



SP435W

Dual OP AMP with Voltage Regulator

DESCRIPTION

The **SP435WA/B** 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.

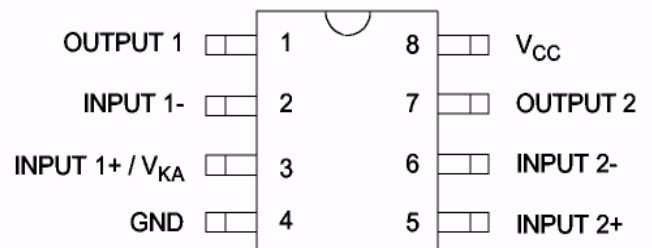
FEATURES

- Input offset voltage: 0.5mV
- Supply current: 75 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 36V
- Fixed output voltage reference: 2.5V
- Voltage tolerance: 0.4% and 1%
- Sink current capability from 0.05 to 80mA
- Typical Output Impedance : 0.2Ω
- SOP-8 Package

APPLICATIONS

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

PIN CONFIGURATION (SOP-8)



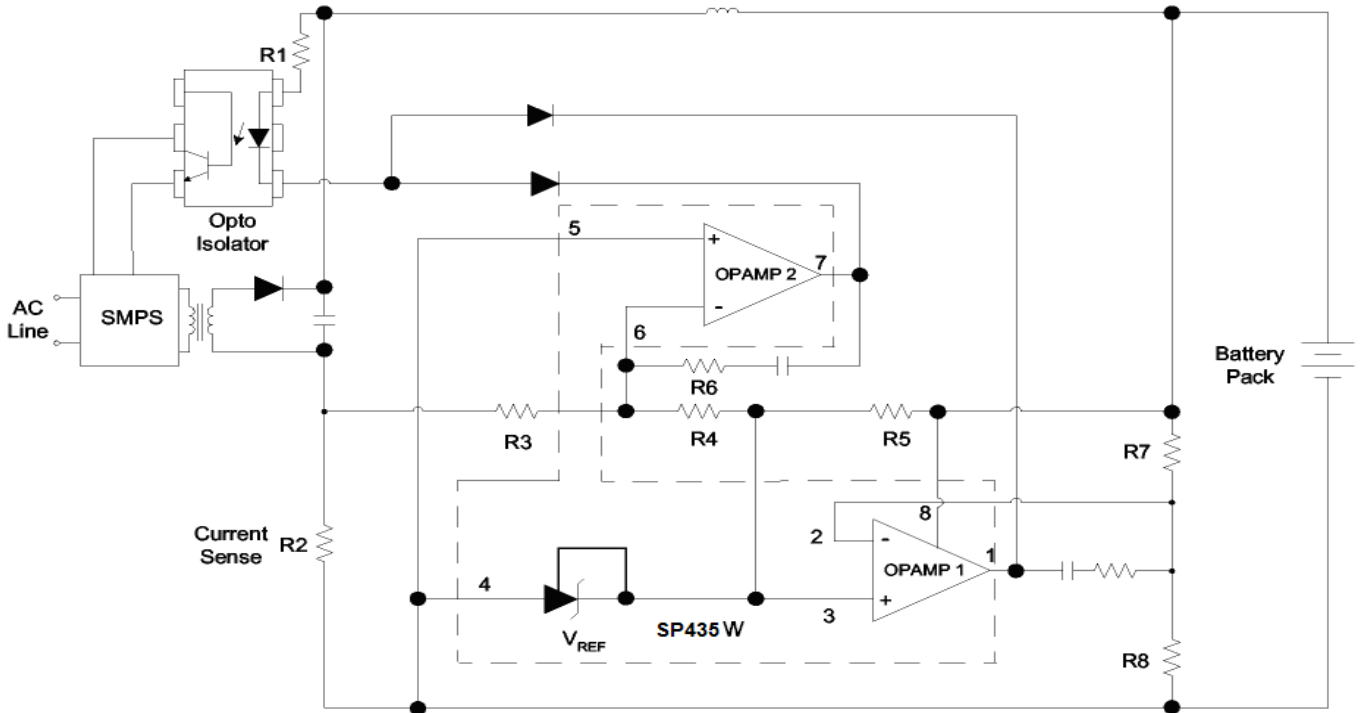
PART MARKING





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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 _{KA}	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 _{CC}	Power Supply Voltage

ORDERING INFORMATION

Part Number	Voltage tolerance	Package	Part Marking
SP435WAS8RGB	±0.5%	SOP-8	SP435W
SP435WBS8RGB	±1%	SOP-8	SP435W

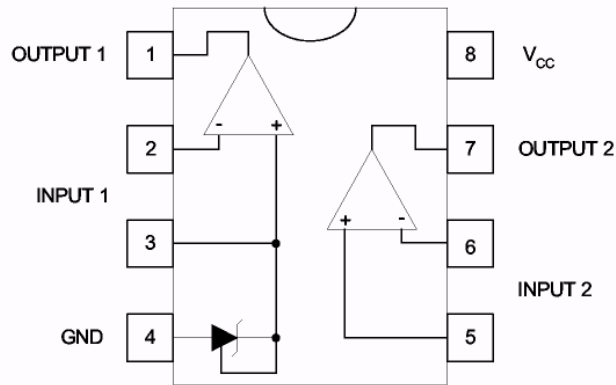
※ SP435WA/BS8RGB : 13" Tape Reel; Pb – Free, Halogen-Free



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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 _{CC}	DC Supply Voltage (V _{cc} to Ground)	40	V
V _{IN}	OP Amp 1 and 2 Input Voltage (Pin 2, 5, 6)	-0.3~V _{cc} +0.3	V
V _{ID}	OP Amp 2 Input Differential Voltage (Pin 5, 6)	40	V
I _K	Voltage Reference Cathode Current (Pin 3)	100	mA
T _{STG}	Storage Temperature Range	-65 to 150	°C
T _{LEAD}	Lead Soldering Temperature for 5 sec.	260	°C
T _{ope}	Operation Temperature Range	-40 ~ 105	°C
P _D	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
SUPPLY						
V_{CC}	Supply Voltage		3		36	V
I_{CC}	Supply Current, excluding Current in Voltage Reference	$V_{CC} = 5\text{V}$, no load		0.15	0.25	mA
		$V_{CC} = 30\text{V}$, no Load		0.2	0.3	
VOLTAGE REFERENCE SECTION						
V_{REF}	Reference Voltage:SP435WAS8RGB	$I_{KA} = 10\text{ mA}$, $T_A = 25^{\circ}\text{C}$	2.49	2.5	2.51	V
V_{REF}	Reference Voltage:SP435WBS8RGB	$I_{KA} = 10\text{ mA}$, $T_A = 25^{\circ}\text{C}$	2.475	2.5	2.525	V
ΔV_{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	$V_{KA} = V_{REF}$		0.01	0.05	mA
$ Z_{KA} $	Dynamic Impedance	$V_{KA} = V_{REF}$, $I_{KA} = 1\text{mA}\sim 80\text{mA}$, $f < 1\text{KHz}$		0.2	0.5	Ω
OP AMP 1 SECTION ($V_{CC+} = 5\text{V}$, $V_O = 1.4\text{V}$)						
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	
αV_{IO}	Input Offset Voltage Temperature Drift	$T_A = -40^{\circ}\text{C}\sim 85^{\circ}\text{C}$		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	$V_{CC+} = 5\sim 30\text{V}$	70	90		dB
$I_{O(SINK)}$	Output Sink Current	$V_{CC} = 15\text{V}$, $V_{ID} = -1\text{V}$, $V_O = 2\text{V}$	7	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	$V_{CC} = 30\text{V}$, $V_{ID} = 1\text{V}$, $R_L = 10\text{K}\Omega$	27	28		V
V_{OL}	Output Voltage Swing Low	$V_{CC} = 30\text{V}$, $V_{ID} = -1\text{V}$, $R_L = 10\text{K}\Omega$		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	$V_{CC} = 30\text{V}$, $R_L = 2\text{K}\Omega$, $C_L = 100\text{ pF}$	0.7	1		MHz



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ELECTRICAL CHARACTERISTICS

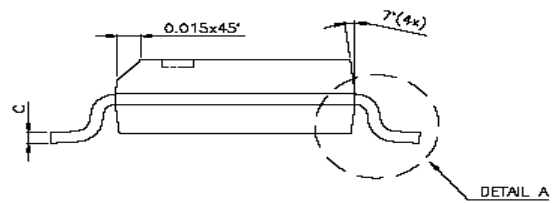
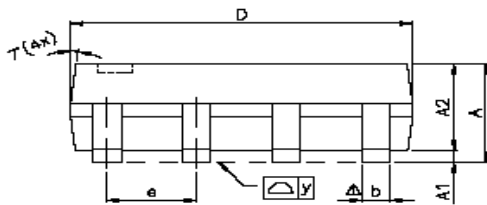
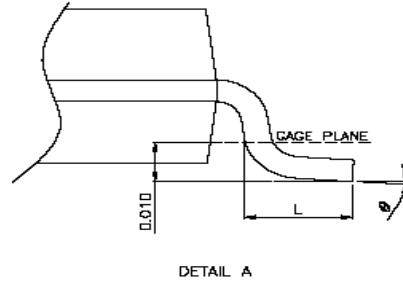
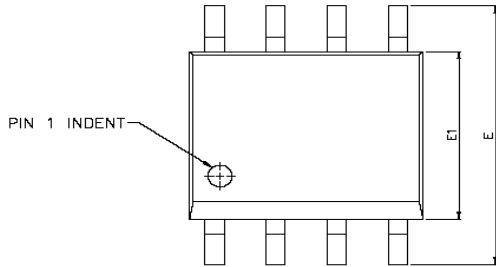
(Unless otherwise stated, these specifications apply TA=25°C; VCC=+5V)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
OP AMP 2 SECTION (V _{CC+} = 5V, V _O = 1.4V)						
V _{IO}	Input Offset Voltage	T _A = 25°C		0.5	3.0	mV
		T _A = -40°C~85°C			5.0	
α V _{IO}	Input Offset Voltage Temperature Drift	T _A = -40°C~85°C		7		μV/°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} = 0 to 36V	0		V _{CC} - 1.5	V
CMRR	Common Mode Rejection Ratio	T _A = 25°C, V _{CM} = 0~3.5V	70	85		dB
A _{VD}	Large Signal Voltage Gain	V _{CC} = 15V, R _L = 2KΩ, V _O = 1.4~11.4V	85	100		V/mV
K _{SVR}	Power Supply Rejection Ratio	V _{CC+} = 5~30V	70	90		dB
I _{O(SINK)}	Output Sink Current	V _{CC} = 15V, V _{ID} = -1V, V _O = 2V	7	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} = 30V, V _{ID} = 1V, R _L = 10KΩ	27	28		V
V _{OL}	Output Voltage Swing Low	V _{CC} = 30V, V _{ID} = -1V, R _L = 10KΩ		17	100	mV
SR	Slew Rate	V _{CC} = 18V, R _L = 2KΩ, V _I = 0.5~2V, C _L = 100 pF	0.2	0.5		V/μS
GBW	Gain Bandwidth Product	V _{CC} = 30V, R _L = 2KΩ, C _L = 100 pF,	0.7	1		MHz



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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
y	—	—	0.076	—	—	0.003
θ	0°	—	8°	0°	—	8°



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