

INTERCONNECT CIRCUIT FOR PRINT COMPONENT

BACKGROUND

[0001] Inkjet printing involves depositing ink onto a surface, such as sheet of paper. Print fluid can be stored in a print fluid reservoir until it is used for printing. Print dies may dispense the print fluid for printing. An interconnect circuit may interface with a printer control interface and the print dies.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIG. 1 illustrates a perspective view of an example print component.

[0003] FIG. 2 illustrates an exploded view of the print component of FIG. 1.

[0004] FIG. 3 illustrates a front view of the print component of FIG. 1.

[0005] FIG. 4 illustrates a fluidic structure assembly including the fluidic structure, the fluid ejection device, and the interconnect circuit, as used in FIG. 1.

[0006] FIG. 5 illustrates the interconnect circuit of FIG. 1.

[0007] FIG. 6 illustrates an example fluidic structure assembly including a fluidic structure, a print component having one fluid ejection die, and an interconnect circuit.

[0008] FIG. 7 is a block diagram of an example interconnect circuit.

[0009] FIG. 8 is a block diagram of an example print component.

[0010] FIG. 9 is a block diagram of an example print component including at least one bond.

[0011] FIG. 10 illustrates the contact pads on a north portion of the interconnect circuit of FIG. 1.

[0012] FIG. 11 illustrates the contact pads on a north portion of the interconnect circuit of FIG. 6.

[0013] FIG. 12 illustrates example bond wires to connect contact pads to fluid ejection dies.

[0014] FIG. 13 illustrates the interconnect circuit of FIG. 6 attached to a molded body.

[0015] FIG. 14 illustrates a portion of the interconnect circuit of FIG. 1 including the tooling hole.

[0016] FIG. 15 illustrates a cross-section of an example interconnect circuit.

[0017] FIG. 16 illustrates an exploded view of the fluidic structure assembly of FIG. 6.

[0018] FIG. 17 illustrates an exploded view of the fluidic structure assembly of FIG. 1.

[0019] FIG. 18 is a block diagram of an example interconnect circuit.

[0020] FIG. 19 is a block diagram of an example fluid ejection device assembly including the interconnect circuit of FIG. 18.

[0021] FIG. 20 is a block diagram of an example interconnect circuit.

[0022] FIG. 21 is a block diagram of an example flexible circuit including a metal plating and a protective layer.

[0023] FIG. 22 illustrates the south end of the fluidic structure assembly of FIG. 4.

[0024] FIG. 23 illustrates a close-up of a portion of FIG. 22.

[0025] FIG. 24 illustrates the north end of the fluidic structure assembly of FIG. 4.

[0026] FIG. 25 illustrates a close-up of a portion of FIG. 24.

[0027] FIG. 26 is a block diagram of an example interconnect circuit.

[0028] The foregoing and other features of the present disclosure will become apparent from the following description and appended claims, taken in conjunction with the accompanying drawings. Understanding that these drawings depict only several examples in accordance with the disclosure and are therefore, not to be considered limiting of its scope, the disclosure

will be described with additional specificity and detail through use of the accompanying drawings.

DETAILED DESCRIPTION

[0029] In the following detailed description, reference is made to the accompanying drawings, which form a part hereof. In the drawings, similar symbols typically identify similar components, unless context dictates otherwise. The illustrative examples described in the detailed description, drawings, and claims are not meant to be limiting. Other embodiments may be utilized, and other changes may be made, without departing from the spirit or scope of the subject matter presented here. It will be readily understood that the aspects of the present disclosure, as generally described herein, and illustrated in the figures, can be arranged, substituted, combined, and designed in a wide variety of different configurations, all of which are explicitly contemplated and made part of this disclosure.

[0030] This disclosure relates to print components. A print component may be any component for print systems, such as an exchangeable print cartridge, or a component of a cartridge such as a fluid ejection device (e.g., printhead) or other integrated circuit associated with a cartridge. A print component may include a print component for dispensing print fluid and a reservoir for storing the print fluid. The print fluid may include any 2D or 3D print agent including ink for printing on a medium such as paper (2D) or (e.g., powdered) build material (3D). The print fluid may include dispensable fluid to be dispensed at relatively high precision (as to volume and/or location) for fields of implementation other than 2D or 3D imaging, including but not limited to forensic, laboratory or pharmaceutical applications.

[0031] FIG. 1 illustrates a perspective view of an example print component 100. The print component 100 may be a fluid ejection device assembly that includes a fluid ejection device. The print component may be, or may be associated with, a replaceable print cartridge. The

print component 100 includes a molded body 110. The molded body 110 may include reservoir chambers for storing print fluid. Separate reservoir chambers of the molded body 110 may store different types of print fluid. In an example, the molded body 110 includes three separate reservoir chambers for storing cyan, yellow, and magenta print fluid, respectively. The print component 100 may include a fluidic structure 120. The fluidic structure may be attached to the molded body 110. The fluidic structure 120 may be in a recess 109 of the molded body 110. The fluidic structure 120 may be attached to the molded body 110 to create a fluidic path from the reservoir chambers of the molded body 110 to a fluid ejection device 130. In an example, the fluid ejection device 130 is a fluid ejection device and the print component 100 is a fluid ejection device assembly, whereby the assembly includes an integrated circuit in the form of the fluid ejection device 130. The fluid ejection device 130 includes a packaging that includes at least one fluid ejection die. In this example, three separate fluid ejection dies are provided in the packaging. The packaging may comprise a molded, encapsulation- and or PCB compound and/or other packaging material. In certain examples, other types of integrated circuits may be provided instead of a fluid ejection device, to connect to the molded body 110 and/or interconnect circuit 140 and/or a host print apparatus, but in this example we will refer to the fluid ejection device 130 instead of, more generally, an integrated circuit.

[0032] The fluidic structure 120 may include and/or support the fluid ejection device 130. The fluid ejection device 130 may include at least one fluid ejection die. In the illustrated example, the fluid ejection device 130 may include a first fluid ejection die 131a, a second fluid ejection die 131b, and a third fluid ejection die 131c, referred to collectively as fluid ejection dies 131. Each of the fluid ejection dies 131 may include a nozzle array for ejecting the print fluid. The fluid ejection dies 131 may receive the print fluid from the reservoir chambers of the molded body 110. Each fluid ejection die may output a different type of print

fluid. In an example, the first fluid ejection die 131a outputs cyan print fluid, the second fluid ejection die 131b outputs magenta print fluid, and the third fluid ejection die 131c outputs yellow print fluid. The print component 100 may include an encapsulant 134 on the fluidic structure 120. The encapsulant 134 may cover wires 132 and/or connections connecting the fluid ejection device 130 to an interconnect circuit 140. The encapsulant 134 may be supported by the fluidic structure 120.

[0033] The fluid ejection dies 131 are fluidic integrated circuits, or in other words, lab-on-chip type circuits, designed to house logic to drive drop generators, as well as channel and eject fluid. The fluid ejection dies 131 may each include a substrate, thin film circuitry and a nozzle plate. The fluid ejection dies 131 may include drop generators or drop ejectors which may include nozzles in the nozzle plate, resistors in the thin film circuitry to drive drops out of the nozzles, and transistors in the thin film circuitry to activate the resistors. In the examples illustrated in the different figures, the fluid ejection device includes one or more dies embedded in a rigid molded compound. The compound fluid ejection device is attached to a fluidic structure. In other examples, the fluid ejection device may include a single print (i.e., fluid ejection) die with one or more drop generator arrays, not embedded in compound.

[0034] The print component 100 includes the interconnect circuit 140. The interconnect circuit 140 may be a flexible circuit. The interconnect circuit 140 may include circuitry to connect to a printer, to control the fluid ejection dies 131. The interconnect circuit 140 may be attached to the molded body 110. The circuitry of the interconnect circuit 140 may include contact pads for receiving signals to control the fluid ejection dies 131.

[0035] FIG. 2 illustrates an exploded view of the print component 100 of FIG. 1. The print component 100 may include an interconnect circuit adhesive 121. The interconnect circuit adhesive 121 may be a pressure-sensitive adhesive. The interconnect circuit adhesive 121 may be used to attach the interconnect circuit 140 to the fluidic structure 120 as parts of a

fluidic structure assembly. The fluidic structure assembly may further include the fluid ejection device 130. The fluidic structure assembly of the fluidic structure 120 and the interconnect circuit 140 may be attached to the molded body 110 by placing the fluidic structure 120 in the recess 109 of the molded body 110 and bending the interconnect circuit 140 to attach the interconnect circuit 140 to the molded body 110 using a molded body-interconnect circuit adhesive 101.

[0036] The fluidic structure 120 may be attached to the molded body 110 using a first joint adhesive 117a and second joint adhesive 117b, referred to collectively herein as joint adhesives 117. The first joint adhesive 117a may be the same as the second joint adhesive 117b. The first joint adhesive 117a may surround a first output of the molded body 110 and a second output of the molded body 110. The second joint adhesive 117b may surround a third output of the molded body 110. The first joint adhesive 117a may be located at a first fluidic joint between the first output of the molded body 110 and a first input of the fluidic structure 120 and a second fluidic joint between the second output of the molded body 110 and a second input of the fluidic structure 120. The second joint adhesive 117b may be located at a third fluidic joint between the third output of the molded body 110 and a third input of the fluidic structure 120. The joint adhesives 117 may form fluid-tight fluidic paths between the molded body and the fluidic structure 120. The joint adhesive 117 may attach the fluidic structure to the molded body.

[0037] The fluidic structure 120 may alternatively or additionally be attached to the molded body 110 using at least one structural adhesive 115. The at least one structural adhesive 115 may be located on a shelf 1114 in the recess 109 of the molded body 110. An edge of the fluidic structure 120 may contact the at least one structural adhesive on the shelf 114 of the recess 109 such that the fluidic structure 120 is secured within the recess. The interconnect circuit 140 may be sandwiched between the fluidic structure 120 and the shelf 114. A front

edge of the shelf 114 facing a front face of the molded body 110 to which the interconnect circuit 140 is attached may be parallel to the front face to facilitate bending of the interconnect circuit 140 to attach the interconnect circuit 140 to the front face. The front edge of the shelf 114 being parallel to the front face may facilitate bending the interconnect circuit 140 along a line parallel to the front face such that the interconnect circuit 140 lines up with the molded body-interconnect circuit adhesive 101.

[0038] The molded body 110 may include a support 112 to support the interconnect circuit 140. The interconnect circuit 140 may be sandwiched between the support 112 and the fluidic structure 120. A front edge of the support 112 facing the front face of the molded body 110 may be parallel to the front face to facilitate bending of the interconnect circuit 140 to attach the interconnect circuit 140 to the front face. The front edge of the support 112 being parallel to the front face may facilitate bending the interconnect circuit 140 along a line parallel to the front face such that the interconnect circuit 140 lines up with the molded body-interconnect circuit adhesive 101. The front edge of the support 112 may be in a line with the front edge of the shelf 114 to facilitate bending the interconnect circuit 140 to attach to the molded body 110. The support 112 may be a first support for the interconnect circuit 140 and the shelf 114 may be a second support for the interconnect circuit 140.

[0039] The print component 100 may include a support adhesive 113 to attach the interconnect circuit 140 to the support 112. The print component 100 may include at least one UV adhesive 111 to hold the fluidic structure 120 in place at least during manufacturing. In an example, the UV adhesive 111 is applied to the molded body 110, the fluidic structure 120 is placed on the molded body and the fluidic structure contacts the UV adhesive 111. The UV adhesive 111 is cured to hold the fluidic structure 120 in place, and hot air is flowed through the recess 109 to cure the joint adhesives 117, the at least one structural adhesive 115, and the support adhesive 113.

[0040] The print component 100 may include a print component adhesive 133 to attach the fluidic ejection device 130 to the fluidic structure 120. The fluid ejection device 130 may be attached to the fluidic structure 120 before the fluidic structure 120 is attached to the molded body. The wires 132 connecting the fluid ejection device 130 to the interconnect circuit 140 may be covered by the encapsulant 134.

[0041] FIG. 3 illustrates a front view of the print component 100 of FIG. 1. A center axis A of an electrical interconnect pad array 142 of the interconnect circuit 140 may align with a center axis of the molded body 110. The electrical interconnect pad array 142 includes a plurality of electrical interconnect pads. The center axis A of the electrical interconnect pad array 142 may align with a center axis of the second fluid ejection die 131b of the fluid ejection device 130. The center axis A of the electrical interconnect pad array 142 may align with a centroid of the print component 100. In some examples, a first distance 104 between a first edge of the interconnect circuit 140 and a first edge of the molded body 110 is the same as a second distance 102 between a second edge of the interconnect circuit 140 and a second edge of the molded body 110. In some examples, a third distance 106 between the first edge of the molded body 110 and the center axis A of the electrical interconnect pad array 142 is the same as a fourth distance 108 between the second edge of the molded body 110 and the center axis A of the electrical interconnect pad array 142. The first and second edge of the molded body 110 may be defined by side edges of a front wall of the molded body 110.

[0042] Aligning the center axis A of the electrical interconnect pad array 142 with the center axis of the molded body 110 and/or the second fluid ejection die 131b reduces a rotational movement of the print component 100 when installed in a host controller, such as a printer. The host controller may include a contact array corresponding to the electrical interconnect pad array 142. The contact array may contact the electrical interconnect pad array 142 to connect the interconnect circuit 140 to a host controller circuit. Centering the interconnect

circuit 140 and/or aligning the center axis A of the electrical interconnect pad array 142 with the center axis of the molded body 110 reduces rotational movement of the print component due to the contact between the contact array of the host controller and the electrical interconnect pad array 142. The host controller may be a printer. Also a relatively narrow interconnect circuit and interconnect pad array are obtained, whereby thin lines of the interconnect circuit may extend along the center axis A, between the interconnect pads.

[0043] FIG. 4 illustrates a fluidic structure assembly including the fluidic structure 120, the fluid ejection device 130, the interconnect circuit 140, the wires 132, and the encapsulant 134 (not shown) of FIG. 1. The interconnect circuit 140 may include a first (end) portion 141, a middle portion 145, and a second (end) portion 147. In the drawing, the second portion 147 is partially covered by a head surface of the fluidic structure 120.

[0044] The first portion 141 may include the electrical interconnect pad array 142. The electrical interconnect pad array 142 may include electrical interconnect pads 142a-142m. The electrical interconnect pads 142a-142m may be arranged along both sides of the center axis A of the electrical interconnect pad array 142. The electrical interconnect pads 142a-142m may be arranged in two columns with one column on a first side of the center axis A of the electrical interconnect pad array 142 and a second column on a second side of the center axis A of the electrical interconnect pad array 142. The two columns may extend substantially parallel to each other and the center axis A of the electrical interconnect pad array 142. The center axis A of the electrical interconnect pad array 142 may align with the second fluid ejection die 131b (or a middle nozzle array of the fluid ejection device 130) in an installed state. In the illustrated example, all of the electrical interconnect pads 142a-142m, that are to connect to the host controller, of the print component are provided in no more than two columns.

[0045] The center axis A of the electrical interconnect pad array 142 may align with a center axis or center fluid ejection die of the fluid ejection device 130. The second portion may include contact pads 146. The contact pads 146 may be connected by the wires 132 to the fluid ejection dies 131. The wires 132 may pass through vias 124 to connect the fluid ejection dies 131 to the contact pads 136. The contact pads 146 may include north contact pads and south contact pads, the north contact pads being farther from the electrical interconnect pad array 142 than the south contact pads. The wires 132 may include north wires and south wires, the north wires being farther from the electrical interconnect pad array 142 than the south wires. The wires may be bond wires, interconnect beams, or other interconnect circuitry. The north contact pads may be connected by the north wires to north ends of the fluid ejection dies 131. The south contact pads may be connected by the south wires to south ends of the fluid ejection dies 131.

[0046] The middle portion 145 may include lines 144 connecting the electrical interconnect pad array 142 to the contact pads 146. The lines 144 may be metal traces and/or flex lines. In some examples, the electrical interconnect pad array 142 and the contact pads 146 may be defined as opposite ends of the lines 144. The electrical interconnect pads 142a-142m may be widened portions of the lines 144 to facilitate connection with the contact array of the host controller. The contact pads 146 may be portions of the lines 144 to which the wires 132 are connected. The electrical interconnect pads 142-142m and the contact pads 146 may each form a widening area or a bump at opposite ends of the lines 144.

[0047] The interconnect circuit 140 may include a flexible substrate 148. A connective routing, including the electrical interconnect pad array 142, the lines 144, and the contact pads 146 may be located on or over the flexible substrate 148. The flexible substrate 148 may be electrically insulative. The interconnect circuit 140 may include a protect layer 149. The protect layer 149 may extend over a portion of the electrical interconnect pad array 142 and

over the lines 144. The electrical interconnect pads 142a-142m may be exposed to facilitate connection with the contact array of the host controller. The contact pads 146 may be exposed to facilitate connection with the wires connecting the contact pads 146 to the fluid ejection dies 131.

[0048] The second portion 147 may be laterally displaced relative to the first portion 141. The second portion 147 may be laterally displaced relative to the center axis A of the electrical interconnect pad array 142. A center axis of the second portion 147 may be laterally displaced relative to the center axis A of the electrical interconnect pad array 142. The center axis of the second portion 147 may be parallel to the center axis A of the electrical interconnect pad array 142. The contact pads 146 may be laterally displaced relative to the center axis of the second portion. The contact pads may be laterally displaced relative to the center axis of the second portion towards the fluid ejection device 130 in an installed state. The second portion 147 may extend only along one side of the fluid ejection device 130 in an installed state. The wires 132 may extend from the fluid ejection dies 131 toward the contact pads 146 in a same direction as a direction of displacement of the second portion 147 from the center axis A of the electrical interconnect pad array 142. The second portion 147 may be displaced in a first direction from the center axis A of the electrical interconnect pad array 142 and the wires 132 may extend in the first direction toward the contact pads 146.

[0049] A center axis of the middle portion 145 may extend at an acute angle relative to the center axis A of the of the electrical interconnect pad array 142. The center axis of the middle portion 145 may extend at an angle of 45° relative to the center axis of the electrical interconnect pad array. A center axis of the flexible substrate 148 in the middle portion 145 may extend at an acute angle relative to the center axis A of the of the electrical interconnect pad array 142. The angles may be measured on a side of the center axis A nearer the second portion 147. A general direction of the lines 144 in the middle portion 145 may extend at an

acute angle relative to a general direction of the lines 144 in the first portion 141 and/or the second portion 147.

[0050] The interconnect circuit 140 may include metal structures 143. The metal structures 143 may include a first metal structure 143a and a second metal structure 143b. The metal structures 143 may be insulated from the electrical interconnect pad array 142, the lines 144, and the contact pads 146. The metal structures 143 may increase a stiffness of the flexible circuit. The metal structures 143 may be of a same material as the electrical interconnect pad array 142, the lines 144, and the contact pads 146.

[0051] The electrical interconnect pads 142-142m of the electrical interconnect pad array 142 may include a first electrical interconnect pad 142a, a second electrical interconnect pad 142b, a third electrical interconnect pad 142c, a fourth electrical interconnect pad 142d, a fifth electrical interconnect pad 142e, a sixth electrical interconnect pad 142f, a seventh electrical interconnect pad 142 g, an eighth electrical interconnect pad 142h, a ninth electrical interconnect pad 142i, a tenth electrical interconnect pad 142j, an eleventh electrical interconnect pad 142k, a twelfth electrical interconnect pad 142l, and a thirteenth electrical interconnect pad 142m. Each of the electrical interconnect pads 142-142m may correspond to a host controller contact on a host controller contact array. Each of the electrical interconnect pads 142-142m may correspond to contact pad of the contact pads 146, the corresponding contact pad connected to a corresponding wire of the wires 132 connected to corresponding bond pads of circuitry of bond pads of the fluid ejection dies 131 by corresponding lines of the lines 144. The bond pads of the fluid ejection dies may correspond to the host controller contact array such that the host controller can control the fluid ejection dies 131 using electrical signals, voltages, and/or impulses transmitted from the host controller contact array via the electrical interconnect pad array 142, the lines 144, the contact pads 146, and the wires 132.

[0052] In an example, a voltage is conducted from a contact on the host controller contact to a corresponding electrical interconnect pad of the electrical interconnect pad array 142. The voltage is conducted from the electrical interconnect pad to a corresponding line of the lines 144 connected to the electrical interconnect pad. The voltage is conducted from the line to a corresponding contact pad of the contact pads 146 connected to the line. The voltage is conducted from the contact pad to a corresponding wire of the wires 132 connected to the contact pad. The voltage is conducted from the wire to a corresponding bond pad of the fluid ejection dies 131 connected to the wire. The voltage causes one or more of the fluid ejection dies 131 to eject fluid. In this way, the electrical interconnect pad, the line, the contact pad, and the wire form an electrical path between the host controller contact and the corresponding bond pads of the fluid ejection dies 131.

[0053] The first electrical interconnect pad 142a may be a pen detect pad. The first electrical interconnect pad 142a may have a voltage of 0-3.3 V. The second electrical interconnect pad 142b may be a sense, or analog reading signal pad which is a low-voltage input/output pad for temperature measurement, strain gauge sensing and non-volatile memory reads. The second electrical interconnect pad 142b may have a voltage of 0-3.3 V. The second electrical interconnect pad 142b may transmit analog signal values between 0 and 3.3 V. The third electrical interconnect pad 142c may be a mode pad which supplies a low-voltage input signal for selecting between a data loading mode and a register access mode. The third electrical interconnect pad 142c may have a voltage of 0-3.3 V. The third electrical interconnect pad 142c may transmit a logic low signal and a logic high signal. In some examples, the logic low signal may be approximately 0 V and the logic high signal may be approximately 3.3 V. In some examples, the logic low signal may be approximately 3.3 V and the logic high signal may be approximately 0 V. The fourth electrical interconnect pad 142d may be a clock pad which is a low-voltage input signal for providing a clock signal and for loading fire pulse

group data and for register access. The fourth electrical interconnect pad 142d may have a voltage of 0-3.3 V. The fifth electrical interconnect pad 142e may be a first data select pad. The sixth electrical interconnect pad 142f may be a second data select pad. The seventh electrical interconnect pad 142g may be a third data select pad. The first, second, and third data select pads may be low-voltage input/output signal pads for receiving input for the fluid ejection dies 131 for loading for pulse data packets and configuration register data. The first, second, and third data select pads may be used for sending output from the fluid ejection dies 131 to the host controller contact array when serially shifting out status register data. The fifth through seventh electrical interconnect pads 142e-142g may each have a voltage of 0-3.3 V. The fifth through seventh electrical interconnect pads 142e-142g may transmit logic low signals and logic high signals. In some examples, the logic low signals may be approximately 0 V and the logic high signals may be approximately 3.3 V. In some examples, the logic low signals may be approximately 3.3 V and the logic high signals may be approximately 0 V. The eighth electrical interconnect pad 142h may be a low-voltage ground pad and may be connected to the first electrical interconnect pad 142a. The ninth electrical interconnect pad 142i may be a high-voltage power supply input pad for powering fluid ejection resistors of the fluid ejection dies 131 and for programming non-volatile memory bits. The ninth electrical interconnect pad 142i may have a voltage of 0-35 volts. The tenth electrical interconnect pad 142j may be a high-voltage ground pad which serves as a return path for the fluid ejection resistors of the fluid ejection dies 131. The eleventh electrical interconnect pad 142k may be low-voltage power supply input pad. The eleventh electrical interconnect pad 142k may have a voltage of 5.5 volts, plus or minus 3%. The twelfth electrical interconnect pad 142l may be a fire pad. The twelfth electrical interconnect pad 142l may transmit a logic low signal and a logic high signal of approximately 0 V and 3.3 V, respectively. The thirteenth electrical interconnect pad 142m may be a reset pad which is a low-voltage input signal pad

for resetting one or more of the fluid ejection dies 131. The thirteenth electrical interconnect pad 142m may transmit a logic low signal and a logic high signal of approximately 0 V and 3.3 V, respectively.

[0054] The voltages discussed herein may be DC voltages. Furthermore, the voltages discussed herein may be approximate values. Furthermore, the voltages used for logic high and logic low may be dependent on the voltages used by the host controller. In an example, a host controller may use approximately 0 V for logic low and approximately 3.3 V for logic high. In another example, a host controller may use approximately 3.3 V for logic low and approximately 0 V for logic high.

[0055] A first loop between the second electrical interconnect pad 142b and ground may be separate from a second loop between the ninth electrical interconnect pad 142i and ground. The first and second loops may be separate such that the first and second loops are not concentric, or such that the second loop does not encompass the first loop.

[0056] In some examples, the electrical interconnect pads 142-142m may each be substantially square. In some examples, the electrical interconnect pads 142-142m may be substantially round. Substantially square electrical interconnect pads have the advantage of including an increase contact surface relative to round electrical interconnect pads. Substantially square electrical interconnect pads have the advantage of having right angles with an edge of the protect layer 149, as opposed to acute angles with the edge of the protect layer 149 as with round electrical interconnect pads. Acute angles with the edge of the protect layer 149 may provide greater nucleation sites for humidity, print fluid, and/or debris than right angle with the edge of the protect layer 149. In some examples, the electrical interconnect pads 142-142m include at least one rounded corner. In some examples, the electrical interconnect pads 142-142m include at least one chamfered corner. In some

examples, the lines 144 include at least one rounded corner. In some examples, the lines 144 include at least one chamfered corner.

[0057] FIG. 5 illustrates the interconnect circuit 140 of FIG. 1. The electrical interconnect pad array 142 is on a same side of the interconnect circuit 140 as the lines 144 and the contact pads 146. The interconnect circuit 140 may be a thin circuit or ultra-thin circuit, such as a thin printed circuit board (PCB) having a thickness between 0.2 mm and 1 mm. The flexible substrate 148 may be rigid or semi-rigid with a hinge allowing the interconnect circuit 140 to bend to attach to the molded body 110 and the fluid ejection device 130. The interconnect circuit 140 may have a thickness of less than 0.2 mm. The interconnect circuit 140 may include the connective routing which includes the lines 144, the electrical interconnect pad array 142, and the contact pads 146 on the flexible substrate 148. The term “flexible,” as in the flexible substrate 148 or a flexible circuit, refers to a capacity to bend, or flex over 90° without breaking or sustaining damage. In some examples, the flexible substrate 148 may be a layer of PET approximately .05 mm thick on which circuitry is deposited to make the interconnect circuit. In some examples, the flexible substrate 148 may be polyimide.

[0058] FIG. 6 illustrates an example fluidic structure assembly including a fluidic structure 620, a print component 630 having a fluid ejection die 631, an interconnect circuit 640, wires 632 connecting the interconnect circuit 640 to the fluid ejection die 631, and an encapsulant (not shown) covering the wires 632. The print component 630 may be similar to the fluid ejection device 130 of FIG. 1, with the difference that the print component 630 has only one fluid ejection die 631.

[0059] The interconnect circuit 640 may include an electrical interconnect pad array 642 including electrical interconnect pads 642a-642k on a first portion 641 of the interconnect circuit 640. The interconnect circuit 640 may include contact pads 646 on a second portion 647 of the interconnect circuit 640, the contact pads 646 connected to the electrical

interconnect pad array 642 by lines 644, such as metal traces and/or flex lines. Wires 632, such as bond wires, may connect the fluid ejection die 631 to the contact pads 646. The wires 632 may pass through vias 624 to connect the fluid ejection die 631 to the contact pads 646.

[0060] The interconnect circuit 640 may include a flexible substrate 140 on or above which the electrical interconnect pad array 642, the lines 644, and the contact pads 646 are located. The first portion 641, the middle portion 645, and the second portion 647 may be oriented similar to the first portion 141, the middle portion 145, and the second portion 147 of FIG. 4. The interconnect circuit 640 may be a flexible circuit. The print component 630 may be a fluid ejection device.

[0061] The interconnect circuit 640 may include metal structures 643. The metal structures 643 may include a first metal structure 643a and a second metal structure 643b. The metal structures 643 may be insulated from the electrical interconnect pad array 642, the lines 644, and the contact pads 646. The metal structures 643 may increase a stiffness of the flexible circuit. The metal structures 643 may be of a same material as the electrical interconnect pad array 642, the lines 644, and the contact pads 646.

[0062] The electrical interconnect pads 642a-642k may have similar functions to the electrical interconnect pads 142a-142m of the interconnect circuit 140 of FIG. 4, with the exception that the electrical interconnect pads 642a-642k include only one data select pad. A fifth electrical interconnect pad 642e may be the single data select pad of the electrical interconnect array 642. The electrical interconnect pads 642a-642k and 642f-642k may have the same functions and relative locations as the electrical interconnect pads 142a-142d and 142h-142m.

[0063] FIG. 7 is a block diagram of an example interconnect circuit 700. The interconnect circuit may include a first portion 741 including an electrical interconnect pad array 742 to

connect to a host controller-side contact array to electrically connect the interconnect circuit 700 with a host controller circuit, the electrical interconnect pad array 742 extending along both sides of a center axis of the electrical interconnect pad array 701; and a second portion 747 including contact pads 746 connected to the electrical interconnect pads through lines 744, the contact pads 746 to connect with an integrated circuit of a print component, the second portion 747 displaced laterally relative to the center axis of the electrical interconnect pad array 701.

[0064] The interconnect circuit 700 may include a middle portion connecting the first portion 741 and the second portion 747. The middle portion may include the lines 744. A center axis of the middle portion may extend at an acute angle relative to the center axis of the electrical interconnect pad array 701. The interconnect circuit 700 may include an electrically insulative support substrate to support the lines 744, where a center axis of the substrate in the middle portion extends at an acute angle relative to a center axis of the substrate in the first portion and/or second portion. Center axes of the first portion and second portion may extend parallel to each other. A general direction of the lines in the middle portion extends at an acute angle with a general direction of the lines in the first portion and/or second portion. The center axis of the middle portion may extend at an angle of 45° relative to the center axis of the electrical interconnect pad array 701. The second portion may extend only along one lateral side of the print component. The center axis of the electrical interconnect pad array 701 may align with a center axis of a die of the integrated circuit of the print component in an installed state. The first portion 741 may be attached to a molded reservoir body such that the center axis of the electrical interconnect pad array 701 aligns with a center axis of the molded body. The contact pads 746 may be displaced laterally relative to a center axis of the second portion. The contact pads may be displaced laterally relative to the center axis of the second portion towards the print component in an installed state. The contact pads may be provided in two groups, one

group of contact pads to connect to a first end of at least one fluid ejection die of the print component, and another group of contact pads to connect to a second end of the at least one fluid ejection die of the print component. The interconnect circuit may be a flex circuit including a flexible substrate, and the lines 744 may be flex lines. The print component may be a fluid ejection device. The electrical interconnect pad array 742 may include two columns, with a first column on a first side of the center axis of the electrical interconnect pad array 701, and a second column on a second side of the center axis of the electrical interconnect pad array 701. The columns may extend substantially parallel to each other and the center axis of the electrical interconnect pad array 701.

[0065] FIG. 8 is a block diagram of an example print component 800. The print component 800 may include a molded reservoir body 810, an integrated circuit 830, the interconnect circuit 740 of FIG. 7 attached to the molded body 810 and the integrated circuit 830, the first portion 741 attached to a front face of the molded body 810 along a center axis of the face of the molded body 801, and the second portion 747 comprising at least one contact pad 746, the at least one contact pad 746 electrically connected to the integrated circuit 830, the second portion 747 laterally displaced relative to the center axis of the face of the molded body 801.

[0066] The at least one contact pad 746 may be connected with the integrated circuit 830 via one or more bond wires. The print component may include at least one die and the at least one die may be connected to the interconnect circuit 740 via at least one corresponding bond wire.

[0067] FIG. 9 is a block diagram of an example print component 900 including at least one bond 932. The print component 900 may include a molded body 910, an integrated circuit 934, and an interconnect circuit 940 attached to the molded body 940 and the integrated circuit 934. The interconnect circuit 940 may include a first end portion 941 including at least one electrical interconnect pad 942, the first end portion 941 attached to the molded body 910, a

second end portion 947 may include at least one contact pad 946, the second end portion 947 laterally displaced relative to the first end portion 941 in a first direction, and at least one bond 932 electrically connecting the integrated circuit 934 and the at least one contact pad 936, the at least one bond 932 extending along the first direction.

[0068] The interconnect circuit 940 may be a flex circuit including a flexible substrate. The integrated circuit 934 may be a fluid ejection device. The interconnect circuit 940 may include an electrical interconnect pad array including the at least one electrical interconnect pad 942. The electrical interconnect pad array may include two columns, with a first column on a first side of a center axis of the electrical interconnect pad array, and a second column on a second side of the center axis of the electrical interconnect pad array. The columns may extend substantially parallel to each other and the center axis of the electrical interconnect pad array. The interconnect circuit 940 may include a middle portion connecting the first end portion 941 and the second end portion 947, where the interconnect circuit 940 includes an electrically insulative support substrate, where the substrate of the middle portion extends at an acute angle relative to a center axis of an electrical interconnect pad array including the at least one electrical interconnect pad 942. The middle portion may extend at an angle of 45° relative to the center axis of the electrical interconnect pad array. The second end portion 947 may extend only along one lateral side of the integrated circuit 934. The center axis of the electrical interconnect pad array may align with a center axis of a fluid ejection die of the integrated circuit 934. The center axis of the electrical interconnect pad array may align with a center axis of the molded body 910. The contact pads may be provided in two groups, one group of contact pads connected to one end of at least one fluid ejection die of the integrated circuit 934, and another group of contact pads connected to another end of the at least one fluid ejection die. The at least one bond 932 may extend through a molded via in a fluidic structure supporting the integrated circuit 934, the fluidic structure to channel fluid from at

least one molded reservoir of the molded body to at least one fluid ejection die of the integrated circuit.

[0069] FIG. 10 illustrates the north contact pads 1046 of the contact pads 146 of the interconnect circuit 140 of FIG. 1. The south contact pads of the contact pads 146 may have similar characteristics to the north contact pads 1046. The north contact pads 1046 may be portions of the lines 144 to which wires are bonded to connect the interconnect circuit 140 to the fluid ejection device 130. The lines 144 may include first segments connecting the electrical interconnect pad array 142 to the contact pads 146. The lines 144 may include second segments extending past the contact pads 146 to increase a stiffness of the interconnect circuit 140. An example second segment 1052 extends past the north contact pads 1046, parallel to at least a portion of the first segment of the line of the lines 144 extending between an electrical interconnect pad of the electrical interconnect pad array 142 and a contact pad of the north contact pads 1046. The second segment 1052 may extend beneath the protect layer 149. In some examples, the line may turn adjacent the contact pad. The line may turn adjacent the contact pad to allow the second segment 1052 to extend parallel to the lines 144. Another example second segment 1056 extends perpendicular to its corresponding contact pad of the north contact pads 1046. The second segment 1056 may extend perpendicular to its corresponding line and other lines of the lines 144 to increase a stiffness of the interconnect circuit 140. The second segments 1052 and 1056 may increase a stiffness of the interconnect circuit 140 to increase a reliability of bonds between the north wires of the wires 136 and the north contact pads 1046. The second segments 1052 and 1056 may have a width equal to or different than a width of the north contacts 1046. The lines 144 may include widened portions to increase a stiffness of the lines 144. An example widened portion 1058 increases a width of a line of the lines 144 to increase a stiffness of the interconnect circuit 140.

[0070] The lines 144 may include gussets to reinforce the lines in the first segments and/or the second segments. An example gusset 1054 reinforces a line of the lines 144 at a corner of the line. The lines 144 may include gussets in the first and/or second segments of the lines 144. The lines 144 may include gussets adjacent the contact pads 1046. The gusset 1054 may increase a stiffness of the interconnect circuit 140 to increase a reliability of bonds between the north wires of the wires 136 and the north contact pads 1046.

[0071] FIG. 11 illustrates the north contact pads 1146 on a north portion of the interconnect circuit 640 of FIG. 6. The south contact pads of the contact pads 646 may have similar characteristics to the north contact pads 1146. The north contact pads 1146 of the interconnect circuit 640 may have similar characteristics to the north contact pads 1046 of the interconnect circuit 140 of FIG. 1.

[0072] The north contact pads 1146 may be portions of the lines 644 to which wires are bonded to connect the interconnect circuit 640 to the fluid ejection device 130. The lines 644 may include first segments connecting the electrical interconnect pad array 642 to the contact pads 646. The lines 644 may include second segments extending past the contact pads 646 to increase a stiffness of the interconnect circuit 640. An example second segment 1152 extends past the north contact pads 1146, parallel to at least a portion of the first segment of the line of the lines 644 extending between an electrical interconnect pad of the electrical interconnect pad array 642 and a contact pad of the north contact pads 1146. The second segment 1152 may extend beneath the protect layer 649. In some examples, the line may turn adjacent the contact pad. The line may turn adjacent the contact pad to allow the second segment 1152 to extend parallel to the lines 644. Another example second segment 1156 extends perpendicular to its corresponding contact pad of the north contact pads 1146. The second segment 1156 may extend perpendicular to its corresponding line and other lines of the lines 644 to increase a stiffness of the interconnect circuit 640. The second segments 1152 and 1156 may increase

a stiffness of the interconnect circuit 640 to increase a reliability of bonds between the north wires of the wires 636 and the north contact pads 1146. The second segments 1152 and 1156 may have a width equal to or different than a width of the north contacts 1146. The lines 644 may include widened portions to increase a stiffness of the lines 644. An example widened portion 1158 increases a width of a line of the lines 644 to increase a stiffness of the interconnect circuit 640.

[0073] The lines 644 may include gussets to reinforce the lines in the first segments and/or the second segments. An example gusset 1154 reinforces a line of the lines 644 at a corner of the line. The lines 644 may include gussets in the first and/or second segments of the lines 644. The lines 644 may include gussets adjacent the contact pads 1146. The gusset 1154 may increase a stiffness of the interconnect circuit 640 to increase a reliability of bonds between the north wires of the wires 636 and the north contact pads 1146.

[0074] FIG. 12 illustrates example bond wires 1232 to connect contact pads 1246 to fluid ejection dies. The example bond wires 1232 may be bonded to lines 1244 of a flexible circuit at the contact pads 1246. Similar to the lines 144 and 644 of FIGS. 10 and 11, respectively, the lines 1244 may extend past the contact pads 1246 and may include gussets and widened portions.

[0075] FIG. 13 illustrates the interconnect circuit 640 of FIG. 6 attached to a molded body 1310. The interconnect circuit 640 may be attached to the molded body using a molded body-interconnect circuit adhesive (not shown), similar to the molded body-interconnect circuit adhesive 101 of FIG. 1. The interconnect circuit 640 may be attached to the molded body 1310 and may curve to attach to a print component (not shown). The interconnect circuit 640 may lift off of the molded body 1310 along a liftoff edge 1301. The liftoff edge 1301 may correspond to an edge of the interconnect circuit adhesive. The second metal structure 643b may extend from below the liftoff edge 1301 to above the liftoff edge 1301. The second metal

structure 643b may increase a stiffness of the interconnect circuit 640 across the liftoff edge 1301. The second metal structure 643b may distribute a peel force exerted on the interconnect circuit 640 at the liftoff edge 1301 to prevent the interconnect circuit 640 from peeling off of the molded body 1310. In some example, the first metal structure 643a and/or the second metal structure 643b extend across the liftoff edge 1301.

[0076] FIG. 14 illustrates a portion of the interconnect circuit 140 of FIG. 1 including a tooling hole 1410 of the interconnect circuit 140. The tooling hole 1410 may be used to align the interconnect circuit 140 when attaching the interconnect circuit 140 to a molded body, such as the molded body 110 of FIG. 1. The tooling hole 1410 may be formed by punching through, or otherwise cutting through, the substrate 148 and the protect layer 149. Forming the tooling hole 1410 by punching through the substrate 148 and the protect layer 149 causes the tooling hole 1410 to be more precisely formed and rigid than if the tooling hole were punched through the substrate 148 and then the protect layer were applied.

[0077] A gusset 1412 may be formed in the lines 144 to surround the tooling hole 1410. The gusset 1412 may reinforce the tooling hole 1410 to stiffen the edge of the tooling hole 1410 and improve a precision of aligning the interconnect circuit 640 for attachment using the tooling hole 1410. The gusset 1412 may reinforce the tooling hole 1410 to prevent tears or damage to the interconnect circuit 140.

[0078] The second electrical interconnect pad 142ab may be on a first lateral side of the electrical interconnect pad array 142 and the ninth electrical interconnect pad 142i may be on a second lateral side of the electrical interconnect pad array 142. Having the second electrical interconnect pad 142b and the ninth electrical interconnect pad 142a on opposite sides of the electrical interconnect pad array 142 may improve a function of the second electrical interconnect pad 142b by separating the second electrical interconnect pad 142b which carries low-voltage sense signals from the high-voltage ninth electrical interconnect pad 142i which

carries high-voltage power signals. Separation of low-voltage and high-voltage components may reduce a noise on the low-voltage components due to the high-voltage components.

[0079] Lines connected to the second electrical interconnect pad 142b and the ninth electrical interconnect pad 142i may be separated by a first distance 1414. The line connected to the second electrical interconnect pad 142b may be a second line 144a. The line connected to the ninth electrical interconnect pad 142i may be a ninth line 144i. The first distance 1414 may be measured between edges of the second line 144b and the ninth line 144i. The first distance 1414 may vary along the length of the second line 144b and the ninth line 144i.

[0080] The third electrical interconnect pad 142c and its corresponding third line 144c of the lines 144 may be separated from the second line 144b by a second distance 1416. The second distance 1416 may vary over a length of the third line 144c and the length of the second line 144b. The second distance 1416 may be measured between edges of the third line 144c and the second line 144b.

[0081] The second distance 1416 may be smaller than the first distance 1414, as the second electrical interconnect pad 142b and the third electrical interconnect pad 142c are both low-voltage pads, so it is not as important to separate them and their corresponding lines as it is to separate the second electrical interconnect pad 142b and the ninth (high-voltage) electrical interconnect pad 142i. The first distance 1414 may be greater than or equal to twice the second distance 1416. The first distance 1414 may be greater than or equal to twice the second distance along a length of the lines 144. The first distance 1414 and the second distance 1416 may each be greater than a minimum distance between adjacent lines of the lines 144. In an example, the second distance 1416 is greater than or equal to 60 microns along the length of the lines 144 and the first distance 1414 is greater than or equal to 100 microns along the length of the lines 144. In another example, the second distance 1416 is greater than or equal

to 100 microns along the length of the lines 144 and the first distance 1414 is greater than or equal to 270 microns along the length of the lines 144.

[0082] FIG. 15 illustrates a cross-section of an example interconnect circuit 1540. The interconnect circuit 1540 may be similar to the interconnect circuit 140 of FIG. 1 and/or the interconnect circuit 640 of FIG. 6. Discussion of characteristics of the interconnect circuit 1540 may be applied to the interconnect circuit 140 of FIG. 1 and/or the interconnect circuit 640 of FIG. 6.

[0083] The interconnect circuit 1540 may include a substrate 1508. The interconnect circuit 1540 may include a substrate adhesive 1501. The substrate adhesive 1501 may be used to attach components to the substrate 1508, such as connective routing 1544 including electrical interconnect pads, contact pads, and lines. The interconnect circuit 1540 may include the connective routing 1544 on the substrate adhesive 1501 above the substrate 1508. The connective routing 1544 may include a metal core 1544a and a metal plating 1544b. The metal core 1544a may be a conductive core including a conductive metal, such as copper. The metal plating 1544b may be a conductive metal plating including one or more conductive metals or metal alloys, such as a gold/nickel alloy. In an example, the metal plating 1544b includes a layer of nickel and a layer of gold plated over the layer of nickel. The layer of nickel may be plated on the metal core 1544a and then the gold plated on the layer of nickel to form the metal plating 1544b. In some examples, a portion of the connective routing 1544 includes the metal plating 1544b. In other examples, the entirety of the connective routing 1544 includes the metal plating 1544b.

[0084] The interconnect circuit 1540 may include a protect layer 1509 and a protect layer adhesive 1502 to attach the protect layer 1509 to the interconnect circuit 1540. The protect layer 1509 and protect layer adhesive 1502 may cover a portion of the connective routing 1544. A portion of the connective routing 1544, such as the electrical interconnect pads and

contact pads may be exposed to facilitate electrical connection. The interconnect circuit may be formed by depositing the metal core 1544a of the connective routing 1544 over the substrate 1508, plating the metal core 1544a with the metal plating 1544b, and then adding the protect layer 1509 and protect layer adhesive 1502 to the interconnect circuit 1540. In this way, the entirety of the connective routing 1544 includes the metal plating 1544b, including the portion of the connective routing 1544 covered by the protect layer 1509. This has the advantage of increased uniformity and conductivity in the connective routing 1544.

[0085] FIG. 16 illustrates an exploded view of the fluidic structure assembly of FIG. 6. The interconnect circuit 640 may have the electrical interconnect pad array 642, the lines 644, and the contact pads 646 on a first surface of the interconnect circuit 640. A second surface of the interconnect circuit 640, opposite the first surface, may be shown in FIG. 16, such that the electrical interconnect pad array 642, the lines 644, and the contact pads 646 are not shown in FIG. 16.

[0086] An interconnect circuit adhesive 621 may be used to attach the interconnect circuit 640 to the fluidic structure 620. The interconnect circuit adhesive 621 may be shaped such that the interconnect circuit adhesive 621 does not cover the vias 624 through which the wires 632 pass to connect the print component 630 to the contact pads 646. In this way, the encapsulant 634 may pass through the vias 624 to contact the interconnect circuit 640, increasing a stability of the interconnect circuit 640. The interconnect circuit adhesive 621 may be shaped to allow a support, such as the support 112 of FIG. 1, to contact the interconnect circuit 620 such that the interconnect circuit 620 is sandwiched between the support and the fluidic structure 620. The interconnect circuit adhesive 621 may be a pressure-sensitive adhesive, or any other substance for attaching the interconnect circuit 640 to the fluidic structure 620.

[0087] The fluidic structure 620 may include a vent labyrinth 622. The vent labyrinth 622 may connect nozzle arrays of the print component 630 to a back or side of the fluidic structure 620 to control a humidity of the nozzle arrays. The length and volume of the vent labyrinth 622 determine the humidity of the nozzle arrays. The interconnect circuit adhesive 621 covers a surface of the vent labyrinth 622. Covering the surface of the vent labyrinth 622 with the interconnect circuit adhesive 621 allows the vent labyrinth 622 to be molded, and provides precise control over a volume and length of the vent labyrinth 622.

[0088] FIG. 17 illustrates an exploded view of the fluidic structure assembly of FIG. 1. The interconnect circuit 140 may have the electrical interconnect pad array 142, the lines 144, and the contact pads 146 on a first surface of the interconnect circuit 140. A second surface of the interconnect circuit 140, opposite the first surface, may be shown in FIG. 17, such that the electrical interconnect pad array 142, the lines 144, and the contact pads 146 are not shown in FIG. 17.

[0089] The interconnect circuit adhesive 121 may be used to attach the interconnect circuit 140 to the fluidic structure 120. The interconnect circuit adhesive 121 may be shaped such that the interconnect circuit adhesive 121 does not cover the vias 124 through which the wires 132 pass to connect the fluid ejection device 130 to the contact pads 146. In this way, the encapsulant 134 may pass through the vias 124 to contact the interconnect circuit 140, increasing a stability of the interconnect circuit 140. The interconnect circuit adhesive 121 may be shaped to allow the support 112 of FIG. 1 to contact the interconnect circuit 120 such that the interconnect circuit 120 is sandwiched between the support 112 and the fluidic structure 120. The interconnect circuit adhesive 121 may be a pressure-sensitive adhesive, or any other substance for attaching the interconnect circuit 140 to the fluidic structure 120.

[0090] FIG. 18 is a block diagram of an example flexible circuit 1840 for a fluid ejection assembly. The flexible circuit may include a connective routing 1818 including metal traces

1844, electrical interconnect pads 1842, and contacts 1846, where each metal trace is to electrically connect an electrical interconnect pad on a first portion 1841 of the flexible circuit 1840 to a contact on a second portion 1847 of the flexible circuit 1840, the contact to connect to a fluid ejection die, and a metal structure 1843 located between, and distanced from, the electrical interconnect pad and the contact, the metal structure electrically insulated from the routing 1818, the metal structure 1843 to increase a stiffness of at least a portion of the flexible circuit 1840.

[0091] The flexible circuit 1840 may include a substrate and a protect layer at opposite sides of the routing 1818, where at least a portion of the metal structure 1843 extends between the substrate and the protect layer, and/or in the same layer as the routing 1818. The metal trace may include a first segment connecting the electrical interconnect pad to the contact, and a second segment extending beyond the contact to increase the stiffness of the flexible circuit 1840. The contact may extend between the first and second segment and there may be a turn in the trace adjacent the contact. At least a portion of the first and second segments may extend between a substrate of the flexible circuit 1840 and the protect layer, whereas the contact is exposed. The first segment and the second segment may be perpendicular and/or parallel to each other. The metal trace may include a gusset connecting the first segment and the second segment and/or adjacent the contact and/or in the second segment. The metal trace, the electrical interconnect pad, and the contact may have a same height and/or may be part of a same routing layer. The flexible circuit 1840 may include a metal plating over the electrical interconnect pad, the metal trace, and the contact, and a protective layer over a portion of the metal plating. The flexible circuit 1840 may include a hole for aligning the flexible circuit for attachment to a fluid ejection device assembly, the hole formed by punching through the substrate of the flexible circuit 1840 and the protect layer.

[0092] FIG. 19 is a block diagram of an example fluid ejection device assembly 1900 including the interconnect circuit 1840 of FIG. 18. The fluid ejection device assembly 1900 may include the flexible circuit 1840 of FIG. 18, and a fluid ejection die 1931 at a bottom 1905 of the fluid ejection device assembly 1900, where the electrical interconnect pads 1842 of the flexible circuit 1840 extend along a front 1910 of the fluid ejection device assembly 1900, where the one or more metal traces 1844 extend along, and curve between, the front 1910 and bottom 1905 of the fluid ejection device assembly 1900 to connect to the fluid ejection die 1931, and where the metal structure 1843 is provided at the front 1910 of the fluid ejection device assembly 1900 beneath the interconnect pads 1842.

[0093] FIG. 20 is a block diagram of an example interconnect circuit 2000 to connect an integrated circuit of a print component to a printer controller. The interconnect circuit 2000 may include a thin substrate 2048 and connective routing 2018 supported by the substrate 2048, the connective routing 2018 may include metal traces 2044, electrical interconnect pads 2042 and contacts 2046, and a protective layer 2049 to protect at least a portion of the routing 2018, where each metal trace of the metal traces 2044 is to electrically connect an electrical interconnect pad of the electrical interconnect pads 2042 on a first portion of the flexible substrate 2048 to a contact of the contact pads 2046 on a second portion of the flexible substrate 2048, the interconnect pad to connect to the printer and the contact to connect to a fluid ejection die, where at least one metal trace of the metal traces 2044 includes a first segment 2044a in the first and second portion, between the interconnect pad and contact, and a second segment 2044b that extends beyond the contact, in the second portion, and where the interconnect pads 2042 and contacts are exposed from the protective layer 2049 to facilitate connection to printer and die, respectively.

[0094] The interconnect circuit may include a metal structure located between, and distanced from, the electrical interconnect pads and the contacts, the metal structure electrically

insulated from the connective routing, the metal structure to increase a stiffness of at least a portion of the flexible circuit.

[0095] FIG. 21 is a block diagram of an example flexible circuit 2100 for a fluid ejection assembly including a metal plating 2144a and a protective layer 2149. The flexible circuit 2100 may include a flexible substrate 2148, a connective routing over the substrate 2118, the connective routing 2118 including metal traces 2144, electrical interconnect pads 2142, and contacts 2146, where each metal trace is to electrically connect an electrical interconnect pad on a first portion of the flexible circuit 2100 to a contact on a second portion of the flexible circuit 2100, where each electrical interconnect pad is to connect to a corresponding printer contact, and where each contact is to connect to a fluid ejection die, a metal plating 2121 over the electrical interconnect pads 2142, the metal traces 2144, and the contacts 2146, and a protective layer 2149 over a portion of the metal plating 2121.

[0096] The electrical interconnect pads 2142, the contacts 2146, and the metal traces 2144 may have a same height. At least one metal trace of the metal traces 2144 may include a first segment connecting the electrical interconnect pad to the contact, and a second segment extending beyond the contact to increase the stiffness of the flexible circuit 2140. At least a portion of the second segment extends between a substrate of the flexible circuit 2140 and the protect layer 2149. The first segment and the second segment may be perpendicular and/or parallel to each other. At least one metal trace of the metal traces 2144 may include a triangular gusset connecting the first segment and the second segment, and/or adjacent the contact and/or in the second segment. The flexible circuit 2140 may include a hole for aligning the flexible circuit 2140 for attachment to a fluid ejection device assembly, the hole formed by punching through the substrate of the flexible circuit 2140 and the protect layer 2149, the hole positioned adjacent the interconnect pads 2142. At least one metal trace of the metal traces 2144 includes a circular gusset to reinforce the hole.

[0097] FIG. 22 illustrates a south end of the fluidic structure assembly of FIG. 4. The south end of the fluidic structure assembly includes the south contact pads of the contact pads 146 and the south wires of the wires 132. Each of the first fluid ejection die 131a, the second fluid ejection die 131b, and the third fluid ejection die 131c include south bond pads connected via the south wires to the south contact pads.

[0098] FIG. 23 illustrates a close-up of a portion 2201 of FIG. 22. The south contact pads of the contact pads 146 may be connected to an eleventh line 144k, a tenth line 144j, and a ninth line 144i of the lines. The eleventh line 144k may be connected to the eleventh electrical interconnect pad 142k. The tenth line 144j may be connected to the tenth electrical interconnect pad 142j. The ninth line 144i may be connected to the ninth electrical interconnect pad 142i.

[0099] The south wires may include an eleventh wire 132k connected to the eleventh line 144k at a corresponding contact pad, a tenth wire 132j connected to the tenth line 144j at a corresponding contact pad, and a ninth wire 132i connected to the ninth line 144i at a corresponding contact pad. The south wires are referred to as such not to signify a number of wires or an order of wires, but to signify electrical connection to corresponding lines of the lines 144.

[0100] FIG. 24 illustrates the north end of the fluidic structure assembly of FIG. 4. The north end of the fluidic structure assembly includes the north contact pads of the contact pads 146 and the north wires of the wires 132. Each of the first fluid ejection die 131a, the second fluid ejection die 131b, and the third fluid ejection die 131c include north bond pads connected via the north wires to the north contact pads.

[0101] FIG. 25 illustrates a close-up of a portion 2401 of FIG. 24. The north contact pads of the contact pads 146 may be connected to the tenth line 144j, the ninth line 144i, a twelfth

line 144l, a thirteenth line 144m, an eighth line 144h, the second line 144b, the third line 144c, a fourth line 144d, a fifth line 144e, a sixth line 144f, and a seventh line 144g of the lines, each connected to their corresponding electrical interconnect pad of the electrical interconnect pad array 142.

[0102] The south wires may include a fourteenth wire 132j-2 connected to the tenth line 144j at a corresponding contact pad, a fifteenth wire 132i-2 connected to the ninth line 144i at a corresponding contact pad, a twelfth wire connected to the twelfth line 144l at a corresponding contact pad, a thirteenth wire 132m connected to the thirteenth line 144m at a corresponding contact pad, an eighth wire 132h connected to the eighth line 144h at a corresponding contact pad, a second wire 132b connected to the second line 144b at a corresponding contact pad, a third wire 132c connected to the third line 144c at a corresponding contact pad, a fourth wire 132d connected to the fourth line 144d at a corresponding contact pad, a fifth wire 132e connected to the fifth line 144e at a corresponding contact pad, a sixth wire 132f connected to the sixth line 144f at a corresponding contact pad, and a seventh wire 132g connected to the seventh line 144g at a corresponding contact pad. The north wires are referred to as such not to signify a number of wires or an order of wires, but to signify electrical connection to corresponding lines of the lines 144.

[0103] In this way, the fluid ejection dies 131 are electrically connected to the electrical interconnect pad array 142 such that the host controller can control the fluid ejection dies 131.

[0104] FIG. 26 is a block diagram of an example flexible circuit 2640 to connect an integrated circuit of a print component to a host controller. The flexible circuit 2640 may include a first portion 2641 including an electrical interconnect pad array 2642 to connect to the host controller, the electrical interconnect pad array 2642 including a first electrical interconnect pad 2642a on a first lateral side of the first portion 2641, and a second electrical interconnect

pad 2642b on a second lateral side of the first portion 2641. The flexible circuit 2640 may include a second portion 2647 separate from the first portion 2641, including a contact pad array 2646 to connect to the integrated circuit, the contact pad array 2646 including a first contact pad 2646a to connect to a fluid ejection device, and a second contact pad 2646b to connect to the fluid ejection device. The flexible circuit 2640 may include a first trace 2644a connecting the first electrical interconnect pad 2642a to the first contact pad 2646a, and a second trace 2644b connecting the second electrical interconnect pad 2642b to the second contact pad 2646b, where the first trace 2644a is configured to conduct a higher voltage than the second trace 2644b, where the first electrical interconnect pad 2642a, the second electrical interconnect pad 2642b, the first contact pad 2646a, the second contact pad 2646b, the first trace 2644a, and the second trace 2644b are on a same surface of the flexible circuit 2640.

[0105] The electrical interconnect pad array 2642 may be provided in two parallel columns along two lateral sides of a center axis and equidistant from the center axis, one column on the first side and one column on the second side of the first portion 2641. A width of the electrical interconnect pad array 2641 may be less than four times the width of a surface of the first electrical interconnect pad. The corresponding traces may extend at least partially parallel to the center axis and to each other in at least the first portion 2641. The parallel portion of the traces in the first portion 2641 may extend at least partially between the interconnect pads 2642a, 2642b. The first electrical interconnect pad 2642a includes at least one of a high power supply, logic power that is lower than the high power supply, fire that is lower power than the high power supply, reset and/or ground, and where the at least one second electrical interconnect pad includes at least one of data, clock, mode and/or analog read pad. The first trace 2644a may be wider than the second trace 2644b. The first trace 2644a is to deliver power to the fluid ejection device to drive fluid ejection. The second trace 2644b may be an analog reading trace to sense at least one characteristic of the fluid ejection

device. The first trace 2644a and the second trace 2644b include at least one rounded or chamfered corner. The fluid ejection device may be configured to transmit analog data signals to the host controller. The fluid ejection device may include drop generators to eject fluid.

[0106] FIG. 27 is a block diagram of an example flexible circuit 2740 including a third trace 2744c connecting a third electronic interconnect pad 2742c to a third contact pad 2746c. The flexible circuit 2700 may include a first portion 2741 including a first electrical interconnect pad 2742a on a first lateral side of the first portion 2741, a second electrical interconnect pad 2742b on a second lateral side of the first portion, and a third electrical interconnect pad 2742c on the first lateral side of the first portion 2741, a second portion 2747 including a first contact pad 2746a to connect to a fluid ejection device, a second contact pad 2746b to connect to the fluid ejection device, and a third contact pad 2746c to connect to the fluid ejection device. The flexible circuit 2740 may include a first trace 2744a connecting the first electrical interconnect pad 2742a to the first contact pad 2746a, a second trace 2744b connecting the second electrical interconnect pad 2742b to the second contact pad 2746b, the second trace 2744b separated from the first trace 2744a by a first distance, and a third trace 2744c connecting the third electrical interconnect pad 2742c to the third contact pad 2746c, the third trace 2744c separated from the first trace 2742a by a second distance, where the first distance is greater than the second distance.

[0107] The first trace 2744a is configured to receive a higher voltage than the second trace 2744b. The first trace 2744a is wider than the second trace 2744b. The first trace 2744a may be to deliver power to the fluid ejection device to drive fluid ejection. The second trace 2744b may be an analog reading trace to sense at least one characteristic of the fluid ejection device. The third trace may control a data transfer mode of the fluid ejection device. The first distance is greater than or equal to two times the second distance. The first trace, the second trace, and

the third trace may include at least one rounded or chamfered corner. The second contact pad 2746b is closer to a distal edge of the second portion than the first contact pad 2746a.

[0108] FIG. 28 is a block diagram of an example thin circuit 2840 to attach to a replaceable component that is replaced with respect to a host printer. The thin circuit 2840 may include an insulative support structure 2848, an electrical interconnect pad array 2842 to enable the replaceable component to communicate with a host printer circuit, the electrical interconnect pad array 2842 consisting of two parallel columns 2842a, 2842b at each side of a center axis 2801, each column including a plurality of pads, where a first column 2842a of the two parallel columns includes pads to conduct higher energy signals including a high power supply, logic power lower than the high power, fire that is lower power than high power, reset and/or ground, a second column 2842b of the two parallel columns includes pads to conduct lower energy signals, which energy is lower than the higher energy signals, the pads including data, clock, mode and/or analog reading signals, and parallel routings 2844a, 2844b extending from the electrical interconnect pad array to connect to an integrated circuit of a print component.

[0109] The first column 2842a may include a first higher energy electrical interconnect pad to conduct a voltage greater than 4 VDC, and/or a second higher energy electrical interconnect pad to conduct a voltage greater than 10 VDC, and the second column 2842b may include a first lower energy electrical interconnect pad to transmit a logic low value of approximately 0 V and a logic high value of approximately 3.3 V, and/or a second lower energy electrical interconnect pad that transmits analog voltage values between 0 and 3.3 V. The first column 2842a may include at least one lower energy electrical interconnect pad to transmit a logic low value of approximately 0 V value and a logic high value of approximately 3.3 V, and/or the second column 2842b may include a plurality of lower energy electrical interconnect pads to transmit a logic low value of approximately 0 V value and a logic high value of

approximately 3.3 V. The integrated circuit may be configured to transmit memory and/or analog values using lower energy signals over the lower energy pads, in response to instruction signals over the lower energy pads. The integrated circuit may include a fluid ejection device to eject fluid based on the lower energy and higher energy signals.

[0110] The thin circuit 2840 may be a flexible circuit or a thin printed circuit board (PCB). The integrated circuit may include a fluid ejection device or a replacement memory device for a fluid ejection device. A first distance between a power routing of the parallel routings 2844a, 2844b and an analog reading signal routing of the parallel routings may be greater than a second distance between the analogue reading signal routing and a mode routing of the parallel routings. The first distance may be greater than or equal to two times the second distance. The parallel routings may include at least one rounded or chamfered corner.

[0111] Any of the print component device assemblies or fluid ejection device assemblies discussed herein may include any of the interconnect circuits or flexible circuits discussed herein. Furthermore, any of the interconnect circuits discussed herein may be part of any of the print component device assemblies or fluid ejection device assemblies discussed herein. Furthermore, characteristics of interconnect circuits or flex circuits are not limited to the specific examples discussed. Characteristics described in conjunction with one interconnect circuit may apply to another interconnect circuit. For example, FIG. 13 discusses how the metal structures 643 of the interconnect circuit 640 may extend above a liftoff edge 1301 of the interconnect circuit 640. Similarly, the metal structures 143 of the interconnect circuit 140 may extend above a liftoff edge of the interconnect circuit 140. In another example, the electrical interconnect pads 142a-142m of the interconnect circuit 140 of FIG. 1 are described as being able to have rounded or chamfered corners. Similarly, the electrical interconnect pads 642a-642k of the interconnect circuit 640 may have rounded or chamfered corners.

[0112] The herein described subject matter sometimes illustrates different components contained within, or connected with, different other components. It is to be understood that such depicted architectures are merely exemplary, and that in fact many other architectures can be implemented which achieve the same functionality. In a conceptual sense, any arrangement of components to achieve the same functionality is effectively "associated" such that the desired functionality is achieved. Hence, any two components herein combined to achieve a particular functionality can be seen as "associated with" each other such that the desired functionality is achieved, irrespective of architectures or intermedial components. Likewise, any two components so associated can also be viewed as being "operably connected," or "operably coupled," to each other to achieve the desired functionality, and any two components capable of being so associated can also be viewed as being "operably couplable," to each other to achieve the desired functionality. Specific examples of operably couplable include but are not limited to physically mateable and/or physically interacting components and/or wirelessly interactable and/or wirelessly interacting components and/or logically interacting and/or logically interactable components.

[0113] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity. For example, recitations of plural elements can be understood to include of the element discussed.

[0114] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.). It will be further understood by those

within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means at least two recitations, or two or more recitations). Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase

presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B." Further, unless otherwise noted, the use of the words "approximate," "about," "around," "substantially," etc., mean plus or minus ten percent.

[0115] The foregoing description of illustrative examples has been presented for purposes of illustration and of description. It is not intended to be exhaustive or limiting with respect to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the disclosed embodiments. It is intended that the scope of the invention be defined by the claims appended hereto and their equivalents.

[0116] According to different aspects, the present disclosure may relate to interconnect circuits for connecting print components with host controllers, such as printer ASICs. The interconnect circuits may be any thin circuit, such as a flexible circuit (flex circuit) or a thin or ultra-thin PCB. For example, a flexible circuit could be replaced by a thin PCB. The print component may comprise a fluid ejection device or memory device or any component of a print cartridge. Connecting circuitry of the interconnect circuit may comprise lines, wires, traces or routings or the like. Bonds such as wires such as bond wires may connect electrical interconnect pads of the interconnect circuit to an integrated circuit of the print component.

[0117] According to one aspect, the present disclosure relates to a flexible or other thin circuit to connect an integrated circuit of a print component to a host controller, the flexible circuit comprising: a first portion comprising an electrical interconnect pad array to connect to the host controller, the electrical interconnect pad array including: a first electrical interconnect pad on a first lateral side of the first portion; and a second electrical interconnect pad on a second lateral side of the first portion; a second portion separate from the first portion, including a contact pad array to connect to the integrated circuit, the contact pad array on the

first surface the second portion including: a first contact pad to connect to a fluid ejection device; a second contact pad to connect to the fluid ejection device; a first trace connecting the first electrical interconnect pad to the first contact pad; and a second trace connecting the second electrical interconnect pad to the second contact pad.

[0118] According to another aspect, a flexible circuit comprises: a first portion including: a first electrical interconnect pad on a first lateral side of the first portion;

[0119] a second electrical interconnect pad on a second lateral side of the first portion; and a third electrical interconnect pad on the first lateral side of the first portion; a second portion including: a first contact pad to connect to a fluid ejection device; a second contact pad to connect to the fluid ejection device; and

[0120] a third contact pad to connect to the fluid ejection device; a first trace connecting the first electrical interconnect pad to the first contact pad; a second trace connecting the second electrical interconnect pad to the second contact pad, the second trace separated from the first trace by a first distance; and a third trace connecting the third electrical interconnect pad to the third contact pad, the third trace separated from the first trace by a second distance, wherein the first distance is greater than the second distance.

[0121] According to yet another aspect, a thin circuit to attach to a print component that is replaceable with respect to a host printer is provided, the thin circuit comprising: an insulative support structure; an electrical interconnect pad array to enable the replaceable component to communicate with a host printer circuit; the electrical interconnect pad array consisting of two parallel columns at each side of a center axis, each column comprising a plurality of pads, the columns at opposite sides of an axis; wherein a first column of the two parallel columns includes pads to conduct higher energy signals including a high power supply pad, a logic pad lower than the high power supply pad, a fire pad that is lower power than the high power

supply pad, a reset pad, and/or a ground pad; a second column of the two parallel columns includes pads to conduct lower energy signals, which energy is lower than the higher energy signals, the pads including a data pad, a clock pad, a mode pad, and/or an analog reading signal pad; and parallel routings extending from the electrical interconnect pad array to connect to an integrated circuit of the component.

[0122] According to another aspect, an interconnect circuit is provided, the interconnect circuit comprising: a first portion including an electrical interconnection pad array to connect to a host controller-side contact array, to electrically connect the interconnect circuit with a host controller circuit, the electrical interconnection pad array extending along both sides of a center axis of the electrical interconnection pad array; and a second portion including contact pads connected to the electrical interconnection pads through lines, the contact pads to connect with an integrated circuit of a print component, the second portion displaced laterally relative to the center axis of the electrical interconnection pad array.

[0123] According to another aspect, a print component is provided, the print component comprising: a molded body; an integrated circuit; and an interconnect circuit attached to the molded body and the integrated circuit, the interconnect circuit comprising: a first end portion comprising at least one electrical interconnect pad, the first end portion attached to the molded body; a second end portion comprising at least one contact pad, the second end portion laterally displaced relative to the first end portion in a first direction; and at least one bond electrically connecting the integrated circuit and the at least one contact pad, the at least one bond extending along the first direction.

[0124] According to again another aspect, a flexible circuit for a fluid ejection assembly is provided, the flexible circuit comprising: a connective routing comprising metal traces, electrical interconnect pads, and contacts, wherein each metal trace is to electrically connect an electrical interconnect pad on a first portion of the flexible circuit to a contact on a second

portion of the flexible circuit, the contact to connect to a fluid ejection die; and a metal structure located between, and distanced from, the electrical interconnect pad and the contact, the metal structure electrically insulated from the routing, the metal structure to increase a stiffness of at least a portion of the flexible circuit.

[0125] According to yet another aspect, an interconnect circuit is provided, to connect an integrated circuit of a print component to a printer controller, the interconnect circuit comprising: a thin substrate and connective routing supported by the substrate, the connective routing comprising metal traces, electrical interconnect pads and contacts; and a protective layer to protect at least a portion of the routing, wherein each metal trace is to electrically connect an electrical interconnect pad on a first portion of the flexible substrate to a contact on a second portion of the flexible substrate, the interconnect pad to connect to the printer and the contact to connect to a fluid ejection die, wherein at least one metal trace of the metal traces includes a first segment in the first and second portion, between the interconnect pad and contact, and a second segment that extends beyond the contact, in the second portion, and wherein the interconnect pads and contacts are exposed from the protective layer to facilitate connection to printer and die, respectively.

[0126] In again another aspect, a flexible circuit for a fluid ejection assembly may be provided, the flexible circuit comprising: a flexible substrate; a connective routing over the substrate, the connective routing comprising metal traces, electrical interconnect pads, and contacts, wherein each metal trace is to electrically connect an electrical interconnect pad on a first portion of the flexible circuit to a contact on a second portion of the flexible circuit, wherein each electrical interconnect pad is to connect to a corresponding printer contact, and wherein each contact is to connect to a fluid ejection die; a metal plating over the electrical interconnect pads, the metal traces, and the contacts; and a protective layer over a portion of the metal plating.

[0127] According to another aspect, an interconnect circuit is provided, to connect an integrated circuit for a fluid ejection assembly to a printer, the interconnect circuit comprising: a flexible substrate; an array of electrical interconnect pads on the substrate, to connect to corresponding printer contacts; an array of contacts, on the substrate, the contacts to electrically connect to at least one integrated circuit; and metal traces connecting each electrical interconnect pad to the corresponding contact, wherein each electrical interconnect pad, metal trace, and contact may be located on a same side of the substrate.

[0128] According to yet another aspect, a flexible circuit for a fluid ejection assembly is provided, the flexible circuit comprising: a substrate; connective routing over the substrate to connect a printer to a fluid ejection die of the fluid ejection assembly, the connective routing including printer-connect contacts adjacent a first end of the connective routing and die contacts adjacent a second end of the connecting routing, wherein the printer-connect contacts are rectangular.

[0129] Any or any combination of these aspects may be provided with any or any combination of the following features. Each of the following features may be combined into the foregoing aspects, or omitted. The first trace may be configured to conduct a higher voltage than the second trace. The first electrical interconnect pad, the second electrical interconnect pad, the first contact pad, the second contact pad, the first trace, and the second trace may be on a same surface of the flexible circuit. The electrical interconnect pad array may be provided in two parallel columns along two lateral sides of a center axis and equidistant from the center axis, one column on the first side and one column on the second side of the first portion. All interconnect pads to connect to the host controller may be provided in no more than the two columns. A width of the electrical interconnect pad array may be less than four times the width of the surface of a contact pad. The corresponding traces may extend at least partially parallel to the center axis and to each other in at least the first

portion. The parallel portion of the traces in the first portion may extend at least partially between the interconnect pads. The first electrical interconnect pad may comprise at least one of: a high power supply, logic power that is lower than the high power supply, fire that is lower power than the high power supply, reset and/or ground, and the at least one second electrical interconnect pad may comprises at least one of a data, clock, mode and/or analog read pad. The first trace may be wider than the second trace. The first trace may be to deliver power to the fluid ejection device to drive fluid ejection. The second trace may be an analog reading trace to communicate analog values corresponding to data and/or to at least one sensed characteristic of the fluid ejection device. The first trace and the second trace may include at least one chamfered corner. The fluid ejection device may be configured to transmit analog data signals to the host controller. The fluid ejection device comprises drop generators to eject fluid. The first trace may be configured to receive a higher voltage than the second trace. The first trace may be wider than the second trace. The first trace may be configured to deliver power to the fluid ejection device to drive fluid ejection. The second trace may be an analog reading trace to sense at least one characteristic of the fluid ejection device. The third trace may be to control a data transfer mode of the fluid ejection device. The first distance may be greater than or equal to two times the second distance. The first trace, the second trace, and the third trace may include at least one chamfered corner. The second contact pad may be closer to a distal edge of the second portion than the first contact pad. The first column may include: a first higher energy electrical interconnect pad to conduct a voltage greater than 4 VDC, and/or a second higher energy electrical interconnect pad to conduct a voltage greater than 10 VDC, and, the second column may include: a first lower energy electrical interconnect pad to transmit a logic low value of approximately 0 V and a logic high value of approximately 3.3 V, and/or a second lower energy electrical interconnect pad that transmits analog voltage values between 0 and 3.3 V. The first column may include at least

one lower energy electrical interconnect pad to transmit a logic low value of approximately 0 V value and a logic high value of approximately 3.3 V, and/or the second column includes a plurality of lower energy electrical interconnect pads to transmit a logic low value of approximately 0 V and a logic high value of approximately 3.3 V. The integrated circuit may be configured to transmit memory and/or analog values using lower energy signals over the lower energy pads, in response to instruction signals over the lower energy pads. The integrated circuit may comprise a fluid ejection device to eject fluid based on the lower energy and higher energy signals. The thin circuit may be a flexible circuit or a thin printed circuit board (PCB). The integrated circuit may comprise a fluid ejection device or a replacement memory device for a fluid ejection device. A first distance between a power routing of the parallel routings and an analog reading signal routing of the parallel routings may be greater than a second distance between the analogue reading signal routing and a mode routing of the parallel routings. The first distance may be greater than or equal to two times the second distance. The parallel routings may include at least one chamfered corner. A fluid ejection device assembly may comprise: a fluid ejection device; and the flexible/thin/interconnect circuit. A middle portion may connecting the first portion and the second portion. A center axis of the middle portion may extend at an acute angle relative to the center axis of the electrical interconnection pad array. An electrically insulative support substrate may support the lines, wherein a center axis of the substrate in the middle portion extends at an acute angle relative to a center axis of the substrate in the first portion and/or second portion. Center axes of the first portion and second portion may extend parallel to each other. A general direction of the lines in the middle portion may extend at an acute angle with a general direction of the lines in the first portion and/or second portion. The center axis of the middle portion may extend at an angle of 45° relative to the center axis of the electrical interconnection pad array. The contact pads may be displaced laterally relative to a center axis of the second portion.

The contact pads may be displaced laterally relative to the center axis of the second portion towards the integrated circuit in an installed state. The integrated circuit may comprise at least one fluid ejection die, and the contact pads may be provided in two groups, one group of contact pads to connect to a first end of the at least one fluid ejection die of the print component, and another group of contact pads to connect to a second end of the at least one fluid ejection die of the print component. The interconnect circuit may be a flex circuit comprising a flexible substrate, and the lines may be flex lines. The print component may comprises a fluid ejection device. The electrical interconnection pad array may comprise two columns, with a first column on a first side of the center axis of the electrical interconnection pad array, and a second column on a second side of the center axis of the electrical interconnection pad array. The columns may extend substantially parallel to each other and the center axis of the electrical interconnection pad array. The second portion may extend only along one side of the integrated circuit. The center axis of the electrical interconnection pad array may aligns with a center axis of the integrated circuit of the print component in an installed state. The print component may include a molded reservoir body to hold fluid, wherein the first portion is attached to the molded reservoir body such that the center axis of the electrical interconnection pad array aligns with a center axis of the molded body. The print component may comprise a molded reservoir body; the interconnect circuit attached to the molded body and the integrated circuit, the first portion attached to a front face of the molded body along a center axis of the face of the molded body; and the second portion comprising at least one contact pad, the at least one contact pad electrically connected to the integrated circuit, the second portion laterally displaced relative to the center axis of the face of the molded body. The at least one contact pad may be connected with the integrated circuit via one or more wires. The integrated circuit may comprise at least one fluid ejection die and the at least one die is connected to the interconnect circuit via at least one corresponding wire.

The interconnect circuit may be a flex circuit comprising a flexible substrate. The integrated circuit may be a fluid ejection device. The print component may comprise an electrical interconnection pad array including the at least one electrical interconnect pad. The electrical interconnection pad array may comprise two columns, with a first column on a first side of a center axis of the electrical interconnection pad array, and a second column on a second side of the center axis of the electrical interconnection pad array. The columns may extend substantially parallel to each other and to the center axis of the electrical interconnection pad array. The interconnect circuit may include a middle portion connecting the first end portion and the second end portion, wherein the interconnect circuit comprises an electrically insulative support substrate, wherein the substrate of the middle portion extends at an acute angle relative to a center axis of an electrical interconnect pad array including the at least one electrical interconnect pad. The middle portion may extend at an angle of 45° relative to the center axis of the electrical interconnect pad array. The second end portion may extend only along one lateral side of the integrated circuit. The center axis of the electrical interconnect pad array may align with a center axis of a fluid ejection die of the integrated circuit. The center axis of the electrical interconnect pad array may align with a center axis of the molded body. The at least one contact pad may be displaced laterally relative to a center axis of the second end towards the integrated circuit. The contact pads may be provided in two groups, one group of contact pads connected to one end of at least one fluid ejection die of the integrated circuit, and another group of contact pads connected to another end of the at least one fluid ejection die. The at least one bond may extend through a molded via in a fluidic structure supporting the integrated circuit, the fluidic structure to channel fluid from at least one molded reservoir of the molded body to at least one fluid ejection die of the integrated circuit. The flexible (or other thin) circuit may comprise a substrate and a protect layer at opposite sides of the routing, wherein at least a portion of the metal structure extends between

the substrate and the protect layer, and/or in the same layer as the routing. The metal trace may include a first segment connecting the electrical interconnect pad to the contact, and a second segment extending beyond the contact to increase the stiffness of the flexible circuit. The contact may extend between the first and second segment and there may be a turn in the trace adjacent the contact. At least a portion of the first and second segments may extend between a substrate of the flexible circuit and the protect layer, whereas the contact is exposed. The first segment and the second segment may be perpendicular and/or parallel to each other. The metal trace may include a gusset connecting the first segment and the second segment and/or adjacent the contact and/or in the second segment. The metal trace, the electrical interconnect pad, and the contact may have a same height and/or are part of a same routing layer. The flexible circuit may further comprise: a metal plating over the electrical interconnect pad, the metal trace, and the contact; and a protective layer over a portion of the metal plating. The flexible circuit may include a hole for aligning the flexible circuit for attachment to a fluid ejection device assembly, wherein the hole may be formed by punching through the substrate of the flexible circuit and the protect layer. A fluid ejection device assembly may comprise: the flexible circuit; and the fluid ejection die at a bottom of the fluid ejection device assembly, wherein the electrical interconnect pads of the flexible circuit extend along a front of the fluid ejection device assembly, wherein the one or more metal traces extend along, and curve between, the front and bottom of the fluid ejection device assembly to connect to the fluid ejection die, and wherein the metal structure is provided at the front of the fluid ejection device assembly beneath the interconnect pads. A metal structure may be located between, and distanced from, the electrical interconnect pads and the contacts. The metal structure may be electrically insulated from the connective routing. The metal structure may increase a stiffness of at least a portion of the flexible circuit. The electrical interconnect pads, the contacts, and the metal traces may have a same height. At

least one metal trace of the metal traces may include a first segment connecting the electrical interconnect pad to the contact, and a second segment extending beyond the contact to increase the stiffness of the flexible circuit. At least a portion of the second segment may extend between a substrate of the flexible circuit and the protect layer. The first segment and the second segment may be perpendicular and/or parallel to each other. At least one metal trace of the metal traces may include a triangular gusset connecting the first segment and the second segment, and/or adjacent the contact and/or in the second segment. The flexible circuit may include a hole for aligning the flexible circuit for attachment to a fluid ejection device assembly. The hole may be formed by punching through the substrate of the flexible circuit and the protect layer, the hole positioned adjacent the interconnect pads. At least one metal trace of the metal traces may include a circular gusset to reinforce the hole. A fluid ejection device assembly may comprise: the flexible circuit, wherein the fluid ejection die is at a bottom of the fluid ejection device assembly, the electrical interconnect pads of the flexible circuit extend along a front of the fluid ejection device assembly, and the metal traces curve around the front and bottom of the fluid ejection device assembly to connect to the fluid ejection die. The array of electrical interconnect pads, the array of contacts, and the metal traces may have a same height. At least one metal trace of the metal traces may include a first segment connecting the electrical interconnect pad to the contact, and a second segment extending from the contact to increase the stiffness of the interconnect circuit. At least a portion of the second segment may extend between a substrate of the flexible circuit and the protect layer. The first segment and the second segment may be perpendicular to each other. The at least one metal trace may include a triangular gusset connecting the first segment and the second segment. The interconnect circuit may include a hole for alignment, for example for aligning the interconnect circuit for attachment to a fluid ejection device assembly. The alignment hole of this disclosure may be formed by punching through the substrate of the

flexible circuit and the protect layer. At the least one metal trace of the metal traces may include a circular gusset to reinforce the hole. A fluid ejection device assembly may comprise: the interconnect circuit, where the fluid ejection die is at a bottom of the fluid ejection device assembly, the electrical interconnect pads of the flexible circuit extend along a front of the fluid ejection device assembly, and the one or more metal traces curve around the front and bottom of the fluid ejection device assembly to connect to the fluid ejection die. A metal plating may be provided over the connecting circuitry. A protect layer may be provided over at least a portion of the metal plating. The rectangular printer-connect contacts may have rounded corners. The rectangular printer-connect contacts may have chamfered corners. The printer-connect contacts (i.e., electrical interconnect pads) may be provided along two parallel lines. The die contacts may be provided in a line. A metal structure may be provided to the flexible circuit to increase a stiffness of the flexible circuit, wherein the metal structure may be insulated from the connecting routing. The metal structure may be of the same material as the connecting routing. A fluid ejection device assembly may comprise: the flexible circuit; a fluid ejection die at a bottom of the fluid ejection device assembly, wherein the printer-connect contacts of the flexible circuit extend along a front of the fluid ejection device assembly, and the connecting circuitry may curve around the front and bottom of the fluid ejection device assembly to connect to the fluid ejection die. The die contacts may be above a level of the fluid ejection die as the flexible circuit curves from the front of the fluid ejection device assembly to the fluid ejection device, running along a top surface opposite a printing surface of the fluid ejection device. The fluid ejection device assembly may comprise a reservoir body to provide fluid to the fluid ejection die.

WHAT IS CLAIMED IS:

1. A flexible circuit to connect an integrated circuit of a print component to a host controller, the flexible circuit comprising:
 - a first portion comprising an electrical interconnect pad array to connect to the host controller, the electrical interconnect pad array including:
 - a first electrical interconnect pad on a first lateral side of the first portion; and
 - a second electrical interconnect pad on a second lateral side of the first portion;
 - a second portion separate from the first portion, including a contact pad array to connect to the integrated circuit, the contact pad array on the first surface the second portion including:
 - a first contact pad to connect to a fluid ejection device;
 - a second contact pad to connect to the fluid ejection device;
 - a first trace connecting the first electrical interconnect pad to the first contact pad; and
 - a second trace connecting the second electrical interconnect pad to the second contact pad, wherein the first trace is configured to conduct a higher voltage than the second trace., wherein the first electrical interconnect pad, the second electrical interconnect pad, the first contact pad, the second contact pad, the first trace, and the second trace are on a same surface of the flexible circuit.
2. The flexible circuit of claim 1, wherein the first electrical interconnect pad, the second electrical interconnect pad, the first contact pad, the second contact pad, the first trace, and the second trace are on a same surface of the flexible circuit.
3. The flexible circuit of claim 1 or claim 2, wherein the electrical interconnect pad array is provided in two parallel columns along two lateral sides of a center axis and equidistant from the center axis, one column on the first side and one column on the second side of the first portion.
4. The flexible circuit of any of claims 1-3, wherein a width of the electrical interconnect pad array is less than four times the width of the surface of a contact pad.

5. The flexible circuit of any of claims 1-4, wherein the corresponding traces extending at least partially parallel to the center axis and to each other in at least the first portion.
6. The flexible circuit of any of claims 1-5, wherein the parallel portion of the traces in the first portion extend at least partially between the interconnect pads.
7. The flexible circuit of any of claims 1-6, wherein the first electrical interconnect pad comprises at least one of: a high power supply, logic power that is lower than the high power supply, fire that is lower power than the high power supply, reset and/or ground, and wherein the at least one second electrical interconnect pad comprises at least one of a data, clock, mode and/or analog read pad.
8. The flexible circuit of any of claims 1-7, wherein the first trace is wider than the second trace.
9. The flexible circuit of any of claims 1-8, wherein the first trace is to deliver power to the fluid ejection device to drive fluid ejection.
10. The flexible circuit of any of claims 1-9, wherein the second trace is an analog reading trace to communicate analog values corresponding to data and/or to at least one sensed characteristic of the fluid ejection device.
11. The flexible circuit of any of claims 1-10, wherein the first trace and the second trace include at least one chamfered corner.
12. The flexible circuit of any of claims 1-11, wherein the fluid ejection device is configured to transmit analog data signals to the host controller.
13. The flexible circuit of any of claims 1-12, wherein the fluid ejection device comprises drop generators to eject fluid.
14. A flexible circuit comprising:
a first portion including:

a first electrical interconnect pad on a first lateral side of the first portion;
a second electrical interconnect pad on a second lateral side of the first portion; and
a third electrical interconnect pad on the first lateral side of the first portion;
a second portion including:
 a first contact pad to connect to a fluid ejection device;
 a second contact pad to connect to the fluid ejection device; and
 a third contact pad to connect to the fluid ejection device;
a first trace connecting the first electrical interconnect pad to the first contact pad;
a second trace connecting the second electrical interconnect pad to the second contact pad, the second trace separated from the first trace by a first distance; and
a third trace connecting the third electrical interconnect pad to the third contact pad, the third trace separated from the first trace by a second distance, wherein the first distance is greater than the second distance.

15. The flexible circuit of claim 14, wherein the first trace is configured to receive a higher voltage than the second trace.

16. The flexible circuit of claim 14 or claim 15, wherein the first trace is wider than the second trace.

17. The flexible circuit of any of claims 14-16, wherein the first trace is to deliver power to the fluid ejection device to drive fluid ejection.

18. The flexible circuit of any of claims 14-17, wherein the second trace is an analog reading trace to communicate analog values corresponding to data and/or to at least one sensed characteristic of the fluid ejection device.

19. The flexible circuit of any of claims 14-18, wherein the third trace is to control a data transfer mode of the fluid ejection device.

20. The flexible circuit of any of claims 14-19, wherein the first distance is greater than or equal to two times the second distance.

21. The flexible circuit of any of claims 14-20, wherein the first trace, the second trace, and the third trace include at least one chamfered corner.

22. The flexible circuit of any of claims 1-21, wherein the second contact pad is closer to a distal edge of the second portion than the first contact pad.

23. A thin circuit to attach to a print component that is replaceable with respect to a host printer, the thin circuit comprising:

an insulative support structure;

an electrical interconnect pad array to enable the replaceable component to communicate with a host printer circuit;

the electrical interconnect pad array consisting of two parallel columns at each side of a center axis, each column comprising a plurality of pads, the columns at opposite sides of an axis;

wherein a first column of the two parallel columns includes pads to conduct higher energy signals including a high power supply pad, a logic pad lower than the high power supply pad, a fire pad that is lower power than the high power supply pad, a reset pad, and/or a ground pad;

a second column of the two parallel columns includes pads to conduct lower energy signals, which energy is lower than the higher energy signals, the pads including a data pad, a clock pad, a mode pad, and/or an analog reading signal pad; and

parallel routings extending from the electrical interconnect pad array to connect to an integrated circuit of the component.

24. The thin circuit of claim 23, further comprising parallel routings extending from the electrical interconnect pad array to connect to an integrated circuit of the component.

25. The thin circuit of claim 23 or claim 24, wherein the first column includes:

a first higher energy electrical interconnect pad to conduct a voltage greater than 4 VDC, and/or

a second higher energy electrical interconnect pad to conduct a voltage greater than 10 VDC, and wherein

the second column includes:

a first lower energy electrical interconnect pad to transmit a logic low value of approximately 0 V and a logic high value of approximately 3.3 V, and/or

a second lower energy electrical interconnect pad that transmits analog voltage values between 0 and 3.3 V.

26. The thin circuit of any of claims 23-25, wherein the first column includes at least one lower energy electrical interconnect pad to transmit a logic low value of approximately 0 V value and a logic high value of approximately 3.3 V, and/or the second column includes a plurality of lower energy electrical interconnect pads to transmit a logic low value of approximately 0 V and a logic high value of approximately 3.3 V.

27. The thin circuit of any of claims 23-26, wherein the integrated circuit is configured to transmit memory and/or analog values using lower energy signals over the lower energy pads, in response to instruction signals over the lower energy pads.

28. The thin circuit of any of claims 23-27, wherein the integrated circuit comprises a fluid ejection device to eject fluid based on the lower energy and higher energy signals.

29. The thin circuit of any of claims 23-28, wherein the thin circuit is a flexible circuit or a thin printed circuit board (PCB).

30. The thin circuit of any of claims 23-29, wherein the integrated circuit comprises a fluid ejection device or a replacement memory device for a fluid ejection device.

31. The thin circuit of any of claims 23-30, wherein a first distance between a power routing of the parallel routings and an analog reading signal routing of the parallel routings is greater than a second distance between the analogue reading signal routing and a mode routing of the parallel routings.

32. The thin circuit of claim 30, wherein the first distance is greater than or equal to two times the second distance.

33. The thin circuit of any of claims 23-32, wherein the parallel routings include at least one chamfered corner.

34. A fluid ejection device assembly comprising:
a fluid ejection device; and
the flexible circuit of any of claims 1-22.

35. A fluid ejection device assembly comprising:
a fluid ejection device; and
the thin circuit of any of claims 23-33.