Design Note:

HFDN-29.0

Rev.1; 04/08

Using the MAX3645 as a Pin-for-Pin Replacement of the Mindspeed™ MC2045-2/2Y

maxim integrated™

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1 Introduction

The MAX3645 is a pin-for-pin replacement of the Mindspeed™ MC2045-2 and MC2045-2Y post-amplifiers. Critical performance advantages of the MAX3645 include stable LOS (loss-of-signal) assert/deassert levels over the supply range, stable LOS hysteresis over the programmable levels, and better sensitivity.

The MAX3645 does not require board layout modifications, but external component values need to be adjusted in order to match previous LOS assert/deassert levels and LOS assert/deassert times. This design note provides typical data that can be used to determine new external component values.

2 Replacement Design

Recommended external component values are given in the MAX3645 datasheet but adjustments are required to match previous design settings.

2.1 LOS Assert/Deassert Levels

An external threshold resistor (R_{TH}) connected from the TH pin to ground programs the LOS assert/deassert levels. The MAX3645 recommended range for R_{TH} is 0Ω to 2kΩ, which provides a guaranteed LOS deassert range of 2mVpp to 20mVpp (differential). A big advantage of the MAX3645 is the ability to maintain the same assert/deassert levels over the supply range. The assert/deassert levels of the MC2045-2 and MC2045-2Y are also programmed with an external threshold resistor but the levels change significantly with supply voltage.

Typical LOS deassert levels of the MAX3645, MC2045-2, and MC2045-2Y with the supply set to 3.3V and 5V are given in Figures 1 and 2.

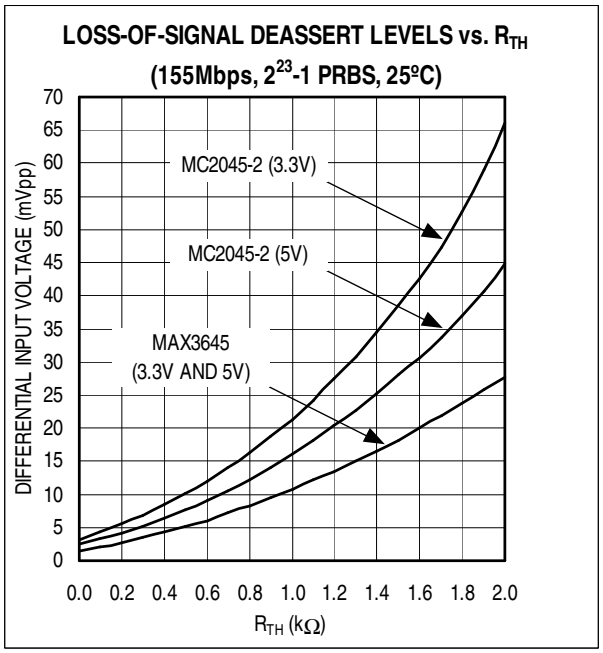

Figure 1. MAX3645 vs. MC2045-2 LOS Deassert Levels

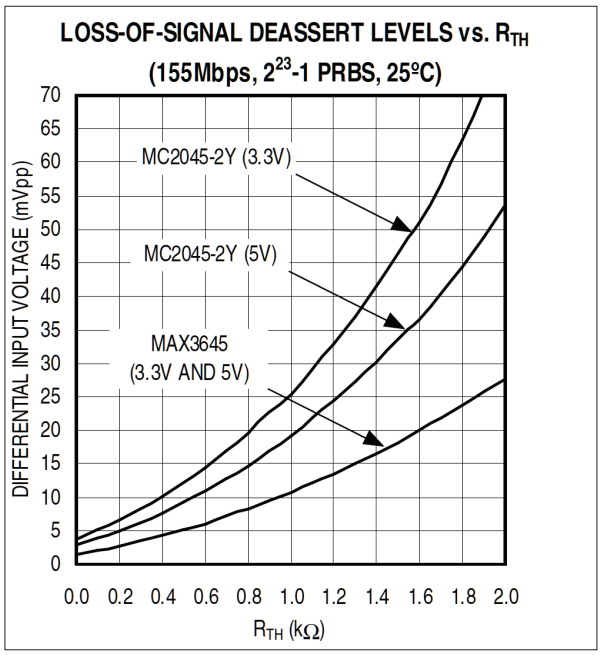

Figure 2. MAX3645 vs. MC2045-2Y LOS Deassert Levels

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The new R_{TH} value that provides approximately the same deassert level with the MAX3645 as with the MC2045-2/2Y can be determined in two steps using Figures 1 and 2:

1. Use the R_{TH} value of the previous design to find the corresponding deassert level on the appropriate Mindspeed curve. The appropriate curve depends on whether the previous design used the MC2045-2 or the MC2045-2Y, and whether the design assumed a 3.3V or 5V supply.
2. Find the same deassert level on the MAX3645 curve. Then scale down to the x-axis to find the new R_{TH} value.

2.2 LOS Hysteresis

The MAX3645 LOS hysteresis is much more stable than the MC2045-2/2Y over the programmable threshold range. The LOS hysteresis was calculated as $10\log(V_{DEASSERT}/V_{ASSERT})$. Typical data points are given in Figure 3 over the R_{TH} range of 0Ω to 2kΩ.

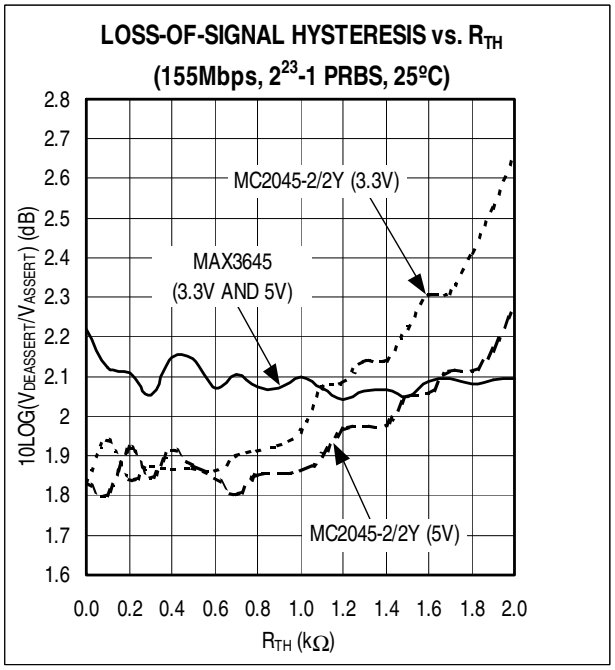


Figure 3. LOS Hysteresis vs. R_{TH}

No significant change in hysteresis is apparent between the MC2045-2 and MC2045-2Y, but the hysteresis changes significantly with supply voltage and over the R_{TH} range. The MAX3645 hysteresis remains stable over supply voltage with less than 0.15dB variation over the entire R_{TH} range.

2.3 Input Sensitivity

The MAX3645 has better sensitivity than the MC2045-2/2Y. The minimum differential input specification of the MAX3645 is 1.0mVpp whereas the MC2045-2/2Y is 1.6mVpp. Typically the MAX3645 has a BER<10^{-12} with input amplitudes down to 0.5mVpp (differential).

The LOS assert/deassert levels of the MAX3645 can be programmed lower than the MC2045-2/2Y. For example, at the lowest possible threshold setting (R_{TH} = 0Ω) the assert/deassert levels of the MAX3645 are approximately a factor of 2 lower than the assert/deassert levels of the MC2045-2/2Y.

2.4 LOS Assert/Deassert Times

The external capacitor C_{SD} determines the internal power detector time constant, which determines the LOS assert/deassert time. Table 1 provides typical assert/deassert times for the MAX3645 with three different capacitor values. A C_{SD} of 1nF is recommended for the MAX3645.

Table 1. Typical MAX3645 Assert/Deassert Time

C_{SD}	Assert Time	Deassert Time
0.1nF	3µs	3µs
1nF	21µs	21µs
10nF	222µs	222µs

The MC2045-2/2Y datasheets recommend using a 10nF capacitor for C_{SD}. A 10nF capacitor typically provides assert/deassert times of 5-6µs with the MC2045-2/2Y, but assert/deassert times of 222µs with the MAX3645. Therefore, to match the assert/deassert times of the MC2045-2/2Y, the MAX3645 requires a C_{SD} value that is approximately 40 times smaller than the value used with the MC2045-2/2Y.

2.5 Other External Components

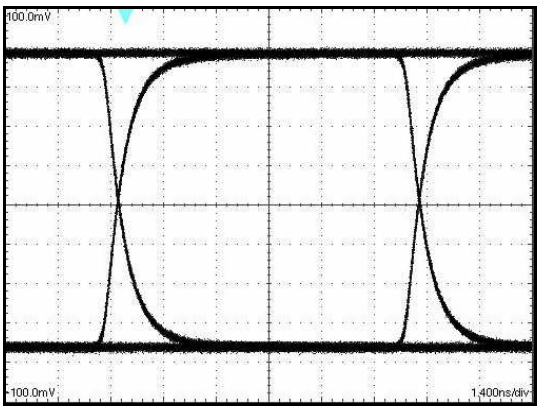
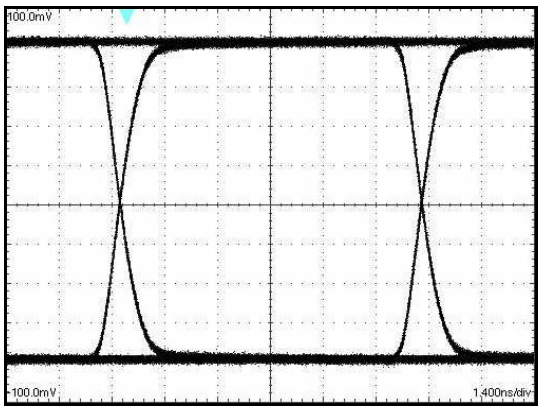
The external capacitor C_{AZ} determines the time constant of the DC offset correction loop. A C_{AZ} value of 0.1µF is recommended for the MAX3645.

Typically 0.1µF capacitors are used to AC-couple the data inputs of the MAX3645.

2.6 Eye Diagrams

The eye diagrams given in Table 2 were taken under typical conditions for an overall performance comparison. [V_{CC} = 3.3V, 2^{23}-1 PRBS, V_{IN} = 15mVpp (differential), R_{TH} = 500Ω (MC2045-2) and 950Ω (MAX3645)].

Table 2. Eye Diagram Comparison

	Mindspeed MC2045-2	Maxim MAX3645
125Mbps		
200Mbps