

## 5-V PECL/ECL 1:2 Fanout Buffer

### FEATURES

- 1:2 PECL/ECL Fanout Buffer
- Operating Range
  - PECL:  $V_{CC} = 4.2\text{ V to }5.7\text{ V}$  With  $V_{EE} = 0\text{ V}$
  - NECL:  $V_{CC} = 0\text{ V}$  With  $V_{EE} = -4.2\text{ V to }-5.7\text{ V}$
- 5-ps Skew Between Outputs
- Support for Clock Frequencies  $>2.5\text{ GHz}$
- 265-ps Typical Propagation Delay
- Deterministic Output Value for Open Input Conditions
- Drop-In Compatible With MC10EL11, MC100EL11
- Built-In Input Pulldown Resistors
- Built-In Temperature Compensation

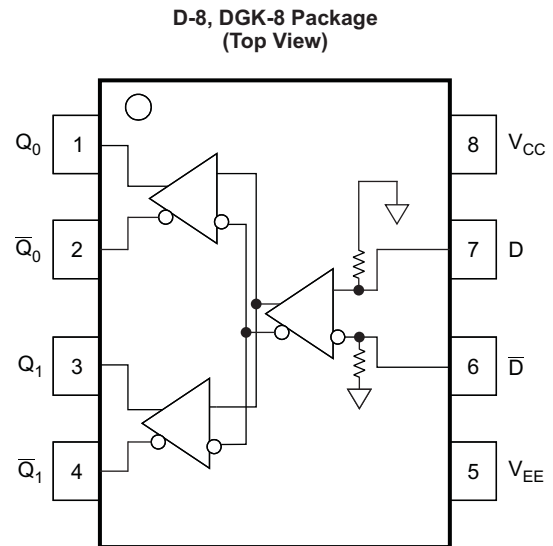
### APPLICATIONS

- Data and Clock Transmission Over Backplane
- Signaling Level Conversion

### DESCRIPTION

The SN65EL11 is a differential 1:2 PECL/ECL fanout buffer. The device includes circuitry to maintain a known logic level when inputs are in an open condition. The SN65EL11 is housed in an industry-standard SOIC-8 package and is also available in a TSSOP-8 package.

### PINOUT ASSIGNMENT



P0065-02

**Table 1. Pin Description**

PIN	FUNCTION
D, $\bar{D}$	PECL/ECL data inputs
$Q_0$ , $\bar{Q}_0$ , $Q_1$ , $\bar{Q}_1$	PECL/ECL outputs
$V_{CC}$	Positive supply
$V_{EE}$	Negative supply

### ORDERING INFORMATION<sup>(1)</sup>

PART NUMBER	PART MARKING	PACKAGE	LEAD FINISH
SN65EL11D	SN65EL11	SOIC	NiPdAu
SN65EL11DGK	SN65EL11	SOIC-TSSOP	NiPdAu

(1) Leaded device options not initially available; contact a sales representative for further details.



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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.

## ABSOLUTE MAXIMUM RATINGS<sup>(1)</sup>

PARAMETER	CONDITIONS	VALUE	UNIT
Absolute PECL-mode supply voltage, $V_{CC}$	$V_{EE} = 0\text{ V}$	6	V
Absolute NECL-mode supply voltage, $V_{EE}$	$V_{CC} = 0\text{ V}$	–6	V
PECL-mode input voltage	$V_{EE} = 0\text{ V}; V_I \leq V_{CC}$	6	V
NECL-mode input voltage	$V_{CC} = 0\text{ V}; V_I \geq V_{EE}$	–6	V
Output current	Continuous	50	mA
	Surge	100	mA
Operating temperature range		–40 to 85	°C
Storage temperature range		–65 to 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.

## POWER DISSIPATION RATINGS

PACKAGE	CIRCUIT BOARD MODEL	POWER RATING $T_A < 25^\circ\text{C}$ (mW)	THERMAL RESISTANCE, JUNCTION-TO-AMBIENT, NO AIRFLOW	DERATING FACTOR $T_A > 25^\circ\text{C}$ (mW/°C)	POWER RATING $T_A = 85^\circ\text{C}$ (mW)
SOIC	Low-K	719	139	7	288
	High-K	840	119	8	336
SOIC-TSSOP	Low-K	469	213	5	188
	High-K	527	189	5	211

## THERMAL CHARACTERISTICS

PARAMETER		PACKAGE	VALUE	UNIT
$\theta_{JB}$	Junction-to-board thermal resistance	SOIC	79	°C/W
		SOIC-TSSOP	120	
$\theta_{JC}$	Junction-to-case thermal resistance	SOIC	98	°C/W
		SOIC-TSSOP	74	

## KEY ATTRIBUTES

CHARACTERISTICS	VALUE
Internal input pulldown resistor	75 k $\Omega$
Moisture sensitivity level	Level 1
Flammability rating (oxygen index: 28 to 34)	UL 94 V-0 at 0.125 in
ESD-HBM	4 kV
ESD-machine model	200 V
Meets or exceeds JEDEC Spec EIA/JESD78 latchup test	

**PECL DC CHARACTERISTICS<sup>(1)</sup> ( $V_{CC} = 5\text{ V}$ ;  $V_{EE} = 0\text{ V}$ )<sup>(2)</sup>**

PARAMETER		–40°C			25°C			85°C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$I_{CC}$	Power-supply current		18	26		21	26		23	26	mA
$V_{OH}$	Output HIGH voltage <sup>(3)</sup>	3915		4120	3915	4000	4120	3915		4120	mV
$V_{OL}$	Output LOW voltage <sup>(3)</sup>	3170		3380	3170	3288	3380	3170		3380	mV
$V_{IH}$	Input HIGH voltage (single-ended)	3835		4120	3835		4120	3835		4120	mV
$V_{IL}$	Input LOW voltage (single-ended)	3190		3525	3190		3525	3190		3525	mV
$V_{IHCMR}$	Input HIGH voltage, common-mode range (differential) <sup>(4)</sup>	2.5		4.6	2.5		4.6	2.5		4.6	V
$I_{IH}$	Input HIGH current			150			150			150	μA
$I_{IL}$	Input LOW current	0.5			0.5			0.5			μA

- (1) The device meets these specifications after thermal equilibrium has been established when mounted in a test socket or printed-circuit board with maintained transverse airflow greater than 500 lpm (2.54 m/s). Electrical parameters are assured only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.
- (2) Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.25 V / –0.5 V.
- (3) Outputs are terminated through a 50-Ω resistor to  $V_{CC} - 2\text{ V}$ .
- (4)  $V_{IHCMR}$  min varies 1:1 with  $V_{EE}$ ;  $V_{IHCMR}$  max varies 1:1 with  $V_{CC}$ . The  $V_{IHCMR}$  range is referenced to the more-positive side of the differential input signal. Normal operation is obtained if the HIGH level falls within the specified range and the peak-to-peak voltage lies between  $V_{PP}$  min and 1 V.

**NECL DC CHARACTERISTICS<sup>(1)</sup> ( $V_{CC} = 0\text{ V}$ ;  $V_{EE} = 5\text{ V}$ )<sup>(2)</sup>**

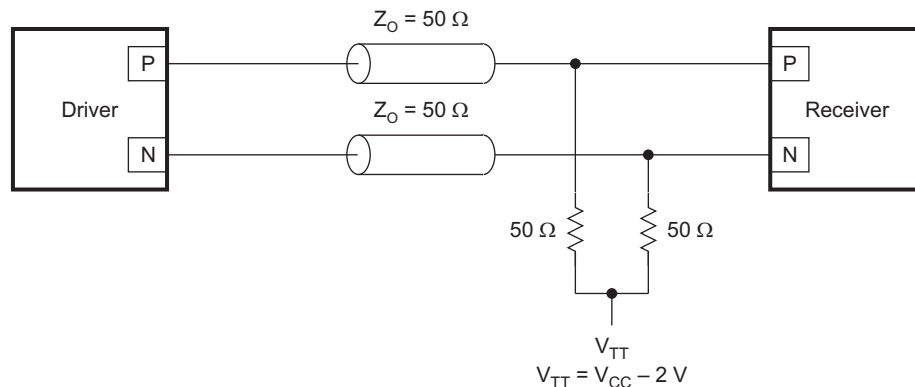
PARAMETER		–40°C			25°C			85°C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
$I_{EE}$	Power-supply current		19	26		21	26		23	26	mA
$V_{OH}$	Output HIGH voltage <sup>(3)</sup>	–1085		–880	–1025	–995	–880	–1025		–880	mV
$V_{OL}$	Output LOW voltage <sup>(3)</sup>	–1830		–1620	–1810	–1712	–1620	–1810		–1620	mV
$V_{IH}$	Input HIGH voltage (single-ended)	–1165		–880	–1165		–880	–1165		–880	mV
$V_{IL}$	Input LOW voltage (single-ended)	–1810		–1475	–1810		–1475	–1810		–1475	mV
$V_{IHCMR}$	Input HIGH voltage, common-mode range (differential) <sup>(4)</sup>	–2.5		–0.4	–2.5		–0.4	–2.5		–0.4	V
$I_{IH}$	Input HIGH current			150			150			150	μA
$I_{IL}$	Input LOW current	0.5			0.5			0.5			μA

- (1) The device meets these specifications after thermal equilibrium has been established when mounted in a test socket or printed-circuit board with maintained transverse airflow greater than 500 lpm (2.54 m/s). Electrical parameters are assured only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.
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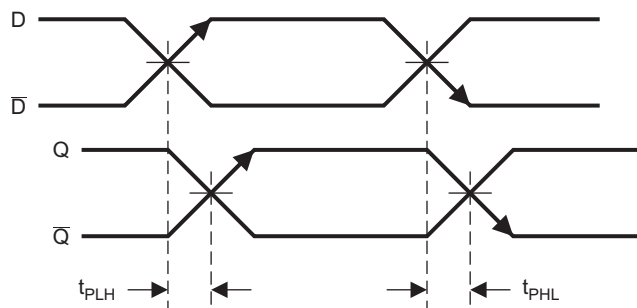
**AC CHARACTERISTICS<sup>(1)</sup> ( $V_{CC} = 5\text{ V}$ ;  $V_{EE} = 0\text{ V}$  or  $V_{CC} = 0\text{ V}$ ;  $V_{EE} = -5\text{ V}$ )<sup>(2)</sup>**

PARAMETER		−40°C			25°C			85°C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
f <sub>MAX</sub>	Maximum switching frequency <sup>(3)</sup> (see <a href="#">Figure 6</a> )	3.5			3.4			3.1			GHz
t <sub>PLH</sub> /t <sub>PHL</sub>	Propagation delay to output (see <a href="#">Figure 2</a> )	200		300	200		300	200		300	ps
t <sub>SKEW</sub>	Device skew <sup>(4)</sup> (see <a href="#">Figure 5</a> )	7		15	7		15	7		15	ps
	Duty cycle skew <sup>(5)</sup>	5		15	5		15	5		15	
t <sub>JITTER</sub>	Random clock jitter (RMS)	0.2			0.2			0.2			ps
V <sub>PP</sub>	Input swing <sup>(6)</sup> (see <a href="#">Figure 3</a> )	150		1000	150		1000	150		1000	mV
t <sub>r</sub> /t <sub>f</sub>	Q-output rise/fall times (20%–80%) (see <a href="#">Figure 4</a> )	150		250	150		250	150		250	ps

- (1) The device meets these specifications after thermal equilibrium has been established when mounted in a test socket or printed-circuit board with maintained transverse airflow greater than 500 lfpm (2.54 m/s). Electrical parameters are assured only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.
- (2) Input and output parameters vary 1:1 with  $V_{CC}$ .  $V_{EE}$  can vary +0.25 V / –0.5 V.
- (3) Maximum switching frequency is measured at an output amplitude of 300 mVpp.
- (4) Within-device skew defined as identical transitions on similar paths through a device.
- (5) Duty cycle skew is the difference between a  $t_{PLH}$  and  $t_{PHL}$  propagation delay through a device.
- (6)  $V_{PP(min)}$  is the minimum input swing for which ac parameters are assured.

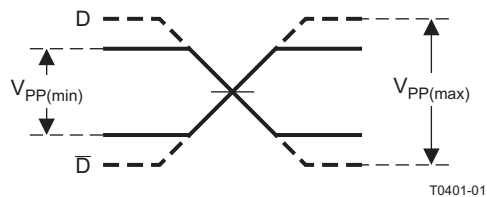
**Typical Termination for Output Driver**


S0078-02

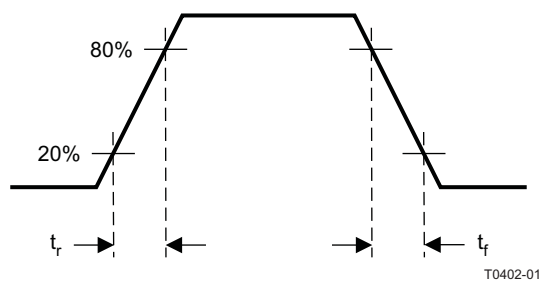
**Figure 1. Typical Termination for Output Driver**


T0400-01

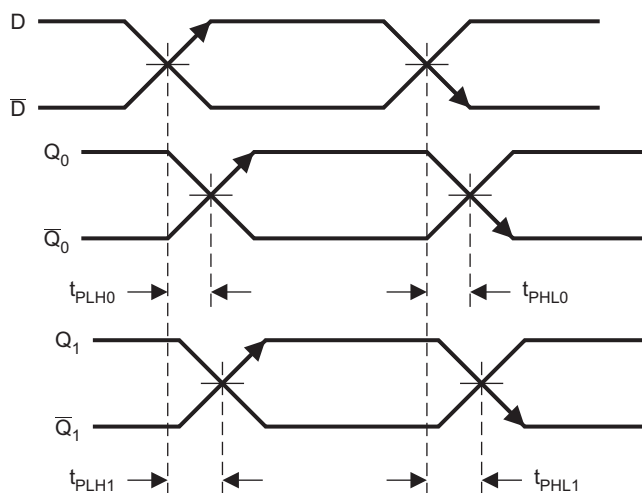
**Figure 2. Propagation Delay**



**Figure 3. Input Voltage Swing**



**Figure 4. Output Rise and Fall Times**



$$\text{Device Skew} = [(t_{PLH1} - t_{PLH0}), (t_{PHL1} - t_{PHL0})]$$

T0403-01

**Figure 5. Device Skew**

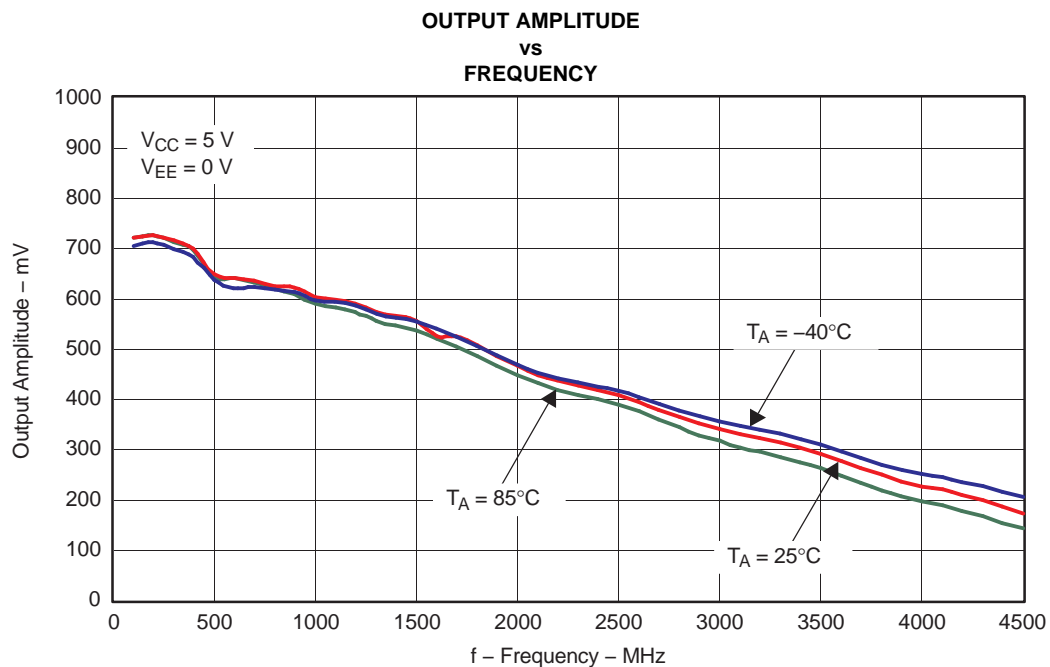


Figure 6.

G001

## PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN65EL11D	ACTIVE	SOIC	D	8	75	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	EL11	<a href="#">Samples</a>
SN65EL11DGK	ACTIVE	VSSOP	DGK	8	80	RoHS & Green	NIPDAU	Level-1-260C-UNLIM	-40 to 85	SILI	<a href="#">Samples</a>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

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## TUBE



\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
SN65EL11D	D	SOIC	8	75	506.6	8	3940	4.32
SN65EL11DGK	DGK	VSSOP	8	80	330.2	6.6	3005	1.88

**D0008A****PACKAGE OUTLINE****SOIC - 1.75 mm max height**

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

**NOTES:**

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 [0.15] per side.
4. This dimension does not include interlead flash.
5. Reference JEDEC registration MS-012, variation AA.

# EXAMPLE BOARD LAYOUT

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



4214825/C 02/2019

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

## EXAMPLE STENCIL DESIGN

D0008A

SOIC - 1.75 mm max height

SMALL OUTLINE INTEGRATED CIRCUIT



SOLDER PASTE EXAMPLE  
BASED ON .005 INCH [0.125 MM] THICK STENCIL  
SCALE:8X

4214825/C 02/2019

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

**DGK0008A****PACKAGE OUTLINE****VSSOP - 1.1 mm max height**

SMALL OUTLINE PACKAGE



4214862/A 04/2023

**NOTES:**

PowerPAD is a trademark of Texas Instruments.

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-187.

# EXAMPLE BOARD LAYOUT

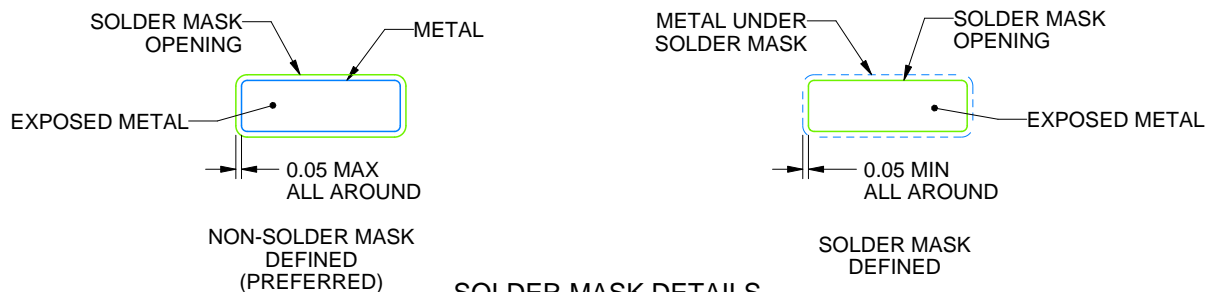
DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 15X



SOLDER MASK DETAILS

4214862/A 04/2023

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.
7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.
8. Vias are optional depending on application, refer to device data sheet. If any vias are implemented, refer to their locations shown on this view. It is recommended that vias under paste be filled, plugged or tented.
9. Size of metal pad may vary due to creepage requirement.

## EXAMPLE STENCIL DESIGN

DGK0008A

™ VSSOP - 1.1 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
SCALE: 15X

4214862/A 04/2023

NOTES: (continued)

11. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
12. Board assembly site may have different recommendations for stencil design.

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