## Description

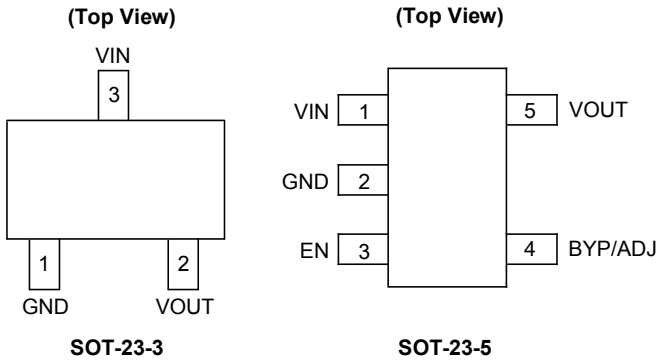
The AP2210 is a 300mA ULDO regulator which provides very low noise, ultra-low dropout voltage (typically 250mV at 300mA), very low standby current (1μA maximum), and excellent power supply ripple rejection (PSRR 75dB at 100Hz). This device is used in battery powered applications, such as handsets and PDAs; and in noise sensitive applications, such as RF electronics.

The AP2210 also features individual logic compatible enable/shutdown control inputs, a low power shutdown mode for extended battery life, overcurrent protection, overtemperature protection, and reversed current protection.

The AP2210 has 2.5V, 2.8V, 3.0V, 3.3V, 3.6V, 4.0V, 5.0V, and ADJ versions.

The AP2210 is available in the space saving SOT-23-3 and SOT-23-5 packages.

## Pin Assignments




## Features

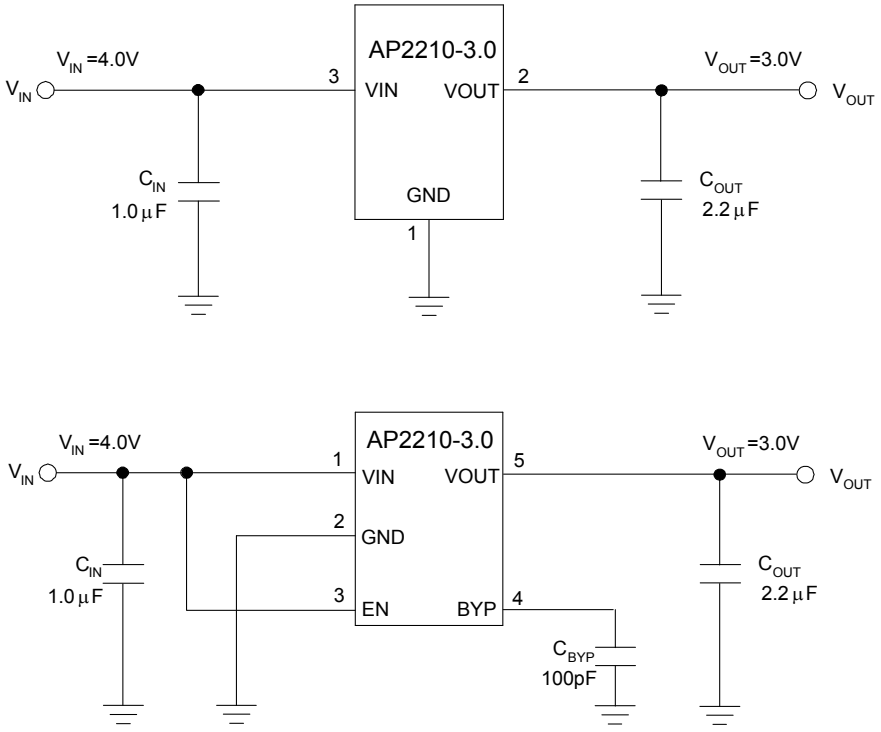
- Up to 300mA Output Current
- Excellent ESR Stability
- Low Standby Current
- Low Dropout Voltage: $V_{DROP}$ = 250mV at 300mA
- High Output Accuracy: ±1%
- Good Ripple Rejection Ability: 75dB at 100Hz and $I_{OUT}$ = 100μA
- Tight Load and Line Regulation
- Low Temperature Coefficient
- Over-Current Protection
- Thermal Protection
- Reverse Current Protection
- Logic-controlled Enable
- Moisture Sensitivity: Level 3 Per J-STD-020
- Terminals: SOT-23-3/SOT-23-5 Finish—Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight:
  - SOT-23-3: 0.014 grams (Approximate)
  - SOT-23-5: 0.015 grams (Approximate)
  - **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- Lead-Free Packages, Available in "Green" Molding Compound: SOT-23-3, SOT-23-5
  - **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-Q100/101/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

## Applications

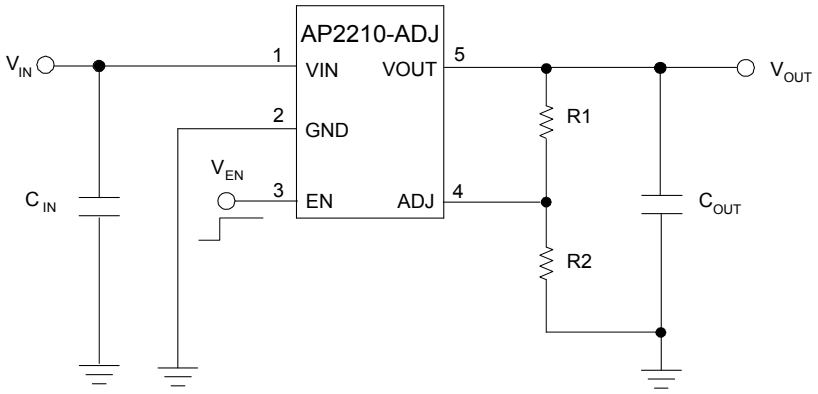
- Cellular Phones
- Cordless Phones
- Wireless Communicators
- PDAs/Palmtops
- PC Motherboards
- Consumer Electronics

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 (Note 4)




For Fixed Version




$V_{OUT}$ = 1.25V*(1+R2/R1)

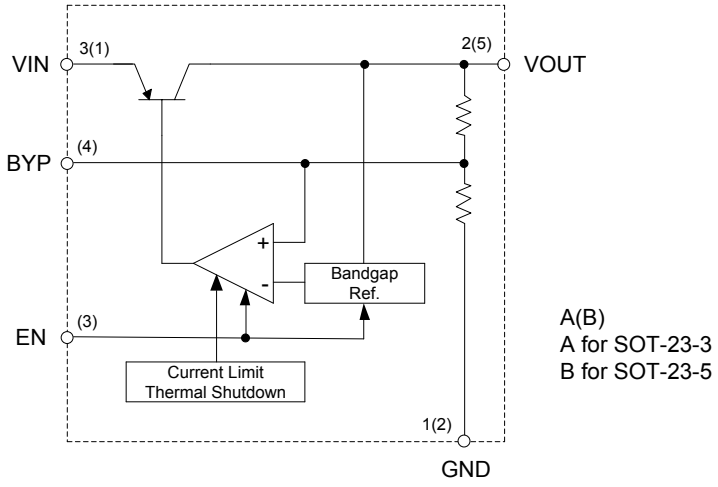
For Adjustable Version

Notes: 4. Dropout voltage is 250mV when $T_A$ = +25°C. In order to obtain a normal output voltage, $V_{OUT}$+0.25V is the minimum input voltage which will result a low PSRR, imposing a bad influence on system. Therefore, the recommended input voltage is $V_{OUT}$+1V to 13.2V. For AP2210-3.0 version, its input voltage can be set from 4V ($V_{OUT}$+1V) to 13.2V.

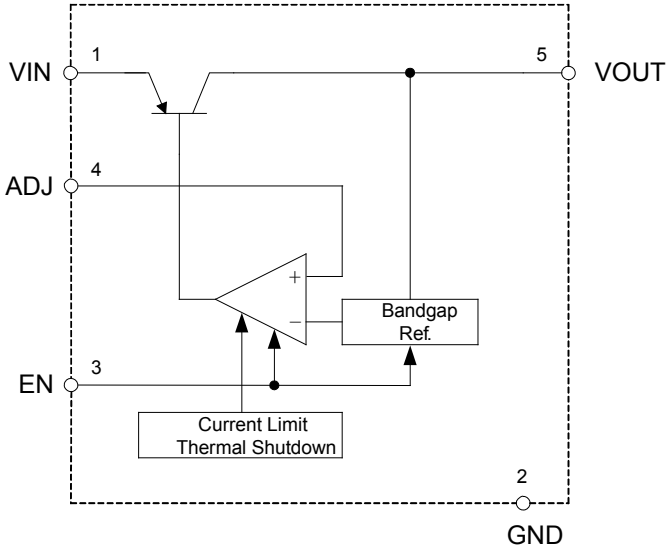
## Pin Descriptions

| Pin Number | | Pin Name | Function |
|---|---|---|---|
| SOT23-3 | SOT23-5 | | |
| 1 | 2 | GND | Ground |
| 2 | 5 | VOUT | Regulated output voltage |
| 3 | 1 | VIN | Input voltage |
| – | 3 | EN | Enable input: CMOS or TTL compatible input. Logic high=enable, logic low=shutdown |
| – | 4 | BYP/ADJ | Bypass capacitor for low noise operation/Adjustable Output |

## Functional Block Diagram




Fixed Version




ADJ Version (For SOT-23-5)

## Absolute Maximum Ratings (Note 5)

| Symbol | Parameter | Rating | | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Supply Input Voltage | 15 | | V |
| $V_{EN}$ | Enable Input Voltage | 15 | | V |
| $P_D$ | Power Dissipation | Internally Limited (Thermal Protection) | | W |
| $T_{LEAD}$ | Lead Temperature (Soldering, 10sec) | +260 | | °C |
| $T_J$ | Junction Temperature | +150 | | °C |
| $T_{STG}$ | Storage Temperature | -65 to +150 | | °C |
| ESD | ESD (Machine Model) | 300 | | V |
| $\theta_{JA}$ | Thermal Resistance (No Heatsink) | SOT-23-3 | 200 | °C/W |
| | | SOT-23-5 | 200 | |

Notes: 5. 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 |
|---|---|---|---|---|
| $V_{IN}$ | Supply Input Voltage | 2.5 | 13.2 | V |
| $V_{EN}$ | Enable Input Voltage | 0 | 13.2 | V |
| $T_J$ | Operating Junction Temperature | -40 | +125 | °C |

## AP2210-2.5 Electrical Characteristics ($V_{IN}$ = 3.5V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **48** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = 3.5V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $V_{DROP}$ | Dropout Voltage (Note 9) | $I_{OUT}$ = 100µA | — | 15 | 50 | mV |
| | | | — | — | **70** | |
| | | $I_{OUT}$ = 50mA | — | 110 | 150 | |
| | | | — | — | **230** | |
| | | $I_{OUT}$ = 100mA | — | 140 | 250 | |
| | | | — | — | **300** | |
| | | $I_{OUT}$ = 150mA | — | 165 | 275 | |
| | | | — | — | **350** | |
| | | $I_{OUT}$ = 300mA | — | 250 | 400 | |
| | | | — | — | **500** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |

## AP2210-2.5 Electrical Characteristics (Cont.) ($V_{IN}$ = 3.5V, $I_{OUT}$ = 100μA, $C_{IN}$ = 1.0μF, $C_{OUT}$ = 2.2μF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2μF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | μA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | μA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

## AP2210-2.8 Electrical Characteristics ($V_{IN}$ = 3.8V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **42.8** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = 3.8V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $V_{DROP}$ | Dropout Voltage (Note 9) | $I_{OUT}$ = 100µA | — | 15 | 50 | mV |
| | | | — | — | **70** | |
| | | $I_{OUT}$ = 50mA | — | 110 | 150 | |
| | | | — | — | **230** | |
| | | $I_{OUT}$ = 100mA | — | 140 | 250 | |
| | | | — | — | **300** | |
| | | $I_{OUT}$ = 150mA | — | 165 | 275 | |
| | | | — | — | **350** | |
| | | $I_{OUT}$ = 300mA | — | 250 | 400 | |
| | | | — | — | **500** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |

## AP2210-2.8 Electrical Characteristics (Cont.) ($V_{IN}$ = 3.8V, $I_{OUT}$ = 100μA, $C_{IN}$ = 1.0μF, $C_{OUT}$ = 2.2μF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2μF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | μA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | μA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

## AP2210-3.0 Electrical Characteristics ($V_{IN}$ = 4V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **40** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = 4V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $V_{DROP}$ | Dropout Voltage (Note 9) | $I_{OUT}$ = 100µA | — | 15 | 50 | mV |
| | | | — | — | **70** | |
| | | $I_{OUT}$ = 50mA | — | 110 | 150 | |
| | | | — | — | **230** | |
| | | $I_{OUT}$ = 100mA | — | 140 | 250 | |
| | | | — | — | **300** | |
| | | $I_{OUT}$ = 150mA | — | 165 | 275 | |
| | | | — | — | **350** | |
| | | $I_{OUT}$ = 300mA | — | 250 | 400 | |
| | | | — | — | **500** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |

## AP2210-3.0 Electrical Characteristics (Cont.) ($V_{IN}$ = 4V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2µF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | µA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | µA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

## AP2210-3.3 Electrical Characteristics ($V_{IN}$ = 4.3V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **36.3** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = 4.3V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $V_{DROP}$ | Dropout Voltage (Note 9) | $I_{OUT}$ = 100µA | — | 15 | 50 | mV |
| | | | — | — | **70** | |
| | | $I_{OUT}$ = 50mA | — | 110 | 150 | |
| | | | — | — | **230** | |
| | | $I_{OUT}$ = 100mA | — | 140 | 250 | |
| | | | — | — | **300** | |
| | | $I_{OUT}$ = 150mA | — | 165 | 275 | |
| | | | — | — | **350** | |
| | | $I_{OUT}$ = 300mA | — | 250 | 400 | |
| | | | — | — | **500** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |

## AP2210-3.3 Electrical Characteristics (Cont.) ($V_{IN}$ = 4.3V, $I_{OUT}$ = 100μA, $C_{IN}$ = 1.0μF, $C_{OUT}$ = 2.2μF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2μF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | μA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | μA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

## AP2210-3.6 Electrical Characteristics ($V_{IN}$ = 4.6V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **48** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = 4.6V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $V_{DROP}$ | Dropout Voltage (Note 9) | $I_{OUT}$ = 100µA | — | 15 | 50 | mV |
| | | | — | — | **70** | |
| | | $I_{OUT}$ = 50mA | — | 110 | 150 | |
| | | | — | — | **230** | |
| | | $I_{OUT}$ = 100mA | — | 140 | 250 | |
| | | | — | — | **300** | |
| | | $I_{OUT}$ = 150mA | — | 165 | 275 | |
| | | | — | — | **350** | |
| | | $I_{OUT}$ = 300mA | — | 250 | 400 | |
| | | | — | — | **500** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |

## AP2210-3.6 Electrical Characteristics (Cont.) ($V_{IN}$ = 4.6V, $I_{OUT}$ = 100μA, $C_{IN}$ = 1.0μF, $C_{OUT}$ = 2.2μF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2μF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | μA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | μA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

## AP2210-4.0 Electrical Characteristics ($V_{IN}$ = 5.0V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **48** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = 5.0V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $V_{DROP}$ | Dropout Voltage (Note 9) | $I_{OUT}$ = 100µA | — | 15 | 50 | mV |
| | | | — | — | **70** | |
| | | $I_{OUT}$ = 50mA | — | 110 | 150 | |
| | | | — | — | **230** | |
| | | $I_{OUT}$ = 100mA | — | 140 | 250 | |
| | | | — | — | **300** | |
| | | $I_{OUT}$ = 150mA | — | 165 | 275 | |
| | | | — | — | **350** | |
| | | $I_{OUT}$ = 300mA | — | 250 | 400 | |
| | | | — | — | **500** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |

## AP2210-4.0 Electrical Characteristics (Cont.) ($V_{IN}$ = 5.0V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2µF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | µA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | µA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

## AP2210-5.0 Electrical Characteristics ($V_{IN}$ = 6.0V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **48** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = 6.0V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $V_{DROP}$ | Dropout Voltage (Note 9) | $I_{OUT}$ = 100µA | — | 15 | 50 | mV |
| | | | — | — | **70** | |
| | | $I_{OUT}$ = 50mA | — | 110 | 150 | |
| | | | — | — | **230** | |
| | | $I_{OUT}$ = 100mA | — | 140 | 250 | |
| | | | — | — | **300** | |
| | | $I_{OUT}$ = 150mA | — | 165 | 275 | |
| | | | — | — | **350** | |
| | | $I_{OUT}$ = 300mA | — | 250 | 400 | |
| | | | — | — | **500** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |

## AP2210-5.0 Electrical Characteristics (Cont.) ($V_{IN}$ = 6.0V, $I_{OUT}$ = 100μA, $C_{IN}$ = 1.0μF, $C_{OUT}$ = 2.2μF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2μF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | μA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | μA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

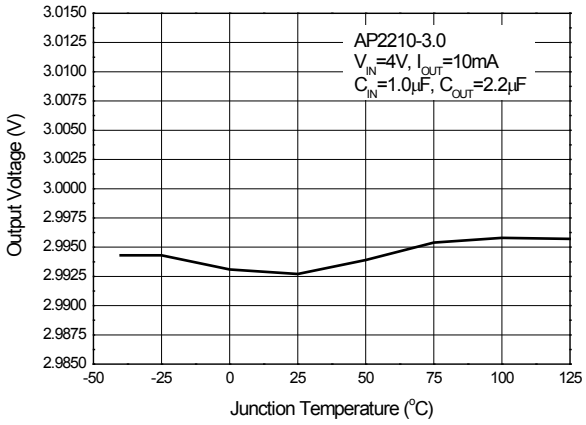
## AP2210-ADJ Electrical Characteristics ($V_{IN}$ = $V_{OUT}$+1V, $I_{OUT}$ = 100µA, $C_{IN}$ = 1.0µF, $C_{OUT}$ = 2.2µF, $V_{EN}$ ≥ 2.0V, $T_J$ = +25°C, **Bold** typeface applies over -40°C ≤ $T_J$ ≤ +125°C (Note 6), unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $\Delta V_{OUT}/V_{OUT}$ | Output Voltage Accuracy | Variation from specified $V_{OUT}$ | -1 | — | 1 | % |
| | | | **-2** | — | **2** | |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient (Note 7) | — | — | **120** | — | µV/°C |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | — | — | **48** | — | ppm/°C |
| $V_{RLINE}$ | Line Regulation | $V_{IN}$ = $V_{OUT}$+1V to 13.2V | — | 1.5 | 4.5 | mV |
| | | | — | — | **12** | |
| $V_{RLOAD}$ | Load Regulation (Note 8) | $I_{OUT}$ = 0.1mA to 300mA | — | 1 | 6 | mV |
| | | | — | — | **30** | |
| $I_{STD}$ | Standby Current | $V_{EN}$ ≤ 0.4V (shutdown) | — | 0.01 | 1 | µA |
| | | $V_{EN}$ ≤ 0.18V (shutdown) | — | — | **5** | |
| $I_{GND}$ | Ground Pin Current (Note 10) | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 100µA | — | 100 | 150 | µA |
| | | | — | — | **180** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 50mA | — | 350 | 600 | |
| | | | — | — | **800** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 150mA | — | 1.3 | 1.9 | mA |
| | | | — | — | **2.5** | |
| | | $V_{EN}$ ≥ 2.0V, $I_{OUT}$ = 300mA | — | 4 | 10 | |
| | | | — | — | **15** | |
| PSRR | Ripple Rejection | f = 100Hz, $I_{OUT}$ = 100µA | — | 75 | — | dB |
| $I_{LIMIT}$ | Current Limit | $V_{OUT}$ = 0V | — | **450** | 900 | mA |
| $e_{no}$ | Output Noise | $I_{OUT}$ = 50mA, $C_{OUT}$ = 2.2µF, 100pF from BYP to GND | — | 260 | — | $nV/\sqrt{Hz}$ |
| $V_{IL}$ | Enable Input Logic-low Voltage | Regulator shutdown | — | — | 0.4 | V |
| | | | — | — | **0.18** | |
| $V_{IH}$ | Enable Input Logic-high Voltage | Regulator enabled | **2.0** | — | — | V |
| $I_{IL}$ | Enable Input Logic-low Current | $V_{IL}$ ≤ 0.4V | — | 0.01 | 1 | µA |
| | | $V_{IL}$ ≤ 0.18V | — | — | **2** | |
| $I_{IH}$ | Enable Input Logic-high Current | $V_{IL}$ ≥ 2.0V | — | 5 | 20 | µA |
| | | $V_{IL}$ ≥ 2.0V | — | — | **25** | |

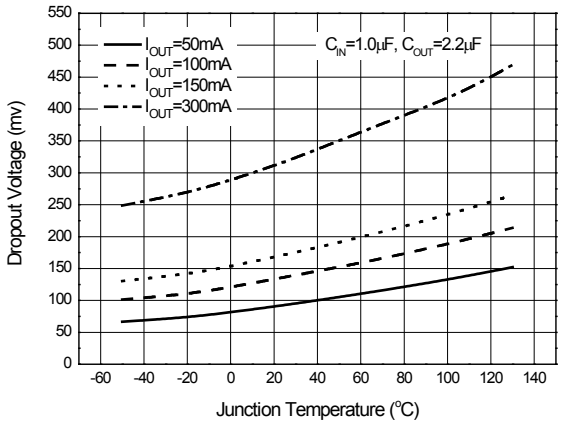
Notes:
6. Specifications in bold type are limited to -40°C ≤ $T_J$ ≤ +125°C. Limits over temperature are guaranteed by design, but not tested in production.
7. Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.
8. Regulation is measured at constant junction temperature using low duty cycle pulse testing. Parts are tested for load regulation in the load range from 0.1mA to 300mA. Changes in output voltage due to heating effects are covered by the thermal regulation specification.
9. Dropout voltage is defined as the input to output differential at which the output voltage drops 1% ($T_J$ = +25°C) or 2% (-40°C ≤ $T_J$ ≤ +125°C) below its nominal value measured at 1V differential.
10. Ground pin current is the regulator quiescent current plus pass transistor base current. The total current drawn from the supply is the sum of the load current plus the ground pin current.

## Performance Characteristics

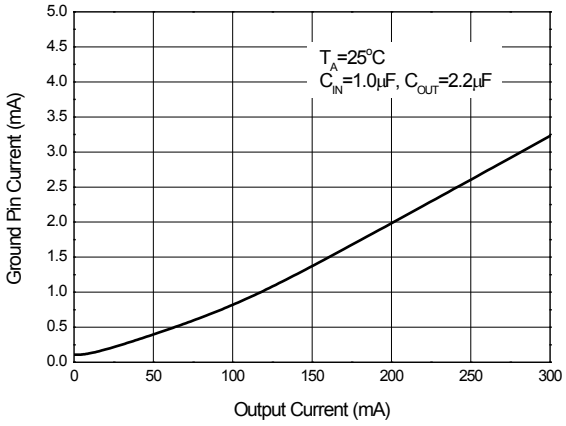
### Output Voltage vs. Junction Temperature



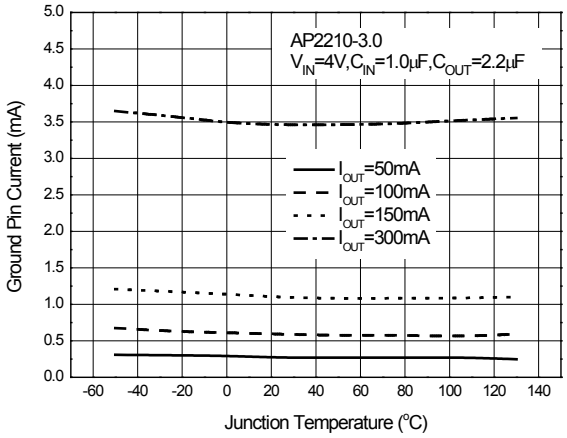

### Dropout Voltage vs. Junction Temperature



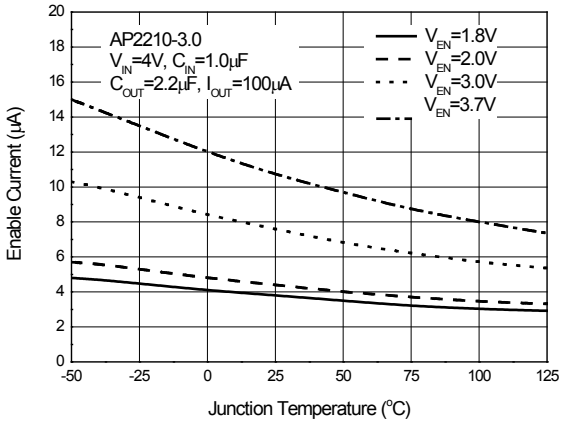

### Ground Pin Current vs. Output Current



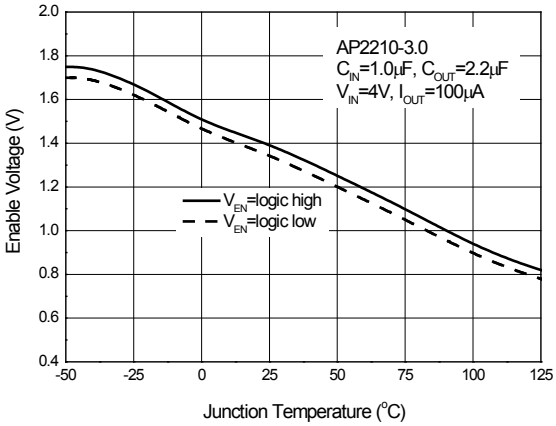

### Ground Pin Current vs. Junction Temperature




### Enable Current vs. Junction Temperature

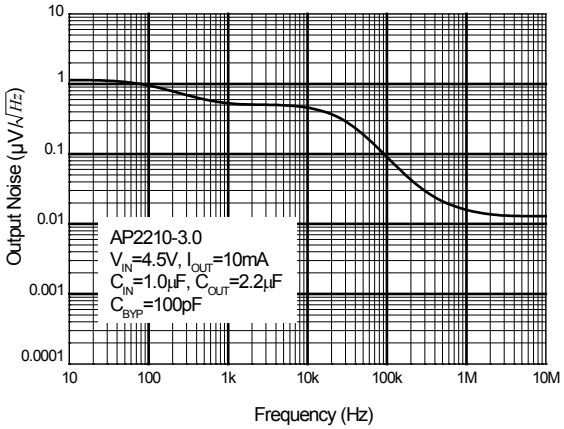



### Enable Voltage vs. Junction Temperature

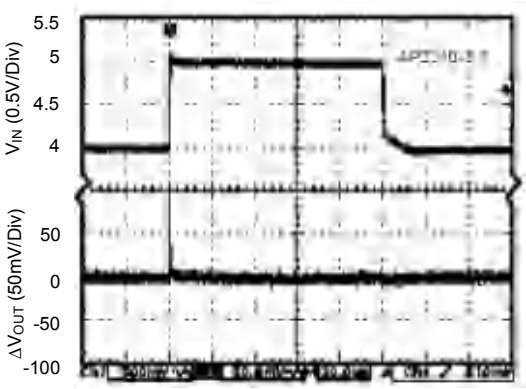


## Performance Characteristics (Cont.)

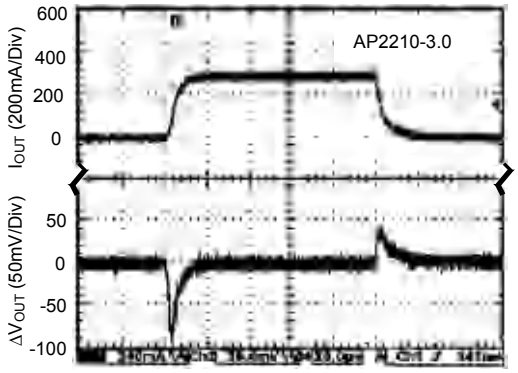
**Output Noise vs. Frequency**



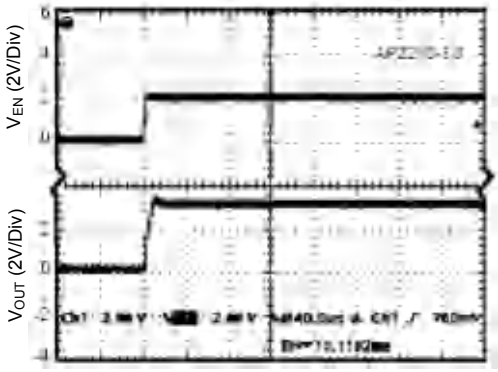

**Line Transient**
**(Conditions: $V_{IN}$ =4 to 5V, $V_{EN}$ =2V, $I_{OUT}$ = 1mA, $C_{OUT}$ = 2.2μF)**



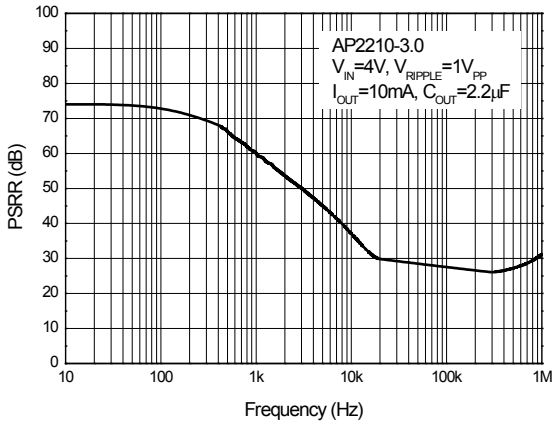

**Load Transient**
**(Conditions: $V_{IN}$ = 4V, $V_{EN}$ = 2V, $I_{OUT}$ = 10mA to 300mA, $C_{IN}$ = 1.0μF, $C_{OUT}$ = 2.2μF)**



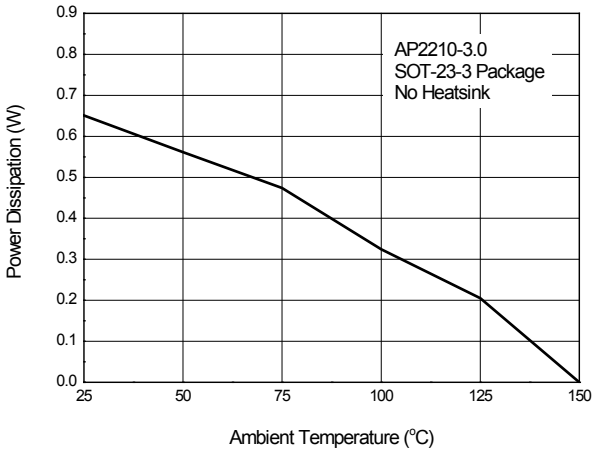

**$V_{EN}$ vs. $V_{OUT}$**
**(Conditions: $V_{EN}$ = 0 to 2V, $V_{IN}$ = 4V, $I_{OUT}$ = 30mA, $C_{IN}$ = 1.0μF, $C_{OUT}$ = 2.2μF)**




**PSRR vs. Frequency**

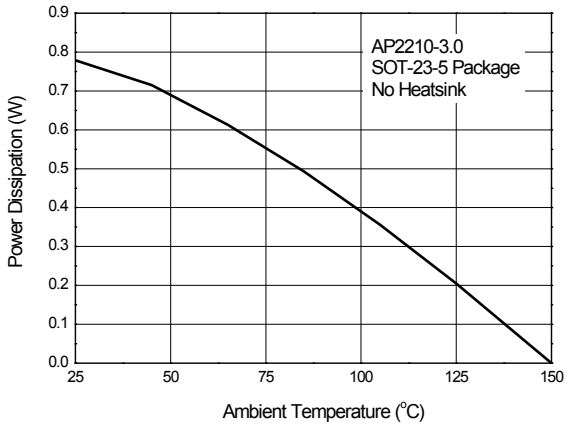



**Power Dissipation vs. Ambient Temperature**

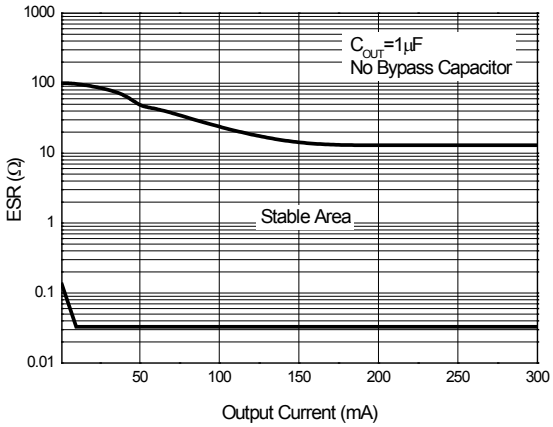


## Performance Characteristics (Cont.)

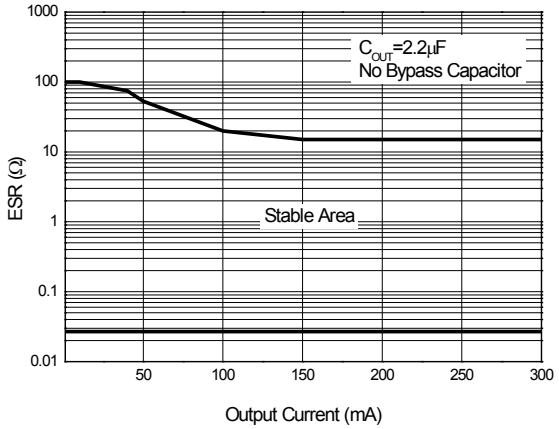
**Power Dissipation vs. Ambient Temperature**



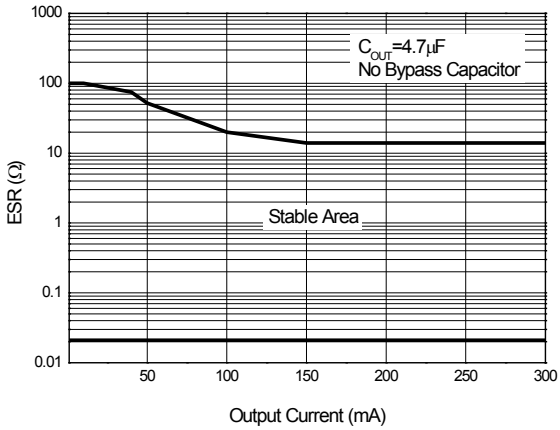

**ESR vs. Output Current**




**ESR vs. Output Current**




**ESR vs. Output Current**



## Application Information

**Input Capacitor**

A 1μF minimum capacitor is recommended to be placed between $V_{IN}$ and GND.

**Output Capacitor**

An output capacitor is required to prevent oscillation. A 1.0μF minimum is recommended when $C_{BYP}$ is unused. A 2.2μF minimum is recommended when $C_{BYP}$ is 100pF. The output capacitor may be increased to improve transient response.

**Noise Bypass Capacitor**

A bypass capacitor is connected to the internal voltage reference. A small capacitor connected from BYP to GND makes this reference quiet, resulting in a significant reduction in output noise, but the ESR stable area will be narrowed. In order to keep the output stability, it is recommended to use the bypass capacitor no more than 100pF.

The start-up speed of the AP2210 is inversely proportional to the value of the reference bypass capacitor. In some cases, if output noise is not a major concern and rapid turn-on is necessary, omit $C_{BYP}$ and leave BYP open.

**Power Dissipation**

Thermal shutdown may take place if the maximum power dissipation is exceeded in application. Under all possible operating conditions, the junction temperature must be within the range specified under absolute maximum ratings to avoid thermal shutdown.

To determine if the power dissipated in the regulator reaches the maximum power dissipation (see Figure Power Dissipation vs. Ambient Temperature and Figure ESR vs. Output Current in Page 22), use:

$T_J = P_D*\theta_{JA} + T_A$

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

Where: $T_J \le T_{J(max)}$, $T_{J(max)}$ is absolute maximum ratings for the junction temperature; $V_{IN}*I_{GND}$ can be ignored due to its small value.

$T_{J(max)}$ is +150°C, $\theta_{JA}$ is 200°C/W, no heatsink is required since the package alone will dissipate enough heat to satisfy these requirements, unless the calculated value for power dissipation exceeds the limit.

Example (3.0V version):

$I_{OUT}$ = 300mA, $T_A$ = +50°C, $V_{IN(Max)}$ is:

(150°C-50°C)/(0.3A*200°C/W)+3.0V=4.67V

Therefore, for good performance, please make sure that the input voltage is less than 4.67V without heatsink when $T_A$ = +50°C.

## Ordering Information

**AP2210 X - X X X**

| Product Name | Package | Output Voltage | Packing | E1/G1 |
|---|---|---|---|---|
| | N : SOT-23-3<br>K : SOT-23-5 | 2.5 : Fixed Output 2.5V<br>2.8 : Fixed Output 2.8V<br>3.0 : Fixed Output 3.0V<br>3.3 : Fixed Output 3.3V<br>3.6 : Fixed Output 3.6V<br>4.0 : Fixed Output 4.0V<br>5.0 : Fixed Output 5.0V<br>ADJ : Adjustable Output | TR : Tape & Reel | E1 : RoHS Compliant<br>G1 : Green |

| Package | Temperature Range | Part Number | | Marking ID | | Packing |
|---|---|---|---|---|---|---|
| | | RoHS Compliant | Green | RoHS Compliant | Green | |
| SOT-23-3 | -40°C to +85°C | AP2210N-2.8TRE1 (Note 11) | AP2210N-2.8TRG1 | EH3 | GH3 | 3000/Tape & Reel |
| | | AP2210N-3.0TRE1 (Note 11) | AP2210N-3.0TRG1 | EH4 | GH4 | 3000/Tape & Reel |
| | | AP2210N-3.3TRE1 (Note 11) | AP2210N-3.3TRG1 | EH5 | GH5 | 3000/Tape & Reel |
| | | — | AP2210N-3.6TRG1 | — | GB7 | 3000/Tape & Reel |
| | | — | AP2210N-4.0TRG1 | — | GC7 | 3000/Tape & Reel |
| | | — | AP2210N-5.0TRG1 | — | GH9 | 3000/Tape & Reel |
| SOT-23-5 | -40°C to +85°C | AP2210K-2.5TRE1 (Note 11) | — | E5C | — | 3000/Tape & Reel |
| | | AP2210K-2.8TRE1 (Note 11) | AP2210K-2.8TRG1 | E5F | G5F | 3000/Tape & Reel |
| | | AP2210K-3.0TRE1 (Note 11) | AP2210K-3.0TRG1 | E5H | G5H | 3000/Tape & Reel |
| | | AP2210K-3.3TRE1 (Note 11) | AP2210K-3.3TRG1 | E5K | G5K | 3000/Tape & Reel |
| | | — | AP2210K-3.6TRG1 | — | G5I | 3000/Tape & Reel |
| | | — | AP2210K-4.0TRG1 | — | G5J | 3000/Tape & Reel |
| | | — | AP2210K-5.0TRG1 | — | G5L | 3000/Tape & Reel |
| | | — | AP2210K-ADJTRG1 | — | G5M | 3000/Tape & Reel |

Lead-Free

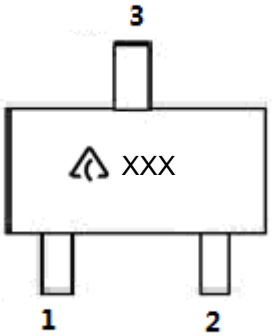
Lead-Free

Notes: 11. Not recommended for new design.

## Marking Information

**(1) SOT-23-3**

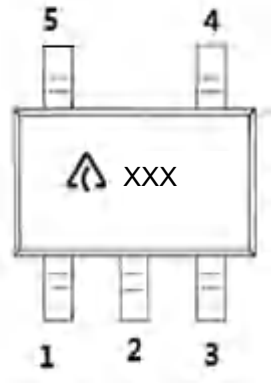
**(Top View)**




: Logo
XXX: Marking ID
(See Ordering Information)

**(2) SOT-23-5**

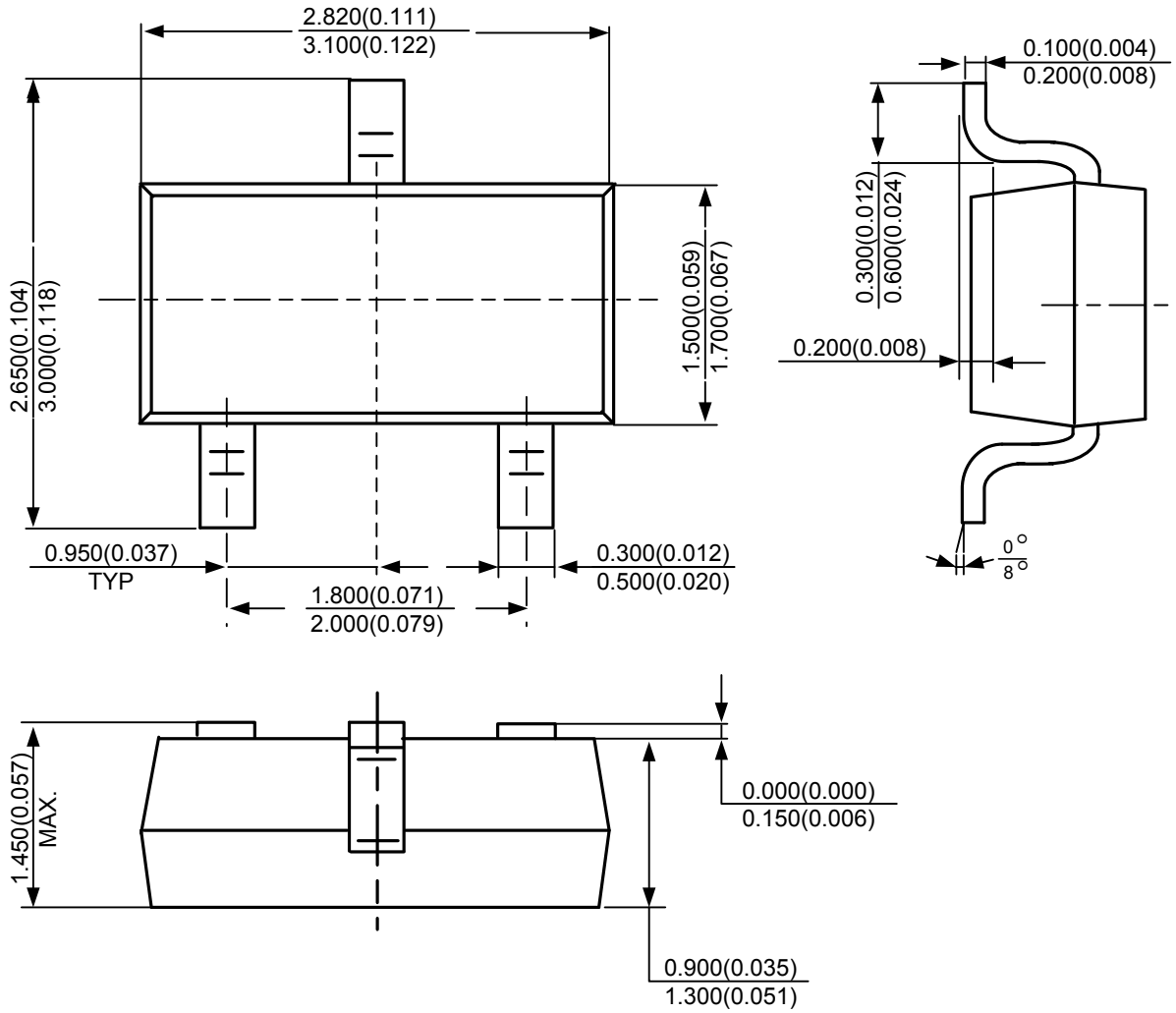
**(Top View)**




: Logo
XXX: Marking ID
(See Ordering Information)

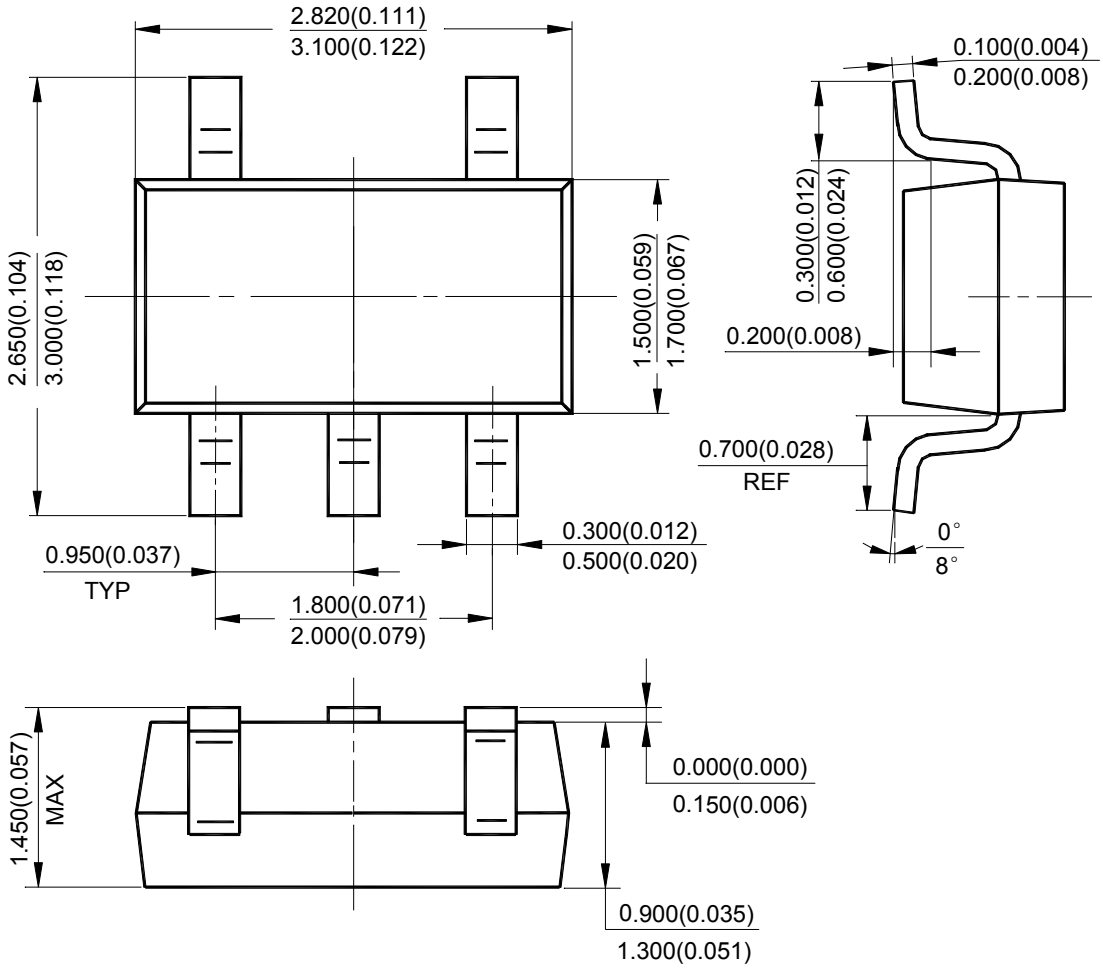
## Package Outline Dimensions (All dimensions in mm(inch).)

**(1) Package Type: SOT-23-3**



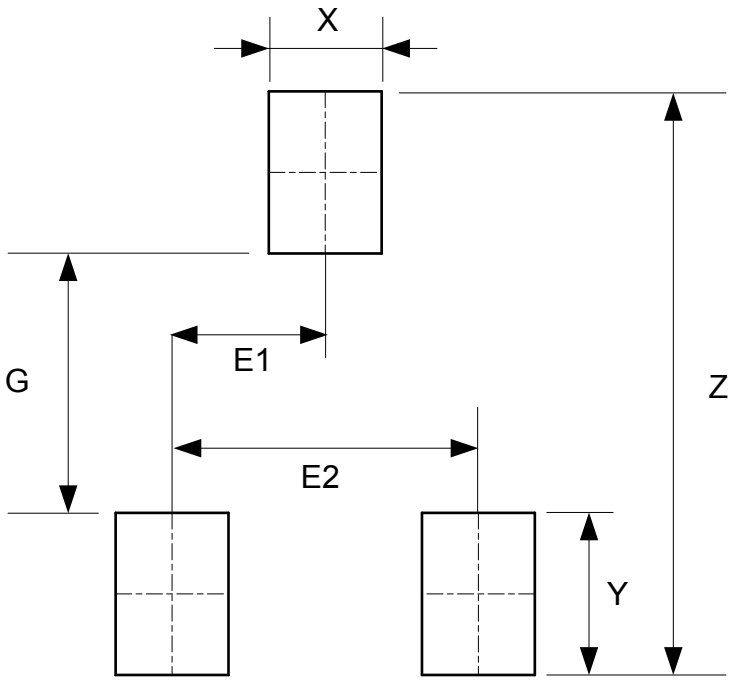
## Package Outline Dimensions (Cont. All dimensions in mm(inch).)

**(2) Package Type: SOT-23-5**



## Suggested Pad Layout

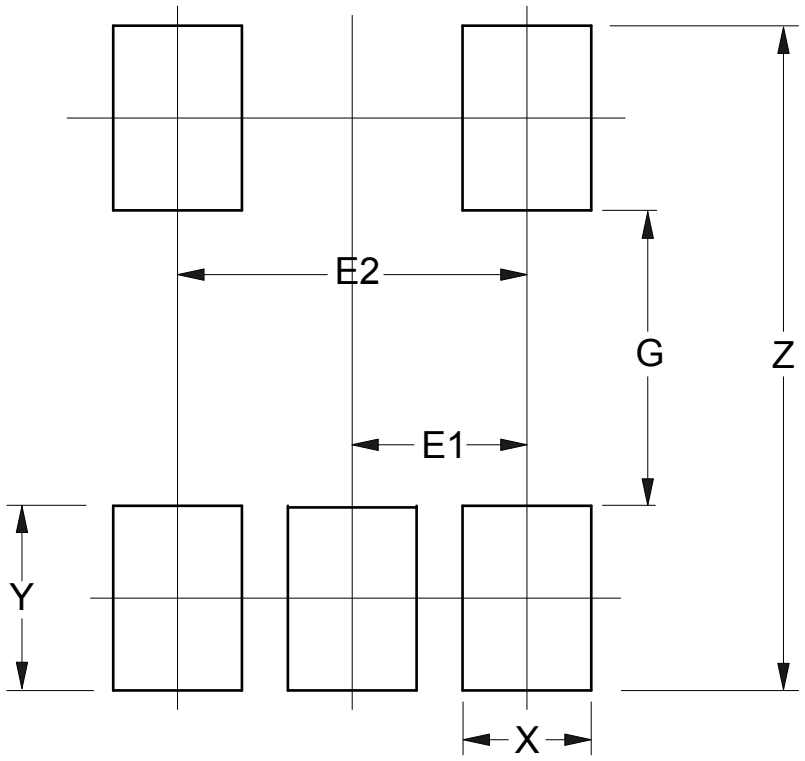
**(1) Package Type: SOT-23-3**




| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E1 (mm)/(inch) | E2 (mm)/(inch) |
|---|---|---|---|---|---|---|
| Value | 3.600/0.142 | 1.600/0.063 | 0.700/0.028 | 1.000/0.039 | 0.950/0.037 | 1.900/0.075 |

## Suggested Pad Layout (Cont.)

**(2) Package Type: SOT-23-5**




| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E1 (mm)/(inch) | E2 (mm)/(inch) |
|---|---|---|---|---|---|---|
| Value | 3.600/0.142 | 1.600/0.063 | 0.700/0.028 | 1.000/0.039 | 0.950/0.037 | 1.900/0.075 |

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