TUSB8042A Four-Port USB 3.2 x1 Gen1 Hub

1 Features

- Four port USB 3.2 x1 Gen1 (5Gbps) hub
- USB 2.0 hub features
  - Multiple transaction translator (MTT) hub: four transaction translators
  - Two asynchronous endpoint buffers per transaction translator
- Supports battery charging:
  - Supports D+/D– divider charging port (ACP1, ACP2, and ACP3) when the upstream port is unconnected or not configured
  - Supports automatic mode for transition between DCP or ACP modes when the upstream port is unconnected
  - Supports galaxy charging
  - CDP mode (upstream port connected)
  - DCP mode (upstream port unconnected)
  - DCP mode complies with Chinese telecommunications industry standard YD/T 1591-2009
- Supports operation as a USB 3.2 x1 Gen1 or USB 2.0 compound device
- Per port or ganged power switching and overcurrent notification inputs
- Supports four external downstream ports
- Supports vendor requests to read and write I^2C and EEPROM read at 100k
- I^2C controller supports clock stretching
- OTP ROM, Serial EEPROM or I^2C/SMBus target interface for custom configurations:
  - VID and PID
  - Port customizations
  - Manufacturer and product strings (not by OTP ROM)
  - Serial number (not by OTP ROM)
- Application Feature selection using pin selection or EEPROM or I^2C/SMBus target interface
- Provides 128-bit Universally Unique Identifier (UUID)
- Single clock input, 24MHz crystal or oscillator
- Downstream ports configurable to USB 2.0 only
- 64-pin QFN package (RGC)

2 Applications

- Computer systems
- Docking stations
- Monitors
- Set-top boxes

3 Description

The TUSB8042A is a four-port USB 3.2 x1 Gen1 (5Gbps) hub. The device provides simultaneous SuperSpeed USB, high-speed, or full-speed connections on the upstream port. The device also provides SuperSpeed USB, high-speed, full-speed, or low-speed connections on the downstream port. When the upstream port is connected to an electrical environment that only supports high-speed, full-speed, or low-speed connections, SuperSpeed USB connectivity is disabled on the downstream ports.

When the upstream port is connected to an electrical environment that only supports full-speed or low-speed connections, SuperSpeed USB and high-speed connectivity are disabled on the downstream ports.

The TUSB8042A supports per port or ganged power switching and overcurrent protection, and supports battery charging applications.

An individually port power controlled hub switches power on or off to each downstream port as requested by the USB host. Also when an individually port power controlled hub senses an overcurrent event, only power to the affected downstream port is switched off.

A ganged hub switches on power for all the downstream ports when power is required for any port. The power to the downstream ports is not switched off unless all ports are in a state that allows power to be removed. Also when a ganged hub senses an overcurrent event, power to all downstream ports is switched off.

The TUSB8042A downstream ports provide support for battery charging applications by providing Battery Charging Downstream Port (CDP) handshaking support. The device also supports a Dedicated Charging Port (DCP) mode when the upstream port is not connected. The DCP mode supports USB devices which support with the USB Battery Charging, Galaxy Charging, and Chinese Telecommunications Industry Standard YD/T 1591-2009. In addition when upstream port is unconnected, the TUSB8042A supports the divider charging port modes (ACPx modes) and an automatic transition through all modes, starting with ACP3 and ending in DCP.

The TUSB8042A provides pin strap configuration for some features including battery-charging support, and also provides customization though OTP ROM, I^2C EEPROM, or through an I^2C/SMBus target interface for PID, VID, and custom port and phy configurations. Custom string support is also available when using an I^2C EEPROM or the I^2C/SMBus target interface.
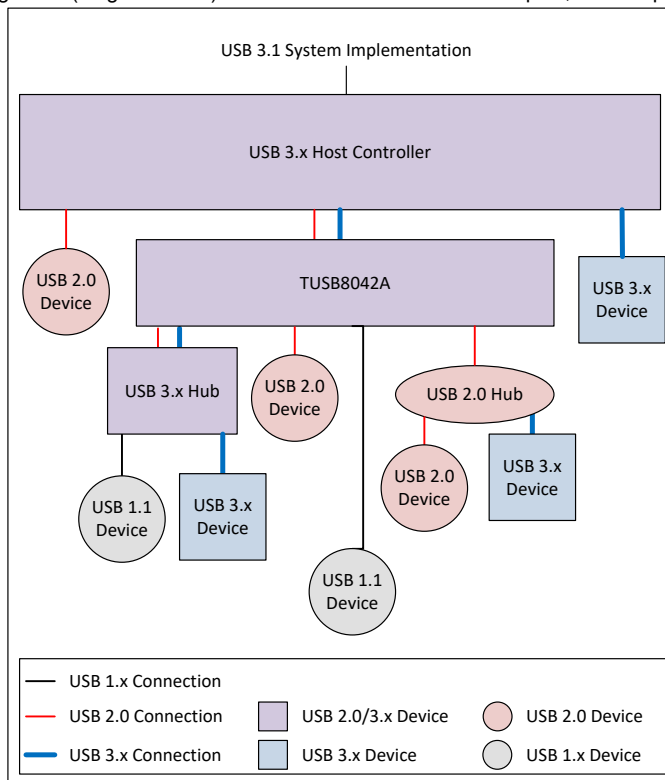
The device is available in a 64-pin RGC package and is offered in a commercial version (TUSB8042A) for operation over the temperature range of 0°C to 70°C, and in an industrial version (TUSB8042AI) for operation over the temperature range of –40°C to 85°C.

Package Information

PART NUMBER[1]	PACKAGE	PACKAGE SIZE[2]
TUSB8042A	RGC (VQFN, 64)	9mm × 9mm
TUSB8042AI	RGC (VQFN, 64)	9mm × 9mm

(1) For all available packages, see Section 12.
(2) The package size (length × width) is a nominal value and includes pins, where applicable.

Diagram

Product Folder Links: *TUSB8042A*

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4 Device Variants

The following table describes the key differences between TUSB8042A device variants.

Table 4-1. Device Variant Information

ORDERABLE DEVICE	PACKAGE TYPE	PACKAGE DRAWING	PINS	DEVICE MARKING
TUSB8042ARGCR/T	VQFN	RGC	64	TUSB8042A
TUSB8042A1RGCR/T	VQFN	RGC	64	TUSB8042A1

4.1 Device Version Comparison

Table 4-2. Register Comparison Table

	REGISTER ADDRESS	TUSB8042A DEFAULT	TUSB8042A1 DEFAULT
Device Configuration Register (Table 8-7) bit 2 (u1u2TimerOvr)	0x5	0	1

Product Folder Links: *TUSB8042A*

5 Pin Configuration and Functions
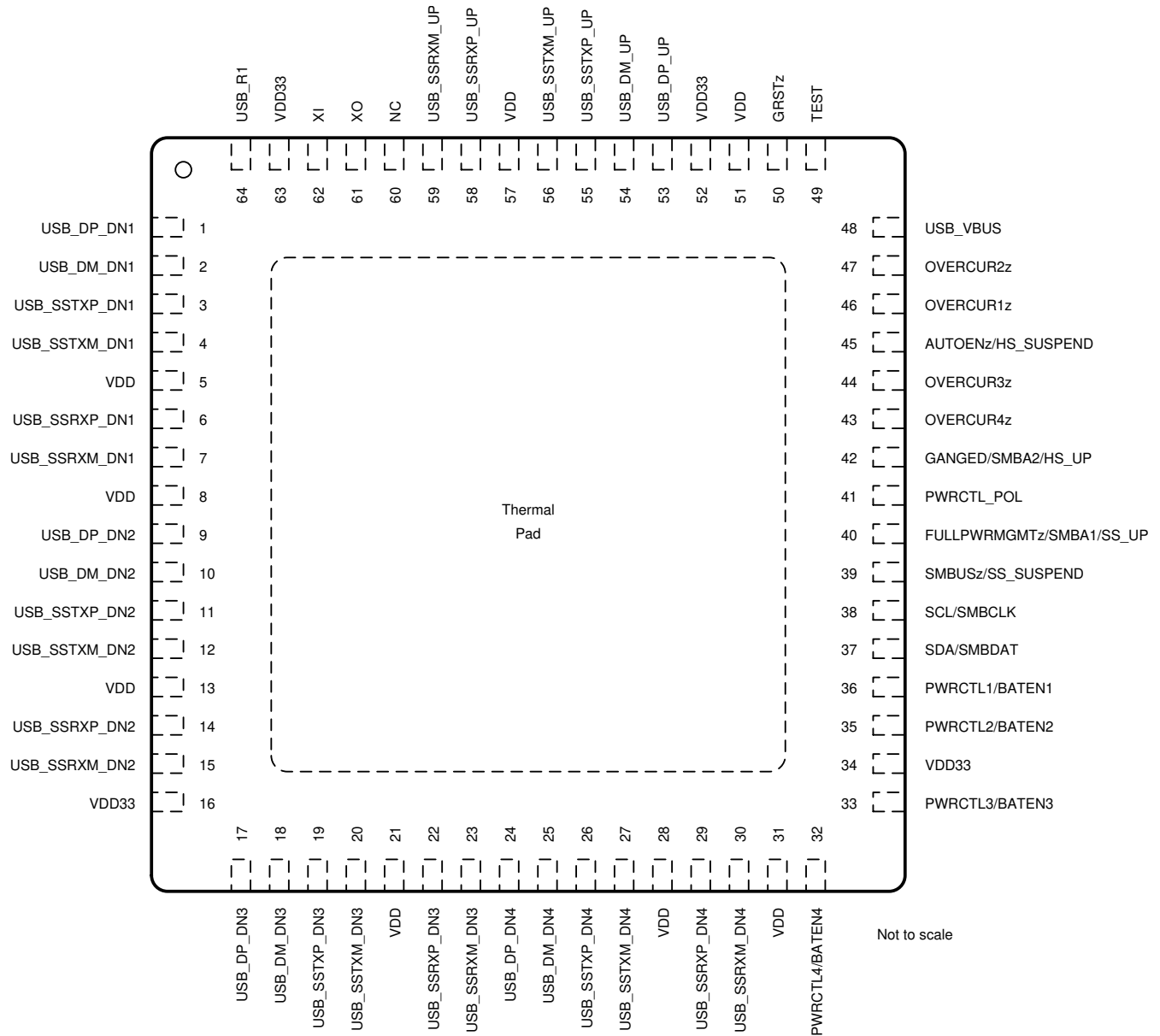
Figure 5-1. RGC Package 64-Pin (VQFN) (Top View)

Table 5-1. Pin Functions

PIN		I/O	DESCRIPTION
NAME	NO.		
Clock and Reset Signals			
GRSTz	50	I, PU	Global power reset. This reset brings all of the TUSB8042A internal registers to the default states. When GRSTz is asserted, the device is completely nonfunctional.
XI	62	I	Crystal input. This pin is the crystal input for the internal oscillator. The input can alternately be driven by the output of an external oscillator. When using a crystal, a 1MΩ feedback resistor is required between XI and XO.
XO	61	O	Crystal output. This pin is the crystal output for the internal oscillator. If XI is driven by an external oscillator, this pin can be left unconnected. When using a crystal, a 1MΩ feedback resistor is required between XI and XO.

Table 5-1. Pin Functions (continued)

PIN		I/O	DESCRIPTION
NAME	NO.		
USB Upstream Signals			
USB_SSTXP_UP	55	O	USB SuperSpeed transmitter differential pair (positive)
USB_SSTXM_UP	56	O	USB SuperSpeed transmitter differential pair (negative)
USB_SSRXP_UP	58	I	USB SuperSpeed receiver differential pair (positive)
USB_SSRXM_UP	59	I	USB SuperSpeed receiver differential pair (negative)
USB_DP_UP	53	I/O	USB High-speed differential transceiver (positive)
USB_DM_UP	54	I/O	USB High-speed differential transceiver (negative)
USB_R1	64	I	Precision resistor reference. Connect a 9.53kΩ ±1% resistor between USB_R1 and GND.
USB_VBUS	48	I	USB upstream port power monitor. The VBUS detection requires a voltage divider. The signal USB_VBUS must be connected to VBUS through a 90.9KΩ ±1% resistor, and to ground through a 10kΩ ±1% resistor from the signal to ground.
USB Downstream Signals			
USB_SSTXP_DN1	3	O	USB SuperSpeed transmitter differential pair (positive)
USB_SSTXM_DN1	4	O	USB SuperSpeed transmitter differential pair (negative)
USB_SSRXP_DN1	6	I	USB SuperSpeed receiver differential pair (positive)
USB_SSRXM_DN1	7	I	USB SuperSpeed receiver differential pair (negative)
USB_DP_DN1	1	I/O	USB High-speed differential transceiver (positive)
USB_DM_DN1	2	I/O	USB High-speed differential transceiver (negative)
PWRCTL1/BATEN1	36	I/O, PD	USB Port 1 Power On Control for Downstream Power/Battery Charging Enable. The pin is used for control of the downstream power switch for Port 1. This pin be left unconnected if power management is not implemented. In addition, the value of the pin is sampled at the deassertion of reset to determine the value of the battery charging support for Port 1 as indicated in the Battery Charging Support register: 0 = Battery charging not supported 1 = Battery charging supported
OVERCUR1z	46	I, PU	USB Port 1 Overcurrent Detection. This pin is typically connected to the overcurrent output of the downstream port power switch for Port 1. 0 = An overcurrent event has occurred 1 = An overcurrent event has not occurred When GANGED power management is enabled, this pin or one of the other OVERCURz pins must be connected to the overcurrent output of the power switch or circuit which detects the overcurrent conditions. For the case when another OVERCURz pin is used, this pin can be left unconnected.
USB_SSTXP_DN2	11	O	USB SuperSpeed transmitter differential pair (positive)
USB_SSTXM_DN2	12	O	USB SuperSpeed transmitter differential pair (negative)
USB_SSRXP_DN2	14	I	USB SuperSpeed receiver differential pair (positive)
USB_SSRXM_DN2	15	I	USB SuperSpeed receiver differential pair (negative)
USB_DP_DN2	9	I/O	USB High-speed differential transceiver (positive)
USB_DM_DN2	10	I/O	USB High-speed differential transceiver (negative)
PWRCTL2/BATEN2	35	I/O, PD	USB Port 2 Power On Control for Downstream Power/Battery Charging Enable. The pin is used for control of the downstream power switch for Port 2. This pin be left unconnected if power management is not implemented. In addition, the value of the pin is sampled at the deassertion of reset to determine the value of the battery charging support for Port 2 as indicated in the Battery Charging Support register: 0 = Battery charging not supported 1 = Battery charging supported

Product Folder Links: *TUSB8042A*

Table 5-1. Pin Functions (continued)

PIN		I/O	DESCRIPTION
NAME	NO.		
OVERCUR2z	47	I, PU	USB Port 2 Overcurrent Detection. This pin is typically connected to the overcurrent output of the downstream port power switch for Port 2. 0 = An overcurrent event has occurred 1 = An overcurrent event has not occurred When GANGED power management is enabled, this pin or one of the other OVERCURz pins must be connected to the overcurrent output of the power switch or circuit which detects the overcurrent conditions. For the case when another OVERCURz pin is used, this pin can be left unconnected.
USB_SSTXP_DN3	19	O	USB SuperSpeed transmitter differential pair (positive)
USB_SSTXM_DN3	20	O	USB SuperSpeed transmitter differential pair (negative)
USB_SSRXP_DN3	22	I	USB SuperSpeed receiver differential pair (positive)
USB_SSRXM_DN3	23	I	USB SuperSpeed receiver differential pair (negative)
USB_DP_DN3	17	I/O	USB High-speed differential transceiver (positive)
USB_DM_DN3	18	I/O	USB High-speed differential transceiver (negative)
PWRCTL3/BATEN3	33	I/O, PD	USB Port 3 Power On Control for Downstream Power/Battery Charging Enable. The pin is used for control of the downstream power switch for Port 3. This pin be left unconnected if power management is not implemented. In addition, the value of the pin is sampled at the deassertion of reset to determine the value of the battery charging support for Port 3 as indicated in the Battery Charging Support register: 0 = Battery charging not supported 1 = Battery charging supported
OVERCUR3z	44	I, PU	USB Port 3 Overcurrent Detection. This pin is typically connected to the overcurrent output of the downstream port power switch for Port 3. 0 = An overcurrent event has occurred 1 = An overcurrent event has not occurred When GANGED power management is enabled, this pin or one of the other OVERCURz pins must be connected to the overcurrent output of the power switch or circuit which detects the overcurrent conditions. For the case when another OVERCURz pin is used, this pin can be left unconnected.
USB_SSTXP_DN4	26	O	USB SuperSpeed transmitter differential pair (positive)
USB_SSTXM_DN4	27	O	USB SuperSpeed transmitter differential pair (negative)
USB_SSRXP_DN4	29	I	USB SuperSpeed receiver differential pair (positive)
USB_SSRXM_DN4	30	I	USB SuperSpeed receiver differential pair (negative)
USB_DP_DN4	24	I/O	USB High-speed differential transceiver (positive)
USB_DM_DN4	25	I/O	USB High-speed differential transceiver (negative)
PWRCTL4/BATEN4	32	I/O, PD	USB Port 4 Power On Control for Downstream Power/Battery Charging Enable. The pin is used for control of the downstream power switch for Port 4. This pin be left unconnected if power management is not implemented. In addition, the value of the pin is sampled at the deassertion of reset to determine the value of the battery charging support for Port 4 as indicated in the Battery Charging Support register: 0 = Battery charging not supported 1 = Battery charging supported

Table 5-1. Pin Functions (continued)

PIN		I/O	DESCRIPTION
NAME	NO.		
OVERCUR4z	43	I, PU	USB Port 4 Overcurrent Detection. This pin is typically connected to the overcurrent output of the downstream port power switch for Port 4. 0 = An overcurrent event has occurred 1 = An overcurrent event has not occurred When GANGED power management is enabled, this pin or one of the other OVERCURz pins must be connected to the overcurrent output of the power switch or circuit which detects the overcurrent conditions. For the case when another OVERCURz pin is used, this pin can be left unconnected.
I²C/SMBUS I²C Signals			
SCL/SMBCLK	38	I/O, PD	I²C clock/SMBus clock. Function of pin depends on the setting of the SMBUSz input. When SMBUSz = 1, this pin acts as the serial clock interface for an I²C EEPROM. When SMBUSz = 0, this pin acts as the serial clock interface for an SMBus host. Can be left unconnected if external interface not implemented.
SDA/SMBDAT	37	I/O, PD	I²C data/SMBus data. Function of pin depends on the setting of the SMBUSz input. When SMBUSz = 1, this pin acts as the serial data interface for an I²C EEPROM. When SMBUSz = 0, this pin acts as the serial data interface for an SMBus host. Can be left unconnected if external interface not implemented.
SMBUSz/SS_SUSPEND	39	I/O, PU	I²C/SMBus mode select/SuperSpeed USB Suspend Status. The value of the pin is sampled at the deassertion of reset set I²C or SMBus mode as follows: 1 = I²C Mode Selected 0 = SMBus Mode Selected Can be left unconnected if external interface not implemented. After reset, this signal indicates the SuperSpeed USB Suspend status of the upstream port if enabled through the stsOutputEn bit in the Additional Feature Configuration register. When enabled, a value of 1 indicates the connection is suspended.
Test and Miscellaneous Signals			
FULLPWRMGMTz/ FULLAUTOz/SMBA1/ SS_UP	40	I/O, PD	Full power management enable/SMBus address bit 1/SuperSpeed USB Connection Status Upstream port. The value of the pin is sampled at the deassertion of reset to set the power switch control follows: 0 = Power switching and overcurrent inputs supported 1 = Power switching and overcurrent inputs not supported Full power management is the ability to control power to the downstream ports of the TUSB8042A using PWRCTL[4:1]/BATEN[4:1]. If BATENx = 1 on any port, full power management must be enabled so the value of the terminal is sampled at the deassertion to initialize the value of the FULLAUTOz bit. When AUTOENz = 0 and FULLAUTOz = 0: all ACP modes are supported. When AUTOENz = 0 and FULLAUTOz = 1: only highest current ACP mode is used in auto mode. When SMBus mode is enabled, this pin sets the value of the SMBus target address bit 1. Can be left unconnected if full power management and SMBus are not implemented. After reset, this signal indicates the SuperSpeed USB connection status of the upstream port if enabled through the stsOutputEn bit in the Additional Feature Configuration register. When enabled a value of 1 indicates the upstream port is connected to a SuperSpeed USB capable port. Note: Power switching must be supported for battery charging applications.
PWRCTL_POL	41	I/O, PU	Power Control Polarity. The value of the pin is sampled at the deassertion of reset to set the polarity of PWRCTL[4:1]. 0 = PWRCTL polarity is active low 1 = PWRCTL polarity is active high

Product Folder Links: *TUSB8042A*

Table 5-1. Pin Functions (continued)

PIN		I/O	DESCRIPTION
NAME	NO.		
GANGED/SMBA2/ HS_UP	42	I/O, PD	Ganged operation enable/SMBus Address bit 2/HS Connection Status Upstream Port. The value of the pin is sampled at the deassertion of reset to set the power switch and overcurrent detection mode as follows: 0 = Individual power control supported when power switching is enabled 1 = Power control gangs supported when power switching is enabled When SMBus mode is enabled using SMBUSz, this pin sets the value of the SMBus target address bit 2. After reset, this signal indicates the High-speed USB connection status of the upstream port if enabled through the stsOutputEn bit in Additional Feature Configuration register. When enabled, a value of 1 indicates the upstream port is connected to a High-speed USB capable port. Note: Individual power control must be enabled for battery-charging applications.
AUTOENz/ HS_SUSPEND	45	I/O, PU	Automatic Charge Mode Enable/HS Suspend Status. The value of the pin is sampled at the deassertion of reset to determine if automatic mode is enabled as follows: 0 = Automatic Mode is enabled on ports that are enabled for battery charging when the hub is unconnected. Please note that CDP is not supported on Port 1 when operating in Automatic mode. 1 = Automatic Mode is disabled This value is also used to set the autoEnz bit in the Battery Charging Support Register. After reset, this signal indicates the High-speed USB Suspend status of the upstream port if enabled through the stsOutputEn bit in Additional Feature Configuration register. When enabled, a value of 1 indicates the connection is suspended.
TEST	49	I	This pin is reserved for factory test. For normal operation, this pin requires an external pulldown resistor to ground on PCB. Recommend 10k or stronger resistor.
Power and Ground Signals			
VDD	5, 8, 13, 21, 28, 31, 51, 57	PWR	1.1V power rail
VDD33	16, 34, 52, 63	PWR	3.3V power rail
VSS (Thermal Pad)		PWR	Ground. Thermal pad must be connected to ground.
NC	60	—	No connect, leave floating

6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)[1]

		MIN	MAX	UNIT
Supply voltage range	V_{DD} Supply voltage range	−0.3	1.4	V
	V_{DD33} Supply voltage range	−0.3	3.8	V
Voltage range	USB_SSRXP_UP, USB_SSRXN_UP, SSRXP_DN[4:1], USB_RXN_DP[4:1] and USB_VBUS terminals	−0.3	1.4	V
	XI terminal	−0.3	2.45	V
	All other terminals	−0.3	3.8	V
T_{stg}	Storage temperature	−65	150	°C

(1) Operation outside the Absolute Maximum Ratings may cause permanent device damage. Absolute Maximum Ratings do not imply functional operation of the device at these or any other conditions beyond those listed under Recommended Operating Conditions. If used outside the Recommended Operating Conditions but within the Absolute Maximum Ratings, the device may not be fully functional, and this may affect device reliability, functionality, performance, and shorten the device lifetime.

6.2 ESD Ratings

			VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins[1]	±2000	V
		Charged device model (CDM), per ANSI/ESDA/JEDEC JS-002, all pins[2]	±500	

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

		MIN	NOM	MAX	UNIT
V_{DD}	1.1V Supply voltage	0.99	1.1	1.26	V
V_{DD33}	3.3V Supply voltage	3.0	3.3	3.6	V
USB_VBUS	Voltage at USB_VBUS terminal.	0		1.155	V
T_A	TUSB8042A Ambient temperature	0		70	°C
T_A	TUSB8042AI Ambient temperature	−40		85	°C
T_J	Junction temperature	−40		105	°C

6.4 Thermal Information

	THERMAL METRIC[1]	TUSB8042A	UNIT
		RGC	
		64 PINS	
$R_{\theta JA}$	Junction-to-ambient thermal resistance	26	°C/W
$R_{\theta JC(top)}$	Junction-to-case (top) thermal resistance	11.5	°C/W
$R_{\theta JB}$	Junction-to-board thermal resistance	5.3	°C/W
Ψ_{JT}	Junction-to-top characterization parameter	0.2	°C/W
Ψ_{JB}	Junction-to-board characterization parameter	5.2	°C/W
$R_{\theta JC(bot)}$	Junction-to-case (bottom) thermal resistance	1.0	°C/W

(1) For more information about traditional and new thermal metrics, see the Semiconductor and IC Package Thermal Metrics application note.

6.5 Electrical Characteristics

over operating free-air temperature and voltage range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
Low Power Modes						
I_{DD_PWRON}	V_{DD} current after power On (after reset)	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		18		mA
I_{DD33_PWRON}	V_{DD33} current after power On (after reset)	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		2		mA
I_{DD_UPDISC}	V_{DD} current when upstream port is disconnected	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		21		mA
I_{DD33_UPDISC}	V_{DD33} current when upstream port is disconnected	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		2		mA
$I_{DD\_SUSPEND}$	V_{DD} current in suspend	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		20		mA
$I_{DD33\_SUSPEND}$	V_{DD33} current in suspend	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		2		mA
Active Power Modes (US State / DS State)						
I_{DD_SMBUS}	V_{DD} current during SMbus programming.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		275		mA
I_{DD33_SMBUS}	V_{DD33} current during SMbus programming	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		75		mA
$I_{DD\_3H\_1SS\_0HS\_U12}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 1 SS device, and 0 HS device. Links in U1/U2.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		215		mA
$I_{DD33\_3H\_1SS\_0HS\_U12}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 1 SS device, and 0 HS device. Links in U1/U2.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_1SS\_0HS\_U0}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 1 SS device, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		330		mA
$I_{DD33\_3H\_1SS\_0HS\_U0}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 1 SS device, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_2SS\_0HS\_U12}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 2 SS devices, and 0 HS device. Links in U1/U2	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		301		mA
$I_{DD33\_3H\_2SS\_0HS\_U12}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 2 SS devices, and 0 HS device. Links in U1/U2	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_2SS\_0HS\_U0}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 2 SS devices, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		440		mA
$I_{DD33\_3H\_2SS\_0HS\_U0}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 2 SS devices, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_3SS\_0HS\_U12}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 3 SS devices, and 0 HS device. Links in U1/U2	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		360		mA

Product Folder Links: *TUSB8042A*

over operating free-air temperature and voltage range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{DD33\_3H\_3SS\_0HS\_U12}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 3 SS devices, and 0 HS device. Links in U1/U2	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_3SS\_0HS\_U0}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 3 SS devices, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		560		mA
$I_{DD33\_3H\_3SS\_0HS\_U0}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 3 SS devices, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_4SS\_0HS\_U12}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 4 SS devices, and 0 HS device. Links in U1/U2	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		467		mA
$I_{DD33\_3H\_4SS\_0HS\_U12}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 4 SS devices, and 0 HS device. Links in U1/U2	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_4SS\_0HS\_U0}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 4 SS devices, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		650		mA
$I_{DD33\_3H\_4SS\_0HS\_U0}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 4 SS devices, and 0 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_3H\_1SS\_1HS\_U0}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 1 SS device, and 1 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		372		mA
$I_{DD33\_3H\_1SS\_1HS\_U0}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 1 SS devices, and 1 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		84		mA
$I_{DD\_3H\_1SS\_2HS\_U0}$	V_{DD} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 2 SS device, and 2 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		480		mA
$I_{DD33\_3H\_1SS\_2HS\_U0}$	V_{DD33} current upstream port connected to USB 3.0 Host, downstream port(s) connected to 2 SS devices, and 2 HS device. Links in U0.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		95		mA
$I_{DD\_2H\_0SS\_1HS}$	V_{DD} current upstream port connected to USB 2.0 Host, downstream port(s) connected to 0 SS device, and 1 HS device.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD33\_2H\_0SS\_1HS}$	V_{DD33} current upstream port connected to USB 2.0 Host, downstream port(s) connected to 0 SS devices, and 1 HS device.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		45		mA
$I_{DD\_2H\_0SS\_4HS}$	V_{DD} current upstream port connected to USB 2.0 Host, downstream port(s) connected to 0 SS device, and 4 HS device.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		74		mA

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over operating free-air temperature and voltage range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$I_{DD33\_2H\_0SS\_4HS}$	V_{DD33} current upstream port connected to USB 2.0 Host, downstream port(s) connected to 0 SS devices, and 4 HS device.	V_{DD} = 1.1V; V_{DD33} = 3.3V; T_A = 25°C;		76		mA
3.3V I/O						
V_{IH}	High-level input voltage[1]		2		3.6	V
V_{IL}	Low-level input voltage[1]		0		0.8	V
V_I	Input voltage		0		3.6	V
V_O	Output voltage[2]		0		3.6	V
t_t	Input transition time (t_{RISE} and t_{FALL})				25	ns
V_{HYS}	Input hysteresis[3]				0.13 x V_{DD33}	V
V_{OH}	High-level output voltage	I_{OH} = –4 mA	2.4			V
V_{OL}	Low-level output voltage	I_{OH} = 4 mA			0.4	V
I_{OZP}	High-impedance output current with internal pullup or pulldown resistor.[4]	V_I = 0 to V_{DD33};	–250		250	µA
I_I	Input current[5]	V_I = 0 to V_{DD33};	–15		15	µA
R_{PD}	Internal pulldown resistance		13.5	19	27.5	kΩ
R_{PU}	Internal pullup resistance		14.5	19	25	kΩ

(1)   Applies to external inputs and bidirectional buffers
(2)   Applies to external outputs and bidirectional buffers
(3)   Applies to GRSTZ
(4)   Applies to pins with internal pullups/pulldowns.
(5)   Applies to external input buffers

6.6 Timing Requirements

		MIN	NOM	MAX	UNIT
Power-on timings. Refer to Figure 6-1					
t_{d1}	V_{DD} stable before V_{DD33} stable. [2] [3]	0			ms
t_{d2}	V_{DD} and V_{DD33} before deassertion of GRSTz.	3			ms
t_{su_io}	Setup for MISC inputs. [1]	0.1			µs
t_{hd_io}	Hold for MISC inputs. [1]	0.1			µs
t_{VDD33_RAMP}	V_{DD33} supply ramp requirement.	0.2		100	ms
t_{VDD_RAMP}	V_{DD} supply ramp requirement.	0.2		100	ms

(1)   MISC pins sampled at deassertion of GRSTz: BATEN[4:1], AUTOENz, FULLPWRMGMTz, GANGED, SMBUSz, and PWRCTL_POL.
(2)   As long as GRSTz is deasserted after both supplies are stable, there is no power-on relationship between V_{DD33} and V_{DD}. If GRSTz is only connected to a capacitor to GND, then V_{DD} must be stable minimum of 10 µs before V_{DD33}.
(3)   An active reset is required if the V_{DD33} supply is stable before V_{DD} supply. This active reset shall meet the 3 ms power-up delay counting from both power supplies stable to deassertion of GRSTz.
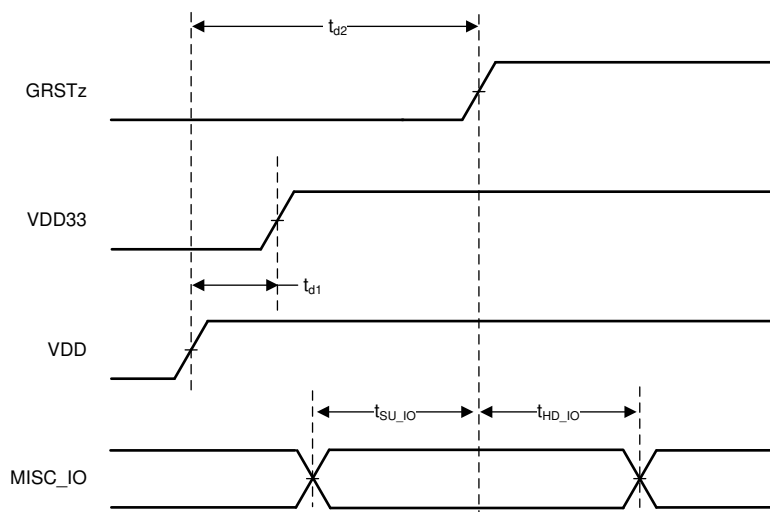
6.7 Timing Diagrams

Figure 6-1. Power-Up Timing Requirements

7 Detailed Description

7.1 Overview

The TUSB8042A is a four-port USB 3.2 x1 Gen1-compliant hub. The device provides simultaneous SuperSpeed USB, high-speed, or full-speed connections on the upstream port. The device also provides SuperSpeed USB, high-speed, full-speed, or low-speed connections on the downstream port. When the upstream port is connected to an electrical environment that only supports high-speed, full-speed, or low-speed connections, SuperSpeed USB connectivity is disabled on the downstream ports. When the upstream port is connected to an electrical environment that only supports full-speed or low-speed connections, SuperSpeed USB and high-speed connectivity are disabled on the downstream ports.

7.2 Functional Block Diagram
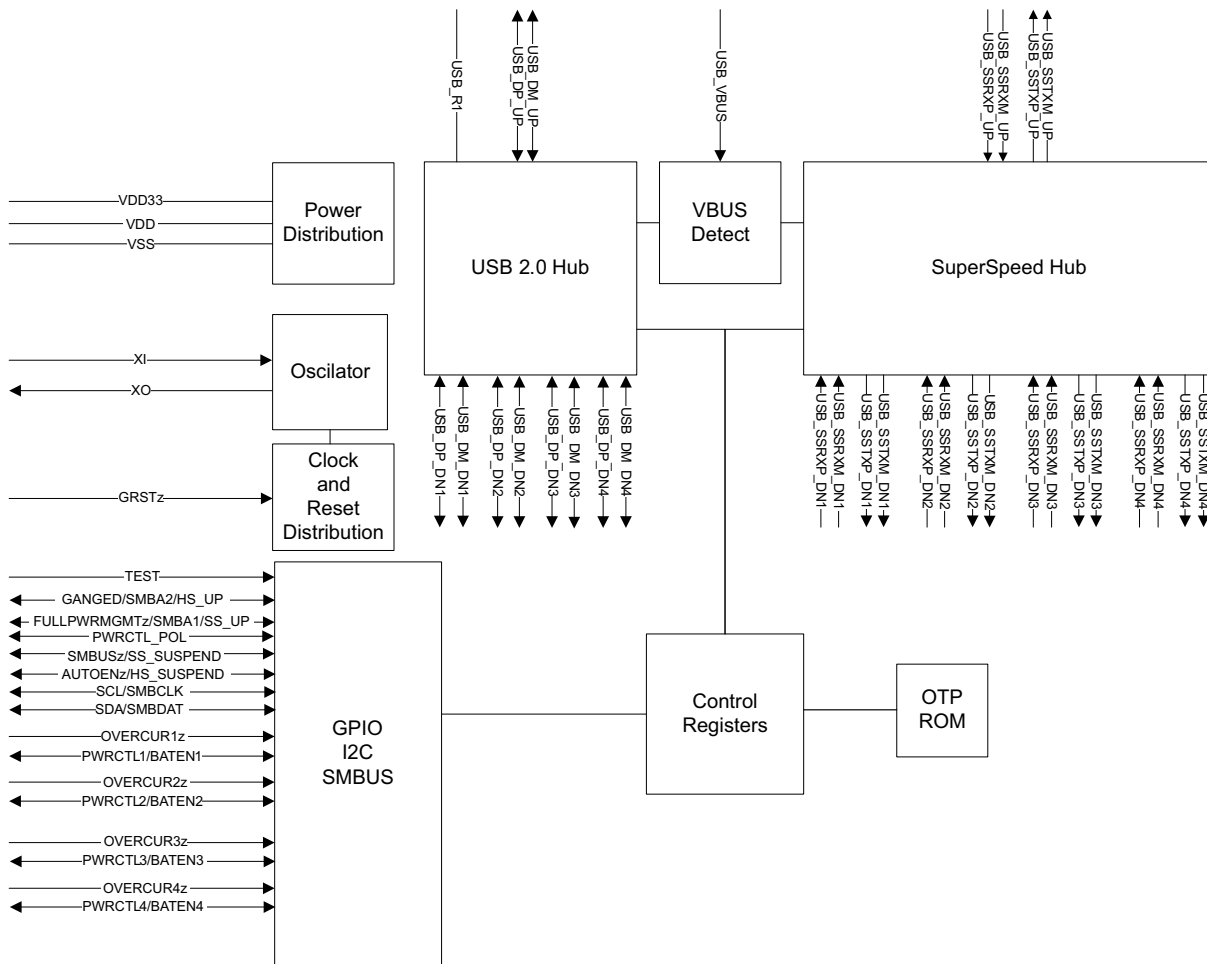
7.3 Feature Description

7.3.1 Battery Charging Features

The TUSB8042A provides support for USB Battery Charging (BC1.2) and custom charging. Battery charging support can be enabled on a per port basis through the REG_6h(batEn[3:0]) or the BATEN[4:1] pins.

USB Battery charging support includes both Charging Downstream Port (CDP) and Dedicated Charging Port (DCP) modes. The DCP mode is compliant with the Chinese Telecommunications Industry Standard YD/T 1591-2009. CDP is enabled when the upstream port has detected valid VBUS, configured, and host sets port power. When the upstream port is not connected and battery charging support is enabled, the TUSB8042A enables DCP mode once all other battery modes such as ACPx have failed or are disabled.

In addition to USB Battery charging (BC1.2), the TUSB8042A supports custom charging indications: Divider Charging (ACP3, ACP2, ACP1 modes), and Galaxy compatible charging. These custom charging modes are only supported when upstream port is unconnected and AUTOMODE is enabled. AUTOMODE can be enabled either thru AUTOENz pin or from Reg_0Ah bit 1 (autoModeEnz) . When in AUTOMODE and upstream port is disconnected, the port automatically transitions from ACP mode to the DCP mode depending on the portable device connected. The divided mode places a fixed DC voltage on the ports DP and DM signals which allows some devices to identify the capabilities of the charger. The default divider mode indicates support for up to 10W (ACP3). The divider mode can be configured to report a lower-current setting (up to 5 W) through REG_0Ah (HiCurAcpModeEn).

When the upstream port is not connected and battery charging support is enabled for a port, the TUSB8042A drives the port power enable active. If AUTOMODE is disabled, then DCP mode is used. If AUTOMODE is enabled and fully automatic mode is disabled (FullAutoEn bit is cleared (Reg_25h Bit 0) or FULLAUTOz pin = 0), then TUSB8042A starts with highest enabled divider current mode (ACPx). The TUSB8042A remains in highest current mode as long as a pullup is not detected on DP pin. If an pullup is detected on DP pin, then TUSB8042A drives the port power enable inactive and switch to Galaxy mode, if enabled, or to DCP mode if Galaxy mode is disabled. The TUSB8042A again drives the port power enable active. The TUSB8042A remains in Galaxy mode as long as no pullup is detected on DP pin. If an pullup is detected on DP pin, then TUSB8042A drives the port power enable inactive and transition to DCP mode. The TUSB8042A again drives the port power enable active. In DCP mode, the TUSB8042A looks for a pullup detected on DP pin or RxVdat. If a pullup or RxVdat is detected on DP, the TUSB8042A remains in DCP mode. If no pullup or RxVdat is detected on DP pin after 2 seconds, the TUSB8042A drives the port power enable inactive and transition back to ACPx mode. This sequence repeats until upstream port is connected.

When Automatic mode is enabled and full automatic mode is enabled (FullAutoEn Reg_25h bit 0 is set or FULLAUTOz pin = 1), TUSB8042A performs same sequence described in previous paragraph with the addition of attempting all supported ACPx modes before sequencing to Galaxy Mode (if enabled) or DCP mode.

The supported battery charging modes when TUSB8042A configured for SMBus or external EEPROM is detailed in Table 7-1.

The supported battery charging modes when TUSB8042A configured for I^{2}C but without an external EEPROM is determined by the sampled state of the pins. These modes are detailed in Table 7-2.

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Table 7-1. TUSB8042A Battery Charging Modes with SMBus or I²C EEPROM

batEn[n] Reg_06h Bits 3:0	Upstream VBUS	HiCurAcpMode En Reg_0Ah Bit 4	autoModeEnz Reg_0Ah Bit 1	FullAutoEn Reg_25h Bit 0	Galaxy_Enz Reg_25h Bit 1	Battery Charging Mode Port x (x = n + 1)
0	Don't Care	Don't Care	Don't Care	Don't Care	Don't Care	No Charging support
1	> 4V	Don't Care	Don't Care	Don't Care	Don't Care	CDP
1	< 4V	Don't Care	1	Don't Care	Don't Care	DCP
1	< 4V	Don't Care	0	1	1	AUTOMODE enabled. Sequences through all ACPx modes and DCP Alternate ACP3, ACP2, ACP1, DCP
1	< 4V	0	0	0	1	AUTOMODE enabled. Sequences between ACP2 and DCP. Alternate ACP2, DCP
1	< 4V	1	0	0	1	AUTOMODE enabled. Sequences between ACP3 and DCP. Alternate ACP3, DCP
1	< 4V	Don't Care	0	1	0	AUTOMODE enabled with Galaxy compatible charging support. Alternate ACP3, ACP2, ACP1, Galaxy, DCP
1	< 4V	0	0	0	0	AUTOMODE enabled with Galaxy compatible charging support. Alternate ACP2, Galaxy, DCP
1	< 4V	1	0	0	0	AUTOMODE enabled with Galaxy compatible charging support. Alternate ACP3, Galaxy, DCP

Table 7-2. TUSB8042A Battery Charging Modes without EEPROM

BATEN[3:0] pins	Upstream VBUS	AUTOENz pin	FULLAUTOz pin	Battery Charging Mode Port x (x = n + 1)
0	Don't Care	Don't Care	Don't Care	No Charging support
1	> 4V	Don't Care	Don't Care	CDP
1	< 4V	1	0	DCP
1	< 4V	0	0	AUTOMODE enabled with Galaxy compatible charging support. Sequences through all ACPx modes. Alternate ACP3, ACP2, ACP1, Galaxy, DCP.
1	< 4V	0	1	AUTOMODE enabled with Galaxy compatible charging support. Alternate ACP3, Galaxy, DCP
1	< 4V	1	1	AUTOMODE enabled. Sequences through all ACPx modes. Alternate ACP3, ACP2, ACP1, DCP.

7.3.2 USB Power Management

The TUSB8042A can be configured for power switched applications using either per-port (Full power managed) or ganged power-enable controls and overcurrent status inputs. When battery charge is enabled, the TUSB8042A always functions in full power managed.

Power switch support is enabled by REG_5h (fullPwrMgmtz) and the per-port or ganged mode is configured by REG_5h (ganged).

The TUSB8042A supports both active high and active low power-enable controls. The PWRCTL[4:1] polarity is configured by REG_Ah (pwrctlPol). The power control polarity can also be selected by the PWRCTL_POL pin.

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7.3.3 One-Time Programmable (OTP) Configuration

The TUSB8042A allows device configuration through one-time programmable non-volatile memory (OTP). The programming of the OTP is supported using vendor-defined USB device requests. For details using the OTP features please contact your TI representative.

Table 7-3 provides a list features which can be configured using the OTP.

Table 7-3. OTP Configurable Features

CONFIGURATION REGISTER OFFSET	BIT FIELD	DESCRIPTION
REG_01h	[7:0]	Vendor ID LSB
REG_02h	[7:0]	Vendor ID MSB
REG_03h	[7:0]	Product ID LSB
REG_04h	[7:0]	Product ID MSB
REG_07h	[0]	Port removable configuration for downstream ports 1. OTP configuration is inverse of rmbl[3:0]; that is, 1 = not removable, 0 = removable.
REG_07h	[1]	Port removable configuration for downstream ports 2. OTP configuration is inverse of rmbl[3:0]; that is, 1 = not removable, 0 = removable.
REG_07h	[2]	Port removable configuration for downstream ports 3. OTP configuration is inverse of rmbl[3:0]; that is, 1 = not removable, 0 = removable.
REG_07h	[3]	Port removable configuration for downstream ports 4. OTP configuration is inverse of rmbl[3:0]; that is, 1 = not removable, 0 = removable.
REG_08h	[3:0]	Port used Configured register.
REG_0Ah	[1]	Battery Charger Automatic Mode enable.
REG_0Ah	[4]	High-current divider mode enable.
REG_0Bh	[0]	USB 2.0 port polarity configuration for upstream port.
REG_0Bh	[1]	USB 2.0 port polarity configuration for downstream ports 1.
REG_0Bh	[2]	USB 2.0 port polarity configuration for downstream ports 2.
REG_0Bh	[3]	USB 2.0 port polarity configuration for downstream ports 3.
REG_0Bh	[4]	USB 2.0 port polarity configuration for downstream ports 4.
REG_25h	[4:0]	Device Configuration Register 3
REG_26h	[3:0]	USB2.0 Only Port Register
REG_F0h	[3:1]	USB BC power switch power off duration during automode.

7.3.4 Clock Generation

The TUSB8042A accepts a crystal input to drive an internal oscillator or an external clock source. If a clock is provided to XI instead of a crystal, XO is left open. Otherwise, if a crystal is used, the connection must to follow the guidelines below. The XI and XO are coupled to other leads and supplies on the PCB, therefore it is important to keep them as short as possible and away from any switching leads. TI also recommends to minimize the capacitance between XI and XO by shielding C1 and C2 with the clean ground lines.
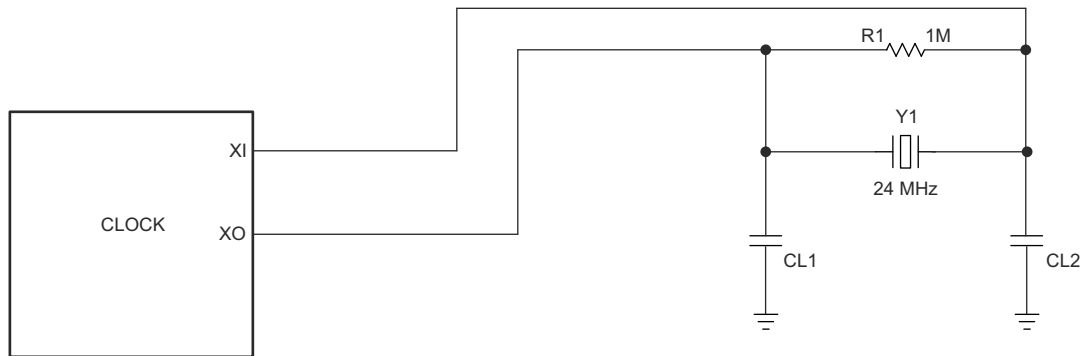
Figure 7-1. TUSB8042A Clock

7.3.5 Crystal Requirements

The crystal must be fundamental mode with load capacitance of 12pF to 24pF and frequency stability rating of ±100PPM or better. To ensure proper start-up oscillation condition, a maximum crystal equivalent series resistance (ESR) of 50Ω is recommended. Use a parallel load capacitor if a crystal source is used. The exact load capacitance value used depends on the crystal vendor. Refer to the *Selection and Specification for Crystals for Texas Instruments USB2.0 Devices* application note for details on how to determine the load capacitance value.

7.3.6 Input Clock Requirements

When using an external clock source such as an oscillator, make sure the reference clock has ±100PPM or better frequency stability, less than 50ps absolute peak-to-peak jitter, or less than 25ps peak-to-peak jitter after applying the USB 3.2 Gen1 jitter transfer function. TI recommends to tie XI to the 1.8V clock source and to leave the XO floating.

7.3.7 Power-Up and Reset

The TUSB8042A does not have specific power sequencing requirements with respect to the core power (VDD) or I/O and analog power (VDD33) as long as GRSTz is held in an asserted state while supplies ramp. The core power (VDD) or I/O power (VDD33) can be powered up for an indefinite period of time while the other is not powered up if all of these constraints are met:

- All maximum ratings and recommended operating conditions are observed.
- All warnings about exposure to maximum rated and recommended conditions are observed, particularly junction temperature. These apply to power transitions as well as normal operation.
- Bus contention while VDD33 is powered up must be limited to 100 hours over the projected life-time of the device.
- Bus contention while VDD33 is powered down may violate the absolute maximum ratings.

A supply bus is powered up when the voltage is within the recommended operating range. The supply bus is powered down when the voltage is below that range, either stable or in transition.

A minimum reset duration of 3ms is required. This is defined as the time when the power supplies are in the recommended operating range to the deassertion of GRSTz. This can be generated using programmable-delay supervisory device or using an RC circuit. When a RC circuit is used, the external capacitor size chosen must be large enough to meet the 3ms minimum duration requirement. The R of the RC circuit is the internal R_{PU}.

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7.4 Device Functional Modes

7.4.1 External Configuration Interface

The TUSB8042A supports a serial interface for configuration register access. The device can be configured by an attached I^2C EEPROM or accessed as a target by an external SMBus controller. The external interface is enabled when both the SCL/SMBCLK and SDA/SMBDAT pins are pulled up to 3.3V at the deassertion of reset. The mode, I^2C controller or SMBus target, is determined by the state of SMBUSz/SS_SUSPEND pin at reset.

7.4.2 I^2C EEPROM Operation

The TUSB8042A supports a single-controller, standard mode (100KHz) or fast mode (400KHz) connection to a dedicated I^2C EEPROM when the I^2C interface mode is enabled. In I^2C mode, the TUSB8042A reads the contents of the EEPROM at bus address 1010000b using 7-bit addressing starting at address 0. The TUSB8042A reads the entire EEPROM contents using a single burst read transaction. The burst read transaction ends when the address reaches FFh .

If the value of the EEPROM contents at address byte 00h equals 55h, the TUSB8042A loads the configuration registers according to the EEPROM map. If the first byte is not 55h, the TUSB8042A exits the I^2C mode and continues execution with the default values in the configuration registers. The hub is not connect on the upstream port until the configuration is completed.

Note

The bytes located above offset Ah are optional. The requirement for data in those addresses is dependent on the options configured in the Device Configuration, and Device Configuration 2 registers.

The minimum size I^2C EEPROM required is 2Kbit.

For details on I^2C operation refer to the UM10204 I^2C-bus Specification and User Manual.

7.4.3 Port Configuration

The TUSB8042A port configurations can be selected by registers or efuse. The Port Used Configuration register (USED[3:0]) define how many ports can possibly be reported by the hub. The device removable configuration register (RMBL[3:0]) define if the ports that USB 3.2 are reported as used have permanently connected devices or not. The USB 2.0 Only Port register (USB2_ONLY[3:0]) define whether or not a used port is reported as part of the USB 2.0 hub or both the USB2.0 and SS hubs. The USB2_ONLY field enables the USB2.0 port even if the corresponding USED bit is low. Table 7-4 shows examples of the possible combinations.

Table 7-4. TUSB8042A Downstream Port Configuration Examples

USED[3:0]	RMBL[3:0]	USB2_ONLY [3:0]	Reported Port Configuration	Physical to Logical Port mapping
1111	1111	0000	4 Port USB 3.2 Hub 4 Port USB2.0 Hub	Physical1 => Logical Port1 for USB 3.2 and USB2.0. Physical2 => Logical Port2 for USB 3.2 and USB2.0. Physical3 => Logical Port3 for USB 3.2 and USB2.0. Physical4 => Logical Port4 for USB 3.2 and USB2.0.
1110	1111	0000	3 Port USB 3.2 Hub 3 Port USB2.0 Hub	Physical1 Not used. Physical2 => Logical Port1 for USB 3.2 and USB2.0. Physical3 => Logical Port2 for USB 3.2 and USB2.0. Physical4 => Logical Port3 for USB 3.2 and USB2.0.
1100	0111	0000	2 Port USB 3.2 Hub 2 Port USB2.0 hub with permanently attached device on Port 2	Physical1 Not used. Physical2 Not used. Physical3 => Logical Port1 for USB 3.2 and USB2.0. Physical4 => Logical Port2 for USB 3.2 and USB2.0.
0011	1111	0010	1 Port USB 3.2 Hub 2 Port USB 2.0 Hub	Physical1 => Logical Port1 for USB 3.2 and USB2.0. Physical2 => Logical Port2 for USB2.0. Physical3 Not Used. Physical4 Not used.
1000	1111	0010	1 Port USB 3.2 Hub 2 Port USB 2.0 Hub	Physical1 Not used. Physical2 => Logical Port2 for USB2.0. Physical3 Not used Physical4 => Logical Port1 for USB 3.2 and USB2.0.
1111	1111	1110	1 Port USB 3.2 Hub 4 Port USB 2.0 Hub	Physical1 => Logical Port1 for USB 3.2 and USB2.0. Physical2 => Logical Port2 for USB2.0. Physical3 => Logical Port3 for USB2.0. Physical4 => Logical Port4 for USB2.0.

7.4.4 SMBus Target Operation

When the SMBus interface mode is enabled, the TUSB8042A supports read block and write block protocols as a target-only SMBus device.

The TUSB8042A target address is 1000 1xyz, where:
- x is the state of GANGED/SMBA2/HS_UP pin at reset,
- y is the state of FULLPWRMGMTz/SMBA1/SS_UP pin at reset, and
- z is the read/write bit; 1 = read access, 0 = write access.

For details on SMBus requirements, refer to the System Management Bus Specification.

Note

If the TUSB8042A is addressed by a host using an unsupported protocol, the device does not respond. The TUSB8042A waits indefinitely for configuration by the SMBus host and does not connect on the upstream port until the SMBus host indicates configuration is complete by clearing the CFG_ACTIVE bit.

Product Folder Links: *TUSB8042A*

8 Register Maps

8.1 Configuration Registers

The internal configuration registers are accessed on byte boundaries. The configuration register values are loaded with defaults but can be overwritten when the TUSB8042A is in I^{2}C or SMBus mode. Refer to Table 7-3 for registers configurable from OTP.

Table 8-1. TUSB8042A Register Map

BYTE ADDRESS	CONTENTS	EEPROM CONFIGURABLE
00h	ROM Signature Register	Yes
01h	Vendor ID LSB	Yes
02h	Vendor ID MSB	Yes
03h	Product ID LSB	Yes
04h	Product ID MSB	Yes
05h	Device Configuration Register	Yes
06h	Battery Charging Support Register	Yes
07h	Device Removable Configuration Register	Yes
08h	Port Used Configuration Register	Yes
09h	Reserved. Must default to 00h.	Yes
0Ah	Device Configuration Register 2	Yes
0Bh	USB 2.0 Port Polarity Control Register	Yes
0Ch-0Fh	Reserved	No
10h-1Fh	UUID Byte [15:0]	No
20h-21h	LangID Byte [1:0]	Yes
22h	Serial Number Length	Yes
23h	Manufacturer String Length	Yes
24h	Product String Length	Yes
25h	Device Configuration Register 3	Yes
26h	USB 2.0 Only Port Register	Yes
27h-2Eh	Reserved	Yes
2Fh	Reserved	No
30h-4Fh	Serial Number String Byte [31:0]	Yes
50h-8Fh	Manufacturer String Byte [63:0]	Yes
90h-CFh	Product String Byte [63:0]	Yes
D0h-D4h	Reserved	Yes, but do not change default.
D5h-D7h	Reserved	No
D8h-DCh	Reserved	Yes, but do not change default.
DDh-EFh	Reserved	No
F0h	Additional Features Configuration Register	Yes
F1h-F7h	Reserved	No
F8h	SMBus Device Status and Command Register	No
F9h - FFh	Reserved	No

8.2 ROM Signature Register

Figure 8-1. Register Offset 0h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-2. Bit Descriptions – ROM Signature Register

Bit	Field	Type	Description
7:0	romSignature	RW	ROM Signature Register. This register is used by the TUSB8042A in I^{2}C 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 TUSB8042A aborts the EEPROM load and executes with the register defaults.

8.3 Vendor ID LSB Register

Figure 8-2. Register Offset 1h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	1	0	1	0	0	0	1

Table 8-3. Bit Descriptions – Vendor ID LSB Register

Bit	Field	Type	Description
7:0	vendorIdLsb	RO/RW	Vendor ID LSB. Least significant byte of the unique vendor ID assigned by the USB-IF; the default value of this register is 51h representing the LSB of the TI Vendor ID 0451h. The value can be overwritten to indicate a customer Vendor ID. Value used for this field is the non-zero value written by EEPROM/SMBus to both PID and VID. If a zero value is written by EEPROM/SMbus to both PID and VID, then value used for this field is the non-zero value from OTP. If a zero value is written by OTP, then value used for this field is 51h.

8.4 Vendor ID MSB Register

Figure 8-3. Register Offset 2h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	1	0	0

Table 8-4. Bit Descriptions – Vendor ID MSB Register

Bit	Field	Type	Description
7:0	vendorIdMsb	RO/RW	Vendor ID MSB. Most significant byte of the unique vendor ID assigned by the USB-IF; the default value of this register is 04h representing the MSB of the TI Vendor ID 0451h. The value can be overwritten to indicate a customer Vendor ID. Value used for this field is the non-zero value written by EEPROM/SMBus to both PID and VID. If a zero value is written by EEPROM/SMbus to both PID and VID, then value used for this field is the non-zero value from OTP. If a zero value is written by OTP, then value used for this field is 04h.

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8.5 Product ID LSB Register

Figure 8-4. Register Offset 3h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	1	0	0	0	0	0	0

Table 8-5. Bit Descriptions – Product ID LSB Register

Bit	Field	Type	Description
7:0	productIdLsb	RO/RW	Product ID LSB. Least significant byte of the product ID assigned by Texas Instruments and reported in the SuperSpeed Device descriptor. the default value of this register is 40h representing the LSB of the SuperSpeed product ID assigned by Texas Instruments The value reported in the USB 2.0 Device descriptor is the value of this register bit wise XORed with 00000010b. The value can be overwritten to indicate a customer product ID. Value used for this field is the non-zero value written by EEPROM/SMBus to both PID and VID. If a zero value is written by EEPROM/SMbus to both PID and VID, then value used for this field is the non-zero value from OTP. If a zero value is written by OTP, then value used for this field is 40h .

8.6 Product ID MSB Register

Figure 8-5. Register Offset 4h

Bit No.	7	6	5	4	3	2	1	0
Reset State	1	0	0	0	0	0	0	1

Table 8-6. Bit Descriptions – Product ID MSB Register

Bit	Field	Type	Description
7:0	productIdMsb	RO/RW	Product ID MSB. Most significant byte of the product ID assigned by Texas Instruments; the default value of this register is 82h representing the MSB of the product ID assigned by Texas Instruments. The value can be overwritten to indicate a customer product ID. Value used for this field is the non-zero value written by EEPROM/SMBus to both PID and VID. If a zero value is written by EEPROM/SMbus to both PID and VID, then value used for this field is the non-zero value from OTP. If a zero value is written by OTP, then value used for this field is 82h.

8.7 Device Configuration Register

Figure 8-6. Register Offset 5h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	1	X	X	0	0

Note

Reset state of REG_05h[1] for TUSB8042A is 0 and for TUSB8042A1 is 1.

Table 8-7. Bit Descriptions – Device Configuration Register

Bit	Field	Type	Description
7	customStrings	RW	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 0 = The Manufacturer String Length, Manufacturer String, Product String Length, Product String, and Language ID registers are read only 1 = The Manufacturer String Length, Manufacturer String, Product String Length, Product String, and Language ID registers can be loaded by EEPROM or written by SMBus The default value of this bit is 0.
6	customSernum	RW	Custom serial number enable. This bit controls the ability to write to the serial number registers. 0 = The Serial Number String Length and Serial Number String registers are read only 1 = Serial Number String Length and Serial Number String registers can be loaded by EEPROM or written by SMBus The default value of this bit is 0.
5	u1u2Disable	RW	U1 U2 Disable. This bit controls the U1/U2 support. 0 = U1/U2 support is enabled 1 = U1/U2 support is disabled When U1/U2 support is disabled, the TUSB8042A does not initiate or accept any U1 or U2 requests on any port, upstream or downstream, unless the device receives or sends a Force_LinkPM_Accept LMP. After receiving or sending an FLPMA LMP, the device continues to enable U1 and U2 according to USB 3.2 protocol until the device gets a power-on reset or is disconnected on the upstream port. When the TUSB8042A is in I^{2}C mode, the TUSB8042A loads this bit from the contents of the EEPROM. When the TUSB8042A is in SMBUS mode, the value can be overwritten by an SMBus host.
4	RSVD	RO	Reserved. This bit is reserved and returns 1 when read.
3	ganged	RW	Ganged. This bit is loaded at the deassertion of reset with the value of the GANGED/SMBA2/HS_UP pin. 0 = When fullPwrMgmtz = 0, each port is individually power switched and enabled by the PWRCTL[4:1]/BATEN[4:1] pins 1 = When fullPwrMgmtz = 0, the power switch control for all ports is ganged and enabled by the PWRCTL[4:1]/BATEN1 pin When the TUSB8042A is in I^{2}C mode, the TUSB8042A loads this bit from the contents of the EEPROM. When the TUSB8042A is in SMBUS mode, the value can be overwritten by an SMBus host.
2	fullPwrMgmtz	RW	Full Power Management. This bit is loaded at the deassertion of reset with the value of the FULLPWRMGMTz/SMBA1/SS_UP pin. 0 = Port power switching status reporting is enabled 1 = Port power switching status reporting is disabled When the TUSB8042A is in I^{2}C mode, the TUSB8042A loads this bit from the contents of the EEPROM. When the TUSB8042A is in SMBUS mode, the value can be overwritten by an SMBus host.

Table 8-7. Bit Descriptions – Device Configuration Register (continued)

Bit	Field	Type	Description
1	u1u2TimerOvr	RW	U1 U2 Timer Override. When this field is set, the TUSB8042A overrides the downstream ports U1/U2 timeout values set by USB 3.2 Host software. If software sets value in the range of 1h - FFh, the TUSB8042A uses the value of FFh. If software sets value to 0, then TUSB8042A uses value of 0. REG_09h [6] must be set to enable this feature.
0	RSVD	RO	Reserved. This field is reserved and returns 0 when read.

8.8 Battery Charging Support Register

Figure 8-7. Register Offset 6h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	X	X	X	X

Table 8-8. Bit Descriptions – Battery Charging Support Register

Bit	Field	Type	Description
7:4	RSVD	RO	Reserved. Read only, returns 0 when read.
3:0	batEn[3:0]	RW	Battery Charger Support. The bits in this field indicate whether the downstream port implements the charging port features. 0 = The port is not enabled for battery charging support features 1 = The port is enabled for battery charging support features Each bit corresponds directly to a downstream port, that is batEn0 corresponds to downstream port 1 and batEN1 corresponds to downstream port 2. The default value for these bits are loaded at the deassertion of reset with the value of PWRCTL/BATEN[3:0]. When in I^{2}C/SMBus mode the bits in this field can be overwritten by EEPROM contents or by an SMBus host.

8.9 Device Removable Configuration Register

Figure 8-8. Register Offset 7h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	X	X	X	X

Table 8-9. Bit Descriptions – Device Removable Configuration Register

Bit	Field	Type	Description
7	customRmbl	RW	Custom Removable. This bit controls selection of port removable bits, port used bits, and USB2_ONLY bits. 0 = rmbl[3:0], used[3:0], and USB2_ONLY[3:0] are read only and the values are loaded from the OTP ROM 1 = rmbl[3:0], used[3:0], and USB2_ONLY[3:0] are read/write and can be loaded by EEPROM or written by SMBus This bit can be written simultaneously with rmbl[3:0].
6:4	RSVD	RO	Reserved. Read only, returns 0 when read.
3:0	rmbl[3:0]	RO/RW	Removable. The bits in this field indicate whether a device attached to downstream ports 4 through 1 are removable or permanently attached. 0 = The device attached to the port is not removable 1 = The device attached to the port is removable Each bit corresponds directly to a downstream port n + 1, that is rmbl0 corresponds to downstream port 1, rmbl1 corresponds to downstream port 2, and so forth. This field is read only unless the customRmbl bit is set to 1. Otherwise the value of this filed reflects the inverted values of the OTP ROM non_rmb[3:0] field.

8.10 Port Used Configuration Register

Figure 8-9. Register Offset 8h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	1	1	1	1

Table 8-10. Bit Descriptions – Port Used Configuration Register

Bit	Field	Type	Description
7:4	RSVD	RO	Reserved. Read only.
3:0	used[3:0]	RO/RW	Used. The bits in this field indicate whether a port is enabled. 0 = The port is not used or disabled 1 = The port is used or enabled Each bit corresponds directly to a downstream port, that is used0 corresponds to downstream port 1, used1 corresponds to downstream port 2, and so forth. This field is read only unless the customRmbl bit is set to 1. When the corresponding USB2_ONLY bit is set, the USB2 port is used and enabled regardless of the bit programmed into this field.

Product Folder Links: *TUSB8042A*

8.11 Device Configuration Register 2

Figure 8-10. Register Offset Ah

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	X	0	0	0	0	0

Table 8-11. Bit Descriptions – Device Configuration Register 2

Bit	Field	Type	Description
7	Reserved	RO	Reserved. Read-only, returns 0 when read.
6	customBCfeatures	RW	Custom Battery Charging Feature Enable. This bit controls the ability to write to the battery charging feature configuration controls. 0 = The HiCurAcpModeEn is read only and the values are loaded from the OTP ROM. 1 = The HiCurAcpModeEn bit is read/write and can be loaded by EEPROM or written by SMBus. This bit can be written simultaneously with HiCurAcpModeEn.
5	pwrctlPol	RW	Power enable polarity. This bit is loaded at the deassertion of reset with the value of the PWRCTL_POL pin. 0 = PWRCTL polarity is active low 1 = PWRCTL polarity is active high When the TUSB8042A is in I^{2}C mode, the TUSB8042A loads this bit from the contents of the EEPROM. When the TUSB8042A is in SMBUS mode, the value can be overwritten by an SMBus host.
4	HiCurAcpModeEn	RO/RW	High-current ACP mode enable. This bit enables the high-current tablet charging mode when the automatic battery charging mode is enabled for downstream ports. 0 = High current divider mode disabled . High current is ACP2(default) 1 = High current divider mode enabled. High current mode is ACP3 This bit is read only unless the customBCfeatures bit is set to 1. If customBCfeatures is 0, the value of this bit reflects the value of the OTP ROM HiCurAcpModeEn bit.
3:2	Reserved	RW	Reserved. These registers are unused and returns whatever value was written.
1	autoModeEnz	RW	Automatic Mode Enable. This bit is loaded at the deassertion of reset with the value of the AUTOENz/HS_SUSPEND pin. The automatic mode only applies to downstream ports with battery charging enabled when the upstream port is not connected. Under these conditions: 0 = Automatic mode battery charging features are enabled. 1 = Automatic mode is disabled; only Battery Charging DCP and CDP mode is supported. NOTE: When the upstream port is connected, Battery Charging CDP mode is supported on all ports that are enabled for battery charging support regardless of the value of this bit.
0	RSVD	RO	Reserved. Read only, returns 0 when read.

8.12 USB 2.0 Port Polarity Control Register

Figure 8-11. Register Offset Bh

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-12. Bit Descriptions – USB 2.0 Port Polarity Control Register

Bit	Field	Type	Description
7	customPolarity	RW	Custom USB 2.0 Polarity. This bit controls the ability to write the p[4:0]_usb2pol bits. 0 = The p[4:0]_usb2pol bits are read only and the values are loaded from the OTP ROM. 1 = The p[4:0]_usb2pol bits are read/write and can be loaded by EEPROM or written by SMBus. This bit can be written simultaneously with the p[4:0]_usb2pol bits
6:5	RSVD	RO	Reserved. Read only, returns 0 when read.
4	p4_usb2pol	RO/RW	Downstream Port 4 DM/DP Polarity. This controls the polarity of the port. 0 = USB 2.0 port polarity is as documented by the pin out 1 = USB 2.0 port polarity is swapped from that documented in the pin out; that is, DM becomes DP and DP becomes DM. This bit is read only unless the customPolarity bit is set to 1. If customPolarity is 0 the value of this bit reflects the value of the OTP ROM p4_usb2pol bit.
3	p3_usb2pol	RO/RW	Downstream Port 3 DM/DP Polarity. This controls the polarity of the port. 0 = USB 2.0 port polarity is as documented by the pin out 1 = USB 2.0 port polarity is swapped from that documented in the pin out; that is, DM becomes DP and DP becomes DM. This bit is read only unless the customPolarity bit is set to 1. If customPolarity is 0 the value of this bit reflects the value of the OTP ROM p3_usb2pol bit.
2	p2_usb2pol	RO/RW	Downstream Port 2 DM/DP Polarity. This controls the polarity of the port. 0 = USB 2.0 port polarity is as documented by the pin out 1 = USB 2.0 port polarity is swapped from that documented in the pin out; that is, DM becomes DP and DP becomes DM. This bit is read only unless the customPolarity bit is set to 1. If customPolarity is 0 the value of this bit reflects the value of the OTP ROM p2_usb2pol bit.
1	p1_usb2pol	RORW	Downstream Port 1 DM/DP Polarity. This controls the polarity of the port. 0 = USB 2.0 port polarity is as documented by the pin out 1 = USB 2.0 port polarity is swapped from that documented in the pin out; that is, DM becomes DP and DP becomes DM. This bit is read only unless the customPolarity bit is set to 1. If customPolarity is 0 the value of this bit reflects the value of the OTP ROM p1_usb2pol bit.
0	p0_usb2pol	RO/RW	Upstream Port DM/DP Polarity. This controls the polarity of the port. 0 = USB 2.0 port polarity is as documented by the pin out 1 = USB 2.0 port polarity is swapped from that documented in the pin out; that is, DM becomes DP and DP becomes DM. This bit is read only unless the customPolarity bit is set to 1. If customPolarity is 0 the value of this bit reflects the value of the OTP ROM p0_usb2pol bit.

Product Folder Links: *TUSB8042A*

8.13 UUID Registers

Figure 8-12. Register Offset 10h-1Fh

Bit No.	7	6	5	4	3	2	1	0
Reset State	X	X	X	X	X	X	X	X

Table 8-13. Bit Descriptions – UUID Byte N Register

Bit	Field	Type	Description
7:0	uuidByte[n]	RO	UUID byte N. The UUID returned in the Container ID descriptor. The value of this register is provided by the device and is meets the UUID requirements of Internet Engineering Task Force (IETF) RFC 4122 A UUID URN Namespace.

8.14 Language ID LSB Register

Figure 8-13. Register Offset 20h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	1	0	0	1

Table 8-14. Bit Descriptions – Language ID LSB Register

Bit	Field	Type	Description
7:0	langIdLsb	RO/RW	Language ID least significant byte. This register contains the value returned in the LSB of the LANGID code in string index 0. The TUSB8042A only supports one language ID. The default value of this register is 09h representing the LSB of the LangID 0409h indicating English United States. When customStrings is 1, this field can be overwritten by the contents of an attached EEPROM or by an SMBus host.

8.15 Language ID MSB Register

Figure 8-14. Register Offset 21h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-15. Bit Descriptions – Language ID MSB Register

Bit	Field	Type	Description
7:0	langIdMsb	RO/RW	Language ID most significant byte. This register contains the value returned in the MSB of the LANGID code in string index 0. The TUSB8042A only supports one language ID. The default value of this register is 04h representing the MSB of the LangID 0409h indicating English United States. When customStrings is 1, this field can be overwritten by the contents of an attached EEPROM or by an SMBus host.

8.16 Serial Number String Length Register

Figure 8-15. Register Offset 22h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	1	1	0	0	0

Table 8-16. Bit Descriptions – Serial Number String Length Register

Bit	Field	Type	Description
7:6	RSVD	RO	Reserved. Read only, returns 0 when read.
5:0	serNumStringLen	RO/RW	Serial number string length. The string length in bytes for the serial number string. The default value is 18h indicating that a 24 byte serial number string is supported. The maximum string length is 32 bytes. When customSernum is 1, this field can be overwritten by the contents of an attached EEPROM or by an SMBus host. When the field is non-zero, a serial number string of serNumbStringLen bytes is returned at string index 1 from the data contained in the Serial Number String registers.

8.17 Manufacturer String Length Register

Figure 8-16. Register Offset 23h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-17. Bit Descriptions – Manufacturer String Length Register

Bit	Field	Type	Description
7	RSVD	RO	Reserved. Read only, returns 0 when read.
6:0	mfgStringLen	RO/RW	Manufacturer string length. The string length in bytes for the manufacturer string. The default value is 0, indicating that a manufacturer string is not provided. The maximum string length is 64 bytes. When customStrings is 1, this field can be overwritten by the contents of an attached EEPROM or by an SMBus host. When the field is non-zero, a manufacturer string of mfgStringLen bytes is returned at string index 3 from the data contained in the Manufacturer String registers.

8.18 Product String Length Register

Figure 8-17. Register Offset 24h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-18. Bit Descriptions – Product String Length Register

Bit	Field	Type	Description
7	RSVD	RO	Reserved. Read only, returns 0 when read.
6:0	prodStringLen	RO/RW	Product string length. The string length in bytes for the product string. The default value is 0, indicating that a product string is not provided. The maximum string length is 64 bytes. When customStrings is 1, this field can be overwritten by the contents of an attached EEPROM or by an SMBus host. When the field is non-zero, a product string of prodStringLen bytes is returned at string index 3 from the data contained in the Product String registers.

Product Folder Links: *TUSB8042A*

8.19 Device Configuration Register 3

Figure 8-18. Register Offset 25h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-19. Bit Descriptions – Device Configuration Register 3

Bit	Field	Type	Description
7:6	RSVD	RO	Reserved. Read only, returns 0 when read.
5	bcdUSB30	RW	This field when set forces SS hub to report bcdUSB = 3.0 instead of 3.2.
4	USB2.0_only	RW	USB 2.0 hub reports as 2.0 only. This bit disables the USB 2.0 hub from reporting 5Gbps support in the wSpeedsSupported field of the USB SS BOS SS device capability descriptor. This bit also disables the USB3.0 hub. This bit is read/write but the read value returned is the Boolean OR of this bit and the corresponding eFuse bit. If either bit is set, this feature is enabled.
3	USB2_DFP_UNCONF	RW	This field when set enables USB 2.0-defined Unconfigured state on DFPs.
2	I2C_100k	R/W	I^2C 100kHz. This bit controls the clock rate of the I^2C controller for both USB to I^2C requests. The EEPROM reads occurs at 400K unless eFuse is used to set the rate to 100k. This bit is read/write but the read value returned is the Boolean OR of this bit and the corresponding eFuse bit. If either bit is set, this feature is enabled.
1	Galaxy_Enz	R/W	Disable Galaxy compatible modes. When this field is high, Galaxy charging compatible mode does not included in AUTOMODE charger sequence. This bit is read/write but the read value returned is the Boolean OR of this bit and the corresponding eFuse bit. If either bit is set, this feature is disabled.
0	FullAutoEn	R/W	Enable all divider battery charging modes. When automode is enabled and this bit is set, any DS port enabled for battery charging attempts all divider battery charging modes before DCP, starting with the highest current option. The bit is writable, but the value read back is the Boolean OR of this bit and the corresponding eFuse control. If either bit is set, eFuse or this register, this feature is enabled.

8.20 USB 2.0 Only Port Register

Figure 8-19. Register Offset 26h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-20. Bit Descriptions – USB 2.0 Only Port Register

Bit	Field	Type	Description
7:4	RSVD	RO	Reserved. Read only.
3:0	USB2_ONLY[3:0]	RO/RW	USB 2.0 Only Ports. The bits in this field primarily indicate whether a port is enabled only for USB 2.0 operation. This field is read-only unless customRmbl bit is set. Also, these bits overrides the corresponding USED bit. A value of 0 indicates the hub port is enabled for both USB 3.2 and USB 2.0. A value of 1 indicates the hub port is enabled only for USB 2.0 operation.

8.21 Serial Number String Registers

Figure 8-20. Register Offset 30h-4Fh

Bit No.	7	6	5	4	3	2	1	0
Reset State	X	X	x	x	x	x	x	x

Table 8-21. Bit Descriptions – Serial Number Registers

Bit	Field	Type	Description
7:0	serialNumber[n]	RO/RW	Serial Number byte N. The serial number returned in the Serial Number string descriptor at string index 1. The default value of these registers is assigned by TI. When customSernum is 1, these registers can be overwritten by EEPROM contents or by an SMBus host.

Product Folder Links: *TUSB8042A*

8.22 Manufacturer String Registers

Figure 8-21. Register Offset 50h-8Fh

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-22. Bit Descriptions – Manufacturer String Registers

Bit	Field	Type	Description
7:0	mfgStringByte[n]	RW	Manufacturer string byte N. These registers provide the string values returned for string index 3 when mfgStringLen is greater than 0. The number of bytes returned in the string is equal to mfgStringLen. The programmed data is in UNICODE UTF-16LE encodings as defined by The Unicode Standard, Worldwide Character Encoding, Version 5.0.

8.23 Product String Registers

Figure 8-22. Register Offset 90h-CFh

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-23. Bit Descriptions – Product String Byte N Register

Bit	Field	Type	Description
7:0	prodStringByte[n]	RO/RW	Product string byte N. These registers provide the string values returned for string index 2 when prodStringLen is greater than 0. The number of bytes returned in the string is equal to prodStringLen. The programmed data is in UNICODE UTF-16LE encodings as defined by The Unicode Standard, Worldwide Character Encoding, Version 5.0.

8.24 Additional Feature Configuration Register

Figure 8-23. Register Offset F0h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-24. Bit Descriptions – Additional Feature Configuration Register

Bit	Field	Type	Description
7:5	Reserved	RW	Reserved. This field defaults to 3'b000 and must not be changed.
4	stsOutputEn	RW	Status output enable. This field when set enables of the Status output signals, HS_UP, HS_SUSPEND, SS_UP, SS_SUSPEND. 0 = STS outputs are disabled. 1 = STS outputs are enabled. This bit can be loaded by EEPROM or overwritten by a SMBUS host.
3:1	pwronTime	RW	Power On Delay Time. When the efuse_pwronTime field is all 0s, this field sets the delay time from the removal disable of PWRCTL to the enable of PWRCTL when transitioning battery charging modes. For example, when disabling the power on a transition from ACP to DCP Mode. The nominal timing is defined as follows: $$TPWRON\_EN = (pwronTime \times 1) \times 200ms \qquad (1)$$ This field can be overwritten by EEPROM contents or by an SMBus host.
0	usb3spreadDis	RW	USB3 Spread Spectrum Disable. This bit allows firmware to disable the spread spectrum function of the USB3 phy PLL. 0 = Spread spectrum function is enabled 1= Spread spectrum function is disabled This bit can be loaded by EEPROM or overwritten by a SMBUS host.

8.25 SMBus Device Status and Command Register

Figure 8-24. Register Offset F8h

Bit No.	7	6	5	4	3	2	1	0
Reset State	0	0	0	0	0	0	0	0

Table 8-25. Bit Descriptions – SMBus Device Status and Command Register

Bit	Field	Type	Description
7:2	RSVD	RO	Reserved. Read only, returns 0 when read.
1	smbusRst	RSU	SMBus interface reset. This bit loads the registers back to the GRSTz values. Note, that since this bit can only be set when in SMBus mode the cfgActive bit is also reset to 1. When the software sets this bit, the software must reconfigure the registers as necessary. This bit is set by writing a 1 and is cleared by hardware on completion of the reset. A write of 0 has no effect.
0	cfgActive	RCU	Configuration active. This bit indicates that configuration of the TUSB8042A is currently active. The bit is set by hardware when the device enters the I^{2}C or SMBus mode. The TUSB8042A shall not connect on the upstream port while this bit is 1. When in I^{2}C mode, the bit is cleared by hardware when the TUSB8042A exits the I^{2}C mode. When in the SMBus mode, this bit must be cleared by the SMBus host to exit the configuration mode and allow the upstream port to connect. The bit is cleared by a writing 1. A write of 0 has no effect.

9 Application and Implementation

Note

Information in the following applications sections is not part of the TI component specification, and TI does not warrant its accuracy or completeness. TI's customers are responsible for determining suitability of components for their purposes, as well as validating and testing their design implementation to confirm system functionality.

9.1 Application Information

The TUSB8042A is a four-port USB 3.2 x1 Gen1-compliant hub. The device provides simultaneous SuperSpeed USB, high-speed, or full-speed connections on the upstream port. The device also provides SuperSpeed USB, high-speed, full-speed, or low-speed connections on the downstream port. The TUSB8042A can be used in any application that requires additional USB-compliant ports. For example, a specific notebook may only have two downstream USB ports. By using the TUSB8042A, the notebook can increase the downstream port count to five.

9.2 Typical Application

9.2.1 Discrete USB Hub Product

A common application for the TUSB8042A is as a self-powered, standalone USB hub product. The product is powered by an external 5V DC Power adapter. In this application, using a USB cable TUSB8042A upstream port is plugged into a USB Host controller. The downstream ports of the TUSB8042A are exposed to users for connecting USB hard drives, cameras, flash drives, and so forth.
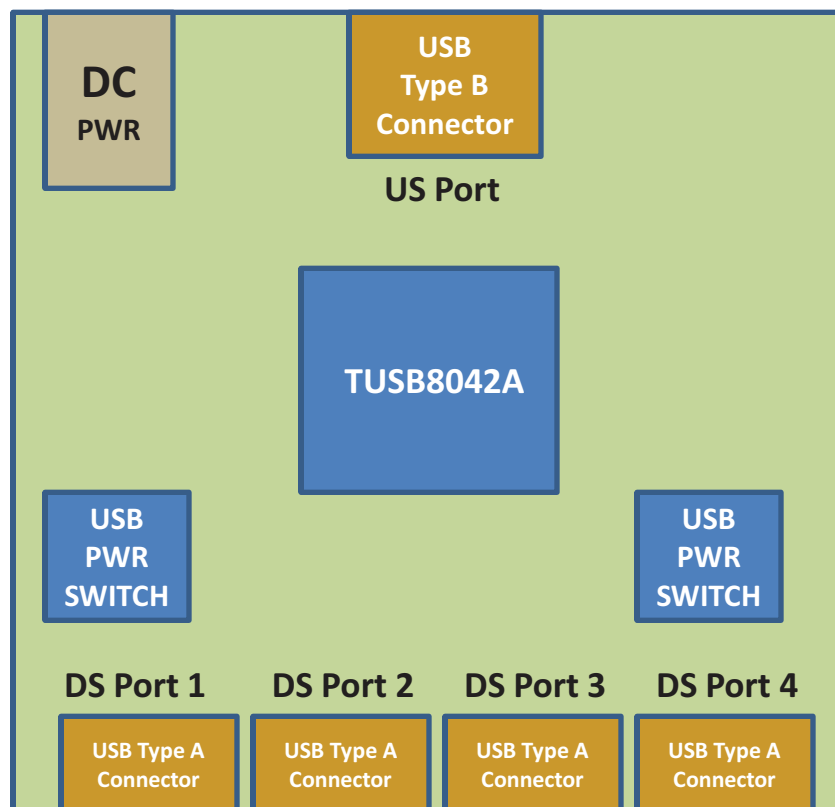
Figure 9-1. Discrete USB Hub Product

Product Folder Links: *TUSB8042A*

9.2.1.1 Design Requirements

Table 9-1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
VDD Supply	1.1V
VDD33 Supply	3.3V
Upstream Port USB Support (SS, HS, FS)	SS, HS, FS
Downstream Port 1 USB Support (SS, HS, FS, LS)	SS, HS, FS, LS
Downstream Port 2 USB Support (SS, HS, FS, LS)	SS, HS, FS, LS
Downstream Port 3 USB Support (SS, HS, FS, LS)	SS, HS, FS, LS
Downstream Port 4 USB Support (SS, HS, FS, LS)	SS, HS, FS, LS
Number of Removable external exposed Downstream Ports	4
Number of Non-Removable external exposed Downstream Ports	0
Full Power Management of Downstream Ports	Yes. (FULLPWRMGMTZ = 0)
Individual Control of Downstream Port Power Switch	Yes. (GANGED = 0)
Power Switch Enable Polarity	Active High. (PWRCTL_POL = 1)
Battery Charge Support for Downstream Port 1	Yes
Battery Charge Support for Downstream Port 2	Yes
Battery Charge Support for Downstream Port 3	Yes
Battery Charge Support for Downstream Port 4	Yes
I^{2}C EEPROM Support	No
24MHz Clock Source	Crystal

9.2.1.2 Detailed Design Procedure

9.2.1.2.1 Upstream Port Implementation

The upstream of the TUSB8042A is connected to a USB3 Type-B connector. This particular example has GANGED pin and FULLPWRMGMTZ pin pulled low which results in individual power support each downstream port. The VBUS signal from the USB3 Type-B connector is feed through a voltage divider. The purpose of the voltage divider is to make sure the level meets USB_VBUS input requirements
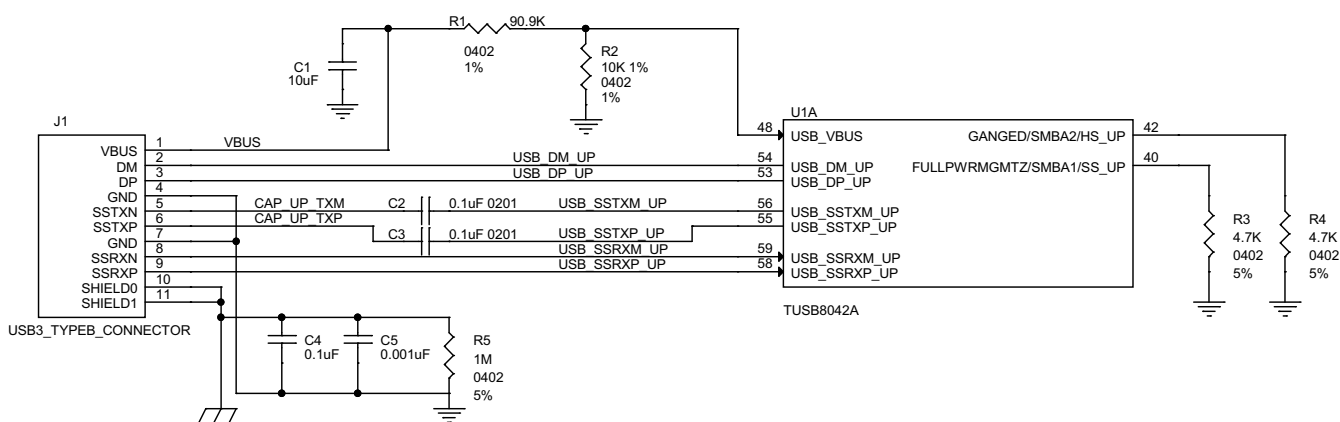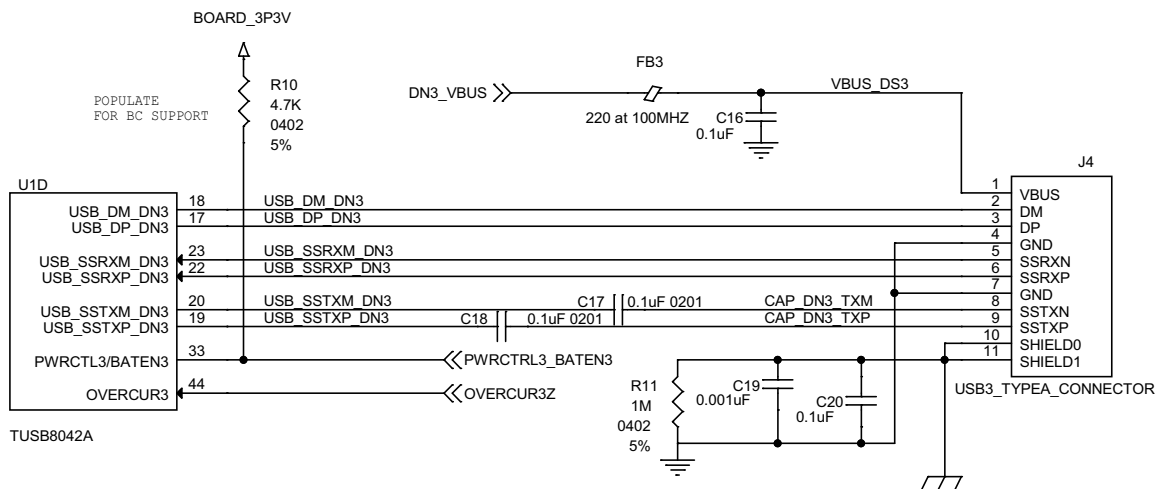

Figure 9-2. Upstream Port Implementation

9.2.1.2.2 Downstream Port 1 Implementation

The downstream port 1 of the TUSB8042A is connected to a USB3 Type-A connector. With BATEN1 pin pulled up, Battery Charge support is enabled for Port 1. If Battery Charge support is not needed, then TI recommends to uninstall the pullup resistor on BATEN1.
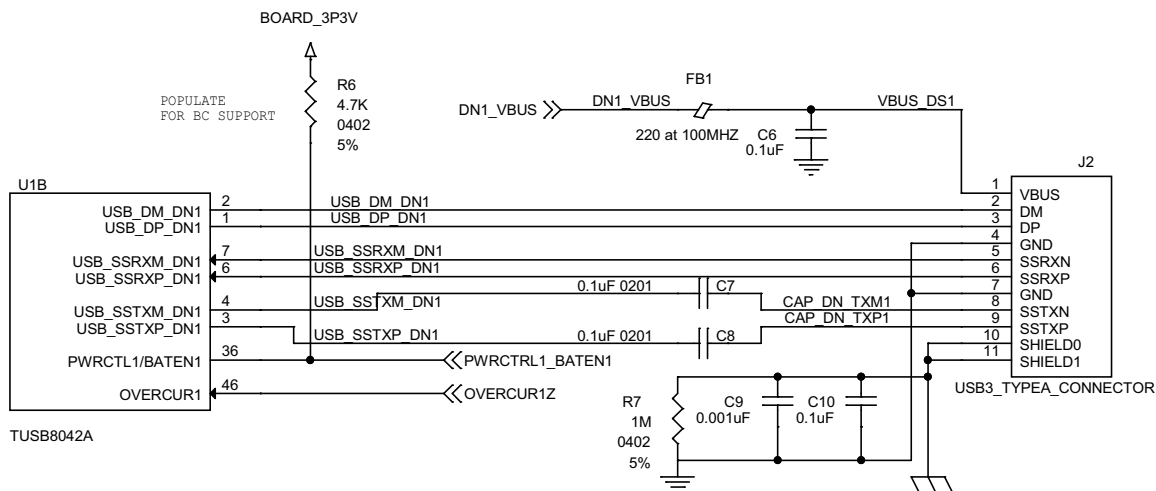
Figure 9-3. Downstream Port 1 Implementation

9.2.1.2.3 Downstream Port 2 Implementation

The downstream port 2 of the TUSB8042A is connected to a USB3 Type-A connector. With BATEN2 pin pulled up, Battery Charge support is enabled for Port 2. If Battery Charge support is not needed, then TI recommends to uninstall the pullup resistor on BATEN2. For ferrite bead used on the VBUS connection, a lower resistance is recommended due to noticeable IR drop during high current charging modes. The isolation between the Type-A connectors shield ground and signal ground pins is not required. Some applications may have better ESD/EMI performance when the grounds are shorted together.
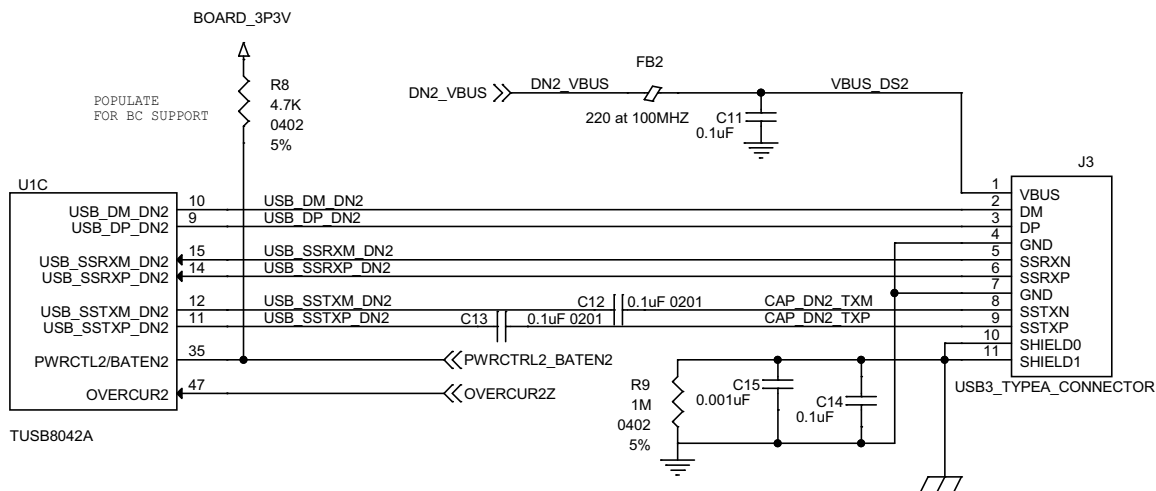
Figure 9-4. Downstream Port 2 Implementation

Product Folder Links: *TUSB8042A*

9.2.1.2.4 Downstream Port 3 Implementation

The downstream port3 of the TUSB8042A is connected to a USB3 Type-A connector. With BATEN3 pin pulled up, Battery Charge support is enabled for Port 3. If Battery Charge support is not needed, then TI recommends to uninstall the pullup resistor on BATEN3. For ferrite bead used on the VBUS connection, a lower resistance is recommended due to noticeable IR drop during high current charging modes. The isolation between the Type-A connectors shield ground and signal ground pins is not required. Some applications may have better ESD/EMI performance when the grounds are shorted together.

Figure 9-5. Downstream Port 3 Implementation

9.2.1.2.5 Downstream Port 4 Implementation

The downstream port 4 of the TUSB8042A is connected to a USB3 Type-A connector. With BATEN4 pin pulled up, Battery Charge support is enabled for Port 4. If Battery Charge support is not needed, then TI recommends to uninstall the pullup resistor on BATEN4. For ferrite bead used on the VBUS connection, a lower resistance is recommended due to noticeable IR drop during high current charging modes. The isolation between the Type-A connectors shield ground and signal ground pins is not required. Some applications may have better ESD/EMI performance when the grounds are shorted together.
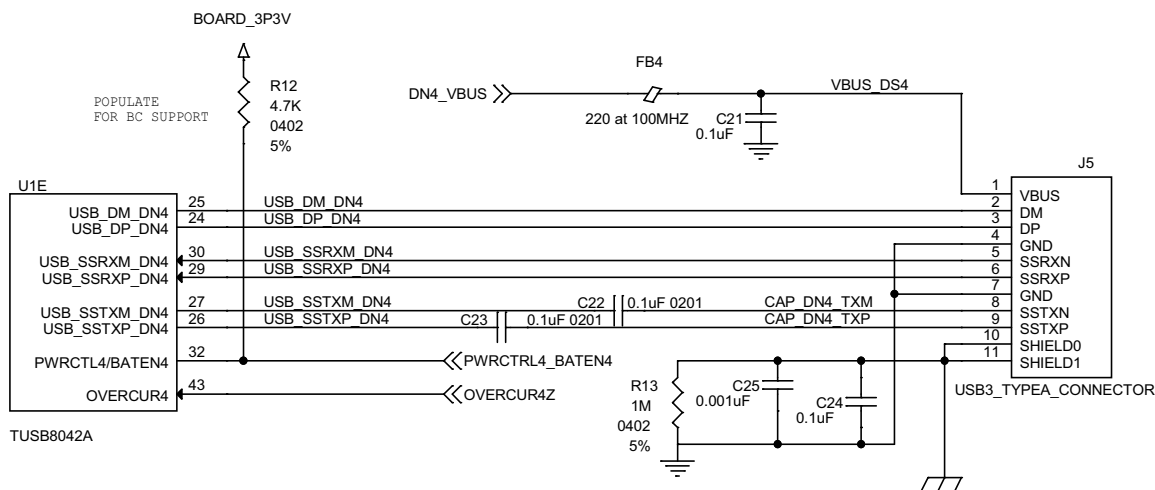
Figure 9-6. Downstream Port 4 Implementation

9.2.1.2.6 VBUS Power Switch Implementation

This particular example uses the Texas Instruments TPS2561 Dual Channel Precision Adjustable Current-Limited power switch. For details on this power switch or other power switches available from Texas Instruments, refer to the Texas Instruments website.
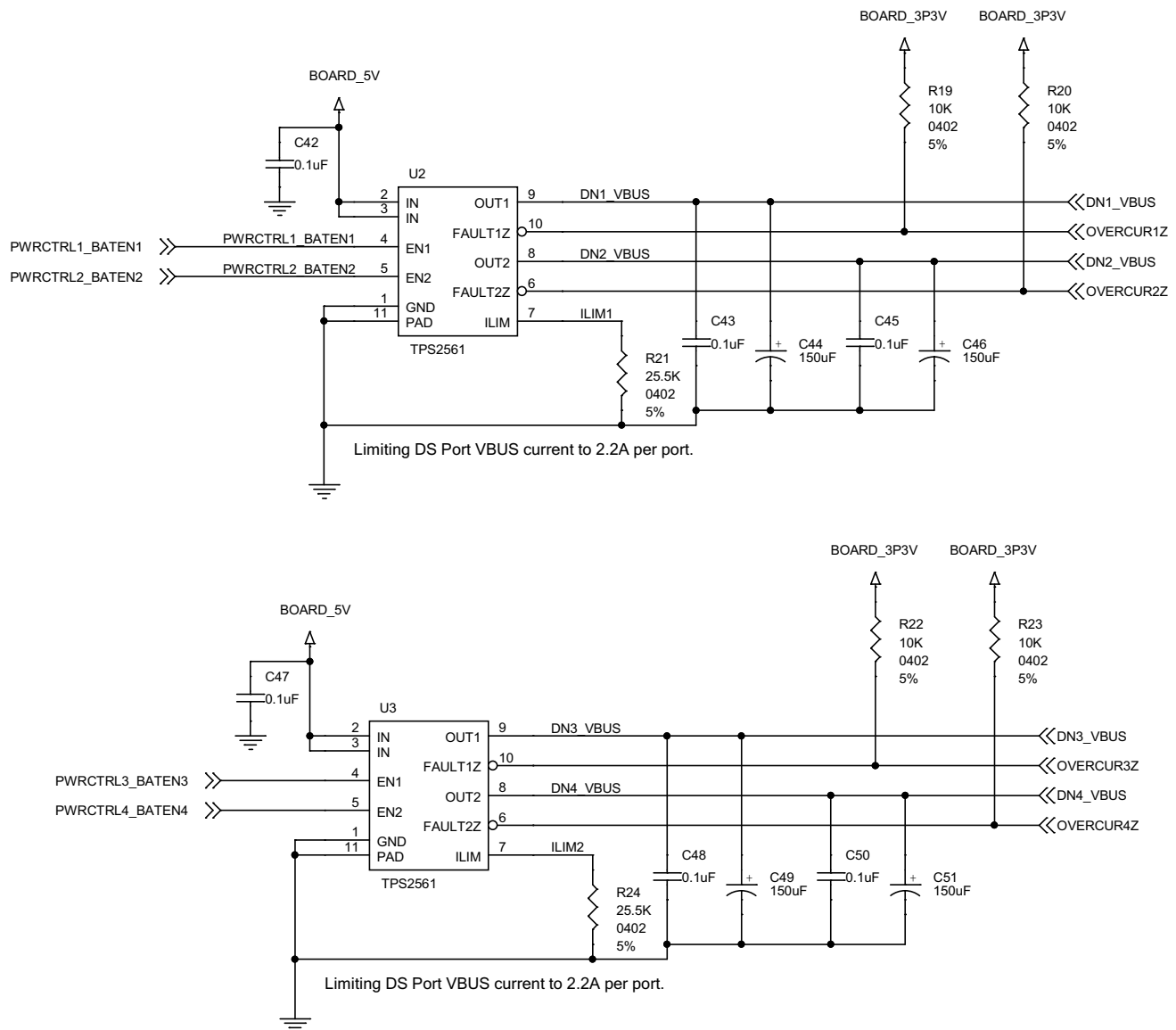
Figure 9-7. VBUS Power Switch Implementation

9.2.1.2.7 Clock, Reset, and Misc

The PWRCTL_POL is left unconnected which results in active high power enable (PWRCTL1, PWRCTL2, PWRCTL3, and PWRCTL4) for a USB VBUS power switch. SMBUSz pin is also left unconnected which selects I^2C mode. Both PWRCTL_POL and SMBUSz pins have internal pullups. The 1µF capacitor on the GRSTN pin can only be used if the VDD11 supply is stable before the VDD33 supply. The depending on the supply ramp of the two supplies, the capacitor size may require an adjustment.
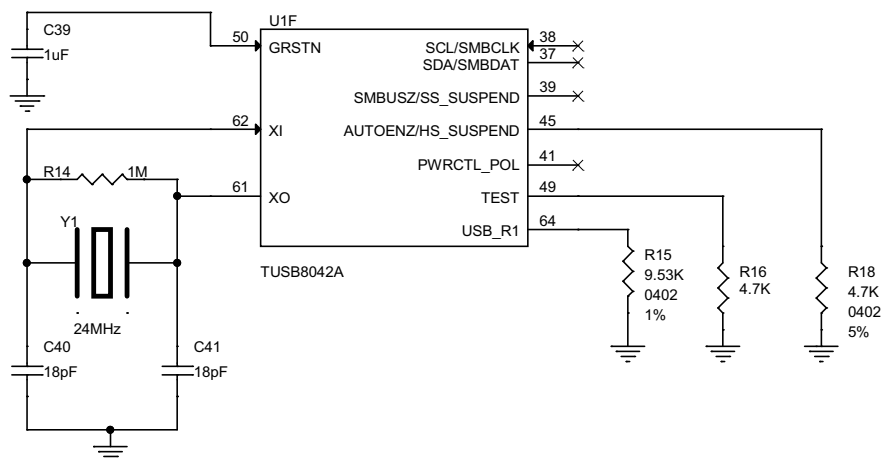
Figure 9-8. Clock, Reset, and Misc

9.2.1.2.8 TUSB8042A Power Implementation
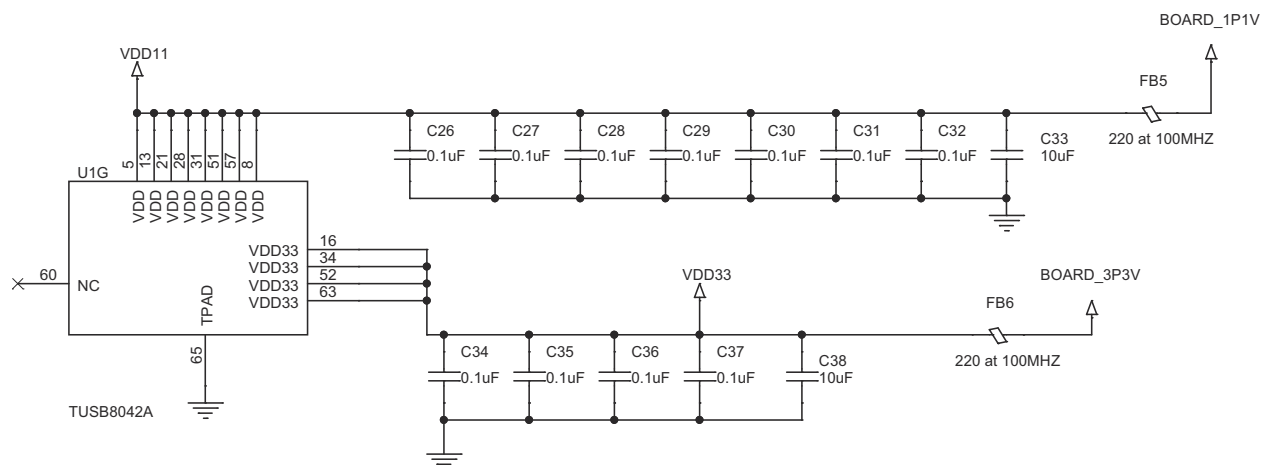
Figure 9-9. TUSB8042A Power Implementation

Product Folder Links: *TUSB8042A*

9.2.1.3 Application Curves
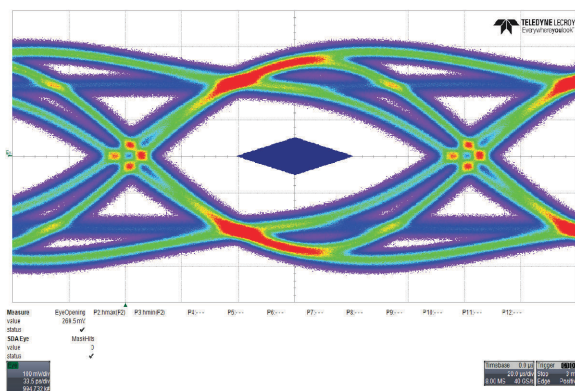
Figure 9-10. Upstream Port
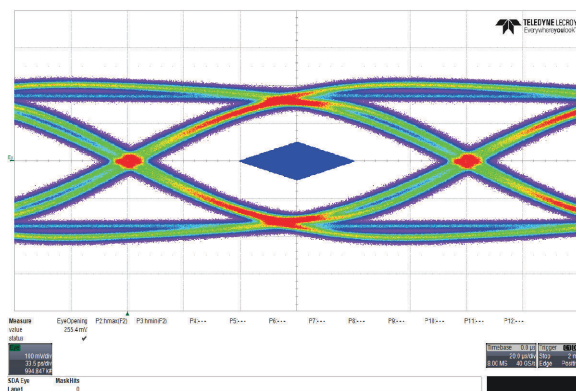
Figure 9-11. Downstream Port 1
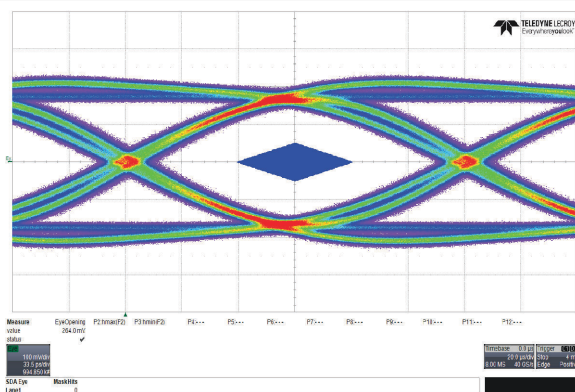
Figure 9-12. Downstream Port 2
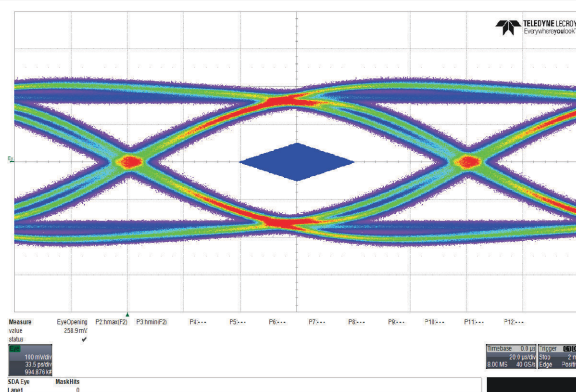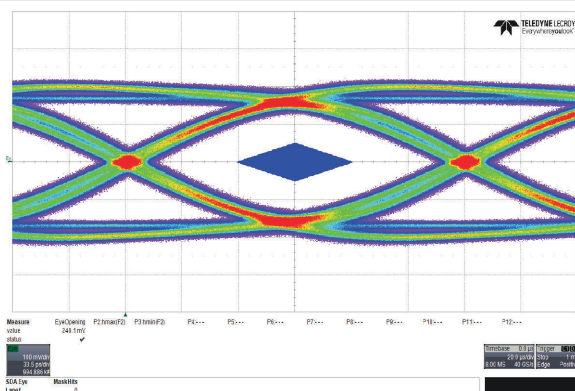

Figure 9-13. Downstream Port 3
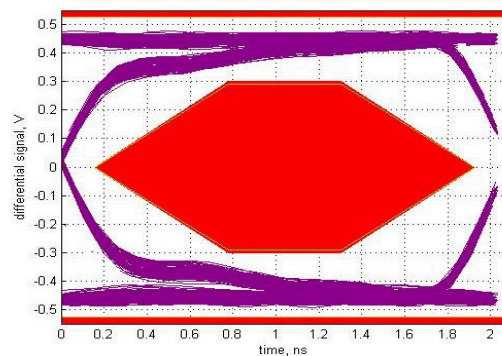

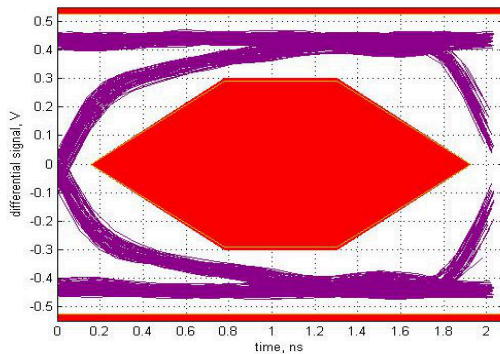**Figure 9-14. Downstream Port 4**

Figure 9-15. High-Speed Upstream Port

Product Folder Links: *TUSB8042A*

Figure 9-16. High-Speed Downstream Port 1
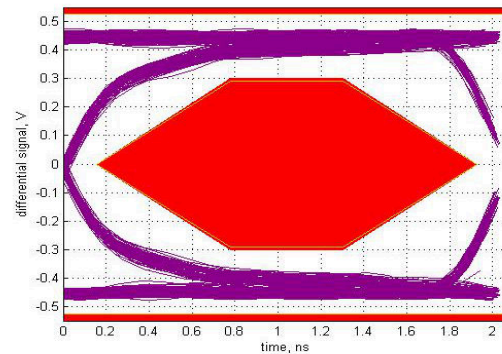
Figure 9-17. High-Speed Downstream Port 2
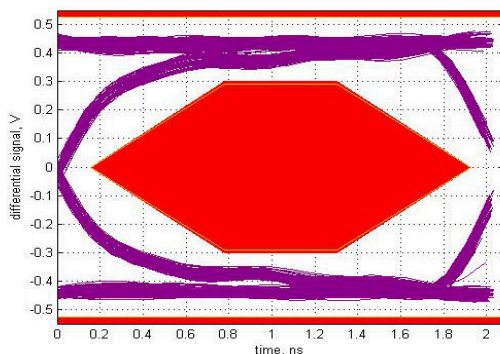
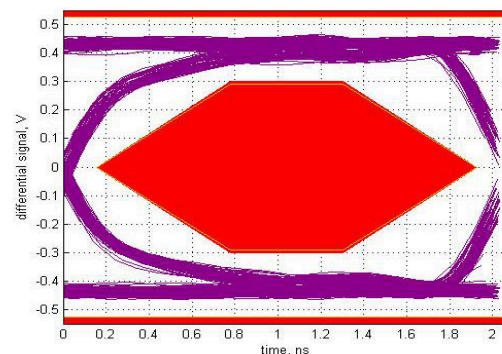**Figure 9-18. High-Speed Downstream Port 3**

Figure 9-19. High-Speed Downstream Port 4

9.3 Power Supply Recommendations

9.3.1 TUSB8042A Power Supply

Implement V_{DD} and V_{DD33} as a single power planes.

- The V_{DD} pins of the TUSB8042A supply 1.1V (nominal) power to the core of the TUSB8042A. This power rail can be isolated from all other power rails by a ferrite bead to reduce noise.
- The DC resistance of the ferrite bead on the core power rail can affect the voltage provided to the device due to the high current draw on the power rail. The output of the core voltage regulator can be adjusted to account for this, or a ferrite bead with low DC resistance (less than 0.05Ω) can be selected.
- The V_{DD33} pins of the TUSB8042A supply 3.3V power rail to the I/O of the TUSB8042A. This power rail can be isolated from all other power rails by a ferrite bead to reduce noise.
- All power rails require a 10µF capacitor or 1µF capacitors for stability and noise immunity. These bulk capacitors can be placed anywhere on the power rail. Place the smaller decoupling capacitors as close to the TUSB8042A power pins as possible with an optimal grouping of two of differing values per pin.

9.3.2 Downstream Port Power

- The downstream port power, VBUS, must be supplied by a source capable of supplying 5V and up to 900mA per port. Downstream port power switches can be controlled by the TUSB8042A signals. It is also possible to leave the downstream port power always enabled.
- A large bulk low-ESR capacitor of 22µF or larger is required on the VBUS pin of each downstream port to limit in-rush current.
- The ferrite beads on the VBUS pins of the downstream USB port connections are recommended for both ESD and EMI reasons. A 0.1µF capacitor on the USB connector side of the ferrite provides a low impedance path to ground in case a fast rise time ESD current coupled onto the VBUS trace from the cable.

9.3.3 Ground

TI recommends that only one board ground plane be used in the design. This provides the best image plane for signal traces running above the plane. TI recommends to connect the thermal pad of the TUSB8042A and any of the voltage regulators to the ground plane with vias. An earth or chassis ground is implemented only near the USB port connectors on a different plane for EMI and ESD purposes.

9.4 Layout

9.4.1 Layout Guidelines

9.4.1.1 Placement

1. Place the 9.53K ±1% resistor connected to pin USB_R1 as close as possible to the TUSB8042A.
2. Place a 0.1µF capacitor as close as possible on each VDD and VDD33 power pin.
3. Place the 100nF capacitors on the SSTXP and SSTXM nets close to the USB connector (Type-A, Type-B, and so forth).
4. Place ESD and EMI protection devices (if used) as close as possible to the USB connector.
5. If a crystal is used, place the crystal as close as possible to the TUSB8042A XI and XO pins.
6. Place voltage regulators as far away from the TUSB8042A, the crystal, and the differential pairs as possible.
7. In general, place the large bulk capacitors associated with each power rail as close to the voltage regulators as possible.

9.4.1.2 Package Specific

1. The TUSB8042A package has a 0.5mm pin pitch.
2. The TUSB8042A package has a 6.0mm × 6.0mm thermal pad. This thermal pad must be connected to ground through a system of vias.
3. TI recommends to solder mask all vias under device, except for those connected to thermal pad, to avoid any potential issues with thermal pad layouts.

9.4.1.3 Differential Pairs

This section describes the layout recommendations for all the TUSB8042A differential pairs: USB_DP_XX, USB_DM_XX, USB_SSTXP_XX, USB_SSTXM_XX, USB_SSRXP_XX, and USB_SSRXM_XX.

1. Must be designed with a differential impedance of 90Ω ±10%.
2. To minimize crosstalk, TI recommends to keep high-speed signals away from each other. Separate each pair by at least 5 times the signal trace width. Separating with ground as depicted in the layout example also helps minimize crosstalk.
3. Route all differential pairs on the same layer adjacent to a solid ground plane.
4. Do not route differential pairs over any plane split.
5. Adding test points causes impedance discontinuity, and therefore negative impacts signal performance. If test points are used, place the points in series and symmetrically. The test paints must not be placed in a manner that causes stub on the differential pair.
6. Avoid 90 degree turns in trace. Keep the use of bends in differential traces to a minimum. When bends are used, make sure the number of left and right bends are as equal as possible and the angle of the bend is ≥ 135 degrees. This minimizes any length mismatch causes by the bends and therefore minimize the impact bends have on EMI.
7. Minimize the trace lengths of the differential pair traces. The maximum recommended trace length for SS differential pair signals and USB 2.0 differential pair signals is eight inches. Longer trace lengths require very careful routing to ensure proper signal integrity.
8. Match the etch lengths of the differential pair traces (that is, DP and DM or SSRXP and SSRXM or SSTXP and SSTXM). Make sure there is less than a 5mil difference between a SS differential pair signal and the complement. Make sure the USB 2.0 differential pairs do not exceed 50 mils relative trace length difference.
9. The etch lengths of the differential pair groups do not need to match (that is, the length of the SSRX pair to that of the SSTX pair), but make sure to minimize all trace lengths.
10. Minimize the use of vias in the differential pair paths as much as possible. If this is not practical, make sure that the same via type and placement are used for both signals in a pair. If any vias are used, place the vias as close to the TUSB8042A device as possible.

11. To ease routing, the polarity of the SS differential pairs can be swapped. This means that SSTXP can be routed to SSTXM or SSRXM can be routed to SSRXP.

12. To ease routing of the USB2 DP and DM pair, the polarity of these pins can be swapped. If this is done, the appropriate Px_usb2pol register, where x = 0, 1, 2, 3, or 4, must be set.

13. Do not place power fuses across the differential pair traces.
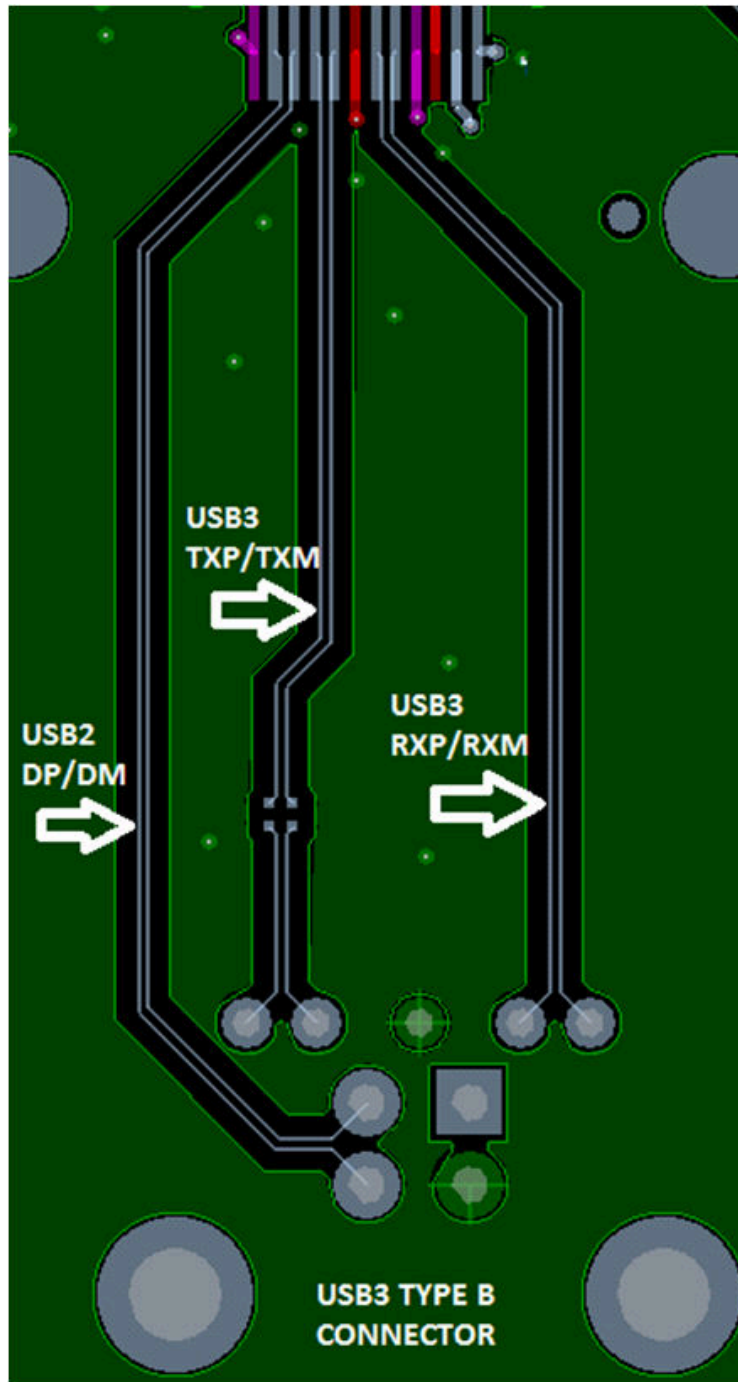
9.4.2 Layout Examples

9.4.2.1 Upstream Port

Figure 9-20. Example Routing of Upstream Port
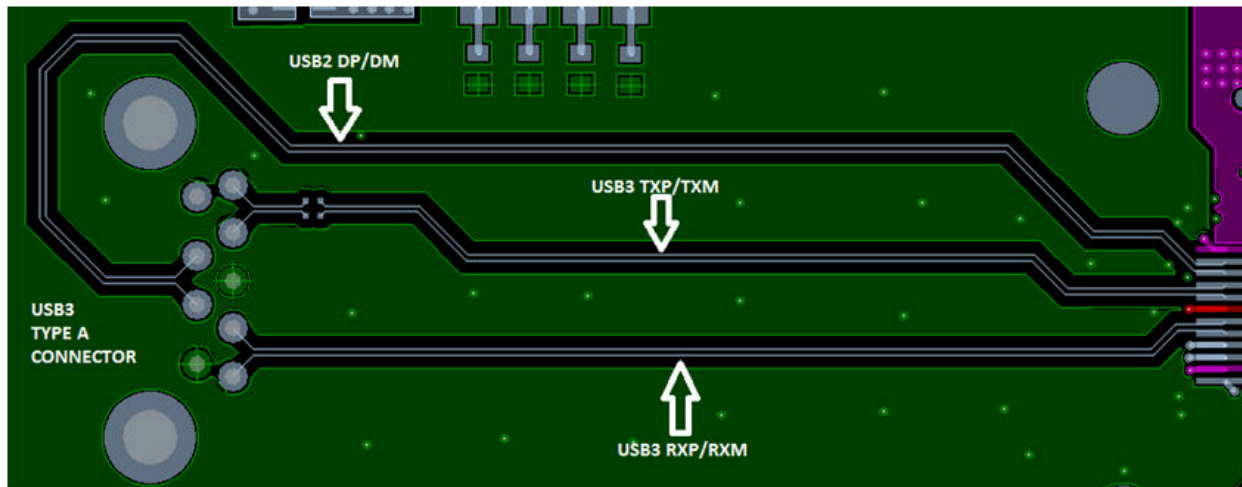
9.4.2.2 Downstream Port

Figure 9-21. Example Routing of Downstream Port

The remaining three downstream ports routing can be similar to the example provided.

10 Device and Documentation Support

10.1 Documentation Support

10.1.1 Related Documentation

For related documentation, see the following:
- Texas Instruments, *Selection and Specification for Crystals for Texas Instruments USB2.0 Devices* application note

10.2 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on ti.com. Click on *Notifications* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

10.3 Support Resources

TI E2E™ support forums are an engineer's go-to source for fast, verified answers and design help — straight from the experts. Search existing answers or ask your own question to get the quick design help you need.

Linked content is provided "AS IS" by the respective contributors. They do not constitute TI specifications and do not necessarily reflect TI's views; see TI's Terms of Use.

10.4 Trademarks

TI E2E™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

10.5 Electrostatic Discharge Caution

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

10.6 Glossary

TI Glossary   This glossary lists and explains terms, acronyms, and definitions.

11 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

12 Mechanical, Packaging, and Orderable Information

The following pages include mechanical packaging and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.
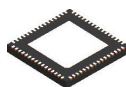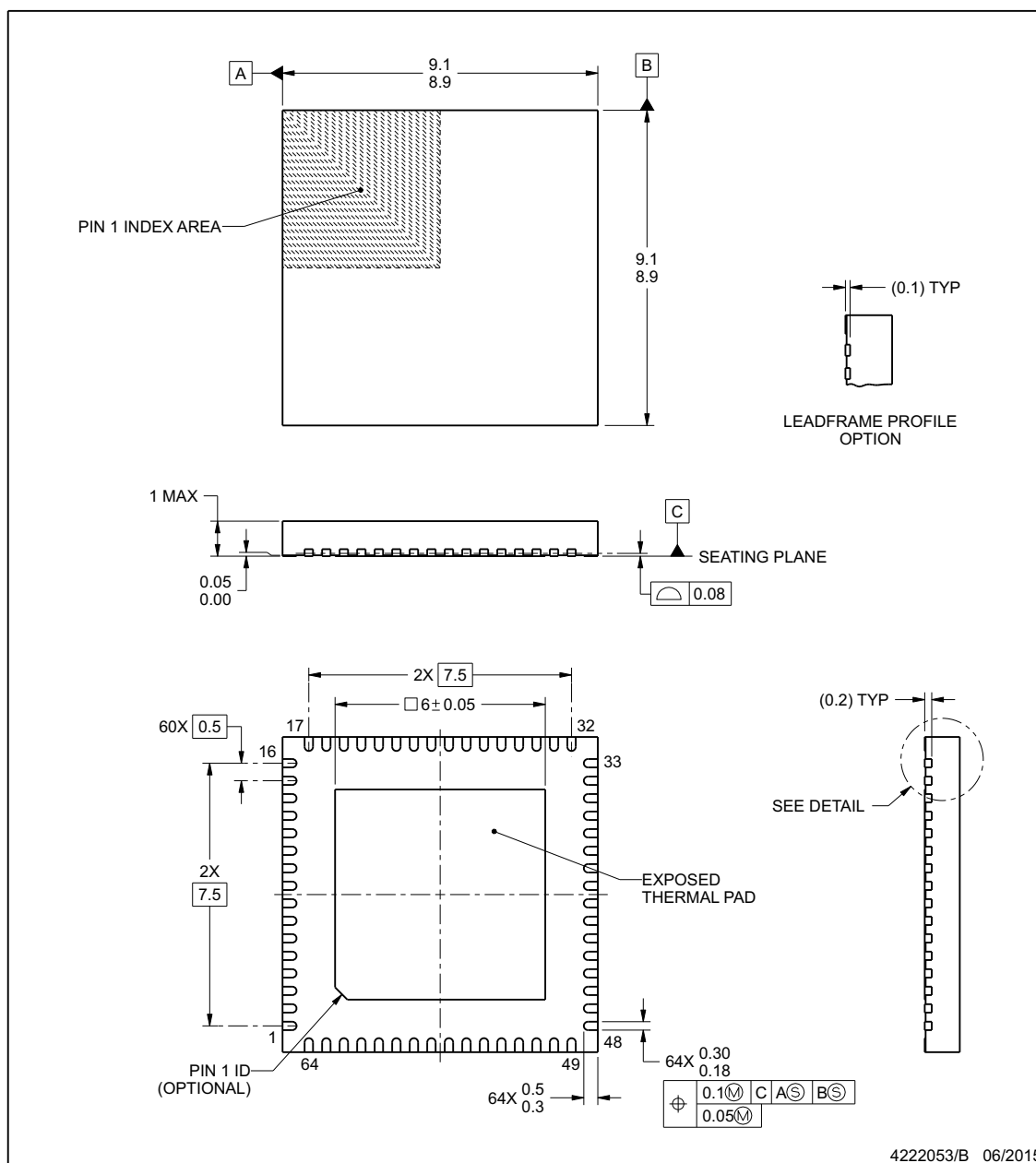
PACKAGE OUTLINE

RGC0064G

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.

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Product Folder Links: TUSB8042A

EXAMPLE BOARD LAYOUT

RGC0064G

VQFN - 1 mm max height
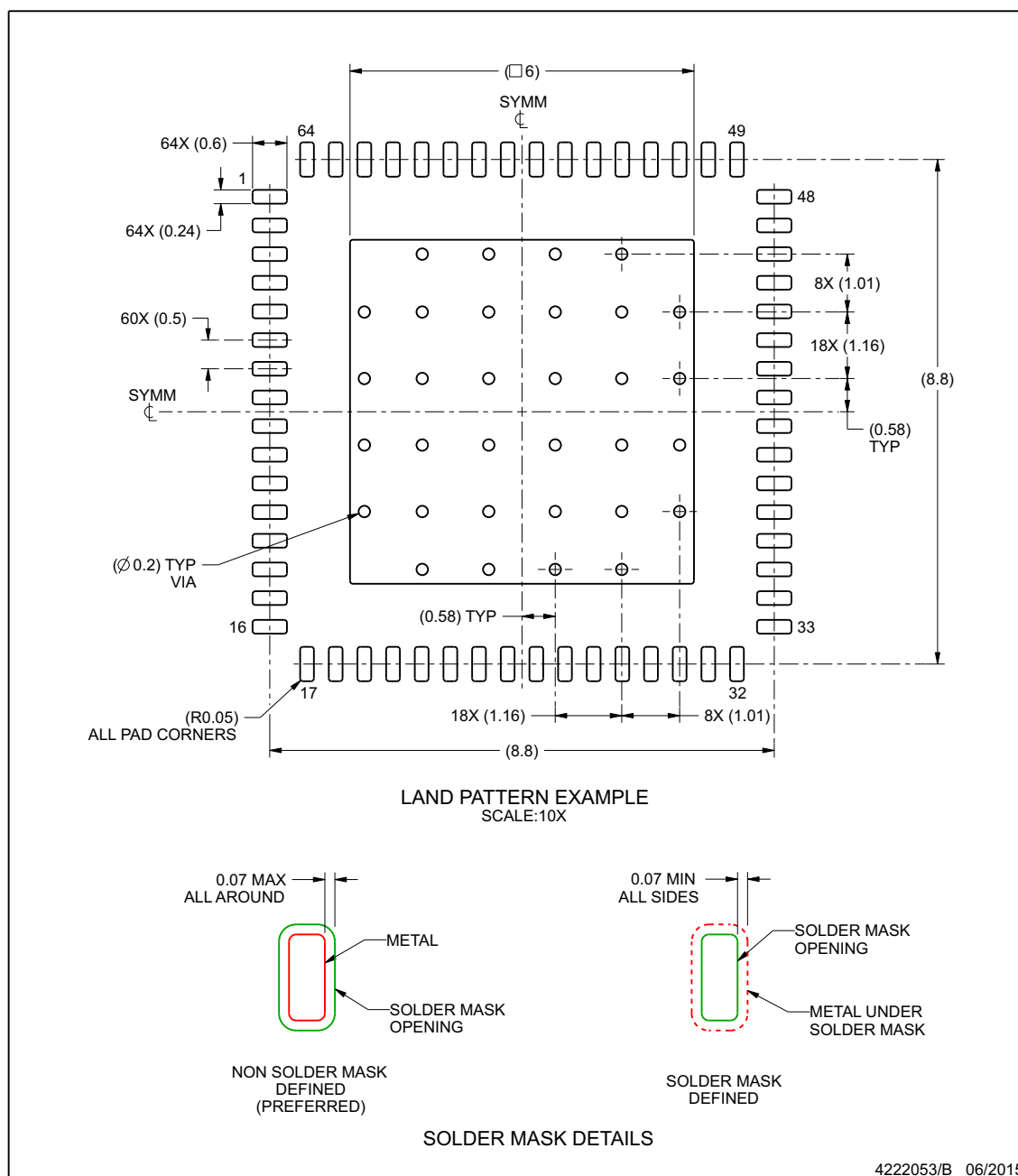
PLASTIC QUAD FLATPACK - NO LEAD

LAND PATTERN EXAMPLE
SCALE:10X

SOLDER MASK DETAILS

NON SOLDER MASK
DEFINED
(PREFERRED)

SOLDER MASK
DEFINED

4222053/B 06/2015

NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

www.ti.com

EXAMPLE STENCIL DESIGN

RGC0064G

VQFN - 1 mm max height

PLASTIC QUAD FLATPACK - NO LEAD

25X (□ 0.96)

(1.16) TYP

(R0.05) TYP

64X (0.6)

64

49

1

48

64X (0.24)

60X (0.5)

(1.16) TYP

SYMM

(8.8)

16

33

METAL
TYP

17

32

(R0.05) TYP

SYMM

(8.8)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
64% PRINTED SOLDER COVERAGE BY AREA
SCALE:12X

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NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate
   design recommendations.

Product Folder Links: *TUSB8042A*

PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
TUSB8042A1RGCR	Active	Production	VQFN (RGC) | 64	2000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A1
TUSB8042A1RGCR.A	Active	Production	VQFN (RGC) | 64	2000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A1
TUSB8042A1RGCT	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A1
TUSB8042A1RGCT.A	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A1
TUSB8042AIRGCR	Active	Production	VQFN (RGC) | 64	2000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A
TUSB8042AIRGCR.A	Active	Production	VQFN (RGC) | 64	2000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A
TUSB8042AIRGCT	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A
TUSB8042AIRGCT.A	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A
TUSB8042ARGCR	Active	Production	VQFN (RGC) | 64	2000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 70	TUSB8042A
TUSB8042ARGCR.A	Active	Production	VQFN (RGC) | 64	2000 | LARGE T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 70	TUSB8042A
TUSB8042ARGCT	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 70	TUSB8042A
TUSB8042ARGCT.A	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	0 to 70	TUSB8042A
TUSB8042ARGCTG4	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A
TUSB8042ARGCTG4.A	Active	Production	VQFN (RGC) | 64	250 | SMALL T&R	Yes	NIPDAU	Level-3-260C-168 HR	-40 to 85	TUSB8042A

(1) Status: For more details on status, see our product life cycle.

(2) Material type: When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) RoHS values: Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) Lead finish/Ball material: Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) MSL rating/Peak reflow: The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

(6) Part marking: There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

TAPE AND REEL INFORMATION

REEL DIMENSIONS

TAPE DIMENSIONS

A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
TUSB8042A1RGCR	VQFN	RGC	64	2000	330.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2
TUSB8042A1RGCT	VQFN	RGC	64	250	180.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2
TUSB8042AIRGCR	VQFN	RGC	64	2000	330.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2
TUSB8042AIRGCT	VQFN	RGC	64	250	180.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2
TUSB8042ARGCR	VQFN	RGC	64	2000	330.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2
TUSB8042ARGCT	VQFN	RGC	64	250	180.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2
TUSB8042ARGCTG4	VQFN	RGC	64	250	180.0	16.4	9.3	9.3	1.1	12.0	16.0	Q2

TAPE AND REEL BOX DIMENSIONS

*All dimensions are nominal

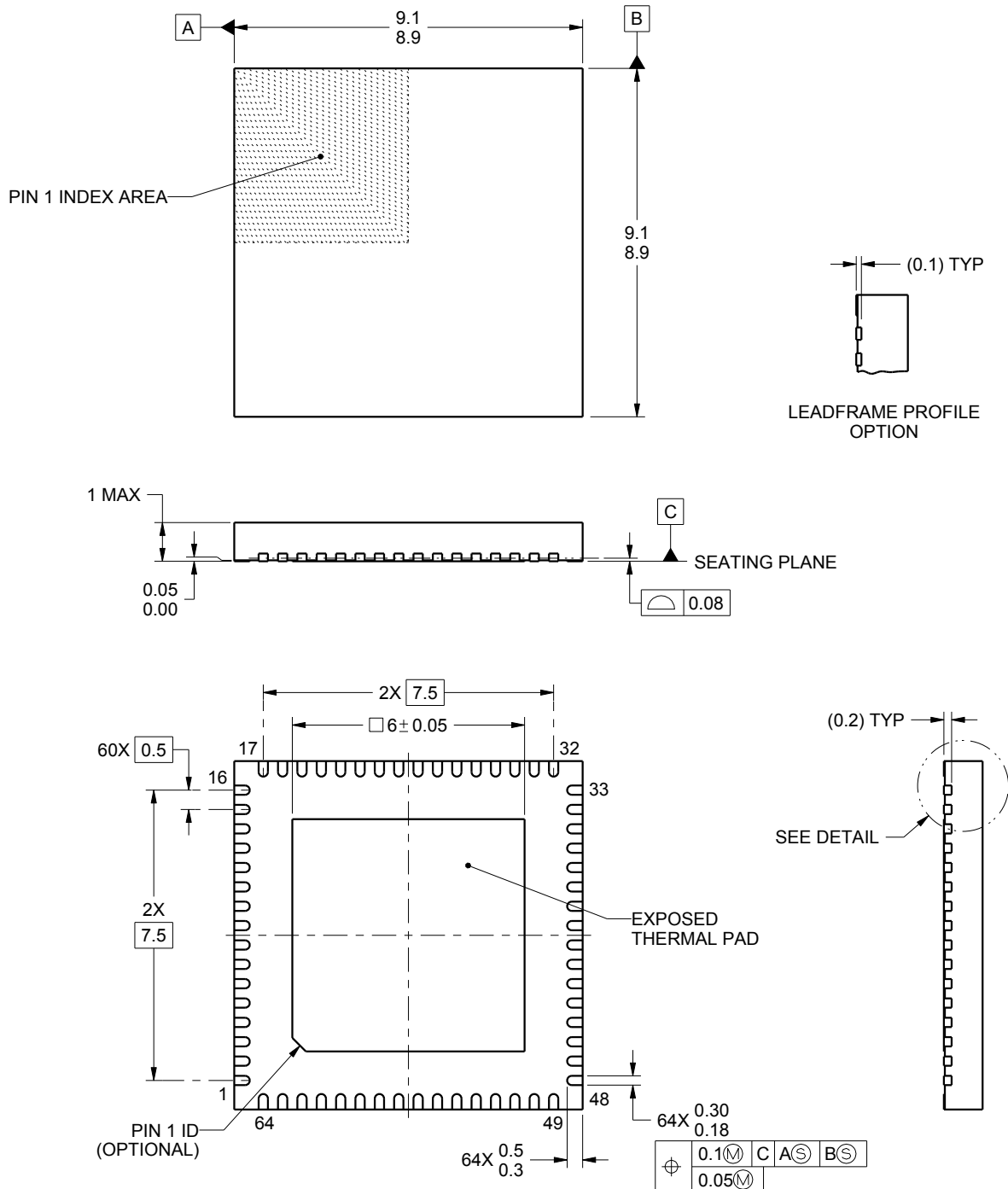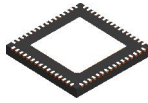| Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TUSB8042A1RGCR	VQFN	RGC	64	2000	367.0	367.0	38.0
TUSB8042A1RGCT	VQFN	RGC	64	250	210.0	185.0	35.0
TUSB8042AIRGCR	VQFN	RGC	64	2000	367.0	367.0	38.0
TUSB8042AIRGCT	VQFN	RGC	64	250	210.0	185.0	35.0
TUSB8042ARGCR	VQFN	RGC	64	2000	367.0	367.0	38.0
TUSB8042ARGCT	VQFN	RGC	64	250	210.0	185.0	35.0
TUSB8042ARGCTG4	VQFN	RGC	64	250	210.0	185.0	35.0

RGC 64

9 x 9, 0.5 mm pitch
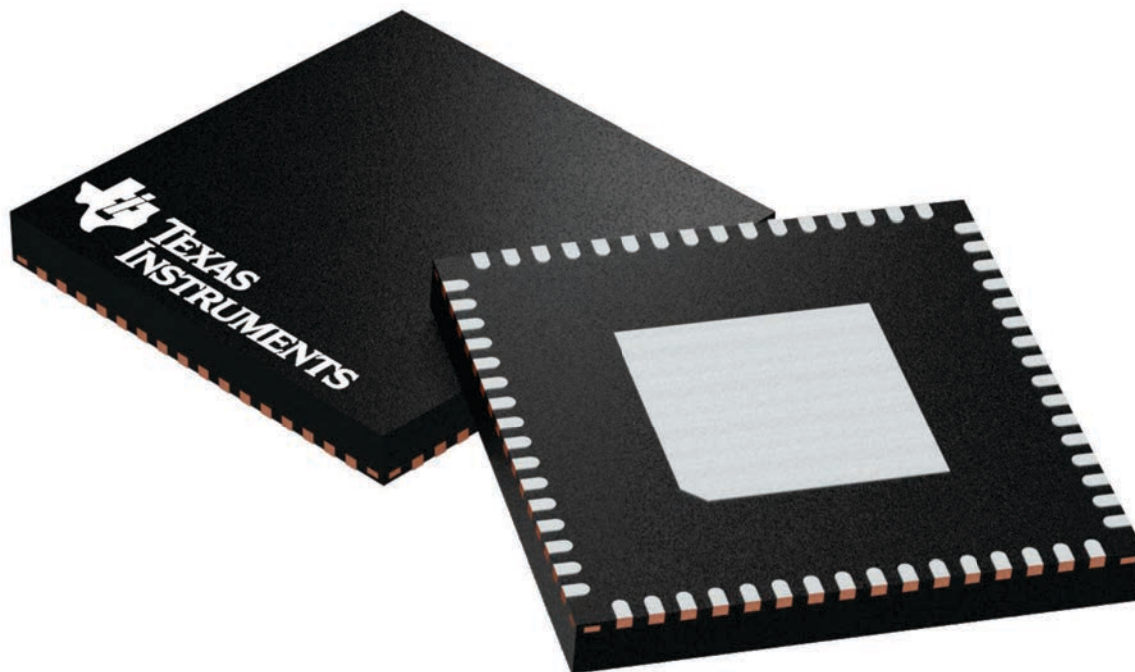
Images above are just a representation of the package family, actual package may vary.
Refer to the product data sheet for package details.

4224597/A

A

9.1
8.9

B

PIN 1 INDEX AREA

9.1
8.9

(0.1) TYP

LEADFRAME PROFILE
OPTION

1 MAX

C

SEATING PLANE

0.05
0.00

0.08

2X 7.5

□ 6 ± 0.05

(0.2) TYP

60X 0.5

17

32

33

16

SEE DETAIL

2X
7.5

EXPOSED
THERMAL PAD

1

48

PIN 1 ID
(OPTIONAL)

64

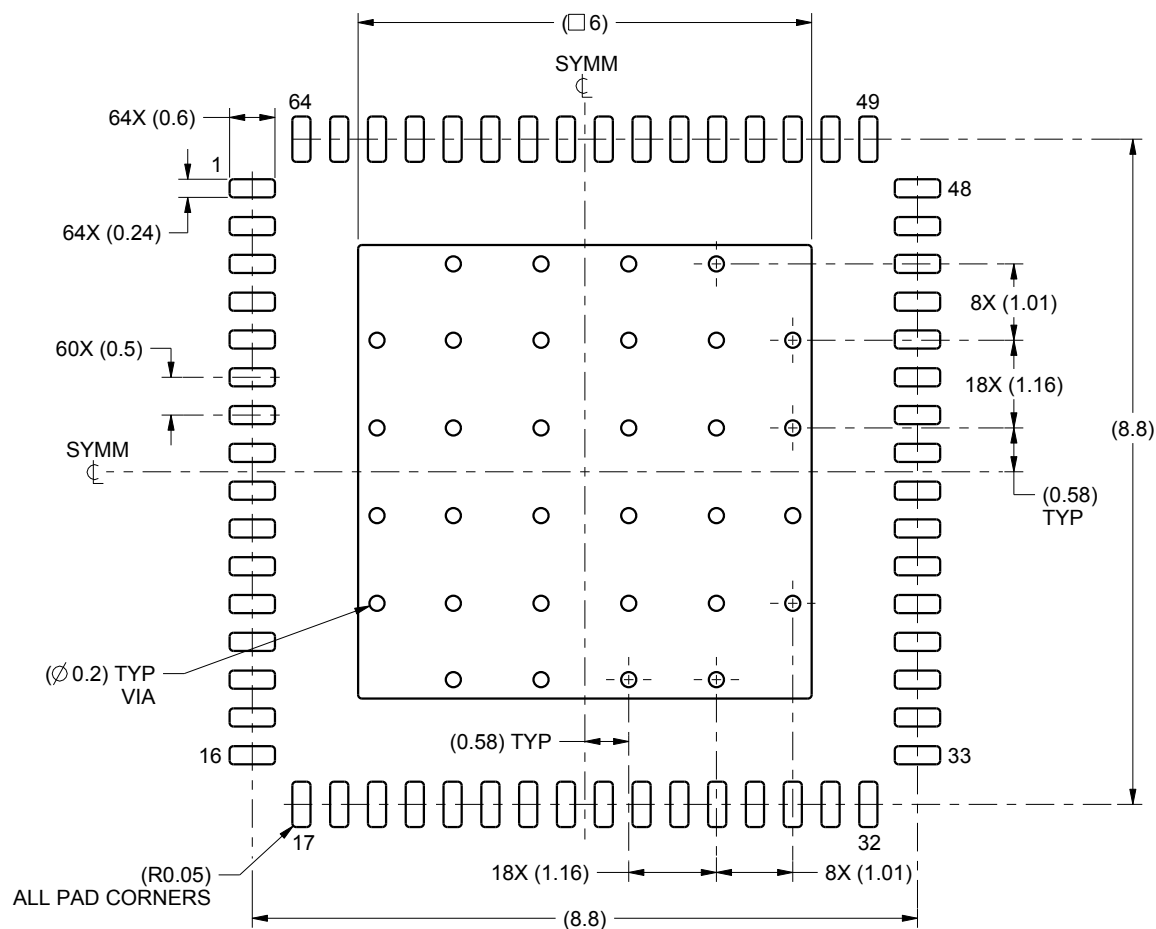49

64X 0.30
0.18

64X 0.5
0.3

0.1 Ⓜ C AⓈ BⓈ

0.05 Ⓜ

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NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. The package thermal pad must be soldered to the printed circuit board for thermal and mechanical performance.
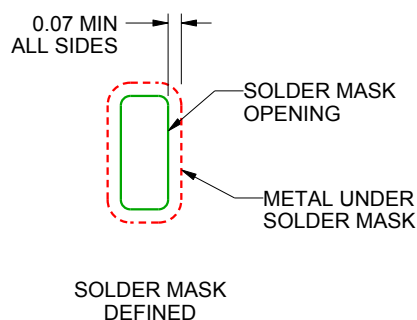
RGC0064G

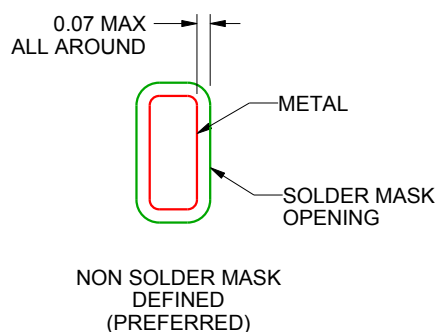**VQFN - 1 mm max height**

PLASTIC QUAD FLATPACK - NO LEAD

(□ 6)

SYMM

64X (0.6)

64

1

64X (0.24)

60X (0.5)

SYMM

(⌀ 0.2) TYP
VIA

16

(R0.05)
ALL PAD CORNERS

17

49

48

8X (1.01)

18X (1.16)

(8.8)

(0.58)
TYP

(0.58) TYP

33

32

18X (1.16)   8X (1.01)

(8.8)

LAND PATTERN EXAMPLE
SCALE:10X

0.07 MAX
ALL AROUND

METAL

SOLDER MASK
OPENING

NON SOLDER MASK
DEFINED
(PREFERRED)

0.07 MIN
ALL SIDES

SOLDER MASK
OPENING

METAL UNDER
SOLDER MASK

SOLDER MASK
DEFINED

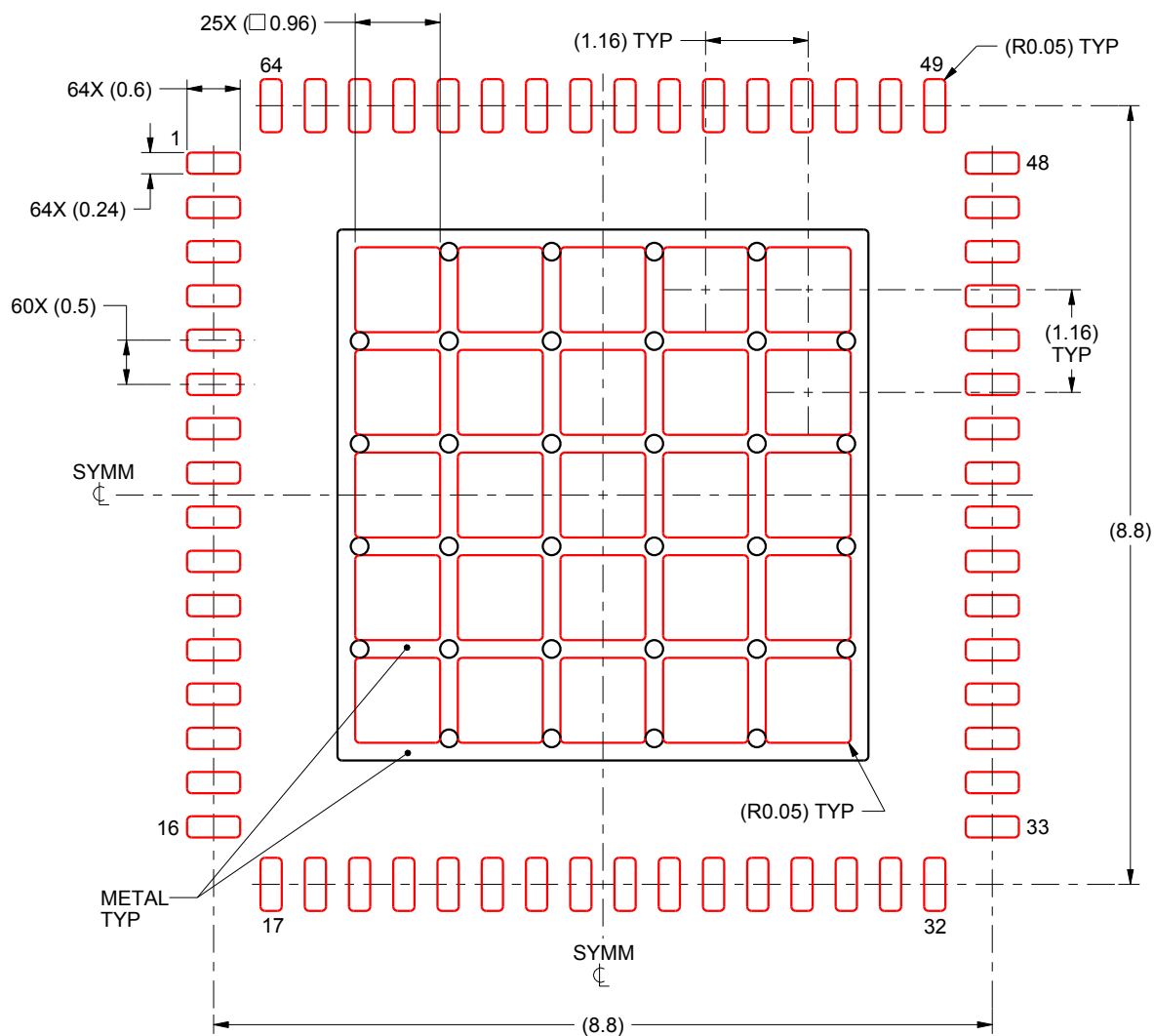**SOLDER MASK DETAILS**

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NOTES: (continued)

4. This package is designed to be soldered to a thermal pad on the board. For more information, see Texas Instruments literature number SLUA271 (www.ti.com/lit/slua271).

25X (□0.96)

64X (0.6)

64

1

64X (0.24)

60X (0.5)

SYMM
₵

METAL
TYP

16

17

(1.16) TYP

49

(R0.05) TYP

48

(1.16)
TYP

(8.8)

33

(R0.05) TYP

32

SYMM
₵

(8.8)

SOLDER PASTE EXAMPLE
BASED ON 0.125 mm THICK STENCIL

EXPOSED PAD
64% PRINTED SOLDER COVERAGE BY AREA
SCALE:12X

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NOTES: (continued)

5. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate
   design recommendations.

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