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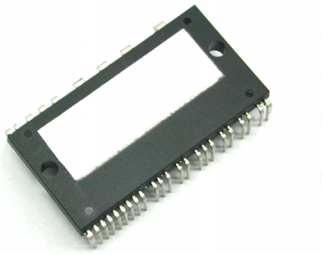
SEMICONDUCTOR®

May, 2003

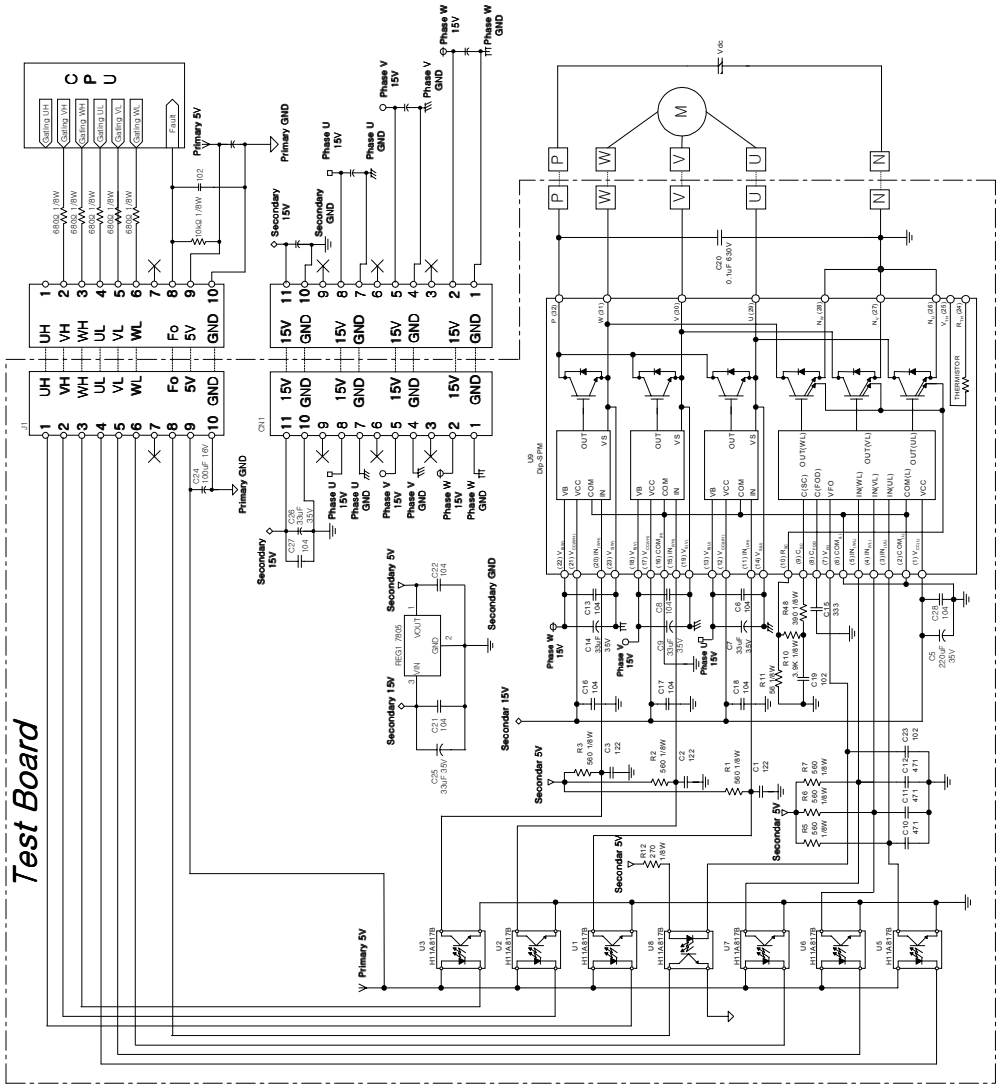
Application Note 9033

DIP-Smart Power Module Test Board V

SPM™ TEST BOARD for use in Isolated Inverter GND (Interface using Optocouplers with Five Isolated Power Supplies)



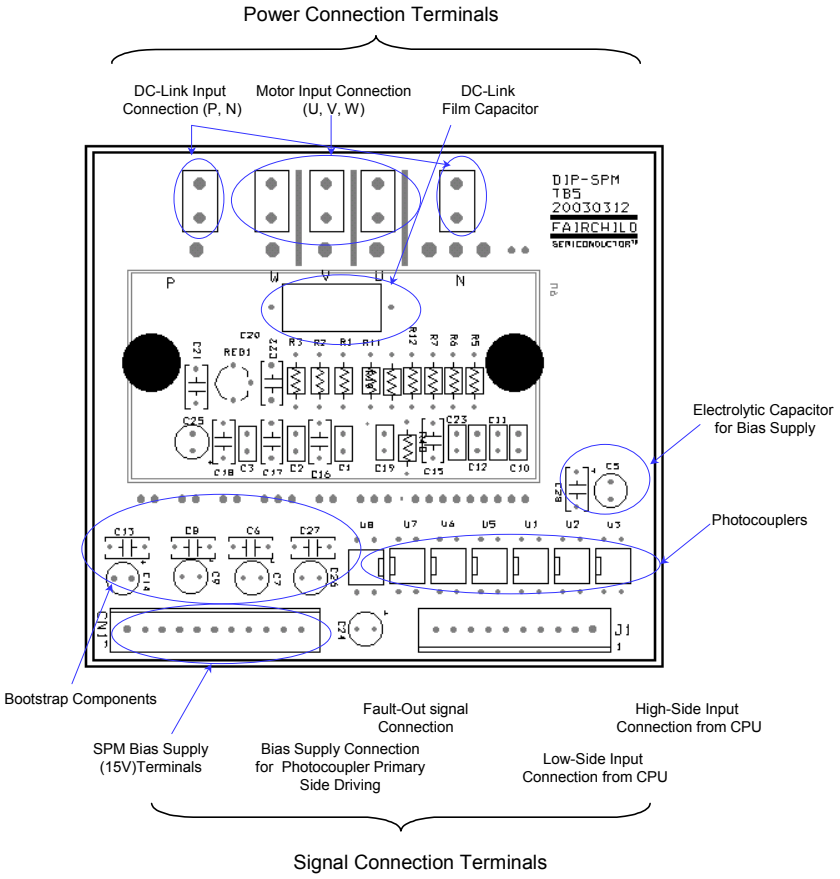
Schematics and External Interface Diagram



Note)

1. Dead time of > 10μs would be required in order to prevent a inverter-leg from being arm-short. It depends on the optocoupler's characteristics. In this board, a slow and low-cost type of optocoupler is selected.
2. Five isolated power supplies are required.
   For the primary side: +5V for CPU operation.
   For the secondary side: +15V for SPM operation. +5V is generated by the use of the voltage regulator of7805.
   For each U, V, W phase side: +15V for $V_{B(U, V, W)}$ and $V_{S(U, V, W)}$ operation of SPM.

PCB Map


Power Connection Terminals
DC-Link Input Connection (P, N)
Motor Input Connection (U, V, W)
DC-Link Film Capacitor
DIP-SPM
TB5
20030312
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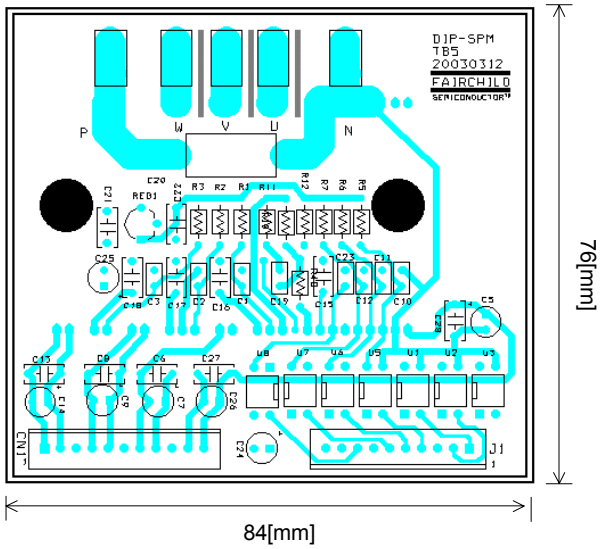
P
W
V
U
N
Electrolytic Capacitor for Bias Supply
Photocouplers
Bootstrap Components
SPM Bias Supply (15V)Terminals
Fault-Out signal Connection
Bias Supply Connection for Photocoupler Primary Side Driving
High-Side Input Connection from CPU
Low-Side Input Connection from CPU
Signal Connection Terminals

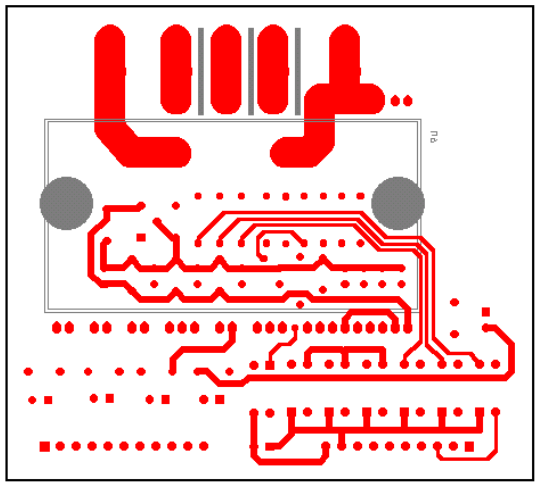
External Connection

Signal Interface 1 (J1)	1	High-Side Input Signal from CPU (Phase U)
	2	High-Side Input Signal from CPU (Phase V)
	3	High-Side Input Signal from CPU (Phase W)
	4	Low-Side Input Signal from CPU (Phase U)
	5	Low-Side Input Signal from CPU (Phase V)
	6	Low-Side Input Signal from CPU (Phase W)
	7	No connection
	8	Fault-Out Signal to CPU
	9	Bias Supply (+5V) Terminal for Photo coupler Primary Side Driving
	10	Bias Supply GroundTerminal for Photo coupler Primary Side Driving
Signal Interface 2 (CN1)	1	SPM Bias Supply +15V Terminal for High_Side (Phase W)
	2	SPM Bias Supply Ground Terminal for High_Side (Phase W)
	3	No Connection
	4	SPM Bias Supply +15V Terminal High_Side (Phase V)
	5	SPM Bias Supply Ground Terminal High_Side (Phase V)
	6	No Connection
	7	SPM Bias Supply +15V Terminal for High_Side (Phase U)
	8	SPM Bias Supply Ground Terminal for High_Side (Phase U)
	9	No Connection
	10	SPM Bias Supply +15V Terminal
	11	SPM Bias Supply Ground Terminal
Power Connection	P	Positive DC Link Input Connection
	N	Negative DC Link Input Connection
	U	Motor Input Connection (Phase U)
	V	Motor Input Connection (Phase V)
	W	Motor Input Connection (Phase W)

Photograph of Assembled PCB



(a) Top Side View



(b) Bottom Side View

Part List

Part No.	Rating	Characteristics	Definition
R1	560Ω, 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (UH)
R2	560Ω, 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (VH)
R3	560Ω, 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (WH)
R4	20Ω, 1/4W	Carbon Film Resistor (5%)	Bootstrap Resistor (Phase U)
R5	560Ω, 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (UL)
R6	560Ω, 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (VL)
R7	560Ω, 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (WL)
R8	20Ω, 1/4W	Carbon Film Resistor (5%)	Bootstrap Resistor (Phase V)
R9	20Ω, 1/4W	Carbon Film Resistor (5%)	Bootstrap Resistor (Phase W)
R10	3.9kΩ, 1/8W	Carbon Film Resistor (5%)	Low-Pass-Filter for Current Sensing
R11	56Ω, 1/8W	Carbon Film Resistor (5%)	Current Sensing Resistor
R12	270Ω, 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (Fault-Out)
R48	390Ω, 1/8W	Carbon Film Resistor (5%)	Series Resistor for Csc
C1	1.2nF	Ceramic Capacitor	High-Side Pull-Up Capacitor (Phase U)
C2	1.2nF	Ceramic Capacitor	High-Side Pull-Up Capacitor (Phase V)
C3	1.2nF	Ceramic Capacitor	High-Side Pull-Up Capacitor (Phase W)
C5	33μF, 35V	Electrolytic Capacitor	+15V Bias Voltage Source Capacitor
C6	100nF	Ceramic Capacitor	Bypass Capacitor for Bootstrap Supply (Phase U)
C7	33μF, 35V	Electrolytic Capacitor	Bootstrap Capacitor (Phase U)
C8	100nF	Ceramic Capacitor	Bypass Capacitor for Bootstrap Supply (Phase V)
C9	33μF, 35V	Electrolytic Capacitor	Bootstrap Capacitor (Phase V)
C10	470pF	Ceramic Capacitor	Low-Side Pull-Up Capacitor (Phase U)
C11	470pF	Ceramic Capacitor	Low-Side Pull-Up Capacitor (Phase V)
C12	470pF	Ceramic Capacitor	Low-Side Pull-Up Capacitor (Phase W)
C13	100nF	Ceramic Capacitor	Bypass Capacitor for Bootstrap Supply (Phase W)
C14	33μF, 35V	Electrolytic Capacitor	Bootstrap Capacitor (Phase W)
C15	33nF	Ceramic Capacitor	Capacitor for Selection for Fault Out Duration
C16	100nF	Ceramic Capacitor	+15V Bias Voltage Bypass Capacitor (WH)
C17	100nF	Ceramic Capacitor	+15V Bias Voltage Bypass Capacitor (VH)
C18	100nF	Ceramic Capacitor	+15V Bias Voltage Bypass Capacitor (UH)
C19	1nF	Ceramic Capacitor	Low-Pass-Fault for Current Sensing
C20	0.1μF, 630V	Film Capacitor	Snubber Capacitor to Suppress the Spike-Voltage
C21	100nF	Ceramic Capacitor	+15V Bias Voltage Bypass Capacitor
C22	1μF	Monolithic Capacitor	+5V Bias Voltage Bypass Capacitor
C23	1nF	Ceramic Capacitor	Pull-Up Capacitor of Fault-Out Signal
C24	100μF, 16V	Electrolytic Capacitor	+5V Bias Voltage Source Capacitor (for the Primary Side)
C25	33μF, 35V	Electrolytic Capacitor	+15V Bias Voltage Source Capacitor
C26	33μF, 35V	Electrolytic Capacitor	+15V Bias Voltage Source Capacitor
C27	100nF	Ceramic Capacitor	+15V Bias Voltage Bypass Capacitor
C28	100nF	Ceramic Capacitor	+15V Bias Voltage Bypass Capacitor

Part List

Part No.	Rating	Characteristics	Definition
U1	B	Photocoupler (H11A817B)	Photocoupler for Signal Interface (UH)
U2	B	Photocoupler (H11A817B)	Photocoupler for Signal Interface (VH)
U3	B	Photocoupler (H11A817B)	Photocoupler for Signal Interface (WH)
U4	-	DIP-SPM	See the datasheet
U5	B	Photocoupler (H11A817B)	Photocoupler for Signal Interface (UL)
U6	B	Photocoupler (H11A817B)	Photocoupler for Signal Interface (VL)
U7	B	Photocoupler (H11A817B)	Photocoupler for Signal Interface (WL)
U8	B	Photocoupler (H11A817B)	Photocoupler for Signal Interface (Fault-Out)
REG1	100mA	Voltage Regulator (KA78L05A)	3-Terminal Positive Voltage Regulator

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