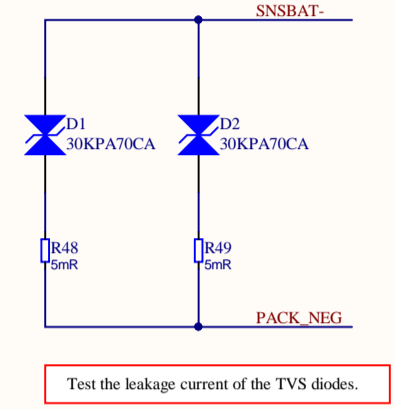


BMS Power Board REV1.2 - Schematic



INPUT	
4S Config	Normal VBAT = 12.8V Charger Voltage = 14.6V
8S Config	Normal VBAT = 25.6V Charger Voltage = 29.2V
16S Config	Normal VBAT = 51.2V Charger Voltage = 58.4V

FET states (16S)	
No Charger	Discharge FET is OFF = GND Charge FET is OFF = VBAT PACK_NEG = VBAT (58V max)
	Discharge FET is ON = V_FET_ON (12V) Charge FET is ON = V_FET_ON (12V) PACK_NEG = GND (0V) When opening Discharge FETs it's important to open Charge FETs as soon as possible as in OFF state the current will go through the body diode and heat up FETs.
Charger Connected	Discharge FET is ON = V_FET_ON (12V) Charge FET is OFF = VPACK (-7V) PACK_NEG = VBAT - VCHARGE (51V - 58V = -7V)
	Discharge FET is ON = V_FET_ON (12V) Charge FET is ON = V_FET_ON (12V) PACK_NEG = GND (0V)
Reversed Charger	Discharge FET is OFF = GND Charge FET is OFF = VPACK PACK_NEG = VBAT + VCHARGE (51V + 58V = 109V)

R103 (R104) turns off the FETs when CHGDRV goes LOW since D5 prevents the driver from pulling current from the gate. Driver is used for turning ON FETs only.

D7 limits the gate-source voltage at 16V

Calculations

STEP 1 - Select FET
FET P/N: TDM3742
RDS(ON) = 2.9 mOhm
Qg = 34 nC
Rg = 1.3 Ohm
Vgs(th) = 3V
Ciss = 3.6nF
Vgs = 4.5V
Cgd = 9nF = 0.091nF
VDS = 59V (16S config)

STEP 2 - Define Turn-On/Off Time
T_on_off = 60ns

STEP 3 - Select External Gate Resistance
Rg_ext = 18 Ohm
Rg_ext_total = 0.6 Ohm

STEP 4 - Select Driving Specs
Bank (30 FETs) specs:
- Vgs = 12V
- Qg_total = 744nC * 30 = 22320nC
- Iqg_avg = 22320nC/60ns = 37A
- Rg_ext_total = 1.3 Ohm / 30 = 0.04 Ohm
- Rg_ext = 0.8 Ohm = 0.04 Ohm * 20 = 0.8 Ohm
- Ciss_total = 3.6nF * 30 = 108nF
- Cgd_total = 0.091nF * 30 = 2.7nF

