



# SP435W

## Dual OP AMP with Voltage Regulator

### DESCRIPTION

The SP435W is a monolithic IC specifically designed to control the output current and voltage levels of switch mode battery chargers and power supplies.

The device contains two operational amplifiers and a precision shunt regulator. Op Amp 1 is designed for voltage control, whose non-inverting input internally connects 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.

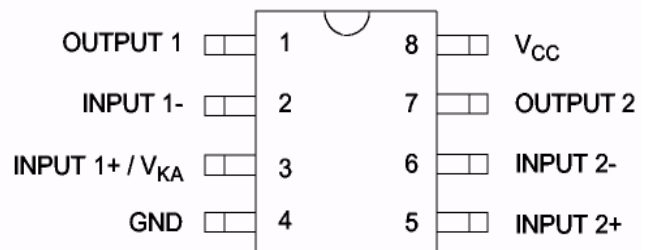
### APPLICATIONS

- Battery Power Equipment
- Linear Regulators
- Switch Power Supply
- Cellular Phone
- Digital Cameras
- Computer Disk Drivers
- Instrumentation

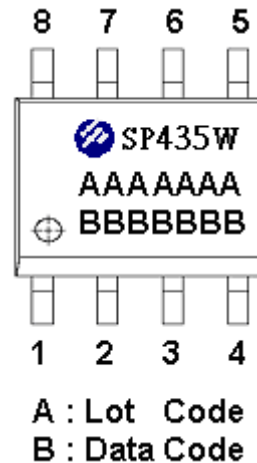
### FEATURES

- Input offset voltage: 0.5mV
- Supply current: 250 uA per Op Amp at 5.0V supply voltage
- Unity gain bandwidth: 1MHz
- Output voltage swing: 0 to (VCC- 1.5) V
- Power supply range: 3 to 18V
- Fixed output voltage reference: 2.5V
- Voltage tolerance: 1%
- Sink current capability from 0.2 to 80mA

### PIN CONFIGURATION ( SOP-8 )



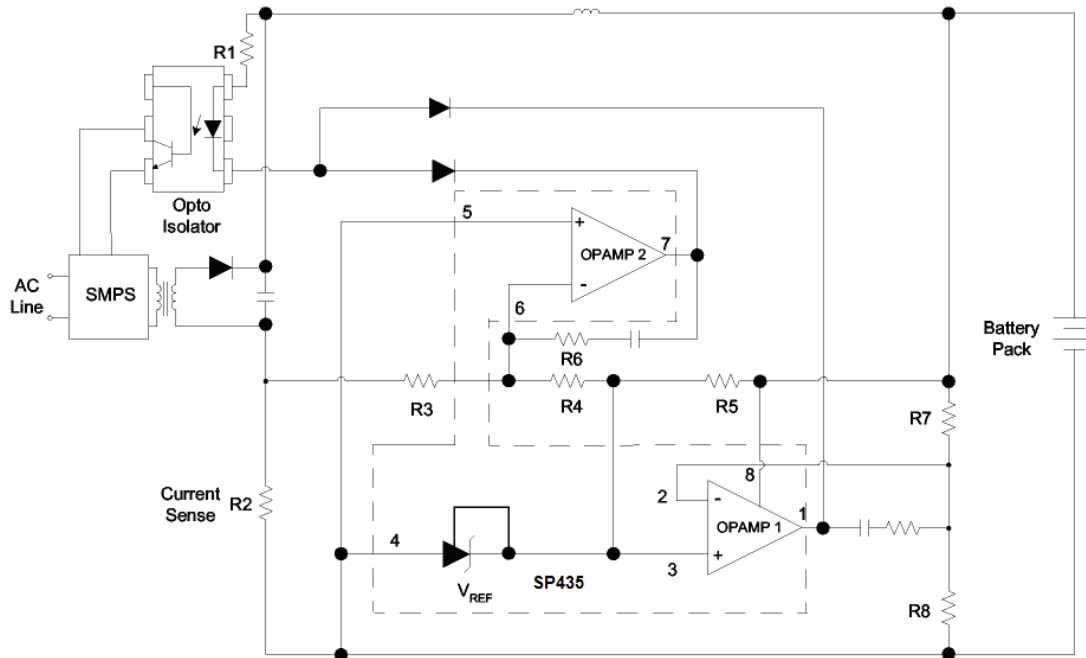
### PART MARKING





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## TYPICAL APPLICATION CIRCUIT



## PIN DESCRIPTION

Pin	Symbol	Description
1	Output 1	OP Amp Output 1
2	Input 1-	OP Amp Input 1 Voltage
3	Input 1+ V <sub>KA</sub>	Power Switching Output
4	GND	Ground
5	Input 2+	OP Amp Input 2 Voltage
6	Input 2-	OP Amp Input 2 Voltage
7	Output 2	OP Amp Output 2
8	V <sub>cc</sub>	Power Supply Voltage

## ORDERING INFORMATION

Part Number	Package	Part Marking
SP435WS8RGB	SOP-8	SP435W

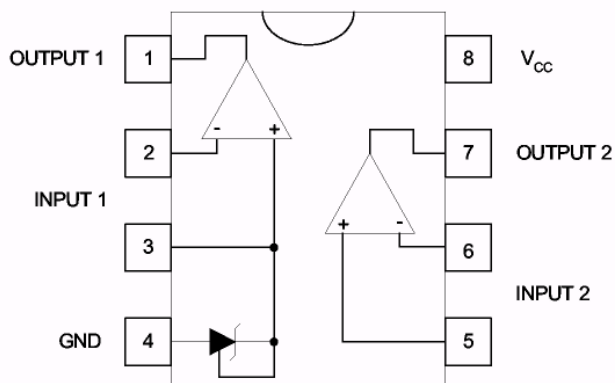
※ SP435WS8RGB : 13" Tape Reel; Pb – Free, Halogen-Free



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### BLOCK DIAGRAM



### ABSOLUTE MAXIMUM RATINGS (TA=25°C, unless otherwise specified.)

The following ratings designate persistent limits beyond which damage to the device may occur.

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage (V <sub>cc</sub> to Ground)	20	V
V <sub>IN</sub>	OP Amp 1 and 2 Input Voltage (Pin 2, 5, 6)	-0.3~V <sub>cc</sub> +0.3	V
V <sub>ID</sub>	OP Amp 2 Input Differential Voltage (Pin 5, 6)	20	V
I <sub>K</sub>	Voltage Reference Cathode Current (Pin 3)	100	mA
T <sub>STG</sub>	Storage Temperature Range	-65 to 150	°C
T <sub>LEAD</sub>	Lead Soldering Temperature for 5 sec.	260	°C
T <sub>ope</sub>	Operation Temperature Range	-40 ~ 85	°C
P <sub>D</sub>	Power Dissipation	500	mW



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### ELECTRICAL CHARACTERISTICS

(Unless otherwise stated, these specifications apply  $T_A=25^{\circ}\text{C}$ ;  $V_{CC}=+5\text{V}$ )

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>SUPPLY</b>						
$V_{CC}$	Supply Voltage		3		18	V
$I_{CC}$	Supply Current, excluding Current in Voltage Reference	$V_{CC} = 5\text{V}$ , no load		0.45	0.6	mA
		$V_{CC} = 18\text{V}$ , no Load		0.6	0.8	
<b>VOLTAGE REFERENCE SECTION</b>						
$V_{REF}$	Reference Voltage	$I_{KA} = 10\text{ mA}$	2.475	2.5	2.525	V
$\Delta V_{REF}$	Reference Voltage Deviation over Temp Range	$I_{KA} = 10\text{ mA}$ , $T_A = -40\sim 85^{\circ}\text{C}$		5	24	mV
$I_{MIN}$	Minimum Cathode Current for Regulation	$V_{KA} = V_{REF}$		0.2	1.0	mA
$ Z_{KA} $	Dynamic Impedance	$V_{KA} = V_{REF}$ , $I_{KA} = 1\text{mA}\sim 80\text{mA}$ , $f < 1\text{KHz}$		0.3	0.5	$\Omega$
<b>OP AMP 1 SECTION (<math>V_{CC+} = 5\text{V}</math>, <math>V_O = 1.4\text{V}</math>)</b>						
$V_{IO}$	Input Offset Voltage	$T_A = 25^{\circ}\text{C}$		0.5	3.0	mV
		$T_A = -40^{\circ}\text{C}\sim 85^{\circ}\text{C}$			5.0	
$\alpha V_{IO}$	Input Offset Voltage Temperature Drift			7		$\mu\text{V}/^{\circ}\text{C}$
$I_{IB}$	Input Bias Current (Inverting Input Only)			20	150	nA
$A_{VD}$	Large Signal Voltage Gain	$V_{CC} = 15\text{V}$ , $R_L = 2\text{K}\Omega$ , $V_O = 1.4\sim 11.4\text{V}$	85	100		V/mV
$K_{SVR}$	Power Supply Rejection Ratio	$V_{CC+} = 5\sim 18\text{V}$	60	90		dB
$I_{O(SINK)}$	Output Sink Current	$V_{CC} = 15\text{V}$ , $V_{ID} = -1\text{V}$ , $V_O = 2\text{V}$	10	20		mA
$I_{O(SOURCE)}$	Output Source Current	$V_{CC} = 15\text{V}$ , $V_{ID} = 1\text{V}$ , $V_O = 2\text{V}$	20	40		mA
$V_{OH}$	Output Voltage Swing High	$V_{CC} = 18\text{V}$ , $V_{ID} = 1\text{V}$ , $R_L = 10\text{K}\Omega$	16	16.5		V
$V_{OL}$	Output Voltage Swing Low	$V_{CC} = 18\text{V}$ , $V_{ID} = -1\text{V}$ , $R_L = 10\text{K}\Omega$		17	100	mV
SR	Slew Rate	$V_{CC} = 18\text{V}$ , $R_L = 2\text{K}\Omega$ , $V_I = 0.5\sim 2\text{V}$ , $C_L = 100\text{ pF}$	0.2	0.5		$\text{V}/\mu\text{S}$
GBW	Gain Bandwidth Product	$V_{CC} = 18\text{V}$ , $R_L = 2\text{K}\Omega$ , $V_I = 10\text{mV}$ , $C_L = 100\text{ pF}$ , $f = 100\text{KHz}$	0.5	1		MHz



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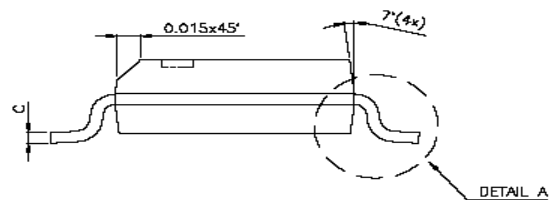
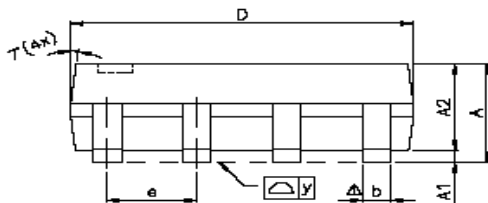
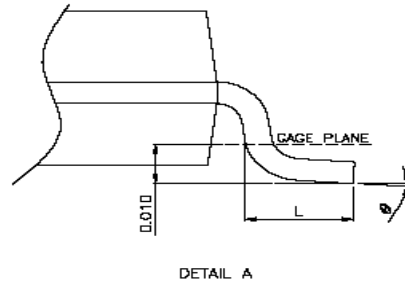
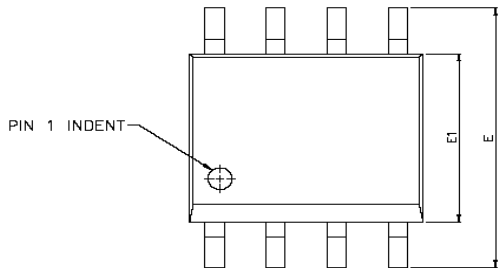
## Dual OP AMP with Voltage Regulator

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
<b>OP AMP 2 SECTION</b> ( $V_{CC+} = 5V$ , $V_O = 1.4V$ )						
$V_{IO}$	Input Offset Voltage	$T_A = 25^\circ C$		0.5	3.0	mV
		$T_A = -40^\circ C \sim 85^\circ C$			5.0	
$\alpha V_{IO}$	Input Offset Voltage Temperature Drift			7		$\mu V/^\circ C$
$I_{IO}$	Input Offset Current			2	30	nA
$I_{IB}$	Input Bias Current (Inverting Input Only)			20	150	nA
$V_{ICR}$	Input Common Mode Voltage Range	$V_{CC} = 18V$			$V_{CC} - 1.5$	V
CMRR	Common Mode Rejection Ratio	$T_A = 25^\circ C$ , $V_{CM} = 0 \sim 3.5V$	70	85		dB
$A_{VD}$	Large Signal Voltage Gain	$V_{CC} = 15V$ , $R_L = 2K\Omega$ , $V_O = 1.4 \sim 11.4V$	85	100		V/mV
$K_{SVR}$	Power Supply Rejection Ratio	$V_{CC+} = 5 \sim 18V$	60	90		dB
$I_{O(SINK)}$	Output Sink Current	$V_{CC} = 15V$ , $V_{ID} = -1V$ , $V_O = 2V$	10	20		mA
$I_{O(SOURCE)}$	Output Source Current	$V_{CC} = 15V$ , $V_{ID} = 1V$ , $V_O = 2V$	20	40		mA
$V_{OH}$	Output Voltage Swing High	$V_{CC} = 18V$ , $V_{ID} = 1V$ , $R_L = 10K\Omega$	16	16.5		V
$V_{OL}$	Output Voltage Swing Low	$V_{CC} = 18V$ , $V_{ID} = -1V$ , $R_L = 10K\Omega$		17	100	mV
SR	Slew Rate	$V_{CC} = 18V$ , $R_L = 2K\Omega$ , $V_I = 0.5 \sim 2V$ , $C_L = 100 pF$	0.2	0.5		$V/\mu S$
GBW	Gain Bandwidth Product	$V_{CC} = 18V$ , $R_L = 2K\Omega$ , $V_I = 10mV$ , $C_L = 100 pF$ , $f = 100KHz$	0.5	1		MHz



# SP435W Dual OP AMP with Voltage Regulator

## SOP- 8 PACKAGE OUTLINE



SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.47	1.60	1.73	0.058	0.063	0.068
A1	0.10	—	0.25	0.004	—	0.010
A2	—	1.45	—	—	0.057	—
b	0.33	0.41	0.51	0.013	0.016	0.020
C	0.19	0.20	0.25	0.0075	0.008	0.0098
D	4.80	4.85	4.95	0.189	0.191	0.195
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e	—	1.27	—	—	0.050	—
L	0.38	0.71	1.27	0.015	0.028	0.050
$\Delta$ y	—	—	0.076	—	—	0.003
$\phi$	0°	—	8°	0°	—	8°



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