SGM48536/SGM48537 SGM48538/SGM48539/SGM48540 Single High-Speed, Low-Side Gate Drivers with Negative Input Voltage Capability

GENERAL DESCRIPTION

The SGM48536/37/38/39/40 are single high-speed low-side gate drivers for MOSFET and IGBT power switches. These devices can provide rail-to-rail driving capability and very small propagation delays (18.5ns, TYP). They also provide 4A peak source current and 8A peak sink current (asymmetrical drive) when V_{DD} = 12V. The input can withstand a maximum negative voltage of -10V.

The operating voltage range is 9V to 25V. The devices feature under-voltage lockout (UVLO) function. After UVLO is triggered, the output remains low.

The SGM48536 adopts separate output architecture. The separate output structure with asymmetric drive improves the immunity of the device to the parasitic Miller conduction effect and reduces ground bounce.

The SGM48537 adopts a dual-input design. IN+ or IN- can independently control the output of the driver. The unused pin can be functioned as an enable control pin. In order to ensure that the output remains low when an input pin is floating, these input pins have internal pull-up and pull-down resistors.

The input thresholds of these devices are compatible with low voltage TTL and CMOS logic, which will not be affected by V_{DD} changes. A Schmitt trigger is used at the input, and a wide range of hysteresis voltage is designed to enhance the immunity.

The SGM48536 is available in a Green SOT-23-6 package. The SGM48537/38/39/40 are all available in a Green SOT-23-5 package.

FEATURES

- **Asymmetrical Drive**
  - **4A Peak Source Current**
  - **8A Peak Sink Current**
- **TTL and CMOS Compatible Logic Threshold**
- **Logic Levels Independent of Supply Voltage**
- **Hysteretic Input Logic for High Noise Immunity**
- **Outputs are Logic Low when Inputs are Floating**
- **Negative Voltage Handling Capability:**
  - **-10V DC at Inputs**
  - **-2V, 200ns Pulse for Outputs**
- **Glitch-Free Operation at Power-Up and Power-Down: Outputs are Pulled Low during Supply UVLO**
- **Fast Propagation Delay: 18.5ns (TYP)**
- **Fast Rise Time: 9.5ns (TYP)**
- **Fast Fall Time: 8ns (TYP)**
- **SGM48536 Separate Output Options Allow for Tuning of Turn-on and Turn-off Currents**
- **SGM48537 Dual Input Design (Choice of an Inverting (IN-) or Non-Inverting (IN+) Driver Configuration)**
  - **Unused Input Pin Can be Used for Enable or Disable Function**
- **Input Pin Absolute Maximum Voltage Levels Not Restricted by VDD Pin Bias Supply Voltage**
- **-40℃ to +140℃ Operating Junction Temperature Range**
- **Packaging:**
  SGM48536 Available in a Green SOT-23-6 Package
  SGM48537/38/39/40 Available in a Green SOT-23-5 Package

APPLICATIONS

Power MOSFETs
IGBT Driving for Power Supplies
DC/DC Converters
Solar Power, Motor Drivers

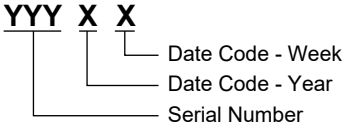
PACKAGE/ORDERING INFORMATION

MODEL	PACKAGE DESCRIPTION	SPECIFIED TEMPERATURE RANGE	ORDERING NUMBER	PACKAGE MARKING	PACKING OPTION
SGM48536	SOT-23-6	-40℃ to +140℃	SGM48536XN6G/TR	SZKXX	Tape and Reel, 3000
SGM48537	SOT-23-5	-40℃ to +140℃	SGM48537XN5G/TR	GJUXX	Tape and Reel, 3000
SGM48538	SOT-23-5	-40℃ to +140℃	SGM48538XN5G/TR	GJVXX	Tape and Reel, 3000
SGM48539	SOT-23-5	-40℃ to +140℃	SGM48539XN5G/TR	GJWXX	Tape and Reel, 3000
SGM48540	SOT-23-5	-40℃ to +140℃	SGM48540XN5G/TR	GJYXX	Tape and Reel, 3000

MARKING INFORMATION

NOTE: XX = Date Code.

SOT-23-6/SOT-23-5



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_{DD} ..... -0.3V to 28V
EN, IN+, IN- Voltage Range..... -10V to 28V
OUT Voltage Range
DC.....-0.3V to V_{DD} + 0.3V
Repetitive Pulse < 200ns .....-2V to V_{DD} + 0.3V
Maximum Output Pulsed Source/Sink Current (0.5μs),
I_{OUT_PULSED}.....4A/8A
Package Thermal Resistance
SOT-23-6, θ_{JA} ..... 173℃/W
SOT-23-6, θ_{JB} ..... 52.9℃/W
SOT-23-6, θ_{JC} ..... 103.7℃/W
Package Thermal Resistance
SOT-23-5, θ_{JA} ..... 171.9℃/W
SOT-23-5, θ_{JB} ..... 38.6℃/W
SOT-23-5, θ_{JC} ..... 60.1℃/W
Junction Temperature.....+150℃
Storage Temperature Range .....-65℃ to +150℃
Lead Temperature (Soldering, 10s).....+260℃
ESD Susceptibility
HBM.....3000V
CDM 1000V

RECOMMENDED OPERATING CONDITIONS

Supply Voltage Range, V_{DD} .....9V to 25V
EN, IN+, IN- Voltage Range..... -10V to 25V
Operating Junction Temperature Range.....-40℃ to +140℃

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

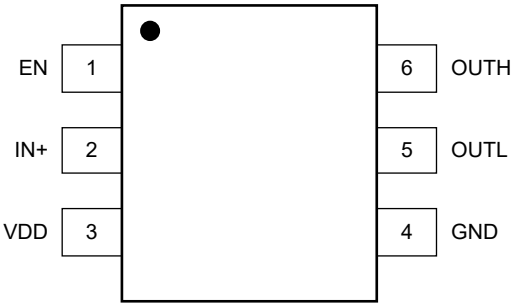
This integrated circuit can be damaged if ESD protections are not considered carefully. SGMICRO recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance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

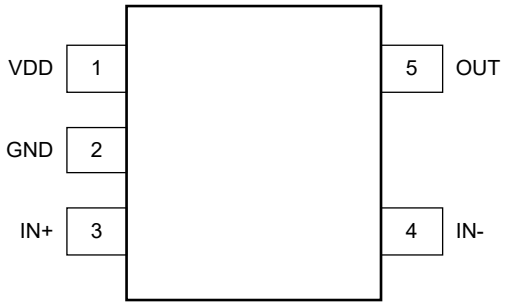
PIN CONFIGURATIONS

SGM48536 (TOP VIEW)



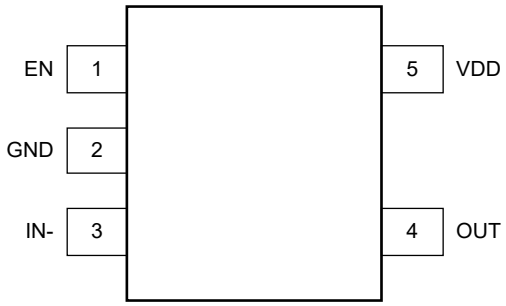
SOT-23-6

SGM48537 (TOP VIEW)



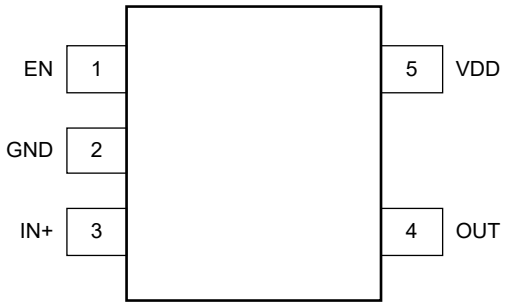
SOT-23-5

SGM48538 (TOP VIEW)



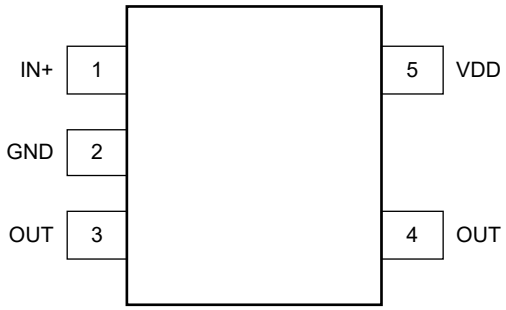
SOT-23-5

SGM48539 (TOP VIEW)



SOT-23-5

SGM48540 (TOP VIEW)



SOT-23-5

PIN DESCRIPTION

PIN					NAME	I/O	FUNCTION
SGM48536	SGM48537	SGM48538	SGM48539	SGM48540			
1	—	1	1	—	EN	I	Enable Input. Pull EN high or leave it floating to enable output. Pull EN low to disable output, ignoring input state.
2	3	—	3	1	IN+	I	Non-Inverting Input. OUT is logic low if IN+ is unbiased or left floating. For the SGM48537, when IN- is used as an inverting input, pull IN+ up to VDD to enable output. Inject PWM signal to this pin when the driver is used in non-inverting configuration.
—	4	3	—	—	IN-	I	Inverting Input. OUT is logic low if IN- is unbiased or left floating. For the SGM48537, when IN+ is used as a non-inverting input, pull IN- down to GND to enable output. Inject PWM signal to this pin when the driver is used in inverting configuration.
3	1	5	5	5	VDD	I	Power Supply Input.
4	2	2	2	2	GND	—	Ground. Reference pin for all signals.
5	—	—	—	—	OUTL	O	Driver Sink Current Output.
6	—	—	—	—	OUTH	O	Driver Source Current Output.
—	5	4	4	3, 4	OUT	O	Driver Source/Sink Current Output.

NOTE: I: input, O: output.

FUNCTION TABLE

Table 1. Function Table (SGM48536)

IN+	EN	OUTH	OUTL	OUT (OUTH and OUTL Pins Tied Together)
L	L	High-Impedance	L	L
L	H	High-Impedance	L	L
H	L	High-Impedance	L	L
H	H	H	High-Impedance	H
H	Floating	H	High-Impedance	H
Floating	H	High-Impedance	L	L

Table 2. Function Table (SGM48537)

IN+	IN-	OUT
L	L	L
L	H	L
H	L	H
H	H	L
Floating	Any	L
Any	Floating	L

Table 3. Function Table (SGM48538/SGM48539)

EN	SGM48538		SGM48539	
	IN-	OUT	IN+	OUT
H	L	H	L	L
H	H	L	H	H
L	Any	L	Any	L
Any	Floating	L	Floating	L
Floating	L	H	L	L
Floating	H	L	H	H

Table 4. Function Table (SGM48540)

IN+	OUT
L	L
H	H
Floating	L

TYPICAL APPLICATIONS

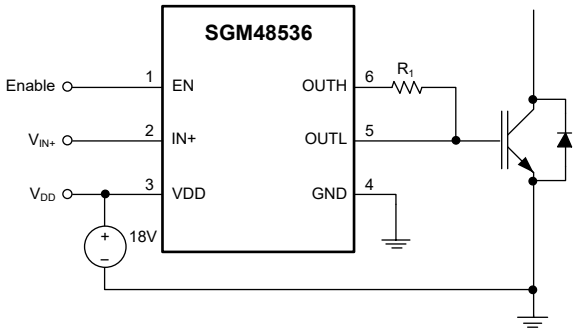
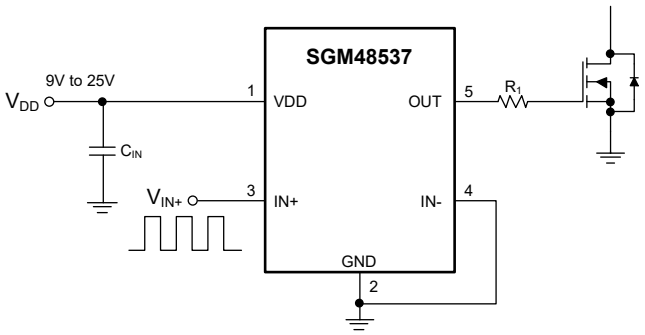
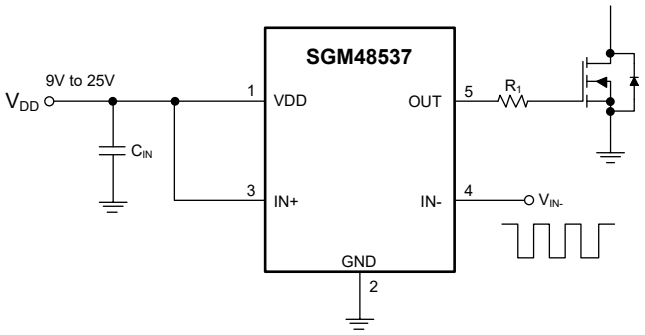


Figure 1. SGM48536 Driving IGBT



(IN- is grounded to the enable output)

Figure 2. SGM48537 Using Non-Inverting Input



(IN+ is tied to VDD enable output)

Figure 3. SGM48537 Using Inverting Input

FUNCTIONAL BLOCK DIAGRAMS

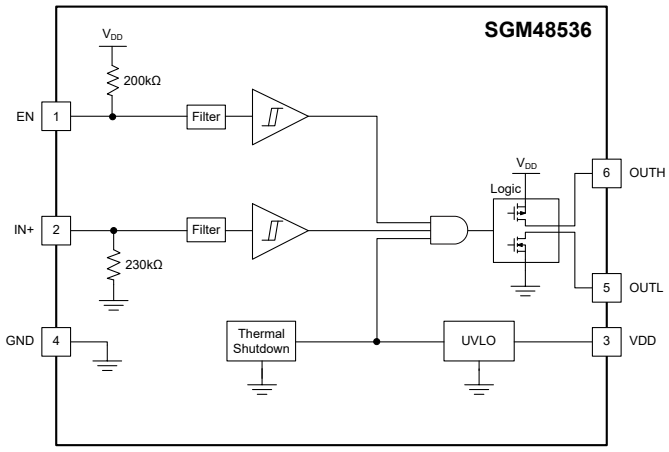


Figure 4. SGM48536 Block Diagram

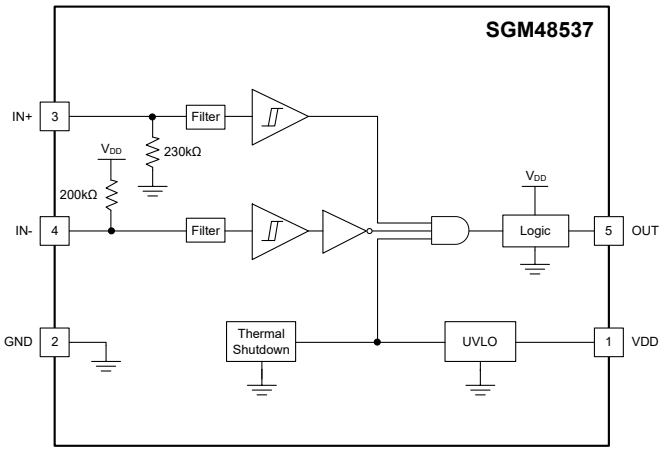


Figure 5. SGM48537 Block Diagram

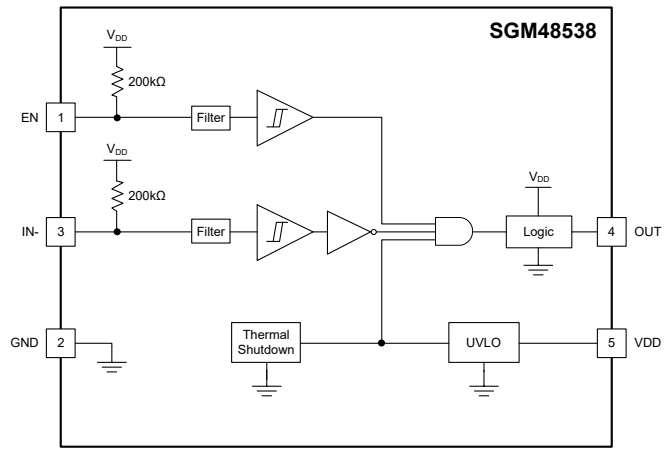


Figure 6. SGM48538 Block Diagram

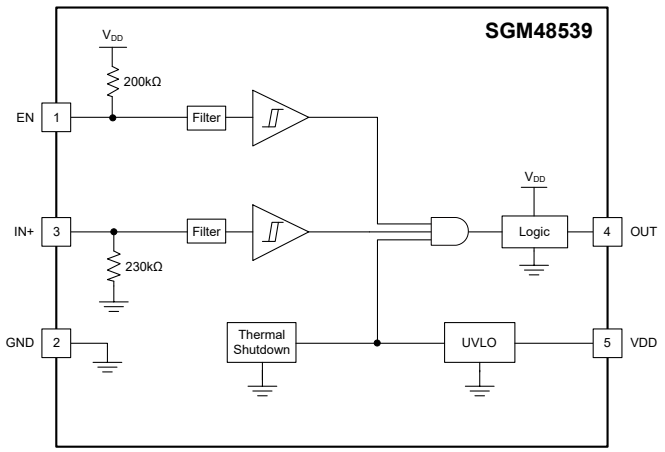


Figure 7. SGM48539 Block Diagram

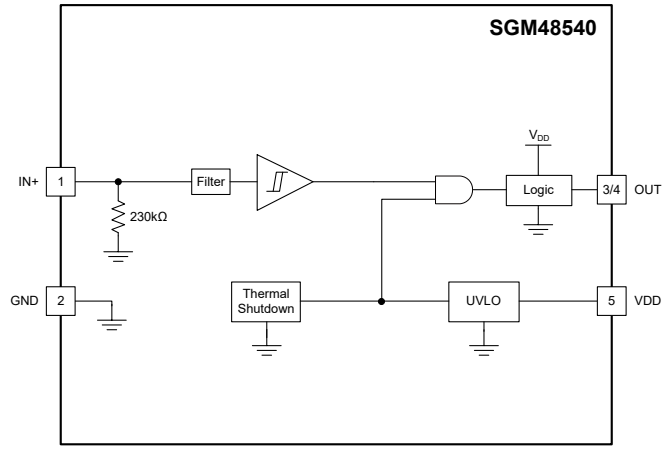
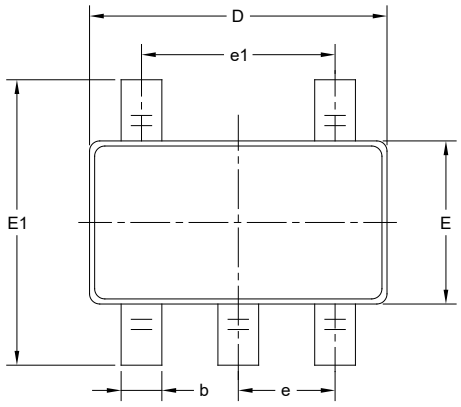
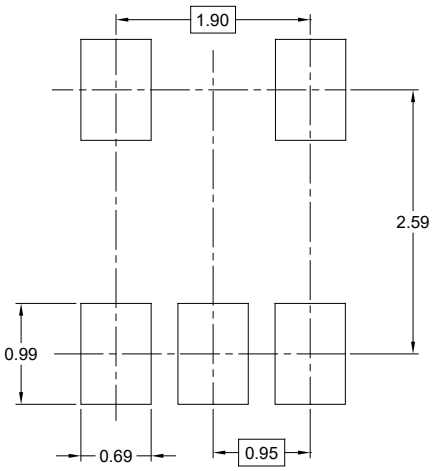


Figure 8. SGM48540 Block Diagram

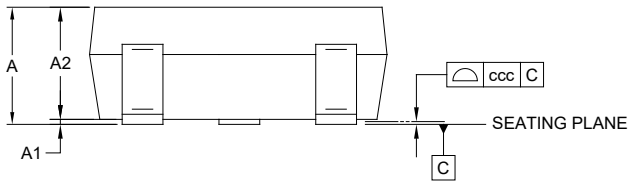
PACKAGE OUTLINE DIMENSIONS

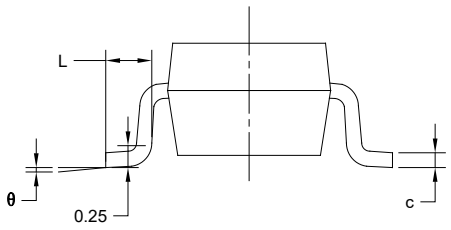
SOT-23-5





RECOMMENDED LAND PATTERN (Unit: mm)



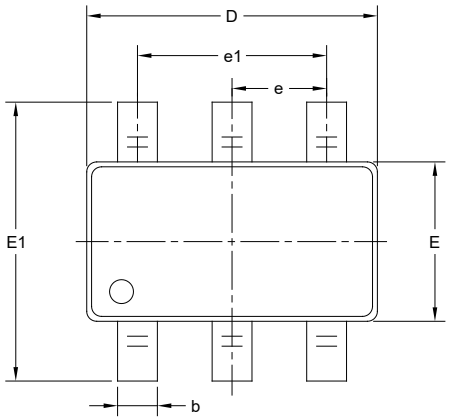


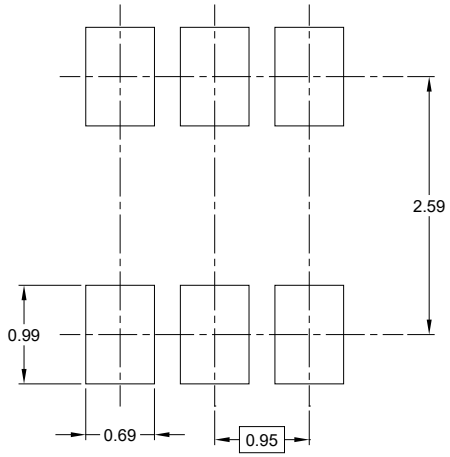
Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

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 MO-178.

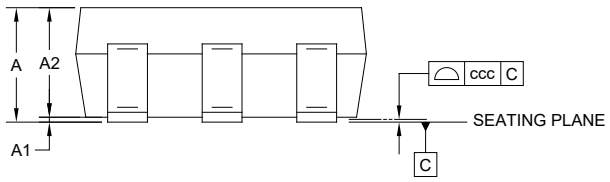
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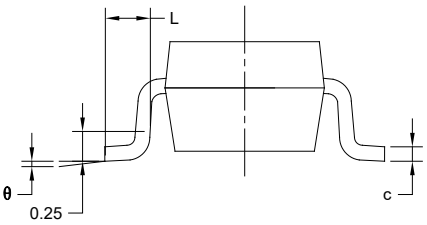
SOT-23-6





RECOMMENDED LAND PATTERN (Unit: mm)



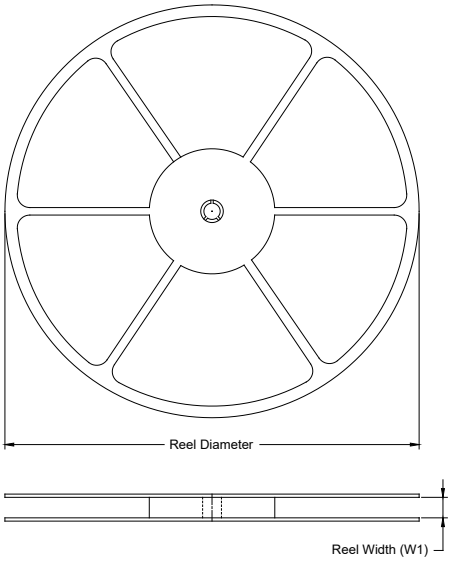


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	-	-	1.450
A1	0.000	-	0.150
A2	0.900	-	1.300
b	0.300	-	0.500
c	0.080	-	0.220
D	2.750	-	3.050
E	1.450	-	1.750
E1	2.600	-	3.000
e	0.950 BSC		
e1	1.900 BSC		
L	0.300	-	0.600
θ	0°	-	8°
ccc	0.100		

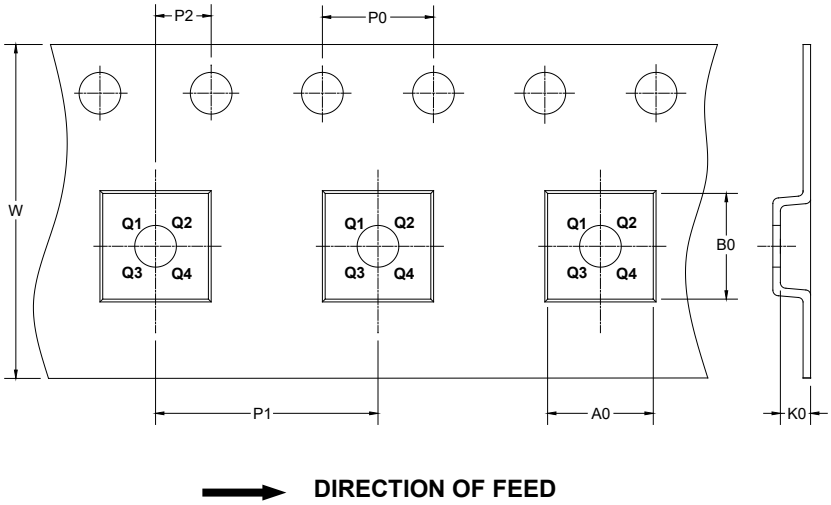
NOTES:
1. This drawing is subject to change without notice.
2. The dimensions do not include mold flashes, protrusions or gate burrs.
3. Reference JEDEC MO-178.

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



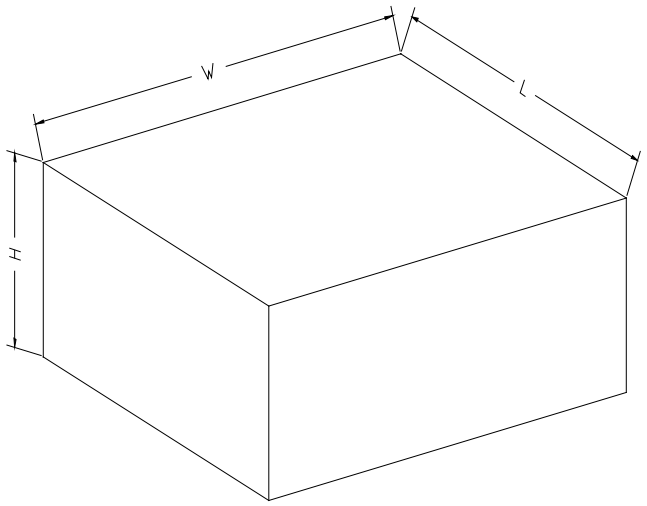
NOTE: The picture is only for reference. Please make the object as the standard.

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
SOT-23-5	7″	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOT-23-6	7″	9.5	3.23	3.17	1.37	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