

## Low-Power, 1.62V to 3.63V, 1:2 Inverting Fanout Buffer IC

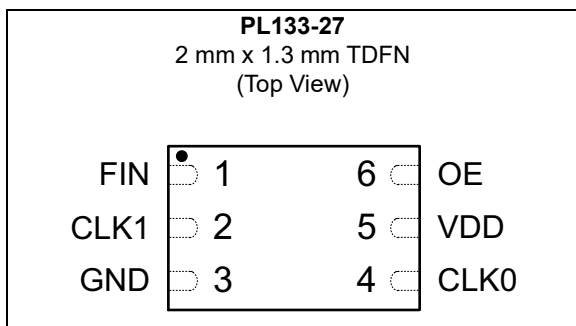
### Features

- Two LVCMOS Outputs
- Input/Output Frequency: 1 MHz to 150 MHz
- Supports LVCMOS or Sine-Wave Input Clock
- Extremely Low Additive Jitter
- 8 mA Output Drive Strength
- Low Current Consumption
- Single 1.8V, 2.5V, or 3.3V  $\pm 10\%$  Power Supply
- Operating Temperature Range:
  - 0° to +70°C (Commercial)
  - -40° to +85°C (Industrial)
- Available in TDFN-6L Green/RoHS-Compliant Package

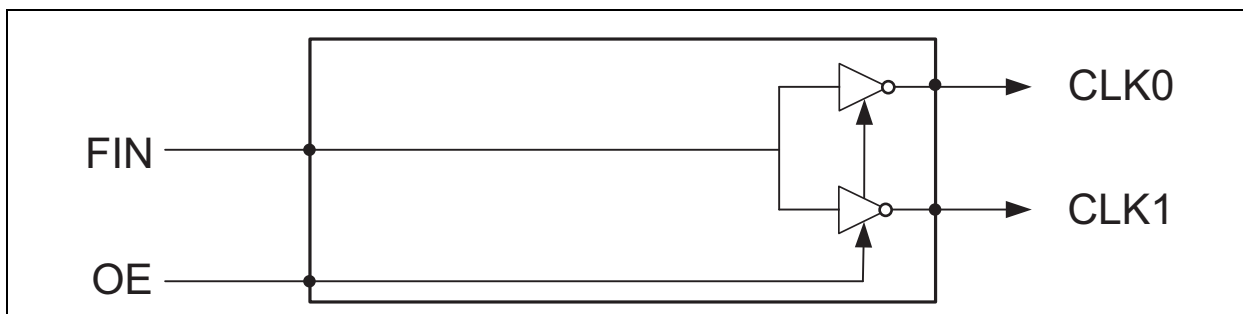
### General Description

The PL133-27 is an advanced inverting fanout buffer design for high performance, low-power, small form-factor applications. The PL133-27 accepts a reference clock input of 1 MHz to 150 MHz and produces two outputs of the same frequency. Reference clock inputs may be LVCMOS or sine-wave signals (the inputs are internally AC-coupled). PL133-27 is designed to fit in a small 2 mm x 1.3 mm x 0.6 mm TDFN package and offers the best phase noise, jitter performance, and lowest power consumption of any comparable IC.

### Package Type



### Functional Block Diagram



# PL133-27

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings †

Supply Voltage Range ( $V_{DD}$ )	.....	-0.5V to +4.6V
Input Voltage Range ( $V_{IN}$ )	.....	-0.5V to $V_{DD}+0.5V$
Output Voltage Range ( $V_{OUT}$ )	.....	-0.5V to $V_{DD}+0.5V$

† **Notice:** Exposure of the device under conditions beyond the limits specified by Maximum Ratings for extended periods may cause permanent damage to the device and affect product reliability. These conditions represent a stress rating only, and functional operations of the device at these or any other conditions above the operational limits noted in this specification is not implied. Parts are tested to commercial grade only.

### AC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Input Frequency	$f_{IN}$	1	—	150	MHz	@ $V_{DD} = 2.5V$ and $3.3V$
		1	—	65		@ $V_{DD} = 1.8V$
Input Signal Amplitude	—	0.8	—	$V_{DD}$	$V_{PP}$	Internally AC-coupled
Output Rise Time	$t_r$	—	2	3	ns	15 pF Load, 10/90% $V_{DD}$ , 3.3V
Output Fall Time	$t_f$	—	2	3	ns	15 pF Load, 90/10% $V_{DD}$ , 3.3V
Output-to-Output Skew	—	—	—	500	ps	—
Duty Cycle	—	45	50	55	%	Input duty cycle is 50%

### DC ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Units	Condition
Supply Current, Dynamic	$I_{DD}$	—	1.8	—	mA	$V_{DD} = 3.3V$ , 25 MHz, No Load
		—	1.3	—		$V_{DD} = 2.5V$ , 25 MHz, No Load
		—	0.8	—		$V_{DD} = 1.8V$ , 25 MHz, No Load
Operating Voltage	$V_{DD}$	1.62	—	3.63	V	—
Output Low Voltage	$V_{OL}$	—	—	0.4	V	$I_{OL} = +4$ mA, $V_{DD} = 3.3V$
Output High Voltage	$V_{OH}$	2.4	—	—	V	$I_{OL} = -4$ mA, $V_{DD} = 3.3V$
Output Current	$I_{OSD}$	8	—	—	mA	$V_{OL} = 0.4V$ , $V_{OH} = 2.4V$ , $V_{DD} = 3.3V$

### TEMPERATURE SPECIFICATIONS

Parameters	Symbol	Min.	Typ.	Max.	Units	Conditions
<b>Temperature Ranges</b>						
Ambient Operating Temperature	$T_A$	-40	—	+85	°C	—
Storage Temperature	$T_S$	-65	—	+150	°C	—

2.0 NOISE CHARACTERISTICS

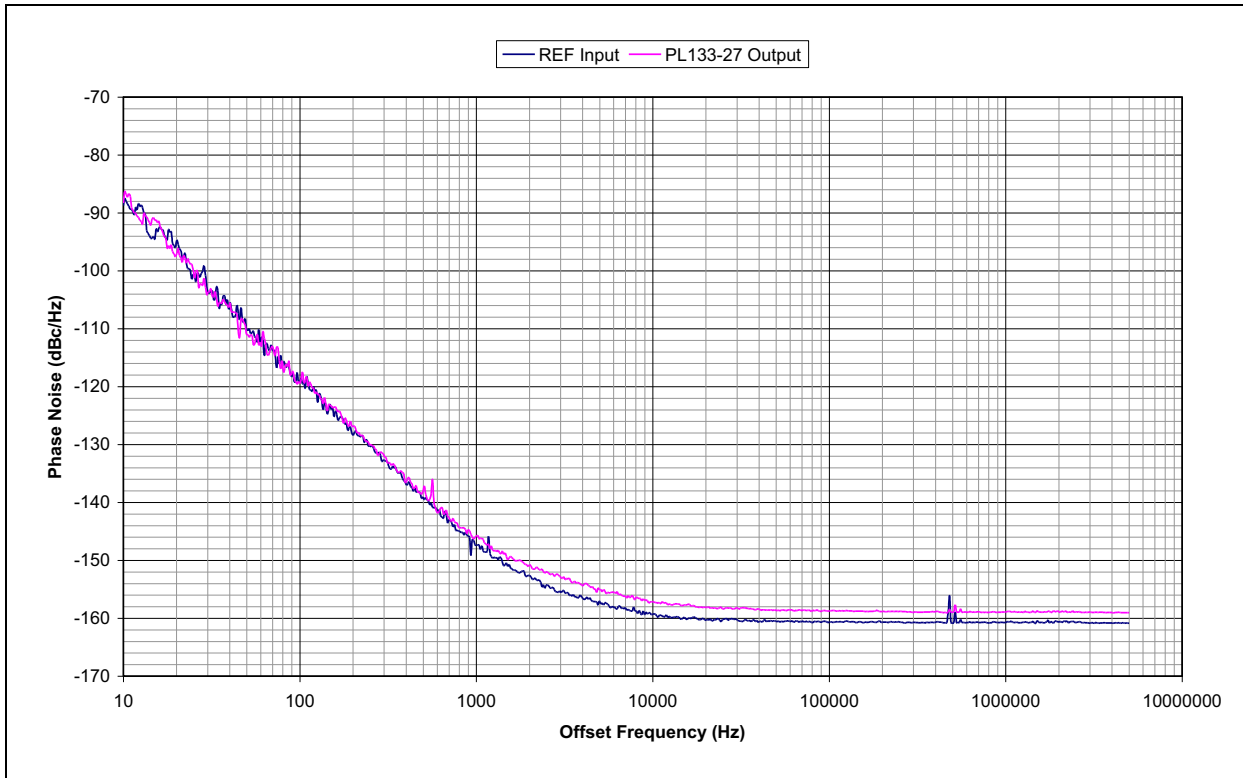


FIGURE 2-1: PL133-27 Additive Phase Jitter.  $V_{DD} = 3.3V$ ,  $CLK = 26\text{ MHz}$ , Integration Range: 12 kHz to 5 MHz, 0.127 ps Typical.

TABLE 2-1: NOISE CHARACTERISTICS

Parameter	Symbol	Min.	Typ.	Max.	Units	Conditions
Additive Phase Jitter		—	130	—	fs	$V_{DD} = 3.3V$ , Frequency = 26 MHz Offset = 12 kHz ~ 5 MHz
		—	150	—		$V_{DD} = 3.3V$ , Frequency = 100 MHz Offset = 12 kHz ~ 20 MHz

When a buffer is used to pass a signal then the buffer will add a little bit of its own noise. The phase noise on the output of the buffer will be a little bit more than the phase noise in the input signal. To quantify the noise addition in the buffer we compare the Phase Jitter numbers from the input and the output. The difference is called Additive Phase Jitter. The formula for the Additive Phase Jitter is as follows:

EQUATION 2-1:

$$\text{Additive Phase Jitter} = \sqrt{\text{Output Phase Jitter}^2 - \text{Input Phase Jitter}^2}$$

## 3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 3-1](#).

**TABLE 3-1: PIN FUNCTION TABLE**

Pin Number	Pin Name	Pin Type	Description
1	FIN	I	Reference clock input.
2	CLK1	O	Clock output (inverted).
3	GND	P	Ground connection.
4	CLK0	O	Clock output (inverted).
5	VDD	P	V <sub>DD</sub> connection.
6	OE	I	Output enable input.

### 3.1 Layout Recommendations

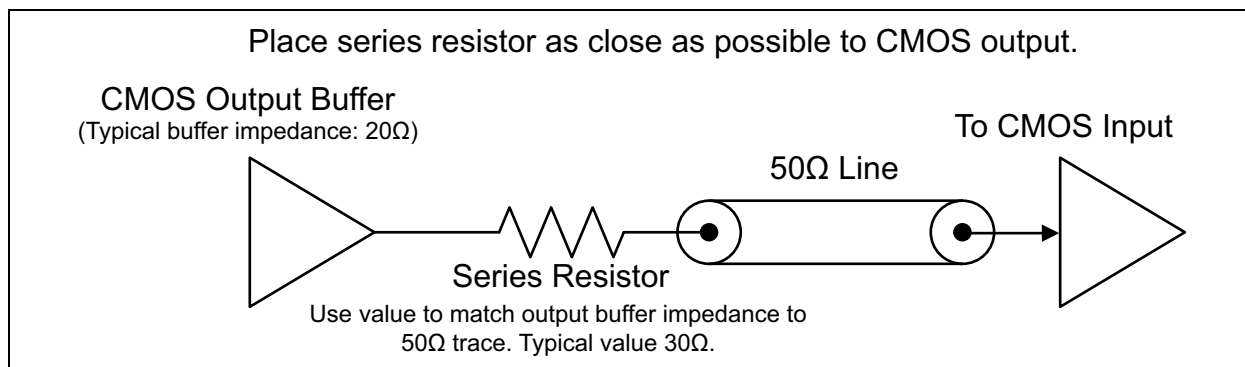
The following guidelines are to assist you with a performance-optimized PCB design.

#### 3.1.1 SIGNAL INTEGRITY AND TERMINATION CONSIDERATIONS

- Keep traces short.
- Trace = Inductor. With a capacitive load this equals ringing.
- Long trace = Transmission Line. Without proper termination this will cause reflections (looks like ringing).
- Design long traces as “striplines” or “microstrips” with defined impedance.
- Match trace at one side to avoid reflections bouncing back and forth.

#### 3.1.2 DECOUPLING AND POWER SUPPLY CONSIDERATIONS

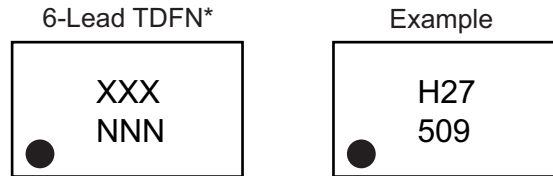
- Place decoupling capacitors as close as possible to the VDD pin to limit noise from the power supply.
- Multiple VDD pins should be decoupled separately for best performance.
- The addition of a ferrite bead in series with VDD can help prevent noise from other board sources.
- The value of decoupling capacitor is frequency dependent. Typical values to use are 0.1  $\mu$ F for designs using crystals <50 MHz and 0.01  $\mu$ F for designs using crystals >50 MHz.



**FIGURE 3-1:** Typical CMOS Termination.

## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information



<b>Legend:</b>	XX...X	Product code or customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.
	•, ▲, ▼	Pin one index is identified by a dot, delta up, or delta down (triangle mark).
<b>Note:</b>	In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.	
	Underbar ( _ ) and/or Overbar ( ¯ ) symbol may not be to scale.	

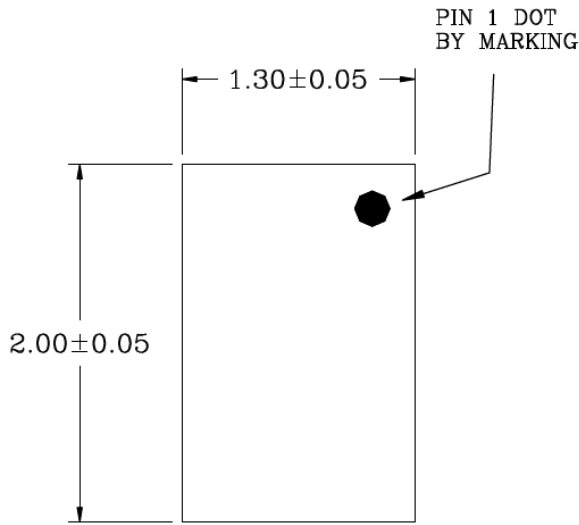
# PL133-27

## 6-Lead TDFN 2.0 mm x 1.3 mm Package Outline Drawing and Recommended Land Pattern

**TITLE**

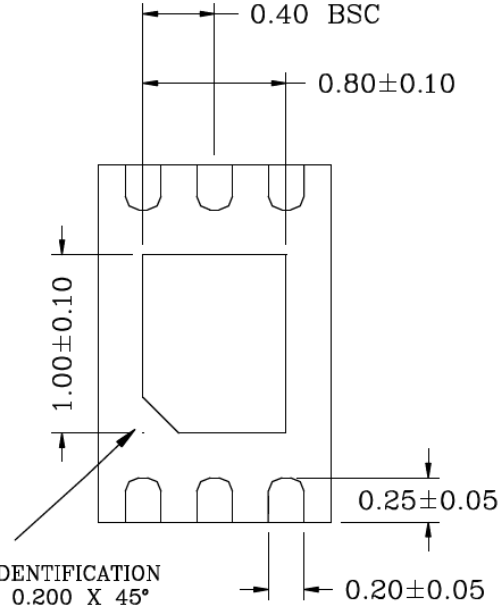
6 LEAD TDFN 2.0x1.3 mm PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

<b>DRAWING #</b>	TDFN2013-6LD-PL-1	<b>UNIT</b>	MM
<b>Lead Frame</b>	NiPdAu	<b>Lead Finish</b>	NiPdAu



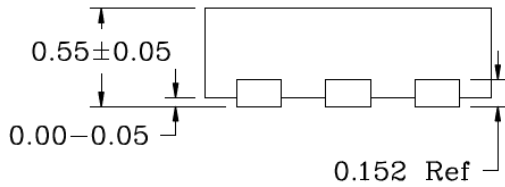
TOP VIEW

NOTE: 1, 2



BOTTOM VIEW

NOTE: 1, 2



SIDE VIEW

NOTE: 1, 2

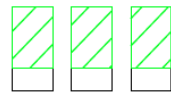
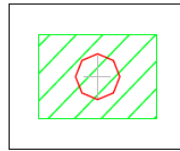
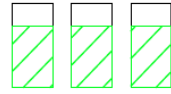
**NOTES**

1. MAX PACKAGE WARPAGE IS 0.05mm.
2. MAX ALLOWABLE BURR IS 0.076mm IN ALL DIRECTIONS.
3. PIN #1 IS ON TOP WILL BE LASER MARKED.
4. UNIT IN mm.
5. SHADED AREA IS SOLDER STENCIL OPENING.
6. RECOMMENDED VIA SIZE IS 0.30-0.35mm.

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>.

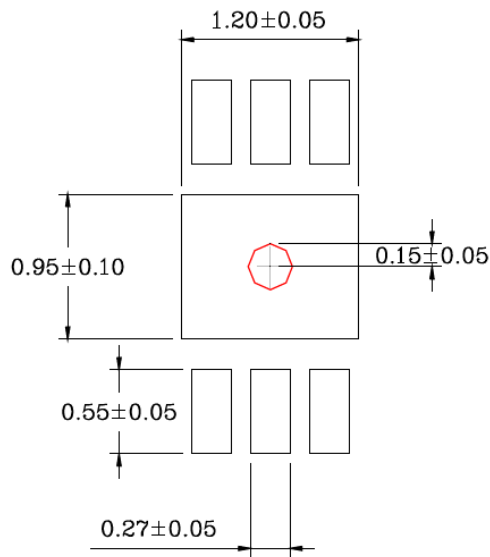
POD-Land Pattern TDFN2013-6LD-PL-1

## RECOMMENDED LAND PATTERN



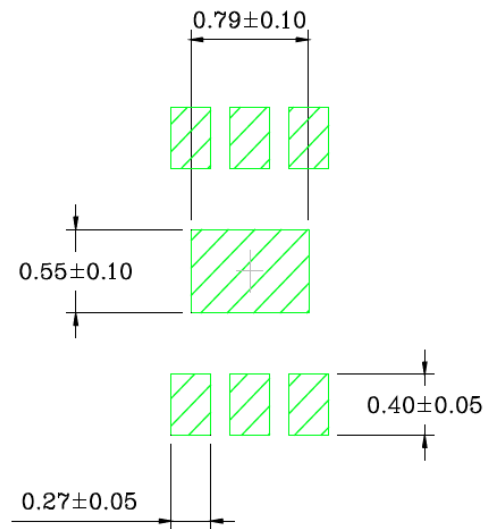
### STACKED-UP

NOTE: 4, 5, 6



### EXPOSED METAL TRACE

NOTE: 4, 6



### SOLDER STENCIL OPENING

NOTE: 4, 5

Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>.

NOTES:



## APPENDIX A: REVISION HISTORY

### Revision A (October 2020)

- Converted Micrel document PL133-27 to Microchip data sheet DS20006429A.
- Minor text changes throughout.

NOTES:

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

<u>Part No.</u>	<u>X</u>	<u>X</u>	<u>-X</u>	<b>Examples:</b>
Device	Package	Temp. Range	Packing	
<b>Device:</b>	PL133-27:	Low-Power, 1.62V to 3.63V, 1:2 Fanout Buffer IC		a) PL133-27GC: 6-Lead TDFN, 0°C to +70°C Temperature Range, 20/Bag
<b>Package:</b>	G	=	6-Lead 2 mm x 1.3 mm TDFN	b) PL133-27GI: 6-Lead TDFN, -40° to +85°C Temperature Range, 20/Bag
<b>Temperature Range:</b>	C	=	0°C to +70°C (NiPdAu Lead-Free)	c) PL133-27GC-R: 6-Lead TDFN, 0°C to +70°C Temperature Range, 3,000/Reel
	I	=	-40° to +85°C (NiPdAu Lead-Free)	d) PL133-27GI-R: 6-Lead TDFN, -40° to +85°C Temperature Range, 3,000/Reel
<b>Tape and Reel:</b>	<blank>=		20/Bag	
	R	=	3,000/Reel	
				<b>Note 1:</b> Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

# PLL133-27

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NOTES:

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