



SPECIAL CONSIDERATIONS WHEN INTERFACING THE MAX3735A TO THE DS1859

The MAX3735A and the DS1859 are commonly used in 155Mbps to 2.7Gbps SFP module applications. These devices work well together by providing the high speed operation, safety circuitry and monitoring that is often used in such modules. However, in some applications, special care should be taken regarding the interface of the two devices.

As part of the safety circuitry, the MAX3735A provides two external monitors, one for the transmit power and the other for laser bias current. If the bias current or transmit power exceeds the externally set levels a safety fault will be asserted. In addition there is a high-speed over current protection circuit provided for the modulation output of the MAX3735.

If excessive current is drawn out of the modulation set pin (MODSET) of the MAX3735A (which would result in a large modulation current at the output) a safety fault will assert and the laser output will shutdown until the TX_DISABLE pin is toggled or until VCC is cycled (assuming the fault condition has been removed). The excessive current draw can be caused by a low voltage short on the modulation pin or if the resistance seen from the modset pin to ground is too small.

Through simulation it is determined that a fault condition will never occur as long as the resistance from the MODSET pin to ground is always greater than $3k\Omega$ and a fault will always occur if the resistance is less than $2.3k\Omega$.

The typical minimum resistance (resistance corresponding to a 00h setting) of the DS1859 $50k\Omega$ resistor is $0.65k\Omega$ to $1.35k\Omega$ and the minimum resistance of the $20k\Omega$ resistor is $0.2k\Omega$ to $0.55k\Omega$. Therefore digital settings inside these resistors should never be set at levels that would result in a resistance (as seen from the modset pin to ground) less than $3k\Omega$.

Given that the over current protection circuitry inside the MAX3735A is high-speed, the transient resistance of the DS1859 must also be considered. The DS1859 uses a series of switches and resistor to transition from one resistor setting to another. When the settings are changed, the switches transition to the next setting in a make before break fashion. For the specific transition of 10h (16d) to any value less than 10h the instantaneous resistance will momentarily (approximately 4 to 16ns) go to a 00h setting.

A fault condition may occur in special cases where the user is trying to obtain the

maximum modulation current of 85mA which corresponds to a modset resistance of $3.4k\Omega$ to $3.65k\Omega$ over process, temperature, and voltage and the DS1859 is connected directly (no series or parallel resistance) to the MAX3735A MODSET pin. For example a setting of 10h in the DS1859 $50k\Omega$ option will result in a modset pin resistance of approximately 4.2k. This setting would correspond to approximately 82mA of modulation current. If the resistor were to transition from 10h to 0Fh the instantaneous resistance would be approximately $1k\Omega$ for a few nanoseconds and a fault condition would assert.

Given the very short transition time (typical 8nS) of this low resistance setting and the low bandwidth of changing the actual modulation current (about 2MHz), the low resistance transitions do not translate to excessive laser current but the internal high-speed safety circuitry may still detect the transition and assert a fault.

If approximately 80mA of modulation current is more than sufficient for the application, always using settings greater than 10h will ensure that the instantaneous resistance is always greater than or equal to 10h and no faults will occur. In addition, if only currents less than approximately 80mA are needed the user can insert

series resistance between the DS1859 and the MAX3735A (Figure 1, approximately $2.5\text{k}\Omega$ for the $50\text{k}\Omega$ resistor option and about $2.9\text{k}\Omega$ for the $20\text{k}\Omega$ resistor option). The series resistor should be placed as close as possible to the MAX3735A MODSET pin. This will ensure that even a steady state or instantaneous 00h transition will not trigger a fault condition.

In cases where the full 85mA of modulation current are required for the applications, a series resistor (placed as close as possible to the MAX3735A MODSET pin) and a $0.01\mu\text{F}$ capacitor in parallel with the DS1859 (Figure 2) are recommended. Please note that the capacitance must be placed after the series resistor as capacitance directly on the MODSET pin may cause instability.

This circuitry ensures that the instantaneous low resistance transitions do not cause safety fault conditions and allows the user to reach the 85mA of modulation current over process, temperature, and voltage. The user will however need to ensure that the steady state resistance of the series resistor plus the DS1859 resistance are always greater than $3.0\text{k}\Omega$.

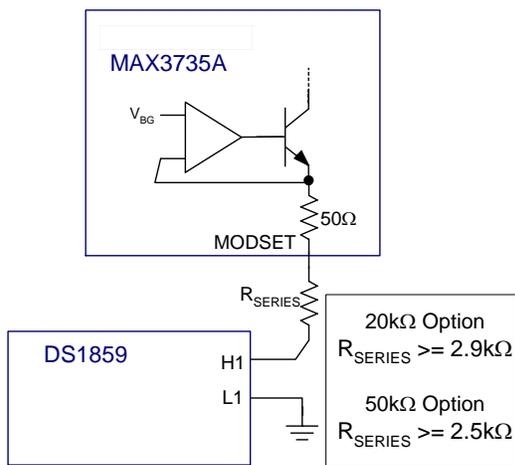


Figure 1. Series Resistor
($<80\text{mA}$ Modulation Current)

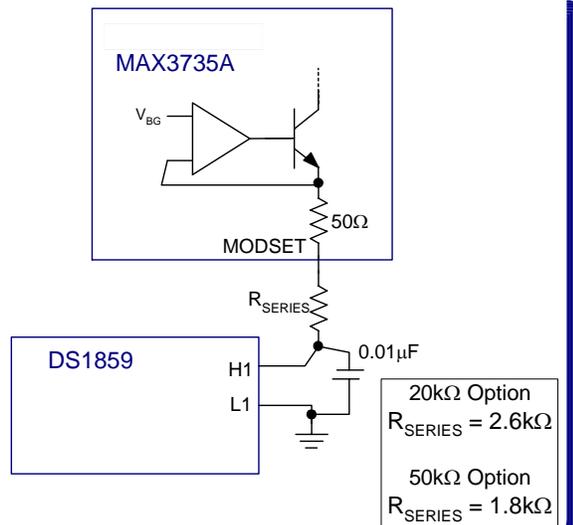


Figure 2. Series Resistor
(up to 85mA Modulation Current)