µSmartDigi™

Alabama D-STAR Project

D-STAR Training Seminar

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by

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μSmartDigi™

- μSmartDigi™ APRS® Digipeater
- μSmartDigi™ D-Gate™ D-STAR Gateway
- μSmartDigi™ ???

µSmartDigi™ Basics

- 1.5in x 2.5in PCB Expansion Board for Coastal ChipWorks TNC-X
- CPU is Microchip's dsPIC 30F/33FJ DSP Microcontroller Family
- 30+ MIPS
- Powered at 8-16 VDC, 100-200 mA
- Programmed in native C

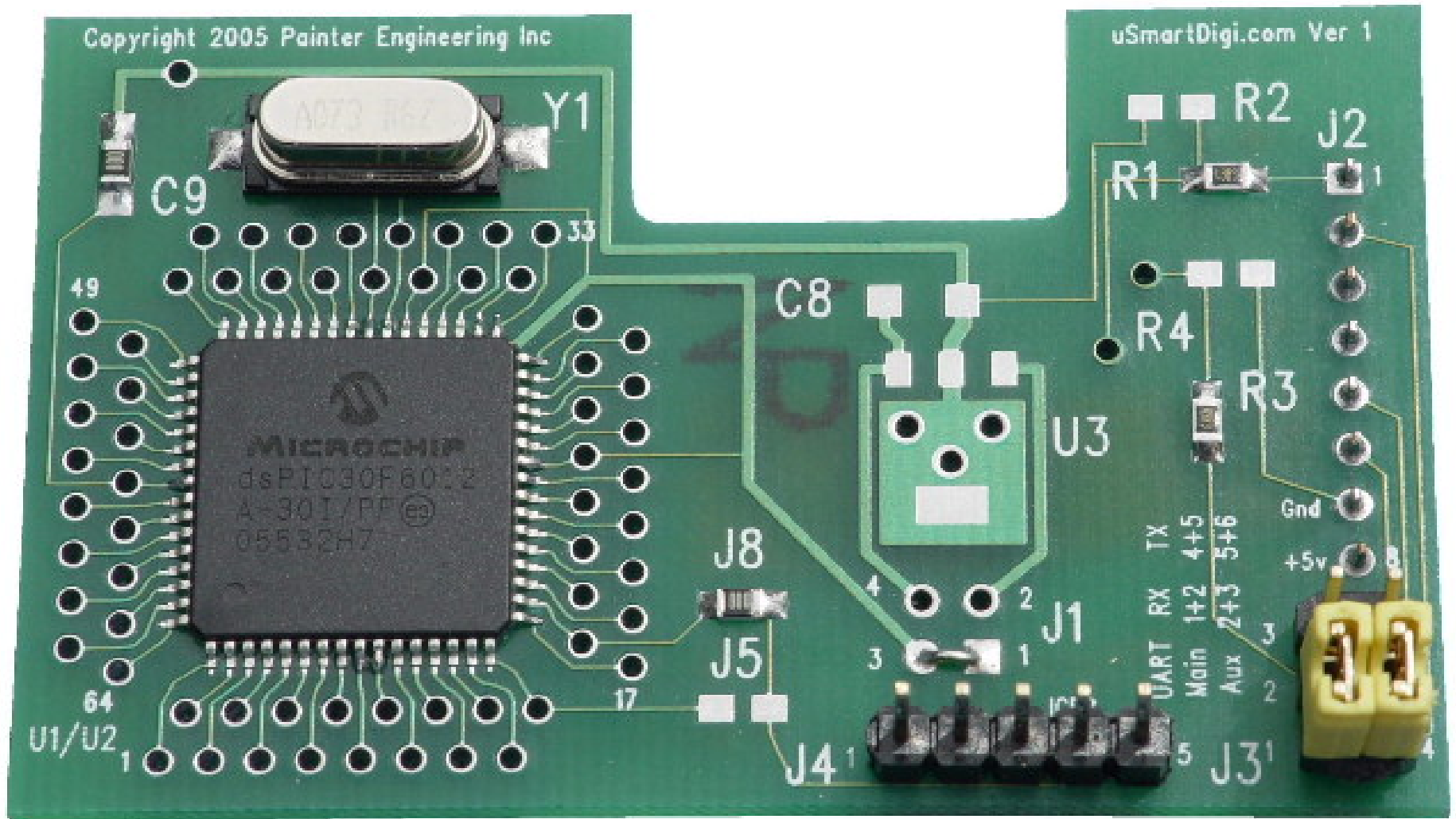# μSmartDigi™ Basics

- ◆ **CPU Capacities**
  - 128-256 kB Program Memory
  - 48 k Instructions
  - 8-16 kB SRAM
  - 4 kB EEPROM
- ◆ **Current Use**
  - ~89 kB Program Memory
  - ~8 kB SRAM, ~2.8 kB EEPROM

μSmartDigi™ Common Features

- ◈ Operates without dedicated PC/Laptop
- ◈ Firmware is Field Flashable without special hardware
- ◈ Configuration and Rules stored in EEPROM
- ◈ Interactive Monitor for Configuration changes and Message Logging

μSmartDigi™ Common Features

◆ PC/Laptop Utility

- Processes Configuration and Rules from ASCII text files

- Performs extensive error checking

- Downloads Configuration and Rules into EEPROM

- Flashes Firmware distributed in Intel Hex format (standard for Microchip)

μSmartDigi™ Common Features

◆ PC/Laptop Utility cont.

- Communicates with **μSmartDigi™** over RS-232 or TNC-X Optional USB Module

◆ Use PC/Laptop Terminal Emulator, etc. to Monitor Logged Messages, directly enter Configuration Parameters (but not Rules)

μSmartDigi™ Common Features

◆ User-configurable Rule Processing

◆ Log output is UI-View style

◆ Performs Duplicate Checking

μSmartDigi™ Common Features

◆ Duplicate Checking Function

- ▪ Fields src, src ssid, dst, info

- ▪ Uses Fast CCITT CRC16 1021 Normal Table-based algorithm

- ▪ User-defined time window (default 28 seconds)

μSmartDigi™ Digi Features

◆ Configured with fixed Lat-Lon or uses real-time updates from attached GPS

◆ Supports a combo of GPS and Log Monitoring on single serial port

μSmartDigi™ Digi Features

◆ Sample Transaction

```
DROP: Path Rules: Bad Digi: -0 and H=0
KD6FVP-2>APS224,N6EX-1,WIDE1 <UI Len=45>:
>152343z[224]*We know most of your faults!!!

DROP: Path Rules: Digi1 RELAY
N6XQY-12>GPSLJ,RELAY,WIDE2-2 <UI Len=71>:
$GPRMC,013641.06,A,3348.1607,N,11807.4631,W,34.0,090.5,231105,13.,E*73
```

μSmartDigi™ Digi Features

◆ Packet-Checking Algorithm
Uses short-circuit logic
1. Verify Digipeater Path

2. Perform Duplicate Check

3. Decode Position Information

4. Process against User-defined Rules

μSmartDigi™ Digi Features

◆ Verify Digipeater Path

  ■ Checks for Generic Path (dst field)

  ■ Checks for exhaustion

  ■ Optionally scans for RELAY

  ■ Ignores TRACE

  ■ Applies hop-count limits (Max, Total)
     eg. WIDE1-1,WIDE4-4

μSmartDigi™ Digi Features

◆ Perform Duplicate Check

- Fields src, src ssid, dst, info

- Uses Fast CCITT CRC16 1021 Normal Table-based algorithm

- User-defined time window (default 28 seconds)

µSmartDigi™ Digi Features

- **Decode Position Information**
  - Raw NMEA Messages
    - GGA
    - RMC
  - MIC-E
  - Base-91 Compression

μSmartDigi™ Digi Features

◆ Position Information Currently Supported

- $ (GGA and RMC only)
- !=
- /@
- `\

μSmartDigi™ Digi Features

◆ Process against User-defined Rules

- Implicit and Explicit Rules

- Short-circuit logic

- Specify *PASS* or *DROP*

- Match src or dst fields with optional wild character (*)

- Geoposition based on *compass* direction, *circle*, *sector* (pie segment) or *rectangle*

μSmartDigi™ Digi Features

◆ Process against User-defined Rules

■ Lat, Lon and Angles are specified in several flexible formats

- Colon: [s]DDD:MM:SS[.F*]
  -38:33:29.222 45:18:

- Dotted: [s]DDD.MM.[F*]
  -103.00. -38.33.379

- DMC (Degrees Minutes seConds):
  N 39d 23.7m, 33.9c, W104d40m8.4c, -42.5d

μSmartDigi™ Digi Features

◆ Process against User-defined Rules

- Rules are edited in an ASCII file

- No special editor

- Files are portable

- PC/Laptop Utility reads, error checks, complies into compressed internal format and downloads into EEPROM

μSmartDigi™ Digi Features

◆ Example Rules

```
implicit    pass
drop src ab0vo
pass dst APU25N
pass circle 2.5    n 39d 31m,    W 104.669d    // hole
drop cir    50.5   n 39d 31m,    w 104.669d    // donut
drop compass W     39:31:00, w 104.669d  # drops West
drop rect   40d 0m .5c, -104d 30m,39d, -103d   /* box
drop sect   32d, 60d, 5    // drops all packets 5 miles or
                           // greater from the repeater
                           // from 32deg from N to 60deg
                           // from North
```

µSmartDigi™ Digi Features

◆ Configuration Parameters

- Parameters are edited in an ASCII file or interactively into the µSmartDigi™

- No special editor

- Files are portable

- PC/Laptop Utility reads, error checks and complies into compressed internal format and downloads into EEPROM

μSmartDigi™ Digi Features

◆ Configuration Parameters (subset)

```
call         CALL
ssid         SSID
position     Lat Lon
havegps      y | n
log          y | n
host         [baud]
tnc          [baud]
gps          [baud]
nsr          y | n
relay        y | n
widemax      N
widetotal    N
dupewin      seconds
```

μSmartDigi™ D-Gate™ Features

◆ Gates D-STAR Digital Messages to APRS® RF Network

◆ Requires specific D-STAR Message Format

◆ Message Format Calculator at http://www.aprs-is.net/dprscalc.htm courtesy of Pete Loveall, AE5PL

µSmartDigi™ D-Gate™ Features

D-PRS Message Calculator

[Home] [Up] [D-PRS Message Calculator] [D-PRS Symbols] [DStarTNC2.zip]

This page calculates the necessary GPS message for use with D-PRS. Your browser must have JavaScript enabled to use this page.

Note that the symbol code occupies the first four characters of the GPS message (space padded) and that there is a checksum appended to the text preceded by an asterisk.

The D-PRS CallSSID can be used to look up your station on www.jfindu.net or www.findu.com

MyCall 8 Char Max Right Space Padded	D-PRS Symbol	GPS Message
AB0VO 9	DIGI (white center) Symbol: ⊕ Overlay:	D-GATE TEST
D-PRS CallSSID: AB0VO-9		Input into TX Message C1: BD D-GATE TEST*71

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μSmartDigi™ D-Gate™ Features

◆ Eliminates duplicates based on Call Sign within 10-second window

◆ Eliminates duplicate messages within a configurable 28-second window (classic dupe checking)

◆ Filters messages according to set of User-defined Rules

μSmartDigi™ D-Gate™ Features

- Gateway Function
  - Converts D-STAR NMEA GPS data to Third-party Position Reports
  - Converts Symbol and Text Data
  - Use User-defined Path

μSmartDigi™ D-Gate™ Features

◆ Sample Transaction

```
D-STAR:
$GPGGA,163212,3901.6726,N,10440.1415,W,1,05,2.8,2319.4,M,-21.7,M,,*40
$GPRMC,163214,A,3901.6717,N,10440.1413,W,1.7,200.6,140806,9.7,E,A*07
AB0VO  9,BD  D-GATE TEST*71

PASS:
AB0VO-3>APRS,WIDE1-1,WIDE2-2 <UI Len=69>:
}AB0VO-9>APRS,DSTAR*:!3901.67N/10440.14W#200/001 D-GATE TEST/A=007607
```

μSmartDigi™ Summary

◆ Q&A

◆ Web Sites

http://usmartdigi.com

http://www.tnc-x.com

http://www.aprs-is.net/dprscalc.htm

http://www.icomamerica.com/amateur/d-star/dstar2.asp

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