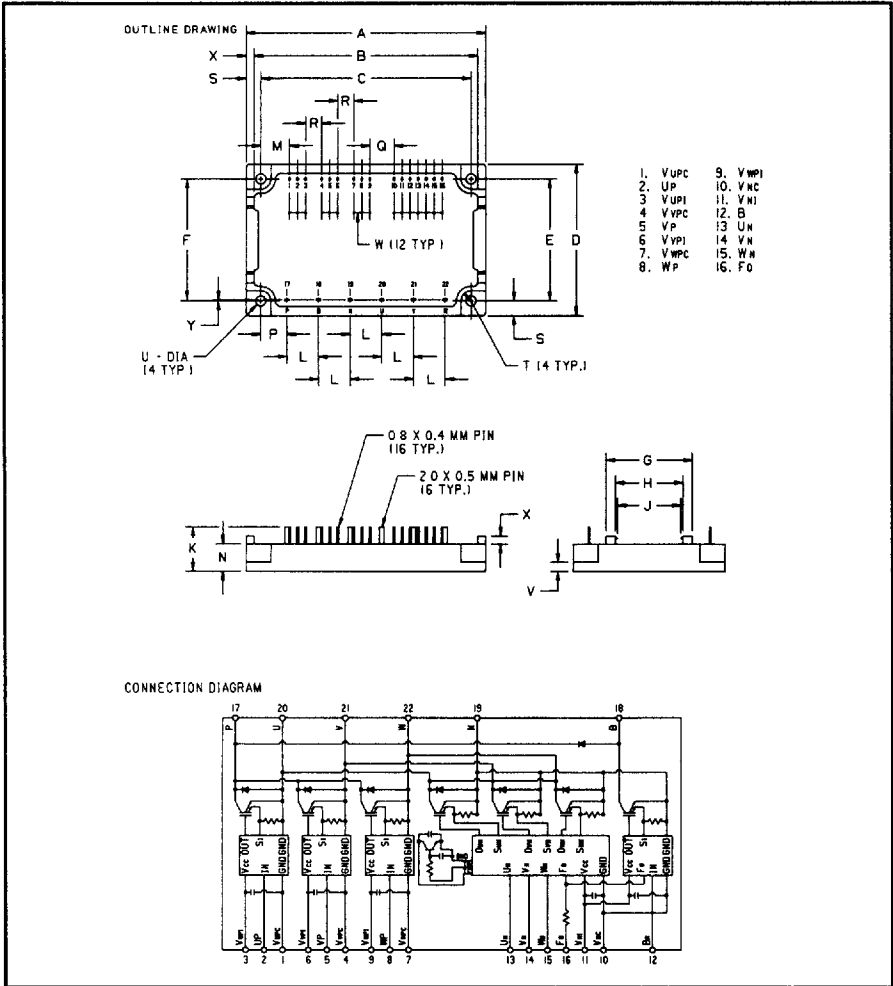




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Intellimod™-3 Modules
Three Phase + Brake
IGBT Inverter Output
30 Amperes/110-230 Volt Line



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, $T_j = 25^\circ\text{C}$ 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
Control Sector						
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	–	μS
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 $V_{\text{UP1}} - V_{\text{UPC}}$, $V_{\text{VP1}} - V_{\text{VPC}}$, $V_{\text{WP1}} - V_{\text{WPC}}$, $V_{\text{N1}} - V_{\text{NC}}$	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_{PWM}	3- \emptyset Sinusoidal	–	15	20	kHz
Dead Time	t_{DEAD}	For each Input Pulse	2.9	–	–	μS
		Using example Interface Circuit*	5.4	–	–	μS
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_{FO}	$V_D = 15\text{V}$	20	40	60	μS
		Using example Interface Circuit*	25	100	–	μS
		$V_D = 15\text{V}$				
Brake Sector						
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_{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_{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
IGBT Inverter Sector						
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	μS
	t_{tr}	$V_{CC} = 300\text{V}, I_C = 20\text{A},$	–	0.15	0.4	μS
	$t_{C(on)}$	$T_J = 125^\circ\text{C}$	–	0.4	1.2	μS
	t_{off}	Fig. 4, 5	–	2.0	3.4	μS
	$t_{C(off)}$		–	0.6	1.2	μS

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 ± 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	μS

*See Intellimod-3 Applications Data Section 4.3.

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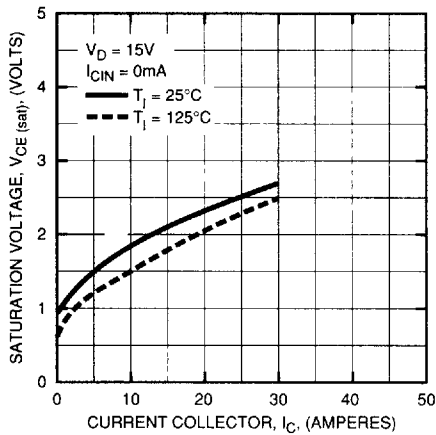
Intellimod-3 Modules

Three Phase + Brake IGBT Inverter Output

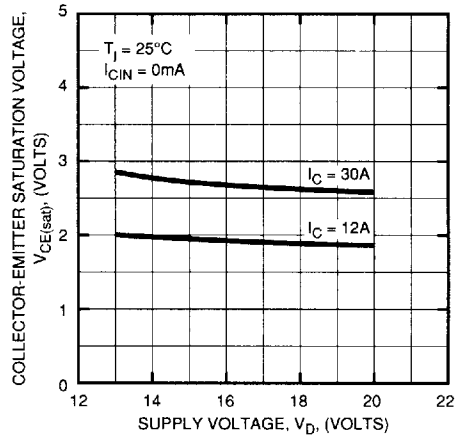
30 Amperes/110-230 Volt Line

Inverter Part

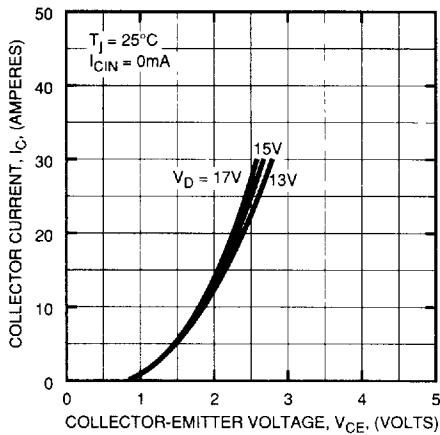
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



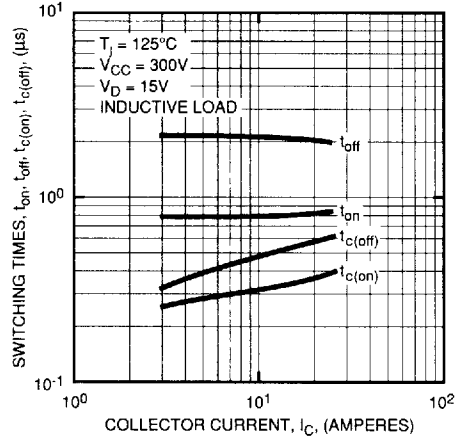
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



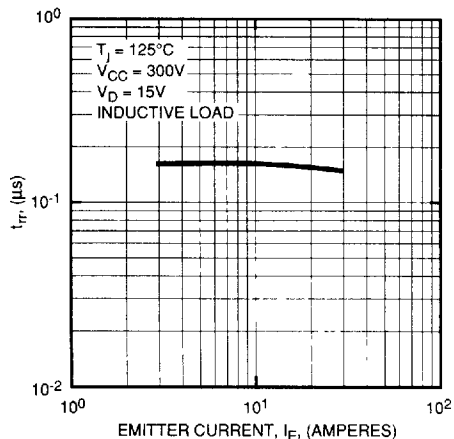
OUTPUT CHARACTERISTICS (TYPICAL)



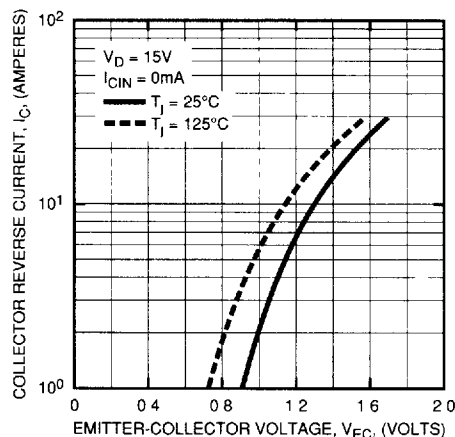
SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL)



REVERSE RECOVERY CHARACTERISTICS OF FREE-WHEEL DIODE (TYPICAL)



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

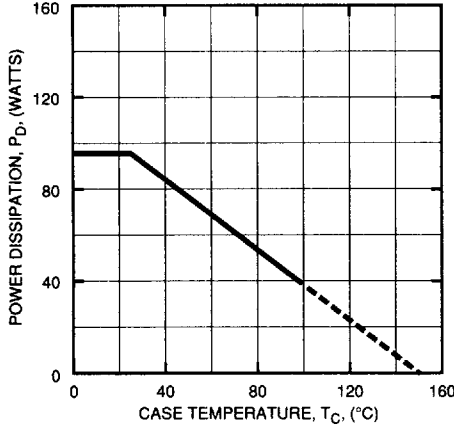


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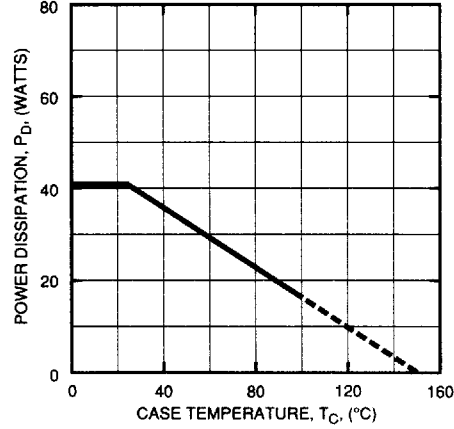
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Intellimod-3 Modules
Three Phase + Brake IGBT Inverter Output
 30 Amperes/110-230 Volt Line
 Inverter Part

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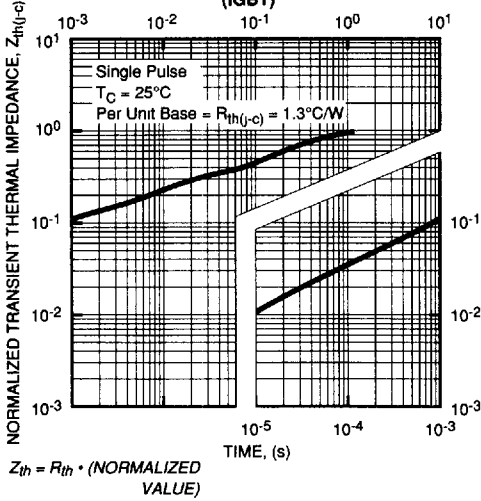
**POWER DISSIPATION DERATING CURVE
 (PER IGBT ELEMENT)**



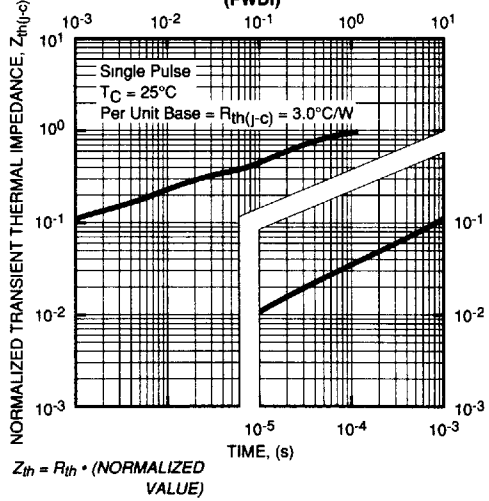
**POWER DISSIPATION DERATING CURVE
 (PER FWDI ELEMENT)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
 (IGBT)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS
 (FWDI)**





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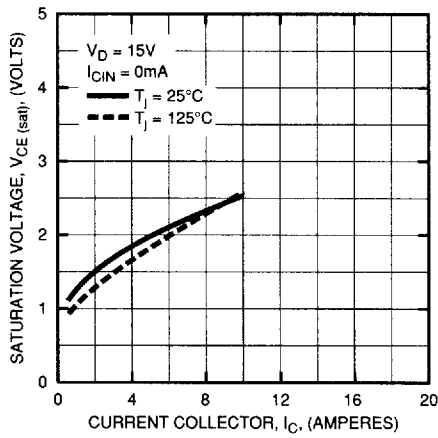
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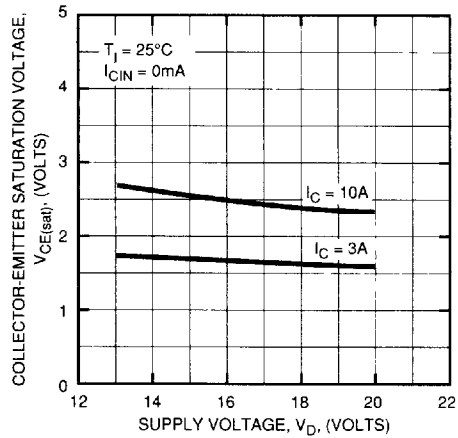
PM30RHC060
Intellimod-3 Modules
Three Phase + Brake IGBT Inverter Output
30 Amperes/110-230 Volt Line
Brake Part

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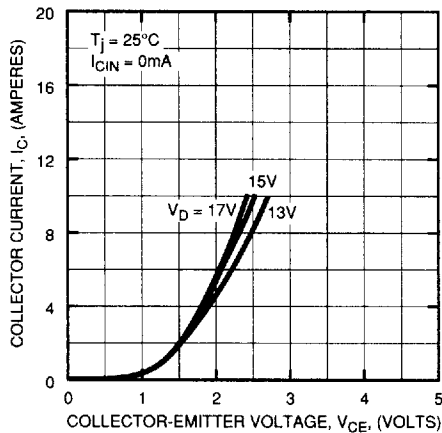
SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



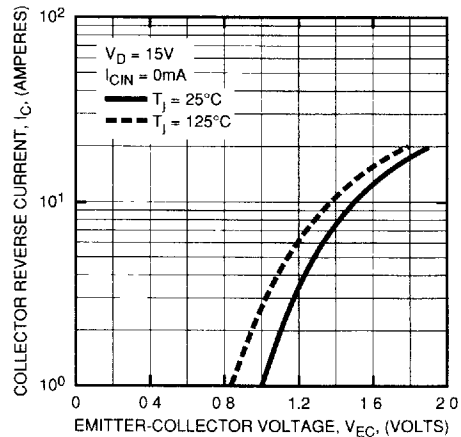
COLLECTOR-EMITTER SATURATION VOLTAGE (TYPICAL)



OUTPUT CHARACTERISTICS (TYPICAL)



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





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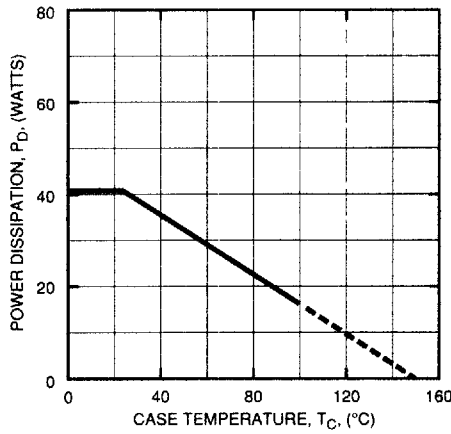
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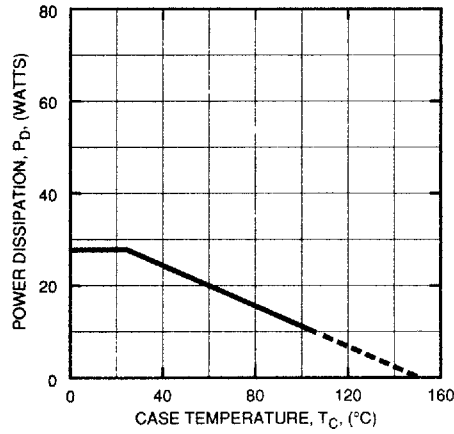
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Intellimod-3 Modules
Three Phase + Brake IGBT Inverter Output
30 Amperes/110-230 Volt Line
Brake Part

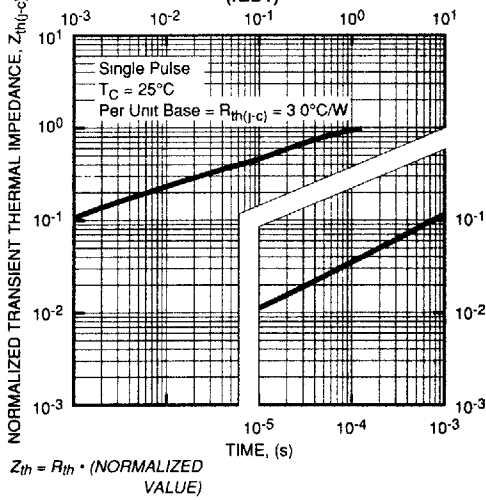
POWER DISSIPATION DERATING CURVE
 (PER IGBT ELEMENT)



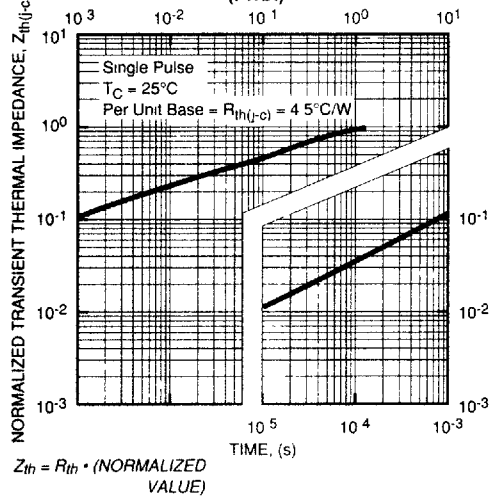
POWER DISSIPATION DERATING CURVE
 (PER FWDI ELEMENT)



TRANSIENT THERMAL
 IMPEDANCE CHARACTERISTICS
 (IGBT)



TRANSIENT THERMAL
 IMPEDANCE CHARACTERISTICS
 (FWDI)



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Three Phase + Brake IGBT Inverter Output
 30 Amperes/110-230 Volt Line

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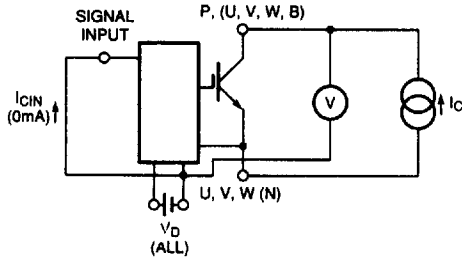


Figure 1 V_{CES} Test

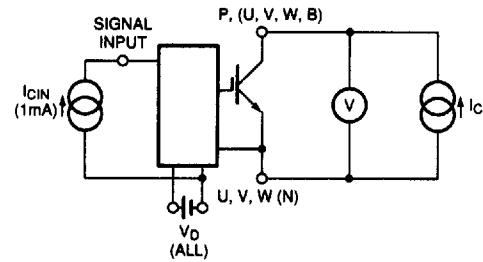


Figure 2 $V_{CE(SAT)}$ Test

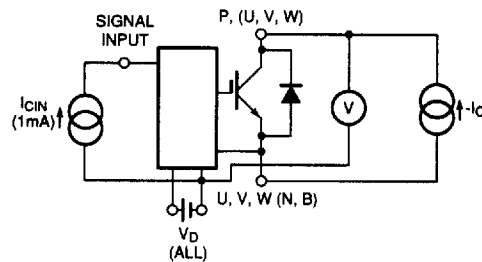
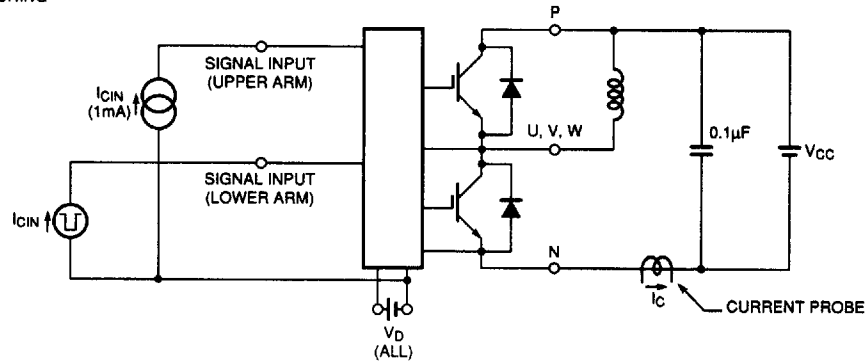


Figure 3 V_{EC} Test

A) LOWER ARM SWITCHING



B) UPPER ARM SWITCHING

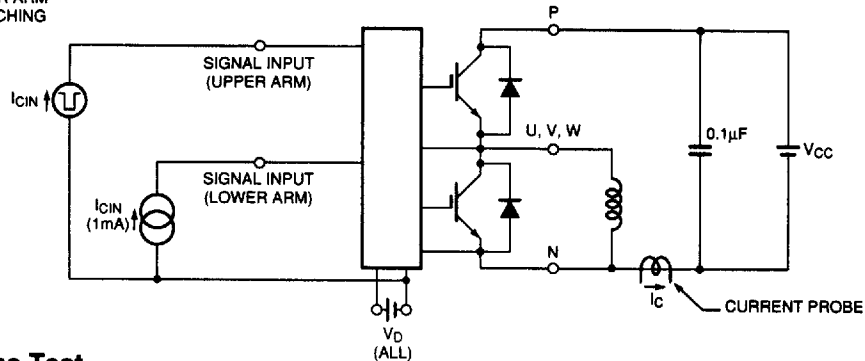


Figure 4 Switching Time Test

PM30RHC060

Intellimod-3 Modules

Three Phase + BrakeIGBT Inverter Output

30 Amperes/110-230 Volt Line

T-57-29

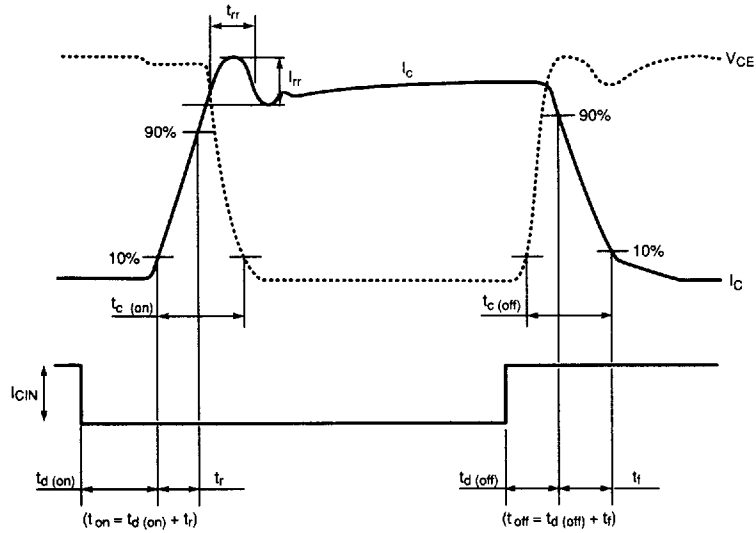


Figure 5 Switching Test Waveform

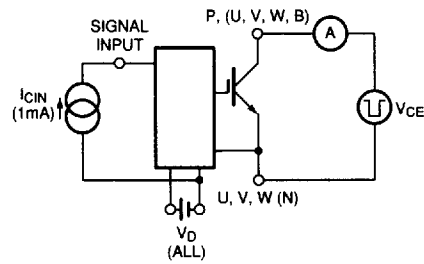


Figure 6 I_{CES} Test

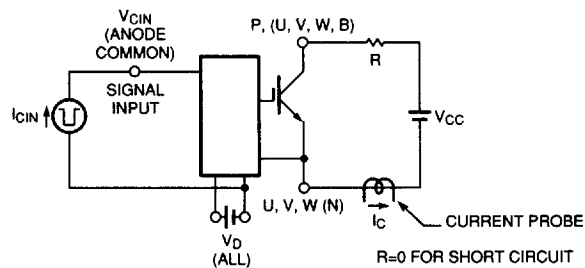


Figure 7 Over Current and Short Circuit Test