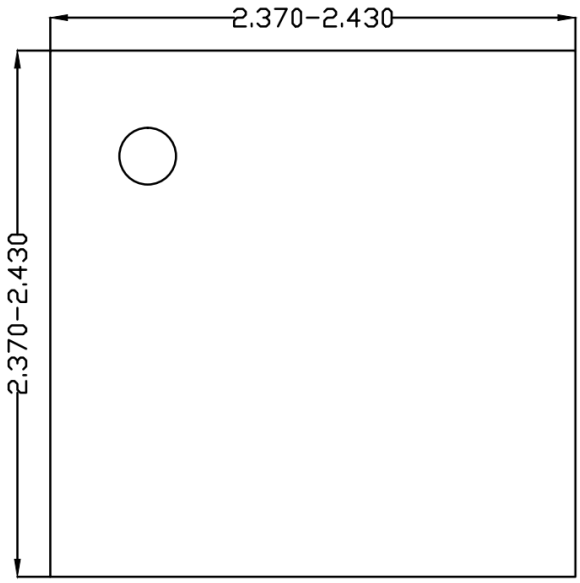
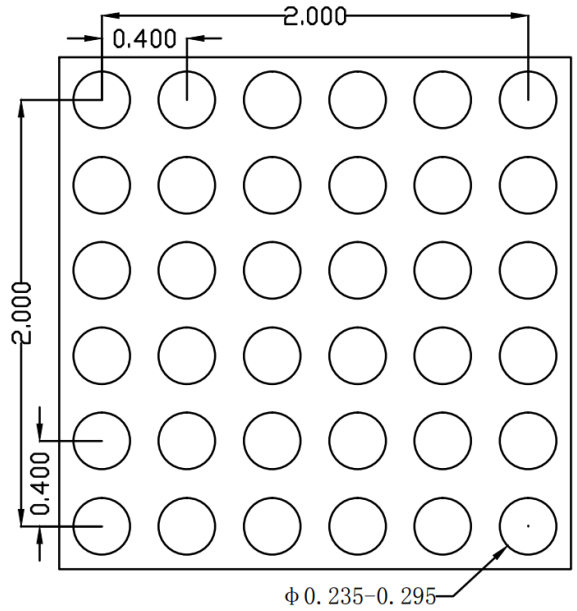


Figure4. PCB Layout Suggestion

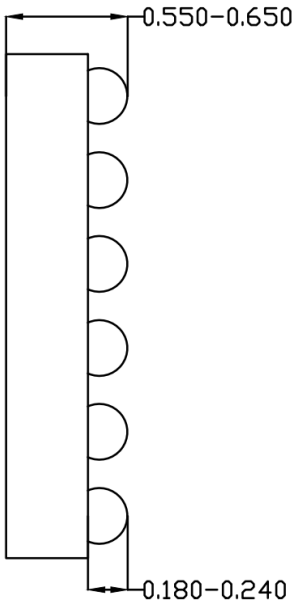
CSP 2.4×2.4 -36 Package Outline



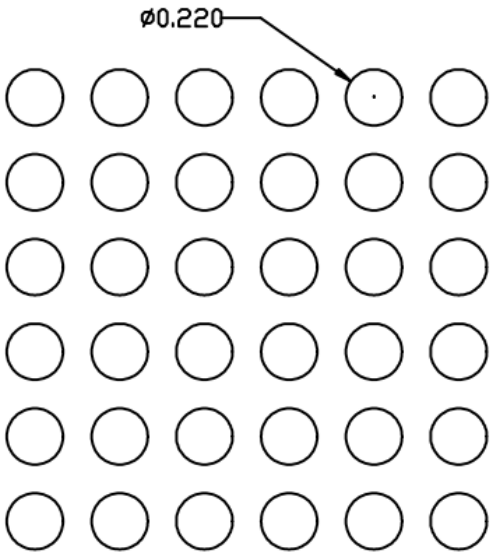
Top View



Bottom View



Side View



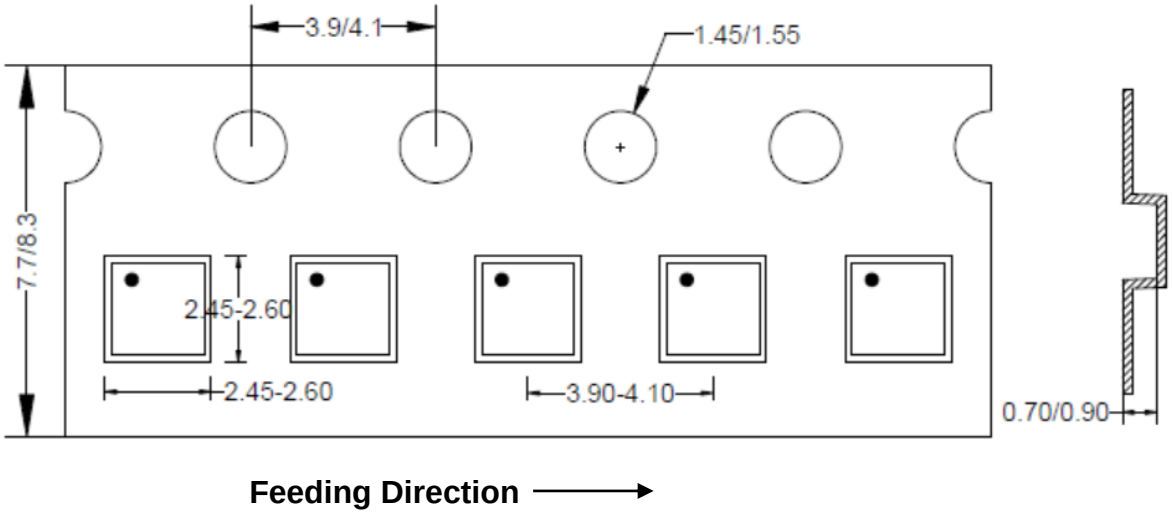
Recommended PCB layout
(Reference only)

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

Taping & Reel Specification

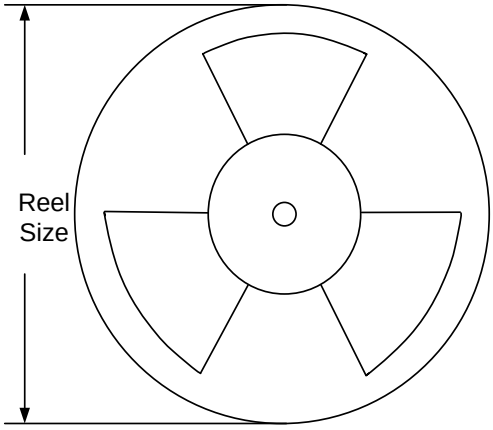
1. Taping Orientation

CSP2.4×2.4-36



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 (pcs)
CSP2.4×2.4-36	8	4	7"	280	160	3000

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
Nov.16, 2023	Revision 1.0	Initial Release

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