

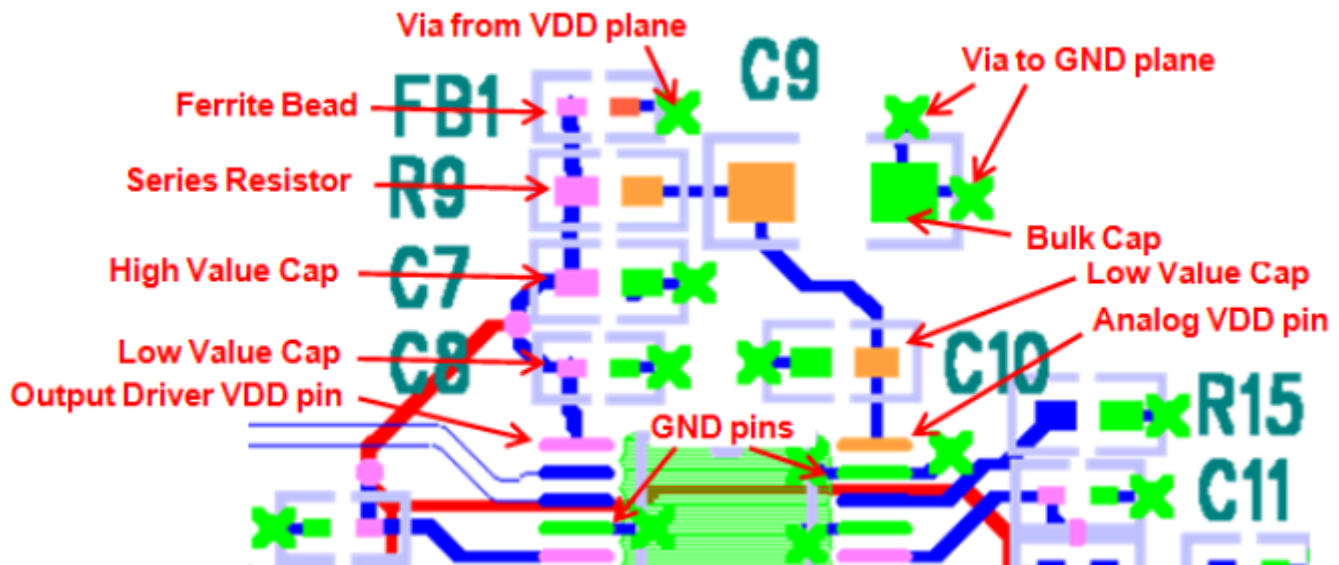
## Introduction

- Layout goal: keep EMI as low as possible.
- Automotive applications require EMI to be 10–40dB lower than non-automotive applications due to more stringent reliability requirements.
- Automotive requirements are legislated by international laws and standards.
- Two main sources of EMI:
  - Clock & Data paths → Design PCB traces as transmission lines to contain the clock and data signals inside the traces.
  - Power Supply → Use power supply filtering to prevent noise from spreading through power planes.
- See [AN-953](#) for a quick guide about output terminations.
- See [AN-954](#) for a more detailed explanation of the following guidelines.

## Guidelines

- Properly match PCB trace impedance and termination to avoid reflections.
- Maintain a certain characteristic impedance (50Ω) throughout the clock/data trace:
  - Do not obstruct the return current in the ground plane for the clock/data trace → Do not interrupt the ground plane(s) underneath or above a clock/data trace.
  - Avoid square (90°) corners in clock/data traces. Round the corners.
  - Avoid vias in clock/data traces.
- Bypass each power pin with a capacitor (0.01μF–0.1μF) to avoid ripple from clock and data signals on the power pin of the clock generator IC.
- Route power from a power plane to the bypass capacitor first, then to the power pin.

Figure 1. Layout Example Showing Recommended Routing of Power Traces



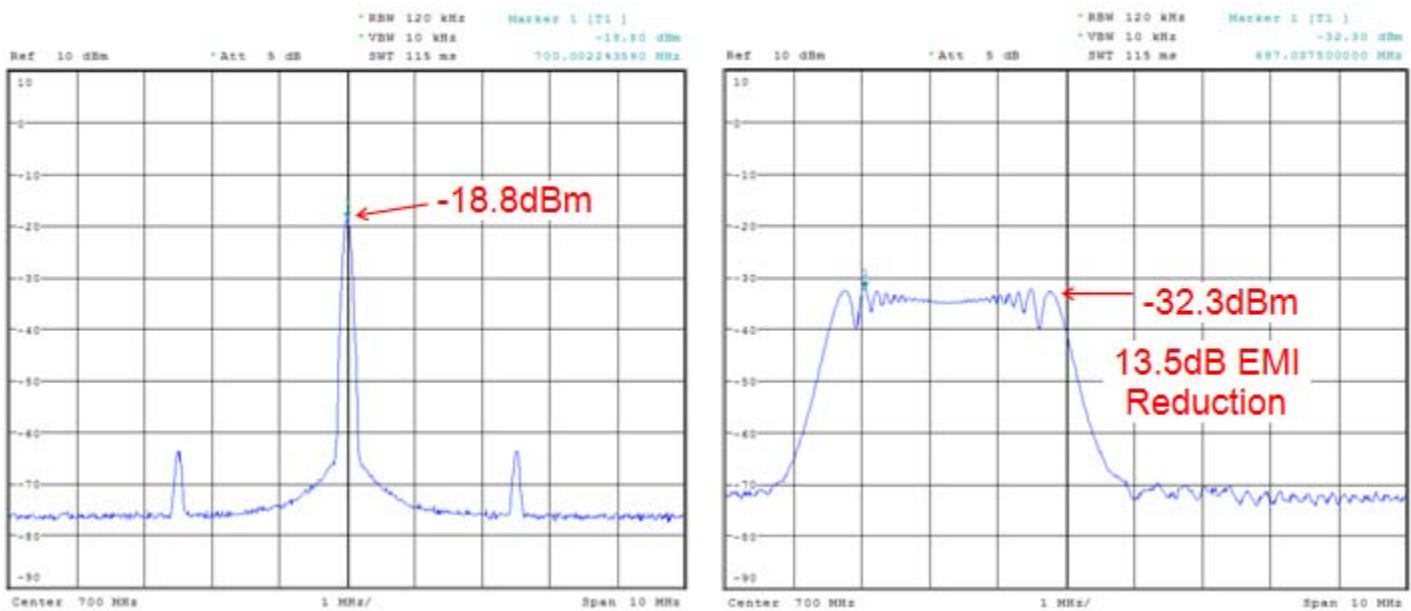
- The preferred ferrite bead for power supply filtering is a “signal bead” with a DC resistance in the range 0.3Ω to 0.5Ω. The DC resistance avoids ringing in the power supply filter.
- Note the DC current handling capability of the ferrite bead. The problem is not power dissipation, but rather, saturation of the ferrite material which compromises the filtering ability.

## IDT Timing Device Features for Lowering EMI

- Spread spectrum modulation is an active method of EMI reduction with system wide impact. Radiated emissions from every clock and data signal that is derived from a spread spectrum clock is reduced. Conducted emissions will be reduced when a spread spectrum clock is used in a switch mode power supply regulator.
- Programmable clock edge slew rate reduces radiated emissions from that clock.
- Staggering edge rate at the start of each edge softens reflections and therefor reduces radiated emissions.
- $V_{DD}$  and GND ( $V_{SS}$ ) pins right next to each other to optimize bypassing and reduce both radiated and conducted emissions

### Spread Spectrum Example

This example illustrates the EMI reducing ability of spread spectrum. The plots below show the 7th harmonic of a 100MHz clock without spread spectrum modulation on the left and with spread spectrum modulation on the right.



Spread spectrum modulation reduces the emissions at 700MHz with 13.5dB

## Revision History

Table 1. Revision History

Revision Date	Description of Change
March 8, 2017	<ul style="list-style-type: none"><li>▪ Added link to AN-953.</li><li>▪ Updated “IDT Timing Device Features for Lowering EMI” section and added “Spread Spectrum Example” section.</li></ul>
February 28, 2017	<ul style="list-style-type: none"><li>▪ Initial release.</li></ul>

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