

1.5A Low Dropout Positive Regulator

FEATURES

- Dropout Voltage 1.3V at 1.5A Output Current.
- Fast Transient Response.
- Line Regulation, typical at 0.015%.
- Load Regulation, typical at 0.1%.
- Current Limiting and Thermal Protection.
- Adjustable Output Voltage or Fixed at 1.8V, 2.5V, 2.85V, 3.3V, and 5V.
- Standard 3-Pin Power Packages.

APPLICATIONS

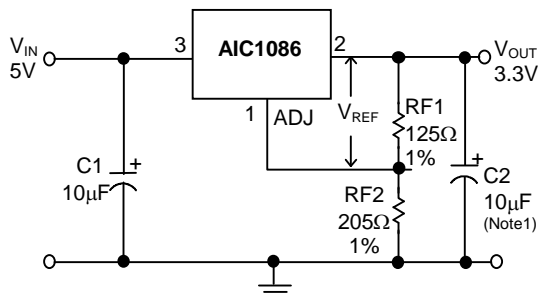
- Post Regulator for Switching Supply.
- Battery Chargers.
- PC Add-On Card.

DESCRIPTION

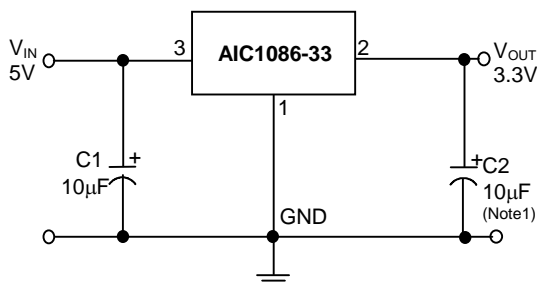
The AIC1086 is a low dropout three-terminal regulator designed to provide output current up to 1.5A. The device is available in an adjustable version and fixed output voltage of 1.8V, 2.5V, 2.85V, 3.3V and 5V. Dropout voltage of maximum of 1.5V is guaranteed at 1.5A output current. The quality of low dropout voltage and fast transient response make this device ideal for low voltage microprocessor applications.

The AIC1086 requires output capacitance of a minimum of 10 μ F for stability. Built-in output current limiting and thermal limiting provide maximal protection to the AIC1086 against fault conditions.

TYPICAL APPLICATION CIRCUIT



Adjustable Voltage Regulator



Fixed Voltage Regulator

$$V_{REF} = V_{OUT} - V_{ADJ} = 1.25V \text{ (typ.)}$$

$$V_{OUT} = V_{REF} \times (1 + RF2/RF1) + I_{ADJ} \times RF2$$

$$I_{ADJ} = 55\mu A \text{ (typ.)}$$

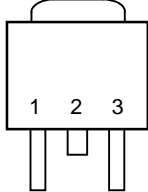
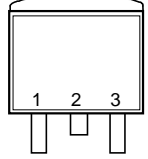
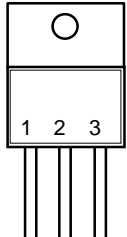
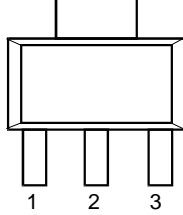
- (1) C1 needed if device is far away from filter capacitors.
- (2) C2 required for stability.

ORDERING INFORMATION

AIC1086-XX XX XX

- PACKING TYPE
TR: TAPE & REEL
TB: TUBE
BG: BAG (for SOT-223)
- PACKAGING TYPE
E: TO-252
M: TO-263
T: TO-220
Y: SOT-223
- C: COMMERCIAL
P: LEAD FREE COMMERCIAL
G: GREEN PACKAGE
- OUTPUT VOLTAGE
DEFAULT: ADJUSTABLE
18: 1.8V
25: 2.5V
28: 2.85V
33: 3.3V
50: 5.0V

Example: AIC1086-28CETR
 → 2.85V version in TO-252 Package & Taping & Reel Packing Type
 AIC1086-28PMTR
 → 2.85V version in TO-263 Lead Free Package & Taping & Reel Packing Type

| PIN CONFIGURATION | |
|---|---|
| TO-252 (CE&PE) TOP VIEW 1: ADJ 2: VOUT (TAB) 3: VIN |  |
| TO-263 (CM&PM) TOP VIEW 1: ADJ 2: VOUT (TAB) 3: VIN |  |
| TO-220 (CT&PT) FRONT VIEW 1: ADJ 2: VOUT (TAB) 3: VIN |  |
| SOT-223 (CY&PY) TOP VIEW 1: ADJ 2: VOUT (TAB) 3: VIN |  |

SOT-223 Marking

| Part No. | CY | PY | GY |
|--------------|------|-------|-------|
| AIC1086 | 1086 | 1086P | 1086G |
| AIC1086-18XY | AX18 | AX18P | AX18G |
| AIC1086-25XY | AX25 | AX25P | AX25G |
| AIC1086-28XY | AX28 | AX28P | AX28G |
| AIC1086-33XY | AX33 | AX33P | AX33G |
| AIC1086-50XY | AX50 | AX50P | AX50G |

■ ABSOLUTE MAXIMUM RATINGS

| | | |
|--|---------|----------------|
| VIN pin to ADJ/ GND pin | | 7V |
| Operating Temperature Range | | -40°C to 85°C |
| Operating Junction Temperature Range | | 0°C ~ 125°C |
| Storage Temperature Range | | -65°C ~ 150°C |
| Maximum Junction Temperature | | 125°C |
| Lead Temperature (Soldering, 10 sec) | | 260°C |
| Thermal Resistance (Junction to Case) | TO-220 |3°C /W |
| | TO-252 |12.5°C /W |
| | SOT-223 |15°C /W |
| | TO-263 |3°C /W |
| Thermal Resistance Junction to Ambient (Assume no ambient airflow, no heatsink) | TO-252 |100°C/W |
| | TO-263 |60°C /W |
| | SOT-223 |155°C /W |
| | TO-220 |50°C /W |

Absolute Maximum Ratings are those values beyond which the life of a device may be impaired.

■ TEST CIRCUIT

Refer to TYPICAL APPLICATION CIRCUIT.

■ ELECTRICAL CHARACTERISTICS
($V_{IN}=5V$, $T_J=25^{\circ}C$, $I_O=10mA$, unless otherwise specified) (Note2)

| PARAMETER | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|--|---|-------|------------|------------|---------|
| Reference Voltage | AIC1086 (ADJ), $T_J=25^{\circ}C$ | 1.238 | 1.25 | 1.262 | V |
| | $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | 1.225 | 1.25 | 1.275 | |
| Output Voltage | AIC1086-18, $V_{IN}=3.3V$ | 1.78 | 1.80 | 1.82 | V |
| | AIC1086-25, $V_{IN}=5V$ | 2.47 | 2.50 | 2.53 | |
| | AIC1086-28, $V_{IN}=5V$ | 2.82 | 2.85 | 2.88 | |
| | AIC1086-33, $V_{IN}=5V$ | 3.26 | 3.30 | 3.33 | |
| | AIC1086-50, $V_{IN}=7V$ | 4.95 | 5.00 | 5.05 | |
| Line Regulation | $2.75 \leq V_{IN} \leq 7V$, $V_{OUT}=1.25V$ $T_J=25^{\circ}C$ | | 0.015 | 0.2 | % |
| | $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | | 0.035 | 0.2 | |
| Load Regulation | $T_J=25^{\circ}C$, $I_O=10mA \sim 1.5A$ $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | | 0.1 0.2 | 0.3 0.4 | % |
| Dropout Voltage | ΔV_{OUT} , $\Delta V_{REF}=1\%$, $I_O=1.5A$ $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | | 1.3 | 1.5 | V |
| Current Limit | $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | 1.5 | 2.0 | | A |
| Adjusted Pin Current (I_{ADJ}) | $2.75 \leq V_{IN} \leq 7V$, $10mA \leq I_O \leq 1.5A$ $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | | 55 | 120 | μA |
| Adjusted Pin Current Change (ΔI_{ADJ}) | $2.75 \leq V_{IN} \leq 7V$, $10mA \leq I_O \leq 1.5A$ $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | | 0.2 | 5 | μA |
| Temperature Stability | $I_O=0.5A$, $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | | 0.5 | | % |
| GND Current | $2.65 \leq V_{IN} \leq 7V$ | | 10 | 14 | mA |
| Minimum Load Current | $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | | 5 | 10 | mA |
| RMS Output Noise (% of V_{OUT}) | $10Hz \leq f \leq 10KHz$ | | 0.003 | | % |
| Ripple Rejection Ratio | 120Hz input ripple, $C_{OUT}=25\mu F$ | 60 | 72 | | dB |

Note 1: To avoid output oscillation, aluminum electrolytic output capacitor is recommended and ceramic capacitor is not suggested.

Note 2: Specifications are production tested at $T_A=25^{\circ}C$. Specifications over the $-40^{\circ}C$ to $85^{\circ}C$ operating temperature range are assured by design, characterization and correlation with Statistical Quality Controls (SQC).

Note 3: Regulation is measured at constant junction temperature, using pulse testing with a low ON time.

Note 4: Current limit is measured by pulsing a short time.

Note 5: Dropout voltage is defined as the input to output differential at which the output voltage drops 100mV below the value measured with a 1V differential.

■ TYPICAL PERFORMANCE CHARACTERISTICS

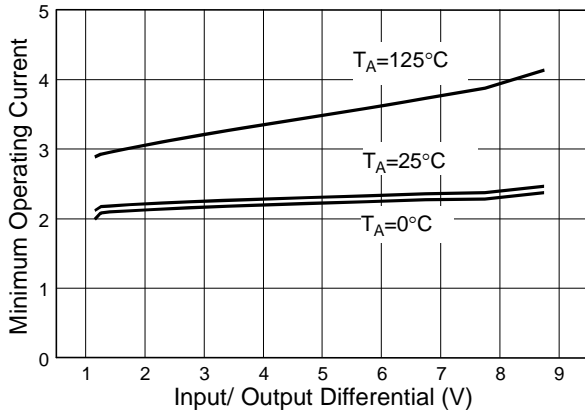


Fig. 1 AIC1086 Min. Load Current (Adjustable Version)

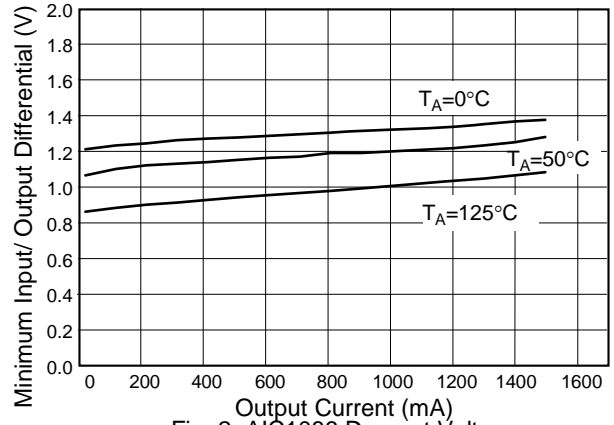


Fig. 2 AIC1086 Dropout Voltage

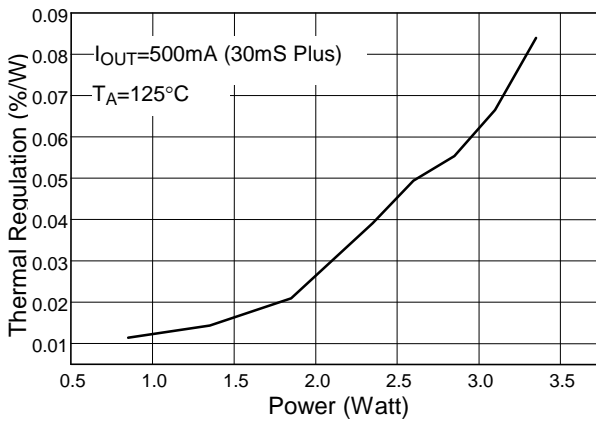


Fig. 3 AIC1086 (ADJ) Power vs. Thermal Regulation

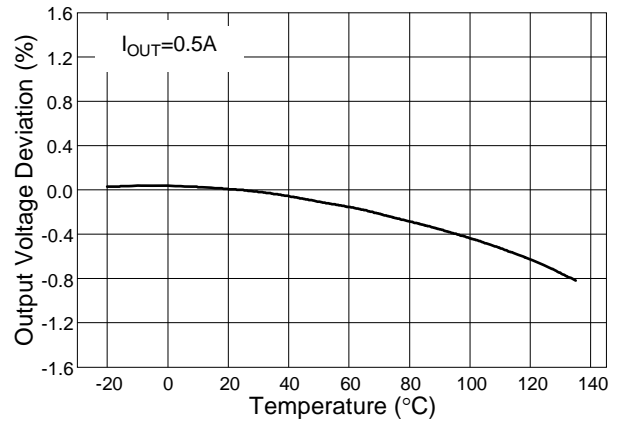


Fig. 4 AIC1086 (ADJ) Temperature Stability

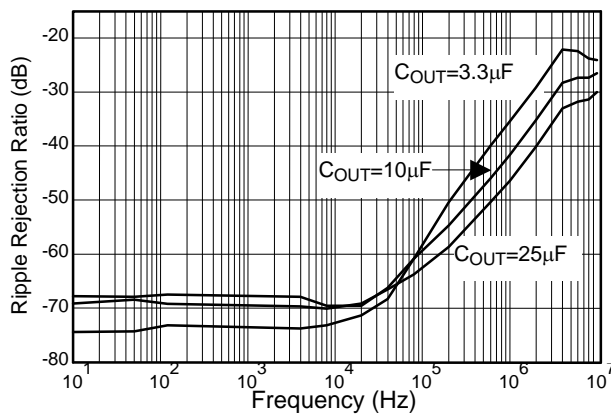


Fig. 5 AIC1086 (ADJ) Ripple Rejection Ratio (dB)

■ **TYPICAL PERFORMANCE CHARACTERISTICS (Continued)**

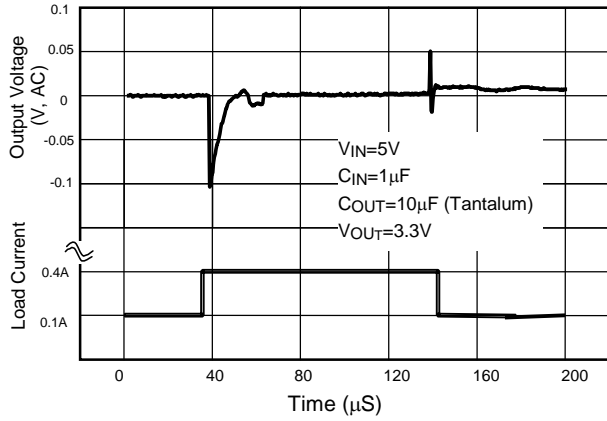


Fig. 6 Load Transient Response

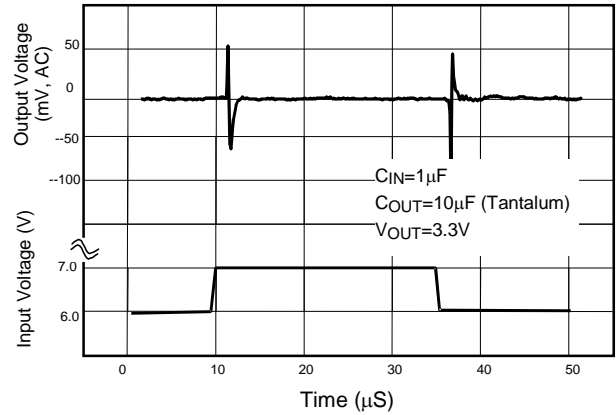
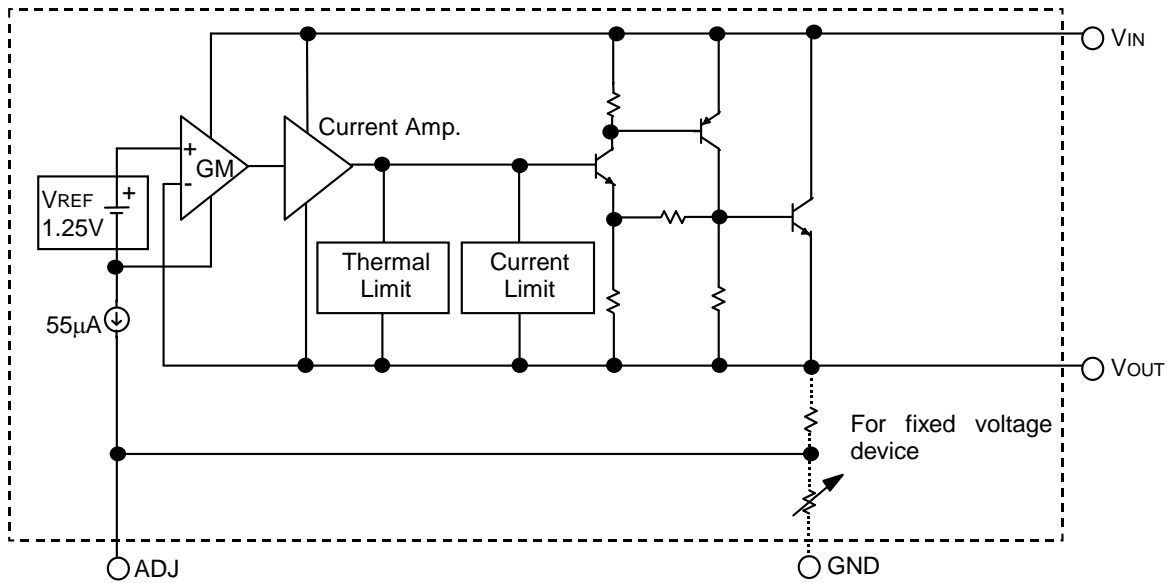


Fig. 7 Line Transient Response

■ **BLOCK DIAGRAM**



■ **PIN DESCRIPTIONS**

- ADJ PIN - Providing $V_{REF}=1.25\text{V}$ (typ.) for adjustable V_{OUT} . $V_{REF}=V_{OUT}-V_{ADJ}$ and $I_{ADJ}=55\mu\text{A}$ (typ.) (GND PIN - Power ground.)
- VOUT PIN - Adjustable output voltage.
- VIN PIN - Power Input.

APPLICATION INFORMATION

INPUT-OUTPUT CAPACITORS

Linear regulators require input and output capacitors to maintain stability. Input capacitor at 10 μ F with a 10 μ F aluminum electrolytic output capacitor is recommended.

POWER DISSIPATION

The AIC1086 obtains thermal-limiting circuitry, which is designed to protect the device against overload condition. For continuous load condition, maximum rating of junction temperature must not be exceeded. It is important to pay more attention in thermal resistance. It includes junction to case, junction to ambient. The maximum power dissipation of AIC1086 depends on the thermal resistance of its case and circuit board, the temperature difference between the die junction and ambient air, and the rate of airflow. The rate of temperature rise is greatly affected by the mounting pad configuration on the PCB, the

board material, and the ambient temperature. When the IC mounting with good thermal conductivity is used, the junction temperature will be low even when large power dissipation applies.

The power dissipation across the device is

$$P = I_{OUT} (V_{IN} - V_{OUT})$$

The maximum power dissipation is:

$$P_{MAX} = \frac{(T_{J-max} - T_A)}{R\theta_{JA}}$$

Where T_{J-max} is the maximum allowable junction temperature (125°C), and T_A is the ambient temperature suitable in application.

As a general rule, the lower temperature is, the better reliability of the device is. So the PCB mounting pad should provide maximum thermal conductivity to maintain low device temperature.

APPLICATION EXAMPLES

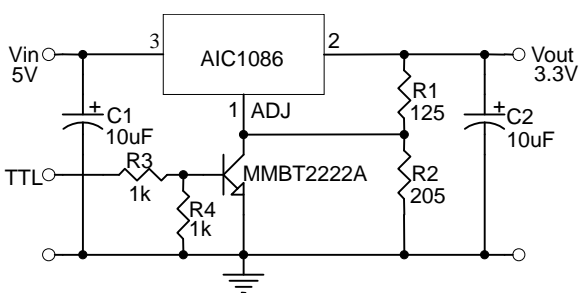
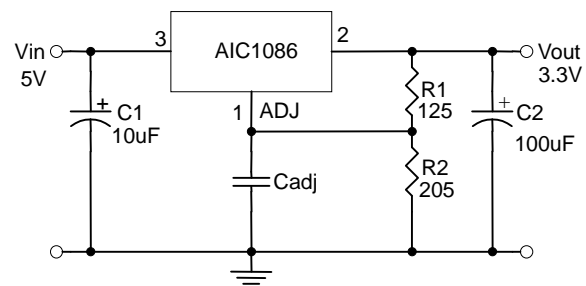


Fig. 8 $V_{OUT}=3.3V$ with Shutdown



* Cadj can improve ripple rejection

Fig. 9 Improving Ripple Rejection

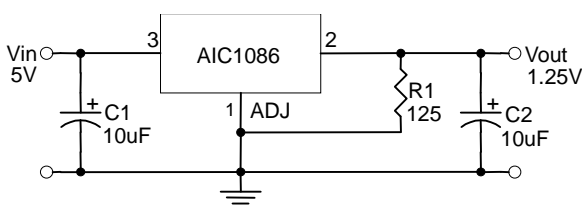


Fig. 10 $V_{OUT}=1.25V$ Application Circuit

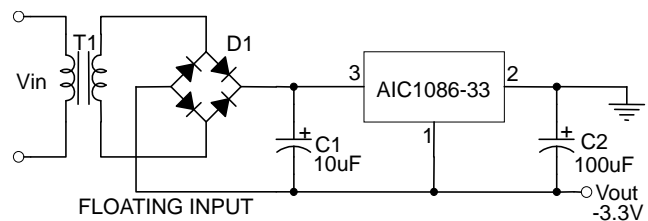
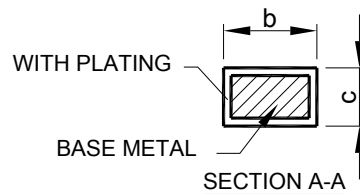
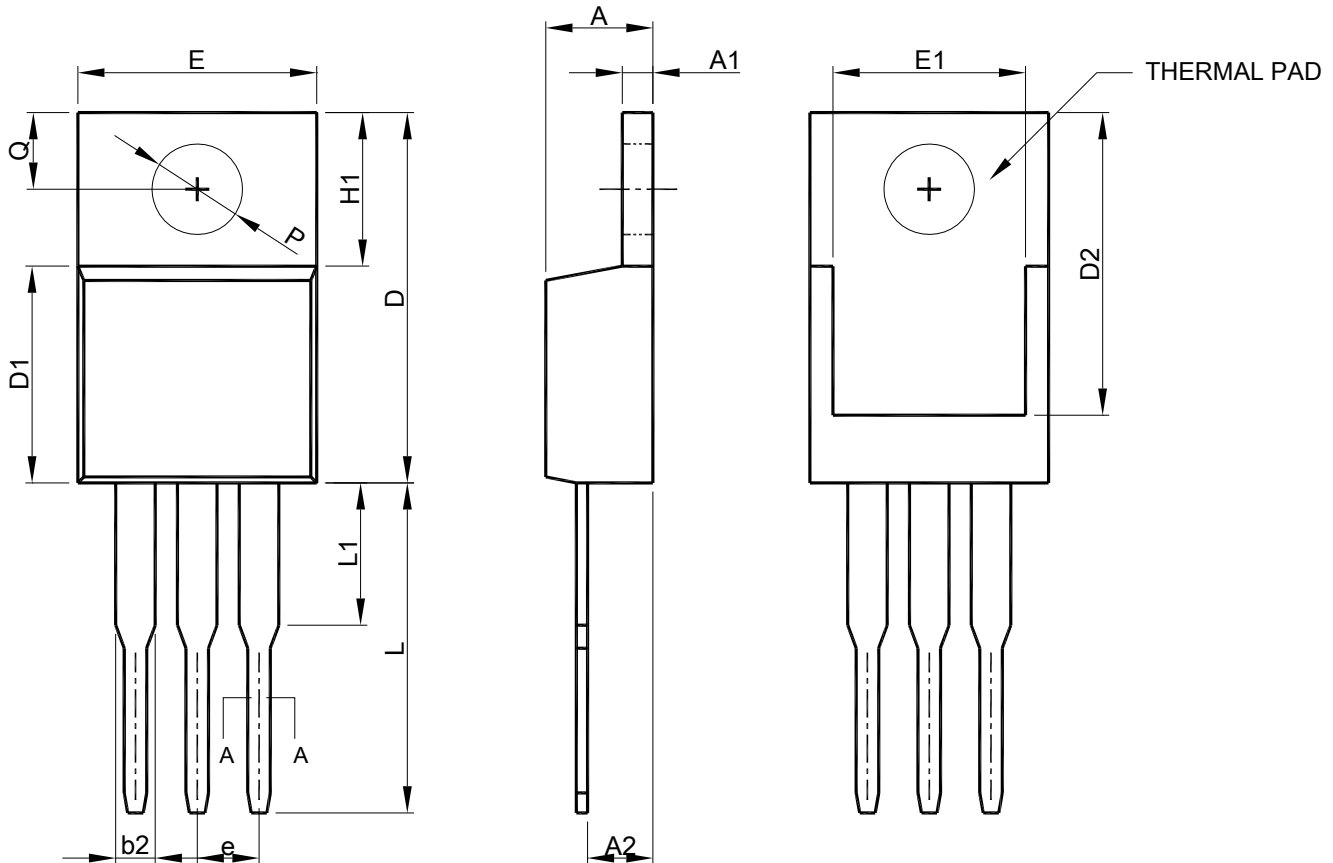


Fig. 11 Low Dropout Negative Supply

PHYSICAL DIMENSIONS

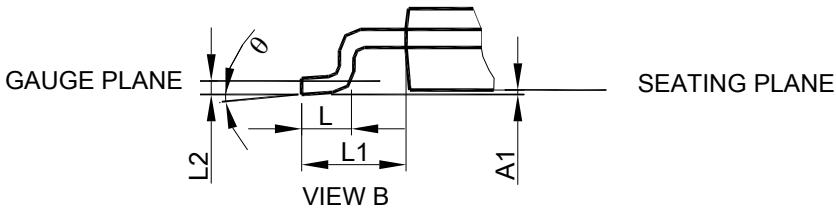
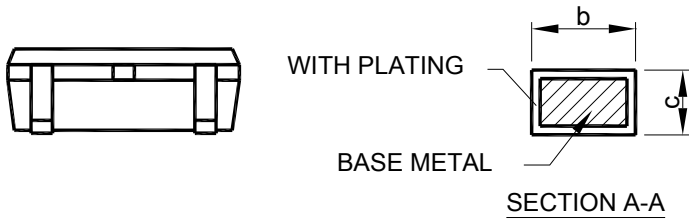
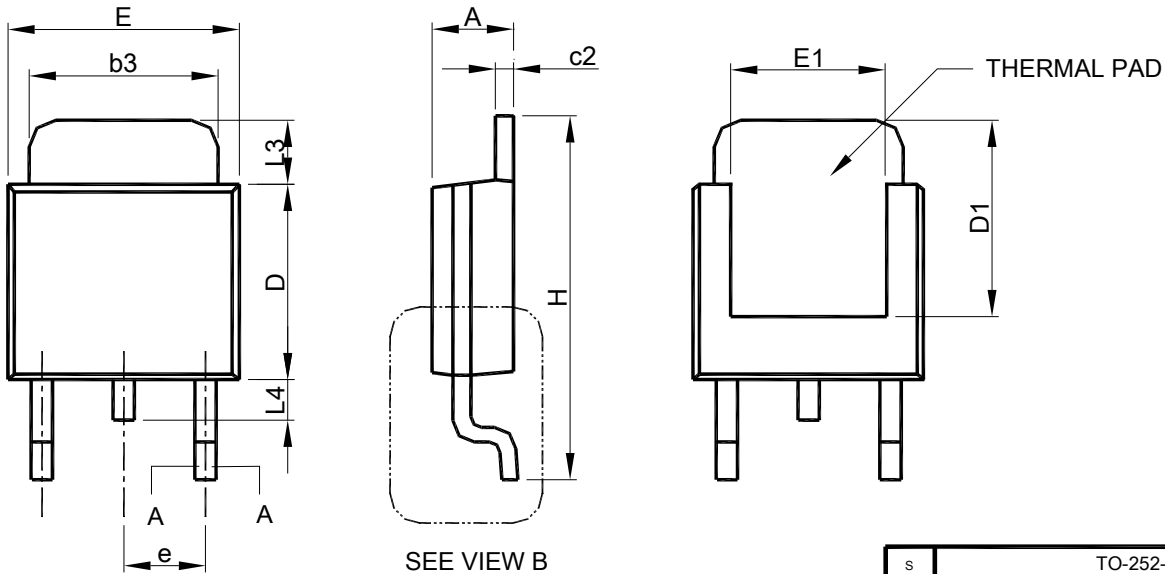
● TO-220 (unit: mm)



| SYMBOL | TO-220 | |
|--------|-------------|-------|
| | MILLIMETERS | |
| | MIN. | MAX. |
| A | 3.56 | 4.82 |
| A1 | 0.51 | 1.39 |
| A2 | 2.04 | 2.92 |
| b | 0.38 | 1.01 |
| b2 | 1.15 | 1.77 |
| c | 0.35 | 0.61 |
| D | 14.23 | 16.51 |
| D1 | 8.38 | 9.02 |
| D2 | 11.75 | 12.88 |
| E | 9.66 | 10.66 |
| E1 | 6.86 | 8.90 |
| e | 2.54 BSC | |
| H1 | 5.85 | 6.85 |
| L | 12.70 | 14.73 |
| L1 | -- | 6.35 |
| P | 3.54 | 4.08 |
| Q | 2.54 | 3.42 |

- Note: 1. Refer to JEDEC TO-220AB.
 2. Dimension "E" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side.
 3. Dimension "D1" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

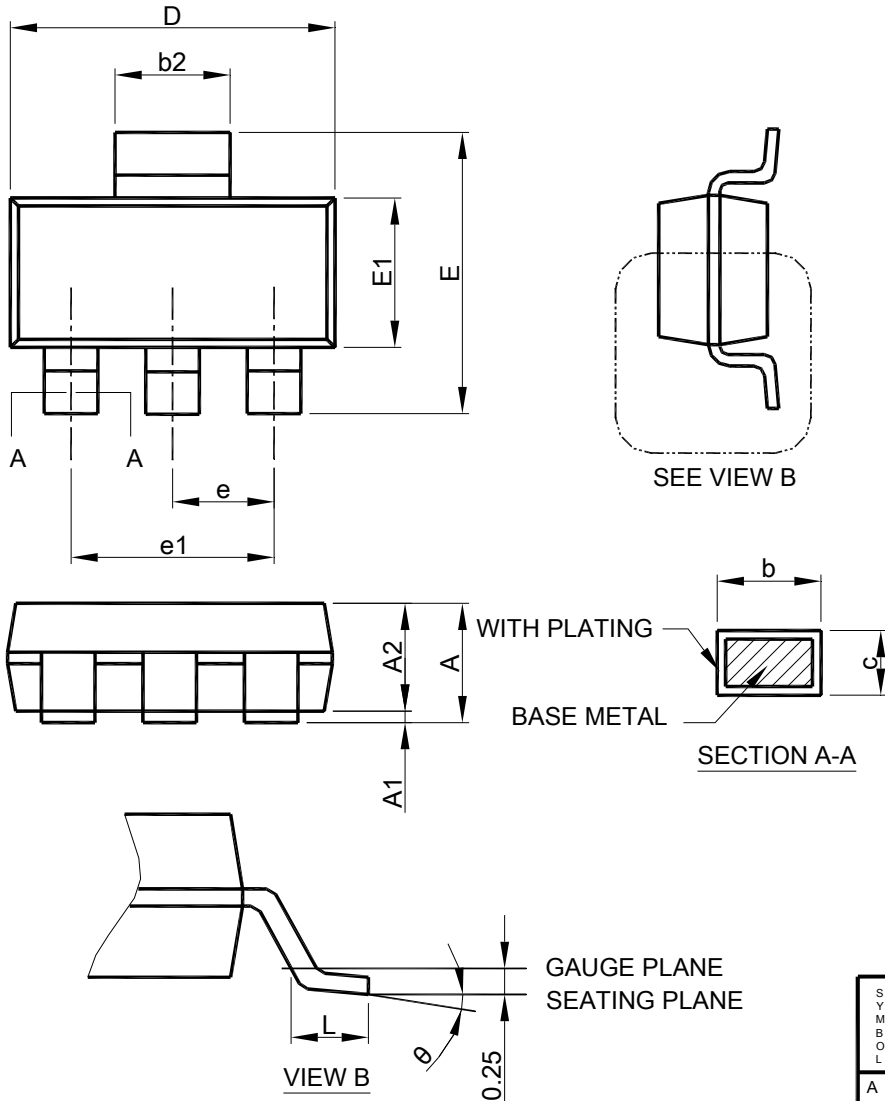
● TO-252 (unit: mm)



| SYMBOL | TO-252-3L | |
|--------|-------------|-------|
| | MILLIMETERS | |
| | MIN. | MAX. |
| A | 2.19 | 2.38 |
| A1 | 0.00 | 0.13 |
| b | 0.64 | 0.89 |
| b3 | 4.95 | 5.46 |
| c | 0.46 | 0.61 |
| c2 | 0.46 | 0.89 |
| D | 5.33 | 6.22 |
| D1 | 4.60 | 6.00 |
| E | 6.35 | 6.73 |
| E1 | 3.90 | 5.46 |
| e | 2.28 BSC | |
| H | 9.40 | 10.41 |
| L | 1.40 | 1.78 |
| L1 | 2.67 REF | |
| L2 | 0.51 BSC | |
| L3 | 0.89 | 2.03 |
| L4 | -- | 1.02 |
| θ | 0° | 8° |

- Note: 1. Refer to JEDEC TO-252AA and AB.
 2. Dimension "E" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .
 3. Dimension "D" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

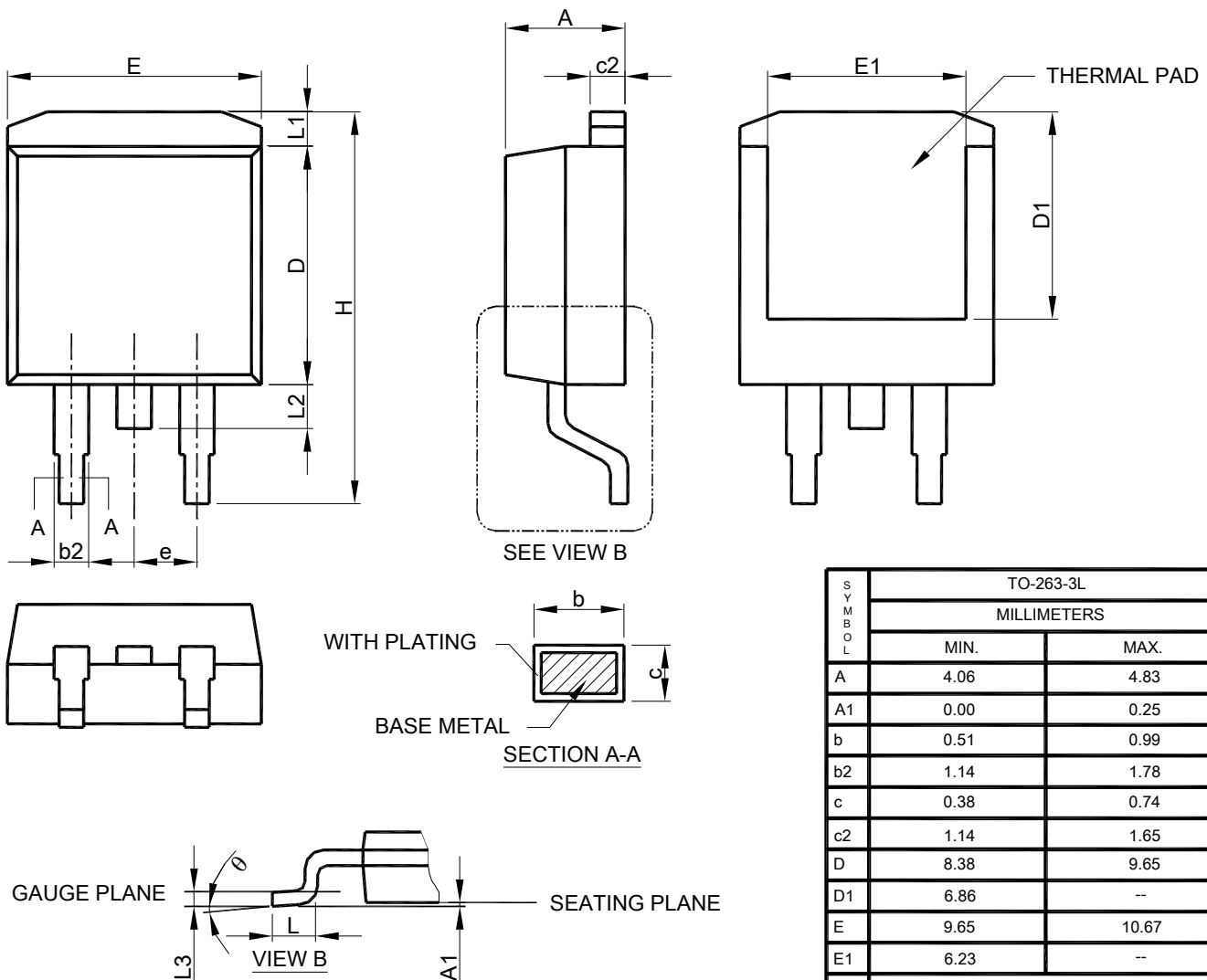
● SOT-223(unit: mm)



- Note: 1. Refer to JEDEC TO-261AA.
 2. Dimension "D" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .
 3. Dimension "E1" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

| SYMBOL | SOT-223 | |
|----------|-------------|------|
| | MILLIMETERS | |
| | MIN. | MAX. |
| A | | 1.80 |
| A1 | 0.02 | 0.10 |
| A2 | 1.55 | 1.65 |
| b | 0.66 | 0.84 |
| b2 | 2.90 | 3.10 |
| c | 0.23 | 0.33 |
| D | 6.30 | 6.70 |
| E | 6.70 | 7.30 |
| E1 | 3.30 | 3.70 |
| e | 2.30 BSC | |
| e1 | 4.60 BSC | |
| L | 0.90 | |
| θ | 0° | 8° |

● TO-263 (unit: mm)



| SYMBOL | TO-263-3L | |
|--------|-------------|-------|
| | MILLIMETERS | |
| | MIN. | MAX. |
| A | 4.06 | 4.83 |
| A1 | 0.00 | 0.25 |
| b | 0.51 | 0.99 |
| b2 | 1.14 | 1.78 |
| c | 0.38 | 0.74 |
| c2 | 1.14 | 1.65 |
| D | 8.38 | 9.65 |
| D1 | 6.86 | -- |
| E | 9.65 | 10.67 |
| E1 | 6.23 | -- |
| e | 2.54 BSC | |
| H | 14.61 | 15.88 |
| L | 1.78 | 2.79 |
| L1 | -- | 1.68 |
| L2 | -- | 1.78 |
| L3 | 0.25 BSC | |
| θ | 0° | 8° |

- Note:
1. Refer to JEDEC TO-263AB.
 2. Dimension "E" does not include mold flash, protrusions or gate burrs. Mold flash, protrusion or gate burrs shall not exceed 6 mil per side .
 3. Dimension "D" does not include inter-lead flash or protrusions.
 4. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

Note:

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