



# Open-Drain SOT $\mu$ P Reset Circuit

MAX6315

## General Description

## Features

The MAX6315 low-power CMOS microprocessor ( $\mu$ P) supervisory circuit is designed to monitor power supplies in  $\mu$ P and digital systems. It provides excellent circuit reliability and low cost by eliminating external components and adjustments. The MAX6315 also provides a debounced manual reset input.

This device performs a single function: it asserts a reset signal whenever the  $V_{CC}$  supply voltage falls below a preset threshold or whenever manual reset is asserted. Reset remains asserted for an internally programmed interval (reset timeout period) after  $V_{CC}$  has risen above the reset threshold or manual reset is deasserted. The MAX6315's open-drain  $\overline{\text{RESET}}$  output can be pulled up to a voltage higher than  $V_{CC}$ .

The MAX6315 comes with factory-trimmed reset threshold voltages in 100mV increments from 2.5V to 5V. Preset timeout periods of 1ms, 20ms, 140ms, and 1120ms (minimum) are also available. The device comes in a SOT143 package.

For microcontrollers ( $\mu$ Cs) and  $\mu$ Ps with bidirectional reset pins, see the MAX6314 data sheet.

- ◆ **Small SOT143 Package**
- ◆ **Open-Drain  $\overline{\text{RESET}}$  Output Can Exceed  $V_{CC}$**
- ◆ **Precision, Factory-Set  $V_{CC}$  Reset Thresholds: 100mV Increments from 2.5V to 5V**
- ◆  **$\pm 1.8\%$  Reset Threshold Accuracy at  $T_A = +25^\circ\text{C}$**
- ◆  **$\pm 2.5\%$  Reset Threshold Accuracy Over Temp.**
- ◆ **Four Reset Timeout Periods Available: 1ms, 20ms, 140ms, or 1120ms (minimum)**
- ◆ **Immune to Short  $V_{CC}$  Transients**
- ◆ **5 $\mu$ A Supply Current**
- ◆ **Pin-Compatible with MAX811**

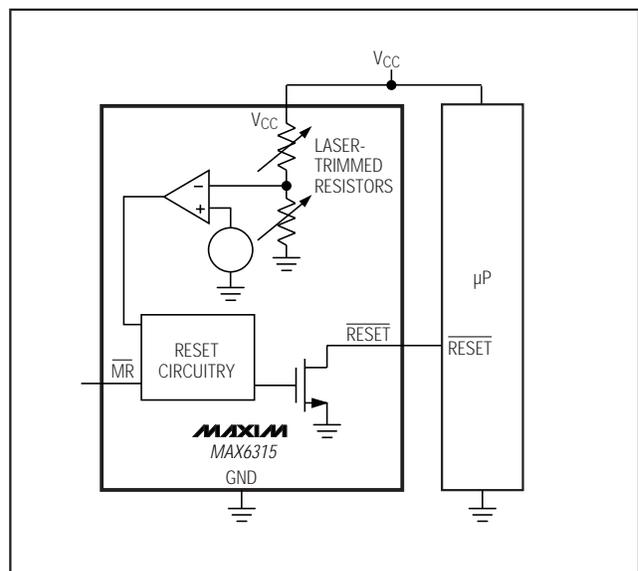
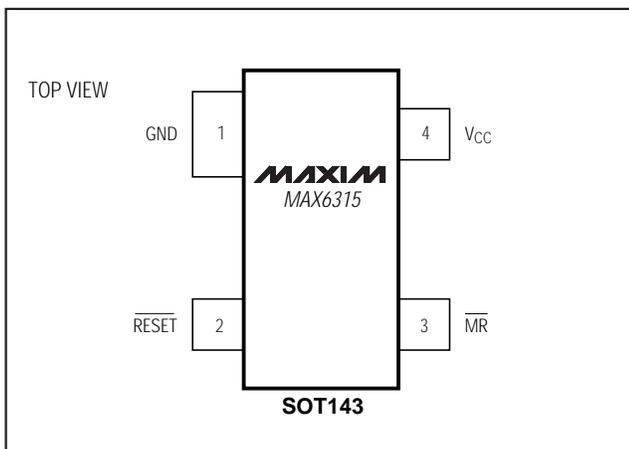
## Applications

*Ordering and Marking Information appear at end of data sheet.*

- Computers
- Controllers
- Intelligent Instruments
- Critical  $\mu$ P and  $\mu$ C Power Monitoring
- Portable/Battery-Powered Equipment

## Pin Configuration

## Typical Operating Circuit



# Open-Drain SOT $\mu$ P Reset Circuit

## ABSOLUTE MAXIMUM RATINGS

$V_{CC}$ .....	-0.3V to +6.0V	Continuous Power Dissipation ( $T_A = +70^\circ\text{C}$ )	
RESET.....	-0.3V to +6.0V	SOT143 (derate 4mW/ $^\circ\text{C}$ above +70 $^\circ\text{C}$ ).....	320mW
All Other Pins.....	-0.3V to ( $V_{CC} + 0.3\text{V}$ )	Operating Temperature Range .....	-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$
Input Current ( $V_{CC}$ ).....	20mA	Storage Temperature Range .....	-65 $^\circ\text{C}$ to +160 $^\circ\text{C}$
Output Current (RESET).....	20mA	Lead Temperature (soldering, 10sec) .....	+300 $^\circ\text{C}$
Rate of Rise ( $V_{CC}$ ).....	100V/ $\mu\text{s}$		

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

( $V_{CC} = +2.5\text{V}$  to +5.5V,  $T_A = -40^\circ\text{C}$  to +85 $^\circ\text{C}$ , unless otherwise noted. Typical values are at  $T_A = +25^\circ\text{C}$ .)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Operating Voltage Range	$V_{CC}$	$T_A = -40^\circ\text{C}$ to +85 $^\circ\text{C}$	1.0		5.5	V
$V_{CC}$ Supply Current	$I_{CC}$	$V_{CC} = 5.5\text{V}$ , no load		5	12	$\mu\text{A}$
		$V_{CC} = 3.6\text{V}$ , no load		4	10	
Reset Threshold (Note 1)	$V_{TH}$	$T_A = +25^\circ\text{C}$	$V_{TH} - 1.8\%$	$V_{TH}$	$V_{TH} + 1.8\%$	V
		$T_A = -40^\circ\text{C}$ to +85 $^\circ\text{C}$	$V_{TH} - 2.5\%$		$V_{TH} + 2.5\%$	
Reset Threshold Tempco	$\Delta V_{TH}/^\circ\text{C}$			60		ppm/ $^\circ\text{C}$
$V_{CC}$ to Reset Delay		$V_{CC}$ = falling at 1mV/ $\mu\text{s}$		35		$\mu\text{s}$
Reset Timeout Period	$t_{RP}$	MAX6315US_ _D1-T	1	1.4	2	ms
		MAX6315US_ _D2-T	20	28	40	
		MAX6315US_ _D3-T	140	200	280	
		MAX6315US_ _D4-T	1120	1570	2240	
<b>MANUAL RESET INPUT</b>						
MR Input Threshold	$V_{IL}$	$V_{TH} > 4.0\text{V}$	0.8		V	
	$V_{IH}$		2.4			
	$V_{IL}$	$V_{TH} < 4.0\text{V}$	0.3 x $V_{CC}$			
	$V_{IH}$		0.7 x $V_{CC}$			
MR Minimum Input Pulse			1		$\mu\text{s}$	
MR Glitch Rejection				100	ns	
MR to Reset Delay				500	ns	
MR Pull-Up Resistance			32	63	100	k $\Omega$
RESET Output Voltage	$V_{OL}$	$V_{CC} > 4.25\text{V}$ , $I_{SINK} = 3.2\text{mA}$			0.4	V
		$V_{CC} > 2.5\text{V}$ , $I_{SINK} = 1.2\text{mA}$			0.3	
		$V_{CC} > 1.2\text{V}$ , $I_{SINK} = 0.5\text{mA}$				
		$V_{CC} > 1.0\text{V}$ , $I_{SINK} = 80\mu\text{A}$			0.3	
RESET Output Leakage Current		$V_{CC} > V_{TH}$ , RESET deasserted			1	$\mu\text{A}$

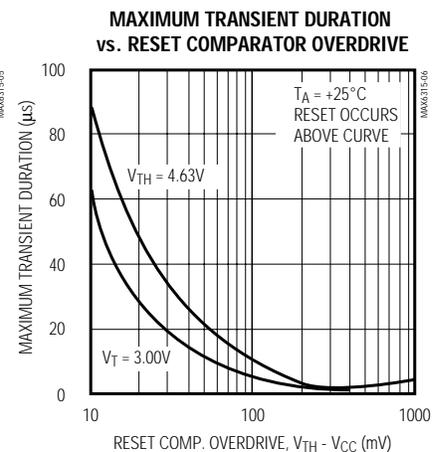
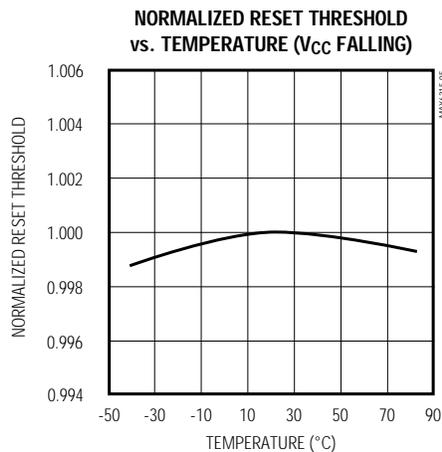
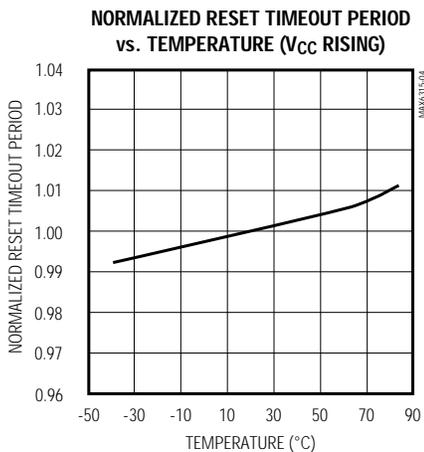
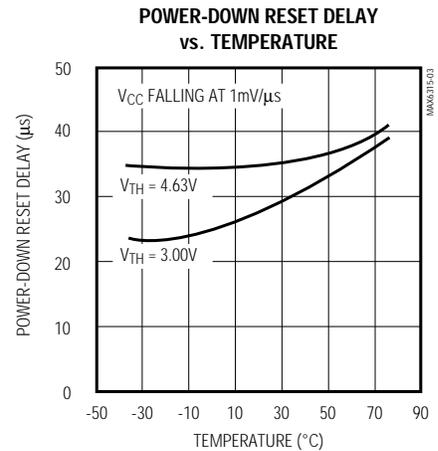
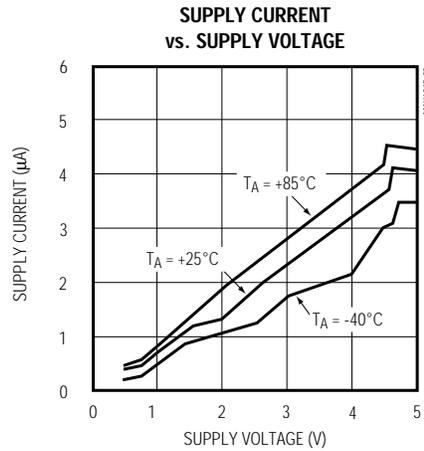
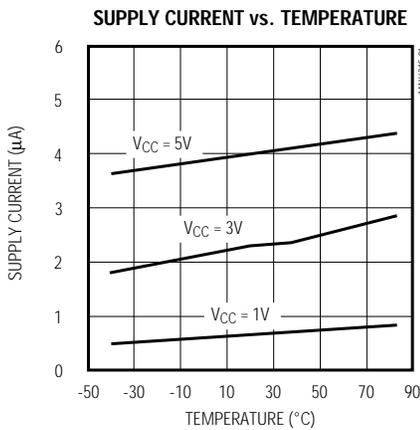
**Note 1:** The MAX6315 monitors  $V_{CC}$  through an internal factory-trimmed voltage divider that programs the nominal reset threshold. Factory-trimmed reset thresholds are available in 100mV increments from 2.5V to 5V (see *Ordering and Marking Information*).

# Open-Drain SOT $\mu$ P Reset Circuit

## Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

MAX6315



## Pin Description

PIN	NAME	FUNCTION
1	GND	Ground
2	$\overline{\text{RESET}}$	Active-Low Open-Drain Output. Connect to an external pull-up resistor. Can be pulled up to a voltage higher than $V_{CC}$ , but less than 6V.
3	$\overline{\text{MR}}$	Manual Reset Input. A logic low on $\overline{\text{MR}}$ asserts reset. Reset remains asserted as long as $\overline{\text{MR}}$ is low, and for the reset timeout period ( $t_{RP}$ ) after the reset conditions are terminated. Connect to $V_{CC}$ if not used.
4	$V_{CC}$	Supply Voltage and Reset Threshold Monitor Input

# Open-Drain SOT $\mu$ P Reset Circuit

## Detailed Description

### Reset Output

A microprocessor's ( $\mu$ P's) reset input starts the  $\mu$ P in a known state. The MAX6315 asserts reset to prevent code-execution errors during power-up, power-down, or brownout conditions.  $\overline{\text{RESET}}$  is guaranteed to be a logic low for  $V_{CC} > 1\text{V}$  (see *Electrical Characteristics*). Once  $V_{CC}$  exceeds the reset threshold, the internal timer keeps reset asserted for the reset timeout period ( $t_{RP}$ ); after this interval  $\overline{\text{RESET}}$  goes high. If a brownout condition occurs (monitored voltage dips below its programmed reset threshold),  $\overline{\text{RESET}}$  goes low. Any time  $V_{CC}$  dips below the reset threshold, the internal timer resets to zero and  $\overline{\text{RESET}}$  goes low. The internal timer starts when  $V_{CC}$  returns above the reset threshold, and  $\overline{\text{RESET}}$  remains low for the reset timeout period.

The MAX6315's  $\overline{\text{RESET}}$  output structure is a simple open-drain N-channel MOSFET switch. Connect a pull-up resistor to any supply in the 0V to +6V range. Select a resistor value large enough to register a logic low when  $\overline{\text{RESET}}$  is asserted (see *Electrical Characteristics*), and small enough to register a logic high while supplying all input current and leakage paths connected to the  $\overline{\text{RESET}}$  line. A 10k $\Omega$  pull-up is sufficient in most applications.

Often, the pull-up connected to the MAX6315's  $\overline{\text{RESET}}$  output will connect to the supply voltage monitored at the IC's  $V_{CC}$  pin. However, some systems may use the open-drain output to level-shift from the monitored supply to reset circuitry powered by some other supply (Figure 1). This is one useful feature of an open-drain output. Keep in mind that as the MAX6315's  $V_{CC}$  decreases below 1V, so does the IC's ability to sink current at  $\overline{\text{RESET}}$ . Finally, with any pull-up,  $\overline{\text{RESET}}$  will be pulled high as  $V_{CC}$  decays toward 0V. The voltage where this occurs depends on the pull-up resistor value and the voltage to which it connects (see *Electrical Characteristics*).

### Manual-Reset Input

Many  $\mu$ P-based products require manual-reset capability, allowing the operator, a test technician, or external logic circuitry to initiate a reset. A logic low on  $\overline{\text{MR}}$  asserts reset. Reset remains asserted while  $\overline{\text{MR}}$  is low, and for the reset active timeout period after  $\overline{\text{MR}}$  returns high.

$\overline{\text{MR}}$  has an internal 63k $\Omega$  pull-up resistor, so it can be left open if not used. Connect a normally open momentary switch from  $\overline{\text{MR}}$  to GND to create a manual reset function; external debounce circuitry is not required.

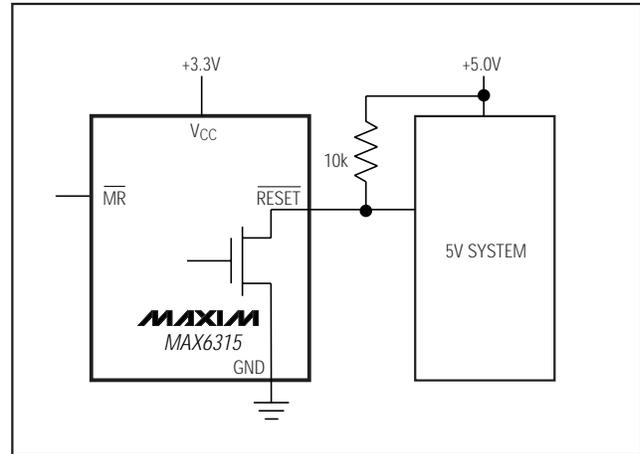


Figure 1. MAX6315 Open-Drain  $\overline{\text{RESET}}$  Output Allows Use with Multiple Supplies

If  $\overline{\text{MR}}$  is driven from long cables or if the device is used in a noisy environment, connecting a 0.1 $\mu$ F capacitor from  $\overline{\text{MR}}$  to ground provides additional noise immunity.

## Applications Information

### Negative-Going $V_{CC}$ Transients

In addition to issuing a reset to the  $\mu$ P during power-up, power-down, and brownout conditions, these devices are relatively immune to short-duration negative-going transients (glitches). The *Typical Operating Characteristics* show the Maximum Transient Duration vs. Reset Threshold Overdrive, for which reset pulses are not generated. The graph was produced using negative-going pulses, starting at  $V_{RST\ max}$  and ending below the programmed reset threshold by the magnitude indicated (reset threshold overdrive). The graph shows the maximum pulse width that a negative-going  $V_{CC}$  transient may typically have without causing a reset pulse to be issued. As the transient amplitude increases (i.e., goes farther below the reset threshold), the maximum allowable pulse width decreases. A 0.1 $\mu$ F bypass capacitor mounted close to  $V_{CC}$  provides additional transient immunity.

# Open-Drain SOT $\mu$ P Reset Circuit

## Ordering Information

MAX6315

PART <sup>†</sup>	NOMINAL V <sub>TH</sub> (V)	MIN t <sub>RP</sub> (ms)	SOT TOP MARK <sup>††</sup>
MAX6315US50D1-T	5.00	1	FX_ _
MAX6315US49D1-T	4.90	1	FY_ _
MAX6315US48D1-T	4.80	1	FZ_ _
MAX6315US47D1-T	4.70	1	GA_ _
MAX6315US46D1-T	4.63	1	GB_ _
MAX6315US45D1-T	4.50	1	GC_ _
<b>MAX6315US44D1-T<sup>†††</sup></b>	4.39	1	GD_ _
MAX6315US43D1-T	4.30	1	GE_ _
MAX6315US42D1-T	4.20	1	GF_ _
MAX6315US41D1-T	4.10	1	GG_ _
MAX6315US40D1-T	4.00	1	GH_ _
MAX6315US39D1-T	3.90	1	GI_ _
MAX6315US38D1-T	3.80	1	GJ_ _
MAX6315US37D1-T	3.70	1	GK_ _
MAX6315US36D1-T	3.60	1	GL_ _
MAX6315US35D1-T	3.50	1	GM_ _
MAX6315US34D1-T	3.40	1	GN_ _
MAX6315US33D1-T	3.30	1	GO_ _
MAX6315US32D1-T	3.20	1	GP_ _
MAX6315US31D1-T	3.08	1	GQ_ _
MAX6315US30D1-T	3.00	1	GR_ _
MAX6315US29D1-T	2.93	1	GS_ _
MAX6315US28D1-T	2.80	1	GT_ _
MAX6315US27D1-T	2.70	1	GU_ _
<b>MAX6315US26D1-T<sup>†††</sup></b>	2.63	1	GV_ _
MAX6315US25D1-T	2.50	1	GW_ _

PART <sup>†</sup>	NOMINAL V <sub>TH</sub> (V)	MIN t <sub>RP</sub> (ms)	SOT TOP MARK <sup>††</sup>
MAX6315US50D2-T	5.00	20	GX_ _
MAX6315US49D2-T	4.90	20	GY_ _
MAX6315US48D2-T	4.80	20	GZ_ _
MAX6315US47D2-T	4.70	20	HA_ _
MAX6315US46D2-T	4.63	20	HB_ _
MAX6315US45D2-T	4.50	20	HC_ _
<b>MAX6315US44D2-T<sup>†††</sup></b>	4.39	20	HD_ _
MAX6315US43D2-T	4.30	20	HE_ _
MAX6315US42D2-T	4.20	20	HF_ _
MAX6315US41D2-T	4.10	20	HG_ _
MAX6315US40D2-T	4.00	20	HH_ _
MAX6315US39D2-T	3.90	20	HI_ _
MAX6315US38D2-T	3.80	20	HJ_ _
MAX6315US37D2-T	3.70	20	HK_ _
MAX6315US36D2-T	3.60	20	HL_ _
MAX6315US35D2-T	3.50	20	HM_ _
MAX6315US34D2-T	3.40	20	HN_ _
MAX6315US33D2-T	3.30	20	HO_ _
MAX6315US32D2-T	4.20	20	HP_ _
MAX6315US31D2-T	3.08	20	HO_ _
MAX6315US30D2-T	3.00	20	HR_ _
MAX6315US29D2-T	2.93	20	HS_ _
MAX6315US28D2-T	2.80	20	HT_ _
MAX6315US27D2-T	2.70	20	HU_ _
<b>MAX6315US26D2-T<sup>†††</sup></b>	2.63	20	HV_ _
MAX6315US25D2-T	2.50	20	HW_ _

<sup>†</sup>The MAX6315 is available in a SOT143 package, -40°C to +85°C temperature range.

<sup>††</sup>The first two letters in the package top mark identify the part, while the remaining two letters are the lot tracking code.

<sup>†††</sup>Sample stocks generally held on the bolded products; also, the bolded products have 2,500 piece minimum-order quantities. Non-bolded products have 10,000 piece minimum-order quantities. Contact factory for details.

**Note:** All devices available in tape-and-reel only. Contact factory for availability.

# Open-Drain SOT $\mu$ P Reset Circuit

MAX6315

## Ordering Information (continued)

PART <sup>†</sup>	NOMINAL V <sub>TH</sub> (V)	MIN t <sub>RP</sub> (ms)	SOT TOP MARK <sup>††</sup>
MAX6315US50D3-T	5.00	140	HX__
MAX6315US49D3-T	4.90	140	HY__
MAX6315US48D3-T	4.80	140	HZ__
MAX6315US47D3-T	4.70	140	IA__
<b>MAX6315US46D3-T<sup>†††</sup></b>	4.63	140	IB__
MAX6315US45D3-T	4.50	140	IC__
<b>MAX6315US44D3-T<sup>†††</sup></b>	4.39	140	ID__
MAX6315US43D3-T	4.30	140	IE__
MAX6315US42D3-T	4.20	140	IF__
MAX6315US41D3-T	4.10	140	IG__
MAX6315US40D3-T	4.00	140	IH__
MAX6315US39D3-T	3.90	140	II__
MAX6315US38D3-T	3.80	140	IJ__
MAX6315US37D3-T	3.70	140	IK__
MAX6315US36D3-T	3.60	140	IL__
MAX6315US35D3-T	3.50	140	IM__
MAX6315US34D3-T	3.40	140	IN__
MAX6315US33D3-T	3.30	140	IO__
MAX6315US32D3-T	3.20	140	IP__
<b>MAX6315US31D3-T<sup>†††</sup></b>	3.08	140	IQ__
MAX6315US30D3-T	3.00	140	IR__
<b>MAX6315US29D3-T<sup>†††</sup></b>	2.93	140	IS__
MAX6315US28D3-T	2.80	140	IT__
MAX6315US27D3-T	2.70	140	IU__
<b>MAX6315US26D3-T<sup>†††</sup></b>	2.63	140	IV__
MAX6315US25D3-T	2.50	140	IW__

PART <sup>†</sup>	NOMINAL V <sub>TH</sub> (V)	MIN t <sub>RP</sub> (ms)	SOT TOP MARK <sup>††</sup>
MAX6315US50D4-T	5.00	1120	IX__
MAX6315US49D4-T	4.90	1120	IY__
MAX6315US48D4-T	4.80	1120	IZ__
MAX6315US47D4-T	4.70	1120	JA__
MAX6315US46D4-T	4.63	1120	JB__
MAX6315US45D4-T	4.50	1120	JC__
<b>MAX6315US44D4-T<sup>†††</sup></b>	4.39	1120	JD__
MAX6315US43D4-T	4.30	1120	JE__
MAX6315US42D4-T	4.20	1120	JF__
MAX6315US41D4-T	4.10	1120	JG__
MAX6315US40D4-T	4.00	1120	JH__
MAX6315US39D4-T	3.90	1120	JI__
MAX6315US38D4-T	3.80	1120	JJ__
MAX6315US37D4-T	3.70	1120	JK__
MAX6315US36D4-T	3.60	1120	JL__
MAX6315US35D4-T	3.50	1120	JM__
MAX6315US34D4-T	3.40	1120	JN__
MAX6315US33D4-T	3.30	1120	JO__
MAX6315US32D4-T	3.20	1120	JP__
MAX6315US31D4-T	3.08	1120	JQ__
MAX6315US30D4-T	3.00	1120	JR__
MAX6315US29D4-T	2.93	1120	JS__
MAX6315US28D4-T	2.80	1120	JT__
MAX6315US27D4-T	2.70	1120	JU__
<b>MAX6315US26D4-T<sup>†††</sup></b>	2.63	1120	JV__
MAX6315US25D4-T	2.50	1120	JW__

<sup>†</sup>The MAX6315 is available in a SOT143 package, -40°C to +85°C temperature range.

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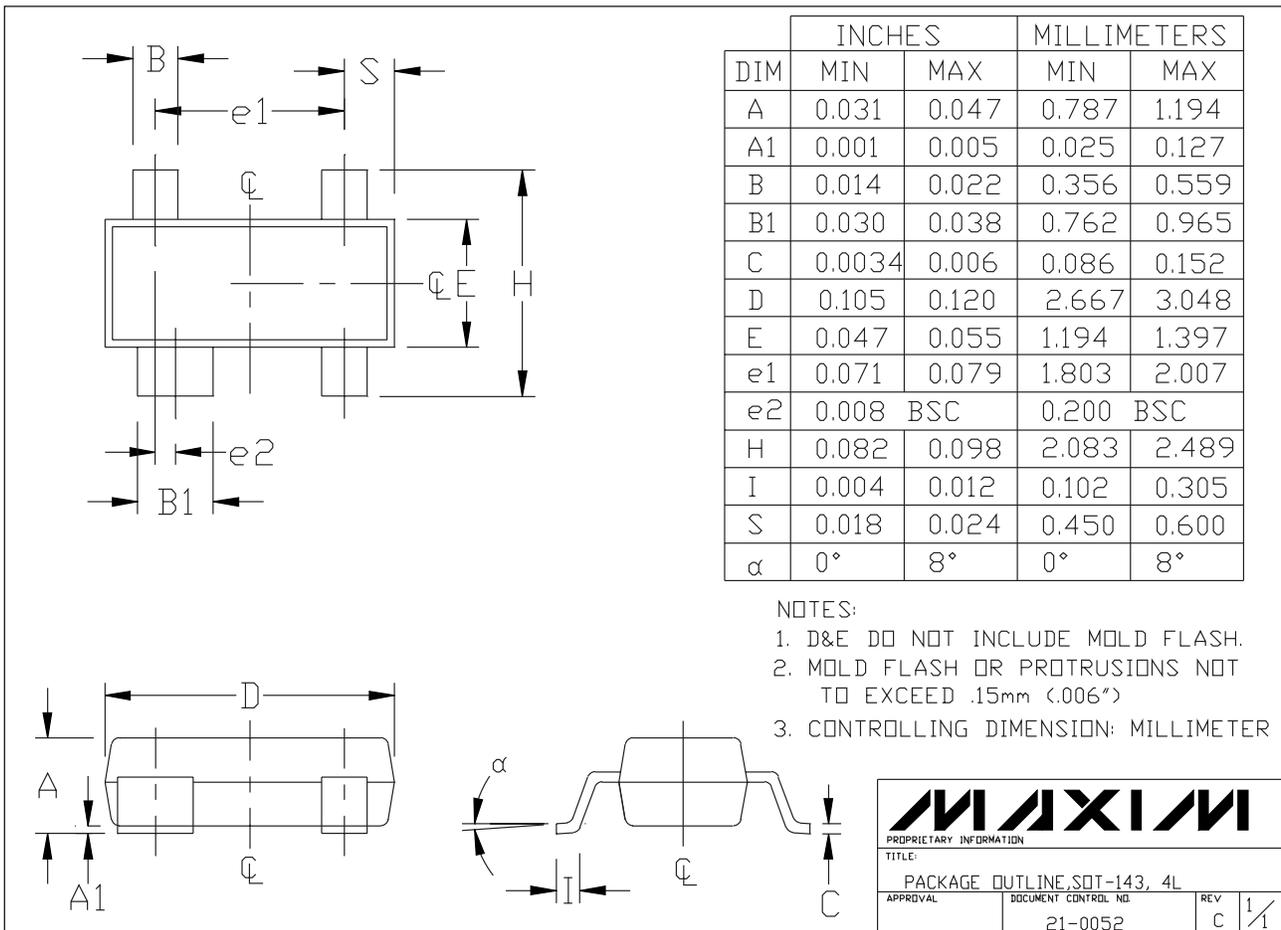
# Open-Drain SOT $\mu$ P Reset Circuit

## Chip Information

TRANSISTOR COUNT: 519

## Package Information

MAX6315



SOT1434.EPS

# Open-Drain SOT $\mu$ P Reset Circuit

## NOTES

*Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.*

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