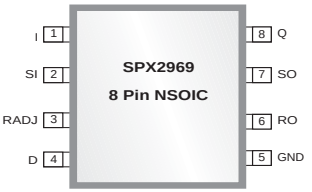
150mA Low Dropout Voltage Regulator

FEATURES

- 5V Fixed Output
- 150mA current capability
- 250mV Dropout
- Programmable Reset Threshold
- 250µA Quiescent Current
- Over Temperature Protection
- Reverse Polarity Protection
- Integrated Pull Up Resistor on Logic Outputs
- -40° to +125°C Operating Range



Available in Lead Free Packaging

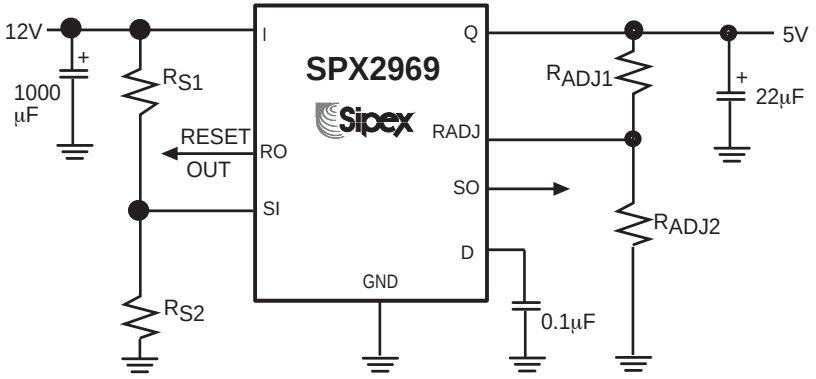
APPLICATIONS

- Automotive
- Industrial
- Wireless Base Station

DESCRIPTION

The SPX2969 is a low dropout linear regulator with integrated PNP pass transistor. This part is designed for high voltage applications, which can withstand up to 45V and 125°C. The output voltage is set at a fixed 5V, and the part is guaranteed to deliver at least 150mA. The SPX2969 provides multiple protection mechanisms, including over-temperature and over-current detection. The part has a built-in reset circuit to monitor when the output voltage is below 4.65V. The reset voltage threshold can be programmed down to 3.5V using an external resistor voltage divider, while the reset timing can be programmed via an external capacitor. A built in comparator compares the signal at the pin SI, normally fed by a voltage divider from the input voltage, with the reference and gives an early warning on the pin SO. Both the sense output and the reset output delay signals contain integrated 20kΩ pull up resistors. The part is available in an 8 Pin NSOIC package.

TYPICAL APPLICATION CIRCUIT



ABSOLUTE MAXIMUM RATINGS

Input Voltage ..... -40V to 45V
Input Current ..... internally limited
Sense Input Voltage ..... -40V to 45V
Sense Input Current ..... -1mA to 1mA
Reset Threshold Voltage ..... -0.3 to 7V
Reset Threshold Current ..... -10 to 10mA
Reset Delay Voltage ..... -0.3 to 7V
Reset Delay Current ..... internally limited
Ground Current ..... 50mA (min)
Reset Output Voltage ..... -0.3 to 7V
Reset Output Current ..... internally limited
Sense Output Voltage ..... -0.3 to 7V
Sense Output Current ..... internally limited

Output Voltage ..... -0.3 to 7V
Output Current ..... internally limited

Thermal Data
Junction to Ambient (8 Pin NSOIC) ..... 163°C/W
Junction to Pin 4, all GND Pins grounded ..... 30°C/W
Storage Temperature ..... -50°C to +150°C
Junction Temperature. (Note 1).....-40°C to +150°C

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

ELECTRICAL CHARACTERISTICS

V_{IN} = 13.5V; -40°C < T_J < 125°C. The ♦ denotes the specifications which apply over the full operating temperature range, unless otherwise specified.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS		CONDITIONS
Output Voltage	V_Q	4.90	5.00	5.10	V	♦	1mA < I_Q 100mA 6V < V_I < 16V
Current Limit	I_Q	150	250	500	mA	♦	
Current Consumption I_q= I_I- I_Q	I_q	-	240	300	µA		I_Q < 1 mA, Tj < 85°C
Current Consumption I_q= I_I- I_Q	I_q	-	250	700	µA	♦	I_Q = 10mA
Current Consumption I_q= I_I- I_Q	I_q	-	2	8	mA	♦	I_Q = 50mA
Dropout Voltage	V_{DR}	-	0.25	0.5	V	♦	I_Q = 100mA (Q - I) when output drops below 2% (see note 2)
Load Regulation	V_Q	-	2	20	mV	♦	I_Q = 5mA to 100mA
Line Regulation	V_Q	-	1	10	mV	♦	V_I = 6V to 26V I_Q = 1 mA
Reset Generator							
Threshold Voltage	V_{RT}	4.50	4.65	4.80	V	♦	
Reset Adjust	$V_{RADJ, TH}$	1.26	1.35	1.44	V	♦	V_Q = 3.5V (see note 3)
Reset Pullup	-	10	20	40	KΩ	♦	
Saturation Voltage	$V_{RO, SAT}$	-	0.1	0.4	V	♦	R_{intern}

Note 1: Specifications in the -40°C to 150°C range are guaranteed by design, not production tested.
Note 2: Dropout voltage = V_I - V_Q measured when the output voltage has dropped 100mV from the nominal value obtained at 13.5V input.
Note 3: The reset threshold V_{RT} can be decreased via an external voltage divider connected to the RADJ. In this case the reset condition is reached if V_Q < V_{RT} and V_{RADJ} < $V_{RADJ, TH}$. Dimensioning the voltage divider according to: $V_{THRES} = V_{RADJ, TH}$ X (R_{ADJ1} +R_{ADJ2})/R_{ADJ2}.

ELECTRICAL CHARACTERISTICS

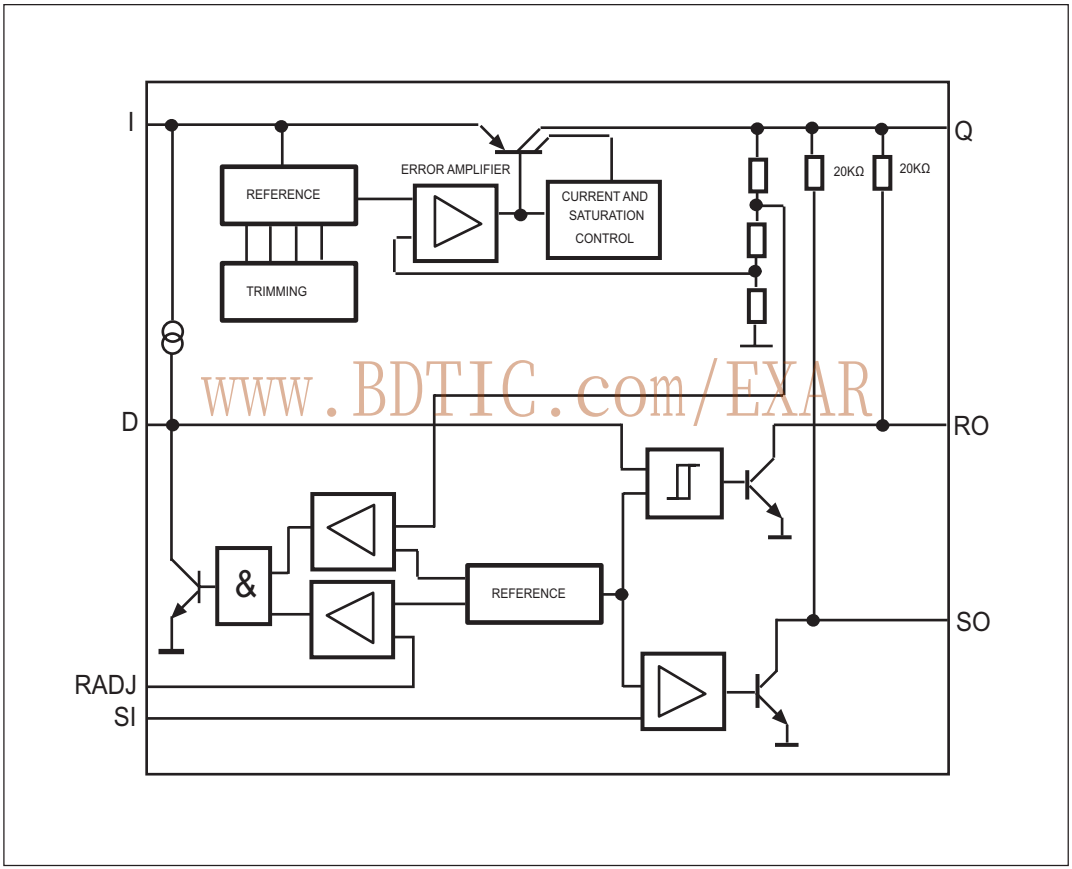
V_{IN} = 13.5V; -40°C < T_J < 125°C. The ♦ denotes the specifications which apply over the full operating temperature range, unless otherwise specified.

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS		CONDITIONS
Reset Generator							
Upper Delay Switching Threshold	V_{UD}	1.4	1.8	2.2	V	♦	
Lower Delay Switching Threshold	V_{LD}	0.3	0.45	0.60	V	♦	
Saturation Voltage Delay Capacitor	$V_{D, SAT}$	-	-	0.1	V	♦	$V_Q < V_{RT}$
Charge Current	I_D	3.0	6.5	9.5	µA	♦	V_D =1V
Delay Time L to H	t_D	17	28	-	ms	♦	C_D = 100nF
Delay Time H to L	t_t	-	1	-	µs	♦	C_D = 100nF
Input Voltage Sense							
Sense Threshold High	$V_{SI, high}$	1.25	1.33	1.36	V	♦	
Sense Threshold Low	$V_{SI, low}$	1.18	1.22	1.28	V	♦	
Sense Output low Voltage	$V_{SO, low}$	-	0.1	0.4	V	♦	V_{SI} < 1.20V V_Q > 3V R_{intern}
Sense Pull up	-	10	20	40	K	♦	
Sense Input Current	i_{si}	-1	0.1	1	µA	♦	
Sense Response Time	-		2		µs	♦	

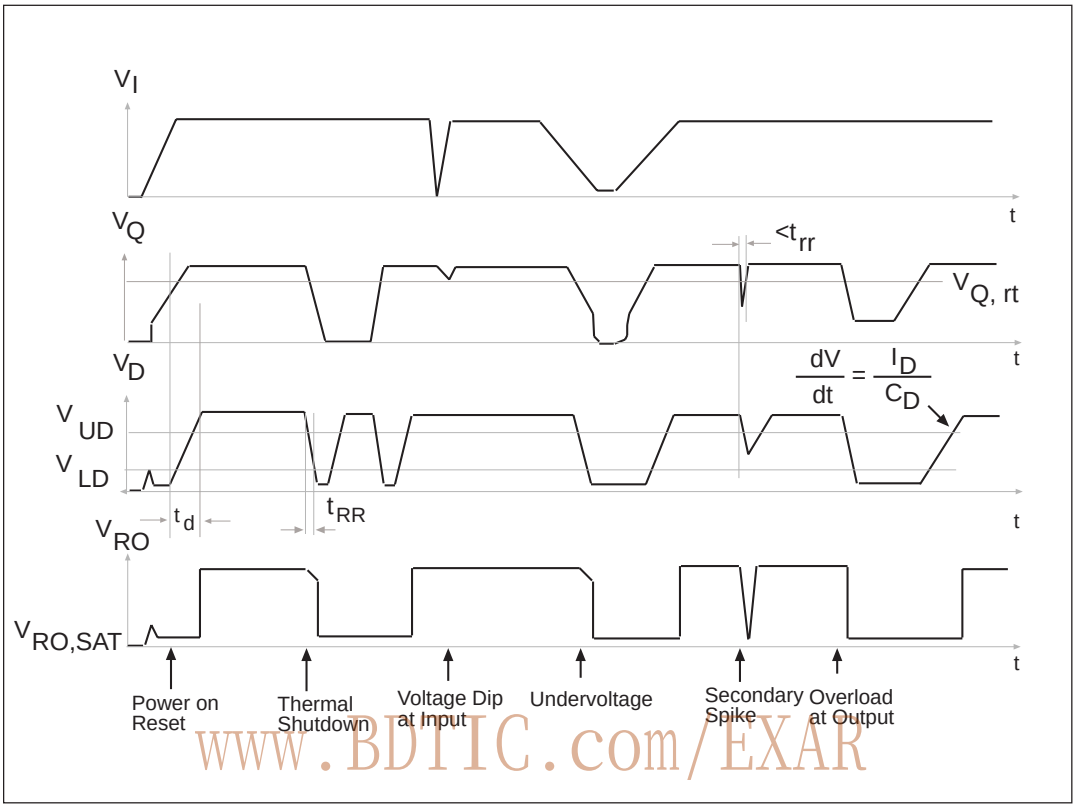
APPLICATIONS INFORMATION

The input capacitor C_I is necessary for compensating line influences. Using a resistor of approximately 1Ω in series with C_I, the oscillating circuit consisting of input inductance and input capacitance can be damped. The output capacitor C_Q is necessary for the stability of the regulating circuit. Stability is guaranteed at values ≥ 10µF and at an ESR ≤ 10Ω within the operating temperature range. The delay pin capacitor's variation and temperature coefficient may cause a small difference in the reset delay.

BLOCK DIAGRAM

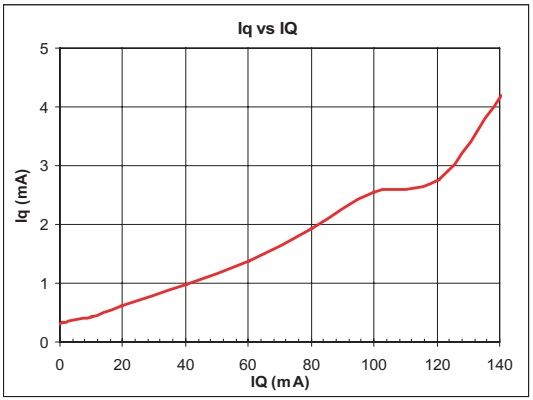


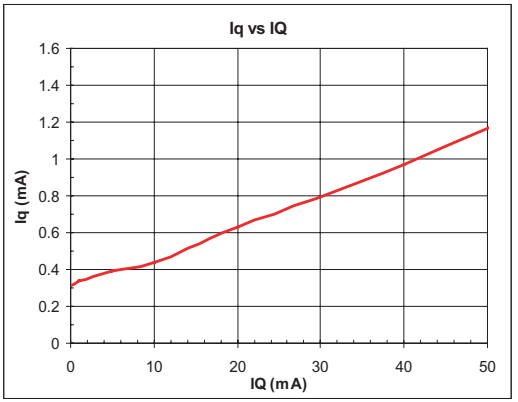
RESET TIMING DIAGRAM

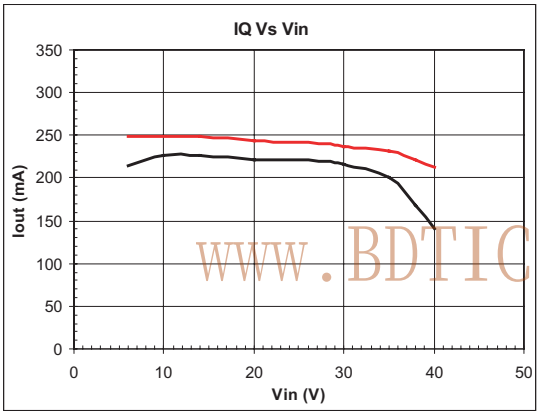


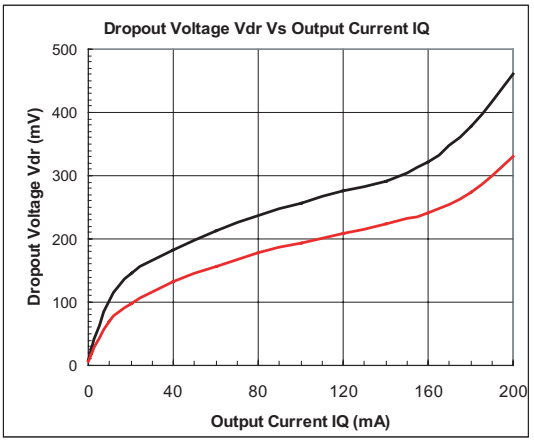
PIN DESCRIPTION

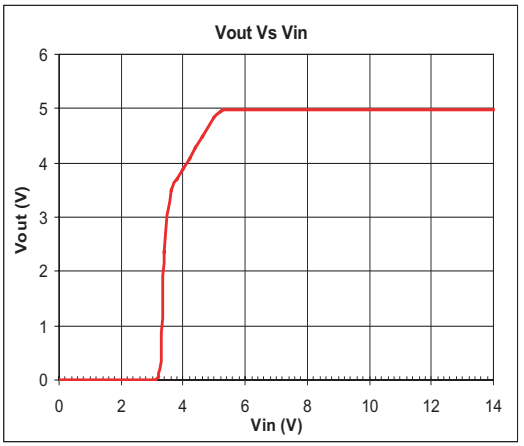
PIN NUMBER	PIN NAME	DESCRIPTION (8 PIN NSOIC)
1	V_{IN}	Input. Decouple to GND with a Ceramic capacitor.
2	SENSE IN	Sense Input. If not needed, connect to Q.
3	R_{ADJ}	Reset Threshold Adj. If not needed, connect to GND.
4	DELAY	Reset Delay. To select delay time, connect to GND via capacitor.
5	GND	Ground
6	RESET	Reset Output. The open-collector output is internally linked to Q via a resistor. Leave open if not needed.
7	SENSE OUT	Sense Output. The open-collector output is internally linked to Q via a resistor. Leave open if not needed.
8	V_{OUT}	5V Output. Connect to GND with a 10µF capacitor, ESR<10.





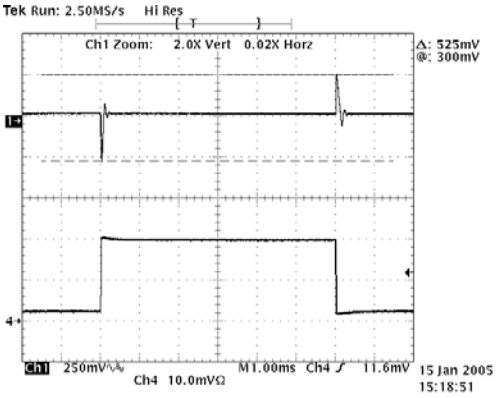




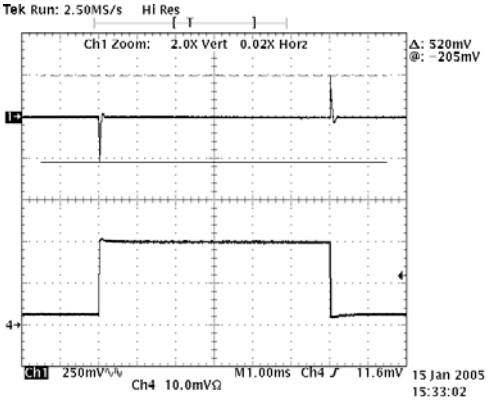


Red: T_J = 125˚C; Black:T_J = 125˚C

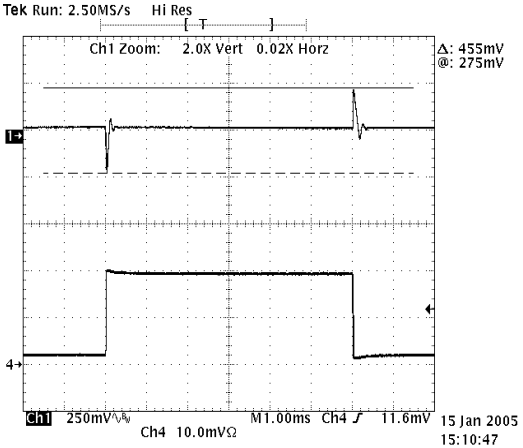
RL = 50 Ohms



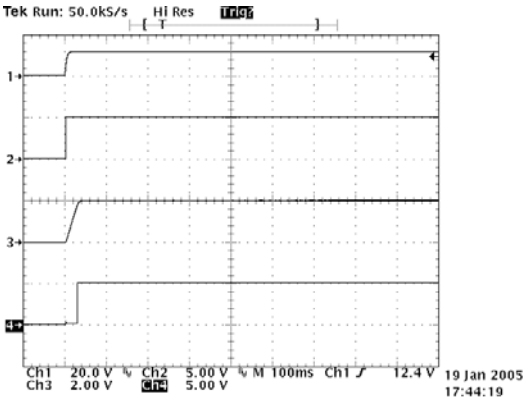
Load Transient Response:
Vin = 13.5V 25˚C, 10 uF Ceramic,
Ch1 = Vout, Ch2 = Iout (100mA/div)



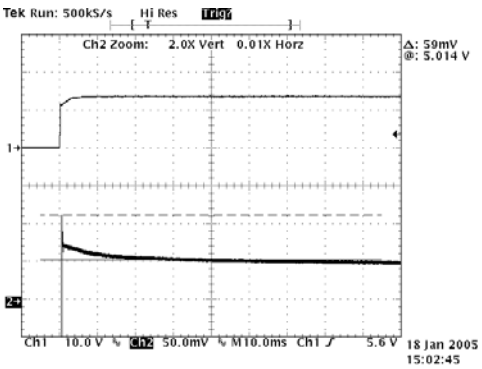
Load Transient Response:
Vin = 13.5V 25˚C, 10 uF Aluminum,
Ch1 = Vout, Ch2 = Iout (100mA/div)



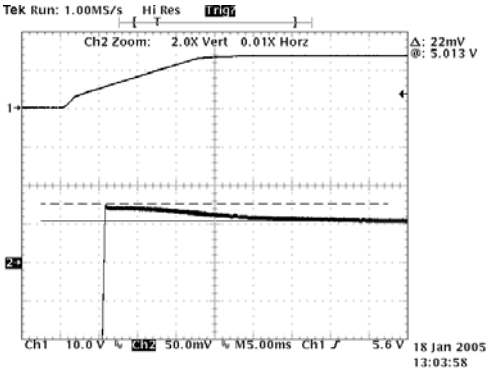
Load Transient Response:
Vin = 13.5V 25C, 10 uF Tantalum, Ch1 = Vout, Ch2 = Iout (100mA/div)



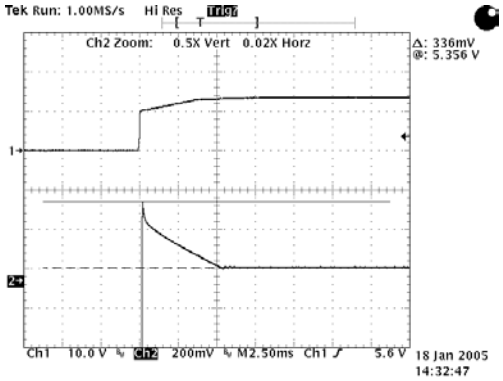
Reset Output Startup:
CH1=Vin, CH2=Vout
CH3=VD, CH4=VRO



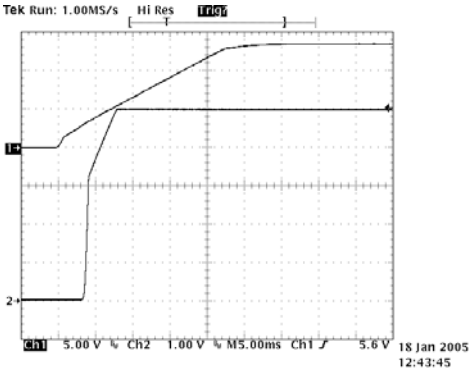
Fast Start up,:
Vin=13.5V, 200mA Load, 85˚C,
Ch1 = Vin, Ch2 = Vout



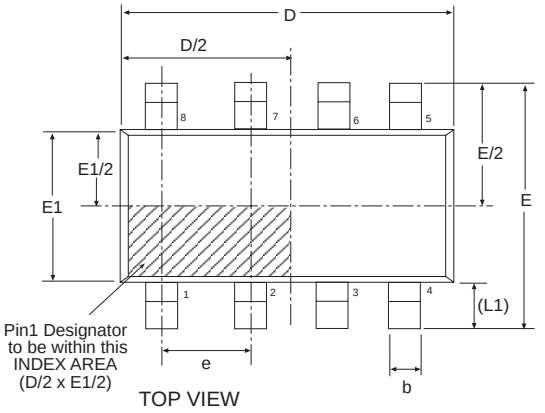
Slow Start up:
Vin=13.5V, 200mA Load, 25˚C,
Ch1 = Vin, Ch2 = Vout

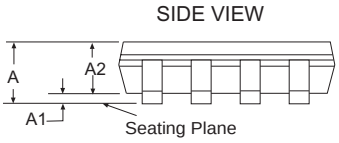


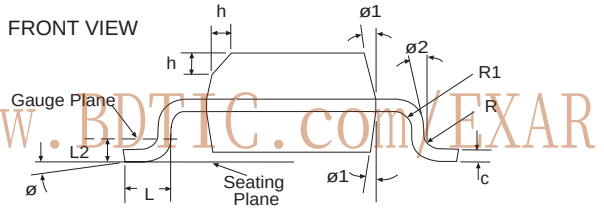
Fast Start up:
Vin=13.5V, No Load, 25˚C,
Ch1 = Vin, Ch2 = Vout



Slow Start up:
Vin=13.5V, 200mA Load, 25˚C,
Ch1 = Vin, Ch2 = Vout







8 Pin NSOIC		JEDEC MS-012		Variation AA		
SYMBOL	Dimensions in Millimeters: Controlling Dimension			Dimensions in Inches Conversion Factor: 1 Inch = 25.40 mm		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	-	1.75	0.053	-	0.069
A1	0.10	-	0.25	0.004	-	0.010
A2	1.25	-	1.65	0.049	-	0.065
b	0.31	-	0.51	0.012	-	0.020
c	0.17	-	0.25	0.007	-	0.010
E	6.00 BSC			0.236 BSC		
E1	3.90 BSC			0.154 BSC		
e	1.27 BSC			0.050 BSC		
h	0.25		0.50	0.010	-	0.020
L	0.40	-	1.27	0.016	-	0.050
L1	1.04 REF			0.041 REF		
L2	0.25 BSC			0.010 BSC		
R	0.07	-	-	0.003	-	-
R1	0.07	-	-	0.003	-	-
ø	0º	-	8º	0º	-	8º
ø1	5º	-	15º	5º	-	15º
ø2	0º	-	-	0º	-	-
D	4.90 BSC			0.193 BSC		
SIPEX Pkg Signoff Date/Rev:				JL Aug16-05 / Rev A		

ORDERING INFORMATION

Part number	Output Voltage	Package Type
SPX2969CS	5.0V	8 Pin NSOIC
SPX2969CS/TR	5.0V	8 Pin NSOIC

Available in lead free packaging. To order add "-L" suffix to part number.
Example: SPX2969CS/TR = standard; SPX2969CS-L/TR = lead free

/TR = Tape and Reel
Pack quantity is 2,500 for NSOIC.

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Sipex
Corporation
ANALOG EXCELLENCE

Sipex Corporation

Headquarters and
Sales Office
233 South Hillview Drive
Milpitas, CA 95035
TEL: (408) 934-7500
FAX: (408) 935-7600