



# SGM9155

## Single Channel, Video Filter Driver for HD (720p)

### PRODUCT DESCRIPTION

The SGM9155 video filter is intended to replace passive LC filters and drivers with an integrated device. The 6th-order channel offers High Definition (HD) filter. The SGM9155 may be directly driven by a DC-coupled DAC output or an AC-coupled signal. Internal bias circuitry provides constant bias voltage for AC-coupled input.

The output can be AC- or DC-coupled. DC coupling the output removes the need for large output coupling capacitors.

The SGM9155 is available in Green SOT-23-6 and SC70-5 packages. It operates over an ambient temperature range of -40°C to +85°C.

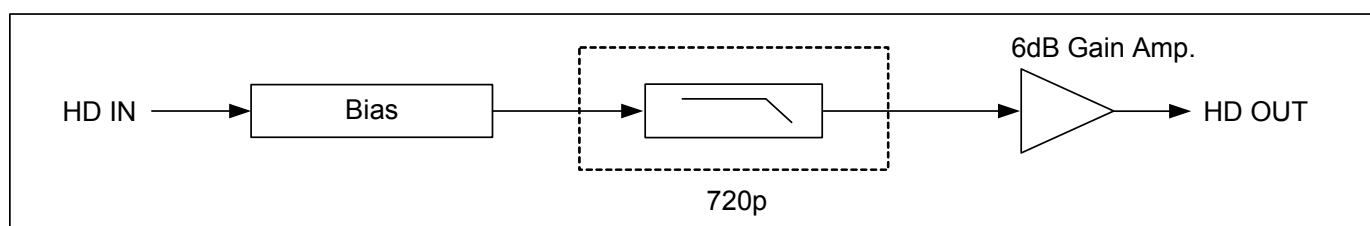
### FEATURES

- 6dB Gain for 720p High Definition Mode
- Bias Mode Active with AC-Coupled Input
- Bias Mode Inactive with DC-Coupled Input
- AC- or DC-Coupled Output
- DC-Coupled Output Eliminates AC Coupling Capacitor
- Available in Green SOT-23-6 and SC70-5 Packages
- -40°C to +85°C Operating Temperature Range

### APPLICATIONS

Set-Top Boxes  
Communication Devices  
Portable and Handheld Products  
Personal Video Recorders  
Video on Demand  
DVD Players  
HDTVs

### BLOCK DIAGRAM



## PACKAGE/ORDERING INFORMATION

| MODEL                    | PACKAGE DESCRIPTION | SPECIFIED TEMPERATURE RANGE | ORDERING NUMBER | PACKAGE MARKING | PACKING OPTION      |
|--------------------------|---------------------|-----------------------------|-----------------|-----------------|---------------------|
| SGM9155A<br>( 6dB Gain ) | SOT-23-6            | -40°C to +85°C              | SGM9155AYN6G/TR | SZ2XX           | Tape and Reel, 3000 |
|                          | SC70-5              | -40°C to +85°C              | SGM9155AYC5G/TR | SZ3XX           | Tape and Reel, 3000 |

NOTE: XX = 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.

## MARKING INFORMATION

**SY Y X X**

\_\_\_\_\_ Date code - Month ("A" = Jan. "B" = Feb. ... "L" = Dec.)  
 \_\_\_\_\_ Date code - Year ("A" = 2010, "B" = 2011 ...)  
 \_\_\_\_\_ Chip I.D.

For example: SZ3EA (2014, January)

## ABSOLUTE MAXIMUM RATINGS

Input Voltage Range ..... GND - 0.3V to  $V_{CC} + 0.3V$   
 Supply Voltage,  $V_{CC}$  ..... 6.0V  
 Junction Temperature ..... 150°C  
 Storage Temperature Range ..... -65°C to +150°C  
 Lead Temperature (Soldering, 10s) ..... 260°C  
 ESD Susceptibility  
 HBM ..... 8000V  
 MM ..... 400V

## RECOMMENDED OPERATING CONDITIONS

Operating Voltage Range ..... 3.1V to 5.5V  
 Operating Temperature Range ..... -40°C to +85°C

## OVERSTRESS CAUTION

Stresses beyond those listed may cause permanent damage to the device. Functional operation of the device at these or any other conditions beyond those indicated in the operational section of the specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

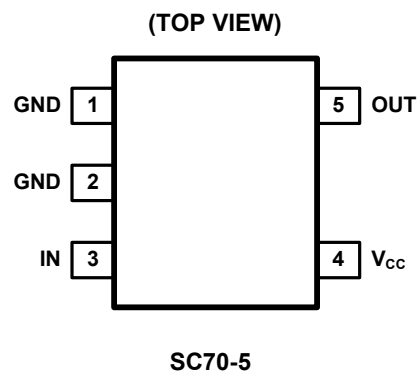
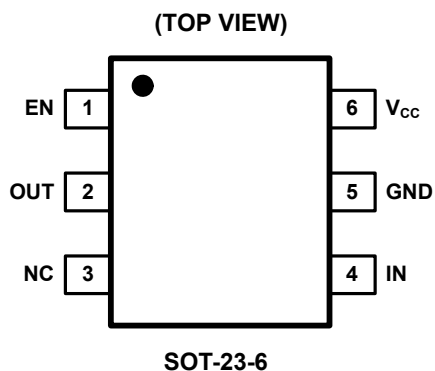
## ESD SENSITIVITY CAUTION

This integrated circuit can be damaged by ESD if you don't pay attention to ESD protection. 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 very small parametric changes could cause the device not to meet its published specifications.

## DISCLAIMER

SG Micro Corp reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time

## PIN CONFIGURATIONS



## PIN DESCRIPTION

| PIN      |        | NAME            | FUNCTION                |
|----------|--------|-----------------|-------------------------|
| SOT-23-6 | SC70-5 |                 |                         |
| 1        | —      | EN              | Enable Pin.             |
| 2        | 5      | OUT             | Video Output.           |
| 3        | —      | NC              | No Internal Connection. |
| 4        | 3      | IN              | Video Input.            |
| 5        | 1, 2   | GND             | Ground.                 |
| 6        | 4      | V <sub>CC</sub> | Power Supply.           |

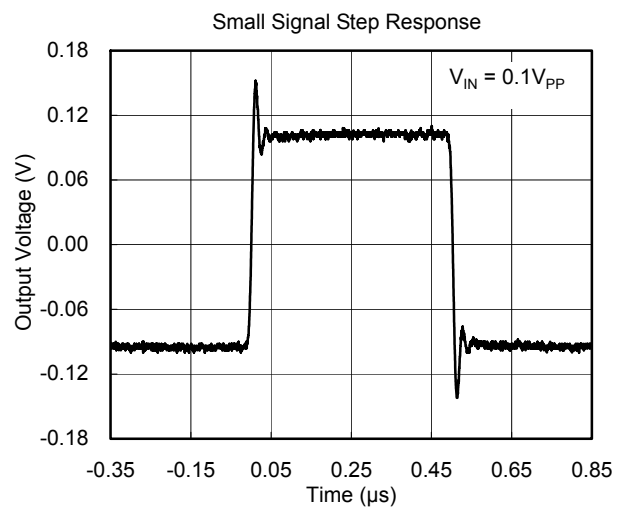
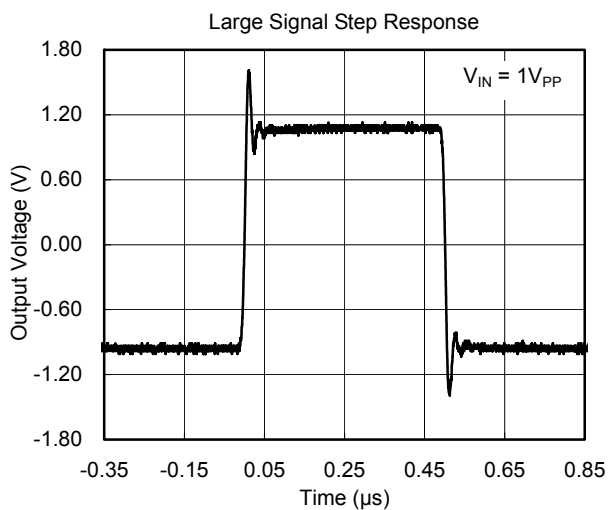
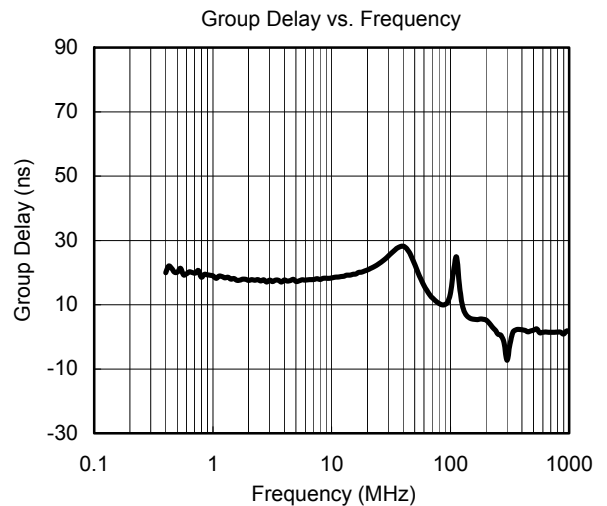
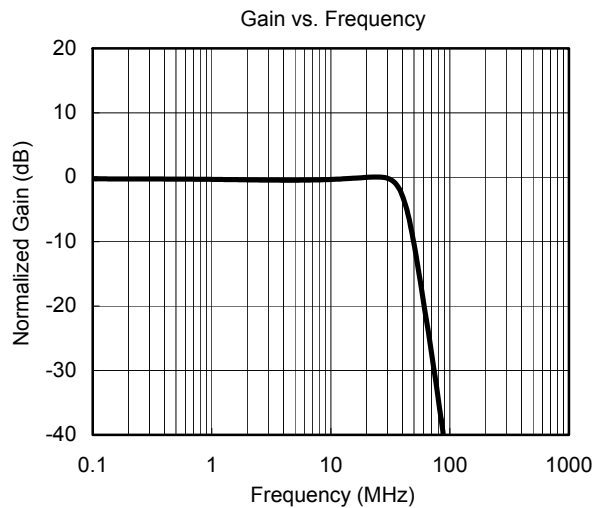
**ELECTRICAL CHARACTERISTICS**

( $V_{CC} = 5V$ , SGM9155A  $V_{IN} = 1V_{PP}$ ,  $T_A = +25^{\circ}C$ ,  $R_{SOURCE} = 37.5\Omega$ ; the input is AC-coupled with  $0.1\mu F$ ; the output is AC-coupled with  $220\mu F$  into  $150\Omega$ , referenced to  $400kHz$ , unless otherwise noted.)

| PARAMETER   | CONDITIONS                               | MIN  | TYP  | MAX  | UNITS      |
|---|--|------|------|------|------------|
| <b>DC ELECTRICAL CHARACTERISTICS</b>                        |  |      |      |      |            |
| Operating Voltage Range ( $V_{CC}$ )                        |  | 3.1  | 5    | 5.5  | V          |
| Quiescent Current ( $I_Q$ )                                 | No load                                  |      | 12.5 | 16.5 | mA         |
| Output Level Shift Voltage ( $V_{OLS}$ )                    | $V_{IN} = 0V$ , no load                  |      | 360  | 550  | mV         |
| Voltage Gain of SGM9155A ( $A_V$ )                          | $R_L = 150\Omega$                        | 5.75 | 6.1  | 6.35 | dB         |
| Output Voltage High Swing                                   | $V_{IN} = 3V$ , $R_L = 150\Omega$ to GND |      | 4.8  |      | V          |
| Shutdown Current  |  |      | 1.3  | 15   | $\mu A$    |
| Video Input Voltage Range                                   | Referenced to GND if DC-coupled          |      | 1.4  |      | $V_{PP}$   |
| Power Supply Rejection Ratio (PSRR)                         | DC                                       |      | 52   |      | dB         |
| $V_{IH}$ of EN Pin  |  | 2.4  |      |      | V          |
| $V_{IL}$ of EN Pin  |  |      |      | 0.8  | V          |
| <b>720p HIGH DEFINITION MODE ELECTRICAL CHARACTERISTICS</b> |  |      |      |      |            |
| Channel Gain  | Active video input range = $1V_{PP}$     |      | 6    |      | dB         |
| -1dB Bandwidth of SGM9155A                                  | $R_L = 150\Omega$                        |      | 36   |      | MHz        |
| -3dB Bandwidth of SGM9155A                                  | $R_L = 150\Omega$                        |      | 40   |      | MHz        |
| Filter Response (Normalized Gain)                           | $f_{IN} = 400kHz$ to $74.25MHz$          |      | 30   |      | dB         |
| Group Delay Variation (D/DT)                                | Difference between $400kHz$ and $30MHz$  |      | 3.8  |      | ns         |
| Slew Rate   | 2V output step, 80% to 20%               |      | 175  |      | V/ $\mu s$ |
| Fall Time   | 2V output step, 80% to 20%               |      | 6.5  |      | ns         |
| Rise Time   | 2V output step, 80% to 20%               |      | 7.0  |      | ns         |
| Signal to Noise Ratio (SNR)                                 | $100kHz$ to $30MHz$                      |      | -65  |      | dB         |
| Enable Time ( $t_{ON}$ )                                    |  |      | 2    |      | $\mu s$    |
| Disable Time ( $t_{OFF}$ )                                  |  |      | 0.5  |      | $\mu s$    |

## TYPICAL PERFORMANCE CHARACTERISTICS

$V_{CC} = 5V$ , SGM9155A  $V_{IN} = 1V_{PP}$ ,  $T_A = +25^\circ C$ ,  $R_{SOURCE} = 37.5\Omega$ ; the input is AC-coupled with  $0.1\mu F$ ; the output is AC-coupled with  $220\mu F$  into  $150\Omega$ , referenced to  $400kHz$ , unless otherwise noted.



## TYPICAL APPLICATION CIRCUITS

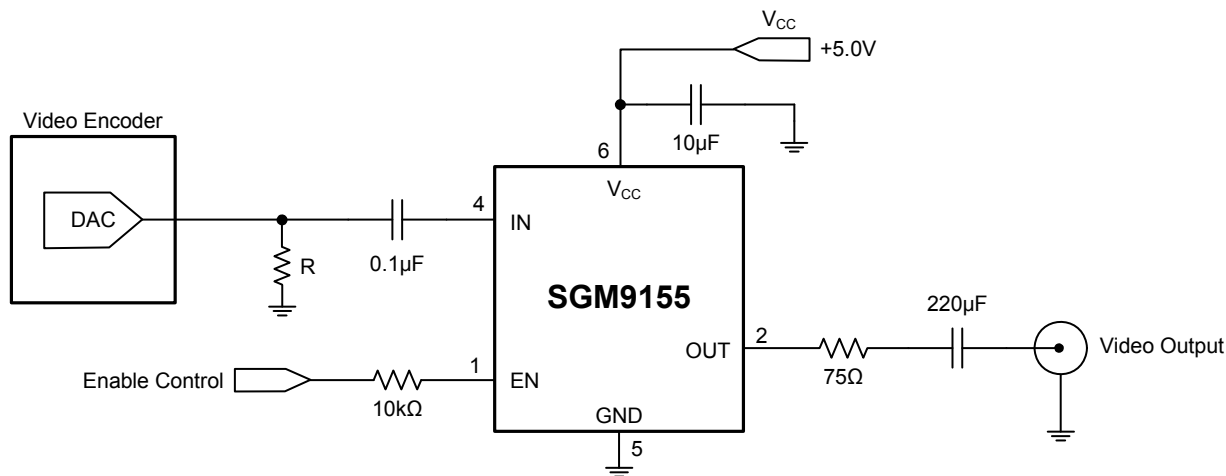


Figure 1. AC-Coupled Input and Output Application Circuit

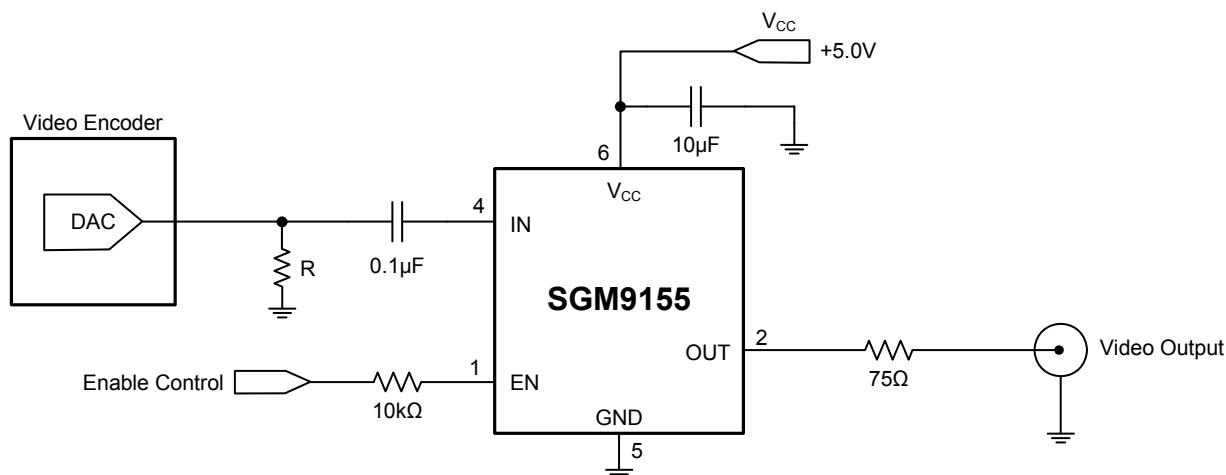


Figure 2. AC-Coupled Input and DC-Coupled Output Application Circuit

## NOTE:

1. Power supply  $V_{CC}$  must be sequenced on first before input video signals.

## APPLICATION INFORMATION

## Application Circuits

The SGM9155 video filter provides 6dB gain from input to output. In addition, the input is slightly offset to optimize the output driver performance. The offset is held to the minimum required value to decrease the standing DC current into the load.

For symmetric signals like Chroma, U, V, Pb and Pr, the average DC bias is fairly constant and the input can be AC-coupled. DAC output can also drive these same signals without the AC coupling capacitor.

## I/O Configurations

For an AC-coupled DAC drive with AC-coupled output, use the configuration in Figure 3.

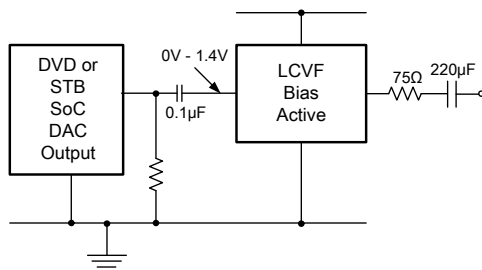


Figure 3. AC-Coupled Input and Output

Alternatively, if the DAC's average DC output level causes the signal to exceed the range from 0V to 1.4V, it can be AC-coupled as shown in Figure 4.

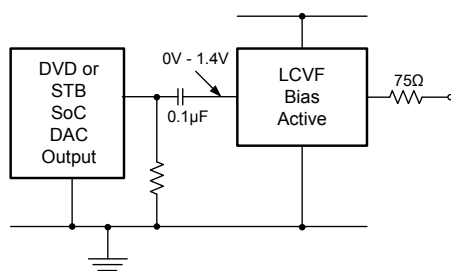


Figure 4. AC-Coupled Input, DC-Coupled Output

For a DC-coupled DAC drive with DC-coupled output, use the configuration in Figure 5.

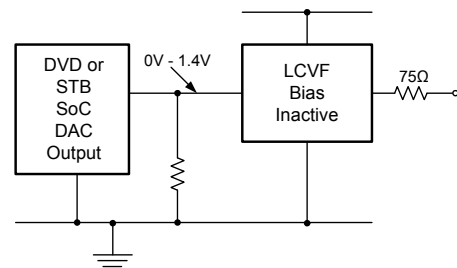


Figure 5. DC-Coupled Input and Output

NOTE: The video tilt or line time distortion is dominated by the AC coupling capacitor. The value may need to be increased beyond 220µF to obtain satisfactory operation in some applications.

## Power Dissipation

The SGM9155 output drive configuration must be considered when calculating overall power dissipation. Care must be taken not to exceed the maximum die junction temperature. The following equations can be used to calculate the power dissipation and internal temperature rise.

$$T_J = T_A + P_D \cdot \theta_{JA} \quad (1)$$

where:

$$P_D = V_{CC} \cdot I_{CC} - (V_O^2 / R_L) \quad (2)$$

where:

$$V_O = 2V_{IN} + 0.36V \quad (3)$$

$V_{IN}$  = RMS value of input signal

$I_{CC} = 12.5mA$

$V_{CC} = 5.0V$

$R_L$  = channel load resistance

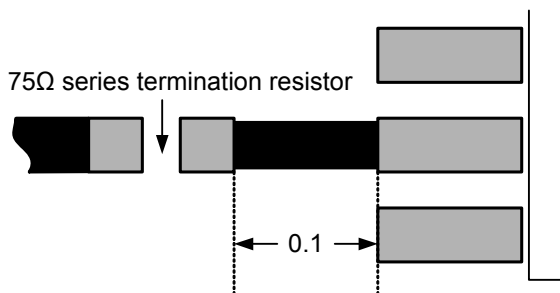
Board layout can also affect thermal characteristics. Refer to the Layout Considerations section for details.

The SGM9155 is specified to operate with output currents typically less than 50mA. Internal amplifiers are current limited to a maximum of 80mA and should withstand brief-duration short-circuit conditions. This capability is not guaranteed.

## APPLICATION INFORMATION

### Output Considerations

The selection of the coupling capacitor is a function of the subsequent circuit input impedance and the leakage current of the input being driven. In order to obtain the highest quality output video signal the series termination resistor must be placed as close to the device output pin as possible. This greatly reduces the parasitic capacitance and inductance effect on the SGM9155 output driver. Recommended distance from device pin to series termination resistor should be no greater than 0.1 inches.



**Figure 6. Distance from Device Pin to Series Termination Resistor**

### Thermal Considerations

Since the interior of systems such as set-top boxes, TVs and DVD players are at +70°C, consideration must be given to providing an adequate heat sink for the device package for maximum heat dissipation. When designing a system board, determine how much power each device dissipates. Ensure that devices of high power are not placed in the same location, such as directly above (top plane) or below (bottom plane) each other on the PCB.

### Layout Considerations

General layout and supply bypassing play a major role in high-frequency performance and thermal characteristics. We offer a demonstration board to guide layout and aid device evaluation. The demo board is a four-layer board with full power and ground planes. Following this layout configuration provides optimum performance and thermal characteristics for the device. For the best results, follow the steps and recommended routing rules listed below.

### Recommended Routing/Layout Rules

- Do not run analog and digital signals in parallel.
- Use separate analog and digital power planes to supply power.
- Do not run traces on top of the ground plane.
- Run no traces over ground/power splits.
- Avoid routing at 90-degree angles.
- Minimize clock and video data trace length differences.
- Include 0.01μF and 0.1μF ceramic power supply bypass capacitors.
- Place the 0.1μF capacitor within 0.1 inches of the device power pin.
- Place the 0.01μF capacitor within 0.75 inches of the device power pin.
- For multi-layer boards, use a large ground plane to help dissipate heat.
- For two-layer boards, use a ground plane that extends beyond the device body at least 0.5 inches on all sides. Include a metal paddle under the device on the top layer.
- Minimize all trace lengths to reduce series inductance.
- Place a 75Ω series resistor within 0.5 inches of the output pin to isolate the output driver from board parasitics.

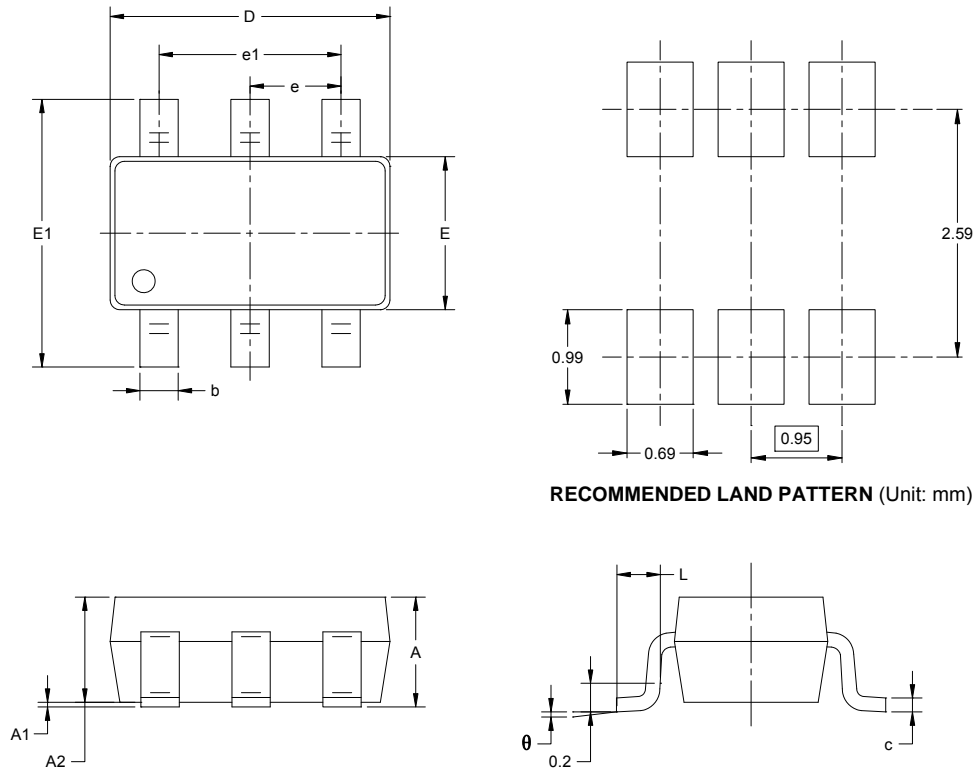
### PCB Thermal Layout Considerations

- Understand the system power requirements and environmental conditions.
- Maximize thermal performance of the PCB.
- Consider using 70μm of copper for high-power designs.
- Make the PCB as thin as possible by reducing FR4 thickness.
- Use vias in the power pad to tie adjacent layers together.
- Remember that baseline temperature is a function of board area, not copper thickness.
- Consider modeling techniques a first-order approximation.



## PACKAGE OUTLINE DIMENSIONS

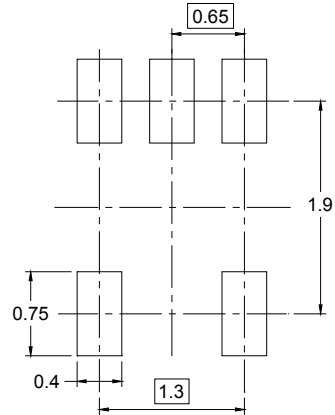
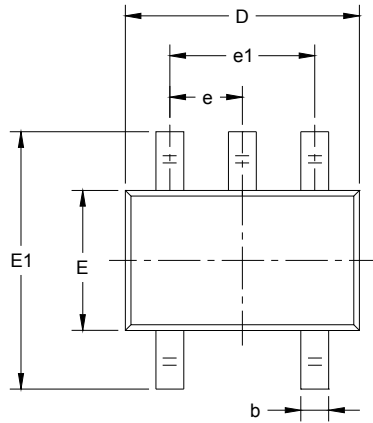
### SOT-23-6



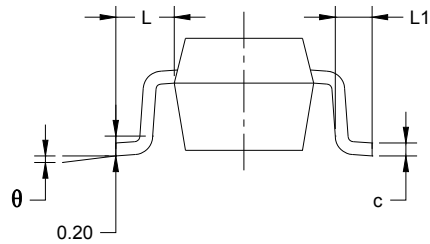
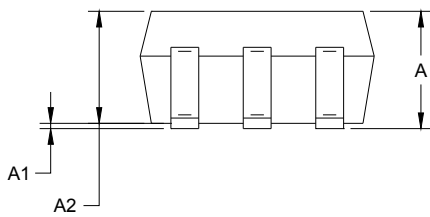
| Symbol   | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|----------|------------------------------|-------|-------------------------|-------|
|          | MIN                          | MAX   | MIN                     | MAX   |
| A        | 1.050                        | 1.250 | 0.041                   | 0.049 |
| A1       | 0.000                        | 0.100 | 0.000                   | 0.004 |
| A2       | 1.050                        | 1.150 | 0.041                   | 0.045 |
| b        | 0.300                        | 0.500 | 0.012                   | 0.020 |
| c        | 0.100                        | 0.200 | 0.004                   | 0.008 |
| D        | 2.820                        | 3.020 | 0.111                   | 0.119 |
| E        | 1.500                        | 1.700 | 0.059                   | 0.067 |
| E1       | 2.650                        | 2.950 | 0.104                   | 0.116 |
| e        | 0.950 BSC                    |       | 0.037 BSC               |       |
| e1       | 1.900 BSC                    |       | 0.075 BSC               |       |
| L        | 0.300                        | 0.600 | 0.012                   | 0.024 |
| $\theta$ | 0°                           | 8°    | 0°                      | 8°    |

## PACKAGE OUTLINE DIMENSIONS

### SC70-5



RECOMMENDED LAND PATTERN (Unit: mm)

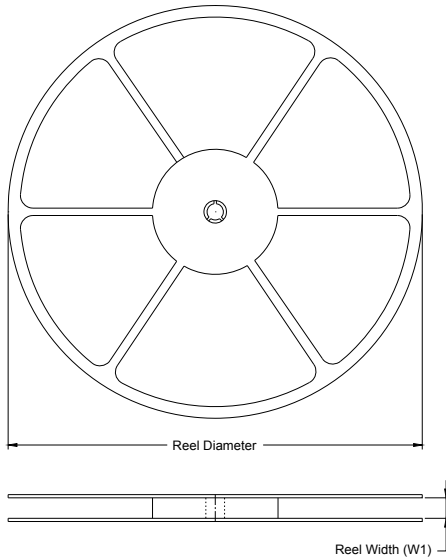


| Symbol | Dimensions<br>In Millimeters |       | Dimensions<br>In Inches |       |
|--------|------------------------------|-------|-------------------------|-------|
|        | MIN                          | MAX   | MIN                     | MAX   |
| A      | 0.900                        | 1.100 | 0.035                   | 0.043 |
| A1     | 0.000                        | 0.100 | 0.000                   | 0.004 |
| A2     | 0.900                        | 1.000 | 0.035                   | 0.039 |
| b      | 0.150                        | 0.350 | 0.006                   | 0.014 |
| c      | 0.080                        | 0.150 | 0.003                   | 0.006 |
| 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     | 1.300 BSC                    |       | 0.051 BSC               |       |
| L      | 0.525 REF                    |       | 0.021 REF               |       |
| L1     | 0.260                        | 0.460 | 0.010                   | 0.018 |
| θ      | 0°                           | 8°    | 0°                      | 8°    |

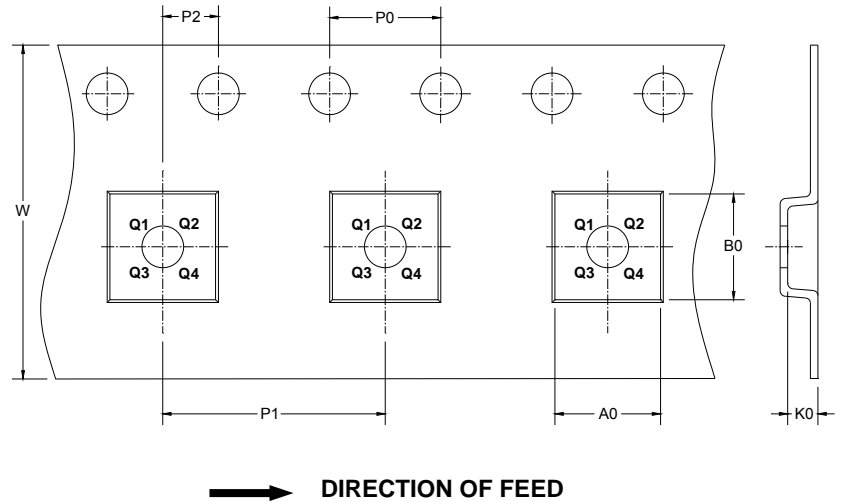
# PACKAGE INFORMATION

## TAPE AND REEL INFORMATION

### REEL DIMENSIONS



### TAPE DIMENSIONS



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

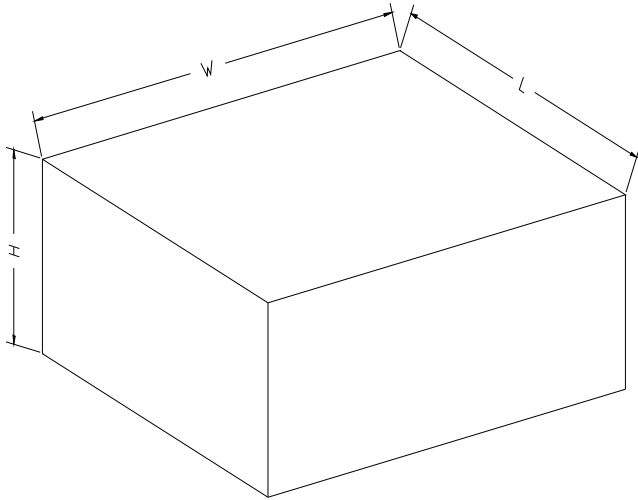
### KEY PARAMETER LIST OF TAPE AND REEL

| Package Type | Reel Diameter | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P0 (mm) | P1 (mm) | P2 (mm) | W (mm) | Pin1 Quadrant |
|--------------|---------------|--------------------|---------|---------|---------|---------|---------|---------|--------|---------------|
| SOT-23-6     | 7"            | 9.5                | 3.17    | 3.23    | 1.37    | 4.0     | 4.0     | 2.0     | 8.0    | Q3            |
| SC70-5       | 7"            | 9.5                | 2.25    | 2.55    | 1.20    | 4.0     | 4.0     | 2.0     | 8.0    | Q3            |

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 |
|-------------|-------------|------------|-------------|--------------|
| 7" (Option) | 368         | 227        | 224         | 8            |
| 7"          | 442         | 410        | 224         | 18           |

DD00002

REVISION HISTORY

| VERSION | DATE | PAGE | LOCATION | REMARK |
|---------|------|------|----------|--------|
|         |      |      |          |        |