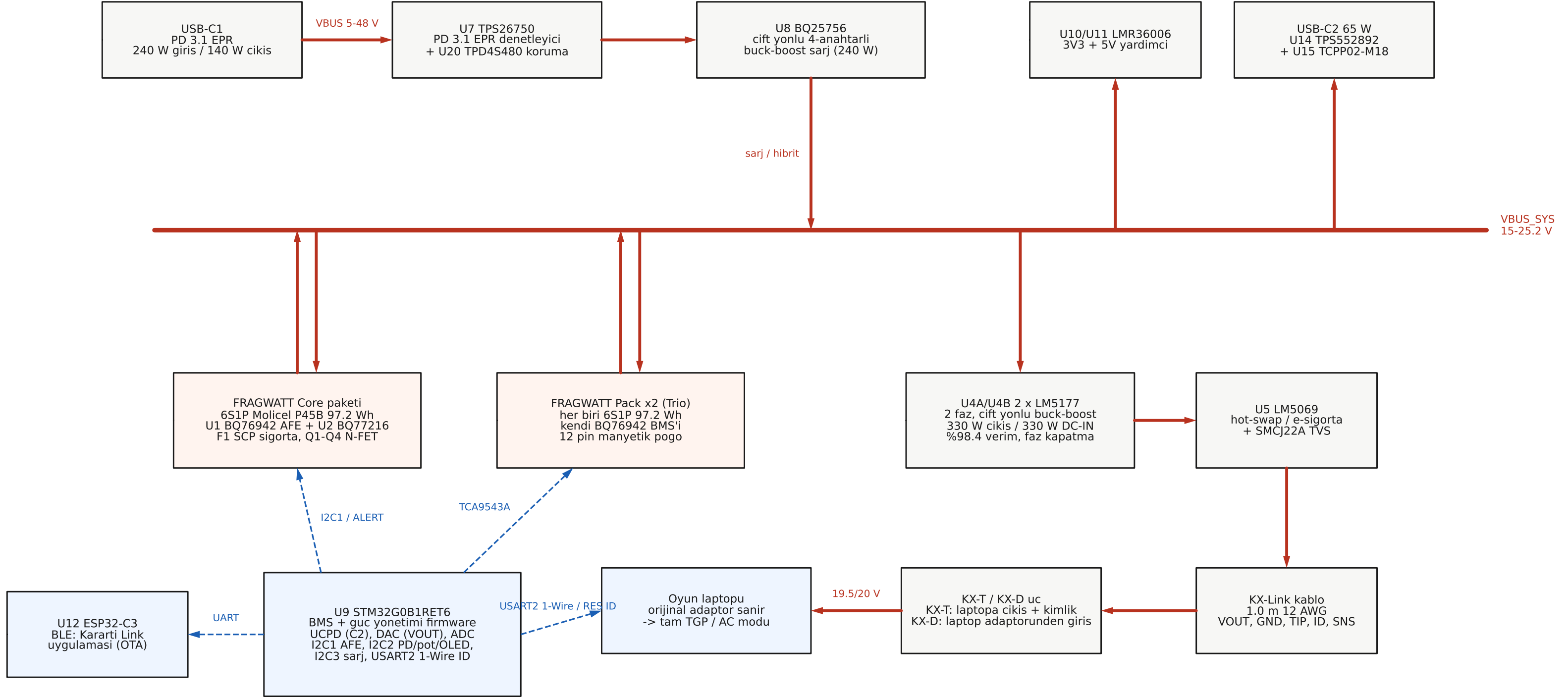
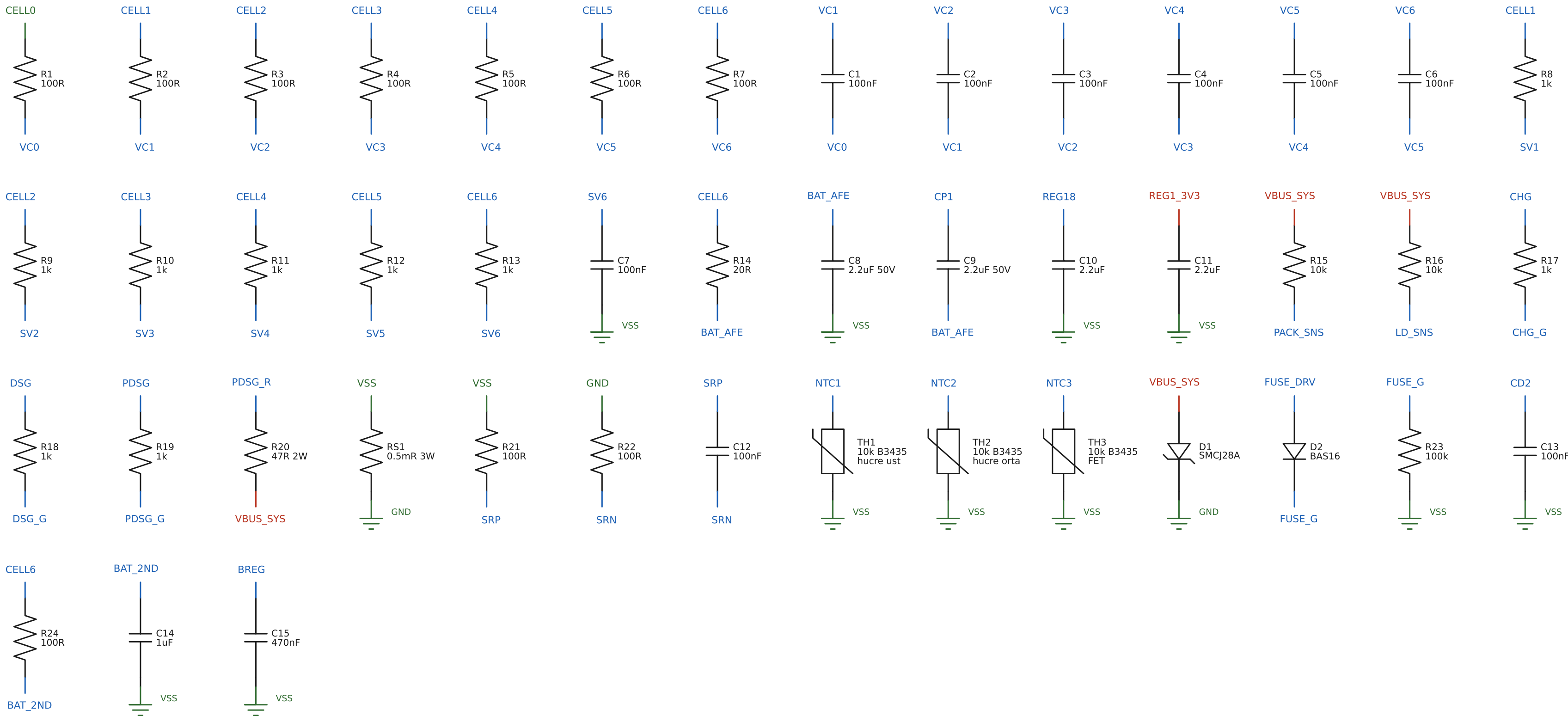
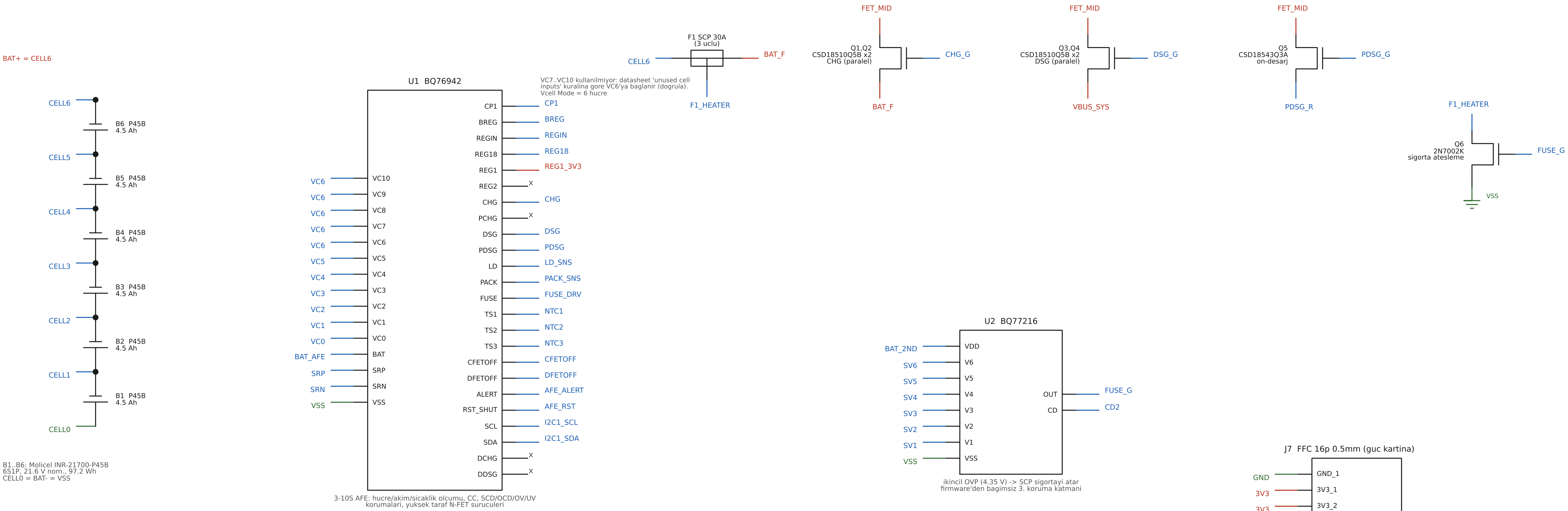


Batarya-bara mimarisi: paketler (her biri kendi CHG/DSG FET'leri ile) VBUS_SYS'e baglanir; sarj cihazi once yuku besler, kalan gucle paketleri sarj eder.

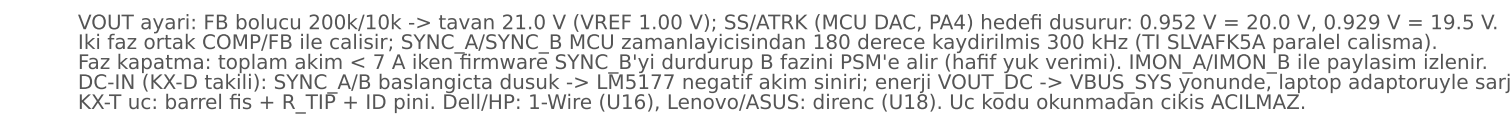
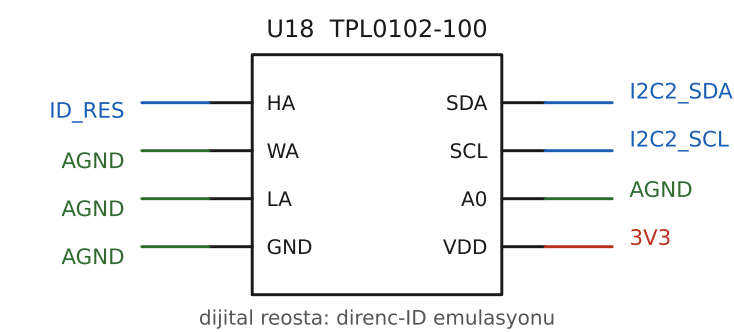
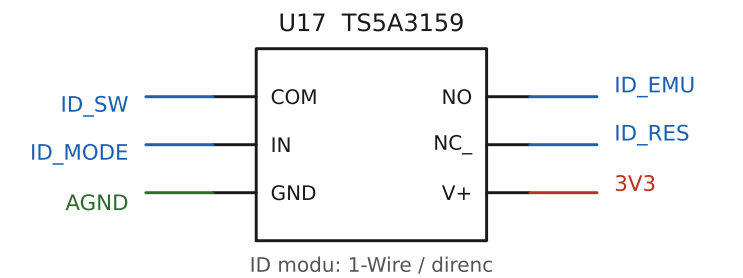
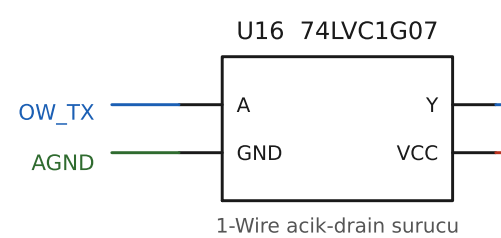
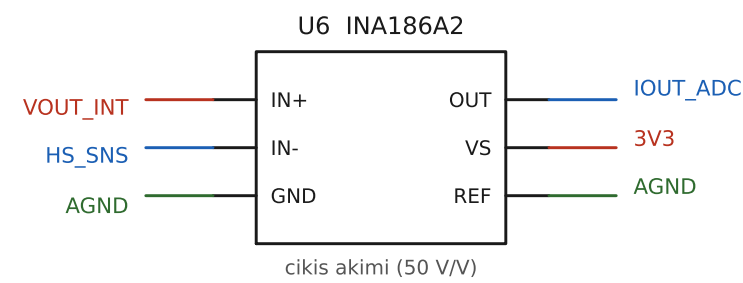
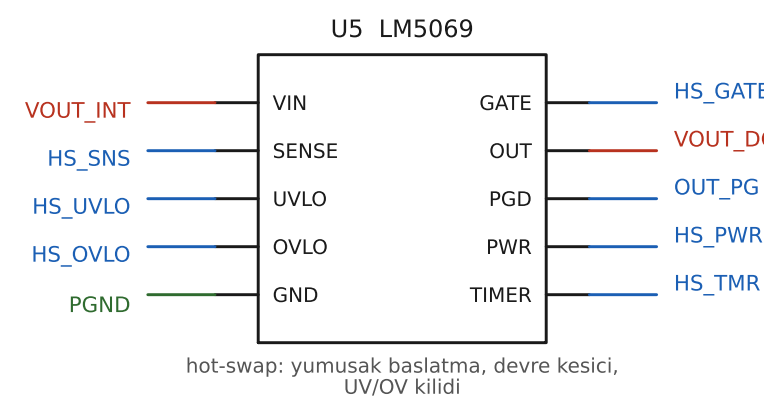
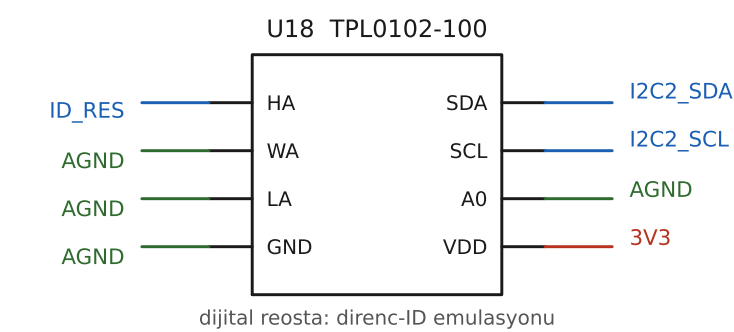
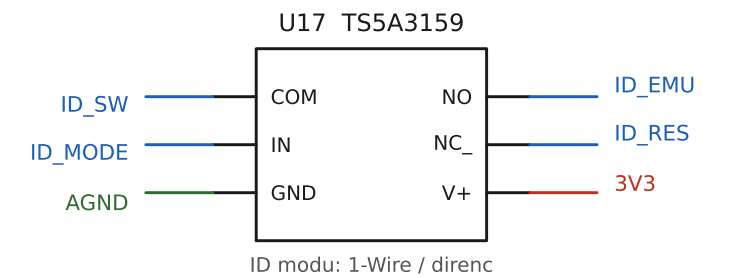
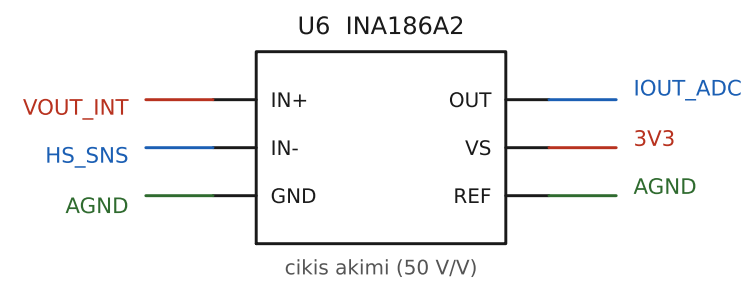
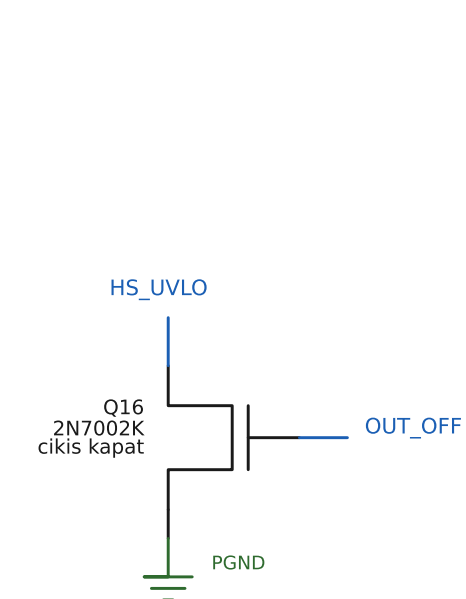


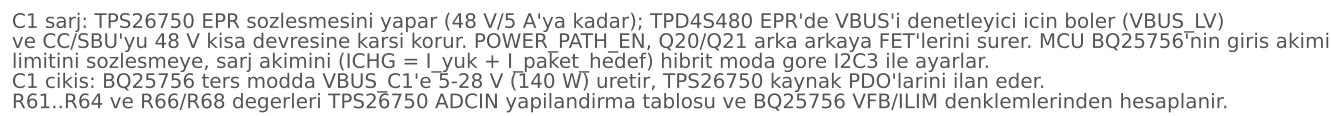
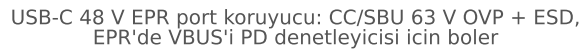
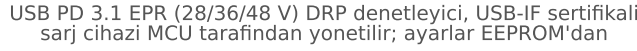
OLED 128x32 | buton | buzzer | akilli fan (giris havasi NTC) | 3x hucre NTC + guc NTC | TIP_SENSE ADC | DAC -> LM5177 SS/ATRK | SYNC_A/B

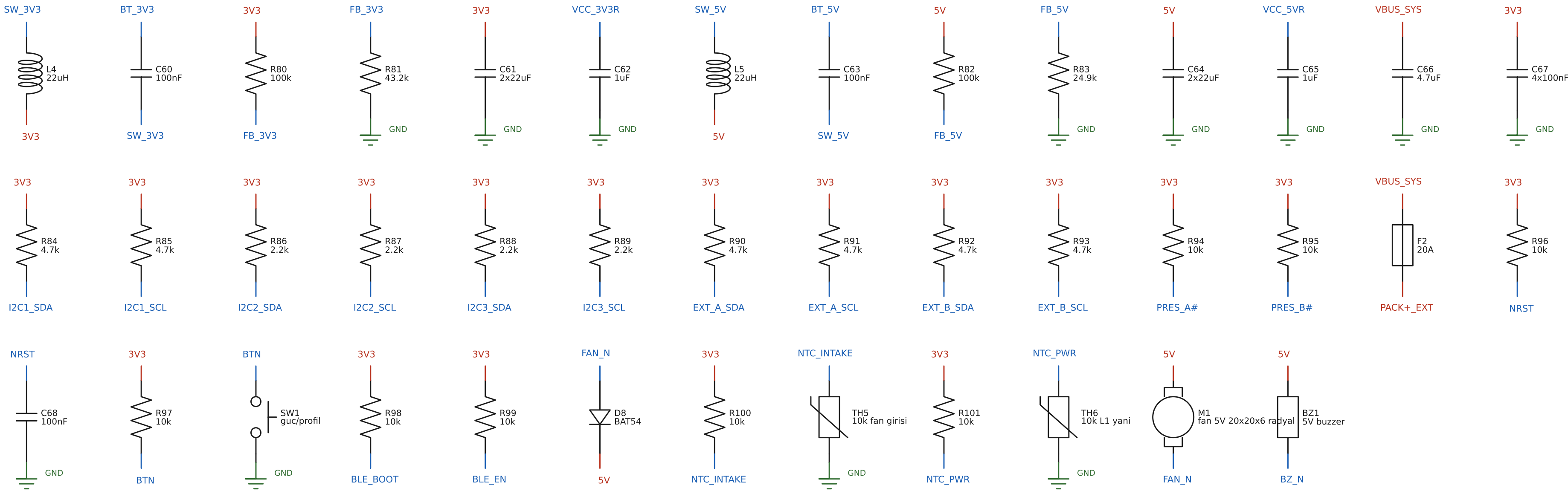
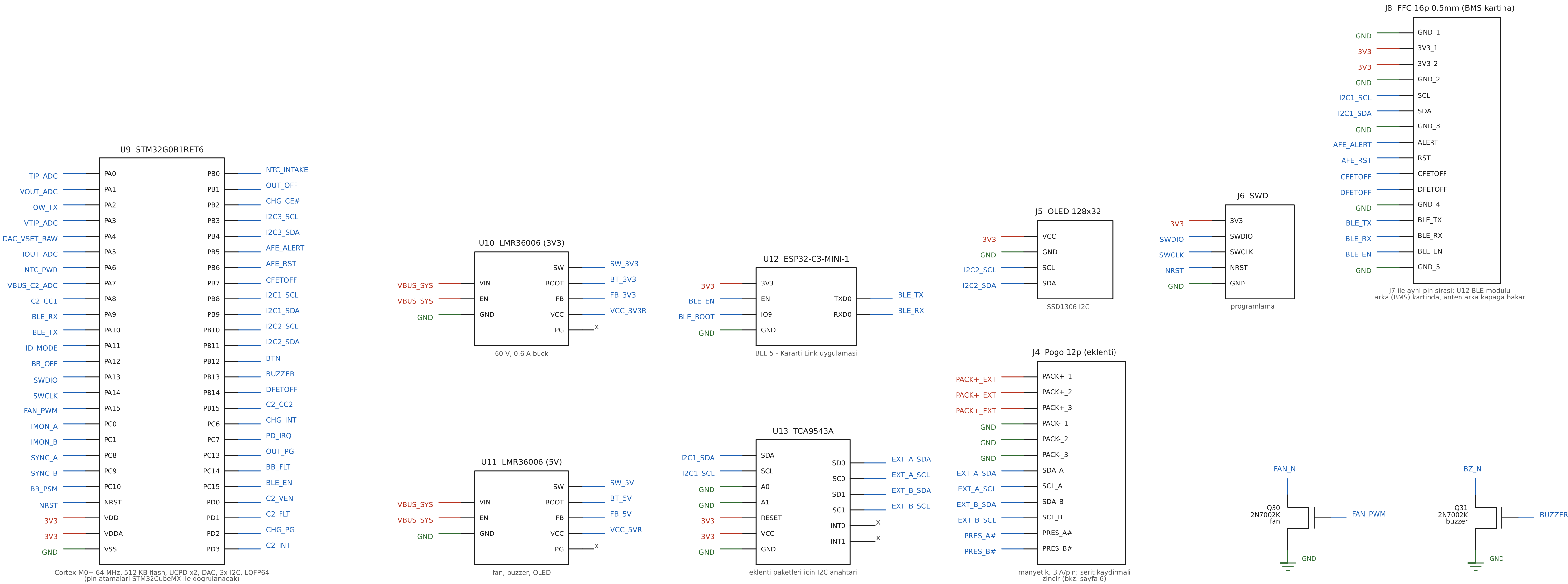
Arka arkaya (ortak drain) yuksek taraf N-FET: CHG kapaliyken sarj, DSG kapaliyken desarj engellenir.
Govde diyet koruması: FET kapaliyken ters yon akimi esigi asarsa AFE FET'i acar (ideal diyet davranisi).



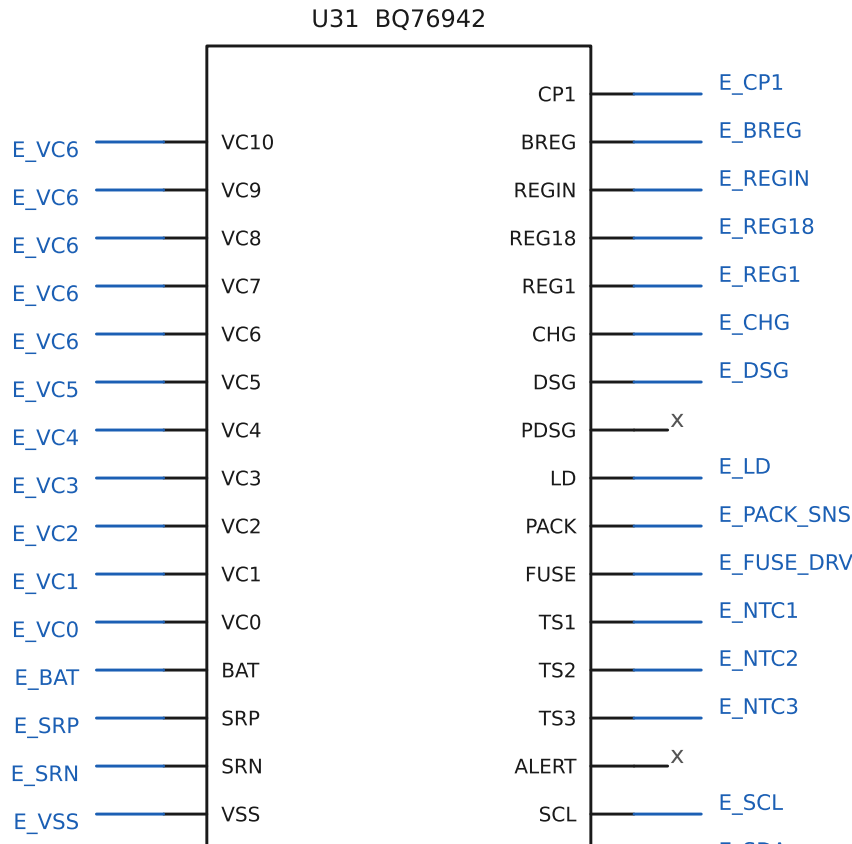
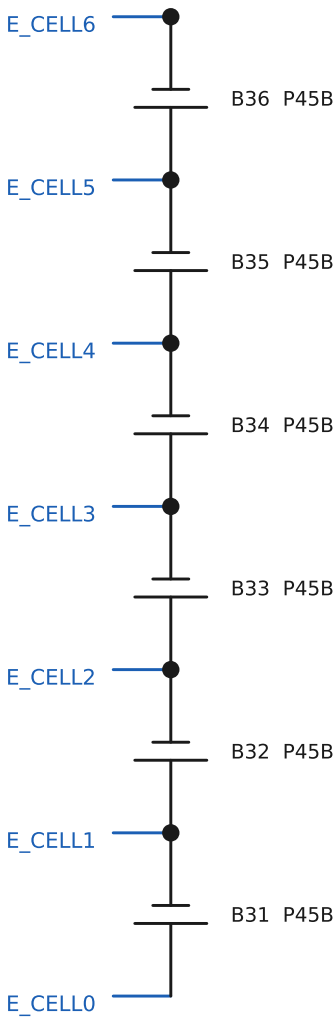
Q7 (BREG/REGIN on-regulator): MMBT5551, kollektor BAT_AFE, baz BREG, emiter REGIN (datasheet tipik devresi).
I2C1 pull-up'leri (4.7k -> 3V3) MCU sayrasinda. AFE adresi 0x10 (7-bit 0x08).



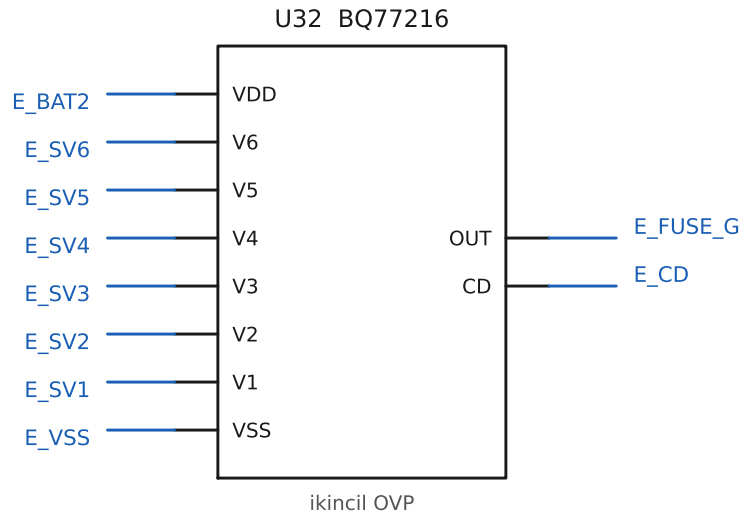
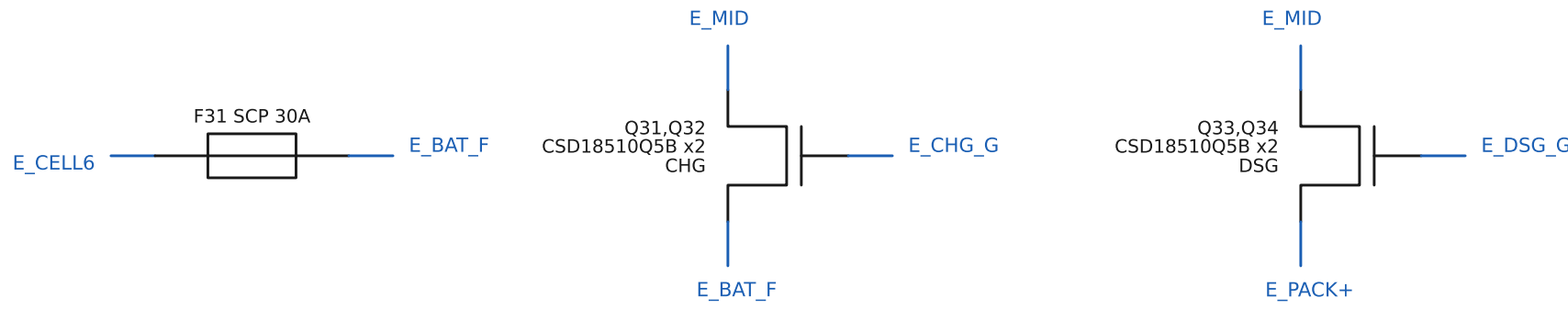




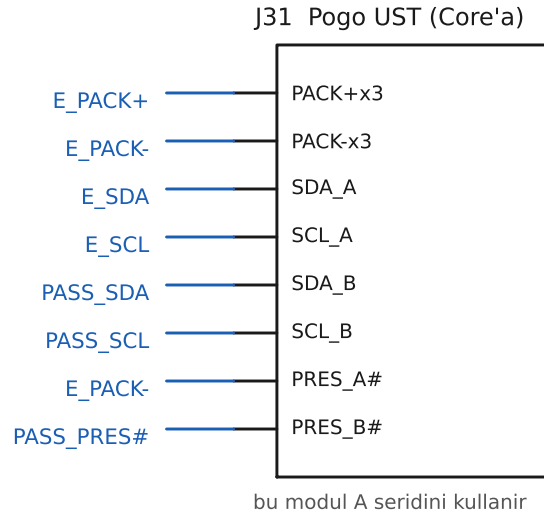
I2C1: AFE (0x08) + TCA9543A (0x70) -> eklenti A/B | I2C2: TPS26750, TPL0102, TPS552892, OLED | I2C3: BQ25756 (özel hat).
Kritik koruma sinyalleri (CFETOFF/DFETOFF, OUT_OFF, BB_OFF) doğrudan GPIO: firmware kilitletense de AFE ve donanım korumaları çalışır.
Bağımsız watchdog (IWDG) 500 ms; ESP32-C3 güvenlik zincirinde değildir (sadece telemetri/ayar).



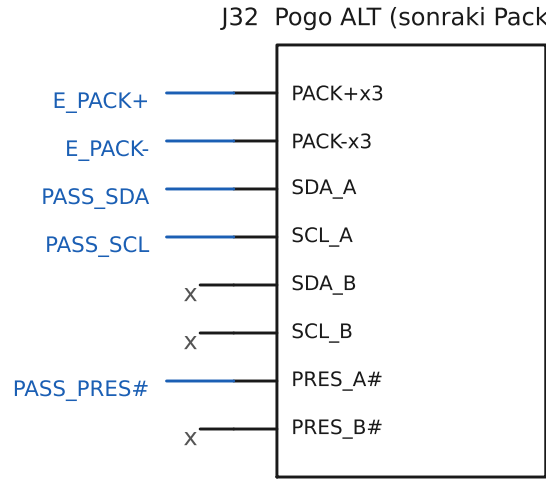
Core ile aynı koruma ayarları; host Core MCU



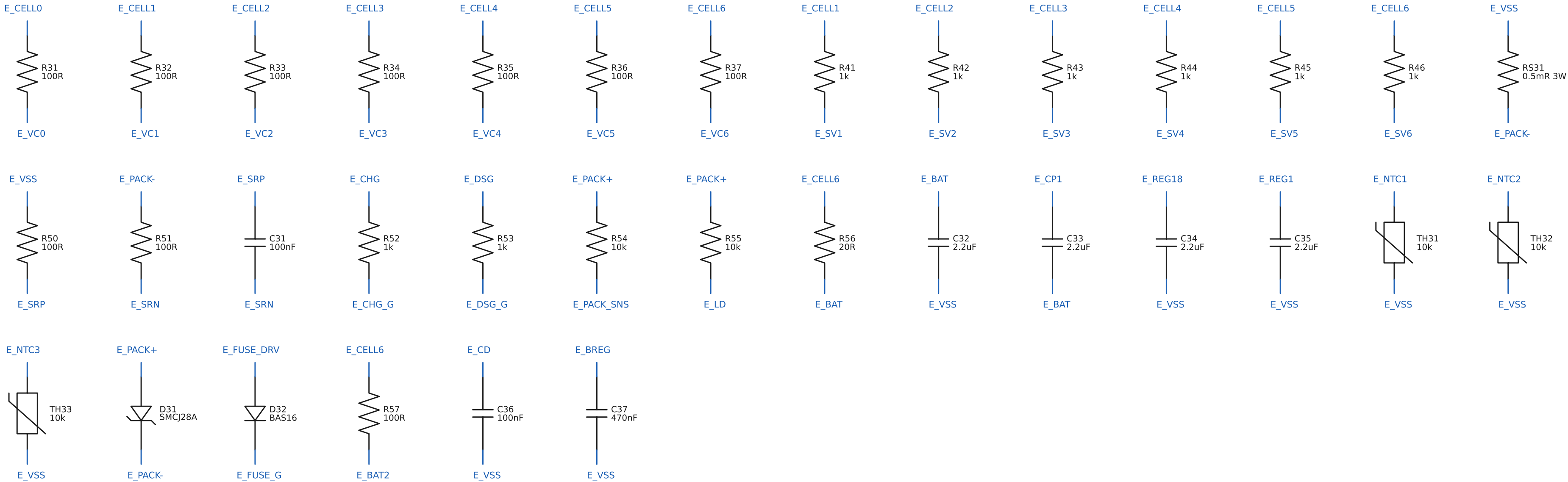
ikincil OVP



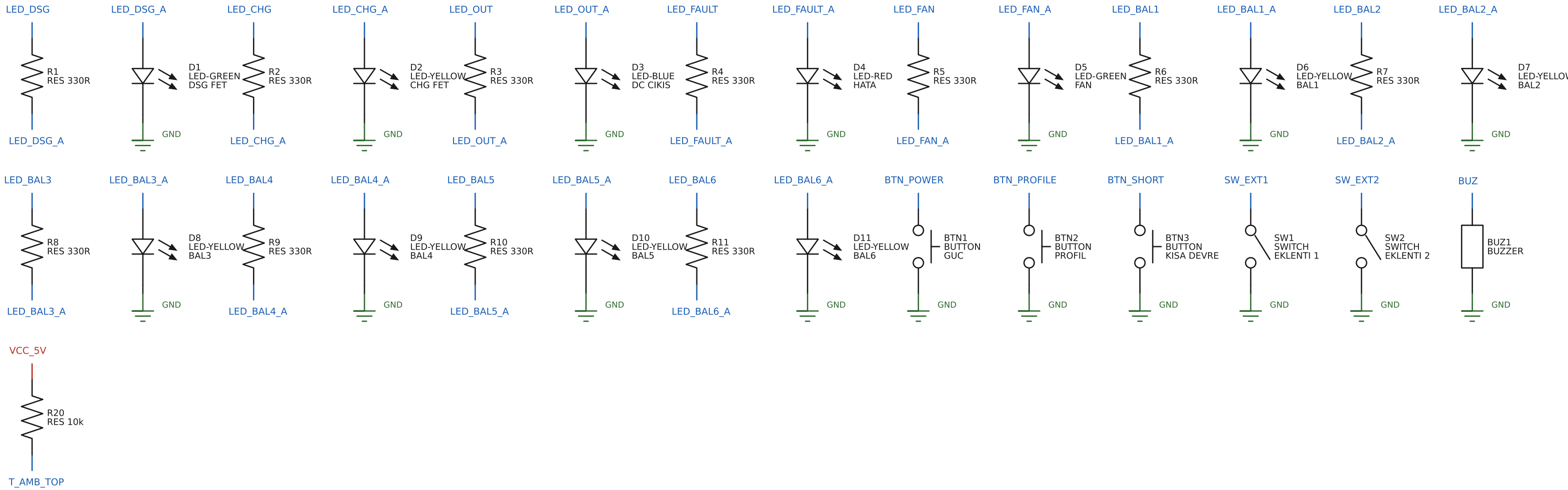
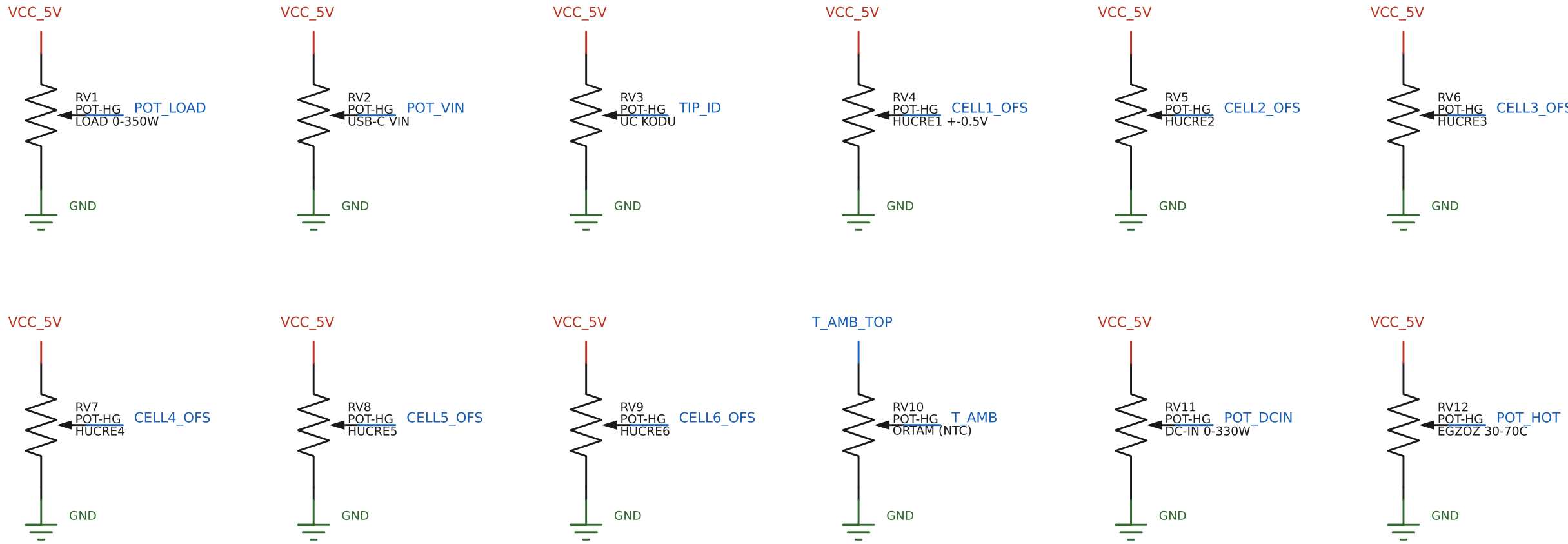
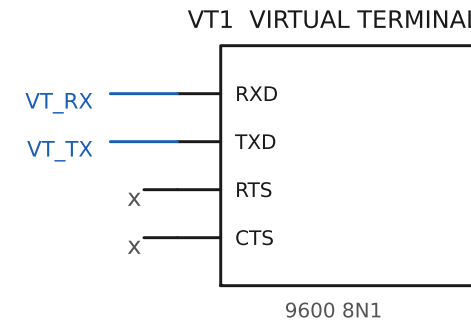
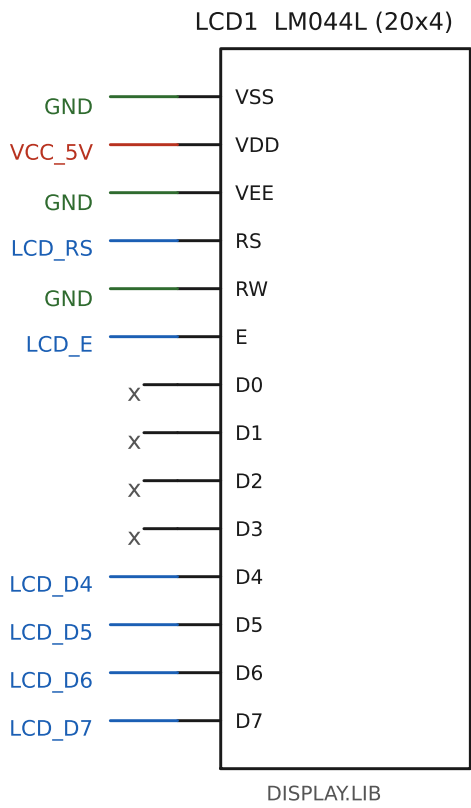
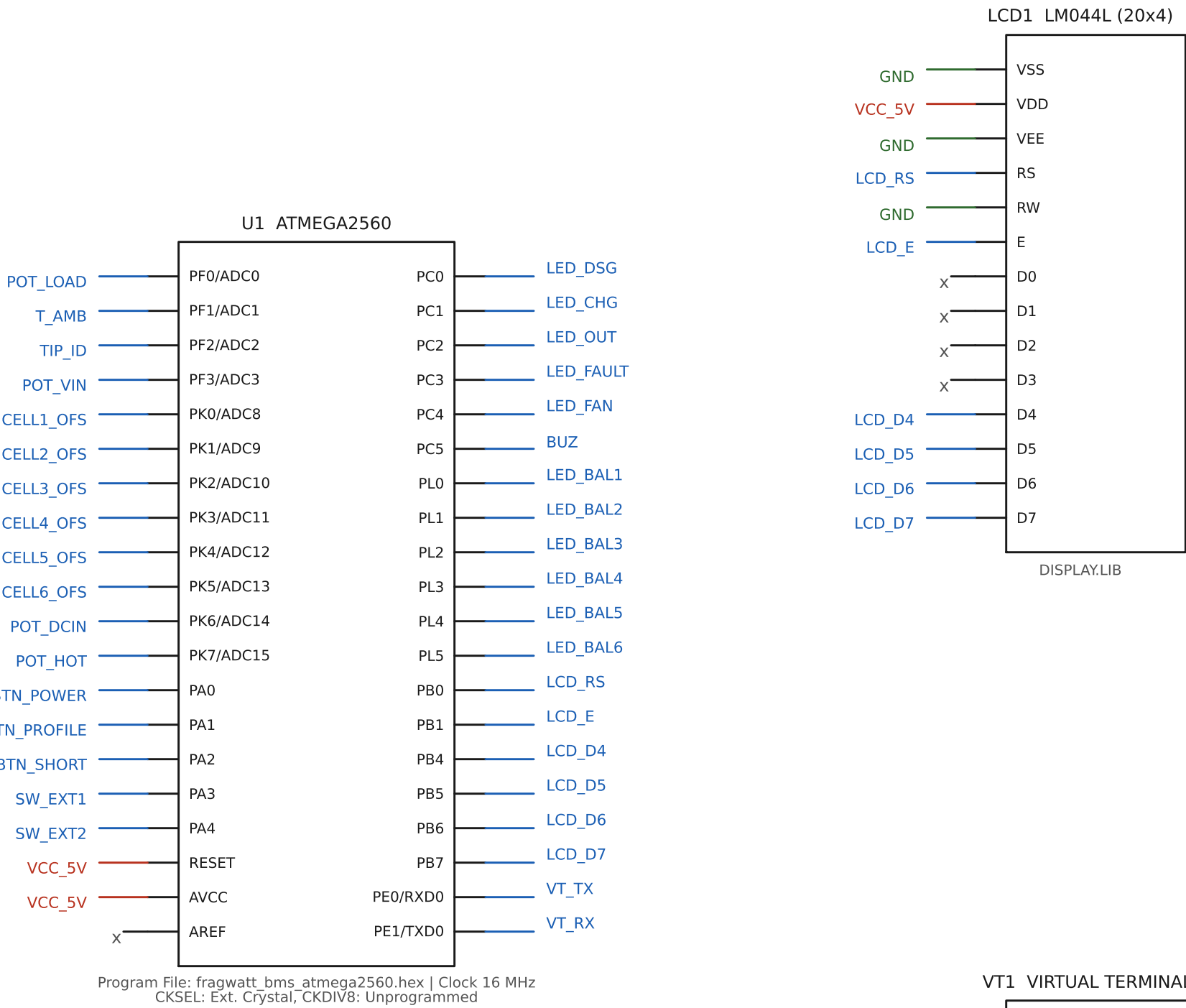
bu modul A seridini kullanır



B seridi alttaki module A olur



Serit kaydırma: J31'in B serit hatları (SDA, B/SCL, B/PRES_B#) J32'de A konumuna tasınır. Böylece Core'a en yakın modul A kanalını, altındaki modul Core'un B kanalını görür; iki aynı modul aynı I2C adresiyle çalışmaz (TCA9543A kanalları). PRES_A# modul içinde PACK-ye bağlıdır -> Core 'modül var' algılar. Sigorta F31 -> FET etkinleştirme, Core kontrolü olmadan kapalı. Q35 (sigorta atesleme, 2N7002K), F31 ısıtıcı ve Q36 (BREG, MMBT5551) bağlantıları Core sayfası 2 ile ayrıdır.



RV10 yerine gercek NTC kullanilacaksa: VCC_5V - RES 10k - T_AMB - NTC (10k, B3950) - GND. Potla: %50 = 25 C, %20 = ~60 C, %77 = ~0 C.
Hucre potlari ortada (%50) = 0 mV sapma; her %1 = 10 mV. LOAD potu %1 = 3.5 W. VIN potu 5/9/15/20/28/36/48 V'a oturur, %98 ustu = asiri gerilim testi.
Proteus'ta guc pinleri gizlidir (VCC/GND otomatik). Ayrinti: hardware/proteus/PROTEUS_KURULUM.md

