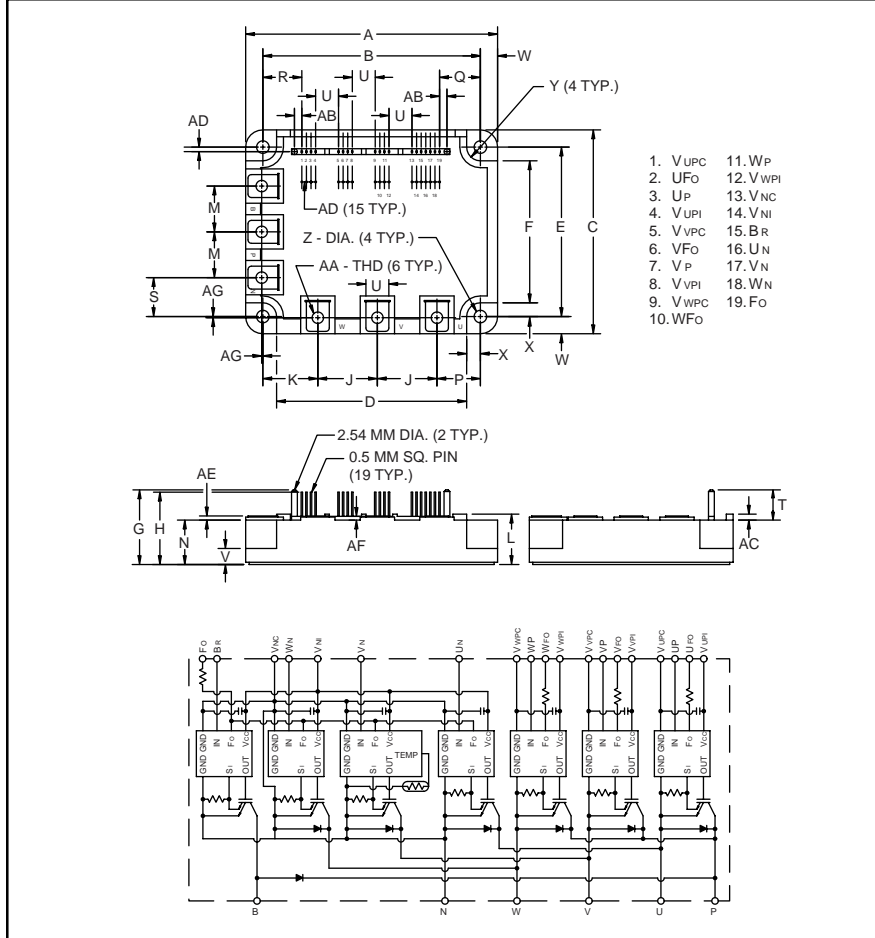


### Intellimod™ Module Three Phase + Brake IGBT Inverter Output 50 Amperes/1200 Volts



1. V<sub>UPC</sub>
2. U<sub>FO</sub>
3. U<sub>P</sub>
4. V<sub>UPI</sub>
5. V<sub>VPC</sub>
6. V<sub>FO</sub>
7. V<sub>P</sub>
8. V<sub>VPI</sub>
9. V<sub>WPC</sub>
10. W<sub>FO</sub>
11. W<sub>P</sub>
12. V<sub>WPI</sub>
13. V<sub>NC</sub>
14. V<sub>NI</sub>
15. B<sub>R</sub>
16. U<sub>N</sub>
17. V<sub>N</sub>
18. W<sub>N</sub>
19. F<sub>O</sub>



#### 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 Current
  - 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. PM50RSA120 is a 1200V, 50 Ampere Intellimod™ Intelligent Power Module.

Outline Drawing and Circuit Diagram

Dimensions	Inches	Millimeters
A	4.33±0.04	110.0±1.0
B	3.74±0.02	95.0±0.5
C	3.50±0.04	89.0±1.0
D	3.27	83.0
E	2.91±0.02	74.0±0.5
F	2.44	62.0
G	1.28	32.6
H	1.24	31.6
J	1.02	26.0
K	0.94	24.0
L	0.87 +0.06/-0.022.0	+1.5/-0.0
M	0.79	20.0
N	0.76	19.4
P	0.75	19.0
Q	0.708	17.98
R	0.670	17.02

Dimensions	Inches	Millimeters
S	0.67	17.0
T	0.52	13.2
U	0.39	10.0
V	0.31	8.0
W	0.30	7.5
X	0.24	6.0
Y	0.24 Rad.	Rad. 6.0
Z	0.22 Dia.	Dia. 5.5
AA	Metric M5	M5
AB	0.127	3.22
AC	0.10	2.6
AD	0.08	2.0
AE	0.07	1.8
AF	0.06	1.6
AG	0.02	0.5

Type	Current Rating Amperes	V <sub>CEs</sub> Volts (x 10)
PM	50	120



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**PM50RSA120**  
**Intellimod™ Module**  
**Three Phase + Brake IGBT Inverter Output**  
**50 Amperes/1200 Volts**

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

Characteristics	Symbol	PM50RSA120	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	$T_C$	-20 to 100	$^\circ\text{C}$
Mounting Torque, M5 Mounting Screws	—	17	in-lb
Mounting Torque, M5 Main Terminal Screw	—	17	in-lb
Module Weight (Typical)	—	550	Grams
Supply Voltage Protected by OC and SC ( $V_D = 13.5 - 16.5\text{V}$ , Inverter Part, $T_j = 125^\circ\text{C}$ )	$V_{\text{CC(prot.)}}$	800	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	$V_{\text{RMS}}$	2500	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 ( $U_P$ , $V_P$ , $W_P$ , $U_N$ , $V_N$ , $W_N$ , $B_r$ )	$V_{\text{CIN}}$	20	Volts
Fault Output Supply Voltage	$V_{\text{FO}}$	20	Volts
Fault Output Current	$I_{\text{FO}}$	20	mA

**IGBT Inverter Sector**

Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ )	$V_{\text{CES}}$	1200	Volts
Collector Current, $\pm$	$I_C$	50	Amperes
Peak Collector Current, $\pm$	$I_{\text{CP}}$	100	Amperes
Supply Voltage (Applied between P - N)	$V_{\text{CC}}$	900	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	1000	Volts
Collector Dissipation	$P_C$	347	Watts

**Brake Sector**

Collector-Emitter Voltage	$V_{\text{CES}}$	1200	Volts
Collector Current, $\pm$	$I_C$	15	Amperes
Peak Collector Current, $\pm$	$I_{\text{CP}}$	30	Amperes
Supply Voltage (Applied between P - N)	$V_{\text{CC}}$	900	Volts
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	1000	Volts
Collector Dissipation	$P_C$	138	Watts
Diode Forward Current	$I_F$	15	Amperes
Diode DC Reverse Voltage	$V_{\text{R(DC)}}$	1200	Volts

**PM50RSA120**  
**Intellimod™ Module**  
**Three Phase + Brake IGBT Inverter Output**  
**50 Amperes/1200 Volts**

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Control Sector</b>						
Over Current Trip Level Inverter Part	OC	$-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$	59	112	—	Amperes
Over Current Trip Level Brake Part			22	50	—	Amperes
Short Circuit Trip Level Inverter Part	SC	$-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$	—	183	—	Amperes
Short Circuit Trip Level Brake Part			—	95	—	Amperes
Over Current Delay Time	$t_{\text{off}}(\text{OC})$	$V_D = 15\text{V}$	—	10	—	$\mu\text{S}$
Over Temperature Protection	OT	Trip Level	111	118	125	$^\circ\text{C}$
	$\text{OT}_R$	Reset Level	—	100	—	$^\circ\text{C}$
Supply Circuit Under Voltage Protection	UV	Trip Level	11.5	12.0	12.5	Volts
	$\text{UV}_R$	Reset Level	—	12.5	—	Volts
Supply Voltage	$V_D$	Applied between $V_{\text{UP}1}$ - $V_{\text{UPC}}$ , $V_{\text{VP}1}$ - $V_{\text{VPC}}$ , $V_{\text{WP}1}$ - $V_{\text{WPC}}$ , $V_{\text{N}1}$ - $V_{\text{NC}}$	13.5	15	16.5	Volts
Circuit Current	$I_D$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{N}1}$ - $V_{\text{NC}}$	—	44	60	mA
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{XP}1}$ - $V_{\text{XPC}}$	—	13	18	mA
Input ON Threshold Voltage	$V_{\text{CIN}(\text{on})}$	Applied between	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{\text{CIN}(\text{off})}$	$U_P$ , $V_P$ , $W_P$ , $U_N$ , $V_N$ , $W_N$ , $B_r$	1.7	2.0	2.3	Volts
PWM Input Frequency	$f_{\text{PWM}}$	3- $\emptyset$ Sinusoidal	—	15	20	kHz
Fault Output Current	$I_{\text{FO}(\text{H})}$	$V_D = 15\text{V}$ , $V_{\text{FO}} = 15\text{V}$	—	—	0.01	mA
	$I_{\text{FO}(\text{L})}$	$V_D = 15\text{V}$ , $V_{\text{FO}} = 15\text{V}$	—	10	15	mA
Minimum Fault Output Pulse Width	$t_{\text{FO}}$	$V_D = 15\text{V}$	1.0	1.8	—	mS



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**PM50RSA120**  
**Intellimod™ Module**  
**Three Phase + Brake IGBT Inverter Output**  
**50 Amperes/1200 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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**IGBT Inverter Sector**

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
Diode Forward Voltage	$V_{FM}$	$-I_C = 50\text{A}, V_D = 15\text{V}, V_{CIN} = 5\text{V}$	—	2.5	3.5	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}$	—	2.5	3.5	Volts
		$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}, T_j = 125^\circ\text{C}$	—	2.2	3.2	Volts
Inductive Load Switching Times	$t_{on}$		0.5	1.0	2.5	$\mu\text{S}$
	$t_{rr}$	$V_D = 15\text{V}, V_{CIN} = 0 \sim 15\text{V}$	—	0.15	0.3	$\mu\text{S}$
	$t_{C(on)}$	$V_{CC} = 600\text{V}, I_C = 50\text{A}$	—	0.4	1.0	$\mu\text{S}$
	$t_{off}$	$T_j = 125^\circ\text{C}$	—	2.5	3.5	$\mu\text{S}$
	$t_{C(off)}$		—	0.7	1.2	$\mu\text{S}$

**Brake Sector**

Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}, T_j = 25^\circ\text{C}$	—	2.8	3.8	Volts
		$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}, T_j = 125^\circ\text{C}$	—	2.5	3.5	Volts
Diode Forward Voltage	$V_{FM}$	$-I_C = 15\text{A}, V_D = 15\text{V}, V_{CIN} = 5\text{V}$	—	2.5	3.5	Volts
Collector Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, T_j = 25^\circ\text{C}$	—	—	1	mA
		$V_{CE} = V_{CES}, T_j = 125^\circ\text{C}$	—	—	10	mA



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**50 Amperes/1200 Volts**

### Thermal Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{th(j-c)Q}$	Each Inverter IGBT	—	—	0.36	°C/Watt
	$R_{th(j-c)D}$	Each Inverter FWDi	—	—	1.0	°C/Watt
	$R_{th(c-f)Q}$	Each Brake IGBT	—	—	0.9	°C/Watt
	$R_{th(c-f)D}$	Each Brake FWDi	—	—	2.0	°C/Watt
Contact Thermal Resistance	$R_{th(c-f)}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.027	°C/Watt

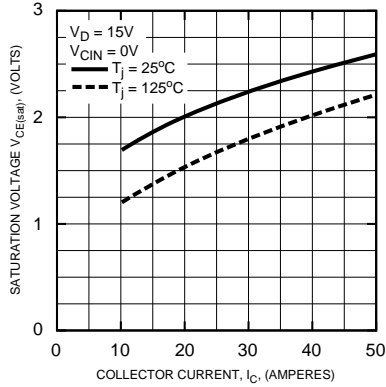
### Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	$V_{CC}$	Applied across P-N Terminals	0 ~ 800	Volts
	$V_D$	Applied between $V_{UP1}$ - $V_{UPC}$ , $V_{N1}$ - $V_{NC}$ , $V_{VP1}$ - $V_{VPC}$ , $V_{WP1}$ - $V_{WPC}$	$15 \pm 1.5$	Volts
Input ON Voltage	$V_{CIN(on)}$	Applied between	0 ~ 0.8	Volts
Input OFF Voltage	$V_{CIN(off)}$	$U_P$ , $V_P$ , $W_P$ , $U_N$ , $V_N$ , $W_N$ , $B_r$	$4.0 \sim V_D$	Volts
PWM Input Frequency	$f_{PWM}$	Using Application Circuit	5 ~ 20	kHz
Minimum Dead Time	$t_{DEAD}$	Input Signal	$\geq 3.0$	$\mu S$

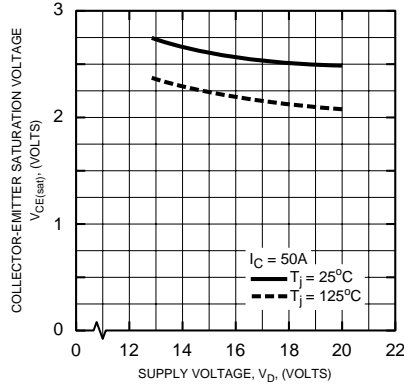
**PM50RSA120**  
**Intellimod™ Module**  
**Three Phase + Brake IGBT Inverter Output**  
**50 Amperes/1200 Volts**

**Inverter Part**

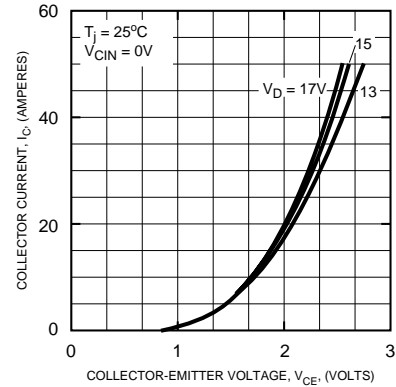
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



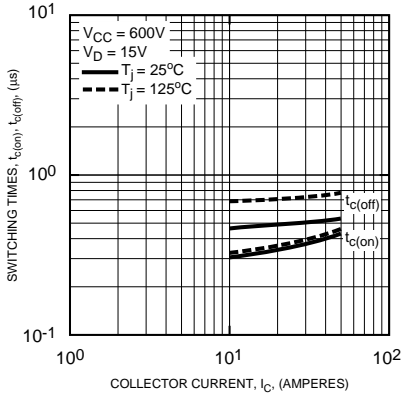
**COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)**



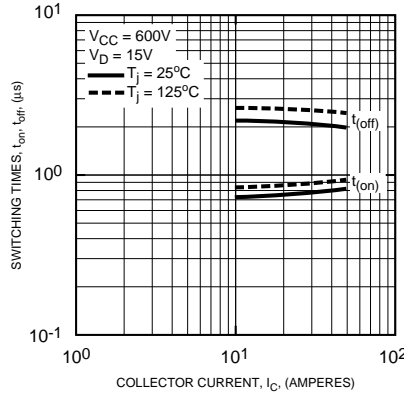
**OUTPUT CHARACTERISTICS (TYPICAL)**



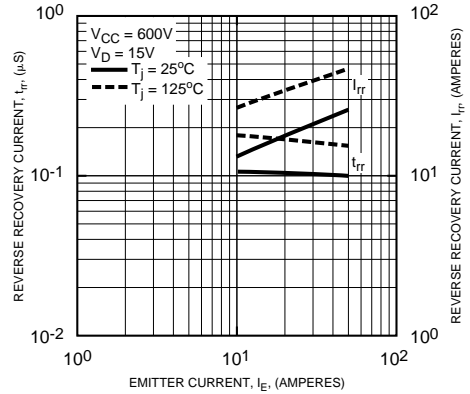
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



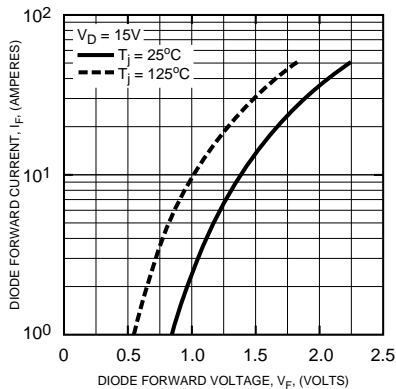
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



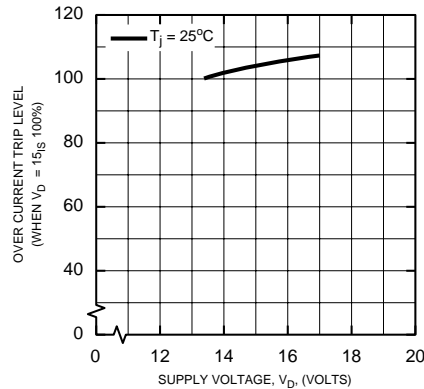
**REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)**



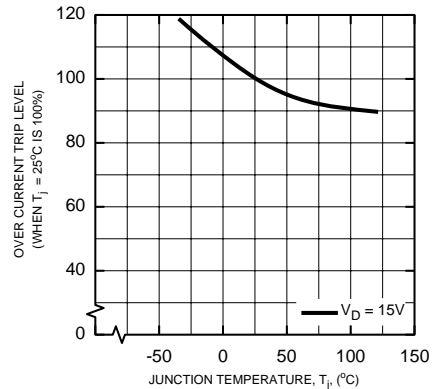
**DIODE FORWARD CHARACTERISTICS**



**OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)**

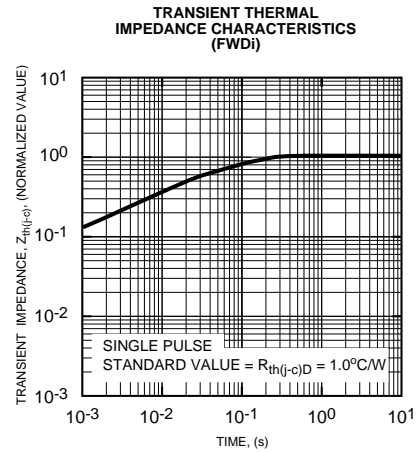
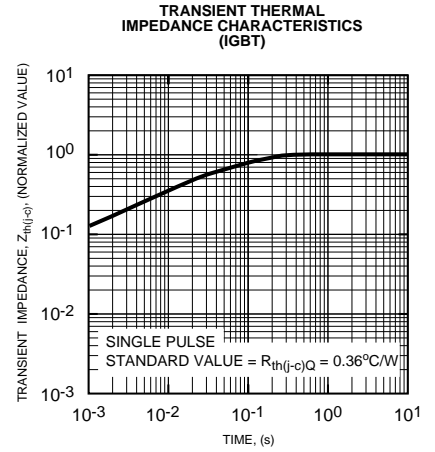
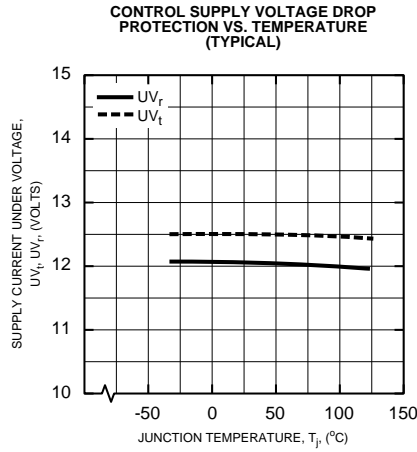
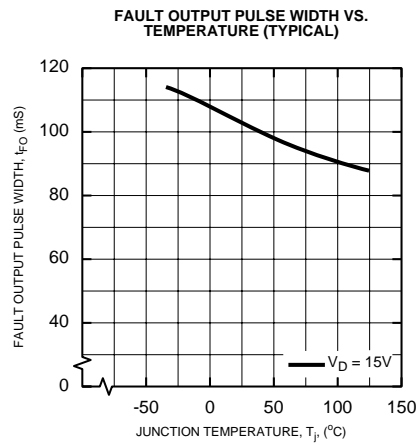


**OVER CURRENT TRIP LEVEL VS. TEMPERATURE (TYPICAL)**



**PM50RSA120**  
**Intellimod™ Module**  
**Three Phase + Brake IGBT Inverter Output**  
**50 Amperes/1200 Volts**

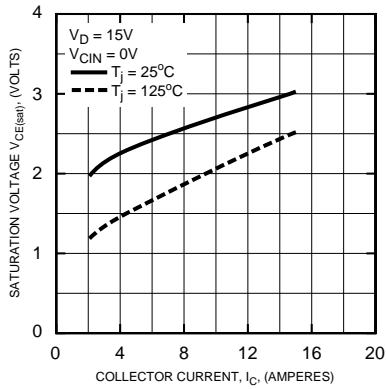
**Inverter Part**



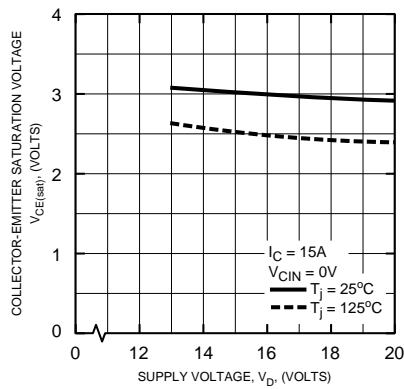
**PM50RSA120**  
**Intellimod™ Module**  
**Three Phase + Brake IGBT Inverter Output**  
**50 Amperes/1200 Volts**

**Brake Part**

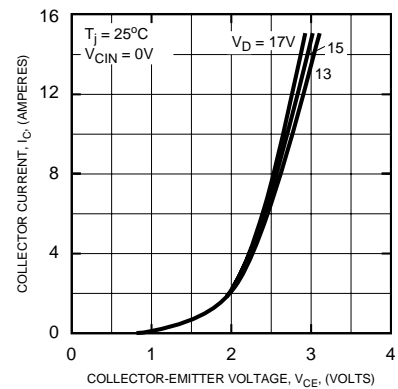
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



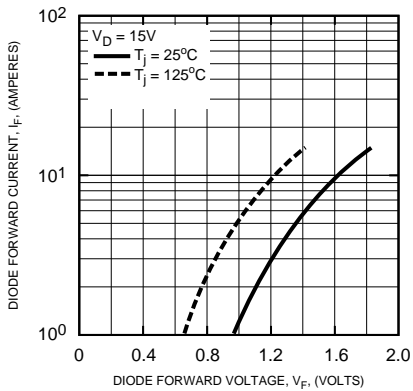
**COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)**



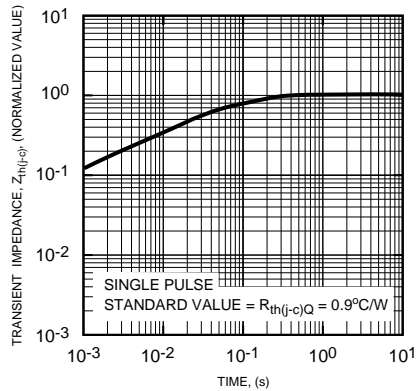
**OUTPUT CHARACTERISTICS (TYPICAL)**



**DIODE FORWARD CHARACTERISTICS (TYPICAL)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWD)**

