1.0MHZ, 2A STEP-DOWN DC-DC BUCK CONVERTER

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 1μA. Other key features include overtemperature and short-circuit protection, and undervoltage lockout to prevent deep battery discharge.

The AP3429/A delivers 2A maximum output current while consuming only 90μA 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.

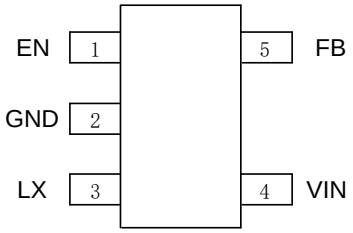
The AP3429/A is available in TSOT25 package.

Applications

- 5V or 3.3V points of load conversions
- Telecoms/networking equipment
- Set-top boxes
- Storage equipment
- Video cards
- DDR power supplies

Pin Assignments

(Top View)



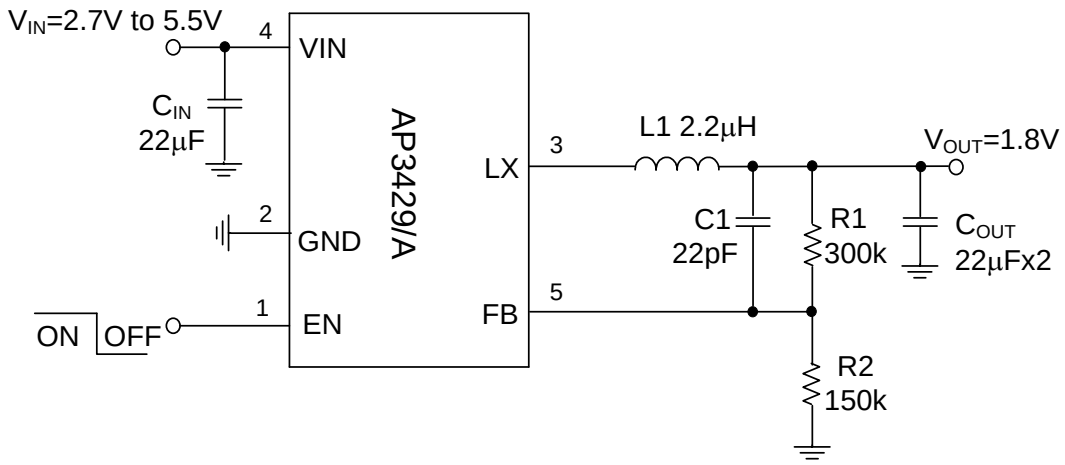
TSOT25

Features

- Output Current: Up to 2A
- Output Voltage: 0.6V to V_{IN}
- Input Voltage: 2.7V to 5.5V
- Shutdown Current: <1μA
- 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
- Overvoltage 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)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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.

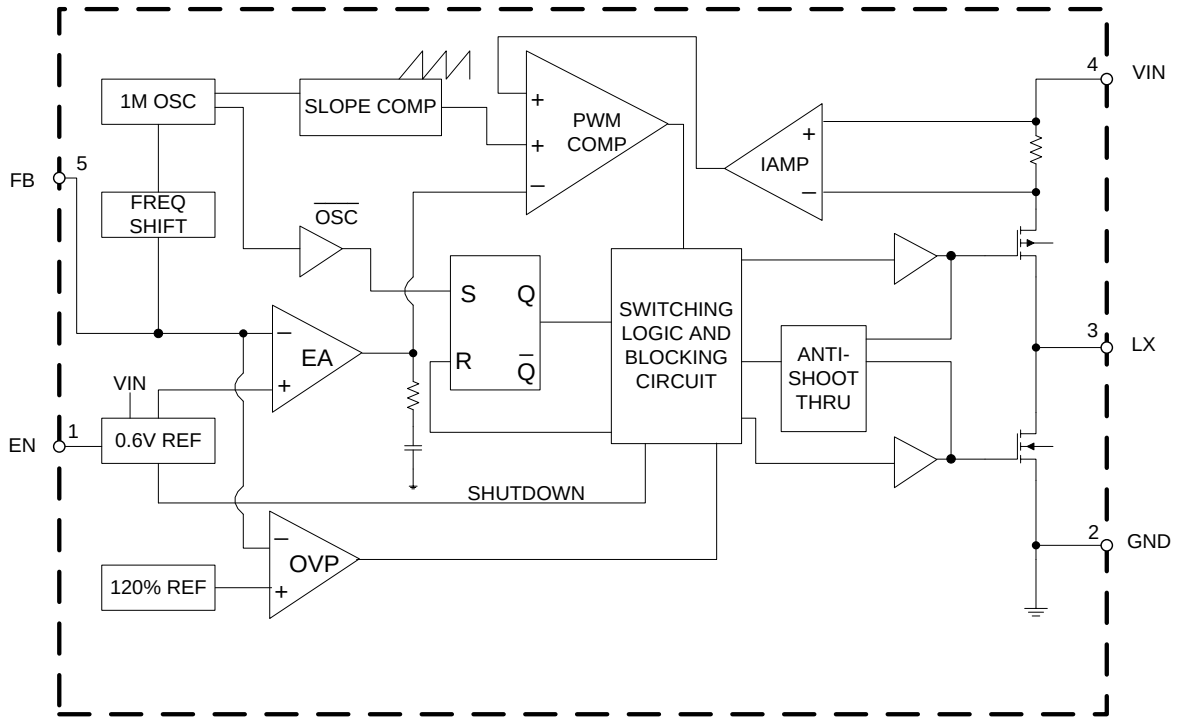
Typical Applications Circuit



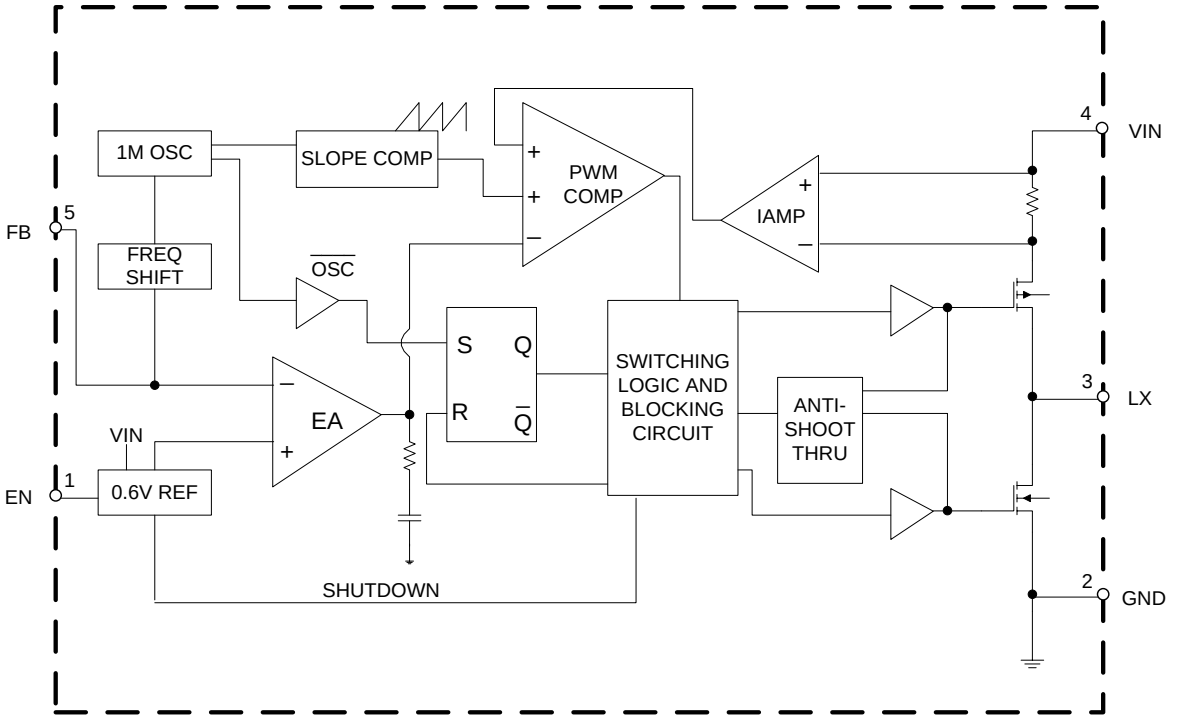
Pin Descriptions

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.

Functional Block Diagram



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°C)	0.4	W
θ_{JA}	Thermal Resistance (Junction to Ambient)	220	°C/W
θ_{JC}	Thermal Resistance (Junction to Case, Simulation)	130	ºC/W
T_J	Operating Junction Temperature	+150	°C
T_{STG}	Storage Temperature	-55 to +150	°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* can 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 can affect device reliability.

Recommended Operating Conditions

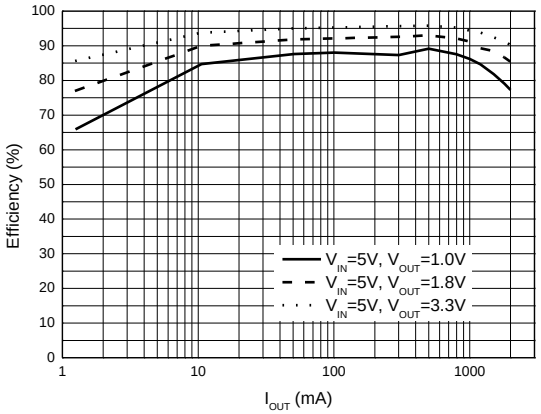
Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage Range	2.7	5.5	V
T_A	Operating Ambient Temperature	-40	+85	°C
T_J	Junction Temperature Range	-40	+125	°C

Electrical Characteristics (@V_{IN} = 5V, V_{OUT} = 1.8V, L = 2.2µH, C_{IN} = 22µF, C_{OUT} = 22µF×2, T_A = +25°C, unless otherwise specified.)

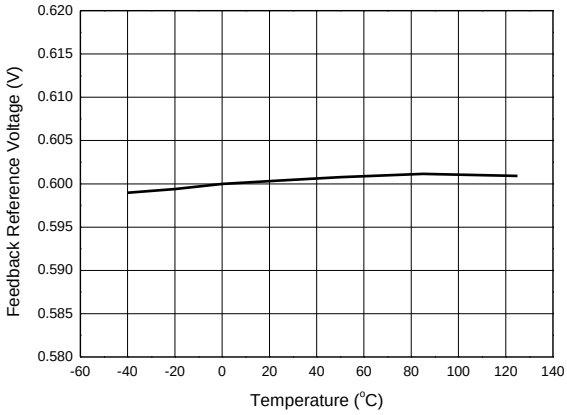
Symbol	Parameters	Conditions	Min	Typ	Max	Unit
V_{IN}	Input Voltage Range	—	2.7	—	5.5	V
V_{FB}	Regulated Feedback Voltage	—	0.588	0.6	0.612	V
I_{FB}	FB Leakage Current	V_{FB} = 1V	—	—	0.2	µA
I_Q	Quiescent Current	V_{FB} = 0.65V	—	90	—	µA
I_{SD}	Shutdown Current	V_{EN} = 0V	—	0.1	1	µA
I_{LIM}	Peak Inductor 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	—	mΩ
		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}	Overtemperature Protection	—	—	+160	—	°C
T_{OTH}	OTP Hysteresis	—	—	+30	—	°C
V_{IOVP}	V_{IN} Overvoltage Protection	—	—	6.25	—	V
V_{IHSY}	IOVP Hysteresis	—	—	0.25	—	V
t_{SS}	Soft-Start Time	—	—	1.8	—	ms

Performance Characteristics (@T_A = +25°C, V_{IN} = 5V, V_{OUT} = 1.8V, unless otherwise specified.)

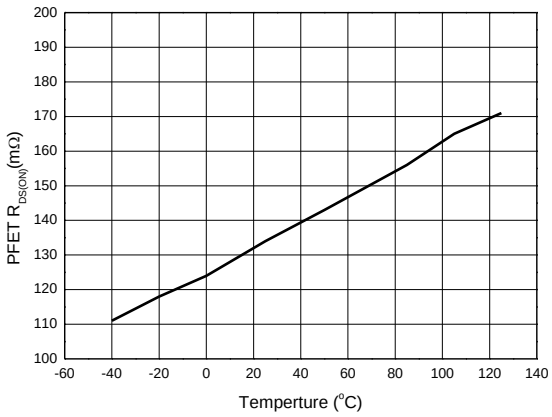
Efficiency vs. Load Current



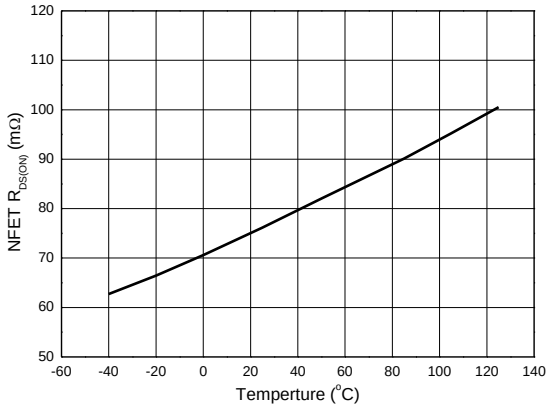
Feedback Reference Voltage vs. Temperature



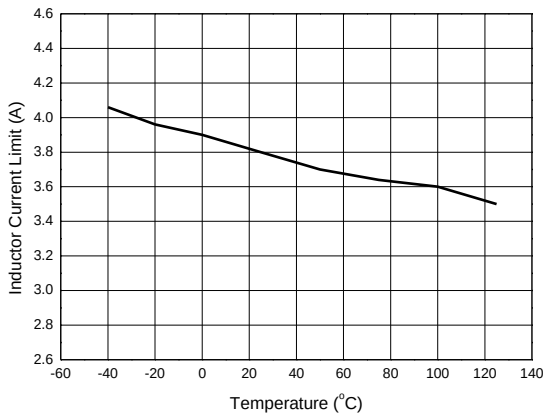
PFET Drain-Source On-State Resistance vs. Temperature



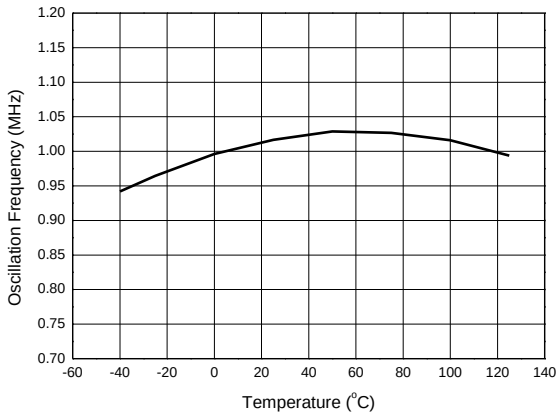
NFET Drain-Source On-State Resistance vs. Temperature



Inductor Current Limit vs. Temperature

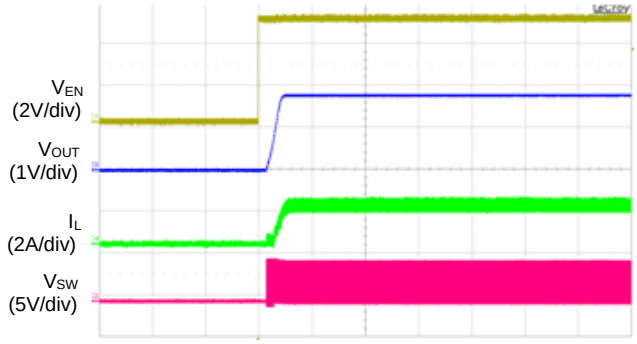


Oscillation Frequency vs. Temperature



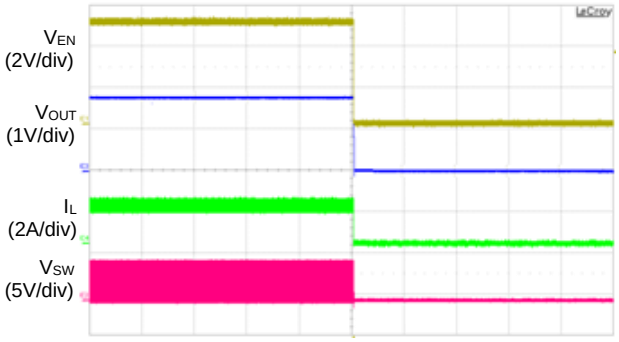
Performance Characteristics (@T_A = +25°C, V_{IN} = 5V, V_{OUT} = 1.8V, unless otherwise specified.) (continued)

Enable Turn-on Characteristic (I_{OUT}=2A)



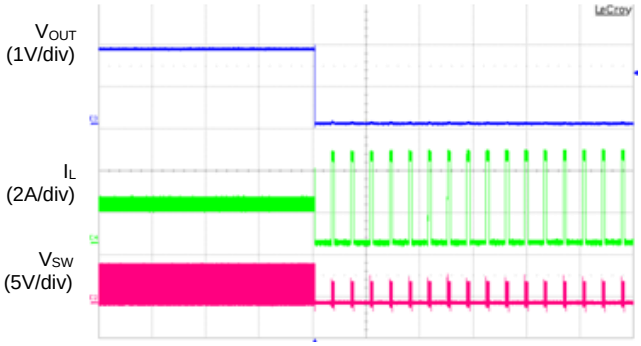
Time (5ms/div)

Enable Turn-off Characteristic (I_{OUT}=2A)



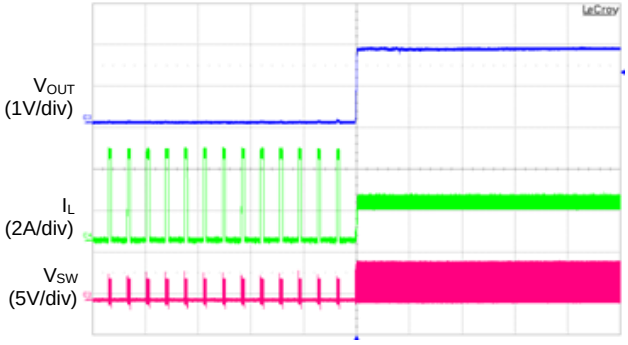
Time (5ms/div)

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



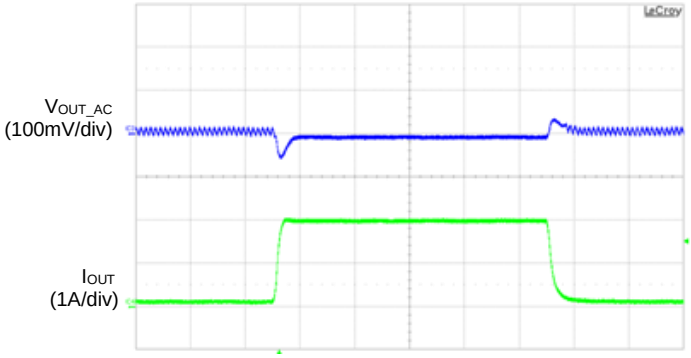
Time (50ms/div)

SCP Recovery (I_{OUT}=2A)



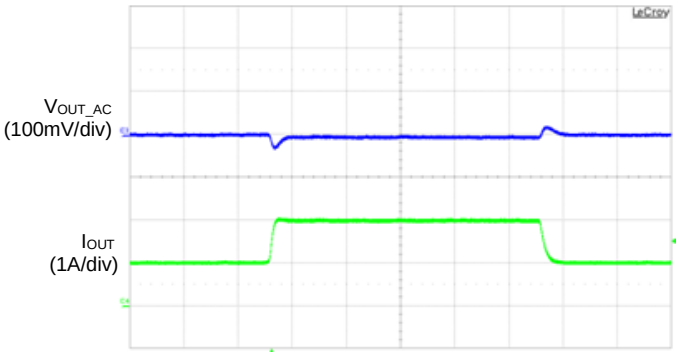
Time (50ms/div)

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



Time (100µs/div)

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



Time (100µs/div)

Application Information

Typical Applications Circuit is shown on page 2 and for the circuit parameters setting please refer to the following descriptions.

Undervoltage Lockout (UVLO) Circuit

The AP3429/A provides an undervoltage 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 COUT capacitance value and the load. When the V_{IN} is rising higher than UVLO released voltage, the IC will restart the operation.

Overcurrent Protection

The AP3429/A has internal overcurrent 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.

Overvoltage Protection

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

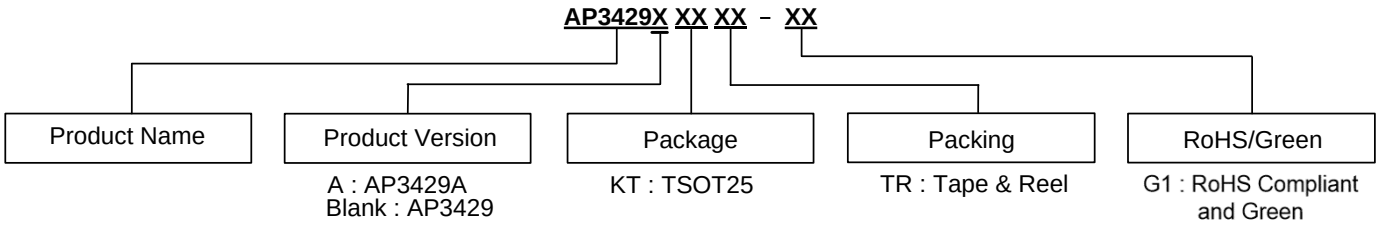
Overtemperature Protection

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 Overvoltage Protection

When input voltage of AP3429/A is near 6.25V, the IC will enter input overvoltage 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

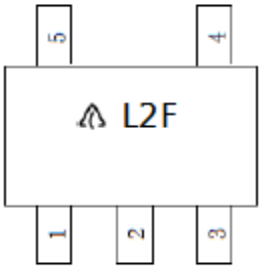


Orderable Part Number	Marking ID	Temperature Range	Package	Packing	
				Qty.	Carrier
AP3429AKTTR-G1	L2E	-40 to +85°C	TSOT25	3000	Tape & Reel
AP3429KTTR-G1	L2F			3000	Tape & Reel

Marking Information

AP3429

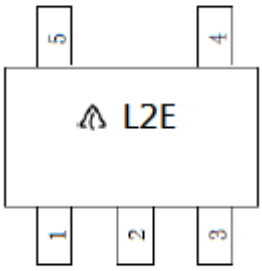
(Top View)



First Line: Logo and Marking ID

AP3429A

(Top View)

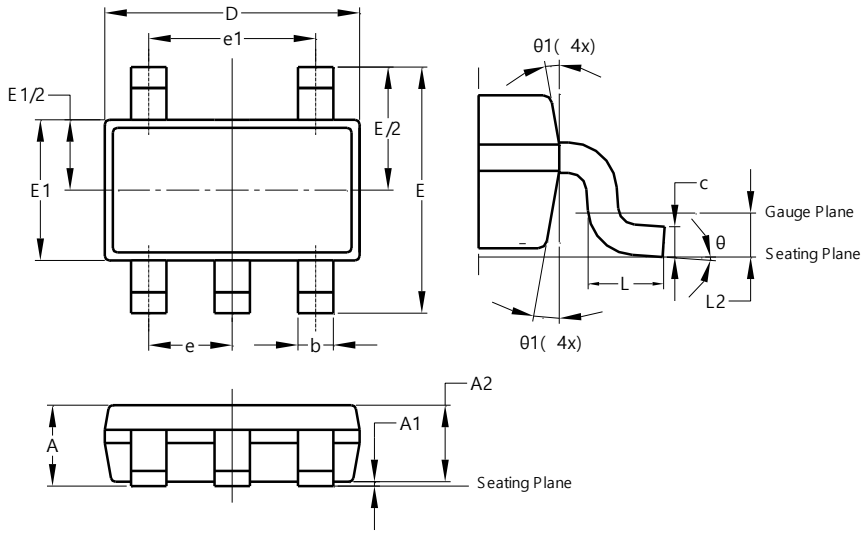


First Line: Logo and Marking ID

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

TSOT25

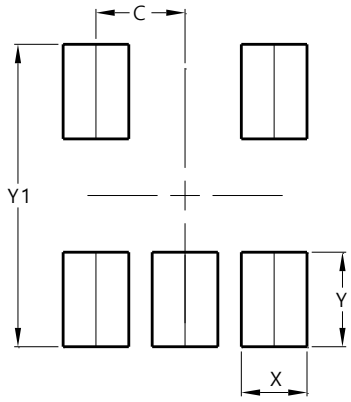


TSOT25			
Dim	**Min**	**Max**	**Typ**
A	-	1.00	-
A1	0.01	0.10	-
A2	0.84	0.90	-
b	0.30	0.45	-
c	0.12	0.20	-
D	-	-	2.90
E	-	-	2.80
E1	-	-	1.60
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	0.50	-
L2	0.25 BSC		
θ	0°	8°	4°
θ1	4°	12°	-
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

TSOT25



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

Mechanical Data

- Moisture Sensitivity: Level 3 per J-STD-020
- Terminals: Finish - Mate Tin Plated Leads, Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.01365 grams (Approximate)

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