# VR13 / VR13.HC / VR14 multiphase VR porting guide

**Texas Instruments**

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# Contents

- FW programming solutions
- Porting concept from system
- Porting steps

# FW programming solution

- Off line programming by 3rd party
- Off line programming by customer's factory
- On line programming by customer's factory
- On line programming with BIOS by customer's system

# FW programming solution

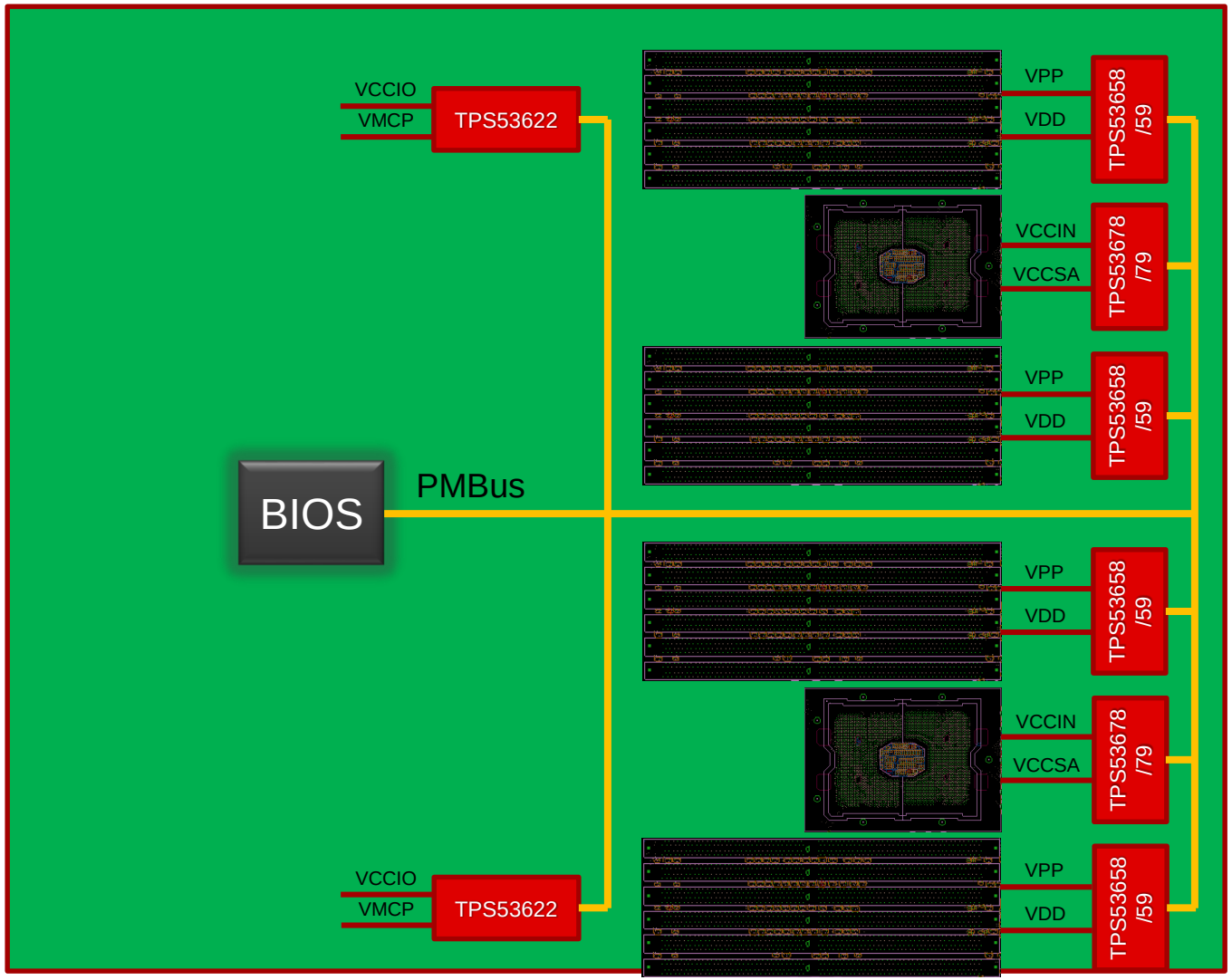
- Advantages and Disadvantages

| | Offline by 3rd party | Offline by customer factory | Online by customer factory | Online by customer system BIOS |
|---|---|---|---|---|
| Advantages | 1. Easy for assembly. | 1. Less part no. | 1. Less part no. | 1. Less part no.<br>2. Easy for assembly.<br>3. Saving programming cost. |
| Disadvantages | 1. Higher IC cost.<br>2. More part no. | 1. Higher production cost/effort. | 1. Higher production cost/effort. | 1. No. (only BIOS FW RD effort) |

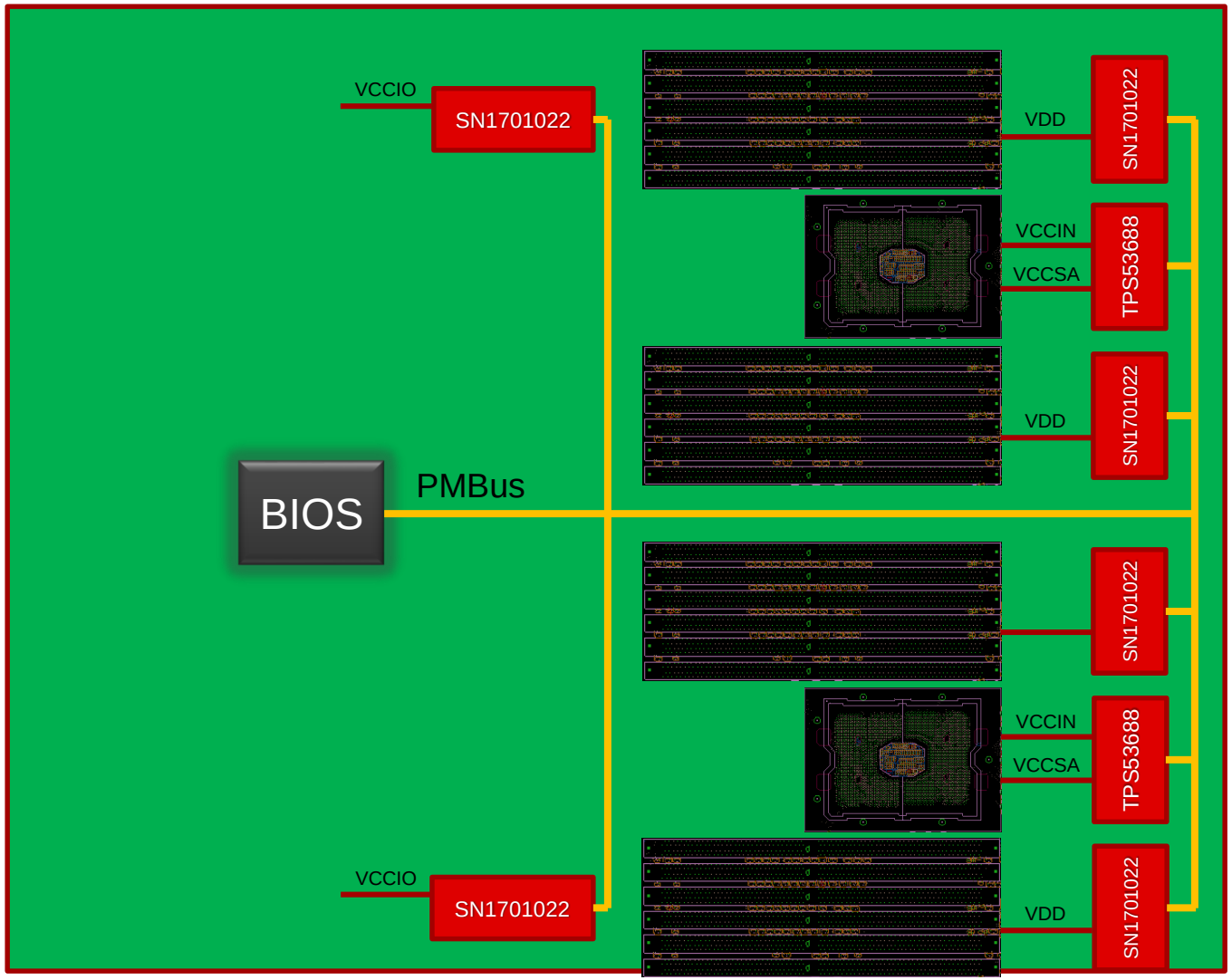
# Porting concept from system

- In general, customer often online or offline to program the parameters to NVM of VR IC.
- Customer got higher cost for production if they choose online programming. If they choose offline solution, the procurement staff need to buy more items (because IC with different parameters) that increase stock cost.
- The porting concept is saving parameters in BIOS and load to the RAM of VR IC through PMBus when motherboard startup every time.
- The benefits are
  - Saving production cost.
  - Minimized items to different project.
  - RD still keep the optimized parameters to every project.

# VR13 Porting concept from system

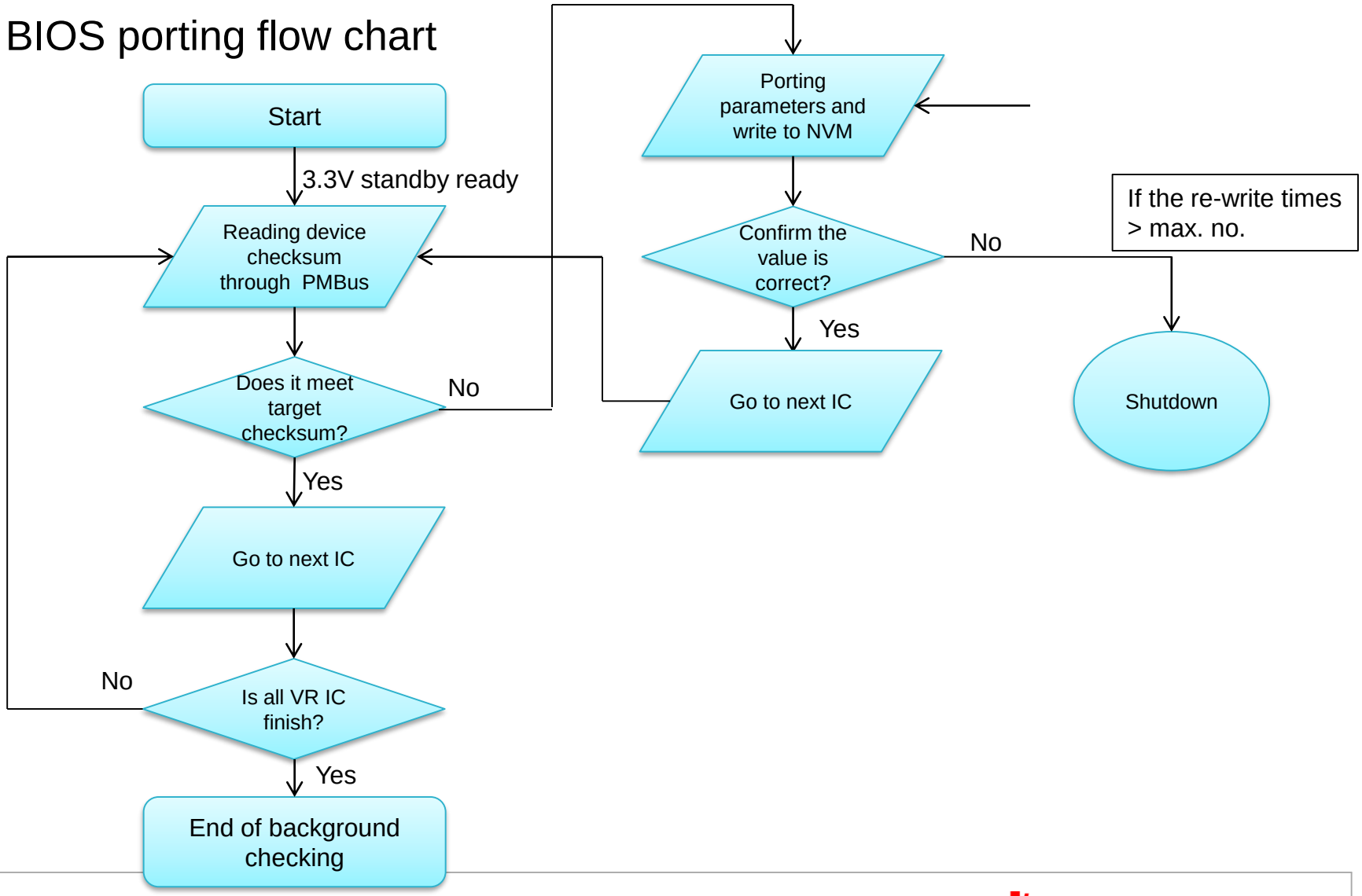


# VR13.HC Porting concept from system



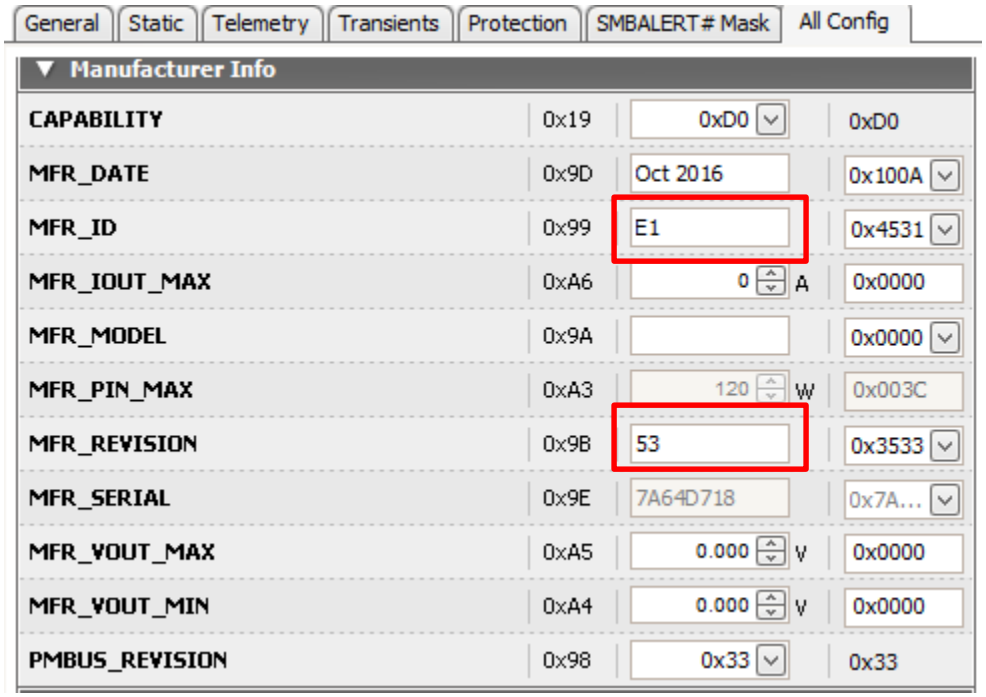
# Porting steps

- BIOS porting flow chart



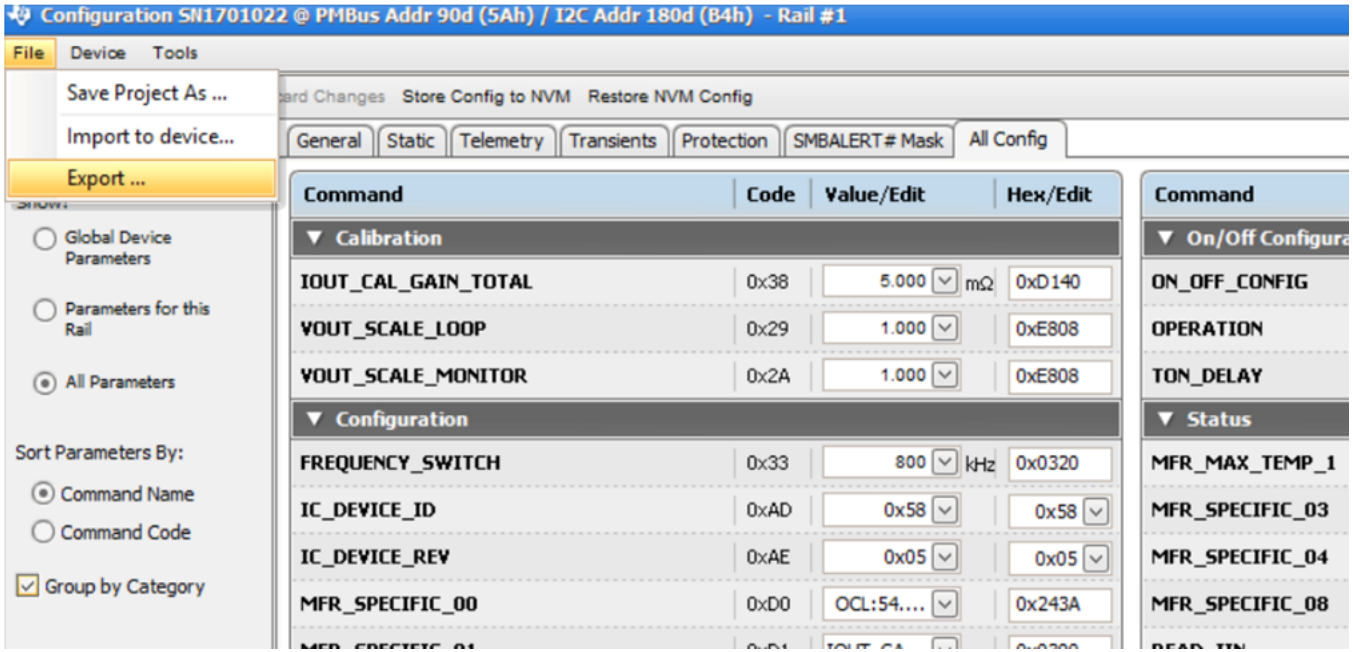
# VR13(SN1701021/2) Porting SOP

- **Step 1**
  - Go to All Config
  - Write register MFR_ID [0x99] → User Data 00 (Example : E1)
  - Write register MFR_REVISION [0x9B] → User Data 01 (Example : 53)
  - Write to Hardware
  - Store to NVM



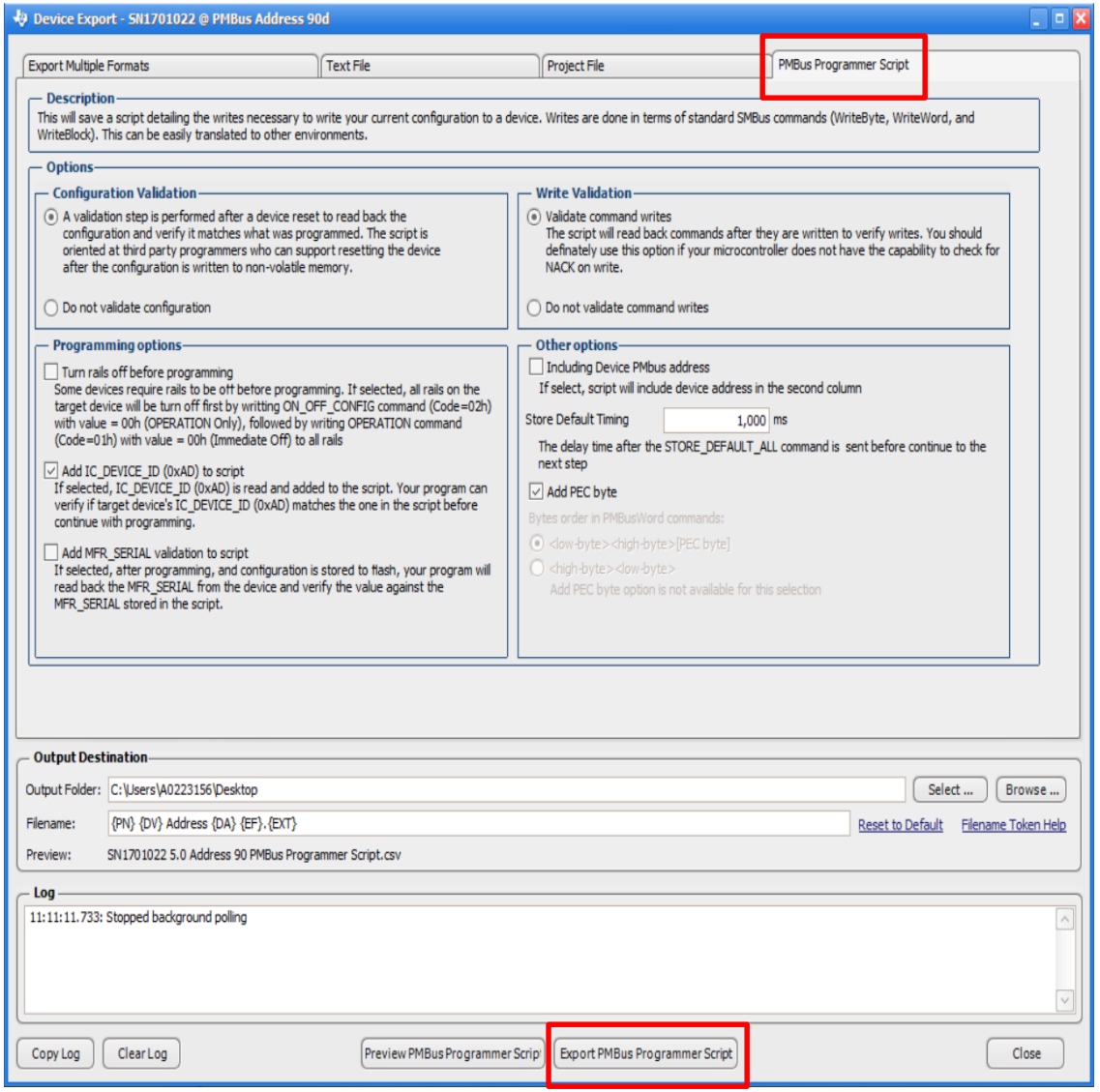
# VR13(SN1701021/2) Porting SOP

- **Step 2**
  - Go into configure device
  - File → Export



# VR13(SN1701021/2) Porting SOP

- **Step 3**
  - Select **PMBus Programmer Script**
  - **Don't change** any check box or button
  - Click **Export PMBus Programmer Script**



# VR13(SN1701021/2) Porting SOP

- **Step 4**
  - Collect USER DATA 0~12, VOUT_MAX[Rail#1] and VOUT_MAX[Rail#2] value

| | | |
|---|---|---|
| Comment | Write VOUT_MAX [Rail #1] 1.520 V | |
| WriteByte | 0x00 | 0x0041 |
| ReadByte | 0x00 | 0x00 |
| WriteWor | 0x24 | 0xFF00FF |
| ReadWord | 0x24 | 0xFF00 |

| | | |
|---|---|---|
| Comment | Write VOUT_MAX [Rail #2] 3.040 V | |
| WriteByte | 0x00 | 0x0146 |
| ReadByte | 0x00 | 0x01 |
| WriteWor | 0x24 | 0xFF00FF |
| ReadWord | 0x24 | 0xFF00 |

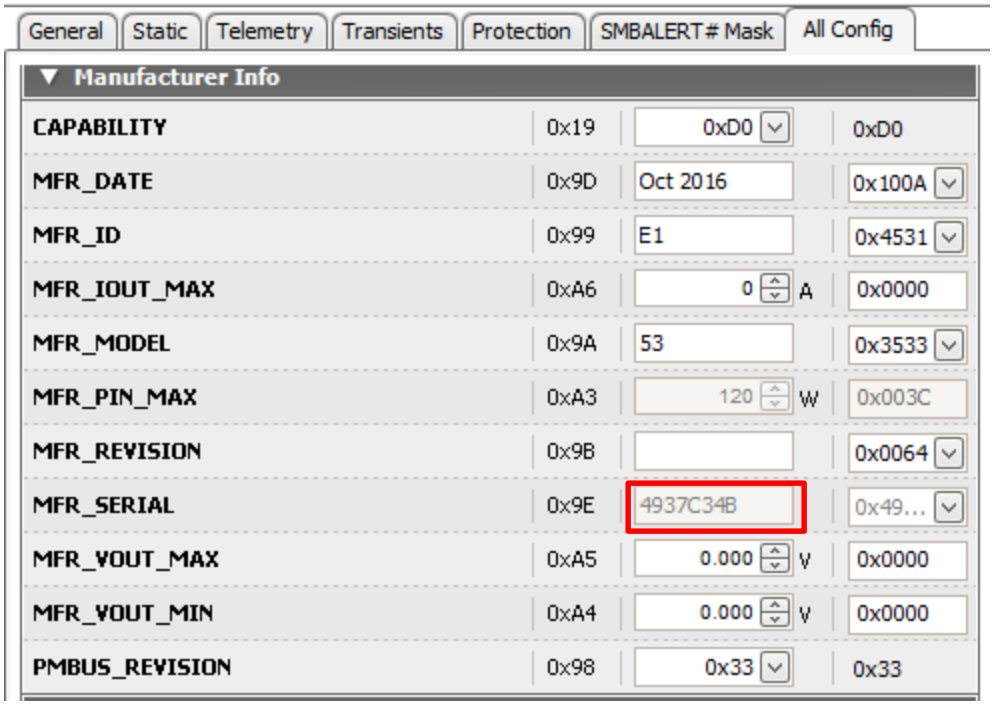
| | | |
|---|---|---|
| Comment | Write USER_DATA_00 [Rail #1] | 1184030050C3 |
| BlockWrite | 0xB0 | 0x061184030050C3AB |
| BlockRead | 0xB0 | 0x061184030050C3 |
| Comment | Write USER_DATA_01 [Rail #1] | 000000000040 |
| BlockWrite | 0xB1 | 0x06000000000040A1 |
| BlockRead | 0xB1 | 0x06000000000040 |
| Comment | Write USER_DATA_02 [Rail #1] | 890200000000 |
| BlockWrite | 0xB2 | 0x068902000000001D |
| BlockRead | 0xB2 | 0x06890200000000 |
| Comment | Write USER_DATA_03 [Rail #1] | 0064100A16C0 |
| BlockWrite | 0xB3 | 0x060064100A16C0E4 |

.
.
.

| | | |
|---|---|---|
| Comment | Write USER_DATA_10 [Rail #1] | 02602880C18D |
| BlockWrite | 0xBA | 0x0602602880C18D12 |
| BlockRead | 0xBA | 0x0602602880C18D |
| Comment | Write USER_DATA_11 [Rail #1] | 00622000A021 |
| BlockWrite | 0xBB | 0x0600622000A02181 |
| BlockRead | 0xBB | 0x0600622000A021 |
| Comment | Write USER_DATA_12 [Rail #1] | 8C500200F801 |
| BlockWrite | 0xBC | 0x068C500200F801CB |
| BlockRead | 0xBC | 0x068C500200F801 |

# VR13(SN1701022) Porting SOP

- **Step 5**
  - Check [**Checksum**] in MFR_SERIAL (0x9E)



# VR13 Porting file example

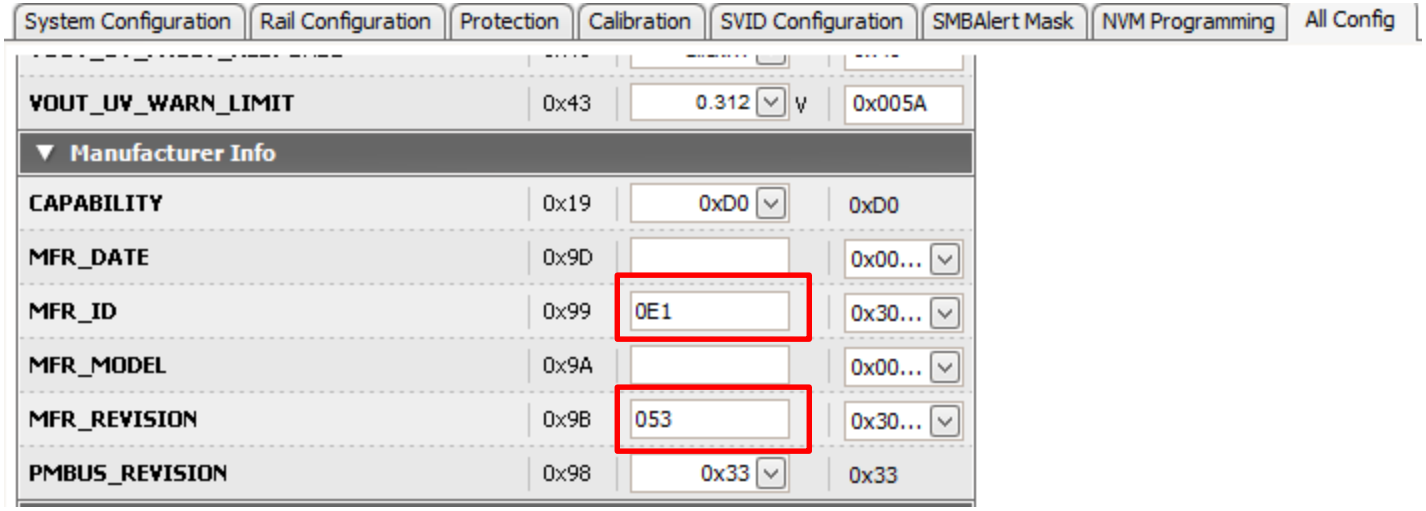
- **Step 6**
  - Fill in previous value into porting file.

VR13 example

| Step | Action | Register command | Register address | Data | Command type | Description |
|---|---|---|---|---|---|---|
| 1 | Write | PAGE | 00h | 00 | R/W | Switch to page 0. |
| 2 | Write | USER_DATA_00 | B0h | 1184030050C3 (example) | R/W, NVM | Write data to USER_DATA_00. |
| 3 | Write | USER_DATA_01 | B1h | 000000000040 (example) | R/W, NVM | Write data to USER_DATA_01. |
| 4 | Write | USER_DATA_02 | B2h | 890200000000 (example) | R/W, NVM | Write data to USER_DATA_02. |
| 5 | Write | USER_DATA_03 | B3h | 0064100A16C0 (example) | R/W, NVM | Write data to USER_DATA_03. |
| 6 | Write | USER_DATA_04 | B4h | 4424C777C777 (example) | R/W, NVM | Write data to USER_DATA_04. |
| 7 | Write | USER_DATA_05 | B5h | 8332C5BFCF3C (example) | R/W, NVM | Write data to USER_DATA_05. |
| 8 | Write | USER_DATA_06 | B6h | E51B0F160080 (example) | R/W, NVM | Write data to USER_DATA_06. |
| 9 | Write | USER_DATA_07 | B7h | 80FF091033FF (example) | R/W, NVM | Write data to USER_DATA_07. |
| 10 | Write | USER_DATA_08 | B8h | 00020000008D (example) | R/W, NVM | Write data to USER_DATA_08. |
| 11 | Write | USER_DATA_09 | B9h | 0001608080AE (example) | R/W, NVM | Write data to USER_DATA_09. |
| 12 | Write | USER_DATA_10 | BAh | 02602880C18D (example) | R/W, NVM | Write data to USER_DATA_10. |
| 13 | Write | USER_DATA_11 | BBh | 00622000A021 (example) | R/W, NVM | Write data to USER_DATA_11. |
| 14 | Write | USER_DATA_12 | BCh | 8C500200F801 (example) | R/W, NVM | Write data to USER_DATA_12. |
| 15 | Write | VOUT_MAX | 24h | FF00 (example) | R/W, NVM | Write data to VOUT_MAX of page 0. |
| 16 | Write | PAGE | 00h | 01 | R/W | Switch to page 1. |
| 17 | Write | VOUT_MAX | 24h | FF00 (example) | R/W, NVM | Write data to VOUT_MAX of page 1. |
| 18 | Write | STORE_DEFAULT_ALL | 11h | | W | Stores all current storable register setting into NVM as new defaults. |
| 19 | Read | MFR_SERIAL | 9Eh | 4937C34B (example) | R | If the checksum matched (4937C34B), the NVM programming is correct. |

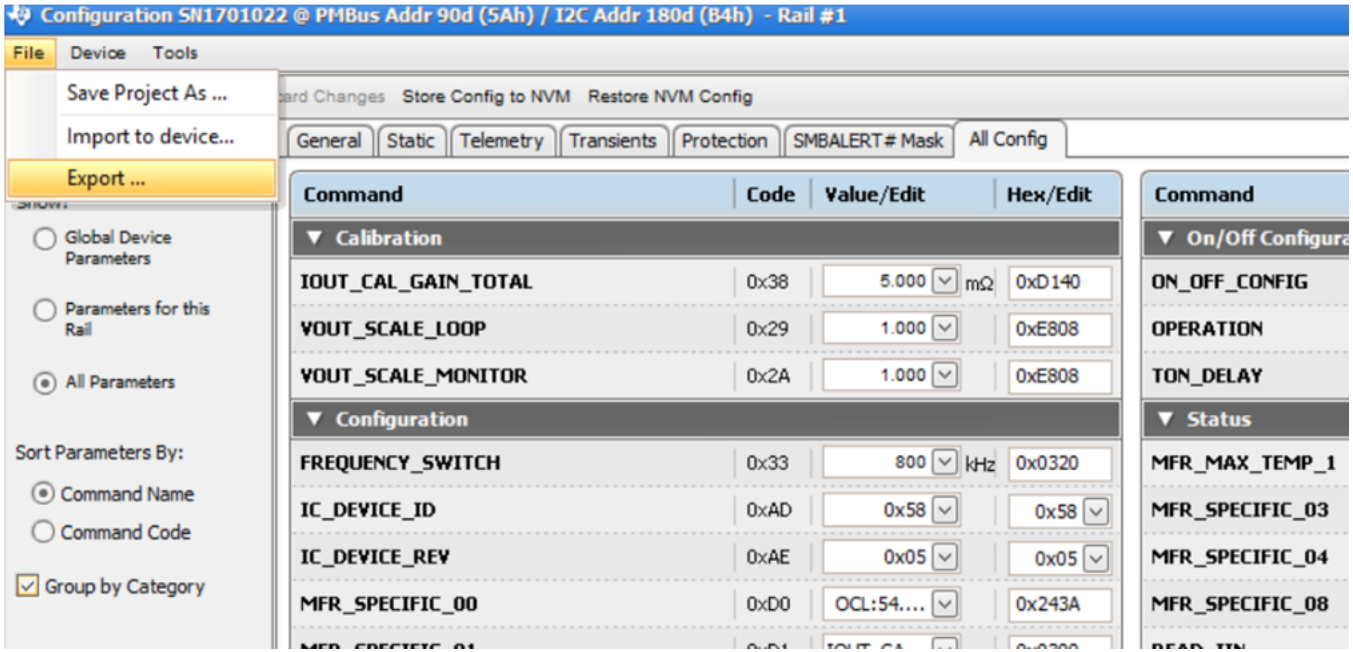
# VR13.HC/VR14 (TPS53688/9) Porting SOP

- **Step 1**
  - Go to All Config
  - Write register MFR_ID [0x99] → User Data 00 (Example : 0E1)
  - Write register MFR_REVISION [0x9B] → User Data 01 (Example : 053)
  - **Please add one more character – 0 in front of User Data 00 and 01**
  - Write to Hardware
  - Store to NVM



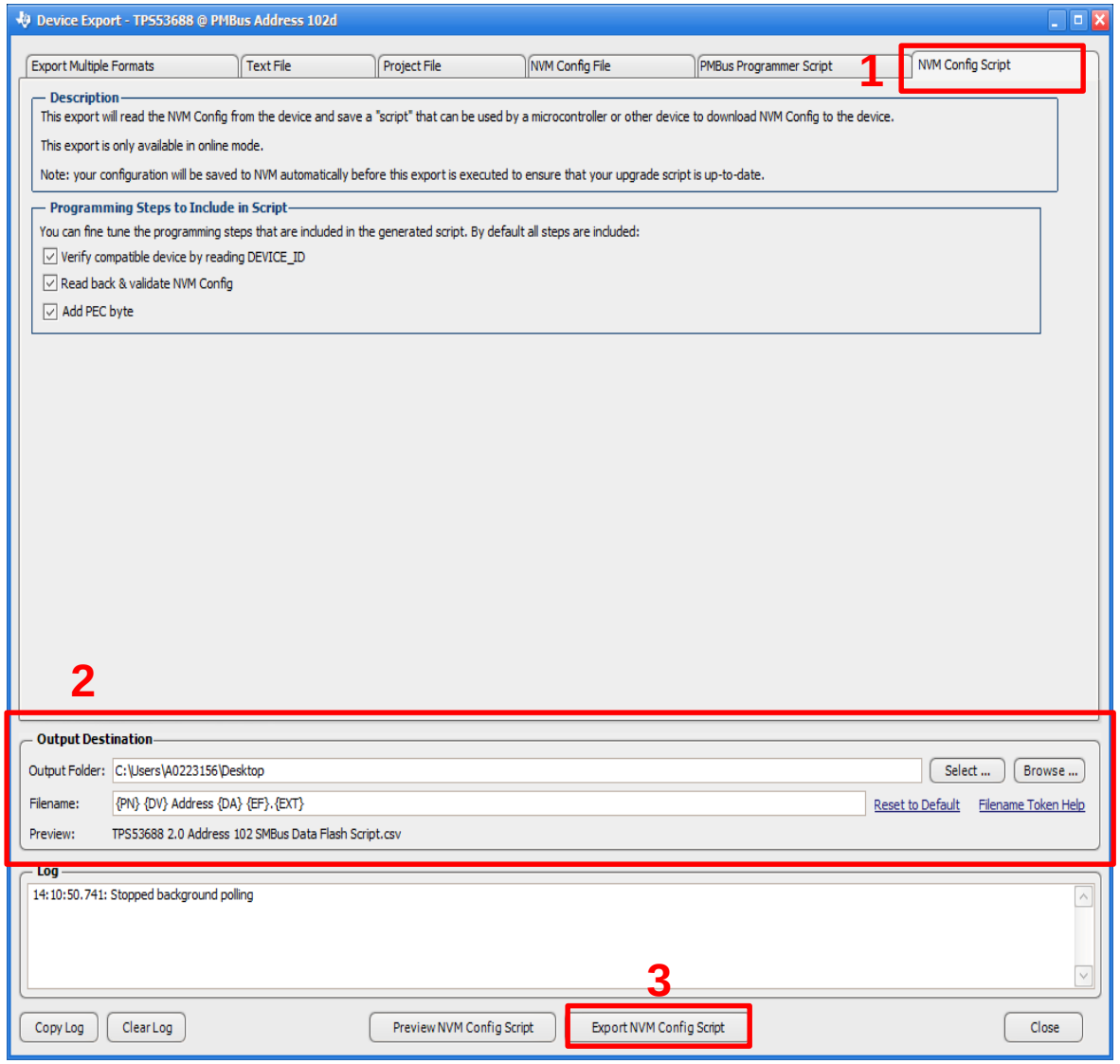
# VR13.HC/VR14 (TPS53688/9) Porting SOP

- **Step 2**
  - Go into configure device
  - File → Export



# VR13.HC/VR14 (TPS53688/9) Porting SOP

- **Step 3**
  - Select **NVM Config Script**
  - **Don't change** any check box or button
  - Select **Output Destination**
  - Click **Export NVM Config Script**



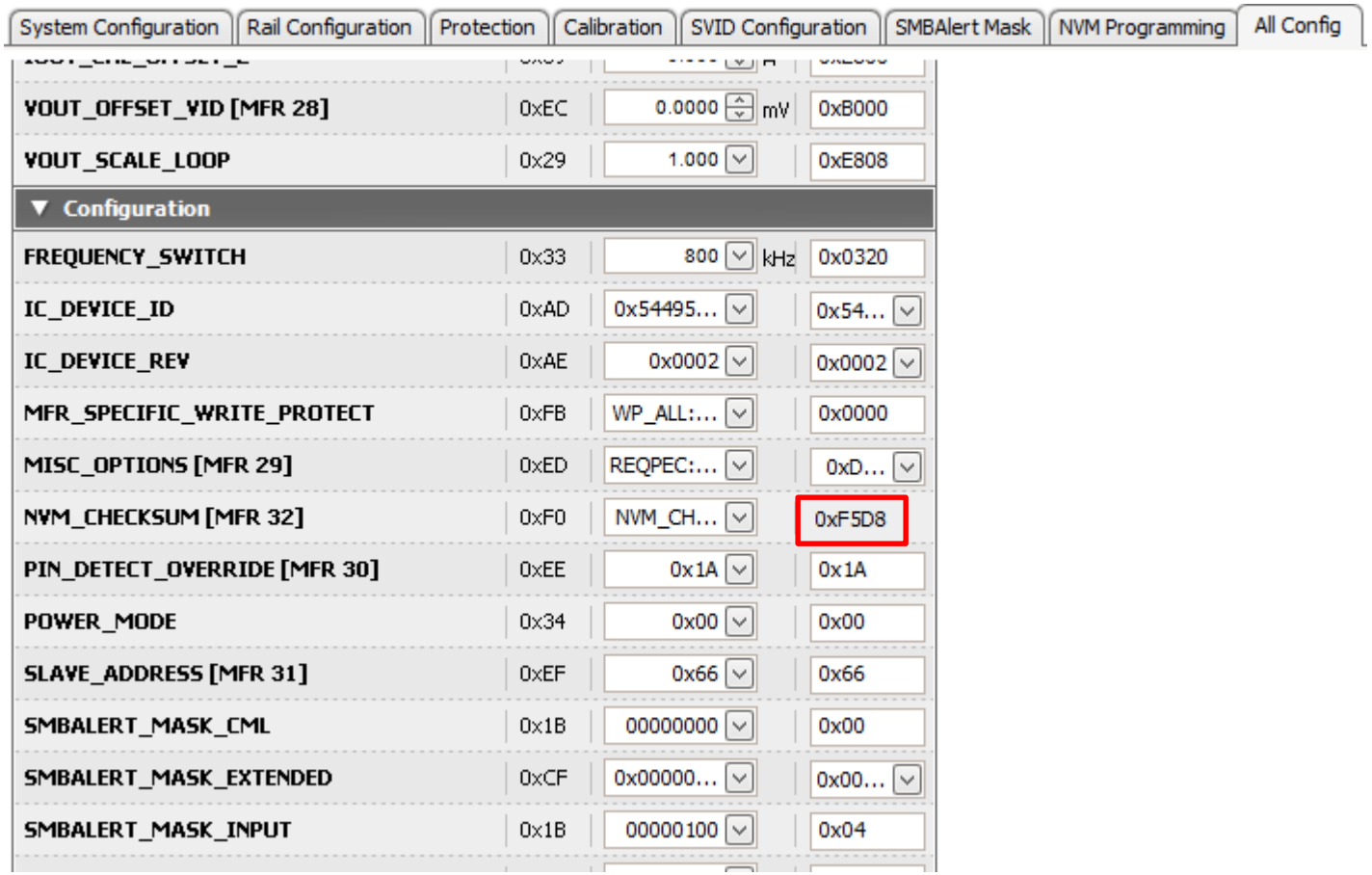
# VR13.HC/VR14 (TPS53688/9) Porting SOP

- **Step 4**
  - Collect Register F5 and F6 index 0~8 value(as in red square)

| | | | |
|---|---|---|---|
| Comment | Write USER_NVM_INDEX [MFR_37] | 0x00 | |
| WriteByte | 0x66 | 0xF5 | 0x0022 |
| Comment | Write USER_NVM [MFR_38], index = 0, value = 0x0 | | xFFFFFFFFFFFFFFFFFFD8F5171700000000040000242779008300000008A00FF00 |
| BlockWrit | 0x66 | 0xF6 | 0x20FFFFFFFFFFFFFFFFFFD8F5171700000000040000242779008300000008A00FF0008 |
| Comment | Write USER_NVM [MFR_38], index = 1, value = 0x0 | | xC957400C00000000CACD7460404060602020206060606060612060C52512C52512 |
| BlockWrit | 0x66 | 0xF6 | 0x20C957400C00000000CACD7460404060602020206060606060612060C52512C52512F2 |
| Comment | Write USER_NVM [MFR_38], index = 2, value = 0x0 | | xCF5519089014514F525053515001010101020201010404538 2C8000002550000 |
| BlockWrit | 0x66 | 0xF6 | 0x20CF5519089014514F525053515001010101020201010404538 2C800000255 00009E |
| Comment | Write USER_NVM [MFR_38], index = 3, value = 0x0 | | x0000814007A03881000D0E10102D91382B3B262B0D1033FF0F0731440F0FFA80 |
| BlockWrit | 0x66 | 0xF6 | 0x200000814007A03881000D0E10102D91382B3B262B0D1033FF0F0731440F0FFA80B3 |
| Comment | Write USER_NVM [MFR_38], index = 4, value = 0x0 | | x828481838586900000000C040082222200000444444444444F0000088470002 |
| BlockWrit | 0x66 | 0xF6 | 0x208284818385869000000000C040082222200000444444444444F000008847000242 |
| Comment | Write USER_NVM [MFR_38], index = 5, value = 0x0 | | xAE00000EDAFE4964010E140064FF50120A0A000062FFFF0000DA0000030E0101 |
| BlockWrit | 0x66 | 0xF6 | 0x20AE00000EDAFE4964010E140064FF50120A0A000062FFFF0000DA0000030E010168 |
| Comment | Write USER_NVM [MFR_38], index = 6, value = 0x0 | | x0101010101010101410 12E2A038D0000100000000000600000000000002A0B14 |
| BlockWrit | 0x66 | 0xF6 | 0x200101010101010101410 12E2A038D0000100000000000600000000000002A0B14BB |
| Comment | Write USER_NVM [MFR_38], index = 7, value = 0x0 | | x10000800EE220C80BB001B00001B008FFFFFFFFFFF87C487C403000000304531 |
| BlockWrit | 0x66 | 0xF6 | 0x2010000800EE220C80BB001B00001B008FFFFFFFFFF87C487C40300000030453146 |
| Comment | Write USER_NVM [MFR_38], index = 8, value = 0x0 | | x30353300000000000000000000000000000000000000000000000000000000000000 |
| BlockWrit | 0x66 | 0xF6 | 0x2030353300000000000000000000000000000000000000000000000000000000000000E9 |

# VR13.HC/VR14 (TPS53688/9) Porting SOP

- **Step 5**
  - Check [**Checksum**] in NVM_CHECKSUM (0xF0 for TPS53688, 0xF4 for TPS53689)



# VR13.HC/VR14 (TPS53688/9) Porting SOP

- **Step 6-1**
  - Fill in previous value into porting file(TPS53688).

VR13.HC example

| Step | Action | Register command | Register address | Data |
|---|---|---|---|---|
| 1 | Write byte | USER_NVM_INDEX | F5h | 0x00 (example) |
| 2 | Write block | USER_NVM_EXECUTE (INDEX 0) | F6h | FFFFFFFFFFFFFFFFFD8F5171700000000040000242779008300000008A00FF00 (example) |
| 3 | Write block | USER_NVM_EXECUTE (INDEX 1) | F6h | C957400C00000000CACD7460404060602020206060606060612060C52512C52512 (example) |
| 4 | Write block | USER_NVM_EXECUTE (INDEX 2) | F6h | CF5519089014514F525053515001010101020201010404538 2C8000002550000 (example) |
| 5 | Write block | USER_NVM_EXECUTE (INDEX 3) | F6h | 0000814007A03881000D0E10102D91382B3B262B0D1033FF0F0731440F0FFA80 (example) |
| 6 | Write block | USER_NVM_EXECUTE (INDEX 4) | F6h | 8284818385869000000000C040082222200000444444444444F0000088470002 (example) |
| 7 | Write block | USER_NVM_EXECUTE (INDEX 5) | F6h | AE00000EDAFE4964010E140064FF50120A0A000062FFFF0000DA0000030E0101 (example) |
| 8 | Write block | USER_NVM_EXECUTE (INDEX 6) | F6h | 0101010101010101410 12E2A038D000010000000000060000000000002A0B14 (example) |
| 9 | Write block | USER_NVM_EXECUTE (INDEX 7) | F6h | 10000800EE220C80BB001B00001B008FFFFFFFFFFF87C487C403000000304531 (example) |
| 10 | Write block | USER_NVM_EXECUTE (INDEX 8) | F6h | 3035330000000000000000000000000000000000000000000000000000000000000000 (example) |
| 11 | Read | NVM_CHECKSUM | F0h | F5D8 (example) |

# VR13.HC/VR14 (TPS53688/9) Porting SOP

- **Step 6-2**
  - Fill in previous value into porting file(TPS53689).

VR14 example

| Action | Register command | Register address | Data | Command type | Description |
|---|---|---|---|---|---|
| Write byte | USER_NVM_INDEX | F5h | 0x00 (example) | R/W, NVM | Set USER_NVM_INDEX at 0 |
| Write block | USER_NVM_EXECUTE (INDEX 0) | F6h | FFFFFFFFFFFFFFFFFD8F5171700000000040000242779008300000008A00FF00 (exampl | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX0 |
| Write block | USER_NVM_EXECUTE (INDEX 1) | F6h | C957400C00000000CACD7460404060602020206060606060612060C52512C52512 (exan | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX1 |
| Write block | USER_NVM_EXECUTE (INDEX 2) | F6h | CF5519089014514F525053515001010101020201010404538 2C8000002550000 (exam | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX2 |
| Write block | USER_NVM_EXECUTE (INDEX 3) | F6h | 0000814007A03881000D0E10102D91382B3B262B0D1033FF0F0731440F0FFA80 (exam | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX3 |
| Write block | USER_NVM_EXECUTE (INDEX 4) | F6h | 828481838586900000000C0400822222000004444444444444F0000088470002 (exam | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX4 |
| Write block | USER_NVM_EXECUTE (INDEX 5) | F6h | AE00000EDAFE4964010E140064FF50120A0A000062FFFF0000DA0000030E0101 (exam | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX5 |
| Write block | USER_NVM_EXECUTE (INDEX 6) | F6h | 0101010101010101141012E2A038D0000100000000000600000000000002A0B14 (exan | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX6 |
| Write block | USER_NVM_EXECUTE (INDEX 7) | F6h | 10000800EE220C80BB001B00001B008FFFFFFFFFFF87C487C403000000304531 (examp | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX7 |
| Write block | USER_NVM_EXECUTE (INDEX 8) | F6h | 3035330000000000000000000000000000000000000000000000000000000000000000 (exam | R/W, NVM | Write data to USER_NVM_EXECUTE INDEX8 |
| Read | NVM_CHECKSUM | F4h | F5D8 (example) | R | If the checksum matched (F5D8), the NVM programming is correct. |