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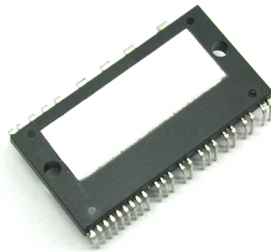


May, 2003

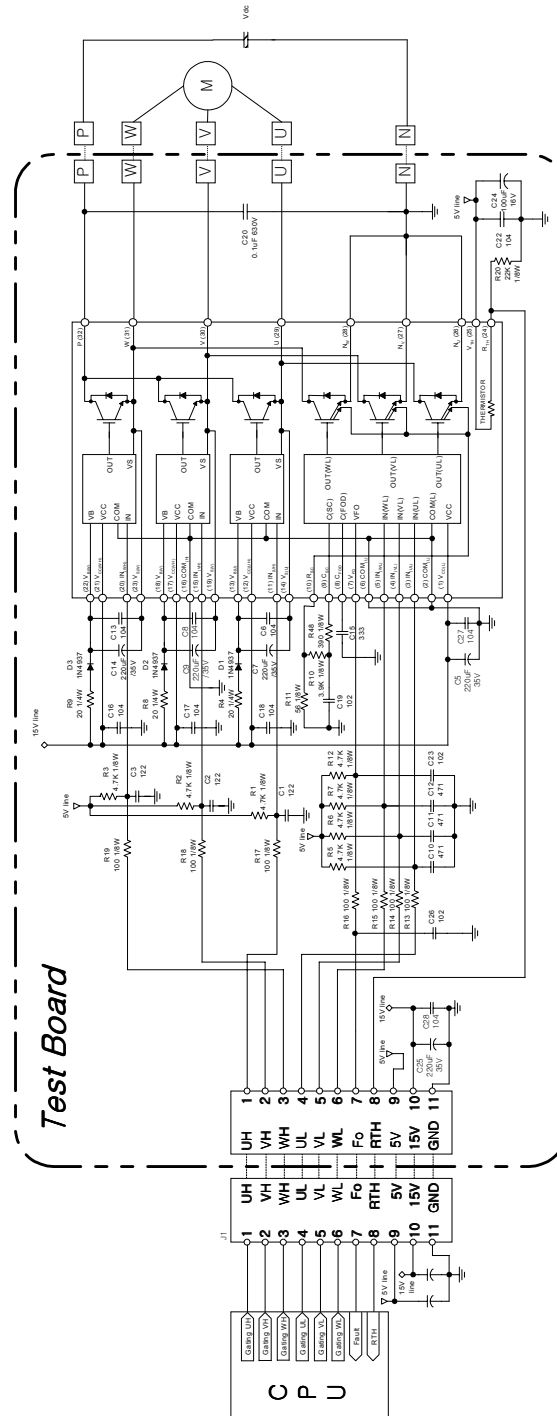
**Application Note 9031**

**DIP-Smart Power Module Test Board III**

**SPM™ TEST BOARD for use in Direct Interface with CPU  
(without Shunt Resistor)**



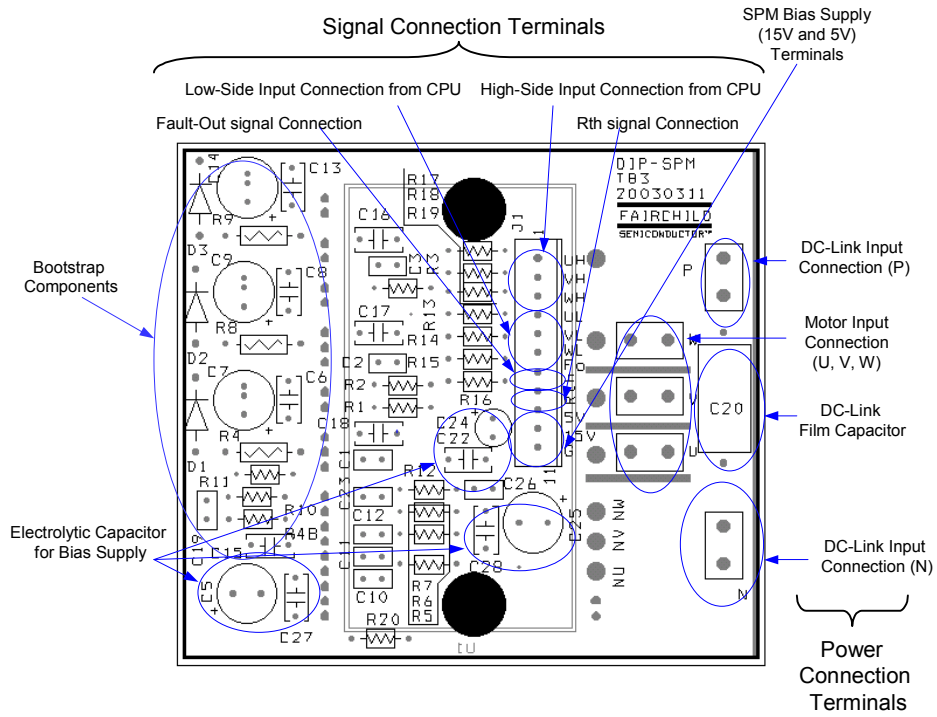
## Schematics and External Interface Diagram



### Note)

1. Common-grounded power supplies of +5V and +15V are used for CPU and SPM2 operation.
2. For further details, see the datasheet and application note.

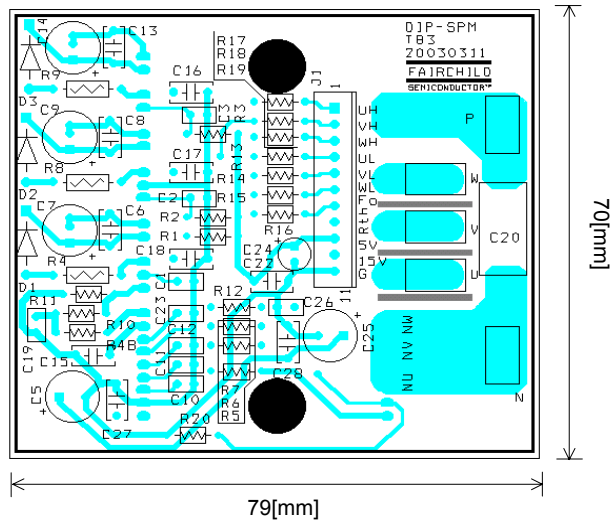
# PCB Map



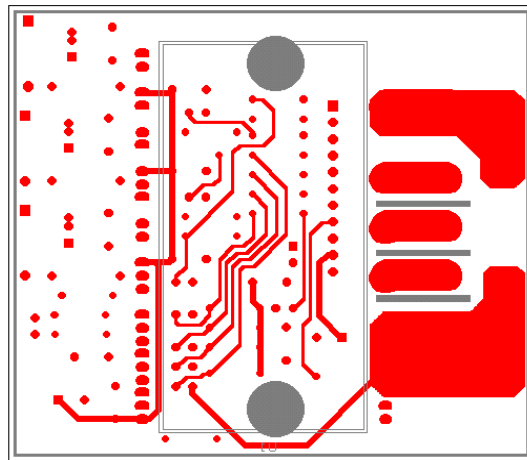
## External Connection

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	Fault-Out Signal to CPU
	8	Thermistor Out Signal to CPU
	9	SPM Bias Supply +5V Terminal
	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 1

Part No.	Rating	Characteristics	Definition
R1	4.7k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (UH)
R2	4.7k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (VH)
R3	4.7k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (WH)
R4	20 $\Omega$ , 1/4W	Carbon Film Resistor (5%)	Bootstrap Resistor (Phase U)
R5	4.7k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (UL)
R6	4.7k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (VL)
R7	4.7k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (WL)
R8	20 $\Omega$ , 1/4W	Carbon Film Resistor (5%)	Bootstrap Resistor (Phase V)
R9	20 $\Omega$ , 1/4W	Carbon Film Resistor (5%)	Bootstrap Resistor (Phase W)
R10	47 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Low-Pass-Filter for Current Sensing
R11	47 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Current Sensing Resistor
R12	4.7k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Pull-Up Resistor (Fault-Out)
R13	100 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Series Resistor for Signal Interface (UL)
R14	100 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Series Resistor for Signal Interface (VL)
R15	100 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Series Resistor for Signal Interface (WL)
R16	100 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Series Resistor for Signal Interface (Fault-Out)
R17	100 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Series Resistor for Signal Interface (UH)
R18	100 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Series Resistor for Signal Interface (VH)
R19	100 $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Series Resistor for Signal Interface (WH)
R20	22k $\Omega$ , 1/8W	Carbon Film Resistor (5%)	Voltage Divider Resistor for Thermistor
R48	390 $\Omega$ , 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	220 $\mu$ F, 35V	Electrolytic Capacitor	+15V Bias Voltage Source Capacitor
C6	100nF	Ceramic Capacitor	Bypass Capacitor for Bootstrap Supply (Phase U)
C7	220 $\mu$ F, 35V	Electrolytic Capacitor	Bootstrap Capacitor (Phase U) - for washing machines
	33 $\mu$ F, 35V		Bootstrap Capacitor (Phase U) - for air conditioners
C8	100nF	Ceramic Capacitor	Bypass Capacitor for Bootstrap Supply (Phase V)
C9	220 $\mu$ F, 35V	Electrolytic Capacitor	Bootstrap Capacitor (Phase V) - for washing machines
	33 $\mu$ F, 35V		Bootstrap Capacitor (Phase V) - for air conditioners
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	220 $\mu$ F, 35V	Electrolytic Capacitor	Bootstrap Capacitor (Phase W) - for washing machines
	33 $\mu$ F, 35V		Bootstrap Capacitor (Phase W) - for air conditioners
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, 25V	Ceramic Capacitor	Low-Pass-Fault for Current Sensing
C20	0.1 $\mu$ F, 630V	Film Capacitor	Snubber Capacitor to Suppress the Spike-Voltage

## Part List 2

Part No.	Rating	Characteristics	Definition
C22	100nF	Ceramic Capacitor	+5V Bias Voltage Source Capacitor
C23	1nF	Ceramic Capacitor	Pull-Up Capacitor of Fault-Out Signal
C24	100 $\mu$ F, 16V	Electrolytic Capacitor	+5V Bias Voltage Source Capacitor
C25	220 $\mu$ F, 35V	Electrolytic Capacitor	+15V Bias Voltage Source Capacitor
C26	1nF	Ceramic Capacitor	Bypass Capacitor for Fault-Out Signal
C27	100nF	Ceramic Capacitor	+15V Bias Voltage Source Capacitor
C28	100nF	Ceramic Capacitor	+15V Bias Voltage Source Capacitor
C32	100nF	Ceramic Capacitor	+5V Bias Voltage Bypass Capacitor for Op-amp
D1	1A, 600V	Fast Recovery Diode, (1N4937)	Bootstrap Diode (Phase U)
D2	1A, 600V	Fast Recovery Diode, (1N4937)	Bootstrap Diode (Phase V)
D3	1A, 600V	Fast Recovery Diode, (1N4937)	Bootstrap Diode (Phase W)
U1	-	DIP-SPM	See the datasheet.

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