

SCLS743A - DECEMBER 2013-REVISED FEBRUARY 2014

SN74LV1T34

SN74LV1T34 Single Power Supply Single Buffer GATE CMOS Logic Level Shifter

Features

- Single-Supply Voltage Translator at 5.0/3.3/2.5/1.8V V_{CC}
- Operating Range of 1.8V to 5.5V
- **Up Translation**
 - 1.2V⁽¹⁾ to 1.8V at 1.8V V_{CC}
 - 1.5V⁽¹⁾ to 2.5V at 2.5V V_{CC}
 - 1.8V⁽¹⁾ to 3.3V at 3.3V V_{CC}
 - 3.3V to 5.0V at 5.0V V_{CC}
- **Down Translation**
 - 3.3V to 1.8V at 1.8V V_{CC}
 - 3.3V to 2.5V at 2.5V V_{CC}
 - 5.0V to 3.3V at 3.3V V_{CC}
- Logic Output is Referenced to V_{CC}
- **Output Drive**
 - 8.0mA Output Drive at 5.0V
 - 7.0mA Output Drive at 3.3V
 - 3.0mA Output Drive at 1.8V
- Characterized up to 50MHz at 3.3V V_{CC}
- 5.0V Tolerance on Input Pins
- -40°C to 125°C Operating Temperature Range
- Latch-Up Performance Exceeds 250mA Per JESD 17
- ESD Performance Tested Per JESD 22
 - 2000-V Human-Body Model (A114-B, Class II)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)
- Supports Standard Logic Pinouts
- CMOS Output B Compatible with AUP1G and LVC1G Families
- Refer to the V_{IH}/V_{II} and output drive for lower V_{CC} condition

2 Applications

- Industrial controllers
- Telecom
- Portable applications
- Servers
- PC and notebooks
- Automotive

3 Description

SN74LV1T34 is a low voltage CMOS gate logic that operates at a wider voltage range for industrial, portable, telecom, and automotive applications. The output level is referenced to the supply voltage and is able to support 1.8V/2.5V/3.3V/5V CMOS levels.

The input is designed with a lower threshold circuit to match 1.8V input logic at $V_{CC} = 3.3V$ and can be used in 1.8V to 3.3V level up translation. In addition, the 5V tolerant input pins enable down translation (e.g. 3.3V to 2.5V output at V_{CC} = 2.5V). The wide V_{CC} range of 1.8V to 5.5V allows generation of desired output levels to connect to controllers or processors.

The SN74LV1T34 is designed with current-drive capability of 8 mA to reduce line reflections, overshoot, and undershoot caused by high-drive outputs.

Device Information

ORDER NUMBER	PACKAGE	BODY SIZE
SN74LV1T34DBVR	SOT-23 (5)	2,90mm x 1,60mm
SN74LV1T34DCKR	SC70 (5)	2,00mm x 1,25mm

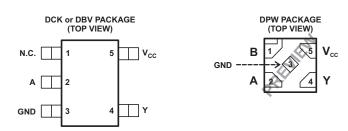




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4 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (December 2013) to Revision A Page Updated document formatting. 1



Function Table

INPUT (Lower Level Input)	OUTPUT (V _{CC} CMOS)
A	Υ
Н	Н
L	L

SUPPLY V _{CC} = 3.3V							
INPUT	OUTPUT						
(Lower Leve	(V _{CC} CMOS)						
Α	В	Υ					
VIH(min) =	VOH(min) = 2.9 V						
VIL(max) =	VOL(max)= 0.2 V						

4.1 Logic Diagram



Switching Characteristics at 50 MHz

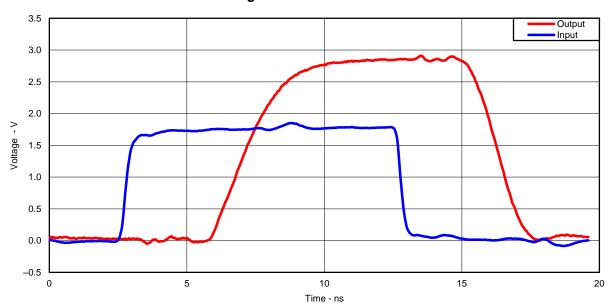


Figure 1. Excellent Signal Integrity (1.8V to 3.3V at 3.3V V_{CC})

Logic Diagram (continued)

Switching Characteristics at 50 MHz

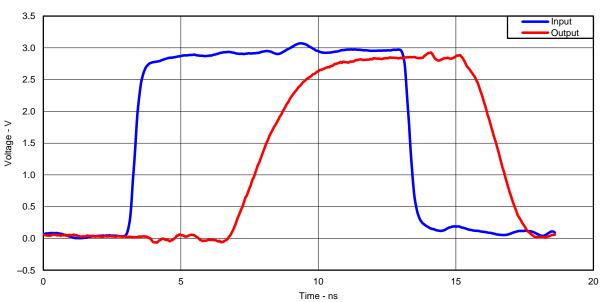


Figure 2. Excellent Signal Integrity (3.3V to 3.3V at 3.3V V_{CC})

Switching Characteristics at 15 MHz

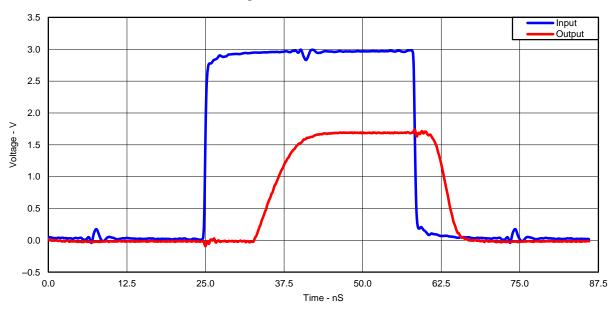


Figure 3. Excellent Signal Integrity (3.3V to 1.8V at 1.8V V_{CC})



4.2 Typical Design Examples

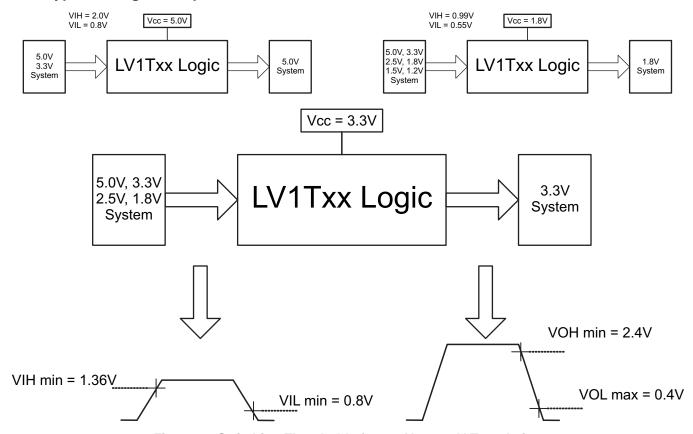


Figure 4. Switching Thresholds for 1.8-V to 3.3-V Translation



4.3 Absolute Maximum Ratings⁽¹⁾

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

			MIN	MAX	UNIT		
V_{CC}	Supply voltage range	-0.5	7.0	V			
V_{I}	Input voltage range (2)	Input voltage range ⁽²⁾					
V	Voltage range applied to	-0.5	4.6	V			
Vo	Voltage range applied to	-0.5	$V_{CC} + 0.5$	V			
I_{IK}	Input clamp current	V ₁ < 0		-20	mA		
I_{OK}	Output clamp current	$V_O < 0$ or $V_O > V_{CC}$		±20	mA		
Io	Continuous output curren	t		±25	mA		
	Continuous current through	gh VCC or GND		±50	mA		
0	Package thermal	DBV package		206	°C/W		
θ_{JA}	impedance ⁽³⁾	DCK package		252	C/VV		
T _{stg}	Storage temperature rang	-65	150	°C			

⁽¹⁾ 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.

4.4 Recommended Operating Conditions⁽¹⁾

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

			MIN	MAX	UNIT
V _{CC}	Supply voltage		1.6	5.5	V
V_{I}	Input voltage		0	5.5	V
Vo	Output voltage		0	Vcc	V
		V _{CC} = 1.8 V		-3.0	
	High-level output	V _{CC} = 2.5 V		-5.0	mA
I _{OH}	current	V _{CC} = 3.3 V		-7.0	mA
		V _{CC} = 5.0 V		-8.0	
		V _{CC} = 1.8 V		3.0	
	Low-level output	V _{CC} = 2.5 V		5.0	mA
l _{OL}	current	V _{CC} = 3.3 V		7.0	mA
		V _{CC} = 5.0 V		8.0	
		V _{CC} = 1.8 V		20	
$\Delta t/\Delta v$	Input transition rise or fall rate	$V_{CC} = 3.3 \text{ V or } 2.5 \text{ V}$		20	ns/V
		V _{CC} = 5.0 V		20	
T _A	Operating free-air temp	perature	-40	125	°C

⁽¹⁾ 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.

⁽²⁾ The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.

⁽³⁾ The package thermal impedance is calculated in accordance with JESD 51-7.



4.5 Electrical Characteristics

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

PARAMETER		TEST CONDITIONS	V	T _A	T _A = 25°C			$T_A = -40$ °C to 125°C		
I ANAMETER		TEST CONDITIONS	V _{CC}	MIN	TYP	MAX	MIN	MAX	UNIT	
			$V_{CC} = 1.65 \text{ V to } 1.8 \text{ V}$	0.95			1.0			
			V _{CC} = 2.0 V	0.99			1.03			
			V_{CC} = 2.25 V to 2.5 V	1.145			1.18			
	High-level input		V _{CC} = 2.75 V	1.22			1.25		V	
VIH	voltage		_{VCC} = 3.0 V to 3.3 V	1.37			1.39		V	
			V _{CC} = 3.6 V	1.47			1.48			
			$V_{CC} = 4.5 \text{ V to } 5.0 \text{ V}$	2.02			2.03			
			V _{CC} = 5.5 V	2.1			2.11			
			V _{CC} = 1.65 V to 2.0 V			0.57		0.55		
,	Low-level input		V _{CC} = 2.25 V to 2.75 V			0.75		0.71		
√ _{IL}	voltage		V _{CC} = 3.0 V to 3.6 V			0.8		0.65	V	
		V _{CC} = 4.5 V to 5.5 V			0.8		0.8			
		I _{OH} = -20 μA	1.65 V to 5.5 V	V _{CC} - 0.1			V _{CC} - 0.1			
		I 00 A	1.65 V	1.28			1.21			
	$I_{OH} = -2.0 \text{ mA}$	1.8 V	1.5			1.45		V		
		I _{OH} = -3.0 mA	2.3 V	2.0			1.93			
		I _{OH} = -3.0 mA	2.5 V	2.25			2.15			
V_{OH}	I _{OH} = -3.0 mA	201/	2.78			2.7				
		I _{OH} = -5.5 mA	3.0 V	2.6			2.49			
		$I_{OH} = -5.5 \text{ mA}$	3.3 V	2.9			2.8	,	.,	
		I _{OH} = -4.0 mA	4.5.4	4.2			4.1		V	
		$I_{OH} = -8.0 \text{ mA}$	4.5 V	4.1			3.95			
		I _{OH} = -8.0 mA	5.0 V	4.6			4.5			
		I _{OL} = 20 μA	1.65 V to 5.5 V			0.1		0.1		
		I _{OL} = 2.0 mA	1.65 V			0.2		0.25		
		I _{OH} = 3.0 mA	2.3 V			0.15		0.2		
V _{OL}		I _{OL} = 3.0 mA	2.21/			0.11		0.15	V	
		I _{OL} = 5.5 mA	3.0 V			0.21		0.252		
		I _{OL} = 4.0 mA	4.5.4			0.15		0.2		
		I _{OL} = 8.0 mA	4.5 V			0.3		0.35		
ı	A input	V _I = 0 V or V _{CC}	0 V, 1.8 V, 2.5 V, 3.3 V, 5.5 V			0.1		±1.0	μA	
			5.0 V			1.0		10.0		
		$V_{I} = 0 \text{ V or } V_{CC}; I_{O} = 0;$	3.3 V			1.0		10.0		
CC		Open on loading	2.5 V			1.0		10.0	μA	
			1.8 V			1.0		10.0		
		One input at 0.3 V or 3.4 V Other inputs at 0 or V_{CC} , $I_{O} = 0$	5.5 V			1.35		1.5	mA	
ΔI _{CC}		One input at 0.3 V or 1.1 V Other inputs at 0 or V_{CC} , $I_{O} = 0$	1.8 V			10.0		10.0	μA	
C _i		V _I = V _{CC} or GND	3.3 V		2.0	10.0	2.0	10.0	pF	
C _o		V _O = V _{CC} or GND	3.3 V		2.5		2.5		pF	

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4.6 Switching Characteristics

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

PARAMETER	FROM	то	FREQUENCY		_	T _A = 25°C	;	T _A = -65°C to 1	25°C	UNIT		
PARAMETER	(INPUT)	(OUTPUT)	(TYP)	V _{cc}	CL	MIN TYP	MAX	MIN TYP	MAX	UNII		
			DC to 50MHz	5.0 V	15 pF	2.7	5.5	3.4	6.5	no		
					30 pF	3.0	6.5	4.1	7.5	ns		
	Any In			DC to Solvii iz	3.3 V	15 pF	4.0	7.0	5.0	8.0	ns	
		_		3.5 V	30 pF	4.9	8.0	6.0	9.0	115		
t _{pd}		Any in		DC to 25MUs	DC to 25MHz	DC to 25MUs	2.5 V	15 pF	5.8	8.5	6.8	9.5
		DC to 25MHZ	JC to 25MHZ 2.5 V	30 pF	6.5	9.5	7.5	10.5	ns			
			DC to 15MHz	DC +- 45MU- 4.0.V	15 pF	10.5	13.0	11.8	14.0			
				DC to 15MHz 1.8 V	το TSIVIMZ 1.8 V	30 pF	12.0	14.5	12.0	15.5	ns	

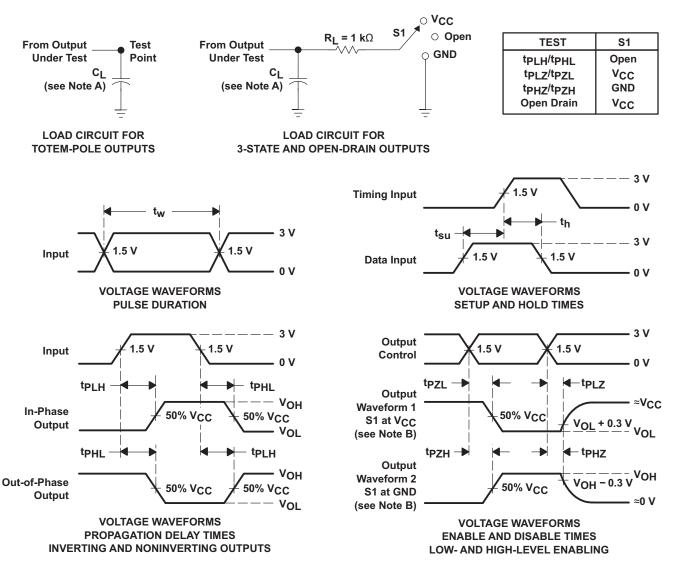
4.7 Operating Characteristics

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

	PARAMETER	TEST CONDITIONS	V _{CC}	TYP	UNIT
			1.8 V ± 0.15 V	14	pF
C _{pd} Power dissipation capa	Device discipation consistence	f = 1 MHz and 10 MHz	$2.5 \text{ V} \pm 0.2 \text{ V}$	14	
	Power dissipation capacitance	I = I MHZ and IO MHZ	$3.3 \text{ V} \pm 0.3 \text{ V}$	14	
			$5.0 \text{ V} \pm 0.5 \text{ V}$	14	



5 Parameter Measurement Information



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 1 MHz, $Z_Q = 50 \Omega$, $t_f \leq$ 3 ns. $t_f \leq$ 3 ns.
- D. The outputs are measured one at a time, with one input transition per measurement.
- E. All parameters and waveforms are not applicable to all devices.

Figure 5. Load Circuit and Voltage Waveforms



Parameter Measurement Information (continued)

5.1 More Product Selection

DEVICE	PACKAGE	DESCRIPTION
SN74LV1T00	DCK, DBV	2-Input Positive-NAND Gate
SN74LV1T02	DCK, DBV	2-Input Positive-NOR Gate
SN74LV1T04	DCK, DBV	Inverter Gate
SN74LV1T08	DCK, DBV	2-Input Positive-AND Gate
SN74LV1T34	DCK, DBV, DPW	Single Buffer Gate
SN74LV1T14	DCK, DBV	Single Schmitt-Trigger Inverter Gate
SN74LV1T32	DCK, DBV	2-Input Positive-OR Gate
SN74LV1T86	DCK, DBV	Single 2-Input Exclusive-Or Gate
SN74LV1T125	DCK, DBV	Single Buffer Gate with 3-state Output
SN74LV1T126	DCK, DBV	Single Buffer Gate with 3-state Output
SN74LV4T125	RGY, PW	Quadruple Bus Buffer Gate With 3-State Outputs



6 Device and Documentation Support

6.1 Trademarks

All trademarks are the property of their respective owners.

6.2 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

6.3 Glossary

SLYZ022 — TI Glossary.

This glossary lists and explains terms, acronyms and definitions.

7 Mechanical, Packaging, and Orderable Information

The following packaging information and addendum reflect the most current data available for the designated devices. This data is subject to change without notice and revision of this document.

Product Folder Links: SN74LV1T34



PACKAGE OPTION ADDENDUM

21-Feb-2014

PACKAGING INFORMATION

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
SN74LV1T34DBVR	ACTIVE	SOT-23	DBV	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(NEJ3 ~ NEJS)	Samples
SN74LV1T34DCKR	ACTIVE	SC70	DCK	5	3000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	-40 to 125	(WJ3 ~ WJS)	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.
- (5) 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.
- (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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PACKAGE OPTION ADDENDUM

21-Feb-2014

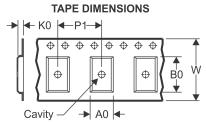
n no event shall TI's liability arising out of	such information exceed the total purchase pr	rice of the TI part(s) at issue in this	document sold by TI to Customer on an annual basis.

PACKAGE MATERIALS INFORMATION

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TAPE AND REEL INFORMATION





	Dimension designed to accommodate the component width
	Dimension designed to accommodate the component length
	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 Type	Package Drawing		SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
SN74LV1T34DBVR	SOT-23	DBV	5	3000	180.0	8.4	3.23	3.17	1.37	4.0	8.0	Q3
SN74LV1T34DBVR	SOT-23	DBV	5	3000	178.0	9.2	3.3	3.2	1.55	4.0	8.0	Q3
SN74LV1T34DCKR	SC70	DCK	5	3000	178.0	9.2	2.4	2.4	1.22	4.0	8.0	Q3
SN74LV1T34DCKR	SC70	DCK	5	3000	180.0	8.4	2.47	2.3	1.25	4.0	8.0	Q3

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*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)				
SN74LV1T34DBVR	SOT-23	DBV	5	3000	202.0	201.0	28.0				
SN74LV1T34DBVR	SOT-23	DBV	5	3000	180.0	180.0	18.0				
SN74LV1T34DCKR	SC70	DCK	5	3000	180.0	180.0	18.0				
SN74LV1T34DCKR	SC70	DCK	5	3000	202.0	201.0	28.0				

DBV (R-PDSO-G5)

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. Falls within JEDEC MO-178 Variation AA.



DBV (R-PDSO-G5)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.



DCK (R-PDSO-G5)

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. Falls within JEDEC MO-203 variation AA.



DCK (R-PDSO-G5)

PLASTIC SMALL OUTLINE



NOTES:

- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
- D. Publication IPC-7351 is recommended for alternate designs.
- E. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.



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Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have *not* been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

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