

# SGM706B

## Low-Cost, Microprocessor Supervisory Circuit

### GENERAL DESCRIPTION

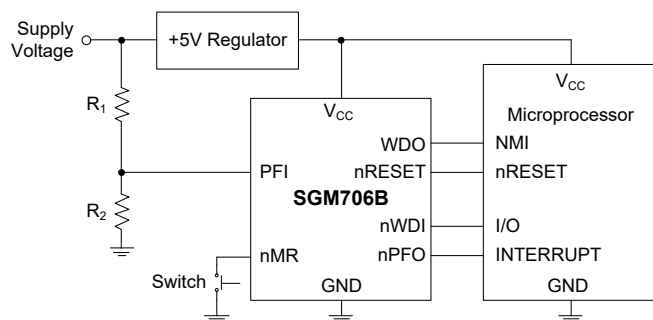
The SGM706B is an integrated microprocessor supervisory device. Compared with the design using a single IC or discrete components, this integration design has the advantage of improving system stability and accuracy. The SGM706B can be reset under power-up, power-down or even voltage reduction brownout conditions. When  $V_{CC}$  is as low as 1V, the reset output can still operate. And it also has a low-level active manual reset nMR function.

The SGM706B provides an independent watchdog monitoring circuit, which can activate this function when its power input has not toggled for more than 1.6s.

When the power supply fails, the battery power is low, or the additional power supply needs to be monitored, it can be realized by the 1.25V threshold detector of the SGM706B.

The SGM706B is available in Green UTDFN-1.5×1.5-8L, SOIC-8 and MSOP-8 packages. It operates over an ambient temperature range of -40°C to +125°C.

### TYPICAL APPLICATION



### FEATURES

- **Ultra-Low Supply Current:** < 1 $\mu$ A (TYP)
- **Precision Supply-Voltage Monitor**
  - 4.63V for SGM706B-L
  - 4.38V for SGM706B-M
  - 4.0V for SGM706B-J
  - 3.08V for SGM706B-T
  - 2.93V for SGM706B-S
  - 2.63V for SGM706B-R
- **Guaranteed nRESET Valid at  $V_{CC}$  = 1V**
- **Reset Pulse Width:** 200ms (TYP)
- **Debounced TTL/CMOS-Compatible**
- **Manual Reset Input**
- **Watchdog Timer with 1.6s (TYP) Timeout**
- **1.25V Threshold Detector for Power-Fail or Low-Battery Warning**
- **-40°C to +125°C Operating Temperature Range**
- **Available in Green UTDFN-1.5×1.5-8L, SOIC-8 and MSOP-8 Packages**

### APPLICATIONS

Computers  
Battery-Powered Applications  
Portable Equipment  
Automotive Equipment  
Safety Systems  
Intelligent Instruments  
Critical  $\mu$ P Power Monitoring  
Microprocessor Systems

## PACKAGE/ORDERING INFORMATION

| MODEL   | RESET THRESHOLD (V) | PACKAGE DESCRIPTION | ORDERING NUMBER    | PACKAGE MARKING           | PACKING OPTION      |
|---------|---------------------|---------------------|--------------------|---------------------------|---------------------|
| SGM706B | 4.63                | UTDFN-1.5×1.5-8L    | SGM706B-LXUDW8G/TR | CK0<br>XXX                | Tape and Reel, 4000 |
|         | 4.63                | SOIC-8              | SGM706B-LXS8G/TR   | SGM<br>706BLXS8<br>XXXXX  | Tape and Reel, 4000 |
|         | 4.63                | MSOP-8              | SGM706B-LXMS8G/TR  | SGM706BL<br>XMS8<br>XXXXX | Tape and Reel, 4000 |
|         | 4.38                | UTDFN-1.5×1.5-8L    | SGM706B-MXUDW8G/TR | CK1<br>XXX                | Tape and Reel, 4000 |
|         | 4.38                | SOIC-8              | SGM706B-MXS8G/TR   | SGM<br>706BMXS8<br>XXXXX  | Tape and Reel, 4000 |
|         | 4.38                | MSOP-8              | SGM706B-MXMS8G/TR  | SGM706BM<br>XMS8<br>XXXXX | Tape and Reel, 4000 |
|         | 4.0                 | UTDFN-1.5×1.5-8L    | SGM706B-JXUDW8G/TR | CK2<br>XXX                | Tape and Reel, 4000 |
|         | 4.0                 | SOIC-8              | SGM706B-JXS8G/TR   | SGM<br>706BJXS8<br>XXXXX  | Tape and Reel, 4000 |
|         | 4.0                 | MSOP-8              | SGM706B-JXMS8G/TR  | SGM706BJ<br>XMS8<br>XXXXX | Tape and Reel, 4000 |
|         | 3.08                | UTDFN-1.5×1.5-8L    | SGM706B-TXUDW8G/TR | CG5<br>XXX                | Tape and Reel, 4000 |
|         | 3.08                | SOIC-8              | SGM706B-TXS8G/TR   | SGM<br>706BTXS8<br>XXXXX  | Tape and Reel, 4000 |
|         | 3.08                | MSOP-8              | SGM706B-TXMS8G/TR  | SGM706BT<br>XMS8<br>XXXXX | Tape and Reel, 4000 |
|         | 2.93                | UTDFN-1.5×1.5-8L    | SGM706B-SXUDW8G/TR | CBE<br>XXX                | Tape and Reel, 4000 |
|         | 2.93                | SOIC-8              | SGM706B-SXS8G/TR   | SGM<br>706BSXS8<br>XXXXX  | Tape and Reel, 4000 |
|         | 2.93                | MSOP-8              | SGM706B-SXMS8G/TR  | SGM706BS<br>XMS8<br>XXXXX | Tape and Reel, 4000 |
|         | 2.63                | UTDFN-1.5×1.5-8L    | SGM706B-RXUDW8G/TR | CG4<br>XXX                | Tape and Reel, 4000 |
|         | 2.63                | SOIC-8              | SGM706B-RXS8G/TR   | SGM<br>706BRXS8<br>XXXXX  | Tape and Reel, 4000 |
|         | 2.63                | MSOP-8              | SGM706B-RXMS8G/TR  | SGM706BR<br>XMS8<br>XXXXX | Tape and Reel, 4000 |

**PACKAGE/ORDERING INFORMATION (continued)****MARKING INFORMATION**

NOTE: XXX = Date Code and Trace Code. XXXXX = Date Code, Trace Code and Vendor Code.

**UTDFN-1.5×1.5-8L**

Y Y Y — Serial Number  
X X X  
— Trace Code  
— Date Code - Year

**SOIC-8/MSOP-8**

X X X X X  
— Vendor Code  
— Trace Code  
— Date Code - Year

Green (RoHS & HSF): SG Micro Corp defines "Green" to mean Pb-Free (RoHS compatible) and free of halogen substances. If you have additional comments or questions, please contact your SGMICRO representative directly.

**ABSOLUTE MAXIMUM RATINGS**

Terminal Voltage (With Respect to GND)

$V_{CC}$  ..... -0.3V to 6.0V

All Other Inputs ..... -0.3V to ( $V_{CC} + 0.3V$ )

Input Current

$V_{CC}$  ..... 20mA

GND ..... 20mA

Output Current

All Outputs..... 20mA

Package Thermal Resistance

UTDFN-1.5×1.5-8L,  $\theta_{JA}$  ..... 131°C/W

SOIC-8,  $\theta_{JA}$  ..... 145°C/W

MSOP-8,  $\theta_{JA}$  ..... 190°C/W

Junction Temperature ..... +150°C

Storage Temperature Range ..... -65°C to +150°C

Lead Temperature (Soldering, 10s) ..... +260°C

ESD Susceptibility

HBM..... 4000V

MM..... 400V

CDM ..... 1000V

**RECOMMENDED OPERATING CONDITIONS**

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

**OVERSTRESS CAUTION**

Stresses beyond those listed in Absolute Maximum Ratings may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect reliability. Functional operation of the device at any conditions beyond those indicated in the Recommended Operating Conditions section is not implied.

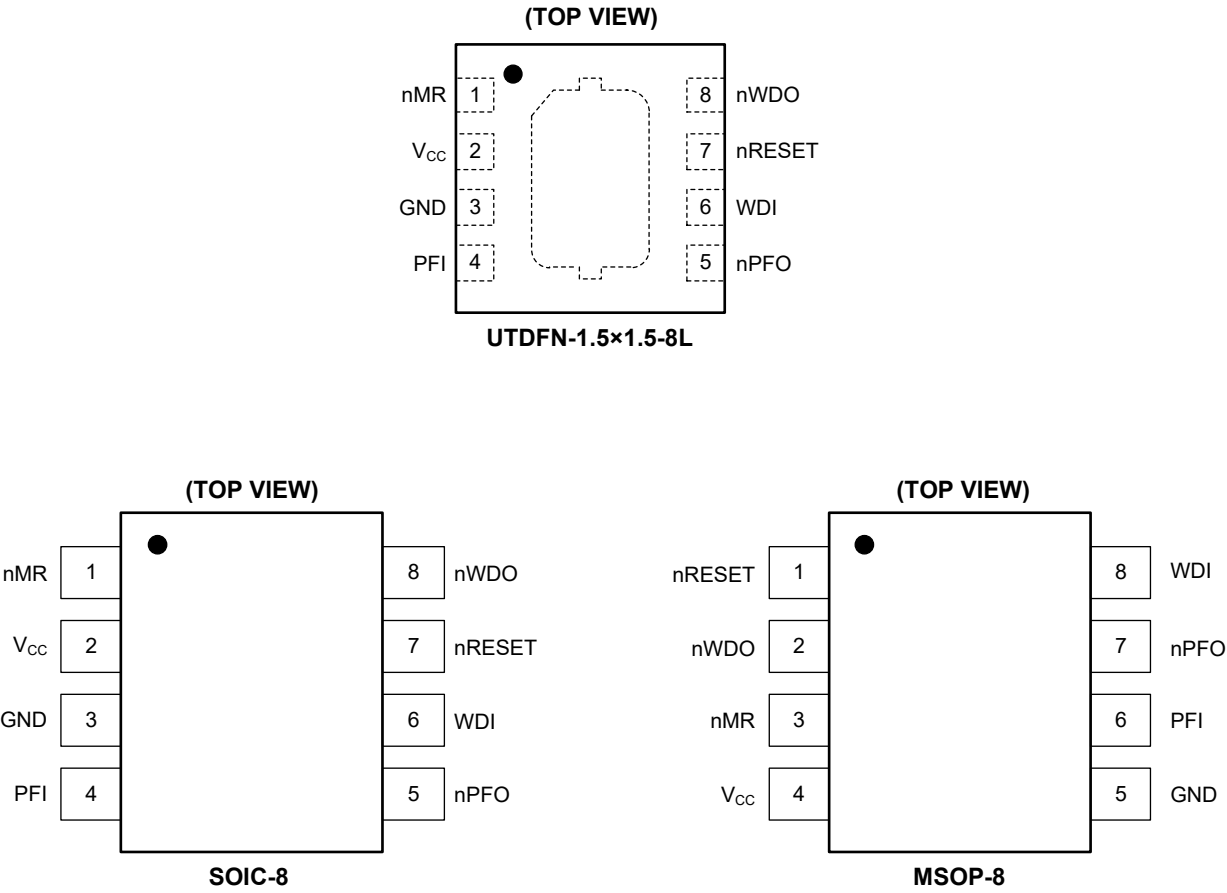
**ESD SENSITIVITY CAUTION**

This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because even small parametric changes could cause the device not to meet the published specifications.

**DISCLAIMER**

SG Micro Corp reserves the right to make any change in circuit design, or specifications without prior notice.

PIN CONFIGURATIONS



## PIN DESCRIPTION

| PIN              |        |        | NAME     | FUNCTION                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------|--------|--------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| UTDFN-1.5×1.5-8L | SOIC-8 | MSOP-8 |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1                | 1      | 3      | nMR      | Manual Reset Input Pin. It is an active-low reset input with an internal 234μA ( $V_{CC} = +5V$ ) pull-up current. nMR can be driven by a CMOS/TTL logic or by a switch shorting to GND. If not used, leave it open or connect it to $V_{CC}$ .                                                                                                                                                                                                                   |
| 2                | 2      | 4      | $V_{CC}$ | Supply Voltage Pin.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3                | 3      | 5      | GND      | Ground.                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 4                | 4      | 6      | PFI      | Power-Fail Voltage Monitor Input Pin. nPFO will go low when PFI is lower than 1.25V. If not used, connect PFI to GND or $V_{CC}$ .                                                                                                                                                                                                                                                                                                                                |
| 5                | 5      | 7      | nPFO     | Power-Fail Voltage Monitor Output Pin. nPFO will go low when PFI is lower than 1.25V. nPFO will remain high when PFI is more than 1.25V.                                                                                                                                                                                                                                                                                                                          |
| 6                | 6      | 8      | WDI      | Watchdog Input Pin. If the WDI remains high or low for longer than the watchdog timeout period (1.6s, TYP), the internal watchdog timer expires and WDO goes low. The internal watchdog timer is kept clear while a reset is asserted or WDI is three-stated. The timer is also cleared if the WDI input is changed (on rising or falling edges). The watchdog feature is disabled if the WDI is left open or if it is connected to a three-stated buffer output. |
| 7                | 7      | 1      | nRESET   | Active-Low Reset Output Pin. It delivers a 200ms (TYP) low pulse when activated. nRESET remains low if $V_{CC}$ is below the reset threshold or nMR is logic low. It goes (or remains) low for 200ms after any of the following events: $V_{CC}$ rises above the reset threshold or the nMR input goes from low to high.                                                                                                                                          |
| 8                | 8      | 2      | nWDO     | Watchdog Output Pin. If the WDI finishes the watchdog timeout period (1.6s, TYP) and remains low before the timer is cleared, the $\overline{WDO}$ goes low. WDO is different from RESET in that it does not have a minimum pulse width. Once $V_{CC}$ is higher than the reset threshold, $\overline{WDO}$ will immediately go high.                                                                                                                             |
| Exposed Pad      | —      | —      | —        | Exposed pad. It can be left floating.                                                                                                                                                                                                                                                                                                                                                                                                                             |

## ELECTRICAL CHARACTERISTICS

( $T_A = +25^\circ\text{C}$ ,  $V_{CC} = 4.72\text{V}$  to  $5.5\text{V}$  for SGM706B-L;  $V_{CC} = 4.47\text{V}$  to  $5.5\text{V}$  for SGM706B-M;  $V_{CC} = 4.08\text{V}$  to  $5.5\text{V}$  for SGM706B-J;  $V_{CC} = 3.15\text{V}$  to  $5.5\text{V}$  for SGM706B-T;  $V_{CC} = 2.99\text{V}$  to  $5.5\text{V}$  for SGM706B-S;  $V_{CC} = 2.69\text{V}$  to  $5.5\text{V}$  for SGM706B-R, Full =  $-40^\circ\text{C}$  to  $+125^\circ\text{C}$ , unless otherwise noted.)

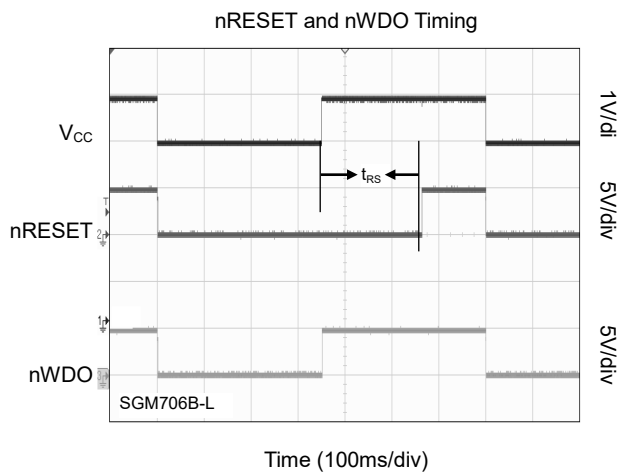
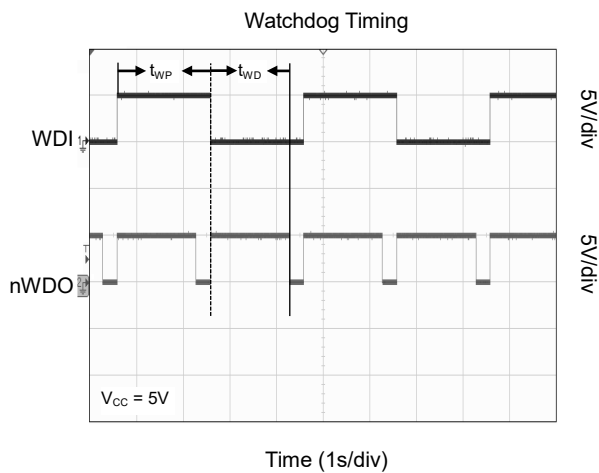
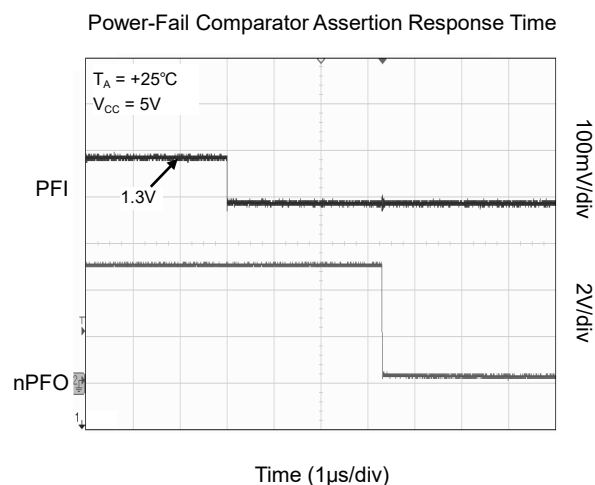
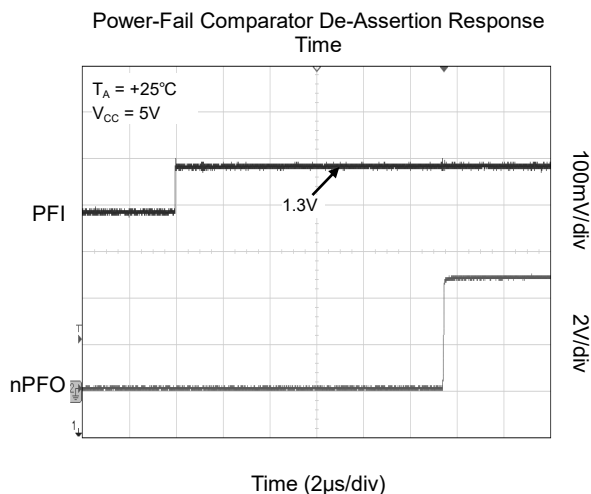
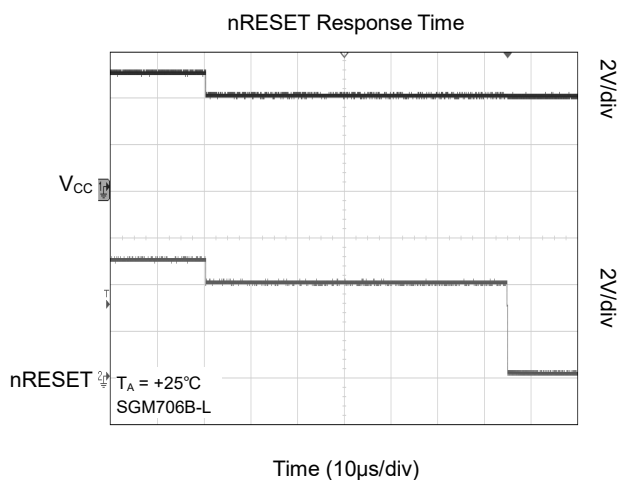
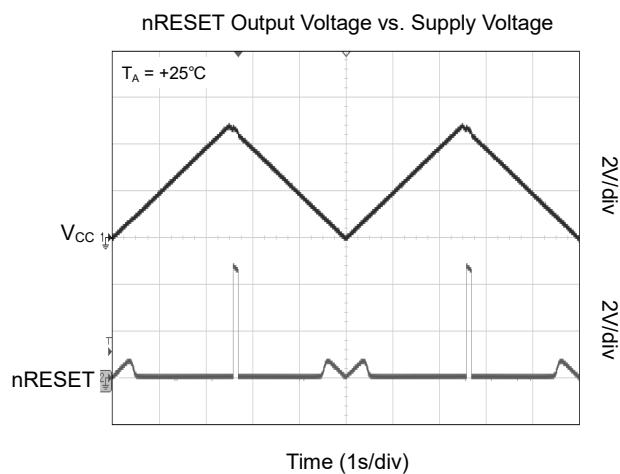
| PARAMETER                                |                                                   | CONDITIONS                               | TEMP                | MIN                 | TYP   | MAX  | UNITS                 |
|------------------------------------------|---------------------------------------------------|------------------------------------------|---------------------|---------------------|-------|------|-----------------------|
| Operating Voltage Range ( $V_{CC}$ )     |                                                   |                                          | Full                | 1.0                 |       | 5.5  | V                     |
| Supply Current ( $I_{SUPPLY}$ )          |                                                   | $V_{CC} = 3.6\text{V}$                   | Full                |                     | 0.6   | 1.2  | $\mu\text{A}$         |
|                                          |                                                   | $V_{CC} = 5.5\text{V}$                   | Full                |                     | 0.8   | 1.5  | $\mu\text{A}$         |
| nRESET Threshold ( $V_{nRST}$ )          | SGM706B-L                                         |                                          | $+25^\circ\text{C}$ | 4.55                | 4.63  | 4.70 | V                     |
|                                          |                                                   |                                          | Full                | 4.52                | 4.63  | 4.72 |                       |
|                                          | SGM706B-M                                         |                                          | $+25^\circ\text{C}$ | 4.30                | 4.38  | 4.45 |                       |
|                                          |                                                   |                                          | Full                | 4.28                | 4.38  | 4.47 |                       |
|                                          | SGM706B-J                                         |                                          | $+25^\circ\text{C}$ | 3.93                | 4.0   | 4.07 |                       |
|                                          |                                                   |                                          | Full                | 3.92                | 4.0   | 4.08 |                       |
|                                          | SGM706B-T                                         |                                          | $+25^\circ\text{C}$ | 3.03                | 3.08  | 3.14 |                       |
|                                          |                                                   |                                          | Full                | 3.02                | 3.08  | 3.15 |                       |
|                                          | SGM706B-S                                         |                                          | $+25^\circ\text{C}$ | 2.88                | 2.93  | 2.98 |                       |
|                                          |                                                   |                                          | Full                | 2.87                | 2.93  | 2.99 |                       |
|                                          | SGM706B-R                                         |                                          | $+25^\circ\text{C}$ | 2.58                | 2.63  | 2.68 |                       |
|                                          |                                                   |                                          | Full                | 2.57                | 2.63  | 2.69 |                       |
| nRESET Threshold Hysteresis              | SGM706B-L                                         |                                          | $+25^\circ\text{C}$ |                     | 20    |      | mV                    |
|                                          | SGM706B-M                                         |                                          | $+25^\circ\text{C}$ |                     | 19    |      |                       |
|                                          | SGM706B-J                                         |                                          | $+25^\circ\text{C}$ |                     | 17    |      |                       |
|                                          | SGM706B-T                                         |                                          | $+25^\circ\text{C}$ |                     | 13    |      |                       |
|                                          | SGM706B-S                                         |                                          | $+25^\circ\text{C}$ |                     | 13    |      |                       |
|                                          | SGM706B-R                                         |                                          | $+25^\circ\text{C}$ |                     | 11    |      |                       |
| nRESET Threshold Temperature Coefficient |                                                   |                                          | Full                |                     | 20    |      | ppm/ $^\circ\text{C}$ |
| nRESET Pulse Width ( $t_{RS}$ )          |                                                   |                                          | Full                | 140                 | 200   | 290  | ms                    |
| nRESET Output Voltage                    | $I_{SOURCE} = 800\mu\text{A}$                     |                                          | Full                | $0.7 \times V_{CC}$ |       |      | V                     |
|                                          | $I_{SINK} = 3.2\text{mA}$                         |                                          | Full                |                     |       | 0.4  |                       |
|                                          | $V_{CC} = 1\text{V}$ , $I_{SINK} = 50\mu\text{A}$ |                                          | Full                |                     |       | 0.3  |                       |
| Watchdog Timeout Period ( $t_{WD}$ )     |                                                   |                                          | Full                | 1.1                 | 1.6   | 2.4  | s                     |
| WDI Pulse Width ( $t_{WP}$ )             |                                                   | $V_{IL} = 0\text{V}$ , $V_{IH} = V_{CC}$ | Full                | 90                  |       |      | ns                    |
| WDI Input Threshold                      | Low                                               | $V_{CC} = 5\text{V}$                     | Full                |                     |       | 0.8  | V                     |
|                                          | High                                              | $V_{CC} = 5\text{V}$                     | Full                | 3.5                 |       |      |                       |
|                                          | Low                                               | $V_{nRST(MAX)} < V_{CC} < 3.6\text{V}$   | Full                |                     |       | 0.8  |                       |
|                                          | High                                              | $V_{nRST(MAX)} < V_{CC} < 3.6\text{V}$   | Full                | $0.7 \times V_{CC}$ |       |      |                       |
| WDI Input Current                        | WDI = $V_{CC}$                                    | UTDFN-1.5×1.5-8L only                    | Full                |                     | 0.01  | 1.2  | $\mu\text{A}$         |
|                                          |                                                   | Other packages                           | Full                |                     | 0.01  | 1.0  |                       |
|                                          | WDI = 0V                                          |                                          | Full                | -1.0                | -0.01 |      |                       |
| nWDO Output Voltage                      | $I_{SOURCE} = 800\mu\text{A}$                     |                                          | Full                | $0.7 \times V_{CC}$ |       |      | V                     |
|                                          | $I_{SINK} = 1.2\text{mA}$                         |                                          | Full                |                     |       | 0.2  |                       |

**ELECTRICAL CHARACTERISTICS (continued)**

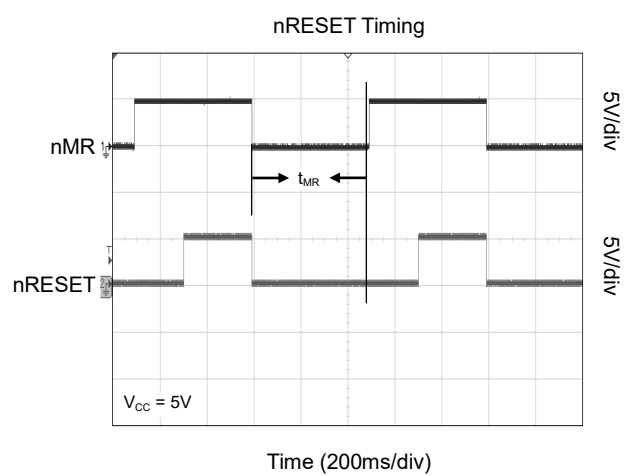
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| PARAMETER                                  |      | CONDITIONS                     |                       | TEMP | MIN                   | TYP  | MAX  | UNITS |
|--------------------------------------------|------|--------------------------------|-----------------------|------|-----------------------|------|------|-------|
| nMR Pull-Up Current                        |      | nMR = 0V, V <sub>CC</sub> = 5V |                       | Full | 100                   |      | 300  | μA    |
| nMR Pulse Width (t <sub>MR</sub> )         |      |                                |                       | Full | 300                   |      |      | ns    |
| nMR Input Threshold                        | Low  |                                |                       | Full |                       |      | 0.8  | V     |
|                                            | High |                                |                       | Full | 2                     |      |      |       |
| nMR to nRESET Out Delay (t <sub>MD</sub> ) |      |                                |                       | Full |                       |      | 420  | ns    |
| PFI Input Threshold                        |      | V <sub>CC</sub> = 5V           | UTDFN-1.5×1.5-8L only | Full | 1.20                  | 1.25 | 1.30 | V     |
|                                            |      |                                | Other packages        | Full | 1.21                  | 1.25 | 1.29 | V     |
| PFI Input Current                          |      |                                |                       | Full |                       | 0.2  | 50   | nA    |
| nPFO Output Voltage                        |      | I <sub>SOURCE</sub> = 800μA    |                       | Full | 0.7 × V <sub>CC</sub> |      |      | V     |
|                                            |      | I <sub>SINK</sub> = 3.2mA      |                       | Full |                       |      | 0.3  |       |

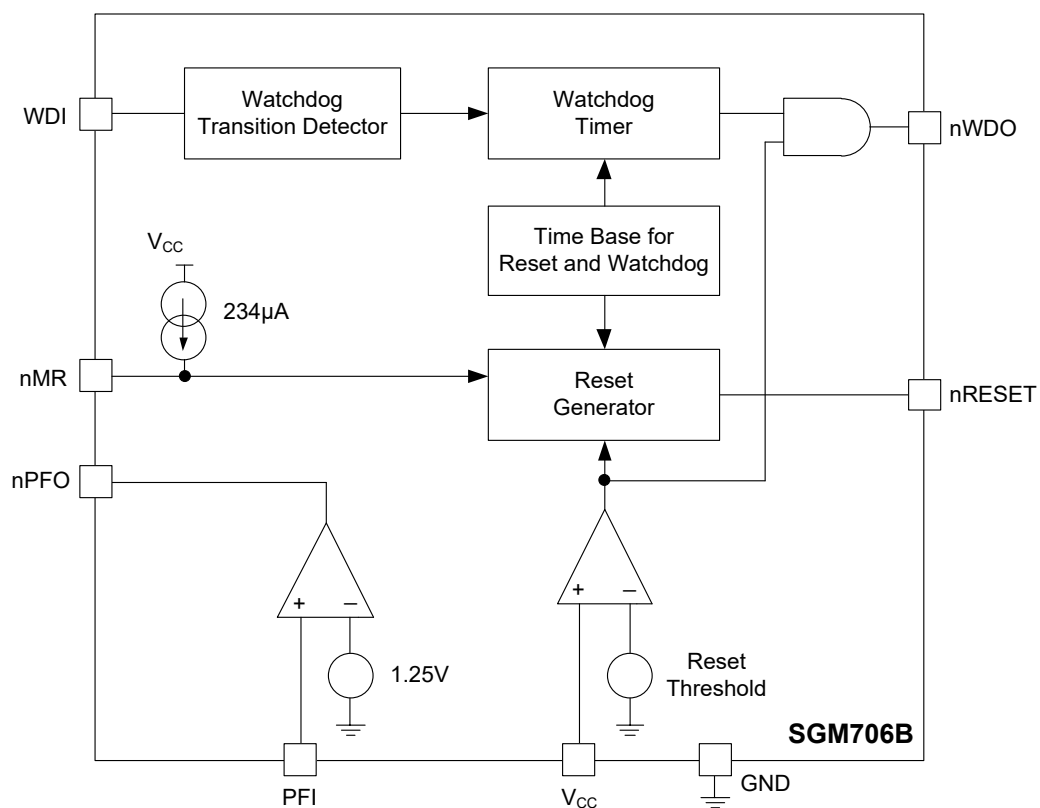
## TYPICAL PERFORMANCE CHARACTERISTICS



## TYPICAL PERFORMANCE CHARACTERISTICS (continued)



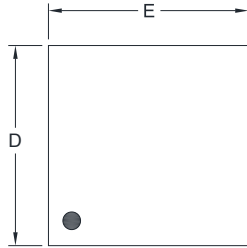
## FUNCTIONAL BLOCK DIAGRAM



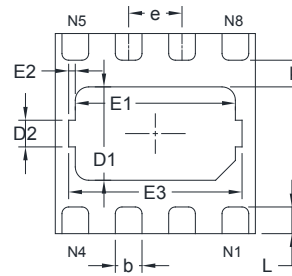
## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

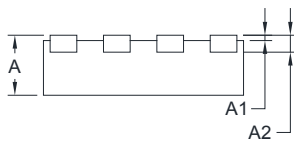
#### UTDFN-1.5×1.5-8L



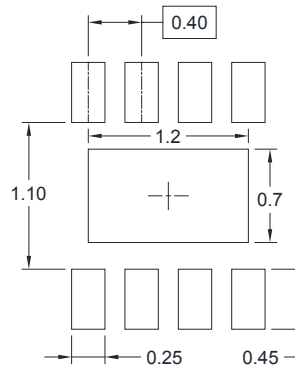
TOP VIEW



BOTTOM VIEW



SIDE VIEW



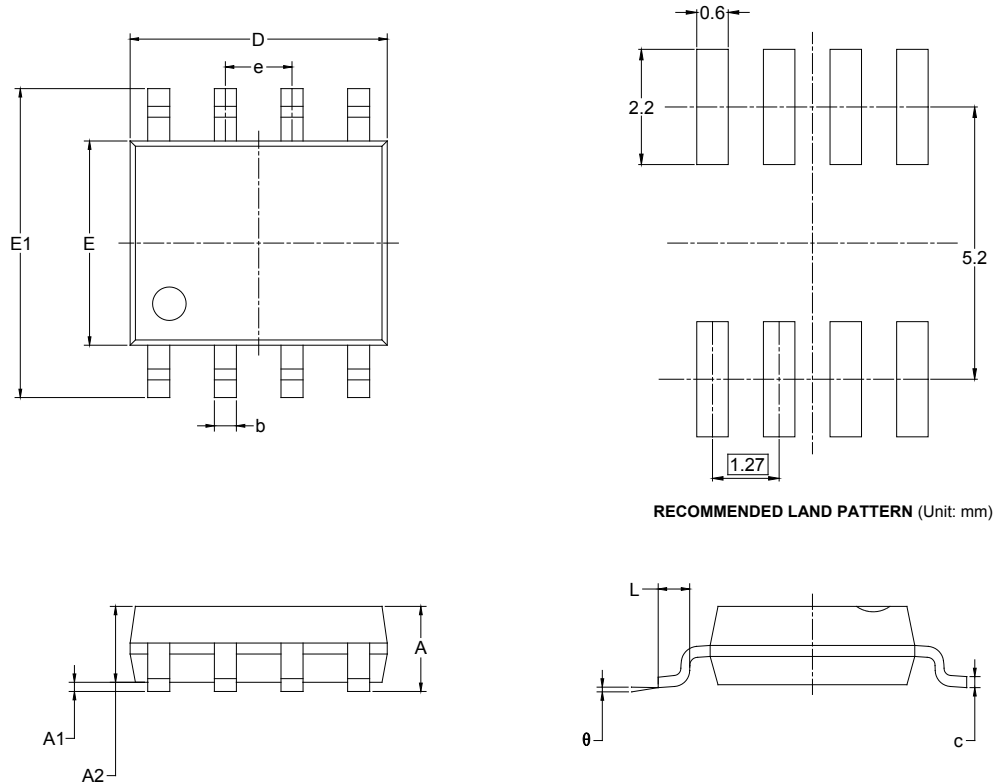
RECOMMENDED LAND PATTERN (Unit: mm)

| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.400                        | 0.500 | 0.016                   | 0.020 |
| A1     | 0.000                        | 0.050 | 0.000                   | 0.002 |
| A2     | 0.127 REF                    |       | 0.005 REF               |       |
| D      | 1.450                        | 1.550 | 0.057                   | 0.061 |
| D1     | 0.600                        | 0.800 | 0.024                   | 0.031 |
| D2     | 0.200 REF                    |       | 0.008 REF               |       |
| E      | 1.450                        | 1.550 | 0.057                   | 0.061 |
| E1     | 1.100                        | 1.300 | 0.043                   | 0.051 |
| E2     | 0.050 REF                    |       | 0.002 REF               |       |
| E3     | 1.200                        | 1.400 | 0.047                   | 0.055 |
| k      | 0.200 REF                    |       | 0.008 REF               |       |
| b      | 0.150                        | 0.250 | 0.006                   | 0.010 |
| e      | 0.400 BSC                    |       | 0.016 BSC               |       |
| L      | 0.150                        | 0.250 | 0.006                   | 0.010 |

## PACKAGE INFORMATION

### PACKAGE OUTLINE DIMENSIONS

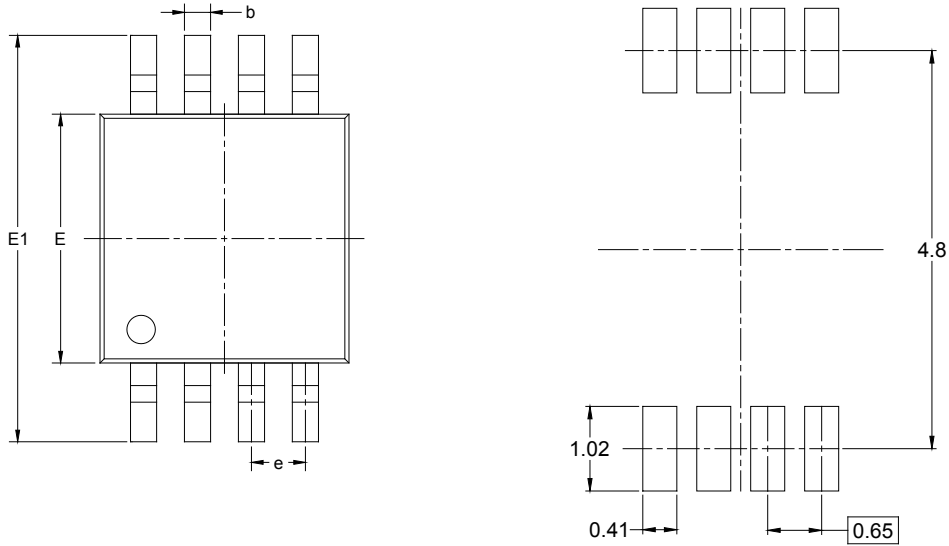
#### SOIC-8



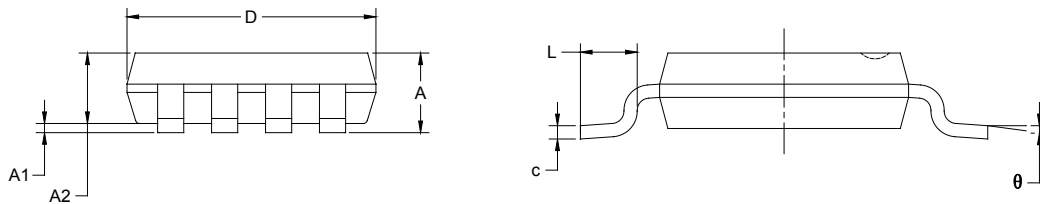
| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 1.350                        | 1.750 | 0.053                   | 0.069 |
| A1     | 0.100                        | 0.250 | 0.004                   | 0.010 |
| A2     | 1.350                        | 1.550 | 0.053                   | 0.061 |
| b      | 0.330                        | 0.510 | 0.013                   | 0.020 |
| c      | 0.170                        | 0.250 | 0.006                   | 0.010 |
| D      | 4.700                        | 5.100 | 0.185                   | 0.200 |
| E      | 3.800                        | 4.000 | 0.150                   | 0.157 |
| E1     | 5.800                        | 6.200 | 0.228                   | 0.244 |
| e      | 1.27 BSC                     |       | 0.050 BSC               |       |
| L      | 0.400                        | 1.270 | 0.016                   | 0.050 |
| θ      | 0°                           | 8°    | 0°                      | 8°    |

## PACKAGE OUTLINE DIMENSIONS

### MSOP-8



RECOMMENDED LAND PATTERN (Unit: mm)

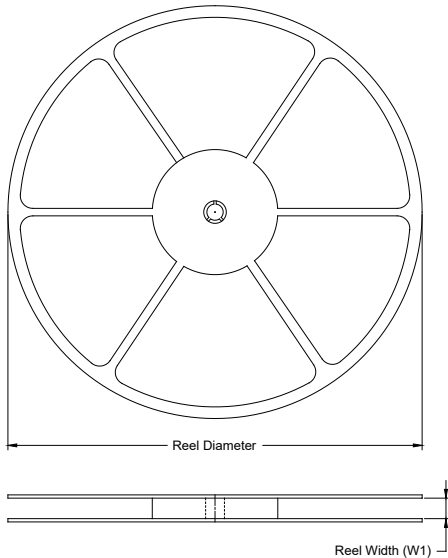


| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.820                        | 1.100 | 0.032                   | 0.043 |
| A1     | 0.020                        | 0.150 | 0.001                   | 0.006 |
| A2     | 0.750                        | 0.950 | 0.030                   | 0.037 |
| b      | 0.250                        | 0.380 | 0.010                   | 0.015 |
| c      | 0.090                        | 0.230 | 0.004                   | 0.009 |
| D      | 2.900                        | 3.100 | 0.114                   | 0.122 |
| E      | 2.900                        | 3.100 | 0.114                   | 0.122 |
| E1     | 4.750                        | 5.050 | 0.187                   | 0.199 |
| e      | 0.650 BSC                    |       | 0.026 BSC               |       |
| L      | 0.400                        | 0.800 | 0.016                   | 0.031 |
| θ      | 0°                           | 6°    | 0°                      | 6°    |

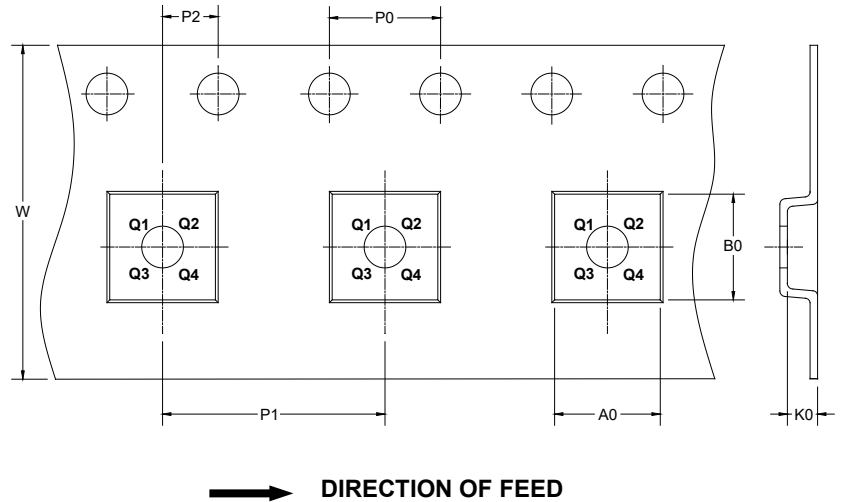
## PACKAGE INFORMATION

### TAPE AND REEL INFORMATION

#### REEL DIMENSIONS



#### TAPE DIMENSIONS



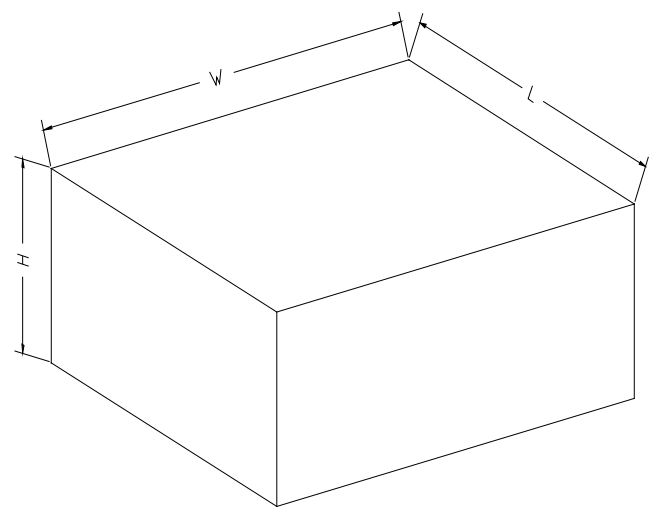
NOTE: The picture is only for reference. Please make the object as the standard.

#### KEY PARAMETER LIST OF TAPE AND REEL

| Package Type     | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|------------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| UTDFN-1.5×1.5-8L | 7"            | 9.0                | 1.70    | 1.70    | 0.75    | 4.0     | 4.0     | 2.0     | 8.0    | Q1            |
| SOIC-8           | 13"           | 12.4               | 6.40    | 5.40    | 2.10    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |
| MSOP-8           | 13"           | 12.4               | 5.20    | 3.30    | 1.50    | 4.0     | 8.0     | 2.0     | 12.0   | Q1            |

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CARTON BOX DIMENSIONS



NOTE: The picture is only for reference. Please make the object as the standard.

KEY PARAMETER LIST OF CARTON BOX

| Reel Type   | Length (mm) | Width (mm) | Height (mm) | Pizza/Carton |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368         | 227        | 224         | 8            |
| 7"          | 442         | 410        | 224         | 18           |
| 13"         | 386         | 280        | 370         | 5            |

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