TWO-CHANNEL EMI FILTER FOR AUDIO SPEAKER/AVIF CONNECTOR

Check for Samples: TPD2F702

FEATURES

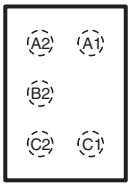
- **Two-Channel EMI Filter for Audio Speaker or AVIF Ports**
- **Best in class EMI Noise Filtering for Audio Applications (-3dB Bandwidth = 1.2MHz)**
- **> 50 dB Crosstalk Attenuation at 100 MHz**
- **Integrated ESD Protection Exceeds IEC61000-4-2 (Level 4) at the Connector Ports (Level 4) on the Connector Side**
  - **±15-kV Human-Body Model (HBM)**
  - **±30-kV IEC 61000-4-2 Contact Discharge**
  - **±30-kV IEC 61000-4-2 Air-Gap Discharge**
- **Pi-Style (C-R-C) Filter Configuration (C1 = 30 pF, R = 15 Ω, C2 = 5000 pF)**
- **Ultra Low Leakage Current (100-nA max)**
- **Space-Saving WCSP Package and Flow-Through Pin Mapping**
- **Industrial Temperature Range: –40°C to 85°C**

APPLICATIONS

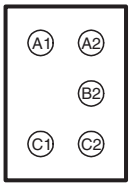
- **Mobile Phones**
- **PDAs**
- **Headsets**
- **Portable Gaming**

YFK PACKAGE

TOP VIEW (Bump Facing Down)



BOTTOM VIEW (Bump Facing Up)



TERMINAL ASSIGNMENTS

	1	2
A	Ch 1 Input, ESD Level 1	Ch 1 Output, ESD Level 4
B	Depopulated Ball	Ground
C	Ch 2 Input, ESD Level 1	Ch 2 Output, ESD Level 4

DESCRIPTION/ORDERING INFORMATION

The TPD2F702 is a two-channel EMI filter for audio interface applications. With the integration of 5000 pF capacitor in a space saving low noise WCSP package, the TPD2F702 offers superior EMI noise supression (2MHz to 6GHz) compared to discrete implementation. The device is optimized for AVIF connector or speaker port interfaces. This low-pass filter array also provides system level ESD protection to eliminate the need for external ESD clamps. The TPD2F702 exceeds ±30-kV ratings per IEC6100-4-2 Contact and Air-Gap specifications. It is primarily used in the mobile-phone audio headphone speaker interface, but can be used in other audio applications.

The TPD2F702 is a highly integrated device designed to suppress EMI/RFI noise in all systems subjected to electromagnetic interferences. This filter includes ESD protection circuitry which prevents damage to the application when subjected to ESD surges far exceeding IEC 61000-4-2 (Level 4).

The TPD2F702 is specified for –40°C to 85°C operation.

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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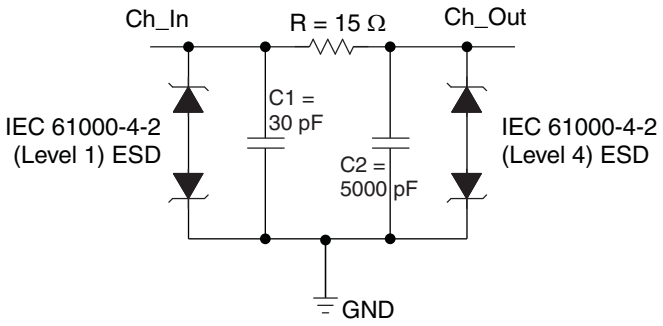
ORDERING INFORMATION

T_A	PACKAGE(1) (2)		ORDERABLE PART NUMBER	TOP-SIDE MARKING
–40°C to 85°C	WCSP – YFK	Tape and reel	TPD2F702YFKR	5V

(1) Package drawings, thermal data, and symbolization are available at www.ti.com/packaging.
(2) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI Web site at www.ti.com.

SCHEMATIC
(One of Two Channels)



ABSOLUTE MAXIMUM RATINGS(1)

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

		MIN	MAX	UNIT
V_{IO}	Continuous IO voltage	–5.5	5.5	V
	Total power dissipation		200	mW
T_A	Characterized free-air operating temperature range	–40	85	°C
	Reflow temperature 1.6 mm (1/16 inch) from case for 10 seconds		260	°C

(1) Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rated conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING CONDITIONS

		MIN	MAX	UNIT
V_{IO}	Continuous IO voltage	–5	5	V

ESD RATINGS

ESD TYPE	TERMINAL	TYP	UNIT
IEC 61000-4-2 Contact Discharge	Input	±4	kV
	Output	±30	
IEC 61000-4-2 Air-Gap Discharge	Input	±4	kV
	Output	±30	
Human-Body Model	Input	±15	kV
	Output	±15	

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ELECTRICAL CHARACTERISTICS

T_A = –40°C to 85°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP	MAX	UNIT
V_{BR}	DC break-down voltage	I_I = 1 mA	Input pin	±14		±18.2	V
		I_O = 1 mA	Output pin	±14		±18.2	
I_{IO}	Current from input or output	V_I or V_O = 2.5 V	Input, output pins		0.01	0.1	µA
C1	Capacitance of the input terminal	V_I = 0 V, V_{OSC} = 30 mV, f = 100 kHz	Input pin		30		pF
C2	Capacitance of the output terminal	V_O = 0 V, V_{OSC} = 30 mV, f = 100 kHz	Output pin		5000		pF
R	Series resistor			12	15	18	Ω
R_{dyn}	Dynamic resistance	I_I = 1.5 A or I_O = 1.5 A	Output clamp		1		Ω
			Input clamp		3		
f_C	Cut-off frequency	Z_{SOURCE} = 50 Ω, Z_{LOAD} = 50 Ω			1.2		MHz

TYPICAL OPERATING CHARACTERISTICS

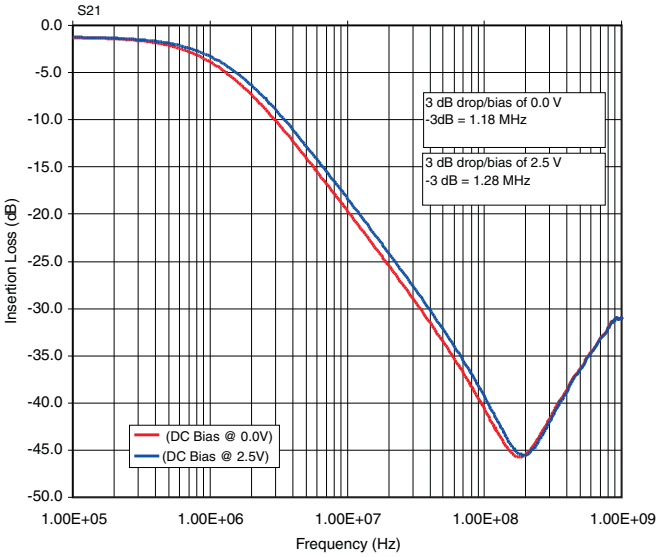

Figure 1. Insertion Loss

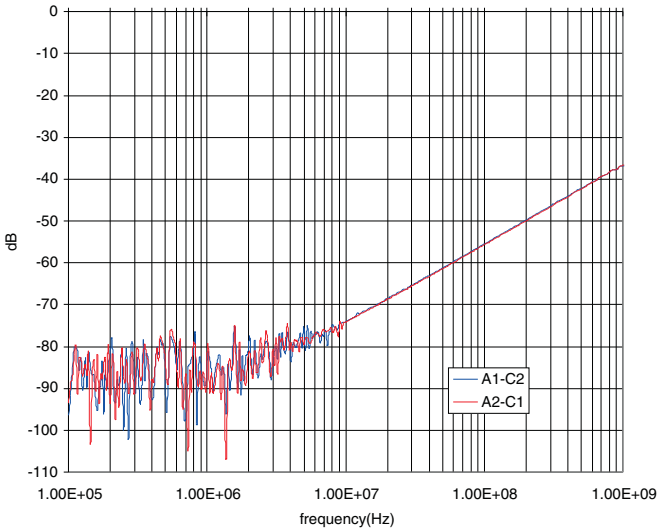

Figure 2. Channel-to-Channel Crosstalk with 50 Ω Termination for the Non-Measuring Pins

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TYPICAL OPERATING CHARACTERISTICS (continued)

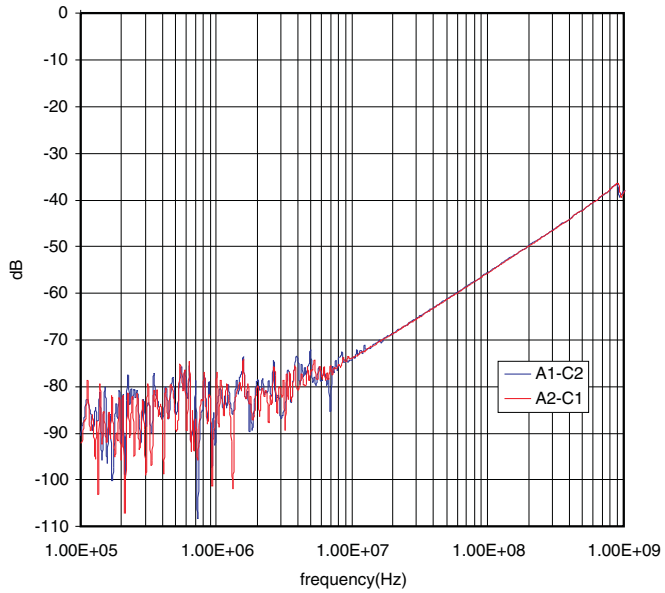

Figure 3. Channel-to-Channel Crosstalk with No Termination for the Non-Measuring Pins

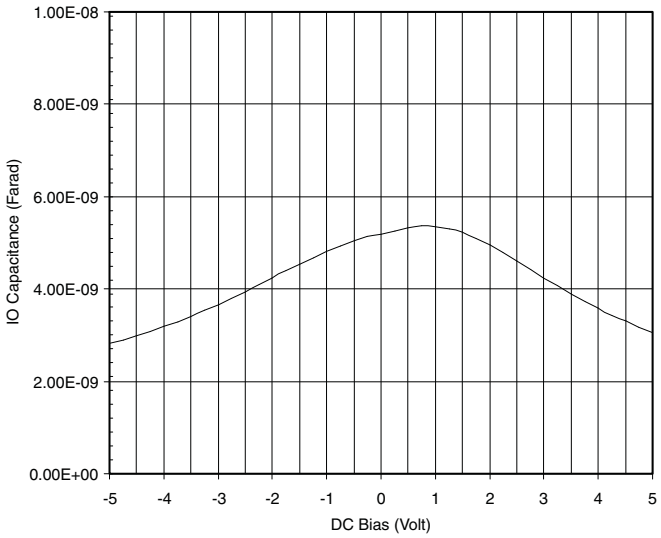

Figure 4. IO Capacitance Versus IO Voltage (Measured at f = 100 kHz)

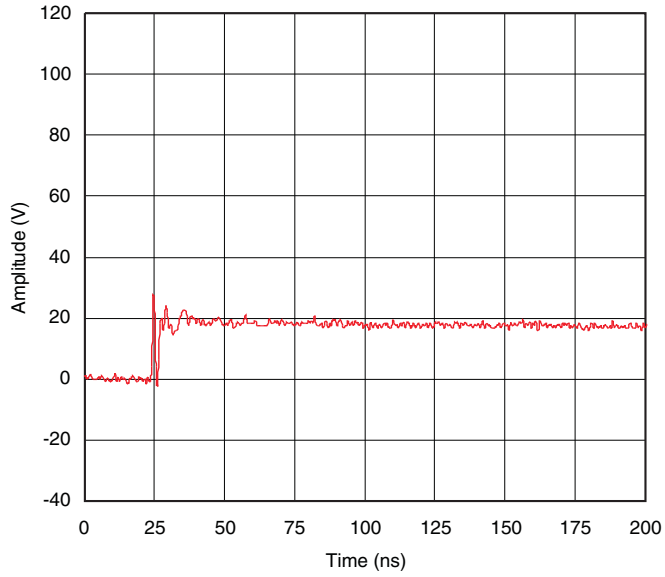

Figure 5. IEC Clamping Waveforms +8 kV Contact, Out Stressed and In Measured

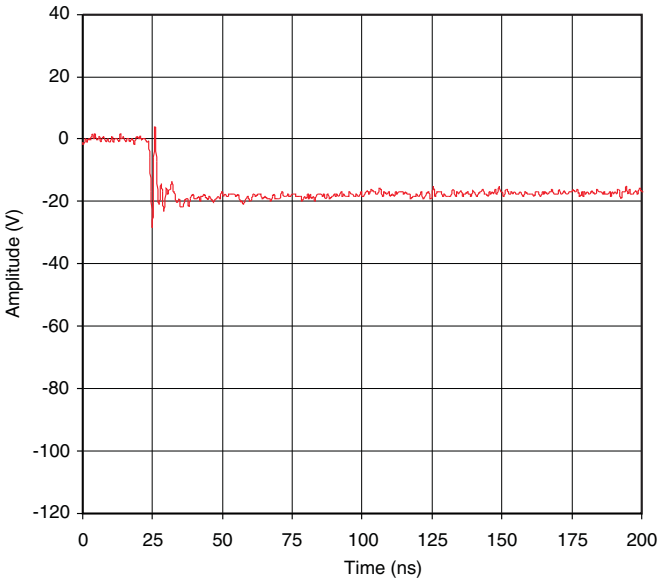

Figure 6. IEC Clamping Waveforms –8 kV Contact, Out Stressed and In Measured

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TYPICAL OPERATING CHARACTERISTICS (continued)

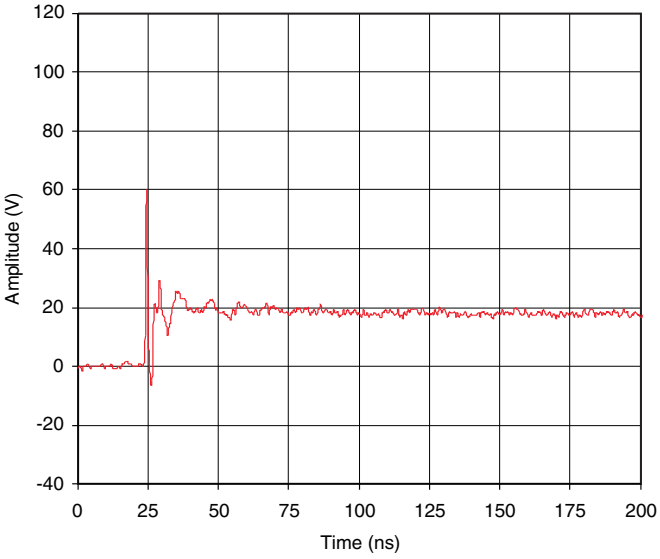

Figure 7. IEC Clamping Waveforms +15 kV Contact, Out Stressed and In Measured

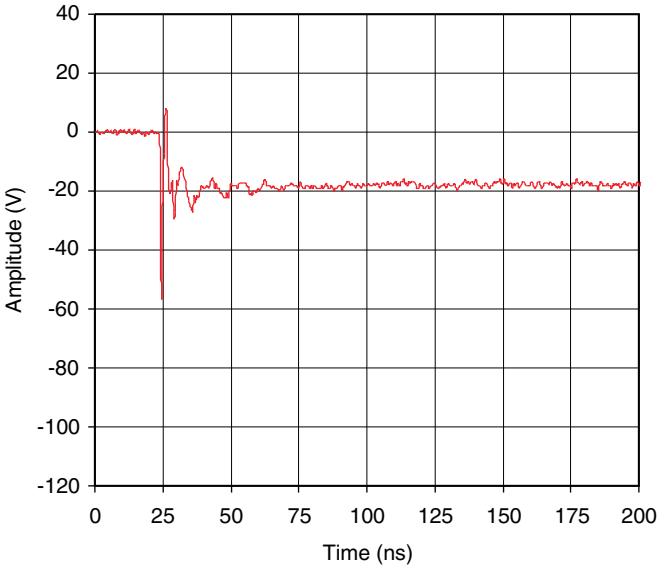

Figure 8. IEC Clamping Waveforms –15 kV Contact, Out Stressed and In Measured

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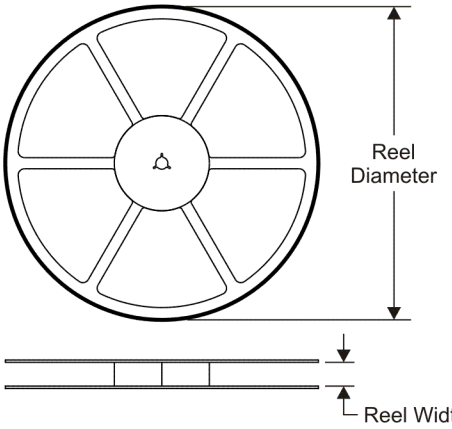
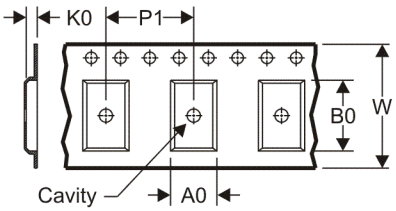
TAPE AND REEL INFORMATION

REEL DIMENSIONS

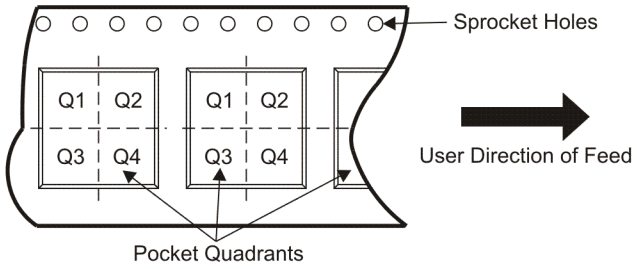


TAPE DIMENSIONS



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

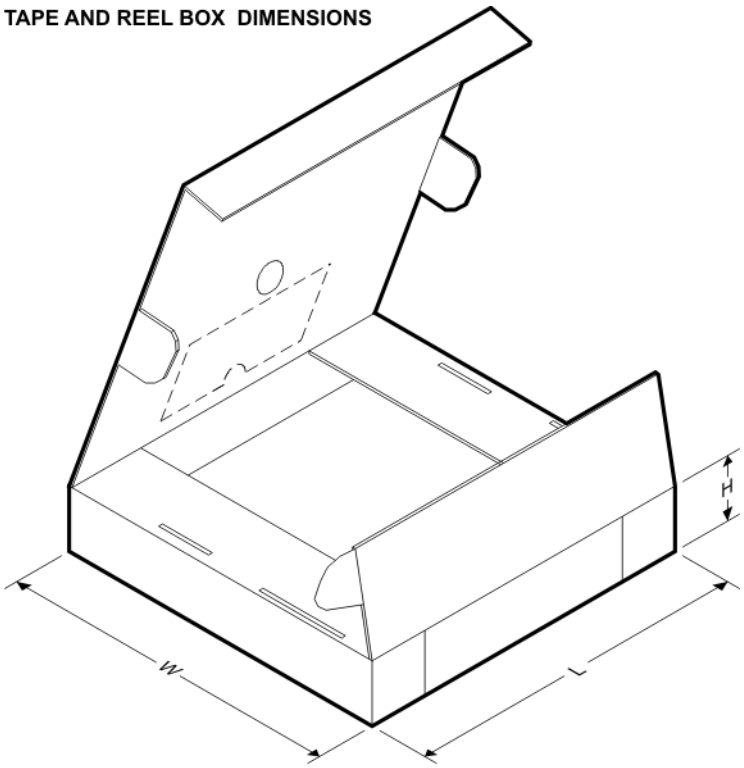
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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
TPD2F702YFKR	DSBGA	YFK	5	3000	180.0	8.4	1.02	1.42	0.62	4.0	8.0	Q2

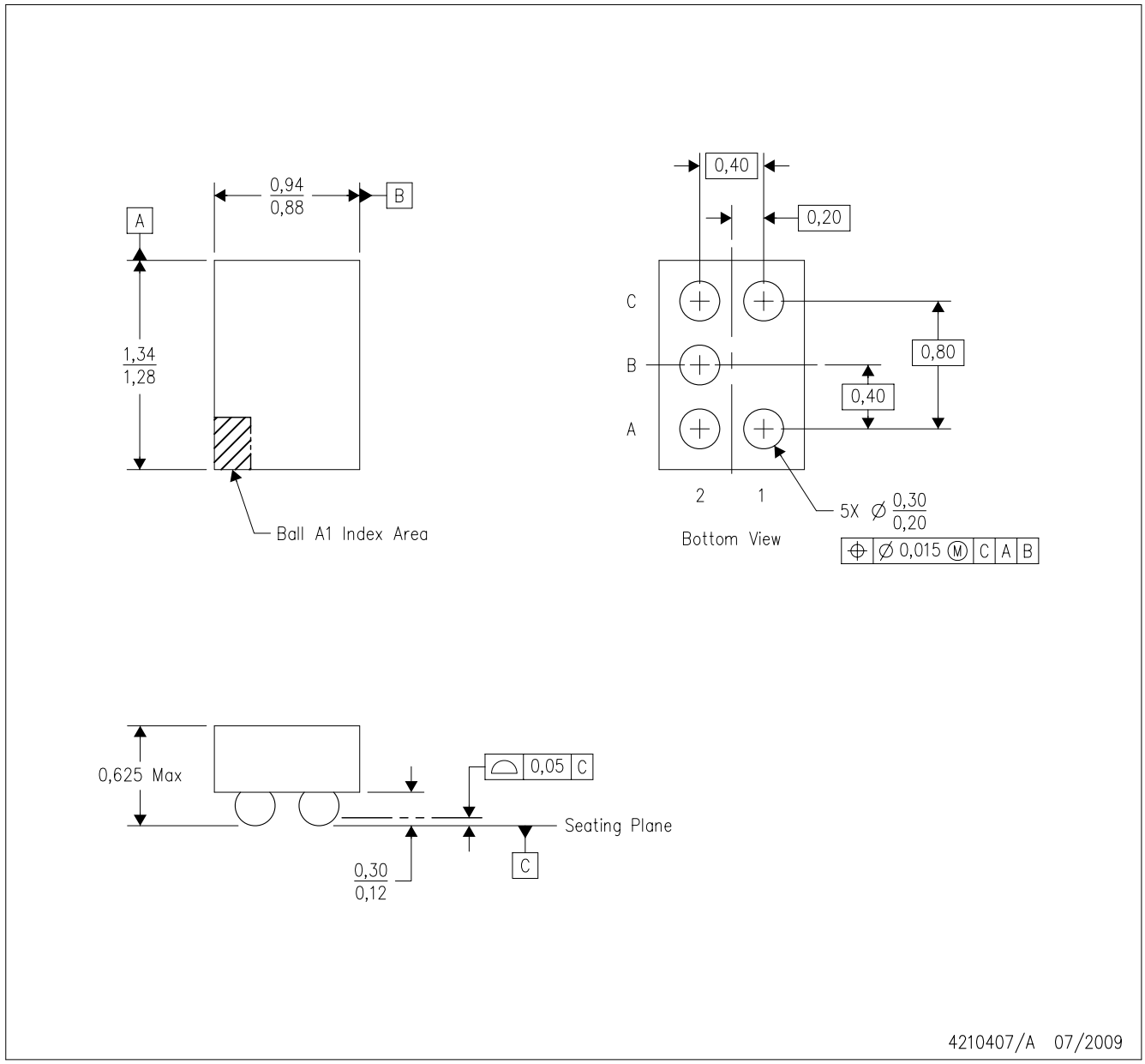
TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
TPD2F702YFKR	DSBGA	YFK	5	3000	210.0	185.0	35.0

YFK (R–XBGA–N5) (CUSTOM) DIE–SIZE BALL GRID ARRAY



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.
D. This is a Pb–free solder ball design.

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