Datasheet

FS8844

250 mA Low Quiescent Current LDO Linear Regulator

Fortune SEMICONDUCTOR CORPORATION

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1. General Description

The FS8844 series is a positive voltage regulator with high accuracy output voltage and ultra-low quiescent current which is typically 2.0μA. The device is ideal for handheld communication equipments and battery powered applications which require low quiescent current.

The FS8844 contains a bandgap reference voltage source, an error amplifier, a P-channel pass transistor, a resistor-divider for setting output voltage, a current limiter, and temperature limit protection circuits. The high-accuracy output voltage is preset at an internally trimmed voltage 1.8V, 2.8V or 3.3V. Other output voltages can be mask-optioned from 1.2V to 5.0V with 100mV increment.

The FS8844 has been designed to be used with low cost ceramic capacitors and requires a minimum output capacitor of 1.0μF. The devices are available in SOT-23 packages.

2. Applications

- DSC
- PDA
- MP3 player
- Digital Video Recorder
- Battery Powered Instrument
- Portable Commu

3. Features

- 2.0μA Quiescent Current (Typ.)
- High accuracy of output voltage
- ±2.0% : VOUT≧2.1 V
- ±2.4% : VOUT≦2.0 V
- Low Dropout: 550 mV @ IOUT=250mA (MIN.)
- 250 mA Output
- Thermal Overload Shutdown Protection
- Output Short Circuit Protection
- Stable Operation with Virtually Any Output Capacitor Type
- SOT-23 Packages

4. Ordering Information

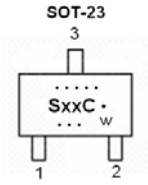
FS8844-xx x x

- Output Voltage
  - 18 : 1.8V
  - 28 : 2.8V
  - 30 : 3.0V :
  - 33 : 3.3V
- G : G stands for Green-Package
- Package / Pin Out
  - C : SOT-23 — 1.GND 2.OUT 3.IN

Note : Mask option output types are available by order only.

5. Pin Configurations

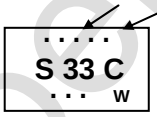
Part No.	Pin 1	Pin 2	Pin 3
FS8844-xxGC	GND	OUT	IN



6. Package Marking Information

SOT-23

EX：FS8844-33GC

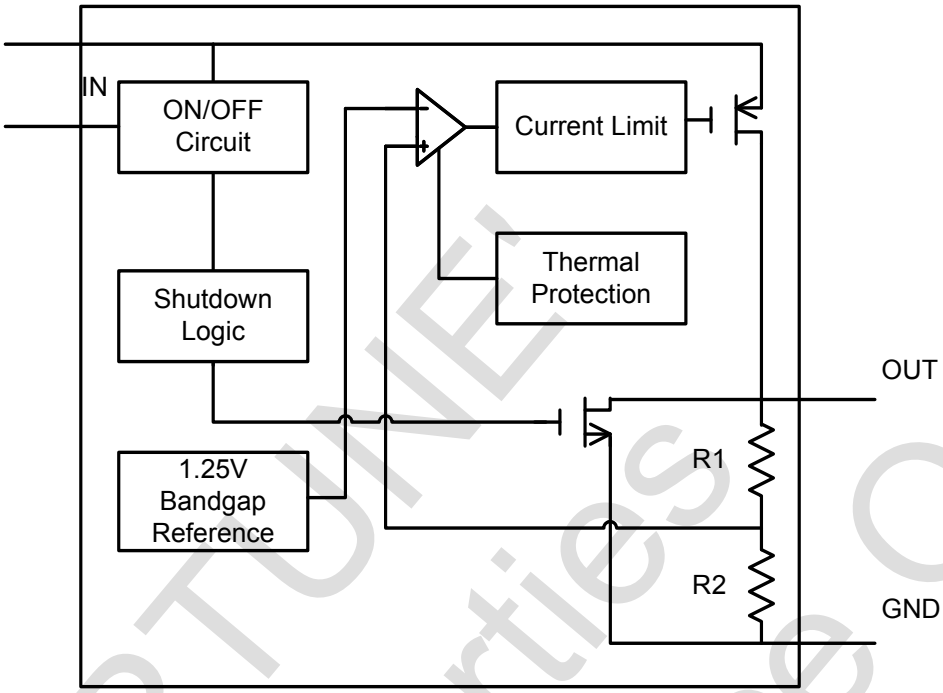


Top Point: Lot No.
Bottom Point: Year
w : week, A~Z & A ~ Z

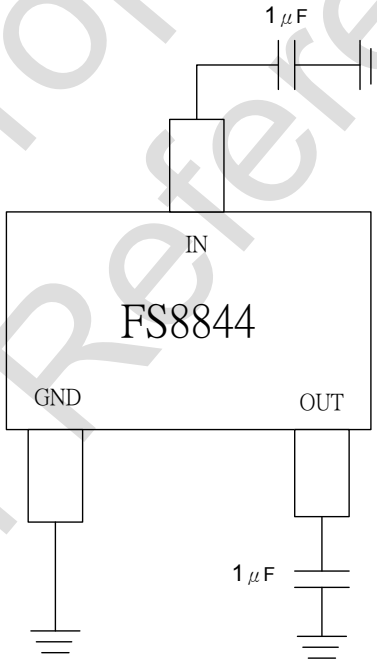
7. Pin Description

Part NO.	Symbol	Description
FS8844-xxxx	GND	Ground pin that provides the reference for all voltages.
	IN	Regulator input pin that supplies voltage can range from 2.5V to 6.0V. Bypass this pin with a 1μF capacitor to GND.
	OUT	Regulator output pin that can source up to 250mA. Bypass this pin with a 1μF capacitor to GND.

8. Functional Block Diagram



9. Typical Application Circuit



10. Absolute Maximum Ratings

Input voltage V_{IN} to GND ---------- 7V
EN to GND Voltage ---------- 7V
EN to Input Voltage ---------- +0.3V
Output current ---------- 350mA
Continuous power dissipation, P_D
SOT-23 ---------- 300mW
Junction Temperature, T_J ---------- +155°C
Storage temperature range, T_{STG} ---------- -55°C to +150°C
Operating junction temperature range ---------- -40°C to +125°C
Lead temperature (soldering, 10sec) ---------- 260°C

Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and function operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

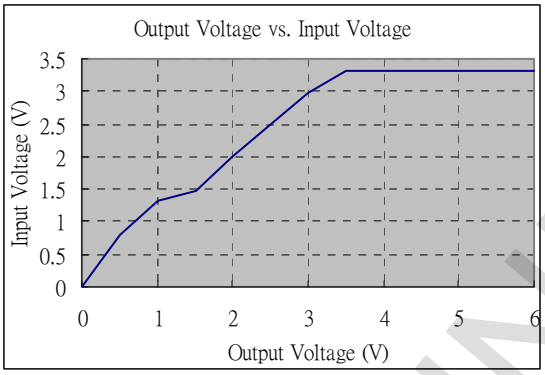
11. Electrical Characteristics

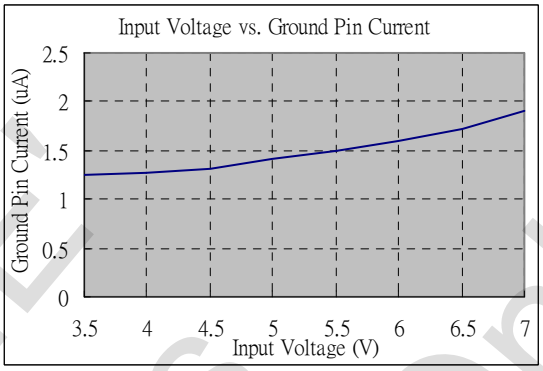
(T_A=25℃, unless otherwise noted.)

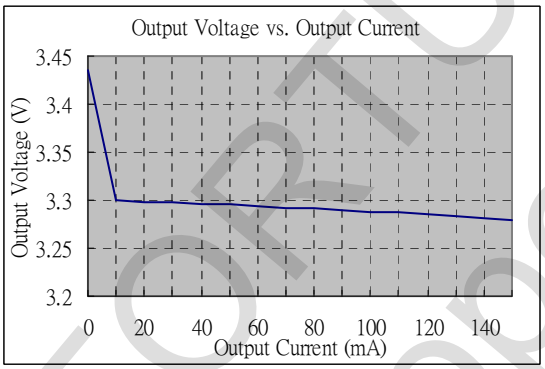
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
VIN	Input Voltage		1.8		6.0	V
ΔVOUT	Output Voltage Accuracy	VIN>VOUT+1.0V, VOUT≦2.0V	-2.4		+2.4	%
		VIN>VOUT+1.0V, VOUT≧2.1V	-2.0		+2.0	%
IMAX	Output Current	VIN>VOUT+1.0V	250	300		mA
ISC	Short-Circuit Current	VOUT=0V, VIN>VOUT+0.48V		200	300	mA
IQ	Quiescent Current	ILOAD=0mA, VIN=VOUT+1.0V		2.0	4.5	μA
VDROP	Dropout Voltage	VIN=VOUT=3.3V, IOUT=100mA		280	350	mV
		VIN=VOUT=3.3V, IOUT=250mA		700	850	mV
ΔVLINE	Line Regulation	VIN = 4.0 ~ 5.5 V, ILOAD=1mA			0.10	%/V
ΔVLOAD	Load Regulation	IOUT=1mA to 100mA			0.01	%/mA
VIH	EN Pin Input Voltage “H”	VIH ≦ VIN	0.9	1.0	1.5	V
VIL	EN Pin Input Voltage “L”				0.8	V
IEN	EN Pin Leakage Current			0.01	0.1	μA
eN	Output Noise	F=1Hz to 10KHz, COUT=1μF		150		μVRMS
PSRR	Ripple Rejection	F=100Hz, COUT=1μF		50		dB
TSD	Thermal Shutdown Temperature			155		°C
THYS	Thermal Shutdown Hysteresis			10		°C
TC	Output Voltage Temperature Coefficent	IOUT=1mA, -40°C ≤ TA ≤ 80°C		100		ppm/°C

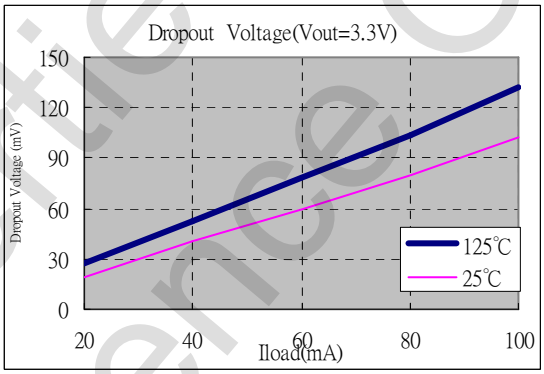
12. Typical Operating Characteristics

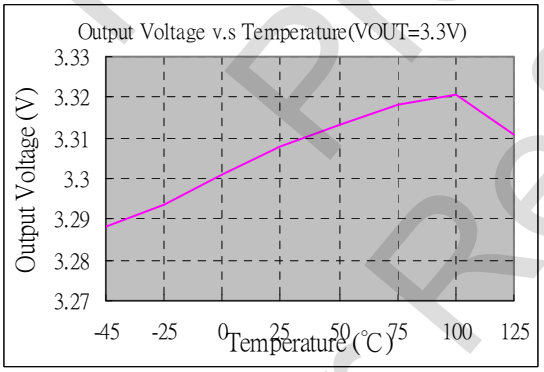
(FS8844-33GC tested, CIN=1.0μF, COUT=1.0μF, TA=+25℃, unless otherwise noted.)

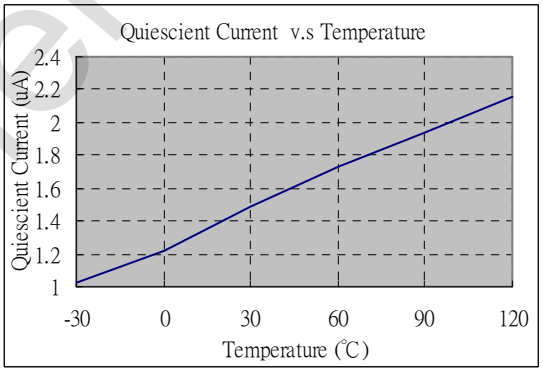




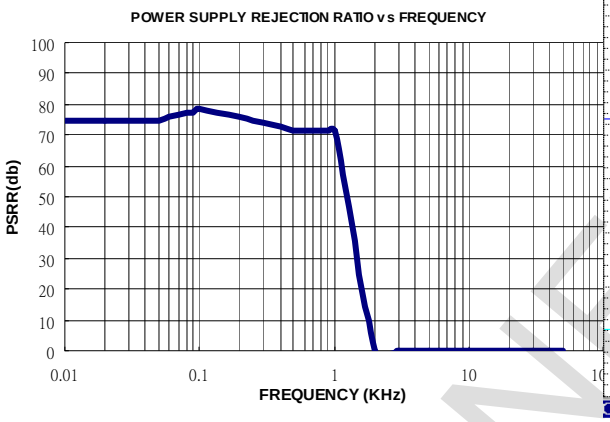




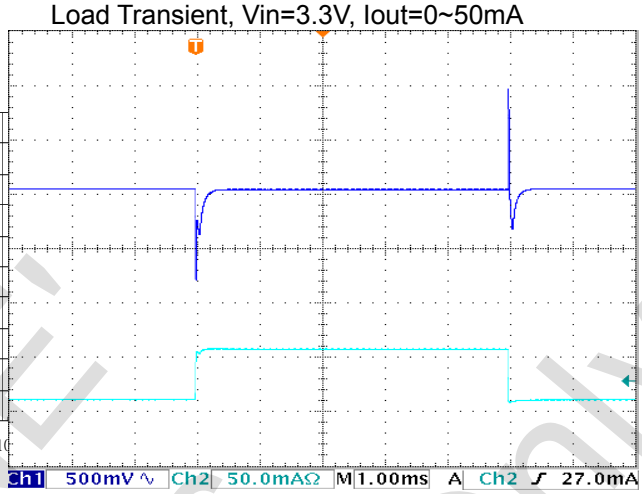




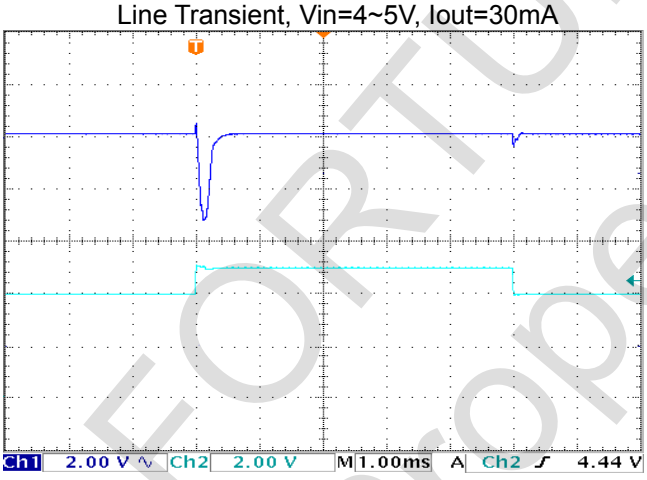
PSRR
(Vin=5V,Vout=3.3V,Load=50mA)



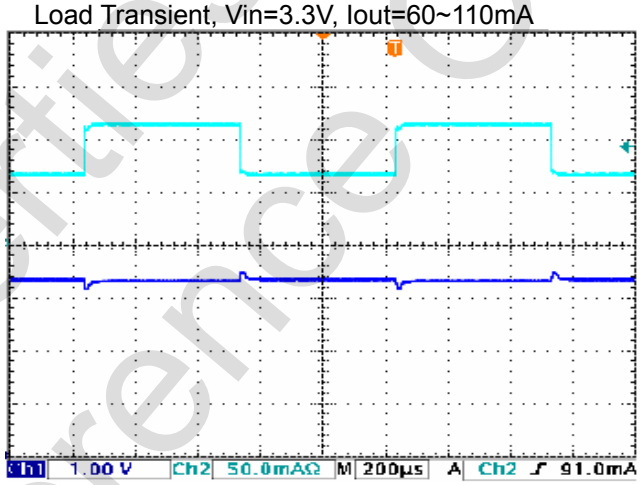
Load Transient, Vin=3.3V, Iout=0~50mA



Line Transient, Vin=4~5V, Iout=30mA



Load Transient, Vin=3.3V, Iout=60~110mA



13. Detail Description

The FS8844 is a low quiescent current LDO linear regulator. The device provides preset 1.8V, 2.8V and 3.3V output voltages for output current up to 150mA. Other mask options for special output voltages from 1.2V to 5.0V with 100mV increment are also available. As illustrated in function block diagram, it consists of a 1.23V reference, error amplifier, a P-channel pass transistor, an ON/OFF control logic, and an internal feedback voltage divider.

The 1.23V bandgap reference is connected to the error amplifier, which compares this reference with the feedback voltage and amplifies the voltage difference. If the feedback voltage is lower than the reference voltage, the pass-transistor gate is pulled lower, which allows more current to pass to the output pin and increases the output voltage. If the feedback voltage is too high, the pass-transistor gate is pulled up to decrease the output voltage.

The output voltage is feed back through an internal resistive divider connected to OUT pin. Additional blocks include an output current limiter and shutdown logic.

Internal P-channel Pass Transistor

The FS8844 features a P-channel MOSFET pass transistor. Unlike similar designs using PNP pass transistors, P-channel MOSFETs require no base drive, which reduces quiescent current. PNP-based regulators also waste considerable current in dropout conditions when the pass transistor saturates, and use high base-drive currents under large loads. The FS8844 does not suffer from these problems and consumes only 2.0μA (Typ.) of current consumption under light loads.

Output Voltage Selection

The FS8844 output voltage is preset at an internally trimmed voltage 1.8V, 2.8V or 3.3V. The output voltage also can be mask-optioned from 1.2V to 5.0V with 100mV increment by special order. The first two digits of part number suffix identify the output voltage (see ***Ordering Information***). For example, the FS8844-33GC has a preset 3.3V output voltage.

Current Limit

The FS8844 also includes a fold back current limiter. It monitors and controls the pass transistor's gate voltage, estimates the output current, and limits the output current within 350mA.

Thermal Overload Protection

Thermal overload protection limits total power dissipation in the FS8844. When the junction temperature exceeds T_J = +155°C, a thermal sensor turns off the pass transistor, allowing the IC to cool down. The thermal sensor turns the pass transistor on again after the junction temperature cools down by 10°C, resulting in a pulsed output during continuous thermal overload conditions.

Thermal overload protection is designed to protect the FS8844 in the event of fault conditions. For continuous operation, the maximum operating junction temperature rating of T_J = +125°C should not be exceeded.

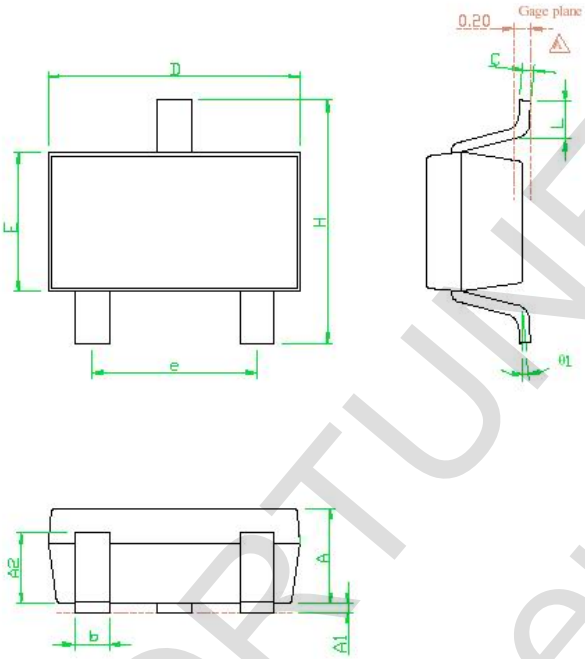
Input-Output Voltage

A regulator's minimum input-output voltage differential, or dropout voltage, determines the lowest usable supply voltage. In battery-powered systems, this will determine the useful end-of-life battery voltage. The FS8844 uses a P-channel MOSFET pass transistor, its dropout voltage is a function of drain-to-source on-resistance ($R_{DS(ON)}$) multiplied by the load current.

$$V_{DROPOUT} = V_{IN} - V_{OUT} = R_{DS(ON)} \times I_{OUT}$$

14. Package Outline

SOT-23



NOTE
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS
2. TOLERANCE ±0.1000 mm (4 mil) UNLESS OTHERWISE SPECIFIED
3. COPLANARITY : 0.1000 mm
4. DIMENSION L IS MEASURED IN GAGE PLANE

SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.00	1.10	1.30
A1	0.00	——	0.10
A2	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E	1.40	1.60	1.80
e	——	1.90(TYP)	——
H	2.60	2.80	3.00
L	0.37	——	——
θ1	1°	5°	9°

15. Revision History

Ver.	Date	Page	Description
1.0	2005/12/22	4 ~ 6	Typical Operating Characteristics
1.1	2006/02/10	2~9	Pin Configurations, Rev. no from page 2 to 9
1.2	2006/03/10	1,4	Electrical Characteristics
1.3	2006/05/11	1,7	Add 1.2V, 1.28V option
1.4	2006/09/27	All	Revise datasheet format
1.5	2009/12/30	3	Update package type G stands for Green-Package Update Output Voltage 18：1.8V、29：2.9V、30：3.0V、33：3.3V
1.6	2010/03/04	6	Revise Dropout Iout=100mA Typ：280mV Max：350mV Revise Dropout Iout=250mA Typ：700mV Max：850mV
1.7	2011/01/31	3	Add Output 3.0V option
1.8	2014/05/22	2	Revised company address