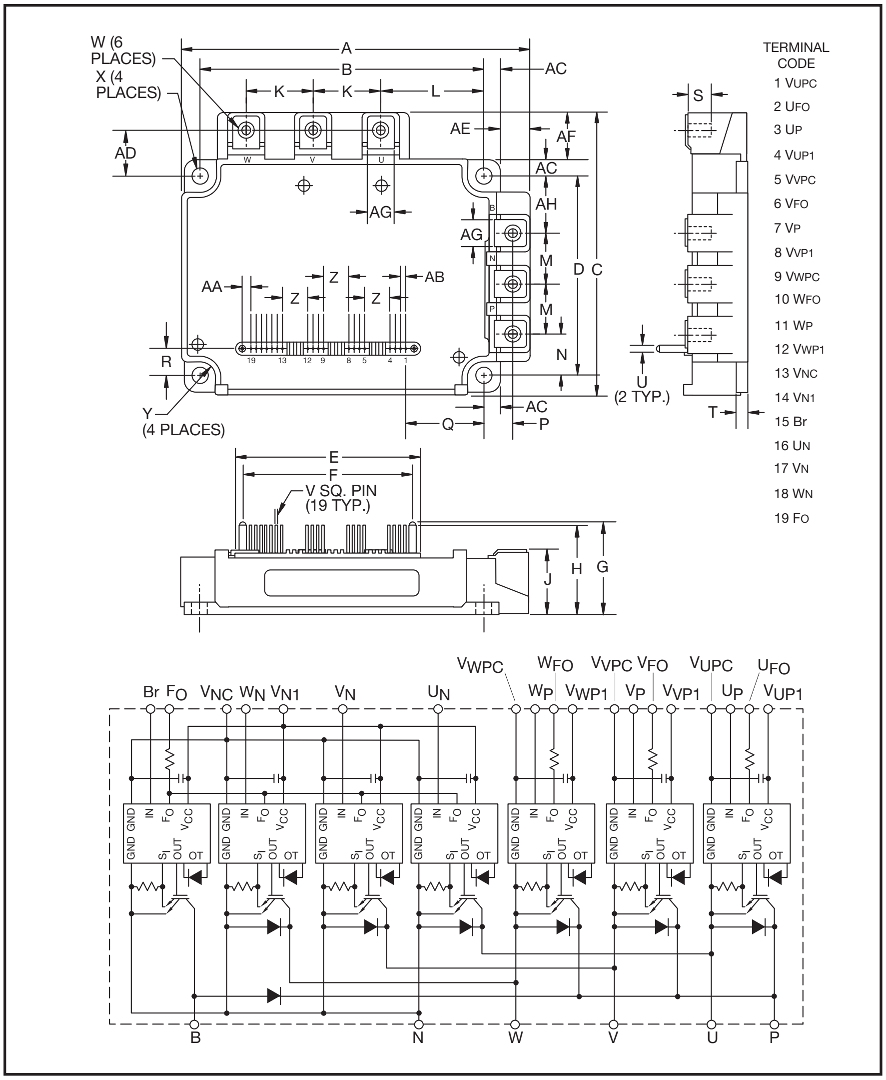
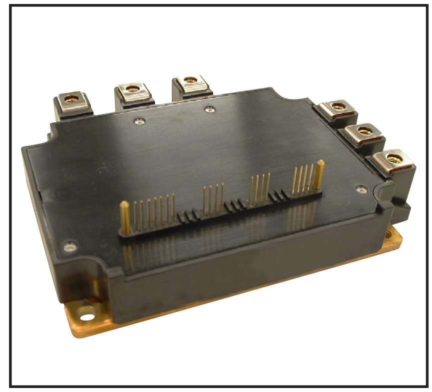
Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272
www.pwrx.com

Intellimod™ L1-Series

Three Phase
IGBT Inverter + Brake
200 Amperes/600 Volts



Outline Drawing and Circuit Diagram



Dimensions	Inches	Millimeters
A	5.31	135.0
B	4.33±0.02	110±0.5
C	4.33	110.0
D	3.07	78.0±0.5
E	2.81	71.5
F	2.62	66.5
G	1.37	34.7
H	1.32	33.6
J	0.95+0.04/-0.01	24.1+1.0/-0.5
K	1.02	26.0
L	1.59	40.5
M	0.79	20.0
N	0.65	16.5
P	0.43±0.01	11.0±0.3
Q	1.19	30.15
R	0.43	11.0

Dimensions	Inches	Millimeters
S	0.51	13.0
T	0.16	4.0
U	0.1 Dia.	Dia.2.5
V	0.02 Sq.	Sq. 0.5
W	M5 Metric	M5
X	0.22 Dia.	Dia. 5.5
Y	0.24 Rad.	Rad. 6
Z	0.39	10.0
AA	0.13	3.25
AB	0.08	2.0
AC	0.24	6.05
AD	0.71	18.0
AE	0.46	11.7
AF	0.74	18.7
AG	0.41	10.5
AH	0.85	21.5

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. PM200RL1A060 is a 600V, 200 Ampere Intellimod™ Intelligent Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 10)
PM	200	60

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

Characteristics	Symbol	PM200RL1A060	Units
Power Device Junction Temperature	T_j	-20 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°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)	$V_{CC(surge)}$	500	Volts
Self-protection Supply Voltage Limit (Short Circuit protection Capability)*	$V_{CC(prot.)}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	V_{ISO}	2500	Volts

IGBT Inverter Sector

Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	600	Volts
Collector Current (T_C = 25°C) (Note 1)	$\pm I_C$	200	Amperes
Peak Collector Current (T_C = 25°C)	$\pm I_{CP}$	400	Amperes
Collector Dissipation (T_C = 25°C) (Note 1)	P_C	625	Watts

IGBT Brake Sector

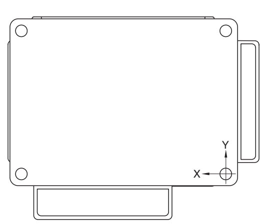
Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	600	Volts
Collector Current (T_C = 25°C) (Note 1)	$\pm I_C$	100	Amperes
Peak Collector Current (T_C = 25°C)	$\pm I_{CP}$	200	Amperes
Collector Dissipation (T_C = 25°C) (Note 1)	P_C	390	Watts
Diode Forward Current	I_F	100	Amperes
Diode Rated DC Reverse Voltage (T_C = 25°C)	$V_{R(DC)}$	600	Volts

Control Sector

Supply Voltage (Applied between V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{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_{NC})	V_{CIN}	20	Volts
Fault Output Supply Voltage (Applied between U_{FO}-V_{UPC}, V_{FO}-V_{VPC}, W_{FO}-V_{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

*VD = 13.5 ~ 16.5V, Inverter Part, T_j = 125°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	24.5	24.5	58.0	58.0	88.0	88.0	39.0	39.0	72.5	72.5	102.5	102.5	12.2	6.8
Y	57.4	46.6	57.4	46.6	57.4	46.6	28.2	38.8	28.2	38.8	28.2	38.8	27.0	61.4

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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 = 15V, V_{CIN} = 0V, I_C = 200A, T_j = 25°C	—	1.75	2.35	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 200A, T_j = 125°C	—	1.75	2.35	Volts
Diode Forward Voltage	V_{EC}	$-I_C$ = 200A, 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 = 200A, 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 = 100A, T_j = 25°C	—	1.75	2.35	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 100A, T_j = 125°C	—	1.75	2.35	Volts
Forward Voltage	V_{FM}	I_F = 100A	—	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	400	—	—	Amperes
(-20°C ≤ T_j ≤ 125°C, V_D = 15V)		Brake Part	200	—	—	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.

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units

Thermal Characteristics, T_j = 25°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)	—	—	0.20*	°C/Watt
Inverter Part	$R_{th(j-c)D}$	FWDi (Per 1 Element) (Note 1)	—	—	0.30*	°C/Watt
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	IGBT (Note 1)	—	—	0.32*	°C/Watt
Brake Part	$R_{th(j-c)D}$	FWDi (Note 1)	—	—	0.53*	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied (Note 1)	—	—	0.023	°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}, V_P-V_{VPC}, W_P-V_{WPC}, U_N- V_N- W_N-Br-V_{NC}	≤0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$		≥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 ≤ ±5V/μs, Variation ≤ 2V peak to peak.

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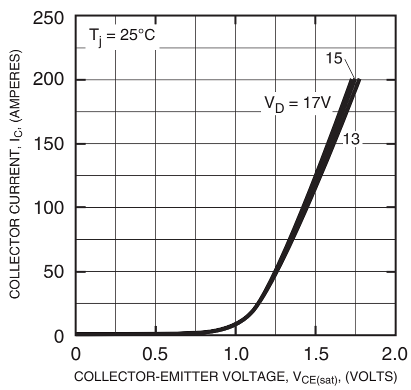
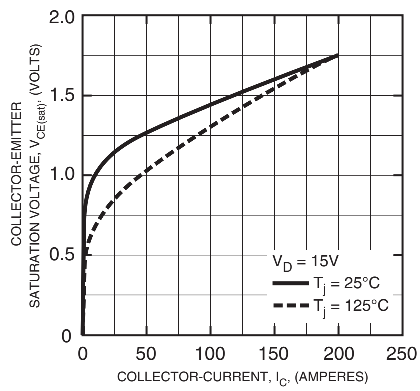
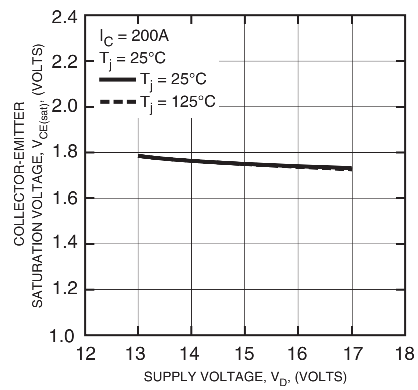
OUTPUT CHARACTERISTICS
(TYPICAL - INVERTER PART)



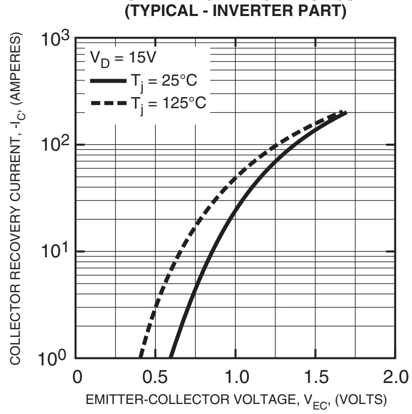
COLLECTOR-EMITTER
SATURATION VOLTAGE CHARACTERISTICS
(TYPICAL - INVERTER PART)



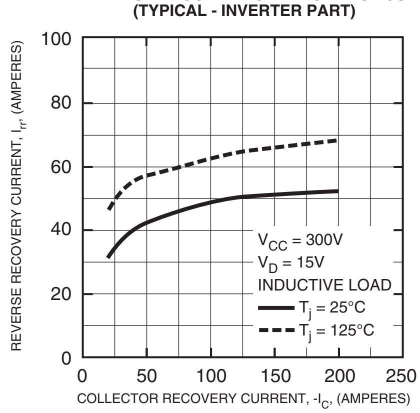
COLLECTOR-EMITTER SATURATION VOLTAGE
VS. SUPPLY VOLTAGE CHARACTERISTICS
(TYPICAL - INVERTER PART)



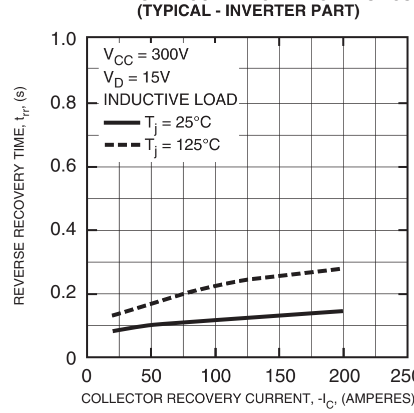
FREE-WHEEL DIODE
FORWARD CHARACTERISTICS
(TYPICAL - INVERTER PART)



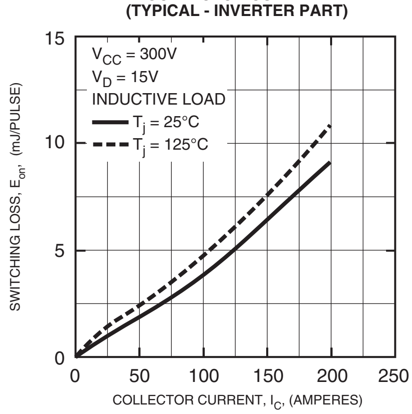
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL - INVERTER PART)



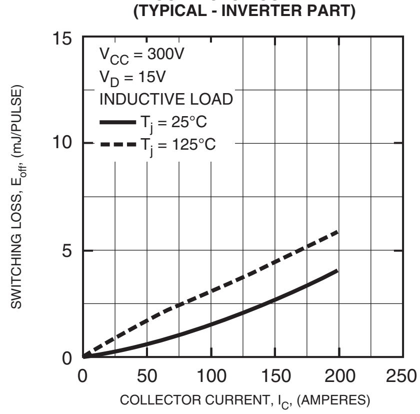
REVERSE RECOVERY CHARACTERISTICS
(TYPICAL - INVERTER PART)



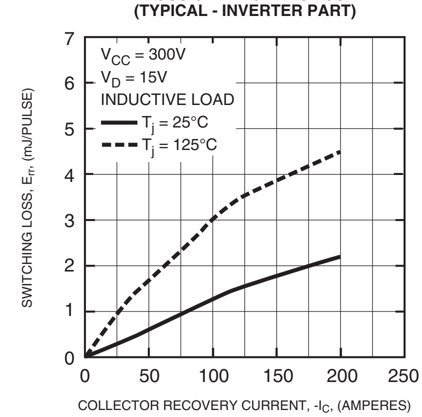
SWITCHING LOSS (ON) VS.
COLLECTOR CURRENT
(TYPICAL - INVERTER PART)



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



SWITCHING RECOVERY
LOSS CHARACTERISTICS
(TYPICAL - INVERTER PART)



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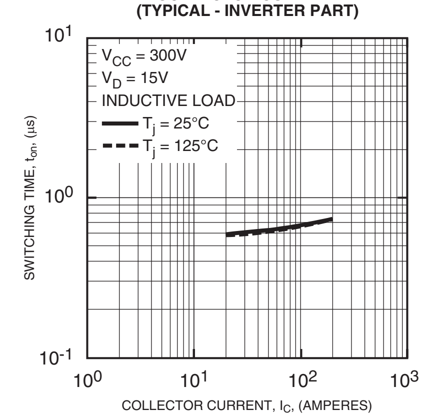
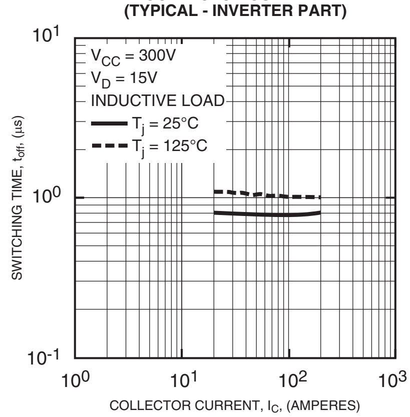
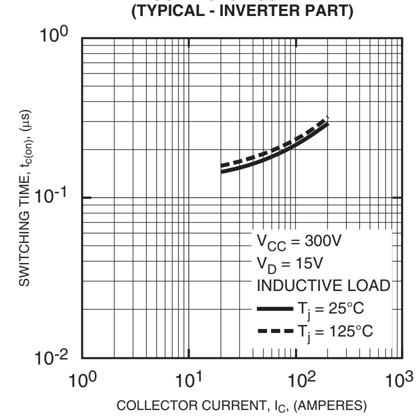
SWITCHING TIME (ON) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



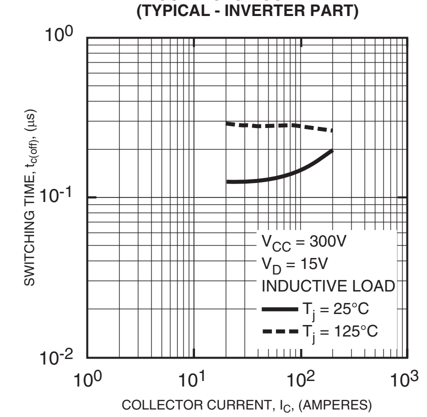
SWITCHING TIME (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



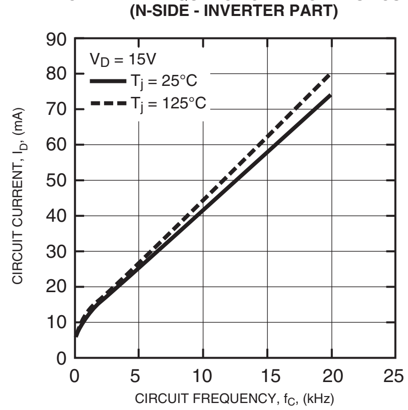
SWITCHING TIME (ON) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



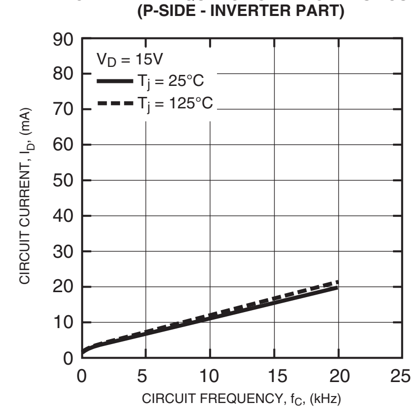
SWITCHING TIME (OFF) VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)



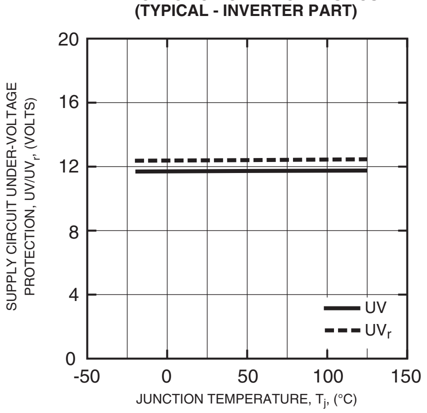
CIRCUIT CURRENT VS. CARRIER FREQUENCY CHARACTERISTICS (N-SIDE - INVERTER PART)



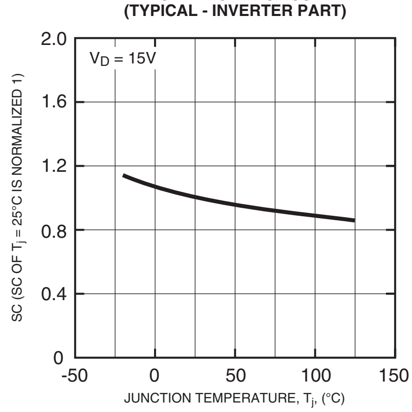
CIRCUIT CURRENT VS. CARRIER FREQUENCY CHARACTERISTICS (P-SIDE - INVERTER PART)



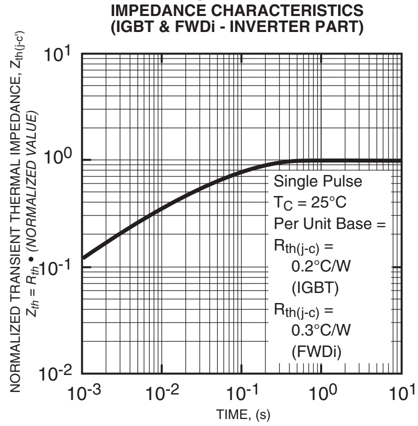
SUPPLY CIRCUIT UNDER-VOLTAGE PROTECTION CHARACTERISTICS (TYPICAL - INVERTER PART)



SHORT CIRCUIT TRIP LEVEL CHARACTERISTICS (TYPICAL - INVERTER PART)



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



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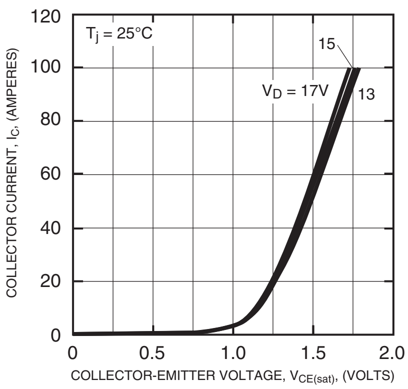
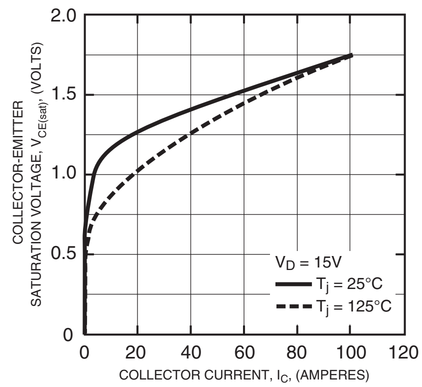
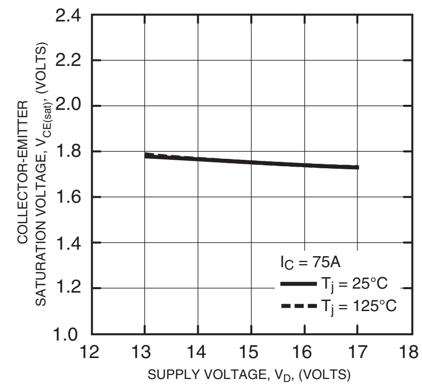
OUTPUT CHARACTERISTICS (TYPICAL - BRAKE PART)



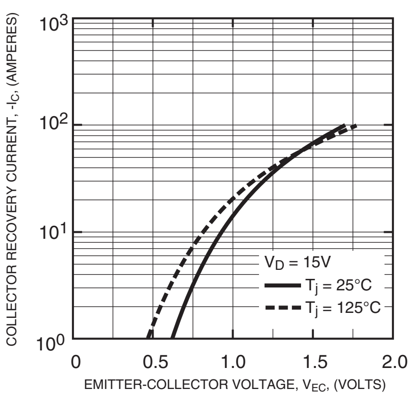
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL - BRAKE PART)



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



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



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDi - BRAKE PART)