Low Power Low Offset Voltage Dual Comparators

Features

The LM2903 consists of two independent precision voltage comparators with an offset voltage specification as low as 2.0 mV max for two comparators which were designed specifically to operate from a single power supply over a wide range of voltages.

Application areas include limit comparators, simple analog to digital converters; pulse, squarewave and time delay generators; wide range VCO; MOS clock timers; multivibrators and high voltage digital logic gates.

D SUFFIX
TSSOP

D SUFFIX
SOIC

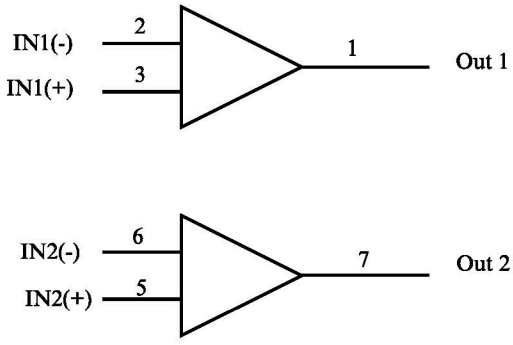
LM2903P TSSOP
LM2903D SOIC
T_A = -40° to 125° C for all packages.

- Single or Split Supply Operation
- Low Input Bias Current
- Low Input Offset Current
- Input Common Mode Voltage Range to Gnd
- Low Output Saturation Voltage
- TTL and CMOS Compatible

Applications

- Vacuum robot
- Single phase UPS
- Server PSU
- Cordless power tool
- Wireless infrastructure
- Applicances
- Building automation
- Factory automation & control
- Motor drives
- Infotainment & cluster

LOGIC DIAGRAM

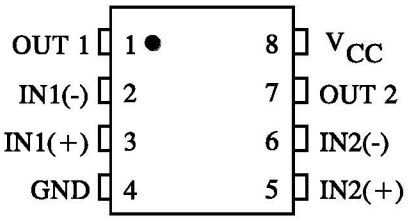


PIN 8 = V_{CC}
PIN 4 = GND

Ordering Information

Part Number	Package	Packing	Temperature（TA）	Package Qty	Note
LM2903DR	SOIC-8	Reel	-40°C ~ 125°C	2500	
LM2903PWR	TSSOP-8	Reel	-40°C ~ 125°C	2500	
LM2903AVQDR	SOIC-8	Reel	-40°C ~ 125°C	2500	
LM2903AVQPWR	TSSOP-8	Reel	-40°C ~ 125°C	2500	

PIN ASSIGNMENT



PIN			I/O	DESCRIPTION
NAME	SOIC	TSSOP		
1OUT	1	1	Output	Output pin of comparator 1
1IN–	2	2	Input	Negative input pin of comparator 1
1IN+	3	3	Input	Positive input pin of comparator 1
GND	4	4	—	Ground
2IN+	5	5	Input	Positive input pin of comparator 2
2IN-	6	6	Input	Negative input pin of comparator 2
2OUT	7	7	Output	Output pin of comparator 2
V_{CC}	8	8	—	Positive Supply

MAXIMUM RATINGS*

Symbol	Parameter	Value	Unit
V_{CC}	Power Supply Voltages Single Supply Split Supplies	 36 ±18	 V
V_{IDR}	Input Differential Voltage Range	36	V
V_{ICR}	Input Common Mode Voltage Range (1)	-0.3 to V_{CC}	V
I_{SC}	Output Short Circuit to Ground	Continuous	
I_{IN}	Input Current, per pin (2)	50	mA
T_J	Junction Temperature Plastic Packages	 150	 °C
Tstg	Storage Temperature	-65 to +150	°C
T_L	Lead Temperature, 1mm from Case for 10 Seconds	260	°C
P_D	Power Dissipation @T_A=25°C Plastic Package Derate above 25°C	 570 5.7	 mW mW/°C

* Stresses beyond 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-rated conditions for extended periods may affect device reliability.
Functional operation should be restricted to the Recommended Operating Conditions.
Notes:
1. Split Power Supplies.
2. V_{IN}<-0.3V. This input current will only exist when voltage at any of the input leads is driven negative.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V_{CC}	DC Supply Voltage	±2.5 or 5.0	±15 or 30	V
T_A	Operating Temperature, All Package Types For LM293	-40	+125	°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V_{IN} and V_{OUT} should be constrained to the range GND≤(V_{IN} or V_{OUT})≤V_{CC}.
Unused inputs must always be tied to an appropriate logic voltage level (e.g., either GND or V_{CC}). Unused outputs must be left open.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Guaranteed Limit			Unit
			Min	Typ	Max	
V_{IO}	Input Offset Voltage	V_O=1.4V V_{CC}=5.0-30V;R_S≤100Ω V_{ICR}=0V - (V_{CC}-1.5)V	-	2.0*	7.0	mV
I_{IB}	Input Bias Current	V_O=1.4V V_{CC}=5.0-30V V_{ICR}=0V - (V_{CC}-1.5)V	-	-25*	-400	nA
I_{IO}	Input Offset Current	V_O=1.4V V_{CC}=5.0-30V V_{ICR}=0V - (V_{CC}-1.5)V	-	50*	200	nA
V_{ICR}	Input Common Mode Voltage Range	V_{CC}=5.0-30V	0		V_{CC}-2.0V	V
I_{CC}	Supply Current	R_L=∞,V_{CC}=5.0 R_L=∞,V_{CC}=30V	- -	0.8*	1.0* 2.5*	mA
A_{VOL}	Voltage Gain	V_{CC}=15V, R_L=15KΩ	-	200*	-	V/mV
t_1	Large Signal Response Time	V_{IN}=TTL Logic Swing, V_{ref}=1.4V, V_{CC}=5.0V, R_L=5.1KΩ, V_{RL}=5.0V	-	300*	-	ns
t_2	Response Time (Note 6)	V_{CC}=5.0V, R_L=5.1KΩ, V_{RL}=5.0V	-	1.3*	-	μs
I_{sink}	Output Sink Current	V_I(-)=1.0V, V_I(+)=0V, V_0≤1.5V, V_{CC}=5.0V	6.0*	20*	-	mA
V_{sat}	Saturation Voltage	V_I(-)=1.0V, V_I(+)=0V, I_{sink}≤4.0mA, V_{CC}=5.0V	-	-	700	mV
I_{OL}	Output Leakage Current	V_I(+)=1.0V, V_I(-)=0V, V_0=5.0V V_0=30V		0.1*	 1000	nA
V_{IDR}	Differential Input Voltage Range	All V_{IN}≥GND or V-Supply (if used)			V_{CC}	V

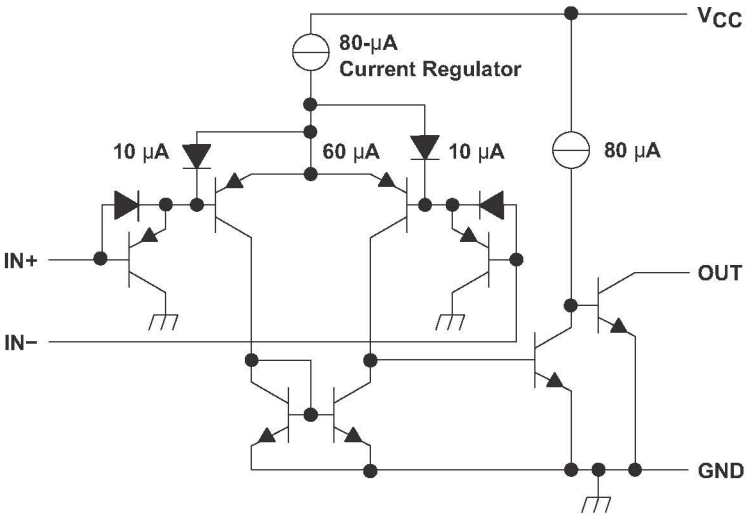
*=@25°C

(1) Full range (minimum or maximum) for LM2903 is –40°C to 125°C. All characteristics are measured with zero common-mode input voltage, unless otherwise specified.

(2) V_{CC} MAX = 30 V for non-V devices and 32 V for V-suffix devices,The LM2903AV.

(3) The voltage at either input should not be allowed to go negative by more than 0.3 V otherwise output may be incorrect and excessive input current can flow. The upper end of the common-mode voltage range is limited by VCC – 2V. However only one input needs to be in the valid common mode range, the other input can go up the maximum VCC level and the comparator provides a proper output state. Either or both inputs can go to maximum VCC level without damage.

Functional Block Diagram



COMPONENT COUNT	
Epi-FET	1
Diodes	2
Resistors	2
Transistors	30

Feature Description

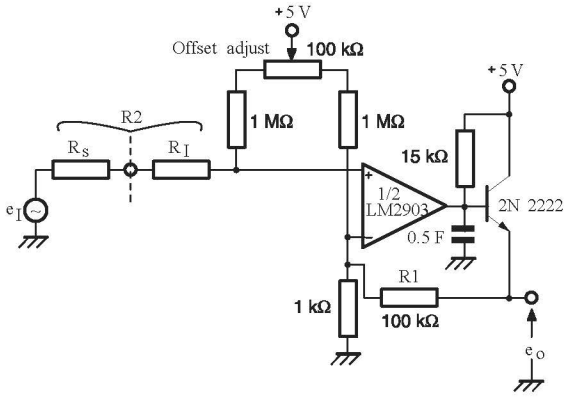
The comparator consists of a PNP darlington pair input, allowing the device to operate with very high gain and fast response with minimal input bias current. The input Darlington pair creates a limit on the input common mode voltage capability, allowing the comparator to accurately function from ground to V_{CC}– 1.5 V input. Allow for V_{CC}– 2 V at cold temperature.

The output consists of an open drain NPN (pull-down or low side) transistor. The output NPN sinks current when the negative input voltage is higher than the positive input voltage and the offset voltage. The V_{OL} is resistive and scales with the output current.

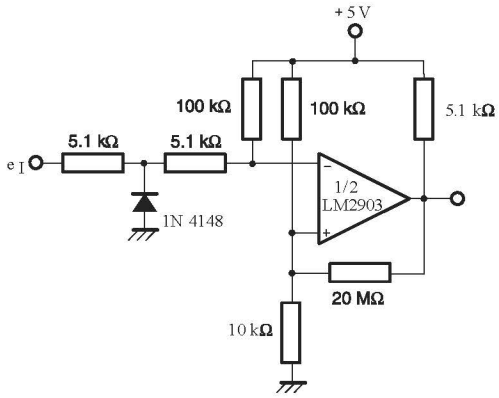
The device operates solely as a voltage comparator, comparing the differential voltage between the positive and negative pins and outputting a logic low or high impedance (logic high with pullup) based on the input differential polarity.

Typical Application

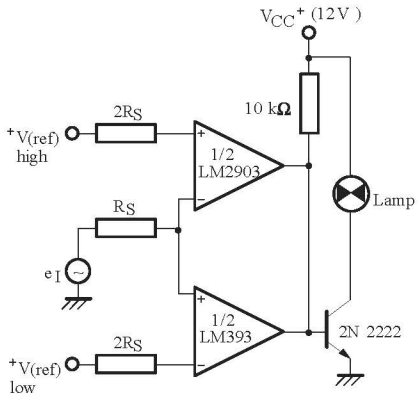
Low-frequency op amp with offset adjust



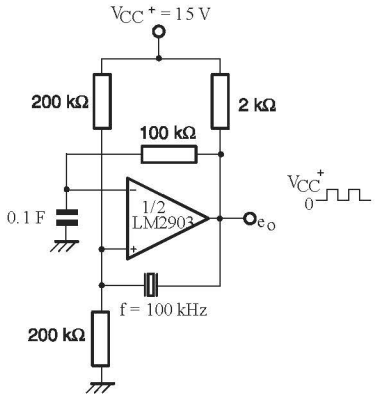
Zero crossing detector (single power supply)



Limit comparator



Crystal controlled comparator



TYPICAL PERFORMANCE CHARACTERISTICS

(V_{CC}=1.5V, T_A=+25°C, (each comporator))

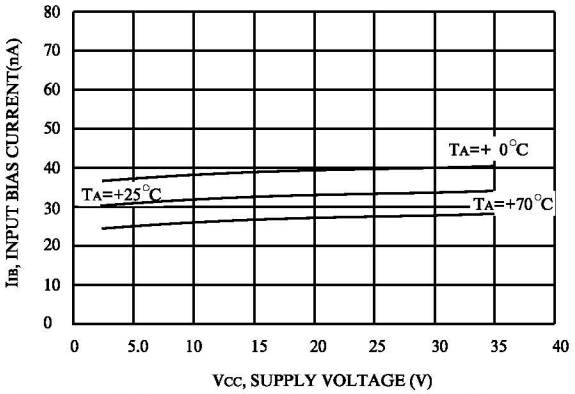


Figure 1. Input Bias Current versus Power Supply Voltage

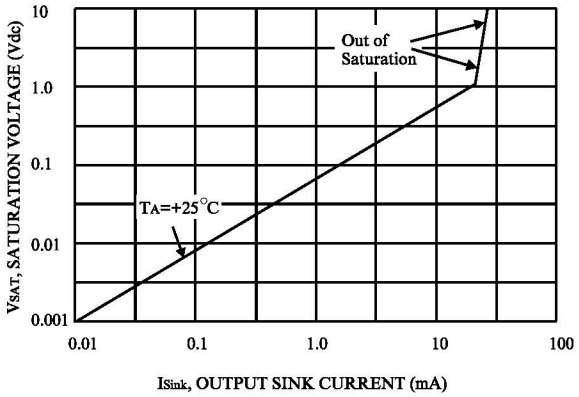


Figure 2. Output Saturation Voltage versus Output Sink Current

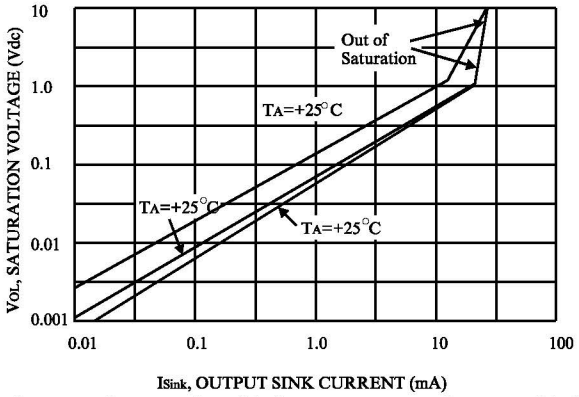


Figure 3. Output Saturation Voltage versus Output Sink Current

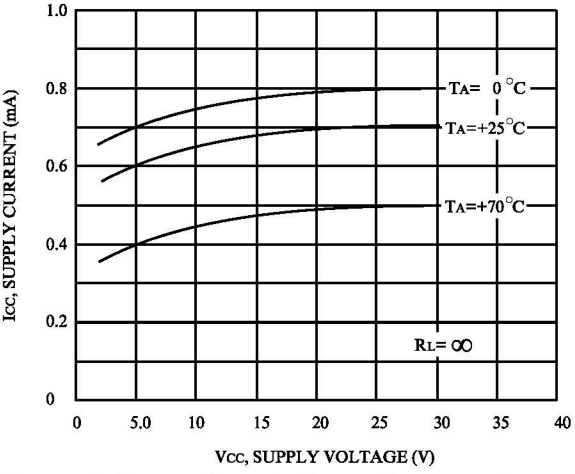


Figure 4. Power Supply Current versus Power Supply Voltage

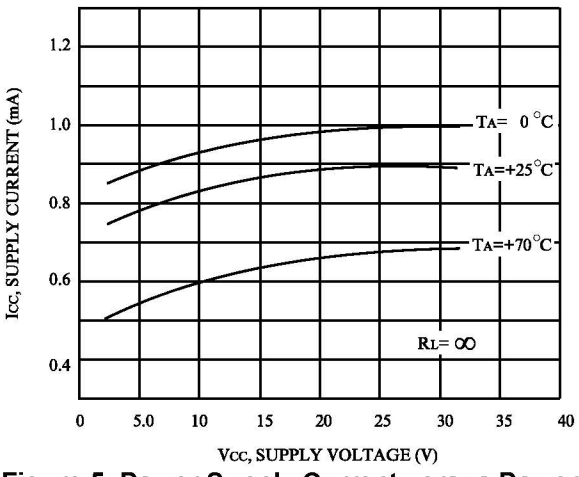
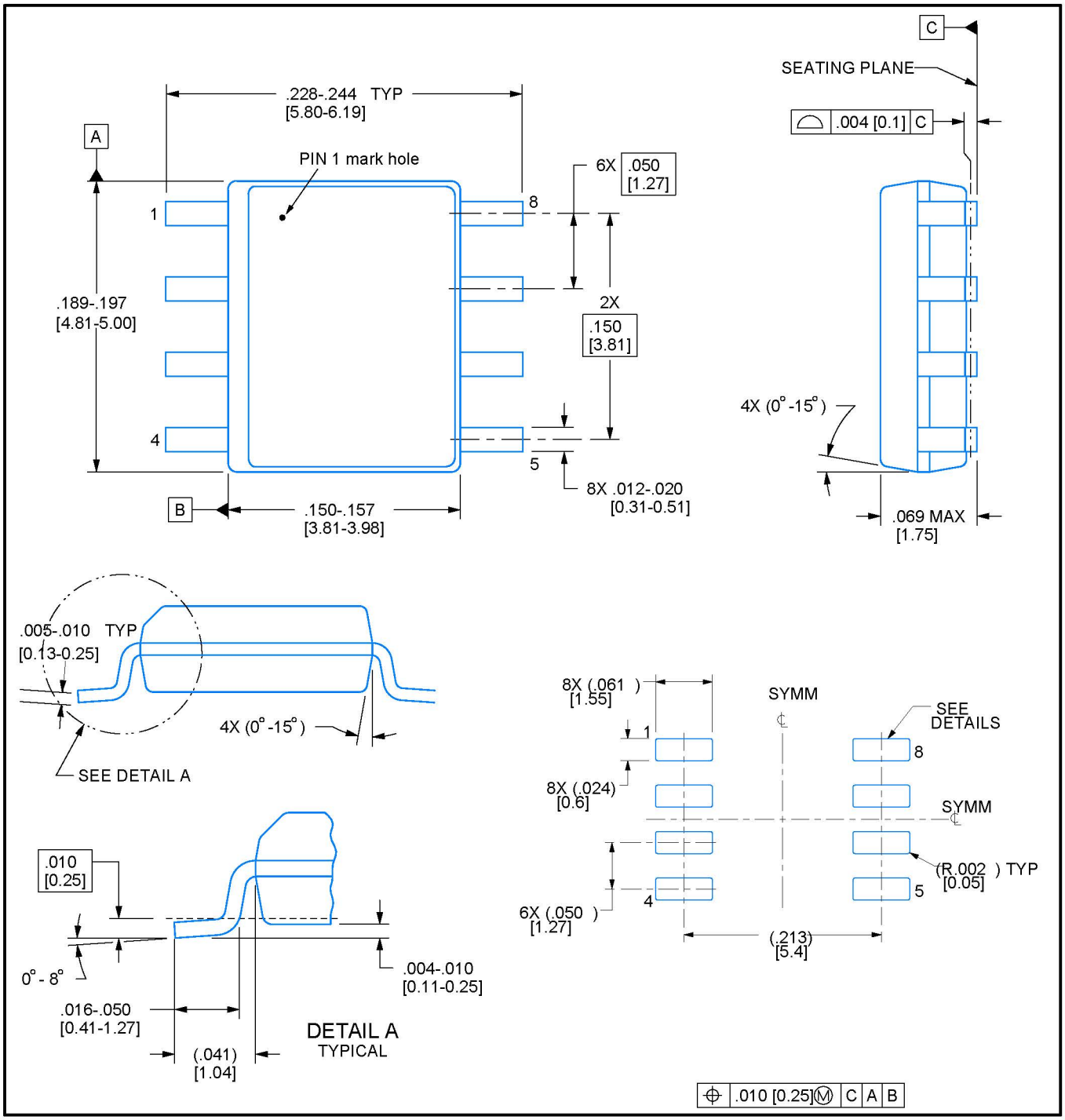


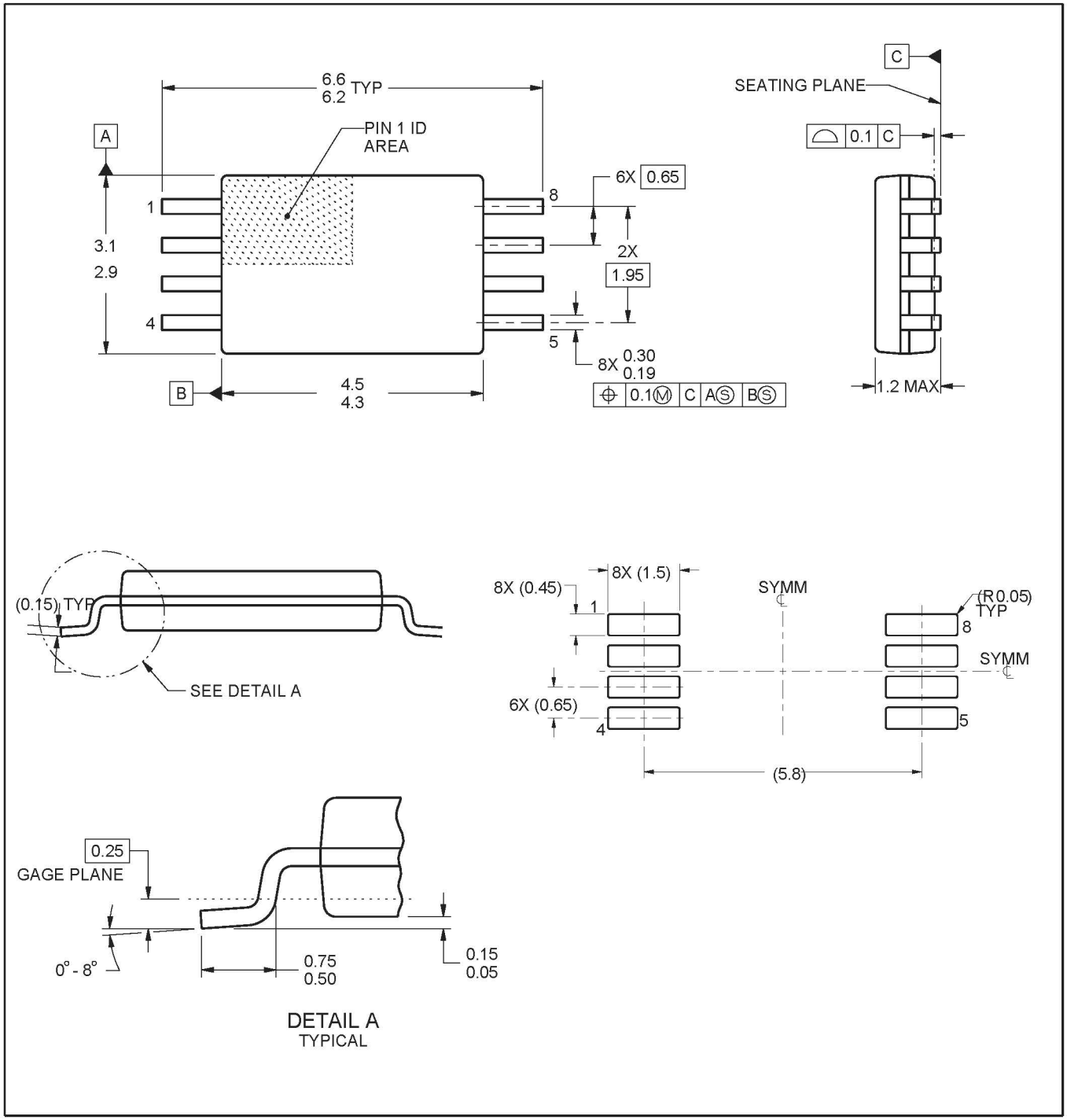
Figure 5. Power Supply Current versus Power Supply Voltage

PACKAGE OUTLINE SOIC - 8,1.75 mm max height



NOTES: Linear dimensions are in inches [millimeters]. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.

PACKAGE OUTLINE TSSOP -8, 1.2 mm max height



NOTES: All linear dimensions are in millimeters.This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.

This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.