

Replacing PE4246 with PE4270

Application Note 76



Summary

This application note makes the case for using the PE4270 75 Ω single-pole, double-throw (SPDT) as a drop-in replacement for the PE4246 50 Ω SPDT switch through the illustration of the following:

- Package and functional similarities
 - Operating range comparison
 - RF performance overlay over the PE4246's wider bandwidth
 - Large signal and other parametric specification comparison
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Introduction

The PE4246 RF SPDT switch was released in 2004 to cover a broad range of high-isolation 50 Ω applications from 1 to 5000 MHz. For multiple reasons, this switch was rendered end-of-life (EOL) on September 20, 2017, and was to be made obsolete a year after. A number of customers already using this part would ideally like to see a drop-in replacement that has minimal impact on their existing system. pSemi's existing portfolio does not contain a 50 Ω switch that is a drop-in replacement for this part. This application note makes the case for a 75 Ω switch to fill that role.

The PE4270 is a high-isolation absorptive SPDT switch that was designed for 75 Ω cable television (CATV) applications and thus specified over the 1 to 3000 MHz range that is typical for this market. However, it shares the same package, pin-out, functionality and footprint of the PE4246. As such, it is a viable drop-in replacement, provided there is enough similarity in electrical requirements and RF performance, particularly the latter above 3 GHz where the part is technically out of specification per its datasheet.

A switch's input impedance is primarily determined by the system load impedance seen at its output. For absorptive switches, the internal termination only affects ports in the OFF state. Thus, an absorptive switch's categorization as '50 Ω ' or '75 Ω ' is relevant mainly to its off-port termination, not so much its through-path performance. (For more information on the interchangeability of 50 Ω and 75 Ω switches, refer to application note AN48, *Using a 50 Ω Switch Within a 75 Ω System*.)

This application note takes a comparative look at all aspects of the PE4246 and PE4270 and provides data up to 6 GHz with the hope of providing customers the confidence needed to use the latter as a drop-in replacement for the former.

Part Diagrams

Figure 1 through Figure 4 show comparison diagrams for functional, pin and package characteristics of the PE4246 and PE4270. The parts are quite identical in all of these respects, except for the port terminations of 50Ω vs 75Ω as is shown in Figure 1.

Figure 1 ▪ PE4246 and PE4270 Functional Diagrams

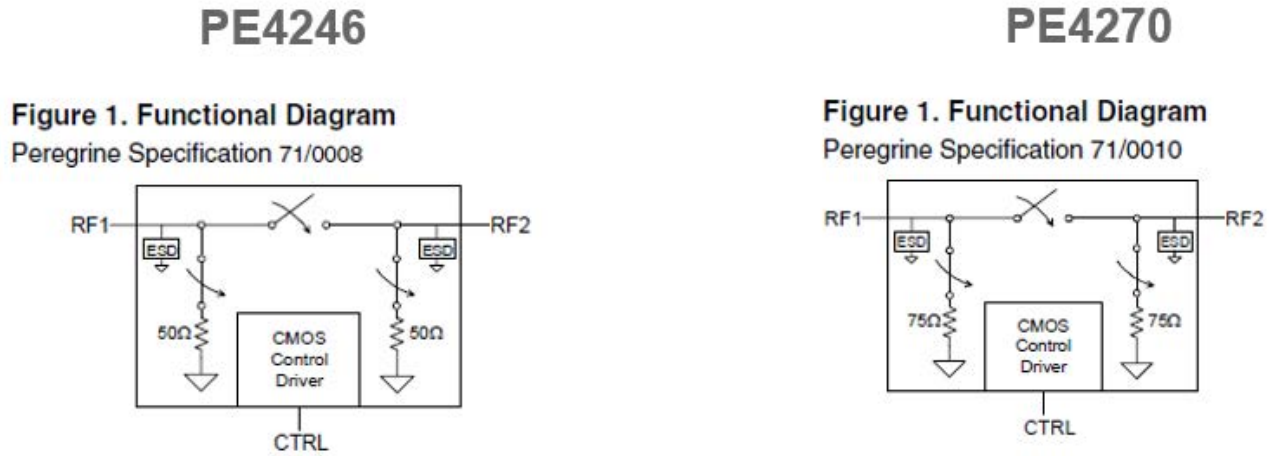


Figure 2 ▪ PE4246 and PE4270 Pin Diagrams



Figure 3 ■ PE4246 Package Drawing

6-lead DFN

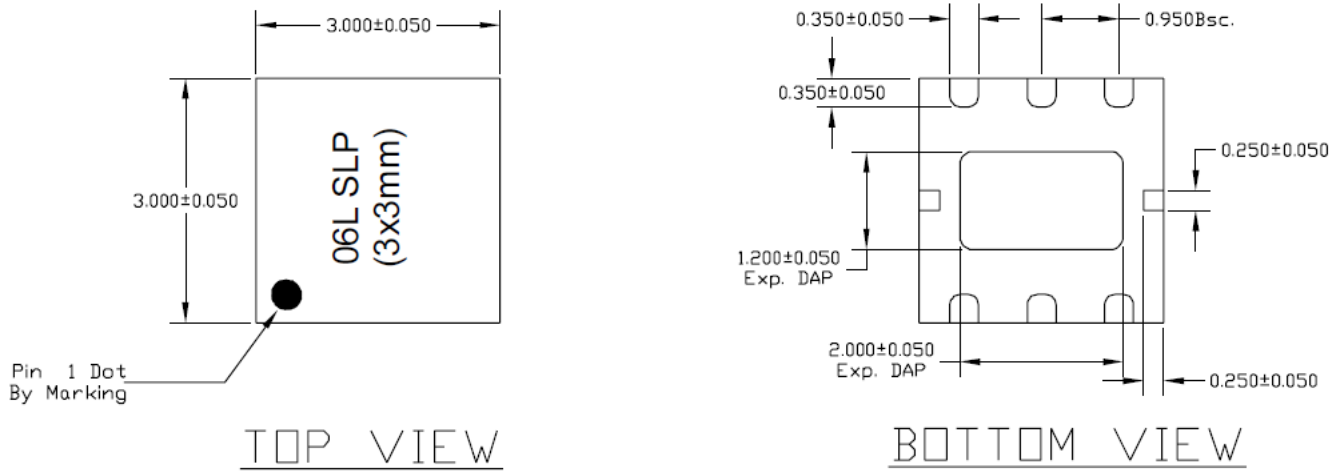
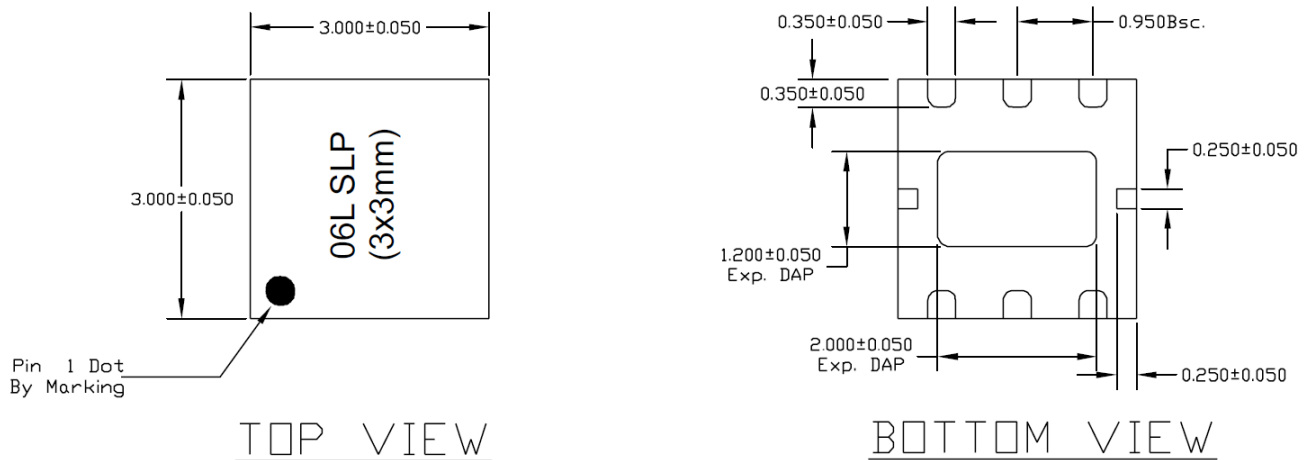


Figure 4 ■ PE4270 Package Drawing

6-lead DFN



Operating Ranges

A comparison of the operating ranges are shown in **Table 1** and **Table 2**. The only difference here is that the PE4270 draws lower supply current than the PE4246.

Table 1 ▪ PE4246 Operating Ranges

Parameter	Min	Typ	Max	Unit
V _{DD} power supply	2.7	3.0	3.3	V
I _{DD} power supply current (V _{DD} = 3V, V _{CNTL} = 3V)		33	40	μA
T _{OP} operating temperature	-40		85	°C
Control voltage high	0.7xV _{DD}		5	V
Control voltage low	0		0.3xV _{DD}	V

Table 2 ▪ PE4270 Operating Ranges

Parameter	Min	Typ	Max	Unit
V _{DD} power supply	2.7	3.0	3.3	V
I _{DD} power supply current (V _{DD} = 3V, V _{CNTL} = 3V)		8	20	μA
T _{OP} operating temperature	-40		85	°C
Control voltage high	0.7xV _{DD}		5	V
Control voltage low	0		0.3xV _{DD}	V

Truth Tables

A comparison of the control logic truth tables **Table 3** and **Table 4**.

Table 3 ▪ PE4246 Control Logic Truth Table

Control Voltage	Signal Path
CTRL = CMOS or TTL High	RF1 to RF2
CTRL = CMOS or TTL Low	RF1 isolated from RF2

Table 4 ▪ PE4270 Control Logic Truth Table

Control Voltage (CTRL)	Signal Path (RF1 to RF2)
High	ON
Low	OFF

Small Signal Performance

S-parameter data of the PE4270 was measured in a 50Ω system. Figure 5 through Figure 8 show, overlaid, the small signal performance comparison of both parts.

Figure 5 ■ ON State—Insertion Loss

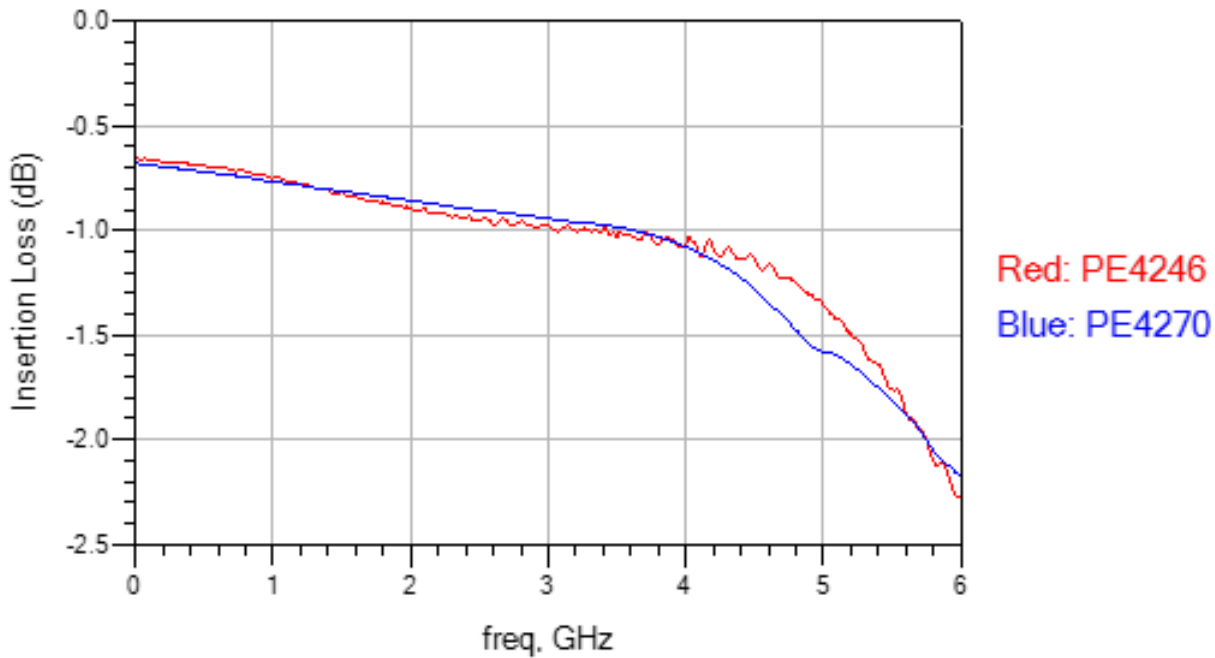


Figure 6 ■ ON State—Return Loss

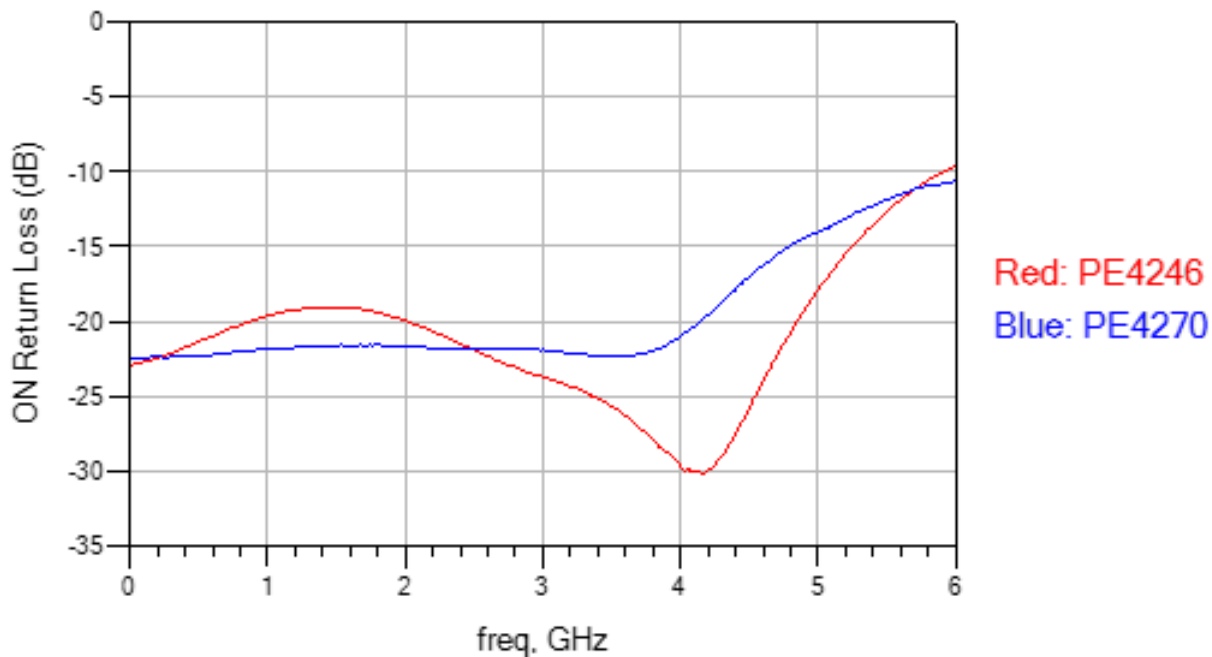


Figure 7 ■ OFF State—Isolation

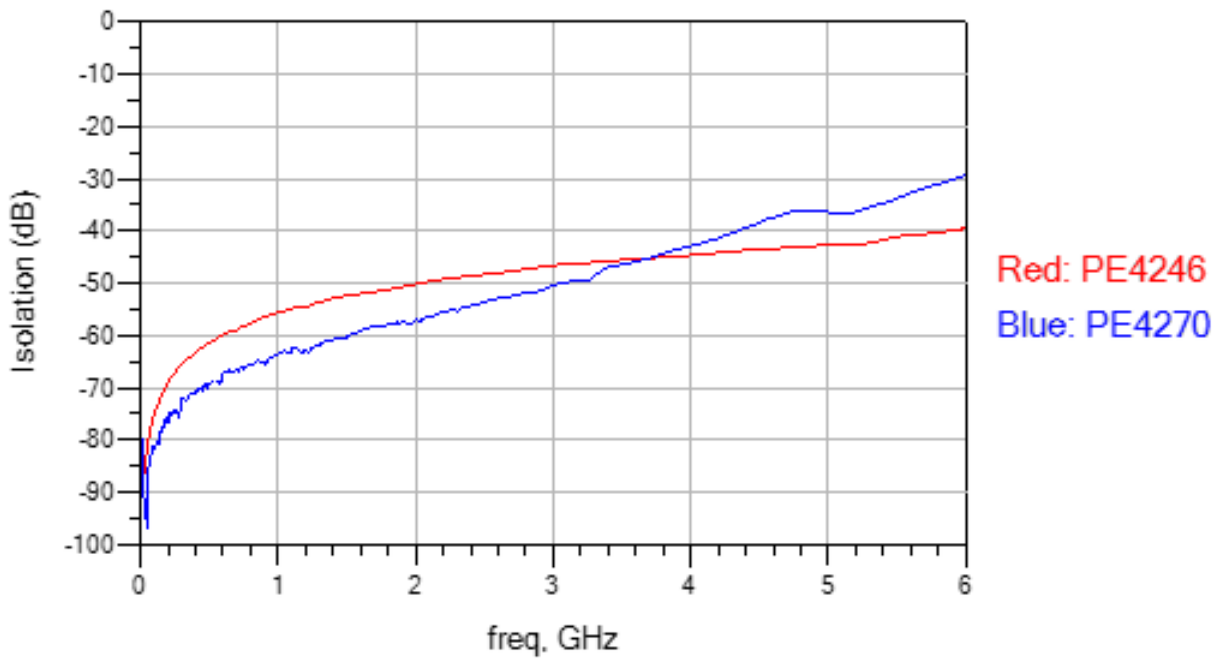
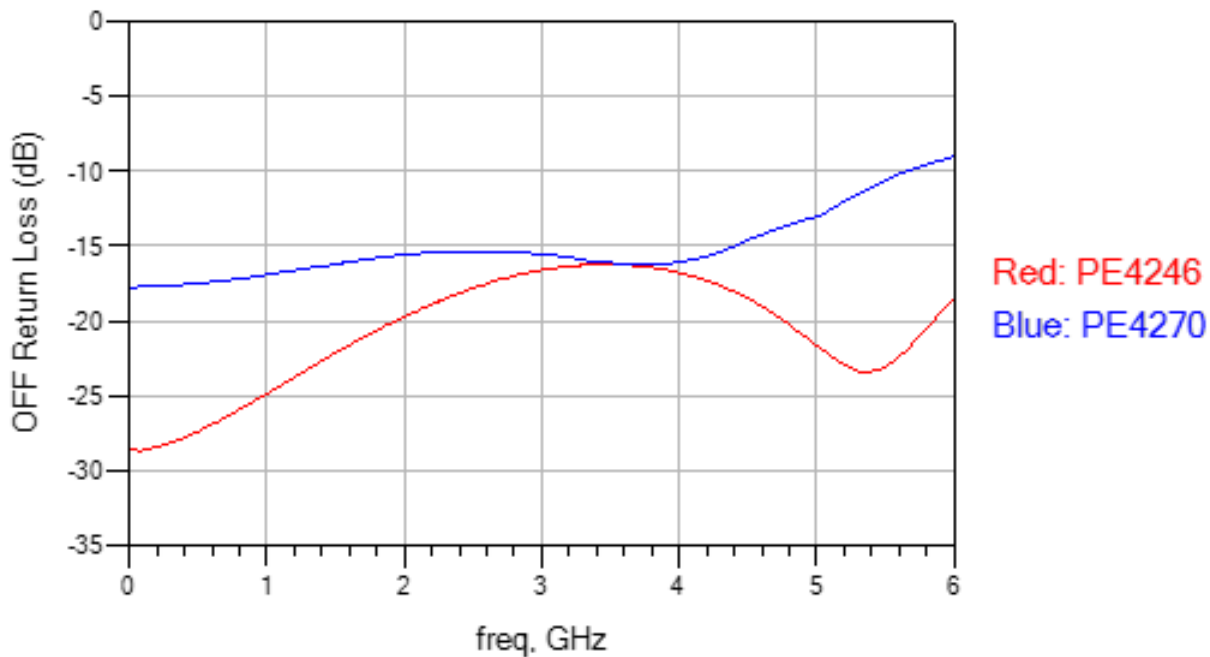


Figure 8 ■ OFF State—Return Loss



In general, the small-signal performance of the PE4270 is quite similar to the PE4246 over the entire 0–5 GHz frequency range. The only parameter that is consistently worse is the OFF state return loss. This is to be expected because the PE4270’s off port termination is closer to 75Ω by design. However, at ~15 dB, this performance is still quite respectable.

Large Signal and Other Specifications

A few other electrical specifications including large signal performance are summarized in **Table 5**. The only parameter showing degradation is P1dB.

Table 5 • *Other Miscellaneous Specifications*

Parameter	PE4246	PE4270	Unit
Pmax_ON	30	30	dBm
Pmax_OFF	24	24	dBm
P1db	33	30	dBm
IIP3	50	50	dBm
Switching Time	2	2	us
Video Feedthrough	15	15	mV _{pp}
ESD (HBM)	200	500	V

Conclusion

The PE4270 appears to be a very viable option to replace the PE4246, which is at end-of-life. Both parts are functionally identical with the same package footprint and pin-out. Supply and control voltages are also identical. Even though the PE4270 is only rated up to 3 GHz, it shows very comparable RF performance to the PE4246 up to the latter's own rated frequency of 5 GHz.

The PE4270 would thus be a direct drop-in replacement for the PE4246. Please note that it is also the only pSemi offering available that would not require a customer board re-spin to migrate away from the EOL part.

Sales Contact

For additional information, contact Sales at sales@psemi.com.

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