TUSB804x EEPROM User's Guide

When SMBUSz (pin 39) of a TUSB804x device is left unconnected or pulled high, the TUSB804x is considered to be in I2C mode. In this mode, an optional EEPROM can be attached to the TUSB804x device to configure various features of the hub. This document provides a sample EEPROM file along with explanations of the various register fields and how they impact the TUSB804x devices.

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1   TUSB8044 Sample EEPROM File

TUSB8044Sample EEPROM file in txt format.

```
'TUSB8044 EEPROM Data File
'Created 8/08/2018 12:16:31 PM
00    55    01010101
01    51    01010001    'VID LSB
02    04    00000100    'VID MSB
03    40    01000000    'PID LSB
04    84    10000100    'PID MSB
05    10    00010000    'DEVICE CONFIG 1
06    00    00000000  'BC SUPPORT
07    0F    00001111    'DEVICE REMOVABLE
08    0F    00001111    'PORT USED
09    00    00000000    'RSVD
0A    22    00100010    'DEVICE CONFIG 2
0B    00    00000000    'USB 2.0 PORT POLARITY
0C    00    00000000    'NOT EEPROM CONFIGURABLE
0D    00    00000000    'NOT EEPROM CONFIGURABLE
0E    00    00000000    'NOT EEPROM CONFIGURABLE
0F    00    00000000    'NOT EEPROM CONFIGURABLE
10    00    00000000    'NOT EEPROM CONFIGURABLE
11    00    00000000    'NOT EEPROM CONFIGURABLE
12    00    00000000    'NOT EEPROM CONFIGURABLE
13    00    00000000    'NOT EEPROM CONFIGURABLE
14    00    00000000    'NOT EEPROM CONFIGURABLE
15    00    00000000    'NOT EEPROM CONFIGURABLE
16    00    00000000    'NOT EEPROM CONFIGURABLE
17    00    00000000    'NOT EEPROM CONFIGURABLE
18    00    00000000    'NOT EEPROM CONFIGURABLE
19    00    00000000    'NOT EEPROM CONFIGURABLE
1A    00    00000000    'NOT EEPROM CONFIGURABLE
1B    00    00000000    'NOT EEPROM CONFIGURABLE
1C    00    00000000    'NOT EEPROM CONFIGURABLE
1D    00    00000000    'NOT EEPROM CONFIGURABLE
1E    00    00000000    'NOT EEPROM CONFIGURABLE
1F    00    00000000    'NOT EEPROM CONFIGURABLE
20    09    00001001    'LANGUAGE ID
21    04    00000100    'LANGUAGE ID
22    00    00000000    'SERIAL NUMBER LENGTH
23    00    00000000    'MANUFACTURER LENGTH
24    00    00000000    'PRODUCT STRING LENGTH
25    00    00000000    'DEVICE CONFIG 3
26    00    00000000    'USB 2.0 ONLY
27    01    00000001    'BB SVID LSB
28    FF    11111111    'BB SVID MSB
29    EE    11101110    'BB PID LSB
2A    82    10000010    'BB PID MSB
2B    80    10000000    'BB Config
2C    2C    00101100    'BB String Length - default
2D    2D    00101101    'BB String Length - default
2E    00    00000000    'NOT EEPROM CONFIGURABLE
2F    00    00000000    'NOT EEPROM CONFIGURABLE
30    00    00000000    'SERIAL NUMBER STRING TO 4FH
...
4F    00    00000000
50    00    00000000    'MANUFACTURER STRING TO 8FH
...
8F    00    00000000
90    00    00000000    'PRODUCT STRING TO CFH
...
CF    00    00000000
D0    00    00000000    'NOT EEPROM CONFIGURABLE
D1    00    00000000    'NOT EEPROM CONFIGURABLE
D2    00    00000000    'NOT EEPROM CONFIGURABLE
D3    00    00000000    'NOT EEPROM CONFIGURABLE
```

```
        D4      00      00000000        'NOT EEPROM CONFIGURABLE
        D5      00      00000000        'NOT EEPROM CONFIGURABLE
        D6      00      00000000        'NOT EEPROM CONFIGURABLE
        D7      00      00000000        'NOT EEPROM CONFIGURABLE
        D8      00      00000000        'NOT EEPROM CONFIGURABLE
        D9      00      00000000        'NOT EEPROM CONFIGURABLE
        DA      00      00000000        'NOT EEPROM CONFIGURABLE
        DB      00      00000000        'NOT EEPROM CONFIGURABLE
        DC      00      00000000        'NOT EEPROM CONFIGURABLE
        DD      00      00000000        'NOT EEPROM CONFIGURABLE
        DE      00      00000000        'NOT EEPROM CONFIGURABLE
        DF      00      00000000        'NOT EEPROM CONFIGURABLE
        E0      00      00000000        'NOT EEPROM CONFIGURABLE
        E1      00      00000000        'NOT EEPROM CONFIGURABLE
        E2      00      00000000        'NOT EEPROM CONFIGURABLE
        E3      00      00000000        'NOT EEPROM CONFIGURABLE
        E4      00      00000000        'NOT EEPROM CONFIGURABLE
        E5      00      00000000        'NOT EEPROM CONFIGURABLE
        E6      00      00000000        'NOT EEPROM CONFIGURABLE
        E7      00      00000000        'NOT EEPROM CONFIGURABLE
        E8      00      00000000        'NOT EEPROM CONFIGURABLE
        E9      00      00000000        'NOT EEPROM CONFIGURABLE
        EA      00      00000000        'NOT EEPROM CONFIGURABLE
        EB      00      00000000        'NOT EEPROM CONFIGURABLE
        EC      00      00000000        'NOT EEPROM CONFIGURABLE
        ED      00      00000000        'NOT EEPROM CONFIGURABLE
        EE      00      00000000        'NOT EEPROM CONFIGURABLE
        EF      00      00000000        'NOT EEPROM CONFIGURABLE
        F0      00      00000000        'ADDITIONAL FEATURES

        'DATA FILE FORMAT: <HEX ADDRESS><TAB><HEX DATA>. EVERYTHING AFTER <DATA> IS IGNORED.
        'USE <'> FOR IN-LINE COMMENTING.
        'DATA FILE PARSING STOPS AT FIRST BLANK LINE.
```

2   TUSB804x Register Descriptions

This section provides in-depth descriptions of the TUSB804x registers that are modifiable by external EEPROM.

2.1   ROM Signature Register - 00h

This register is used by the TUSB804x in I2C mode to validate the attached EEPROM has been programmed. The first byte of the EEPROM is compared to the mask 55h and if not a match, the TUSB804x aborts the EEPROM load and executes with the register defaults. This ensures a corrupted EEPROM is not loaded.

2.2   Vendor ID / Product ID Registers - 01h to 04h

Vendor ID default is 0451h which is the Texas Instruments Vendor ID assigned by the USB-IF. This register can be overwritten with a customer's USB-IF approved Vendor ID or it can be left as the Texas Instruments Vendor ID. Product ID default is 8x40h as reported in the SuperSpeed Device Descriptor. The value reported in the USB 2.0 Device Descriptor will be 8x42h. Per the USB specification, the two parts of the hub (SuperSpeed and USB 2.0) must report different Product IDs. The Product ID can be overwritten with customer values, and the USB 2.0 Device Descriptor will be bit wise XORed at bit 1. Please note that if the Product ID is modified, the Vendor ID should be modified too to prevent unintentionally reporting as a different Texas Instruments device.

2.3 Device Configuration Register I - 05h

Register 05h is used to configure the TUSB804x. Bit 7 is the custom strings enable. This bit controls the ability to write to the Manufacturer String Length, Manufacturer String, Product String Length, Product String, and Language ID registers. The default value of this bit is 0. Bit 6 is the custom serial number enable. This bit controls the ability to write to the serial number registers. The default value of this bit is 0.

Bit 5 is U1 U2 Disable. This bit controls the U1/U2 support. For the TUSB804x to be compliant to USB 3.x specifications it should have U1/U2 enabled at all times, but the low power states can be disabled for interoperability debug. When U1/U2 is disabled, TUSB804x will not initiate or accept any U1 or U2 requests on any port, upstream or downstream, unless it receives or sends a Force_LinkPM_Accept LMP. Bits 2 and 3 set the fullPwrMgmtz and ganged functions of the TUSB804x. When configured by EEPROM, these bits override the pin configuration settings of the TUSB804x.

Bit 1 is the U1 U2 Timer Override. When this field is set, the TUSB804x will override the downstream ports U1/U2 timeout values set by USB3.1 Host software. If software sets value in the range of 1h - FFh, the TUSB804x will use the value of FFh. This feature is a rarely used debug feature and should not be set during normal operation.

2.4 Port Configuration Registers - 06h to 08h

The Battery Charging Support Register 06h, bits 3:0, is used to set the battery charging enables for the downstream ports. When using an EEPROM, this field overwrites the values set by pin configuration. This register defaults to 00h.

The Device Removable Configuration register at 07h has the customRmbl bit 7 which must be set to overwrite the default TUSB804x values of the removable ports, used ports and USB 2.0 only ports. Bits 3:0 of register 07h set whether a downstream port is defined as removable (devices can be removed from the port) or non-removable (device is permanently connected to the port). This register defaults to 0Fh.

The Port Used Register at 08h sets which ports are enabled or disabled. All combinations are supported with the exception of both ports 1 and 3 marked as disabled. This field is read only unless the customRmbl bit in register 07h is set to 1. When the corresponding USB2_ONLY bit is set, the USB2 port will be used and enabled regardless of the bit programmed into this field. This register defaults to 0Fh.

2.5 Reserved Register - 09h

This register must be set to 00h when using EEPROM.

2.6 Device Configuration Register II - 0Ah

Register 0Ah is also used to configure the TUSB804x. Bit 6 is the custom Battery Charging Feature Enable. This bit controls the ability to write to the battery charging feature configuration controls (Hi CurAcpModeEn) HiCurAcpModeEn (bit 4) is the current ACP mode enable. When set high this bit enables the high-current tablet charging mode when the automatic battery charging mode is enabled for downstream ports. The Power enable polarity bit (5) sets the polarity of the downstream port power controls. It overrides the PWRCTL_POL pin setting. Set low is active low, set high is active high. Bit 1 is Automatic Mode Enable. The automatic mode only applies to downstream ports with battery charging enabled when the upstream port is not connected. Under these conditions: When set low, the Automatic mode battery charging features are enabled. When set high, Automatic mode is disabled; only Battery Charging DCP and CDP mode is supported.

Please note that TUSB8041/A have bits 3 and 2 defined differently. Bit 3 is cpdEN, which should always be set low during normal operation. Bit 2 is the dsportEcr-en. When set high, this bit enables the DSPORT ECR functionality added to the USB 3.0 specification in April 2013. The most noticeable impact is that downstream ports do not ener compliance mode unless enabled by the host. The DSPORT ECR is enabled in all later TUSB804x silicon.

2.7   Port Polarity Control Register - 0Bh

Register 0Bh can be used to change the polarity of the USB 2.0 ports of TUSB804x. For register 0Bh to overwrite the default settings bit 7, customPolarity, must be set. All exposed ports can have USB 2.0 polarity swapped. Per USB 3.x specification, SuperSpeed signals can automatically support polarity swap without any additional configuration needed.

2.8   String Descriptor Configuration Registers - 20h to 24h

Language ID default is 0409h which indicates United States English. This language ID applies to the string descriptors and can only be overwritten by EEPROM only when the customStrings bit in register 05h is set.

Serial Number String Length defaults to 18h (24 bytes), and maximum is 32 bytes. When the CustomSerNum bit is set in register 05h, this register can be overwritten by EEPROM.

Manufacturer String Length and Product String Length default to zero. If the customStringsBit is set in Register 05h, these lengths can be modified by EEPROM up to 64 bytes.

2.9   Device Configuration III and USB 2.0 Only Registers - 25h to 26h (Not Available on the TUSB8041/A)

Various features can be configured in register 25h. Bit 4, USB2.0_only, when set forces the TUSB804x to report as USB 2.0 only hub, it removes all mention of USB 3.0 capability from the hub descriptors. Bit 2, I2C_100k, controls the clock rate of the I2C master for USB to I2C requests . The EEPROM reads will still occur at 400K. Bit 1, Galaxy_Enz, disables Galaxy compatible battery charging modes. When this field is high, Galaxy charging compatible mode will not be included in automode charger sequence. When automode is enabled and bit 0, FullAutoEn, is set any downstream port enabled for battery charging will attempt all divider battery charging modes before DCP, starting with the highest current option.

USB2_ONLY is set in bits 3:0 of Register 26h and can be used to define a downstream USB port of the TUSB804x as a USB 2.0 only port. These bits are only valid if the customRmbl bit in register 07h is set. Downstream ports default to USB 3.0 and USB 2.0 capable. These bits will override the USED bits in register 08h.

2.10 Billboard Configuration Registers - 27h to 2Dh (Available only on the TUSB8044)

Billboard SVID can be overwritten using registers 27h and 28h. The TUSB8044 default Billboard SVID is FF01h. The Billboard Product ID can be overwritten using registers 29 and 2Ah. The default TUSB8044 Billboard PID is 82EEh.

VCONN power defined in bits 7:4 and bAdditionalFailureInfo bit 1 of register 2Bh cannot be modified from the default by EEPROM. The bmConfigured bits (3:2) in register 2Bh are set by the BBbmConfigured(1:0) pins and not by EEPROM. Also, the BillboardEN bit 0 in register 2Bh is set by the BBEN pin and not by EEPROM.

The Billboard String 1 Length is defined in register 2Ch. It indicates the length in number of UNICODE characters of the Billboard string1. This is not the length of the string descriptor. BBString1Len size + BBString2Len size must be <= 480 bytes, or < 480 if # characters in string 1 is odd, because string 2 must start on an address that is a multiple of 4 (bytes). The bLength field of the Additional Info URL string descriptor is 2 + (2 * BBString1Len). This field defaults to 0x2C and can be overwritten by EEPROM.

The Billboard String 2 Length is defined in register 2Dh. It indicates the length in number of UNICODE characters of the Billboard string2. This is not the length of the string descriptor. The bLength field of the Alternate Mode string descriptor is 2 + (2 * BBString2Len). This field defaults to 0x2D and can be overwritten by EEPROM.

2.11 String Descriptors - 30h to CFh

The Serial Number registers (30h-4Fh) will define the number returned in the Serial Number string descriptor at string index 1 when customSernum is set in register 05h. The stringlength is defined by the serNumbStringLen in register 22h . The serial number string is only provided on the USB 2.0 hub instance of the TUSB804x, not the SuperSpeed hub instance. USB specification requires no two instances to report the same serial number.

The Manufacturer String registers (50h-8Fh) will provide the values returned for string index 3 when mfgStringLen in register 23h is greater than 0 and customStrings in register 05h is set. The number of bytes returned in the string is equal to mfgStringLen. The programmed data should be in UNICODE UTF-16LE encoding as defined by The Unicode Standard, Worldwide Character Encoding, Version 5.0.

The Product String registers (90h-CFh) will provide the values returned for string index 2 when prodStringLen in register 24h is greater than 0 and customStrings in register 05h is set. The number of bytes returned in the string is equal to prodStringLen. The programmed data should be in UNICODE UTF-16LE encoding as defined by The Unicode Standard, Worldwide Character Encoding, Version 5.0.

2.12 Additional Feature Configuration Register - F0h

Bits 7:5 of Register F0h are all zero and should not be overwritten. Bit 4, stsOutputEn, enables optional status outputs to be generated on various GPIOs. These outputs can be used for LEDs or debug. Bits 3:1 can be used to increase the pwronTime, this is the amount of time that the PWRCTL output toggles low when switching between battery charging modes. PwronTime only impacts ports that have battery charging enabled. Bit 0, usb3spreadDis, can be used to disable the spread spectrum function of the USB 3.0 phys in the hub. It is a non-compliant mode and should only be used for debug of interoperability and EMI issues.

2.13 Billboard String Descriptors - 100h to 2DFh (Available only on the TUSB8044)

Billboard String 1 and String 2 are defined in registers 100h to 2DFh. String 1 defaults http://www.displayport.org and String 2 defaults to "DisplayPort" The default can be changed using EEPROM. The length of these strings is defined in registers 2Ch and 2Dh.

3 Related TUSB804x Devices

This is a list of the TUSB804x devices described by this document:

- TUSB8041
- TUSB8041A
- TUSB8042
- TUSB8043
- TUSB8044

Table 1. Supported Registers by Device

	TUSB8041/A	TUSB8042	TUSB8043	TUSB8044
ROM Signature Register - 00h	YES	YES	YES	YES
Vendor ID / Product ID Registers - 01h to 04h	YES	YES	YES	YES
Device Configuration Register I - 05h	YES	YES	YES	YES
Port Configuration Registers - 06h to 08h	YES	YES	YES	YES
Reserved Register - 09h	YES	YES	YES	YES
Device Configuration Register II - 0Ah	YES	YES	YES	YES
Port Polarity Control Register - 0Bh	YES	YES	YES	YES
String Descriptor Configuration Registers - 20h to 24h	YES	YES	YES	YES
Device Configuration III and USB 2.0 Only Registers - 25h to 26h	NO	YES	YES	YES
Billboard Configuration Registers - 27h to 2Dh	NO	NO	NO	YES
String Descriptors - 30h to CFh	YES	YES	YES	YES
Additional Feature Configuration Register F0h	YES	YES	YES	YES
Billboard String Descriptors - 100h-2DFh	NO	NO	NO	YES