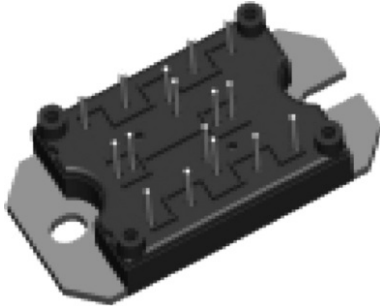


## "Full Bridge" FREDFET MTP (Power MOSFET), 31 A



MTP

### FEATURES

- Low on-resistance
- High performance optimized built-in fast recovery diodes
- Fully characterized capacitance and avalanche voltage and current
- Al<sub>2</sub>O<sub>3</sub> 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 <sub>DSS</sub>	500 V
R <sub>DS(on)</sub>	0.25 Ω
I <sub>D</sub>	31 A
Type	Modules - MOSFET
Package	MTP

### BENEFITS

- Low gate charge Q<sub>g</sub> results in simple drive requirement
- Improved gate, avalanche and dynamic dV/dt ruggedness
- Low t<sub>rr</sub> 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 <sub>GS</sub> 10 V	I <sub>D</sub>	T <sub>C</sub> = 25 °C	31	A
		T <sub>C</sub> = 100 °C	19	
Pulsed drain current	I <sub>DM</sub> <sup>(1)</sup>		124	
Maximum power dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	1140	W
		T <sub>C</sub> = 100 °C	456	
Gate to source voltage	V <sub>GS</sub>		± 30	V
RMS isolation voltage	V <sub>ISOL</sub>	Any terminal to case, t = 1 min	2500	
Peak diode recovery dV/dt	dV/dt <sup>(2)</sup>		15	V/ns
Operating junction temperature range	T <sub>J</sub>		- 55 to + 150	°C
Operating storage temperature range	T <sub>Stg</sub>		- 55 to + 125	°C

**Notes**

<sup>(1)</sup> Repetitive rating; pulse width limited by maximum junction temperature  
<sup>(2)</sup> I<sub>SD</sub> ≤ 31 A, di/dt ≤ 340 A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>J</sub> ≤ 150 °C

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ 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	$\Omega$
		$V_{GS} = 10\text{ V}, I_D = 31\text{ A}$	-	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	$\mu\text{A}$
		$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	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	

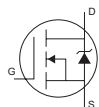
**Notes**

- (1) Pulse width  $\leq 400\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$
- (2)  $I_{CES}$  includes also opposite leg overall leakage

<b>DYNAMIC CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ 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	$C_{iss}$	$V_{GS} = 0\text{ V}$	-	4808	7210	pF
Output capacitance	$C_{oss}$	$V_{DS} = 25\text{ V}$	-	1165	1750	
Reverse transfer capacitance	$C_{rss}$	$f = 1.0\text{ MHz}$	-	40	60	

**Note**

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

<b>DIODE CHARACTERISTICS</b> ( $T_J = 25\text{ }^\circ\text{C}$ 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  $\leq 2\%$



<b>AVALANCHE CHARACTERISTICS</b>					
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

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Operating junction temperature range	$T_J$		- 40	-	150	°C
Storage temperature range	$T_{Stg}$		- 40	-	125	
Junction to case per MOSFET	$R_{thJC}$		-	-	0.44	°C/W
Case to sink	$R_{thCS}$	Heatsink compound thermal conductivity = 1 W/mK	-	0.06	-	
Clearance <sup>(1)</sup>		External shortest distance in air between 2 terminals	5.5	-	-	mm
Creepage <sup>(1)</sup>		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

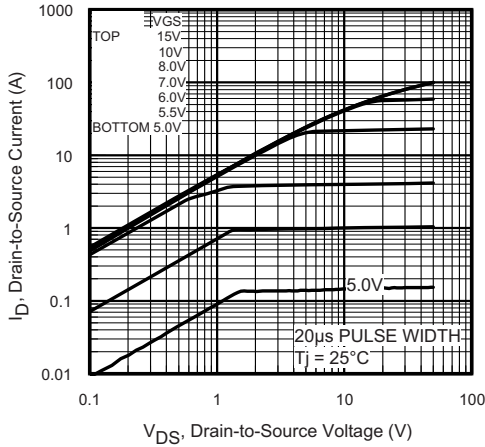


Fig. 1 - Typical Output Characteristics

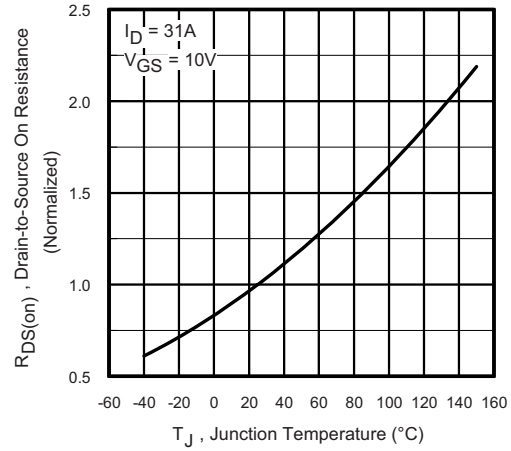


Fig. 4 - Normalized On-Resistance vs. Temperature

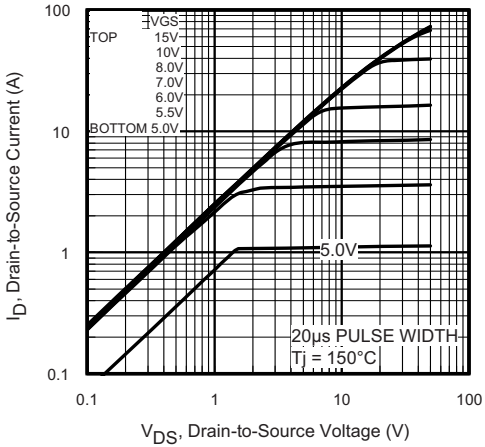


Fig. 2 - Typical Output Characteristics

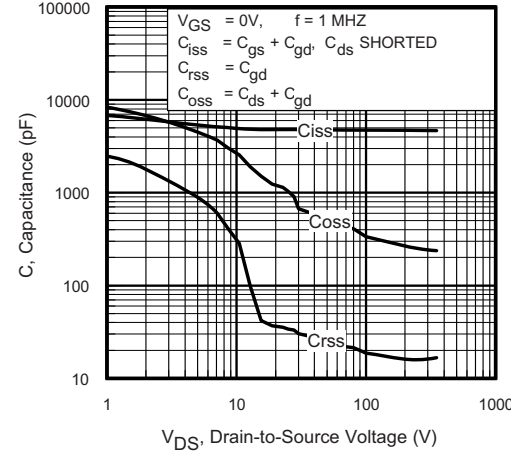


Fig. 5 - Typical Capacitance vs. Drain to Source Voltage

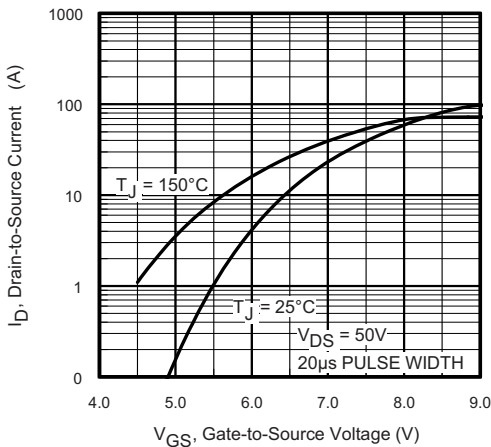


Fig. 3 - Typical Transfer Characteristics

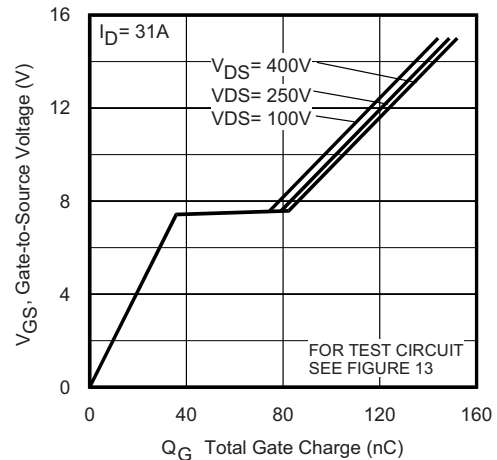


Fig. 6 - Typical Gate Charge vs. Gate to Source Voltage

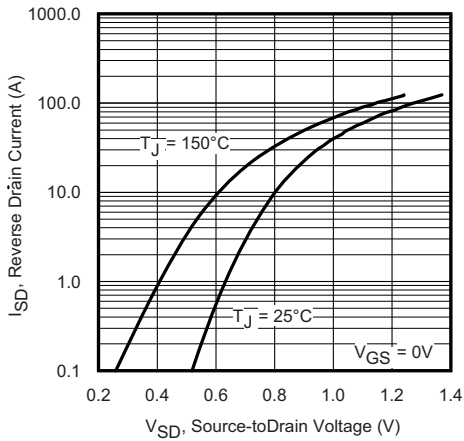


Fig. 7 - Typical Source Drain Diode Forward Voltage

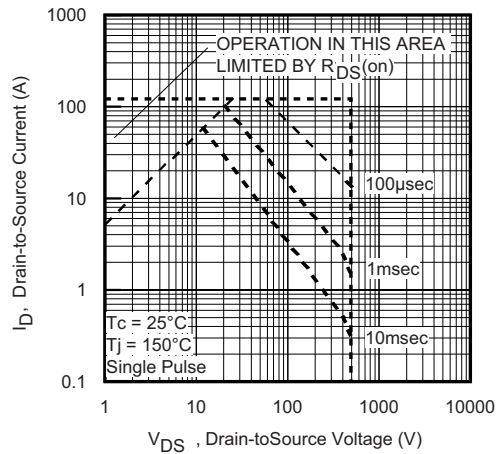


Fig. 8 - Maximum Safe Operating Area

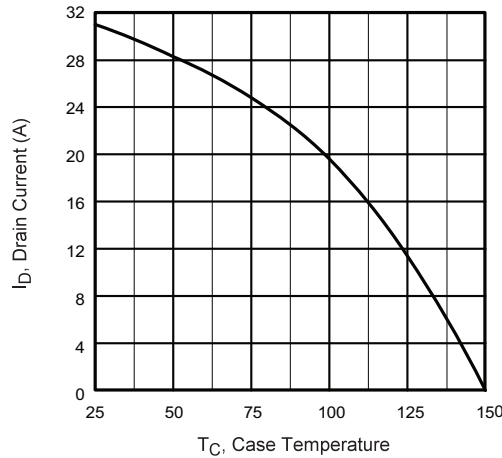


Fig. 9 - Maximum Drain Current vs. Case Temperature

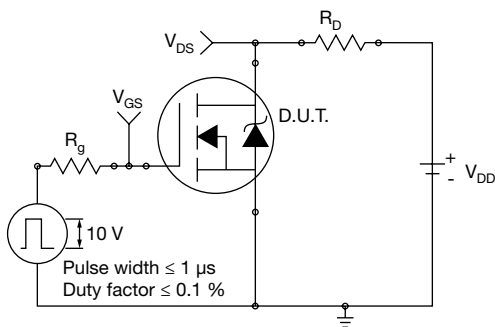


Fig. 10a - Switching Time Test Circuit

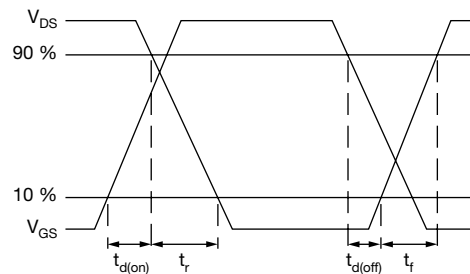


Fig. 10b - Switching Time Waveforms

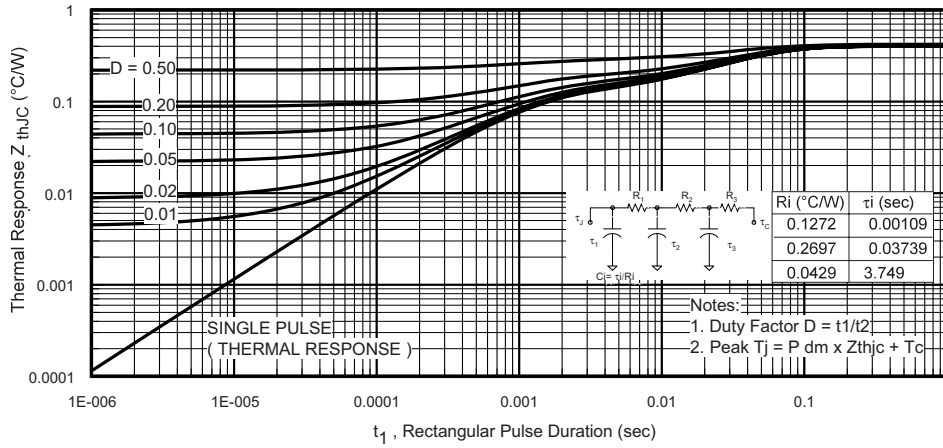


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction to Case

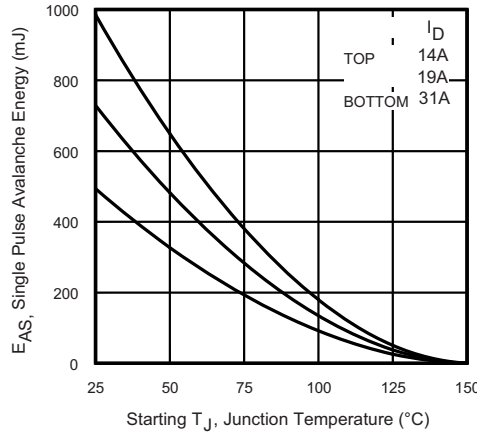


Fig. 12a - Maximum Avalanche Energy vs. Drain Current

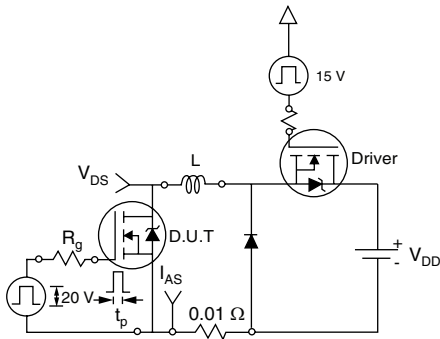


Fig. 12b - Unclamped Inductive Test Circuit

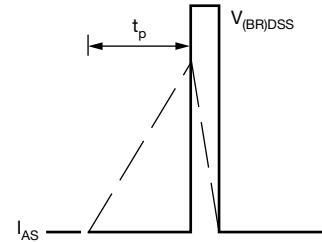


Fig. 12c - Unclamped Inductive Waveforms

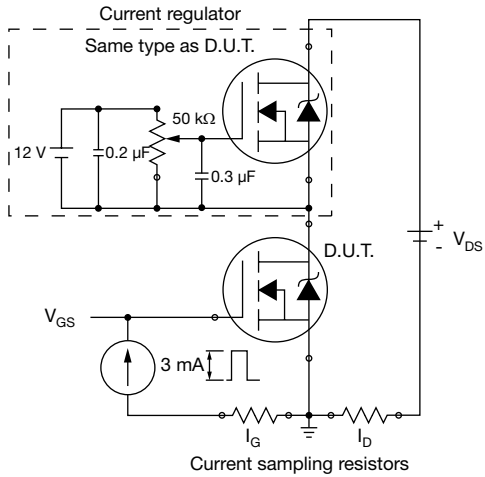


Fig. 13a - Gate Charge Test Circuit

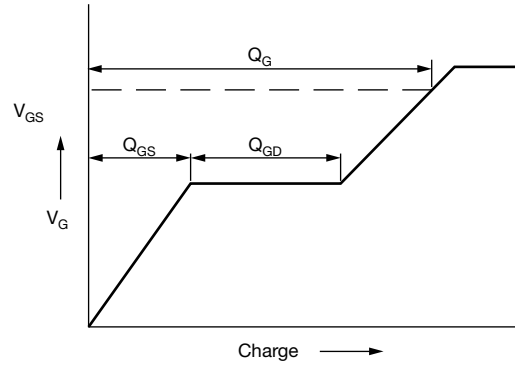


Fig. 13b - Basic Gate Charge Waveform

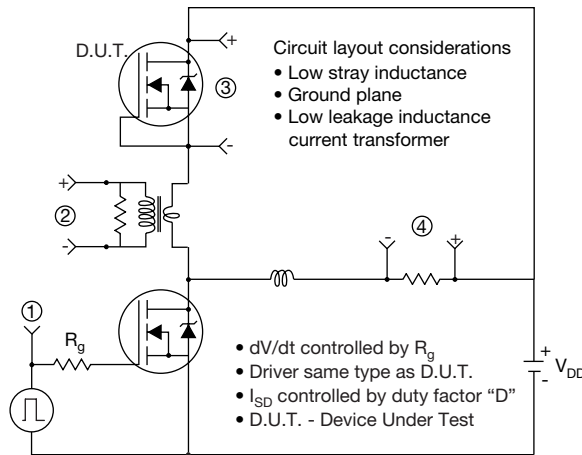


Fig. 14 - Peak Diode Recovery dV/dt Test Circuit

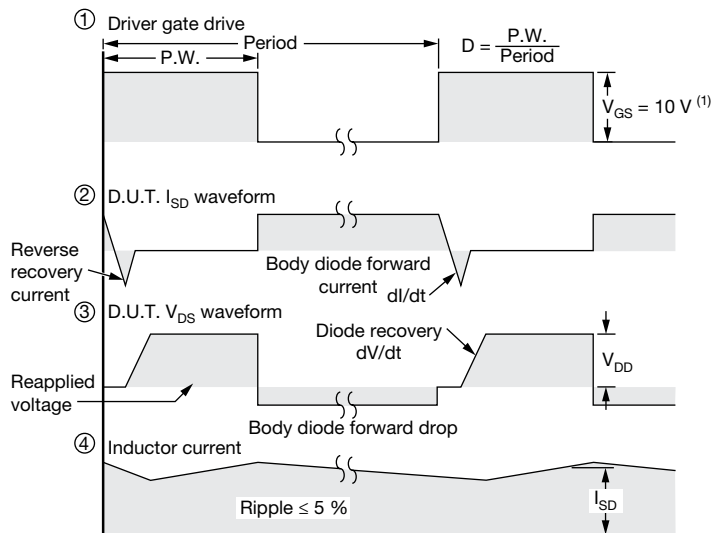

 (1)  $V_{GS} = 5\text{ V}$  for logic level devices

Fig. 15 - For N-Channel Power MOSFETs

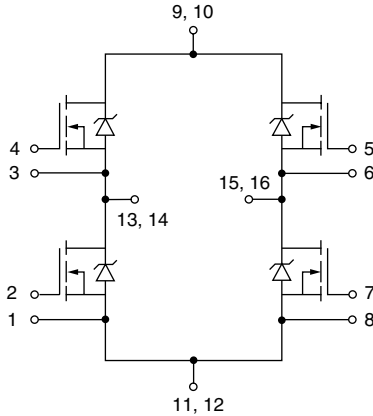


Fig. 16 - Electrical diagram

### ORDERING INFORMATION TABLE

Device code	<b>19</b>	<b>MT</b>	<b>050</b>	<b>X</b>	<b>F</b>	<b>A</b>	<b>PbF</b>
	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 = Al<sub>2</sub>O<sub>3</sub> DBC substrate
- 7** - PbF = Lead (Pb)-free

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Full bridge	F	

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95245">www.vishay.com/doc?95245</a>







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