

Description

The AP3429/A is a 2A step-down DC-DC converter. At heavy load, the constant frequency PWM control performs excellent stability and transient response. No external compensation components are required.

The AP3429/A supports a range of input voltages from 2.7V to 5.5V, allowing the use of a single Li+/Li- polymer cell, multiple Alkaline/NiMH cell, and other standard power sources. The output voltage is adjustable from 0.6V to the input voltage. The AP3429/A employs internal power switch and synchronous rectifier to minimize external part count and realize high efficiency. During shutdown, the input is disconnected from the output and the shutdown current is less than 1 μ A. Other key features include over-temperature and short circuit protection, and under-voltage lockout to prevent deep battery discharge.

The AP3429/A delivers 2A maximum output current while consuming only 90 μ A of no-load quiescent current. Ultra-low $R_{DS(ON)}$ integrated MOSFETs and 100% duty cycle operation make the AP3429/A an ideal choice for high output voltage, high current applications which require a low dropout threshold.

The AP3429/A is available in TSOT25 package.

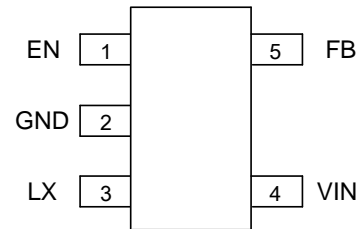
Applications

- 5V or 3.3V Point of Load Conversion
- Telecom/Networking Equipment
- Set Top Boxes
- Storage Equipment
- Video Cards
- DDR Power Supply

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Pin Assignments

(Top View)

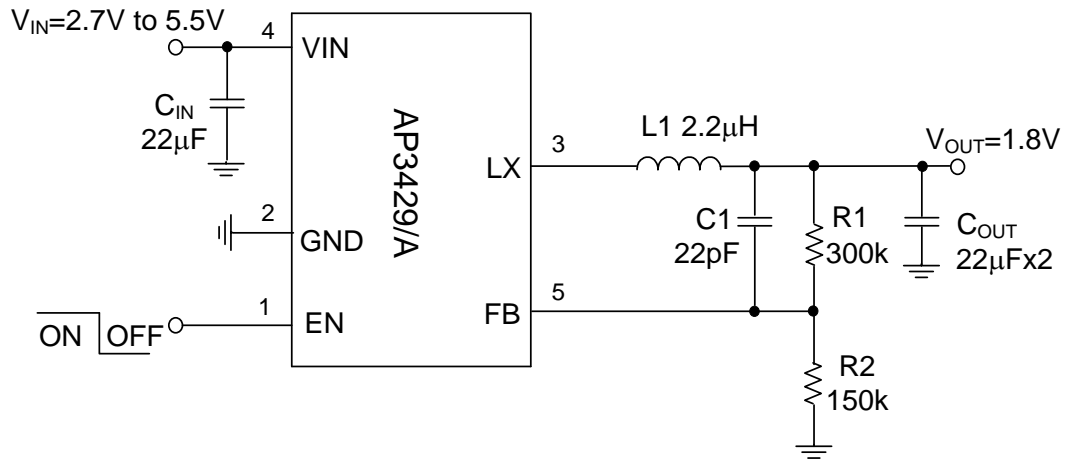


TSOT25

Features

- Output Current: Up to 2A
- Output Voltage: 0.6V to V_{IN}
- Input Voltage: 2.7V to 5.5V
- Shutdown Current: <1 μ A
- 100% Duty Cycle Operation
- 1MHz Switching Frequency
- Internal Soft Start
- No External Compensation Required
- Short Circuit Protection
 - AP3429: Latch Off Protection
 - AP3429A: Hiccup Mode Protection
- Over Voltage Protection
 - AP3429: Latch Off Protection
 - AP3429A: No Latch Off Protection
- Thermal Shutdown
- TSOT25 package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

Typical Applications Circuit



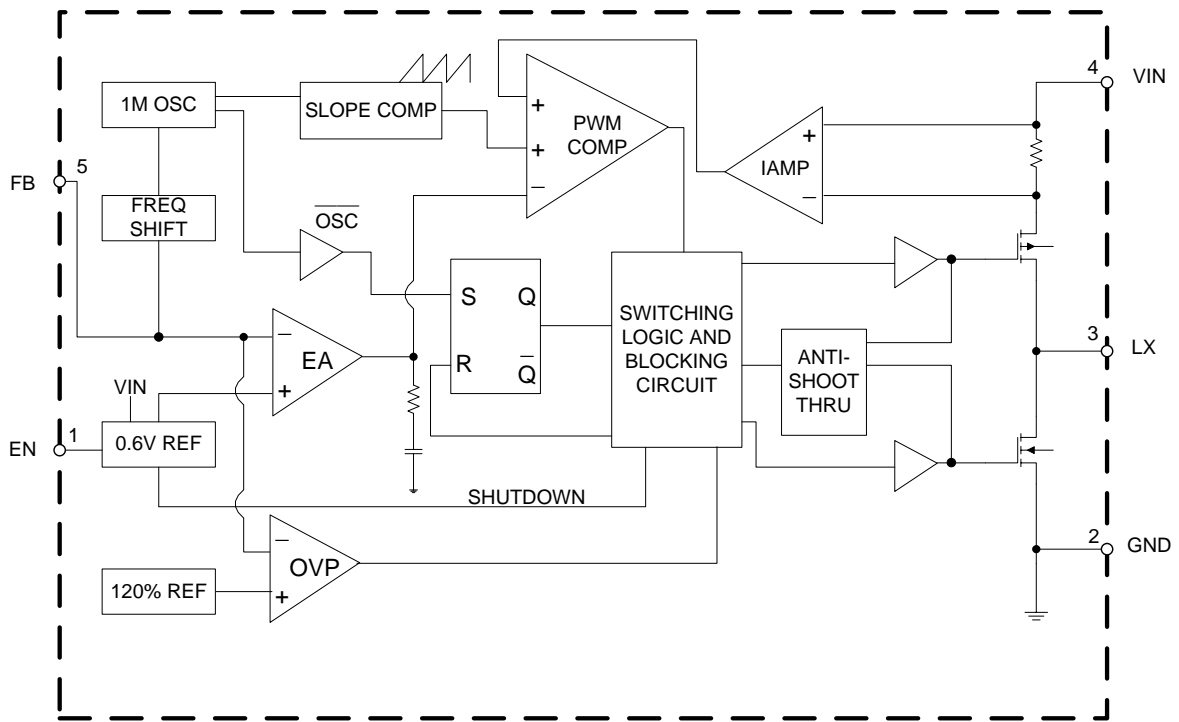
Pin Descriptions

| Pin Number | Pin Name | Function |
|------------|----------|---|
| 1 | EN | Enable control input. Force this pin voltage above 1.5V enables the chip, and below 0.4V shuts down the device. |
| 2 | GND | Ground pin. |
| 3 | LX | The drains of the internal main and synchronous power MOSFETs. |
| 4 | VIN | Bias supply. Chip main power supply pin. |
| 5 | FB | Feedback voltage to internal error amplifier. The threshold voltage is 0.6V. |

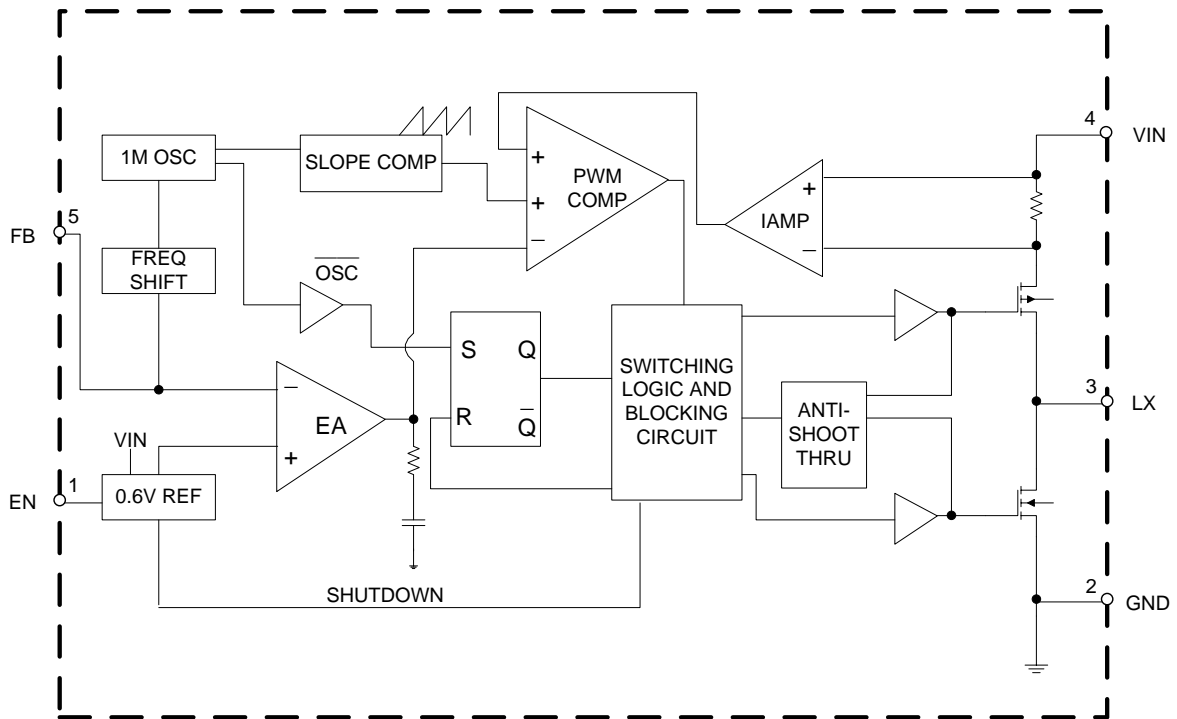
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Functional Block Diagram

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Function Block Diagram of AP3429



Function Block Diagram of AP3429A

Absolute Maximum Ratings (Note 4)

| Symbol | Parameter | Rating | Unit |
|---------------|---|----------------------|---------------|
| V_{IN} | Input Voltage | -0.3 to 6 | V |
| V_{EN} | EN Pin Voltage | -0.3 to $V_{IN}+0.3$ | V |
| V_{LX} | LX Pin Voltage | -0.3 to $V_{IN}+0.3$ | V |
| V_{FB} | Feedback Pin Voltage | -0.3 to $V_{IN}+0.3$ | V |
| P_D | Power Dissipation (on PCB, $T_A = +25^{\circ}C$) | 0.4 | W |
| θ_{JA} | Thermal Resistance (Junction to Ambient) | 220 | $^{\circ}C/W$ |
| θ_{JC} | Thermal Resistance (Junction to Case, Simulation) | 130 | $^{\circ}C/W$ |
| T_J | Operating Junction Temperature | +150 | $^{\circ}C$ |
| T_{STG} | Storage Temperature | -55 to +150 | $^{\circ}C$ |
| V_{MM} | ESD (Machine Model) | 200 | V |
| V_{HBM} | ESD (Human Body Model) | 2000 | V |

Note 4: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

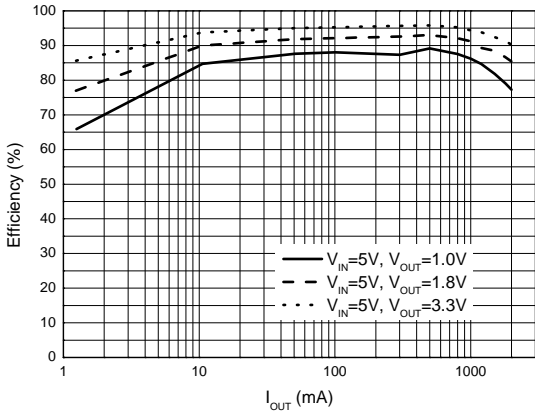
| Symbol | Parameter | Min | Max | Unit |
|----------|-------------------------------|-----|------|-------------|
| V_{IN} | Input Voltage Range | 2.7 | 5.5 | V |
| T_A | Operating Ambient Temperature | -40 | +85 | $^{\circ}C$ |
| T_J | Junction Temperature Range | -40 | +125 | $^{\circ}C$ |

Electrical Characteristics (@ $V_{IN} = 5V$, $V_{OUT} = 1.8V$, $L = 2.2\mu H$, $C_{IN} = 22\mu F$, $C_{OUT} = 22\mu F \times 2$, $T_A = +25^\circ C$, unless otherwise specified.)

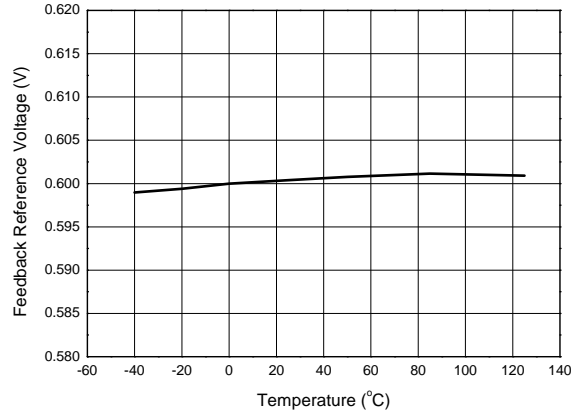
| Symbol | Parameters | Conditions | Min | Typ | Max | Unit |
|--------------|--|------------------------------|-------|------|-------|------------|
| V_{IN} | Input Voltage Range | – | 2.7 | – | 5.5 | V |
| V_{FB} | Regulated Feedback Voltage | – | 0.588 | 0.6 | 0.612 | V |
| I_{FB} | FB Leakage Current | $V_{FB} = 1V$ | – | – | 0.2 | μA |
| I_Q | Quiescent Current | $V_{FB} = 0.65V$ | – | 90 | – | μA |
| I_{SD} | Shutdown Current | $V_{EN} = 0V$ | – | 0.1 | 1 | μA |
| I_{LIM} | Peak Inductor Current | – | 3 | – | – | A |
| V_{SCP} | Short Circuit Protection Latch Off Threshold | – | – | 0.3 | – | V |
| f_{OSC} | Oscillator Frequency | – | – | 1 | – | MHz |
| $R_{DS(ON)}$ | Drain to Source On-state Resistance | $I_{LX} = 100mA$, high side | – | 110 | – | m Ω |
| | | $I_{LX} = 100mA$, low side | – | 80 | – | |
| V_{ENH} | EN High Threshold | – | 1.5 | – | – | V |
| V_{ENL} | EN Low Threshold | – | – | – | 0.4 | V |
| I_{EN} | EN Leakage Current | $V_{IN} = V_{EN} = 5V$ | -1.0 | – | 1.0 | μA |
| V_{UVLO} | Input UVLO Threshold | – | – | 2.4 | 2.7 | V |
| V_{HYS} | UVLO Hysteresis | – | – | 0.2 | – | V |
| – | Maximum Duty Cycle | – | 100 | – | – | % |
| R_{DSCH} | Output Discharge Switch On Resistance | – | – | 50 | – | Ω |
| T_{OTP} | Over Temperature Protection | – | – | +160 | – | $^\circ C$ |
| T_{OTH} | OTP Hysteresis | – | – | +30 | – | $^\circ C$ |
| V_{IOVP} | V_{IN} Over Voltage Protection | – | – | 6.25 | – | V |
| V_{IHYS} | IOVP Hysteresis | – | – | 0.25 | – | V |
| t_{SS} | Soft-start Time | – | – | 1.8 | – | ms |

Performance Characteristics (@ $T_A = +25^\circ\text{C}$, $V_{IN} = 5\text{V}$, $V_{OUT} = 1.8\text{V}$, unless otherwise specified.)

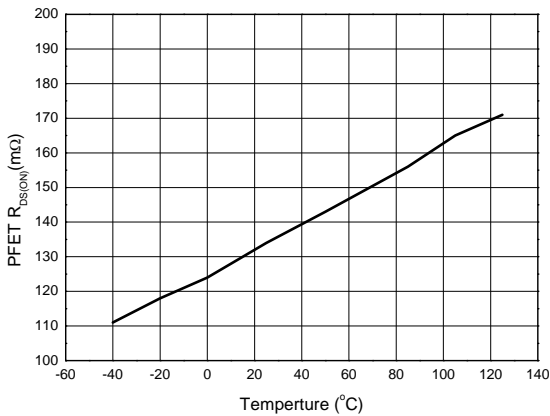
Efficiency vs. Load Current



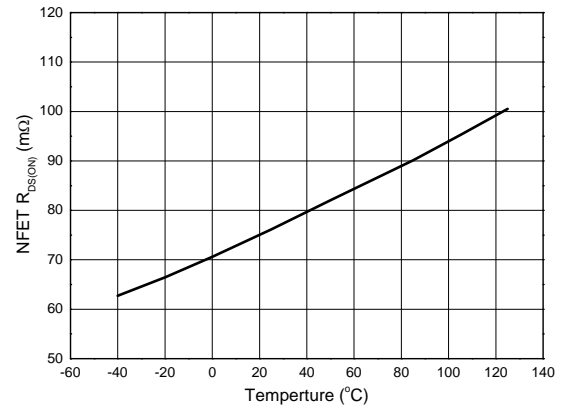
Feedback Reference Voltage vs. Temperature



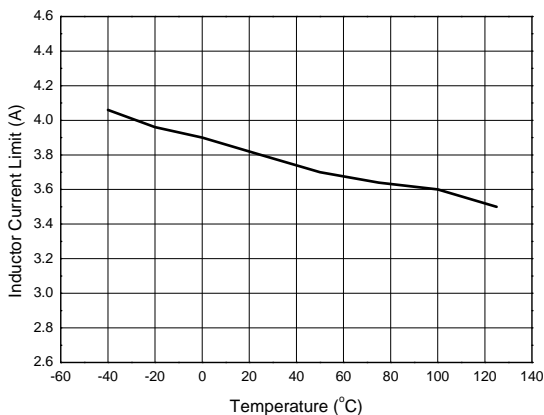
PFET Drain-Source On-State Resistance vs. Temperature



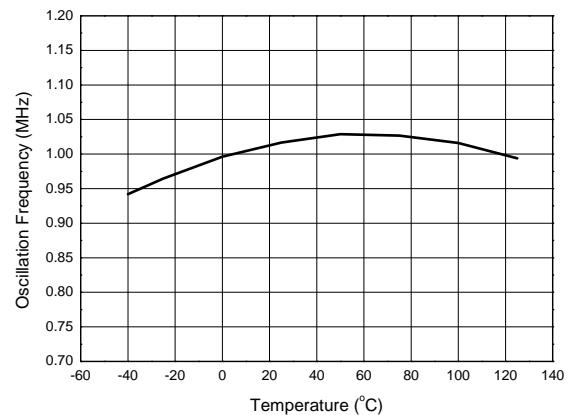
NFET Drain-Source On-State Resistance vs. Temperature



Inductor Current Limit vs. Temperature



Oscillation Frequency vs. Temperature

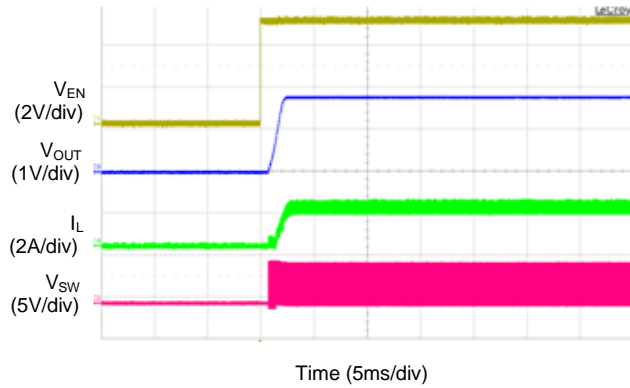


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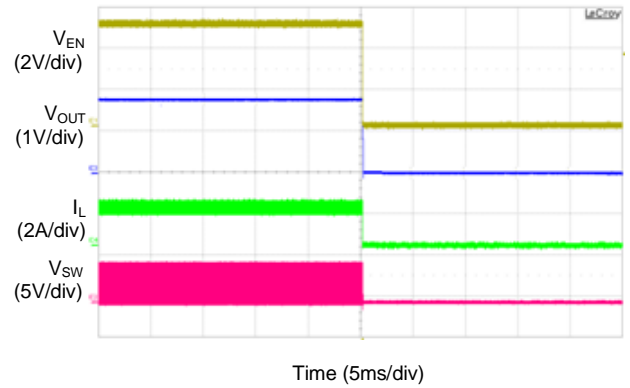
Performance Characteristics (Cont. @ $T_A = +25^\circ\text{C}$, $V_{IN} = 5\text{V}$, $V_{OUT} = 1.8\text{V}$, unless otherwise specified.)

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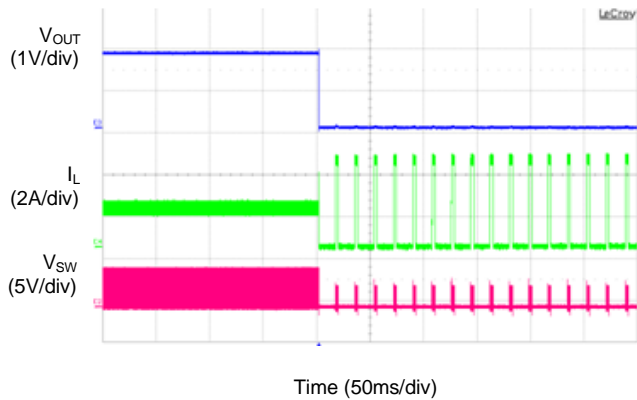
Enable Turn on Characteristic ($I_{OUT}=2\text{A}$)



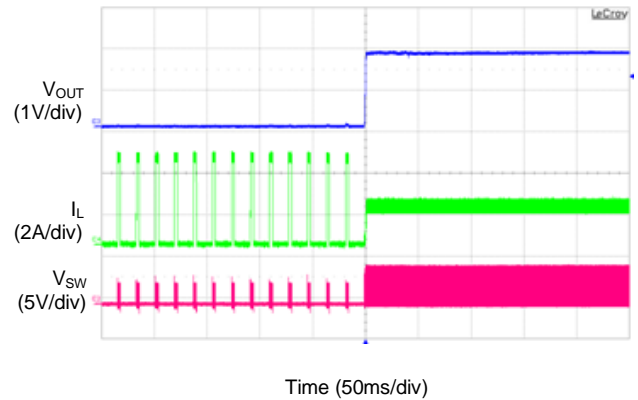
Enable Turn off Characteristic ($I_{OUT}=2\text{A}$)



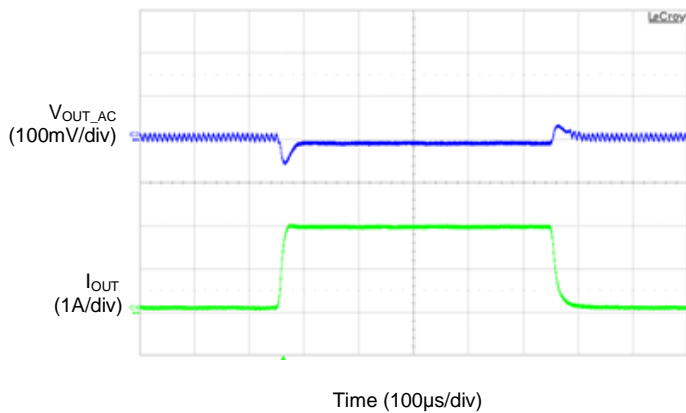
Short Current Protection ($I_{OUT}=2\text{A}$)



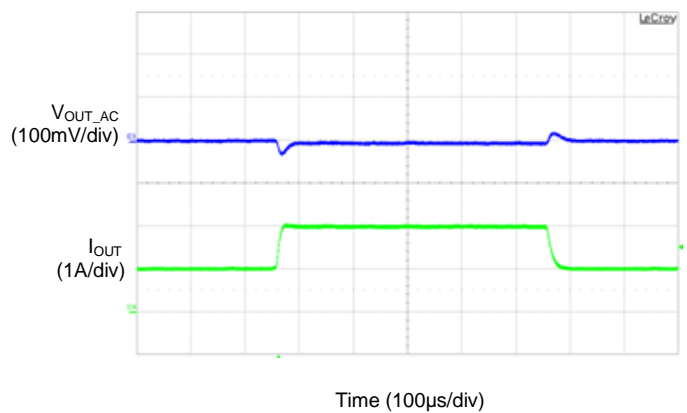
SCP Recovery ($I_{OUT}=2\text{A}$)



Load Transient ($I_{OUT}=0.1\text{A}$ to 2A)



Load Transient ($I_{OUT}=1\text{A}$ to 2A)



Application Information

Typical application circuit is shown in the application circuit and for the circuit parameters setting please refers to the following descriptions.

Under Voltage Lockout (UVLO) Circuit

The AP3429/A provides an under voltage lockout circuit to prevent it from undefined status. When the V_{IN} drops lower than the UVLO detector threshold, the UVLO circuit starts to operate, V_{REF} stops, and high-side and low-side built-in switch transistors turn "OFF". As a result, V_{OUT} drops according to the C_{OUT} capacitance value and the load. When the V_{IN} is rising higher than UVLO released voltage, the IC will restart the operation.

Over Current Protection

The AP3429/A has internal over current protection function to protect from catastrophic failures. The IC can monitor the PMOS current, if the peak current is higher than the current limit threshold, OCP function will be triggered and enter cycle by cycle current limit mode. If V_{FB} drops under 0.3V for example, output node shorted to GND, AP3429 will enter latch off mode. IC will turn off both power switches. It will remain latch off state until the V_{IN} or Enable recycled to release it. AP3429A will enter hiccup mode to protect itself, if short circuit is removed, and V_{FB} rises over 0.3V, the AP3429A recovers to normal operation again.

Over Voltage Protection

The AP3429 has internal output OVP circuits. When V_{OUT} is exceeds 120% of the regulation level for more than 40 μ s, the power switching will be turned off. IC enter latch off mode and will restart until V_{IN} or Enable voltage recycled.

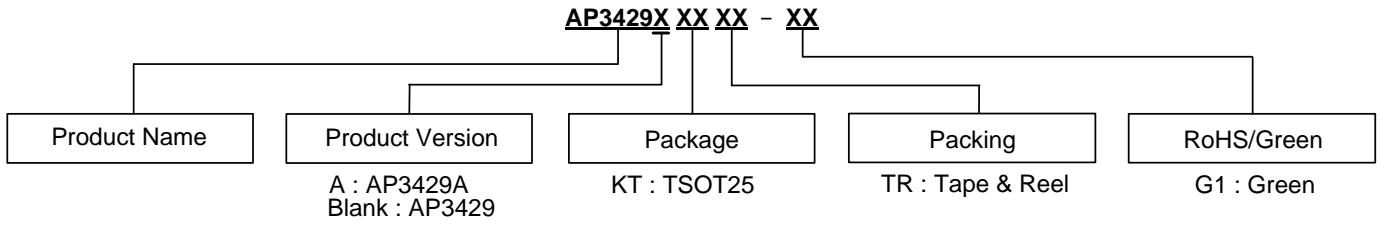
Over Temperature Protection

The internal thermal temperature protection circuitry of AP3429/A is provided to protect the integrated circuit in the event that the maximum junction temperature is exceeded. When the junction temperature exceeds +160°C, it shuts down the internal control circuit and switching power MOSFET. The AP3429/A will restart automatically under the control of soft start circuit when the junction temperature decreases to +130°C.

Input Over Voltage Protection

When input voltage of AP3429/A is near 6.25V, the IC will enter Input-Over-Voltage-Protection. It would be shut down and there will be no output voltage in this state. As the input voltage goes down below 6V, it will leave input OVP and recover the output voltage.

Ordering Information

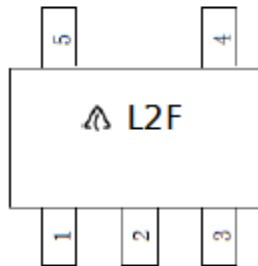


| Package | Temperature Range | Part Number | Marking ID | Packing |
|---------|-------------------|----------------|------------|------------------|
| TSOT25 | -40 to +85°C | AP3429AKTTR-G1 | L2E | 3000/Tape & Reel |
| | | AP3429KTTR-G1 | L2F | 3000/Tape & Reel |

Marking Information

AP3429

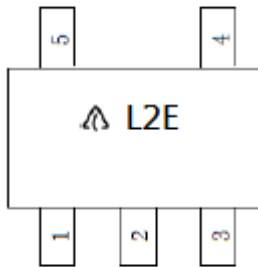
(Top View)



First Line: Logo and Marking ID

AP3429A

(Top View)

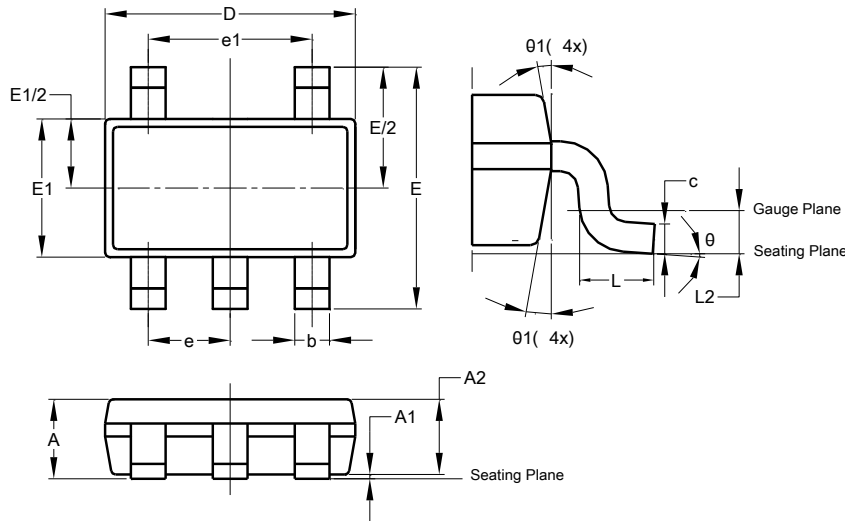


First Line: Logo and Marking ID

Package Outline Dimensions

Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.

(1) Package Type: TSOT25

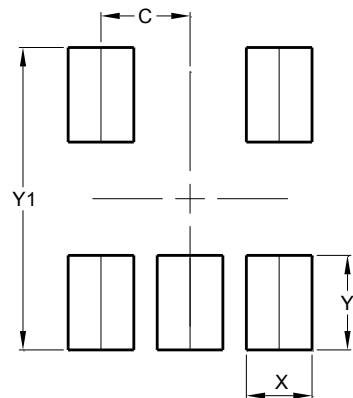


| TSOT25 | | | |
|----------------------|----------|------|------|
| Dim | Min | Max | Typ |
| A | - | 1.00 | - |
| A1 | 0.01 | 0.10 | - |
| A2 | 0.84 | 0.90 | - |
| b | 0.30 | 0.45 | - |
| c | 0.12 | 0.20 | - |
| D | - | - | 2.90 |
| E | - | - | 2.80 |
| E1 | - | - | 1.60 |
| e | 0.95 BSC | | |
| e1 | 1.90 BSC | | |
| L | 0.30 | 0.50 | |
| L2 | 0.25 BSC | | |
| θ | 0° | 8° | 4° |
| θ1 | 4° | 12° | - |
| All Dimensions in mm | | | |

Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.

(1) Package Type: TSOT25



| Dimensions | Value (in mm) |
|------------|---------------|
| C | 0.950 |
| X | 0.700 |
| Y | 1.000 |
| Y1 | 3.199 |

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