SGM791A
Single Load Detector with 300nA Operating Current

GENERAL DESCRIPTION

The SGM791A is a low current, single load sensing device that can detect connection or removal of the load on a supply bus. By using short pulse injections into the input capacitance and measuring the voltage change, load existence is periodically checked.

The most recent detection status of the SNS pin can be reported on the FLG output.

The device is available in a Green UTDFN-1×1-4L package. It operates in the ambient temperature range of -40℃ to +85℃.

FEATURES

- **2.5V to 5.5V Operating Voltage Range**
- **Very Low Operating Current: 300nA (TYP)**
- **Internal PFET Open-Drain Output**
- **160ms Detection Period**
- **Available in a Green UTDFN-1×1-4L Package**

APPLICATIONS

TWS headphone
Power Bank
Powered Storage Box
Wall Socket
Low Standby Power Cord Supply

TYPICAL APPLICATION

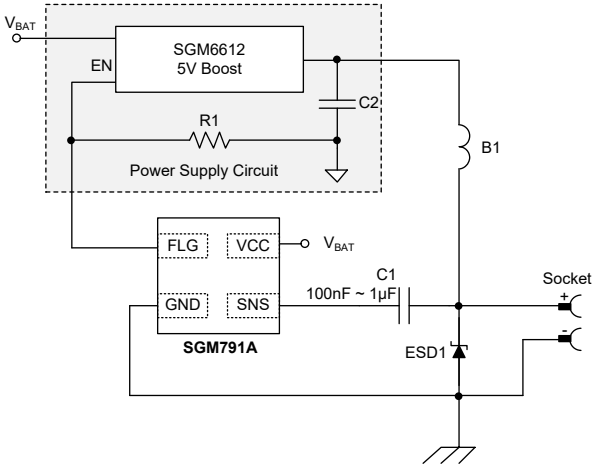


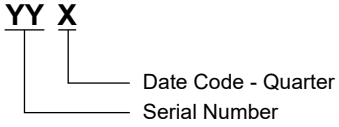
Figure 1. Typical Application Circuit

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM791A	UTDFN-1×1-4L	-40℃ to +85℃	SGM791AYUDH4G/TR	C4X	Tape and Reel, 10000

MARKING INFORMATION

NOTE: X = Date 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 Range, V_{CC} ..... -0.3V to 6V
SNS, FLG Voltage Ranges ..... -0.3V to V_{CC} + 0.3V
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 8000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{CC} ..... 2.5V to 5.5V
Operating Temperature Range ..... -40℃ to +85℃
Load Capacitor ..... 100nF (MIN)

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

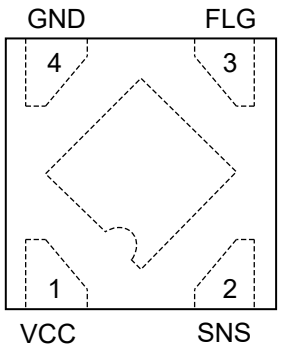
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

SGM791A (TOP VIEW)



UTDFN-1×1-4L

PIN DESCRIPTION

PIN	NAME	TYPE	FUNCTION
1	VCC	P	Power Supply Input.
2	SNS	IO	Load Sensing Pin.
3	FLG	O	Open-Drain PFET Flag Output for the Load Status Sensed by the SNS. It is in high-impedance (Hi-Z) state if the load is detached. It is pulled high when a load is connected.
4	GND	G	Ground.
Exposed Pad	—	—	The exposed pad should be connected to a large ground plane to maximize thermal performance.

NOTE: IO: input or output pin; O: output pin; P: power pin; G: ground of the internal circuit.

ELECTRICAL CHARACTERISTICS

(At T_A = +25℃, V_{CC} = 3.7V, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Supply Voltage Range	V_{CC}		2.5		5.5	V
Under-Voltage Lockout Threshold	V_{UVLO}	V_{CC} rising		2.1		V
		V_{CC} falling		2.0		V
Operating Current	I_{CC}	V_{CC} = 5.0V		300	500	nA
SNS						
Test Pulse Width	t_{TEST}	V_{CC} = 2.5V		30		ns
		V_{CC} = 5.5V		45		
Detection Repeat Period	t_{DET}	V_{CC} = 2.5V	100	175	250	ms
		V_{CC} = 5.5V	80	150	220	
Pull-Up Resistance	R_{UP_SNS}	V_{CC} = 2.5V, V_{SNS} = 1.25V		42		Ω
		V_{CC} = 5.5V, V_{SNS} = 2.0V		25		Ω
Pull-Down Resistance	R_{DOWN_SNS}	I_{OUT} = 1mA		400		Ω
FLG						
Pull-Up Resistance	R_{UP_FLG}	I_{OUT} = -50μA	10	14	18	kΩ
Leakage Current when High-Impedance	I_{L_LKG}	V_{FLG} = 0V or V_{CC}		±0.01	±1	μA

FUNCTIONAL BLOCK DIAGRAM

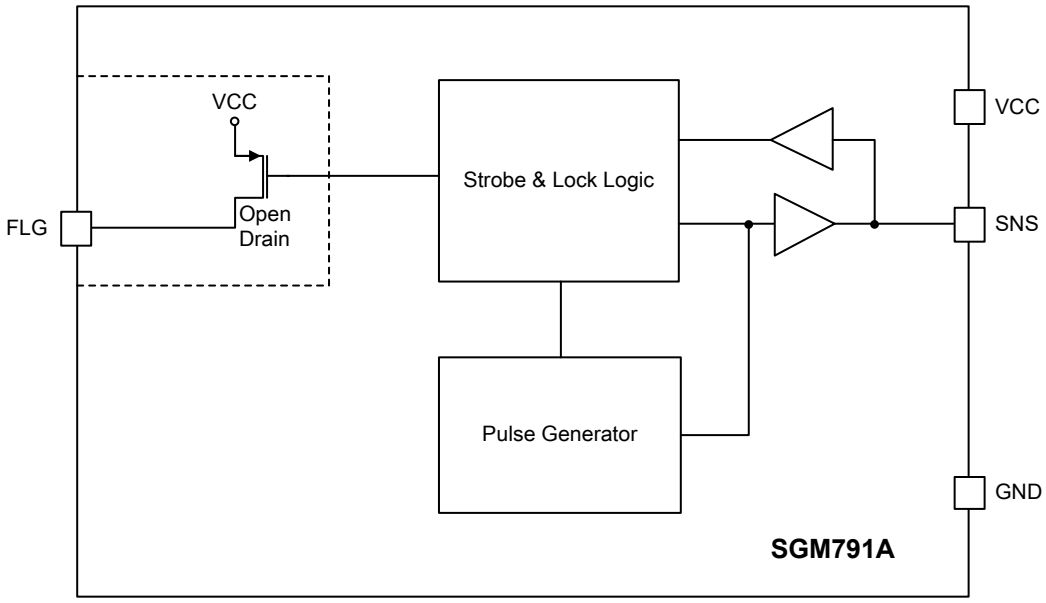


Figure 2. Block Diagram

DETAILED DESCRIPTION

In many applications, detection of the load existence is necessary for system operation. For example, a power bank must detect the connection or removal of the loads to power up or power down the power circuits. The SGM791A provides a simple load detection solution for these applications by checking the load capacitance as indicator. The SNS pin acts as a pulse source with relatively large internal resistance. Short pulses of t_{TEST} (35ns, TYP) time are periodically injected by the SNS pin to the power bus every t_{DET} (160ms, TYP) period (5 ~ 7 times per second).

The SNS pin couples to the bus by a capacitor. With ferrite beads used on the bus, the permanent capacitances of the power bus are isolated and the load capacitance can be detected directly by injecting signals. High-impedance ferrite beads block the pulses from injecting into the bus capacitors. The SNS pin sends the pulses periodically and checks the resulting voltage change. When a load capacitance is attached to the SNS pin, the pulse voltage will drop, and if the load is removed, the pulse voltage will rise.

FLG Pin

Right after each detection (t_{DET}) period of the SGM791A, the status of the load connected to the SNS is updated on the FLG output. The FLG state remains unchanged until the next test.

Table 1 summarizes how the FLG is updated depending on the load sense input.

Table 1. SGM791A Detection Logic

SNS	FLG
With Load Capacitance	High
Without Load Capacitance	Hi-Z

Components Selection

Referring to Figure 1 and Figure 3, a few external components are needed to complete the load detection circuit. It is important that the ferrite bead B1 should have enough current rating to carry the load current and high enough impedance at high frequency to isolate the test pulses from the permanent bus capacitors. FBSWB0402-102-201R is recommended. Coupling capacitor C1 can be chosen in a range from 100nF to 1μF.

If the load connection point is close to the sense pin, the SGM791A can easily detect connection or removal of the load with minimum 100nF input capacitance. If the load is away from the device, the load capacitance must be increased to ensure detection.

Application Example

Figure 1 shows how the SGM791A can be used in applications with no host to turn on or off (enable/disable) a power supply when a load is connected or disconnected. The power supply is enabled if a load is connected to the load port (SNS).

Figure 3 shows how the SGM791A is used to detect whether it is connected or not with a power bus. The bus may be powered off.

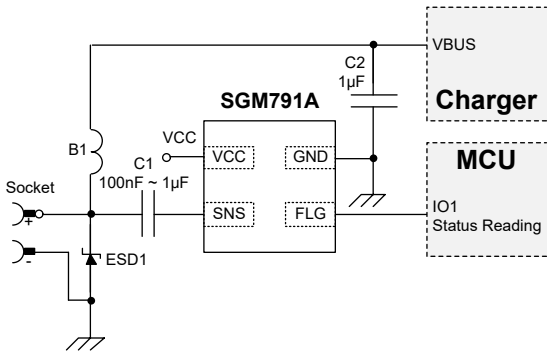


Figure 3. SGM791A Used for Power Bus Status Detection

REVISION HISTORY

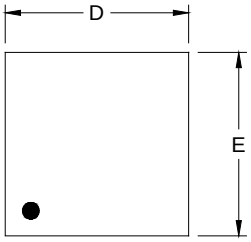
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (DECEMBER 2020) to REV.A

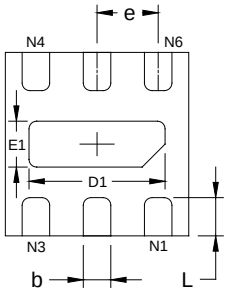
Changed from product preview to production data ..... All

PACKAGE OUTLINE DIMENSIONS

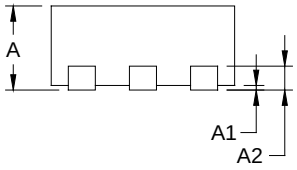
UTDFN-1.2×1.2-6L



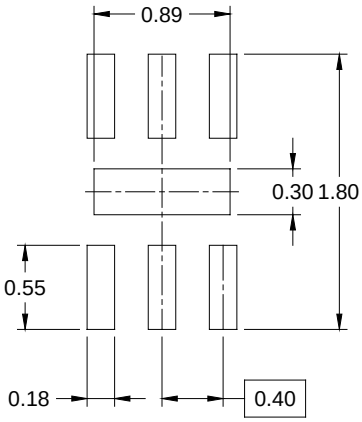
TOP VIEW



BOTTOM VIEW



SIDE VIEW

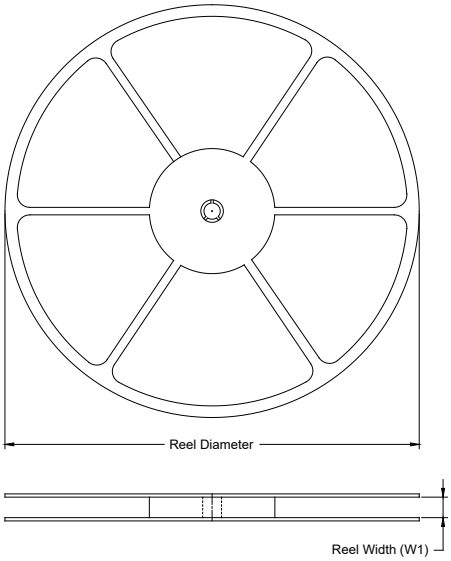


RECOMMENDED LAND PATTERN (Unit: mm)

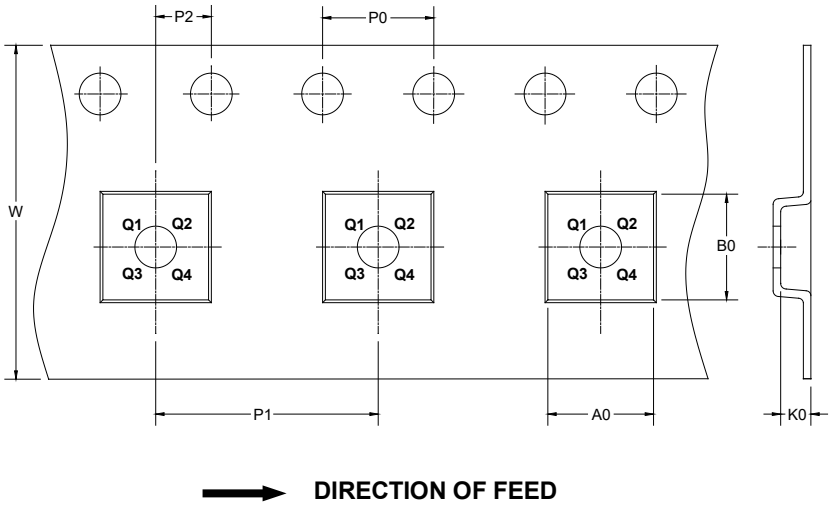
Symbol	Dimensions In Millimeters		
	MIN	MOD	MAX
A	0.500	0.550	0.600
A1			0.050
A2	0.152 REF		
e	0.400 BSC		
D	1.150	1.200	1.250
E	1.150	1.200	1.250
D1	0.840	0.890	0.940
E1	0.250	0.300	0.350
b	0.130	0.180	0.230
L	0.200	0.250	0.300

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



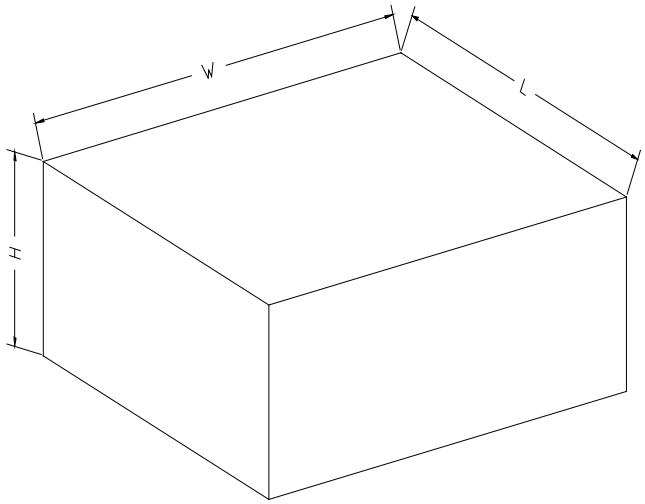
NOTE: The picture is only for reference. Please make the object as the standard.

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-1.2×1.2-6L	7″	9.0	1.35	1.35	0.73	4.0	4.0	2.0	8.0	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
7″ (Option)	368	227	224	8
7″	442	410	224	18

DD0002