150mA High Voltage Low Dropout Linear Regulator

Description

The FC6160 is a high voltage, low dropout, positive linear regulator with very low quiescent current. The precision of feedback reference voltage is within ±1% and output current is up to 150mA.

The FC6160 is designed and optimized to work with low-value, low cost ceramic capacitors. The FC6160 consumes less than 1uA during shutdown mode, allowing for flexibility in power management. Besides its current limit protection and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

The FC6160 is housed in low-profile, space-saving SOT-23-5 package.

Features

- Operating Voltage from 5V to 18V
- High Power Supply Ripple Rejection at 65dB
- Guaranteed 150mA Output Current
- Very Low Quiescent Current at 70μA
- 1% Initial Accuracy
- Needs Only 1μF Capacitor for Stability
- Thermal Shutdown Protection
- Current Limit Protection
- Active Low Shutdown Control
- Low-ESR Ceramic Capacitor for Output Stability
- RoHS Compliant

Applications

- DSC
- Wireless Devices
- LCD Modules
- Battery Power Systems
- Card Readers
- PDA

Pin Assignments

S5 Package (SOT-23-5)

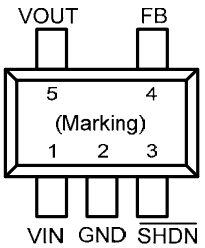


Figure 1. Pin Assignment of FC6160

Ordering Information

FC6160□□□

- TR: Tape/Reel
- G: Green
- Package Type S5: SOT-23-5

SOT-23-5 Marking

Part Number	Product Code
FC6160S5G	**P6=**

Typical Application Circuit

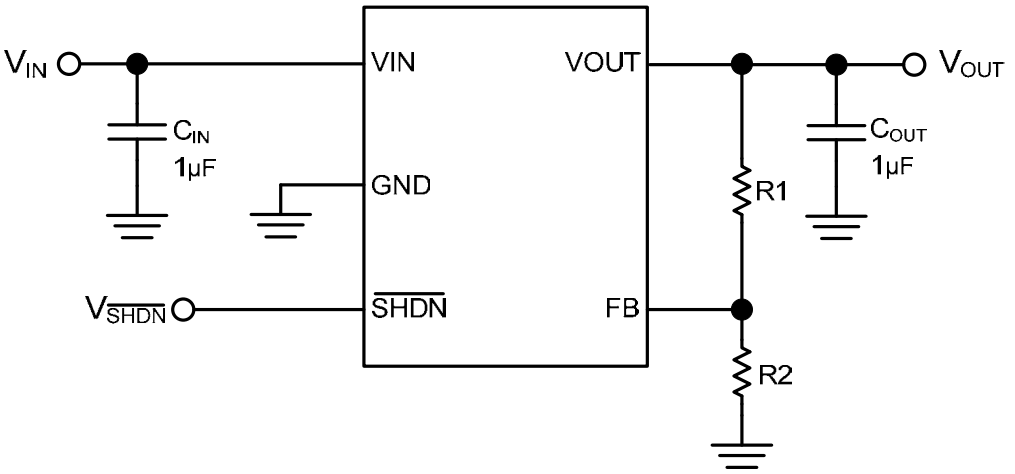


Figure 2. Typical Application Circuit of FC6160

Functional Pin Description

Pin Name	Pin Function
VIN	Power is supplied to this device from this pin which is required an input filter capacitor. In general, the input capacitor in the range of 1µF to 10µF is sufficient.
VOUT	The output supplies power to loads. The output capacitor is required to prevent output voltage from oscillation. The large output capacitor could reduce output noise, improve stability, and PSRR.
GND	Common ground pin
FB	Output voltage feedback
$\overline{\text{SHDN}}$	Pull this pin high to enable FC6160 , pull this pin low to shutdown the device

Block Diagram

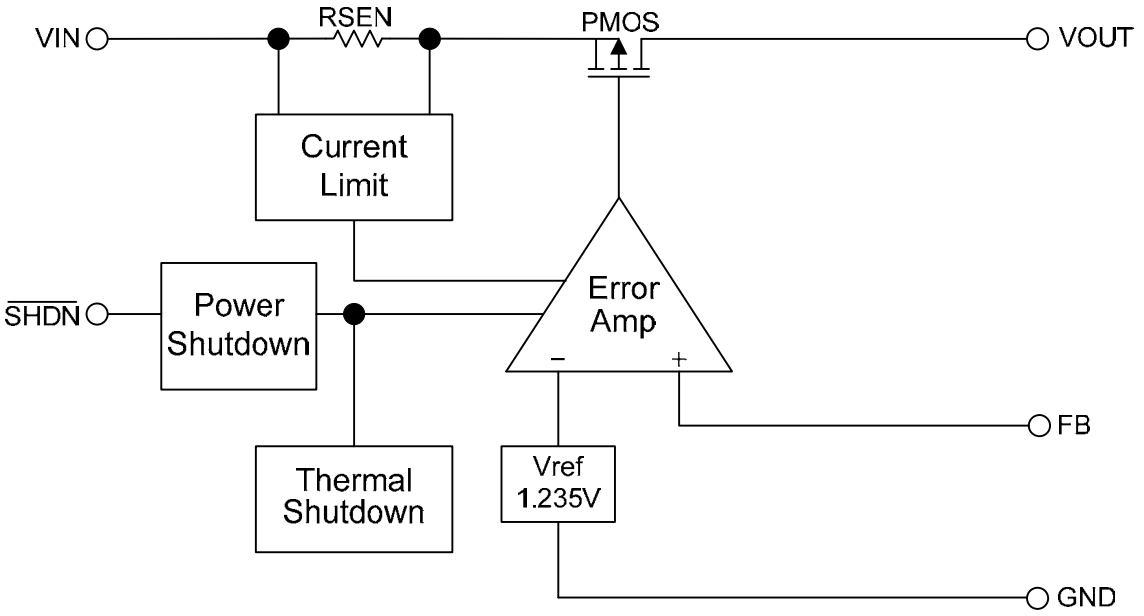


Figure 3. Block Diagram of FC6160

Absolute Maximum Ratings

- VIN, VOUT, /SHDN---------- +20V
- FB---------- +6V
- Power Dissipation @25℃, SOT-23-5 (P_D)---------- +0.4W
- Package Thermal Resistance :

  SOT-23-5 (θ_{JA})---------- +250℃/W

  SOT-23-5 (θ_{JC})---------- +148℃/W
- Maximum Junction Temperature (T_J)---------- +150℃
- Storage Temperature Range (T_{STG})---------- -65℃ to +150℃
- Lead Temperature (Soldering, 10 sec.) (T_{LEAD})---------- +260℃

Note1：Stresses beyond those listed under “Absolute Maximum Ratings" may cause permanent damage to the device.

Recommended Operating Conditions

- Input Voltage (V_{IN})---------- +5V to +18V
- Operating Temperature Range (T_{OPR})---------- -40℃ to +85℃

Electrical Characteristics

(V_{IN}=15V, $\overline{SHDN}$ pin connected to V_{IN}, C_{IN}=1μF, C_{OUT}=1μF, T_A=25 ºC, unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage Tolerance (V_{OUT})	ΔV_{OUT}		-1		1	%
Current Limit	I_{LIMIT}	R_{Load}=1Ω		360	500	mA
Quiescent Current	I_Q	I_O= 0mA		55	90	μA
Standby Current	I_{STBY}	/SHDN=GND			1	μA
Feedback Reference	V_{FB}		1.222	1.235	1.247	V
Dropout Voltage (Note2)	V_{DROP}	I_O=150mA		500	850	mV
Line Regulation	ΔV_{LINE}	I_O=1mA, V_{IN}=V_{OUT} +1V to 16V		0.03	0.2	%
Load Regulation (Note3)	ΔV_{LOAD}	I_O=1mA to 150mA		0.1	0.5	%
Output Noise (Note4)	V_{NOISE}	C_{OUT} = 1μF, C_{IN} = 1μF 10Hz~100kHz		300		μV_{RMS}
Ripple Rejection (Note4)	PSRR	V_{IN}=V_{OUT}+1V, f_{RIPPLE} = 120Hz, C_{OUT} = 1μF		65		dB
Temperature Coefficient (Note4)	TC	I_{OUT} = 1mA, V_{IN} = 15V		50		ppm/ºC
Thermal Shutdown Threshold (Note4)	T_{SD}			150		ºC
	ΔT_{SD}	Hysteresis		10		ºC
$\overline{SHDN}$ Pin Threshold	$V_{\overline{SHDN}(ON)}$	ON	3.0			V
	$V_{\overline{SHDN}(OFF)}$	OFF			0.4	V
$\overline{SHDN}$ Pin Current	$I_{\overline{SHDN}}$				0.1	μA

Note2：The dropout voltage is defined as V_{IN}-V_{OUT}, which is measured when V_{OUT} drops 2% of its normal value with the specified output current.

Note3：Load regulation and dropout voltage are measured at a constant junction temperature by using a 40ms low duty cycle current pulse.

Note4：The specification is guaranteed by design, not production tested.

Typical Performance Curves

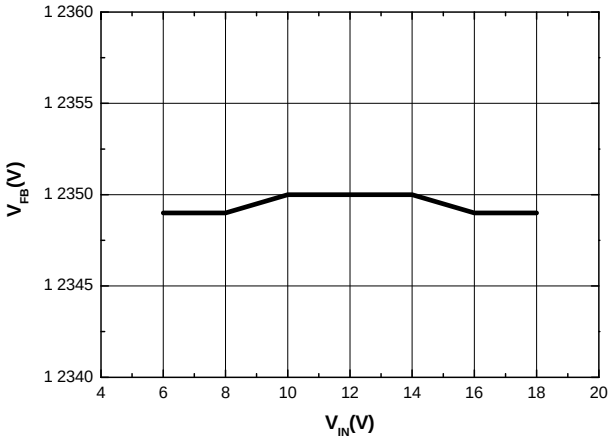


Figure 4. Line Regulation (I_{OUT}=0mA)

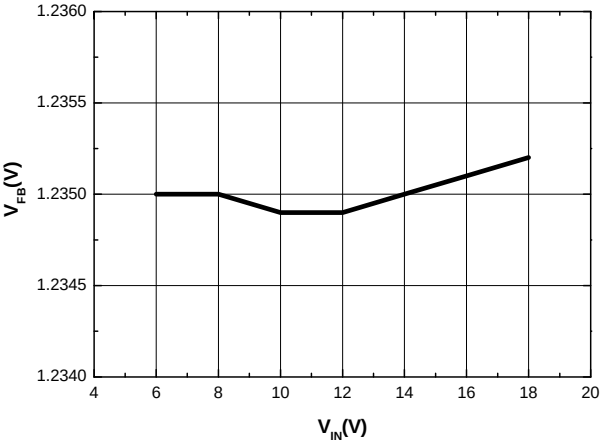


Figure 5. Line Regulation (I_{OUT}=1mA)

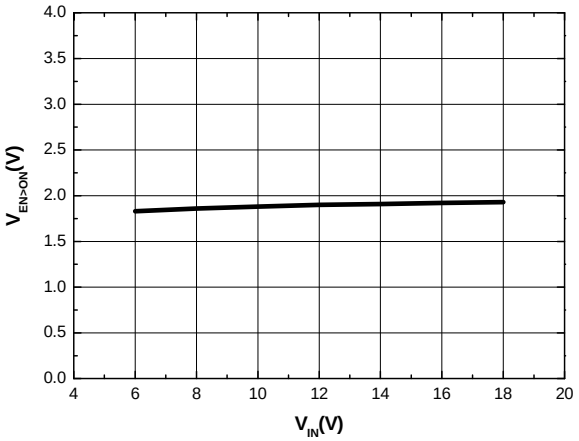


Figure 6. Input Voltage vs. Enable ON

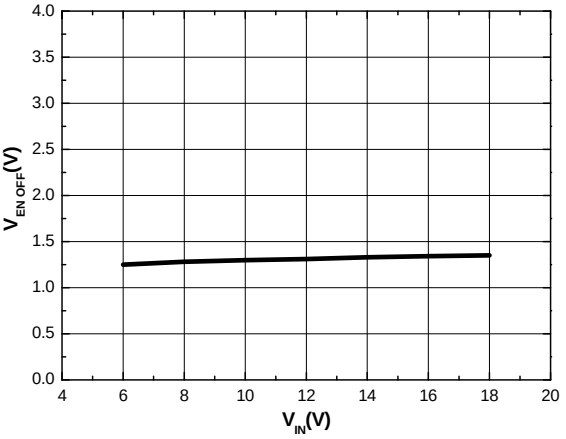


Figure 7. Input Voltage vs. Enable OFF

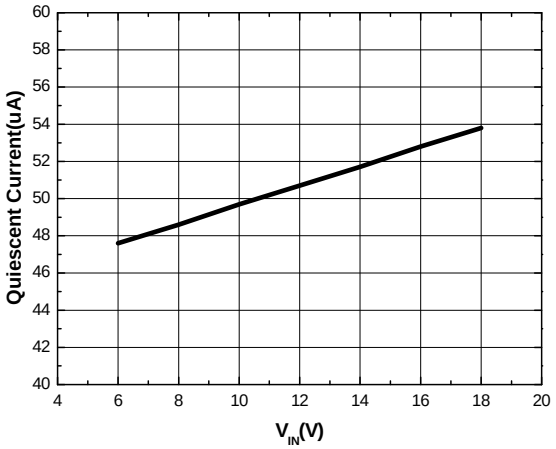


Figure 8. Input Voltage vs. Quiescent Current

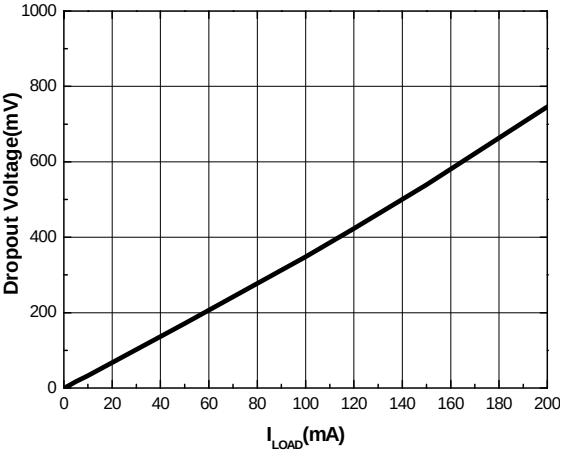


Figure 9. Output Current vs. Dropout Voltage (V_N=12V)

Typical Performance Curves (Continued)

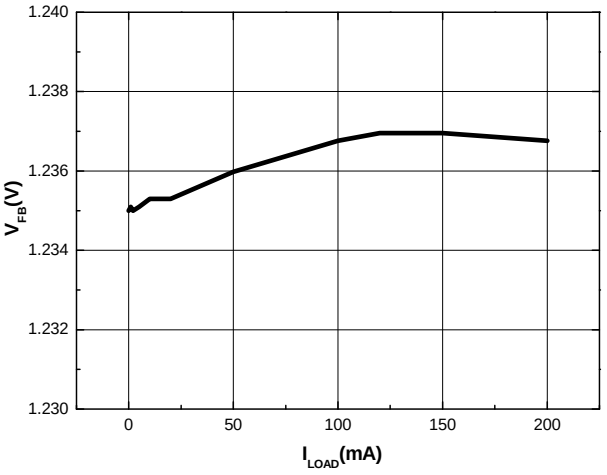


Figure 10. Load Regulation

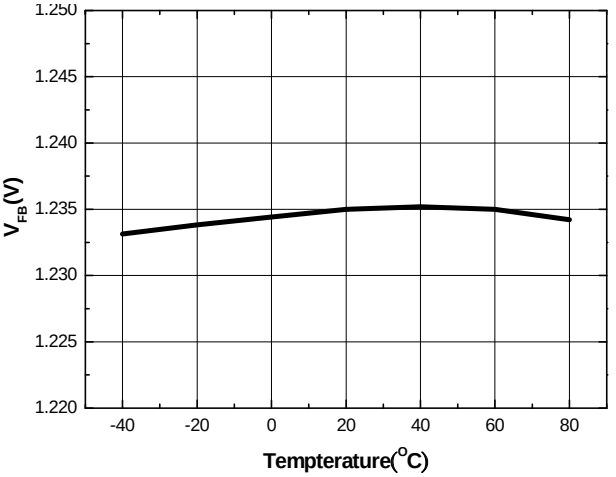


Figure 11. Temperature vs. Feedback voltage

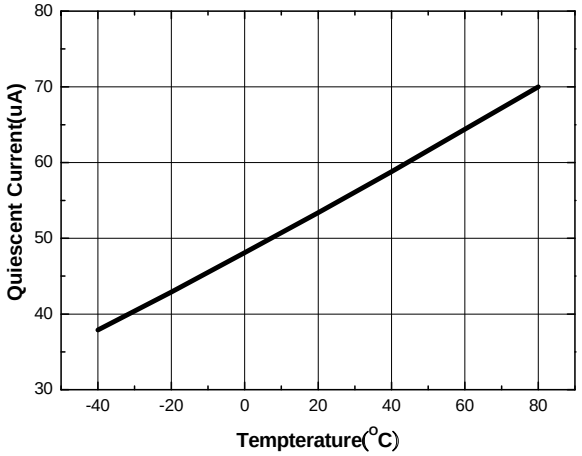


Figure 12. Temperature vs. Quiescent Current

Application Information

The FC6160 is a high voltage, low dropout linear regulator that could provide 150mA output current at 800mV dropout voltage. Besides, current limit and on chip thermal shutdown features provide protection against any combination of overload or ambient temperature that could exceed junction temperature.

Shutdown Control

Force /SHDN pin high to enable the FC6160 and turned off the device by pulling it low. The /SHDN pin can't be floated and must be tied to the V_{IN} if not used.

Output Voltage Setting

The output voltage of regulator is determined by connecting external resistor dividers. The external resistor divider connects with FB pin. The output voltage is determined by the following equation:

$$V_{OUT} = \frac{R_1 + R_2}{R_2} \times V_{FB} = \left\{1 + \frac{R_1}{R_2}\right\} \times 1.235$$

PSRR (Power Supply Rejection Ratio)

The FC6160 has high 65dB PSRR. Ripple rejection is the ability of the regulator to reduce input voltage ripple. It is specified with a 120Hz and $1V_{P-P}$ signal applying to input, with 1uF output capacitor. Ripple rejection, expressed in dB, is the ratio of output ripple to input ripple.

Output and Input Capacitor

The FC6160 is designed to be stable with low ESR ceramic capacitors. Higher values of capacitors and ESR could improve output stability. So the ESR of output capacitor is very important because it generates a zero to provide phase lead for loop stability. It is recommended to use 1uF to 10uF X5R or X7R dielectric ceramic capacitors with 30mΩ to 50mΩ ESR range between VOUT and GND for transient stability.

Larger value of the output capacitor decreases the peak deviations and provides to improve transition response for larger current changes.

The ESR is not essential for input capacitor, but its voltage and temperature coefficient have to be considered for device application environment.

Over Temperature Protection

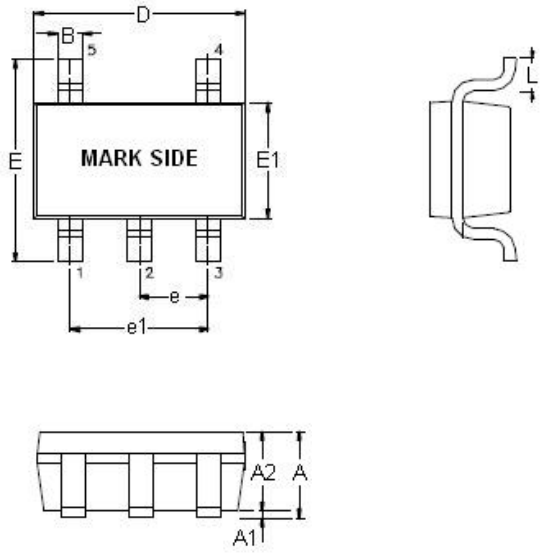
Over temperature protection function is integrated in the chip. The thermal protection function prevents the excessive power dissipation form overheating. When the chip temperature is higher than 150°C, the controller is shutdown. When the junction temperature cools down to a constant value, the thermal protection is released and the chip operates normal again.

Thermal Consideration

The power handling capability of the device will be limited by allowable operation junction temperature (125°C). The power dissipated by the device will be estimated by $P_D = I_{OUT} \times (V_{IN}-V_{OUT})$. The power dissipation should be lower than the maximum power dissipation listed in "Absolute Maximum Ratings" section.

Outline Information

SOT-23-5 Package (Unit: mm)



SYMBOLS UNIT	DIMENSION IN MILLIMETER	
	MIN	MAX
A	1.00	1.20
A1	0.00	0.10
A2	1.00	1.10
B	0.35	0.50
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.90	1.00
e1	1.80	2.00
L	0.35	0.55

Note：Followed From JEDEC MO-178-C.