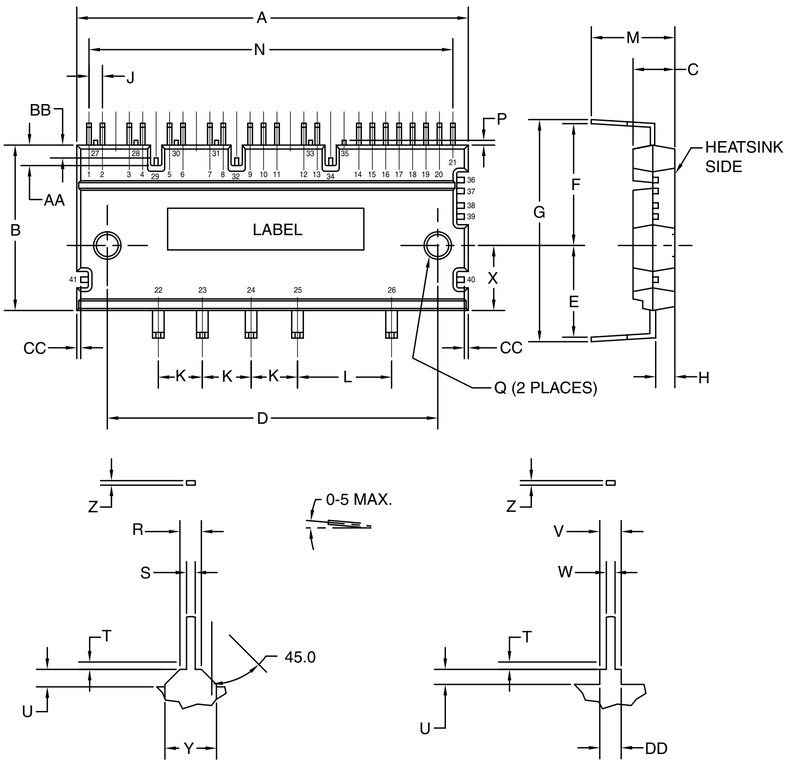
Powerex, Inc., 200 E. Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

Intellimod™ Module

Dual-In-Line Intelligent Power Module 30 Amperes/600 Volts



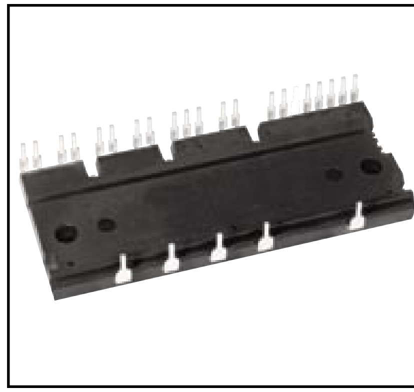
TERMINAL CODE

1 U_P	8 V_{VFS}	15 V_{NC}	22 P	29 NC	36 NC
2 V_{P1}	9 W_P	16 C_{IN}	23 U	30 NC	37 NC
3 V_{UFB}	10 V_{P1}	17 C_{FO}	24 V	31 NC	38 NC
4 V_{UFS}	11 V_{PC}	18 F_O	25 W	32 NC	39 NC
5 V_P	12 V_{WFB}	19 U_N	26 N	33 NC	40 NC
6 V_{P1}	13 V_{WFS}	20 V_N	27 NC	34 NC	41 NC
7 V_{VFB}	14 V_{N1}	21 W_N	28 NC	35 NC	

Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	3.11±0.02	79.0±0.5
B	1.22±0.02	31.0±0.5
C	0.28±0.02	7.0±0.5
D	2.64±0.01	67.0±0.3
E	0.53±0.02	13.4±0.5
F	0.84±0.02	21.4±0.5
G	1.37±0.02	34.9±0.5
H	0.15±0.01	3.8±0.2
J	0.11±0.01	2.8±0.3
K	0.39±0.01	10.0±0.3
L	0.79±0.01	20.0±0.3
M	0.63±0.02	16.0±0.5
N	2.98	75.6
P	0.04	1.0

Dimensions	Inches	Millimeters
Q	0.18±0.01 Dia.	4.5±0.2 Dia.
R	0.07±0.002	1.9±0.05
S	0.04±0.01	1.0±0.2
T	0.02 Max.	0.5 Max.
U	0.06±0.02	1.6±0.5
V	0.07±0.002	1.70±0.05
W	0.03±0.01	0.8±0.2
X	0.45±0.02	11.5±0.5
Y	0.13 Max.	3.25 Max.
Z	0.03	0.7
AA	0.18	4.5
BB	0.12	3.1
CC	0.02	0.6
DD	0.07 Max.	1.85 Max.



Description:

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 5th 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

Applications:

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

Ordering Information:

PS21867-A is a 600V, 30 Ampere DIP Intelligent Power Module.

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

Characteristics	Symbol	PS21867-AP	Units
Power Device Junction Temperature*	T_j	-20 to 125	°C
Module Case Operation Temperature (See T_f Measurement Point Illustration)	T_f	-20 to 100	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Mounting Torque, M4 Mounting Screws	—	13	in-lb
Module Weight (Typical)	—	65	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 DIP-IPM is 150°C (@$T_f \le$ 100°C). However, to ensure safe operation of the DIP-IPM, the average junction temperature should be limited to $T_{j(avg)} \le$ 125°C (@$T_f \le$ 100°C).
**V_D = 13.5 ~ 16.5V, Inverter Part, T_j = 125°C, Non-repetitive, Less than 2μs

IGBT Inverter Sector

Characteristics	Symbol	PS21867-AP	Units
Collector-Emitter Voltage (T_f = 25°C)	V_{CES}	600	Volts
Collector Current (T_f = 25°C)	$\pm I_C$	30	Amperes
Peak Collector Current (T_f = 25°C, <1ms)	$\pm I_{CP}$	60	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	60.6	Watts

Control Sector

Characteristics	Symbol	PS21867-AP	Units
Supply Voltage (Applied between V_{P1}-V_{PC}, V_{N1}-V_{NC})	V_D	20	Volts
Supply Voltage (Applied between V_{UFB}-V_{UFS}, V_{VFB}-V_{VFS}, V_{WFB}-V_{WFS})	V_{DB}	20	Volts
Input Voltage (Applied between U_P, V_P, W_P-V_{PC}, U_N, V_N, W_N-V_{NC})	V_{IN}	-0.5 ~ V_D+0.5	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}	1	mA
Current Sensing Input Voltage (Applied between C_{IN}-V_{NC})	V_{SC}	-0.5 ~ V_D+0.5	Volts

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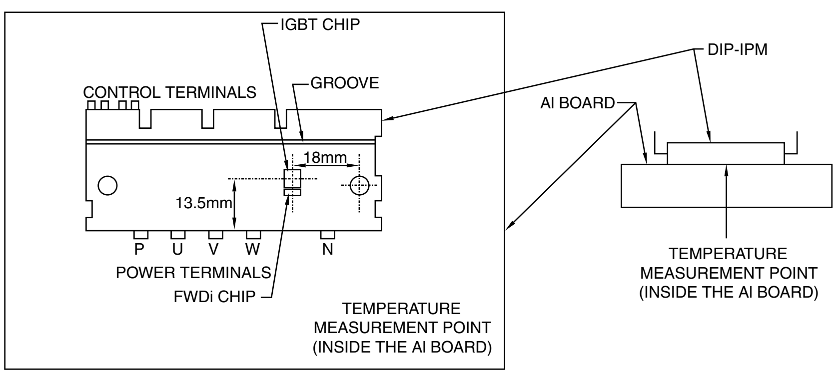
Electrical and Mechanical Characteristics, T_j = 25°C unless otherwise specified

IGBT Inverter Sector

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Collector-Emitter 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, $-I_C$ = 30A, V_{IN} = 5V	—	1.5	2.0	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 30A, T_j = 25°C, $V_D = V_{DB}$ = 15V, V_{IN} = 0V	—	1.6	2.1	Volts
		I_C = 30A, T_j = 125°C, $V_D = V_{DB}$ = 15V, V_{IN} = 0V	—	1.7	2.2	Volts
Inductive Load Switching Times	t_{on}	V_{CC} = 300V, $V_D = V_{DB}$ = 15V, I_C = 30A, T_j = 125°C, V_{IN} = 5 ⇔ 0V, Inductive Load (Upper-Lower Arm)	0.7	1.30	1.90	µs
	t_{rr}		—	0.30	—	µs
	$t_{C(on)}$		—	0.40	0.60	µs
	t_{off}		—	1.70	2.40	µs
	$t_{C(off)}$		—	0.50	0.80	µs

T_f Measurement Point



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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_{P1}-V_{PC}, 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	$V_D = V_{DB}$ = 15V, V_{IN} = 5V, Total of V_{P1}-V_{PC}, V_{N1}-V_{NC}	—	—	5.00	mA
		$V_D = V_{DB}$ = 15V, V_{IN} = 0V, Total of V_{P1}-V_{PC}, V_{N1}-V_{NC}	—	—	7.00	mA
		$V_D = V_{DB}$ = 15V, V_{IN} = 5V, V_{UFB}-V_{UFS}, V_{VFB}-V_{VFS}, V_{WFB}-V_{WFS}	—	—	0.40	mA
		$V_D = V_{DB}$ = 15V, V_{IN} = 0V, V_{UFB}-V_{UFS}, V_{VFB}-V_{VFS}, V_{WFB}-V_{WFS}	—	—	0.55	mA
Fault Output Voltage	V_{FOH}	V_{SC} = 0V, F_O Circuit: 10kΩ to 5V Pull-up	4.9	—	—	Volts
	V_{FOL}	V_{SC} = 1V, I_{FO} = 1mA	—	—	0.95	Volts
Input Current	I_{IN}	V_{IN} = 5V	1.0	1.50	2.00	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, $T_j \leq$ 125°C	10.0	—	12.0	Volts
Protection	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}	C_{FO} = 22nF	1.0	1.8	—	ms
ON Threshold Voltage	$V_{th(on)}$	Applied between U_P, V_P, W_P-V_{PC}, U_N, V_N, W_N-V_{NC}	2.1	2.3	2.6	Volts
OFF Threshold Voltage	$V_{th(off)}$		0.8	1.4	2.1	Volts

Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Fin	$R_{th(j-f)Q}$	IGBT Part (Per 1/6 Module)	—	—	1.65	°C/Watt
Thermal Resistance	$R_{th(j-f)D}$	FWDi Part (Per 1/6 Module)	—	—	3.00	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Supply Voltage	V_{CC}	Applied between P-N Terminals	0	300	400	Volts
Control Supply Voltage	V_D	Applied between V_{P1}-V_{PC}, 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
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	—	—	20	kHz

* 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 51A.

**Fault signal is asserted when the lower 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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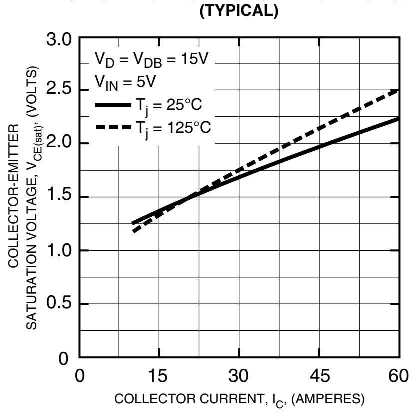
Recommended Conditions for Use

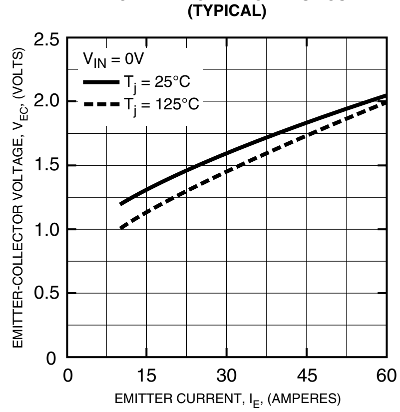
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Allowable rms Current*	I_O	V_{CC} = 300V, V_D = 15V, f_C = 5kHz, PF = 0.8, Sinusoidal, $T_j \le$ 125°C, $T_f \le$ 100°C	—	—	18.9	Arms
		V_{CC} = 300V, V_D = 15V, f_C = 15kHz, PF = 0.8, Sinusoidal, $T_j \le$ 125°C, $T_f \le$ 100°C	—	—	11.6	Arms
Minimum Input Pulse Width	$P_{WIN(on)}$**		0.3	—	—	μs
	$P_{WIN(off)}$***					
	Below Rated Current	200 ≤ V_{CC} ≤ 350V, 13.5 ≤ V_D ≤ 16.5V, 13.0 ≤ V_{DB} ≤ 18.5V, -20°C ≤ T_f ≤ 100°C, N-line Wiring Inductance Less Than 10nH	1.5	—	—	μs
	Between Rated Current & 1.7 Times of rated Current		3.0	—	—	μs
V_{NC} Variation	V_{NC}	Between V_{NC}-N (Including Surge)	-5.0	—	5.0	Volts
Arm Shoot-through Blocking Time	t_{DEAD}	For Each Input Signal, T_f < 100°C	2.0	—	—	μs

* The allowable rms current value depends on the actual application conditions.
**If input signal ON pulse is less than $P_{WIN(on)}$, the device may not respond.
***The IPM may fail to respond to an ON pulse if the preceeding OFF pulse is less than $P_{WIN(off)}$.

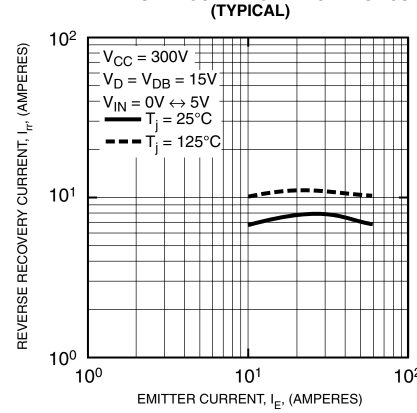
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



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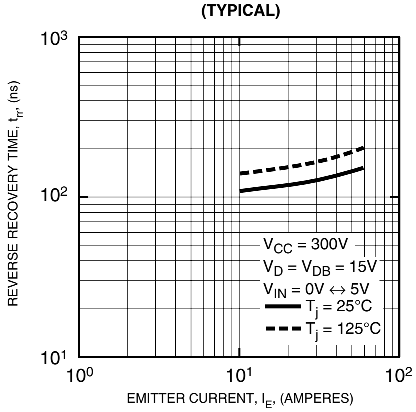
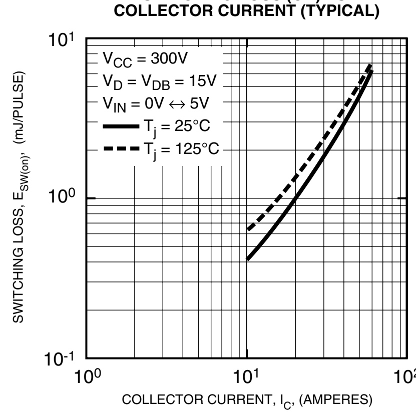


SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL)



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