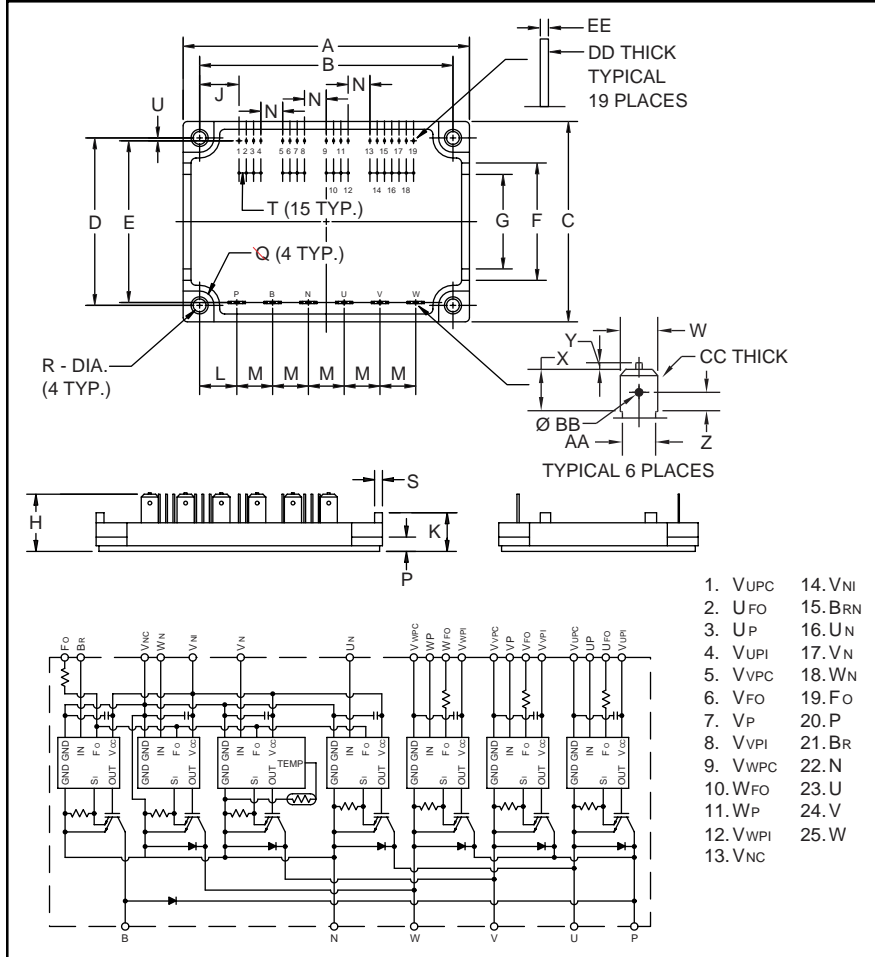


Intellimod™ Module

Three Phase + Brake
IGBT Inverter Output
50 Amperes/600 Volts



Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|------------|------------|-------------|
| A | 3.96±0.04 | 100.5±1.0 |
| B | 3.48±0.02 | 88.5±0.5 |
| C | 2.76±0.04 | 70.0±1.0 |
| D | 2.30±0.02 | 58.5±0.5 |
| E | 2.22±0.02 | 56.5±0.5 |
| F | 1.61 | 41.0 |
| G | 1.30 | 33.0 |
| H | 0.75±0.04 | 19.0±1.0 |
| J | 0.542 | 13.77 |
| K | 0.53 | 13.5 |
| L | 0.51 | 13.0 |
| M | 0.49±0.01 | 12.5±0.25 |
| N | 0.300±0.01 | 7.62±0.25 |
| P | 0.20 | 5.0 |

| Dimensions | Inches | Millimeters |
|------------|------------|-------------|
| Q | 0.20 Rad. | Rad. 5.0 |
| R | 0.18 Dia. | Dia. 4.5 |
| S | 0.108 | 2.75 |
| T | 0.100±0.01 | 2.54±0.25 |
| U | 0.030 | 0.75 |
| W | 0.25 | 6.35 |
| X | 0.313 | 7.95 |
| Y | 0.039 | 1.0 |
| Z | 0.134 | 3.4 |
| AA | 0.236 | 6.0 |
| BB | 0.065 | 1.65 |
| CC | 0.032 | 0.8 |
| DD | 0.016 | 0.4 |
| EE | 0.24 | 0.6 |

1. VUPC
2. UFO
3. UP
4. VUPI
5. VVPC
6. VFO
7. VP
8. VVPI
9. VVWC
10. WFO
11. WWP
12. VVPI
13. VNC
14. VNI
15. BRN
16. UN
17. VN
18. WNI
19. FO
20. P
21. BR
22. N
23. U
24. V
25. W



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. PM50RSK060 is a 600V, 50 Ampere Intellimod™ Intelligent Power Module.

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

PM50RSK060
Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
50 Amperes/600 Volts

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

| Characteristics | Symbol | PM50RSK060 | 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, M4 Mounting Screws | — | 13 | in-lb |
| Module Weight (Typical) | — | 110 | Grams |
| Supply Voltage Protected by OC and SC ($V_D = 13.5 - 16.5\text{V}$, Inverter Part, $T_j = 125^\circ\text{C}$) | $V_{\text{CC(prot.)}}$ | 400 | Volts |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | V_{RMS} | 2500 | Volts |

Control Sector

| | | | |
|--|------------------|----|-------|
| Supply Voltage Applied between ($V_{\text{UP1}}-V_{\text{U1PC}}$, $V_{\text{VP1}}-V_{\text{V1PC}}$, $V_{\text{WP1}}-V_{\text{W1PC}}$, $V_{\text{N1}}-V_{\text{N1C}}$) | 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} | 600 | Volts |
| Collector Current, \pm | I_C | 50 | Amperes |
| Peak Collector Current, \pm | I_{CP} | 100 | Amperes |
| Supply Voltage (Applied between P - N) | V_{CC} | 450 | Volts |
| Supply Voltage, Surge (Applied between P - N) | $V_{\text{CC(surge)}}$ | 500 | Volts |
| Collector Dissipation | P_C | 100 | Watts |

Brake Sector

| | | | |
|---|------------------------|-----|---------|
| Collector-Emitter Voltage | V_{CES} | 600 | Volts |
| Collector Current, \pm | I_C | 15 | Amperes |
| Peak Collector Current, \pm | I_{CP} | 30 | Amperes |
| Supply Voltage (Applied between P - N) | V_{CC} | 450 | Volts |
| Supply Voltage, Surge (Applied between P - N) | $V_{\text{CC(surge)}}$ | 500 | Volts |
| Collector Dissipation | P_C | 43 | Watts |
| Diode Forward Current | I_F | 15 | Amperes |
| Diode DC Reverse Voltage | $V_{\text{R(DC)}}$ | 600 | Volts |

PM50RSK060
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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 |
|---|------------------------------|--|------|------|------|------------------|
| Control Sector | | | | | | |
| Over Current Trip Level Inverter Part | OC | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ | 65 | 88 | — | Amperes |
| Over Current Trip Level Brake Part | | | 18 | 26 | — | Amperes |
| Short Circuit Trip Level Inverter Part | SC | $-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ | — | 132 | — | Amperes |
| Short Circuit Trip Level Brake Part | | | — | 39 | — | Amperes |
| Over Current Delay Time | $t_{\text{off}}(\text{OC})$ | $V_D = 15\text{V}$ | — | 10 | — | μS |
| Over Temperature Protection | OT | Trip Level | 100 | 110 | 120 | $^\circ\text{C}$ |
| | OT_R | Reset Level | — | 90 | — | $^\circ\text{C}$ |
| 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 $V_{\text{UP}1}-V_{\text{UPC}}$, $V_{\text{VP}1}-V_{\text{VPC}}$, $V_{\text{WP}1}-V_{\text{WPC}}$, $V_{\text{N}1}-V_{\text{NC}}$ | 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_{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 |



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

PM50RSK060
Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
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 |
|--------------------------------------|---------------|--|------|------|------|---------------|
| 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} | $-I_C = 50\text{A}, V_D = 15\text{V}, V_{CIN} = 5\text{V}$ | — | 2.2 | 3.3 | Volts |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}$ | — | 1.8 | 2.7 | Volts |
| | | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}, T_j = 125^\circ\text{C}$ | — | 1.85 | 2.78 | Volts |
| Inductive Load Switching Times | t_{on} | | 0.4 | 0.8 | 2.0 | μS |
| | t_{rr} | $V_D = 15\text{V}, V_{CIN} = 0 \sim 15\text{V}$ | — | 0.15 | 0.3 | μS |
| | $t_{C(on)}$ | $V_{CC} = 300\text{V}, I_C = 50\text{A}$ | — | 0.4 | 1.0 | μS |
| | t_{off} | $T_j = 125^\circ\text{C}$ | — | 2.0 | 2.9 | μS |
| | $t_{C(off)}$ | | — | 0.5 | 1.0 | μS |
| Brake Sector | | | | | | |
| Collector-Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}, T_j = 25^\circ\text{C}$ | — | 2.6 | 3.5 | Volts |
| | | $V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 50\text{A}, T_j = 125^\circ\text{C}$ | — | 3.0 | 4.0 | Volts |
| Diode Forward Voltage | V_{FM} | $-I_C = 15\text{A}, V_D = 15\text{V}, V_{CIN} = 5\text{V}$ | — | 1.7 | 2.2 | 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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PM50RSK060
Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
50 Amperes/600 Volts

Thermal Characteristics

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|-------------------------------------|----------------|---|------|------|-------|---------|
| Junction to Case Thermal Resistance | $R_{th(j-c)Q}$ | Each Inverter IGBT | — | — | 1.25 | °C/Watt |
| | $R_{th(j-c)D}$ | Each Inverter FWDi | — | — | 3.0 | °C/Watt |
| | $R_{th(c-f)Q}$ | Each Brake IGBT | — | — | 2.9 | °C/Watt |
| | $R_{th(c-f)D}$ | Each Brake FWDi | — | — | 5.4 | °C/Watt |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Case to Fin Per Module, Thermal Grease Applied | — | — | 0.038 | °C/Watt |

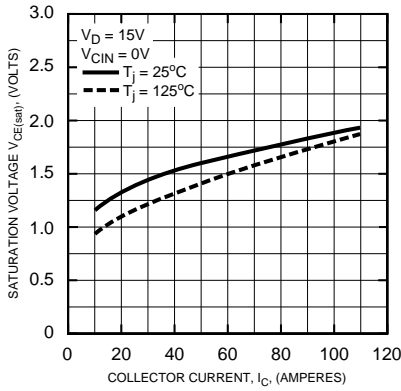
Recommended Conditions for Use

| Characteristic | Symbol | Condition | Value | Units |
|---------------------|----------------|--|----------------|---------|
| Supply Voltage | V_{CC} | Applied across P-N Terminals | 0 ~ 400 | 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 | ≥ 2.5 | μS |

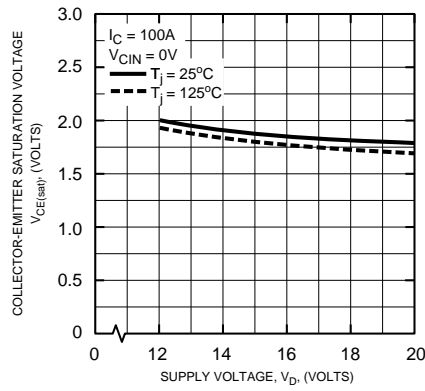
PM50RSK060
Intellimod™ Module
Three Phase + Brake IGBT Inverter Output
50 Amperes/600 Volts

Inverter Part

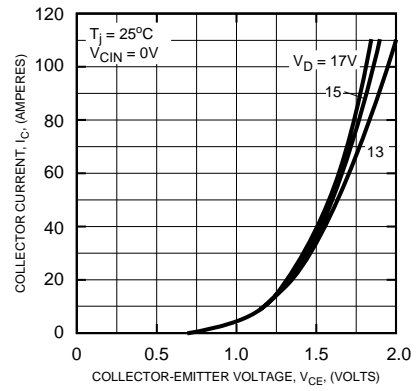
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



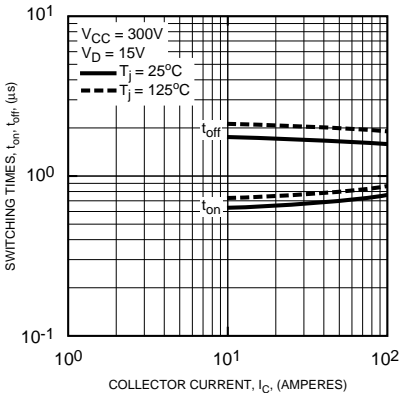
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



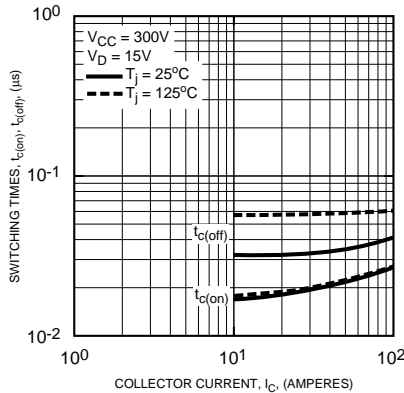
OUTPUT CHARACTERISTICS (TYPICAL)



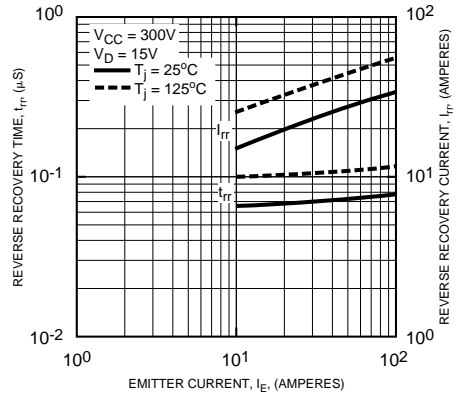
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



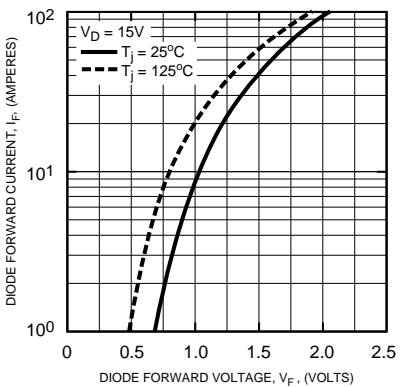
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



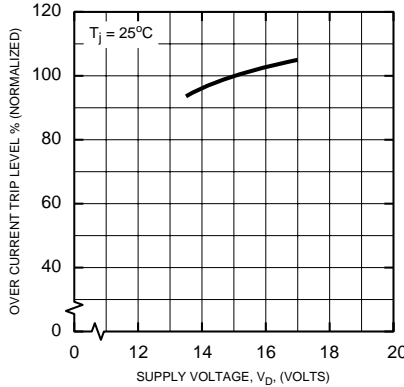
REVERSE RECOVERY CURRENT VS. COLLECTOR CURRENT (TYPICAL)



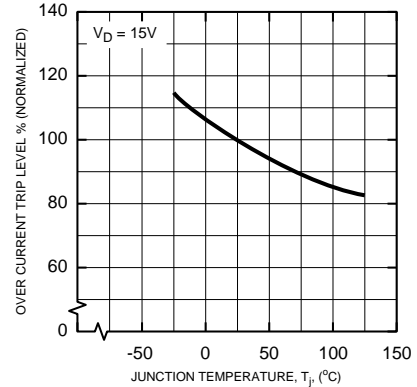
DIODE FORWARD CHARACTERISTICS



OVER CURRENT TRIP LEVEL VS. SUPPLY VOLTAGE (TYPICAL)

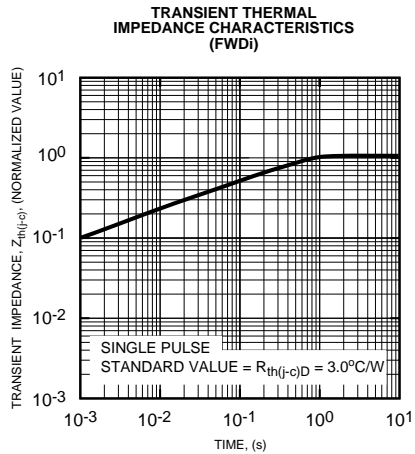
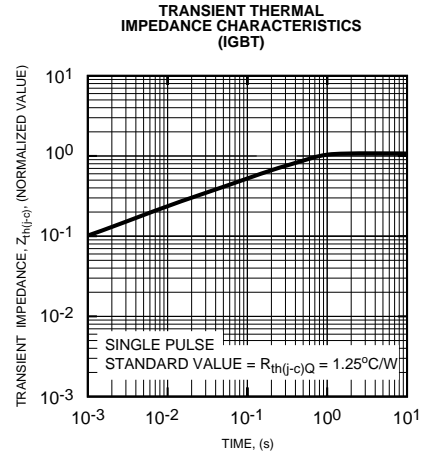
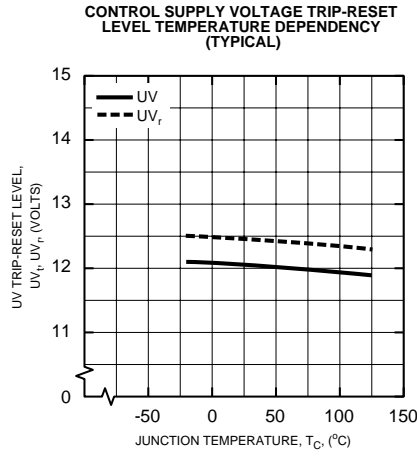
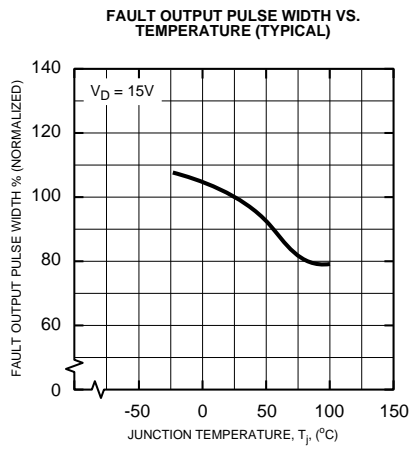


OVER CURRENT TRIP LEVEL VS. TEMPERATURE (TYPICAL)



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Inverter Part



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Brake Part

