

FAN1950/FAN1951

1.5A Low-Voltage Low-Dropout Regulator

Features

- 1.5A minimum guaranteed output current
- 500mV maximum dropout at 1.5A
 - Ideal for 2.5V to 1.8V or 1.65V conversion
 - Ideal for 3.0V to 2.5V conversion
- Current Limiting and Thermal shutdown
- External Shut-down control (FAN1951 only)
- Error flag output (FAN1951 only)
- Fast transient response
- Low ground current

Applications

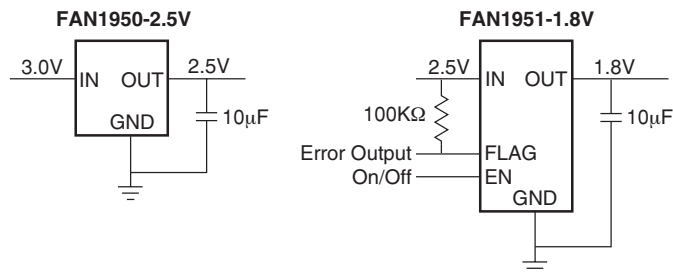
- General purpose conversion for low-voltage CPUs, DSP and FPGAs
- SMPS post regulator
- Cable/Satellite set-top boxes
- PCI Graphics adapter cards

General Description

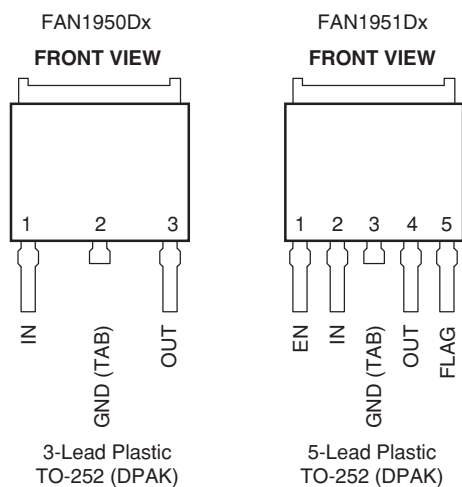
The FAN1950 and FAN1951 are 1.5A low-dropout linear regulators that provide a low voltage, high current output with a minimum of external components. Both of these devices use a PNP output pass element achieving a maximum 500mV dropout at 1.5A load current. In addition these devices offer overcurrent limit and thermal shutdown features to ensure full protection.

The FAN1951 offers a logic level enable pin and an error flag output to indicate undervoltage and over-current conditions. 1.8V and 2.5V fixed output versions are available. 3.3V, 1.65V and 1.5V options are available upon request.

Typical Application



Pin Assignments



Pin Descriptions

| Pin Number | | Pin Name | Pin Function Description |
|------------|---------|----------|--|
| FAN1950 | FAN1951 | | |
| NA | 1 | EN | Enable (Input) – TTL/CMOS compatible input. Logic HIGH enables the output |
| 1 | 2 | IN | Input Supply Voltage |
| 2 | 3 | GND | Ground. This pin and TAB are ground. |
| 3 | 4 | OUT | Output Voltage |
| NA | 5 | FLAG | Error Flag (Output). Open-collector output. Active-low indicates an output fault condition. |

Absolute Maximum Ratings

Absolute maximum ratings are the values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

| Parameter | Min. | Typ. | Max. | Units |
|--|------|------|--------------------|-------|
| Supply Voltage: IN | -0.2 | | 15 | V |
| Enable Voltage: EN | -0.2 | | 15 | V |
| FLAG voltage: FLAG | -0.2 | | 15 | V |
| Junction Temperature (T _J) | -55 | | 150 | °C |
| Storage Temperature | -65 | | 150 | °C |
| Lead Soldering Temperature, 10 seconds | | | 300 | °C |
| Power Dissipation (P _D) | | | Internally Limited | W |

Recommended Operating Conditions

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|------------|------|------|------|-------|
| Supply Voltage | | 2.25 | | 14 | V |
| Package Thermal Resistance (θ _{JC}) | TO-252 | | 3 | | °C/W |
| Junction Operating Temperature | | -40 | | 125 | °C |

Electrical Specifications

(V_{IN} = V_{OUT} + 1V, V_{EN} = 2.5V, T_J = +25°C unless specified otherwise)

The • denotes specifications which apply over the full operating temperature range.

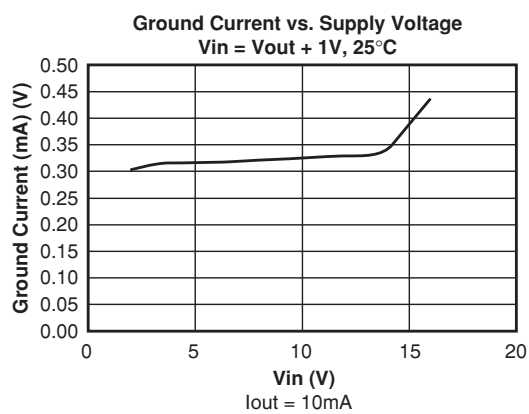
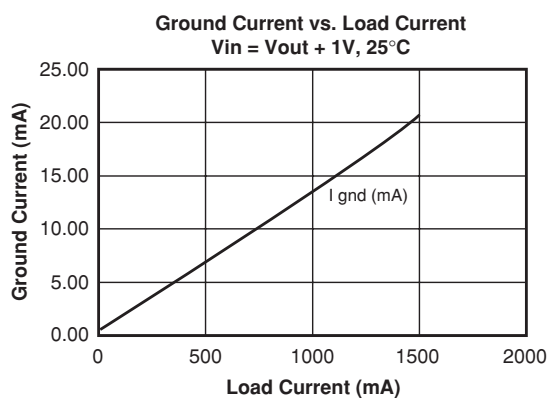
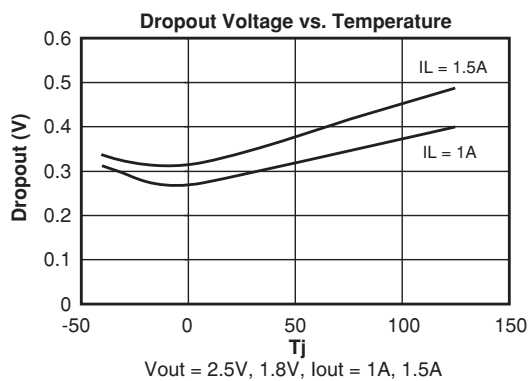
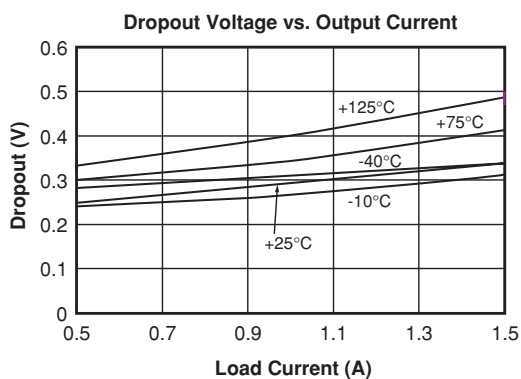
| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|--|----------------|----------|----------|-------------|
| Output Voltage (V _{OUT}) Tolerance | 10mA ≤ I _{OUT} ≤ 1.0A, 10mA ≤ I _{OUT} ≤ 1.5A, V _{OUT} + 1V ≤ V _{IN} ≤ 8V | • -2 • -2.5 | | 2 2.5 | % |
| Line Regulation ^{1,2} | I _{OUT} = 10mA, V _{OUT} + 1V ≤ V _{IN} ≤ 14V | | .06 | 0.5 | % |
| Load Regulation ^{1,2} | V _{IN} = V _{OUT} + 1V, 10mA ≤ I _{OUT} ≤ 1.5A | | 0.2 | 1 | % |
| Dropout Voltage ³ | I _{OUT} = 1.5A, ΔV _{OUT} = -1% | • | 350 | 500 | mV |
| Ground Current | I _{OUT} = 750mA I _{OUT} = 1.5A | • | 10 20 | 20 | mA mA |
| Minimum Load Current | V _{OUT} + 1V ≤ V _{IN} ≤ 8V | • | 5 | 10 | mA |
| Current Limit | V _{OUT} = 0V, V _{IN} = V _{OUT} + 1V | • | 2.5 | | A |
| EN Input Voltage (FAN1951 only) | V _{IH} (On) V _{IL} (Off) | • 2.25 • | | 0.8 | V V |
| EN Input Current (FAN1951 only) | I _{IH} , V _{EN} = 2.25V I _{IL} , V _{EN} = 0.8V | • • | | 30 4 | μA μA |
| FLAG Threshold Voltage (FAN1951 only) | Low threshold, % V _{OUT} High threshold, % V _{OUT} Hysteresis | | 93 1 | 99.2 | % % % |
| FLAG Output Leakage Current ⁴ (FAN1951 only) | V _{FLAG} = 14V | • | | 2 | μA |
| FLAG Output-Low Voltage (FAN1951 only) | I _{OL} = 250μA | • | | 400 | mV |

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|------------------------------|--|------|------|------|---------|
| Thermal Shutdown Temperature | | | 150 | | °C |
| Thermal Shutdown Hysteresis | | | 10 | | °C |
| Shutdown output current | $V_{EN} \leq 0.8V, V_{IN} \leq 8V, V_{OUT} = 0V$ | • | | 20 | μA |

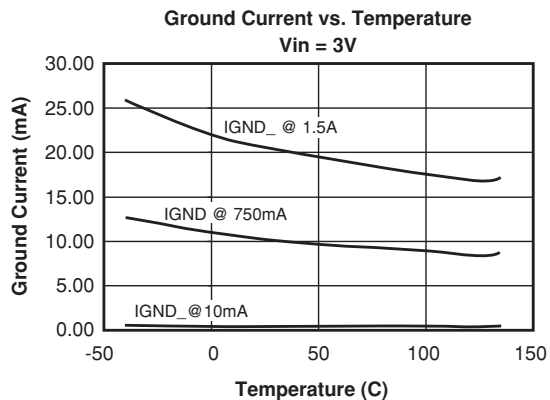
Notes:

1. See thermal regulation specifications for changes in output voltage due to heating effects. Load and line regulation are measured at a constant junction temperature by low duty cycle pulse testing.
2. Line and load regulation are guaranteed up to the maximum power dissipation. Power dissipation is determined by input/output differential and the output current. Guaranteed maximum output power will not be available over the full input/output voltage range.
3. Dropout voltage = $V_{IN} - V_{OUT}$ when V_{OUT} decreases to 98% of its nominal output voltage with $V_{IN} = V_{OUT} + 1V$. For output voltages below 2.25V, dropout voltage is the input-to-output voltage differential with the minimum input voltage being 2.25V. Minimum input operating voltage is 2.25V.
4. Flag output cannot be pulled to a voltage higher than V_{IN} .

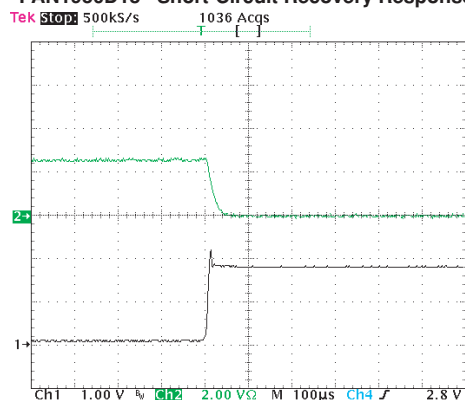
Typical Performance Characteristics



Typical Performance Characteristics (continued)

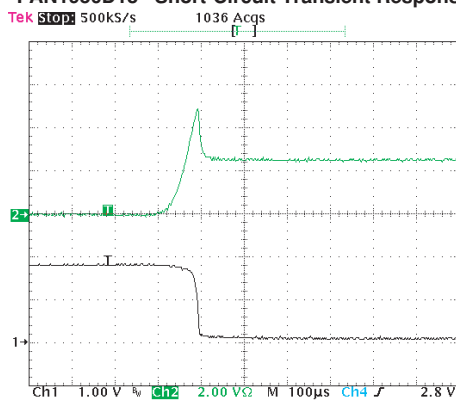


FAN1950D18 Short-Circuit Recovery Response



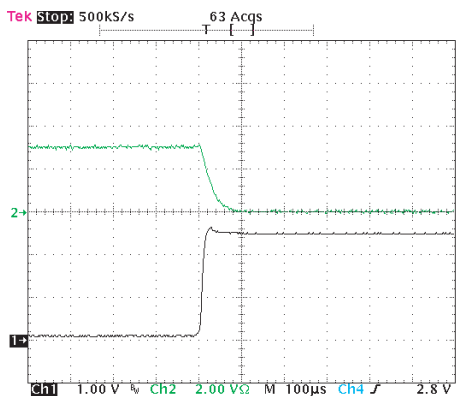
Vin = 3V, Vout = 1.8V
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

FAN1950D18 Short-Circuit Transient Response



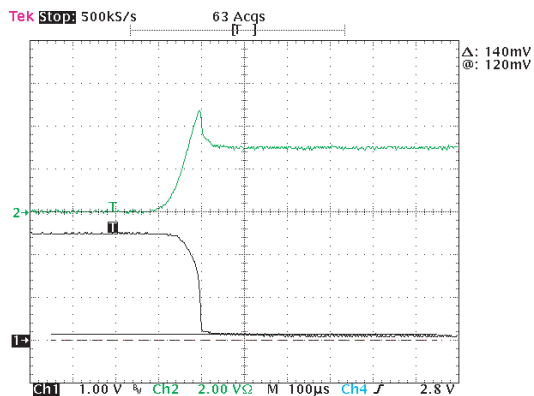
Vin = 3V, Vout = 1.8V
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

FAN1950D25 Short-Circuit Recovery Response



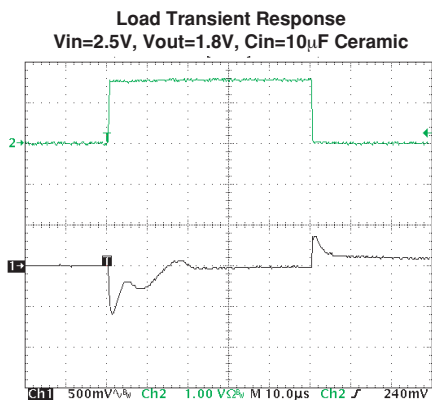
Vin = 3V, Vout = 2.5V
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

FAN1950D25 Short-Circuit Transient Response

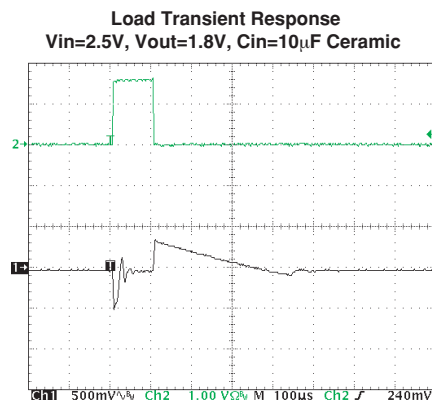


Vin = 3V, Vout = 2.5V
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

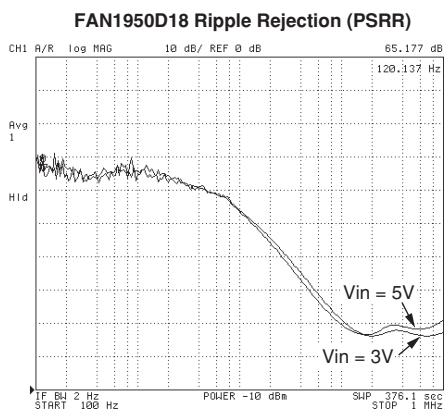
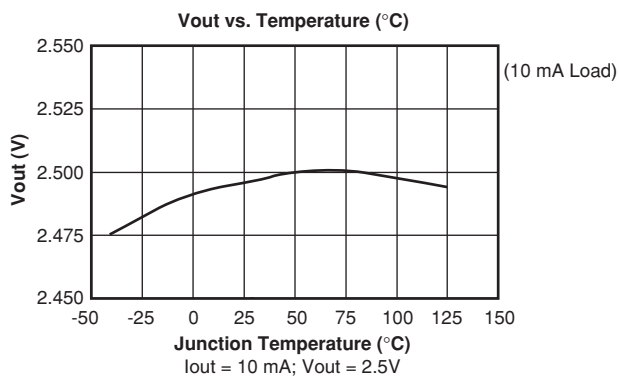
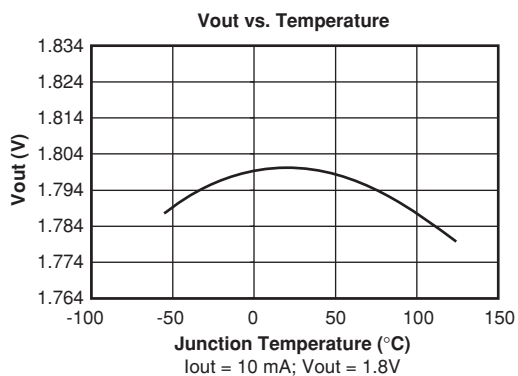
Typical Performance Characteristics (continued)



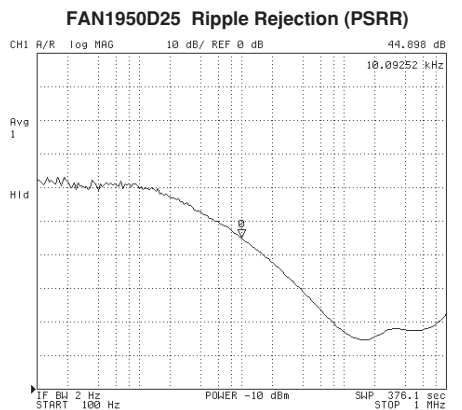
Cout = 10 μ F Tantalum (ESR~700m Ω)
 Ch1 – Vout (AC, 0.5V/div) Ch2 – Load Current (1A/div.)



Cout = 10 μ F Ceramic
 Ch1 – Vout (AC, 0.5V/div.) Ch2 – Load Current (1A/div.)



Vin = 3V and 5V Vout = 1.8V Iload = 1A
 Cin = Cout = 10 μ F/ 6.3V Tantalum
 PSRR – 10dB/div



Vin = 5V Vout = 2.5V Iload = 1A
 Cin = Cout = 10 μ F/ 6.3V Tantalum
 PSRR – 10dB/div

Input and Output Capacitor Requirements

A 4.7 μ F or greater Input Capacitor (Ceramic or Tantalum), installed closely between V_{IN} and GND leads of the part, is required for stability, better transient response, noise and ripple rejection. A higher value of electrolytic input capacitor can be recommended if the bulk capacitor of the power supply is located more than 3– 4 inches from the device or a large and fast-rise-time load is a requirement.

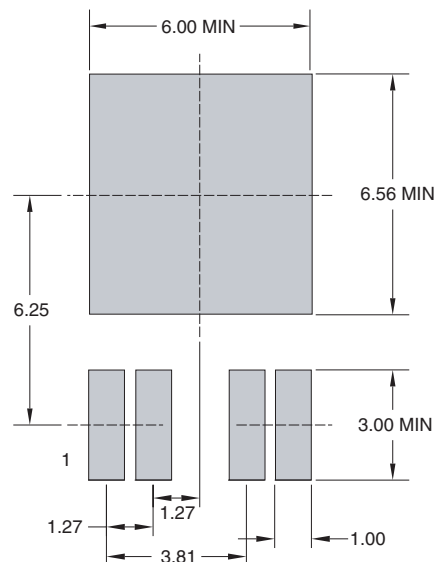
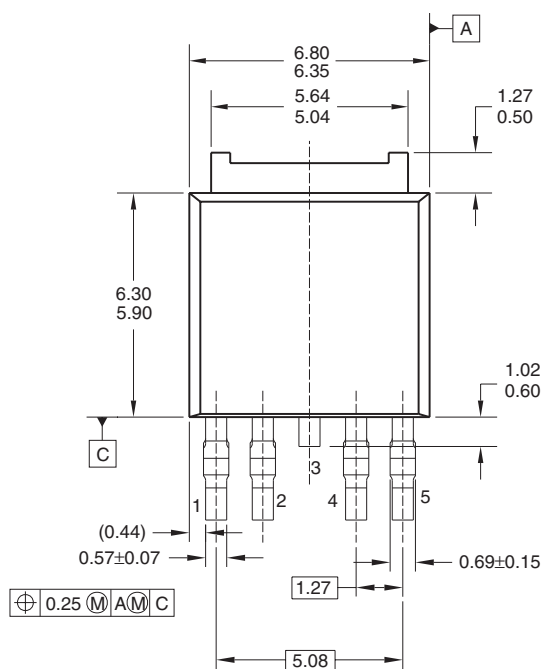
FAN1950 and FAN1951, as most of LDO regulators, require an Output Capacitor. The recommended value of this capacitor is 10 μ F. The larger capacitor will

additionally improve the Transient Response, Ripple Rejection and output noise. The low-ESR Tantalum capacitors are the best for this application: they provide stable work and good transient response over the temperature range. Using the Ceramic capacitors as the Output capacitor can provoke instability (oscillation in the Output Voltage).

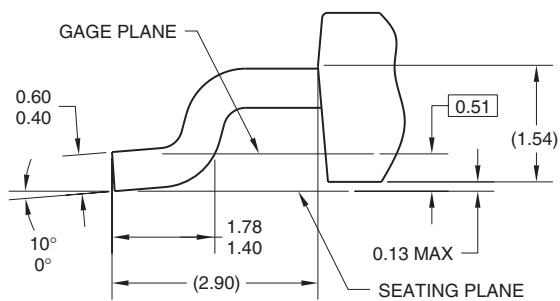
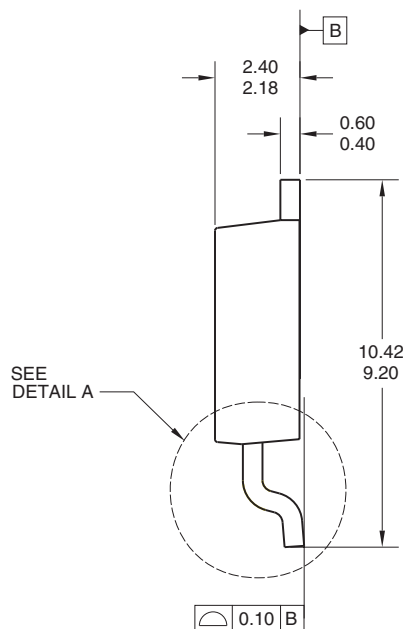
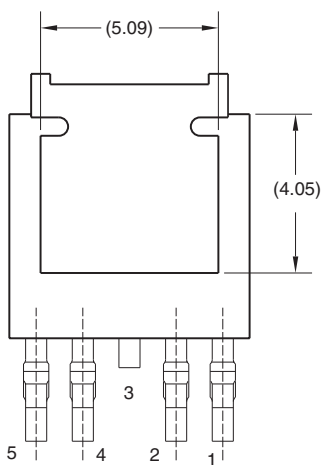
Aluminum electrolytic capacitors also can be used if their ESR is below 3 Ω .

Mechanical Dimensions

5-Lead TO-252 DPAK Package



LAND PATTERN RECOMMENDATION

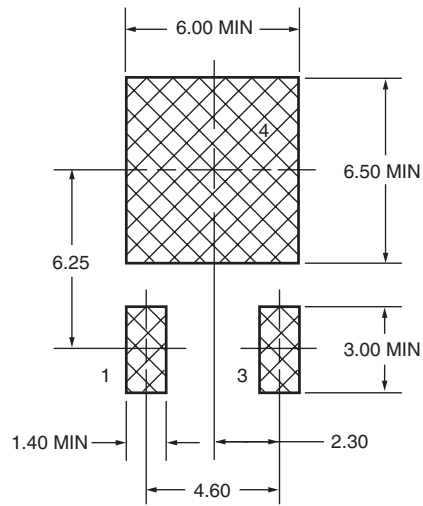
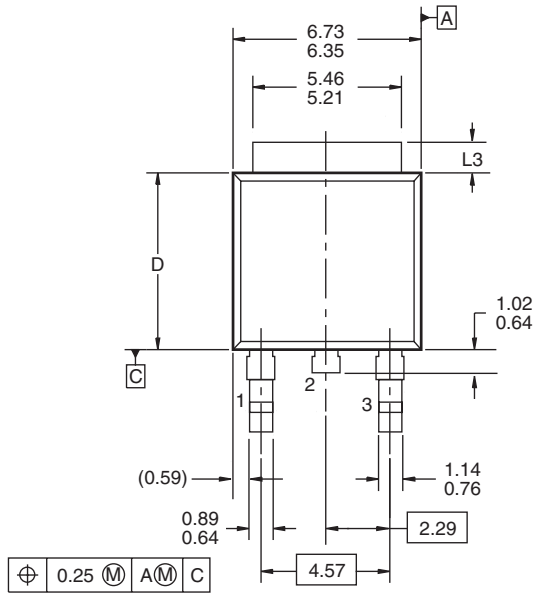


DETAIL A
(ROTATED 90°)
SCALE: 2X

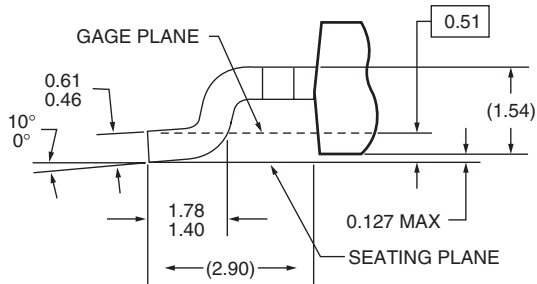
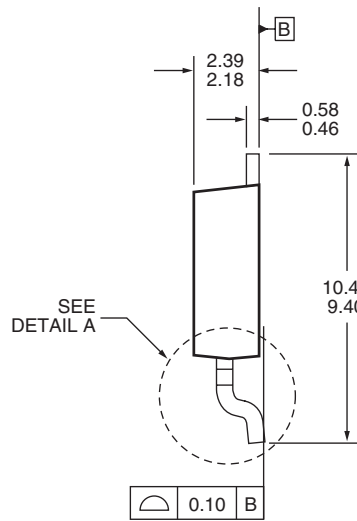
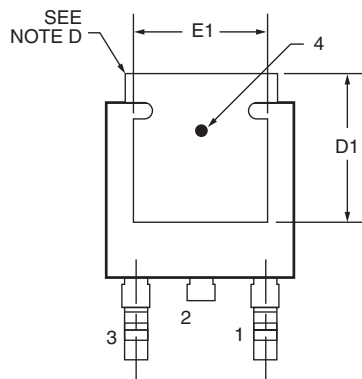
NOTES: UNLESS OTHERWISE SPECIFIED
 A) ALL DIMENSIONS ARE IN MILLIMETERS.
 B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA, DATED NOV. 1999.

Mechanical Dimensions

3-Lead TO-252 DPAK Package



LAND PATTERN RECOMMENDATION



DETAIL A
(ROTATED -90°)
SCALE 12X

NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C. VARIATION AA & AB, DATED NOV. 1999.
- C) DIMENSIONING AND TOLERANCING PER ASME Y14.5-1994.
- D) HEAT SINK TOP EDGE COULD BE IN CHAMFERED CORNERS OR EDGE PROTRUSION.
- E) DIMENSIONS L3, D, E1 & D1 TABLE:

| | OPTION AA | OPTION AB |
|----|-------------|-------------|
| L3 | 0.89 - 1.27 | 1.52 - 2.03 |
| D | 5.97 - 6.22 | 5.33 - 5.59 |
| E1 | 4.32 MIN | 3.81 MIN |
| D1 | 5.21 MIN | 4.57 MIN |

Ordering Information

| Part Number | Output Voltage | Package |
|-------------|----------------|-------------------------------------|
| FAN1951D18X | 1.8V | 5 Lead TO-252 DPAK in Tape and Reel |
| FAN1951D25X | 2.5V | 5 Lead TO-252 DPAK in Tape and Reel |
| FAN1950D25X | 2.5V | 3 Lead TO-252 DPAK in Tape and Reel |

Note: Please contact sales for other voltage and package options.

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.