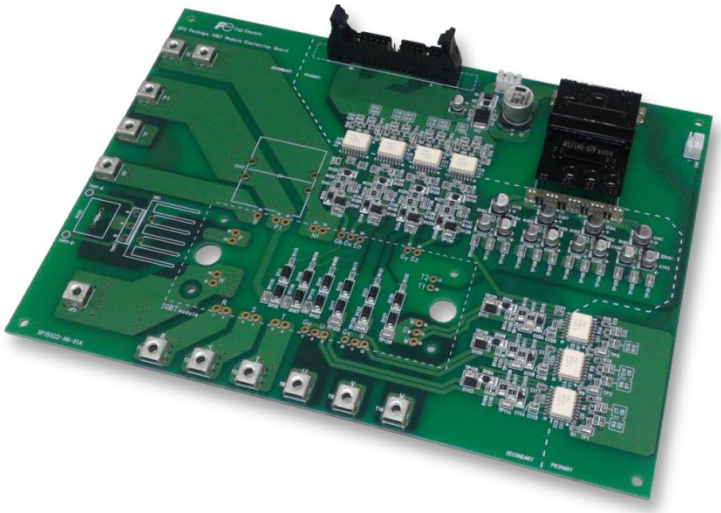
FUJI IGBT Module EP2 Package Evaluation Board



December, 2017

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

Evaluation Board for EP2 Package Module

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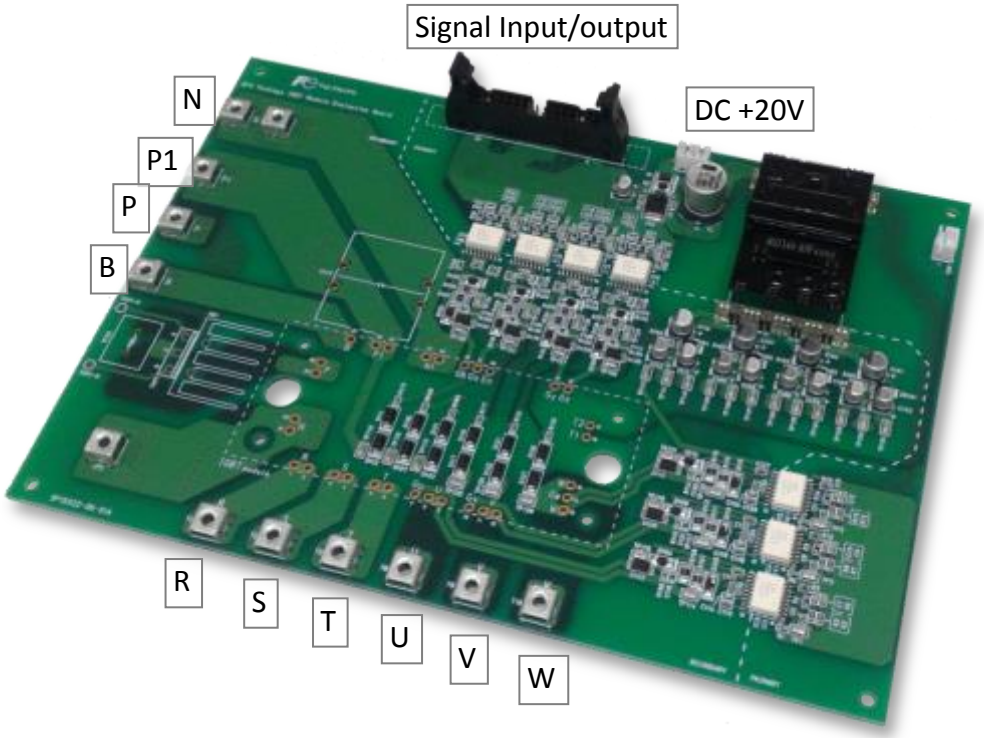


235mm x 165mm

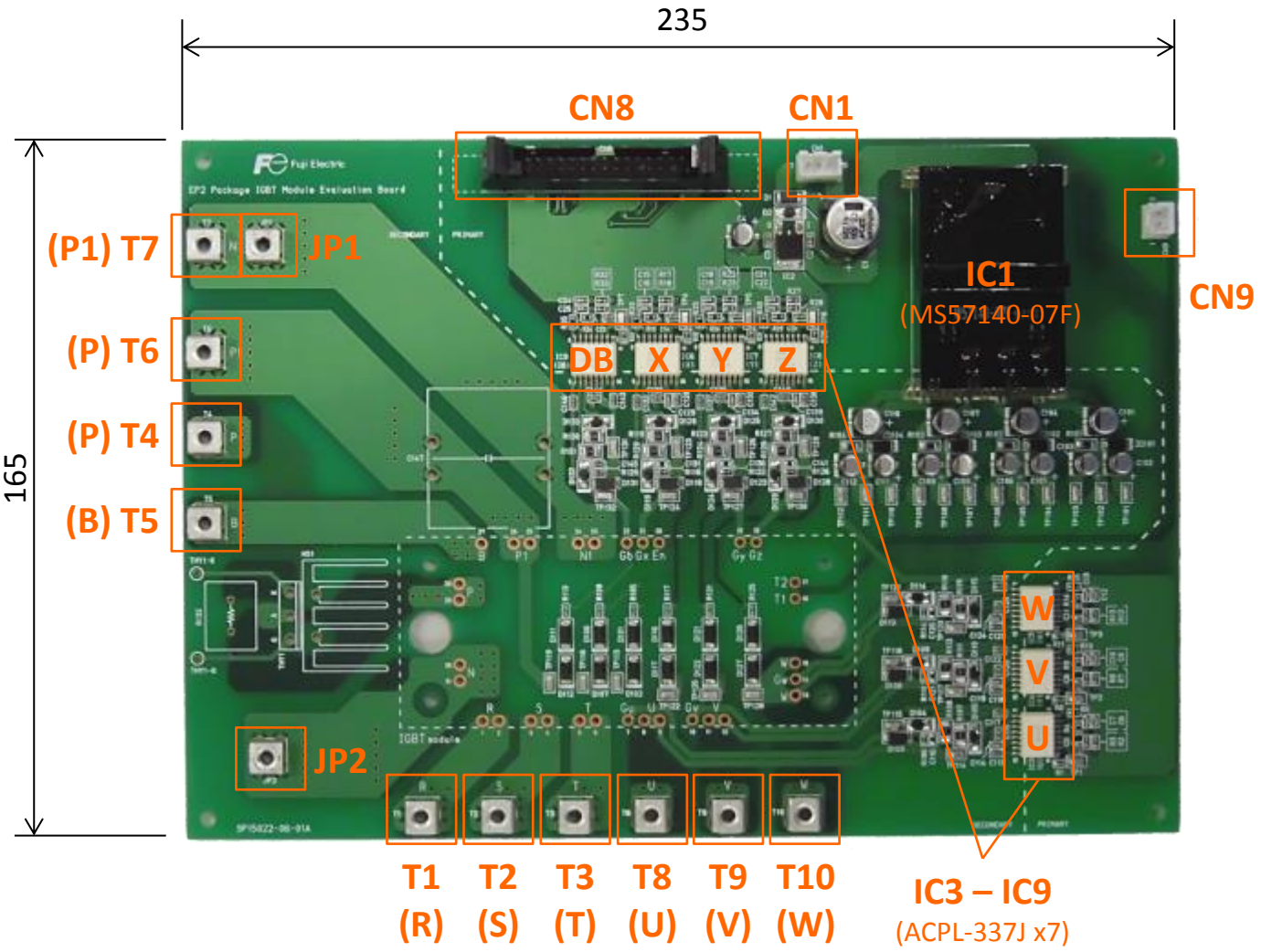
- ✓ On-board isolated DC/DC power supply
- ✓ Broadcom (Avago) ACPL-337J driver IC
  Integrated fail-safe IGBT protection
  - Desaturation detection, “Soft” IGBT turn-off and fault feedback
  - Under Voltage Lock Out (UVLO) protection with feedback
- ✓ +5V CMOS level for PWM and fault signals
- ✓ V_{GE}= +15V/-6V gate drive
- ✓ Support V_{GE}= +15V/0V gate drive (Option)
- ✓ We can provide the circuit diagram, PCB pattern, BOM to support your driver design

Supported modules : EP2 solder pins (M719), “M” type module

(V series) 7MBR25VM120-50, 7MBR35VM120-50, 7MBR50VM120-50

(X series) 7MBR50XMA065-50, 7MBR75XMA065-50,
7MBR35XMA120-50, 7MBR50XMA120-50, 7MBR75XME120-50

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

T5: Brake terminal

T4, T6: DC+ terminal

T7: DC- terminal

T8 – T10: 3ϕ AC output terminal

JP1, JP2: Jumper connection

Assembling

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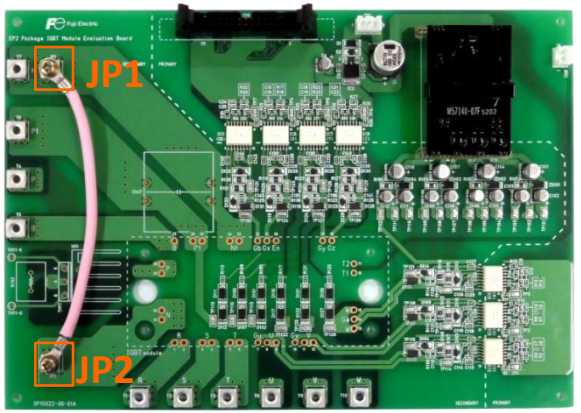
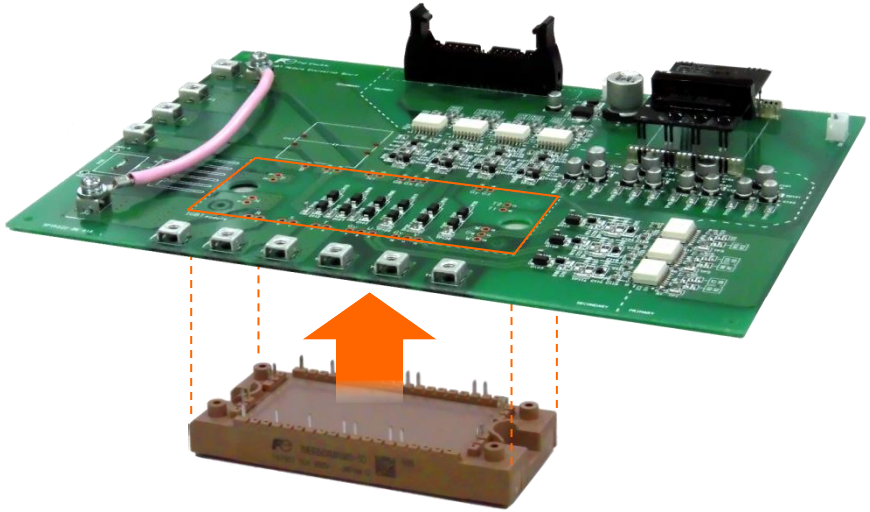
(1) Attach IC1 (MS57140-07F)

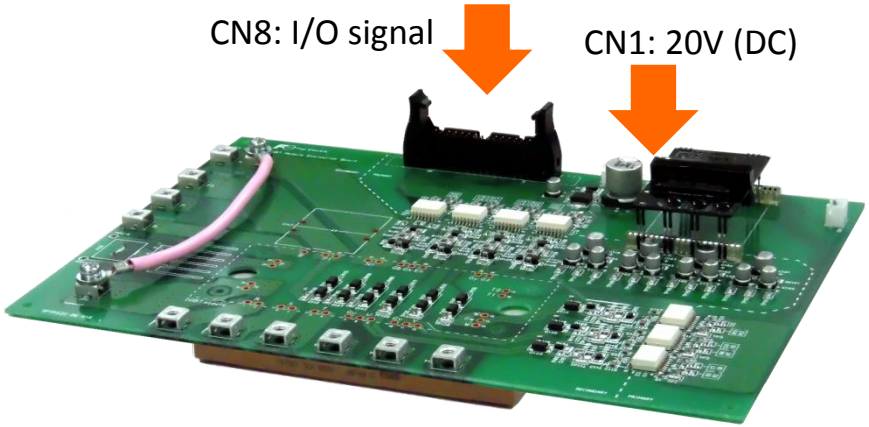
(2) Connect JP1 and JP2



(3) Attach and solder IGBT module to PCB



(4) Connect I/O signal and DC power supply



I/O Pin Assignments

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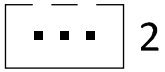
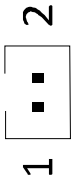
CN1



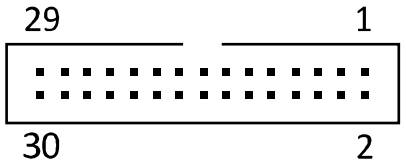
PIN No.	Pin name	Function
1	VDC_IN	+20V
2	NC	NC
3	GND	GND

CN9



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

CN8



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	

Electrical Characteristics

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Description	Parameter	Value	Unit	Remarks
DC input voltage for DC/DC converter	$V_{DC(in)}$	18 ~ 22	V	Recommended value: 20V
DC output votlage of DC/DC converter	V_{out1}	+15/-6	V	Gate-Emitter voltage
Primary side control voltage	V_{out2}	5	V	Non-isolation
PWM singal 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 threshould low to high	V_{UVLO+}	12.5	V	Follow the specification of ACPL-337J
UVLO threshould 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

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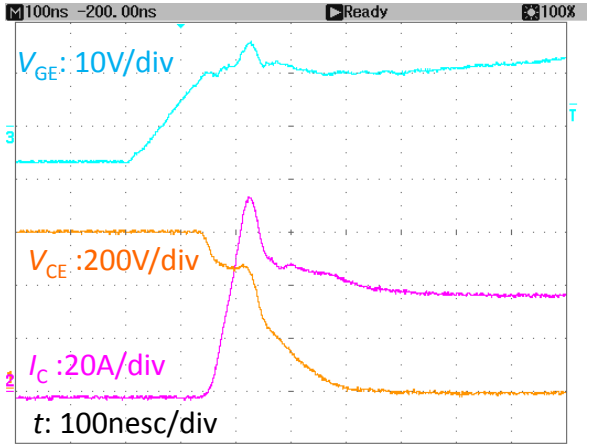
Test condition:

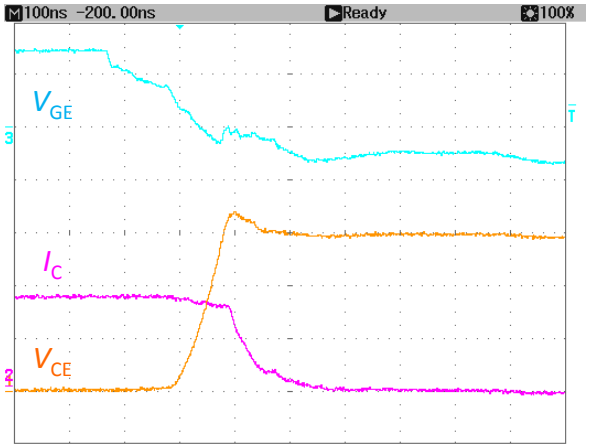
Module: 7MBR35XMA120-50

V_{cc}=600V, I_C=35A, $C_{snubber}$=0.22μF, R_G=15Ω, V_{GE}=+15V/-6V, T_{vj}=R.T.

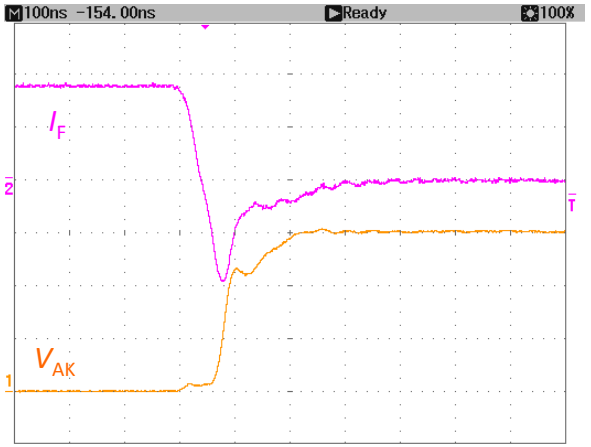
Turn on



Turn off



Reverse Recovery



Short Circuit Protection (DESAT)

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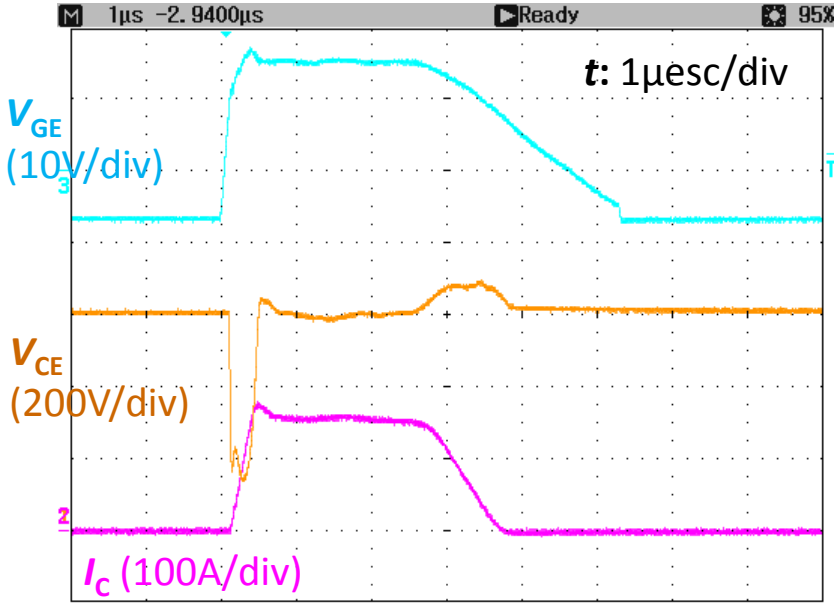
Test condition:

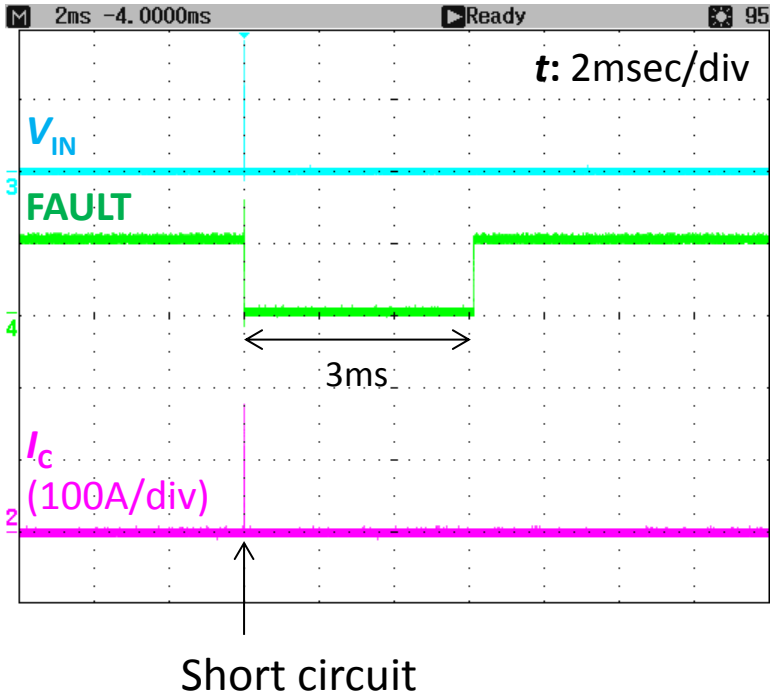
Module: 7MBR35XMA120-50

V_{cc}=600V, R_G=15Ω, V_{GE}=+15V/-6V, T_{vj}=R.T.

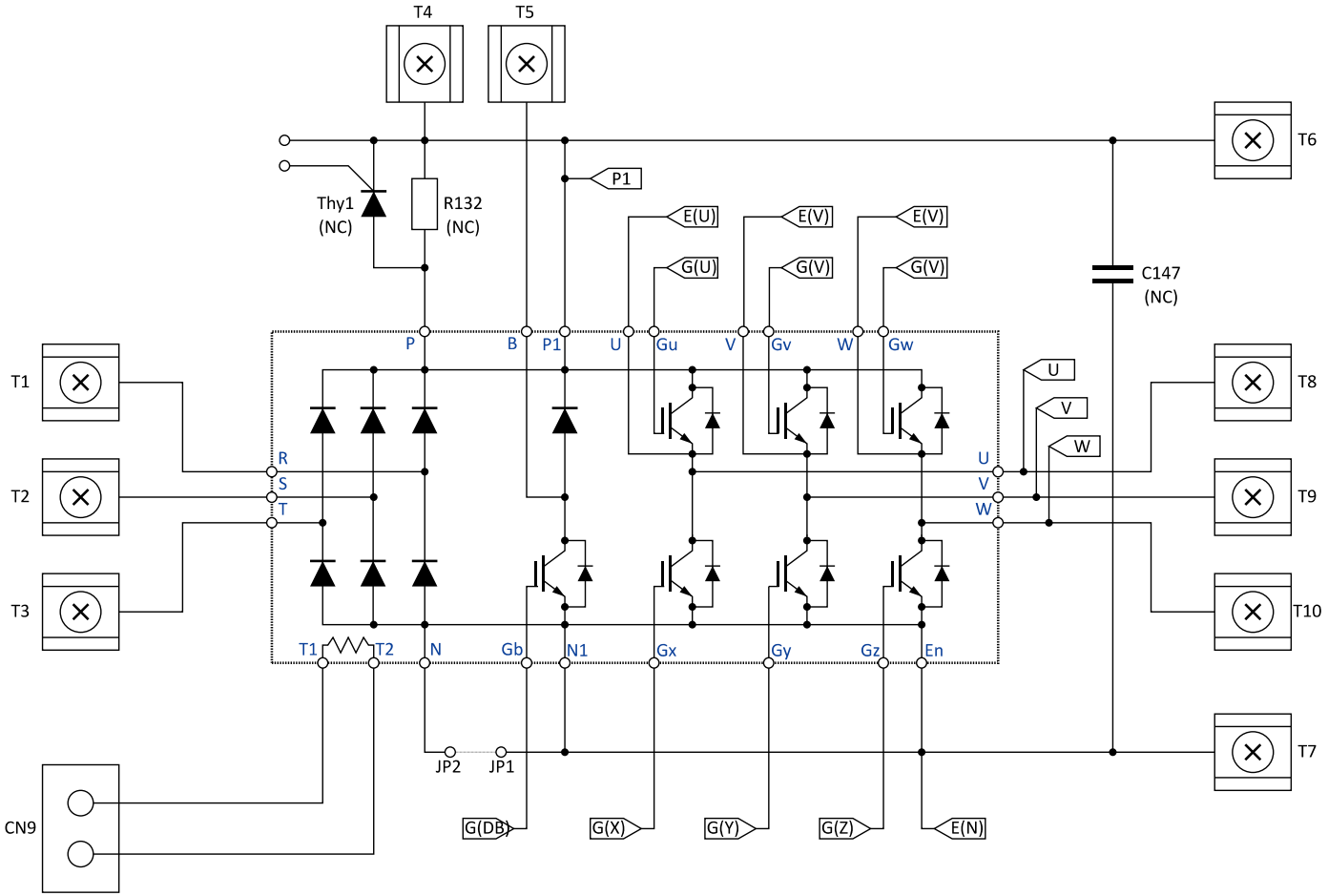
Short circuit waveforms



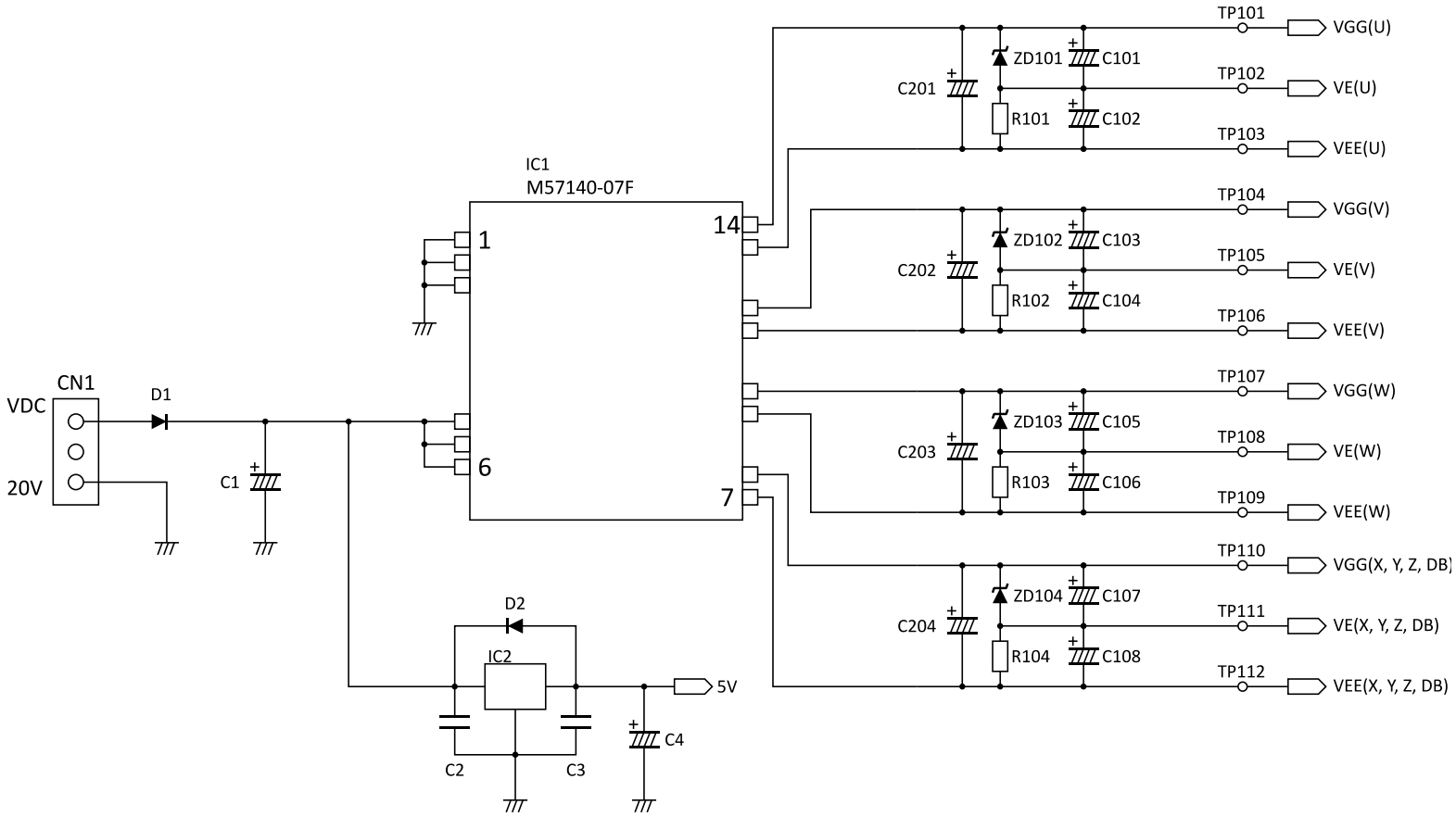
FAULT signal output



Circuit Diagram (Main Circuit)



Circuit Diagram (DC/DC Power Supply)



Circuit Diagram (Gate Drive)

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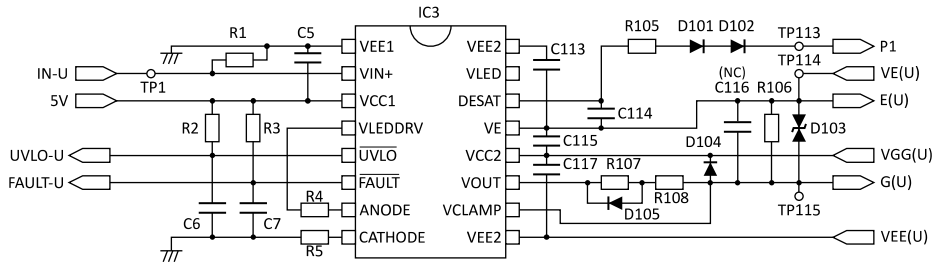

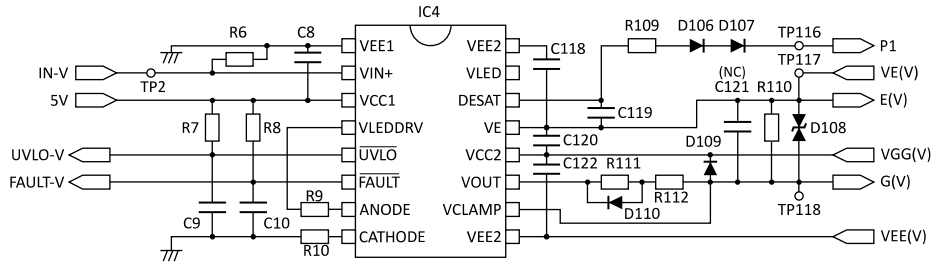

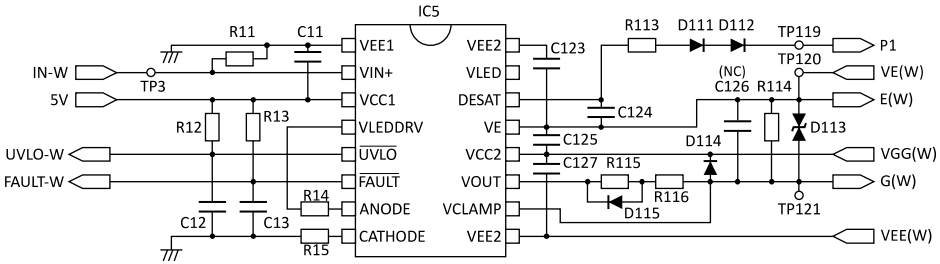

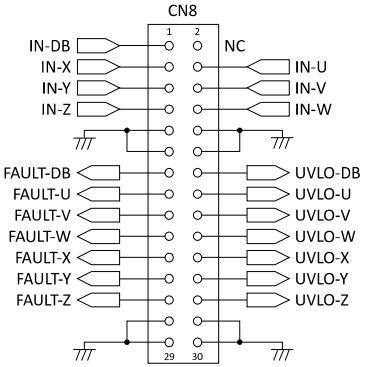

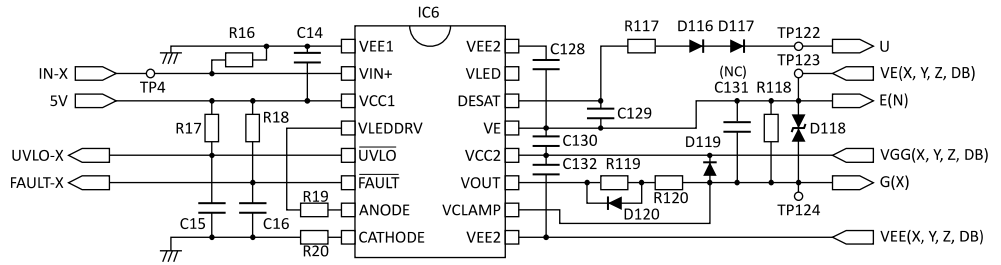

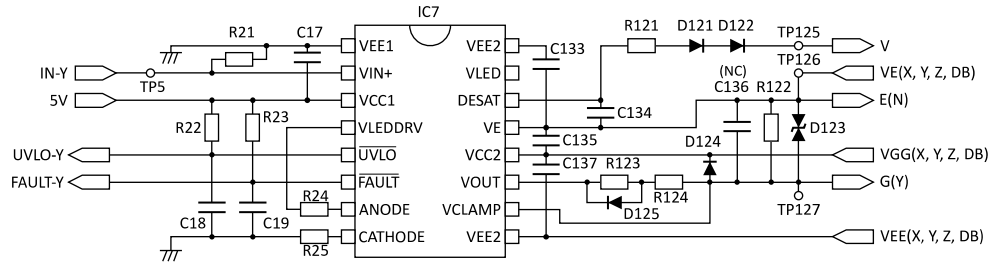

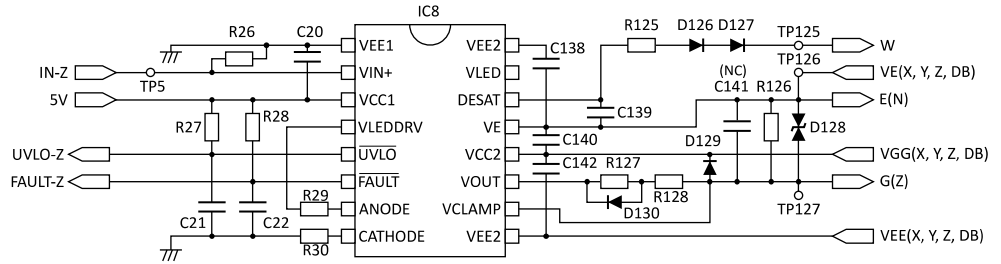

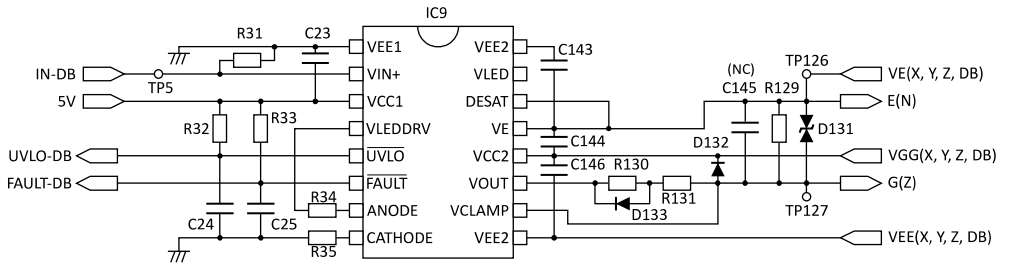

Bill of Material

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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	27	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, R129	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		
	R132	0	3Ω, 10W			NC
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		
	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 C145	0		1608		NC
	C147	0				NC

Bill of Material (Cont'd)

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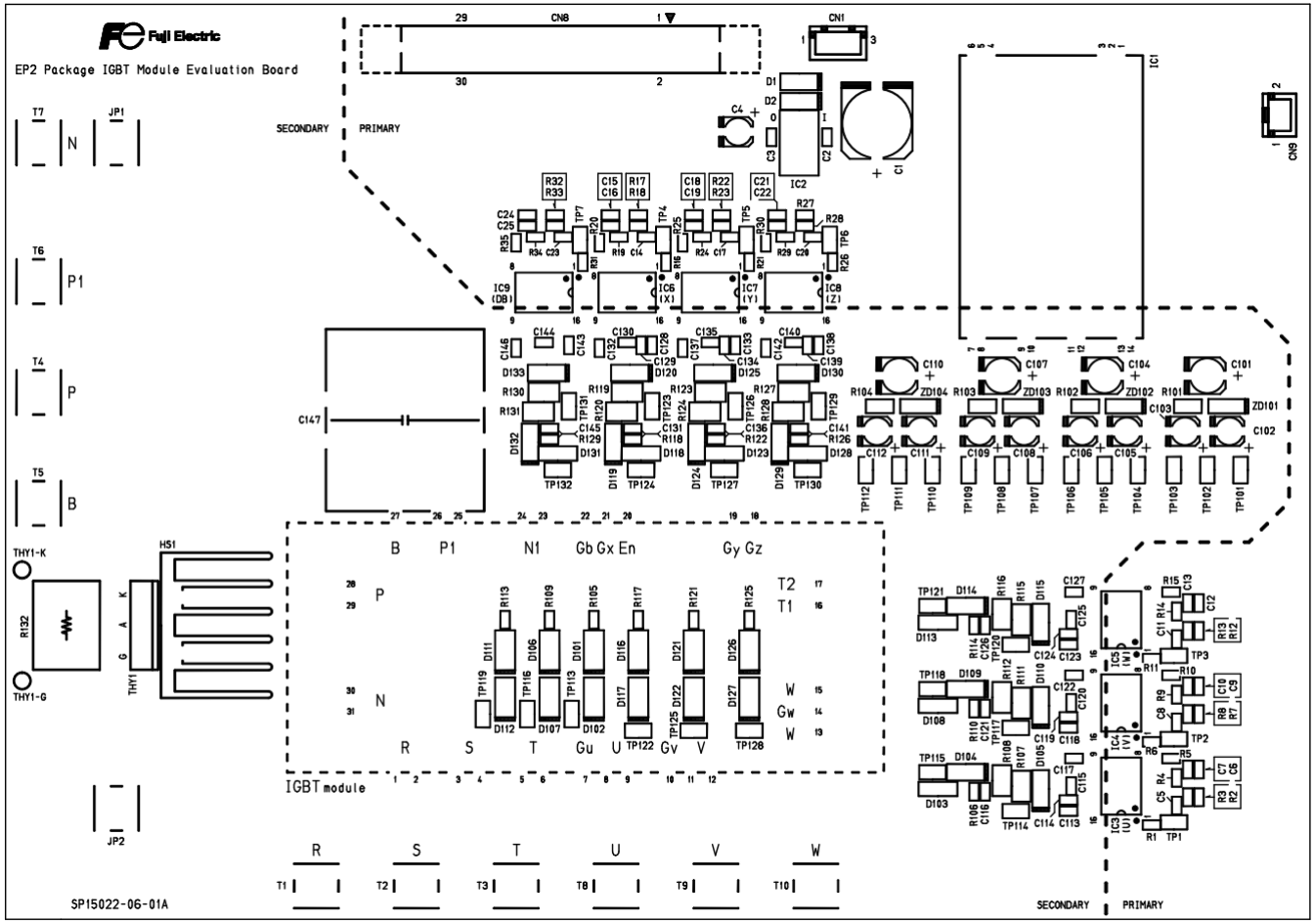
Component		Qty.	Value	Package	Manufacturer	Note
Diode	D2, D104, D105, D109, D110, D114, D115, D119, D120, D124, D125, D129, D130, D132, D133	15	40V, 1A			
	D101, D102, D106, D107, D111, D112, D116, D117, D121, D122, D126, D127	12	600V, 1A			
Zenner Diode	D101, D102, D103, D104	4	15V, 1W			
Thyristor	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				

PCB Layers



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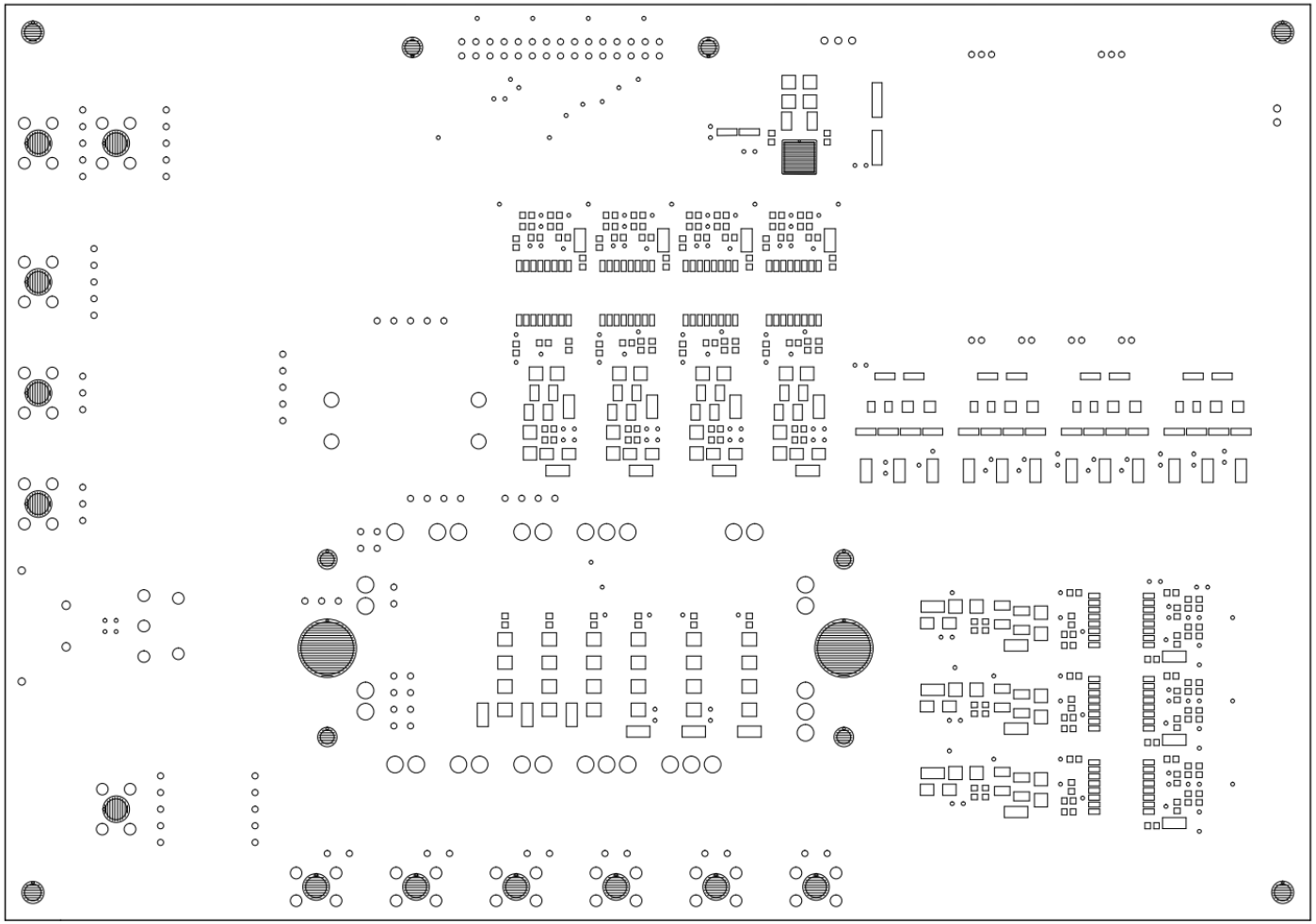
PCB Layers



(Top Solder Resist Layer)

PCB Layers

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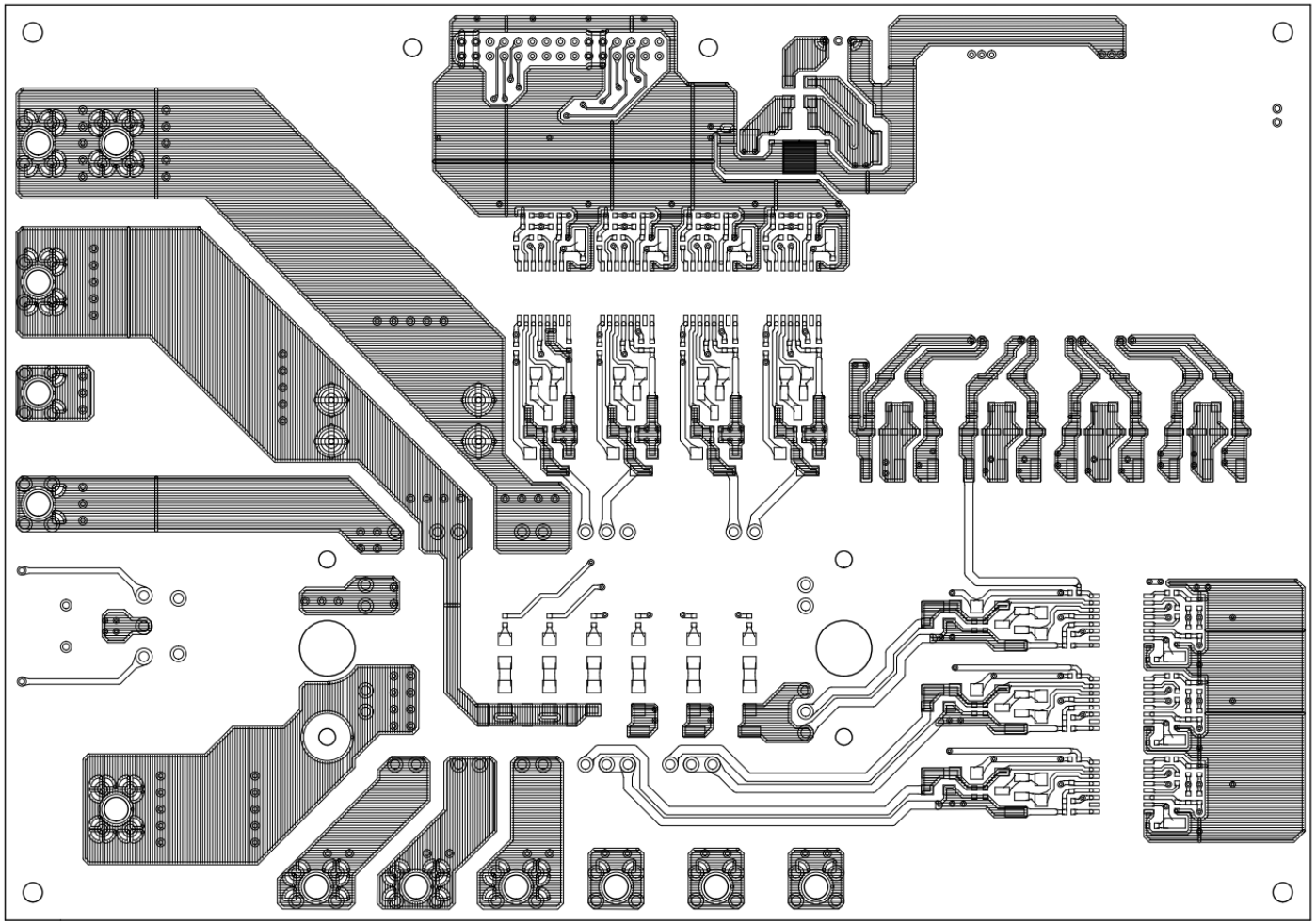
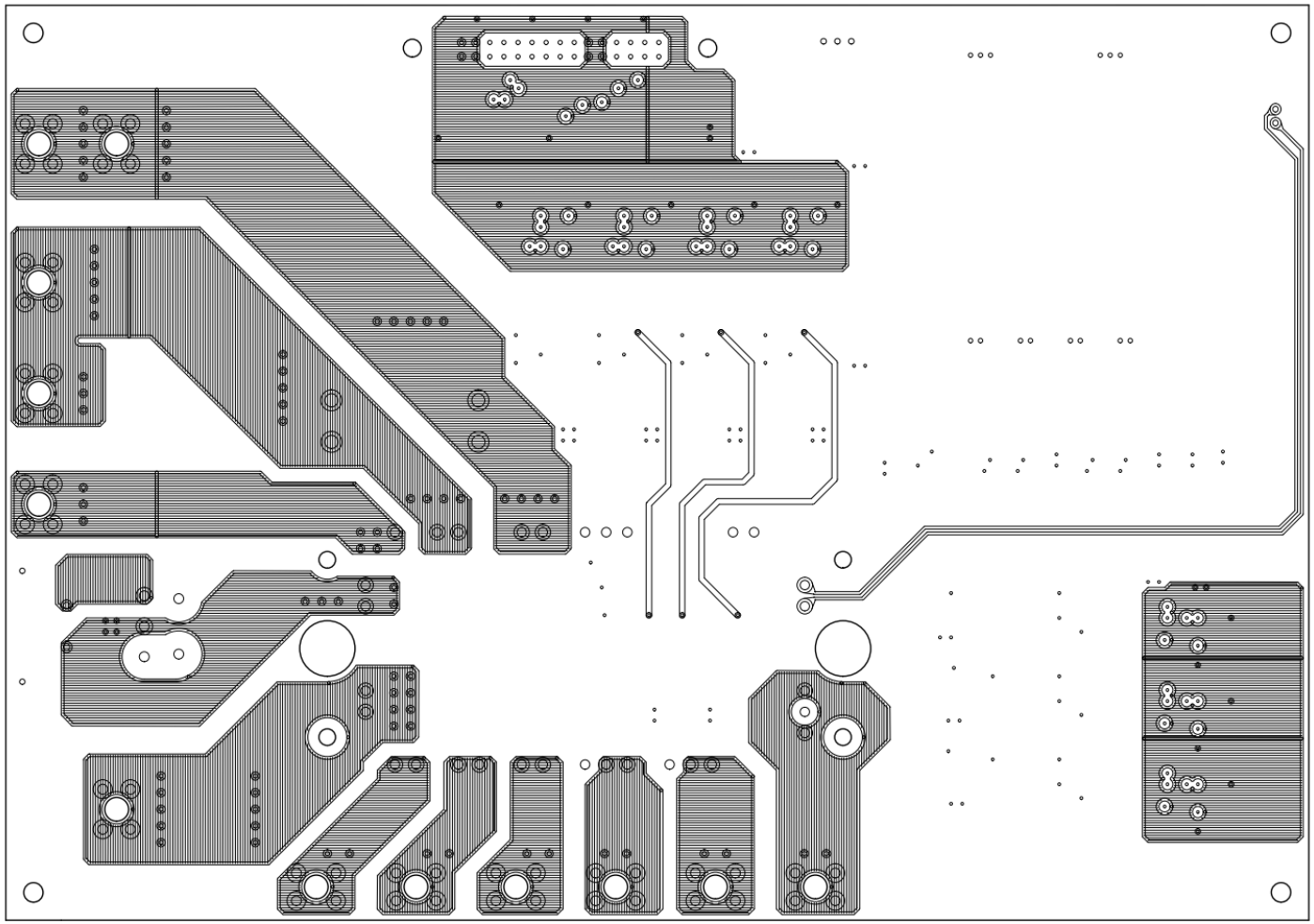


(Top Layer)

PCB Layers



(Layer 2)

PCB Layers

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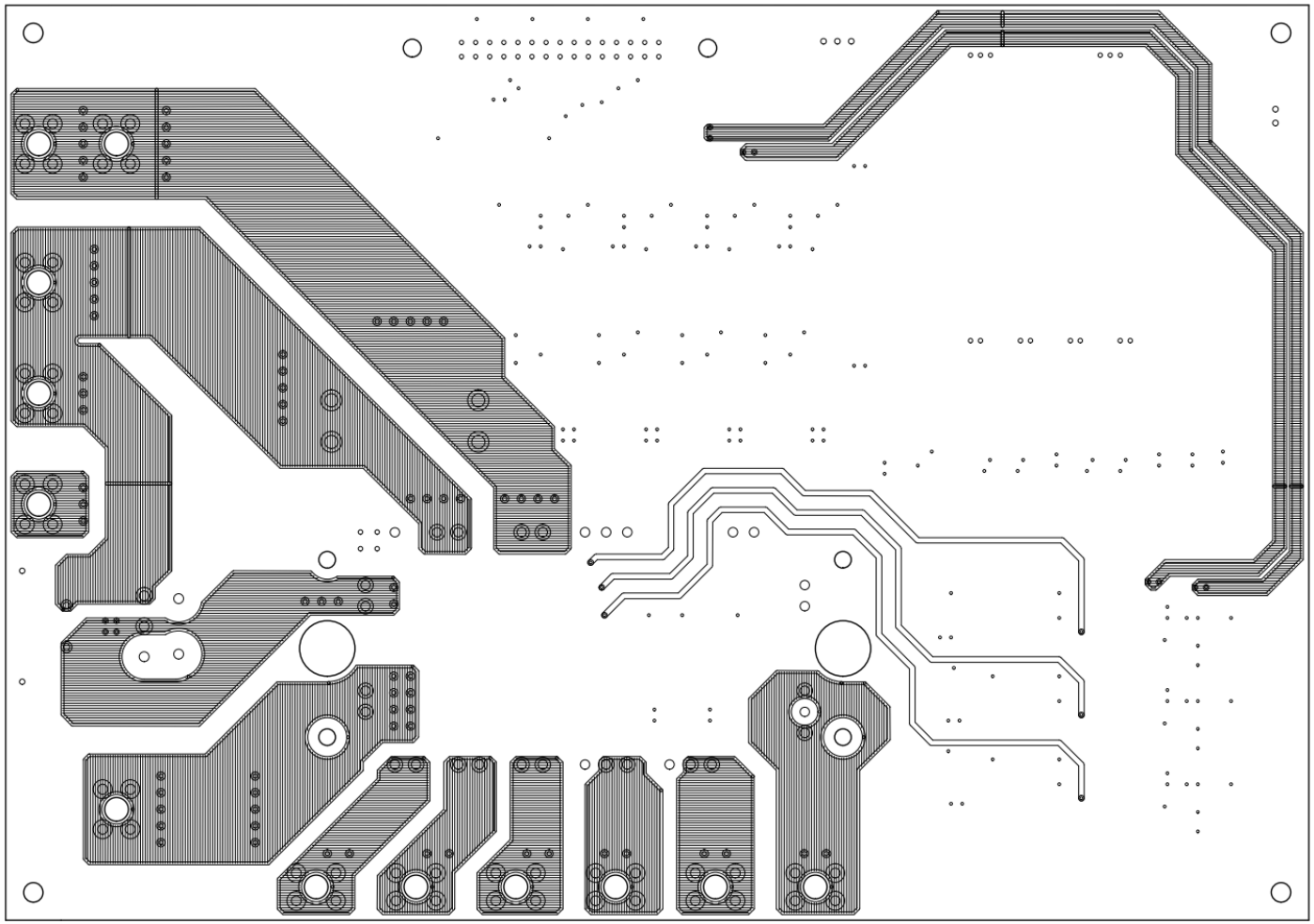
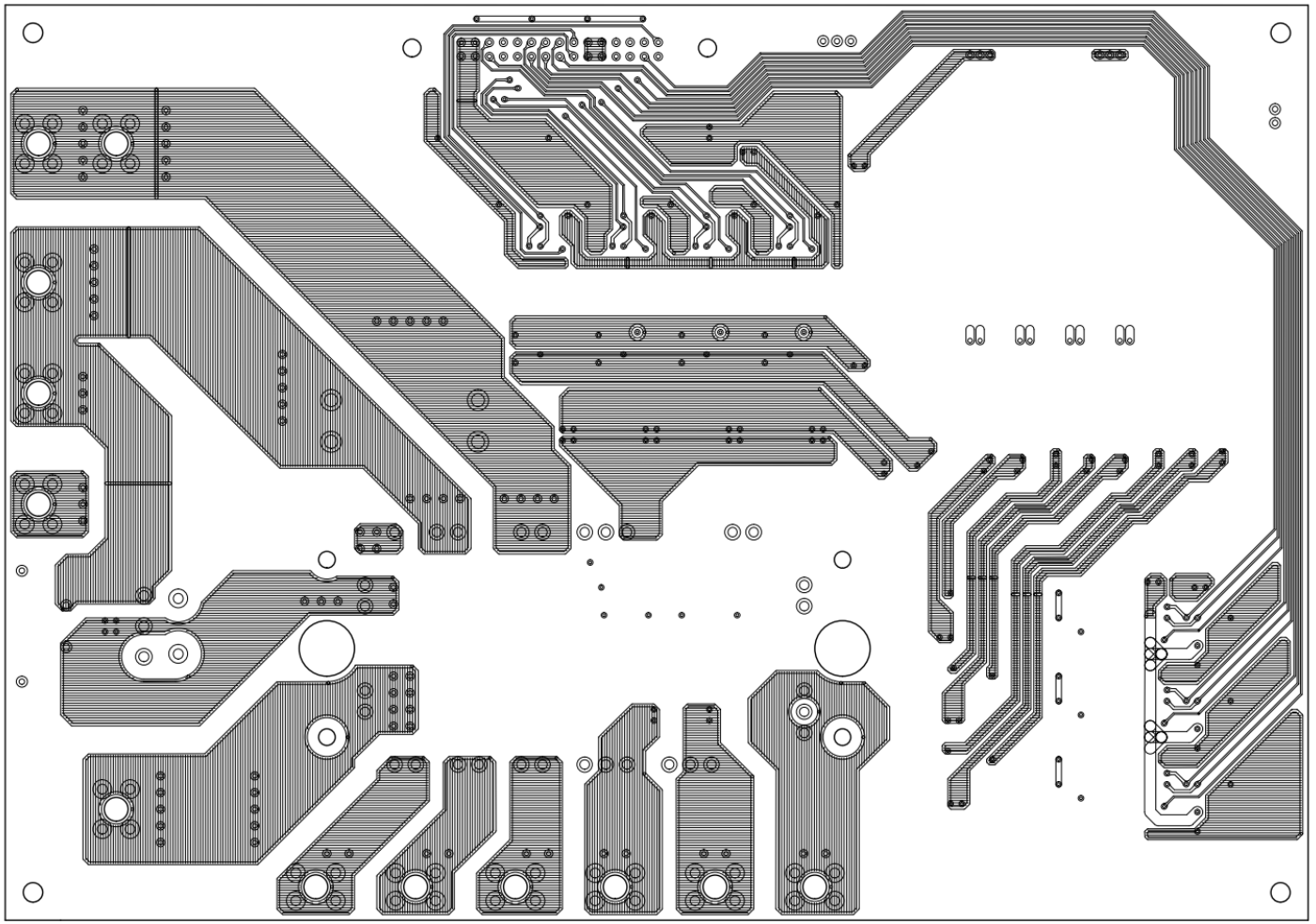


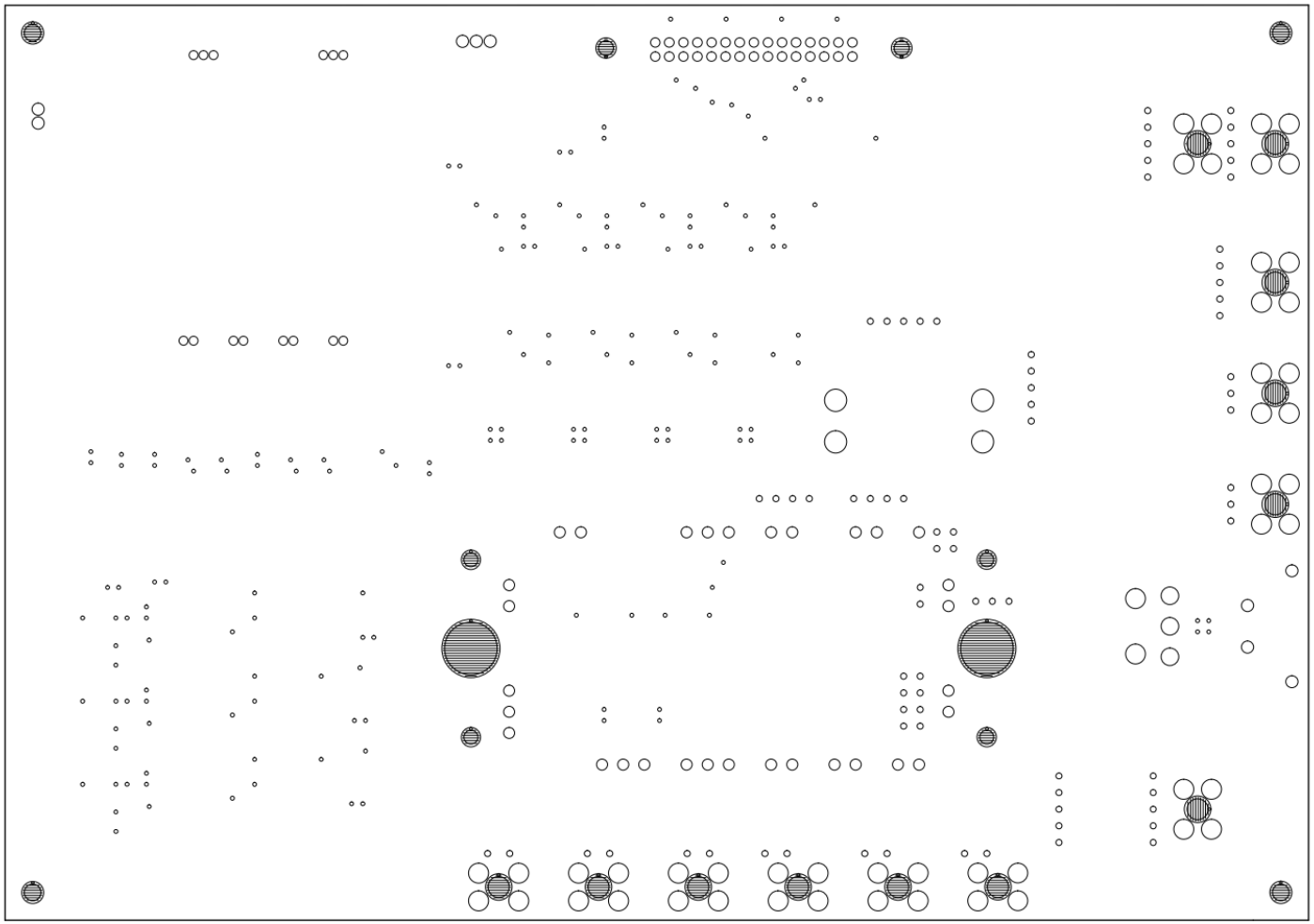
(Layer 3)

PCB Layers



(Bottom Layer)

PCB Layers



(Bottom Solder Resist Layer)

Contact

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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.

If you don’t know the contact address, please request through our website:
www.fujielectric.com/products/semiconductor/contact/

For more information, please visit our website: www.fujielectric.com/products/semiconductor/

Warnings

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   - Computers - OA equipment - Communications equipment (terminal devices) - Measurement equipment
   - Machine tools - Audiovisual equipment - Electrical home appliances - Personal equipment - Industrial robots etc.
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   - Transportation equipment (mounted on cars and ships) - Trunk communications equipment -Traffic-signal control equipment
   - Gas leakage detectors with an auto-shut-off feature - Emergency equipment for responding to disasters and anti-burglary devices
   - Safety devices - Medical equipment.
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   - Space equipment - Aeronautic equipment - Nuclear control equipment - Submarine repeater equipment
7.
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