Question: “How do you execute GDDR-5 device training during a shmoo run?”

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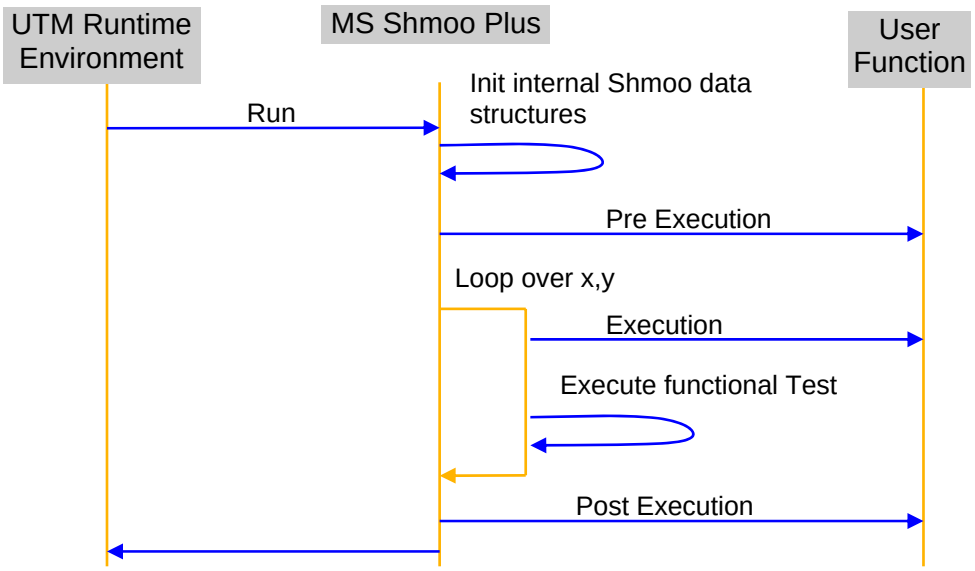
Due to high speeds, GDDR-5 devices require adjusting timings through device training steps. These timing adjustment values are dependant on device settings like VDD, frequency etc. When shmooing along such a parameter the device training needs to be executed repetitively during the shmoo run. The shmoo supplied with smartest do not allow this, so how can this be done?

Answer from Dong-Myong Kim, Verigy Germany

Shmoo’s are an important tool for customers to characterize new devices. A tAC vs. Frequency or VDD vs Frequency shmoo are standard shmoos to judge the device performance. Due to ever increasing speeds more and more devices, like the GDDR-5 and DDR-4, contain device training steps to adjust the timings at runtime. When running a shmoo the necessity to execute the device training during the shmoo run arises.

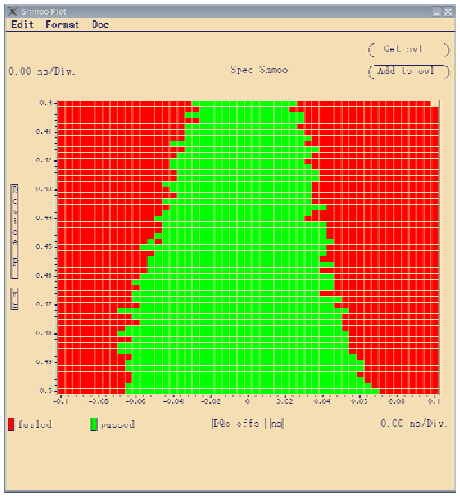
For the HSM community an enhanced shmoo tool “MS Shmoo Plus” has been developed, that allows the integration of the device training into the shmoo execution.

The “MS Shmoo Plus” defines three hook functions that are called before, during the shmoo loop and after the shmoo execution. These functions are contained in a standalone shared library, allowing to switch or modify the additional functionality without the need to touch the “MS Shmoo Tool” code.

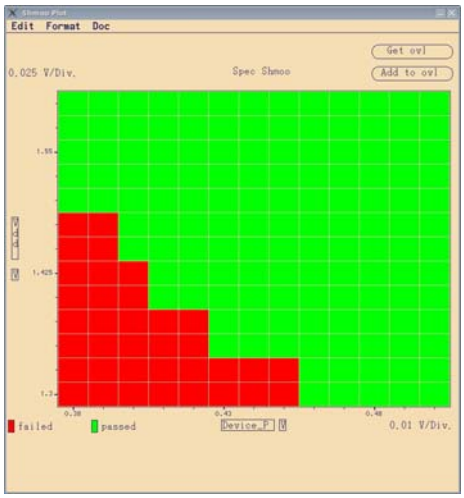


For GDDR-5 devices these functions are used as follows. During the PreExecuting the current values of the shmoo parameter settings is stored. These values are restored after the shmoo execution. During the Execution function call it is checked whether a device training is required and if so, it is executed.

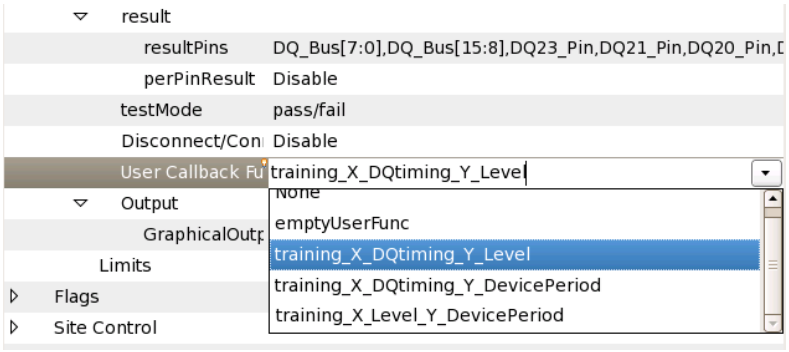
For a tAC vs Frequency shmoo it is necessary to run the device training, every time the frequency is changed. Thus the training is executed after each complete shmoo line.



For a VDD vs. Frequency shmoo the training must be executed when either the supply voltage or the frequency is changed, thus after each shmoo point setting.



As the examples show the functionality to be executed depends on the shmoo parameters. Therefore multiple Execute functions should be accessible. The MS Shmoo Plus allows to define a “infinite” number of functions and select them directly from the test method’s user interface.



The “MS Shmoo Plus” is currently used at customer site to support the GDDR-5 characterization. Due to its flexible architecture the tool natively supports all devices, that require the execution of device specific functionality during the shmoo execution run.