

CLAIMS:

1. A smartcard comprising:  
contact pads for electrical connection to an external power source for  
5 provision of power to the smartcard in a contact mode of the smartcard;  
a contactless power harvesting system for provision of power to the smartcard  
in a contactless mode of the smartcard; and  
a main circuit on-board the smartcard for receiving and managing the power  
provided from the contact pads or from the contactless power harvesting system;  
10 wherein the main circuit includes components requiring power in order to  
provide the smartcard with required functionality; and  
wherein the main circuit is connected to the contact pads via a current limiting  
circuit for controlling the levels of current drawn via the contact pads, the current  
limiting circuit comprising an integrator, wherein the current limiting circuit produces  
15 an output voltage that rises steadily and hence controls the inrush current with the  
current being limited so as to be within an allowed current defined by a maximum  
current for a terminal or reader that the card is intended to be connected to.
2. A smartcard as claimed in claim 1, wherein the integrator is implemented  
20 using an op amp, a MOSFET or a JFET.
3. A smartcard as claimed in claim 1 or 2, wherein the main circuit and the  
current limit circuit consist of components with a height of less than 0.84 mm in order  
to be housed within a smartcard body with thickness of less than 0.84 mm.  
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4. A smartcard as claimed in any preceding claim, wherein the current limiting  
circuit uses a field effect transistor with its source terminal connected to a high  
voltage terminal of the contact pad for connection to a high voltage terminal of the  
30 external power source, its gate arranged to be coupled via a feedback resistor to a  
low voltage terminal of the contact pad for connection to a low voltage terminal of the  
external power source, a feedback capacitor connected between the gate and the  
transistor's drain terminal, and the drain terminal providing voltage to the main circuit  
on-board the smartcard.  
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5. A smartcard as claimed in claim 4, wherein the feedback capacitor has a  
greater capacitance to dominate the internal capacitance of the transistor.

6. A smartcard as claimed in claim 4 or 5, comprising a capacitor connected across the source and gate terminals of the transistor to dominate the internal capacitance of the transistor in order to eliminate a spike in current at turn-on.

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7. A smartcard as claimed in claim 6, wherein the capacitance of the capacitor connected across the source and gate terminals of the transistor and the capacitance of the feedback capacitor are chosen to prevent the initial gate source voltage from rising above a turn on threshold voltage of the transistor.

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8. A smartcard as claimed in any preceding claim, wherein the main circuit on-board the smartcard includes a capacitance between main voltage rails of the main circuit in order to store energy during contactless power harvesting.

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9. A smartcard as claimed in any preceding claim, wherein the main circuit on-board the smartcard includes one or more of: a biometric sensor for obtaining biometric data from a user of the smartcard; a control system for controlling operation of other components on the smartcard; and/or a memory device for storing software and/or data.

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10. A smartcard as claimed in any preceding claim, including a biometric sensor on the smartcard for identification of an authorised user of the electronic card, wherein the smartcard is arranged to be fully operable only when the biometric sensor provides an indication of an authorised user.

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11. A smartcard as claimed in any preceding claim, wherein the smartcard is an access card, a credit card, a debit card, a pre-pay card, a loyalty card and/or an identity card.

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12. A smartcard as claimed in any preceding claim, wherein the smartcard is a financial card for interaction with an ATM machine.

13. A smartcard as claimed in any preceding claim, wherein the current limiting circuit is arranged to limit the current drawn via the contact pads to a maximum of 43 mA.

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14. A smartcard as claimed in any preceding claim, the smartcard having a width of between 85.47 mm and 85.72 mm, a height of between 53.92 mm and 54.03 mm and a thickness less than 0.84 mm.
- 5 15. A method for manufacturing a smartcard, the method comprising:  
providing contact pads for electrical connection to an external power source for provision of power to the smartcard in a contact mode of the smartcard;  
providing a contactless power harvesting system for provision of power to the smartcard in a contactless mode of the smartcard; and  
10 providing a main circuit on-board the smartcard for receiving and managing the power provided from the contact pads or from the contactless power harvesting system;  
wherein the main circuit includes components requiring power in order to provide the smartcard with required functionality; and  
15 wherein the main circuit is connected to the contact pads via a current limiting circuit for controlling the levels of current drawn via the contact pads, the current limiting circuit comprising an integrator, wherein the current limiting circuit produces an output voltage that rises steadily and hence controls the inrush current with the current being limited so as to be within an allowed current defined by a maximum  
20 current for a terminal or reader that the card is intended to be connected to.
16. A method as claimed in claim 15, comprising providing the smartcard with features as claimed in any of claims 2 to 14.
- 25 17. A method as claimed in claim 15 or 16, comprising selecting components for the current limiting circuit based on the external power source that the smartcard will be used with.