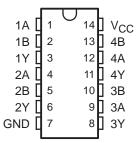
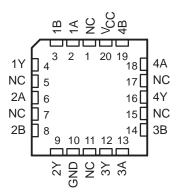
- 2-V to 6-V V<sub>CC</sub> Operation
- Inputs Accept Voltages to 6 V
- Max t<sub>pd</sub> of 9 ns at 5 V

SN54AC86... J OR W PACKAGE SN74AC86... D, DB, N, NS, OR PW PACKAGE (TOP VIEW)



# SN54AC86 ... FK PACKAGE (TOP VIEW)



NC - No internal connection

#### description/ordering information

The 'AC86 devices are quadruple 2-input exclusive-OR gates. The devices perform the Boolean function  $Y = A \oplus B$  or  $Y = \overline{AB} + A\overline{B}$  in positive logic.

A common application is as a true/complement element. If one of the inputs is low, the other input is reproduced in true form at the output. If one of the inputs is high, the signal on the other input is reproduced inverted at the output.

#### ORDERING INFORMATION

TA	PACKAGI	ʆ	ORDERABLE PART NUMBER	TOP-SIDE MARKING
	PDIP – N	Tube	SN74AC86N	SN74AC86N
-40°C to 85°C	SOIC - D	Tube	SN74AC86D	1000
	SOIC - D	Tape and reel	SN74AC86DR	AC86
	SOP - NS	Tape and reel	SN74AC86NSR	AC86
	SSOP – DB	Tape and reel	SN74AC86DBR	AC86
	TOOOD DW	Tube	SN74AC86PW	4000
	TSSOP – PW	Tape and reel	SN74AC86PWR	AC86
	CDIP – J	Tube	SNJ54AC86J	SNJ54AC86J
-55°C to 125°C	CFP – W	Tube	SNJ54AC86W	SNJ54AC86W
	LCCC – FK	Tube	SNJ54AC86FK	SNJ54AC86FK

<sup>†</sup> 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.



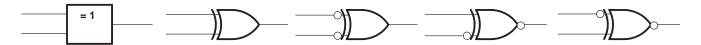
#### **FUNCTION TABLE** (each gate)

INP	UTS	OUTPUT
Α	В	Υ
L	L	L
L	Н	Н
Н	L	Н
Н	Н	L

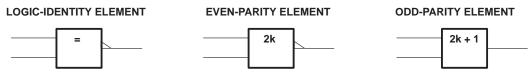
#### exclusive-OR logic

An exclusive-OR gate has many applications, some of which can be represented better by alternative logic symbols.

#### **EXCLUSIVE OR**



These five equivalent exclusive-OR symbols are valid for an 'AC86 gate in positive logic; negation may be shown at any two ports.



The output is active (low) if all inputs stand at the same logic level (i.e., A = B).

The output is active (low) if an even number of inputs (i.e., 0 or 2) are active.

The output is active (high) if an odd number of inputs (i.e., only 1 of the 2) are active.

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

Supply voltage range, V <sub>CC</sub>	–0.5 V to 7 V
	0.5 V to V <sub>CC</sub> + 0.5 V
Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )	±20 mA
Output clamp current, IOK (VO < 0 or VO > VCC	c) ±20 mA
Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )	±50 mA
Package thermal impedance, $\theta_{JA}$ (see Note 2):	D package
	DB package 96°C/W
	N package 80°C/W
	NS package 76°C/W
	PW package 113°C/W
Storage temperature range, T <sub>stg</sub>	-65°C to 150°C

<sup>†</sup> 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 voltage ratings may be exceeded if the input and output current ratings are observed.

2. The package thermal impedance is calculated in accordance with JESD 51-7.



#### recommended operating conditions (see Note 3)

			SN54	AC86	SN74/	AC86	
			MIN	MAX	MIN	MAX	UNIT
VCC	Supply voltage		2	6	2	6	V
		V <sub>CC</sub> = 3 V	2.1		2.1		
$V_{\text{IH}}$	High-level input voltage	V <sub>CC</sub> = 4.5 V	3.15		3.15		V
		$V_{CC} = 5.5 \text{ V}$	3.85		3.85		
		V <sub>CC</sub> = 3 V		0.9		0.9	
$V_{IL}$	Low-level input voltage	V <sub>CC</sub> = 4.5 V		1.35		1.35	V
		V <sub>CC</sub> = 5.5 V		1.65		1.65	
٧ <sub>I</sub>	Input voltage		0	VCC	0	VCC	V
VO	Output voltage		0	VCC	0	Vcc	V
		V <sub>CC</sub> = 3 V		-12		-12	
loh	High-level output current	V <sub>CC</sub> = 4.5 V		-24		-24	mA
		V <sub>CC</sub> = 5.5 V		-24		-24	
		V <sub>CC</sub> = 3 V		12		12	
loL	Low-level output current	V <sub>CC</sub> = 4.5 V		24		24	mA
		V <sub>CC</sub> = 5.5 V		24		24	
Δt/Δν	Input transition rise or fall rate			8		8	ns/V
TA	Operating free-air temperature		-55	125	-40	85	°C

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, Implications of Slow or Floating CMOS Inputs, literature number SCBA004.

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

242445752		١,,	Т	A = 25°C	;	SN54/	AC86	SN74/	AC86	
PARAMETER	TEST CONDITIONS	vcc	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNIT
		3 V	2.9			2.9		2.9		
	ΙΟΗ = -50 μΑ	4.5 V	4.4			4.4		4.4		
		5.5 V	5.4			5.4		5.4		
.,	I <sub>OH</sub> = -12 mA	3 V	2.56			2.4		2.46		.,
VOH		4.5 V	3.86			3.7		3.76		V
	$I_{OH} = -24 \text{ mA}$	5.5 V	4.86			4.7		4.76		
	$I_{OH} = -50 \text{ mA}^{\dagger}$	5.5 V				3.85				
	I <sub>OH</sub> = -75 mA <sup>†</sup>	5.5 V						3.85		
		3 V		0.002	0.1		0.1		0.1	
	I <sub>OL</sub> = 50 μA	4.5 V		0.001	0.1		0.1		0.1	
		5.5 V		0.001	0.1		0.1		0.1	
.,	I <sub>OL</sub> = 12 mA	3 V			0.36		0.5		0.44	.,
V <sub>OL</sub>		4.5 V			0.36		0.5		0.44	V
	I <sub>OL</sub> = 24 mA	5.5 V			0.36		0.5		0.44	
	$I_{OL} = 50 \text{ mA}^{\dagger}$	5.5 V					1.65			
	$I_{OL} = 75 \text{ mA}^{\dagger}$	5.5 V							1.65	
IJ	V <sub>I</sub> = V <sub>CC</sub> or GND	5.5 V			±0.1		±1		±1	μΑ
Icc	$V_I = V_{CC}$ or GND, $I_O = 0$	5.5 V			2		40		20	μΑ
Ci	VI = V <sub>CC</sub> or GND	5 V		2.6						pF

<sup>†</sup> Not more than one output should be tested at a time, and the duration of the test should not exceed 10 ms.



## SN54AC86, SN74AC86 QUADRUPLE 2-INPUT EXCLUSIVE-OR GATES

SCAS533C - AUGUST 1995 - REVISED OCTOBER 2003

# switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 3.3 V $\,\pm\,$ 0.3 V (unless otherwise noted) (see Figure 1)

	FROM	то	T <sub>A</sub> = 25°C			SN54/	AC86	SN74/		
PARAMETER	(INPUT)	(OUTPUT)	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNIT
t <sub>PLH</sub>	A or B	V	2	6.5	11.5	1	14	1.5	12.5	
<sup>t</sup> PHL	AUID	Y	2	6	11.5	1	14	1.5	12.5	ns

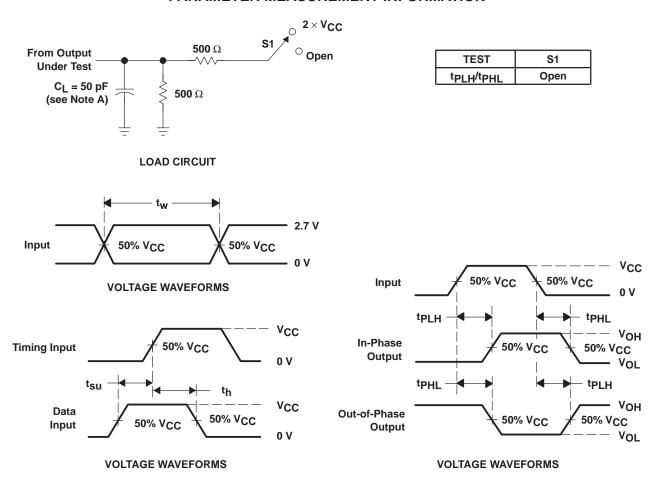
# switching characteristics over recommended operating free-air temperature range, $V_{CC}$ = 5 V $\,\pm\,$ 0.5 V (unless otherwise noted) (see Figure 1)

242445	FROM	то	T <sub>A</sub> = 25°C			SN54/	AC86	SN74/		
PARAMETER	(INPUT)	(OUTPUT)	MIN	TYP	MAX	MIN	MAX	MIN	MAX	UNIT
t <sub>PLH</sub>	A or B	Y	1.5	4.5	8.5	1	10	1	9	no
t <sub>PHL</sub>	AUIB		1.5	4.5	8.5	1	10	1	9.5	ns

## operating characteristics, $V_{CC} = 5 \text{ V}$ , $T_A = 25^{\circ}\text{C}$

	PARAMETER	TEST CON	NDITIONS	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance	$C_L = 50 pF$ ,	f = 1 MHz	25	pF

#### PARAMETER MEASUREMENT INFORMATION



NOTES: A.  $C_L$  includes probe and jig capacitance.

- B. All input pulses are supplied by generators having the following characteristics: PRR  $\leq$  1 MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.
- C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms





17-Mar-2017

#### **PACKAGING INFORMATION**

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish (6)	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
5962-89550012A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 89550012A SNJ54AC 86FK	Samples
5962-8955001CA	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8955001CA SNJ54AC86J	Samples
5962-8955001DA	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8955001DA SNJ54AC86W	Samples
SN74AC86D	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86DBR	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86DBRG4	ACTIVE	SSOP	DB	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86DE4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86DG4	ACTIVE	SOIC	D	14	50	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86DR	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86DRE4	ACTIVE	SOIC	D	14	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86N	ACTIVE	PDIP	N	14	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	-40 to 85	SN74AC86N	Samples
SN74AC86NSR	ACTIVE	so	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86NSRG4	ACTIVE	so	NS	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86PW	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86PWE4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86PWG4	ACTIVE	TSSOP	PW	14	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples



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#### PACKAGE OPTION ADDENDUM

17-Mar-2017

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AC86PWR	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86PWRE4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SN74AC86PWRG4	ACTIVE	TSSOP	PW	14	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 85	AC86	Samples
SNJ54AC86FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type	-55 to 125	5962- 89550012A SNJ54AC 86FK	Samples
SNJ54AC86J	ACTIVE	CDIP	J	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8955001CA SNJ54AC86J	Samples
SNJ54AC86W	ACTIVE	CFP	W	14	1	TBD	A42	N / A for Pkg Type	-55 to 125	5962-8955001DA SNJ54AC86W	Samples

(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.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.



#### **PACKAGE OPTION ADDENDUM**

17-Mar-2017

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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#### OTHER QUALIFIED VERSIONS OF SN54AC86, SN74AC86:

Catalog: SN74AC86

Military: SN54AC86

NOTE: Qualified Version Definitions:

- Catalog TI's standard catalog product
- Military QML certified for Military and Defense Applications

## **PACKAGE MATERIALS INFORMATION**

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#### TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



#### \*All dimensions are nominal

Device		Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74AC86DBR	SSOP	DB	14	2000	330.0	16.4	8.2	6.6	2.5	12.0	16.0	Q1
SN74AC86DR	SOIC	D	14	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
SN74AC86NSR	SO	NS	14	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1
SN74AC86PWR	TSSOP	PW	14	2000	330.0	12.4	6.9	5.6	1.6	8.0	12.0	Q1

www.ti.com 26-Jan-2013



\*All dimensions are nominal

7 III dillionorio di o richimal							
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74AC86DBR	SSOP	DB	14	2000	367.0	367.0	38.0
SN74AC86DR	SOIC	D	14	2500	367.0	367.0	38.0
SN74AC86NSR	SO	NS	14	2000	367.0	367.0	38.0
SN74AC86PWR	TSSOP	PW	14	2000	367.0	367.0	35.0

# FK (S-CQCC-N\*\*)

## LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a metal lid.
- D. Falls within JEDEC MS-004



#### **MECHANICAL DATA**

## NS (R-PDSO-G\*\*)

# 14-PINS SHOWN

#### PLASTIC SMALL-OUTLINE PACKAGE



- 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.



# W (R-GDFP-F14)

## CERAMIC DUAL FLATPACK



- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within MIL STD 1835 GDFP1-F14



CERAMIC DUAL IN LINE PACKAGE



Images above are just a representation of the package family, actual package may vary. Refer to the product data sheet for package details.

4040083-5/G





CERAMIC DUAL IN LINE PACKAGE



- 1. All controlling linear dimensions are in inches. Dimensions in brackets are in millimeters. Any dimension in brackets or parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
- 2. This drawing is subject to change without notice.
- 3. This package is hermitically sealed with a ceramic lid using glass frit.
- His package is remitted by sealed with a ceramic its using glass mit.
   Index point is provided on cap for terminal identification only and on press ceramic glass frit seal only.
   Falls within MIL-STD-1835 and GDIP1-T14.



CERAMIC DUAL IN LINE PACKAGE



# D (R-PDSO-G14)

#### PLASTIC SMALL OUTLINE



- 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 0.006 (0,15) each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
- E. Reference JEDEC MS-012 variation AB.



# D (R-PDSO-G14)

# PLASTIC SMALL OUTLINE



- 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.



PW (R-PDSO-G14)

#### PLASTIC SMALL OUTLINE



- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M—1994.
- B. This drawing is subject to change without notice.
  - Sody length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO-153



# PW (R-PDSO-G14)

# PLASTIC SMALL OUTLINE



- 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.



# N (R-PDIP-T\*\*)

## PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.



#### 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

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