EEPOD LLC
FLEXSTATION-IOT
USER MANUAL

www.eepod.com

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REVISION HISTORY

Revision	Release Date	Author	Change Descriptions
1.01	May 2, 2024	Kerby Suhre	First Draft

1 INTRODUCTION

The following sections document the capabilities of the EEPod FlexStation-IOT. The FlexStation-IOT is a powerful all-in-one test stand, capable of testing and simulating ECUs over a wide voltage range (0-24VDC) with an average power output up to 100W and surge/peak currents up to 10A. The FlexStation-IOT is controlled by the the EEPod MyCANIC-IOT vehicle interface that allows for control of vehicle CAN / CAN-FD networks messages / signals as well as fine resolution voltage control (10mV resolution) with sub-millisecond timing to create any power supply waveform imaginable. The FlexStation-IOT includes a variable voltage power output, a switched variable voltage power output (for simulating an ignition/ACC signal as well as a fixed 12VDC output for reference devices (including the MyCANIC-IOT). Additionally, the FlexStation-IOT has the ability to provide the often necessary CAN/CAN-FD messaging and network termination (on up to four separate channels) required to sleep/wake/operate a modern ECU. This combination of features will allow the electrical, software and test engineers to perform an number of complex ECU qualification tests for a fraction of the cost at a test lab, while also giving the flexibility to run the tests as many times as desired.

Several complex tests are included with the FlexStation-IOT to demonstrate the capability, and more can be easily added with a firmware upgrade as new test cases are defined. Also, because the EEPod FlexStation-IOT voltage-controlled power supply (VCPS) is an amplifier-based (OPA549) output, the need for a large wattage sink resistor as called out in some electrical tests, is not necessary as the amplifier can sink as well as source current.

The FlexStation-IOT hardware consists of a MyCANIC-IOT vehicle interface and Expansion-IOT vehicle interface (which is basically another embedded MyCANIC-IOT with potentiometers and switches for easy control of an ECU simulation environment). There is a 24VDC 150W internal power supply that is connected to a control board that allows the MyCANIC-IOT to control the voltage and waveform of the Vout supply at a very fine level. This is also a large heat sink and thermally-controlled variable speed fan to keep the system operating efficiently. Internally there is a large red switch to set Vout to a fixed12VDC output or PRG if the user wants to be able to programmatically control the output.

2 ECU Connections

Connections to the test ECU are done with banana jack connections, a 16-position Nanofit connector, J1962 OBDII connector and Ethernet jacks as shown in the pictures below. Connect all HAT (Hot at All Times) connections to the 12 VDC banana jack, connect the device under test (DUT) to the Vout banana jack and connect any switched power inputs (e.g. IGN/ACC) to Vout-SW. For ECUs requiring CAN simulation, connect to the appropriate FDCAN1-FDCAN4 connections (note that termination impedance of 120-ohm is provided by the MyCANIC-IOT or Expansion-IOT). Note that custom ECU harnesses that connect to the Nanofit connector can be made by our partner company Flextech Solutions LLC (www.flextechsolutions.net).

2.1 Fixed 12 VDC Output

Fixed 12 VDC output with up to 5A current. This output is also used to power the MyCANIC-IOT and Expansion-IOT.

2.2 FDCAN1-FDCAN4 Networks

The four FDCAN networks are capable of providing any CAN / CAN-FD vehicle messaging required by the ECU under test. FDCAN/FDCAN2 are controlled by the MyCANIC-IOT and FDCAN3/FDCAN4 are controlled by the Expansion-IOT.

2.3 ISO9141/LIN Network

The ISO9141/LIN line connected to both the MyCANIC-IOT and Expander-IOT.

2.4 Vout (0-24VDC) Output

The Vout output is capable of providing 0-24VDC @ 5A continuous. The output voltage is controlled by the MyCANIC-IOT with a resolution of 10mV and sub-millisecond timing control.

2.5 Vout-SW (0-24VDC) Output

The Vout-SW is a switched version of the Vout output that can be controlled by the MyCANIC-IOT via a relay.

2.6 Ethernet Jacks

There are two standard Ethernet jacks that are connected to the MyCANIC-IOT and Expansion-IOT. To connect the two units together without an access point / switch, you will need a crossover cable.

2.7 VPRG / AIN2 / AIN3

These are the same connections available on the TRRS jack of the MyCANIC-IOT (Ref. MyCANIC-IOT User Manual).

3 POWER SUPPLY WITH RIPPLE VOLTAGE CAPABILITY

The FlexStation-IOT can be used as an adjustable power supply by selecting Power Supply in the Utilities menu of the MyCANIC-IOT. The user can select the output voltage (0-24VDC), ripple voltage and ripple frequency before turning on the output. With the output on, the user can control turning on and off the Vout-SW output using the keypad.

4 Ford CI 230 Test – Immunity from Power Cycling

This test is from the Ford FMC1278 document and is used to verify that an ECU can survive power voltage cycling. Reference the FMC1278 specification for the exact voltage and timing details. The oscilloscope screen capture images below show the voltage waveforms for both the power and ignition signals.

4.1 Verification of Test Setup

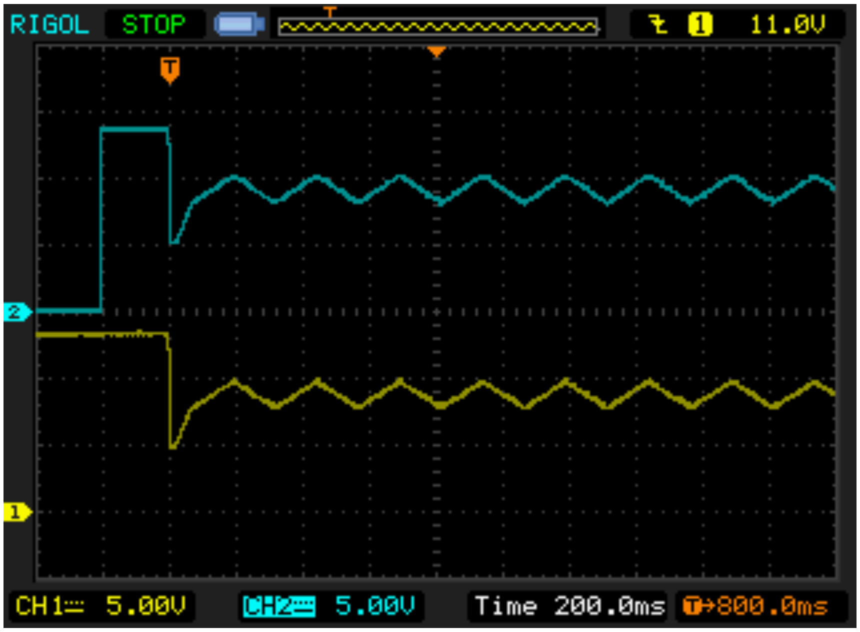

Fig. 2-1: CI230 IGN vs Vout with 4Hz cycling detail

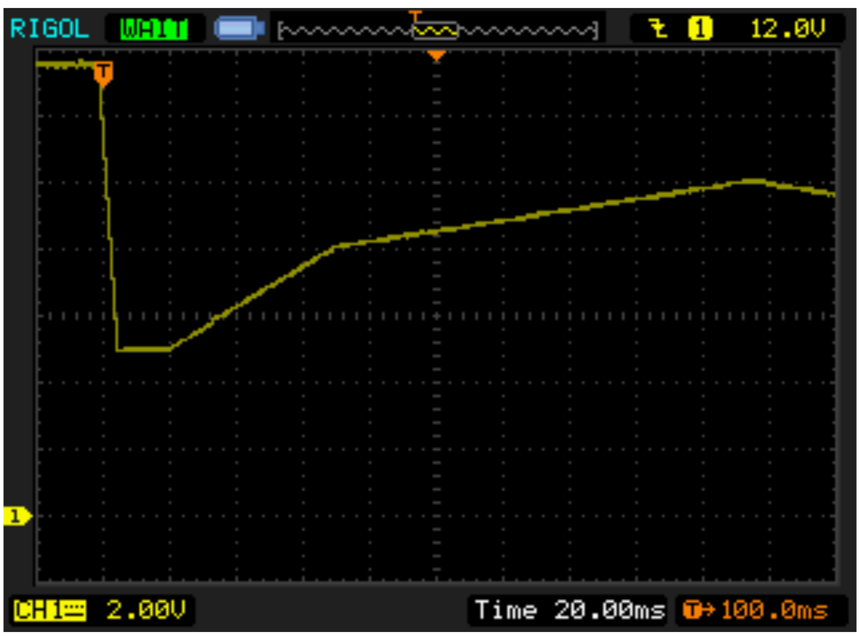

Fig. 2-2: Initial voltage ramp detail of Vout (same for IGN)

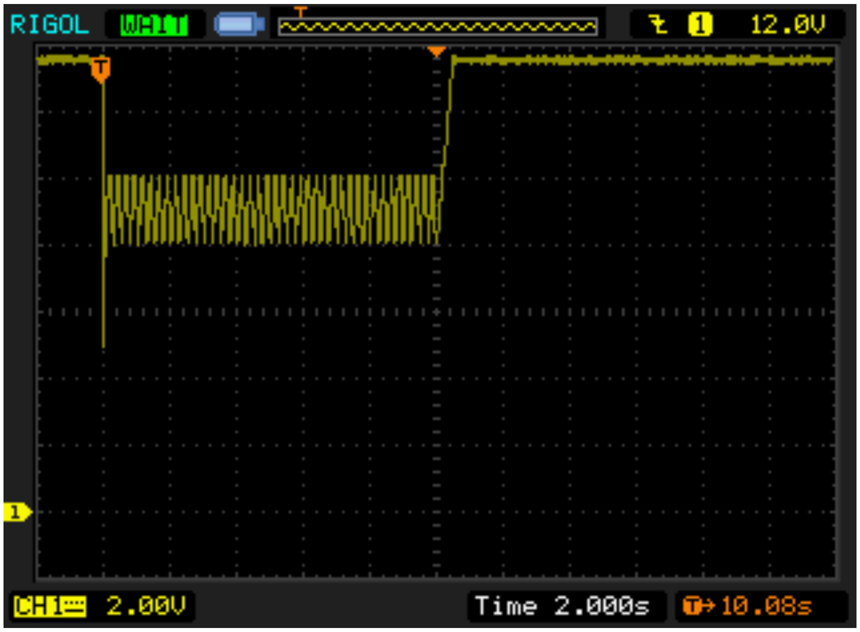

Fig 2-3: Complete test cycle of Vout (same for IGN with exception of 200msec before test starts)

5 Ford CI 260 Test – Immunity to Voltage Dropout

This test is from the Ford FMC1278 document and is used to verify that an ECU can survive power dropouts of varying lengths of time. Reference the FMC1278 specification for the exact voltage and timing details. The oscilloscope screen capture images below voltage waveforms for each of the test interations.

5.1 Verification of Test Setup

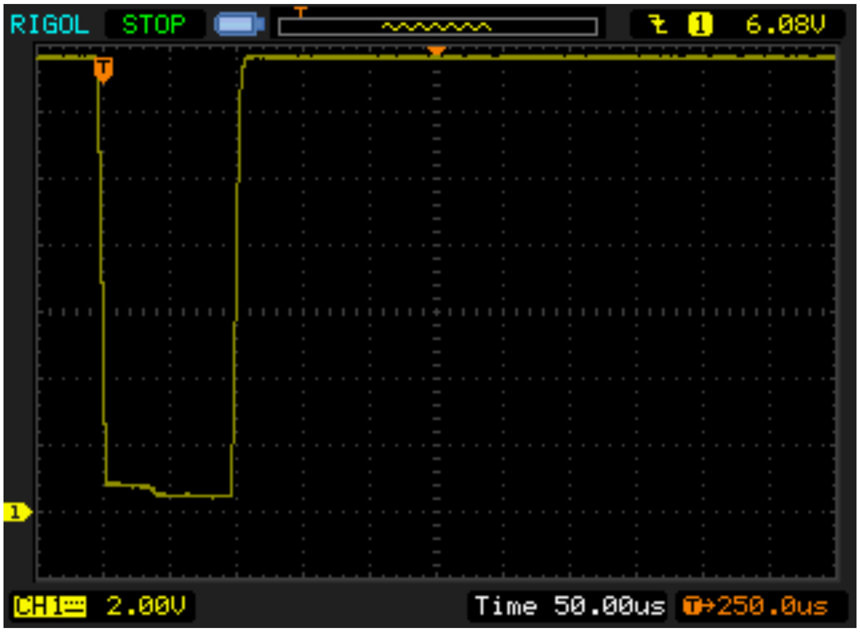

Fig: 3-1: Detail of 100usec dropout on Vout (same for IGN)

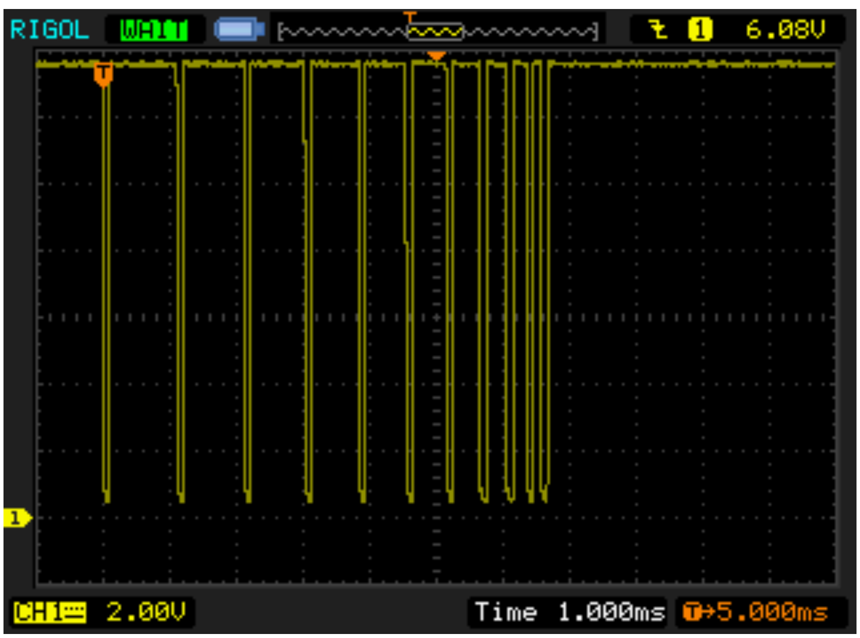

Fig 3-2: Detail of first of 3 cycles at 100usec dropout (same for IGN)

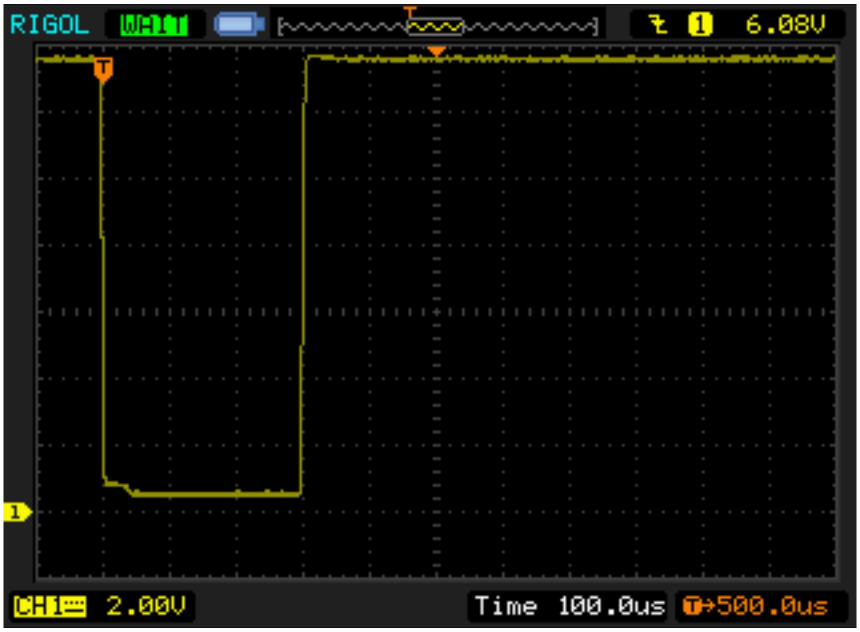

Fig: 3-3: Detail of 300usec dropout on Vout (same for IGN)

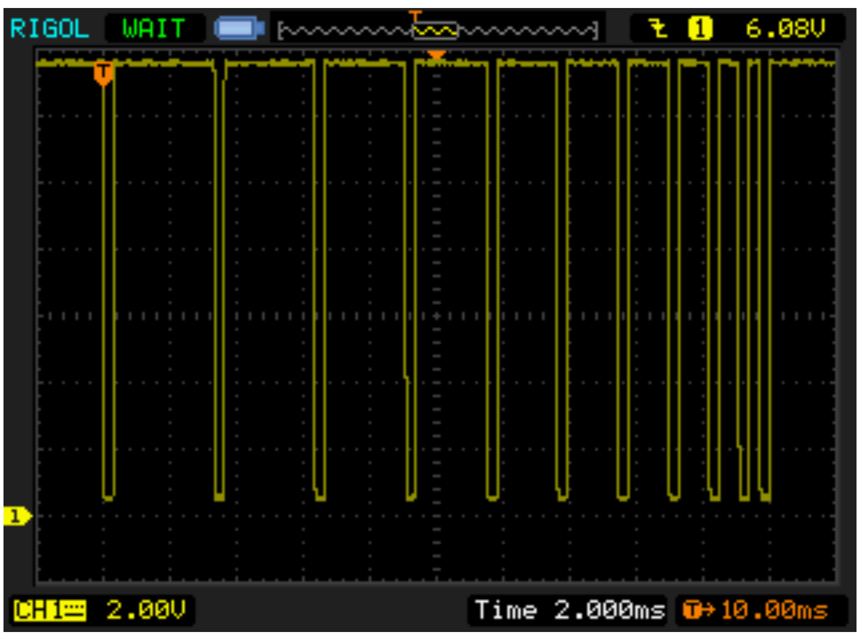

Fig 3-4: Detail of first of 3 cycles at 300usec dropout (same for IGN).

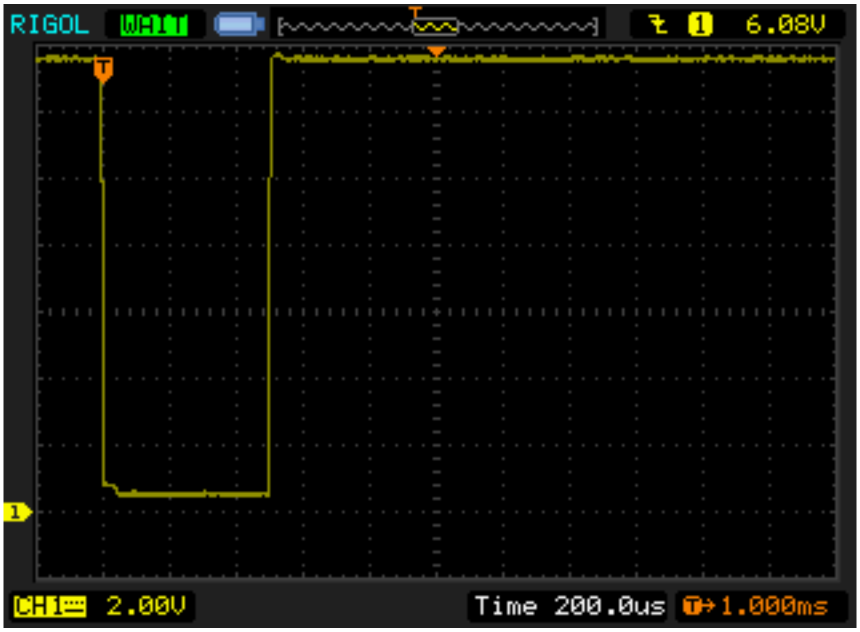

Fig: 3-5: Detail of 500usec dropout on Vout (same for IGN)

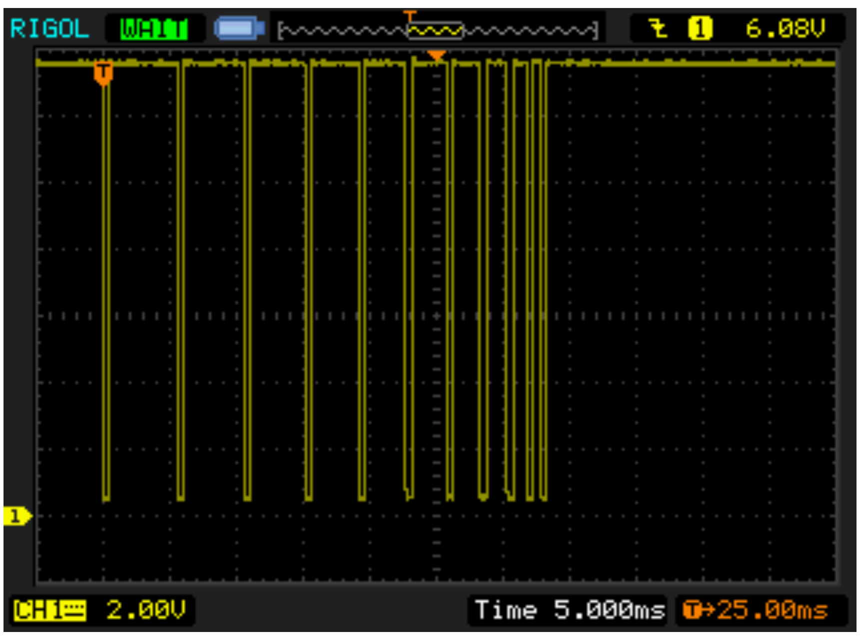

Fig 3-6: Detail of first of 3 cycles at 500usec dropout (same for IGN).

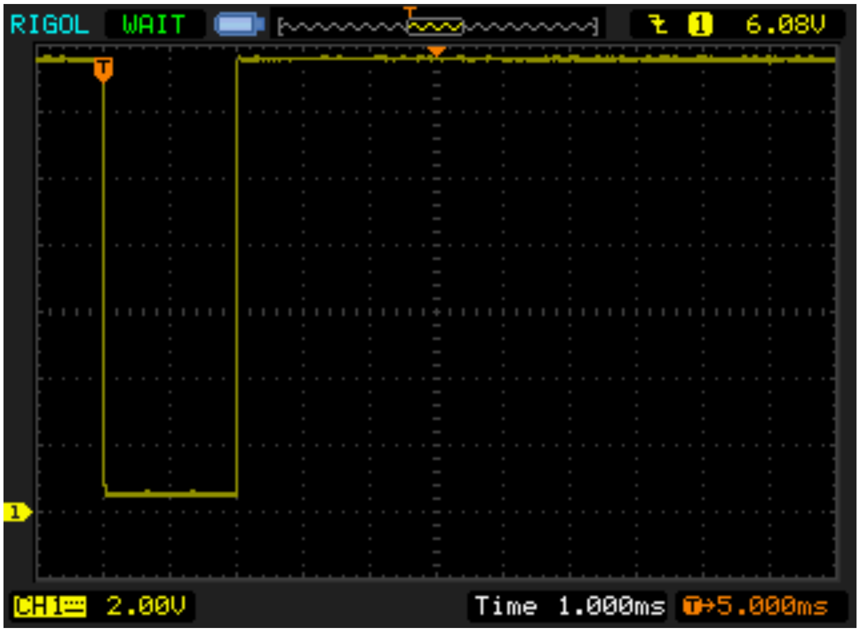

Fig: 3-7: Detail of 2msec dropout on Vout (same for IGN)

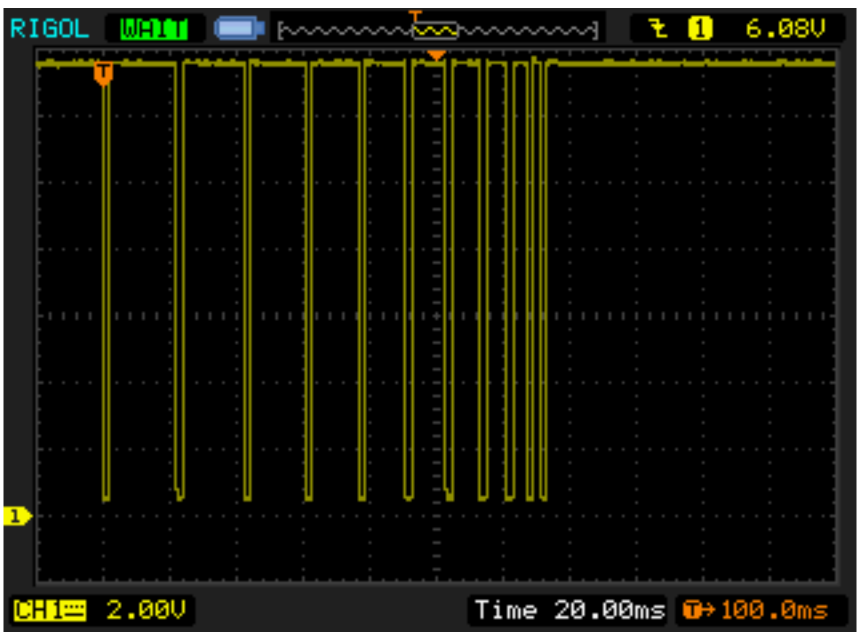

Fig 3-8: Detail of first of 3 cycles at 2msec dropout (same for IGN).

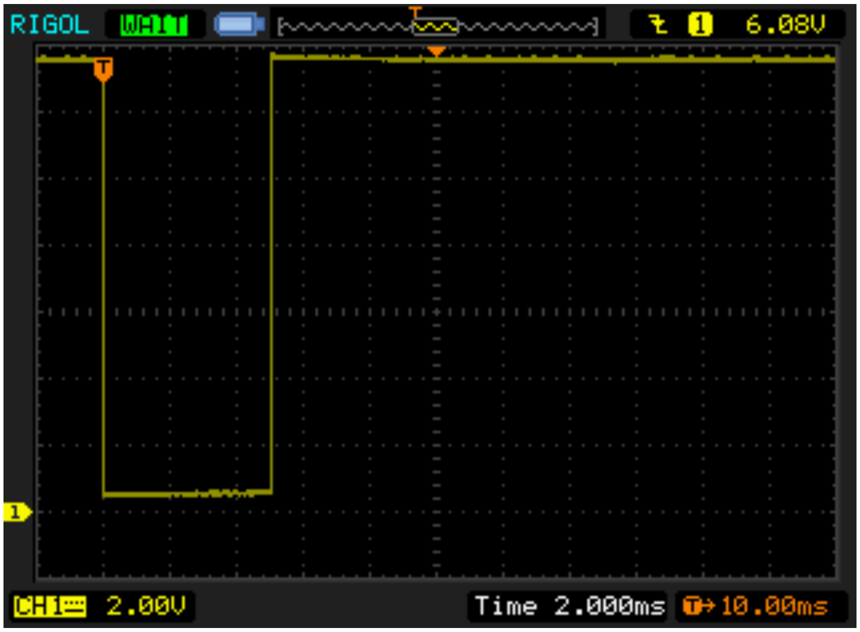

Fig: 3-9: Detail of 5msec dropout on Vout (same for IGN)

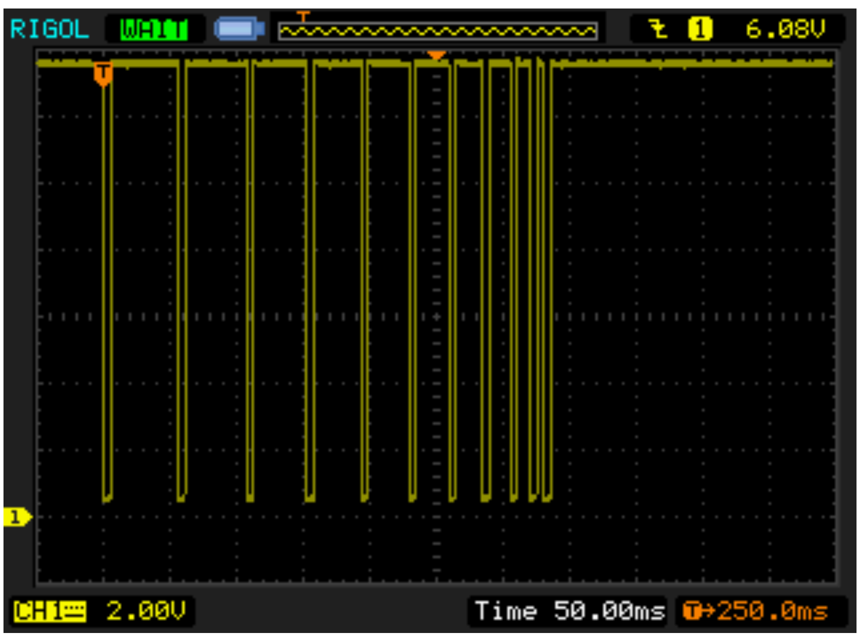

Fig 3-10: Detail of first of 3 cycles at 5msec dropout (same for IGN).

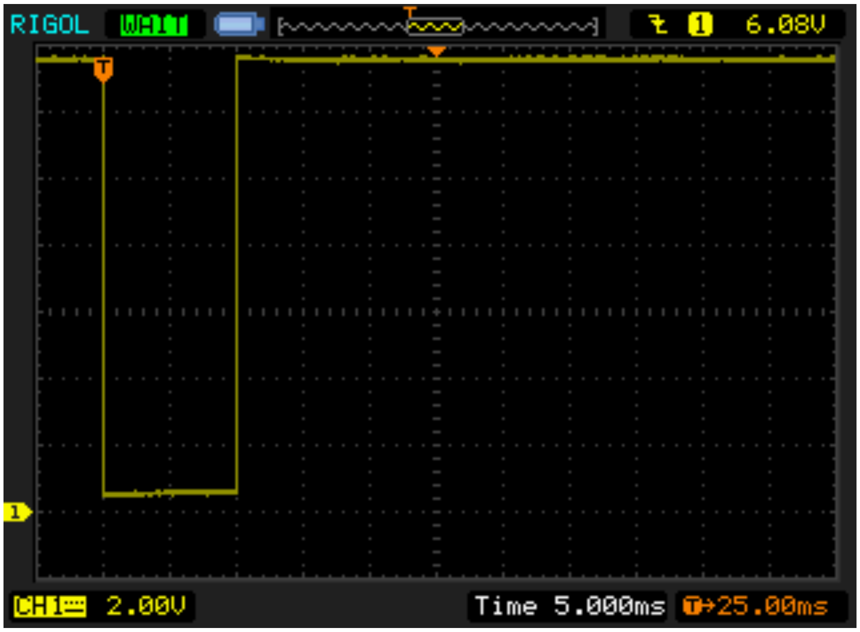

Fig: 3-11: Detail of 10msec dropout on Vout (same for IGN)

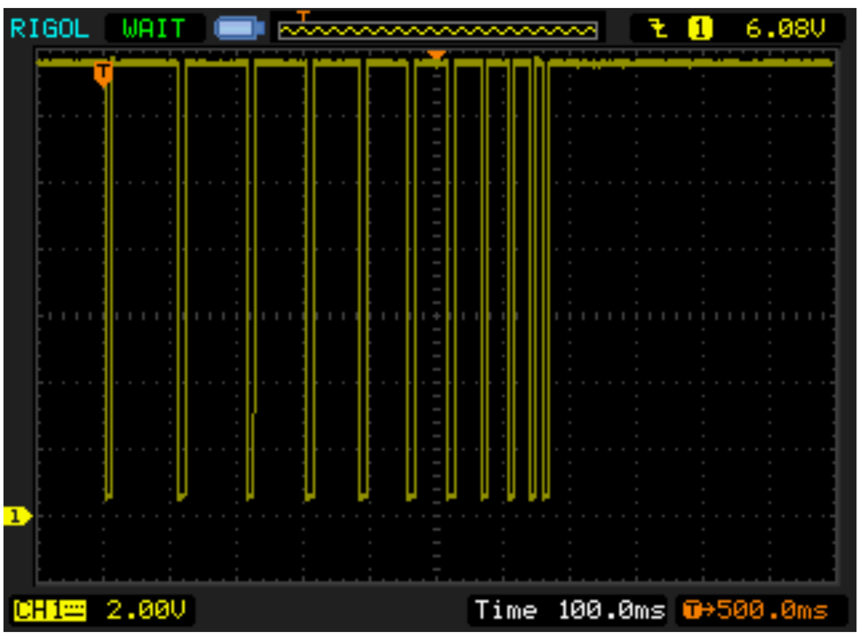

Fig 3-12: Detail of first of 3 cycles at 10msec dropout (same for IGN).

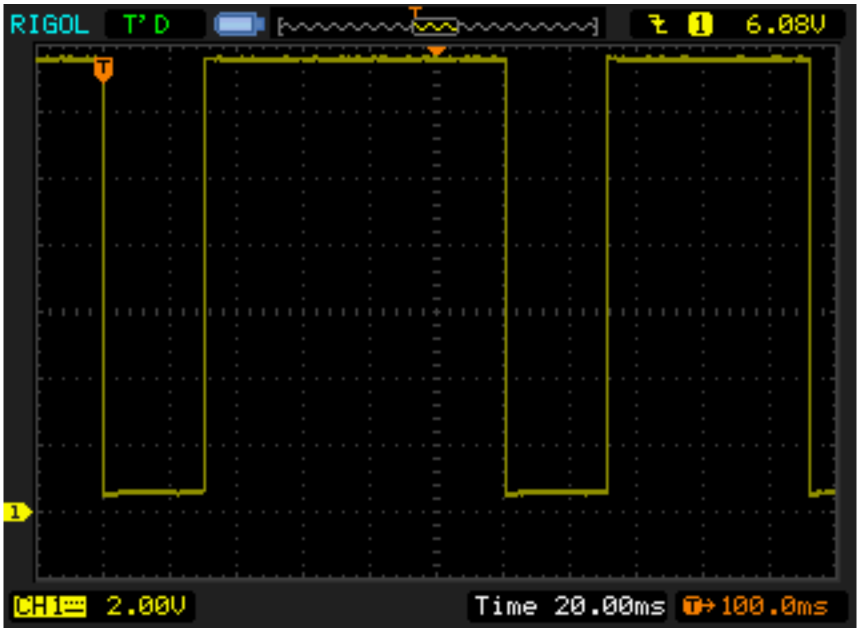

Fig: 3-13: Detail of 30msec dropout on Vout (same for IGN)

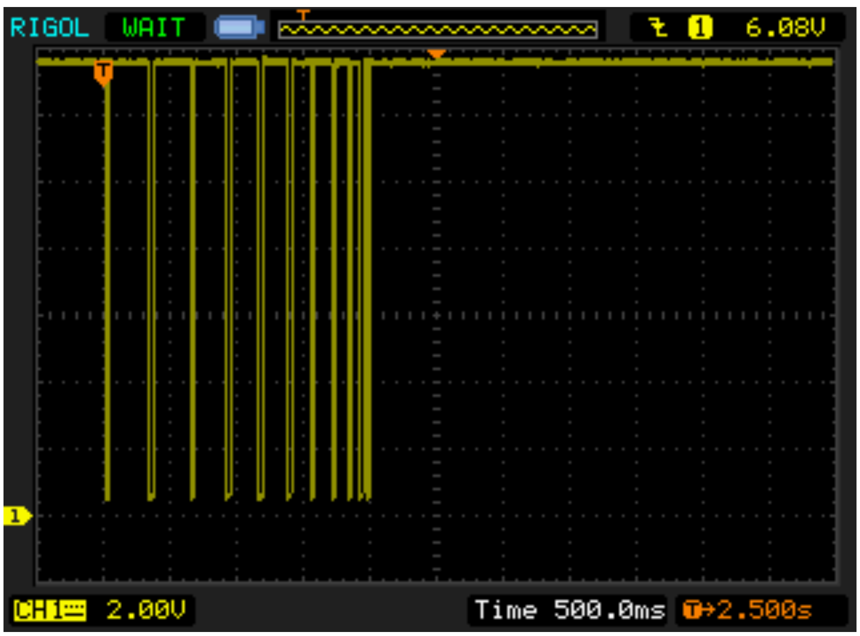

Fig 3-14: Detail of first of 3 cycles at 30msec dropout (same for IGN).

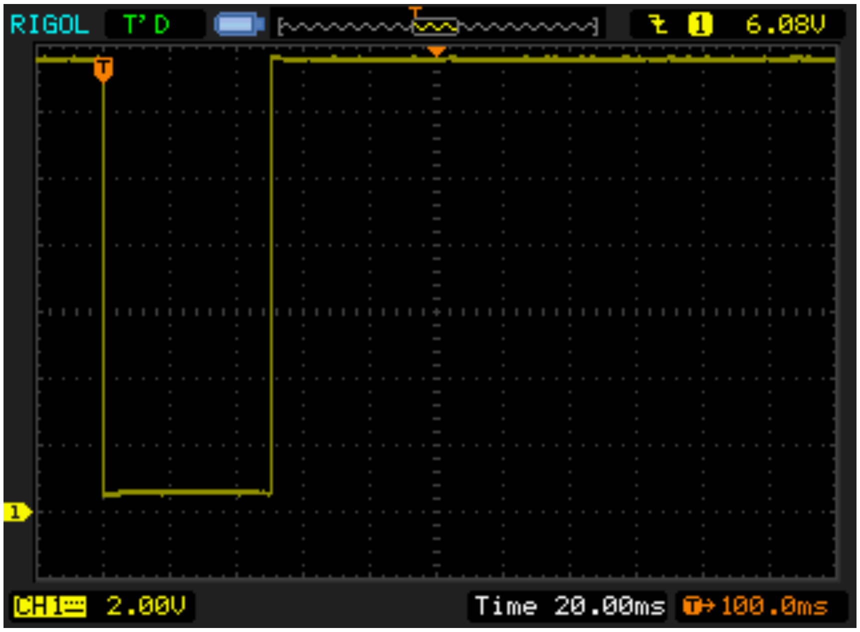

Fig: 3-15: Detail of 50msec dropout on Vout (same for IGN)

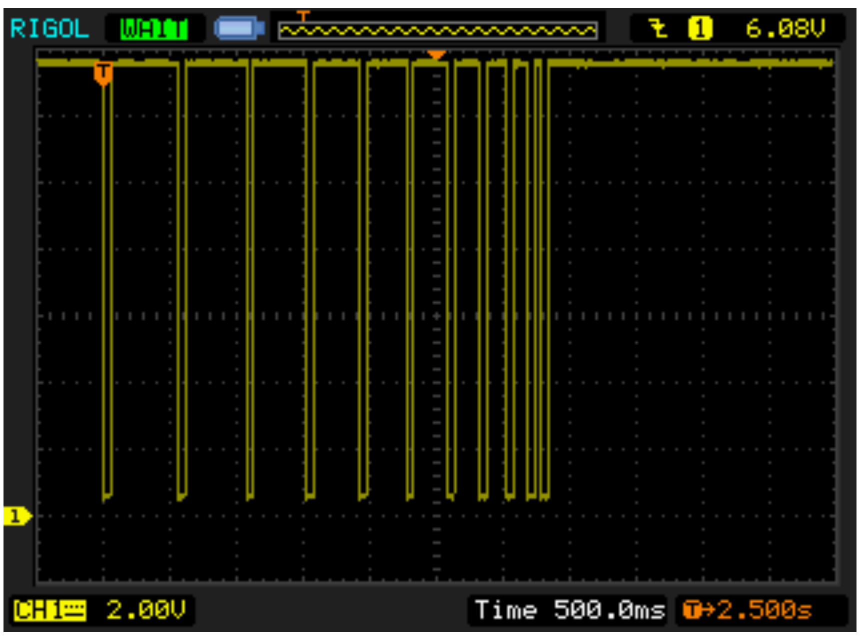

Fig 3-16: Detail of first of 3 cycles at 50msec dropout (same for IGN).

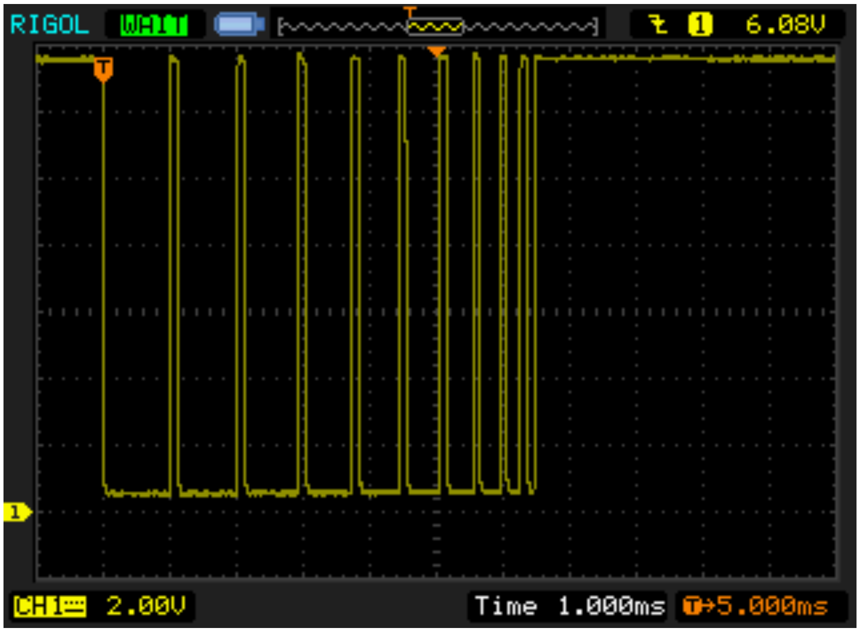

Fig 3-17: Detail of first of 3 cycles at T=100usec Waveform B

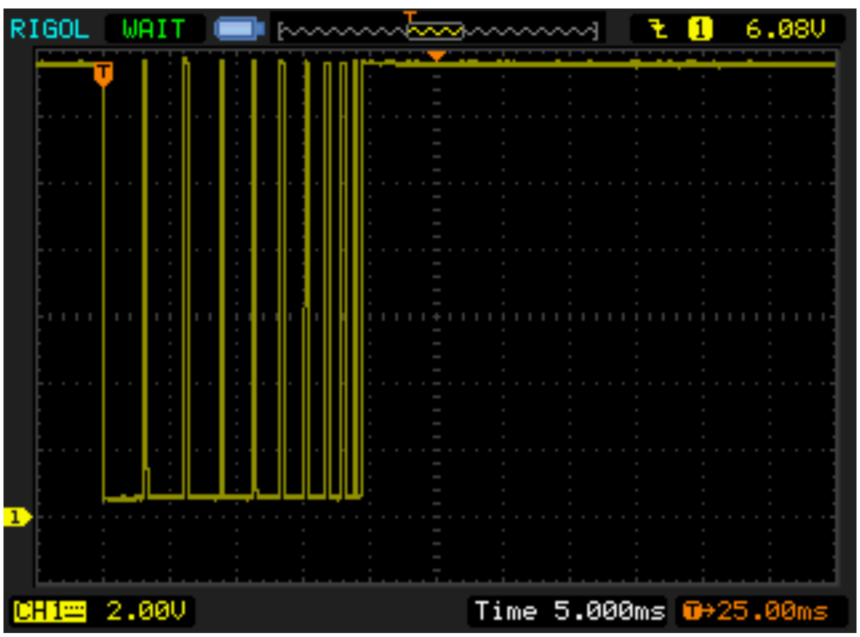

Fig 3-18: Detail of first of 3 cycles at T=300usec Waveform B

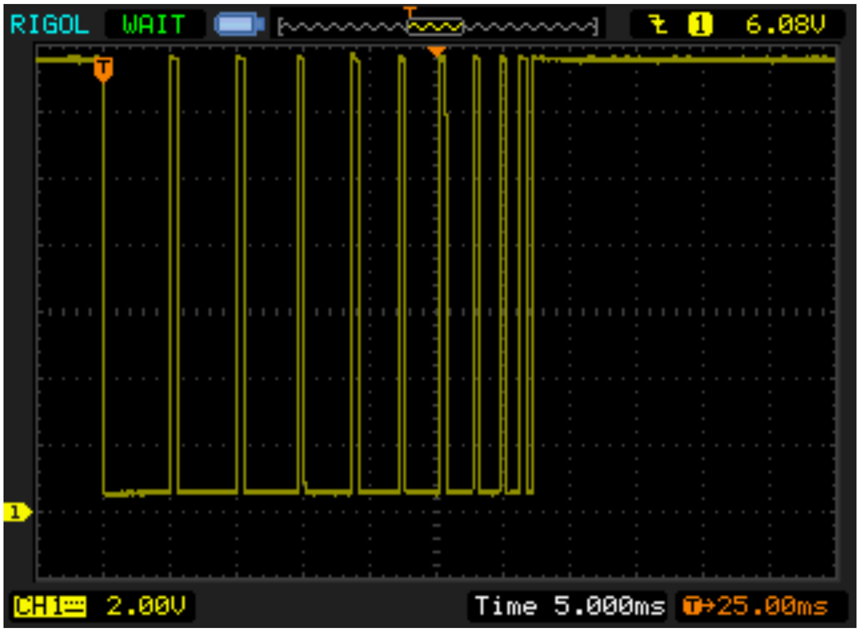

Fig 3-19: Detail of first of 3 cycles at T=500usec Waveform B

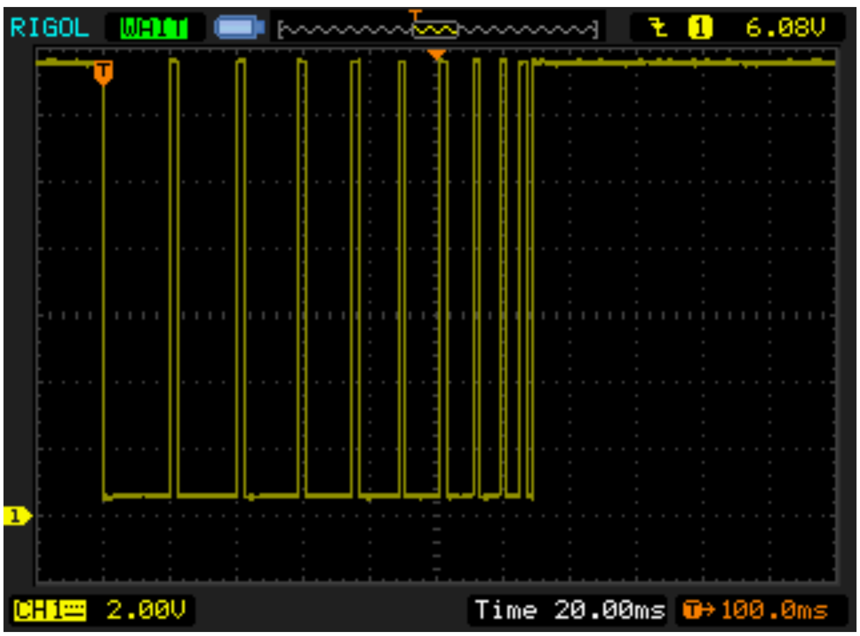

Fig 3-20: Detail of first of 3 cycles at T=2msec Waveform B

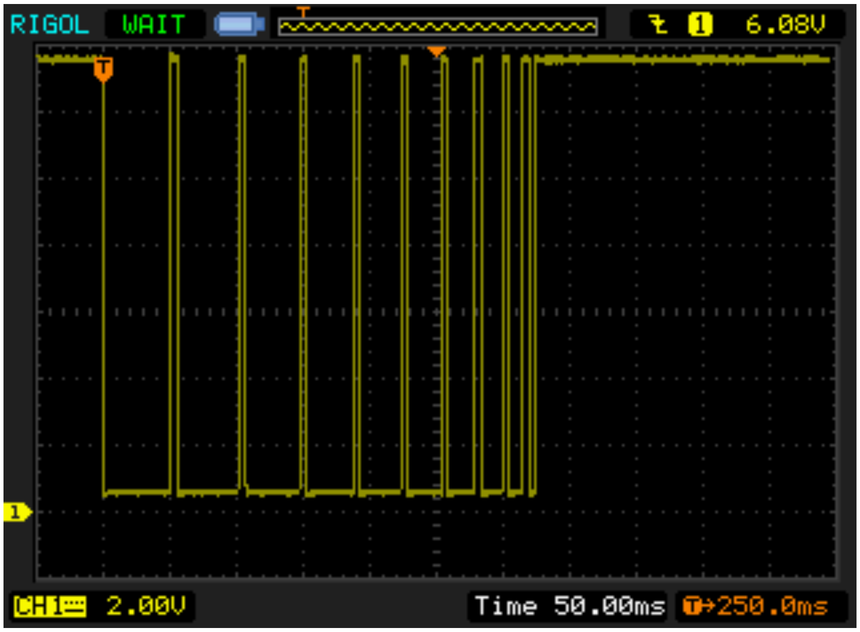

Fig 3-21: Detail of first of 3 cycles at T=5msec Waveform B

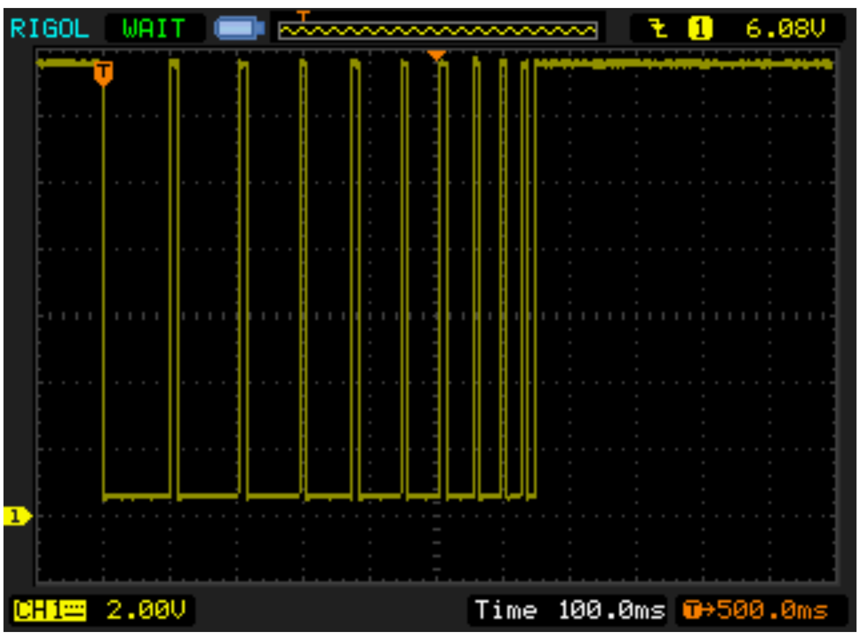

Fig 3-22: Detail of first of 3 cycles at T=10msec Waveform B

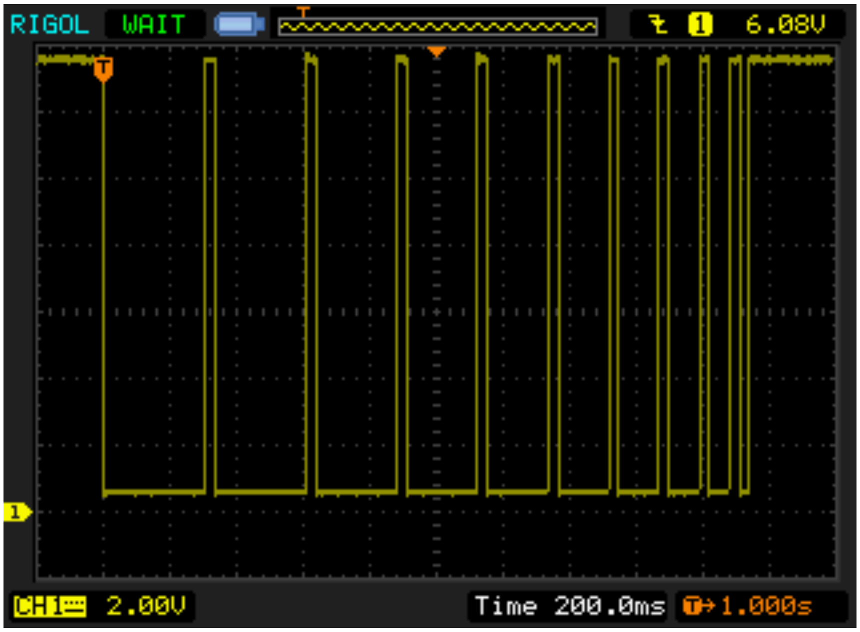

Fig 3-23: Detail of first of 3 cycles at T=30msec Waveform B

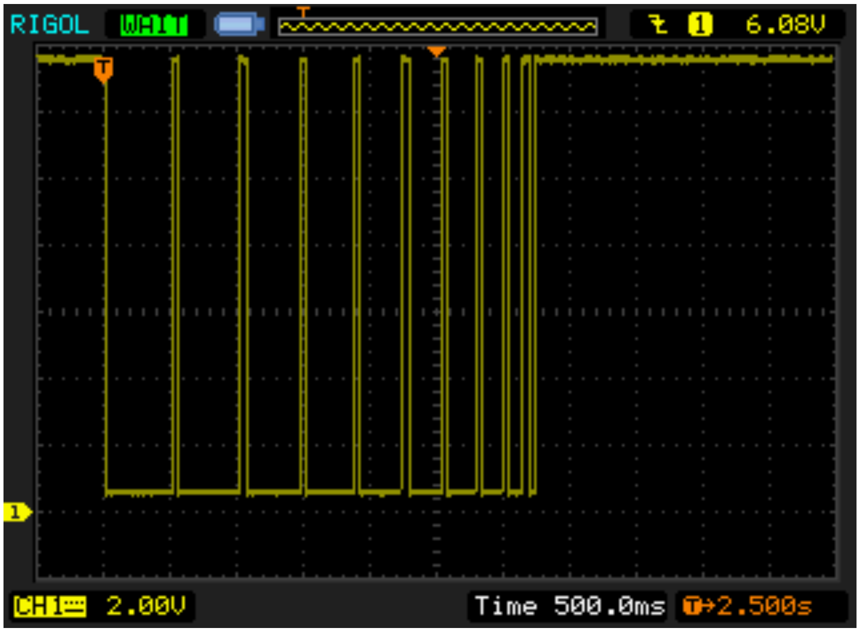

Fig 3-24: Detail of first of 3 cycles at T=50msec Waveform B

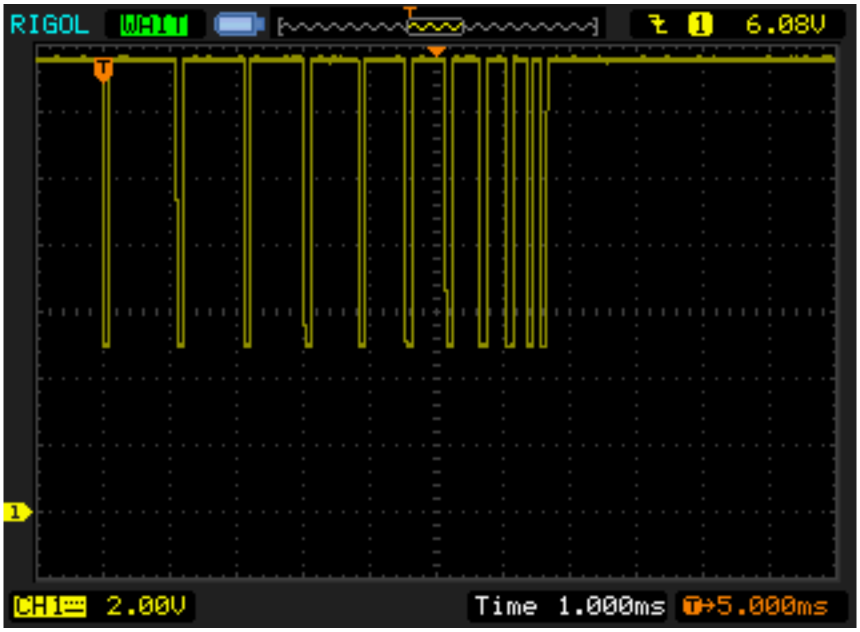

Fig 3-25: Detail of first of 10 cycles at T=100usec Waveform D

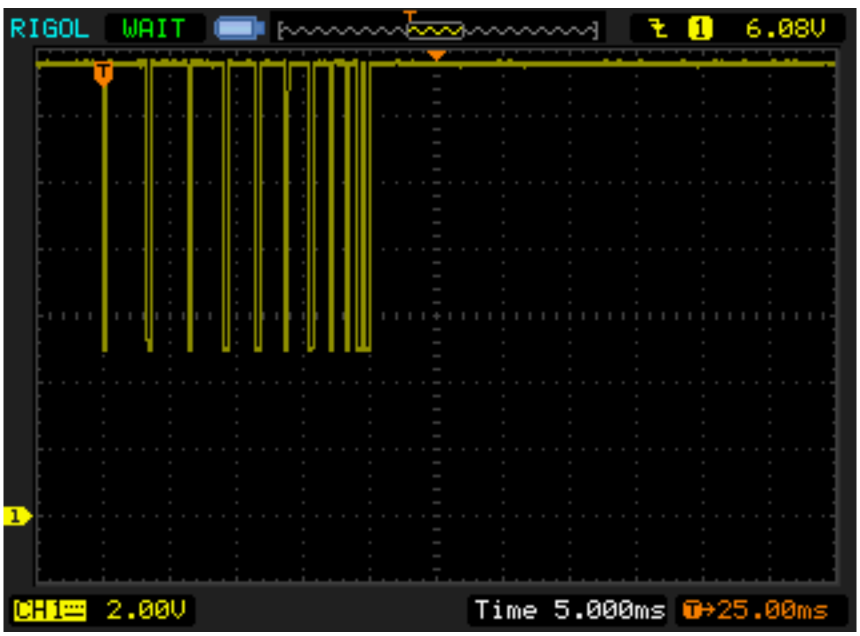

Fig 3-26: Detail of first of 10 cycles at T=300usec Waveform D

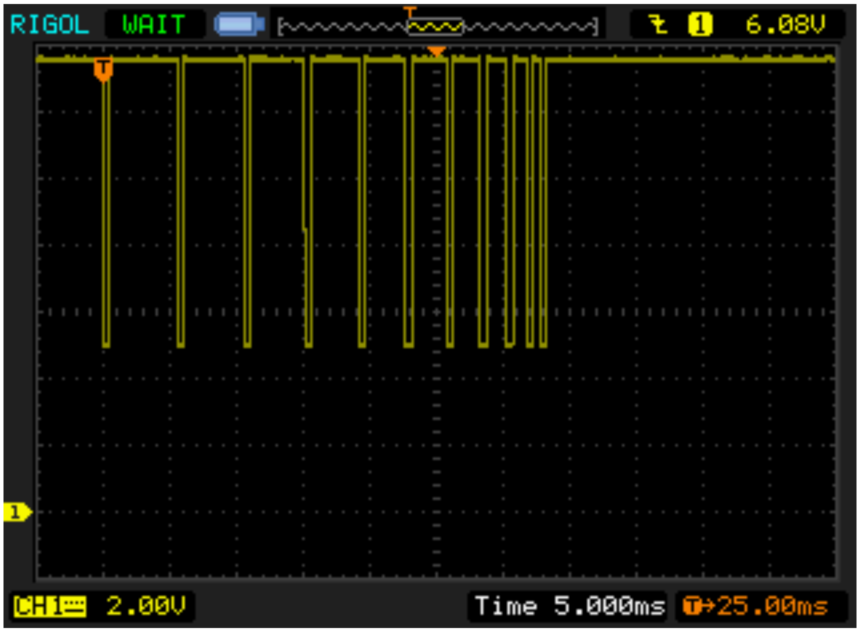

Fig 3-27: Detail of first of 10 cycles at T=500usec Waveform D

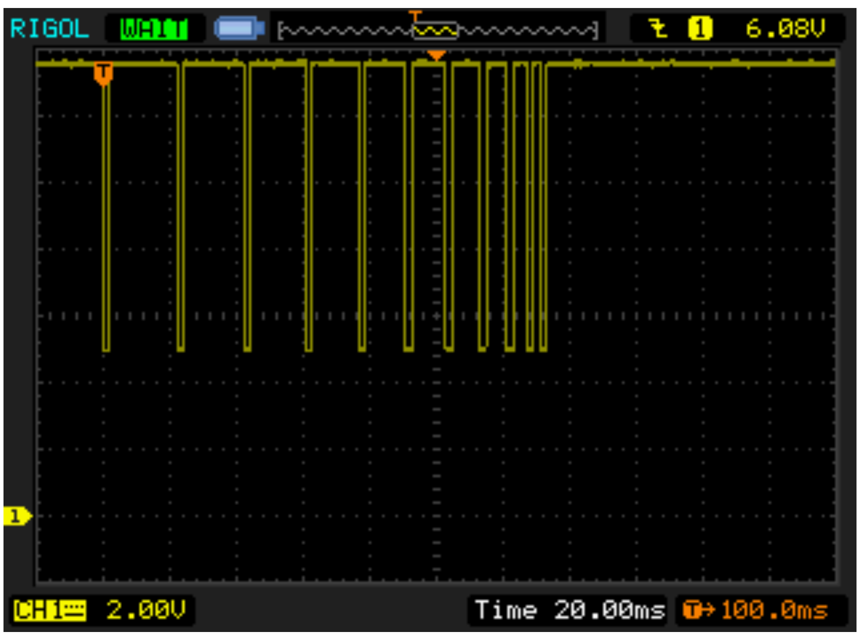

Fig 3-28: Detail of first of 10 cycles at T=2msec Waveform D

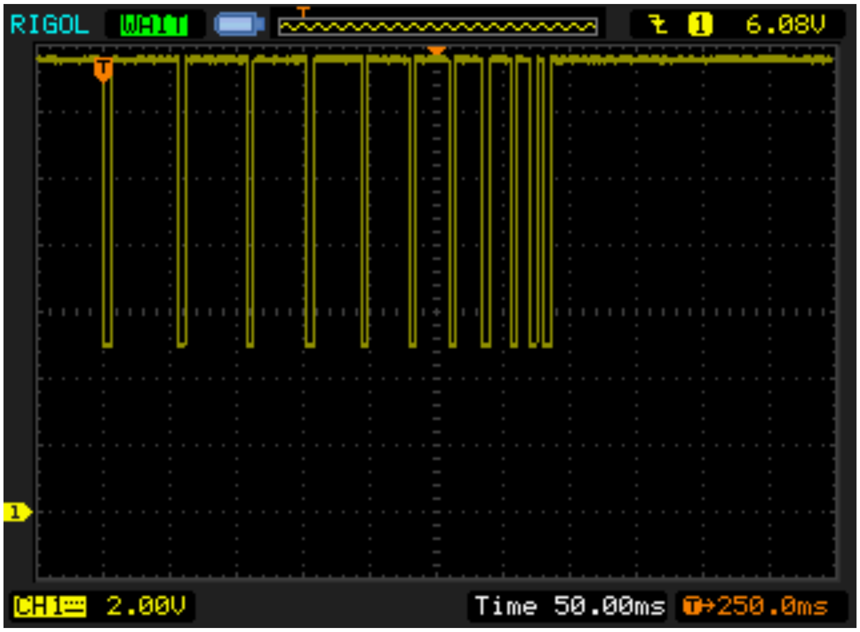

Fig 3-29: Detail of first of 10 cycles at T=5msec Waveform D

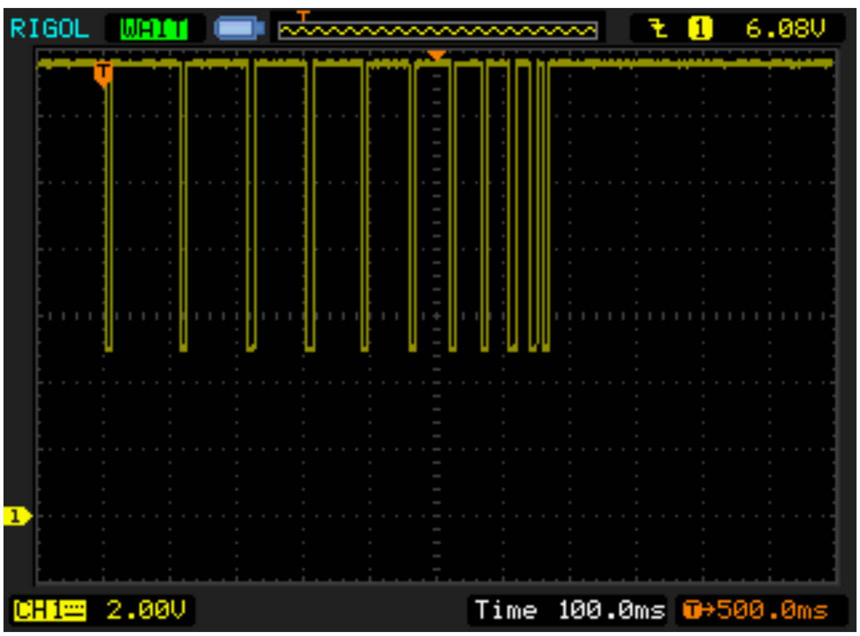

Fig 3-30: Detail of first of 10 cycles at T=10msec Waveform D

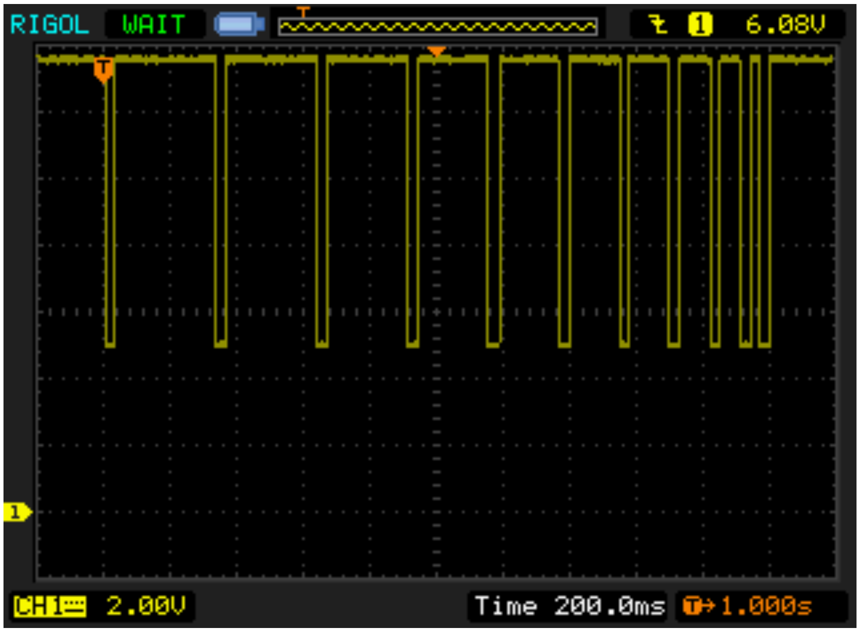

Fig 3-31: Detail of first of 10 cycles at T=30msec Waveform D

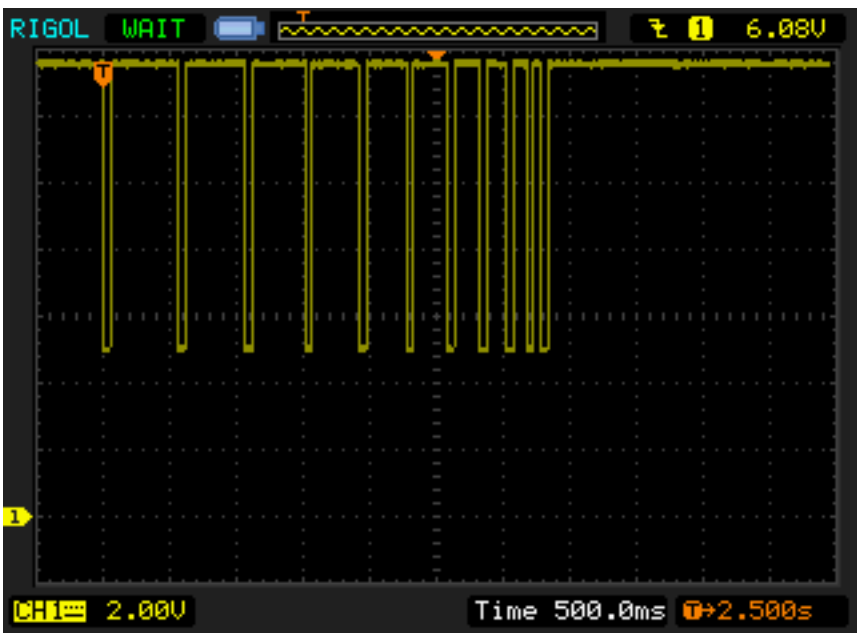

Fig 3-32: Detail of first of 10 cycles at T=50msec Waveform D

6 FORD DROWSY TEST – IMMUNITY TO VARYING NETWORK SLEEP/WAKEUP TIME

This test is designed to exercise the CAN network sleep/wake feature to make sure the ECU properly wakes up at any point during the sleep process.

7 NANOFIT CONNECTOR PINOUT

Pin	Description
1	12 VDC
2	Ground
3	FDCAN1+
4	FDCAN1-
5	FDCAN2+
6	FDCAN2-
7	FDCAN3+
8	FDCAN3-
9	FDCAN4+
10	FDCAN4-
11	AIN2
12	AIN3
13	ISO9141/LIN
14	VPROG
15	Vout
16	Vout-SW

8 J1962 OBDII Connector Pinout

Pin	Description
1	
2	
3	FDCAN2+
4	Ground
5	Ground
6	FDCAN1+
7	ISO9141 / LIN
8	
9	
10	
11	
12	
13	ISO9141/LIN
14	FDCAN1-
15	
16	12 VDC