## BuildingBus 48 Physical Layer

| | | | | | |
|---|---|---|---|---|---|
| **Requirements** | | | **4** | wires | number of wires (48V_pwr+, 48V_pwr-, data, earth_gn |
| | | | **single-ended** | | signaling (1-wire data w.r.t. 48V_pwr-) |
| | | | **3** | V | maximum common mode voltage between devices (+- |
| | | | **1** | V | maximum coupling of signal from adjacent wires (e.g. + |
| | | | **32** | | maximum # of devices on cable |
| | | | **9000** | pF | maximum capacitance between data wire and Pwr- wi |
| **Master Controller** | MasterCtlr Voltage | Volts | **16** | | |
| | MasterCtlr R_Series | ohms | **330** | | |
| **Transmitter** | Tmit R_Series | ohms | **33** | | |
| **Receiver** | Power Supply | Volts | **3.30** | | |
| | Max Rcvr Vin | Volts | 3.20 | | |
| | Additional Voltage | Volts | **1.50** | | |
| | Max Cable Voltage | Volts | 17.00 | | |
| **Receiver Voltage Divider** | Rcvr vDivider | ratio | 0.19 | | |
| | Rcvr R1_divider | ohms | **100,000** | | |
| | Rcvr R2_divider | ohms | 23,188 | check: | 3.20 |
| | vDivider Pwr | mW | 2.08 | | |
| **Receiver Filter** | target timeconstant | uSec | 0.50 | | |
| | cutoff-frequency | MHz | 0.32 | | |
| | R/C filter capacitor | pF | 5.00 | | |
| **Logic 0 Power** | Logic 0 Current | mA | 44 | | |
| | Logic 0 Power | mW | 705 | | |
| | % time signaling 0 | % | 1% | | |
| | Avg Pwr over time | mW | 7 | | |
| **Cable Voltages** | | Cable | Rcvr vDivider | | |

| | (Volts) | (Volts) |
|---|---|---|
| Cable, Logic 1 | 15.5 | 2.92 |
| Cable, Logic 0 | 2.31 | 0.43 |
| Logic_0 + Vcm_Max + Vcouple_Max | 6.31 | 1.19 |

**Rcvr Analog Comparator**

| | | | |
|---|---|---|---|
| Hysteresis | Volts | **2.00** | difference between rcvr hysteresis threshold_lo and th |
| Rcvr Threshold Low | 6.31 | 1.19 | Hysteresis References: https://www.ti.com/l |
| Rcvr Threshold Hi | 8.31 | 1.56 | http://rohmfs.rohm.c |
| Rcvr Threshold Middle | | 1.38 | https://www.analog.c |
| Threshold Pwr V. | Volts | 3.30 | |
| Threshold R1 | ohms | **100,000** | |
| Threshold R2 | ohms | 71,502 | vout = Vin * R2 / (R1 + R2), vout * (R1 + R2) = Vin * F |
| Threshold Rh | ohms | 315,455 | Reference (page 7 of the following document): https:// |

**Syncrhonization**

> hard sync: all devices allign to recessive-to-dominant edge of the transmitted Start-Of-Frame bit
> re-sync: each device looks for getting recessive to dominant transition (1 to 0) outside SYNC_SEG
> any changes in bit value are expected to occur during the SYNC_SEG segment (first 25% of bit, 2.5uSec); oth
> when you pull down line (e.g. tmit R_series (e.g. 33 ohm) and NPN), you need to move fast since this could
> If you tmit a 0 and then a 1, then the 1 is sampled at the 75% time (e.g. 7.5uSec). Also, you do NOT want co

| | | |
|---|---|---|
| > Reference: | Synchronisation & Timing, NXP #AN1798 | https://www.nxp.com/docs/en/a |
| | CANbus Physical Layer, TI #SLLA270 | https://www.ti.com/lit/an/slla27 |

**Driving Capacitance**

| | | | |
|---|---|---|---|
| total network length | ft | **300** | worst case: 300 ft of 30pF/ft cable |
| capacitance-per-ft | pF/ft | **30** | |
| total capacitance | pF | 9000 | |
| pull-up time constant | uSec | 3.0 | |

**Calculate Pull-up Resistance give uSec Timeconstant for risetime**

| | | | | |
|---|---|---|---|---|
| | target rise time (uSec TC) | uSec | **3.0** | target TC for rise-time |
| | Pull-Voltage | Volts | 16 | |
| | current to pull at TC rate | mA | 48 | |
| | power to pull at TC rate | mW | 768 | |
| | pull-up resistance | ohms | 333 | e.g. Need 330 ohms to drive 9000pF 16V wi |
| **Transmitter Switch** | Transistor | Time to reverse diode is too long: | | KSP44, PM |
| | | Works ok: | | KSC5502, $ |
| | Mosfets | Works, yet rings badly (cannot control rise/fall via R/C at NPN BASE): | | BSS225, $0 |

ıd_shield) -- data is single-ended

3V, e.g. 35meters / 4Amps /18awg;  or 18meters / 8Amps /18awg)
ł-1V) after reciever filter (e.g. after 500KHz filter)

re

ıreshold_hi

it/ug/tidu020a/tidu020a.pdf?ts=1602578956799&ref_url=https%253A%252F%252Fwww.google.com%252F
om/en/products/databook/applinote/ic/amp_linear/comparator/gpl_cmp_hysteresis-e.pdf
:om/en/analog-dialogue/articles/curing-comparator-instability-with-hysteresis.html

R2,  vout*R1 + vout*R2 - Vin*R2 = 0,  vout*R2 - Vin*R2 = -vout*R1,  R2 = - vout*R1 / (vout - vin)
/www.ti.com/lit/ug/tidu020a/tidu020a.pdf?ts=1602578956799&ref_url=https%253A%252F%252Fwww.google.com%252F

ıerwise, we re-sync
be used for re-syncrhonization
mparator flipping 1/0/1 due to ringing otherwise re-sync will occur and goof everything up.

application-note/AN1798.pdf
'0/slla270.pdf?ts=1602684992276&ref_url=https%253A%252F%252Fwww.google.com%252F

th 3uSec TC (timeconstant)  I = C dv/dt,  dt = C*dV/I

BTA45, ZTX458, 2nJ6517
5.30, DPAK

).15, 90mA, 600V, SOT-89