

# TLV2361, TLV2362

## HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

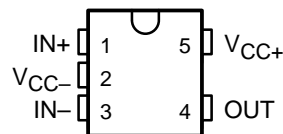
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- **Low Supply-Voltage Operation . . .  $V_{CC} = \pm 1$  V Min**
- **Wide Bandwidth . . . 7 MHz Typ at  $V_{CC\pm} = \pm 2.5$  V**
- **High Slew Rate . . . 3 V/ $\mu$ s Typ at  $V_{CC\pm} = \pm 2.5$  V**
- **Wide Output Voltage Swing . . .  $\pm 2.4$  V Typ at  $V_{CC\pm} = \pm 2.5$  V,  $R_L = 10$  k $\Omega$**
- **Low Noise . . . 8 nV/ $\sqrt{\text{Hz}}$  Typ at  $f = 1$  kHz**

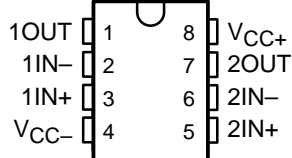
### description/ordering information

The TLV236x devices are high-performance dual operational amplifiers built using an original Texas Instruments bipolar process. These devices can be operated at a very low supply voltage ( $\pm 1$  V), while maintaining a wide output swing. The TLV236x devices offer a dramatically improved dynamic range of signal conditioning in low-voltage systems. The TLV236x devices also provide higher performance than other general-purpose operational amplifiers by combining higher unity-gain bandwidth and faster slew rate. With their low distortion and low-noise performance, these devices are well suited for audio applications.

TLV2361 . . . DBV PACKAGE  
(TOP VIEW)



TLV2362 . . . D, DGK, P, PS, OR PW PACKAGE  
(TOP VIEW)



### ORDERING INFORMATION

$T_A$	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
$-0^\circ\text{C}$ to $70^\circ\text{C}$	SOT-23 (DBV)	Reel of 3000	TLV2361CDBVR	VAAC
$-40^\circ\text{C}$ to $85^\circ\text{C}$	SOT-23 (DBV)	Reel of 3000	TLV2361IDBVR	VAAI
$-20^\circ\text{C}$ to $85^\circ\text{C}$	MSOP/VSSOP (DGK)	Reel of 2500	TLV2362IDGKR	YBS
	PDIP (P)	Tube of 50	TLV2362IP	TLV2362IP
	SOIC (D)	Tube of 75	TLV2362ID	2362I
		Reel of 2500	TLV2362IDR	
	SOP (PS)	Reel of 2000	TLV2362IPSR	TY2362
	TSSOP (PW)	Tube of 150	TLV2362IPW	TY2362
Reel of 2000		TLV2362IPWR		

† 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).



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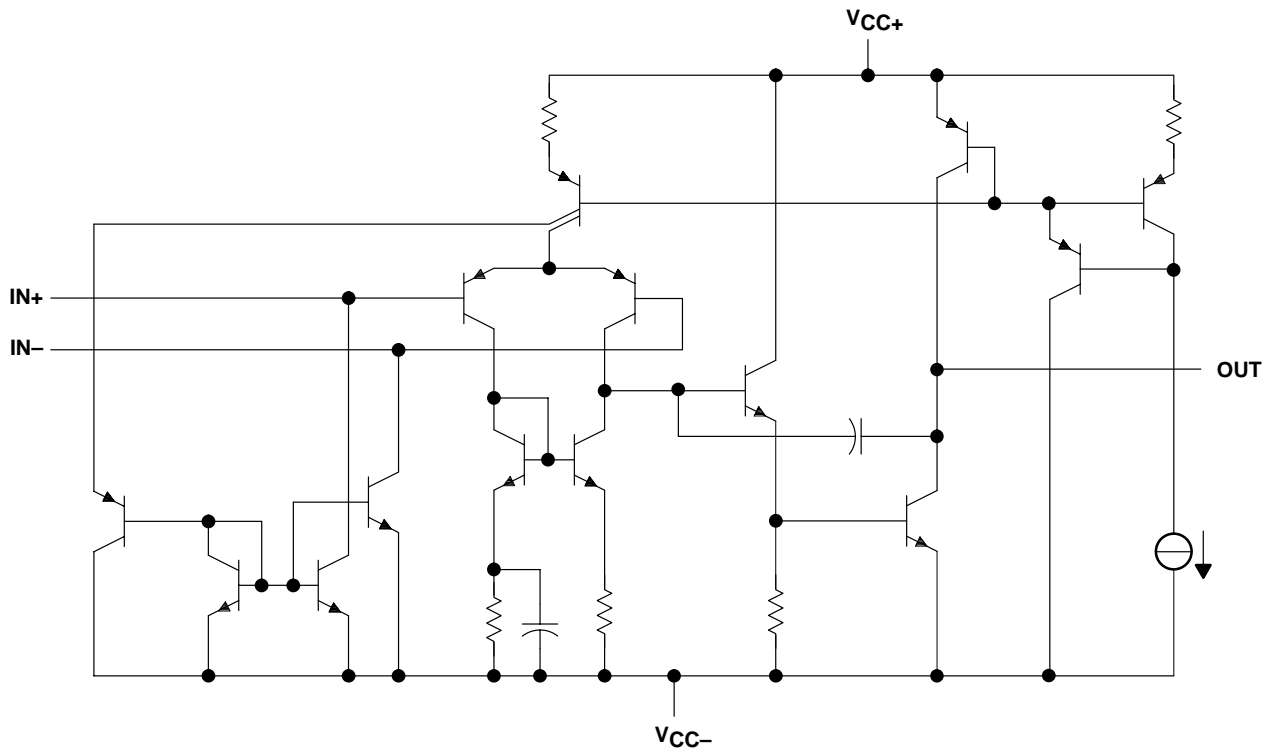
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# TLV2361, TLV2362 HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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equivalent schematic (each amplifier)



ACTUAL DEVICE COMPONENT COUNT		
COMPONENT	TLV2361	TLV2362
Transistors	30	46
Resistors	6	11
Diodes	1	1
Capacitors	2	4
JFET	1	1

# TLV2361, TLV2362

## HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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### absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Supply voltage, $V_{CC+}$ (see Note 1)	3.5 V
Supply voltage, $V_{CC-}$ (see Note 1)	–3.5 V
Differential input voltage, $V_{ID}$ (see Note 2)	$\pm 3.5$ V
Input voltage, $V_I$ (any input) (see Notes 1 and 3)	$V_{CC\pm}$
Output voltage, $V_O$	$\pm 3.5$ V
Output current, $I_O$	20 mA
Duration of short-circuit current at (or below) 25°C (output shorted to GND)	Unlimited
Package thermal impedance, $\theta_{JA}$ (see Note 4): D package	97°C/W
DBV package	206°C/W
DGK package	172°C/W
P package	85°C/W
PS package	95°C/W
PW package	149°C/W
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	260°C
Storage temperature range, $T_{stg}$	–65°C to 150°C

† 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.

- NOTES: 1. All voltage values, except differential voltages, are with respect to the midpoint between  $V_{CC+}$  and  $V_{CC-}$ .  
 2. Differential voltages are at  $IN+$  with respect to  $IN-$ .  
 3. All input voltage values must not exceed  $V_{CC}$ .  
 4. The package thermal impedance is calculated in accordance with JESD 51-7.

### recommended operating conditions

		MIN	MAX	UNIT
$V_{CC}$	Supply voltage	$\pm 1$	$\pm 2.5$	V
$T_A$	Operating free-air temperature	TLV2361C	0	70
		TLV2361I	–40	85
		TLV2362I	–20	85



# TLV2361, TLV2362 HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TLV2361 and TLV2362 electrical characteristics, $V_{CC\pm} = \pm 1.5\text{ V}$ (unless otherwise noted)

PARAMETER		TEST CONDITIONS		$T_A$	MIN	TYP	MAX	UNIT
$V_{IO}$	Input offset voltage	$V_O = 0,$	$V_{IC} = 0$	25°C	1	6		mV
				Full range		7.5		
$I_{IO}$	Input offset current	$V_O = 0,$	$V_{IC} = 0$	25°C	5	100		nA
				Full range		150		
$I_{IB}$	Input bias current	$V_O = 0,$	$V_{IC} = 0$	25°C	20	150		nA
				Full range		250		
$V_{IC}$	Common-mode input voltage	$ V_{IO}  \leq 7.5\text{ mV}$		25°C	$\pm 0.5$			V
				Full range	$\pm 0.5$			
$V_{OM+}$	Maximum positive-peak output voltage	$R_L = 10\text{ k}\Omega$		25°C	1.2	1.4		V
		$R_L \geq 10\text{ k}\Omega$		Full range	1.2			
$V_{OM-}$	Maximum negative-peak output voltage	$R_L = 10\text{ k}\Omega$		25°C	-1.2	-1.4		V
		$R_L \geq 10\text{ k}\Omega$		Full range	-1.2			
$I_{CC}$	Supply current (per amplifier)	$V_O = 0,$	No load	25°C	1.4	2.25		mA
				Full range		2.75		mA
$A_{VD}$	Large-signal differential voltage amplification	$V_O = \pm 1\text{ V},$	$R_L = 10\text{ k}\Omega$	TLV2361	25°C	60	80	dB
				TLV2362		55		
CMRR	Common-mode rejection ratio	$V_{IC} = \pm 0.5\text{ V}$		25°C	75			dB
$k_{SVR}$	Supply-voltage rejection ratio	$V_{CC\pm} = \pm 1.5\text{ V to } \pm 2.5\text{ V}$		25°C	80			dB

## TLV2361 and TLV2362 operating characteristics, $V_{CC\pm} = \pm 1.5\text{ V}, T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
SR	Slew rate	$A_V = 1,$	$V_I = \pm 0.5\text{ V}$			2.5		V/ $\mu\text{s}$
$B_1$	Unity-gain bandwidth	$A_V = 40,$	$R_L = 10\text{ k}\Omega,$	$C_L = 100\text{ pF}$		6		MHz
$V_n$	Equivalent input noise voltage	$R_S = 100\ \Omega,$	$R_F = 10\text{ k}\Omega,$	$f = 1\text{ kHz}$		9		nV/ $\sqrt{\text{Hz}}$



# TLV2361, TLV2362

## HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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### TLV2361 and TLV2362 electrical characteristics, $V_{CC\pm} = \pm 2.5$ V (unless otherwise noted)

PARAMETER		TEST CONDITIONS		$T_A$	MIN	TYP	MAX	UNIT
$V_{IO}$	Input offset voltage	$V_O = 0,$	$V_{IC} = 0$	25°C	1	6		mV
				Full range			7.5	
$I_{IO}$	Input offset current	$V_O = 0,$	$V_{IC} = 0$	25°C	5	100		nA
				Full range			150	
$I_{IB}$	Input bias current	$V_O = 0,$	$V_{IC} = 0$	25°C	20	150		nA
				Full range			250	
$V_{IC}$	Common-mode input voltage	$ V_{IO}  \leq 7.5$ mV		25°C	$\pm 1.5$			V
				Full range	$\pm 1.4$			
$V_{OM+}$	Maximum positive-peak output voltage	$R_L = 10$ k $\Omega$		25°C	2	2.4		V
		$R_L \geq 10$ k $\Omega$		Full range	2			
$V_{OM-}$	Maximum negative-peak output voltage	$R_L = 10$ k $\Omega$		25°C	-2	-2.4		V
		$R_L \geq 10$ k $\Omega$		Full range	-2			
$I_{CC}$	Supply current (per amplifier)	$V_O = 0,$	No load	25°C	1.75	2.5		mA
				Full range	3			
AVD	Large-signal differential voltage amplification	$V_O = \pm 1$ V,	$R_L = 10$ k $\Omega$	TLV2361	25°C	60	80	dB
				TLV2362		60		
CMRR	Common-mode rejection ratio	$V_{IC} = \pm 0.5$ V		25°C	85		dB	
kSVR	Supply-voltage rejection ratio	$V_{CC\pm} = \pm 1.5$ V to $\pm 2.5$ V		25°C	80		dB	

### TLV2361 and TLV2362 operating characteristics, $V_{CC\pm} = \pm 2.5$ V, $T_A = 25^\circ\text{C}$

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
SR	Slew rate	$A_V = 1,$	$V_I = \pm 0.5$ V		3		V/ $\mu$ s
$B_1$	Unity-gain bandwidth	$A_V = 40,$	$R_L = 10$ k $\Omega,$ $C_L = 100$ pF		7		MHz
$V_n$	Equivalent input noise voltage	$R_S = 100$ $\Omega,$	$R_F = 10$ k $\Omega,$ $f = 1$ kHz		8		nV/ $\sqrt{\text{Hz}}$
THD + N	Total harmonic distortion, plus noise	$A_V = 1,$ $f = 3$ kHz	$V_O = \pm 1.2$ V, $R_L = 10$ k $\Omega,$		0.004		%



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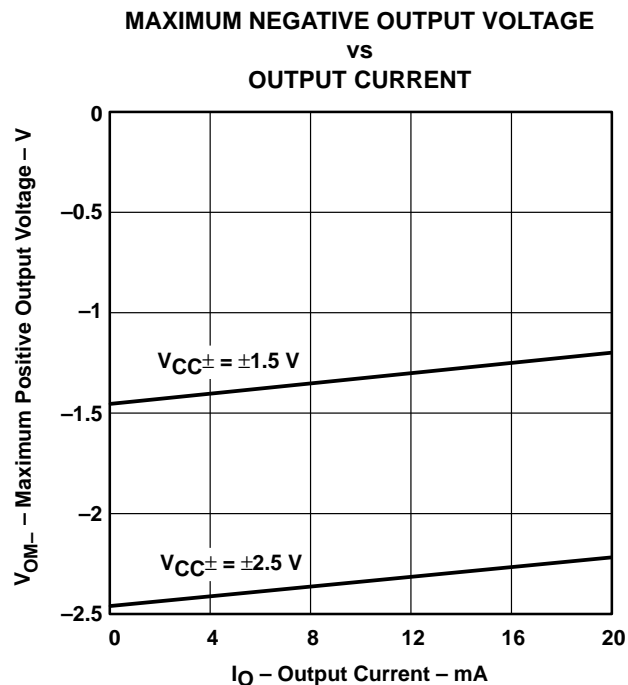
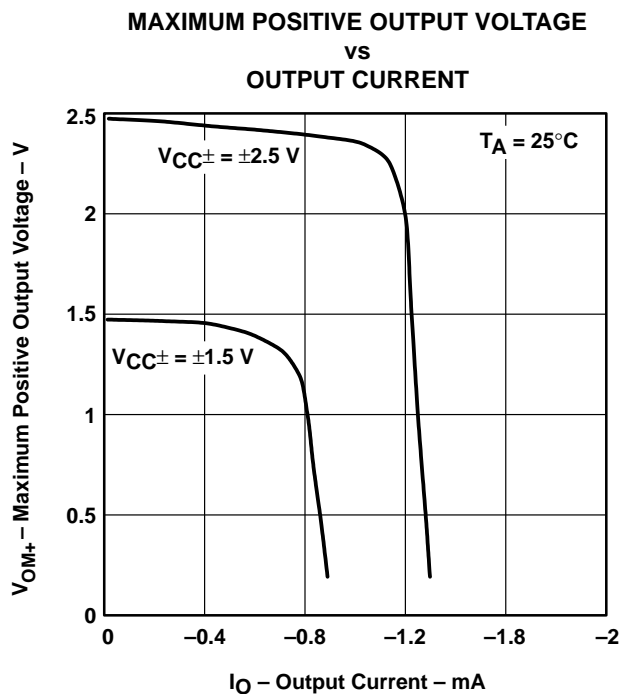
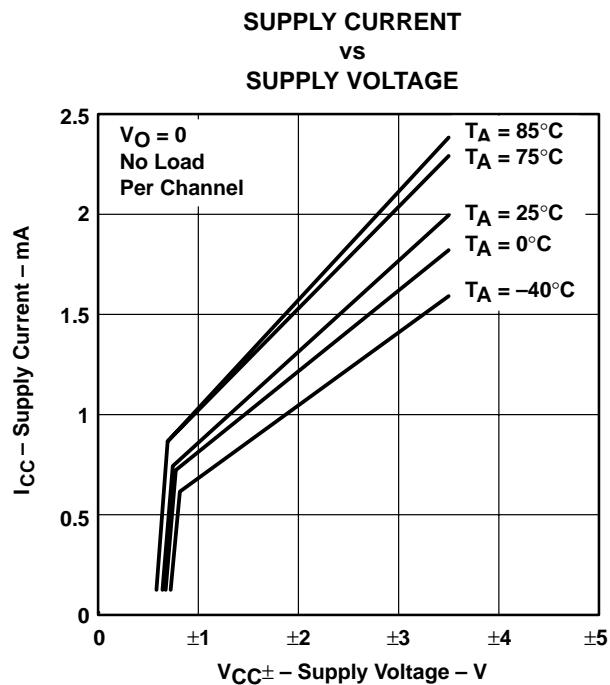
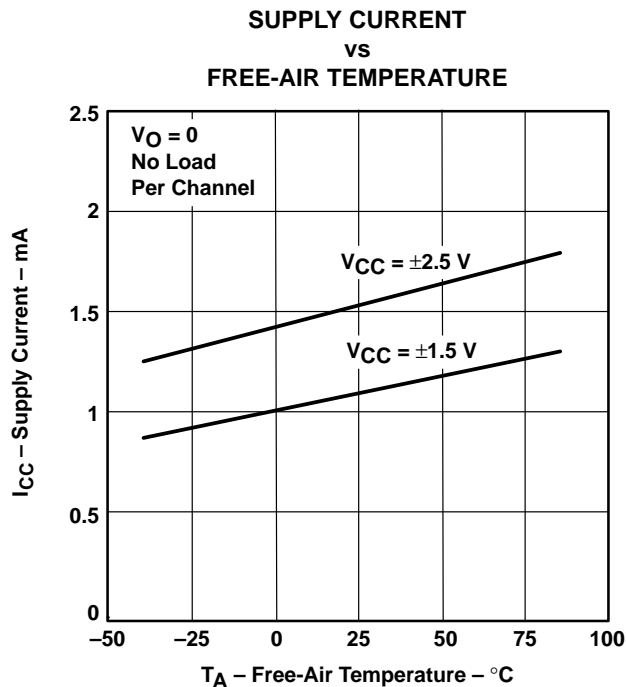
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## TYPICAL CHARACTERISTICS

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### TYPICAL CHARACTERISTICS



# TLV2361, TLV2362 HIGH-PERFORMANCE LOW-VOLTAGE OPERATIONAL AMPLIFIERS

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## TYPICAL CHARACTERISTICS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE  
vs  
FREQUENCY

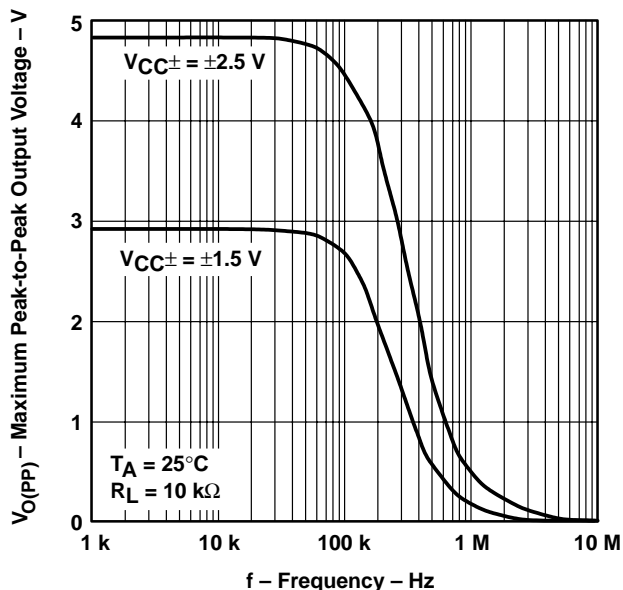


Figure 5

EQUIVALENT INPUT NOISE VOLTAGE  
vs  
FREQUENCY

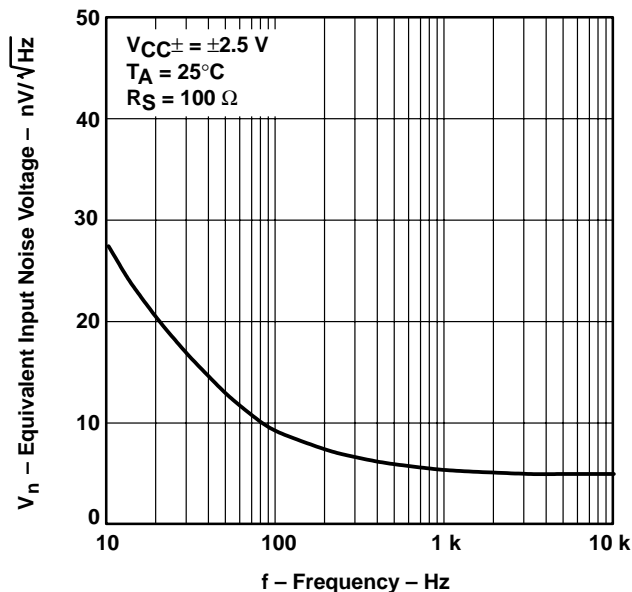


Figure 6

TOTAL HARMONIC DISTORTION  
vs  
FREQUENCY

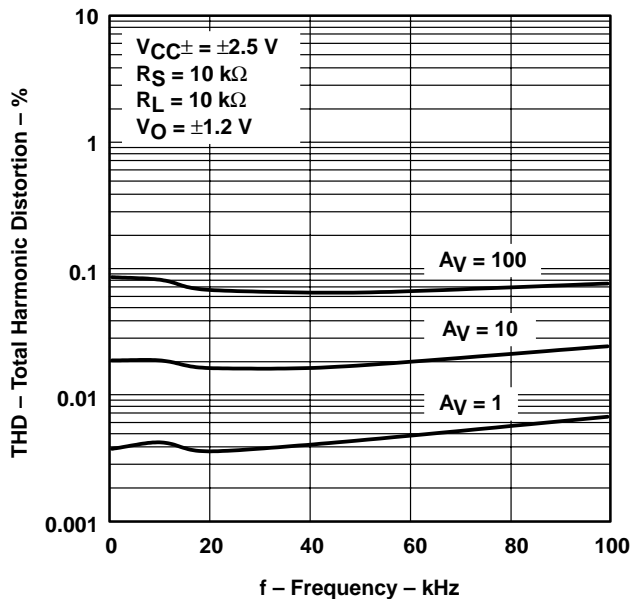


Figure 7

TOTAL HARMONIC DISTORTION  
vs  
OUTPUT VOLTAGE

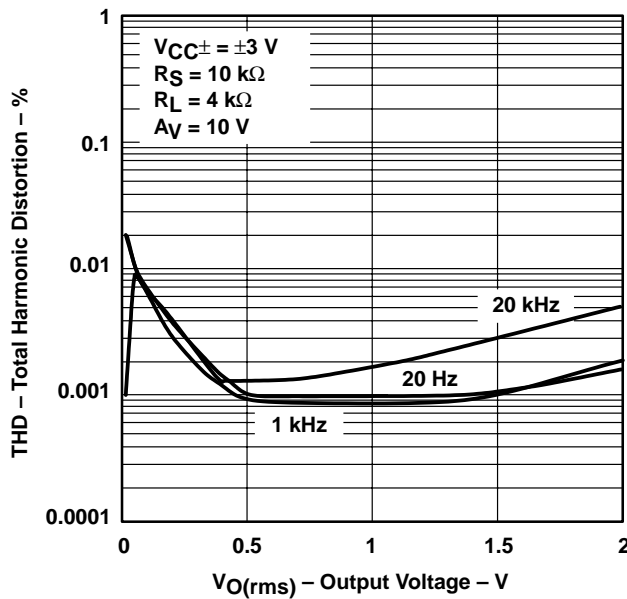
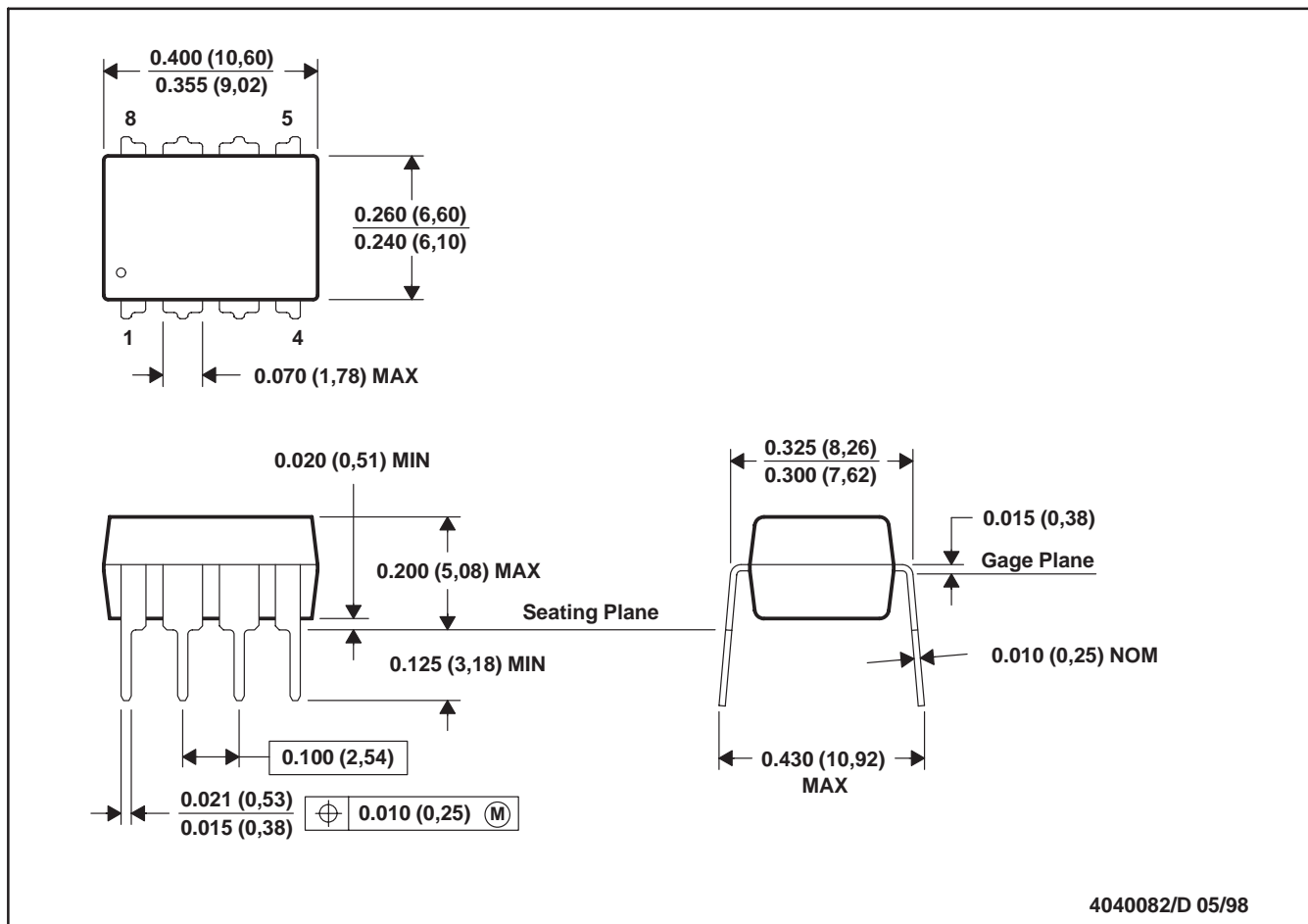


Figure 8



P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE

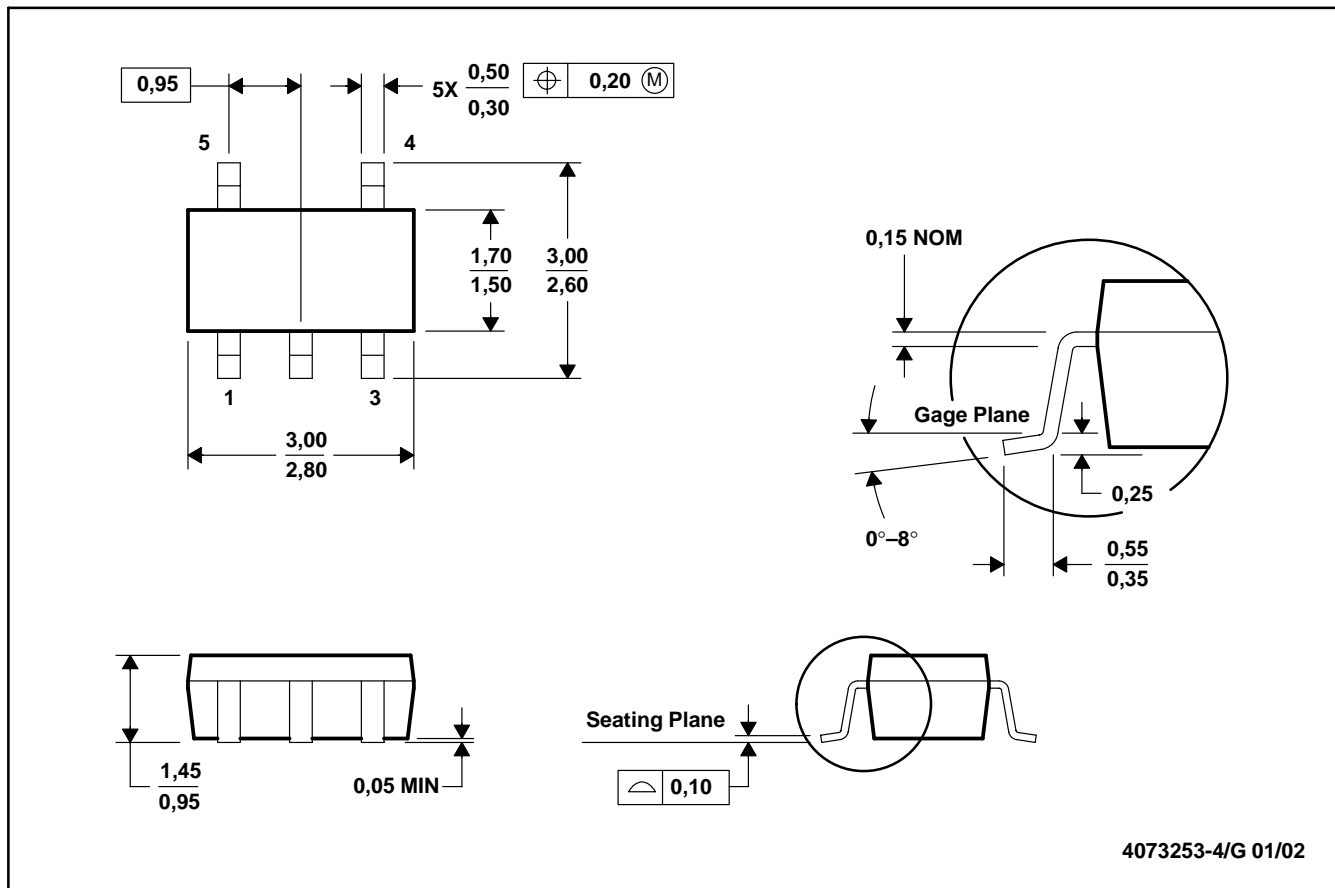


- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-001

For the latest package information, go to [http://www.ti.com/sc/docs/package/pkg\\_info.htm](http://www.ti.com/sc/docs/package/pkg_info.htm)

DBV (R-PDSO-G5)

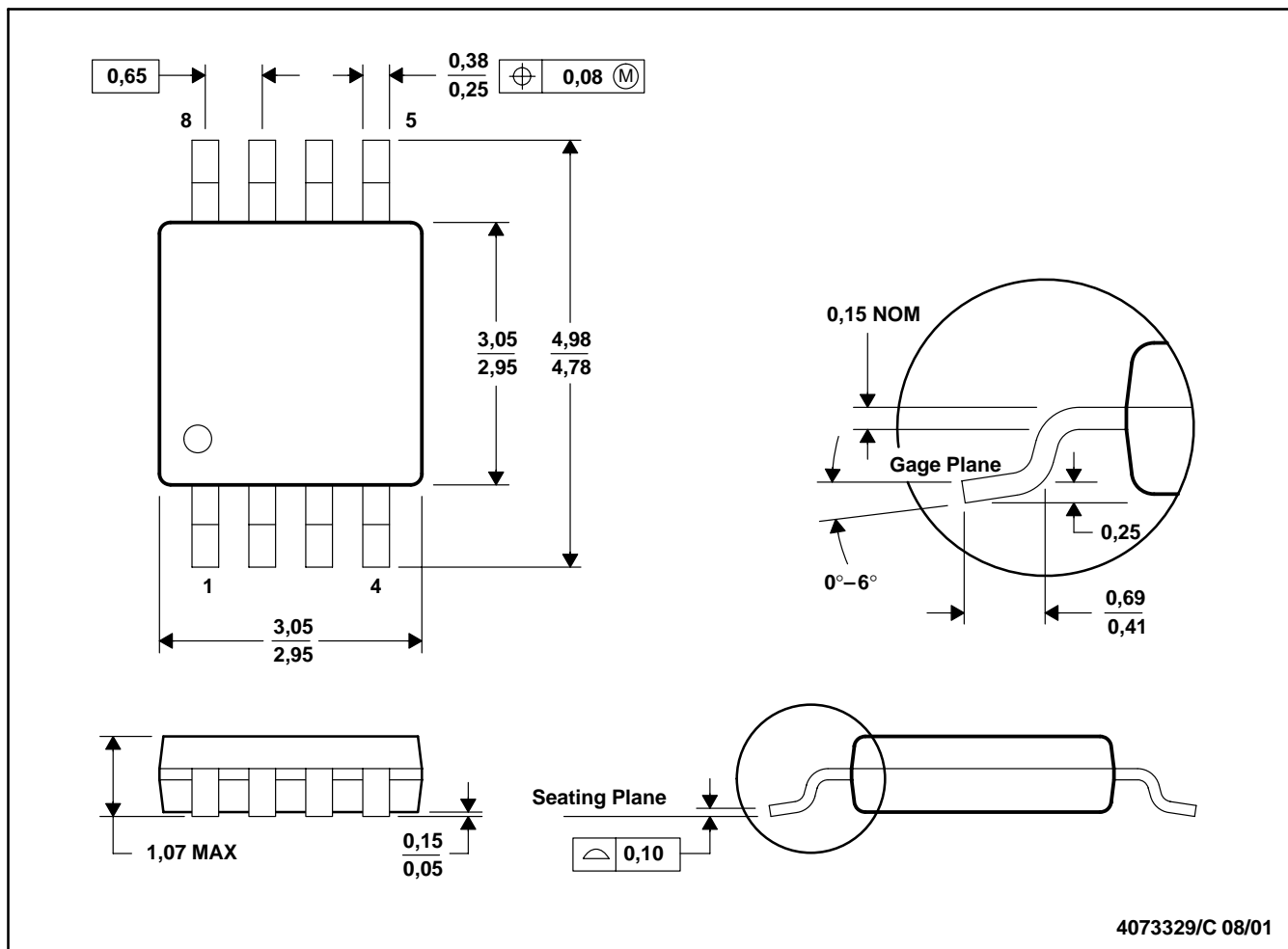
PLASTIC SMALL-OUTLINE



- NOTES: A. All linear dimensions are in millimeters.  
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 C. Body dimensions do not include mold flash or protrusion.  
 D. Falls within JEDEC MO-178

DGK (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE

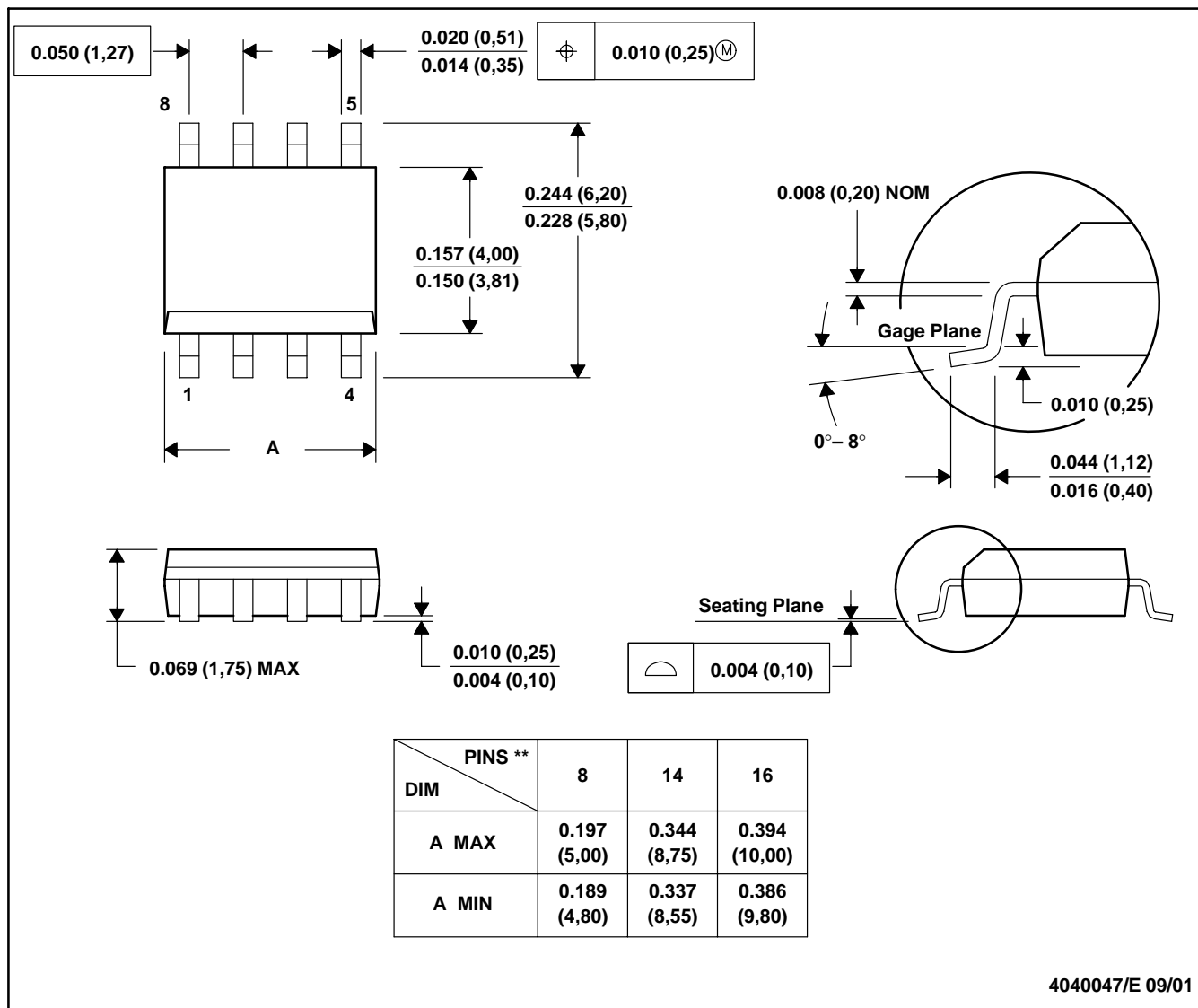


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 B. This drawing is subject to change without notice.  
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 D. Falls within JEDEC MO-187

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

PLASTIC SMALL-OUTLINE PACKAGE

8 PINS SHOWN

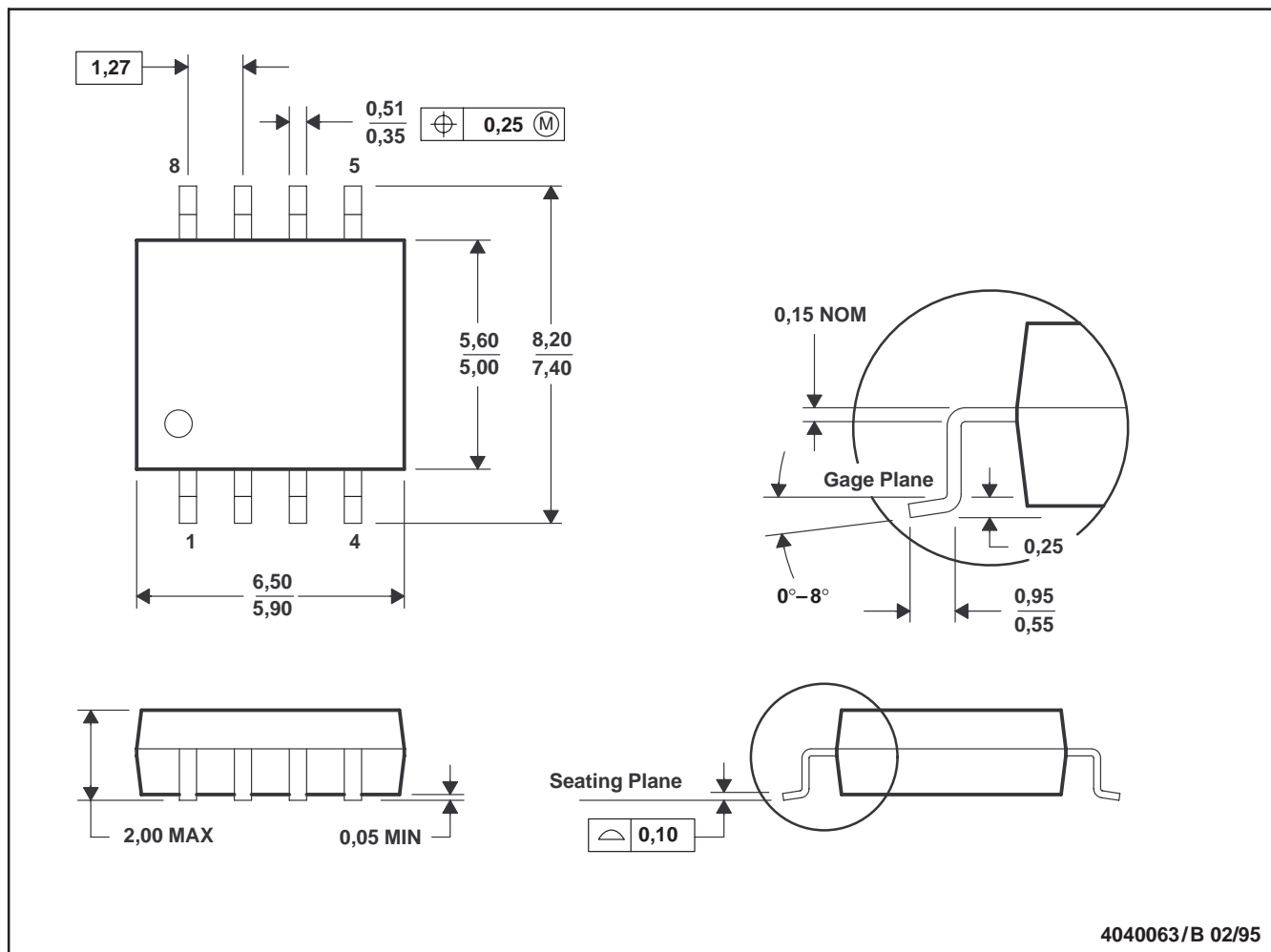


4040047/E 09/01

- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).  
 D. Falls within JEDEC MS-012

PS (R-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 dimensions do not include mold flash or protrusion, not to exceed 0,15.

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

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- NOTES: A. All linear dimensions are in millimeters.  
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 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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