Fuze Division
Close Combat Armaments Center
TACOM-ARDEC

ADVANCED CONCEPTS FUZE TEAM

Committed To Excellence

DIGITIZING OF THE ANALOG TIME FUZE HYDRA 70 SYSTEM

Roger Sitara
Fuze Division
Close Combat Armaments Center
TACOM-ARDEC

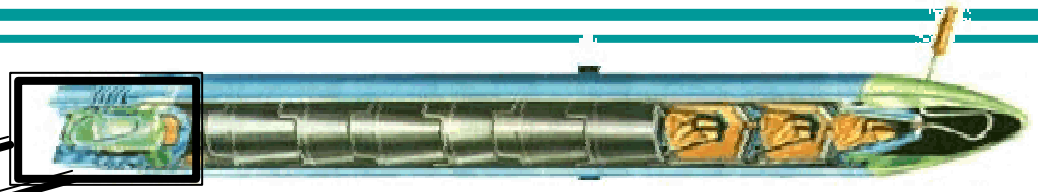
1 MAY 2002

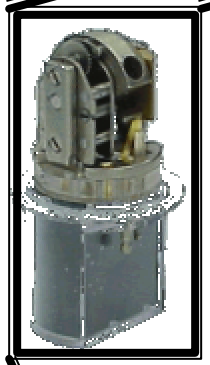
Committed To Excellence

OUTLINE
DIGITAL M439 FUZE CIRCUIT

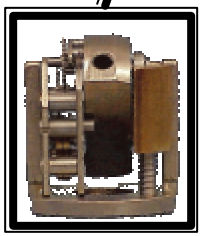
- PROGRAM OBJECTIVES
- BACKGROUND
- CURRENT ANALOG CIRCUIT
- DIGITAL CIRCUIT REQUIREMENTS
- DIGITAL CIRCUIT
- TEST RESULTS AND DATA
- FUTURE DEVELOPMENTS

2.75 INCH ROCKET FUZE, REMOTE SET, M439 DESCRIPTION/MISSION

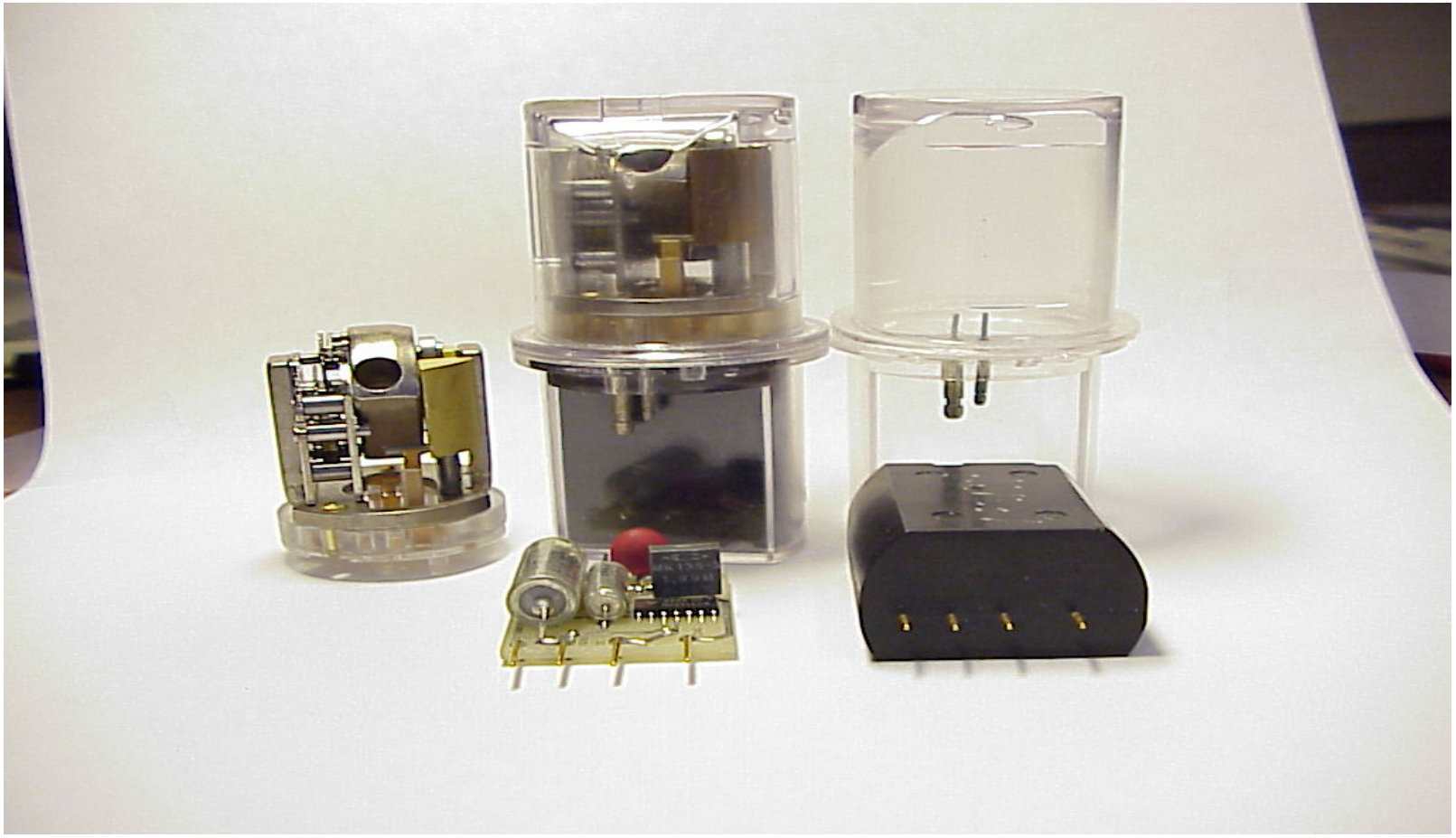




- **USED ON:**
  - → M261 MULTIPURPOSE SUBMUNITION H.E. WARHEAD
  - → M267 PRACTICE MULTIPURPOSE SUBMUNITION
  - → M255A1 – FLECHETTE
  - → M264 – SMOKE, RED PHOSPHOROUS
- **ELECTRONIC VARIABLE TIME DELAY FUZE**
  - → RC TIMING CIRCUIT
  - → 5 – 25 SECONDS; +/- 2.5%
  - → SETTABLE IN-FLIGHT THROUGH M147 OR M138 ANALOG SETTER
- **USES BASIC MECHANICAL M423 TYPE DOUBLE INTEGRATING/ACCELEROMETER S&A**



M439 Fuze Components



Committed To Excellence

PROGRAM OBJECTIVES
DIGITAL M439 TIME FUZE

- ACCURACY: BETTER THAN +/- 0.5%
- COMPATIBILITY: DIGITAL SETTERS AND BACKWARD COMPATIBLE WITH CURRENT ANALOG SETTERS
- COMPATIBLE WITH MIL-STD-1760, INTERFACE STANDARD FOR AIRCRAFT/STORES CONNECTION SYSTEM
- COMPATIBLE WITH MIL-STD-1553, AIRCRAFT DIGITAL DATA BUS

TYPICAL FUZE CHARACTERISTICS

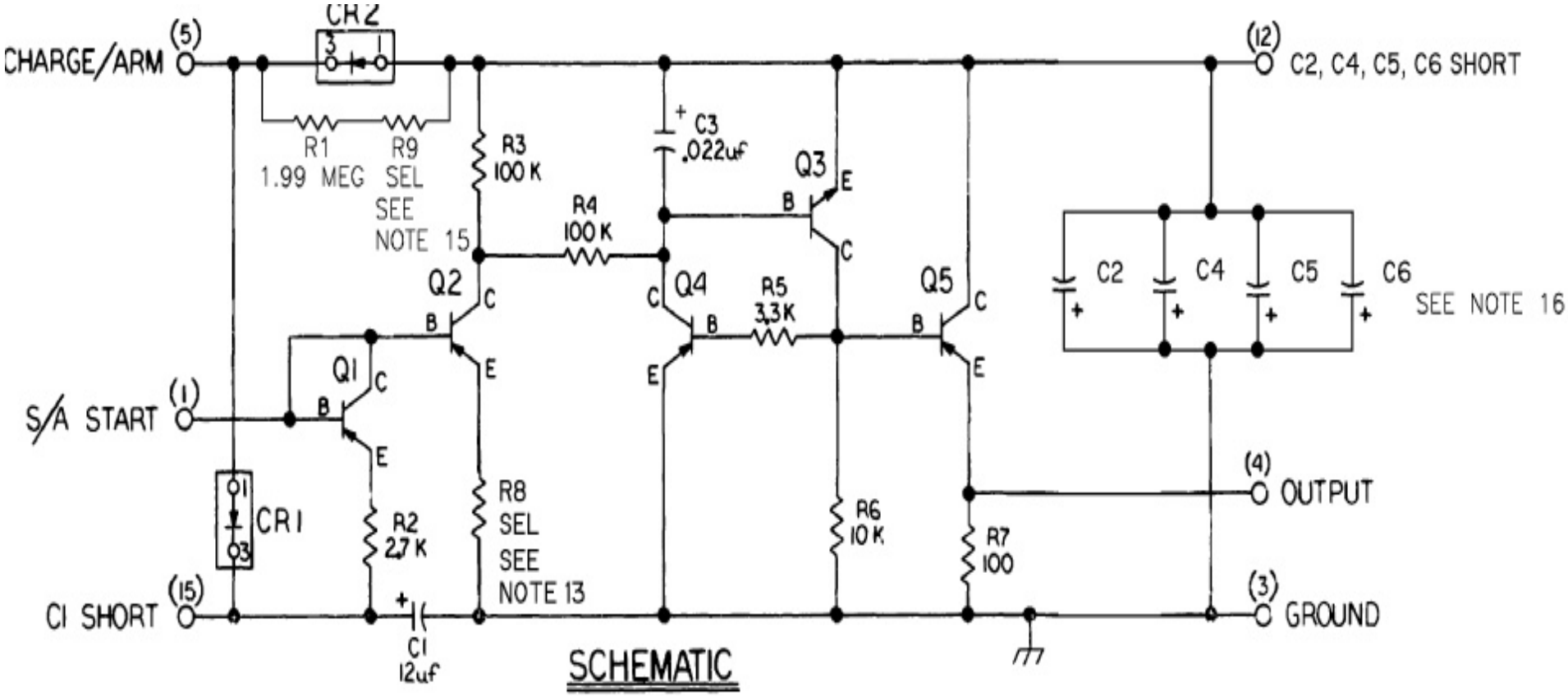
ANALOG FUZE M439	DIGITAL FUZE M439A1
OBSOLETE DISCRETE COMPONENTS	SINGLE CHIP ASIC PROCESSOR
SPECIAL CAPACITOR	STANDARD ENERGY STORAGE CAPACITOR
SPECIAL TIMING RESISTOR	NO TIMING RESISTOR
PRODUCTION LOT VARIATIONS	MINIMIZED PRODUCTION LOT VARIATIONS
TIME-OUT ACCURACY 2.5%	TIME-OUT ACCURACY 0.5%
ANALOG SET INTERFACE ONLY	ANALOG OR DIGITAL SET INTERFACE

Digital Time Fuze

Study to Replace Fuze R-C Timer with Digital Timer

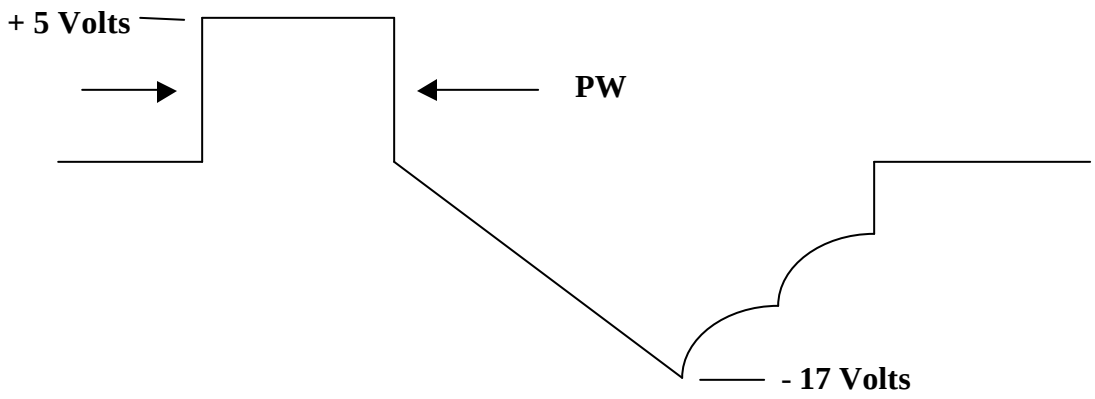
- Generated draft performance spec, ICD and platform study.
- Contract awarded to fab and test prototypes - 60 fuzes and EA assemblies
  - Digital and analog setting capability
  - ASIC based timer with ceramic resonator time base
  - Improved time-out accuracy
    - Demonstrated < 0.5% setting accuracy for both analog and digital setting over temperature (but limited quantity of electronic modules tested)
  - Low power – operates off energy from setter

M439 FUZE ANALOG CIRCUIT



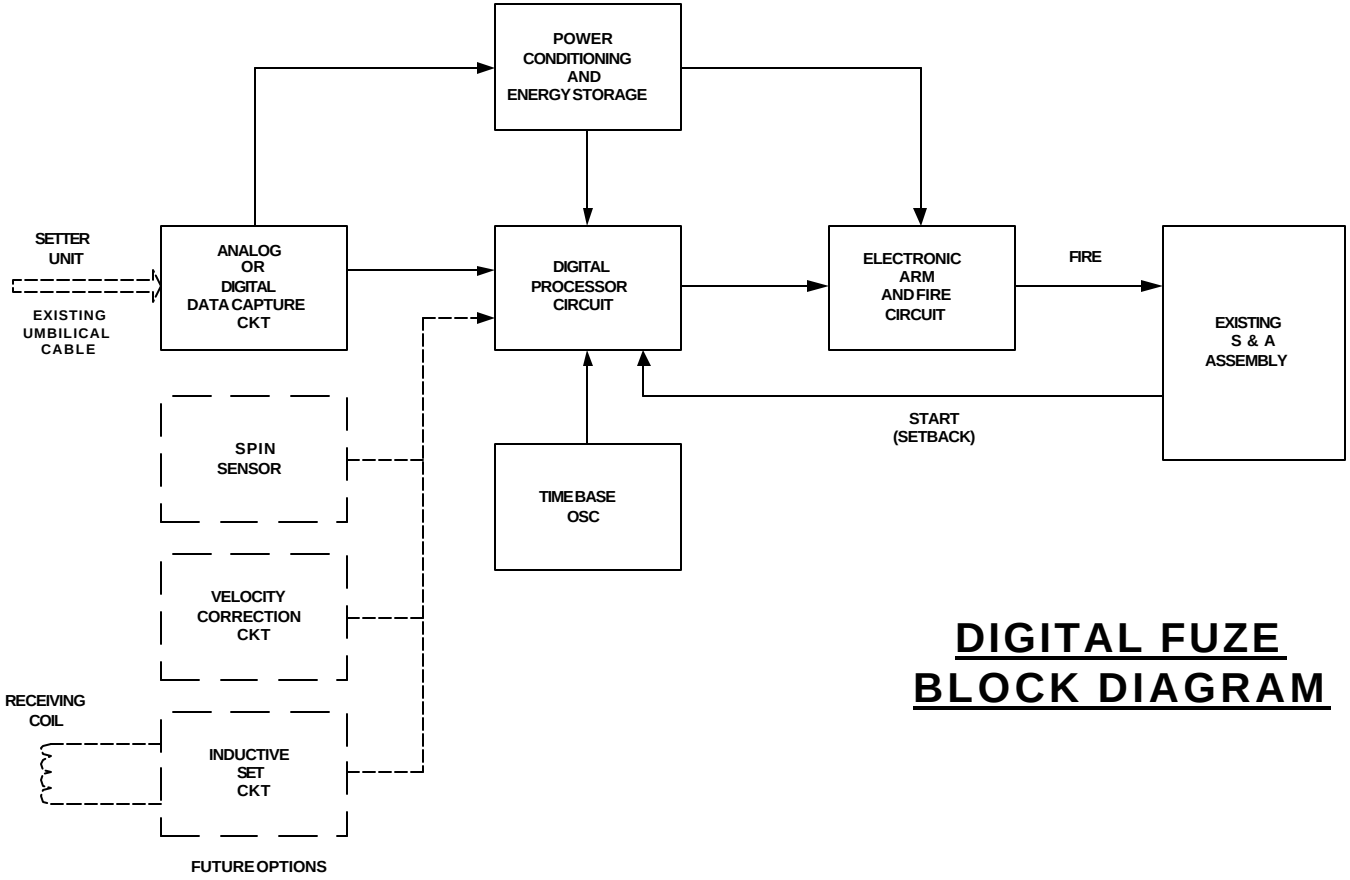
Committed To Excellence

M439 Analog Interface



TIME OUT DESIRED = 1000 * PW

DIGITAL FUZE SCHEMATIC



DIGITAL FUZE BLOCK DIAGRAM

INTERTEK LABORATORIES, INC.

Ref: Digital Fuze Block Diagram.vsd

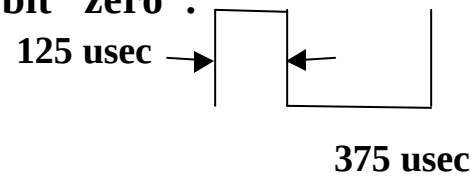
Proposed Digital Interface

Power Up Period (PUP)	Forward Message Period (FMP)	Delay (DLY)	Reverse Message Period (RMP)

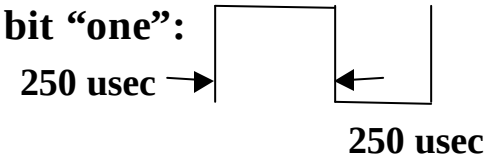
TIMING

PUP: 20 milliseconds
FMP: 10 milliseconds Mode select code, timing data, checksum
DLY: 6 milliseconds*
RMP: 10 milliseconds Fuze/Warhead ID code (5 bits, 32 combinations)

Data bit "zero":



Data bit "one":

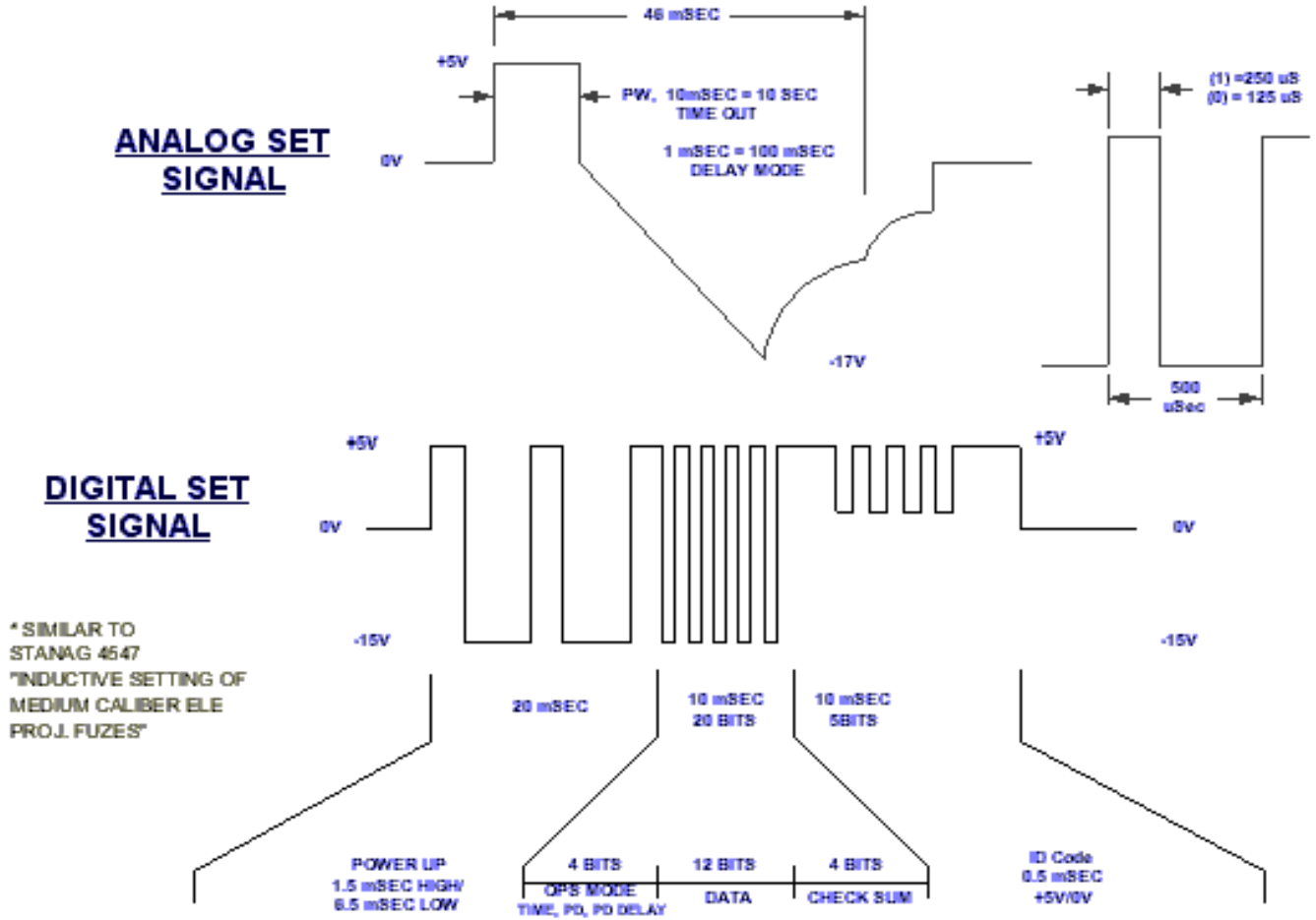


Maximum data rate: TBD

Data bit period: 500 microseconds

*This is the maximum allowable delay to meet the 2.75 inch rocket ripple rate, delay may be reduced if desired.

ANALOG / DIGITAL SET SIGNAL



M439 Digital Fuze YPG Tests

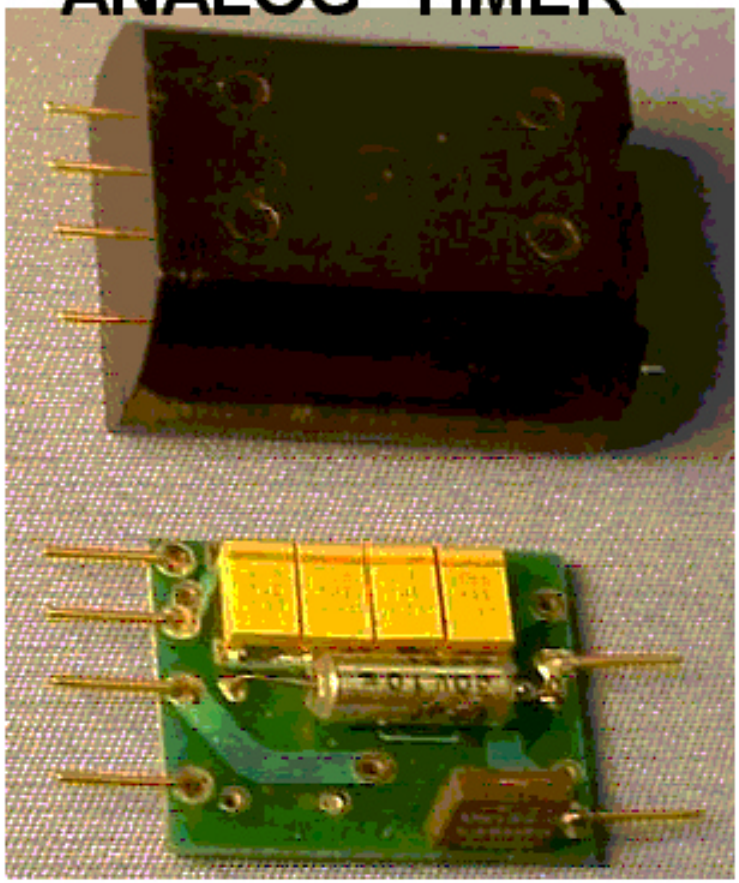
		DIGITAL FUZE		
Range/Set Time	0.5% Seconds	**Total Fired**	**Average Time** Seconds	**Std. Dev** Seconds
1.2km: 2.05 Sec	2.0397-2.06	8	2.044	.007
3.7km: 8.01 Sec	7.97-8.05	8	8.016	.011
6.6 Km: 20.5 Sec	20.40-20.60	10	20.483	.011

Summary

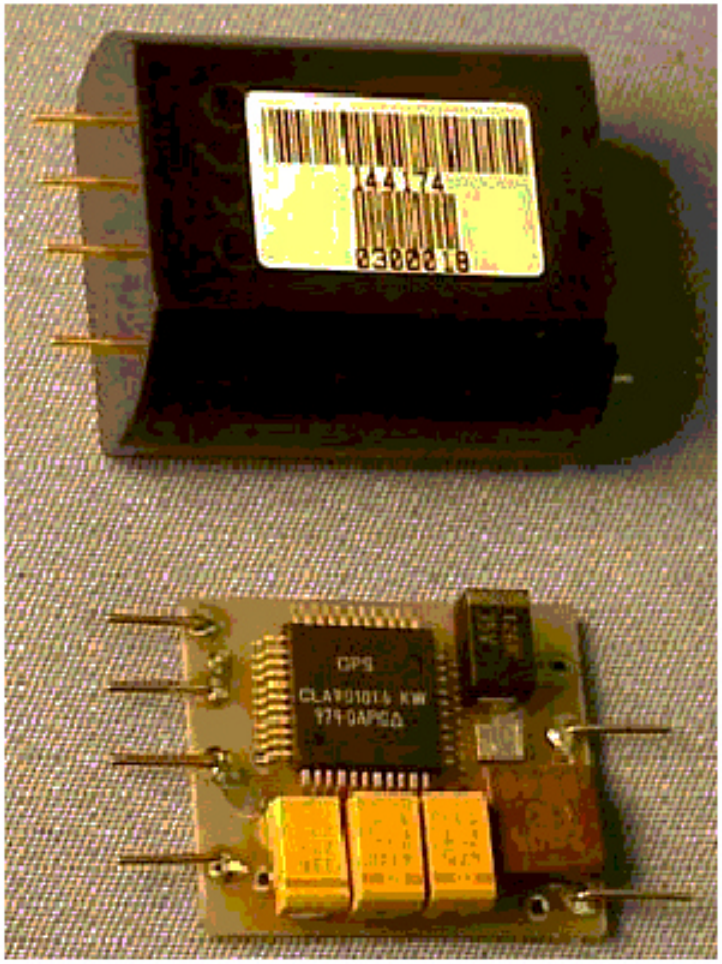
- **26 Rockets fired**
- **26/26 fuzes functioned within 1% of the set time**
  - **24/26 fuzes functioned within 0.5% of the set time**
  - **Remaining two fuzes(cold temp.) functioned >.5% by one msec and 1.3 msec**

EXISTING M439 ELE MODULE

ANALOG TIMER



DIGITAL MODULE CONFIGURATION



SUMMARY
DIGITAL FUZE

- M439 DIGITAL FUZE COMPATIBLE WITH DIGITAL AND ANALOG SETTERS HAS BEEN SUCCESSFULLY DEMONSTRATED

- PLANS ARE IN PROCESS FOR FULL SCALE DEVELOPMENT AND TYPE CLASSIFICATION