

Two diodes in series to keep galvanic isolation between vehicle and TSAC (3xTS voltage, EV1.2.1)  
 $V_f = 1000V \rightarrow 2 \cdot V_f = 2000V > 3 \cdot 556V$

Relay carry-current: 2.5A  
 Max switching capacity: 100W  $\rightarrow$  Max switching current =  $100W/600V = .167A$

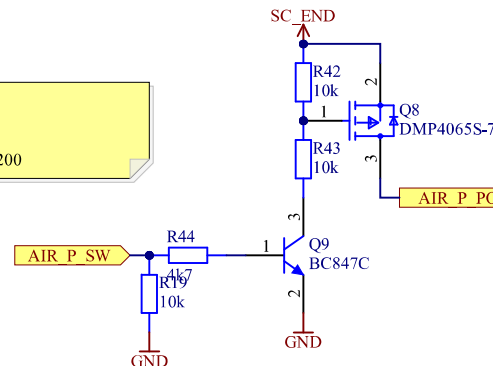
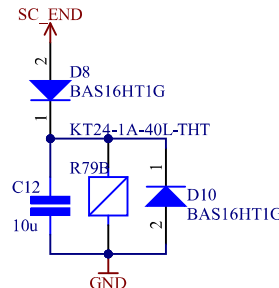
Switch on:  
 $\rightarrow$  Relay opens  
 $\rightarrow$  Constant current source (depletion nfet) limits to 0.05A  
 $\rightarrow$  Full current (600V/1000Ohm = .6A) switched on after  $t_{bounce} (=1.1ms \rightarrow 2ms)$  determined by RC

Switch off:  
 $\rightarrow$  Relay stays on because of diode-decoupled C  
 $\rightarrow$  MOSFET turns off because opto is off  
 $\rightarrow$  Relay opens after MOSFET turns off

$I_{LED} = 10mA$   
 $V_f = 1.5V$   
 $V_{SC\_END} = 24V$   
 $R = (24V - 1.5V) / 10mA = 2250ohm \rightarrow 2200ohm$

$I_{LED} = 10mA$   
 $V_f = 1.5V$   
 $V_{iso} = 24V$   
 $R = (24V - 2 \cdot 1.1V - 1.5V) / 10mA = 2030 \rightarrow 2200$

Precharge detection logic states:  
 PC open: PCHRG\_ACT = GND  
 PC closed: PCHRG\_ACT = 3.3V



Peak current at 556V (Limited by PTCs' R25):  $556V / (2 \cdot 500Ohm) = 0.55A$   
 Tolerance of PTCEL = 30%  $\rightarrow$  Peakcurrent at least resistance:  $0.55 / 0.7 = 0.79A$

MOSFET cont. current: 1.8A at 100°C die-temp  
 MOSFET pulsed current: 5A

This is the same calculation as for the discharge as both have to absorb the same energy:

$1/2 \cdot (550V)^2 \cdot 2 \cdot 200uF = 62J$   
 (DTI Inverter has 200uF DC bus, two are installed; other capacitances in the vehicle are negligible)

Two PCTEL are going to be used in series, so each absorb's half the bus energy (31J):  
 According to datasheet table "CONSECUTIVE ENERGY / LOAD-DUMPS AT DIFFERENT TAMB FOR PTCEL17":  
 3.5 consecutive dumps at 85°C, 31J

This ensures three consecutive dumps in the 5 minutes required for scrutineering.  
 PTCEL13 could also be used, but the required space for PTCEL17 isn't much greater and the cost is negligible.

Alternative to PTCEL: TDK EPCOS B59219J0130A020  
 (Other footprint)

\*Monitor SC  
 \*Precharge if SC closed  
 \*Turn on AIR if SC closed AND voltage difference over AIR is  $\leq 10\%$  of max TS voltage

Title: <b>precharge</b>		
Projekt: <b>tsac-distribution.PrjPcb</b>	Revision: <b>xx.xx</b>	
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Checked by: <b>UNCHECKED</b>	Zur Schwedenschanze 15	
Rules: <b>EV5.7</b>	Haus 18	
Sheet <b>6</b> of <b>9</b>	<b>Size: A4</b>	18435 Stralsund
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