SGM858xQ
Automotive Windowed Watchdog Timer

GENERAL DESCRIPTION

The SGM858xQ is a windowed watchdog timer designed to monitor and reset the microcontroller unit (MCU). During power-up or under-voltage conditions, it generates a low-level reset signal to the MCU. In normal operation, the MCU must cyclically send trigger signals within a programmable time window (long/short window mode via MODE pin). The watchdog will issue a reset signal to the MCU under the occurrence of missing or faulty triggers of WDI. The SGM858AQ features a 5V power supply, and SGM858BQ features a 3.3V power supply.

The device is AEC-Q100 qualified (Automotive Electronics Council (AEC) standard Q100 Grade 1) and it is suitable for automotive applications.

The SGM858xQ is available in a Green SOIC-8 package.

FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  Device Temperature Grade 1
  T_A = -40℃ to +125℃
- **Functional Safety**
  - **Available Documentation in the Design of Functional Safety Systems**
- **Windowed Watchdog Function**
- **Watchdog Disable Function**
- **Power-On Reset During Power-Up and Under-Voltage**
- **Programmable Short Window Mode or Long Window Mode**
- **Available in a Green SOIC-8 Package**

APPLICATIONS

Driver Monitoring
Automotive Telematics Control Unit
Digital Cockpit Processing Unit
On-Board & Wireless Charger (OBC)
ADAS Domain Controller
Microcontrollers and DSPs

代理商 威尔迈 www.visvie.com
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TYPICAL APPLICATION

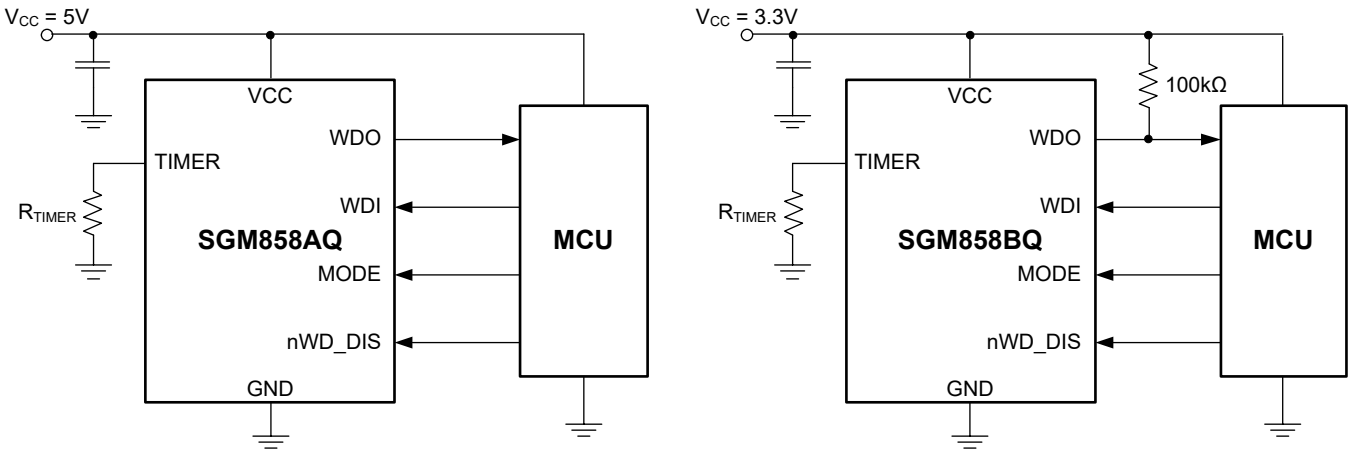


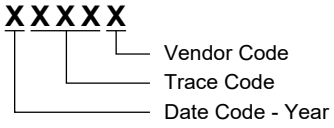
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE TOP MARKING	PACKING OPTION
SGM858AQ	SOIC-8	-40℃ to +125℃	SGM858AQS8G/TR	1ZES8 XXXXX	Tape and Reel, 4000
SGM858BQ	SOIC-8	-40℃ to +125℃	SGM858BQS8G/TR	1ZDS8 XXXXX	Tape and Reel, 4000

MARKING INFORMATION

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



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

Supply Voltage of All Pins ..... -0.3V to 6V
Package Thermal Resistance
SOIC-8, θ_{JA} ..... 157.2℃/W
SOIC-8, θ_{JB} ..... 98℃/W
SOIC-8, θ_{JC} ..... 94.2℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility (1) (2)
HBM ..... ±3000V
CDM ..... ±1000V

NOTES:

1. For human body model (HBM), all pins comply with AEC-Q100-002 specification.

2. For charged device model (CDM), all pins comply with AEC-Q100-011 specification.

RECOMMENDED OPERATING CONDITIONS

Supply Voltage, V_{CC}
SGM858AQ 5V
SGM858BQ 3.3V
Operating Junction Temperature Range ..... -40℃ to +125℃

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

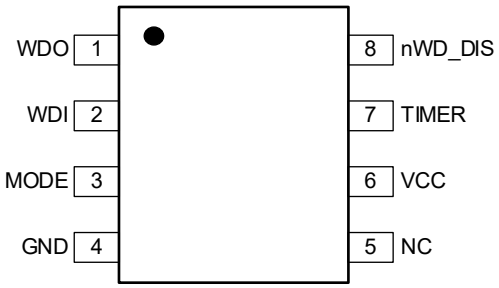
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance 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 CONFIGURATION

(TOP VIEW)



SOIC-8

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	WDO	Watchdog Output Pin. It sends a reset signal to the MCU. For SGM858AQ, the WDO is a push-pull output. For SGM858BQ, the WDO is an open-drain output.
2	WDI	Watchdog Input Pin. It receives a trigger signal from the MCU.
3	MODE	Mode Switching Pin. When MODE is high, the watchdog enters the long window mode. When MODE is low, the watchdog enters the short window mode. This pin features a weak internal pull-up.
4	GND	Ground.
5	NC	No Connection.
6	VCC	Power Supply Pin. 5V for SGM858AQ, 3.3V for SGM858BQ.
7	TIMER	Watchdog Timer Pin. Adjust the timeout period using an external resistor.
8	nWD_DIS	Watchdog Disable Pin. When nWD_DIS is high, the watchdog is enabled. When nWD_DIS is low, the watchdog is disabled. This pin features a weak internal pull-up.

ELECTRICAL CHARACTERISTICS

(V_{CC} = 5V for SGM858AQ, V_{CC} = 3.3V for SGM858BQ, T_A = -40℃ to +125℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS
Power Supply						
Timer Voltage		R_{TIMER} = 51kΩ		0.3		V
Quiescent Current	I_Q	SGM858AQ, R_{TIMER} = 100kΩ		10	15	μA
		SGM858BQ, R_{TIMER} = 100kΩ		9	15	
		SGM858AQ, R_{TIMER} = 51kΩ		13.5	20	μA
		SGM858BQ, R_{TIMER} = 51kΩ		12	20	
Power-On Reset Threshold	V_{POR_H}	SGM858AQ, WDO goes high with rising VCC	4.4	4.6	4.8	V
		SGM858BQ, WDO goes high with rising VCC	2.9	3.0	3.1	
	V_{POR_L}	SGM858AQ, WDO goes low with falling VCC	4.3	4.5	4.7	V
		SGM858BQ, WDO goes low with falling VCC	2.8	2.9	3.0	
Timing						
Single Period	t	R_{TIMER} = 51kΩ	-15%	930	15%	μs
Power-On Delay	t_0	R_{TIMER} = 51kΩ		10		Cycle
Sync Signal Monitoring Time	t_1	R_{TIMER} = 51kΩ		450		Cycle
Watchdog Window Close Time (Short Mode)	t_2	R_{TIMER} = 51kΩ, MODE = low		15		Cycle
Watchdog Window Open Time (Short Mode)	t_3	R_{TIMER} = 51kΩ, MODE = low		10		Cycle
Watchdog Window Close Time (Long Mode)	t_4	R_{TIMER} = 51kΩ, MODE = high		1500		Cycle
Watchdog Window Open Time (Long Mode)	t_5	R_{TIMER} = 51kΩ, MODE = high		1000		Cycle
WDO Reset Pulse Width	t_6	R_{TIMER} = 51kΩ		4		Cycle
WDI_OK Pulse Width			10			μs
Input and Output						
WDI High-Level Input Voltage		SGM858AQ	3.2			V
		SGM858BQ	2.1			
WDI Low-Level Input Voltage		SGM858AQ			0.8	V
		SGM858BQ			0.6	
WDI Input Current		SGM858AQ, WDI = 5V			1	μA
		SGM858BQ, WDI = 3.3V			1	
MODE High-Level Input Voltage		SGM858AQ	3.2			V
		SGM858BQ	2.1			
MODE Low-Level Input Voltage		SGM858AQ			0.8	V
		SGM858BQ			0.6	
MODE Input Current		SGM858AQ, MODE = 5V			1	μA
		SGM858BQ, MODE = 3.3V			1	
		SGM858AQ, MODE = 0V		4	6	μA
		SGM858BQ, MODE = 0V		2.6	4.5	

ELECTRICAL CHARACTERISTICS (continued)

(V_{CC} = 5V for SGM858AQ, V_{CC} = 3.3V for SGM858BQ, T_A = -40℃ to +125℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNITS
nWD_DIS High-Level Input Voltage		SGM858AQ	3.2			V
		SGM858BQ	2.1			
nWD_DIS Low-Level Input Voltage		SGM858AQ			0.8	V
		SGM858BQ			0.6	
nWD_DIS Input Current		SGM858AQ, nWD_DIS = 5V			1	μA
		SGM858BQ, nWD_DIS = 3.3V			1	
		SGM858AQ, nWD_DIS = 0V		4	8	μA
		SGM858BQ, nWD_DIS = 0V		2.6	4.5	
WDO High-Level Output Voltage		SGM858AQ, V_{CC} = 5V, I_{WDO} = 1mA	4.9			V
		SGM858BQ, V_{CC} = 3.3V, $R_{PULL-UP}$ = 10kΩ	3.29			
WDO Low-Level Output Voltage		SGM858AQ, V_{CC} = 5V, I_{WDO} = 1mA			0.1	V
		SGM858AQ, V_{CC} = 1.1V, I_{WDO} = 300μA			0.1	
		SGM858BQ, sink 1mA current			0.1	

TIMING DIAGRAM

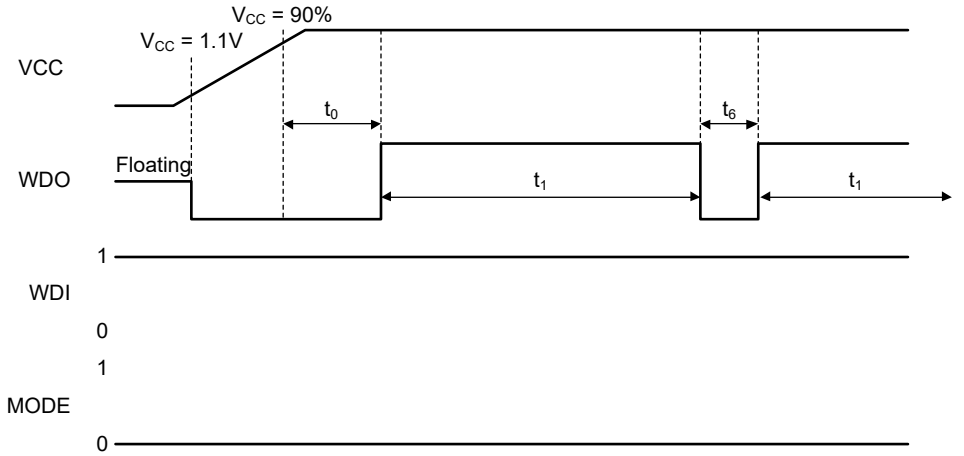


Figure 2. Power-On Reset and No Sync Signal

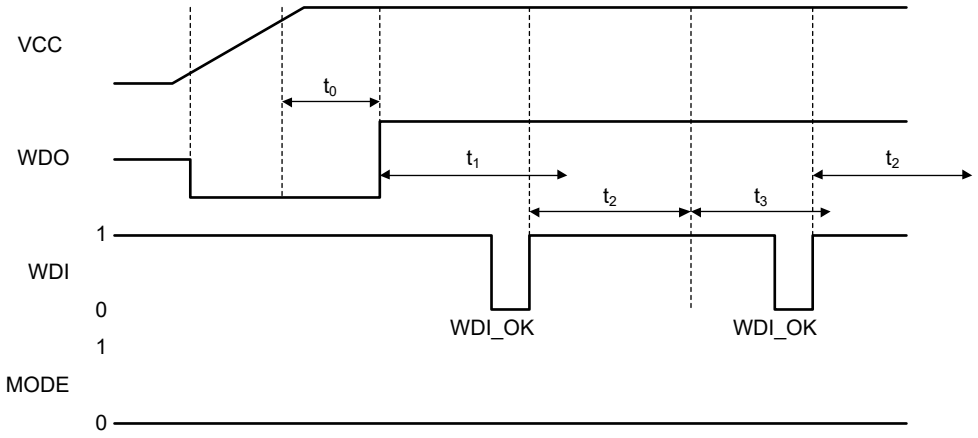


Figure 3. Synchronized by WDI and Triggered in Open Window (MODE = 0, Short Window Mode)

TIMING DIAGRAM (continued)

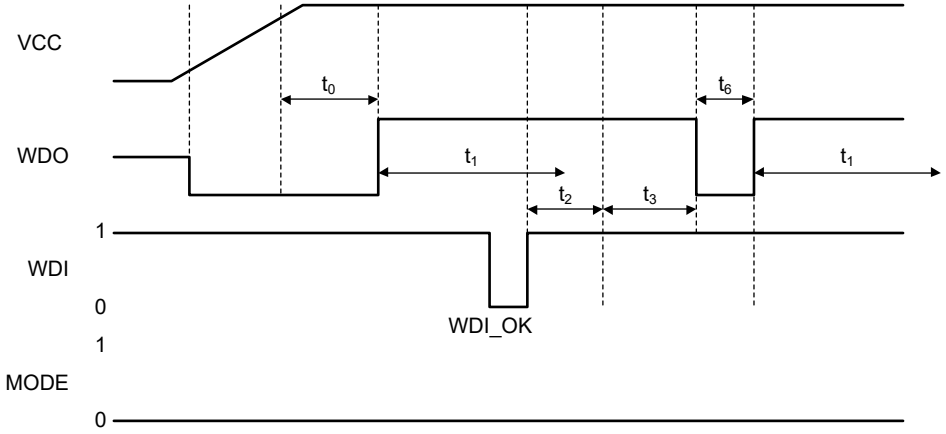
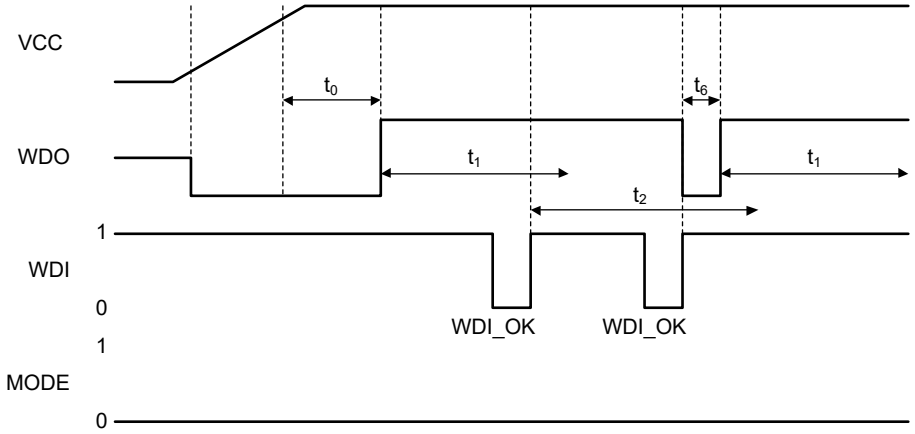


Figure 4. Synchronized by WDI and No Trigger Signal (MODE = 0, Short Window Mode)



NOTE: 1. When the rising edge of WDI_OK occurs while WDO is low, the t_6 timer resets. And the WDO reset signal lasts for t_6 + WDI_OK period.

Figure 5. Synchronized by WDI and Triggered in Closed Window (MODE = 0, Short Window Mode)

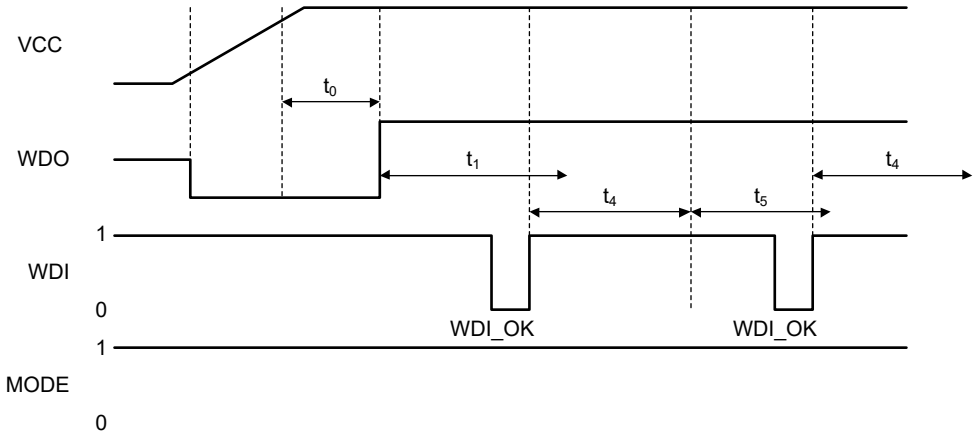


Figure 6. Synchronized by WDI and Triggered in Open Window (MODE = 1, Long Window Mode)

TIMING DIAGRAM (continued)

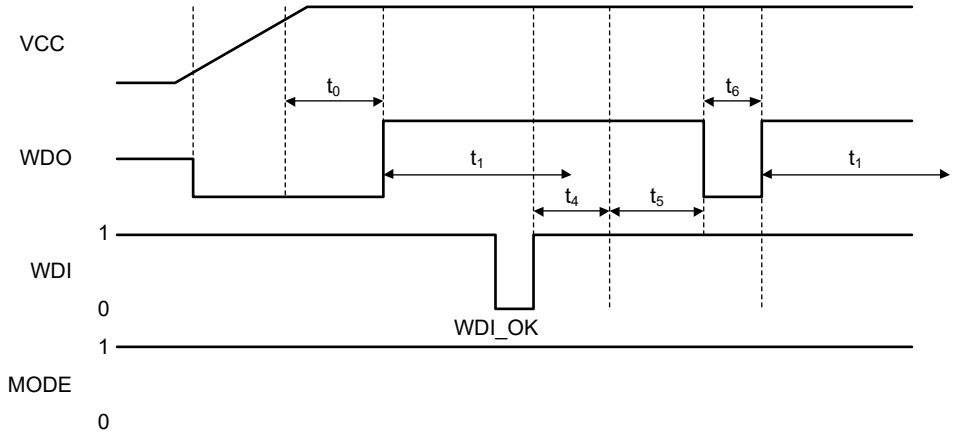
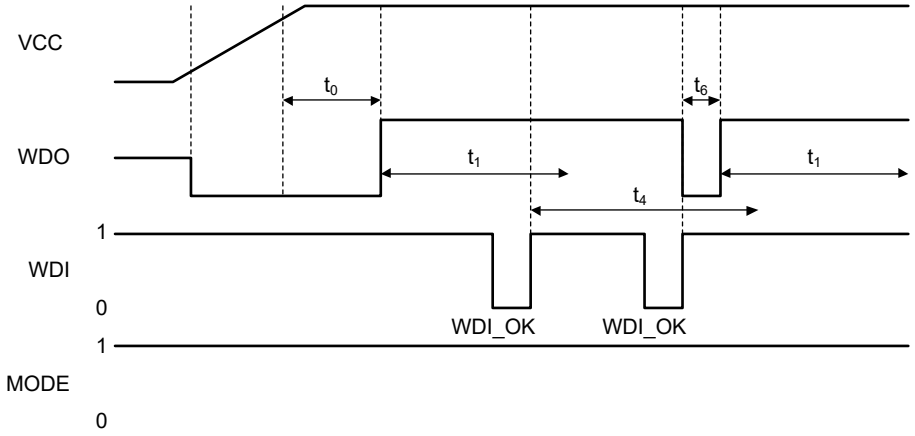


Figure 7. Synchronized by WDI and No Trigger Signal (MODE = 1, Long Window Mode)



NOTE: 1. When the rising edge of WDI_OK occurs while WDO is low, the t_6 timer resets. And the WDO reset signal lasts for t_6 + WDI_OK period.

Figure 8. Synchronized by WDI and Triggered in Closed Window (MODE = 1, Long Window Mode)

STATE DIAGRAM

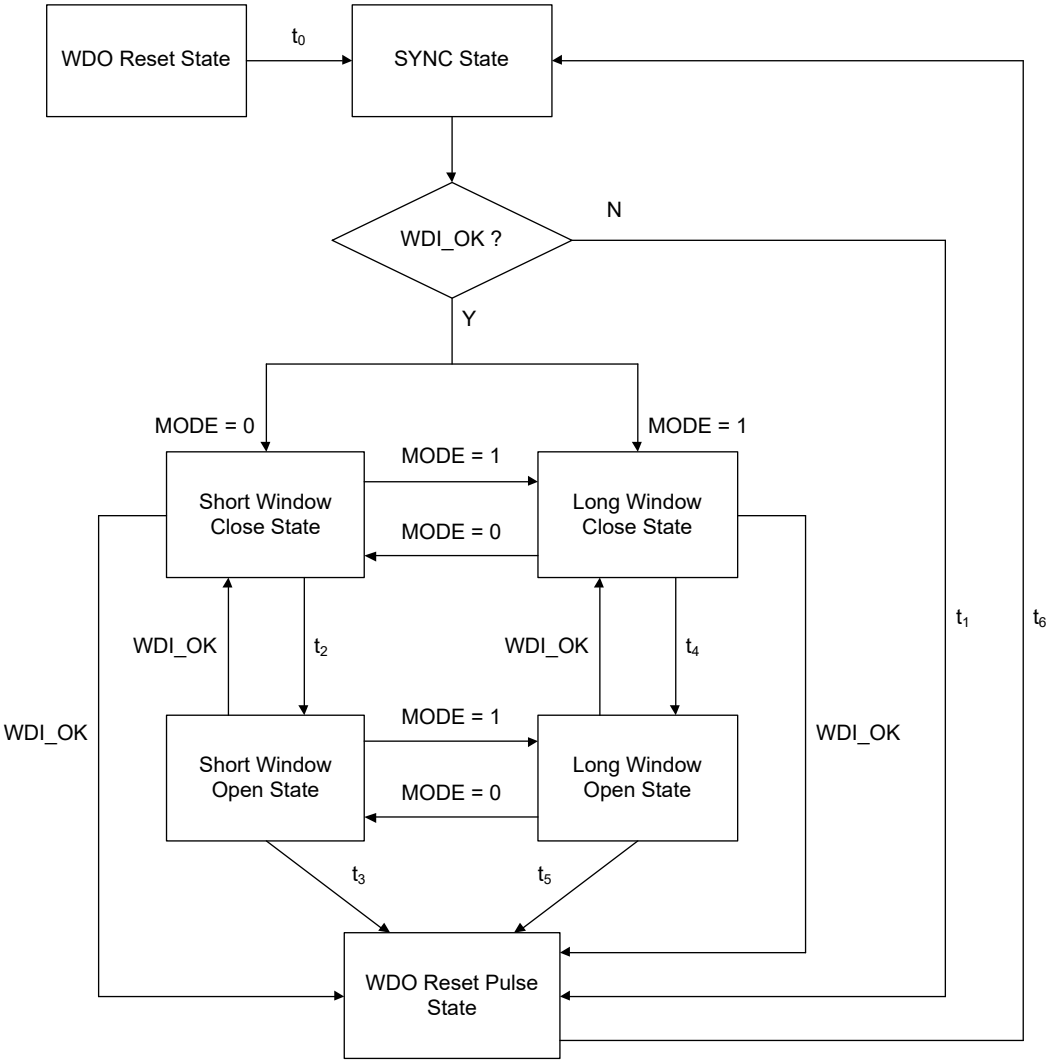
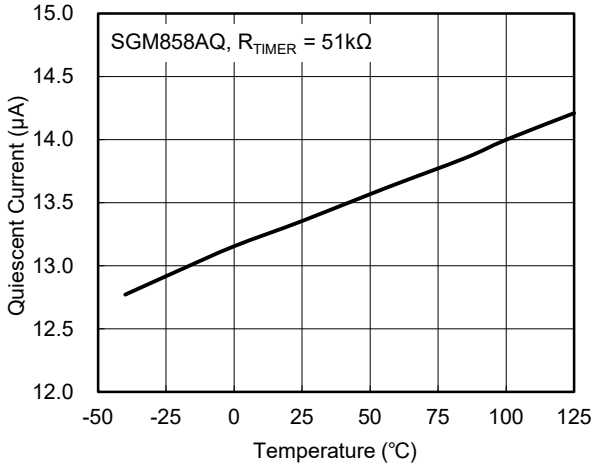


Figure 9. State Diagram

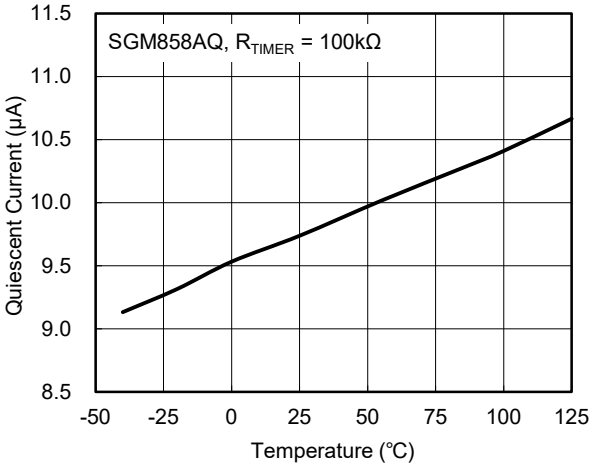
TYPICAL PERFORMANCE CHARACTERISTICS

V_{CC} = 5V for SGM858AQ, V_{CC} = 3.3V for SGM858BQ, unless otherwise noted.

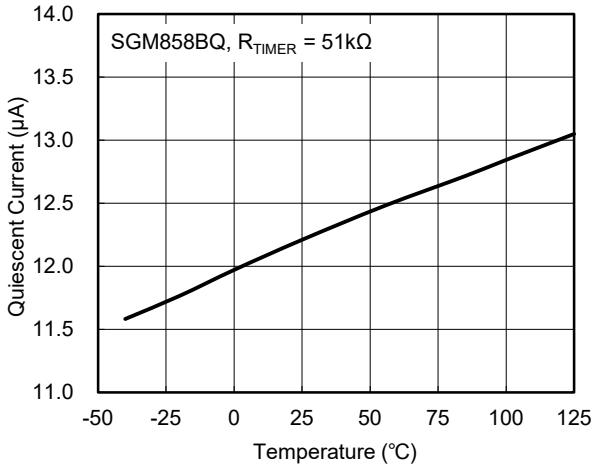
Quiescent Current vs. Temperature



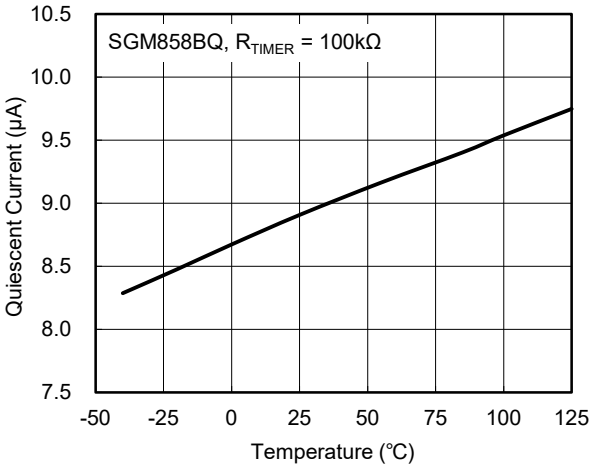
Quiescent Current vs. Temperature



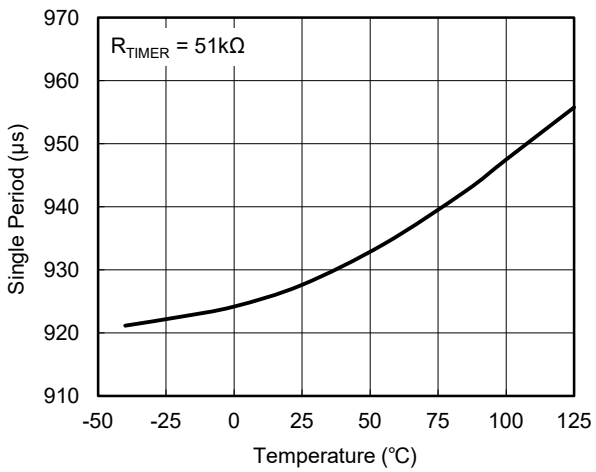
Quiescent Current vs. Temperature



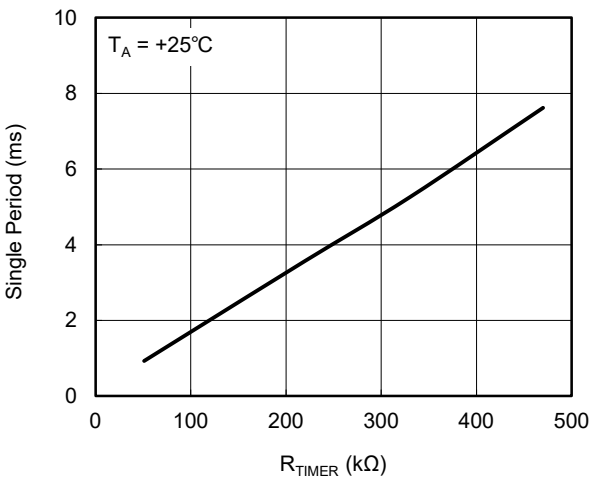
Quiescent Current vs. Temperature



Single Period vs. Temperature



Single Period vs. R_{TIMER}



FUNCTIONAL BLOCK DIAGRAM

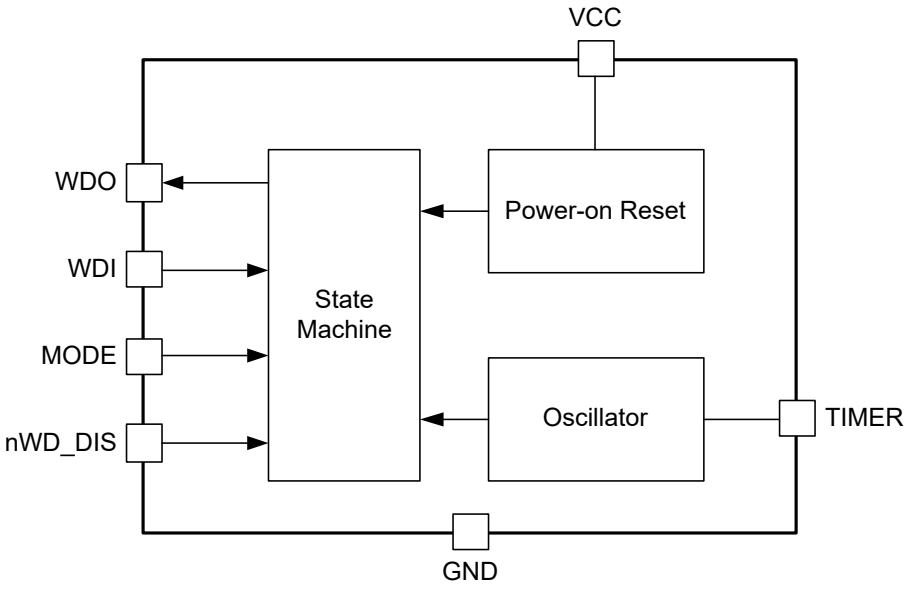


Figure 10. Block Diagram

DETAILED DESCRIPTION

Supply Voltage

The recommended supply voltage for SGM858AQ is 5V with ±10% tolerance, and the recommended supply voltage for SGM858BQ is 3.3V with ±10% tolerance. Besides, the WDO pin is floating when V_{CC} < 1.1V and will be asserted low as the VCC pin voltage rises over 1.1V. The WDO pin further remains low for a period of t_0 to wait the MCU to restart when VCC increases to 90% of the recommended voltage.

TIMER

The SGM858xQ provides a TIMER pin to adjust the single period (t) with an external resistor.

$$t(\mu s) = 15.75 \times R_{TIMER}(k\Omega) + 125 \quad (1)$$

$$R_{TIMER}(k\Omega) = 0.063 \times t(\mu s) - 7.94 \quad (2)$$

For example: R_{TIMER} = 51kΩ, t ≈ 0.93ms.

Monitor MCU Synchronization Signal

When V_{CC} increases to 90% of the recommended voltage and WDO timeouts for t_0, the SGM858xQ enters synchronous signal monitoring state. After that, if the SGM858xQ receives a WDI_OK signal within t_1, it will identify the MODE pin setup and enter a close state of either the short window mode or the long window mode. Otherwise, the WDO keeps high for t_1 and goes low for t_6 to wait for a new synchronous signal monitoring state.

Short Window Mode

Once the SGM858xQ enters the short window close state, the WDO is asserted low for t_6 and wait for a new synchronous signal monitoring state when a WDI_OK is received during t_2.

If no WDI_OK is received in t_2, then the SGM858xQ enters the short window open state. Furthermore, if no WDI_OK is received in t_2 but received in t_3, then the SGM858xQ returns back to the short window close state. Under this condition, the WDO maintains logic high and the watchdog works in normal operation.

However, if no WDI_OK is received in both t_2 and t_3, the WDO is asserted low for t_6 and SGM858xQ waits for a new synchronous signal monitoring state.

When the rising edge of WDI_OK occurs while WDO is low, the t_6 timer resets. And the WDO reset signal lasts for t_6 + WDI_OK period (See Figure 11).

DETAILED DESCRIPTION (continued)

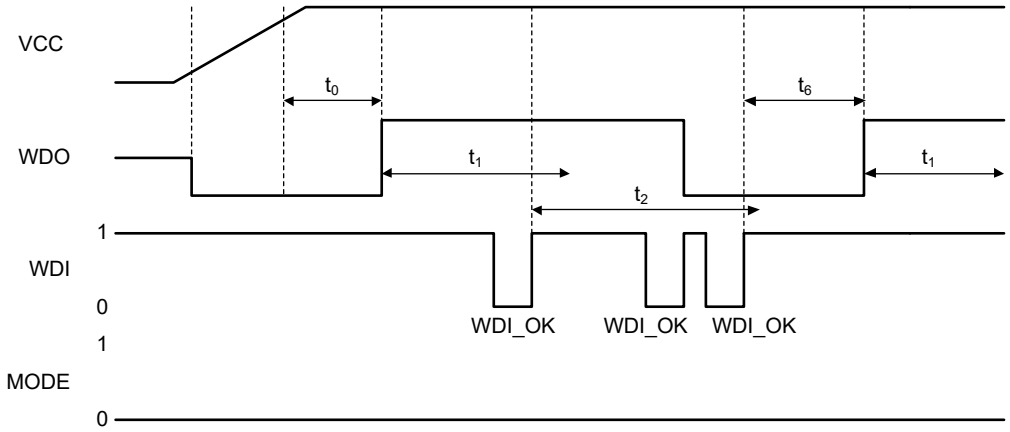


Figure 11. WDI Triggered under WDO Reset State for Short Window Mode

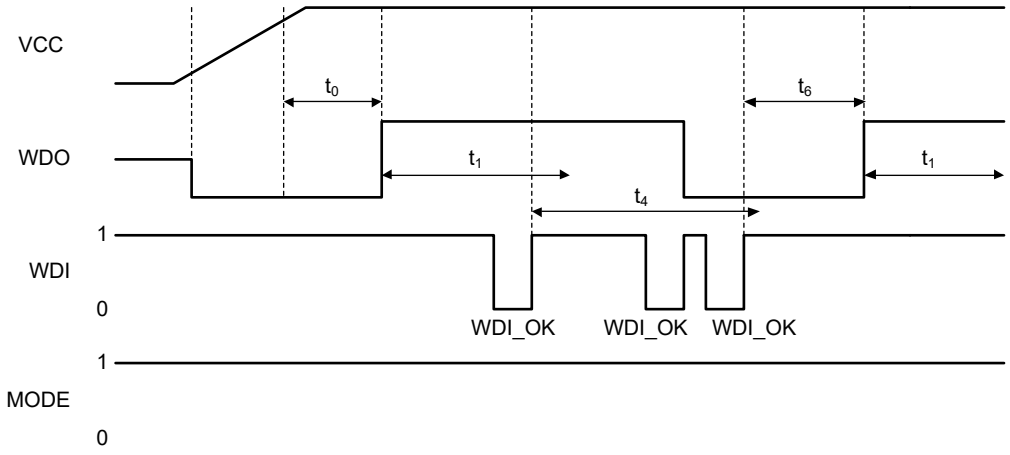


Figure 12. WDI Triggered under WDO Reset State for Long Window Mode

Long Window Mode

Once the SGM858xQ enters the long window close state, the WDO is asserted low for t_6 and wait for a new synchronous signal monitoring state when a WDI_OK is received during t_4.

If no WDI_OK is received in t_4, then the SGM858xQ enters the long window open state. Furthermore, if no WDI_OK is received in t_4 but received in t_5, then the SGM858xQ returns back to the long window close state. Under this condition, the WDO maintains logic high and the watchdog works in normal operation.

However, if no WDI_OK is received in both t_4 and t_5, the WDO is asserted low for t_6 and SGM858xQ waits for a new synchronous signal monitoring state.

When the rising edge of WDI_OK occurs while WDO is low, the t_6 timer resets. And the WDO reset signal lasts for t_6 + WDI_OK period (See Figure 12).

Watchdog Disable

When nWD_DIS is high, the watchdog is enabled. When nWD_DIS is low, the watchdog is disabled. This pin features a weak internal pull-up. When left floating, the watchdog is enabled naturally due to this feature.

MODE Detection and Transition

The MODE pin can be used to decide whether the device enters short window mode or long window mode after t_0. When the SGM858xQ received a WDI_OK during t_1, it detects the MODE setup and enters either the short window mode or the long window mode.

DETAILED DESCRIPTION (continued)

The mode transition can also be accomplished during the watchdog close state (t_2 or t_4) or open state (t_3 or t_5) by toggling the MODE pin logic level. One should be noticed that the mode transition during close/open state will turn out to be another mode corresponding state. For example, if a MODE state transition (from short window mode to long window mode) occurs during t_2, the SGM858xQ switches to the long window mode close state and the remaining time in t_2 expands to 100 multiples of that in t_4. A similar mode transition in t_3 is depicted in Figure 13.

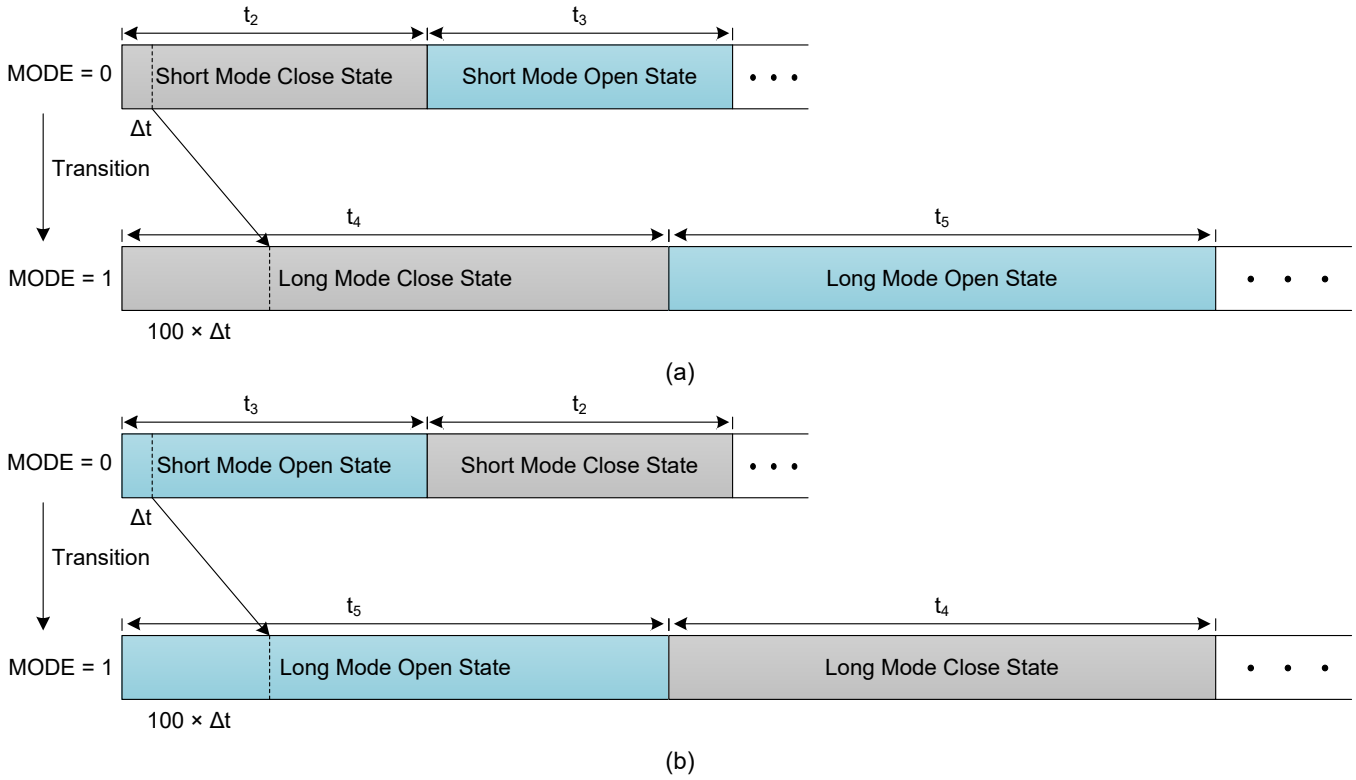


Figure 13. MODE Transition during Close/Open State

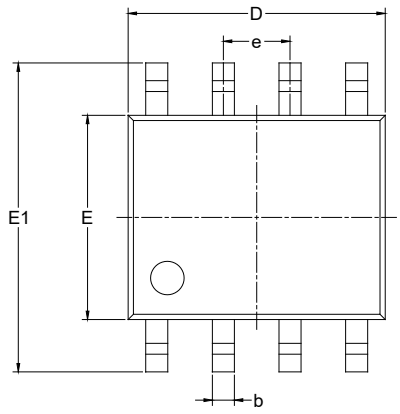
REVISION HISTORY

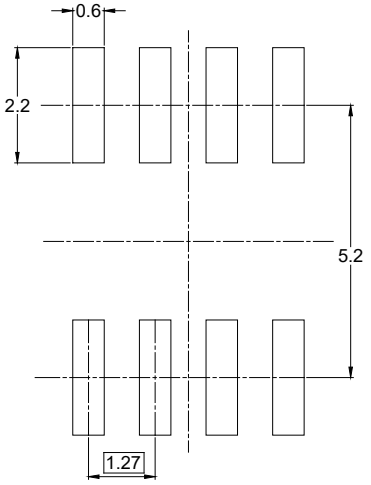
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original to REV.A (NOVEMBER 2025)	Page
Changed from product preview to production data	All

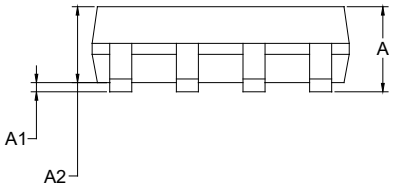
PACKAGE OUTLINE DIMENSIONS

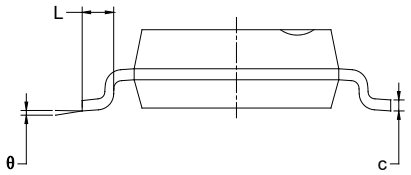
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)



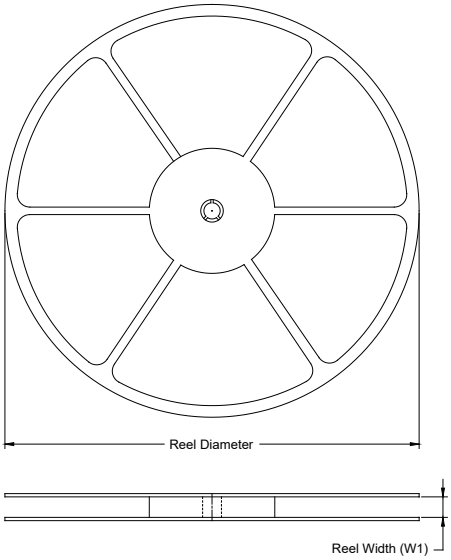


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

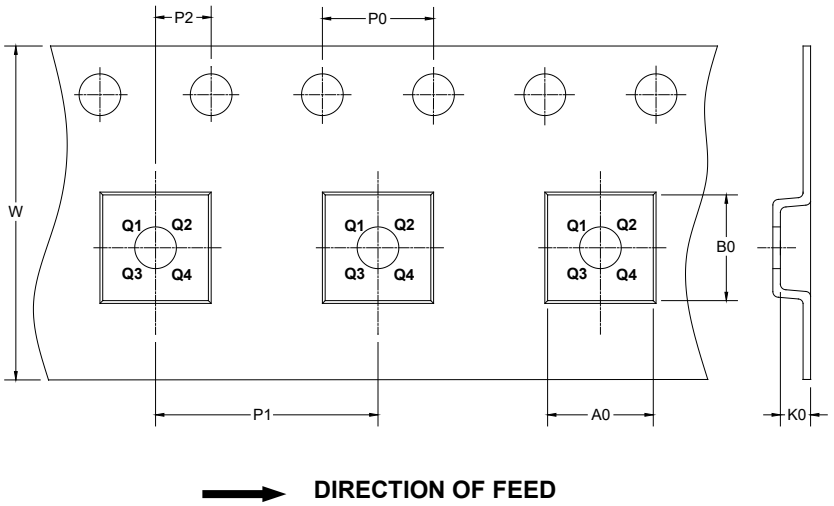
NOTES:
1. Body dimensions do not include mode flash or protrusion.
2. This drawing is subject to change without notice.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



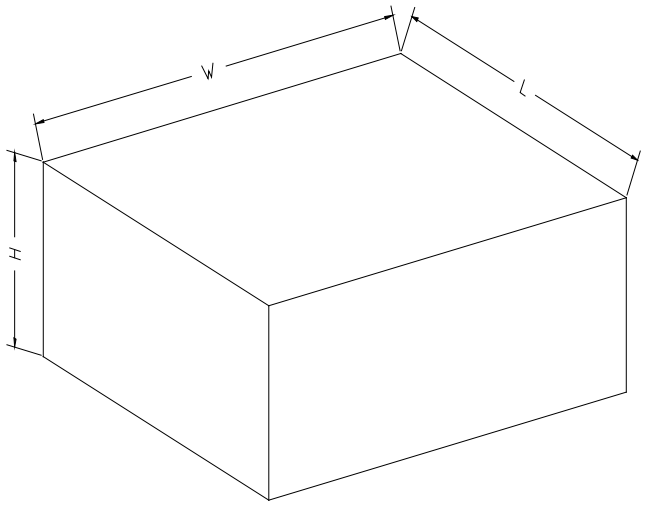
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOIC-8	13″	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1

DD0001

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
13″	386	280	370	5

DD0002