

FDS Series Technical Specifications

Unless otherwise stated, all technical specifications apply to digital oscilloscope with the attenuation switch of the probe set to 10X.

- The instrument must be operated continuously for more than thirty minutes under the specified operating temperature.
- If the operating temperature range changes not less than 5°C, it is required to open the system function menu and execute “Self-calibration” program.

All specifications are guaranteed except those marked with “Typical”.

Oscilloscope

Performance Characteristics		Instruction			
Bandwidth		100 MHz			
Vertical Resolution		FDS1102	8 bits		
		FDS1102A	8 bits /12 bits /14 bits		
Acquisition	Mode	Normal, Peak detect, Averaging			
	Real-time Acquisition Rate	FDS1102	Dual CH	8 bits	500 MS/s
			Single CH		1 GS/s
		FDS1102A	Dual CH	8 bits mode	500 MS/s
				12 bits mode	250 MS/s
				14 bits mode	100 MS/s
			Single CH	8 bits mode	1 GS/s
	12 bits mode	500 MS/s			
	14 bits mode	100 MS/s			
	Waveform Refresh Rate		65,000 wfms/s		
Channel		2			
Multi-level Gray Scale Display & Color Temperature Display(Use gray scale to indicate frequency of occurrence,where frequently occurring waveform are bright.)		Support			
Horizontal Accuracy		±20 ppm (typical value, ambient temperature: +25°C)			
Input	Input Coupling	DC, AC, grounding			
	Input Impedance	1 MΩ±2%, parallel with 15 pF±5 pF			

	Probe attenuation coefficient	10uX-50kX,step by 1 – 2 - 5, support custom			
	Maximum Input Voltage	1MΩ:≤300 Vrms			
	Bandwidth limit	20 MHz, full bandwidth			
	Channel –channel isolation	50 Hz: 100:1 10 MHz: 40:1			
	Time delay between channel(typical)	150ps			
Horizon	Sampling rate range	FDS1102	Dual CH	8 bits mode	0.05 S/s ~ 500 MS/s
			Single CH		0.05 S/s ~ 1 GS/s
		FDS1102A	Dual CH	8 bits mode	0.05 S/s ~ 500 MS/s
				12 bits mode	0.05 S/s ~ 250 MS/s
				14 bits mode	0.05 S/s ~ 100 MS/s
			Single CH	8 bits mode	0.05 S/s ~ 1 GS/s
				12 bits mode	0.05 S/s ~ 500 MS/s
				14 bits mode	0.05 S/s ~ 100 MS/s
	Interpolation	(Sinx)/x			
	Maximum Storage Depth	10M			
	Scanning speed (S/div)	2ns/div - 1000s/div,step by 1-2-5			
Relay time accuracy	±20 ppm(typical, environment temperature is +25℃)				
Time interval(ΔT) measurement accuracy(CD ~100MHz)	Single: ±(1 interval time+1 ppm×reading+0.6 ns); Average>16: ±(1 interval time +1 ppm×reading+0.4 ns)				
Vertical	Vertical Sensitivity	1 mV/div~ 10 V/div			
	Displacement	±2V(1 mV/div - 50 mV/div); ± 20 V (100 mV/div - 1 V/div); ± 200 V (2 V/div - 10 V/div)			

	Analog bandwidth	100 MHz			
	Single bandwidth	Full bandwidth			
	Low Frequency(A C coupling , -3dB)	≥10 Hz(at BNC)			
	Rising Time(at BNC,typical)	≤3.5 ns			
	DC Gain Accuracy	FDS1102	8 bits mode	1 mV	4%
				≥2 mV	3%
		FDS1102A	8 bits mode	1 mV	4%
				≥2 mV	3%
		12 bits mode	1 mV	3%	
		14 bits mode	≥2 mV	2%	
	DC accuracy (average)	Delta Volts between any two averages of ≥16 waveforms acquired with the same scope setup and ambient conditions (ΔV): $\pm(3\% \text{ rdg} + 0.05 \text{ div})$			
	Waveform inverted ON/OFF				
Trigger Type		Edge trigger, video trigger, pulsewidth trigger, slope trigger, under-amplitude trigger, over-amplitude trigger, timeout trigger, Nth edge trigger, logic trigger, RS232/UART, I2C, SPI, CAN and LIN			
Trigger Mode		Auto, Normal, Single			
Signal System and Line/Field Frequency (Video Trigger Mode)		Support NTSC, PAL and SECAM broadcasting system of any field frequency or line frequency			
Measurement	Cursor Measurement	ΔV 、 ΔT 、 $\Delta T \& \Delta V$ between cursors、 auto cursor、 support XY/FFT/ZOOM window、 based on screen percentage			
	Auto Measurement	Period,Frequency,+Width,-Width,Rise Time,Fall Time, ScrDuty,+Duty,-Duty,Vavg,Vpp,VRMS,Overshoot,Vmax ,Vmin,Vtop,CycRms,Vbase,Vamp,Preshoot,StdDev,+PulseCnt,-PulseCnt,RiseCnt,FallCnt,Area,CycArea,Delay($\Psi - \Phi$),Delay($\Psi - \Phi$),Delay($\Psi - \Phi$),Delay($\Psi - \Phi$),Phase($\Psi - \Phi$),Phase($\Psi - \Phi$),Phase($\Psi - \Phi$),Phase($\Psi - \Phi$),FR R,FRF,FFR,FFF,LRR,LRF,LFR,LFF			

	Mathematical operation	+, -, *, /, Intg, Diff, Sqrt, Function operation (Lg/Ln/Exp/Abs/Sine/Cosine/Tan), User Defined Function, digital filter (low pass, high pass, band pass, band reject) FFT、FFTrms
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Trigger

Performance Characteristics		Instruction
Trigger level range	Internal	±5 div from the screen center
	EXT	±2V
	EXT/5	±10V
Trigger level Accuracy (typical) the source is adapted to rising and falling time ≥20ns	Internal	±0.3 div
	EXT	±(10 mV+6% Set value)
	EXT/5	±(50 mV +6% Set value)
Trigger displacement	According to Record length and time base	
Trigger Holdoff range	100 ns – 10 s	
50% level setting (typical)	Input signal frequency ≥ 50 Hz	
Edge Trigger	slope	Rising, Falling
Video Trigger	Modulation	Support standard NTSC, PAL and SECAM broadcast systems
	Line number range	1-525 (NTSC) and 1-625 (PAL/SECAM)
Pulse Trigger	Trigger condition	Positive pulse: >, <, = Negative pulse: >, <, =
	Pulse Width range	30 ns to 10 s
Slope Trigger	Trigger condition	Positive pulse: >, <, = Negative pulse: >, <, =
	Time setting	30 ns to 10 s
Runt Trigger	Polarity	Positive, Negative
	Pulse Width Condition	>, =, <
	Pulse Width Range	30 ns to 10 s
Windows Trigger	Polarity	Positive, Negative
	Trigger Position	Enter, Exit, Time
	Windows	30 ns to 10 s

	Time	
Timeout Trigger	Edge Type	Rising, Falling
	Idle Time	30 ns to 10 s
The Nth Edge Trigger	Edge Type	Rising, Falling
	Idle Time	30 ns to 10 s
	Edge Number	1 to 128
Logic trigger	Logic Mode	AND, OR, XNOR, XOR
	Input Mode	H, L, X, Rising, Falling
	Output Mode	Goes True, Goes False, Is True >, Is True <, Is True =
RS232/UART Trigger	Polarity	Normal, Inverted
	Trigger Condition	Start, Error, Check Error, Data
	Baud Rate	Common, Custom
	Data Bits	5 bit, 6 bit, 7 bit, 8 bit
I2C Trigger	Trigger Condition	Start, Restart, Stop, ACK Lost, Address, Data, Addr/Data
	Address Bits	7 bit, 8 bit, 10 bit
	Address Range	0 to 127, 0 to 255, 0 to 1023
	Byte Length	1 to 5
SPI Trigger	Trigger Condition	Timeout
	Timeout Value	30 ns to 10 s
	Data Bits	4 bit to 32 bit
	Edge	Rising, Falling
CAN Trigger	Signal Type	CAN_H, CAN_L, TX, RX
	Trigger Condition	Start of Frame, Type of Frame, Identifier, Data, ID & Data, End of Frame, Missing Ack, Bit Stuffing Error
	Baud Rate	Common, Custom
	Sample Point	5% to 95%
	Frame Type	Data, Remote, Error, Overload
LIN Trigger	Condition	Interval, ID, ID/Data, Data Error
	Baud Rate	Common, Custom

Waveform Generator

Bandwidth	50 MHz
Sample Rate	300M Sa/s
Vertical Resolution	14 bits
Channel	2

Waveforms		
Standard waveforms	Sine wave, square wave, ramp wave, pulse wave, noise	
Arbitrary waveforms	exponential rise, exponential decline, Sin(x)/x, step wave, noise etc 28 build-in waveforms	
Frequency Feature		
Sine wave	1 μ Hz to 50 MHz	
Square wave	1 μ Hz to 25 MHz	
Ramp wave	1 μ Hz to 1 MHz	
Pulse wave	1 μ Hz to 10 MHz	
Noise wave(-3 dB)	20 MHz(Gaussian white noise)	
Arbitrary wave(except DC)	1 μ Hz to 10 MHz	
Frequency resolution	1 μ Hz or 7 significant figures	
Frequency stability	\pm 30 ppm at 0 to 40 $^{\circ}$ C	
Frequency aging rate	\pm 30 ppm per year	
Amplitude characteristic		
Output amplitude	High Z	2mVpp to 10Vpp
	50 Ω	1mVpp to 5Vpp
Amplitude accuracy	\pm (1% of setting + 1 mVpp)(typical 1kHz sine,0V offset)	
Amplitude resolution	1mVpp or 4 digits	
DC offset range (AC+ DC)	High Z	\pm 5 Vpk - Amplitude Vpp/2
	50 Ω	\pm 2.5 Vpk - Amplitude Vpp/2
	Note: When offset >2.5Vpp, amplitude \geq 10mV(High Z) When offset >1.25Vpp, amplitude \geq 5mV(50 Ω)	
DC offset accuracy	\pm (1 % of setting + 1 mV + amplitude Vpp * 0.5%)	
Offset resolution	1mVpp	
Output Impedance	50 Ω (typical)	
Waveforms characteristic		
Sine		
Bandwidth flatness(1Vpp , relative)	\leq 10MHz: \pm 0.3dB \leq 50MHz: \pm 0.5dB	

1kHz,50Ω)	
Harmonic distortion	Typical value(0dBm) DC to 1MHz:<-65dBc 1MHz to 50MHz:<-60dBc
Total harmonic distortion	<0.2%, 10Hz to 20kHz, 1Vpp
Non-harmonic distortion	Typical value(0dBm) ≤10MHz:<70dBc; >10MHz:<70dBc+6c/sound interval
Phase noise	Typical value(0dBm, 10kHz offset) 10MHz:≤-110dBc/Hz
Square	
Rising falling time	<20ns
Jitter	200ps +30ppm
Overshoot	<5%
Ramp	
Linearity	<the 1% of maximum output(typical value 1 kHz , 1 Vpp , symmetry50%)
Symmetry	0% to 100%
Pulse	
Period	100ns to 1Ms
Pulsewidth	≥40ns
Overshoot	<5%
Jitter	200ps +30ppm
Noise	
Type	Gaussian white noise
Bandwidth (-3dB)	20 MHz
Arbitrary	
Bandwidth	10MHz
Waveforms length	2 to 8192 points
Sample rate	300M Sa/s
Amplitude accuracy	14bits
Modulation characteristic	
Modulate type	AM, FM,PM, FSK
AM	
Carrier	Sine、Square、Ramp、Arb(Except DC)
Internal modulation waveform	Sine、Square、Ramp、Noise
Internal	2 MHz to 20 kHz

amplitude modulation frequency	
Depth	0% to 100%
FM	
Carrier	Sine、 Square、 Ramp、 Arb(Except DC)
Internal modulation waveform	Sine、 Square、 Ramp、 Noise
Internal modulation frequency	2 mHz to 20 kHz
Frequency offset	2 mHz to Carrier frequent
PM	
Carrier	Sine、 Square、 Ramp、 Arb(Except DC)
Internal modulation waveform	Sine、 Square、 Ramp、 Noise
Internal phase modulation frequency	2 mHz to 20 kHz
Phase deviation range	0° to 180°
FSK	
Carrier	Sine、 Square、 Ramp、 Arb(Except DC)
FSK rate	2 mHz to 100kHz
FSK hopfreq	1 μHz to Maximum frequency of corresponding carrier
Sweep	
Carrier	Sine、 Square、 Ramp、 Arb(Except DC)
Min/Max start frequent	1μHz(minimum)/Maximum frequency of corresponding carrier
Max/Min stop frequent	1μHz(minimum)/Maximum frequency of corresponding carrier
Type	Line、 Log
Sweep time	1 ms to 500 s ± 0.1%
Trigger source	Internal、 Manual
Burst	
Waveforms	Sine、 Square、 Ramp、 Pulse and Arb(Except DC)
Carrier frequency	1 μHz to Maximum frequency of corresponding carrier /2
Trigger source	Manual、 Internal
N-cycle trigger cycle	1 us to 500s
N periodicity	1 to 400000 (Max =Burst Period / Period)/infinite
Voltage range and sensitivity(No modulation source)	

Input resistance	1M Ω
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Power Supply

Rated output	
Voltage	0.1~15V
Current	0.1~3A
Power	15W
Load Regulation	
Voltage	$\leq 0.1\% + 3\text{mV}$
Current	$\leq 0.1\% + 3\text{mA}$
Power Regulation	
Voltage	$\leq 0.1\% + 3\text{mV}$
Current	$\leq 0.1\% + 3\text{mA}$
Noise & Ripple(20Hz-20MHz)	
Voltage(Vp-p)	$\leq 10\text{mVp-p}$
Voltage(rms)	$\leq 2\text{mVrms}$
Current(rms)	$\leq 5\text{mA rms}$
Settings Resolution	
Voltage	10mV
Current	10mA
Read Back Resolution	
Voltage	10mV
Current	1mA
Settings Accuracy(25°C\pm5°C)	
Voltage	$\leq 0.8\% + 10\text{mV}$
Current	$\leq 1\% + 8\text{mA}$
Read Back Accuracy(25°C\pm5°C)	
Voltage	$\leq 0.3\% + 10\text{mV}$
Current	$\leq 0.3\% + 8\text{mA}$
Response time	
Transient recovery time(50% ~ 100% rated load)	$\leq 1\text{ms}$
Protect function	
OVP	0~16V
OCP	0~3.1A

Multimeter

Function		Measurement Range	Resolution	Function
DC	mV	20.000 mV/200.00 mV	0.001mV	$\pm(0.5\% + 10\text{dig})$

Voltage (V)	V	2.0000V/20.000V/200.00V	0.1mV	±(0.3%+5dig)
		1000.0V	0.1V	±(0.5%+5dig)
AC Voltage (V)	mV	20.000 mV/200.00 mV	0.001mV	±(0.8%+10dig)
	V	2.0000V/20.000V/200.00V	0.1mV	±(0.8%+10dig)
		750.0V	0.1V	±(1%+10dig)
DC Current (A)	μA	200.00μA/2000.0μA	0.01μA	±(0.5%+10dig)
	mA	20.000mA/200.00mA	0.001mA	±(0.5%+10dig)
	A	20.000A [1]	0.001A	±(2%+10dig)
AC Current (A)	μA	200.00μA/2000.0μA	0.01μA	±(0.8%+10dig)
	mA	20.000mA/200.00mA	0.001mA	±(0.8%+10dig)
	A	20.000A [1]	0.001A	±(2.5%+10dig)
Resistance (Ω)		200.00Ω/2.0000kΩ/20.000kΩ/200.00kΩ/2.0000MΩ/20.000MΩ	0.01Ω	±(0.8%+10dig)
		100.00MΩ	0.01 MΩ	±(5%+10dig)
Capacitance (F)		2.0000nF/20.000nF/200.00nF/2.0000μF/20.000μF	0.1pF	±(4%+10dig)
		200.00μF/2.0000mF/20.000mF [2]	0.01μF	±(4%+10dig)
Duty Cycle (%) ^[3]		0.1% - 99.9% (Typical:V _{rms} =1 V, f=1 kHz)	0.1%	±(1.2%+3dig)
		0.1% - 99.9%(≥1 kHz)		±(2.5%+3dig)

[1] When measuring current, for 10 A to 15 A, the measuring duration should not be over 2 minutes within 10 minutes, and in this 10 minutes, no other current should flow through except within the measuring duration; for 15 A to 20 A, the measuring duration should not be over 10 seconds within 15 minutes, and in this 15 minutes, no other current should flow through except within the measuring duration.

[2] When measuring big capacitance, the measuring duration should be over 30 seconds.

[3] When measuring duty cycle, the typical waveform is Square.

Note:

- **Standard conditions:** The environment temperature is 18°C to 28°C, the relative humidity is less than 80%.
- **When measuring AC voltage/current or capacitance, accuracy guarantee range is 5% to 100% of the range.**
- **When measuring resistance and capacitance, the influence of the resistance reactance of the pen itself on the measured value should be considered.**

Characteristics	Instruction
Display	19999
Frequency Response (Hz)	(40 - 1000) Hz
Sample rate for digital data	3 times/second
Auto ranging	√

True Virtual Value	√
Diodes Test	√
On-off Buzzer	√
Data Hold	√
Relative Measurement	√
Input Protection	√
Input Impedance	≥10 MΩ

General Technical Specifications

Display:

Characteristics	Instruction
Display Type	10.4 inch Colored LCD (Liquid Crystal Display)
Display Resolution	1024 (Horizontal) ×768 (Vertical) Pixels
Display Colors	65536 colors, TFT

Output of the Probe Compensator:

Characteristics	Instruction
Output voltage(typical)	About 5 V, with the Peak-to-Peak voltage ≥1
Frequent(typical)	Square wave of 1 KHz

Others:

Characteristics	Instruction
Communication Interface	HDMI; USB dev*1, USB Host *4; Trig Out(P/F); LAN interface; earphone jack
Power Supply	100V – 240 VACRMS, 50/60 Hz, CAT II
Power Consumption	PWR empty load <30W
	PWR full load <90W
Fuse	2 A, T class, 250 V
Touch Screen	Multi-touch capacitive touch screen

Environment:

Characteristics	Instruction
Temperature	Working temperature:0℃~40℃ Storage temperature:-20℃~+60℃
relative humanity	≤90%
Height	Operating: 3,000 m Non-operating: 15,000 m
Cooling Method	Fan cooling

Mechanical Specifications:

Characteristics	Instruction
Dimension	421 mm × 221 mm × 115 mm (L*H*W)
Weight	Approx. 4.25 kg (without accessories)

Interval Period of Adjustment:

One year is recommended for the calibration interval period.



V1.0.6