

FEATURES

- Trench Gate IGBT
- 10 μ s Short Circuit Withstand
- High Thermal Cycling Capability
- Soft Punch Through Silicon
- Isolated AlSiC Base with AlN Substrates
- Lead Free construction
- Low $V_{CE(sat)}$ Device
- High Current Density

APPLICATIONS

- High Reliability Inverters
- Motor Controllers
- Traction Drives
- Active Front End Rectifiers

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 DIM1200DDM17-PT500 is a dual switch 1700V, trench gate, insulated gate bipolar transistor (IGBT) module with enhanced field stop and implantation technology. The IGBT has a wide reverse bias safe operating area (RBSOA) plus 10 μ s short circuit withstand. This device is optimised for traction drives and other 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:

DIM1200DDM17-PT500

Note: When ordering, please use the complete part number

KEY PARAMETERS

V_{CES}	1700V
$V_{CE(sat)}$ * (typ)	1.8 V
I_C (max)	1200A
$I_{C(PK)}$ (max)	2400A

* Measured at the power busbars, not the auxiliary terminals

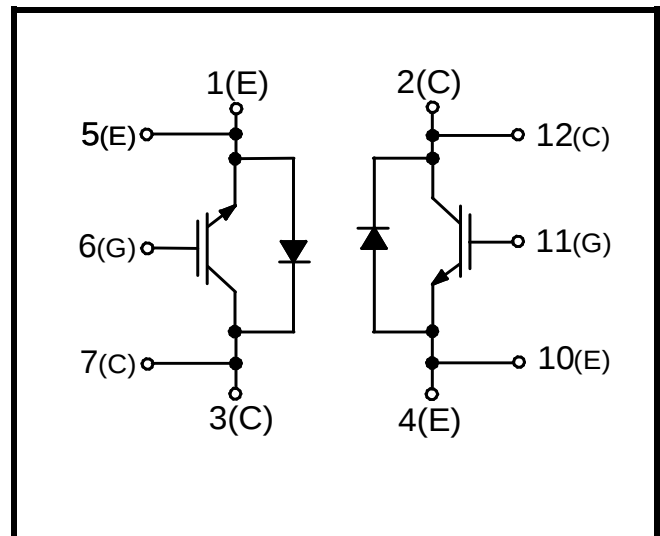
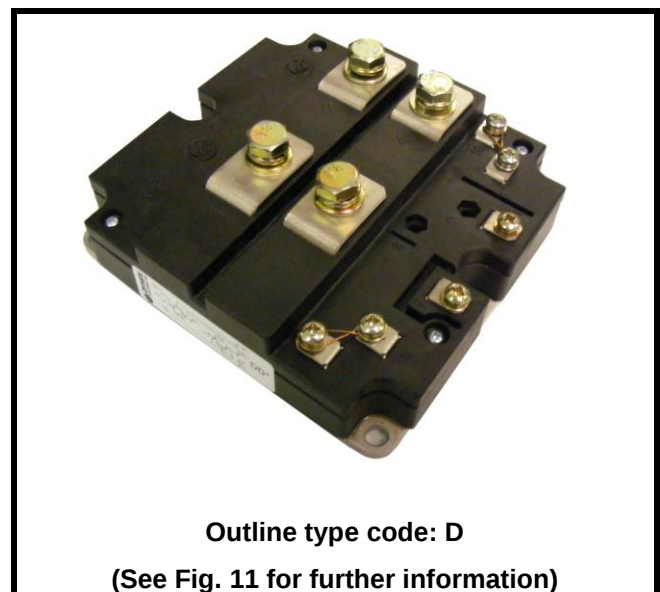


Fig. 1 Circuit configuration



Outline type code: D

(See Fig. 11 for further information)

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_{case} = 25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Max.	Units
V _{CES}	Collector-emitter voltage	V _{GE} = 0V	1700	V
V _{GES}	Gate-emitter voltage		±20	V
I _C	Continuous collector current	T _{case} = 90°C	1200	A
I _{C(PK)}	Peak collector current	1ms, T _{case} = 140°C	2400	A
P _{max}	Max. transistor power dissipation	T _{case} = 25°C, T _{vj} = 150°C	5680	W
I ² t	Diode I ² t value	V _R = 0, t _p = 10ms, T _j = 150°C	130	kA ² s
V _{isol}	Isolation voltage – per module	Commoned terminals to base plate. AC RMS, 1 min, 50Hz	4000	V
Q _{PD}	Partial discharge – per module	IEC1287, V ₁ = 1800V, V ₂ = 1300V, 50Hz RMS	10	pC

THERMAL AND MECHANICAL RATINGS

Internal insulation material:	AlN
Baseplate material:	AlSiC
Creepage distance:	20mm
Clearance:	10mm
CTI (Comparative Tracking Index):	>600

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
R _{th(j-c)}	Thermal resistance – transistor (per switch)	Continuous dissipation - junction to case		-	22	°C/kW
R _{th(j-c)}	Thermal resistance – diode (per switch)	Continuous dissipation - junction to case		-	44	°C/kW
R _{th(c-h)}	Thermal resistance – case to heatsink (IGBT)	Mounting torque 5Nm (with mounting grease)		-	12	°C/kW
R _{th(c-h)}	Thermal resistance – case to heatsink (Diode)	Mounting torque 5Nm (with mounting grease)		-	24	°C/kW
T _j	Junction temperature	Transistor	-40	-	150	°C
		Diode	-40	-	150	°C
T _{stg}	Storage temperature range	-	-40	-	150	°C
	Screw torque	Mounting – M6	-	-	5	Nm
		Electrical connections – M4	-	-	2	Nm
		Electrical connections – M8	-	-	10	Nm

ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I_{CES}	Collector cut-off current	$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}$			1	mA
		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 125^{\circ}\text{C}$			20	mA
		$V_{\text{GE}} = 0\text{V}, V_{\text{CE}} = V_{\text{CES}}, T_{\text{case}} = 150^{\circ}\text{C}$			30	mA
I_{GES}	Gate leakage current	$V_{\text{GE}} = \pm 20\text{V}, V_{\text{CE}} = 0\text{V}$			0.5	μA
$V_{\text{GE(TH)}}$	Gate threshold voltage	$I_{\text{C}} = 40\text{mA}, V_{\text{GE}} = V_{\text{CE}}$	5.0	6.0	7.0	V
$V_{\text{CE(sat)}}$	Collector-emitter saturation voltage	$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 1200\text{A}$		1.8	2.2	V
		$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 1200\text{A}, T_{\text{j}} = 125^{\circ}\text{C}$		2.1	2.5	V
		$V_{\text{GE}} = 15\text{V}, I_{\text{C}} = 1200\text{A}, T_{\text{j}} = 150^{\circ}\text{C}$		2.2	2.6	V
I_{F}	Diode forward current	DC		1200		A
I_{FM}	Diode maximum forward current	$t_{\text{p}} = 1\text{ms}$		2400		A
V_{F}	Diode forward voltage	$I_{\text{F}} = 1200\text{A}$		1.9	2.3	V
		$I_{\text{F}} = 1200\text{A}, T_{\text{j}} = 125^{\circ}\text{C}$		2.1	2.5	V
		$I_{\text{F}} = 1200\text{A}, T_{\text{j}} = 150^{\circ}\text{C}$		2.1	2.5	V
C_{ies}	Input capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 100\text{kHz}$		109		nF
Q_{g}	Gate charge	$\pm 15\text{V}$		11.6		μC
C_{res}	Reverse transfer capacitance	$V_{\text{CE}} = 25\text{V}, V_{\text{GE}} = 0\text{V}, f = 100\text{kHz}$		3.0		nF
L_{M}	Module inductance – per switch	-		20		nH
R_{INT}	Internal transistor resistance – per switch	-		270		$\mu\Omega$
SC_{Data}	Short circuit current, I_{SC}	$T_{\text{j}} = 150^{\circ}\text{C}, V_{\text{CC}} = 1000\text{V}$ $t_{\text{p}} \leq 10\mu\text{s}, V_{\text{GE}} \leq 15\text{V}$ $V_{\text{CE(max)}} = V_{\text{CES}} - L^* \times \text{dI/dt}$ IEC 60747-9		4700		A

Note:

* L is the circuit inductance + L_{M}

ELECTRICAL CHARACTERISTICS

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 1200\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 900\text{V}$ $R_{G(\text{ON})} = 0.5\Omega$ $R_{G(\text{OFF})} = 0.5\Omega$ $L_S \sim 150\text{nH}$		1200		ns
t_f	Fall time			400		ns
E_{OFF}	Turn-off energy loss			570		mJ
$t_{d(\text{on})}$	Turn-on delay time			480		ns
t_r	Rise time			230		ns
E_{ON}	Turn-on energy loss			83		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1200\text{A}$ $V_{CE} = 900\text{V}$ $dI_F/dt = 4500\text{A}/\mu\text{s}$		240		μC
I_{rr}	Diode reverse recovery current			710		A
E_{rec}	Diode reverse recovery energy			155		mJ

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

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 1200\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 900\text{V}$ $R_{G(\text{ON})} = 0.5\Omega$ $R_{G(\text{OFF})} = 0.5\Omega$ $L_S \sim 150\text{nH}$		1250		ns
t_f	Fall time			480		ns
E_{OFF}	Turn-off energy loss			640		mJ
$t_{d(\text{on})}$	Turn-on delay time			480		ns
t_r	Rise time			240		ns
E_{ON}	Turn-on energy loss			116		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1200\text{A}$ $V_{CE} = 900\text{V}$ $dI_F/dt = 4500\text{A}/\mu\text{s}$		380		μC
I_{rr}	Diode reverse recovery current			835		A
E_{rec}	Diode reverse recovery energy			265		mJ

 $T_{\text{case}} = 150^{\circ}\text{C}$ unless stated otherwise

Symbol	Parameter	Test Conditions	Min	Typ.	Max	Units
$t_{d(\text{off})}$	Turn-off delay time	$I_C = 1200\text{A}$ $V_{GE} = \pm 15\text{V}$ $V_{CE} = 900\text{V}$ $R_{G(\text{ON})} = 0.5\Omega$ $R_{G(\text{OFF})} = 0.5\Omega$ $L_S \sim 150\text{nH}$		1280		ns
t_f	Fall time			490		ns
E_{OFF}	Turn-off energy loss			660		mJ
$t_{d(\text{on})}$	Turn-on delay time			480		ns
t_r	Rise time			240		ns
E_{ON}	Turn-on energy loss			128		mJ
Q_{rr}	Diode reverse recovery charge	$I_F = 1200\text{A}$ $V_{CE} = 900\text{V}$ $dI_F/dt = 4500\text{A}/\mu\text{s}$		415		μC
I_{rr}	Diode reverse recovery current			870		A
E_{rec}	Diode reverse recovery energy			295		mJ

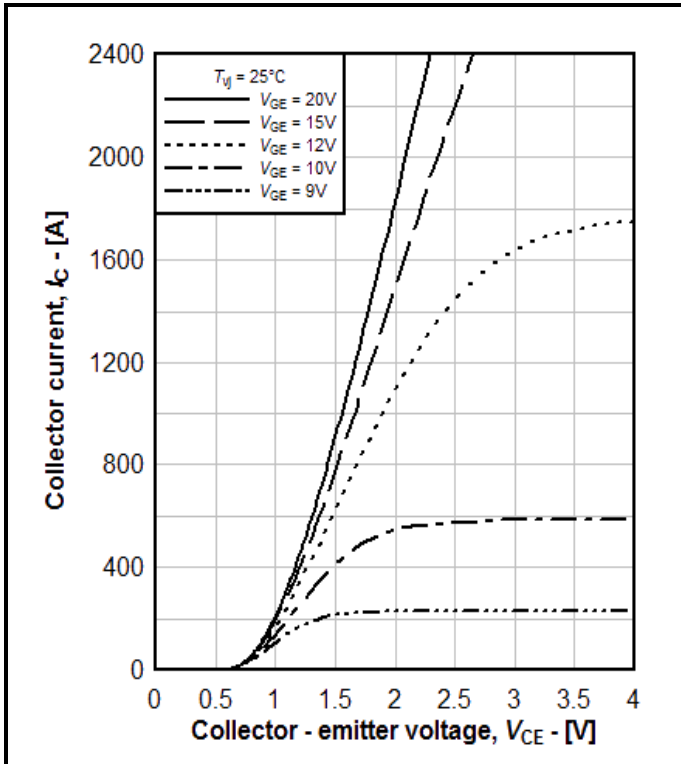


Fig. 3 Typical output characteristics

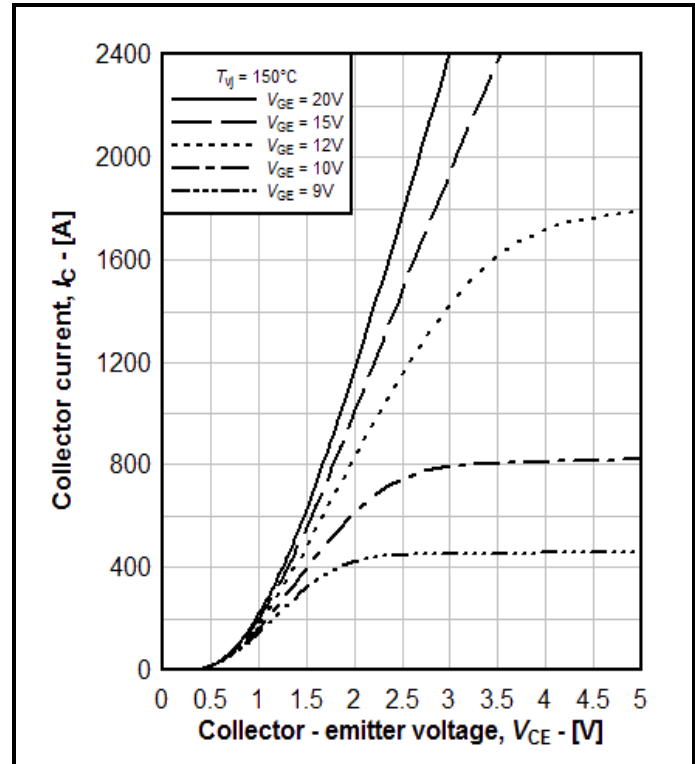


Fig. 4 Typical output characteristics

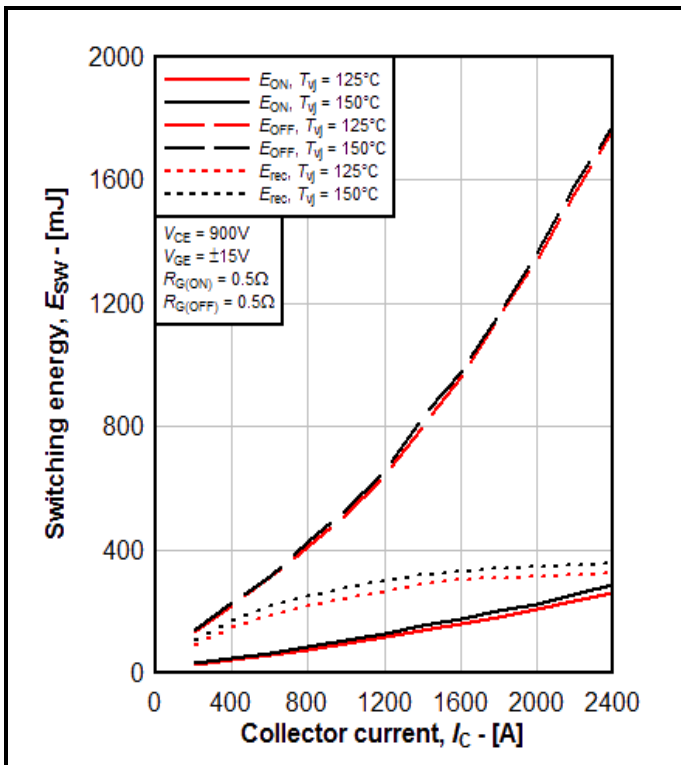


Fig. 5 Typical switching energy vs collector current

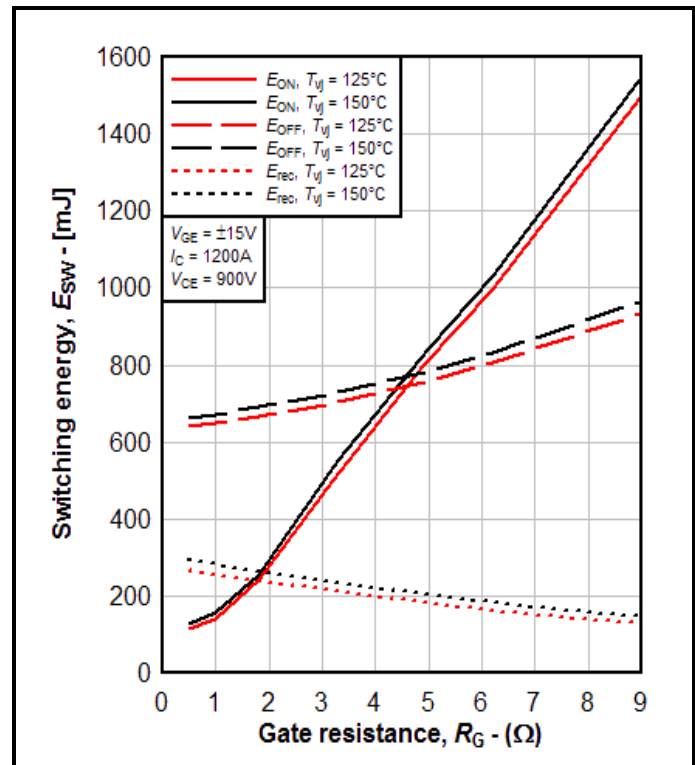


Fig. 6 Typical switching energy vs gate resistance

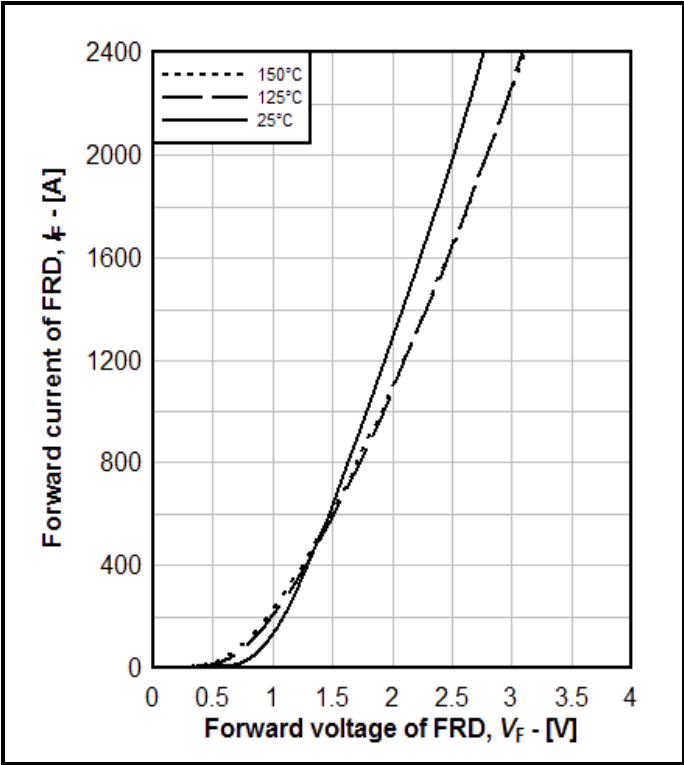


Fig. 7 Diode typical forward characteristics

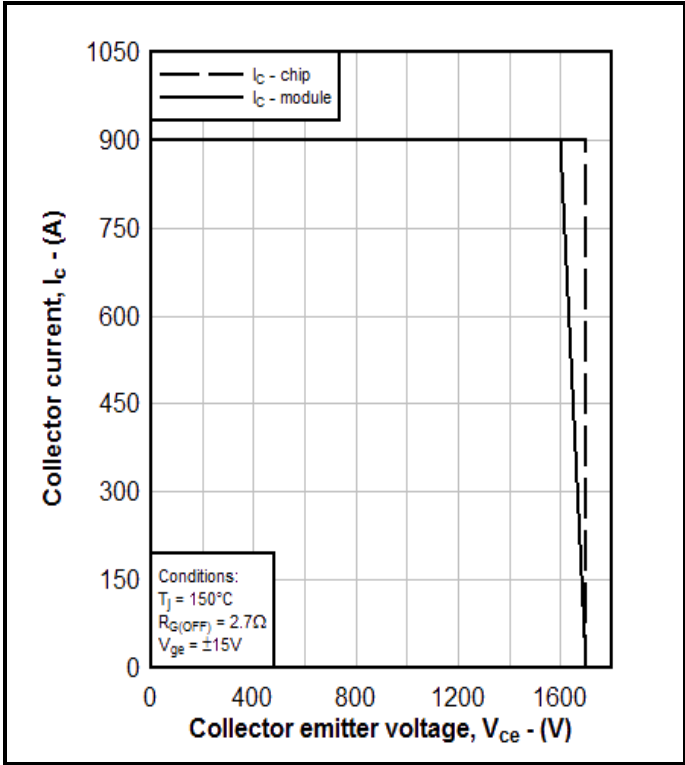


Fig. 8 Reverse bias safe operating area

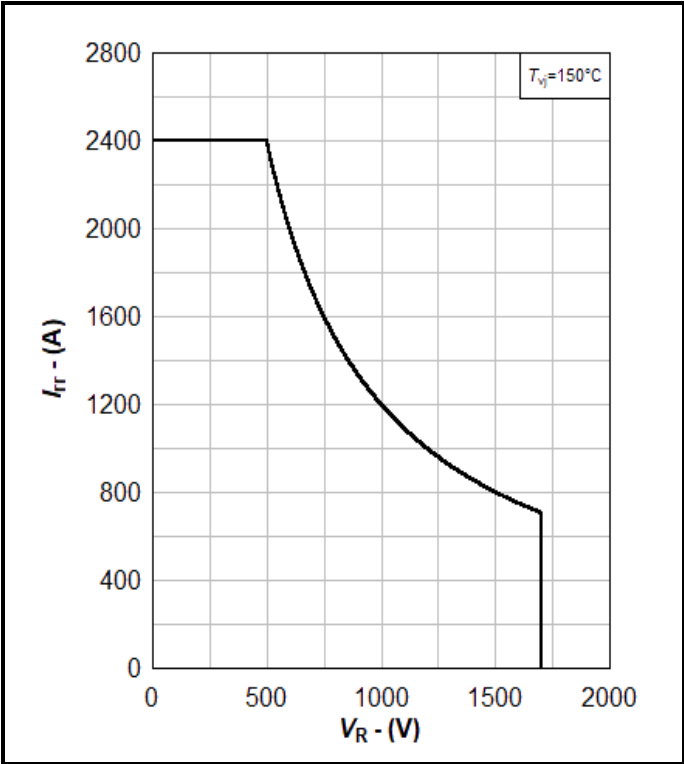


Fig. 9 Diode reverse bias safe operating area

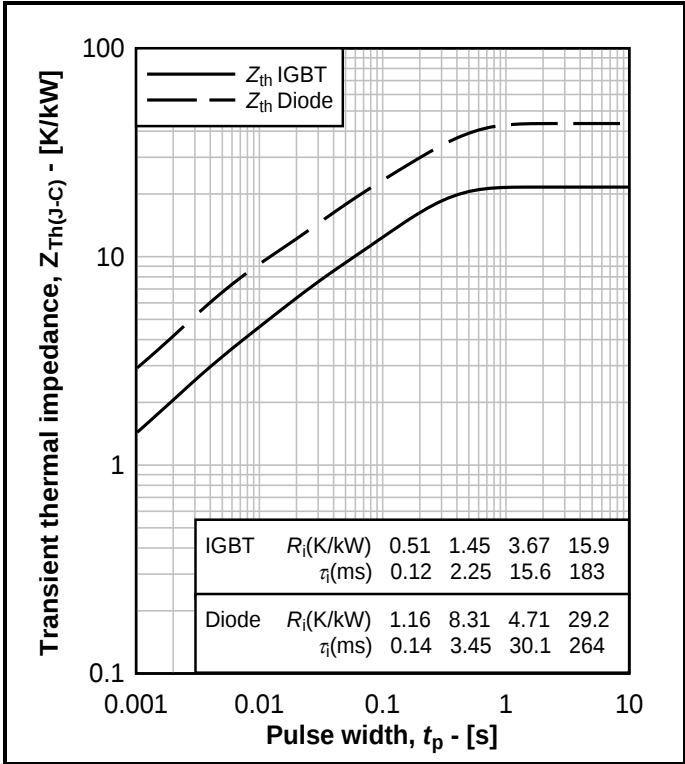


Fig. 10 Transient thermal impedance

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