Various physical attachment configurations have been used to electrically isolate the semiconductor integrated circuit die from the die attach paddle. One such attachment configuration uses non-conductive epoxy to achieve physical attachment and electrical isolation. However, this has proven over time to be ineffective and unreliable in preventing high quiescent currents due to conductive paths between the semiconductor integrated circuit die and the die attach paddle.

Another similar but more effective approach is to screen print one or two layers of non-conductive epoxy onto the backside of an integrated circuit wafer. The integrated circuit wafer comprises a plurality of semiconductor integrated circuit dice. The screen printed epoxy is partially cured (B-stage) and is thereafter ready for singulation into individual dice. The individual integrated circuit dice are then attached to respective die attach paddles of a plurality of leadframes by heating the die attach paddles then scrubbing the non-conductive B-stage epoxy coated dice onto the heated die attach paddles. After the dice have been attached to the respective die attach paddles, they are heated until the non-conductive B-stage epoxy is hard cured (C-stage). This form of attachment does solve the silver migration problem long term, but the useful storage life of the B-stage epoxy integrated circuit wafer is only about two to four weeks.

SUMMARY

Therefore, a need exists for a better way of coating the backside of a semiconductor integrated circuit wafer with a non-conductive material so that the coating may have~~has~~ a long storage (shelf) life, aids in the attachment of singulated semiconductor integrated circuit dice to die attach paddles of leadframes, and prevents or substantially reduces silver migration from the die attach paddle during operation of the semiconductor integrated circuit die.

According to teachings of this disclosure, a uniform layer of non-conductive material, *e.g.*, epoxy, is screen printed onto the backside of an integrated circuit wafer to a required thickness, and then heated until it is hard cured (C-stage). The screen printing may apply the non-conductive material in a pattern onto the backside of the integrated circuit wafer. The integrated circuit wafer, having the hard cured coating thereon, is then sawn apart to separate each individual integrated circuit die from each other in the wafer (singulated) for preparation to be attached to respective die attach paddles of leadframes. The required thickness may be

from about one to three milli-inches, preferably from about 1.5 to 2.5 milli-inches, and most preferably about two milli-inches.

During the process of attaching the die to a die attach paddle, a non-conductive adhesive, *e.g.*, epoxy, is dispensed onto the mating face of the die attach paddle. Then the face of the die having the hard cured coating is placed into the recently dispensed non-conductive adhesive on the mating face of the die attach paddle. Next the die and die attach paddle assembly are heated to hard cure the adhesive between the mating faces of the die and die attach paddle. After the adhesive has been hard cured, the integrated circuit bond pads may be wire bonded to the leadframe leads (conductive leads used for the finished integrated circuit external circuit connections). Thereby providing long term electrical isolation of the integrated circuit die from the die attach paddle of the leadframe, and effectively eliminating silver migration from the die attach paddle which causes conductive paths to form that increase unwanted leakage currents in the die and ultimately cause failure during operation thereof.

According to an aspect of the present invention ~~specific example embodiment of this disclosure~~, there is provided a method for attaching semiconductor dice to leadframe die attach paddles, the method comprise~~s~~ing the steps of: applying a non-conductive material to a back face of a semiconductor integrated circuit wafer, the semiconductor integrated circuit wafer comprising a plurality of integrated circuit dice; heating the semiconductor integrated circuit wafer and the non-conductive material thereon until the non-conductive material is hard cured; mounting the semiconductor integrated circuit wafer on a wafer carrier; wherein the hard cured non-conductive material is between the semiconductor integrated circuit wafer and the wafer carrier; separating each of the plurality of integrated circuit dice from each other; dispensing non-conductive adhesive on faces of die attach paddles of a plurality of leadframes; placing the plurality of integrated circuit dice into the non-conductive adhesive on the faces of respective ones of the die attach paddles; heating the plurality of integrated circuit dice and die attach paddles until the non-conductive adhesive is hard cured; attaching bond pads of the plurality of integrated circuit dice to respective conductive leads of the plurality of leadframes with bond wires; and separating each of the plurality of leadframes into integrated circuits.