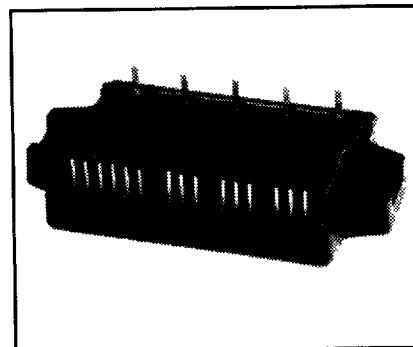
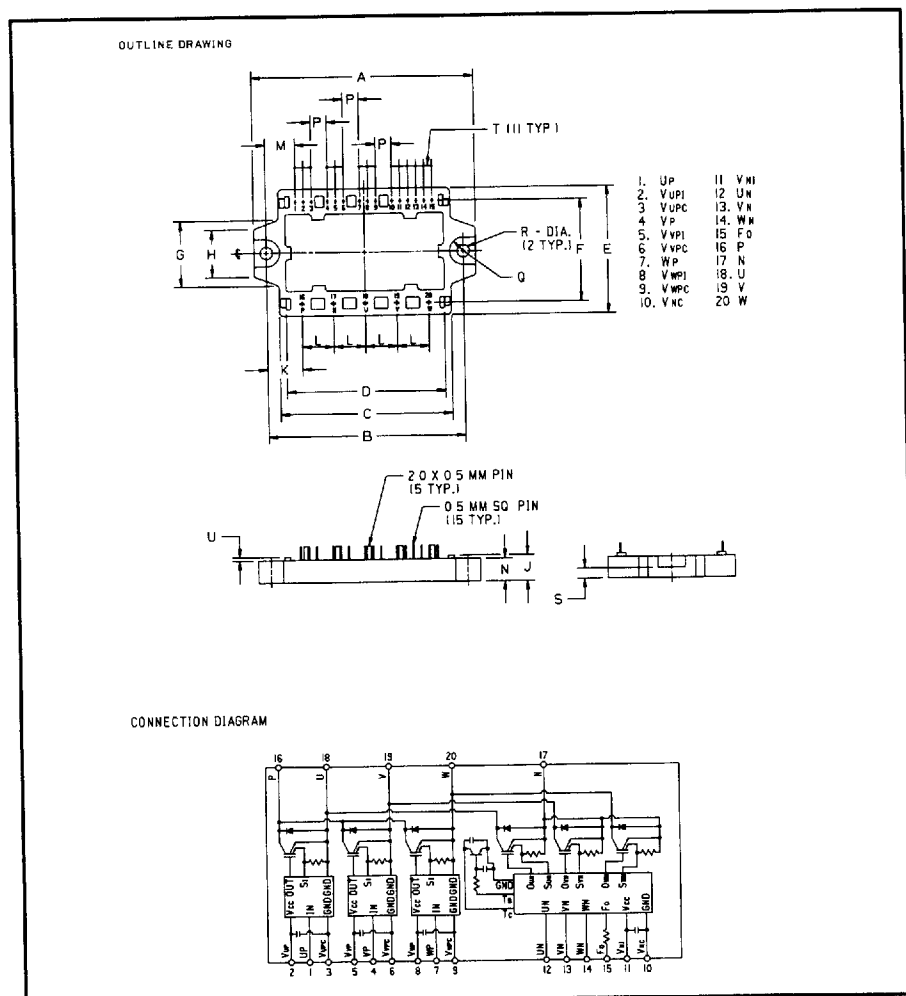


Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412) 925-7272  
Powerex, Europe, S.A. 428 Avenue G. Durand, BP107, 72003 Le Mans, France (43) 41.14.14

**Intellimod™-3 Modules**  
Three Phase  
IGBT Inverter Output  
20 Amperes/110-230 Volt Line



### Description

Powerex Intellimod-3 Modules are designed for applications requiring a high frequency (20kHz) output switching inverter. The modules are isolated from the baseplate, consisting of complete drive, control and protection circuitry for the IGBT inverter.

### Features:

- ☐ Complete Output Power Circuit
- ☐ Gate Drive Circuit
- ☐ Protection Logic
  - Short Circuit
  - Over-Current
  - Over Temperature
  - Under Voltage

### Applications:

- ☐ Inverters
- ☐ Small UPS
- ☐ Motion/Servo Control
- ☐ AC Motor Control

**Ordering Information**  
PM20CHA060

110-230 Volt Line, PM20CHA060 Outline Drawing

| Dimensions | Inches    | Millimeters |
|------------|-----------|-------------|
| A          | 3.86±0.04 | 98.0±1.0    |
| B          | 3.42±0.02 | 87.0±0.5    |
| C          | 2.99      | 76.0        |
| D          | 2.76      | 70.0        |
| E          | 2.20±0.04 | 56.0±1.0    |
| F          | 1.77      | 45.0        |
| G          | 1.14      | 29.0        |
| H          | 0.83      | 21.0        |
| J          | 0.63      | 16.0        |
| K          | 0.61      | 15.5        |

| Dimensions | Inches    | Millimeters |
|------------|-----------|-------------|
| L          | 0.55      | 14.0        |
| M          | 0.521     | 13.24       |
| N          | 0.39      | 10.0        |
| P          | 0.28      | 7.12        |
| Q          | 0.24R     | 6.0R        |
| R          | 0.22 Dia. | 5.5 Dia     |
| S          | 0.20      | 5.0         |
| T          | 0.14      | 3.56        |
| U          | 0.06      | 1.5V        |



POWEREX INC

51E D ■ 7294621 0005659 TT? ■ PRX

Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412) 925-7272

Powerex, Europe, S.A. 428 Avenue G. Durand, BP107, 72003 Le Mans, France (43) 41.14.14

T-57-29

PM20CHA060

Intellimod-3 Modules

Three Phase IGBT Inverter Output

20 Amperes/110-230 Volt Line

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

| Characteristics                                                                       | Symbol                 | PM20CHA060  | 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          | Kg-cm            |
| Module Weight (Typical)                                                               | —                      | 90          | Grams            |
| Supply Voltage Protected by OC and SC ( $V_D = 13.5 - 16.5\text{ V}$ , Inverter Part) | $V_{CC(\text{prot.})}$ | 400         | Volts            |
| Isolation Voltage AC 1 minute, 60Hz                                                   | $V_{RMS}$              | 2500        | 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 Current Applied Between ( $U_P$ , $V_P$ , $W_P$ , $U_N$ , $V_N$ , $W_N$ )                                        | $I_{CIN}$ | 20 | mA    |
| Input Voltage Applied Between ( $U_P$ , $V_P$ , $W_P$ , $U_N$ , $V_N$ , $W_N$ )                                        | $V_{CIN}$ | 20 | Volts |
| Fault Output Supply Voltage                                                                                            | $V_{FO}$  | 20 | Volts |
| Fault Output Current                                                                                                   | $I_{FO}$  | 20 | mA    |

### IGBT Inverter Sector

|                                              |                        |     |         |
|----------------------------------------------|------------------------|-----|---------|
| Collector-Emitter Voltage Fig. 1             | $V_{CES}$              | 600 | Volts   |
| Collector Current $\pm$                      | $I_C$                  | 20  | Amperes |
| Peak Collector Current $\pm$                 | $I_{CP}$               | 40  | Amperes |
| Supply Voltage (Applied between P - N)       | $V_{CC}$               | 400 | Volts   |
| Supply Voltage (Surge) Applied between P - N | $V_{CC(\text{surge})}$ | 500 | Volts   |
| Collector Dissipation                        | $P_C$                  | 62  | Watts   |



POWEREX INC

51E D ■ 7294621 0005660 719 ■ PRX

Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412) 925-7272

Powerex, Europe, S.A. 428 Avenue G. Durand, BP107, 72003 Le Mans, France (43) 41.14.14

T-57-29

PM20CHA060

Intellimod-3 Modules

Three Phase IGBT Inverter Output

20 Amperes/110-230 Volt Line

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

| Characteristics                         | Symbol         | Test Conditions                                                                                       | Min. | Typ. | Max. | Units            |
|-----------------------------------------|----------------|-------------------------------------------------------------------------------------------------------|------|------|------|------------------|
| <b>Control Sector</b>                   |                |                                                                                                       |      |      |      |                  |
| Overcurrent Trip Level Inverter Part    | OC             | $-20^\circ\text{C} \leq T \leq +125^\circ\text{C}$                                                    | 28   | 38   | —    | Amperes          |
| Short Circuit Trip Level Inverter Part  | SC             | $-20^\circ\text{C} \leq T \leq +125^\circ\text{C}$                                                    | —    | 57   | —    | Amperes          |
| Overcurrent Delay Time                  | $t_{off(OC)}$  | $V_D = 15\text{V}$ Fig. 7                                                                             | —    | 10   | —    | $\mu\text{S}$    |
| Over Temperature Protection             | OT             | Trip Level                                                                                            | 100  | 110  | 120  | $^\circ\text{C}$ |
| Over Temperature Protection             | $OT_R$         | Reset Level                                                                                           | —    | 90   | —    | $^\circ\text{C}$ |
| Supply Circuit Under Voltage Protection | UV             | Trip Level                                                                                            | 11.5 | 12.0 | 12.5 | Volts            |
| Supply Circuit Under Voltage Protection | $UV_R$         | Reset Level                                                                                           | —    | 12.5 | —    | Volts            |
| Supply Voltage                          | $V_D$          | Applied between $V_{UP1} - V_{UPC}$ ,<br>$V_{VP1} - V_{PC}$ , $V_{WP1} - V_{WPC}$ , $V_{N1} - V_{NC}$ | 13.5 | 15   | 16.5 | Volts            |
| Circuit Current                         | $I_D$          | $V_D = 15\text{V}$ , $I_{CIN} = 1\text{mA}$ , $V_{N1} - V_{NC}$                                       | —    | 25   | 40   | mA               |
|                                         | $I_D$          | $V_D = 15\text{V}$ , $I_{CIN} = 1\text{mA}$ , $V_{XP1} - V_{XPC}$                                     | —    | 7    | 12   | mA               |
| Input Bias On Current                   | $I_{CIN(on)}$  | Sink Current at<br>$U_P, V_P, W_P, U_N, V_N, W_N$                                                     | 0.1  | 0.22 | 0.5  | mA               |
| Input Bias Off Current                  | $I_{CIN(off)}$ | Sink current at<br>$U_P, V_P, W_P, U_N, V_N, W_N$                                                     | 0.1  | 0.22 | 0.5  | mA               |
| PWM Input Frequency                     | $f_{PWM}$      | 3- $\phi$ Sinusoidal                                                                                  | —    | 15   | 20   | kHz              |
| Dead Time                               | $t_{DEAD}$     | For each Input Pulse                                                                                  | 2.0  | —    | —    | $\mu\text{S}$    |
|                                         |                | Using example Interface Circuit*                                                                      | 5.0  | —    | —    | $\mu\text{S}$    |
| Fault Output Current                    | $I_{FO(H)}$    | $V_D = 15\text{V}$ , $V_{FO} = 15\text{V}$                                                            | —    | —    | 0.01 | mA               |
|                                         | $I_{FO(L)}$    | $V_D = 15\text{V}$ , $V_{FO} = 15\text{V}$                                                            | —    | 10   | 15   | mA               |
| Minimum Fault Output Pulse Width        | $t_{FO}$       | $V_D = 15\text{V}$                                                                                    | 20   | 40   | 60   | $\mu\text{S}$    |
|                                         |                | Using example Interface Circuit*<br>$V_D = 15\text{V}$                                                | 25   | 100  | —    | $\mu\text{S}$    |

\*See Intellimod-3 Applications Data Section 4.3.



POWEREX INC

51E D ■ 7294621 0005661 655 ■ PRX

Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412) 925-7272

Powerex, Europe, S.A. 428 Avenue G. Durand, BP107, 72003 Le Mans, France (43) 41.14.14

PM20CHA060

Intellimod-3 Modules

Three Phase IGBT Inverter Output

20 Amperes/110-230 Volt Line

T-57-29

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

| Characteristics                      | Symbol        | Test Conditions                                                                                                                                 | Min. | Typ. | Max. | Units         |
|--------------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------|------|------|---------------|
| <b>IGBT Inverter Sector</b>          |               |                                                                                                                                                 |      |      |      |               |
| Collector Cutoff Current             | $I_{CEX}$     | $V_{CE} = V_{CEX}$ , $T_j = 25^\circ\text{C}$ , Fig. 6                                                                                          | —    | —    | 1    | mA            |
| Collector Cutoff Current             | $I_{CEX}$     | $V_{CE} = V_{CEX}$ , $T_j = 125^\circ\text{C}$ , Fig. 6                                                                                         | —    | —    | 10   | mA            |
| Diode Forward Voltage                | $V_{FM}$      | $-I_C = 20\text{A}$ , $V_D = 15\text{V}$ , $I_{CIN} = 1\text{mA}$ ,<br>Fig. 3                                                                   | —    | 1.9  | 2.5  | Volts         |
| Collector Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}$ , $I_{CIN} = 0\text{mA}$ , $I_C = 20\text{A}$ ,<br>Fig. 2                                                                    | —    | 2.6  | 3.5  | Volts         |
| Collector Emitter Saturation Voltage | $V_{CE(sat)}$ | $V_D = 15\text{V}$ , $I_{CIN} = 0\text{mA}$ , $I_C = 20\text{A}$ ,<br>$T_j = 125^\circ\text{C}$ , Fig. 2                                        | —    | 2.5  | 3.4  | Volts         |
| Inductive Load Switching Times       | $t_{on}$      | $V_D = 15\text{V}$ , $I_{CIN} = 0\text{mA}$ ,<br>$V_{CC} = 300\text{V}$ , $I_C = 20\text{A}$ ,<br>$T_j = 125^\circ\text{C}$ ,<br>Fig. 4, Fig. 5 | 0.5  | 0.9  | 1.5  | $\mu\text{S}$ |
|                                      | $t_{rr}$      |                                                                                                                                                 | —    | 0.15 | 0.4  | $\mu\text{S}$ |
|                                      | $t_{C(on)}$   |                                                                                                                                                 | —    | 0.3  | 1.0  | $\mu\text{S}$ |
|                                      | $t_{off}$     |                                                                                                                                                 | —    | 2.0  | 2.5  | $\mu\text{S}$ |
|                                      | $t_{C(off)}$  |                                                                                                                                                 | —    | 0.5  | 1.5  | $\mu\text{S}$ |

**Thermal Characteristics**

| Characteristics                      | Symbol         | Test Conditions                     | Min. | Typ. | Max. | Units              |
|--------------------------------------|----------------|-------------------------------------|------|------|------|--------------------|
| Junction to Case Thermal Resistances | $R_{th(j-c)Q}$ | Inverter IGBT Part                  | —    | —    | 2.0  | $^\circ\text{C/W}$ |
|                                      | $R_{th(j-c)F}$ | Inverter FWD                        | —    | —    | 4.5  | $^\circ\text{C/W}$ |
| Contact Thermal Resistance           | $R_{th(c-f)}$  | Case to Fin, Thermal Grease Applied | —    | —    | 0.4  | $^\circ\text{C/W}$ |

**Recommended Operating Conditions**

| Characteristics     | Symbol         | Test Conditions                                                                                        | Value        | Units         |
|---------------------|----------------|--------------------------------------------------------------------------------------------------------|--------------|---------------|
| Supply Voltage      | $V_{CC}$       | Applied across P-N Terminals                                                                           | 0 ~ 400      | Volts         |
|                     | $V_D$          | Applied between $V_{UP1} - V_{UPC}$ ,<br>$V_{N1} - V_{NC}$ , $V_{VP1} - V_{VPC}$ , $V_{WP1} - V_{WPC}$ | $15 \pm 1.5$ | Volts         |
| Input On Current    | $I_{CIN(on)}$  | Applied between<br>$U_P, V_P, W_P, U_N, V_N, W_N$                                                      | 0 ~ 0.5      | mA            |
| Input Off Current   | $I_{CIN(off)}$ |                                                                                                        | 0.5 ~ 2      | mA            |
| PWM Input Frequency | $f_{PWM}$      | Using example Interface Circuit*                                                                       | 5 ~ 20       | kHz           |
| Minimum Dead Time   | $t_{DEAD}$     | Using example Interface Circuit*                                                                       | 5.0          | $\mu\text{S}$ |

\*See Intellimod-3 Applications Data Section 4.3.

## PM20CHA060

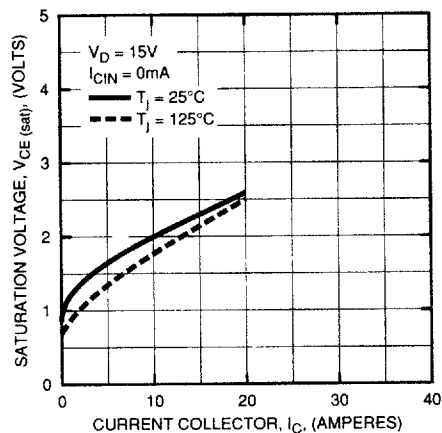
### Intellimod-3 Modules

### Three Phase IGBT Inverter Output

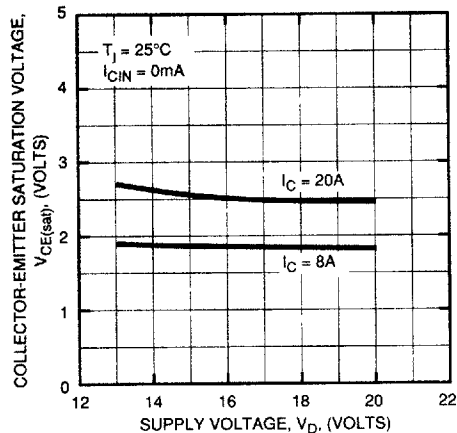
20Amperes/110-230 Volt Line

T-57-29

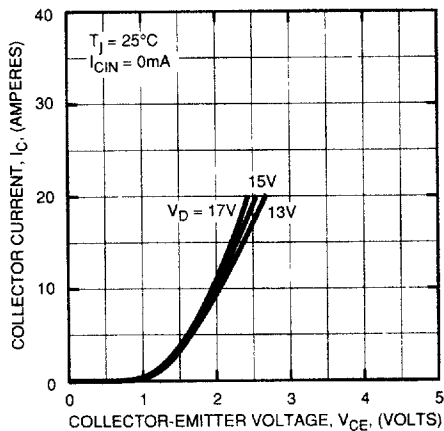
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



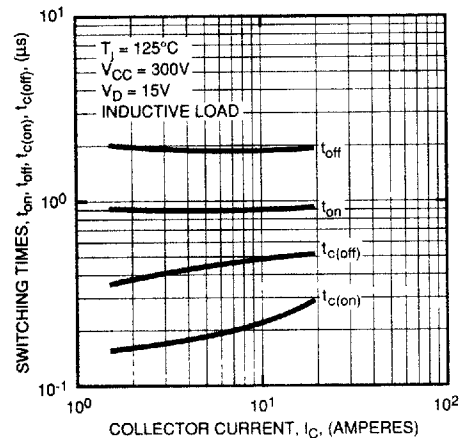
**COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)**



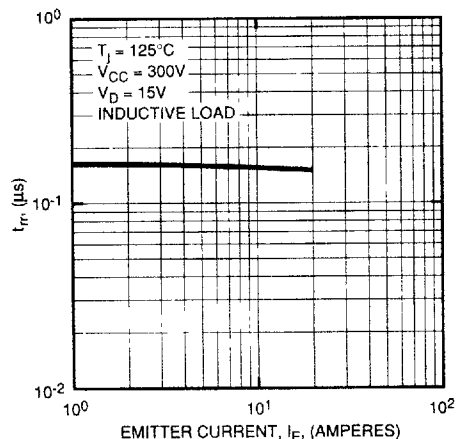
**OUTPUT CHARACTERISTICS (TYPICAL)**



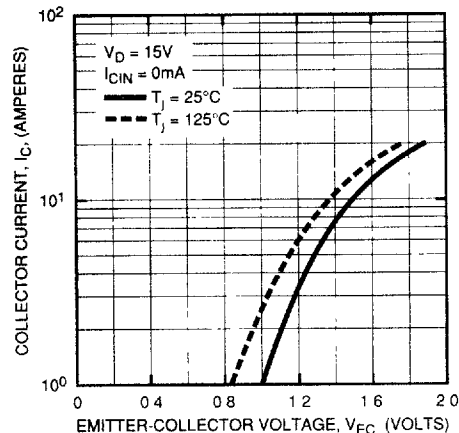
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



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



**REVERSE COLLECTOR CURRENT VS. EMITTER-COLLECTOR VOLTAGE (DIODE FORWARD CHARACTERISTICS) (TYPICAL)**





POWEREX INC

51E D 7294621 0005663 428 PRX

Powerex, Inc., Hillis Street, Youngwood, Pennsylvania 15697 (412) 925-7272

Powerex, Europe, S.A. 428 Avenue G. Durand, BP107, 72003 Le Mans, France (43) 41.14.14

PM20CHA060

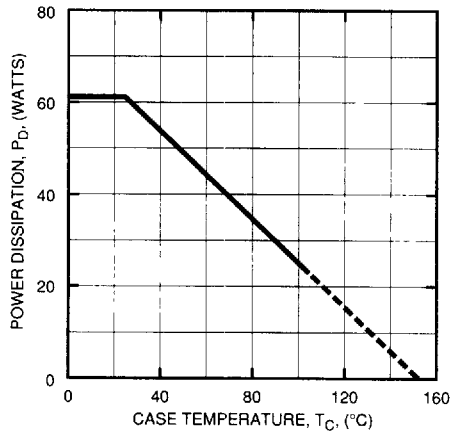
Intellimod-3 Modules

Three Phase IGBT Inverter Output

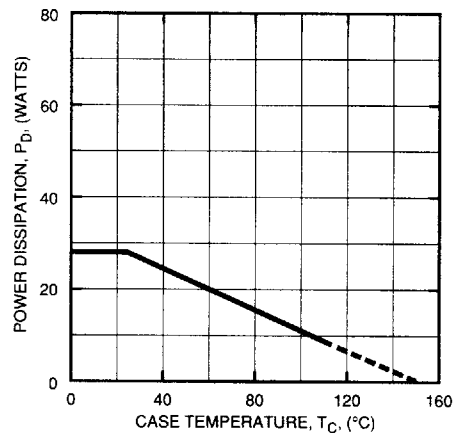
20 Amperes/110-230 Volt Line

T-57-29

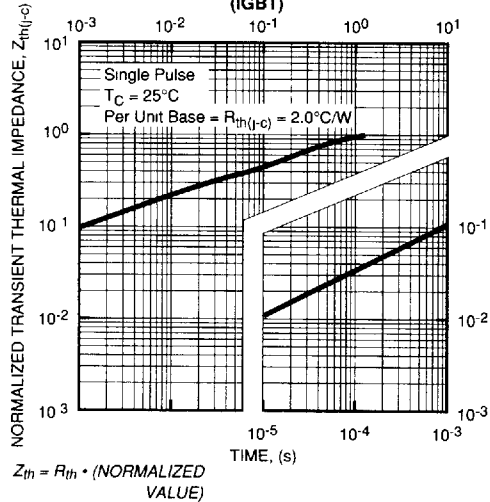
POWER DISSIPATION DERATING CURVE  
(PER IGBT ELEMENT)



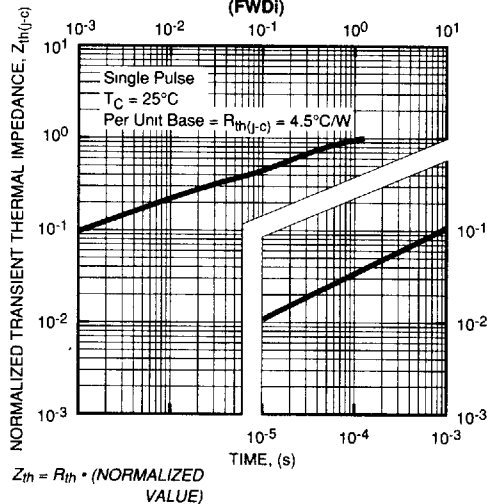
POWER DISSIPATION DERATING CURVE  
(PER FWDI ELEMENT)



TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(IGBT)



TRANSIENT THERMAL  
IMPEDANCE CHARACTERISTICS  
(FWDI)



## PM20CHA060

### Intellimod-3 Modules

#### Three Phase IGBT Inverter Output

20 Amperes/110-230 Volt Line

T-57-29

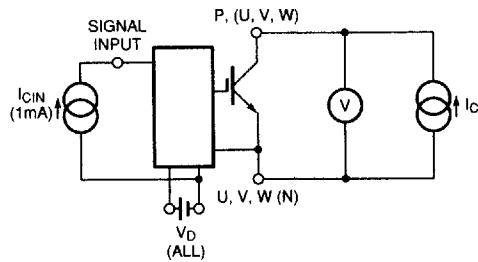


Figure 1  $V_{CES}$  Test

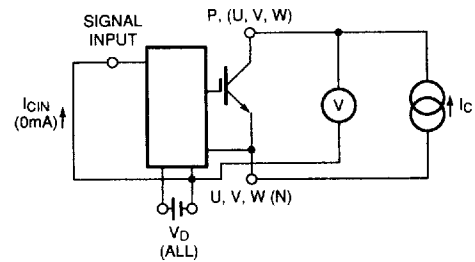


Figure 2  $V_{CE(SAT)}$  Test

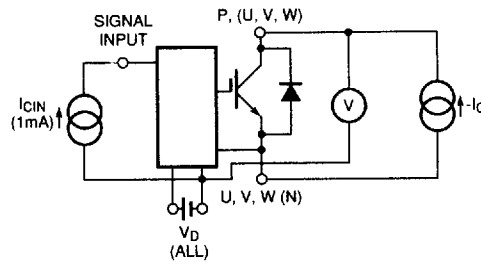
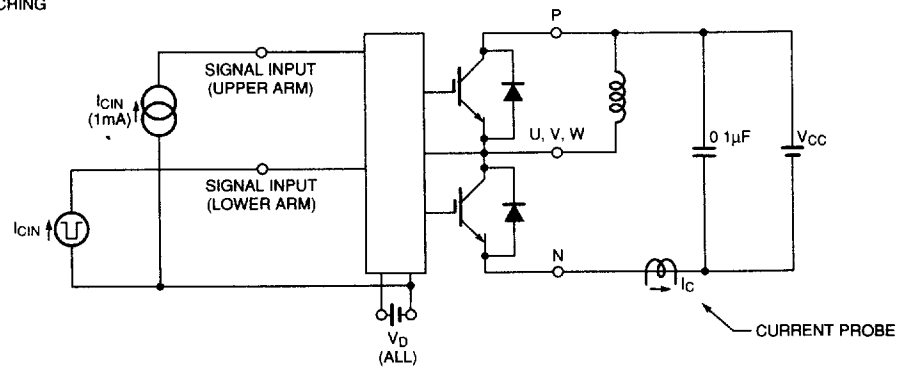


Figure 3  $V_{EC}$  Test

#### A) LOWER ARM SWITCHING



#### B) UPPER ARM SWITCHING

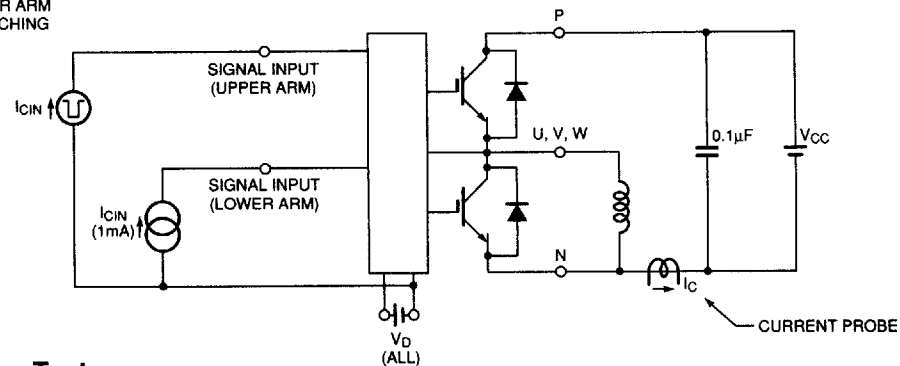


Figure 4 Switching Time Test

T-57-29

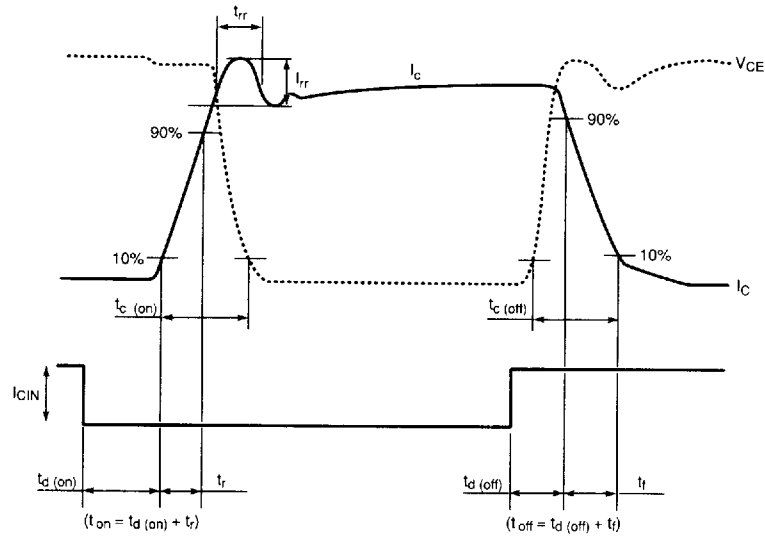


Figure 5 Switching Test Waveform

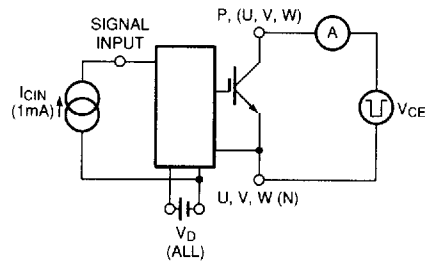


Figure 6  $I_{CES}$  Test

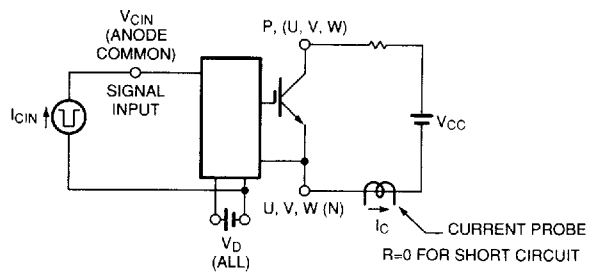


Figure 7 Over Current and Short Circuit Test