# 300mA HIGH SPEED, EXTREMELY LOW NOISE CMOS LDO REGULATOR AP2129

## General Description

The AP2129 is a 300mA, positive Voltage regulator ICs fabricated by CMOS process. The AP2129 provides two kinds of output voltage operation modes for setting the output voltage. Fixed output voltage mode senses the output voltage on $V_{OUT}$, adjustable output voltage mode needs two resistors as a voltage divider

The AP2129 series have features of low dropout voltage, low noise, high output voltage accuracy, and low current consumption which make them ideal for use in various battery-powered devices.

AP2129 has 1.0V, 1.2V, 1.8V, 2.6V, 2.8V, 3.0V and 3.3V fixed voltage version and 0.8V to 4.5V adjustable voltage version.

The AP2129 series are available in DFN-1.5x2-6 (1.0V, 1.2V, 1.8V, 2.6V, 2.8V, 3.0V, 3.3V) and SOT-23-5 (1.0V, 1.2V, 3.3V, ADJ) packages.

## Features

- Wide Operating Voltage: 1.8V to 6V
- High Output Voltage Accuracy: ±2%
- High Ripple Rejection:
  65dB@ f=1kHz, 45dB@ f=10kHz
- Low Standby Current: 0.1μA
- Low Quiescent Current: 60μA Typical
- Low Output Noise: 60μVrms
- Short Current Limit: 50mA
- Over Temperature Protection
- Compatible with Low ESR Ceramic Capacitor: 1μF for $C_{IN}$ and $C_{OUT}$
- Excellent Line/Load Regulation
- Soft Start Time: 50μs
- Auto Discharge Resistance: $R_{DS(ON)}$=60Ω

## Applications

- Datacom
- Notebook Computers
- Mother Board

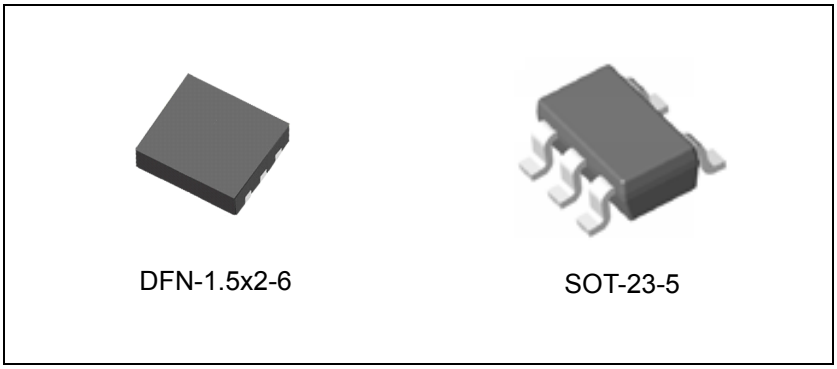
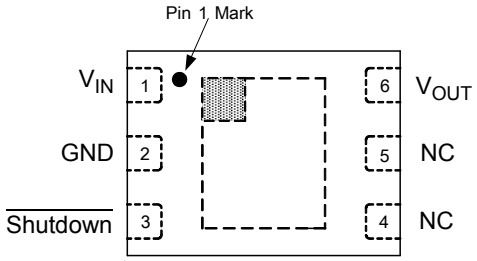



Figure 1. Package Type of AP2129

## Pin Configuration

DN Package
(DFN-1.5x2-6)




K Package
(SOT-23-5)

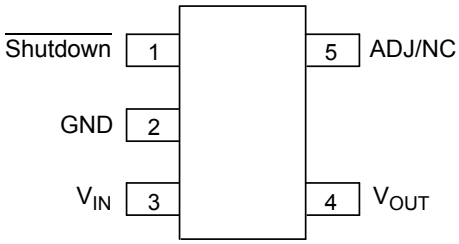
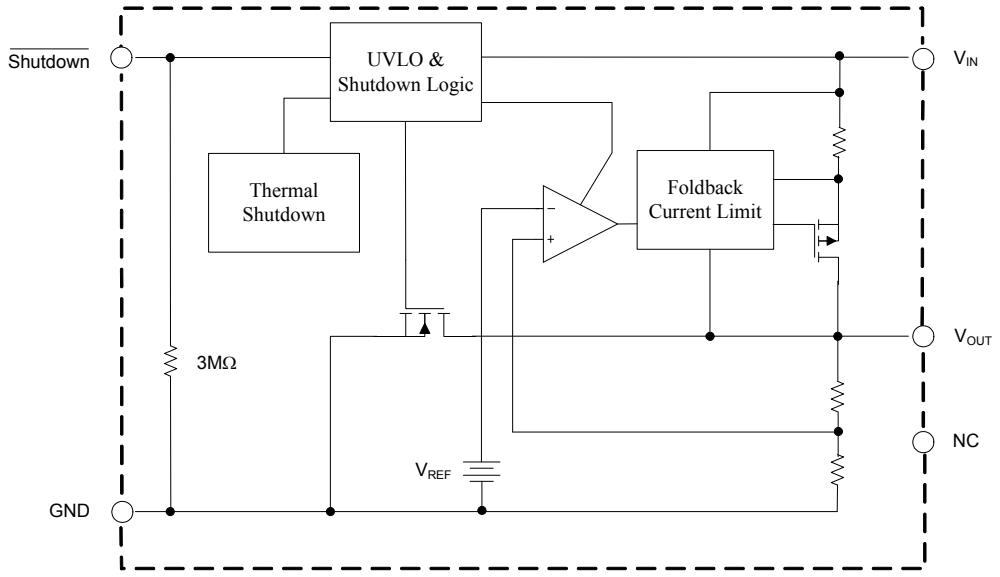



Figure 2. Pin Configuration of AP2129 (Top View)

## Pin Description

| Pin Number | | Pin Name | Function |
|---|---|---|---|
| DFN-1.5x2-6 | SOT-23-5 | | |
| 1 | 3 | $V_{IN}$ | Input Voltage |
| 2 | 2 | GND | Ground |
| 3 | 1 | $\overline{\text{Shutdown}}$ | Active High Enable Input Pin. Logic high=enable, logic low=shut-down |
| 4, 5 | | NC | No Connection |
| | 5 | ADJ/NC | Adjust Output for ADJ version/No Connection for Fixed Version |
| 6 | 4 | $V_{OUT}$ | Regulated Output Voltage |

## Functional Block Diagram



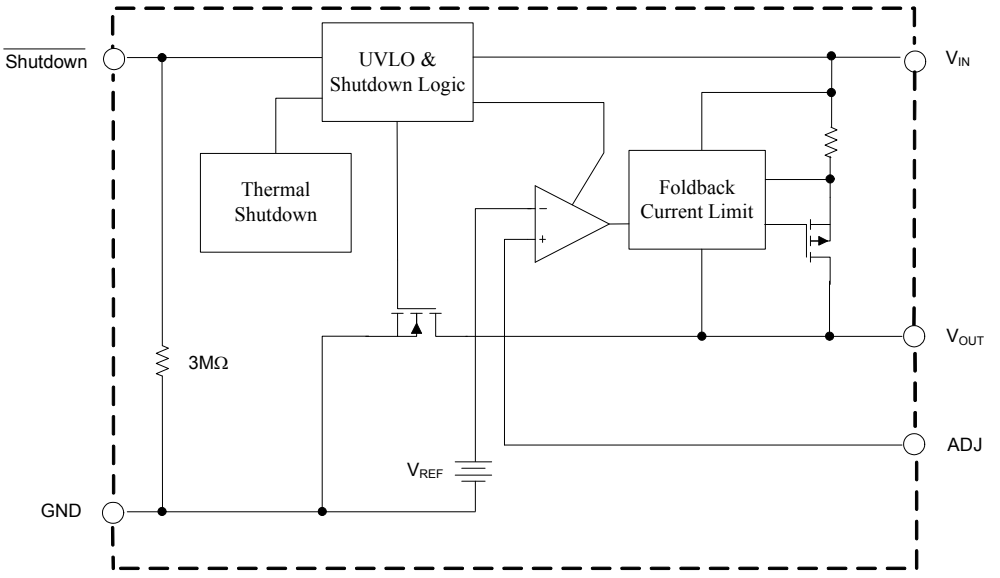
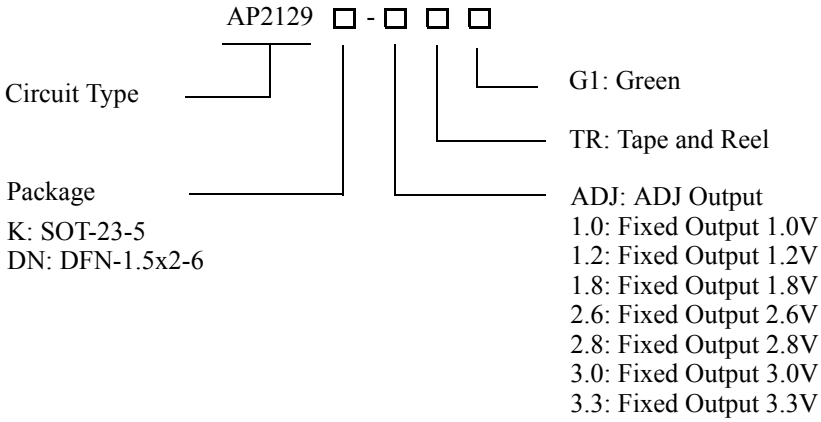




Figure 3. Functional Block Diagram of AP2129

## Ordering Information




| Package | Temperature Range | Part Number | Marking ID | Packing Type |
|---|---|---|---|---|
| SOT-23-5 | -40 to 85°C | AP2129K- ADJTRG1 | GEJ | Tape & Reel |
| | | AP2129K-1.0TRG1 | GEK | Tape & Reel |
| | | AP2129K-1.2TRG1 | GEL | Tape & Reel |
| | | AP2129K-3.3TRG1 | GEM | Tape & Reel |
| DFN-1.5x2-6 | -40 to 85°C | AP2129DN-1.0TRG1 | LA | Tape & Reel |
| | | AP2129DN-1.2TRG1 | MA | Tape & Reel |
| | | AP2129DN-1.8TRG1 | LB | Tape & Reel |
| | | AP2129DN-2.6TRG1 | MB | Tape & Reel |
| | | AP2129DN-2.8TRG1 | LC | Tape & Reel |
| | | AP2129DN-3.0TRG1 | MC | Tape & Reel |
| | | AP2129DN-3.3TRG1 | LD | Tape & Reel |

BCD Semiconductor's products, as designated with "G1" suffix in the part number, are RoHS compliant and Green.

## Absolute Maximum Ratings (Note 1)

| Parameter | Symbol | Value | | Unit |
|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | 6.5 | | V |
| Shutdown Input Voltage | $V_{CE}$ | -0.3 to $V_{IN}$+0.3 | | V |
| Output Current | $I_{OUT}$ | 450 | | mA |
| Junction Temperature | $T_J$ | 150 | | °C |
| Storage Temperature Range | $T_{STG}$ | -65 to 150 | | °C |
| Lead Temperature (Soldering, 10sec) | $T_{LEAD}$ | 260 | | °C |
| Thermal Resistance (Junction to Ambient) | $\theta_{JA}$ | DFN-1.5x2-6 | 100 | °C/W |
| | | SOT-23-5 | 250 | |
| ESD (Human Body Model) | ESD | 6000 | | V |
| ESD (Machine Model) | ESD | 200 | | V |

Note 1: 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

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Input Voltage | $V_{IN}$ | 1.8 | 6 | V |
| Operating Ambient Temperature Range | $T_A$ | -40 | 85 | °C |

## Electrical Characteristics

### AP2129-1.0/1.2/1.8/2.6/2.8/3.0/3.3 Electrical Characteristics

($C_{IN}$=1μF, $C_{OUT}$=1μF, Bold typeface applies over -40°C≤$T_J$≤85°C, unless otherwise specified.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Output Voltage | $V_{OUT}$ | $V_{IN}$=$V_{OUT}$+1V, (Note 2)<br>1mA≤$I_{OUT}$≤300mA | 98%*<br>$V_{OUT}$ | | 102%*<br>$V_{OUT}$ | V |
| Input Voltage | $V_{IN}$ | | 1.8 | | 6 | V |
| Maximum Output Current | $I_{OUT(MAX)}$ | | | 450 | | mA |
| Load Regulation | $\Delta V_{OUT}$<br>/($\Delta I_{OUT}$*$V_{OUT}$) | $V_{IN}$-$V_{OUT}$=1V, (Note 2)<br>1mA≤$I_{OUT}$≤300mA | | | 1.5 | %/A |
| Line Regulation | $\Delta V_{OUT}$<br>/($\Delta V_{IN}$*$V_{OUT}$) | $V_{OUT}$+0.5V≤$V_{IN}$≤6V, (Note 2)<br>$I_{OUT}$=30mA | | | 0.06 | %/V |
| Dropout Voltage | $V_{DROP}$ | $V_{OUT}$=1.0V, $I_{OUT}$=300mA | | 800 | | mV |
| | | $V_{OUT}$=1.2V, $I_{OUT}$=300mA | | 600 | | |
| | | $V_{OUT}$=1.8V, $I_{OUT}$=300mA | | 600 | 700 | |
| | | $V_{OUT}$=2.6V/2.8V/3.0V/3.3V,<br>$I_{OUT}$=300mA | | 170 | 300 | |
| Quiescent Current | $I_Q$ | $V_{IN}$=$V_{OUT}$+1V, $I_{OUT}$=0mA | | 60 | 90 | μA |
| Standby Current | $I_{STD}$ | $V_{IN}$=$V_{OUT}$+1V,<br>$V_{\overline{SHUTDOWN}}$ in off mode | | 0.1 | 1.0 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 1Vp-p<br>$V_{IN}$=$V_{OUT}$+1V, f=100Hz | | 65 | | dB |
| | | f=1KHz | | 65 | | dB |
| | | f=10KHz | | 45 | | dB |
| Output Voltage Temperature Coefficient | ($\Delta V_{OUT}$/$V_{OUT}$)<br>/ΔT | $I_{OUT}$=30mA, -40°C≤$T_J$≤85°C | | **±100** | | ppm/°C |
| Output Current Limit | $I_{LIMIT}$ | $V_{IN}$-$V_{OUT}$=1V, $V_{OUT}$=0.98*$V_{OUT}$ | | 400 | | mA |
| Short Current Limit | $I_{SHORT}$ | $V_{OUT}$=0V | | 50 | | mA |
| Soft Start Time | $t_{UP}$ | | | 50 | | μs |
| RMS Output Noise | $V_{NOISE}$ | $T_A$=25°C, 10Hz ≤f≤100kHz | | 60 | | μVrms |
| $\overline{\text{Shutdown}}$ "High" Voltage | | $\overline{\text{Shutdown}}$ input voltage "High" | 1.5 | | 6 | V |
| $\overline{\text{Shutdown}}$ "Low" Voltage | | $\overline{\text{Shutdown}}$ input voltage "Low" | 0 | | 0.4 | V |
| $V_{OUT}$ Discharge MOSFET $R_{DS(ON)}$ | | $\overline{\text{Shutdown}}$ input voltage "Low" | | 60 | | Ω |
| $\overline{\text{Shutdown}}$ Pull Down Resistance | | | | 3 | | MΩ |
| Thermal Shutdown | | | | 165 | | °C |
| Thermal Shutdown Hysteresis | | | | 30 | | °C |
| Thermal Resistance | $\theta_{JC}$ | DFN-1.5x2-6 | | 20 | | °C/W |
| | | SOT-23-5 | | 150 | | |

Note 2: $V_{IN}$=2.8V for 1.0 and 1.2 version

## Electrical Characteristics (Continued)

## AP2129-ADJ Electrical Characteristics

($C_{IN}$=1μF, $C_{OUT}$=1μF, Bold typeface applies over -40°C≤$T_J$≤85°C, unless otherwise specified.)

| Parameter | Symbol | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| Reference Voltage | $V_{REF}$ | $V_{IN}$=1.8V<br>1mA≤$I_{OUT}$≤300mA | | 0.748 | 0.8 | 0.816 | V |
| Input Voltage | $V_{IN}$ | | | 1.8 | | 6 | V |
| Maximum Output Current | $I_{OUT(MAX)}$ | | | | 450 | | mA |
| Load Regulation | $\Delta V_{OUT}$ /($\Delta I_{OUT}$*$V_{OUT}$) | $V_{IN}$-$V_{OUT}$=1V,<br>1mA≤$I_{OUT}$≤300mA | | | | 1.5 | %/A |
| Line Regulation | $\Delta V_{OUT}$ /($\Delta V_{IN}$*$V_{OUT}$) | $V_{OUT}$+0.5V≤$V_{IN}$≤6V<br>$I_{OUT}$=30mA | | | | 0.06 | %/V |
| Quiescent Current | $I_Q$ | $V_{IN}$=$V_{OUT}$+1V, $I_{OUT}$=0mA | | | 60 | 90 | μA |
| Standby Current | $I_{STD}$ | $V_{IN}$=$V_{OUT}$+1V,<br>$V_{\overline{SHUTDOWN}}$ in off mode | | | 0.1 | 1.0 | μA |
| Power Supply Rejection Ratio | PSRR | Ripple 1Vp-p<br>$V_{IN}$=$V_{OUT}$+1V | f=100Hz | | 65 | | dB |
| | | | f=1KHz | | 65 | | dB |
| | | | f=10KHz | | 45 | | dB |
| Output Voltage Temperature Coefficient | ($\Delta V_{OUT}$/$V_{OUT}$) /$\Delta$T | $I_{OUT}$=30mA, -40°C≤$T_J$≤85°C | | | **±100** | | ppm/°C |
| Output Current Limit | $I_{LIMIT}$ | | | | 400 | | mA |
| Short Current Limit | $I_{SHORT}$ | $V_{OUT}$=0V | | | 50 | | mA |
| Soft Start Time | $t_{UP}$ | | | | 50 | | μs |
| RMS Output Noise | $V_{NOISE}$ | $T_A$=25°C, 10Hz ≤f≤100kHz | | | 60 | | μVrms |
| $\overline{\text{Shutdown}}$ "High" Voltage | | $\overline{\text{Shutdown}}$ input voltage "High" | | 1.5 | | 6 | V |
| $\overline{\text{Shutdown}}$ "Low" Voltage | | $\overline{\text{Shutdown}}$ input voltage "Low" | | 0 | | 0.4 | V |
| $V_{OUT}$ Discharge MOSFET $R_{DS(ON)}$ | | $\overline{\text{Shutdown}}$ input voltage "Low" | | | 60 | | Ω |
| $\overline{\text{Shutdown}}$ Pull Down Resistance | | | | | 3 | | MΩ |
| Thermal Shutdown | | | | | 165 | | °C |
| Thermal Shutdown Hysteresis | | | | | 30 | | °C |
| Thermal Resistance | $\theta_{JC}$ | DFN-1.5x2-6 | | | 20 | | °C/W |
| | | SOT-23-5 | | | 150 | | |

## Typical Performance Characteristics

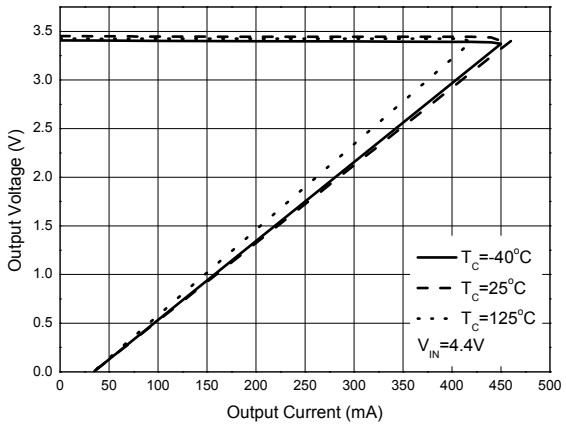



Figure 4. Output Voltage vs. Output Current

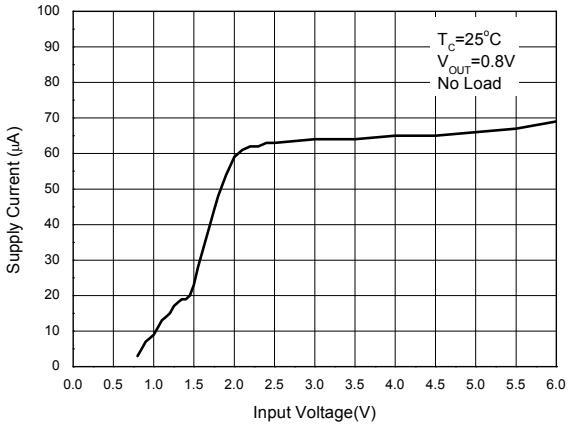



Figure 5. Supply Current vs. Input Voltage

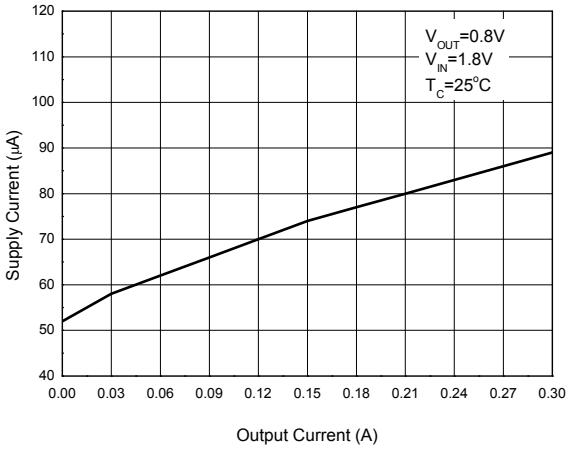



Figure 6. Supply Current vs. Output Current

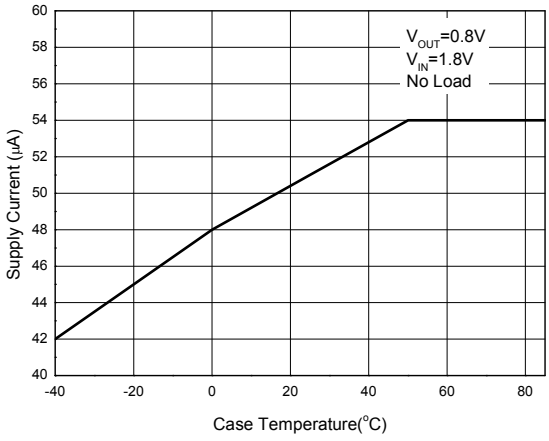



Figure 7. Supply Current vs. Case Temperature

## Typical Performance Characteristics (Continued)

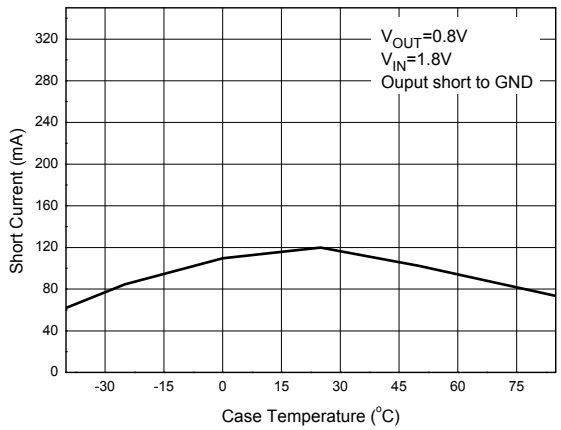



Figure 8. Short Current vs. Case Temperature

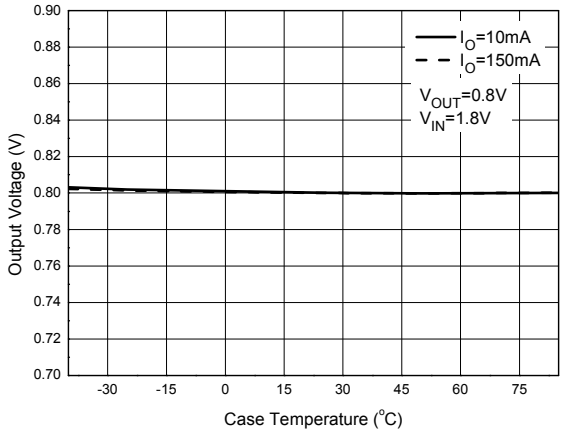



Figure 9. Output Voltage vs. Case Temperature

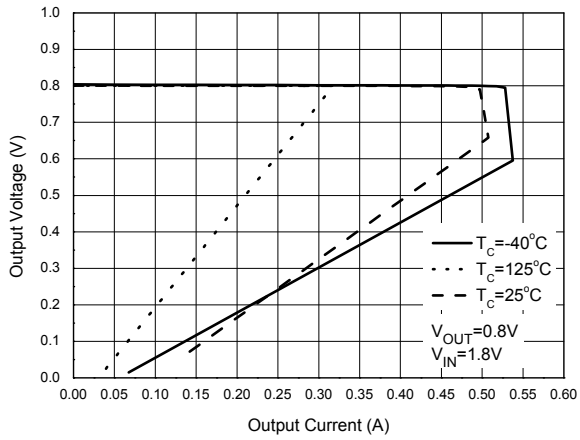



Figure 10. Output Voltage vs. Output Current

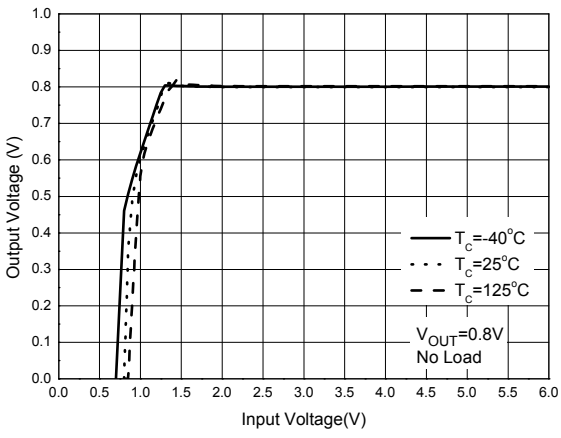



Figure 11. Output Voltage vs. Input Voltage

## Typical Performance Characteristics (Continued)

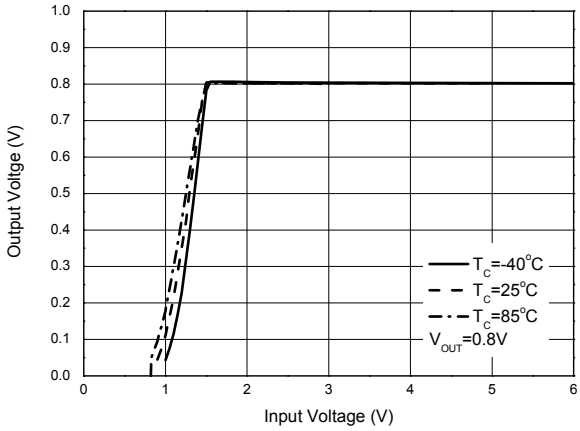



Figure 12. Output Voltage vs. Input Voltage
($I_{OUT}$=300mA)

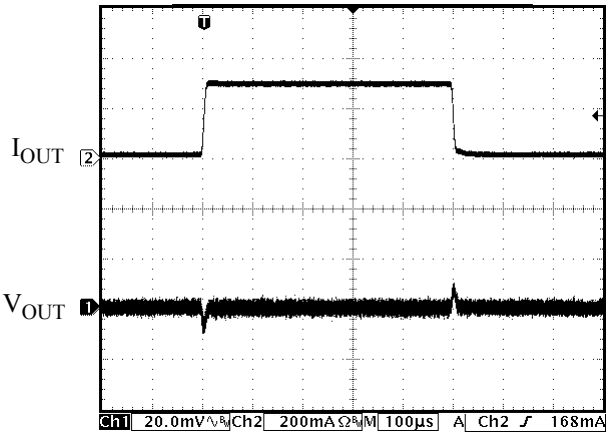



Figure 13. Load Transient
(Conditions: $C_{IN}$=$C_{OUT}$=1µF, $V_{IN}$=2.5V, $V_{OUT}$=0.8V)

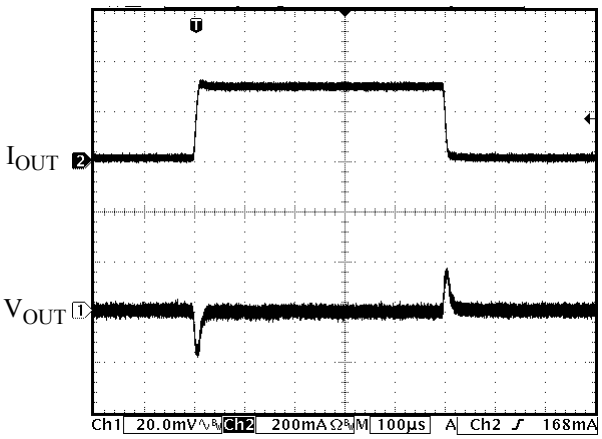



Figure 14. Load Transient
(Conditions: $C_{IN}$=$C_{OUT}$=1µF, $V_{IN}$=4.4V, $V_{OUT}$=3.3V)

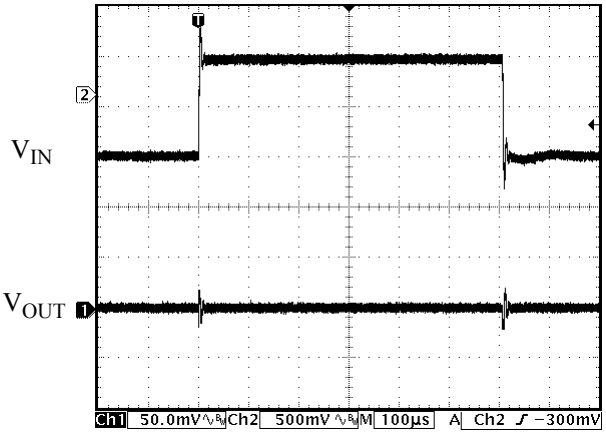



Figure 15. Line Transient
(Conditions: $I_{OUT}$=30mA, $C_{IN}$=$C_{OUT}$=1µF,
$V_{IN}$=2.5 to 3.5V, $V_{OUT}$=0.8V)

## Typical Performance Characteristics (Continued)

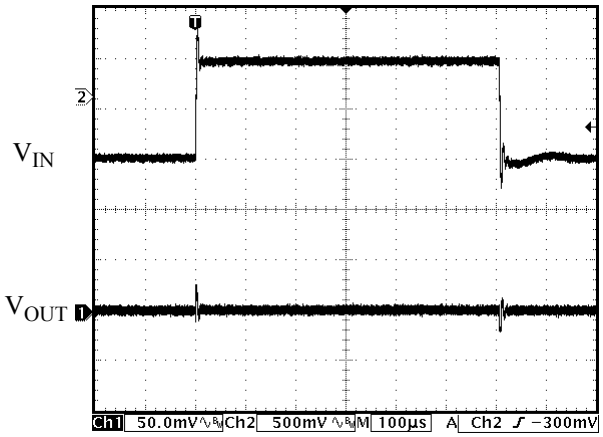



Figure 16. Line Transient

(Conditions: $I_{OUT}$=30mA, $C_{IN}$=$C_{OUT}$=1µF, $V_{IN}$=4 to 5V, $V_{OUT}$=3.3V)

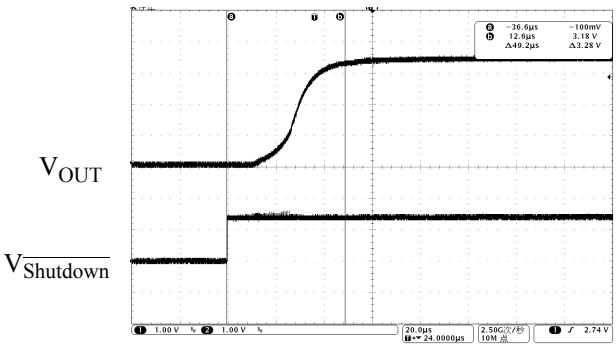



Figure 17. Soft Start Time

(Conditions: $I_{OUT}$=0mA, $C_{IN}$=$C_{OUT}$=1µF, $V_{\overline{Shutdown}}$=0 to 2V, $V_{OUT}$=3.3V)

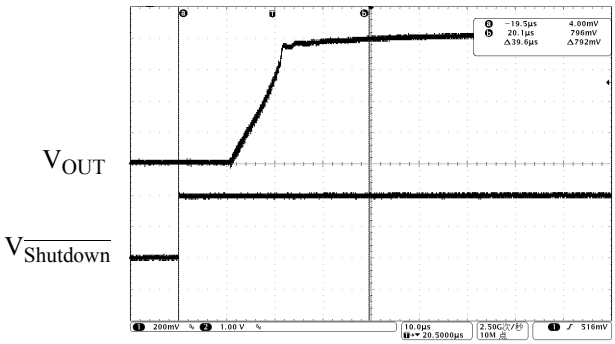



Figure 18. Soft Start Time

(Conditions: $I_{OUT}$=0mA, $C_{IN}$=$C_{OUT}$=1µF, $V_{\overline{Shutdown}}$=0 to 2V, $V_{OUT}$=0.8V)

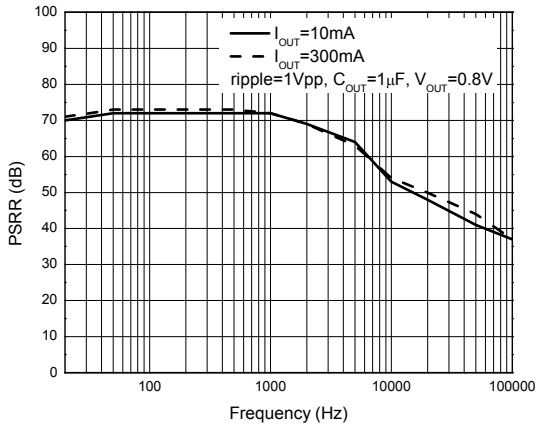



Figure 19. PSRR vs. Frequency

## Typical Performance Characteristics (Continued)

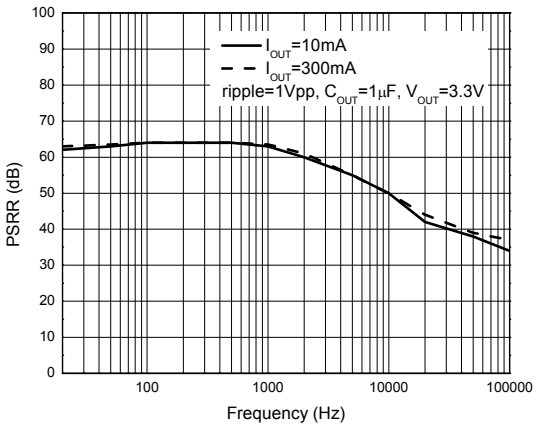



Figure 20. PSRR vs. Frequency

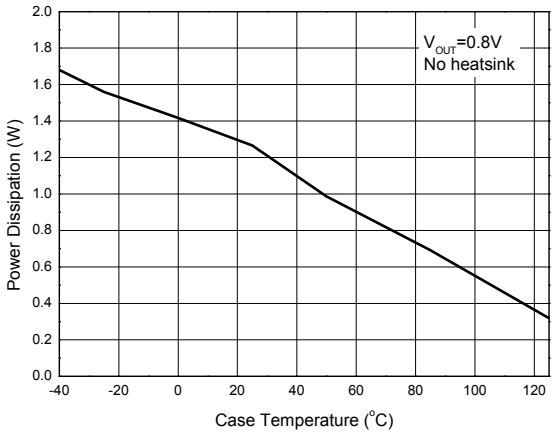
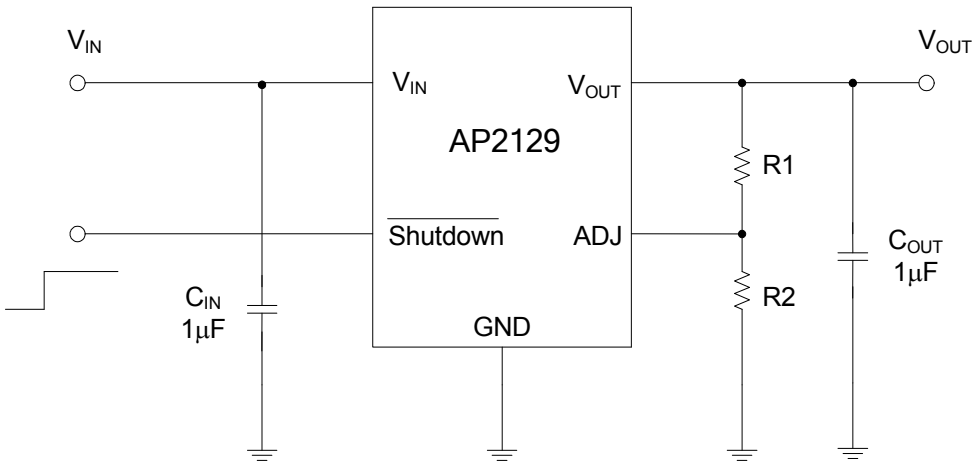
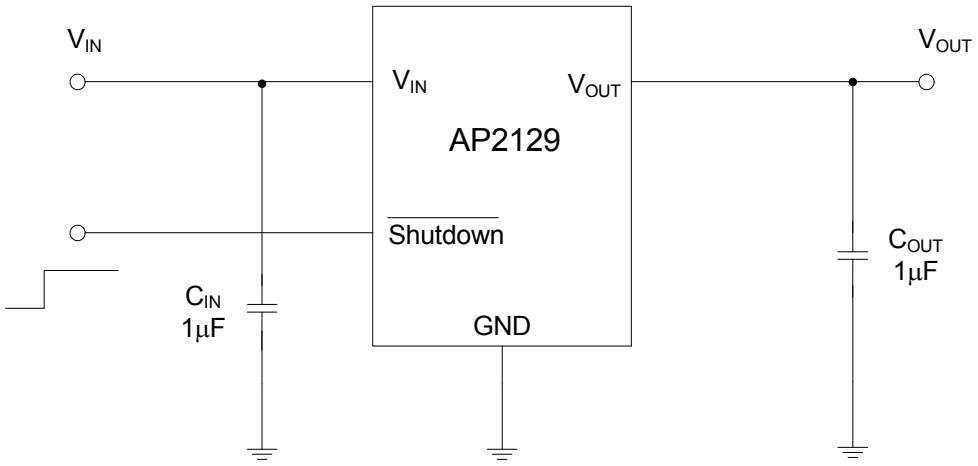



Figure 21. Power Dissipation vs. Case Temperature

## Typical Application




$V_{OUT}$=0.8*(1+R1/R2) V

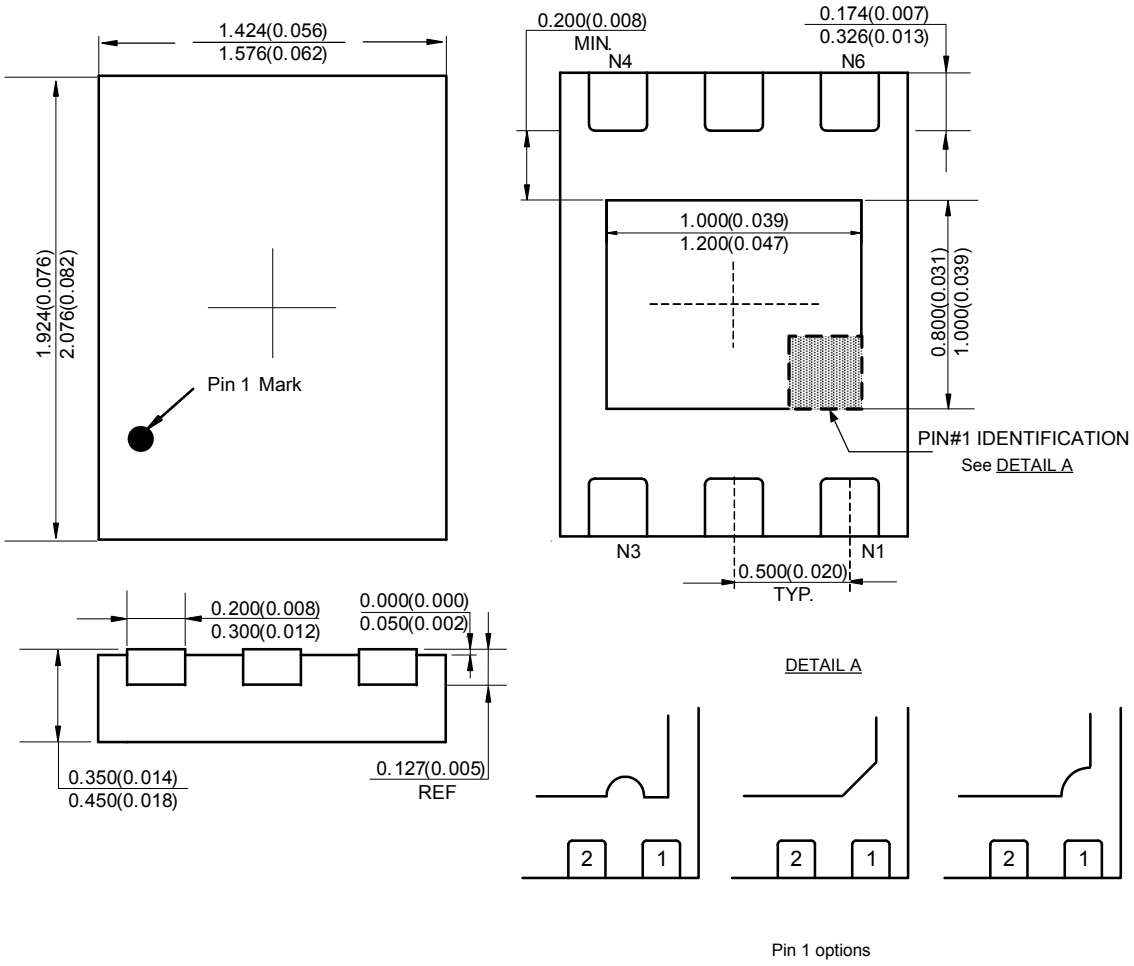



$V_{OUT}$=1.0V, 1.2V, 1.8V, 2.6V, 2.8V, 3.0V, 3.3V

Figure 22. Typical Application of AP2129

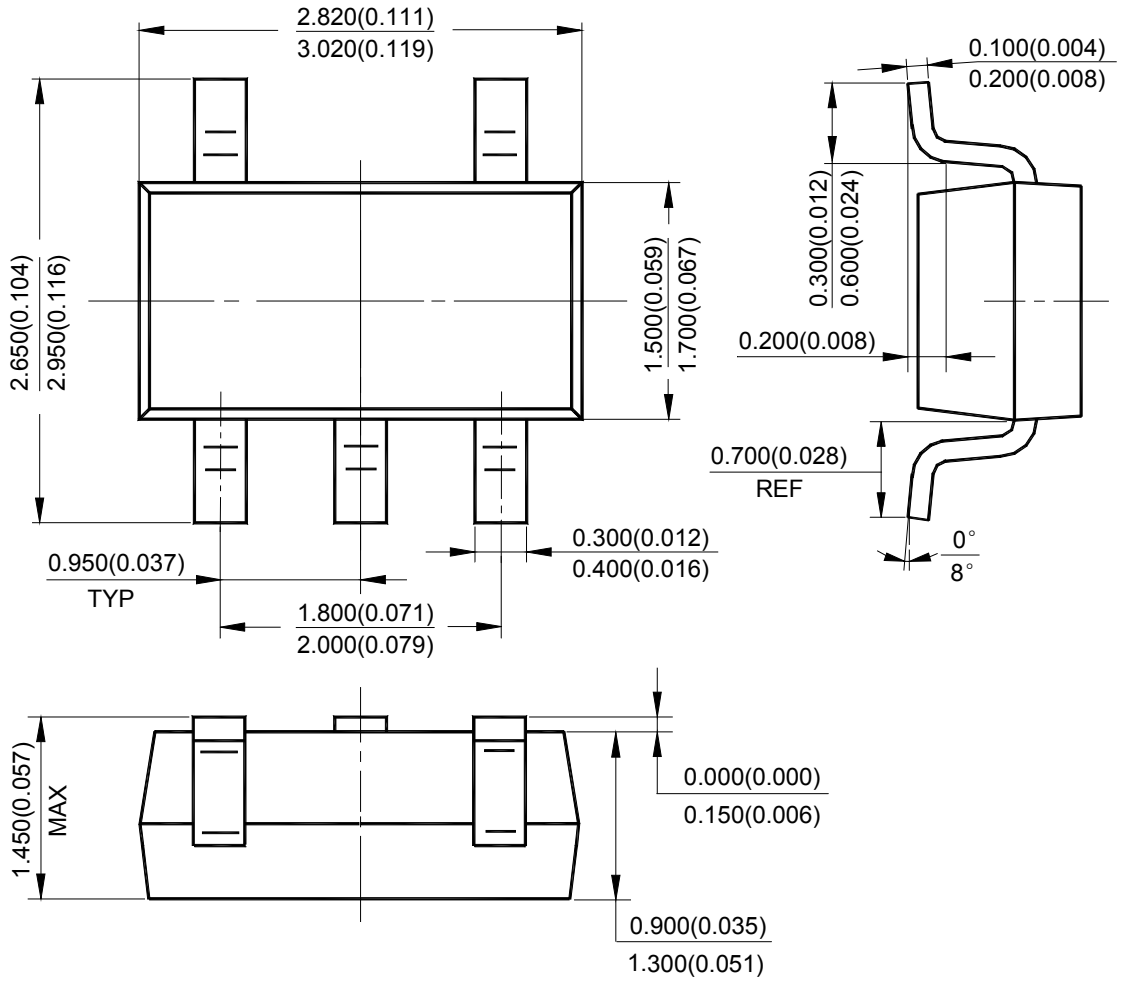
## Mechanical Dimensions

**DFN-1.5x2-6** **Unit: mm(inch)**



## Mechanical Dimensions (Continued)

**SOT-23-5** **Unit: mm(inch)**



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