Functional Safety Information

DRV81602-Q1, DRV81242-Q1, DRV81620-Q1 and DRV81080-Q1
Functional Safety FIT Rate, FMD and Pin FMA

TEXAS INSTRUMENTS

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1 Overview

This document contains information for the DRV81602-Q1 (24-pin HTSSOP (PWP) package) and variants DRV81242-Q1, DRV81620-Q1, and DRV81080-Q1 to aid in a functional safety system design. Information provided are:

- Functional safety failure in time (FIT) rates of the semiconductor component estimated by the application of industry reliability standards
- Component failure modes and distribution (FMD) based on the primary function of the device
- Pin failure mode analysis (pin FMA)

The following figures show the device functional block diagrams for reference, where VM or VM_xx are the supply pins from the battery and the VDD is the digital logic supply. The VM pins also have voltage monitoring on the supply function referenced as VM in this document.
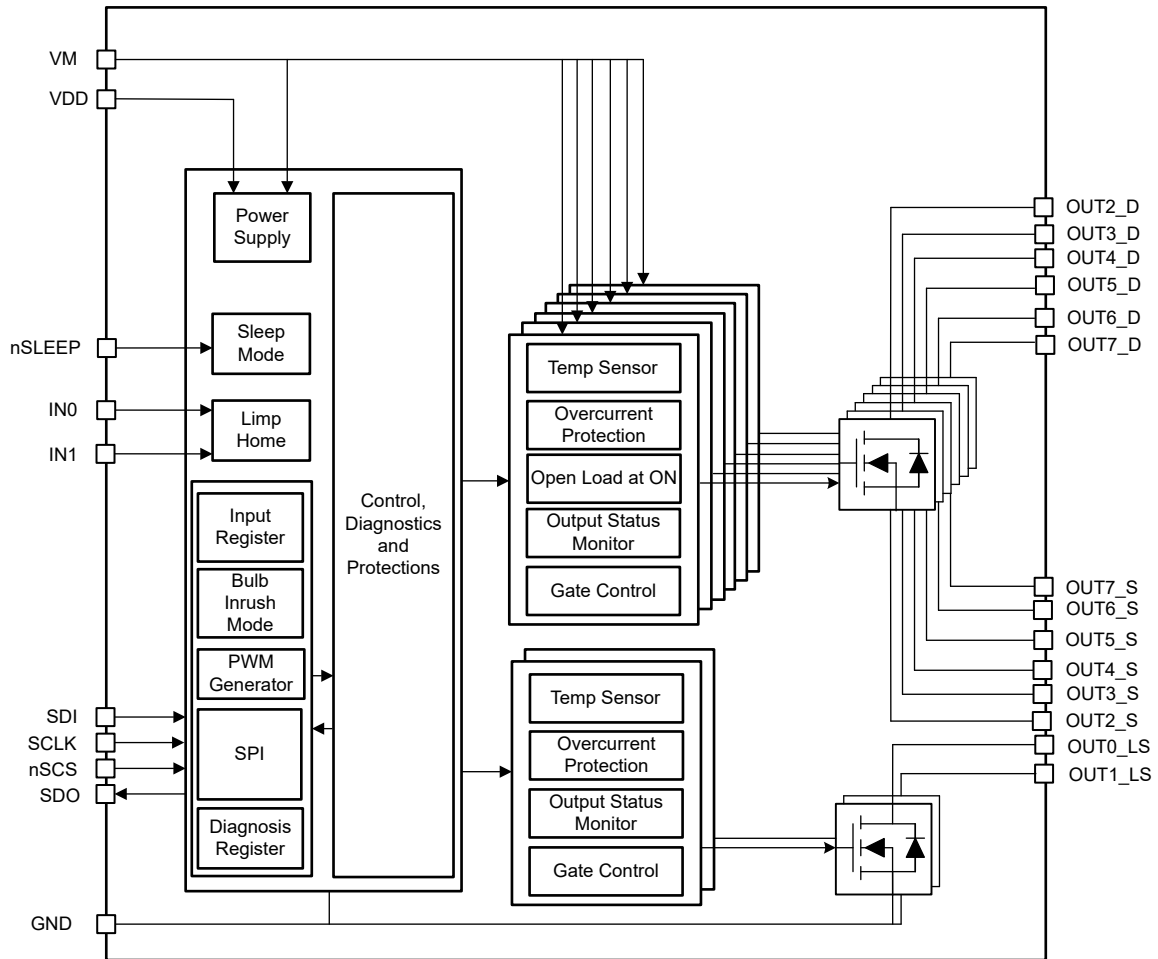

Figure 1-1. DRV81602-Q1 Functional Block Diagram
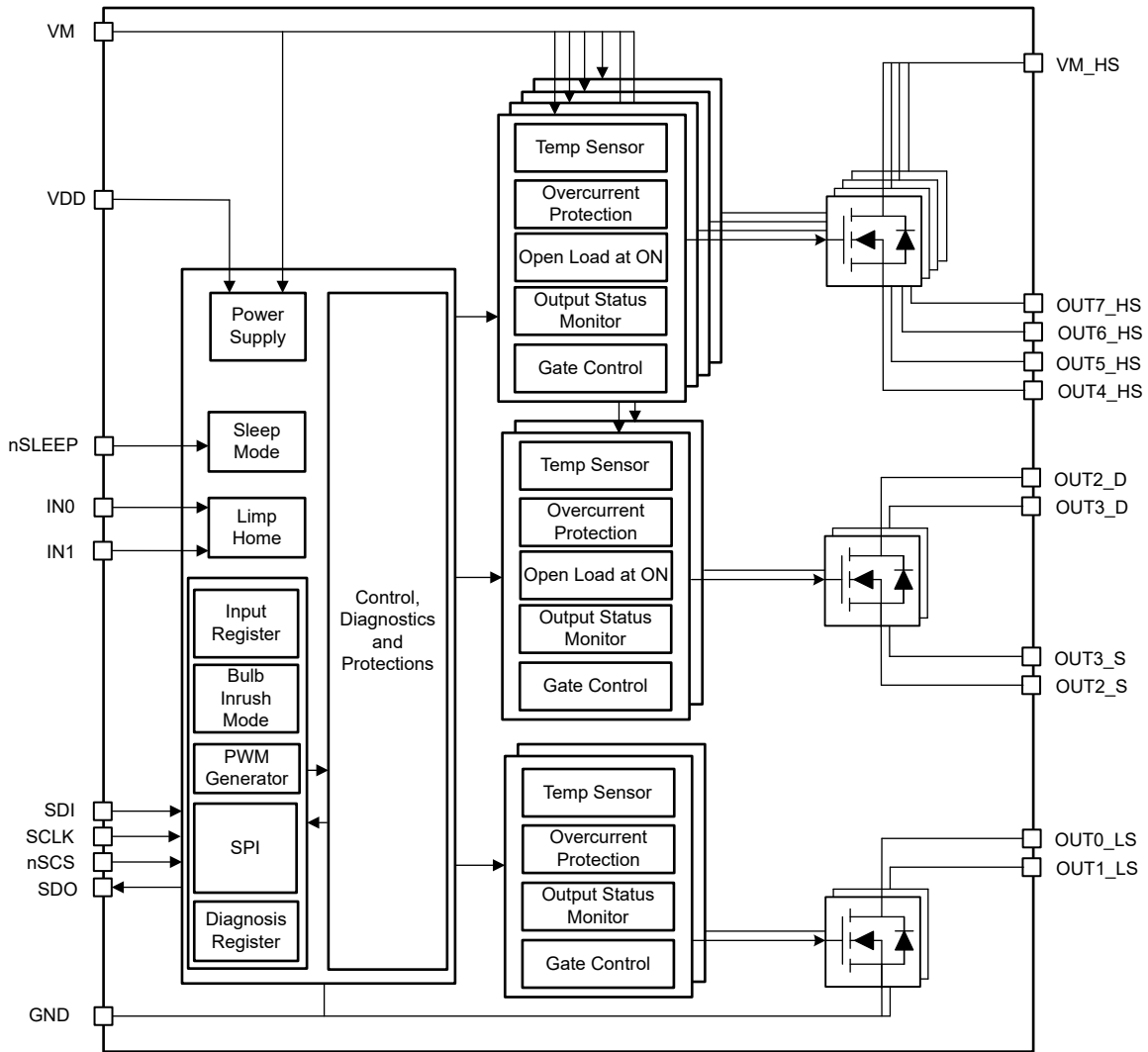
Figure 1-2. DRV81242-Q1 Functional Block Diagram
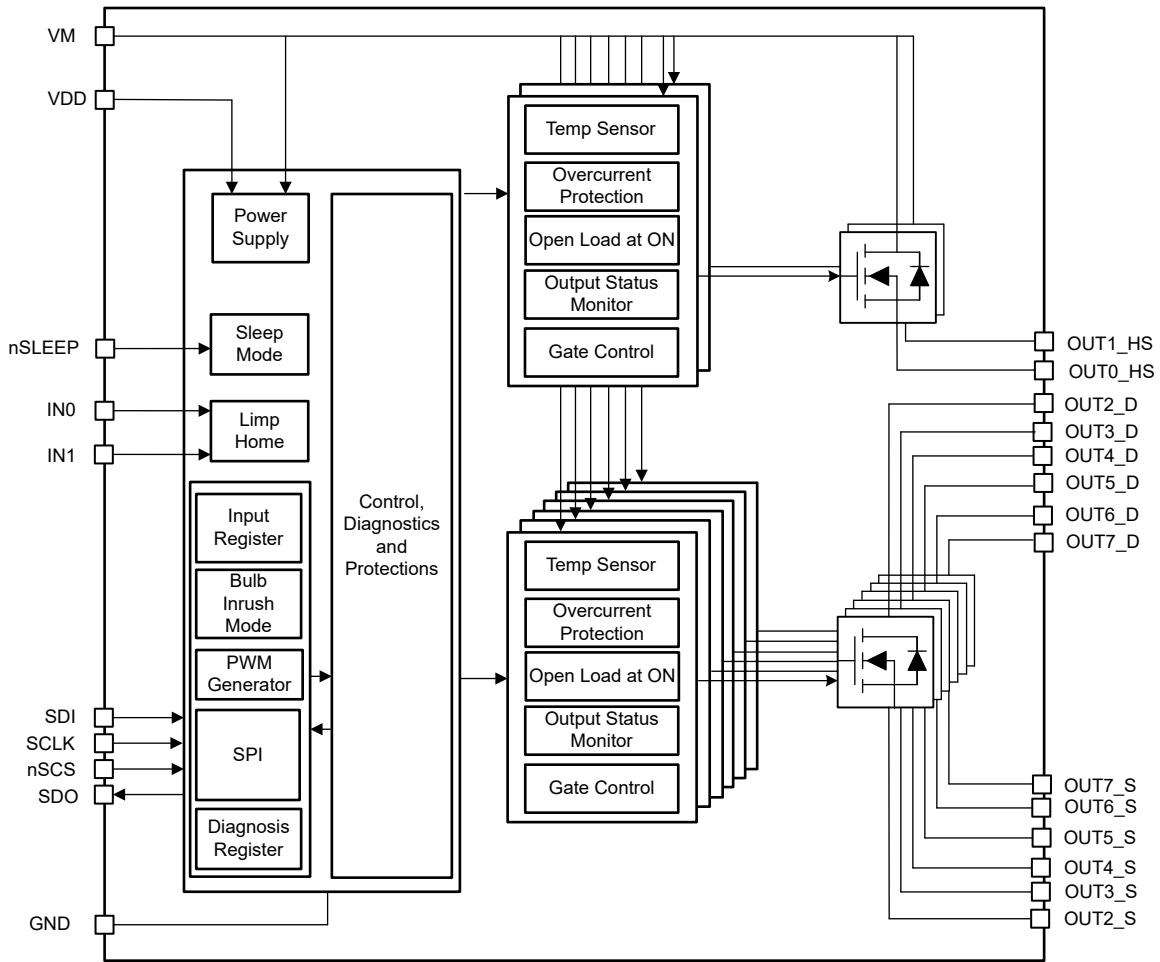
Figure 1-3. DRV81620-Q1 Functional Block Diagram

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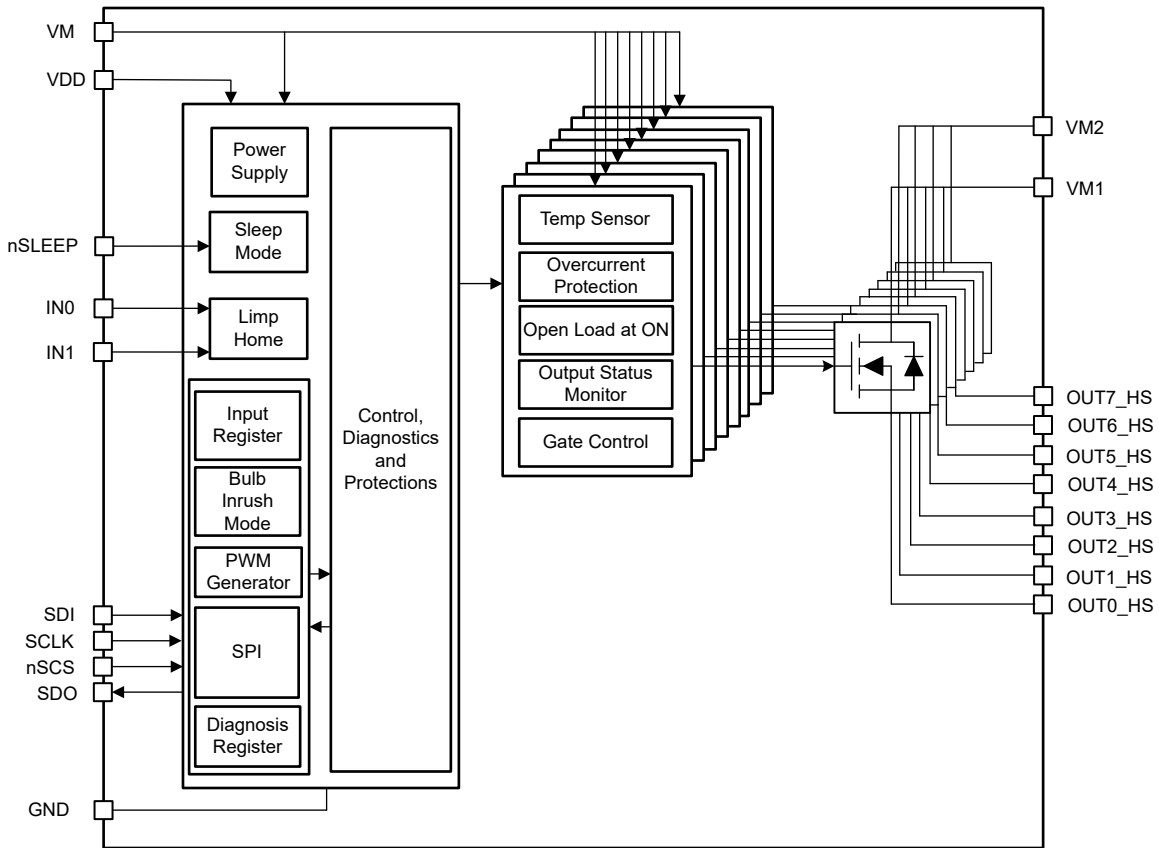
Figure 1-4. DRV81080-Q1 Functional Block Diagram

DRV81602-Q1 and variants DRV81242-Q1, DRV81620-Q1, and DRV81080-Q1 were developed using a quality-managed development process, but were not developed in accordance with the IEC 61508 or ISO 26262 standards.

2 Functional Safety Failure In Time (FIT) Rates

This section provides functional safety failure in time (FIT) rates for the DRV81602-Q1 and device variants DRV81242-Q1, DRV81620-Q1, and DRV81080-Q1; based on two different industry-wide used reliability standards:

- Table 2-1 provides FIT rates based on IEC TR 62380 / ISO 26262 part 11
- Table 2-2 provides FIT rates based on the Siemens Norm SN 29500-2

Table 2-1. Component Failure Rates per IEC TR 62380 / ISO 26262 Part 11

FIT IEC TR 62380 / ISO 26262	FIT (Failures Per 10^9 Hours)
Total component FIT rate	23
Die FIT rate	7
Package FIT rate	16

The failure rate and mission profile information in Table 2-1 comes from the reliability data handbook IEC TR 62380 / ISO 26262 part 11:

- Mission profile: Motor control from table 11 or figure 16
- Power dissipation: 1W
- Climate type: World-wide table 8 or figure 13
- Package factor (lambda 3): Table 17b or figure 15
- Substrate material: FR4
- EOS FIT rate assumed: 0 FIT

Table 2-2. Component Failure Rates per Siemens Norm SN 29500-2

Table	Category	Reference FIT Rate	Reference Virtual T_J
5	CMOS, BICMOS Digital, analog, or mixed	25 FIT	55°C

The reference FIT rate and reference virtual T_J (junction temperature) in Table 2-2 come from the Siemens Norm SN 29500-2 tables 1 through 5. Failure rates under operating conditions are calculated from the reference failure rate and virtual junction temperature using conversion information in SN 29500-2 section 4.

3 Failure Mode Distribution (FMD)

The failure mode distribution estimation for the DRV81602-Q1 and device variants in Table 3-1 comes from the combination of common failure modes listed in standards such as IEC 61508 and ISO 26262, the ratio of sub-circuit function size and complexity, and from best engineering judgment.

The failure modes listed in this section reflect random failure events and do not include failures resulting from misuse or overstress.

Table 3-1. Die Failure Modes and Distribution

Die Failure Modes	Failure Mode Distribution (%)
OUT is stuck LOW when commanded OFF	8
OUT is stuck OFF when commanded LOW	8
OUT ON resistance is too high when commanded LOW	5
OUT slew rate is too fast or too slow	5
OUT is stuck HIGH when commanded OFF	8
OUT is stuck OFF when commanded HIGH	8
OUT ON resistance is too high when commanded HIGH	5
Incorrect fault indication	25
Incorrect operation of the clamp circuit	4
Incorrect operation of other features (BIM, PWM, and so forth)	24

4 Pin Failure Mode Analysis (Pin FMA)

This section provides a failure mode analysis (FMA) for the pins of the DRV81602-Q1 and for the device variations DRV81242-Q1, DRV81620-Q1, and DRV81080-Q1. The failure modes covered in this document include the typical pin-by-pin failure scenarios:

- Pin short-circuited to ground (see Table 4-2, Table 4-6, Table 4-10, and Table 4-14)
- Pin open-circuited (see Table 4-3, Table 4-7, Table 4-11, and Table 4-15)
- Pin short-circuited to an adjacent pin (see Table 4-4, Table 4-8, Table 4-12, and Table 4-16)
- Pin short-circuited to supply (see Table 4-5, Table 4-9, Table 4-13, and Table 4-17)

Table 4-2 through Table 4-17 also indicate how these pin conditions can affect the device as per the failure effects classification in Table 4-1.

Table 4-1. TI Classification of Failure Effects

Class	Failure Effects
A	Potential device damage that affects functionality.
B	No device damage, but loss of functionality.
C	No device damage, but performance degradation.
D	No device damage, no impact to functionality or performance.

Following are the assumptions of use and the device configuration assumed for the pin FMA in this section:

- The device is used with external components consistent with the values described in the external component table of the datasheet.

4.1 DRV81602-Q1 Pin FMA

Figure 4-1 shows the DRV81602-Q1 pin diagram for the 24-pin HTSSOP (PWP) package. For a detailed description of the device pins, see the *Pin Configuration and Functions* section in the DRV81602-Q1 datasheet.
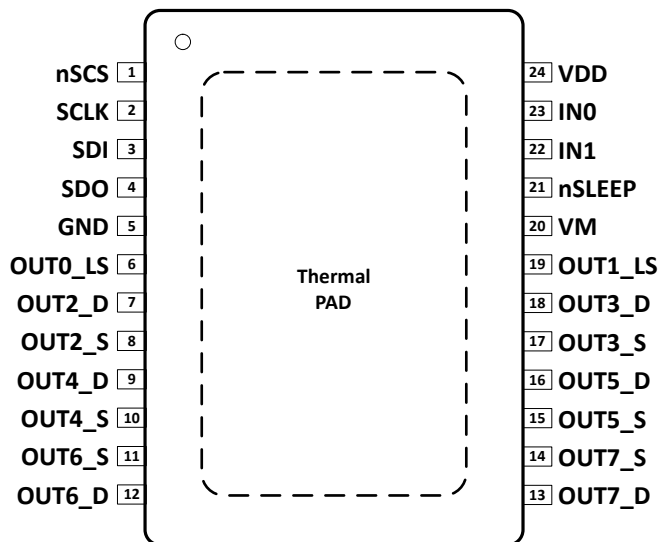

Figure 4-1. DRV81602-Q1 Pin Diagram

Table 4-2. Pin FMA for Device Pins Short-Circuited to Ground

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	The device operates as intended.	D
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
OUT4_D	9	There is a loss of load control.	B
OUT4_S	10	There is a loss of load control.	B
OUT6_S	11	There is a loss of load control.	B
OUT6_D	12	There is a loss of load control.	B
OUT7_D	13	There is a loss of load control.	B
OUT7_S	14	There is a loss of load control.	B
OUT5_S	15	There is a loss of load control.	B
OUT5_D	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-3. Pin FMA for Device Pins Open-Circuited

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	There is a loss of load control.	B
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
OUT4_D	9	There is a loss of load control.	B
OUT4_S	10	There is a loss of load control.	B
OUT6_S	11	There is a loss of load control.	B
OUT6_D	12	There is a loss of load control.	B
OUT7_D	13	There is a loss of load control.	B
OUT7_S	14	There is a loss of load control.	B
OUT5_S	15	There is a loss of load control.	B
OUT5_D	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-4. Pin FMA for Device Pins Short-Circuited to Adjacent Pin

Pin Name	Pin No.	Shorted to Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	2	SPI communication is not functional.	B
SCLK	2	3	SPI communication is not functional.	B
SDI	3	4	SPI communication is not functional.	B
SDO	4	5	SPI communication is not functional.	B
GND	5	6	There is a loss of load control.	B
OUT0_LS	6	7	There is a loss of load control.	B
OUT2_D	7	8	There is a loss of load control.	B
OUT2_S	8	9	There is a loss of load control.	B
OUT4_D	9	10	There is a loss of load control.	B
OUT4_S	10	11	There is a loss of load control.	B
OUT6_S	11	12	There is a loss of load control.	B
OUT6_D	12	13	There is a loss of load control.	B
OUT7_D	13	14	There is a loss of load control.	B
OUT7_S	14	15	There is a loss of load control.	B
OUT5_S	15	16	There is a loss of load control.	B
OUT5_D	16	17	There is a loss of load control.	B
OUT3_S	17	18	There is a loss of load control.	B
OUT3_D	18	19	There is a loss of load control.	B
OUT1_LS	19	20	There is a loss of load control.	B
VM	20	21	False faults are potentially detected on the VM pin.	B
nSLEEP	21	22	There is a loss of load control.	B
IN1	22	23	There is a loss of load control.	B
IN0	23	24	There is a loss of load control.	B
VDD	24	1	SPI communication is not functional.	B

Table 4-5. Pin FMA for Device Pins Short-Circuited to Supply

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	The maximum voltage of the low voltage pin is violated.	A
SCLK	2	The maximum voltage of the low voltage pin is violated.	A
SDI	3	The maximum voltage of the low voltage pin is violated.	A
SDO	4	The maximum voltage of the low voltage pin is violated.	A
GND	5	The voltage monitor indicates an undervoltage warning for the supply functions.	B
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
OUT4_D	9	There is a loss of load control.	B
OUT4_S	10	There is a loss of load control.	B
OUT6_S	11	There is a loss of load control.	B
OUT6_D	12	There is a loss of load control.	B
OUT7_D	13	There is a loss of load control.	B
OUT7_S	14	There is a loss of load control.	B
OUT5_S	15	There is a loss of load control.	B
OUT5_D	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The device operates as intended.	D
nSLEEP	21	There is no impact to the functions of the device.	D
IN1	22	The maximum voltage of the low voltage pin is violated.	A
IN0	23	The maximum voltage of the low voltage pin is violated.	A
VDD	24	The maximum voltage of the low voltage pin is violated.	A

4.2 DRV81242-Q1 Pin FMA

Figure 4-2 shows the DRV81242-Q1 pin diagram for the 24-pin HTSSOP (PWP) package. For a detailed description of the device pins, see the *Pin Configuration and Functions* section in the DRV81242-Q1 datasheet.
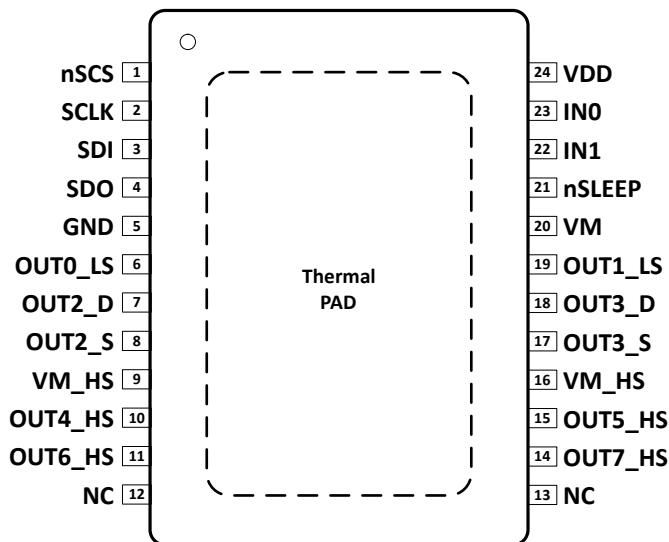

Figure 4-2. DRV81242-Q1 Pin Diagram

Table 4-6. Pin FMA for Device Pins Short-Circuited to Ground

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	The device operates as intended.	D
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
VM_HS	9	The voltage monitor indicates an undervoltage warning for the supply functions.	B
OUT4_HS	10	There is a loss of load control.	B
OUT6_HS	11	There is a loss of load control.	B
NC	12	There is no impact to the functions of the device.	D
NC	13	There is no impact to the functions of the device.	D
OUT7_HS	14	There is a loss of load control.	B
OUT5_HS	15	There is a loss of load control.	B
VM_HS	16	The voltage monitor indicates an undervoltage warning for the supply functions.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-7. Pin FMA for Device Pins Open-Circuited

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	There is a loss of load control.	B
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
VM_HS	9	There is a loss of load control.	B
OUT4_HS	10	There is a loss of load control.	B
OUT6_HS	11	There is a loss of load control.	B
NC	12	There is no impact to the functions of the device.	D
NC	13	There is no impact to the functions of the device.	D
OUT7_HS	14	There is a loss of load control.	B
OUT5_HS	15	There is a loss of load control.	B
VM_HS	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-8. Pin FMA for Device Pins Short-Circuited to Adjacent Pin

Pin Name	Pin No.	Shorted to Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	2	SPI communication is not functional.	B
SCLK	2	3	SPI communication is not functional.	B
SDI	3	4	SPI communication is not functional.	B
SDO	4	5	SPI communication is not functional.	B
GND	5	6	There is a loss of load control.	B
OUT0_LS	6	7	There is a loss of load control.	B
OUT2_D	7	8	There is a loss of load control.	B
OUT2_S	8	9	There is a loss of load control.	B
VM_HS	9	10	There is a loss of load control.	B
OUT4_HS	10	11	There is a loss of load control.	B
OUT6_HS	11	12	There is no impact to the functions of the device.	D
NC	12	13	There is no impact to the functions of the device.	D
NC	13	14	There is no impact to the functions of the device.	D
OUT7_HS	14	15	There is a loss of load control.	B
OUT5_HS	15	16	There is a loss of load control.	B
VM_HS	16	17	There is a loss of load control. The voltage monitor indicates an undervoltage warning for the supply functions.	B
OUT3_S	17	18	There is a loss of load control.	B
OUT3_D	18	19	There is a loss of load control.	B
OUT1_LS	19	20	There is a loss of load control.	B
VM	20	21	False faults are potentially detected on the VM pin.	B
nSLEEP	21	22	There is a loss of load control.	B
IN1	22	23	There is a loss of load control.	B
IN0	23	24	There is a loss of load control.	B
VDD	24	1	SPI communication is not functional.	B

Table 4-9. Pin FMA for Device Pins Short-Circuited to Supply

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	The maximum voltage of the low voltage pin is violated.	A
SCLK	2	The maximum voltage of the low voltage pin is violated.	A
SDI	3	The maximum voltage of the low voltage pin is violated.	A
SDO	4	The maximum voltage of the low voltage pin is violated.	A
GND	5	The voltage monitor indicates an undervoltage warning for the supply functions.	B
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
VM_HS	9	The device operates as intended.	D
OUT4_HS	10	There is a loss of load control.	B
OUT6_HS	11	There is a loss of load control.	B
NC	12	There is no impact to the functions of the device.	D
NC	13	There is no impact to the functions of the device.	D
OUT7_HS	14	There is a loss of load control.	B
OUT5_HS	15	There is a loss of load control.	B
VM_HS	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The device operates as intended.	D
nSLEEP	21	There is no impact to the functions of the device.	D
IN1	22	The maximum voltage of the low voltage pin is violated.	A
IN0	23	The maximum voltage of the low voltage pin is violated.	A
VDD	24	The maximum voltage of the low voltage pin is violated.	A

4.3 DRV81620-Q1 Pin FMA

Figure 4-3 shows the DRV81620-Q1 pin diagram for the 24-pin HTSSOP (PWP) package. For a detailed description of the device pins, see the *Pin Configuration and Functions* section in the DRV81620-Q1 datasheet.
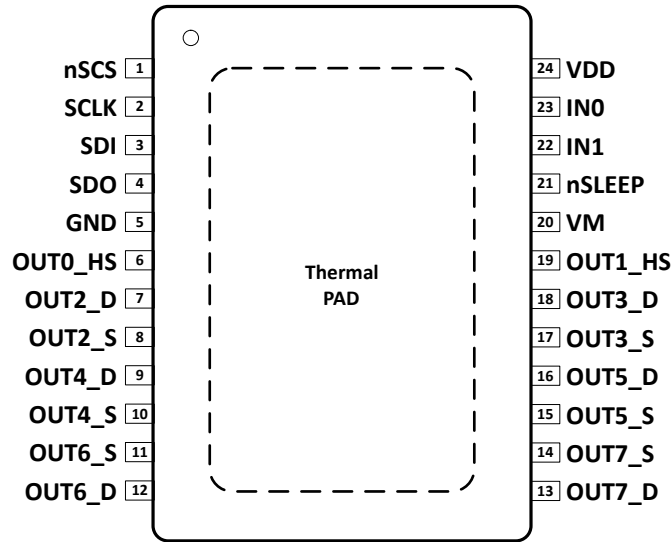
nSCS 1	24 VDD
SCLK 2	23 IN0
SDI 3	22 IN1
SDO 4	21 nSLEEP
GND 5	20 VM
OUT0_HS 6	19 OUT1_HS
OUT2_D 7	**Thermal PAD** 18 OUT3_D
OUT2_S 8	17 OUT3_S
OUT4_D 9	16 OUT5_D
OUT4_S 10	15 OUT5_S
OUT6_S 11	14 OUT7_S
OUT6_D 12	13 OUT7_D

Figure 4-3. DRV81620-Q1 Pin Diagram

Table 4-10. Pin FMA for Device Pins Short-Circuited to Ground

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	The device operates as intended.	D
OUT0_HS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
OUT4_D	9	There is a loss of load control.	B
OUT4_S	10	There is a loss of load control.	B
OUT6_S	11	There is a loss of load control.	B
OUT6_D	12	There is a loss of load control.	B
OUT7_D	13	There is a loss of load control.	B
OUT7_S	14	There is a loss of load control.	B
OUT5_S	15	There is a loss of load control.	B
OUT5_D	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_HS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-11. Pin FMA for Device Pins Open-Circuited

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	There is a loss of load control.	B
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
OUT4_D	9	There is a loss of load control.	B
OUT4_S	10	There is a loss of load control.	B
OUT6_S	11	There is a loss of load control.	B
OUT6_D	12	There is a loss of load control.	B
OUT7_D	13	There is a loss of load control.	B
OUT7_S	14	There is a loss of load control.	B
OUT5_S	15	There is a loss of load control.	B
OUT5_D	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-12. Pin FMA for Device Pins Short-Circuited to Adjacent Pin

Pin Name	Pin No.	Shorted to Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	2	SPI communication is not functional.	B
SCLK	2	3	SPI communication is not functional.	B
SDI	3	4	SPI communication is not functional.	B
SDO	4	5	SPI communication is not functional.	B
GND	5	6	There is a loss of load control.	B
OUT0_LS	6	7	There is a loss of load control.	B
OUT2_D	7	8	There is a loss of load control.	B
OUT2_S	8	9	There is a loss of load control.	B
OUT4_D	9	10	There is a loss of load control.	B
OUT4_S	10	11	There is a loss of load control.	B
OUT6_S	11	12	There is a loss of load control.	B
OUT6_D	12	13	There is a loss of load control.	B
OUT7_D	13	14	There is a loss of load control.	B
OUT7_S	14	15	There is a loss of load control.	B
OUT5_S	15	16	There is a loss of load control.	B
OUT5_D	16	17	There is a loss of load control.	B
OUT3_S	17	18	There is a loss of load control.	B
OUT3_D	18	19	There is a loss of load control.	B
OUT1_LS	19	20	There is a loss of load control.	B
VM	20	21	False faults are potentially detected on the VM pin.	B
nSLEEP	21	22	There is a loss of load control.	B
IN1	22	23	There is a loss of load control.	B
IN0	23	24	There is a loss of load control.	B
VDD	24	1	SPI communication is not functional.	B

Table 4-13. Pin FMA for Device Pins Short-Circuited to Supply

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	The maximum voltage of the low voltage pin is violated.	A
SCLK	2	The maximum voltage of the low voltage pin is violated.	A
SDI	3	The maximum voltage of the low voltage pin is violated.	A
SDO	4	The maximum voltage of the low voltage pin is violated.	A
GND	5	The voltage monitor indicates an undervoltage warning for the supply functions.	B
OUT0_LS	6	There is a loss of load control.	B
OUT2_D	7	There is a loss of load control.	B
OUT2_S	8	There is a loss of load control.	B
OUT4_D	9	There is a loss of load control.	B
OUT4_S	10	There is a loss of load control.	B
OUT6_S	11	There is a loss of load control.	B
OUT6_D	12	There is a loss of load control.	B
OUT7_D	13	There is a loss of load control.	B
OUT7_S	14	There is a loss of load control.	B
OUT5_S	15	There is a loss of load control.	B
OUT5_D	16	There is a loss of load control.	B
OUT3_S	17	There is a loss of load control.	B
OUT3_D	18	There is a loss of load control.	B
OUT1_LS	19	There is a loss of load control.	B
VM	20	The device operates as intended.	D
nSLEEP	21	There is no impact to the functions of the device.	D
IN1	22	The maximum voltage of the low voltage pin is violated.	A
IN0	23	The maximum voltage of the low voltage pin is violated.	A
VDD	24	The maximum voltage of the low voltage pin is violated.	A

4.4 DRV81080-Q1 Pin FMA

Figure 4-4 shows the DRV81080-Q1 pin diagram for the 24-pin HTSSOP (PWP) package. For a detailed description of the device pins, see the *Pin Configuration and Functions* section in the DRV81080-Q1 datasheet.
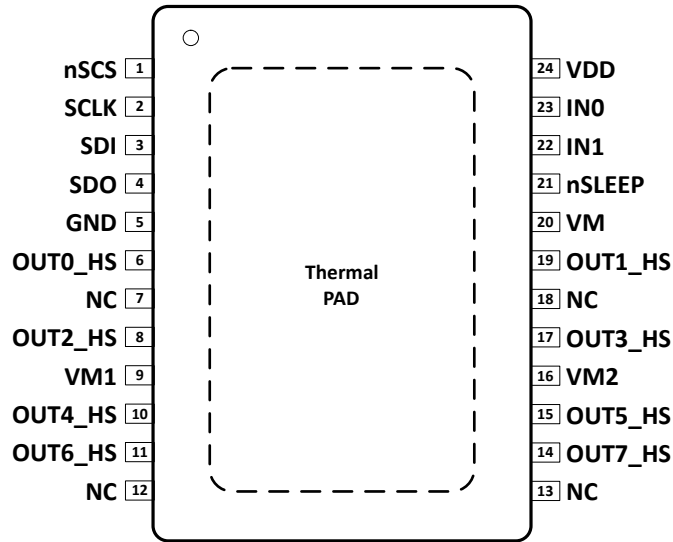

Figure 4-4. DRV81080-Q1 Pin Diagram

Table 4-14. Pin FMA for Device Pins Short-Circuited to Ground

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	The device operates as intended.	D
OUT0_HS	6	There is a loss of load control.	B
NC	7	There is no impact to the functions of the device.	D
OUT2_HS	8	There is a loss of load control.	B
VM1	9	There is a loss of load control.	B
OUT4_HS	10	There is a loss of load control.	B
OUT6_HS	11	There is a loss of load control.	B
NC	12	There is no impact to the functions of the device.	D
NC	13	There is no impact to the functions of the device.	D
OUT7_HS	14	There is a loss of load control.	B
OUT5_HS	15	There is a loss of load control.	B
VM2	16	There is a loss of load control.	B
OUT3_HS	17	There is a loss of load control.	B
NC	18	There is no impact to the functions of the device.	D
OUT1_HS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-15. Pin FMA for Device Pins Open-Circuited

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	SPI communication is not functional.	B
SCLK	2	SPI communication is not functional.	B
SDI	3	SPI communication is not functional.	B
SDO	4	SPI communication is not functional.	B
GND	5	There is a loss of load control.	B
OUT0_HS	6	There is a loss of load control.	B
NC	7	There is no impact to the functions of the device.	D
OUT2_HS	8	There is a loss of load control.	B
VM1	9	There is a loss of load control.	B
OUT4_HS	10	There is a loss of load control.	B
OUT6_HS	11	There is a loss of load control.	B
NC	12	There is no impact to the functions of the device.	D
NC	13	There is no impact to the functions of the device.	D
OUT7_HS	14	There is a loss of load control.	B
OUT5_HS	15	There is a loss of load control.	B
VM2	16	There is a loss of load control.	B
OUT3_HS	17	There is a loss of load control.	B
NC	18	There is no impact to the functions of the device.	D
OUT1_HS	19	There is a loss of load control.	B
VM	20	The voltage monitor indicates an undervoltage warning for the supply functions.	B
nSLEEP	21	SPI communication is not functional.	B
IN1	22	There is a loss of load control.	B
IN0	23	There is a loss of load control.	B
VDD	24	SPI communication is not functional.	B

Table 4-16. Pin FMA for Device Pins Short-Circuited to Adjacent Pin

Pin Name	Pin No.	Shorted to Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	2	SPI communication is not functional.	B
SCLK	2	3	SPI communication is not functional.	B
SDI	3	4	SPI communication is not functional.	B
SDO	4	5	SPI communication is not functional.	B
GND	5	6	There is a loss of load control.	B
OUT0_HS	6	7	There is a loss of load control.	B
NC	7	8	There is no impact to the functions of the device.	D
OUT2_HS	8	9	There is a loss of load control.	B
VM1	9	10	There is a loss of load control.	B
OUT4_HS	10	11	There is a loss of load control.	B
OUT6_HS	11	12	There is no impact to the functions of the device.	D
NC	12	13	There is no impact to the functions of the device.	D
NC	13	14	There is no impact to the functions of the device.	D
OUT7_HS	14	15	There is a loss of load control.	B
OUT5_HS	15	16	There is a loss of load control.	B
VM2	16	17	There is a loss of load control.	B
OUT3_HS	17	18	There is a loss of load control.	B
NC	18	19	There is no impact to the functions of the device.	D
OUT1_HS	19	20	There is a loss of load control.	B
VM	20	21	False faults are potentially detected on the VM pin.	B
nSLEEP	21	22	There is a loss of load control.	B
IN1	22	23	There is a loss of load control.	B
IN0	23	24	There is a loss of load control.	B
VDD	24	1	SPI communication is not functional.	B

Table 4-17. Pin FMA for Device Pins Short-Circuited to Supply

Pin Name	Pin No.	Description of Potential Failure Effects	Failure Effect Class
nSCS	1	The maximum voltage of the low voltage pin is violated.	A
SCLK	2	The maximum voltage of the low voltage pin is violated.	A
SDI	3	The maximum voltage of the low voltage pin is violated.	A
SDO	4	The maximum voltage of the low voltage pin is violated.	A
GND	5	The voltage monitor indicates an undervoltage warning for the supply functions.	B
OUT0_HS	6	There is a loss of load control.	B
NC	7	There is no impact to the functions of the device.	D
OUT2_HS	8	There is a loss of load control.	B
VM1	9	The device operates as intended.	D
OUT4_HS	10	There is a loss of load control.	B
OUT6_HS	11	There is a loss of load control.	B
NC	12	There is no impact to the functions of the device.	D
NC	13	There is no impact to the functions of the device.	D
OUT7_HS	14	There is a loss of load control.	B
OUT5_HS	15	There is a loss of load control.	B
VM2	16	The device operates as intended.	D
OUT3_HS	17	There is a loss of load control.	B
NC	18	There is no impact to the functions of the device.	D
OUT1_HS	19	There is a loss of load control.	B
VM	20	The device operates as intended.	D
nSLEEP	21	There is no impact to the functions of the device.	D
IN1	22	The maximum voltage of the low voltage pin is violated.	A
IN0	23	The maximum voltage of the low voltage pin is violated.	A
VDD	24	The maximum voltage of the low voltage pin is violated.	A

5 Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

DATE	REVISION	NOTES
February 2026	*	Initial Release

IMPORTANT NOTICE AND DISCLAIMER