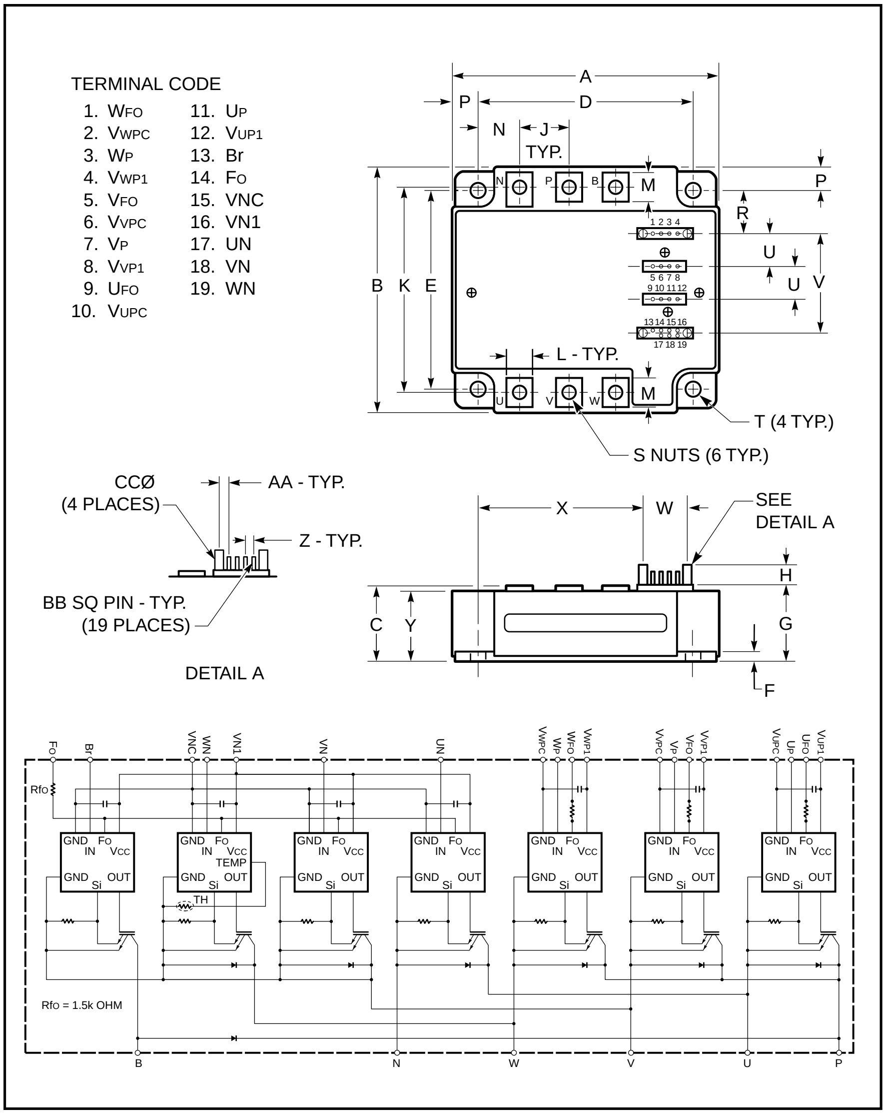
Powerex, Inc., 200 Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

Intellimod™ Module

Three Phase + Brake
IGBT Inverter Output
50 Amperes/1200 Volts



Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	4.33	110.0
B	3.50	89.0
C	0.87 +0.04/-0.02	22.0 +1.0/-0.5
D	3.74±0.010	95.0±0.25
E	2.91±0.010	74.0±0.25
F	0.16	4.0
G	0.87	22.0
H	0.42	10.6
J	0.79	20.0
K	2.99±0.02	76.0±0.5
L	0.39	10.0
M	0.49	12.5
N	0.67	17.0

Dimensions	Inches	Millimeters
P	0.30	7.5
R	0.65	16.5
S	M5 Metric	M5
T	0.22 Dia.	Dia. 5.5
U	0.56±0.010	14.1±0.25
V	1.72±0.012	43.57±0.3
W	0.57±0.012	14.6±0.3
X	2.90	73.7
Y	0.78	19.7
Z	0.10±0.010	2.54±0.25
AA	0.137±0.010	3.49±0.25
BB	0.02 SQ	0.64 SQ
CC	0.12 +0.04/-0.02	3.0 +1.0/-0.5

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
  - – Under Voltage

Applications:

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

Ordering Information:

Example: Select the complete part number from the table below -i.e. PM50RVA120 is a 1200V, 50 Ampere Intellimod™ Intelligent Power Module.

Type	Current Rating Amperes	V_{CES} Volts (x 10)
PM	50	120

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

Characteristics	Symbol	PM50RVA120	Units
Power Device Junction Temperature	T_j	-20 to 150	°C
Storage Temperature	T_{stg}	-40 to 125	°C
Case Operating Temperature	T_C	-20 to 100	°C
Mounting Torque, M5 Mounting Screws (Typical)	—	17	in-lb
Mounting Torque, M5 Main Terminal Screws (Typical)	—	17	in-lb
Module Weight (Typical)	—	560	Grams
Supply Voltage (Applied between P - N)	$V_{CC(surge)}$	1000	Volts
Supply Voltage Protected by SC (V_D = 13.5 ~16.5V, Inverter Part, T_j = 125°C Start)	$V_{CC(prot.)}$	800	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	V_{RMS}	2500	Volts

Control Sector

Characteristics	Symbol	PM50RVA120	Units
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_P, W_P, U_N, V_N, W_N, B_r)	V_{CIN}	20	Volts
Fault Output Supply Voltage (Applied between F_O-V_{NC}, $*_{FO}$-V_{*PC})	V_{FO}	20	Volts
Fault Output Current (Sink Current at F_O Terminals)	I_{FO}	20	mA

IGBT Inverter Sector

Characteristics	Symbol	PM50RVA120	Units
Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	1200	Volts
Collector Current, ± (T_C = 25°C)	I_C	50	Amperes
Peak Collector Current, ± (T_C = 25°C)	I_{CP}	100	Amperes
Collector Dissipation (T_C = 25°C)	P_C	338	Watts

Brake Sector

Characteristics	Symbol	PM50RVA120	Units
Collector-Emitter Voltage (V_D = 15V, V_{CIN} = 15V)	V_{CES}	1200	Volts
Collector Current, ± (T_C = 25°C)	I_C	15	Amperes
Peak Collector Current, ± (T_C = 25°C)	I_{CP}	30	Amperes
Collector Dissipation (T_C = 25°C)	P_C	134	Watts
FWDi Forward Current (T_C = 25°C)	I_F	15	Amperes
FWDi Rated DC Reverse Voltage (T_C = 25°C)	$V_{R(DC)}$	1200	Volts

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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						
Over Current Trip Level Brake Part	OC	-20°C ≤ T_j ≤ 125°C, V_D = 15V	22	—	—	Amperes
Short Circuit Trip Level Inverter Part	SC	-20°C ≤ T_j ≤ 125°C, V_D = 15V	59	—	—	Amperes
Short Circuit Trip Level Brake Part			—	52	—	Amperes
Short Circuit Current Shut-off Time	$t_{off(SC)}$	V_D = 15V	—	10	—	µS
Over Temperature Protection	OT	Trip Level	111	118	125	°C
(V_D = 15V, Lower Arm)	OT_r	Reset Level	90	100	110	°C
Supply Circuit Under Voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
(-20°C ≤ T_j ≤ 125°C)	UV_r	Reset Level	—	12.5	—	Volts
Supply Voltage	V_D	Applied between V_{UP1}-V_{UPC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC}	—	15	—	Volts
Circuit Current	I_D	V_D = 15V, V_{CIN} = 15V, V_{N1}-V_{NC}	—	44	60	mA
		V_D = 15V, V_{CIN} = 15V, V_{XP1}-V_{XPC}	—	13	18	mA
Input ON Threshold Voltage	$V_{CIN(on)}$	Applied between U_P-V_{UPC}, V_P-V_{VPC},	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{CIN(off)}$	W_P-V_{WPC}, U_N, V_N, W_N, Br-V_{NC}	1.7	2.0	2.3	Volts
Fault Output Current	$I_{FO(H)}$	V_D = 15V, V_{FO} = 15V	—	—	0.01	mA
	$I_{FO(L)}$	V_D = 15V, V_{FO} = 15V	—	10	15	mA
Minimum Fault Output Pulse Width	t_{FO}	V_D = 15V	1.0	1.8	—	mS

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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 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	—	—	10.0	mA
FWDi Forward Voltage	V_{EC}	$-I_C$ = 50A, V_D = 15V, V_{CIN} = 15V	—	2.50	3.50	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 50A, Pulsed, T_j = 25°C	—	2.65	3.30	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 50A, Pulsed, T_j = 125°C	—	2.75	3.35	Volts
Inductive Load Switching Times	t_{on}	V_D = 15V, V_{CIN} = 0V ~ 15V, V_{CC} = 600V, I_C = 50A, T_j = 125°C	0.4	0.9	2.3	µS
	t_{rr}		—	0.2	0.3	µS
	$t_{C(on)}$		—	0.4	1.0	µS
	t_{off}		—	2.4	3.4	µS
	$t_{C(off)}$		—	0.7	1.2	µS
Brake Sector						
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	—	—	10.0	mA
FWDi Forward Voltage	V_{FM}	I_F = 15A	—	2.50	3.50	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	V_D = 15V, V_{CIN} = 0V, I_C = 15A, T_j = 25°C	—	2.50	3.30	Volts
		V_D = 15V, V_{CIN} = 0V, I_C = 15A, T_j = 125°C	—	2.20	3.20	Volts

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Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	Each Inverter IGBT	—	—	0.37	°C/Watt
	$R_{th(j-c)D}$	Each Inverter FWDi	—	—	0.70	°C/Watt
	$R_{th(j-c)Q}$	Each Brake IGBT	—	—	0.93	°C/Watt
	$R_{th(j-c)D}$	Each Brake FWDi Part	—	—	1.50	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.027	°C/Watt

Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	V_{CC}	Applied across P-N Terminals	≤ 800	Volts
	$V_{CE(surge)}$	Applied across C-E Terminals	≤ 1000	Volts
	V_D	Applied between V_{UP1}-V_{UPC}, V_{N1}-V_{NC}, V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}	15 ± 1.5	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between	≤ 0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$	U_P, V_P, W_P, U_N, V_N, W_N, B_r	≥ 4.0	Volts
Arm Shoot-Through Blocking Time	t_{DEAD}	For IPM's each Input Signal	≥ 3.0	µS

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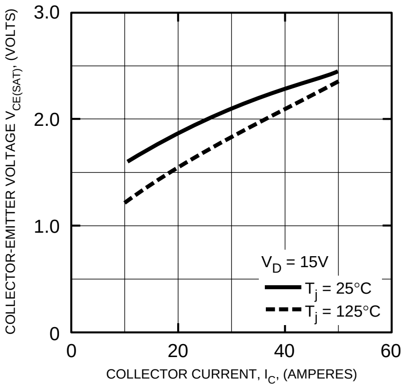
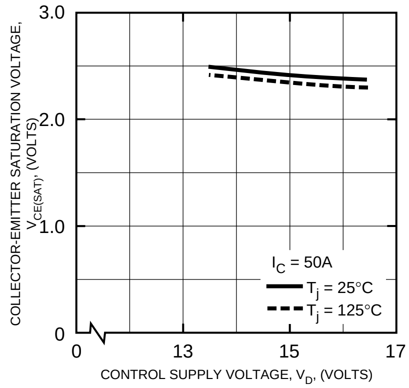
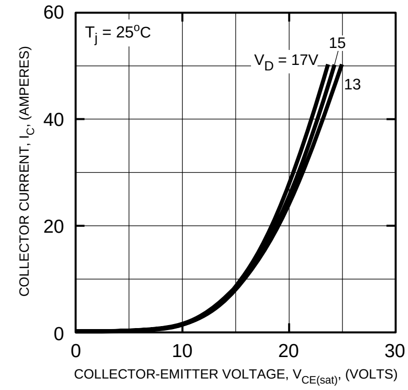
Inverter Part



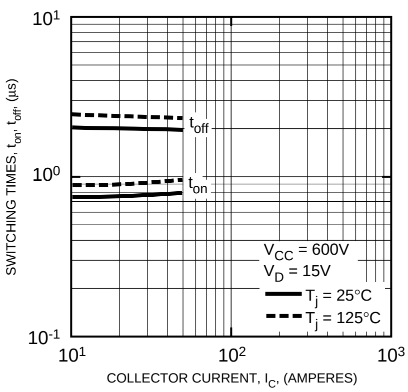
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



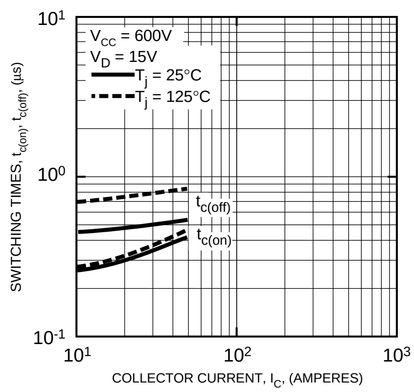
COLLECTOR-EMITTER SATURATON VOLTAGE CHARACTERISTICS (TYPICAL)



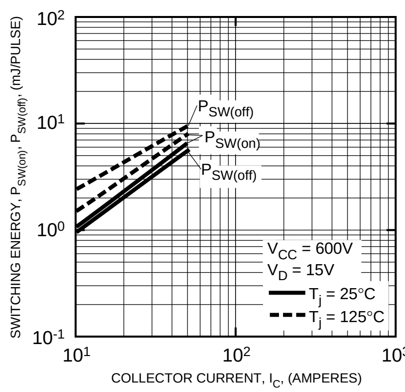
OUTPUT CHARACTERISTICS (TYPICAL)



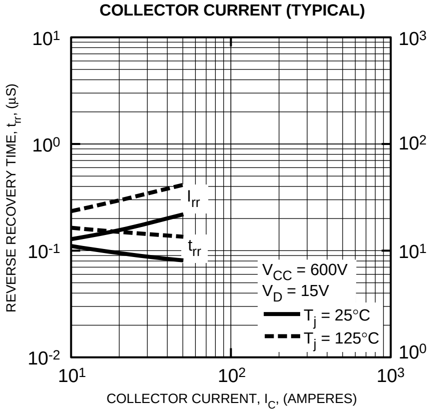
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



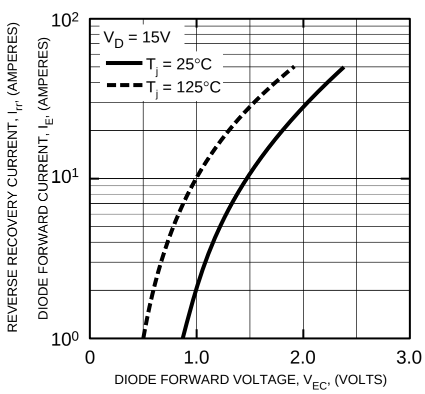
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



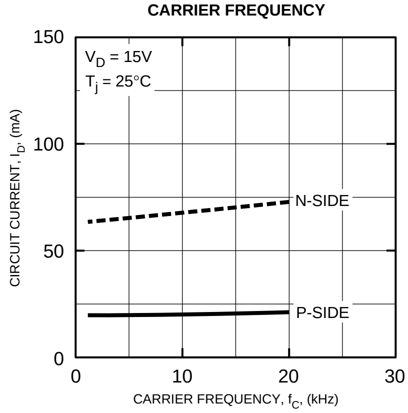
SWITCHING LOSS CHARACTERISTICS (TYPICAL)



REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)



DIODE FORWARD CHARACTERISTICS



CIRCUIT CURRENT VS. CARRIER FREQUENCY

![POWEREX]

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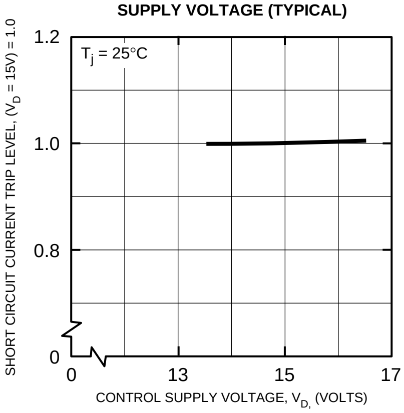
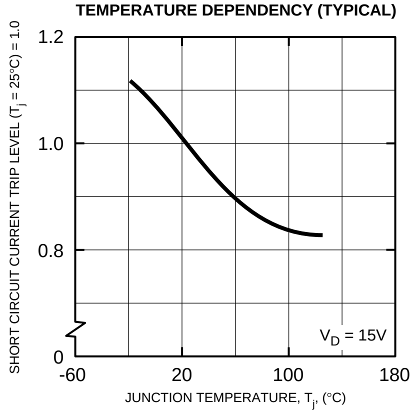
Inverter Part

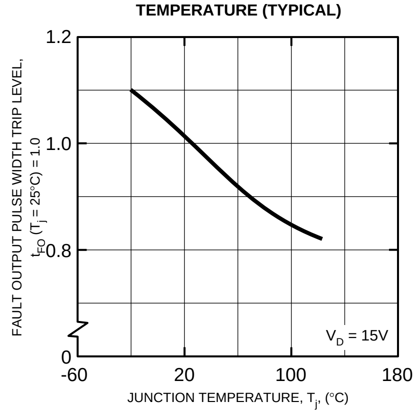
OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)



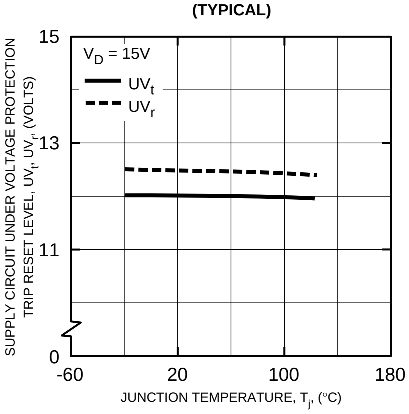
OVER CURRENT TRIP LEVEL TEMPERATURE DEPENDENCY (TYPICAL)



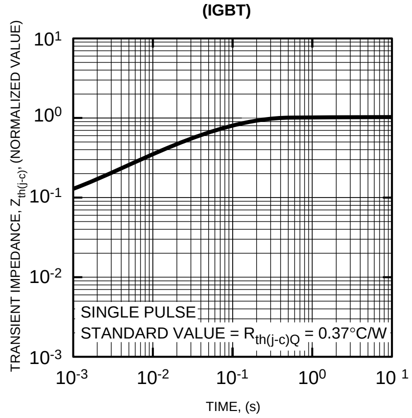
FAULT OUTPUT PULSE WIDTH VS. TEMPERATURE (TYPICAL)



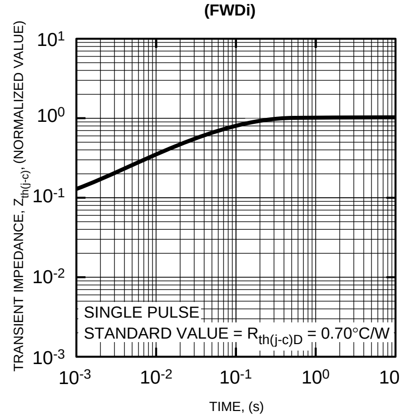
CONTROL SUPPLY VOLTAGE TRIP-RESET LEVEL TEMPERATURE DEPENDANCY (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDi)



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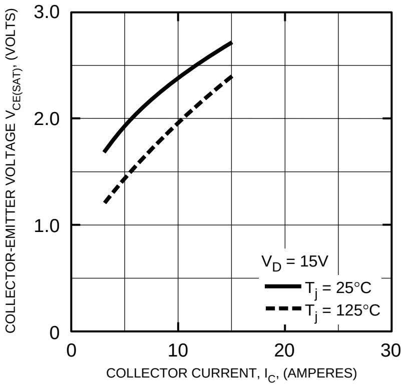
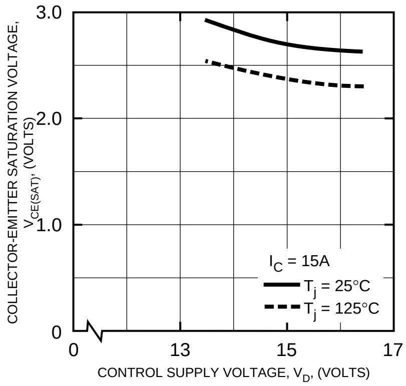
Brake Part

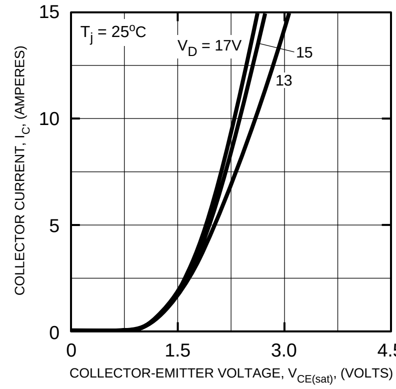
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



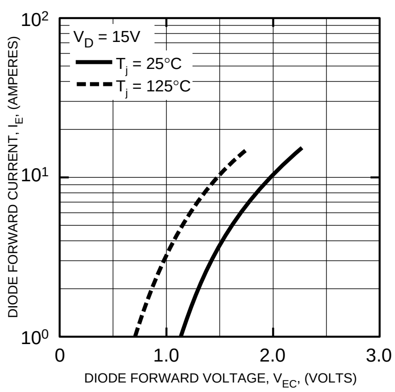
COLLECTOR-EMITTER SATURATON VOLTAGE CHARACTERISTICS (TYPICAL)



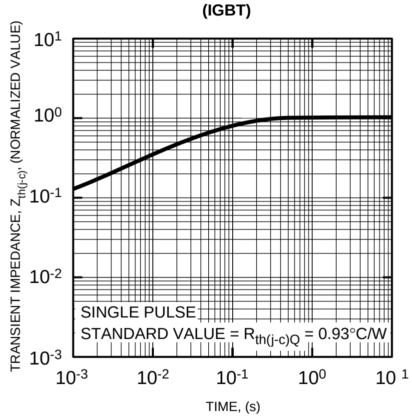
OUTPUT CHARACTERISTICS (TYPICAL)



DIODE FORWARD CHARACTERISTICS



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWDi)