

Requirements

1. Switch 3 channels of 12V or optionally 5V at 0.8A max continuous, 1.25A peak inrush.

Notable loads (from Gene's power budget spreadsheet)

Motorized Valve	5V @ 0.8A max
ISUS	12V @ 0.35A max
Iridium	12V @ 0.5A max
all others	<0.1A

2. Circuit breaker function: 1.25A @ 15 msec (12V power supply limits at 3A)
3. UART Serial I/O: 3 channels of XR20M1280 UART, run core at 1.8V for power. Max baud 115k (?) RS232 level shifting with full handshaking on one port and bare-bones on two ports.
4. "Native" Serial I/O: 3 channels from G400 SOM. Max baud = ? RS232 level shifting with RTX/CTS handshaking on one port, bare-bones on two ports.

Design Notes

1. Clock

UART baud clock: needs integer multiple (plus can trim by .0625 fractions if needed).
Nominal $9600 \times 16 = 153.6 \text{ kHz}$; max $115.2\text{kbaud} \times 16 = 1.8432 \text{ MHz}$. $1.84 \text{ MHz}/12 = 153.6 \text{ kHz}$. (Clock input requires 1.8V if Vcore is 1.8V.)

Energy Monitor timebase: Sample Clock allowed range is 100-400 kHz, "target" 250 kHz, with 4X-8X-12X etc prescaler. So Clkin input should be 1-2-3 MHz; 1.84 MHz with 8X prescaler will yield 230.4 kHz sample clock. Clkin threshold Vclkin(th) is 1.3V max so 1.8V clock should work.

Oscillator: LTC6930-7.37 @ 7.37 MHz with divider set to 4 yields 1.84 MHz, will run on 1.8V and should draw ~180 uA (0.3 mW). Part claims low impedance output with

controlled rise/fall times, so run unbuffered; fanout is 6 inputs all of which are crystal oscillator inputs. Locate part near centerline of board to minimize trace length/reflection time. N.B. Linear Tech recommends two 0.1 uF bypass caps for this part, see spec Fig 1.

2. UART

3. Level Shifter

4. Current Limiter/Pwr Switch

No UV lockout... regulated pwr supply input

EMI per channel (alternate is 1 ea for 12V and 5V; per-channel gives isolation between loads too)

No fuse... current too low, resistance too high

Current Limit. Supplies are 12V @ 3A and 5V @ 1A. Highest load is 0.8A (valve).

50% margin $\rightarrow$ 1.2A. 50 mV drop $\rightarrow$.0417 use .04 ohm $\rightarrow$ actual CL = 1.25A

MOSFET: Dpak for large thermal mass. 25-35V, 2-10mohm... 6 pages of choices.

All seem to allow 10V @ 2A for between 100msec and continuous (@ Tc=25).

All are trench gate and intended for sync rect applications ☺

Fairchild FDD8896 looks okay, 6 mohm/30V/\$1

Gate slowdown cap for inrush: shoot for 0.75A (0.5A margin).

Per LT spec p. 15, $C = (30\mu\text{A}/0.75) \times 470\mu\text{F} = .018\mu\text{F}$

Overvoltage – try +25%, so 15V on 12V boards and 6.25V on 5V boards

LT4363 FB pin threshold 1.275V @ 1uA max, 0.2uA typ. bias

Hold bias-error to 1% typ for Energy Monitor accuracy

LTC2946 A/D In 2.048V FS, 3 Mohm min, 10 MOhm typ

Total divider bias current typ $0.2\mu\text{A} + 0.2\mu\text{A} = 0.4\mu\text{A}$

$.01275\text{V}/0.4\mu\text{A} = \sim 32\text{k}$ divider output impedance, min.

$15/1.275 = 11.76$ div, $6.25/1.275 = 4.9$ div.

Don't bother with precision monolithic dividers since OVP does not require precision and the energy measurement is be-nice-if.

Divider calc suggests 42.2k for bottom, 453k for 12V top (+0.26%), 165k for 5V top (-0.16%).

Energy Monitor

Actual division ratios are 11.73 for 12V and 4.910 for 5V boards

LTC2946 ADIN is 2.048V FS and 0.500 mV/count (12 bit)

so scale factors are 24.02V FS and 5.865 mV/count for 12V,

and 10.06V FS and 2.455 mV/count for 5V

5. Datamate connectors

Series M80-5, with jackscrews *and* board mount screws. 3mm tail = 0.118"

(note series 666 is already in CIS Database, presumably in use here...)

6 pin: M80-5400642 = DigiKey 952-1024-5-ND

12 pin: M80-5401242 = DigiKey 952-1931-ND

Note "small bore" crimp sockets are AWG 24-28, "large bore" required for AWG 22.

Current rating ~3A

Female mate is M80-481 (hex socket jackscrews, no shroud). Avail for 6-pin, not for

12... for 12 have to use M80-461 slotted jackscrews, no shroud.

(Also available M80-941 with str relief hood)

Review Questions

1. Are we okay with combined power and signal ground nets? Maybe have Batt, Pwr (12V/5V), and Sig (3V3/1V8)?
2. Harwin "L-Tek" M80-666 series with clips is already in use here (or at least is in CIS Database) – alas these are SMT with no board mount.
3. Y-caps on Mobo (with access to frame ground) for CM control?
4. No UV lockout on pwr switch – OK?
5. Exar never specifies logic sense of SLEEP pin. Assuming High=Sleep.
6. How lucky do we feel with the MAX level shifter AutoShutdownPlus mode?
7. Use GPIOs for RTS/CTS on Ch. A of native serial boards?
8. Missing a requested feature on I2C addressing: local select jumper... what was it?
9. How far to recess Harwin connectors from board edge
10. Testpoints.