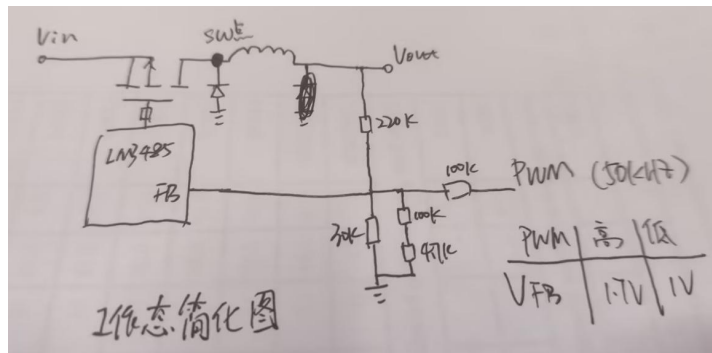
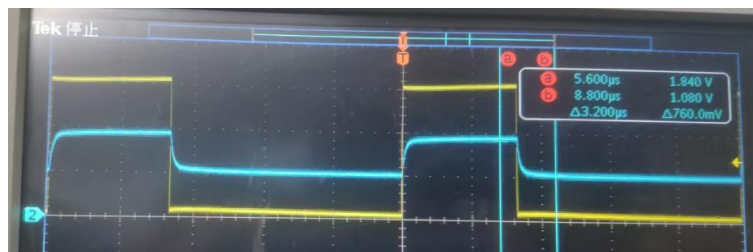


About LM3485MM Charging Current Low Bad Analysis

1、A bad phenomenon: DC power supply 23.5V / current limit 2.1A to X1000 pro product charging, the normal product input current can be charged to 2.1A, abnormal product charging current can only be 1.6A or so, can not be 2.1A, will be OK and NG to adjust the bad phenomenon to follow the IC away. Material No. 21011-01105-10(LM3485MM,TI)

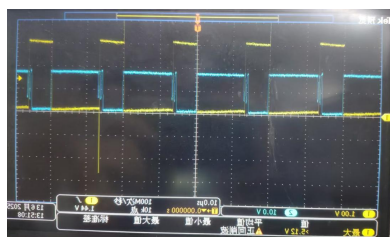
2、Second, bad further analysis:

- (1) simplify the circuit diagram and the principle of operation as shown on the right
- (2) the load battery from 13.5V replaced by 11V, the charging current can reach 1.9A
- (3) through the oscilloscope to capture the NG product PWM waveform (yellow) and IC-FB waveform (blue) without delay, the following figure:

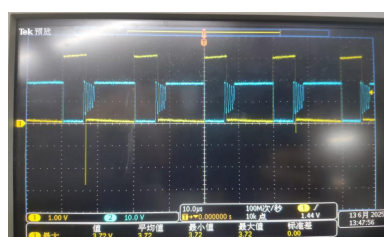


Working principle: as above charging simplified schematic, PWM is high (3.3V), FB voltage is about 1.7V greater than 1.242V + 10mV, IC off mos, PWM is low (0V), FB voltage is about 1V lower than 1.242V, IC on MOS. PWM frequency 50kHz. PWM duty cycle through the MCU detects input solar panel voltage and Battery voltage adjustment

3、capture the PWM (yellow) and SW (blue) switch waveforms found that the normal product almost no delay, NG products have a delay, as follows



OK



NG

4、summary

(1) through the analysis of normal products can be synchronous with the PWM signal (or FB signal) to adjust the MOS on/off, NG products can not be synchronous with the PWM signal (or FB signal) to adjust the MOS off

(2) NG products IC-PGATE turn on time in the last shutdown at about 9uS, and can not be further advanced, even if the Vfb is below the threshold

(3) about the charging current is greater when the battery voltage is low, the reason is that As the IC-PGATE off fixed length of time in 9uS, open length of 11uS, low battery voltage, VIN-Vbat voltage difference is greater, the inductor current peak is greater, due to the work in intermittent mode, the performance of the battery voltage can be low when the input charging current is greater.

5、For shutdown 9uS time limit anomalies for further analysis

(1) whether the inductor overcurrent caused by the delay? Inductor current peak 9A, MOS open Rds about 10mR, R2 (Radj) 110k according to theoretical calculations to trigger the overcurrent protection needs 60A. R2 will be changed to 200K/300K has not been improved, R2 110k change 10K will trigger the overcurrent protection, charging current 1.6A to change the 0.6A. The actual current is not exceeded to exclude the anomalies caused by the overcurrent and overcurrent protection function can work.

(2) whether FB falling edge slowly caused by delay, VFB1.7V down to 1.24V about 1.24V. VFB1.7V down to 1.24V about 1.4uS, test SW waveform delay VFB 1.24V 2.8uS, remove R7/C6/C28 anomalies did not improve, exclude the impact of R7/C6/C28.

(3) whether the VFB low voltage is close to the threshold value of the FB, R8 and 200K to make the VFB low 1V is much lower than 1.242V, the anomaly of the R8 and 200K to make the VFB low 1V is much lower than 1.242V, the anomaly of the VFB low voltage is much lower than 1.242V, the anomaly of the VFB low voltage. 1.242V, the anomaly is still not improved, indicating that the VFB is not caused by abnormal

(4) remove the MCU signal control of the VFB, so that the IC itself according to the Vfb duty cycle control of the output voltage, test the output voltage in line with the theoretical value, indicating that the Vfb voltage is normal. By adjusting the input and output voltage ratio to make the MOS shutdown time become shorter, found that the NG IC minimum shutdown time to 9uS can not continue to get smaller, the normal IC shutdown time can be shorter.

(5) PGATE to ground to power impedance OK / NG products have no significant difference between the 50K / 100K positive and negative test.

(6) external PWM signal to replace the MCU PWM signal test, adjust the duty cycle to test the VFB - Vpgate waveform found that the NG VFB is the same as the VFB, the VFB is the same as the VFB. Vpgate waveform found that the NG product Vpgate shutdown time can only follow the Vfb changes until 9uS (test 4PCS are so), OK product can be 0% duty cycle. Fixed duty cycle adjustment frequency, NG products Vpgate shutdown time can only follow the Vfb changes until 9uS, normal products can be lower.

(7) shielding current detection function (Isense connected to VIN, ADJ ground) anomalies disappeared, the charging input current can be up to 2.1A, no 9uS shutdown limit.

(8) the test Iadj about 6uA is normal, Isense series into 100R Resistor phenomenon does not improve

(9) according to the specification of another resistance current detection method of connection into the 4mR Sense resistor and sampling at both ends of the detection inductor current, the minimum shutdown time can be up to 2.6uS@50KHZ, change the 8mR the same as the same no change in the

(10) test the MOS turn on the delay of OK IC is about 50nS, NG IC is about 120nS, test Ipgate OK is about 0.31A NG is about 0.155A 11, is the MOS turn on the delay of OK IC is about 50nS, NG IC is about 120nS, test Ipgate OK is about 0.31A NG is about 0.155A

(11) whether the MOS turn-on delay is greater than 100nS threshold leads to anomalies, NG IC in the MOS heating a bit of turn-on time from 120nS to 80nS, there are still 9uS turn-off time limit, replace the MOS FDD4141 model (junction capacitance is smaller, the Rds is quite) turn-on time from 120nS to 68nS still 9uS turn-off time limit, exclude the MOS turn-on speed effect. MOS turn on speed impact.

conclusion: NG products directly shielded current detection function (Isense connected to VIN, ADJ ground) can be restored to normal, the actual inductor current is not exceeded, indicating that the IC internal misjudgment of overcurrent caused by anomalies, the time with the specifications of 9uS consistent