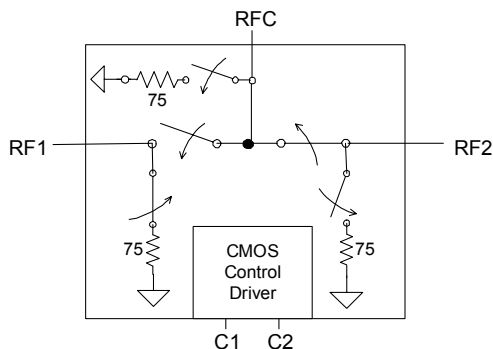


Product Description

The PE42801 is an UltraCMOS™ Switch designed for CATV applications, covering a broad frequency range from DC up to 2.2 GHz. This single-supply SPDT switch integrates a two-pin CMOS control interface. It also provides low insertion loss with extremely low bias requirements while operating on a single 3 V supply. In a typical CATV application, the PE42801 provides for a cost effective and manufacturable solution when compared to mechanical relays.

The PE42801 is manufactured on Peregrine's UltraCMOS™ process, a patented variation of silicon-on-insulator (SOI) technology on a sapphire substrate, offering the performance of GaAs with the economy and integration of conventional CMOS.

Figure 1. Functional Diagram



75 Ω SPDT CATV UltraCMOS™ Switch DC—2.2 GHz

Features

- 75 Ω characteristic impedance
- Integrated 75 Ω 0.25 watt terminations
- CTB performance of 85 dBc
- High isolation 60 dB at 1 GHz
- Low insertion loss: typically 0.5 dB at 5 MHz, 1.1 dB at 1 GHz
- High input IP3: 50 dBm
- CMOS two-pin control
- Single +3 V supply operation
- Low current consumption: 8 μA
- Unique all off terminated mode
- 4x4 mm QFN package

Figure 2. Package Type
4x4 mm 20-Lead QFN



Table 1. Electrical Specifications @ +25 °C ($Z_S = Z_L = 75 \Omega$)

Parameter	Condition	Minimum	Typical	Maximum	Units
Operating Frequency ¹		DC		2200	MHz
Insertion Loss	5 MHz – 250 MHz		0.5	0.6	dB
	250 MHz – 750 MHz		0.8	0.95	
	750 MHz – 1000 MHz		0.9	1.1	
	1000 MHz – 2200 MHz		1.1	1.3	
Isolation	5 MHz – 250 MHz	65	70		dB
	250 MHz – 750 MHz	60	63		
	750 MHz – 1000 MHz	56	60		
	1000 MHz – 2200 MHz	44	47		
Input IP2 ²	5 MHz - 1000 MHz		75		dBm
Input IP3 ²	5 MHz - 1000 MHz	50	50		dBm
Input 1dB Compression ²	1000 MHz	29	26		dBm
CTB / CSO	77 & 110 channels; Power Out = 44 dBmV		-85		dBc
Switching Time	50% CTRL to 10/90 RF		2		μs
Video Feedthrough ³	5 MHz - 1000 MHz			15	mV _{pp}

Notes: 1. Device linearity will begin to degrade below 5 MHz.
2. Measured in a 50 Ω system.
3. Measured with a 1 ns risetime, 0/3 V pulse and 500 MHz bandwidth

Figure 3. Pin Configuration (Top View)

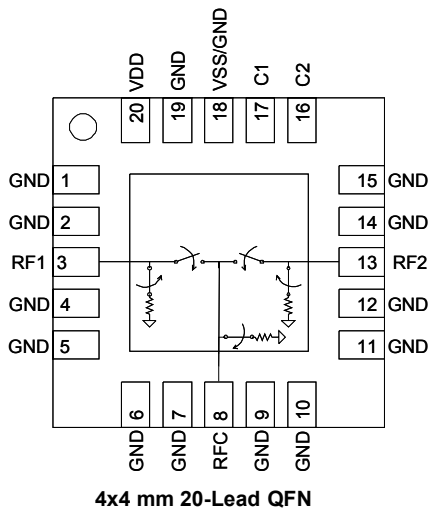


Table 2. Pin Descriptions

No.	Name	Description
1	GND	Ground
2	GND	Ground
3 ¹	RF1	RF I/O
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8 ¹	RFC	Common
9	GND	Ground
10	GND	Ground
11	GND	Ground
12	GND	Ground
13 ¹	RF2	RF I/O
14	GND	Ground
15	GND	Ground
16 ²	C2	Control 2
17 ²	C1	Control 1
18 ³	VSS / GND	Negative Supply Option
19	GND	Ground
20	VDD	Supply
Pad	GND	Ground Pad

Notes:

1. RF pins 3, 8, and 13 must be at 0 VDC. The RF pins do not require DC blocking capacitors for proper operation if the 0 VDC requirement is met.
2. Pins 16 and 17 are the CMOS controls that set the three operating states.
3. Connect pin 18 to GND to enable the on-chip negative voltage generator. Connect pin 18 to V_{SS} (-3 V) to bypass and disable internal -3 V supply generator. Also, see paragraph "Switching Frequency."

Table 3. Absolute Maximum Ratings

Symbol	Parameter/Condition	Min	Max	Unit
V _{DD}	Power supply voltage	-0.3	4.0	V
V _I	Voltage on CTRL input	-0.3	V _{DD} + 0.3	V
P _{RF}	RF CW power		24	dBm
T _{ST}	Storage temperature	-65	150	°C
T _{OP}	Operating temperature	-40	85	°C
V _{ESD}	ESD voltage (Human Body Model)		1000	V

Table 4. DC Electrical Specifications @ 25 °C

Parameter	Min	Typ	Max	Unit
V _{DD} Power Supply	2.7	3.0	3.3	V
I _{DD} Power Supply Current (V _{DD} = 3 V)		8	20	μA
Control Voltage High	70% V _{DD}			V
Control Voltage Low			30% V _{DD}	V

Electrostatic Discharge (ESD) Precautions

When handling this UltraCMOS™ device, observe the same precautions that you would use with other ESD-sensitive devices. Although this device contains circuitry to protect it from damage due to ESD, precautions should be taken to avoid exceeding the rating specified.

Latch-Up Avoidance

Unlike conventional CMOS devices, UltraCMOS™ devices are immune to latch-up.

Switching Frequency

The PE42801 has a maximum 25 kHz switching rate when the internal negative voltage generator is used (pin 18=GND). The rate at which the PE42801 can be switched is only limited to the switching time if an external -3 V supply is provided at pin 18 (V_{SS}).

Table 5. RF Path Truth Table

C1	C2	RFC – RF1	RFC – RF2
Low	Low	OFF	OFF
Low	High	OFF	ON
High	Low	ON	OFF
High	High	N/A ¹	N/A ¹

Table 6. Termination Truth Table

C1	C2	RFC – 75 Ω	RF1 – 75 Ω	RF2 – 75 Ω
Low	Low	X ²	X ²	X ²
Low	High		X ²	
High	Low			X ²
High	High	N/A ¹	N/A ¹	N/A ¹

Notes: 1. The operation of the PE42801 is not supported or characterized in the C1=VDD and C2=VDD state.
2. "X" denotes termination enabled.

Evaluation Kit

The SPDT Switch Evaluation Kit board was designed to ease customer evaluation of the PE42801 SPDT switch. The RFC port is connected through a 75 Ω transmission line to J2. Port 1 and Port 2 are connected through 75 Ω transmission lines to J1 and J3. A through transmission line connects F connectors J4 and J5. This transmission line can be used to estimate the loss of the PCB over the environmental conditions being evaluated.

The board is constructed of a four metal layer FR4 material with a total thickness of 0.062". The transmission lines were designed using a coplanar waveguide with ground plane (28 mil core, 21 mil width, 30 mil gap).

J6 provides a means for controlling DC and digital inputs to the device. The provided jumpers short the package pin to ground for logic low. When the jumper is removed, the pin is pulled up to V_{DD} for logic high.

When the jumper is in place, 3 μ A of current will flow through the 1 M Ω pull up resistor. This extra current should not be attributed to the requirements of the device.

Proper PCB design is essential for full isolation performance. This eval board demonstrates good trace and ground management for minimum coupling and radiation.

Figure 4. Evaluation Board Layouts
Peregrine Specification 101/0148

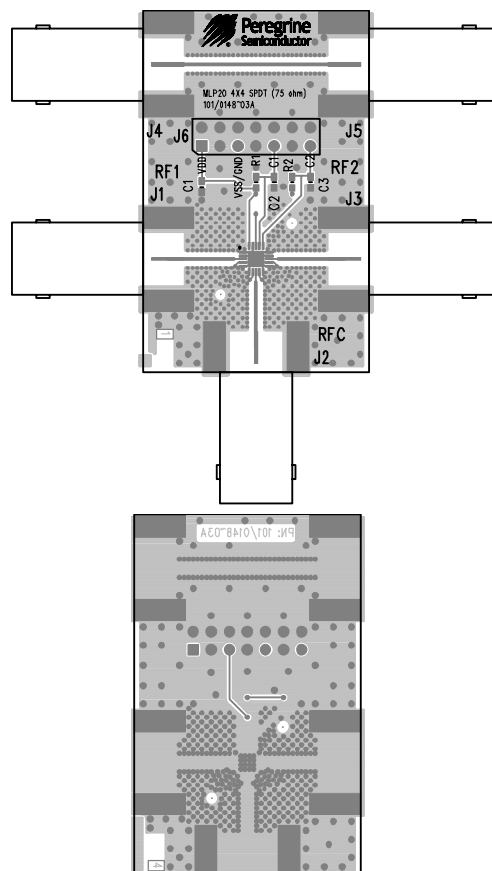
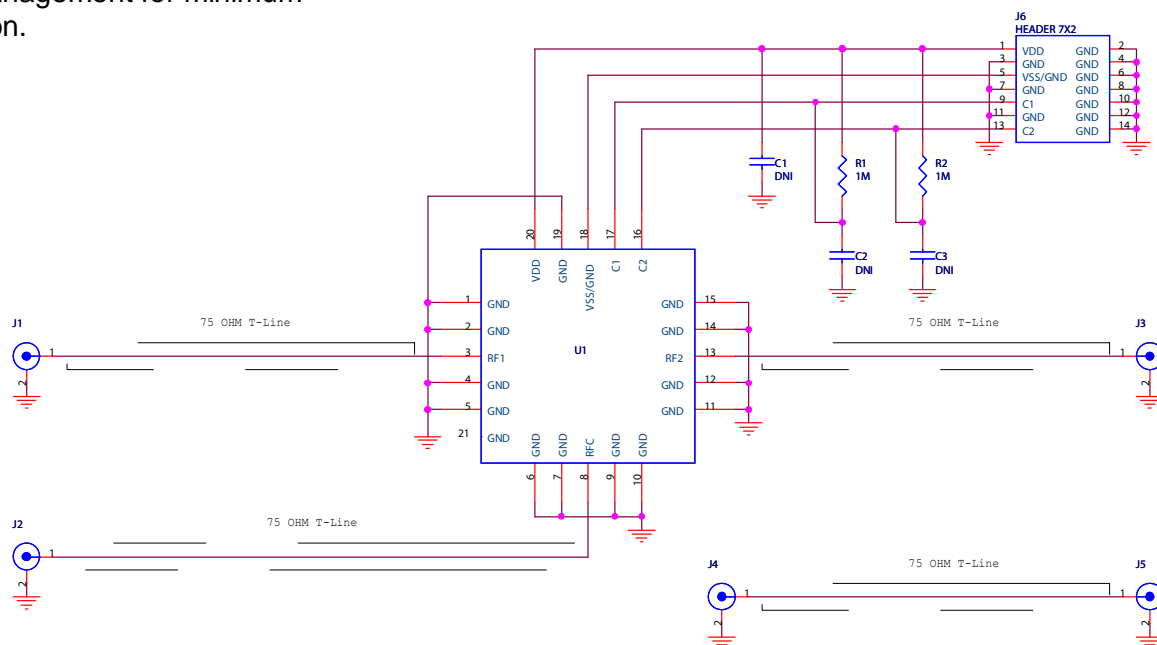


Figure 5. Evaluation Board Schematic
Peregrine Specification 102/0195



Typical Performance Data from -40°C to +85°C, 75 Ω impedance

Figure 6. Insertion Loss (RFC to RF1 or RF2)

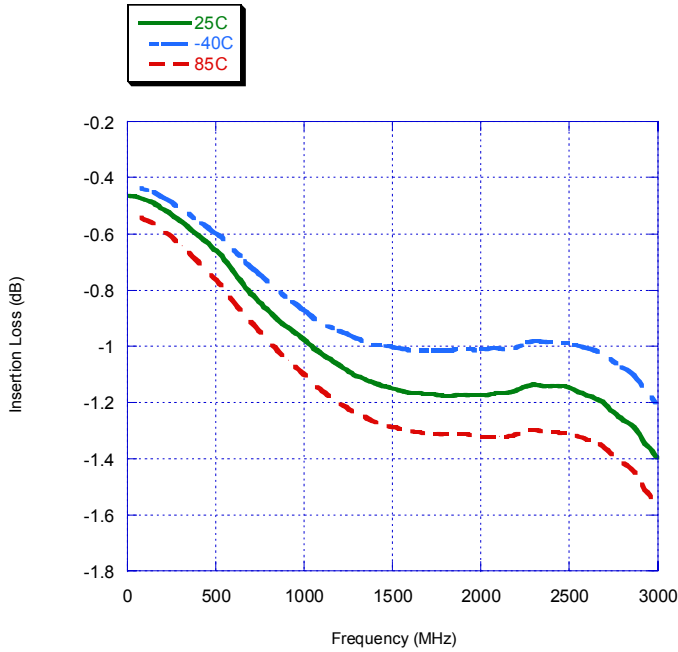


Figure 7. Input to Output Isolation

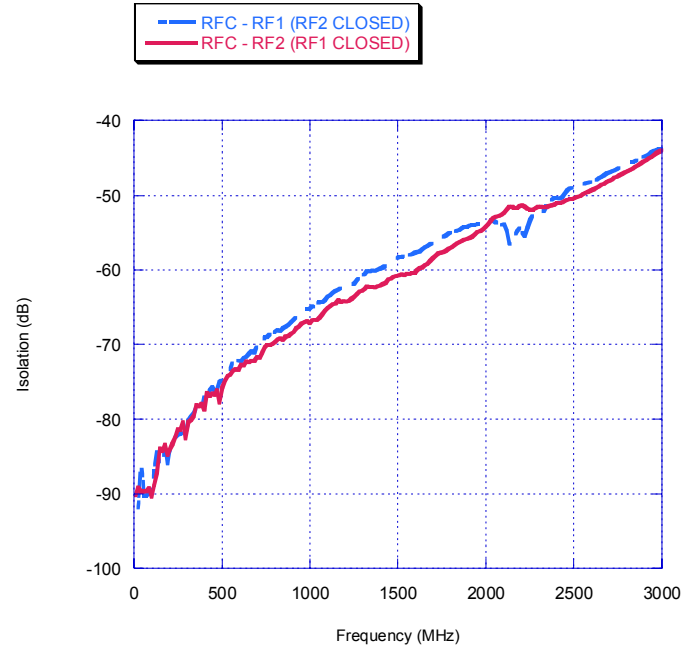


Figure 8. Input to Output Isolation

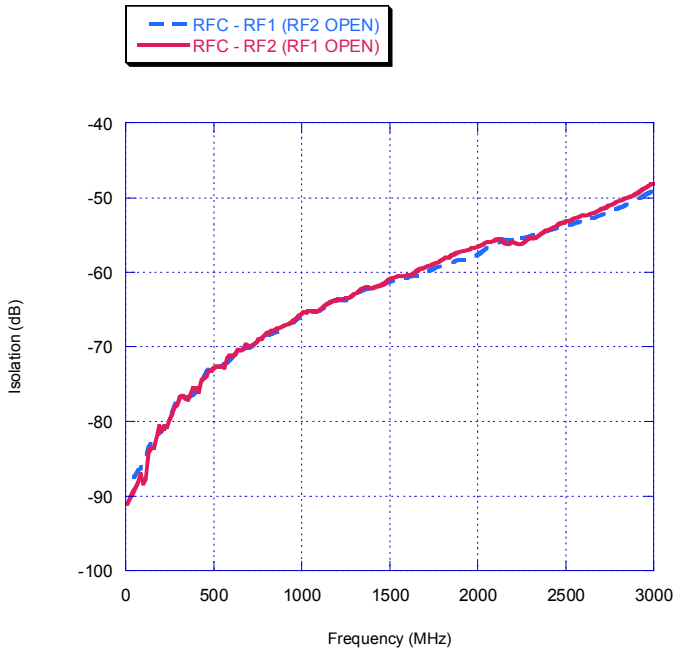
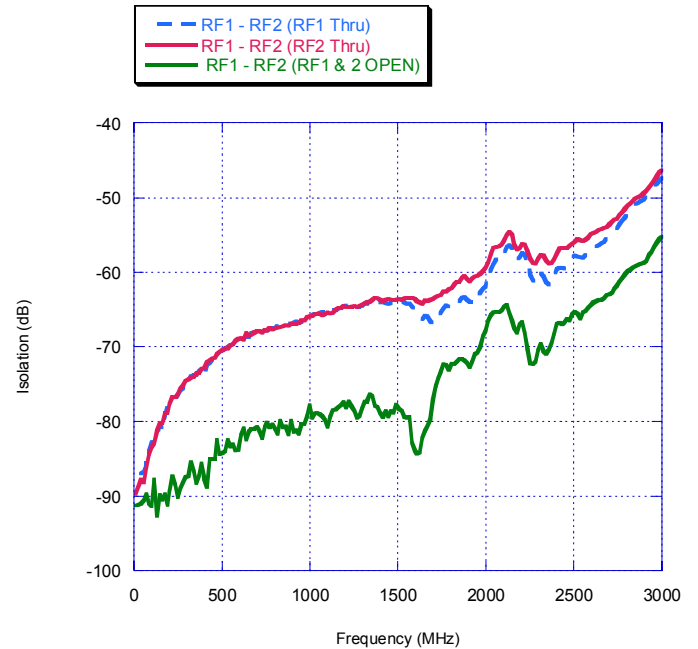


Figure 9. Isolation – RF1 To RF2



Typical Performance Data @ +25°C, 75 Ω impedance

Figure 10. RFC Return Loss

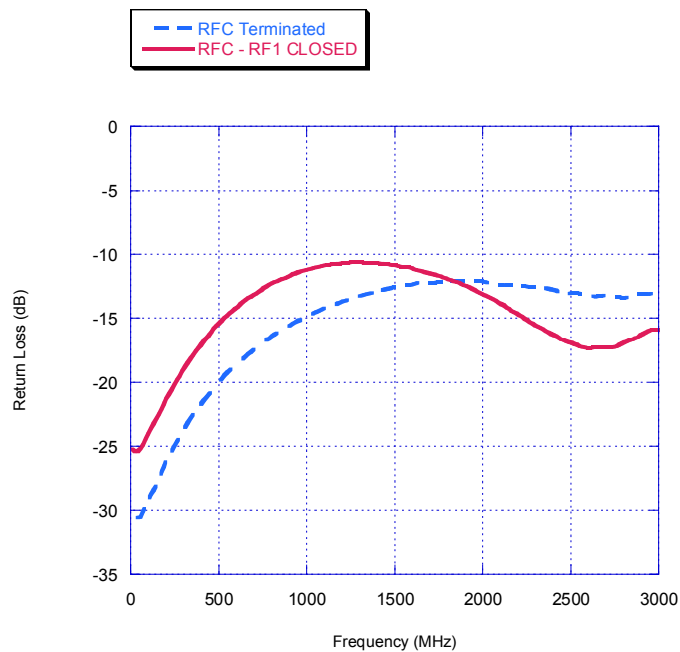


Figure 11. RF1 Return Loss

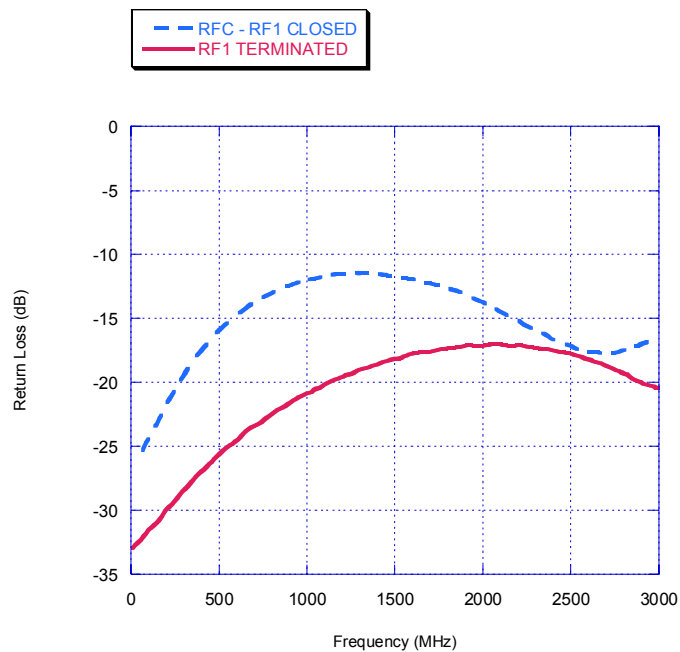


Figure 12. RF2 Return Loss

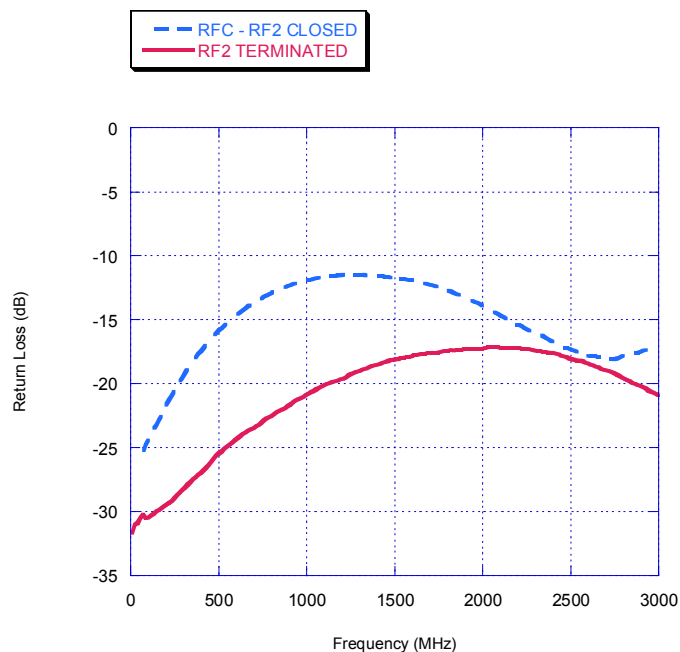
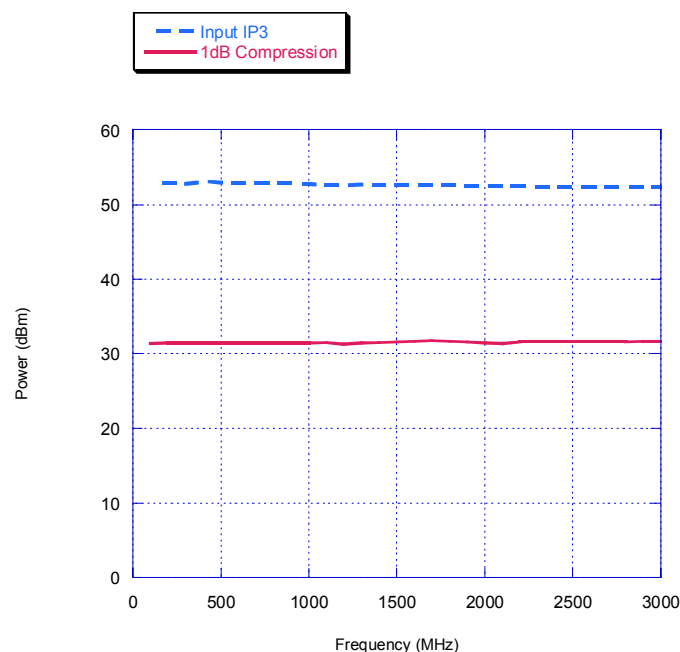
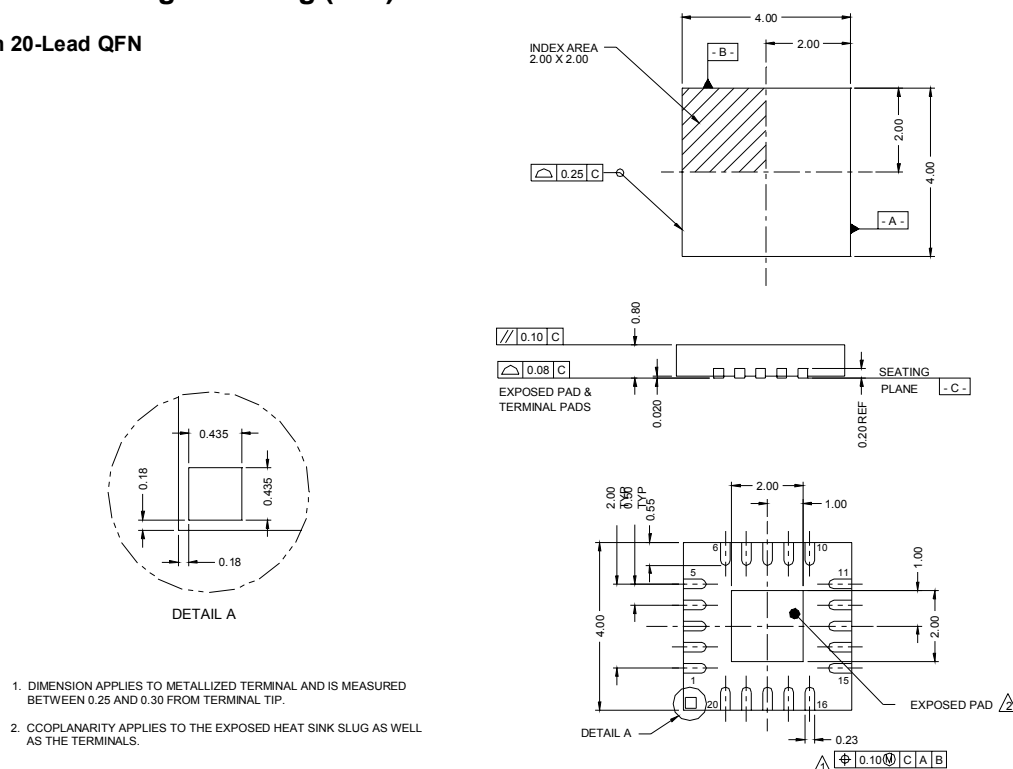


Figure 13. Linearity: 50 Ω Impedance



4x4 mm 20-Lead QFN



Technical drawing of a 4x4 grid of square holes in a plate. The drawing includes the following dimensions and features:

- Grid Dimensions:**
 - Overall width: 12.0 ± 0.3
 - Overall height: 12.0 ± 0.3
 - Distance between hole centers (pitch): 8.0
- Individual Hole Dimensions:**
 - Inner square hole side: $\varnothing 1.5 \pm 0.1/-0.0$
 - Outer square hole side: 4.0 (See Note 1)
 - Inner square hole corner radius: $R0.25$
 - Outer square hole corner radius: $R0.25$
- Section A-A Details:**
 - Section line A-A passes through the holes.
 - Section A-A shows a thickness of 0.30 ± 0.05 .
 - Section A-A shows a corner radius of $R0.3 \text{ MAX}$.
 - Section A-A shows a distance of 0.30 ± 0.05 from the hole center to the outer edge.
 - Section A-A shows a distance of 0.30 ± 0.05 from the hole center to the inner edge.
 - Section A-A shows a distance of 0.30 ± 0.05 from the hole center to the outer edge.
 - Section A-A shows a distance of 0.30 ± 0.05 from the hole center to the inner edge.
- Other Dimensions:**
 - Distance from hole center to outer edge: 2.0 ± 0.05 (See Note 6)
 - Distance from hole center to inner edge: 2.0 ± 0.05 (See Note 6)
 - Distance from hole center to outer edge: 2.0 ± 0.05 (See Note 6)
 - Distance from hole center to inner edge: 2.0 ± 0.05 (See Note 6)
 - Distance from hole center to outer edge: 2.0 ± 0.05 (See Note 6)
 - Distance from hole center to inner edge: 2.0 ± 0.05 (See Note 6)

$A_o = 4.35 \text{ mm}$
 $B_o = 4.35 \text{ mm}$
 $K_o = 1.1 \text{ mm}$

Notes:

1. 10 sprocket hole pitch cumulative tolerance ± 0.02 .
2. Camber not to exceed 1mm in 100mm.
3. Material: PS + C.
4. Ao and Bo measured as indicated.
5. Ko measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Order Code	Part Marking	Description	Package	Shipping Method
EK-42801-01	PE42801EK	PE42801-20QFN 4x4mm-EK	Evaluation Kit	1/ Box
PE42801MLI	42801	PE42801G-20QFN 4x4mm-75A	Green 20-lead 4x4mm QFN	75 units / Tube
PE42801MLI-Z	42801	PE42801G-20QFN 4x4mm-3000C	Green 20-lead 4x4mm QFN	3000 units / T&R

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