US009647658B2

(12) **United States Patent**
Yilmaz

(10) **Patent No.: US 9,647,658 B2**
(45) **Date of Patent: May 9, 2017**

(54) **RESISTIVE INTERPOLATION FOR A TOUCH SENSOR WITH OPAQUE CONDUCTIVE MATERIAL**

(71) Applicant: **Esat Yilmaz**, Santa Cruz, CA (US)

(72) Inventor: **Esat Yilmaz**, Santa Cruz, CA (US)

(73) Assignee: **Atmel Corporation**, San Jose, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1115 days.

(21) Appl. No.: **13/671,106**

(22) Filed: **Nov. 7, 2012**

(65) **Prior Publication Data**

US 2014/0125403 A1 May 8, 2014

(51) **Int. Cl.**

G08B 19/00	(2006.01)
H03K 17/96	(2006.01)
G06F 3/044	(2006.01)

(52) **U.S. Cl.**

CPC ***H03K 17/9622*** (2013.01); ***G06F 3/044*** (2013.01)

(58) **Field of Classification Search**

USPC 307/652; 327/517

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,663,607	B2	2/2010	Hotelling	
7,875,814	B2	1/2011	Chen	
7,920,129	B2	4/2011	Hotelling	
8,031,094	B2	10/2011	Hotelling	
8,031,174	B2	10/2011	Hamblin	
8,040,326	B2	10/2011	Hotelling	
8,049,732	B2	11/2011	Hotelling	
8,179,381	B2	5/2012	Frey	
2006/0132462	A1*	6/2006	Geaghan	G06F 3/044 345/173
2009/0315854	A1	12/2009	Matsuo	
2010/0044122	A1*	2/2010	Sleeman	G01D 5/2405 178/18.06
2010/0045632	A1*	2/2010	Yilmaz	G01D 5/2405 345/174
2011/0025639	A1	2/2011	Trend	
2011/0095996	A1	4/2011	Yilmaz	
2011/0279400	A1	11/2011	Yilmaz	
2012/0139829	A1*	6/2012	Anno	G06F 3/041 345/156
2012/0242588	A1	9/2012	Myers	
2012/0242592	A1	9/2012	Rothkopf	

(Continued)

FOREIGN PATENT DOCUMENTS

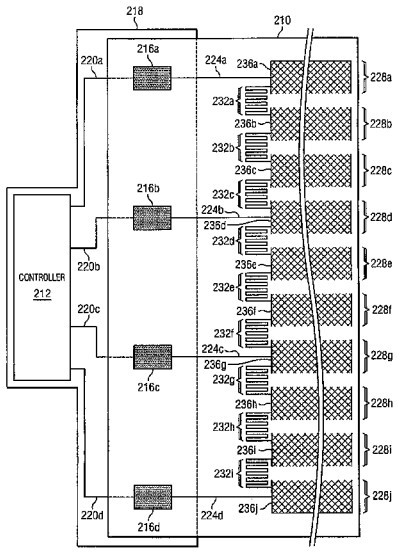
WO WO 2012/129247 9/2012

OTHER PUBLICATIONS

U.S. Appl. No. 61/454,936, filed Mar. 21, 2011, Myers.
U.S. Appl. No. 61/454,950, filed Mar. 21, 2011, Lynch.
U.S. Appl. No. 61/454,894, filed Mar. 21, 2011, Rothkopf.

Primary Examiner — Hal Kaplan
Assistant Examiner — Xuan Ly
(74) *Attorney, Agent, or Firm* — Baker Botts L.L.P.

(57) **ABSTRACT**

In one embodiment, an apparatus comprises a substrate. The apparatus further comprises a plurality of drive electrodes disposed on the substrate. Each of the plurality of drive electrodes is formed of an opaque conductive material. The apparatus further comprises a plurality of resistors. For each adjacent pair of drive electrodes of the plurality of drive electrodes, a resistor of the plurality of resistors is coupled between the pair of drive electrodes.

19 Claims, 4 Drawing Sheets