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The measurement of LF noise spectral exponent
of optocouplers by three-point method

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In the electronics low-frequency (LF) noise often used for reliability estimation of semiconductor devices. Spectral exponent of noise may be used as an informative parameter. The simplest method of exponent measurement is to measure power spectral density (PSD) of noise on two frequencies [1]. Then the noise spectral exponent is

$$\gamma = ln(G_1/G_2)/ln(f_2/f_1), \tag{1}$$

where G_1, G_2 are PSDs; f_1, f_2 are corresponding frequencies.

To eliminate the influence of white noise the method of exponent evaluation by three points of spectrum is proposed:

$$\gamma_m = log_k((G_1 - G_{add})/(G_{add} - G_2)), \tag{2}$$

where G_{add} is PSD of LF noise on additional point; $k = (f_2/f_1)^{1/2}$.

For investigation HCNR200 high‑linearity analog optocouplers of Avago Technologies were chosen. We performed electric noise measurement of LED in 10 samples of optocouplers. Noise measurements were carried out by noise generator method. Measurement setup mainly consists of G2-37 noise generator and selective nanovoltmeter Unipan 233.

Input current was set at 5 mA. The relative effective bandwidth (– 3db) of analyzing filter was set at 0.2. We measured PSD of noise on three frequencies: 200 Hz, 1000 Hz and 5000 Hz. And then we calculated spectral exponent values by (1) and by (2). We found, that mean value of γ is 1.11 for calculating by (1), and γ is 2.16 for calculating by (2). And standard deviations are 0.22 and 0.24 respectively.

So, it is obviously, that results of spectral exponent measuring by two frequencies may be extremely doubtful. Therefore, it is necessary to develop measurement setups based on a formula (2).

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1. M.I. Gorlov, D.Yu. Smirnov, N.N. Koz'yakov, *Semiconductors* **43**, 1737 (2009).