



# THE DATASHEET OF LMV710IDBVRE4

## FEATURES

- 2.7-V and 5-V Performance
- Low Offset Voltage . . . 0.4 mV Typ, 3 mV Max
- Input Common-Mode Range . . . 200 mV Beyond the Rails
- Rail-to-Rail Swing Into 600  $\Omega$
- Gain Bandwidth . . . 5 MHz Typ
- Slew Rate . . . 5 V/ $\mu$ s Typ
- Turn-On Time From Shutdown . . . <10  $\mu$ s
- Shutdown Current . . . 0.2  $\mu$ A Typ
- Space-Saving Packages
  - SOT-23-5/6
  - SC-70

## APPLICATIONS

- Wireless Phones, Mobile Phones, PDAs
- GSM/TDMA/CDMA Power Amp Control
- AGC, RF Power Detectors
- Temperature Compensation
- Wireless LANs
- Bluetooth
- HomeRF

## DESCRIPTION/ORDERING INFORMATION

The LMV710, LMV711, and LMV715 are single BiCMOS operational amplifiers designed to meet the demands of low power, low cost, and small size required by battery-powered portable electronics. These devices have an input common-mode voltage range that exceeds the rails, rail-to-rail output, and high output-current drive. The devices offer a bandwidth of 5 MHz and a slew rate of 5 V/ $\mu$ s.

On the LMV711 and LMV715, a separate shutdown pin can be used to disable the device and reduce the supply current to 0.2  $\mu$ A typical. The device features a turn-on time of less than 10  $\mu$ s. It is an ideal solution for power-sensitive applications, such as cellular phones, pagers, palm computers, etc.

The LMV710I, LMV711I, and LMV715I are characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

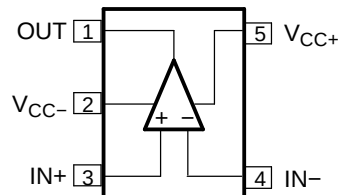
## ORDERING INFORMATION

| T <sub>A</sub>                                | PACKAGE <sup>(1)</sup> |              | ORDERABLE PART NUMBER | TOP-SIDE MARKING <sup>(2)</sup> |
|-----------------------------------------------|------------------------|--------------|-----------------------|---------------------------------|
| $-40^{\circ}\text{C}$ to $85^{\circ}\text{C}$ | SOT-23-5 – DBV         | Reel of 3000 | LMV710IDBVR           | RB4_                            |
|                                               | SC-70 – DCK            | Reel of 3000 | LMV710IDCKR           | RE_                             |
|                                               | SOT-23-6 – DBV         | Reel of 3000 | LMV711IDBVR           | RB5_                            |
|                                               | SC-70 – DCK            | Reel of 3000 | LMV711IDCKR           | RF_                             |
|                                               | SOT-23-6 – DBV         | Reel of 3000 | LMV715IDBVR           | 4B9_                            |
|                                               | SC-70 – DCK            | Reel of 3000 | LMV715IDCKR           | RL_                             |

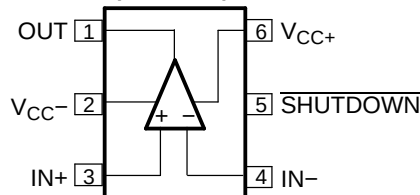
(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

(2) DBV/DCK: The actual top-side marking has one additional character that designates the assembly/test site.

**LMV710**  
**DBV (SOT-23-5) OR DCK (SC-70) PACKAGE**  
**(TOP VIEW)**



**LMV711/LMV715**  
**DBV (SOT-23-6) OR DCK (SC-70) PACKAGE**  
**(TOP VIEW)**



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

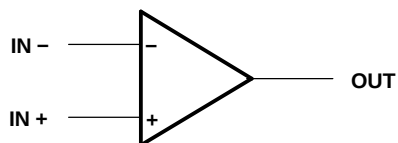
# LMV710, LMV711, LMV715

## SINGLE LOW-POWER RRIO OPERATIONAL AMPLIFIERS

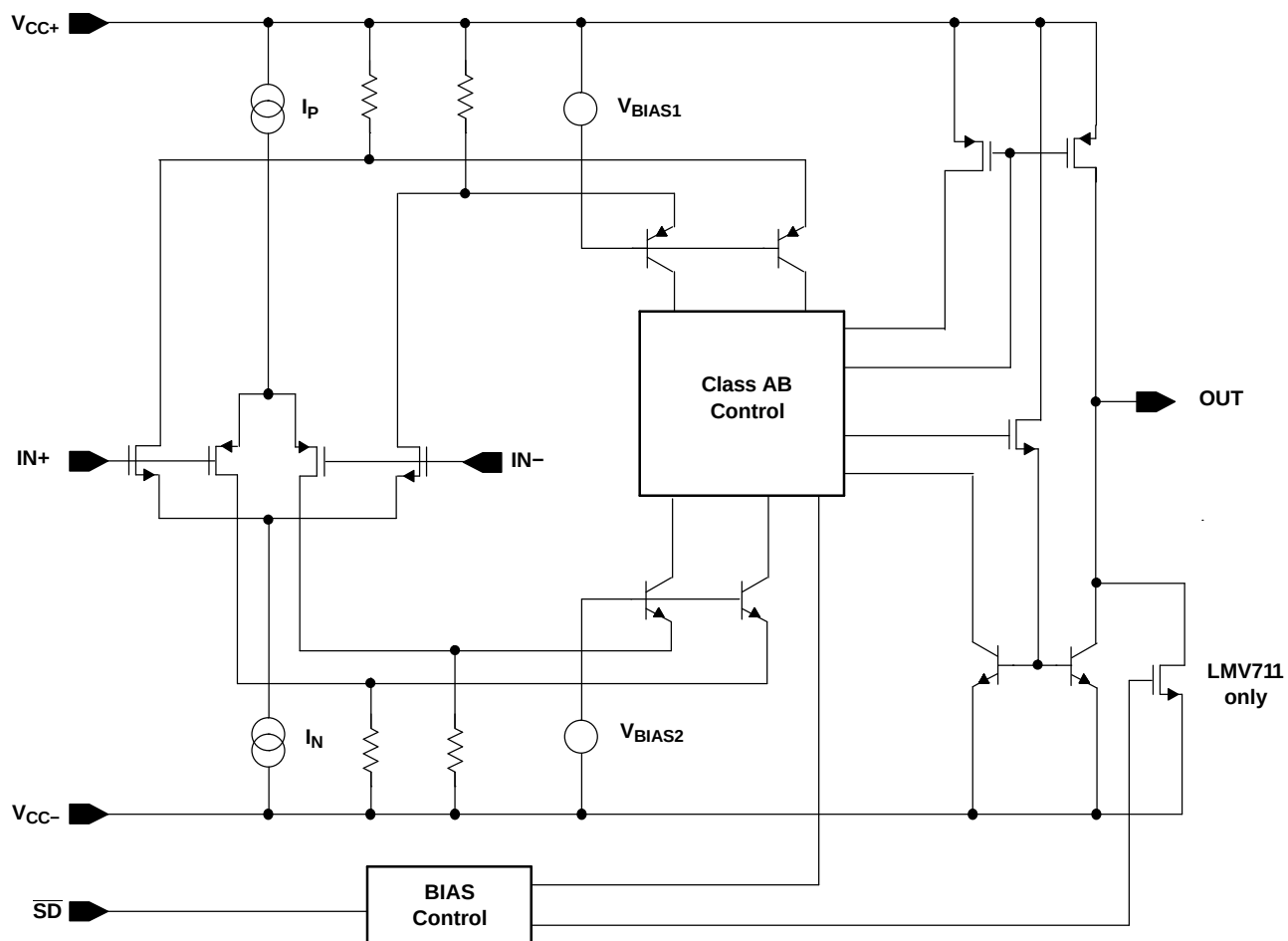
### WITH HIGH OUTPUT CURRENT DRIVE AND SHUTDOWN

SLOS463A–APRIL 2005–REVISED JULY 2005

#### SYMBOL (EACH AMPLIFIER)



#### SIMPLIFIED SCHEMATIC



## Absolute Maximum Ratings<sup>(1)</sup>

over operating free-air temperature range (unless otherwise noted)

|                     |                                             |             |       | MIN             | MAX             | UNIT |    |
|---------------------|---------------------------------------------|-------------|-------|-----------------|-----------------|------|----|
| $V_{CC+} - V_{CC-}$ | Supply voltage <sup>(2)</sup>               |             |       |                 | 6               | V    |    |
| $V_{ID}$            | Differential input voltage <sup>(3)</sup>   |             |       |                 | ±Supply voltage | V    |    |
| $V_I$               | Input voltage (either input)                |             |       | $V_{CC-} - 0.4$ | $V_{CC+} + 0.4$ | V    |    |
| $V_O$               | Output voltage                              |             |       | $V_{CC-} - 0.4$ | $V_{CC+} + 0.4$ | V    |    |
| $I_I$               | Input current <sup>(4)</sup>                |             |       |                 | ±10             | mA   |    |
| $\theta_{JA}$       | Package thermal impedance <sup>(5)(6)</sup> | DBV package | 5 pin |                 | 206             | °C/W |    |
|                     |                                             |             | 6 pin |                 | 165             |      |    |
|                     |                                             | DCK package | 5 pin |                 | 252             |      |    |
|                     |                                             |             | 6 pin |                 | 259             |      |    |
| $T_J$               | Operating virtual junction temperature      |             |       |                 | 150             | °C   |    |
| $T_{std}$           | Storage temperature range                   |             |       |                 | −65             | 150  | °C |

- (1) Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
- (2) All voltage values (except differential voltages and  $V_{CC}$  specified for the measurement of  $I_{OS}$ ) are with respect to the network GND.
- (3) Differential voltages are at  $IN+$  with respect to  $IN-$ .
- (4) Excessive input current will flow if a differential input voltage in excess of approximately 0.6 V is applied between the inputs unless some limiting resistance is used.
- (5) Maximum power dissipation is a function of  $T_J(\text{max})$ ,  $\theta_{JA}$ , and  $T_A$ . The maximum allowable power dissipation at any allowable ambient temperature is  $P_D = (T_J(\text{max}) - T_A)/\theta_{JA}$ . Operating at the absolute maximum  $T_J$  of 150°C can affect reliability.
- (6) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions

|                     |                                |  | MIN | MAX | UNIT |
|---------------------|--------------------------------|--|-----|-----|------|
| $V_{CC+} - V_{CC-}$ | Supply voltage                 |  | 2.7 | 5   | V    |
| $T_A$               | Operating free-air temperature |  | –40 | 85  | °C   |

## ESD Protection

|                  | TYP | UNIT |
|------------------|-----|------|
| Human-Body Model | TBD | V    |
| Machine Model    | TBD | V    |

# LMV710, LMV711, LMV715

## SINGLE LOW-POWER RRIO OPERATIONAL AMPLIFIERS

### WITH HIGH OUTPUT CURRENT DRIVE AND SHUTDOWN

SLOS463A–APRIL 2005–REVISED JULY 2005

### Electrical Characteristics

$V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = \text{GND}$ ,  $V_{IC} = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER          |                                             | TEST CONDITIONS                                                      |                 | T <sub>A</sub> | MIN            | TYP          | MAX | UNIT |
|--------------------|---------------------------------------------|----------------------------------------------------------------------|-----------------|----------------|----------------|--------------|-----|------|
| V <sub>IO</sub>    | Input offset voltage                        | V <sub>IC</sub> = 0.85 V and 1.85 V                                  |                 | 25°C           | 0.4            |              |     | mV   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 3.2            |              |     |      |
| I <sub>IB</sub>    | Input bias current                          |                                                                      |                 | 25°C           | 4              |              |     | pA   |
| CMRR               | Common-mode rejection ratio                 | 0 ≤ V <sub>IC</sub> ≤ 2.7 V                                          |                 | 25°C           | 50             | 75           |     | dB   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 45             |              |     |      |
| k <sub>SVR</sub>   | Supply-voltage rejection ratio              | 2.7 V ≤ V <sub>CC+</sub> ≤ 5 V,<br>V <sub>IC</sub> = 0.85 V          |                 | 25°C           | 70             | 110          |     | dB   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 68             |              |     |      |
|                    |                                             | 2.7 V ≤ V <sub>CC+</sub> ≤ 5 V,<br>V <sub>IC</sub> = 1.85 V          |                 | 25°C           | 70             | 95           |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 68             |              |     |      |
| V <sub>ICR</sub>   | Common-mode input voltage range             | CMRR ≥ 50 dB                                                         |                 | 25°C           | –0.2<br>to 2.9 | –0.3<br>to 3 |     | V    |
| I <sub>OS</sub>    | Output short circuit current <sup>(1)</sup> | Sourcing V <sub>O</sub> = 0                                          |                 | 25°C           | 15             | 28           |     | mA   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 12             |              |     |      |
|                    |                                             | Sinking V <sub>O</sub> = 5 V                                         |                 | 25°C           | 25             | 40           |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 22             |              |     |      |
| V <sub>O</sub>     | Output voltage                              | R <sub>L</sub> = 10 kΩ to 1.35 V                                     | V <sub>OH</sub> | 25°C           | 2.62           | 2.68         |     | V    |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 2.6            |              |     |      |
|                    |                                             |                                                                      | V <sub>OL</sub> | 25°C           | 0.01 0.12      |              |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 0.15           |              |     |      |
|                    |                                             | R <sub>L</sub> = 600 Ω to 1.35 V                                     | V <sub>OH</sub> | 25°C           | 2.52           | 2.55         |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 2.5            |              |     |      |
|                    |                                             |                                                                      | V <sub>OL</sub> | 25°C           | 0.05 0.23      |              |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 0.3            |              |     |      |
| V <sub>O(SD)</sub> | Output voltage level in shutdown mode       | LMV711 only                                                          |                 | 25°C           | 50             | 200          |     | mV   |
| I <sub>O(SD)</sub> | Output leakage current in shutdown mode     | LMV715 only                                                          |                 | 25°C           | 1              |              |     | pA   |
| C <sub>O(SD)</sub> | Output capacitance in shutdown mode         | LMV715 only                                                          |                 | 25°C           | 32             |              |     | pF   |
| I <sub>CC</sub>    | Supply current                              | ON mode                                                              |                 | 25°C           | 1.22           | 1.7          |     | mA   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 1.9            |              |     |      |
|                    |                                             | Shutdown mode, $\overline{\text{SHDN}}$ = 0                          |                 | 25°C           | 0.002          | 10           |     | μA   |
| A <sub>V</sub>     | Large-signal voltage gain                   | Sourcing R <sub>L</sub> = 10 kΩ,<br>V <sub>O</sub> = 1.35 V to 2.3 V |                 | 25°C           | 80             | 115          |     | dB   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 76             |              |     |      |
|                    |                                             | Sinking R <sub>L</sub> = 10 kΩ,<br>V <sub>O</sub> = 0.4 V to 1.35 V  |                 | 25°C           | 80             | 113          |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 76             |              |     |      |
|                    |                                             | Sourcing R <sub>L</sub> = 600 Ω,<br>V <sub>O</sub> = 1.35 V to 2.2 V |                 | 25°C           | 80             | 110          |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 76             |              |     |      |
|                    |                                             | Sinking R <sub>L</sub> = 600 Ω,<br>V <sub>O</sub> = 0.5 V to 1.35 V  |                 | 25°C           | 80             | 100          |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 76             |              |     |      |
| SR <sup>(2)</sup>  | Slew rate                                   |                                                                      |                 | 25°C           | 5              |              |     | V/μs |
| GBWP               | Gain bandwidth product                      |                                                                      |                 | 25°C           | 5              |              |     | MHz  |
| Φ <sub>m</sub>     | Phase margin                                |                                                                      |                 | 25°C           | 60             |              |     | deg  |
| T <sub>(on)</sub>  | Amplifier turn-on time                      |                                                                      |                 | 25°C           | <10            |              |     | μs   |

(1) Shorting the output to either supply rails will adversely affect reliability.

(2) Number specified is the slower of the positive and negative slew rates.

**Electrical Characteristics (continued)**
 $V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = \text{GND}$ ,  $V_{IC} = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER                                           | TEST CONDITIONS    | $T_A$ | MIN           | TYP           | MAX         | UNIT                   |
|-----------------------------------------------------|--------------------|-------|---------------|---------------|-------------|------------------------|
| $\overline{\text{SHDN}}$ Shutdown pin voltage range | $V_{(\text{ON})}$  | 25°C  | 2.4<br>to 2.7 | 1.5<br>to 2.7 |             | V                      |
|                                                     | $V_{(\text{OFF})}$ |       |               | 0 to 1        | 0<br>to 0.8 |                        |
| $V_n$ Input referred voltage noise                  | $f = 1\text{ kHz}$ | 25°C  |               | 20            |             | nV/ $\sqrt{\text{Hz}}$ |

**Electrical Characteristics**
 $V_{CC+} = 3.2\text{ V}$ ,  $V_{CC-} = \text{GND}$ , and  $V_{IC} = 1.6\text{ V}$  (unless otherwise noted)

| PARAMETER            | TEST CONDITIONS       |          | $T_A$         | MIN  | TYP  | MAX  | UNIT |
|----------------------|-----------------------|----------|---------------|------|------|------|------|
| $V_O$ Output voltage | $I_O = 6.5\text{ mA}$ | $V_{OH}$ | 25°C          | 2.95 | 3    |      | V    |
|                      |                       |          | –40°C to 85°C | 2.92 |      |      |      |
|                      |                       | $V_{OL}$ | 25°C          |      | 0.01 | 0.18 |      |
|                      |                       |          | –40°C to 85°C |      |      | 0.25 |      |

# LMV710, LMV711, LMV715

## SINGLE LOW-POWER RRIO OPERATIONAL AMPLIFIERS

### WITH HIGH OUTPUT CURRENT DRIVE AND SHUTDOWN

SLOS463A–APRIL 2005–REVISED JULY 2005

#### Electrical Characteristics

$V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = \text{GND}$ ,  $V_{IC} = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER          |                                             | TEST CONDITIONS                                                      |                 | T <sub>A</sub> | MIN         | TYP         | MAX | UNIT |
|--------------------|---------------------------------------------|----------------------------------------------------------------------|-----------------|----------------|-------------|-------------|-----|------|
| V <sub>IO</sub>    | Input offset voltage                        | V <sub>IC</sub> = 0.85 V and 1.85 V                                  |                 | 25°C           | 0.4         |             |     | mV   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 3.2         |             |     |      |
| I <sub>IB</sub>    | Input bias current                          |                                                                      |                 | 25°C           | 4           |             |     | pA   |
| CMRR               | Common-mode rejection ratio                 | 0 ≤ V <sub>IC</sub> ≤ 2.7 V                                          |                 | 25°C           | 50          | 75          |     | dB   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 48          |             |     |      |
| k <sub>SVR</sub>   | Supply-voltage rejection ratio              | 2.7 V ≤ V <sub>CC+</sub> ≤ 5 V,<br>V <sub>IC</sub> = 0.85 V          |                 | 25°C           | 70          | 110         |     | dB   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 68          |             |     |      |
|                    |                                             |                                                                      |                 | 25°C           | 70          | 95          |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 68          |             |     |      |
| V <sub>ICR</sub>   | Common-mode input voltage range             | CMRR ≥ 50 dB                                                         |                 | 25°C           | –0.2 to 5.2 | –0.3 to 5.3 |     | V    |
| I <sub>OS</sub>    | Output short circuit current <sup>(1)</sup> | Sourcing V <sub>O</sub> = 0                                          |                 | 25°C           | 25          | 35          |     | mA   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 21          |             |     |      |
|                    |                                             | Sinking V <sub>O</sub> = 5 V                                         |                 | 25°C           | 25          | 40          |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 21          |             |     |      |
| V <sub>O</sub>     | Output voltage                              | R <sub>L</sub> = 10 kΩ to 1.35 V                                     | V <sub>OH</sub> | 25°C           | 4.92        | 4.98        |     | V    |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 4.9         |             |     |      |
|                    |                                             |                                                                      | V <sub>OL</sub> | 25°C           | 0.01 0.12   |             |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 0.15        |             |     |      |
|                    |                                             | R <sub>L</sub> = 600 Ω to 1.35 V                                     | V <sub>OH</sub> | 25°C           | 4.82        | 4.85        |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 4.8         |             |     |      |
|                    |                                             |                                                                      | V <sub>OL</sub> | 25°C           | 0.05 0.23   |             |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 0.3         |             |     |      |
| V <sub>O(SD)</sub> | Output voltage level in shutdown mode       | LMV711 only                                                          |                 | 25°C           | 50          | 200         |     | mV   |
| I <sub>O(SD)</sub> | Output leakage current in shutdown mode     | LMV715 only                                                          |                 | 25°C           | 1           |             |     | pA   |
| C <sub>O(SD)</sub> | Output capacitance in shutdown mode         | LMV715 only                                                          |                 | 25°C           | 32          |             |     | pF   |
| I <sub>CC</sub>    | Supply current                              | ON mode                                                              |                 | 25°C           | 1.17        | 1.7         |     | mA   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 1.9         |             |     |      |
|                    |                                             | Shutdown mode, $\overline{\text{SHDN}}$ = 0                          |                 | 25°C           | 0.2         | 10          |     | μA   |
| A <sub>V</sub>     | Large-signal voltage gain                   | Sourcing R <sub>L</sub> = 10 kΩ,<br>V <sub>O</sub> = 1.35 V to 2.3 V |                 | 25°C           | 80          | 123         |     | dB   |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 76          |             |     |      |
|                    |                                             | Sinking R <sub>L</sub> = 10 kΩ,<br>V <sub>O</sub> = 0.4 V to 1.35 V  |                 | 25°C           | 80          | 120         |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 76          |             |     |      |
|                    |                                             | Sourcing R <sub>L</sub> = 600 Ω,<br>V <sub>O</sub> = 1.35 V to 2.2 V |                 | 25°C           | 80          | 110         |     |      |
|                    |                                             |                                                                      |                 | –40°C to 85°C  | 76          |             |     |      |
| SR <sup>(2)</sup>  | Slew rate                                   |                                                                      |                 | 25°C           | 5           |             |     | V/μs |
|                    |                                             |                                                                      |                 | 25°C           | 5           |             |     |      |
| Φ <sub>m</sub>     | Phase margin                                |                                                                      |                 | 25°C           | 60          |             |     | deg  |
| T <sub>(on)</sub>  | Amplifier turn-on time                      |                                                                      |                 | 25°C           | <10         |             |     | μs   |

(1) Shorting the output to either supply rails will adversely affect reliability.

(2) Number specified is the slower of the positive and negative slew rates.

## Electrical Characteristics (continued)

$V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = \text{GND}$ ,  $V_{IC} = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

| PARAMETER                                           | TEST CONDITIONS    | $T_A$ | MIN      | TYP      | MAX      | UNIT                   |
|-----------------------------------------------------|--------------------|-------|----------|----------|----------|------------------------|
| $\overline{\text{SHDN}}$ Shutdown pin voltage range | $V_{(\text{ON})}$  | 25°C  | 2.4 to 5 | 2 to 5   |          | V                      |
|                                                     | $V_{(\text{OFF})}$ |       |          | 0 to 1.5 | 0 to 0.8 |                        |
| $V_n$ Input referred voltage noise                  | $f = 1\text{ kHz}$ | 25°C  |          | 20       |          | nV/ $\sqrt{\text{Hz}}$ |

## TYPICAL PERFORMANCE CHARACTERISTICS

### GRAPH PREVIEWS

- Figure 1. Supply Current vs Supply Voltage (ON Mode)
- Figure 2. LMV711/LMV715 Supply Current vs Supply Voltage (Shutdown Mode)
- Figure 3. Output Positive Swing vs Supply Voltage  $R_L = 600\ \Omega$
- Figure 4. Output Negative Swing vs Supply Voltage  $R_L = 600\ \Omega$
- Figure 5. Output Positive Swing vs Supply Voltage  $R_L = 10\ \text{k}\Omega$
- Figure 6. Output Negative Swing vs Supply Voltage  $R_L = 10\ \text{k}\Omega$
- Figure 7. Output Positive Swing vs Supply Voltage ( $I_{\text{SRC}} = 7\ \text{mA}$ )
- Figure 8. Output Negative Swing vs Supply Voltage ( $I_{\text{SINK}} = 7\ \text{mA}$ )
- Figure 9. Input Voltage Noise vs Frequency
- Figure 10. PSRR vs Frequency
- Figure 11. CMRR vs Frequency
- Figure 12. LMV711/LMV715 Turn-On Characteristics
- Figure 13. Sourcing Current vs Output Voltage
- Figure 14. Sinking Current vs Output Voltage
- Figure 15. THD+N vs Frequency ( $V_{\text{CC}} = 5\ \text{V}$ )
- Figure 16. THD+N vs Frequency ( $V_{\text{CC}} = 2.7\ \text{V}$ )
- Figure 17. THD+N vs  $V_{\text{OUT}}$  ( $V_{\text{CC}\pm} = \pm 2.5\ \text{V}$ )
- Figure 18. THD+N vs  $V_{\text{OUT}}$  ( $V_{\text{CC}\pm} = \pm 1.35\ \text{V}$ )
- Figure 19.  $C_{\text{CM}}$  vs  $V_{\text{CM}}$  ( $V_{\text{CC}} = 2.7\ \text{V}$ )
- Figure 20.  $C_{\text{CM}}$  vs  $V_{\text{CM}}$  ( $V_{\text{CC}} = 5\ \text{V}$ )
- Figure 21.  $C_{\text{DIFF}}$  vs  $V_{\text{CM}}$  ( $V_{\text{CC}} = 2.7\ \text{V}$ )
- Figure 22.  $C_{\text{DIFF}}$  vs  $V_{\text{CM}}$  ( $V_{\text{CC}} = 5\ \text{V}$ )
- Figure 23. Open-Loop Frequency Response ( $V_{\text{CC}\pm} = \pm 1.35\ \text{V}$ )
- Figure 24. Open-Loop Frequency Response ( $V_{\text{CC}\pm} = \pm 1.6\ \text{V}$ )
- Figure 25. Open-Loop Frequency Response ( $V_{\text{CC}\pm} = \pm 2.5\ \text{V}$ )
- Figure 26. Open-Loop Frequency Response ( $V_{\text{CC}\pm} = \pm 1.35\ \text{V}$ )
- Figure 27. Open-Loop Frequency Response ( $V_{\text{CC}\pm} = \pm 1.6\ \text{V}$ )
- Figure 28. Open-Loop Frequency Response ( $V_{\text{CC}\pm} = \pm 2.5\ \text{V}$ )
- Figure 29. Noninverting Large Signal Pulse Response
- Figure 30. Noninverting Small Signal Pulse Response Figure
- Figure 31. Inverting Large Signal Pulse Response
- Figure 32. Inverting Small Signal Pulse Response
- Figure 33.  $V_{\text{OS}}$  vs  $V_{\text{CM}}$  ( $V_{\text{CC}} = 2.7\ \text{V}$ )
- Figure 34.  $V_{\text{OS}}$  vs  $V_{\text{CM}}$  ( $V_{\text{CC}} = 5\ \text{V}$ )

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| LMV710IDBVR      | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV710IDBVRE4    | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV710IDBVRG4    | ACTIVE                | SOT-23       | DBV             | 5    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV710IDCKR      | ACTIVE                | SC70         | DCK             | 5    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV710IDCKRE4    | ACTIVE                | SC70         | DCK             | 5    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV710IDCKRG4    | ACTIVE                | SC70         | DCK             | 5    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV711IDBVR      | ACTIVE                | SOT-23       | DBV             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV711IDBVRE4    | ACTIVE                | SOT-23       | DBV             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV711IDBVRG4    | ACTIVE                | SOT-23       | DBV             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV711IDCKR      | ACTIVE                | SC70         | DCK             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV711IDCKRE4    | ACTIVE                | SC70         | DCK             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV711IDCKRG4    | ACTIVE                | SC70         | DCK             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV715IDBVR      | ACTIVE                | SOT-23       | DBV             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV715IDBVRE4    | ACTIVE                | SOT-23       | DBV             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV715IDBVRG4    | ACTIVE                | SOT-23       | DBV             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV715IDCKR      | ACTIVE                | SC70         | DCK             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| LMV715IDCKRE4    | ACTIVE                | SC70         | DCK             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| LMV715IDCKRG4    | ACTIVE                | SC70         | DCK             | 6    | 3000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSELETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

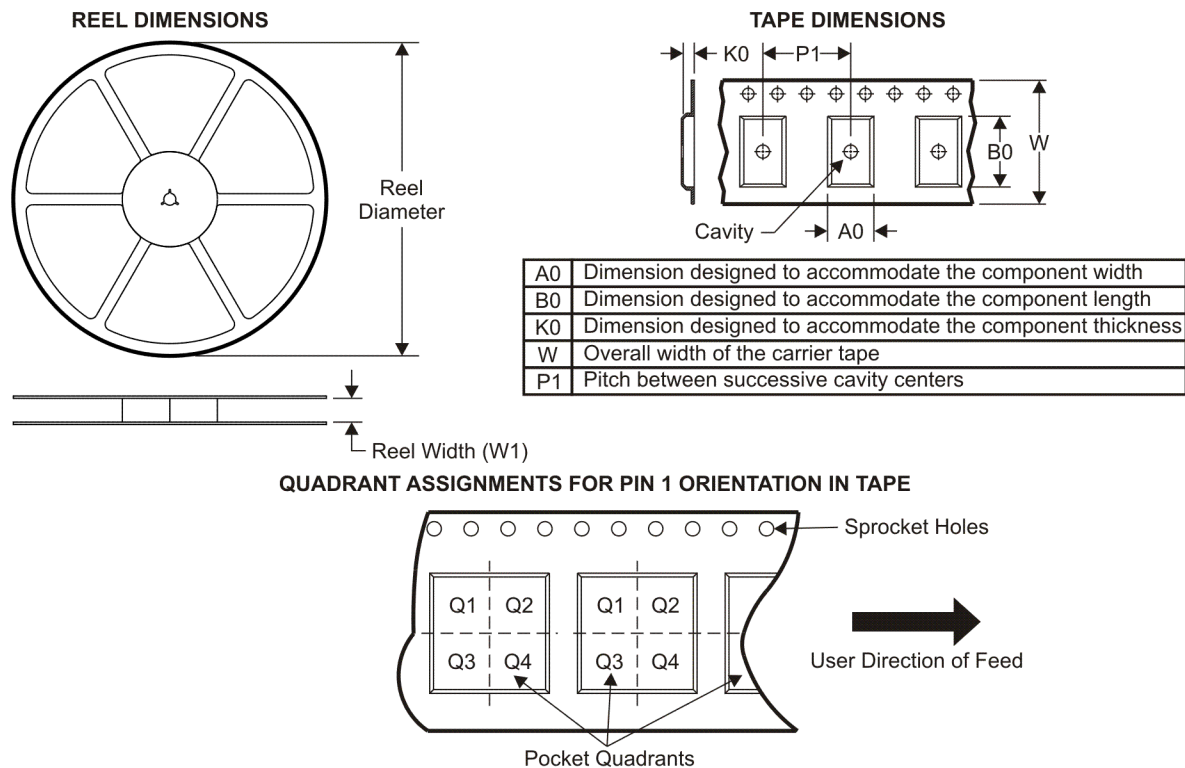
**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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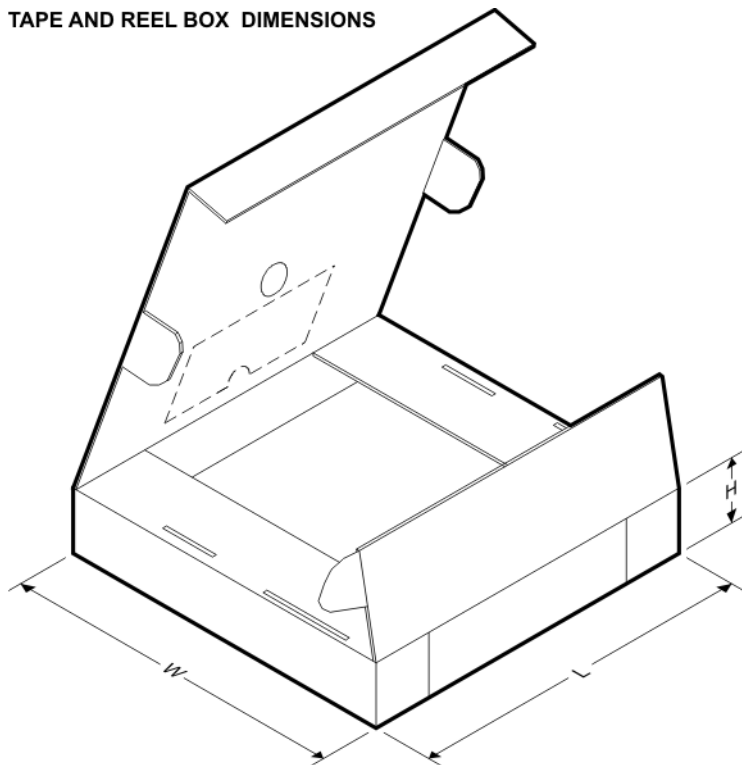
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**TAPE AND REEL INFORMATION**


\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| LMV710IDBVR | SOT-23       | DBV             | 5    | 3000 | 179.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| LMV710IDCKR | SC70         | DCK             | 5    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LMV711IDBVR | SOT-23       | DBV             | 6    | 3000 | 179.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| LMV711IDCKR | SC70         | DCK             | 6    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |
| LMV715IDBVR | SOT-23       | DBV             | 6    | 3000 | 179.0              | 8.4                | 3.2     | 3.2     | 1.4     | 4.0     | 8.0    | Q3            |
| LMV715IDCKR | SC70         | DCK             | 6    | 3000 | 179.0              | 8.4                | 2.2     | 2.5     | 1.2     | 4.0     | 8.0    | Q3            |

## TAPE AND REEL BOX DIMENSIONS

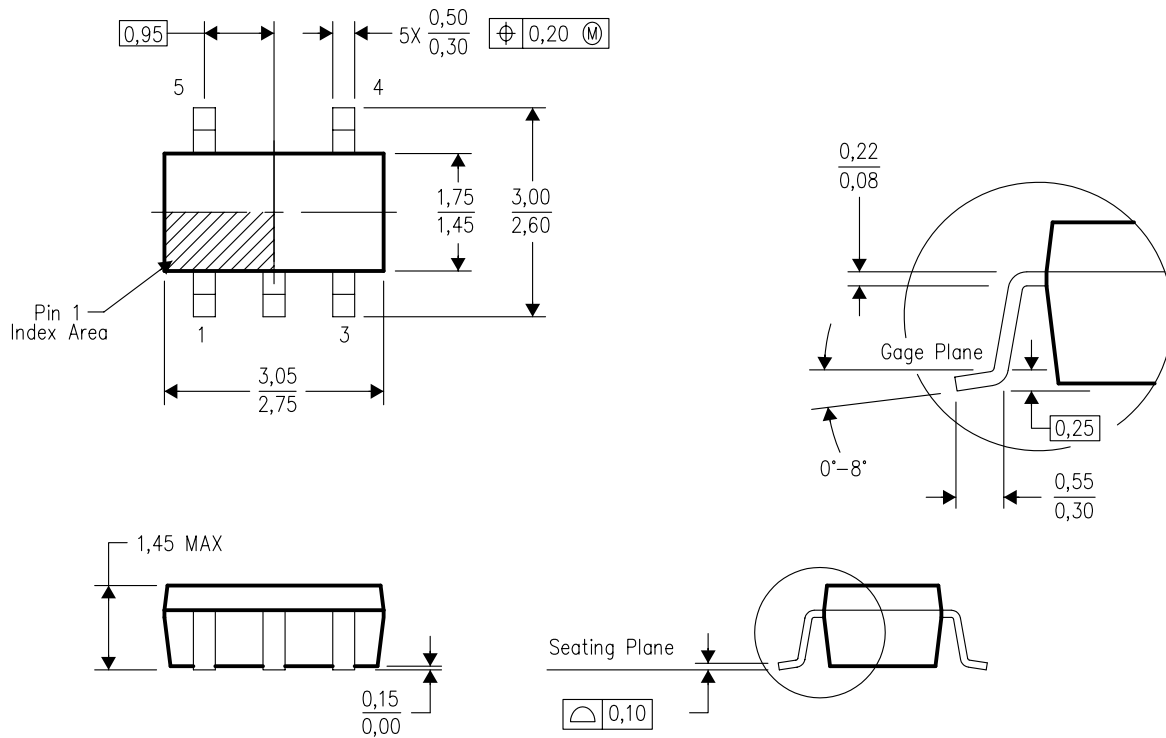


\*All dimensions are nominal

| Device      | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| LMV710IDBVR | SOT-23       | DBV             | 5    | 3000 | 203.0       | 203.0      | 35.0        |
| LMV710IDCKR | SC70         | DCK             | 5    | 3000 | 203.0       | 203.0      | 35.0        |
| LMV711IDBVR | SOT-23       | DBV             | 6    | 3000 | 203.0       | 203.0      | 35.0        |
| LMV711IDCKR | SC70         | DCK             | 6    | 3000 | 203.0       | 203.0      | 35.0        |
| LMV715IDBVR | SOT-23       | DBV             | 6    | 3000 | 203.0       | 203.0      | 35.0        |
| LMV715IDCKR | SC70         | DCK             | 6    | 3000 | 203.0       | 203.0      | 35.0        |

## DBV (R-PDSO-G5)

## PLASTIC SMALL-OUTLINE PACKAGE

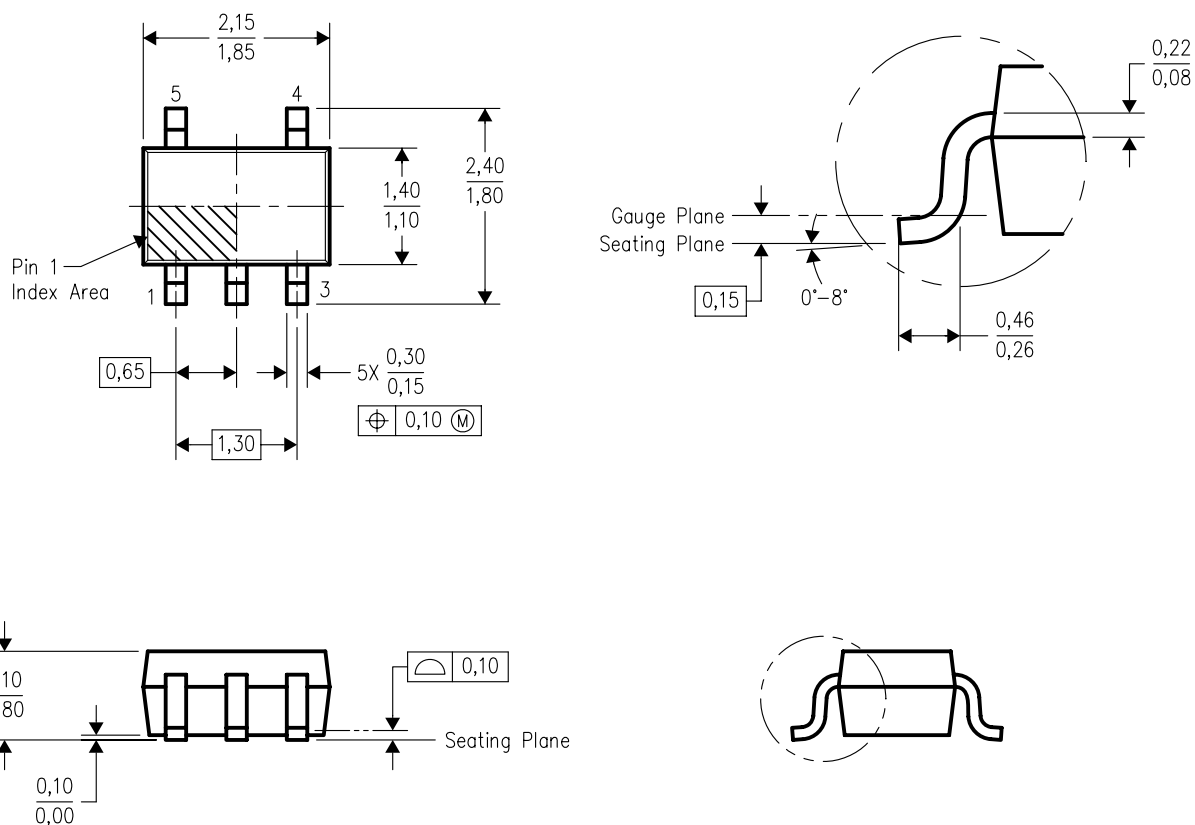


4073253-4/K 03/2006

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Falls within JEDEC MO-178 Variation AA.

## DCK (R-PDSO-G5)

## PLASTIC SMALL-OUTLINE PACKAGE

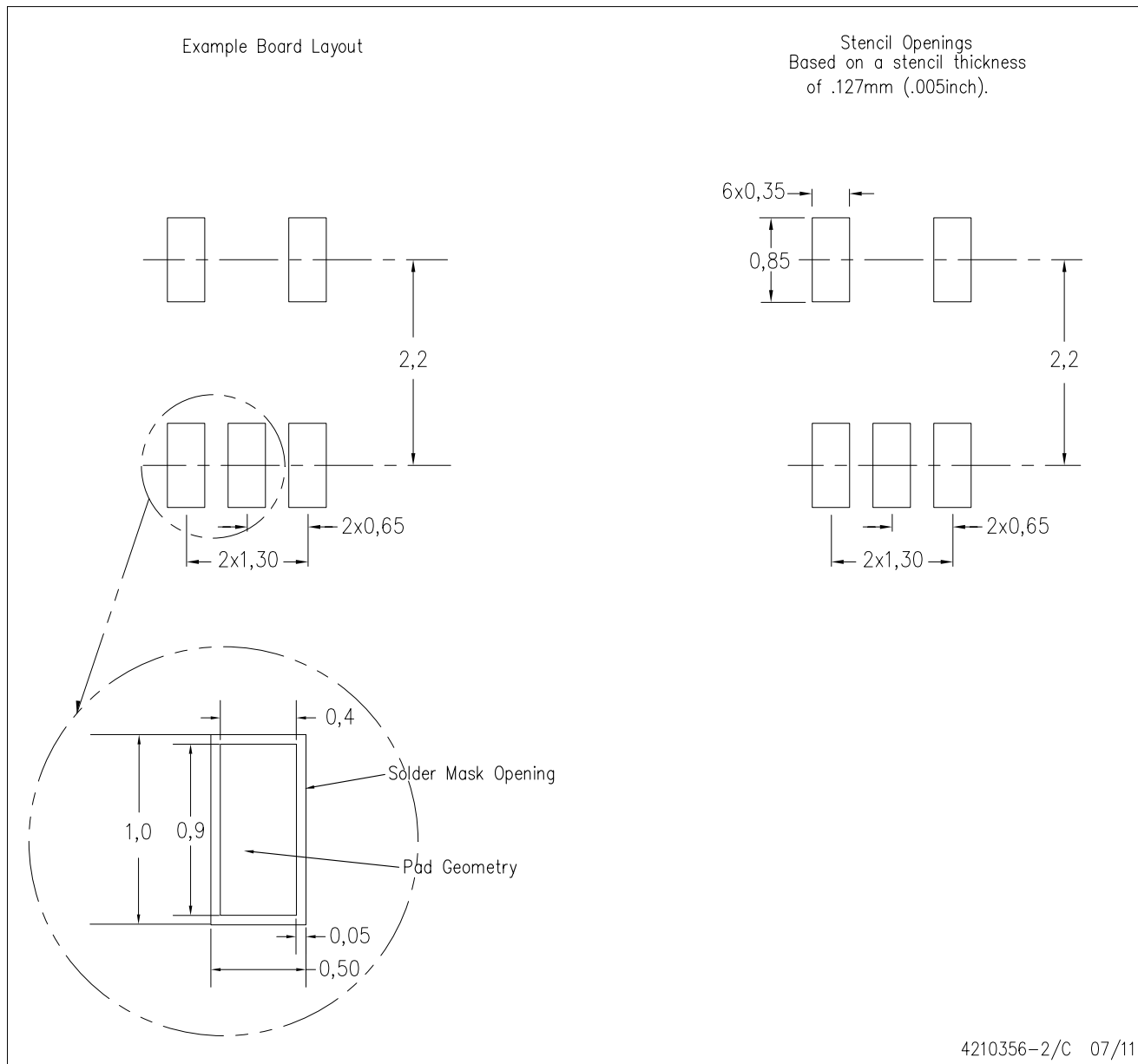


4093553-3/G 01/2007

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - Falls within JEDEC MO-203 variation AA.

DCK (R-PDSO-G5)

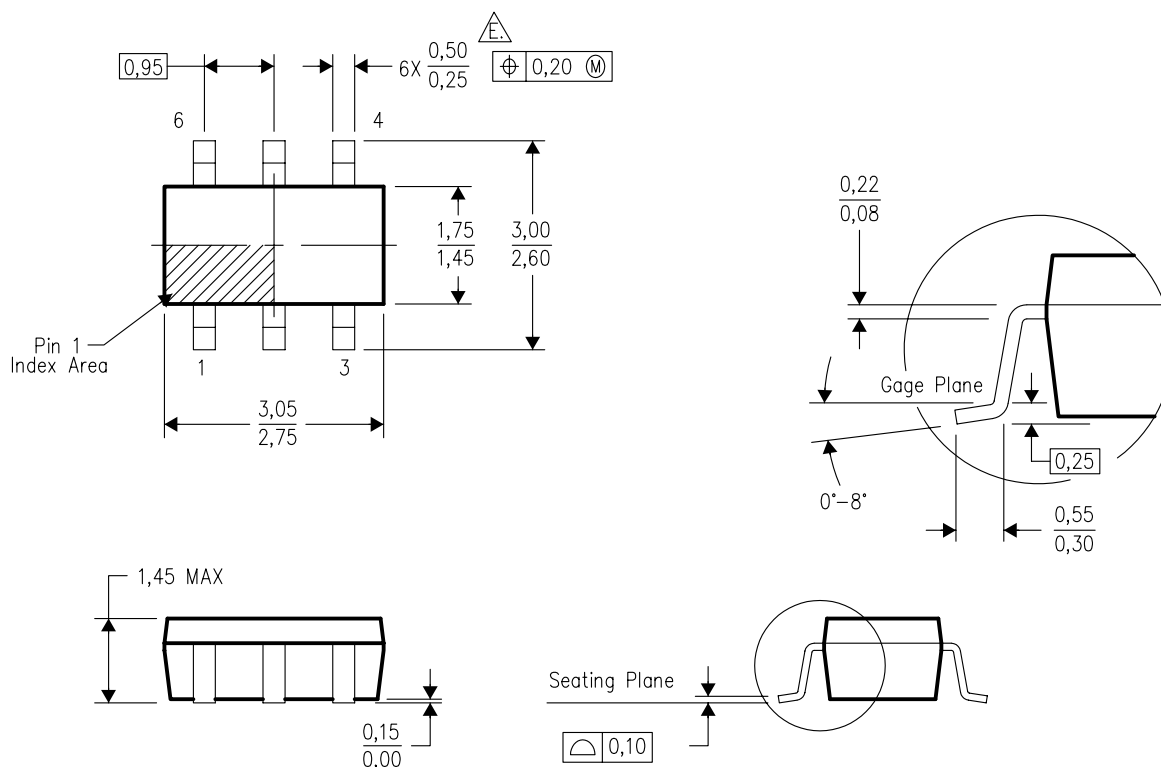
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

## DBV (R-PDSO-G6)

## PLASTIC SMALL-OUTLINE PACKAGE

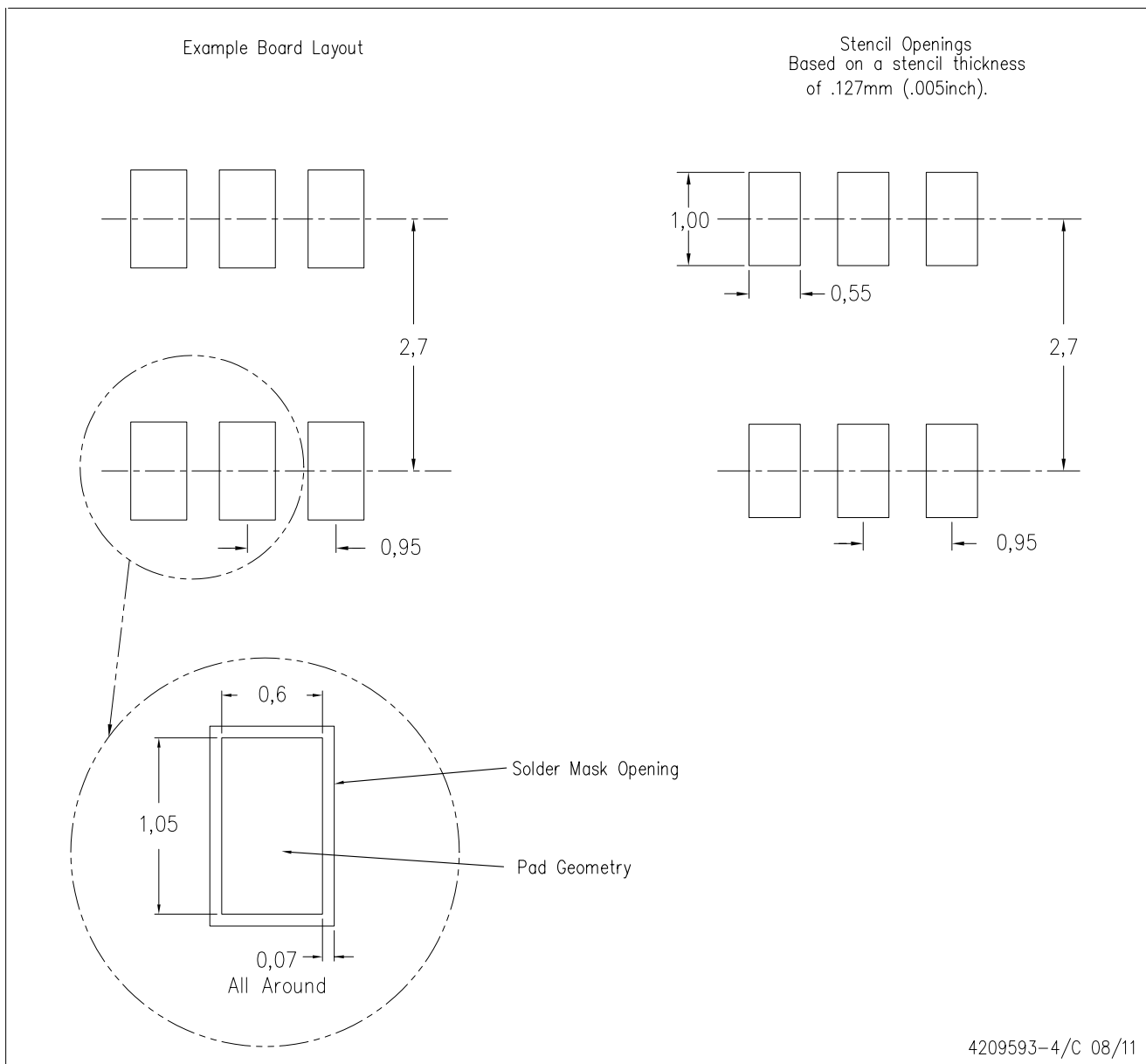


4073253-5/K 03/2006

- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.
-  Falls within JEDEC MO-178 Variation AB, except minimum lead width.

DBV (R-PDSO-G6)

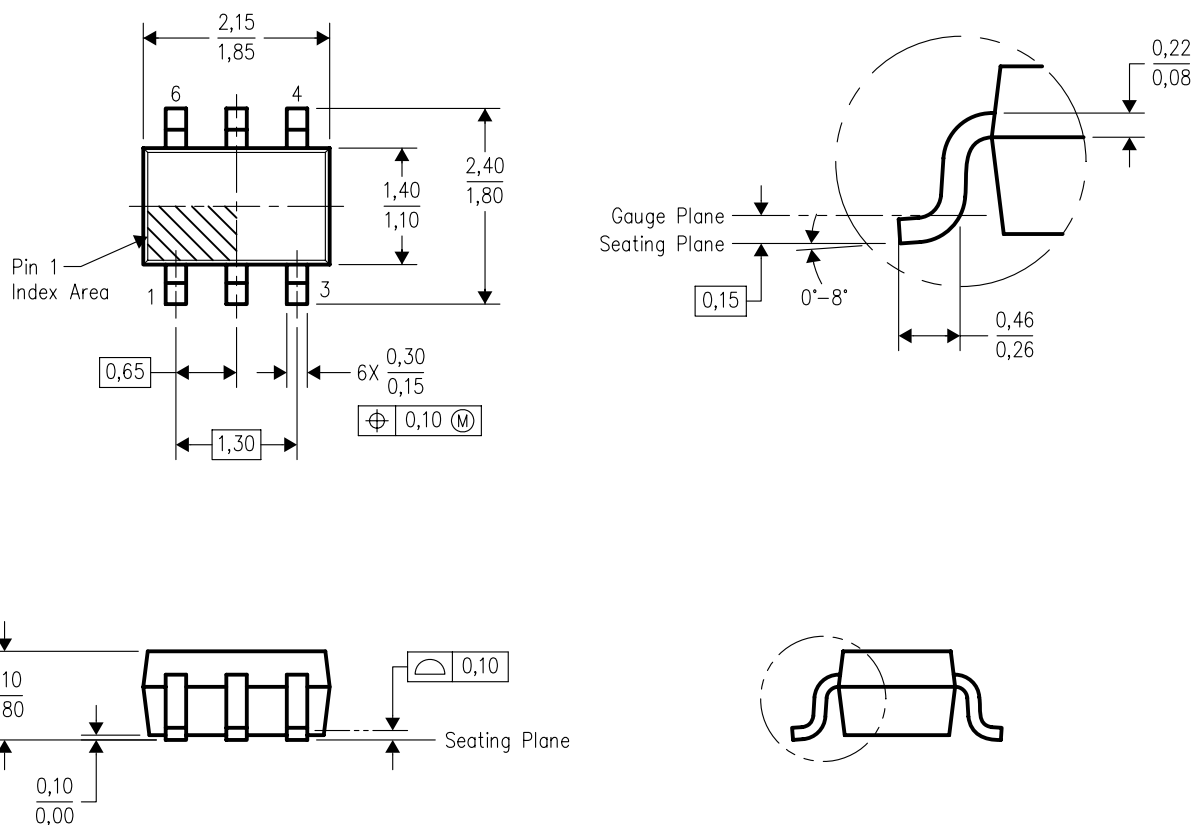
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

## DCK (R-PDSO-G6)

## PLASTIC SMALL-OUTLINE PACKAGE

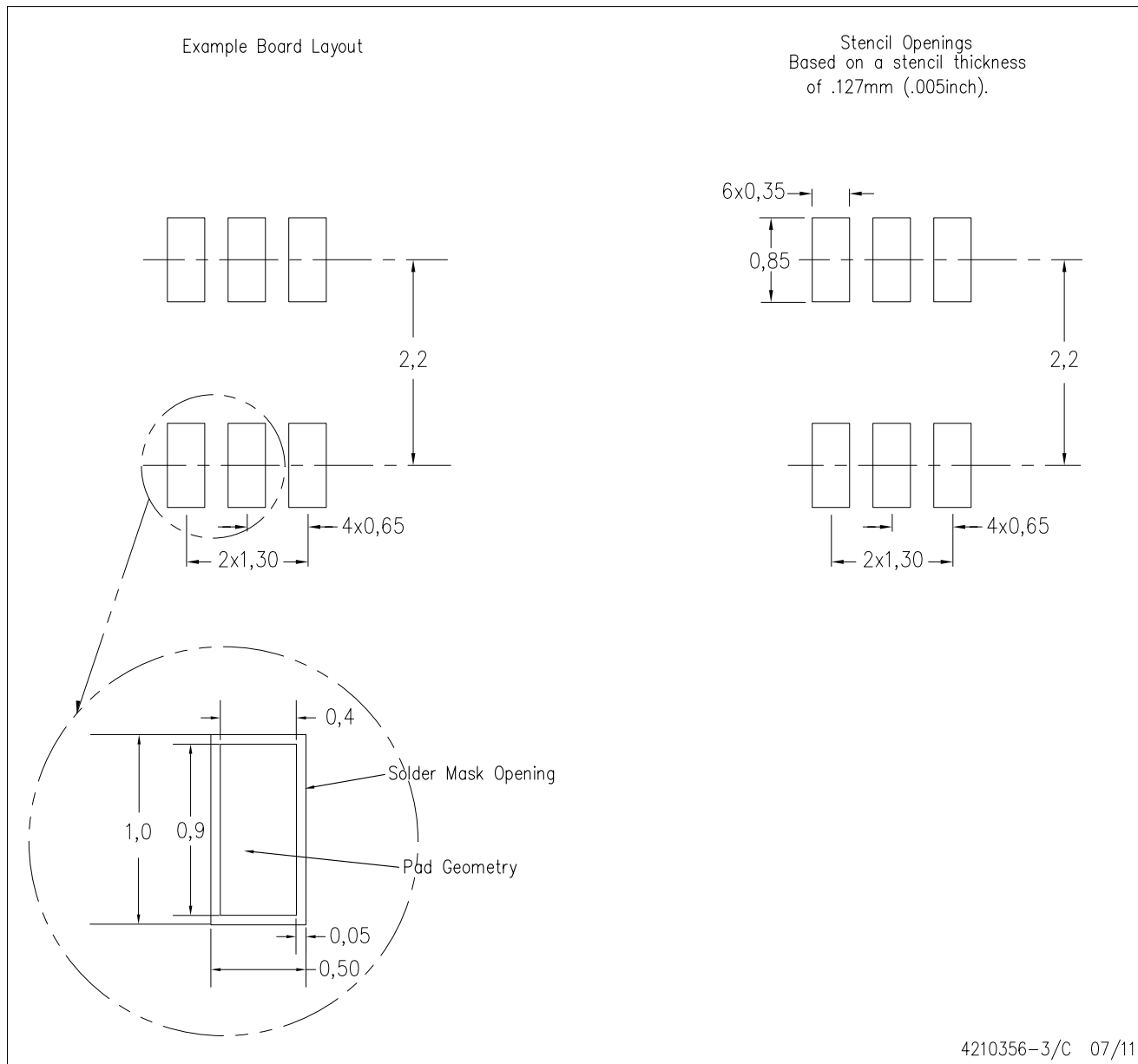


4093553-4/G 01/2007

- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - Falls within JEDEC MO-203 variation AB.

DCK (R-PDSO-G6)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
  - D. Publication IPC-7351 is recommended for alternate designs.
  - E. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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