THE DATASHEET OF

LMV710IDBVRG4

www.win-source.net 0086-755-83957316

TEXAS INSTRUMENTS
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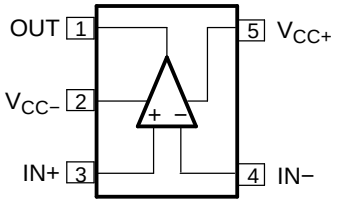
LMV710, LMV711, LMV715
SINGLE LOW-POWER RRIO OPERATIONAL AMPLIFIERS WITH HIGH OUTPUT CURRENT DRIVE AND SHUTDOWN

SLOS463A–APRIL 2005–REVISED JULY 2005

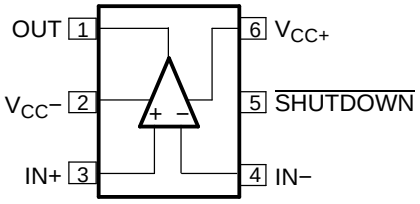
FEATURES

- 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 Ω
- Gain Bandwidth . . . 5 MHz Typ
- Slew Rate . . . 5 V/μs Typ
- Turn-On Time From Shutdown . . . <10 μs
- Shutdown Current . . . 0.2 μA Typ
- Space-Saving Packages
  - SOT-23-5/6
  - SC-70

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)



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/μs.

On the LMV711 and LMV715, a separate shutdown pin can be used to disable the device and reduce the supply current to 0.2 μA typical. The device features a turn-on time of less than 10 μs. 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°C to 85°C.

ORDERING INFORMATION

T_A	PACKAGE(1)		ORDERABLE PART NUMBER	TOP-SIDE MARKING(2)
–40°C to 85°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.
(2) DBV/DCK: The actual top-side marking has one additional character that designates the assembly/test site.

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.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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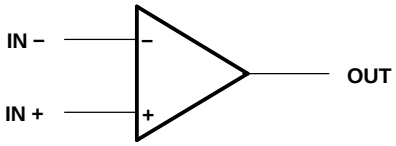
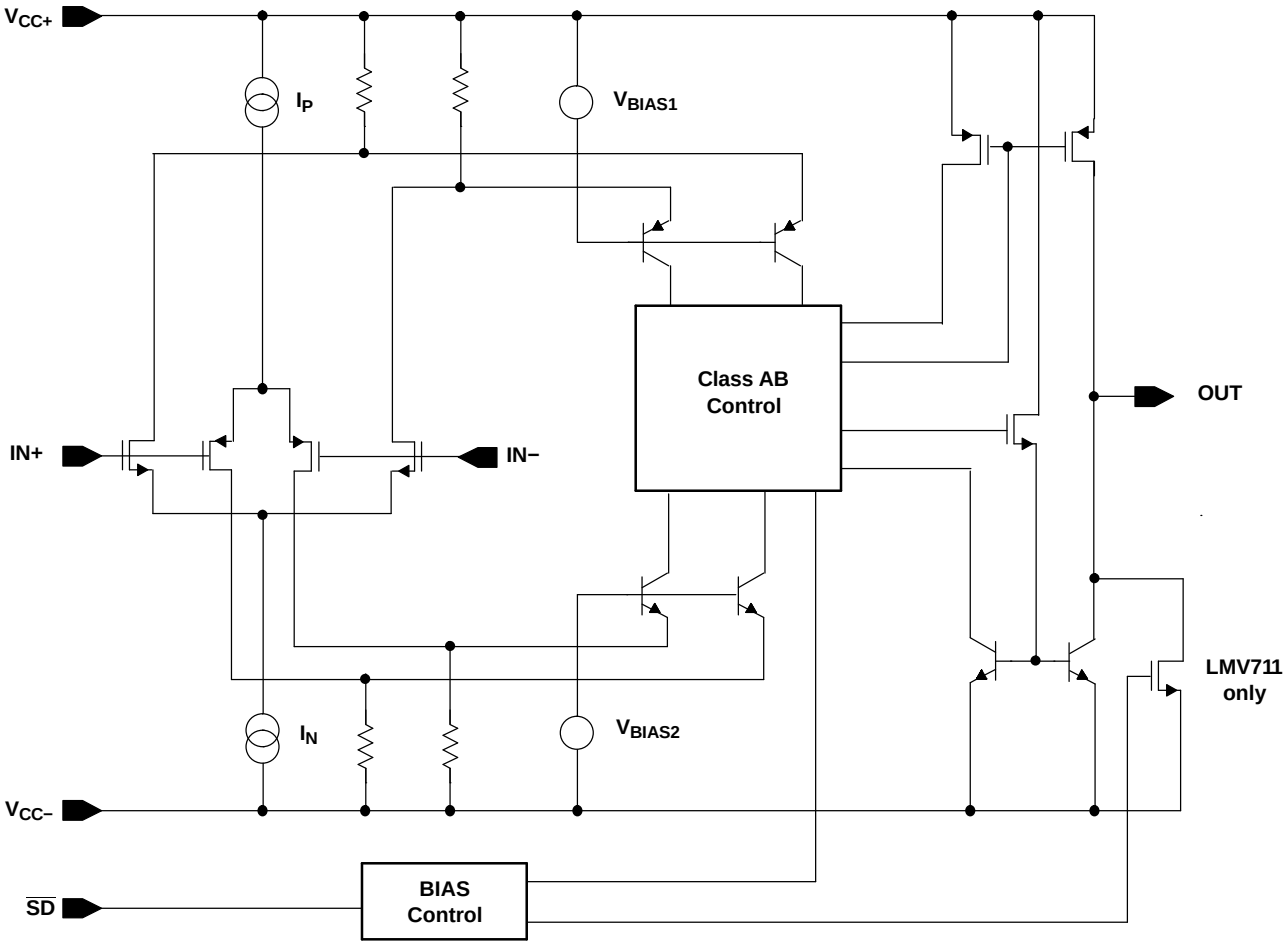
SYMBOL (EACH AMPLIFIER)



SIMPLIFIED SCHEMATIC



Absolute Maximum Ratings(1)

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

				MIN	MAX	UNIT
$V_{CC+} - V_{CC-}$	Supply voltage(2)				6	V
V_{ID}	Differential input voltage(3)				±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(4)				±10	mA
θ_{JA}	Package thermal impedance(5)(6)	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_{stg}	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 $T_J(max)$, θ_{JA}, and T_A. The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. 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

Electrical Characteristics

V_{CC+} = 2.7 V, V_{CC-} = GND, V_{IC} = 1.35 V, and R_L > 1 MΩ (unless otherwise noted)

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

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

Electrical Characteristics

V_{CC+} = 3.2 V, V_{CC-} = GND, and V_{IC} = 1.6 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_O	Output voltage	I_O = 6.5 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	

Electrical Characteristics

V_{CC+} = 5 V, V_{CC-} = GND, V_{IC} = 2.5 V, and R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		T_A	MIN	TYP	MAX	UNIT
V_{IO}	Input offset voltage	V_{IC} = 0.85 V and 1.85 V		25°C		0.4	3	mV
				–40°C to 85°C			3.2	
I_{IB}	Input bias current			25°C		4		pA
CMRR	Common-mode rejection ratio	0 ≤ V_{IC} ≤ 2.7 V		25°C	50	75		dB
				–40°C to 85°C	48			
k_{SVR}	Supply-voltage rejection ratio	2.7 V ≤ V_{CC+} ≤ 5 V, V_{IC} = 0.85 V		25°C	70	110		dB
				–40°C to 85°C	68			
		2.7 V ≤ V_{CC+} ≤ 5 V, V_{IC} = 1.85 V		25°C	70	95		
				–40°C to 85°C	68			
V_{ICR}	Common-mode input voltage range	CMRR ≥ 50 dB		25°C	–0.2 to 5.2	–0.3 to 5.3		V
I_{OS}	Output short circuit current(1)	Sourcing V_O = 0		25°C	25	35		mA
				–40°C to 85°C	21			
		Sinking V_O = 5 V		25°C	25	40		
				–40°C to 85°C	21			
V_O	Output voltage	R_L = 10 kΩ to 1.35 V	V_{OH}	25°C	4.92	4.98		V
				–40°C to 85°C	4.9			
			V_{OL}	25°C		0.01	0.12	
				–40°C to 85°C			0.15	
		R_L = 600 Ω to 1.35 V	V_{OH}	25°C	4.82	4.85		
				–40°C to 85°C	4.8			
			V_{OL}	25°C		0.05	0.23	
				–40°C to 85°C			0.3	
$V_{O(SD)}$	Output voltage level in shutdown mode	LMV711 only		25°C		50	200	mV
$I_{O(SD)}$	Output leakage current in shutdown mode	LMV715 only		25°C		1		pA
$C_{O(SD)}$	Output capacitance in shutdown mode	LMV715 only		25°C		32		pF
I_{CC}	Supply current	ON mode		25°C		1.17	1.7	mA
				–40°C to 85°C			1.9	
		Shutdown mode, $\overline{SHDN}$ = 0		25°C		0.2	10	µA
A_V	Large-signal voltage gain	Sourcing R_L = 10 kΩ, V_O = 1.35 V to 2.3 V		25°C	80	123		dB
				–40°C to 85°C	76			
		Sinking R_L = 10 kΩ, V_O = 0.4 V to 1.35 V		25°C	80	120		
				–40°C to 85°C	76			
		Sourcing R_L = 600 Ω, V_O = 1.35 V to 2.2 V		25°C	80	110		
				–40°C to 85°C	76			
		Sinking R_L = 600 Ω, V_O = 0.5 V to 1.35 V		25°C	80	118		
				–40°C to 85°C	76			
SR(2)	Slew rate			25°C		5		V/µs
GBWP	Gain bandwidth product			25°C		5		MHz
Φ_m	Phase margin			25°C		60		deg
$T_{(on)}$	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 V, V_{CC-} = GND, V_{IC} = 2.5 V, and R_L > 1 MΩ (unless otherwise noted)

PARAMETER		TEST CONDITIONS	T_A	MIN	TYP	MAX	UNIT
$\overline{SHDN}$	Shutdown pin voltage range	$V_{(ON)}$	25°C	2.4 to 5	2 to 5		V
		$V_{(OFF)}$			0 to 1.5	0 to 0.8	
V_n	Input referred voltage noise	f = 1 kHz	25°C		20		nV/√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 Ω)
Figure 4. Output Negative Swing vs Supply Voltage R_L = 600 Ω)
Figure 5. Output Positive Swing vs Supply Voltage R_L = 10 kΩ)
Figure 6. Output Negative Swing vs Supply Voltage R_L = 10 kΩ)
Figure 7. Output Positive Swing vs Supply Voltage (I_{SRC} = 7 mA)
Figure 8. Output Negative Swing vs Supply Voltage (I_{SINK} = 7 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_{CC} = 5 V)
Figure 16. THD+N vs Frequency (V_{CC} = 2.7 V)
Figure 17. THD+N vs V_{OUT} ($V_{CC±}$ = ±2.5 V)
Figure 18. THD+N vs V_{OUT} ($V_{CC±}$ = ±1.35 V)
Figure 19. C_{CM} vs V_{CM} (V_{CC} = 2.7 V)
Figure 20. C_{CM} vs V_{CM} (V_{CC} = 5 V)
Figure 21. C_{DIFF} vs V_{CM} (V_{CC} = 2.7 V)
Figure 22. C_{DIFF} vs V_{CM} (V_{CC} = 5 V)
Figure 23. Open-Loop Frequency Response ($V_{CC±}$ = ±1.35 V)
Figure 24. Open-Loop Frequency Response ($V_{CC±}$ = ±1.6 V)
Figure 25. Open-Loop Frequency Response ($V_{CC±}$ = ±2.5 V)
Figure 26. Open-Loop Frequency Response ($V_{CC±}$ = ±1.35 V)
Figure 27. Open-Loop Frequency Response ($V_{CC±}$ = ±1.6 V)
Figure 28. Open-Loop Frequency Response ($V_{CC±}$ = ±2.5 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_{OS} vs V_{CM} (V_{CC} = 2.7 V)
Figure 34. V_{OS} vs V_{CM} (V_{CC} = 5 V)

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
LMV710IDBVR	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 85	RB4B	
LMV710IDBVRE4	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 85		
LMV710IDBVRG4	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 85		
LMV710IDCKR	OBSOLETE	SC70	DCK	5		TBD	Call TI	Call TI	-40 to 85	REB	
LMV710IDCKRE4	OBSOLETE	SC70	DCK	5		TBD	Call TI	Call TI	-40 to 85		
LMV710IDCKRG4	OBSOLETE	SC70	DCK	5		TBD	Call TI	Call TI	-40 to 85		
LMV711IDBVR	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	-40 to 85	RB5B	
LMV711IDBVRE4	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	-40 to 85		
LMV711IDBVRG4	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	-40 to 85		
LMV711IDCKR	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	-40 to 85	RFB	
LMV711IDCKRE4	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	-40 to 85		
LMV711IDCKRG4	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	-40 to 85		
LMV715IDBVR	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	-40 to 85	RB9B	
LMV715IDBVRE4	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	-40 to 85		
LMV715IDBVRG4	OBSOLETE	SOT-23	DBV	6		TBD	Call TI	Call TI	-40 to 85		
LMV715IDCKR	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	-40 to 85	RLB	
LMV715IDCKRE4	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	-40 to 85		
LMV715IDCKRG4	OBSOLETE	SC70	DCK	6		TBD	Call TI	Call TI	-40 to 85		

(1) 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.
OBSOLETE: TI has discontinued the production of the device.

(2) 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)

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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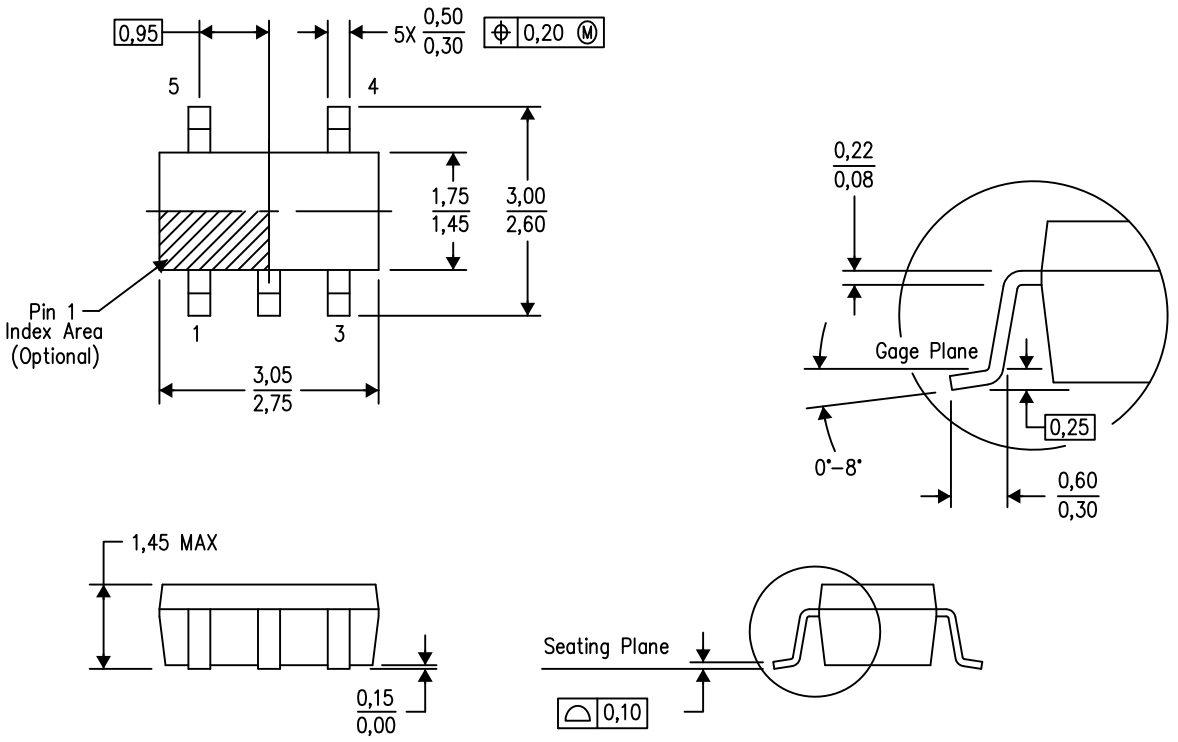
In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

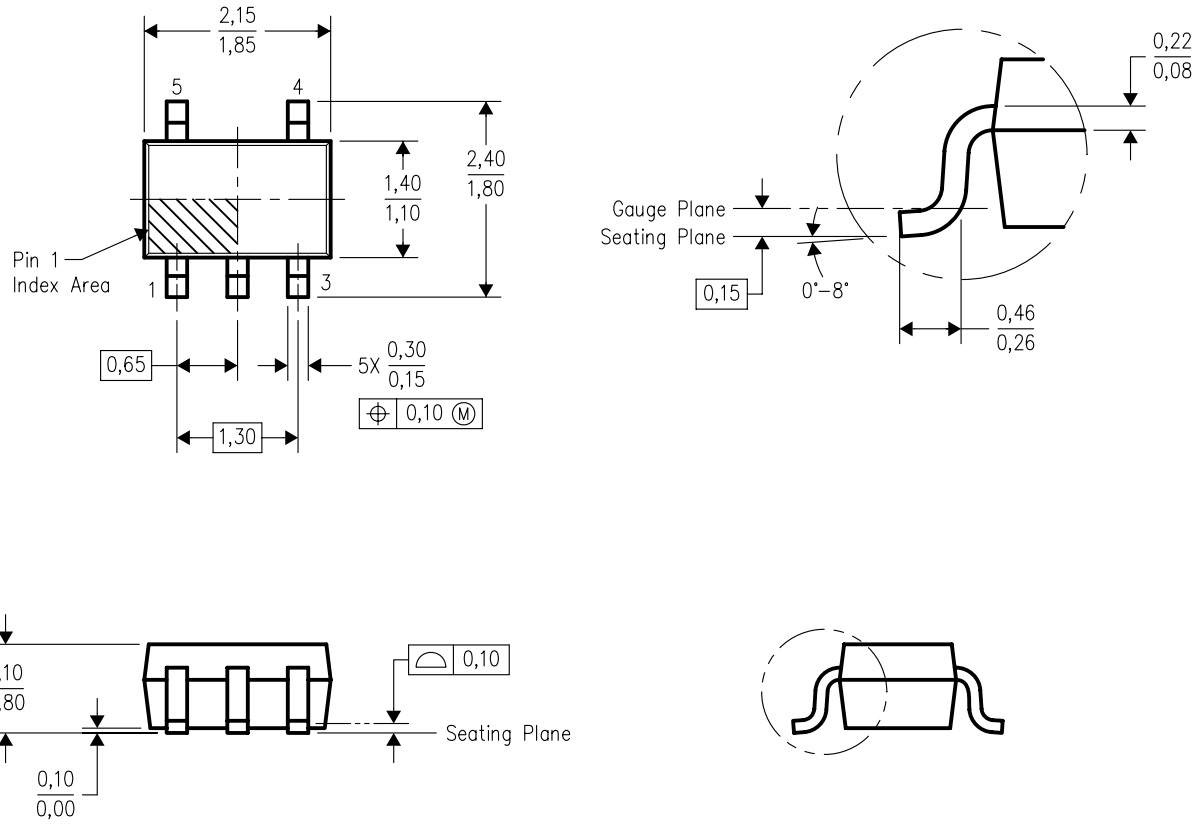
DBV (R–PDSO–G5) PLASTIC SMALL–OUTLINE PACKAGE



4073253–4/N 12/14

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



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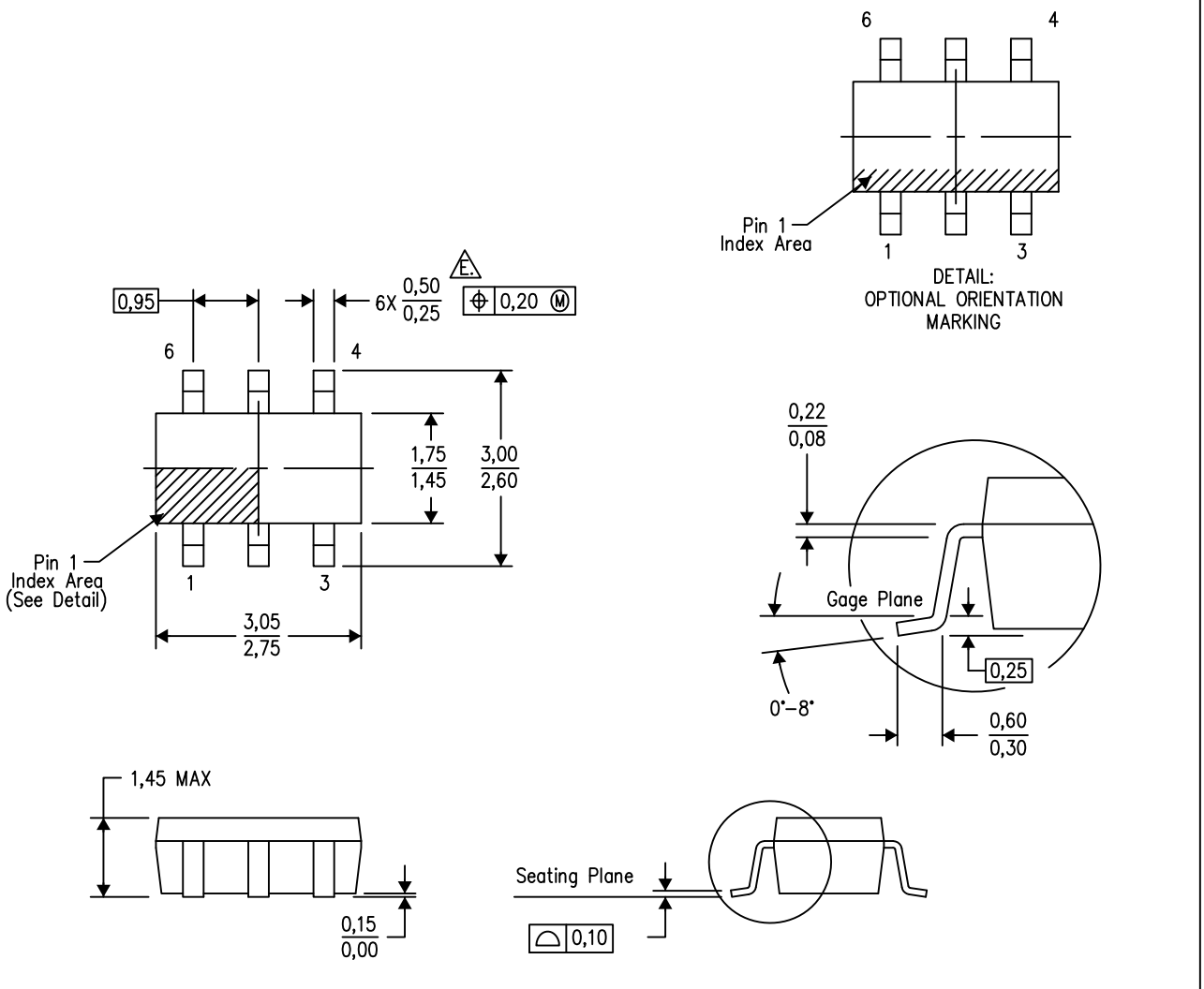
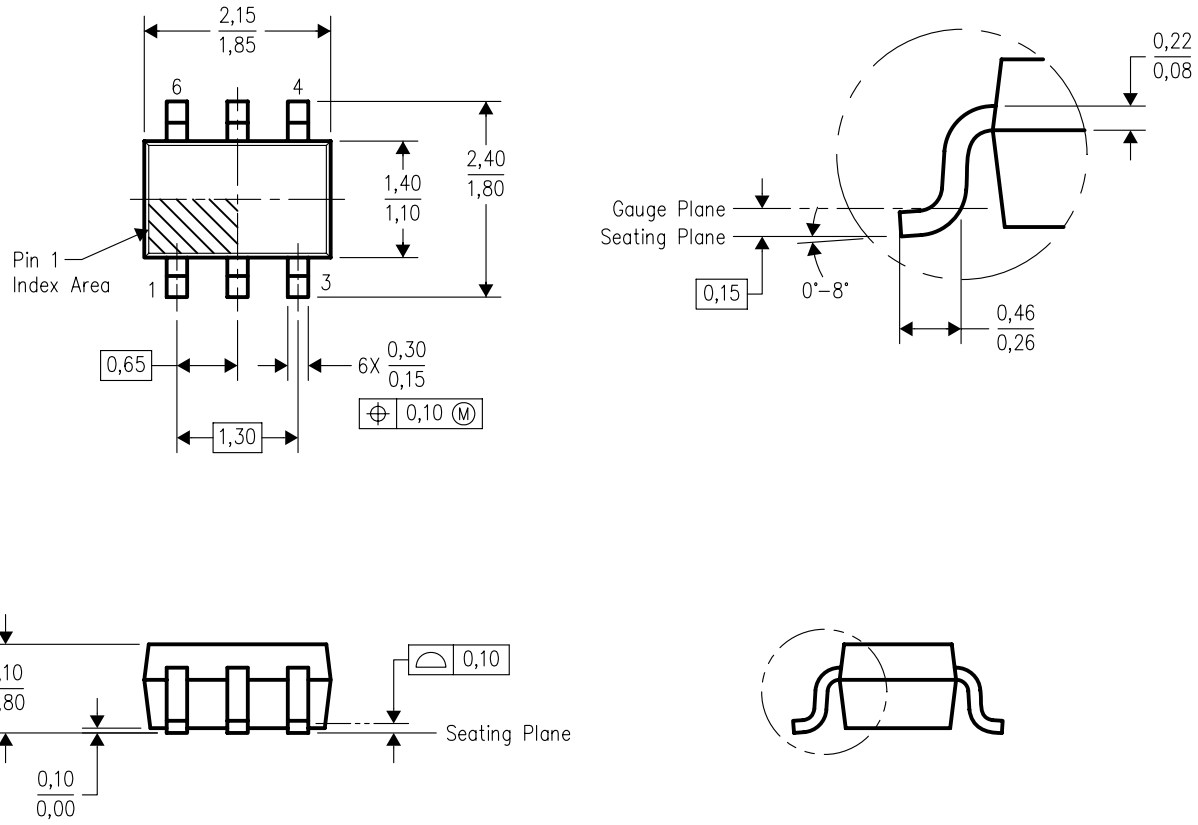
NOTES:
A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
D. Falls within JEDEC MO–203 variation AA.

DBV (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



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.
E. Falls within JEDEC MO–178 Variation AB, except minimum lead width.

DCK (R–PDSO–G6) PLASTIC SMALL–OUTLINE PACKAGE



4093553–4/G 01/2007

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–203 variation AB.

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