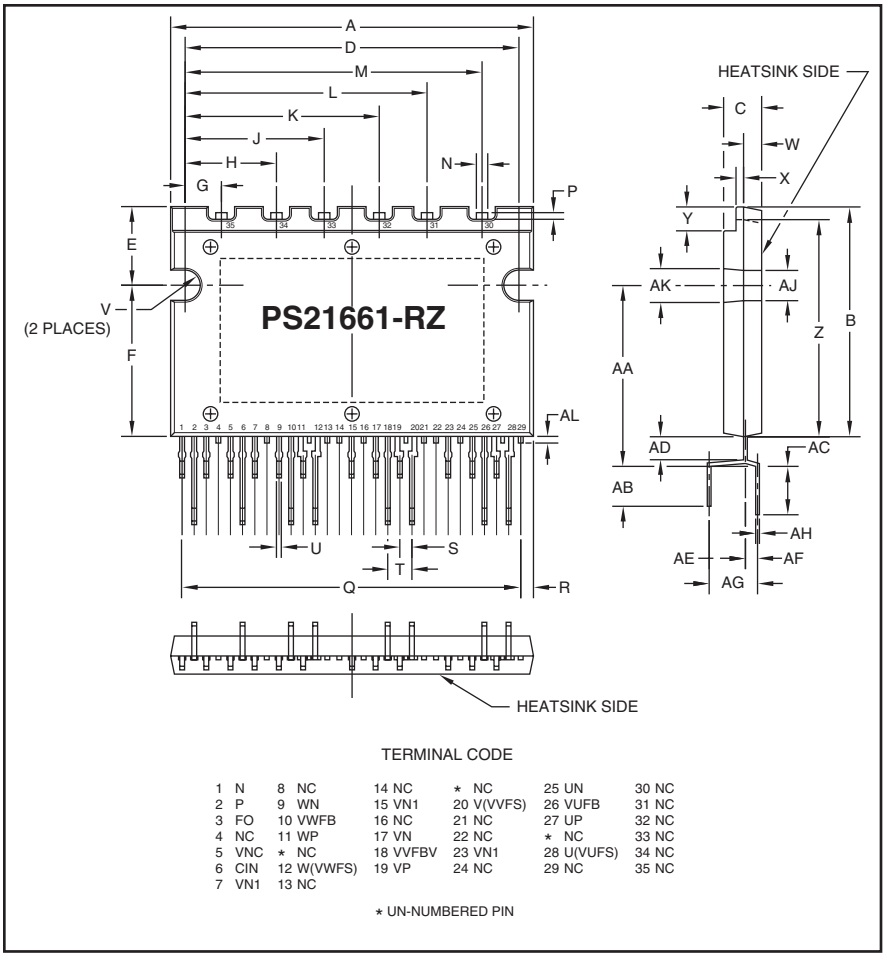
Powerex, Inc., 200 E. Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

Intellimod™ Module

Single-In-Line Intelligent Power Module

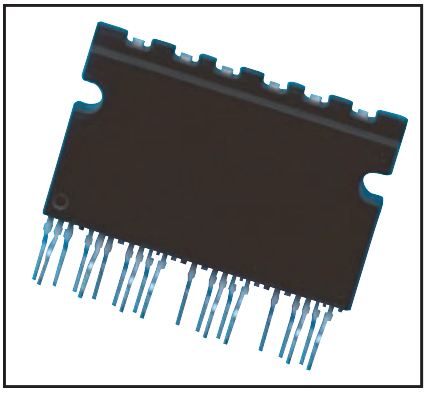
3 Amperes/600 Volts



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.

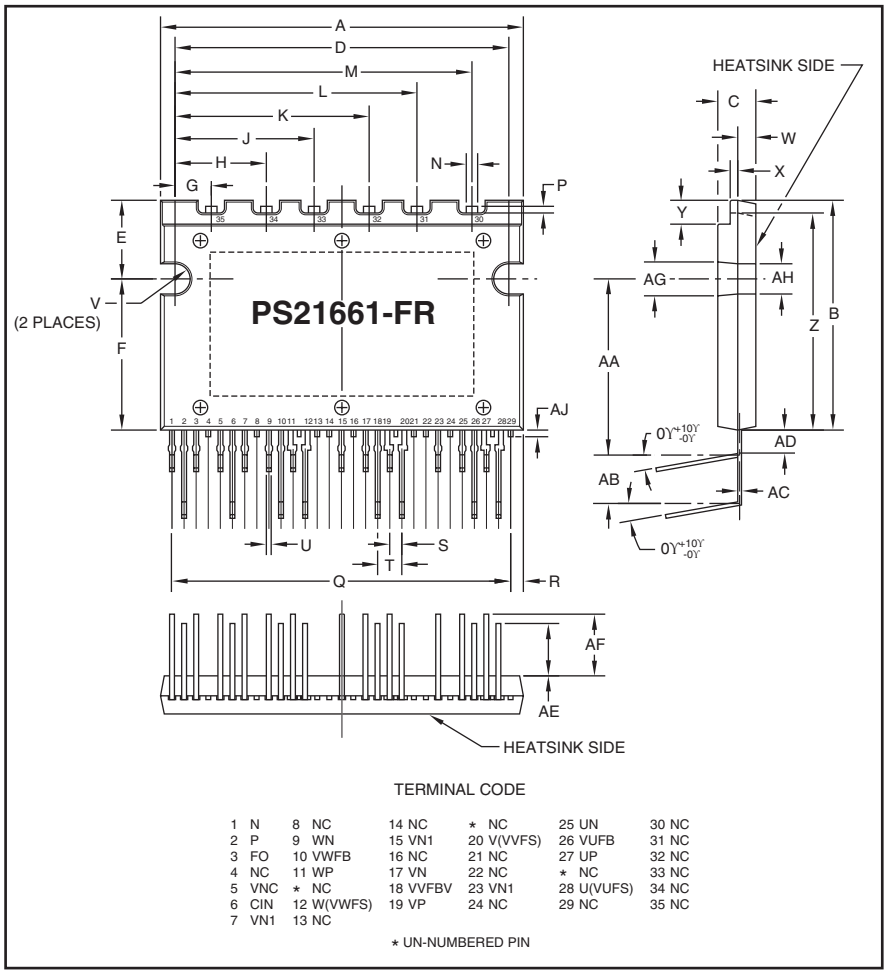
Features:
- ☐ Compact Packages
- ☐ Single Power Supply
- ☐ Integrated HVICs
- ☐ Direct Connection to CPU

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.

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

PS21661-RZ/-FR
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

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

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

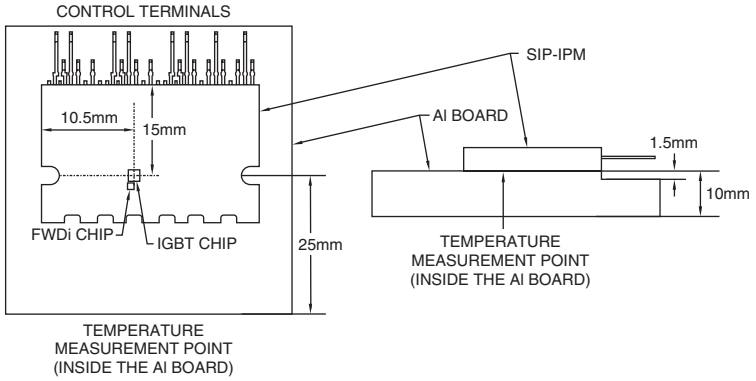
IGBT Inverter Sector

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 ≤ 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

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



Electrical and Mechanical Characteristics, T_j = 25°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°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
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}	13.0	15.0	18.5	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})	—	—	0.35	mA
		V_{DB} = 15V, V_{IN} = 5V, V_{UFB}-U(V_{UFS}), V_{VFB}-V(V_{VFS}), V_{WFB}-W(V_{WFS})	—	—	0.35	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
Short-Circuit Trip Level*	$V_{SC(ref)}$	T_j = 25°C, V_D = 15V	0.43	0.48	0.53	Volts
Supply Circuit Undervoltage	UV_{DBt}	Trip Level, T_j ≤ 125°C	10.0	—	12.0	Volts
	UV_{DBr}	Reset Level, T_j ≤ 125°C	10.5	—	12.5	Volts
	UV_{Dt}	Trip Level, T_j ≤ 125°C	10.3	—	12.5	Volts
	UV_{Dr}	Reset Level, T_j ≤ 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

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

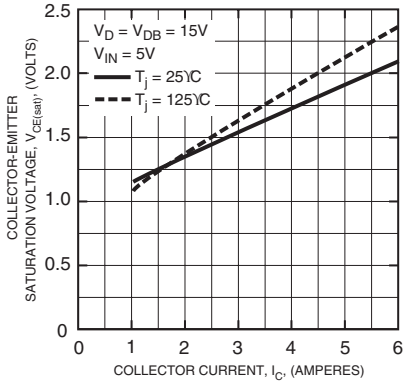
* Short-Circuit protection is functioning only at the lower-arms. Please select the value of the external shunt resistor such that the SC trip level is less than 5.1A.
**FO signal is only asserted when the SC or UV protection is activated on the low side.

Recommended Conditions for Use

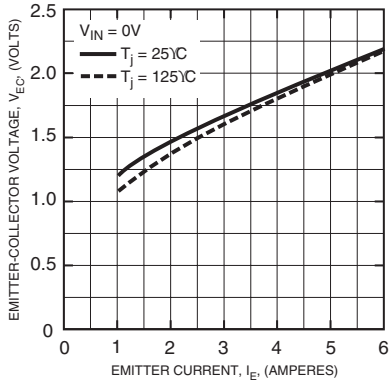
Characteristic	Symbol	Condition	Min.	Typ.	Value	Units
Supply Voltage	V_{CC}	Applied between P-N Terminals	0	300	400	Volts
Control Supply Voltage	V_D	Applied between V_{N1}-V_{NC}	13.5	15.0	16.5	Volts
	V_{DB}	Applied between V_{UFB}-U(V_{UFS}), V_{VFB}-V(V_{VFS}), V_{WFB}-W(V_{WFS})	13.0	15.0	18.5	Volts
Control Supply Variation	ΔV_D, ΔV_{DB}		-1	—	1	V/μs
PWM Input Frequency	f_{PWM}	$T_f \le 100°C$, $T_j \le 125°C$	—	15	—	kHz
Allowable RMS Current*	I_O	V_{CC} = 300V, V_D = 15V, f_c = 5kHz, P_F = 0.8 Sinusoidal, $T_j \le 125°C$, $T_f \le 100°C$	—	—	3.0	Arms
		V_{CC} = 300V, V_D = 15V, f_c = 15kHz, P_F = 0.8 Sinusoidal, $T_j \le 125°C$, $T_f \le 100°C$	—	—	2.1	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	2.0	—	—	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.

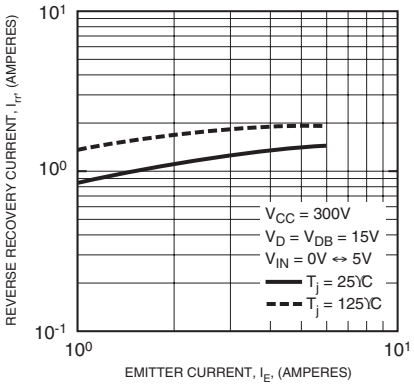
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



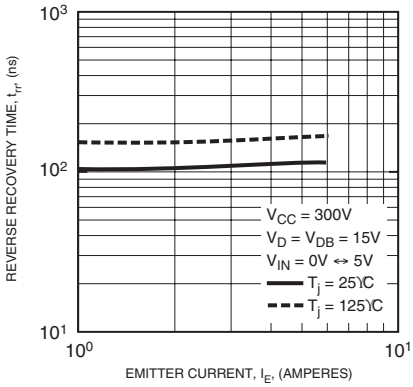
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



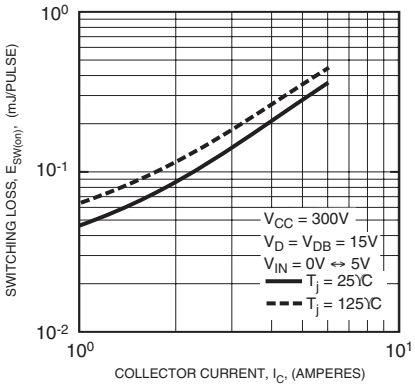
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



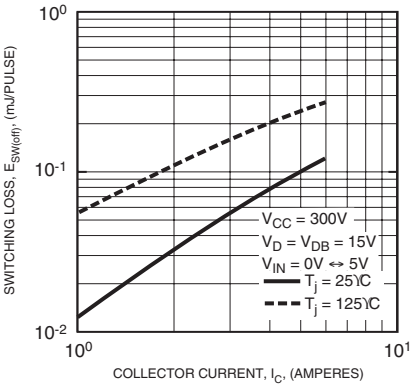
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL)

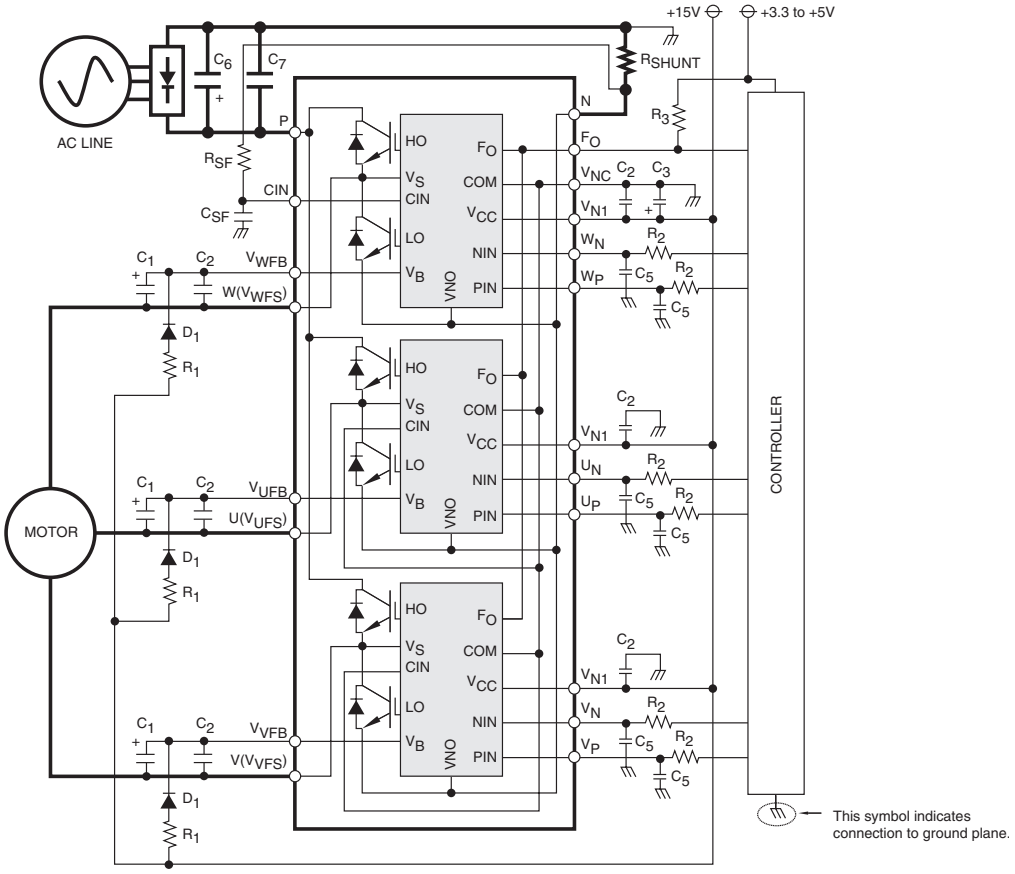


SWITCHING LOSS (OFF) VS. COLLECTOR CURRENT (TYPICAL)



PS21661-RZ/-FR
Intellimod™ Module
Single-In-Line Intelligent Power Module
3 Amperes/600 Volts

SIP-IPM Application Circuit



Component Selection:

Dsgn.	Typ. Value	Description
D_1	1A, 600V	Boot strap supply diode – Ultra fast recovery
C_1	10-100uF, 50V	Boot strap supply reservoir – Electrolytic, long life, low Impedance, 105°C (Note 5)
C_2	0.22-2.0uF, 50V	Local decoupling/High frequency noise filters – Multilayer ceramic (Note 8)
C_3	10-100uF, 50V	Control power supply filter – Electrolytic, long life, low Impedance, 105°C
C_5	100pF, 50V	Optional Input signal noise filter – Multilayer ceramic (Note 1)
C_6	200-2000uF, 450V	Main DC bus filter capacitor – Electrolytic, long life, high ripple current, 105°C
C_7	0.1-0.22uF, 450V	Surge voltage suppression capacitor – Polyester/Polypropylene film (Note 9)
C_{SF}	1000pF, 50V	Short circuit detection filter capacitor – Multilayer Ceramic (Note 6, Note 7)
R_{SF}	1.8k ohm	Short circuit detection filter resistor (Note 6, Note 7)
R_{SHUNT}	5-100 mohm	Current sensing resistor - Non-inductive, temperature stable, tight tolerance (Note 10)
R_1	10 ohm	Boot strap supply inrush limiting resistor (Note 5)
R_2	330 ohm	Optional control input pull-up resistor (Note 1, Note 2)
R_3	1k ohm	Fault output signal pull-up resistor (Note 3)

Notes:

1) To prevent input signal oscillations minimize wiring length to controller (~2cm). Additional RC filtering (C5 etc.) may be required. If filtering is added be careful to maintain proper dead time and voltage levels. See application notes for details.
2) Internal HVIC provides high voltage level shifting allowing direct connection of all six driving signals to the controller.
3) F_O output is an open collector type. Pull-up resistor (R3) should be adjusted to current sink capability of the module.
5) Boot strap supply component values must be adjusted depending on the PWM frequency and technique.
6) Wiring length associated with R_{SHUNT}, R_{SF}, C_{SF} must be minimized to avoid improper operation of the SC function.
7) R_{SF}, C_{SF} set short circuit protection trip time. Recommend time constant is 1.5us-2.0us. See application notes.
8) Local decoupling/high frequency filter capacitors must be connected as close as possible to the modules pins.
9) The length of the DC link wiring between C6, C7, the DIP's P terminal and the shunt must be minimized to prevent excessive transient voltages. In particular C7 should be mounted as close to the DIP as possible.
10) Use high quality, tight tolorance current sensing resistor. Connect resistor as close as possible to the DIP's N terminal. Be careful to check for proper power rating. See application notes for calculation of resistance value.

ООО «ЛайфЭлектроникс» “LifeElectronics” LLC

ИНН 7805602321 КПП 780501001 Р/С 40702810122510004610 ФАКБ "АБСОЛЮТ БАНК" (ЗАО) в г.Санкт-Петербурге К/С 30101810900000000703 БИК 044030703

Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- *Конкурентоспособные цены и скидки постоянным клиентам.*
- *Специальные условия для постоянных клиентов.*
- *Подбор аналогов.*
- *Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.*

- *Приемлемые сроки поставки, возможна ускоренная поставка.*
- *Доставку товара в любую точку России и стран СНГ.*
- *Комплексную поставку.*
- *Работу по проектам и поставку образцов.*
- *Формирование склада под заказчика.*

- *Сертификаты соответствия на поставляемую продукцию (по желанию клиента).*
- *Тестирование поставляемой продукции.*
- *Поставку компонентов, требующих военную и космическую приемку.*
- *Входной контроль качества.*
- *Наличие сертификата ISO.*

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- *Регистрацию проекта у производителя компонентов.*
- *Техническую поддержку проекта.*
- *Защиту от снятия компонента с производства.*
- *Оценку стоимости проекта по компонентам.*
- *Изготовление тестовой платы монтаж и пусконаладочные работы.*

Тел: +7 (812) 336 43 04 (многоканальный)
Email: org@lifeelectronics.ru

www.lifeelectronics.ru