

GENERAL DESCRIPTION

The SGM42412xQ is a dual low-side driver full protected by embedded protections and intended for a wide range of automotive applications. It is usually used to direct the resistance or inductive charge attached to one side of the battery. Built-in thermal shutdown, short-circuit, overload protection and voltage clamp protect the device in all kinds of harsh environments. If an overload condition occurs, the output current is limited to protect the device. During prolonged overloading, the device limits the dissipation energy to a safe level for heat interruption operations. The device has the function of thermal shutdown and automatic restart. Once the fault situation disappears, the device can operate normally, and the inductive load can be quickly demagnetized during decay time.

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

The SGM42412AQ is available in Green SOIC-8 and SOIC-8 (Exposed Pad) Packages. The SGM42412BQ is available in a Green SOIC-8 package.

FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
Device Temperature Grade 1
 $T_A = -40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$
- **Full Set of Protections**
 - ♦ Short-Circuit Protection
 - ♦ ESD Protection
 - ♦ Overload Protection
 - ♦ Thermal Shutdown with Automatic Restart
- **Output Clamp Voltage: 44V (TYP)**
- **Continuous Drain Current at $T_A = +25^{\circ}\text{C}$:**
SOIC-8:
 - ♦ 2.5A, 1-Channel On
 - ♦ 1.7A/CH, 2-Channel On
 SOIC-8 (Exposed Pad):
 - ♦ 3.2A, 1-Channel On
 - ♦ 2.4A/CH, 2-Channel On
- **On-Resistance: 130mΩ (TYP)**
- **Power and Current Limitation: $I_{\text{LIMH}} = 6\text{A}$ (TYP)**
- **SGM42412AQ Available in Green SOIC-8 and SOIC-8 (Exposed Pad) Packages**
- **SGM42412BQ is Available in a Green SOIC-8 Package**

SIMPLIFIED SCHEMATIC

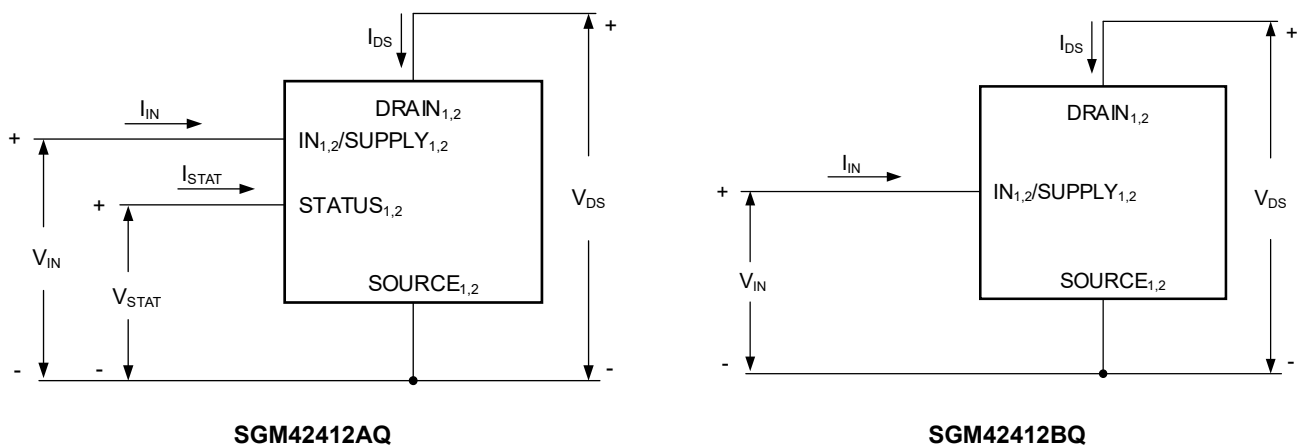


Figure 1. Current and Voltage Conventions

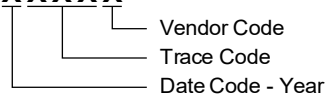
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE TOP MARKING	PACKING OPTION
SGM42412AQ	SOIC-8	-40°C to +125°C	SGM42412AQS8G/TR	1FZS8 XXXXX	Tape and Reel, 4000
	SOIC-8 (Exposed Pad)	-40°C to +125°C	SGM42412AQPS8G/TR	1G1PS8 XXXXX	Tape and Reel, 4000
SGM42412BQ	SOIC-8	-40°C to +125°C	SGM42412BQS8G/TR	1G0S8 XXXXX	Tape and Reel, 4000

MARKING INFORMATION

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

XXXXX



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

Logic Pin and Supply Pin	6V
STATUS Pin	5.5V
Maximum Jump Start Voltage for Single Pulse Short-Circuit Protection, V_{DRAIN_JS}	28V
Drain-Source Voltage ($V_{IN} = 0V$), V_{DS}	Internally Clamped
DC Drain Current, I_{DS}	Internally Clamped
Reverse DC Drain Current, $-I_{DS}$	2A/Channel
DC Supply Current, I_S	-1mA to 10mA
DC Input Current, I_{IN}	-1mA to 10mA
DC Status Current, I_{STAT}	-1mA to 10mA
Single Pulse Avalanche Energy ($L = 8.5mH$, $T_J = +150^\circ C$, $R_L = 0\Omega$, $V_{BATT} = 13.5V$, $I_{OUT} = I_{LIML}$)	37mJ
Package Thermal Resistance	
SOIC-8, θ_{JA}	92.8°C/W
SOIC-8, θ_{JB}	41.1°C/W
SOIC-8, θ_{JC}	41.4°C/W
SOIC-8 (Exposed Pad), θ_{JA}	33.4°C/W
SOIC-8 (Exposed Pad), θ_{JB}	11.0°C/W
SOIC-8 (Exposed Pad), θ_{JC} (TOP)	43.9°C/W
SOIC-8 (Exposed Pad), θ_{JC} (BOT)	2.4°C/W
Package Thermal Characterization Parameter	
SOIC-8, ψ_{JT}	6.6°C/W
SOIC-8, ψ_{JB}	39.9°C/W
SOIC-8 (Exposed Pad), ψ_{JT}	3°C/W
SOIC-8 (Exposed Pad), ψ_{JB}	10.7°C/W
Junction Temperature	+150°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 10s)	+260°C
ESD Susceptibility ^{(1) (2)}	
HBM	±6000V
CDM	±1000V

NOTES:

- For human body model (HBM), all pins comply with AEC-Q100-002 specification.
- For charged device model (CDM), all pins comply with AEC-Q100-011 specification.

RECOMMENDED OPERATING CONDITIONS

Operating Ambient Temperature Range -40°C to +125°C
 Operating Junction Temperature Range -40°C to +150°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.

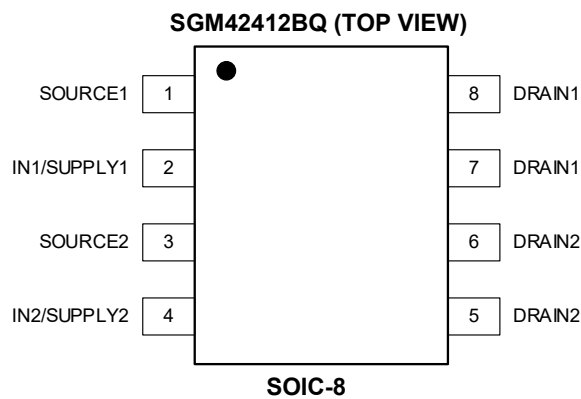
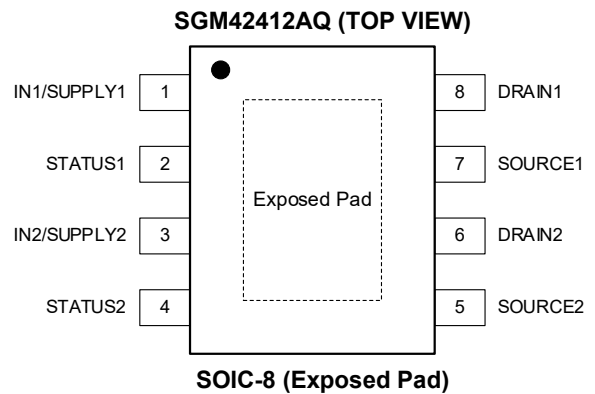
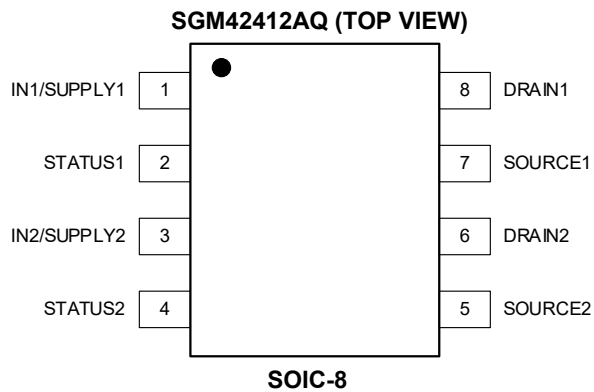
ESD SENSITIVITY CAUTION

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
SGM42412AQ		SGM42412BQ		
SOIC-8	SOIC-8 (Exposed Pad)	SOIC-8		
1	1	2	IN1/SUPPLY1	Voltage Controlled Input Pin/Digital Power Supply. Control the output switch state.
2	2	—	STATUS1	Open-Drain Digital Diagnostic Pin.
3	3	4	IN2/SUPPLY2	Voltage Controlled Input Pin/Digital Power Supply. Control the output switch state.
4	4	—	STATUS2	Open-Drain Digital Diagnostic Pin.
5	5	3	SOURCE2	Source.
6	6	5, 6	DRAIN2	Drain.
7	7	1	SOURCE1	Source.
8	8	7, 8	DRAIN1	Drain.
—	Exposed Pad	—	Exposed Pad	GND or SOURCE.

Table 1. Truth Table

CONDITIONS	INx/SUPPLYx	DRAINx	STATUSx ⁽¹⁾
Normal Operation	L	H	H
	H	L	H
Current Limit	L	H	H
	H	X	H
Over-Temperature	L	H	H
	H	H	L
Under-Voltage	L	H	X
	H	H	X

NOTE: 1. SGM42412AQ Only.

Table 2. Recommended Connections

CONNECTION/PIN	STATUSx	NC	INx/SUPPLYx
Floating	X	X	X
To ground	Not allowed	X	Through 10kΩ resistor

NOTE: 1. X: do not care.

ELECTRICAL CHARACTERISTICS

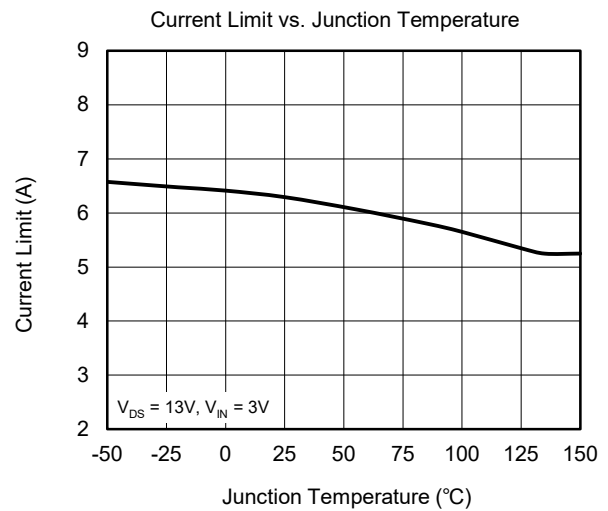
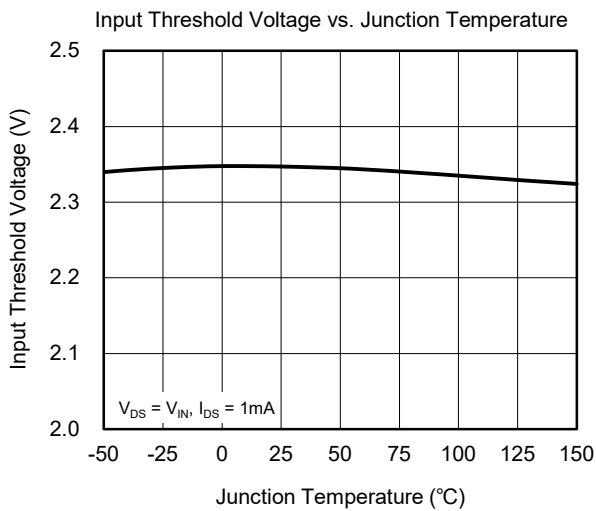
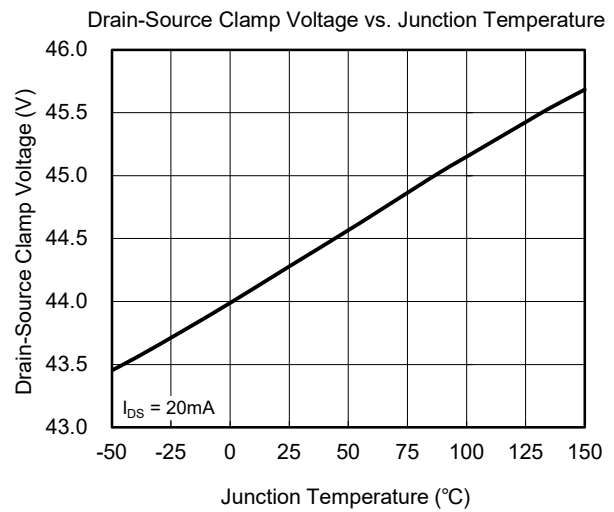
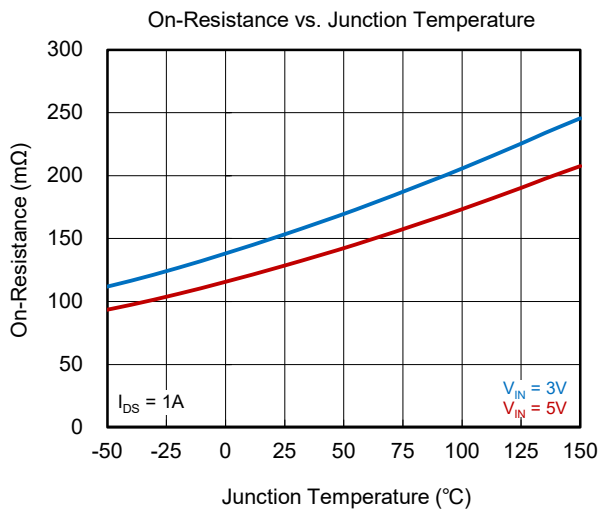
(V_{IN} = V_{SUPPLY} = 4.5V to 5.5V, T_J = -40°C to +150°C, typical values are measured at T_J = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Power MOS Characteristics							
Operating Supply Voltage	V _{SUPPLY}			3.5	5	5.5	V
On-Resistance	R _{ON}	V _{IN} = V _{SUPPLY} = 5V, I _{DS} = 1A	T _J = +25°C		130	170	mΩ
			T _J = +150°C			260	
Drain-Source Clamp Voltage	V _{CLAMP}	V _{IN} = 0V, I _{DS} = 20mA		41	44	49	V
Drain-Source Clamp Threshold Voltage	V _{CLTH}	V _{IN} = 0V, I _{DS} = 2mA		40			V
Off-State Output Current	I _{DSS}	V _{IN} = 0V, V _{DS} = 13V	T _J = +25°C			1	μA
			T _J = +150°C			3	
Source-Drain Diode							
Forward on Voltage	V _{SD}	I _{DS} = 1A, V _{IN} = 0V			0.87		V
Input Characteristics							
Supply Current from Input Pin	I _{ISS}	On-state, V _{SUPPLY} = V _{IN} = 5V, V _{DS} = 0V			39	85	μA
Input Clamp Voltage	V _{ICL}	I _S = 1mA		6.3		7.2	V
		I _S = -1mA			-0.6		V
Input Threshold Voltage	V _{INTH}	V _{DS} = V _{IN} , I _{DS} = 1mA		1		3	V
Status Pin ⁽¹⁾							
Status Low Output Voltage	V _{STAT}	I _{STAT} = 1mA				0.5	V
Status Leakage Current	I _{LSTAT}	Normal operation, V _{STAT} = 5V				1	μA
Status Pin Input Capacitance	C _{STAT}	Normal operation, V _{STAT} = 5V				100	pF
Status Clamp Voltage	V _{STCL}	I _{STAT} = 1mA		6.3		7.2	V
		I _{STAT} = -1mA			-0.6		
Switching Characteristics (V _{CC} = 13V)							
Turn-On Delay Time	t _{D_ON}	R _L = 13Ω, V _{CC} = 13V			15.5		μs
Turn-Off Delay Time	t _{D_OFF}	R _L = 13Ω, V _{CC} = 13V			12.1		μs
Rise Time	t _R	R _L = 13Ω, V _{CC} = 13V			17.3		μs
Fall Time	t _F	R _L = 13Ω, V _{CC} = 13V			12.5		μs
Slew-Rate On	-dV _{DS} /dt _{ON}	80% to 20% V _{CC}			-0.67		V/μs
Slew-Rate Off	dV _{DS} /dt _{OFF}	20% to 80% V _{CC}			0.91		V/μs
Switching Energy Losses at Turn-On	W _{ON}	R _L = 13Ω, V _{CC} = 13V			48		μJ
Switching Energy Losses at Turn-Off	W _{OFF}	R _L = 13Ω, V _{CC} = 13V			38		μJ
Protection and Diagnostics							
DC Short-Circuit Current	I _{LIMH}	V _{DS} = 13V, V _{IN} = V _{SUPPLY} = 5V		3.5	6	8.5	A
Short Circuit Current during Thermal Cycling	I _{LIML}	V _{DS} = 13V, T _R < T _J < T _{SD} , V _{IN} = V _{SUPPLY} = 5V			3.3		A
Step Response Current Limit	t _{DLIM}	V _{DS} = 13V, V _{IN} = 5V			22		μs
Shutdown Temperature	T _{SD}				170		°C
Reset Temperature	T _R				158		°C
Thermal Reset of STATUS ⁽¹⁾	T _{RS}				158		°C
Thermal Hysteresis (T _{SD} - T _R)	T _{HYS}				12		°C

NOTE:

1. Valid for SGM42412AQ.

TYPICAL PERFORMANCE CHARACTERISTICS



SWITCHING CHARACTERISTICS

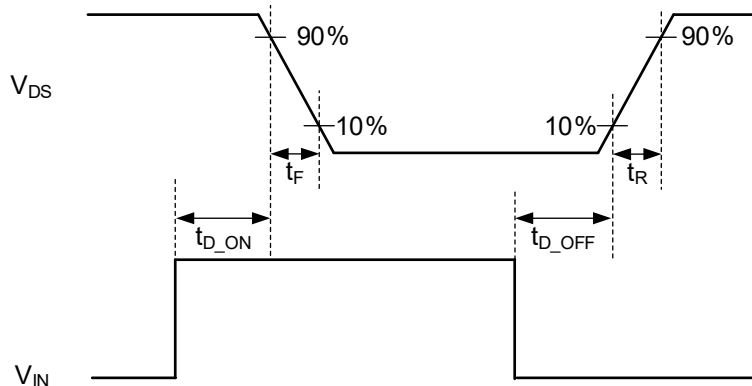


Figure 2. Switching Characteristics

TYPICAL APPLICATION CIRCUITS

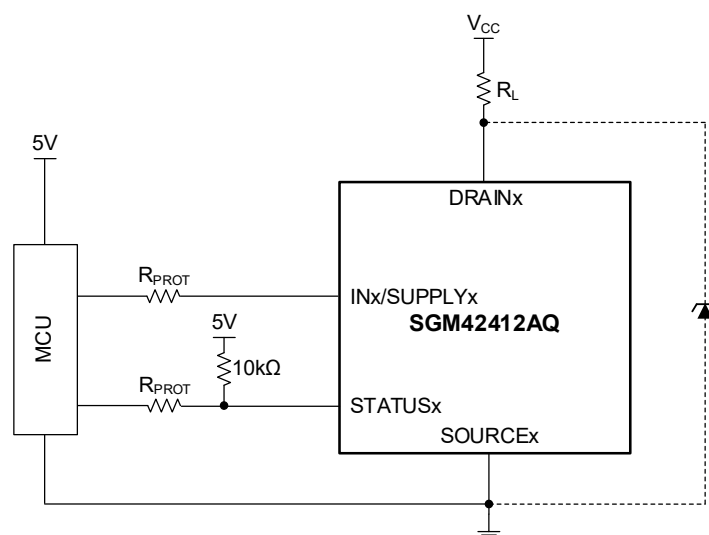


Figure 3. Application Schematic

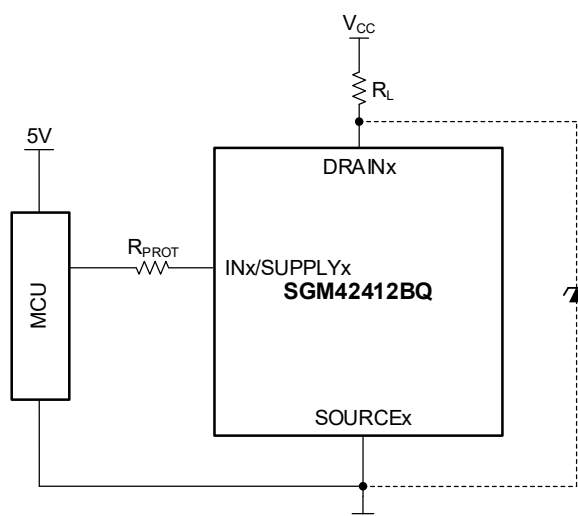


Figure 4. Application Schematic

NOTE: 1. For better surge protection, it is recommended to add a TVS (e.g. SGM18HU1ANXUGI2G) in parallel between the DRAIN and SOURCE pins.

FUNCTIONAL BLOCK DIAGRAM

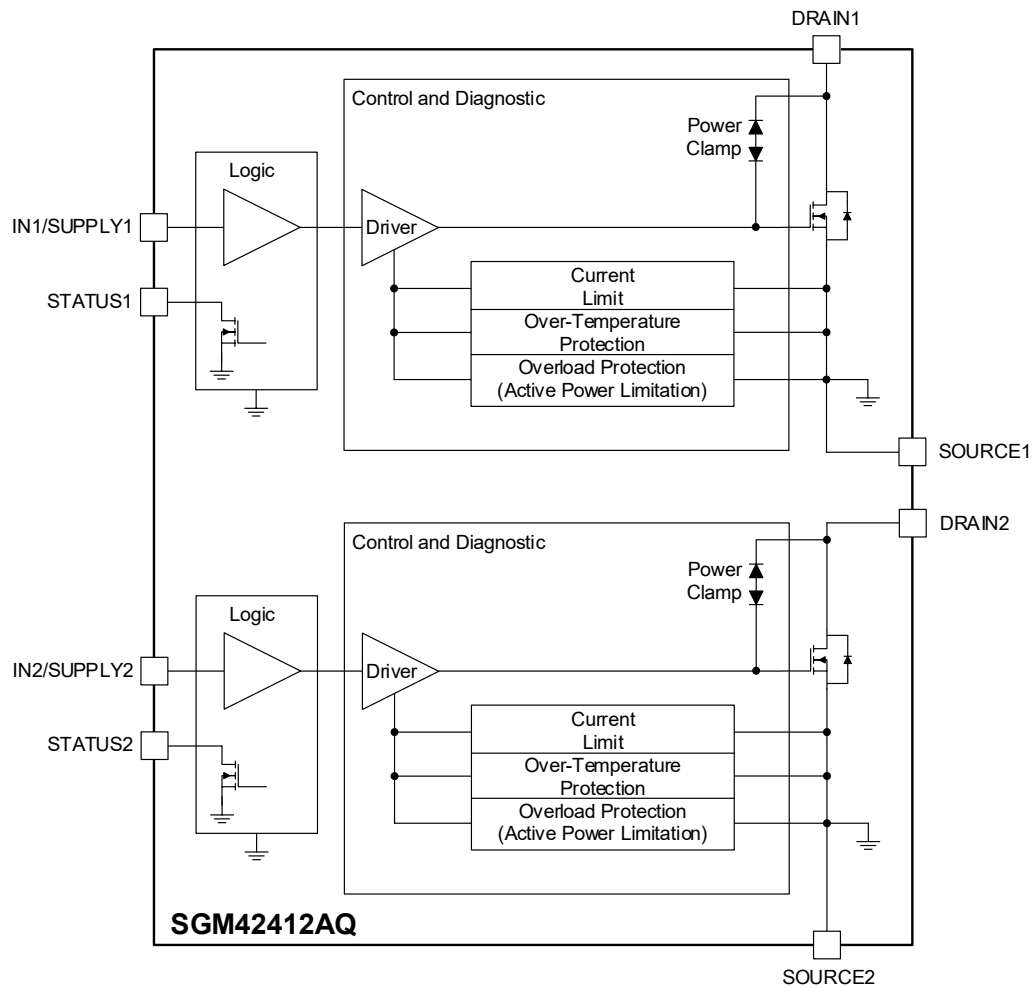


Figure 5. Block Diagram

FUNCTIONAL BLOCK DIAGRAM (continued)

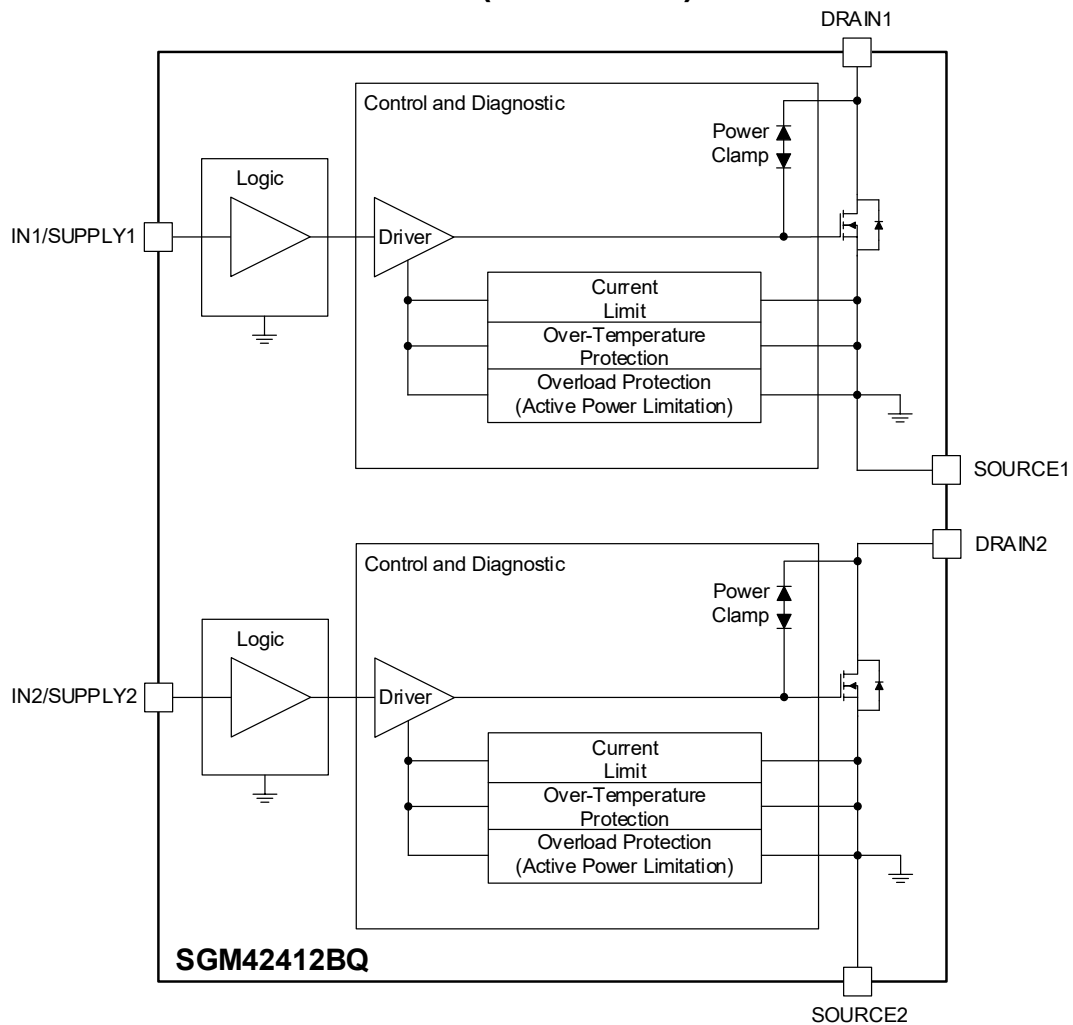


Figure 6. Block Diagram

APPLICATION INFORMATION

MCU I/O Protection

In some severe conditions, such as the ISO7637-2 test, a negative pulse occurs on the SOURCE pin. This pulse can cause damage on the connected microcontroller. Serial resistors are recommended to protect the microcontroller, when choosing the serial resistor, there are several factors need to consider, such as MCU I/O leakage current, low-side driver input threshold level, MCU I/O latch-up current limit. Please refer to example calculation below:

$$0.7/I_{\text{LATCHUP}} \leq R_{\text{PROT}} \leq (V_{\text{OH}\mu\text{C}} - V_{\text{INTH}})/I_{\text{ISSMAX}}$$

where $I_{\text{LATCHUP}} \geq 20\text{mA}$, $V_{\text{OH}\mu\text{C}} \geq 4.5\text{V}$, $35\Omega \leq R_{\text{PROT}} \leq 21\text{k}\Omega$.

Recommended values: $R_{\text{PROT}} = 1\text{k}\Omega$.

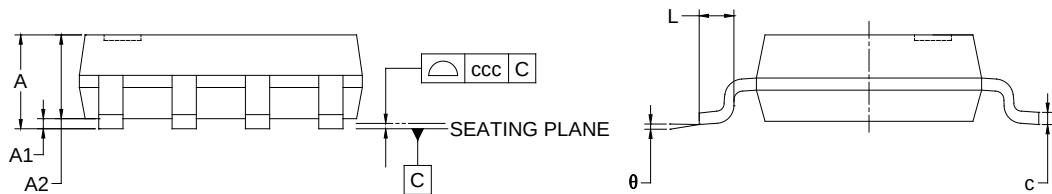
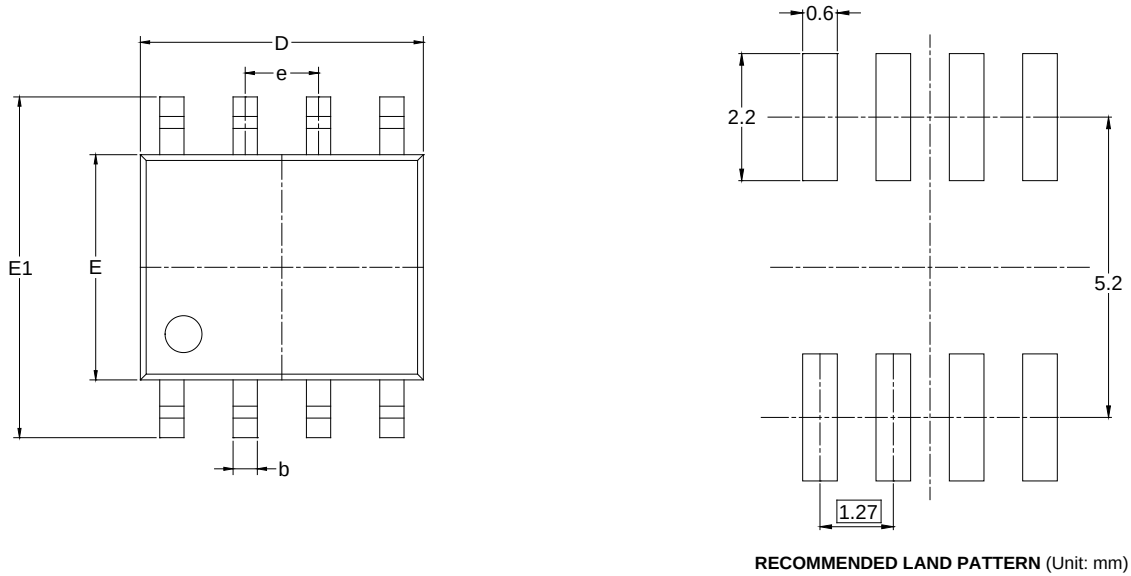
REVISION HISTORY

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

OCTOBER 2026 – REV.A to REV.A.1	Page
Added Model SGM42412AQ	All
Changes from Original to REV.A (AUGUST 2026)	Page
Changed from product preview to production data.....	All

PACKAGE OUTLINE DIMENSIONS

SOIC-8



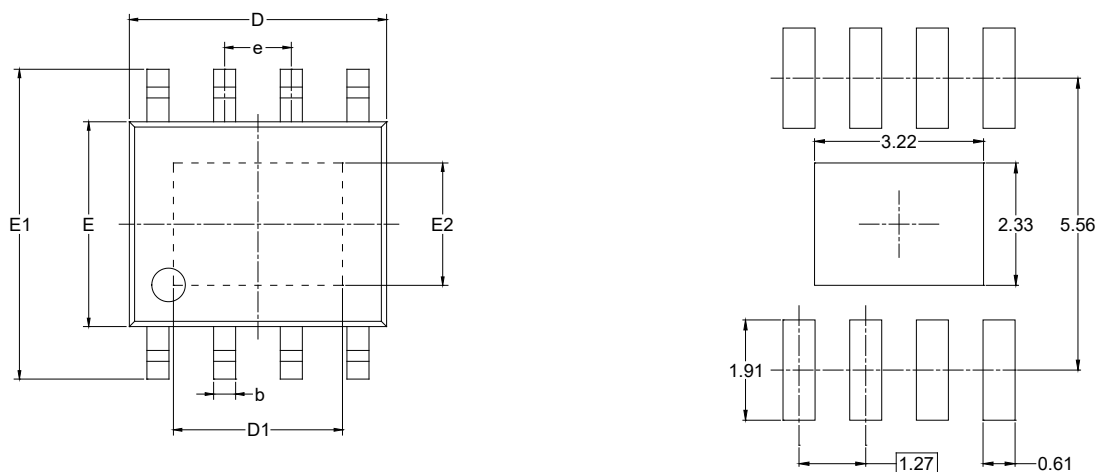
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.350	-	1.750
A1	0.100	-	0.250
A2	1.350	-	1.550
b	0.330	-	0.510
c	0.170	-	0.250
D	4.700	-	5.100
E	3.800	-	4.000
E1	5.800	-	6.200
e	1.270 BSC		
L	0.400	-	1.270
θ	0°	-	8°
ccc	0.100		

NOTES:

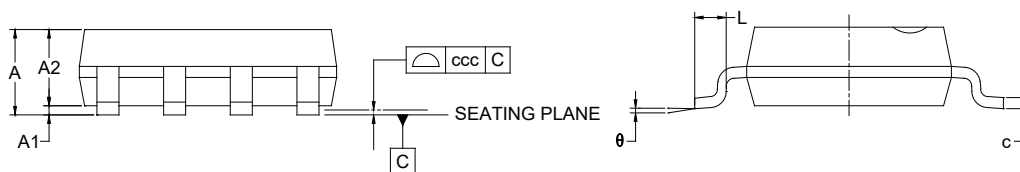
1. This drawing is subject to change without notice.
2. This dimension does not include mold flash, protrusions or gate burrs. Mold flash, protrusions or gate burrs shall not exceed 0.15mm per side.
3. Reference JEDEC MS-012.

PACKAGE OUTLINE DIMENSIONS

SOIC-8 (Exposed Pad)



RECOMMENDED LAND PATTERN (Unit: mm)



Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A			1.700
A1	0.000	-	0.150
A2	1.250	-	1.650
b	0.330	-	0.510
c	0.170	-	0.250
D	4.700	-	5.100
D1	3.020	-	3.420
E	3.800	-	4.000
E1	5.800	-	6.200
E2	2.130	-	2.530
e	1.27 BSC		
L	0.400	-	1.270
θ	0°	-	8°
ccc	0.100		

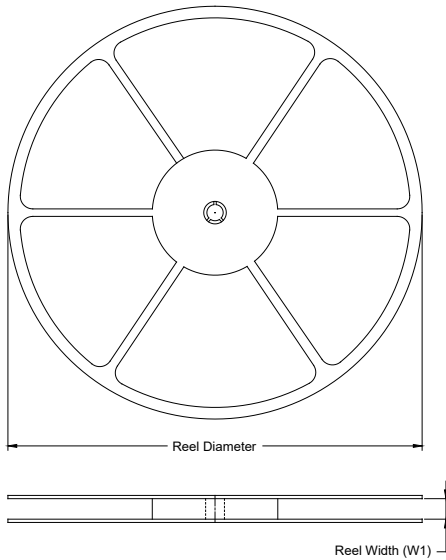
NOTES:

1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MS-012.

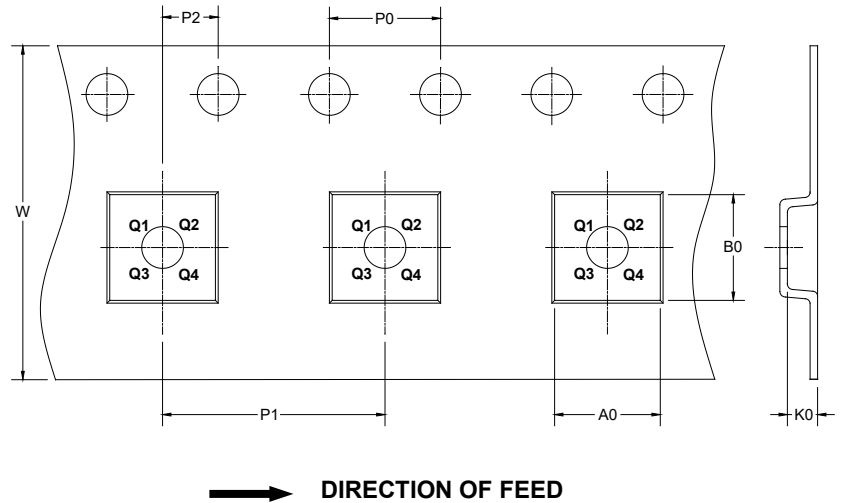
PACKAGE INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



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

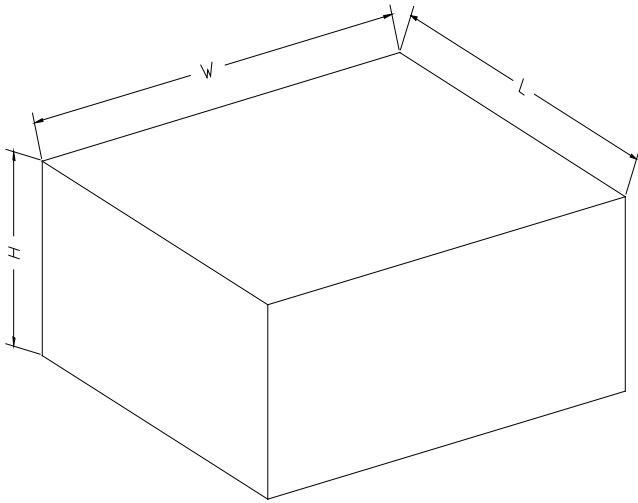
KEY PARAMETER LIST OF TAPE AND REEL

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOIC-8	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1
SOIC-8 (Exposed Pad)	13"	12.4	6.40	5.40	2.10	4.0	8.0	2.0	12.0	Q1

DD00001

PACKAGE INFORMATION

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