UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
TEXARKANA DIVISION

NEXGEN CONTROL SYSTEMS, LLC, ***Plaintiff,*** v. **NXP SEMICONDUCTORS N.V. AND NXP B.V.,** ***Defendants.***	**Civil Action No._____** **JURY TRIAL DEMANDED**

COMPLAINT FOR PATENT INFRINGEMENT

NexGen Control Systems, LLC ("NexGen" or "Plaintiff") bring this action and make the following allegations of patent infringement relating to U.S. Patent Nos. 8,278,855 (the "'855 patent"); 6,906,574 (the "'574 patent"); and 8,531,150 (the "'150 patent") (collectively, the "patents-in-suit"). Defendants NXP Semiconductors N.V. and NXP B.V. (collectively, "NXP" or "Defendant") infringe the patents-in-suit in violation of the patent laws of the United States of America, 35 U.S.C. § 1 *et seq*.

INTRODUCTION

1. NexGen's portfolio of over 950 patent assets encompasses core technologies in the fields of semiconductors and power management. NexGen's patents arose from the research and development efforts of Mitsubishi Electric Corporation.

2. In an effort to facilitate the licensing of Mitsubishi's foundational technology, NexGen is pursuing remedies for infringement of its patents in venues throughout the world. NexGen is pursuing infringement actions against several large automotive companies throughout the United States, Japan, the People's Republic of China, and Germany.

3. Highlighting the importance of the patents-in-suit is the fact that the NexGen's patent portfolio has been cited by over 2500 U.S. and international patents and patent applications assigned to a wide variety of the largest producers of automotive and semiconductor technologies. NexGen's patents have been cited by companies such as:

- DENSO Corporation[1]
- Robert Bosch GmbH[2]
- Toyota Motor Corporation[3]
- Hitachi, Ltd.[4]
- Hyundai Motor Company[5]
- Siemens AG[6]
- Continental Automotive GmbH[7]
- Toshiba Corporation[8]
- Nissan Motor Co., Ltd.[9]
- Panasonic Corporation[10]

CO-PENDING ENFORCEMENT PROCEEDINGS IN CHINA AND EUROPE

4. NexGen's portfolio of over 950 patent assets encompasses core technologies in the fields of automotive electrical power generation, transformation, and regulation, as well as lifesaving safety innovations. The patent portfolio held by NexGen is international in scope and includes numerous European, Chinese, and Japanese patent grants.

[1] *See, e.g.*, U.S. Patent Nos. 6,906,574; 8,045,345; 8,489,262; 8,083,015; 8,427,004; 8,077,491; and 8,278,855.
[2] *See, e.g.*, U.S. Patent Nos. 6,906,574 and 7,772,806.
[3] *See, e.g.*, U.S. Patent Nos. 8,489,262; 8,083,015; 8,427,004; 8,077,491; and 8,278,855.
[4] *See, e.g.*, U.S. Patent Nos. 8,531,150; 7,772,806; 8,045,345; 8,489,262; 8,547,713; 8,427,004; and 8,077,491.
[5] *See, e.g.*, U.S. Patent Nos. 8,531,150; 7,772,806; 8,045,345 and 8,083,015.
[6] *See, e.g.*, U.S. Patent Nos. 7,772,806 and 8,278,855.
[7] *See, e.g.*, U.S. Patent Nos. 7,772,806 and 8,083,015.
[8] *See, e.g.*, U.S. Patent Nos. 8,489,262; 8,427,004; 8,278,855; and 7,772,806.
[9] *See, e.g.*, U.S. Patent Nos. 8,489,262; 8,083,015; 8,427,004; and 8,278,855.
[10] *See, e.g.*, U.S. Patent Nos. 8,045,345; 8,547,713; and 8,278,855.

5. In an effort to facilitate the licensing of Mitsubishi Electric Corporation's foundational technology, NexGen is pursuing remedies for infringement of its patents in venues throughout the world.

6. On January 13, 2023, NexGen's complaint against NXP (China) Management Co., Ltd. and others for patent infringement was accepted by the Shanghai Intellectual Property Court of the People's Republic of China. The complaint alleges that NXP (China) Management Co., Ltd. and Arrow Electronics (Shanghai) Co., Ltd. have infringed Chinese Patent No. ZL200780100586.7. The case number for NexGen's infringement action is: （2023）沪73知民初72号. NexGen is seeking injunctive relief relating to the sale of the following products: NXP's MC56F83 and MC56F84 series digital signal controllers.

7. NexGen is also concurrently litigating patent infringement claims against Infineon Technology (Wuxi) Co., Ltd., in the Shanghai Intellectual Property Court of the People's Republic of China in Case No. (2021) Hu 73 Zhiminchu No. 1580.

THE PARTIES

NEXGEN CONTROL SYSTEMS, LLC

8. NexGen Control Systems, LLC ("NexGen") is a Delaware limited liability company with its principal place of business at 225 S. 6th Street, Suite 3900, Minneapolis, Minnesota 55402. NexGen is the owner by assignment of all right, title, and interest in each of the patents-in-suit.

NXP

9. Defendant NXP Semiconductors N.V. is a Dutch corporation with a principal place of business at High Tech Campus 60, 5656 AG Eindhoven, Netherlands.

10. Defendant NXP B.V. is a Dutch company with a principal place of business at High

Tech Campus 60, 5656 AG Eindhoven, Netherlands. NXP B.V. is a wholly owned subsidiary of NXP Semiconductors N.V.

11. NXP conducts business operations throughout the United States, and specifically the State of Texas, where it sells, develops, and/or markets the products accused of infringement herein.

JURISDICTION AND VENUE

12. This action arises under the patent laws of the United States, Title 35 of the United States Code. Accordingly, this Court has exclusive subject matter jurisdiction over this action under 28 U.S.C. §§ 1331 and 1338(a).

13. This Court has personal jurisdiction over NXP in this action because NXP has committed acts within the Eastern District of Texas giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over NXP would not offend traditional notions of fair play and substantial justice.

14. Defendant NXP, directly and/or through subsidiaries or intermediaries (including distributors, retailers, and others), has committed and continues to commit acts of infringement in this District by, among other things, offering to sell and selling products and/or services that infringe the patents-in-suit.

15. NXP Semiconductors N.V. is the ultimate parent of NXP B.V. and a network of subsidiary entities that conduct NXP's vertically integrated business as "a global semiconductor company and a long-standing supplier in the industry, with over 50 years of innovation and operating history." 2021 NXP U.S. Securities and Exchange Commission 10-K at 3. NXP Semiconductors N.V. operates this network of subsidiaries as one common enterprise. *See id.* at 2 ("[A]ll references herein to 'we,' 'our,' us,' 'NXP' and the 'Company' are to NXP Semiconductors N.V. and its consolidated subsidiaries."); *id.* at 8 ("We manage our manufacturing

assets together through one centralized organization to ensure we realize scale benefits in asset utilization, purchasing volumes and overhead leverage across businesses."). NXP, as a single enterprise of multiple operating subsidiaries acting in consort with one another and in consort with NXP Semiconductors N.V. and NXP B.V., has a common Board of Directors with responsibility "for the overall conduct of the NXP Group." Rules Governing the Board of Directors of NXP Semiconductors N.V. (Aug. 2022) at Article 1.1. Annually, the common Board of Directors of the NXP Group sets "the corporate strategy of the NXP Group." *Id.* at Article 1.3(b).

16. The NXP Group, led by NXP Semiconductors N.V. and NXP B.V. conduct extensive operations directly relevant to the design, development, manufacturing, marketing, and selling of the accused products in the United States and the State of Texas. NXP's United States Headquarters is located in Austin, Texas, and NXP also maintains a manufacturing facility in Austin, Texas.

17. NXP Semiconductors N.V. and NXP B.V. manage and direct the conduct of its subsidiaries, including NXP USA, Inc., to design, develop, manufacture, market, and sell the accused products in the United States and the State of Texas. NXP Semiconductors N.V. and NXP B.V., as ultimate parent companies of a network of vertically integrated operating subsidiary companies with a common executive team, orchestrate through their subsidiaries the accused products' placement in the stream of commerce that end in the extensive sales of products in the United States that infringe NexGen's patents, including the patents-in-suit.

18. Among the various global subsidiaries acting in consort at the direction and control of NXP Semiconductors N.V. and the common executive leadership among the NXP Group is NXP USA, Inc., which is a Delaware corporation with a principal place of business at 6501 W. William Cannon Drive, Austin, Texas 78735. NXP USA, Inc. is a wholly owned subsidiary of

Freescale Semiconductor Holdings V, Inc., which in turn is a wholly owned subsidiary of NXP B.V.

19. NXP has committed acts of infringement in this District by commercializing, marketing, selling, distributing, testing, and servicing certain Accused Products. Venue is proper in in this District pursuant to 28 U.S.C. § 1391(c)(3) because the NXP Defendants are foreign corporations that are not residents of the United States and are subject to personal jurisdiction in this District. The NXP Defendants are subject to venue in any judicial district including this District. *See In re HTC Corp.*, 889 F.3d 1349, 1354 (Fed. Cir. 2018).

20. This Court has personal jurisdiction over NXP. NXP has conducted and does conduct business within the State of Texas. NXP, directly or through subsidiaries or intermediaries (including distributors, retailers, and others), ships, distributes, makes, uses, offers for sale, sells, imports, and/or advertises (including by providing an interactive web page) its products and/or services in the United States and the Eastern District of Texas and/or contributes to and actively induces its customers to ship, distribute, make, use, offer for sale, sell, import, and/or advertise (including the provision of an interactive web page) infringing products and/or services in the United States and the Eastern District of Texas. NXP, directly and/or through subsidiaries or intermediaries (including distributors, retailers, and others), has purposefully and voluntarily placed one or more of its infringing products and/or services, as described below, into the stream of commerce with the expectation that those products will be purchased and used by customers and/or consumers in the Eastern District of Texas. These infringing products and/or services have been and continue to be made, used, sold, offered for sale, purchased, and/or imported by customers and/or consumers in the Eastern District of Texas. NXP has committed acts of patent infringement within the Eastern District of Texas. NXP interacts with customers in Texas,

including through visits to customer sites in Texas. Through these interactions and visits, NXP directly infringes the patents-in-suit. NXP also interacts with customers who sell the Accused Products into Texas, knowing that these customers will sell the Accused Products into Texas, either directly or through intermediaries.

21. On information and belief, Defendant NXP B.V. owns and operates the www.nxp.com website, which is a highly interactive website where customers in the United States and within the State of Texas can and have ordered one or more of the accused products, which were shipped by one or more subsidiaries within the NXP Group to customers in the United States and the State of Texas.

22. NXP has minimum contacts with this District such that the maintenance of this action within this District would not offend traditional notions of fair play and substantial justice. Thus, the Court therefore has both general and specific personal jurisdiction over NXP.

THE ASSERTED PATENTS

U.S. PATENT NO. 8,278,855

23. U.S. Patent No. 8,278,855 (the "'855 patent") entitled, *Controller of Motor Preventing an Increase in Inverter Loss*, was filed on October 29, 2007. NexGen is the owner by assignment of the '855 patent. A true and correct copy of the '855 patent is attached hereto as Exhibit 1.

24. The '855 patent discloses novel controllers of electric motors.

25. The inventions disclosed in the '855 patent improve the efficiency of electric motor configurations by ensuring the inverter does not increase inverter loss beyond the capacity of the motor.

26. The '855 patent discloses a motor controller with a voltage-command generating unit that generates a pulse-width modulation signal to control a switching element provided in an

inverter, to the inverter connected to a direct-current power source and outputting a three-phase alternating current of an arbitrary frequency and an arbitrary voltage to an alternating-current motor.

27. The ‘855 patent discloses a motor controller with a current-command generating unit that generates and outputs a current command to cause the alternating-current motor to generate torque based on an input torque command.

28. The ‘855 patent discloses a motor controller wherein the current-command generating unit is configured to output the current-command that is calculated based on a relationship between the torque command and a state quantity of the alternating-current motor, to maintain a terminal voltage of the alternating-current motor to a maximum value that can be generated under the direct-current power source, and to output a current command adjusted to maintain or decrease a loss of the inverter under a predetermined condition in which the loss of the inverter increases or estimated to increase.

29. The ‘855 patent has been cited by 42 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the ‘855 patent as relevant prior art:

- Toshiba Corporation
- Toyota Motor Corporation
- DENSO Corporation
- Nissan Motor Co., Ltd.
- Panasonic Corporation
- Dongfang Electric Corporation
- Siemens AG
- Ford Global Technologies, LLC
- Rockwell Automation Technologies, Inc.
- Hamilton Sundstrand Corporation
- Control Tech Ltd.
- SK Hynix Inc.
- Renault SA
- Renesas Electronics Corporation

- LG Electronics Inc.
- Sinfonia Technology Co., Ltd.

U.S. PATENT NO. 6,906,574

30. U.S. Patent No. 6,906,574 (the "'574 patent") entitled, *Drive Circuit For Driving Power Semiconductor Device*, was filed on July 28, 2003, and claims priority to July 30, 2002. NexGen is the owner by assignment of the '574 patent. A true and correct copy of the '574 patent is attached hereto as Exhibit 2.

31. The '574 patent discloses novel circuits for driving power semiconductor devices.

32. The inventions disclosed in the '574 patent improve the reliability of power semiconductor devices by detecting and protecting components against short circuits.

33. The '574 patent discloses a drive circuit comprising a control means for controlling switching of a power semiconductor advice according to a turn-on instruction or turn-off instruction sent to the power semiconductor device from outside the drive circuit.

34. The '574 patent discloses a drive circuit comprising abnormality detection means for detecting a value of a voltage that appears at a control terminal of the power semiconductor device, and for detecting occurrence of an abnormality in the power semiconductor device when the value detected reaches an on-state value within a time period after receiving a turn-on instruction, the time period being shorter than a normal time period that elapses when the value detected reaches the on-state value after receiving a turn-on instruction in absence of an abnormality in the power semiconductor device.

35. The '574 patent discloses a drive circuit comprising abnormality detection means for detecting a value of a current that flows into the control terminal of the power semiconductor device, and for detecting occurrence of an abnormality in the power semiconductor device when the value detected reaches an on-state value within a time period after receiving a turn-on

instruction, the time period being shorter than a normal time period that elapses when the value detected reaches the on-state value after receiving a turn-on instruction in absence of an abnormality in the power semiconductor device.

36. By monitoring for abnormal voltage and/or current signals, the technologies disclosed in the '574 patent instruct gates within the power semiconductor devices to become turned off such that the devices are not destroyed through the receipt of large currents.

37. The '574 patent discloses sending an amplified gate instruction in response to the detection of an abnormal voltage or current to prevent the power semiconductor device from being destroyed due to large current flows that result from short circuits.

38. The '574 patent has been cited by 66 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the '574 patent as relevant prior art:

- DENSO Corporation
- Infineon Technologies Austria AG
- Robert Bosch GmbH
- Rohm Co., Ltd.
- Kia Motors Corporation
- Samsung Electronics Co., Ltd.
- Dialog Semiconductor GmbH
- American Power Conversion Corporation

U.S. PATENT NO. 8,531,150

39. U.S. Patent No. 8,531,150 (the "'150 patent") entitled, *DCDC Converter*, was filed on September 19, 2008. NexGen is the owner by assignment of the '150 patent. A true and correct copy of the '150 patent is attached hereto as Exhibit 3.

40. The '150 patent discloses improved DC-DC converters that permit DC-DC conversion even when input capacitors are subjected to overvoltage.

41. The ‘150 patent teaches the suppression of electric oscillation occurring in an LC filter circuit.

42. The ‘150 patent discloses a DC-DC converter that has an input filter circuit that includes an input reactor connected to a DC power supply.

43. The ‘150 patent discloses a DC-DC converter that has an input capacitor and converts a DC voltage of the input capacitor into an arbitrary DC voltage to output the DC voltage.

44. The ‘150 patent discloses a DC-DC converter that includes a switching circuit with an input end connected to the input filter circuit.

45. The ‘150 patent discloses a DC-DC converter with a switching circuit that includes an upper arm side switching element and a lower arm side switching element.

46. The ‘150 patent discloses a DC-DC converter that further includes a smoothing filter circuit connected to an output end of the switching circuit.

47. The ‘150 patent discloses a DC-DC converter that includes a control unit that feeds back a state amount of the smoothing filter circuit and controls to turn on and off the switching circuit.

48. The ‘150 patent discloses a DC-DC converter that that includes a control unit that further includes a damping control unit that calculates, based on the voltage of the input capacitor, a damping operation amount for adjusting the state amount of the smoothing filter circuit by dividing the voltage of the input capacitor by a DC component of the voltage of the input capacitor to calculate a fluctuation rate of the voltage of the input capacitor, where the damping operation amount corresponds to the fluctuation rate.

49. The '150 patent has been cited by several patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the '150 patent as relevant prior art:

- Fuji Electric Co., Ltd.
- General Electric
- Toyota Industries Corporation
- Hitachi, Ltd.
- Texas Instruments Inc.
- Hyundai Motor Company

COUNT I
INFRINGEMENT OF U.S. PATENT NO. 8,278,855

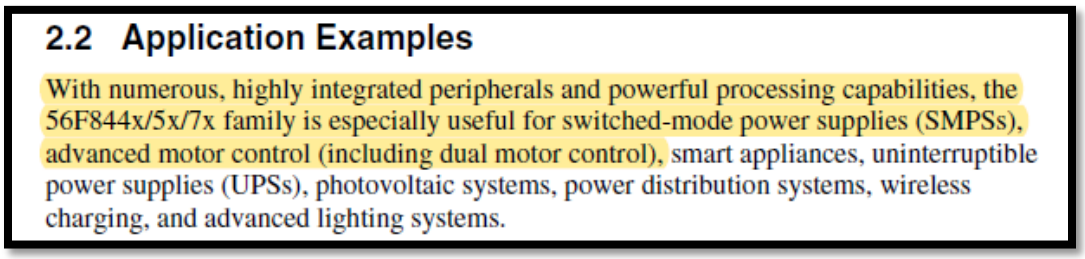
50. Plaintiff references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

51. NXP designs, makes, uses, sells, and/or offers for sale the following products: MC56F83xxx Series Controllers (including: MC56F83789, MC56F83769, MC56F83786, MC56F83766, MC56F83783, MC56F83763, MC56F83689, MC56F83686, MC56F83683, and MC56F83663) and MC56F84xxx Series Controllers (including: MC56F84441, MC56F84442, MC56F84451, MC56F84452, MC56F84462, MC56F84540, MC56F84543, MC56F84550, MC56F84553, MC56F84565, MC56F84567, MC56F84587, MC56F84763, MC56F84766, MC56F84769, MC56F84786, and MC56F84789) (collectively, the "NXP '855 Products(s)").

52. One or more NXP subsidiaries and/or affiliates use the NXP '855 Products in regular business operations.

53. The NXP '855 Products include technology for controlling the switching element in an inverter.

54. The NXP '855 Products comprise a motor controller for sensing and control of AC motors as shown in the below excerpt from NXP documentation.

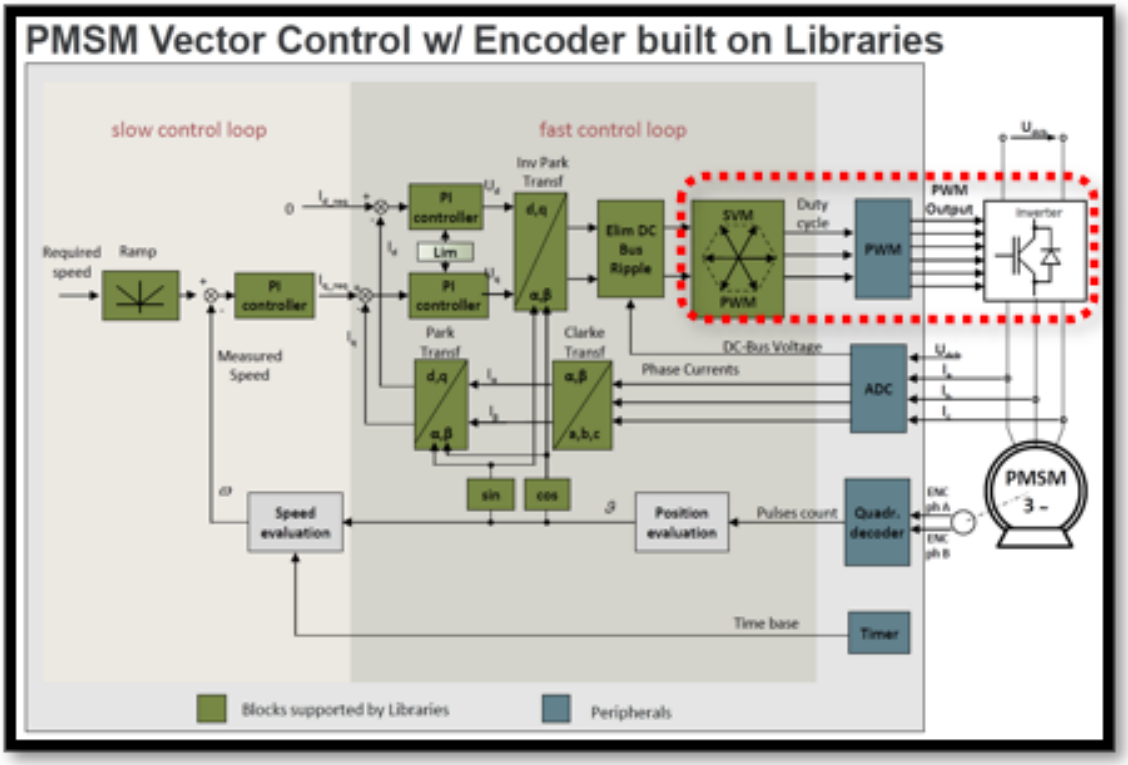


2.2 Application Examples

With numerous, highly integrated peripherals and powerful processing capabilities, the 56F844x/5x/7x family is especially useful for switched-mode power supplies (SMPSs), advanced motor control (including dual motor control), smart appliances, uninterruptible power supplies (UPSs), photovoltaic systems, power distribution systems, wireless charging, and advanced lighting systems.

NXP MC56F8458X REFERENCE MANUAL, REV. 2 at 52 (March 2014) (emphasis added).

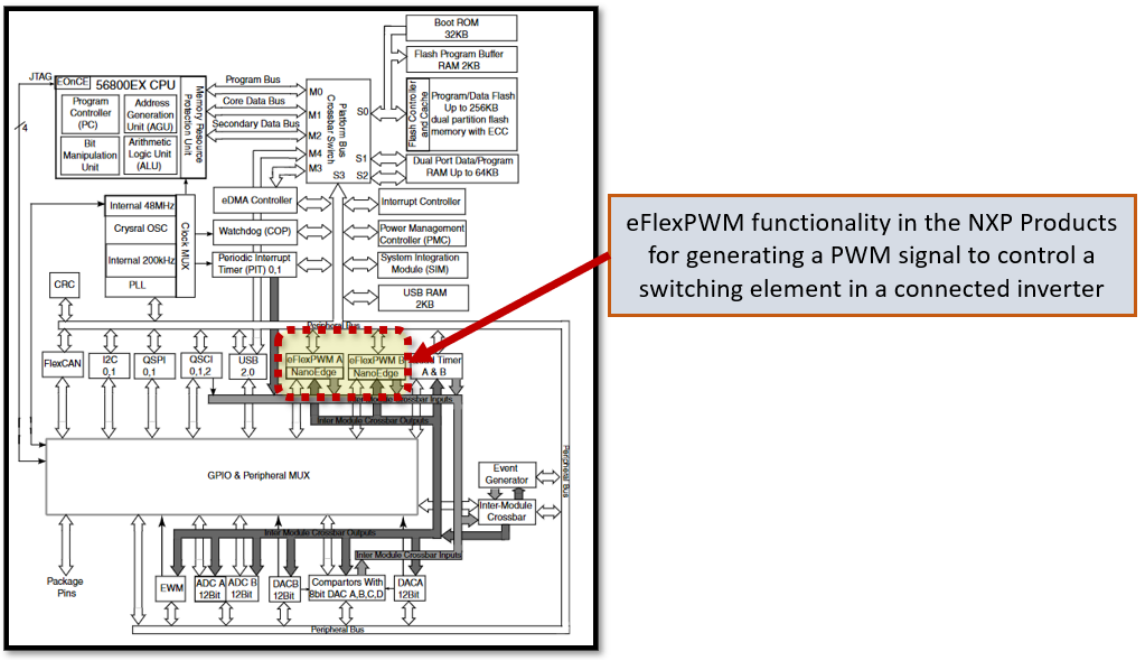
55. The NXP '855 Products are controllers of motors that includes a voltage-command generating unit that generates a pulse-width modulation signal to control a switching element provided in an inverter, to the inverter connected to a direct-current power source and outputting a three-phase alternating current of an arbitrary frequency and an arbitrary voltage to an alternating-current motor. The following excerpt from NXP documentation shows how the NXP Products comprise a motor controller that outputs a signal to an inverter that powers an AC motor. The highlighted section below shows the voltage command that is sent to the inverter for controlling an AC Motor.



Petr Staszko, *Efficient and Easy Motor Control with New Kinetis KVxx and DSC Families,* NXP-FREESCALE PRESENTATION EUF-IND-T0584 at 34 (June 2014) (annotation added).

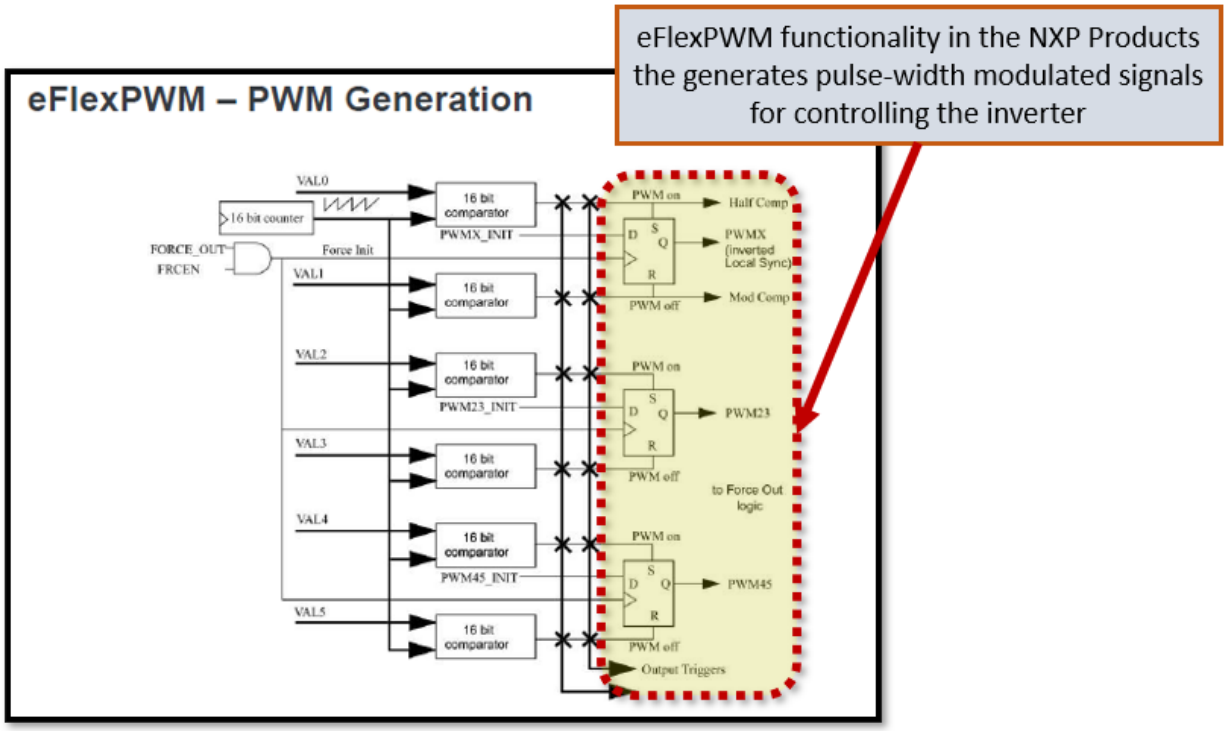
56. The NXP '855 Products are a controller of a motor that includes a current-command generating unit that generates and outputs a current command to cause the alternating-current motor to generate torque based on an input torque command.

57. The NXP '855 Products comprise a voltage-command generating unit that generates a pulse-width modulation (PWM) signal to control a switching element provided in an inverter. Specifically, the NXP '855 Products include Enhanced Flex Pulse Modulator functionality (eFlexPWM) which generates a PWM signal to control a switching element provided in an inverter.



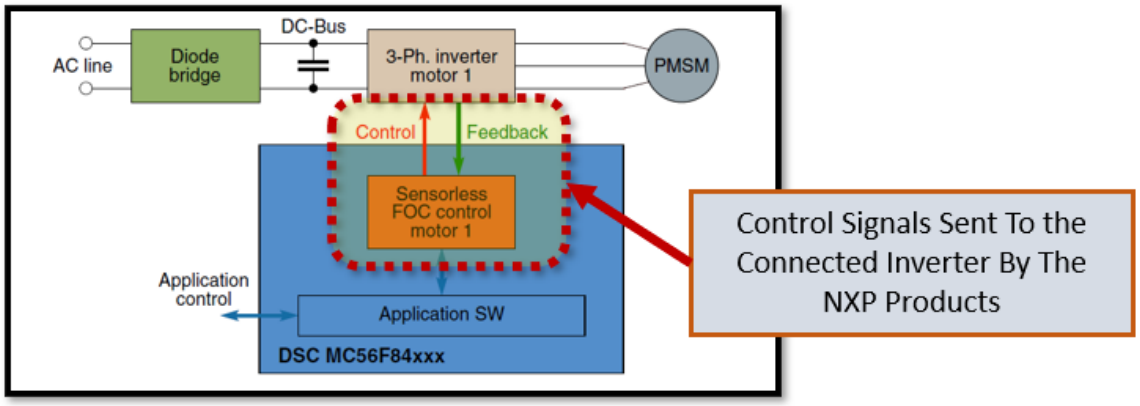
NXP MC56F837XXDS REVISION 2.2 DATA SHEET at 14 (January 2021) (annotation added).

58. The following diagram shows how the eFlexPWM generates a PWM signal that controls a switching element in a connected inverter. Here the eFlexPWM unit is generating a PWMX, PWM23 and PWM45 signal that is transmitted to the connected inverter.



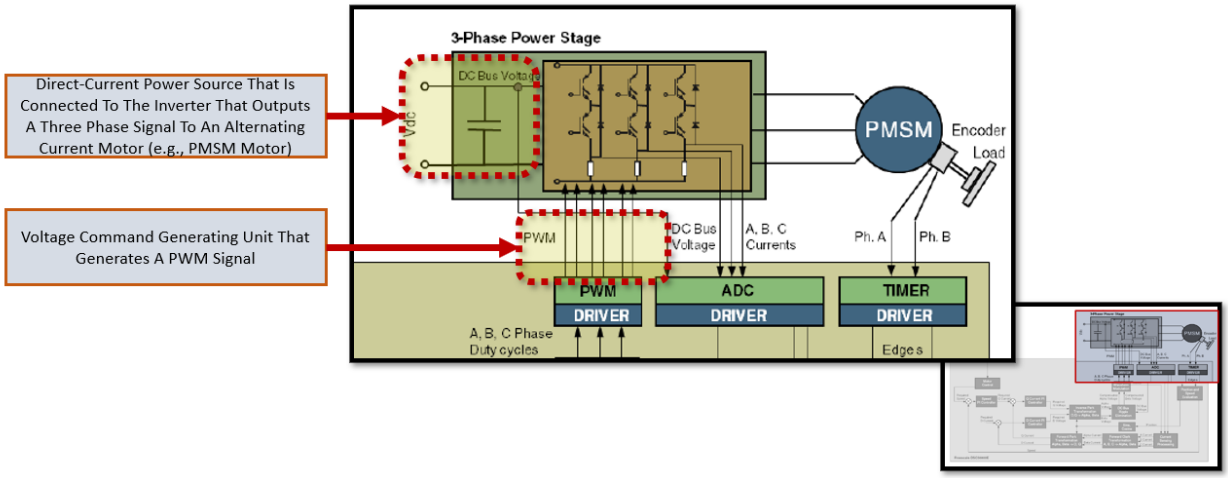
Petr Staszko, *Efficient and Easy Motor Control with New Kinetis KVxx and DSC Families,* NXP-FREESCALE PRESENTATION EUF-IND-T0584 at 22 (June 2014) (annotation added).

59. The NXP '855 Products through the eFlexPWM functionality send signals to the connected inverter. These signals control the inverter and through the inverter control the PMSM motor.



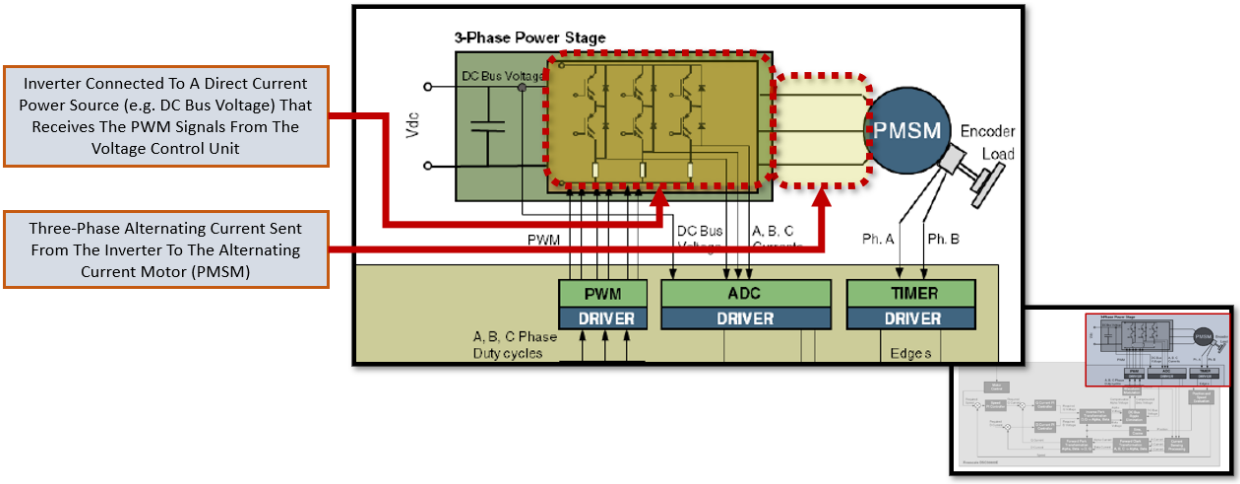
DSC MC56F84xxx In The Motor Control Application, NXP-FREESCALE DOCUMENT AN4625 at 5 (October 2012) (annotation added).

60. The below excerpt from NXP documentation shows the voltage command generating unit in the NXP '855 Products that sends a PWM signal to the inverter that is connected to a direct current power source (e.g., DC Bus Voltage).



Dual Sensorless PMSM Field-Oriented Control With Power Factor Correction on MC56F84789 DSC, NXP DESIGN REFERENCE MANUAL REV. 0.0 at 24 (May 2013) (annotation added).

61. The NXP '855 Products further comprise functionality wherein pulse-width modulation signal sent by the NXP '855 Products controls an inverter that is connected to DC power source and the inverter outputs a three-phase alternating current of an arbitration frequency and voltage to an AC motor.



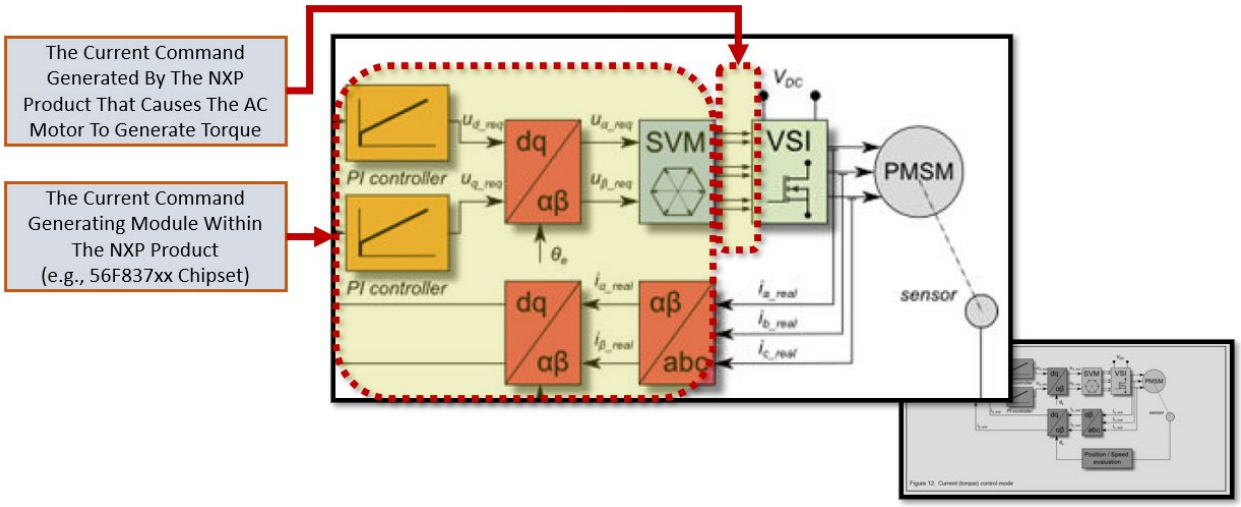
Dual Sensorless PMSM Field-Oriented Control With Power Factor Correction on MC56F84789 DSC, NXP DESIGN REFERENCE MANUAL REV. 0.0 at 24 (May 2013) (annotation added).

62. The NXP '855 Products contain a current-command generating unit that generates and outputs a signal (current command) that causes an AC motor to generate torque based on an input torque command. Specifically, in Current (torque) control mode the current command generating unit generates a current command "isq_req" which generates torque.

> The Current FOC or torque control requires the rotor position feedback, as well as the currents transformed into the d-q reference frame. There are two reference variables (Id_req and Iq_req) available for motor control, as shown in Figure 12. The d-axis current component isd_req is responsible for the rotor flux control, while the q-axis current component of the current isq_req generates torque and the motor runs by its application. By changing the polarity of the isq_req current, the motor changes the rotation direction. Supposing that the BEMF observer is tuned correctly, the current PI controllers can be tuned using the Current FOC control structure.

Sensorless PMSM Field-Oriented Control on DSC 56F837xx, Rev. 0, NXP APPLICATION NOTE NO. 12745 at 18 (March 2020) (emphasis added).

63. The below excerpt from NXP documentation shows the current command generating unit and its outputting of a current command to the AC motor to generate torque based on an input torque command.



Sensorless PMSM Field-Oriented Control on DSC 56F837xx, Rev. 0, NXP APPLICATION NOTE NO. 12745 at 19 (March 2020) (annotation added).

64. NXP documentation states that the NXP '855 Products control an alternating current motor such as a permanent-magnet synchronous motor (PMSM) using two "current-control" loops that include a "quadrature-axis current" that "corresponds to the motor torque.

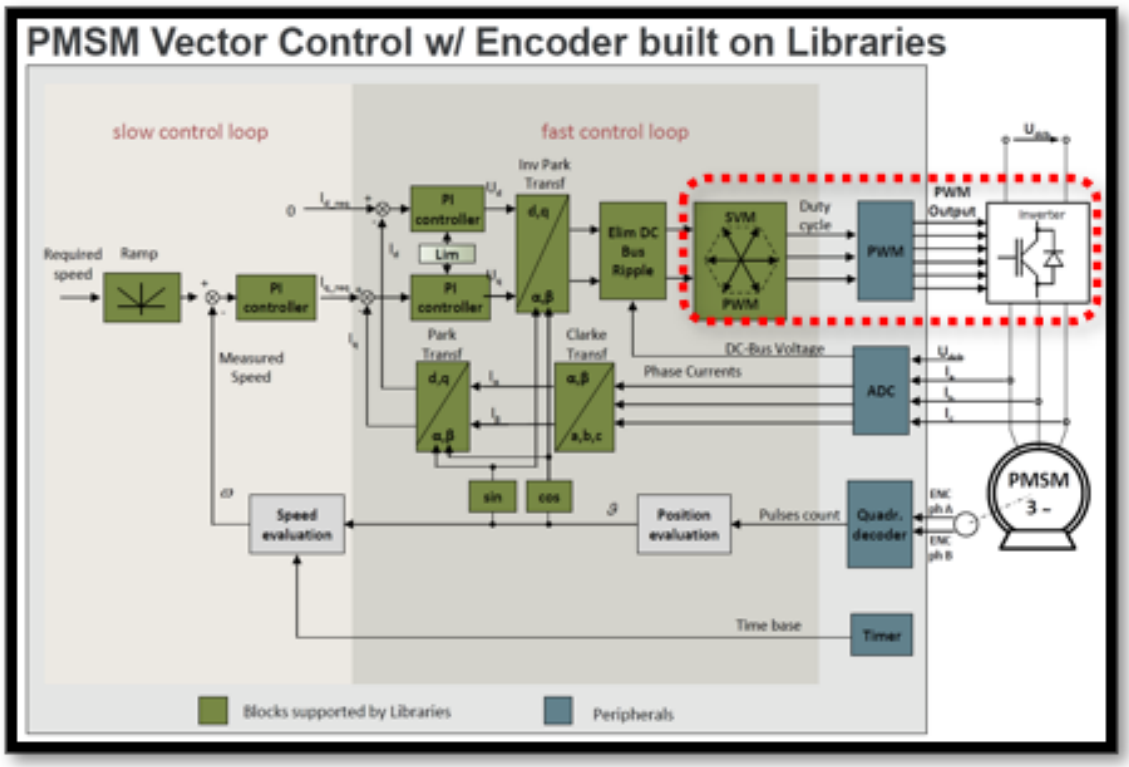
> To achieve the goal of the PMSM control, the algorithm uses feedback signals. The essential feedback signals are the 3-phase stator current and DC-bus voltage. The regulator output is used for the stator voltage. To operate properly, the presented control structure requires either the position and speed sensors on the motor shaft or an advanced algorithm to estimate the position and speed.
>
> The fast control loop executes these two independent current-control loops:
>
> - The direct-axis current (i_{sd}) PI controllers—the direct-axis current (i_{sd}) is used to control the rotor magnetizing flux.
> - The quadrature-axis current (i_{sq}) PI controllers—the quadrature-axis current corresponds to the motor torque.

Sensorless PMSM Field-Oriented Control, Design Reference Manual, Rev. 1, NXP DRM NO. 148 AT 7 (February 2016) (emphasis added).

65. The NXP '855 Products are a controller of a motor that includes a current-command generating unit that is configured to output the current-command that is calculated based on a relationship between the torque command and a state quantity of the alternating-current motor, to maintain a terminal voltage of the alternating-current motor to a maximum value that can be

generated under the direct-current power source, and to output a current command adjusted to maintain or decrease a loss of the inverter under a predetermined condition in which the loss of the inverter increases or estimated to increase.

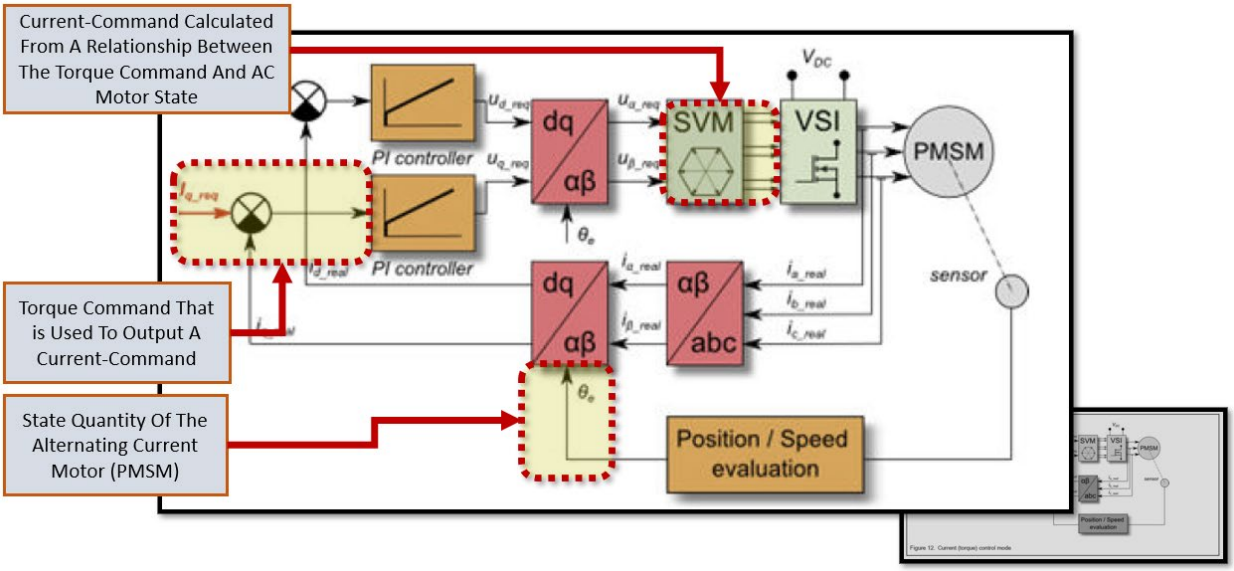
66. The following excerpt from NXP documentation shows how the NXP '855 Products comprise a motor controller that outputs a signal to an inverter that powers an AC motor. The highlighted section below shows the voltage command that is sent to the inverter for controlling an AC Motor.



Petr Staszko, *Efficient and Easy Motor Control with New Kinetis KVxx and DSC Families,* NXP-FREESCALE PRESENTATION EUF-IND-T0584 at 34 (June 2014) (annotation added).

67. The NXP '855 Products comprise a current-command generating unit that is configured to output a current-command that is calculated based on a relationship between the torque command and the state quality of the alternating motor. The below excerpt from NXP

documentation shows that current-command that is generated using the toque command and state quantity of the alternating current motor.



Sensorless PMSM Field-Oriented Control on DSC 56F837xx, Rev. 0, NXP APPLICATION NOTE NO. 12745 at 19 (March 2020) (annotation added).

68. The current command is generated by the NXP '855 Products to maintain a terminal voltage of the alternating current motor (PMSM) where the terminal voltage is a maximum value that can be generated by the direct current power source that is driving the inverter (DC voltage). Specifically, during the tuning process (stator inductance) the maximum terminal voltage that can be maintained by the motor is calculated. The following excerpt from NXP documentation describes that the "tuning process begins with a 0-V amplitude and the *F start* frequency, which are applied to the motor. The amplitude is gradually increased by *Ud inc* up to a half of the DC bus voltage (DCbus/2) until *Id ampl* is reached." DCBus/2 is the maximum terminal voltage. The sinusoidal measurement signal (amplitude and frequency obtained during the tuning process is then applied to the motor.

For the stator inductance *LS* identification purposes, a sinusoidal measurement voltage is applied to the motor. During the *LS* measurement, the voltage control is enabled. The frequency and amplitude of the sinusoidal voltage are obtained before the actual measurement, during the tuning process. The tuning process begins with a 0-V amplitude and the *F start* frequency, which are applied to the motor. The amplitude is gradually increased by *Ud inc* up to a half of the DC bus voltage (DCbus/2) until *Id ampl* is reached. If *Id ampl* is not reached even with DCbus/2 and *F start*, the frequency of the measuring signal is gradually decreased by *F dec* down to *F min* again until *Id ampl* is reached. If *Id ampl* is still not reached, the measurement continues with DCbus/2 and *F min*. The tuning process is shown in Figure 6.

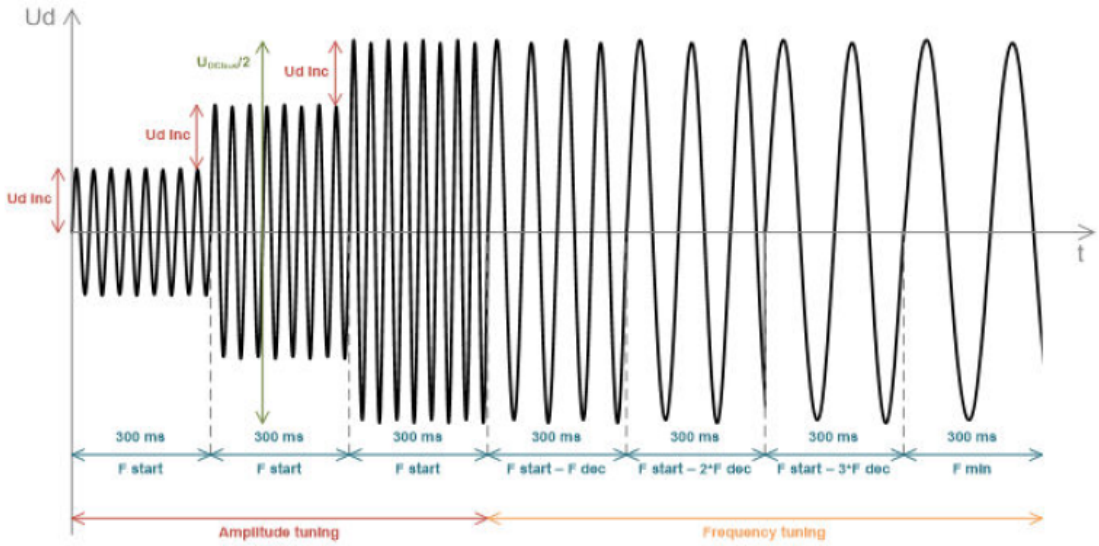


Figure 6. Tuning Ls measuring signal

When the tuning process is complete, the sinusoidal measurement signal (with the amplitude and frequency obtained during the tuning process) is applied to the motor. The total impedance of the RL circuit is then calculated from the voltage and current amplitudes and Ls is calculated from the total impedance of the RL circuit.

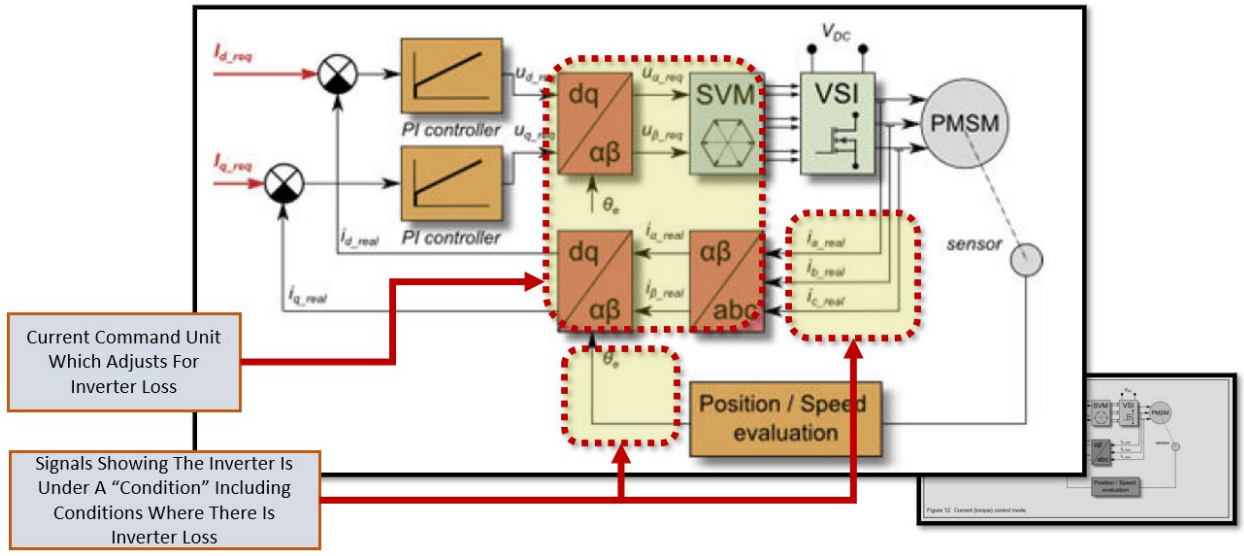
Sensorless PMSM Field-Oriented Control on DSC 56F837xx, Rev. 0, NXP APPLICATION NOTE NO. 12745 at 13 (March 2020) (annotation added).

69. The current command that is generated by the NXP '855 Products is adjusted to maintain or decrease a loss of the inverter under a condition in which the loss of the inverter is estimated to increase. Specifically, during the power stage characterization of the NXP '855 Products the inverter error (loss) is measured and that error is used to adjust the current command. The following excerpt from NXP documentation describes the measurement of *U*error which represents inverter loss.

Each inverter introduces a total error voltage *U*error which is caused by the dead-time, current clamping effect, and transistor voltage drop. The total error voltage *U*error depends on the phase current *i*s and this dependency is measured during the power stage characterization process. An example of the inverter error characteristic is in Figure 5. The power stage characterization is a part of the MCAT and can be controlled from the *Motor Identif* tab. To perform the characterization, connect a motor with a known stator resistance *R*s and set this value in the *Calib Rs* field. Then specify the *Calibration Range*, which is the range of the stator current *i*s, in which the measurement of the *U*error is performed. Afterwards, start the characterization by clicking the *Calibrate* button. The characterization gradually performs 65 *i*sd current steps, from *i*s = -*I*s,calib to *i*s = *I*s,calib, each taking 300 ms. Be aware that the whole process takes about 20 seconds and that the motor must withstand this load. The acquired characterization data is saved to a file and used later for the phase voltage correction during the *R*s measurement process. The following *R*s measurement can be done with the maximum current *I*s,calib. It is recommended to use a motor with a low *R*s for characterization purposes.

Sensorless PMSM Field-Oriented Control on DSC 56F837xx, Rev. 0, NXP APPLICATION NOTE NO. 12745 at 19 (March 2020) (annotation added).

70. The following diagram from NXP documentation shows the estimated inverter loss is measured through signals sent from the inverter and PMSM sensor.



Sensorless PMSM Field-Oriented Control on DSC 56F837xx, Rev. 0, NXP APPLICATION NOTE NO. 12745 at 19 (March 2020) (annotation added).

71. The NXP '855 Products are available to businesses and individuals throughout the United States.

72. The NXP '855 Products are provided to businesses and individuals located in the Western District of Texas.

73. By making, using, testing, offering for sale, and/or selling drive circuits for driving power semiconductor devices, including but not limited to the NXP '855 Products, NXP has injured Plaintiff and is liable to Plaintiff for directly infringing one or more claims of the '855 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

74. NXP also indirectly infringes the '855 patent.

75. NXP has had knowledge of the '855 patent since at least service of this Complaint or shortly thereafter, and NXP knew of the '855 patent and knew of its infringement, including by way of this lawsuit.

76. NXP indirectly infringes the '855 patent by actively inducing infringement under 35 U.S.C. § 271(b).

77. NXP intended to induce patent infringement by third-party customers and users of the NXP '855 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. NXP specifically intended and was aware that the normal and customary use of the accused products would infringe the '855 patent. NXP performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '855 patent and with the knowledge that the induced acts would constitute infringement. For example, NXP provides the NXP '855 Products that have the capability of operating in a manner that infringe one or more of the claims of the '855 patent, including at least claim 1, and NXP further provides documentation and training materials that cause customers and end users of the NXP '855 Products to utilize the products in a manner that directly infringe one or more claims of the '855 patent.[11] By providing instruction and training to

[11] *See e.g.*, NXP MC56F8458x REFERENCE MANUAL, REV. 2 (March 2014); NXP MC56F837XXDS REVISION 2.2 DATA SHEET (January 2021); Petr Staszko, *Efficient and Easy Motor Control with New Kinetis KVxx and DSC Families,* NXP-FREESCALE PRESENTATION EUF-

customers and end-users on how to use the NXP '855 Products in a manner that directly infringes one or more claims of the '855 patent, including at least claim 1, NXP specifically intended to induce infringement of the '855 patent. NXP engaged in such inducement to promote the sales of the NXP '855 Products, e.g., through NXP user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '855 patent. Accordingly, NXP has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '855 patent, knowing that such use constitutes infringement of the '855 patent.

78. NXP indirectly infringes the '855 patent by contributing to the infringement by its customers and end users under 35 U.S.C. § 271(c) by making, using, importing, selling, or offering to sell within the United States the NXP '855 Products, which incorporate or constitute a material part of the inventions claimed by the '855 patent. NXP does so knowing that these products are especially made or especially adapted for uses that infringe the '855 patent, and not staple articles or commodities of commerce suitable for substantial non-infringing use.

79. The '855 patent is well-known within the industry as demonstrated by multiple citations to the '855 patent in published patents and patent applications assigned to technology companies and academic institutions. NXP is utilizing the technology claimed in the '855 patent without paying a reasonable royalty. NXP is infringing the '855 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

IND-T0584 (June 2014); *DSC MC56F84xxx In The Motor Control Application*, NXP-FREESCALE DOCUMENT AN4625 (October 2012); *Dual Sensorless PMSM Field-Oriented Control With Power Factor Correction on MC56F84789 DSC*, NXP DESIGN REFERENCE MANUAL REV. 0.0 (May 2013); and *Sensorless PMSM Field-Oriented Control on DSC 56F837xx, Rev. 0,* NXP APPLICATION NOTE NO. 12745 (March 2020).

80. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '855 patent.

81. As a result of NXP's infringement of the '855 patent, Plaintiff has suffered monetary damages, and seeks recovery in an amount adequate to compensate for NXP's infringement, but in no event less than a reasonable royalty for the use made of the invention by NXP together with interest and costs as fixed by the Court.

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 6,906,574

82. Plaintiff references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

83. NXP designs, makes, uses, sells, and/or offers for sale in the United States drive circuits for driving power semiconductor devices.

84. NXP designs, makes, sells, offers to sell, imports, and/or uses the following products: NXP Gate Drivers including the: GD3162 Series Gate Drivers, GD3160 Series Gate Drivers, and GD3100 Series Gate Drivers (collectively, the "'NXP '574 Products").

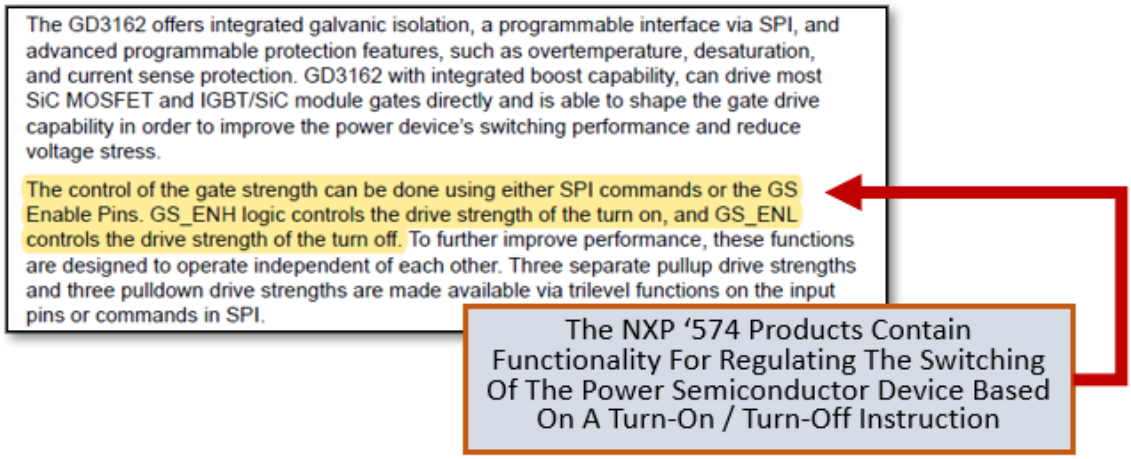
85. One or more NXP subsidiaries and/or affiliates use the NXP '574 Products in regular business operations.

86. One or more of the NXP '574 Products include technology for monitoring for abnormal voltage and current signals.

87. The NXP '574 Products instruct gates within power semiconductor devices to become turned off such that the devices are not destroyed through the receipt of large currents.

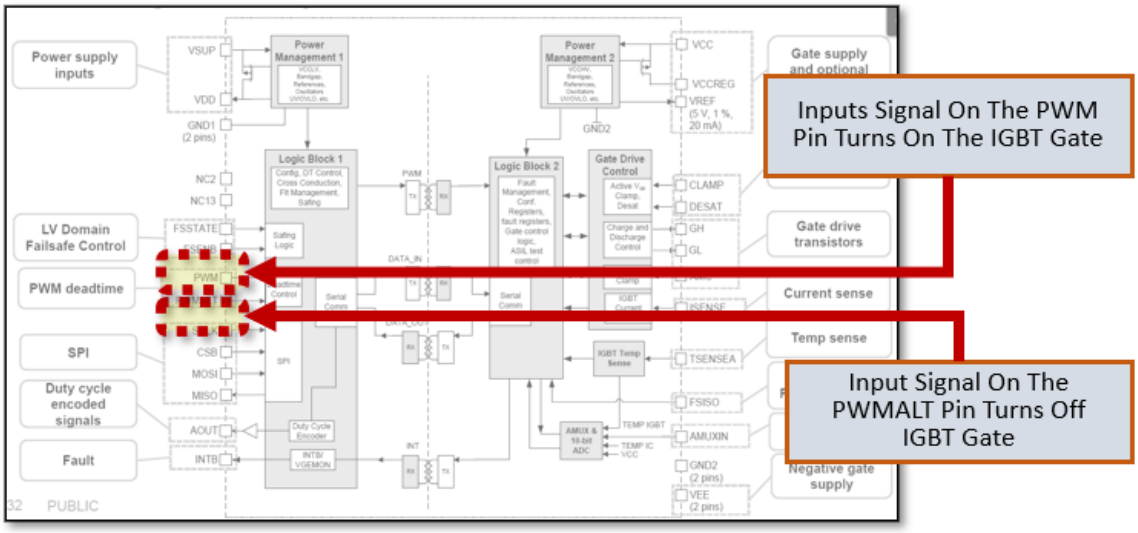
88. The NXP '574 Products comprise means for regulating the switching of a power semiconductor device in response to external turn-on or turn-off instructions sent to the device via the drive circuit. Specifically, the NXP '574 Products contain a control structure used to regulate

the switching of the power semiconductor device in response to external turn-on or turn-off instructions transmitted to the device from the drive circuit.



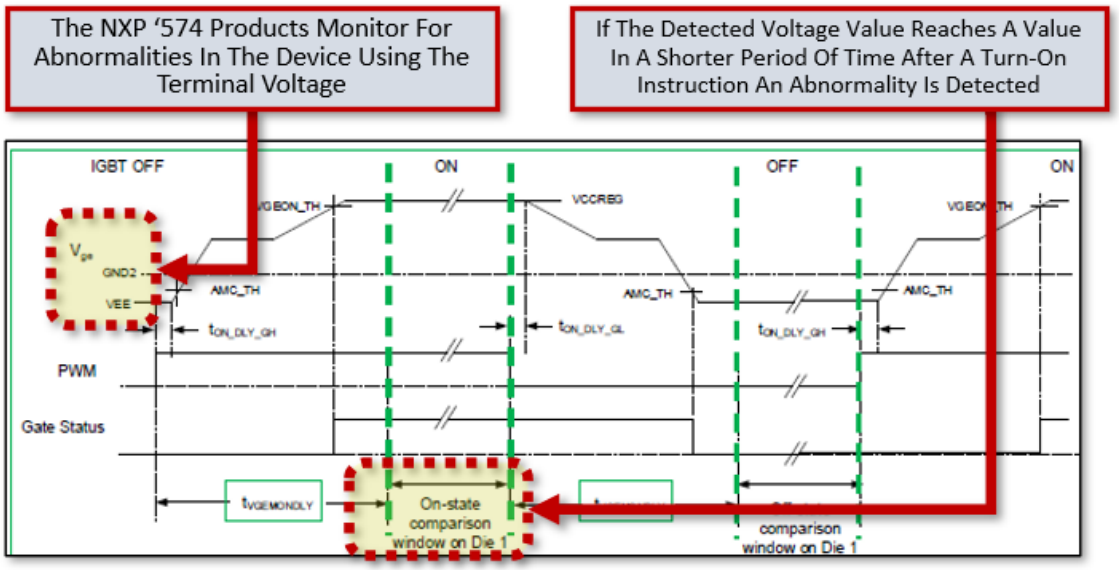
GD3162 Advanced IGBT/SiC Gate Driver With Dynamic Gate Strength Adjust – Objective Short Data Sheet Rev. 1, NXP DOCUMENTATION at 1 (November 29, 2022) (annotation added).

89. The drive circuit in the NXP '574 Products send turn-on or turn-off instructions to the power semiconductor device, and these instructions dictate when the device should allow current to flow through it and when it should block the flow of current. The control mechanisms within the NXP '574 Products receive these instructions and regulate the switching of the device. By following these instructions, the device can control the flow of current in a circuit.



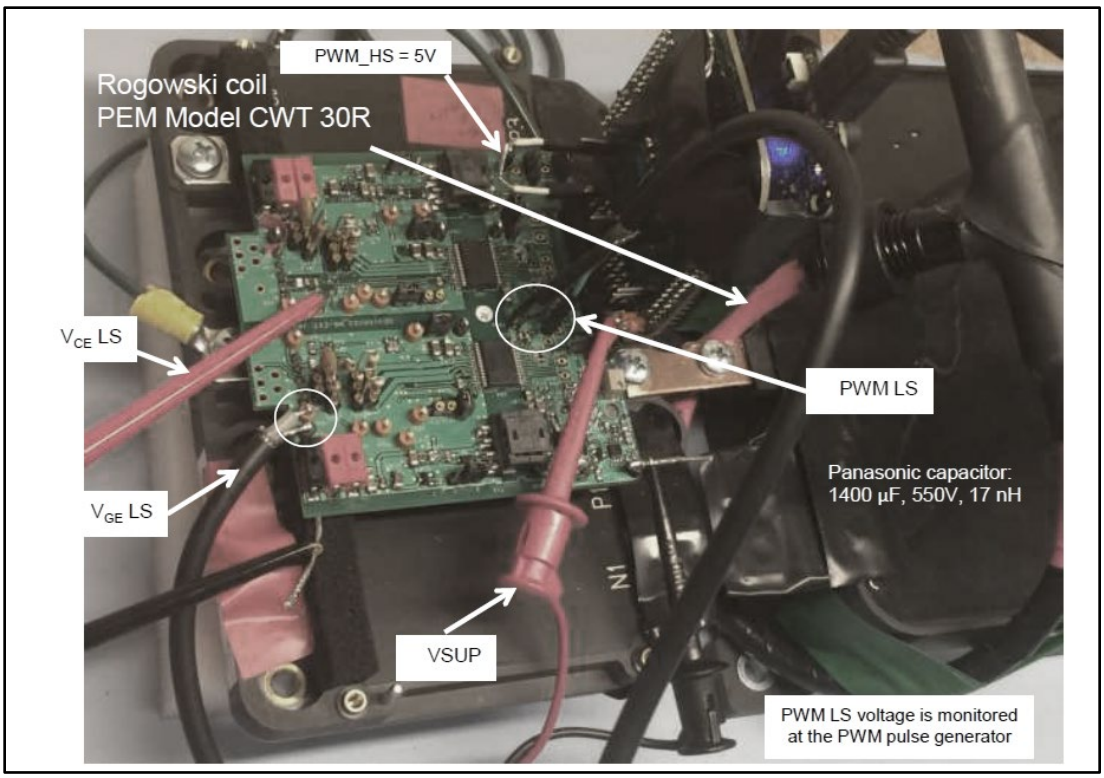
Kim Gauen, *Simplify Your Inverter Through Advancements In IGBT Gate Drivers – MC33GD3100 IGBT Gate Driver Session #AMF-AUT-T2371,* NXP Presentation at 32 (October 6, 2016) (annotation added).

90. The NXP '574 Products comprise an abnormality detection system responsible for monitoring the voltage and current levels at the power semiconductor device's control terminal. It detects abnormalities in the device when the value of either the voltage or current reaches an on-state value within a shorter time period after receiving a turn-on instruction. This time period is shorter than the normal period that elapses when the value reaches the on-state value in the absence of any abnormalities in the power semiconductor device.



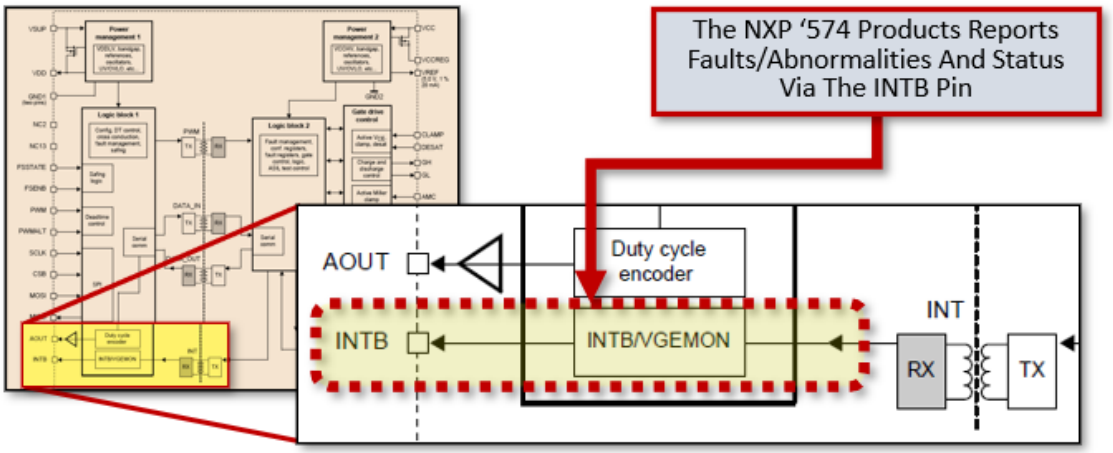
Travis Alexander, *NXP's GD3100: Advanced Isolated High-Voltage Gate Driver for Enabling ePowertrains Session #AMF-AUT-T3661*, NXP PRESENTATION at 30 (November 2019) (annotation added).

91. The NXP '574 Products contain an abnormality detection system that monitors either the voltage or current that passes through the control terminal of the NXP '574 Products. If the detected value reaches an on-state value within a shorter time period than usual after receiving a turn-on instruction, the NXP '574 Products detect the presence of an abnormality in the device. In the absence of an abnormality, the detected value would normally reach the on-state value after a longer time period. The abnormality detection system is designed to quickly identify any issues with the NXP '574 Product and alert the system to take corrective action.



Kim Gauen, *Simplify Your Inverter Through Advancements In IGBT Gate Drivers – MC33GD3100 IGBT Gate Driver Session #AMF-AUT-T2371,* NXP Presentation at 61 (October 6, 2016) (annotation added).

92. The abnormality detection means of the NXP '574 Products monitor the voltage or current at the control terminal of a power semiconductor device. When the NXP '574 Products receive a turn-on instruction, the abnormality detection means begins monitoring the voltage or current at the control terminal. Normally, it takes a specific amount of time for the voltage or current to reach a certain value that indicates that the device has successfully turned on. However, if there are abnormalities in the NXP '574 Products, such as a short circuit or an open circuit, the voltage or current may reach the on-state value much faster than usual.



MC33GD3100 Advanced IGBT/SiC Gate Driver – Product Short Datasheet Rev. 9.0, NXP DOCUMENTATION AT 4 (March 5, 2020) (annotation added).

93. The abnormality detection means in the NXP '574 Products is designed to detect this rapid increase in voltage or current and identify it as an abnormality. Once an abnormality is detected, the NXP '574 Product can take corrective action such as shutting down the device or triggering an alarm. This is important for preventing damage to the device or the surrounding equipment.

> The current sense pin, ISENSE, can be used to monitor the sense cells of a current sense IGBT. Responding directly to an overcurrent or short-circuit condition using current sensing can be a much faster way to respond to a severe overcurrent condition (as compared to desaturation detection).
>
> The MC33GD3100 can also monitor temperature sense diodes or thermistors if the IGBT/SiC has them. An ADC allows reporting the temperature via the SPI as well as using the ADC reading to trigger overtemperature warning or fault conditions. Monitoring the IGBT/SiC temperature via the AOUT pin also allows real time monitoring of the system's performance in the field.

MC33GD3100 Advanced IGBT/SiC Gate Driver – Product Short Datasheet Rev. 9.0, NXP DOCUMENTATION AT 10 (March 5, 2020) (emphasis added).

94. The NXP '574 Products include a drive circuit including a control means for controlling switching of the power semiconductor device according to a turn-on instruction or turn-off instruction sent to the power semiconductor device from outside the drive circuit.

95. The NXP '574 Products include a drive circuit including an abnormality detection means for detecting the value of at least one of a voltage that appears at a control terminal of the power semiconductor device and a current that flows into the control terminal of the power semiconductor device.

96. The NXP '574 Products include a drive circuit including an abnormality detection means that detects occurrence of an abnormality in the power semiconductor device when the value detected reaches an on-state value within a time period after receiving a turn-on instruction, the time period being shorter than a normal time period that elapses when the value detected reaches the on-state value after receiving a turn-on instruction in absence of an abnormality in the power semiconductor device.

97. NXP has directly infringed and continues to directly infringe the '574 patent by, among other things, making, using, offering for sale, and/or selling drive circuits for driving power semiconductor devices, including but not limited to the NXP '574 Products.

98. The NXP '574 Products are available to businesses and individuals throughout the United States.

99. The NXP '574 Products are provided to businesses and individuals located in the Western District of Texas.

100. By making, using, testing, offering for sale, and/or selling drive circuits for driving power semiconductor devices, including but not limited to the NXP '574 Products, NXP has injured Plaintiff and is liable to Plaintiff for directly infringing one or more claims of the '574 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

101. NXP also indirectly infringes the '574 patent.

102. NXP has had knowledge of the '574 patent since at least service of this Complaint or shortly thereafter, and NXP knew of the '574 patent and knew of its infringement, including by way of this lawsuit.

103. NXP indirectly infringes the '574 patent by actively inducing infringement under 35 U.S.C. § 271(b).

104. NXP intended to induce patent infringement by third-party customers and users of the NXP '574 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. NXP specifically intended and was aware that the normal and customary use of the accused products would infringe the '574 patent. NXP performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '574 patent and with the knowledge that the induced acts would constitute infringement. For example, NXP provides the NXP '574 Products that have the capability of operating in a manner that infringe one or more of the claims of the '574 patent, including at least claim 1, and NXP further provides documentation and training materials that cause customers and end users of the NXP '574 Products to utilize the products in a manner that directly infringe one or more claims of the '574 patent.[12] By providing instruction and training to

[12] *See e.g., UM11603 RDGD31603PHSEVM Three-Phase Inverter Reference Design User Manual Rev. 1,* NXP DOCUMENTATION (August 18, 2021); *GD3162 Advanced IGBT/SiC Gate Driver With Dynamic Gate Strength Adjust – Preliminary Short Datasheet Rev. 1,* NXP DOCUMENTATION (November 29, 2022); *Vehicle Electrification Solutions – Semiconductor System Solutions For Electrified Ecosystems Rev. 5*, NXP DOCUMENTATION (2022); *MC33GD3100 Advanced IGBT/SiC Gate Driver – Product Short Datasheet Rev. 9.0,* NXP DOCUMENTATION (March 5, 2020); Susan Xue*, GD3160: Advanced HV Isolated SiC Gate Driver For Automotive ePowertrains,* NXP PRESENTATION (August 2021); *GD3160: Advanced High-Voltage Gate Driver With Integrated Isolation – Fact Sheet Rev. 1,* NXP DOCUMENTATION (2022); *UM11777 FRDMGD3160HB8EVM Half-Bridge Evaluation Board – User Manual Rev. 1,* NXP DOCUMENTATION (May 6, 2022); Travis Alexander, *NXP's GD3100: Advanced Isolated High-Voltage Gate Driver for Enabling ePowertrains Session #AMF-AUT-T3661*, NXP PRESENTATION (November 2019); *AN13091 EV Traction Motor Power Inverter Control Reference Platform – Application Note Rev. 1*, NXP DOCUMENTATION (March 19, 2021); *Kim Gauen, Simplify Your Inverter Through Advancements In IGBT Gate Drivers – MC33GD3100 IGBT Gate Driver Session #AMF-AUT-T2371,* NXP PRESENTATION (October 6, 2016); *GD3162 Advanced IGBT/SiC*

customers and end-users on how to use the NXP '574 Products in a manner that directly infringes one or more claims of the '574 patent, including at least claim 1, NXP specifically intended to induce infringement of the '574 patent. NXP engaged in such inducement to promote the sales of the NXP '574 Products, e.g., through NXP user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '574 patent. Accordingly, NXP has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '574 patent, knowing that such use constitutes infringement of the '574 patent.

105. NXP indirectly infringes the '574 patent by contributing to the infringement by its customers and end users under 35 U.S.C. § 271(c) by making, using, importing, selling, or offering to sell within the United States the NXP '574 Products, which incorporate or constitute a material part of the inventions claimed by the '574 patent. NXP does so knowing that these products are especially made or especially adapted for uses that infringe the '574 patent, and not staple articles or commodities of commerce suitable for substantial non-infringing use.

106. The '574 patent is well-known within the industry as demonstrated by multiple citations to the '574 patent in published patents and patent applications assigned to technology companies and academic institutions. NXP is utilizing the technology claimed in the '574 patent without paying a reasonable royalty. NXP is infringing the '574 patent in a manner best described

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Gate Driver With Dynamic Gate Strength Adjust – Objective Short Data Sheet Rev. 1, NXP DOCUMENTATION (November 29, 2022); Jim Shepard & Don Laybourn, *ePowertrain: NXP Portfolio For The Electrification Of Vehicles – Session #AMF-AUT-T2720,* NXP PRESENTATION (June 2017); Rick Beale, *High-Voltage Power Inverter Platform for EV Traction Motors - Session #AMF-AUT-T3200*, NXP PRESENTATION (October 2018); and *High Voltage Gate Driver Demo Using Half-Bridge EVM*, NXP SEMICONDUCTORS YOUTUBE.COM CHANNEL (October 13, 2021), available at: https://www.youtube.com/watch?v=zTUm_SR8XFQ.

as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

107. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '574 patent.

108. As a result of NXP's infringement of the '574 patent, Plaintiff has suffered monetary damages, and seeks recovery in an amount adequate to compensate for NXP's infringement, but in no event less than a reasonable royalty for the use made of the invention by NXP together with interest and costs as fixed by the Court.

COUNT III
INFRINGEMENT OF U.S. PATENT NO. 8,531,150

109. Plaintiff references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

110. NXP designs, makes, uses, sells, and/or offers for sale in the United States DC-DC converters.

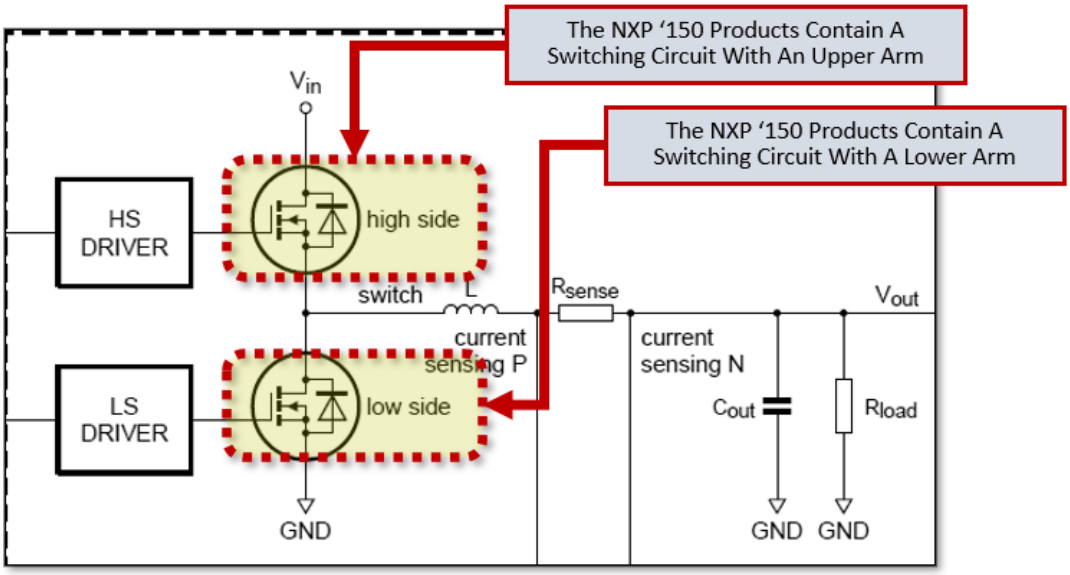
111. NXP designs, makes, sells, offers to sell, imports, and/or uses the following NXP Power Management Integrated Circuits ("PMICs") and Safety System Basis Chips ("Safety SBCs") including the following products: MC33907, MC33908, FS45, FS5502, FS56, FS65, FS66, FS84, FS85, FS86, VR5500, and VR5510 (collectively, the "'NXP '150 Products").

112. One or more NXP subsidiaries and/or affiliates use the NXP '150 Products in regular business operations.

113. The NXP '150 Products include DC-DC converters with an input filter circuit including an input reactor.

114. The NXP '150 Products consist of a switching circuit that is connected to the input filter circuit at the input end and comprises a switching element on both the upper and lower arms.

Specifically, the NXP '150 Products contain a switching circuit, which features an input end linked to the input filter circuit, which contains both an upper arm side switching component and a lower arm side switching component.



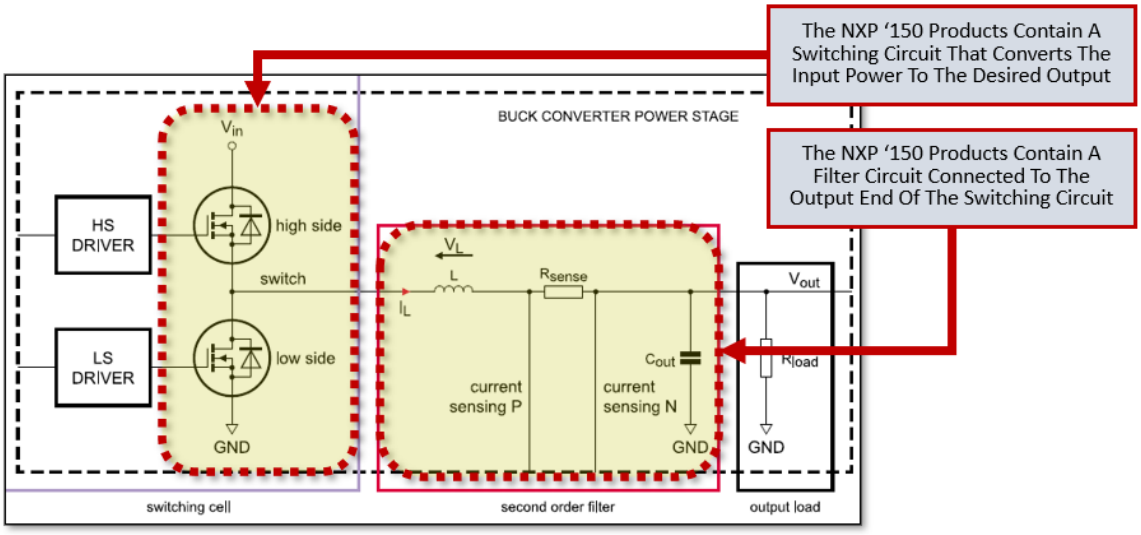
AN12540 – FS85 VPRE Stability – Rev. 1.0, NXP DOCUMENTATION AT 2 (October 1, 2019) (annotation added).

115. The switching circuit in the NXP '150 Products contains two switching elements, one on the upper arm side and another on the lower arm side. These switching elements function as switches that control the flow of electrical current through the circuit. When the upper arm side switching element in the NXP '150 Products is turned on (closed), the current flows through it and the load connected to the circuit. At the same time, the lower arm side switching element in the NXP '150 Products is turned off (open), preventing current flow through that path. Conversely, when the lower arm side switching element is turned on, the upper arm side switching element is turned off.

> VPRE block is a high voltage, synchronous, peak current mode buck controller. VPRE is working with external logical level NMOS in force PWM mode at 455 kHz and in Automatic Pulse Skipping (APS) mode at 2.22 MHz. The APS mode helps to maintain the correct output voltage at high input voltage by skipping some turn ON cycles of the HS FET below the minimum duty cycle. VPRE input voltage is naturally limited to V_{SUP} = L_{PI_DCR} x I_{PRE} + V_{PRE_UVL} / D_{MAX} with D_{MAX} = 1 – (F_{PRE_SW} x $T_{PRE\_OFF\_MIN}$). A bootstrap capacitor is required to supply the gate drive circuit of the high-side NMOS. The output voltage is configurable by OTP from 3.3 V to 5.0 V, and the switching frequency is configurable by OTP at 455 kHz for 12 V and 24 V transportation applications or 2.22 MHz for 12 V automotive applications. The stability is ensured by an external Type 2 compensation network with slope compensation.
>
> The output current is sensed via an external shunt in series with the inductor and the maximum current capability is defined by the external components (NMOS gate charge, inductor, shunt resistor), the gate driver current capability and the switching frequency. An overcurrent detection is implemented to protect the external MOSFETs. If an overcurrent is detected after the HS minimum TON time, the HS is turned OFF and will be turned ON again at the next rising edge of the switching clock. The overcurrent induces a duty cycle reduction that could lead to the output voltage gradually dropping, causing an undervoltage condition on VPRE and/or one of the cascaded regulators.

FS5502 High Voltage PMIC With Multiple SMPS and LDO – Data Sheet Rev. 4.0, NXP DOCUMENTATION at 52 (October 27, 2021) (emphasis added).

116. In the NXP '150 Products the rapid and precise switching operation of these elements helps convert the input power into a desired output, often alternating current (AC) or direct current (DC) with specific voltage or current levels. The switching circuit, in combination with additional circuitry like output filters, determines the overall performance and efficiency of the power converter system.



AN12540 – FS85 VPRE Stability – Rev. 1.0, NXP DOCUMENTATION AT 3 (October 1, 2019) (annotation added).

117. The NXP '150 Products comprise an output end of the switching circuit that is connected to a smoothing filter circuit. Specifically, the NXP '150 Products contain a filtering circuit connected to the output side of the switching mechanism, designed to smooth the voltage waveform.

118. The filtering circuit in the NXP '150 Products consists of inductors and capacitors, forming a smoothing filter. The inductor and capacitor work together to attenuate the high-frequency voltage fluctuations and allow the desired DC component to pass through, resulting in a smooth and steady output voltage.

The first part is the switching cell, composed of a high side and a low side transistor. The high side transistor is directly connected to the supply (Vin), whereas the low side transistor is connected to the ground (GND). These two transistors are never closed at the same time, if one is closed the other is open.

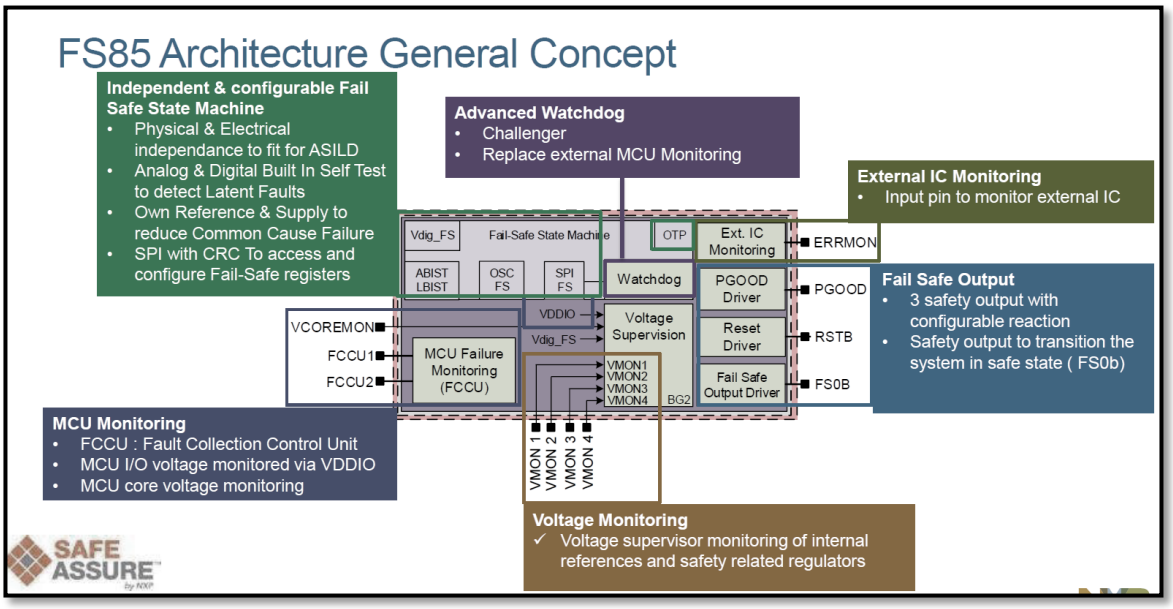
- When the high side transistor is closed, the energy is accumulated through the inductor (L). Then, the second part, a second order low-pass filter, removes the high frequency harmonics, resulting in an output voltage as constant as possible. The third part, output load, is always connected in parallel to the output. The current is sensed through the resistor (Rsense).
- When the low side transistor is closed, the energy is released through the low side.

AN12540 – FS85 VPRE Stability – Rev. 1.0, NXP DOCUMENTATION AT 3 (October 1, 2019) (annotation added).

119. The NXP '150 Products contain a switching mechanism that creates a waveform with rapid voltage transitions. This waveform contains the desired output voltage (DC component) and unwanted high-frequency voltage ripples. The inductor in the NXP '150 Products resists sudden changes in current, smoothing the sharp transitions in the square waveform. As the current passes through the inductor, it stores and releases energy, causing the waveform to become less abrupt and more continuous. Further, the capacitor in the NXP '150 Products' filtering circuit acts as a reservoir, storing energy when the voltage is high and releasing it when the voltage is low. This further smooths out the voltage waveform by compensating for any remaining voltage

fluctuations. The combined action of the inductor and capacitor in the NXP '150 Products smoothing filter results in a stable and smooth output voltage with minimal high-frequency voltage ripples.

120. The NXP '150 Products comprise a control unit that monitors the status of the smoothing filter circuit and regulates the operation of the switching circuit by controlling its on/off state. Specifically, the NXP '150 Products contain a control module that receives feedback from the smoothing filter circuit's state and regulates the activation and deactivation of the switching mechanism.



Vincent Lagardelle and Baher Ahmad, *Scalable & Safe Power Management Solutions Overview – AMF-AUT-T3350,* NXP PRESENTATION at 32 (October 2018).

121. The control module in the NXP '150 Products receive feedback from the smoothing filter circuit's state and adjusts the operation of the switching mechanism accordingly. The control module in the NXP '150 Products monitors the output voltage, which is passed through the smoothing filter circuit. This output voltage is a representation of the filter circuit's state, reflecting the effectiveness of the filter in smoothing out the voltage waveform. The control module in the

NXP '150 Products then compares the monitored output voltage with a reference voltage, which represents the desired output voltage level. Based on this comparison, the control module in the NXP '150 Products determines if the output voltage needs to be increased, decreased, or maintained.

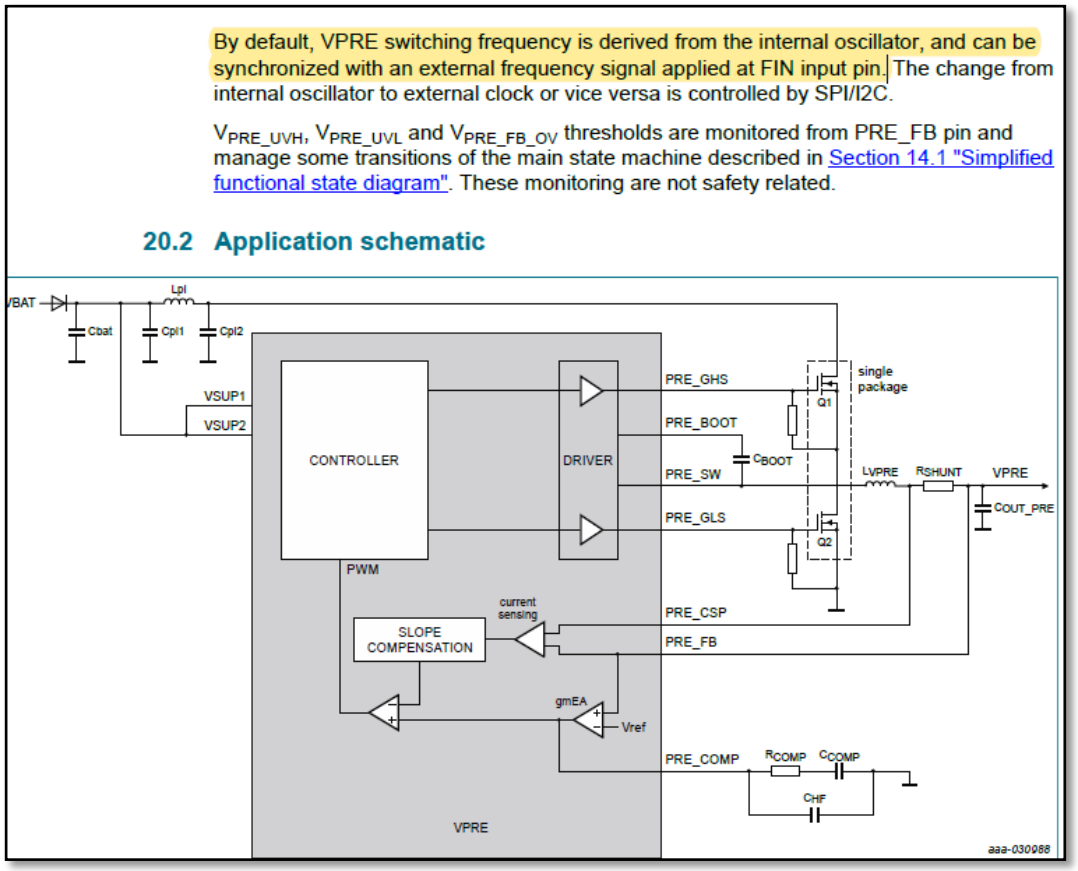
122. In the NXP '150 Products the control module adjusts the duty cycle of the switching mechanism. The duty cycle represents the proportion of time the switches are in the "on" state during a switching cycle. By changing the duty cycle, the control module effectively controls the amount of energy transferred from the input to the output of the converter. If the output voltage is lower than the desired reference voltage, the control module increases the duty cycle, allowing more energy to be transferred to the output. Conversely, if the output voltage is higher than the reference voltage, the control module decreases the duty cycle, reducing the energy transfer.

> Slope compensation is needed when the duty cycle is above 50 %. The real current and the desired inductor current are different at the same time due to noisy environment. That is why a current ripple ΔI between the desired inductor current and the real inductor current appears. This current ripple reduces with time (stability) when the duty cycle is under 50 %. On the contrary, if the duty cycle is above 50 %, the ripple increases with time (instability). Adding a slope compensation ramp allows reduction of this current ripple and maintains converter stability. It is important that the slope compensation ramp is appropriately sized to not affect the stability.

AN12540 – FS85 VPRE Stability – Rev. 1.0, NXP DOCUMENTATION AT 9 (October 1, 2019) (emphasis added).

123. The NXP '150 Products comprise a control unit that incorporates a damping control mechanism that utilizes the input capacitor's voltage to calculate a damping operation quantity. This quantity adjusts the status of the smoothing filter circuit by determining the voltage fluctuation rate, obtained by dividing the input capacitor voltage by its DC component. The damping operation quantity corresponds to the voltage fluctuation rate.

124. The damping control module in the NXP '150 Products computes a damping operation value to adjust the state of the smoothing filter circuit, based on the voltage of the input capacitor. The module calculates the voltage fluctuation rate of the input capacitor by dividing its voltage by the DC component of its voltage. The damping operation value is then determined in correspondence with the fluctuation rate.



FS84/FS85C Fail-Safe System Basis Chip With Multiple SMPS and LDO – Data Sheet Rev. 6.0, NXP DOCUMENTATION at 87 (August 11, 2020) (emphasis added).

125. The NXP '150 Products contain a damping control module that monitors the voltage of the input capacitor. The damping control module then calculates the fluctuation rate by dividing the voltage of the input capacitor by the DC component of the voltage. The fluctuation rate that is calculated by the NXP '150 Products represents the extent of voltage variations in the input capacitor relative to the desired DC voltage. Based on the calculated fluctuation rate, the

damping control module in the NXP '150 Products determines a damping operation value. This value represents the necessary adjustment required to minimize voltage fluctuations and stabilize the output voltage. The damping control module uses the damping operation value to adjust the state of the smoothing filter circuit.

126. NXP has directly infringed and continues to directly infringe the '150 patent by, among other things, making, using, offering for sale, and/or selling DC-DC converters, including but not limited to the NXP '150 Products.

127. The NXP '150 Products are available to businesses and individuals throughout the United States.

128. The NXP '150 Products are provided to businesses and individuals located in the Western District of Texas.

129. By making, using, testing, offering for sale, and/or selling DC-DC converters, including but not limited to the NXP '150 Products, NXP has injured Plaintiff and is liable to Plaintiff for directly infringing one or more claims of the '150 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

130. NXP also indirectly infringes the '150 patent.

131. NXP has had knowledge of the '150 patent since at least service of this Complaint or shortly thereafter, and NXP knew of the '150 patent and knew of its infringement, including by way of this lawsuit.

132. NXP indirectly infringes the '150 patent by actively inducing infringement under 35 U.S.C. § 271(b).

133. NXP intended to induce patent infringement by third-party customers and users of the NXP '150 Products and had knowledge that the inducing acts would cause infringement or was

willfully blind to the possibility that its inducing acts would cause infringement. NXP specifically intended and was aware that the normal and customary use of the accused products would infringe the '150 patent. NXP performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '150 patent and with the knowledge that the induced acts would constitute infringement. For example, NXP provides the NXP '150 Products that have the capability of operating in a manner that infringe one or more of the claims of the '150 patent, including at least claim 1, and NXP further provides documentation and training materials that cause customers and end users of the NXP '150 Products to utilize the products in a manner that directly infringe one or more claims of the '150 patent.[13] By providing instruction and training to customers and end-users on how to use the NXP '150 Products in a manner that directly infringes one or more claims of the '150 patent, including at least claim 1, NXP specifically intended to induce infringement of the '150 patent. NXP engaged in such inducement to promote the sales of

[13] *See e.g., FS5600 Automotive Buck Regulator And Controller With Voltage Monitors And Watchdog Timer – Data Sheet Rev. 3*, NXP DOCUMENTATION (August 2, 2022); *AN13191, FS5600 Design Guidelines - Application Note Rev. 1*, NXP DOCUMENTATION (April 27, 2021); *AN13615, NXP PMIC Solution For AG55xQ Series Module – Application Note Rev. 1*, NXP DOCUMENTATION (May 27, 2022); Marc Osajda, *Analog Solutions for Automotive EUF-ACC-T1573*, NXP FREESCALE PRESENTATION (June 2015); *Safety Manual for 33907 and 33908 Rev. 2.0*, NXP DOCUMENTATION (July 2015); *MC33907_08 Data Sheet Rev. 3.0*, NXP DOCUMENTATION (February 2, 2014); David Lopez, *Electrification – Functional Safety Backbone Solutions to Attach with S32 – AMF-AUT-T3351*, NXP PRESENTATION (October 2018); *35FS4500, 35FS6500: ASIL B – Short Data Sheet Rev. 2.0,* NXP DOCUMENTATION (April 14, 2021); Vincent Lagardelle and Baher Ahmad, *Scalable & Safe Power Management Solutions Overview – AMF-AUT-T3350,* NXP PRESENTATION (October 2018); *AN5238 - FS6500 and FS4500 Safe System Basis Chip Hardware Design and Product Guideline Rev. 7.0,* NXP DOCUMENTATION (June 2019); *AN12540 – FS85 VPRE Stability – Rev. 1.0,* NXP DOCUMEntation (October 1, 2019); *FS84/FS85C Fail-Safe System Basis Chip With Multiple SMPS and LDO – Data Sheet Rev. 6.0*, NXP DOCUMENTATION (August 11, 2020); *FS5502 High Voltage PMIC With Multiple SMPS and LDO – Data Sheet Rev. 4.0*, NXP DOCUMENTATION (October 27, 2021); and *VR5510 Multi-Output PMIC with SMPS and LDO – Data Sheet Rev. 5.0,* NXP DOCUMENTATION (April 6, 2022).

the NXP '150 Products, e.g., through NXP user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '150 patent. Accordingly, NXP has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '150 patent, knowing that such use constitutes infringement of the '150 patent.

134. NXP indirectly infringes the '150 patent by contributing to the infringement by its customers and end users under 35 U.S.C. § 271(c) by making, using, importing, selling, or offering to sell within the United States the NXP '150 Products, which incorporate or constitute a material part of the inventions claimed by the '150 patent. NXP does so knowing that these products are especially made or especially adapted for uses that infringe the '150 patent, and not staple articles or commodities of commerce suitable for substantial non-infringing use.

135. The '150 patent is well-known within the industry as demonstrated by multiple citations to the '150 patent in published patents and patent applications assigned to technology companies and academic institutions. NXP is utilizing the technology claimed in the '150 patent without paying a reasonable royalty. NXP is infringing the '150 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

136. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '150 patent.

137. As a result of NXP's infringement of the '150 patent, Plaintiff has suffered monetary damages, and seeks recovery in an amount adequate to compensate for NXP's infringement, but in no event less than a reasonable royalty for the use made of the invention by NXP together with interest and costs as fixed by the Court.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff NexGen Control Systems, LLC respectfully requests that this Court enter:

A. A judgment in favor of Plaintiff that NXP has infringed, either literally and/or under the doctrine of equivalents, the '855, '574, and '150 patents;

B. An award of damages resulting from NXP's acts of infringement in accordance with 35 U.S.C. § 284;

C. A judgment and order finding that NXP's infringement was willful, wanton, malicious, bad-faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate within the meaning of 35 U.S.C. § 284 and awarding to Plaintiff enhanced damages.

D. A judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding to Plaintiff its reasonable attorneys' fees against NXP.

E. Any and all other relief to which Plaintiff may show itself to be entitled.

JURY TRIAL DEMANDED

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Plaintiff NexGen Control Systems, LLC requests a trial by jury of any issues so triable by right.

Dated: March 15, 2023

Respectfully submitted,

/s/ Daniel P. Hipskind

Dorian S. Berger (CA SB No. 264424)
Daniel P. Hipskind (CA SB No. 266763)
Erin E. McCracken (CA SB No. 244523)
BERGER & HIPSKIND LLP
9538 Brighton Way, Ste. 320
Beverly Hills, CA 90210
Telephone: 323-886-3430
Facsimile: 323-978-5508
E-mail: dsb@bergerhipskind.com
E-mail: dph@bergerhipskind.com
E-mail: eem@bergerhipskind.com

Elizabeth L. DeRieux
State Bar No. 05770585
Capshaw DeRieux, LLP
114 E. Commerce Ave.
Gladewater, TX 75647
Telephone: 903-845-5770
E-mail: ederieux@capshawlaw.com

Attorneys for NexGen Control Systems, LLC