TWL6032 Fully Integrated Power Management with Power Path and Battery Charger

1 Device Overview

1.1 Features

- Five Highly Efficient Buck Converters
  - One 3 MHz, 0.6 to 2.1 V at 5.0 A, DVS-Capable
  - One 6 MHz, 0.6 to 2.1 V at 2.5 A, DVS-Capable
  - Three 6 MHz, 0.6 to 2.1 V at 1.1 A, One Is DVS-Capable
  - Extended Mode for Higher Output Voltages
- 11 General-Purpose Low-Dropout Voltage Regulators (LDOs)
  - Six 1.0 to 3.3 V at 0.2 A With Battery or Preregulated Supply:
    - One Can be Used as Vibrator Driver
    - One 1.0 to 3.3 V at 50 mA With Battery or Preregulated Supply
    - One Low-Noise 1.0 to 3.3 V at 50 mA With Battery or Preregulated Supply
    - One 3.3 V at 100 mA USB LDO
    - Two LDOs for TWL6032 Internal Use
- USB OTG Module:
  - ID Detection, Accessory Charger Adapter (ACA) Support
  - Accessory Detection Protocol (ADP) Support
- Backup Battery Charger
- 12-Bit Sigma-Delta Analog-to-Digital Converter (ADC) With 19 Input Channels:
  - Seven External Input Channels
- 13-Bit Coulomb Counter With Four Programmable Integration Periods
- Low-Power Consumption:
  - 8 µA in BACKUP State
  - 20 µA in WAIT-ON State
  - 110 µA in SLEEP State, With Two DC-DC Converters Active
- Real-Time Clock (RTC) With Timer and Alarm Wake-Up:
  - Three Buffered 32-kHz Outputs
- SIM and SD/MMC Card Detections
- Two Digital PWM Outputs
- Thermal Monitoring:
  - High-Temperature Warning
  - Thermal Shutdown
- Control:
  - Configurable Power-Up and Power-Down Sequences (OTP Memory)
  - Configurable Sequences Between SLEEP and ACTIVE States (OTP Memory)
  - Three Digital Output Signals that can be Included in the Startup Sequence to Control External Devices
  - Two Inter-Integrated Circuit (I^2C) Interfaces
  - All Resources Configurable by I^2C
- System Voltage Regulator and Battery Charger With Power Path From USB:
  - Input Current Limit to Comply With USB Standard
  - 3-MHz Switched-Mode Regulator With Integrated Power FET for up to 2.0-A Current
  - Dedicated Control Loop for Battery Current and Voltage
  - External Low-Ohmic FET for Power Path and Battery Charging
  - Boost Mode Operation for USB OTG
  - Supplement Mode to Deliver Current From Battery During Power Path Operation
  - Charger for Single-Cell Li-Ion and Li-Polymer Battery Packs
  - Safety Timer and Reset Control
  - Thermal Protection
  - Input/Output Overvoltage Protection
  - Charging Indicator LED Driver
  - Compliant With:
    - USB 2.0
    - OTG and EH 2.0
    - USB Battery Charging 1.2
    - YD/T 1591-2006
    - Japanese Battery Charging Guidelines (JEITA)
- Battery Voltage Range From 2.5 to 5.5 V
- Package 5.21-mm × 5.36-mm 155-Pin WCSP

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1.2 Applications

- Mobile Phones and Smart Phones
- Tablets
- Gaming Handsets
- Portable Media Players
- Portable Navigation Systems
- Handheld Devices

1.3 Description

The TWL6032 device is an integrated power-management integrated circuit (PMIC) for applications powered by a rechargeable battery. The device provides five configurable step-down converters with a current capability of up to 5.0 A for memory, processor core, I/O, auxiliary, preregulation for LDOs, and so forth. The device also contains nine LDO regulators for external use that can be supplied from a battery or a preregulated supply. The power-up and power-down controller is configurable and can support any power-up or power-down sequence (programmed in OTP memory). The RTC provides three 32-kHz clock outputs: seconds, minutes, hours, day, month, and year information; as well as alarm wakeup and timer. The TWL6032 device supports 32-kHz clock generation based on a crystal oscillator.

The device integrates a switched-mode system supply regulator from a USB connector. The switched-mode regulator includes power paths from the USB and battery with supplemental mode for immediate startup, even with an empty battery. The battery switch uses an external low-ohmic PMOS transistor allowing minimal serial resistance during fast charging and when operating from battery. The device can also be used without the external PMOS transistor; in this case, the battery is always tied to the system supply and the switched-mode regulator is used for battery charging.

The TWL6032 device is available in a 155-pin WCSP package, 5.21 mm × 5.36 mm with a 0.4-mm ball pitch.

Figure 1-1 shows the TWL6032 device block diagram.

Table 1-1. Device Information(1)

PART NUMBER	PACKAGE	BODY SIZE
TWL6032A1Bx	YFF (155)	5.21 mm × 5.36 mm
TWL6032A2Bx	YFF (155)	5.21 mm × 5.36 mm

(1) For more information, see Section 3, *Mechanical Packaging and Orderable Information*.

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1.4 Functional Block Diagram

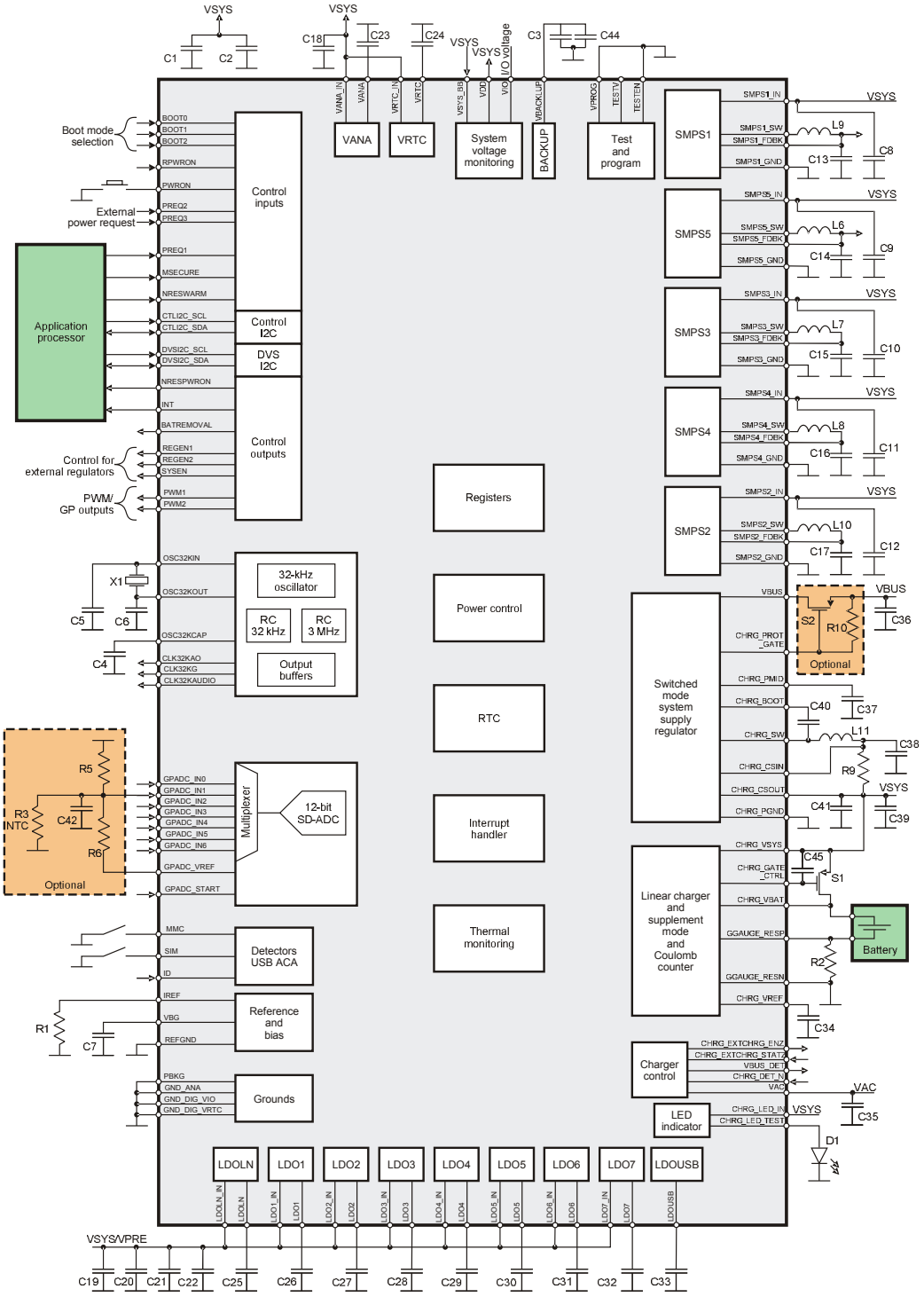


Figure 1-1. TWL6032 Device Block Diagram

For the complete TWL6032 data sheet (SWCS057), contact your TI sales representative.

2 Revision History

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

Changes from Revision A (September 2012) to Revision B	Page
• Changed document to standard TI format.	1

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3 Mechanical Packaging and Orderable Information

3.1 Packaging 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.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TWL6032A1B4YFFR	ACTIVE	DSBGA	YFF	155	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A1B4	Samples
TWL6032A1B4YFFT	ACTIVE	DSBGA	YFF	155	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A1B4	Samples
TWL6032A1B6YFFR	ACTIVE	DSBGA	YFF	155	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A1B6	Samples
TWL6032A2B0YFFR	ACTIVE	DSBGA	YFF	155	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B0	Samples
TWL6032A2B0YFFT	ACTIVE	DSBGA	YFF	155	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B0	Samples
TWL6032A2B4YFFR	ACTIVE	DSBGA	YFF	155	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B4	Samples
TWL6032A2B4YFFT	ACTIVE	DSBGA	YFF	155	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B4	Samples
TWL6032A2B6YFFR	ACTIVE	DSBGA	YFF	155	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B6	Samples
TWL6032A2B7YFFR	ACTIVE	DSBGA	YFF	155	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B7	Samples
TWL6032A2B7YFFT	ACTIVE	DSBGA	YFF	155	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B7	Samples
TWL6032A2B8YFFR	ACTIVE	DSBGA	YFF	155	3000	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B8	Samples
TWL6032A2B8YFFT	ACTIVE	DSBGA	YFF	155	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2B8	Samples
TWL6032A2BEYFFT	ACTIVE	DSBGA	YFF	155	250	Green (RoHS & no Sb/Br)	SNAGCU	Level-1-260C-UNLIM	-40 to 85	TWL6032 A2BE	Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
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Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

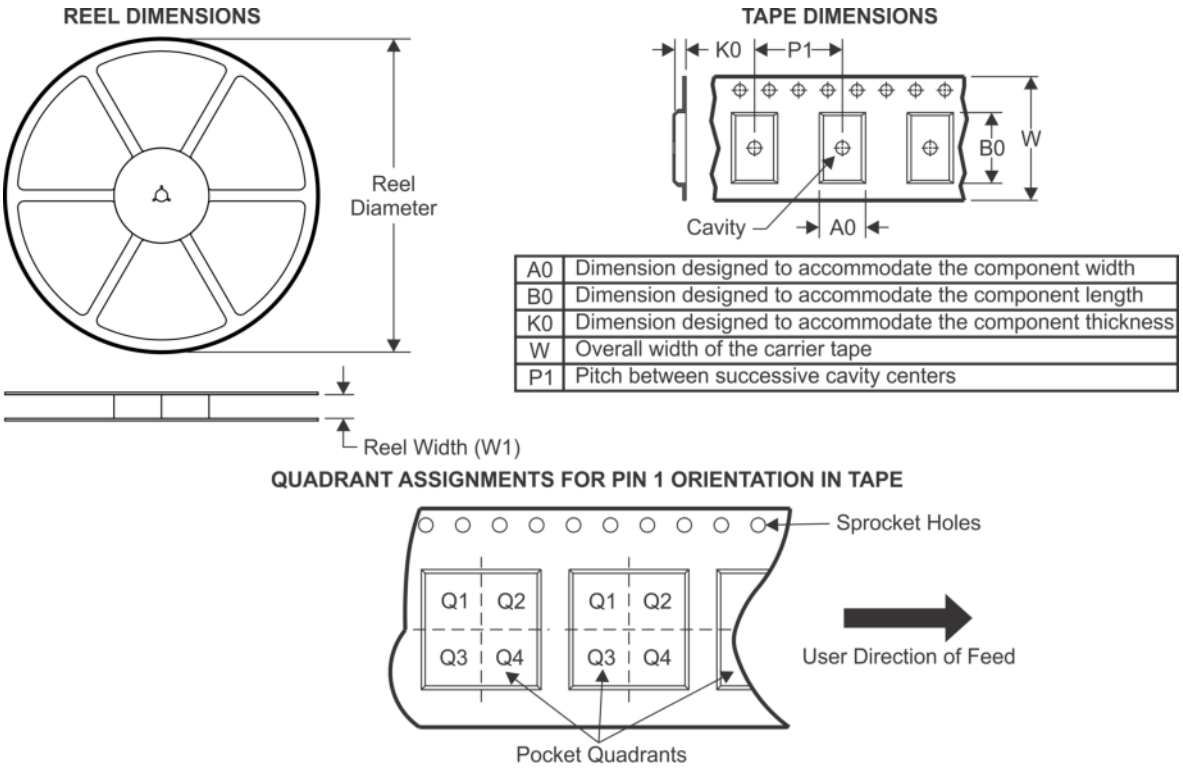
(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

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

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TAPE AND REEL INFORMATION

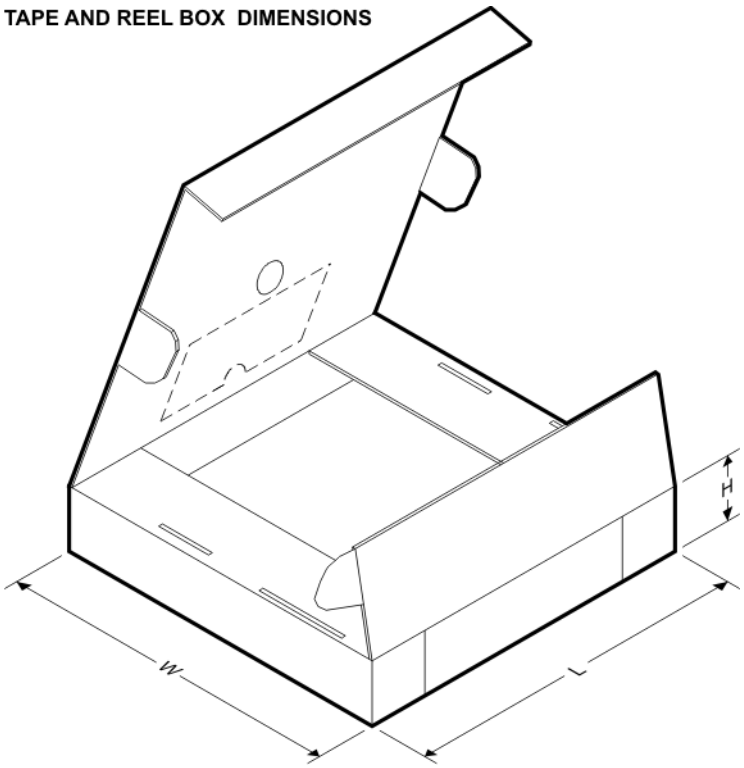


A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

*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
TWL6032A1B4YFFR	DSBGA	YFF	155	3000	330.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A1B4YFFT	DSBGA	YFF	155	250	180.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A1B6YFFR	DSBGA	YFF	155	3000	330.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B0YFFR	DSBGA	YFF	155	3000	330.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B0YFFT	DSBGA	YFF	155	250	180.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B4YFFR	DSBGA	YFF	155	3000	330.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B4YFFT	DSBGA	YFF	155	250	180.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B6YFFR	DSBGA	YFF	155	3000	330.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B7YFFR	DSBGA	YFF	155	3000	330.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B7YFFT	DSBGA	YFF	155	250	180.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B8YFFR	DSBGA	YFF	155	3000	330.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2B8YFFT	DSBGA	YFF	155	250	180.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1
TWL6032A2BEYFFT	DSBGA	YFF	155	250	180.0	12.4	5.35	5.49	0.86	8.0	12.0	Q1

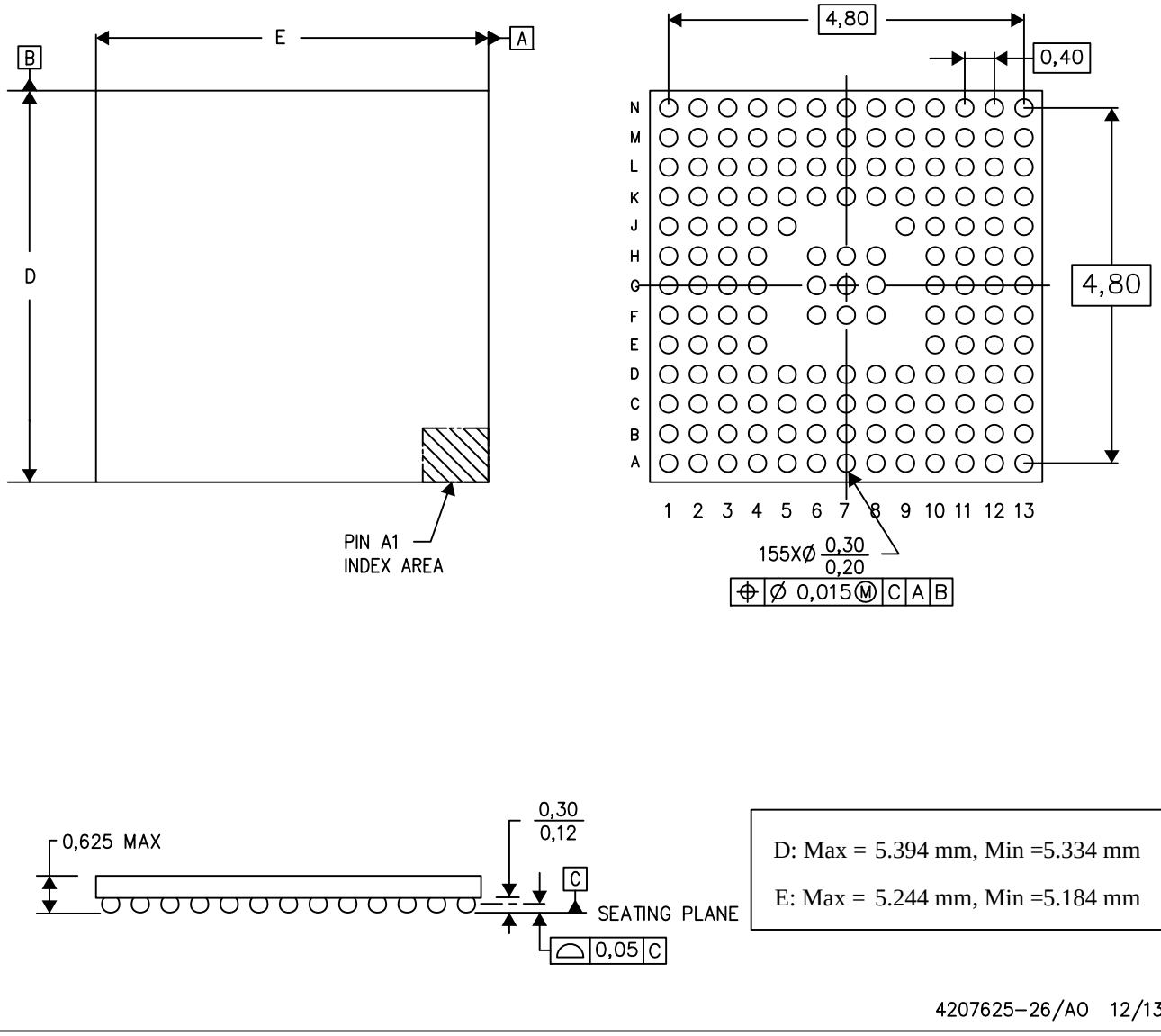
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TWL6032A1B4YFFR	DSBGA	YFF	155	3000	367.0	367.0	35.0
TWL6032A1B4YFFT	DSBGA	YFF	155	250	182.0	182.0	20.0
TWL6032A1B6YFFR	DSBGA	YFF	155	3000	367.0	367.0	35.0
TWL6032A2B0YFFR	DSBGA	YFF	155	3000	367.0	367.0	35.0
TWL6032A2B0YFFT	DSBGA	YFF	155	250	182.0	182.0	20.0
TWL6032A2B4YFFR	DSBGA	YFF	155	3000	367.0	367.0	35.0
TWL6032A2B4YFFT	DSBGA	YFF	155	250	182.0	182.0	20.0
TWL6032A2B6YFFR	DSBGA	YFF	155	3000	367.0	367.0	35.0
TWL6032A2B7YFFR	DSBGA	YFF	155	3000	367.0	367.0	35.0
TWL6032A2B7YFFT	DSBGA	YFF	155	250	182.0	182.0	20.0
TWL6032A2B8YFFR	DSBGA	YFF	155	3000	367.0	367.0	35.0
TWL6032A2B8YFFT	DSBGA	YFF	155	250	182.0	182.0	20.0
TWL6032A2BEYFFT	DSBGA	YFF	155	250	182.0	182.0	20.0

YFF (R–XBGA–N155) DIE–SIZE BALL GRID ARRAY



D: Max = 5.394 mm, Min =5.334 mm

E: Max = 5.244 mm, Min =5.184 mm

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NOTES: A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
B. This drawing is subject to change without notice.
C. NanoFree™ package configuration.

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