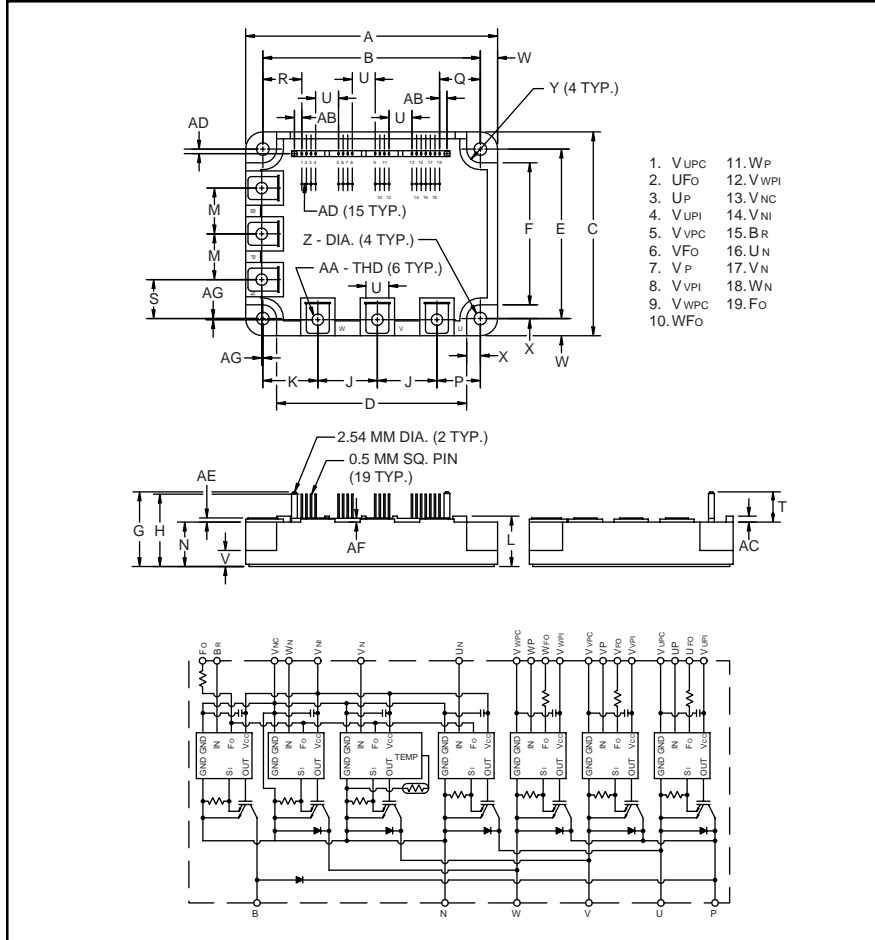


Intellimod™ Module Three Phase + Brake IGBT Inverter Output 50 Amperes/1200 Volts



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 _{CES} Volts (x 10) |
|------|---------------------------|----------------------------------|
| PM | 50 | 120 |



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

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_{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_{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_{CIN} | 20 | Volts |
| Fault Output Supply Voltage | V_{FO} | 20 | Volts |
| Fault Output Current | I_{FO} | 20 | mA |

IGBT Inverter Sector

| | | | |
|--|------------------------|------|---------|
| Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$) | V_{CES} | 1200 | Volts |
| Collector Current, \pm | I_C | 50 | Amperes |
| Peak Collector Current, \pm | I_{CP} | 100 | Amperes |
| Supply Voltage (Applied between P - N) | V_{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_{CES} | 1200 | Volts |
| Collector Current, \pm | I_C | 15 | Amperes |
| Peak Collector Current, \pm | I_{CP} | 30 | Amperes |
| Supply Voltage (Applied between P - N) | V_{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 |
|---|------------------------------|--|------|------|------|------------------|
| Control Sector | | | | | | |
| 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 | — | μS |
| Over Temperature Protection | OT | Trip Level | 111 | 118 | 125 | $^\circ\text{C}$ |
| | OT_R | Reset Level | — | 100 | — | $^\circ\text{C}$ |
| Supply Circuit Under Voltage Protection | UV | Trip Level | 11.5 | 12.0 | 12.5 | Volts |
| | UV_R | Reset Level | — | 12.5 | — | Volts |
| Supply Voltage | V_D | Applied between $V_{\text{UP}1}$ - V_{UPC} , $V_{\text{VP}1}$ - V_{VPC} , $V_{\text{WP}1}$ - V_{WPC} , $V_{\text{N}1}$ - V_{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_{NC} | — | 44 | 60 | mA |
| | | $V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$, $V_{\text{XP}1}$ - V_{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_{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_{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 |
|-----------------|--------|-----------------|------|------|------|-------|
|-----------------|--------|-----------------|------|------|------|-------|

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 | μS |
| | t_{rr} | $V_D = 15\text{V}, V_{CIN} = 0 \sim 15\text{V}$ | — | 0.15 | 0.3 | μS |
| | $t_{C(on)}$ | $V_{CC} = 600\text{V}, I_C = 50\text{A}$ | — | 0.4 | 1.0 | μS |
| | t_{off} | $T_j = 125^\circ\text{C}$ | — | 2.5 | 3.5 | μS |
| | $t_{C(off)}$ | | — | 0.7 | 1.2 | μS |

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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PM50RSA120
Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
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 |

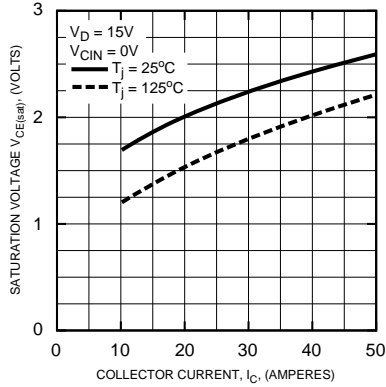
Recommended Conditions for Use

| 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 ± 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 | ≥ 3.0 | μS |

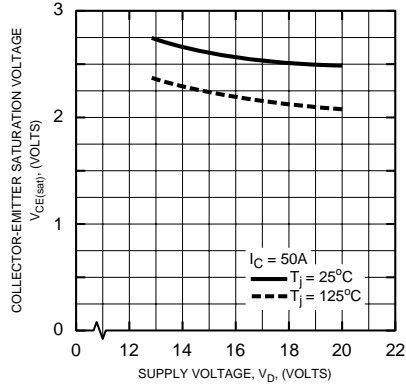
PM50RSA120
Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
50 Amperes/1200 Volts

Inverter Part

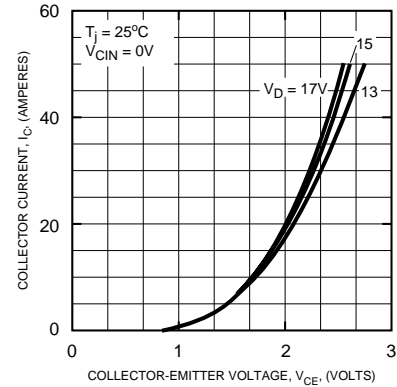
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



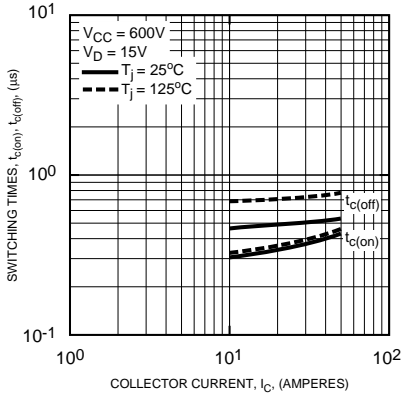
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



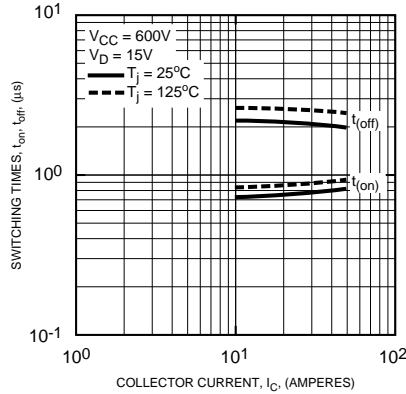
OUTPUT CHARACTERISTICS (TYPICAL)



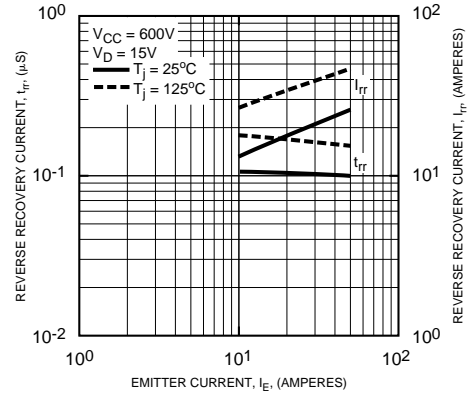
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



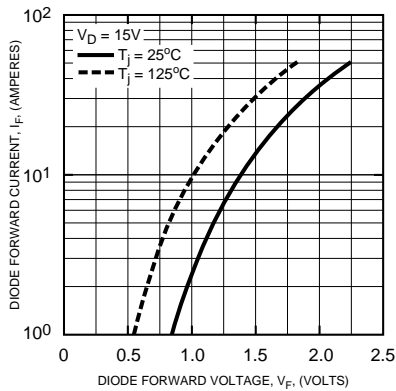
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



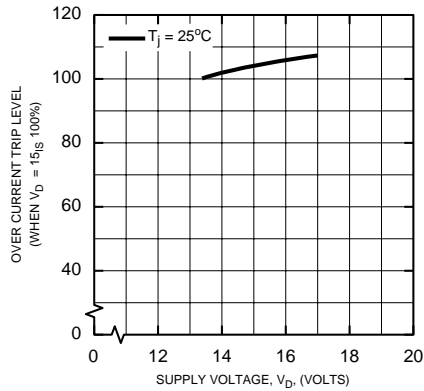
REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)



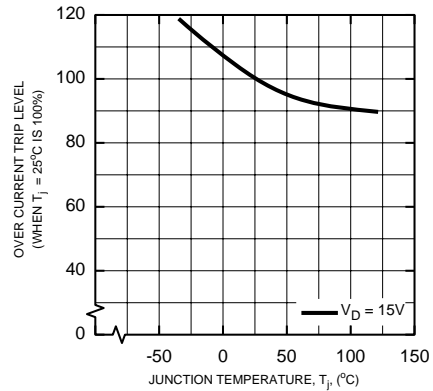
DIODE FORWARD CHARACTERISTICS



OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)



OVER CURRENT TRIP LEVEL VS. TEMPERATURE (TYPICAL)

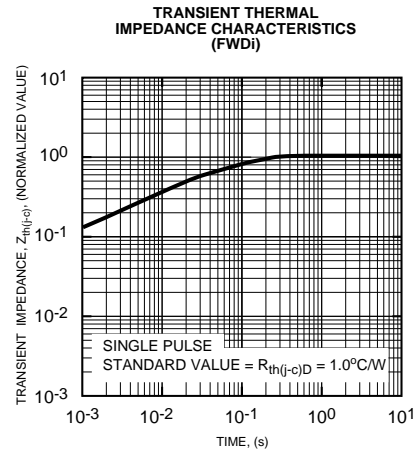
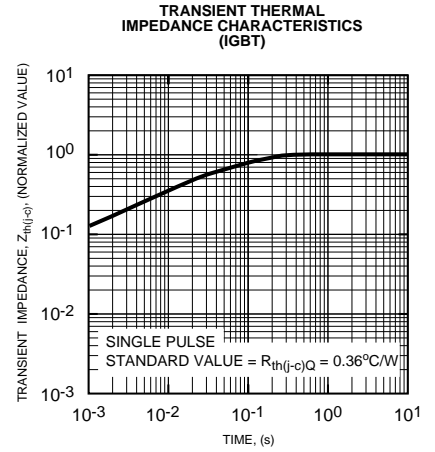
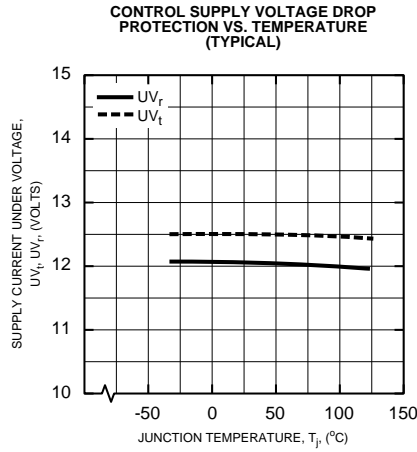
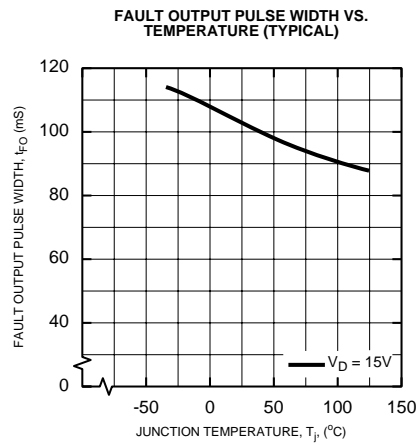




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Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
50 Amperes/1200 Volts

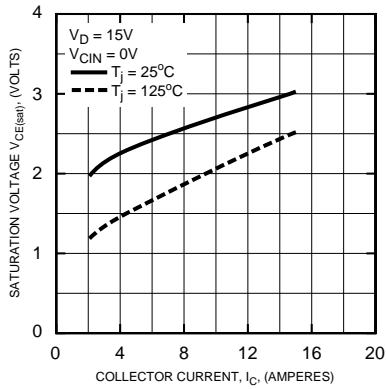
Inverter Part



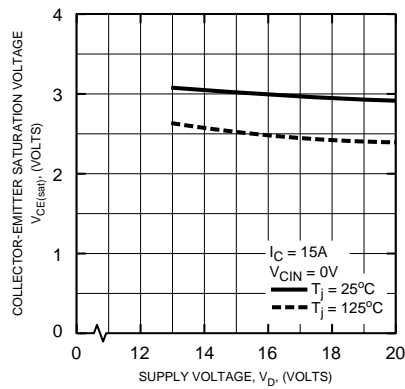
PM50RSA120
Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
50 Amperes/1200 Volts

Brake Part

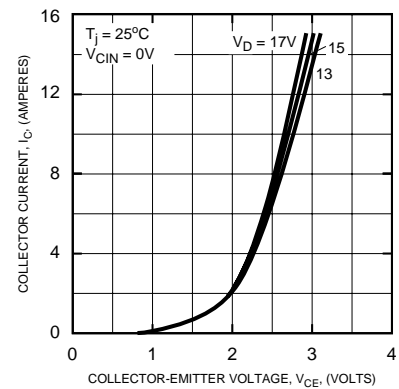
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



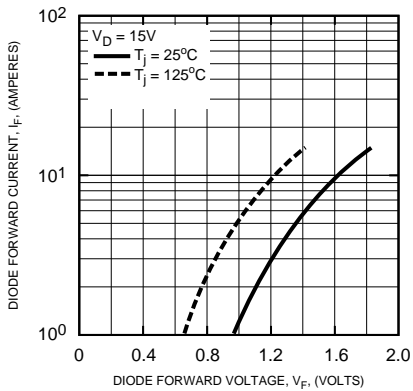
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



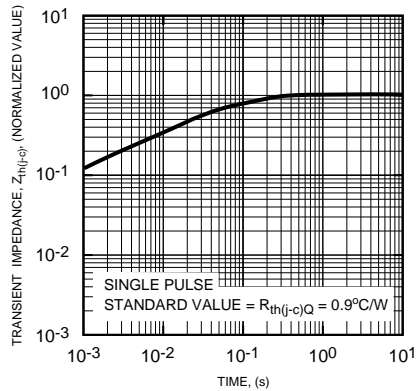
OUTPUT CHARACTERISTICS (TYPICAL)



DIODE FORWARD CHARACTERISTICS (TYPICAL)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT)



TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (FWD)

