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Your mileage may vary

I've been enjoying relief from our high gasoline prices thanks to the HEV (hybrid-electric vehicle) I've been driving. Among the car's features is a display that provides the instantaneous mileage, the integral of that measure over each of the six most-recent five-minute intervals, and the integral since the last reset, which I initiate after refueling.

With so much information at hand, drivers can learn how their driving style influences fuel economy. I've used the display as a biofeedback system to learn how to squeeze the most mileage out of the fuel I've used, and, in all modesty, I think I've become pretty good at it. On a tank of gasoline, I can easily average in excess of 45 mpg—more than 50 mpg with care. Overall, I'm elated ... with one sticking point.

My vehicle's EPA (Environmental Protection Agency)-estimated mileage is 51 mpg on the highway (**Reference 1**). The HEV's city-mileage rating is 60 mpg, however, and that number, though attainable for short runs, is simply hokum as a representation of sustainable performance.

The problem isn't with me, my vehicle, HEVs, or vehicles made by a given manufacturer; the problem is the dissimilarity between the conditions under which the manufacturers and the EPA's National Vehicle and Fuel Emissions Laboratory collect data and those under which you and I drive. Prompted by research from Consumers Union, the publishers of *Consumer Reports*, the EPA announced last January that it will revamp its fuel-economy-ratings data-collection method for the first time in 20 years, effective with 2008 models (**references 2 and 3**). Expect falling estimates.

Perhaps the best deadpan line on the subject appeared in *The New York Times*, which quoted Toyota spokesperson Martha Voss: "The ratings might change, but the performance of our customers' cars won't change" (**Reference 4**). For anyone who has spent considerable time pouring over specifications and designing to parametric goals, this statement seems almost perfect in how upside down it is.

Yet it reminds me of an ongoing challenge that OEM designers face when working with a vendor's data sheets, particularly those for analog and mixed-signal ICs, the behaviors of which tend to be highly parametric. Given the cost of production testing—a large fraction of an IC's *full-factory cost*—vendors must test a reasonable number of parameters over an affordable set of conditions. From the OEM designer's perspective, IC specifications *and* the conditions under which they apply must be *relevant*, *realistic*, and *reproducible*.

Relevant: Test conditions must include the range under which the IC will operate in your product. It sounds obvious, but IC makers cannot predict the specific environment your product presents to theirs. So you must confirm that their test conditions are relevant to the environment your product will provide or, as they say, "your mileage may vary"—and

not in ways that are dependable or easy to predict.

Realistic: IC makers are usually clear on how OEMs are likely to use their products and accordingly develop test suites. Read carefully, however, for specifications written with test conditions that vary for particular parameters. Determine whether these are realistic within the context of your design. Your product's performance simultaneously depends on all critical specs.

Reproducible: Though you shouldn't need to second-guess an IC maker's data sheet, you should be able to confirm critical specifications on the bench. As ICs provide greater functional density and increasing bandwidths, you must be able to confirm that your layout does not present strays or coupling paths that compromise the performance that your IC selection promises. Vendors' layout recommendations and evaluation boards can reduce your design's risk of failure and provide a solid reference for comparison for little cost or effort.**EDN**

REFERENCES

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- 4 Maynard, Micheline, "EPA planning closer estimate of car mileage," *The New York Times*, Jan 11, 2006, www.nytimes.com.

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