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[Continued on next page]

(54) Title: SOFT START CIRCUITS AND TECHNIQUES

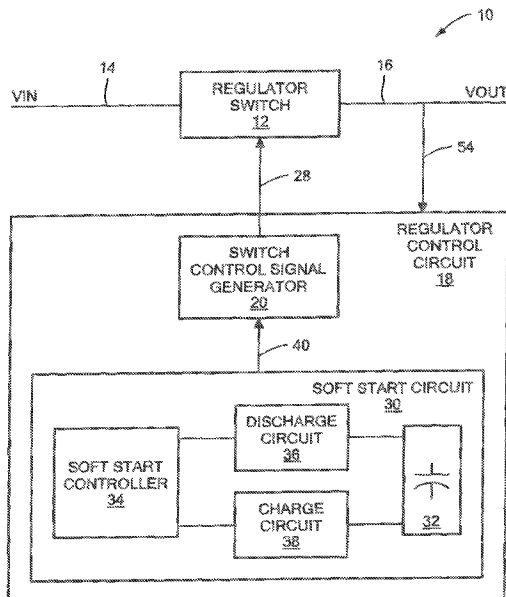


FIG. 1

(57) Abstract: A regulator control circuit includes a switch control signal generator to generate a switch control signal and a soft start circuit to generate a soft start signal for use by the switch control signal generator. The soft start circuit includes a soft start controller and a decreasing circuit to decrease the soft start signal in response to the soft start controller. The soft start controller may comprise a non-regulation detector to detect a non-regulation condition. Embodiments include decreasing the soft start signal in response to a non-regulation condition lasting a predetermined time, detecting the non-regulation condition in response to a maximum duty cycle of the regulator switch, generating a soft start level indicator to control decreasing the soft start signal, and maintaining the soft start signal at a predetermined relationship with respect to a feedback signal.

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TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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INTERNATIONAL SEARCH REPORT

International application No PCT/US2014/011577

A. CLASSIFICATION OF SUBJECT MATTER INV. G05F1/46 H02M3/00 H02M1/36 H02M3/156 ADD.				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) G05F H02M				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
Y	US 5 966 003 A (TAKIMOTO KYUICHI [JP] ET AL) 12 October 1999 (1999-10-12) abstract; figure 12 -----	1-17		
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X	US 2011/221415 A1 (OTSUKA MASAFUMI [JP] ET AL) 15 September 2011 (2011-09-15) abstract; figure 3 -----	18-33		
Y		8-17		
A	US 2005/110469 A1 (INABA KATSUMI [JP] ET AL) 26 May 2005 (2005-05-26) abstract; figures 1,5,6,8,9 -----	1-33		
	-/--			
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
* Special categories of cited documents : <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed </td> <td style="width: 50%; border: none; vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family </td> </tr> </table>			"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family			
Date of the actual completion of the international search	Date of mailing of the international search report			
23 October 2014	05/11/2014			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Arias Pérez, Jagoba			

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/011577

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/011577

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 8 145 934 B1 (FERRIS TIMOTHY A [US] ET AL) 27 March 2012 (2012-03-27) abstract; figure 2B -----	1-7
A	US 2004/245974 A1 (KITANI HIROSHI [JP] ET AL) 9 December 2004 (2004-12-09) paragraph [0028] - paragraph [0033]; figure 1 -----	1-33
A	US 2011/009171 A1 (WATANABE MASATOSHI [JP] ET AL) 13 January 2011 (2011-01-13) paragraph [0021] - paragraph [0024]; figure 1 -----	1-33
A	US 2005/024033 A1 (NAKATA KENICHI [JP]) 3 February 2005 (2005-02-03) abstract; figures 1,2 -----	1-33
A	US 2006/239045 A1 (CHEN YUNG-CHIH [TW] ET AL) 26 October 2006 (2006-10-26) abstract; figure 2 -----	1-33
A	US 6 229 289 B1 (PIOVACCARI ALESSANDRO [US] ET AL) 8 May 2001 (2001-05-08) column 9, line 46 - line 58 -----	1-33

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/US2014/011577

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-7

Circuit for generating a soft start signal, wherein the soft start signal is decreased in response to a non-regulation condition associated with an output of the regulator lasting for a predetermined period of time.

2. claims: 8-17

Switching regulator control circuit comprising a circuit configured having first input responsive to a soft start signal and a soft start circuit generating the soft start signal, the soft start circuit detecting a non-regulation condition in response to the duty cycle being a maximum duty cycle and decreasing the soft start signal in response to the detection of the non-regulation condition.

3. claims: 18-33

Regulator control circuit comprising an error amplifier having first input responsive to a soft start signal and an output indicative of the soft start signal having a predetermined relationship with respect to the feedback signal and a soft start circuit generating the soft start signal, wherein the soft start circuit decreasing the soft start signal until the soft start level indicator transitions.
