

MAX6711L/M/R/S/T/Z,  
MAX6712L/M/R/S/T/Z,  
MAX6713L/M/R/S/T/Z

4-Pin SC70 Microprocessor  
Reset Circuits with Manual Reset Input

## Absolute Maximum Ratings

Terminal Voltage (with respect to GND)

|                                                        |                             |
|--------------------------------------------------------|-----------------------------|
| $V_{CC}$ .....                                         | -0.3V to +6.0V              |
| RESET, $\overline{\text{RESET}}$ (push-pull).....      | -0.3V to ( $V_{CC}$ + 0.3V) |
| RESET (open drain).....                                | -0.3V to +6.0V              |
| $\overline{\text{MR}}$ .....                           | -0.3V to ( $V_{CC}$ + 0.3V) |
| Input Current, $V_{CC}$ , $\overline{\text{MR}}$ ..... | 20mA                        |
| Output Current, RESET, $\overline{\text{RESET}}$ ..... | 20mA                        |

Rate of Rise,  $V_{CC}$  ..... 100V/ $\mu$ s

Continuous Power Dissipation ( $T_A$  = +70°C)

4-Pin SC70 (derate 3.1mW/°C above +70°C).....245mW

Operating Temperature Range ..... -40°C to +125°C

Storage Temperature Range ..... -65°C to +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

( $V_{CC}$  = full range,  $T_A$  = -40°C to +125°C, unless otherwise noted. Typical values are at  $V_{CC}$  = +5V for L/M versions,  $V_{CC}$  = +3.3V for T/S versions,  $V_{CC}$  = +3V for R version,  $V_{CC}$  = +2.5V for Z version, and  $T_A$  = +25°C.) (Note 1)

| PARAMETER                   | SYMBOL   | CONDITIONS                                  | MIN                             | TYP | MAX  | UNITS   |
|-----------------------------|----------|---------------------------------------------|---------------------------------|-----|------|---------|
| VCC Range                   |          | $T_A$ = 0°C to +70°C                        | 1.0                             |     | 5.5  | V       |
|                             |          | $T_A$ = -40°C to +105°C                     | 1.2                             |     | 5.5  |         |
| Supply Current              | $I_{CC}$ | $T_A$ = -40°C to +85°C                      | $V_{CC}$ < 5.5V, MAX671_L/M     |     | 16   | $\mu$ A |
|                             |          |                                             | $V_{CC}$ < 3.6V, MAX671_R/S/T/Z |     | 12   |         |
|                             |          | $T_A$ = +85°C to +105°C                     | $V_{CC}$ < 5.5V, MAX671_L/M     |     | 75   |         |
|                             |          |                                             | $V_{CC}$ < 3.6V, MAX671_R/S/T/Z |     | 75   |         |
| Reset Threshold             | $V_{TH}$ | MAX671_L                                    | $T_A$ = +25°C                   |     | 4.56 | V       |
|                             |          |                                             | $T_A$ = -40°C to +85°C          |     | 4.50 |         |
|                             |          |                                             | $T_A$ = +85°C to +105°C         |     | 4.40 |         |
|                             |          | MAX671_M                                    | $T_A$ = +25°C                   |     | 4.31 |         |
|                             |          |                                             | $T_A$ = -40°C to +85°C          |     | 4.25 |         |
|                             |          |                                             | $T_A$ = +85°C to +105°C         |     | 4.16 |         |
|                             |          | MAX671_T                                    | $T_A$ = +25°C                   |     | 3.04 |         |
|                             |          |                                             | $T_A$ = -40°C to +85°C          |     | 3.00 |         |
|                             |          |                                             | $T_A$ = +85°C to +105°C         |     | 2.92 |         |
|                             |          | MAX671_S                                    | $T_A$ = +25°C                   |     | 2.89 |         |
|                             |          |                                             | $T_A$ = -40°C to +85°C          |     | 2.85 |         |
|                             |          |                                             | $T_A$ = +85°C to +105°C         |     | 2.78 |         |
|                             |          | MAX671_R                                    | $T_A$ = +25°C                   |     | 2.59 |         |
|                             |          |                                             | $T_A$ = -40°C to +85°C          |     | 2.55 |         |
|                             |          |                                             | $T_A$ = +85°C to +105°C         |     | 2.50 |         |
|                             |          | MAX671_Z                                    | $T_A$ = +25°C                   |     | 2.28 |         |
|                             |          |                                             | $T_A$ = -40°C to +85°C          |     | 2.25 |         |
|                             |          |                                             | $T_A$ = +85°C to +105°C         |     | 2.21 |         |
| Reset-Threshold Tempco      |          |                                             | 30                              |     |      | ppm/°C  |
| VCC to Reset Delay (Note 2) |          | $V_{CC}$ = $V_{TH}$ to ( $V_{TH}$ - 100 mV) | 20                              |     |      | $\mu$ s |
| Reset Active Timeout Period |          | $T_A$ = -40°C to +85°C                      | 140                             | 240 | 460  | ms      |
|                             |          | $T_A$ = +85°C to +125°C                     | 100                             |     | 840  |         |

MAX6711L/M/R/S/T/Z,  
MAX6712L/M/R/S/T/Z,  
MAX6713L/M/R/S/T/Z

4-Pin SC70 Microprocessor  
Reset Circuits with Manual Reset Input

### Electrical Characteristics (continued)

( $V_{CC}$  = full range,  $T_A$  = -40°C to +125°C, unless otherwise noted. Typical values are at  $V_{CC}$  = +5V for L/M versions,  $V_{CC}$  = +3.3V for T/S versions,  $V_{CC}$  = +3V for R version,  $V_{CC}$  = +2.5V for Z version, and  $T_A$  = +25°C.) (Note 1)

| PARAMETER                                  | SYMBOL | CONDITIONS                                                                          | MIN                 | TYP                 | MAX | UNITS            |
|--------------------------------------------|--------|-------------------------------------------------------------------------------------|---------------------|---------------------|-----|------------------|
| RESET Output-Voltage Low (MAX6711/MAX6713) | VOL    | $V_{CC} = V_{TH} \text{ min, ISINK} = 1.2\text{mA, MAX6711R/S/T/Z, MAX6713R/S/T/Z}$ |                     |                     | 0.3 | V                |
|                                            |        | $V_{CC} = V_{TH} \text{ min, ISINK} = 3.2\text{mA, MAX6711L/M, MAX6713L/M}$         |                     |                     | 0.4 |                  |
|                                            |        | $V_{CC} > 1.0\text{V, ISINK} = 50\mu\text{A}$                                       |                     |                     | 0.3 |                  |
| RESET Output-Voltage High (MAX6711)        | VOH    | $V_{CC} > V_{TH} \text{ max, ISOURCE} = 500\mu\text{A, MAX6711R/S/T/Z}$             | $0.8 \times V_{CC}$ |                     |     | V                |
|                                            |        | $V_{CC} > V_{TH} \text{ max, ISOURCE} = 800\mu\text{A, MAX6711L/M}$                 | $V_{CC} \times 1.5$ |                     |     |                  |
| RESET Output-Voltage Low (MAX6712)         | VOL    | $V_{CC} = V_{TH} \text{ max, ISINK} = 1.2\text{mA, MAX6712R/S/T/Z}$                 |                     |                     | 0.3 | V                |
|                                            |        | $V_{CC} = V_{TH} \text{ max, ISINK} = 3.2\text{mA, MAX6712L/M}$                     |                     |                     | 0.4 |                  |
| RESET Output-Voltage High (MAX6712)        | VOH    | $1.8\text{V} < V_{CC} < V_{TH} \text{ min, ISOURCE} = 150\mu\text{A}$               | $0.8 \times V_{CC}$ |                     |     | V                |
| RESET Open-Drain Output-Leakage Current    |        | $V_{CC} > V_{TH}$ , RESET deasserted                                                |                     |                     | 1   | $\mu\text{A}$    |
| MR Input Threshold                         | VIL    |                                                                                     | $0.3 \times V_{CC}$ |                     |     | V                |
|                                            | VIH    |                                                                                     |                     | $0.7 \times V_{CC}$ |     |                  |
| MR Pull-Up Resistance                      |        |                                                                                     | 10                  | 20                  |     | $\text{k}\Omega$ |
| MR Minimum Pulse Width                     |        |                                                                                     | 1                   |                     |     | $\mu\text{s}$    |
| MR Glitch Immunity                         |        |                                                                                     |                     | 100                 |     | ns               |
| MR to Reset Delay                          |        |                                                                                     |                     | 200                 |     | ns               |

**Note 1:** Production testing done at  $T_A$  = +25°C; limits over temperature guaranteed by design only.

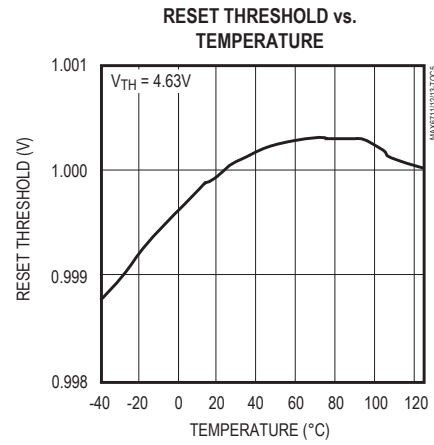
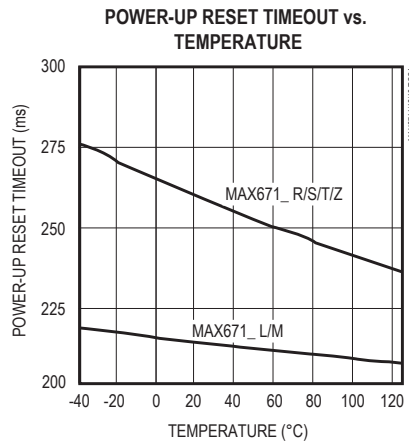
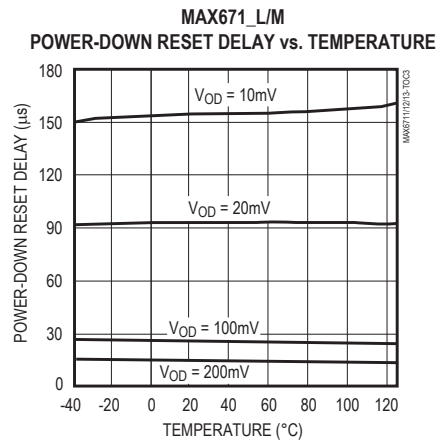
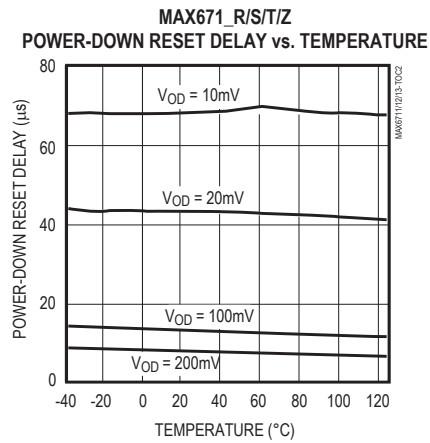
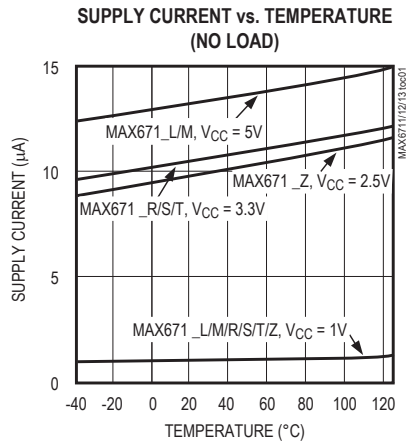
**Note 2:**  $\overline{\text{RESET}}$  output for MAX6711/MAX6713; RESET output for MAX6712.

# MAX6711L/M/R/S/T/Z, MAX6712L/M/R/S/T/Z, MAX6713L/M/R/S/T/Z

## 4-Pin SC70 Microprocessor Reset Circuits with Manual Reset Input

### Typical Operating Characteristics

( $V_{CC}$  = full range,  $T_A$  =  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ , unless otherwise noted. Typical values are at  $V_{CC}$  = +5V for L/M versions,  $V_{CC}$  = +3.3V for T/S versions,  $V_{CC}$  = +3V for R version,  $V_{CC}$  = +2.5V for Z version, and  $T_A$  =  $+25^{\circ}\text{C}$ .)



# MAX6711L/M/R/S/T/Z, MAX6712L/M/R/S/T/Z, MAX6713L/M/R/S/T/Z

## Pin Description

| PIN | NAME                                               | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | GND                                                | Ground                                                                                                                                                                                                                                                                                                                                                                                                     |
| 2   | $\overline{\text{RESET}}$<br>(MAX6711/<br>MAX6713) | $\overline{\text{RESET}}$ output remains low while $V_{CC}$ is below the reset threshold, and for at least 140ms after $V_{CC}$ rises above the reset threshold.                                                                                                                                                                                                                                           |
|     | RESET<br>(MAX6712)                                 | RESET output remains high while $V_{CC}$ is below the reset threshold, and for at least 140ms after $V_{CC}$ rises above the reset threshold.                                                                                                                                                                                                                                                              |
| 3   | $\overline{\text{MR}}$                             | Manual Reset Input. RESET ( $\overline{\text{RESET}}$ ) remains asserted as long as $\overline{\text{MR}}$ is low, and for at least 140ms after $\overline{\text{MR}}$ is deasserted. This active-low input has an internal 20k $\Omega$ (typ) pull-up resistor.<br><br>It can be driven from a TTL- or CMOS- logic line, or shorted to ground with a switch. Leave open or connect to $V_{CC}$ if unused. |
| 4   | $V_{CC}$                                           | Supply Voltage (+5.0V, +3.3V, +3.0V, or +2.5V)                                                                                                                                                                                                                                                                                                                                                             |

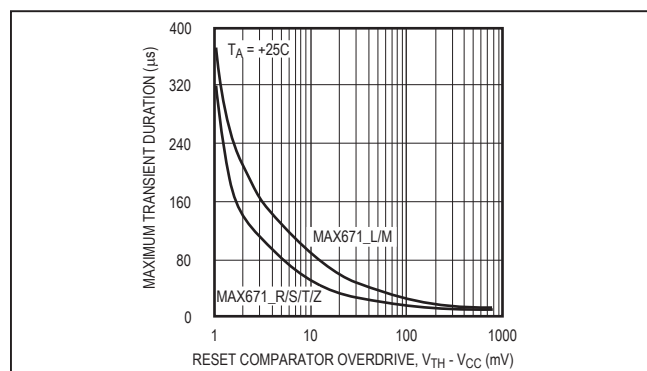


Figure 1. Maximum Transient Duration Without Causing a Reset Pulse vs. Reset Comparator Overdrive

## Detailed Description

### Reset Output

A microprocessor's ( $\mu\text{P}$ 's) reset input starts the  $\mu\text{P}$  in a known state. The MAX6711/MAX6712/MAX6713 assert reset to prevent code-execution errors during power-up, power-down, or brownout conditions. They assert a reset signal whenever the  $V_{CC}$  supply voltage declines below a preset threshold, keeping it asserted for at

## 4-Pin SC70 Microprocessor Reset Circuits with Manual Reset Input

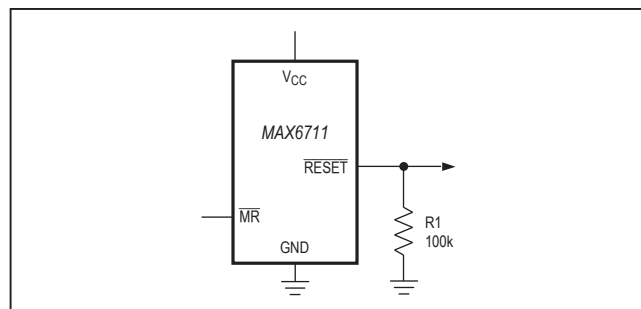


Figure 2.  $\overline{\text{RESET}}$  Valid to  $V_{CC}$  = Ground Circuit

least 140ms after  $V_{CC}$  has risen above the reset threshold. The MAX6713 uses an open-drain output, and the MAX6711/MAX6712 have a push-pull output stage. Connect a pull-up resistor on the MAX6713's RESET output to any supply between 0 and 6V.

### Manual Reset Input

Many  $\mu\text{P}$ -based systems require manual reset capability, allowing the operator, a test technician, or external logic circuitry to initiate a reset. Reset remains asserted while MR is low, and for at least 140ms after MR returns high. This input has an internal 20k $\Omega$  pullup resistor, so it can be left open if it is not used.  $\overline{\text{MR}}$  can be driven with TTL- or CMOS-logic levels, or with open-drain/collector outputs. To create a manual reset function, connect a normally open momentary switch from  $\overline{\text{MR}}$  to ground; external debounce circuitry is not required. If  $\overline{\text{MR}}$  is driven from long cables or if the device is used in a noisy environment, connecting a 0.1 $\mu\text{F}$  capacitor from MR to ground provides additional noise immunity.

## Applications Information

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

In addition to issuing a reset to the  $\mu\text{P}$  during power-up, power-down, and brownout conditions, the MAX6711/MAX6712/MAX6713 are relatively immune to short-duration negative-going  $V_{CC}$  transients (glitches).

Figure 1 shows typical transient duration vs. reset comparator overdrive, for which the MAX6711/MAX6712/MAX6713 do **not** generate a reset pulse. The graph was generated using a negative-going pulse applied to  $V_{CC}$ , starting 0.5V above the actual reset threshold and ending below it by the magnitude indicated (reset comparator overdrive). The graph indicates the maximum pulse width a negative-going  $V_{CC}$  transient can have without causing a reset pulse. As the magnitude of the transient increases (goes farther below the reset threshold), the

## MAX6711L/M/R/S/T/Z, MAX6712L/M/R/S/T/Z, MAX6713L/M/R/S/T/Z

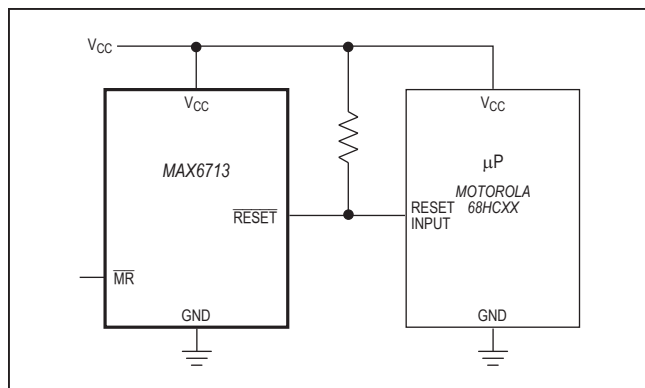


Figure 3. Interfacing to  $\mu$ Ps with Bidirectional Reset I/O

maximum allowable pulse width decreases. Typically, for the MAX671\_L and MAX671\_M, a  $V_{CC}$  transient that goes 100mV below the reset threshold and lasts 20 $\mu$ s or less will not cause a reset pulse. A 0.1 $\mu$ F bypass capacitor mounted as close as possible to the  $V_{CC}$  pin provides additional transient immunity.

### Ensuring a Valid Reset Output Down to $V_{CC} = 0$

When  $V_{CC}$  falls below 1V, the MAX6711  $\overline{\text{RESET}}$  output no longer sinks current—it becomes an open circuit. Therefore, high-impedance CMOS-logic inputs connected to  $\overline{\text{RESET}}$  can drift to undetermined voltages. This presents no problem in most applications since most  $\mu$ P and other circuitry is inoperative with  $V_{CC}$  below 1V. However, in applications where  $\overline{\text{RESET}}$  must be valid down to 0, adding a pull-down resistor to  $\overline{\text{RESET}}$  causes any stray leakage currents to flow to ground, holding  $\overline{\text{RESET}}$  low (Figure 2). R1's value is not critical; 100k $\Omega$  is large enough not to load  $\overline{\text{RESET}}$  and small enough to pull  $\overline{\text{RESET}}$  to ground.

A 100k $\Omega$  pull-up resistor to  $V_{CC}$  is also recommended for the MAX6712 if RESET is required to remain valid for  $V_{CC} < 1V_{66}$ .

### Interfacing to $\mu$ Ps with Bidirectional Reset Pins

Since the  $\overline{\text{RESET}}$  output on the MAX6713 is open-drain, this device interfaces easily with  $\mu$ Ps that have bidirectional reset pins, such as the Motorola 68HC11. Connecting the  $\mu$ P supervisor's RESET output directly to the  $\mu$ P's  $\overline{\text{RESET}}$  pin with a single pull-up resistor allows either device to assert reset (Figure 3).

## 4-Pin SC70 Microprocessor Reset Circuits with Manual Reset Input

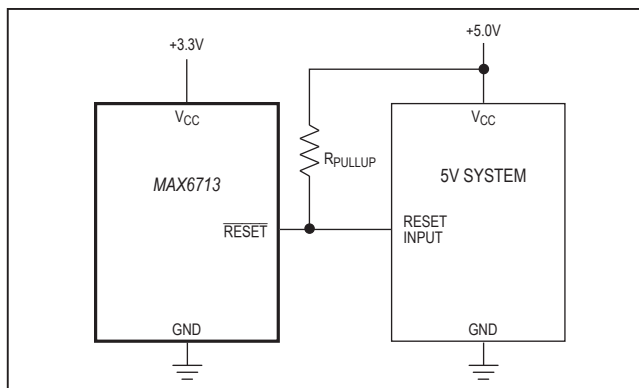


Figure 4. MAX6713 Open-Drain  $\overline{\text{RESET}}$  Output Allows Use with Multiple Supplies

### MAX6713 Open-Drain RESET Output Allows Use with Multiple Supplies

Generally, the pull-up connected to the MAX6713 will connect to the supply voltage that is being 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 4). Note that as the MAX6713's  $V_{CC}$  decreases below 1V, so does the IC's ability to sink current at  $\overline{\text{RESET}}$ . Also, with any pullup,  $\overline{\text{RESET}}$  will be pulled high as  $V_{CC}$  decays toward 0. The voltage where this occurs depends on the pull-up resistor value and the voltage to which it is connected.

### Benefits of Highly Accurate Reset Threshold

Most  $\mu$ P supervisor ICs have reset threshold voltages between 5% and 10% below the value of nominal supply voltages. This ensures a reset will **not** occur within 5% of the nominal supply, but **will** occur when the supply is 10% below nominal.

When using ICs rated at only the nominal supply  $\pm 5\%$ , a zone of uncertainty where the supply is between 5% and 10% low, and where the reset may or may not be asserted is left.

The MAX671\_L/T/Z use highly accurate circuitry to ensure that reset is asserted close to the 5% limit, and long before the supply has declined to 10% below nominal.

## Chip Information

TRANSISTOR COUNT: 380

MAX6711L/M/R/S/T/Z,  
MAX6712L/M/R/S/T/Z,  
MAX6713L/M/R/S/T/Z

## 4-Pin SC70 Microprocessor Reset Circuits with Manual Reset Input

### Selector Guide

| PART/SUFFIX     | RESET THRESHOLD (V) | OUTPUT TYPE                          | TOP MARK |
|-----------------|---------------------|--------------------------------------|----------|
| <b>MAX6711L</b> | 4.63                | Push-Pull $\overline{\text{RESET}}$  | AAB      |
| MAX6711M        | 4.38                | Push-Pull $\overline{\text{RESET}}$  | AAC      |
| MAX6711T        | 3.08                | Push-Pull $\overline{\text{RESET}}$  | AAD      |
| MAX6711S        | 2.93                | Push-Pull $\overline{\text{RESET}}$  | AAE      |
| MAX6711R        | 2.63                | Push-Pull $\overline{\text{RESET}}$  | AAF      |
| MAX6711Z        | 2.32                | Push-Pull $\overline{\text{RESET}}$  | AAG      |
| <b>MAX6712L</b> | 4.63                | Push-Pull RESET                      | AAH      |
| MAX6712M        | 4.38                | Push-Pull RESET                      | AAI      |
| MAX6712T        | 3.08                | Push-Pull RESET                      | AAJ      |
| MAX6712S        | 2.93                | Push-Pull RESET                      | AAK      |
| MAX6712R        | 2.63                | Push-Pull RESET                      | AAL      |
| MAX6712Z        | 2.32                | Push-Pull RESET                      | AAM      |
| <b>MAX6713L</b> | 4.63                | Open-Drain $\overline{\text{RESET}}$ | AAN      |
| MAX6713M        | 4.38                | Open-Drain $\overline{\text{RESET}}$ | AAO      |
| MAX6713T        | 3.08                | Open-Drain $\overline{\text{RESET}}$ | AAP      |
| MAX6713S        | 2.93                | Open-Drain $\overline{\text{RESET}}$ | AAQ      |
| MAX6713R        | 2.63                | Open-Drain $\overline{\text{RESET}}$ | AAR      |
| MAX6713Z        | 2.32                | Open-Drain $\overline{\text{RESET}}$ | AAS      |

### Package Information

For the latest package outline information and land patterns (footprints), go to [www.maximintegrated.com/packages](http://www.maximintegrated.com/packages). Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

| PACKAGE TYPE | PACKAGE CODE | OUTLINE NO.             | LAND PATTERN NO.        |
|--------------|--------------|-------------------------|-------------------------|
| 4 SC70       | X4-1         | <a href="#">21-0098</a> | <a href="#">90-0187</a> |

MAX6711L/M/R/S/T/Z,  
MAX6712L/M/R/S/T/Z,  
MAX6713L/M/R/S/T/Z

## 4-Pin SC70 Microprocessor Reset Circuits with Manual Reset Input

### Revision History

| REVISION<br>NUMBER | REVISION<br>DATE | DESCRIPTION                                                               | PAGES<br>CHANGED |
|--------------------|------------------|---------------------------------------------------------------------------|------------------|
| 2                  | 5/14             | No /V OPNs; removed automotive reference from <i>Applications</i> section | 1                |

For pricing, delivery, and ordering information, please contact Maxim Direct at 1-888-629-4642, or visit Maxim Integrated's website at [www.maximintegrated.com](http://www.maximintegrated.com).

*Maxim Integrated cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim Integrated product. No circuit patent licenses are implied. Maxim Integrated reserves the right to change the circuitry and specifications without notice at any time. The parametric values (min and max limits) shown in the Electrical Characteristics table are guaranteed. Other parametric values quoted in this data sheet are provided for guidance.*