**TELEDYNE**
**DEFENCE & SPACE**
Everywhere**you**look™

## 2 to 18GHz Instantaneous Frequency Measurement Unit

The DR058-F1 utilises proprietary Teledyne Defence & Space (TDS) technology to provide state of the art performance in a package measuring only 152mm x 147mm x 30mm and weighing 1.55kg.

The DR058-F1 is a clocked sampling IFM, providing a digital 14-bit output word of the RF input frequency for each clock cycle. An external trigger will force a sample to be taken asynchronously. The internal analogue bandwidth is sufficient to capture a 50ns pulse.

With a resolution of 14 bits, the DR058-F1 gives a nominal frequency resolution of 1 MHz and an rms accuracy of ≤4.5MHz with an input SNR of 3dB or better.

Designed specifically for fast jet applications this product will withstand the most demanding of environments. It is characterised for −40ºC to +85ºC. For applications outside this range, please contact the TDL sales team.

External connections are made via a 51 way high density D type for power and digital I/O and SMA for the RF input.

This product is recommended for new designs. Other IFM configurations are available and for further information, please contact the TDS Sales Team.

### ◣ FEATURES

- 14 Bit resolution
- External trigger or clocked sampling 50ns pulse capable
- 16GHz Instantaneous bandwidth
- -50dBm sensitivity
- Small form factor
- Low weight
- Low power consumption

### ◣ APPLICATIONS

- Electronic Support Measures (ESM)
- Radar Warning Receivers (RWR)
- ECM Set-on
- Airborne, Fixed Wing & Rotary
- Land
- Naval

See restrictions on published datasheets at www.teledynedefence.co.uk/

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## ELECTRICAL SPECIFICATIONS

| Ref | Parameter | Units | Value | | | Notes |
|---|---|---|---|---|---|---|
| | | | Min | Nom | Max | |
| 1 | Operating Frequency Range | GHz | 1.955 | | 18.045 | |
| 2 | Unambiguous Bandwidth | GHz | 1.5 | | 18.5 | |
| 3 | Frequency Resolution | MHz | | 1 | | 1 |
| 4 | Digital Frequency Resolution | Bits | | 14 | | |
| 5 | Clock Rate | MHz | 15 | | 50 | |
| 6 | Throughput Time | ns | 88 | | 118 | 2 |
| 7 | RF Input Dynamic Range | dBm | -50 | | 10 | |
| 8 | RF Input Signal/Noise Ratio | dB | 3 | | | 3 |
| 9 | RF Input Pulse Width | ns | 50 | | CW | 4 |
| 10 | Recovery Time | ns | | | 50 | 5 |
| 11 | RF Input VSWR | | | | 2.2:1 | |
| 12 | Frequency Error (RMS) at 3 dB SNR | MHz | | | 4.5 | 6 |
| 13 | Frequency Peak Error at 3 dB SNR | MHz | | 15 | | 6 |
| 14 | Peak Error Rate at 3 dB SNR | % | | | 0.04 | 7 |
| 15 | Bad Data Error Rate at 3 dB SNR | % | | | 1 | 8 |
| 16 | Simultaneous Signal: Level | dBc | 10 | | | 9 |
| 17 | Simultaneous Signal: Frequency Separation | MHz | | 100 | | 9 |
| 18 | Overload Power | dBm | | | 20 | 10 |
| 19 | Temperature Range (operating) | °C | -40 | | 85 | |
| 20 | Power Consumption | Watts | | | 25 | |
| 21 | Power Supply Current: +12v Rail | mA | | | 900 | |
| 22 | Power Supply Current: +5v Rail | mA | | | 2500 | |
| 23 | Power Supply Current: -5v Rail | mA | | | 350 | |
| 24 | Weight (Approx.) | kg | | | 1.55 | |

1. Nominal frequency resolution is unambiguous bandwidth divided by number of bits.
2. See timing diagrams. Based on a 50 MHz clock.
3. Minimum SNR required for nominal operation.
4. Minimum pulse width is defined by internal video bandwidth.
5. Given as the maximum time required between the removal of a pulse of RF at any power within the operating dynamic range and the arrival of the next pulse to ensure the correct measurement of the second pulse.
6. The actual resolution, i.e.,the change of frequency required to change 1 bit of the output word varies with frequency. The rms accuracy is calculated as the standard deviation of the frequency distribution. The rms accuracy is specified for 3dB and 0dB input SNR. The rms error excludes those measurements that are flagged as "bad data".
7. The percentage number of measurements that exceed the peak error frequency.
8. The percentage number of measurements that cause the 'bad data' signal to be asserted.
9. Simultaneous signals are defined as signals which overlap by at least 30ns during a measurement cycle. A valid measurement will be made on the larger of two signals provided that a) the amplitude difference between them is 10dB and b) there is at least 100MHz frequency separation.
10. Maximum input power without damage.

## TIMING INFORMATION
Continuously Clocked Mode
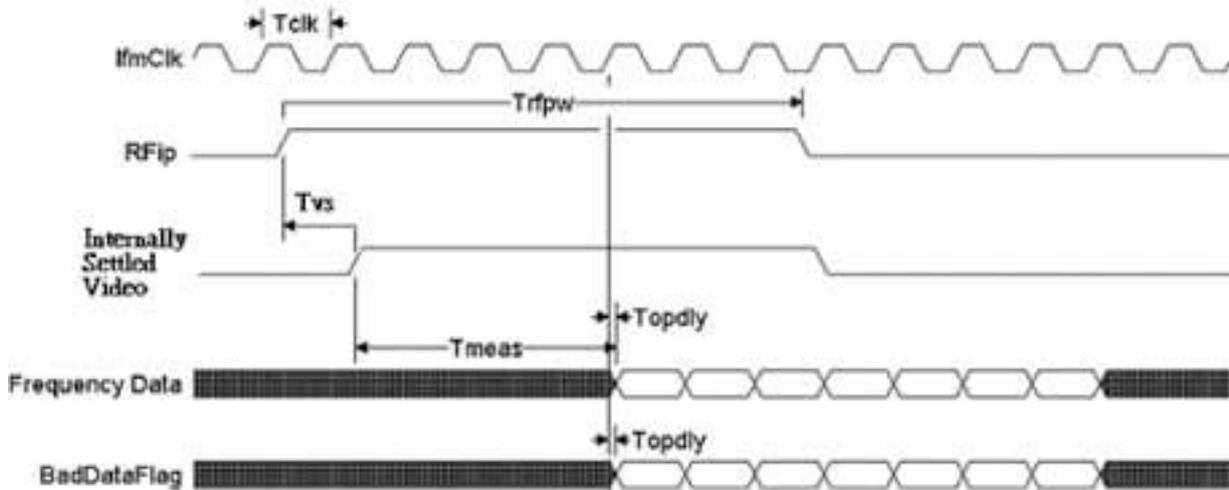


| Parameter | Description | Timings | | |
|-----------|-------------|------|---------|-----|
| | | Min | Nominal | Max |
| **Tclk** | ClockPeriod | 20 ns | | 67 ns |
| **Trfpw** | RF Pulse Width | Tclk+30 ns | | CW |
| **Topdly** | Data Output Delay | 0 ns | | 10 ns |
| **Tvs** | Video Settling time | 15 ns | | 25 ns |
| **Tmeas** | Throughput Time from settled video digitisation | | Tclk(3.5±0.5)+Topdly | |

Note that the recovery time between two consecutive pulses can be as low asTclk.
No Data Valid output is provided in continuous clock mode.

## TIMING INFORMATION
Triggered Mode
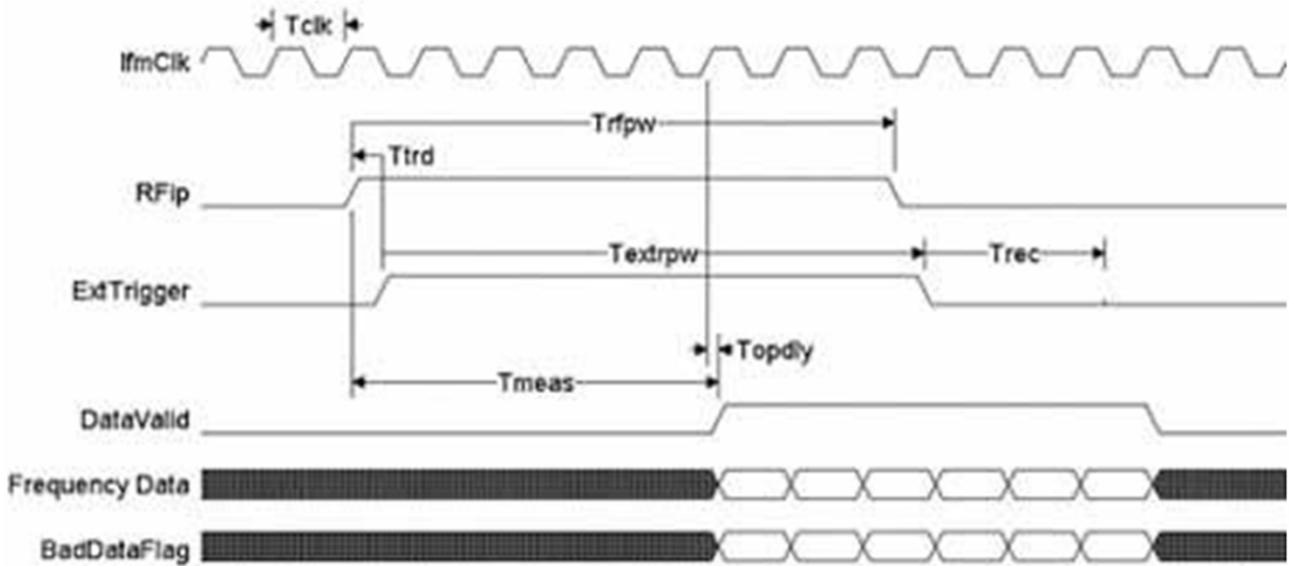


| Parameter | Description | Timings | | |
|---|---|---|---|---|
| | | **Min** | **Nominal** | **Max** |
| **Tclk** | Clock Period | 20 ns | | 67 ns |
| **Trfpw** | RF Pulse Width | 50 ns | | CW |
| **Textrpw** | External Trigger Width | 35 ns | | CW |
| **Topdly** | Data Output Delay | 0 ns | | 10 ns |
| **Trec (Note 1)** | Recovery Time | | | 50 ns |
| **Ttrd (Note 2)** | Trigger Delay from RF | 4 ns | | 12 ns |
| **Tmeas** | Throughput Time | | Trd+Tclk (4.5±0.5)+Topdly | |

Note 1    If a second pulse starts within this period the frequency measured may not be correct.
Note 2    This timing will ensure that the frequency within a 50 ns pulse is measured correctly..

When no external trigger is supplied, but RF is present, the device will run in continuous clock mode. The rising edge of ExtTrigger causes the digitized tier video data at the front of the pipeline to be held (frozen) after a delay of approximately 25 ns (to allow video to settle) for a minimum period of 1 clock cycle to guarantee that this data enters the pipeline at the next rising clock edge.

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## PIN DESIGNATIONS

| Pin | Signal | Direction |
| --- | --- | --- |
| 1 | IFM Clock + | Input |
| 2 | 0V | Return |
| 3 | 0V | Return |
| 4 | Ext Trigger - | Input |
| 5 | Freq 1 - | Output |
| 6 | Ext Trigger + | Input |
| 7 | Freq 3 - | Output |
| 8 | Bad Data - | Output |
| 9 | Freq 7 - | Output |
| 10 | Freq 9 - | Output |
| 11 | Data Valid - | Output |
| 12 | Freq 11 - | Output |
| 13 | Data Valid + | Output |
| 14 | Freq 12 - | Output |
| 15 | 0V | Return |
| 16 | 0V | Return |
| 17 | -5V | Power |
| 18 | 0V | Return |
| 19 | IFM Clock + | Input |
| 20 | 0V | Return |
| 21 | 0V | Return |
| 22 | Freq 0 - | Output |
| 23 | Freq 1 + | Output |
| 24 | Freq 2 - | Output |
| 25 | Freq 3 + | Output |
| 26 | Freq 4 - | Output |
| 27 | Bad Data + | Output |
| 28 | Freq 8 - | Output |
| 29 | Freq 11 + | Output |
| 30 | Freq 10 - | Output |
| 31 | Freq 12 + | Output |
| 32 | 0V | Return |
| 33 | Freq 13 - | Output |
| 34 | 0V | Return |
| 35 | Freq 13 + | Output |
| 36 | +12V | Power |
| 37 | 0V | Return |
| 38 | Freq 0 + | Output |
| 39 | Freq 2 + | Output |
| 40 | Freq 4 + | Output |
| 41 | Freq 5 + | Output |
| 42 | Freq 5 - | Output |
| 43 | Freq 7 + | Output |
| 44 | Freq 6 + | Output |
| 45 | Freq 6 - | Output |
| 46 | Freq 9 + | Output |
| 47 | Freq 8 + | Output |
| 48 | Freq 10 + | Output |
| 49 | OV | Return |
| 50 | +5V | Power |
| 51 | +5V | Power |

## ENVIRONMENTAL SCREENING

100% of units subjected to: burn in 8 hours operational at 71ºC, random vibration (as below), 5min per axis, thermal shock (as below), random vibration (as below), 5min per axis.

Environmental Data
Compliance can be shown by similarity to the following environmental conditions:

Sinusoidal Vibration: MIL-STD-202F, Method 204 - 5g profile between 5 and 104Hz for 90 min per axis
Random Vibration: MIL-STD-810D, Method 514.3 – specified profile (below) with max of 0.2g²/Hz for 60 min per axis, 20 to 2000Hz
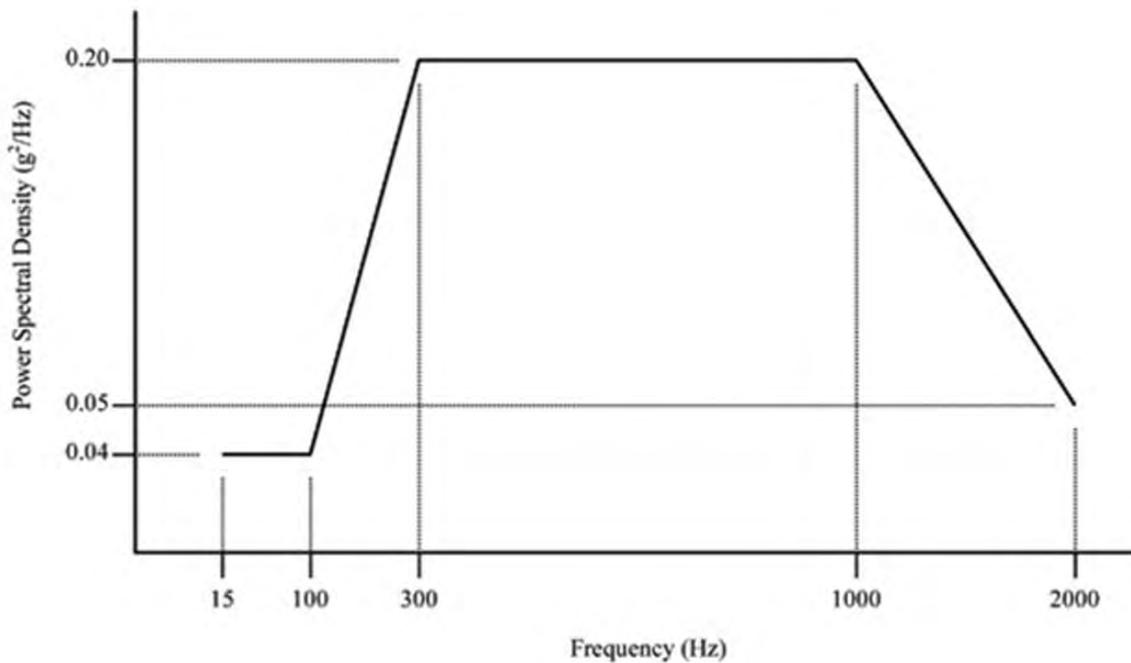


Mechanical Shock: MIL-STD-202F, Method 213B – 15g/11ms, 3 shocks in each axis in each direction (18 total) Acceleration: MIL-STD-202F, Method 212A, condition B, 6 to 14g

High Temperature storage: MIL-STD-810D, Method 501.2 - 95ºC for 8 hours

High Temperature operational: MIL-STD-820D, Method 501.2 – 71ºC / 30min, 60ºC / 60min, 55ºC / 4hr Thermal Shock: 10 Cycles of –40ºC to 71ºC, 5 min ramp, 2hr dwell

Low Temperature storage: MIL-STD-810D, Method 502.2 - -54ºC for 8 hours.
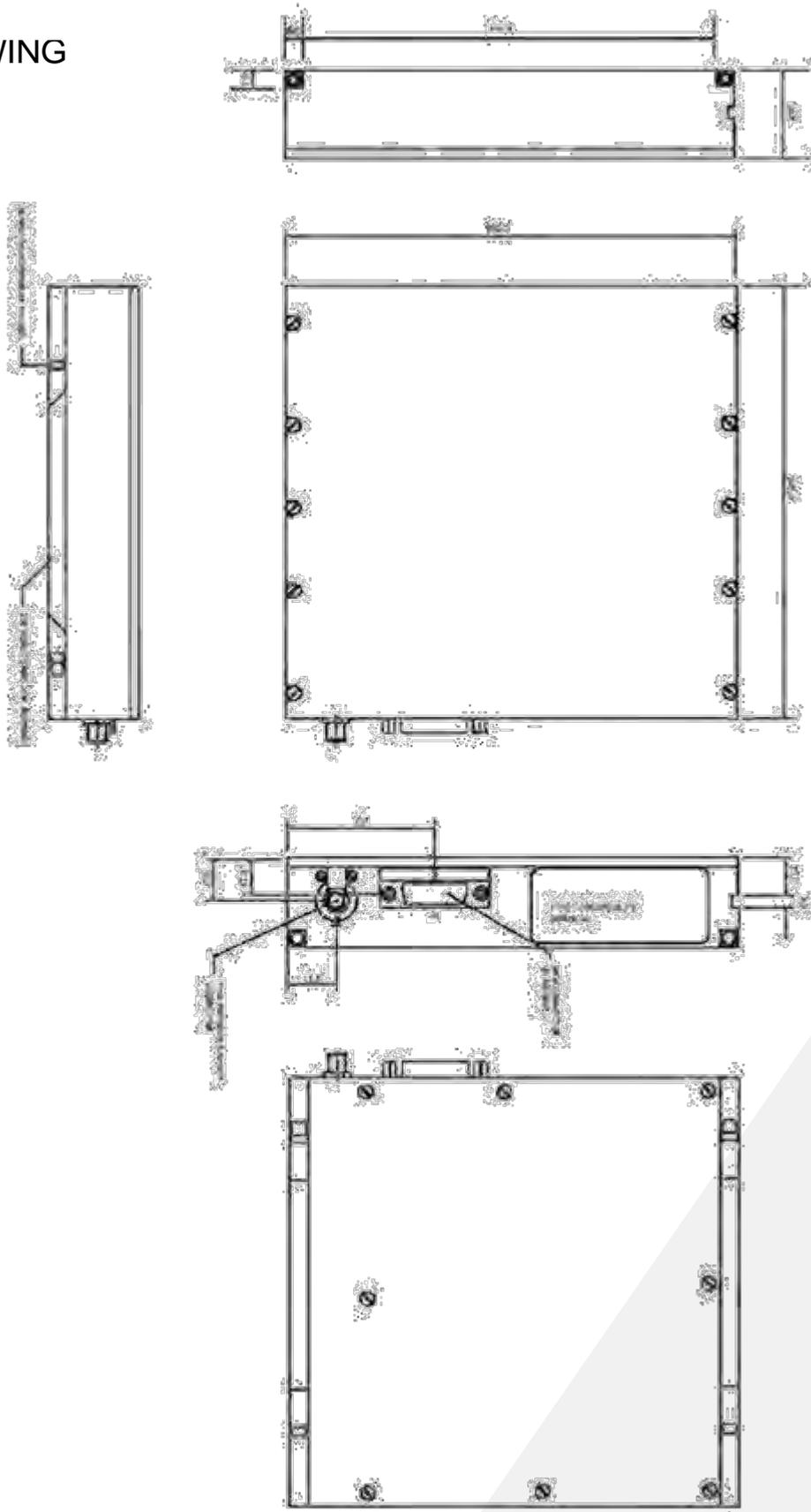Low temperature operational: MIL-STD-810D, Method 502.2 - -40ºC / 60min.

Combined temperature, altitude & humidity: MIL-STD-810D. Method 520 – temperature –40ºC to 70ºC, storage condition sea level to 17000m (87.6mb), operating condition sea level to 11000m (228mb), relative humidity at sea level 75%, 10 Cycles.

Humidity: MIL-STD-810D, Method 507.2, procedure 2 – RH 85% to 95%, temperature 30ºC to 60ºC, 24 hour cycle, 10 cycles.

EMI/EMC: Generally in accordance with MIL-STD-461E. Please note that system precautions must be taken to prevent interfering signals entering the high gain RF front end.

## OUTLINE DRAWING