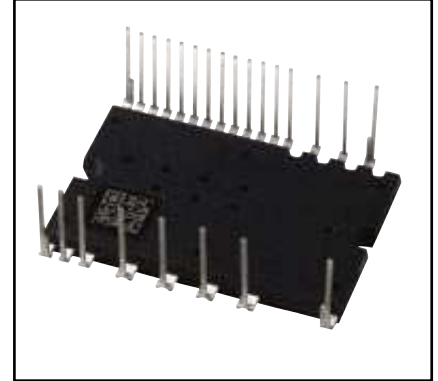
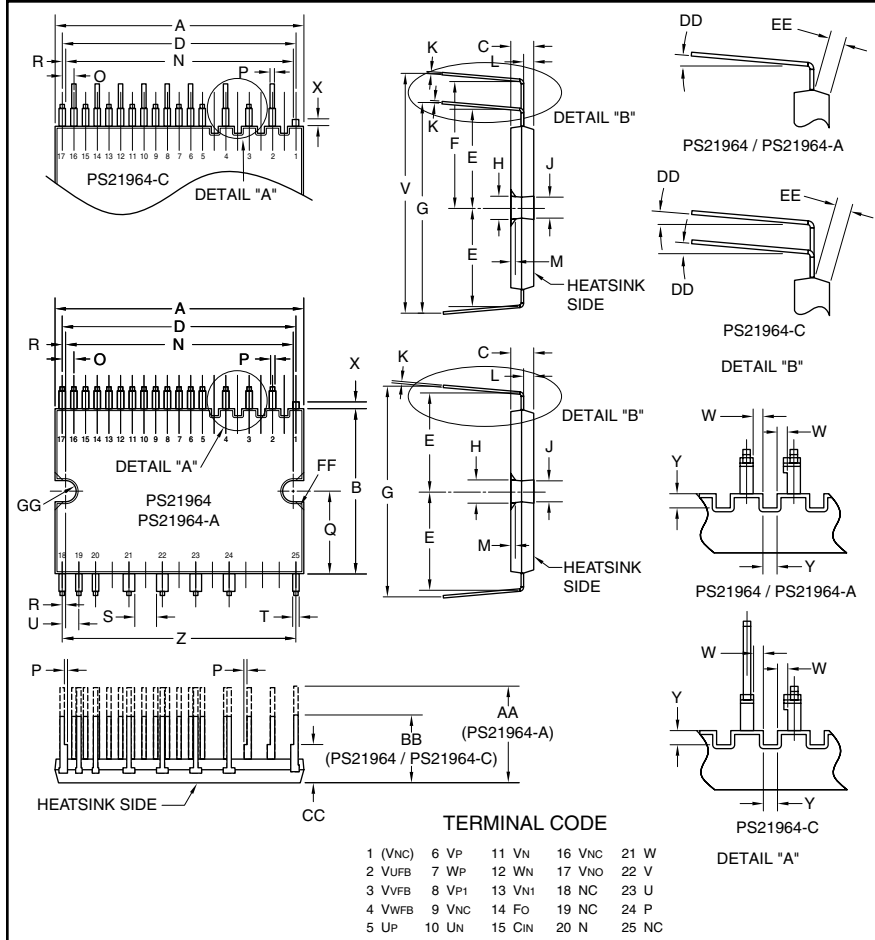


### Intellimod™ Module Dual-In-Line Intelligent Power Module 15 Amperes/600 Volts



#### 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
- Reduced  $R_{th}$

#### Applications:

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

#### Ordering Information:

PS21964 is a 600V, 15 Ampere short pin DIP Intelligent Power Module.

PS21964-A – long pin type  
PS21964-C – zigzag pin type

#### Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	1.50±0.02	38.0±0.5
B	0.94±0.02	24.0±0.5
C	0.14	3.5
D	1.40	35.56
E	0.57±0.02	14.4±0.5
F	0.74±0.02	18.9±0.5
G	1.15±0.02	29.2±0.5
H	0.14	3.5
J	0.13	3.3
K	0.016	0.4
L	0.06±0.02	1.5±0.05
M	0.031	0.8
N	1.39±0.019	35.0±0.3
O	0.07±0.008	1.778±0.2
P	0.02	0.5
Q	0.47	12.0

Dimensions	Inches	Millimeters
R	0.011	0.28
S	0.12	3.08
T	0.024	0.6
U	0.1±0.008	2.54±0.2
V	1.33±0.02	33.7±0.5
W	0.03	0.678
X	0.04	1.0
Y	0.05	1.2
Z	1.40	35.56
AA	0.55±0.02	14.0±0.5
BB	0.37±0.02	9.5±0.5
CC	0.22±0.02	5.5±0.5
DD	0 ~ 5°	0 ~ 5°
EE	0.06 MIN.	1.5 Min.
FF	0.05	1.2
GG	0.063 Rad.	1.6 Rad.

**PS21964, PS21964-A, PS21964-C**  
**Intellimod™ Module**  
**Dual-In-Line Intelligent Power Module**  
 15 Amperes/600 Volts

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

Characteristics	Symbol	PS21964, PS21964-A	
		PS21964-C	Units
Power Device Junction Temperature*	$T_j$	-20 to 150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$	-40 to 125	$^\circ\text{C}$
Case Operating Temperature (Note 1)	$T_C$	-20 to 100	$^\circ\text{C}$
Mounting Torque, M3 Mounting Screws	—	6	in-lb
Module Weight (Typical)	—	10	Grams
Heatsink Flatness (Note 2)	—	-50 to 100	$\mu\text{m}$
Self-protection Supply Voltage Limit (Short Circuit Protection Capability)**	$V_{\text{CC(prot.)}}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal, Connection Pins to Heatsink Plate	$V_{\text{ISO}}$	1500	Volts

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

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

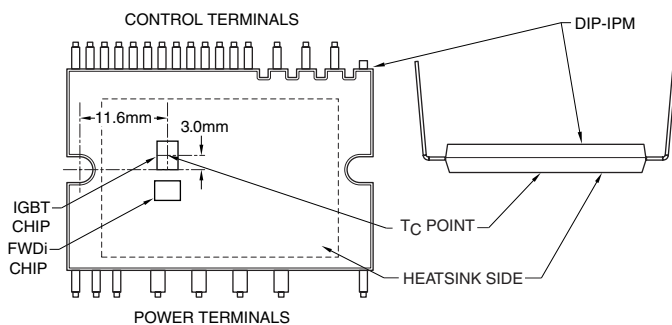
## IGBT Inverter Sector

Collector-Emitter Voltage	$V_{\text{CES}}$	600	Volts
Each Collector Current, $\pm$ ( $T_C = 25^\circ\text{C}$ )	$I_C$	15	Amperes
Each Peak Collector Current, $\pm$ ( $T_C = 25^\circ\text{C}$ , Less than 1ms)	$I_{\text{CP}}$	30	Amperes
Supply Voltage (Applied between P - N)	$V_{\text{CC}}$	450	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	500	Volts
Collector Dissipation ( $T_C = 25^\circ\text{C}$ , per 1 Chip)	$P_C$	33.3	Watts

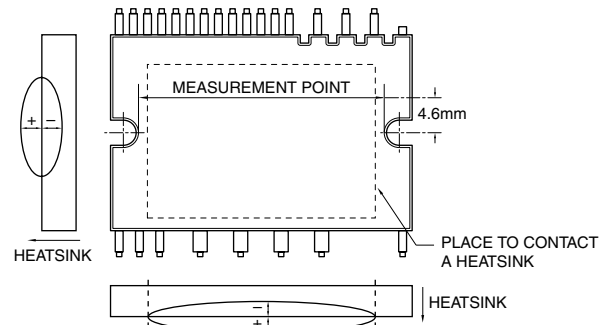
## Control Sector

Supply Voltage (Applied between $V_{P1-V_{NC}}$ , $V_{N1-V_{NC}}$ )	$V_D$	20	Volts
Supply Voltage (Applied between $V_{UFB-U}$ , $V_{VFB-V}$ , $V_{WFB-W}$ )	$V_{\text{DB}}$	20	Volts
Input Voltage (Applied between $U_P, V_P, W_P-V_{NC}$ ; $U_N, V_N, W_N-V_{NC}$ )	$V_{\text{IN}}$	$-0.5 \sim V_D + 0.5$	Volts
Fault Output Supply Voltage (Applied between $F_O-V_{NC}$ )	$V_{\text{FO}}$	$-0.5 \sim V_D + 0.5$	Volts
Fault Output Current (Sink Current at $F_O$ Terminal)	$I_{\text{FO}}$	1	mA
Current Sensing Input Voltage (Applied between $C_{\text{IN}}-V_{NC}$ )	$V_{\text{SC}}$	$-0.5 \sim V_D + 0.5$	Volts

Note 1 –  $T_C$  Measure Point



Note 2 – Flatness Measurement Position



PS21964, PS21964-A, PS21964-C  
 Intellimod™ Module  
 Dual-In-Line Intelligent Power Module  
 15 Amperes/600 Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>IGBT Inverter Sector</b>						
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = V_{DB} = 15\text{V}, I_C = 15\text{A}, V_{IN} = 5\text{V}, T_j = 25^\circ\text{C}$	—	1.70	2.20	Volts
		$V_D = V_{DB} = 15\text{V}, I_C = 15\text{A}, V_{IN} = 5\text{V}, T_j = 125^\circ\text{C}$	—	1.80	2.30	Volts
Diode Forward Voltage	$V_{EC}$	$-I_C = 15\text{A}, V_{IN} = 0\text{V}$	—	1.70	2.20	Volts
Inductive Load Switching Times	$t_{on}$		0.70	1.30	1.90	$\mu\text{s}$
	$t_{rr}$	$V_{CC} = 300\text{V}, V_D = V_{DB} = 15\text{V},$	—	0.30	—	$\mu\text{s}$
	$t_{C(on)}$	$I_C = 15\text{A}, T_j = 125^\circ\text{C},$	—	0.50	0.75	$\mu\text{s}$
	$t_{off}$	$V_{IN} = 0 \Leftrightarrow 5\text{V}, \text{Inductive Load},$	—	1.60	2.20	$\mu\text{s}$
	$t_{C(off)}$		—	0.50	0.80	$\mu\text{s}$
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

## Control Sector

Circuit Current	$I_D$	$V_{IN} = 5\text{V}$	Total of $V_{P1-V_{NC}}, V_{N1-V_{NC}}$	—	—	2.80	mA
			$V_{UFB-U}, V_{VFB-V}, V_{WFB-W}$	—	—	0.55	mA
		$V_{IN} = 0\text{V}$	Total of $V_{P1-V_{NC}}, V_{N1-V_{NC}}$	—	—	2.80	mA
			$V_{UFB-U}, V_{VFB-V}, V_{WFB-W}$	—	—	0.55	mA
Fault Output Voltage	$V_{FOH}$	$V_{SC} = 0\text{V}, F_O \text{ Terminal Pull-up to } 5\text{V by } 10\text{k}\Omega$	4.9	—	—	Volts	
		$V_{SC} = 1\text{V}, I_{FO} = 1\text{mA}$	—	—	0.95	Volts	
Input Current	$I_{IN}$	$V_{IN} = 5\text{V}$	0.70	1.00	1.50	mA	
Short Circuit Trip Level*	$V_{SC(ref)}$	$V_D = 15\text{V}^*$	0.43	0.48	0.53	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**	$t_{FO}$		20	—	—	$\mu\text{s}$	
ON Threshold Voltage	$V_{th(on)}$	Applied between	—	2.1	2.6	Volts	
OFF Threshold Voltage	$V_{th(off)}$	$U_P, V_P, W_P-V_{NC},$	0.8	1.3	—	Volts	
ON/OFF Threshold Hysteresis Voltage	$V_{th(hys)}$	$U_N, V_N, W_N-V_{NC}$	0.35	0.65	—	Volts	

\* Short Circuit protection is functioning only for the low-arms. Please select the value of the external shunt resistor such that the  $S_C$  trip level is less than 1.7 times the current rating.

\*\* Fault signal is asserted only for a  $U_V$  or  $S_C$  condition on the low side. On a  $S_C$  fault the  $F_O$  duration will be 20 $\mu\text{sec}$ . On a  $U_V$  condition the fault signal will be asserted as long as the  $U_V$  condition exists or for 20 $\mu\text{sec}$ , whichever is longer.

PS21964, PS21964-A, PS21964-C  
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 15 Amperes/600 Volts

## Thermal Characteristics

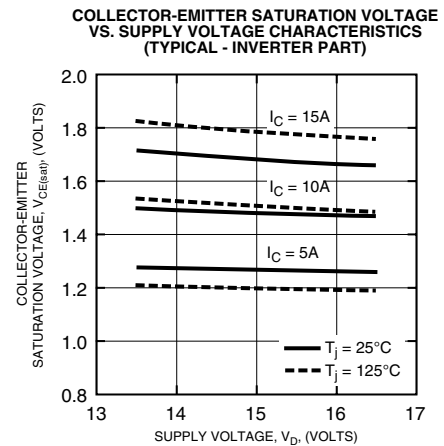
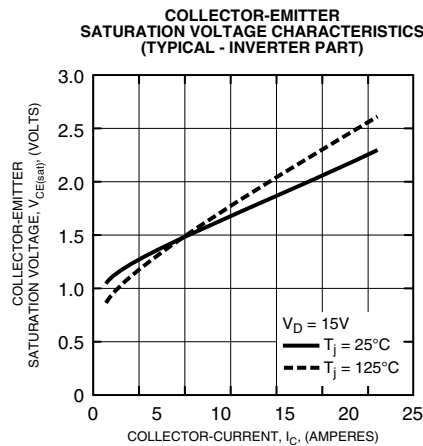
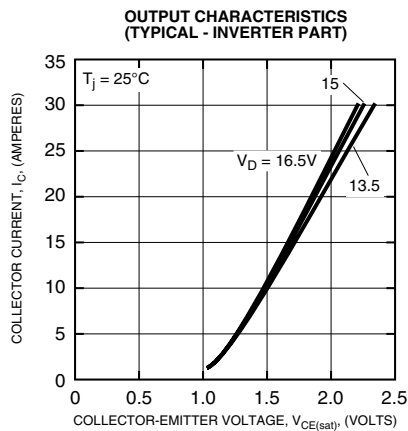
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case	$R_{th(j-c)Q}$	Inverter IGBT (Per 1/6 Module)	—	—	3.0	°C/Watt
	$R_{th(j-c)D}$	Inverter FWDi (Per 1/6 Module)	—	—	3.9	°C/Watt

## Recommended Conditions for Use

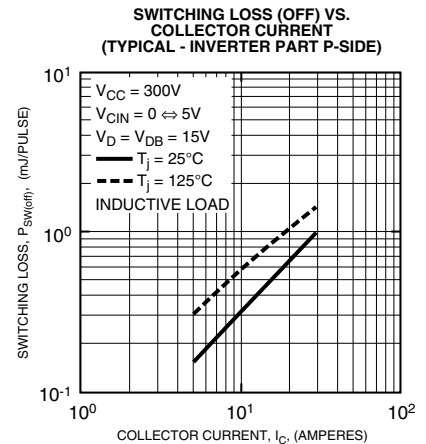
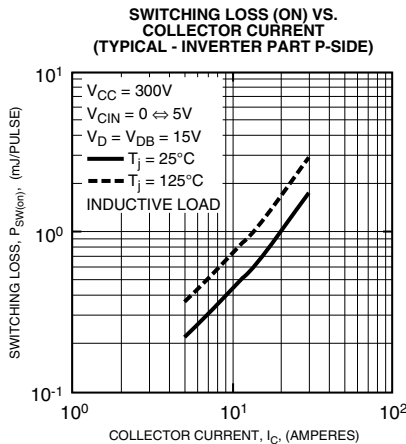
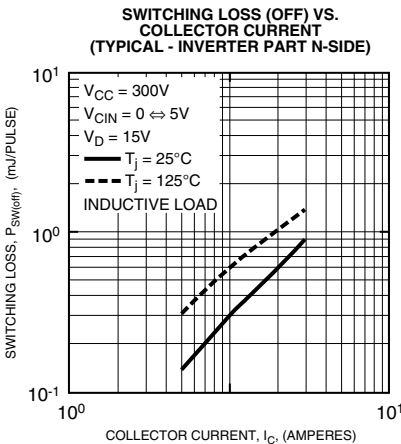
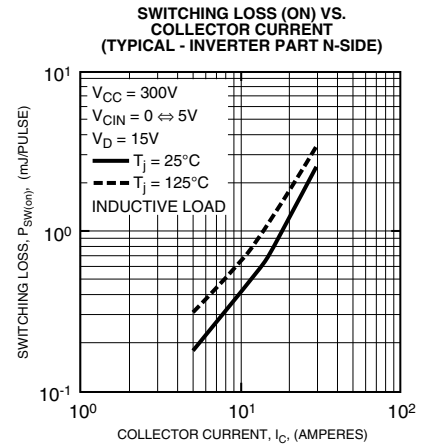
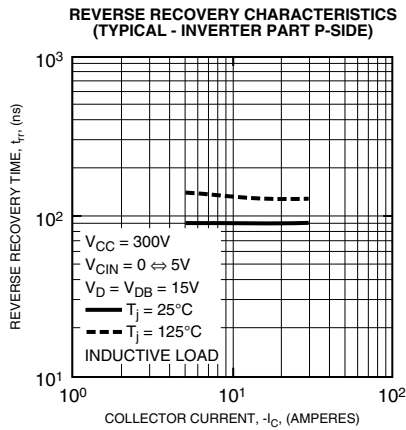
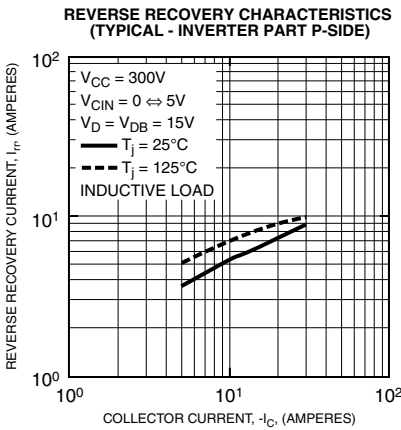
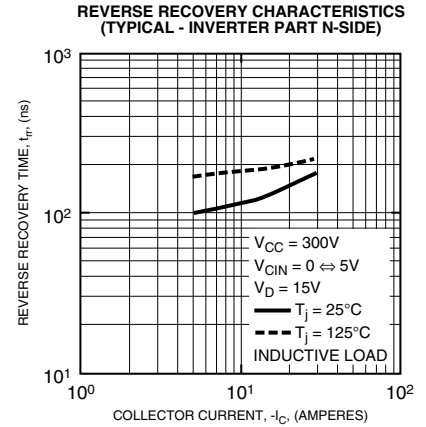
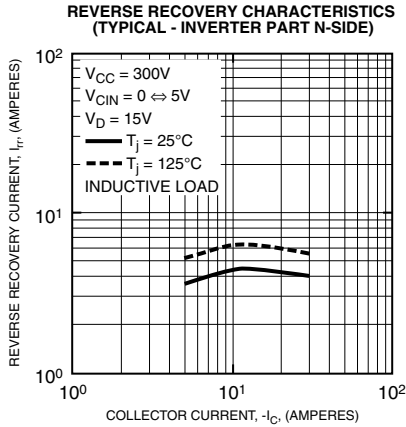
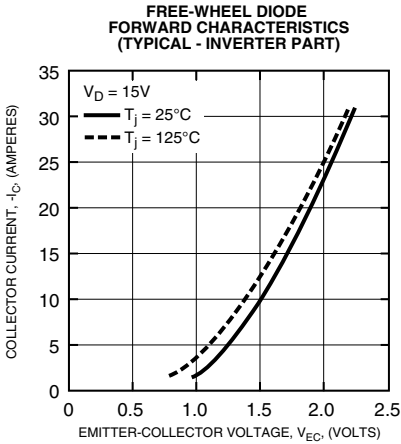
Characteristic	Symbol	Condition	Min.	Typ.	Value	Units
Supply Voltage	$V_{CC}$	Applied between P-N Terminals	0	300	400	Volts
Control Supply Voltage	$V_D$	Applied between $V_{P1}$ - $V_{NC}$ , $V_{N1}$ - $V_{NC}$	13.5	15.0	16.5	Volts
	$V_{DB}$	Applied between $V_{UFB-U}$ , $V_{VFB-V}$ , $V_{WFB-W}$	13.0	15.0	18.5	Volts
Control Supply Variation	$dV_D$ , $dV_{DB}$		-1	—	1	V/ $\mu$ s
Arm Shoot-through Blocking Time	$t_{DEAD}$	For Each Input Signal, $T_C \leq 100^\circ\text{C}$	1.5	—	—	$\mu$ s
Output r.m.s. Current*	$I_O$ $f_{PWM} = 5\text{kHz}$	$V_{CC} = 300\text{V}$ , $V_D = V_{DB} = 15\text{V}$ , P.F. = 0.8, Sinusoidal PWM, $T_j \leq 100^\circ\text{C}$ , $T_C \leq 100^\circ\text{C}$	—	—	7.5	$A_{rms}$
	$I_O$ $f_{PWM} = 15\text{kHz}$		—	—	4.5	$A_{rms}$
Allowable Minimum Input	$P_{WIN(on)}$		0.5	—	—	$\mu$ s
Pulse Width**	$P_{WIN(off)}$		0.5	—	—	$\mu$ s
$V_{NC}$ Voltage Variation	$V_{NC}$	Between $V_{NC-N}$ (Including Surge)	-5.0	—	5.0	Volts

\*The allowable r.m.s. current also depends on the actual application conditions.

\*\*DIP-IPM might not make response or work properly if the input signal plus width is less than the recommended minimum value.



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 15 Amperes/600 Volts



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