

### FEATURES

- 10µs Short Circuit Withstand
- High Thermal Cycling Capability
- Non Punch Through Silicon
- Isolated AISiC Base with AlN Substrates
- Lead Free construction

### APPLICATIONS

- Matrix Converters
- Brushless Motor Controllers
- Frequency Converters

The Powerline range of high power modules includes half bridge, chopper, dual, single and bi-directional switch configurations covering voltages from 1200V to 6500V and currents up to 2400A.

The DIM400PBM17-A000 is a bi-directional switch 1700V, n-channel enhancement mode, insulated gate bipolar transistor (IGBT) module. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10µs short circuit withstand. This device is optimised for applications requiring high thermal cycling capability.

The module incorporates an electrically isolated base plate and low inductance construction enabling circuit designers to optimise circuit layouts and utilise grounded heat sinks for safety.

### ORDERING INFORMATION

Order As:

#### DIM400PBM17-A000

Note: When ordering, please use the complete part number

### KEY PARAMETERS

$V_{DRM}$		$\pm 1700V$
$V_T^*$	(typ)	4.9V
$I_C$	(max)	400A
$I_{C(PK)}$	(max)	800A

\* Measured at the power busbars, not the auxiliary terminals

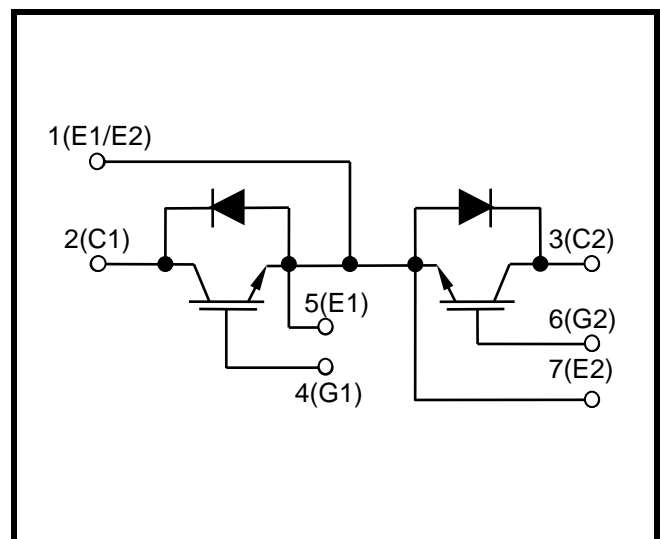


Fig. 1 Circuit configuration

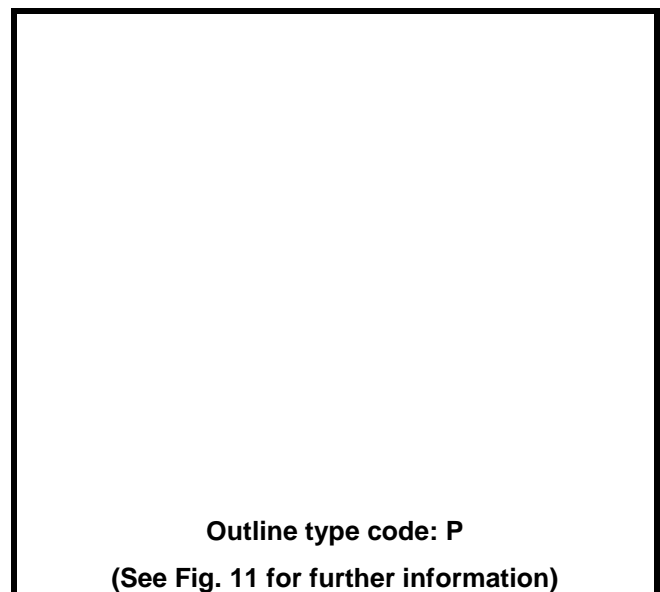


Fig. 2 Package

**ABSOLUTE MAXIMUM RATINGS**

Stresses above those listed under ‘Absolute Maximum Ratings’ may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package. Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliability.

**T<sub>case</sub> = 25°C unless stated otherwise**

Symbol	Parameter	Test Conditions	Max.	Units
V <sub>CES</sub>	Collector-emitter voltage	V <sub>GE</sub> = 0V	±1700	V
V <sub>GES</sub>	Gate-emitter voltage		±20	V
I <sub>C</sub>	Continuous collector current	T <sub>case</sub> = 50°C	400	A
I <sub>C(PK)</sub>	Peak collector current	1ms, T <sub>case</sub> = 110°C	800	A
P <sub>max</sub>	Max. transistor power dissipation	T <sub>case</sub> = 25°C, T <sub>j</sub> = 150°C	3470	W
I <sup>2</sup> t	Diode I <sup>2</sup> t value	V <sub>R</sub> = 0, t <sub>p</sub> = 10ms, T <sub>j</sub> = 125°C	30	kA <sup>2</sup> s
V <sub>isol</sub>	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V
Q <sub>PD</sub>	Partial discharge – per module	IEC1287, V <sub>1</sub> = 1800V, V <sub>2</sub> = 1300V, 50Hz RMS	10	pC

**THERMAL AND MECHANICAL RATINGS**

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	33mm
Clearance:	20mm
CTI (Comparative Tracking Index):	350

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
R <sub>th(j-c)</sub>	Thermal resistance – transistor	Continuous dissipation - junction to case	-	-	36	°C/kW
R <sub>th(j-c)</sub>	Thermal resistance – diode	Continuous dissipation - junction to case	-	-	80	°C/kW
R <sub>th(c-h)</sub>	Thermal resistance – case to heatsink (per module)	Mounting torque 5Nm (with mounting grease)	-	-	16	°C/kW
T <sub>j</sub>	Junction temperature	Transistor	-	-	150	°C
		Diode	-	-	125	°C
T <sub>stg</sub>	Storage temperature range	-	-40	-	125	°C
	Screw torque	Mounting – M6	-	-	5	Nm
		Electrical connections – M5	-	-	4	Nm

**ELECTRICAL CHARACTERISTICS**
**T<sub>case</sub> = 25°C unless stated otherwise.**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I <sub>CES</sub>	Collector cut-off current	V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub>			1	mA
		V <sub>GE</sub> = 0V, V <sub>CE</sub> = V <sub>CES</sub> , T <sub>case</sub> = 125°C			12	mA
I <sub>GES</sub>	Gate leakage current	V <sub>GE</sub> = ± 20V, V <sub>CE</sub> = 0V			2	μA
V <sub>GE(TH)</sub>	Gate threshold voltage	I <sub>C</sub> = 20mA, V <sub>GE</sub> = V <sub>CE</sub>	4.5	5.5	6.5	V
V <sub>CE(sat)</sub> <sup>†</sup>	Collector-emitter saturation voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 400A		2.7	3.2	V
		V <sub>GE</sub> = 15V, I <sub>C</sub> = 400A, T <sub>j</sub> = 125°C		3.4	4.0	V
V <sub>T</sub>	On-state voltage - (measured across terminals 2 and 3)	V <sub>GE</sub> = 15V, I <sub>C</sub> = 400A		4.9		V
		V <sub>GE</sub> = 15V, I <sub>C</sub> = 400A, T <sub>j</sub> = 125°C		5.7		V
I <sub>F</sub>	Diode forward current	DC			400	A
I <sub>FM</sub>	Diode maximum forward current	t <sub>p</sub> = 1ms			800	A
V <sub>F</sub> <sup>†</sup>	Diode forward voltage	I <sub>F</sub> = 400A		2.2	2.5	V
		I <sub>F</sub> = 400A, T <sub>j</sub> = 125°C		2.3	2.6	V
C <sub>ies</sub>	Input capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz		30		nF
Q <sub>g</sub>	Gate charge	±15V		4.5		μC
C <sub>res</sub>	Reverse transfer capacitance	V <sub>CE</sub> = 25V, V <sub>GE</sub> = 0V, f = 1MHz				nF
L <sub>M</sub>	Module inductance			20		nH
R <sub>INT</sub>	Internal resistance			270		μΩ
SC <sub>Data</sub>	Short circuit current, I <sub>SC</sub>	T <sub>j</sub> = 125°C, V <sub>CC</sub> = 1000V t <sub>p</sub> ≤ 10μs, V <sub>GE</sub> ≤ 15V V <sub>CE(max)</sub> = V <sub>CES</sub> - L* x di/dt IEC 60747-9		1600		A

**Note:**
<sup>†</sup> Measured at the power busbars, not the auxiliary terminals

<sup>\*</sup> L is the circuit inductance + L<sub>M</sub>

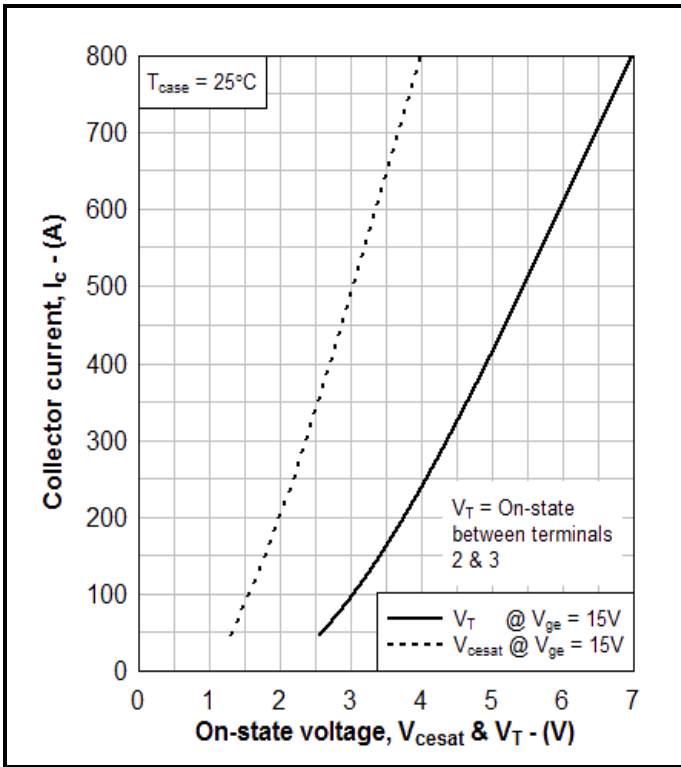
## ELECTRICAL CHARACTERISTICS

$T_{case} = 25^{\circ}\text{C}$  unless stated otherwise

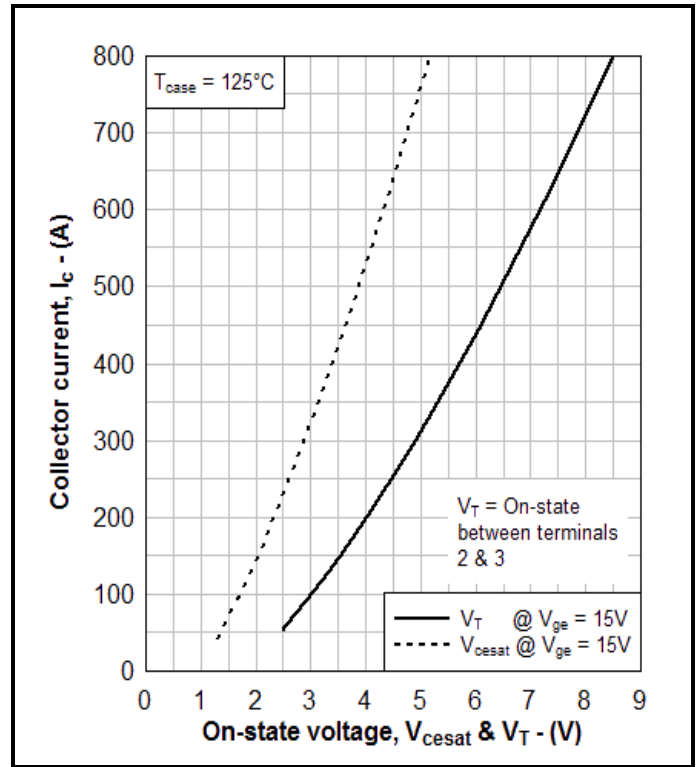
Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units	
$t_{d(off)}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 900\text{V}$ $R_{G(ON)} = 4.7\Omega$ $R_{G(OFF)} = 4.7\Omega$ $L_S \sim 100\text{nH}$		1150		ns	
$t_f$	Fall time			100		ns	
$E_{OFF}$	Turn-off energy loss				120		mJ
$t_{d(on)}$	Turn-on delay time				250		ns
$t_r$	Rise time				250		ns
$E_{ON}$	Turn-on energy loss				150		mJ
$Q_{rr}$	Diode reverse recovery charge	$I_F = 400\text{A}$ $V_{CE} = 900\text{V}$ $di_F/dt = 3000\text{A}/\mu\text{s}$		100		$\mu\text{C}$	
$I_{rr}$	Diode reverse recovery current				230		A
$E_{rec}$	Diode reverse recovery energy				70		mJ

$T_{case} = 125^{\circ}\text{C}$  unless stated otherwise

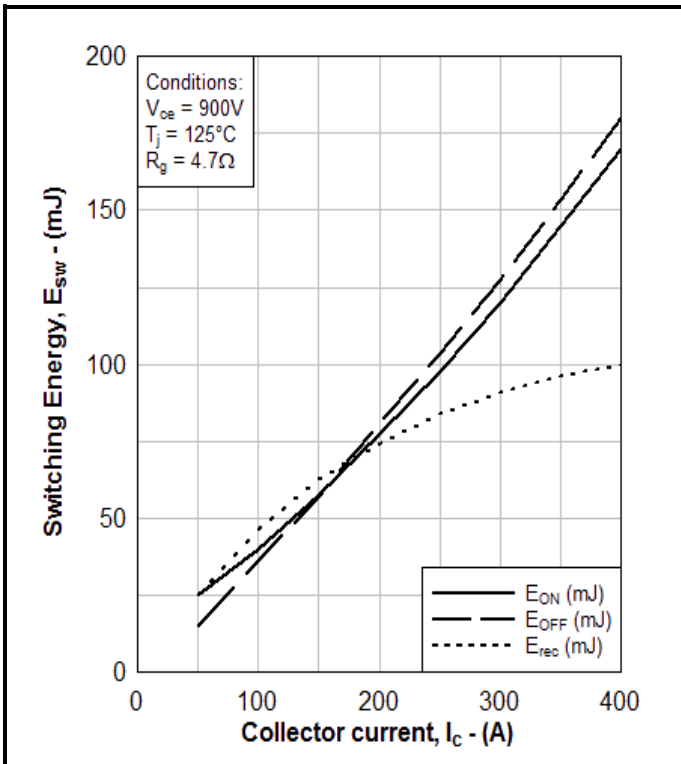
Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units	
$t_{d(off)}$	Turn-off delay time	$I_C = 400\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 900\text{V}$ $R_{G(ON)} = 4.7\Omega$ $R_{G(OFF)} = 4.7\Omega$ $L_S \sim 100\text{nH}$		1400		ns	
$t_f$	Fall time				130		ns
$E_{OFF}$	Turn-off energy loss				180		mJ
$t_{d(on)}$	Turn-on delay time				400		ns
$t_r$	Rise time				250		ns
$E_{ON}$	Turn-on energy loss				170		mJ
$Q_{rr}$	Diode reverse recovery charge	$I_F = 400\text{A}$ $V_{CE} = 900\text{V}$ $di_F/dt = 2500\text{A}/\mu\text{s}$		170		$\mu\text{C}$	
$I_{rr}$	Diode reverse recovery current				270		A
$E_{rec}$	Diode reverse recovery energy				100		mJ



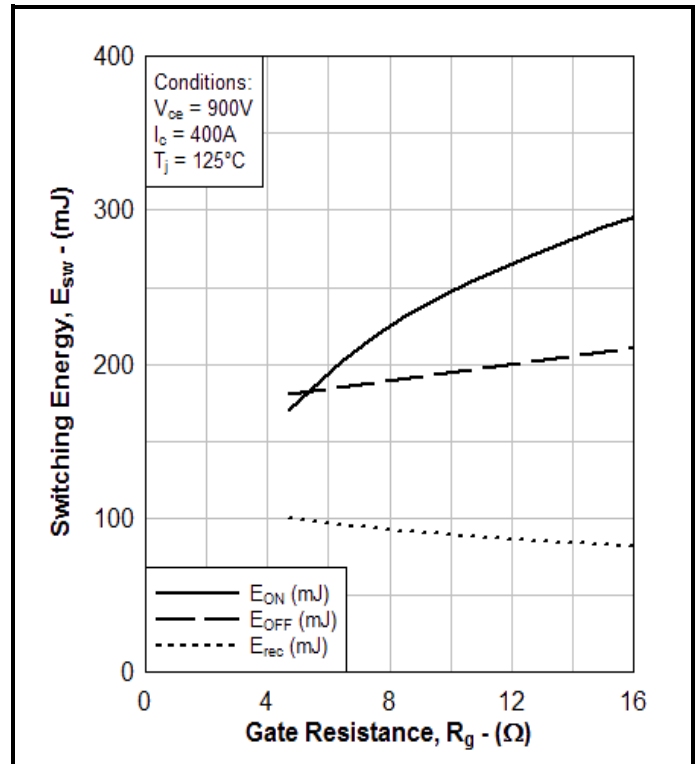
**Fig. 3 Typical output characteristics**



**Fig. 4 Typical output characteristics**



**Fig. 5 Typical switching energy vs collector current**



**Fig. 6 Typical switching energy vs gate resistance**

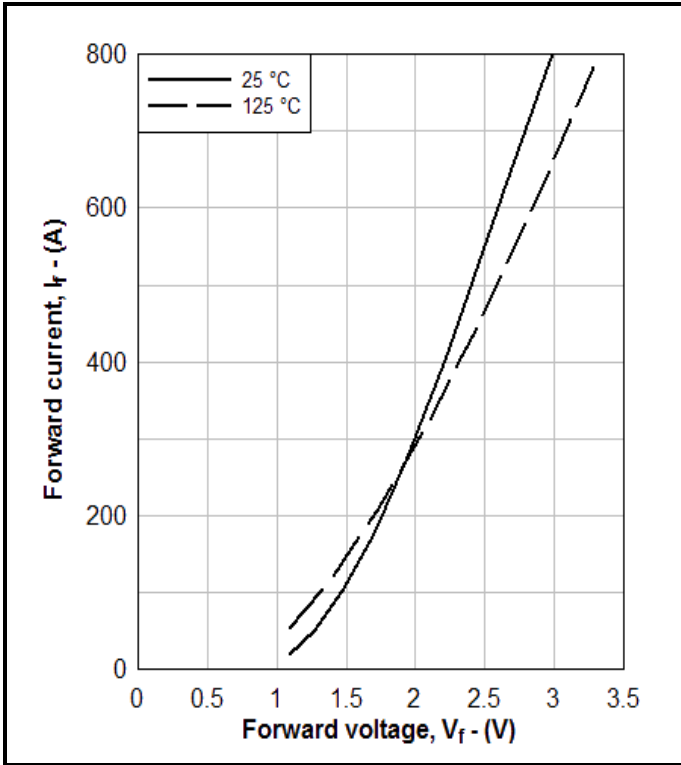


Fig. 7 Diode typical forward characteristics

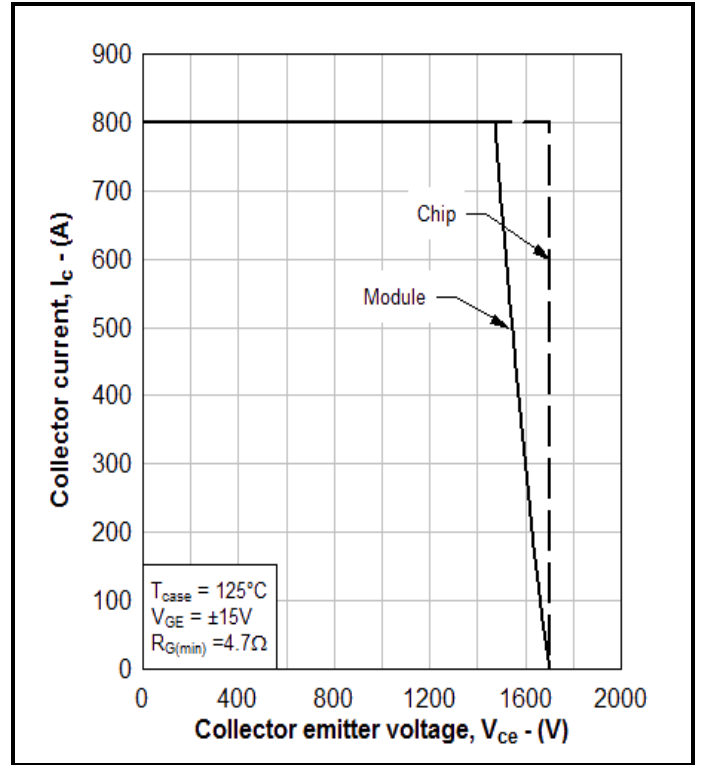


Fig. 8 Reverse bias safe operating area

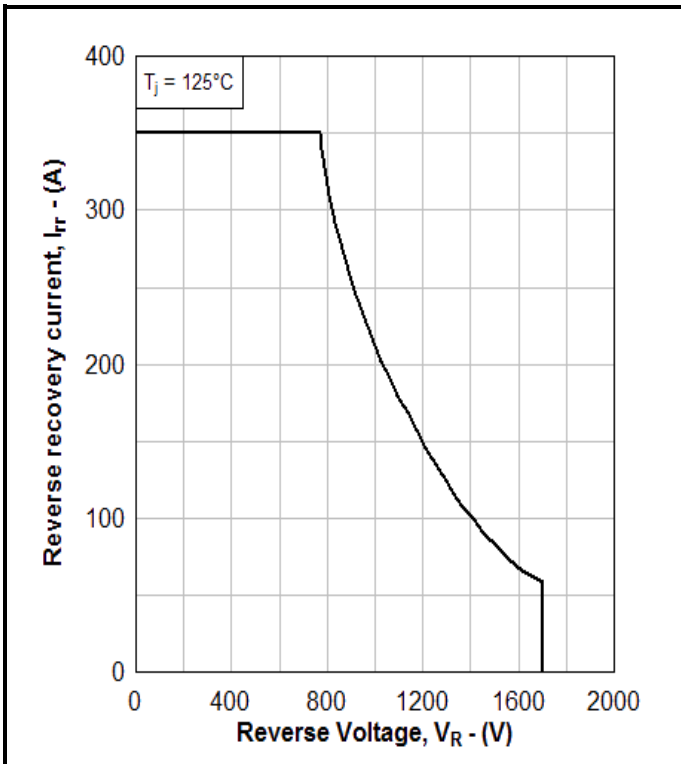


Fig. 9 Diode reverse bias safe operating area

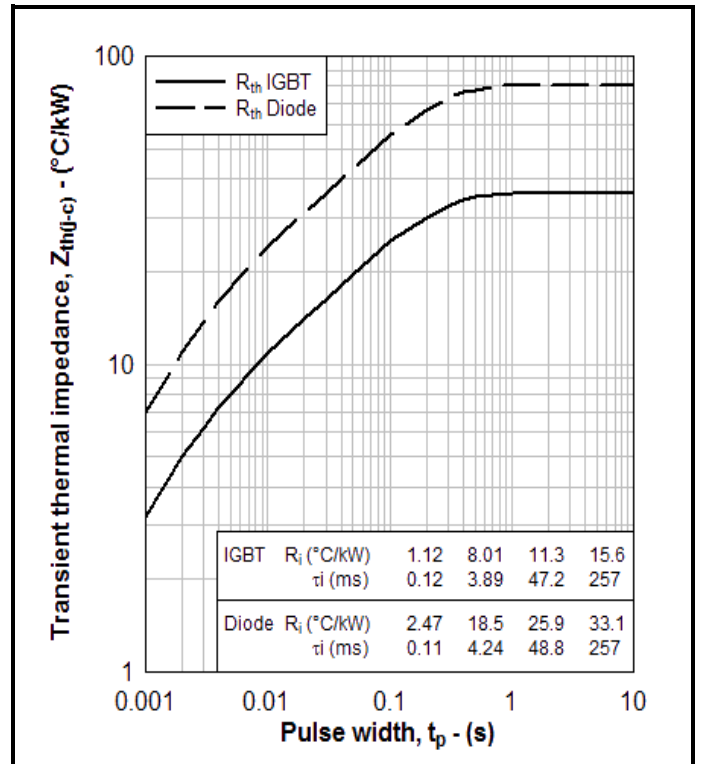


Fig. 10 Transient thermal impedance



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