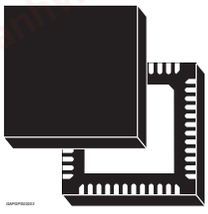
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FDA903Q

1 CH class D digital input automotive power amplifier with diagnostics, load current monitoring wide voltage operation range for car audio and telematic

Data brief



VFQFPN 7x7x1.0 48L
(Exposed pad down)

Features

- AEC-Q100 qualified
- Integrated 108 dB D/A conversion
- I^2S and TDM digital input (4/8/16CH TDM)
- Input sampling frequency: 44.1 kHz, 48 kHz, 96 kHz, 192 kHz
- Full I^2C bus driving (3.3/1.8 V)
- CISPR 25 - Class V (Fourth edition)
- Very low quiescent current
- Output lowpass filter included in the feedback allowing outstanding audio performances
- Wide operating supply range from 3.3 to 18 V, suitable for car radio, telematics and e-call
- MOSFET power outputs allowing high output power capability
  - 1 x 25 W /4 Ω @ 14.4 V, 1 kHz THD = 1%
  - 1 x 31 W /4 Ω @ 14.4 V, 1 kHz THD = 10%
- 2 Ω loads driving
- Amplitude limiter function (configurable through I^2C)
- I^2C bus diagnostics:
  - Short to V_{CC}/GND
  - Short load and open load detection (also in play mode)
  - Four thermal warnings
- DC offset detector (also in play) and 'hot spot' detection
- Clipping detector
- Integrated thermal protection
- Legacy mode ('no I^2C' mode), 4 configurable settings
- Short circuit and ESD integrated protections
- Package: VFQFPN48 exposed pad down

Table 1. Device summary

Order code	Package	Packing
FDA903Q-V0T	VFQFPN48 (exposed pad down)	Tape & reel
FDA903Q-V0Y		Tray

For further information contact your local STMicroelectronics sales office. www.st.com

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Contents

1 **Description** 5

2 **Block diagram** 6

3 **Pin description** 7

4 **Application diagram** 10

5 **Electrical specifications** 11

5.1 Absolute maximum ratings 11

5.2 Maximum operating voltage 12

5.3 Thermal data 12

6 **Package information** 13

6.1 VFQFPN (7x7x1.0 48L - opt. D) package information 13

7 **Revision history** 15

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List of tables

Table 1. Device summary . . . 1
Table 2. Pin list function . . . 7
Table 3. Absolute maximum ratings . . . 11
Table 4. Maximum operating voltage . . . 12
Table 5. Thermal data - QFN48 slug-down package . . . 12
Table 6. VFQFPN (7x7x1.0 48L - opt. D) package mechanical data . . . 14
Table 7. Document revision history . . . 15

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List of figures

Figure 1. Block diagram 6
Figure 2. Pin connection diagram (BOTTOM view) 7
Figure 3. Application diagram 10
Figure 4. VFQFPN (7x7x1.0 48L - opt. D) package outline 13

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1 Description

The FDA903Q is a single bridge class D amplifier, designed in the most advanced BCD technology, intended for any automotive audio application (car radio, telematics and e-call, noise and tone generators, etc).

The FDA903Q integrates a high performance D/A converter together with powerful MOSFET outputs in class D, so it is very compact and powerful, moreover it reaches outstanding efficiency performances (90%).

It has a very wide operating range: it can be operated both with standard car battery levels (5.5-18 V operating, compatible to load dump pulse) and with external step-down generated voltages or emergency battery (since it is compatible to minimum 3.3 V operative).

The feedback loop includes the output L-C low-pass filter, allowing superior frequency response linearity and lower distortion.

FDA903Q is configurable through I^2C bus interface and integrates a complete diagnostics array specially intended for automotive applications including innovative open load and DC offset detection in play mode.

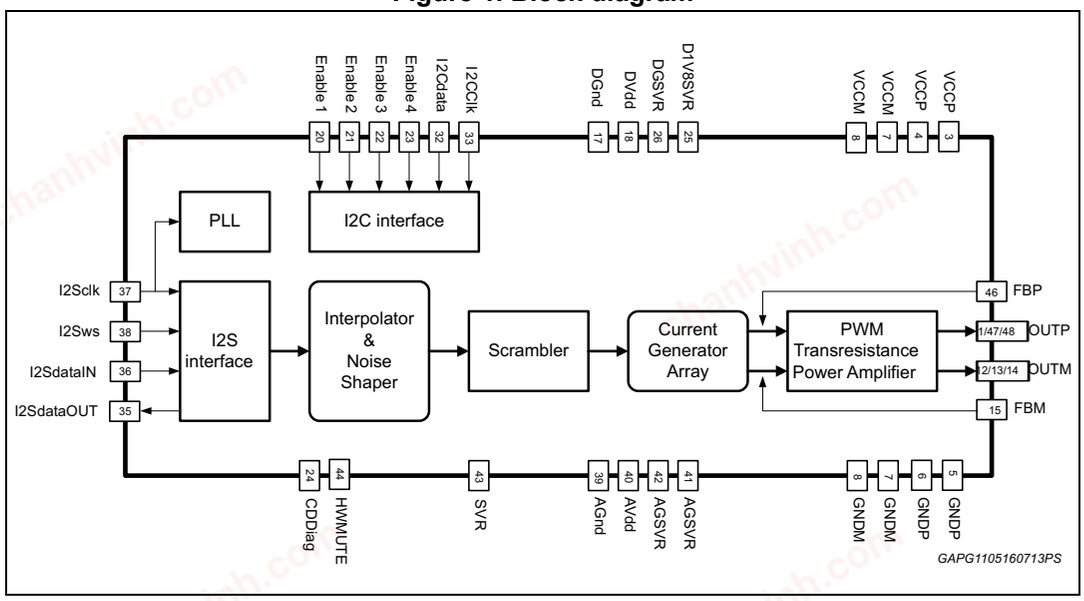
Thanks to the solutions implemented to solve the EMI problems, the device is intended to be used in the standard single DIN car-radio box together with the tuner.

Moreover, FDA903Q features a configurable amplitude limiter function, and can be optionally operated under no I^2C mode ('legacy mode').

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2 Block diagram

Figure 1. Block diagram



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3 Pin description

Figure 2. Pin connection diagram (BOTTOM view)

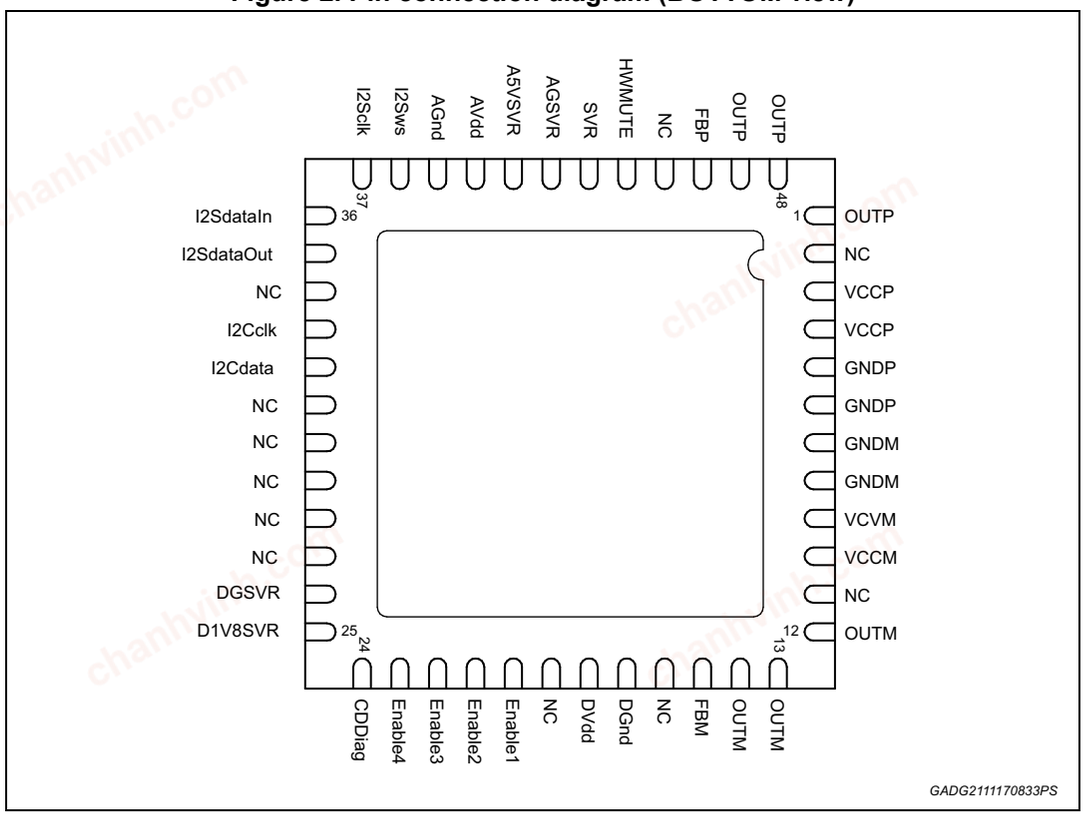


Table 2. Pin list function

N#	Pin	Function	Definition	Internal structure
1	OUTP	Channel half bridge plus	Output	-
2	NC	Not connected	-	-
3	VCCP	Channel half bridge plus	Supply	-
4	VCCP	Channel half bridge plus	Supply	-
5	GNDP	Channel half bridge plus	Supply	-
6	GNDP	Channel half bridge plus	Supply	-
7	GNDM	Channel half bridge minus	Supply	-
8	GNDM	Channel half bridge minus	Supply	-
9	VCCM	Channel half bridge minus	Supply	-
10	VCCM	Channel half bridge minus	Supply	-
11	NC	Not connected	-	-
12	OUTM	Channel half bridge minus	Output	-
13	OUTM	Channel half bridge minus	Output	-

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Table 2. Pin list function (continued)

N#	Pin	Function	Definition	Internal structure
14	OUTM	Channel half bridge minus	Output	-
15	FBM	Channel half bridge minus, Feedback	Input	-
16	NC	Not connected	-	-
17	DGnd	Digital ground	Supply	-
18	DVdd	Digital supply	Supply	-
19	NC	Not connected	-	-
20	Enable1	Enable pin	Input	-
21	Enable2	Enable pin	Input	-
22	Enable3	Enable pin	Input	-
23	Enable4	Enable pin	Input	-
24	CDDiag	Clipping detector and diagnostic	Output	Open-Drain
25	D1V8SVR	Positive digital supply V(SVR) + 0.9 V (Internally generated)	Internal	-
26	DGSVR	Negative digital supply V(SVR) - 0.9 V (Internally generated)	Internal	-
27	NC	Not connected	-	-
28	NC	Not connected	-	-
29	NC	Not connected	-	-
30	NC	Not connected	-	-
31	NC	Not connected	-	-
32	I2Cdata	I^2C Data	Input/Output	Open-Drain
33	I2Cclk	I^2C Clock	Input	-
34	NC	Not connected	-	-
35	I2SdataOut	I^2S/TDM data and PWM synchronization signal	Output	Pull-Up & Pull-Down
36	I2SdataIn	I^2S/TDM data	Input	-
37	I2Sclk	I^2S/TDM Clock	Input	-
38	I2Sws	I^2S/TDM Sync/Word Select	Input	-
39	AGnd	Analog ground	Supply	-
40	AVdd	Analog supply	Supply	-
41	A5VSVR	Positive Analog Supply V(SVR) + 2.5 V (Internally generated)	Internal	-
42	AGSVR	Negative Analog Supply V(SVR) - 2.5 V (Internally generated)	Internal	-
43	SVR	Supply Voltage Ripple Rejection Capacitor	Internal	-
44	HWMUTE	Hardware mute pin	Input	-
45	NC	Not connected	-	-

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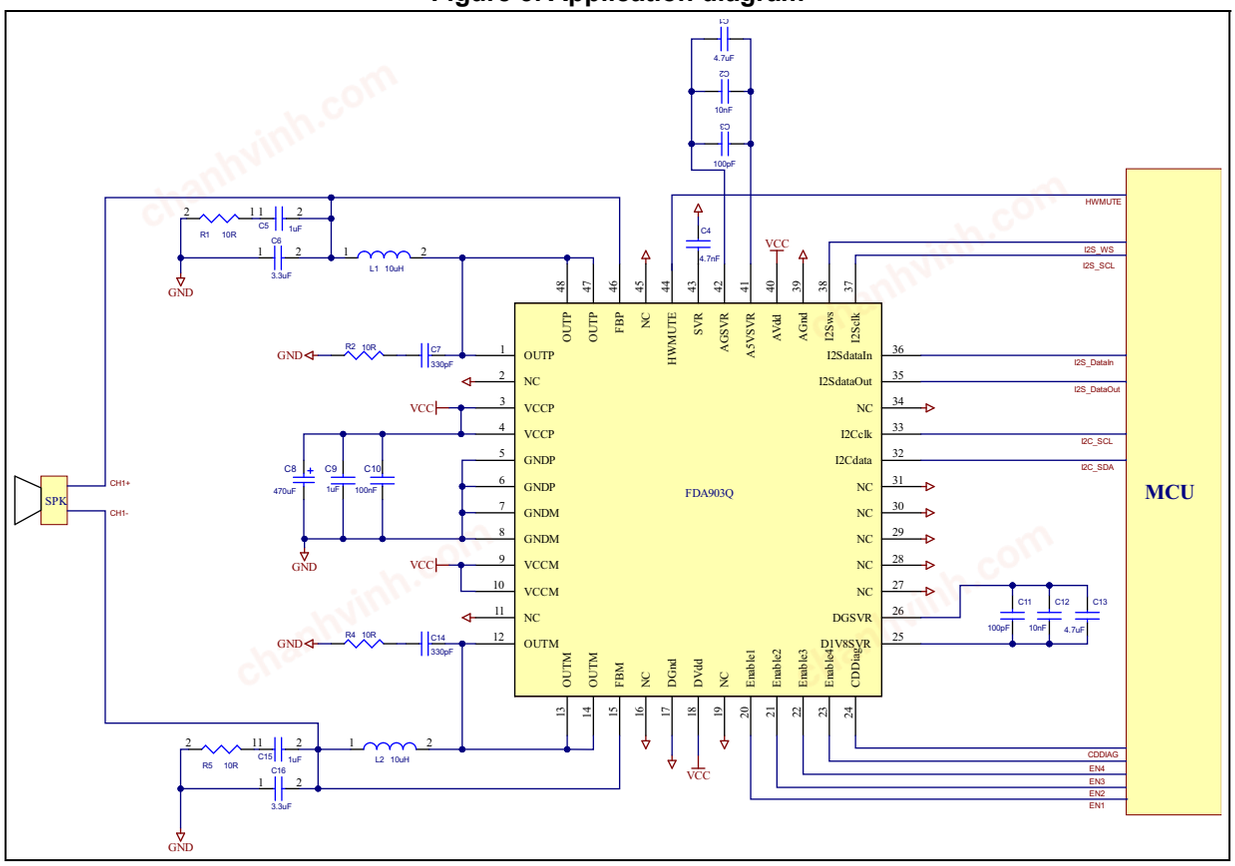
Table 2. Pin list function (continued)

N#	Pin	Function	Definition	Internal structure
46	FBP	Channel half bridge plus, Feedback	Input	-
47	OUTP	Channel half bridge plus	Output	-
48	OUTP	Channel half bridge plus	Output	-

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4 Application diagram

Figure 3. Application diagram



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5 Electrical specifications

5.1 Absolute maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
VCC_{max} [V_{CCP} ,V_{CCM}, A_{VDD}, D_{VDD}]	DC supply voltage	-0.3 to 28	V
	Transient supply voltage for t = 100 ms(1)	-0.3 to 40	V
GND_{max} [D_{GND}, A_{GND}, GNDP, GNDM]	Ground pin voltage difference	-0.3 to 0.3	V
ΔVCC_{max} [DVDD-AVDD, VCCP-DVDD, VCCP-AVDD, VCCM-DVDD, VCCM-AVDD, VCCP-VCCM]	Supply pins voltage difference	-0.3 to 0.3	V
ΔGND_{max} [AGND-DGND, GNDP-AGND, GNDP-DGND, GNDM-DGND, GNDM-AGND, GNDP-GNDM]	Ground pin voltage difference	-0.3 to 0.3	V
V_{I2C} [I2Cdata, I2Cclk]	I^2C bus pins voltage	-0.3 to 5.5	V
V_{I2S} [I2SdataIN, I2SdataOUT, I2Sclk, I2Sws]	I^2S bus pins voltage	-0.3 to 5.5	V
Enable [Enable1, Enable2, Enable3, Enable4]	Enables	-0.3 to 5.5	V
Vmute [HWMute]	Hardware mute	-0.3 to 7	V
VCD [CDDiag]	CD/DIAG pins voltage	-0.3 to 5.5	V
I_o	Output current (repetitive f > 10 Hz)	Internally limited	A
T_{amb}	Ambient operating temperature	-40 to 125	°C
T_{stg}, T_j	Storage and junction temperature	-55 to 150	°C
ESDHBM	ESD protection HBM	2000	V
ESDCDM	ESD protection CDM	500	V

1. V_{CC} = 35 V for t < 400 ms as per ISO16750-2 load dump with centralized load dump suppression.

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5.2 Maximum operating voltage

Table 4. Maximum operating voltage

Symbol	Parameter	Value	Unit
VCC_{max} [V_{CCP} ,V_{CCM}, A_{VDD}, D_{VDD}]	DC supply voltage	18	V
V_{I2C} [I2Cdata, I2Cclk]	I^2C bus pins voltage	3.6	V
V_{I2S} [I2SdataIN, I2Sclk, I2Sws, SyncOUT]	I^2S bus pins voltage	3.6	V
Enable [Enable1, Enable2, Enable3, Enable4]	Enables	3.6	V
Vmute [HWMute]	Hardware mute	5	V
VCD [CDDiag]	CD/DIAG pins voltage	3.6	V

5.3 Thermal data

Table 5. Thermal data - QFN48 slug-down package

Symbol	Parameter	Value	Unit
$R_{th\ j\text{-}a\text{-}2s2pv}$	Thermal resistance junction-to-ambient (2s2p+vias)	28.5	°C/W

Note: 2s2p is referred to a board with 2 layers dedicated to the signals and 2 layers dedicated to the power signals and supplies.

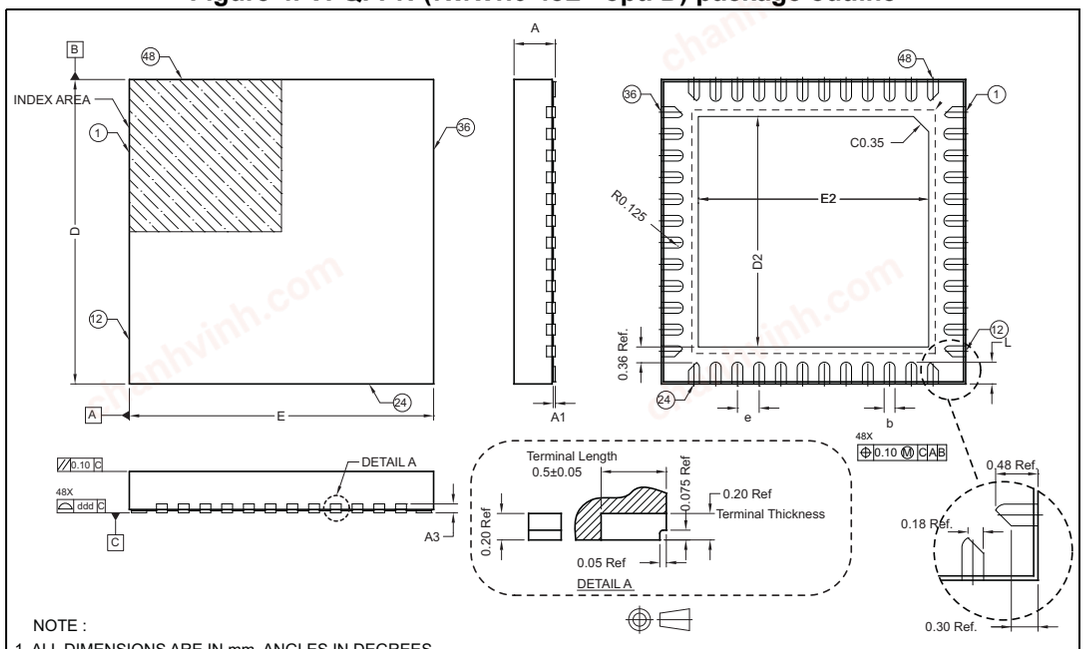
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6 Package information

In order to meet environmental requirements, ST offers these devices in different grades of *ECOPACK* packages, depending on their level of environmental compliance. ECOPACK specifications, grade definitions and product status are available at: *www.st.com*. ECOPACK is an ST trademark.

6.1 VFQFPN (7x7x1.0 48L - opt. D) package information

Figure 4. VFQFPN (7x7x1.0 48L - opt. D) package outline



NOTE :

1. ALL DIMENSIONS ARE IN mm. ANGLES IN DEGREES.
2. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS. COPLANARITY SHALL NOT EXCEED 0.08 mm.
3. WARPAGE SHALL NOT EXCEED 0.10 mm.
4. REFER JEDEC MO-220.

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Table 6. VFQFPN (7x7x1.0 48L - opt. D) package mechanical data

Symbol	Dimensions		
	Min.	Typ.	Max.
A	0.85	0.95	1.05
A1	-	0.00	0.05
A2	-	0.75	-
A3	-	0.20	-
b	0.15	0.25	0.35
D	6.85	7.00	7.15
D2	5.15	5.30	5.45
E	6.85	7.00	7.15
E2	5.15	5.30	5.45
e	0.45	0.50	0.55
L	0.45	0.50	0.55
ddd	-	-	0.08

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7 Revision history

Table 7. Document revision history

Date	Revision	Changes
03-May-2021	1	Initial release.

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