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Discontinuing Use of the Machine Model for Device ESD Qualification

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Foreword

The machine model test, as a requirement for component ESD qualification, is being rapidly discontinued across the industry. This publication is intended to document why MM evaluation is not necessary for qualification. The following major conclusions can be made about MM in general:

- MM is redundant to HBM at the device level since it produces the same failure mechanisms, and the two models generally track each other in robustness and in failure modes produced.
- The MM test has more variability and, consequently, less repeatability than HBM due to the MM's greater sensitivity to parasitic effects in the tester circuitry.
- There are no significant engineering studies (with verified data) which could be used to establish a required passing level for MM.
- The test method was incorrectly given the name "machine model", though no firm, unique connection between the model and actual machine-induced device failures was ever established. In fact the model was developed as a "low-voltage HBM".
- CDM does a better job of screening for fast metal-to-metal contact events than MM.
- The vast majority (> 99%) of electrical failures in manufacturing correlate to CDM or to EOS and not to MM.
- MM testing has not shown any additional failures not explained by CDM, HBM or EOS.
- MM testing consumes resources and creates time-to-market delays while providing no additional failure modes or protection strategies which have not been covered by HBM and CDM.
- *It is important to understand the scope of this memorandum.* It summarizes what has been learned about the test method *only*. The information summarized here in no way diminishes the importance of proper grounding of any metal which may come in contact with ESD-sensitive devices or the importance of avoiding hard metal-to-metal discharges.