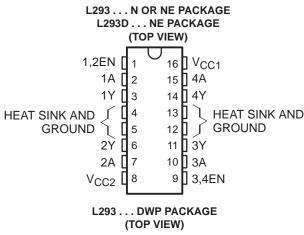
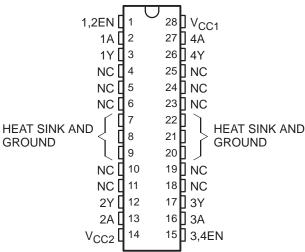
- Featuring Unitrode L293 and L293D
 Products Now From Texas Instruments
- Wide Supply-Voltage Range: 4.5 V to 36 V
- Separate Input-Logic Supply
- Internal ESD Protection
- Thermal Shutdown
- High-Noise-Immunity Inputs
- Functionally Similar to SGS L293 and SGS L293D
- Output Current 1 A Per Channel (600 mA for L293D)
- Peak Output Current 2 A Per Channel (1.2 A for L293D)
- Output Clamp Diodes for Inductive Transient Suppression (L293D)

description/ordering information

The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

All inputs are TTL compatible. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-





Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications.

ORDERING INFORMATION

TA	PACKAGE [†]	ORDERABLE PART NUMBER	TOP-SIDE MARKING	
	HSOP (DWP)	Tube of 20	L293DWP	L293DWP
0°C to 70°C	PDIP (N)	Tube of 25	L293N	L293N
	PDIP (NE)	Tube of 25	L293NE	L293NE
	FDIF (NL)	Tube of 25	L293DNE	L293DNE

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



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.



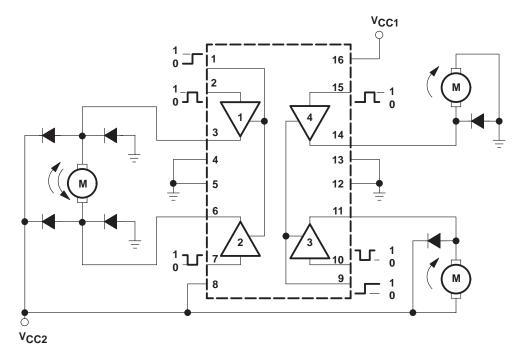
description/ordering information (continued)

On the L293, external high-speed output clamp diodes should be used for inductive transient suppression.

A V_{CC1} terminal, separate from V_{CC2} , is provided for the logic inputs to minimize device power dissipation.

The L293and L293D are characterized for operation from 0°C to 70°C.

block diagram



NOTE: Output diodes are internal in L293D.

FUNCTION TABLE (each driver)

INPU	OUTPUT		
Α	EN	Υ	
Н	Н	Н	
L	Н	L	
Х	L	Z	

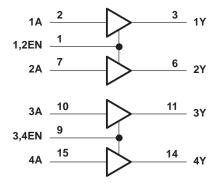
H = high level, L = low level, X = irrelevant, Z = high impedance (off)



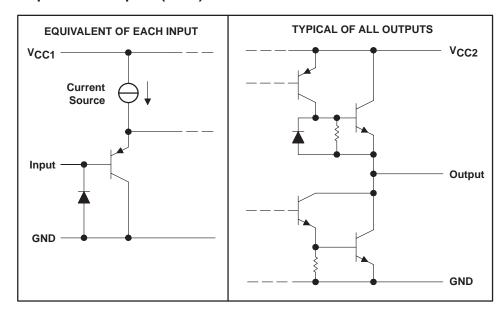
[†] In the thermal shutdown mode, the output is in the high-impedance state, regardless of the input levels.

L293, L293D

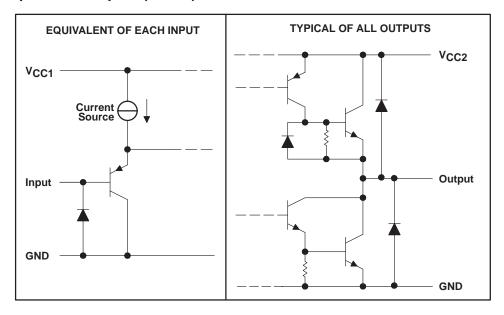
logic diagram



schematics of inputs and outputs (L293)



schematics of inputs and outputs (L293D)



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

Supply voltage, V _{CC1} (see Note 1)	
Input voltage, V ₁	
Output voltage range, V _O	
Peak output current, I_{O} (nonrepetitive, t \leq 5 ms): L293 .	002
Peak output current, I _O (nonrepetitive, $t \le 3$ ms): L293 .	
Continuous output current, IO: L293	
Continuous output current, IO: L293D	
Package thermal impedance, θ_{JA} (see Notes 2 and 3): [
• • • • • • • • • • • • • • • • • • • •	N package
	NE package TBD°C/W
Maximum junction temperature, T _.	
Storage temperature range, T _{stg}	

[†] 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 are with respect to the network ground terminal.
 - 2. Maximum power dissipation is a function of $T_J(max)$, θ_{JA} , and T_A . The maximum allowable power dissipation at any allowable ambient temperature is $P_D = (T_J(max) - T_A)/\theta_{JA}$. Operating at the absolute maximum T_J of 150°C can affect reliability.
 - 3. The package thermal impedance is calculated in accordance with JESD 51-7.



recommended operating conditions

		MIN	MAX	UNIT
	V _{CC1}	4.5	7	V
	Supply voltage VCC2	V _{CC1}	36	V
\/	V _{CC1} ≤ 7 V	2.3	V _{CC1}	V
VIH	High-level input voltage V _{CC1} ≥ 7 V	2.3	7	V
V_{IL}	Low-level output voltage	-0.3†	1.5	V
TA	Operating free-air temperature	0	70	°C

[†] The algebraic convention, in which the least positive (most negative) designated minimum, is used in this data sheet for logic voltage levels.

electrical characteristics, V_{CC1} = 5 V, V_{CC2} = 24 V, T_A = 25°C

	PARAMETER			TEST CONDITIONS	MIN	TYP	MAX	UNIT
Vон	High-level output voltage		L293: I _{OH} : L293D: I _{OH}		V _{CC2} -1.8	V _{CC2} – 1.4		V
VOL	V _{OL} Low-level output voltage		L293: I _{OL} = L293D: I _{OL} :			1.2	1.8	V
Vокн	High-level output clamp ve	oltage	L293D: I _{OK}	=-0.6 A		V _{CC2} + 1.3		V
VOKL	Low-level output clamp vo	oltage	L293D: I _{OK}	= 0.6 A		1.3		V
	I _{IH} High-level input current A EN					0.2	100	
ЧH			V _I = 7 V			0.2	10	μΑ
		А	., .			-3	-10	
¹IL	Low-level input current	EN	V _I = 0			-2	-100	μΑ
				All outputs at high level		13	22	
ICC1	Logic supply current		$I_O = 0$	All outputs at low level		35	60	mA
				All outputs at high impedance		8	24	
				All outputs at high level		14	24	
ICC2	ICC2 Output supply current		IO = 0	All outputs at low level		2	6	mA
				All outputs at high impedance		2	4	

switching characteristics, V_{CC1} = 5 V, V_{CC2} = 24 V, T_A = 25°C

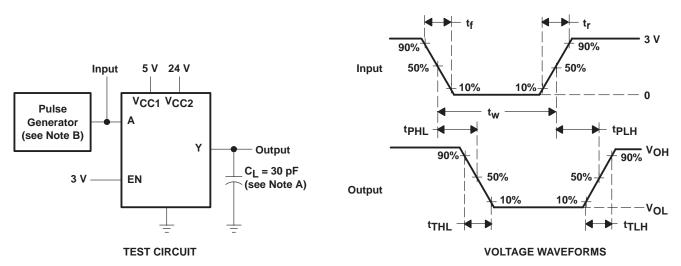
	DADAMETED	TEST SOUDITIONS	L293NE, L293DNE			
	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
tPLH	Propagation delay time, low-to-high-level output from A input			800		ns
tPHL	Propagation delay time, high-to-low-level output from A input	C 20 pE Soo Figure 1		400		ns
^t TLH	Transition time, low-to-high-level output	C _L = 30 pF, See Figure 1		300		ns
tTHL	Transition time, high-to-low-level output			300		ns

switching characteristics, V_{CC1} = 5 V, V_{CC2} = 24 V, T_A = 25°C

	PARAMETER	TEST CONDITIONS	L293DWP, L293N L293DN			UNIT
			MIN	TYP	MAX	
tPLH	Propagation delay time, low-to-high-level output from A input			750		ns
tPHL	Propagation delay time, high-to-low-level output from A input	C _I = 30 pF, See Figure 1		200		ns
tTLH	Transition time, low-to-high-level output	oL = 30 pr., See Figure 1	·	100		ns
tTHL	Transition time, high-to-low-level output		·	350	·	ns



PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and jig capacitance.

B. The pulse generator has the following characteristics: $t_{\Gamma} \le 10$ ns, $t_{W} = 10$ μ s, PRR = 5 kHz, $Z_{O} = 50$ Ω .

Figure 1. Test Circuit and Voltage Waveforms

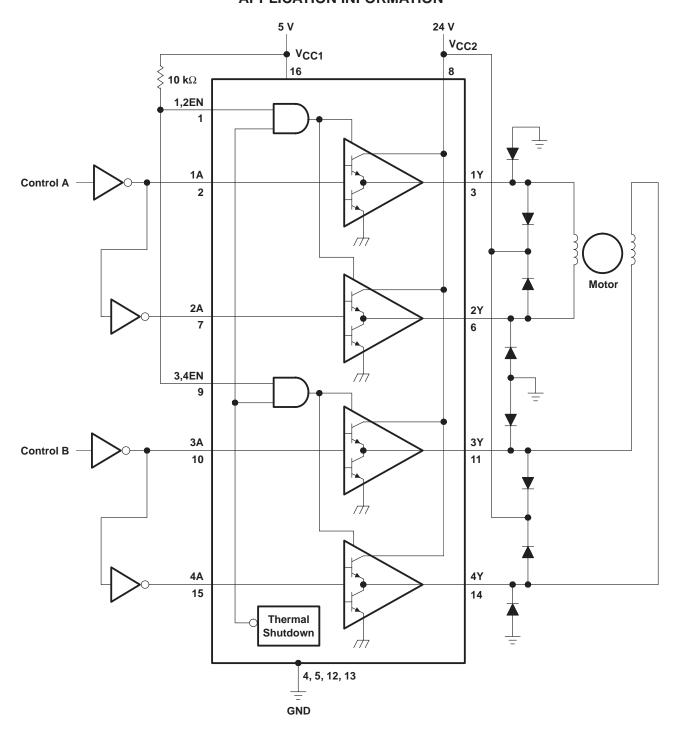


Figure 2. Two-Phase Motor Driver (L293)

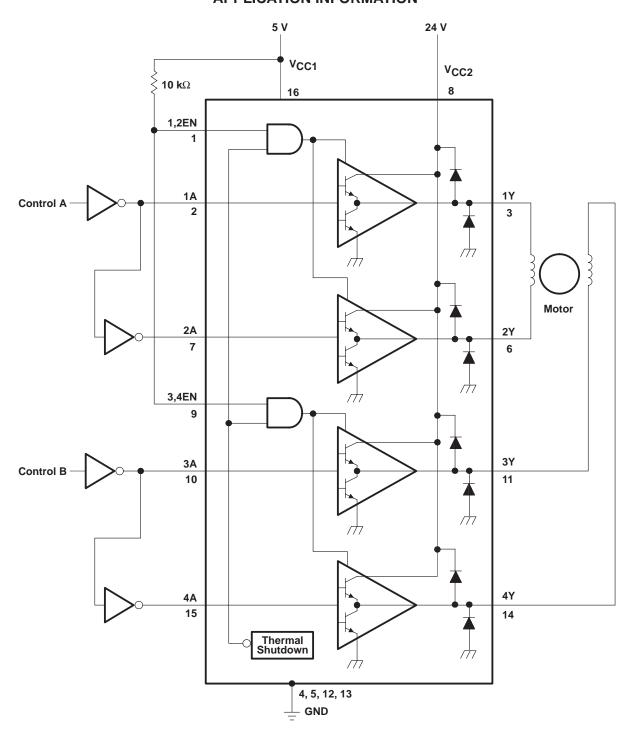
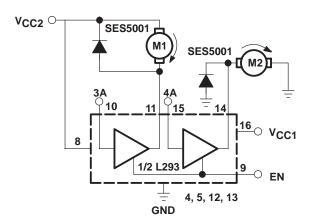


Figure 3. Two-Phase Motor Driver (L293D)





EN	3A	M1	4A	M2
Н	Н	Fast motor stop	Н	Run
Н	L	Run	L	Fast motor stop
L	Х	Free-running motor stop	Х	Free-running motor stop

L = low, H = high, X = don't care

Figure 4. DC Motor Controls (connections to ground and to supply voltage)

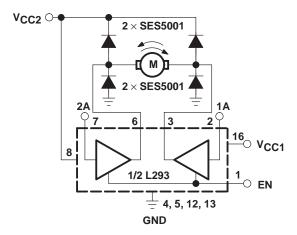
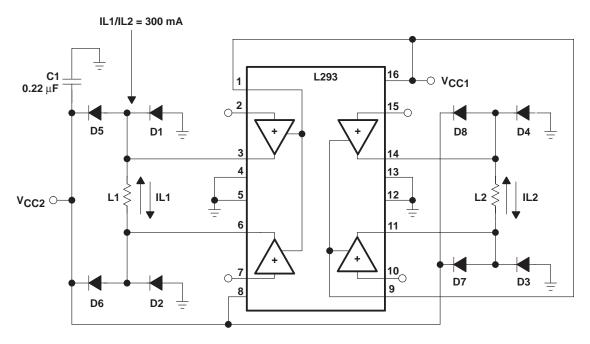


Figure 5. Bidirectional DC Motor Control

EN	1A	2A	FUNCTION
Н	L	Н	Turn right
Н	Н	L	Turn left
Н	L	L	Fast motor stop
Н	Н	Н	Fast motor stop
L	Χ	Х	Fast motor stop

L = low, H = high, X = don't care



D1-D8 = SES5001

Figure 6. Bipolar Stepping-Motor Control

mounting instructions

The Rthj-amp of the L293 can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board or to an external heat sink.

Figure 9 shows the maximum package power P_{TOT} and the θ_{JA} as a function of the side ℓ of two equal square copper areas having a thickness of 35 μ m (see Figure 7). In addition, an external heat sink can be used (see Figure 8).

During soldering, the pin temperature must not exceed 260°C, and the soldering time must not exceed 12 seconds.

The external heatsink or printed circuit copper area must be connected to electrical ground.



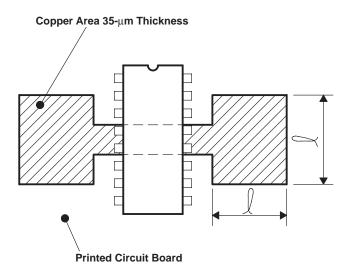


Figure 7. Example of Printed Circuit Board Copper Area (used as heat sink)

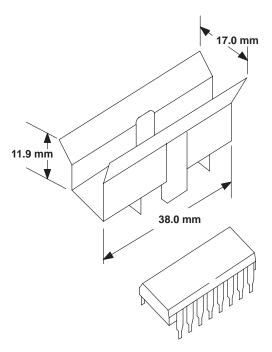
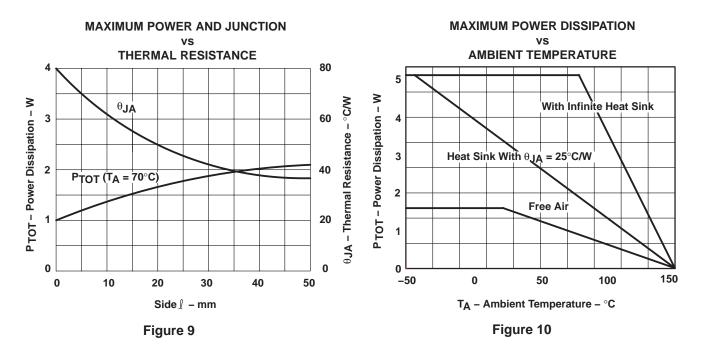


Figure 8. External Heat Sink Mounting Example ($\theta_{JA} = 25^{\circ}\text{C/W}$)



PACKAGE OPTION ADDENDUM

12-Sep-2005



RUMENTS

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp (3)
L293DDWP	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI
L293DDWPTR	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI
L293DN	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
L293DNE	ACTIVE	PDIP	NE	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
L293DNEE4	ACTIVE	PDIP	NE	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
L293DSP	OBSOLETE			16		TBD	Call TI	Call TI
L293DSP883B	OBSOLETE			16		TBD	Call TI	Call TI
L293DSP883C	OBSOLETE		UTR			TBD	Call TI	Call TI
L293DWP	ACTIVE	SO Power PAD	DWP	28	20 (Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
L293DWPG4	ACTIVE	SO Power PAD	DWP	28	20	TBD	Call TI	Call TI
L293DWPTR	OBSOLETE	SO Power PAD	DWP	28		TBD	Call TI	Call TI
L293N	ACTIVE	PDIP	N	16	25 (Green (RoHS & no Sb/Br)	Call TI	Level-NC-NC-NC
L293NE	ACTIVE	PDIP	NE	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC
L293NEE4	ACTIVE	PDIP	NE	16	25	Pb-Free (RoHS)	CU NIPDAU	Level-NC-NC-NC

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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PACKAGE OPTION ADDENDUM

12-Sep-2005

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N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



NOTES:

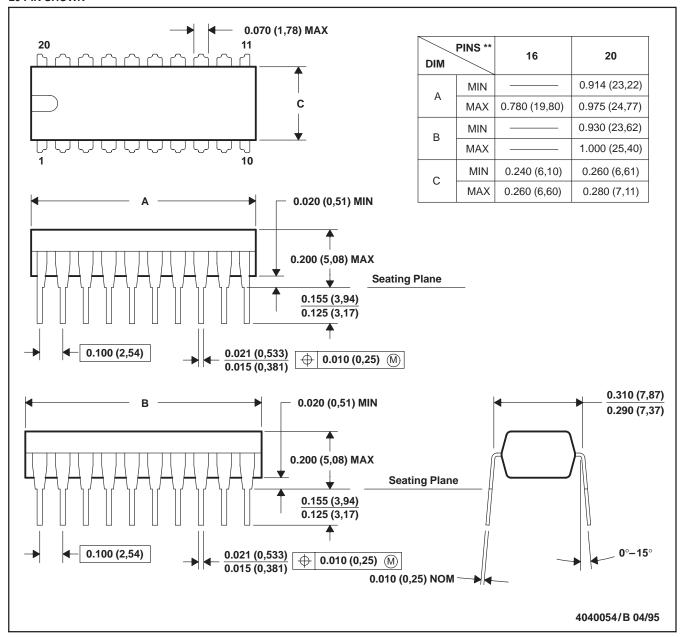
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
- The 20 pin end lead shoulder width is a vendor option, either half or full width.



NE (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

20 PIN SHOWN



NOTES: A. All linear dimensions are in inches (millimeters).

B. This drawing is subject to change without notice.

C. Falls within JEDEC MS-001 (16 pin only)

DWP (R-PDSO-G**)

PowerPAD™ PLASTIC SMALL-OUTLINE PACKAGE

20 PINS SHOWN



NOTES:

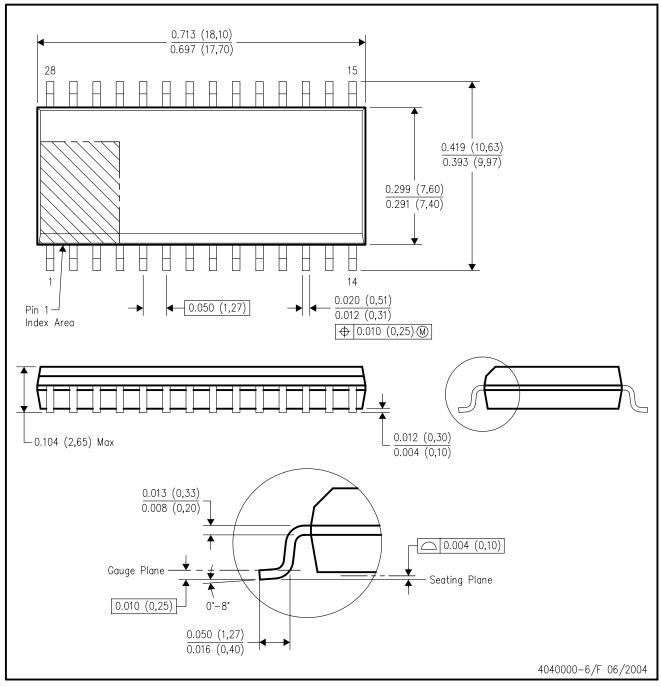
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPad Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 for information regarding recommended board layout. This document is available at www.ti.com http://www.ti.com. See the product data sheet for details regarding the exposed thermal pad dimensions.

PowerPAD is a trademark of Texas Instruments.



DW (R-PDSO-G28)

PLASTIC SMALL-OUTLINE PACKAGE



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-013 variation AE.



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