

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****General Description**

The AP2111 is CMOS process low dropout linear regulator with enable function, the regulator delivers a guaranteed 600mA (Min) continuous load current.

The AP2111 provides 1.2V, 1.5V, 1.8V, 2.5V, 3.3V, 4.8V regulated output and 0.8V to 5V adjustable output, and provides excellent output accuracy 1.5%, it is also provides a excellent load regulation, line regulation and excellent load transient performance due to very fast loop response. The AP2111 has built-in auto discharge function.

The AP2111 features low power consumption.

The AP2111 is available in SOIC-8, PSOP-8 SOT-223 and SOT-23-5 packages.

**Features**

- Output Voltage Accuracy:  $\pm 1.5\%$
- Output Current: 600mA (Min)
- Foldback Short Current Protection: 50mA
- Enable Function to Turn On/Off  $V_{OUT}$
- Low Dropout Voltage (3.3V): 250mV (Typ) @  $I_{OUT}=600mA$
- Excellent Load Regulation: 0.2%/A (Typ)
- Excellent Line Regulation: 0.02%/V (Typ)
- Low Quiescent Current: 55 $\mu A$  (Typ)
- Low Standby Current: 0.01 $\mu A$  (Typ)
- Low Output Noise: 50 $\mu V_{RMS}$
- PSRR: 65dB @  $f=1kHz$ , 65dB @  $f=100Hz$
- OTSD Protection
- Stable with 1.0 $\mu F$  Flexible Cap: Ceramic, Tantalum and Aluminum Electrolytic
- Operating Temperature Range: -40°C to 85°C
- ESD: MM 400V, HBM 4000V

**Applications**

- Laptop computer
- Potable DVD
- LCD Monitor

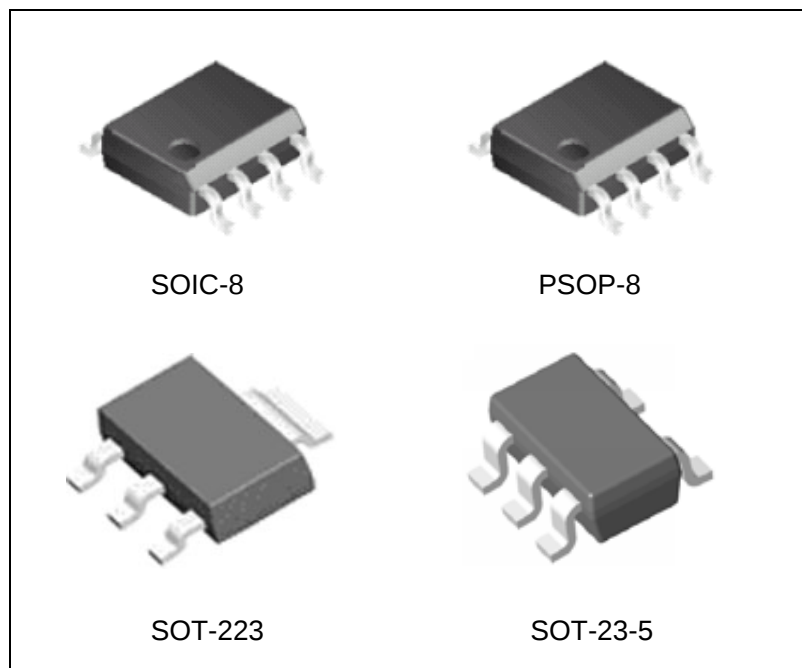


Figure 1. Package Types of AP2111

# 600mA CMOS LDO REGULATOR WITH ENABLE

AP2111

## Pin Configuration

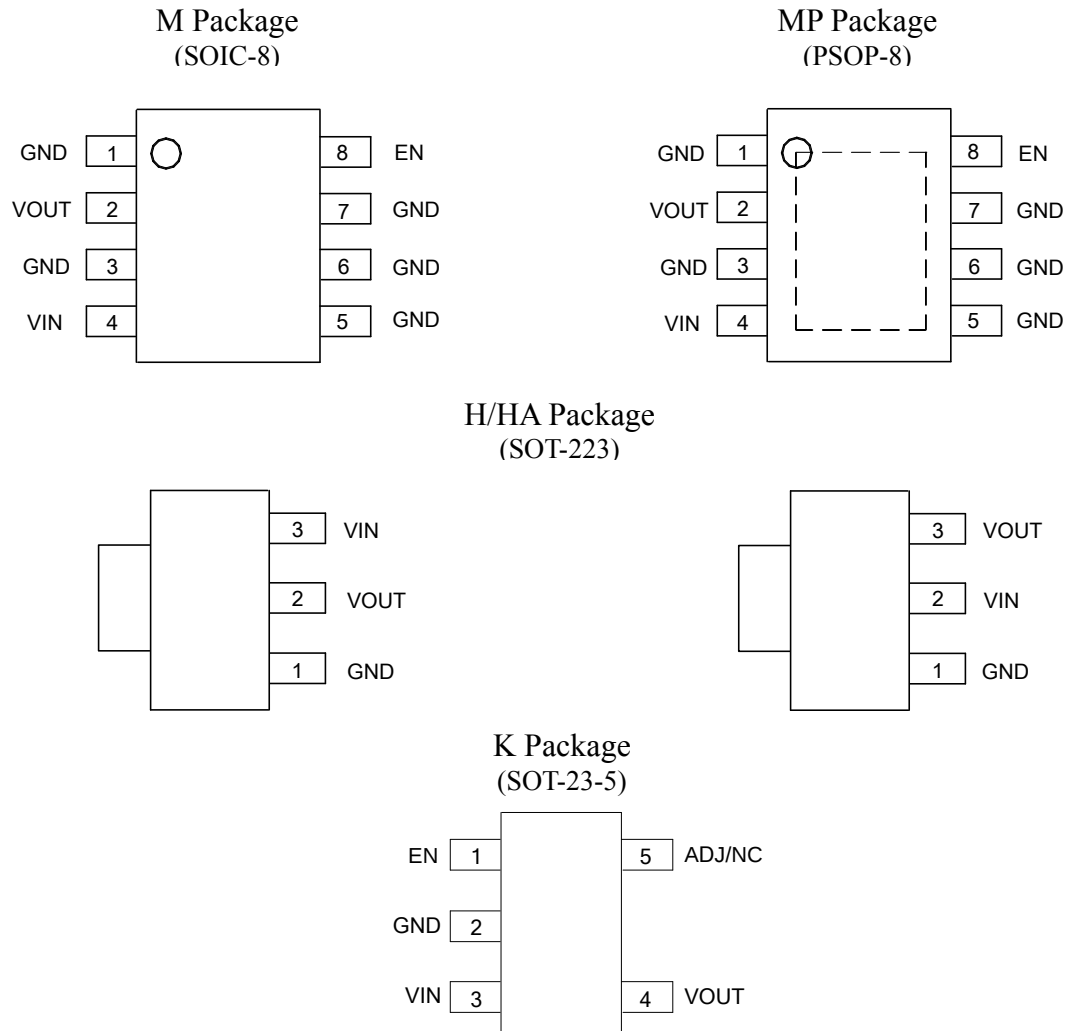


Figure 2. Pin Configuration of AP2111 (Top View)

## Pin Descriptions

| Pin Number    |            |             |          | Pin Name | Function                                                     |
|---------------|------------|-------------|----------|----------|--------------------------------------------------------------|
| SOIC-8/PSOP-8 | SOT-223(H) | SOT-223(HA) | SOT-23-5 |          |                                                              |
| 4             | 3          | 2           | 3        | VIN      | Input voltage                                                |
| 2             | 2          | 3           | 4        | VOUT     | Output voltage                                               |
| 8             |            |             | 1        | EN       | Chip enable, H – normal work, L – shutdown output            |
| 1, 3, 5, 6, 7 | 1          | 1           | 2        | GND      | Ground                                                       |
|               |            |             | 5        | ADJ/NC   | Adjust output for ADJ version/No connected for fixed version |

# 600mA CMOS LDO REGULATOR WITH ENABLE

AP2111

## Functional Block Diagram

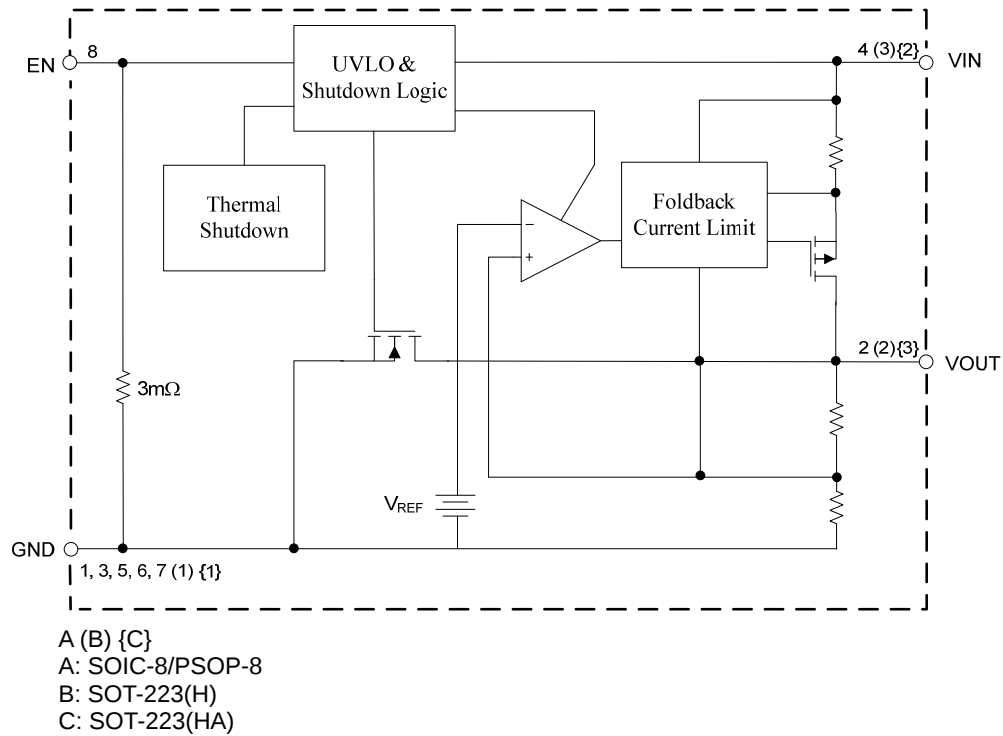


Figure 3. Functional Block Diagram of AP2111 for Fixed Version

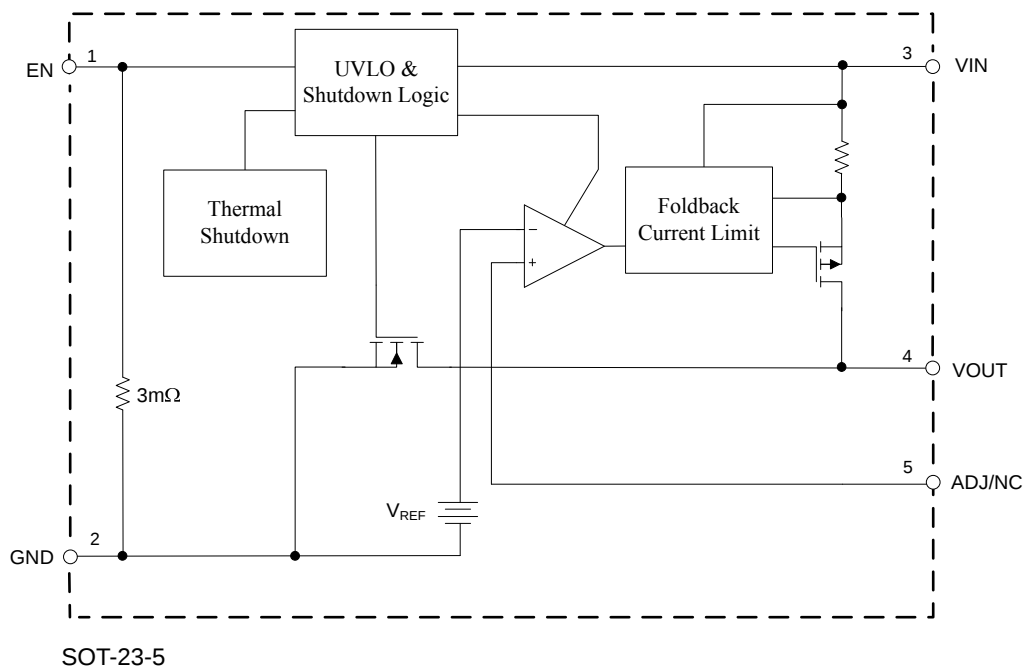
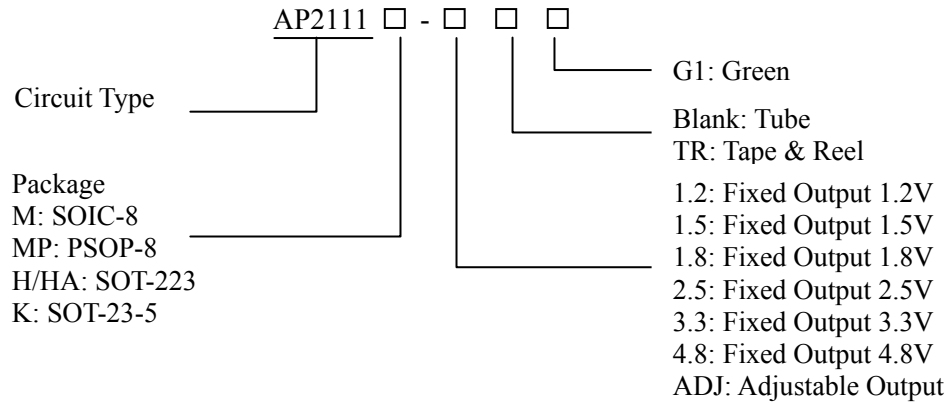


Figure 4. Functional Block Diagram of AP2111 for Adjustable Version

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Ordering Information**

| Package    | Temperature Range | Part Number      | Marking ID   | Packing Type |
|------------|-------------------|------------------|--------------|--------------|
| SOIC-8     | -40 to 85°C       | AP2111M-1.2G1    | 2111M-1.2G1  | Tube         |
|            |                   | AP2111M-1.2TRG1  | 2111M-1.2G1  | Tape & Reel  |
|            |                   | AP2111M-1.5G1    | 2111M-1.5G1  | Tube         |
|            |                   | AP2111M-1.5TRG1  | 2111M-1.5G1  | Tape & Reel  |
|            |                   | AP2111M-1.8G1    | 2111M-1.8G1  | Tube         |
|            |                   | AP2111M-1.8TRG1  | 2111M-1.8G1  | Tape & Reel  |
|            |                   | AP2111M-2.5G1    | 2111M-2.5G1  | Tube         |
|            |                   | AP2111M-2.5TRG1  | 2111M-2.5G1  | Tape & Reel  |
|            |                   | AP2111M-3.3G1    | 2111M-3.3G1  | Tube         |
|            |                   | AP2111M-3.3TRG1  | 2111M-3.3G1  | Tape & Reel  |
| PSOP-8     | -40 to 85°C       | AP2111MP-1.2G1   | 2111MP-1.2G1 | Tube         |
|            |                   | AP2111MP-1.2TRG1 | 2111MP-1.2G1 | Tape & Reel  |
|            |                   | AP2111MP-1.5G1   | 2111MP-1.5G1 | Tube         |
|            |                   | AP2111MP-1.5TRG1 | 2111MP-1.5G1 | Tape & Reel  |
|            |                   | AP2111MP-1.8G1   | 2111MP-1.8G1 | Tube         |
|            |                   | AP2111MP-1.8TRG1 | 2111MP-1.8G1 | Tape & Reel  |
|            |                   | AP2111MP-2.5G1   | 2111MP-2.5G1 | Tube         |
|            |                   | AP2111MP-2.5TRG1 | 2111MP-2.5G1 | Tape & Reel  |
|            |                   | AP2111MP-3.3G1   | 2111MP-3.3G1 | Tube         |
|            |                   | AP2111MP-3.3TRG1 | 2111MP-3.3G1 | Tape & Reel  |
| SOT-223(H) | -40 to 85°C       | AP2111H-1.2TRG1  | GH11B        | Tape & Reel  |
|            |                   | AP2111H-1.5TRG1  | GH13G        | Tape & Reel  |
|            |                   | AP2111H-1.8TRG1  | GH11G        | Tape & Reel  |
|            |                   | AP2111H-2.5TRG1  | GH11H        | Tape & Reel  |
|            |                   | AP2111H-3.3TRG1  | GH11C        | Tape & Reel  |
|            |                   | AP2111H-4.8TRG1  | GH13D        | Tape & Reel  |

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Ordering Information (Continued)**

| Package     | Temperature Range | Part Number      | Marking ID | Packing Type |
|-------------|-------------------|------------------|------------|--------------|
| SOT-223(HA) | -40 to 85°C       | AP2111HA-1.2TRG1 | GH11J      | Tape & Reel  |
|             |                   | AP2111HA-1.5TRG1 | GH14G      | Tape & Reel  |
|             |                   | AP2111HA-1.8TRG1 | GH11K      | Tape & Reel  |
|             |                   | AP2111HA-2.5TRG1 | GH11L      | Tape & Reel  |
|             |                   | AP2111HA-3.3TRG1 | GH11M      | Tape & Reel  |
|             |                   | AP2111HA-4.8TRG1 | GH11N      | Tape & Reel  |
| SOT-23-5    | -40 to 85°C       | AP2111K-1.5TRG1  | G3S        | Tape & Reel  |
|             |                   | AP2111K-ADJG1    | G3Q        | Tube         |
|             |                   | AP2111K-ADJTRG1  | G3Q        | Tape & Reel  |

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

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Absolute Maximum Ratings (Note 1)**

| Parameter                            | Symbol        | Value      |     | Unit |
|--------------------------------------|---------------|------------|-----|------|
| Power Supply Voltage                 | $V_{IN}$      | 6.5        |     | V    |
| Operating Junction Temperature Range | $T_J$         | 150        |     | °C   |
| Storage Temperature Range            | $T_{STG}$     | -65 to 150 |     | °C   |
| Lead Temperature (Soldering, 10sec)  | $T_{LEAD}$    | 260        |     | °C   |
| Thermal Resistance (No Heatsink)     | $\theta_{JA}$ | SOIC-8     | 144 | °C/W |
|                                      |               | PSOP-8     | 143 |      |
|                                      |               | SOT-223    | 128 |      |
|                                      |               | SOT-23-5   | 250 |      |
| ESD (Machine Model)                  |               | 400        |     | V    |
| ESD (Human Body Model)               |               | 4000       |     | 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 | Typ | Max | Unit |
|-------------------------------------|----------|-----|-----|-----|------|
| Supply Voltage                      | $V_{IN}$ | 2.5 |     | 6.0 | V    |
| Operating Ambient Temperature Range | $T_A$    | -40 |     | 85  | °C   |

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Electrical Characteristics****AP2111-1.2 Electrical Characteristic (Note 2)**

$V_{IN}=2.5V$ ,  $C_{IN}=1.0\mu F$  (Ceramic),  $C_{OUT}=1.0\mu F$  (Ceramic), Typical  $T_A=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_A \leq 85^\circ C$  ranges, unless otherwise specified (Note 3).

| Parameter                              | Symbol                                            | Conditions                                           | Min                     | Typ                         | Max                      | Unit            |
|----------------------------------------|---------------------------------------------------|------------------------------------------------------|-------------------------|-----------------------------|--------------------------|-----------------|
| Output Voltage                         | $V_{OUT}$                                         | $V_{IN}=2.5V$ , $1mA \leq I_{OUT} \leq 30mA$         | $V_{OUT} \times 98.5\%$ | 1.2                         | $V_{OUT} \times 101.5\%$ | V               |
| Maximum Output Current                 | $I_{OUT(Max)}$                                    | $V_{IN}=2.5V$ , $V_{OUT}=1.182V$ to $1.218V$         | 600                     |                             |                          | mA              |
| Load Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$ | $V_{IN}=2.5V$ , $1mA \leq I_{OUT} \leq 600mA$        |                         | 0.2                         |                          | %/A             |
| Line Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$  | $2.5V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$          |                         | 0.02                        |                          | %/V             |
| Dropout Voltage                        | $V_{DROP}$                                        | $I_{OUT}=10mA$                                       |                         | 1000                        | 1300                     | mV              |
|                                        |                                                   | $I_{OUT}=300mA$                                      |                         | 1000                        | 1300                     |                 |
|                                        |                                                   | $I_{OUT}=600mA$                                      |                         | 1000                        | 1300                     |                 |
| Quiescent Current                      | $I_Q$                                             | $V_{IN}=2.5V$ , $I_{OUT}=0mA$                        |                         | 55                          | 80                       | $\mu A$         |
| Standby Current                        | $I_{STD}$                                         | $V_{IN}=2.5V$ , $V_{EN}$ in OFF mode                 |                         | 0.01                        | 1.0                      | $\mu A$         |
| Power Supply Rejection Ratio           | PSRR                                              | Ripple 0.5Vp-p<br>$V_{IN}=2.5V$ ,<br>$I_{OUT}=100mA$ | $f=100Hz$               | 65                          |                          | dB              |
|                                        |                                                   |                                                      | $f=1kHz$                | 65                          |                          |                 |
| Output Voltage Temperature Coefficient | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$       | $I_{OUT}=30mA$<br>$T_A=-40^\circ C$ to $85^\circ C$  |                         | <b><math>\pm 100</math></b> |                          | ppm/ $^\circ C$ |
| Short Current Limit                    | $I_{SHORT}$                                       | $V_{OUT}=0V$                                         |                         | 50                          |                          | mA              |
| RMS Output Noise                       | $V_{NOISE}$                                       | No Load, $10Hz \leq f \leq 100kHz$                   |                         | 50                          |                          | $\mu V_{RMS}$   |
| VEN High Voltage                       | $V_{IH}$                                          | Enable logic high, regulator on                      | 1.5                     |                             | 6.0                      | V               |
| VEN Low Voltage                        | $V_{IL}$                                          | Enable logic low, regulator off                      | 0                       |                             | 0.4                      |                 |
| Start-up Time                          | $t_S$                                             | No Load                                              |                         | 20                          |                          | $\mu s$         |
| EN Pull Down Resistor                  | $R_{PD}$                                          |                                                      |                         | 3.0                         |                          | m $\Omega$      |
| VOOUT Discharge Resistor               | $R_{DCHG}$                                        | Set EN pin at Low                                    |                         | 60                          |                          | $\Omega$        |
| Thermal Shutdown Temperature           | $T_{OTSD}$                                        |                                                      |                         | 160                         |                          | $^\circ C$      |
| Thermal Shutdown Hysteresis            | $T_{HYOTSD}$                                      |                                                      |                         | 30                          |                          |                 |
| Thermal Resistance (Junction to Case)  | $\theta_{JC}$                                     | SOIC-8                                               |                         | 74.6                        |                          | $^\circ C/W$    |
|                                        |                                                   | PSOP-8                                               |                         | 43.7                        |                          |                 |
|                                        |                                                   | SOT-223                                              |                         | 50.9                        |                          |                 |

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

Note 3: Production testing at  $T_A=25^\circ C$ . Over temperature specifications guaranteed by design only.

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Electrical Characteristics (Continued)****AP2111-1.5 Electrical Characteristic (Note 2)**

$V_{IN}=2.5V$ ,  $C_{IN}=1.0\mu F$  (Ceramic),  $C_{OUT}=1.0\mu F$  (Ceramic), Typical  $T_A=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_A \leq 85^\circ C$  ranges, unless otherwise specified (Note 3).

| Parameter                              | Symbol                                            | Conditions                                           | Min                     | Typ                         | Max                      | Unit            |
|----------------------------------------|---------------------------------------------------|------------------------------------------------------|-------------------------|-----------------------------|--------------------------|-----------------|
| Output Voltage                         | $V_{OUT}$                                         | $V_{IN}=2.5V$ , $1mA \leq I_{OUT} \leq 30mA$         | $V_{OUT} \times 98.5\%$ | 1.5                         | $V_{OUT} \times 101.5\%$ | V               |
| Maximum Output Current                 | $I_{OUT(Max)}$                                    | $V_{IN}=2.5V$ , $V_{OUT}=1.478V$ to $1.523V$         | 600                     |                             |                          | mA              |
| Load Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$ | $V_{IN}=2.5V$ , $1mA \leq I_{OUT} \leq 600mA$        |                         | 0.2                         |                          | %/A             |
| Line Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$  | $2.5V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$          |                         | 0.02                        |                          | %/V             |
| Dropout Voltage                        | $V_{DROP}$                                        | $I_{OUT}=10mA$                                       |                         | 700                         | 1000                     | mV              |
|                                        |                                                   | $I_{OUT}=300mA$                                      |                         | 700                         | 1000                     |                 |
|                                        |                                                   | $I_{OUT}=600mA$                                      |                         | 700                         | 1000                     |                 |
| Quiescent Current                      | $I_Q$                                             | $V_{IN}=2.5V$ , $I_{OUT}=0mA$                        |                         | 55                          | 80                       | $\mu A$         |
| Standby Current                        | $I_{STD}$                                         | $V_{IN}=2.5V$ , $V_{EN}$ in OFF mode                 |                         | 0.01                        | 1.0                      | $\mu A$         |
| Power Supply Rejection Ratio           | PSRR                                              | Ripple 0.5Vp-p<br>$V_{IN}=2.5V$ ,<br>$I_{OUT}=100mA$ | $f=100Hz$               | 65                          |                          | dB              |
|                                        |                                                   |                                                      | $f=1kHz$                | 65                          |                          |                 |
| Output Voltage Temperature Coefficient | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$       | $I_{OUT}=30mA$<br>$T_A=-40^\circ C$ to $85^\circ C$  |                         | <b><math>\pm 100</math></b> |                          | ppm/ $^\circ C$ |
| Short Current Limit                    | $I_{SHORT}$                                       | $V_{OUT}=0V$                                         |                         | 50                          |                          | mA              |
| RMS Output Noise                       | $V_{NOISE}$                                       | No Load, $10Hz \leq f \leq 100kHz$                   |                         | 50                          |                          | $\mu V_{RMS}$   |
| VEN High Voltage                       | $V_{IH}$                                          | Enable logic high, regulator on                      | 1.5                     |                             | 6.0                      | V               |
| VEN Low Voltage                        | $V_{IL}$                                          | Enable logic low, regulator off                      | 0                       |                             | 0.4                      |                 |
| Start-up Time                          | $t_S$                                             | No Load                                              |                         | 20                          |                          | $\mu s$         |
| EN Pull Down Resistor                  | $R_{PD}$                                          |                                                      |                         | 3.0                         |                          | m $\Omega$      |
| VOOUT Discharge Resistor               | $R_{DCHG}$                                        | Set EN pin at Low                                    |                         | 60                          |                          | $\Omega$        |
| Thermal Shutdown Temperature           | $T_{OTSD}$                                        |                                                      |                         | 160                         |                          | $^\circ C$      |
| Thermal Shutdown Hysteresis            | $T_{HYOTSD}$                                      |                                                      |                         | 30                          |                          |                 |
| Thermal Resistance (Junction to Case)  | $\theta_{JC}$                                     | SOIC-8                                               |                         | 74.6                        |                          | $^\circ C/W$    |
|                                        |                                                   | PSOP-8                                               |                         | 43.7                        |                          |                 |
|                                        |                                                   | SOT-223                                              |                         | 50.9                        |                          |                 |
|                                        |                                                   | SOT-23-5                                             |                         | 150                         |                          |                 |

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

Note 3: Production testing at  $T_A=25^\circ C$ . Over temperature specifications guaranteed by design only.

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Electrical Characteristics (Continued)****AP2111-1.8 Electrical Characteristic (Note 2)**

$V_{IN}=2.8V$ ,  $C_{IN}=1\mu F$  (Ceramic),  $C_{OUT}=1\mu F$  (Ceramic), Typical  $T_A=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_A \leq 85^\circ C$  ranges, unless otherwise specified (Note 3).

| Parameter                              | Symbol                                            | Conditions                                                              | Min                             | Typ                         | Max                              | Unit            |
|----------------------------------------|---------------------------------------------------|-------------------------------------------------------------------------|---------------------------------|-----------------------------|----------------------------------|-----------------|
| Output Voltage                         | $V_{OUT}$                                         | $V_{IN}=2.8V$ , $1mA \leq I_{OUT} \leq 30mA$                            | $\frac{V_{OUT}}{\times 98.5\%}$ | 1.8                         | $\frac{V_{OUT}}{\times 101.5\%}$ | V               |
| Maximum Output Current                 | $I_{OUT(Max)}$                                    | $V_{IN}=2.8V$ ,<br>$V_{OUT}=1.773V$ to $1.827V$                         | 600                             |                             |                                  | mA              |
| Load Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$ | $V_{OUT}=1.8V$ , $V_{IN}=V_{OUT}+1V$ ,<br>$1mA \leq I_{OUT} \leq 600mA$ |                                 | 0.2                         |                                  | %/A             |
| Line Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$  | $2.8V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$                             |                                 | 0.02                        |                                  | %/V             |
| Dropout Voltage                        | $V_{DROP}$                                        | $I_{OUT}=10mA$                                                          |                                 | 500                         | 700                              | mV              |
|                                        |                                                   | $I_{OUT}=300mA$                                                         |                                 | 500                         | 700                              |                 |
|                                        |                                                   | $I_{OUT}=600mA$                                                         |                                 | 500                         | 700                              |                 |
| Quiescent Current                      | $I_Q$                                             | $V_{IN}=2.8V$ , $I_{OUT}=0mA$                                           |                                 | 55                          | 80                               | $\mu A$         |
| Standby Current                        | $I_{STD}$                                         | $V_{IN}=2.8V$ , $V_{EN}$ in OFF mode                                    |                                 | 0.01                        | 1.0                              | $\mu A$         |
| Power Supply Rejection Ratio           | PSRR                                              | Ripple 0.5Vp-p<br>$V_{IN}=2.8V$ ,<br>$I_{OUT}=100mA$                    | $f=100Hz$                       | 65                          |                                  | dB              |
|                                        |                                                   |                                                                         | $f=1kHz$                        | 65                          |                                  |                 |
| Output Voltage Temperature Coefficient | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$       | $I_{OUT}=30mA$<br>$T_A=-40^\circ C$ to $85^\circ C$                     |                                 | <b><math>\pm 100</math></b> |                                  | ppm/ $^\circ C$ |
| Short Current Limit                    | $I_{SHORT}$                                       | $V_{OUT}=0V$                                                            |                                 | 50                          |                                  | mA              |
| RMS Output Noise                       | $V_{NOISE}$                                       | No Load, $10Hz \leq f \leq 100kHz$                                      |                                 | 50                          |                                  | $\mu V_{RMS}$   |
| VEN High Voltage                       | $V_{IH}$                                          | Enable logic high, regulator on                                         | 1.5                             |                             | 6.0                              | V               |
| VEN Low Voltage                        | $V_{IL}$                                          | Enable logic low, regulator off                                         | 0                               |                             | 0.4                              |                 |
| Start-up Time                          | $t_S$                                             | No Load                                                                 |                                 | 20                          |                                  | $\mu s$         |
| EN Pull Down Resistor                  | $R_{PD}$                                          |                                                                         |                                 | 3.0                         |                                  | $m\Omega$       |
| VOOUT Discharge Resistor               | $R_{DCHG}$                                        | Set EN pin at Low                                                       |                                 | 60                          |                                  | $\Omega$        |
| Thermal Shutdown Temperature           | $T_{OTSD}$                                        |                                                                         |                                 | 160                         |                                  | $^\circ C$      |
| Thermal Shutdown Hysteresis            | $T_{HYOTSD}$                                      |                                                                         |                                 | 30                          |                                  |                 |
| Thermal Resistance (Junction to Case)  | $\theta_{JC}$                                     | SOIC-8                                                                  |                                 | 74.6                        |                                  | $^\circ C/W$    |
|                                        |                                                   | PSOP-8                                                                  |                                 | 43.7                        |                                  |                 |
|                                        |                                                   | SOT-223                                                                 |                                 | 50.9                        |                                  |                 |

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

Note 3: Production testing at  $T_A=25^\circ C$ . Over temperature specifications guaranteed by design only.

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Electrical Characteristics (Continued)****AP2111-2.5 Electrical Characteristic (Note 2)**

$V_{IN}=3.5V$ ,  $C_{IN}=1\mu F$  (Ceramic),  $C_{OUT}=1\mu F$  (Ceramic), Typical  $T_A=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_A \leq 85^\circ C$  ranges, unless otherwise specified (Note 3).

| Parameter                              | Symbol                                            | Conditions                                                           | Min                             | Typ                         | Max                              | Unit            |
|----------------------------------------|---------------------------------------------------|----------------------------------------------------------------------|---------------------------------|-----------------------------|----------------------------------|-----------------|
| Output Voltage                         | $V_{OUT}$                                         | $V_{IN}=3.5V$ , $1mA \leq I_{OUT} \leq 30mA$                         | $\frac{V_{OUT}}{\times 98.5\%}$ | 2.5                         | $\frac{V_{OUT}}{\times 101.5\%}$ | V               |
| Maximum Output Current                 | $I_{OUT(Max)}$                                    | $V_{IN}=3.5V$ , $V_{OUT}=2.463V$ to $2.537V$                         | 600                             |                             |                                  | mA              |
| Load Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$ | $V_{OUT}=2.5V$ , $V_{IN}=V_{OUT}+1V$ , $1mA \leq I_{OUT} \leq 600mA$ |                                 | 0.2                         |                                  | %/A             |
| Line Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$  | $3.5V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$                          |                                 | 0.02                        |                                  | %/V             |
| Dropout Voltage                        | $V_{DROP}$                                        | $I_{OUT}=10mA$                                                       |                                 | 5                           | 8                                | mV              |
|                                        |                                                   | $I_{OUT}=300mA$                                                      |                                 | 125                         | 200                              |                 |
|                                        |                                                   | $I_{OUT}=600mA$                                                      |                                 | 250                         | 400                              |                 |
| Quiescent Current                      | $I_Q$                                             | $V_{IN}=3.5V$ , $I_{OUT}=0mA$                                        |                                 | 55                          | 80                               | $\mu A$         |
| Standby Current                        | $I_{STD}$                                         | $V_{IN}=3.5V$ , $V_{EN}$ in OFF mode                                 |                                 | 0.01                        | 1.0                              | $\mu A$         |
| Power Supply Rejection Ratio           | PSRR                                              | Ripple 0.5Vp-p<br>$V_{IN}=3.5V$ ,<br>$I_{OUT}=100mA$                 | $f=100Hz$                       | 65                          |                                  | dB              |
|                                        |                                                   |                                                                      | $f=1kHz$                        | 65                          |                                  |                 |
| Output Voltage Temperature Coefficient | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$       | $I_{OUT}=30mA$<br>$T_A=-40^\circ C$ to $85^\circ C$                  |                                 | <b><math>\pm 100</math></b> |                                  | ppm/ $^\circ C$ |
| Short Current Limit                    | $I_{SHORT}$                                       | $V_{OUT}=0V$                                                         |                                 | 50                          |                                  | mA              |
| RMS Output Noise                       | $V_{NOISE}$                                       | No Load, $10Hz \leq f \leq 100kHz$                                   |                                 | 50                          |                                  | $\mu V_{RMS}$   |
| VEN High Voltage                       | $V_{IH}$                                          | Enable logic high, regulator on                                      | 1.5                             |                             | 6.0                              | V               |
| VEN Low Voltage                        | $V_{IL}$                                          | Enable logic low, regulator off                                      | 0                               |                             | 0.4                              |                 |
| Start-up Time                          | $t_S$                                             | No Load                                                              |                                 | 20                          |                                  | $\mu s$         |
| EN Pull Down Resistor                  | $R_{PD}$                                          |                                                                      |                                 | 3.0                         |                                  | $m\Omega$       |
| VOOUT Discharge Resistor               | $R_{DCHG}$                                        | Set EN pin at Low                                                    |                                 | 60                          |                                  | $\Omega$        |
| Thermal Shutdown Temperature           | $T_{OTSD}$                                        |                                                                      |                                 | 160                         |                                  | $^\circ C$      |
| Thermal Shutdown Hysteresis            | $T_{HYOTSD}$                                      |                                                                      |                                 | 30                          |                                  |                 |
| Thermal Resistance (Junction to Case)  | $\theta_{JC}$                                     | SOIC-8                                                               |                                 | 74.6                        |                                  | $^\circ C/W$    |
|                                        |                                                   | PSOP-8                                                               |                                 | 43.7                        |                                  |                 |
|                                        |                                                   | SOT-223                                                              |                                 | 50.9                        |                                  |                 |

Note 2: To prevent the short circuit current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

Note 3: Production testing at  $T_A=25^\circ C$ . Over temperature specifications guaranteed by design only.

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Electrical Characteristics (Continued)****AP2111-3.3 Electrical Characteristic (Note 2)**

$V_{IN}=4.3V$ ,  $C_{IN}=1\mu F$  (Ceramic),  $C_{OUT}=1\mu F$  (Ceramic), Typical  $T_A=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_A \leq 85^\circ C$  ranges, unless otherwise specified (Note 3).

| Parameter                              | Symbol                                            | Conditions                                           | Min                             | Typ                         | Max                              | Unit            |
|----------------------------------------|---------------------------------------------------|------------------------------------------------------|---------------------------------|-----------------------------|----------------------------------|-----------------|
| Output Voltage                         | $V_{OUT}$                                         | $V_{IN}=4.3V$ , $1mA \leq I_{OUT} \leq 30mA$         | $\frac{V_{OUT}}{\times 98.5\%}$ | 3.3                         | $\frac{V_{OUT}}{\times 101.5\%}$ | V               |
| Maximum Output Current                 | $I_{OUT(Max)}$                                    | $V_{IN}=4.3V$ , $V_{OUT}=3.251V$ to $3.350V$         | 600                             |                             |                                  | mA              |
| Load Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$ | $V_{IN}=4.3V$ , $1mA \leq I_{OUT} \leq 600mA$        |                                 | 0.2                         |                                  | %/A             |
| Line Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$  | $4.3V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$          |                                 | 0.02                        |                                  | %/V             |
| Dropout Voltage                        | $V_{DROP}$                                        | $I_{OUT}=10mA$                                       |                                 | 5                           | 8                                | mV              |
|                                        |                                                   | $I_{OUT}=300mA$                                      |                                 | 125                         | 200                              |                 |
|                                        |                                                   | $I_{OUT}=600mA$                                      |                                 | 250                         | 400                              |                 |
| Quiescent Current                      | $I_Q$                                             | $V_{IN}=4.3V$ , $I_{OUT}=0mA$                        |                                 | 55                          | 80                               | $\mu A$         |
| Standby Current                        | $I_{STD}$                                         | $V_{IN}=4.3V$ , $V_{EN}$ in OFF mode                 |                                 | 0.01                        | 1.0                              | $\mu A$         |
| Power Supply Rejection Ratio           | PSRR                                              | Ripple 0.5Vp-p<br>$V_{IN}=4.3V$ ,<br>$I_{OUT}=100mA$ | $f=100Hz$                       | 65                          |                                  | dB              |
|                                        |                                                   |                                                      | $f=1kHz$                        | 65                          |                                  |                 |
| Output Voltage Temperature Coefficient | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$       | $I_{OUT}=30mA$<br>$T_A=-40^\circ C$ to $85^\circ C$  |                                 | <b><math>\pm 100</math></b> |                                  | ppm/ $^\circ C$ |
| Short Current Limit                    | $I_{SHORT}$                                       | $V_{OUT}=0V$                                         |                                 | 50                          |                                  | mA              |
| RMS Output Noise                       | $V_{NOISE}$                                       | No Load, $10Hz \leq f \leq 100kHz$                   |                                 | 50                          |                                  | $\mu V_{RMS}$   |
| VEN High Voltage                       | $V_{IH}$                                          | Enable logic high, regulator on                      | 1.5                             |                             | 6.0                              | V               |
| VEN Low Voltage                        | $V_{IL}$                                          | Enable logic low, regulator off                      | 0                               |                             | 0.4                              |                 |
| Start-up Time                          | $t_S$                                             | No Load                                              |                                 | 20                          |                                  | $\mu s$         |
| EN Pull Down Resistor                  | $R_{PD}$                                          |                                                      |                                 | 3.0                         |                                  | $m\Omega$       |
| VOOUT Discharge Resistor               | $R_{DCHG}$                                        | Set EN pin at Low                                    |                                 | 60                          |                                  | $\Omega$        |
| Thermal Shutdown Temperature           | $T_{OTSD}$                                        |                                                      |                                 | 160                         |                                  | $^\circ C$      |
| Thermal Shutdown Hysteresis            | $T_{HYOTSD}$                                      |                                                      |                                 | 30                          |                                  |                 |
| Thermal Resistance (Junction to Case)  | $\theta_{JC}$                                     | SOIC-8                                               |                                 | 74.6                        |                                  | $^\circ C/W$    |
|                                        |                                                   | PSOP-8                                               |                                 | 43.7                        |                                  |                 |
|                                        |                                                   | SOT-223                                              |                                 | 50.9                        |                                  |                 |

Note 2: To prevent the short circuit current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

Note 3: Production testing at  $T_A=25^\circ C$ . Over temperature specifications guaranteed by design only.

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Electrical Characteristics (Continued)****AP2111-4.8 Electrical Characteristic (Note 2) (Only for SOT-223)**

$V_{IN}=5.5V$ ,  $C_{IN}=1\mu F$  (Ceramic),  $C_{OUT}=1\mu F$  (Ceramic), Typical  $T_A=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_A \leq 85^\circ C$  ranges, unless otherwise specified (Note 3).

| Parameter                              | Symbol                                            | Conditions                                           | Min                             | Typ                         | Max                              | Unit            |
|----------------------------------------|---------------------------------------------------|------------------------------------------------------|---------------------------------|-----------------------------|----------------------------------|-----------------|
| Output Voltage                         | $V_{OUT}$                                         | $V_{IN}=5.5V$ , $1mA \leq I_{OUT} \leq 30mA$         | $\frac{V_{OUT}}{\times 98.5\%}$ | 4.8                         | $\frac{V_{OUT}}{\times 101.5\%}$ | V               |
| Maximum Output Current                 | $I_{OUT(Max)}$                                    | $V_{IN}=5.5V$ , $V_{OUT}=4.751V$ to $4.850V$         | 600                             |                             |                                  | mA              |
| Load Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$ | $V_{IN}=5.5V$ , $1mA \leq I_{OUT} \leq 600mA$        |                                 | 0.2                         |                                  | %/A             |
| Line Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$  | $5.5V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$          |                                 | 0.02                        |                                  | %/V             |
| Dropout Voltage                        | $V_{DROP}$                                        | $I_{OUT}=10mA$                                       |                                 | 5                           | 8                                | mV              |
|                                        |                                                   | $I_{OUT}=300mA$                                      |                                 | 100                         | 200                              |                 |
|                                        |                                                   | $I_{OUT}=600mA$                                      |                                 | 200                         | 400                              |                 |
| Quiescent Current                      | $I_Q$                                             | $V_{IN}=5.5V$ , $I_{OUT}=0mA$                        |                                 | 55                          | 80                               | $\mu A$         |
| Standby Current                        | $I_{STD}$                                         | $V_{IN}=5.5V$ , $V_{EN}$ in OFF mode                 |                                 | 0.01                        | 1.0                              | $\mu A$         |
| Power Supply Rejection Ratio           | PSRR                                              | Ripple 0.5Vp-p<br>$V_{IN}=5.5V$ ,<br>$I_{OUT}=100mA$ | $f=100Hz$                       | 65                          |                                  | dB              |
|                                        |                                                   |                                                      | $f=1kHz$                        | 65                          |                                  |                 |
| Output Voltage Temperature Coefficient | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$       | $I_{OUT}=30mA$<br>$T_A=-40^\circ C$ to $85^\circ C$  |                                 | <b><math>\pm 100</math></b> |                                  | ppm/ $^\circ C$ |
| Short Current Limit                    | $I_{SHORT}$                                       | $V_{OUT}=0V$                                         |                                 | 50                          |                                  | mA              |
| RMS Output Noise                       | $V_{NOISE}$                                       | No Load, $10Hz \leq f \leq 100kHz$                   |                                 | 50                          |                                  | $\mu V_{RMS}$   |
| Thermal Shutdown Temperature           | $T_{OTSD}$                                        |                                                      |                                 | 160                         |                                  | $^\circ C$      |
| Thermal Shutdown Hysteresis            | $T_{HYOTSD}$                                      |                                                      |                                 | 30                          |                                  |                 |
| Thermal Resistance (Junction to Case)  | $\theta_{JC}$                                     | SOT-223                                              |                                 | 50.9                        |                                  |                 |

Note 2: To prevent the short circuit current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

Note 3: Production testing at  $T_A=25^\circ C$ . Over temperature specifications guaranteed by design only.

**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Electrical Characteristics (Continued)****AP2111-ADJ Electrical Characteristic (Note 2) (Only for SOT-23-5)**

$V_{IN}=2.5V$ ,  $C_{IN}=1.0\mu F$  (Ceramic),  $C_{OUT}=1.0\mu F$  (Ceramic), Typical  $T_A=25^\circ C$ , **Bold** typeface applies over  $-40^\circ C \leq T_A \leq 85^\circ C$  ranges, unless otherwise specified (Note 3).

| Parameter                              | Symbol                                            | Conditions                                           | Min                     | Typ                         | Max                      | Unit            |
|----------------------------------------|---------------------------------------------------|------------------------------------------------------|-------------------------|-----------------------------|--------------------------|-----------------|
| Reference Voltage                      | $V_{REF}$                                         | $V_{IN}=2.5V$ , $1mA \leq I_{OUT} \leq 30mA$         | $V_{REF} \times 98.5\%$ | 0.8                         | $V_{REF} \times 101.5\%$ | V               |
| Maximum Output Current                 | $I_{OUT(Max)}$                                    | $V_{IN}=2.5V$ , $V_{REF}=0.788V$ to $0.812V$         | 600                     |                             |                          | mA              |
| Load Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta I_{OUT}}$ | $V_{IN}=2.5V$ , $1mA \leq I_{OUT} \leq 600mA$        |                         | 0.2                         |                          | %/A             |
| Line Regulation                        | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta V_{IN}}$  | $2.5V \leq V_{IN} \leq 6V$ , $I_{OUT}=30mA$          |                         | 0.02                        |                          | %/V             |
| Quiescent Current                      | $I_Q$                                             | $V_{IN}=2.5V$ , $I_{OUT}=0mA$                        |                         | 55                          | 80                       | $\mu A$         |
| Standby Current                        | $I_{STD}$                                         | $V_{IN}=2.5V$ , $V_{EN}$ in OFF mode                 |                         | 0.01                        | 1.0                      | $\mu A$         |
| Power Supply Rejection Ratio           | PSRR                                              | Ripple 0.5Vp-p<br>$V_{IN}=2.5V$ ,<br>$I_{OUT}=100mA$ | $f=100Hz$               | 65                          |                          | dB              |
|                                        |                                                   |                                                      | $f=1kHz$                | 65                          |                          |                 |
| Output Voltage Temperature Coefficient | $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$       | $I_{OUT}=30mA$<br>$T_A=-40^\circ C$ to $85^\circ C$  |                         | <b><math>\pm 100</math></b> |                          | ppm/ $^\circ C$ |
| Short Current Limit                    | $I_{SHORT}$                                       | $V_{OUT}=0V$                                         |                         | 50                          |                          | mA              |
| RMS Output Noise                       | $V_{NOISE}$                                       | No Load, $10Hz \leq f \leq 100kHz$                   |                         | 50                          |                          | $\mu V_{RMS}$   |
| VEN High Voltage                       | $V_{IH}$                                          | Enable logic high, regulator on                      | 1.5                     |                             | 6.0                      | V               |
| VEN Low Voltage                        | $V_{IL}$                                          | Enable logic low, regulator off                      | 0                       |                             | 0.4                      |                 |
| Start-up Time                          | $t_s$                                             | No Load                                              |                         | 20                          |                          | $\mu s$         |
| EN Pull Down Resistor                  | $R_{PD}$                                          |                                                      |                         | 3.0                         |                          | $m\Omega$       |
| VOUT Discharge Resistor                | $R_{DCHG}$                                        | Set EN pin at Low                                    |                         | 60                          |                          | $\Omega$        |
| Thermal Shutdown Temperature           | $T_{OTSD}$                                        |                                                      |                         | 160                         |                          | $^\circ C$      |
| Thermal Shutdown Hysteresis            | $T_{HYOTSD}$                                      |                                                      |                         | 30                          |                          |                 |
| Thermal Resistance (Junction to Case)  | $\theta_{JC}$                                     | SOT-23-5                                             |                         | 150                         |                          | $^\circ C/W$    |

Note 2: To prevent the Short Circuit Current protection feature from being prematurely activated, the input voltage must be applied before a current source load is applied.

Note 3: Production testing at  $T_A=25^\circ C$ . Over temperature specifications guaranteed by design only.

# 600mA CMOS LDO REGULATOR WITH ENABLE

AP2111

## Typical Performance Characteristics

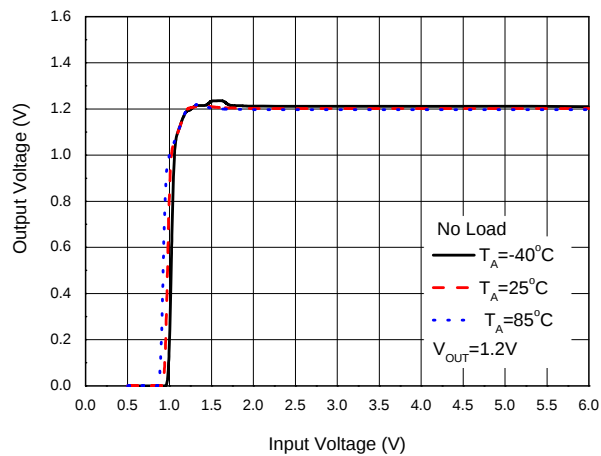


Figure 5. Output Voltage vs. Input Voltage

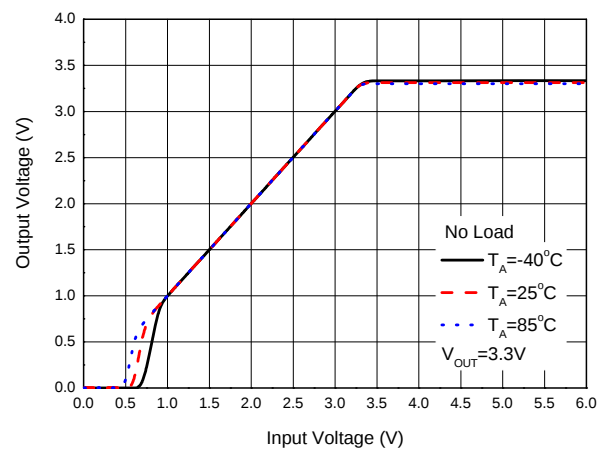


Figure 6. Output Voltage vs. Input Voltage

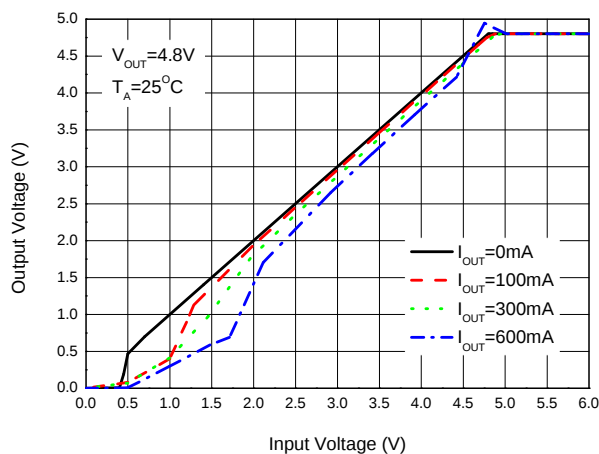


Figure 7. Output Voltage vs. Input Voltage

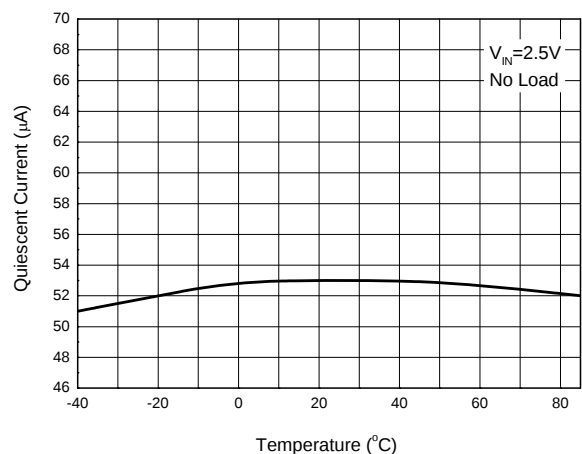


Figure 8. Quiescent Current vs. Temperature

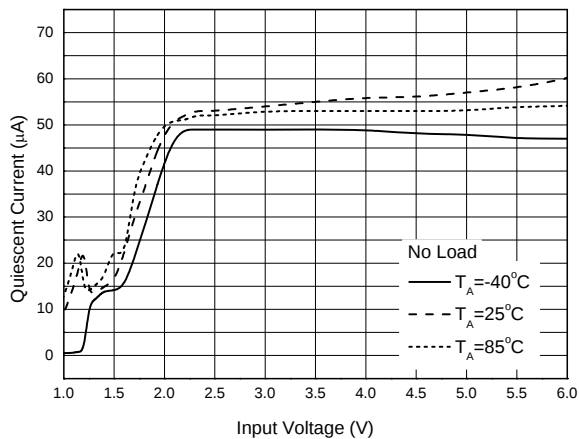
**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Typical Performance Characteristics (Continued)**

Figure 9. Quiescent Current vs. Input Voltage

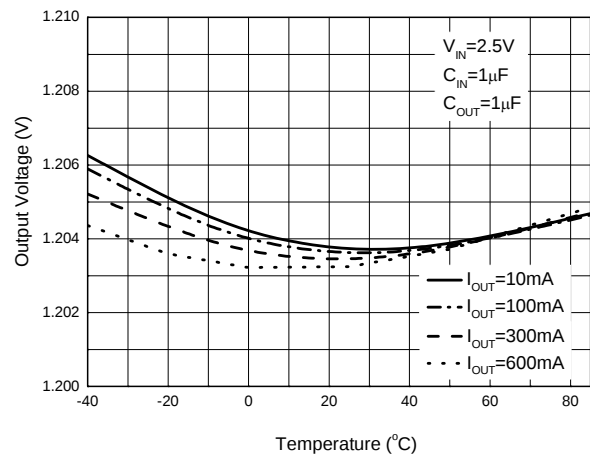


Figure 10. Output Voltage vs. Temperature

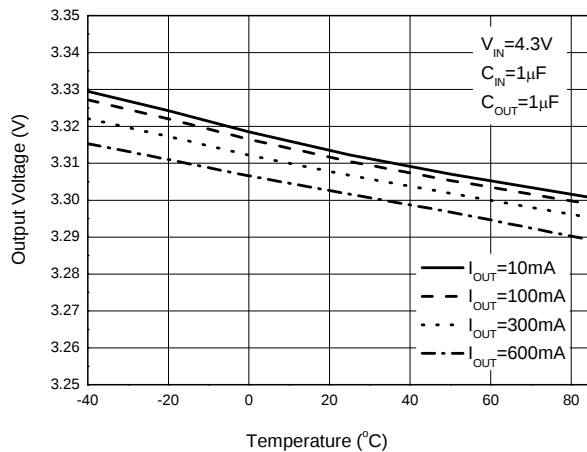


Figure 11. Output Voltage vs. Temperature

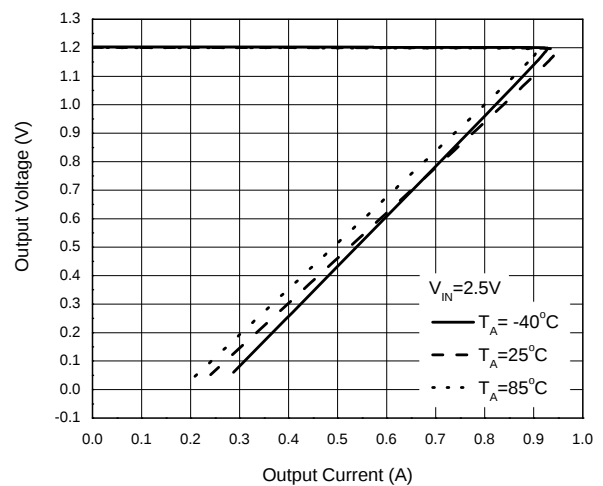


Figure 12. Output Voltage vs. Output Current

# 600mA CMOS LDO REGULATOR WITH ENABLE

AP2111

## Typical Performance Characteristics (Continued)

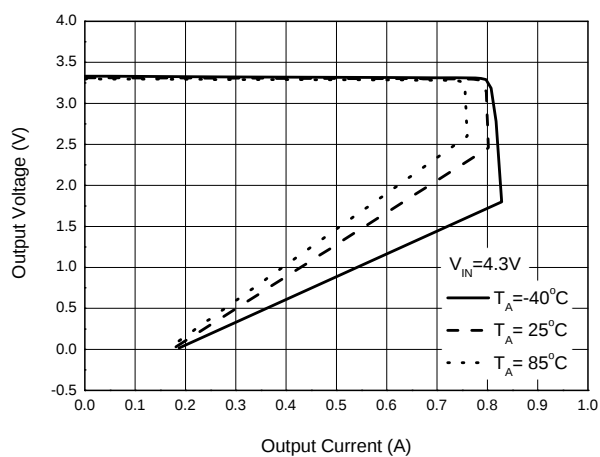


Figure 13. Output Voltage vs. Output Current

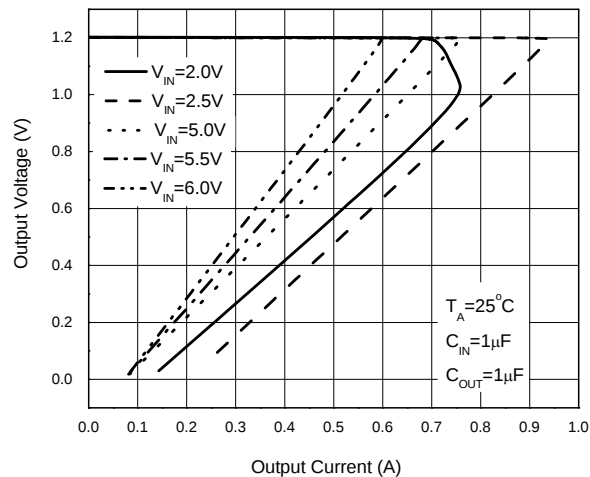


Figure 14. Output Voltage vs. Output Current

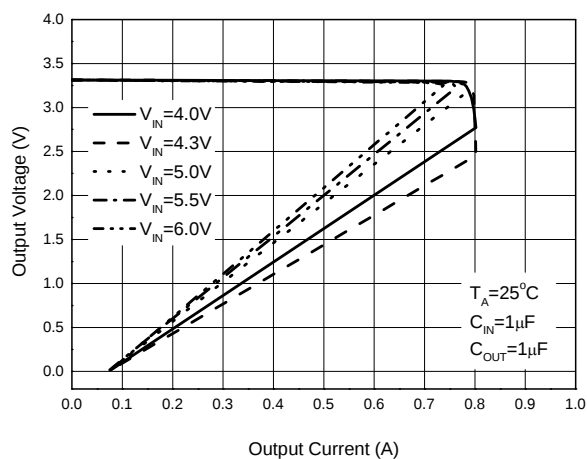


Figure 15. Output Voltage vs. Output Current

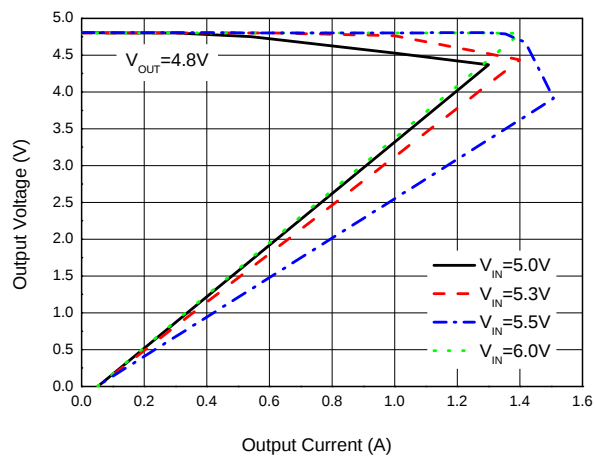


Figure 16. Output Voltage vs. Output Current

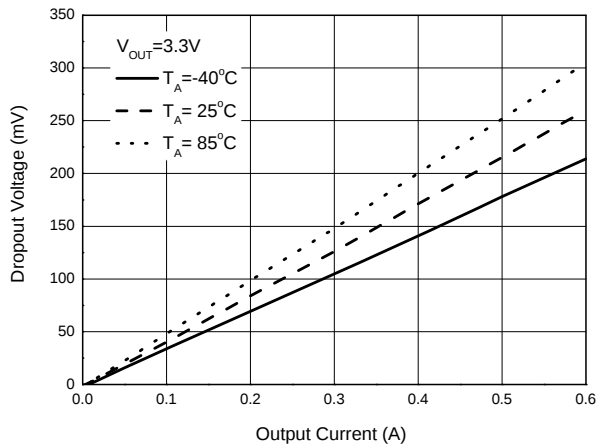
**600mA CMOS LDO REGULATOR WITH ENABLE**
**AP2111**
**Typical Performance Characteristics (Continued)**


Figure 17. Dropout Voltage vs. Output Current

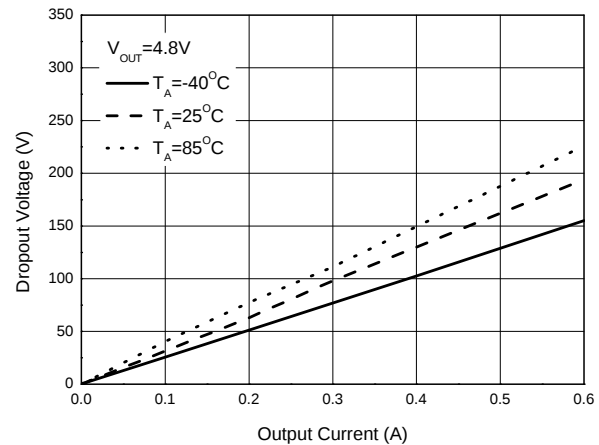


Figure 18. Dropout Voltage vs. Output Current

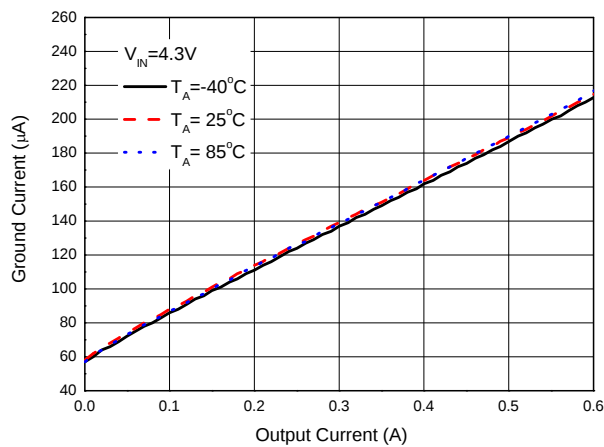


Figure 19. Ground Current vs. Output Current

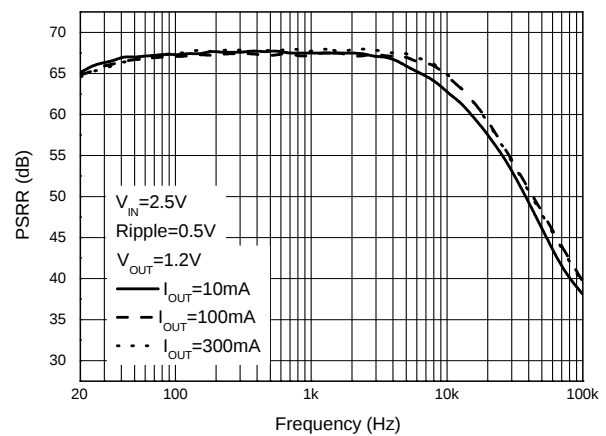


Figure 20. PSRR vs. Frequency

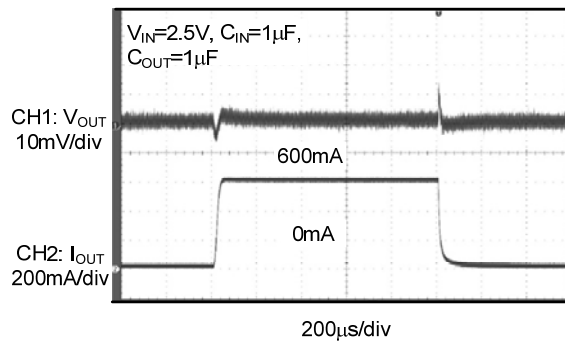
**600mA CMOS LDO REGULATOR WITH ENABLE**
**AP2111**
**Typical Performance Characteristics (Continued)**


Figure 21. Load Transient

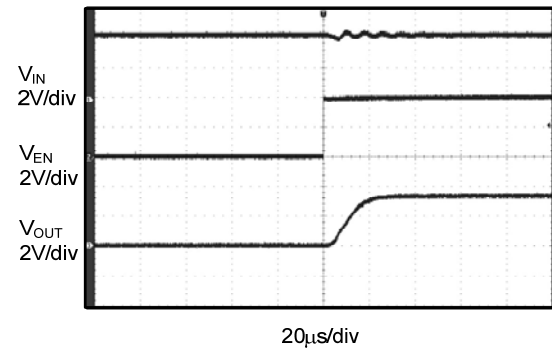


Figure 22. Enable On

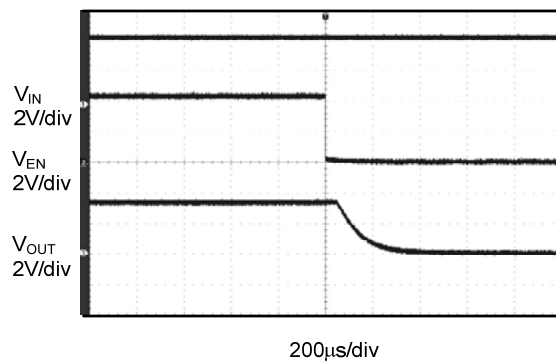
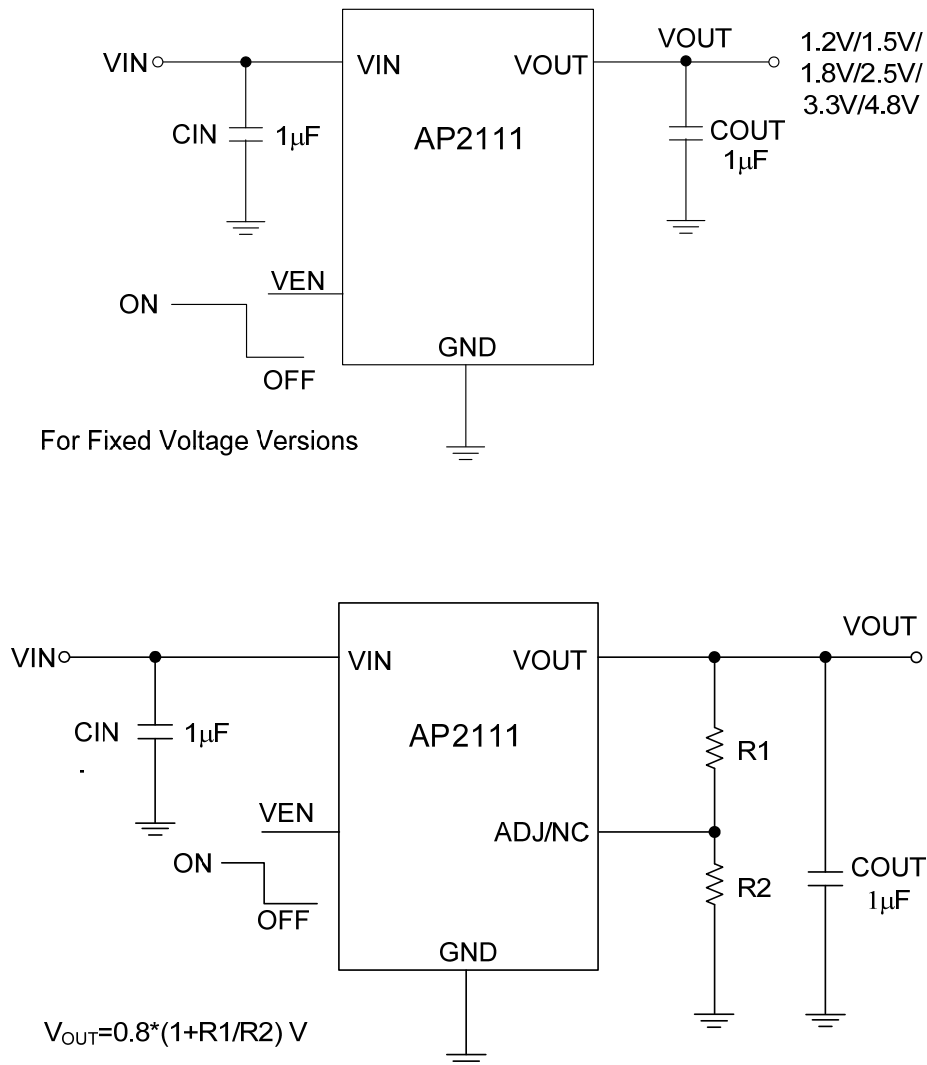
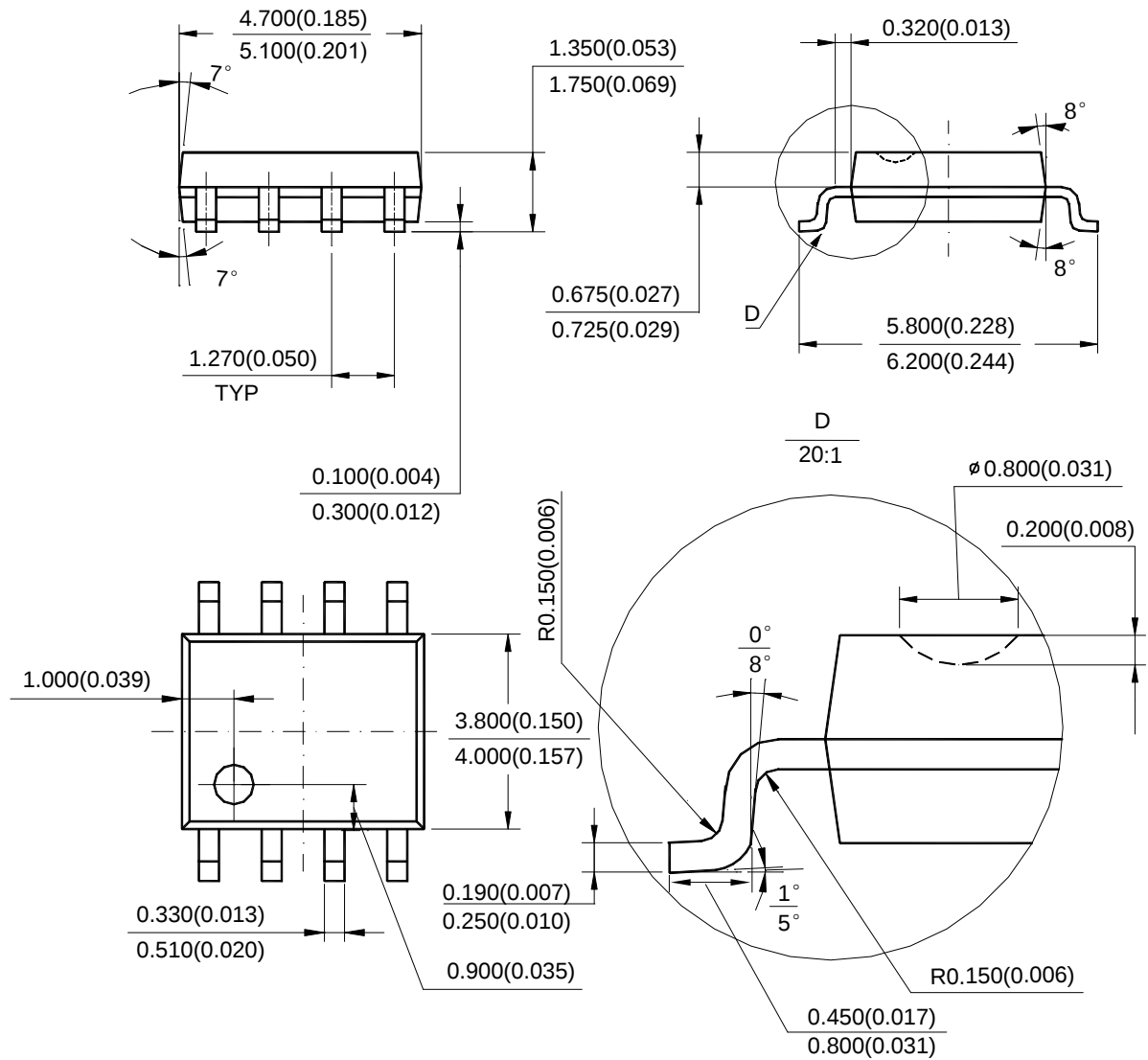


Figure 23. Enable Off

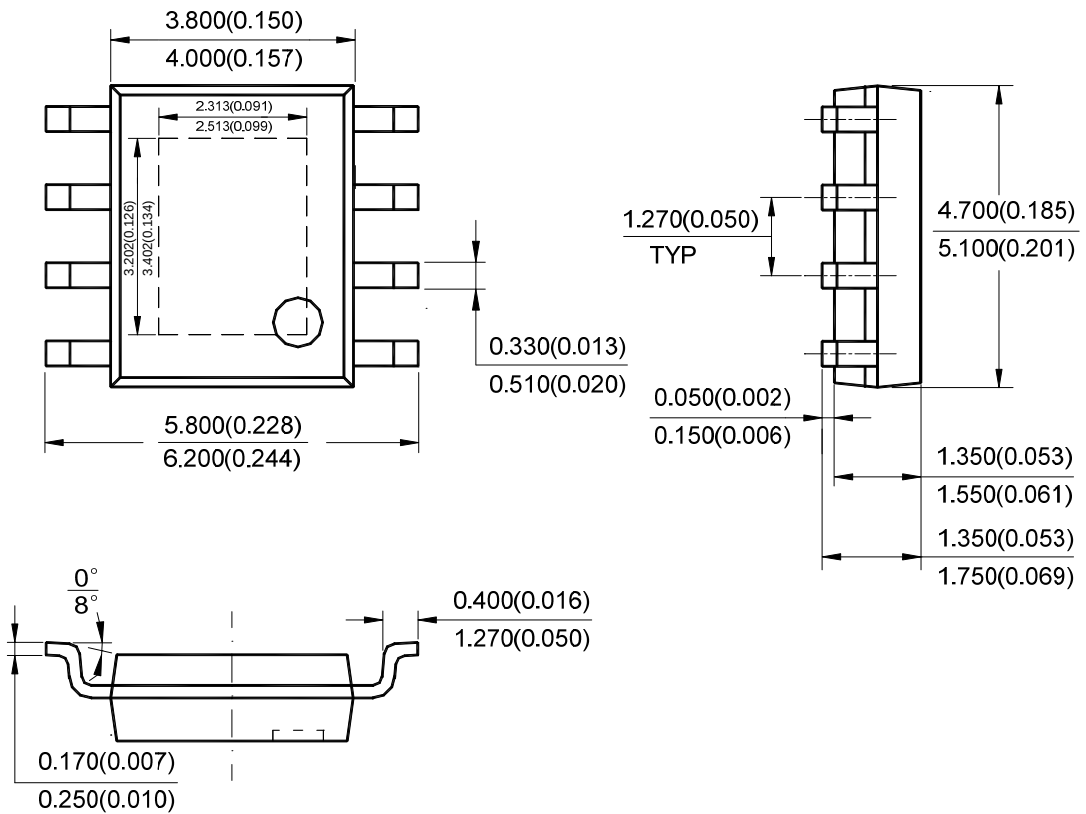
**600mA CMOS LDO REGULATOR WITH ENABLE****AP2111****Typical Application (Note 4)**

Note 4: It is recommended to use X7R or X5R dielectric capacitor if 1.0 $\mu$ F ceramic capacitor is selected as input/output capacitors.

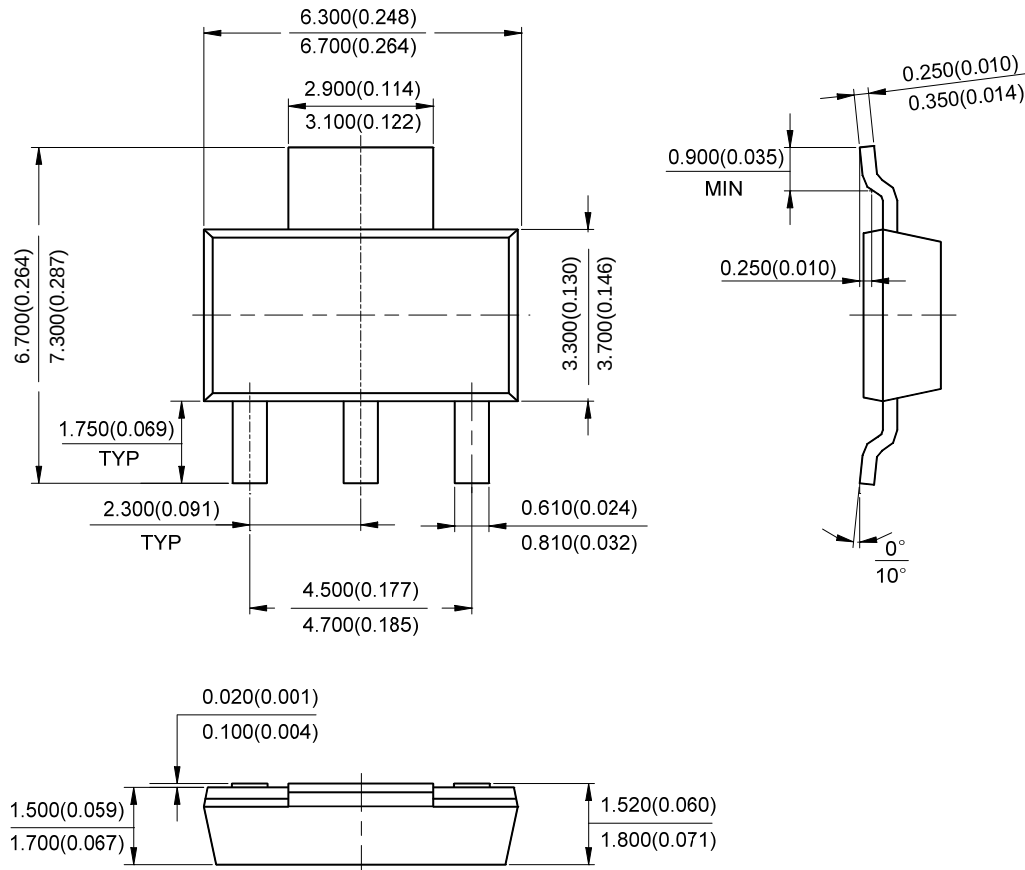
Figure 24. Typical Application of AP2111

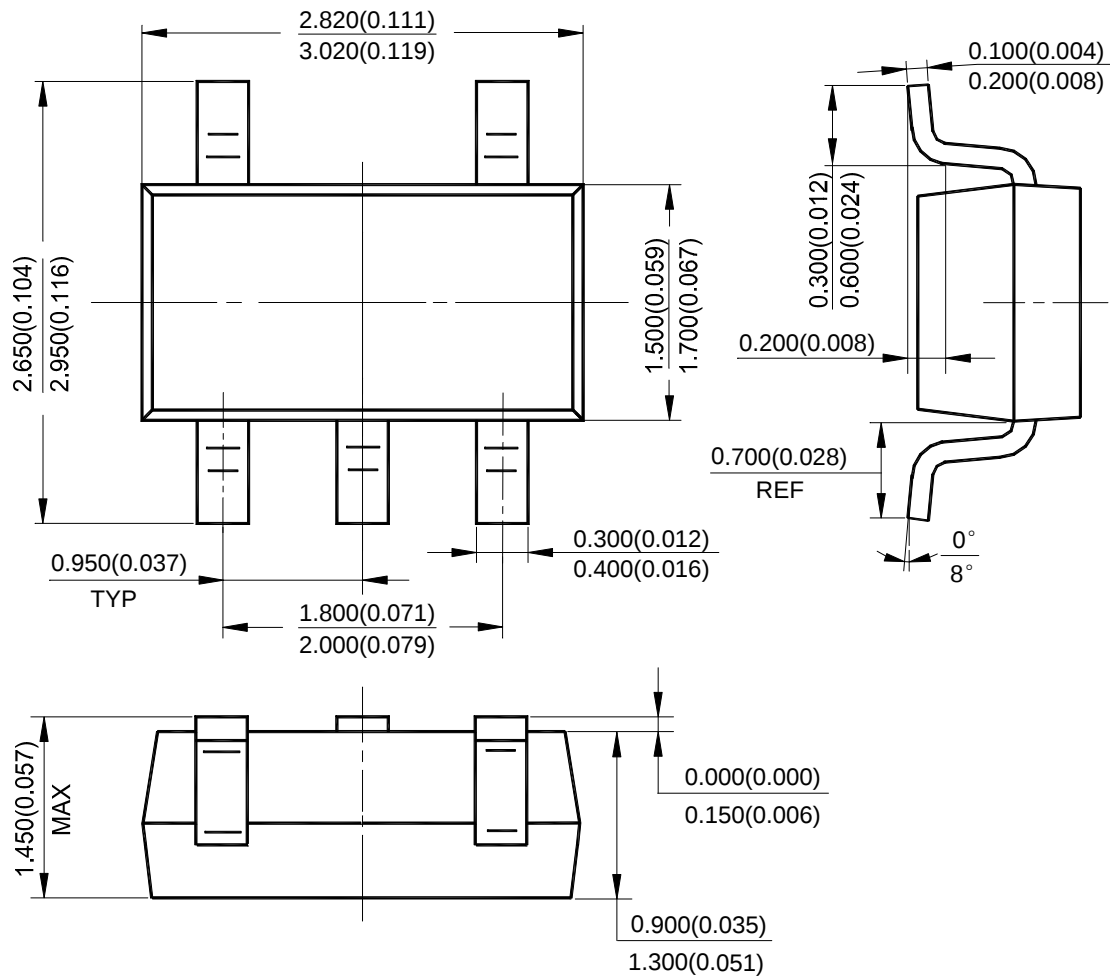
**600mA CMOS LDO REGULATOR WITH ENABLE**
**AP2111**
**Mechanical Dimensions**
**SOIC-8**
**Unit: mm(inch)**


Note: Eject hole, oriented hole and mold mark is optional.

**600mA CMOS LDO REGULATOR WITH ENABLE**
**AP2111**
**Mechanical Dimensions (Continued)**
**PSOP-8**
**Unit: mm(inch)**


Note: Eject hole, oriented hole and mold mark is optional.

**600mA CMOS LDO REGULATOR WITH ENABLE**
**AP2111**
**Mechanical Dimensions (Continued)**
**SOT-223**
**Unit: mm(inch)**


**600mA CMOS LDO REGULATOR WITH ENABLE**
**AP2111**
**Mechanical Dimensions (Continued)**
**SOT-23-5**
**Unit: mm(inch)**




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