

**GENERAL DESCRIPTION**

The =U is a monolithic IC specifically designed to regulate the output current and voltage levels of switching battery chargers and power supplies.

The device contains two Op Amps and a 2.5V precision shunt voltage reference. Op Amp 1 is designed for voltage control with its non-inverting input internally connected to the output of the shunt regulator. Op Amp 2 is for current control with both inputs uncommitted. The IC offers the power converter designer a control solution that features increased precision with a corresponding reduction in system complexity and cost.

**PIN CONFIGURATION**

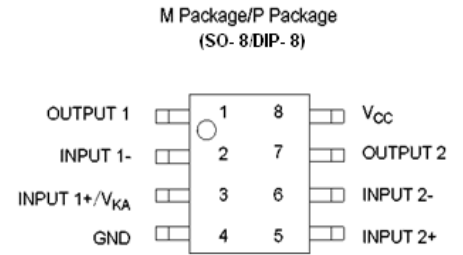


Figure 1. Pin Configuration of =U

**FEATURES**

**Op Amp**

- Input Offset Voltage: 0.5mV
- Supply Current: 75  $\mu$ A per Op Amp at 5.0V Supply Voltage
- Unity Gain Bandwidth: 1MHz
- Output Voltage Swing: 0 to  $V_{CC}-1.5V$
- Power Supply Range: 3 to 36V

**Voltage Reference**

- Fixed Output Voltage Reference: 2.5V
- Reference Voltage Tolerance =U  $\pm 0.4\%$ ,
- Sink Current Capability: 0.05 to 80mA
- Typical Output Impedance: 0.2 $\Omega$

**APPLICATIONS**

- Battery Charger
- Switching Power Supply

The =U is available in standard packages DIP-8 and SO-8.

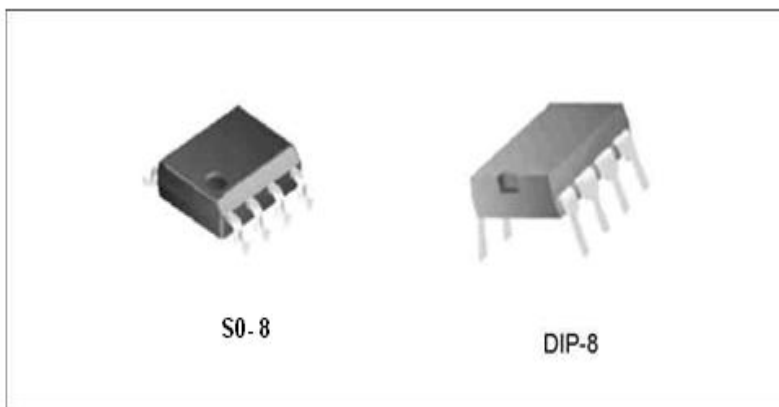


Figure 2. Package Types of =U

### ABSOLUTE MAXIMUM RATINGS (Note 1)

Parameter	Symbol	Ratings	Unit	
Power Supply Voltage (V <sub>CC</sub> to GND)	V <sub>CC</sub>	40	V	
Op Amp 1 and 2 Input Voltage Range (Pins 2, 5, 6)	V <sub>IN</sub>	-0.3 to V <sub>CC</sub> +0.3	V	
Op Amp 2 Input Differential Voltage (Pins 5, 6)	V <sub>ID</sub>	40	V	
Voltage Reference Cathode Current (Pin 3)	I <sub>K</sub>	100	mA	
Power Dissipation (T <sub>A</sub> =25 °C)	P <sub>D</sub>	DIP-8	800	mW
		SO-8	500	
Operating Junction Temperature	T <sub>J</sub>	150	°C	
Storage Temperature Range	T <sub>STG</sub>	-65 to 150	°C	
Lead Temperature (soldering, 10 seconds)	T <sub>LEAD</sub>	260	°C	

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

### RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Ratings		Unit
		Min	Max	
Supply Voltage	V <sub>IN</sub>	3	36	V
Ambient Temperature	T <sub>J</sub>	-40	105	°C

### ELECTRICAL CHARACTERISTICS

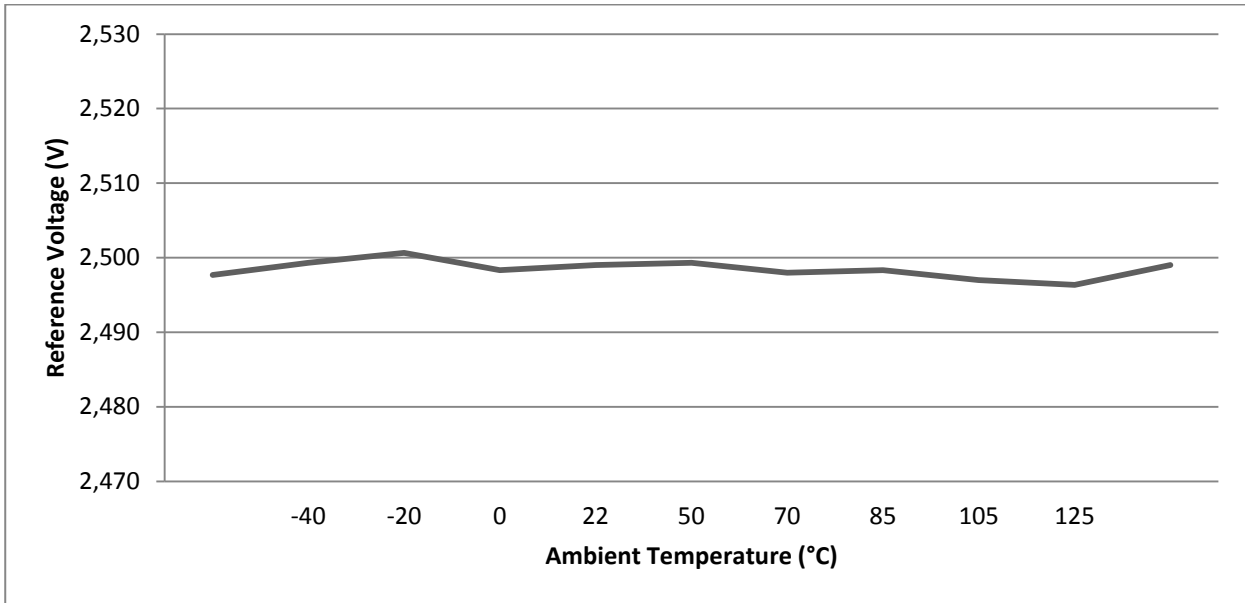
Operating Conditions: V<sub>CC</sub> =+5V, T<sub>A</sub>=25°C unless otherwise

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	
Total Supply Current, excluding Current in Voltage Reference	I <sub>CC</sub>	V <sub>CC</sub> =5V, no load, -40°C≤T <sub>A</sub> ≤105°C		0.15	0.25	mA	
		V <sub>CC</sub> =30V, no load, -40°C≤T <sub>A</sub> ≤105°C		0.20	0.30		
Voltage Reference Section							
Reference Voltage	V <sub>REF</sub>	I <sub>K</sub> =10 mA	T <sub>A</sub> =25°C	2.482	2.50	2.518	V
			-40°C≤T <sub>A</sub> ≤105°C	2.478	2.50	2.522	
Packaged chip with Vref accuracy ±0.4%				90		%	
Reference Voltage Deviation Over Full Temperature Range	ΔV <sub>REF</sub>	I <sub>K</sub> =10mA, T <sub>A</sub> =-40 to 105°C		5	24	mV	
Minimum Cathode Current for Regulation	I <sub>min</sub>			0.01	0.05	mA	
Dynamic Impedance	ZKA	I <sub>K</sub> =1.0 to 80mA, f<1kHz		0.2	0.5	Ω	
<b>Op Amp 1 Section (V<sub>CC</sub>=5V, V<sub>O</sub>=1.4V, T<sub>A</sub>=25°C, unless otherwise noted)</b>							
Input Offset Voltage	V <sub>IO</sub>	T <sub>A</sub> =25°C		0.5	3	mV	
		T <sub>A</sub> =-40 to 105°C			5		
Input Offset Voltage Temperature Drift	DV <sub>IO</sub>	T <sub>A</sub> =-40 to 105°C		7		μV/°C	
Input Bias Current (Inverting Input Only)	I <sub>IB</sub>	T <sub>A</sub> =25°C		20	150	nA	
Large Signal Voltage Gain	AVD	V <sub>CC</sub> =15V, R <sub>L</sub> =2kΩ, V <sub>O</sub> =1.4 to 11.4V	85	100		dB	
Power Supply Rejection Ratio	PSRR	V <sub>CC</sub> =5 to 30V	70	90		dB	
Output Current	Source	I <sub>SOURCE</sub>	V <sub>CC</sub> =15V, V <sub>ID</sub> =1V, V <sub>O</sub> =2V	20	40	mA	
	Sink	I <sub>SINK</sub>	V <sub>CC</sub> =15V, V <sub>ID</sub> =-1V, V <sub>O</sub> =2V	7	20	mA	
Output Voltage Swing (High)	V <sub>OH</sub>	V <sub>CC</sub> =30V, R <sub>L</sub> =10kΩ, V <sub>ID</sub> =1V	27	28		V	

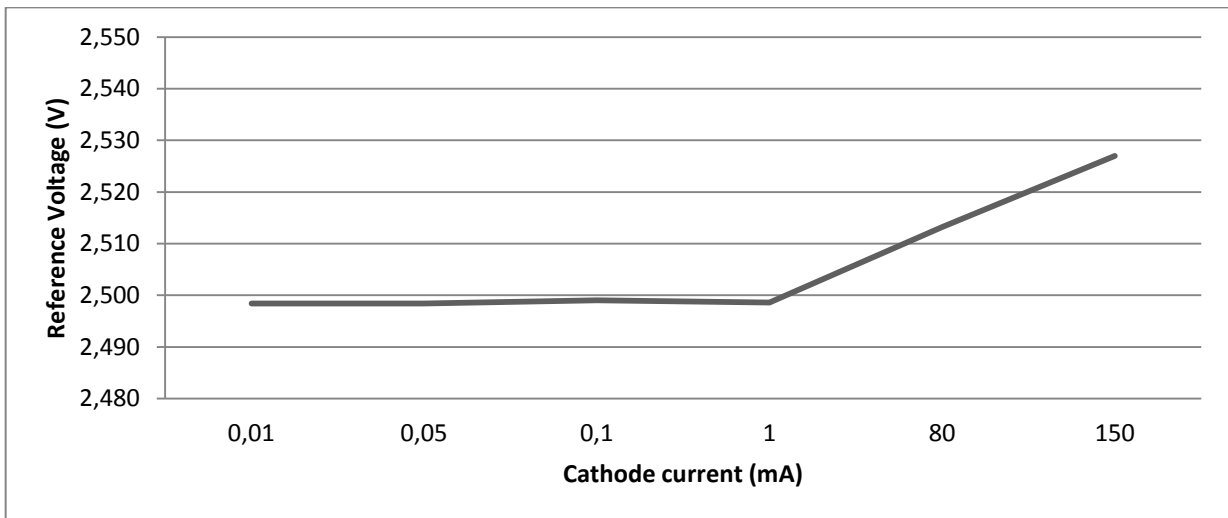
Output Voltage Swing (Low)	$V_{OL}$	$V_{CC}=30V, R_L=10k\Omega, V_{ID}=-1V$		17	100	mV
Slew Rate	SR	$V_{CC}=18V, R_L=2k\Omega, A_V=1, V_{IN}=0.5$ to 2V, $C_L=100pF$	0.2	0.5		V/ $\mu s$
Unity Gain Bandwidth	GBW	$V_{CC}=30V, R_L=2k\Omega, C_L=100pF$	0.7	1.0		MHz
<b>Op Amp 2 Section</b> ( $V_{CC}=5V, V_O=1.4V, T_A=25^\circ C$ , unless otherwise noted)						
Input Offset Voltage	$V_{IO}$	$T_A=25^\circ C$		0.5	3	mV
		$T_A=-40$ to $105^\circ C$			5	
Input Offset Voltage Temperature Drift	$DV_{IO}$	$T_A=-40$ to $105^\circ C$		7		$\mu V/^\circ C$
Input Offset Current	$I_{IB}$	$T_A=25^\circ C$		2	30	nA
Input Bias Current	AVD	$T_A=25^\circ C$		20	150	nA
Input Voltage Range	PSRR	$V_{CC}=0$ to 36V	0		$V_{CC}-1.5$	V
Common Mode Rejection Ratio	CMRR	$T_A=25^\circ C, V_{CM}=0$ to 3.5V	70	85		dB
Large Signal Voltage Gain	AVD	$V_{CC}=15V, R_L=2k\Omega, V_O=1.4$ to 11.4V	85	100		dB
Power Supply Rejection Ratio	PSRR	$V_{CC}=5$ to 30V	70	90		dB
Output Current	Source	$I_{SOURCE}$	$V_{CC}=15V, V_{ID}=1V, V_O=2V$	20	40	mA
	Sink	$I_{SINK}$	$V_{CC}=15V, V_{ID}=-1V, V_O=2V$	7	20	
Output Voltage Swing (High)	$V_{OH}$	$V_{CC}=30V, R_L=10k\Omega, V_{ID}=1V$	27	28		V
Output Voltage Swing (Low)	$V_{OL}$	$V_{CC}=30V, R_L=10k\Omega, V_{ID}=-1V$		17	100	mV
Slew Rate	SR	$V_{CC}=18V, R_L=2k\Omega, A_V=1, V_{IN}=0.5$ to 2V, $C_L=100pF$	0.2	0.5		V/ $\mu s$
Unity Gain Bandwidth	GBW	$V_{CC}=30V, R_L=2k\Omega, C_L=100pF$	0.7	1.0		MHz

TYPICAL CHARACTERISTICS

Reference Voltage vs. Ambient Temperature



Reference Voltage vs Cathode Current



FUNCTIONAL BLOCK DIAGRAM

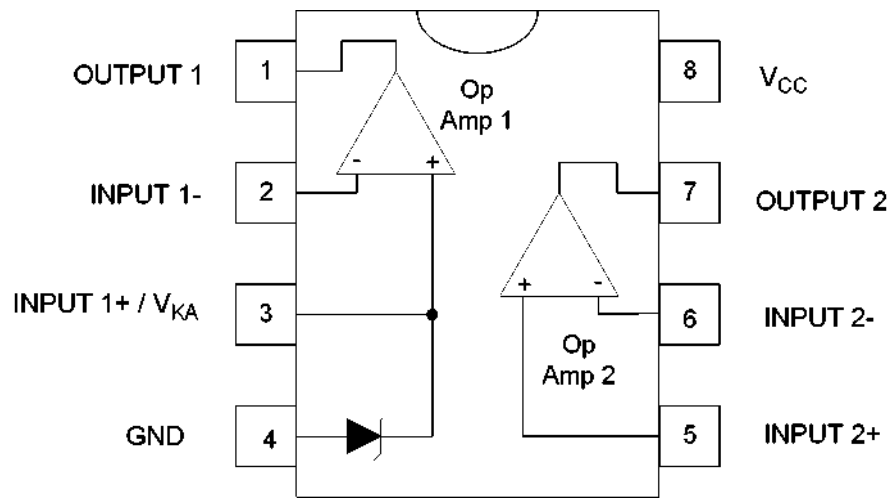
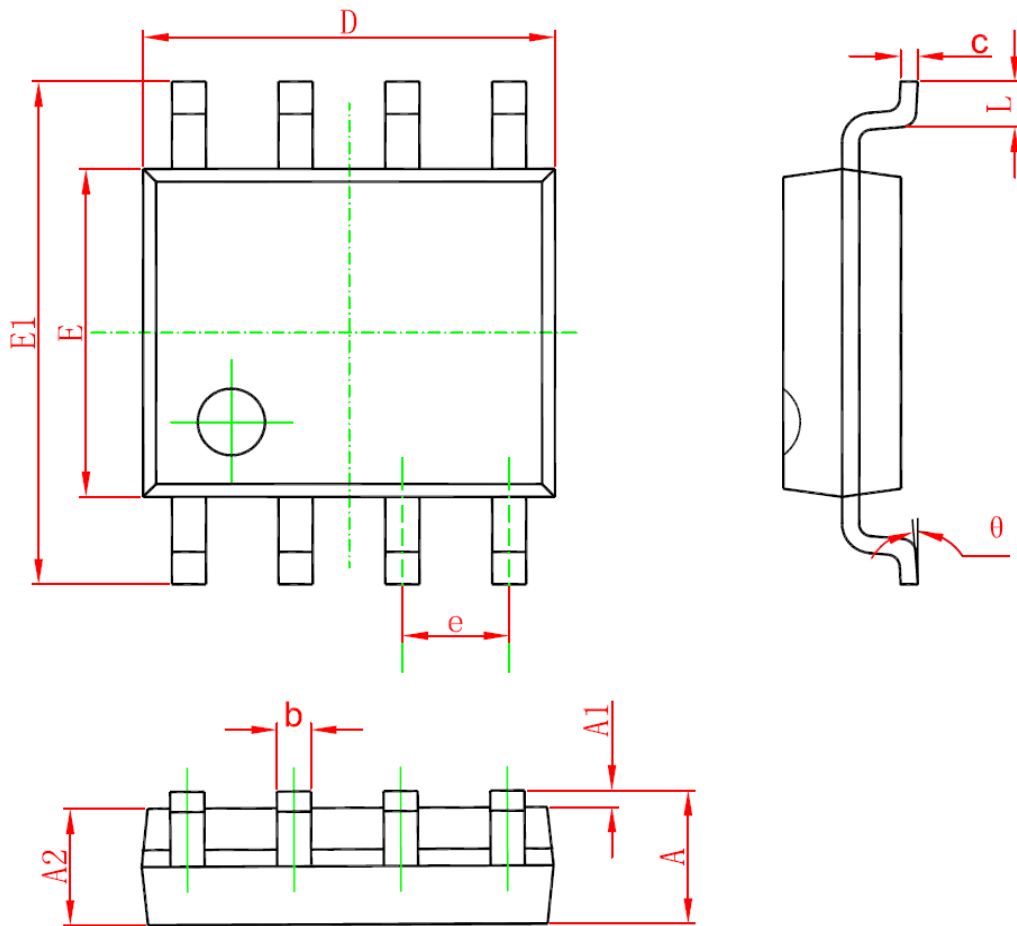


Figure 3. Functional Block Diagram of =U

**SOP8 PACKAGE OUTLINE DIMENSIONS**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050 (BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°