

## Experimentally Validated Analytical Model for Thermal Analysis of Multi-Stage Depressed Collector

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**Abstract :** Multi-stage depressed collectors (MDC) are used as an efficiency enhancement technique in traveling wave tubes the high-energy electron beam, after its interaction with the RF signal, gets velocity sorted and collected at various depressed electrodes of the MDC. The ultimate goal is to identify an optimum thermal management scheme (cooling mechanism) that could extract the heat efficiently from the electrodes. Careful thermal analysis, incorporating the cooling mechanism is required to ensure that the maximum temperature does not exceed the safe limits. A simple analytical model for quick prediction of the thermal has been developed. The model has been developed for the worst-case un-modulated DC condition, where all the thermal power is dissipated in the last electrode (typically, fourth electrode in the case of the four-stage depressed collector). It considers the thermal contact resistances at various braze joints accounting for the practical non-uniformities. Analytical results obtained from the model have been validated with simulated and experimental results.

**Keywords :** multi-stage depressed collector, TWTs, thermal contact resistance, thermal management

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