BROADCOM®

Data Sheet

ACPF-8041

Band 41 Filter for HPUE

Description

The Broadcom® ACPF-8041 is a miniature LTE Band 41 (2496 MHz to 2690 MHz) Tx/Rx bandpass filter designed for use in high-power user equipment (HPUE) applications.

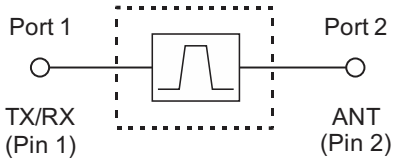
The ACPF-8041 supports +33 dBm (LTE modulation) power requirements for HPUE applications. Low insertion loss in Band 41 reduces power amplifier output and minimizes current consumption, important for HPUE applications.

The ACPF-8041 is designed with the Broadcom innovative Film Bulk Acoustic Resonator (FBAR) technology, which makes possible ultra-small, high-Q filters at a fraction of their usual size.

The ACPF-8041 also utilizes the Broadcom advanced Microcap bonded-wafer technology. This miniaturization process results in a package size of only 1.4 mm × 1.8 mm and maximum height of 0.775 mm.

The ACPF-8041 is compatible with high-volume, lead-free SMT soldering processes.

Functional Block Diagram



Features

- Low insertion loss
  - Minimizes PA output
  - Minimizes current consumption
- High power rating
  - Designed for HPUE: +33 dBm avg, +38 dBm peak (LTE modulation)
- High rejection in ISM Band and low harmonics
  - Enables coexistence with 2.4-GHz and 5-GHz Wi-Fi
- 50Ω input/output
  - No external matching required
- Subminiature size
  - 1.4 mm × 1.8 mm footprint
  - 0.775 mm maximum height
- Environmental
  - RoHS 6 compliant
  - Halogen free
  - TBBPA free

Specifications

- Performance guaranteed –20 to +85°C
- Band 41 insertion loss: 3.1 dB maximum

Applications

- High power user equipment (HPUE) wireless applications operating in Band 41

Table 1: ACPF-8041 Electrical Specifications

Z_0 = 50Ω, T_C = –20°C to +85°C, unless otherwise specified.[a]

Symbol	Parameter	Min[b]	Typ[c]	Max[b]	Unit
S21	Insertion Loss, Band 41				
	2496 to 2500 MHz (+25°C)	—	2.1	2.7	dB
	2496 to 2500 MHz (–20 to +85°C)	—	—	3.1	dB
	2500 to 2545 MHz (+25°C)	—	1.5	2.4	dB
	2500 to 2545 MHz (–20 to +85°C)	—	—	2.5	dB
	2545 to 2665 MHz (+25°C)	—	1.2	1.6	dB
	2545 to 2665 MHz (–20 to +85°C)	—	—	1.8	dB
	2665 to 2690 MHz (+25°C)	—	1.1	1.6	dB
	2665 to 2690 MHz (–20 to +85°C)	—	—	1.8	dB
S21	Attenuation, 0 to 699 MHz	35	48	—	dB
S21	Attenuation, 699 to 916 MHz	35	48	—	dB
S21	Attenuation, 916 to 1565 MHz	30	36	—	dB
S21	Attenuation, 1565 to 1615 MHz	30	36	—	dB
S21	Attenuation, 1615 to 1710 MHz	30	39	—	dB
S21	Attenuation, 1710 to 1785 MHz	35	43	—	dB
S21	Attenuation, 1805 to 1880 MHz	25	35	—	dB
S21	Attenuation, 1880 to 1920 MHz	25	32	—	dB
S21	Attenuation, 1920 to 1990 MHz	20	29	—	dB
S21	Attenuation, 1990 to 2300 MHz	12	20	—	dB
S21	Attenuation, 2300 to 2400 MHz	12	23	—	dB
S21	Attenuation, Wi-Fi 802.11 b/g/n Band[d]				
	2401 to 2473 MHz, Wi-Fi Ch 1–11 (+25°C)	40	48	—	dB
	2401 to 2473 MHz, Wi-Fi Ch 1–11 (–20 to +85°C)	40	—	—	dB
	2456 to 2478 MHz, Wi-Fi Ch 12 (+25°C)	39	45	—	dB
	2456 to 2478 MHz, Wi-Fi Ch 12 (–20 to +85°C)	27	—	—	dB
	2461 to 2483 MHz, Wi-Fi Ch 13 (+25°C)	25	44	—	dB
	2461 to 2483 MHz, Wi-Fi Ch 13 (–20 to +25°C)	—	—	—	dB
S21	Attenuation, 2760 to 2850 MHz	18	36	—	dB
S21	Attenuation, 2850 to 3300 MHz	12	19	—	dB
S21	Attenuation, 3300 to 4000 MHz	18	26	—	dB
S21	Attenuation, 4000 to 4992 MHz	25	37	—	dB
S21	Attenuation, 4992 to 5380 MHz	35	54	—	dB
S21	Attenuation, 5380 to 7488 MHz	25	40	—	dB
S21	Attenuation, 7488 to 8070 MHz	30	46	—	dB
S11	Return Loss (SWR), Tx/Rx, 2496 to 2690 MHz	12	19 (1.3)	(1.7)	dB
S22	Return Loss (SWR), Ant, 2496 to 2690 MHz	12	19 (1.3)	(1.7)	dB

a. T_C is the case temperature and is defined as the temperature of the underside of the filter where it contacts the circuit board.

b. Min/Max specifications are guaranteed at the indicated temperature (unless otherwise noted).

c. Typical data is the average value (arithmetic mean) of the parameter over the indicated band at +25°C.

d. Wi-Fi Channel Average Attenuation, obtained by averaging |S21| over the center 19 MHz of the channel(s) and converting to dB value.

Table 2: Absolute Maximum Ratings[a]

Parameter	Value	Unit
Storage Temperature	–40 to +125	°C
Maximum Average RF Input Power to Tx/Rx (Pin 1, Port 1) [b, c]	+33	dBm
Maximum Peak RF Input Power to Tx/Rx (Pin 1, Port 1) [b, c]	+38	dBm
Maximum DC Voltage, Pin 1 to GND[d]	+5	VDC
Maximum DC Voltage, Pin 2 to GND[e]	0	VDC

a. Operation in excess of any one of these conditions may result in permanent damage to the device.

b. LTE modulation. Applies over temperature range of T_C = –20° to +85°C.

c. The ACPF-8041 is not symmetrical. The higher system power (Tx) should be connected to the input side of the filter, Port 1 (Pin 1).

d. The DC resistance from Pin 1 (Tx/Rx) to ground of this device is typically hundreds of kilohms to megohms.

e. The internal DC resistance of Pin 2 (Ant) to ground is approximately a short circuit.

Table 3: Maximum Recommended Operating Conditions[a]

Parameter	Value	Unit
Operating Temperature, T_C[b]	–30 to +85	°C

a. The device will function over the recommended range without degradation in reliability or permanent change in performance, but is not guaranteed to meet electrical specifications.

b. T_C is the case temperature and is defined as the temperature of the underside of the filter where it contacts the circuit board.

ACPF-8041 Typical Performance at T_C = 25°C

Figure 1: Insertion Loss in Passband, 2496 to 2690 MHz

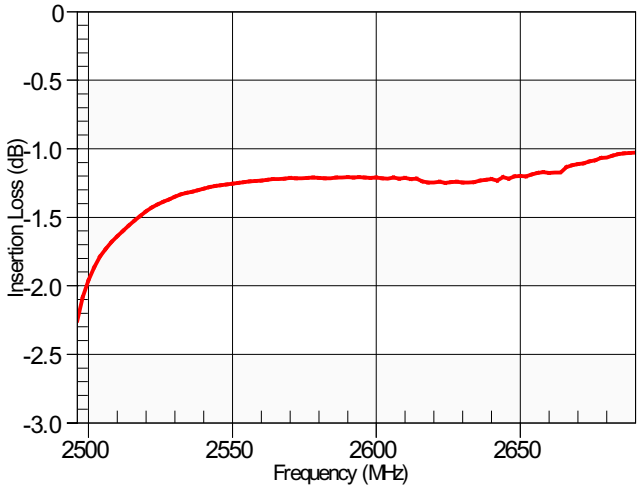


Figure 2: Attenuation, 2400 to 2800 MHz

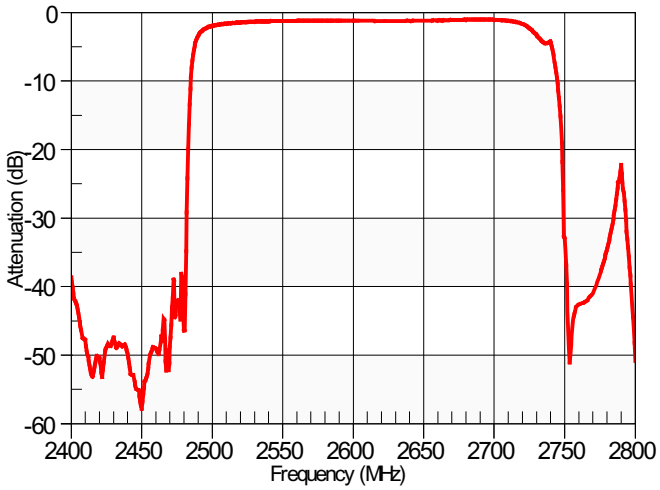


Figure 3: Attenuation, Wideband, 100 to 12,000 MHz

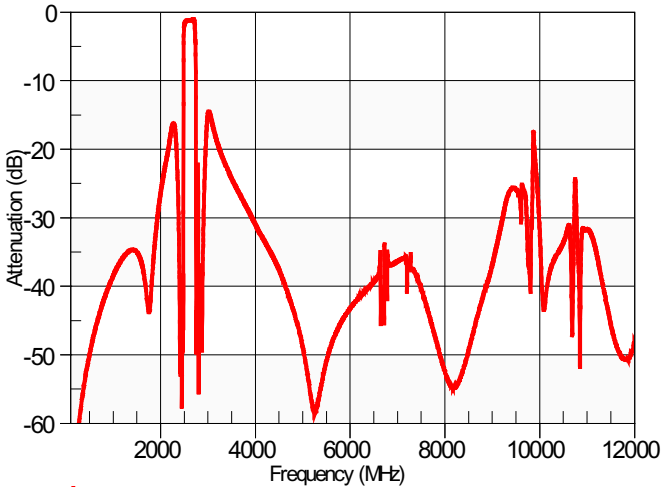


Figure 4: Attenuation, Low Side of Passband, 100 to 2700 MHz

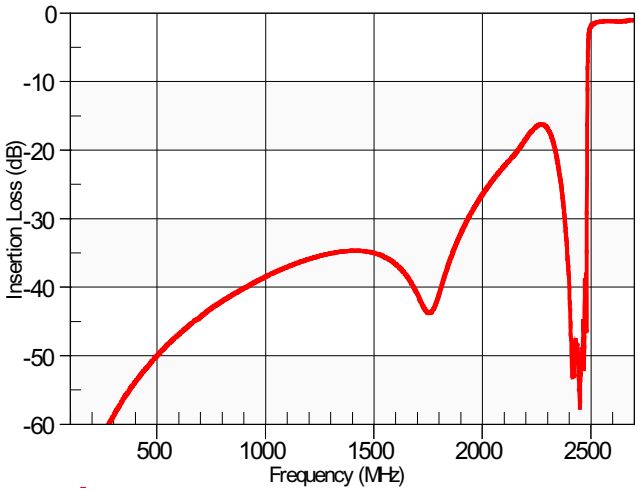


Figure 5: Attenuation, High Side of Passband, 2400 to 8500 MHz

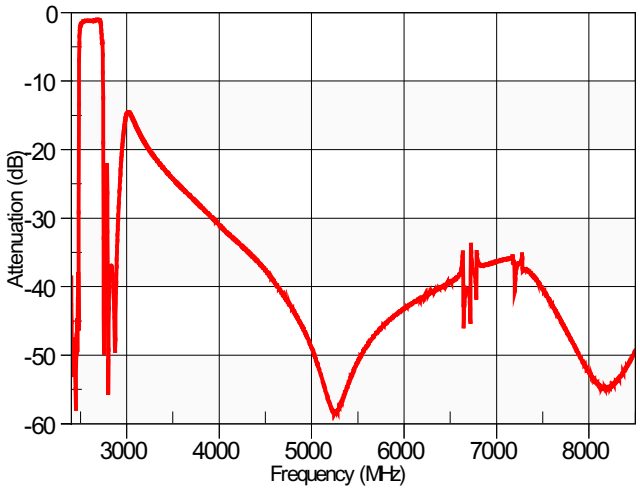


Figure 6: Rejection in Wi-Fi Band, 2401 to 2483 MHz

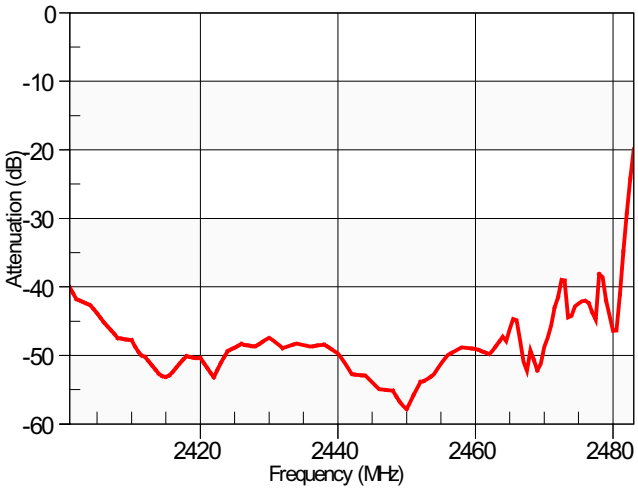


Figure 7: Input Return Loss (Port 1), 2496 to 2690 MHz

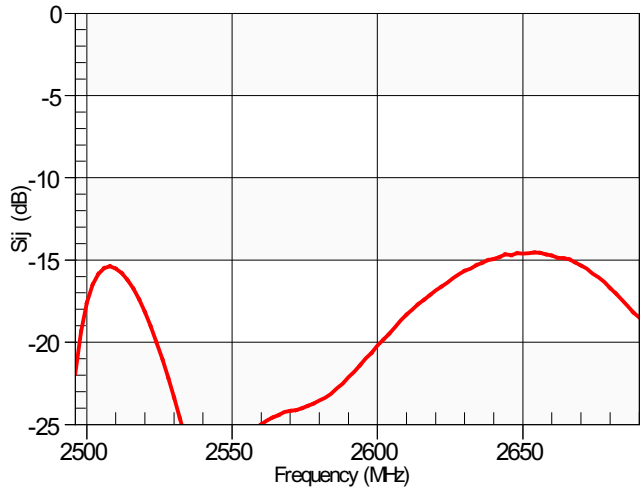


Figure 8: Input Impedance, S11, 2496 to 2690 MHz

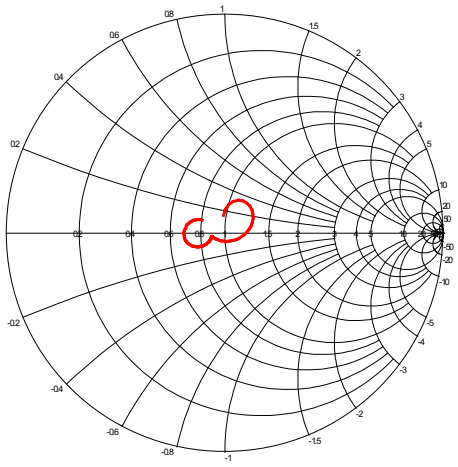


Figure 9: Output Return Loss (Port 2), 2496 to 2690 MHz

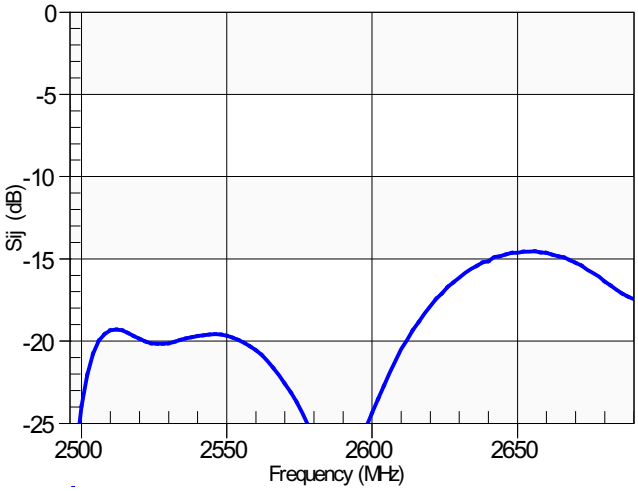


Figure 10: Output Impedance, S22, 2496 to 2690 MHz

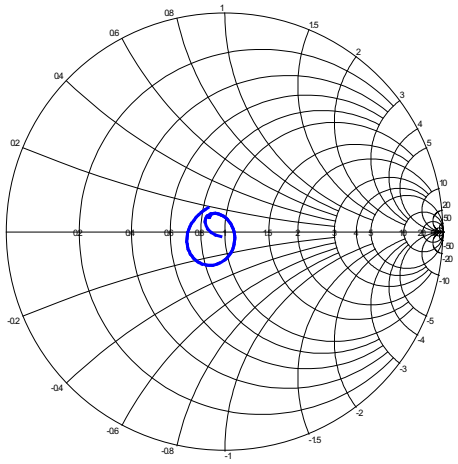
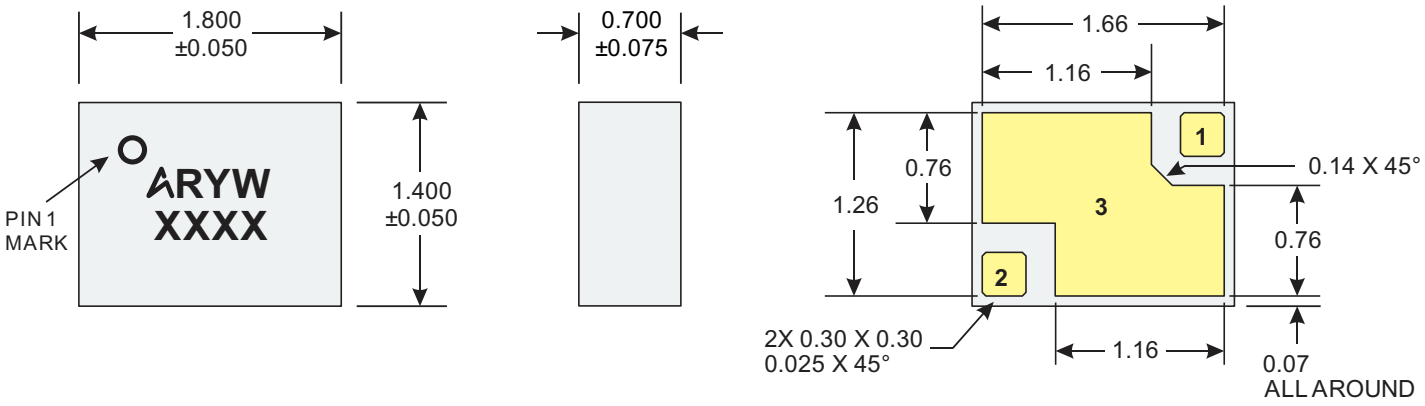


Figure 11: Package Outline Drawing and Marking



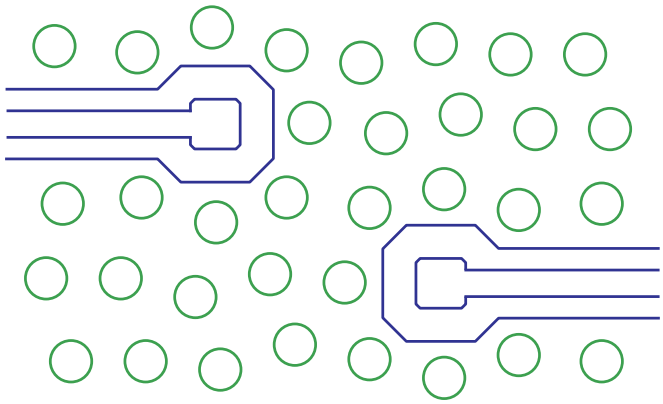
Unless Otherwise Specified:

1. Dimensions in millimeters
2. Dimensions are nominal
3. Tolerances: X. XX ± 0.05
   X. XXX ± 0.025
4. Contact areas are gold plated
5. Package marking:
   "A" = Avago logo
   R = ACPF-8041
   Y = Year (last digit)
   W = Work Week
   XXXX = Lot number

Pin Connections

1 Tx/Rx
2 Ant
3 GND

Figure 12: PCB Layout



A circuit board layout using the principles illustrated in Figure 12 is recommended to optimize performance of the ACPF-8041.

To achieve optimum performance from the ACPF-8041, it is important to maximize isolation between the Input and Output ports. High isolation is achieved by: (1) maintaining a continuous ground plane around the In/Out connections and filter mounting area, and (2) surrounding the In/Out ports with sufficient ground vias to enclose the connections in a "Faraday cage" shield.

Ground vias between metal layers 1 and 2 are typically Ø0.20 mm. The second metal layer under the filter is a continuous ground plane.

NOTE: For low power applications (for example, Rx), this filter is symmetrical and either port can be used for the Input or Output. If used in higher power applications (for example, PA chain), using Port 1 as the Input will provide slightly improved harmonic performance.

Figure 13: ACPF-8041 Superposed on PCB Pattern

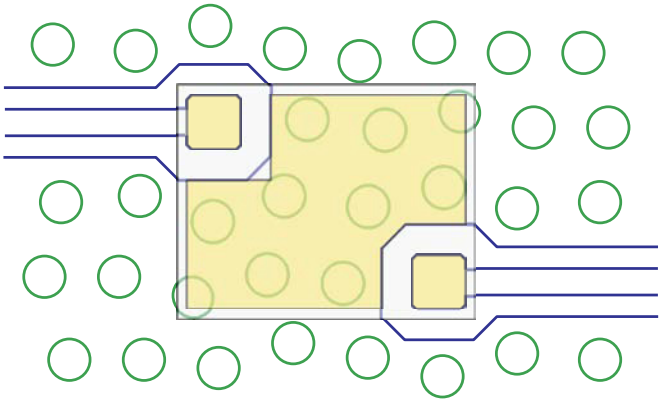
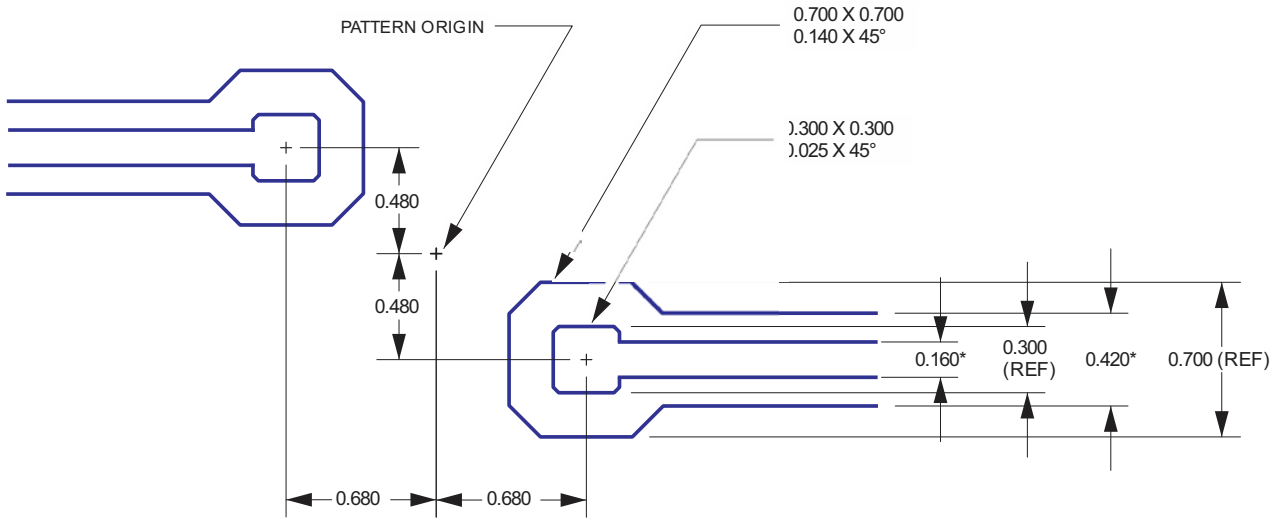


Figure 14: PCB Detail, Metal Dimensions

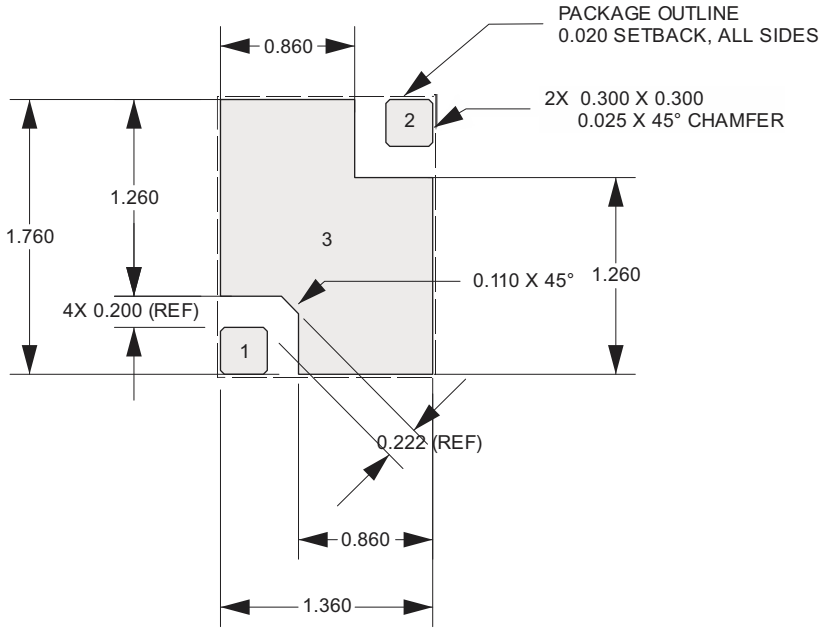


NOTE: Dimensions are in millimeters (mm).

The transmission line dimensions shown are designed to achieve an impedance of 50 ohms for a 75-µm thick PCB layer with a dielectric constant of 3.4.

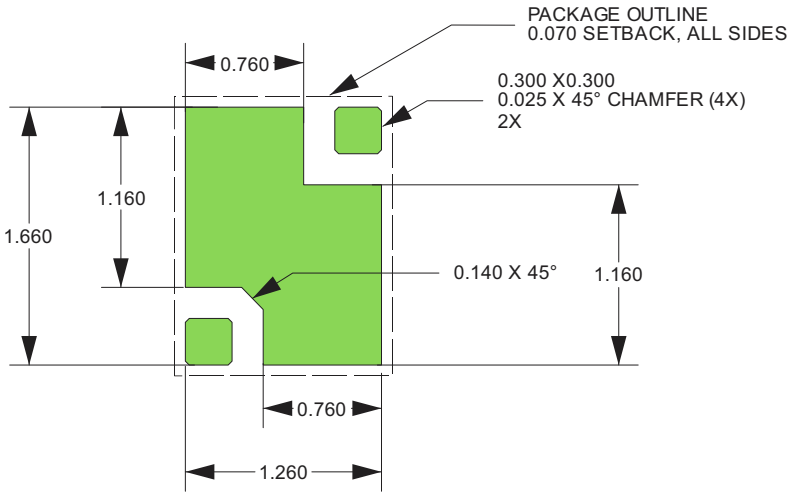
If other PCB materials or thicknesses are used, the two dimensions indicated with an "*" (line width and spacing) should be adjusted to retain a Zo of 50 ohms.

Figure 15: Recommended Land Pattern



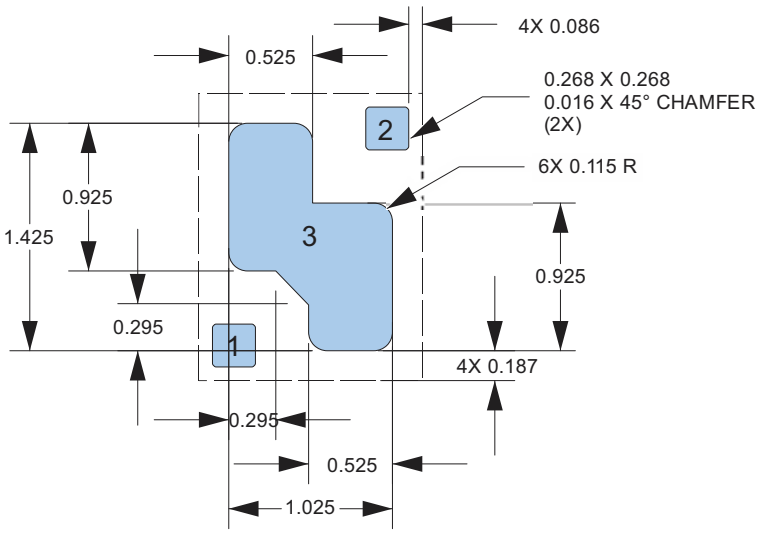
NOTE: Dimensions are in millimeters (mm).

Figure 16: Recommended Solder Mask



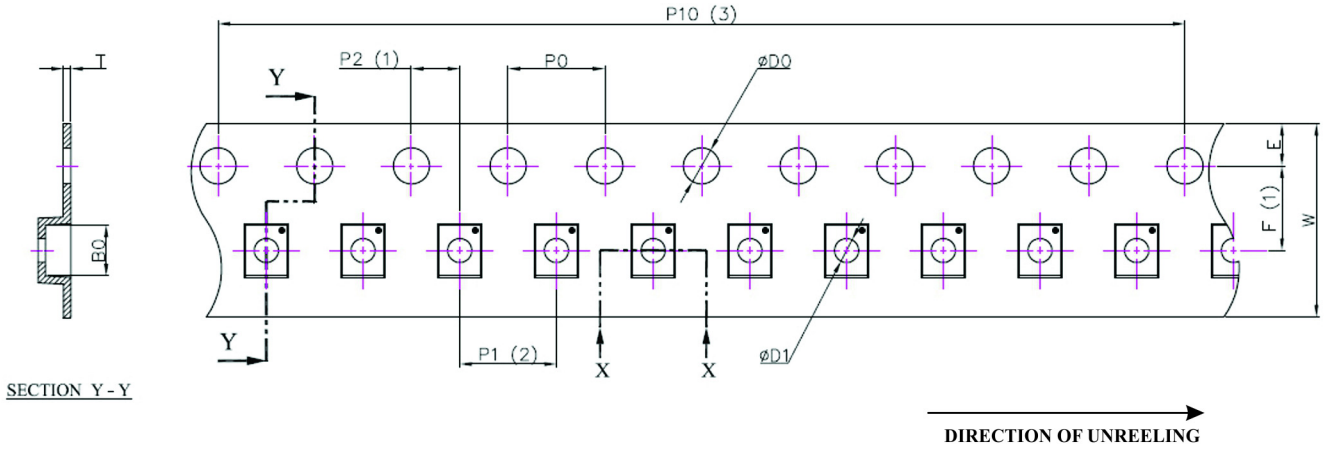
NOTE: Dimensions are in millimeters (mm).

Figure 17: Recommended Solder Stencil



NOTE: Dimensions are in millimeters (mm).

Figure 18: SMT Tape Packing and Pin 1 Mark Location

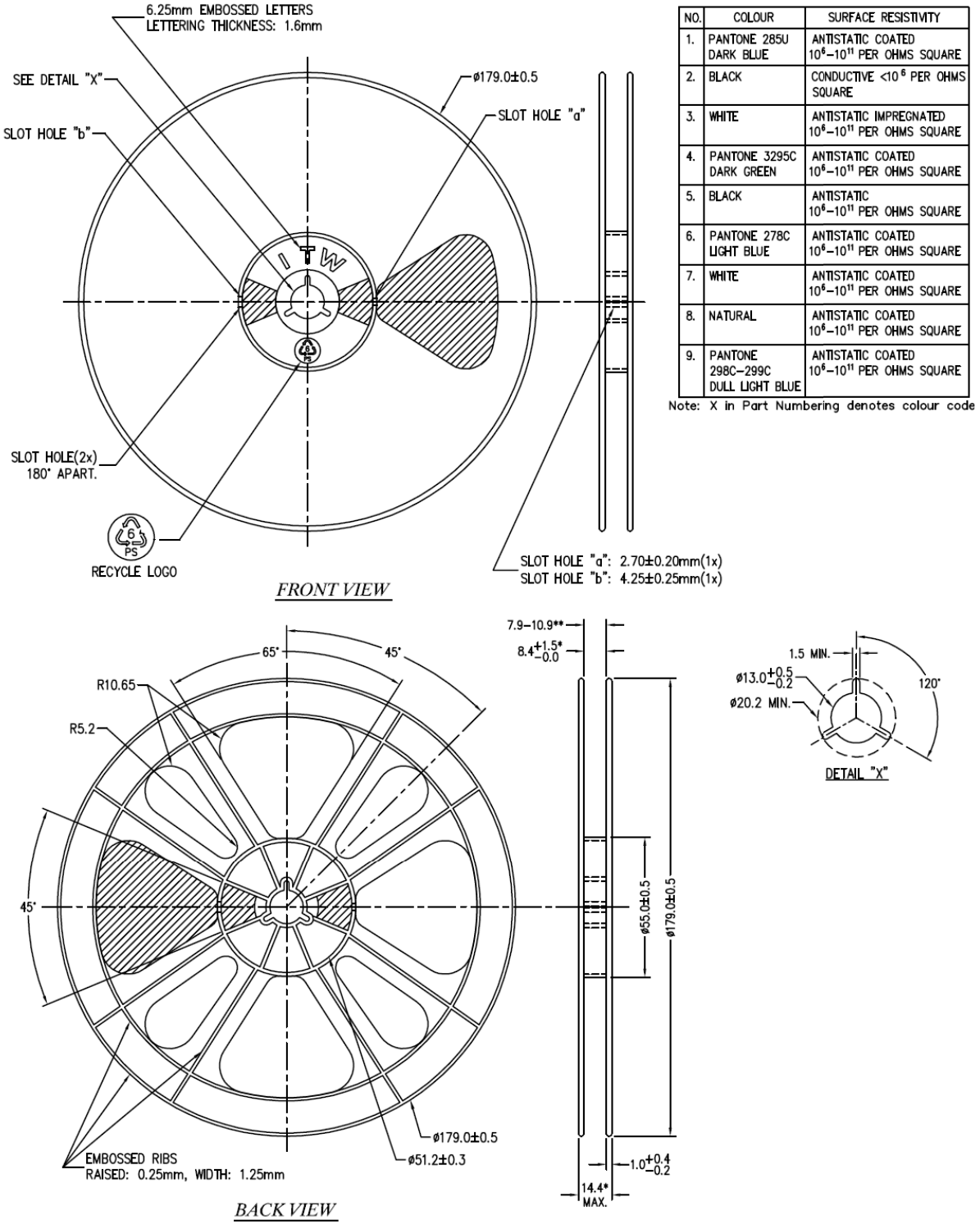


Dimension List			
Annote	Milimeter	Annote	Milimeter
A0	1.70±0.10	P2	2.00±0.05
B0	2.10±0.10	P10	40.00±0.20
K0	1.05±0.10	E	1.75±0.10
D0	$1.50^{+0.10}_{-0}$	F	3.50±0.05
D1	1.00±0.10	T	0.30±0.05
P0	4.00±0.10	W	$8.00^{+0.30}_{-0.10}$
P1	4.00±0.10		

NOTE(S):

1) MEASURE FROM CENTERLINE OF SPROCKET HOLE TO CENTERLINE OF POCKET.
2) MEASURE FROM CENTERLINE OF POCKET TO CENTERLINE OF POCKET.
3) PITCH TOLERANCE FOR SPROCKET HOLE, 10 PITCH CUMULATIVE TOLERANCE IS ±0.2mm.
4) ALLOWABLE CAMBER TO BE 1mm PER 250mm IN LENGTH FOR SINGLE WINDING AND 2mm PER 250mm IN LENGTH FOR CROSS WINDING.

Figure 19: SMT Reel Drawing



NO.	COLOUR	SURFACE RESISTIVITY
1.	PANTONE 285U DARK BLUE	ANTISTATIC COATED 10^6–10^{11} PER OHMS SQUARE
2.	BLACK	CONDUCTIVE <10^6 PER OHMS SQUARE
3.	WHITE	ANTISTATIC IMPREGNATED 10^6–10^{11} PER OHMS SQUARE
4.	PANTONE 3295C DARK GREEN	ANTISTATIC COATED 10^6–10^{11} PER OHMS SQUARE
5.	BLACK	ANTISTATIC 10^6–10^{11} PER OHMS SQUARE
6.	PANTONE 278C LIGHT BLUE	ANTISTATIC COATED 10^6–10^{11} PER OHMS SQUARE
7.	WHITE	ANTISTATIC COATED 10^6–10^{11} PER OHMS SQUARE
8.	NATURAL	ANTISTATIC COATED 10^6–10^{11} PER OHMS SQUARE
9.	PANTONE 298C–299C DULL LIGHT BLUE	ANTISTATIC COATED 10^6–10^{11} PER OHMS SQUARE

Note: X in Part Numbering denotes colour code

NOTES:
1. * MEASURED AT HUB AREA
2. ** MEASURED AT OUTER FLANGE.
3. ALL FLANGE EDGES TO BE ROUNDED.
4. CREF. OLD P/D: H–JE0008–01 & H–JE0012–01)

Table 4: Package Moisture Sensitivity

Feature	Test Method	Performance
Moisture Sensitivity Level (MSL) at 260°C	JESD22-A113D	Level 3

Figure 20: Verified SMT Solder Profile

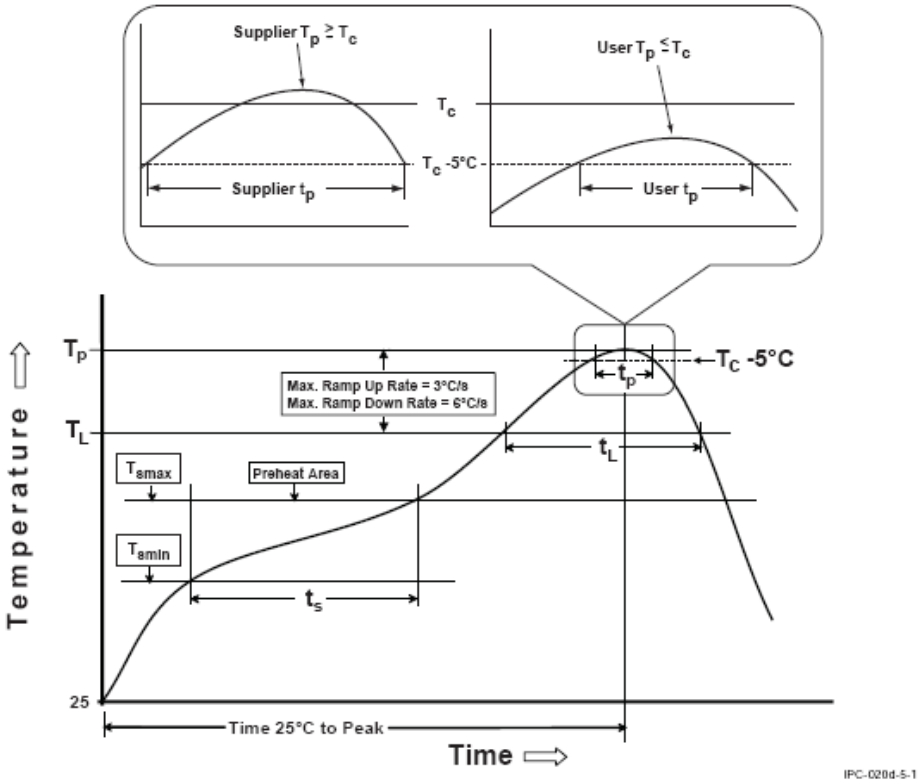


Table 5: Ordering Information

Part Number	Number of Devices	Container
ACPF-8041-BLK	100	Tape strip or Gel-Pack
ACPF-8041-TR1	3000	178 mm (7-inch) reel

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