



# T3AFG30/T3AFG60 Data Sheet

**Function/Arbitrary Waveform Generators** 

# Debug with Confidence 30 MHz – 60 MHz

Teledyne Test Tools T3AFG30 and T3AFG60 range of function/arbitrary generators are a series of dual-channel waveform generators with specifications of up to 60 MHz maximum bandwidth, 150MSa/s maximum sampling rate and 14-bit vertical resolution.

The proprietary Arbitrary & Pulse techniques used in the T3AFG30/T3AFG60 models helps to solve the weaknesses inherent in traditional DDS generators when generating arbitrary, square and pulse waveforms. With the above advantages the T3AFG30 and T3AFG60 generators can provide users with a variety of high fidelity and low jitter signals, which can meet the growing requirements of a wide range of complex applications.

### **Tools for Improved Debugging**

- Deep Memory 16 kpts/Ch.
- Wide Range of Modulation Types AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst and PSK.
- High Resolution 14 bit resolution.
- Bandwidth Models of 30 MHz and 60 MHz.
- Built In Arbitrary Waveforms.
- User Defined Waveforms.
- Lower cost 5 MHz and 10 MHz single channel models are also available.

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- Generate complex arbitrary waveforms.
- Quickly set up modulated waveforms.
- Generate waveforms with low noise, low spurious signal content and high dynamic range.
- Wide choice of bandwidths. Other models available up to 500 MHz.
- Load and replay built in Arbitrary Waveforms.
- Store and recall user defined waveforms.
- Enquire about the T3AFG5 and T3AFG10.

### **Key Specifications**

30 MHz, 60 MHz
2 Independent Channels
16 kpts/Ch
150 MS/s
4.3 inch TFT LCD Display
USB Host, USB Device, LAN

# **PRODUCT OVERVIEW**

### **Ordering Information**

Model	Bandwidth	Channel	Memory per Ch	Sample Rate per Ch
T3AFG30	30 MHz	2	16 kpts	150 MS/s
T3AFG60	60 MHz	2	16 kpts	150 MS/s

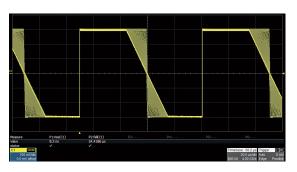
Function	T3AFG30/T3AFG60
Built-in Waveforms	5 Standard, 196 Arbitrary
Input/Output	2 Waveform Outputs, Counter Input, Aux In/Out, 10 MHz Clock In/Out
Modulation Functions	AM, DSB-AM, FM, PM, FSK, ASK, PSK, PWM, Sweep, Burst, Harmonic
TrueArb and EasyPulse	Yes
Maximum Amplitude Output	≤ 10 MHz: 10 Vpp at 50 Ω, 20 Vpp at HiZ > 10 MHz: 5 Vpp at 50 Ω, 10 Vpp at HiZ
Vertical D/A Resolution	14 Bits
Display Size	4.3" Color TFT

### **Excellent Performance**

- Model bandwidths from 30 MHz to 60 MHz
- All Models have 2 Channels
- 16 kpts/Channel memory



- USB host port for mass storage
- USB device port (USBTMC)
- LAN port



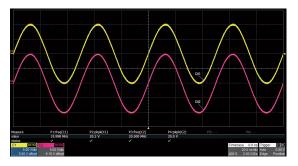
The rise/fall times can be set independently to a minimum of 16.8 ns at any frequency and to a maximum of 22.4s.

CH1:Si	ne.OFF.HiZ	Z Burst	CH2:Squ	are.OFF.Hiz	Mod
			Frequency Amplitude Offset Phase	10.00000 6.000 Vpr 0.000 Vdd 0.0 °	<b>)</b>
Start Pha	se 0.0°				
Cycles	100000	0Cycle	Load	HiZ	
Burst Per	iod 100.000	0001 s	Output	OFF	5 <mark>8</mark> 5
NCycle Gated	Cycles Infinite	Start Phase	Burst Period	Source Internal	Page 1/2 ►

Burst mode supports 'N Cycle' and 'Gated' modes with the Burst source being configured as 'Internal', 'External' or 'Manual'.



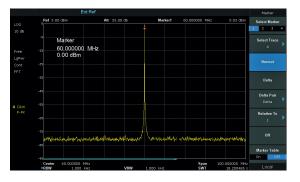
The T3AFG range of Function/Arbitrary Waveform Generators support a wide range of modulation types including AM, FM, PM, FSK, ASK, PSK and DSB-AM.



Output amplitude into a high impedance load can be as high 20 Vpp at frequencies up to 10 MHz, and 10 Vpp for frequencies greater than 20 MHz.

CH1:Si	ne.OFF.HiZ	Sweep	CH2:SqL	are.OFF.H	iZ Mod
		Frequency Amplitude Offset Phase		op	
Sweep Time <mark>1</mark> .000000 s					
Start Freq 0.000000 Hz			Load	HiZ	
Stop Freq 20.000000kHz		00kHz	Output	OFF	<del>р</del> т <mark>ж</mark> т
Sweep	StartFreq	StopFreq	Source	Trig Out	Page
Time	CenterFreq	FreqSpan	Internal	Off	1/2 ►

Sweep mode supports 'Linear' and 'Log' sweep, with 'Up' and 'Down' direction, and Sweep source can be configured as 'Internal', 'External' or 'Manual'.

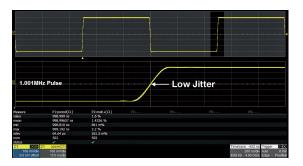


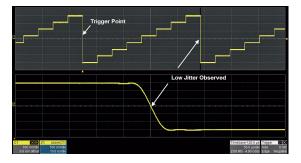
Sine wave output exhibits almost no spurious artefacts at 60 MHz and 0 dBm.

		Count	er:ON		
Freque	ncy	9.	999 780MH	z	
Positiv	e Width	50	0.6ns		
Duty	Duty		50.6 %		
Freq D	eviation	-21.931 523ppm			
Ref Fre	q	10.000 000MHz			
					다. 전 <mark>호</mark> 전
State	Frequency	Pwidth	RefFreq	Catur	Cancel
On	Period	Nwidth	TrigLev	Setup	Cancer

The counter functionality, accessed via the rear panel BNC, gives a DC or AC coupled counter capability from 100 mHz to 200 MHz.







The Teledyne Test Tools T3AFG30 and T3AFG60, with its low jitter design, can generate waveforms with exceptional edge stability. With better jitter performance comes better edge stability, and higher confidence in your circuit design.

### **Smart Capabilities**

- Sweep output carrier can be Sine, Square, Ramp and Arbitrary waveforms
- Burst output under internal or external signal control
- Waveform types include DC
- Frequency Resolution 1 µHz
- DSB-AM: Double Sideband AM modulation Function
- Harmonic Function generating up to 16 harmonics
- Multi-Language User Interface

### I/O Connectivity

- LAN and USB connection
- 10 MHz Reference Input/Output
- Aux Input/Output
- External modulation input
- External burst/sweep trigger input
- External gate input
- The Aux Input/Output will output a trigger pulse when an internal source is used
- External Counter input

# SPECIFICATIONS

### **Frequency Specification**

Waveform         Sine Square, Ramp, Pulse, Noise, Arbitrary           Sine         1 µH2 = 30 MH2         1 µH2 = 60 MH2           Square         1 µH2 = 12.5 MH2         1 µH2 = 60 MH2           Pulse         1 µH2 = 12.5 MH2         1 µH2 = 60 MH2           Ramp/Triangular         1 µH2 = 12.5 MH2         1 µH2 = 60 MH2           Noise         60 MH2 (3 dB)         Abtrary         1 µH2 = 60 MH2           Resolution         1 µH2 = 60 MH2         1 H2 = 60 MH2           Resolution         1 µH2 = 60 MH2         1 H2 = 60 MH2           Resolution         1 µH2 = 60 MH2         1 H2 = 60 MH2           Resolution         1 µH2 = 60 MH2         1 H2 = 60 MH2           Resolution         1 µH2 = 60 MH2         1 H2 = 60 MH2           Resolution         1 µH2 = 60 MH2         1 H2 = 60 MH2           Accuracy         IP yet arging +/- 25 pm at 0 = 40 Degrees C         1 H2 = 50 MH2           Sine Wave         IP = 60 MH2 - 30 MH2 < -60 dBc         1 0 MH2 - 80 MH2 < -50 dBc           Sine Wave         ID < 10 MH2 - 50 MH2 < -50 dBc         30 MH2 - 60 MH2 - 80 MH2 < -50 dBc           Sine Wave         ID < 0 MH2 - 50 MH2 < -50 dBc         30 MH2 - 60 MH2 < -50 dBc           Sine Wave         ID < 0 MH2 - 90 %, 50 O load at 1 Vpp. 50 0 Load           Duty Cycle	Frequency Specification			
Sine         1 µHz - 30 MHz         1 µHz - 60 MHz           Siguare         1 µHz - 40 MHz         1 µHz - 60 MHz           Noise         60 MHz (2 6 48)         1 µHz - 60 MHz           Ramp/Triangular         1 µHz - 6 40 MHz         1 µHz - 60 MHz           Noise         60 MHz (3 68)         40 MHz           Arbitrary         1 µHz - 6 MHz         1 µHz           Recolution         1 µHz         60 MHz (3 68)           Arbitrary         1 µHz - 6 MHz         10 MHz           Accuracy         1 ¤year aging +/- 25 ppm at 0 - 40 Degrees C         30 MHz - 60 MHz           Sine Wave         00 C - 10 MHz         - 60 dBc         10 MHz - 30 MHz           Barmonic Distortion         10 MHz - 30 MHz         - 60 dBc         10 MHz - 30 MHz           Spurous signal (non-harmonic)         10 MHz - 60 MHz < - 65 dBc         10 MHz - 30 MHz         -60 dBc           Spurous signal (non-harmonic)         10 MHz - 30 MHz < - 60 MBz         -60 dBc         -           Spurous signal (non-harmonic)         10 MHz - 30 MHz < - 65 dBc         10 MHz - 30 MHz         -60 dBc           Spurous signal (non-harmonic)         10 MHz - 60 MHz < - 40 dBc         -         -         -           Varge of the signal (noi Nerse (noi Nersignal (noi Nersignal (noi Nersignal (noi Nersignal (noi Nersignal	Model	T3AFG30	T3AFG60	
Square         1 µHz - 30 MHz         1 µHz - 60 MHz           Pulse         1 µHz - 12.5 MHz         Ramp/Triangular         1 µHz - 60 MHz           Noise         60 MHz (-3 dB)         Athitary         1 µHz - 60 MHz           Arbitrary         1 µHz - 60 MHz         -60 dBc	Waveform	Sine, Square, Ramp, Pulse, Noise, Arbitrary		
Pulse         1 μHz - 12.6 MHz           Ramp/Triangular         1 μHz - 500 kHz           Noise         60 MHz (2 d di)           Arbitrary         1 μHz - 6 MHz           Resolution         1 μHz           Accuracy         1" year aging +/- 25 ppm at 0 - 40 Degrees C           Sine Wave         0 C = 10 MHz - 50 dBc           Harmonic Distortion         0 C = 10 MHz - 50 dBc           10 MHz - 30 MHz - 50 dBc         0 MHz - 40 dBc           Total harmonic distortion         0 075 %, 0 dBm, 10 Hz - 20 kHz           Spurious signal (non-harmonic)         D C + 10 MHz - 65 dBc           10 MHz - 40 MHz - 40 dBc         20 MHz - 60 MHz - 40 dBc           Square Wave         IBes/fall time         4 2 ns,10 % - 90 %, 50 Ω load at 1 Vpp           Bise/fall time         4 2 ns,10 % - 90 %, 50 Ω load at 1 Vpp         38 ns,10 % - 90 %, 50 Ω load at 2.5 Vpp           Overshoot         3 % (typical. 100 Hz 1 Vpp, 50 Ω Load)         Duty Cycle         0001 % - 99 99 %, Limited By Frequency           Jitter         300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load         Duty Cycle         0001 % - 99 99 %, Dim of period, 1 Vpp, 50 Ω Load           Pulse width         32.6 ns, Min: Accuracy +/< (0.01 % + 1 ns)	Sine	1 μHz – 30 MHz	1 μHz – 60 MHz	
Ramp/Triangular         1 µHz - 500 kHz           Noise         60 MHz (-3 dB)           Arbitrary         1 µHz           Resolution         1 µHz           Accuracy         2 µDz           Actian         0 µDz           Start         0 µDz	Square	1 μHz – 30 MHz	1 μHz – 60 MHz	
Noise         60 MHz (-3 dB)           Arbitrary         1 µHz - 6 MHz           Arbitrary         1 µHz - 6 MHz           Recolution         1 µHz           Accuracy         1" year aging +/- 25 ppm at 0 - 40 Degrees C           Sine Wave         III Wave           Harmonic Distortion         DC - 10 MHz - 50 dBc           10 MHz - 30 MHz - < 60 dBc	Pulse	1 μHz – 12.5 MHz		
Arbitrary         1 µHz           Resolution         1 µHz           Resolution         1 µHz           Accuracy         1 P year aging +/- 25 ppm at 0 – 40 Degrees C           Sine Wave         DC – 10 MHz         <-60 dBc	Ramp/Triangular	1 μHz – 500 kHz		
Resolution       1 µHz         Accuracy       I* year aging +/- 25 ppm at 0 – 40 Degrees C         Sine Wave         Harmonic Distortion       DC – 10 MHz – < 50 dBc	Noise	60 MHz (-3 dB)		
Accuracy         1ª year aging +/- 25 ppm at 0 – 40 Degrees C           Sine Wave         DC – 10 MHz – 30 MHz – 60 dBc 10 MHz – 30 MHz – 40 dBc           Total harmonic Distortion         DC – 10 MHz – 40 dBc           10 MHz – 60 MHz – 40 dBc         30 MHz – 60 MHz – 450 dBc           Spurious signal (non-harmonic)         DC + 10 MHz – 65 dBc           10 MHz – 50 MHz – 456 dBc         10 MHz – 50 MHz – 450 dBc           30 MHz – 60 MHz – 40 dBc         30 MHz – 60 MHz – 40 dBc           Square Wave         Netro + 50 dBc           Rise/fall time         4.2 ns, 10 % – 90 %, 50 0 Load at 1 Vpp         3.8 ns, 10 % – 90 %, 50 Q load at 2.5 Vpp           Overshoot         3 % (typical. 100 kHz, 1 Vpp, 50 0 Load)         Duty Cycle         0.001 % – 99.99 % Limited By Frequency           Jitter         300 pp + 0.05 ppm of period, 1 Vpp, 50 0 Load         Pulse         Duty Cycle           Pulse width         32.6 ns, Min. Accuracy +/- (0.01 % + 1 ns)         Rise/Fall time (10 % – 90 %, typical)         16.8 ns – 22.4 s           Duty Cycle         0.001 % ns = 99.99 % .001 % Resolution, Limited by Pulse Width         Overshoot         3 % (typical. 10 kHz, 1 Vpp, 50 0 Load)           Overshoot         3 % (typical. 10 kHz, 1 Vpp, 50 0 Load)         Itter(k-pk)         300 ps + 0.05 pm of period, 1 Vpp, 50 0 Load           Ramp/Triangle Wave         Linearity         <=1 % of Vpp (typical, 1	Arbitrary	1 μHz – 6 MHz		
Sine Wave         DC = 10 MHz         < 60 dBc           Harmonic Distortion         DC = 0 MHz         < 60 dBc	Resolution	1 µHz		
Harmonic Distortion         DC = 10 MHz         < 60 dBc           10 MHz         30 MHz         < 60 dBc	Accuracy	1 <sup>st</sup> year aging +/- 25 ppm at 0 – 40 Degrees C		
10 MHz - 30 MHz - 40 dBc           30 MHz - 60 MHz - 20 KHz           Spurious signal (non-harmonic)           DC + 10 MHz - 30 MHz - 55 dBc           10 MHz - 30 MHz - 55 dBc           30 MHz - 60 MHz - 40 dBc           Square Wave           Rise/fall time         4.2 ns,10 % - 90 %, 50 0 load at 1 Vpp           0 MHz - 30 MHz - 40 dBc           Square Wave           Rise/fall time         4.2 ns,10 % - 90 %, 50 0 load at 1 Vpp           0 WHz - 30 MHz - 40 dBc           Square Wave           Rise/fall time         4.2 ns,10 % - 90 %, 50 0 load at 2.5 Vpp           Overshoot         3% (typical, 100 KHz, 1 Vpp, 50 0 Load)           Duty Cycle         0.001 % - 99.999 % Limited By Frequency           Jitter         300 ps + 0.05 ppm of period, 1 Vpp, 50 0 Load           Pulse width         32.6 ns, Min. Accuracy +/- (0.01 % + 1 ns)           Rise/Fall time (10 % - 90 %, typical)         16.8 ns - 22.4 s           Duty Cycle         0.001 % - 99.99 %, 0.001 % Resolution, Limited by Pulse Width           Overshoot         3% (typical, 100 KHz, 1 Vpp, 50 0 Load)           Jitter(pk-pk)         300 ps + 0.05 ppm of period, 1 Vpp, 50 0 Load           Ramp/Triangle Wave         Set for Vpp (typical, 1 KHz, 1 Vpp, 100 % symmetric)           Symmetry         0 % - 100 %	Sine Wave			
30 MHz         < 40 dBc	Harmonic Distortion	DC – 10 MHz <- 60 dBc		
Total harmonic distortion         0.075 %, 0 dBm, 10 Hz - 20 kHz           Spurious signal (non-harmonic)         DC < 10 MHz - <65 dBc				
Spurious signal (non-harmonic)         DC < 10 MHz < 66 dBc 10 MHz - 30 MHz < < 55 dBc 30 MHz < < 40 dBc				
10 MHz - 30 MHz - 65 5 dBc           30 MHz - 60 MHz - 60 MHz           Rise/Fall time         4.2 ns,10 % - 90 %, 50 Q load at 1 Vpp         3.8 ns,10 % - 90 %, 50 Q load at 2.5 Vpp           Overshoot         3 % (typical, 100 kHz, 1 Vpp, 50 Q Load)         Duty Cycle         0.001 % - 99.999 % Limited By Frequency           Jitter         300 ps + 0.05 ppm of period, 1 Vpp, 50 Q Load         Pulse         Pulse           Pulse width         32.6 ns, Min. Accuracy +/~ (0.01 % + 1 ns)         Rise/Fall time (10 % - 90 %, typical)         16.8 ns - 22.4 s           Duty Cycle         0.001 % - 99.999 %, 0.001 % Resolution, Limited by Pulse Width         Overshoot         3 % (typical, 100 kHz, 1 Vpp, 50 Q Load)           Overshoot         3.00 ps + 0.05 ppm of period, 1 Vpp, 50 Q Load         Type, 50 Q Load           Buty Cycle         0.001 % - 99.999 %, 0.001 % Resolution, Limited by Pulse Width         Overshoot           Overshoot         3.% (typical, 10 kHz, 1 Vpp, 50 Q Load)         State period           Jitter (pk-pk)         300 ps + 0.05 ppm of period, 1 Vpp, 50 Q Load         State period           Ramp / Triangle Wave         Inearity         <= 1 % of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)				
30 MHz - 60 MHz         <-40 dBc	Spurious signal (non-harmonic)			
Square Wave         Rise/fall time       4.2 ns,10 % - 90 %, 50 Ω load at 1 Vpp       3.8 ns,10 % - 90 %, 50 Ω load at 2.5 Vpp         Overshoot       3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)       Duty Cycle         Duty Cycle       0.001 % - 99.999 % Limited By Frequency       Jitter         Pulse       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load       Pulse         Pulse width       32.6 ns, Min. Accuracy +/- (0.01% + 1 ns)       Rise/Fall time (10% - 90%, typical)         Rise/Fall time (10% - 90%, typical)       16.8 ns - 22.4 s       Duty Cycle         Overshoot       3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)       Jitter(pk-pk)         300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load       Sample Triangle Wave       Linearity         Linearity       <= 1 % of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)				
Rise/fall time         4.2 ns,10 % - 90 %, 50 0 load at 1 Vpp         3.8 ns,10 % - 90 %, 50 0 load at 2.5 Vpp           Overshoot         3 % (typical, 100 kHz, 1 Vpp, 50 0 Load)         Duty Cycle         0.001 % - 99.999 % Limited By Frequency           Jitter         300 ps + 0.05 ppm of period, 1 Vpp, 50 0 Load         Pulse           Pulse width         32.6 ns, Min. Accuracy +/- (0.01% + 1 ns)           Rise/Fall time (10 % - 90 %,typical)         16.8 ns - 22.4 s           Duty Cycle         0.001 % - 99.999 %, 0.001 % Resolution, Limited by Pulse Width           Overshoot         3 % (typical, 100 kHz, 1 Vpp, 50 0 Load)           Jitter(pk)         300 ps + 0.05 ppm of period, 1 Vpp, 50 0 Load           Ramp/Triangle Wave         Linearity           Linearity         <= 1 % of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)				
Overshoot       3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)         Duty Cycle       0.001 % - 99 999 % Limited By Frequency         Jitter       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load         Pulse       Pulse width         Bise/Fall time (10 % - 90 %,typical)       16.8 ns - 22.4 s         Duty Cycle       0.001 % - 99 999 %, 0.001 % Resolution, Limited by Pulse Width         Overshoot       3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)         Jitter(pk-pk)       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load)         Jitter(pk-pk)       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load)         Jitter(pk-pk)       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load)         Jitter(pk-pk)       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load)         Symmetry       0 % = 100 %         Harmonic Output       0 % = 100 %         Order       10 Maximum         Type       Even, Odd, All         Arbitrary Wave       16 k points         Vertical resolution       14 bits         Sample rate       30 MSa/s Arb Mode, 150 MSa/s DDS Mode         Min. Rise/Fall time       8 ns (typical)         Jitter(pk-pk)       300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk         Number of built in Arb waveforms       196 waveforms         Noise Characteristics       -3 dB bandwidth				
Duty Cycle     0.001% - 99.999 % Limited By Frequency       Jitter     300 ps + 0.05 ppm of period, 1 Vpp, 50 0 Load       Pulse       Pulse width     32.6 ns, Min. Accuracy +/- (0.01% + 1 ns)       Rise/Fall time (10% - 90%,typical)     16.8 ns - 22.4 s       Duty Cycle     0.001% - 99.999 %, 0.001% Resolution, Limited by Pulse Width       Overshoot     3 % (typical, 100 kHz, 1 Vpp, 50 0 Load)       Jitter(pk-pk)     300 ps + 0.05 ppm of period, 1 Vpp, 50 0 Load       Ramp/Triangle Wave     Linearity       Linearity     <= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)		4.2 ns,10 % – 90 %, 50 Ω load at 1 Vpp	3.8 ns,10 % – 90 %, 50 Ω load at 2.5 Vpp	
Jitter         300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load           Pulse         Pulse width         32.6 ns, Min. Accuracy +/- (0.01% + 1 ns)           Rise/Fall time (10% - 90%,typical)         16.8 ns - 22.4 s         Duty Cycle         0.001% - 99.999%, 0.001% Resolution, Limited by Pulse Width           Overshoot         3% (typical, 100 kHz, 1 Vpp, 50 Ω Load)         Jitter(pk-pk)         300 ps + 0.05 pm of period, 1 Vpp, 50 Ω Load           Ramp/Triangle Wave	Overshoot	3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)		
Pulse         Pulse width       32.6 ns, Min. Accuracy +/- (0.01% + 1 ns)         Rise/Fall time (10% - 90%, typical)       16.8 ns - 22.4 s         Duty Cycle       0.001% - 99.999%, 0.001% Resolution, Limited by Pulse Width         Overshoot       3% (typical, 100 kHz, 1 Vpp, 50 Ω Load)         Jitter(pk-pk)       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load         Ramp / Triangle Wave       Linearity         Linearity       <= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100% symmetric)	Duty Cycle	0.001 % – 99.999 % Limited By Frequency		
Pulse width32.6 ns, Min. Accuracy +/- (0.01% + 1 ns)Rise/Fall time (10% - 90%, typical)16.8 ns - 22.4 sDuty Cycle0.001% - 99.999%, 0.001% Resolution, Limited by Pulse WidthOvershoot3% (typical, 100 kHz, 1 Vpp, 50 Ω Load)Jitter(pk-pk)300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω LoadRamp / Triangle WaveLinearity<= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)	Jitter	300 ps + 0.05 ppm of period, 1 Vpp, 50 $\Omega$ Load		
Rise/Fall time (10 % - 90 %,typical)16.8 ns - 22.4 sDuty Cycle0.001 % - 99.999 %, 0.001 % Resolution, Limited by Pulse WidthOvershoot3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)Jitter(pk-pk)300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω LoadRamp/Triangle WaveLinearityLinearity<= 1 % of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)	Pulse			
Rise/Fall time (10% – 90%,typical)16.8 ns – 22.4 sDuty Cycle0.001% – 99.999%, 0.001% Resolution, Limited by Pulse WidthOvershoot3% (typical, 100 kHz, 1 Vpp, 50 Ω Load)Jitter(pk-pk)300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω LoadRamp / Triangle WaveLinearity<= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100% symmetric)	Pulse width	32.6 ns, Min. Accuracy +/- (0.01% + 1 ns)		
Overshoot       3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)         Jitter(pk-pk)       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load         Ramp / Triangle Wave <ul> <li>Linearity</li> <li>&lt;= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)</li> <li>Symmetry</li> <li>0 % - 100 %</li> <li>Harmonic Output</li> <li>Order</li> <li>10 Maximum</li> <li>Type</li> <li>Even, Odd, All</li> <li>Arbitrary Wave</li> <li>Waveform length</li> <li>16 k points</li> <li>Vertical resolution</li> <li>14 bits</li> <li>Sample rate</li> <li>30 MSa/s Arb Mode, 150 MSa/s DDS Mode</li> <li>Min. Rise/Fall time</li> <li>8 ns (typical)</li> <li>Jitter(pk-pk)</li> <li>300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk</li> <li>Number of built in Arb waveforms</li> <li>Arb waveforms</li> <li>60 MHz</li> <li>DC Characteristics</li> <li>-3 dB bandwidth</li> <li>60 MHz</li> </ul>	Rise/Fall time (10 % – 90 %,typical)	16.8 ns – 22.4 s		
Jitter(pk-pk)       300 ps + 0.05 ppm of period, 1 Vpp, 50 Ω Load         Ramp / Triangle Wave       Linearity         Linearity       <= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)	Duty Cycle	0.001 % - 99.999 %, 0.001 % Resolution, Limited	d by Pulse Width	
Ramp / Triangle Wave         Linearity       <= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)	Overshoot	3 % (typical, 100 kHz, 1 Vpp, 50 Ω Load)		
Linearity       <= 1% of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)	Jitter(pk-pk)			
Symmetry       0 % - 100 %         Harmonic Output         Order       10 Maximum         Type       Even, Odd, All         Arbitrary Wave         Waveform length       16 k points         Vertical resolution       14 bits         Sample rate       30 MSa/s Arb Mode, 150 MSa/s DDS Mode         Min. Rise/Fall time       8 ns (typical)         Jitter(pk-pk)       300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk         Number of built in Arb waveforms       196 waveforms         -3 dB bandwidth       60 MHz         DC Characteristics	Ramp/Triangle Wave			
Symmetry       0 % - 100 %         Harmonic Output         Order       10 Maximum         Type       Even, Odd, All         Arbitrary Wave         Waveform length       16 k points         Vertical resolution       14 bits         Sample rate       30 MSa/s Arb Mode, 150 MSa/s DDS Mode         Min. Rise/Fall time       8 ns (typical)         Jitter(pk-pk)       300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk         Number of built in Arb waveforms       196 waveforms         -3 dB bandwidth       60 MHz         DC Characteristics	Linearity	<= 1 % of Vpp (typical, 1 kHz, 1 Vpp, 100 % symr	netric)	
Order       10 Maximum         Type       Even, Odd, All         Arbitrary Wave           Waveform length       16 k points         Vertical resolution       14 bits         Sample rate       30 MSa/s Arb Mode, 150 MSa/s DDS Mode         Min. Rise/Fall time       8 ns (typical)         Jitter(pk-pk)       300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk         Number of built in Arb waveforms       196 waveforms         Noise Characteristics           -3 dB bandwidth       60 MHz			,	
Order       10 Maximum         Type       Even, Odd, All         Arbitrary Wave           Waveform length       16 k points         Vertical resolution       14 bits         Sample rate       30 MSa/s Arb Mode, 150 MSa/s DDS Mode         Min. Rise/Fall time       8 ns (typical)         Jitter(pk-pk)       300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk         Number of built in Arb waveforms       196 waveforms         Noise Characteristics           -3 dB bandwidth       60 MHz		·		
Type       Even, Odd, All         Arbitrary Wave       I6 k points         Waveform length       16 k points         Vertical resolution       14 bits         Sample rate       30 MSa/s Arb Mode, 150 MSa/s DDS Mode         Min. Rise/Fall time       8 ns (typical)         Jitter(pk-pk)       300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk         Number of built in Arb waveforms       196 waveforms         Noise Characteristics       -3 dB bandwidth         OC Characteristics       60 MHz	Order	10 Maximum		
Arbitrary Wave         Waveform length       16 k points         Vertical resolution       14 bits         Sample rate       30 MSa/s Arb Mode, 150 MSa/s DDS Mode         Min. Rise/Fall time       8 ns (typical)         Jitter(pk-pk)       300 ps, TrueArb Mode, 67 ns DDS Mode, pk-pk         Number of built in Arb waveforms       196 waveforms         Noise Characteristics       -3 dB bandwidth         DC Characteristics       60 MHz				
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Number of built in Arb waveforms     196 waveforms       Noise Characteristics     -3 dB bandwidth       -3 dB bandwidth     60 MHz       DC Characteristics				
Arb waveforms     Image: Characteristics       -3 dB bandwidth     60 MHz       DC Characteristics				
-3 dB bandwidth 60 MHz DC Characteristics		196 waveforms		
DC Characteristics	Noise Characteristics			
	-3 dB bandwidth	60 MHz		
	DC Characteristics			
Range  -IU V to +IU V HIZ Load	Range	-10 V to +10 V HiZ Load		
-5 V to + 5 V 50 Ω Load		-5 V to + 5 V 50 Ω Load		
Accuracy +/- (1 % + 3 mV) HiZ Load	Accuracy	+/- (1 % + 3 mV) HiZ Load		

### **Harmonic Output Characteristics**

Order	16
Туре	All, Even, Odd
<b>Output Characteristics</b>	

Range	2 mV − 20 Vpp ≤ 10 MHz HiZ load, 2 mV − 10 Vpp > 10 MHz HiZ load. Values are halved into 50 Ω load
Accuracy	+/- (1% + 1 mVpp) 10 kHz sine wave, 0 V offset
Amplitude Flatness	+/- 0.3 dB, 50 Ω load, 2.5 Vpp (reference 10 kHz sine wave)
Output impedance	50 Ω +/- 0.5 Ω at 10 kHz sine wave
Output current	+/- 200 mA
Channel to channel Crosstalk	-60 dBc, 0 dBm, sine wave, 50 Ω load

### **Modulation Characteristics – AM**

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulation Wave	Sine, Square, Ramp, Noise, Arb
Modulation Depth	0 - 120 %
Modulation Frequency	1 mHz – 20 MHz, Modulation source "internal"

### **Modulation Characteristics – FM**

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulation Wave	Sine, Square, Ramp, Noise, Arb
Modulation Depth	0 - 0.5 * BW, BW is the max output frequency limited by the frequency settings
Modulation Frequency	1 mHz – 20 kHz, Modulation source "internal"

### **Modulation Characteristics – PM**

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Arb, Noise
Phase Deviation	0 Deg - 360 Deg
Modulation Frequency	1 mHz to 20 kHz with 'internal' modulation source

### **Modulation Characteristics – ASK**

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Square with 50 % duty cycle
Keying Frequency	1 mHz to 50 kHz Limited by frequency setting with 'internal' modulation source

### **Modulation Characteristics – FSK**

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Square with 50 % duty cycle
Modulation Frequency	1 mHz to 50 kHz with 'internal' modulation source

### **Modulation Characteristics – PSK**

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Square with 50 % duty cycle
Modulation Frequency	1 mHz to 50 kHz with 'internal' modulation source

# SPECIFICATIONS

### **Modulation Characteristics – PWM**

Pulse
Internal/External
Sine, Square, Ramp, Noise, Arb
1 mHz to 1 MHz with 'internal' modulation source
Minimum 6.67 ns
Sine, Square, Ramp, Noise, Pulse, Arb
Count (1–1 M cycles), Infinite, Gated
2 mHz – Maximum output frequency
0 Deg to 360 Deg
1 µs – 1000 seconds
Internal, External, Manual
Internal, External
Maximum of 100 seconds

Carrier	Sine, Square, Ramp, Arb
Туре	Linear, Log
Direction	Up, Down
Carrier Frequency	1 µHz – Maximum output frequency
Sweep Time	1 ms – 500 seconds
Trigger Source	Internal, External, Manual

### **Frequency Counter Characteristics**

Function	Frequency, Period, Positive / Negative Pulse Width, Duty Cycle
Coupling	DC, AC, HF REJ
Frequency Range	DC: 100 mHz – 200 MHz, AC: 10 Hz – 200 MHz
DC Input Amplitude	100 mV rms - +/- 2.5 V < 100 MHz
	200 mV rms – +/- 2.5 V 100 MHz – 200 MHz
AC Input Amplitude	100 mV rms – 5Vp-p < 100 MHz
	200 mV rms – 5Vp-p 100 MHz – 200 MHz
Input Impedance	1 ΜΩ

### **Reference Clock Input**

Frequency	10 MHz
Amplitude	Minimum 1.4 Vp-p
Input Impedance	5 kΩ AC coupled

### **Reference Clock Output**

Frequency	10 MHz Synchronised to the internal reference clock
Amplitude	Minimum 2 Vp-p into high impedance load
Output Impedance	50 Ω

### **External Trigger Input**

V in Low	-0.5 V to +0.8 V
V in High	+2 V to +5.5 V
Direction	Up, Down
Input Impedance	100 kΩ
Minimum Pulse Width	100 ns
Maximum Response Time	100 ns – Sweep, 600 ns – Burst

### **Trigger Output**

V out Low	Maximum 0.44 V at 8 mA
V out High	Mimimum 3.8 V at -8 mA
Output Impedance	100 Ω
Maximum Frequency	1 MHz

### Sync Output

V out Low	Maximum 0.44 V at 8 mA
V out High	Mimimum 3.8 V at -8 mA
Output Impedance	100 Ω
Maximum Frequency	10 MHz
Pulse Width	500 ns

### **Modulation Input**

Frequency	0 Hz to 50 kHz
Input Impedance	10 kΩ
Amplitude at 100 % Modulation Depth	Min 11 Vp-p, Тур 12 Vp-p, Max 13 Vp-p

### **General Characteristics**

Power		
Voltage	100 V to 240 V (+/-10 %) at 50 Hz / 60Hz 100 V to 120 V (+/-10 %) at 400 Hz	
Power Consumption	Typical 21 W, Maximum 50 W	
Display		
Color Depth	24 bit	
Contrast Ratio	350:1	
Luminance	300 cd/m <sup>2</sup>	
Environment		
Operating Temperature	0 Deg C to 40 Deg C	
Storage Temperature	-20 Deg C to 60 Deg C	
Operating Humidity	$5\%$ to 90 % $\leq$ 30 Deg C   5 % to 50 % > 30 Deg C	
Non-Operating Humidity	5 % to 95 %	
Maximum Operating Altitude	3048 m ≤ 30 Deg C	
Maximum Non-Operating Altitude	15000 m	
Calibration		
Calibration Interval	Annually	
Mechanical		
Dimensions	W x D x H = 260.3 mm x 107.2 mm x 295.7 mm	
Net Weight	3.43 kg	
Gross Weight	4.35 kg	
Compliance		
LVD	IEC 61010-2:2010	
EMC	EN61326-1:2013	

### **Ordering information**

Models	T3AFG30 30 MHz	
	T3AFG60 60 MHz	
Standard Accessories	Quick Start Guide	
	USB Cable	
	Calibration Certificate	
	Power Cord	

# **ABOUT TELEDYNE TEST TOOLS**



### **Company Profile**

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-tomarket. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

### **Location and Facilities**

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

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