

Stacks Core Datasheet

SA13729

General Description

The Stacks Core is the backbone of the Stacks platform. All Decks and accessories are controlled through the Core using Python, or Modbus TCP.

The Core provides features for powering and communicating with a DUT (Device Under Test). The peripherals of an Atmel SAM4 microcontroller are provided with electrical protection. Available peripherals include CAN (with transceiver), RS485 (with transceiver), SPI, I2C, serial UART, PWM, Timer/Counter, Clock outputs, ADC inputs, and DAC outputs (buffered). To power the DUT, the Core provides +12V, +5V, and +3.3V all controllable and with current sense and programmable current limits providing up to 50W, and a -12V bias supply.

Since the Core is the power supply for the Stacks platform, it provides 70W of power for all connected Decks and optionally, accessories. The Core accepts DC input power from 16V to 75V using a standard 5.5/2.5mm jack. This allows operation from any +48V industrial bus or standard laptop power supply. It also can be powered via PoE (Power over Ethernet) for remote installations.

A full bodied anodized aluminum enclosure provides physical protection for the Stack. Electrically, all Core I/O are ESD protected, ±12V tolerant, and short circuit protected.



Applications

- Automated Test Systems
- Design Verification
- Rapid Prototyping

Features

- Gateway to Stacks Decks and Accessories
- +12V, +5V, +3.3V, -12V DUT powers
- 1 SPI bus
- 3 PWM outputs
- 2 Clock outputs
- 1 Frequency Counter
- 1 CAN bus
- 1 I2C bus
- 1 UART Rx/Tx pair
- 11 DIOs
- 4 ADCs
- 2 DACs

Related Products

Description	Part Number
Core Breakout Board	SA13711
Analog Deck	SA13730
Relay Deck	SA13731
Stacks Accessories	Various

Rear Panel Connection

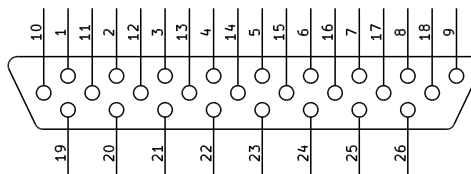


Figure 1: Connector Diagram

Table of Contents

Pin Functionality Table.....	2
General Characteristics	4
+3.3V DUT Power.....	5
+5.0V DUT Power.....	6
+12V DUT Power.....	7
-12V DUT Power.....	8
Multi-Function Pins	9
ADC Inputs.....	10
SPI	11
DAC.....	12
RS485	13
CAN.....	14

Pin Functionality Table

Please refer to Figure 1.

Stacks Core DA-26 Connector Pin Functionality Chart:

Pin #	Function Name	Default Function	Functionality
1	DIO0	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	AD1		Analog-to-Digital Converter input. Can be read on command. Range 0V to 2.5V.
	PCK2		Programmable Clock. Outputs a configurable clock signal based on the on-board crystal.
2	DIO1	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	AD3		Analog-to-Digital Converter input. Can be read on command. Range 0V to 2.5V.
	PWML1		Pulse Width Modulation output. 16-bit resolution. This is the low-side compliment of the high-side. It is active-high.
3	DIO2	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	PWMH2		Pulse Width Modulation output. 16-bit resolution. This is the high-side compliment of the low-side. It is active-low.
4	SPI_MISO	X	SPI Master In Slave Out (MISO) line. Stacks Core is the master. Works in conjunction with the other SPI lines. This line is high impedance when not communicating.
5	SPI_CLK	X	SPI clock signal. Stacks Core always generates this signal. This line is high impedance when not communicating.
6	DIO3	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	SDA		I2C Data line. Open-drain.
	SPI_CS3		SPI Chip Select line. Works in conjunction with the other SPI lines.
7	GND	X	Ground for signals and power.
8	+5V_DUT	X	Switchable output that provides +5V for any purpose. Protected by a programmable current limit and a series schottky diode. When this is switched on, the pin connects to the Stacks internal +5V rail. The load may

Pin #	Function Name	Default Function	Functionality
			be resistive, capacitive, or inductive.
9	+12V_DUT	X	Switchable output that provides +12V for any purpose. Protected by a programmable current limit and a reverse-current shutoff circuit. When this is switched on, the pin connects to the Stacks internal +12V rail. The load may be resistive, capacitive, or inductive. If the load is resistive, it must be 12 ohms or greater when the output is turned on.
10	DIO4	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	AD0		Analog-to-Digital Converter input. Can be read on command. Range 0V to 2.5V.
	PWMH3		Pulse Width Modulation output. 16-bit resolution. This is the high-side compliment of the low-side. It is active-low.
	PCK1		Programmable Clock. Outputs a configurable clock signal based on the on-board crystal.
11	DIO5	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	AD0		Analog-to-Digital Converter input. Can be read on command. Range 0V to 2.5V.
	PWML0		Pulse Width Modulation output. 16-bit resolution. This is the low-side compliment of the high-side. It is active-high.
12	DIO6	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	PWMH0		Pulse Width Modulation output. 16-bit resolution. This is the high-side compliment of the low-side. It is active-low.
13	DIO7	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	PWML3		Pulse Width Modulation output. 16-bit resolution. This is the low-side compliment of the high-side. It is active-high.
14	SPI_MOSI	X	SPI Master Out Slave In (MOSI) line. Stacks Core is the master. Works in conjunction with the other SPI lines. This line is high impedance when not communicating. 3.3V CMOS.
15	DIO8	X	General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	SCL		I2C Clock line. Open-drain.
	TCLK0		Timer Counter clock input. This clock can be configured to be used for the Time Counter pin.
16	+3.3V_DUT	X	Switchable output that provides +3.3V for any purpose. Protected by a programmable current limit and a reverse-current shutoff circuit. When this is switched on, the pin connects to the Stacks internal +3.3V rail. The load may be resistive, capacitive, or inductive.
17	GND	X	Ground for signals and power.
18	GND	X	Ground for signals and power.
19	+RS485_ACCESSORY	X	RS485 communication line. Used for Stacks accessory bus. May be configured for user devices as well. Idle high, active low line.
20	-RS485_ACCESSORY	X	RS485 communication line. Used for Stacks accessory bus. May be configured for user devices as well. Idle low, active high line.
21	DIO9		General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	URXD	X	Diagnostic UART console receive terminal. This function may be disabled through configuration.
	SPI_CS1		SPI Chip Select line. Works in conjunction with the other SPI lines.

Pin #	Function Name	Default Function	Functionality
22	DIO10		General purpose I/O line. Can be controlled on command. Has configurable 100k pull-up and pull-down resistors.
	UTXD	X	Diagnostic UART console transmit terminal. This function may be disabled through configuration.
	SPI_CS2		SPI Chip Select line. Works in conjunction with the other SPI lines.
23	CANH	X	CAN transceiver I/O line. Dominant High.
	DAC0		DAC channel 0 output. Maybe configured to output DAC instead of CAN.
24	CANL	X	CAN transceiver I/O line. Dominant Low.
	DAC1		DAC channel 1 output. Maybe configured to output DAC instead of CAN.
25	GND	X	Ground for signals and power.
26	-12V_DUT	X	Output that provides -12V for any purpose. Always on and non-switchable. Connected to the Stacks internal -12V rail through a PTC for protection.
SHD	SHIELD	X	Connector shield is connected to chassis, and is capacitively coupled to GND through capacitors.

General Characteristics

Recommended Male 26-pin D-sub (DC-37) Mating Connector:

Norcomp 180-M26-103L001

Recommended Power Adapter:

Meanwell GSM90B19-P1M

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

T_A = 25C, unless otherwise specified.

Description	Rating
Measurement Category	CAT I
Maximum GND-to-Earth Voltage	±500V
Maximum GND-to-Chassis Voltage	±500V
Maximum GND-to-Ethernet PoE Voltage ⁽⁴⁾	±100V

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to Stacks GND pins.

(3) As designed and characterized, not fully tested in production.

(4) Applicable to RJ45 connector pins 4, 5, 7, 8.

Electrical Characteristics⁽¹⁾⁽²⁾

T_A = 25C, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OUTPUT						
Input Voltage	V _{IN}	Operational	16	-	48	V
Quiescent Power	P _{IN}	Core only	-	2.5	-	W
Input Power	P _{IN}	Decks/DUT Power Max Draw	-	-	100	W
OTHER						
GND-to-Earth Leakage		Using GSM90B19-P1M	-	-	100	μA _{RMS}
Chassis-to-GND Resistance			-	10	-	MΩ
Chassis-to-GND Capacitance			-	500	-	pF

+3.3V DUT Power

+3.3V DUT Power provides a controllable 3.3V rail that can be used externally. It can be enabled/disabled and has a programmable current limit. It can be configured to auto-retry or latch a fault on overcurrent. When disabled, a discharge resistor is connected to the output.

Protection: This feature is current limited to protect from short circuits. It is also protected from overvoltage and has reverse current blocking and limiting. Negative voltages are clamped to GND by a diode.

Applicable Pins: DA-26 pin 16.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

T_A = 25C, unless otherwise specified.

Description	Rating
Continuous Applied Voltage ⁽⁴⁾	-0.2V to +14V
Negative Clamping Current, I _{CLAMP} ⁽⁵⁾	1.0A

- (1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.
- (2) Voltages are relative to GND pins.
- (3) As designed and characterized, not fully tested in production.
- (4) Applied voltage ratings may be exceeded if the clamping current ratings are observed.
- (5) Input terminal is diode-clamped to GND for input voltages that swing below GND. Signals that negatively exceed the applied voltage rating must be current limited to less than I_{CLAMP}

Recommended Operating Ratings

T_A = 25C, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Output Voltage, V _{OUT}	Continuous	0	-	V _{OUT}	V
Output Current, I _{OUT}	Continuous	0	-	I _{LIMIT}	A

Electrical Characteristics⁽²⁾

T_A = 25C, V_{SUPPLY} = 20V, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OUTPUT						
Output Voltage ⁽¹⁾	V _{OUT}	0 = I _{OUT}	3.1	3.35	3.5	V
		0 < I _{OUT} < I _{LIMIT}	2.75	-	3.5	V
Output Impedance	R _{OUT}		-	0.18	-	Ω
CURRENT SENSE MEASUREMENT						
Gain Error ⁽¹⁾⁽³⁾			-	-	±2	%
Offset Error ⁽¹⁾⁽³⁾			-	-	±15	mA
OUTPUT CURRENT LIMIT						
Range ⁽¹⁾	I _{LIMIT}		0.25	-	2.0	A
Setpoint Gain Error ⁽¹⁾			0	-	+20	%
Setpoint Offset Error ⁽¹⁾			0	-	+200	mA
OTHER						
Short Circuit Response Time	t _{SHORT}	V _{SHORT} = 0V	-	2	-	μs
Reverse Current Limit	I _{ROCP}	V _{OUT} + 200mV	-	0.72	-	A
Capacitance at Pin	C _P	Pin-to-ground, output off	-	4.7	-	μF
		Pin-to-ground, output on	500	-	-	μF
Discharge Resistance	R _{DIS}		-	600	-	Ω

(1) Parameter 100% production tested at T_A = 25C

(2) As designed and characterized, not fully tested in production unless otherwise specified. Accuracy specifications valid after 30-min warm-up.

(3) Factory calibrated.

+5.0V DUT Power

+5.0V DUT Power provides a controllable 5.0V rail that can be used externally. It can be enabled/disabled and has a programmable current limit. It can be configured to auto-retry or latch a fault on overcurrent. When disabled, a discharge resistor is connected to the output.

Protection: This feature is current limited to protect from short circuits. It is also protected from overvoltage and has a reverse current blocking diode. Negative voltages are clamped to GND by a diode.

Applicable Pins: DA-26 pin 8.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25^\circ\text{C}$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage ⁽⁴⁾	-0.2V to +20V
Negative Clamping Current, I_{CLAMP} ⁽⁵⁾	1.0A

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to GND pins.

(3) As designed and characterized, not fully tested in production.

(4) Applied voltage ratings may be exceeded if the clamping current ratings are observed.

(5) Input terminal is diode-clamped to GND for input voltages that swing below GND. Signals that negatively exceed the applied voltage rating must be current limited to less than I_{CLAMP} .

Recommended Operating Ratings

$T_A = 25^\circ\text{C}$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Output Voltage, V_{OUT}	Continuous	0	-	V_{OUT}	V
Output Current, I_{OUT}	Continuous	0	-	I_{LIMIT}	A

Electrical Characteristics⁽²⁾

$T_A = 25^\circ\text{C}$, $V_{\text{SUPPLY}} = 20\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OUTPUT						
Output Voltage ⁽¹⁾	V_{OUT}	$0 = I_{\text{OUT}}$	4.95	5.15	5.35	V
		$0 < I_{\text{OUT}} < I_{\text{LIMIT}}$	4.55	-	5.35	V
Output Impedance	R_{OUT}		-	0.18	-	Ω
CURRENT SENSE MEASUREMENT						
Gain Error ⁽¹⁾⁽³⁾			-	-	± 2	%
Offset Error ⁽¹⁾⁽³⁾			-	-	± 15	mA
OUTPUT CURRENT LIMIT						
Range ⁽¹⁾	I_{LIMIT}		0.25	-	2.0	A
Setpoint Gain Error ⁽¹⁾			0	-	+20	%
Setpoint Offset Error ⁽¹⁾			0	-	+200	mA
OTHER						
Short Circuit Response Time	t_{SHORT}	$V_{\text{OUT}} = 0\text{V}$	-	2	-	μs
Capacitance at Pin	C_{P}	Pin-to-ground, output off	-	4.7	-	μF
		Pin-to-ground, output on	30	-	-	μF
Discharge Resistance	R_{DIS}		-	10	-	k Ω

(1) Parameter 100% production tested at $T_A = 25^\circ\text{C}$

(2) As designed and characterized, not fully tested in production unless otherwise specified. Accuracy specifications valid after 30-min warm-up.

(3) Factory calibrated.

+12V DUT Power

+12V DUT Power provides a controllable 12V rail that can be used externally. It can be enabled/disabled and has a programmable current limit. It can be configured to auto-retry or latch a fault on overcurrent. When disabled, a discharge resistor is connected to the output.

Protection: This feature is current limited to protect from short circuits. It is also protected from overvoltage and has a reverse current blocking diode. Negative voltages are clamped to GND by a diode.

Applicable Pins: DA-26 pin 9.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25\text{C}$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage ⁽⁴⁾	-0.2V to +20V
Negative Clamping Current, I_{CLAMP} ⁽⁵⁾	1.0A

- (1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.
- (2) Voltages are relative to GND pins.
- (3) As designed and characterized, not fully tested in production.
- (4) Applied voltage ratings may be exceeded if the clamping current ratings are observed.
- (5) Input terminal is diode-clamped to GND for input voltages that swing below GND. Signals that negatively exceed the applied voltage rating must be current limited to less than I_{CLAMP} .

Recommended Operating Ratings

$T_A = 25\text{C}$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Output Voltage, V_{OUT}	Continuous	0	-	V_{OUT}	V
Output Current, I_{OUT}	Continuous	0	-	I_{LIMIT}	A

Electrical Characteristics⁽²⁾

$T_A = 25\text{C}$, $V_{\text{SUPPLY}} = 20\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OUTPUT						
Output Voltage ⁽¹⁾	V_{OUT}	$0 = I_{\text{OUT}}$	12.35	12.5	12.7	V
		$0 < I_{\text{OUT}} < I_{\text{LIMIT}}$	11.7	-	12.7	V
Output Impedance	R_{OUT}		-	0.11	-	Ω
CURRENT SENSE MEASUREMENT						
Gain Error ⁽¹⁾⁽³⁾			-	-	± 2	%
Offset Error ⁽¹⁾⁽³⁾			-	-	± 15	mA
OUTPUT CURRENT LIMIT						
Range ⁽¹⁾	I_{LIMIT}		0.6	-	4.5	A
Setpoint Gain Error ⁽¹⁾			0	-	+10	%
Setpoint Offset Error ⁽¹⁾			0	-	+0.6	A
OTHER						
Minimum Startup Load Resistance		Resistive only	13	-	-	Ω
Short Circuit Response Time	t_{SHORT}	$V_{\text{OUT}} = 0\text{V}$	-	2.5	-	μs
Capacitance at Pin	C_{P}	Pin-to-ground, output off	-	1.0	-	μF
		Pin-to-ground, output on	400	-	-	μF
Discharge Resistance	R_{DIS}		-	10	-	k Ω

(1) Parameter 100% production tested at $T_A = 25\text{C}$

(2) As designed and characterized, not fully tested in production unless otherwise specified. Accuracy specifications valid after 30-min warm-up.

(3) Factory calibrated.

-12V DUT Power

-12V DUT Power provides a controllable -12V rail that can be used externally. It can be enabled/disabled, and is protected by a PTC resettable fuse.

Applicable Pins: DA-26 pin 26.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25\text{C}$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage	-20V to +12.5V

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to GND pins.

(3) As designed and characterized, not fully tested in production.

Recommended Operating Ratings

$T_A = 25\text{C}$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Output Voltage, V_{OUT}	Continuous	V_{OUT}	-	0	V
Output Current, I_{OUT}	Continuous	-100	-	0	mA

Electrical Characteristics⁽²⁾

$T_A = 25\text{C}$, $V_{SUPPLY} = 20\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OUTPUT						
Output Voltage ⁽¹⁾	V_{OUT}	$I_{RATED} < I_{OUT} < 0$	-12.7	-12.4	-11.5	V
Rated Output Current ⁽¹⁾	I_{RATED}		-100	-	0	mA
Output Impedance	R_{OUT}		-	5	-	Ω
CURRENT SENSE MEASUREMENT						
Gain Error ⁽¹⁾			-	-	± 4	%
Offset Error ⁽¹⁾			-	+2	± 10	mA
OTHER						
Capacitance at Pin	C_P	Pin-to-ground	-	100	-	nF
Discharge Resistance	R_{DIS}		-	10	-	k Ω

(1) Parameter 100% production tested at $T_A = 25\text{C}$

(2) As designed and characterized, not fully tested in production unless otherwise specified. Accuracy specifications valid after 30-min warm-up.

Multi-Function Pins

The Core's multi-function pins connect through protection circuitry to the processor. The functions may be selected in software. All functions share the limits below, except the ADC pins when enabled.

Applicable Pins: DA-26 pins 1-3, 6, 10-13, 15, 21, 22.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25C$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage ⁽⁴⁾	-13V to +13V
Short Circuit to GND	Continuous

- (1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.
- (2) Voltages are relative to GND pins.
- (3) As designed and characterized, not fully tested in production.
- (4) Exceeding Recommended Operating Ratings may cause erroneous Core processor behavior and erroneous ADC readings.

Recommended Operating Ratings

$T_A = 25C$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Continuous Applied Voltage		0	-	3.3	V
Output Current		0	-	4	mA

Electrical Characteristics⁽²⁾

$T_A = 25C$, $V_{SUPPLY} = 20V$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Logic High Input Voltage	V_{IH}		2.0	-	-	V
Logic Low Input Voltage	V_{IL}		-	-	0.8	V
Logic High Output Voltage	V_{OH}	$I_O = -4mA$	2.6	-	-	V
Logic Low Output Voltage	V_{OL}	$I_O = 4mA$	-	-	0.6	V
Output Impedance	R_{OUT}		-	80	-	Ω

- (1) Parameter 100% production tested at $T_A = 25C$
- (2) As designed and characterized, not fully tested in production unless otherwise specified.

ADC Inputs

The ADC inputs are shared with some of the multi-function pins. The ADC inputs provide a basic analog voltage reading. The measurements are from an oversampled 12-bit ADC.

The limits in this section only apply to the ADC pins when they are enabled in software.

Applicable Pins: DA-26 pins 1, 2, 10, 11.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

T_A = 25C, unless otherwise specified.

Description	Rating
Continuous Applied Voltage ⁽⁴⁾	-13V to +13V
Short Circuit to GND	Continuous

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to GND pins.

(3) As designed and characterized, not fully tested in production.

(4) Exceeding Recommended Operating Ratings may cause erroneous Core processor behavior and erroneous ADC readings.

Recommended Operating Ratings

T_A = 25C, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Continuous Applied Voltage ⁽¹⁾		0	-	2.5	V

(1) Exceeding this rating may cause erroneous ADC readings.

Electrical Characteristics⁽²⁾

T_A = 25C, V_{SUPPLY} = 20V, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Calibrated Voltage Range	V _{RANGE}		0.01	-	2.45	V
Gain Error ⁽¹⁾⁽³⁾			-	±0.1	±1.0	%
Offset Error ⁽¹⁾⁽³⁾			-	-	±15	mV
Noise			-	4	-	mV _{pp}

(1) Parameter 100% production tested at T_A = 25C

(2) As designed and characterized, not fully tested in production unless otherwise specified. Accuracy specifications valid after 30-min warm-up.

(3) Factory calibrated.

SPI

The Core's SPI interface allows connecting to external SPI devices.

Applicable Pins: DA-26 pins 4, 5, 14.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25\text{C}$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage ⁽⁴⁾	-13V to +13V
Short Circuit to GND	Continuous
Negative Clamping Current, I_{CLAMP} ⁽⁵⁾	50mA

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to GND pins.

(3) As designed and characterized, not fully tested in production.

(4) Applied voltage ratings may be exceeded if the clamping current ratings are observed.

(5) Input terminal is diode-clamped to GND for input voltages that swing below GND. Signals that negatively exceed the applied voltage must be current limited to less than I_{CLAMP} .

Recommended Operating Ratings

$T_A = 25\text{C}$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Continuous Applied Voltage		0	-	3.3	V
Output Current		0	-	8	mA

Electrical Characteristics⁽²⁾

$T_A = 25\text{C}$, $V_{SUPPLY} = 20\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Logic High Input Voltage	V_{IH}		2.0	-	-	V
Logic Low Input Voltage	V_{IL}		-	-	0.8	V
Logic High Output Voltage	V_{OH}	$I_O = -8\text{mA}$	2.4	-	-	V
Logic Low Output Voltage	V_{OL}	$I_O = 8\text{mA}$	-	-	0.7	V
Output Impedance	R_{OUT}		-	80	-	Ω

(1) Parameter 100% production tested at $T_A = 25\text{C}$

(2) As designed and characterized, not fully tested in production unless otherwise specified.

DAC

A 12 bit DAC provides a conditioned $\pm 3.3V$ output voltage via a 3.5mm TRS jack. The DAC output may also be multiplexed to the rear DA-26 via software, using the same pins as CAN. The default setting is to have the DAC output only on the TRS jack, and not the DA-26. Enabling output to the DA-26 does not change the connection to the TRS jack (it remains connected). These specifications are always applicable to the TRS jack connection, but are only applicable on the DA-26 pins when the DAC feature is multiplexed to the referenced pins. Bandwidth may be set to low bandwidth for lower noise or high bandwidth for waveform generation.

Applicable Pins: 3.5mm TRS jack. 2 pins: Standard Audio Left (Tip) is DAC0, Audio Right (Ring) is DAC1. Sleeve is GND. Software-controlled connection to DA-26 pin 23, 24.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25C$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage	-12.5V to +12.5V

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to GND pins.

(3) As designed and characterized, not fully tested in production.

Recommended Operating Ratings

$T_A = 25C$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage	V_{OUT}	Continuous	-3.3	-	3.3	V
Output Current	I_{OUT}	Continuous	-15	-	25	mA

Electrical Characteristics⁽²⁾

$T_A = 25C$, $V_{SUPPLY} = 20V$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Output Voltage ⁽¹⁾⁽³⁾	V_{OUT}		-3.3	-	3.3	V
Output Current	I_{+OUT}	Sourcing	25	40	-	mA
	I_{-OUT}	Sinking	15	40	-	mA
Output Impedance	R_{OUT_TRS}	Connected to the TRS Jack	-	0.01	-	Ω
	R_{OUT_DSUB}	Connected through the DA-26 MUX	-	0.4	-	Ω
Resolution			-	1.7	-	mV
Gain Error ⁽¹⁾⁽³⁾			-	± 0.3	± 1.5	%
Offset Error ⁽¹⁾⁽³⁾⁽⁴⁾			-	± 3	± 20	mV
Bandwidth	BW	Low bandwidth Mode	-	200	-	Hz
		High Bandwidth Mode	-	40	-	kHz

(1) Parameter 100% production tested at $T_A = 25C$

(2) As designed and characterized, not fully tested in production unless otherwise specified. Accuracy specifications valid after 30-min warm-up.

(3) Factory calibrated.

(4) When connected through the DA-26 MUX, add 1.5mV of offset

RS485

A RS485 transceiver provides capability to communicate on RS485 networks, particularly to accessories.

Applicable Pins: DA-26 pin 19, 20.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25\text{C}$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage	-27V to +27V
ESD, HBM	$\pm 16\text{kV}$

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to GND pins.

(3) As designed and characterized, not fully tested in production.

Recommended Operating Ratings

$T_A = 25\text{C}$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Voltage at any bus terminal to GND		-20	-	25	V
Differential Input Voltage		-25	-	25	V
Output Current, I_{OUT}		-110	-	110	mA

Electrical Characteristics⁽²⁾

$T_A = 25\text{C}$, $V_{SUPPLY} = 20\text{V}$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Positive-going Differential Input Voltage Threshold	V_{IT+}	$I_O = 8\text{mA}$	-	60	200	mV
Negative-going Differential Input Voltage Threshold	V_{IT-}	$I_O = 8\text{mA}$	-200	-60	-	mV
Bus Output Voltage, Differential	V_{OD}		1.8	-	5.25	V
Short Circuit Output Current	I_{OS}		-250	-	250	mA

(1) Parameter 100% production tested at $T_A = 25\text{C}$

(2) As designed and characterized, not fully tested in production unless otherwise specified.

CAN

A CAN transceiver and controller provides capability to communicate on CAN networks. This function shares pins on the DA-26 with the DAC and is multiplexed by software. These specifications are only applicable when the CAN feature is multiplexed on the DA-26 to the referenced pins.

Applicable Pins: Software-controlled connection to DA-26 pin 23, 24.

Absolute Maximum Ratings⁽¹⁾⁽²⁾⁽³⁾

$T_A = 25C$, unless otherwise specified.

Description	Rating
Continuous Applied Voltage	-15V to +15V

(1) Stresses beyond those listed may cause permanent device damage. Functional operation range of the device is defined in Recommended Operating Ratings or Electrical Characteristics. Exposure to absolute max ratings for extended periods may reduce device reliability.

(2) Voltages are relative to GND pins.

(3) As designed and characterized, not fully tested in production.

Recommended Operating Ratings

$T_A = 25C$, unless otherwise specified.

Parameter	Conditions	Min	Typ	Max	Unit
Voltage at any bus terminal to GND		-12	-	+12	V
Differential Input Voltage		-6	-	6	V
Output Current, I_{OUT}		-70	-	70	mA

Electrical Characteristics⁽²⁾

$T_A = 25C$, $V_{SUPPLY} = 20V$, unless otherwise specified.

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
High-level Input Voltage	V_{IH}		2	-	5.25	V
Low-level Input Voltage	V_{IL}		0	-	0.8	V
Bus Output Voltage (Dominant)	$V_{O(D)}$	CANH	2.9	-	4.5	V
		CANL	0.8	-	1.75	V
Bus Output Voltage (Recessive)	$V_{O(R)}$		2	2.5	3	V

(1) Parameter 100% production tested at $T_A = 25C$

(2) As designed and characterized, not fully tested in production unless otherwise specified.

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