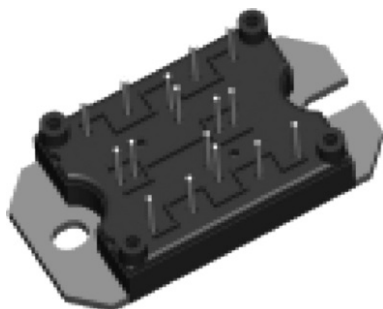


"Full Bridge" FREDFET MTP (Power MOSFET), 31 A



MTP

FEATURES

- Low on-resistance
- High performance optimized built-in fast recovery diodes
- Fully characterized capacitance and avalanche voltage and current
- Al_2O_3 DBC
- Very low stray inductance design for high speed operation
- UL approved file E78996 
- Compliant to RoHS directive 2002/95/EC



RoHS
COMPLIANT

PRODUCT SUMMARY

V_{DSS}	500 V
$R_{\text{DS(on)}}$	0.25 Ω
I_{D}	31 A
Type	Modules - MOSFET
Package	MTP

BENEFITS

- Low gate charge Q_{g} results in simple drive requirement
- Improved gate, avalanche and dynamic dV/dt ruggedness
- Low t_{rr} and soft diode reverse recovery
- Optimized for welding, UPS and SMPS applications
- Outstanding ZVS and high frequency operation
- Direct mounting to heatsink
- PCB solderable terminals
- Very low junction to case thermal resistance

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Continuous drain current at V_{GS} 10 V	I_{D}	$T_{\text{C}} = 25\text{ }^{\circ}\text{C}$	31	A
		$T_{\text{C}} = 100\text{ }^{\circ}\text{C}$	19	
Pulsed drain current	$I_{\text{DM}}^{(1)}$		124	
Maximum power dissipation	P_{D}	$T_{\text{C}} = 25\text{ }^{\circ}\text{C}$	1140	W
		$T_{\text{C}} = 100\text{ }^{\circ}\text{C}$	456	
Gate to source voltage	V_{GS}		± 30	V
RMS isolation voltage	V_{ISOL}	Any terminal to case, $t = 1\text{ min}$	2500	
Peak diode recovery dV/dt	$\text{dV/dt}^{(2)}$		15	V/ns
Operating junction temperature range	T_{J}		- 55 to + 150	$^{\circ}\text{C}$
Operating storage temperature range	T_{Stg}		- 55 to + 125	$^{\circ}\text{C}$

Notes

⁽¹⁾ Repetitive rating; pulse width limited by maximum junction temperature

⁽²⁾ $I_{\text{SD}} \leq 31\text{ A}$, $\text{dI/dt} \leq 340\text{ A/}\mu\text{s}$, $V_{\text{DD}} \leq V_{(\text{BR})\text{DSS}}$, $T_{\text{J}} \leq 150\text{ }^{\circ}\text{C}$

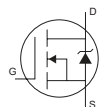
ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Drain to source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	500	-	-	V
Temperature coefficient of breakdown voltage	$\Delta V_{(BR)DSS}/\Delta T_J$	$I_D = 4\text{ mA}$, reference to $T_J = 25\text{ }^{\circ}\text{C}$	-	0.48	-	V/ $^{\circ}\text{C}$
Static drain to source on-resistance	$R_{DS(on)}^{(1)}$	$V_{GS} = 10\text{ V}$, $I_D = 19\text{ A}$	-	0.19	0.22	Ω
		$V_{GS} = 10\text{ V}$, $I_D = 31\text{ A}$	-	0.21	0.25	
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	3.0	-	6.0	V
Drain to source leakage current	$I_{DSS}^{(2)}$	$V_{DS} = 500\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	50	μA
		$V_{DS} = 400\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125\text{ }^{\circ}\text{C}$	-	-	2	mA
Gate to source forward leakage	I_{GSS}	$V_{GS} = 30\text{ V}$	-	-	150	nA
Gate to source reverse leakage		$V_{GS} = -30\text{ V}$	-	-	-150	

Notes(1) Pulse width $\leq 400\text{ }\mu\text{s}$, duty cycle $\leq 2\%$ (2) I_{CES} includes also opposite leg overall leakage**DYNAMIC CHARACTERISTICS** ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Forward transconductance	g_{fs}	$V_{DS} = 50\text{ V}$, $I_D = 19\text{ A}$	-	26	-	S
Total gate charge	$Q_g^{(1)}$	$I_D = 31\text{ A}$ $V_{DS} = 400\text{ V}$ $V_{GS} = 10\text{ V}$	-	105	160	nC
Gate to source charge	$Q_{gs}^{(1)}$		-	36	55	
Gate to drain ("Miller") charge	$Q_{gd}^{(1)}$		-	46	70	
Turn-on delay time	$t_{d(on)}$	$I_D = 31\text{ A}$ $V_{DS} = 250\text{ V}$ $V_{GS} = 10\text{ V}$ $R_g = 4.3\text{ }\Omega$	-	49	74	ns
Turn-off delay time	$t_{d(off)}$		-	80	120	
Rise time	t_r		-	165	250	
Fall time	t_f		-	76	115	
Input capacitance	C_{iss}	$V_{GS} = 0\text{ V}$ $V_{DS} = 25\text{ V}$ $f = 1.0\text{ MHz}$	-	4808	7210	pF
Output capacitance	C_{oss}		-	1165	1750	
Reverse transfer capacitance	C_{rss}		-	40	60	

Note(1) Pulse width $\leq 400\text{ }\mu\text{s}$, duty cycle $\leq 2\%$ **DIODE CHARACTERISTICS** ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Continuous source current (body diode)	I_S	MOSFET symbol showing the integral reverse p-n junction diode 	-	-	31	A
Pulsed source current (body diode)	$I_{SM}^{(1)}$		-	-	124	
Diode forward voltage	$V_{SD}^{(2)}$	$T_J = 25\text{ }^{\circ}\text{C}$, $I_S = 31\text{ A}$, $V_{GS} = 0\text{ V}$	-	1.01	1.1	V
Reverse recovery time	t_{rr}	$T_J = 125\text{ }^{\circ}\text{C}$, $I_F = 31\text{ A}$; $dI/dt = 100\text{ A}/\mu\text{s}^{(2)}$	-	252	378	ns
Reverse recovery charge	Q_{rr}		-	1619	2428	nC

Notes

(1) Repetitive rating; pulse width limited by maximum junction temperature

(2) Pulse width $\leq 400\text{ }\mu\text{s}$, duty cycle $\leq 2\%$

**AVALANCHE CHARACTERISTICS**

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS
Single pulse avalanche energy	$E_{AS}^{(1)}$	-	-	493	mJ
Avalanche current	$I_{AR}^{(2)}$	-	-	31	A
Repetitive avalanche energy	$E_{AR}^{(2)}$	-	-	114	mJ

Notes

⁽¹⁾ Starting $T_J = 25\text{ }^{\circ}\text{C}$, $L = 1.0\text{ mH}$, $R_g = 25\text{ }\Omega$, $I_{AS} = 31\text{ A}$

⁽²⁾ Repetitive rating; pulse width limited by maximum junction temperature

THERMAL - MECHANICAL SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	T_J		- 40	-	150	$^{\circ}\text{C}$
Storage temperature range	T_{Stg}		- 40	-	125	
Junction to case per MOSFET	R_{thJC}		-	-	0.44	$^{\circ}\text{C/W}$
Case to sink	R_{thCS}	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	
Clearance ⁽¹⁾		External shortest distance in air between 2 terminals	5.5	-	-	mm
Creepage ⁽¹⁾		Shortest distance along external surface of the insulating material between 2 terminals	8	-	-	
Weight			-	66	-	g

Note

⁽¹⁾ Standard version only i.e. without optional thermistor

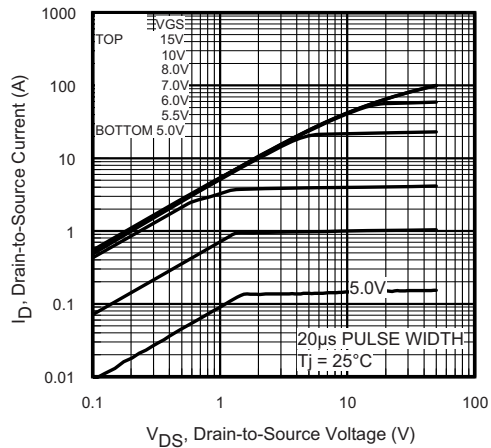


Fig. 1 - Typical Output Characteristics

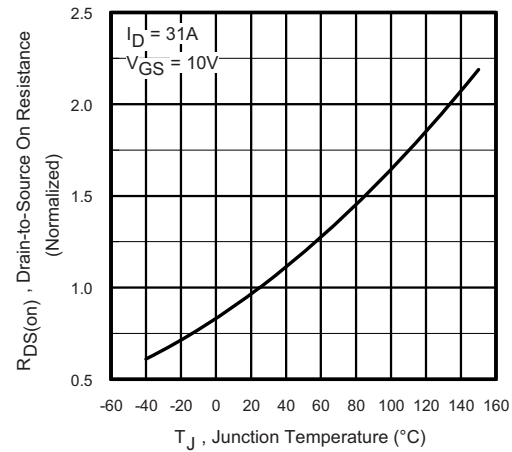


Fig. 4 - Normalized On-Resistance vs. Temperature

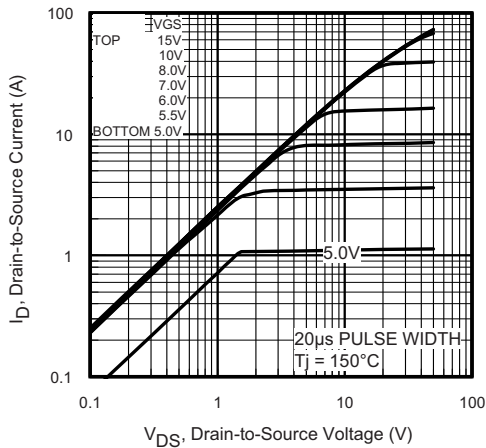


Fig. 2 - Typical Output Characteristics

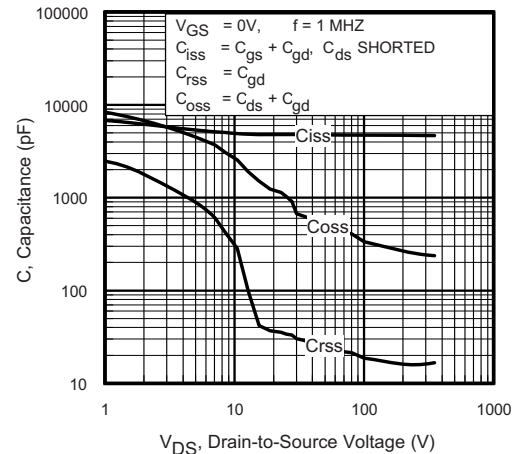


Fig. 5 - Typical Capacitance vs. Drain to Source Voltage

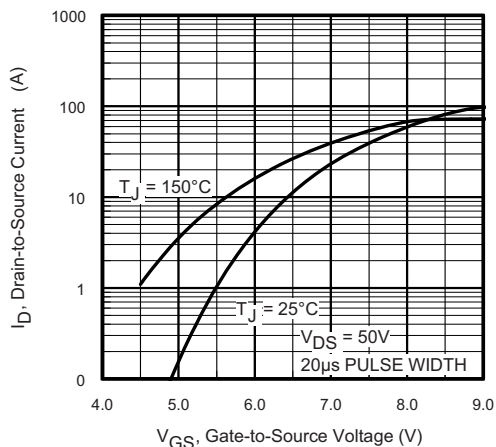


Fig. 3 - Typical Transfer Characteristics

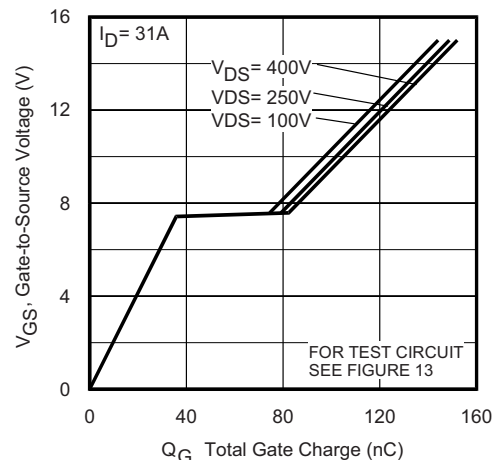


Fig. 6 - Typical Gate Charge vs. Gate to Source Voltage

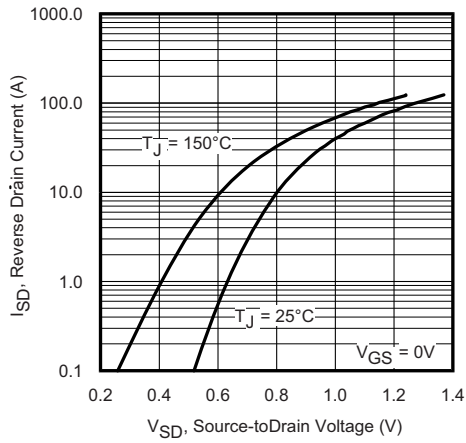


Fig. 7 - Typical Source Drain Diode Forward Voltage

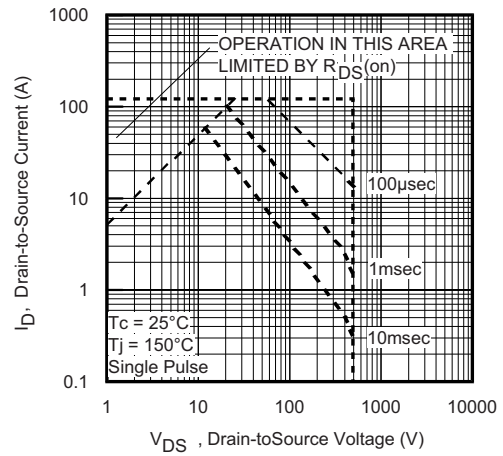


Fig. 8 - Maximum Safe Operating Area

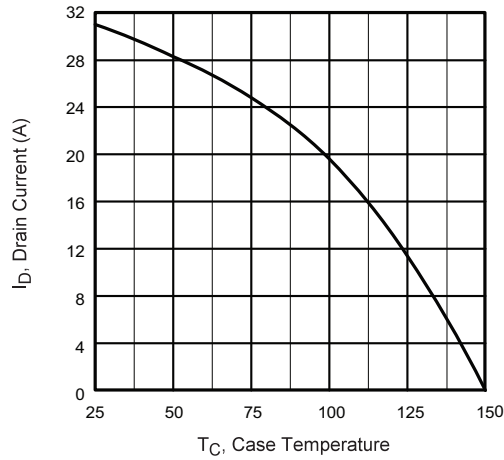


Fig. 9 - Maximum Drain Current vs. Case Temperature

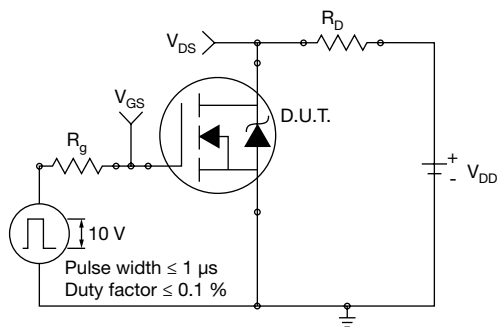


Fig. 10a - Switching Time Test Circuit

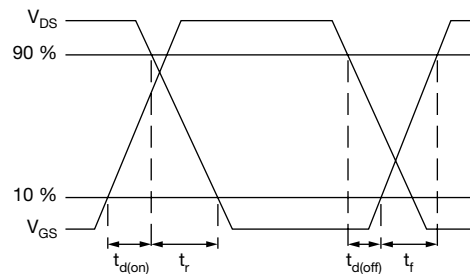


Fig. 10b - Switching Time Waveforms

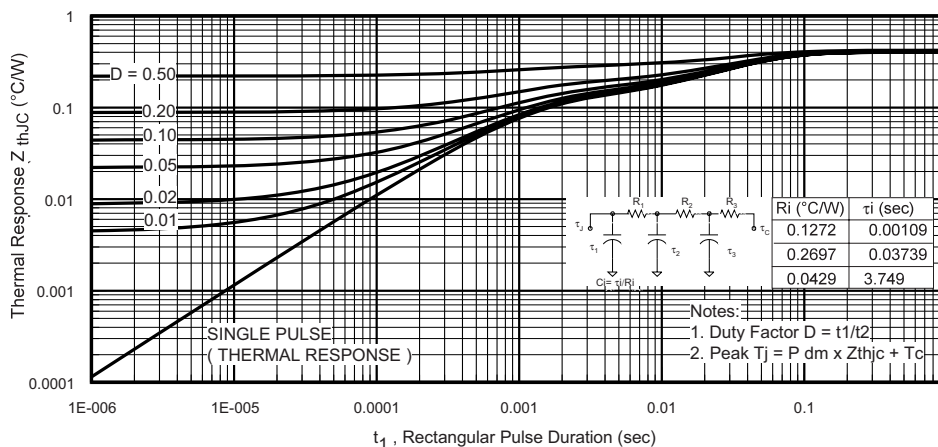


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction to Case

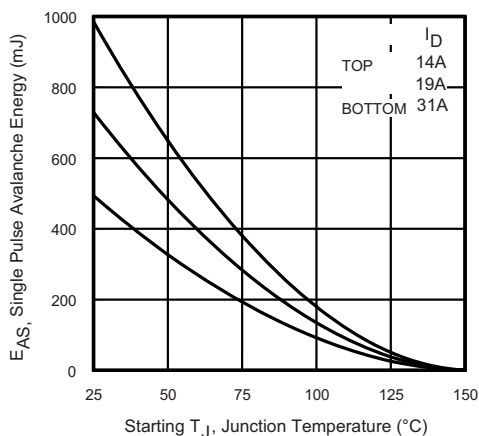


Fig. 12a - Maximum Avalanche Energy vs. Drain Current

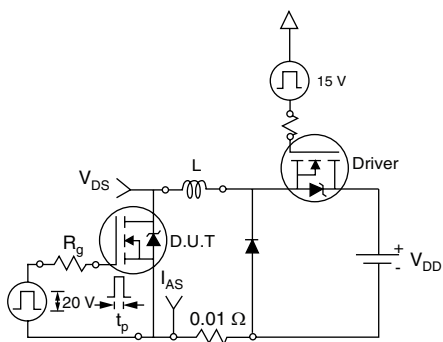


Fig. 12b - Unclamped Inductive Test Circuit

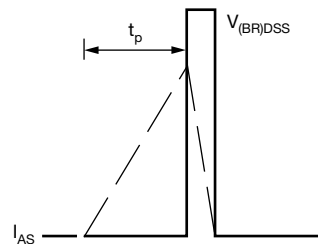


Fig. 12c - Unclamped Inductive Waveforms

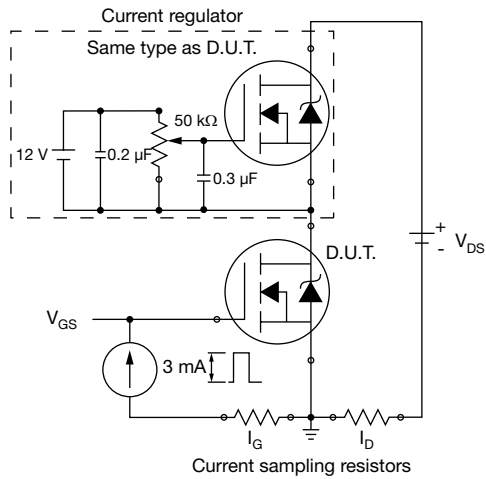


Fig. 13a - Gate Charge Test Circuit

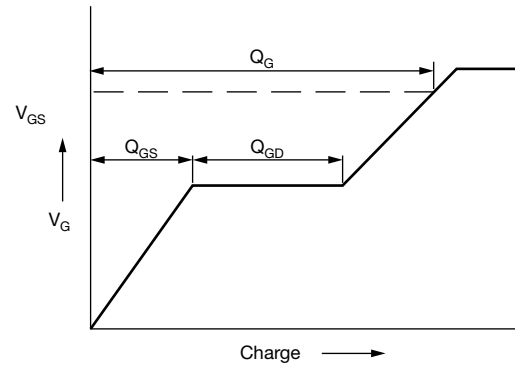


Fig. 13b - Basic Gate Charge Waveform

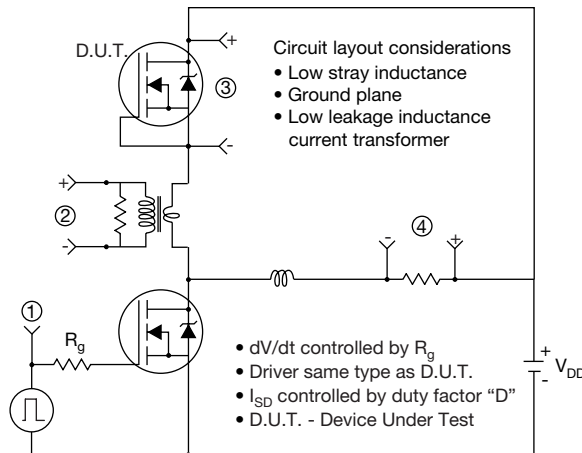


Fig. 14 - Peak Diode Recovery dV/dt Test Circuit

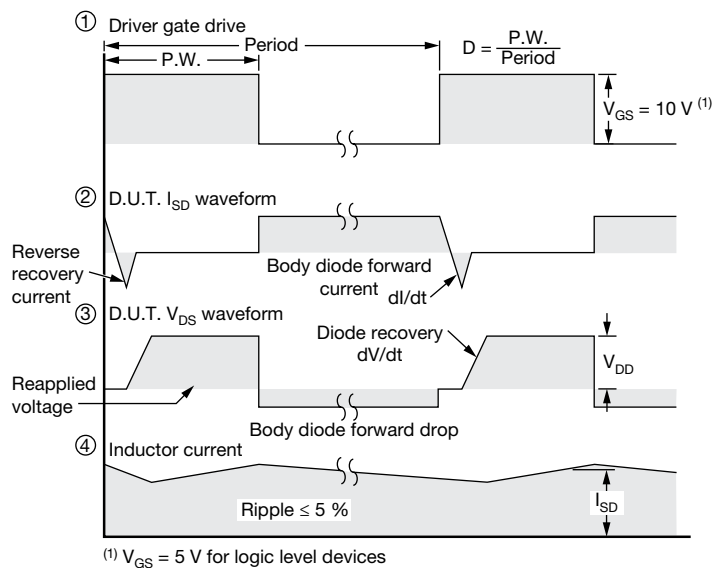


Fig. 15 - For N-Channel Power MOSFETs

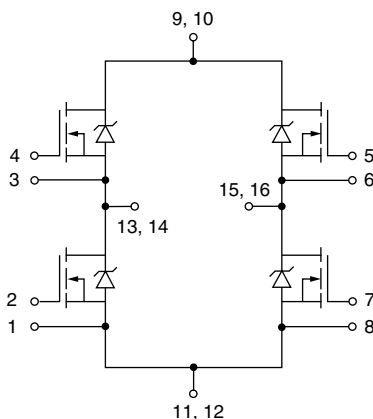


Fig. 16 - Electrical diagram

ORDERING INFORMATION TABLE

Device code	19	MT	050	X	F	A	PbF
	①	②	③	④	⑤	⑥	⑦

- 1** - Current rating
- 2** - Essential part number
- 3** - Voltage code (050 = 500 V)
- 4** - Speed/type (X = Power MOSFET)
- 5** - Circuit configuration
(F = Full bridge - see Circuit Configuration table)
- 6** - A = Al₂O₃ DBC substrate
- 7** - PbF = Lead (Pb)-free

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Full bridge	F	

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95245

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 and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. 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.