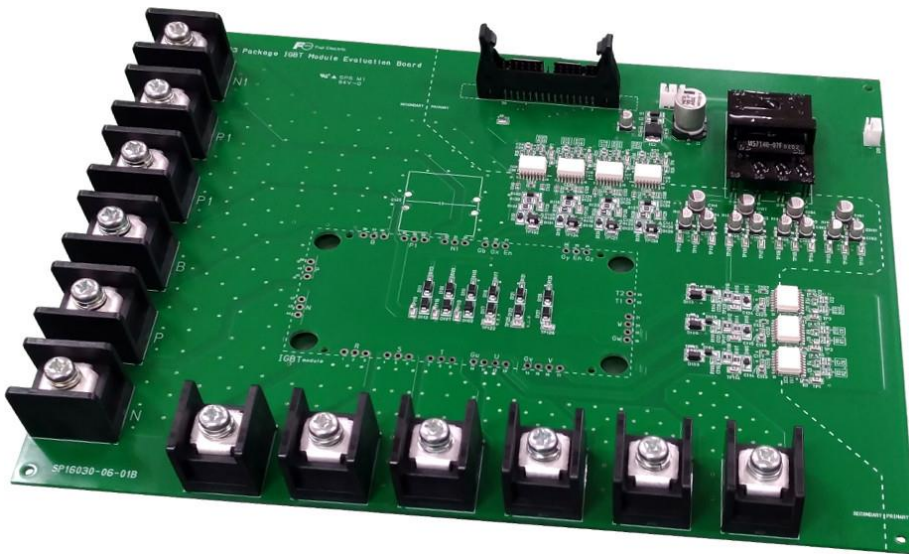
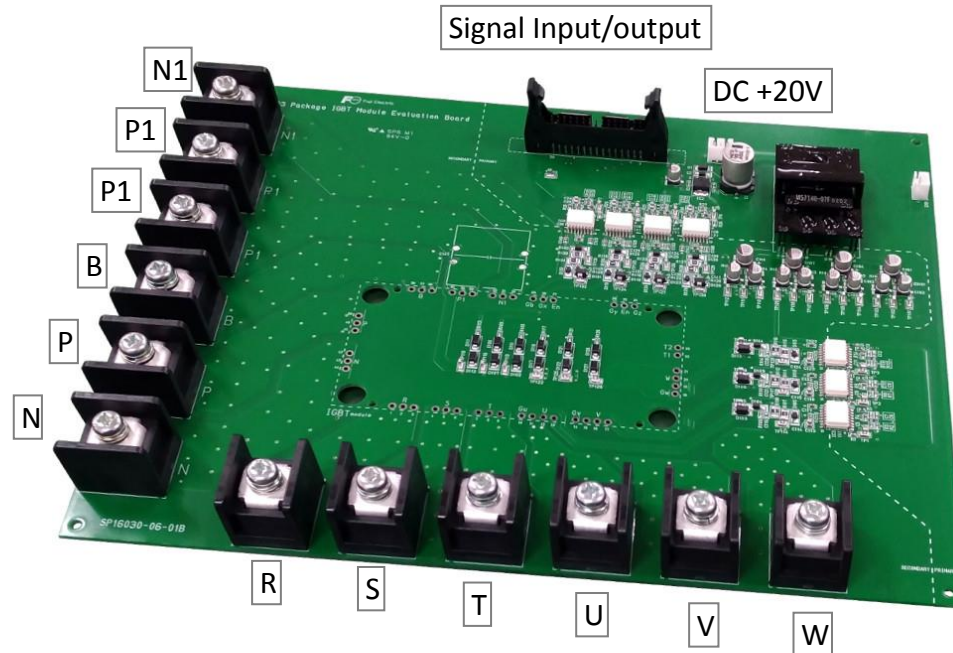


# FUJI IGBT Module EP3 Package Evaluation Board



December, 2017

Device Application Technology Dept.  
Sales Div., Electronic Devices Business Gr.  
Fuji Electric Co., Ltd.



315.8mm x 237mm

- ✓ On-board isolated DC/DC power supply
- ✓ Broadcom (Avago) ACPL-337J driver IC  
Integrated fail-safe IGBT protection
  - Desaturation detection, “Soft” IGBT turn-off and fault feedback
  - Under Voltage Lock Out (UVLO) protection with feedback
- ✓ +5V CMOS level for PWM and fault signals
- ✓  $V_{GE} = +15V/-6V$  gate drive
- ✓ We can provide the circuit diagram, PCB pattern, BOM to support your driver design

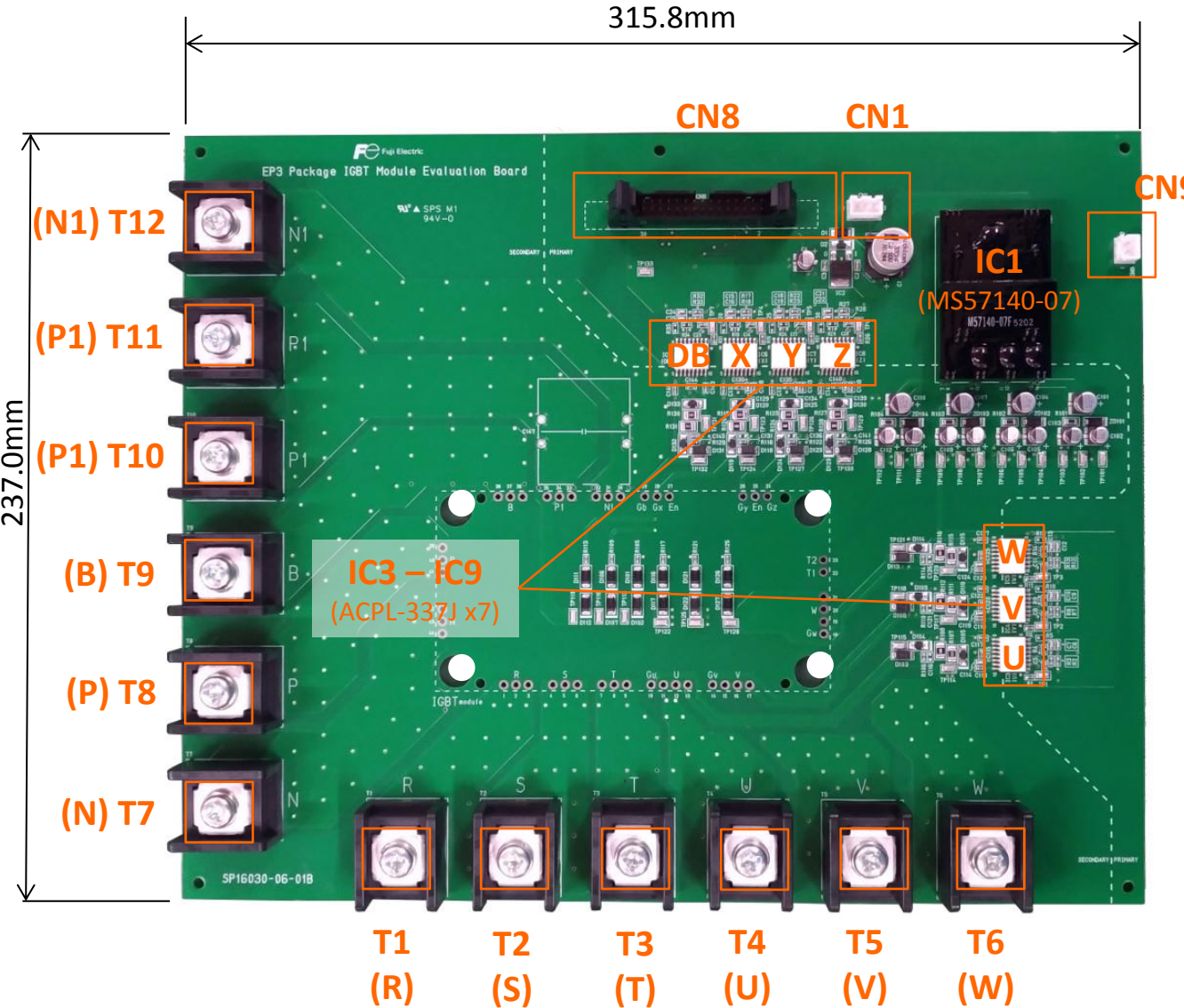
## Supported modules : EP3 solder pins (M720), “M” type module

(V series) 7MBR50VN-120-50, 7MBR75VN-120-50, 7MBR100VN-120-50, 7MBR150VN-120-50

(X series) 7MBR75XNA065-50, 7MBR100XNA065-50, 7MBR150XNA065-50

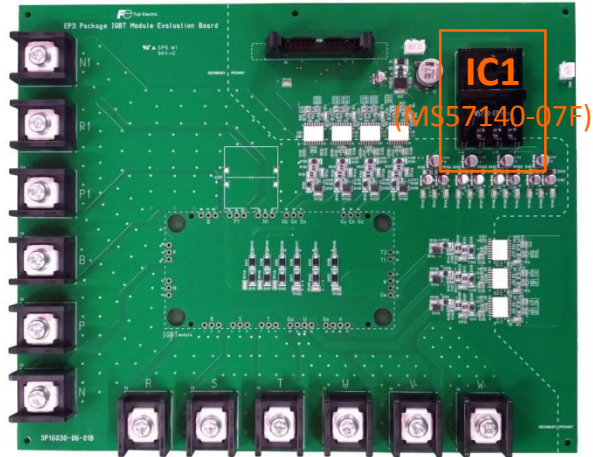
7MBR75XNA120-50, 7MBR100XNA120-50, 7MBR150XNE120-50

# Layout of the Evaluation Board

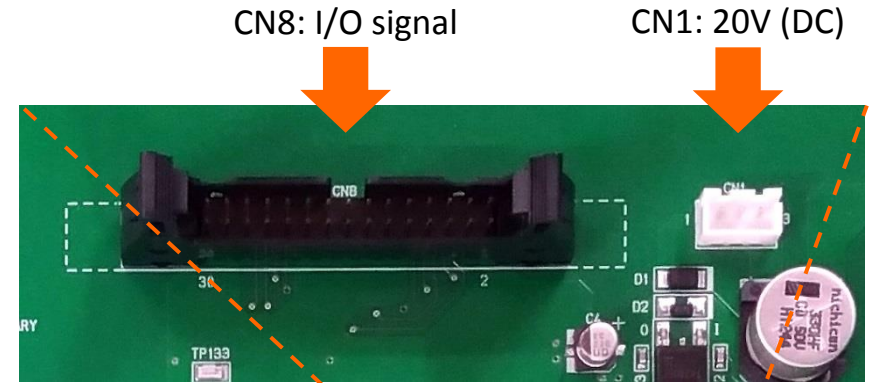


- IC1:** DC/DC power supply
- IC3 – IC9:** Gate driver IC  
ACPL-337J
- CN1:** Power supply connector  
(DC +20V)
- CN8:** Gate PWM signal input/  
Fault signal output
- CN9:** NTC output
- T1 – T3:** 3φ AC input terminal
- T4 – T6:** 3φ AC output terminal
- T7, T12:** DC- terminal
- T8,T10,T11:** DC+ terminal
- T9:** Brake terminal

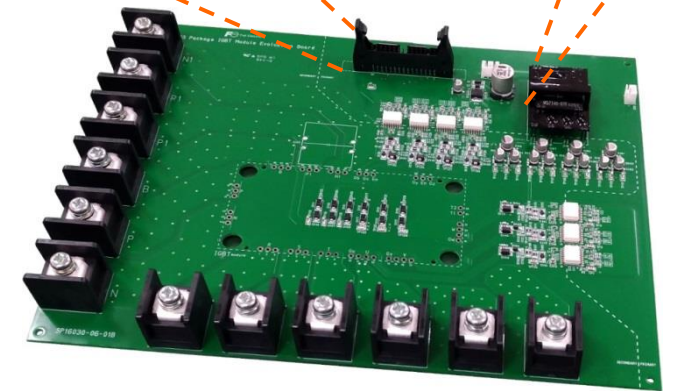
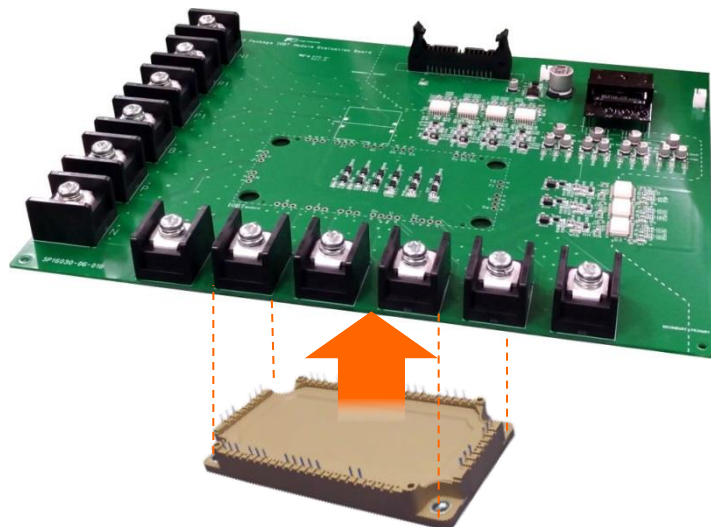
## (1) Attach IC1 (MS57140-07F)



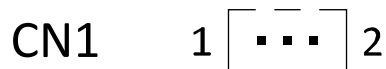
## (3) Connect I/O signal and DC power supply



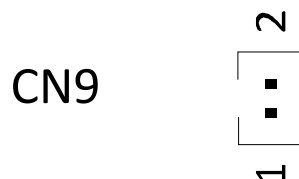
## (2) Attach and solder IGBT module to PCB



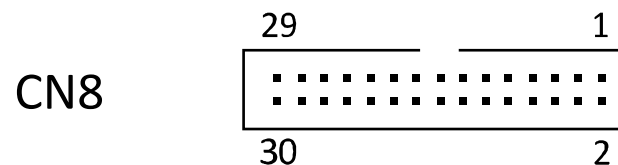
# I/O Pin Assignments



PIN No.	Pin name	Function
1	VDC_IN	+20V
2	NC	NC
3	GND	GND



PIN No.	Pin name	Function
1	T1	T1
2	T2	T2



PIN No.	Pin name	Function
1	IN-DB	PWM signal for B phase
2	NC	
3	IN-X	PWM signal for X phase
4	IN-U	PWM signal for U phase
5	IN-Y	PWM signal for Y phase
6	IN-V	PWM signal for V phase
7	IN-Z	PWM signal for Z phase
8	IN-W	PWM signal for W phase
9 - 12	GND	
13	FAULT-DB	DESAT fault output for B phase
14	UVLO-DB	Undervoltage lockout output for B phase
15	FAULT-U	DESAT fault output for U phase
16	UVLO-U	Undervoltage lockout output for U phase
17	FAULT-V	DESAT fault output for V phase
18	UVLO-V	Undervoltage lockout output for V phase
19	FAULT-W	DESAT fault output for W phase
20	UVLO-W	Undervoltage lockout output for W phase
21	FAULT-X	DESAT fault output for X phase
22	UVLO-X	Undervoltage lockout output for X phase
23	FAULT-Y	DESAT fault output for X phase
24	UVLO-Y	Undervoltage lockout output for Y phase
25	FAULT-Z	DESAT fault output for X phase
26	UVLO-Z	Undervoltage lockout output for Z phase
27 - 30	GND	

Description	Parameter	Value	Unit	Remarks
DC input voltage for DC/DC converter	$V_{DC(in)}$	18 ~ 22	V	Recommended value: 20V
DC output voltage of DC/DC converter	$V_{out1}$	+15/-6	V	Gate-Emitter voltage
Primary side control voltage	$V_{out2}$	5	V	Non-isolation
PWM signal input voltage	$V_{IN}$	0 / +5	V	
Peak output current	$I_{O(peak)}$	4	A	Follow the specification of ACPL-337J
Peak output current for gate drive per IGBT	$I_{O(peak)}$	4	A	Follow the specification of ACPL-337J
Operating temperature	$T_{opr}$	-10... +75	°C	
Storage temperature	$T_{stg}$	-20... +85	°C	
FAULT output current	$I_{FAULT}$	10	mA	Follow the specification of ACPL-337J
FAULT pin voltage	$V_{FAULT}$	5	V	Follow the specification of ACPL-337J
FAULT logic low output current	$I_{FAULT\_L}$	9.0	mA	Follow the specification of ACPL-337J
UVLO output current	$I_{UVLO}$	10	mA	Follow the specification of ACPL-337J
UVLO pin voltage	$V_{UVLO}$	5	V	Follow the specification of ACPL-337J
UVLO threshold low to high	$V_{UVLO+}$	12.5	V	Follow the specification of ACPL-337J
UVLO threshold high to low	$V_{UVLO-}$	11.3	V	Follow the specification of ACPL-337J
DESAT detection threshold	$V_{DESAT}$	7	V	Follow the specification of ACPL-337J
Output Mute Time due to DESAT	$t_{DESAT(MUTE)}$	3.0	ms	Follow the specification of ACPL-337J
Time Input Kept Low Before Fault Reset to High	$t_{DESAT(RESET)}$	3.0	ms	Follow the specification of ACPL-337J

Please refer to datasheet of ACPL-337J and M57140-07F for other characteristics.

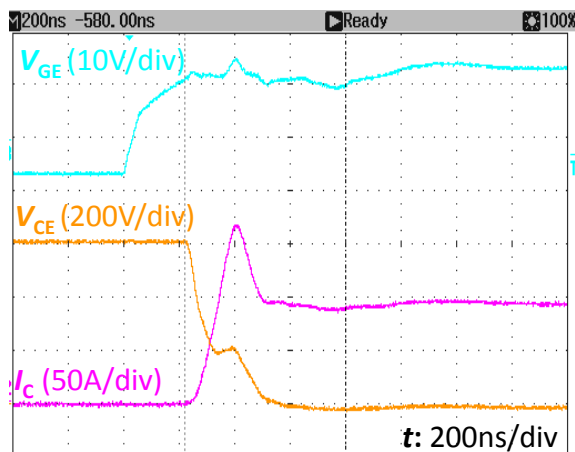
# Example of Switching Waveform

## Test condition:

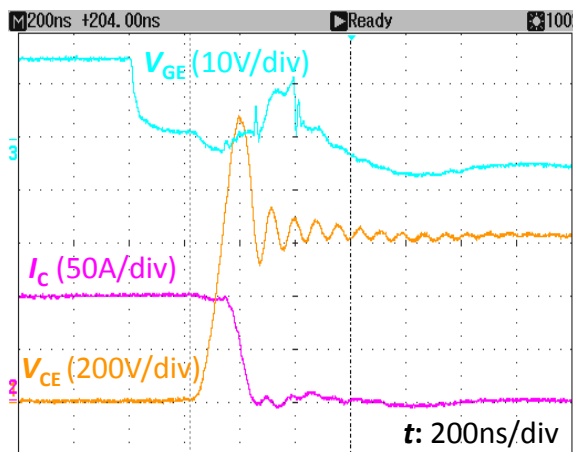
Module: 7MBR100XNE120-50

$V_{CC}=600V$ ,  $R_G=5.1\Omega$ ,  $V_{GE}=+15V/-6V$ ,  $T_{vj}=R.T.$

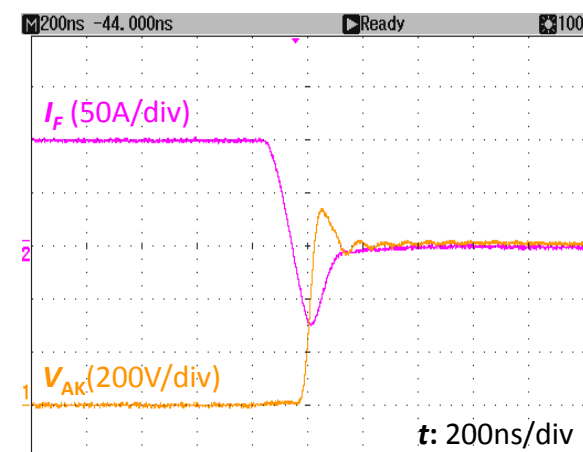
### Turn on



### Turn off



### Reverse Recovery



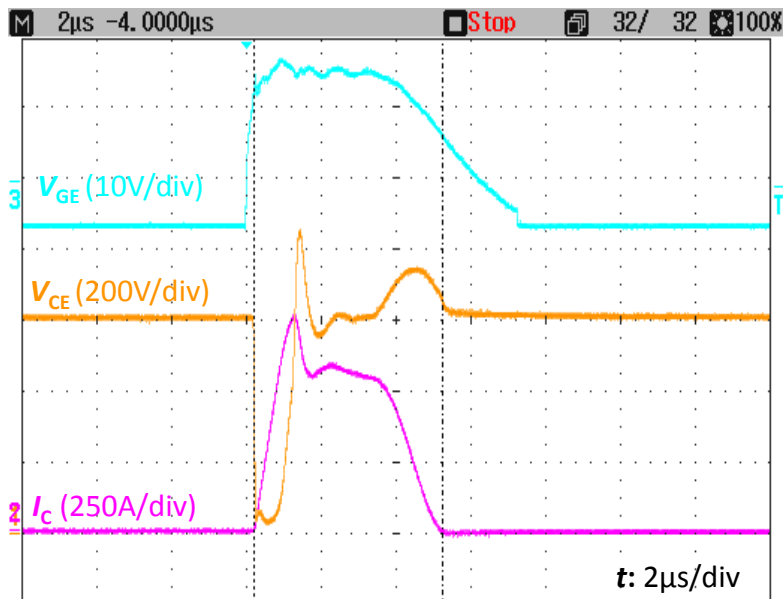
# Short Circuit Protection (DESAT)

## Test condition:

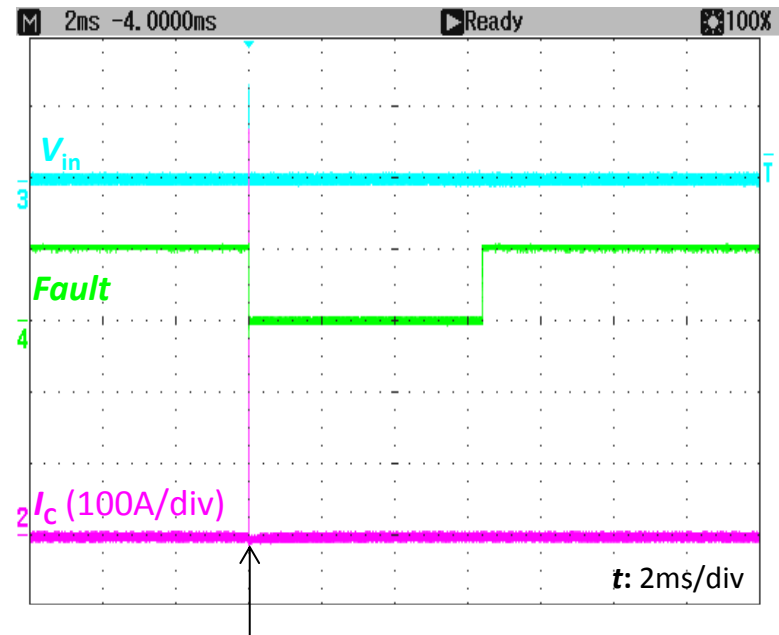
Module: 7MBR100XNE120-50

$V_{CC}=600V$ ,  $R_G=5.1\Omega$ ,  $V_{GE}=+15V/-6V$ ,  $T_{vj}=R.T.$

## Short circuit waveforms



## FAULT signal output

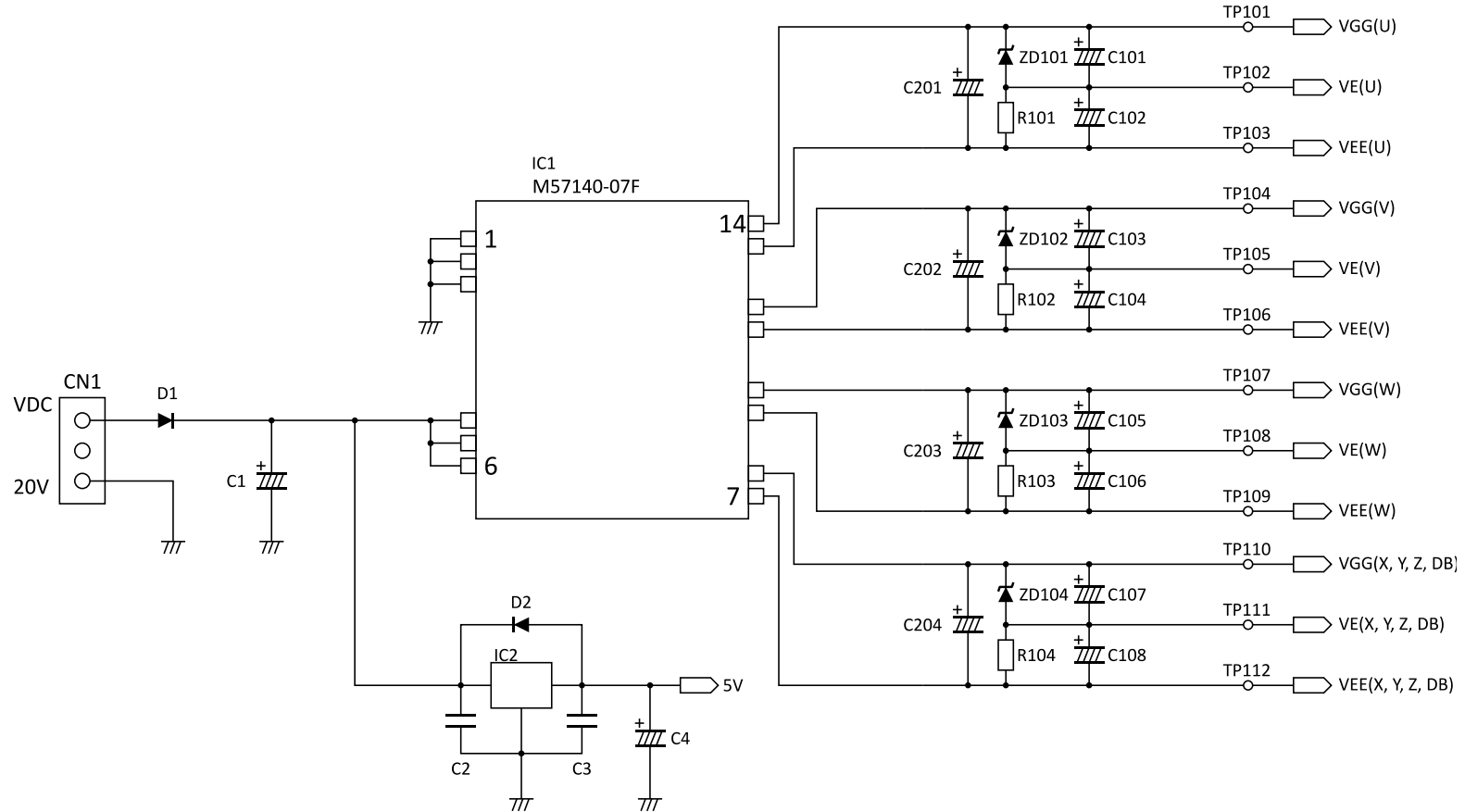


Short circuit

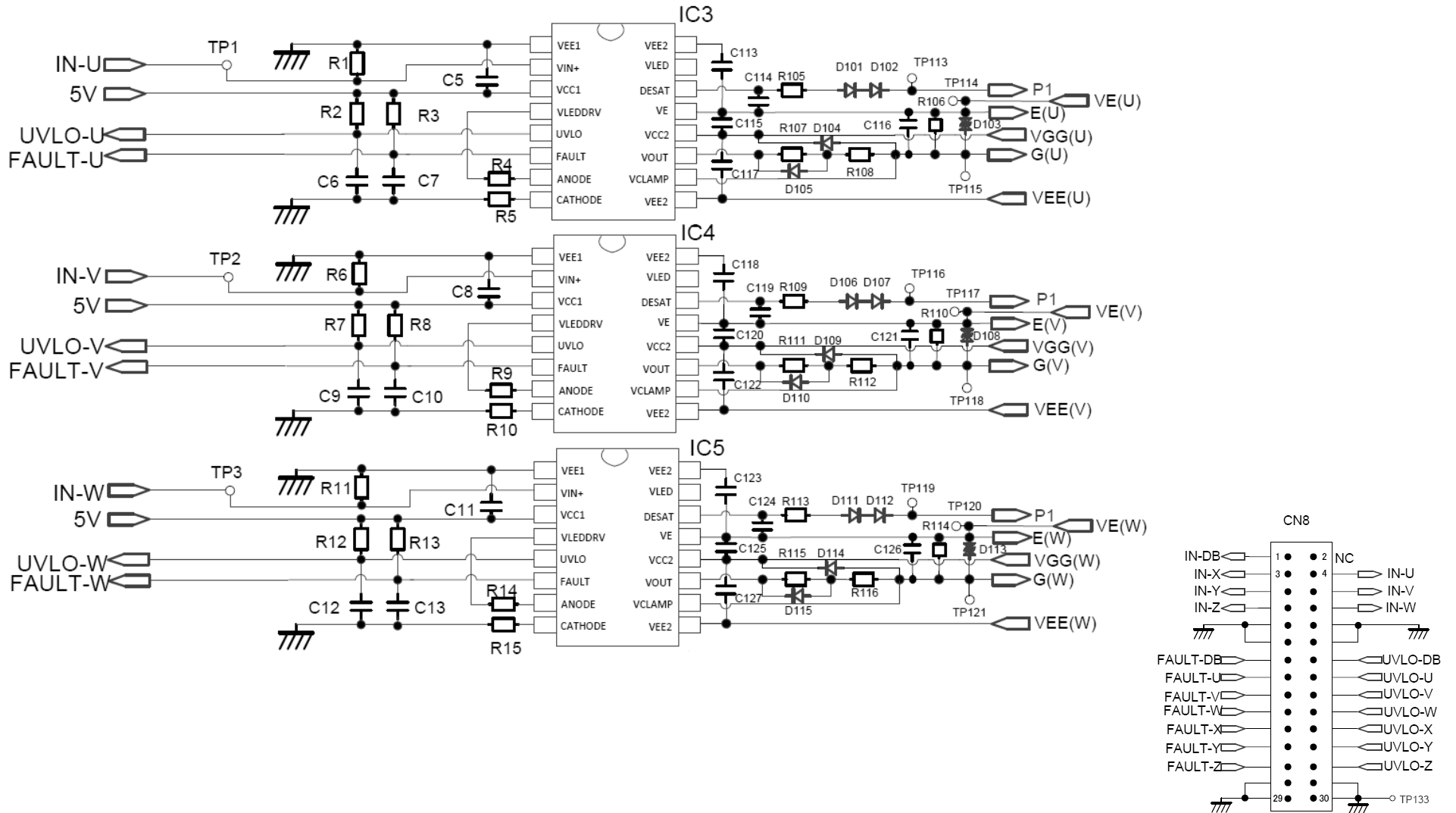




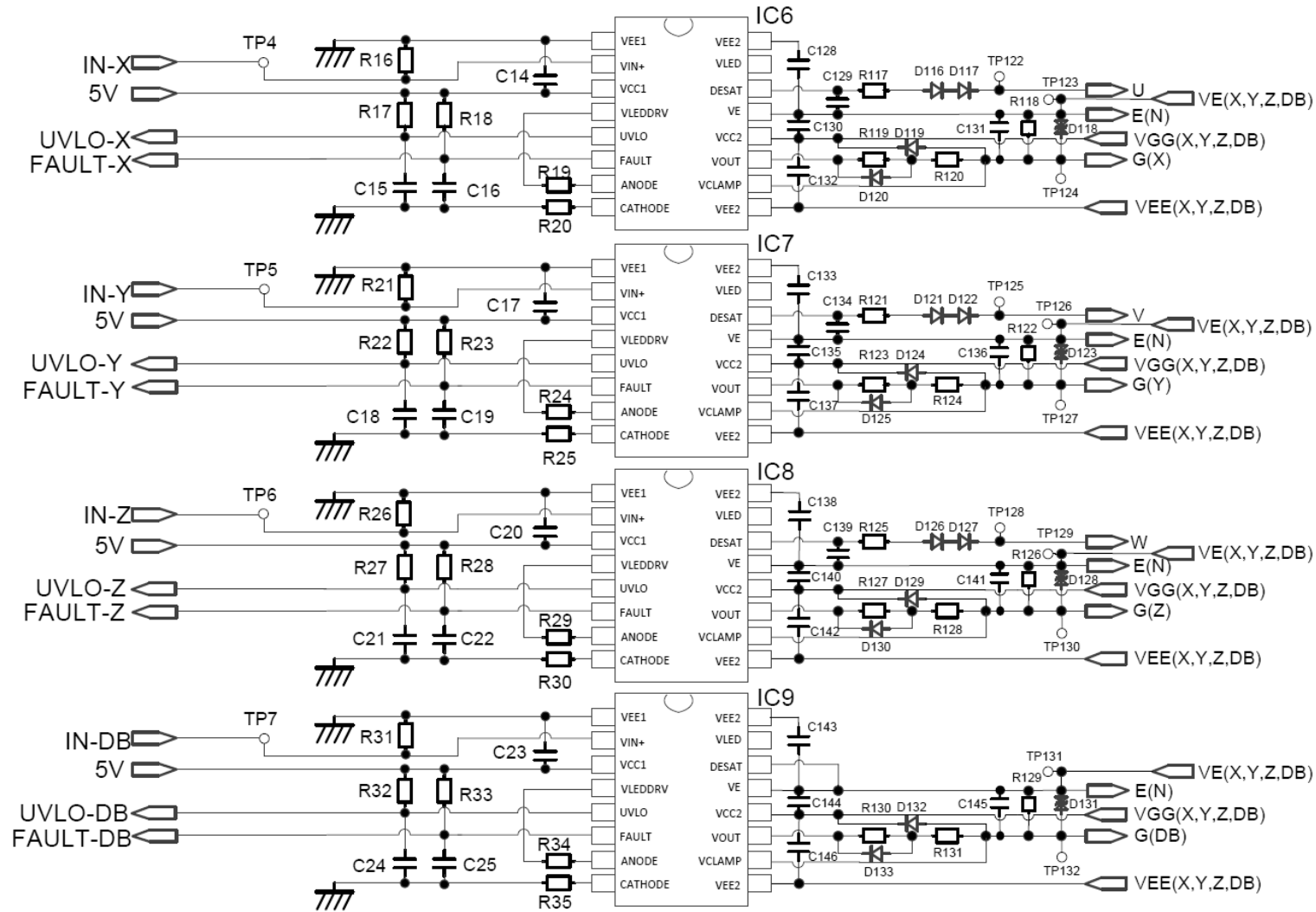
# Circuit Diagram (DC/DC Power Supply)



# Circuit Diagram (Gate Drive) (1/2)



# Circuit Diagram (Gate Drive) (2/2)



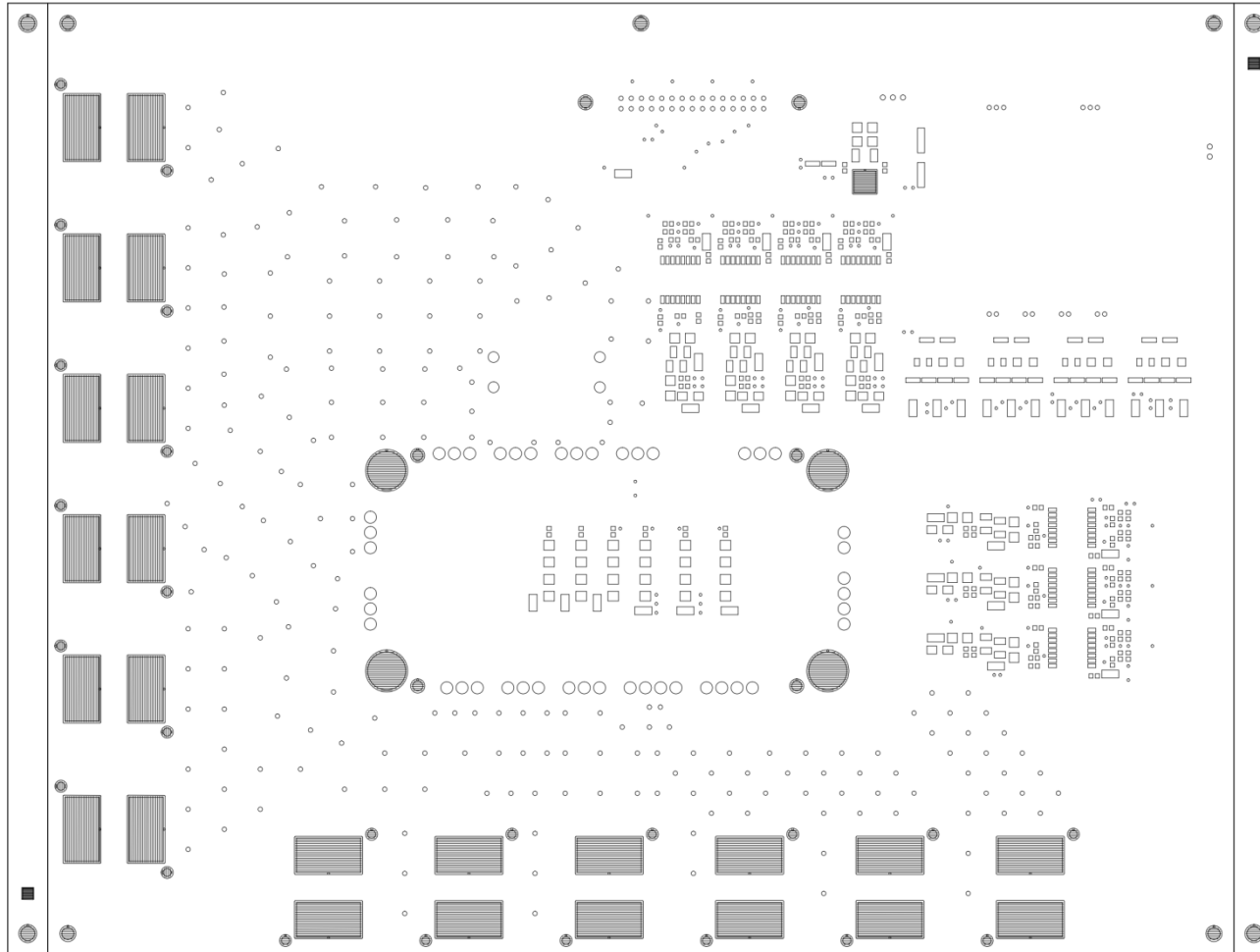
# Bill of Material

Component		Qty.	Value	Package	Manufacturer	Note
Resistor	R1, R2, R3, R6, R7, R8, R11, R12, R13, R16, R17, R18, R21, R22, R23, R26, R27, R28, R31, R32, R33, R106, R110, R114, R118, R122, R126, R129	28	10kΩ, 1/10W	1608		
	R4, R5, R9, R10, R14, R15, R19, R20, R24, R25, R29, R30, R34, R35	14	150Ω, 1/10W	1608		
	R101, R102, R103, R104	4	4.7kΩ, 1/4W	3216		
	R105, R109, R113, R117, R121, R125,	7	1kΩ, 1/10W	1608		
	R107, R111, R115, R119, R123, R127, R130	7	0kΩ, 1/2W	3225		Gate resistance: $R_G$
	R108, R112, R116, R120, R124, R128	6	15Ω, 1/2W	3225		Gate resistance: $R_G$
	R131	1	27Ω, 1/2W	3225		
Capacitor	C1	1	330μF, 50V	φ12.5 x 14.5		
	C4, C102, C103, C105, C106, C108, C109, C111, C112	9	22μF, 25V	φ5 x 6		
	C5, C8, C11, C14, C17, C20, C23, C113, C115, C117, C118, C120, C122, C123, C125, C127, C128, C130, C137, C138, C140, C142, C143, C144, C145, C146	29	1μF, 50V	1608		
	C101, C104, C107, C110	4	47μF, 25V	φ6.3 x 6		
	C114, C119, C124, C129, C134, C139	6	220pF, 50V			
	C6, C7, C9, C10, C12, C13, C15, C16, C18, C19, C21, C22, C24, C25	14	330pF, 50V			
	C2, C3	2	0.1μF, 50V			
	C116, C121, C126, C131, C136, C141	0		1608		NC
	C147	0				NC

# Bill of Material (Cont'd)

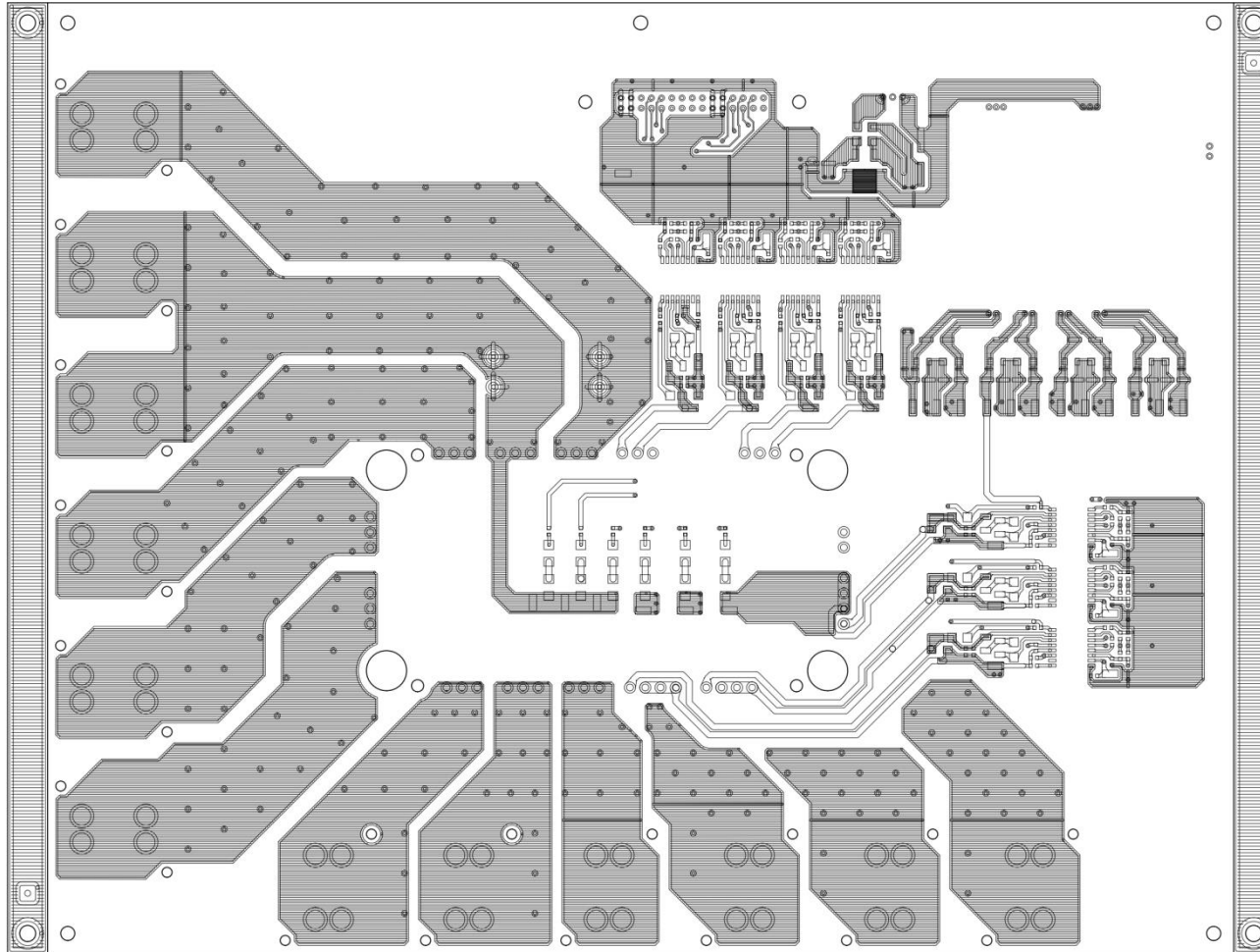
Component		Qty.	Value	Package	Manufacturer	Note
Diode	D1	1	40V, 5A			NC
	D2, D104, D105, D109, D110, D114, D115, D119, D120, D124, D125, D129, D130, D132, D133	15	40V, 1A			
	D101, D102, D106, D107, D111, D112, D116, D117, D121, D122, D126, D127	12	600V, 1A			
Zenner Diode	D101, D102, D103, D104	4	15V, 1W			
TVS	D103, D108, D113, D118, D123, D128, D131	7	22.2V - 24.5V		Broadcom (AVAGO Technologies)	
Thyristor	Thy1	0				NC
IC	IC1	1	MS57140-07F		Isahaya Electronics	
	IC2	1	TA7805F			
	IC3, IC4, IC5, IC6, IC7, IC8, IC9	7	ACPL-337J		Broadcom (AVAGO Technologies)	
Connector	CN1	1	B2B-XH-A(LF)(SN)	3p		
	CN8	1	XG4A-3031	30p		
	CN9	1	B2B-XH-A(LF)(SN)	2p		
Terminal	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10, T11, T12	12	PCB-9 M4			
Test Pin	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP101, TP102, TP103, TP104, TP105, TP106, TP107, TP108, TP109, TP110, TP111, TP112, TP113, TP114, TP115, TP116, TP117, TP118, TP119, TP120, TP121, TP122, TP123, TP124, TP125, TP126, TP127, TP128, TP129, TP130, TP131, TP132, TP133	40	HK-2-S			
PCB	SP15022-06-01A	1				



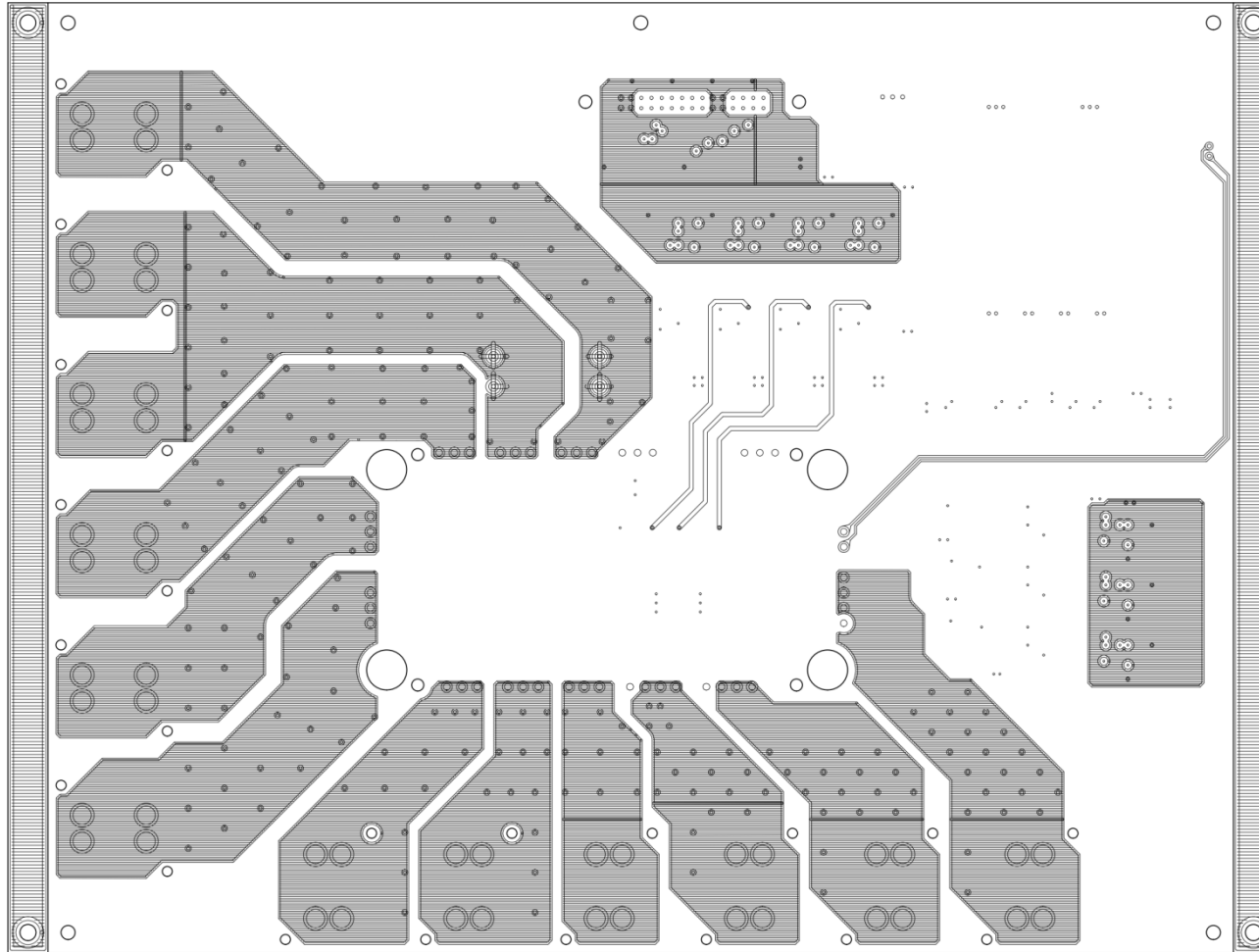


**(Top Solder Resist Layer)**

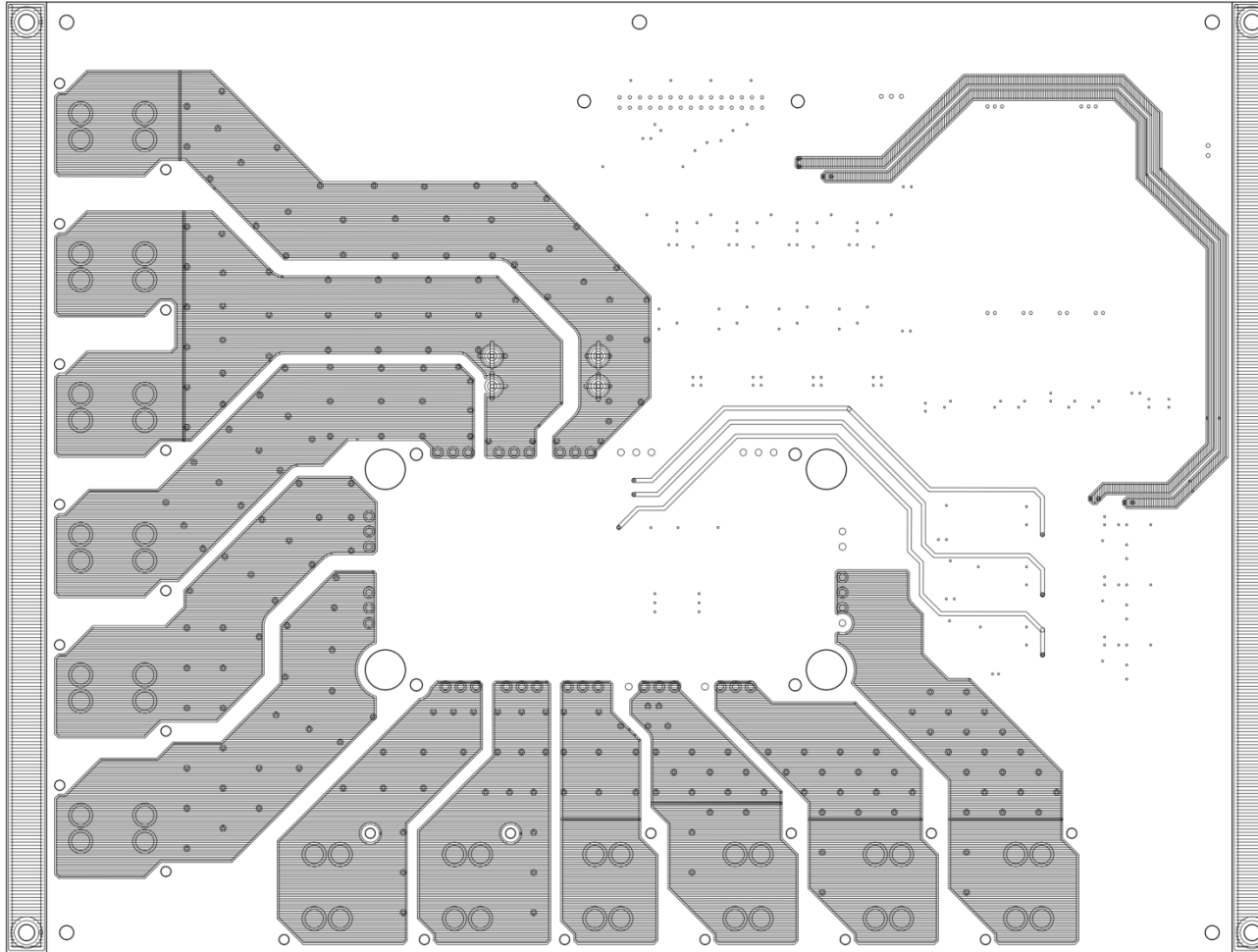




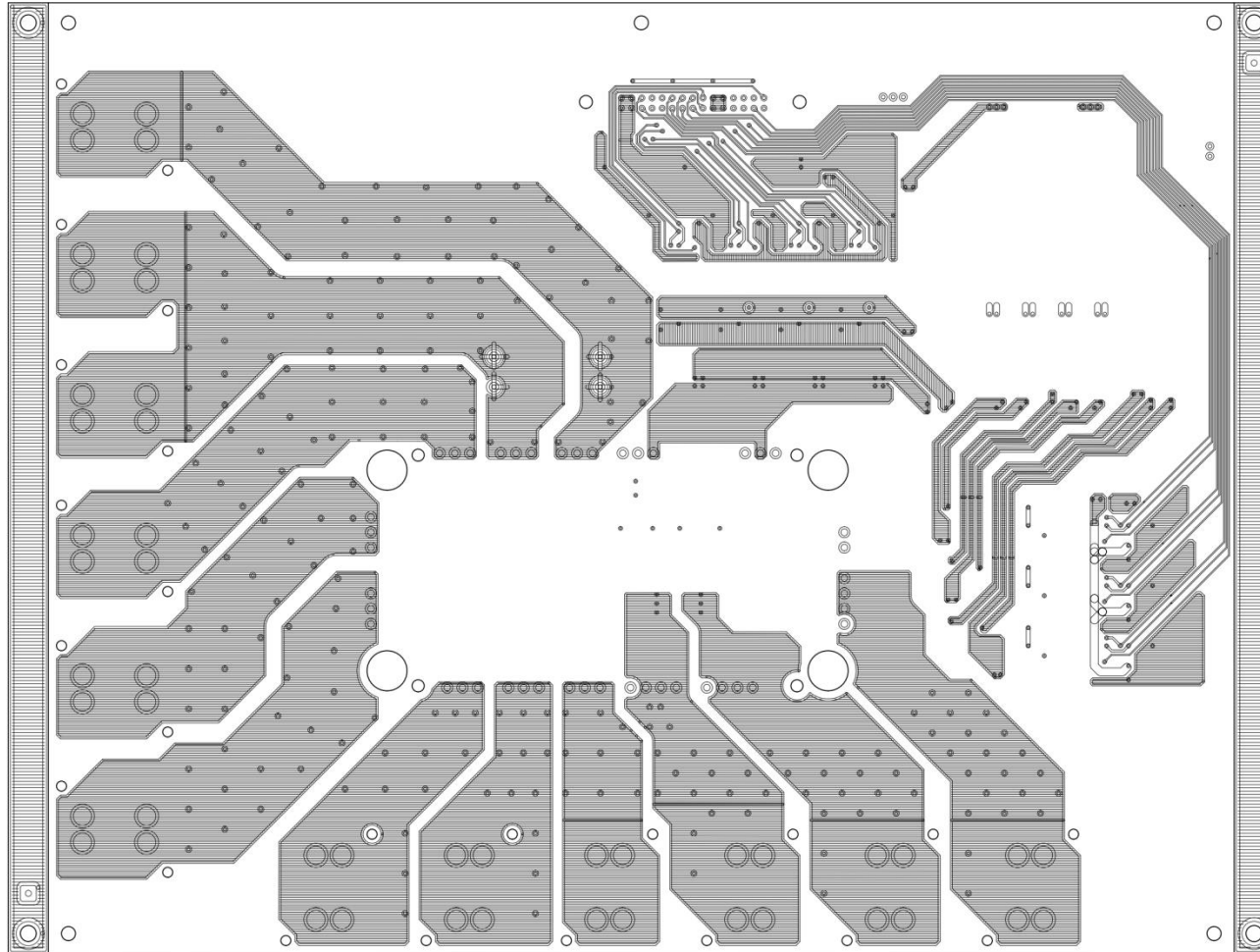
**(Top Layer)**



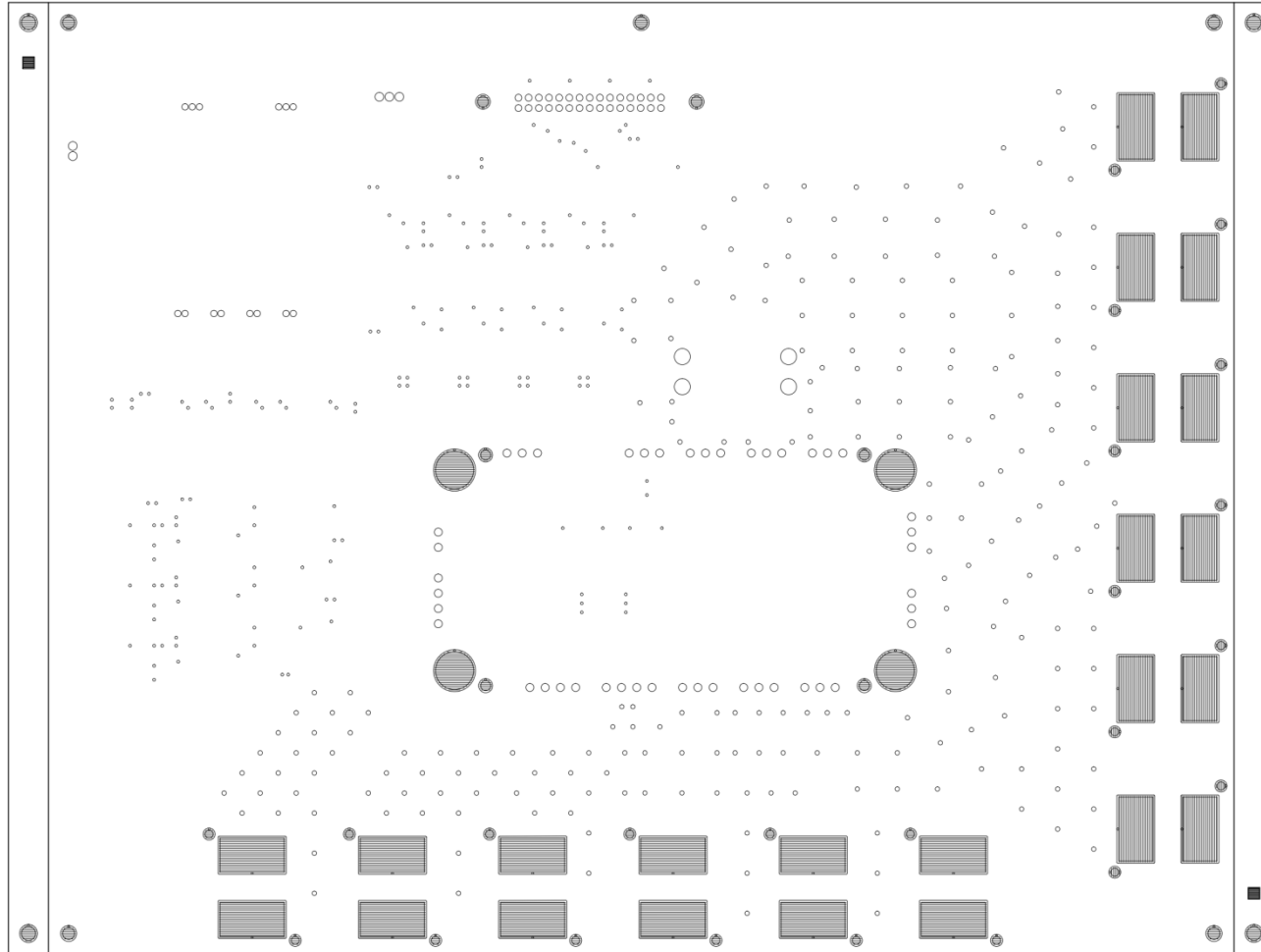
**(Layer 2)**



**(Layer 3)**



**(Bottom Layer)**



**(Bottom Solder Resist Layer)**

This evaluation board can be ordered via a representative at our company or one of our dealers.  
CAD-data and gerber-data for this evaluation board are also available on request.

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