

Dual/Triple-Voltage μP Supervisory Circuits

ABSOLUTE MAXIMUM RATINGS

V _{CC5} , V _{CC3} to GND	-0.3V to +6V
RST (MAX6352/55/58)	-0.3V to +6V
RST, MR, WDI, RST5, RSTIN (MAX6351/53/56/59).....	-0.3V to (V _{CC5} + 0.3V)
RST, RST3 (MAX6351/54/57/60)	-3V to (V _{CC3} + 0.3V)
Input/Output Current, All Pins	20mA

Continuous Power Dissipation (T _A = +70°C)	
5-Pin SOT23-5 (derate 7.1mW/°C above +70°C)	571mW
6-Pin SOT23-6 (derate 7.1mW/°C above +70°C)	571mW
Operating Temperature Range	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (soldering, 10sec)	+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_{CC3} = V_{CC5} = +1.2V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
Supply Voltage Range (Note 2)	V _{CC}	T _A = 0°C to +70°C	1.0		5.5	V	
		T _A = -40°C to +85°C	1.2		5.5		
Supply Current	I _{CC5} + I _{CC3}	V _{CC5} = 5.5V, V _{CC3} = 3.6V, all I/O pins open		20	50	μA	
V _{CC5} Threshold (Note 3)	V _{TH5}	MAX63__L_	T _A = +25°C	4.54	4.63	4.72	V
			T _A = -40°C to +85°C	4.5		4.75	
		MAX63__M_	T _A = +25°C	4.3	4.38	4.46	
			T _A = -40°C to +85°C	4.25		4.50	
		MAX63__T_	T _A = +25°C	3.03	3.08	3.14	
			T _A = -40°C to +85°C	3.00		3.15	
MAX63__S_	T _A = +25°C	2.88	2.93	2.98			
	T _A = -40°C to +85°C	2.85		3.00			
V _{CC3} Threshold (Note 3)	V _{TH3}	MAX63__T	T _A = +25°C	3.03	3.08	3.14	V
			T _A = -40°C to +85°C	3.00		3.15	
		MAX63__S	T _A = +25°C	2.88	2.93	2.98	
			T _A = -40°C to +85°C	2.85		3.00	
		MAX63__R	T _A = +25°C	2.58	2.63	2.68	
			T _A = -40°C to +85°C	2.55		2.70	
MAX63__Y	T _A = +25°C	2.16	2.19	2.22			
	T _A = -40°C to +85°C	2.13		2.25			
Reset Threshold Tempco	ΔV _{TH} /°C			20		ppm/°C	
Reset Threshold Hysteresis				V _{TH} /500		V	
V _{CC} to Reset Delay		100mV overdrive		20		μs	
Reset Timeout Period	t _{RP}	V _{CC5} > V _{TH5} (MAX), V _{CC3} > V _{TH3} (MAX)	100	180	280	ms	
RESET Output Voltage Low	V _{OL}	V _{CC5} or V _{CC3} ≥ 2.7V, I _{SINK} = 1.2mA			0.3	V	
		V _{CC5} or V _{CC3} ≥ 4.5V, I _{SINK} = 3.2mA			0.4		
		V _{CC5} or V _{CC3} < 1V, I _{SINK} = 50μA, T _A = 0°C to +70°C			0.3	V	
		V _{CC5} or V _{CC3} < 1.2V, I _{SINK} = 50μA			0.3		

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MAX6351-MAX6360

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC3} = V_{CC5} = +1.2V to +5.5V, T_A = -40°C to +85°C, unless otherwise noted. Typical values are at T_A = +25°C.) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS	
RESET Output Voltage High	V _{OH}	MAX6351/MAX6353/ MAX6354/MAX6356/ MAX6357/MAX6359/ MAX6360 (_Y versions only), V _{CC5} > V _{TH5} (MAX), V _{CC3} > V _{TH3} (MAX)	I _{SOURCE} = 500µA	0.8V _{CC}		V	
		MAX6351/MAX6353/ MAX6354/MAX6356/ MAX6357/MAX6359/ MAX6360 (L_, M_ versions only), V _{CC5} > V _{TH5} (MAX), V _{CC3} > V _{TH3} (MAX)	I _{SOURCE} = 800µA	V _{CC} - 1.5		V	
WATCHDOG INPUT (MAX6358/MAX6359/MAX6360)							
Watchdog Timeout Period	t _{WD}	First timeout period after reset	25.6	46.4	72.0	sec	
		After first WDI falling edge	1.6	2.9	4.5		
WDI Pulse Width (Note 4)	t _{WDI}	V _{IL} = 0.4V, V _{IH} = 0.8V _{CC}	50			ns	
WDI Input Threshold (Note 5)	V _{IL}	V _{CC3} = 5V	0.3V _{CC}			V	
	V _{IH}		0.7V _{CC}				
WDI Input Current (Note 6)		V _{WDI} = V _{CC}		120	160	µA	
		V _{WDI} = 0	-20	-15			
MANUAL RESET INPUT							
MR Input	V _{IL}	MAX63_ _L_, MAX63_ _M_, V _{CC5} > V _{TH5} (MAX)	0.8			V	
	V _{IH}	MAX63_ _L_, MAX63_ _M_, V _{CC5} > V _{TH5} (MAX)		2.3			
	V _{IL}	MAX63_ _Y, V _{CC5} > V _{TH5} (MAX)	0.3V _{CC}				
	V _{IH}	MAX63_ _Y, V _{CC5} > V _{TH5} (MAX)		0.7V _{CC}			
MR Pull-Up Resistance			32	63.5	100	kΩ	
MR Minimum Pulse Width	t _{RP}		10			µs	
MR Glitch Rejection				100		ns	
MR to Reset Delay	t _{MD}			0.1		µs	
ADJUSTABLE RESET COMPARATOR INPUT (MAX6355/MAX6356/MAX6357)							
RSTIN Input Threshold	V _{RSTIN}	V _{CC5} > V _{TH5} (MAX), V _{CC3} > V _{TH3} (MAX)	T _A = +25°C	1.20	1.22	1.24	V
			T _A = -40°C to +85°C	1.19		1.25	
RSTIN Input Current	I _{RSTIN}	0 < V _{RISTIN} < V _{CC5} - 0.3V	-25		25	nA	
RSTIN Hysteresis				2.5		mV	

Note 1: Overtemperature limits are guaranteed by design and not production tested.

Note 2: The reset output is guaranteed to be in the correct state if either V_{CC3} or V_{CC5} is within its specified region of operation.

Note 3: The reset output(s) is asserted if either V_{CC5} or V_{CC3} drops below its associated trip point.

Note 4: Guaranteed by design. Not production tested.

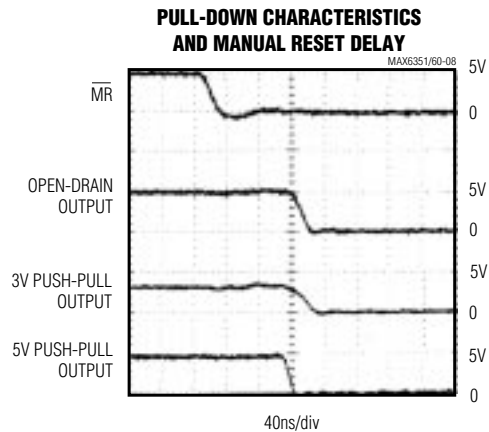
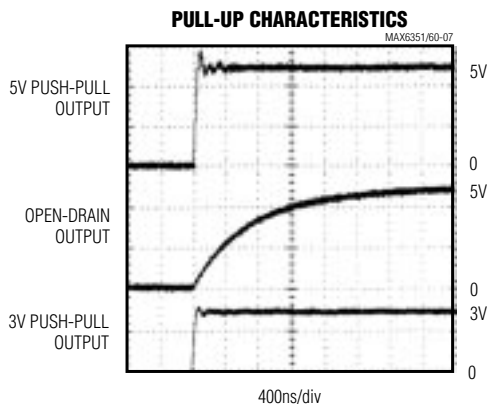
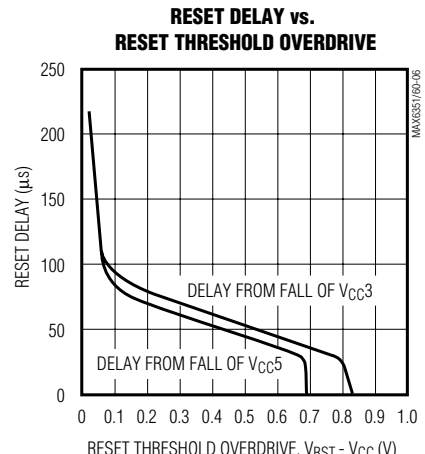
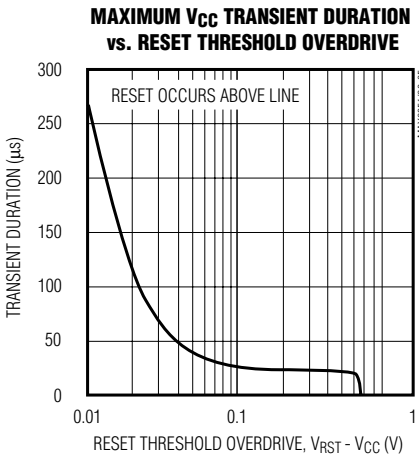
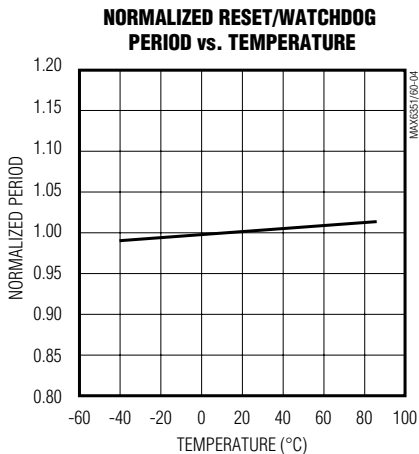
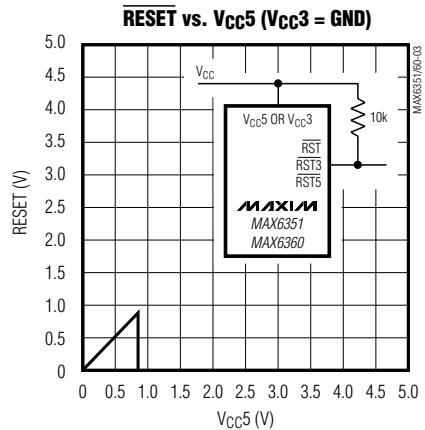
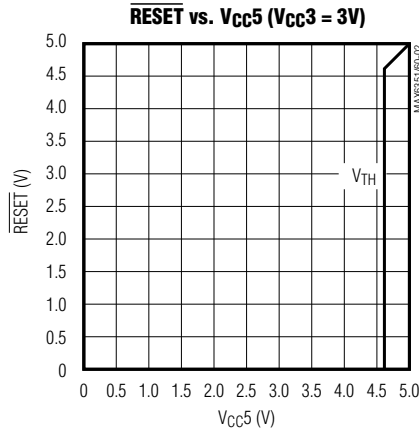
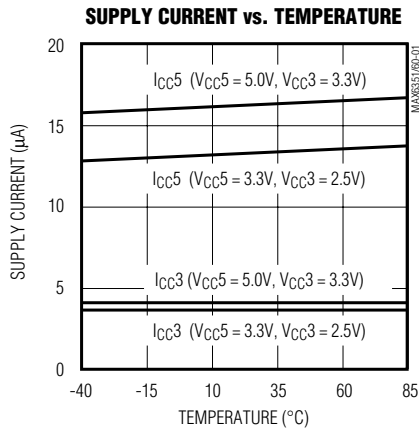
Note 5: WDI is internally serviced within the watchdog timeout period if WDI is left unconnected.

Note 6: The WDI input current is specified as the average input current when the WDI input is driven high or low.

Dual/Triple-Voltage μ P Supervisory Circuits

Typical Operating Characteristics

($V_{CC} = +5V$, $T_A = +25^\circ C$, unless otherwise noted.)



Dual/Triple-Voltage μP Supervisory Circuits

Pin Description

MAX6351-MAX6360

PIN				NAME	FUNCTION
MAX6351	MAX6352 MAX6353 MAX6354	MAX6355 MAX6356 MAX6357	MAX6358 MAX6359 MAX6360		
1	—	—	—	$\overline{\text{RST5}}$	Active-Low, 5V CMOS Reset Output
—	1	1	1	$\overline{\text{RST}}$	Active-Low Reset Output. Open-drain for the MAX6352/MAX6355/MAX6358, 5V push-pull for the MAX6353/MAX6356/MAX6359, and 3V push-pull for the MAX6354/MAX6357/MAX6360.
2	2	2	2	GND	Ground
3	3	3	3	$\overline{\text{MR}}$	Manual-Reset Input. Pull low to force a reset. $\overline{\text{RST}}$, $\overline{\text{RST5}}$, and $\overline{\text{RST3}}$ remain active as long as $\overline{\text{MR}}$ is low and for the timeout period after $\overline{\text{MR}}$ goes high. Leave unconnected or connect to V_{CC5} if unused. $V_{\overline{\text{MR}}}$ must be below V_{CC5} .
4	4	4	4	V_{CC3}	+3.3V/+3.0V Supply Input. Powers the device when it is above V_{CC5} and monitors its own voltage.
5	—	—	—	$\overline{\text{RST3}}$	Active-Low, 3V CMOS Reset Output
—	—	5	—	RSTIN	Undervoltage Reset Comparator Input. Asserts reset when the monitored voltage falls below 1.23V. Set the reset threshold with an external resistor-divider. Connect to V_{CC5} if unused. V_{RSTIN} must be below V_{CC5} .
—	—	—	5	WDI	Watchdog Input. If WDI remains either high or low longer than the timeout period, then reset is triggered. The timer clears when reset is asserted or whenever WDI sees a rising or falling edge. Leave floating to disable it if unused.
6	5	6	6	V_{CC5}	+5V Supply Input. Powers the device when it is above V_{CC3} and monitors its own voltage.

Dual/Triple-Voltage μ P Supervisory Circuits

Detailed Description

Supply Voltages

The MAX6351-MAX6360 microprocessor (μ P) supervisory circuits maintain system integrity by alerting the μ P to fault conditions. These ICs monitor multiple-supply systems and derive their internal power from the highest voltage source present at VCC5 and VCC3. In addition, the output reset state is guaranteed to remain viable while either VCC5 or VCC3 is above +1V.

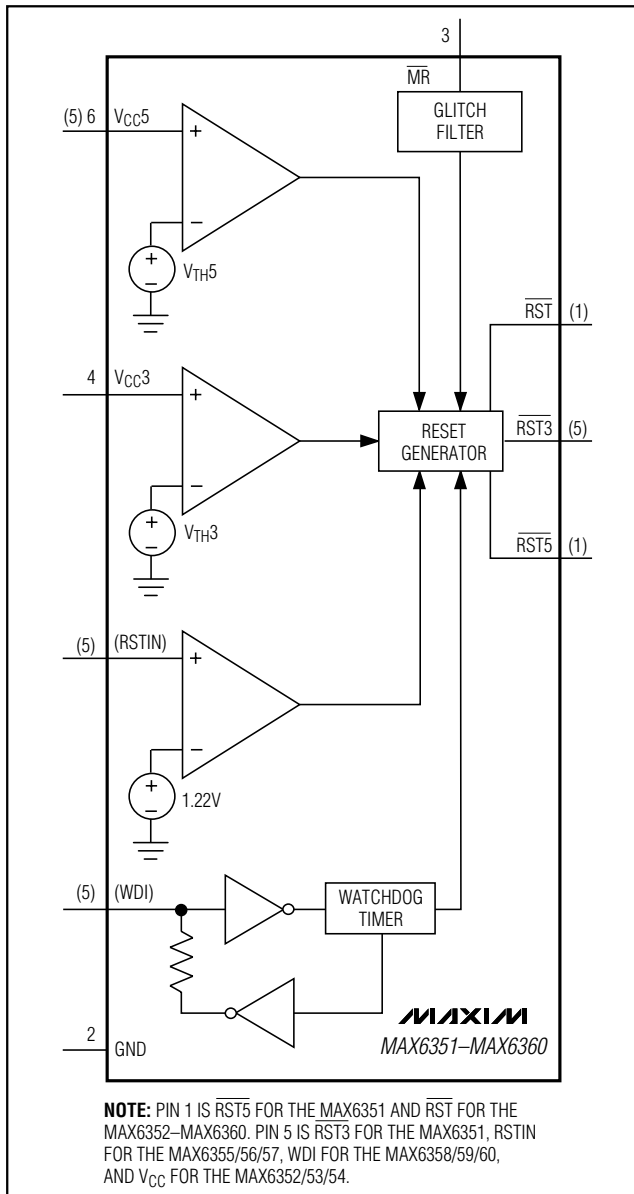


Figure 1. Functional Diagram

Threshold Levels

All the possible input voltage threshold level combinations are indicated by a two-letter code in *Voltage Threshold Levels*. The two standard combinations are LS and SY. LS parts monitor one +5V \pm 5% supply and one +3.3V \pm 10% supply. SY parts monitor one +3.3V \pm 10% supply and one +2.5V \pm 10% supply. The other combinations also monitor +5V \pm 10% supplies, +3.3V \pm 5% supplies, and +3V \pm 5% supplies.

Reset Outputs

The MAX6351 provides a 5V active-low reset and a 3V active-low reset. The MAX6353/MAX6356/MAX6359 provide a 5V active-low push-pull reset and the MAX6354/MAX6357/MAX6360 provide a 3V active-low push-pull reset. The MAX6353/MAX6355/MAX6358 provide an active-low open-drain reset. The higher input voltages of VCC5 and VCC3 maintain the sinking capability of the low reset-output state. The reset outputs are maintained as long as either supply is above +1V.

Negative-Going VCC Transients

The MAX6351-MAX6360 are designed to ignore short negative-going VCC5 and VCC3 transients. See *Typical Operating Characteristics* for a glitch immunity graph.

Third Input Voltage (MAX6355/MAX6356/MAX6357)

The MAX6355/MAX6356/MAX6357 provide an additional input to monitor a third voltage. The threshold voltage at RSTIN is typically 1.22V. To monitor a voltage higher than 1.22V, connect a resistor-divider to the circuit as shown in Figure 2. The threshold at V3 is:

$$V_{3TH} = 1.22 \left(\frac{R1 + R2}{R2} \right)$$

Note that RSTIN is powered by VCC5, and its voltage must therefore remain lower than VCC5.

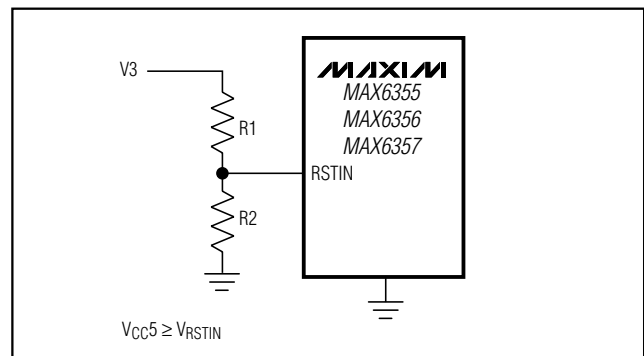


Figure 2. Monitoring a Third Voltage

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Watchdog Input (MAX6358/MAX6359/MAX6360)

The MAX6358/MAX6359/MAX6360 include a WDI to provide a reset if the μ P goes into an infinite loop. After a reset, the start-up timeout period and the initial timeout period is nominally 46.4sec to allow the μ P time to initialize. After the first transition on the WDI and after any toggle of the watchdog thereafter, the timeout period is nominally 2.9sec.

Applications Information

Ensuring a Valid $\overline{\text{RESET}}$ Output Down to $V_{CC} = 0$

In some systems, it is necessary to ensure a valid reset even if V_{CC} falls to 0. In these applications, use the circuit shown in Figure 3. Note that this configuration does not work for the open-drain outputs of the MAX6352/MAX6355/MAX6358.

Monitoring a Negative Voltage

To monitor a negative supply rail using RSTIN or the MAX6355/MAX6356/MAX6357, use the circuit shown in Figure 4. In this configuration, a reset is issued when the negative supply falls below V_{INTH} .

Interfacing to μ Ps with Bidirectional Reset Pins

Microprocessors with bidirectional reset pins will contend with the push-pull outputs of these devices. To prevent this, connect a 4.7k Ω resistor between $\overline{\text{RESET}}$ and the μ P's reset I/O port, as shown in Figure 5. Buffer $\overline{\text{RESET}}$ as shown in the figure if this reset is used by other components in the system.

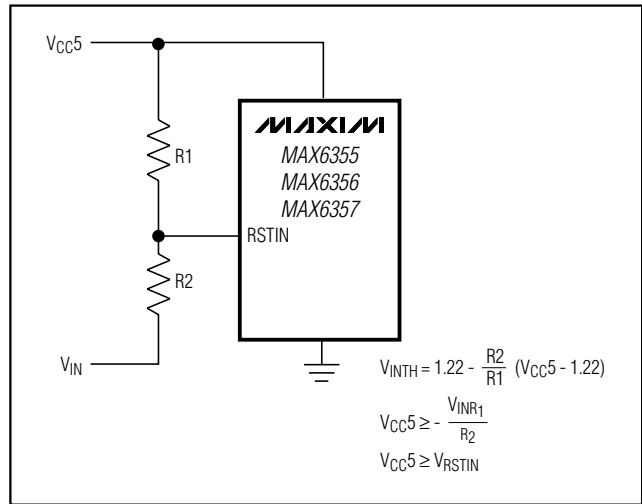


Figure 4. Monitoring a Negative Voltage

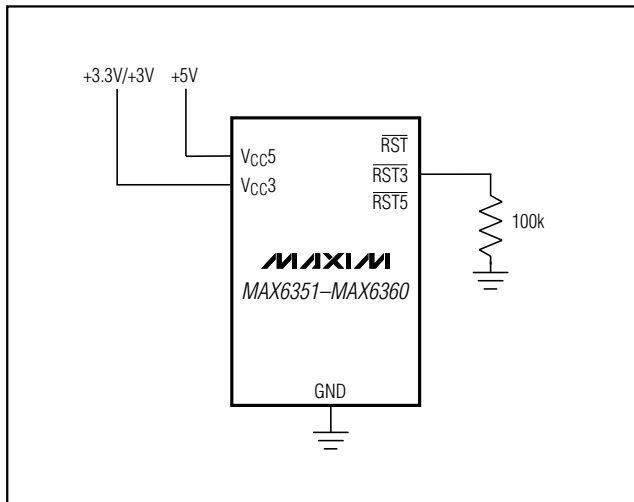


Figure 3. Ensuring a Valid Reset Low to V_{CC5} and $V_{CC3} = 0$

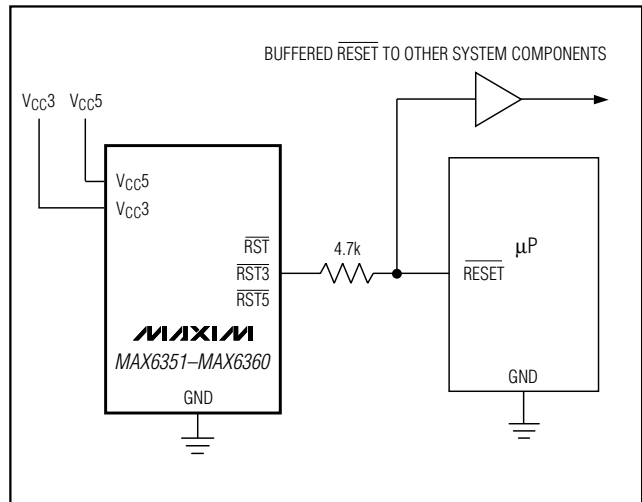


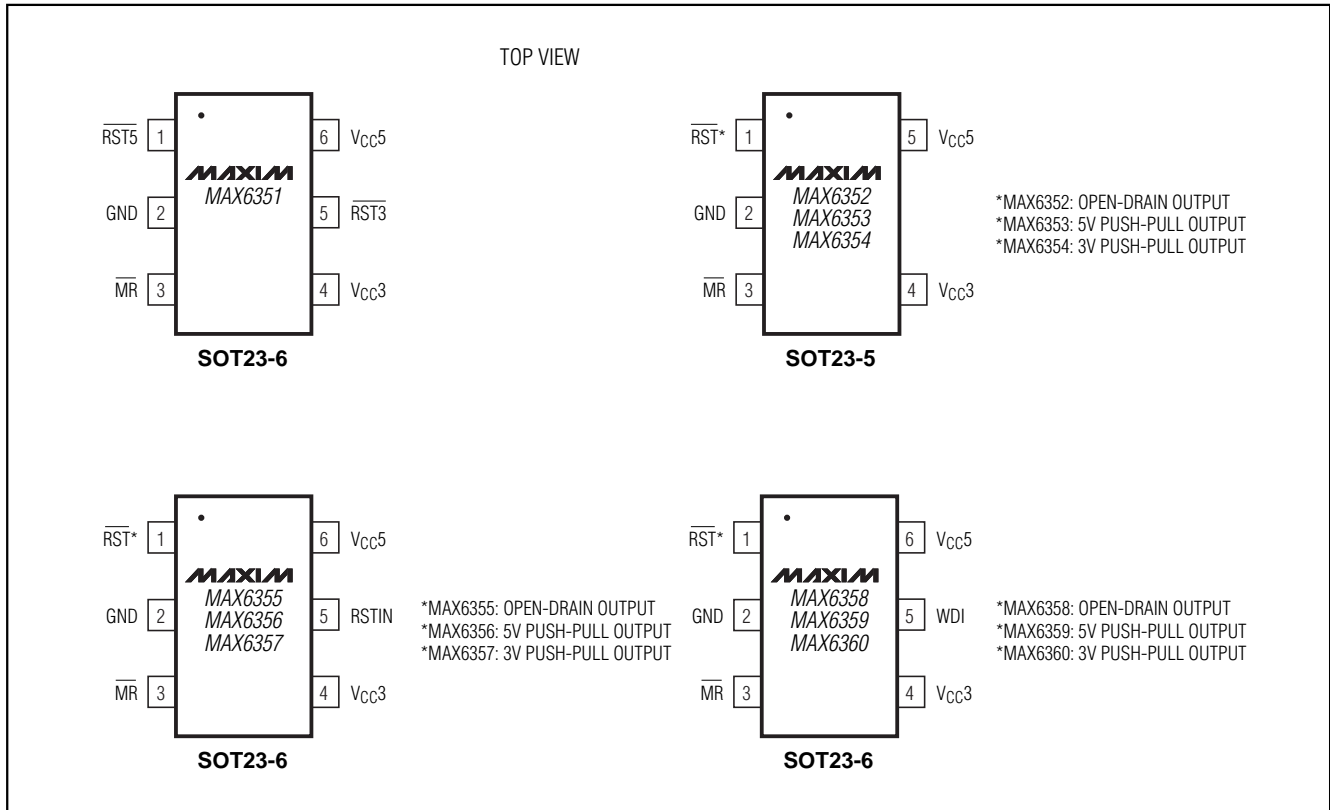
Figure 5. Interfacing to μ Ps with Bidirectional Reset I/O

Chip Information

TRANSISTOR COUNT: 855

Dual/Triple-Voltage µP Supervisory Circuits

Pin Configurations



Selector Guide

PART	PIN COUNT	NUMBER OF SUPPLIES MONITORED	5V \overline{RESET}	3V \overline{RESET}	OPEN-DRAIN \overline{RESET}	WATCHDOG TIMER	MANUAL RESET
MAX6351	6	2	✓	✓	—	—	✓
MAX6352	5	2	—	—	✓	—	✓
MAX6353	5	2	✓	—	—	—	✓
MAX6354	5	2	—	✓	—	—	✓
MAX6355	6	3	—	—	✓	—	✓
MAX6356	6	3	✓	—	—	—	✓
MAX6357	6	3	—	✓	—	—	✓
MAX6358	6	2	—	—	✓	✓	✓
MAX6359	6	2	✓	—	—	✓	✓
MAX6360	6	2	—	✓	—	✓	✓

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