



# THE DATASHEET OF LMV934IPWRG4



## 1.8-V OPERATIONAL AMPLIFIERS WITH RAIL-TO-RAIL INPUT AND OUTPUT

Check for Samples: [LMV932 DUAL](#), [LMV934 QUAD](#), [LMV931 SINGLE](#)

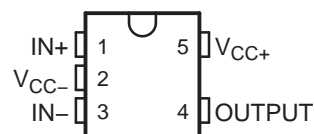
### FEATURES

- 1.8-V, 2.7-V, and 5-V Specifications
- Rail-to-Rail Output Swing
  - 600-Ω Load . . . 80 mV From Rail
  - 2-kΩ Load . . . 30 mV From Rail
- $V_{ICR}$  . . . 200 mV Beyond Rails
- Gain Bandwidth . . . 1.4 MHz
- Supply Current . . . 100 μA/Amplifier
- Max  $V_{IO}$  . . . 4 mV
- Space-Saving Packages
  - LMV931: SOT-23 and SC-70
  - LMV932: MSOP and SOIC
  - LMV934: SOIC and TSSOP

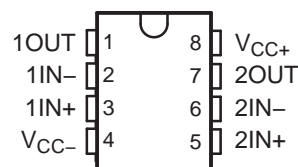
### APPLICATIONS

- Industrial (Utility/Energy Metering)
- Automotive
- Communications (Optical Telecom, Data/Voice Cable Modems)
- Consumer Electronics (PDAs, PCs, CDR/W, Portable Audio)
- Supply-Current Monitoring
- Battery Monitoring

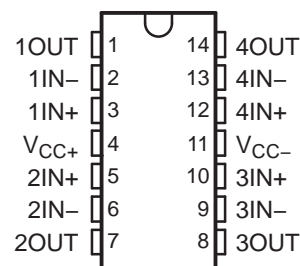
LMV931 . . . DBV (SOT-23-5) OR DCK (SC-70) PACKAGE  
(TOP VIEW)



LMV932 . . . D (SOIC) OR  
DGK (VSSOP/MSOP) PACKAGE  
(TOP VIEW)



LMV934 . . . D (SOIC) OR PW (TSSOP) PACKAGE  
(TOP VIEW)



### DESCRIPTION/ORDERING INFORMATION



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.

**ORDERING INFORMATION**

T <sub>A</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(2)</sup>	
-40°C to 125°C	Single	SOT-23 – DBV	Reel of 3000	LMV931IDBVR	RBB_
			Reel of 250	LMV931IDBVT	PREVIEW
		SC-70 – DCK	Reel of 3000	LMV931IDCKR	RB_
			Reel of 250	LMV931IDCKT	PREVIEW
	Dual	MSOP/VSSOP – DGK	Reel of 2500	LMV932IDGKR	RD_
			Reel of 250	LMV932IDGKT	PREVIEW
		SOIC – D	Tube of 75	LMV932ID	MV932I
			Reel of 2500	LMV932IDR	
	Quad	SOIC – D	Tube of 50	LMV934ID	LMV934I
			Reel of 2500	LMV934IDR	
		TSSOP – PW	Tube of 90	LMV934IPW	MV934I
			Reel of 2000	LMV934IPWR	

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

**DESCRIPTION/ORDERING INFORMATION (CONTINUED)**

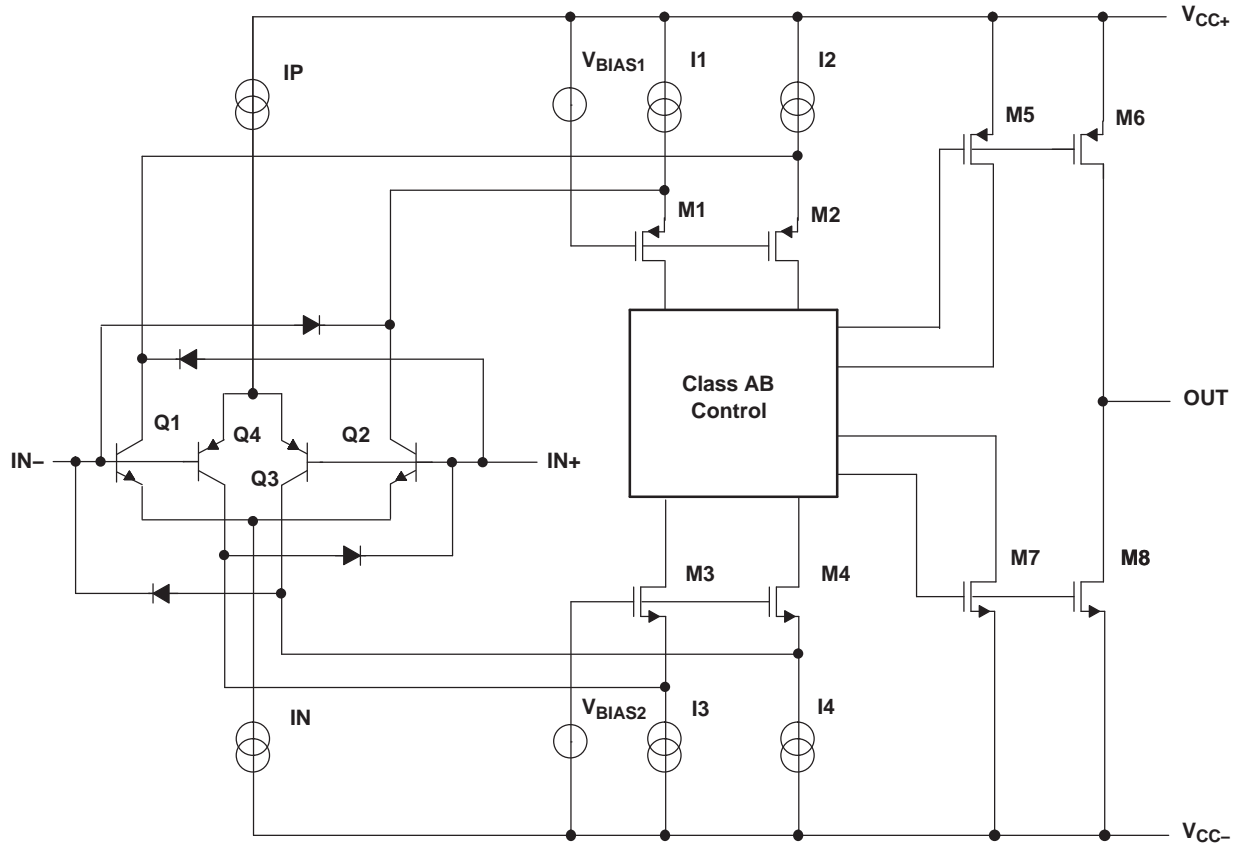
The LMV93x devices are low-voltage low-power operational amplifiers that are well suited for today's low-voltage and/or portable applications. Specified for operation of 1.8 V to 5 V, they can be used in portable applications that are powered from a single-cell Li-ion or two-cell batteries. They have rail-to-rail input and output capability for maximum signal swings in low-voltage applications. The LMV93x input common-mode voltage extends 200 mV beyond the rails for increased flexibility. The output can swing rail-to-rail unloaded and typically can reach 80 mV from the rails, while driving a 600-Ω load (at 1.8-V operation).

During 1.8-V operation, the devices typically consume a quiescent current of 103 μA per channel, and yet they are able to achieve excellent electrical specifications, such as 101-dB open-loop DC gain and 1.4-MHz gain bandwidth. Furthermore, the amplifiers offer good output drive characteristics, with the ability to drive a 600-Ω load and 1000-pF capacitance with minimal ringing.

The LMV93x devices are offered in the latest packaging technology to meet the most demanding space-constraint applications. The LMV931 is offered in standard SOT-23 and SC-70 packages. The LMV932 is available in the traditional MSOP and SOIC packages. The LMV934 is available in the traditional SOIC and TSSOP packages.

The LMV93x devices are characterized for operation from -40°C to 125°C, making the part universally suited for commercial, industrial, and automotive applications.

Figure 1. SIMPLIFIED SCHEMATIC



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

over free-air temperature range (unless otherwise noted)

		MIN	MAX	UNIT
$V_{CC+} - V_{CC-}$	Supply voltage <sup>(2)</sup>		5.5	V
$V_{ID}$	Differential input voltage <sup>(3)</sup>	Supply voltage		
$V_I$	Input voltage range, either input	$V_{CC-} - 0.2$	$V_{CC+} + 0.2$	V
Duration of output short circuit (one amplifier) to $V_{CC\pm}$ <sup>(4) (5)</sup>		Unlimited		
$\theta_{JA}$	Package thermal impedance <sup>(5) (6)</sup>	D package (8 pin)		°C/W
		D package (14 pin)		
		DBV package		
		DCK package		
		DGK package		
		PW package		
$T_J$	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) Applies to both single-supply and split-supply operation. Continuous short-circuit operation at elevated ambient temperature can result in exceeding the maximum allowed junction temperature of 150°C. Output currents in excess of 45 mA over long term may adversely affect reliability.
- (5) Maximum power dissipation is a function of  $T_J(\max)$ ,  $\theta_{JA}$ , 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
$V_{CC}$	Supply voltage ( $V_{CC+} - V_{CC-}$ )	1.8	5	V
$T_A$	Operating free-air temperature	-40	125	°C

### ESD Protection

	TYP	UNIT
Human-Body Model	2000	V
Machine Model	200	V

**Electrical Characteristics**
 $V_{CC+} = 1.8\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = V_{CC+}/2$ ,  $V_O = V_{CC+}/2$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS		$T_A$	MIN	TYP	MAX	UNIT	
$V_{IO}$	Input offset voltage	LMV931 (single)		25°C		1	4	mV	
				Full range			6		
		LMV932 (dual), LMV934 (quad)		25°C		1	5.5		
				Full range			7.5		
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			25°C		5.5		$\mu\text{V}/^\circ\text{C}$	
$I_{IB}$	Input bias current	$V_{IC} = V_{CC+} - 0.8\text{ V}$		25°C		15	35	nA	
				25°C			65		
				Full range			75		
$I_{IO}$	Input offset current			25°C		13	25	nA	
				Full range			40		
$I_{CC}$	Supply current (per channel)			25°C		103	185	$\mu\text{A}$	
				Full range			205		
CMRR	Common-mode rejection ratio	$0 \leq V_{IC} \leq 0.6\text{ V}$ , $1.4\text{ V} \leq V_{IC} \leq 1.8\text{ V}$		25°C	60	78	dB		
				$-40^\circ\text{C}$ to $85^\circ\text{C}$	55				
		$0.2 \leq V_{IC} \leq 0.6\text{ V}$ , $1.4\text{ V} \leq V_{IC} \leq 1.6\text{ V}$	$-40^\circ\text{C}$ to $125^\circ\text{C}$	55					
$k_{SVR}$	Supply-voltage rejection ratio	$1.8\text{ V} \leq V_{CC+} \leq 5\text{ V}$ , $V_{IC} = 0.5\text{ V}$		25°C	75	100	dB		
				Full range	70				
$V_{ICR}$	Common-mode input voltage range	CMRR $\geq 50\text{ dB}$		25°C	$V_{CC-} - 0.2$	$-0.2$ to $2.1$	$V_{CC+} + 0.2$	V	
				$-40^\circ\text{C}$ to $85^\circ\text{C}$	$V_{CC-}$		$V_{CC+}$		
				$-40^\circ\text{C}$ to $125^\circ\text{C}$	$V_{CC-} + 0.2$		$V_{CC+} - 0.2$		
$A_V$	Large-signal voltage gain	LMV931	$V_O = 0.2\text{ V}$ to $1.6\text{ V}$ , $V_{IC} = 0.5\text{ V}$	$R_L = 600\ \Omega$ to $0.9\text{ V}$	25°C	77	101	dB	
					Full range	73			
				$R_L = 2\text{ k}\Omega$ to $0.9\text{ V}$	25°C	80	105		
					Full range	75			
				LMV932, LMV934	$R_L = 600\ \Omega$ to $0.9\text{ V}$	25°C	75		90
						Full range	72		
$R_L = 2\text{ k}\Omega$ to $0.9\text{ V}$	25°C	78	100						
	Full range	75							
$V_O$	Output swing	$R_L = 600\ \Omega$ to $0.9\text{ V}$ , $V_{ID} = \pm 100\text{ mV}$	High level	25°C	1.65	1.72	V		
				Full range	1.63				
			Low level	25°C		0.077		0.105	
				Full range				0.120	
			$R_L = 2\text{ k}\Omega$ to $0.9\text{ V}$ , $V_{ID} = \pm 100\text{ mV}$	High level	25°C	1.75		1.77	
					Full range	1.74			
Low level	25°C		0.024	0.035					
	Full range			0.040					
$I_{OS}$	Output short-circuit current	$V_O = 0\text{ V}$ , $V_{ID} = 100\text{ mV}$	Sourcing	25°C	4	8	mA		
				Full range	3.3				
		$V_O = 1.8\text{ V}$ , $V_{ID} = -100\text{ mV}$	Sinking	25°C	7	9			
				Full range	5				
GBW	Gain bandwidth product			25°C		1.4		MHz	

**Electrical Characteristics (continued)**

$V_{CC+} = 1.8\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = V_{CC+}/2$ ,  $V_O = V_{CC+}/2$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T <sub>A</sub>	MIN	TYP	MAX	UNIT
SR	Slew rate <sup>(1)</sup>	25°C		0.35		V/ $\mu$ S
$\Phi_m$	Phase margin	25°C		67		°
	Gain margin	25°C		7		dB
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$ , $V_{IC} = 0.5\text{ V}$		60		nV/ $\sqrt{\text{Hz}}$
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$		0.06		pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , $A_V = 1$ , $R_L = 600\ \Omega$ , $V_{ID} = 1\text{ V}_{p-p}$		0.023		%
	Amplifier-to-amplifier isolation <sup>(2)</sup>		25°C	123		dB

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

(2) Input referred,  $V_{CC+} = 5\text{ V}$  and  $R_L = 100\text{ k}\Omega$  connected to 2.5 V. Each amplifier is excited, in turn, with a 1-kHz signal to produce  $V_O = 3\text{ V}_{p-p}$ .

## Electrical Characteristics

$V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = V_{CC+}/2$ ,  $V_O = V_{CC+}/2$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS		$T_A$	MIN	TYP	MAX	UNIT			
$V_{IO}$	Input offset voltage	LMV931 (single)		25°C		1	4	mV			
				Full range			6				
		LMV932 (dual), LMV934 (quad)		25°C		1	5.5				
				Full range			7.5				
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			25°C		5.5		$\mu\text{V}/^\circ\text{C}$			
$I_{IB}$	Input bias current			25°C		15	35	nA			
				25°C			65				
				Full range			75				
$I_{IO}$	Input offset current			25°C		8	25	nA			
				Full range			40				
$I_{CC}$	Supply current (per channel)			25°C		105	190	$\mu\text{A}$			
				Full range			210				
CMRR	Common-mode rejection ratio			25°C	60	81		dB			
				-40°C to 85°C	55						
				-40°C to 125°C	55						
$k_{SVR}$	Supply-voltage rejection ratio			25°C	75	100		dB			
				Full range	70						
$V_{ICR}$	Common-mode input voltage range		CMRR $\geq 50\text{ dB}$	25°C	$V_{CC-} - 0.2$	-0.2 to 3	$V_{CC+} + 0.2$	V			
				-40°C to 85°C	$V_{CC-}$		$V_{CC+}$				
				-40°C to 125°C	$V_{CC-} + 0.2$		$V_{CC+} - 0.2$				
$A_V$	Large-signal voltage gain	LMV931	$V_O = 0.2\text{ V to } 2.5\text{ V}$	$R_L = 600\ \Omega$ to 1.35 V	25°C	87	104	dB			
				Full range	86						
		$R_L = 2\text{ k}\Omega$ to 1.35 V		25°C	92	110					
		Full range		91							
		LMV932, LMV934		$R_L = 600\ \Omega$ to 1.35 V	25°C	78	90				
				Full range	75						
$V_O$	Output swing	$R_L = 600\ \Omega$ to 1.35 V, $V_{ID} = \pm 100\text{ mV}$	High level	25°C	2.55	2.62		V			
				Full range	2.53						
			Low level	25°C		0.083	0.11				
				Full range			0.13				
			$R_L = 2\text{ k}\Omega$ to 1.35 V, $V_{ID} = \pm 100\text{ mV}$	High level	25°C	2.65	2.675				
					Full range	2.64					
		Low level		25°C		0.025	0.04				
				Full range			0.045				
		$I_{OS}$		Output short-circuit current	$V_O = 0\text{ V}$ , $V_{ID} = 100\text{ mV}$	Sourcing	25°C		20	30	mA
							Full range		15		
			$V_O = 2.7\text{ V}$ , $V_{ID} = -100\text{ mV}$		Sinking	25°C	18		25		
						Full range	12				
GBW	Gain bandwidth product			25°C		1.4		MHz			

### Electrical Characteristics (continued)

$V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = V_{CC+}/2$ ,  $V_O = V_{CC+}/2$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	MIN	TYP	MAX	UNIT
SR	Slew rate <sup>(1)</sup>	25°C		0.4		V/ $\mu$ S
$\Phi_m$	Phase margin	25°C		70		°
	Gain margin	25°C		7.5		dB
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$ , $V_{IC} = 0.5\text{ V}$		57		nV/ $\sqrt{\text{Hz}}$
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$		0.082		pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , $A_V = 1$ , $R_L = 600\ \Omega$ , $V_{ID} = 1\text{ V}_{p-p}$		0.022		%
	Amplifier-to-amplifier isolation <sup>(2)</sup>	25°C		123		dB

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

(2) Input referred,  $V_{CC+} = 5\text{ V}$  and  $R_L = 100\text{ k}\Omega$  connected to 2.5 V. Each amplifier is excited, in turn, with a 1-kHz signal to produce  $V_O = 3\text{ V}_{p-p}$ .

## Electrical Characteristics

$V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = V_{CC+}/2$ ,  $V_O = V_{CC+}/2$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS		$T_A$	MIN	TYP	MAX	UNIT	
$V_{IO}$	Input offset voltage	LMV931 (single)		25°C		1	4	mV	
				Full range			6		
		LMV932 (dual), LMV934 (quad)		25°C		1	5.5		
				Full range			7.5		
$\alpha_{V_{IO}}$	Average temperature coefficient of input offset voltage			25°C		5.5		$\mu\text{V}/^\circ\text{C}$	
$I_{IB}$	Input bias current			25°C		15	35	nA	
				25°C			65		
				Full range			75		
$I_{IO}$	Input offset current			25°C		9	25	nA	
				Full range			40		
$I_{CC}$	Supply current (per channel)			25°C		116	210	$\mu\text{A}$	
				Full range			230		
CMRR	Common-mode rejection ratio			25°C	60	86		dB	
				–40°C to 85°C	55				
				–40°C to 125°C	55				
$k_{SVR}$	Supply-voltage rejection ratio			25°C	75	100		dB	
				Full range	70				
$V_{ICR}$	Common-mode input voltage range	CMRR $\geq 50\text{ dB}$		25°C	$V_{CC-} - 0.2$	–0.2 to 5.3	$V_{CC+} + 0.2$	V	
				–40°C to 85°C	$V_{CC-}$		$V_{CC+}$		
				–40°C to 125°C	$V_{CC-} + 0.3$		$V_{CC+} - 0.3$		
$A_V$	Large-signal voltage gain	LMV931	$V_O = 0.2\text{ V to }4.8\text{ V}$	$R_L = 600\ \Omega$ to 2.5 V	25°C	88	102	dB	
					Full range	87			
					25°C	94	113		
					Full range	93			
					25°C	81	90		
					Full range	78			
LMV932, LMV934	$R_L = 600\ \Omega$ to 2.5 V	25°C	81	90					
		Full range	78						
		25°C	85	100					
		Full range	82						
		$V_O$	Output swing	$R_L = 600\ \Omega$ to 2.5 V, $V_{ID} = \pm 100\text{ mV}$	High level	25°C	4.855	4.89	V
						Full range	4.835		
Low level	25°C					0.12	0.16		
	Full range						0.18		
$I_{OS}$	Output short-circuit current	$V_O = 0\text{ V}$ , $V_{ID} = 100\text{ mV}$	Sourcing	25°C	80	100	mA		
				Full range	68				
			Sinking	25°C	58	65			
				Full range	45				
GBW	Gain bandwidth product			25°C		1.5		MHz	

**Electrical Characteristics (continued)**

$V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = V_{CC+}/2$ ,  $V_O = V_{CC+}/2$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

	PARAMETER	TEST CONDITIONS	$T_A$	MIN	TYP	MAX	UNIT
SR	Slew rate <sup>(1)</sup>		25°C		0.42		V/ $\mu$ S
$\Phi_m$	Phase margin		25°C		71		°
	Gain margin		25°C		8		dB
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$ , $V_{IC} = 0.5\text{ V}$	25°C		50		nV/ $\sqrt{\text{Hz}}$
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$	25°C		0.07		pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , $A_V = 1$ , $R_L = 600\ \Omega$ , $V_{ID} = 1\text{ V}_{p-p}$	25°C		0.022		%
	Amplifier-to-amplifier isolation <sup>(2)</sup>		25°C		123		dB

- (1) Number specified is the slower of the positive and negative slew rates.
- (2) Input referred,  $V_{CC+} = 5\text{ V}$  and  $R_L = 100\text{ k}\Omega$  connected to 2.5 V. Each amplifier is excited, in turn, with a 1-kHz signal to produce  $V_O = 3\text{ V}_{p-p}$ .

TYPICAL CHARACTERISTICS

$V_{CC+} = 5\text{ V}$ , Single Supply,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)

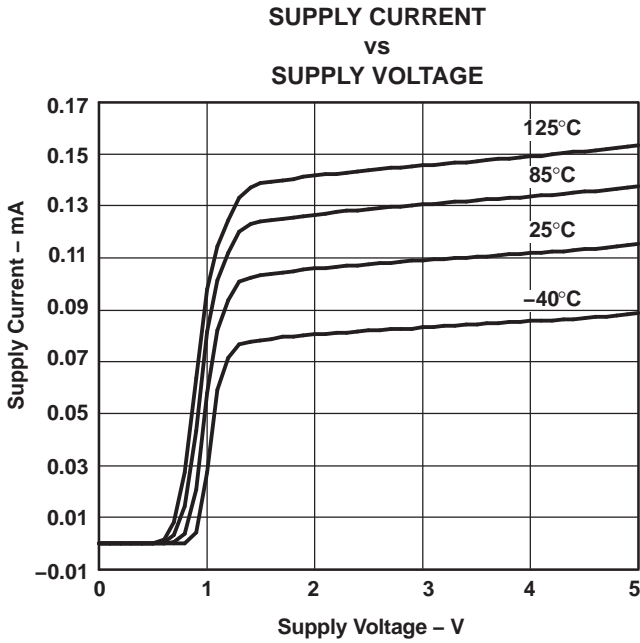


Figure 2.

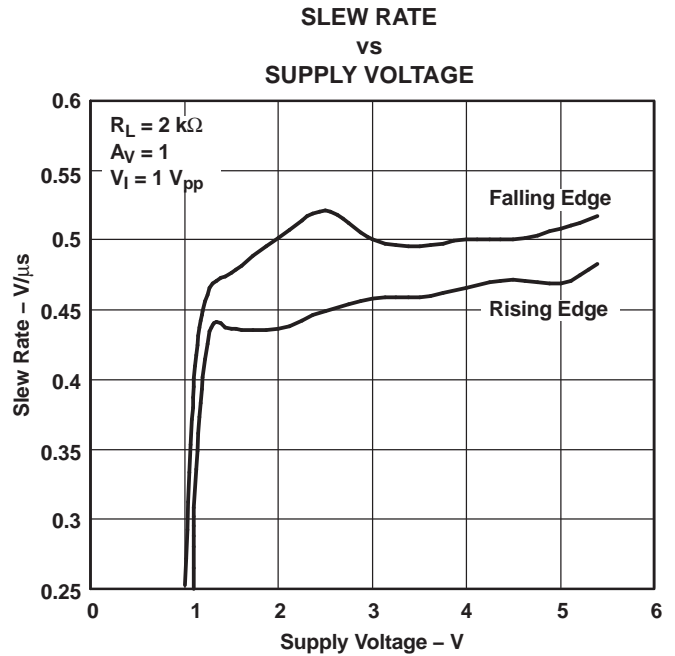


Figure 3.

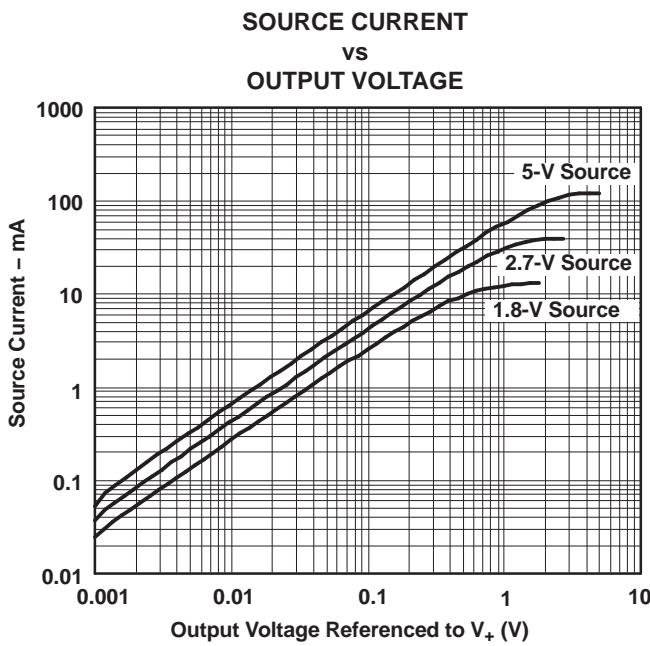


Figure 4.

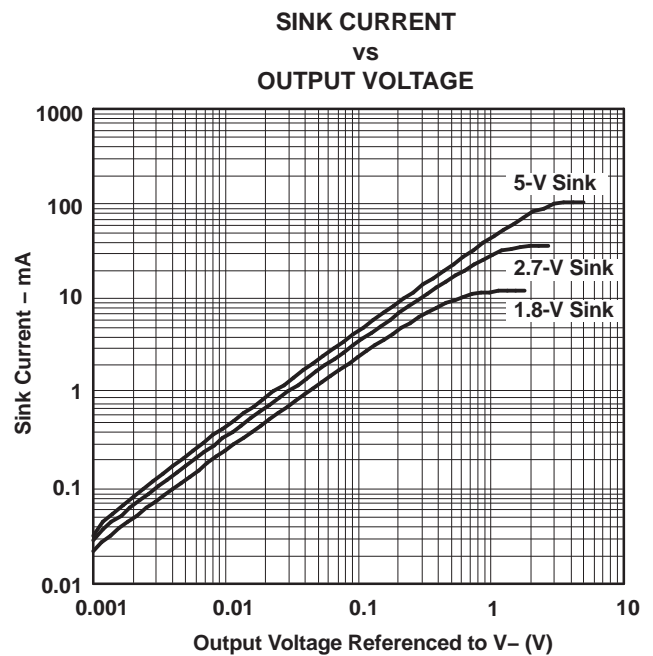


Figure 5.

**TYPICAL CHARACTERISTICS (continued)**

$V_{CC+} = 5\text{ V}$ , Single Supply,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)

**OUTPUT VOLTAGE SWING  
VS  
SUPPLY VOLTAGE**

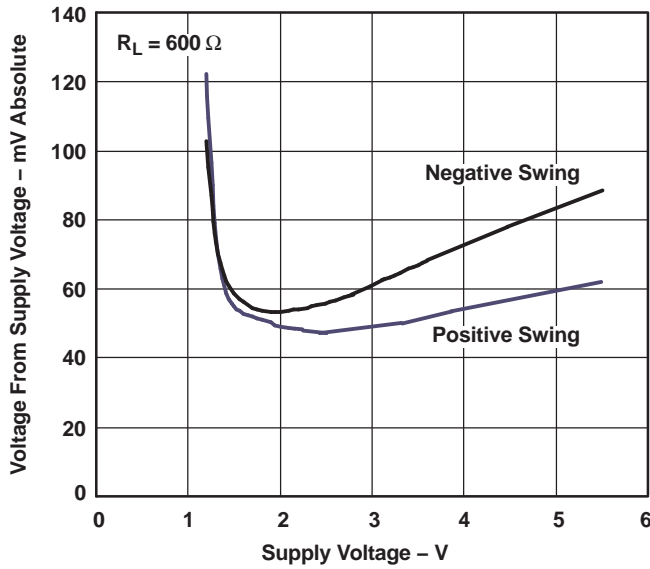


Figure 6.

**OUTPUT VOLTAGE SWING  
VS  
SUPPLY VOLTAGE**

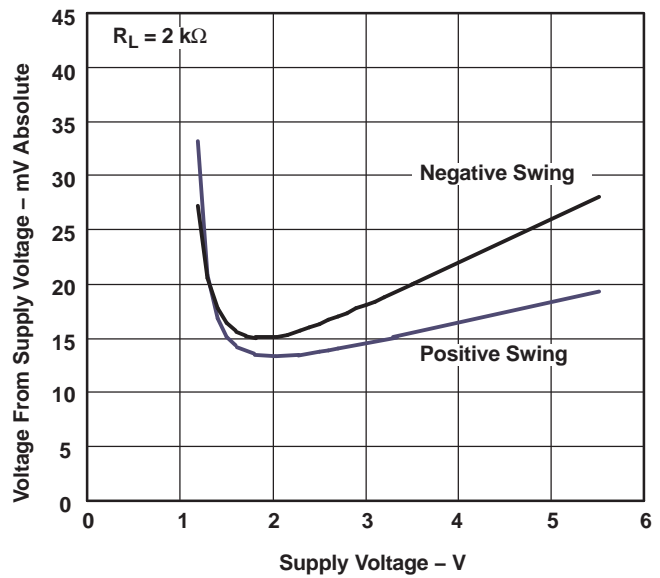


Figure 7.

**SHORT-CIRCUIT CURRENT (SINK)  
VS  
TEMPERATURE**

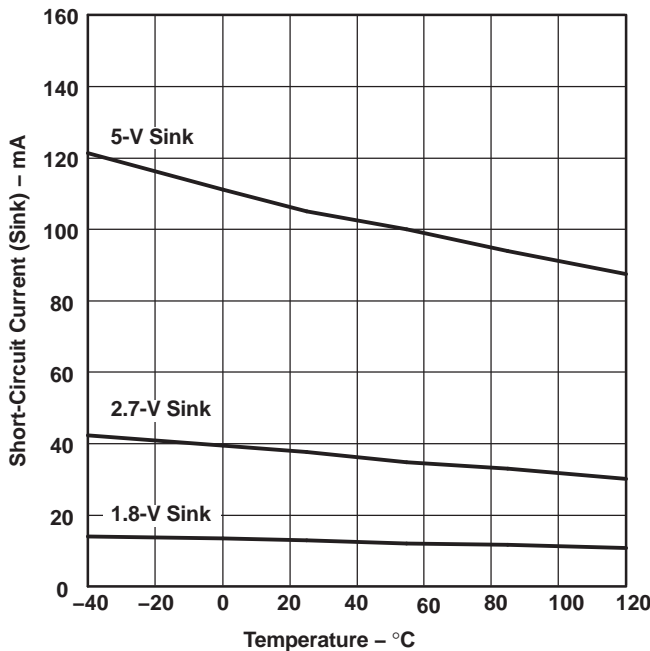


Figure 8.

**SHORT-CIRCUIT CURRENT (SOURCE)  
VS  
TEMPERATURE**

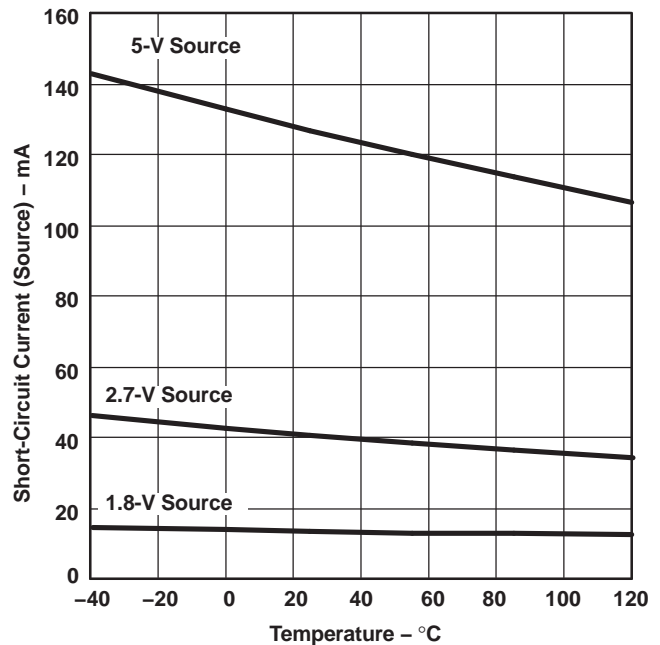


Figure 9.

TYPICAL CHARACTERISTICS (continued)

V<sub>CC+</sub> = 5 V, Single Supply, T<sub>A</sub> = 25°C (unless otherwise specified)

1.8-V FREQUENCY RESPONSE

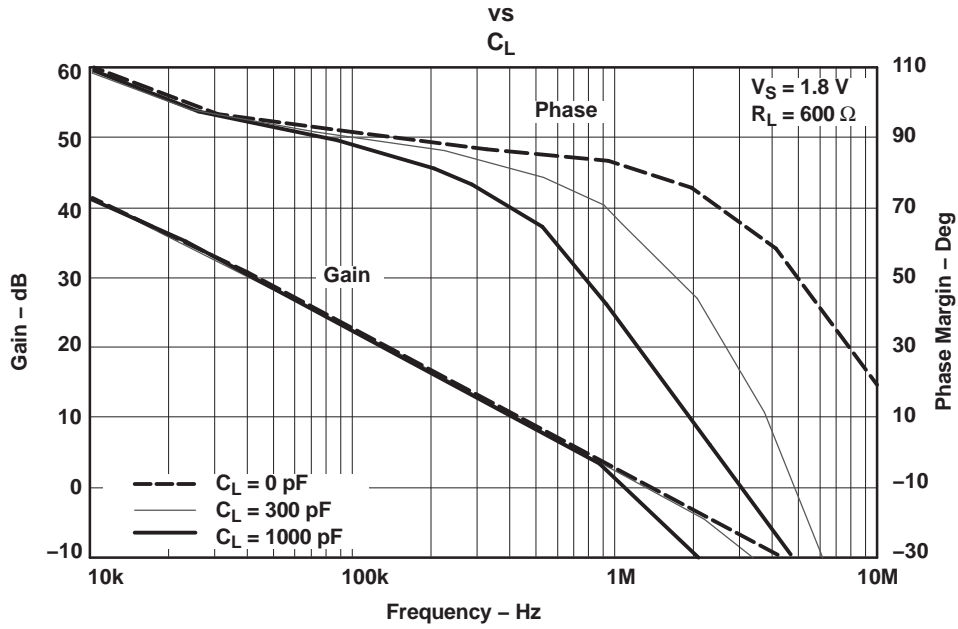


Figure 10.

5-V FREQUENCY RESPONSE

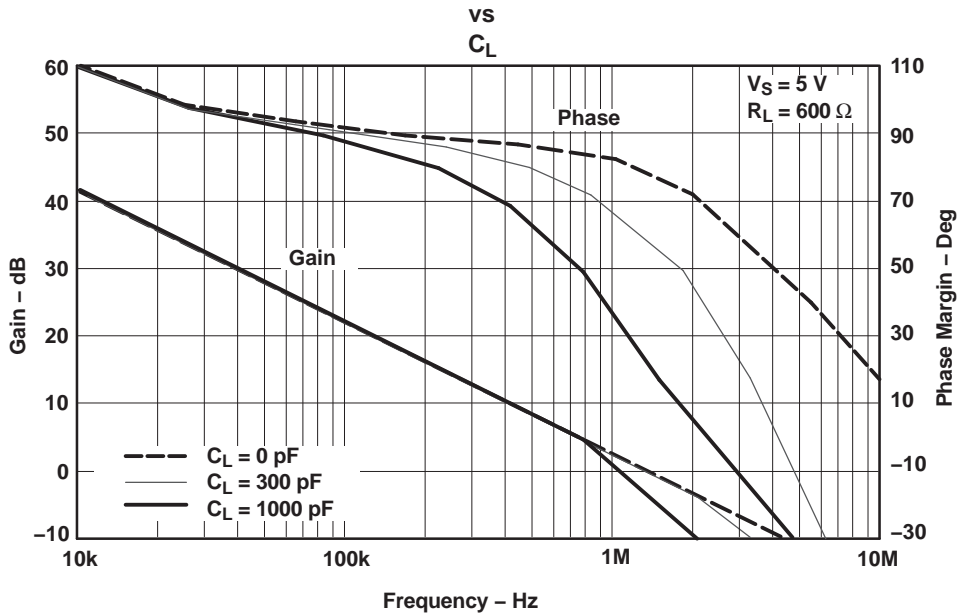


Figure 11.

**TYPICAL CHARACTERISTICS (continued)**

$V_{CC+} = 5\text{ V}$ , Single Supply,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)

**1.8-V FREQUENCY RESPONSE**

vs  
TEMPERATURE

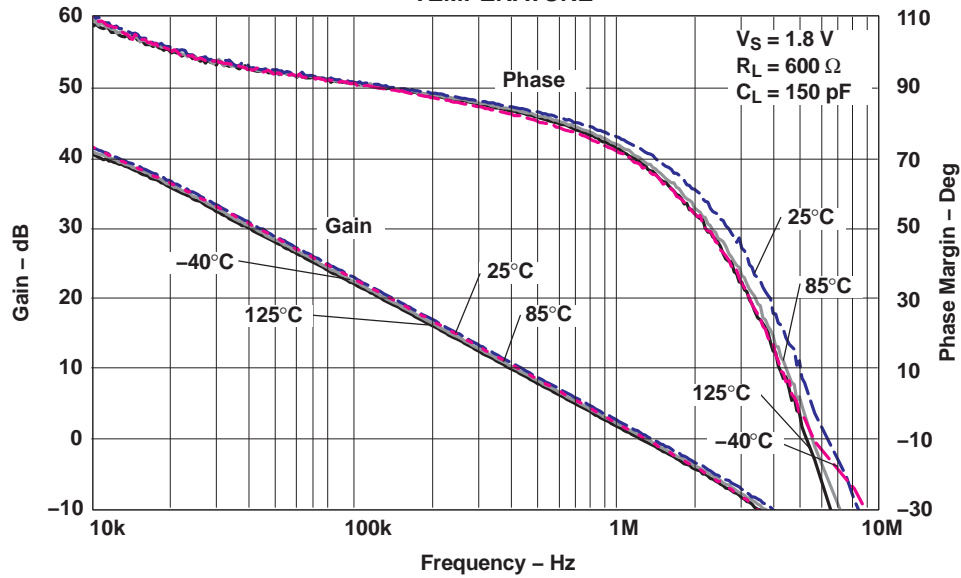


Figure 12.

**5-V FREQUENCY RESPONSE**

vs  
TEMPERATURE

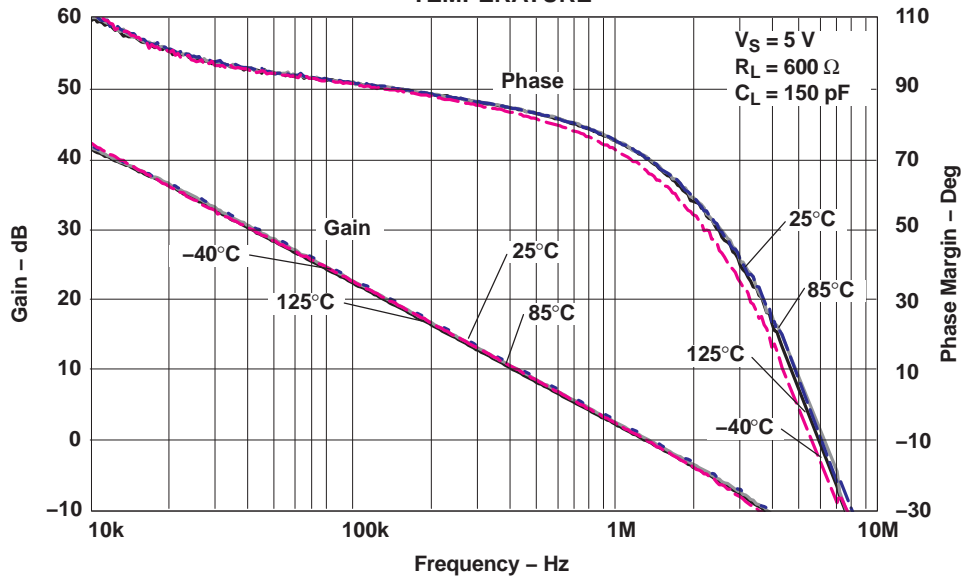


Figure 13.

TYPICAL CHARACTERISTICS (continued)

V<sub>CC+</sub> = 5 V, Single Supply, T<sub>A</sub> = 25°C (unless otherwise specified)

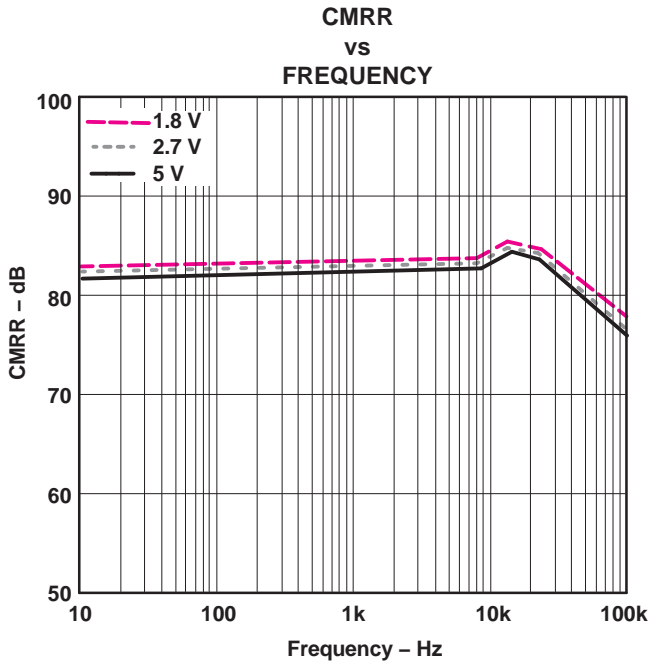


Figure 14.

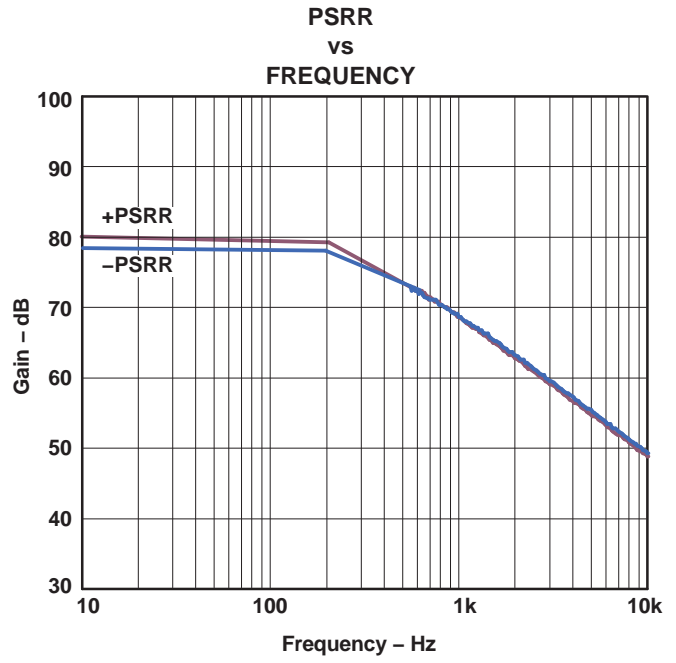


Figure 15.

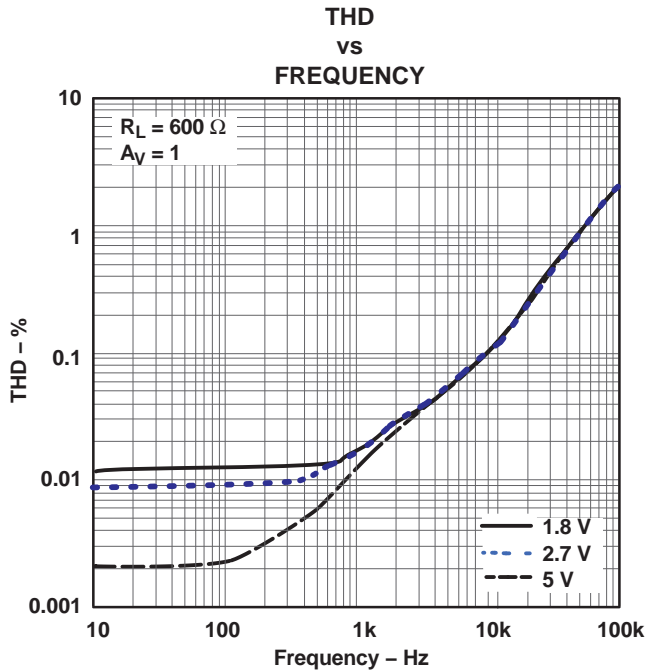


Figure 16.

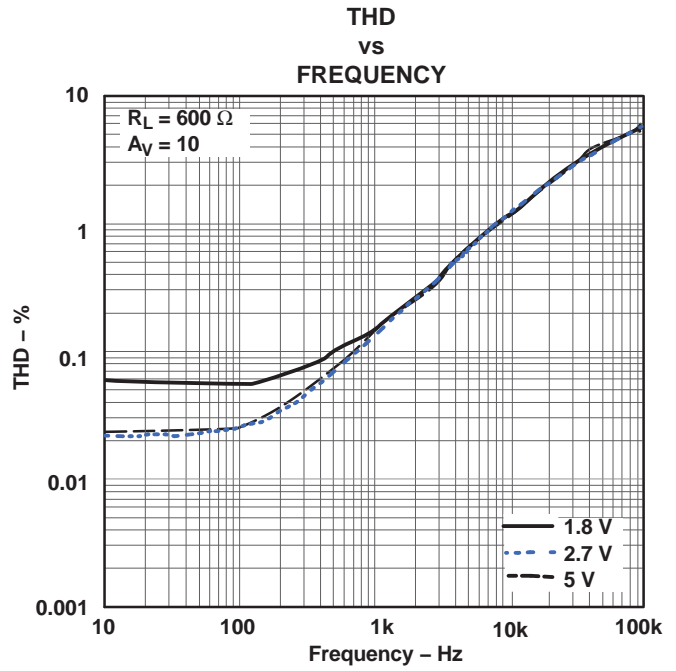


Figure 17.

**TYPICAL CHARACTERISTICS (continued)**

$V_{CC+} = 5\text{ V}$ , Single Supply,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)

**SMALL-SIGNAL NONINVERTING RESPONSE**

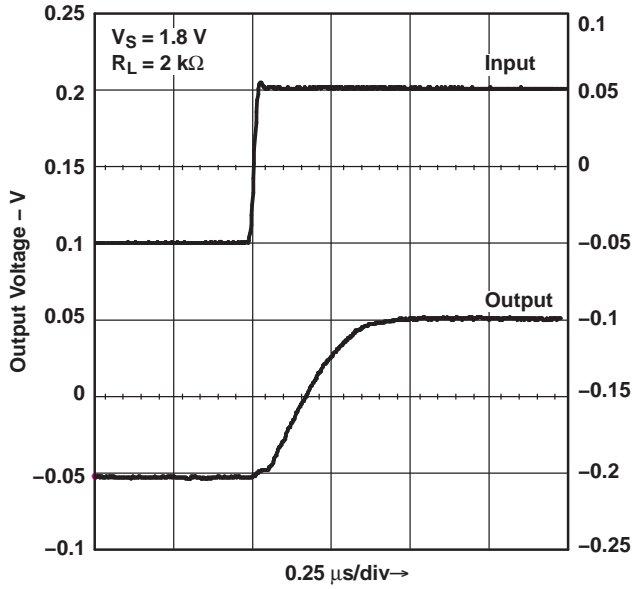


Figure 18.

**SMALL-SIGNAL NONINVERTING RESPONSE**

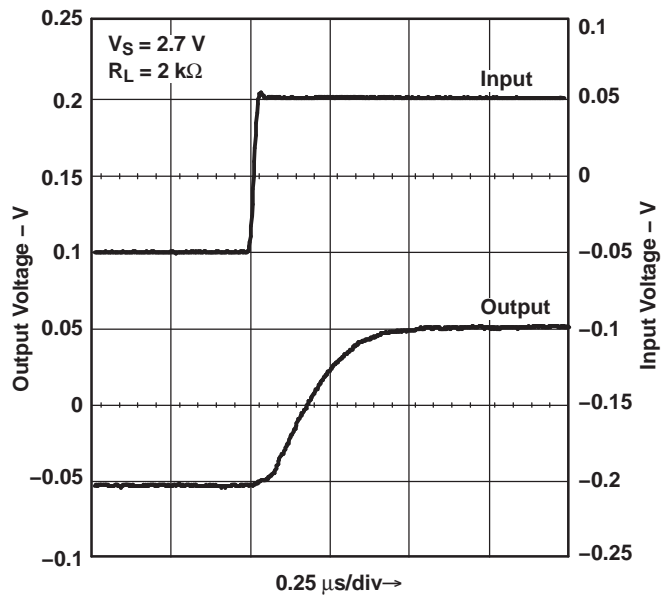


Figure 19.

**SMALL-SIGNAL NONINVERTING RESPONSE**

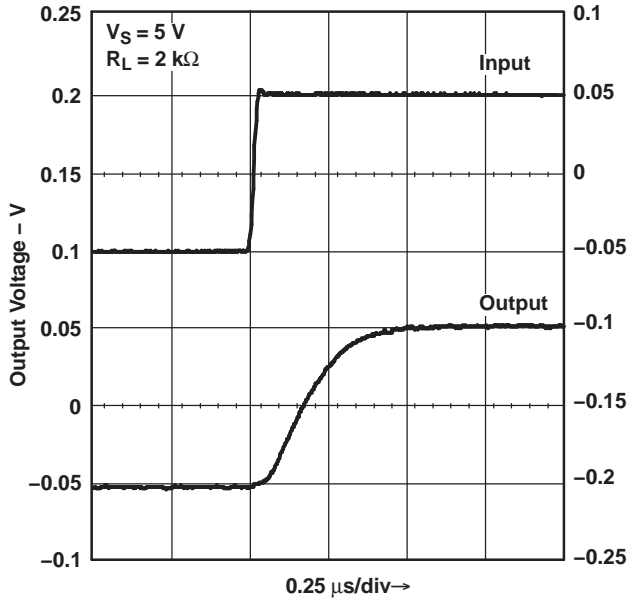


Figure 20.

**LARGE-SIGNAL NONINVERTING RESPONSE**

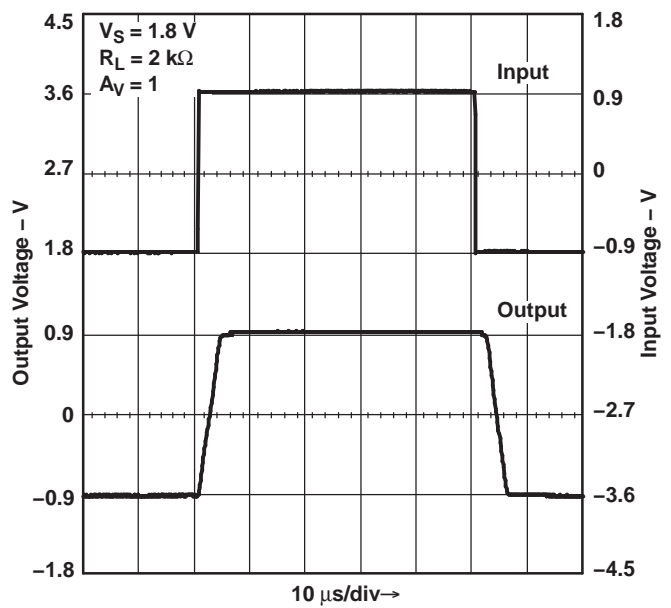


Figure 21.

TYPICAL CHARACTERISTICS (continued)

V<sub>CC+</sub> = 5 V, Single Supply, T<sub>A</sub> = 25°C (unless otherwise specified)

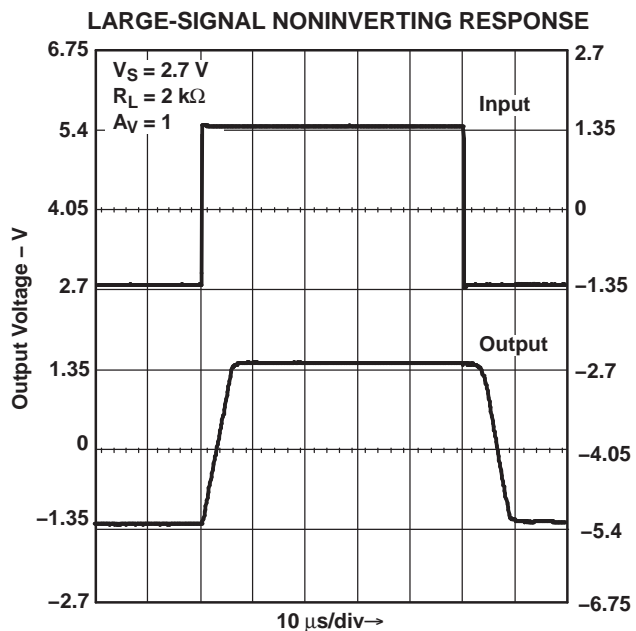


Figure 22.

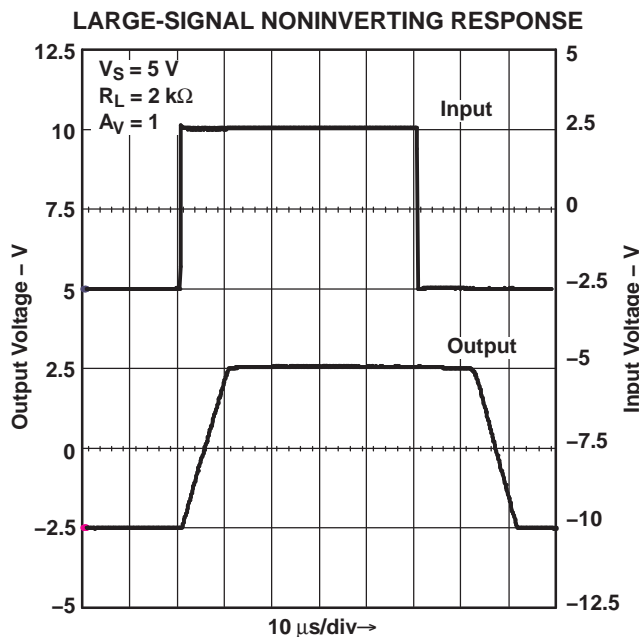


Figure 23.

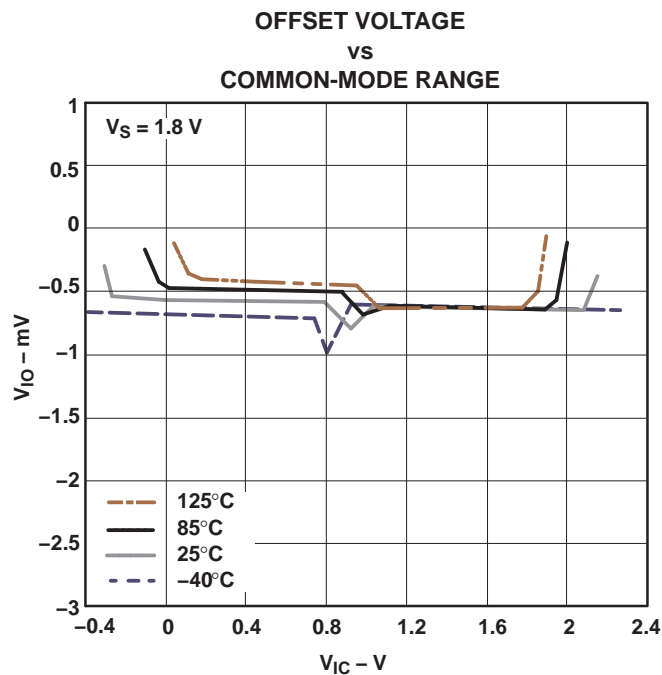


Figure 24.

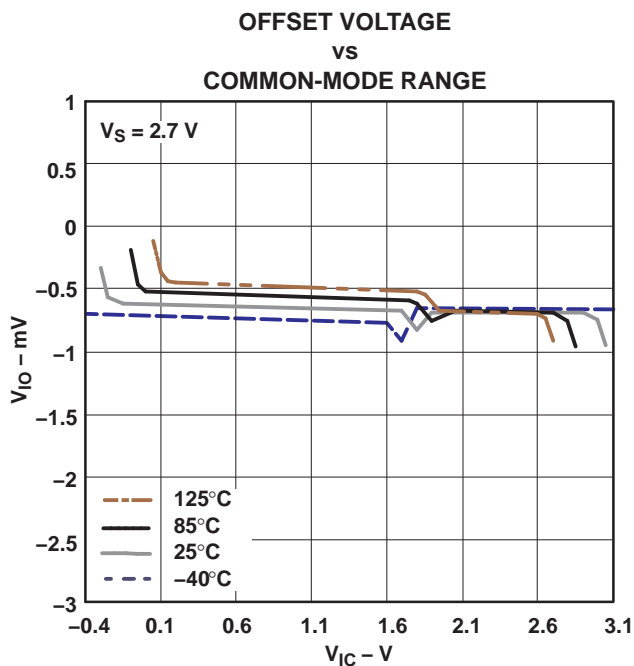


Figure 25.

**TYPICAL CHARACTERISTICS (continued)**

$V_{CC+} = 5\text{ V}$ , Single Supply,  $T_A = 25^\circ\text{C}$  (unless otherwise specified)

**OFFSET VOLTAGE  
 vs  
 COMMON-MODE RANGE**

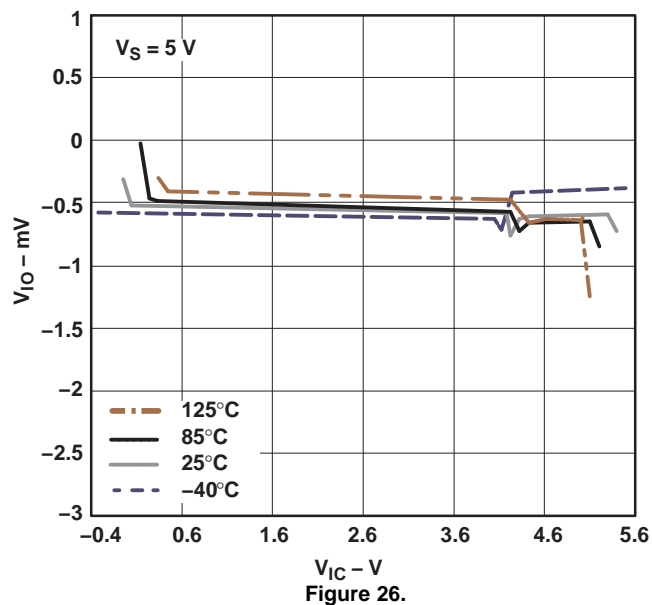


Figure 26.

**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
LMV931IDBVR	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 125	(RBBB ~ RBBC ~ RBBI)	
LMV931IDBVRE4	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 125		
LMV931IDBVRG4	OBSOLETE	SOT-23	DBV	5		TBD	Call TI	Call TI	-40 to 125		
LMV931IDCKR	OBSOLETE	SC70	DCK	5		TBD	Call TI	Call TI	-40 to 125	(RBB ~ RBC ~ RBI)	
LMV931IDCKRE4	OBSOLETE	SC70	DCK	5		TBD	Call TI	Call TI	-40 to 125		
LMV931IDCKRG4	OBSOLETE	SC70	DCK	5		TBD	Call TI	Call TI	-40 to 125		
LMV932ID	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 125	MV932I	
LMV932IDE4	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 125		
LMV932IDG4	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 125		
LMV932IDGKR	OBSOLETE	VSSOP	DGK	8		TBD	Call TI	Call TI	-40 to 125	(RD6 ~ RDB)	
LMV932IDGKRG4	OBSOLETE	VSSOP	DGK	8		TBD	Call TI	Call TI	-40 to 125		
LMV932IDR	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 125	MV932I	
LMV932IDRE4	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 125		
LMV932IDRG4	OBSOLETE	SOIC	D	8		TBD	Call TI	Call TI	-40 to 125		
LMV934ID	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-40 to 125	LMV934I	
LMV934IDE4	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-40 to 125		
LMV934IDG4	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-40 to 125		
LMV934IDR	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-40 to 125	LMV934I	
LMV934IDRE4	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-40 to 125		
LMV934IDRG4	OBSOLETE	SOIC	D	14		TBD	Call TI	Call TI	-40 to 125		
LMV934IPW	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 125	MV934I	
LMV934IPWE4	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 125		
LMV934IPWG4	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 125		
LMV934IPWR	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 125	MV934I	
LMV934IPWRE4	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 125		
LMV934IPWRG4	OBSOLETE	TSSOP	PW	14		TBD	Call TI	Call TI	-40 to 125		

<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.

**OBSOLETE:** 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.

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

<sup>(5)</sup> 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.

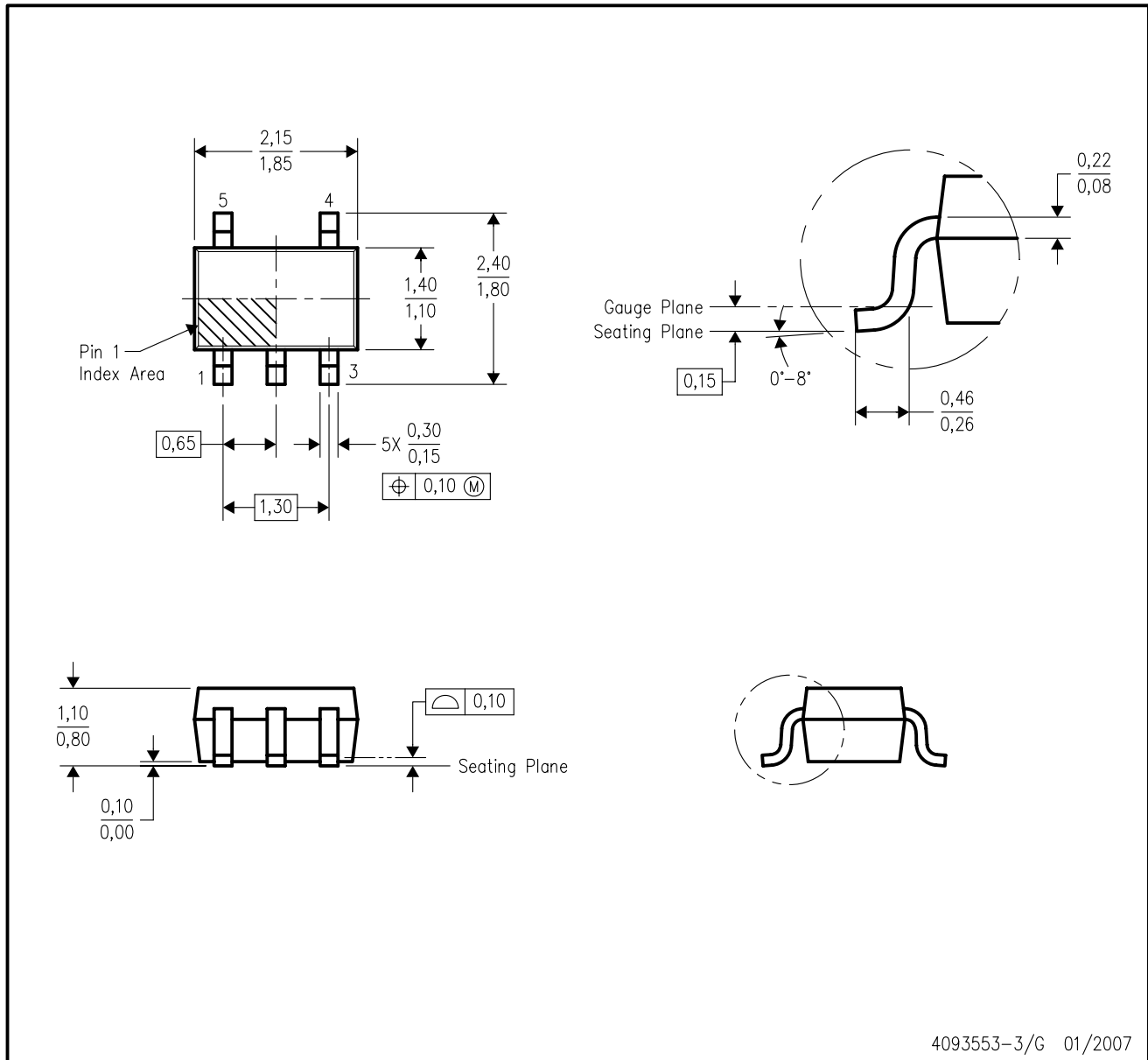
<sup>(6)</sup> Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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DCK (R-PDSO-G5)

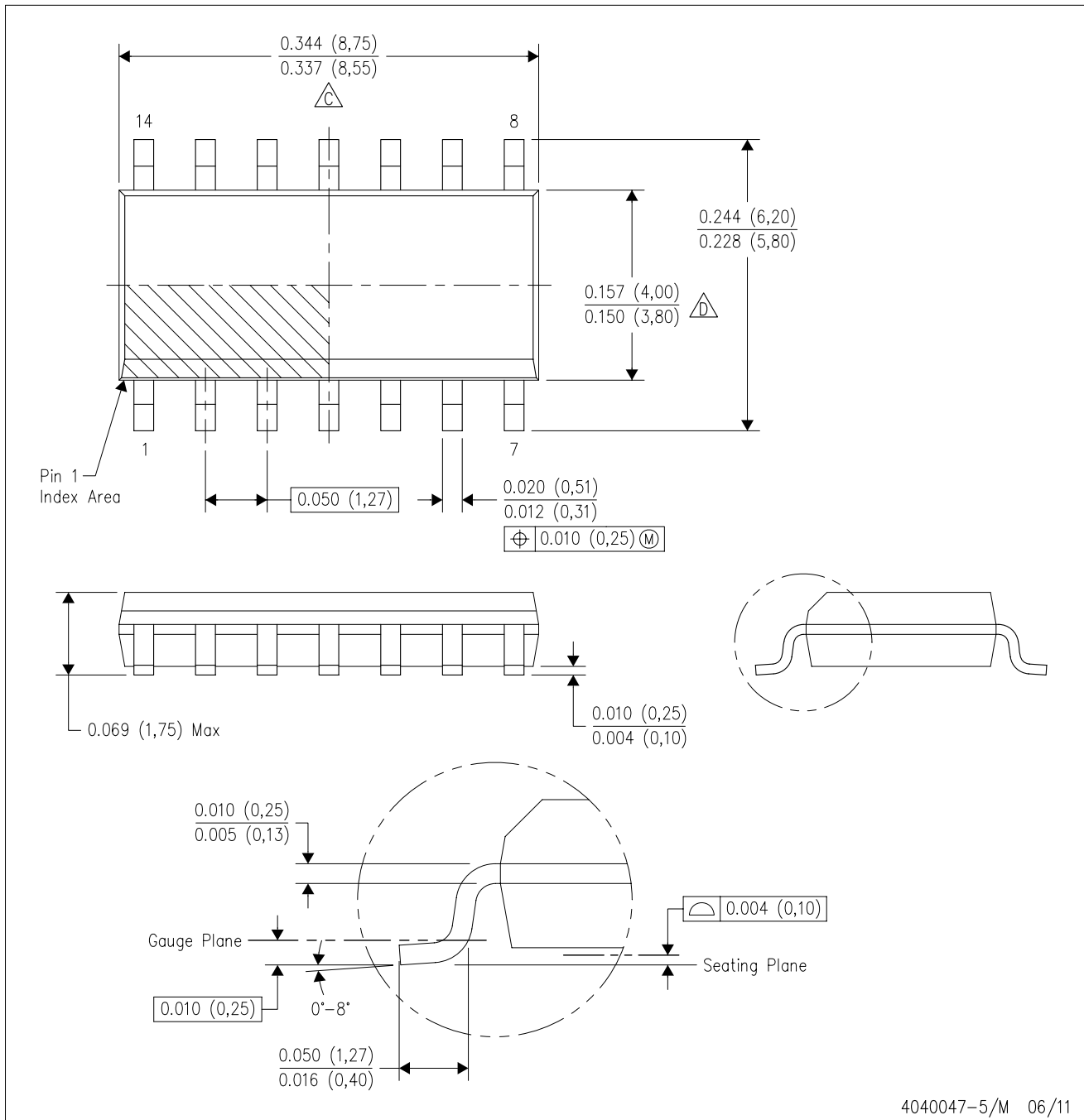
PLASTIC SMALL-OUTLINE PACKAGE



- 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. Falls within JEDEC MO-203 variation AA.

D (R-PDSO-G14)

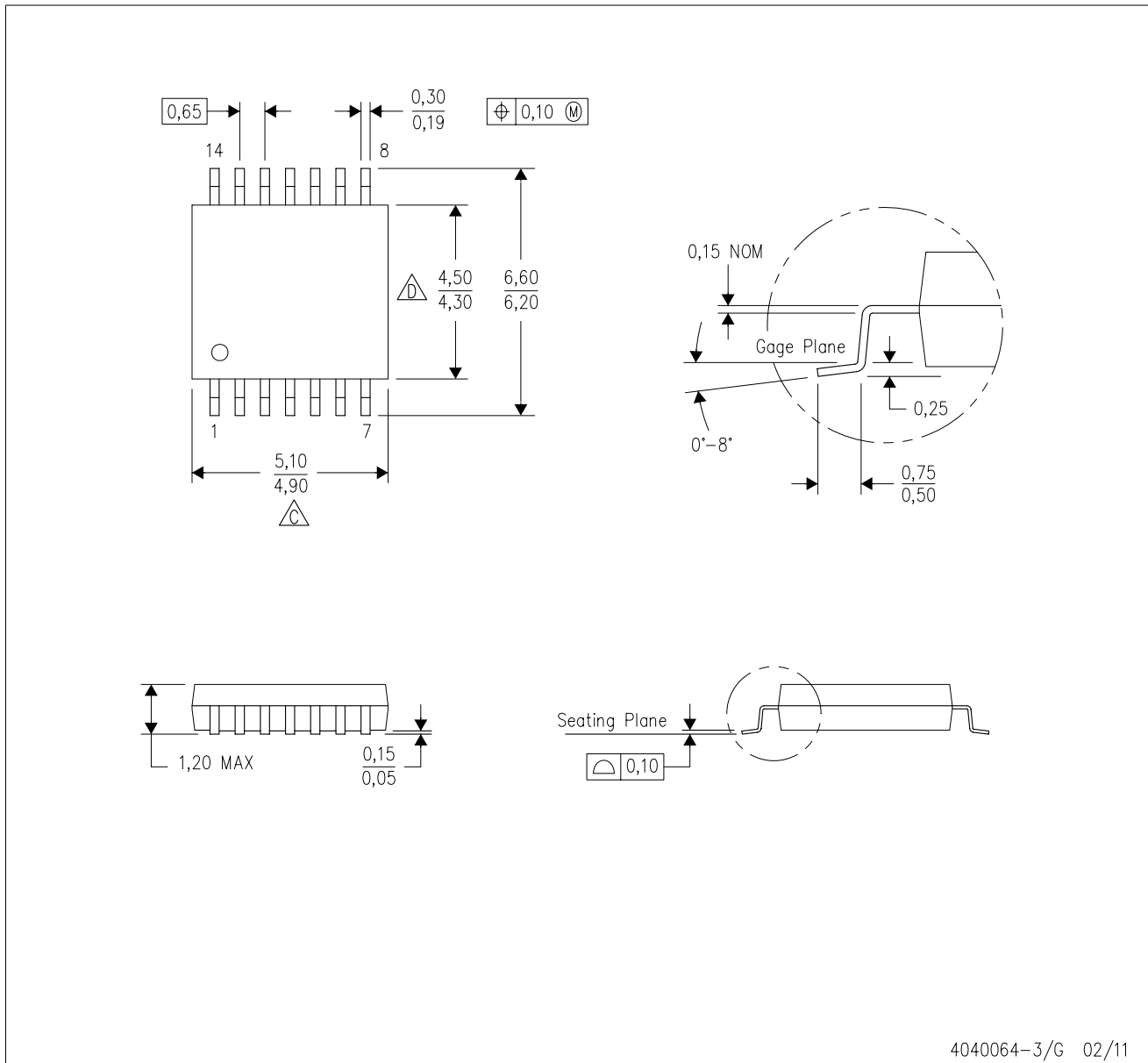
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  -  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  -  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AB.

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



4040064-3/G 02/11

- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  -  C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
  -  D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
  - E. Falls within JEDEC MO-153

D (R-PDSO-G8)

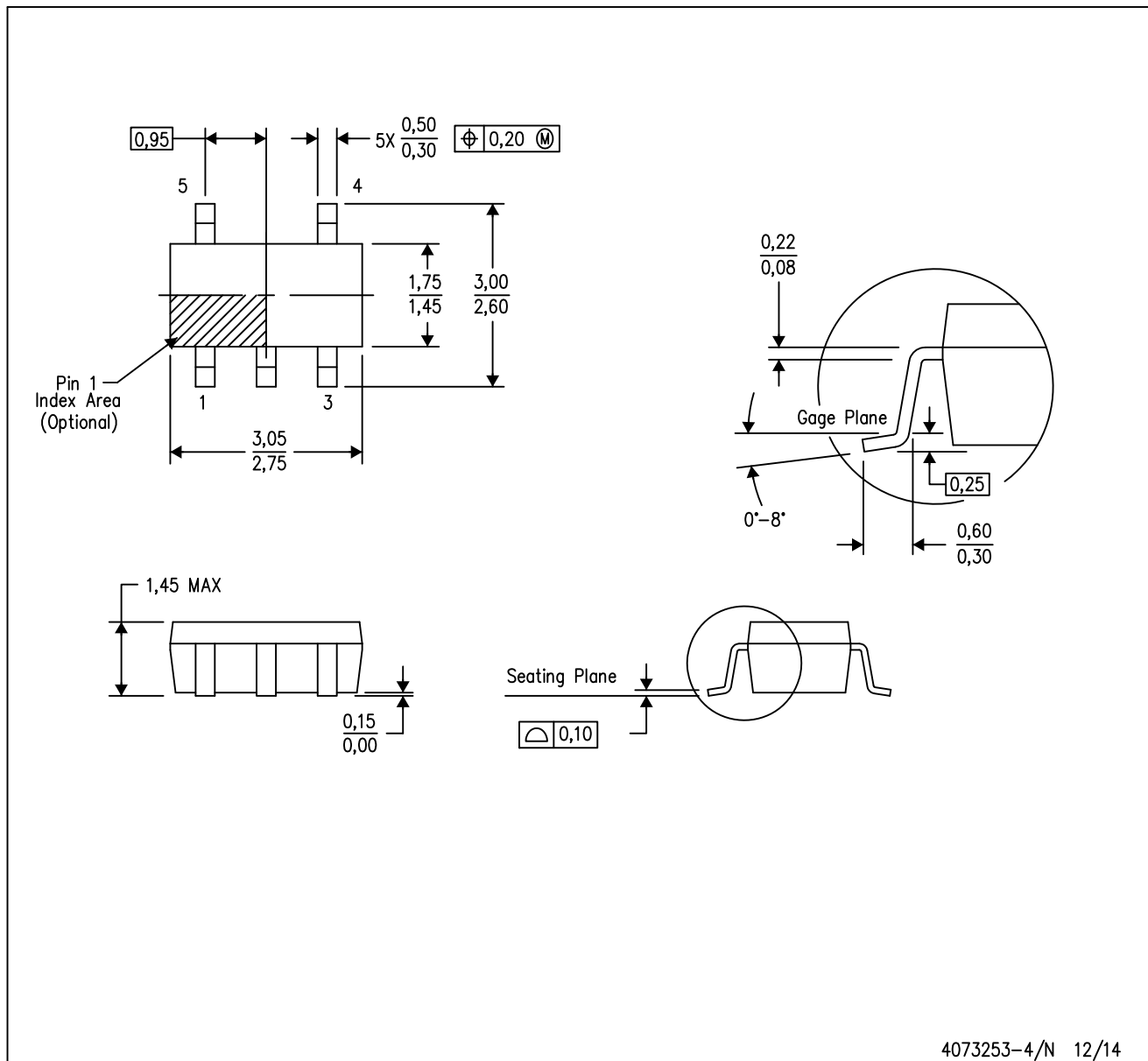
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AA.

DBV (R-PDSO-G5)

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. Falls within JEDEC MO-178 Variation AA.



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