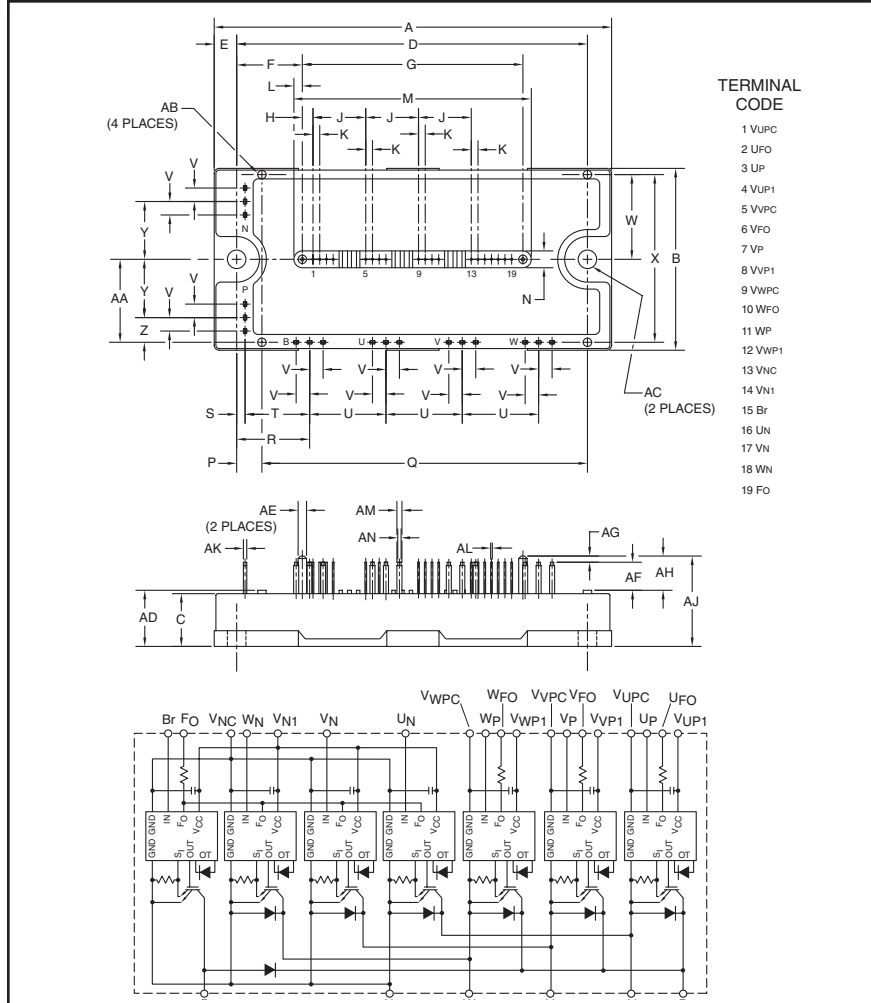


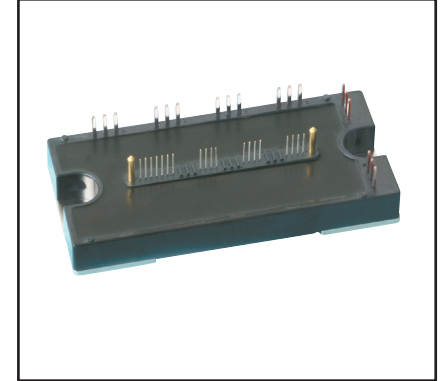
Intellimod™ L1-Series

Three Phase
IGBT Inverter + Brake
50 Amperes/600 Volts



TERMINAL CODE

- 1 VUPC
- 2 UFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 VVPC
- 10 WFO
- 11 WP
- 12 VWP1
- 13 VNC
- 14 VN1
- 15 Br
- 16 UN
- 17 VN
- 18 WN
- 19 FO



Description:

Powerex Intellimod™ Intelligent Power Modules are isolated base modules designed for power switching applications operating at frequencies to 20kHz. Built-in control circuits provide optimum gate drive and protection for the IGBT and free-wheel diode power devices.

Features:

- ☐ Complete Output Power Circuit
- ☐ Gate Drive Circuit
- ☐ Protection Logic
 - Short Circuit
 - Over Temperature
 - Using On-chip Temperature Sensing
 - Under Voltage
- ☐ Low Loss Using Full Gate CSTBT™ IGBT Chip

Applications:

- ☐ Inverters
- ☐ UPS
- ☐ Motion/Servo Control
- ☐ Power Supplies

Ordering Information:

Example: Select the complete part number from the table below -i.e. PM50RL1B060 is a 600V, 50 Ampere Intellimod™ Intelligent Power Module.

Type	Current Rating Amperes	V _{CES} Volts (x 10)
PM	50	60

Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	4.72	120.0
B	2.17	55.0
C	0.63	16.0
D	4.17	106.0
E	0.28	7.0
F	0.78	19.75
G	2.62	66.5
H	0.13	3.25
J	0.63	16.0
K	0.08	2.0
L	0.10	2.5
M	2.81	71.5
N	0.20	5.0
P	0.31	7.75
Q	3.87	98.25
R	0.87	22.0
S	0.10	2.5
T	0.77	19.5
U	0.91	23.0

Dimensions	Inches	Millimeters
V	0.16	4.0
W	1.01	25.75
X	2.00	50.75
Y	0.69	17.5
Z	0.30	7.5
AA	0.98	25.0
AB	0.10 Dia.	Dia. 2.5
AC	0.22 Dia.	Dia. 5.5
AD	0.67	17.0
AE	0.10 Dia.	Dia. 2.5
AF	0.33	8.5
AG	0.08	2.0
AH	0.41	10.5
AJ	1.08	27.5
AK	0.04	1.0
AL	0.02 Sq.	Sq. 0.5
AM	0.06	1.5
AN	0.04	1.0

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

Characteristics	Symbol	PM50RL1B060	Units
Power Device Junction Temperature	T_j	-20 to 150	$^\circ\text{C}$
Storage Temperature	T_{stg}	-40 to 125	$^\circ\text{C}$
Mounting Torque, M5 Mounting Screws	—	31	in-lb
Mounting Torque, M5 Main Terminal Screws	—	31	in-lb
Module Weight (Typical)	—	380	Grams
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	500	Volts
Self-protection Supply Voltage Limit (Short Circuit protection Capability)*	$V_{\text{CC(prot.)}}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	V_{ISO}	2500	Volts

IGBT Inverter Sector

Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$)	V_{CES}	600	Volts
Collector Current ($T_C = 25^\circ\text{C}$) (Note 1)	$\pm I_C$	50	Amperes
Peak Collector Current ($T_C = 25^\circ\text{C}$)	$\pm I_{\text{CP}}$	100	Amperes
Collector Dissipation ($T_C = 25^\circ\text{C}$) (Note 1)	P_C	284	Watts

IGBT Brake Sector

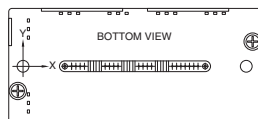
Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$)	V_{CES}	600	Volts
Collector Current ($T_C = 25^\circ\text{C}$) (Note 1)	$\pm I_C$	50	Amperes
Peak Collector Current ($T_C = 25^\circ\text{C}$)	$\pm I_{\text{CP}}$	100	Amperes
Collector Dissipation ($T_C = 25^\circ\text{C}$) (Note 1)	P_C	284	Watts
Diode Forward Current	I_F	50	Amperes
Diode Rated DC Reverse Voltage ($T_C = 25^\circ\text{C}$)	$V_{\text{R(DC)}}$	600	Volts

Control Sector

Supply Voltage (Applied between $V_{\text{UP1}}-V_{\text{UPC}}$, $V_{\text{VP1}}-V_{\text{VPC}}$, $V_{\text{WP1}}-V_{\text{WPC}}$, $V_{\text{N1}}-V_{\text{NC}}$)	V_D	20	Volts
Input Voltage (Applied between U_P-V_{UPC} , V_P-V_{VPC} , W_P-V_{WPC} , $U_N-V_N-W_N-Br-V_{\text{NC}}$)	V_{CIN}	20	Volts
Fault Output Supply Voltage (Applied between $U_{\text{FO}}-V_{\text{UPC}}$, $V_{\text{FO}}-V_{\text{VPC}}$, $W_{\text{FO}}-V_{\text{WPC}}$, F_O-V_{NC})	V_{FO}	20	Volts
Fault Output Current (U_{FO} , V_{FO} , W_{FO} , F_O Terminals)	I_{FO}	20	mA

* $V_D = 13.5 \sim 16.5\text{V}$, Inverter Part, $T_j = 125^\circ\text{C}$

Note 1: T_C (under the chip) Measurement Point



Arm Axis	UP		VP		WP		UN		VN		WN		Br	
	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi	IGBT	FWDi
X	28.7	28.7	65.4	65.4	85.0	85.0	37.2	37.2	55.8	55.8	75.4	75.4	20.2	21.3
Y	-6.3	0.2	-6.3	0.2	-6.3	0.2	5.4	-0.9	5.4	-0.6	5.4	-0.9	-7.4	5.8

PM50RL1B060
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Electrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
IGBT Inverter Sector						
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _D = 15V, V _{CIN} = 0V, I _C = 50A, T _j = 25°C	—	1.75	2.35	Volts
		V _D = 15V, V _{CIN} = 0V, I _C = 50A, T _j = 125°C	—	1.75	2.35	Volts
Diode Forward Voltage	V _{EC}	-I _C = 50A, V _{CIN} = 15V, V _D = 15V	—	1.7	2.8	Volts
Inductive Load Switching Times	t _{on}	V _D = 15V, V _{CIN} = 0 ⇔ 15V V _{CC} = 300V, I _C = 50A T _j = 125°C	0.3	0.8	2.0	μs
	t _{rr}		—	0.4	0.8	μs
	t _{C(on)}		—	0.4	1.0	μs
	t _{off}		—	1.0	2.3	μs
	t _{C(off)}		—	0.3	1.0	μs
Collector-Emitter Cutoff Current	I _{CES}	V _{CE} = V _{CES} , V _D = 15V, T _j = 25°C	—	—	1.0	mA
		V _{CE} = V _{CES} , V _D = 15V, T _j = 125°C	—	—	10	mA
IGBT Brake Sector						
Collector-Emitter Saturation Voltage	V _{CE(sat)}	V _D = 15V, V _{CIN} = 0V, I _C = 50A, T _j = 25°C	—	1.75	2.35	Volts
		V _D = 15V, V _{CIN} = 0V, I _C = 50A, T _j = 125°C	—	1.75	2.35	Volts
Forward Voltage	V _{FM}	I _F = 50A	—	1.7	2.8	Volts
Collector-Emitter Cutoff Current	I _{CES}	V _{CE} = V _{CES} , V _D = 15V, T _j = 25°C	—	—	1.0	mA
		V _{CE} = V _{CES} , V _D = 15V, T _j = 125°C	—	—	10	mA
Control Sector						
Circuit Current	I _D	V _D = 15V, V _{CIN} = 15V, V _{N1} -V _{NC}	—	8	16	mA
		V _D = 15V, V _{CIN} = 15V, V _{XP1} -V _{XPC}	—	2	4	mA
Input ON Threshold Voltage	V _{th(on)}	Applied between U _P -V _{UPC} ,	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	V _{th(off)}	V _P -V _{VPC} , W _P -V _{WPC} , U _N - V _N - W _N -Br-V _{NC}	1.7	2.0	2.3	Volts
Short Circuit Trip Level	SC	Inverter Part	100	—	—	Amperes
(-20°C ≤ T _j ≤ 125°C, V _D = 15V)		Brake Part	100	—	—	Amperes
Short Circuit Current Delay Time	t _{off(SC)}	V _D = 15V	—	0.2	—	μs
Over Temperature Protection	OT	Trip Level	135	—	—	°C
(Detect T _j of IGBT Chip)	OT _(hys)	Reset Level	—	20	—	°C
Supply Circuit Under-voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
(-20 ≤ T _j ≤ 125°C)	UV _R	Reset Level	—	12.5	—	Volts
Fault Output Current*	I _{FO(H)}	V _D = 15V, V _{CIN} = 15V	—	—	0.01	mA
	I _{FO(L)}	V _D = 15V, V _{CIN} = 15V	—	10	15	mA
Fault Output Pulse Width*	t _{FO}	V _D = 15V	1.0	1.8	—	ms

*Fault output is given only when the internal SC, OT and UV protections schemes of either upper or lower arm device operates to protect it.



Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272 www.pwr.com

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50 Amperes/600 Volts

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
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Thermal Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT (Per 1 Element) (Note 1)	—	—	0.44*	$^\circ\text{C/Watt}$
Inverter Part	$R_{th(j-c)D}$	FWDi (Per 1 Element) (Note 1)	—	—	0.75*	$^\circ\text{C/Watt}$
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT (Note 1)	—	—	0.44*	$^\circ\text{C/Watt}$
Brake Part	$R_{th(j-c)D}$	FWDi (Note 1)	—	—	0.75*	$^\circ\text{C/Watt}$
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied (Note 1)	—	—	0.038	$^\circ\text{C/Watt}$

Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across P-N Terminals	≤ 400	Volts
Control Supply Voltage**	V_D	Applied between V_{UP1} - V_{UPC} , V_{VP1} - V_{VPC} , V_{WP1} - V_{WPC} , V_{N1} - V_{NC}	15.0 ± 1.5	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between U_P - V_{UPC} ,	≤ 0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$	V_P - V_{VPC} , W_P - V_{WPC} , U_N - V_{NC} , W_N - Br - V_{NC}	≥ 9.0	Volts
PWM Input Frequency	f_{PWM}	—	≤ 20	kHz
Arm Shoot-through Blocking Time	t_{DEAD}	Input Signal	≥ 2.0	μs

* If you use this value, $R_{th(f-a)}$ should be measured just under the chips.

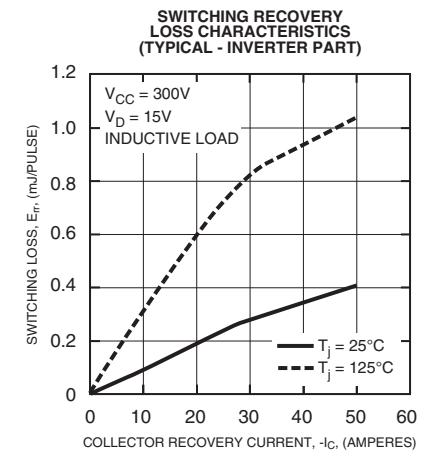
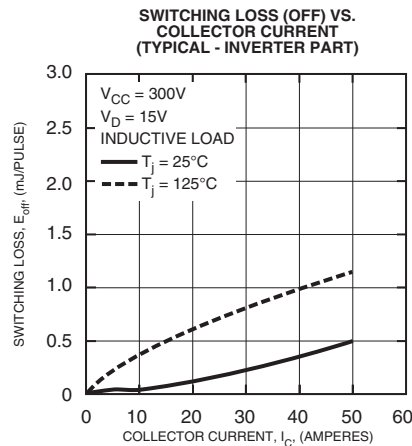
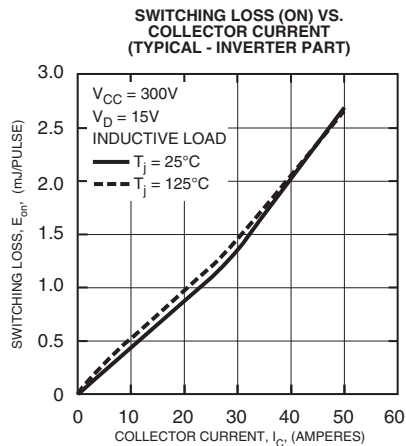
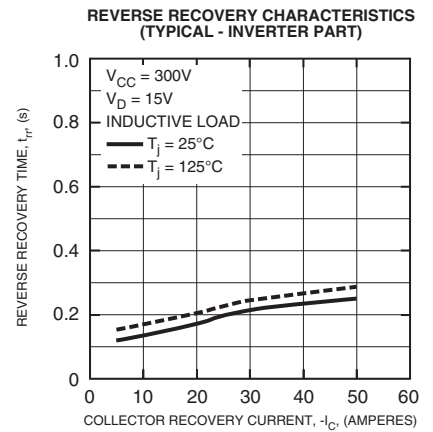
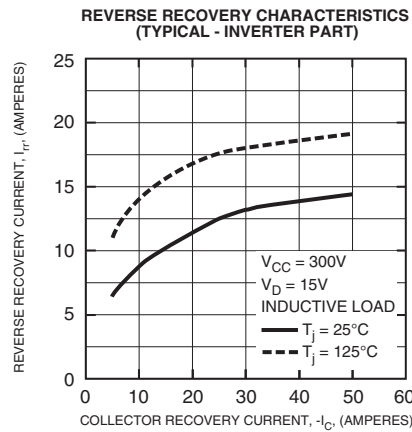
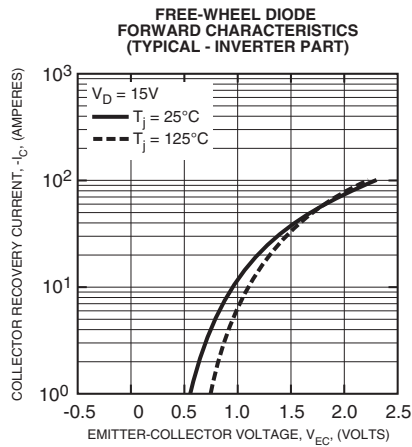
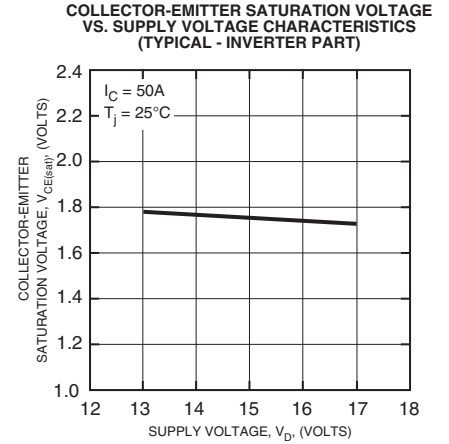
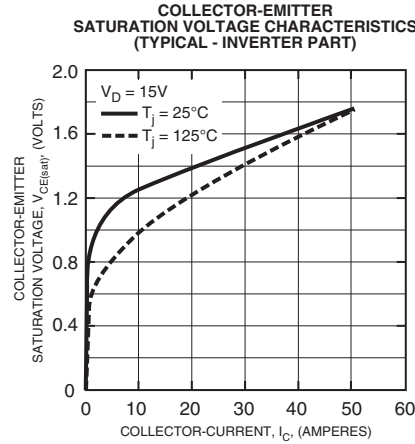
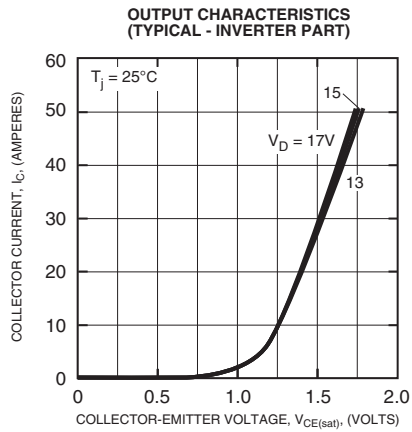
** With ripple satisfying the following conditions: dv/dt swing $\leq \pm 5V/\mu\text{s}$, Variation $\leq 2V$ peak to peak.

PM50RL1B060

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Three Phase IGBT Inverter + Brake

50 Amperes/600 Volts



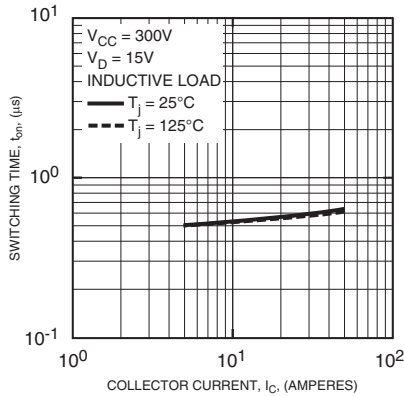
PM50RL1B060

Intellimod™ L1-Series

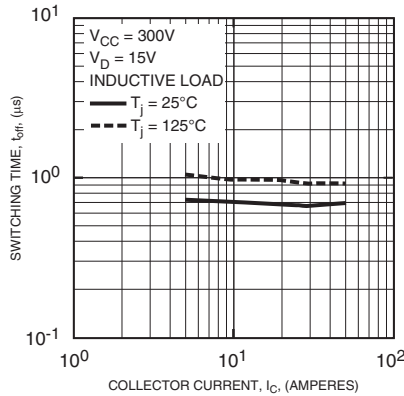
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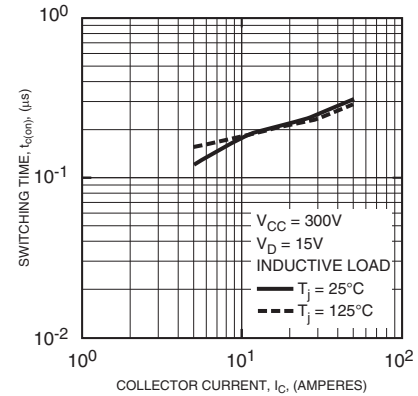
SWITCHING TIME (ON) VS.
COLLECTOR CURRENT
(TYPICAL - INVERTER PART)



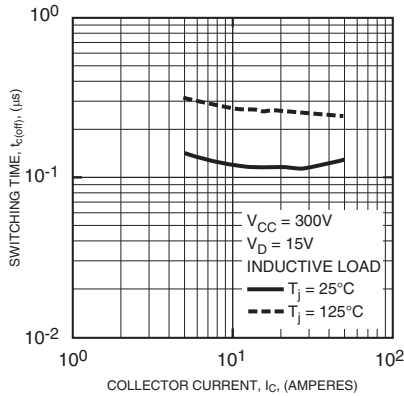
SWITCHING TIME (OFF) VS.
COLLECTOR CURRENT
(TYPICAL - INVERTER PART)



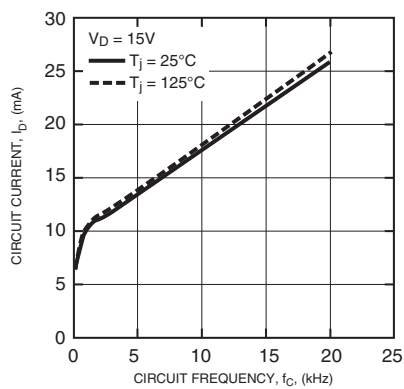
SWITCHING TIME (ON) VS.
COLLECTOR CURRENT
(TYPICAL - INVERTER PART)



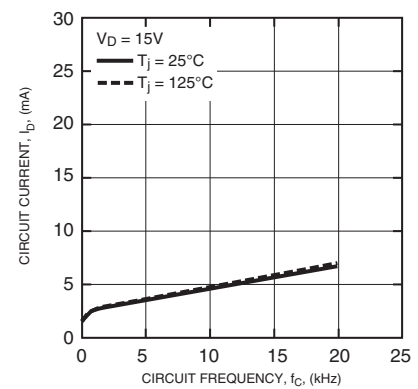
SWITCHING TIME (OFF) VS.
COLLECTOR CURRENT
(TYPICAL - INVERTER PART)



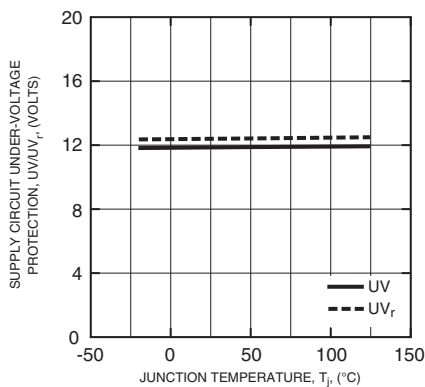
CIRCUIT CURRENT VS.
CARRIER FREQUENCY CHARACTERISTICS
(N-SIDE - INVERTER PART)



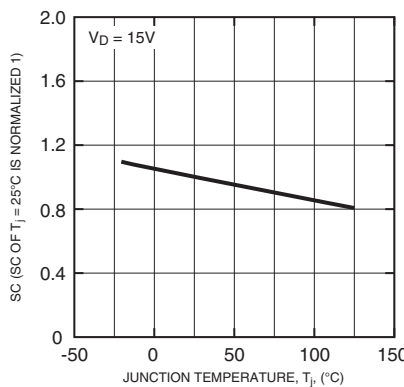
CIRCUIT CURRENT VS.
CARRIER FREQUENCY CHARACTERISTICS
(P-SIDE - INVERTER PART)



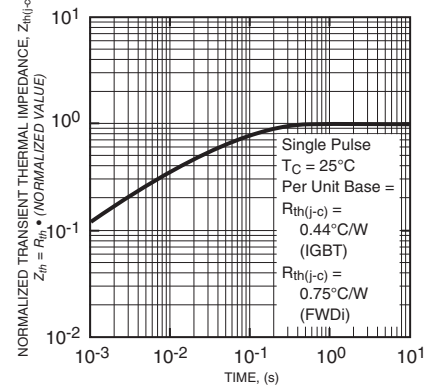
SUPPLY CIRCUIT UNDER-VOLTAGE
PROTECTION CHARACTERISTICS
(TYPICAL - INVERTER PART)



SHORT CIRCUIT TRIP LEVEL
CHARACTERISTICS
(TYPICAL - INVERTER PART)



TRANSIENT THERMAL
IMPEDANCE CHARACTERISTICS
(IGBT & FWDI - INVERTER PART)



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