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.

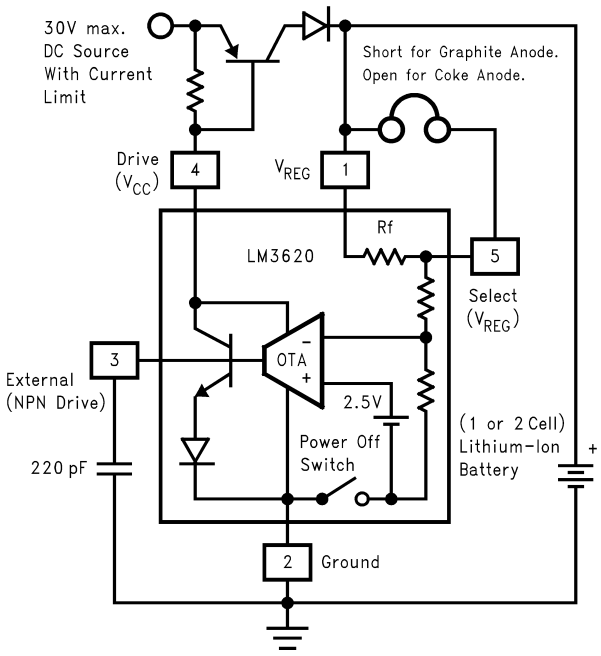
The LM3620 can operate from a wide range of DC input sources (4V to 30V). With no charger supply connected, the controller draws a quiescent current of only 10nA to minimize discharging of a connected battery pack.

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.

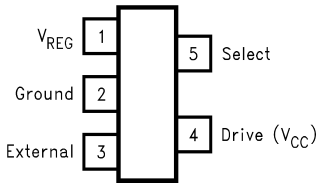
With a trimmed output voltage regulation of ±1.2% initial accuracy, the LM3620 provides a simple, precise solution for end-of-charge control of lithium-ion rechargeable cells.

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

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[1][2]

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°C)[3]		300mW
ESD Susceptibility[4]		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), θ_{J-A} (junction-to-ambient thermal resistance) and T_A (ambient temperature). The maximum power dissipation at any temperature is: $PDiss_{MAX} = (T_{JMAX} - T_A)/\theta_{J-A}$ 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 1.5kΩ resistor into each pin.

OPERATING RATINGS[1]

Ambient Temp. Range	0°C to 70°C
Junction Temp. Range	0°C to 125°C
Thermal Resistance (Junction to Ambient, θ_{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°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/**4.018**	V(min)
				4.149/**4.182**	V(max)
		Pin 5 open (coke anode)	4.2	4.150/**4.116**	V(min)
				4.250/**4.284**	V(max)
	Regulated Output Voltage Tolerance	Either Pin 5 setting		±1.2/**±2.0**	%
V_{REG}/V_{DRIVE}	Supply Sensitivity	V_{REG} for 5V ≤ V_{DRIVE} ≤ 30V	100		µV/V(max)
I_Q	Quiescent Current	V_{REG} = 4.5V, V_{EXT} = 1.0V[1]	400	**750**	µA(max)
I_{OFF}	Off State Current	V_{DRIVE} open circuited[2]	10	**200**	nA(max)
I_{DRIVE}	Drive Pin Sink Current	V_{DRIVE} = 5.0V	20	**15**	mA(min)
$Gm_{(DRIVE)}$	Drive Pin Transconductance	$\Delta I_{DRIVE}/\Delta V_{REG}$ 2mA ≤ I_{DRIVE} ≤15mA	3		A/V
I_{EXT}	External Pin Source Current	V_{EXT} = 1V[3]	3	**2.5**	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} ≤ 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°C to +70°C, limits with standard typeface apply for T_A = 25°C.

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

LM3620-8

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°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/**8.036** 8.298/**8.364**	V(min) V(max)
		Pin 5 open (coke anode)	8.4	8.299/**8.232** 8.501/**8.568**	V(min) V(max)
	Regulated Output Voltage Tolerance	Either Pin 5 setting		±1.2/**±2.0**	%
V_{REG}/V_{DRIVE}	Supply Sensitivity	V_{REG} for 5V ≤ V_{DRIVE} ≤ 30V	200		µV/V(max)
I_Q	Quiescent Current	V_{REG} = 8.7V, V_{EXT} = 1.0V(1)	400	**750**	µA(max)
I_{OFF}	Off State Current	V_{DRIVE} open circuited(2)	10	**200**	nA(max)
I_{DRIVE}	Drive Pin Sink Current	V_{DRIVE} = 5.0V	20	**15**	mA(min)
$Gm_{(DRIVE)}$	Drive Pin Transconductance	$\Delta I_{DRIVE}/\Delta V_{REG}$ 2mA ≤ I_{DRIVE} ≤15mA	1.5		A/V
I_{EXT}	External Pin Source Current	V_{EXT} = 1V(3)	3	**2.5**	mA(min)
$Gm_{(EXT)}$	External Pin Transconductance	$\Delta I_{EXT}/\Delta V_{REG}$, V_{EXT} = 1V 0mA ≤ I_{EXT} ≤ 2.5mA	0.4		A/V
R_{IN}	V_{REG} Input Resistance	Pin 1 to Ground. Circuit biased with V_{DRIVE} applied V_{DRIVE} open circuited	110 42		kΩ MΩ
R_F	Feedback Resistance	Pin 1 to Pin 5	2900		Ω

(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} ≤ 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°C.

LM3620M5-4
Normalized Regulation Voltage Change vs I_{DRIVE}

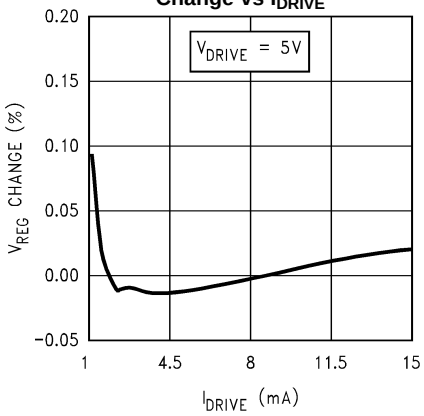


Figure 2.

LM3620M5-4
Normalized Regulation Voltage Change vs V_{DRIVE}

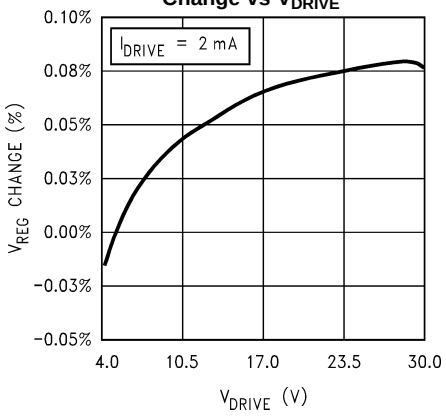


Figure 3.

LM3620M5-4
Normalized Regulation Voltage Change vs I_{EXT}

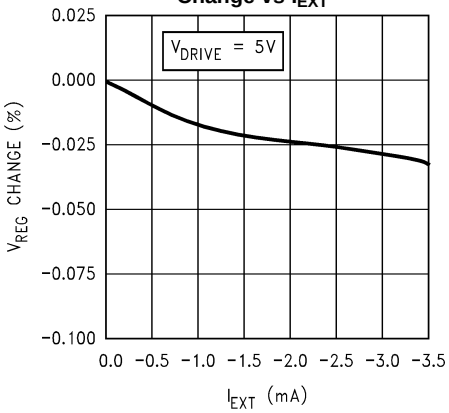


Figure 4.

LM3620M5-4
Quiescent Current vs V_{DRIVE}

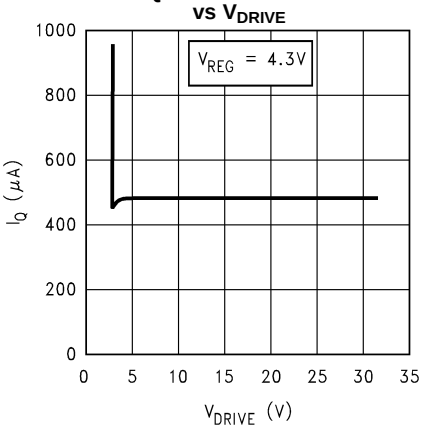


Figure 5.

LM3620M5-4
Off State Current vs V_{DRIVE}

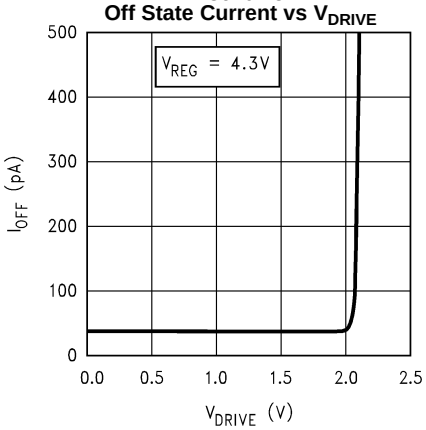


Figure 6.

LM3620M5-4
Off State Current vs Temperature

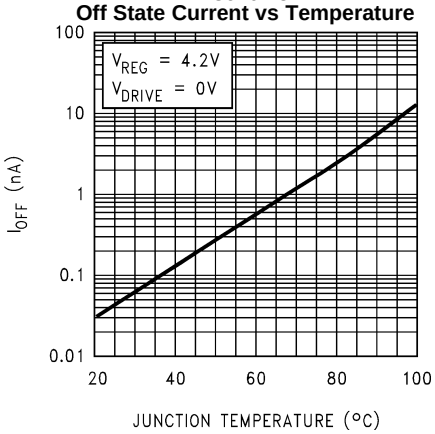


Figure 7.

TYPICAL PERFORMANCE CHARACTERISTICS (continued)

Unless otherwise specified, T_A = 25°C.

LM3620M5-4
Bode Plot ($\Delta V_{DRIVE}/\Delta V_{REG}$)

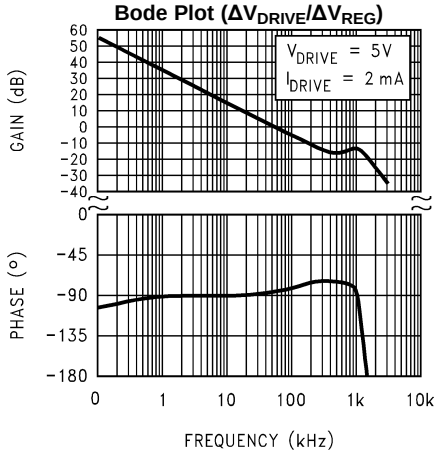


Figure 8.

REVISION HISTORY

Changes from Revision C (April 2013) to Revision D	Page
• Changed layout of National Data Sheet to TI format	5

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