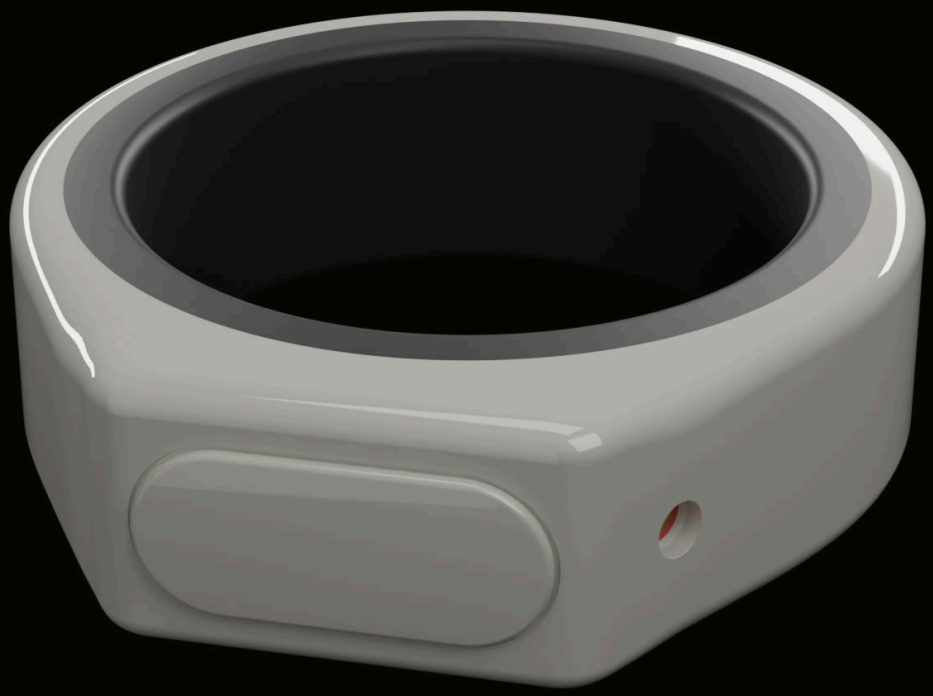
flow XR



Ringlet

Microphone and touch ring for smart glasses. Specification, revision B.

FLOWXR PTE. LTD. · Singapore

October 2026

0. Read me

Ringlet manufacturing pack, rev B, 2026-10-29.

Ringlet is a zirconia signet ring with a MEMS microphone and a capacitive touch pad. It is an input device for smart glasses, phones and laptops.

This pack is for quoting and building the EVT/pilot run: 100 rings and 100 docks, sizes US 8 to 12.

Precedence

1. Drawing beats document.
2. STEP beats drawing.
3. Exception: the styled outer shoulders follow the renders. The STEP carries a nominal R1.0 outer fillet at every size. The final shoulder CAD is a deliverable before tooling (see 2.3).

All dimensions come from one parametric source (Source/params.py).

Changes from rev A

Area	Rev A	Rev B
Profile	Round band, 5 touch grooves	Signet head 1.40 proud, raised stadium pad 11.2 × 4.9
Mic port	θ 35.7°, wall 0.60	θ 33.8° on the flank, wall 1.10, 0.45 spot-face
Mic seal	Silicone gasket	Acoustic PSA ring 0.15 (RL-051)
CMF	Black zirconia, black epoxy	White zirconia, black epoxy bore and side-face ring
Outer shoulders	R1.0 constant	Elliptical, varies round the ring
Battery	Curved cell in band, per size	One flat cell in the head, all sizes
Rigid-flex	Length per size, 74.2 to 82.4	One part, 47.5 long, all sizes
Pilot sizes	US 9 to 12	US 8 to 12

Dock, dongle, SoC, mic, touch IC, haptics, IMU, potting and test are unchanged except where the geometry changes them.

Contents

Section or file	Content
1. Product overview	Product, use, key specs
2. Mechanical specification	Shell, head, potting, tolerances, finishes
3. Bill of materials, BOM.csv	Parts, MPNs, alternates
4. Electronics and rigid-flex	Stack-up, layout rules
5. Assembly process	Steps, fixtures, cure schedules
6. Test and QC	Incoming, in-process, final and reliability tests
7. Sizing	Size table, head angle, mass
8. Dock and dongle	Charging dock and USB dongle

Section or file	Content
9. Request for quote	Scope and questions, English and 中文
10. Open items and risks	Open decisions and risks. Read before quoting.
Ringlet_revB_drawings.pdf	Six drawing sheets: shell, sections, rigid-flex, layout, dock, sizes
CAD/RL-001_shell_zirconia_US8 to US12.step	Zirconia shell, one per size
CAD/RL-002_potting_envelope_US8 to US12.step	Epoxy fill reference body
CAD/ringlet_assembly_US10.step, .glb	Full assembly
CAD/RL-010_flex_outline_US10.dxf	Rigid-flex outline, one part for all sizes
CAD/RL-100_dock_assembly.step	Dock
Source	Parametric source for the model, STEP and drawings

Conventions

Item	Convention
Units	mm, degrees, grams
Default tolerance	±0.05 linear, ±0.5° angular, unless the drawing says otherwise
Z	Finger axis. Band spans z = −4.0 to +4.0.
θ	Angle round the ring, right index finger: 0° dorsal, 90° thumb side, 180° palmar, 270° toward middle finger. Ring is not handed.
Angular datum	Mic port, θ 33.8° (US10). Head centre θ 67.7° (US10). Both vary with size, see section 7.
Part numbers	RL-001 shell, RL-002 potting, RL-010 rigid-flex, RL-020 battery, RL-030 magnet, RL-040 motor, RL-050 vent, RL-051 acoustic PSA ring, RL-060 PSA, RL-100 dock, RL-200 dongle

Nominal size

US10 (bore Ø19.84) is fully modelled and dimensioned. Band section (8.00 × 3.40) and head (1.40 proud) are the same at every size. Shell and potting STEP files are supplied per size.

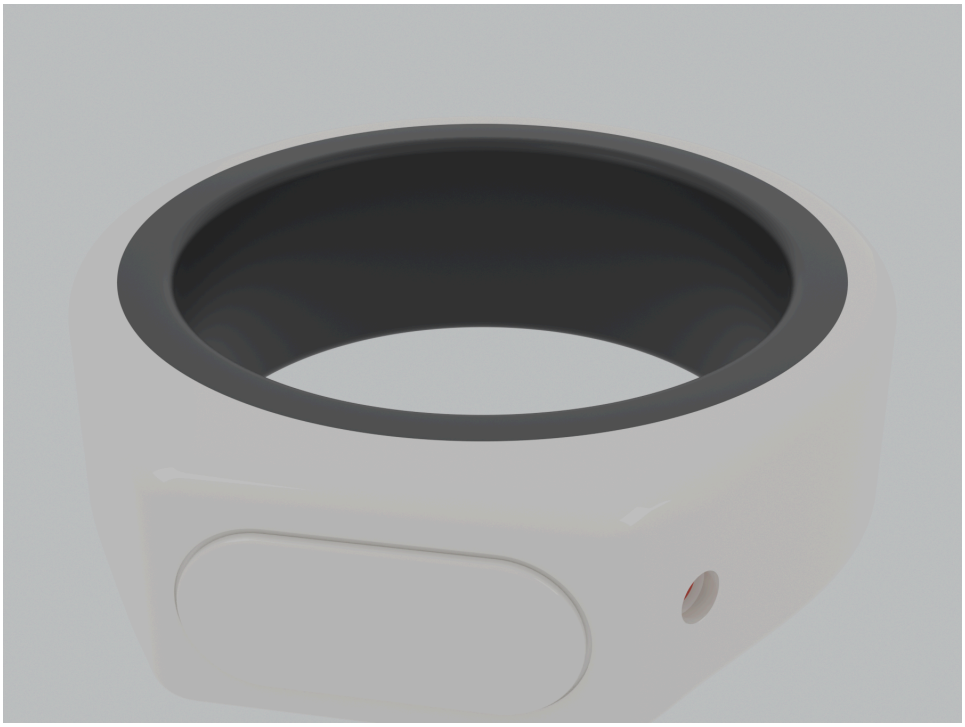
1. Product overview

Ringlet is a finger-worn ring with two functions:

1. Raise-to-talk microphone for dictation, voice commands and calls.
2. Thumb-operated touch remote (tap, double-tap, hold, 1-D scroll) for smart glasses, phone and laptop.

Audio streams over Bluetooth LE Audio to a USB-C dongle, or direct to Android and Windows hosts. Input events go over BLE HID or a companion app.

The shell has a signet profile. The round band runs into two tangent flanks and a flat face on the thumb side, 1.40 proud of the band. The flat carries a raised stadium touch pad and houses the battery.



Key specifications (EVT target)

Item	Value
Band	8.00 wide × 3.40 thick, 3Y-TZP zirconia shell, epoxy-filled, epoxy bore
Head	Flat face 1.40 proud of band (US10: 14.72 from axis, band 13.32), centred at θ 67.7°
Touch pad	Raised stadium 11.2 × 4.9, 0.35 proud
CMF (default)	White polished zirconia, black epoxy bore and side-face inner ring. Black zirconia optional.
Pilot sizes	US 8, 9, 10, 11, 12 (bore Ø18.19 / 18.89 / 19.84 / 20.68 / 21.49)
Mass	5.5 to 6.1 g by size; 5.82 g at US10 (shell 3.2 to 3.5 g)
Microphone	TDK T5838 PDM MEMS, bottom port, 68 dB(A) SNR, behind Gore GAW334 vent. Port Ø1.6 at θ 33.8°, wall 1.10.
Touch	5-segment self-capacitance slider, 12 mm path, through 0.60 zirconia + 0.35 pad
Motion	6-axis IMU LSM6DSO, active only while touch is held or host display is on
Haptics	Ø6 × 2.0 coin ERM, DRV2605L driver
Radio	Nordic nRF5340 (WLCSP95), BLE 5.3, LE Audio unicast server; Pulse W3008 chip antenna

Item	Value
Battery	One flat prismatic LiPo in the head, 3.3 × 6.4 × 10.6, about 16.8 mAh (estimate, Grepow custom, to quote). Same cell for all sizes.
Charging	nPM1100 charger/PMIC; inductive through the shell from a USB-C dock
Runtime (estimate)	1.7 to 2.8 h continuous streaming (6 to 10 mA); 20+ days standby (mic in acoustic-activity-detect)
Ingress	IP67 target (vent rated 2 m / 1 h). Not for swimming.
Host	USB-C dongle (nRF5340, UAC mic + HID) for Mac, iPhone, Windows; direct LE Audio on Android 13+ and Windows 11 24H2

Use

1. Wear on the index finger, head facing the thumb. The mic port is then on the upper flank, away from the palm.
2. Raise to talk: raise the hand to the mouth with the thumb on the pad. Audio opens. Lower or release to close. One buzz on open, two on close.
3. Remote: tap = select, double-tap = back, hold = menu or push-to-talk, slide = scroll.
4. Charge: drop the ring on edge into the dock slot. The magnet turns it so the coils align. Full charge in 60 to 70 min.



Design choices

Choice	Reason
Zirconia shell, not metal	Touch, 2.4 GHz antenna and 6.78 MHz charging field must pass through the shell.
Flat head on thumb side	Tactile landmark, flat electrodes, size-independent battery pocket.
Raised stadium pad	One moulded feature; no thin edges to chip in polishing.
Epoxy bore and side-face ring	One-shot potting, the standard smart-ring process. Skin touches smooth epoxy.
Four rigid islands (⩽ 5.0 long) on 2-layer flex	Rigid FR4 cannot follow the band curve.

Choice	Reason
Bottom-port mic, vent, acoustic PSA ring	Standard earbud acoustic stack.
Flex coil and magnet for charging	No exposed contacts; dock self-aligns.
One flex, one cell for all sizes	Only the shell tool and potting mould change with size.

The band arc after the motor (about 36 mm at US10) is empty epoxy, reserved for an optional second cell (D9, see section 10).

Not in this pack

1. Schematic and PCB layout. The pack gives outline, stack-up, electrode and coil geometry, placement and layout rules.
2. Firmware (Zephyr / nRF Connect SDK).
3. Companion app and dongle firmware.
4. Certification (FCC, CE RED, Bluetooth SIG). Quoted separately, see section 9.
5. Final CAD of the styled outer shoulders (see 2.3).

Other renders (internals, exploded, section, dock) are in `renders/`.

2. Mechanical specification

Use with drawing sheets 1, 2, 4 and 6 (Ringlet_revB_drawings.pdf) and the STEP files. All values nominal, mm, US10 unless stated.

2.1 Cross-section (all sizes)

C-channel open to the bore. Round band, with two tangent flanks and a flat face (head) on the thumb side. The cavity is straight on the flanks, so the wall is thicker there.

Feature	Value	Tolerance / note
Band width W	8.00	±0.05
Band thickness T (bore to outer face)	3.40	±0.05
Head flat face beyond band outer radius	1.40	±0.05. US10: 14.72 from axis, band 13.32.
Head flat half-height, incl. corners	7.40	Flat to flank corner R1.80
Head centre	θ 67.7°	Per size in section 7
Outer wall, band	0.60	±0.04
Outer wall, flat (under pad)	0.60, rising to ≈ 0.70 at pad ends	±0.04 on the flat
Outer wall, flanks	Up to 1.19; 1.10 at mic port	As modelled
Side flanges (each)	0.55	±0.05. Flange stops at bore + 1.80; epoxy forms the inner 1.80 of each side face.
Internal channel width	6.90	W − 2 × 0.55
Channel depth, band	2.80	Wall inner face to bore
Channel depth, head	4.20	Flat inner face to bore
Usable component depth, band	2.40	2.80 − 0.40 epoxy
Head cell pocket	3.48 × 6.40 × 10.60	Flex inner face − 0.10 to bore + 0.40. Fits 3.3 × 6.4 × 10.6 cell + 0.15 swelling.
Raised touch pad	Stadium 11.2 (along flat) × 4.9 (along Z), end R2.45, 0.35 proud, centred on z = 0	Moulded, edge ≈ R0.18
Pad seam	Groove 0.14 wide × 0.10 deep	Moulded parting line
Internal flange-root radius	⩾ R0.15	Prevents sinter cracks

2.2 Sizes

Bore Ø = ISO 8653 circumference / π.

US	Bore Ø	OD (band)	Across head	Head θ	Flex	Mass (g)
8	18.19	24.99	26.39	72.6°	47.5	5.54
9	18.89	25.69	27.09	70.4°	47.5	5.66
10	19.84	26.64	28.04	67.7°	47.5	5.82

US	Bore Ø	OD (band)	Across head	Head θ	Flex	Mass (g)
11	20.68	27.48	28.88	65.4°	47.5	5.97
12	21.49	28.29	29.69	63.4°	47.5	6.11

Same cell (3.3 × 6.4 × 10.6) at all sizes. Across head = flat face to opposite band outer face. See section 7.

2.3 RL-001 zirconia shell

Item	Requirement
Material	3Y-TZP, ⩾ 99.5 % theoretical density (⩾ 6.02 g/cm³). Flexural strength ⩾ 900 MPa, ⩾ 1200 HV. Biocompatible grade, ISO 10993-5/-10 reports on file.
Colour	White, polished (default). Black through-body pigment is an option (D5). No coating.
Process	CIM, debind, sinter, polish. One tool or insert set per size.
External finish	Polished Ra ⩽ 0.05. Pad top may be lapped.
Channel finish	As-sintered Ra ⩽ 1.6, no glaze (epoxy must bond).
Side-face inner edge	At bore + 1.80. Visible bond line: sharp, no chips, concentric to bore within 0.05. Cosmetic spec open (O-B5).
Datums	A = bore axis; B = −Z side face; angular datum = mic port centre

Outer shoulders

Elliptical, radial × axial:

Location	Shoulder
Round band	≈ 1.0 × 1.0
Flanks at islands A2 / B1	≈ 1.56 × 1.20 (max 1.58 × 1.22)
Flank/flat corners	Eases from the flank size down to the flat size
Flat face	≈ 1.14 × 0.85

1. Zirconia over the cavity corner ⩾ 0.40 everywhere.
2. Shoulder size changes smoothly round the ring (no steps), so the polished highlight runs unbroken.
3. STEP files carry a nominal R1.0 fillet instead. Styled surface: per the renders; tooling-grade CAD due before CIM tool cut.
4. Quote cosmetics to the renders, functional dimensions to the STEP.

Features by angle

θ from dorsal toward thumb, US10. See sheets 1 and 4.

Feature	θ	Geometry
Mic port	33.8°	Ø1.60 +0.05/−0 through outer wall at z = 0, normal to upper flank. Wall 1.10. 0.10 × 45° outside chamfer, inside edge R0.05.
Vent spot-face	33.8°	Ø3.5 flat-bottomed pocket, 0.45 deep (vent 0.30 + PSA ring 0.15), into flank inner face, normal to it. Floor Ra ⩽ 0.8, flat. Remaining wall 0.69 / 0.65 / 0.61 at US 8 / 10 / 12 (flank wall at A2 1.06 to 1.14 by size). Wall ⩾ 0.40 at pocket rim and port lip.
Head and touch pad	67.7° (centre)	See 2.1

Feature	θ	Geometry
Touch zone	44.5° to 90.9°	Wall 0.60 ±0.04 on the flat; ⩽ 0.95 at zone ends (≈ 0.4 into each R1.2 flex bend)

Marking

1. Regulatory text and serial: laser-marked on the epoxy bore, not on the ceramic.
2. Logo (optional): laser-etched 0.02 deep on the +Z side face at θ 180°. Artwork to follow.

Inspection

1. 100 % visual: no chips at port, pad seam or side-face inner edge; no pin-holes.
2. Bore, band OD: go/no-go. Head height: gauge.
3. Wall thickness incl. flank at port: one sectioned part per sinter lot.
4. Drop test on samples (section 6).

2.4 RL-002 potting, bore and side-face ring

Item	Requirement
Material	Two-part low-viscosity epoxy, black, Shore D ⩾ 80, Tg ⩾ 80 °C, skin-contact safe (ISO 10993-5/-10), low exotherm, vacuum-degassed. ODM selects a health-ring potting grade; approval on sample.
Cosmetic	Visible on both side faces. Colour and gloss must match the bore.
Geometry	Fills the channel from shell inner wall to bore, and the 1.80 ring between bore and flange edge on both side faces. Flush with ceramic side face, step ⩽ 0.03.
Tooling	Bore: PTFE-coated mandrel per size. Side-face ring and R0.5 bore edges: mould side plates.
Finish	As-moulded gloss, Ra ⩽ 0.2. No visible meniscus. No visible bubbles > 0.1 at bore or side faces.
Thickness over components	⩾ 0.40 (0.35 over motor); 0.58 under the head cell. Verify on first articles by section or X-ray.

2.5 Internal layout (US10)

Flex 47.5 long, all sizes, laid from the antenna end along the cavity outer wall (r 12.72 in the band, straight on flanks and flat, R1.2 bends = 5.5 × flex thickness). Path lengths along that wall.

Zone	θ start to end	Path length	Contents
flex_ant	350.0 to 359.9	2.20	Pulse W3008 chip antenna on stiffened flex, keep-out
Island A1 (rigid)	359.9 to 22.3	5.00	nRF5340 WLCSP, nPM1100, 32 MHz crystal
Island A2 (rigid)	25.8 to 41.8	4.10	T5838 mic, buck inductor, 32 kHz crystal, DC/DC inductor
Touch (flex)	44.5 to 90.9	12.00	5 chevron electrodes on shell-side copper, driven shield behind. Battery tab pads on bore side.
Island B1 (rigid)	94.3 to 111.3	4.30	Touch controller, haptic driver
Island B2 (rigid)	114.8 to 131.5	3.70	IMU, haptic bulk cap, test pads
Coil (flex)	133.7 to 158.5	5.50	Planar coil 5.0 × 6.0, 2 layers; magnet at centre (2.7)

Zone	θ start to end	Path length	Contents
Motor	158.5 to 186.9	6.30	Ø6 × 2.0 coin ERM against shell wall (θ 172.7°), leads to flex pads
flex_end	186.9 to 189.1	0.50	End of flex
Head cell	Under touch zone	10.6	Centred on head. Tabs fold onto pads at flat ends.
Spare (band)	189.1 to 350.0	35.7	Empty, epoxy-filled. Reserved for option D9.
Gaps		0.5 to 1.0 each	Bend zones

Components face the bore. Flex bonded to shell with 50 µm PSA. Sagitta: A2, B1 0; A1 0.17; B2 0.08 (epoxy-filled).

Stack at the mic, outside to inside, along the flank normal (sheet 2):

1. Port Ø1.6 through ≈ 0.65 of wall, 0.10 outside chamfer
2. Gore vent 0.30, then acoustic PSA ring 0.15, both in the spot-face
3. Island A2 rigid 0.48 (Ø0.8 hole)
4. T5838 0.98
5. Epoxy 2.38 to bore

Stack through the head, outside to inside: pad 0.35, flat wall 0.60, flex 0.22, PSA/clearance 0.10, cell 3.3 (+0.15 swelling), epoxy 0.58 (⩾ 0.40) to bore.

2.6 Acoustic port assembly

Item	Requirement
Vent RL-050	Gore GAW334, ID 1.6 / OD 3.2, PET support, adhesive-backed. Bond to spot-face floor, roll ⩾ 2 N for 3 s. Membrane dry, clean, no epoxy.
Acoustic seal RL-051	Acoustic PSA ring OD 3.0 / ID 1.6 × 0.15 (3M 467MP-class), ≈ 0 compression. Bonds island A2 to the vent. Pocket depth sets the seal. Potting stand-off holds A2 during cure.
PCB hole	Ø0.80 in island A2, plated edge, no solder mask inside the PSA seat ring
Port resonance	Check by simulation and golden-sample response before tool cut. If inside the 8 kHz band: add outside counterbore (O-B2).
Acceptance	⩾ 60 dB(A) SNR at the port in the finished ring (capsule 68 dB(A)); ⩽ 3 dB insertion loss at 1 kHz incl. vent. See section 6.

2.7 Magnet RL-030

Item	Requirement
Part	NdFeB N52, Ø1.5 × 0.8, Ni-Cu-Ni, axially magnetised
Position	Shell inner wall at coil centre, θ 146.1° (US10; per size in section 7)
Bond	Cyanoacrylate gel, before the flex is laid in
Polarity	North toward the bore (dock magnet is north up). Mark polarity on reel/tray.

2.8 Mass budget (US10)

Part	g
Zirconia shell, incl. head and pad	3.32
Epoxy	1.48
Battery (head cell)	0.47
Motor	0.25
Rigid-flex	0.17
Components	0.11
Magnet (vent, PSA rings negligible)	0.01
Total	5.82

1. STEP check: 547 mm^3 × 6.05 g/cm^3 = 3.31 g. Bounding box 29.34 × 26.64 × 8.00.
2. Flanges 0.55 to 0.45 saves ≈ 0.3 g. Wall under pad stays 0.60.
3. Option D9 (GRP170722 in band): +0.5 g cell, −0.3 g epoxy.

2.9 DFM requirements for the ceramics vendor

1. Sinter shrink ≈ 20 % linear. Measure on first shots of this body before final tool cut.
2. Wall 0.60 to 1.19 gives uneven shrink. Run a shrink/warp study and compensate the tool (O-B6).
3. Pad, seam, port: moulded (preferred) or green-machined.
4. Vent spot-face: machine normal to the flank, flat, depth 0.45 ±0.03 (proposed). Depth sets the seal.
5. Draft: 0° on flange inner faces (potting mould seal). If draft is needed, put it on the outer-wall inner face, max 1°, keeping 0.60 under the pad.
6. No glazing or sealing of the channel.
7. Polishing: pad edge round ⩽ R0.2, seam groove not filled, no chips on side-face inner edge.
8. Agree a white cosmetic standard (L*a*b* range, grey spot size) on first articles.
9. First-article report: band OD, across-head, bounding box (US10 29.34 × 26.64 × 8.00), bore, W, T at 4 positions, head height, flat flatness, wall thickness map (band, flank at port, flat), port Ø and angle, spot-face depth, pad height and outline, flange inner Ø (bore + 3.60).

3. Bill of materials

EVT, rev B, per ring unless stated. TBC items: section 10. Data file: BOM.csv.

Ring, mechanical

Part no.	Description	Spec	Qty	Notes
RL-001	Zirconia shell, 3Y-TZP white, polished, signet head and raised pad	Custom STEP per size, US 8 to 12	1	CIM tool per size. Black optional (D5). See section 2.
RL-002	Potting epoxy, black, skin-safe. Forms bore and side-face ring.	2-part, Shore D ⩾ 80	≈1.5 g (1.48 at US10)	Approve on sample. Cosmetic surface.
RL-010	Rigid-flex, 2L flex / 4L islands, ENIG, 47.5 long, all sizes	Custom DXF + Gerbers	1	PCBWay/JLC for EVT, ODM for pilot. No size cut.
RL-020	Prismatic LiPo cell in the head, all sizes	Grepow custom 3.3 × 6.4 × 10.6, ≈16.8 mAh (estimate at 0.075 mAh/mm³)	1	Bare cell, protection on flex (nPM1100 + NTC). Foldable tabs at both 10.6 ends.
RL-021	Option D9: curved LiPo in band arc, US 9+	Grepow GRP170722, 16 mAh, 1.7 × 6.5 × 21.8 (rev A cell)	(1)	Not in default build. Parallel with RL-020. Decision open.
RL-030	Alignment magnet	NdFeB N52, Ø1.5 × 0.8, Ni-Cu-Ni, axial	1	Polarity marked.
RL-040	Coin vibration motor, ERM	Ø6.0 × 2.0, 3 V, ⩽ 80 mA	1	"0620" class (Jinlong/Vybronics), MPN TBC. Fallback Ø7 × 2.0, cavity change.
RL-050	Acoustic vent	Gore GAW3341.63.2 (GAW334 1.6/3.2)	1	Adhesive, tape and reel.
RL-051	Acoustic seal ring, replaces rev A silicone gasket	PSA ring OD 3.0 / ID 1.6 × 0.15, 3M 467MP class	1	≈0 compression. Bonds A2 to vent.
RL-060	Flex-to-shell PSA	3M 9471LE 50 µm, 6.3 × 47.5	1	One die, all sizes.
RL-061	Cell-to-flex PSA, tab insulation	3M 9471LE 6.4 × 10.6; Kapton 25 µm	1	
RL-070	Magnet adhesive	CA gel, Loctite 454	trace	

Ring, electronics

Ref	Part	MPN	Package	Qty	Notes
U1	BLE 5.3 / LE Audio SoC	Nordic NRF5340-CLAA-R7	WLCSP95 4.4 × 4.0 × 0.55	1	
U2	Charger + buck PMIC	Nordic NPM1100-CAAA-R7	WLCSP25 2.075 × 2.075	1	15 mA (≈0.9 C) set by R. Confirm vs cell rating.
U3	Touch controller, 5 ch + shield	Azoteq IQS7222C101CSR	WLCSP18 1.62 × 1.62	1	NRND, confirm. Alt IQS7223C, or MTCH6102T-I/ML (QFN 3 × 3: B1 to 5.0, flex +0.7).

Ref	Part	MPN	Package	Qty	Notes
U4	Haptic driver, I²C	TI DRV2605LYZFR	DSBGA-9 1.75 × 1.75	1	
U5	6-axis IMU	ST LSM6DSOTR	LGA-14 2.5 × 3.0 × 0.83	1	Alt LSM6DSV16X
MK1	PDM MEMS mic, bottom port, AAD	TDK MMICT5838-00-012 (T5838)	3.5 × 2.65 × 0.98	1	Alt IM69D130 (4 × 3 × 1.2, A2 grows)
ANT1	2.4 GHz chip antenna	Pulse W3008	3.2 × 1.6 × 1.1	1	Alt W3008C
Y1	32 MHz, ±10 ppm, 8 pF	Epson FA-20H 32.0000MF10Z-K3 / Abracon ABM11W-32.0000MHZ-4-D1X-T3	2016	1	
Y2	32.768 kHz, ±20 ppm	Epson FC-12M 32.7680KA-A3 / Abracon ABS04W-32.768KHZ-T	1210	1	
L1	2.2 µH, nPM1100 buck	Murata DFE201610E-2R2M	2016	1	
L2, L3	10 µH, nRF5340 VDDH + DCC	Murata LQM18PN100MFH / TDK MLZ1608M100	0603	2	Network-core DC/DC in LDO mode drops one.
C1	220 µF 6.3 V polymer, haptic bulk	Panasonic 6SVPC220M	1206	1	Motor inrush > 150 mA
C2 to C30	Decoupling, load, RF match	X5R/C0G	0201, 01005	≈30	
R1 to R10	Pull-ups, charge-set, ID		0201	≈10	
FB1	Ferrite bead, mic supply	Murata BLM03AX	0201	1	
D1	TVS, coil input		0402	1	
BR1	Coil rectifier	Nexperia PMEG2005AESF ×4, or receiver IC	DFN0603	4	6.78 MHz: discrete. 125 kHz: ODM receiver IC (TI BQ51003 class too big). TBC.
TP1 to TP6	Test pads: SWD, UART, VBAT, GND, TOUCH_TEST		Ø0.6	6	

Dock RL-100, per unit

Ref	Part	Spec	Qty
RL-101/102	Housing top + base, PC/ABS, matte black soft-touch	STEP envelope	1 + 1
RL-103	Foot pad	Silicone 1 mm	1
RL-104	Slot liner	Silicone 0.5 mm, 34 × 9	1
RL-110	PCB 26 × 20, 2L, 1.0 mm	Custom	1
J1	USB-C 16-pin, mid-mount, power only	GCT USB4105-GF-A	1
L1	TX coil Ø10, ferrite backed	Würth 760308101303 class or custom	1
U1	Wireless power TX	6.78 MHz class-E (gate driver + GaN/MOSFET) or ODM 125 kHz TX IC	1
M1	Magnet	NdFeB N52 Ø3 × 1	1
LED1	White LED + light pipe	0603, PC pipe 1.5 mm	1

Ref	Part	Spec	Qty
	Screw M1.4 × 3 self-tapping		4
	USB-C to C cable 0.5 m		1

Dongle RL-200

Envelope only, quote separately: nRF5340 (aQFN or WLCSP), USB-C plug, 2-layer PCB, PC housing 24 × 12 × 6. Reference design: nRF5340 Audio DK, USB dongle role.

4. Electronics and rigid-flex

Layout requirements for RL-010. Read with drawing sheet 3 and CAD/RL-010_flex_outline_US10.dxf. Schematic and layout are a separate deliverable.

Circuit unchanged from rev A. Rev B changes the flex outline (one length, ends after the motor), the battery (cell in the head, tabs in the touch zone) and the flex path.

4.1 Power

Item	Value
VBAT	3.0 to 4.2 V, RL-020 head cell, bare. Protection: nPM1100 + NTC.
Charging	Coil, BR1 rectifier, U2 nPM1100 charger at 15 mA
3.0 V rail (nPM1100 buck)	Mic, IMU, touch, haptic driver, nRF5340 VDDH
1.8 V	nRF5340 internal DC/DC, cores
Radio TX	0 dBm
Current (estimate)	Streaming 6 to 10 mA. Touch-only idle 150 to 300 µA. Standby, mic in AAD, ≈50 µA.
Streaming time, ≈16.8 mAh	≈1.7 to 2.8 h

4.2 Interfaces

Net group	From, to	Lines	Routing
PDM	MK1 (A2) to U1 (A1)	CLK, DATA, WAKE	⩽ 25 mm, 50 Ω ref L2. Away from coil and RF.
I2C	U1 (A1) to U3, U4 (B1), U5 (B2)	SDA, SCL, 3 INT	2.2 kΩ pull-ups at U1. Cross the touch zone on L2 at the flex edge, outside the shield.
Touch	Electrodes to U3 (B1)	5 CRX + shield	Guarded. No vias under electrodes.
Haptic	U4 (B1) to motor pads	OUT+, OUT–	0.2 mm. C1 220 µF bulk cap at B2.
Coil	Coil zone to BR1/U2 (B2 to A1)	2	0.2 mm. Tuning C at B2.
Battery	Tab pads (touch zone ends, bore side) to U2 (A1)	VBAT, GND, NTC	0.3 mm. Far-end tab (B1 side) routes back along the flex edge.
RF	U1 to ANT1 (flex_ant)	1	50 Ω CPW, 0.20 trace / 0.15 gap over L2 ground. π-match at U1.
Debug	U1 to TP (B2)	SWDIO, SWDCLK, TX, RX, VBAT, GND	6 × Ø0.6 pads, bore side

4.3 Rigid-flex construction

Item	Spec
Flex zones	Coverlay 12.5 µm PI + 15 µm adh / 18 µm Cu (L2) / 25 µm PI / 18 µm Cu (L1) / coverlay. 0.22 ±0.03.
Rigid islands	Mask / 35 µm Cu (L4) / 90 µm no-flow prepreg / flex core / 90 µm prepreg / 35 µm Cu (L3) / mask. 0.48 ±0.05.
Width	6.30 ±0.05 flex, 6.50 ±0.05 islands
Islands	A1 5.00, A2 4.10, B1 4.30, B2 3.70. Sagitta: A1 0.16, B2 0.08, A2 and B1 0 (flanks).

Item	Spec
Total length	47.50 on the L1 face, all sizes. No size cut, no tail.
Path	r 12.72 in the band (US10), straight on flanks, flat under the pad. R1.2 bends (5.5 × thickness) at both ends of the flat. Touch zone (12 mm) runs ≈0.4 into each bend. Cell clearance to bends 0.26.
Trace/space	0.075 / 0.075 islands (0.4 mm WLCSP), 0.10 / 0.10 flex
Vias	Laser microvia 0.10/0.25, L1 to L2 and L3 to L4. Filled, capped via-in-pad under WLCSP. None in bend zones or R1.2 bends.
Finish	ENIG. No OSP.
Stiffener	0.10 PI under ANT1 and motor pads
Coverlay openings	Component, motor, battery tab (L2) and test pads only
Bend zones	0.8 to 1.0 mm. Perpendicular staggered traces, teardrops, no pours.
L1 marks	"SHELL SIDE" at antenna end. "PAD CENTRE" at path length 18.9.

4.4 Touch electrodes (L1)

1. 5 self-cap chevron segments: 2.4 mm pitch minus 0.20 gap, 5.60 wide, chevron depth 0.90. Target ⩾ 100 positions over 12 mm.
2. Centre the 12 mm zone under the 11.2 mm pad. End segments run ≈0.4 mm into the R1.2 bends: solid copper there, no slits, no vias.
3. 0.80 mm copper-free edge margin. Coverlay over electrodes. No stiffener.
4. L2: driven shield on the touch IC shield output, 0.2 mm larger than the electrodes. Shields the finger and the head cell. Cut back only at the tab pads (4.7 rule 4).
5. L1 guard: hatched ground 25 % (0.15/0.45), 0.3 mm from electrodes.
6. Target 5:1 SNR through 0.95 mm ceramic (0.60 flat + 0.35 pad), 1 mm overlay-equivalent air gap. IC must handle ⩾ 100 pF parasitic (ceramic ε _r ≈30). Bench-verify before tooling (O-B3).

4.5 Charging coil (L1 + L2)

1. Rectangular spiral 5.0 × 6.0, 6 turns per layer, 0.10 / 0.10, layers in series through vias at centre and outside. Ø1.5 copper-free centre for the magnet.
2. L ≈1.1 µH, Q ≈10 at 6.78 MHz. Series C ≈500 pF on B2.
3. For 100 to 200 kHz, use a 0.1 mm wire-wound Ø6 flat coil bonded to the shell instead. Decide at kick-off.
4. Rectifier + 5.0 V clamp at B2. 15 mA (≈0.9 C, confirm cell rating). Charge ≈60 to 70 min.
5. Position θ 146.1° (US10), 78° from the head centre.

4.6 Antenna

1. Pulse W3008 at θ ≈355°, long axis along Z, on 0.10 PI stiffener.
2. Keep-out 4.0 × 4.25 mm. Ground reference on the A1 side only.
3. Band arc θ 188° to 350° (US10) is epoxy only. Nearest metal: head cell, ≈9.5 mm. Option D9 band cell: ⩾ 2 mm from antenna.
4. Tune the π-match on an open sample before potting. Verify after potting by conducted or OTA test.

4.7 Layout rules

1. Components on the bore side only (L4 islands, L2 flex for ANT1). Max height: A1 0.55, A2 1.00 (mic 0.98), B1 0.50, B2 1.20. Rule: sagitta + 0.48 + height ⩽ 2.40.
2. Mic hole Ø0.80 on A2 at arc offset 2.05 from the island start. It is the angular datum to the shell port. No solder mask inside the PSA-ring seat (OD 3.0). The A2 shell-side face sits over the Ø3.5 × 0.45 pocket: keep it flat, no parts, no raised marking.
3. No copper under the vent and PSA ring on L1/L3 except the ground ring.
4. Battery tab pads: 1.2 × 2.0 on L2, one at each end of the flat. 0.30 per end for the tab fold (10.6 cell, 11.2 flat). Weld or solder, fold 180° over the cell end (0.10 PSA/clearance, V12 in section 10). Shield cut 0.2 around each pad. No VBAT/GND behind electrodes.
5. Motor leads to two L2 pads, 0.5 mm from the motor rim. Motor body glued to the shell, not the flex.
6. flex_end (0.5): no copper within 0.5 mm of the edge. Spare arc ⩾ 25.7 mm at US6, 35.7 at US10.
7. Test pads on L4 of B2, pogo access from the bore before potting.
8. Option D9: add two tab pads at flex_end (L2) and a second NTC. Cells in parallel on VBAT.

4.8 Bring-up firmware

Function	Setting
Stack	nRF Connect SDK, nrf5340_audio unicast server
Audio	PDM 16 / 32 kHz, LC3 10 ms frames
Touch	Self-cap slider, 5 ch + shield, 100 Hz, gestures on host MCU
IMU	52 Hz when touch is active or host display on. Raise-to-talk: pitch + speech VAD.
Haptics	Short tick, double tick. DRV2605 auto-cal on first boot after potting.
Test firmware (UART pads)	Mic sensitivity, touch raw counts, IMU self-test, haptic pulse, charge detect, RF TX test mode

5. Assembly process

SOP for EVT and pilot. Yield target ⩾ 85 % EVT, ⩾ 95 % pilot. Clean area, ESD controlled, 22 ± 3 °C, RH 40 to 60 %. The ODM designs fixtures F-01 to F-10 to the requirements below.

Step 0. Incoming

Part	Check
RL-001 shell	Chips, pin-holes, pad edge, seam, side-face inner edge. Colour vs white standard. Bore, band OD and across-head gauges. Port pin gauge Ø1.60/1.65. Spot-face depth 0.45 ±0.03, flatness.
RL-010 flex	AOI, e-test, thickness, ENIG colour. Sample: bend 10× at 2 mm radius.
RL-020 cell	OCV 3.7 to 3.9 V, IR, size ⩽ 3.3 × 6.4 × 10.6, tabs. Store ⩽ 30 % SOC.
RL-050 vent	Reel lot. Membrane at 10×.
Electronics	Per BOM. Bake per MSL (WLCSP MSL 1 to 3).

Step 1. SMT (flat panel)

1. Single-side reflow, bore side. 80 µm stencil, Type 5 paste.
2. Place all parts. MK1 port faces into the Ø0.8 hole. No paste or flux in the hole: stencil blocks it, nozzle avoids the port.
3. Reflow per nRF5340 / T5838 profiles: peak 245 °C, ⩽ 3 cycles. No-clean paste, no wash (protects the mic port).
4. AOI. X-ray WLCSP, voids < 25 %.
5. Test on F-01: program bootloader and test firmware; current; SWD ID; I2C devices; mic at 94 dB SPL = −41 ±3 dBFS; IMU self-test; touch raw counts; haptic registers.
6. Depanel. No size cut. Label each flex with its serial.

Step 2. Shell preparation

1. Clean the channel: IPA, lint-free wipe, plasma 2 min.
2. Vent RL-050: bond in the Ø3.5 × 0.45 spot-face with F-03, concentric to the port ±0.1. Roll ⩾ 2 N, 3 s. Membrane visible through port, no wrinkle.
3. Magnet RL-030: CA gel at the coil centre, θ 146.1° (US10, others in section 7), z = 0, north to bore. Locate with F-04. Cure 10 min.
4. Motor RL-040: glue to the wall at θ 172.7° (US10, others in section 7), z = 0, leads to coil zone. 0.2 mm bead of potting epoxy or CA gel. Hold with F-05. Trim leads to 3 mm.
5. PSA ring RL-051: place on the vent, centred on the port (F-03 station 2), flush with the cavity wall. Keep top liner until flex-in.

Step 3. Flex-in

1. Apply PSA RL-060 to the L1 side. Electrode zone, coil zone and PSA-ring seat stay free. Remove liner.
2. In F-10, attach cell RL-020: weld or solder each tab to its pad (L2, touch zone ends). Fold tabs 180° over the cell ends, insulate with Kapton. Fix with RL-061, centred on "PAD CENTRE". Overhang 0.05 per side, 0.25 to each flange. Leave the bend lines 0.3 mm outside the cell ends free.
3. Solder motor leads.

4. Insert with F-06, antenna end first:
5. Register A2 hole Ø0.8 on the PSA ring, ±0.10 to the port axis. A2 flat on the upper flank.
6. Press touch zone and cell flat to the head, through the R1.2 bends.
7. B1 flat on the lower flank.
8. Wrap the rest round the band. A1 and B2 touch the wall at their ends.
9. Inspect at 10×: PSA ring bonded and concentric; "PAD CENTRE" on head axis; cell ⩾ 0.40 from bore line; flex end clear of antenna end; nothing above flange plane (flat gauge).

Step 4. Pre-pot test

F-07, pogo on B2 test pads. Full functional test: BLE advertise, audio stream to dongle, touch through shell, IMU, haptic, charge detect on dock coil. Record per serial. Last chance for rework.

Step 5. Potting

1. Load in mould F-08 (per size):
2. Polished side plates seal on the flanges outside the 1.80 epoxy ring and form the side-face epoxy flush with the ceramic and the R0.5 bore edges.
3. PTFE mandrel Ø(bore) +0.00/−0.02 forms the bore. Mandrel axis is the datum.
4. Stand-off pins hold A2 on the wall (PSA ring bonded), A1, B1, B2 in place, cell on the flex.
5. Register angle by port and head.
6. Degas epoxy RL-002 at ⩽ 5 mbar, 3 min. Pot time ⩽ 20 min.
7. Fill at ≈50 mbar. Gate θ ≈270°. Vent at the head, θ ≈67°, head up (air traps round the cell). Gate and vent on the bore only. Return to atmosphere, top up, remove meniscus with the lid.
8. Cure per datasheet, typ. 60 °C / 2 h, then 24 h at 23 °C before load. Cell max 60 °C: measure on first pot (V10).
9. Demould, deflash bore. Check: Ra ⩽ 0.2, step to ceramic ⩽ 0.03, bond line continuous, no gap, void or smear on ceramic.
10. Laser-mark bore: model, size, serial, CE/FCC ID when granted.

Step 6. Final test and finishing

1. Visual: port open, membrane visible; pad seam clean; bond line per cosmetic spec; no epoxy on ceramic. Remove smear with approved solvent, re-polish.
2. Test on the dock per section 6: charge, BLE, audio SNR, touch at 5 segments, haptic, IMU.
3. No 100 % leak test after potting. Sample immersion per section 6.
4. Clean, wipe, bag with desiccant, pack with dock in the EVT box.

Rework

Before potting: any flex component; vent and PSA ring once. After potting: none. Scrap, keep for failure analysis.

Fixtures

ID	Purpose
F-01	Panel pogo test and programming
F-02	Not used

ID	Purpose
F-03	Vent and PSA ring placement
F-04	Magnet placement, Hall polarity check, per size
F-05	Motor hold, per size
F-06	Flex press-in, port registered, flat head shoe, per size
F-07	Pre-pot test, pogo on B2
F-08	Potting mould, mandrel, side plates, stand-off pins (5 sizes)
F-09	Final test jig on dock, acoustic chamber
F-10	Cell tab weld and fold, all sizes

6. Test and QC

6.1 Acceptance

Stage	Sampling
Shell incoming	AQL 1.0, ANSI/ASQ Z1.4 level II. Critical: chip at port, pad edge or side-face inner edge; wall under pad < 0.56 or > 0.65; port wall outside first-article ±0.05.
Flex incoming	100 % e-test, AQL 1.0 visual
Pre-pot	100 % functional
Final	100 % functional, AQL 0.65 cosmetic
Reliability	Per build, samples in 6.4

6.2 Final test (100 %, jig F-09)

Test	Method	Pass
Charge	On dock, 5 V	12 to 18 mA within 5 s. Dock LED on. Full ⩽ 70 min.
BLE	Connect to test dongle	RSSI ⩾ −65 dBm at 1 m. Connect ⩽ 2 s.
Audio level	1 kHz, 94 dB SPL, speaker at 10 cm in chamber	−41 ±4 dBFS. Noise ⩽ −101 dBFS(A) (SNR ⩾ 60 dB). THD ⩽ 1 %.
Audio response	Sweep 100 Hz to 8 kHz	±3 dB of golden curve (set after O-B2)
Touch	Robot finger, Ø8 mm conductive rubber, 100 pF to ground, 5 positions on pad	Each ⩾ 5:1 SNR, end segments included. Centroid monotonic. No response from bore side.
IMU	Jig rotates 90°	Sign and magnitude ±5 %
Haptic	100 ms pulse	⩾ 0.5 g peak
Sleep current	30 s idle	⩽ 80 µA
Cosmetic	10× loupe, light box	Ceramic scratch ⩽ 0.2 mm. No stain or epoxy on ceramic. Bubble ⩽ 0.1 mm at bore and side-face ring. Bond line continuous, concentric. Membrane intact.

6.3 Acoustic characterisation (5 golden samples per build)

Test	Method	Output
Sensitivity, SNR, response	Per 6.2, anechoic box, bare and on silicone finger Ø19 mm. Sweep to 20 kHz.	Resonance of the ≈0.65 mm port with vent in 0.45 recess. Compare with rev A golden curve (0.45 port, 0.15 recess).
Handling noise	50 finger rubs on pad, 150 Hz high-pass	Peak dBFS. Target ⩽ −35 dBFS.
Occlusion	Bare vs on artificial hand: lips 10 cm, chest 20 cm, desk 50 cm, side	Report only

6.4 Reliability (per build)

Test	Procedure	n	Pass
IP67	1 m, 30 min, 23 °C, then function test, port check	5	Membrane dry, all pass
Sweat, sunscreen	ISO 105-E04 sweat 24 h, sunscreen 24 h	3	Swelling ⩽ 0.03, no discolour, functional
Drop	1.2 m on granite, 6 orientations × 3, incl. head face down and head corners	3	No crack (dye penetrant), functional
Tumble	0.5 m barrel, 50 cycles	3	Cosmetic AQL, functional
Thermal cycle	−10 °C / +45 °C, 50 cycles, 1 h dwell	5	Functional. No epoxy-ceramic separation (dye), esp. side-face bond line.
Damp heat	40 °C / 90 % RH, 96 h	5	Functional, SNR within 2 dB
Charge cycles	100 cycles on dock	3	Capacity ⩾ 90 %
Touch life	100 k robot taps	2	Sensitivity within 20 %
Ceramic strength	Radial load on mandrel, band and head flat	3	⩾ 300 N, no crack
Biocompatibility	ISO 10993-5 / -10, epoxy and ceramic	docs	Vendor reports
Battery safety	Cell UN38.3, IEC 62133-2 (Grepow). Over-charge and over-discharge test on ring.	docs + 2	Protection trips

6.5 Certification (pilot)

FCC Part 15.247, full test. ISED. CE RED: EN 300 328, EN 62479, EN 301 489. Bluetooth SIG: Nordic QDID + end-product listing. RoHS and REACH declarations from all vendors. Quote lab time separately.

6.6 Traceability

Serial laser-marked in the bore. Per serial, record shell lot, flex panel and serial, cell lot, epoxy lot, pot date, test results and operator (ODM MES or shared sheet). Keep golden samples at the ODM; ship 2 per build to FlowsXR.

7. Sizing

Bore diameter = ISO 8653 inner circumference / π. The band section (8.00 × 3.40) and the head (flat face 1.40 above the band) are the same in all sizes. Source: Source/params.py. Drawing sheet 6 shows the same table.

US	Bore Ø	OD (band)	Across head	Bore circ.	Flex length	Head θ	Mic port θ	Coil / magnet θ	Motor θ	Spare band arc	Cell mAh (est.)	Mass g	Pilot
6	16.51	23.31	24.71	51.9	47.5	78.2°	40.2°	167.2°	197.8°	25.7	16.8	5.26	no
7	17.35	24.15	25.55	54.5	47.5	75.3°	38.4°	161.4°	190.8°	28.2	16.8	5.40	no
8	18.19	24.99	26.39	57.1	47.5	72.6°	36.8°	155.9°	184.3°	30.7	16.8	5.54	yes
9	18.89	25.69	27.09	59.3	47.5	70.4°	35.5°	151.6°	179.2°	32.9	16.8	5.66	yes
10	19.84	26.64	28.04	62.3	47.5	67.7°	33.8°	146.1°	172.7°	35.7	16.8	5.82	yes
11	20.68	27.48	28.88	65.0	47.5	65.4°	32.4°	141.5°	167.3°	38.3	16.8	5.97	yes
12	21.49	28.29	29.69	67.5	47.5	63.4°	31.2°	137.4°	162.4°	40.7	16.8	6.11	yes
13	22.33	29.13	30.53	70.2	47.5	61.4°	30.0°	133.3°	157.5°	43.3	16.8	6.25	no

Units: mm unless marked.

Rules

1. One flex (47.5 mm) and one cell for all sizes. Cell: Grepow custom prismatic 3.3 × 6.4 × 10.6 (to quote), about 16.8 mAh, estimated at 0.075 mAh/mm³.
2. The flex starts at the antenna end, θ 350°. The head is centred on the touch zone. In smaller sizes the head, mic port, coil and motor sit further toward the thumb side. Over US 8 to 12 the head angle moves 9.2° (72.6° to 63.4°).
3. Spare band arc: cavity wall length from the flex end to the antenna end. It is filled with epoxy in the default build. Option D9 uses it for a second cell (US 9 and up).
4. The head cell envelope does not depend on size, so capacity is the same in every size.
5. Per-size tooling: shell tool (CIM), potting mould and mandrel, F-06 press shoe. All other parts and PSA dies are common.

Pilot size mix (proposal, see D10)

US	8	9	10	11	12	Total
Qty	10	20	30	25	15	100

Sizing kit: 20 kits × 8 sizes (US 6 to 13), plain zirconia or printed rings with the same band section and head.

8. Dock and dongle

8.1 Charging dock RL-100

The dock design is unchanged from rev A. The ring stands on edge in the slot, coil down, with the head to one side. The coil is on the round band, so the coil gap is the rev A value. The largest pilot ring (US 12, 29.69 across the head) fits the Ø36 puck.

Fixed by this pack (sheet 5, CAD/RL-100_dock_assembly.step):

Item	Value
Form	Puck Ø36 × 16, top edge R2, bottom edge R0.8, matte black soft-touch PC/ABS
Slot	9.2 wide × 9.0 deep, full diameter; silicone liner 0.5 on floor; floor wall 0.8
Coil	Ø10 coil + ferrite under slot floor centre; gap to ring coil 1.40 at centre
Magnet	NdFeB Ø3 × 1 at coil centre, north up
USB-C	16-pin receptacle on +Y face (perpendicular to slot); 5 V power only; 5.1 kΩ CC pull-downs
LED	One white LED, 1.5 mm light pipe on +Y face, 8 mm from USB-C. Breathing while charging, solid when full
Foot	Silicone pad on base
Split	Base (3 mm) + top; 4 × M1.4 self-tapping screws from below, under the foot pad

Magnet polarity: ring magnet north toward the bore (south faces the shell outer face). Dock magnet north up, so the pair attracts. Check both with a Hall probe on first samples.

ODM to design:

1. Internal ribs and screw bosses.
2. PCB outline inside a 26 × 20 envelope.
3. Light pipe part.
4. Wireless power transmitter circuit. Choose 6.78 MHz or 125 kHz at kick-off (see 4.5). The ring coil changes with this choice.
5. Thermal check: housing ⩽ 45 °C after 2 h at 25 °C ambient.

Requirements:

1. Ring self-aligns and charges in any drop-in orientation, head left or right, all sizes.
2. Charge current into the ring: 15 mA ±20 %.
3. Foreign object detection, or 30 min timeout with no ring.
4. No charging when the ring is removed.
5. Dock input current ⩽ 150 mA at 5 V.

8.2 USB dongle RL-200 (envelope only)

Item	Value
Housing	24 × 12 × 6, PC, 2-part snap fit
Connector	USB-C plug (male)
SoC	nRF5340 (aQFN94 accepted), nRF5340 Audio "USB dongle" role

Item	Value
USB function	UAC1 microphone (16-bit, 32 kHz) + HID consumer control
UI	One RGB LED, one recessed pairing button
Antenna	Chip antenna
Reference	Nordic nRF5340 Audio DK dongle schematics (public)
Firmware	Supplied by FlowsXR

Quote as a separate item: 2-layer PCB, housing, assembly. FCC/CE is covered with the system.

9. Request for quote

English

Subject: RFQ: RINGLET smart ring rev B, EVT 100 pcs + dock

Hello,

RINGLET is a zirconia signet ring with a MEMS microphone, a capacitive touch pad and Bluetooth LE Audio, charged on a USB-C dock. We are looking for a Shenzhen ring ODM for an engineering and pilot run. The attached pack has drawings, STEP, DXF, BOM, process and test plans. Please read section 0 and section 10 first. If you quoted rev A, section 0 lists the changes.

Scope

1. Zirconia shell RL-001, US 8 to 12, white polished 3Y-TZP (black as option). CIM, sinter, polish. Per section 2, sheet 1 and STEP; outer shoulders per renders (STEP has R1.0). Tooling per size, 10 first articles per size, unit price at 100 / 500 / 2,000 / 10,000.
2. Rigid-flex RL-010, one part for all sizes, per section 4 and DXF. NRE, stencil, 150 pcs (includes yield allowance), SMT assembly to our design.
3. Battery RL-020: Grepow custom prismatic LiPo 3.3 × 6.4 × 10.6, about 16.8 mAh (est.), all sizes. NRE, unit price, capacity, rated charge current; or an equivalent cell.
4. Ring assembly per section 5: fixtures F-01 to F-10, potting mould per size, epoxy, vent and PSA ring placement, test. 100 rings (size mix in section 7) + 10 engineering units.
5. Charging dock RL-100, 110 pcs, per section 8: housing tooling (soft tool accepted), PCB, coil, transmitter, assembly.
6. USB dongle RL-200, 110 pcs, separate line.
7. Test: production jigs, acoustic test box, reliability tests in section 6.
8. Options: ring schematic and PCB layout; firmware bring-up support; FCC, CE RED and Bluetooth SIG test coordination.

Please break down the quote into: NRE and tooling, fixtures, unit price per item and quantity, MOQ and lead time per step, payment terms, schedule from PO to EVT and to pilot delivery, and subcontracted items (ceramics, flex, cells) with vendor names.

Questions

1. Can you hold 0.60 ±0.04 on the flat under the pad, with flanks up to about 1.2 thick? Moulded or machined pad, seam and port? Do pad edge and seam stay sharp after polish?
2. Which potting epoxy do you use? Please send data sheet and biocompatibility reports. Black epoxy shows on both side faces next to white ceramic: what bond-line cosmetic standard can you hold?
3. Charging: our 6.78 MHz planar coil, or your 100 to 200 kHz ring dock? If yours, send the receiver coil and IC part numbers.
4. Have you built a capacitive touch ring? Which controller? Our pad is 0.60 zirconia + 0.35 raised pad, cell behind the electrodes.
5. Can you source the Grepow cell, or an equivalent in the same envelope? Capacity and charge rate?
6. Which Ø6 × 2.0 (or thinner) coin motor do you have in production?
7. Expected potting yield with an open acoustic port? How do you keep epoxy off the membrane?
8. What colour and cosmetic standard do you propose for white zirconia (colour range, spots, polish)?

We would like to visit for a kick-off once the quote is agreed.

Best regards,

Prasanth Sasikumar
FlowsXR
prasanth@flowsxr.com

中文

主题：询价：RINGLET 智能戒指 B 版，EVT 100 只 + 充电底座

您好：

RINGLET 是一款氧化锆印章戒指，内置 MEMS 麦克风、电容触控区和蓝牙 LE Audio，通过 USB-C 底座充电。我们正在寻找深圳的 戒指 ODM 完成工程样机和小批量试产。附件资料包含图纸、STEP、DXF、BOM、工艺和测试方案。请先阅读 section 0 和 section 10。如贵司曾报过 A 版，改动清单见 section 0。

报价范围

1. 氧化锆外壳 RL-001，US 8 至 12，白色抛光 3Y-TZP（黑色作为选项）。陶瓷注射成型、烧结、抛光。按 section 2、图纸第 1 页和 STEP；外侧肩部以渲染图为准（STEP 中为 R1.0）。请报每尺寸模具费、每尺寸 10 只首件、100 / 500 / 2,000 / 10,000 只单价。
2. 软硬结合板 RL-010，所有尺寸共用一款，按 section 4 和 DXF。NRE、钢网、150 pcs（含良率余量）、 按我方设计 SMT 贴装。
3. 电池 RL-020：Grepow 定制方形锂聚合物电池 3.3 × 6.4 × 10.6，约 16.8 mAh（估算），所有尺寸共用。NRE、单价、容量、 额定充电电流；或推荐同等电芯。
4. 戒指组装，按 section 5：治具 F-01 至 F-10、每尺寸灌封模具、环氧胶、透气膜和 PSA 胶圈贴装、测试。 100 只戒指（尺寸配比见 section 7）+ 10 只工程样机。
5. 充电底座 RL-100，110 套，按 section 8：外壳模具（可用简易模）、PCB、线圈、发射电路、组装。
6. USB 接收器 RL-200，110 只，单独报价。
7. 测试：生产治具、声学测试箱、section 6 中的可靠性测试。
8. 可选服务：戒指原理图和 PCB Layout；固件调试支持；FCC、CE RED 和蓝牙 SIG 测试协调。

请将报价拆分为：NRE 和模具、治具、各项目在各数量下的单价、各环节 MOQ 和交期、付款条件、从下单到 EVT 交付和试产交付 的时间计划，以及外协项目（陶瓷、软板、电芯）和供应商名称。

问题

1. 能否在触控区下方平面保证 0.60 ±0.04，同时侧翼厚度最大约 1.2？触控区、分型槽和麦克风孔采用成型还是后加工？抛光后 触控区边缘和分型槽能否保持清晰？
2. 贵司使用哪种灌封环氧胶？请提供规格书和生物相容性报告。黑色环氧在两侧面与白色陶瓷相邻：结合线能达到什么外观标准？
3. 充电：采用我方 6.78 MHz 平面线圈，还是贵司 100 至 200 kHz 戒指底座方案？如采用贵司方案，请提供接收线圈和 IC 型号。
4. 贵司是否做过电容触控戒指？使用哪款触控芯片？我方触控区为 0.60 氧化锆 + 0.35 凸台，电极后方为电芯。
5. 能否采购该 Grepow 电芯，或提供同尺寸的同等电芯？容量和充电倍率是多少？
6. 贵司量产中有哪款 Ø6 × 2.0（或更薄）的扁平马达？
7. 带开放声孔的灌封良率预计多少？如何避免环氧胶接触透声膜？
8. 白色氧化锆的颜色和外观标准（色差范围、斑点、抛光），贵司有何建议？

报价确认后，我们希望到贵司进行项目启动会。

此致
敬礼

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10. Open items and risks

Read before quoting. Decisions are made at kick-off. Numbers marked V are from data sheets or estimates and must be checked on real parts.

Decisions

ID	Decision	Default	Alternative	Impact
D1	Charging scheme	6.78 MHz resonant, 2-layer flex spiral coil 5 × 6 + magnet	ODM 100 to 200 kHz scheme, wire-wound Ø6 coil in same zone	Changes island B2 and dock electronics
D2	Touch controller	Azoteq IQS7222C (WLCSP), NRND	IQS7223C; Microchip MTCH6102 (QFN 3 × 3); SAML10 QTouch	MTCH6102: island B1 to 5.0 mm, flex +0.7 mm, head moves
D3	Haptic motor	Ø6 × 2.0 coin ERM, MPN TBC	No haptics; or Ø7 × 2.0	No haptics: flex 6.3 mm shorter. Ø7: cavity 7.2, band 8.3 wide
D4	Head cell	Grepow custom prismatic 3.3 × 6.4 × 10.6, about 16.8 mAh (est.)	Equivalent cell from Grepow or other vendor	Capacity, tabs and charge rate set by the quote
D5	Colour	White polished zirconia + black epoxy	Black zirconia; grey	Pigment changes sinter shrink
D6	Bore marking	Laser on epoxy	None; or on side-face epoxy ring	None
D7	Epoxy	ODM ring grade	Grade named by FlowsXR	Named grade adds qualification time. Colour and gloss approval needed either way
D8	Microphone	TDK T5838	Infineon IM69D130 (69 dB SNR, 4 × 3 × 1.2)	Island A2 to 4.6 mm; port stays on flank
D9	Second cell in band (`BAND_CELL`)	Off, not modelled	Curved Grepow GRP170722 (16 mAh, 1.7 × 6.5 × 21.8) in spare band arc, US 9 and up	About 2× capacity. Needs cells matched at assembly, fault review, second NTC, tab pads, ⩾ 2 mm from antenna, fit check per size
D10	Pilot size mix	US 8 × 10, 9 × 20, 10 × 30, 11 × 25, 12 × 15	To be confirmed by FlowsXR	Sets build quantity per size

Numbers to verify

ID	Item	Value used	Check / action
V1	T5838 port position in package	Package centre	Datasheet DS-000383 land pattern. If off-centre, move PCB hole and shell port
V2	Gore GAW334 thickness	0.30	Spot-face depth 0.45 = 0.30 vent + 0.15 PSA ring. Adjust pocket if vent differs
V3	Coin motor Ø6 × 2.0	Envelope only	If only Ø6 × 2.2 exists, liner over motor is 0.15: not accepted. Use D3
V4	Head cell size, capacity, tabs	3.3 × 6.4 × 10.6, about 16.8 mAh (est.); envelope 3.48 × 6.40 × 10.60 incl. 0.15 swelling	Grepow drawing. 6.4 in 6.9 cavity = 0.25 per side
V5	nRF5340 WLCSP height	0.55	PS v1.3+ (A3 errata). Within budget
V6	IQS7222C status	NRND (DigiKey)	Decide D2

ID	Item	Value used	Check / action
V7	Touch SNR through zirconia flat + pad	Assumed OK	See O-B3
V8	Charge power at 6.78 MHz through 0.6 ceramic + 0.8 plastic + 0.3 air	⩾ 20 mA at 5 V	Bench test. Fallback D1
V9	Antenna gain on hand	−5 dBi effective	OTA test on EVT. Nearest metal (head cell) about 9.5 mm away
V10	Epoxy exotherm vs cell limit 60 °C	Low-exotherm grade	Measure on first pot. Head cell is in the thickest epoxy
V11	Island sagitta filled without voids	Vacuum potting	X-ray first articles
V12	Tab fold and cell seating	0.30 per end for fold; 0.10 PSA/clearance flex to cell	Check real tab thickness. If short, cell loses length, not depth
V13	Charge rate	15 mA, about 0.9 C on 16.8 mAh	Confirm rated cell charge current. If ⩽ 0.7 C, set about 12 mA
V14	Shell mass	3.32 g (est.); STEP 547 mm³ = 3.31 g at US 10	Weigh first articles

Open items

ID	Item	Action
O-B1	Head cell quote (D4)	Grepow quote: drawing, capacity, NRE, lead time. No part is sized to a real cell yet
O-B2	Mic port resonance	Port on upper flank (wall 1.10), vent + 0.15 PSA ring in 0.45 recess; port length 0.69 / 0.65 / 0.61 at US 8 / 10 / 12. Simulate, then measure golden samples to 20 kHz before tool cut
O-B3	Pad touch sensitivity	Electrodes read through 0.60 flat + 0.35 pad; end segments run about 0.4 into R1.2 bends (wall to 0.95); cell behind shield. Bench test 0.95 ceramic plates with real cell before tooling
O-B4	CIM tooling for head	Head, flanks, pad and seam need side action or parting line at pad seam. Vendor to confirm mouldability, parting line, cost per size. Shoulder surface needs tooling-grade CAD (STEP has R1.0)
O-B5	Side-face bond line cosmetics	Zirconia flange edge at bore + 1.80 against black epoxy. Agree step (⩽ 0.03), gap, void, concentricity, smear and chip limits on first articles
O-B6	Sinter shrink uniformity	Wall 0.60 (band, flat) to about 1.19 (flanks). Expect head warp. Shrink study on first shots, compensate tool
O-B7	Flex bends at flat corners	Resolved in CAD: R1.2 bends, 0.26 clearance to cell. Touch zone runs about 0.4 into each bend (solid copper, no vias). Flex vendor to confirm R1.2 for one-time form
O-B8	Island area for the small parts	Placing the BOM passives next to their chips (one-sided islands, 0201 at ~0.15 spacing) leaves 26 without room: A1 holds 4 of 18 SoC/PMIC parts (U1 + U2 + Y1 cover ~77% of it), B2 has no room for the rectifier, TVS and tuning caps. B1 is ~20% full. Layout vendor to rebalance before routing: e.g. move U2 + its parts to B1, use 01005 at the SoC, lengthen A1 or B2 (flex length changes). `cad/detail_parts.py` prints the list

Risks

#	Risk	Mitigation
1	Hand occlusion and finger-rub noise not measured for rings; port is next to the pad	Port on dorsal-thumb flank; 100 to 150 Hz high-pass; raise-to-talk. Bench study (2 × nRF5340 Audio DK + taped mic) before shell tool cut
2	Ring rotates on finger, pad moves from thumb	Head and raised pad give a landmark and resist rotation; per-segment firmware thresholds
3	Vent limits water rating to IP67	Do not market for swimming

#	Risk	Mitigation
4	Flex yield: 4 islands, 3 bend zones, 2 R1.2 bends in 47.5 mm	Keep panel flat through SMT, form once. Budget 15 % loss at EVT
5	Epoxy reaching the mic membrane	PSA ring is the only barrier; bonded seal set by pocket depth. Use a ring ODM, not a general EMS
6	Capacity about 16.8 mAh (est.) in all sizes	D9 for US 11 to 12 if needed
7	White zirconia and visible epoxy show smear, contamination, bond-line defects	Cosmetic spec O-B5; expect lower cosmetic yield
8	Patents US10,681,818 (raise ring to mouth, palm-side mic) and US12,112,756 (mouth-cover wake gesture)	Mic on dorsal-thumb side, trigger is touch + raise. Legal review before launch
9	No third-party LE Audio on Apple	iPhone and Mac use dongle RL-200 for system mic

Assumptions in the geometry

1. Reference wear: right index finger. Nothing is handed; the user rotates the ring.
2. Components on the bore side of the flex; electrodes and coil on the shell side; cell on the bore side of the touch zone.
3. Minimum epoxy over components 0.40 (0.35 at the motor).
4. Head cell capacity estimated at 0.075 mAh/mm³ (GRP170722 achieves 0.066). Treat 16.8 mAh as an upper figure until quoted.