

# 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

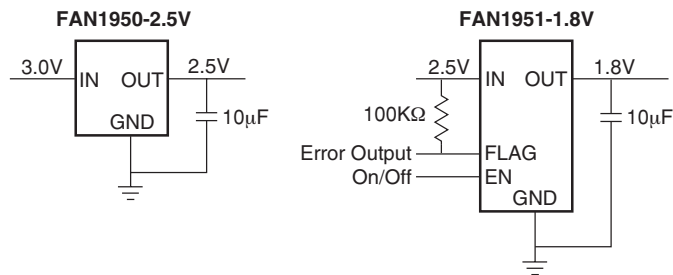
- General purpose conversion for low-voltage CPUs, DSP and FPGAs
- SMPS post regulator
- Cable/Satellite set-top boxes
- PCI Graphics adapter cards

### General Description

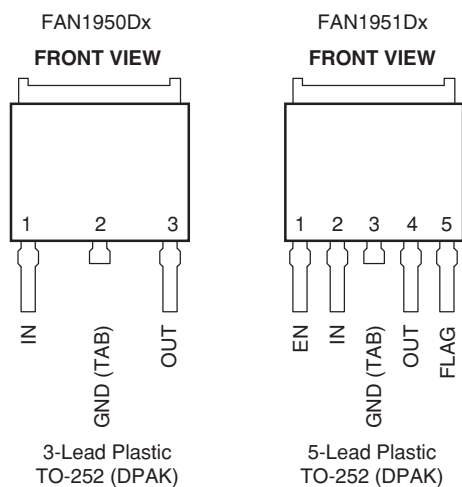
The FAN1950 and FAN1951 are 1.5A low-dropout linear regulators that provide a low voltage, high current output with a minimum of external components. Both of these devices use a PNP output pass element achieving a maximum 500mV dropout at 1.5A load current. In addition these devices offer overcurrent 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	<b>Enable (Input) – TTL/CMOS compatible input.</b> Logic HIGH enables the output
1	2	IN	<b>Input Supply Voltage</b>
2	3	GND	<b>Ground.</b> This pin and TAB are ground.
3	4	OUT	<b>Output Voltage</b>
NA	5	FLAG	<b>Error Flag (Output).</b> 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 <sub>J</sub> )	-55		150	°C
Storage Temperature	-65		150	°C
Lead Soldering Temperature, 10 seconds			300	°C
Power Dissipation (P <sub>D</sub> )			Internally Limited	W

## Recommended Operating Conditions

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

## Electrical Specifications

(V<sub>IN</sub> = V<sub>OUT</sub> + 1V, V<sub>EN</sub> = 2.5V, T<sub>J</sub> = +25°C unless specified otherwise)

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

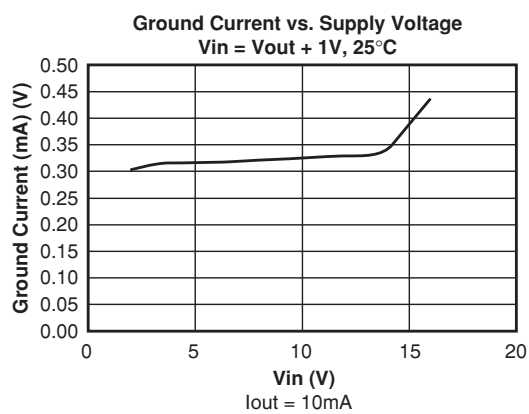
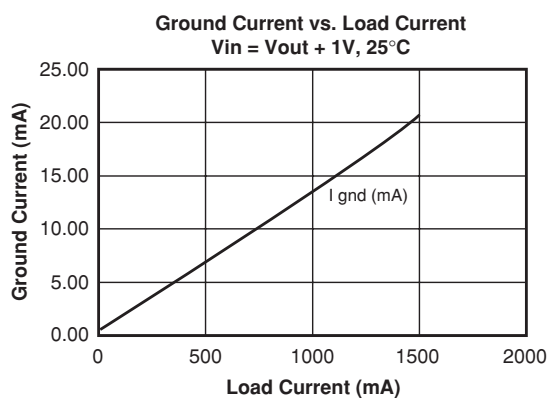
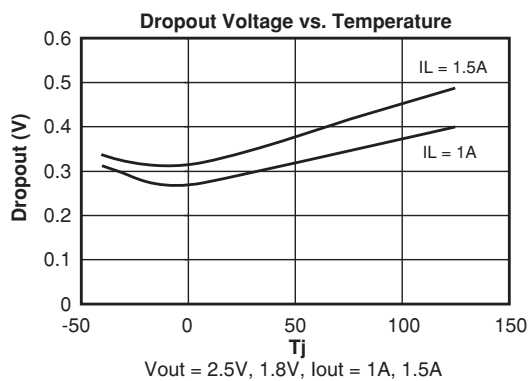
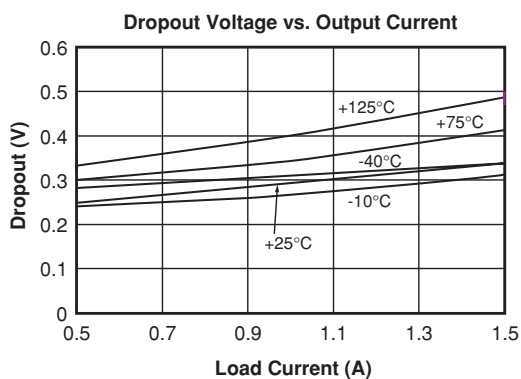
Parameter	Conditions	Min.	Typ.	Max.	Units
Output Voltage (V <sub>OUT</sub> ) Tolerance	10mA ≤ I <sub>OUT</sub> ≤ 1.0A, 10mA ≤ I <sub>OUT</sub> ≤ 1.5A, V <sub>OUT</sub> + 1V ≤ V <sub>IN</sub> ≤ 8V	• -2 • -2.5		2 2.5	%
Line Regulation <sup>1,2</sup>	I <sub>OUT</sub> = 10mA, V <sub>OUT</sub> + 1V ≤ V <sub>IN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

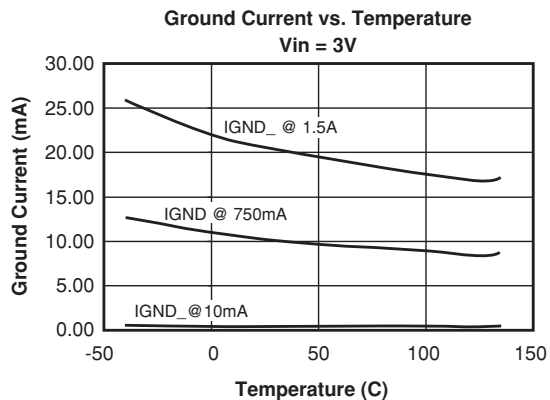
**Notes:**

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  $V_{IN}$ .

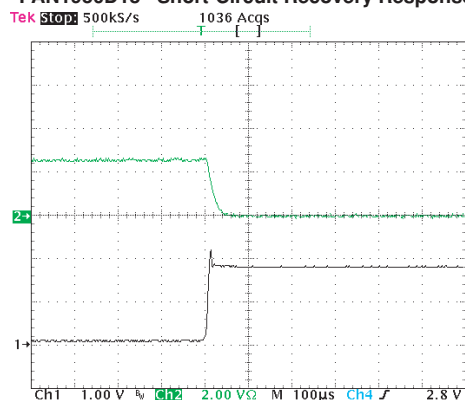
# Typical Performance Characteristics



## Typical Performance Characteristics (continued)

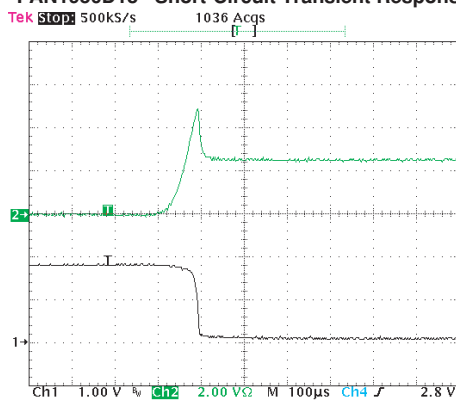


**FAN1950D18 Short-Circuit Recovery Response**



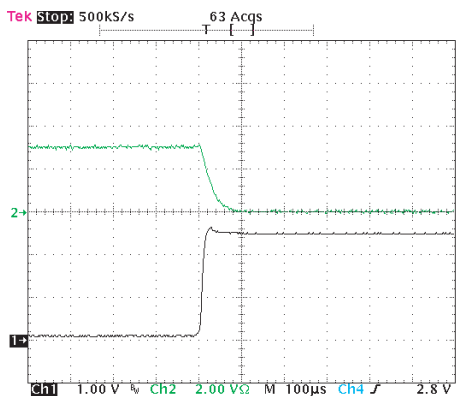
Vin = 3V, Vout = 1.8V  
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

**FAN1950D18 Short-Circuit Transient Response**



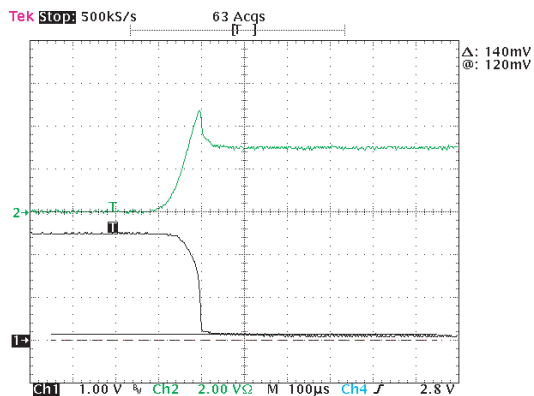
Vin = 3V, Vout = 1.8V  
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

**FAN1950D25 Short-Circuit Recovery Response**



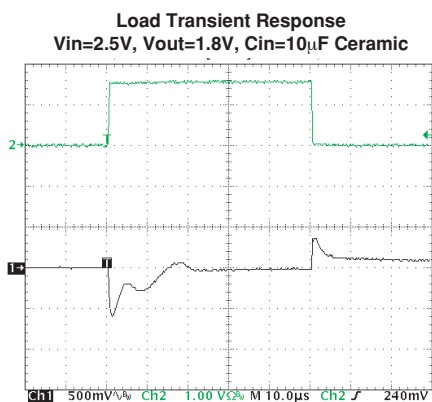
Vin = 3V, Vout = 2.5V  
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

**FAN1950D25 Short-Circuit Transient Response**

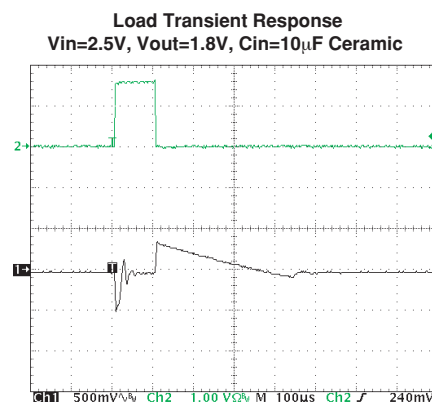


Vin = 3V, Vout = 2.5V  
Ch.1 – Vout (1V/div) Ch.2 – Load Current (2A/div)

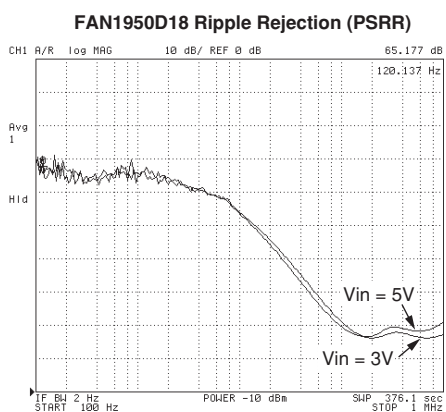
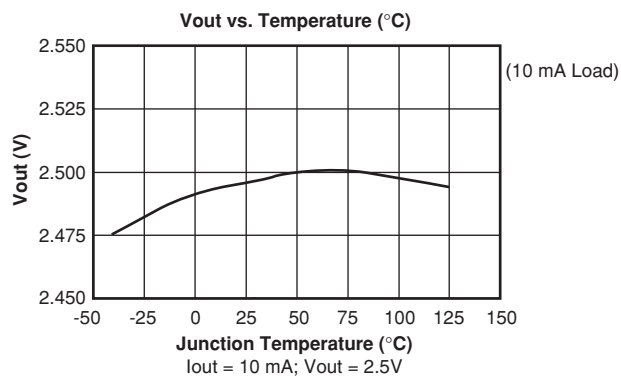
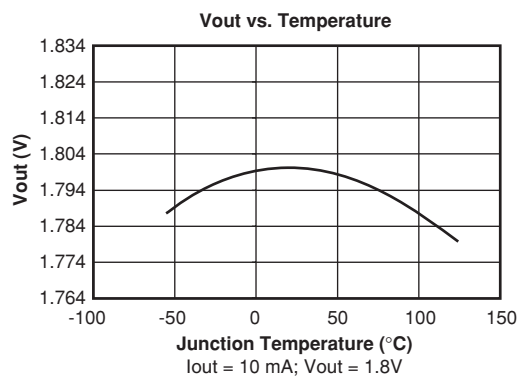
## Typical Performance Characteristics (continued)



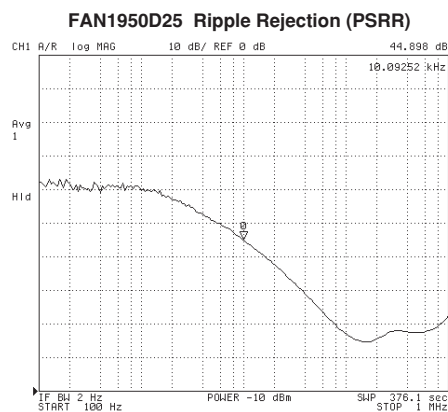
Cout = 10 $\mu$ F Tantalum (ESR~700m $\Omega$ )  
 Ch1 – Vout (AC, 0.5V/div) Ch2 – Load Current (1A/div.)



Cout = 10 $\mu$ 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 $\mu$ F/ 6.3V Tantalum  
 PSRR – 10dB/div



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

**Input and Output Capacitor Requirements**

A 4.7 $\mu$ 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 $\mu$ F. The larger capacitor will

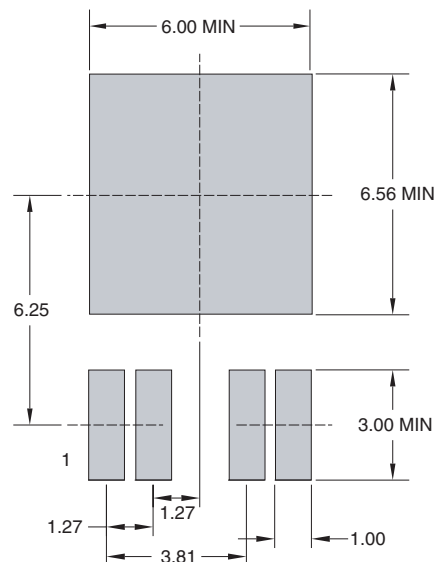
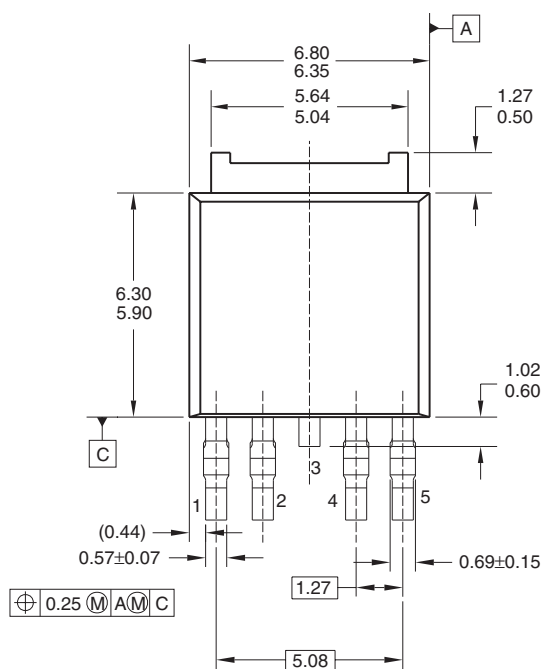
additionally improve the Transient Response, Ripple Rejection and output noise. The low-ESR Tantalum capacitors are the best for this application: they provide stable work and good transient response over the temperature range. Using the Ceramic capacitors as the Output capacitor can provoke instability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

Aluminum electrolytic capacitors also can be used if their ESR is below 3 $\Omega$ .

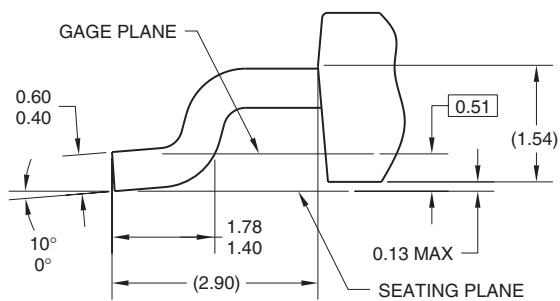
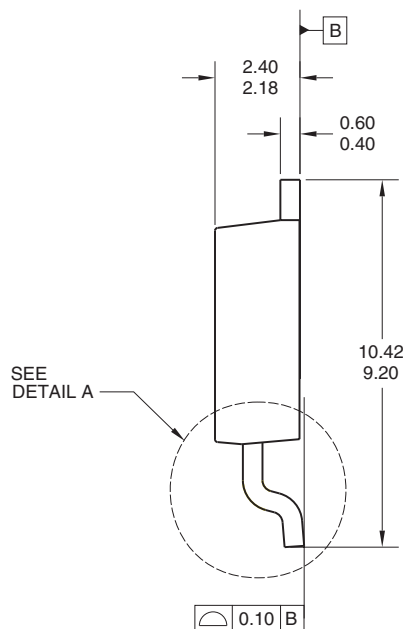
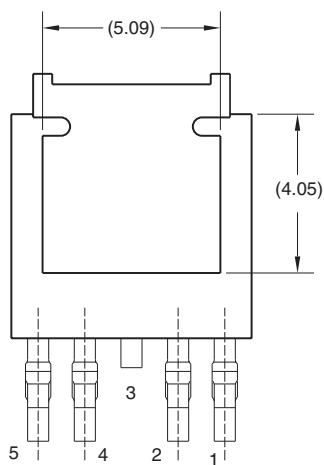


# Mechanical Dimensions

## 5-Lead TO-252 DPAK Package



LAND PATTERN RECOMMENDATION



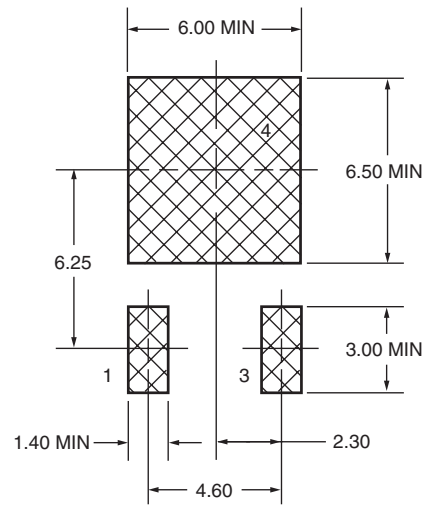
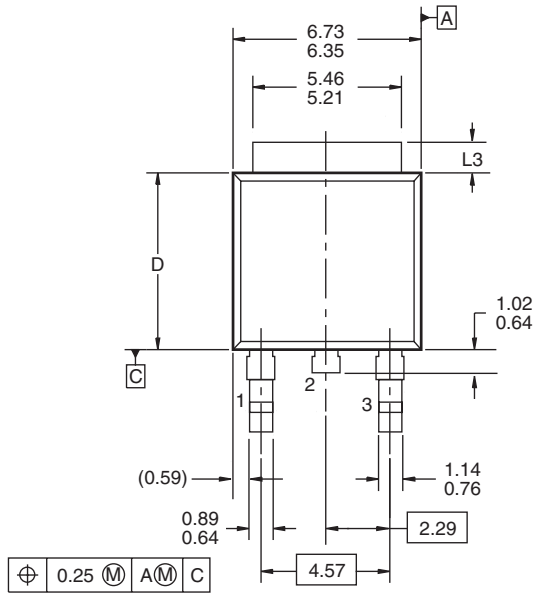
**DETAIL A**  
(ROTATED 90°)  
SCALE: 2X

NOTES: UNLESS OTHERWISE SPECIFIED

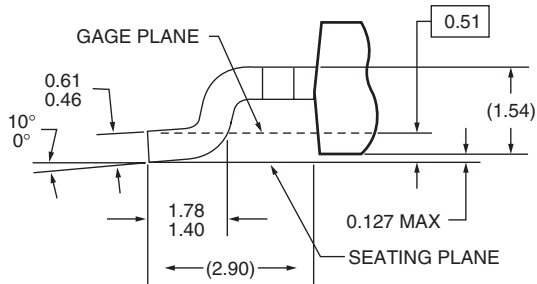
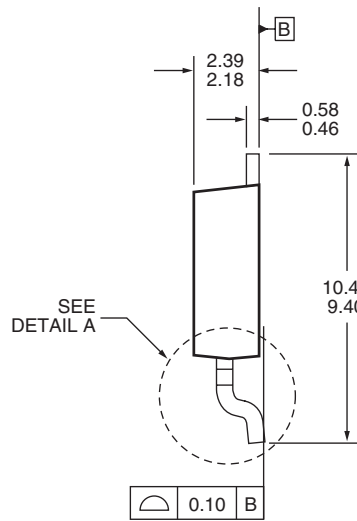
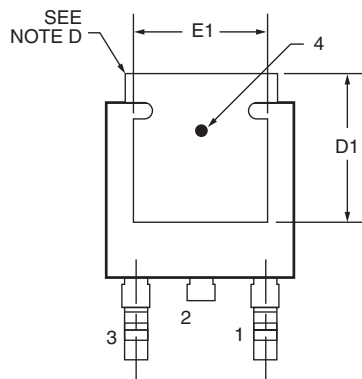
- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) THIS PACKAGE CONFORMS TO JEDEC, TO-252, ISSUE C, VARIATION AA, DATED NOV. 1999.

# 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.