

SN54ABT541, SN74ABT541B OCTAL BUFFERS/DRIVERS WITH 3-STATE OUTPUTS

SCBS093K – JANUARY 1991 – REVISED OCTOBER 1998

- State-of-the-Art **EPIC-IITM** BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Typical V_{OLP} (Output Ground Bounce) < 1 V at $V_{CC} = 5$ V, $T_A = 25^\circ\text{C}$
- High-Impedance State During Power Up and Power Down
- High-Drive Outputs (–32-mA I_{OH} , 64-mA I_{OL})
- Package Options Include Plastic Small-Outline (DW), Shrink Small-Outline (DB), and Thin Shrink Small-Outline (PW) Packages, Ceramic Chip Carriers (FK), Ceramic Flat (W) Package, and Plastic (N) and Ceramic (J) DIPs

description

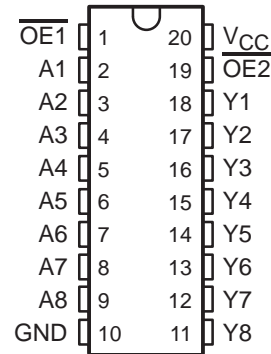
The SN54ABT541 and SN74ABT541B octal buffers and line drivers are ideal for driving bus lines or buffering memory address registers. The devices feature inputs and outputs on opposite sides of the package to facilitate printed circuit board layout.

The 3-state control gate is a two-input AND gate with active-low inputs so that if either output-enable ($\overline{OE1}$ or $\overline{OE2}$) input is high, all eight outputs are in the high-impedance state.

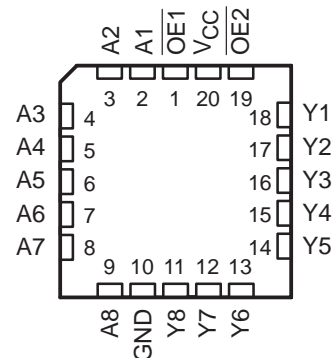
When V_{CC} is between 0 and 2.1 V, the device is in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 2.1 V, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

The SN54ABT541 is characterized for operation over the full military temperature range of -55°C to 125°C . The SN74ABT541B is characterized for operation from -40°C to 85°C .

SN54ABT541 . . . J OR W PACKAGE
SN74ABT541B . . . DB, DW, N, OR PW PACKAGE
(TOP VIEW)



SN54ABT541 . . . FK PACKAGE
(TOP VIEW)



FUNCTION TABLE

INPUTS			OUTPUT Y
$\overline{OE1}$	$\overline{OE2}$	A	
L	L	L	L
L	L	H	H
H	X	X	Z
X	H	X	Z



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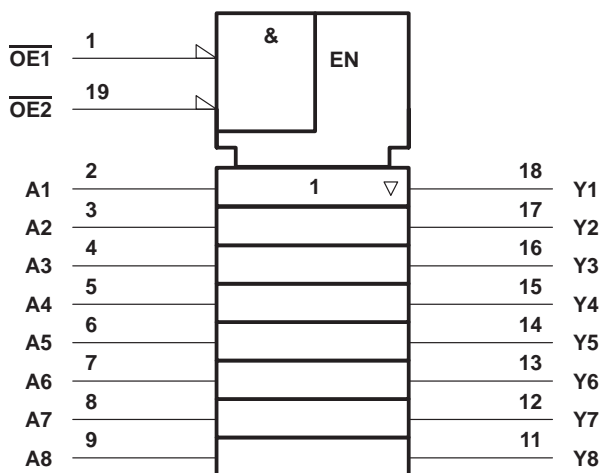
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**TEXAS
INSTRUMENTS**

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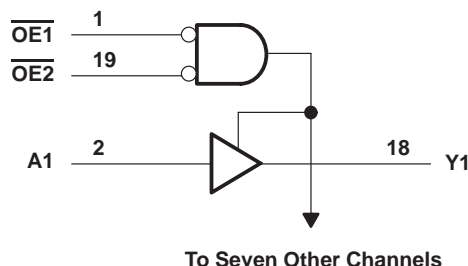
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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

Supply voltage range, V_{CC}	–0.5 V to 7 V
Input voltage range, V_I (see Note 1)	–0.5 V to 7 V
Voltage range applied to any output in the high or power-off state, V_O	–0.5 V to 5.5 V
Current into any output in the low state, I_O : SN54ABT541	96 mA
SN74ABT541B	128 mA
Input clamp current, I_{IK} ($V_I < 0$)	–18 mA
Output clamp current, I_{OK} ($V_O < 0$)	–50 mA
Package thermal impedance, θ_{JA} (see Note 2): DB package	115°C/W
DW package	97°C/W
N package	67°C/W
PW package	128°C/W
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. The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
2. The package thermal impedance is calculated in accordance with JESD 51, except for through-hole packages, which use a trace length of zero.

recommended operating conditions (see Note 3)

	SN54ABT541		SN74ABT541B		UNIT
	MIN	MAX	MIN	MAX	
V_{CC} Supply voltage	4.5	5.5	4.5	5.5	V
V_{IH} High-level input voltage	2		2		V
V_{IL} Low-level input voltage		0.8		0.8	V
I_{OH} High-level output current		–24		–32	mA
I_{OL} Low-level output current		48		64	mA
T_A Operating free-air temperature	–55	125	–40	85	°C

NOTE 3: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

SN54ABT541, SN74ABT541B

OCTAL BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

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

PARAMETER	TEST CONDITIONS	T _A = 25°C			SN54ABT541		SN74ABT541B		UNIT
		MIN	TYP†	MAX	MIN	MAX	MIN	MAX	
V _{IK}	V _{CC} = 4.5 V, I _I = -18 mA			-1.2		-1.2		-1.2	V
V _{OH}	V _{CC} = 4.5 V, I _{OH} = -3 mA	2.5			2.5		2.5		V
	V _{CC} = 5 V, I _{OH} = -3 mA	3			3		3		
	V _{CC} = 4.5 V			2	2				
				2*			2		
V _{OL}	V _{CC} = 4.5 V			0.55	0.55				V
				0.55*			0.55		
V _{hys}			100						mV
I _I	V _{CC} = 5.5 V, V _I = V _{CC} or GND			±1	±1		±1		μA
I _{OZPU}	V _{CC} = 0 to 2.1 V, V _O = 0.5 V to 2.7 V, $\overline{\text{OE}}$ = X			±50**	±50**		±50		μA
I _{OZPD}	V _{CC} = 2.1 V to 0, V _O = 0.5 V to 2.7 V, $\overline{\text{OE}}$ = X			±50**	±50**		±50		μA
I _{OZH}	V _{CC} = 5.5 V, V _O = 2.7 V			10	10		10		μA
I _{OZL}	V _{CC} = 5.5 V, V _O = 0.5 V			-10	-10		-10		μA
I _{off}	V _{CC} = 0, V _I or V _O ≤ 4.5 V			±100			±100		μA
I _{CEX}	V _{CC} = 5.5 V, V _O = 5.5 V			50	50		50		μA
I _{O†}	V _{CC} = 5.5 V, V _O = 2.5 V	-50	-140	-180	-50	-180	-50	-180	mA
I _{CC}	V _{CC} = 5.5 V, I _O = 0, V _I = V _{CC} or GND			5	250	250	250		μA
				22	30	30	30		mA
				1	250	250	250		μA
ΔI _{CC} §	V _{CC} = 5.5 V, One input at 3.4 V, Other inputs at V _{CC} or GND			1.5	1.5		1.5		mA
				50	50		50		μA
				1.5	1.5		1.5		mA
C _i	V _I = 2.5 V or 0.5 V		3						pF
C _o	V _O = 2.5 V or 0.5 V		6						pF

* On products compliant to MIL-PRF-38535, this parameter does not apply.

** On products compliant to MIL-PRF-38535, this parameter is not production tested.

† All typical values are at V_{CC} = 5 V.

‡ Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

§ This is the increase in supply current for each input that is at the specified TTL voltage level rather than V_{CC} or GND.

switching characteristics over recommended ranges of supply voltage and operating free-air temperature, C_L = 50 pF (unless otherwise noted) (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN54ABT541					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A	Y	1	2.6	4.1	1	4.6	ns
t _{PHL}			1	2.9	4.2	1	4.7	
t _{PZH}	$\overline{\text{OE}}$	Y	1.1	3.1	4.8	1.1	5.4	ns
t _{PZL}			2.1	4.4	5.9	2.1	7	
t _{PHZ}	$\overline{\text{OE}}$	Y	2.1	5.1	6.6	2.1	7.5	ns
t _{PLZ}			1.7	4.7	6.2	1.7	6.7	

SN54ABT541, SN74ABT541B

OCTAL BUFFERS/DRIVERS

WITH 3-STATE OUTPUTS

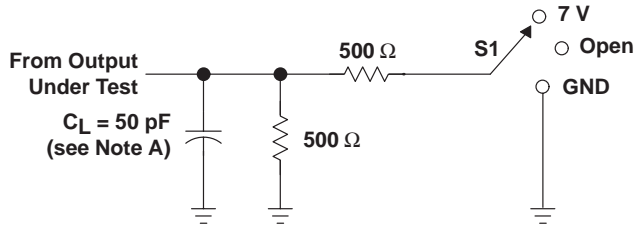
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switching characteristics over recommended ranges of supply voltage and operating free-air temperature, $C_L = 50$ pF (unless otherwise noted) (see Figure 1)

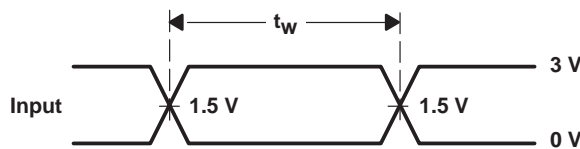
PARAMETER	FROM (INPUT)	TO (OUTPUT)	SN74ABT541B					UNIT
			V _{CC} = 5 V, T _A = 25°C			MIN	MAX	
			MIN	TYP	MAX			
t _{PLH}	A	Y	1	2	3.2	1	3.6	ns
t _{PHL}			1	2.6	3.5	1	3.9	
t _{PZH}	\overline{OE}	Y	2	3.5	4.5	2	4	ns
t _{PZL}			1.9	4	5.1	1.9	5.9	
t _{PHZ}	\overline{OE}	Y	2.2	4.4	5.4	2.2	5.8	ns
t _{PLZ}			1.5	3	4	1.5	4.4	
t _{sk(o)} [†]			0.5			0.5		ns

† Skew between any two outputs of the same package switching in the same direction

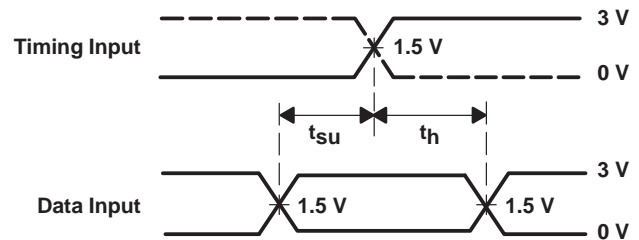
PARAMETER MEASUREMENT INFORMATION



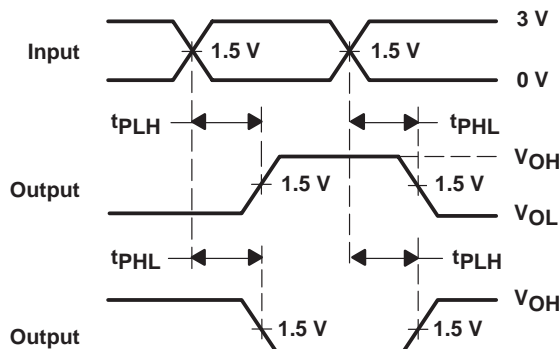
LOAD CIRCUIT



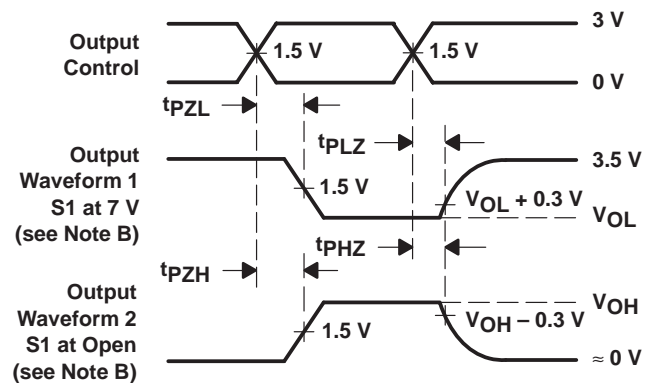
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- NOTES: A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
D. The outputs are measured one at a time with one transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
5962-9471801Q2A	ACTIVE	LCCC	FK	20	1	TBD	Call TI	N / A for Pkg Type
5962-9471801QRA	ACTIVE	CDIP	J	20	1	TBD	Call TI	N / A for Pkg Type
5962-9471801QSA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SN74ABT541BDBLE	OBSOLETE	SSOP	DB	20		TBD	Call TI	Call TI
SN74ABT541BDBR	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BDBRE4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BDBRG4	ACTIVE	SSOP	DB	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1YEAR
SN74ABT541BDW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BDWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BDWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BDWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BN	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ABT541BNE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74ABT541BNSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BNSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BPW	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BPWE4	ACTIVE	TSSOP	PW	20	70	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BPWLE	OBSOLETE	TSSOP	PW	20		TBD	Call TI	Call TI
SN74ABT541BPWR	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74ABT541BPWRE4	ACTIVE	TSSOP	PW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SNJ54ABT541FK	ACTIVE	LCCC	FK	20	1	TBD	Call TI	N / A for Pkg Type
SNJ54ABT541J	ACTIVE	CDIP	J	20	1	TBD	Call TI	N / A for Pkg Type
SNJ54ABT541W	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type

⁽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), 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)

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

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J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



PINS ** DIM	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	—	—	—	—
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. This package is hermetically sealed with a ceramic lid using glass frit.
 - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
 - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a ceramic lid using glass frit.
 - Index point is provided on cap for terminal identification only.
 - Falls within Mil-Std 1835 GDFP2-F20

FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN

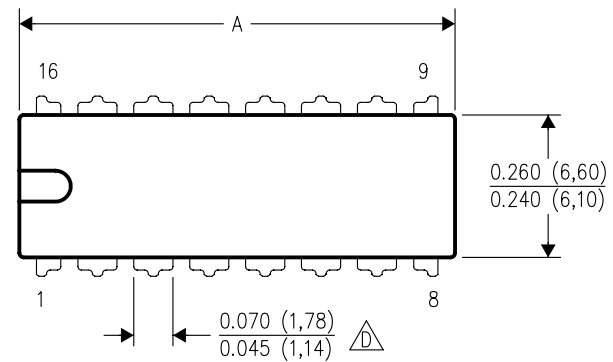


- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - This package can be hermetically sealed with a metal lid.
 - The terminals are gold plated.
 - Falls within JEDEC MS-004

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
MS-001 VARIATION	AA	BB	AC	AD



14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

- 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.

DW (R-PDSO-G20)

PLASTIC SMALL-OUTLINE PACKAGE



4040000-4/F 06/2004

- NOTES:
- All linear dimensions are in inches (millimeters).
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
 - Falls within JEDEC MS-013 variation AC.

MECHANICAL DATA

NS (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

- 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.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 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.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



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

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