April 2008

FAN1950 — 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
- Fast Transient Response
- Low Ground Current

Applications

- General-purpose Conversion for Low-voltage CPUs, DSPs, and FPGAs
- SMPS Post Regulators
- Cable / Satellite Set-top Boxes
- PCI Graphics Adapter Cards

Description

The FAN1950 is a 1.5A low-dropout linear regulator that provides a low-voltage, high-current output with a minimum of external components. This device uses a PNP output pass element, achieving a maximum 500mV dropout at 1.5A load current. Over-current limit and thermal shutdown features to ensure full protection.

Ordering Information

Part Number	Output Voltage	Package	Packing Method
FAN1950D25X	2.5V	3-Lead TO-252 DPAK	Tape and Reel

All packages are lead free per JEDEC: J-STD-020B standard.

Typical Application

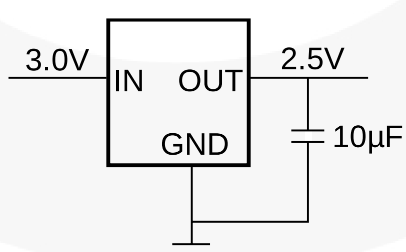


Figure 1. Typical Application

Pin Configuration

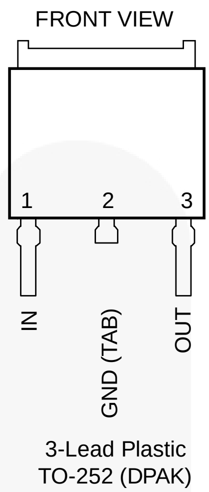


Figure 2. Pin Assignment

Pin Definitions

Pin #	Name	Description
1	IN	Input Supply Voltage
2	GND	**Ground**. This pin and TAB are ground.
3	OUT	Output Voltage

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Min.	Max.	Unit
V_{IN}	Supply Voltage	-0.2	15.0	V
V_{EN}	Enable Voltage[1]	-0.2	15.0	V
FLAG	Flag Voltage[1,2]	-0.2	15.0	V
T_J	Junction Temperature	-55	+150	°C
T_{STG}	Storage Temperature	-65	+150	°C
T_L	Lead Soldering Temperature, 10 Seconds		+300	°C
P_D	Power Dissipation		Internally Limited	W

Notes:
1. Internally connected through bond wires.
2. Flag output cannot be pulled to a voltage higher than V_{IN}.

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{CC}	Supply Voltage	2.25		14.00	V
Θ_{JA}	Thermal Resistance		3		°C/W
T_J	Junction Operating Temperature	-40		+125	°C

Electrical Characteristics

V_{IN}=V_{OUT}+1V, V_{EN}=2.5V, T_J=+25°C, unless other wise specified. The • denotes specifications that apply over the full operating temperature range.

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Units
V_{OUT}	Output Voltage Tolerance	10mA ≤ I_{OUT} ≤ 1.0A	•	-2		2	%
		5mA ≤ I_{OUT} ≤ 1.0A, V_{OUT}+1V ≤ V_{IN} ≤ 8V	•	-2.5		2.5	
R_{LINE}	Line Regulation[3,4]	I_{OUT}=10mA, V_{OUT}+1V ≤ V_{IN} ≤ 14V			.06	.50	%
R_{LOAD}	Load Regulation[3,4]	V_{IN}=V_{OUT} + 1V, 10mA ≤ I_{OUT} ≤ 1.5A			0.2	1.0	%
V_{DO}	Drop-out Voltage[5]	I_{OUT}=1.5A, ΔV_{OUT}=-1%	•		350	500	mV
I_{GND}	Ground Current	I_{OUT}=750mA	•		10	20	mA
		I_{OUT}=1.5A			20	20	
I_{LOAD}	Minimum Load Current	V_{OUT}+1V ≤ V_{IN} ≤ 8V	•		5	10	mA
I_{LIM}	Current Limit	V_{OUT}=0V, V_{IN}=V_{OUT}=1V	•		2.5		A
T_{TSD}	Thermal Shutdown Temperature				+150		°C
T_{HYS}	Thermal shutdown Hysteresis				+10		°C
I_{SDO}	Shutdown Output Current	V_{EN} ≤ 0.8V, V_{IN} ≤ 8V, V_{OUT}=0V	•			20	µA

Notes:

3. 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.
4. 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 is not available over the full input/output voltage range.
5. 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.

Typical Performance Characteristics

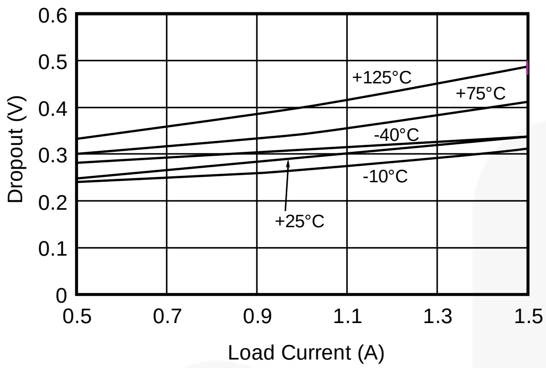
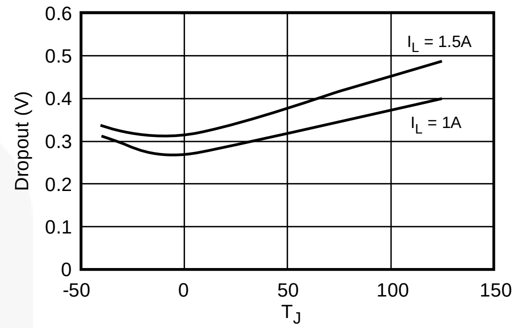
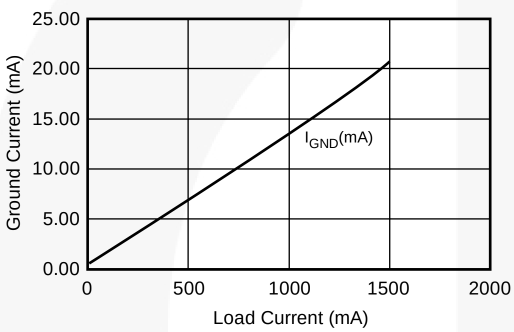


Figure 3. Dropout Voltage vs. Output Current



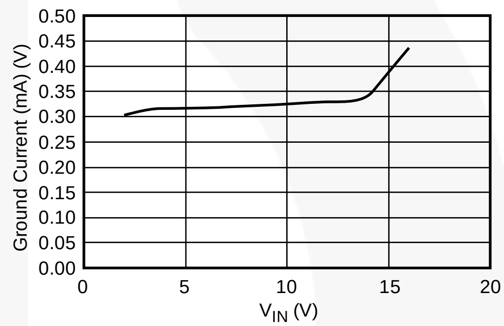
V_{OUT} = 2.5V, 1.8V, I_{OUT} = 1A, 1.5A

Figure 4. Dropout Voltage vs. Temperature



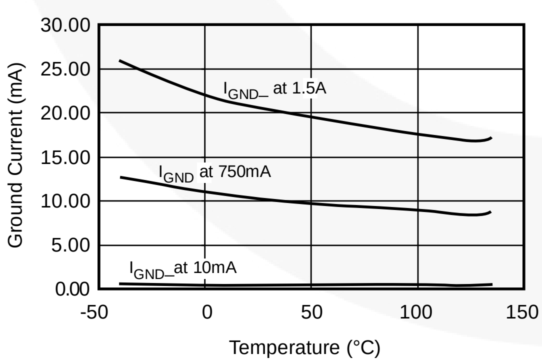
V_{IN} = V_{OUT} + 1V. 25°C

Figure 5. Ground Current vs. Load Current



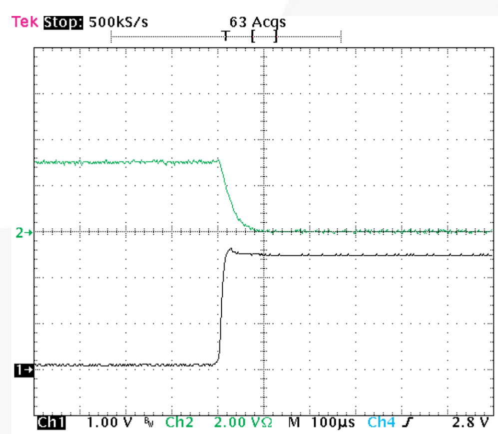
I_{OUT}= 10mA ,V_{IN} = V_{OUT} + 1V, 25°C

Figure 6. Ground Current vs. Supply Voltage



V_{IN} = 3V

Figure 7. Ground Current vs. Temperature

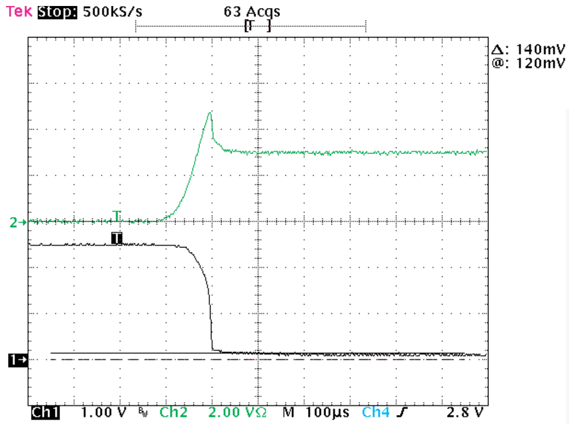


V_{IN} = 3V, V_{OUT} = 2.5V

Ch.1 – V_{OUT} (1V/div) Ch.2 – Load Current (2A/div)

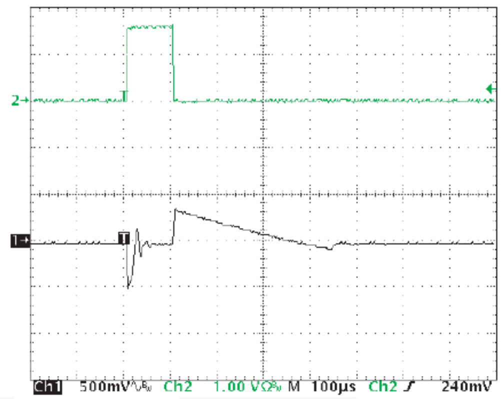
Figure 8. Short-Circuit Recovery Response

Typical Performance Characteristics (Continued)



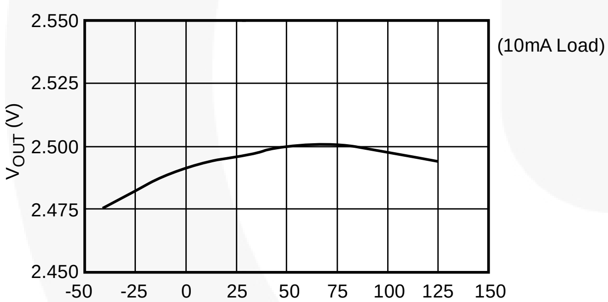
V_{IN} = 3V, V_{OUT} = 2.5V
Ch.1 – V_{OUT} (1V/div) Ch.2 – Load Current (2A/div)

Figure 9. Short-Circuit Transient Response



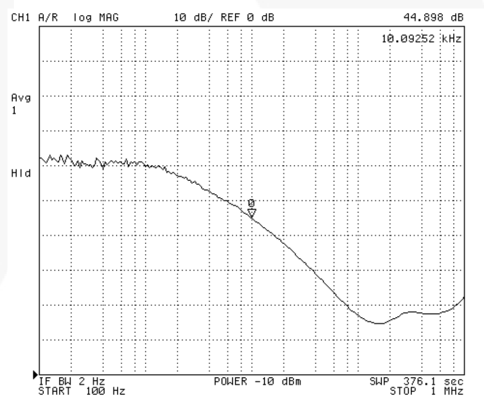
V_{IN}-2.5V, V_{OUT}=1.8V, C_{IN}=10µF Ceramic C_{OUT}=10µF Ceramic
Ch1- V_{OUT}(AC,0.5V/div) Ch2- Load Current (1A/div)

Figure 10. Load Transient Response



I_{OUT} = 10mA; V_{OUT} = 2.5V

Figure 11. V_{OUT} vs. Temperature



V_{IN} = 5V V_{OUT} = 2.5V Load = 1A
C_{IN} = C_{OUT} = 10∝F/ 6.3V Tantalum
PSRR – 10dB/div

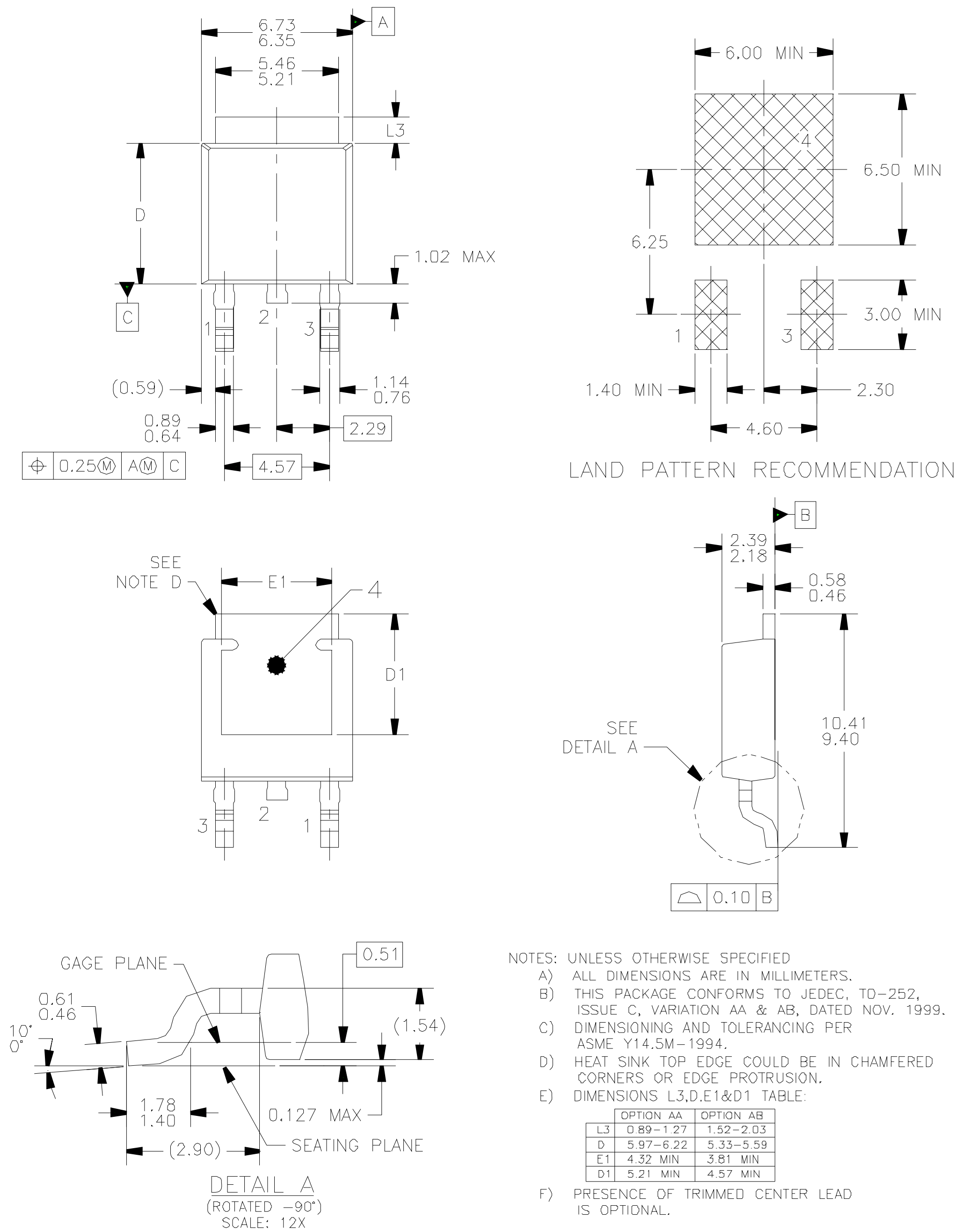
Figure 12. Ripple Rejection

Input and Output Capacitor Requirements

A 4.7µF or greater input capacitor (ceramic or tantalum), installed closely between the 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 used if the bulk capacitor of the power supply is located more than 2-4 inches from the device or a large and fast rise-time load is a requirement.

Most LDO regulators require an output capacitor with a recommended value of 10µF. The larger capacitor improves the transient response, ripple rejection, and output noise. The low-ESR tantalum capacitors are the best for this application because they provide stable work and good transient response over the temperature range. Using a ceramic capacitor as the output capacitor can provoke instability (oscillation ins the output voltage). Aluminum electrolytic capacitors also can be used if the ESR is below 3Ω.

Physical Dimensions



	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

Figure 13. 3-Lead TO-252 DPAK Package

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