

CAN 与单对 10BASE-T1S 以太网收发器的硬件要求比较

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简介

本文档比较了 CAN 与 10BASE-T1S MAC-PHY 通信节点的典型应用框图。

节点硬件比较

图 1 显示了采用 T30HM1TS2500 收发器 (也可采用 NCV7410) 的 MAC-PHY 10BASE-T1S 节点典型应用框图。

图 2 显示了典型的 CAN 节点, 该节点具有高级电源管理、唤醒与抑制控制功能。这里选择了 NCV7343 CAN 收发器, 作为 T30HM1TS2500 以太网收发器的最接近等效器件。

图 3 显示了采用 NCV26004 的 PMD 10BASE-T1S 节点典型应用框图。

最后, 图 4 显示了不带电源管理的基本 CAN 节点; 这是与 PMD 10BASE-T1S 节点最直接的等效方案。

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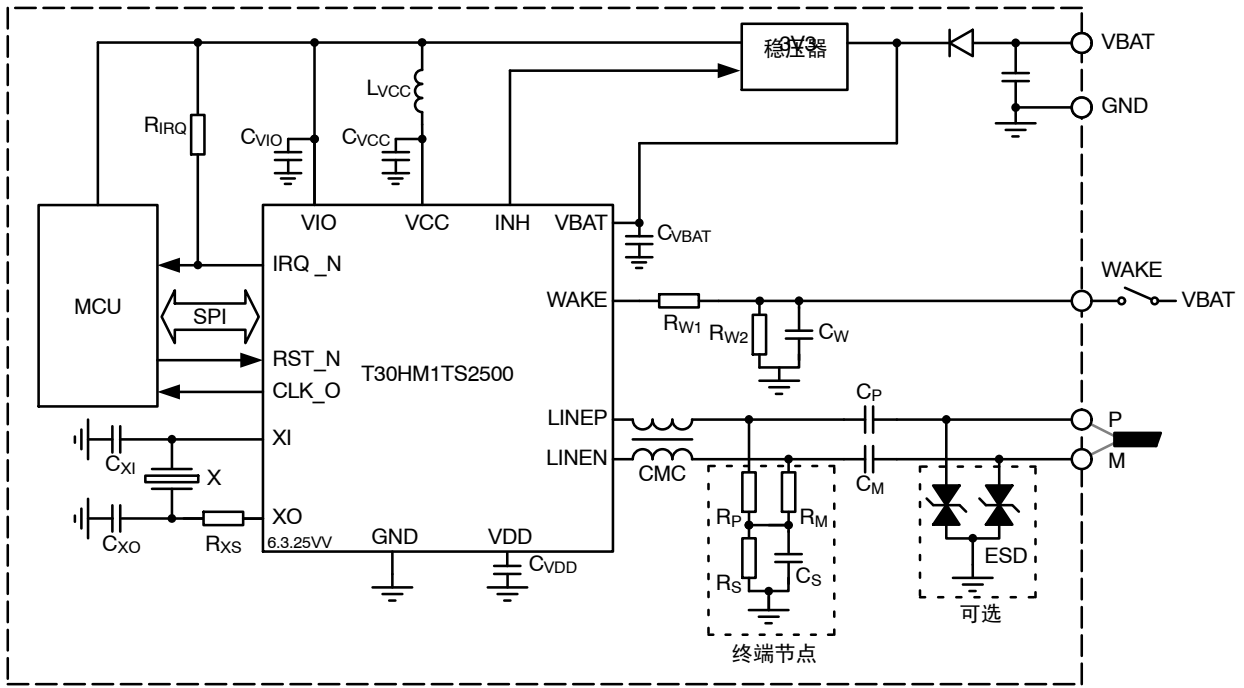


图 1. 10BASE-T1S MAC-PHY 应用框图

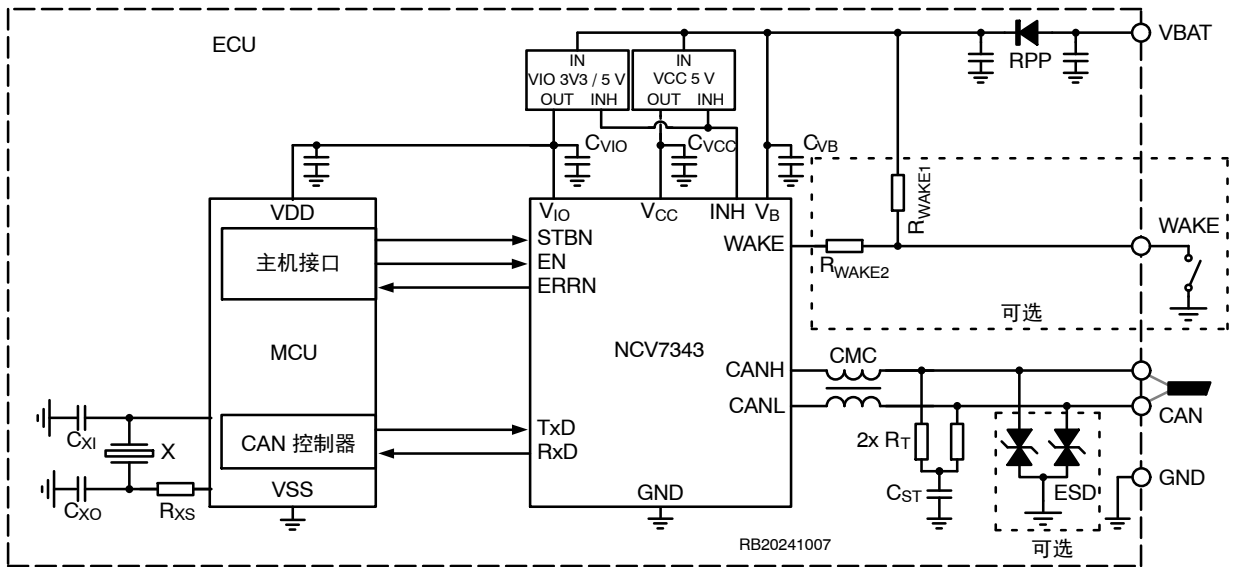


图 2. CAN 节点应用框图 (带电源管理)

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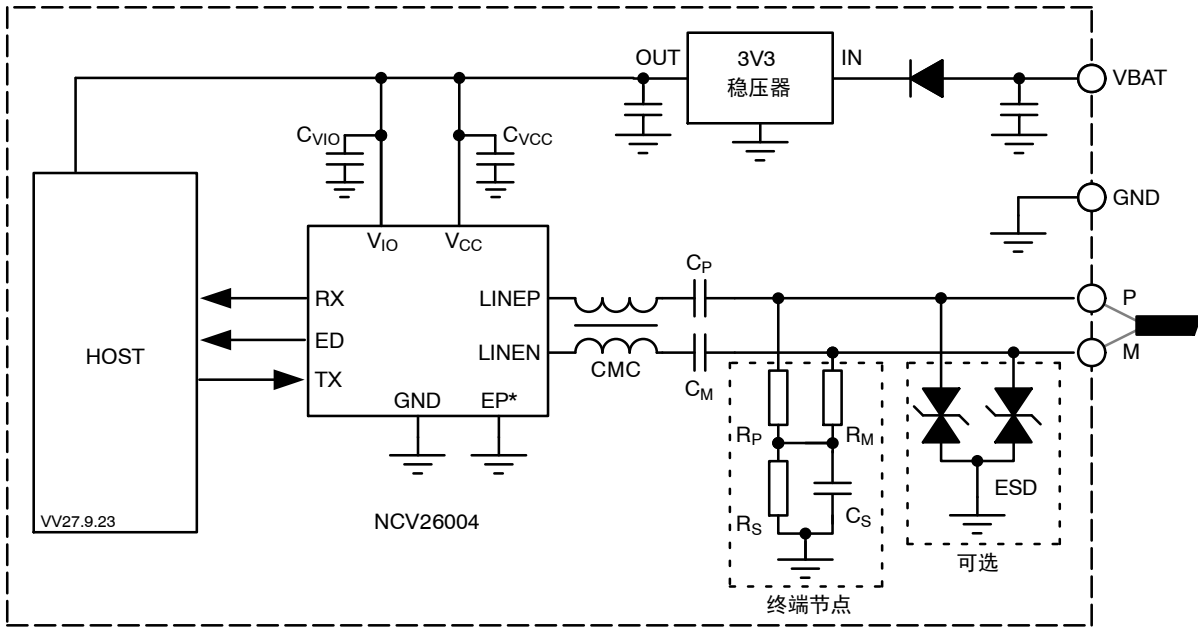


图 3. NCV26004 PMD 应用框图

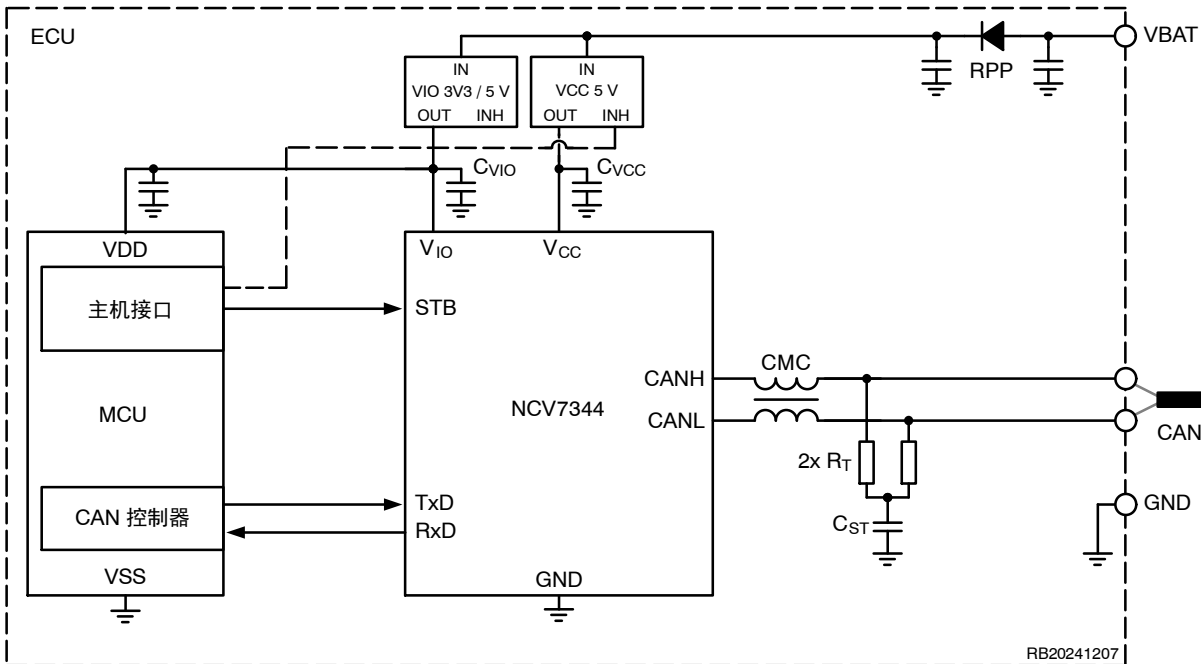


图 4. CAN 节点应用框图 (不带电源管理)

10BASE-T1S 节点的器件成本略高于 CAN 节点:

- 电源去耦成本大致相同。
- CAN 的共模扼流圈 (CMC) 通常为 100 μH (或 51 μH), 而 10BASE-T1S 需要 240 μH (130 μH 正在按照 EMC 要求评估)。240 μH 共模扼流圈价格约高 20%。
- 10BASE-T1S 需要两个电容器来对通信线路进行直流隔离 (图 1 中的 CP 和 CM)。如以下结论所述, 这两个无源电容器虽增加少量成本, 但使实现 PoDL (数据线供电) 成为可能, 并可更好地保护线路免受直流短路的影响, 例如在 48 V 线束等场景中优势明显。通过数据线供电可省去单独的电源线, 从而降低系统成本并简化线束复杂度。
- 微控制器成本不在本文档的讨论范围内, 但假设两者基本相当。
- 10BASE-T1S 可以采用单个 3.3 V 电源 (安森美器件中, VBAT 也可连接到 3.3 V)。大多数 CAN 器件需要 5 V 电源才能与 CAN 总线连接; 目前还没有完全符合 ISO11898 标准且采用单 3.3 V 电源供电的 CAN 收发器。
在现代汽车设计中, 5 V 电源轨通常只需为 CAN 收发器供电; 微控制器与模拟电路均由 3.3 V 供电。
10BASE-T1S 方案可以省去该电源轨, 从而节省一个稳压器 (通常为 LDO)。

收发器的成本是主要差异, 但需要从完整系统角度来看待, 正如结论部分所述。

结论

本文档主要根据客户的具体需求, 对 10BASE-T1S MAC-PHY 和 PMD 节点与最接近 CAN 硬件节点进行了示意性成本比较。本文档并非两种协议的完整比较分析。

以下几点说明了这样一个事实: 成本比较需要在系统层面进行, 而仅对收发器相关硬件进行成本比较可能会产生误导。

CAN-FD 的实际速率上限为 2 Mbps, 而 CAN-FD SIC 则为 5 Mbps, 同时提供相对较高的网络拓扑灵活性。市面上很多微控制器均内置 CAN 控制器。

10BASE-T1S 在菊花链配置下可提供 10 Mbps 速率。采用 PLCA 的 10BASE-T1S 可保证最大延迟, 而 CAN 采用 CSMA/CR (载波侦听多路访问/冲突解决) 非破坏性仲裁, 则无法做到这一点。

10BASE-T1S 具备多项 CAN 收发器不支持的特性。T30HM1TS2500 已具备大部分特性, 而 NCV26004 搭配合适的微控制器后也将具备这些特性。

- 物理层支持 PoDL 和较强的直流短路鲁棒性
- 无需 5 V 电源; 这通常可以省去一整条电源轨
- 信号质量指标 (SQI)
- 模式唤醒, 正常通信不会唤醒收发器
- 唤醒转发功能 (微控制器唤醒前即可实现)
- 线束缺陷检测 (HDD)
- 拓扑发现
- 时间戳
- 增强型抗扰度 (ENI)
- 安全功能
- 在 SDV 中实现无缝软件集成
- 等等

10BASE-T1S 采用以太网协议, 因此可避免在以太网骨干网与边缘节点之间使用网关, 这对区域架构和软件定义汽车 (SDV) 尤为有利。

参考文献

- [1] NCV7410、T30HM1TS2500、NCV26004、NCV7344 和 NCV7343 产品手册 www.onsemi.cn

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修订历史

修订	变更说明	日期
0	发布初始版本	2/25/2026
1	新增中文版	4/17/2026

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