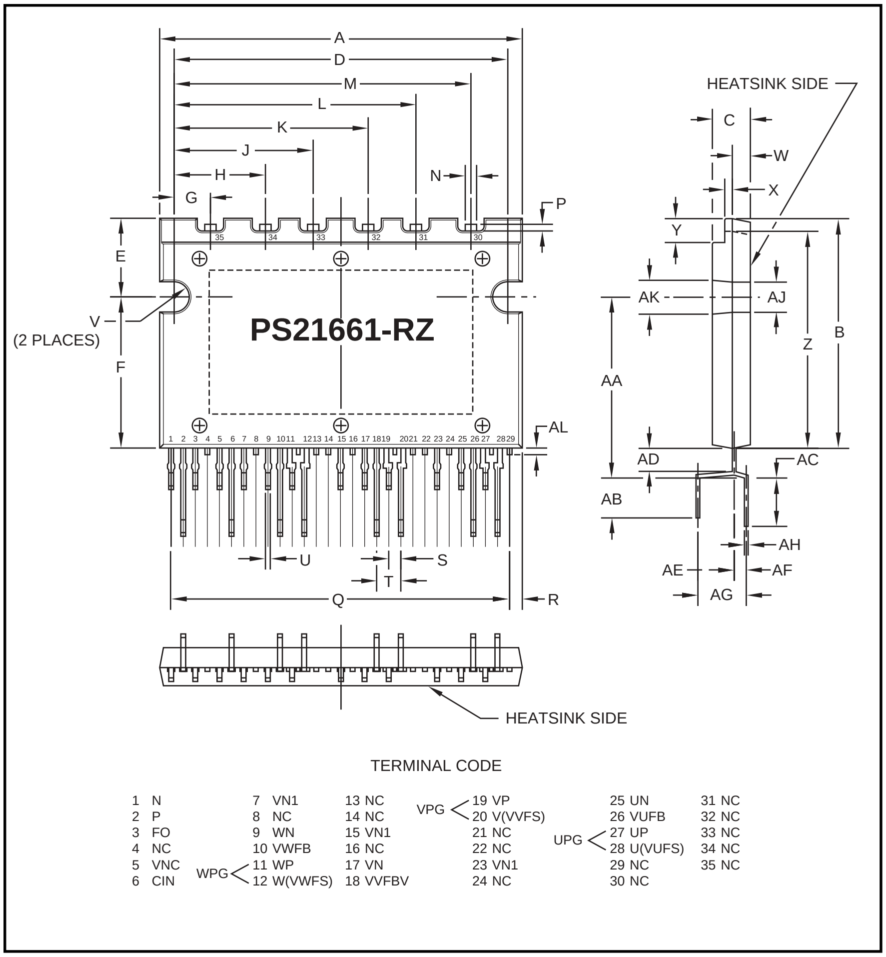
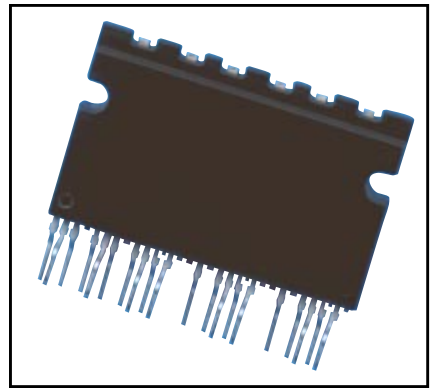
Powerex, Inc., 200 E. Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

Intellimod™ Module

Single-In-Line Intelligent Power Module
3 Amperes/600 Volts



Outline Drawing and Circuit Diagram



Dimensions	Inches	Millimeters
A	1.50	38.0
B	0.94	24.0
C	0.16	4.0
D	1.38	35.0
E	0.33	8.5
F	0.61	15.5
G	0.15	3.8
H	0.38	9.6
J	0.57	14.6
K	0.80	20.4
L	1.00	25.4
M	1.23	31.2
N	0.047	1.2
P	0.028	0.7
Q	1.39	35.28
R	0.048	1.22
S	0.05	1.27
T	0.10	2.54

Dimensions	Inches	Millimeters
U	0.02	0.5
V	0.06	1.6
W	0.07	1.9
X	0.03	0.8
Y	0.11	2.7
Z	0.90	22.8
AA	0.75	19.0
AB	0.17	4.2
AC	0.20	5.2
AD	0.09	2.4
AE	0.15	3.81
AF	0.05	1.27
AG	0.20	5.08
AH	0.016	0.4
AJ	0.13	3.3
AK	0.14	3.6
AL	0.28	0.7

Description:

SIP-IPMs are intelligent power modules that integrate power devices, drivers, and protection circuitry in an ultra compact single-in-line transfer-mold package for use in driving small three phase motors. Use of 5th generation IGBTs, SIP 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

Applications:

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

Ordering Information:

PS21661-RZ is a 600V, 3 Ampere SIP Intelligent Power Module.

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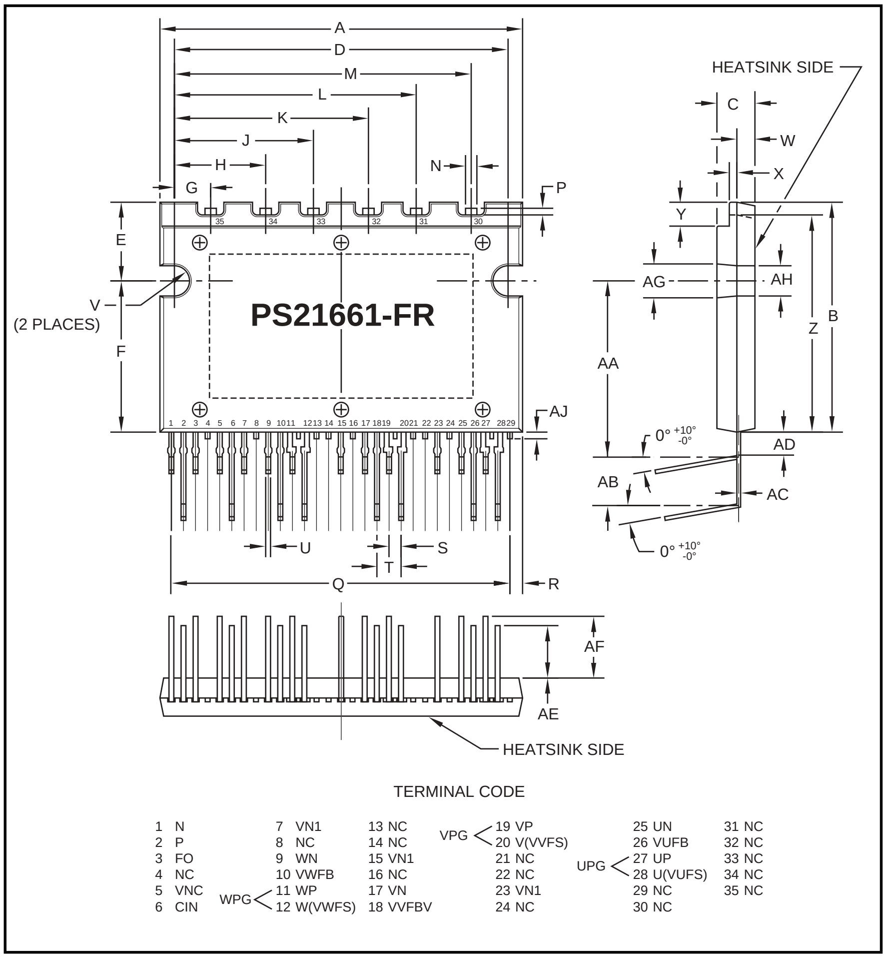

Outline Drawing and Circuit Diagram

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A	1.50	38.0
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F	0.61	15.5
G	0.15	3.8
H	0.38	9.6
J	0.57	14.6
K	0.80	20.4
L	1.00	25.4
M	1.23	31.2
N	0.047	1.2
P	0.028	0.7
Q	1.39	35.28
R	0.048	1.22
S	0.05	1.27

Dimensions	Inches	Millimeters
T	0.10	2.54
U	0.02	0.5
V	0.06	1.6
W	0.07	1.9
X	0.03	0.8
Y	0.11	2.7
Z	0.90	22.8
AA	0.71	18.1
AB	0.20	5.08
AC	0.016	0.4
AD	0.09	2.4
AE	0.22	5.5
AF	0.26	6.5
AG	0.14	3.6
AH	0.13	3.3
AJ	0.028	0.7

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Absolute Maximum Ratings, T_j = 25°C unless otherwise specified

Characteristics	Symbol	PS21661-RZ/-FR	Units
Power Device Junction Temperature*	T_j	-20 to 125	°C
Heatsink Operation Temperature (See T_f Measurement Point Illustration)	T_f	-20 to 100	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Mounting Torque, M3 Mounting Screws	—	7	in-lb
Module Weight (Typical)	—	10	Grams
Self-protection Supply Voltage Limit (Short Circuit Protection Capability)**	$V_{CC(prot.)}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal, Connection Pins to Heatsink Plate	V_{ISO}	2500	Volts

*The maximum junction temperature rating of the power chips integrated within the SIP-IPM is 150°C (@$T_f \leq$ 100°C). However, to ensure safe operation of the SIP-IPM, the average junction temperature should be limited to $T_{j(avg)} \leq$ 125°C (@$T_f \leq$ 100°C).
**V_D = 13.5 ~ 16.5V, Inverter Part, T_j = 125°C, Non-repetitive, Less than 2µs

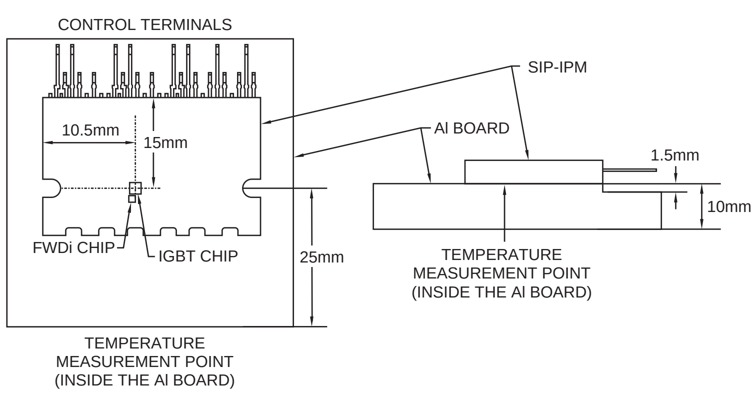
IGBT Inverter Sector

Characteristics	Symbol	PS21661-RZ/-FR	Units
Collector-Emitter Voltage	V_{CES}	600	Volts
Collector Current (T_f = 25°C)	$\pm I_C$	3	Amperes
Peak Collector Current (T_f = 25°C, $t_W \leq$ 1ms)	$\pm I_{CP}$	6	Amperes
Supply Voltage (Applied between P - N)	V_{CC}	450	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{CC(surge)}$	500	Volts
Collector Dissipation (T_f = 25°C, per 1 Chip)	P_C	11.1	Watts

Control Sector

Characteristics	Symbol	PS21661-RZ/-FR	Units
Supply Voltage (Applied between V_{N1}-V_{NC})	V_D	20	Volts
Supply Voltage (Applied between V_{UFB}-U(V_{UFS}), V_{VFB}-V(V_{VFS}), V_{WFB}-W(V_{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_{IN}	-0.5 ~ V_D	Volts
Fault Output Supply Voltage (Applied between F_O-V_{NC})	V_{FO}	-0.5 ~ V_D	Volts
Fault Output Current (Sink Current at F_O Terminal)	I_{FO}	10	mA
Current Sensing Input Voltage (Applied between C_{IN}-V_{NC})	V_{SC}	-0.5 ~ V_D	Volts

T_f Measurement Point



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Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

IGBT Inverter Sector

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector Cutoff Current	I_{CES}	$V_{CE} = V_{CES}$, T_j = 25°C	—	—	1.0	mA
		$V_{CE} = V_{CES}$, T_j = 125°C	—	—	10	mA
Diode Forward Voltage	V_{EC}	T_j = 25°C, $-I_C$ = 3A, V_{IN} = 0V	—	1.55	2.00	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 3A, T_j = 25°C, $V_D = V_{DB}$ = 15V, V_{IN} = 5V	—	1.60	2.15	Volts
		I_C = 3A, T_j = 125°C, $V_D = V_{DB}$ = 15V, V_{IN} = 5V	—	1.70	2.30	Volts
Inductive Load Switching Times	t_{on}	V_{CC} = 300V, $V_D = V_{DB}$ = 15V, I_C = 3A, T_j = 125°C, V_{IN} = 0 ⇔ 5V, Inductive Load (Upper-Lower Arm)	0.50	0.85	1.25	µS
	t_{rr}		—	0.20	—	µS
	$t_{C(on)}$		—	0.35	0.55	µS
	t_{off}		—	1.00	1.50	µS
	$t_{C(off)}$		—	0.55	1.10	µS

Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Fin	$R_{th(j-f)Q}$	IGBT Part (Per 1/6 Module)	—	—	9.0	°C/Watt
Thermal Resistance	$R_{th(j-f)D}$	FWDi Part (Per 1/6 Module)	—	—	9.0	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Min.	Typ.	Value	Units
Supply Voltage	V_{CC}	Applied between P-N Terminals	0	300	400	Volts
Control Supply Voltage	V_D	Applied between V_{N1}-V_{NC}	13.5	15.0	16.5	Volts
	V_{DB}	Applied between V_{UFB}-U(V_{UFS}), V_{VFB}-V(V_{VFS}), V_{WFB}-W(V_{WFS})	13.0	15.0	18.5	Volts
Control Supply Variation	ΔV_D, ΔV_{DB}		-1	—	1	V/µs
PWM Input Frequency	f_{PWM}	$T_f \leq$ 100°C, $T_j \leq$ 125°C	—	15	—	kHz
Allowable RMS Current*	I_O	V_{CC} = 300V, V_D = 15V, f_c = 15kHz, P_F = 0.8 Sinusoidal, $T_j \leq$ 125°C, $T_f \leq$ 100°C	—	—	17	Arms
V_{NC} Terminal Voltage	V_{NC}	Applied between V_{NC}-N (Include Surge Voltage)	-5	—	5	Volts
Minimum Input Pulse Width**	PWIN	ON/OFF	0.3	—	—	µS
Arm Shoot-through Blocking Time	t_{DEAD}	For Each Input Signal	1.5	—	—	µS

* The allowable RMS current value depends on the actual application conditions.
**There might be no output when the input signal width is less than PWIN.

Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Control Sector						
Supply Voltage	V_D	Applied between 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 = 15V, V_{IN} = 0V, Total of V_{N1}-V_{NC} (U, V, W)	—	—	3.60	mA
		V_D = 15V, V_{IN} = 5V, Total of V_{N1}-V_{NC} (U, V, W)	—	—	3.60	mA
	I_{DB}	V_{DB} = 15V, V_{IN} = 0V, V_{UFB}-U(V_{UFS}), V_{VFB}-V(V_{VFS}), V_{WFB}-W(V_{WFS})	—	—	0.50	mA
		V_{DB} = 15V, V_{IN} = 5V, V_{UFB}-U(V_{UFS}), V_{VFB}-V(V_{VFS}), V_{WFB}-W(V_{WFS})	—	—	0.50	mA
Fault Output Voltage	V_{FOH}	V_{SC} = 0V, F_O Circuit: 1k Ω to 5V Pull-up	4.9	—	—	Volts
	V_{FOL}	V_{SC} = 1V, I_{FO} = -10mA	—	—	0.95	Volts
Input Current	I_{IN}	V_{IN} = 5V	0.70	1.06	1.50	mA
PWM Input Frequency	f_{PWM}	$T_f \leq$ 100°C, $T_j \leq$ 125°C	—	15	—	kHz
Short Circuit Trip Level*	$V_{SC(ref)}$	T_j = 25°C, V_D = 15V	0.43	0.48	0.53	Volts
Supply Circuit Under-voltage	UV_{DBt}	Trip Level, $T_j \leq$ 125°C	10.0	—	12.0	Volts
	UV_{DBr}	Reset Level, $T_j \leq$ 125°C	10.5	—	12.5	Volts
	UV_{Dt}	Trip Level, $T_j \leq$ 125°C	10.3	—	12.5	Volts
	UV_{Dr}	Reset Level, $T_j \leq$ 125°C	10.8	—	13.0	Volts
Fault Output Pulse Width**	t_{FO}		20	40	—	µS
ON Threshold Voltage	$V_{th(on)}$	Applied between U_P, V_P, W_P-V_{NC}, U_N, V_N, W_N-V_{NC}	2.10	2.35	2.60	Volts
OFF Threshold Voltage	$V_{th(off)}$		1.10	1.40	1.80	Volts

* Short Circuit protection is functioning only at the lower-arms. Please select the value of the external shunt resistor such that the SC trip level is less than 5.1A.
**FO signal is only asserted when the SC or UV protection is activated on the low side.

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