CAPÍTULO 7. ANEXOS

1. SELECCIÓN DE DRIVERS CON DRIVERSEL™

Driver Select Tool

Preselect	Vcc = 1200 V	
Product	SEMITRANS (106)	
Device	SKM300GB125D	
Number of IGBT Modules	1	
Switching Frequency fsw	10	kHz
Applied Gate Resistor	3	Ohm
	Update	

Result

Driver Channels	2
Collector Emitter Voltage	1200 V
Required Average Current	19 mA
Gate Charge	1.9 µC

Drivers

Name	$I_{out(av)}$ / mA	$\hat{I}_{out}$ / A	V_{isol} / kV	$V_{ce\,max}$ / V	R_{gmin} / Ohm	Channels
1x SKHI22A R or SKHI22B R[1]	40	8	2.5	1200	3.0	2
1x SKHI23/12 R	50	8	2.5	1200	2.7	2
1x SKYPER 32 R or SKYPER 32PRO R	50	15	4.0	1200	1.5	2

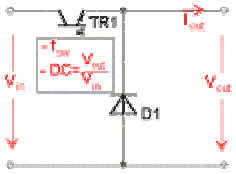
Notes

1) A: 15V - Vin; B: 5V - Vin

2. ESTUDIO TÉRMICO DE CONVERTIDOR BUCK

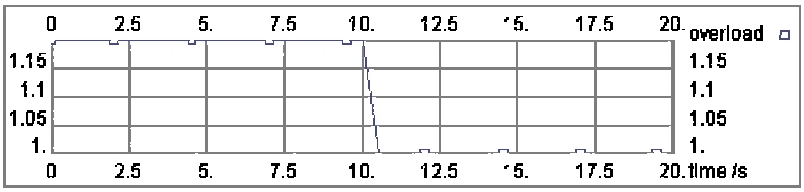
Project:

Topology	DC/DC
Circuit	Buck



Input:

V_{in}	750 V
I_{in}	16.29 A
f_{sw}	10 kHz
Duty Cycle	0.333 (x100%)
V_{out}	250 V
I_{out}	46.67 A
$t_{on\ fwd}$	0.667
Overload Factor	1.2
Overload Duration	10 sec



Overload characteristic

Device:

Product Line	**SEMITRANS**
Device	**SKM300GB125D**
Use Maximum Values	No
Max. Junction Temperature	150

Transistor	Diode
E_{tr} = 27 mJ (@600V)	E_d = 13 mJ
$V_{CE0,125}$ = 1.75 V	$V_{T0,125}$ = 0.9 V
$r_{C,125}$ = 8 mOhm	$r_{T,125}$ = 4.25 mOhm
$V_{CE,sat}$ = 3.35 V	V_f = 1.75 V
I_c = 200.00 A	I_f = 200.00 A
$R_{th(j-c)}$ = 0.075 K/W	$R_{th(j-c)}$ = 0.18 K/W
$R_{th(c-s)}$ = 0.038 K/W	

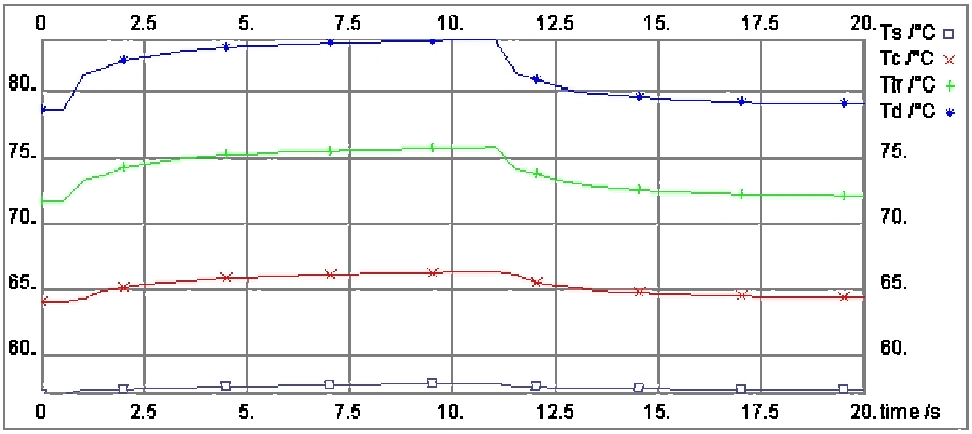
Data set from 2006/08/23

Conditions:

Ambient temperature	40
Number of switches per heat sink	3
Number of parallel devices on the same heat sink	1
Additional power source at this heat sink	0
Predefined SK-Heat Sink	P16_300_16B
Correction Factor	1
Forced Air Cooling, Flow Rate:	295 m^3/h
$R_{th(s-a)}$	0.031 K/W

Calculated losses and temperatures with rated current and at overload:

	Rated Current	Overload
$P_{cond\ tr}$	30 W	38 W
$P_{sw\ tr}$	72 W	88 W
P_{tr}	103 W	126 W
$P_{cond\ d}$	38 W	46 W
$P_{sw\ d}$	43 W	51 W
P_d	81 W	97 W
P_{tot}	551 W	669 W
T_h	57 °C	58 °C
T_c	64 °C	66 °C
T_{tr}	72 °C	76 °C
T_d	79 °C	84 °C



Temperature characteristic overload current

Evaluation:

This configuration seems to be too powerful.

Driver recommendation:

Name	Iout(av) /mA	Îout /A	Visol /kV	Vce max /V	Rgmin / Ohm	Channels
1x SKHI22A R or SKHI22B R(1	40	8	2.5	1200	3.0	2
1x SKHI23/12 R	50	8	2.5	1200	2.7	2
1x SKYPER 32 R or SKYPER 32PRO R	50	15	4.0	1200	1.5	2

Additional characteristics at given nominal operation conditions with one free parameter - R:

None selected

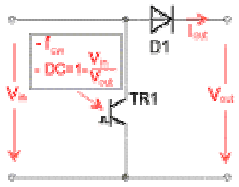
Note:

1) A: 15V - Vin; B: 5V - Vin

3. ESTUDIO TÉRMICO DE CONVERTIDOR BOOST

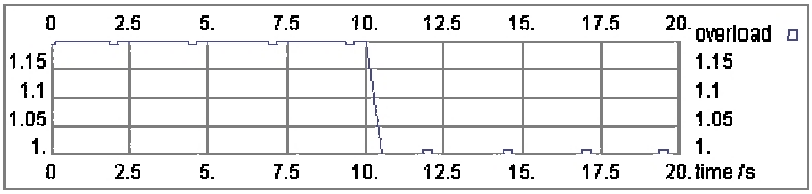
Project

Topology	DC/DC
Circuit	Boost



Circuit

V_{in}	250 V
I_{in}	49.08 A
f_{sw}	10 kHz
Duty Cycle	0.667 (x100%)
V_{out}	750 V
I_{out}	15.56 A
$t_{on\ fwd}$	0.333
Overload Factor	1.2
Overload Duration	10 sec



Overload characteristic

Device

Product Line	**SEMITRANS**
Device	**SKM300GB125D**
Use Maximum Values	No
Max. Junction Temperature	150

Transistor	**Diode**
E_{tr} = 27 mJ (@600V)	E_d = 13 mJ
$V_{CE0.125}$ = 1.75 V	$V_{T0.125}$ = 0.9 V
$r_{C.125}$ = 8 mOhm	$r_{T.125}$ = 4.25 mOhm
$V_{CE.sat}$ = 3.35 V	V_F = 1.75 V
I_c = 200.00 A	I_F = 200.00 A
$R_{th(j-c)}$ = 0.075 K/W	$R_{th(j-c)}$ = 0.18 K/W
$R_{th(c-s)}$ = 0.038 K/W	

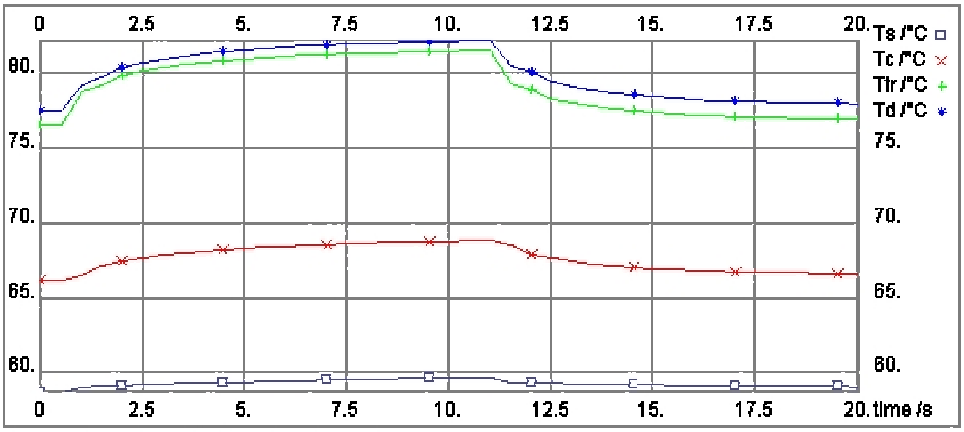
Data set from 2006/08/23

Cooling

Ambient temperature	40
Number of switches per heat sink	3
Number of parallel devices on the same heat sink	1
Additional power source at this heat sink	0
Predefined SK-Heat Sink	P16_300_16B
Correction Factor	1
Forced Air Cooling, Flow Rate:	295 m^3/h
$R_{th(s-a)}$	0.031 K/W

Calculated losses and temperatures with rated current and at overload:

	Rated Current	Overload
$P_{cond\ tr}$	62 W	78 W
$P_{sw\ tr}$	75 W	92 W
P_{tr}	137 W	170 W
$P_{cond\ d}$	19 W	24 W
$P_{sw\ d}$	43 W	51 W
P_d	63 W	74 W
P_{tot}	601 W	733 W
T_h	59 °C	60 °C
T_c	66 °C	69 °C
T_{tr}	77 °C	82 °C
T_d	78 °C	82 °C



Temperature characteristic overload current

Evaluation:

This configuration seems to be too powerful.

Driver suggestion:

Name	Iout(av) /mA	Iout /A	Visol /kV	Vce max /V	Rgmin / Ohm	Channels
1x SKHI22A R or SKHI22B R[1]	40	8	2.5	1200	3.0	2
1x SKHI23/12 R	50	8	2.5	1200	2.7	2
1x SKYPER 32 R or SKYPER 32PRO R	50	15	4.0	1200	1.5	2

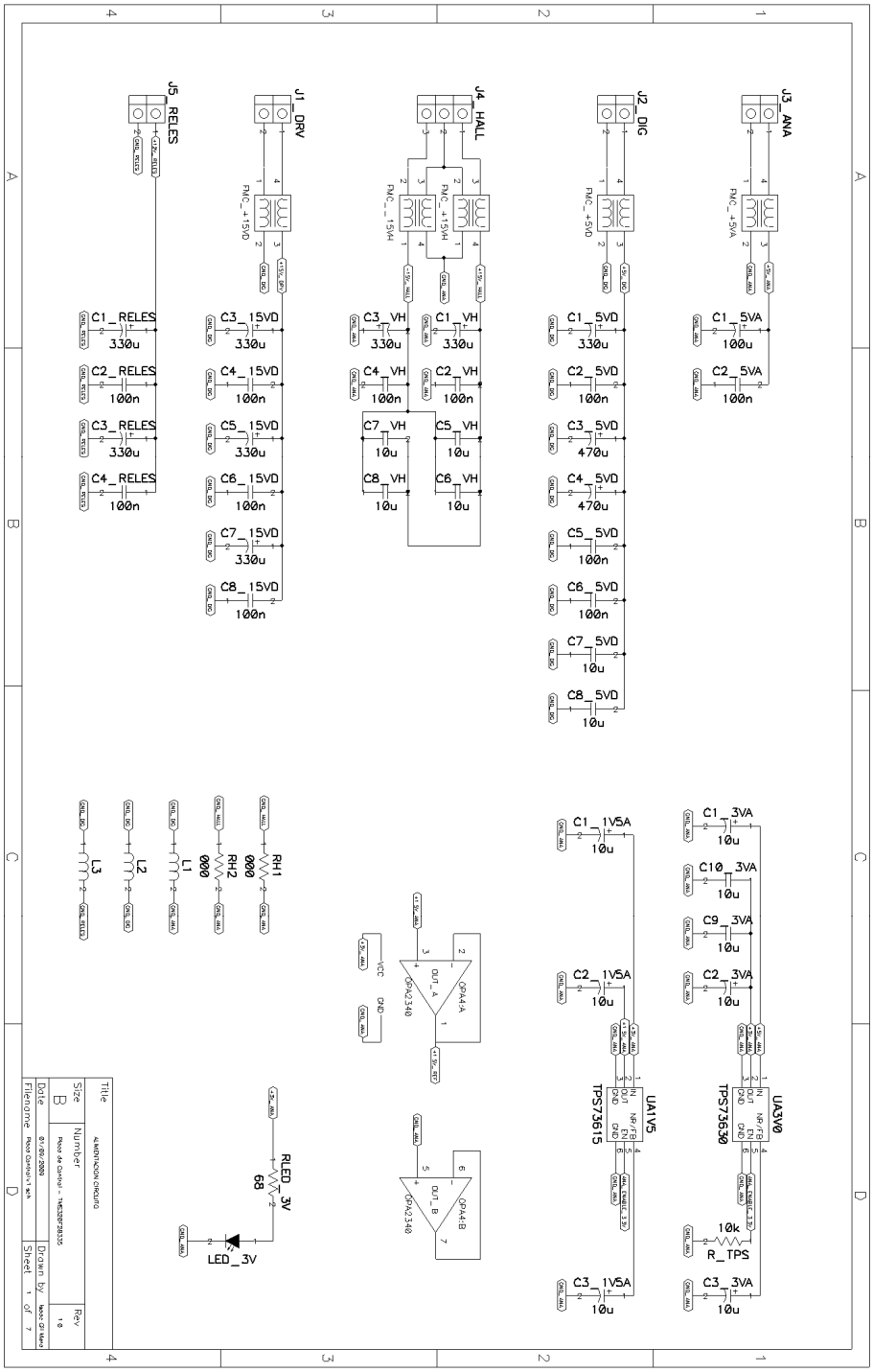
Additional characteristics at given nominal operation conditions with one free parameter:

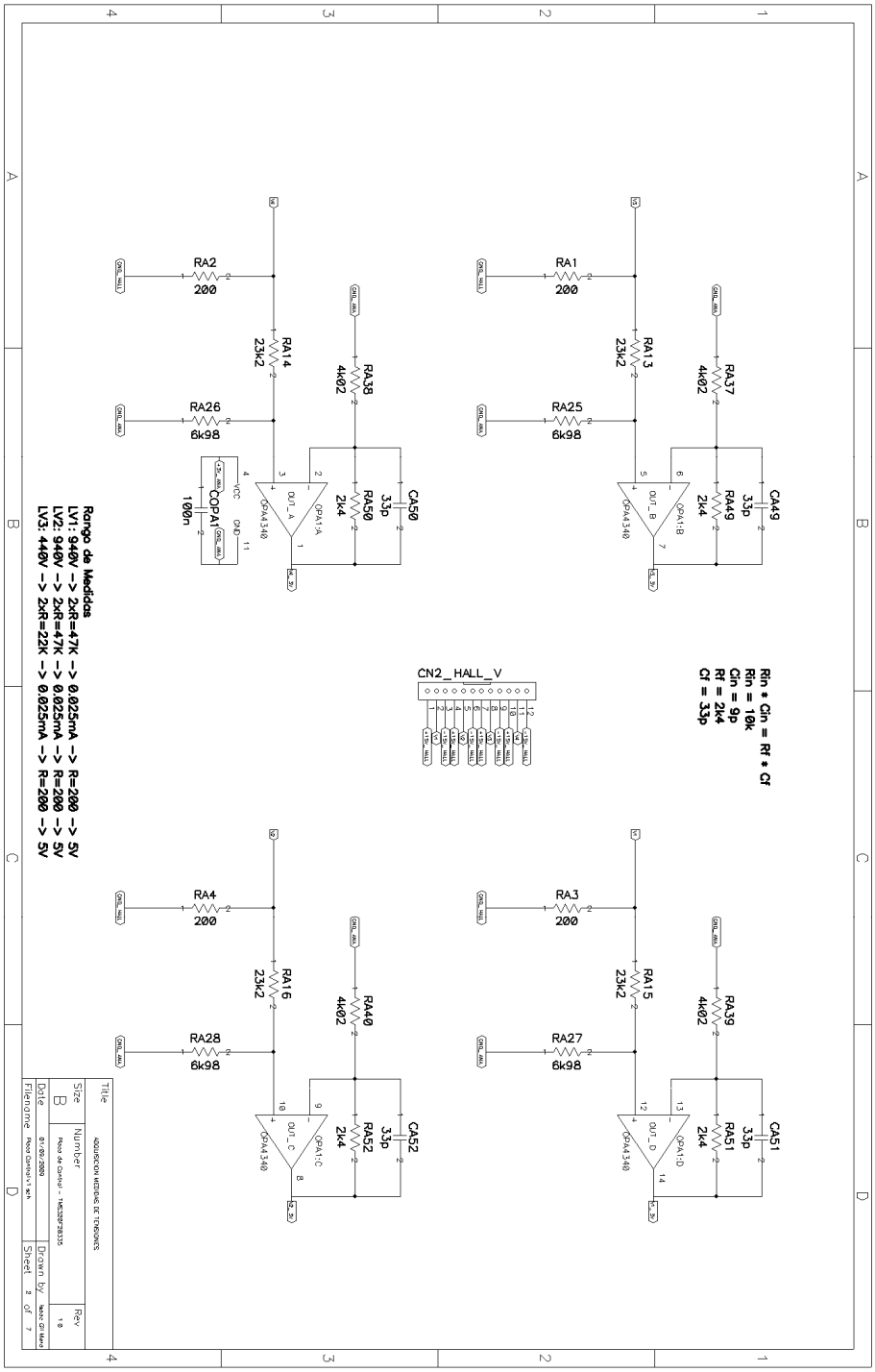
None selected

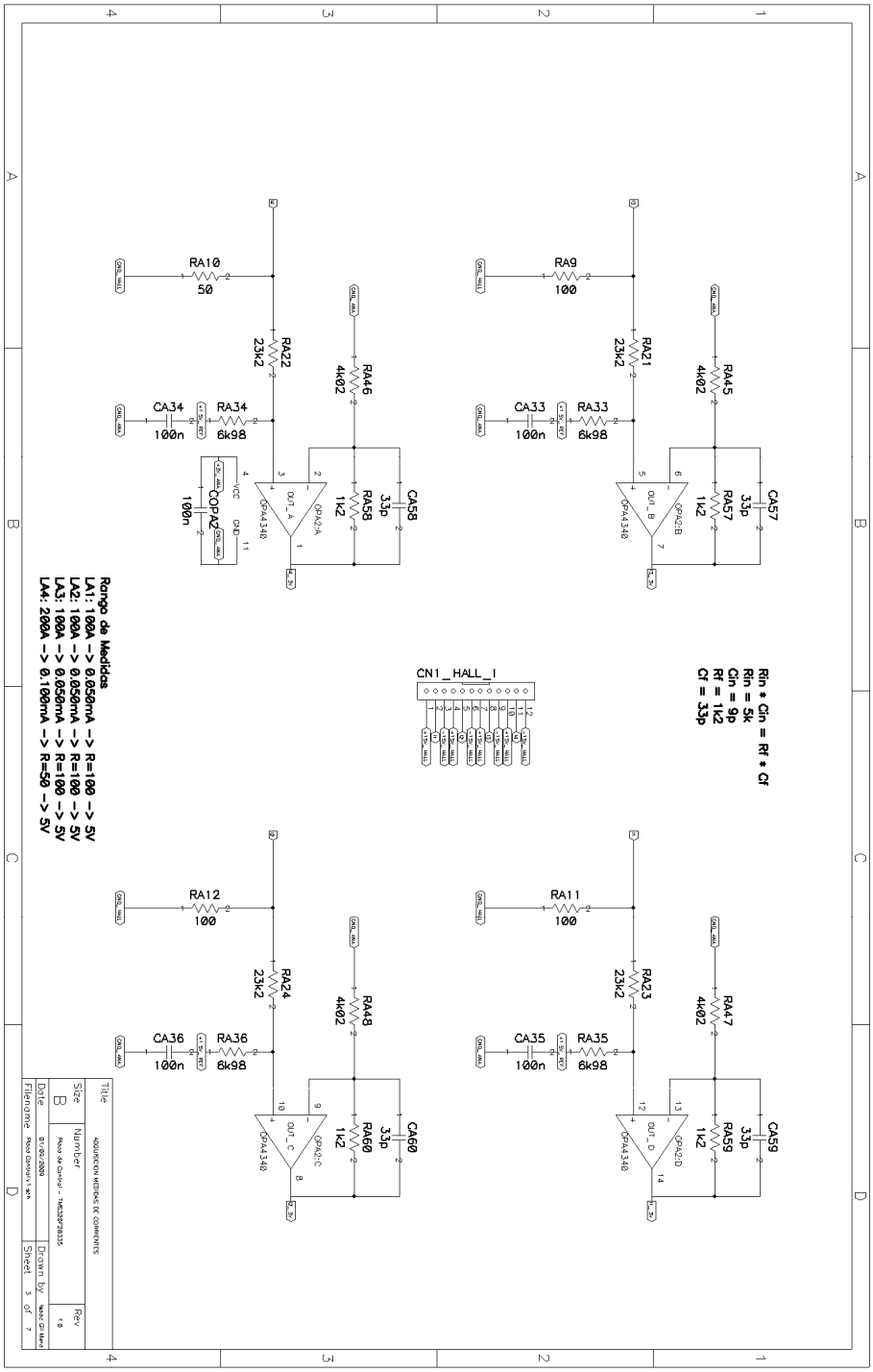
Note:

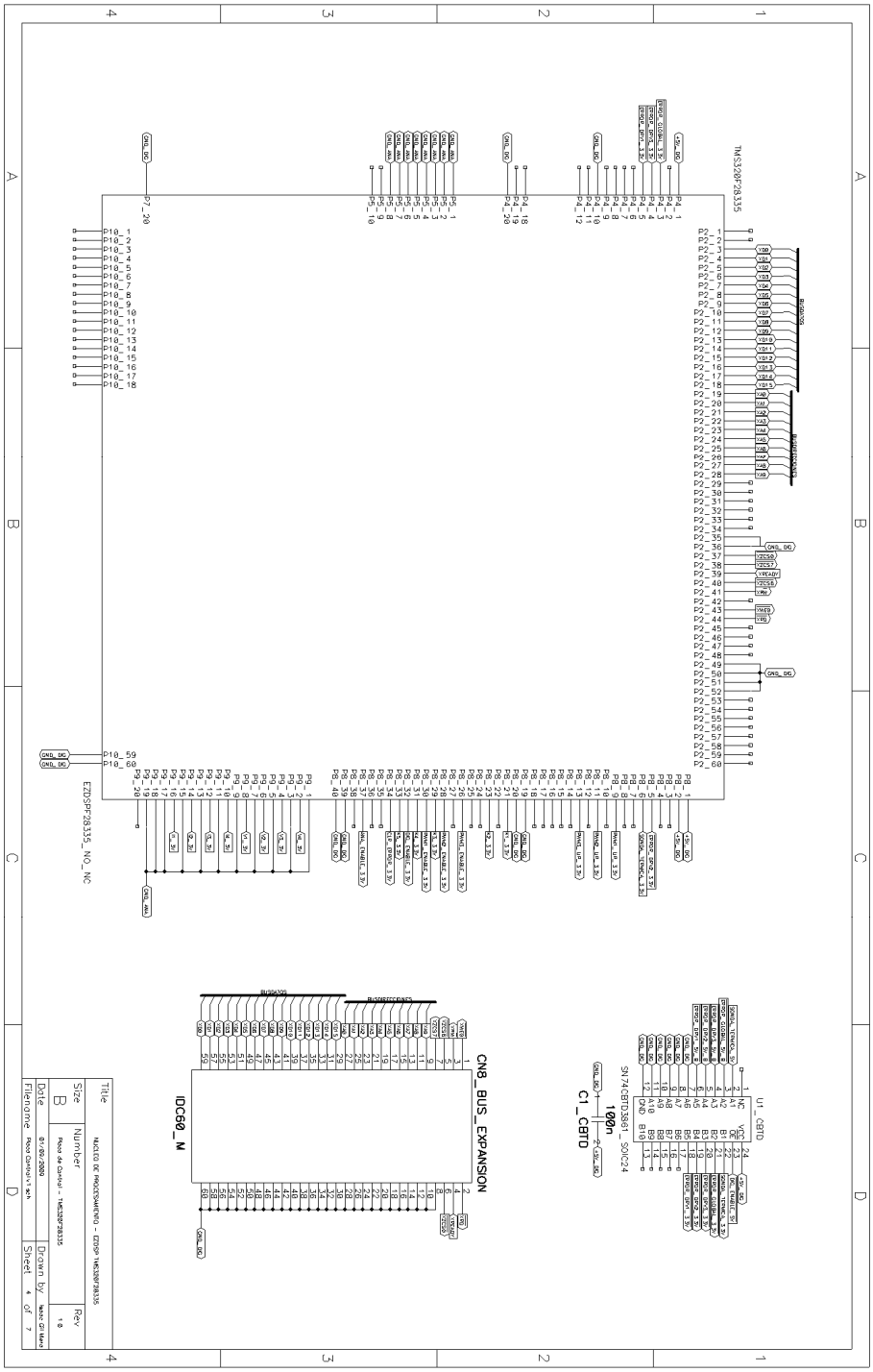
1) A: 15V - Vin; B: 5V - Vin

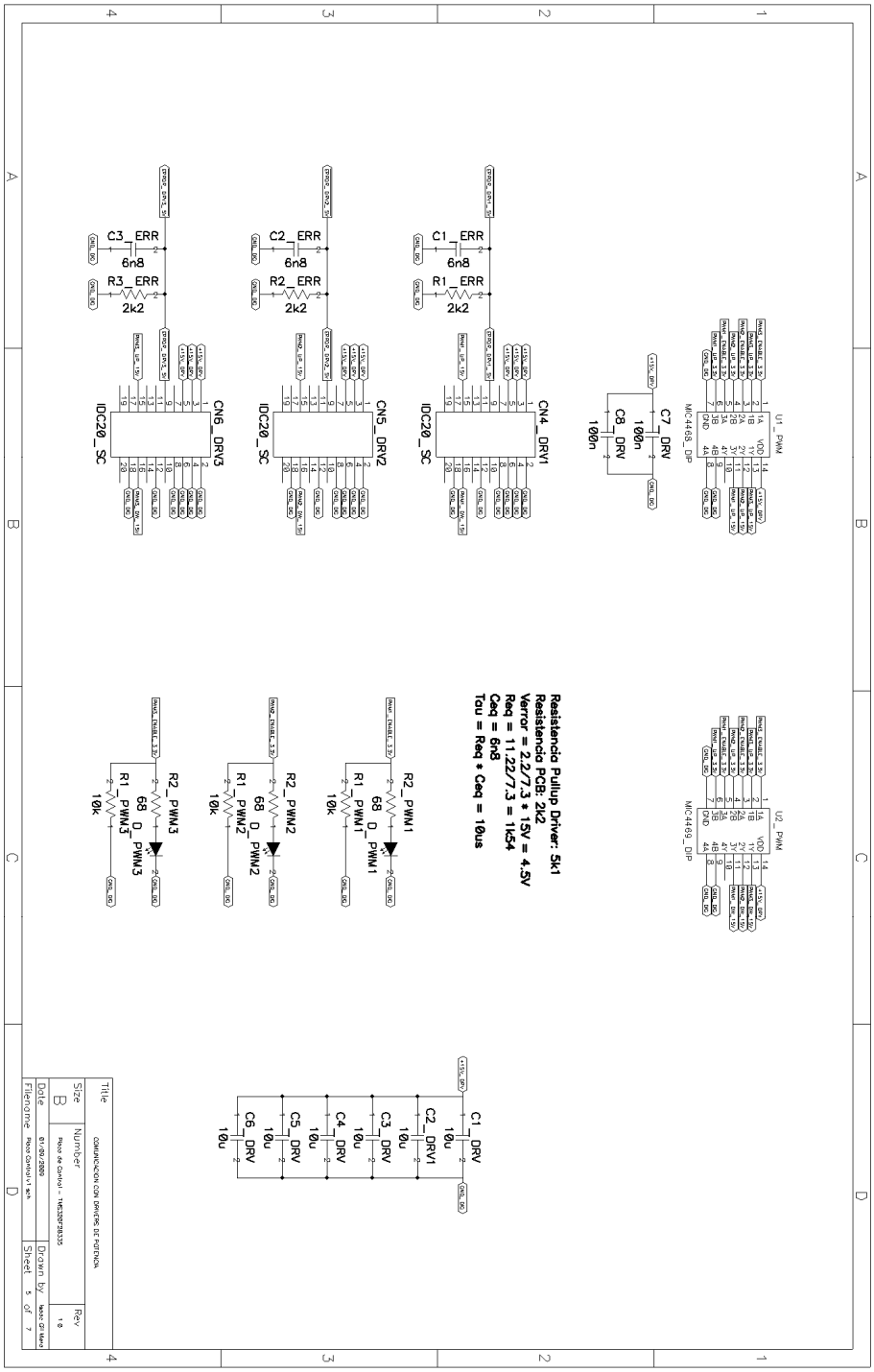
4. ESQUEMÁTICO DE PLACA DE CIRCUITO IMPRESO

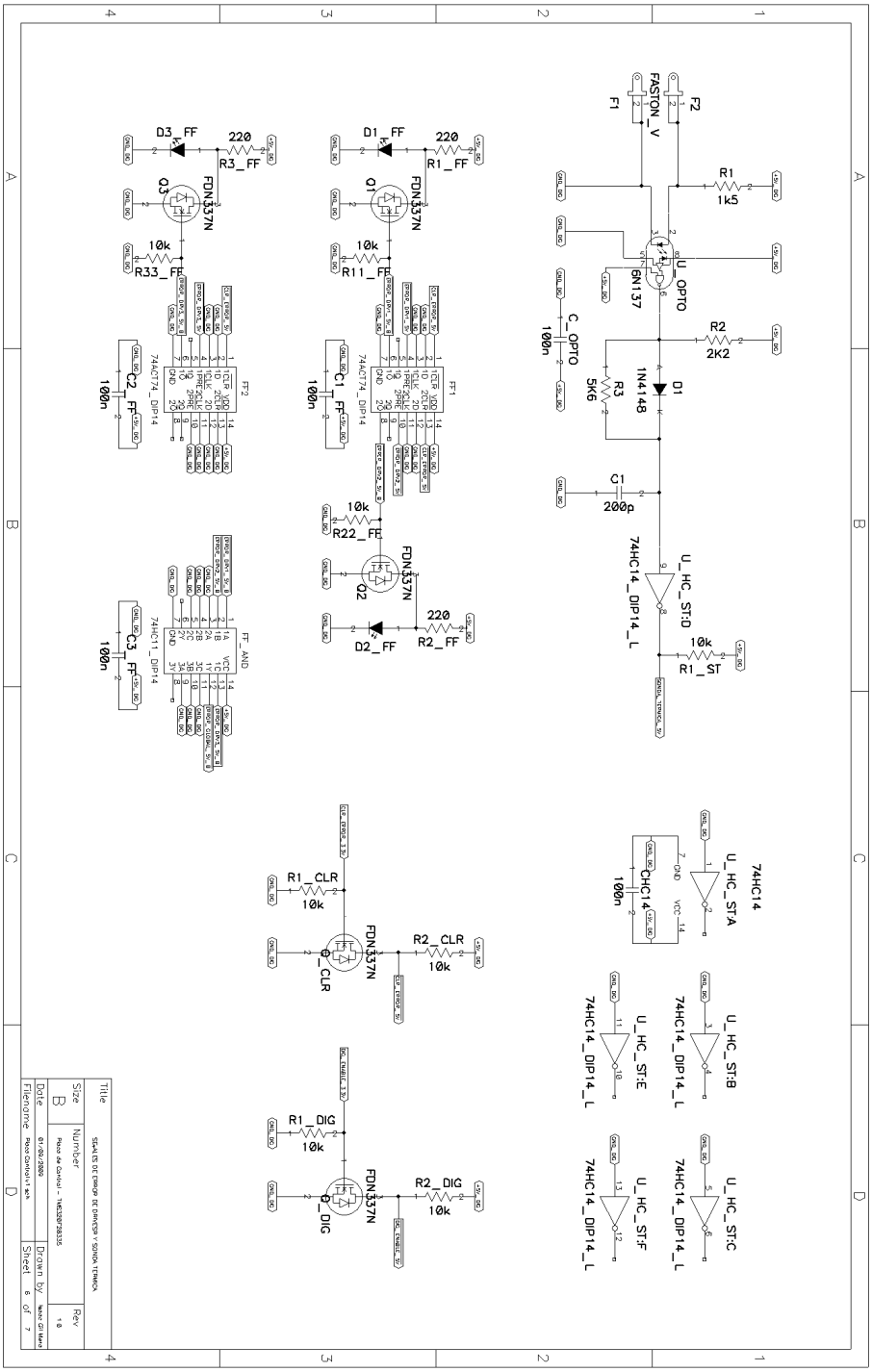


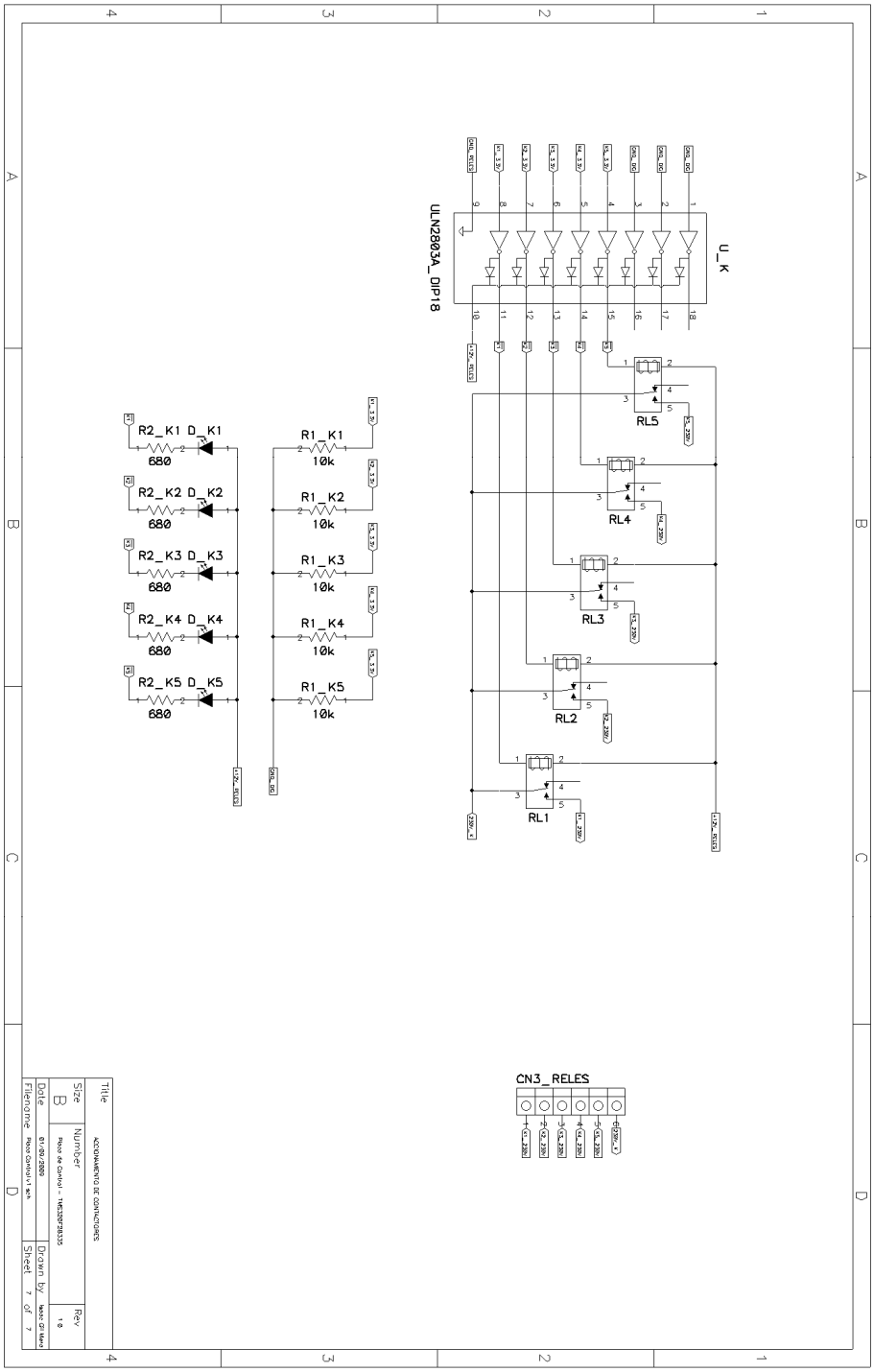

RA2
200
RA14
23k2
RA35
4k02
RA26
6k98
COPA1
100n
OPA4340
OPA1:A
CA50
33p
RA50
2k4
RA1
200
RA13
23k2
RA37
4k02
RA25
6k98
OPA1:B
CA49
33p
RA49
2k4
CN2_HALL_V
Rango de Medidas
LV1: 940V -> 2xR=47K -> 0.025mA -> R=200 -> 5V
LV2: 940V -> 2xR=47K -> 0.025mA -> R=200 -> 5V
LV3: 440V -> 2xR=22K -> 0.025mA -> R=200 -> 5V
Rin * Cin = Rf * Cf
Rin = 10k
Cin = 9p
Rf = 2k4
Cf = 33p
RA4
200
RA16
23k2
RA40
4k02
RA28
6k98
OPA1:C
CA52
33p
RA52
2k4
RA3
200
RA15
23k2
RA39
4k02
RA27
6k98
OPA1:D
CA51
33p
RA51
2k4
Title
ADQUISICION MEDIDAS DE TENSIONES
Size
B
Number
Rev
1.0
Date
Drawn by
Sheet
2 of 7


RA10
50
RA22
23k2
RA46
4k02
CA34
100n
RA34
6k98
COPA2
100n
OPA2:A
OPA340
RA58
1k2
33p
CA58
RA9
100
RA21
23k2
RA45
4k02
CA33
100n
RA33
6k98
OPA2:B
OPA340
RA57
1k2
33p
CA57
CN1_HALL_I
Rango de Medidas
LA1: 100A -> 0.050mA -> R=100 -> 5V
LA2: 100A -> 0.050mA -> R=100 -> 5V
LA3: 100A -> 0.050mA -> R=100 -> 5V
LA4: 200A -> 0.100mA -> R=50 -> 5V
Rin * Cin = Rf * Cf
Rin = 5k
Cin = 9p
Rf = 1k2
Cf = 33p
RA12
100
RA24
23k2
RA48
4k02
CA36
100n
RA36
6k98
OPA2:C
OPA340
RA60
1k2
33p
CA60
RA11
100
RA23
23k2
RA47
4k02
CA35
100n
RA35
6k98
OPA2:D
OPA340
RA59
1k2
33p
CA59
Title
ADQUISICION MEDIDAS DE CORRIENTES
Size
B
Number
Rev
1.0
Date:
Filename:
Drawn by:
Sheet 3 of 7

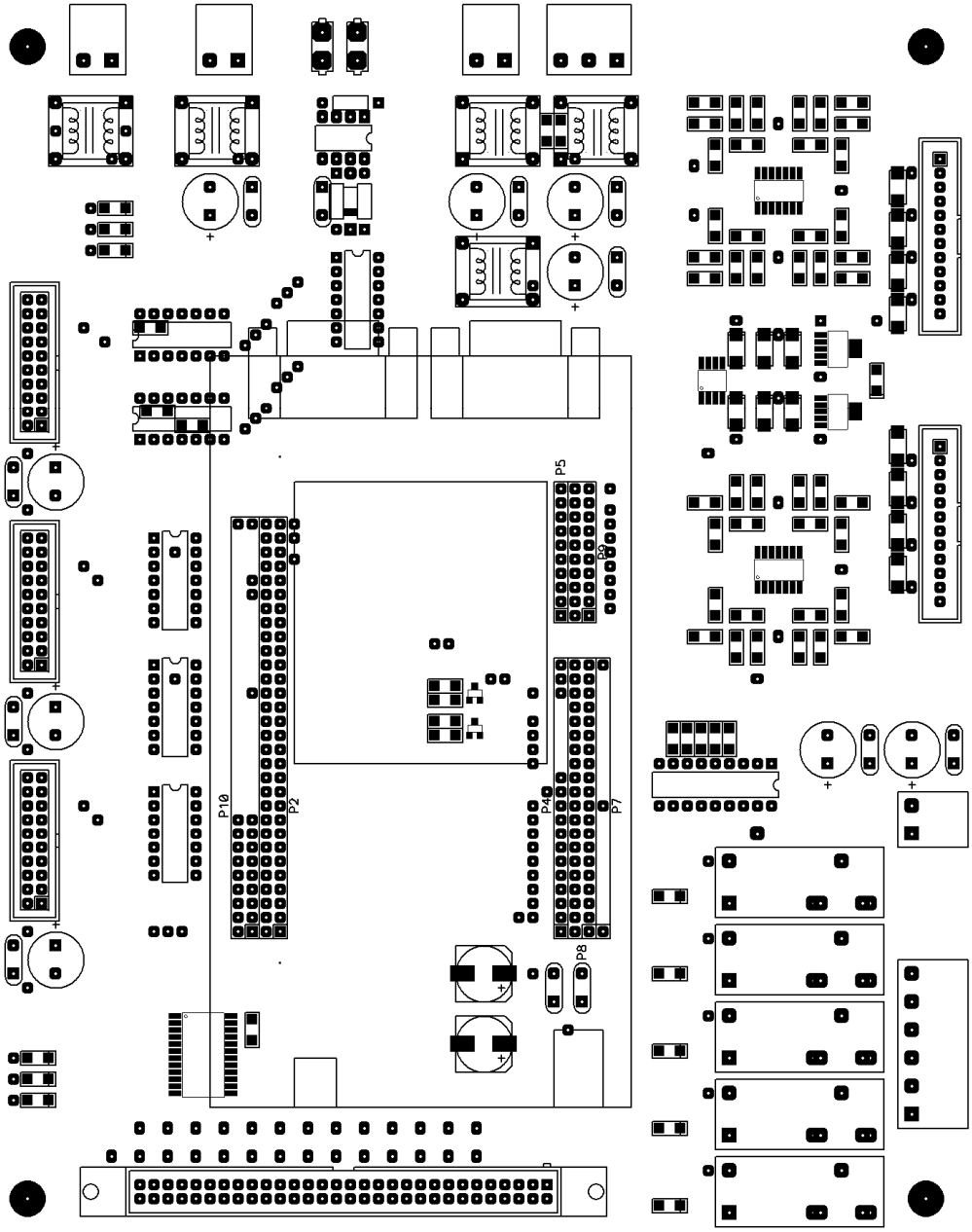

TMS320F28335
EZDSPF28335_NO_NC
CN8_BUS_EXPANSION
IDC60_M
SN74CBTD3861_SOIC24
C1_CBTD
100n
U1_CBTD


C3_ERR
6n8
R3_ERR
2k2
C2_ERR
6n8
R2_ERR
2k2
C1_ERR
6n8
R1_ERR
2k2
IDC20_SC
CN6_DRV3
CN5_DRV2
CN4_DRV1
C7_DRV
100n
C8_DRV
100n
MIC4468_DIP
U1_PWM
MIC4469_DIP
U2_PWM
R2_PWM3
68
D_PWM3
R1_PWM3
10k
R2_PWM2
68
D_PWM2
R1_PWM2
10k
R2_PWM1
68
D_PWM1
R1_PWM1
10k
Resistencia Pullup Driver 5k1
Resistencia PCB_2k2
Verror = 2.2/7.3 * 15V = 4.5V
Req = 11.22/7.3 = 1k54
Ceq = 6n8
Tau = Req * Ceq = 10us
C1_DRV
10u
C2_DRV1
10u
C3_DRV
10u
C4_DRV
10u
C5_DRV
10u
C6_DRV
10u
Title
COMUNICACION CON DRIVERS DE POTENCIA
Size
B
Number
Rev
1.0
Date
Drawn by
Sheet
5 of 7
Filename

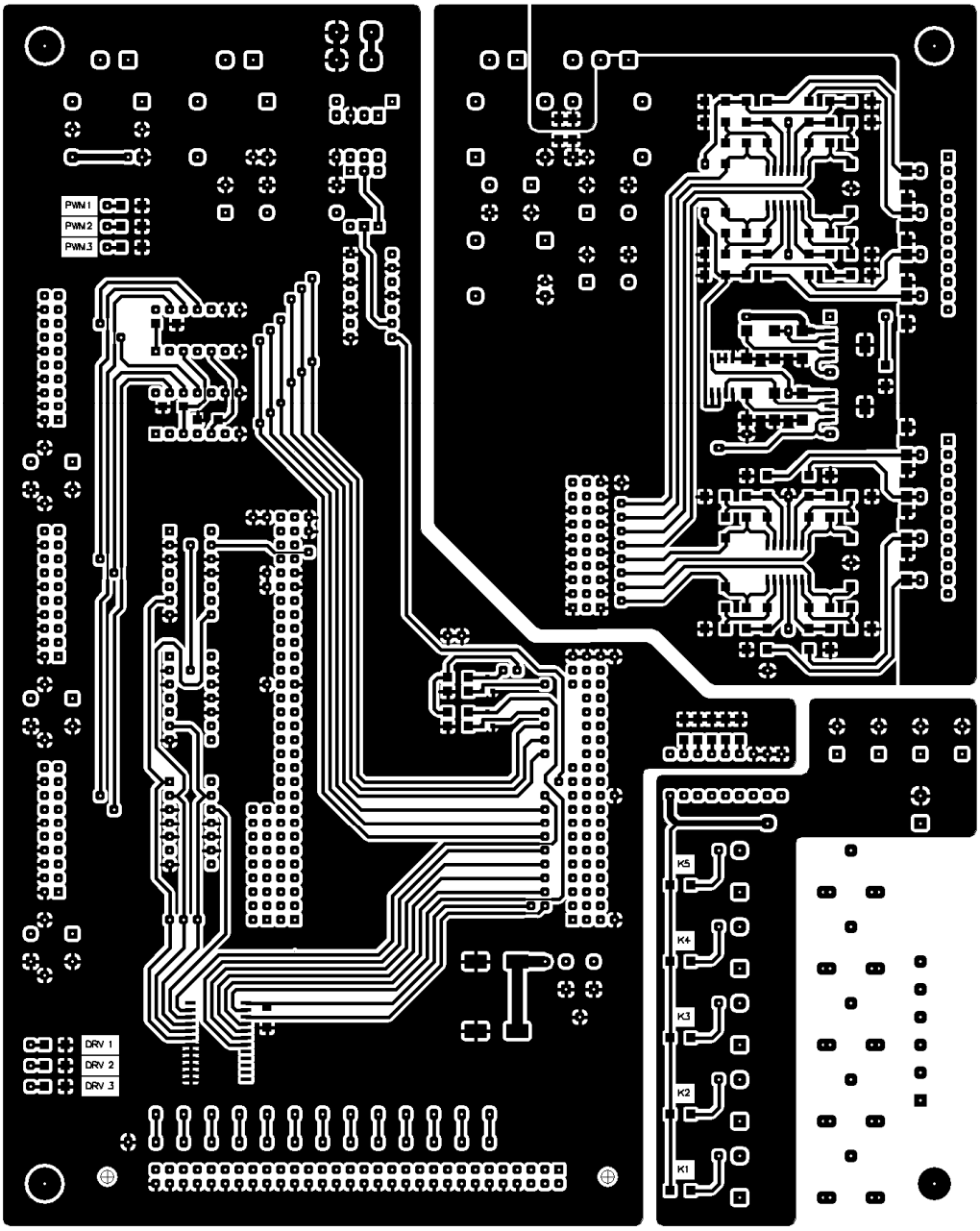

FASTON_V
F1
F2
R1
1k5
U_OPTO
6N137
C_OPTO
100n
R2
2K2
R3
5K6
1N4148
D1
C1
200p
74HC14_DIP14_L
U_HC_ST:D
10k
R1_ST
D3_FF
220
R3_FF
FDN337N
Q3
10k
R33_FF
C2_FF
100n
74ACT74_DIP14
FF2
D1_FF
R1_FF
Q1
R11_FF
C1_FF
FF1
10k
R22_FF
Q2
D2_FF
R2_FF
C3_FF
74HC11_DIP14
FF_AND
74HC14
U_HC_ST:A
CHC14
U_HC_ST:E
U_HC_ST:B
U_HC_ST:F
U_HC_ST:C
R1_CLR
R2_CLR
Q_CLR
R1_DIG
R2_DIG
Q_DIG
Title
Size
B
Number
Date
Filename
Drawn by
Sheet
Rev


ULN2803A_DIP18
U_K
R2_K1 D_K1
680
R2_K2 D_K2
680
R2_K3 D_K3
680
R2_K4 D_K4
680
R2_K5 D_K5
680
R1_K1
10k
R1_K2
10k
R1_K3
10k
R1_K4
10k
R1_K5
10k
RL5
RL4
RL3
RL2
RL1
CN3_RELES

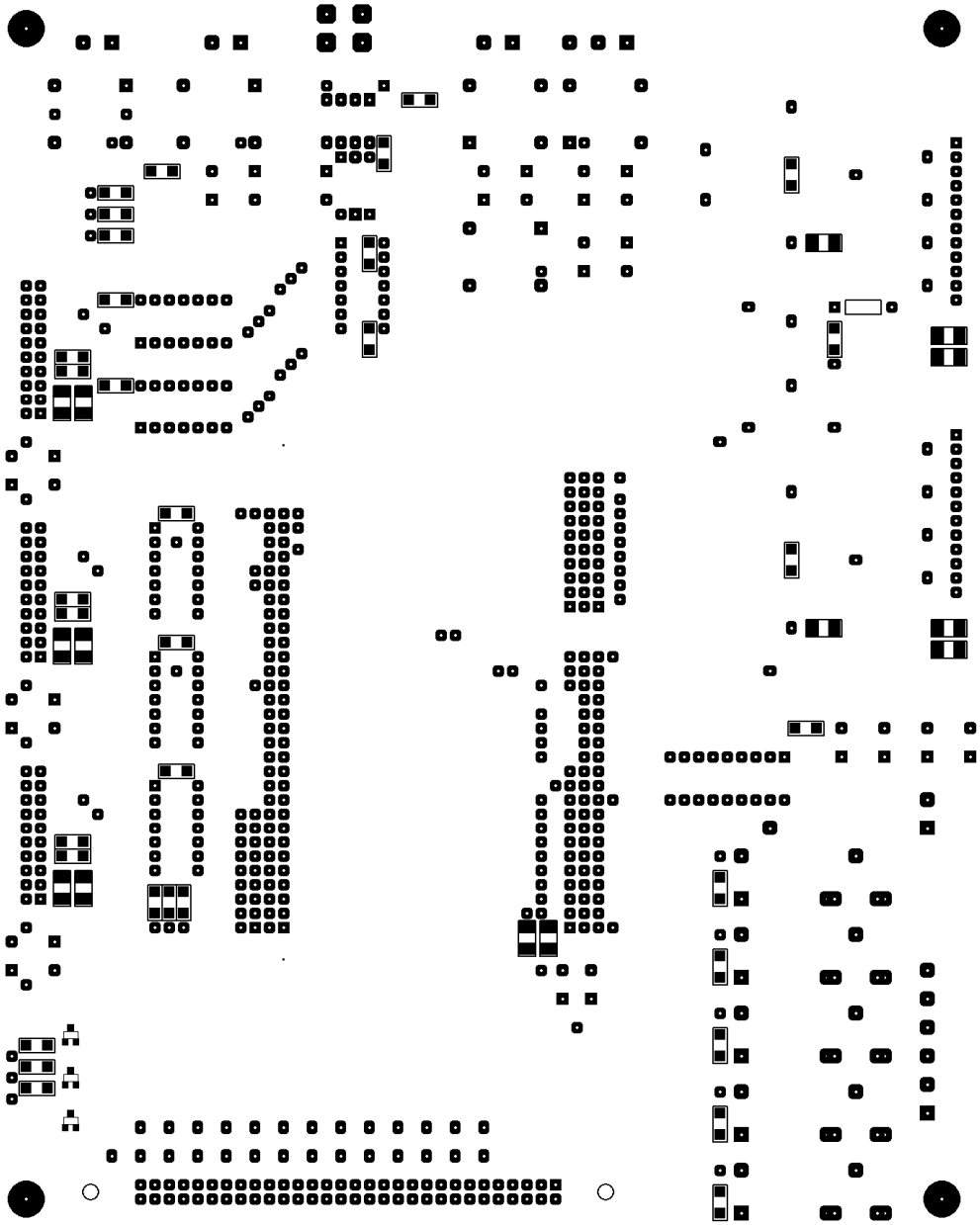
5. LAYOUT DE PLACA DE CIRCUITO IMPRESO



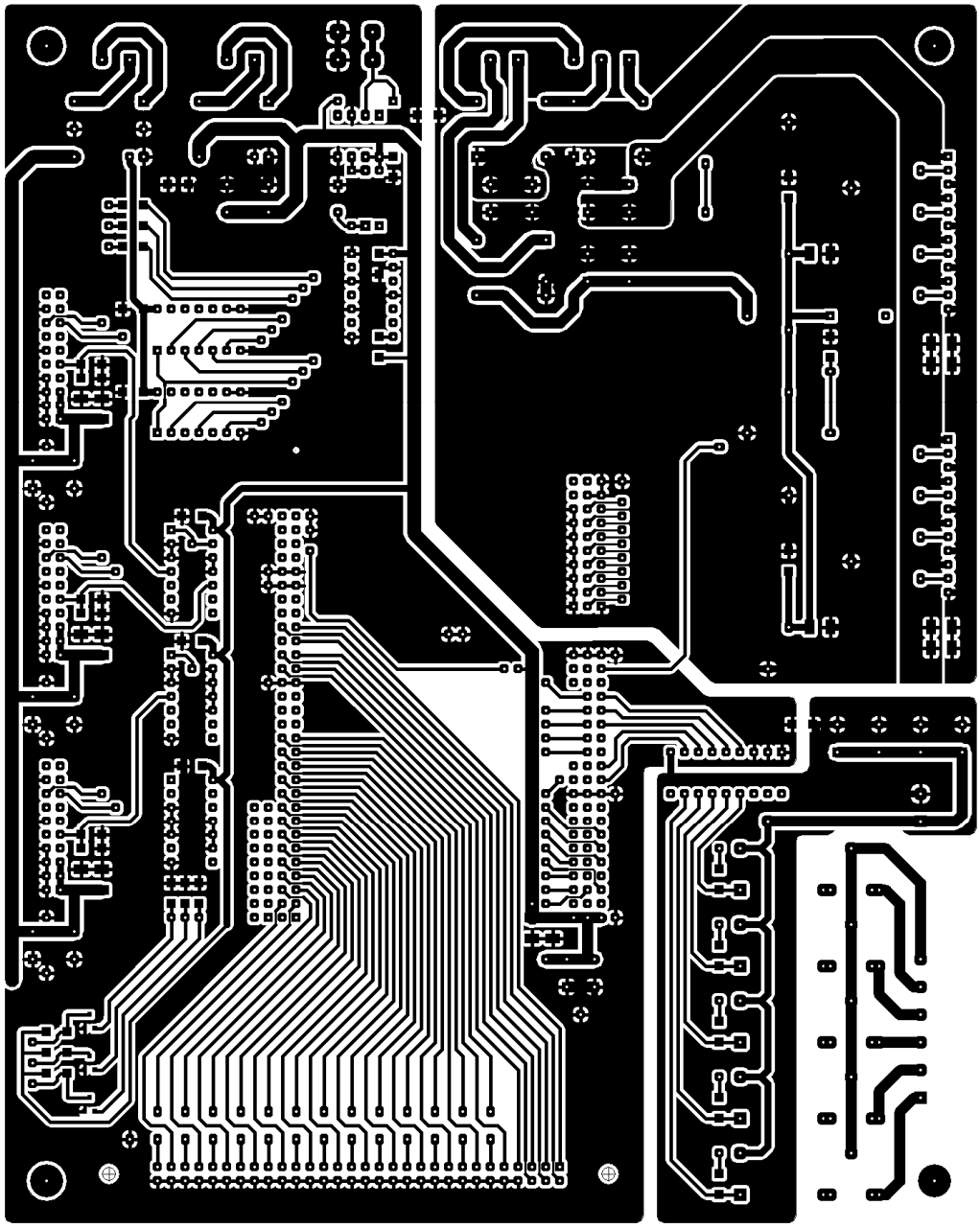
TOP



TOP



BOTTOM



BOTTOM