SGM42402Q
Automotive Low-side Driver with Dual Self-Protection Featuring Current and Temperature Limits

GENERAL DESCRIPTION

SGM42402Q is a dual self-protected, low-side driver, which provides several protection features, including over-current, over-temperature, and ESD, as well as integrated drain-to-gate clamping for over-voltage protection. With its safeguarding capabilities, this device is an ideal option for usage in harsh automotive environments.

The SGM42402Q is AEC-Q100 qualified (Automotive Electronics Council (AEC) standard Q100 Grade 1) and it is suitable for automotive applications.

The SGM42402Q is available in Green SOIC-8 and SOIC-8 (Exposed Pad) packages.

APPLICATIONS

Can Switch Resistance, Inductance and Capacitance Loads

Can Substitute Discrete Circuits and Electromechanical Relays

Automotive/Industrial

FEATURES

- **AEC-Q100 Qualified for Automotive Applications**
  Device Temperature Grade 1
  T_A = -40℃ to +125℃
- **Full Set of Protections**
  - **Short-Circuit Protection**
  - **Over-Voltage Protection**
  - **ESD Protection**
  - **Thermal Shutdown with Automatic Restart**
- **Clamp Integrated for Switching of Inductive Loads**
- **dV/dt Robustness**
- **42V Drain-to-Source Breakdown Voltage**
- **Output Clamp Voltage: 42V**
- **Static Drain-to-Source On-Resistance:**
  110mΩ/Channel (TYP) at 10V
- **Continuous Drain Current:**
  SOIC-8:
  - **3.2A, 1-Channel On**
  - **2.2A/CH, 2-Channel On**

  SOIC-8 (Exposed Pad):
  - **4.2A, 1-Channel On**
  - **3.1A/CH, 2-Channel On**

  Output Peak Current (Thermal Limited): 8.8A
- **Logic Level Input Capable of Analog Driving**
- **Available in Green SOIC-8 and SOIC-8 (Exposed Pad) Packages**

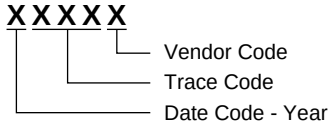
代理商 威尔逸 www.visvie.com
联系电话 138 2526 5270

PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM42402Q	SOIC-8	-40℃ to +125℃	SGM42402QS8G/TR	0J4S8 XXXXX	Tape and Reel, 4000
	SOIC-8 (Exposed Pad)	-40℃ to +125℃	SGM42402QPS8G/TR	0F3PS8 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

Internally Clamped Drain-to-Source Voltage
V_{DSS} 42V
V_{DSS} (T_J = -40℃) 38V
Internally Clamped Drain-to-Gate Voltage
V_{DGR} 42V
V_{DGR} (T_J = -40℃) 38V
Gate-to-Source Voltage, V_{GS} ..... ±14V
Continuous Drain Current, I_{DS} ..... Internally Limited
Maximum Continuous Drain Current, I_{DS} (T_J = +25℃)
SOIC-8, 1-Channel On 3.2A
SOIC-8, 2-Channel On 2.2A/CH
SOIC-8 (Exposed Pad), 1-Channel On 4.2A
SOIC-8 (Exposed Pad), 2-Channel On 3.1A/CH
Single Pulse Drain-to-Source Avalanche Energy (V_{DD} = 32V, V_G = 5.0V, I_{PK} = 1.0A, L = 300mH, R_{G_EXT} = 25Ω), E_{AS} (1) .....
..... 430mJ
Load Dump Voltage (V_{GS} = 0V and 10V, R_I = 2.0Ω, R_L = 9.0Ω, t_d = 400ms), V_{LD} 40V
Package Thermal Resistance
SOIC-8, θ_{JA} ..... 98℃/W
SOIC-8, θ_{JB} ..... 46.6℃/W
SOIC-8, θ_{JC} ..... 46.2℃/W
SOIC-8 (Exposed Pad), θ_{JA} ..... 33.9℃/W
SOIC-8 (Exposed Pad), θ_{JB} ..... 9.8℃/W
SOIC-8 (Exposed Pad), $\theta_{JC\ (TOP)}$ ..... 45.5℃/W
SOIC-8 (Exposed Pad), $\theta_{JC\ (BOT)}$ ..... 1.5℃/W
Junction Temperature ..... +150℃
Storage Temperature Range ..... -65℃ to +150℃
Lead Temperature (Soldering, 10s) ..... +260℃
ESD Susceptibility
HBM 8000V
CDM 2000V

NOTE:

1. $E_{AS} = \frac{1}{2} \times L \times I_{PK}^{2} \times \left(1 - \frac{V_{BAT}}{V_{BAT} - V_{CLAMP}}\right)$

RECOMMENDED OPERATING CONDITIONS

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

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

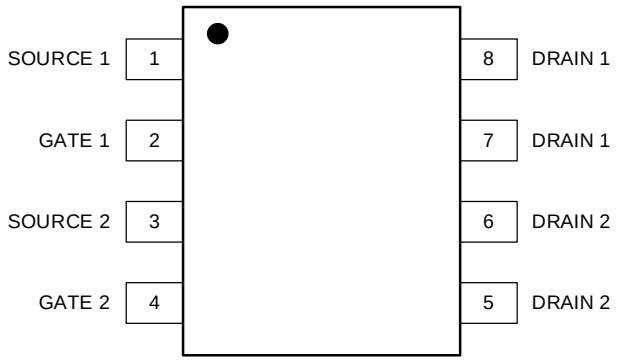
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

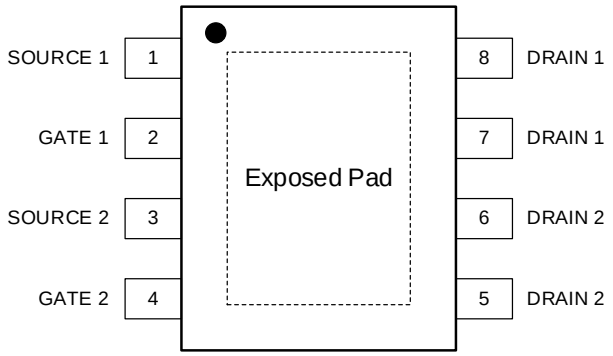
PIN CONFIGURATIONS

(TOP VIEW)



SOIC-8

(TOP VIEW)



SOIC-8 (Exposed Pad)

PIN DESCRIPTION

PIN		SYMBOL	NAME
SOIC-8	SOIC-8 (Exposed Pad)		
1	1	S	SOURCE 1
2	2	G	GATE 1
3	3	S	SOURCE 2
4	4	G	GATE 2
5, 6	5, 6	D	DRAIN 2
7, 8	7, 8	D	DRAIN 1
—	Exposed Pad	—	GND or SOURCE

ELECTRICAL CHARACTERISTICS

(T_J = +25℃, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
Off Characteristics							
Drain-to-Source Breakdown Voltage (1)	V_{BR_DSS}	V_{GS} = 0V, I_{DS} = 10mA, T_J = +25℃		38 (4)	42	44	V
		V_{GS} = 0V, I_{DS} = 10mA, T_J = +125℃ (3)		40	43	45	
Drain Current at Zero Gate Voltage	I_{DSS}	V_{GS} = 0V, V_{DS} = 32V, T_J = +25℃			0.025	0.4	μA
		V_{GS} = 0V, V_{DS} = 32V, T_J = +125℃ (3)			0.2	1	
Gate Input Current	I_{GSSF}	V_{DS} = 0V, V_{GS} = 5V			225	300	μA
On Characteristics (1)							
Gate Threshold Voltage	V_{GS_TH}	V_{GS} = V_{DS}, I_{DS} = 150μA		1.3	1.75	2.2	V
Gate Threshold Temperature Coefficient	V_{GS_TH}/T_J				3.0		-mV/℃
Static Drain-to-Source On-Resistance/Channel	R_{DSON}	V_{GS} = 10V, I_{DS} = 1.7A, T_J = +25℃			110	135	mΩ
		V_{GS} = 10V, I_{DS} = 1.7A, T_J = +125℃ (3)			150	175	
Source-Drain Forward On Voltage	V_{SD}	V_{GS} = 0V, I_S = 7A			1.23		V
Switching Characteristics (3)							
Turn-On Time	t_{ON}	V_{GS} = 10V, V_{DD} = 12V, I_{DS} = 2.5A, R_L = 4.7Ω	10% V_{IN} to 90% I_{DS}		34	45	μs
Turn-Off Time	t_{OFF}		90% V_{IN} to 10% I_{DS}		86	110	μs
Turn-On Rise Time	t_{RISE}		10% I_{DS} to 90% I_{DS}		21	30	μs
Turn-Off Fall Time	t_{FALL}		90% I_{DS} to 10% I_{DS}		42	60	μs
Slew-Rate On	$-dV_{DS}/dt_{ON}$		70% to 50% V_{DD}		0.67	1.0	V/μs
Slew-Rate Off	dV_{DS}/dt_{OFF}		50% to 70% V_{DD}		0.29	0.4	V/μs
Self-Protection Characteristics (2)							
Current Limit	I_{LIM}	V_{DS} = 10V, V_{GS} = 5V, T_J = +25℃		7.8	8.8	9.8	A
		V_{DS} = 10V, V_{GS} = 5V, T_J = +125℃ (3)		5.3	6.8	8.6	
		V_{DS} = 10V, V_{GS} = 10V, T_J = +25℃		8	9	10	
		V_{DS} = 10V, V_{GS} = 10V, T_J = +125℃ (3)		5.5	7	8.8	
Temperature Limit (Turn-Off)	T_{LIM_OFF}	V_{GS} = 5V (3)			155		℃
Thermal Hysteresis	ΔT_{LIM_ON}	V_{GS} = 5V			20		
Temperature Limit (Turn-Off)	T_{LIM_OFF}	V_{GS} = 10V (3)			155		
Thermal Hysteresis	ΔT_{LIM_ON}	V_{GS} = 10V			20		
Gate Input Characteristics (3)							
Gate Input Current in Device On State	I_{GON}	V_{GS} = 5V, I_{DS} = 1A			225		μA
		V_{GS} = 10V, I_{DS} = 1A			225		
Gate Input Current in Current Limit State	I_{GCL}	V_{GS} = 5V, V_{DS} = 10V			0.24		mA
		V_{GS} = 10V, V_{DS} = 10V			0.24		
Gate Input Current in Thermal Limit Fault State	I_{GTL}	V_{GS} = 5V, V_{DS} = 10V			0.08		mA
		V_{GS} = 10V, V_{DS} = 10V			0.08		

NOTES:
1. Pulse test: pulse width ≤ 300μs, duty cycle ≤ 2%.
2. Fault conditions are considered to be outside the normal operating range of the component.
3. Not included in the production testing.
4. MIN value including -40℃.

TEST CIRCUITS AND WAVEFORMS

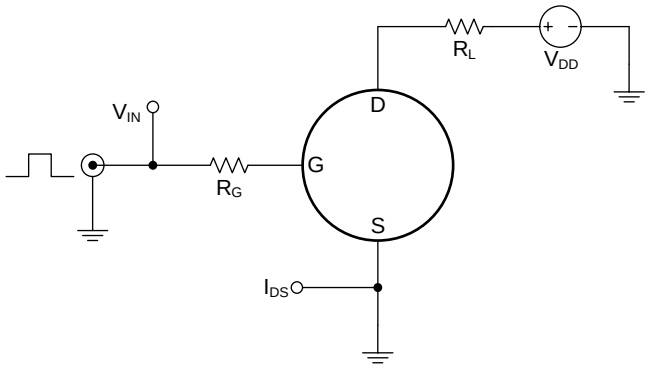


Figure 1. Test Circuit for Switching Resistive Loads

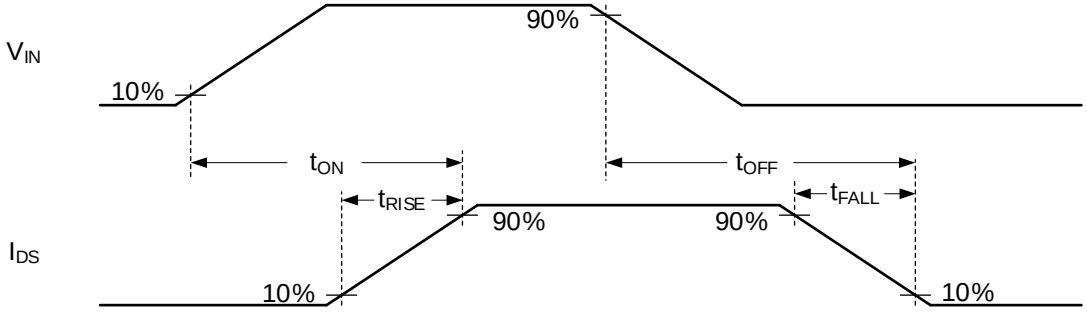


Figure 2. Waveforms for Switching Resistive Loads

TEST CIRCUITS AND WAVEFORMS (continued)

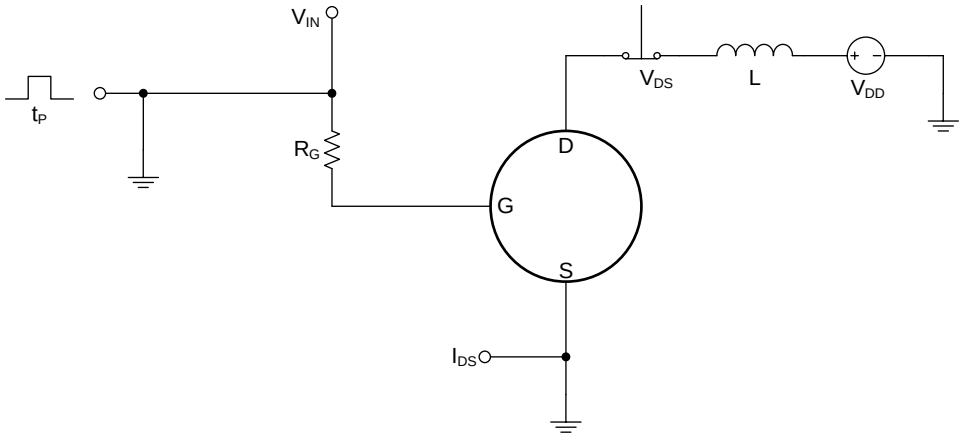


Figure 3. Test Circuit for Switching Inductive Loads

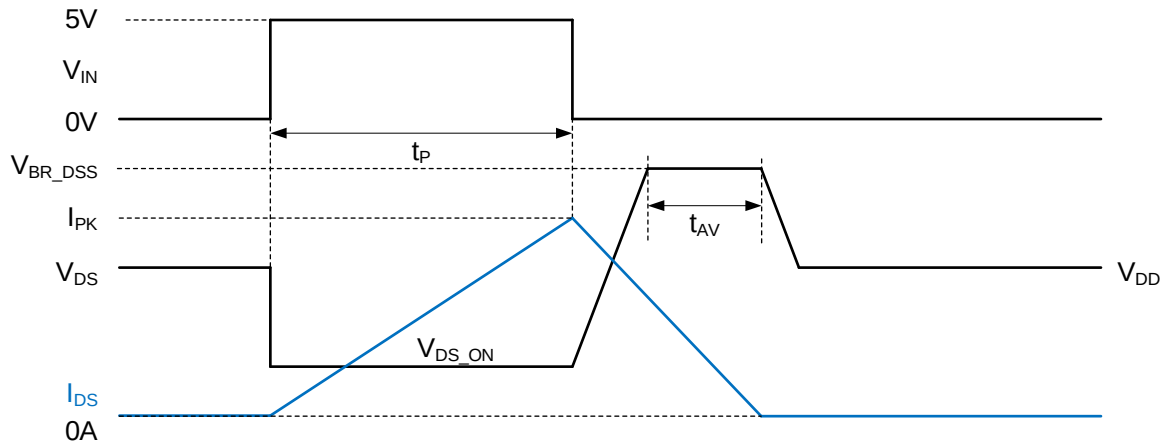
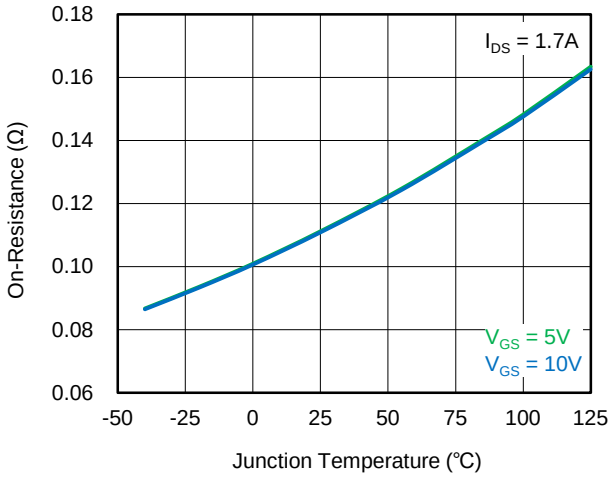


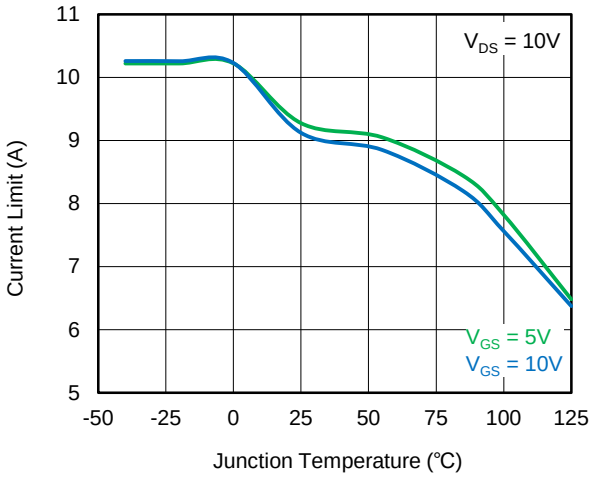
Figure 4. Waveforms for Switching Inductive Loads

TYPICAL PERFORMANCE CHARACTERISTICS

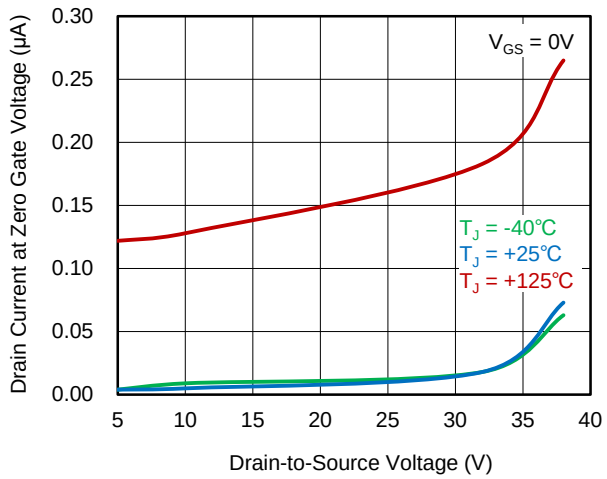
On-Resistance vs. Junction Temperature



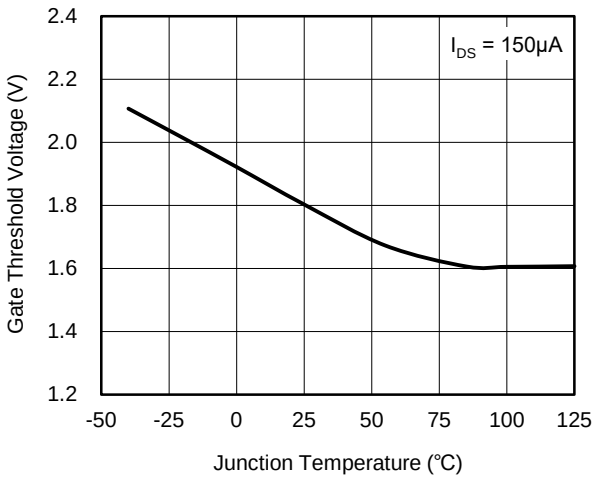
Current Limit vs. Junction Temperature



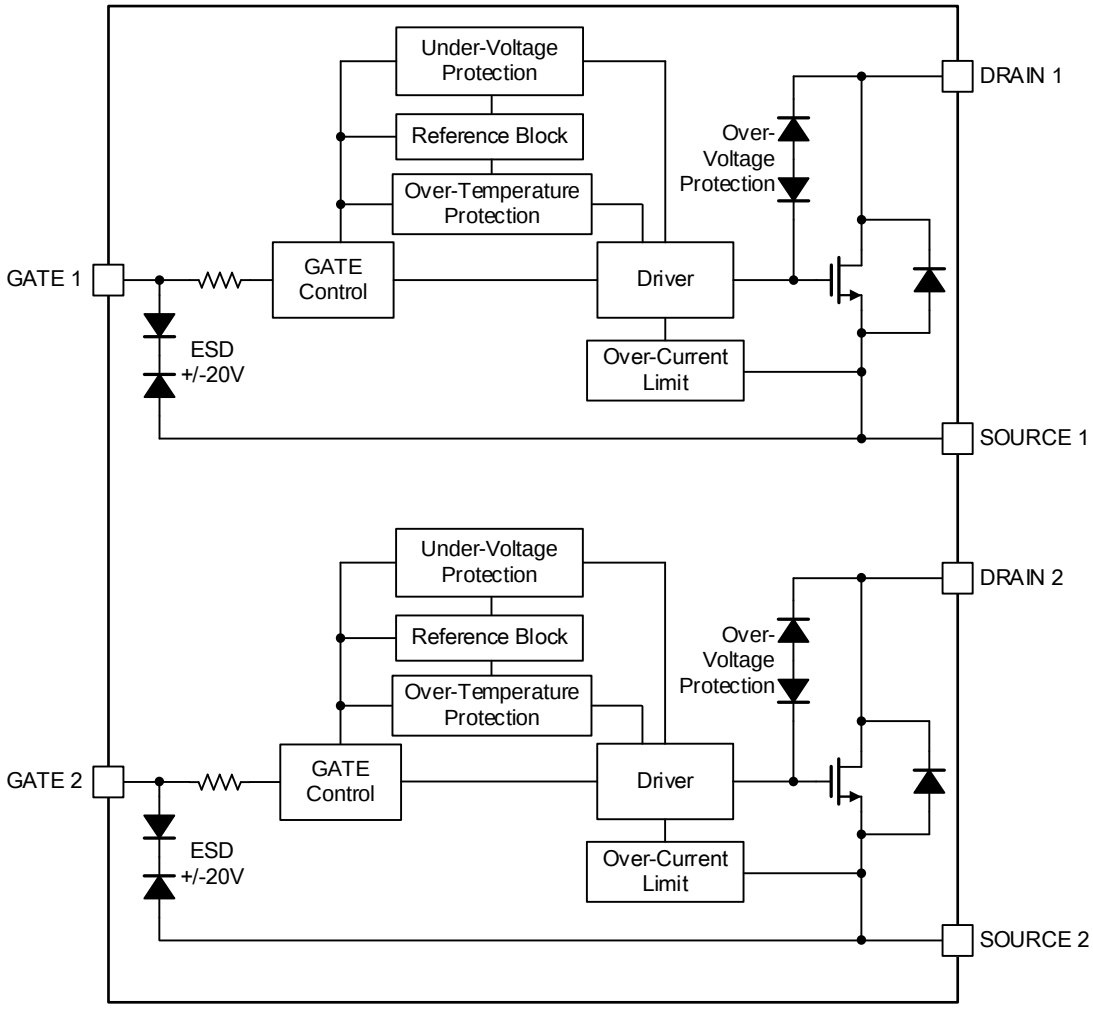
Drain Current at Zero Gate Voltage vs. Drain-to-Source Voltage



Gate Threshold Voltage vs. Junction Temperature



FUNCTIONAL BLOCK DIAGRAM



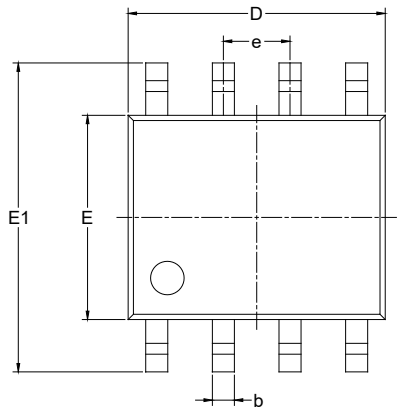
REVISION HISTORY

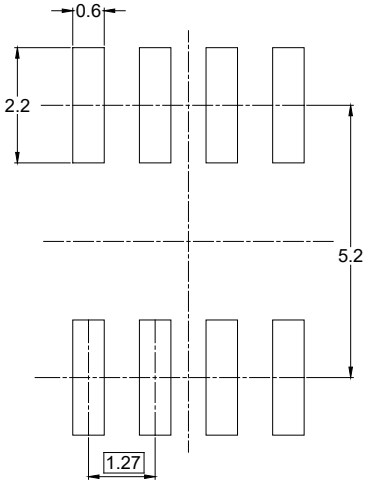
NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (AUGUST 2024) to REV.A	Page
Changed from product preview to production data	All

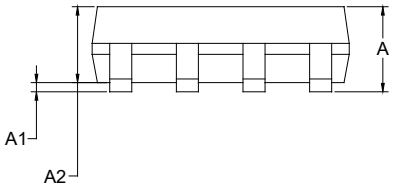
PACKAGE OUTLINE DIMENSIONS

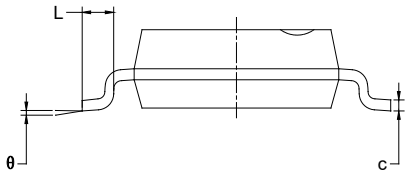
SOIC-8





RECOMMENDED LAND PATTERN (Unit: mm)



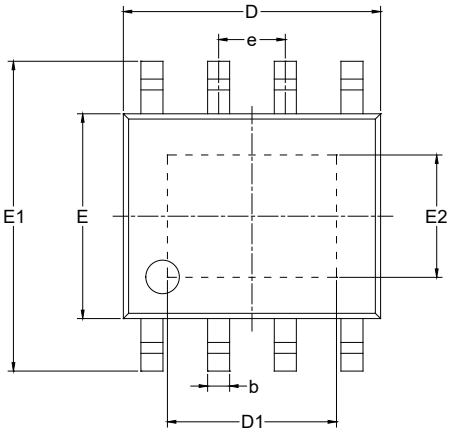


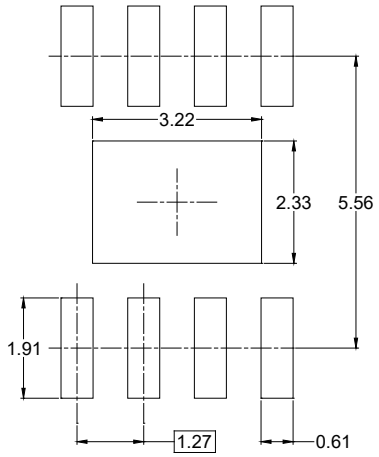
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.27 BSC		0.050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

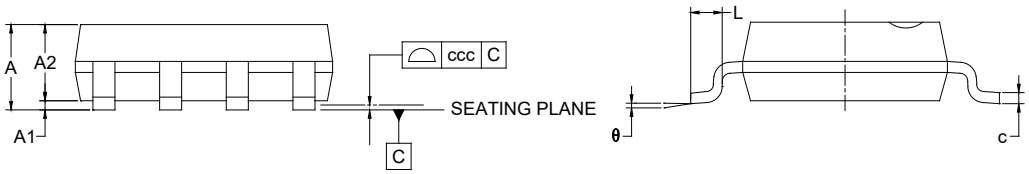
PACKAGE OUTLINE DIMENSIONS

SOIC-8 (Exposed Pad)





RECOMMENDED LAND PATTERN (Unit: mm)

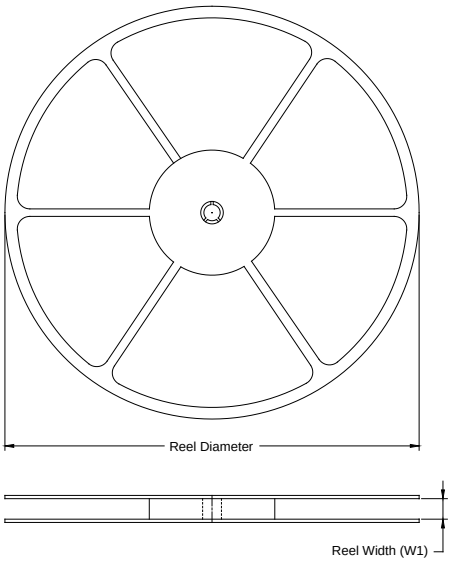


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A			1.700
A1	0.000	-	0.150
A2	1.250	-	1.650
b	0.330	-	0.510
c	0.170	-	0.250
D	4.700	-	5.100
D1	3.020	-	3.420
E	3.800	-	4.000
E1	5.800	-	6.200
E2	2.130	-	2.530
e	1.27 BSC		
L	0.400	-	1.270
θ	0°	-	8°
ccc	0.100		

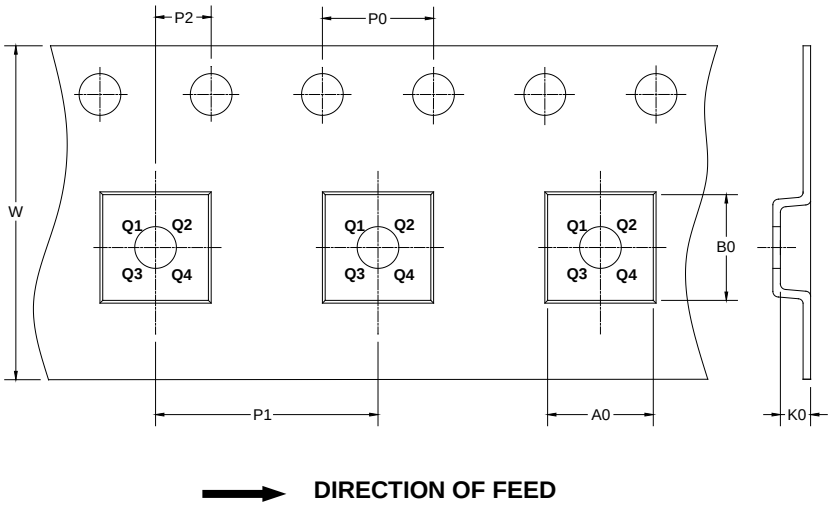
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MS-012.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



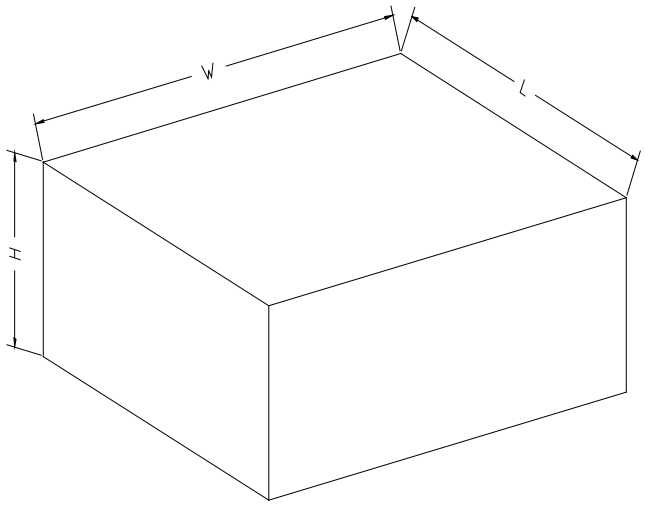
NOTE: The picture is only for reference. Please make the object as the standard.

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

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