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***TI s Buck NexFET™ Power Block  
CSD87384M Defective Issue***

***December 22, 2023***

***Revision 1.0***

## 1. Buck NexFET™ Power Block CSD87384M issue.

- 1) EMTS company has an NDA with Intel and is Intel Korea Design House.
- 2) Referring to the Apollo Lake Atom CPU Reference circuit diagram provided by Intel, EMTS developed the mainboard and has progressed to mass production.
- 3) The PMIC and Power Buck Mosfet used in the problematic Apollo Lake CPU (E3940) are as follows.
  - The products below used the same PMIC and Power Buck Mosfet in the Apollo Lake Atom CPU circuit diagram provided by Intel.

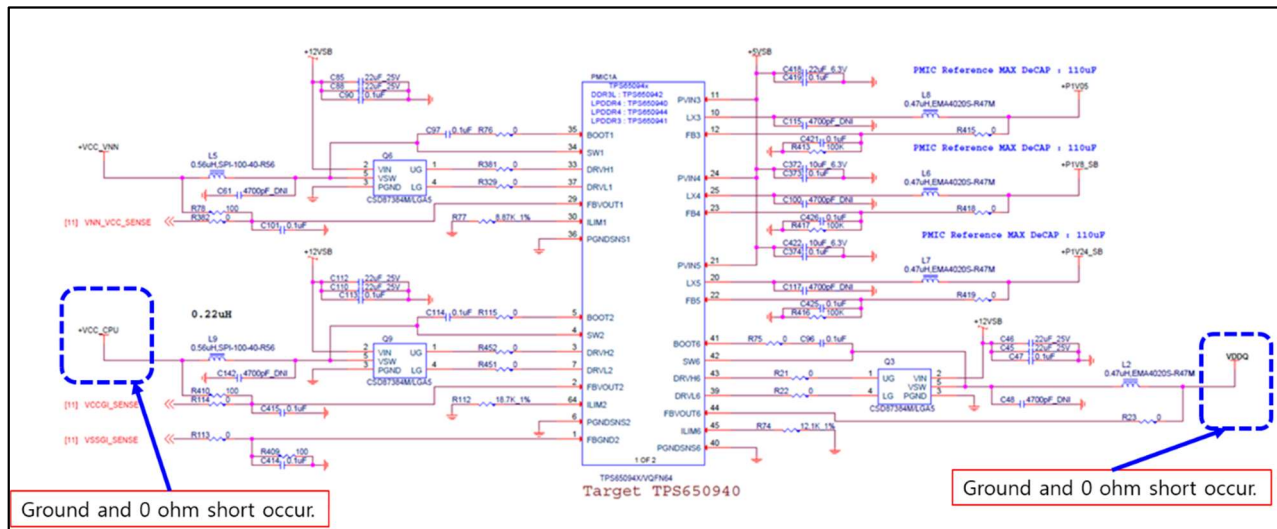
| No. | Item         | Part No.  | SPEC                                                                                                  | Vendro |
|-----|--------------|-----------|-------------------------------------------------------------------------------------------------------|--------|
| 1   | PMIC         | TPS650940 | Apollo Lake PMIC,<br>VNN : 5A / VDDQ : 7A / VCCGI : 21A<br>I2C DVS Controller<br>VDDQ : LPDDR4 (1.1V) | TI     |
| 2   | Buck NexFET™ | CSD87384M | Synchronous Buck NexFET Power Block II                                                                | TI     |

- 4) We developed a board using the above PMIC and Buck NexFET™, and mass production has continued so far, and there have been no special problems until the current defect issue.
- 5) However, during the mass production of the mainboard this year, an issue occurred where the CPU died due to a defect in the CSD87384M.

## 2. Detailed explanation of mainboard CSD87384M defect issues.

- 1) After assembling the Apollo Lake Mainboard 220 EA in EMTS, when 12V power is applied for the first time, a problem occurs in which the mainboard does not boot (Standby Power does not output). (Out of P.P 220 EA, 45 EA are defective)
- 2) When performing a short-open test (resistance measurement) on the Apollo Lake CPU's power supply, it was discovered that the LPDDR4 VDDQ power supply and the +VCC\_CPU power supply, which is the CPU core power supply, were shorted to ground and 0 ohm. (equal to 45 EA)

- VDDQ – Ground Short, +VCC\_CPU- Ground Short, VDDQ - +VCC\_CPU Short



- 3) In the above situation, for defective sample 4 EA, after removing the CPU, when performing a Short-Open Test (resistance measurement), LPDDR4 VDDQ, +VCC\_CPU power ground and all 0 ohm shorts are eliminated.
- 4) After removing the CPU as above, the power short disappears.
- 5) Proceed to re-attach the new Apollo Lake CPU (E3940) on top.
- 6) After attaching the CPU, we performed a Short-Open Test (resistance measurement) on the mainboard and confirmed that there was no power short to ground and 0 ohm.
- 7) After attaching the new Apollo Lake CPU, I turned on the power again for the mainboard that had completed the Short-Open Test (resistance measurement), but confirmed that it did not boot.
- 8) After step 7), we performed the Short-Open Test (resistance measurement) of the mainboard again, and it was confirmed that there was a 0 ohm short with the ground of the LPDDR4 VDDQ and +VCC\_CPU power.

(There was no short before applying 12V power.)

After removing the CPU again in the above state and applying 12V power without the CPU, it was confirmed that the VDDQ and +VCC\_VNN power that should be output as Standby Power from the PMIC are not output.

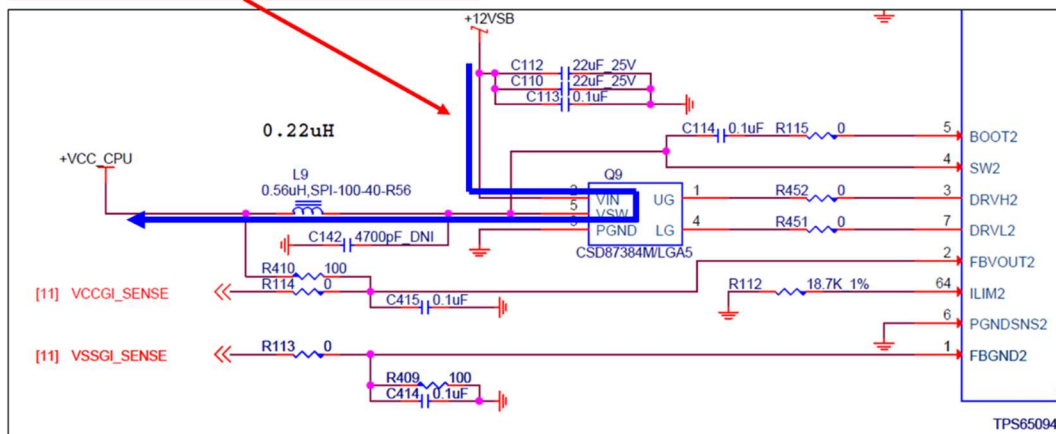
- 9) (Standby Power is power that must be output even if the CPU is not present)
- 10) In the above situation, remove the CSD87384M 3EA used in the mainboard and replace it with a new CSD87384M. With the CPU removed, 12V power is applied to confirm that Standby Power is output normally.

- 11) Replace CSD87384M with a new one, and reattach the new Apollo Lake CPU (E3940) to the mainboard that confirmed that even Standby Power is output.
- 12) Confirm that the mainboard boots normally when 12V power is applied to the board that has completed work 11).

### 3. Conclusion

- 1) This is not the first Mainboard using PMIC and CSD87384M Power configuration produced this year.  
We continued to produce samples and mass-produce products with the PMIC+CSD87384 Power configuration, and there were no such defect issues.
  - There is a history of producing 2K volumes on other boards.
- 2) It is believed that the CSD87384M Power Mosfet assembled on the mainboard produced this year had a defect in the IC itself, causing a problem where the 12V power was input directly to the VDDQ and VCC\_CPU of the Apollo Lake CPU (E3940), causing damage to the CPU. However, an accurate cause analysis is required.
- 3) In the case of PMIC, an Over-Current Protection function exists, so if the current is supplied more than the set value, it is believed that the corresponding OCP function has been activated to protect the CPU. However, considering that OCP does not work, it appears that there is a defect in CSD87384.

Due to a defective CSD87384M,  
12V is applied directly to the CPU power supply.



- 6) Currently, at EMTS, the production schedule for the mass-produced mainboard is being established quickly.  
Production is halted until the cause of the above defects is identified, and a quick analysis of the issue is required, so we request a review of the defects.
- 7) If you have any necessary data for defect analysis, please request it and we will provide it to you.
- 8) Technical data such as the PMIC + CSD87384M circuit diagram designed by EMTS are attached separately.
- 9) Currently defective parts can be sent to us for review.
- 10) Formally request a cause analysis.