

Scenario 1:

Using the TPS259824OEVm evaluation board (circuit breaker version of the eFuse).

Eval board settings are:

I_{timer} = 2ms

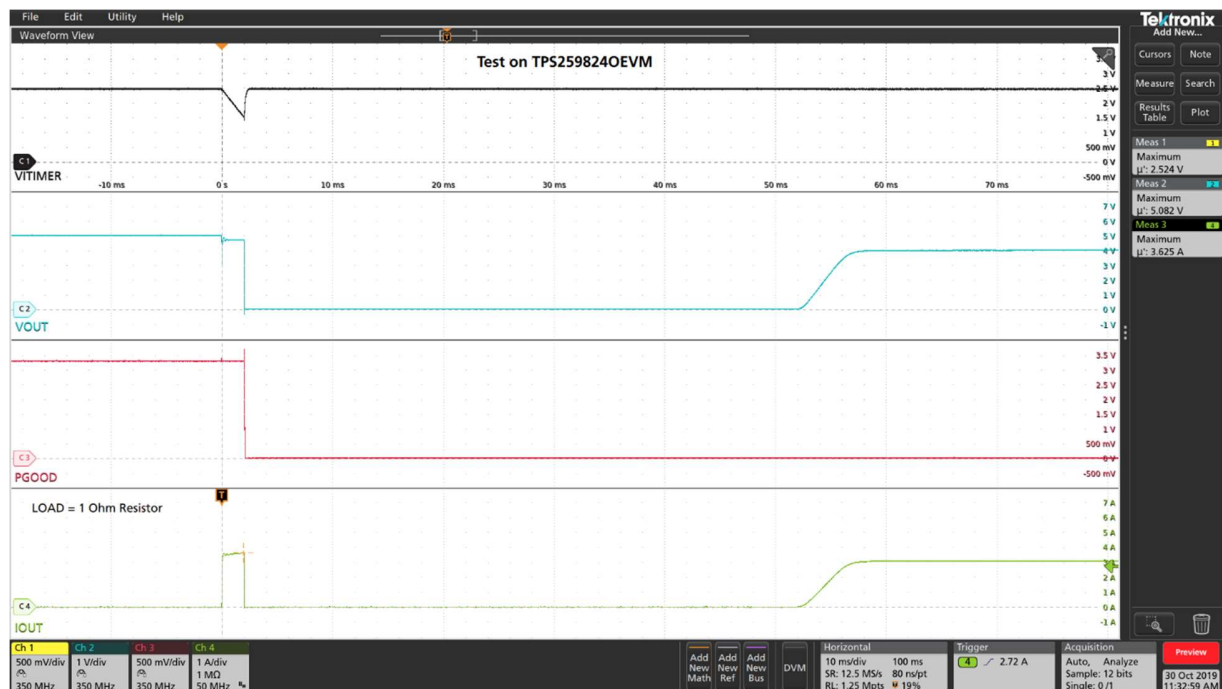
I_{limit} = 3A

Retry Delay = 40ms

NRetry = Infinite

Input Voltage = 5V DC

After powering up the eval board, a 1 ohm resistor is connected and the output current exceeds the 3A limit (by a small amount). The output is fully turned off (expected). After the retry begins, the device seems to operate in current limit mode (not expected). We suspect that it is operating in current limit mode because the output voltage is less than 5V, the power good indication remains off and the output current is maintained at 3A indefinitely. No further trips occur. See below graph.



Question/Problem 1:

The datasheet in section 8.3.3.4 says the following: "After a **fast trip** event, the device restarts in a current limited mode to try and restore power to the load quickly in case the fast trip was triggered by a transient event. However, if the fault is persistent, the device will stay in current limit causing the junction temperature to rise and eventually enter thermal shutdown."

It appears the eFuse is behaving like this even when the fault is due to a "soft overload" condition (not a fast trip event). There is no mention in the datasheet that it should behave like this.

Scenario 2:

Same evaluation board settings as scenario 1, except retry delay is set to latch (no retries after first fault).

After connecting the 1 ohm resistor, the output current exceeds the 3A limit (by a small amount) and the output is fully turned off (expected). Then we press the evaluation board "reset" button (S1) which drives the EN/UVLO pin low to reset to latched fault.

Question/Problem 2:

The expected result is that the device starts up in circuit breaker mode again after the button is released, then immediately trips again because the current will be greater than 3A. The observed behavior is that the eFuse actually starts up in current limited mode once the button is released and maintains the output at 3A.

Scenario 3:

Same evaluation board settings as scenario 2.

The 1 ohm resistor is connected to the output while powered off. The eval board is then powered on. Immediately, the eFuse seems to operate in current limit mode and the output is maintained at 3A with the power good indication off.

Question/Problem 3:

The expected result is that the device starts up in circuit breaker mode initially, but it seems to start up in current limited mode.

Overall Summary of Problems:

It appears that the "circuit breaker" version of the eFuse will only ever operate in circuit breaker mode immediately after operating normally with a fully enabled output and power good indication true. If the device is powered on for the first time, reset by UVLO/EN pin or is automatically recovering from a fault using the retry mechanism, the eFuse appears to operate how the current limited version of the eFuse should operate, not how the circuit breaker version should.

According to the datasheet, this is only explainable if the fault is $>2.1 \times$ the current limit (referred to as a "severe overcurrent" event by the datasheet). Our experiments show this happening without a severe overcurrent fault (in fact, even just slightly above the current threshold).