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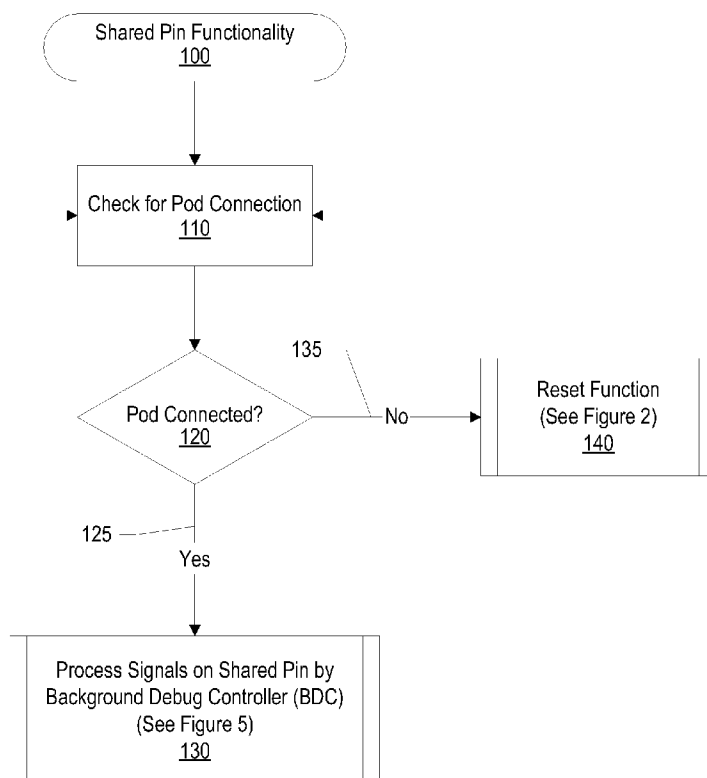
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[Continued on next page]

(54) Title: SYSTEM AND METHOD FOR SHARING RESET AND BACKGROUND COMMUNICATION ON A SINGLE MCU PIN



(57) Abstract: Methods and data processing systems (610) are provided to share a common pin (604) between two circuits (614, 750) in microcontroller unit (MCU). Signals are received at a common pin (604) included in the MCU. If the first circuit (614) has been enabled, then the received signals are analyzed to determine whether the signals are valid command signals for the first circuit (614). If the signals are not a valid command signal, then a second circuit (750) is performed. If the first circuit (614) has not been enabled, then an alternate function is performed. One of the operations performed by the alternate function is to determine whether to enable the first function. In one embodiment, the first circuit is a background debug controller (614) of the MCU and the second circuit is a reset circuit (750).

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System and Method for Sharing Reset and Background Communication on a Single MCU Pin

Field of the Invention

[0001] The present invention relates generally to a system and method for sharing a communications pin on a microcontroller unit (MCU). More particularly, the present invention relates to a system and method for sharing background communications and reset signals at a single MCU pin.

Related Art

[0002] A microcontroller unit (MCU) is a single chip that includes various components such as a processor, random-access memory (RAM), read-only memory (ROM), a clock, and an input/output (I/O) control unit. A microcontroller can be thought of as a “computer on a chip.” Hundreds of millions of MCUs are used in a vast amount of applications from automobile and appliance applications to toys and games. Many microcontrollers can be quite small and inexpensive. Modern automobiles, for example, may include many MCUs to control various functions.

[0003] Because of their small size, some MCUs have limited communication pins for communicating with external devices. While it is desirable to have dedicated communication pins for various functions, this becomes challenging when the number of pins are limited. Background communications and reset functions are desirable in many applications, such as in automotive MCUs. However, with traditional MCU pin limitations, having dedicated communication pins for background and reset functions is often not possible. In some automotive MCU applications, an expansion bus is not available, so traditional emulation is not possible and background debugging is often desirable.

[0004] One possible solution is to increase the number of pins on the MCU. A challenge of this approach, however, is that changing the number of pins in somewhat

standardized MCUs, such as those used in automotive industries, causes changes to how the MCUs are connected to the electrical system. A standard MCU may only have six or eight pins in order to allow it to fit into small applications. Adding an extra pin could result in an undesirable larger package.

[0005] Another possible solution is to forego some functionality. For example, in an automotive application, one pin can be dedicated for reset, in which case background communications will be disabled. This solution has obvious shortcomings in that some functionality cannot be utilized. Not having background communications, for example, would inhibit the ability to diagnose or debug the MCU. This is especially true in situations where traditional emulation is not possible.

Brief Description of the Drawings

[0006] The present invention may be better understood, and its numerous objects, features, and advantages made apparent to those skilled in the art by referencing the accompanying drawings, wherein:

Figure 1 is a high-level flowchart showing shared pin functionality;

Figure 2 is a flowchart showing the steps taken during a reset function of a microcontroller unit (MCU);

Figure 3 is a flowchart showing the steps taken when checking for a synchronization between the MCU and an external device, such as a pod;

Figure 4 is a flowchart showing the steps taken during a hot connect between the MCU and the external device;

Figure 5 is a flowchart showing communications between the external device and the MCU's Background Debug Controller (BDC);

Figure 6 is a block diagram of a data processing system in which the methods described herein can be implemented; and

Figure 7 is a block diagram illustrating the background debug system and reset circuitry of **Figure 6**.

Detailed Description

- [0007] The following is intended to provide a detailed description of an example of the invention and should not be taken to be limiting of the invention itself. Rather, any number of variations may fall within the scope of the invention, which is defined in the claims following the description.
- [0008] **Figure 1** is a high-level flowchart showing shared pin functionality. Processing commences at **100** whereupon, at step **110**, a check is made to see whether an external device is connected to the microcontroller unit (MCU). A “pod” is a common example of an external debugging device that maybe connected to an MCU. A pod allows the operator to communicate with the MCU using various commands. A determination is made as to whether an external device (e.g., a pod) is connected to the MCU (decision **120**). If an external device is connected to the device (MCU), then decision **120** branches to “yes” branch **125** and the received signals are processed by a first circuit that has been enabled at the device (predefined process **130**, see **Figure 5** and corresponding text for processing details). In one embodiment, the first circuit is a Background Debug Controller (BDC) circuit (see, e.g., **Figures 6** and **7** and their corresponding text for details regarding one embodiment of a BDC).
- [0009] On the other hand, if an external device is not connected to the device (MCU), then decision **120** branches to “no” branch **135** whereupon a second function is performed by a second circuit (predefined process **140**, see **Figure 2** and corresponding text for processing details). In one embodiment, the second circuit is a Reset circuit (see, e.g., **Figures 2, 6, and 7** and their corresponding text for details regarding one embodiment of a reset circuit).
- [0010] After the respective first and second functions are performed, processing loops back to check whether an external device is connected. While the two functions that share the common pin are shown as being a Background Debug Controller function and a Reset function, those of skill in the art will appreciate that other

functions are able to share a common pin using the techniques and teachings described herein.

- [0011] **Figure 2** is a flowchart showing the steps taken during a reset function of a microcontroller unit (MCU). Processing commences at **200** whereupon, at step **210**, standard reset processing occurs. In one embodiment, standard reset processing includes resetting most of the control and status registers, loading the program counter (PC) from a reset vector, disabling on-chip peripheral modules, initially configuring I/O pins as general-purpose high-impedance inputs, blocking maskable interrupts by setting I-bit in the condition code register (CCR), and setting the stack pointer (SP) to a predetermined value.
- [0012] At step **220**, the reset function sets a bit in the system reset status register that is associated with the source of the reset. As noted, this bit is set unless the source of the reset is a forced reset received as a background debug command. At step **225**, the reset function switches the Internal Clock Generator to self-clocked mode with a certain frequency ($f_{\text{Self\_reset}}$) selected.
- [0013] At step **230**, the Enable Background Debug Mode (ENBDM) control bit is cleared. This is a control bit associated with the first function. If the first function (e.g., the Background Debug Controller) was enabled when the reset function was invoked, then step **230** will effectively disable the first function. As will be seen, however, the first function can be re-enabled before reset processing is finished (see Figure 3, step 340).
- [0014] Steps **240** and **250** operate to drive and release the common pin in order to determine whether there is an external source of the reset. Step **240** drives the common pin low for a certain number of cycles. In one embodiment, the common pin is driven low for 34 cycles. Step **250** releases the common pin and waits for a certain number of cycles. In one embodiment, the common pin is released for 32 cycles.

- [0015]** After the common pin has been driven and released for a given number of cycles, a determination is made as to whether the common pin is still being driven low (decision **260**). If the common pin is still being driven low, decision **260** branches to "yes" branch **265** which assumes that there is an external source of the reset and, therefore, a synchronization check is made to see if an external device, such as a pod, is attempting to synchronize with the device (MCU). This synchronization check is made at predefined process **270** (see **Figure 3** and corresponding text for processing details). During synchronization processing, the first circuit (e.g., the BDC circuit) can be re-enabled if a good synchronization is established with the external device and a valid command is received.
- [0016]** On the other hand, if the common pin is not still being driven low, decision **260** branches to "no" branch **275** whereupon it is assumed that the reset was caused by an internal source so no synchronization checking is performed and the reset function exits at **295**.
- [0017]** **Figure 3** is a flowchart showing the steps taken when checking for synchronization between the MCU and an external device, such as a pod. Processing commences at **300** whereupon, at step **310**, the first circuit (e.g., the Background Debug Controller (BDC) circuit) signals that a synchronization event is in progress (sync_in_prog). At step **320**, the device (MCU) attempts to synchronize with the external device, such as a pod.
- [0018]** A determination is made as to whether the device (MCU) successfully synchronized with the external device (decision **330**). If a successful synchronization was established, decision **330** branches to "yes" branch **335** whereupon, at step **340**, the MCU receives a command from the external device.
- [0019]** A determination is made as to whether a valid Background Debug Mode (BDM) command was received from the external device (decision **350**). If a valid BDM command was received, then decision **350** branches to "yes" branch **355** whereupon, at step **360**, the first circuit (e.g., Background Debug Controller circuit) is enabled by setting a control bit (e.g., setting ENBDM to 'true'), and the

device (MCU) enters active debug mode (predefined process **370**, see **Figure 5** and corresponding text for processing details). Synchronization processing thereafter ends at **380**.

[0020] On the other hand, if a valid BDM command was not received, decision **350** branches to "no" branch **385** bypassing steps **360** and **370** and the reset function is performed (predefined process **395**, see Figure 2 and corresponding text for processing details). Likewise, returning to decision **330**, if a successful synchronization was not established between the device (MCU) and the external device (pod), then decision **330** branches to "no" branch **390** and the reset function is performed at predefined process **395**.

[0021] **Figure 4** is a flowchart showing the steps taken during a hot connect between the device (MCU) and an external device, such as a pod. In one embodiment, a successful hot connect connects an external device with a running MCU in a manner that permits background communications between the external device and the MCU without resetting the MCU. Processing commences at **400** whereupon, at step **405**, the external device drives the shared pin low. At step **410**, a hot connect control bit is read in the target MCU. The hot connect control bit determines whether hot connections are allowed between the device and external devices. In one embodiment, the hot connect control bit is permanently cleared to disable hot connections when the MCU is initially configured. In another embodiment, the hot connect control bit can be altered after initial configuration, such as by user instructions in normal operating mode. If hot connections are allowed, then the first circuit (e.g., Background Debug Controller circuit) can be enabled without having to reset the MCU.

[0022] A determination is made as to whether the MCU allows hot connections (decision **420**), based on the hot connect control bit. If the device (MCU) does not allow hot connections, then decision **420** branches to "no" branch **425** whereupon, at predefined process **490**, the MCU is reset (see **Figure 2** and corresponding text for reset processing details). On the other hand, if the device allows hot connections, then decision **420** branches to "yes" branch **430** whereupon, at step

435, the first circuit (e.g., the BDC circuit) signals that synchronization is in progress with an external device (sync_in_prog) and, at step **440**, the device attempts to synchronize with the external device, such as a pod.

[0023] A determination is made as to whether the device (MCU) successfully synchronized with the external device (decision **445**). If the device did not establish a successful synchronization, then decision **445** branches to “no” branch **450** whereupon, at predefined process **490**, the MCU is reset (see **Figure 2** and corresponding text for reset processing details). On the other hand, if a successful synchronization was established between the device (MCU) and the external device (pod), then decision **445** branches to “yes” branch **455** whereupon, at step **460**, a command is received from the external device within a preset number of cycles.

[0024] A determination is made as to whether an enablement command was received (within the preset number of cycles) to enable the first circuit (decision **465**). If the enablement command was not received in the preset number of cycles, then decision **465** branches to “no” branch **470** whereupon, at predefined process **490**, the MCU is reset (see **Figure 2** and corresponding text for reset processing details). On the other hand, if the enablement command was received within the preset number of cycles, then decision **465** branches to “yes” branch **475** whereupon, at step **480**, the first circuit (e.g., the BDC circuit) is enabled by setting a control bit (e.g., ENBDM) and the MCU continues running in normal mode. Hot connection processing thereafter ends at **495**. At this point, the user could enter commands through the common pin to read and write memory locations or force the MCU into active background mode.

[0025] **Figure 5** is a flowchart showing communications between the external device and the MCU’s Background Debug Controller (BDC). Processing that takes place at the external device, such as a pod, is shown commencing at **500**, while the processing that takes place at the device (MCU) is shown commencing at **550**. At step **505**, the external device receives a command. In one embodiment, a user interacts with an interface, such as a keyboard, attached to the external

device to generate the input. A determination is made as to whether the input that was received is requesting that the device (MCU) be reset (decision **510**). If the request is not to reset the MCU, then decision **510** branches to “no” branch **515** whereupon, at step **520**, the external device sends valid signals (e.g., valid Background Debug Mode (BDM) signals) over the common (shared) pin to the device (MCU). On the other hand, if the request received at the external device is to reset the attached MCU, then decision **510** branches to “yes” branch **525** whereupon, at step **530**, the external device aborts any activity that was currently being performed and, at step **540**, the external device (pod) sends a reset signal on the common (shared) pin to the device (MCU). In one embodiment, the reset signal is a low pulse which is not a valid BDM signal.

[0026] Turning now to the device’s (MCU’s) handling of the signals, MCU processing commences at **550** whereupon, at step **560**, the signals sent over the common (shared) pin are received at step **560**. A determination is made as to whether a bad signal has been received over the common pin (decision **570**). In one embodiment, a bad signal is a low pulse signal or any signal that is not a valid BDM signal. If a bad signal has not been received, then decision **570** branches to “no” branch **575** whereupon, at step **580**, the first circuit (e.g., the Background Debug Controller circuit) handles the command and then loops back to receive and process the next signal received at the common pin. This looping continues until a bad signal is received at the common pin, in which case decision **570** branches to “yes” branch **585** causing the MCU to reset (predefined process **590**, see **Figure 2** and corresponding text for processing details). As is explained in the description of **Figure 2**, during reset processing the first circuitry (e.g., the BDC circuit) is disabled and can be subsequently enabled if the MCU is successfully synchronized with an external device, such as a pod.

[0027] **Figure 6** is a block diagram of a data processing system in which the methods described herein can be implemented. **Figure 6** illustrates, in block diagram form, a data processing system **610** in accordance with one embodiment of the present invention. Data processing system **610** can be any processing system such as a microcontroller, microprocessor, digital signal processor (DSP), or the

like. Data processing system **610** includes CPU **612**, clock unit **619**, memory module **616**, peripheral modules **618** and **620**, internal address bus **622**, internal data bus **624**, and control signals **626**. CPU **612** includes background debug controller (BDC) circuitry **614** and reset circuitry **750**. Common pin **604** is a serial communication interface connected to both BDC **614** and reset circuitry **750**. Internal data bus **624**, internal address bus **622**, and control signals **626** are coupled between CPU **612** and each of the peripheral modules on data processing system **610**. Clock unit **619** is coupled to CPU **612** via control signals **626** and to BDC circuitry and the reset circuitry with signals **606** and **755**. Clock unit **619** also includes interface signals **608** and **609** for coupling to an oscillator circuit (not shown).

[0028] In operation, CPU **612** receives and executes instructions from a software program stored in memory module **616** via data bus **624**. CPU **612** then directs or uses other resources of the data processing system to perform certain tasks. Memory module **616** may be any type of memory including, but not limited to, static random access memory, dynamic random access memory, or any type of non-volatile memory, such as for example, flash or EEPROM. Peripheral modules **618** and **620** are additional modules, such as for example, another memory module, an analog-to-digital converter, a timer module, a serial communications module, for example, a general purpose input/output module, or the like.

[0029] Clock unit **619** provides clock signals (**606** and **755**) to BDC **614** and reset circuitry **750**, respectively. Clock unit **619** also receives and provides control signals via control signals **626**. For example, clock unit **619** provides clock signals to CPU **612** and receives a STOP signal via control signals **626**. Clock unit **619** also provides system clocks to CPU **612**, BDC **614**, reset circuitry **750**, memory module **616**, and peripheral modules **618** and **620**.

[0030] **Figure 7** is a block diagram illustrating the background debug system and reset circuitry of **Figure 6**. **Figure 7** illustrates one embodiment of BDC **614** and reset circuitry **750** of **Figure 6** in more detail. Common interface pin **604**, which

receives signals from an external host development system (i.e. an external debug host system such as a pod), is coupled to serial command decoder block **710**, command response block **712**, synchronization (sync) detect block **714**, and synchronization (sync) response block **716**. Background debug clock signal **606** controls the timing of operations in serial command decoder block **710**, command response block **712**, sync detect block **714**, and sync response block **716**. Command response block **712** is also coupled to data bus **624** and control signals **626** to allow serial background commands to read or write memory and register values or to initiate debug commands such as GO, TRACE, or enter-active-BACKGROUND. Serial command decoder **710** is also coupled to BDM enable circuitry **703** which provides EN_BDM **765** (enable background debug mode) to reset circuitry **750**.

[0031] BDM enable circuitry **703** may include a control register for storing EN_BDM **765** as one of its control bits or may include other circuitry designed to assert EN_BDM **765**. In one embodiment, EN_BDM **765** may be a bit stored in a control register that is only accessible by a background debug command issued by a host development system via common interface pin **604**. This prevents user code from being able to purposely or inadvertently assert EN_BDM **765** and engage a STOP signal override (not shown). In alternate embodiments, EN_BDM **765** may not be stored as a control bit and may instead be asserted by logic circuitry that detects when valid debug communications are taking place via common interface pin **604**. Alternate embodiments may use different mechanisms and circuitries, other than those described in reference to BDM enable circuitry **703**, for asserting EN_BDM **765** to enable BDC **614**. In addition, BDM enable circuitry **703** may also include a hot connect control register bit that indicates whether a hot connection is permitted between data processing system **610** and an external device over common interface pin **604** without operating reset circuitry **750**.

[0032] During background debug operations, serial commands and data are received via common interface pin **604** and decoded by serial command decoder **710**. Serial command decoder **710** may send a command address **622** to an address generation unit (not shown) which is located in CPU **612**. Command response

block **712** then performs the requested command using signals in data bus **624** and control signals **626**. For some commands, data is written to data processing system **610** via data bus **624** and control signals **626**. For other commands, data is read from data processing system **610** via data bus **624** and control signals **626** and sent back to the external device, such as a pod, as a serial data stream over common interface pin **604**. In this example protocol, the line coupling an external device to common interface pin **604** is asserted low for 34 cycles and released for 32 cycles during reset circuitry processing. If the common pin is still asserted low after being released for 32 cycles, then an external reset source is assumed and Background Debug Controller **614** attempts to synchronize with an external device over common interface pin **604**.

[0033] Reset circuitry **750** receives sync_in_progress signal **760** from sync detect circuitry when an external device attempts to synchronize with data processing system **610**. Reset circuitry **750** receives system clock signal **755** from clock unit **619** (shown in **Figure 6**). Reset circuitry **750** also receives ENBDM signal **765** from BDM Enable Circuitry **703**. ENBDM signal **765** indicates whether background debug mode has been enabled. Reset circuitry's handling of signals over common interface pin signal **604** are based, in part, on the ENBDM signal. When ENBDM is not set, then a signal received at common pin **604** is treated as a reset signal by reset circuitry **750** resulting in MCU reset signal **770** being asserted. If ENBDM is set, then signals received at common pin **604** are treated as background debug commands that are handled by serial command decoder **710**. If a bad signal is detected by serial command decoder **710**, then BDC signals reset circuitry **750** and reset circuitry **750** performs reset processing which results in the assertion of MCU reset signal **770**. Reset circuitry **750** also receives force reset signal **780** from serial command decoder **710** and sync detect unit **714**. Serial command decoder **710** asserts force reset **780** when a valid BDM command is not received from an external device (e.g., a pod) over common pin **604**. Sync detect unit **714** asserts force reset **780** when the MCU is unable to synchronize with an external device that is attempting to connect to the MCU. Receiving reset signal **780** results in reset circuitry **750** resetting the MCU.

[0034] Although the invention has been described with respect to specific conductivity types or polarity of potentials, skilled artisans appreciate that conductivity types and polarities of potentials may be reversed. For example, signals designed as active high may be designed as active low, and those designed as active low may be designed as active high. One of ordinary skill in the art would understand how to modify the circuitry to accommodate such changes.

[0035] While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from this invention and its broader aspects. Therefore, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention. Furthermore, it is to be understood that the invention is solely defined by the appended claims. It will be understood by those with skill in the art that if a specific number of an introduced claim element is intended, such intent will be explicitly recited in the claim, and in the absence of such recitation no such limitation is present. For non-limiting example, as an aid to understanding, the following appended claims contain usage of the introductory phrases "at least one" and "one or more" to introduce claim elements. However, the use of such phrases should not be construed to imply that the introduction of a claim element by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim element to inventions containing only one such element, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an;" the same holds true for the use in the claims of definite articles.

Claims

What is claimed is:

1. A computer-implemented method comprising:
receiving one or more signals at a common pin included in a microcontroller unit (MCU);
in response to determining that a first circuit has been enabled in the MCU:
analyzing the received signals;
in response to the analysis identifying a command encoded in the received signals, performing the command using the first circuit; and
in response to the analysis not identifying the command, performing a preset function using a second circuit; and
in response to determining that the first circuit has not been enabled at the MCU, performing an alternate function.
2. The method of claim 1 wherein the first circuit is a background debug controller, the command is a background debug command, the second circuit is a reset circuit, and the preset and alternate functions are a reset routine.
3. The method of claim 1 wherein performing the preset function further comprises:
driving the common pin for a first plurality of cycles;
after the driving, releasing the common pin for a second plurality of cycles;
in response to determining that the common pin is still being driven after the releasing, attempting to synchronize with an external device over the common pin; and

enabling the first circuit in response to successfully synchronizing with the external device.

4. The method of claim 1 wherein the first circuit is disabled in response to the analysis not identifying the command encoded in the received signals.
5. The method of claim 1 wherein, the alternate function further includes:
determining whether a hot connection is allowed at the MCU;
in response to determining that the hot connection is allowed:

 attempting to synchronize with an external device over the common pin; and

 in response to successfully synchronizing with the external device, enabling the first circuit in response to receiving an enablement command from the external device within a preset number of cycles.
6. The method of claim 5 further comprising:

in response to determining that the hot connection is not allowed, performing the preset function, wherein the preset function is an MCU reset function;

performing the MCU reset function in response to an unsuccessful synchronization with the external device; and

performing the MCU reset function in response to not receiving the enablement command within the preset number of cycles.
7. The method of claim 5 wherein the first circuit is a background debug controller circuit and the second circuit is a reset circuit, the method further comprising:

after enabling the first circuit, receiving one or more background debug commands over the common pin; and

processing the background debug commands by the background debug controller circuit.

8. The method of claim 7 further comprising:
receiving a bad background debug signal after processing the background debug commands;
in response to receiving the bad background debug signal:
disabling the first circuit; and
resetting the MCU using the reset circuit.
9. A computer-implemented method comprising:
receiving, from an external device, one or more signals at a common pin included in a microcontroller unit (MCU) that includes a first and a second circuit, wherein the first circuit is initially disabled;
attempting to synchronize with the external device; and
in response to successfully synchronizing with the external device, enabling the first circuit in response to receiving an enablement command from the external device within a preset number of cycles.
10. The method of claim 9 further comprising:
performing the second function in response to an unsuccessful synchronization with the external device, wherein the preset function is an MCU reset function; and
performing the MCU reset function in response to not receiving the enablement command within the preset number of cycles.
11. The method of claim 10 further comprising:
after enabling the first circuit, receiving one or more command signals at the common pin; and
processing, by the enabled first circuit, commands corresponding to the received command signals.

12. The method of claim 11 further comprising:
receiving a bad signal at the common pin after processing the command signals;
in response to receiving the bad signal:
disabling the first circuit; and
invoking the second circuit.
13. A data processing system comprising:
a processor used to execute a plurality of instructions;
a clock unit that sets one or more clock cycles;
a first circuit connected to the processor;
a second circuit connected to the processor;
a plurality of interface pins, wherein one of the interface pins is a common pin shared by the first and second circuits;
enablement circuitry that operates to enable processing of command signals received at the common pin by the first circuit when an external device, connected to the interface pins, is successfully synchronized with the data processing system; and
operation of the second circuit when signals are received at the common pin that are not processed by the first circuit.
14. The data processing system of claim 13 wherein the first circuit is a background debug controller circuit, the command signals correspond to background debug commands, and the second circuit is a reset circuit.
15. The data processing system of claim 13 wherein operation of the second circuit further comprises:
logic that drives the common pin for a first plurality of clock cycles;

after the driving, logic that releases the common pin for a second plurality of clock cycles;

synchronization logic that determines that the common pin is still low after the second plurality of clock cycles and attempts to synchronize with the external device over the common pin; and

enablement logic operated by the enablement circuitry that enables the first circuit in response to successfully synchronizing with the external device.

16. The data processing system of claim 13 wherein operation of the first circuit further comprises:

logic that disables the first circuit in response to receiving a bad command signal at the common pin.

17. The data processing system of claim 13 further comprising:

a register connected to the processor that includes a hot connection bit that indicates whether a hot connection is allowed by the data processing system;

hot connection logic that attempts to synchronize with the external device over the common pin when the hot connection bit is set; and

enablement logic operated by the enablement circuitry that enables the first circuit when an enablement command is received at the common pin within a preset number of clock cycles after the data processing system is successfully synchronized with the external device.

18. The data processing system of claim 17 further comprising:

logic to operate the second circuit when a signal is received at the common pin and the hot connection bit is not set;

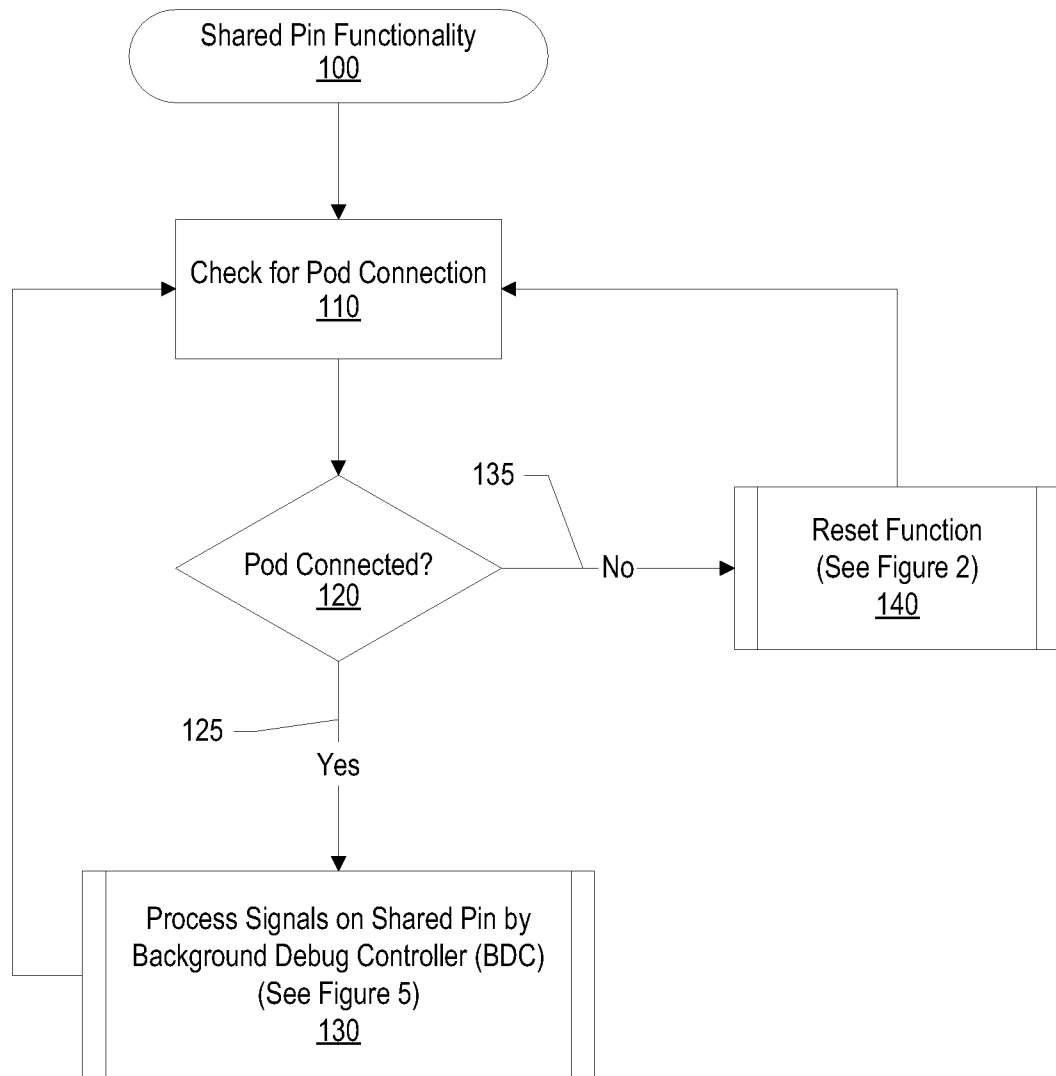
logic to operate the second circuit in response to an unsuccessful synchronization between the data processing system and the external device; and

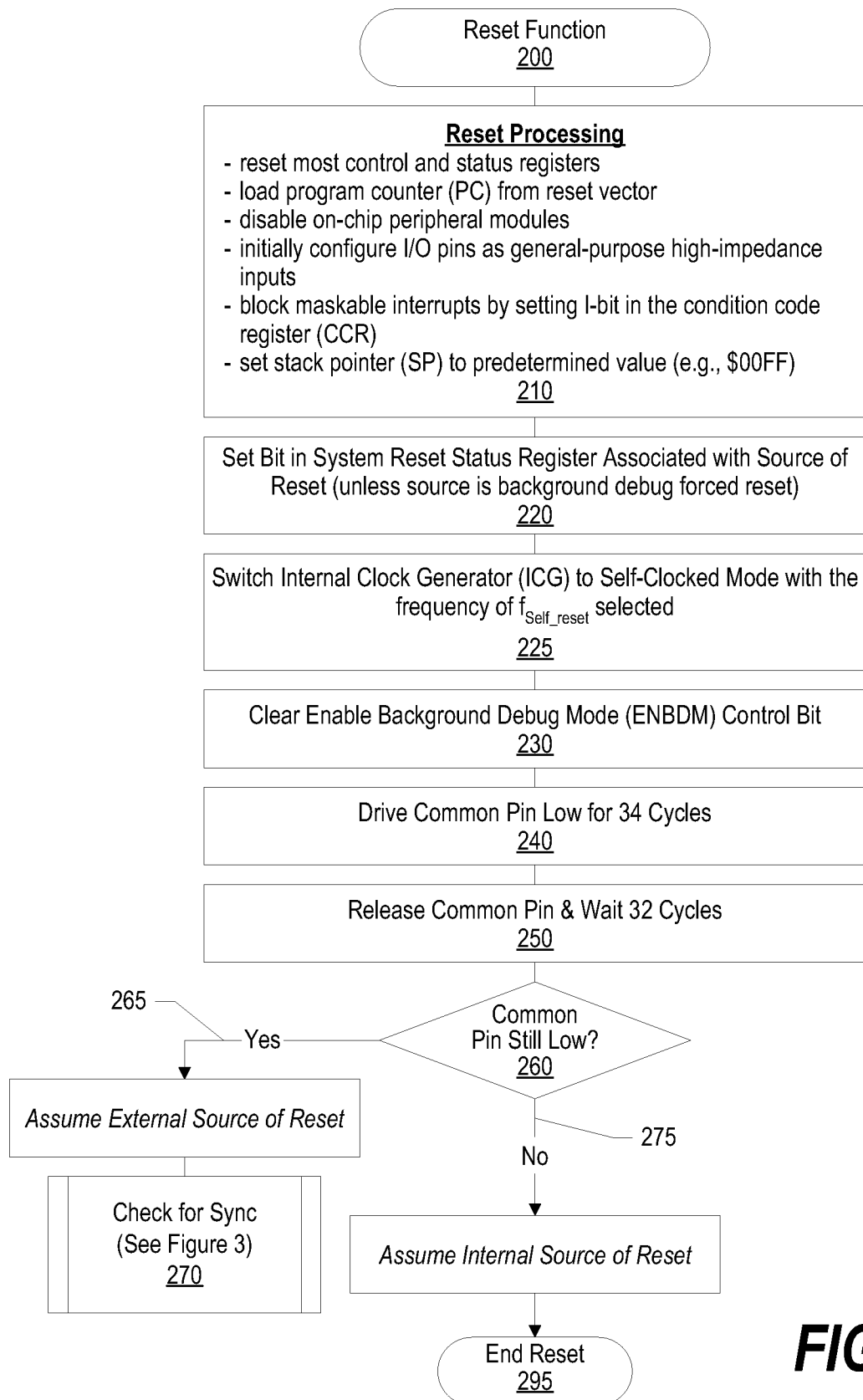
logic to operate the second circuit in response to not receiving the enablement command within the preset number of clock cycles.

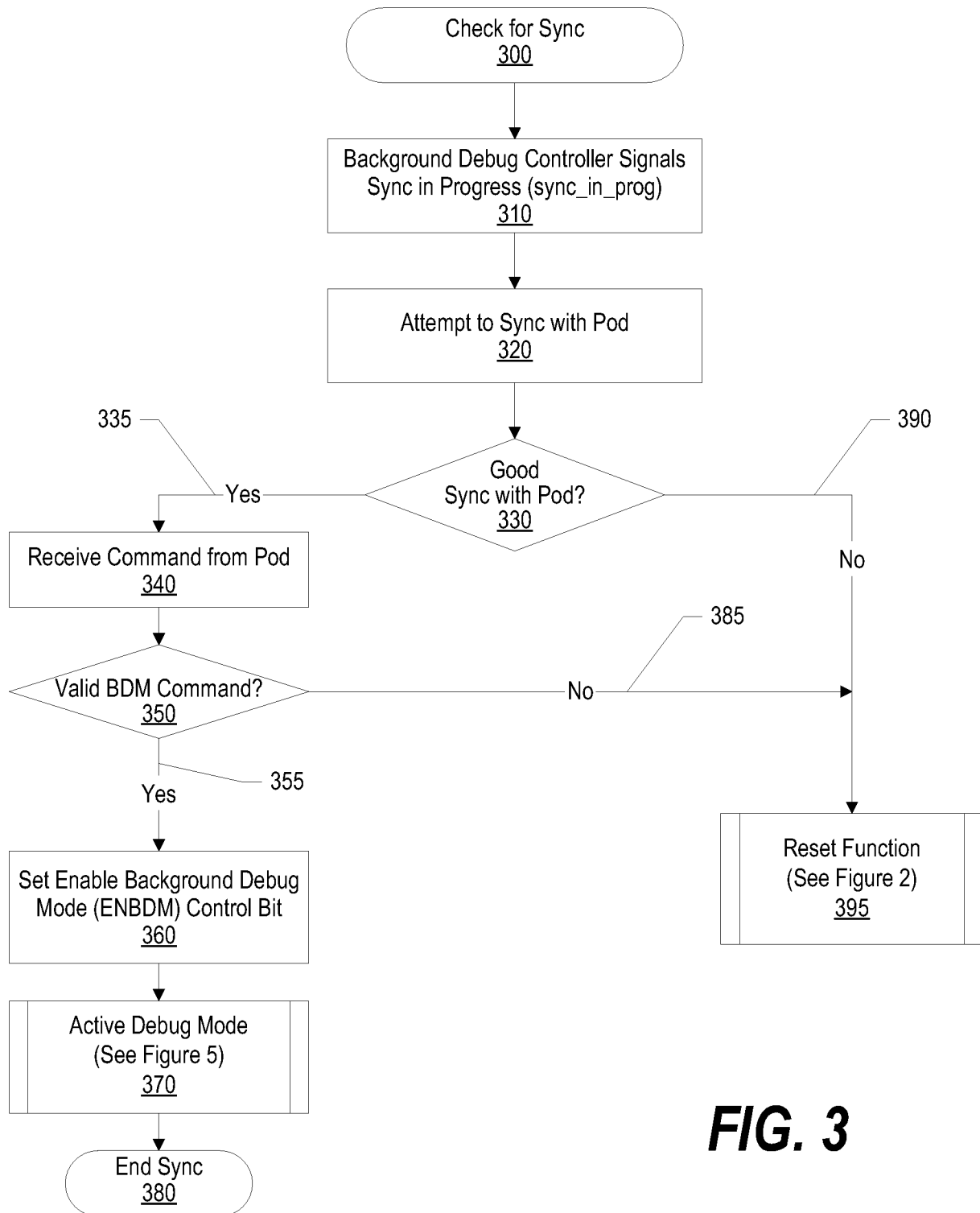
19. The data processing system of claim 17 wherein the first circuit is a background debug controller circuit and the second circuit is a reset circuit, the microcontroller unit further comprising:

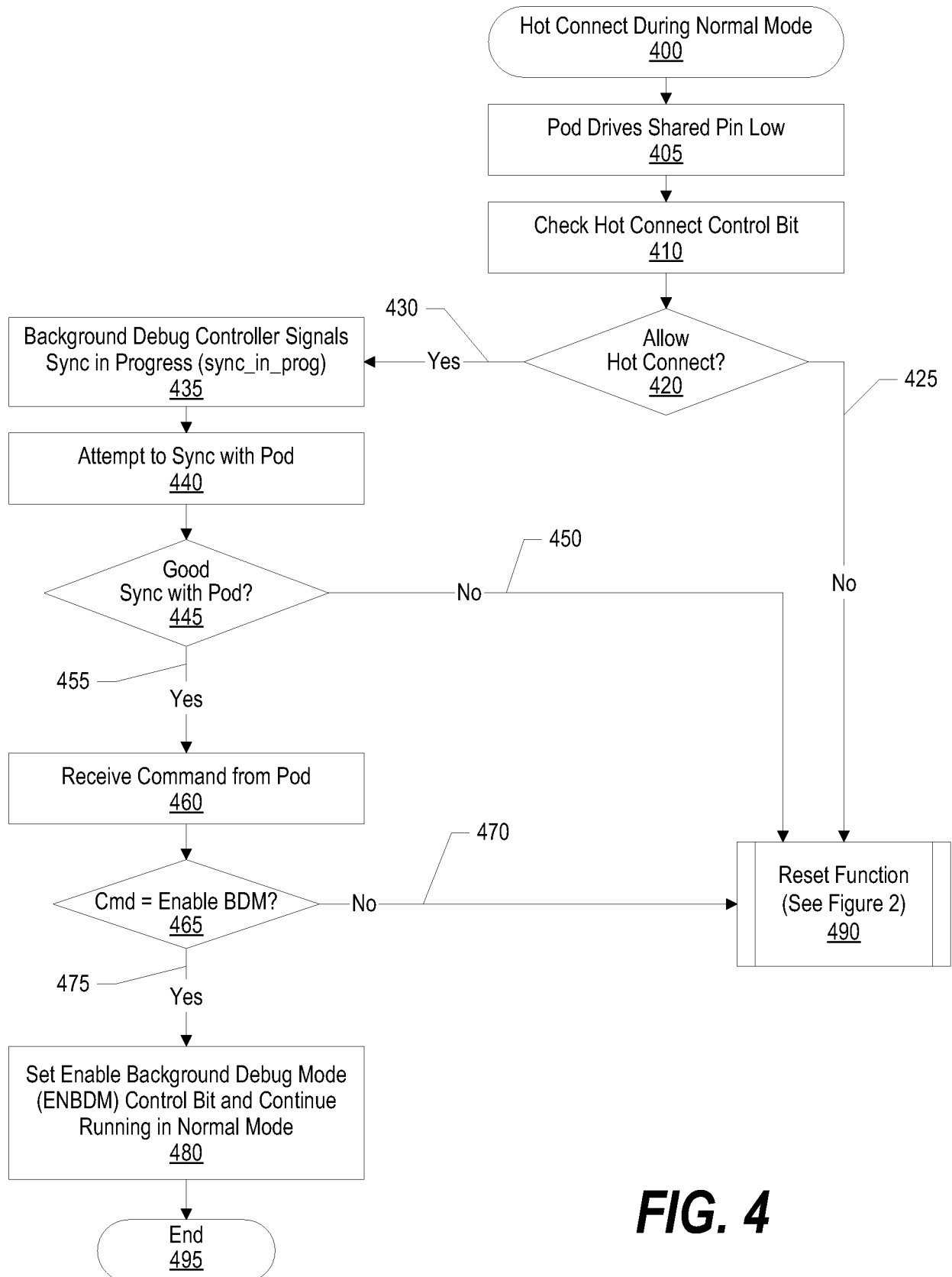
analysis logic that identifies a bad command signal received at the common pin after the external device is successfully synchronized with the data processing system; and

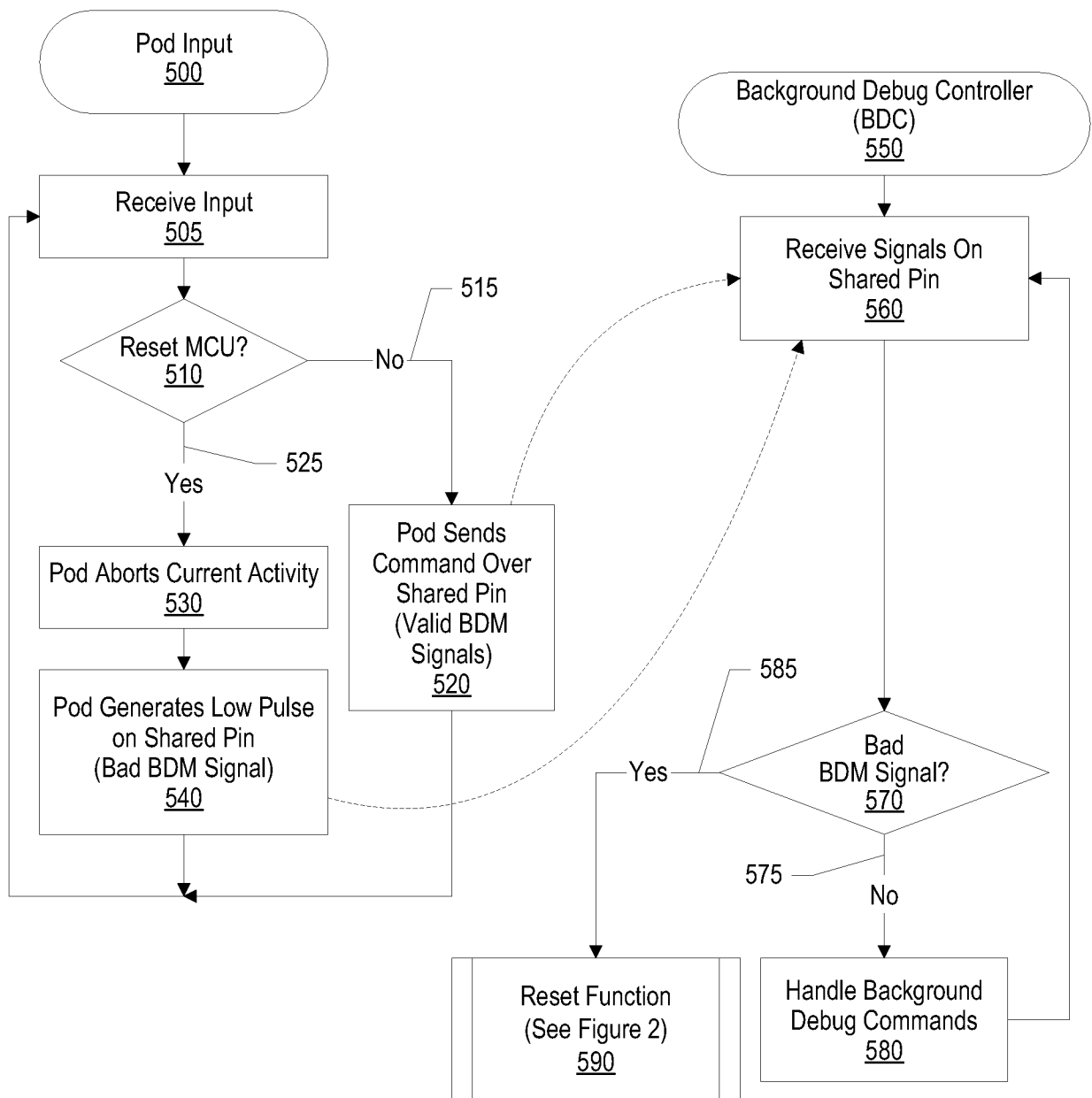
disablement logic that operates the second circuit and disables the first circuit in response to identifying the bad command signal.
20. The data processing system of claim 19 wherein the external device is a pod and wherein the number of interface pins is less than or equal to 8.

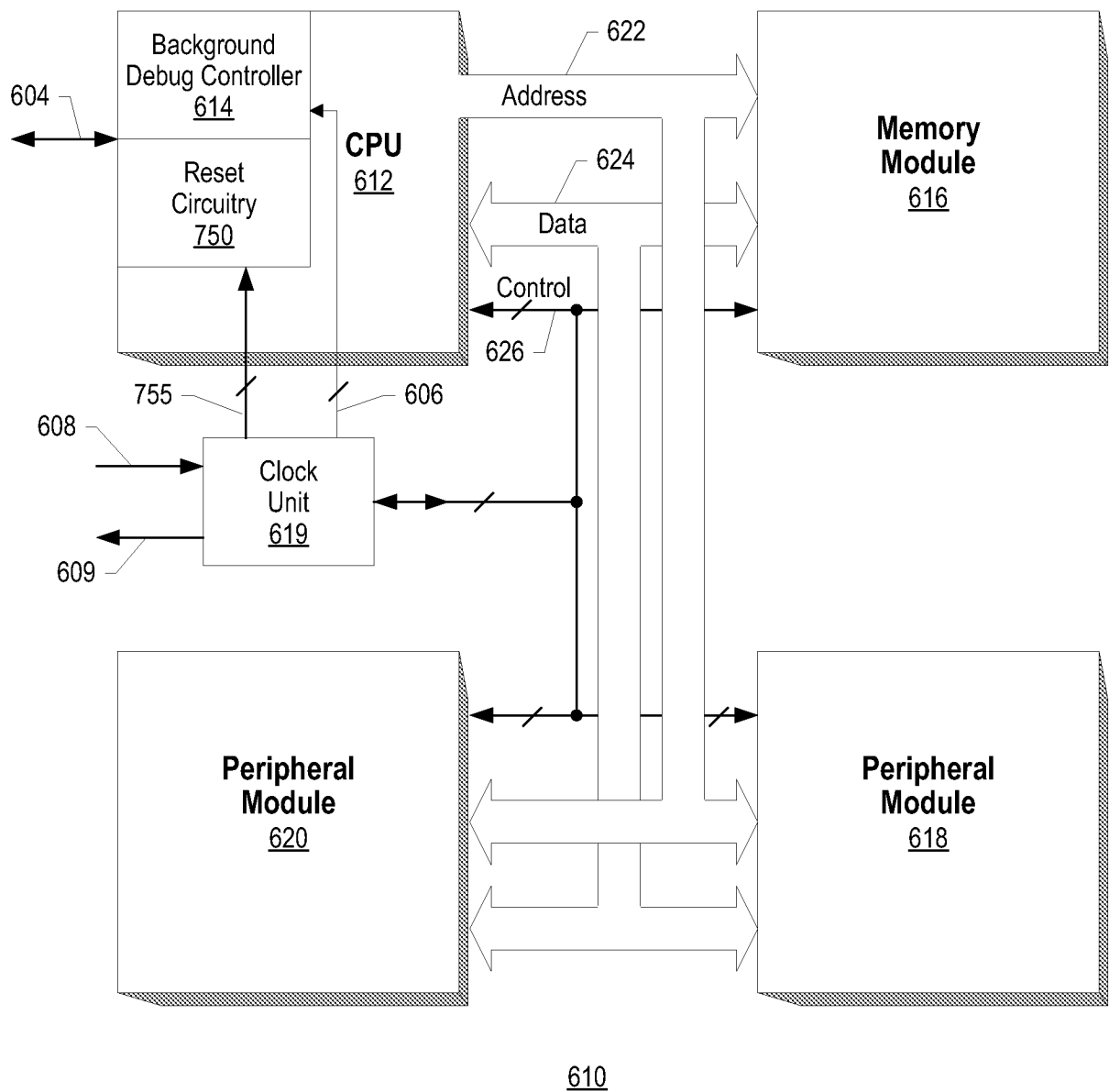
**FIG. 1**

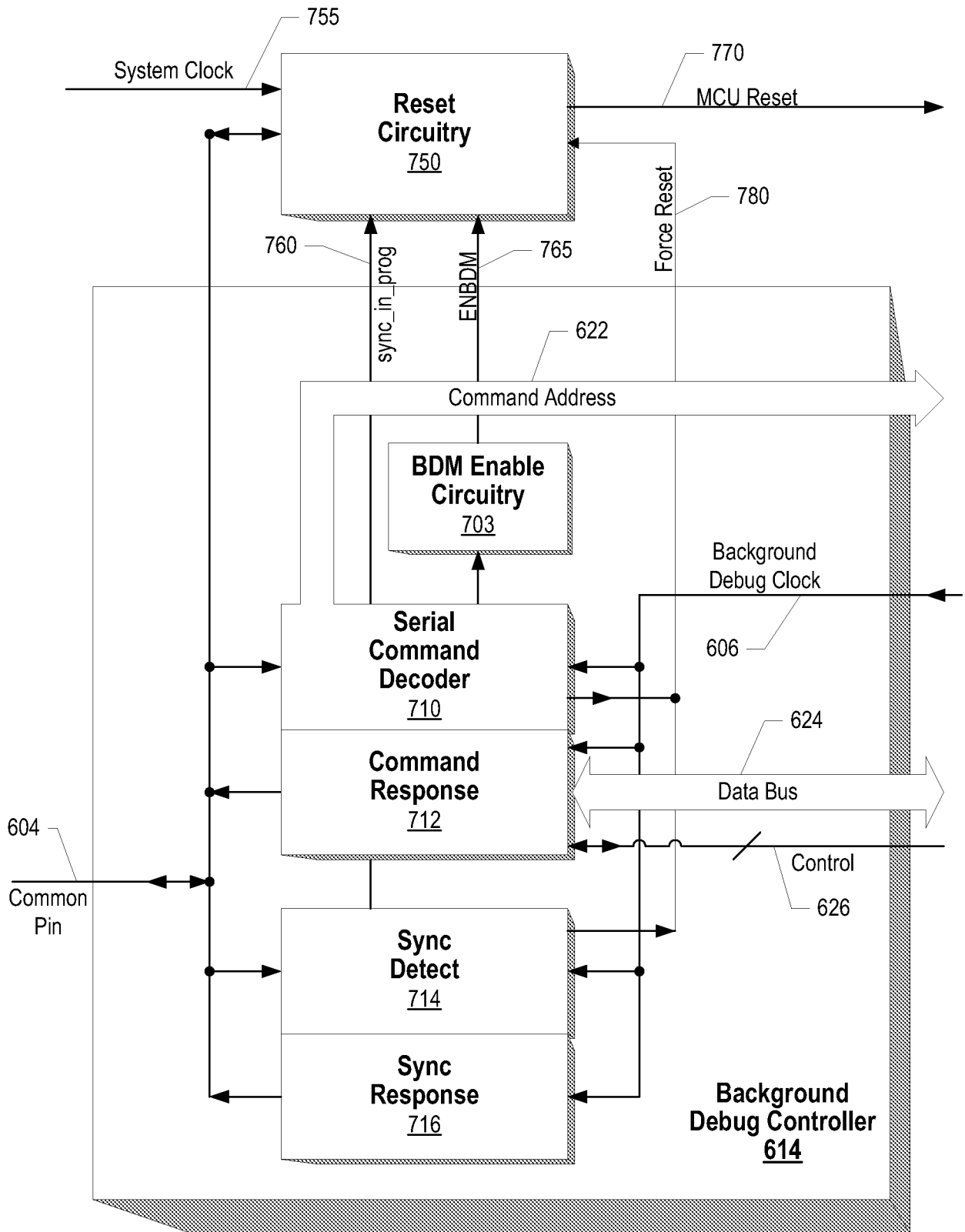
**FIG. 2**

**FIG. 3**

**FIG. 4**

**FIG. 5**

**Fig. 6**

**Fig. 7**