FAN2518, FAN2519

50 mA CMOS LDO Regulators with Fast Start Enable

Features

- Ultra Low Power Consumption
- Enable optimized for CDMA time phases
- 50 mV dropout voltage at 50 mA
- 25 µA ground current at 50 mA
- Enable/Shutdown Control
- SOT23-5 package
- Thermal limiting
- 300 mA peak current

Applications

- Cellular Phones and accessories
- PDAs
- Portable cameras and video recorders
- Laptop, notebook and palmtop computers

Description

The FAN2518/19 family of micropower low-dropout voltage regulators utilize CMOS technology to offer a new level of cost-effective performance in GSM, TDMA, and CDMA cellular handsets, Laptop and Notebook portable computers, and other portable devices. Features include extremely low power consumption and low shutdown current, low dropout voltage, exceptional loop stability able to accommodate a wide variety of external capacitors, and the compact SOT23-5 surface-mount package. In addition, the FAN2518/19 family offer the fast power-cycle time required in CDMA handset applications. These products offer significant improvements over older BiCMOS designs and are pin-compatible with many popular devices. The output is thermally protected against overload.

The FAN2518 and FAN2519 devices are distinguished by the assignment of pin 4:

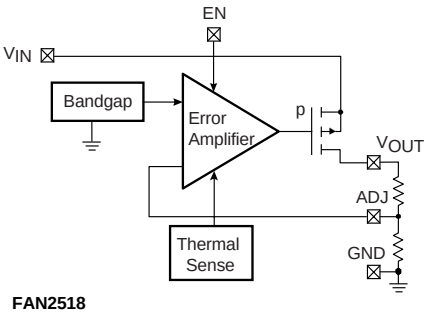
FAN2518: pin 4 – ADJ, allowing the user to adjust the output voltage over a wide range using an external voltage divider.

FAN2518-XX: pin 4 – BYP, to which a bypass capacitor may be connected for optimal noise performance. Output voltage is fixed, indicated by the suffix XX.

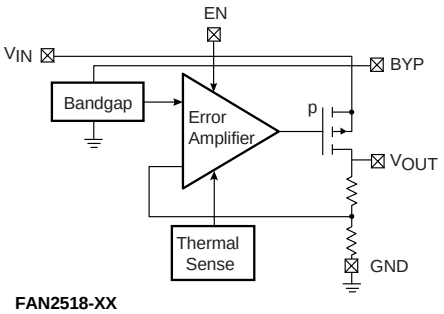
FAN2519-XX: pin 4 – $\overline{ERR}$, a flag which indicates that the output voltage has dropped below the specified minimum due to a fault condition.

The standard fixed output voltages available are 2.5V, 2.6V, 2.7V, 2.8V, 2.85V, 3.0V, and 3.3V. Custom output voltage are also available: please contact your local Fairchild Sales Office for information.

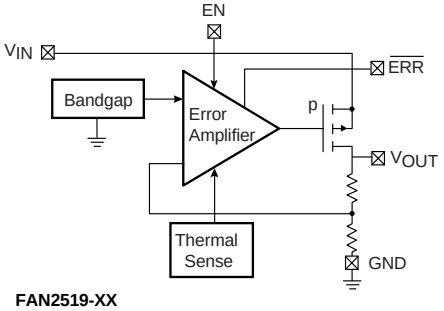
Block Diagrams



FAN2518



FAN2518-XX



FAN2519-XX

Pin Assignments

Pin No.	FAN2518	FAN2518-XX	FAN2519-XX
1.	V_{IN}	V_{IN}	V_{IN}
2.	GND	GND	GND
3.	EN	EN	EN
4.	ADJ	BYP	$\overline{ERR}$
5.	V_{OUT}	V_{OUT}	V_{OUT}

Pin Descriptions

An Enable pin, available on all devices, allows the user to shut down the regulator output to conserve power, reducing supply current to less than 1µA. The output can then be re-Enabled within 500µSec, fulfilling the fast power-cycling needs of CDMA applications. Depending on the model selected, other control and status functions are available at pin 4 to enhance the operation of the device. The adjustable-voltage versions utilize pin 4 to connect to an external voltage divider which feeds back to the regulator error amplifier, thereby setting the voltage as desired. Two other functions are available in the fixed-voltage versions: in noise-sensitive applications, an external Bypass capacitor connection is provided that allows the user to achieve optimal noise performance at the output, while the Error output functions as a diagnostic flag to indicate that the output voltage has dropped more than 5% below the nominal fixed voltage.

Applications Information

External Capacitors – Selection

The FAN2518/19 allows the user to utilize a wide variety of capacitors compared to other LDO products. An innovative design approach offers significantly reduced sensitivity to ESR (Effective Series Resistance), which degrades regulator loop stability in older designs. While the improvements featured in the FAN2518/19 family greatly simplify the design task, capacitor quality still must be considered if the designer is to achieve optimal circuit performance. In general, ceramic capacitors offer superior ESR performance, at a lower cost and a smaller case size than tantalums. Those with X7R or Y5Vdielectric offer the best temperature coefficient characteristics. The combination of tolerance and variation over temperature in some capacitor types can result in significant variations, resulting in unstable performance over rated conditions.

Input Capacitor

An input capacitor of 2.2µF (nominal value) or greater, connected between the Input pin and Ground, located in close proximity to the device, will improve transient response and noise rejection. Higher values will offer superior input ripple rejection and transient response. An input capacitor is recommended when the input source, either a battery or a regulated AC voltage, is located far from the device. Any good quality ceramic, tantalum, or metal film capacitor will give acceptable performance, however tantalum capacitors with a surge current rating appropriate to the application must be selected to avoid catastrophic failure.

Output Capacitor

An output capacitor is required to maintain regulator loop stability. Unlike many other LDO regulators, the FAN2518/19 family of products are nearly insensitive to output capacitor ESR. Stable operation will be achieved with a wide variety of capacitors with ESR values ranging from 10mΩ to 10Ω or more. Tantalum or aluminum electrolytic, or multilayer ceramic types can all be used. A nominal value of at least 1µF is recommended.

Bypass Capacitor (FAN2518 Only)

In the fixed-voltage configuration, connecting a capacitor between the bypass pin and ground can significantly reduce noise on the output. Values ranging from 470pF to 10nF can be used, depending on the sensitivity to output noise in the application.

At the high-impedance Bypass pin, care must be taken in the circuit layout to minimize noise pickup, and capacitors must be selected to minimize current loading (leakage). Noise pickup from external sources can be considerable. Leakage currents into the Bypass pin will directly affect regulator accuracy and should be kept as low as possible; thus, high-quality ceramic and film types are recommended for their low leakage characteristics. Cost-sensitive applications not concerned with noise can omit this capacitor.

Control Functions

Enable Pin

Applying a voltage of 0.4V or less at the Enable pin will disable the output, reducing the quiescent output current to less than 1µA, while a voltage of 2.0V or greater will enable the device. If this shutdown function is not needed, the pin can simply be connected to the V_{IN} pin. Allowing this pin to float will cause erratic operation.

Error Flag (FAN2519 Only)

To indicate conditions such as input voltage dropout (low V_{IN}), overheating, or overloading (excessive output current), the $\overline{ERR}$ pin indicates a fault condition. It is an open-drain output which is HIGH when the voltage at V_{OUT} is greater than 95% of the nominal rated output voltage and LOW when V_{OUT} is less than 95% or the rated output voltage, as specified in the error trip level characteristics.

A logic pullup resistor of 100KΩ is recommended at this output. The pin can be left disconnected if unused.

Thermal Protection

The FAN2518/19 is designed to supply high peak output currents of up to 1A for brief periods, however this output load will cause the device temperature to increase and exceed maximum ratings due to power dissipation. During output overload conditions, when the die temperature exceeds the shutdown limit temperature of 150°C, onboard thermal protection will disable the output until the temperature drops below this limit, at which point the output is then re-enabled. During a thermal shutdown situation the user may assert the power-down function at the Enable pin, reducing power consumption to the minimum level $I_{GND} \cdot V_{IN}$.

Thermal Characteristics

The FAN2518/19 is designed to supply 50mA at the specified output voltage with an operating die (junction) temperature of up to 125°C. Once the power dissipation and thermal resistance is known, the maximum junction temperature of the device can be calculated. While the power dissipation is calculated from known electrical parameters, the thermal resistance is a result of the thermal characteristics of the compact SOT23-5 surface-mount package and the surround-

Absolute Maximum Ratings (beyond which the device may be damaged)[1]

Parameter	Min	Typ	Max	Unit
Power Supply Voltages				
V_{IN} (Measured to GND)	0		7	V
Enable Input (EN)				
Applied voltage (Measured to GND)[2]	0		7	V
$\overline{ERR}$ Output				
Applied voltage (Measured to GND)[2]	0		7	V
Power				
Dissipation[3]		Internally limited		
Temperature				
Junction	-65		150	°C
Lead Soldering (5 seconds)			260	°C
Storage	-65		150	°C
Electrostatic Discharge[4]	4			kV

Notes:

1. Functional operation under any of these conditions is NOT implied. Performance and reliability are guaranteed only if Operating Conditions are not exceeded.
2. Applied voltage must be current limited to specified range.
3. Based upon thermally limited junction temperature:

4. Human Body Model is 4kV minimum using Mil Std. 883E, method 3015.7. Machine Model is 400V minimum using JEDEC method A115-A.

Recommended Operating Conditions

Parameter		Min	Nom	Max	Units
V_{IN}	Input Voltage Range	2.7		6.5	V

Electrical Characteristics (Notes 1, 2)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Regulator						
V_{DO}	Drop Out Voltage	I_{OUT} = 100 µA		2.5	4	mV
		I_{OUT} = 50 mA		50	75	mV
ΔV_O	Output Voltage Accuracy		**-2**		**2**	%
V_{DO}	Reference Voltage Accuracy, Adjustable Mode		1.24	1.32	1.40	V
ΔV_O[3]	Output Voltage Accuracy, Adjustable Mode		-6		6	%
I_{GND}	Ground Pin Current	I_{OUT} = 50 mA			50	µA
Protection						
	Current Limit	Thermally Protected				
I_{GSD}	Shut-Down Current	EN = 0V			1	µA
T_{SH}	Thermal Protection Shutdown Temperature		150			°C
E_{TL}	$\overline{ERR}$ Trip Level	FAN2519 only	90	95	99	%
Enable Input						
V_{IL}	Logic Low Voltage			1.2	**0.4**	V
V_{IH}	Logic High Voltage		**2.0**	1.4		V
I_{IH}	Input Current High				1	µA
I_I	Input Current Low				1	µA

Switching Characteristics (Notes 1, 2)

Parameter	Conditions	Min.	Typ.	Max.	Unit
Enable Input[4]					
Response time				500	µsec
Error Flag (FAN2519-XX)					
Response time				3	msec

Performance Characteristics (Notes 1, 2)

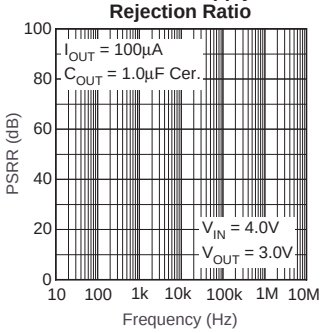
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$\Delta V_{OUT}/\Delta V_{IN}$	Line regulation	V_{IN} = (V_{OUT} + 1) to 6.5V		0.3		%/V
$\Delta V_{OUT}/V_{OUT}$	Load regulation	I_{OUT} = 0.1 to 50mA		1.0	2.0	%
e_N	Output noise	10Hz–1KHz C_{OUT} = 10µF, C_{BYP} = 0.01µF >10KHz, C_{OUT} = 10µF, C_{BYP} = 0.01µF		<7 <0.01		µV/$\sqrt{Hz}$
PSRR	Power Supply Rejection	120 Hz, C_{OUT} = 10µF, C_{BYP} = 0.01µF		43		dB

Notes:

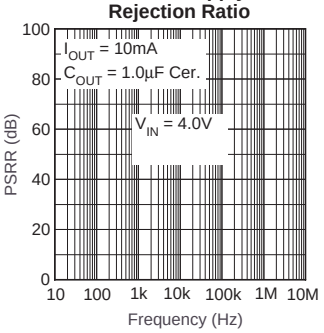
1. Unless otherwise stated, T_A = 25°C, V_{IN} = V_{OUT} + 1V, I_{OUT} = 100µA, V_{IH} > 2.0 V.
2. Bold values indicate -40 ≤ T_J ≤ 125°C.
3. The adjustable version, has a bandgap voltage range of 1.24V to 1.40V with a nominal value of 1.32V.
4. When using repeated cycling.

Typical Performance Characteristics

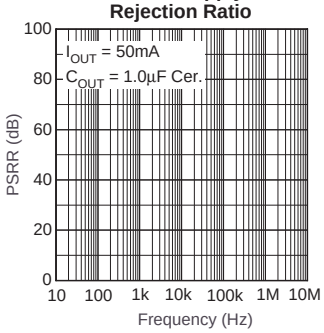
Power Supply Rejection Ratio



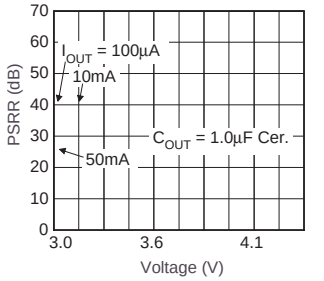
Power Supply Rejection Ratio



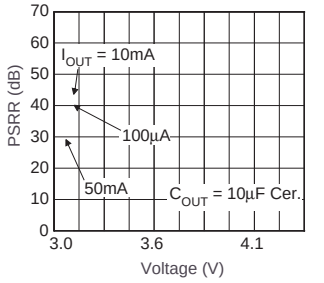
Power Supply Rejection Ratio



Power Supply Rejection Ratio vs. Voltage Drop

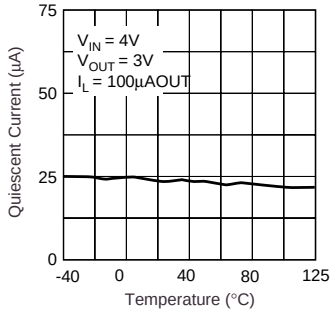


Power Supply Rejection Ratio vs. Voltage Drop

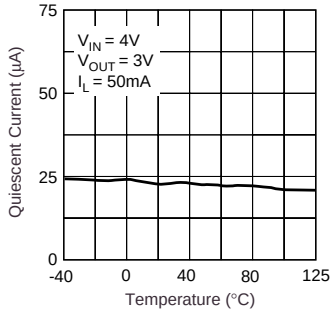


Typical Performance Characteristics (continued)

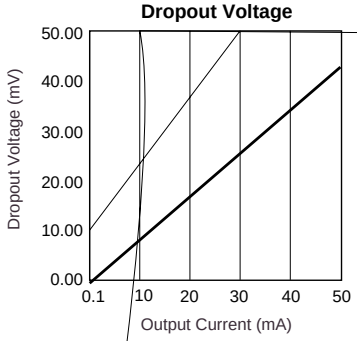
Ground Pin Current



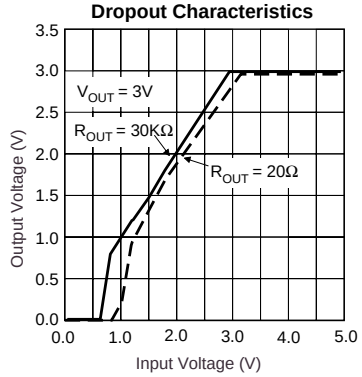
Ground Pin Current



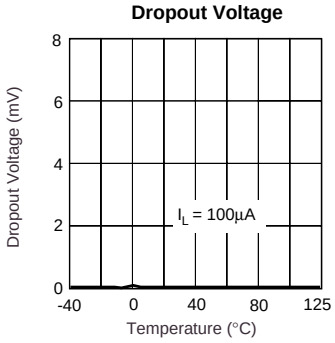
Dropout Voltage



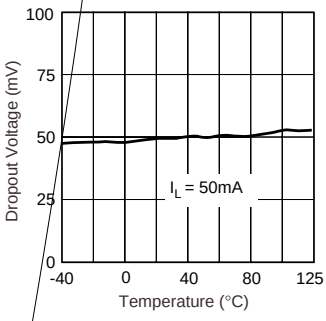
Dropout Characteristics



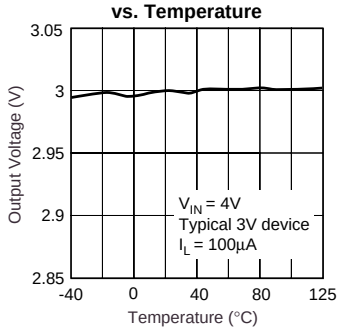
Dropout Voltage



Dropout Voltage



Output Voltage vs. Temperature



Functional Characteristics

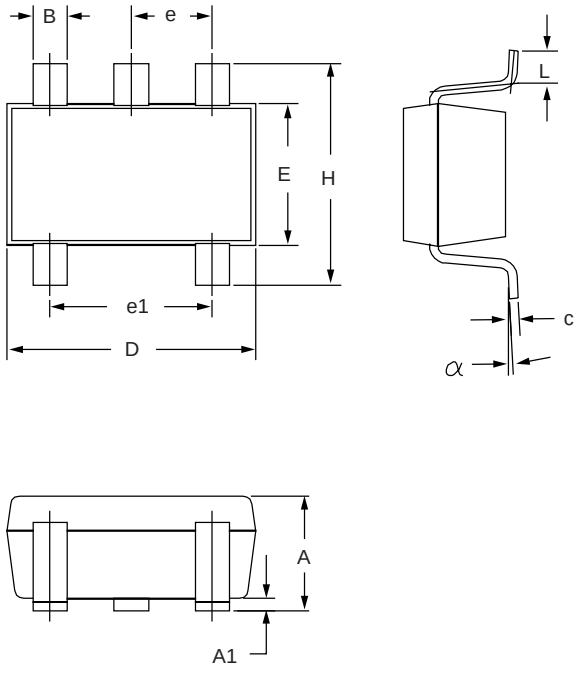
Mechanical Dimensions

5-Lead SOT-23-5 (S) Package

Symbol	Inches		Millimeters		Notes
	Min.	Max.	Min.	Max.	
A	.035	.057	.90	1.45	
A1	.000	.006	.00	.15	
B	.008	.020	.20	.50	
c	.003	.010	.08	.25	
D	.106	.122	2.70	3.10	
E	.059	.071	1.50	1.80	
e	.037 BSC		.95 BSC		
e1	.075 BSC		1.90 BSC		
H	.087	.126	2.20	3.20	
L	.004	.024	.10	.60	
α	0°	10°	0°	10°	

Notes:

1. Package outline exclusive of mold flash & metal burr.
2. Package outline exclusive of solder plating.
3. EIAJ Ref Number SC-74A.



Ordering Information

Product Number	V_{OUT}	Pin 4 Function	Package Marking
FAN2518SX	Adj.	Adjust	ALA
FAN2518S25X	2.5	Bypass	ALE
FAN2518S26X	2.6	Bypass	ALG
FAN2518S27X	2.7	Bypass	ALJ
FAN2518S28X	2.8	Bypass	ALM
FAN2518S285X	2.85	Bypass	ALN
FAN2518S30X	3.0	Bypass	ALW
FAN2518S33X	3.3	Bypass	AL3
FAN2519S25X	2.5	Error output	AME
FAN2519S26X	2.6	Error output	AMG
FAN2519S27X	2.7	Error output	AMJ
FAN2519S28X	2.8	Error output	AMM
FAN2519S285X	2.85	Error output	AMN
FAN2519S30X	3.0	Error output	AMW
FAN2519S33X	3.3	Error output	AM3

Tape and Reel Information

Quantity	Reel Size	Width
3000	7"	8mm