Small PIM module (M729/M733) Evaluation Board

Device Application Technology Dept.
Sales Div.
Electronic Devices Business Gr.

DOC. No.	MT6M14257	
	DATE	NAME
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APPROVED	Jan. 5, 2018	N. Fujisawa

Evaluation Board for M729/M733

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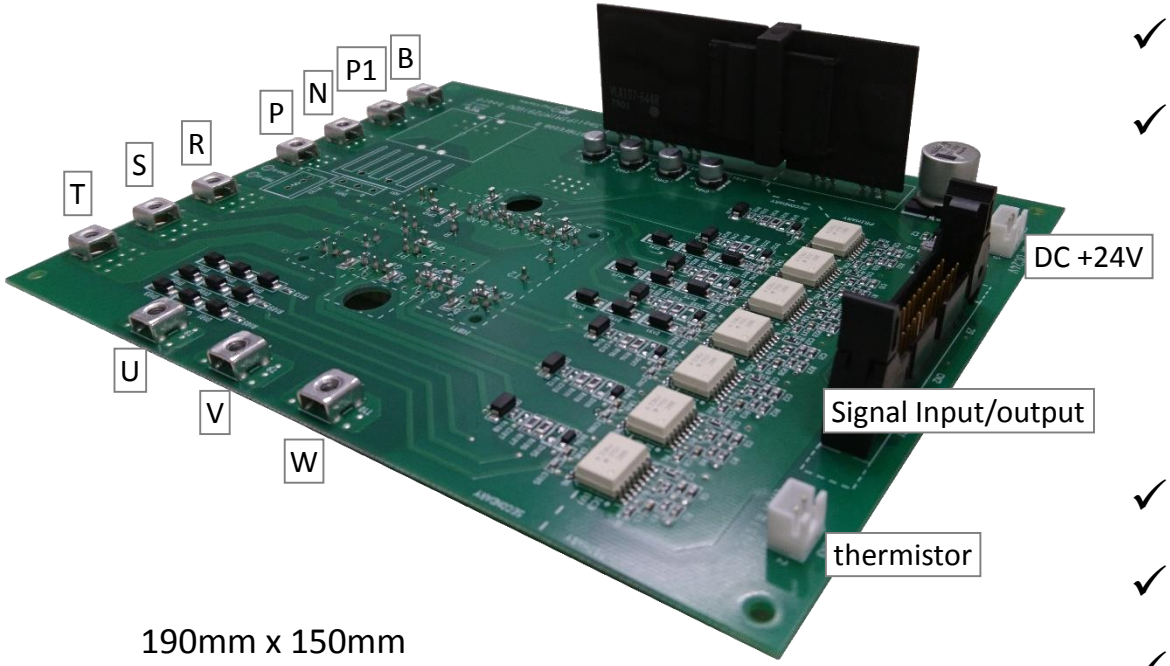

190mm x 150mm

- ✓ On-board isolated DC/DC power supply
- ✓ Broadcom (Avago) ACPL-336J 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/-0V gate drive
- ✓ We can provide the circuit diagram, PCB pattern, BOM to support your driver design

Supported modules : Small PIM (M729/M733) solder pins modules

(V series) 7MBR50VKD060-50, 7MBR15VKD120-50, 7MBR25VKD120-50, 7MBR35VKD120-50
(X series) 7MBR50XKD065-50, 7MBR15XKD120-50, 7MBR25XKD120-50, 7MBR35XKD120-50

Layout of the Evaluation Board

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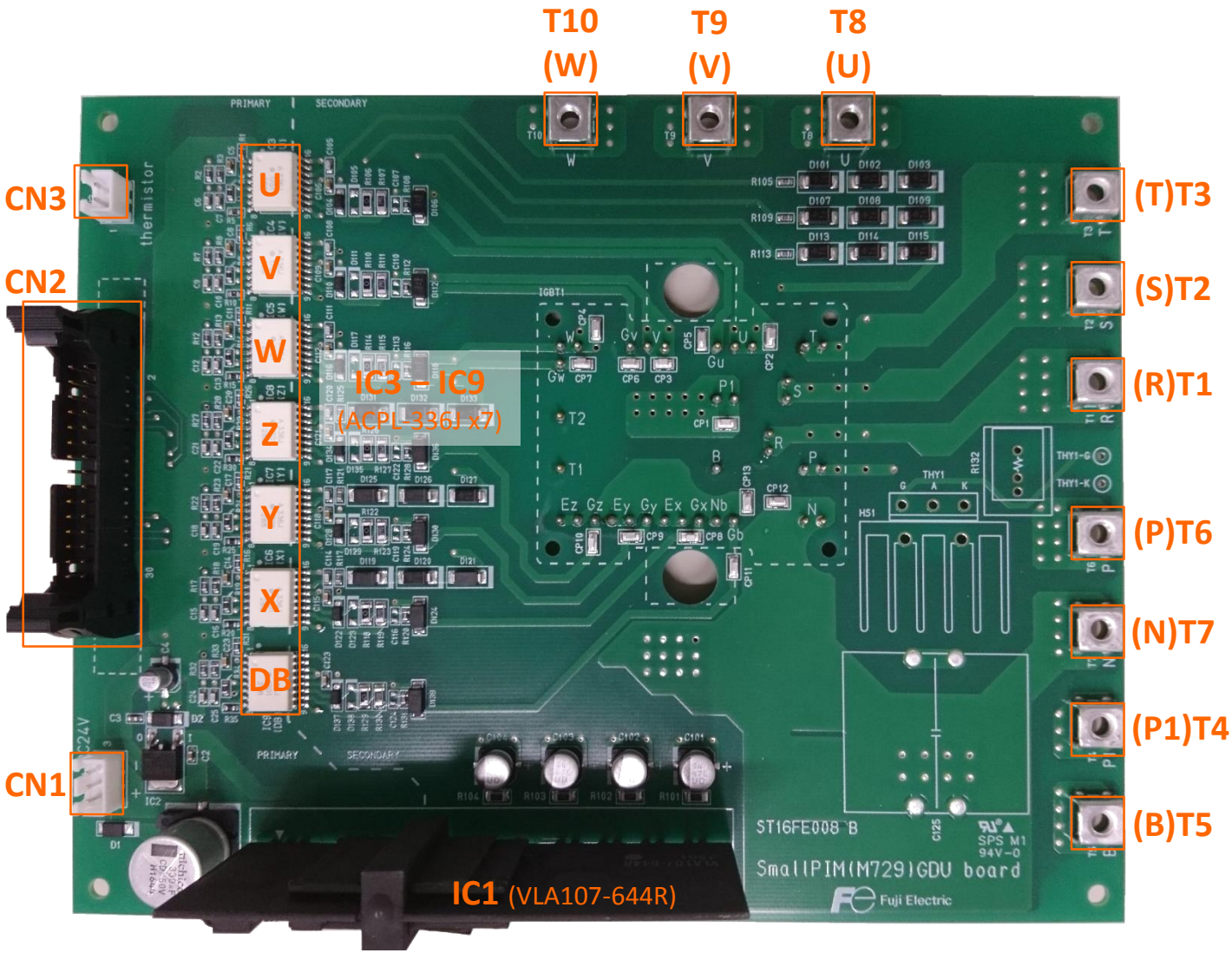

IC3 – IC9: Gate driver IC ACPL-336J

IC1: DC/DC power supply

CN1: Power supply connector (DC +24V)

CN2: Gate PWM signal input/ Fault signal output

CN3: NTC output

T1 – T3: 3ϕ AC input terminal

T8 – T10: 3ϕ AC output terminal

T4,T6: DC+ terminal

T5: Brake terminal

T7: DC- terminal

Assembling(1/2)

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(1) Attach gate resistance(R_G)

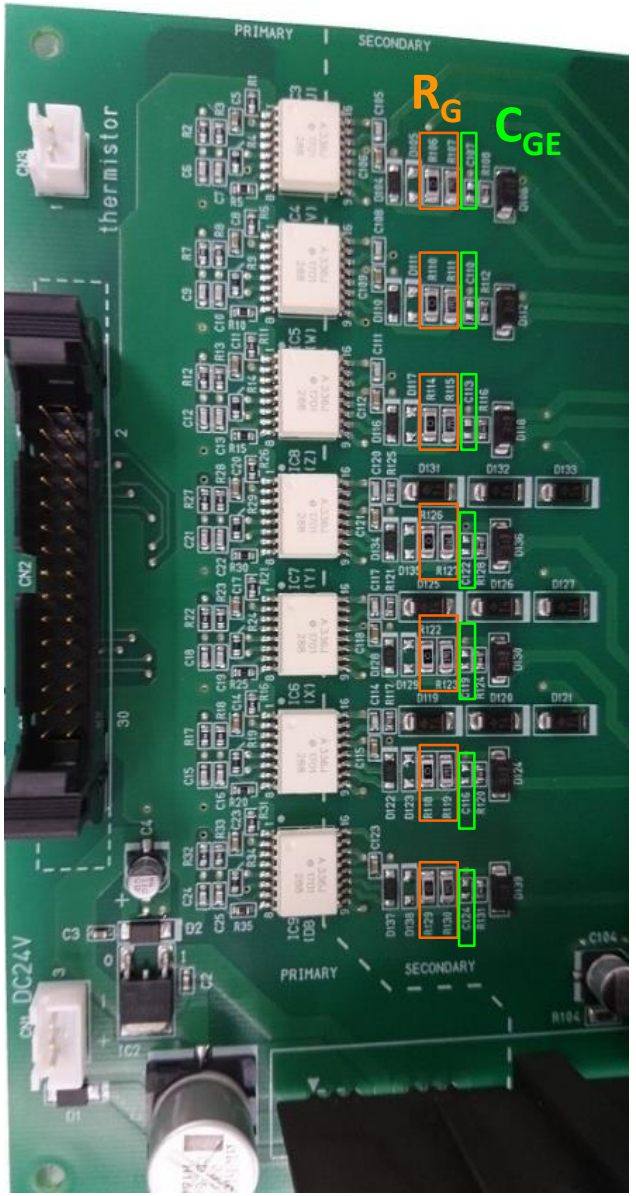
To change R_G , please change
『R106,R110,R114,R118,R122,R126,R129,』and
『R107,R111,R115,R119,R123,R127,R130』. The initial value is
『R106,R110,R114,R118,R122,R126,R129,』: 0Ω
『R107,R111,R115,R119,R123,R127,R130』: 39Ω

The standard R_G of the M729 and M733 modules are shown in the under table.

V series	X series	Standard R_G
7MBR50VKD060-50	7MBR50XKD065-50	8.2Ω
7MBR15VKD120-50	7MBR15XKD120-50	39Ω
7MBR25VKD120-50	7MBR25XKD120-50	20Ω
7MBR35VKD120-50	7MBR35XKD120-50	12Ω

(2) Attach capacitor between gate and emitter (C_{GE})

To add C_{GE}, please attach
『C107,C110,C113,C116,C119,C122,C124』.



Assembling(2/2)

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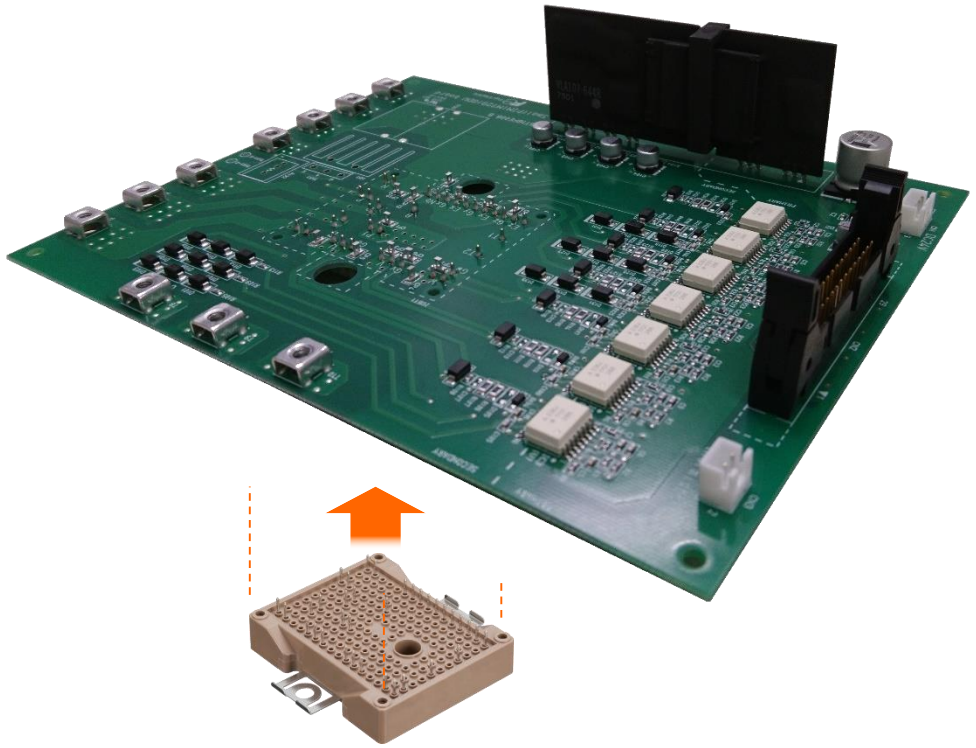
(3) Attach and solder IGBT module to PCB



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

CN2: I/O signal

CN1: 24V (DC)

I/O Pin Assignments

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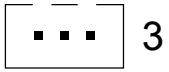
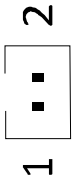
CN1



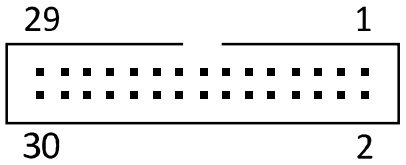
PIN No.	Pin name	Function
1	VDC_IN	+24V
2	NC	NC
3	GND	GND

CN3



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

CN2



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	$V_{DC(in)}$	12~24	V	Recommended value: 24V
DC output votlage of DC/DC converter	V_{out1}	+15/-0	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	$I_{O(peak)}$	2.5	A	Follow the specification of ACPL-336J
Peak output current for gate drive per IGBT	$I_{O(peak)}$	2.5	A	Follow the specification of ACPL-336J
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-336J
FAULT pin voltage	V_{FAULT}	5	V	Follow the specification of ACPL-336J
FAULT logic low output current	I_{FAULT_L}	9.0	mA	Follow the specification of ACPL-336J
UVLO output current	I_{UVLO}	10	mA	Follow the specification of ACPL-336J
UVLO pin voltage	V_{UVLO}	5	V	Follow the specification of ACPL-336J
UVLO threshould low to high	V_{UVLO+}	12.5	V	Follow the specification of ACPL-336J
UVLO threshould high to low	V_{UVLO-}	11.3	V	Follow the specification of ACPL-336J
DESAT detection threshold	V_{DESAT}	7	V	Follow the specification of ACPL-336J
Output Mute Time due to DESAT	$t_{DESAT(MUTE)}$	3.0	ms	Follow the specification of ACPL-336J
Time Input Kept Low Before Fault Reset to High	$t_{DESAT(RESET)}$	3.0	ms	Follow the specification of ACPL-336J

Please refer to datasheet of ACPL-336J and VLA107-644R for other characteristics.

Example of Switching Waveform

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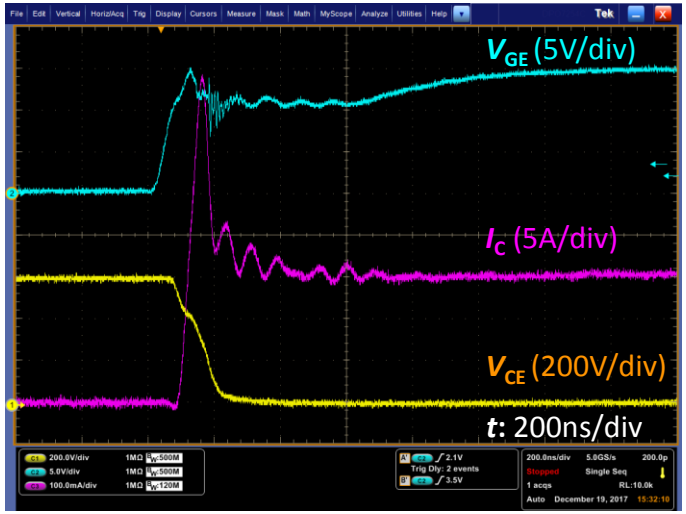
Test condition:

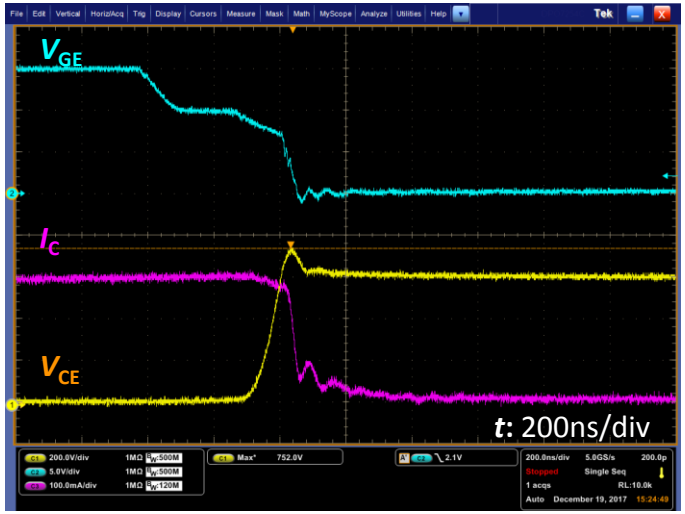
Module: 7MBR15VKD120-50

V_{cc}=600V, I_C, I_F=15A, R_G=39Ω, V_{GE}=+15V/-0V, T_{vj}=R.T.

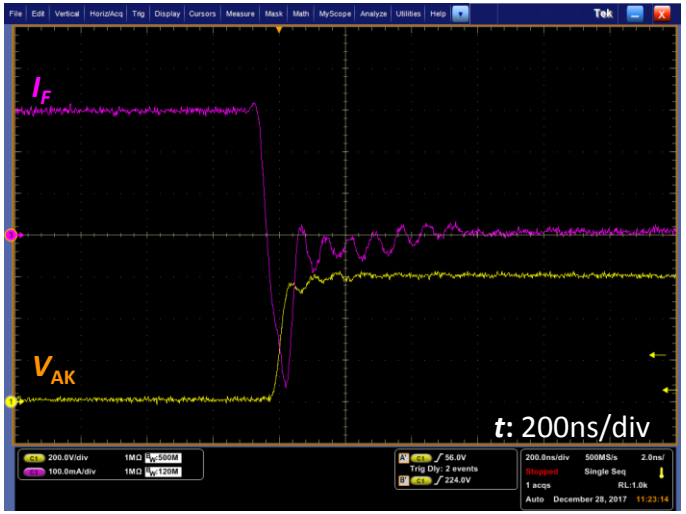
Turn on



Turn off



Reverse Recovery



Short Circuit Protection (DESAT)

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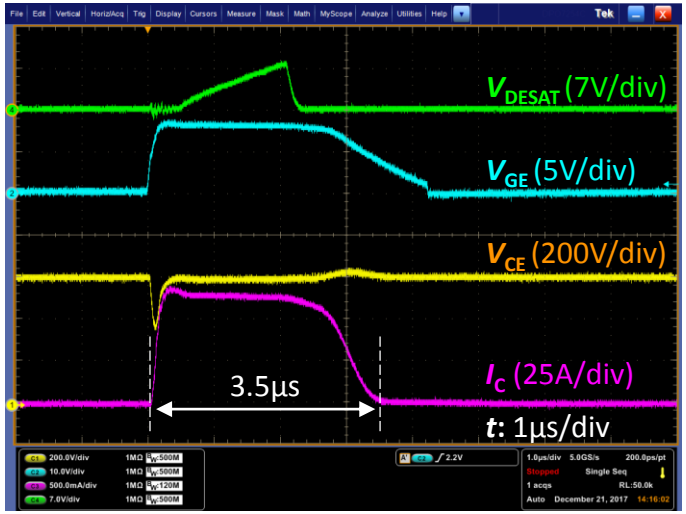
Test condition:

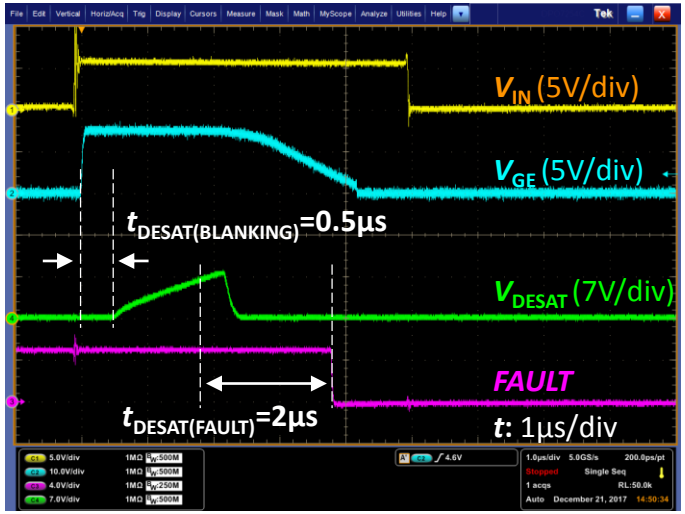
Module: 7MBR15VKD120-50

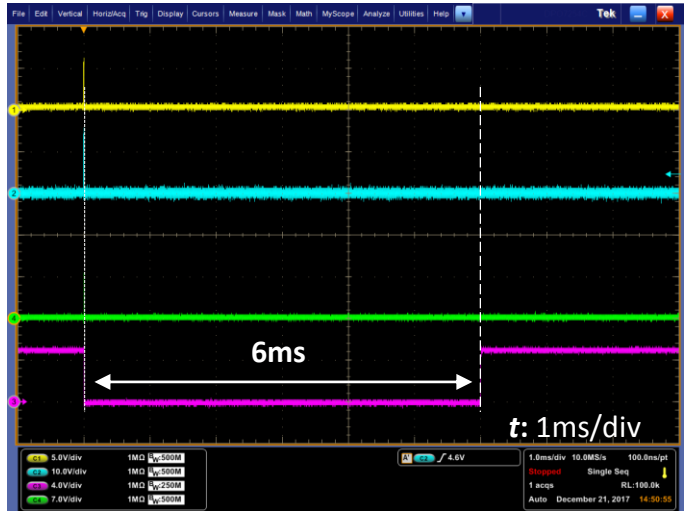
V_{cc}=600V, R_G=39Ω, V_{GE}=+15V/-0V, T_{vj}=R.T.

Short circuit waveforms



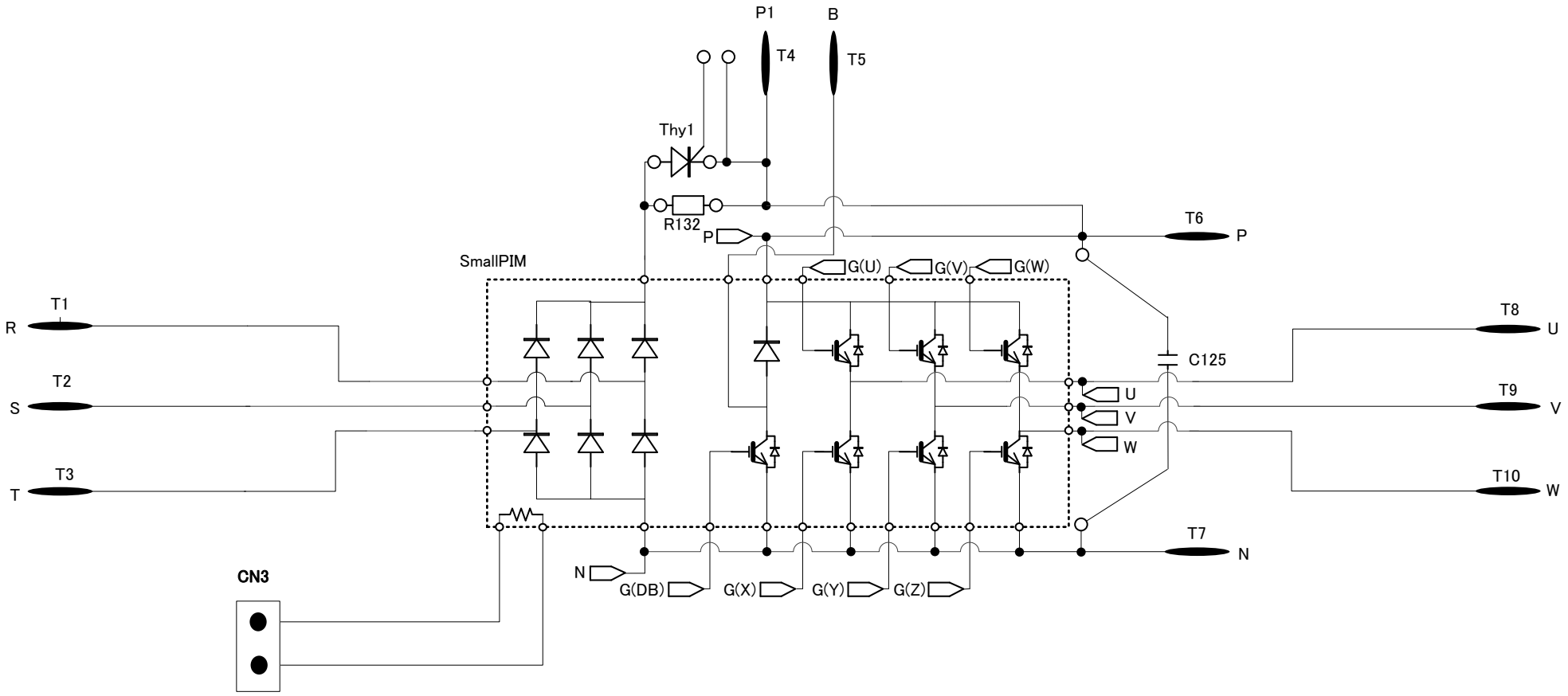
Operation of DESAT detection





Short circuit

Circuit Diagram (Main Circuit)



Circuit Diagram (DC/DC Power Supply)

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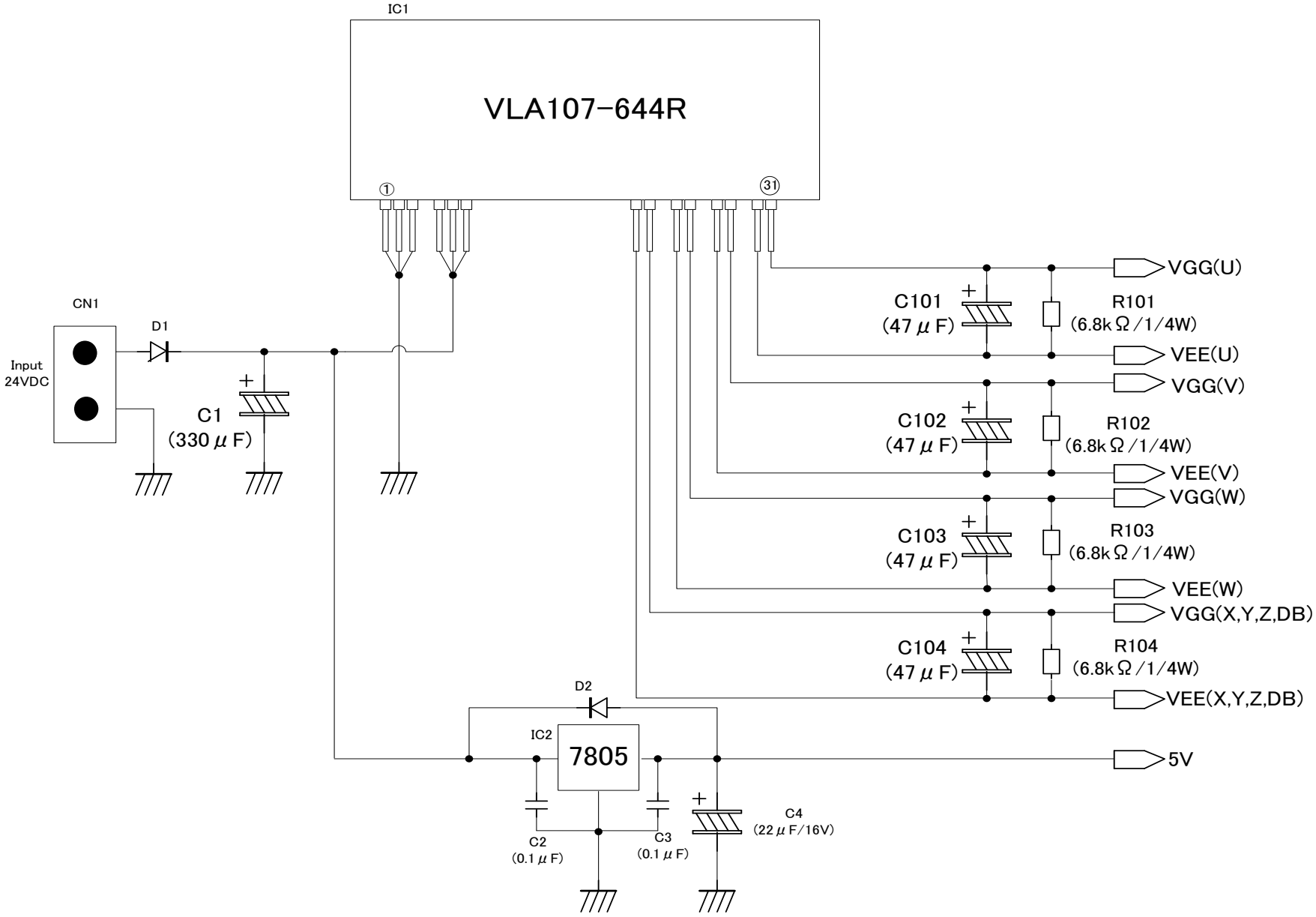
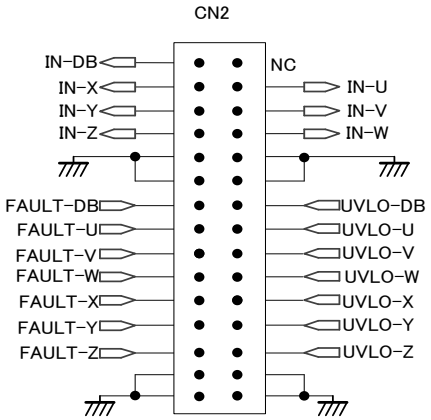
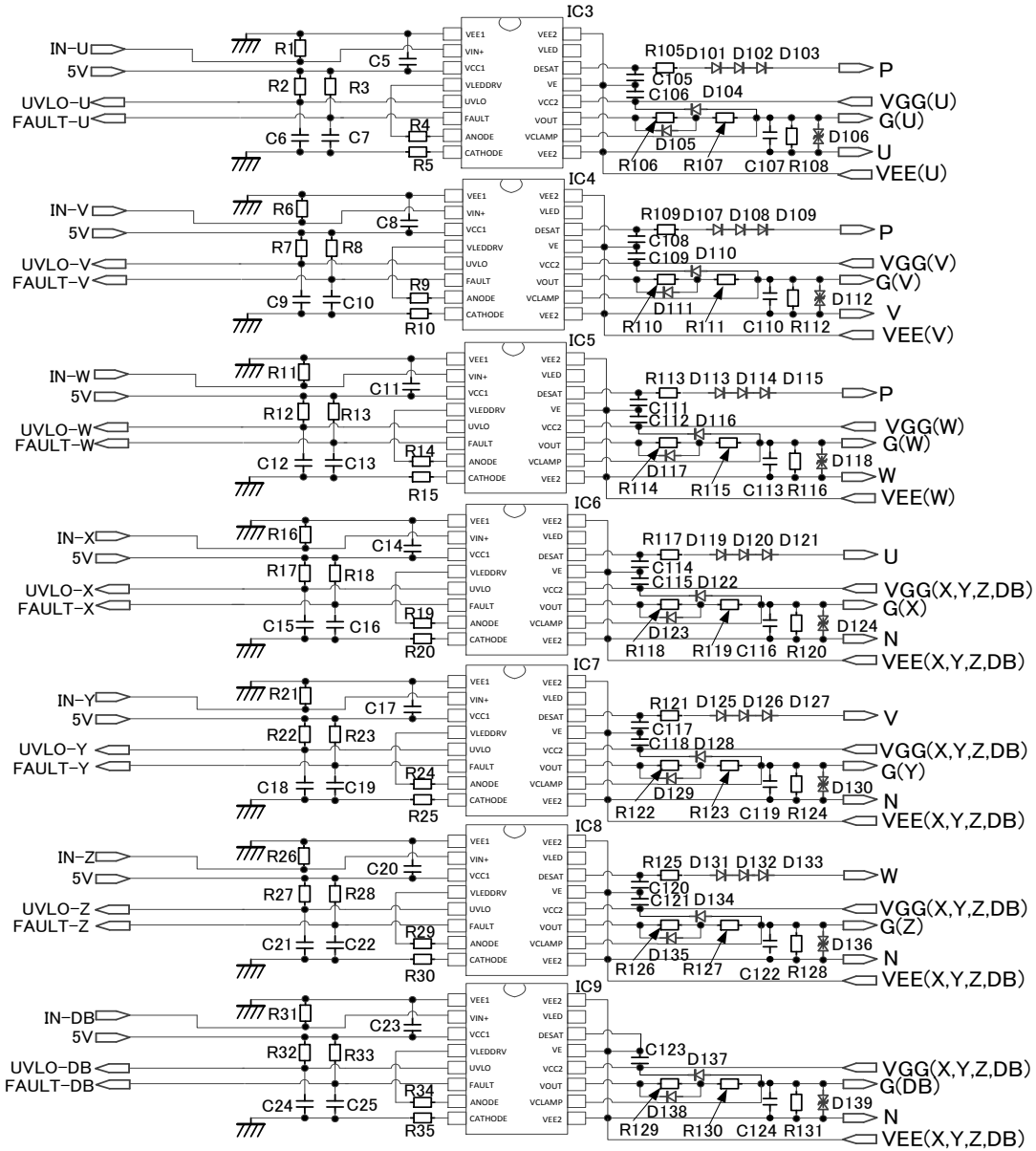


Circuit Diagram (Gate Drive)





Bill of Material

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Component			Qty.	Value	Package	Manufacturer	Note
Resistor	R	1,2,3,6,7,8,11,12,13,16,17,18, 21,22,23,26,27,28,31,32,33, 108,112,116,120,124,128,131	28	10KΩ、1/10W	1608		
		4,5,9,10,14,15,19,20,24,25, 29,30,34,35	14	150Ω、1/10W	1608		
		105,109,113, 117,121,125	6	1KΩ、1/10W	1608		
		101,102,103, 104	4	6.8KΩ、1/4W	3216		
		106,110,114, 118,122,126, 129	7	0Ω、1/4W	3216		Gate resistance: RG
		107,111,115, 119,123,127, 130	7	39Ω、1/4W	3216		Gate resistance: RG
		132	0				Input surge current blocking resistor
Capacitor	C	1	1	50V、330uF			
		4	1	16V、22uF			
		101,102,103, 104	4	25V、47uF			
		2,3	2	50V、0.1uF	1608		
		5,8,11,14,17,20,23, 106,109,112,115,118,121,123	14	50V、1uF	1608		
		6,7,9,10,12,13,15,16,18,19, 21,22,24,25	14	50V、330pF	1608		
		105,108,111, 114,117,120	6	50V、220pF	1608		
		107,110,113, 116,119,122, 124	0		1608		Cge
		125	0				

Bill of Material (Cont'd)

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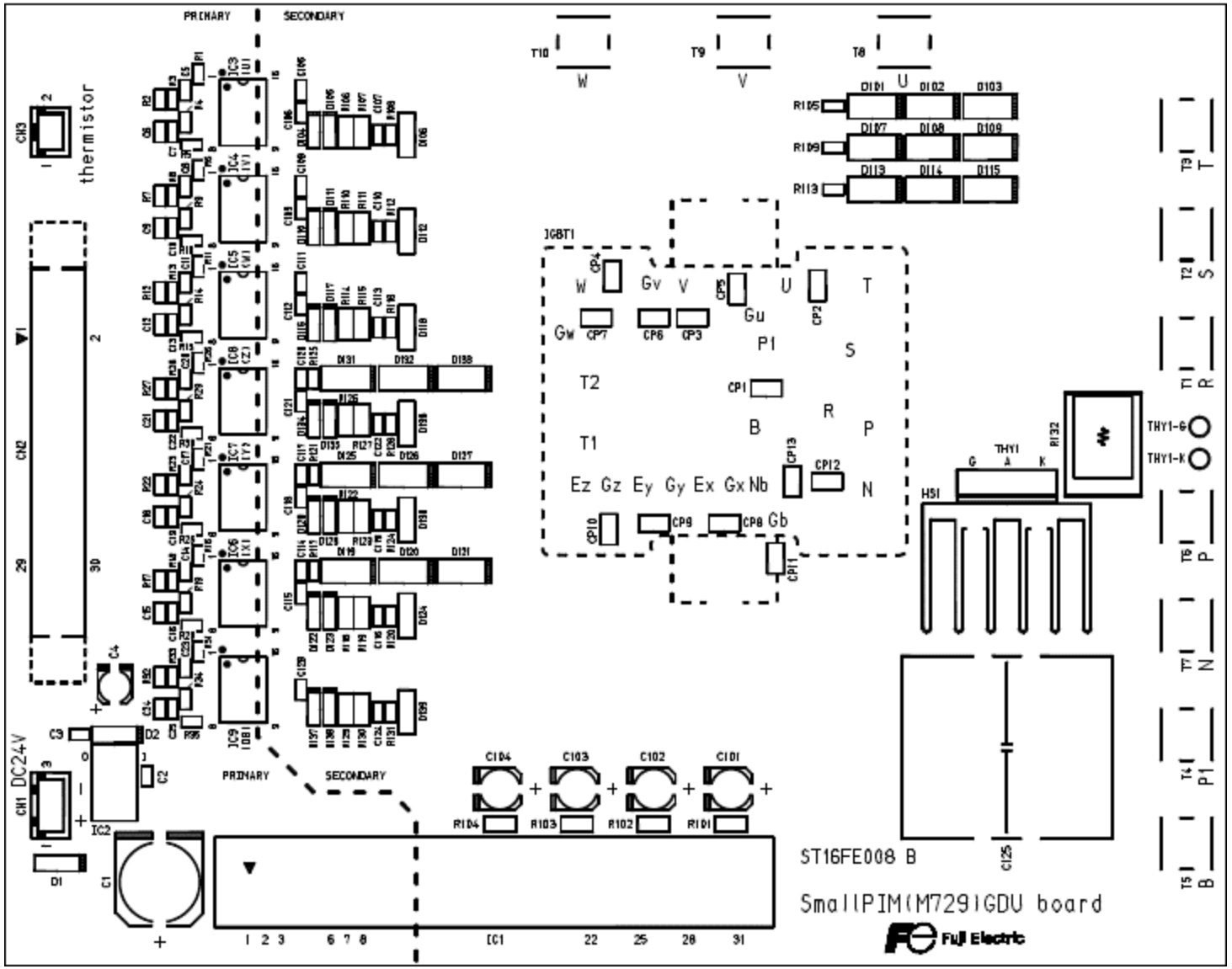
Component			Qty.	Value	Package	Manufacturer	Note
Diode	D	1	1	40V、5A PMEG4050EP			
		2	1	40V、1A PMEG4010EP			
		101,102,103, 107,108,109, 113,114,115, 119,120,121, 125,126,127, 131,132,133	18	600V、1A US1J			
		104,110,116, 122,128,134, 137	7	40V、1A CRS04			
		105,111,117, 123,129,135, 138	0	40V、1A CRS04			
		106,112,118, 124,130,136, 139	7	222V - 24.5V SMAJ20CA			
Thyristor	Thy	1	0	VS-40TPS16-M3			
IC	IC	1	1	VLA107-644R		Isahaya Electronics	
		2	1	NJM7805DL1A			
		3,4,5,6,7,8,9	7	ACPL-336J		Broadcom (AVAGO Technologies)	
Heatsink	HS	1	0	BPUG26-30			
Connector	CN	1	1	B3B-XH-A(LF)(SN)	3p		
		2	1	XG4A-3031	30p		
		3	1	B2B-XH-A	2p		
Terminal	T	1,2,3,4,5,6,7,8,9,10	10	PCB-9 (M4)			
Check pin	CP	1,2,3,4,5,6,7,8,9,10,11,12,13	13	HK-2			

PCB Layers



(Top Silkscreen Layer)

PCB Layers

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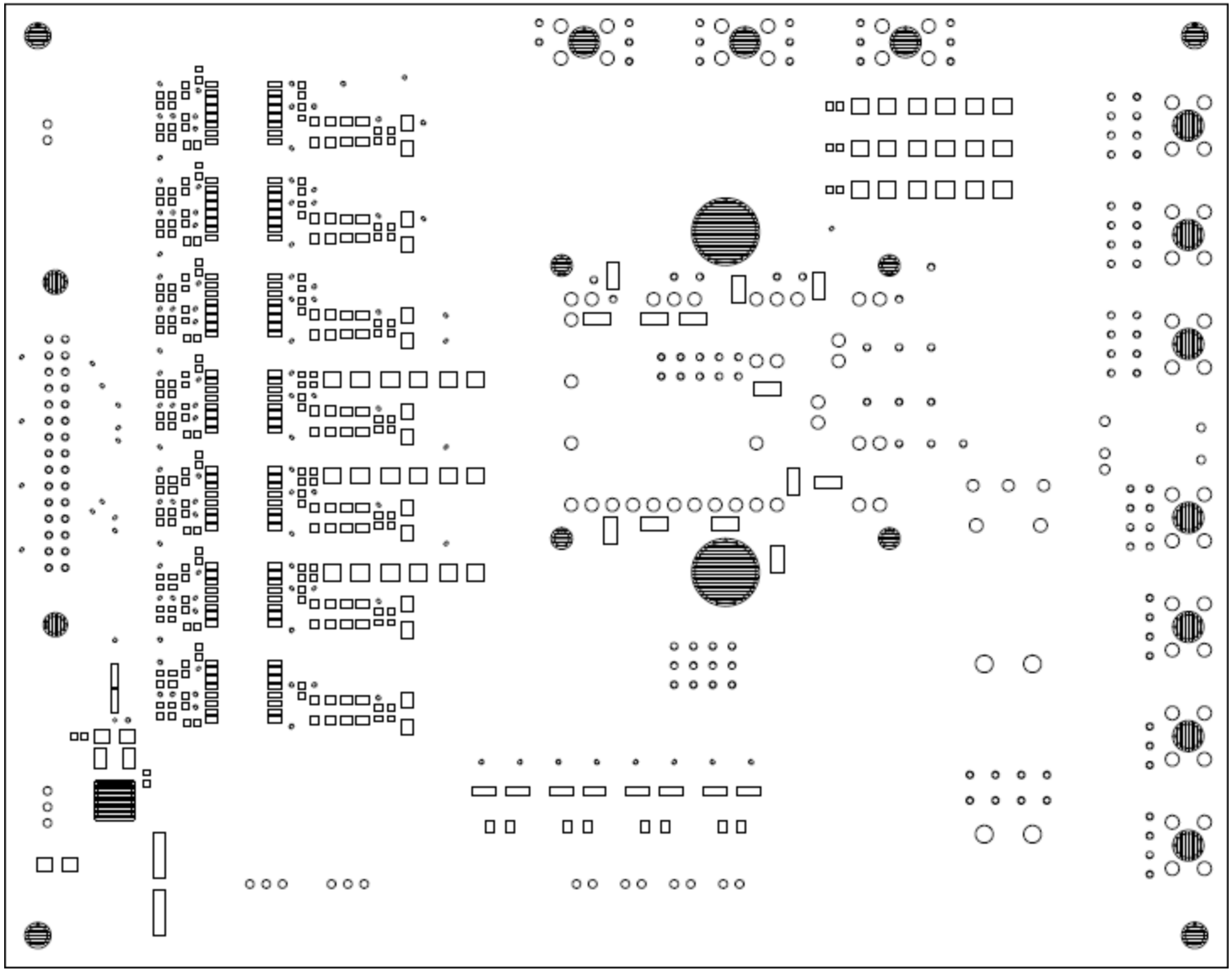

(Top Solder Resist Layer)

PCB Layers

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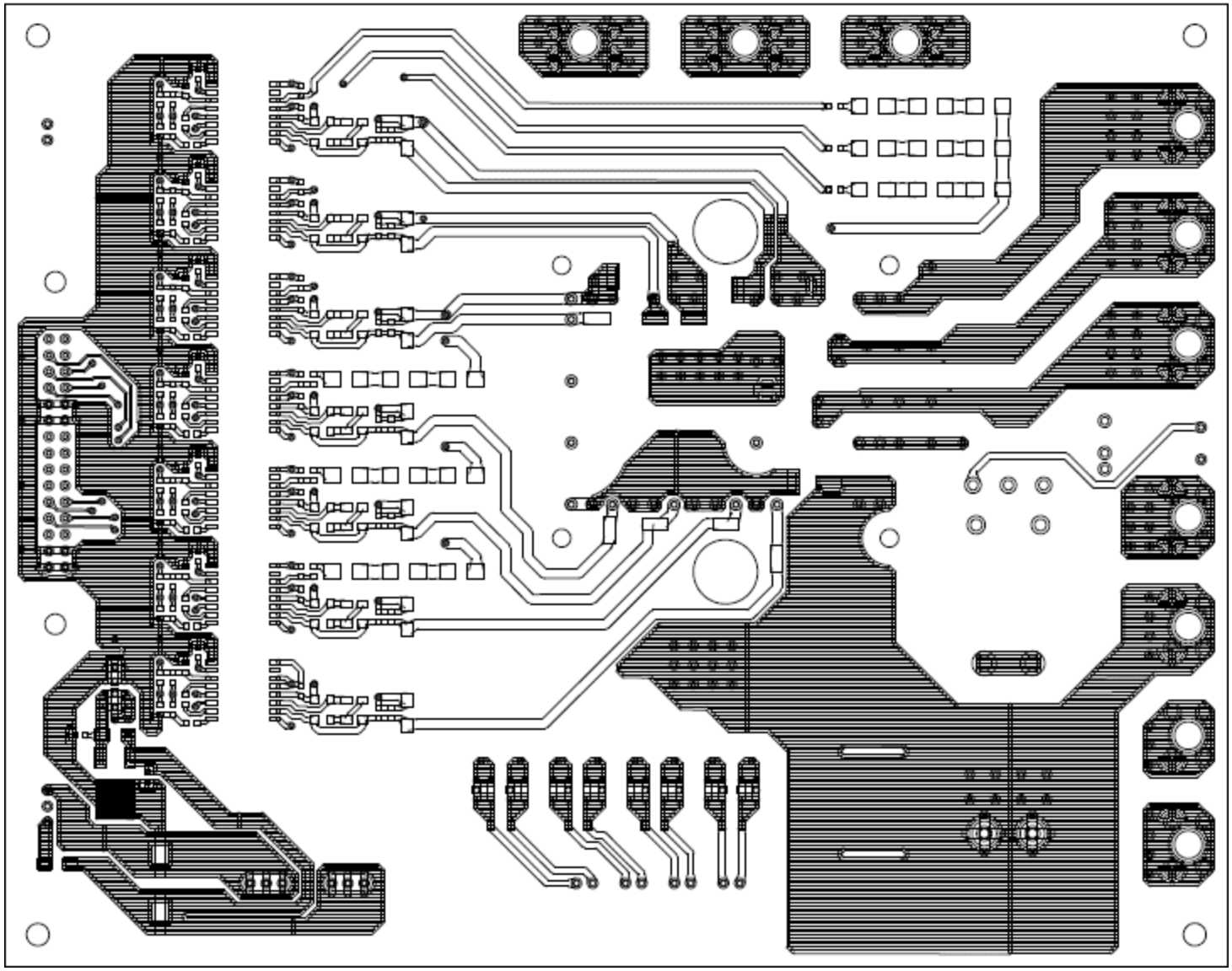

(Top Layer)

PCB Layers

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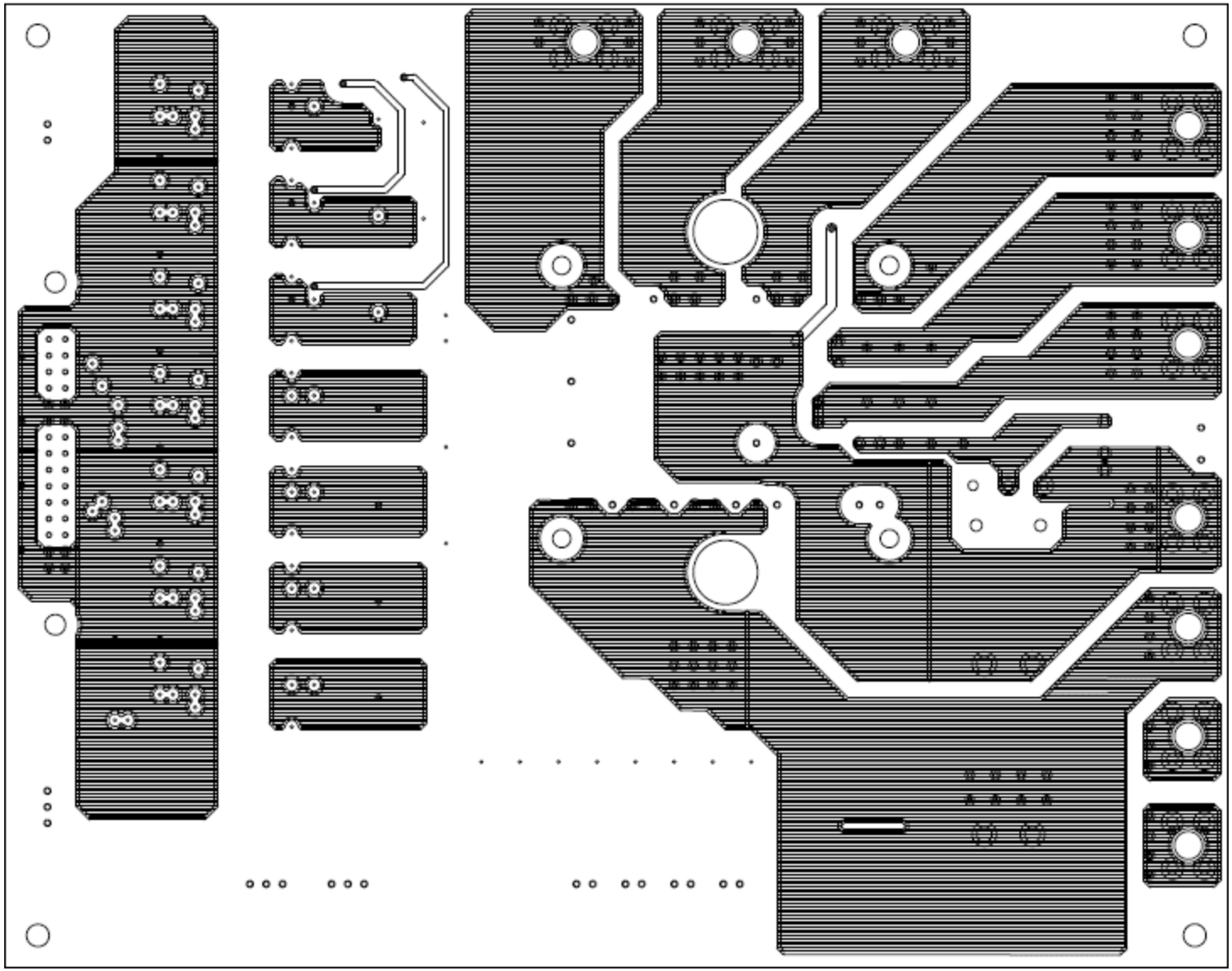

(Layer 2)

PCB Layers

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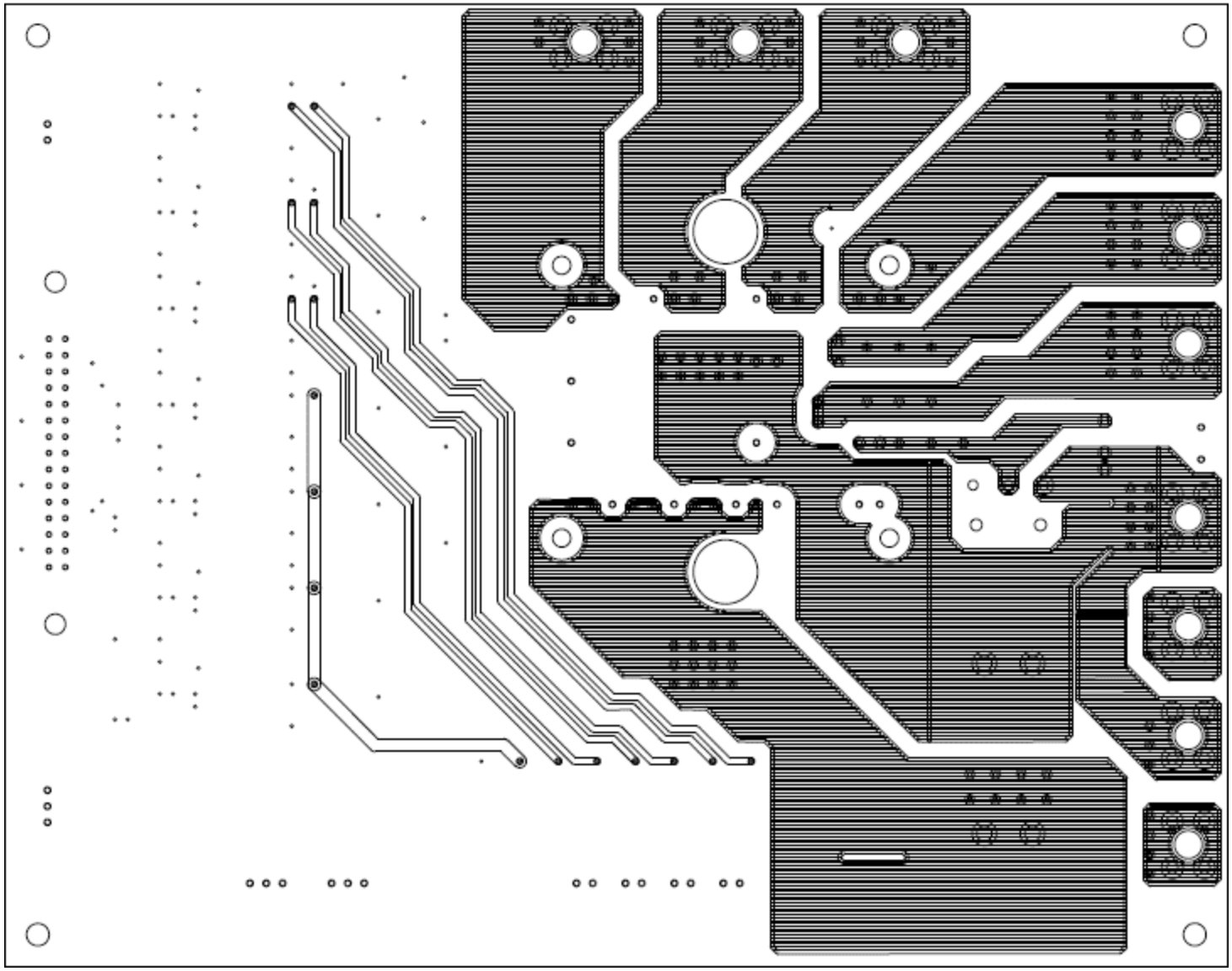

(Layer 3)

PCB Layers

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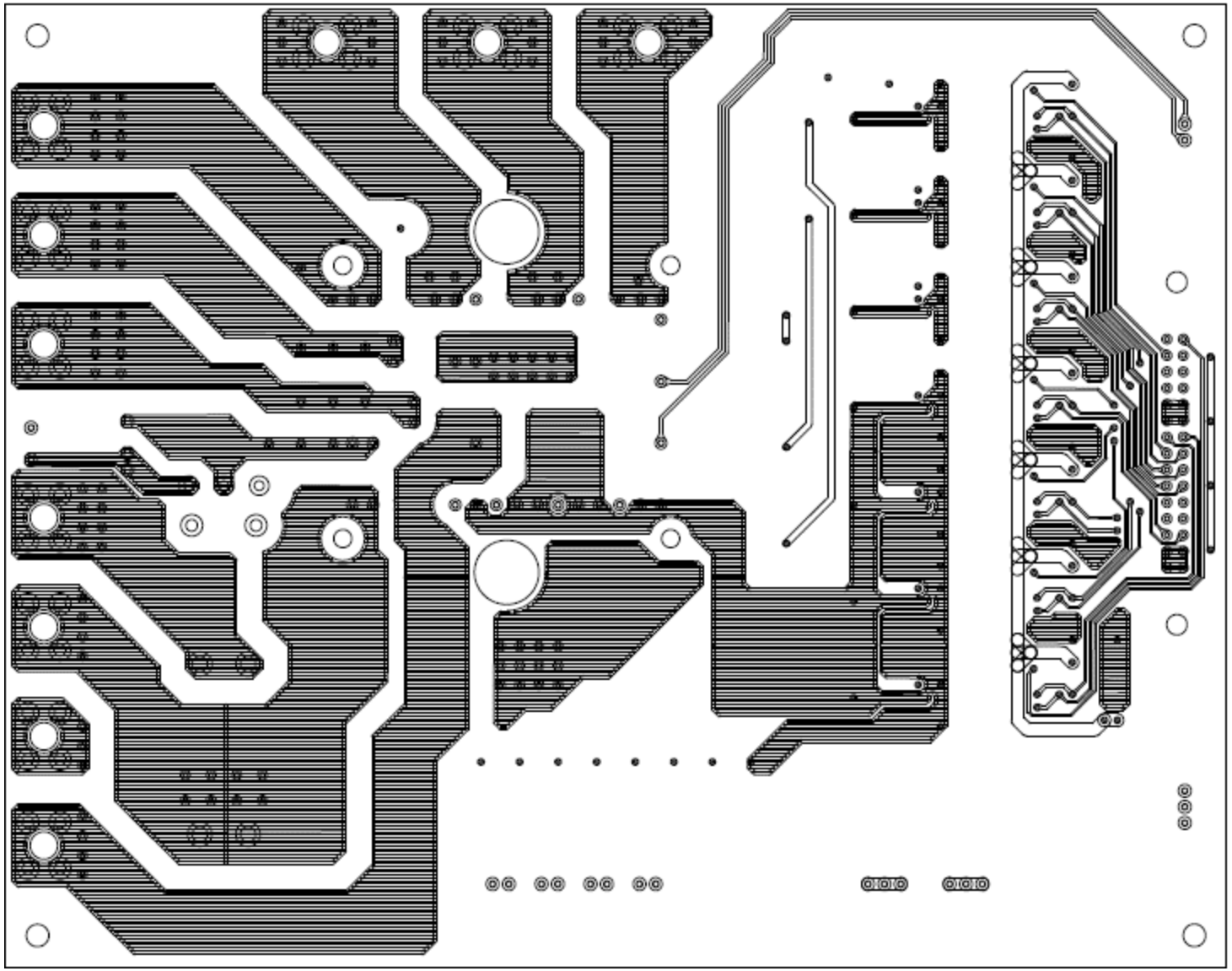
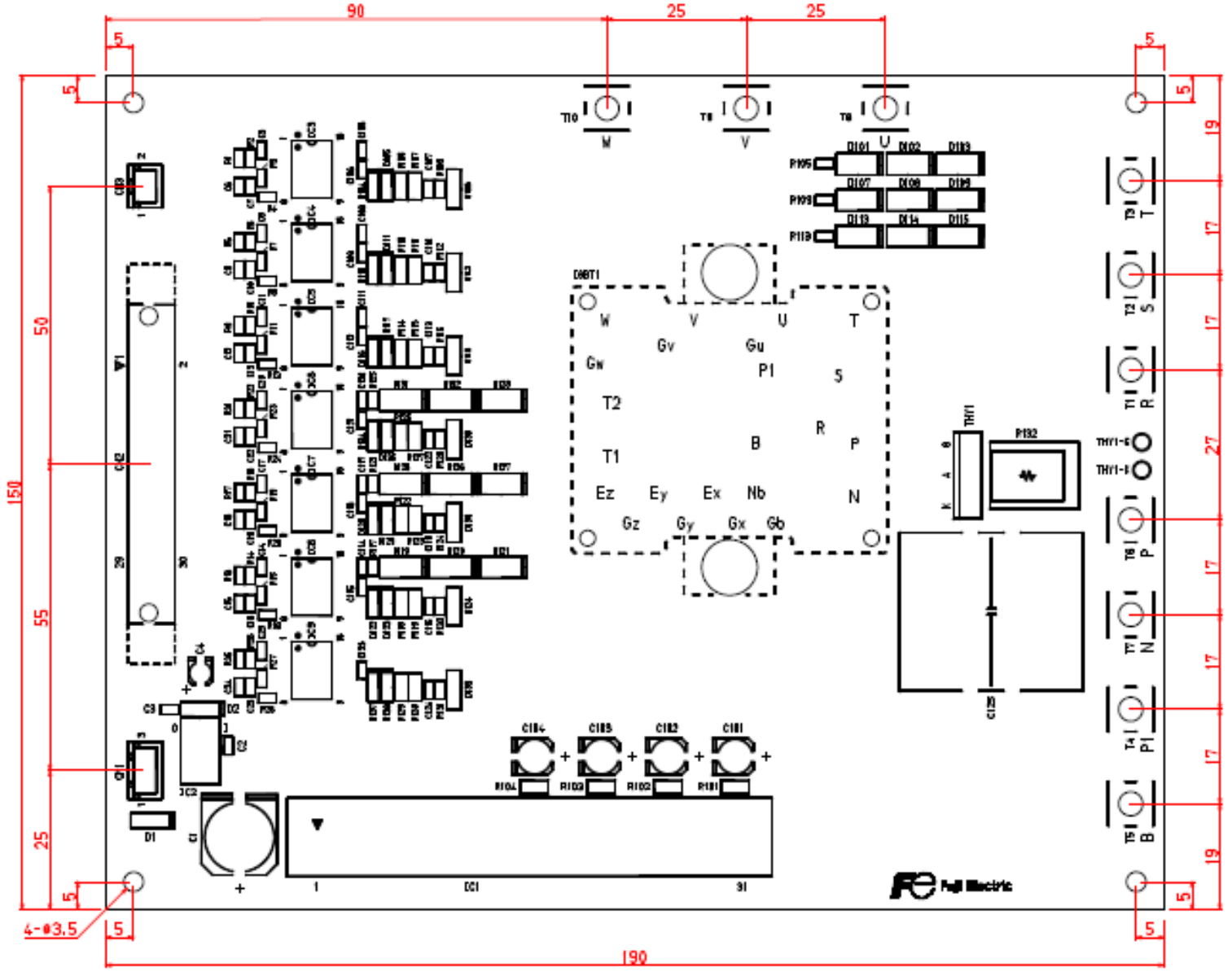


(Bottom Layer)

Dimensions of PCB Layers



Contact

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CAD-data and gerber-data for this evaluation board are also available on request.

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