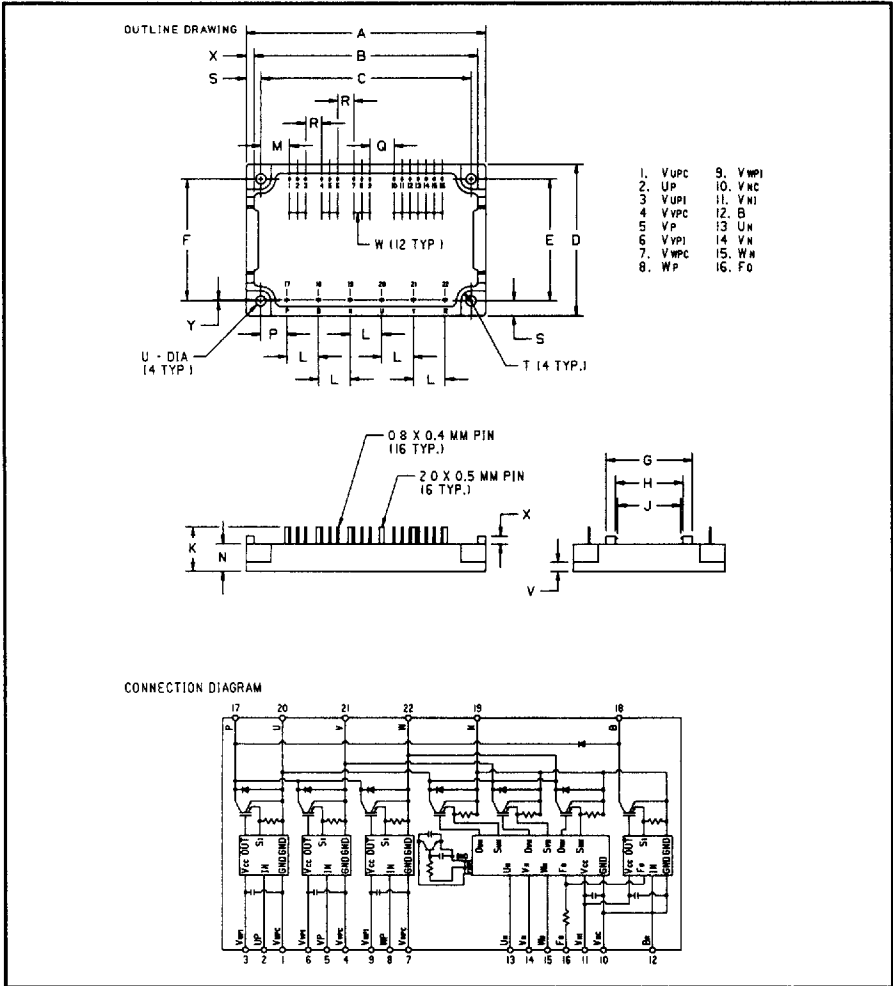




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**Intellimod™-3 Modules**  
**Three Phase + Brake**  
**IGBT Inverter Output**  
**30 Amperes/110-230 Volt Line**



**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**  
 PM30RHC060

110-230 Volt Line, PM30RHC060 Outline Drawing

Dimensions	Inches	Millimeters
A	4.17±0.04	106.0±1.0
B	3.9	99.0
C	3.66±0.02	93.0±0.5
D	2.64±0.04	67.0±1.0
E	2.12±0.02	54.0±0.5
F	2.11±0.02	53.5±0.5
G	1.5	38.0
H	1.18	30.0
J	1.1	28.0
K	0.77±0.04	19.5±1.0
L	0.55±0.01	14.0±0.25
M	0.5	12.7

Dimensions	Inches	Millimeters
N	0.47	12.0
P	0.45	11.5
Q	0.42	10.68
R	0.28	7.12
S	0.26	6.5
T	0.18 R	4.5 R
U	0.18 Dia.	4.5 Dia.
V	0.16±0.02	4.0±0.5
W	0.14	3.56
X	0.14	3.5
Y	0.02	0.5



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**PM30RHC060**  
**Intellimod-3 Modules**  
**Three Phase + Brake IGBT Inverter Output**  
 30 Amperes/110-230 Volt Line

T-57-29

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

Characteristics	Symbol	PM30RHC060	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	—	12	Kg-cm
Module Weight (Typical)	—	140	Grams
Supply Voltage Protected by OC and SC ( $V_D = 13.5 - 16.5\text{V}$ , Inverter Part)	$V_{CC(prot)}$	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 ( $U_P, V_P, U_N, V_N, W_N, B_r$ )	$I_{CIN}$	20	mA
Input Voltage Applied between ( $U_P, V_P, U_N, V_N, W_N, B_r$ )	$V_{CIN}$	20	Volts
Fault Output Supply Voltage	$V_{FO}$	20	Volts
Fault Output Current	$I_{FO}$	20	mA

**IGBT Inverter Sector**

Collector-Emitter Voltage Fig. 1	$V_{CES}$	600	Volts
Collector Current $\pm$	$I_C$	30	Amperes
Peak Collector Current $\pm$	$I_{CP}$	60	Amperes
Supply Voltage (Applied between P - N)	$V_{CC}$	400	Volts
Supply Voltage (Surge) Applied between P - N	$V_{CC(surge)}$	500	Volts
Collector Dissipation	$P_C$	96	Watts

**Brake Sector**

Collector-Emitter Voltage Fig. 1	$V_{CES}$	600	Volts
Collector Current $\pm$	$I_C$	10	Amperes
Peak Collector Current $\pm$	$I_{CP}$	20	Amperes
Supply Voltage (Applied between P - N)	$V_{CC}$	400	Volts
Supply Voltage (Surge) Applied between P - N	$V_{CC(surge)}$	500	Volts
Collector Dissipation	$P_C$	41	Watts
Diode Forward Current	$I_F$	10	Amperes
Diode DC Reverse Voltage	$V_{R(DC)}$	600	Volts



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**PM30RHC060**  
**Intellimod-3 Modules**  
**Three Phase + Brake IGBT Inverter Output**  
 30 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	$-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$	39	53	–	Amperes
Overcurrent Trip Level Brake Part			12	18	–	Amperes
Short Circuit Trip Level Inverter Part	SC	$-20^\circ\text{C} \leq T \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$	–	80	–	Amperes
Short Circuit Trip Level Brake Part			–	27	–	Amperes
Over Current Delay Time	$t_{\text{off(OC)}}$	$V_D = 15\text{V}$ , Fig. 7	–	10	–	$\mu\text{S}$
Over Temperature Protection	OT	Trip Level	100	110	120	$^\circ\text{C}$
Over Temperature Protection	$\text{OT}_R$	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	$\text{UV}_R$	Reset Level	–	12.5	–	Volts
Supply Voltage	$V_D$	Applied between $V_{\text{UP1}} - V_{\text{UPC}}$ , $V_{\text{VP1}} - V_{\text{VPC}}$ , $V_{\text{WP1}} - V_{\text{WPC}}$ , $V_{\text{N1}} - V_{\text{NC}}$	13.5	15	16.5	Volts
Circuit Current	$I_D$	$V_D = 15\text{V}$ , $I_{\text{CIN}} = 1\text{mA}$ , $V_{\text{N1}} - V_{\text{NC}}$	–	41	63	mA
	$I_D$	$V_D = 15\text{V}$ , $I_{\text{CIN}} = 1\text{mA}$ , $V_{\text{XP1}} - V_{\text{XPC}}$	–	7	12	mA
Input Bias On Current	$I_{\text{CIN(on)}}$	Sink Current at $U_P, V_P, W_P, U_N, V_N, W_N$	0.1	0.22	0.5	mA
Input Bias Off Current	$I_{\text{CIN(off)}}$	Sink Current at $U_P, V_P, W_P, U_N, V_N, W_N$	0.1	0.22	0.5	mA
Input On Voltage	$V_{\text{CIN(on)}}$	Applied between $B_r - V_{\text{NC}}$	1.2	1.5	1.8	Volts
Input Off Voltage	$V_{\text{CIN(off)}}$	Applied between $B_r - V_{\text{NC}}$	1.7	2.0	2.3	Volts
PWM Input Frequency	$f_{\text{PWM}}$	3- $\emptyset$ Sinusoidal	–	15	20	kHz
Dead Time	$t_{\text{DEAD}}$	For each Input Pulse	2.9	–	–	$\mu\text{S}$
		Using example Interface Circuit*	5.4	–	–	$\mu\text{S}$
Fault Output Current	$I_{\text{FO(H)}}$	$V_D = 15\text{V}$ , $V_{\text{FO}} = 15\text{V}$	–	–	0.01	mA
	$I_{\text{FO(L)}}$	$V_D = 15\text{V}$ , $V_{\text{FO}} = 15\text{V}$	–	10	15	ma
Minimum Fault Output Pulse Width	$t_{\text{FO}}$	$V_D = 15\text{V}$	20	40	60	$\mu\text{S}$
		Using example Interface Circuit*	25	100	–	$\mu\text{S}$
		$V_D = 15\text{V}$				
<b>Brake Sector</b>						
Collector Emitter Saturation Voltage	$V_{\text{CE(sat)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 10\text{A}$ , $T_j = 25^\circ\text{C}$ , Fig. 2	–	2.6	3.5	Volts
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 0\text{V}$ , $I_C = 10\text{A}$ , $T_j = 125^\circ\text{C}$ , Fig. 2	–	2.9	4.0	Volts
Diode Forward Voltage	$V_{\text{FM}}$	$-I_C = 10\text{A}$ , $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , Fig. 3	–	1.6	2.2	Volts
Collector Cutoff Current	$I_{\text{CEX}}$	$V_{\text{CE}} = V_{\text{CES}}$ , $T_j = 25^\circ\text{C}$ , Fig. 6	–	–	1	mA
		$V_{\text{CE}} = V_{\text{CES}}$ , $T_j = 125^\circ\text{C}$ , Fig. 6	–	–	10	mA

\*See Intellimod-3 Applications Data Section 4.3.



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T-57-29

**PM30RHC060**  
**Intellimod-3 Modules**  
**Three Phase + Brake IGBT Inverter Output**  
 30 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>IGBT Inverter Sector</b>						
Collector Cutoff Current	$I_{CEX}$	$V_{CE} = V_{CES}, T_J = 25^\circ\text{C}, \text{Fig. 6}$	–	–	1	mA
Collector Cutoff Current	$I_{CEX}$	$V_{CE} = V_{CES}, T_J = 125^\circ\text{C}, \text{Fig. 6}$	–	–	10	mA
Diode Forward Voltage	$V_{FM}$	$-I_C = 30\text{A}, V_D = 15\text{V}, I_{CIN} = 1\text{mA}, \text{Fig. 3}$	–	1.7	2.5	Volts
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, I_{CIN} = 0\text{mA}, I_C = 20\text{A}, \text{Fig. 2}$	–	2.7	3.5	Volts
Collector Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, I_{CIN} = 0\text{mA}, I_C = 30\text{A}, \text{Fig. 2}$	–	2.5	3.4	Volts
Inductive Load Switching Times	$t_{on}$	$V_D = 15\text{V}, I_{CIN} = 0\text{mA},$	0.5	0.8	1.5	$\mu\text{S}$
	$t_{tr}$	$V_{CC} = 300\text{V}, I_C = 20\text{A},$	–	0.15	0.4	$\mu\text{S}$
	$t_{C(on)}$	$T_J = 125^\circ\text{C}$	–	0.4	1.2	$\mu\text{S}$
	$t_{off}$	$\text{Fig. 4, 5}$	–	2.0	3.4	$\mu\text{S}$
	$t_{C(off)}$		–	0.6	1.2	$\mu\text{S}$

**Thermal Characteristics**

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal Resistances Junction to Case	$R_{th(I-C)Q}$	Inverter IGBT	–	–	1.3	$^\circ\text{C/W}$
	$R_{th(I-C)F}$	Inverter FWD	–	–	3.0	$^\circ\text{C/W}$
	$R_{th(I-C)Q}$	Brake IGBT	–	–	3.0	$^\circ\text{C/W}$
	$R_{th(I-C)F}$	Brake FWD	–	–	4.5	$^\circ\text{C/W}$
Contact Thermal Resistance	$R_{th(C-f)}$	Case to Fin, Thermal Grease Applied	–	–	0.3	$^\circ\text{C/W}$

**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 $V_{UP1} - V_{UPC},$ $V_{N1} - V_{NC}, V_{VP1} - V_{VPC}, V_{WP1} - V_{WPC}$	$15 \pm 1.5$	Volts
Input On Current	$V_{CIN(on)}$	Applied between	0 ~ 0.5	Volts
Input Off Current	$V_{CIN(off)}$	$U_P, V_P, W_P, U_N, V_N, W_N$	0.5 ~ 2	Volts
Input On Voltage	$V_{CIN(on)}$	Applied between	0 ~ 0.8	Volts
Input Off Voltage	$V_{CIN(off)}$	$B_T - V_{NC}$	4.0 ~ 15	Volts
PWM Input Frequency	$f_{PWM}$	Using example Interface Circuit *	5 ~ 20	kHz
Minimum Dead Time	$t_{DEAD}$	Using example Interface Circuit *	5.4	$\mu\text{S}$

\*See Intellimod-3 Applications Data Section 4.3.

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**PM30RHC060**

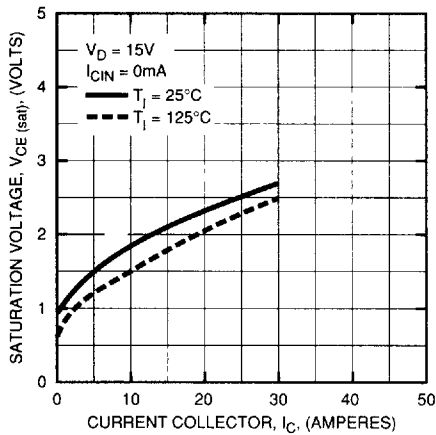
**Intellimod-3 Modules**

**Three Phase + Brake IGBT Inverter Output**

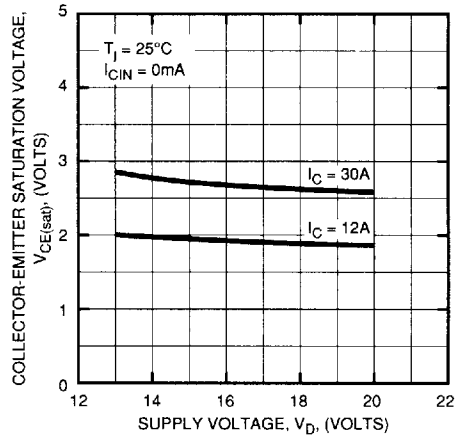
**30 Amperes/110-230 Volt Line**

**Inverter Part**

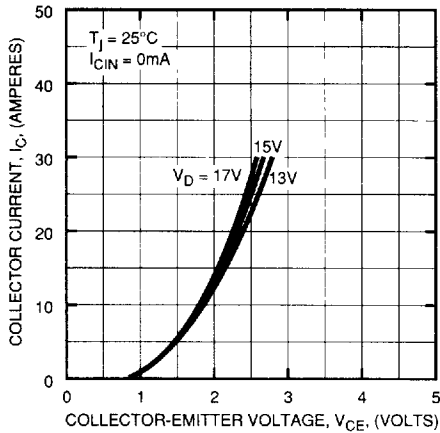
**SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)**



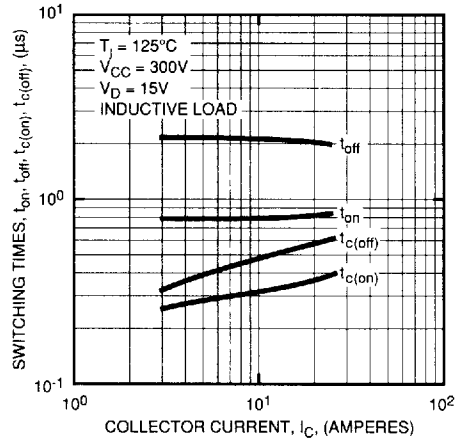
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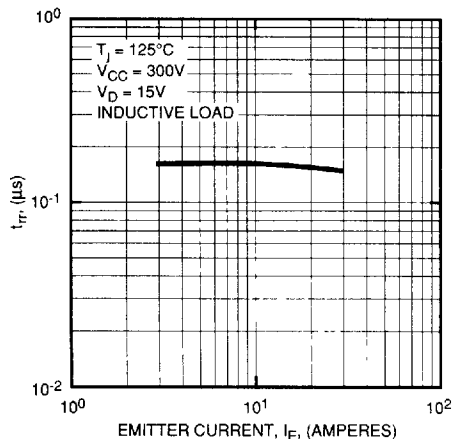
**OUTPUT CHARACTERISTICS (TYPICAL)**



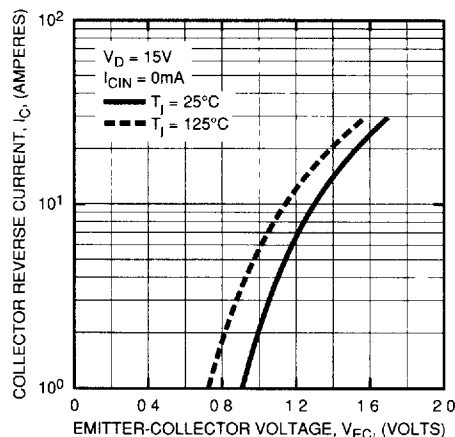
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)**



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



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

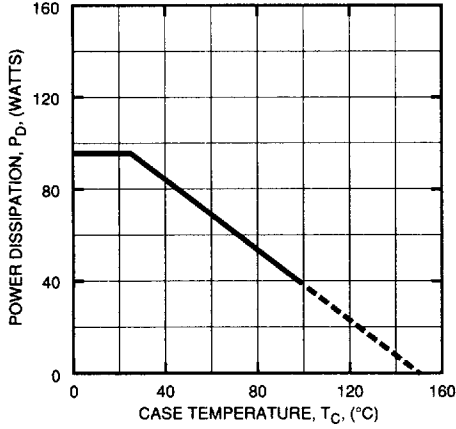


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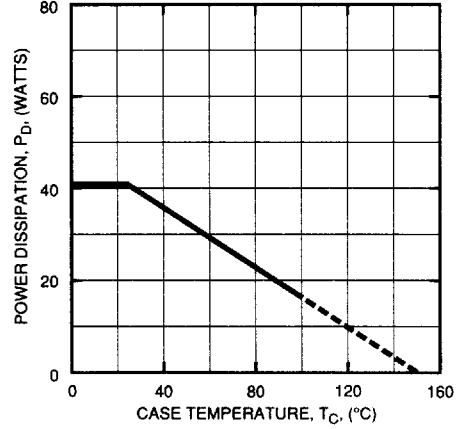
**PM30RHC060**  
**Intellimod-3 Modules**  
**Three Phase + Brake IGBT Inverter Output**  
 30 Amperes/110-230 Volt Line  
 Inverter Part

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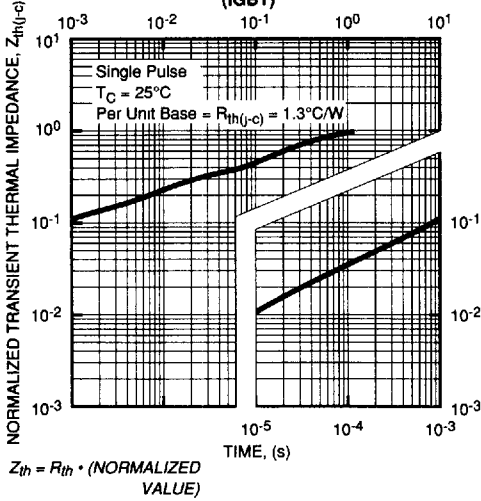
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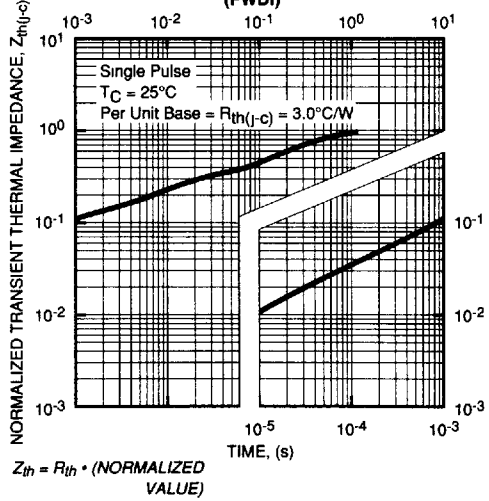
**POWER DISSIPATION DERATING CURVE  
 (PER FWDI ELEMENT)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS  
 (IGBT)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS  
 (FWDI)**





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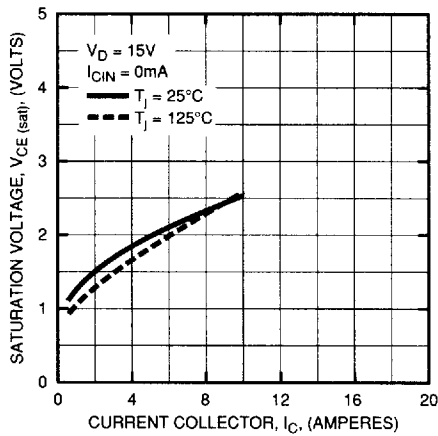
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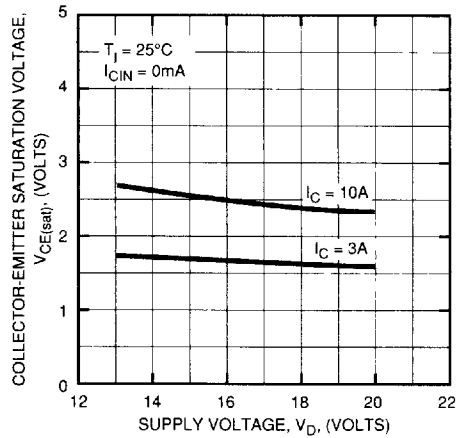
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Intellimod-3 Modules  
Three Phase + Brake IGBT Inverter Output  
30 Amperes/110-230 Volt Line  
Brake Part

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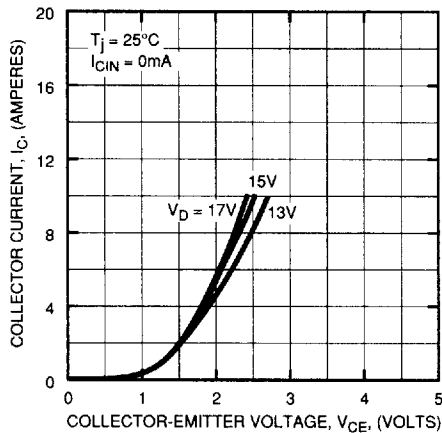
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



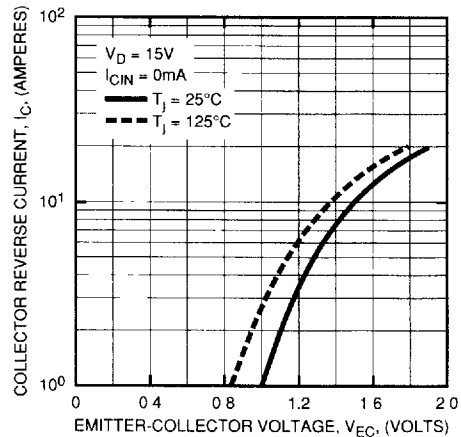
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



OUTPUT CHARACTERISTICS (TYPICAL)



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





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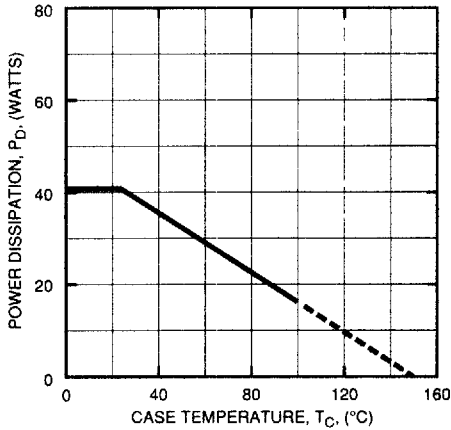
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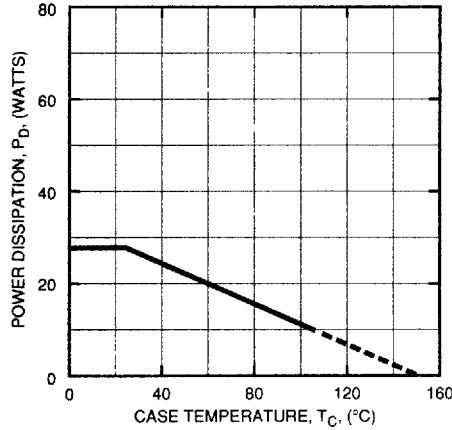
T-57-29

**PM30RHC060**  
**Intellimod-3 Modules**  
**Three Phase + Brake IGBT Inverter Output**  
**30 Amperes/110-230 Volt Line**  
**Brake Part**

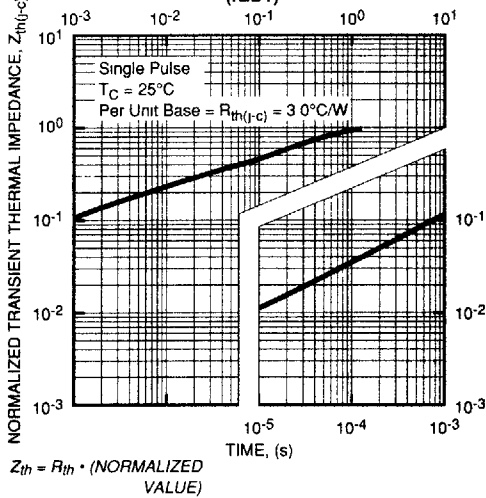
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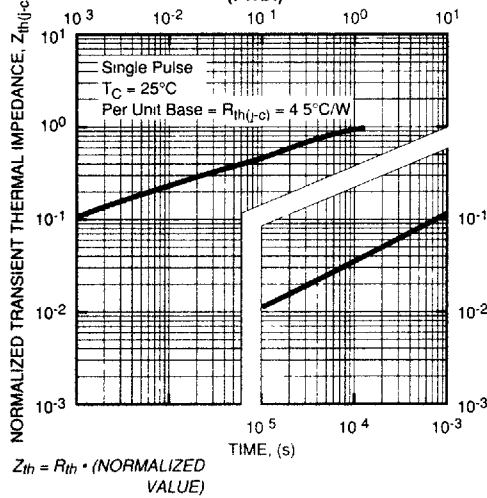
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 (PER FWDI ELEMENT)



TRANSIENT THERMAL  
 IMPEDANCE CHARACTERISTICS  
 (IGBT)

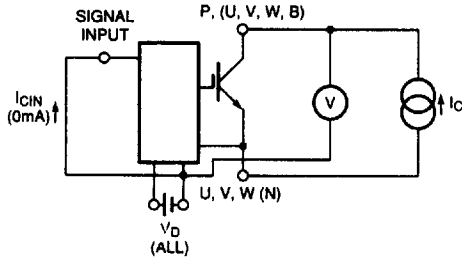


TRANSIENT THERMAL  
 IMPEDANCE CHARACTERISTICS  
 (FWDI)

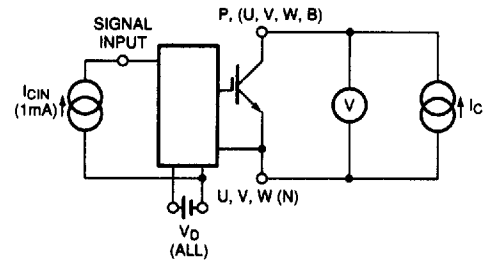




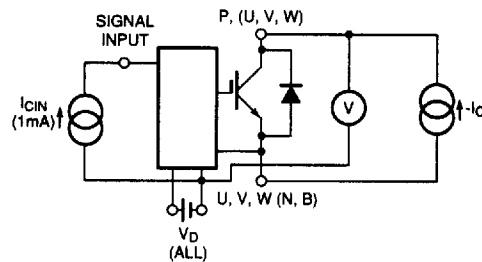
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**Figure 1  $V_{CES}$  Test**

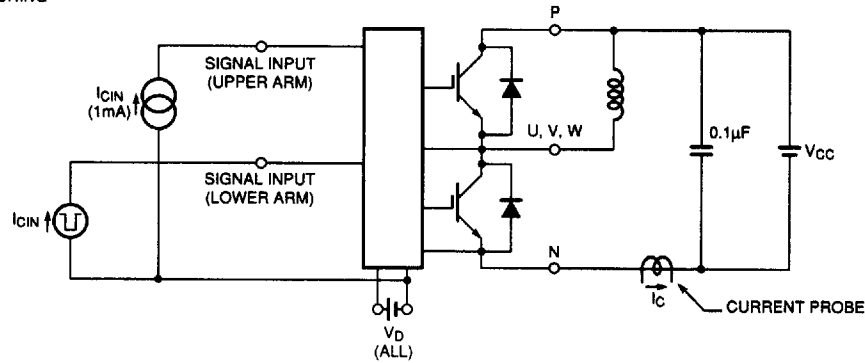


**Figure 2  $V_{CE(SAT)}$  Test**

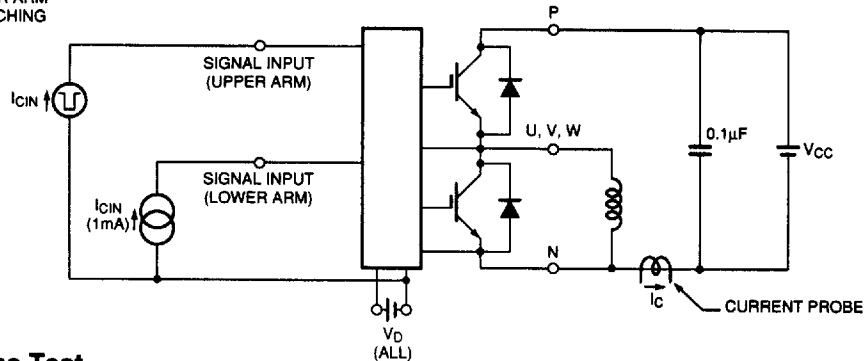


**Figure 3  $V_{EC}$  Test**

A) LOWER ARM SWITCHING



B) UPPER ARM SWITCHING



**Figure 4 Switching Time Test**

T-57-29

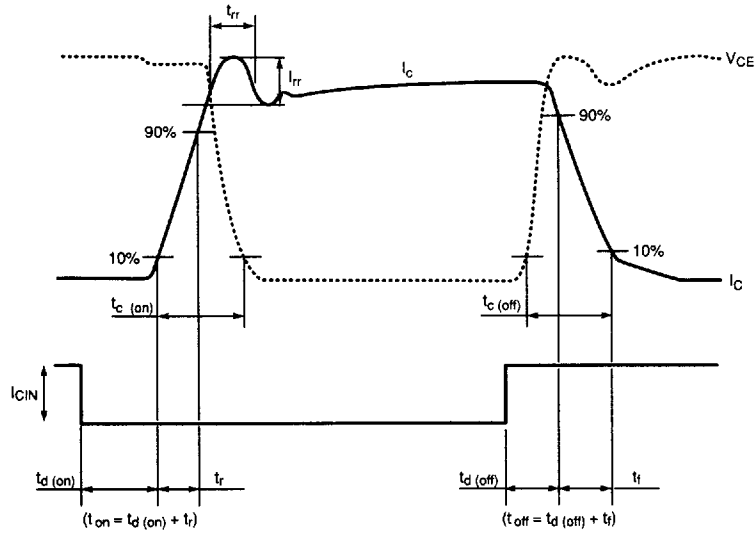


Figure 5 Switching Test Waveform

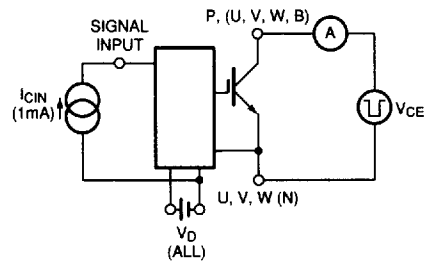


Figure 6  $I_{CES}$  Test

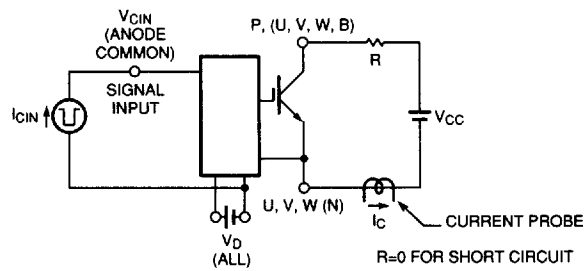


Figure 7 Over Current and Short Circuit Test