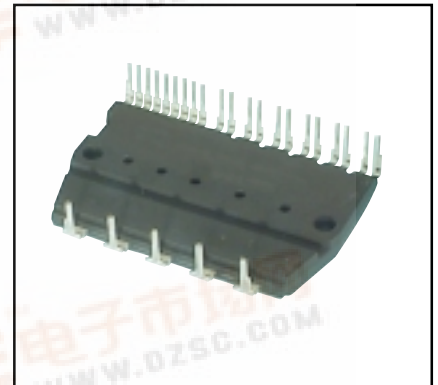
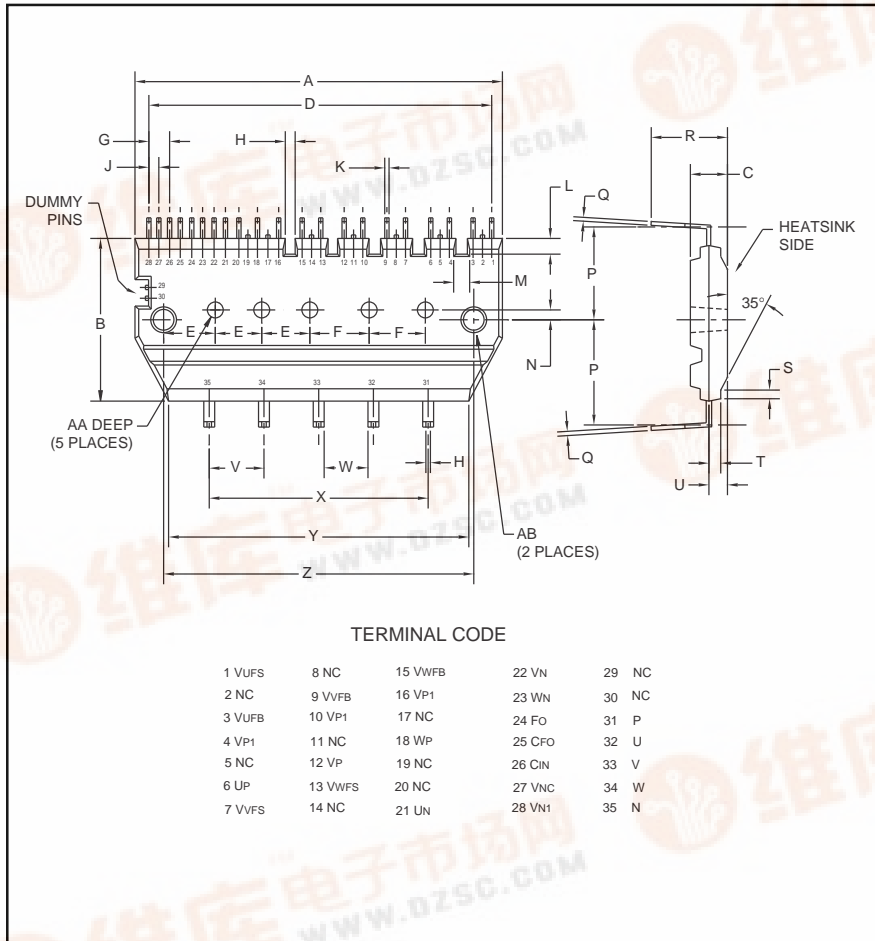




Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

PS20351-G

Intellimod™ Module
Dual-In-Line Intelligent
Power Module
3 Amperes/500 Volts



Description:

DIP and mini-DIP IPMs are intelligent power modules that integrate power devices, drivers, and protection circuitry in an ultra compact dual-in-line transfer-mold package for use in driving small three phase motors. Use of 4th generation IGBTs, DIP packaging, and application specific HVICs allow the designer to reduce inverter size and overall design time.

Features:

- Compact Packages
- Single Power Supply
- Integrated HVICs
- Direct Connection to CPU
- Optimized for 15kHz Operation

Applications:

- Washing Machines
- Refrigerators
- Air Conditioners
- Small Servo Motors
- Small Motor Control

Ordering Information:

PS20351-G is a 500V, 3 Ampere Mini-DIP Intelligent Power Module.

Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	1.93	49.0
B	1.20	30.5
C	0.20	5.0
D	1.82	46.23
E	0.25	6.25
F	0.32	8.0
G	0.14	3.556
H	0.04	1.0
J	0.07	1.778
K	0.02	0.5
L	0.06	1.5
M	0.07 Min.	1.8 Min.
N	0.30	0.75

Dimensions	Inches	Millimeters
P	0.69	17.4
Q	0.02	0.5
R	0.41	10.5
S	0.05	1.2
T	0.05	1.25
U	0.10	2.5
V	0.30	7.62
W	0.16 Min.	4.0 Min.
X	1.20	30.48
Y	1.61	41.0
Z	1.65	42.0
AA	0.08 Dia.	2.0 Dia.
AB	0.13 Dia.	3.3 Dia.





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Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	PS20351-G	Units
Power Device Junction Temperature*	T_j	-20 to 150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to 125	$^\circ\text{C}$
Heatsink Temperature (See T_f Measure Point Illustration)	T_f	-20 to 100	$^\circ\text{C}$
Mounting Torque, M3 Mounting Screws	—	8.5	in-lb
Module Weight (Typical)	—	20	Grams
Heatsink Flatness	—	-50 to 100	μm
Self-protection Supply Voltage Limit (Short Circuit Protection Capability)**	$V_{\text{CC(prot.)}}$	330	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal, Connection Pins to Heatsink Plate	V_{ISO}	1500	Volts

*The maximum junction temperature rating of the power chips integrated within the DIP-IPM is 150°C ($@T_f \leq 100^\circ\text{C}$). However, to ensure safe operation of the DIP-IPM, the average junction temperature should be limited to $T_{j(\text{avg})} \leq 125^\circ\text{C}$ ($@T_f \leq 100^\circ\text{C}$).

** $V_D = 13.5 - 16.5\text{V}$, Inverter Part, $T_j = 125^\circ\text{C}$, Non-repetitive, Less than $2\mu\text{s}$

IGBT Inverter Sector

Collector-Emitter Voltage	V_{CES}	500	Volts
Collector Current, \pm ($T_C = 25^\circ\text{C}$)	I_C	3	Amperes
Peak Collector Current, \pm ($T_C = 25^\circ\text{C}$, Instantaneous Value (Pulse))	I_{CP}	6	Amperes
Supply Voltage (Applied between P - N)	V_{CC}	350	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	400	Volts
Collector Dissipation ($T_C = 25^\circ\text{C}$, per 1 Chip)	P_C	17.8	Watts

Control Sector

Supply Voltage (Applied between $V_{P1}-V_{\text{NC}}$, $V_{N1}-V_{\text{NC}}$)	V_D	20	Volts
Supply Voltage (Applied between $V_{\text{UFB}}-V_{\text{UFS}}$, $V_{\text{VFB}}-V_{\text{VFS}}$, $V_{\text{WFB}}-V_{\text{WFS}}$)	V_{DB}	20	Volts
Input Voltage (Applied between U_P , V_P , W_P-V_{NC} , U_N , V_N , W_N-V_{NC})	V_{CIN}	-0.5 ~ 5.5	Volts
Fault Output Supply Voltage (Applied between F_O-V_{NC})	V_{FO}	-0.5 ~ $V_D+0.5$	Volts
Fault Output Current (Sink Current at F_O Terminal)	I_{FO}	15	mA
Current Sensing Input Voltage (Applied between $C_{\text{IN}}-V_{\text{NC}}$)	V_{SC}	-0.5 ~ $V_D+0.5$	Volts



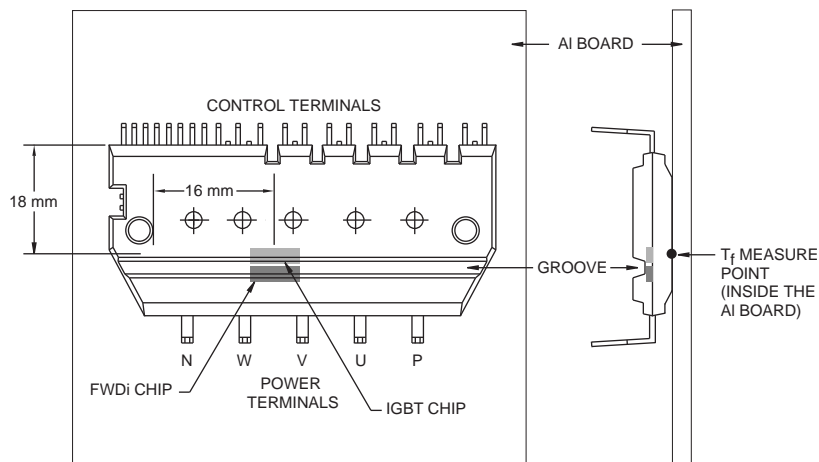
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Electrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Inverter Sector						
Collector Cutoff Current	I_{CES}	$V_{CE} = V_{CES}, T_j = 25^\circ\text{C}$	—	—	1.0	mA
		$V_{CE} = V_{CES}, T_j = 125^\circ\text{C}$	—	—	10	mA
Diode Forward Voltage	V_{EC}	$T_j = 25^\circ\text{C}, -I_C = 3\text{A}, V_{CIN} = 5\text{V}$	—	1.90	2.60	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 3\text{A}, T_j = 25^\circ\text{C}, V_D = V_{DB} = 15\text{V}, V_{CIN} = 0\text{V}$	—	1.70	2.35	Volts
		$I_C = 3\text{A}, T_j = 125^\circ\text{C}, V_D = V_{DB} = 15\text{V}, V_{CIN} = 0\text{V}$	—	1.80	2.45	Volts
Inductive Load Switching Times	t_{on}	$V_{CC} = 300\text{V}, V_D = 15\text{V},$	0.10	0.55	1.05	μS
	t_{rr}	$I_C = 3\text{A},$	—	0.10	—	μS
	$t_{C(on)}$	$T_j = 125^\circ\text{C},$	—	0.15	0.55	μS
	t_{off}	Inductive Load (Upper-Lower Arm),	—	1.00	2.10	μS
	$t_{C(off)}$	$V_{CIN} = 5\text{V(off)}, 0\text{V(on)}$	—	0.30	1.20	μS

T_j Measure Point





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Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Sector						
Supply Voltage	V_D	Applied between $V_{P1}-V_{NC}$, $V_{N1}-V_{NC}$	13.5	15.0	16.5	Volts
	V_{DB}	Applied between $V_{UFB}-V_{UFS}$, $V_{VFB}-V_{VFS}$, $V_{WFB}-V_{WFS}$	13.5	15.0	16.5	Volts
Circuit Current	I_D	$V_D = 15\text{V}$, $V_{CIN} = 5\text{V}$, $V_{DB} = 15\text{V}$, Total of $V_{P1}-V_{NC}$, $V_{N1}-V_{NC}$	—	4.25	8.50	mA
		$V_D = 15\text{V}$, $V_{CIN} = 0\text{V}$, $V_{DB} = 15\text{V}$, Total of $V_{P1}-V_{NC}$, $V_{N1}-V_{NC}$	—	4.95	9.70	mA
		$V_D = 15\text{V}$, $V_{CIN} = 5\text{V}$, $V_{DB} = 15\text{V}$, $V_{UFB}-V_{UFS}$, $V_{VFB}-V_{VFS}$, $V_{WFB}-V_{WFS}$	—	0.50	1.00	mA
		$V_D = 15\text{V}$, $V_{CIN} = 0\text{V}$, $V_{DB} = 15\text{V}$, $V_{UFB}-V_{UFS}$, $V_{VFB}-V_{VFS}$, $V_{WFB}-V_{WFS}$	—	0.50	1.00	mA
Fault Output Voltage	V_{FOH}	$V_{SC} = 0\text{V}$, F_O Circuit: 10k Ω to 5V Pull-up	4.9	—	—	Volts
	V_{FOL}	$V_{SC} = 1\text{V}$, F_O Circuit: 10k Ω to 5V Pull-up	—	0.8	1.2	Volts
	$V_{FO(sat)}$	$V_{SC} = 1\text{V}$, $I_{FO} = 15\text{mA}$	0.8	1.2	1.8	Volts
PWM Input Frequency	f_{PWM}	$T_j \leq 125^\circ\text{C}$, $T_f \leq 100^\circ\text{C}$	—	15	—	kHz
Allowable Dead Time	t_{DEAD}	Relates to Corresponding Input Signal for Blocking Arm Shoot-through ($T_f \leq 100^\circ\text{C}$)	3	—	—	μs
Short Circuit Trip Level*	$V_{SC(ref)}$	$T_j = 25^\circ\text{C}$, $V_D = 15\text{V}^*$	0.45	0.5	0.55	Volts
Supply Circuit Under-voltage	UV_{DBt}	Trip Level, $T_j \leq 125^\circ\text{C}$	10.0	—	12.0	Volts
	UV_{DBr}	Reset Level, $T_j \leq 125^\circ\text{C}$	10.5	—	12.5	Volts
	UV_{Dt}	Trip Level, $T_j \leq 125^\circ\text{C}$	10.3	—	12.5	Volts
	UV_{Dr}	Reset Level, $T_j \leq 125^\circ\text{C}$	10.8	—	13.0	Volts
Fault Output Pulse Width**	t_{FO}	$C_{FO} = 22\text{nF}$	1.0	1.8	—	mS
ON Threshold Voltage (H-side)	$V_{th(on)}$	Applied between U_P , V_P , W_P-V_{NC}	0.8	1.4	2.0	Volts
OFF Threshold Voltage (H-side)	$V_{th(off)}$		2.5	3.0	4.0	Volts
ON Threshold Voltage (L-side)	$V_{th(on)}$	Applied between U_N , V_N , W_N-V_{NC}	0.8	1.4	2.0	Volts
OFF Threshold Voltage (L-side)	$V_{th(off)}$		2.5	3.0	4.0	Volts

* Short Circuit protection operates only at the low-arms. Please select the value of the external shunt resistor such that the SC trip level is less than 5.1A.

**Fault signal is asserted when the low-arm short circuit or control supply under-voltage protective functions operate. The fault output pulse-width t_{FO} depends on the capacitance value of C_{FO} according to the following approximate equation: $C_{FO} = (12.2 \times 10^{-6}) \times t_{FO} (F)$.



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Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Heatsink	$R_{th(j-f)Q}$	Each IGBT	—	—	7.0	°C/Watt
	$R_{th(j-f)D}$	Each FWDi	—	—	8.0	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Min.	Typ.	Value	Units
Supply Voltage	V_{CC}	Applied between P-N Terminals	0	280	330	Volts
Control Supply Voltage	V_D	Applied between V_{P1} - V_{NC} , V_{N1} - V_{NC}	13.5	15.0	16.5	Volts
	V_{DB}	Applied between V_{UFB} - V_{UFS} , V_{VFB} - V_{VFS} , V_{WFB} - V_{WFS}	13.5	15.0	16.5	Volts
Control Supply dv/dt	dV_D/dt , dV_{DB}/dt		-1	—	1	V/ μ s
Input ON Voltage	$V_{CIN(on)}$	Applied between U_P , V_P , W_P - V_{NC}			0 ~ 0.65	Volts
Input OFF Voltage	$V_{CIN(off)}$	Applied between U_N , V_N , W_N - V_{NC}			4.0 ~ 5.5	Volts
PWM Input Frequency	f_{PWM}	$T_j \leq 125^\circ\text{C}$, $T_f \leq 100^\circ\text{C}$	—	15	—	kHz
Arm Shoot-through Blocking Time	t_{DEAD}	For Each Input Signal	3	—	—	μ S

