µSmartDigi™

Presented at Ham-Com 2006

Plano Texas

9-10 June 2006

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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
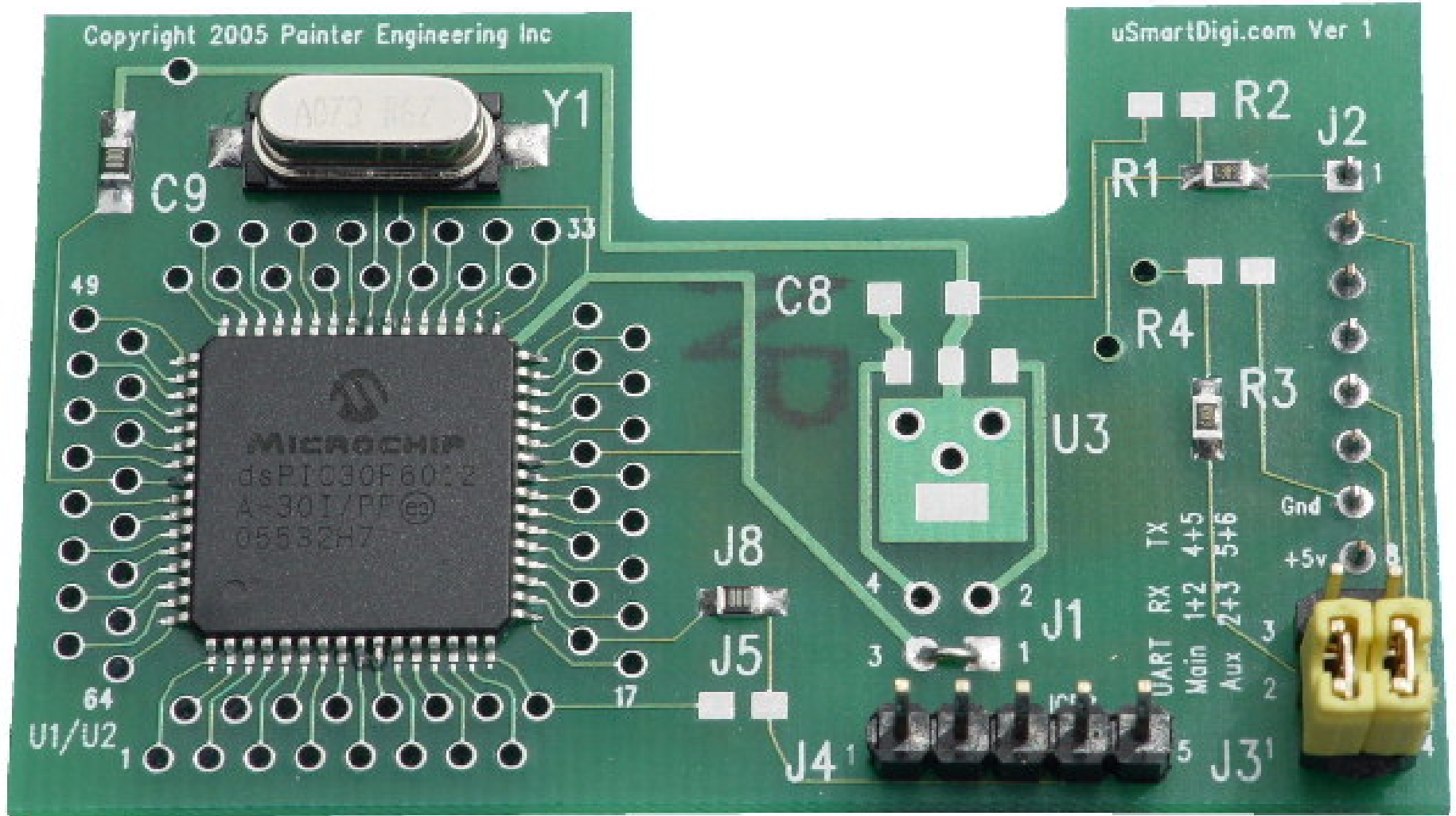- ◆ Powered at 8-16 VDC, 100-200 mA
- ◆ Programmed in native C

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™ 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

- ◆ 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

◆ Expected to change…

- Converts D-STAR NMEA GPS data to Base-91 compressed Position Reports

- Converts Symbol and Text Data

```
D-STAR:
$GPRMC,013318,V,2756.4589,N,08227.2434,W,0.0,0.0,010306,4.5,W,S*1B
AB0VO  9,BD  D-GATE TEST*71


DROP: Line 8, Rule 1:
AB0VO-9>APRS,WIDE1*,WIDE2-2 <UI Len=34>:
!/@Bb%9\S]#! @BD  D-GATE TEST*71
```

µSmartDigi™ Digi Features

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

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

◆ Log output is UI-View style

```
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™ 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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