



TEXAS  
INSTRUMENTS



bq2057, bq2057C  
bq2057T, bq2057W

SILUS025F - MAY 2001 - REVISED JULY 2002

## ADVANCED LINEAR CHARGE MANAGEMENT IC FOR SINGLE- AND TWO-CELL LITHIUM-ION AND LITHIUM-POLYMER

### FEATURES

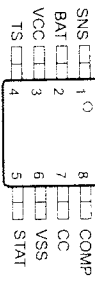
- Ideal for Single (4.1 V or 4.2 V) and Dual-Cell (8.2 V or 8.4 V) Li-Ion or Li-Pol Packs
- Requires Small Number of External Components
- 0.3 V Dropout Voltage for Minimizing Heat Dissipation
- Better Than  $\pm 1\%$  Voltage Regulation Accuracy With Preset Voltages
- AutoComp™ Dynamic Compensation of Battery Pack's Internal Impedance to Reduce Charge Time
- Optional Cell-Temperature Monitoring Before and During Charge
- Integrated Voltage and Current Regulation With Programmable Charge-Current and High- or Low-Side Current Sensing
- Integrated Cell Conditioning for Reviving Deeply Discharged Cells and Minimizing Heat Dissipation During Initial Stage Of Charge
- Charge Status Output for Single or Dual Led or Host Processor Interface
- Automatic Battery-Recharge Feature
- Charge Termination by Minimum Current
- Automatic Low-Power Sleep Mode When V<sub>CC</sub> Is Removed
- EVMs Available for Quick Evaluation
- Packaging: 8-Pin SOIC, 8-Pin TSSOP, 8-Pin MSOP

### DESCRIPTION

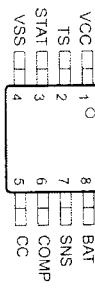
The BENCHMARK bq2057 series advanced Lithium-Ion (Li-Ion) and Lithium-Polymer (Li-Pol) linear charge-management ICs are designed for cost-sensitive and compact portable electronics. They combine high-accuracy current and voltage regulation, battery conditioning, temperature monitoring, charge termination, charge-status indication, and AutoComp charge-rate compensation in a single 8-pin IC. MSOP, TSSOP, and SOIC package options are offered to fit a wide range of end applications.

The bq2057 continuously measures battery temperature using an external thermistor. For safety, the bq2057 inhibits charge until the battery temperature is within user-defined thresholds. The bq2057 then charges the battery in three phases: conditioning, constant current, and constant voltage. If the battery voltage is below the low-voltage threshold (V<sub>lim</sub>), the bq2057 precharges using a low current to condition the battery. The conditioning charge rate is approximately 10% of the regulation current. The conditioning current also minimizes heat dissipation in the external pass-element during the initial stage of the charge. After conditioning, the bq2057 applies a constant current to the battery. An external sense-resistor sets the current. The sense-resistor can be on either the high or low side of the battery without additional components. The constant-current phase continues until the battery reaches the charge-regulation voltage.

bq2057XSN or bq2057XTS  
SOIC (SN) or TSSOP (TS) PACKAGE  
(TOP VIEW)



bq2057XDGK  
MSOP (DGK) PACKAGE  
(TOP VIEW)



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### DESCRIPTION (continued)

The bq2057 then begins the constant-voltage phase. The accuracy of the voltage regulation is better than  $\pm 1\%$  over the operating-temperature and supply-voltage ranges. For single and dual cells, the bq2057 is offered in four fixed-voltage versions: 4.1 V, 4.2 V, 8.2 V, and 8.4 V. Charge stops when the current tapers to the charge termination threshold, I<sub>TERM</sub>. The bq2057 automatically restarts the charge if the battery voltage falls below the V<sub>RECH</sub> threshold.

The designer also may use the AutoComp feature to reduce charging time. This proprietary technique allows safe and dynamic compensation for the internal impedance of the battery pack during charge.

#### AVAILABLE OPTIONS

TA	PACKAGE			
	CHARGE REGULATION VOLTAGE	SOIC (SN)	TSSOP (TS)	MSOP† (DGK)
-20°C to 70°C	4.1 V	Not available	bq2057TS	bq2057DGK
	4.2 V	bq2057CSN	bq2057CTS	bq2057DDGK
	8.2 V	Not available	bq2057TTS	Not available
	8.4 V	bq2057WSN	bq2057WTS	Not available

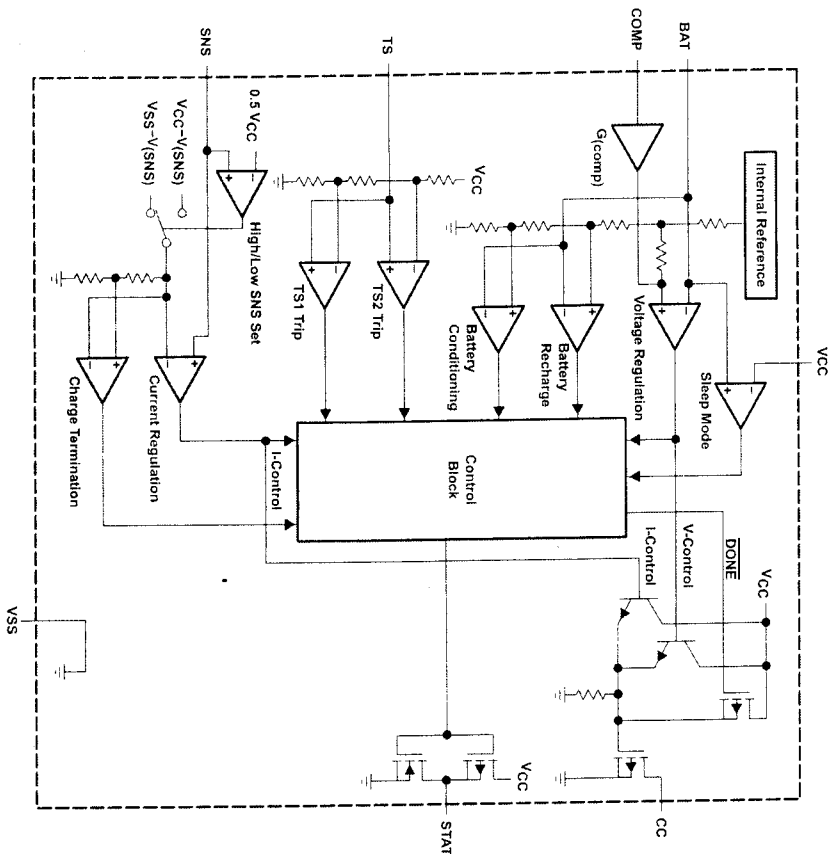
† Note the difference in pinout for this package.

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**bq2057, bq2057C  
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**function block diagram**



**bq2057, bq2057C  
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**Terminal Functions**

NAME	TERMINAL		I/O	DESCRIPTION
	NO.	NO.		
BAT	2	8	1	Voltage sense input
CC	7	5	0	Charge control output
COMP	8	6	1	Charge-rate compensation input (AutoComp)
SNS	1	7	1	Current sense input
STAT	5	3	0	Charge status output
TS	4	2	1	Temperature sense input
VCC	3	1	1	Supply voltage
VSS	6	4		Ground

**detailed description**

**current-sense input**

Battery current is sensed via the voltage developed on this pin by an external sense resistor. The external resistor can be placed on either the high or low side of the battery. (See schematics for details.)

**battery-voltage input**

Voltage sense input tied directly to the positive side of the battery.

**temperature sense input**

Input for an external battery-temperature monitoring circuit. Connecting this input to VCC/2 disables this feature.

**charge-status output**

3-state indication of charge in progress, charge complete, and temperature fault or sleep mode.

**charge-control output**

Source-follower output that drives an external pass-transistor (PNP or P-channel MOSFET) for current and voltage regulation.

**charge-rate compensation input**

Sets the charge-rate compensation level. The voltage-regulation output may be programmed to vary as a function of the charge current delivered to the battery.

**supply voltage input**

Power supply input and current reference for high-side sensing configuration.

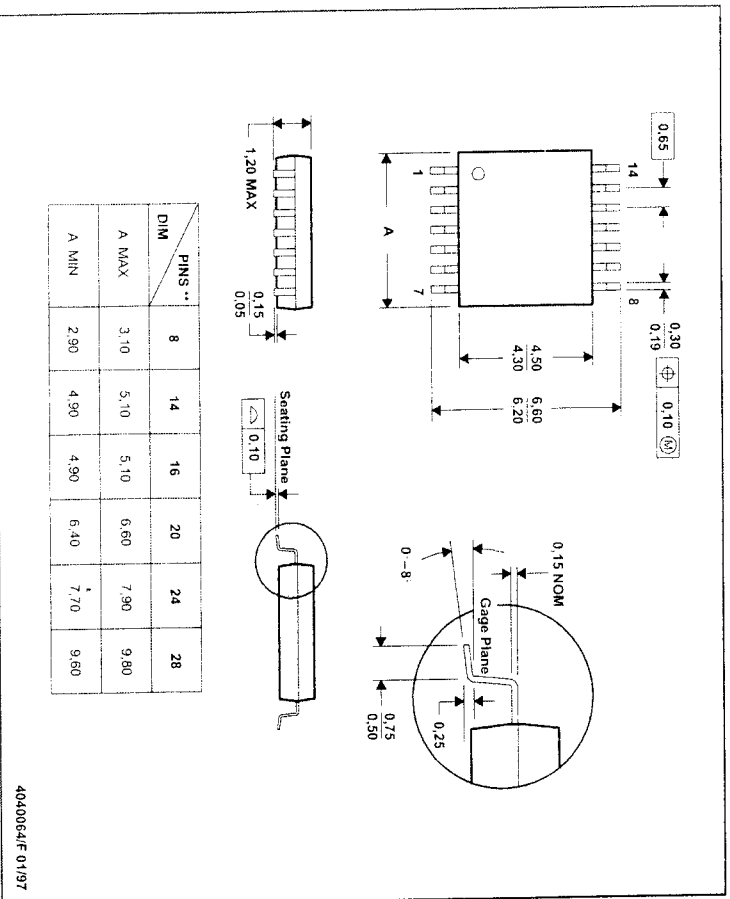
# MECHANICAL DATA

MTS001C JANUARY 1995 - REVISED FEBRUARY 1999

## PLASTIC SMALL-OUTLINE PACKAGE

PW (R-PDSO-G\*\*)

14 PINS SHOWN

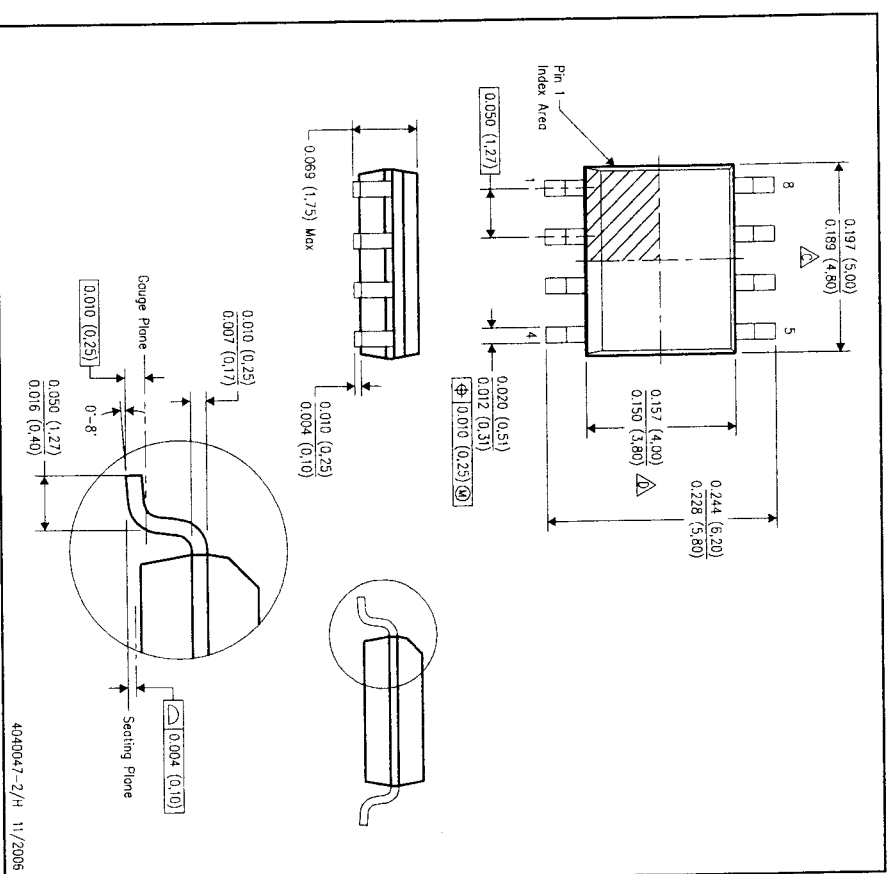


- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.15.
  - Falls within JEDEC MO-153.

# MECHANICAL DATA

D (R-PDSO-G8)

## PLASTIC SMALL-OUTLINE PACKAGE

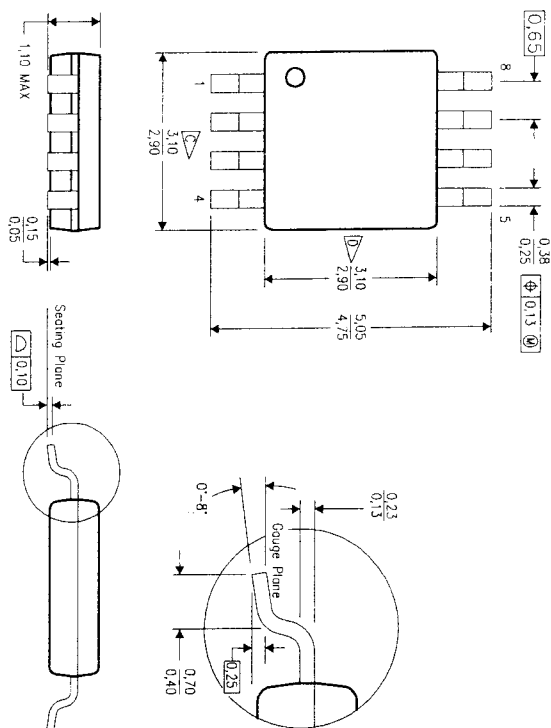


- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body length does not include mold flash, protrusions, or gage burrs. Mold flash, protrusions, or gage burrs shall not exceed .006 (0.15) per end.
  - Body width does not include interlead flash. Interlead flash shall not exceed .017 (0.43) per side.
  - Reference JEDEC MS-012 variation AA.

## MECHANICAL DATA

DGK (S-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



4073329/E 05/06

### NOTES

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- Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
- Falls within JEDEC MO-187 variation AA, except interlead flash.

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Lead (Pb)	1000
Mercury (Hg)	1000
Hexavalent Chromium (Cr6+)	1000
Poly Brominated Biphenyls (PBB)	1000
Poly Brominated Diphenyl Ethers (PBDE)	1000

(1) Maximum limit does not apply to applications covered by RoHS exemptions

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Name/Title: Randy Harris, Executive Director, Business Quality

Date: November 18, 2004

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