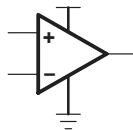


## FAMILY OF LOW-POWER WIDE BANDWIDTH SINGLE SUPPLY OPERATIONAL AMPLIFIERS WITH AND WITHOUT SHUTDOWN

### FEATURES

- Rail-To-Rail Output
- $V_{ICR}$  Includes Ground
- Gain-Bandwidth Product . . . 9 MHz
- Supply Current . . . 730  $\mu\text{A}/\text{Channel}$
- Single, Duals, and Quad Versions
- Ultralow Power Down Mode  
 $I_{DD}(\text{SHDN}) = 4 \mu\text{A}/\text{Channel}$
- Specified Temperature Range  
 $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$  . . . Industrial Grade
- Supply Voltage Range . . . 2.7 V to 5.5 V
- Ultrasmall Packaging  
5 or 6 Pin SOT-23 (TLV2630/1)  
8 or 10 Pin MSOP (TLV2632/3)
- Universal Op-Amp EVM (See SLOU060  
for More Information)

Operational Amplifier



### DESCRIPTION

The TLV263x single supply operational amplifiers provide rail-to-rail output with an input range that includes ground. The TLV263x takes the minimum operating supply voltage down to 2.7 V over the extended industrial temperature range ( $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ ) while adding the rail-to-rail output swing feature. The TLV263x also provides a 9 MHz gain-bandwidth product from only 730  $\mu\text{A}$  of supply current. The maximum recommended supply voltage is 5.5 V, which, when coupled with a 2.7-V minimum, allows the devices to be operated from lithium ion cells.

The combination of wide bandwidth, low noise, and low distortion makes it ideal for high speed and high resolution data converter applications. The ground input range allows it to directly interface to ground rail referred systems.

All members are available in PDIP and SOIC with the singles in the small SOT-23 package, duals in the MSOP, and quads in the TSSOP package.

The 2.7-V operation makes it compatible with Li-Ion powered systems and the operating supply voltage range of many micro-power microcontrollers available today including TI's MSP430.

AMPLIFIER SELECTION TABLE

DEVICE	$V_{DD}$ [V]	$I_{DD}/\text{ch}$ [ $\mu\text{A}$ ]	$V_{ICR}$ [V]	GBW [MHz]	SLEW RATE [V/ $\mu\text{s}$ ]	$V_n$ , 1 kHz [nV/ $\sqrt{\text{Hz}}$ ]	$I_O$ [mA]
OPAx343	2.5–5.5	850	$-0.3$ to $V_{DD} + 0.3$	5.5	6	25	40
OPAx743	3.5–12	1100	$-0.1$ to $V_{DD} + 0.1$	7	10	30	20
TLV278x	1.8–3.6	650	$-0.2$ to $V_{DD} + 0.2$	8	5	9	10
<b>TLV263x</b>	<b>2.7–5.5</b>	<b>730</b>	<b>GND to <math>V_{DD} - 1</math></b>	<b>9</b>	<b>9.5</b>	<b>50</b>	<b>28</b>
TLV262x	2.7–5.5	750	1 V to $V_{DD} + 0.2$	11	10	27	28
OPAx353	2.7–5.5	8000	$-0.1$ to $V_{DD} + 0.1$	44	22	7	40



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

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

**TLV2630, TLV2631**  
**TLV2632, TLV2633**  
**TLV2634, TLV2635**

SLOS362A – JUNE 2001 – REVISED JANUARY 2005

**PACKAGE/ORDERING INFORMATION<sup>(1)</sup>**

PRODUCT	PACKAGE	PACKAGE CODE	SYMBOL	SPECIFIED TEMPERATURE RANGE	ORDER NUMBER	TRANSPORT MEDIA
<b>Single with Shutdown</b>						
TLV2630ID	SOIC-8	D	—	-40°C to 125°C	TLV2630ID TLV2630IDR	Tube Tape and Reel
TLV2630IDBV	SOT-23-6	DBV	VAYI		TLV2630IDBVR† TLV2630IDBVT‡	Tape and Reel
TLV2630IP	DIP-8	P	—		TLV2630IP	Tube
<b>Single without Shutdown</b>						
TLV2631ID	SOIC-8	D	—	-40°C to 125°C	TLV2631ID TLV2631IDR	Tube Tape and Reel
TLV2631IDBV	SOT-23-5	DBV	VAZI		TLV2631IDBVR† TLV2631IDBVT‡	Tape and Reel
TLV2631IP	DIP-8	P	—		TLV2631IP	Tube
<b>Dual without Shutdown</b>						
TLV2632ID	SOIC-8	D	—	-40°C to 125°C	TLV2632ID TLV2632IDR	Tube Tape and Reel
TLV2632IDGK	MSOP-8	DGK	AKG		TLV2632IDGK TLV2632IDGKR	Tube Tape and Reel
TLV2632IP	DIP-8	P	—		TLV2632IP	Tube
<b>Dual with Shutdown</b>						
TLV2633ID	SOIC-14	D	—	-40°C to 125°C	TLV2633ID TLV2633IDR	Tube Tape and Reel
TLV2633IDGS	MSOP-10	DGS	AKK		TLV2633IDGS TLV2633IDGSR	Tube Tape and Reel
TLV2633IN	DIP-14	N	—		TLV2633IN	Tube
<b>Quad without Shutdown</b>						
TLV2634ID	SOIC-14	D	—	-40°C to 125°C	TLV2634ID TLV2634IDR	Tube Tape and Reel
TLV2634IN	DIP-14	N	—		TLV2634IN	Tube
TLV2634IPW	TSSOP-14	PW	—		TLV2634IPW TLV2634IPWR	Tube Tape and Reel
<b>Quad with Shutdown</b>						
TLV2635ID	SOIC-16	D	—	-40°C to 125°C	TLV2635ID TLV2635IDR	Tube Tape and Reel
TLV2635IN	DIP-16	N	—		TLV2635IN	Tube
TLV2635IPW	TSSOP-16	PW	—		TLV2635IPW TLV2635IPWR	Tube Tape and Reel

† The SOT23 package devices are only available taped and reeled. The R Suffix denotes quantities (3,000 pieces per reel).

‡ The T Suffix denotes smaller quantities (250 pieces per mini-reel).

1. For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI website at [www.ti.com](http://www.ti.com).

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

Supply voltage, $V_{DD}$ (see Note 1) .....	6 V
Differential input voltage, $V_{ID}$ .....	$\pm V_{DD}$
Input voltage range, $V_I$ (see Note 1) .....	GND to $V_{DD} - 1$ V
Input current, $I_I$ (any input) .....	$\pm 10$ mA
Output current, $I_O$ .....	$\pm 40$ mA
Continuous total power dissipation .....	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ : I-suffix .....	$-40^\circ\text{C}$ to $125^\circ\text{C}$
Maximum junction temperature, $T_J$ .....	$150^\circ\text{C}$
Storage temperature range, $T_{stg}$ .....	$-65^\circ\text{C}$ to $150^\circ\text{C}$
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .....	$260^\circ\text{C}$

† 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.

NOTE 2: All voltage values, except differential voltages, are with respect to GND.

**recommended operating conditions**

		MIN	MAX	UNIT
Supply voltage, $V_{DD}$	Single supply	2.7	5.5	V
	Split supply	$\pm 1.35$	$\pm 2.75$	
Common-mode input voltage range, $V_{ICR}$		GND	$V_{DD}-1$	V
Operating free-air temperature, $T_A$	I-suffix	-40	125	$^\circ\text{C}$
Shutdown on/off voltage level‡	$V_{IL}$		0.4	V
	$V_{IH}$	2		

‡ Relative to GND.

**electrical characteristics at specified free-air temperature,  $V_{DD} = 2.7$  V, 5 V (unless otherwise noted)**

**dc performance**

PARAMETER	TEST CONDITIONS	$T_A$	MIN	TYP	MAX	UNIT
$V_{IO}$ Input offset voltage	$V_{IC} = V_{DD}/2$ , $V_O = V_{DD}/2$	TLV2634/5	25 $^\circ\text{C}$	250	3500	$\mu\text{V}$
			Full range		4500	
		25 $^\circ\text{C}$	250	4200	$\mu\text{V}$	
		Full range		5200		
$\alpha_{VIO}$ Temperature coefficient of input offset voltage		25 $^\circ\text{C}$		3	$\mu\text{V}/^\circ\text{C}$	
CMRR Common-mode rejection ratio	$V_{IC} = \text{GND to } V_{DD}-1$ V	$V_{DD} = 2.7$ V	25 $^\circ\text{C}$	76	100	dB
			Full range	67		
		$V_{DD} = 5$ V	25 $^\circ\text{C}$	77	100	
			Full range	74		
$A_{VD}$ Large-signal differential voltage amplification	$R_L = 2$ k $\Omega$ , $V_{O(PP)} = V_{DD}-1$ V	25 $^\circ\text{C}$	90	100	dB	
		Full range	82			

**electrical characteristics at specified free-air temperature,  $V_{DD} = 2.7\text{ V}, 5\text{ V}$  (unless otherwise noted) (continued)**

**input characteristics**

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	MIN	TYP	MAX	UNIT
$I_{IO}$ Input offset current	$V_{IC} = V_{DD}/2,$ $V_O = V_{DD}/2$	25°C		1	50	pA
		Full range			100	
25°C			1	50		
		Full range			200	
$r_{i(d)}$ Differential input resistance		25°C		1000		GΩ
$C_{i(c)}$ Common-mode input capacitance	$f = 1\text{ kHz}$	25°C		12		pF

† Full range is –40°C to 125°C for the I-suffix.

**output characteristics**

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	MIN	TYP	MAX	UNIT	
$V_{OH}$ High-level output voltage	$V_{IC} = V_{DD}/2, I_{OH} = -1\text{ mA}$	$V_{DD} = 2.7\text{ V}$	25°C	2.6	2.67	V	
			Full range		2.55		
		25°C	$V_{DD} = 5\text{ V}$		4.92		4.98
				Full range			4.9
	$V_{IC} = V_{DD}/2, I_{OH} = -10\text{ mA}$	$V_{DD} = 2.7\text{ V}$	25°C	2.25	2.43		
			Full range		2.15		
		25°C	$V_{DD} = 5\text{ V}$		4.7		4.8
				Full range			4.65
$V_{OL}$ Low-level output voltage	$V_{IC} = V_{DD}/2, I_{OL} = 1\text{ mA}$	$V_{DD} = 2.7\text{ V}$	25°C		0.03	0.1	mV
			Full range			0.15	
		25°C	$V_{DD} = 5\text{ V}$		0.025	0.08	
				Full range			
	$V_{IC} = V_{DD}/2, I_{OL} = 10\text{ mA}$	$V_{DD} = 2.7\text{ V}$	25°C		0.26	0.45	
			Full range			0.47	
		25°C	$V_{DD} = 5\text{ V}$		0.2	0.3	
				Full range			
$I_O$ Output current	$V_{DD} = 2.7\text{ V},$ $V_O = 0.5\text{ V}$ from rail	Sourcing	25°C		14	mA	
		Sinking			19		
	$V_{DD} = 5\text{ V},$ $V_O = 0.5\text{ V}$ from rail	Sourcing			28		
		Sinking			28		
$I_{OS}$ Short-circuit output current	Sourcing	$V_{DD} = 2.7\text{ V}$	25°C		50	mA	
		$V_{DD} = 5\text{ V}$			95		
	Sinking	$V_{DD} = 2.7\text{ V}$			50		
		$V_{DD} = 5\text{ V}$			95		

† Full range is –40°C to 125°C for the I-suffix.

**power supply**

PARAMETER	TEST CONDITIONS	$T_A^\dagger$	MIN	TYP	MAX	UNIT	
$I_{DD}$ Supply current (per channel)	$V_O = V_{DD}/2,$ $\overline{\text{SHDN}} = V_{DD}$	25°C		730	1000	μA	
		Full range			1350		
PSRR Supply voltage rejection ratio ( $\Delta V_{DD} / \Delta V_{IO}$ )	$V_{DD} = 2.7\text{ V}$ to $5.5\text{ V},$ $V_{IC} = V_{DD}/2$	No load	25°C		70	90	dB
				Full range		65	

† Full range is –40°C to 125°C for the I-suffix.

electrical characteristics at specified free-air temperature,  $V_{DD} = 2.7\text{ V}, 5\text{ V}$  (unless otherwise noted)  
 (continued)

dynamic performance

PARAMETER		TEST CONDITIONS		$T_A^\dagger$	MIN	TYP	MAX	UNIT
GBWP	Gain-bandwidth product	$R_L = 2\text{ k}\Omega, C_L = 10\text{ pF}, f = 10\text{ kHz}$		25°C		9		MHz
SR+	Positive slew rate at unity gain	$R_L = 2\text{ k}\Omega, C_L = 50\text{ pF}$	$V_{DD} = 2.7\text{ V}, V_{O(PP)} = 1.7\text{ V}$			6		V/ $\mu\text{s}$
			$V_{DD} = 5\text{ V}, V_{O(PP)} = 3.5\text{ V}$			6		
SR-	Negative slew rate at unity gain	$R_L = 2\text{ k}\Omega, C_L = 50\text{ pF}$	$V_{DD} = 2.7\text{ V}, V_{O(PP)} = 1.7\text{ V}$			10		V/ $\mu\text{s}$
			$V_{DD} = 5\text{ V}, V_{O(PP)} = 3.5\text{ V}$			9.5		V/ $\mu\text{s}$
$\phi_m$	Phase margin	$R_L = 2\text{ k}\Omega, C_L = 10\text{ pF}$				50		°
	Gain margin				20		dB	

$^\dagger$  Full range is  $-40^\circ\text{C}$  to  $125^\circ\text{C}$  for the I-suffix.

noise/distortion performance

PARAMETER		TEST CONDITIONS		$T_A$	MIN	TYP	MAX	UNIT	
THD + N	Total harmonic distortion plus noise	$V_{O(PP)} = V_{DD}/2, R_L = 2\text{ k}\Omega, f = 10\text{ kHz}$	$A_V = 1$	25°C		0.003%			
			$A_V = 10$			0.02%			
			$A_V = 100$			0.095%			
$V_n$	Equivalent input noise voltage	$f = 1\text{ kHz}$					50		nV/ $\sqrt{\text{Hz}}$
		$f = 10\text{ kHz}$					30		
$I_n$	Equivalent input noise current	$f = 1\text{ kHz}$					0.9		fA/ $\sqrt{\text{Hz}}$

shutdown characteristics

PARAMETER		TEST CONDITIONS		$T_A^\dagger$	MIN	TYP	MAX	UNIT
$I_{DD(SHDN)}$	Supply current, per channel in shutdown mode (TLV2630, TLV2633, TLV2635)	$\overline{\text{SHDN}} = 0.4\text{ V}$		25°C		4	17	$\mu\text{A}$
				Full range			19	
$t_{(on)}$	Amplifier turnon time $^\ddagger$	$R_L = 2\text{ k}\Omega, C_L = 10\text{ pF}$	$V_{DD} = 2.7\text{ V}$	25°C		4.5		$\mu\text{s}$
	$V_{DD} = 5\text{ V}$				1.5			
$t_{(off)}$	Amplifier turnoff time $^\ddagger$						200	

$^\dagger$  Full range is  $-40^\circ\text{C}$  to  $125^\circ\text{C}$  for the I-suffix.

$^\ddagger$  Disable time and enable time are defined as the interval between application of the logic signal to  $\overline{\text{SHDN}}$  and the point at which the supply current has reached half its final value.

**DISSIPATION RATING TABLE**

PACKAGE	$\Theta_{JC}$ (°C/W)	$\Theta_{JA}$ (°C/W)	$T_A \leq 25^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
D (8)	38.3	176	710 mW	142 mW
D (14)	26.9	122.3	1022 mW	204.4 mW
D (16)	25.7	114.7	1090 mW	218 mW
DBV (5)	55	324.1	385 mW	77.1 mW
DBV (6)	55	294.3	425 mW	85 mW
DGK (8)	54.2	259.9	481 mW	96.1 mW
DGS (10)	54.1	259.7	485 mW	97 mW
N (14, 16)	32	78	1600 mW	320.5 mW
P (8)	41	104	1200 mW	240.4 mW
PW (14)	29.3	173.6	720 mW	144 mW
PW (16)	28.7	161.4	774 mW	154.9 mW

**TYPICAL CHARACTERISTICS**

**Table of Graphs**

			<b>FIGURE</b>
$V_{IO}$	Input offset voltage	vs Common-mode input voltage	1, 2
CMRR	Common-mode rejection ratio	vs Frequency	3
$V_{OH}$	High-level output voltage	vs High-level output current	4, 6
$V_{OL}$	Low-level output voltage	vs Low-level output current	5, 7
$I_{DD}$	Supply current	vs Supply voltage	8
$I_{DD}$	Supply current	vs Free-air temperature	9
PSRR	Power supply rejection ratio	vs Frequency	10
$A_{VD}$	Differential voltage amplification & phase	vs Frequency	11
	Gain-bandwidth product	vs Supply voltage	12
		vs Free-air temperature	13
SR	Slew rate	vs Supply voltage	14
		vs Free-air temperature	15, 16
$\phi_m$	Phase margin	vs Load capacitance	17
$V_n$	Equivalent input noise voltage	vs Frequency	18
	Crosstalk	vs Frequency	19
	Voltage-follower large-signal pulse response		20
	Voltage-follower small-signal pulse response		21
$I_{DD(SHDN)}$	Shutdown supply current	vs Free-air temperature	22
$I_{DD(SHDN)}$	Shutdown supply current	vs Supply voltage	23
$I_{DD(SHDN)}$	Shutdown supply current/output voltage	vs Time	24

TYPICAL CHARACTERISTICS

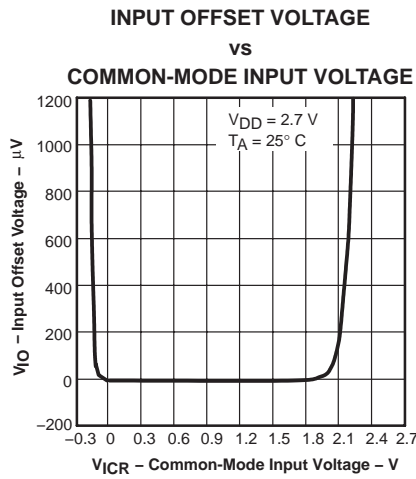


Figure 1

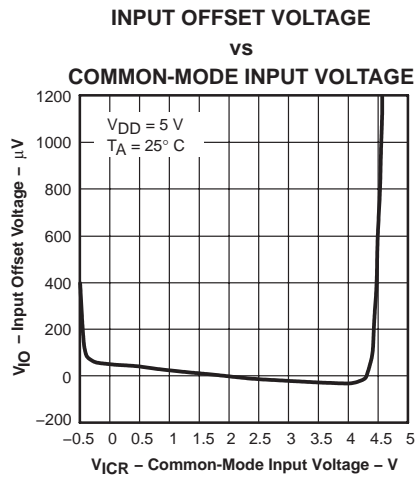


Figure 2

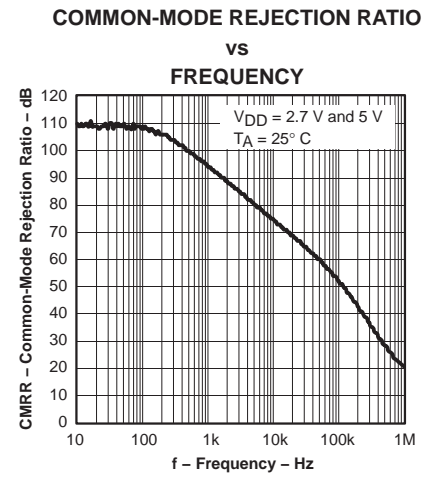


Figure 3

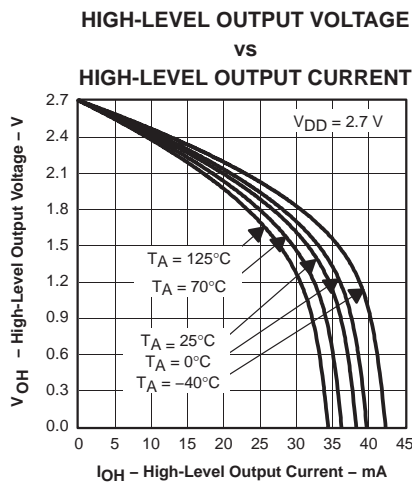


Figure 4

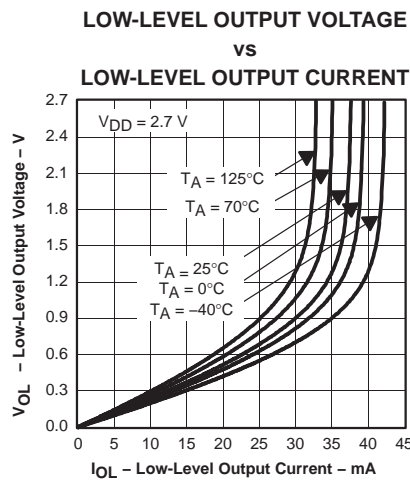


Figure 5

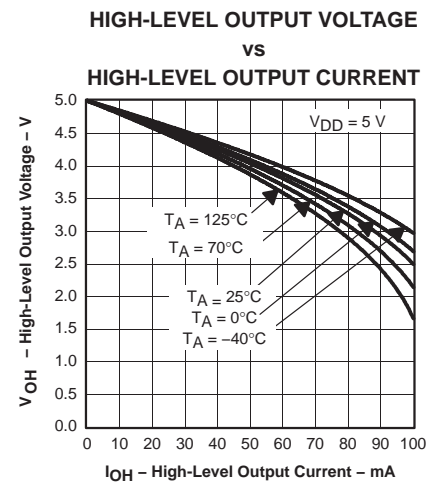


Figure 6

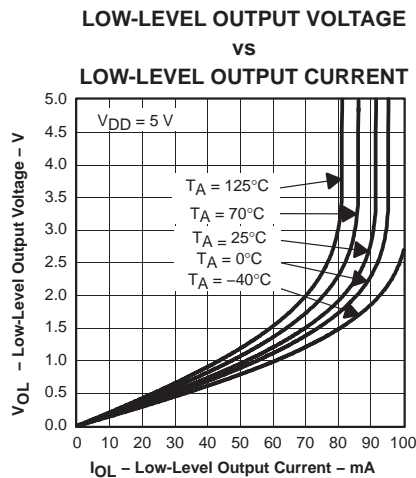


Figure 7

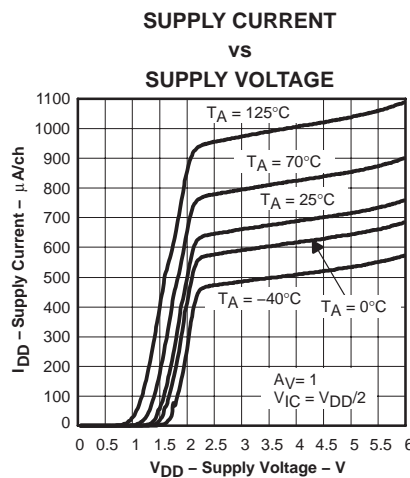


Figure 8

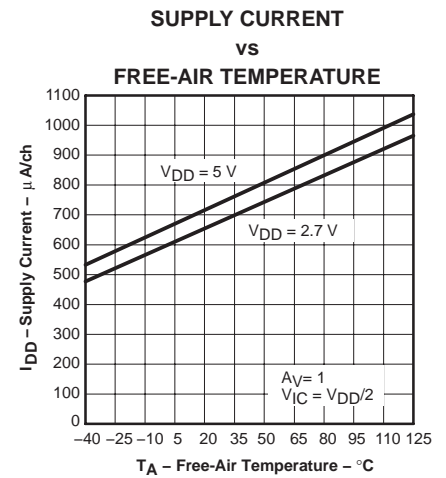


Figure 9

TYPICAL CHARACTERISTICS

POWER SUPPLY REJECTION RATIO

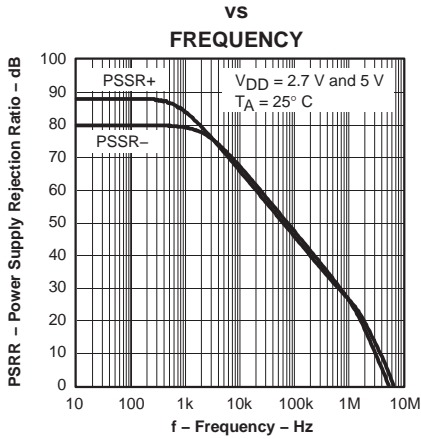


Figure 10

DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE

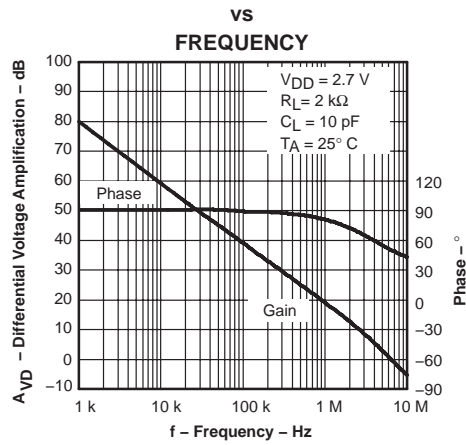


Figure 11

GAIN-BANDWIDTH PRODUCT

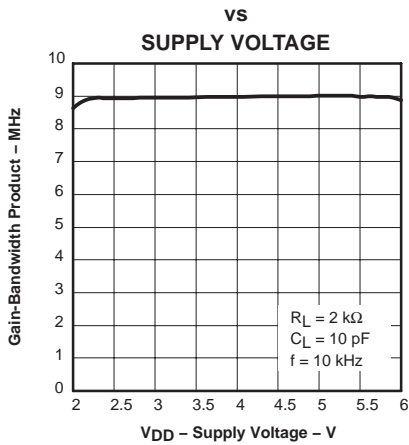


Figure 12

GAIN-BANDWIDTH PRODUCT

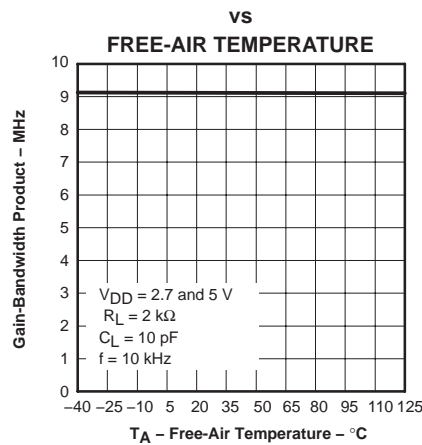


Figure 13

SLEW RATE

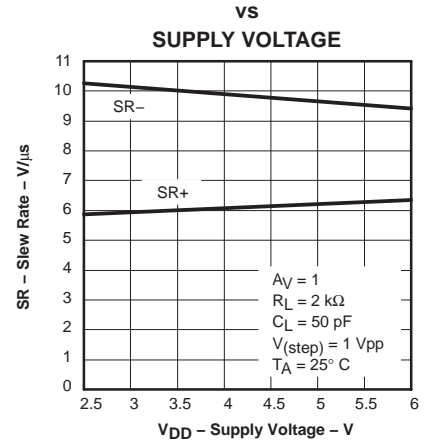


Figure 14

SLEW RATE

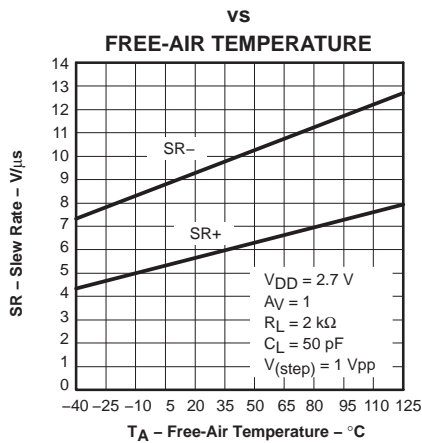


Figure 15

SLEW RATE

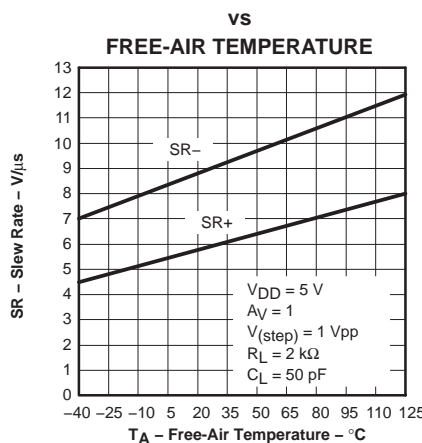


Figure 16

PHASE MARGIN

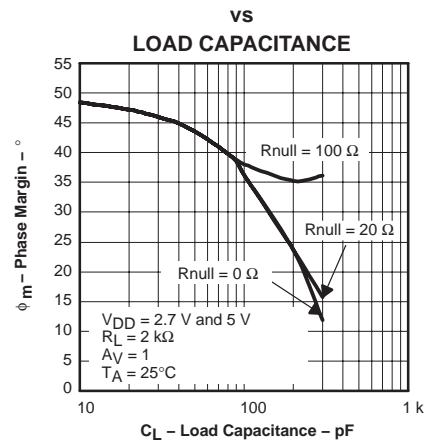


Figure 17

TYPICAL CHARACTERISTICS

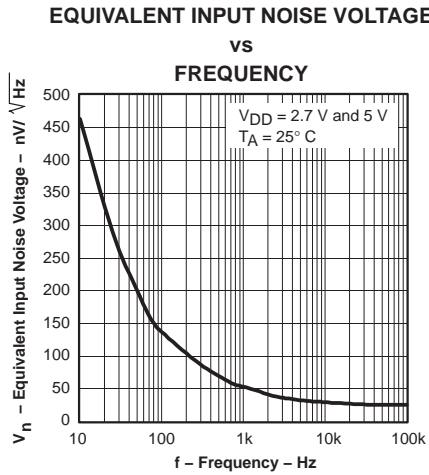


Figure 18

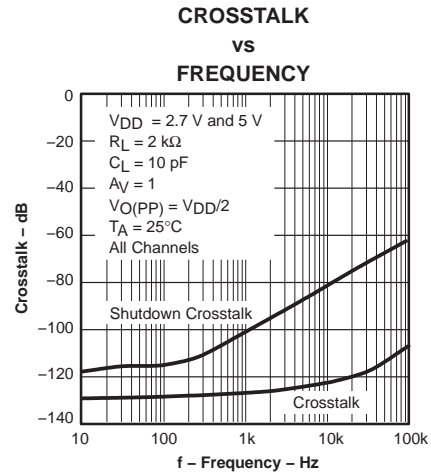


Figure 19

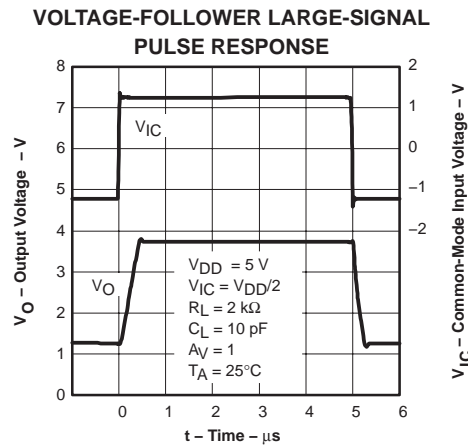


Figure 20

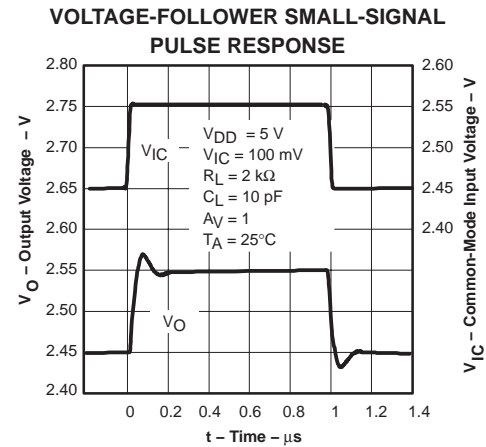


Figure 21

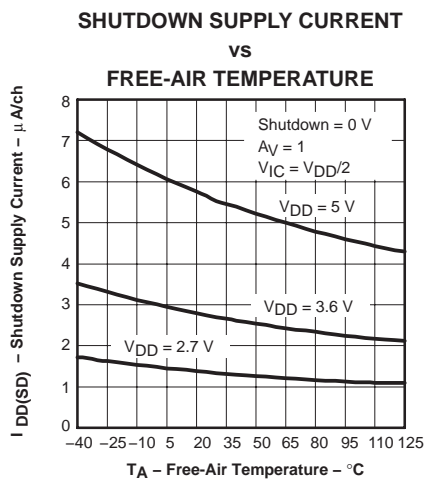


Figure 22

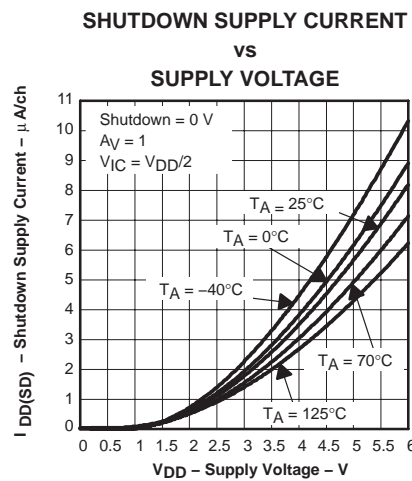


Figure 23

### TYPICAL CHARACTERISTICS

#### SHUTDOWN SUPPLY CURRENT / OUTPUT VOLTAGE vs TIME

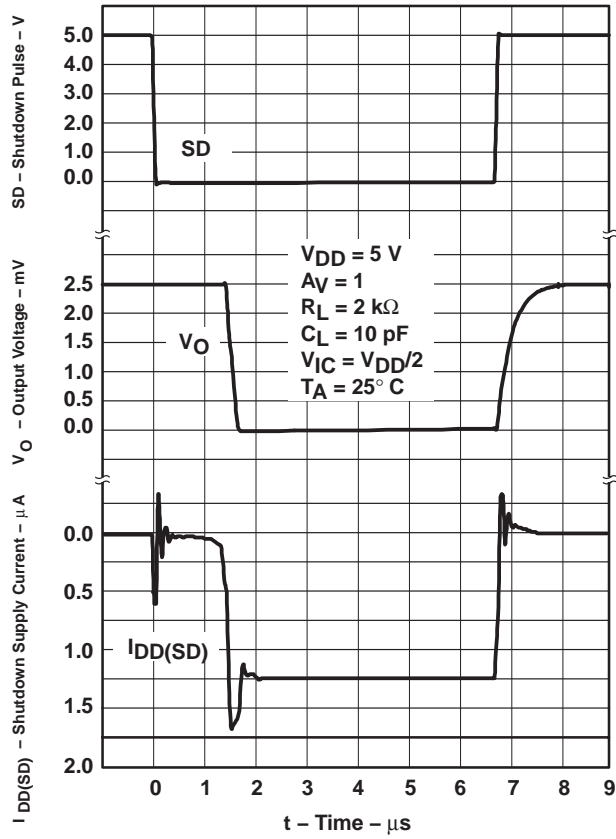
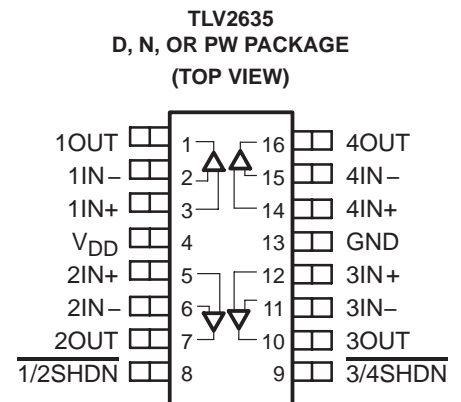
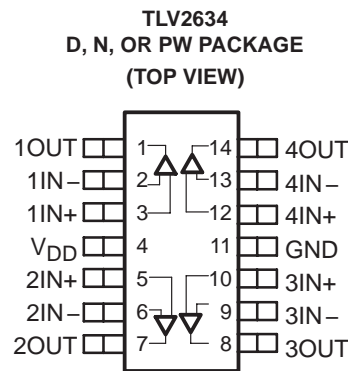
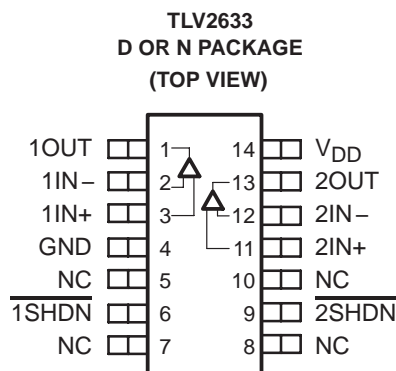
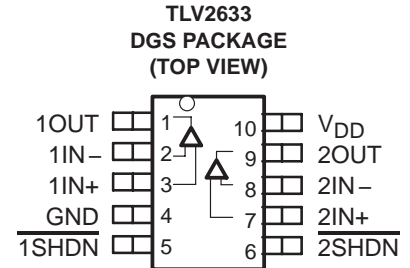
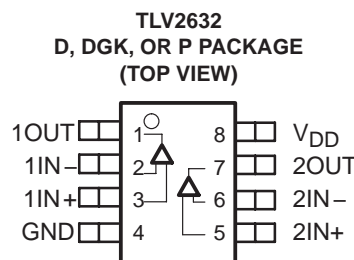
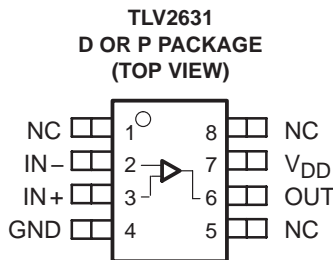
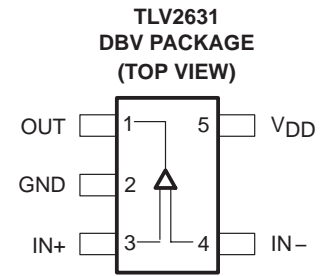
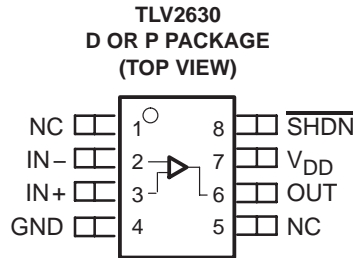
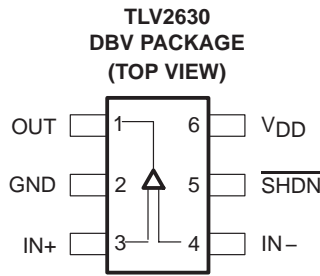


Figure 24

**TLV263x PACKAGE PINOUTS**



NC – No internal connection

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>
TLV2630IDBVR	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2630IDBVRG4	ACTIVE	SOT-23	DBV	6	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2631IDBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2631IDBVRG4	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2631IDBVT	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2631IDBVTG4	ACTIVE	SOT-23	DBV	5	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2631IPE4	ACTIVE	PDIP	P	8		TBD	Call TI	Call TI
TLV2632ID	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2632IDG4	ACTIVE	SOIC	D	8	75	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2632IDGKR	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2632IDGKRG4	ACTIVE	MSOP	DGK	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2632IDR	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2632IDRG4	ACTIVE	SOIC	D	8	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2633IDGSR	ACTIVE	MSOP	DGS	10	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2633IDGSRG4	ACTIVE	MSOP	DGS	10	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2634ID	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2634IDG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2634IPWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2634IPWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2635ID	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
TLV2635IDG4	ACTIVE	SOIC	D	16	40	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.

**Important Information and Disclaimer:**The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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

**TAPE AND REEL INFORMATION**



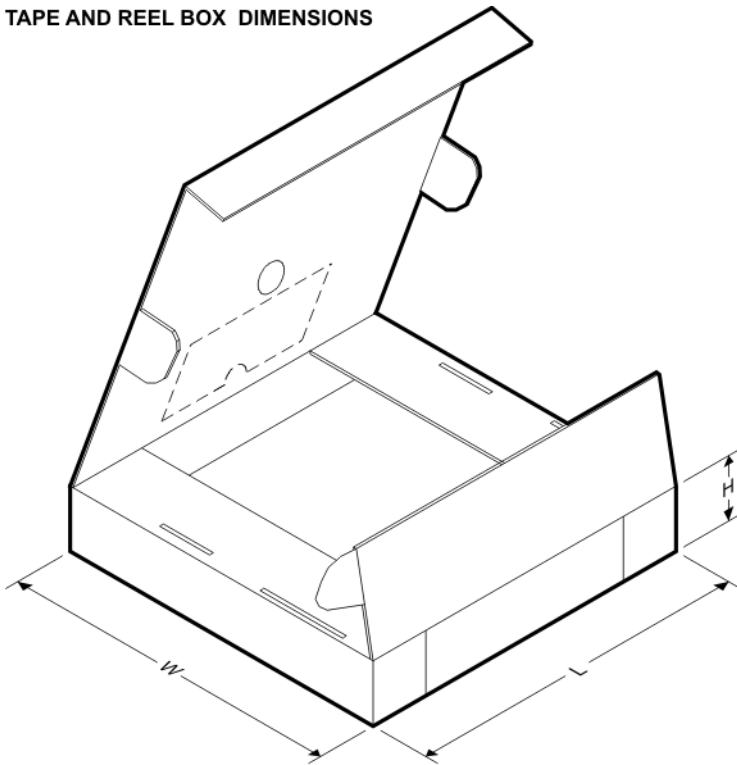
**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**



\*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
TLV2630IDBVR	SOT-23	DBV	6	3000	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TLV2631IDBVR	SOT-23	DBV	5	3000	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TLV2631IDBVT	SOT-23	DBV	5	250	180.0	9.0	3.15	3.2	1.4	4.0	8.0	Q3
TLV2632IDGKR	MSOP	DGK	8	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TLV2632IDR	SOIC	D	8	2500	330.0	12.4	6.4	5.2	2.1	8.0	12.0	Q1
TLV2633IDGSR	MSOP	DGS	10	2500	330.0	12.4	5.3	3.4	1.4	8.0	12.0	Q1
TLV2634IPWR	TSSOP	PW	14	2000	330.0	12.4	7.0	5.6	1.6	8.0	12.0	Q1

**TAPE AND REEL BOX DIMENSIONS**



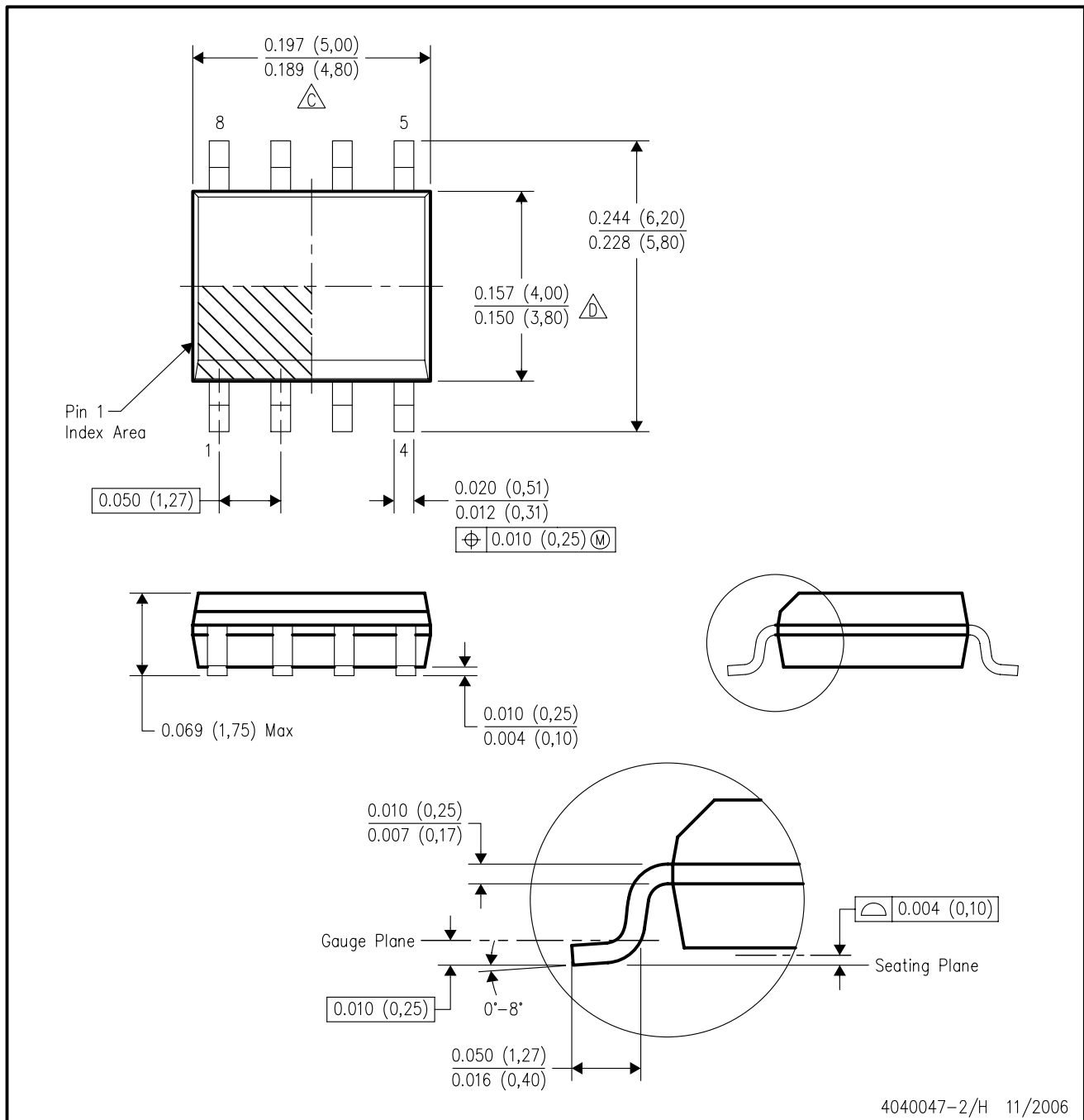
\*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TLV2630IDBVR	SOT-23	DBV	6	3000	182.0	182.0	20.0
TLV2631IDBVR	SOT-23	DBV	5	3000	182.0	182.0	20.0
TLV2631IDBVT	SOT-23	DBV	5	250	182.0	182.0	20.0
TLV2632IDGKR	MSOP	DGK	8	2500	358.0	335.0	35.0
TLV2632IDR	SOIC	D	8	2500	340.5	338.1	20.6
TLV2633IDGSR	MSOP	DGS	10	2500	358.0	335.0	35.0
TLV2634IPWR	TSSOP	PW	14	2000	346.0	346.0	29.0



D (R-PDSO-G8)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in inches (millimeters).
  - 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.
  - Reference JEDEC MS-012 variation AA.

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

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



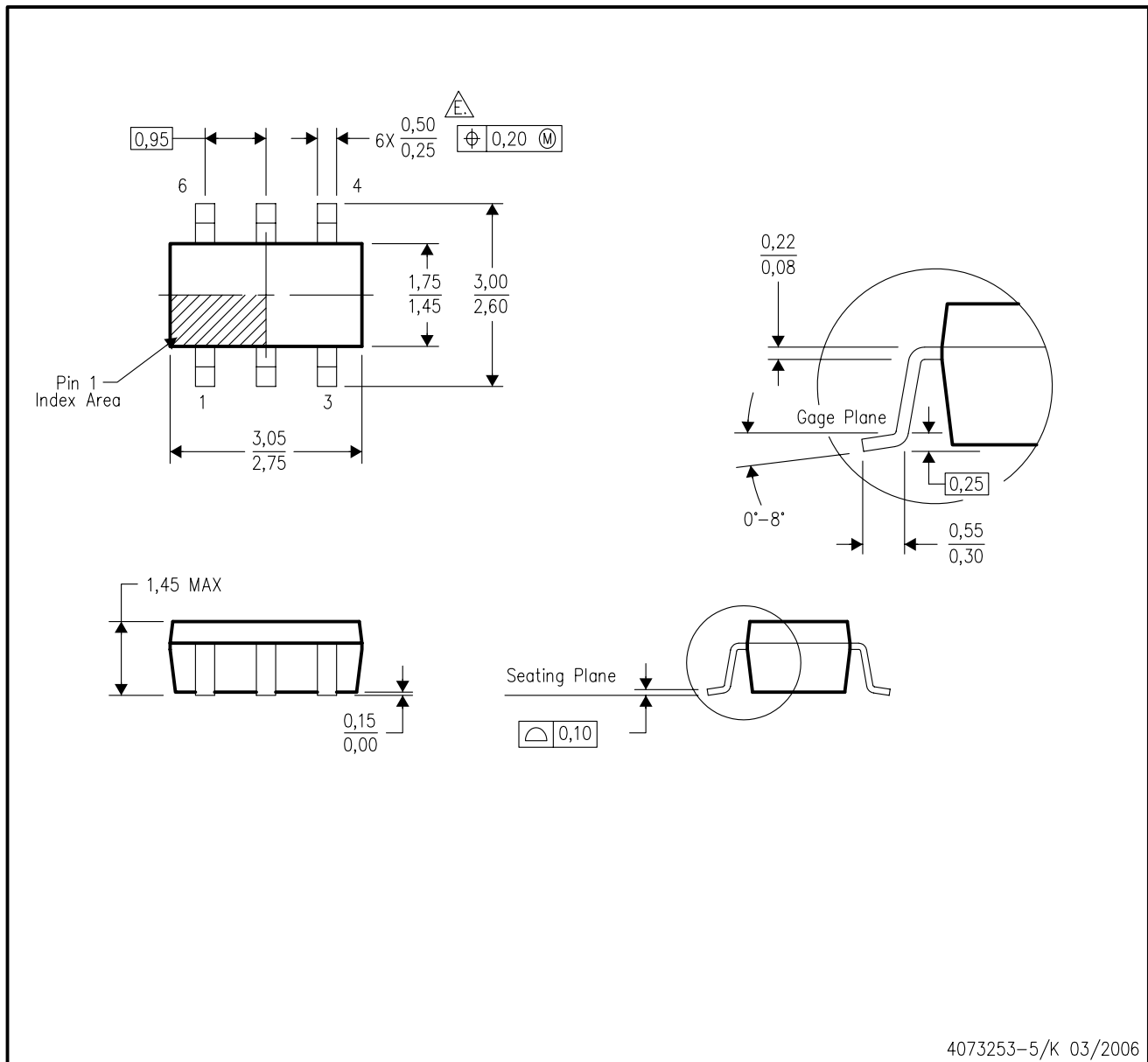
4040064/F 01/97

- 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



DBV (R-PDSO-G6)

PLASTIC SMALL-OUTLINE PACKAGE

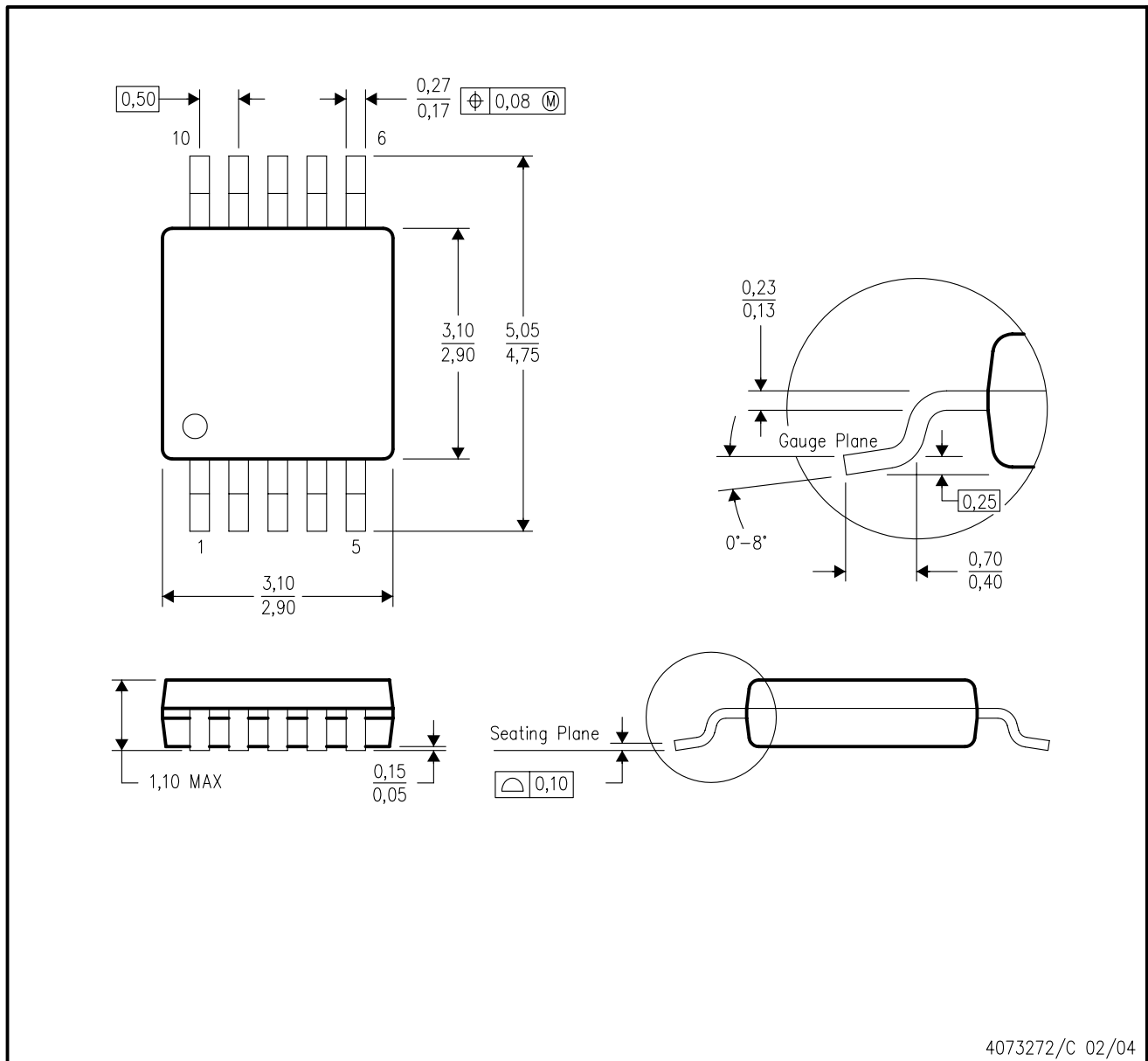


- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
  - D. Leads 1,2,3 may be wider than leads 4,5,6 for package orientation.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



DGS (S-PDSO-G10)

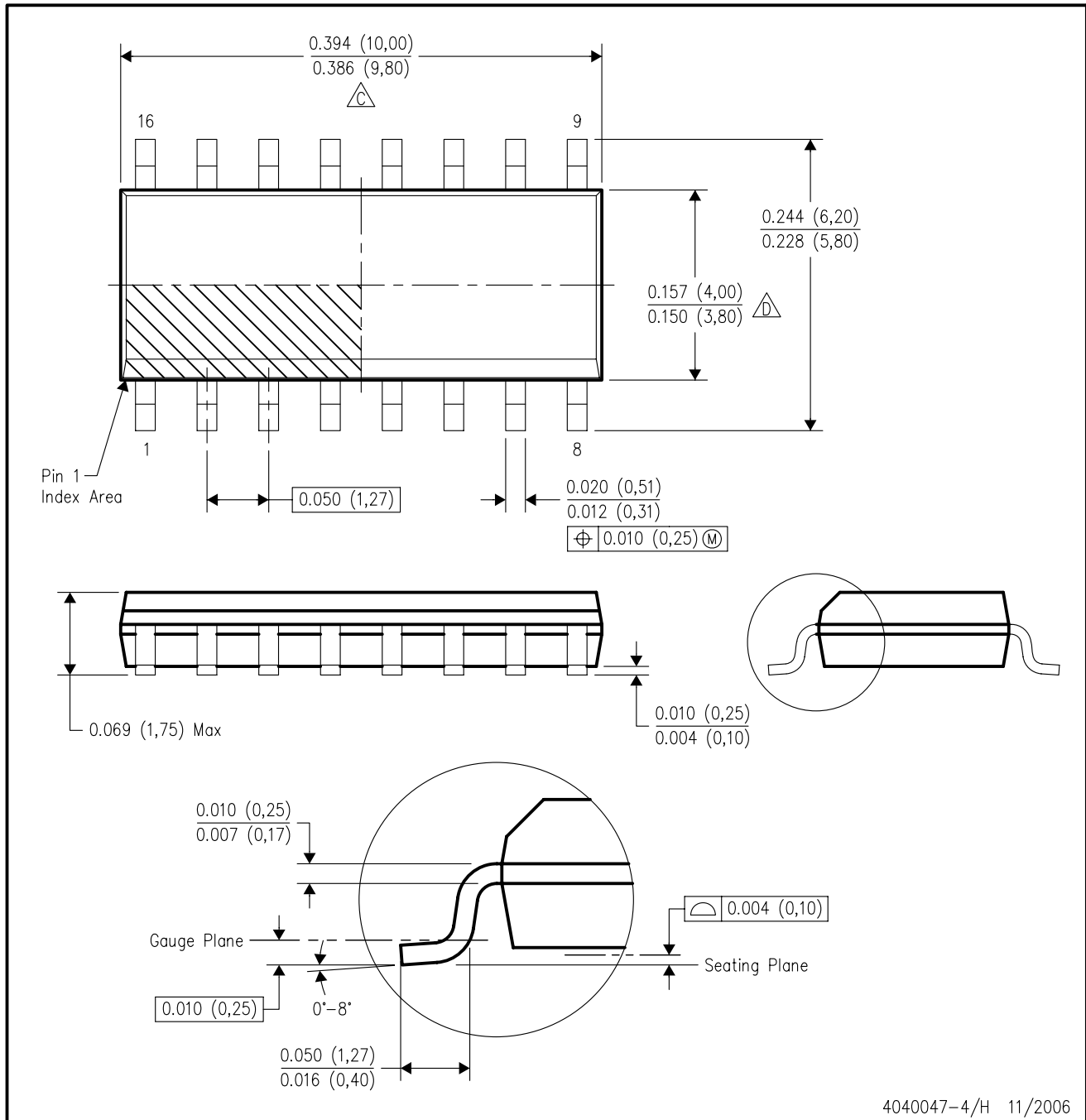
PLASTIC SMALL-OUTLINE PACKAGE



- 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.
  - D. Falls within JEDEC MO-187 variation BA.

D (R-PDSO-G16)

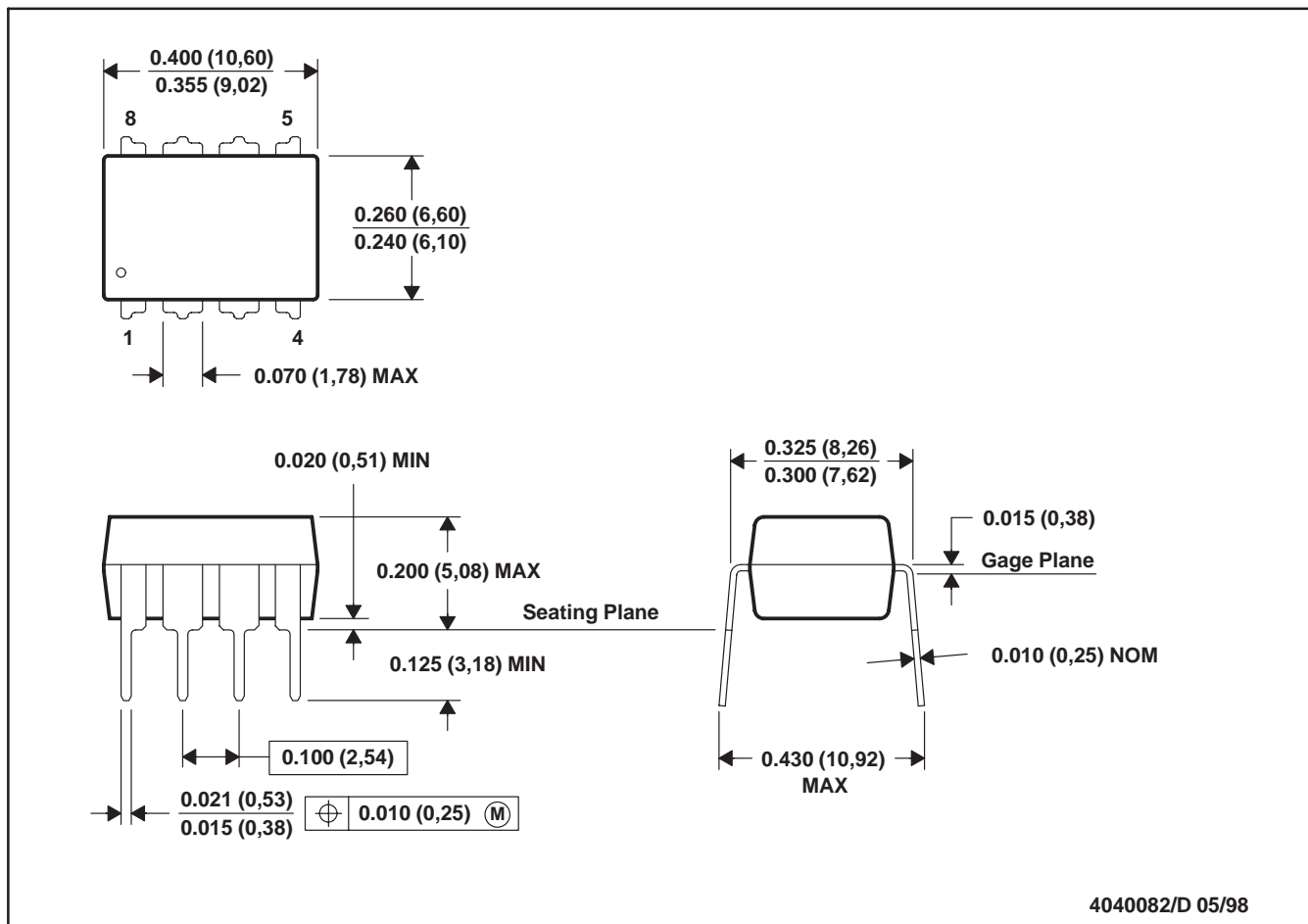
PLASTIC SMALL-OUTLINE PACKAGE



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

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)

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

### Products

Amplifiers	<a href="http://amplifier.ti.com">amplifier.ti.com</a>
Data Converters	<a href="http://dataconverter.ti.com">dataconverter.ti.com</a>
DSP	<a href="http://dsp.ti.com">dsp.ti.com</a>
Clocks and Timers	<a href="http://www.ti.com/clocks">www.ti.com/clocks</a>
Interface	<a href="http://interface.ti.com">interface.ti.com</a>
Logic	<a href="http://logic.ti.com">logic.ti.com</a>
Power Mgmt	<a href="http://power.ti.com">power.ti.com</a>
Microcontrollers	<a href="http://microcontroller.ti.com">microcontroller.ti.com</a>
RFID	<a href="http://www.ti-rfid.com">www.ti-rfid.com</a>
RF/IF and ZigBee® Solutions	<a href="http://www.ti.com/lprf">www.ti.com/lprf</a>

### Applications

Audio	<a href="http://www.ti.com/audio">www.ti.com/audio</a>
Automotive	<a href="http://www.ti.com/automotive">www.ti.com/automotive</a>
Broadband	<a href="http://www.ti.com/broadband">www.ti.com/broadband</a>
Digital Control	<a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a>
Medical	<a href="http://www.ti.com/medical">www.ti.com/medical</a>
Military	<a href="http://www.ti.com/military">www.ti.com/military</a>
Optical Networking	<a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a>
Security	<a href="http://www.ti.com/security">www.ti.com/security</a>
Telephony	<a href="http://www.ti.com/telephony">www.ti.com/telephony</a>
Video & Imaging	<a href="http://www.ti.com/video">www.ti.com/video</a>
Wireless	<a href="http://www.ti.com/wireless">www.ti.com/wireless</a>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265  
Copyright © 2008, Texas Instruments Incorporated