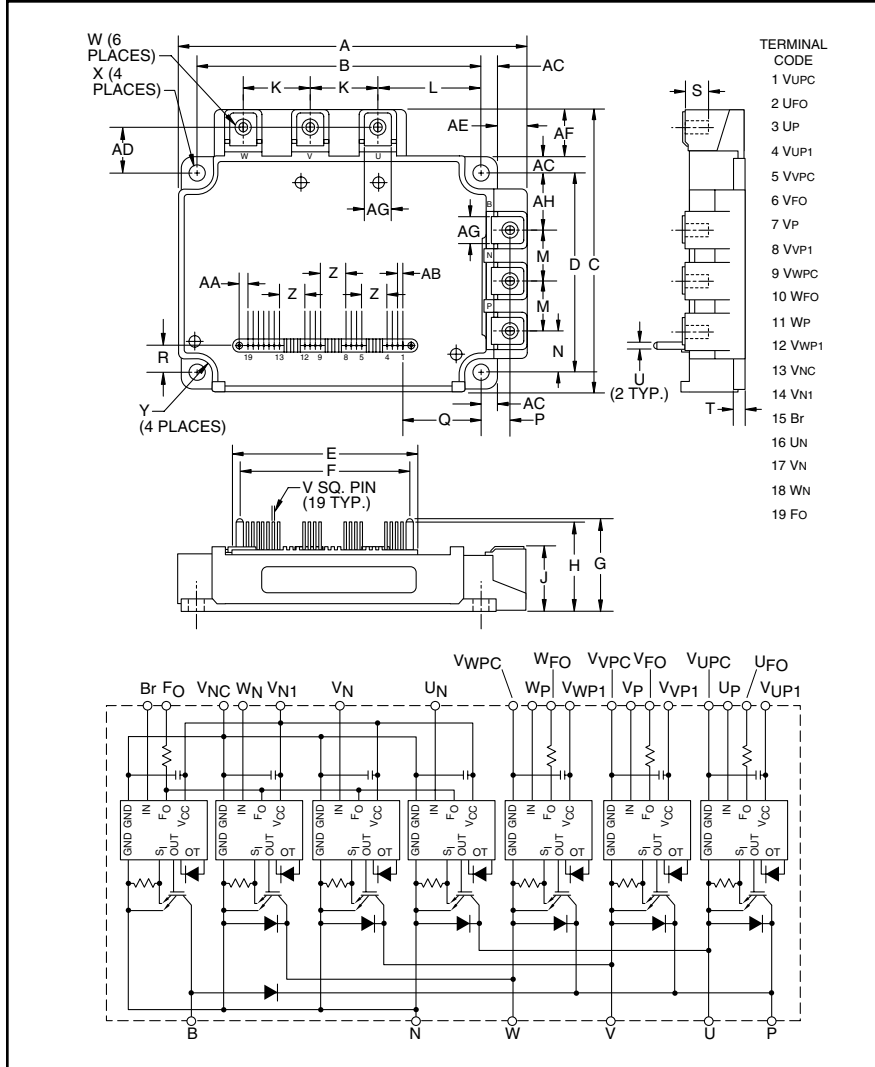


### Intellimod™ L-Series Three Phase IGBT Inverter + Brake 300 Amperes/600 Volts



Outline Drawing and Circuit Diagram



#### 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 Temperature
  - Using On-chip Temperature Sensing
  - Under Voltage
- Low Loss Using 5th Generation IGBT Chip

#### Applications:

- Inverters
- UPS
- Motion/Servo Control
- Power Supplies

#### Ordering Information:

Example: Select the complete part number from the table below -i.e. PM300RLA060 is a 600V, 300 Ampere Intellimod™ Intelligent Power Module.

Dimensions	Inches	Millimeters
A	5.31	135.0
B	4.33±0.02	110±0.5
C	4.33	110.0
D	3.07	78.0±0.5
E	2.81	71.5
F	2.62	66.5
G	1.37	34.7
H	1.32	33.6
J	0.95+0.04/-0.01	24.1+1.0/-0.5
K	1.02	26.0
L	1.59	40.5
M	0.79	20.0
N	0.65	16.5
P	0.43±0.01	11.0±0.3
Q	1.19	30.15
R	0.43	11.0

Dimensions	Inches	Millimeters
S	0.51	13.0
T	0.16	4.0
U	0.1 Dia.	Dia.2.5
V	0.02 Sq.	Sq. 0.5
W	M5 Metric	M5
X	0.22 Dia.	Dia. 5.5
Y	0.24 Rad.	Rad. 6
Z	0.39	10.0
AA	0.13	3.25
AB	0.08	2.0
AC	0.24	6.05
AD	0.71	18.0
AE	0.46	11.7
AF	0.74	18.7
AG	0.41	10.5
AH	0.85	21.5

Type	Current Rating Amperes	V <sub>CES</sub> Volts (x 10)
PM	300	60



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

**PM300RLA060**  
**Intellimod™ L-Series**  
**Three Phase IGBT Inverter + Brake**  
**300 Amperes/600 Volts**

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

Characteristics	Symbol	PM300RLA060	Units
Power Device Junction Temperature	$T_j$	-20 to 150	$^\circ\text{C}$
Storage Temperature	$T_{\text{stg}}$	-40 to 125	$^\circ\text{C}$
Mounting Torque, M5 Mounting Screws	—	31	in-lb
Mounting Torque, M5 Main Terminal Screws	—	31	in-lb
Module Weight (Typical)	—	800	Grams
Supply Voltage, Surge (Applied between P - N)	$V_{\text{CC(surge)}}$	550	Volts
Self-protection Supply Voltage Limit (Short Circuit protection Capability)*	$V_{\text{CC(prot.)}}$	400	Volts
Isolation Voltage, AC 1 minute, 60Hz Sinusoidal	$V_{\text{ISO}}$	2500	Volts

\* $V_D = 13.5 - 16.5\text{V}$ , Inverter Part,  $T_j = 125^\circ\text{C}$

**IGBT Inverter Sector**

Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ )	$V_{\text{CES}}$	600	Volts
Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_C$	300	Amperes
Peak Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_{\text{CP}}$	600	Amperes
Collector Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_C$	801	Watts

**IGBT Brake Sector**

Collector-Emitter Voltage ( $V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ )	$V_{\text{CES}}$	600	Volts
Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_C$	150	Amperes
Peak Collector Current ( $T_C = 25^\circ\text{C}$ )	$\pm I_{\text{CP}}$	300	Amperes
Collector Dissipation, $T_C = 25^\circ\text{C}$ (Note 1)	$P_C$	457	Watts
Diode Rated DC Reverse Voltage ( $T_C = 25^\circ\text{C}$ )	$V_{\text{R(DC)}}$	600	Volts
Diode Forward Current	$I_F$	150	Amperes

**Control Sector**

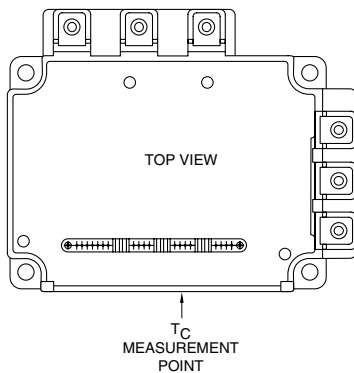
Supply Voltage (Applied between $V_{\text{UP1}}-V_{\text{U1PC}}$ , $V_{\text{VP1}}-V_{\text{V1PC}}$ , $V_{\text{WP1}}-V_{\text{W1PC}}$ , $V_{\text{N1}}-V_{\text{N1C}}$ )	$V_D$	20	Volts
Input Voltage (Applied between $U_P-V_{\text{U1PC}}$ , $V_P-V_{\text{V1PC}}$ , $W_P-V_{\text{W1PC}}$ , $U_N-V_{\text{N1}}-W_N-Br-V_{\text{N1C}}$ )	$V_{\text{CIN}}$	20	Volts
Fault Output Supply Voltage (Applied between $U_{\text{FO}}-V_{\text{U1PC}}$ , $V_{\text{FO}}-V_{\text{V1PC}}$ , $W_{\text{FO}}-V_{\text{W1PC}}$ , $F_O-V_{\text{N1C}}$ )	$V_{\text{FO}}$	20	Volts
Fault Output Current ( $U_{\text{FO}}$ , $V_{\text{FO}}$ , $W_{\text{FO}}$ , $F_O$ Terminals)	$I_{\text{FO}}$	20	mA

**PM300RLA060**  
**Intellimod™ L-Series**  
**Three Phase IGBT Inverter + Brake**  
**300 Amperes/600 Volts**

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>IGBT Inverter Sector</b>						
Collector-Emitter Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 25^\circ\text{C}$	—	—	1.0	mA
		$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 125^\circ\text{C}$	—	—	10	mA
Diode Forward Voltage	$V_{EC}$	$-I_C = 300\text{A}, V_{CIN} = 15\text{V}, V_D = 15\text{V}$	—	2.2	3.3	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 300\text{A}, T_j = 25^\circ\text{C}$	—	1.6	2.1	Volts
		$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 300\text{A}, T_j = 125^\circ\text{C}$	—	1.5	2.0	Volts
Inductive Load Switching Times	$t_{on}$		0.5	1.0	2.4	$\mu\text{s}$
	$t_{rr}$	$V_D = 15\text{V}, V_{CIN} = 0 \Leftrightarrow 15\text{V}$	—	0.2	0.4	$\mu\text{s}$
	$t_{C(on)}$	$V_{CC} = 300\text{V}, I_C = 300\text{A}$	—	0.4	1.0	$\mu\text{s}$
	$t_{off}$	$T_j = 125^\circ\text{C}$	—	1.2	2.5	$\mu\text{s}$
	$t_{C(off)}$		—	0.5	1.0	$\mu\text{s}$
<b>IGBT Brake Sector</b>						
Collector-Emitter Cutoff Current	$I_{CES}$	$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 25^\circ\text{C}$	—	—	1.0	mA
		$V_{CE} = V_{CES}, V_D = 15\text{V}, T_j = 125^\circ\text{C}$	—	—	10	mA
Diode Forward Voltage	$V_{FM}$	$I_F = 150\text{A}$	—	2.2	3.3	Volts
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 150\text{A}, T_j = 25^\circ\text{C}$	—	1.6	2.1	Volts
		$V_D = 15\text{V}, V_{CIN} = 0\text{V}, I_C = 150\text{A}, T_j = 125^\circ\text{C}$	—	1.5	2.0	Volts

Note 1:  $T_C$  (Base Plate) Measurement Point



**PM300RLA060**  
**Intellimod™ L-Series**  
**Three Phase IGBT Inverter + Brake**  
**300 Amperes/600 Volts**

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

Characteristics	Symbol	Test Conditions	Min.	Typ.	Max.	Units
<b>Control Sector</b>						
Short Circuit Trip Level ( $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$ , $V_D = 15\text{V}$ )	SC	Inverter Part	600	—	—	Amperes
		Brake Part	300	—	—	Amperes
Short Circuit Current Delay Time	$t_{\text{off(SC)}}$	$V_D = 15\text{V}$	—	0.2	—	$\mu\text{s}$
Over Temperature Protection (Detect $T_j$ of IGBT Chip)	OT	Trip Level	135	145	155	$^\circ\text{C}$
	$\text{OT}_R$	Reset Level	—	125	—	$^\circ\text{C}$
Supply Circuit Under-voltage Protection ( $-20 \leq T_j \leq 125^\circ\text{C}$ )	UV	Trip Level	11.5	12.0	12.5	Volts
	$\text{UV}_R$	Reset Level	—	12.5	—	Volts
Circuit Current	$I_D$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{N1}}-V_{\text{NC}}$	—	24	34	mA
		$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$ , $V_{\text{XP1}}-V_{\text{XPC}}$	—	6	12	mA
Input ON Threshold Voltage	$V_{\text{th(on)}}$	Applied between $U_P-V_{\text{UPC}}$ ,	1.2	1.5	1.8	Volts
Input OFF Threshold Voltage	$V_{\text{th(off)}}$	$V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N$ , $W_N$ -Br- $V_{\text{NC}}$	1.7	2.0	2.3	Volts
Fault Output Current*	$I_{\text{FO(H)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$	—	—	0.01	mA
	$I_{\text{FO(L)}}$	$V_D = 15\text{V}$ , $V_{\text{CIN}} = 15\text{V}$	—	10	15	mA
Fault Output Pulse Width*	$t_{\text{FO}}$	$V_D = 15\text{V}$	1.0	1.8	—	ms

\*Fault output is given only when the internal SC, OT and UV protections schemes of either upper or lower device operate to protect it.

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

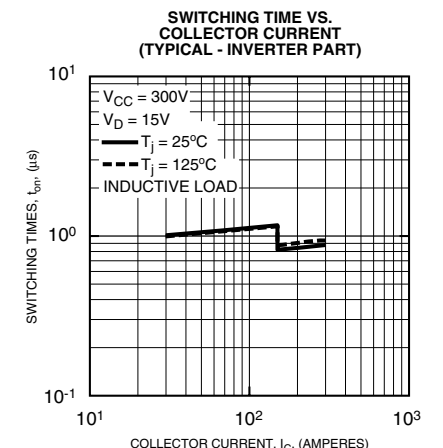
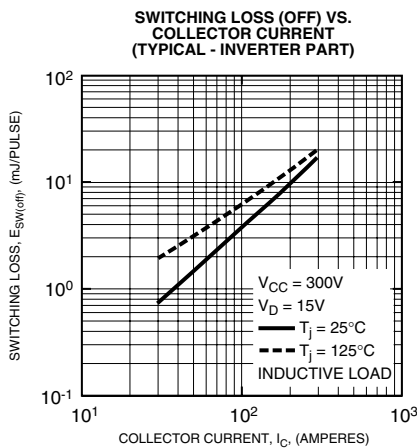
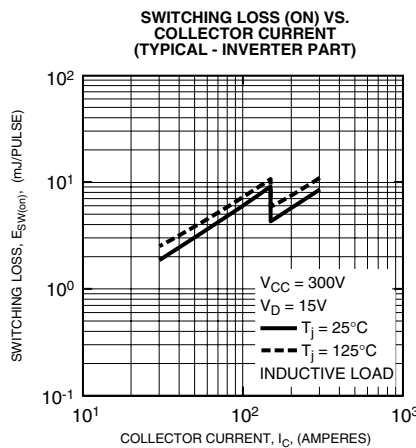
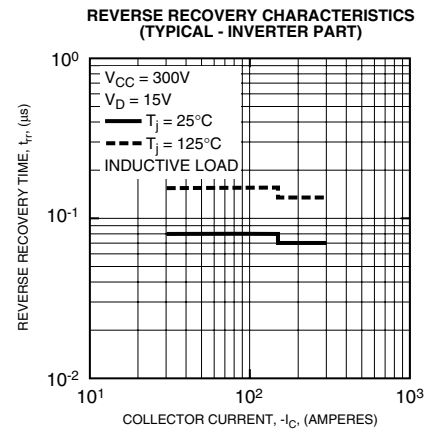
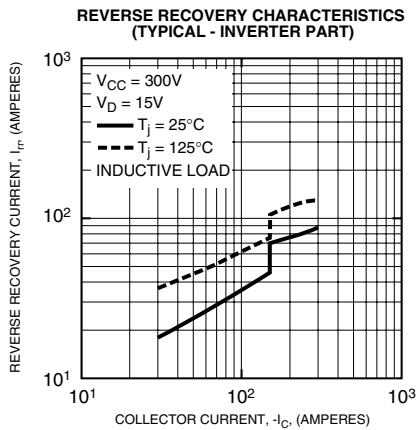
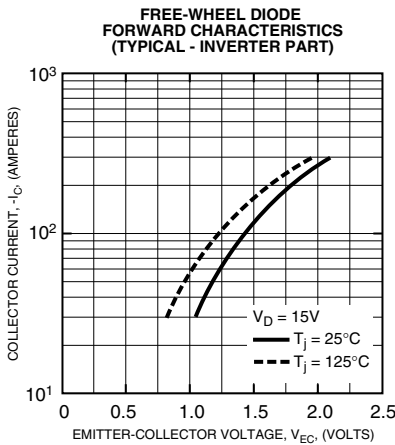
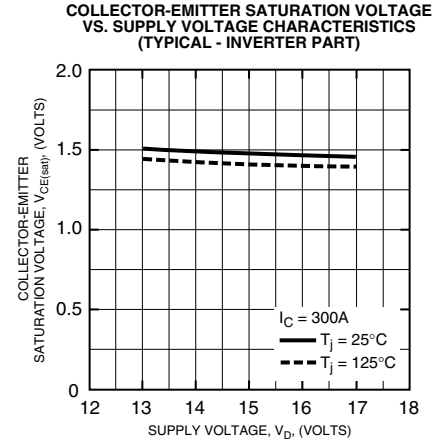
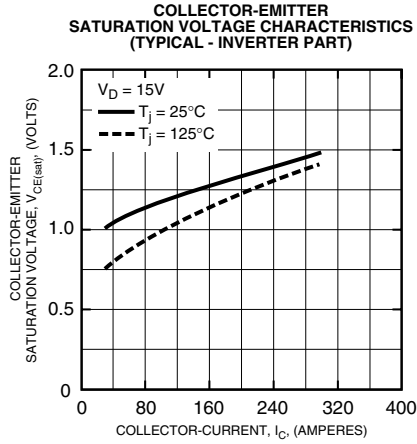
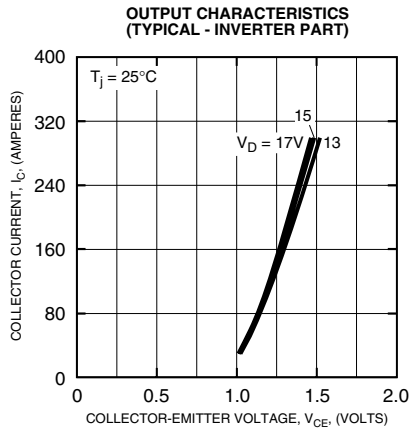
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Units
Junction to Case Thermal Resistance	$R_{\text{th(j-c)Q}}$	Inverter IGBT (Per 1/6 Module) (Note 1)	—	—	0.16	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	Inverter FWDi (Per 1/6 Module) (Note 1)	—	—	0.25	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)Q}}$	Brake IGBT (Per 1/6 Module) (Note 1)	—	—	0.27	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	Brake FWDi (Per 1/6 Module) (Note 1)	—	—	0.44	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)Q}}$	Inverter IGBT (Per 1/6 Module)	—	—	0.12	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	Inverter FWDi (Per 1/6 Module)	—	—	0.19	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)Q}}$	Brake IGBT (Per 1/6 Module)	—	—	0.21	$^\circ\text{C/Watt}$
	$R_{\text{th(j-c)D}}$	Brake FWDi (Per 1/6 Module)	—	—	0.34	$^\circ\text{C/Watt}$
Contact Thermal Resistance	$R_{\text{th(c-f)}}$	Case to Fin Per Module, Thermal Grease Applied	—	—	0.023	$^\circ\text{C/Watt}$

## Recommended Conditions for Use

Characteristic	Symbol	Condition	Value	Units
Supply Voltage	$V_{\text{CC}}$	Applied across P-N Terminals	$\leq 400$	Volts
Control Supply Voltage**	$V_D$	Applied between $V_{\text{UP1}}-V_{\text{UPC}}$ , $V_{\text{VP1}}-V_{\text{VPC}}$ , $V_{\text{WP1}}-V_{\text{WPC}}$ , $V_{\text{N1}}-V_{\text{NC}}$	$15.0 \pm 1.5$	Volts
Input ON Voltage	$V_{\text{CIN(on)}}$	Applied between $U_P-V_{\text{UPC}}$ ,	$\leq 0.8$	Volts
Input OFF Voltage	$V_{\text{CIN(off)}}$	$V_P-V_{\text{VPC}}$ , $W_P-V_{\text{WPC}}$ , $U_N-V_N$ , $W_N$ -Br- $V_{\text{NC}}$	$\geq 9.0$	Volts
PWM Input Frequency	$f_{\text{PWM}}$	—	$\leq 20$	kHz
Arm Shoot-through Blocking Time	$t_{\text{DEAD}}$	Input Signal	$\geq 2.0$	$\mu\text{s}$

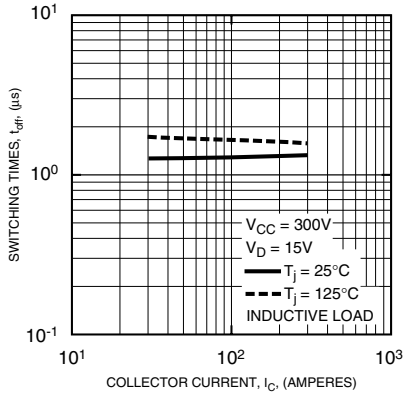
\*\* With ripple satisfying the following conditions:  $dv/dt$  swing  $\leq \pm 5\text{V}/\mu\text{s}$ , Variation  $\leq 2\text{V}$  peak to peak.

**PM300RLA060**  
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**Three Phase IGBT Inverter + Brake**  
**300 Amperes/600 Volts**

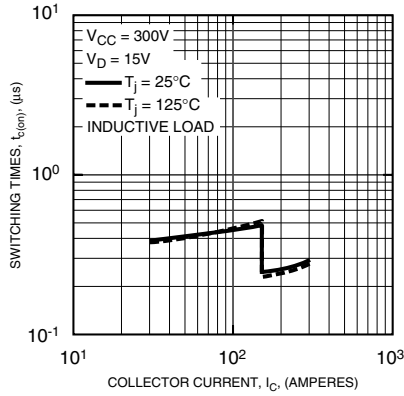


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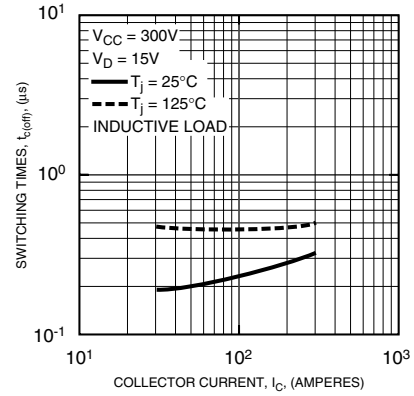
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)**



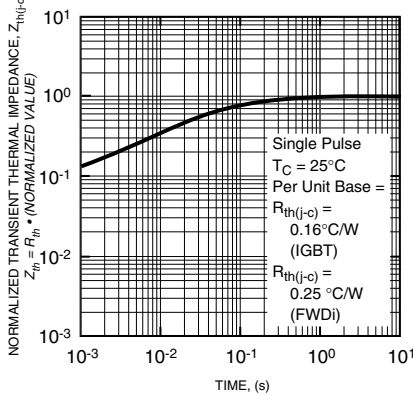
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)**



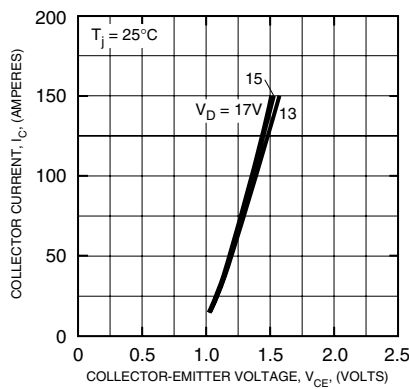
**SWITCHING TIME VS. COLLECTOR CURRENT (TYPICAL - INVERTER PART)**



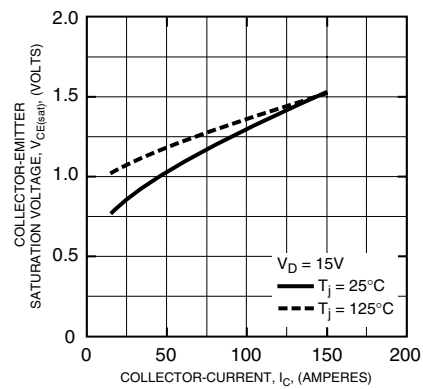
**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDI - INVERTER PART)**



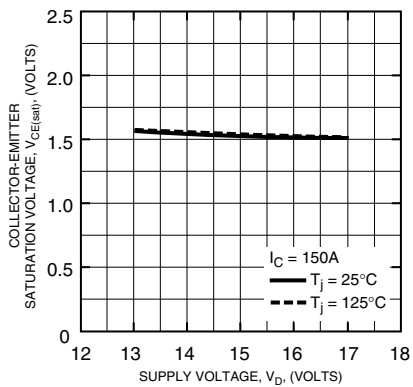
**OUTPUT CHARACTERISTICS (TYPICAL - BRAKE PART)**



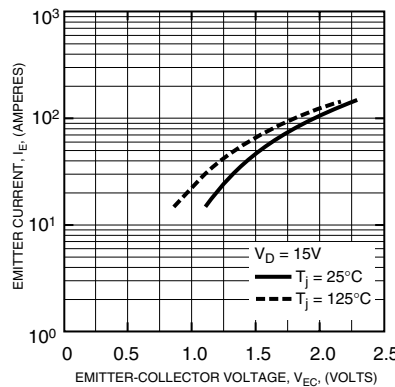
**COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL - BRAKE PART)**



**COLLECTOR-EMITTER SATURATION VOLTAGE VS. SUPPLY VOLTAGE CHARACTERISTICS (TYPICAL - BRAKE PART)**



**FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL - BRAKE PART)**



**TRANSIENT THERMAL IMPEDANCE CHARACTERISTICS (IGBT & FWDI - BRAKE PART)**

