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REVISION	DESCRIPTION	DATE	APPROVED

Charger input connector

J8 M80-400000000-02-321-00-000 — CHARGER_IN

D7 SMDJ54CA

Q26, Q34 SIR170DP-T1-RE3 — R120 0

CHARGER_VOLT at 24V = 0.4V

D8 CDZFHT2RA5.1B — R89 590k, R92 10k, C58 0.1u 100V

At 10A
Maximum 5A each
Normalization factor = 2
Rds_on = 0.00585*2 = 0.0117 each
Power loss = 0.0117*5*5 = 0.2925W
Q26, Q34 Temperature at 40C environment = 40 + 0.2925*54 = 55.795C each

Brake switch connector

J12 BATT_OUT — F2 0678L9250-02 — OUTPUT

J10 M80-400000000-02-321-00-000

D2

Output connector

R131 590k — OUTPUT_VOLT

D3 CDZFHT2RA5.6B — R133 10k, C24 0.1u 100V

OUTPUT_VOLT at 24V = 0.4V

At 10A
Maximum 5A each
Normalization factor = 2
Rds_on = 0.0101*2 = 0.0202 each
Power loss = 0.0202*5*5 = 0.505W
Q30, Q35 Temperature at 40C environment = 40 + 0.505*40 = 60.2 each

DNI

J13 HEATER_CTRL_ISO — Q24 SIR668ADP-T1-RE3 — D15 CDZFHT2RA5.6B — R119 100k

J14 OVERCHARGE_CTRL_ISO — Q25 SIR668ADP-T1-RE3 — D32 CDZFHT2RA5.6B — R22 100k

U19 CMPD3003A TR PBFREE — LTC4357CDCB#TRMPBF

D33, D34, R1 100, R79 0

U20 LT3990IDD#PBF

LT3990
Maximum EN/UVLO Voltage Threshold = 1.28V
Turn on voltage = 1.28*(13.7 + 220)/13.7 = 21.7V

SENSE_A1 — R145 220k, R151 13.7k, R147 374k — C129 10u 100V, C130 0.1u 100V — C127 0.22u 25V — L6 — C128 22p 50V — R146 1M, R148 316k — C131 22u 10V, C132 22u 10V — D35 BAT46WJ,115 — CHARGER_VCC

C62–C65 80V 56u; C87–C98 10u 100V; C98 0.1u 100V

Q30, Q35, D4, R91 200k, C69 4.7u 25V, R144 100, C124 0.1u 100V, R4 100k, R93 300k, Q36 BVSS123LT1G, Q37 BVSS123LT1G, R95 13.7k, R21 100k, D6 CDZFHT2RA5.1B — CHARGE_CTRL

C56, C57, C60, C61 10u 100V; C66, C67 150u 50V

Max inductor current = 0.05/0.005 = 10A

Q1 - Q8 Part number: SIR170DP-T1-RE3
At 10A
Maximum 5A each
Normalization factor = 2
Rds_on = 0.00585*2 = 0.0117 each
Power loss = 0.0117*5*5 = 0.2925W
Q1 - Q8 Temperature at 40C environment = 40 + 0.2925*54 = 55.795C each

SENSE_A1 — R90 0.005 — SENSE_A2 — PACK+

TG1 — R97 0 — Q1, Q2 — R121 DNI, C125 DNI — ST12100STR — D13, Q3, Q4 — R114 0 — TG2

SW1 — L2 74435582200 22u — SW2

BG1 — R115 0 — Q5, Q6 — C126 DNI — Q7, Q8 — R116 0 — BG2

SENSBOT — R117 0.005

SENSE_A1 — R149 DNI, R150 0 — CHARGER_VCC — D12 SS16HE — R167 0 — CHARGER_PVIN

C133 10u 16V, C72 0.1u 100V, C73 10u 16V — D9 SS16HE — C75 1u 50V — R154 0

SENSE_A1, SENSE_A2 — C16 0.033u 50V

R100 100k — CHARGER_PVIN

SENSBOT — R109 0, C76 0.033u 50V, R152 0 — SENSGND

U15 LTC4020IUHF#PBF

PVIN	36	BG2	33
INTVCC	34	SW2	32
		TG2	31
		BST2	30
BG1	37		
SW1	38		
TG1	1		
BST1	2		
SENSVIN	7	VC	28
SENSTOP	6	ITH	27
SENSBOT	5	VFBMAX	26
		VFBMIN	19
RT	8	CSOUT	24
SHDN	9	CSP	23
VIN REG	10	CSN	22
MODE	11	BGATE	21
		BAT	20
STAT1	12	FBG	18
STAT2	13	VFB	17
TIMER	14	NTC	16
RNG/SS	15	PGND	35
ILIMIT	25	SENSGND	4
		SGND	3
		SGND	29
		SGND	39

C77 0.22u 10V, R122 10k, C79 0.22u 10V

Timer = 0.22u*1.46*10^7 = 3 hours
RNS/SS voltage = 0.00005*10000 = 0.5V, charging current = 50% of maximum

D11 BZX84C6V2LT1G — C99 1u 50V — R153 0 — R105 402k, C81 1500p 100V, R8 402k, C142 150p 100V — R107 20, R106 100, R83 0.01 — R112 100 — R158 3.3k, R113 2.7k — C86 DNI — Q31 SUM70101EL-GE3 — BATT_OUT — R103 24.9k, C141 1500p 100V, R104 402k

R84 47k, C82 50V 47p — R85 36k, C135 6800p 50V — C85 100p 50V — C83 DNI — C84 4.7u 6.3V

R77 0 — R32 10k

VFB at 100% = 2.5V
100% battery voltage = 2.5*(402 + 24.9)/24.9 = 42.86V
VFBMAX = 2.75V
Max PACK+ voltage = 2.75*(27 + 402)/27 = 43.7V
VFBMIN = 2.125V
Precharge voltage = 2.125*(33 + 402)/33 = 28V

Q37
Maximum 5A
Normalization factor = 2
Rds_on = 0.0101*2 = 0.0202
Power loss = 0.0202*5*5 = 0.505W
Temperature at 40C environment = 40 + 0.505*40 = 60.2C

R83
Maximum charging current = 0.05/0.01 = 5A
Power loss = 0.01*5*5 = 0.25W

APPROVALS	DATE
ENG: *	
DSN: *	
CHK: *	

REFERENCE DOCUMENTS
BOM:
ASSY DWG:
FAB DWG:
PCB DWG:

SIZE A3 | CAGE CODE | DWG NO. | REV

SCALE: | FILE NAME Charger.SchDoc | SHEET 4 OF 6