

## FEATURES

- 2.5-V, 2.7-V, and 5-V Performance
- $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  Operation
- No Crossover Distortion
- Low Supply Current at  $V_{\text{CC}+} = 5\text{ V}$ :
  - LMV821...0.3 mA Typ
  - LMV822...0.5 mA Typ
  - LMV824...1 mA Typ
- Rail-to-Rail Output Swing
- Gain Bandwidth of 5.5 MHz Typ at 5 V
- Slew Rate of  $1.9\text{ V}/\mu\text{s}$  Typ at 5 V

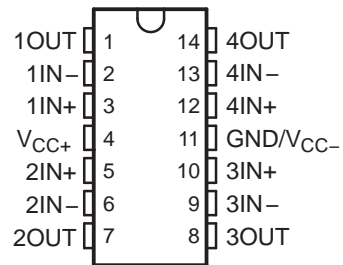
## DESCRIPTION/ ORDERING INFORMATION

The LMV821 single, LMV822 dual, and LMV824 quad devices are low-voltage (2.5 V to 5.5 V), low-power commodity operational amplifiers. Electrical characteristics are very similar to the LMV3xx operational amplifiers (low supply current, rail-to-rail outputs, input common-mode range that includes ground). However, the LMV8xx devices offer a higher bandwidth (5.5 MHz typical) and faster slew rate ( $1.9\text{ V}/\mu\text{s}$  typical).

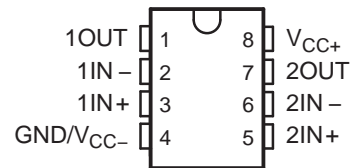
The LMV8xx devices are cost-effective solutions for applications requiring low-voltage/low-power operation and space-saving considerations. The LMV821 is available in the ultra-small DCK package, which is approximately half the size of SOT-23-5. The DCK package saves space on printed circuit boards and enables the design of small portable electronic devices (cordless and cellular phones, laptops, PDAs, PCMIA). It also allows the designer to place the device closer to the signal source to reduce noise pickup and increase signal integrity.

The LMV8xx devices are characterized for operation from  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ . The LMV8xxI devices are characterized for operation from  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .

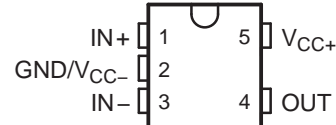
LMV824 . . . D, DGV, OR PW PACKAGE  
(TOP VIEW)



LMV822 . . . D OR DGK PACKAGE  
(TOP VIEW)



LMV821 . . . DBV OR DCK 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.

# LMV821 SINGLE, LMV822 DUAL, LMV824 QUAD LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

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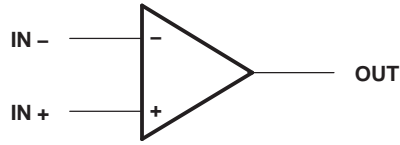
## ORDERING INFORMATION

T <sub>A</sub>	PACKAGE <sup>(1)</sup>		ORDERABLE PART NUMBER	TOP-SIDE MARKING <sup>(2)</sup>	
–40°C to 85°C	Single	SC-70 – DCK	Reel of 3000	LMV821DCKR	RY_
			Reel of 250	LMV821DCKT	
		SOT-23 – DBV	Reel of 3000	LMV821DBVR	RB8_
			Reel of 250	LMV821DBVT	
	Dual	SOIC – D	Tube of 75	LMV822D	MV822
			Reel of 2500	LMV822DR	
		MSOP/VSSOP – DGK	Tube of 100	LMV822DGK	RA_
			Reel of 2500	LMV822DGKR	
	Quad	SOIC – D	Tube of 50	LMV824D	LMV824
			Reel of 2500	LMV824DR	
		TSSOP – PW	Tube of 90	LMV824PW	MV824
			Reel of 2000	LMV824PWR	
TVSOP – DGV		Reel of 2000	LMV824DGV	MV824	
–40°C to 125°C	Single	SC-70 – DCK	Reel of 3000	LMV821IDCKR	RZ_
			Reel of 250	LMV821IDCKT	
		SOT-23 – DBV	Reel of 3000	LMV821IDBVR	RB1_
			Reel of 250	LMV821IDBVT	
	Dual	SOIC – D	Tube of 75	LMV822ID	MV822I
			Reel of 2500	LMV822IDR	
		MSOP/VSSOP – DGK	Tube of 100	LMV822IDGK	R8_
			Reel of 2500	LMV822IDGKR	
	Quad	SOIC – D	Tube of 50	LMV824ID	LMV824I
			Reel of 2500	LMV824IDR	
		TSSOP – PW	Tube of 90	LMV824IPW	MV824I
			Reel of 2000	LMV824IPWR	
TVSOP – DGV		Reel of 2000	LMV824IDGVR	MV824I	

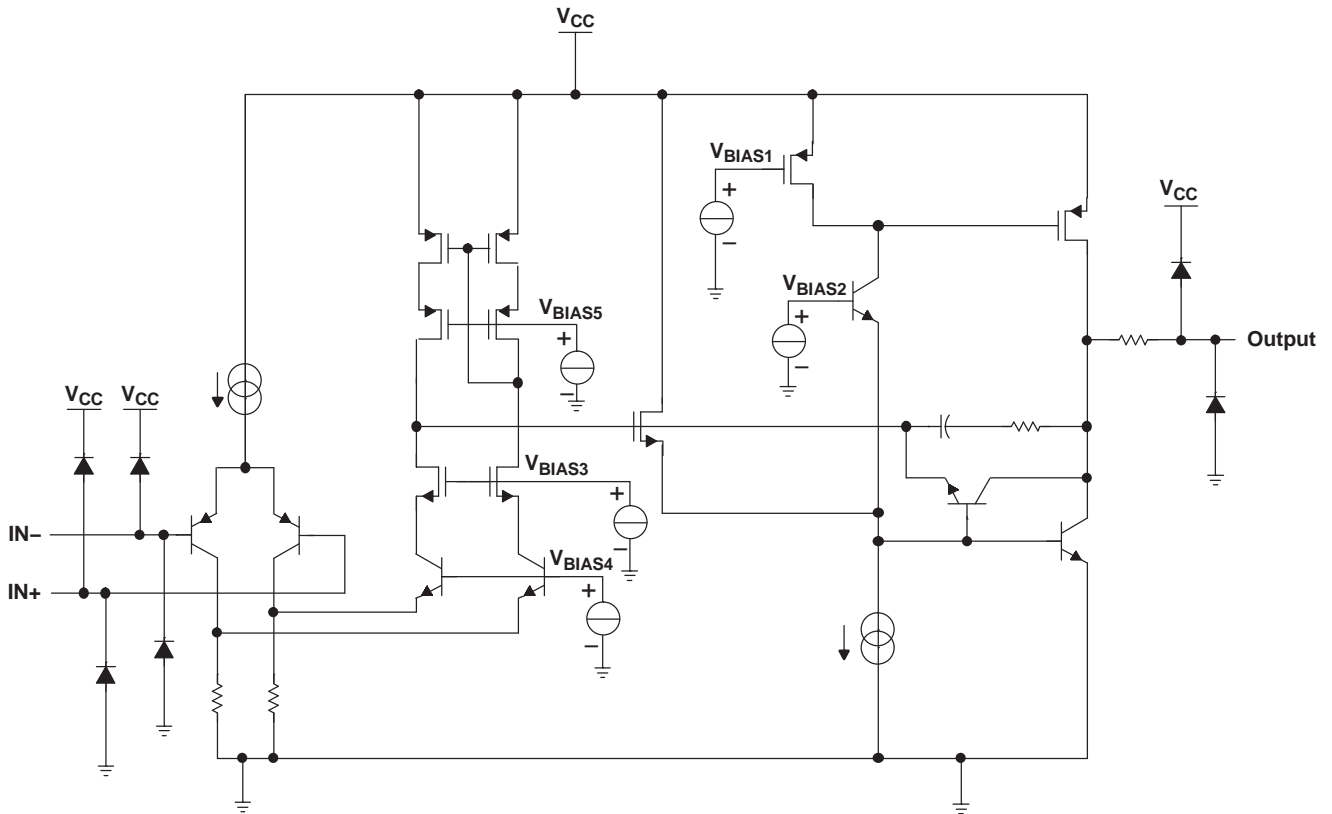
(1) Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

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

**SYMBOL (EACH AMPLIFIER)**



**LMV824 SIMPLIFIED SCHEMATIC**



# LMV821 SINGLE, LMV822 DUAL, LMV824 QUAD LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

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

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

		MIN	MAX	UNIT	
V <sub>CC</sub>	Supply voltage <sup>(2)</sup>		5.5	V	
V <sub>ID</sub>	Differential input voltage <sup>(3)</sup>		±V <sub>CC</sub>	V	
V <sub>I</sub>	Input voltage range (either input)	V <sub>CC-</sub>	V <sub>CC+</sub>	V	
	Duration of output short circuit (one amplifier) to ground <sup>(4)</sup>	At or below T <sub>A</sub> = 25°C, V <sub>CC</sub> ≤ 5.5 V		Unlimited	
θ <sub>JA</sub>	Package thermal impedance <sup>(5)(6)</sup>	D package	8 pin	97	°C/W
			14 pin	86	
		DBV package	206		
		DCK package	252		
		DGK package	172		
		DGV package	127		
PW package	113				
T <sub>J</sub>	Operating virtual junction temperature		150	°C	
T <sub>stg</sub>	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<sub>CC</sub> specified for the measurement of I<sub>OS</sub>) are with respect to the network GND.
- (3) Differential voltages are at IN+ with respect to IN–.
- (4) Short circuits from outputs to V<sub>CC</sub> can cause excessive heating and eventual destruction.
- (5) Maximum power dissipation is a function of T<sub>J(max)</sub>, θ<sub>JA</sub>, and T<sub>A</sub>. The maximum allowable power dissipation at any allowable ambient temperature is P<sub>D</sub> = (T<sub>J(max)</sub> – T<sub>A</sub>)/θ<sub>JA</sub>. Operating at the absolute maximum T<sub>J</sub> 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 <sub>CC</sub>	Supply voltage (single-supply operation)	2.5	5	V	
T <sub>A</sub>	Operating free-air temperature	LMV8xxI	–40	125	°C
		LMV8xx	–40	85	

**LMV8xx 2.5-V Electrical Characteristics**

$V_{CC+} = 2.5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.25\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS		$T_A$	LMV8xx			UNIT
				MIN	TYP	MAX	
$V_{IO}$ Input offset voltage			25°C		1	3.5	mV
			-40°C to 85°C			4	
$V_O$ Output swing	$V_{CC+} = 2.5\text{ V}$ , $R_L = 600\ \Omega$ to 1.25 V	High level	25°C	2.3	2.37		V
			-40°C to 85°C	2.2			
		Low level	25°C		0.13	0.2	
			-40°C to 85°C			0.3	
	$V_{CC+} = 2.5\text{ V}$ , $R_L = 2\text{ k}\Omega$ to 1.25 V	High level	25°C	2.4	2.46		
			-40°C to 85°C	2.3			
		Low level	25°C		0.08	0.12	
			-40°C to 85°C			0.2	

**LMV8xxI 2.5-V Electrical Characteristics**

$V_{CC+} = 2.5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.25\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS		$T_A$	LMV8xxI			UNIT
				MIN	TYP	MAX	
$V_{IO}$ Input offset voltage			25°C		1	3.5	mV
			-40°C to 125°C			5.5	
$V_O$ Output swing	$V_{CC+} = 2.5\text{ V}$ , $R_L = 600\ \Omega$ to 1.25 V	High level	25°C	2.28	2.37		V
			-40°C to 125°C	2.18			
		Low level	25°C		0.13	0.22	
			-40°C to 125°C			0.32	
	$V_{CC+} = 2.5\text{ V}$ , $R_L = 2\text{ k}\Omega$ to 1.25 V	High level	25°C	2.38	2.46		
			-40°C to 125°C	2.28			
		Low level	25°C		0.08	0.14	
			-40°C to 125°C			0.22	

# LMV821 SINGLE, LMV822 DUAL, LMV824 QUAD LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

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## LMV8xx 2.7-V Electrical Characteristics

$V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	LMV8xx			UNIT	
			MIN	TYP	MAX		
$V_{IO}$ Input offset voltage		25°C		1	3.5	mV	
		-40°C to 85°C			4		
$\alpha_{VIO}$ Average temperature coefficient of input offset voltage		25°C		1		$\mu\text{V}/^\circ\text{C}$	
$I_{IB}$ Input bias current		25°C		30	90	nA	
		-40°C to 85°C			140		
$I_{IO}$ Input offset current		25°C		0.5	30	nA	
		-40°C to 85°C			50		
CMRR Common-mode rejection ratio	$V_{IC} = 0$ to 1.7 V	25°C	70	85		dB	
		-40°C to 85°C	68				
$+k_{SVR}$ Positive supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V}$ to 4 V, $V_{CC-} = -1\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$	25°C	75	85		dB	
		-40°C to 85°C	70				
$-k_{SVR}$ Negative supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V}$ , $V_{CC-} = -1\text{ V}$ to -3.3 V, $V_O = 0$ , $V_{IC} = 0$	25°C	73	85		dB	
		-40°C to 85°C	70				
$V_{ICR}$ Common-mode input voltage range	CMRR $\geq 50$ dB	25°C	-0.2 to 1.9	-0.3 to 2		V	
$A_v$ Large-signal voltage amplification	$R_L = 600\ \Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 2.2 V	Sourcing	25°C	90	100	dB	
			-40°C to 85°C	85			
	$R_L = 600\ \Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 0.5 V	Sinking	25°C	85	90		
			-40°C to 85°C	80			
	$R_L = 2\text{ k}\Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 2.2 V	Sourcing	25°C	95	100		
			-40°C to 85°C	90			
	$R_L = 2\text{ k}\Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 0.5 V	Sinking	25°C	90	95		
			-40°C to 85°C	85			
$V_O$ Output swing	$V_{CC+} = 2.7\text{ V}$ , $R_L = 600\ \Omega$ to 1.35 V	High level	25°C	2.5	2.58	V	
				-40°C to 85°C	2.4		
		Low level	25°C		0.13		0.2
				-40°C to 85°C			0.3
	$V_{CC+} = 2.7\text{ V}$ , $R_L = 2\text{ k}\Omega$ to 1.35 V	High level	25°C	2.6	2.66		
				-40°C to 85°C	2.5		
		Low level	25°C		0.08		0.12
				-40°C to 85°C			0.2
$I_O$ Output current	$V_O = 0\text{ V}$	Sourcing	25°C	12	16	mA	
	$V_O = 2.7\text{ V}$	Sinking	25°C	12	26		
$I_{CC}$ Supply current	LMV821		25°C	0.22	0.3	mA	
			-40°C to 85°C		0.5		
	LMV822 (both amplifiers)		25°C	0.45	0.6		
			-40°C to 85°C		0.8		
	LMV824 (all four amplifiers)		25°C	0.72	1		
			-40°C to 85°C		1.2		

**LMV8xx 2.7-V Electrical Characteristics (continued)**
 $V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	$T_A$	LMV8xx			UNIT
				MIN	TYP	MAX	
SR	Slew rate <sup>(1)</sup>		25°C		1.7		V/ $\mu$ s
GBW	Gain bandwidth product	(2)	25°C		5		MHz
$\Phi_m$	Phase margin	(2)	25°C		60		deg
	Gain margin	(2)	25°C		8.6		dB
	Amplifier-to-amplifier isolation	$V_{CC+} = 5\text{ V}$ , $R_L = 100\text{ k}\Omega$ to $2.5\text{ V}$ <sup>(3)</sup>	25°C		135		dB
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$ , $V_{IC} = 1\text{ V}$	25°C		45		nV/ $\sqrt{\text{Hz}}$
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$	25°C		0.18		pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , $A_V = -2$ , $R_L = 10\text{ k}\Omega$ , $V_O = 4.1\text{ V}_{p-p}$	25°C		0.01		%

(1) Connected as voltage follower with 1-V step input. Value specified is the slower of the positive and negative slew rates.

(2) 40-dB closed-loop dc gain,  $C_L = 22\text{ pF}$

(3) Each amplifier excited in turn with 1 kHz to produce  $V_O = 3\text{ V}_{p-p}$

# LMV821 SINGLE, LMV822 DUAL, LMV824 QUAD LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

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## LMV8xxI 2.7-V Electrical Characteristics

$V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	LMV8xxI			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage		25°C		1	3.5	mV
		–40°C to 125°C			5.5	
$\alpha_{VIO}$ Average temperature coefficient of input offset voltage		25°C		1		$\mu\text{V}/^\circ\text{C}$
$I_{IB}$ Input bias current		25°C		30	90	nA
		–40°C to 125°C			140	
$I_{IO}$ Input offset current		25°C		0.5	30	nA
		–40°C to 125°C			50	
CMRR Common-mode rejection ratio	$V_{IC} = 0$ to 1.7 V	25°C	70	85		dB
		–40°C to 125°C	68			
$+k_{SVR}$ Positive supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V}$ to 4 V, $V_{CC-} = -1\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$	25°C	75	85		dB
		–40°C to 125°C	70			
$-k_{SVR}$ Negative supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V}$ , $V_{CC-} = -1\text{ V}$ to –3.3 V, $V_O = 0$ , $V_{IC} = 0$	25°C	73	85		dB
		–40°C to 125°C	70			
$V_{ICR}$ Common-mode input voltage range	CMRR $\geq 50\text{ dB}$	25°C	–0.2 to 1.9	–0.3 to 2		V
$A_V$ Large-signal voltage amplification	$R_L = 600\ \Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 2.2 V	Sourcing	25°C	90	100	dB
			–40°C to 125°C	85		
	$R_L = 600\ \Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 0.5 V	Sinking	25°C	85	90	
			–40°C to 125°C	80		
$R_L = 2\text{ k}\Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 2.2 V	Sourcing	25°C	95	100		
		–40°C to 125°C	90			
$R_L = 2\text{ k}\Omega$ to 1.35 V, $V_O = 1.35\text{ V}$ to 0.5 V	Sinking	25°C	90	95		
		–40°C to 125°C	85			
$V_O$ Output swing	$V_{CC+} = 2.7\text{ V}$ , $R_L = 600\ \Omega$ to 1.35 V	High level	25°C	2.5	2.58	V
			–40°C to 125°C	2.4		
	Low level	25°C		0.13	0.2	
		–40°C to 125°C			0.3	
	$V_{CC+} = 2.7\text{ V}$ , $R_L = 2\text{ k}\Omega$ to 1.35 V	High level	25°C	2.6	2.66	
			–40°C to 125°C	2.5		
Low level	25°C		0.08	0.12		
	–40°C to 125°C			0.2		
$I_O$ Output current	$V_O = 0\text{ V}$	Sourcing	25°C	12	16	mA
	$V_O = 2.7\text{ V}$	Sinking	25°C	12	26	
$I_{CC}$ Supply current	LMV821		25°C	0.22	0.3	mA
			–40°C to 125°C		0.5	
	LMV822 (both amplifiers)		25°C	0.45	0.6	
			–40°C to 125°C		0.8	
	LMV824 (all four amplifiers)		25°C	0.72	1	
			–40°C to 125°C		1.2	



**LMV8xxI 2.7-V Electrical Characteristics (continued)**
 $V_{CC+} = 2.7\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 1\text{ V}$ ,  $V_O = 1.35\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	$T_A$	LMV8xxI			UNIT
				MIN	TYP	MAX	
SR	Slew rate <sup>(1)</sup>		25°C		1.7		V/ $\mu$ s
GBW	Gain bandwidth product	(2)	25°C		5		MHz
$\Phi_m$	Phase margin	(2)	25°C		60		deg
	Gain margin	(2)	25°C		8.6		dB
	Amplifier-to-amplifier isolation	$V_{CC+} = 5\text{ V}$ , $R_L = 100\text{ k}\Omega$ to $2.5\text{ V}$ <sup>(3)</sup>	25°C		135		dB
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$ , $V_{IC} = 1\text{ V}$	25°C		45		nV/ $\sqrt{\text{Hz}}$
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$	25°C		0.18		pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , $A_V = -2$ , $R_L = 10\text{ k}\Omega$ , $V_O = 4.1\text{ V}_{p-p}$	25°C		0.01		%

(1) Connected as voltage follower with 1-V step input. Value specified is the slower of the positive and negative slew rates.

(2) 40-dB closed-loop dc gain,  $C_L = 22\text{ pF}$

(3) Each amplifier excited in turn with 1 kHz to produce  $V_O = 3\text{ V}_{p-p}$

# LMV821 SINGLE, LMV822 DUAL, LMV824 QUAD LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

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## LMV8xx 5-V Electrical Characteristics

$V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 2\text{ V}$ ,  $V_O = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	LMV8xx			UNIT	
			MIN	TYP	MAX		
$V_{IO}$ Input offset voltage		25°C		1	3.5	mV	
		-40°C to 85°C			4		
$\alpha_{VIO}$ Average temperature coefficient of input offset voltage		25°C		1		$\mu\text{V}/^\circ\text{C}$	
$I_{IB}$ Input bias current		25°C		40	100	nA	
		-40°C to 85°C			150		
$I_{IO}$ Input offset current		25°C		0.5	30	nA	
		-40°C to 85°C			50		
CMRR Common-mode rejection ratio	$V_{IC} = 0\text{ to }4\text{ V}$	25°C	72	90		dB	
		-40°C to 85°C	70				
$+k_{SVR}$ Positive supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V to }4\text{ V}$ , $V_{CC-} = -1\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$	25°C	75	85		dB	
		-40°C to 85°C	70				
$-k_{SVR}$ Negative supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V}$ , $V_{CC-} = -1\text{ V to }-3.3\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$	25°C	73	85		dB	
		-40°C to 85°C	70				
$V_{ICR}$ Common-mode input voltage range	CMRR $\geq 50\text{ dB}$	25°C	-0.2 to 4.2	-0.3 to 4.3		V	
$A_v$ Large-signal voltage amplification	$R_L = 600\ \Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }4.5\text{ V}$	Sourcing	25°C	95	105	dB	
			-40°C to 85°C	90			
	$R_L = 600\ \Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }0.5\text{ V}$	Sinking	25°C	95	105		
			-40°C to 85°C	90			
	$R_L = 2\text{ k}\Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }4.5\text{ V}$	Sourcing	25°C	95	105		
			-40°C to 85°C	90			
	$R_L = 2\text{ k}\Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }0.5\text{ V}$	Sinking	25°C	95	105		
			-40°C to 85°C	90			
$V_O$ Output swing	$V_{CC+} = 5\text{ V}$ , $R_L = 600\ \Omega\text{ to }2.5\text{ V}$	High level	25°C	4.75	4.84	V	
			-40°C to 85°C	4.7			
		Low level	25°C		0.17		0.25
			-40°C to 85°C				0.3
	$V_{CC+} = 5\text{ V}$ , $R_L = 2\text{ k}\Omega\text{ to }2.5\text{ V}$	High level	25°C	4.85	4.9		
			-40°C to 85°C	4.8			
		Low level	25°C		0.1		0.15
			-40°C to 85°C				0.2
$I_O$ Output current	$V_O = 0\text{ V}$	Sourcing	25°C	20	45	mA	
			-40°C to 85°C	15			
	$V_O = 5\text{ V}$	Sinking	25°C	20	40		
			-40°C to 85°C	15			
$I_{CC}$ Supply current	LMV821		25°C	0.3	0.4	mA	
			-40°C to 85°C		0.6		
	LMV822 (both amplifiers)		25°C	0.5	0.7		
			-40°C to 85°C		0.9		
	LMV824 (all four amplifiers)		25°C	1	1.3		
			-40°C to 85°C		1.5		

**LMV8xx 5-V Electrical Characteristics (continued)**
 $V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 2\text{ V}$ ,  $V_O = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	$T_A$	LMV8xx			UNIT
				MIN	TYP	MAX	
SR	Slew rate	$V_{CC+} = 5\text{ V}^{(1)}$	25°C	1.4	1.9		V/ $\mu$ s
GBW	Gain bandwidth product	(2)	25°C		5.5		MHz
$\Phi_m$	Phase margin	(2)	25°C		64.2		deg
	Gain margin	(2)	25°C		8.7		dB
	Amplifier-to-amplifier isolation	$V_{CC+} = 5\text{ V}$ , $R_L = 100\text{ k}\Omega$ to $2.5\text{ V}^{(3)}$	25°C		135		dB
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$ , $V_{IC} = 1\text{ V}$	25°C		42		nV/ $\sqrt{\text{Hz}}$
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$	25°C		0.2		pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , $A_V = -2$ , $R_L = 10\text{ k}\Omega$ , $V_O = 4.1\text{ V}_{p-p}$	25°C		0.01		%

(1) Connected as voltage follower with 3-V step input. Value specified is the slower of the positive and negative slew rates.

(2) 40-dB closed-loop dc gain,  $C_L = 22\text{ pF}$

(3) Each amplifier excited in turn with 1 kHz to produce  $V_O = 3\text{ V}_{p-p}$

# LMV821 SINGLE, LMV822 DUAL, LMV824 QUAD LOW-VOLTAGE RAIL-TO-RAIL OUTPUT OPERATIONAL AMPLIFIERS

SLOS434I—FEBRUARY 2004—REVISED JULY 2006

## LMV8xxI 5-V Electrical Characteristics

$V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 2\text{ V}$ ,  $V_O = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS	$T_A$	LMV8xxI			UNIT
			MIN	TYP	MAX	
$V_{IO}$ Input offset voltage		25°C		1	3.5	mV
		-40°C to 125°C			5.5	
$\alpha_{VIO}$ Average temperature coefficient of input offset voltage		25°C		1		$\mu\text{V}/^\circ\text{C}$
$I_{IB}$ Input bias current		25°C		40	100	nA
		-40°C to 125°C			150	
$I_{IO}$ Input offset current		25°C		0.5	30	nA
		-40°C to 125°C			50	
CMRR Common-mode rejection ratio	$V_{IC} = 0\text{ to }4\text{ V}$	25°C	72	90		dB
		-40°C to 125°C	70			
$+k_{SVR}$ Positive supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V to }4\text{ V}$ , $V_{CC-} = -1\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$	25°C	75	85		dB
		-40°C to 125°C	70			
$-k_{SVR}$ Negative supply-voltage rejection ratio	$V_{CC+} = 1.7\text{ V}$ , $V_{CC-} = -1\text{ V to }-3.3\text{ V}$ , $V_O = 0$ , $V_{IC} = 0$	25°C	73	85		dB
		-40°C to 125°C	70			
$V_{ICR}$ Common-mode input voltage range	CMRR $\geq 50\text{ dB}$	25°C	-0.2 to 4.2	-0.3 to 4.3		V
$A_V$ Large-signal voltage amplification	$R_L = 600\ \Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }4.5\text{ V}$	Sourcing	25°C	95	105	dB
			-40°C to 125°C	90		
	$R_L = 600\ \Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }0.5\text{ V}$	Sinking	25°C	95	105	
			-40°C to 125°C	90		
$R_L = 2\text{ k}\Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }4.5\text{ V}$	Sourcing	25°C	95	105		
		-40°C to 125°C	90			
$R_L = 2\text{ k}\Omega\text{ to }2.5\text{ V}$ , $V_O = 2.5\text{ V to }0.5\text{ V}$	Sinking	25°C	95	105		
		-40°C to 125°C	90			
$V_O$ Output swing	$V_{CC+} = 5\text{ V}$ , $R_L = 600\ \Omega\text{ to }2.5\text{ V}$	High level	25°C	4.75	4.84	V
			-40°C to 125°C	4.6		
		Low level	25°C		0.17	
	-40°C to 125°C				0.3	
	$V_{CC+} = 5\text{ V}$ , $R_L = 2\text{ k}\Omega\text{ to }2.5\text{ V}$	High level	25°C	4.85	4.9	
			-40°C to 125°C	4.8		
Low level		25°C		0.1	0.15	
	-40°C to 125°C			0.2		
$I_O$ Output current	$V_O = 0\text{ V}$	Sourcing	25°C	20	45	mA
			-40°C to 125°C	15		
	$V_O = 5\text{ V}$	Sinking	25°C	20	40	
			-40°C to 125°C	15		
$I_{CC}$ Supply current	LMV821		25°C	0.3	0.4	mA
			-40°C to 125°C		0.6	
	LMV822 (both amplifiers)		25°C	0.5	0.7	
			-40°C to 125°C		0.9	
	LMV824 (all four amplifiers)		25°C	1	1.3	
			-40°C to 125°C		1.5	

**LMV8xxI 5-V Electrical Characteristics (continued)**
 $V_{CC+} = 5\text{ V}$ ,  $V_{CC-} = 0\text{ V}$ ,  $V_{IC} = 2\text{ V}$ ,  $V_O = 2.5\text{ V}$ , and  $R_L > 1\text{ M}\Omega$  (unless otherwise noted)

PARAMETER		TEST CONDITIONS	$T_A$	LMV8xxI			UNIT
				MIN	TYP	MAX	
SR	Slew rate	$V_{CC+} = 5\text{ V}^{(1)}$	25°C	1.4	1.9		V/ $\mu$ s
GBW	Gain bandwidth product	(2)	25°C		5.5		MHz
$\Phi_m$	Phase margin	(2)	25°C		64.2		deg
	Gain margin	(2)	25°C		8.7		dB
	Amplifier-to-amplifier isolation	$V_{CC+} = 5\text{ V}$ , $R_L = 100\text{ k}\Omega$ to $2.5\text{ V}^{(3)}$	25°C		135		dB
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$ , $V_{IC} = 1\text{ V}$	25°C		42		nV/ $\sqrt{\text{Hz}}$
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$	25°C		0.2		pA/ $\sqrt{\text{Hz}}$
THD	Total harmonic distortion	$f = 1\text{ kHz}$ , $A_V = -2$ , $R_L = 10\text{ k}\Omega$ , $V_O = 4.1\text{ V}_{p-p}$	25°C		0.01		%

- (1) Connected as voltage follower with 3-V step input. Value specified is the slower of the positive and negative slew rates.  
 (2) 40-dB closed-loop dc gain,  $C_L = 22\text{ pF}$   
 (3) Each amplifier excited in turn with 1 kHz to produce  $V_O = 3\text{ V}_{p-p}$

TYPICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)

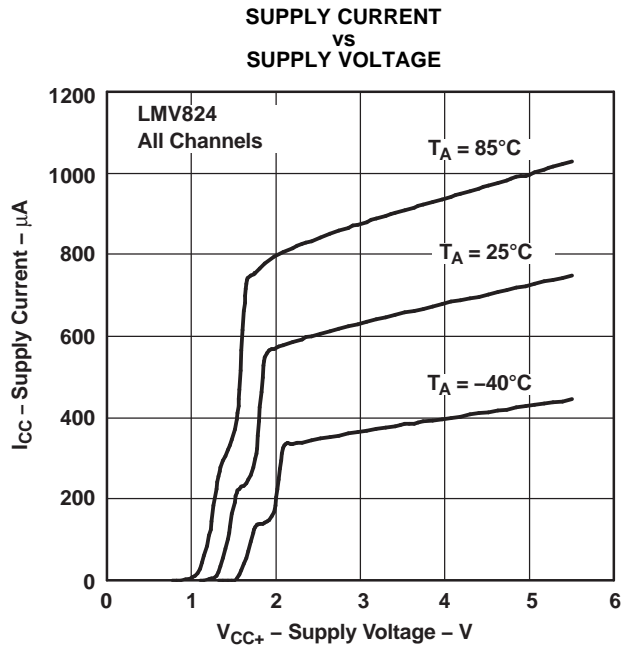


Figure 1.

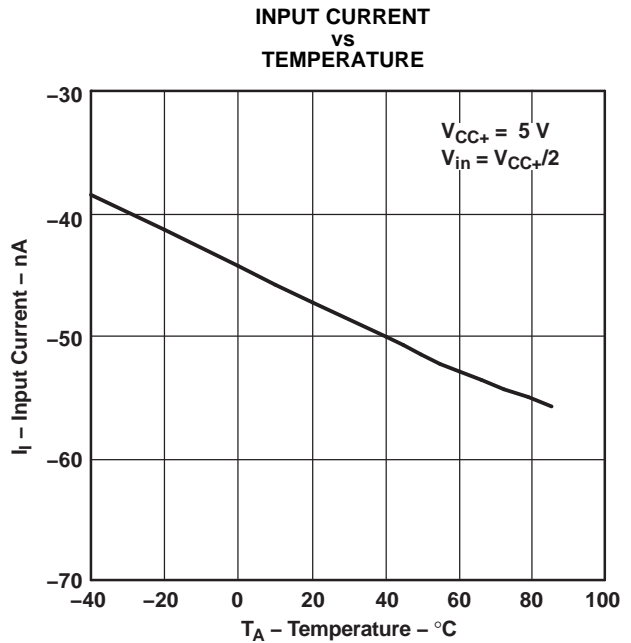


Figure 2.

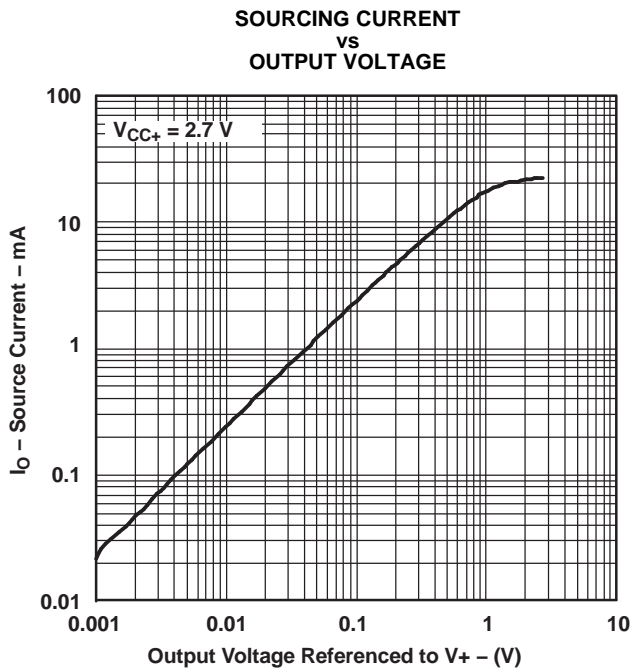


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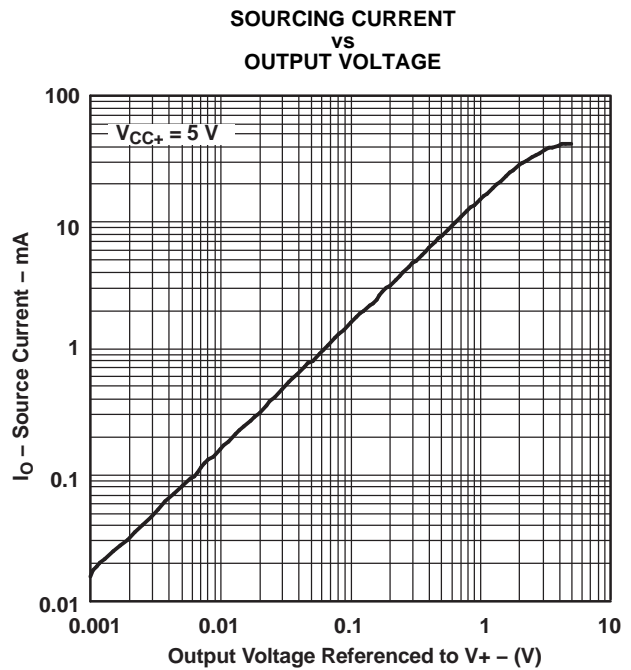


Figure 4.

**TYPICAL CHARACTERISTICS (continued)**

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)

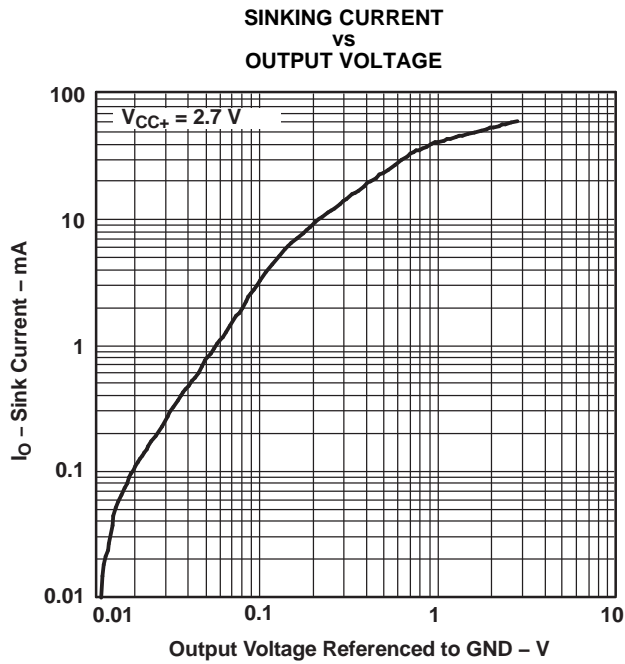


Figure 5.

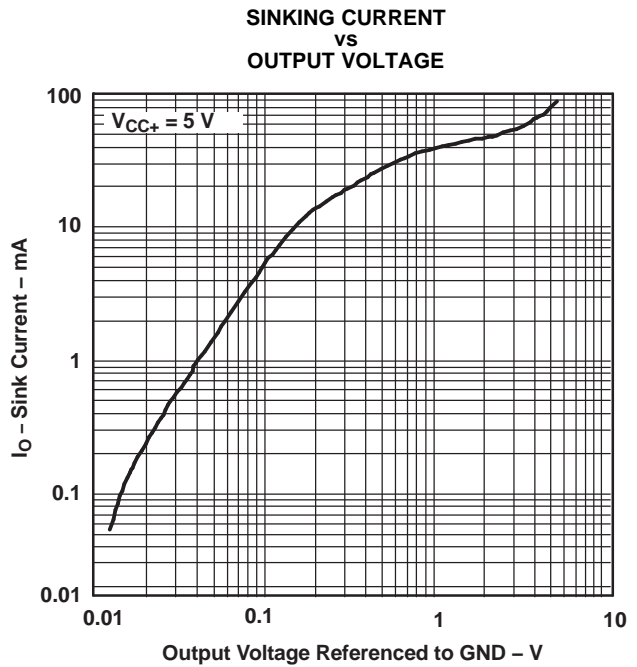


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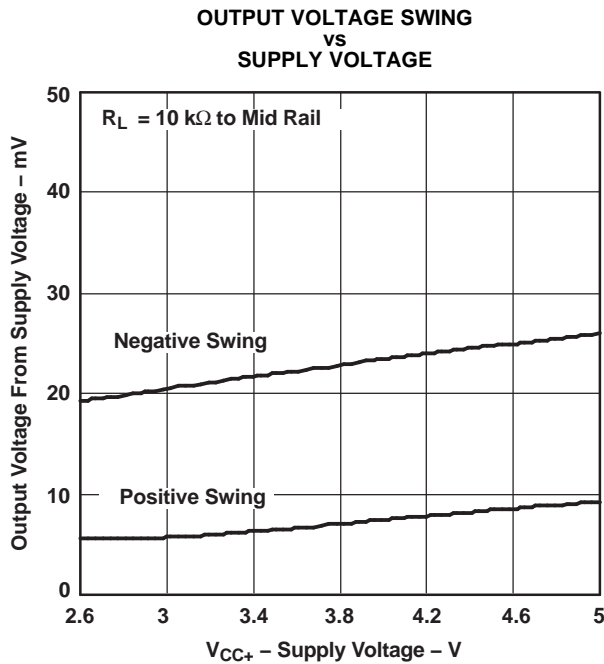


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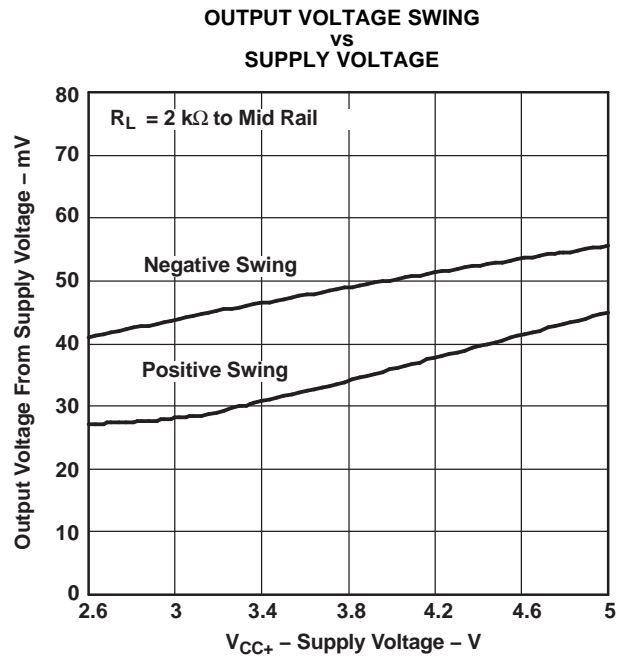


Figure 8.

TYPICAL CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)

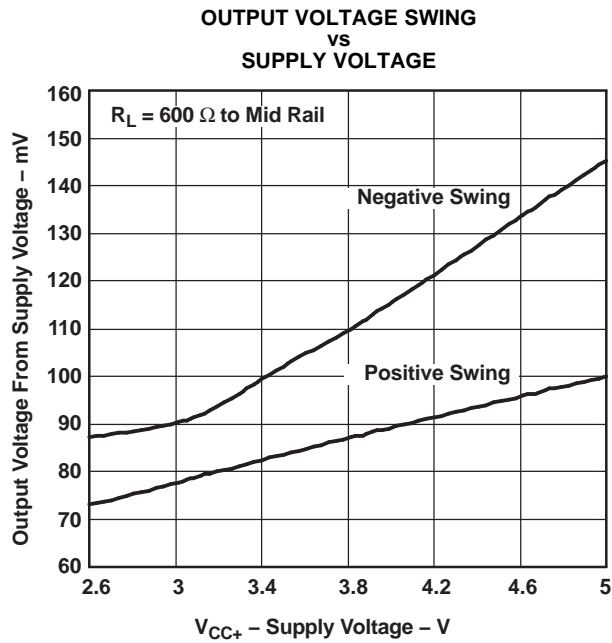


Figure 9.

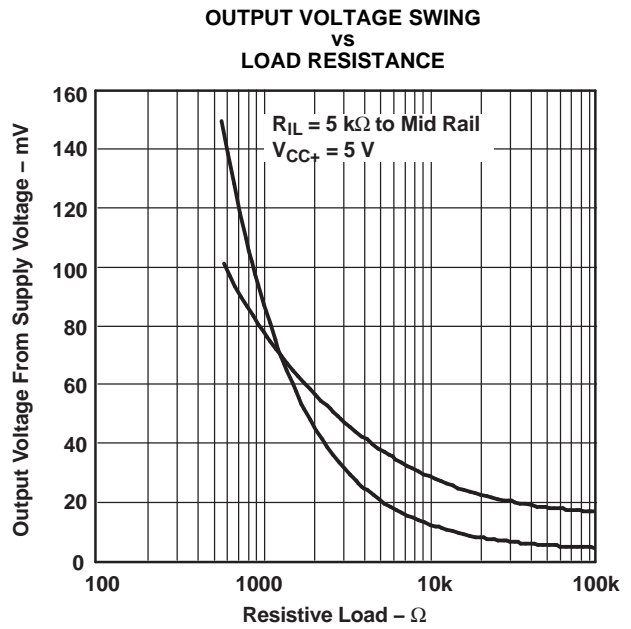


Figure 10.

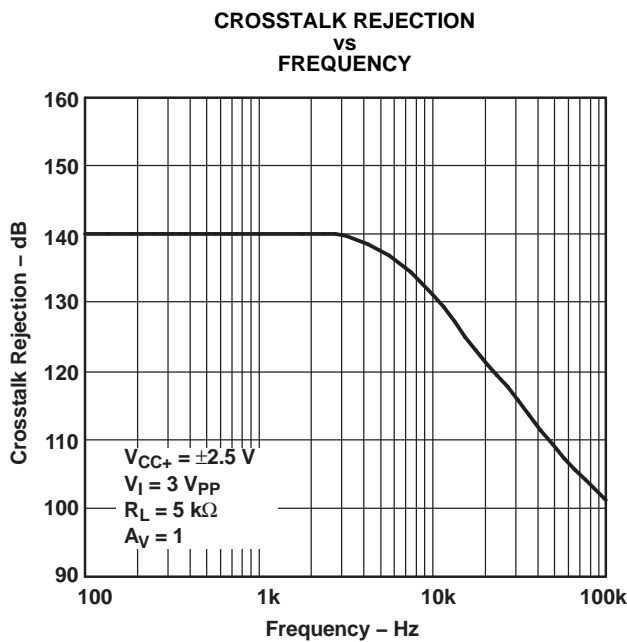


Figure 11.

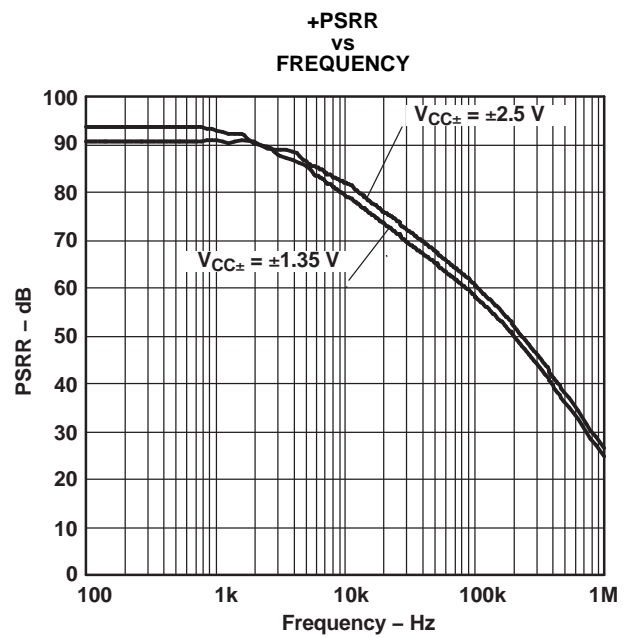
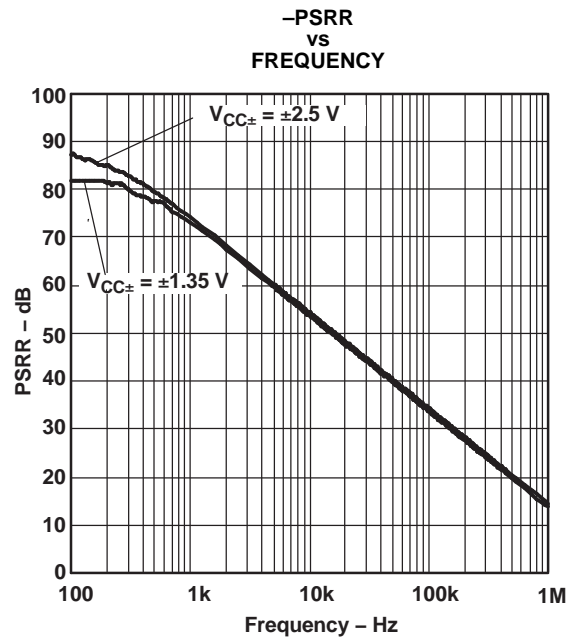


Figure 12.



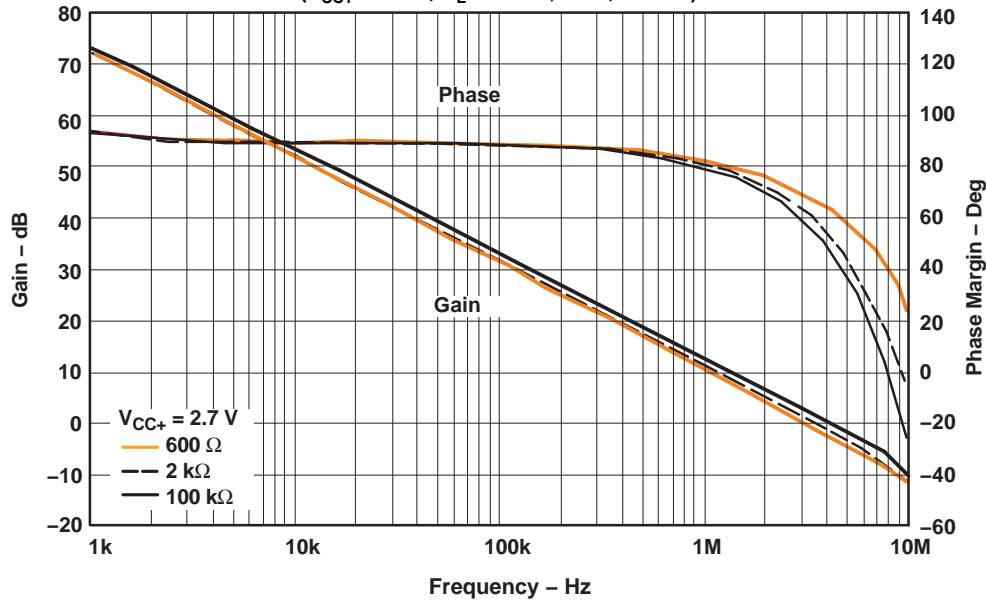
**TYPICAL CHARACTERISTICS (continued)**

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)



GAIN AND PHASE MARGIN  
vs  
FREQUENCY

( $V_{CC+} = 2.7\text{ V}$ ,  $R_L = 600\ \Omega, 2\ \text{k}\Omega, 100\ \text{k}\Omega$ )



TYPICAL CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)

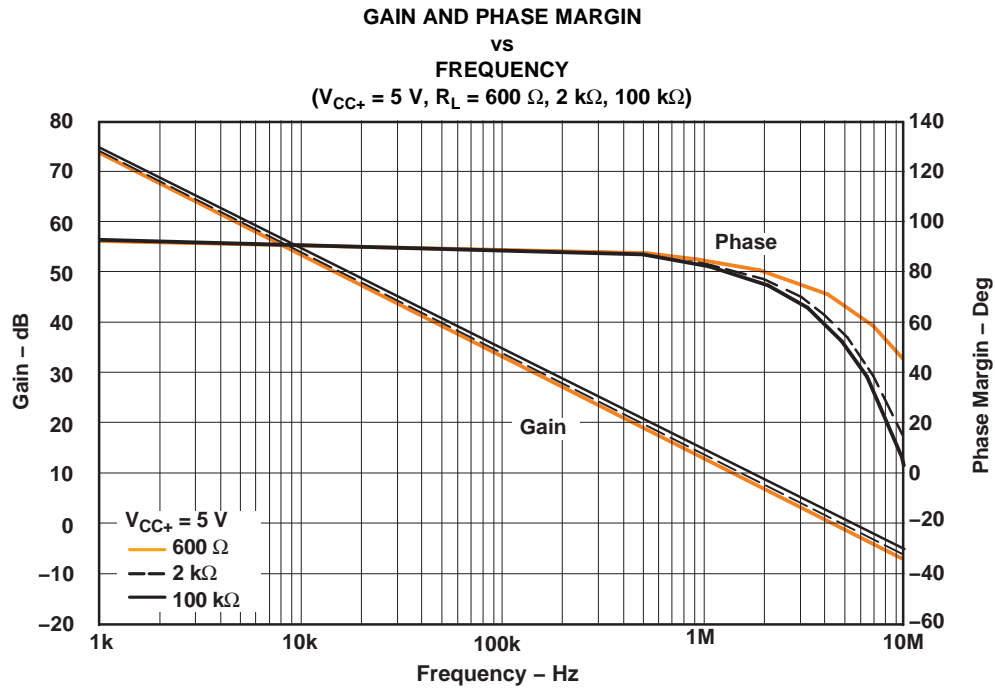


Figure 15.

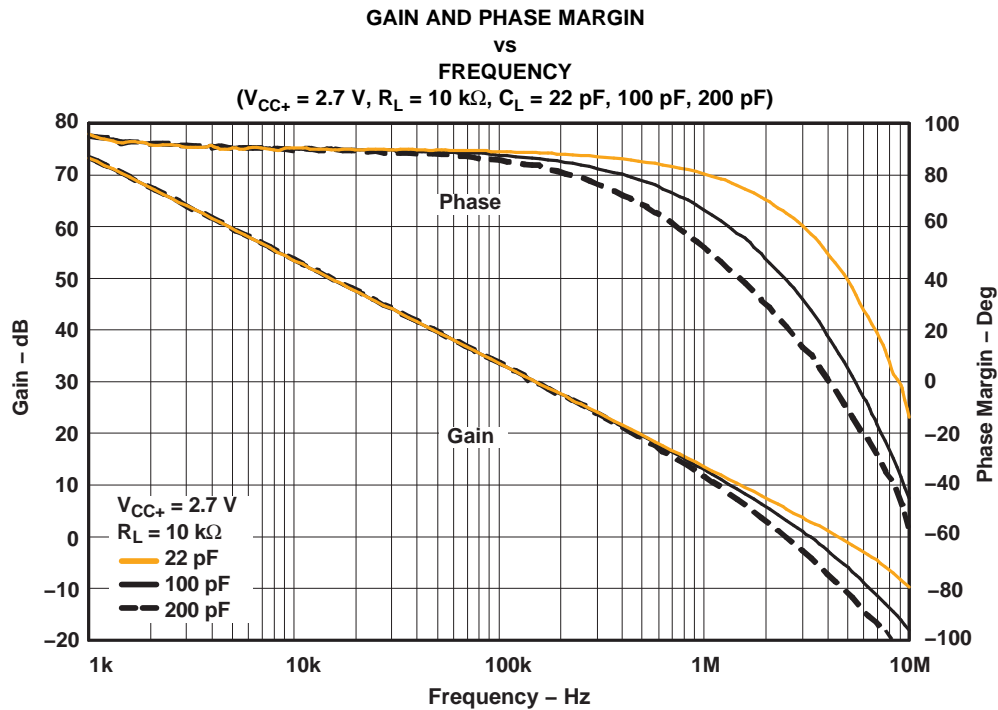
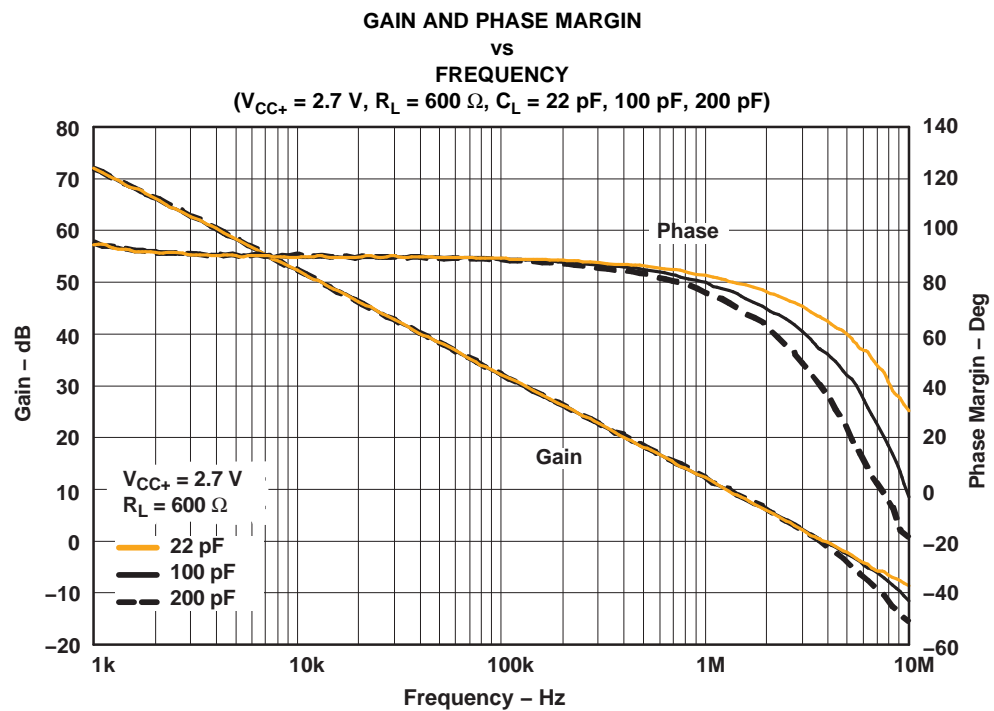
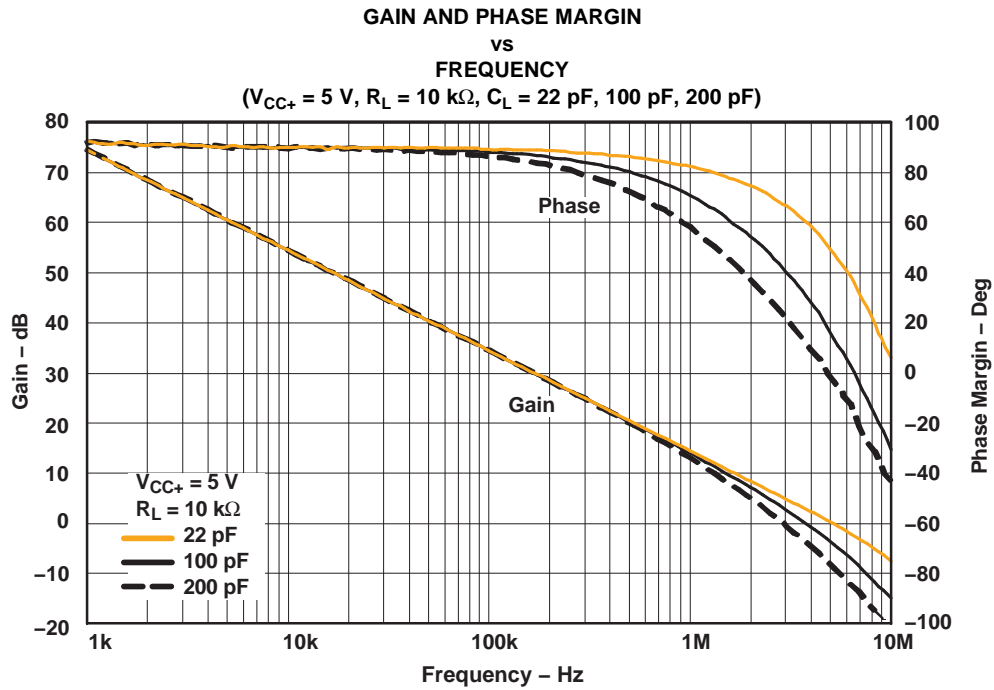


Figure 16.

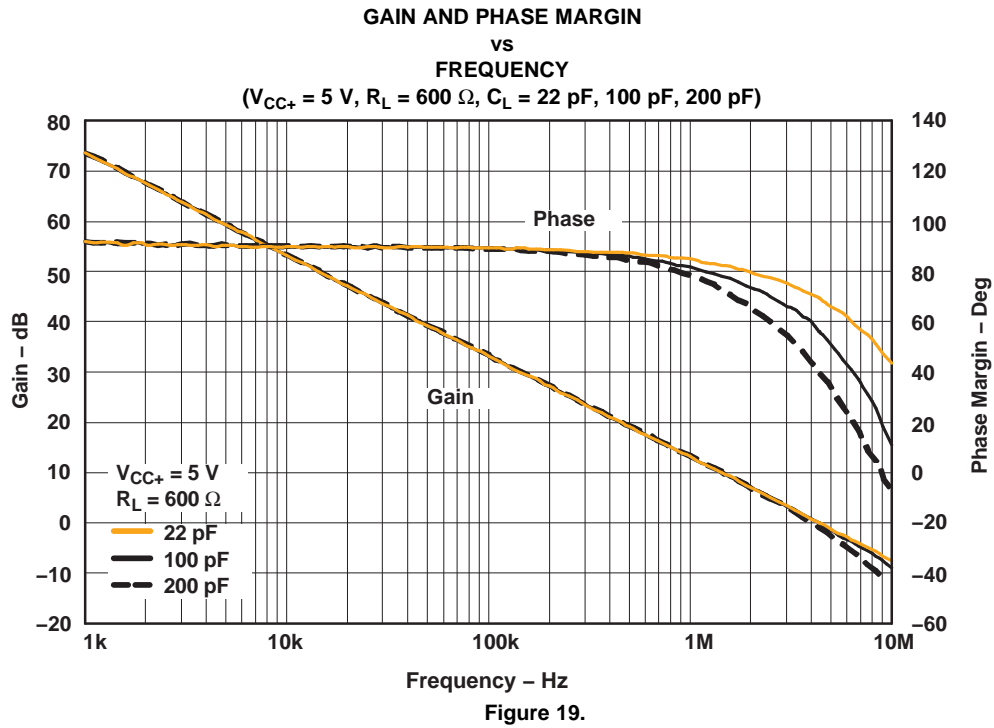
**TYPICAL CHARACTERISTICS (continued)**

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)



TYPICAL CHARACTERISTICS (continued)

$T_A = 25^\circ\text{C}$ ,  $V_{CC+} = 5\text{-V}$  Single Supply (Unless Otherwise Noted)



**PACKAGING INFORMATION**

Orderable Device	Status <sup>(1)</sup>	Package Type	Package Drawing	Pins	Package Qty	Eco Plan <sup>(2)</sup>	Lead/Ball Finish	MSL Peak Temp <sup>(3)</sup>
LMV821DBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DCKRE4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DCKTE4	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821DCKTG4	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDBVRE4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDBVTE4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDCKRE4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDCKRG4	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDCKT	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDCKTE4	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV821IDCKTG4	ACTIVE	SC70	DCK	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822D	ACTIVE	SOIC	D	8	75	Green (RoHS & 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/Ball Finish	MSL Peak Temp <sup>(3)</sup>
LMV822DE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822DG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822DGKR	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822DGKRG4	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822DR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822DRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822DRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822IDE4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822IDGKR	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822IDGKRG4	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822IDRE4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV822IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DGV	ACTIVE	TVSOP	DGV	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DGVRE4	ACTIVE	TVSOP	DGV	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DGVRG4	ACTIVE	TVSOP	DGV	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824DRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824ID	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IDE4	ACTIVE	SOIC	D	14	50	Green (RoHS & 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/Ball Finish	MSL Peak Temp <sup>(3)</sup>
LMV824IDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IDGVR	ACTIVE	TVSOP	DGV	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IDGVRE4	ACTIVE	TVSOP	DGV	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IDGVRG4	ACTIVE	TVSOP	DGV	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IDR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IDRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IDRG4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IPW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IPWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IPWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IPWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IPWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824IPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824PWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824PWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824PWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
LMV824PWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & 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.

**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.

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**OTHER QUALIFIED VERSIONS OF LMV821, LMV822 :**

- Automotive: [LMV821-Q1](#), [LMV822-Q1](#)

NOTE: Qualified Version Definitions:

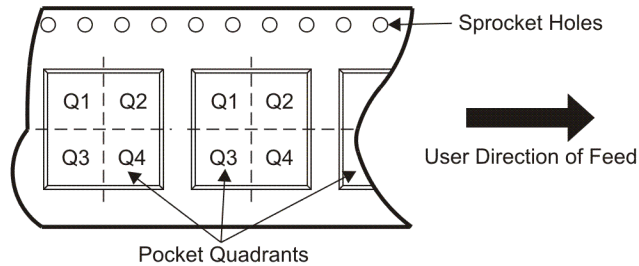
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects



## TAPE AND REEL INFORMATION



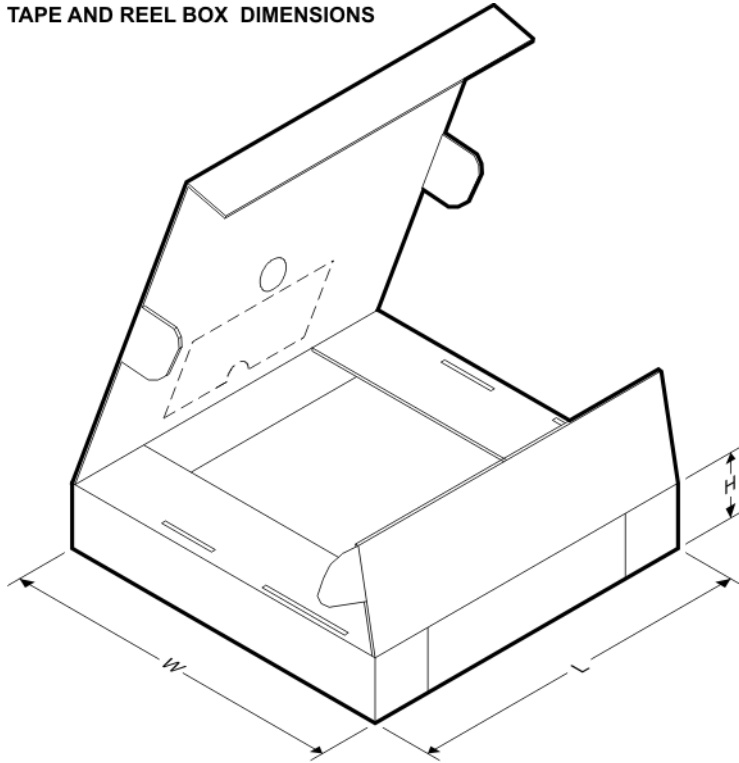
### QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



\*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
LMV821DBVR	SOT-23	DBV	5	3000	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
LMV821DBVR	SOT-23	DBV	5	3000	180.0	9.2	3.23	3.17	1.37	4.0	8.0	Q3
LMV821DBVT	SOT-23	DBV	5	250	178.0	9.0	3.23	3.17	1.37	4.0	8.0	Q3
LMV821DBVT	SOT-23	DBV	5	250	180.0	9.2	3.23	3.17	1.37	4.0	8.0	Q3
LMV821DCKR	SC70	DCK	5	3000	180.0	9.2	2.24	2.34	1.22	4.0	8.0	Q3
LMV821DCKT	SC70	DCK	5	250	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3
LMV821IDBVR	SOT-23	DBV	5	3000	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LMV821IDBVT	SOT-23	DBV	5	250	179.0	8.4	3.2	3.2	1.4	4.0	8.0	Q3
LMV821IDCKT	SC70	DCK	5	250	178.0	9.0	2.4	2.5	1.2	4.0	8.0	Q3
LMV822DGKR	MSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LMV822DR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LMV822IDGKR	MSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
LMV822IDGKR	MSOP	DGK	8	2500	330.0	12.4	5.3	3.3	1.3	8.0	12.0	Q1
LMV822IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
LMV824DGVR	TVSOP	DGV	14	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
LMV824DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
LMV824IDGVR	TVSOP	DGV	14	2000	330.0	12.4	6.8	4.0	1.6	8.0	12.0	Q1
LMV824IDR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1

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
LMV824IPWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1
LMV824PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**


\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMV821DBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0
LMV821DBVR	SOT-23	DBV	5	3000	205.0	200.0	33.0
LMV821DBVT	SOT-23	DBV	5	250	180.0	180.0	18.0
LMV821DBVT	SOT-23	DBV	5	250	205.0	200.0	33.0
LMV821DCKR	SC70	DCK	5	3000	205.0	200.0	33.0
LMV821DCKT	SC70	DCK	5	250	180.0	180.0	18.0
LMV821IDBVR	SOT-23	DBV	5	3000	203.0	203.0	35.0
LMV821IDBVT	SOT-23	DBV	5	250	203.0	203.0	35.0
LMV821IDCKT	SC70	DCK	5	250	180.0	180.0	18.0
LMV822DGKR	MSOP	DGK	8	2500	332.0	358.0	35.0
LMV822DR	SOIC	D	8	2500	340.5	338.1	20.6
LMV822IDGKR	MSOP	DGK	8	2500	332.0	358.0	35.0
LMV822IDGKR	MSOP	DGK	8	2500	370.0	355.0	55.0
LMV822IDR	SOIC	D	8	2500	340.5	338.1	20.6
LMV824DGVR	TVSOP	DGV	14	2000	346.0	346.0	29.0

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Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
LMV824DR	SOIC	D	14	2500	346.0	346.0	33.0
LMV824IDGVR	TVSOP	DGV	14	2000	346.0	346.0	29.0
LMV824IDR	SOIC	D	14	2500	346.0	346.0	33.0
LMV824IPWR	TSSOP	PW	14	2000	346.0	346.0	29.0
LMV824PWR	TSSOP	PW	14	2000	346.0	346.0	29.0

DGV (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN



- 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, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

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.

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.

DGK (S-PDSO-G8)

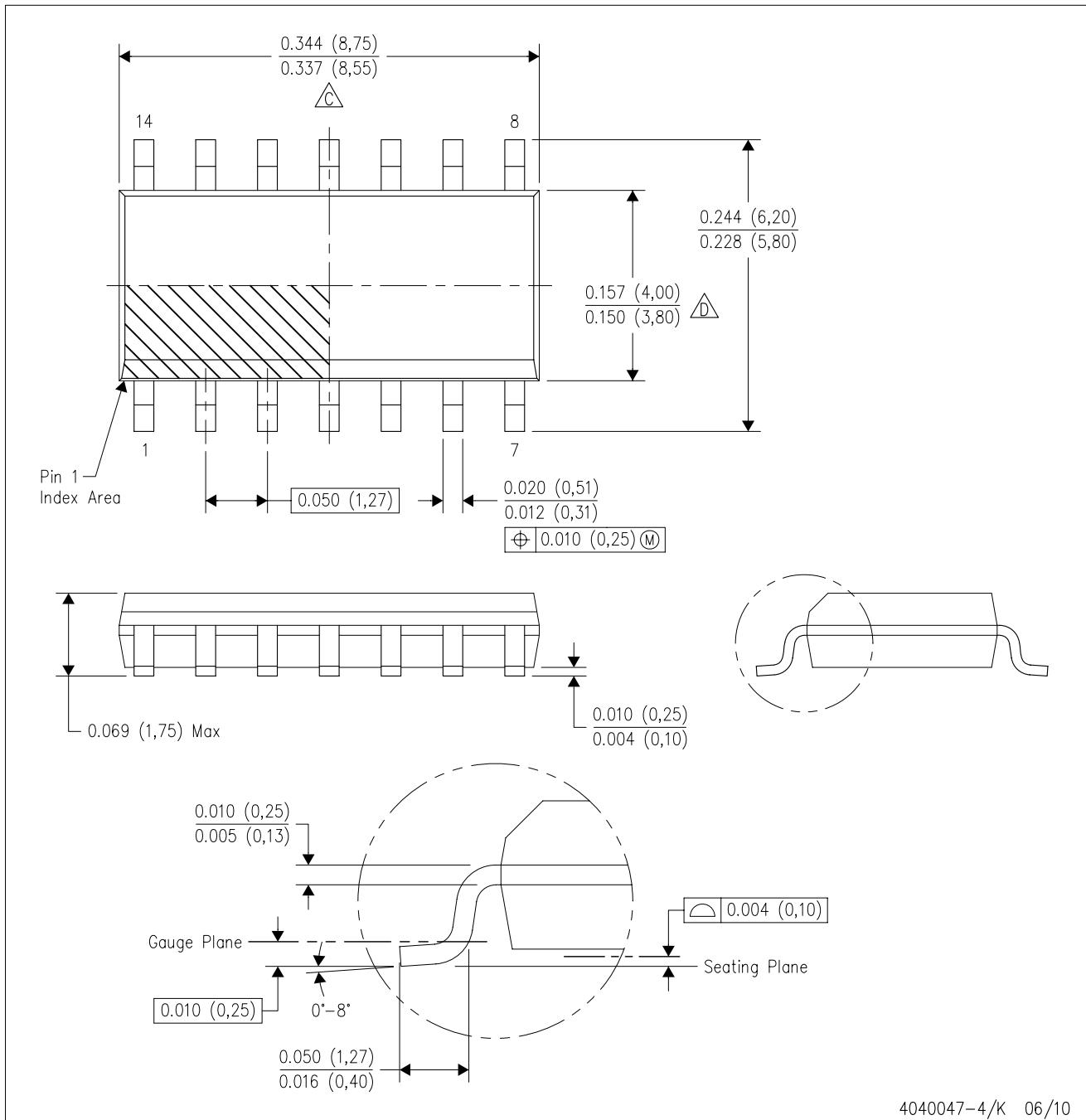
PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in 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 0.15 per end.
  - D. Body width does not include interlead flash. Interlead flash shall not exceed 0.50 per side.
  - E. Falls within JEDEC MO-187 variation AA, except interlead flash.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE

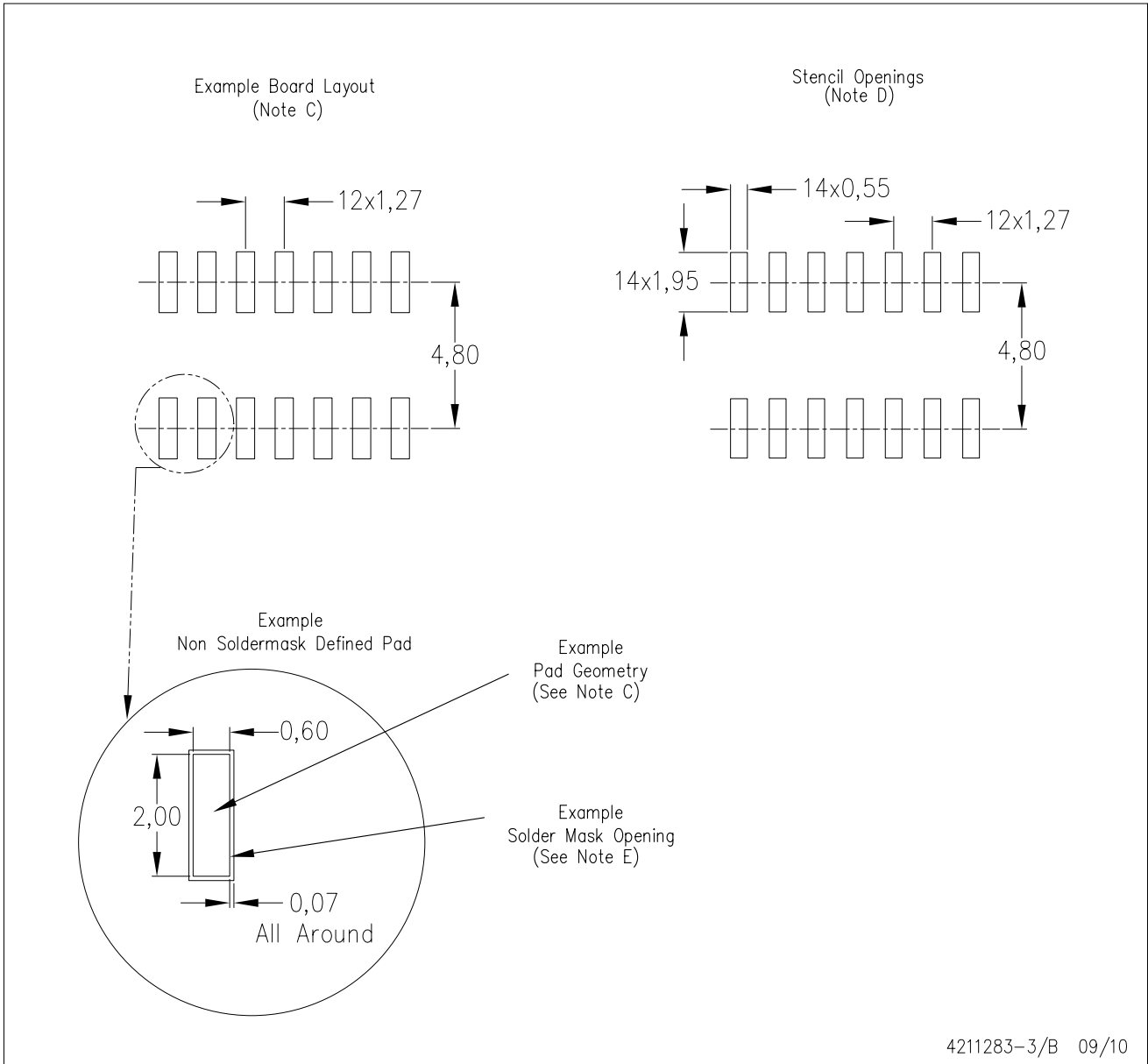


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
  - Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AB.



D (R-PDSO-G14)

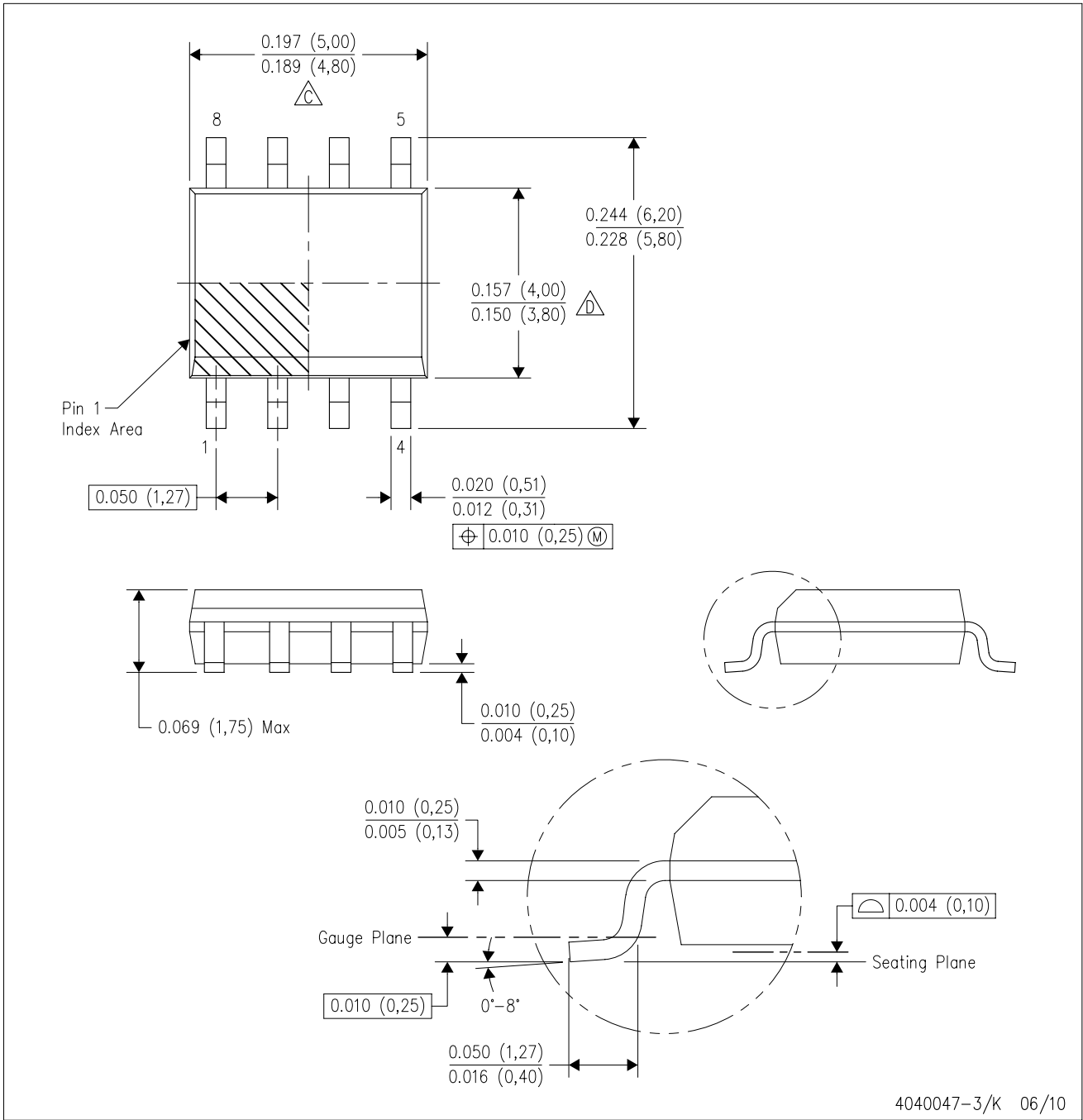
PLASTIC SMALL OUTLINE





- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Publication IPC-7351 is recommended for alternate designs.
  - D. 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. Refer to IPC-7525 for other stencil recommendations.
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

D (R-PDSO-G8)

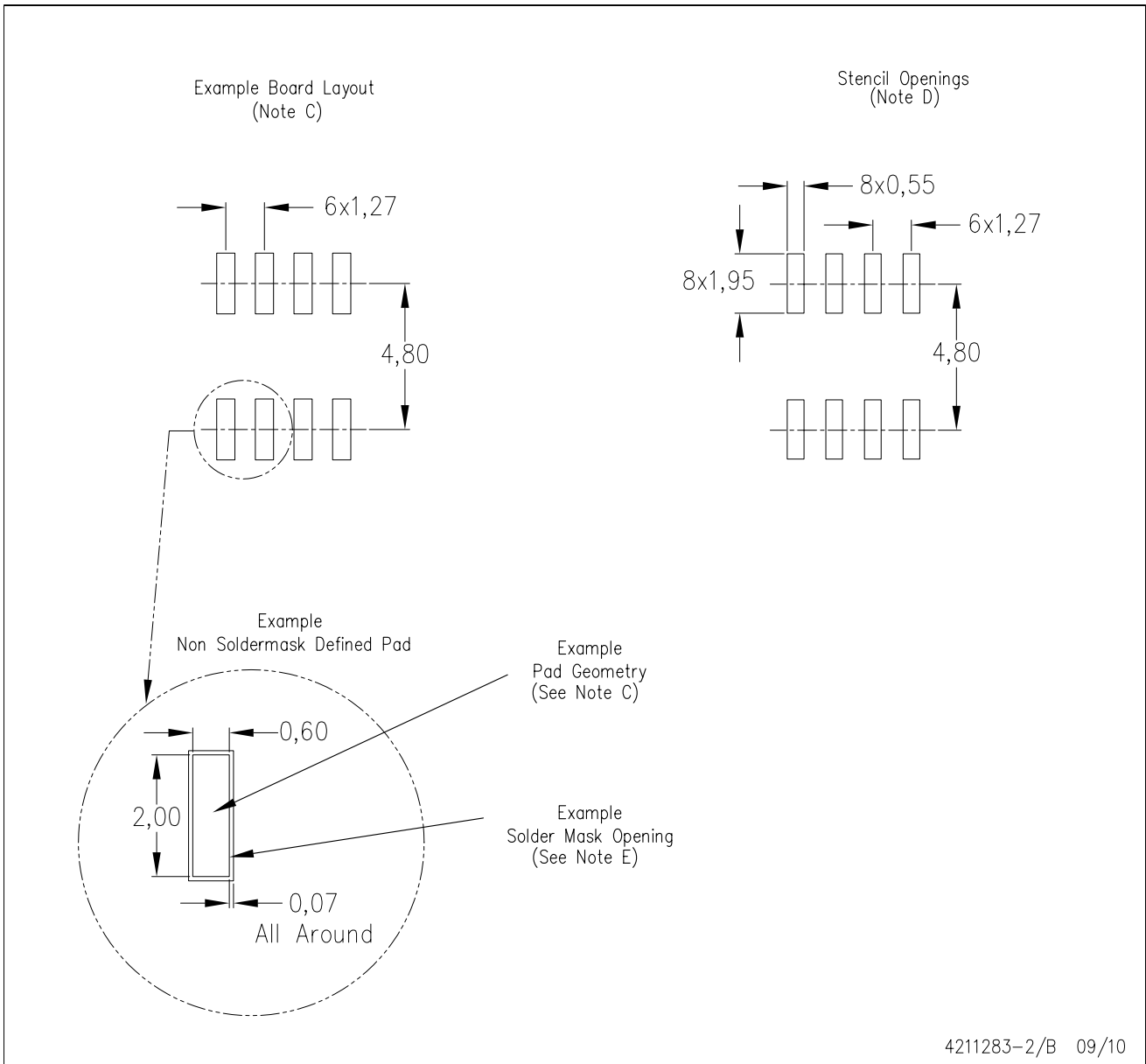
PLASTIC SMALL-OUTLINE PACKAGE



- 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 .006 (0,15) per end.
  -  Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
  - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN

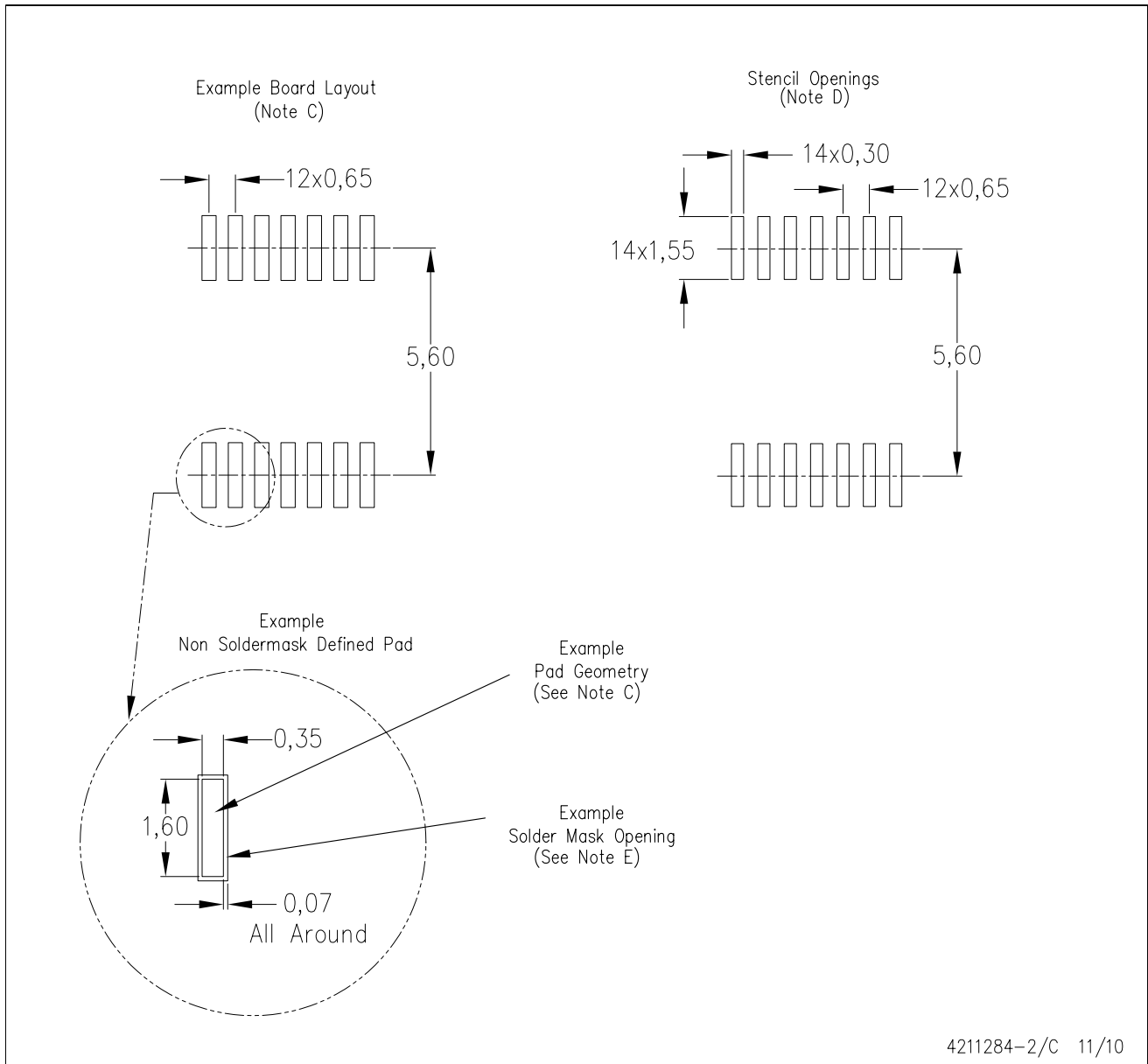


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- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

PW (R-PDSO-G14)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - 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. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>	Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
DLP® Products	<a href="http://www.dlp.com">www.dlp.com</a>	Communications and Telecom	<a href="http://www.ti.com/communications">www.ti.com/communications</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>	Computers and Peripherals	<a href="http://www.ti.com/computers">www.ti.com/computers</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>	Consumer Electronics	<a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>	Energy	<a href="http://www.ti.com/energy">www.ti.com/energy</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>	Industrial	<a href="http://www.ti.com/industrial">www.ti.com/industrial</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>	Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>	Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>	Space, Avionics & Defense	<a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>	Video and Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
		Wireless	<a href="http://www.ti.com/wireless-apps">www.ti.com/wireless-apps</a>

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