

## LM3620 Lithium-Ion Battery Charger Controller

Check for Samples: [LM3620](#)

### FEATURES

- **Voltage Options for Charging 1 or 2 Cell Stacks**
- **Adjustable Output Voltage for Coke or Graphite Anodes**
- **Precision End-of-Charge Voltage Control**
- **Wide Input Voltage Range (4V to 30V)**
- **Low Off State Current (<10nA)**
- **Drive Provided for External Power Stage**
- **Tiny SOT-23 Package**

### DESCRIPTION

The LM3620 series of controllers are monolithic integrated circuits designed to control the charging and end-of-charge control for lithium-ion rechargeable batteries. The LM3620 is available in two versions for one or two cell charger applications. Each version provides the option of selecting the appropriate termination voltage for either coke or graphite anode lithium cells.

The LM3620 can operate from a wide range of DC input sources (4V to 30V). With no charger supply connected, the controller draws a quiescent current of only 10nA to minimize discharging of a connected battery pack.

The LM3620 consists of an operational transconductance amplifier, a bandgap voltage reference, a NPN driver transistor and precision voltage setting resistors. The output of the amplifier is made available to drive an external power transistor if higher drive currents are required.

With a trimmed output voltage regulation of  $\pm 1.2\%$  initial accuracy, the LM3620 provides a simple, precise solution for end-of-charge control of lithium-ion rechargeable cells.

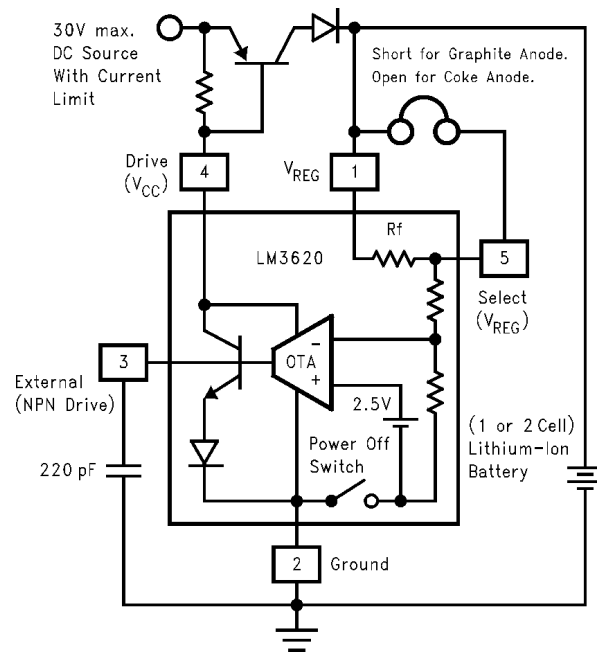
The LM3620 is packaged in a miniature 5-lead SOT-23 surface mount package for very compact designs.



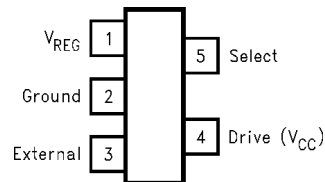
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## Typical Application



## Connection Diagram



The small physical size of the SOT23-5 Package does not allow for the full part number marking. Devices will be marked with the designation shown in the column Package Marking.

**Figure 1. 5-Lead SOT23-5 Surface Mount Package  
See Package MF05A**



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

**ABSOLUTE MAXIMUM RATINGS<sup>(1)(2)</sup>**

Input Voltage ( $V_{DRIVE}$ )		35V
$V_{EXT}$		1.5V
Junction Temperature		150°C
Storage Temperature		-65 to +150°C
Lead Temp. Soldering	Vapor Phase (60 sec.)	215°C
	Infrared (15 sec.)	220°C
Power Dissipation ( $T_A = 25^\circ\text{C}$ ) <sup>(3)</sup>		300mW
ESD Susceptibility <sup>(4)</sup>		2000V

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics.
- (2) If Military/Aerospace specified devices are required, please contact the TI Sales Office/ Distributors for availability and specifications.
- (3) The maximum power dissipation must be derated at elevated temperatures and is limited by  $T_{JMAX}$  (maximum junction temperature),  $\theta_{J-A}$  (junction-to-ambient thermal resistance) and  $T_A$  (ambient temperature). The maximum power dissipation at any temperature is:  $P_{DISSMAX} = (T_{JMAX} - T_A)/\theta_{J-A}$  up to the value listed in the Absolute Maximum Ratings.
- (4) Rating is for the human body model, a 100 pF capacitor discharged through a 1.5k $\Omega$  resistor into each pin.

**OPERATING RATINGS<sup>(1)</sup>**

Ambient Temp. Range	0°C to 70°C
Junction Temp. Range	0°C to 125°C
Thermal Resistance (Junction to Ambient, $\theta_{J-A}$ )	280°C/W
Input Voltage ( $V_{DRIVE}$ )	4V to 30V

- (1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not ensure specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics.

**ELECTRICAL CHARACTERISTICS LM3620-4**

$V_{DRIVE} = 5V$ ,  $I_{DRIVE} = 2mA$ . Limits with **boldface type** apply over the full operating ambient temperature range, 0°C to +70°C, limits with standard typeface apply for  $T_A = 25^\circ\text{C}$ .

Symbol	Parameter	Conditions	Typical	Limit	Units
$V_{REG}$	Regulated Output Voltage (pin 1 to ground)	Pin 5 shorted to pin 1 (graphite anode)	4.1	4.051/ <b>4.018</b>	V(min)
				4.149/ <b>4.182</b>	V(max)
	Regulated Output Voltage Tolerance	Pin 5 open (coke anode)	4.2	4.150/ <b>4.116</b>	V(min)
		Either Pin 5 setting		4.250/ <b>4.284</b>	V(max)
				$\pm 1.2/\pm 2.0$	%
$V_{REG}/V_{DRIVE}$	Supply Sensitivity	$V_{REG}$ for $5V \leq V_{DRIVE} \leq 30V$	100		$\mu\text{V}/\text{V}(\text{max})$
$I_Q$	Quiescent Current	$V_{REG} = 4.5V$ , $V_{EXT} = 1.0V$ <sup>(1)</sup>	400	<b>750</b>	$\mu\text{A}(\text{max})$
$I_{OFF}$	Off State Current	$V_{DRIVE}$ open circuited <sup>(2)</sup>	10	<b>200</b>	nA(max)
$I_{DRIVE}$	Drive Pin Sink Current	$V_{DRIVE} = 5.0V$	20	<b>15</b>	mA(min)
$G_{m(DRIVE)}$	Drive Pin Transconductance	$\Delta I_{DRIVE}/\Delta V_{REG}$ $2mA \leq I_{DRIVE} \leq 15mA$	3		A/V
$I_{EXT}$	External Pin Source Current	$V_{EXT} = 1V$ <sup>(3)</sup>	3	<b>2.5</b>	mA(min)

- (1) Quiescent current is all current flowing to ground when the voltage at the  $V_{REG}$  pin is forced to be above the nominal regulating voltage ( $V_{REG}$ ).
- (2) Off current is all of the current flowing to ground including all leakage current that would be drawn from the battery connected to the  $V_{REG}$  terminal.
- (3) When the External pin is being used as the driving source, it is recommended to keep the operating point of  $V_{EXT} \leq 1V$ . If greater than 1V, the internal circuitry would bias  $I_{DRIVE}$  to conduct up to the current limit level continuously causing unnecessary power dissipation in the device.

## ELECTRICAL CHARACTERISTICS LM3620-4 (continued)

$V_{DRIVE} = 5V$ ,  $I_{DRIVE} = 2mA$ . Limits with **boldface type** apply over the full operating ambient temperature range,  $0^{\circ}C$  to  $+70^{\circ}C$ , limits with standard typeface apply for  $T_A = 25^{\circ}C$ .

Symbol	Parameter	Conditions	Typical	Limit	Units
$G_{m(EXT)}$	External Pin Transconductance	$\Delta I_{EXT}/\Delta V_{REG}$ , $V_{EXT} = 1V$ $0mA \leq I_{EXT} \leq 2.5mA$	0.8		A/V
$R_{IN}$	$V_{REG}$ Input Resistance	Pin 1 to Ground.	46		k $\Omega$
		Circuit biased with $V_{DRIVE}$ applied $V_{DRIVE}$ open circuited	42		M $\Omega$
$R_F$	Feedback Resistance	Pin 1 to Pin 5	1500		$\Omega$

## LM3620-8

$V_{DRIVE} = 5V$ ,  $I_{DRIVE} = 2mA$ . Limits with **boldface type** apply over the full operating ambient temperature range,  $0^{\circ}C$  to  $+70^{\circ}C$ , limits with standard typeface apply for  $T_A = 25^{\circ}C$ .

Symbol	Parameter	Conditions	Typical	Limit	Units
$V_{REG}$	Regulated Output Voltage (pin 1 to ground)	Pin 5 shorted to pin 1 (graphite anode)	8.2	8.102/ <b>8.036</b>	V(min)
				8.298/ <b>8.364</b>	V(max)
	Regulated Output Voltage Tolerance	Pin 5 open (coke anode)	8.4	8.299/ <b>8.232</b>	V(min)
		Either Pin 5 setting		8.501/ <b>8.568</b>	V(max)
				$\pm 1.2/\pm 2.0$	%
$V_{REG}/V_{DRIVE}$	Supply Sensitivity	$V_{REG}$ for $5V \leq V_{DRIVE} \leq 30V$	200		$\mu V/V$ (max)
$I_Q$	Quiescent Current	$V_{REG} = 8.7V$ , $V_{EXT} = 1.0V^{(1)}$	400	<b>750</b>	$\mu A$ (max)
$I_{OFF}$	Off State Current	$V_{DRIVE}$ open circuited <sup>(2)</sup>	10	<b>200</b>	nA(max)
$I_{DRIVE}$	Drive Pin Sink Current	$V_{DRIVE} = 5.0V$	20	<b>15</b>	mA(min)
$G_{m(DRIVE)}$	Drive Pin Transconductance	$\Delta I_{DRIVE}/\Delta V_{REG}$ $2mA \leq I_{DRIVE} \leq 15mA$	1.5		A/V
$I_{EXT}$	External Pin Source Current	$V_{EXT} = 1V^{(3)}$	3	<b>2.5</b>	mA(min)
$G_{m(EXT)}$	External Pin Transconductance	$\Delta I_{EXT}/\Delta V_{REG}$ , $V_{EXT} = 1V$ $0mA \leq I_{EXT} \leq 2.5mA$	0.4		A/V
$R_{IN}$	$V_{REG}$ Input Resistance	Pin 1 to Ground.	110		k $\Omega$
		Circuit biased with $V_{DRIVE}$ applied $V_{DRIVE}$ open circuited	42		M $\Omega$
$R_F$	Feedback Resistance	Pin 1 to Pin 5	2900		$\Omega$

- (1) Quiescent current is all current flowing to ground when the voltage at the  $V_{REG}$  pin is forced to be above the nominal regulating voltage ( $V_{REG}$ ).
- (2) Off current is all of the current flowing to ground including all leakage current that would be drawn from the battery connected to the  $V_{REG}$  terminal.
- (3) When the External pin is being used as the driving source, it is recommended to keep the operating point of  $V_{EXT} \leq 1V$ . If greater than 1V, the internal circuitry would bias  $I_{DRIVE}$  to conduct up to the current limit level continuously causing unnecessary power dissipation in the device.

TYPICAL PERFORMANCE CHARACTERISTICS

Unless otherwise specified,  $T_A = 25^\circ\text{C}$ .

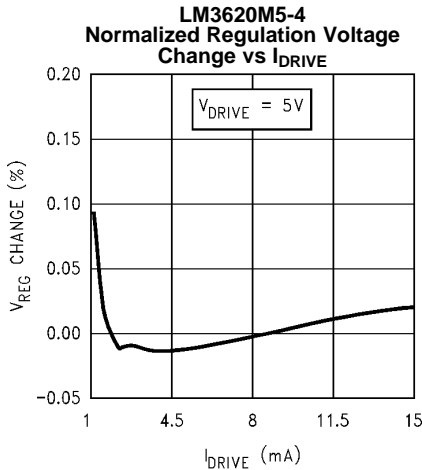


Figure 2.

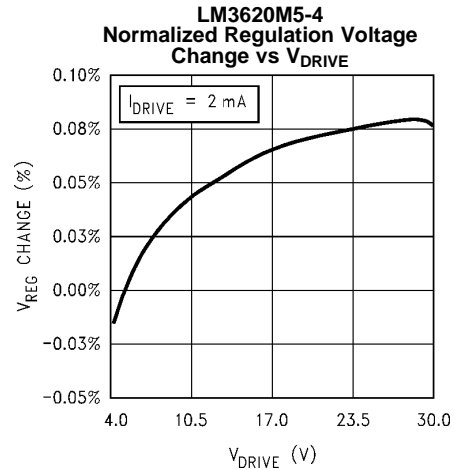


Figure 3.

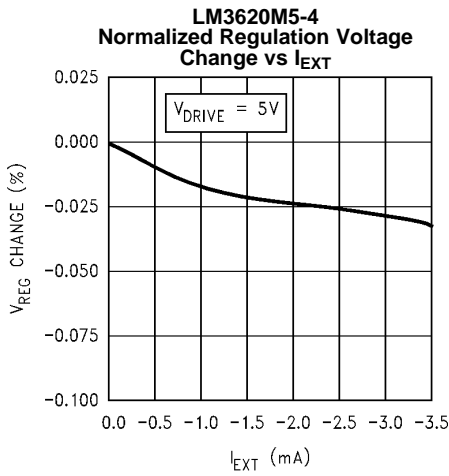


Figure 4.

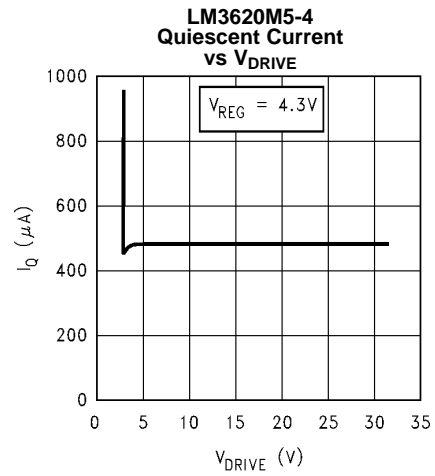


Figure 5.

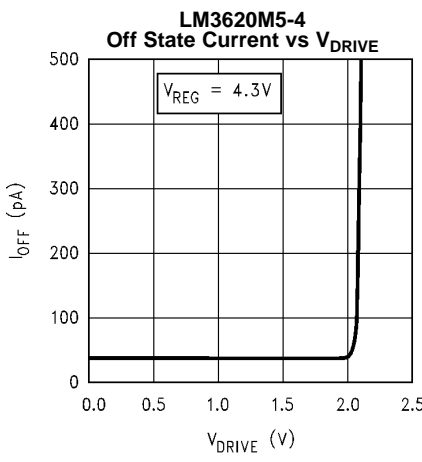


Figure 6.

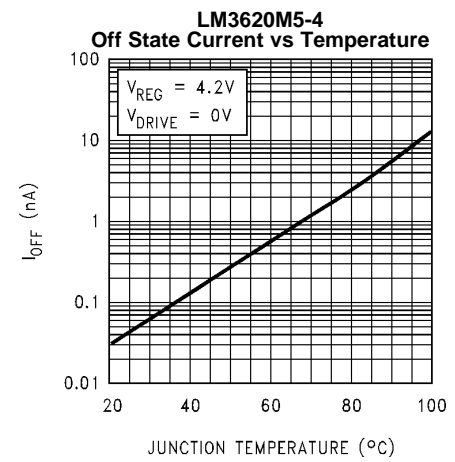
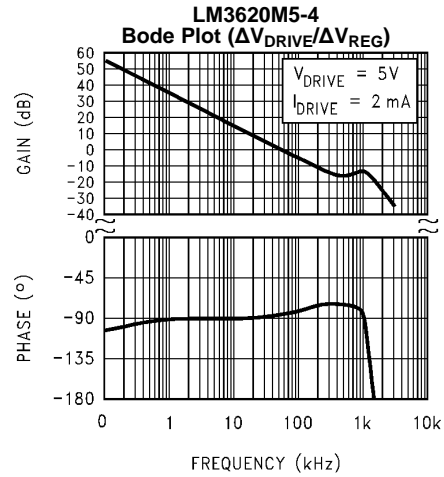


Figure 7.

**TYPICAL PERFORMANCE CHARACTERISTICS (continued)**Unless otherwise specified,  $T_A = 25^\circ\text{C}$ .**Figure 8.**

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**REVISION HISTORY**

<b>Changes from Revision C (April 2013) to Revision D</b>	<b>Page</b>
• Changed layout of National Data Sheet to TI format .....	<a href="#">5</a>

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