SA21340IAAT

36V, 150mA Ultra Low Quiescent LDO

General Description

The SA21340IAAT is an automotive grade, 150mA high current capacity linear regulator with ultra-low ground current and low drop-out voltage. The SA21340I has a fixed 3.3V output voltage. The device offers protective features, including over-current limit, output short protection and over-temperature protection.

The SA21340I is available in a compact SOT23-5 package.

Features

- Wide Input Voltage Range: 4V to 36V
- Fixed Output Voltage: 3.3V ± 2%
- Low-dropout Voltage: 150mV at Full Load 150mA
- Ultra-low Quiescent Current
- Extremely Low Shutdown Current
- Stability with Tantalum or Ceramic Capacitors
- Excellent Load And Line Regulation
- Over-Current Limit Protection
- Output Short Circuit Protection (Hiccup Mode)
- Over-Temperature Protection
- Moisture Sensitivity Level (MSL): 1
- Package SOT23-5
- RoHS Compliant and Halogen Free
- Automotive AEC- Q100 Grade 1 Qualified

Applications

- Note Book
- Cell Phone
- Automotive LED Lighting ECU
- Automotive Body Modules

Typical Application

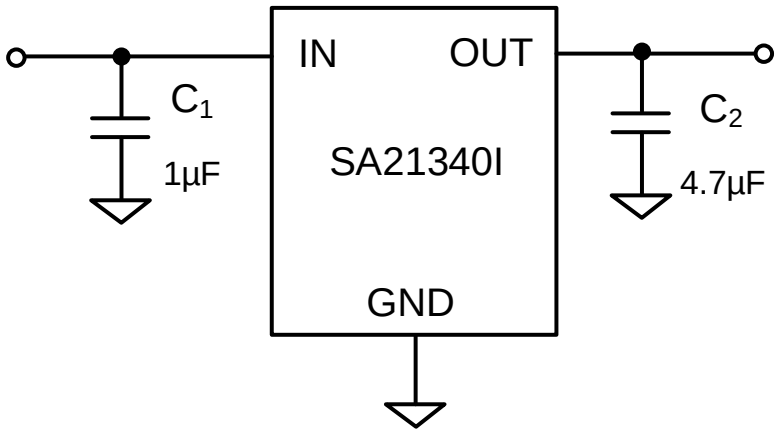


Figure1. Schematic Diagram

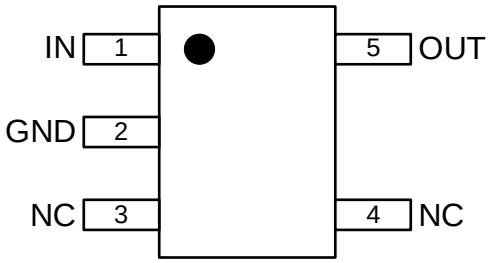
Ordering Information

Ordering Part Number	Package Type	Top Mark
SA21340IAAT	**SOT23-5** RoHS Compliant and Halogen Free	**2f**xyz

Device code: 2f

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

Pinout (top view)



Pin Description

Pin Name	Pin number	Pin Description
IN	1	Power supply input. Bypass this pin to the ground pin with a 1μF capacitor.
GND	2	Ground pin.
OUT	5	Output pin. Bypass this pin to ground pin with a low ESR 4.7μF output capacitor.
NC	3,4	No connection.

Block Diagram

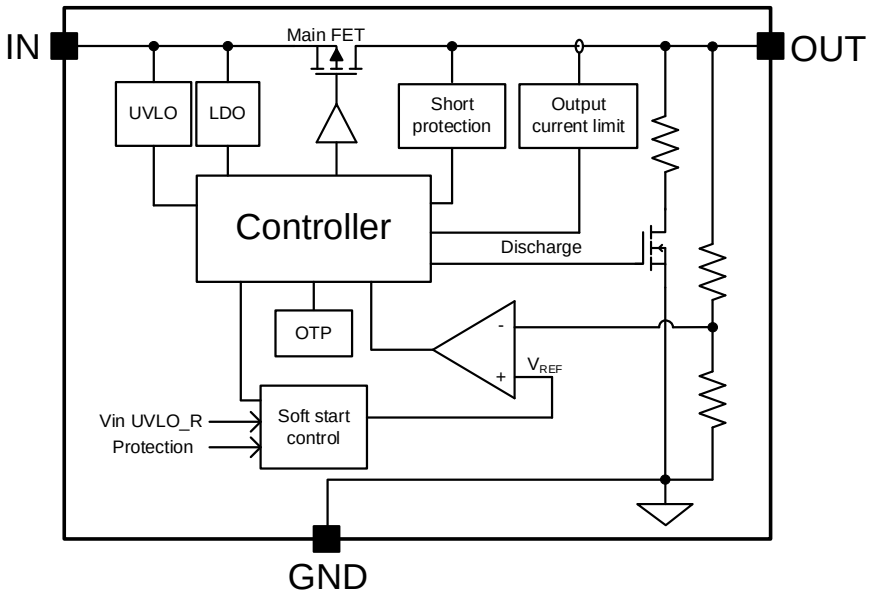


Figure2. Block Diagram

Absolute Maximum Ratings

Parameter (Note1)	Min	Max	Unit
IN	-0.3	40	V
OUT	-0.3	8	
Lead Temperature (Soldering, 10 sec.)		260	°C
Junction Temperature, Operating	-40	150	
Storage Temperature	-65	150	

Thermal Information

Parameter (Note2)	Typ	Unit
θ_{JA} Junction-to-ambient Thermal Resistance	210	°C/W
θ_{JC} Junction-to-case Thermal Resistance	38.4	
P_D Power Dissipation T_A = 25°C	0.47	W

Recommended Operating Conditions

Parameter (Note 3)	Min	Max	Unit
IN	4	36	V
OUT	0	8	
Ambient Temperature	-40	125	°C

Electrical Characteristics

(V_{IN} = V_{EN}=12V, T_J = -40°C~125°C, unless otherwise specified, the values are guaranteed by test design or statistical correlation (Note 4))

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	V_{IN}		4		36	V
Input Voltage UVLO Threshold	V_{ULVO}	V_{IN} rising	2.9	3.3	4	V
UVLO Hysteresis	V_{UVLO_HYS}			200		mV
Output Voltage	V_{OUT}	T_J= -40°C ~ 125°C	3.234	3.3	3.366	V
Line Regulation	ΔV_{LNR}	I_{OUT} = 10mA, 4V≤ V_{IN} ≤ 36V		1	1.5	mV/V
Load Regulation	ΔV_{LDR}	V_{IN}=5V, 10mA ≤ I_{OUT} ≤ 150mA		0.25	0.5	%
Dropout Voltage	ΔV_{DROP}	I_{OUT}=10mA		10	20	mV
		I_{OUT}=150mA		150	300	mV
Quiescent Current	I_Q	I_{OUT}=0mA V_{IN}=(V_{OUT}+1V) ~ 36V		15	22	μA
Current Limit	I_{LMT}	Force V_{OUT} = 3V	600	900	1200	mA
Output Short Protection Threshold	V_{SHORT}	Force V_{OUT} from 3.3V to 0V	0.264	0.528	0.99	V
Output Short Off Time	t_{SHORT_OFF}			16		ms
Power Supply Rejection Ratio (Note 5)	PSRR	Frequency = 100Hz, C_{OUT}=4.7μF, I_{OUT}=10mA, T_A=25°C		60		dB
		Frequency = 100kHz, C_{OUT}=4.7μF, I_{OUT}=10mA, T_A=25°C		35		dB
Soft start Time	t_{SS}			1		ms
Thermal Shutdown Temperature (Note 5)	T_{SD}			150		°C

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Thermal Shutdown Hysteresis (Note 5)	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 T_A = 25°C on a low effective single layer thermal conductivity test board of JEDEC 51-3 thermal measurement standard.

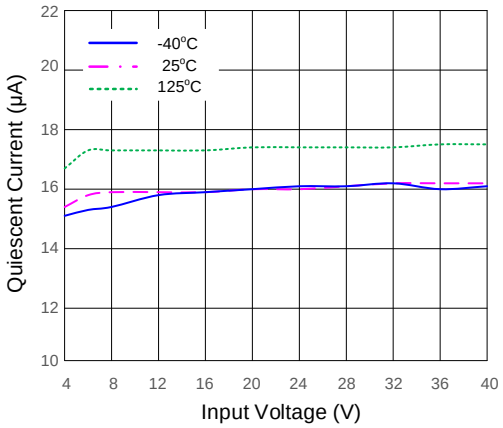
Note 3: The device is not guaranteed to function outside its operating conditions.

Note 4: Unless otherwise stated, limits are 100% production tested under pulsed load conditions such that $T_A \cong T_J$= 25°C. Limits over the operating temperature range (see recommended operating conditions) and relevant voltage range(s) are guaranteed by design, test, or statistical correlation.

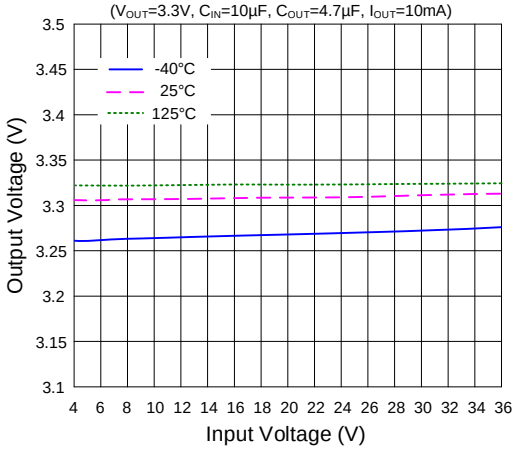
Note 5: Guaranteed by design.

Typical Performance Characteristics

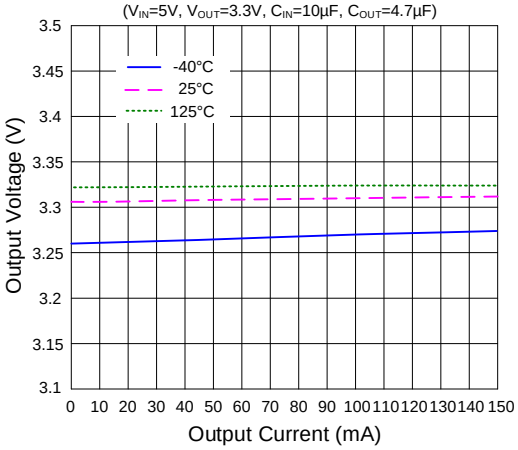
Quiescent Current vs. Input Voltage
(C_{IN}=10μF, C_{OUT}=4.7μF)



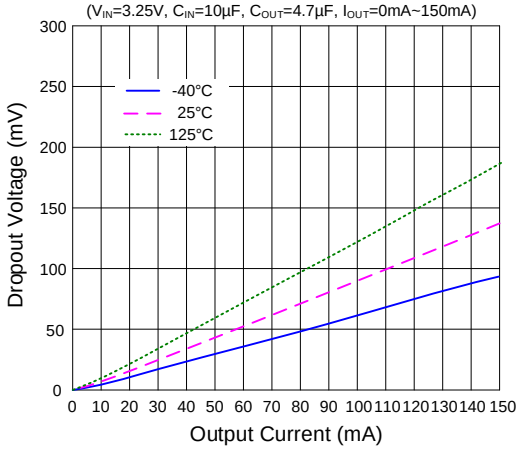
Output Voltage vs. Input Voltage
(V_{OUT}=3.3V, C_{IN}=10μF, C_{OUT}=4.7μF, I_{OUT}=10mA)



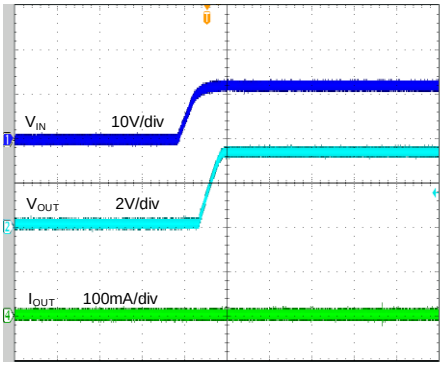
Output Voltage vs. Output Current
(V_{IN}=5V, V_{OUT}=3.3V, C_{IN}=10μF, C_{OUT}=4.7μF)



Dropout Voltage vs. Output Current
(V_{IN}=3.25V, C_{IN}=10μF, C_{OUT}=4.7μF, I_{OUT}=0mA~150mA)

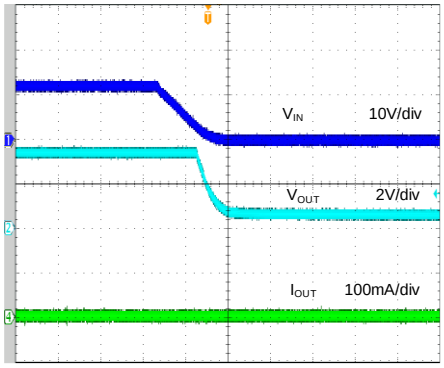


Startup from V_{IN}
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0mA, C_{IN}=10μF, C_{OUT}=4.7μF)



Time (2ms/div)

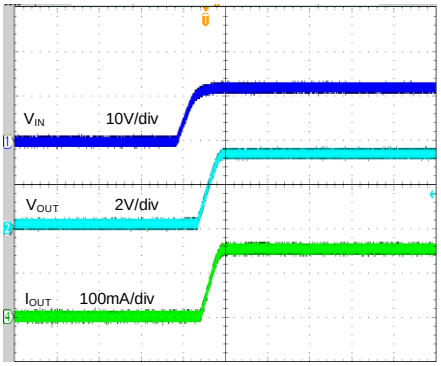
Shutdown from V_{IN}
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=0mA, C_{IN}=10μF, C_{OUT}=4.7μF)



Time (20ms/div)

Startup from V_{IN}

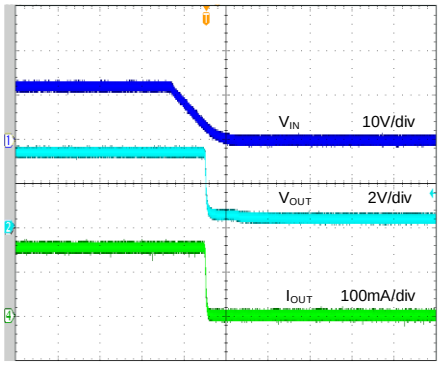
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=150mA, C_{IN}=10μF, C_{OUT}=4.7μF)



Time (2ms/div)

Shutdown from V_{IN}

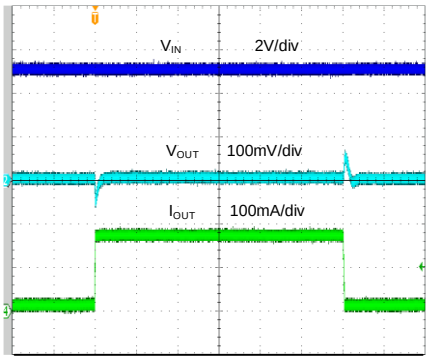
(V_{IN}=12V, V_{OUT}=3.3V, I_{OUT}=150mA, C_{IN}=10μF, C_{OUT}=4.7μF)



Time (20ms/div)

Load Transient

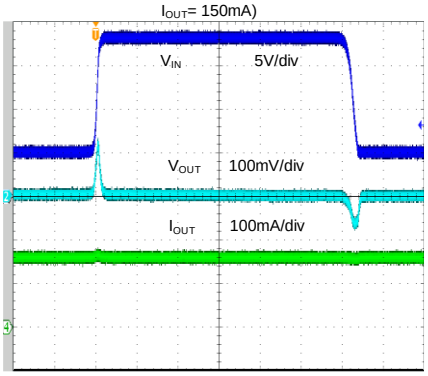
(V_{IN}=5V,V_{OUT}=3.3V, C_{IN}=10μF, C_{OUT}=4.7μF , I_{OUT}=10mA～150mA～10mA)



Time (200μs/div)

Line Transient

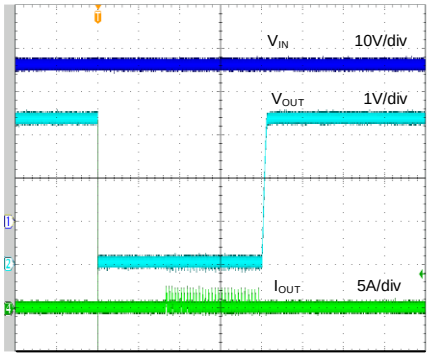
(V_{IN}=5V～18V～5V, V_{OUT}=3.3V, C_{IN}=10μF, C_{OUT}=4.7μF , I_{OUT}= 150mA)



Time (400μs/div)

Short Protection

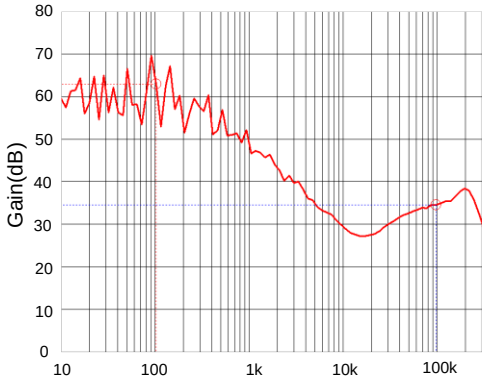
(V_{IN}=36V,V_{OUT}=3.3V, C_{IN}=10μF, C_{OUT}=4.7μF)



Time (10ms/div)

PSRR

(V_{IN}=5V, V_{OUT}=3.3V, I_{OUT}=10mA, C_{OUT}=4.7μF)



Applications Information

The SA21340I is a 150mA high-current capacity linear regulator with ultra-low ground current and low drop-out voltage. This device supports a fixed 3.3V output voltage, also offers protective features, including over-current limit, output short protection and over-temperature protection.

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 high-grade ceramic capacitor close to the IN and GND pins. Care should be taken to minimize the loop area formed by CIN, and the IN/GND pins. A 1μF low ESR ceramic capacitor is recommended for most applications.

Output Capacitor C_{OUT}

For stable operation over the full temperature range, a 4.7μF low-ESR ceramic capacitor is recommended for C_{OUT}. Using larger output-capacitor values such as 22μF can help with reducing the noise, improving load-transient response and PSRR. Some ceramic dielectrics exhibit large capacitance and ESR variations with temperature.

Over Temperature Protection (OTP)

The SA21340I includes over-temperature protection (OTP) circuitry to prevent overheating due to excessive power dissipation. This will turn off the device when the junction temperature exceeds 150°C. Once the junction temperature cools down by approximately 20°C the IC will resume normal operation.

Dropout Voltage

The SA21340I has a very low dropout voltage due to its extra low $R_{DS(ON)}$ of the main PMOS determines the lowest usable supply.

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

Output Short Circuit Protection

If V_{OUT} drops lower than 16% of the OUT set point, the short circuit protection mode will be initiated, and the device will be shut down for approximately 16ms. The device will then restart with a complete soft-start cycle. If the short circuit condition remains another ‘hiccup’ cycle of shutdown and restart will continue indefinitely unless the OTP threshold is reached.

Thermal Considerations

The SA21340I can deliver a current of up to 150mA over the full operating temperature range. However, the maximum output current must be derated at higher ambient temperature. 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.

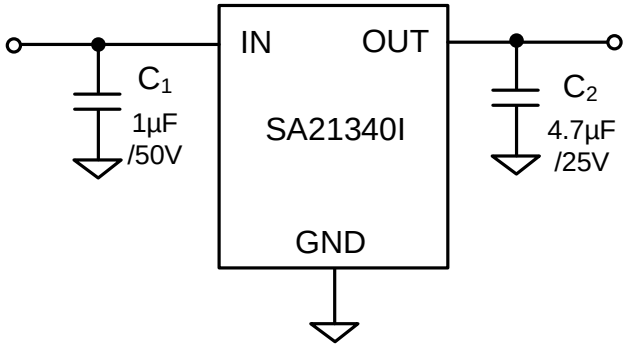
$$P_D=(V_{IN}-V_{OUT})\times I_{OUT}+V_{IN}\times I_{GND}$$

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 and T_A is the maximum ambient temperature. The junction to ambient thermal resistance (θ_{JA}) footprint is 210°C/W for SOT23-5 package.

Schematic



BOM List

Designator	Description	Part Number	Manufacturer
C_1	1μF/50V, 0603,X7R	GCM188R71H105K	Murata
C_2	4.7μF/16V,0603, X7R	GCJ188C70J475K	Murata

PCB Layout Guide

For optimal performance of the SA21340IAAT, the following guidelines must be strictly followed:

1. Place the input/output capacitors as close to the device as possible, minimizing the loop formed by these connections to improve transient performance.
2. Keep all power traces as short and wide as possible. And a 2-layer or 4-layer board is recommended for thermal performance and better current-handling capability.

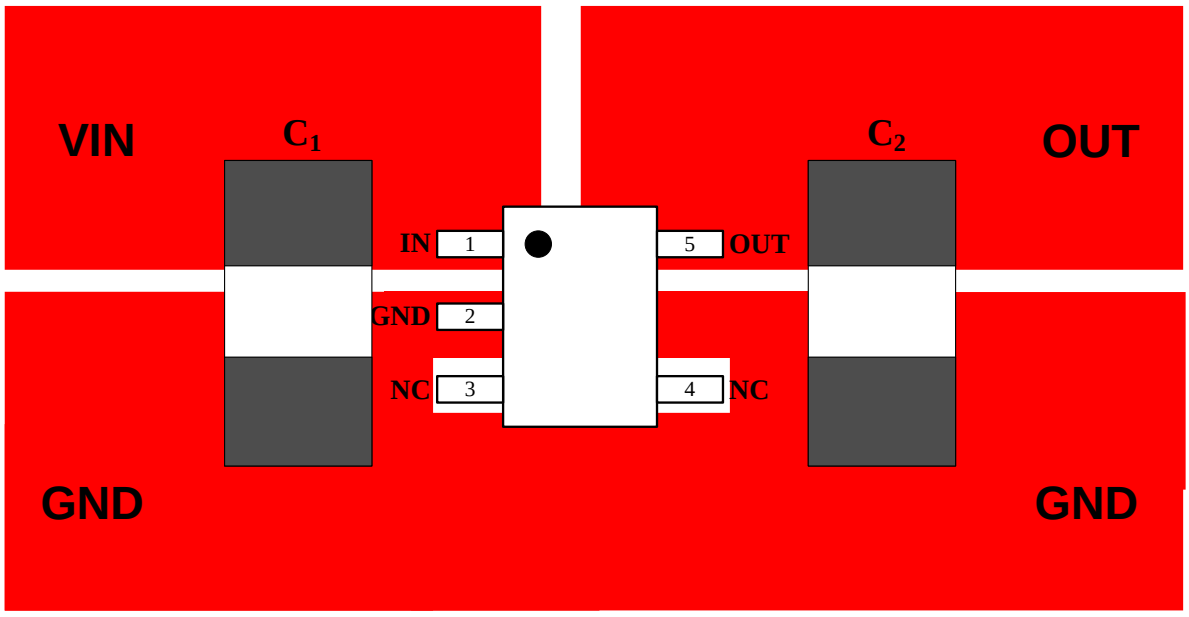
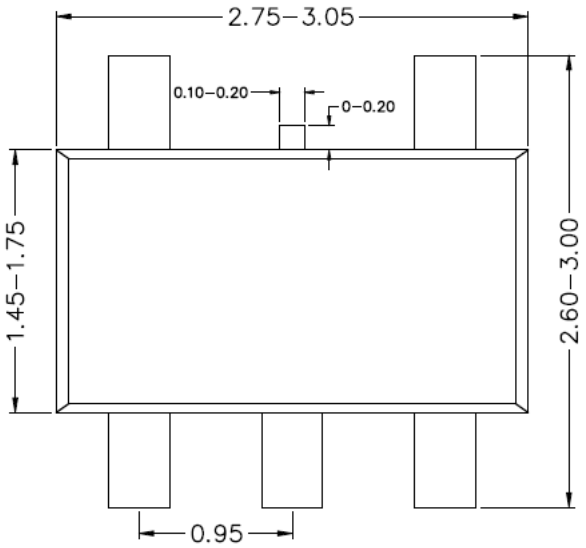
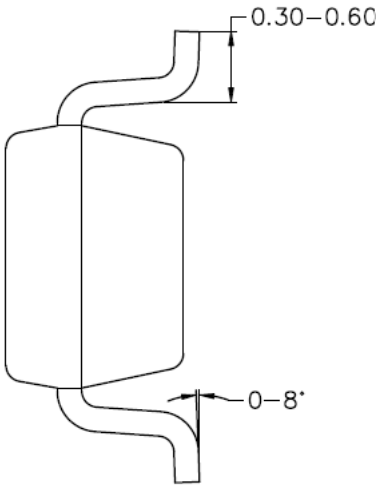


Figure3. PCB Layout Suggestion

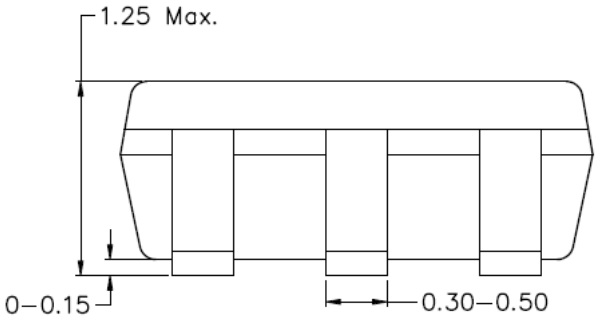
SOT23-5 Package Outline Drawing



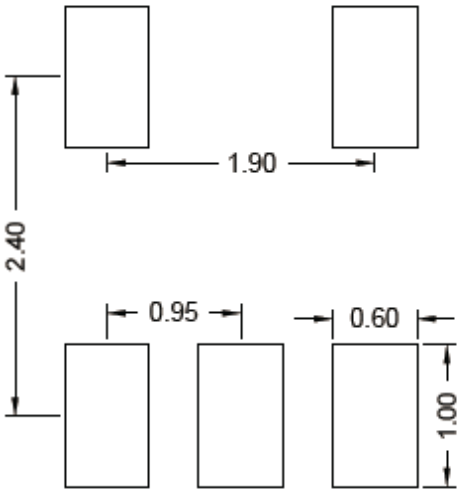
Top view



Side view



Front view



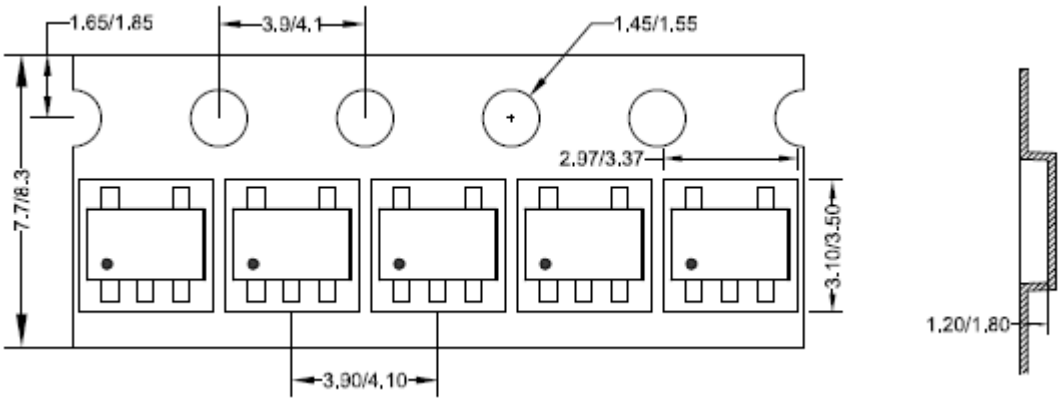
Recommended PCB pad Layout (Reference only)

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

Tape and Reel Information

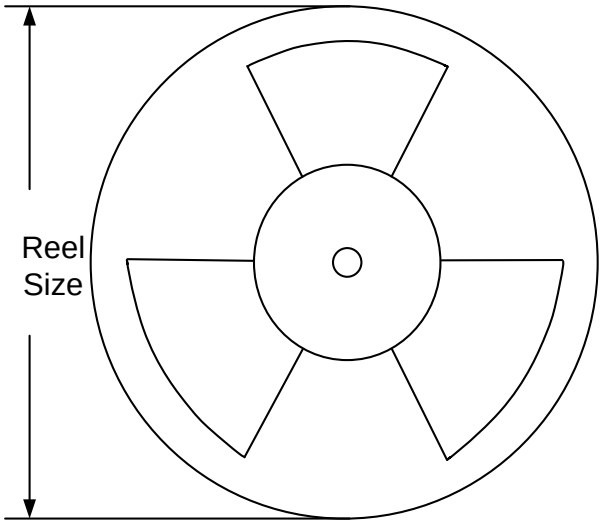
1. Tape Dimension and Pin1 Orientation

SOT23-5



Feeding direction ⟶

2. Reel Dimensions



Package type	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

Revision History

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

Date	Revision	Change
May 29, 2025	Revision 1.0	Initial Release

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