SGM894B
Voltage Detector with Delay Time Adjustable

GENERAL DESCRIPTION

The SGM894B is a low power consumption voltage detector with high accuracy detection. The miniature device offers tremendous flexibility with an adjustable threshold that is available from 1V to 5V with 0.1V increments. The SGM894B has an external capacitor-adjustable time delay. The device is ideal for use in power-supply sequencing, reset sequencing, and power-switching applications.

Moreover, the release delay time can be adjusted by the external capacitor which is connected to the C_D pin. Consequently, the delay time can be set to more than 1s when C_D capacitor is 1μF. Open-drain output configuration is available.

The SGM894B is available in Green XTDFN-0.9×1.2-4L and SC70-4 (R) packages. They are specified over the -40℃ to +125℃ operating temperature range.

APPLICATIONS

Microprocessor Reset Circuitry
Charge Voltage Monitors
Memory Battery Back-Up Switch Circuits
Power Failure Detection Circuits

FEATURES

- **High Accuracy Detection: ±1% (TYP)**
- **Low Power Consumption:0.4μA (TYP) at V_{IN} = 1V**
- **Detection Voltage Range: 1V to 5V (0.1V Increments)**
- **Operating Voltage Range: 1V to 6V**
- **Detection Voltage Temperature Coefficient: ±40ppm/℃ (TYP)**
- **N-Channel Open-Drain Output**
- **Built-in Delay Circuit: Adjustable Delay Time**
- **-40℃ to +125℃ Operating Temperature Range**
- **Available in Green XTDFN-0.9×1.2-4L and SC70-4 (R) Packages**

TYPICAL APPLICATION

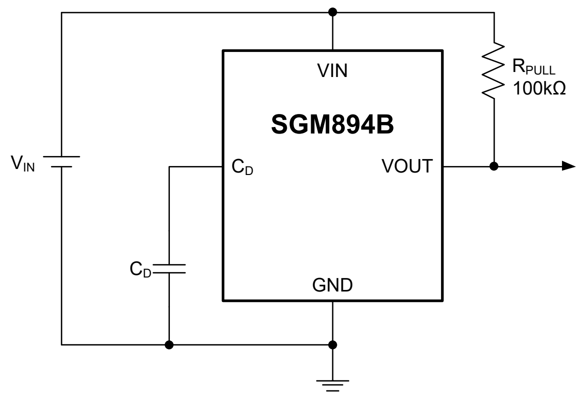


Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	DETECTION VOLTAGE (V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM894B-1.0	1.0	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.0XXEJ4G/TR	Q0XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.0XC4G/TR	OS0XX	Tape and Reel, 3000
SGM894B-1.1	1.1	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.1XXEJ4G/TR	Q6XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.1XC4G/TR	OS1XX	Tape and Reel, 3000
SGM894B-1.2	1.2	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.2XXEJ4G/TR	R9XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.2XC4G/TR	OS2XX	Tape and Reel, 3000
SGM894B-1.3	1.3	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.3XXEJ4G/TR	X5XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.3XC4G/TR	OS3XX	Tape and Reel, 3000
SGM894B-1.4	1.4	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.4XXEJ4G/TR	S1XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.4XC4G/TR	OS4XX	Tape and Reel, 3000
SGM894B-1.5	1.5	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.5XXEJ4G/TR	S2XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.5XC4G/TR	OS5XX	Tape and Reel, 3000
SGM894B-1.6	1.6	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.6XXEJ4G/TR	S3XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.6XC4G/TR	OS6XX	Tape and Reel, 3000
SGM894B-1.7	1.7	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.7XXEJ4G/TR	Q1XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.7XC4G/TR	R6FXX	Tape and Reel, 3000
SGM894B-1.8	1.8	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.8XXEJ4G/TR	S4XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.8XC4G/TR	OS7XX	Tape and Reel, 3000
SGM894B-1.9	1.9	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-1.9XXEJ4G/TR	S5XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-1.9XC4G/TR	OS8XX	Tape and Reel, 3000
SGM894B-2.0	2.0	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.0XXEJ4G/TR	S6XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.0XC4G/TR	OS9XX	Tape and Reel, 3000
SGM894B-2.1	2.1	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.1XXEJ4G/TR	S7XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.1XC4G/TR	OSAXX	Tape and Reel, 3000
SGM894B-2.2	2.2	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.2XXEJ4G/TR	S8XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.2XC4G/TR	OSBXX	Tape and Reel, 3000

PACKAGE/ORDERING INFORMATION (continued)

MODEL	DETECTION VOLTAGE (V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM894B-2.3	2.3	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.3XXEJ4G/TR	S9XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.3XC4G/TR	OSCXX	Tape and Reel, 3000
SGM894B-2.4	2.4	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.4XXEJ4G/TR	Q2XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.4XC4G/TR	OSDXX	Tape and Reel, 3000
SGM894B-2.5	2.5	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.5XXEJ4G/TR	U0XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.5XC4G/TR	OSEXX	Tape and Reel, 3000
SGM894B-2.6	2.6	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.6XXEJ4G/TR	U1XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.6XC4G/TR	OSFXX	Tape and Reel, 3000
SGM894B-2.7	2.7	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.7XXEJ4G/TR	U2XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.7XC4G/TR	OT0XX	Tape and Reel, 3000
SGM894B-2.8	2.8	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.8XXEJ4G/TR	U3XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.8XC4G/TR	OT1XX	Tape and Reel, 3000
SGM894B-2.9	2.9	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-2.9XXEJ4G/TR	U4XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-2.9XC4G/TR	OT2XX	Tape and Reel, 3000
SGM894B-3.0	3.0	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.0XXEJ4G/TR	Q3XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.0XC4G/TR	OT3XX	Tape and Reel, 3000
SGM894B-3.1	3.1	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.1XXEJ4G/TR	U5XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.1XC4G/TR	OT4XX	Tape and Reel, 3000
SGM894B-3.2	3.2	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.2XXEJ4G/TR	U6XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.2XC4G/TR	OT5XX	Tape and Reel, 3000
SGM894B-3.3	3.3	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.3XXEJ4G/TR	U7XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.3XC4G/TR	OT6XX	Tape and Reel, 3000
SGM894B-3.4	3.4	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.4XXEJ4G/TR	X6XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.4XC4G/TR	OT7XX	Tape and Reel, 3000
SGM894B-3.5	3.5	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.5XXEJ4G/TR	X7XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.5XC4G/TR	OT8XX	Tape and Reel, 3000

PACKAGE/ORDERING INFORMATION (continued)

MODEL	DETECTION VOLTAGE (V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM894B-3.6	3.6	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.6XXEJ4G/TR	X8XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.6XC4G/TR	OT9XX	Tape and Reel, 3000
SGM894B-3.7	3.7	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.7XXEJ4G/TR	V1XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.7XC4G/TR	OTAXX	Tape and Reel, 3000
SGM894B-3.8	3.8	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.8XXEJ4G/TR	V2XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.8XC4G/TR	OTBXX	Tape and Reel, 3000
SGM894B-3.9	3.9	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-3.9XXEJ4G/TR	V3XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-3.9XC4G/TR	OTCXX	Tape and Reel, 3000
SGM894B-4.0	4.0	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.0XXEJ4G/TR	Q4XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.0XC4G/TR	OTDXX	Tape and Reel, 3000
SGM894B-4.1	4.1	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.1XXEJ4G/TR	V4XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.1XC4G/TR	OTEXX	Tape and Reel, 3000
SGM894B-4.2	4.2	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.2XXEJ4G/TR	V5XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.2XC4G/TR	OTFXX	Tape and Reel, 3000
SGM894B-4.3	4.3	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.3XXEJ4G/TR	V6XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.3XC4G/TR	OU0XX	Tape and Reel, 3000
SGM894B-4.4	4.4	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.4XXEJ4G/TR	V7XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.4XC4G/TR	OU1XX	Tape and Reel, 3000
SGM894B-4.5	4.5	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.5XXEJ4G/TR	V8XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.5XC4G/TR	OU2XX	Tape and Reel, 3000
SGM894B-4.6	4.6	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.6XXEJ4G/TR	Q5XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.6XC4G/TR	OU3XX	Tape and Reel, 3000
SGM894B-4.7	4.7	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.7XXEJ4G/TR	V9XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.7XC4G/TR	OU4XX	Tape and Reel, 3000
SGM894B-4.8	4.8	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.8XXEJ4G/TR	X0XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.8XC4G/TR	OU5XX	Tape and Reel, 3000

PACKAGE/ORDERING INFORMATION (continued)

MODEL	DETECTION VOLTAGE (V)	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM894B-4.9	4.9	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-4.9XXEJ4G/TR	X1XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-4.9XC4G/TR	OU6XX	Tape and Reel, 3000
SGM894B-5.0	5.0	XTDFN-0.9×1.2-4L	-40℃ to +125℃	SGM894B-5.0XXEJ4G/TR	L7XX	Tape and Reel, 3000
		SC70-4 (R)	-40℃ to +125℃	SGM894B-5.0XC4G/TR	OU7XX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.

XTDFN-0.9×1.2-4L

YY X X
- X — Date Code - Week
- X — Date Code - Year
- YY — Serial Number

SC70-4 (R)

YYY X X
- X — Date Code - Week
- X — Date Code - Year
- YYY — Serial Number

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

Input Voltage Range, V_{IN} .... GND - 0.3V to 7V
Output Current, I_{OUT} 30mA
Output Voltage Range, V_{OUT} .... GND - 0.3V to 7V
C_D Pin Voltage Range, V_{CD} .... GND - 0.3V to V_{IN} + 0.3V
C_D Pin Current, I_{CD} 5mA
Package Thermal Resistance
XTDFN-0.9×1.2-4L, θ_{JA} .... 243℃/W
SC70-4 (R), θ_{JA} .... 680℃/W
Junction Temperature .... +150℃
Storage Temperature Range .... -65℃ to +150℃
Lead Temperature (Soldering, 10s) .... +260℃
ESD Susceptibility
HBM 4000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Operating Junction Temperature Range .... -40℃ to +125℃
Operating Ambient 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.

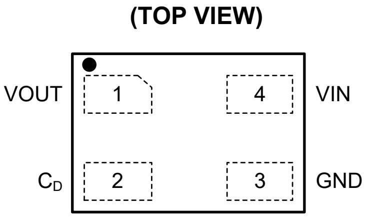
ESD SENSITIVITY CAUTION

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.

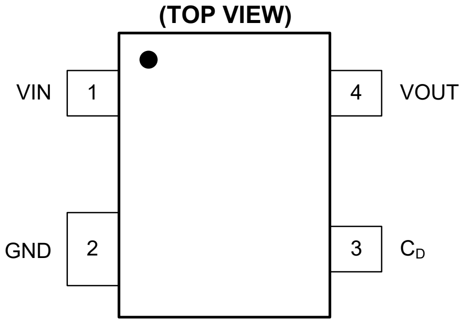
DISCLAIMER

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

PIN CONFIGURATIONS



XTDFN-0.9×1.2-4L



SC70-4 (R)

PIN DESCRIPTION

PIN		NAME	FUNCTION
XTDFN-0.9×1.2-4L	SC70-4 (R)		
1	4	VOUT	Output (Detect ‘L’) Pin.
2	3	C_D	Delay Capacitor Pin.
3	2	GND	Ground.
4	1	VIN	Input Pin.

ELECTRICAL CHARACTERISTICS

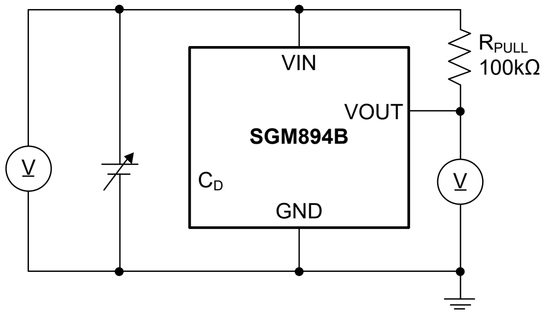
(T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Operating Voltage	V_{IN}	V_{DET} = 1V to 5V [1], T_J = -40℃ to +125℃		1		6	V
Detection Voltage	V_{DET}	V_{IN} = 1V to 6V, Test Circuit 1	T_J = +25℃	E-1			V
			T_J = -40℃ to +125℃	E-2			
Hysteresis Voltage	V_{HYS}	V_{IN} = 1V to 6V, R_{PULL} = 100kΩ, Test Circuit 1		E-3			V
Detection Voltage Temperature Coefficient	$\Delta V_{DET}/(\Delta T_J \times V_{DET})$	T_J = -40℃ to +125℃, Test Circuit 1			±40	±150	ppm/℃
Supply Current	I_{CC}	Test Circuit 2	V_{IN} = 1V		0.4	0.7	μA
			V_{IN} = 3V		0.6	1.1	
			V_{IN} = 6V		1.0	1.5	
Output Current	I_{OUT}	V_{DS_NCH} = 0.5V, Test Circuit 3	V_{IN} = 1V	0.2	0.8		mA
			V_{IN} = 2V	9.0	12.0		
			V_{IN} = 3V	13.0	17.5		
			V_{IN} = 4V	15.0	20.5		
			V_{IN} = 5V	16.0	22.0		
			V_{IN} = 6V	16.5	23.0		
Leakage Current	I_{LEAK}	V_{IN} = V_{OUT} = 6V, C_D: Open, Test Circuit 3			0.02	1.50	μA
Delay Resistance	R_{DELAY}	V_{IN} = 5V, V_{CD} = 0V, Test Circuit 4		1.7	2.2	2.6	MΩ
C_D Pin Sink Current	I_{CD}	V_{CD} = 0.5V, V_{IN} = 1V, Test Circuit 4		110	230	350	μA
C_D Pin Threshold Voltage	V_{TCD}	T_J = -40℃ to +125℃, Test Circuit 5	V_{IN} = 2V	0.9	1.0	1.2	V
			V_{IN} = 6V	2.9	3.0	3.2	
Detection Delay Time	t_{DET0}	V_{IN} = 0.9 × $V_{DET(T)}$ → 1.1 × $V_{DET(T)}$, C_D: Open, Test Circuit 6			40	80	μs
Release Delay Time	t_{DR0}	V_{IN} = 1.1 × $V_{DET(T)}$ → 0.9 × $V_{DET(T)}$, C_D: Open, Test Circuit 6			150	250	μs

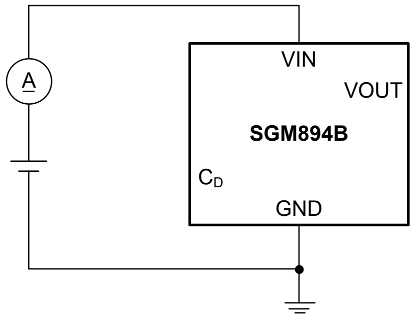
VOLTAGE CHART

Symbol	E-1		E-2		E-3		
Conditions / Nominal Voltage (V)	T_J = +25℃		T_J = -40℃ to +125℃		T_J = +25℃		
	V_{DET} (V), 1% Accuracy		V_{DET} (V), 2% Accuracy		V_{HYS} (V)		
	MIN	MAX	MIN	MAX	MIN	TYP	MAX
1.0	0.990	1.010	0.980	1.020	0.030	0.050	0.070
1.1	1.089	1.111	1.078	1.122	0.033	0.055	0.077
1.2	1.188	1.212	1.176	1.224	0.036	0.060	0.084
1.3	1.287	1.313	1.274	1.326	0.039	0.065	0.091
1.4	1.386	1.414	1.372	1.428	0.042	0.070	0.098
1.5	1.485	1.515	1.470	1.530	0.045	0.075	0.105
1.6	1.584	1.616	1.568	1.632	0.048	0.080	0.112
1.7	1.683	1.717	1.666	1.734	0.051	0.085	0.119
1.8	1.782	1.818	1.764	1.836	0.054	0.090	0.126
1.9	1.881	1.919	1.862	1.938	0.057	0.095	0.133
2.0	1.980	2.020	1.960	2.040	0.060	0.100	0.140
2.1	2.079	2.121	2.058	2.142	0.064	0.105	0.146
2.2	2.178	2.222	2.156	2.244	0.067	0.110	0.153
2.3	2.277	2.323	2.254	2.346	0.070	0.115	0.160
2.4	2.376	2.424	2.352	2.448	0.073	0.120	0.167
2.5	2.475	2.525	2.450	2.550	0.076	0.125	0.174
2.6	2.574	2.626	2.548	2.652	0.079	0.130	0.181
2.7	2.673	2.727	2.646	2.754	0.082	0.135	0.188
2.8	2.772	2.828	2.744	2.856	0.085	0.140	0.195
2.9	2.871	2.929	2.842	2.958	0.088	0.145	0.202
3.0	2.970	3.030	2.940	3.060	0.091	0.150	0.209
3.1	3.069	3.131	3.038	3.162	0.094	0.155	0.216
3.2	3.168	3.232	3.136	3.264	0.097	0.160	0.223
3.3	3.267	3.333	3.234	3.366	0.100	0.165	0.230
3.4	3.366	3.434	3.332	3.468	0.103	0.170	0.237
3.5	3.465	3.535	3.430	3.570	0.106	0.175	0.244
3.6	3.564	3.636	3.528	3.672	0.109	0.180	0.251
3.7	3.663	3.737	3.626	3.774	0.112	0.185	0.258
3.8	3.762	3.838	3.724	3.876	0.115	0.190	0.265
3.9	3.861	3.939	3.822	3.978	0.118	0.195	0.272
4.0	3.960	4.040	3.920	4.080	0.121	0.200	0.279
4.1	4.059	4.141	4.018	4.182	0.124	0.205	0.286
4.2	4.158	4.242	4.116	4.284	0.127	0.210	0.293
4.3	4.257	4.343	4.214	4.386	0.130	0.215	0.300
4.4	4.356	4.444	4.312	4.488	0.133	0.220	0.307
4.5	4.455	4.545	4.410	4.590	0.136	0.225	0.314
4.6	4.554	4.646	4.508	4.692	0.139	0.230	0.321
4.7	4.653	4.747	4.606	4.794	0.142	0.235	0.328
4.8	4.752	4.848	4.704	4.896	0.145	0.240	0.335
4.9	4.851	4.949	4.802	4.998	0.148	0.245	0.342
5.0	4.950	5.050	4.900	5.100	0.151	0.250	0.349

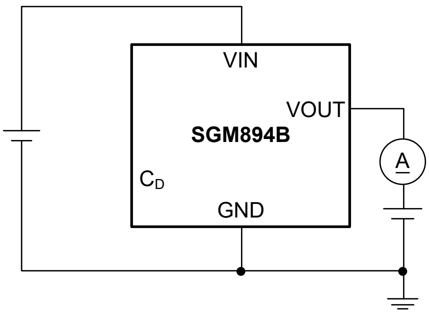
TEST CIRCUITS



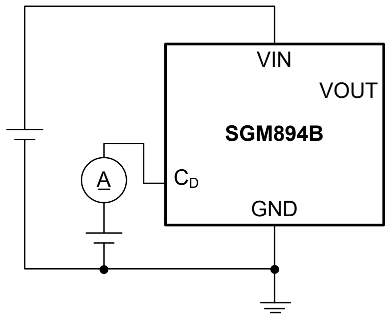
Test Circuit 1



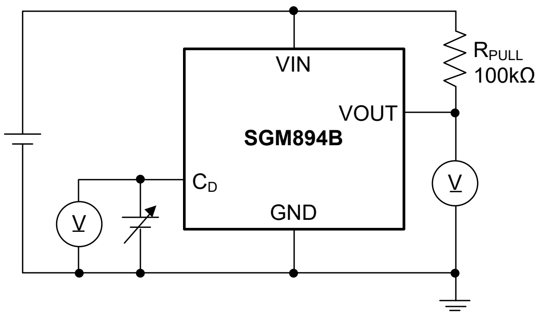
Test Circuit 2



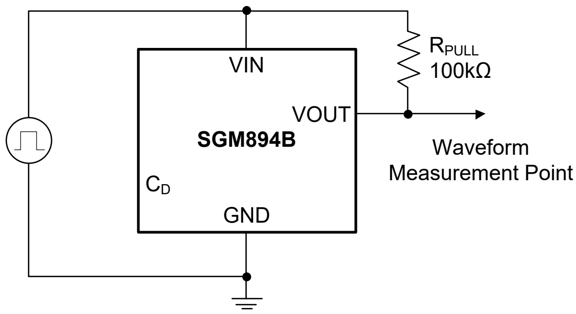
Test Circuit 3



Test Circuit 4

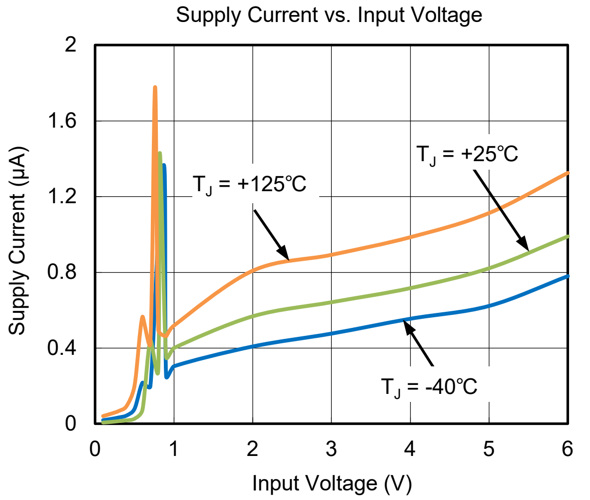


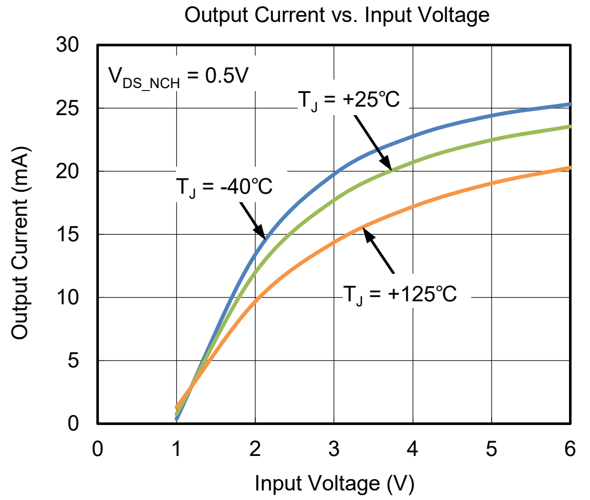
Test Circuit 5

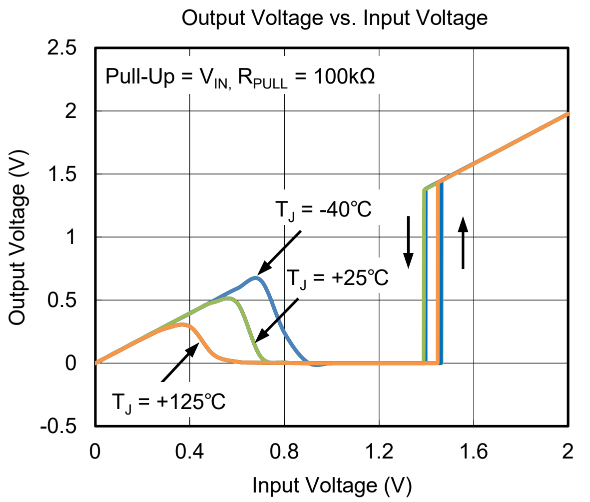


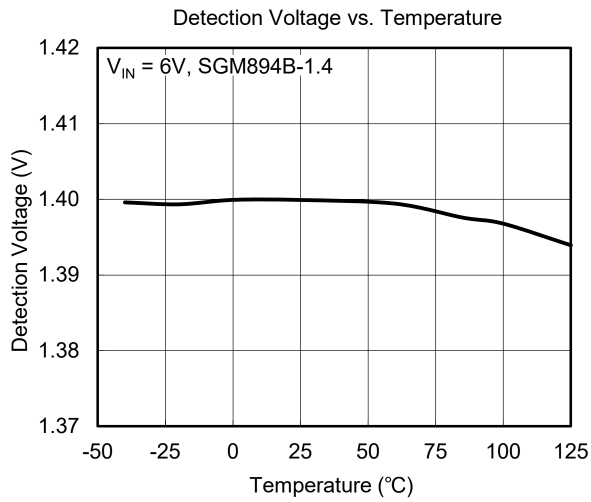
Test Circuit 6

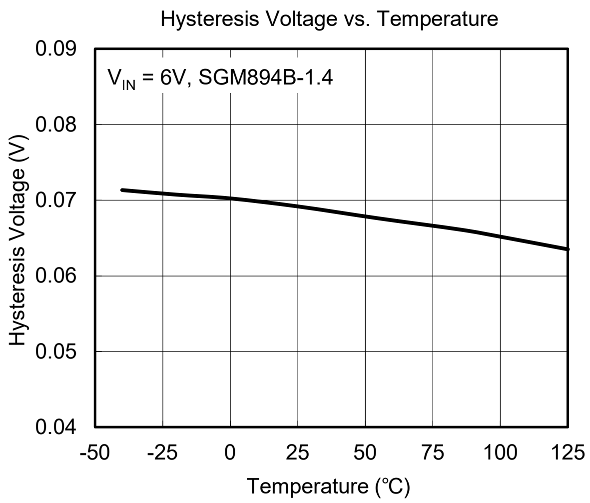
TYPICAL PERFORMANCE CHARACTERISTICS

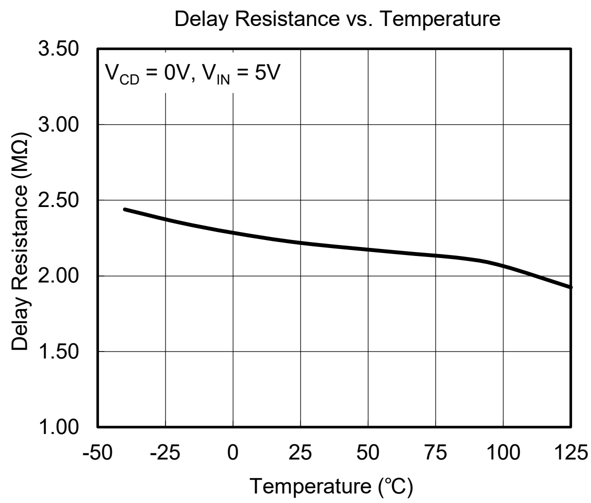




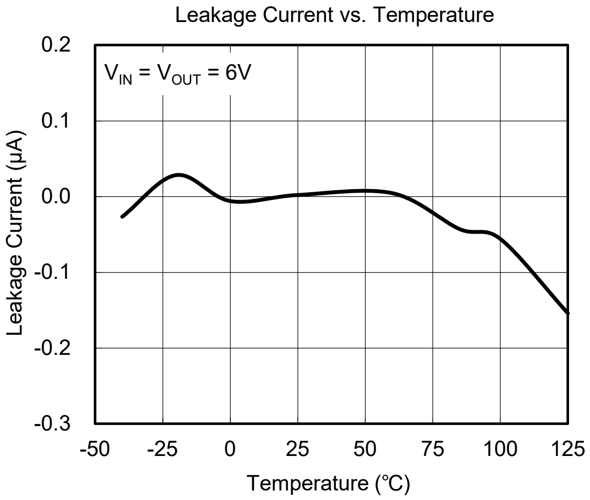


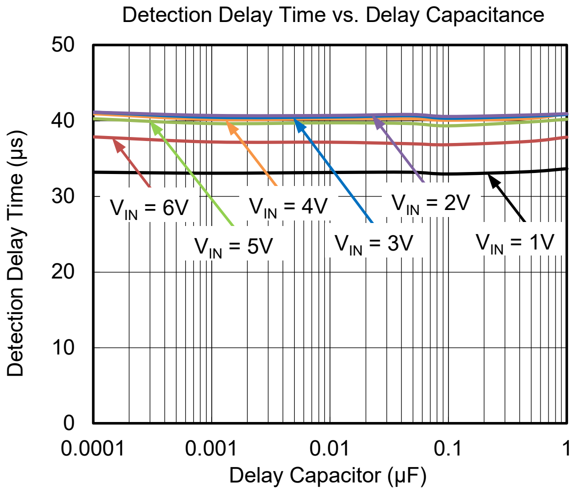


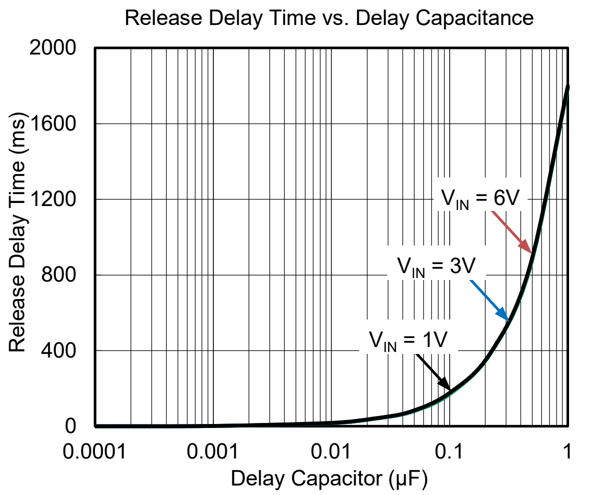




TYPICAL PERFORMANCE CHARACTERISTICS (continued)







FUNCTIONAL BLOCK DIAGRAM

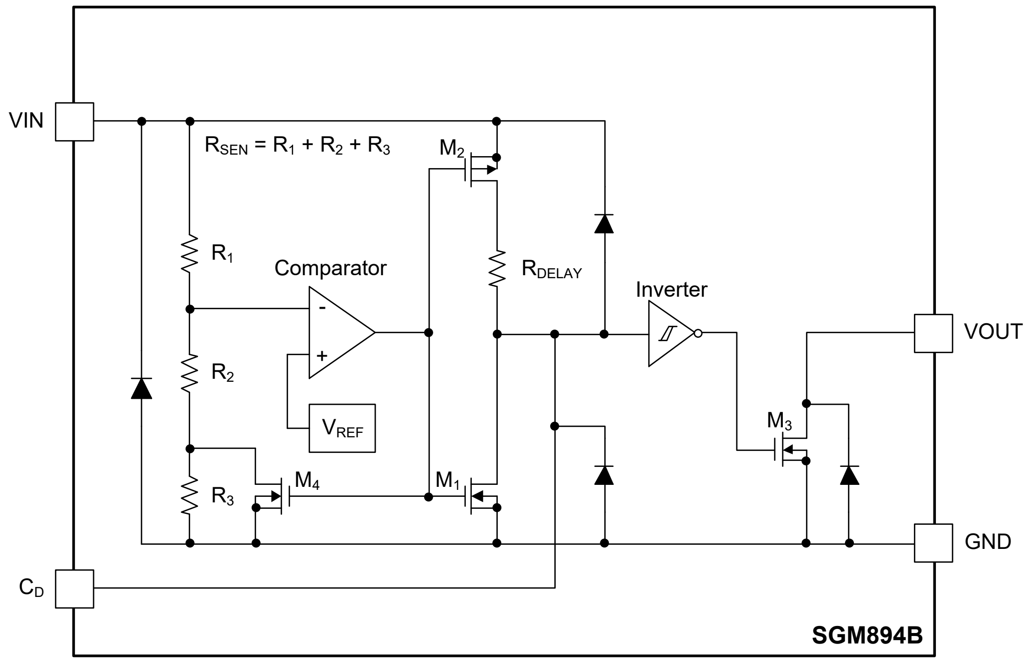


Figure 2. SGM894B Block Diagram

DETAILED DESCRIPTION

A typical circuit example is shown in Figure 3, and the timing chart of Figure 3 is shown in Figure 4.

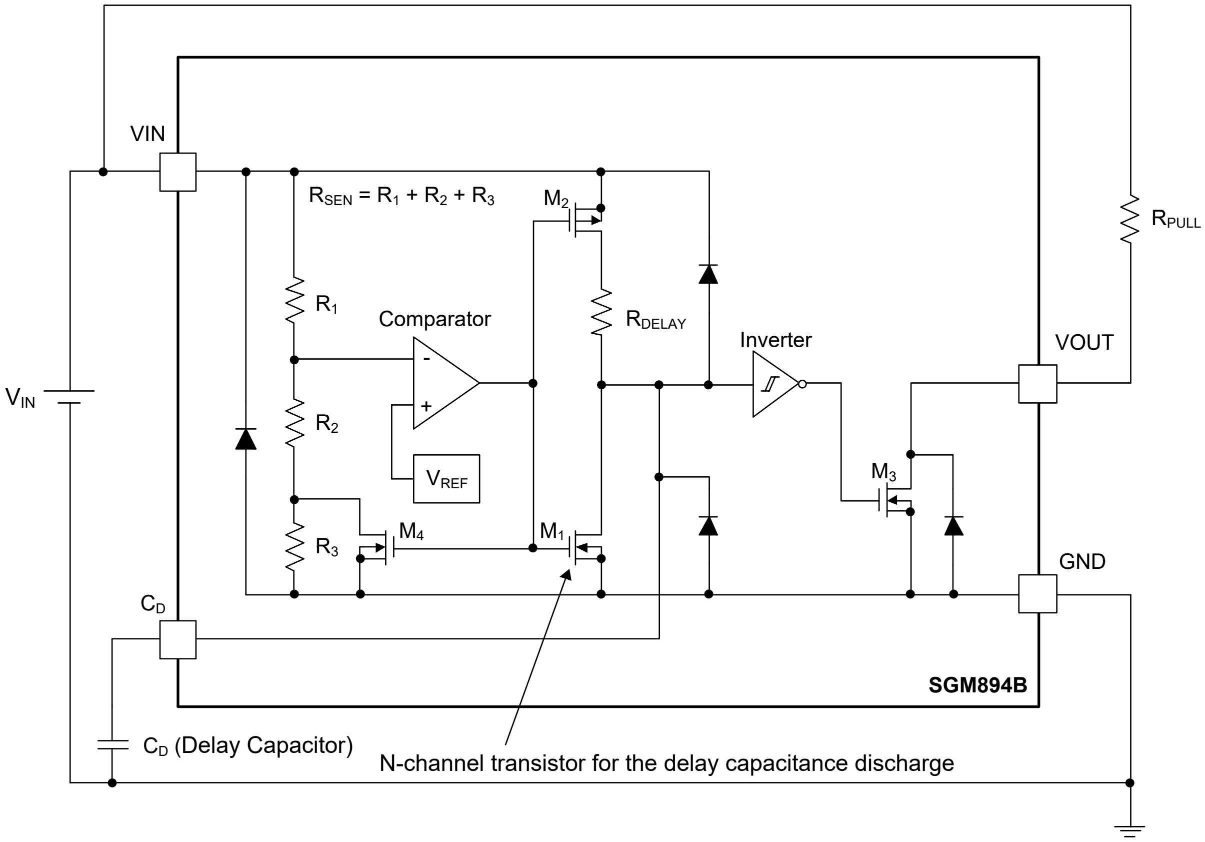


Figure 3. Typical Application Circuit Example

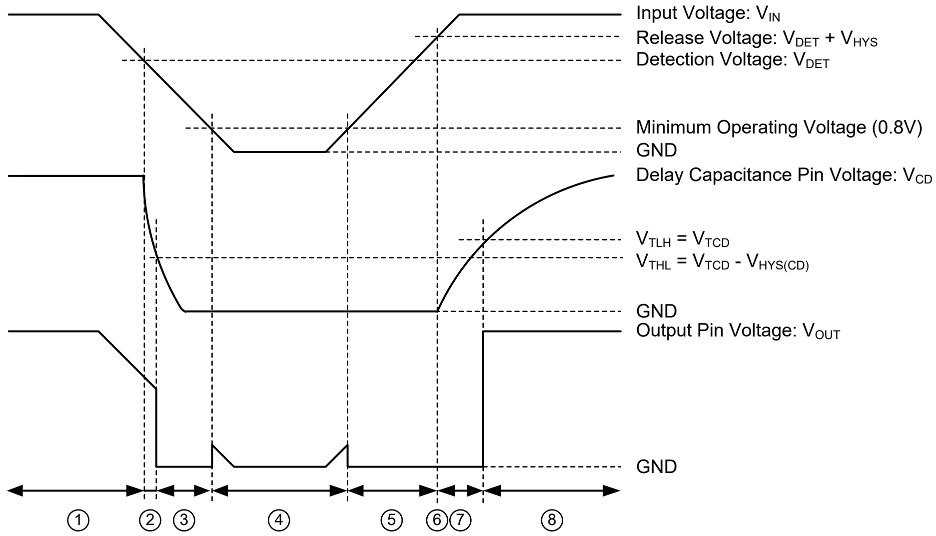


Figure 4. The Timing Chart of Figure 3

DETAILED DESCRIPTION (continued)

The V_{OUT} transition, the delay capacitance (C_D) charge and discharge are determined by the status of power supply and VIN. Figure 5 shows the timing chart. It may go through eight processes, and below words are shown as the description of the sequence.

① Default Status before V_{IN} Falling

In original state, the delay capacitance is charged full and reaches the power supply input voltage (V_{IN}: 1V MIN, 6V MAX).

The input pin is applied sufficiently high voltage (6V MAX). While the input pin voltage (V_{IN}) starts dropping to reach the detection voltage (V_{DET}) ($V_{IN} > V_{DET}$), the output voltage (V_{OUT}) keeps the high level (= V_{IN}).

NOTE: If a pull-up resistor of the SGM894B is connected to added power supply different from the input voltage pin, the voltage where the pull-up resistor is connected will be selected as high level.

② Triggered V_{DET} while V_{IN} Falling

When the input pin voltage goes down and becomes equal to the detection voltage ($V_{IN} = V_{DET}$), an N-channel transistor (M_1) for the delay capacitance discharge is turned on, and starts to discharge the delay capacitance.

An inverter operates as a comparator (rising logic threshold: $V_{TLH} = V_{TCD}$, falling logic threshold: $V_{THL} = V_{TCD} - V_{HYS(CD)}$). When the C_D pin voltage reaches the C_D pin falling logic threshold voltage (= $V_{TCD} - V_{HYS(CD)}$), the inverter will be inverted, and the output voltage changes into the low level (= GND). The detection delay time (t_{DET}) is defined as time which ranges from $V_{IN} = V_{DET}$ to the V_{OUT} of low level (especially, when the C_D pin is not connected: t_{DET0}).

③ V_{OUT} Keeps Low until V_{IN} Rises

The delay capacitance is discharged to the ground voltage (= GND) level, when the input pin voltage keeps below the detection voltage. Then, the output voltage maintains the low level until the input pin voltage increases again to reach the release voltage ($V_{IN} < V_{DET} + V_{HYS}$).

④ V_{IN} Drops to GND

While the input pin voltage drops to less than 0.8V, and then increases to 0.8V or higher again, the output voltage may not be able to maintain the low level. Such an operation is called "Unspecified Operation".

⑤ V_{IN} Rising up to $V_{DET} + V_{HYS}$

The N-channel transistor (M_1) for the delay capacitance discharge will be turned off, and the delay capacitance will be charged via a delay resistor (R_{DELAY}), when the input pin voltage continues to increase up to the release voltage level ($V_{IN} = V_{DET} + V_{HYS}$).

⑥ C_D is Charged when V_{IN} Keeps High

While the C_D pin voltage rises to reach the rising logic threshold voltage (= V_{TCD}) with the input pin voltage equal to the release voltage or higher, the C_D pin will be charged by the time constant of the RC series circuits. Assuming the time to the release delay time (t_{DR}), it can be given by the Equation 1.

$$t_{DR} = R_{DELAY} \times C_D \times 0.79 \quad (1)$$

where R_{DELAY} is 2.2MΩ (TYP).

As an example, presuming that the delay capacitance is 0.68μF, t_{DR} is:

$$2.2 \times 10^6 \times 0.68 \times 10^{-6} \times 0.79 = 1182 \text{ (ms)}$$

Note that the release delay time may be remarkably short when the delay capacitance is not discharged to the ground (= GND) level because time described in ③ and ④ is short.

⑦ V_{OUT} Goes High when C_D is Charged Full

When the delay capacitance pin voltage reaches the delay capacitance pin rising logic threshold voltage (= V_{TCD}), the inverter will be inverted. As a result, the output voltage changes into the high (= V_{IN}) level. The release delay time (t_{DR0}) is defined as time which ranges from $V_{IN} = V_{DET} + V_{HYS}$ to the V_{OUT} of high level with unconnected C_D pin.

⑧ V_{OUT} Keeps High when $V_{IN} > V_{DET}$

The C_D pin is charged until the C_D pin voltage becomes the input voltage level, when the input pin voltage is higher than the detection voltage ($V_{IN} > V_{DET}$). Therefore, the output voltage maintains the high (= V_{IN}) level.

DETAILED DESCRIPTION (continued)

The V_{OUT} status is determined by the V_{IN} and V_{CD}. A summary table of transitions about V_{OUT} is shown below.

Table 1. Function Chart

<table>
<tr><th rowspan="2">V_{IN}</th><th rowspan="2">V_{CD}</th><th colspan="3">Transition of V_{OUT} Condition [1]</th></tr>
<tr><th>①</th><th>⇒</th><th>②</th></tr>
<tr><td rowspan="4">L</td><td>L</td><td rowspan="2">L</td><td rowspan="4">⇒</td><td rowspan="4">L</td></tr>
<tr><td>H</td></tr>
<tr><td>L</td><td rowspan="2">H</td></tr>
<tr><td>H</td></tr>
<tr><td rowspan="4">H</td><td>L</td><td rowspan="2">L</td><td>⇒</td><td>L</td></tr>
<tr><td>H</td><td>⇒</td><td rowspan="3">H</td></tr>
<tr><td>L</td><td rowspan="2">H</td><td rowspan="2">⇒</td></tr>
<tr><td>H</td></tr>
</table>

NOTE:

1. V_{OUT} transits from condition ① to ② because of the combination of V_{CD} and V_{IN}. V_{IN} should exceed the lowest operation voltage.

Examples:

1. V_{OUT} ranges from 'L' to 'H' in the case of V_{IN} = 'H' ($V_{IN} \geq V_{DET} + V_{HYS}$), V_{CD} = 'H' ($V_{CD} \geq V_{TCD}$) while V_{OUT} is 'L'.

2. V_{OUT} maintains 'H' when V_{CD} ranges from 'H' to 'L' ($V_{CD} \leq V_{TCD} - V_{HYS(CD)}$), V_{IN} = 'H' and V_{CD} = 'L' when V_{OUT} becomes 'H' in ex.1.

The release delay time is adjustable by the external capacitor which is connected to C_D. The t_{DR} values for common ideal capacitors are shown below.

Table 2. Release Delay Time Chart [1] [2]

Delay Capacitance (C_D) (μF)	Release Delay Time (t_{DR}) (TYP) (ms)
0.010	17.4
0.022	38.2
0.047	81.7
0.100	174
0.220	382
0.470	817
1.000	1740

NOTES:

1. The release delay time values above are calculated by the Equation 1.
2. The release delay time is influenced by the delay capacitance.

APPLICATION INFORMATION

1. Do not exceed the absolute conditions, and use this IC within the stated maximum ratings. For temporary transitional voltage drop or voltage rising phenomenon, the IC may fail if the rated value is exceeded.

2. Note that a very noisy voltage implementing at the input voltage pin may cause a wrong operation. It is recommended to connect a decouple capacitor as close as possible to the input voltage pin to alleviate this phenomenon. Sometimes, users will mount a resistor between the power supply and the VIN pin. This resistor and the decouple capacitor build a low pass filter which filters the noise of the input voltage. In this case, the IC operation current generates a voltage drop through the series resistor. If the input pin voltage falls below the minimum operating voltage range, the operation may be wrong. Oscillation of the circuit may occur if the voltage drop exceeds the hysteresis voltage.

3. When there is a possibility that the input pin voltage falls rapidly (e.g.: 6V to 0V) with the delay capacitor pin connected to a capacitor, use a Schottky diode connected between the VIN pin and the C_D pin as the Figure 5 shown below.

4. In N-channel open-drain output product, V_{OUT} voltage level is determined by resistance of a pull-up resistor connected at the VOUT pin. Please choose proper resistance values with reference to Figure 6.

During detection, the formula is given as:

$$V_{OUT} = V_{PULL}/(1 + R_{PULL}/R_{ON}) \quad (2)$$

where:
V_{PULL} is the pull-up voltage.
R_{ON} (1) is the on-resistance of N-channel driver M_3 that can be calculated as V_{DS_NCH}/I_{OUT} from electrical characteristics.

For example, when R_{ON} (2) $= 0.5/0.8 \times 10^{-3} = 625\Omega$ (MIN) at $V_{IN} = 1V$, $V_{PULL} = 3V$ and $V_{OUT} \leq 0.1V$ at detection, R_{PULL} can be calculated as follows:

$$R_{PULL} = (V_{PULL}/V_{OUT} - 1) \times R_{ON} = (3/0.1 - 1) \times 625 \approx 18k\Omega$$

In this case, R_{PULL} should be selected higher or equal to 18kΩ in order to keep the output voltage less than 0.1V during detection.

NOTES:
1. R_{ON} is bigger when V_{IN} is smaller.
2. For calculation, minimum V_{IN} should be chosen among the input voltage range.

During releasing, the formula is given as:

$$V_{OUT} = V_{PULL}/(1 + R_{PULL}/R_{OFF}) \quad (3)$$

where:
V_{PULL} is the pull-up voltage.
R_{OFF} is the off-resistance of N-channel driver M_3 that is 15MΩ (MIN) when the driver is off (as to V_{OUT}/I_{LEAK}).

For example, when $V_{PULL} = 6V$ and $V_{OUT} \geq 5.99V$, R_{PULL} can be calculated as follows:

$$R_{PULL} = (V_{PULL}/V_{OUT} - 1) \times R_{OFF} = (6/5.99 - 1) \times 15 \times 10^6 \approx 25k\Omega$$

It is recommended to select the R_{PULL} smaller or equal to 25kΩ so that the output voltage can be higher than 5.99V during releasing.

6. SGMICRO attaches importance to improving the products and their reliability. We require users to incorporate fail-safe designs and post-aging protection treatment in their systems.

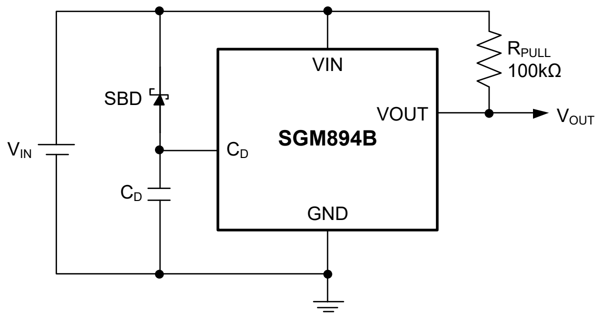
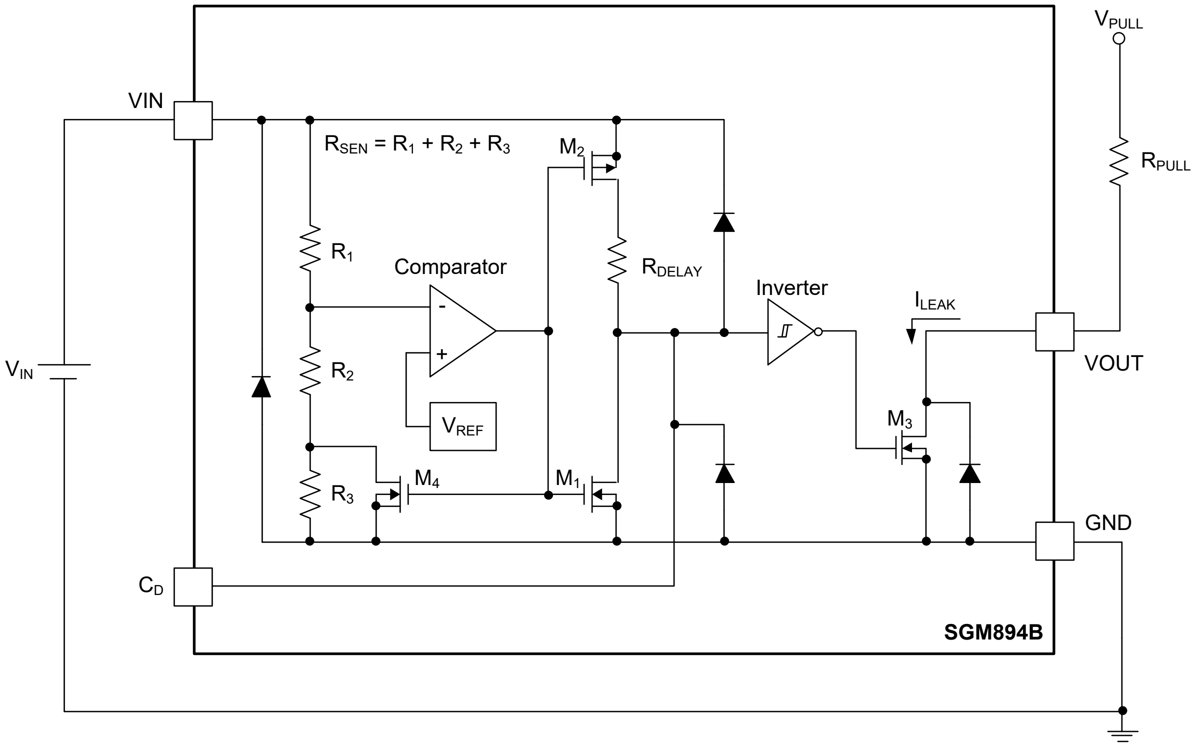


Figure 5. Circuit Example with the Delay Capacitor Pin (C_D) Connected to a Schottky Barrier Diode

APPLICATION INFORMATION (continued)



NOTE: R_{OFF} = V_{OUT}/I_{LEAK}.

Figure 6. Circuit Example of the SGM894B

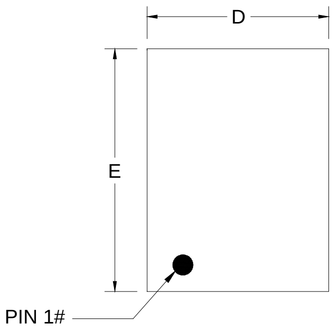
REVISION HISTORY

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

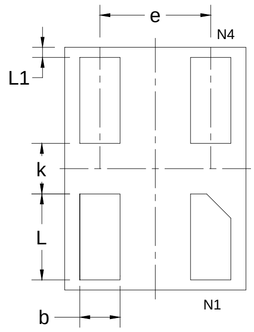
Changes from Original (JUNE 2021) to REV.A	Page
Changed from product preview to production data	All

PACKAGE OUTLINE DIMENSIONS

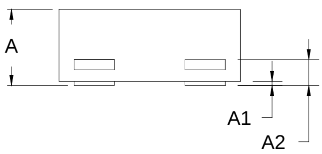
XTDFN-0.9×1.2-4L



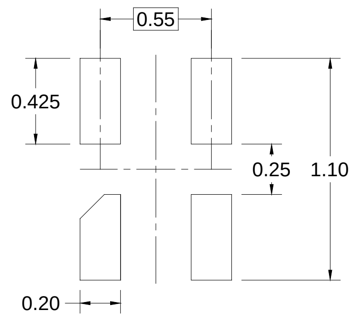
TOP VIEW



BOTTOM VIEW



SIDE VIEW



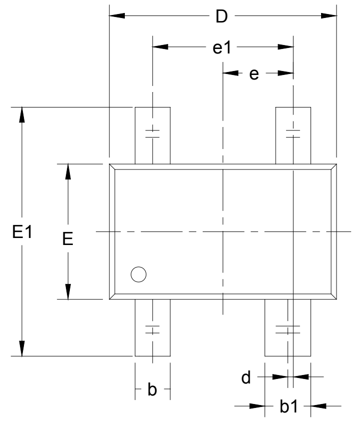
RECOMMENDED LAND PATTERN (Unit: mm)

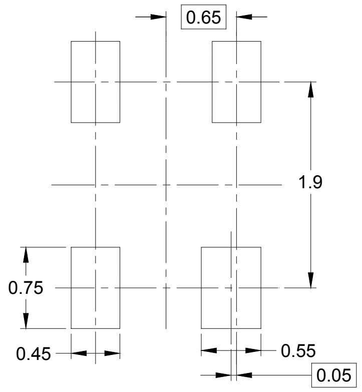
Symbol	Dimensions In Millimeters		
	MIN	**MOD**	**MAX**
A	0.350	-	0.400
A1	0.000	-	0.050
A2	0.127 REF		
D	0.850	0.900	0.950
E	1.150	1.200	1.250
b	0.150	0.200	0.250
e	0.550 BSC		
L	0.375	0.425	0.475
L1	0.050 REF		
k	0.250 REF		

NOTE: This drawing is subject to change without notice.

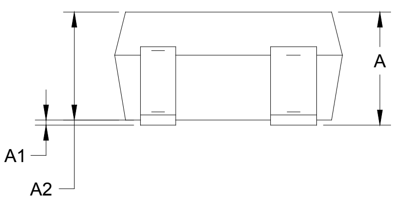
PACKAGE OUTLINE DIMENSIONS

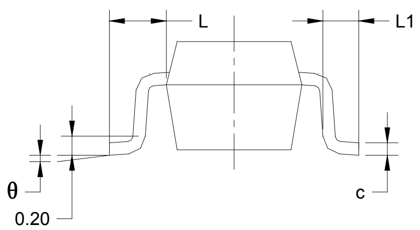
SC70-4 (R)





RECOMMENDED LAND PATTERN (Unit: mm)

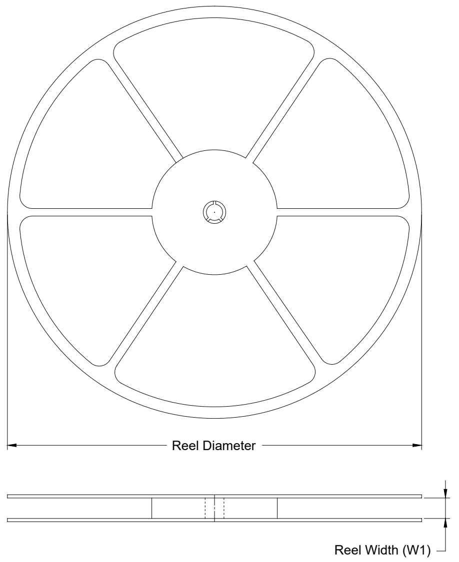




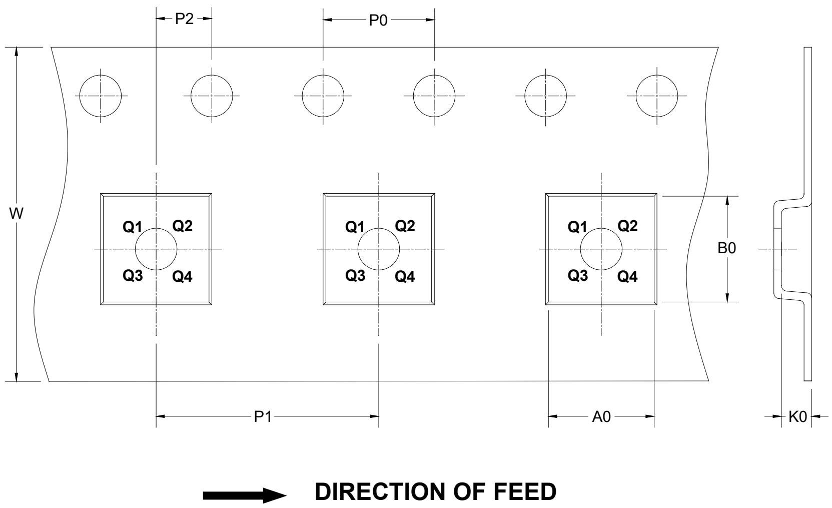
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.250	0.400	0.010	0.016
b1	0.350	0.500	0.014	0.020
c	0.080	0.150	0.003	0.006
d	0.050TYP		0.002TYP	
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.65 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



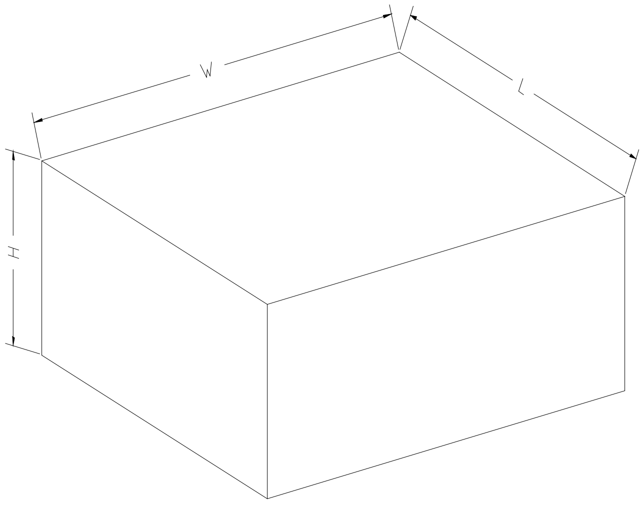
NOTE: The picture is only for reference. Please make the object as the standard.

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
XTDFN-0.9×1.2-4L	7″	8.6	1.02	1.52	0.50	4.0	4.0	2.0	8.0	Q2
SC70-4 (R)	7″	9.5	3.20	2.80	1.30	4.0	4.0	2.0	8.0	Q3

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
7″ (Option)	368	227	224	8
7″	442	410	224	18

DD0002