

General Description

The MAX6340/MAX6421-MAX6426 low-power microprocessor supervisor circuits monitor system voltages from 1.6V to 5V. These devices perform a single function: they assert a reset signal whenever the VCC supply voltage falls below its reset threshold. The reset output remains asserted for the reset timeout period after V_{CC} rises above the reset threshold. The reset timeout is externally set by a capacitor to provide more flexibility.

The MAX6421/MAX6424 have an active-low, pushpull reset output. The MAX6422 has an active-high, push-pull reset output and the MAX6340/MAX6423/ MAX6425/MAX6426 have an active-low, open-drain reset output. The MAX6421/MAX6422/MAX6423 are offered in 4-pin SC70 or SOT143 packages. The MAX6340/MAX6424/MAX6425/MAX6426 are available in 5-pin SOT23-5 packages.

Applications

Portable Equipment

Battery-Powered Computers/Controllers

Automotive

Medical Equipment

Intelligent Instruments

Embedded Controllers

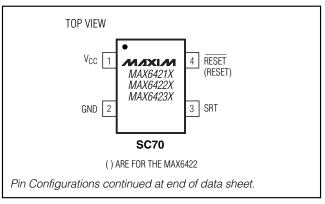
Critical µP Monitoring

Set-Top Boxes

Computers

Typical Operating Circuit appears at end of data sheet.

Pin Configurations



Features

- ♦ Monitor System Voltages from 1.6V to 5V
- ♦ Capacitor-Adjustable Reset Timeout Period
- ♦ Low Quiescent Current (1.6µA typ)
- **♦ Three RESET Output Options** Push-Pull RESET **Push-Pull RESET Open-Drain RESET**
- ♦ Guaranteed Reset Valid to V_{CC} = 1V
- ♦ Immune to Short V_{CC} Transients
- ♦ Small 4-Pin SC70, 4-Pin SOT143, and 5-Pin SOT23 **Packages**
- **♦ MAX6340 Pin Compatible with LP3470**
- ♦ MAX6424/MAX6425 Pin Compatible with NCP300-NCP303, MC33464/MC33465, S807/S808/S809, and RN5VD
- ♦ MAX6426 Pin Compatible with PST92XX

Ordering Information

PART	TEMP RANGE	PIN-PACKAGE
MAX6340UKT	-40°C to +125°C	5 SOT23-5
MAX6421XST	-40°C to +125°C	4 SC70-4
MAX6421UST	-40°C to +125°C	4 SOT143-4
MAX6422XST	-40°C to +125°C	4 SC70-4
MAX6422UST	-40°C to +125°C	4 SOT143-4
MAX6423XST	-40°C to +125°C	4 SC70-4
MAX6423UST	-40°C to +125°C	4 SOT143-4
MAX6424UKT	-40°C to +125°C	5 SOT23-5
MAX6425UKT	-40°C to +125°C	5 SOT23-5
MAX6426UKT	-40°C to +125°C	5 SOT23-5

Note: The MAX6340/MAX6421-MAX6426 are available with factory-trimmed reset thresholds from 1.575V to 5.0V in approximately 0.1V increments. Insert the desired nominal reset threshold suffix (from Table 1) into the blanks. There are 50 standard versions with a required order increment of 2500 pieces. Sample stock is generally held on standard versions only (see Standard Versions Table). Required order increment is 10,000 pieces for nonstandard versions. Contact factory for availability. All devices are available in tape-and-reel only.

Devices are available in both leaded and lead-free packaging. Specify lead-free by replacing "-T" with "+T" when ordering.

Selector Guide appears at end of data sheet.

Maxim Integrated Products 1

ABSOLUTE MAXIMUM RATINGS

All Voltages Referenced to GND	
V _C C	0.3V to +6.0V
SRT, RESET, RESET (push-pull)	0.3V to (V _{CC} + 0.3V)
RESET (open drain)	0.3V to +6.0V
Input Current (all pins)	±20mA
Output Current (RESET, RESET)	±20mA

Continuous Power Dissipation ($T_A = +70^{\circ}C$)	
4-Pin SC70 (derate 3.1mW/°C above +70°C)	245mW
4-Pin SOT143 (derate 4mW/°C above +70°C).	320mW
5-Pin SOT23 (derate 7.1mW/°C above +70°C)	571mW
Operating Temperature Range	40°C to +125°C
Storage Temperature Range	65°C to +150°C
Junction Temperature	+150°C
Lead Temperature (soldering, 10s)	+300°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 in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

 $(V_{CC} = 1V \text{ to } 5.5V, T_A = T_{MIN} \text{ to } T_{MAX}, \text{ unless otherwise specified. Typical values are at } V_{CC} = 5V \text{ and } T_A = +25^{\circ}C.)$ (Note 1)

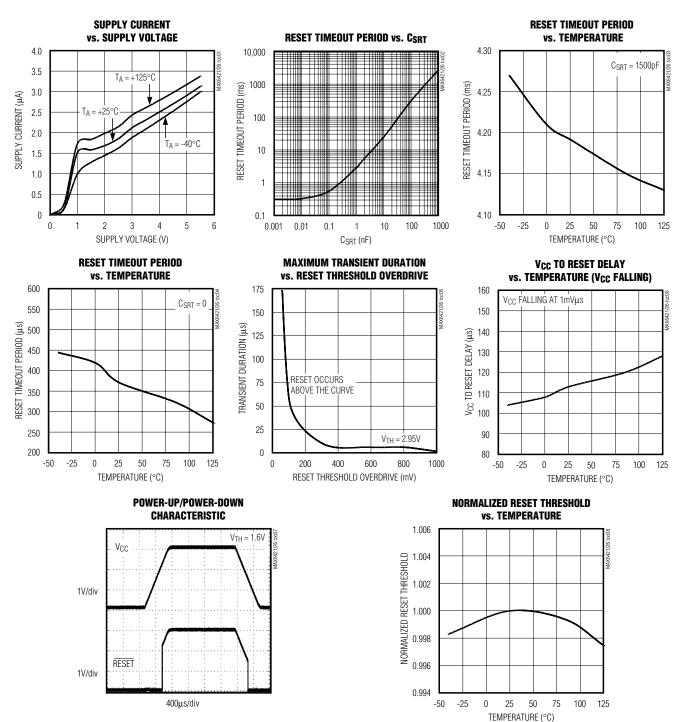
PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Supply Voltage Range	Vcc		1.0		5.5	V	
Supply Current		V _{CC} ≤ 5.0V		2.5	4.2		
	Icc	V _{CC} ≤ 3.3V 1.9			3.4	μΑ	
		V _{CC} ≤ 2.0V		1.6	2.5		
Vac Doost Throshold Acquirequ	\/	$T_A = +25^{\circ}C$ $V_{TH} - 1.5\%$ $V_{TH} + 1.$		_H + 1.5%	V		
V _{CC} Reset Threshold Accuracy	V _{TH}	$T_A = -40$ °C to $+125$ °C	V _{TH} - 2.5%	V _{TH} - 2.5% V _{TH} + 2.5%			
Hysteresis	V _H YST			4 x V _{TH}		mV	
V _{CC} to Reset Delay	t _{RD}	V _{CC} falling at 1mV/µs		80		μs	
Reset Timeout Period	ton	C _{SRT} = 1500pF	3.00	4.375	5.75		
neset Tillleout Fellou	t _{RP}	Csrt = 0		0.275		ms	
V _{SRT} Ramp Current	I _{RAMP}	$V_{SRT} = 0$ to 0.65V; $V_{CC} = 1.6V$ to 5V		240		nA	
V _{SRT} Ramp Threshold	V _{TH-RAMP}	$V_{CC} = 1.6V \text{ to 5V } (V_{RAMP} \text{ rising})$		0.65		V	
RAMP Threshold Hysteresis		V _{RAMP} falling threshold		33		mV	
		$V_{CC} \ge 1.0V$, $I_{SINK} = 50\mu A$		0.3			
RESET Output Voltage Low	V _{OL}	V _{CC} ≥ 2.7V, I _{SINK} = 1.2mA			0.3	V	
		V _{CC} ≥ 4.5V, I _{SINK} = 3.2mA			0.4		
DECET O	Voh	V _{CC} ≥ 1.8V, I _{SOURCE} = 200μA	0.8 x V _C C	0.8 x V _{CC}		V	
RESET Output Voltage High, Push-Pull		V _{CC} ≥ 2.25V, I _{SOURCE} = 500µA	0.8 x V _C C	0.8 x V _{CC}			
i usii-i uii		V _{CC} ≥ 4.5V, I _{SOURCE} = 800µA	0.8 x V _{CC}				
RESET Output Leakage Current, Open-Drain	I _{LKG}	V _{CC} > V _{TH} , reset not asserted			1.0	μΑ	
	Vон	V _{CC} ≥ 1.0V, I _{SOURCE} = 1µA	0.8 x V _{CC}	0.8 x V _{CC}		V	
RESET Output Voltage High		V _{CC} ≥ 1.8V, I _{SOURCE} = 150µA					
		V _{CC} ≥ 2.7V, I _{SOURCE} = 500µA	0.8 x V _C C	0.8 x V _{CC} 0.8 x V _{CC}			
		V _{CC} ≥ 4.5V, I _{SOURCE} = 800µA	0.8 x V _{CC}				
		V _{CC} ≥ 1.8V, I _{SINK} = 500µA		0.3			
RESET Output Voltage Low	VoL	V _{CC} ≥ 2.7V, I _{SINK} = 1.2mA		0.3		V	
		V _{CC} ≥ 4.5V, I _{SINK} = 3.2mA			0.4		

Note 1: Devices production tested at +25°C. Overtemperature limits are guaranteed by design.

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Typical Operating Characteristics

($V_{CC} = 5V$, $C_{SRT} = 1500$ pF, $T_A = +25$ °C, unless otherwise noted.)



Pin Description

PIN							
MAX6340	MAX6 MAX6	422	MAX6424 MAX6425	MAX6426	NAME	FUNCTION	
SOT23	SOT143	SC70	SOT23	SOT23			
1	3	3	5	1	SRT	Set Reset Timeout Input. Connect a capacitor between SRT and ground to set the timeout period. Determine the period as follows: $t_{RP}=2.73\times10^6\times C_{SRT}+275\mu s$ with t_{RP} in seconds and t_{SRT} in farads.	
2	1	2	3	2, 3	GND	Ground	
3	_	_	4	_	N.C.	Not Internally Connected. Can be connected to GND.	
4	2	1	2	5	V_{CC}	Supply Voltage and Reset Threshold Monitor Input	
5	4	4	1	4	RESET	RESET changes from high to low whenever V _{CC} drops below the selected reset threshold voltage. RESET remains low for the reset timeout period after V _{CC} exceeds the reset threshold.	
_	4	4	_	_	RESET	RESET changes from low to high whenever V _{CC} drops below the selected reset threshold voltage. RESET remains high for the reset timeout period after V _{CC} exceeds the reset threshold.	

Detailed Description

Reset Output

The reset output is typically connected to the reset input of a μP . A μP 's reset input starts or restarts the μP in a known state. The MAX6340/MAX6421-MAX6426 μP supervisory circuits provide the reset logic to prevent code-execution errors during power-up, power-down, and brownout conditions (see *Typical Operating Characteristics*).

RESET changes from high to low whenever V_{CC} drops below the threshold voltage. Once V_{CC} exceeds the threshold voltage, RESET remains low for the capacitor-adjustable reset timeout period.

The MAX6422 active-high RESET output is the inverse logic of the active-low $\overline{\text{RESET}}$ output. All device outputs are guaranteed valid for $V_{CC} > 1V$.

The MAX6340/MAX6423/MAX6425 are opendrain RESET outputs. Connect an external pullup resistor to any supply from 0 to 5.5V. Select a resistor value large enough to register a logic low when RESET is asserted and small enough to register a logic high while supplying all input current and leakage paths connected to the RESET line. A $10k\Omega$ to $100k\Omega$ pullup is sufficient in most applications.

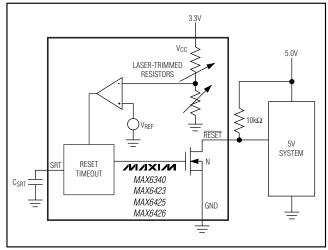


Figure 1. MAX6340/MAX6423/MAX6425/MAX6426 Open-Drain RESET Output Allows Use with Multiple Supplies

Selecting a Reset Capacitor

The reset timeout period is adjustable to accommodate a variety of μP applications. Adjust the reset timeout period (t_{RP}) by connecting a capacitor (C_{SRT}) between SRT and ground. Calculate the reset timeout capacitor as follows:

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 $C_{SRT} = (t_{RP} - 275\mu s) / (2.73 \times 10^6)$

where the is in seconds and CSRT is in farads.

The reset delay time is set by a current/capacitor-controlled ramp compared to an internal 0.65V reference. An internal 240nA ramp current source charges the external capacitor. The charge to the capacitor is cleared when a reset condition is detected. Once the reset condition is removed, the voltage on the capacitor ramps according to the formula: dV/dt = I/C. The CSRT capacitor must ramp to 0.65V to deassert the reset. CSRT must be a low-leakage (<10nA) type capacitor; ceramic is recommended.

Operating as a Voltage Detector

The MAX6340/MAX6421–MAX6426 can be operated in a voltage detector mode by floating the SRT pin. The reset delay times for VCC rising above or falling below the threshold are not significantly different. The reset output is deasserted smoothly without false pulses.

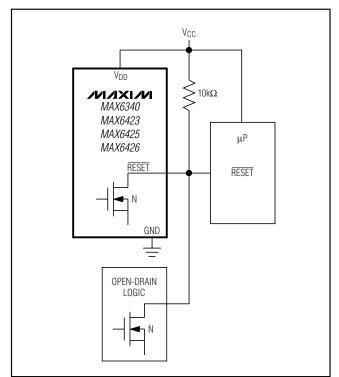


Figure 2. Wired-OR Reset Circuit

Applications Information

Interfacing to Other Voltages for Logic Compatibility

The open-drain outputs of the MAX6340/MAX6423/ MAX6425/MAX6426 can be used to interface to μ Ps with other logic levels. As shown in Figure 1, the open-drain output can be connected to voltages from 0 to 5.5V. This allows for easy logic compatibility to various μ Ps.

Wired-OR Reset

To allow auxiliary circuitry to hold the system in reset, an external open-drain logic signal can be connected to the open-drain $\overline{\text{RESET}}$ of the MAX6340/MAX6423/MAX6425/MAX6426, as shown in Figure 2. This configuration can reset the μP , but does not provide the reset timeout when the external logic signal is released.

Negative-Going Vcc Transients

In addition to issuing a reset to the μP during power-up, power-down, and brownout conditions, these supervisors are relatively immune to short-duration negative-going transients (glitches). The graph Maximum Transient Duration vs. Reset Threshold Overdrive in the *Typical Operating Characteristics* shows this relationship.

The area below the curve of the graph is the region in which these devices typically do not generate a reset pulse. This graph was generated using a negative-going pulse applied to V_{CC} , starting above the actual reset threshold (V_{TH}) and ending below it by the magnitude indicated (reset-threshold overdrive). As the magnitude of the transient decreases (farther below the reset threshold), the maximum allowable pulse width decreases. Typically, a V_{CC} transient that goes 100mV below the reset threshold and lasts 50µs or less does not cause a reset pulse to be issued.

Ensuring a Valid RESET or \overline{RESET} Down to VCC = 0

When V_{CC} falls below 1V, RESET/RESET current-sinking (sourcing) capabilities decline drastically. In the case of the MAX6421/MAX6424, high-impedance CMOS-logic inputs connected to RESET can drift to undetermined voltages. This presents no problems in most applications, since most μ Ps and other circuitry do not operate with V_{CC} below 1V.

In those applications where $\overline{\text{RESET}}$ must be valid down to zero, adding a pulldown resistor between $\overline{\text{RESET}}$ and ground sinks any stray leakage currents, holding $\overline{\text{RESET}}$ low (Figure 3). The value of the pulldown resistor is not critical; 100k Ω is large enough not to load $\overline{\text{RESET}}$ and small enough to pull $\overline{\text{RESET}}$ to ground. For applications using the MAX6422, a 100k Ω pullup resistance.

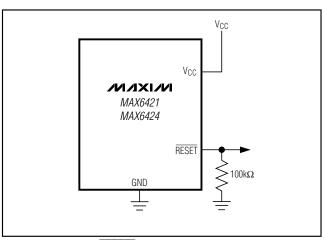


Figure 3. Ensuring \overline{RESET} Valid to $V_{CC} = 0$

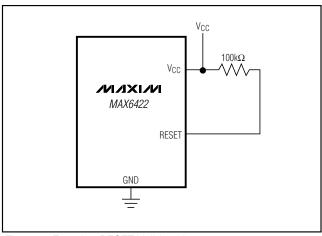


Figure 4. Ensuring RESET Valid to $V_{CC} = 0$

tor between RESET and V_{CC} holds RESET high when V_{CC} falls below 1V (Figure 4). Open-drain RESET versions are not recommended for applications requiring valid logic for V_{CC} down to zero.

Layout Consideration

SRT is a precise current source. When developing the layout for the application, be careful to minimize board capacitance and leakage currents around this pin. Traces connected to SRT should be kept as short as possible. Traces carrying high-speed digital signals and traces with large voltage potentials should be routed as far from SRT as possible. Leakage current and stray capacitance (e.g., a scope probe) at this pin could cause errors in the reset timeout period. When evaluating these parts, use clean prototype boards to ensure accurate reset periods.

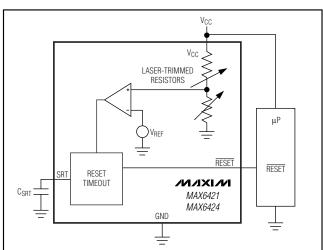
Table 1. Reset Threshold Voltage Suffix

- Labor 11 110001 111100110111 1011111190 01111111					
SUFFIX	MIN	TYP	MAX		
16	1.536	1.575	1.614		
17	1.623	1.665	1.707		
18	1.755	1.800	1.845		
19	1.853	1.900	1.948		
20	1.950	2.000	2.050		
21	2.048	2.100	2.153		
22	2.133	2.188	2.243		
23	2.313	2.313	2.371		
24	2.340	2.400	2.460		
25	2.438	2.500	2.563		
26	2.559	2.625	2.691		
27	2.633	2.700	2.768		
28	2.730	2.800	2.870		
29	2.852	2.925	2.998		
30	2.925	3.000	3.075		
31	2.998	3.075	3.152		
32	3.120	3.200	3.280		
33	3.218	3.300	3.383		
34	3.315	3.400	3.485		
35	3.413	3.500	3.558		
36	3.510	3.600	3.690		
37	3.608	3.700	3.793		
38	3.705	3.800	3.895		
39	3.803	3.900	3.998		
40	3.900	4.000	4.100		
41	3.998	4.100	4.203		
42	4.095	4.200	4.305		
43	4.193	4.300	4.408		
44	4.266	4.375	4.484		
45	4.388	4.500	4.613		
46	4.509	4.625	4.741		
47	4.583	4.700	4.818		
48	4.680	4.800	4.920		
49	4.778	4.900	5.023		
50	4.875	5.000	5.125		
	*	•	•		

Standard Versions Table

PART*	OUTPUT STAGE	TOP MARK
MAX6340UK16-T	Open-Drain RESET	AEBE
MAX6340UK22-T	Open-Drain RESET	AEBG
MAX6340UK26-T	Open-Drain RESET	AEBI
MAX6340UK29-T	Open-Drain RESET	AEBJ
MAX6340UK46-T	Open-Drain RESET	AEBM
MAX6421US16-T	Push-Pull RESET	KADA
MAX6421XS16-T	Push-Pull RESET	ACU
MAX6421US22-T	Push-Pull RESET	KADE
MAX6421XS22-T	Push-Pull RESET	ACY
MAX6421US26-T	Push-Pull RESET	KADG
MAX6421XS26-T	Push-Pull RESET	ADA
MAX6421US29-T	Push-Pull RESET	KADH
MAX6421XS29-T	Push-Pull RESET	ADB
MAX6421US46-T	Push-Pull RESET	KADK
MAX6421XS46-T	Push-Pull RESET	ADE
MAX6422US16-T	Push-Pull RESET	KADB
MAX6422XS16-T	Push-Pull RESET	ACV
MAX6422US22-T	Push-Pull RESET	KADM
MAX6422XS22-T	Push-Pull RESET	ADG
MAX6422US26-T	Push-Pull RESET	KADO
MAX6422XS26-T	Push-Pull RESET	ADI
MAX6422US29-T	Push-Pull RESET	KADP
MAX6422XS29-T	Push-Pull RESET	ADJ
MAX6422US46-T	Push-Pull RESET	KADS
MAX6422XS46-T	Push-Pull RESET	ADM

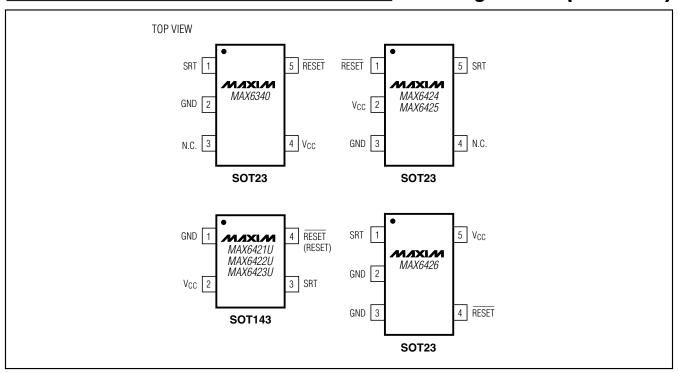
Typical Operating Circuit



PART* **OUTPUT STAGE TOP MARK** Open-Drain RESET **KADC** MAX6423US16-T Open-Drain RESET **ACW** MAX6423XS16-T Open-Drain RESET KADU MAX6423US22-T MAX6423XS22-T Open-Drain RESET ADO MAX6423US26-T Open-Drain RESET KADW MAX6423XS26-T Open-Drain RESET ADQ MAX6423US29-T Open-Drain RESET **KADX** MAX6423XS29-T Open-Drain RESET ADR Open-Drain RESET MAX6423US46-T **KAEA** MAX6423XS46-T Open-Drain RESET ADU MAX6424UK16-T Push-Pull RESET **ADUF** MAX6424UK22-T Push-Pull RESET **ADUK** MAX6424UK26-T Push-Pull RESET **ADUM** Push-Pull RESET **ADUN** MAX6424UK29-T MAX6424UK46-T Push-Pull RESET **ADUQ** Open-Drain RESET MAX6425UK16-T **ADUG** MAX6425UK22-T Open-Drain RESET **ADUS** Open-Drain RESET **ADUU** MAX6425UK26-T MAX6425UK29-T Open-Drain RESET **ADUV** MAX6425UK46-T Open-Drain RESET **ADUY** MAX6426UK16-T Open-Drain RESET **ADUH** MAX6426UK22-T Open-Drain RESET ADVA Open-Drain RESET MAX6426UK26-T **ADVC** MAX6426UK29-T Open-Drain RESET **ADVD** MAX6426UK46-T Open-Drain RESET **ADVG**

^{*}Sample stock is generally held on all standard versions. Contact factory for availability of nonstandard versions.

Pin Configurations (continued)



Selector Guide

PART	PUSH-PULL RESET	PUSH-PULL RESET	OPEN-DRAIN RESET	PIN-PACKAGE
MAX6340			✓	5 SOT23
MAX6421	✓	_	_	4 SOT143/SC70
MAX6422	_	✓	_	4 SOT143/SC70
MAX6423			✓	4 SOT143/SC70
MAX6424	V	_	_	5 SOT23
MAX6425	_	_	✓	5 SOT23

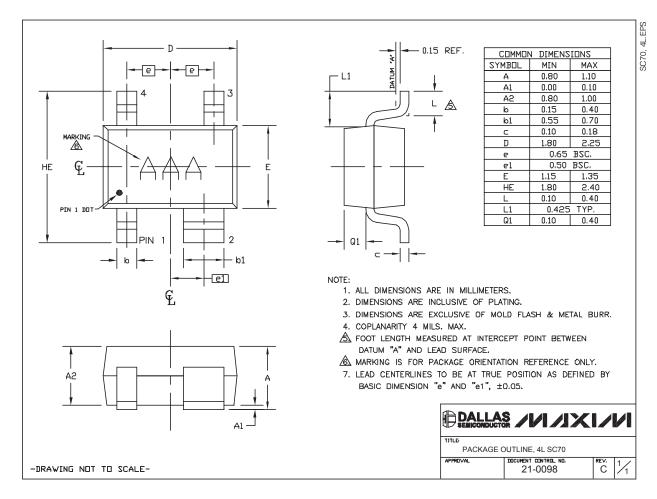
Chip Information

TRANSISTOR COUNT: 295
PROCESS: BICMOS

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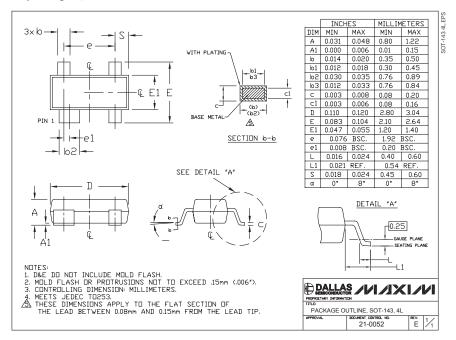
Package Information

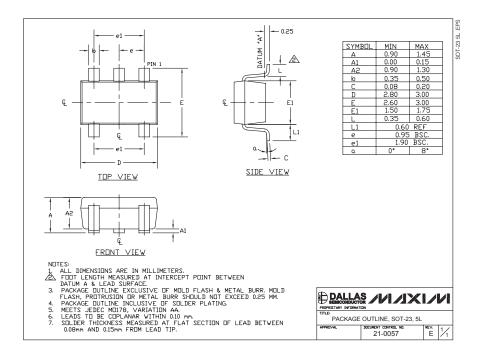
(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/packages**.)



Package Information (continued)

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