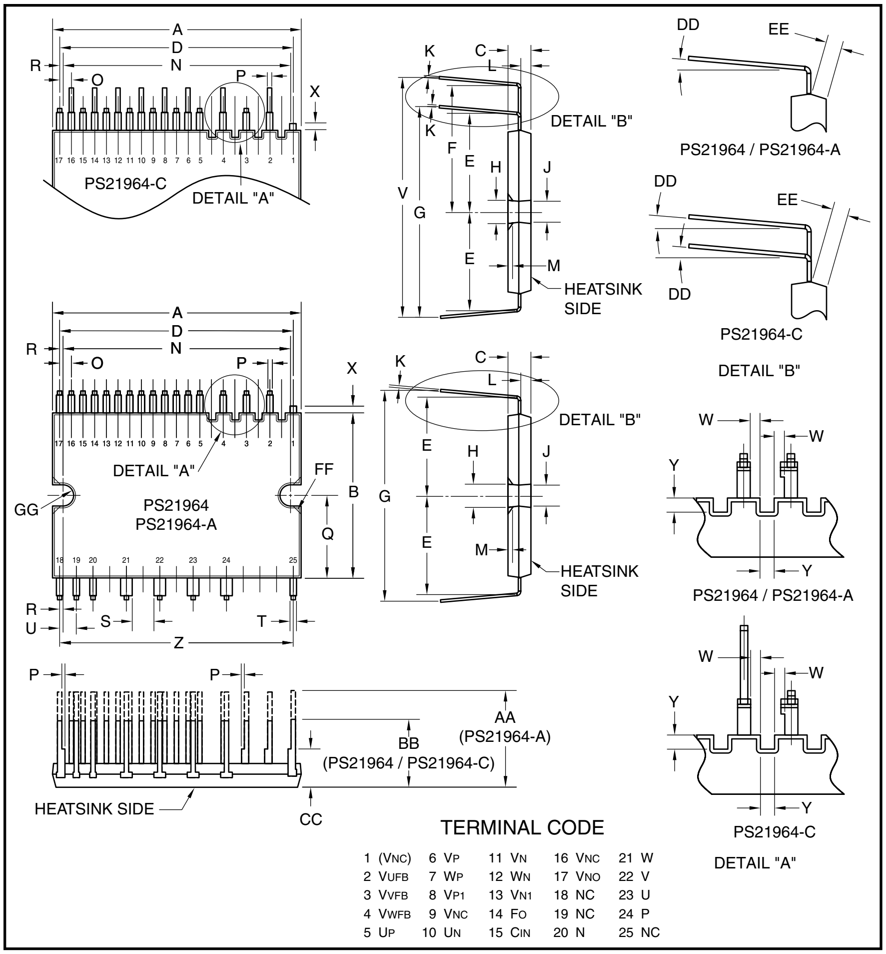
PS21964, PS21964-A, PS21964-C

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

Intellimod™ Module

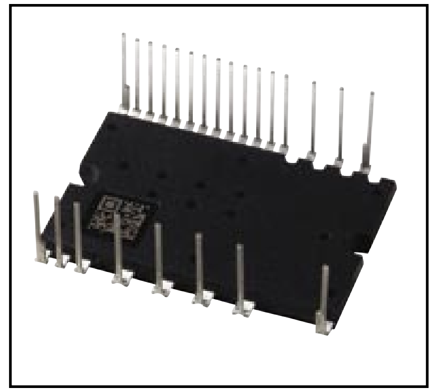
Dual-In-Line Intelligent Power Module
15 Amperes/600 Volts



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.



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

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

Characteristics	Symbol	PS21964, PS21964-A PS21964-C	Units
Power Device Junction Temperature*	T_j	-20 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Case Operating Temperature (Note 1)	T_C	-20 to 100	°C
Mounting Torque, M3 Mounting Screws	—	6	in-lb
Module Weight (Typical)	—	10	Grams
Heatsink Flatness (Note 2)	—	-50 to 100	µm
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}	1500	Volts

*The ma ximum junction temperature rating of the power chips integrated within the DIP-IPM is 150°C (@$T_C \le$ 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_C \le$ 100°C).
**V_D = 13.5 ~ 16.5V, Inverter Part, T_j = 125°C, Non-repetitive, Less than 2µs

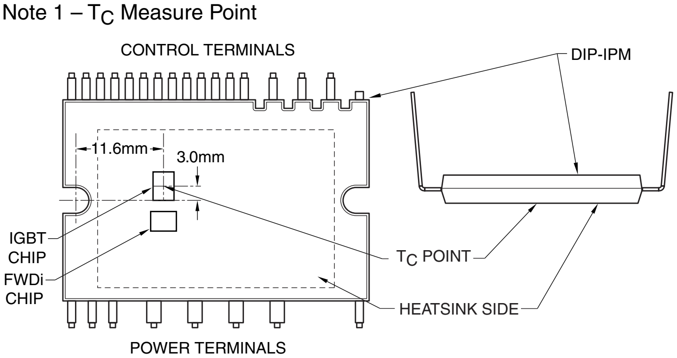
IGBT Inverter Sector

Collector-Emitter Voltage	V_{CES}	600	Volts
Each Collector Current, ± (T_C = 25°C)	I_C	15	Amperes
Each Peak Collector Current, ± (T_C = 25°C, Less than 1ms)	I_{CP}	30	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_C = 25°C, per 1 Chip)	P_C	33.3	Watts

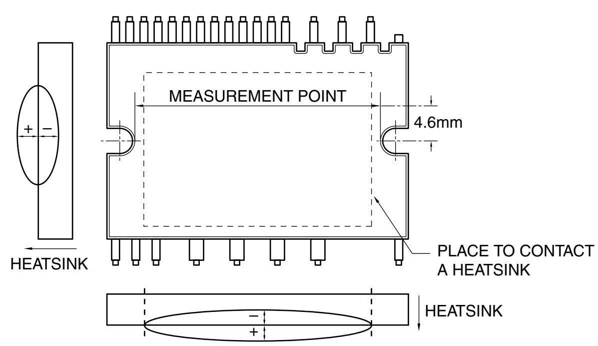
Control Sector

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_{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+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

Note 1 – T_C Measure Point



Note 2 – Flatness Measurement Position



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15 Amperes/600 Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Inverter Sector						
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = V_{DB}$ = 15V, I_C = 15A, V_{IN} = 5V, T_j = 25°C	—	1.70	2.20	Volts
		$V_D = V_{DB}$ = 15V, I_C = 15A, V_{IN} = 5V, T_j = 125°C	—	1.80	2.30	Volts
Diode Forward Voltage	V_{EC}	$-I_C$ = 15A, V_{IN} = 0V	—	1.70	2.20	Volts
Inductive Load Switching Times	t_{on}	V_{CC} = 300V, $V_D = V_{DB}$ = 15V, I_C = 15A, T_j = 125°C, V_{IN} = 0 ⇔ 5V, Inductive Load,	0.70	1.30	1.90	µS
	t_{rr}		—	0.30	—	µS
	$t_{C(on)}$		—	0.50	0.75	µS
	t_{off}		—	1.60	2.20	µS
	$t_{C(off)}$		—	0.50	0.80	µS
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
Control Sector						
Circuit Current $V_D = V_{DB}$ = 15V	I_D	V_{IN} = 5V, Total of V_{P1}-V_{NC}, V_{N1}-V_{NC}	—	—	2.80	mA
		V_{IN} = 5V, V_{UFB}-U, V_{VFB}-V, V_{WFB}-W	—	—	0.55	mA
		V_{IN} = 0V, Total of V_{P1}-V_{NC}, V_{N1}-V_{NC}	—	—	2.80	mA
		V_{IN} = 0V, V_{UFB}-U, V_{VFB}-V, V_{WFB}-W	—	—	0.55	mA
Fault Output Voltage	V_{FOH}	V_{SC} = 0V, F_O Terminal Pull-up to 5V by 10kΩ	4.9	—	—	Volts
	V_{FOL}	V_{SC} = 1V, I_{FO} = 1mA	—	—	0.95	Volts
Input Current	I_{IN}	V_{IN} = 5V	0.70	1.00	1.50	mA
Short Circuit Trip Level*	$V_{SC(ref)}$	V_D = 15V*	0.43	0.48	0.53	Volts
Supply Circuit Under-voltage	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	—	—	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}	—	2.1	2.6	Volts
OFF Threshold Voltage	$V_{th(off)}$		0.8	1.3	—	Volts
ON/OFF Threshold Hysteresis Voltage	$V_{th(hys)}$		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 20µsec. On a U_V condition the fault signal will be asserted as long as the U_V condition exists or for 20µsec, whichever is longer.

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Thermal Characteristics

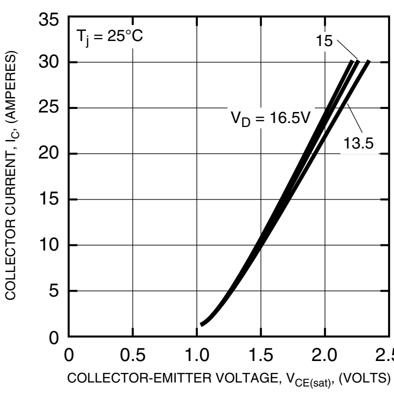
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case	$R_{th(j-c)Q}$	Inverter IGBT (Per 1/6 Module)	—	—	3.0	°C/Watt
	$R_{th(j-c)D}$	Inverter FWDi (Per 1/6 Module)	—	—	3.9	°C/Watt

Recommended Conditions for Use

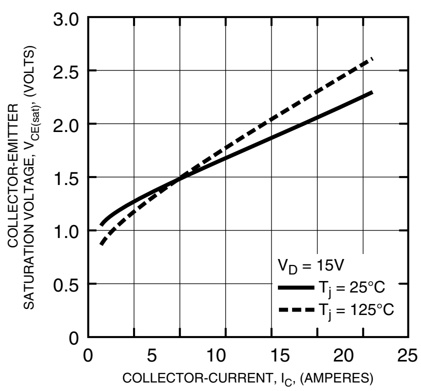
Characteristic	Symbol	Condition	Min.	Typ.	Value	Units
Supply Voltage	V_{CC}	Applied between P-N Terminals	0	300	400	Volts
Control Supply Voltage	V_D	Applied between V_{P1}-V_{NC}, V_{N1}-V_{NC}	13.5	15.0	16.5	Volts
	V_{DB}	Applied between V_{UFB}-U, V_{VFB}-V, V_{WFB}-W	13.0	15.0	18.5	Volts
Control Supply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

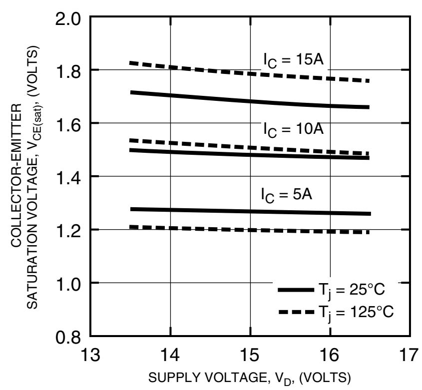
OUTPUT CHARACTERISTICS (TYPICAL - INVERTER PART)



COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL - INVERTER PART)



COLLECTOR-EMITTER SATURATION VOLTAGE VS. SUPPLY VOLTAGE CHARACTERISTICS (TYPICAL - INVERTER PART)



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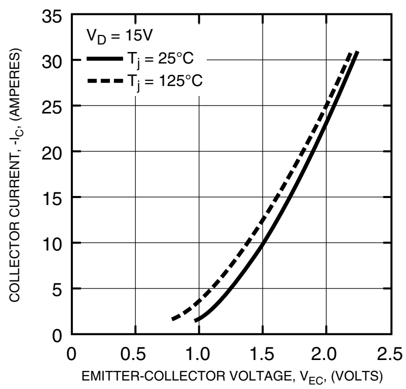
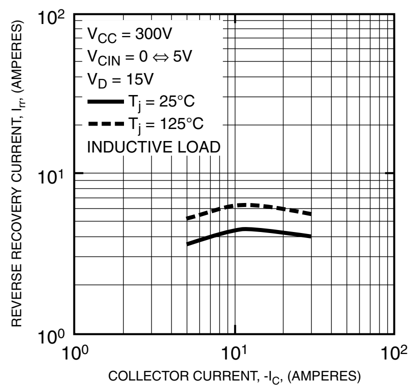
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL - INVERTER PART)



REVERSE RECOVERY CHARACTERISTICS (TYPICAL - INVERTER PART N-SIDE)



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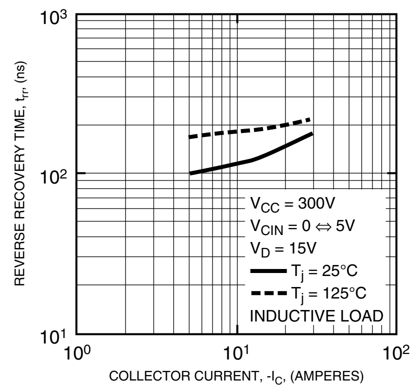
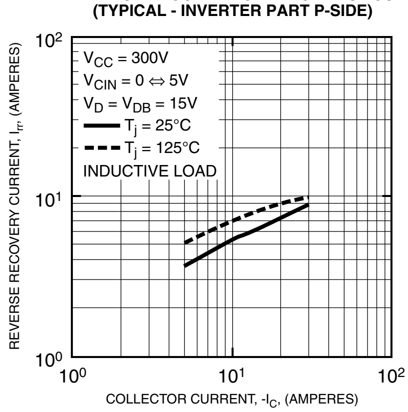


REVERSE RECOVERY CHARACTERISTICS (TYPICAL - INVERTER PART P-SIDE)



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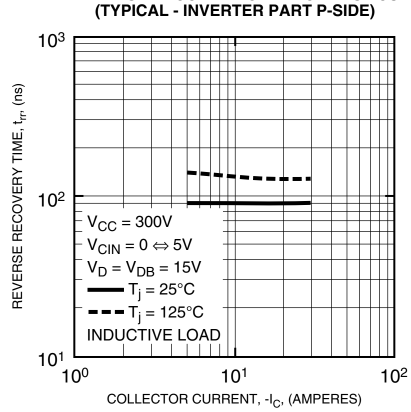
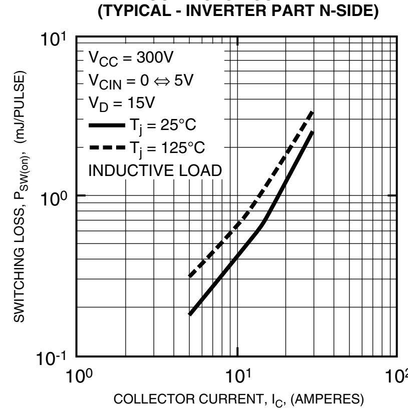
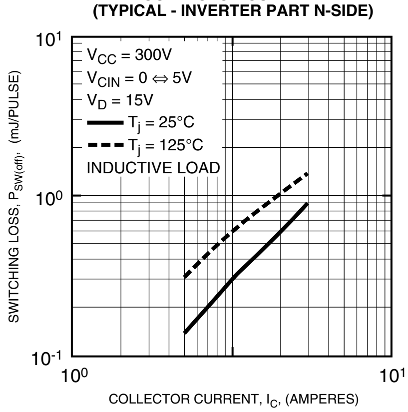


SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART N-SIDE)



SWITCHING LOSS (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART N-SIDE)



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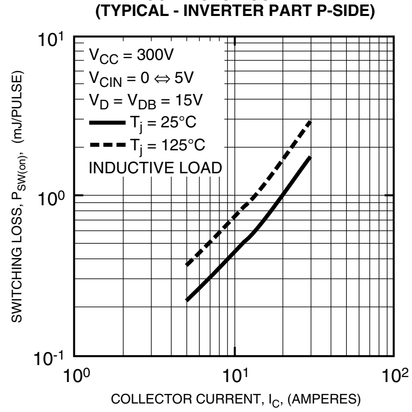
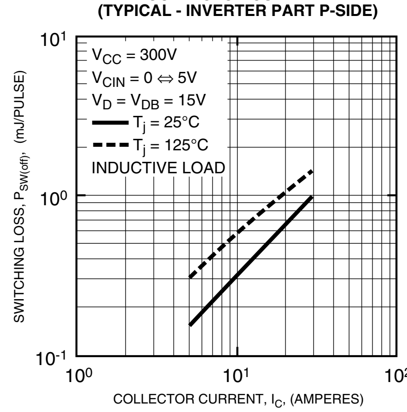


SWITCHING LOSS (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART P-SIDE)



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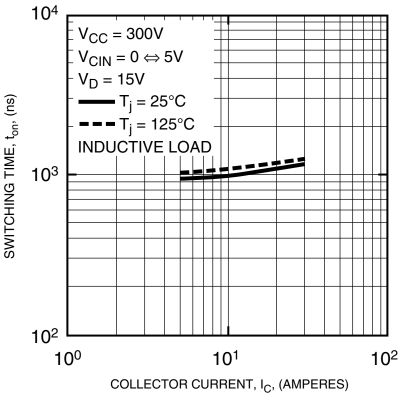
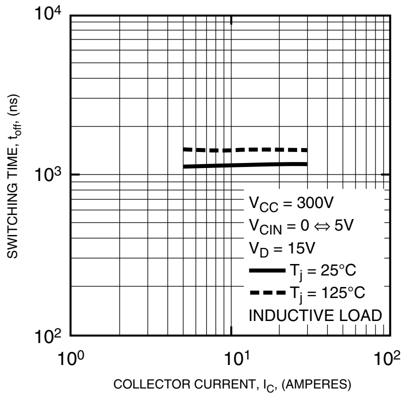
SWITCHING TIME (ON) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART N-SIDE)



SWITCHING TIME (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART N-SIDE)



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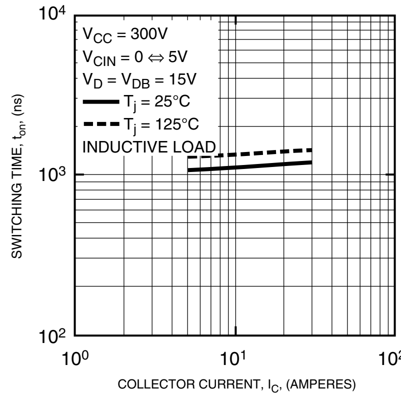
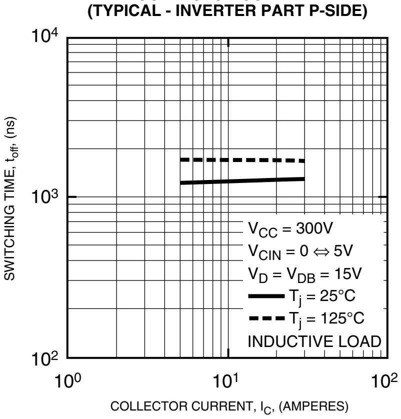


SWITCHING TIME (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART P-SIDE)



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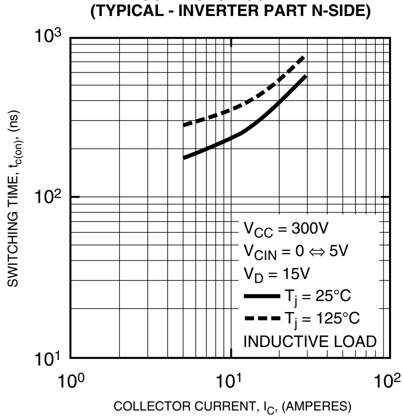

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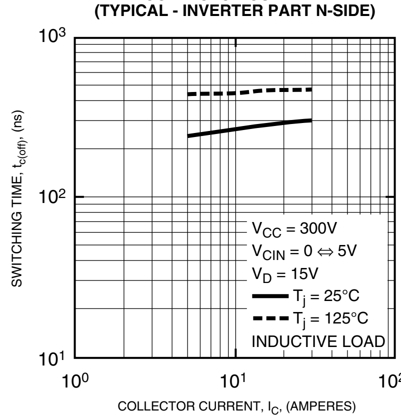

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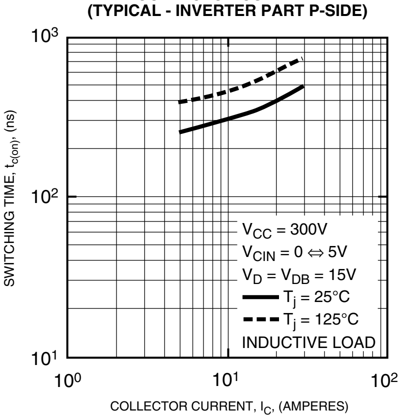

SWITCHING TIME (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART P-SIDE)