AND8299/D

EMC Tests and PCB Guidelines for Automotive Linear Regulators

Introduction

Electromagnetic

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The basic requirement when an amplitude modulation is applied is the peak power shall have the same value as the peak power when a continuous wave is applied, regardless the modulation index m.

$$P_{AM-Peak} = P_{CW-Peak}$$

and

$$P_{AM} = P_{CW}\frac{2 + m^2}{2(1 + m)^2}$$

For example, 80% Amplitude Modulation, 1 kHz (m = 0.8) result is

$$P_{AM} = 0.407 \cdot P_{CW}$$

The forward power is the amount of power that is sent

Method: DPI according to IEC 62132-4

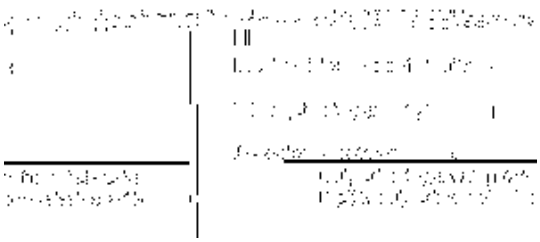
Frequency range: 1MHz to 1GHz

Frequency increment: 5%

Increment duration: 1 s

Frequency modulation: None (continuous wave)

RF Calibration method: Substitution



Particular Linear Regulator Guidelines

Power supplies should be located as close to the power entry point to the PCB, and

Good EMC Test Board

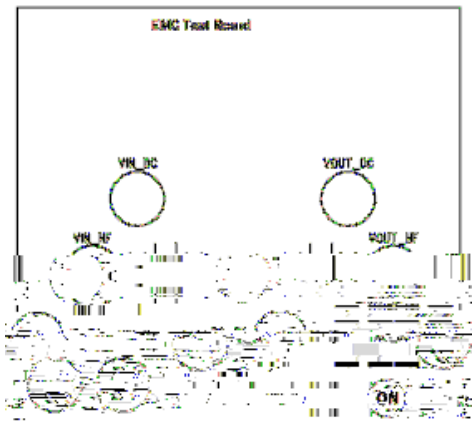


Figure 12. Assembly Top Good Layout

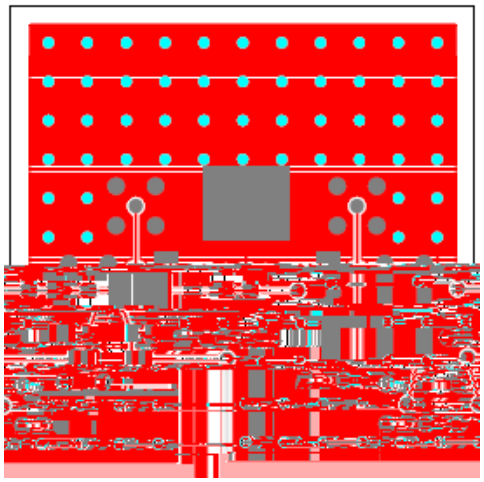


Figure 13. Top Layer EMC Layout

20 mils trace widths are used with short connections. Input and output capacitors are located as close as possible to the DUT pin. It is a four layer board with ground plane.

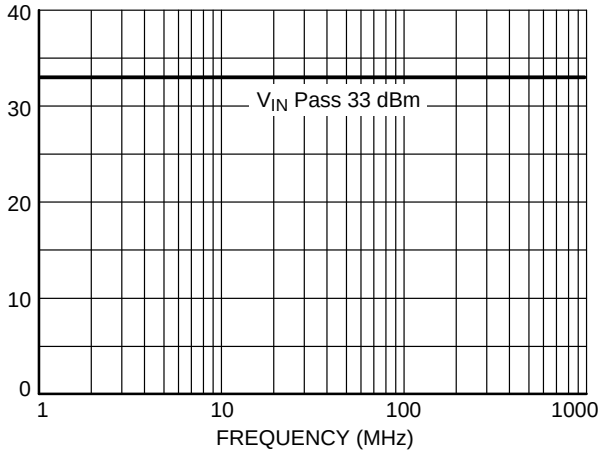


Figure 14. DPI on V_{IN} Pin

The Device passes 33 dBm injection on V_{IN} pin with Reset and V_{OUT} pins monitored.

PCB Without Consideration of EMC Rules

The second PCB is a demo board. The same components are used with a different layout.

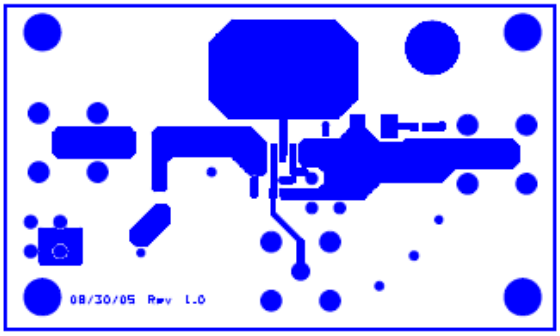


Figure 15. Top Layer Typ Layout

The demo board is a two layer board with ground plane. The trace widths are bigger than 20 mils which increases parasitic inductance. The distance from capacitor to the DUT pins is more than 1 cm. The layout does not follow the power supply guide lines.

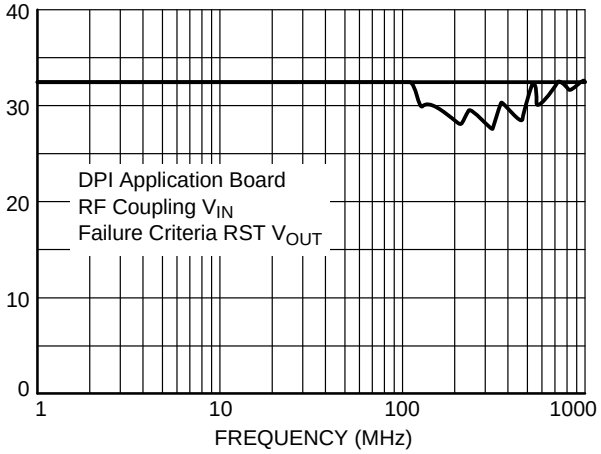


Figure 16. DPI on V_{IN} Pin

In the same test condition, the device is not compliant with 33 dBm power limit in the whole frequency range. Issues appear between 100 MHz and 1 GHz. The lower limit is around 25 dBm @ 205 MHz The RF signal perturbed the output signal and created a reset.

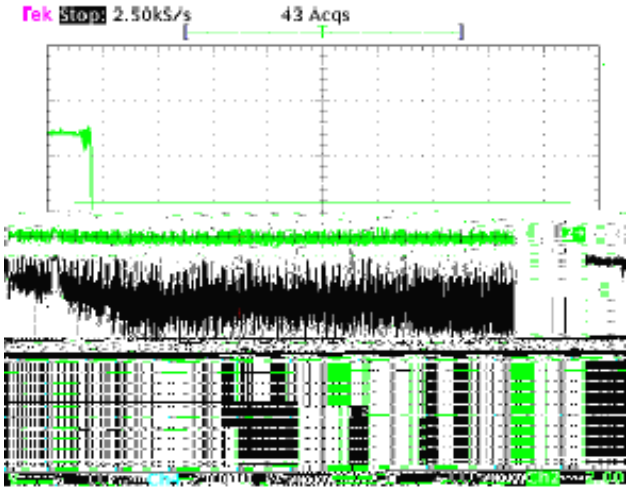


Figure 17. V_{OUT} and Reset Errors

33 dBm is 2 W injection; 25 dBm is 0.3 W injection which is a large performance difference for the same bill of materials.

Conclusion