

### General Description

The SA21345N is an automotive grade 300mA high current capacity linear regulator. It fixes the output voltage at 5V, and features ultra-low ground current and low dropout voltage. The SA21345N offers fully protection features including over-current limit, output short-circuit protection and over temperature operation.

The SA21345N is available in a compact SO8E package.

### Features

- Wide Input Voltage Range: 4V to 36V
- Fixed 5V Output Voltage
- Low Dropout Voltage of (300mV@300mA)
- Ultra-low Quiescent Current
- Extremely Low Shutdown Current
- Stability with Tantalum or Ceramic Capacitors
- Excellent Load and Line Regulation
- 300mA Maximum Load Current for SO8E
- Enable Control Input
- Over Current Limit Protection
- Thermal Shutdown Protection
- Compact Package: SO8E
- RoHS Compliant and Halogen Free
- Automotive AEC-Q100 Grade 1 Qualified

### Applications

- Automotive LED Lighting ECU
- Automotive Body Modules

### Typical Application

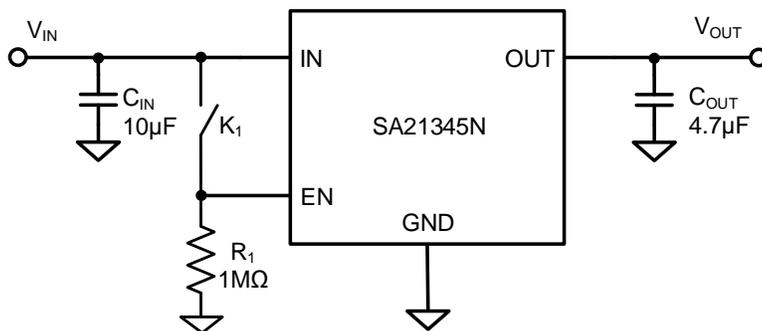


Figure 1. Schematic Diagram

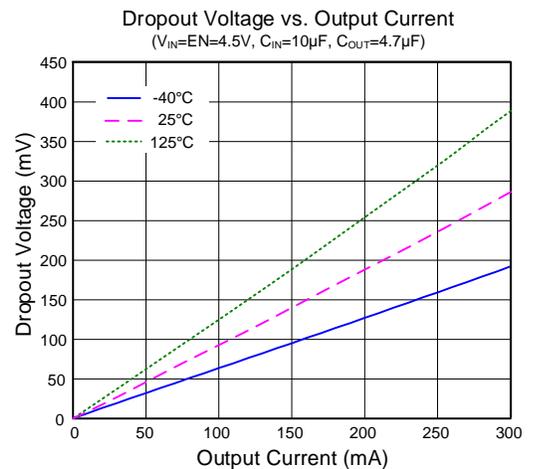


Figure 2. Dropout Characteristics



## Absolute Maximum Ratings

Parameter (Note1)	Min	Max	Unit
IN, EN to GND	-0.3	40	V
OUT to GND	-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
$\theta_{JA}$ Junction-to-ambient Thermal Resistance	30	°C/W
$\theta_{JC}$ Junction-to-case Thermal Resistance	20	
$P_D$ Power Dissipation $T_A=25^\circ\text{C}$	3.3	W

## Recommended Operating Conditions

Parameter (Note3)	Min	Max	Unit
IN, EN	4	36	V
OUT	0	8	V
Ambient Temperature	-40	125	°C

## Electrical Characteristics

( $V_{IN} = V_{EN}=12\text{V}$ ,  $T_J = -40^\circ\text{C}\sim 125^\circ\text{C}$ , unless otherwise specified, the values are guaranteed by test design or statistical correlation.)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Input Voltage	$V_{IN}$		4		36	V
Input Voltage UVLO Threshold	$V_{ULVO}$	$V_{IN}$ rising		3.3	4	V
UVLO Hysteresis	$V_{UVLO,HYS}$			200		mV
Output Voltage	$V_{OUT}$	$T_J = -40^\circ\text{C} \sim 125^\circ\text{C}$	4.9	5	5.1	V
		$T_J = 25^\circ\text{C}$	4.95	5	5.05	V
Line Regulation	$\Delta V_{LNR}$	$I_{OUT} = 10\text{mA}$ , $5.5\text{V} \leq V_{IN} \leq 36\text{V}$		1	1.5	mV/V
Load Regulation	$\Delta V_{LDR}$	$V_{IN}=6\text{V}$ , $10\text{mA} \leq I_{OUT} \leq 300\text{mA}$		0.25	1	%
Dropout Voltage	$\Delta V_{DROP}$	$V_{IN}=4.5\text{V}$ , $I_{OUT}=10\text{mA}$		10	20	mV
		$V_{IN}=4.5\text{V}$ , $I_{OUT}=150\text{mA}$		150	300	mV
		$V_{IN}=4.5\text{V}$ , $I_{OUT}= 300\text{mA}$		300	540	mV
Quiescent Current	$I_Q$	$I_{OUT}=0\text{mA}$ $V_{IN}=(V_{OUT}+1\text{V}) \sim 36\text{V}$		15	22	$\mu\text{A}$
Shutdown Current	$I_{SHDN}$	$V_{EN}=0\text{V}$ , $V_{IN}=24\text{V}$			5	$\mu\text{A}$
Current Limit	$I_{LMT}$	Force $V_{OUT} = 4.5\text{V}$	600			mA
Output Short Protection Threshold	$V_{SHORT}$	Force $V_{OUT}$ from 5V to 0V	0.4	0.8	1.5	V
Output Short Off Time	$t_{SHORT,OFF}$			16		ms
Power Supply Rejection Ratio (Note 4)	PSRR	Frequency = 100Hz, $C_{OUT}=4.7\mu\text{F}$ , $I_{OUT}=10\text{mA}$ , $T_A=25^\circ\text{C}$		60		dB
		Frequency = 100kHz, $C_{OUT}=4.7\mu\text{F}$ , $I_{OUT}=10\text{mA}$ , $T_A=25^\circ\text{C}$		35		dB



# SA21345N

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Enable Input Logic-High Voltage	V <sub>EN_H</sub>		1.5			V
Enable Input Logic-Low Voltage	V <sub>EN_L</sub>				0.4	V
Output Discharge Resistor	R <sub>DIS</sub>			600		Ω
Soft-start Time	t <sub>SS</sub>			1		ms
Thermal Shutdown Temperature (Note 4)	T <sub>SD</sub>			150		°C
Thermal Shutdown Hysteresis (Note 4)	T <sub>HYS</sub>			20		°C

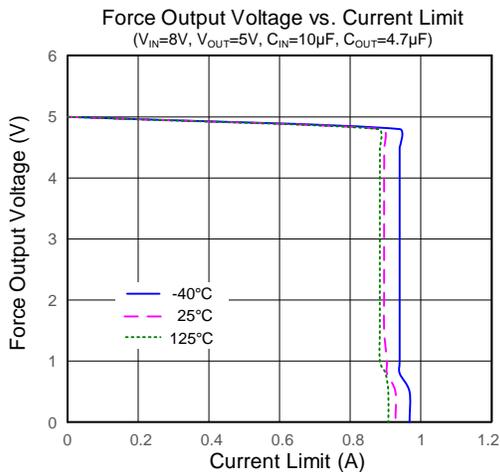
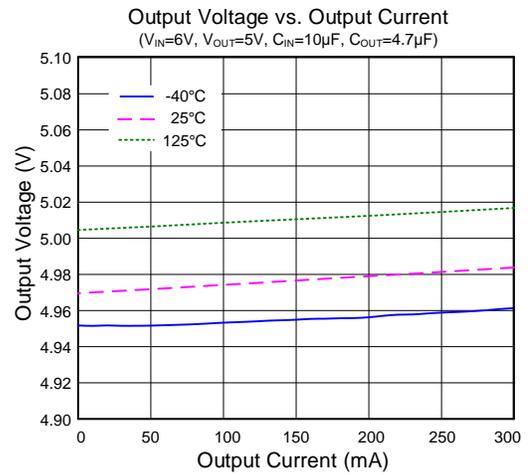
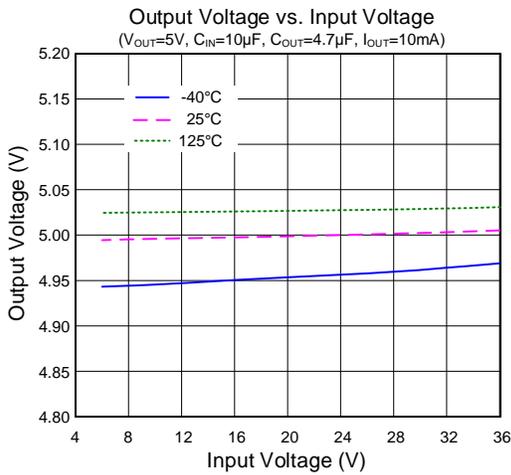
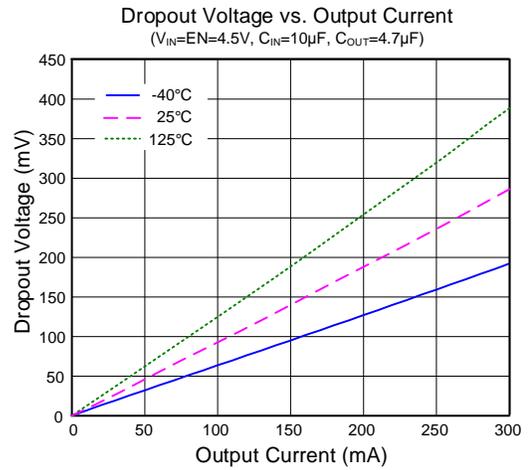
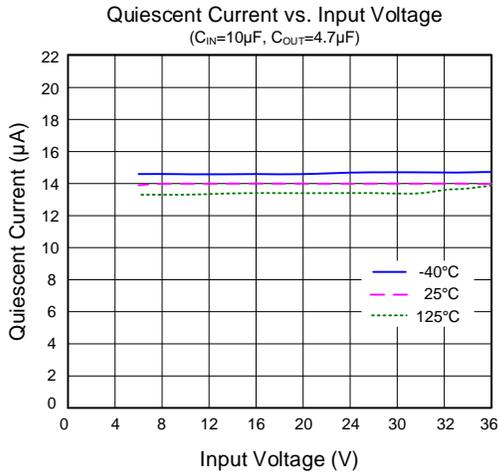
**Note 1:** Stresses beyond the “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specification is not implied. Exposure to absolute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

**Note 2:**  $\theta_{JA}$  is simulated in the natural convection at T<sub>A</sub>=25°C on a Silergy evaluation board following JEDEC51-2 thermal measurement standard.

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

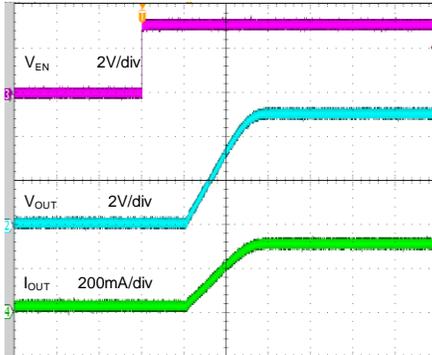
**Note 4:** Guaranteed by design.

## Typical Performance Characteristics



### Startup from Enable

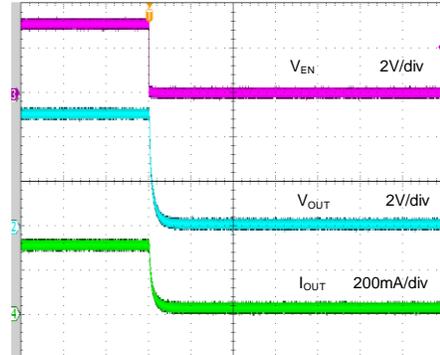
( $V_{IN}=12V$ ,  $V_{OUT}=5V$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=300mA$ )



Time (800µs/div)

### Shutdown from Enable

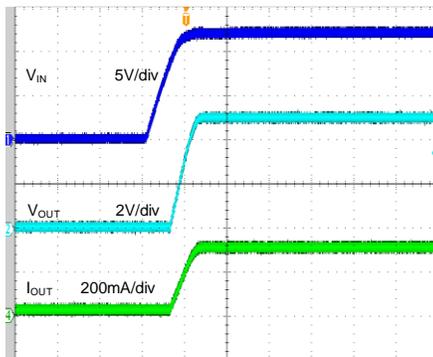
( $V_{IN}=12V$ ,  $V_{OUT}=5V$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=300mA$ )



Time (800µs/div)

### Startup from $V_{IN}$

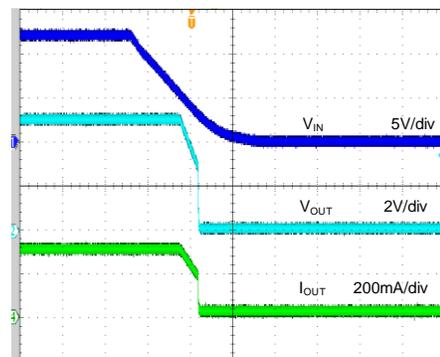
( $V_{IN}=12V$ ,  $V_{OUT}=5V$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=300mA$ )



Time (2ms/div)

### Shutdown from $V_{IN}$

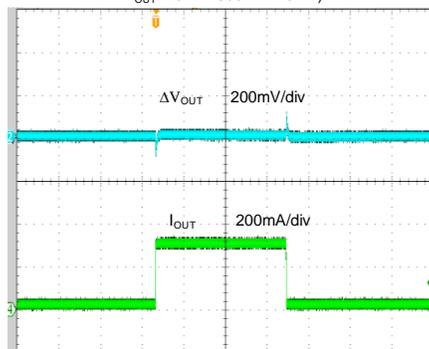
( $V_{IN}=12V$ ,  $V_{OUT}=5V$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=300mA$ )



Time (10ms/div)

### Load Transient

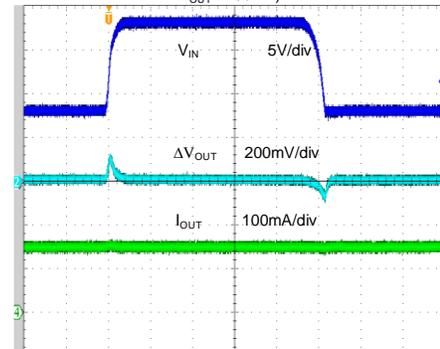
( $V_{IN}=12V$ ,  $V_{OUT}=5V$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=10mA-300mA-10mA$ )



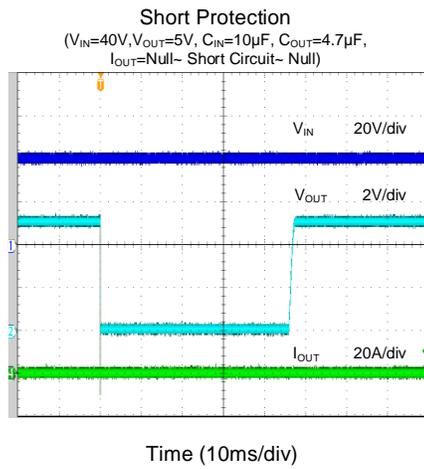
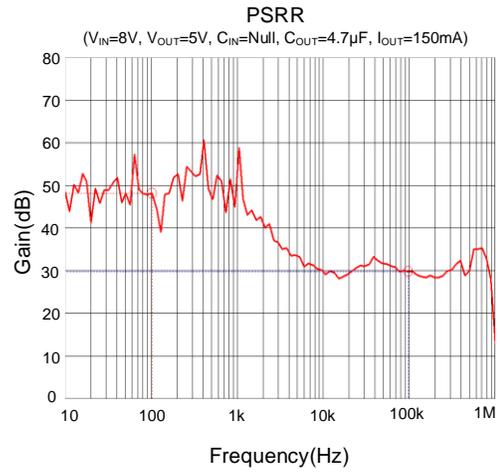
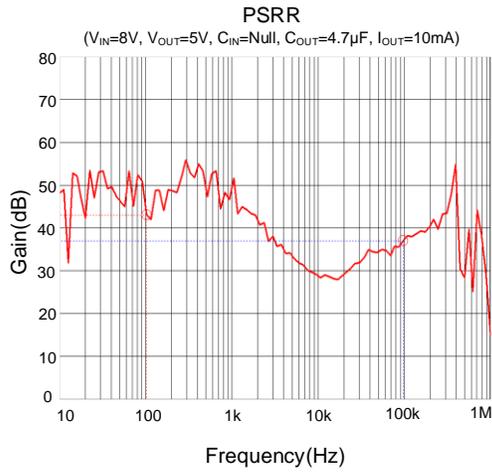
Time (800µs/div)

### Line Transient

( $V_{IN}=8V-18V-8V$ ,  $V_{OUT}=5V$ ,  $C_{IN}=10\mu F$ ,  $C_{OUT}=4.7\mu F$ ,  $I_{OUT}=150mA$ )



Time (400µs/div)



## Application Information

The SA21345N is an automotive grade, 300mA high-current capacity linear regulator with ultra-low ground current and low drop out voltage. The SA21345N has a fixed 5V output voltage. The device offers protective features, including an over-current limit, output short protection, and over-temperature operation.

### Input Capacitor C<sub>IN</sub>:

To minimize the potential noise problem and improve power-supply rejection(PSRR) and transient response, place a typical X5R or better grade ceramic capacitor really close to the IN and GND pins. Care should be taken to minimize the loop area formed by CIN, and IN/GND pins. In this case, a 10 $\mu$ F low ESR ceramic capacitor is recommended.

### Output Capacitor C<sub>OUT</sub>:

For stable operation over the full temperature range, a 4.7 $\mu$ F low-ESR ceramic capacitor is recommended. Use larger output capacitor values such as 22 $\mu$ F to reduce noise, improve load-transient response and PSRR.

### Over Temperature Protection (OTP):

The SA21345N 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

### Output Short Circuit Protect:

If V<sub>OUT</sub> drop below than 0.8V, 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 'hic-cup' cycle of shutdown and restart will continue indefinitely unless the OTP threshold is reached.

### Thermal Considerations:

The SA21345N can deliver a current of up to 300mA 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.

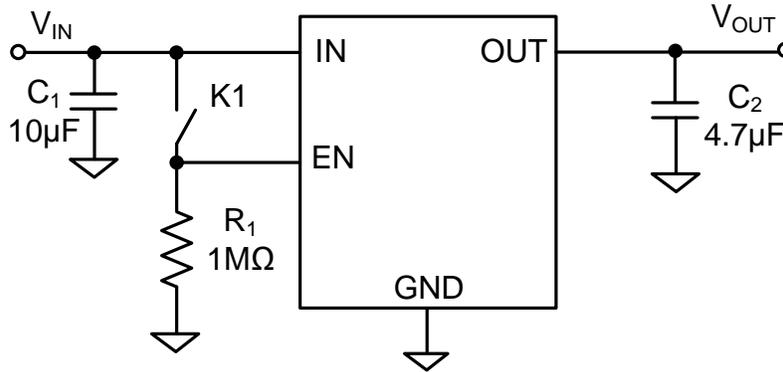
$$P_D = (V_{IN} - V_{OUT}) \times I_{OUT} + V_{IN} \times I_{GND}$$

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<sub>J(MAX)</sub> is the maximum junction temperature of die and T<sub>A</sub> is the maximum ambient temperature. The junction to ambient thermal resistance ( $\theta_{JA}$ ) footprint is 30°C/W for SO8E package.

## Application Schematic



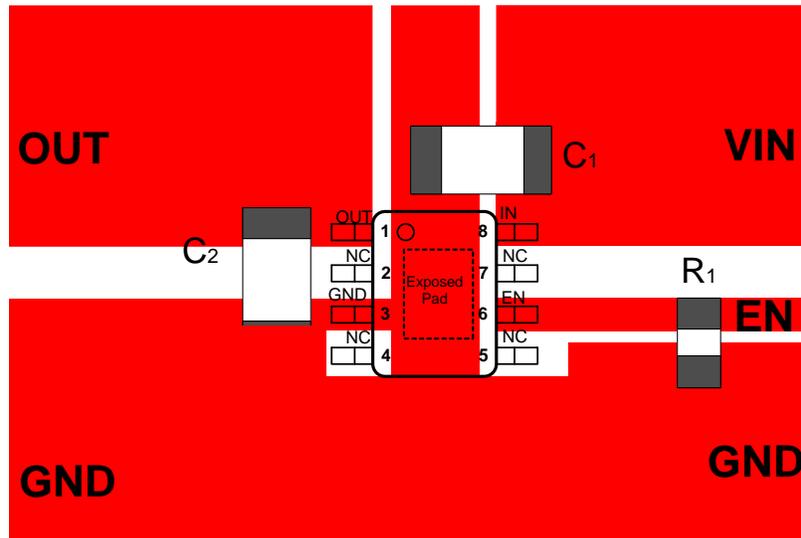
## BOM List

Designator	Description	Part Number	Manufacturer
C <sub>1</sub>	10 $\mu$ F/50V, 1206	GRM31CR61H106K	Murata
C <sub>2</sub>	4.7 $\mu$ F/25V, 1206	GRM31CR61E475K	Murata
R <sub>1</sub>	1M $\Omega$		

## PCB Layout Guide

For best performance of the SA21345N, the following guidelines must be strictly followed:

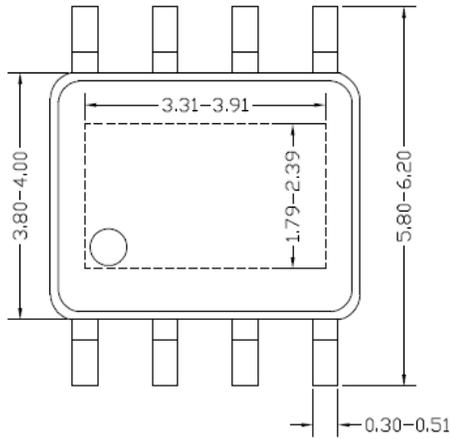
1. Keep all power trace as short and wide as possible. And it is desirable to use 2-layer or 4-layer board for thermal performance and better capability of current flow.
2. Place input/output capacitor close to the IC for better transient performance.



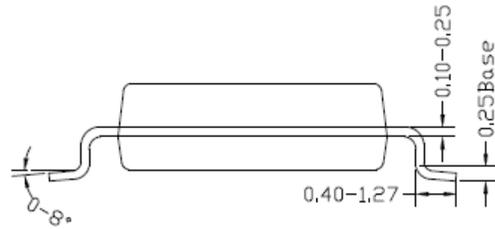
 Top layer

Figure 4. PCB Layout Suggestion

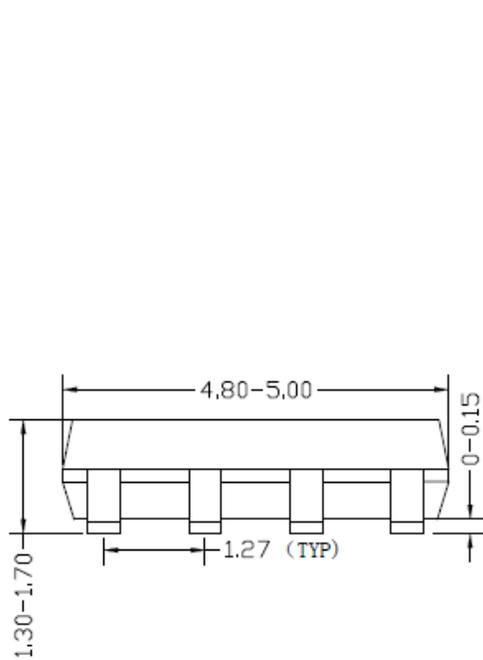
## SO8E Package Outline & PCB layout



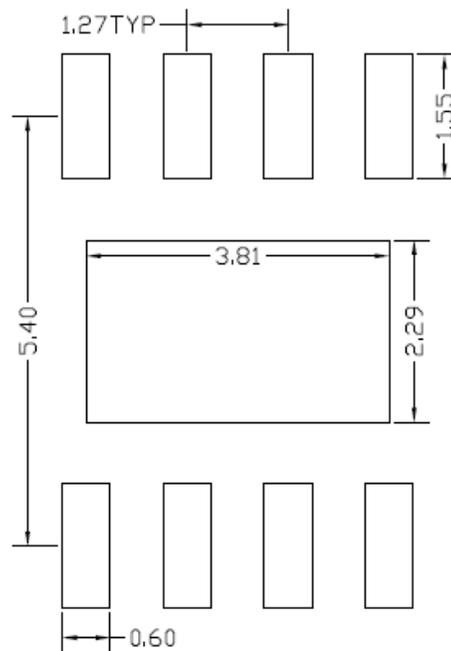
**Top view**



**Side view**



**Front view**

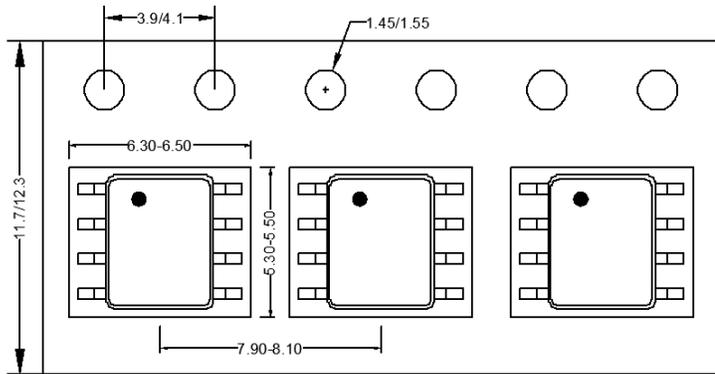


**Recommended PCB Layout  
(Reference Only)**

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

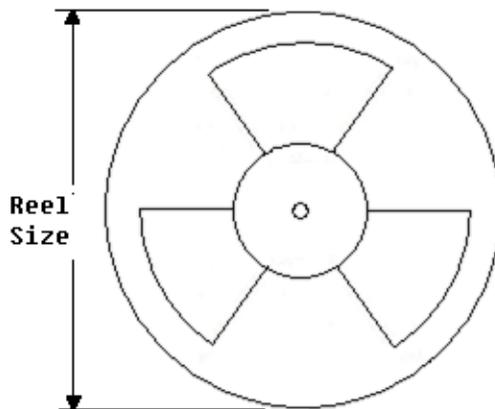
## Taping & Reel Specification

### 1. SO8E Taping Orientation



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
SO8E	12	8	13"	400	400	2500



## Revision History

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

Date	Revision	Change
Aug.20, 2025	Revision 1.0B	<ol style="list-style-type: none"><li>1. Output current changed from 150mA to 300mA;</li><li>2. Add Dropout Voltage when (<math>V_{IN}=4.5V</math>, <math>I_{OUT}=300mA</math>);</li><li>3. Update the test condition of Load Regulation, the max value changed from 0.5% to 1 %;</li><li>4. Update the waveforms (Output Voltage vs. Output Current, Dropout Voltage vs. Output Current, Startup/Shutdown from Enable, Startup/Shutdown from <math>V_{IN}</math>, Load Transient)</li></ol>
Mar. 14, 2024	Revision 1.0A	Add "Automotive AEC-Q100 Grade 1 Qualified" in Page 1
Oct.27, 2023	Revision 1.0	Initial Release



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