

# (19) United States

## (12) Patent Application Publication (10) Pub. No.: US 2023/0230958 A1 Batchelor et al.

Jul. 20, 2023

(43) **Pub. Date:** 

## (54) EMBEDDED TRANSISTOR DEVICES

(71) Applicant: X-Celeprint Limited, Dublin (IE)

(72) Inventors: William Edward Batchelor, Raleigh, NC (US); Ronald S. Cok, Rochester,

NY (US)

(21) Appl. No.: 17/578,873

Jan. 19, 2022 (22) Filed:

### **Publication Classification**

(51) Int. Cl.

H01L 25/065 (2006.01)H01L 25/07 (2006.01)H01L 25/00 (2006.01)

(52) U.S. Cl.

CPC ...... H01L 25/0657 (2013.01); H01L 25/071 (2013.01); H01L 25/50 (2013.01); H01L 2225/06562 (2013.01); H01L 2225/06565 (2013.01); H01L 2225/06541 (2013.01); H01L 2225/06548 (2013.01); H01L 2225/06524 (2013.01); H01L 24/24 (2013.01)

#### **ABSTRACT** (57)

An embedded component stack includes a first metal layer, a first dielectric layer disposed on the first metal layer, a second metal layer disposed on the first dielectric layer, a first component disposed and embedded entirely within the first dielectric layer and entirely between the first metal layer and the second metal layer, a second dielectric layer disposed on the second metal layer, and a second component disposed on or embedded entirely within the second dielectric layer. The first and second components can be bare, unpackaged dies disposed over the metal layers by microtransfer printing. The metal layers can be patterned and can be electrically connected to the components. The first component can be rotated with respect to the second component. Multiple components can be embedded in one or more of the dielectric layers.

