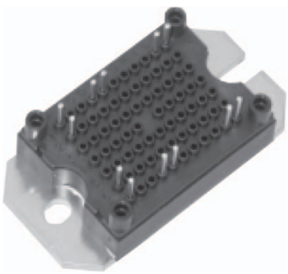
Primary MTP IGBT Power Module



MTP

PRODUCT SUMMARY	
FRED Pt® AP DIODE, T_J = 150 °C	
V_{RRM}	600 V
$I_{F(DC)}$ at 80 °C	11 A
V_F at 25 °C at 60 A	2.08 V
IGBT, T_J = 150 °C	
V_{CES}	600 V
$V_{CE(ON)}$ at 25 °C at 60 A	1.98 V
I_C at 80°C	83 A
FRED Pt® CHOPPER DIODE, T_J = 150 °C	
V_R	600 V
$I_{F(DC)}$ at 80 °C	17 A
V_F at 25 °C at 60 A	2.06 V
Speed	30 kHz to 150 kHz
Package	MTP
Circuit	Dual forward

FEATURES

- Buck PFC stage with warp 2 IGBT and FRED Pt® hyperfast diode
- Integrated thermistor
- Isolated baseplate
- Very low stray inductance design for high speed operation
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS
COMPLIANT

BENEFITS

- Lower conduction losses and switching losses
- Higher switching frequency up to 150 kHz
- Optimized for welding, UPS, and SMPS applications
- PCB solderable terminals
- Direct mounting to heatsink

ABSOLUTE MAXIMUM RATINGS

	PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
FRED Pt Antiparallel Diode	Repetitive peak reverse voltage	V_{RRM}		600	V
	Maximum continuous forward current T_J = 150 °C maximum	$I_{F(DC)}$	T_C = 25 °C	17	A
			T_C = 80 °C	11	
	Maximum power dissipation	P_D	T_C = 25 °C	25	W
IGBT	Collector to emitter voltage	V_{CES}	T_J = 25 °C	600	V
	Gate to emitter voltage	V_{GE}	I_{GES} max. ± 250 ns	± 20	V
	Maximum continuous collector current at V_{GE} = 15 V, T_J = 150 °C maximum	I_C	T_C = 25 °C	121	A
			T_C = 80 °C	83	
	Clamped inductive load current	I_{LM}		300	
	Maximum power dissipation	P_D	T_C = 25 °C	462	W
FRED Pt Chopper Diode	Repetitive peak reverse voltage	V_{RRM}		600	V
	Maximum continuous forward current T_J = 150 °C maximum	I_F	T_C = 25 °C	26	A
			T_C = 80 °C	17	
	Maximum power dissipation	P_D	T_C = 25 °C	56	W
	Maximum operating junction temperature	T_J		150	°C
	Storage temperature range	T_{Stg}		-40 to +150	
	Isolation voltage	V_{ISOL}	V_{RMS} t = 1 s, T_J = 25 °C	3500	V

ELECTRICAL SPECIFICATIONS (T_J = 25 °C unless otherwise noted)							
	PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNITS**
AP Diode	Blocking voltage	BV_{RRM}	0.5 mA	600	-	-	V
	Forward voltage drop	V_{FM}	I_F = 60 A	-	2.08	2.43	V
			I_F = 60 A, T_J = 125 °C	-	2.05	2.3	
IGBT	Collector to emitter breakdown voltage	BV_{CES}	V_{GE} = 0 V, I_C = 0.5 mA	600	-	-	V
	Temperature coefficient of breakdown voltage	$\Delta V_{BR(CES)}/\Delta T_J$	I_C = 0.5 mA (25 °C to 125 °C)	-	0.6	-	V/°C
	Collector to emitter voltage	$V_{CE(ON)}$	V_{GE} 15 V, I_C = 60 A	-	1.93	2.29	V
			V_{GE} = 15 V, I_C = 60 A, T_J = 125 °C	-	2.36	2.80	
	Gate threshold voltage	$V_{GE(th)}$	V_{CE} = V_{GE}, I_C = 500 µA	2.9	-	6.0	V
	Collector to emitter leakage current	I_{CES}	V_{GE} = 0 V, V_{CE} = 600 V	-	-	100	µA
			V_{GE} = 0 V, V_{CE} = 600 V, T_J = 125 °C	-	-	2.0	mA
	Gate to emitter leakage	I_{GES}	V_{GE} = ± 20 V	-	-	± 100	nA
FRED Pt Chopper Diode	Forward voltage drop	V_{FM}	I_F = 60 A	-	2.06	2.53	V
			I_F = 60 A, T_J = 125 °C	-	1.83	2.26	
	Blocking voltage	BV_{RM}	0.5 mA	600	-	-	
	Reverse leakage current	I_{RM}	V_{RRM} = 600 V	-	-	75	µA
			V_{RRM} = 600 V, T_J = 125 °C	-	-	0.5	mA
RECOVERY PARAMETER							
AP Diode	Peak reverse recovery current	I_{rr}	I_F = 60 A dI/dt = 200 A/µs V_R = 200 V	-	67	11	A
	Reverse recovery time	t_{rr}		-	120	160	ns
	Reverse recovery charge	Q_{rr}		-	620	850	nC
FRED Pt Chopper Diode	Peak reverse recovery current	I_{rr}	I_F = 60 A dI/dt = 200 A/µs V_R = 200 V	-	4.5	6.0	A
	Reverse recovery time	t_{rr}		-	67	85	ns
	Reverse recovery charge	Q_{rr}		-	130	250	nC
	Peak reverse recovery current	I_{rr}	I_F = 60 A dI/dt = 200 A/µs V_R = 200 V, T_J = 125 °C	-	9.5	12.0	A
	Reverse recovery time	t_{rr}		-	128	165	ns
	Reverse recovery charge	Q_{rr}		-	601	900	nC

SWITCHING CHARACTERISTICS (T_J = 25 °C unless otherwise noted)							
	PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
PFC IGBT	Total gate charge	Q_g	I_C = 60 A V_{CC} = 480 V V_{GE} = 15 V	-	460	-	nC
	Gate to source charge	Q_{gs}		-	160	-	
	Gate to drain (Miller) charge	Q_{gd}		-	70	-	
	Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 360 V, V_{GE} = 15 V R_g = 5 Ω, L = 500 μH, T_J = 25 °C	-	0.2	-	mJ
	Turn-off switching loss	E_{off}		-	0.96	-	
	Total switching loss	E_{tot}		-	1.16	-	
	Turn-on delay time	$t_{d(on)}$		-	240	-	ns
	Rise time	t_r		-	47	-	
	Turn-off delay time	$t_{d(off)}$		-	240	-	
	Fall time	t_f		-	66	-	
	Turn-on switching loss	E_{on}	I_C = 100 A, V_{CC} = 360 V, V_{GE} = 15 V R_g = 5 Ω, L = 500 μH, T_J = 125 °C	-	0.33	-	mJ
	Turn-off switching loss	E_{off}		-	1.45	-	
	Total switching loss	E_{tot}		-	1.78	-	
	Turn-on delay time	$t_{d(on)}$		-	246	-	ns
	Rise time	t_r		-	50	-	
	Turn-off delay time	$t_{d(off)}$		-	246	-	
	Fall time	t_f		-	71	-	
	Input capacitance	C_{ies}	V_{GE} = 0 V V_{CC} = 30 V f = 1 MHz	-	9500	-	pF
	Output capacitance	C_{oes}		-	780	-	
	Reverse transfer capacitance	C_{res}		-	120	-	

THERMISTOR ELECTRICAL CHARACTERISTICS (T_J = 25 °C unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Resistance	R	T_J = 25 °C	-	30 000	-	Ω
B value	B	T_J = 25 °C/T_J = 85 °C	-	4000	-	K

THERMAL AND MECHANICAL SPECIFICATIONS						
	PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
AP FRED Pt Diode	Junction to case diode thermal resistance	R_{thJC}	-	-	4.9	°C/W
IGBT	Junction to case IGBT thermal resistance		-	-	0.27	
FRED Pt Chopper Diode	Junction to case diode thermal resistance		-	-	2.25	
	Case to sink, flat, greased surface per module	R_{thCS}	-	0.06	-	°C/W
	Mounting torque ± 10 % to heatsink [(1)]		-	-	4	Nm
	Approximate weight		-	65	-	g

Note

[(1)] A mounting compound is recommended and the torque should be rechecked after a period of 3 hours to allow for the spread of the compound.

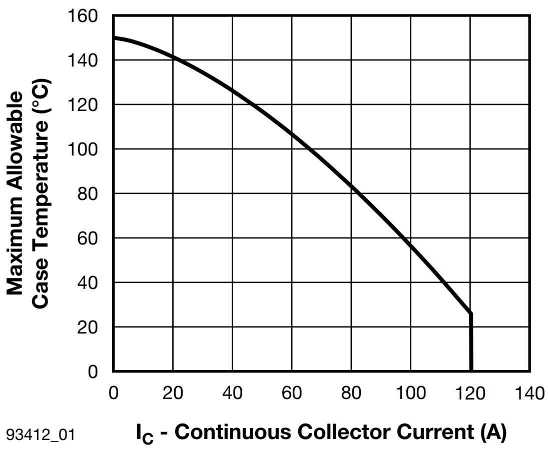


Fig. 1 - Maximum IGBT Continuous Collector Current vs. Case Temperature

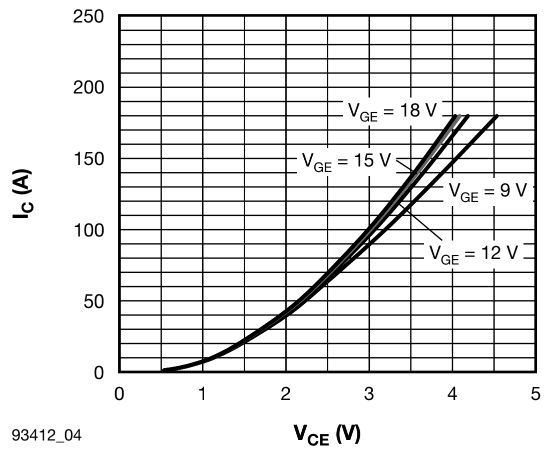


Fig. 4 - Typical IGBT Output Characteristics, T_J = 125 °C

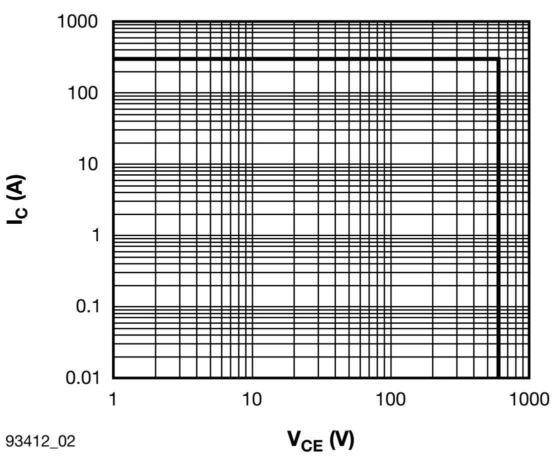


Fig. 2 - IGBT Reverse BIAS SOA T_J = 150 °C, V_{GE} = 15 V

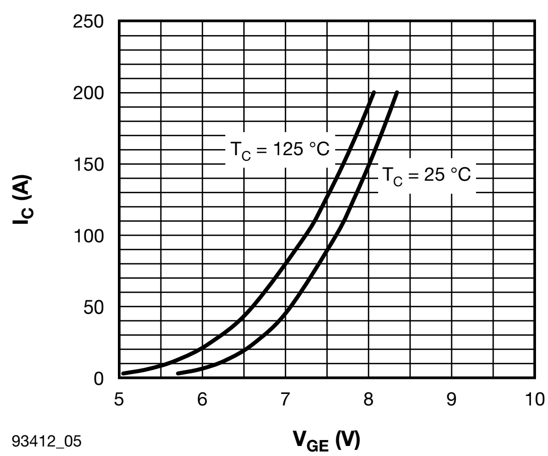


Fig. 5 - Typical IGBT Transfer Characteristics, T_J = 125 °C

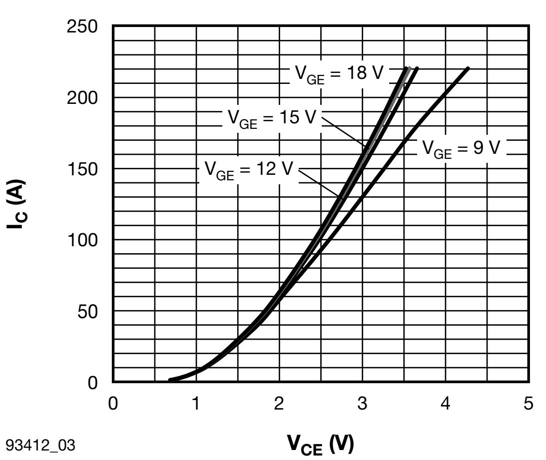


Fig. 3 - Typical IGBT Output Characteristics, T_J = 25 °C

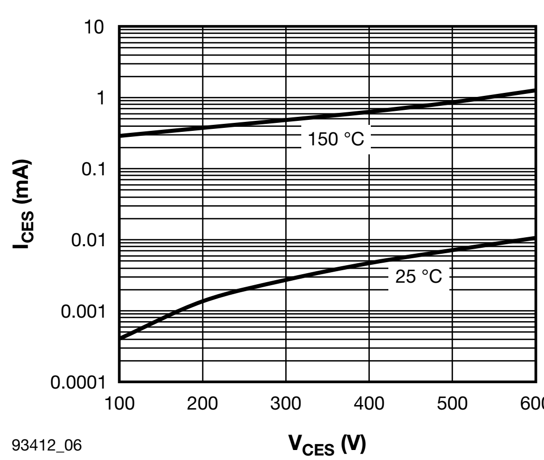


Fig. 6 - Typical IGBT Zero Gate Voltage Collector Current

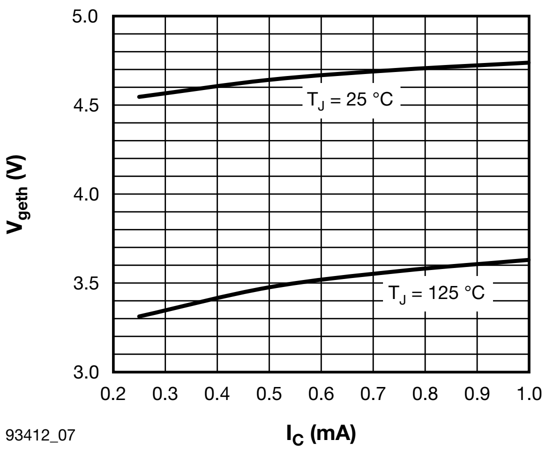


Fig. 7 - Typical IGBT Gate Thresold Voltage

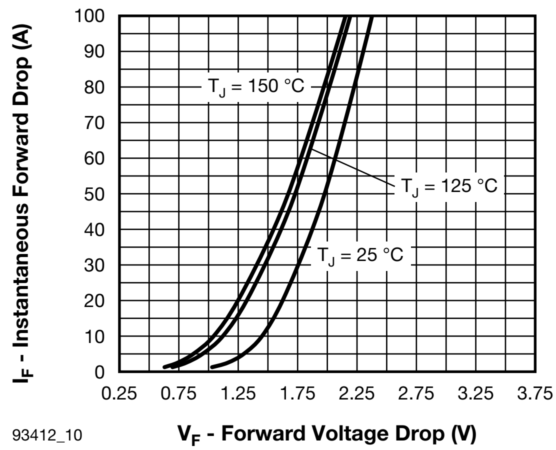


Fig. 10 - Typical PFC Diode Forward Voltage

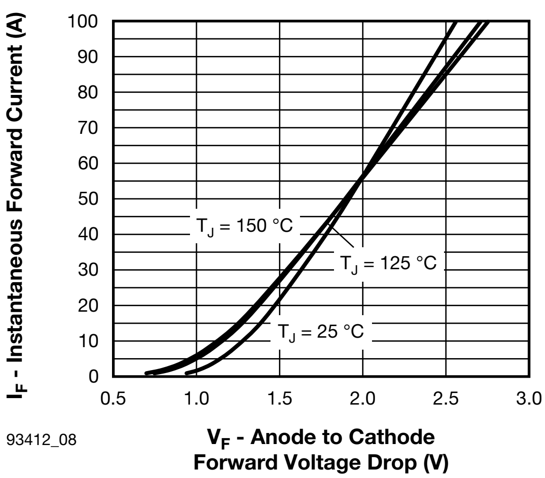


Fig. 8 - Typical Diode Forward Voltage Characteristics of Antiparallel Diode, t_p = 500 µs

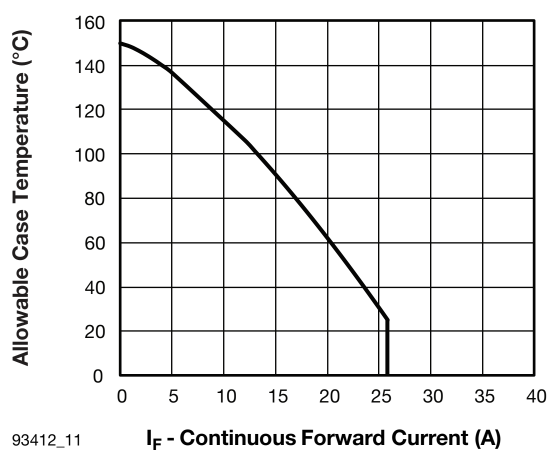


Fig. 11 - Maximum Continuous Forward Current vs. Case Temperature PFC Diode

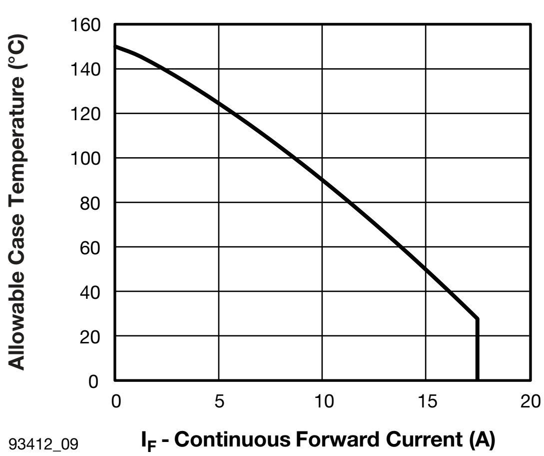


Fig. 9 - Maximum Continuous Forward Current vs. Case Temperature Antiparallel Diode

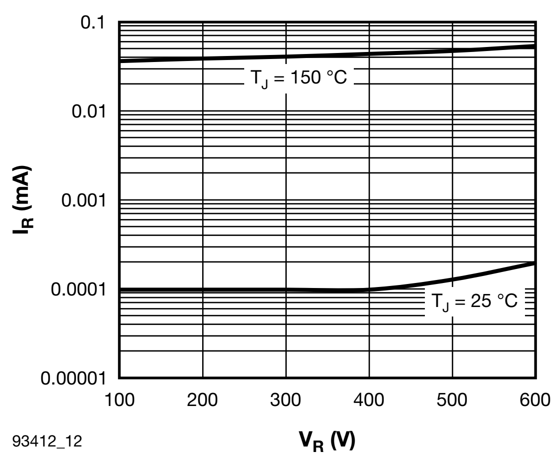


Fig. 12 - Typical FRED Pt Chopper Diode Reverse Current vs. Reverse Voltage

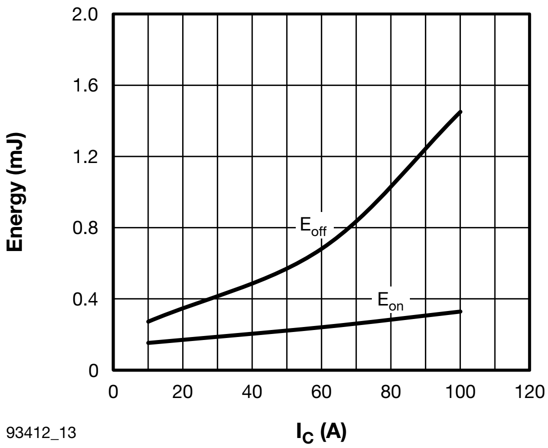


Fig. 13 - Typical IGBT Energy Loss vs. I_C
T_J = 125 °C, V_{CC} = 360 V, V_{GE} = 15 V, L = 500 μH, R_g = 5 Ω

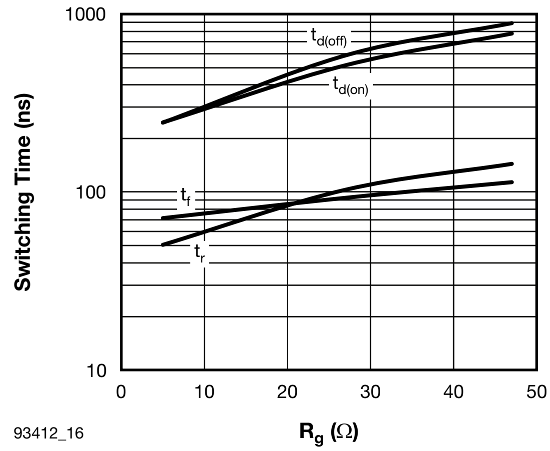


Fig. 16 - Typical IGBT Switching Time vs. R_g, T_J = 125 °C
I_C = 100 A, V_{CE} = 360 V, V_{GE} = 15 V, L = 500 μH

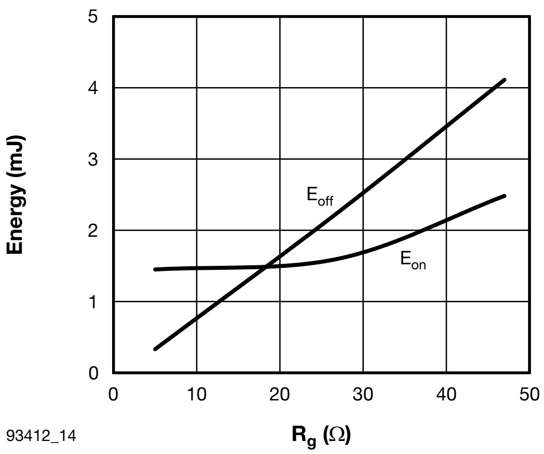


Fig. 14 - Typical IGBT Energy Loss vs. R_g, T_J = 125 °C
I_C = 100 A, V_{CC} = 360 V, V_{GE} = 15 V, L = 500 μH, R_g = 5 Ω

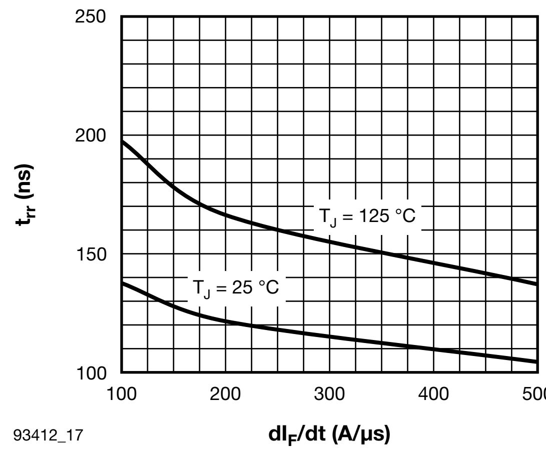


Fig. 17 - Typical t_{rr} Antiparallel Diode vs. dI_F/dt
V_{rr} = 200 V, I_F = 60 A

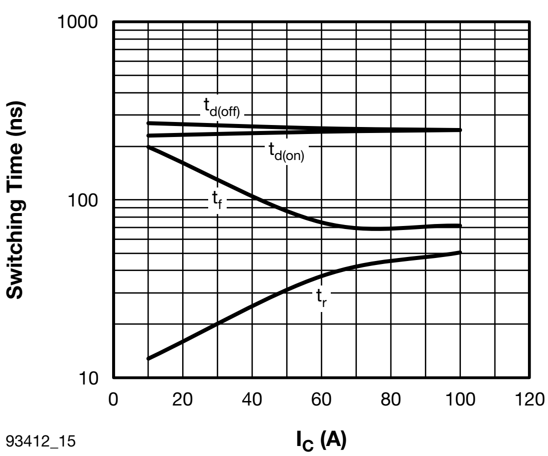


Fig. 15 - Typical IGBT Switching Time vs. I_C
T_J = 125 °C, V_{DD} = 360 V, V_{GE} = 15 V, L = 500 μH, R_g = 5 Ω

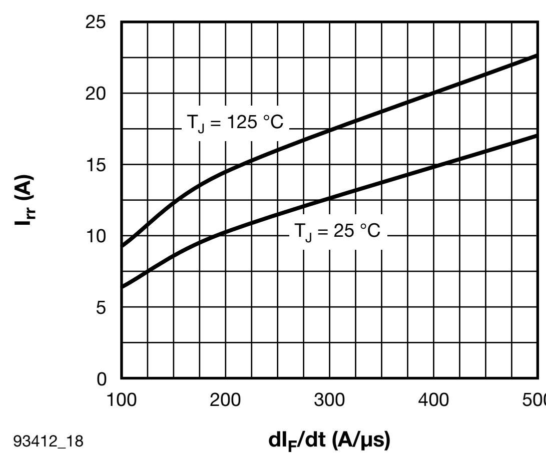


Fig. 18 - Typical I_{rr} Antiparallel Diode vs. dI_F/dt
V_{rr} = 200 V, I_F = 60 A

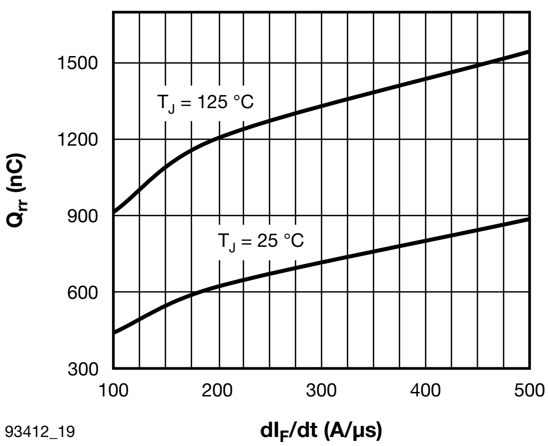


Fig. 19 - Typical Q_{rr} Antiparallel Diode vs. dI_F/dt
V_{rr} = 200 V, I_F = 60 A

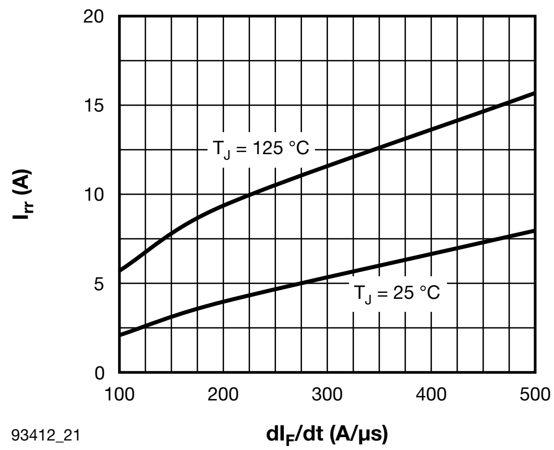


Fig. 21 - Typical I_{rr} Chopper Diode vs. dI_F/dt
V_{rr} = 200 V, I_F = 60 A

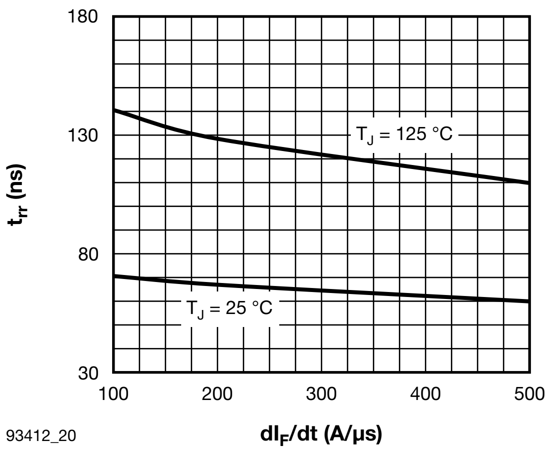


Fig. 20 - Typical t_{rr} Chopper Diode vs. dI_F/dt
V_{rr} = 200 V, I_F = 60 A

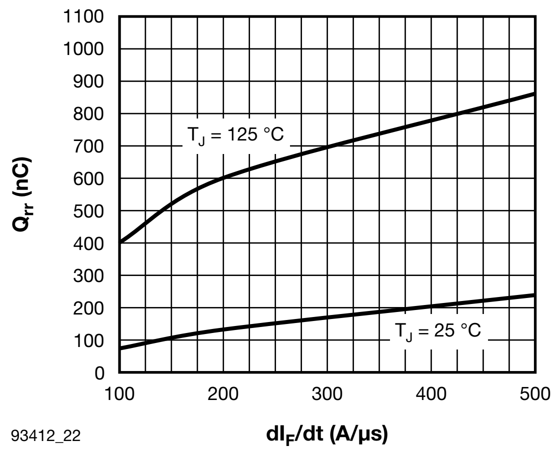


Fig. 22 - Typical Q_{rr} Chopper Diode vs. dI_F/dt
V_{rr} = 200 V, I_F = 40 A

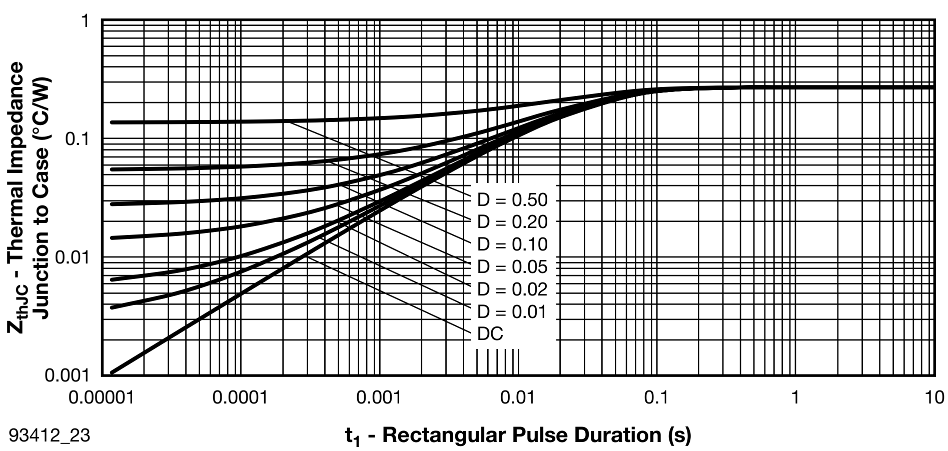


Fig. 23 - Maximum Thermal Impedance Z_{thJC} Characteristics (IGBT)

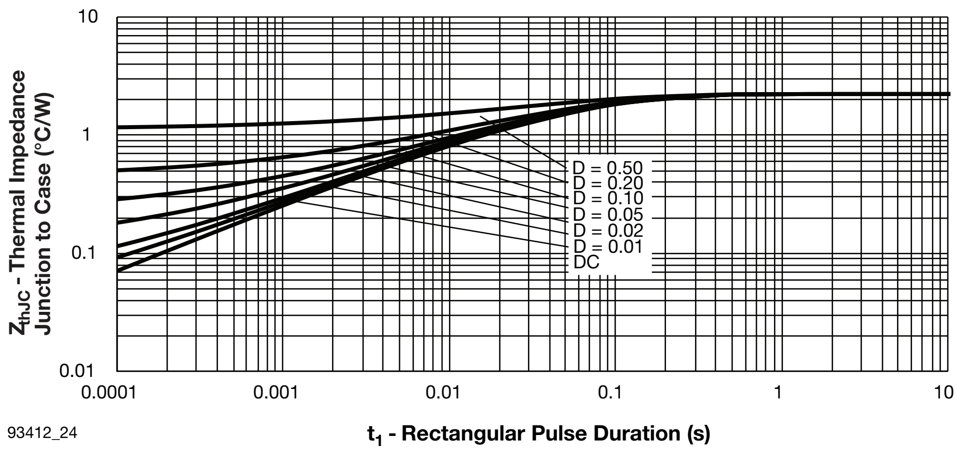


Fig. 24 - Maximum Thermal Impedance Z_{thJC} Characteristics (PFC Diode)

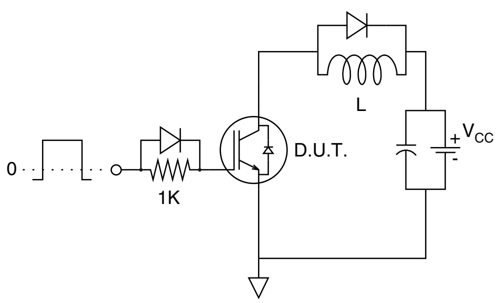


Fig. 25 - Gate Charge Circuit (Turn-Off)

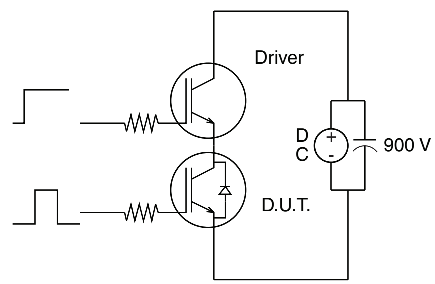


Fig. 27 - S.C. SOA Circuit

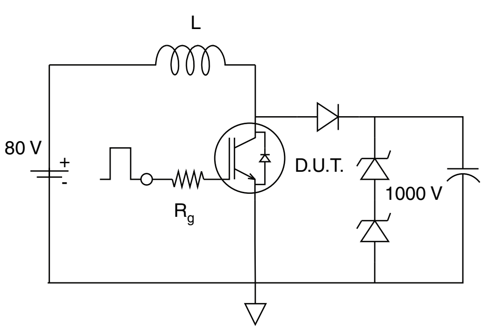


Fig. 26 - RBSOA Circuit

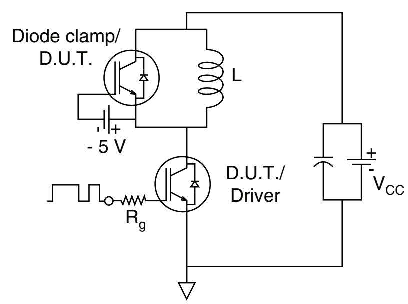


Fig. 28 - Switching Loss Circuit

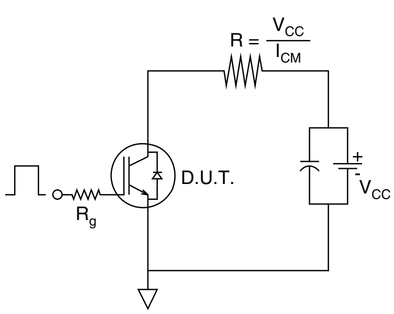
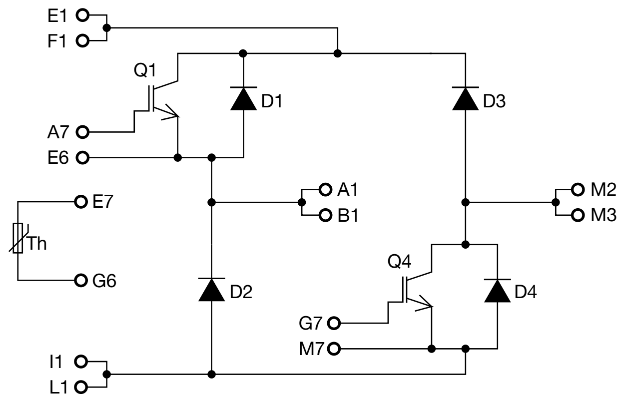


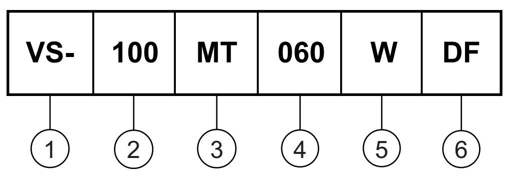
Fig. 29 - Resistive Load Circuit

CIRCUIT CONFIGURATION



ORDERING INFORMATION TABLE

Device code

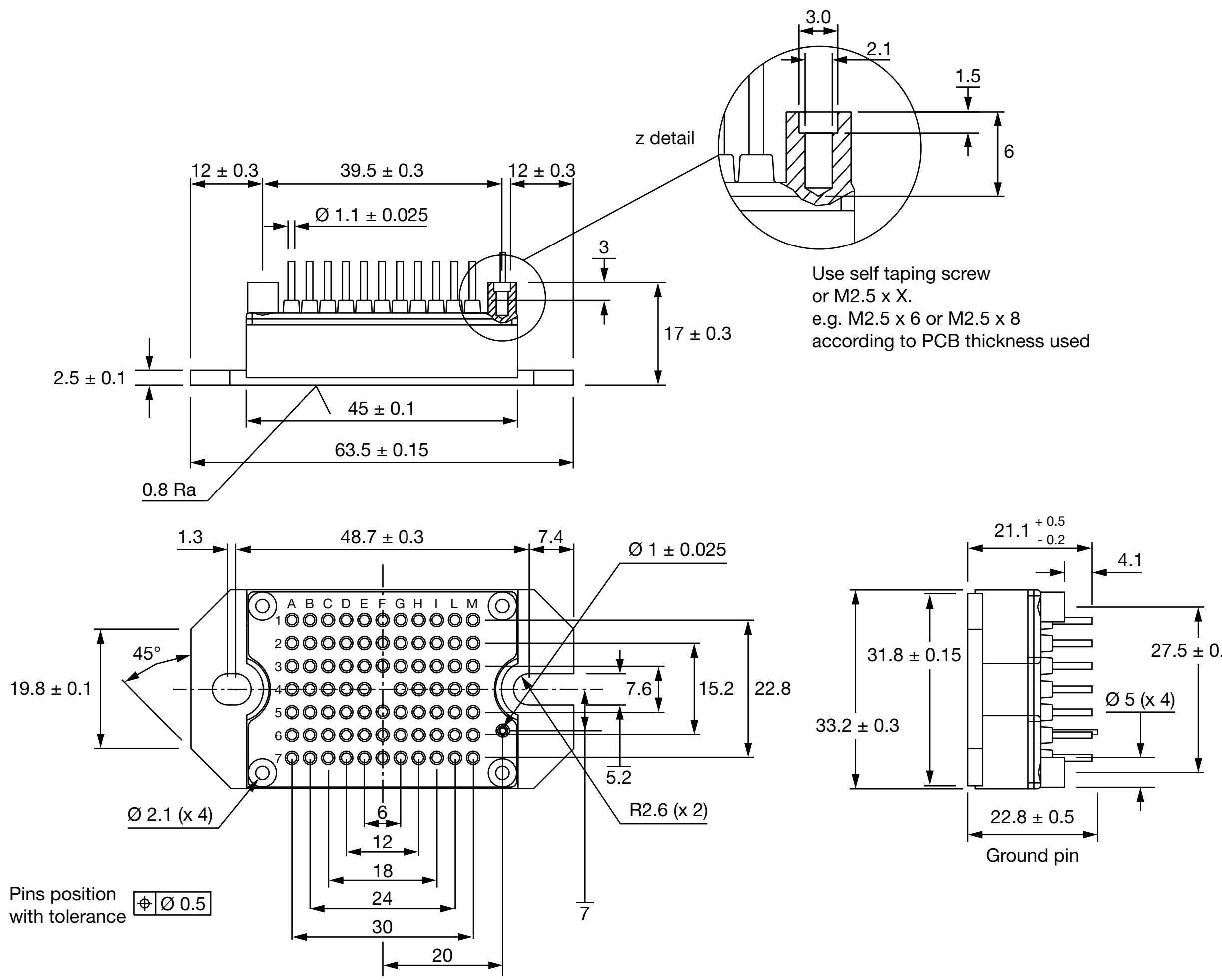


1	-	Vishay Semiconductors product
2	-	Current rating (100 = 100 A)
3	-	Essential part number (MT = MTP package)
4	-	Voltage code x 10 = Voltage rating (example: 060 = 600 V)
5	-	Die IGBT technology (W = Warp Speed IGBT)
6	-	Circuit configuration (DF = Dual forward)

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95383

MTP - Full Pin

DIMENSIONS in millimeters



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.