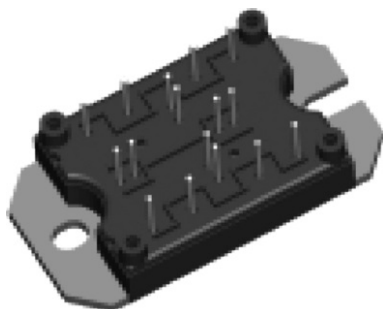


"Full Bridge" FREDFET MTP (Power MOSFET), 31 A



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

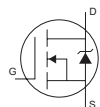
ELECTRICAL CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$ unless otherwise noted)

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

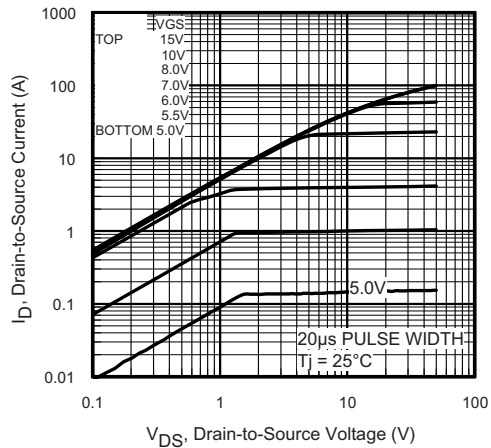


Fig. 1 - Typical Output Characteristics

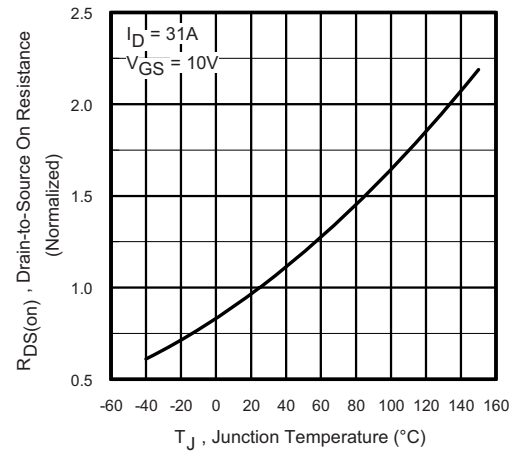


Fig. 4 - Normalized On-Resistance vs. Temperature

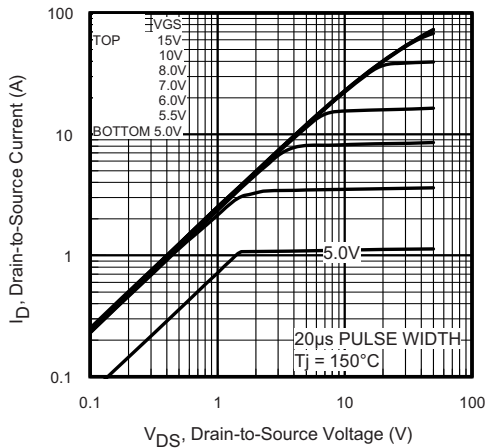


Fig. 2 - Typical Output Characteristics

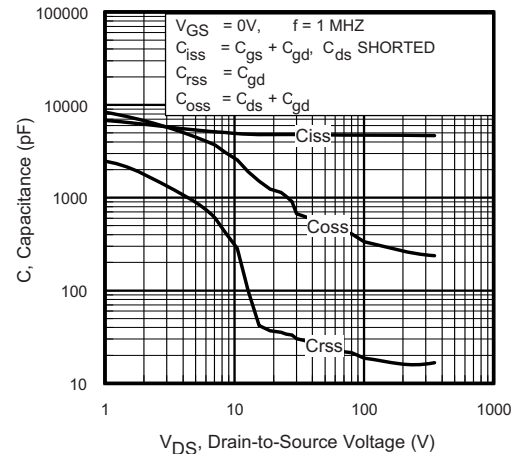


Fig. 5 - Typical Capacitance vs. Drain to Source Voltage

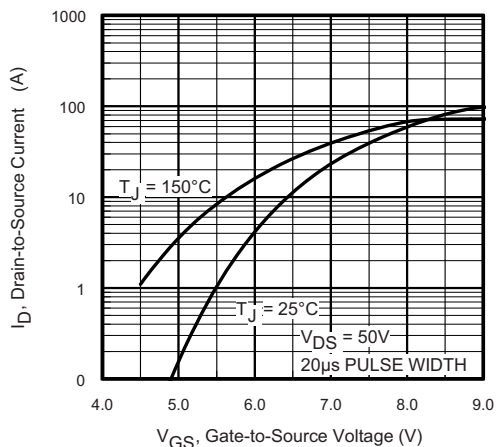


Fig. 3 - Typical Transfer Characteristics

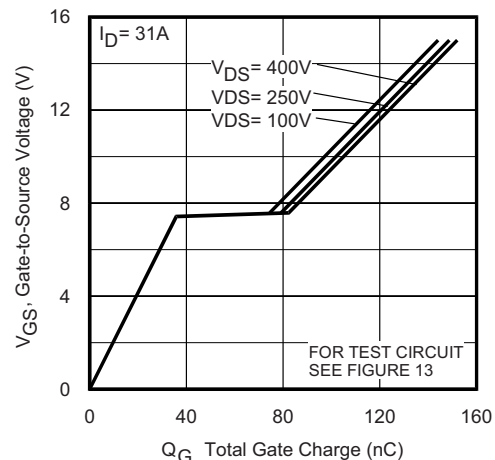


Fig. 6 - Typical Gate Charge vs. Gate to Source Voltage

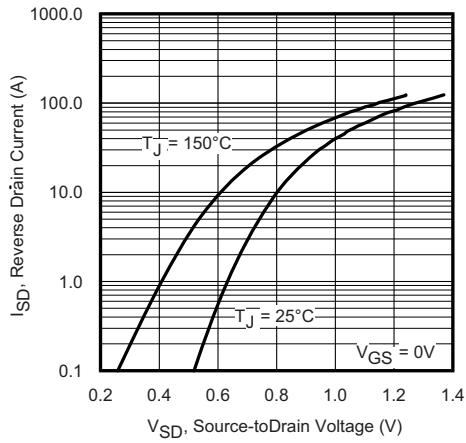


Fig. 7 - Typical Source Drain Diode Forward Voltage

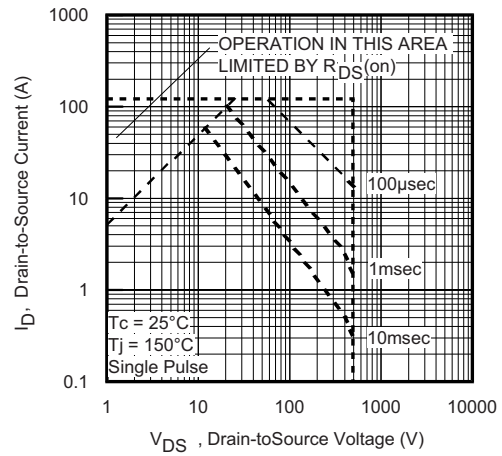


Fig. 8 - Maximum Safe Operating Area

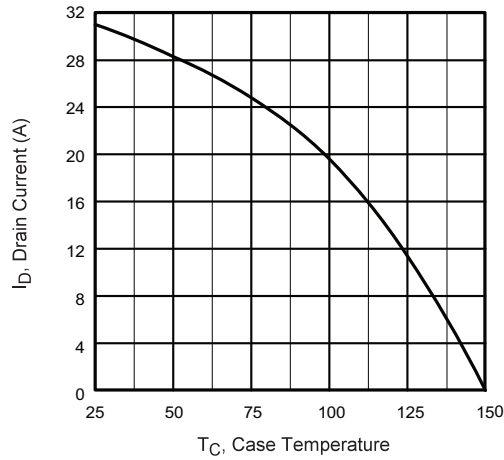


Fig. 9 - Maximum Drain Current vs. Case Temperature

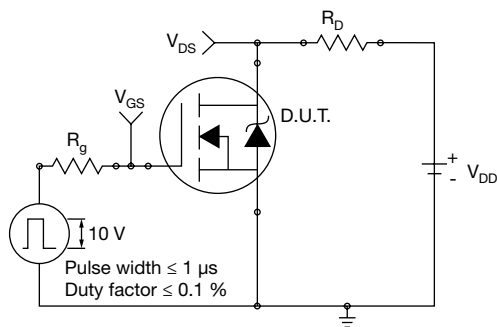


Fig. 10a - Switching Time Test Circuit

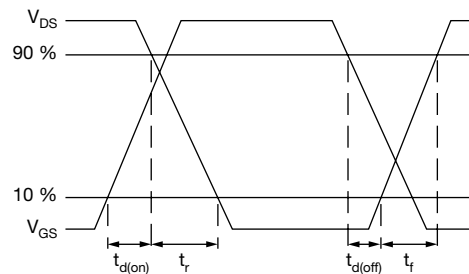


Fig. 10b - Switching Time Waveforms

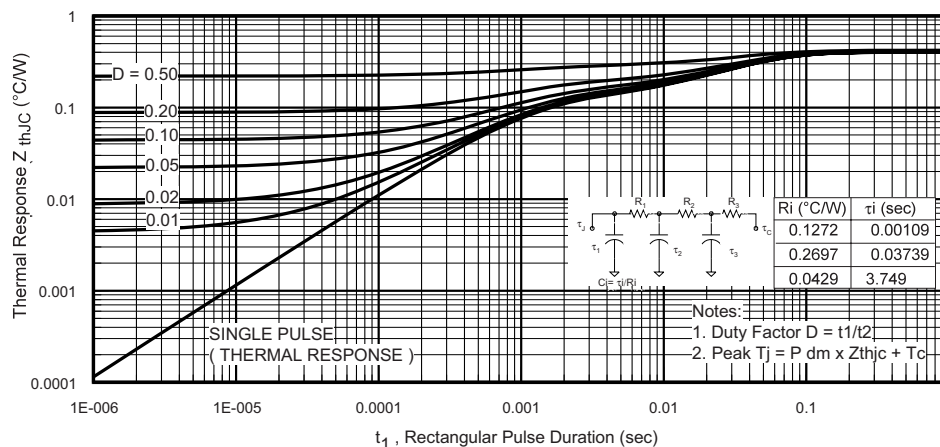


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction to Case

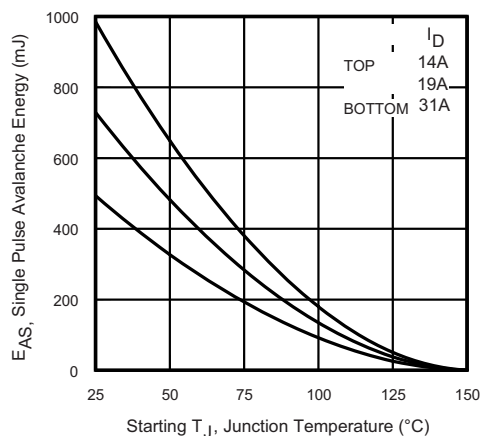


Fig. 12a - Maximum Avalanche Energy vs. Drain Current

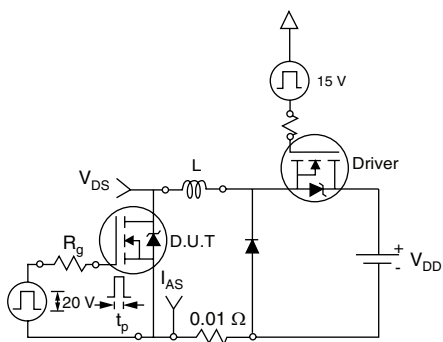


Fig. 12b - Unclamped Inductive Test Circuit

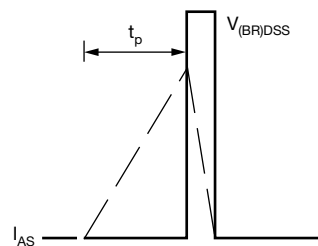


Fig. 12c - Unclamped Inductive Waveforms

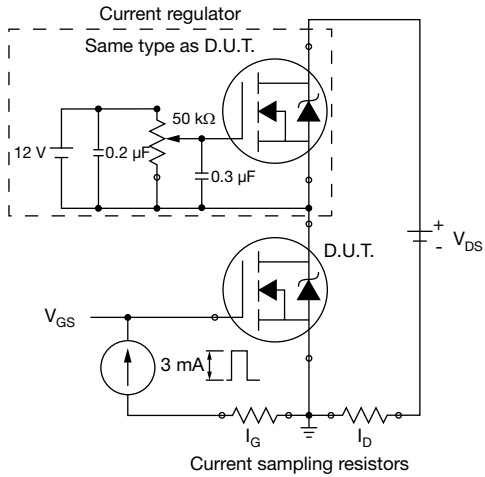


Fig. 13a - Gate Charge Test Circuit

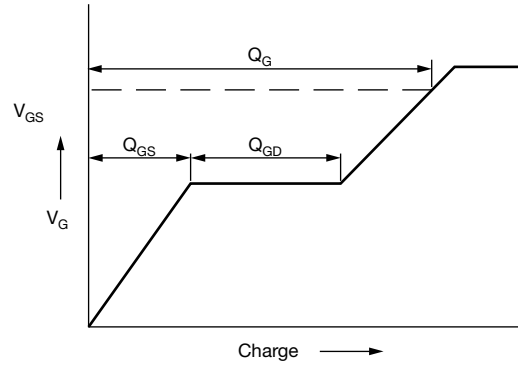


Fig. 13b - Basic Gate Charge Waveform

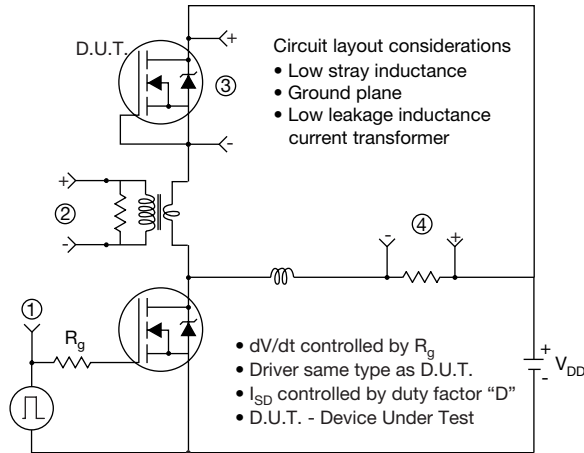


Fig. 14 - Peak Diode Recovery dV/dt Test Circuit

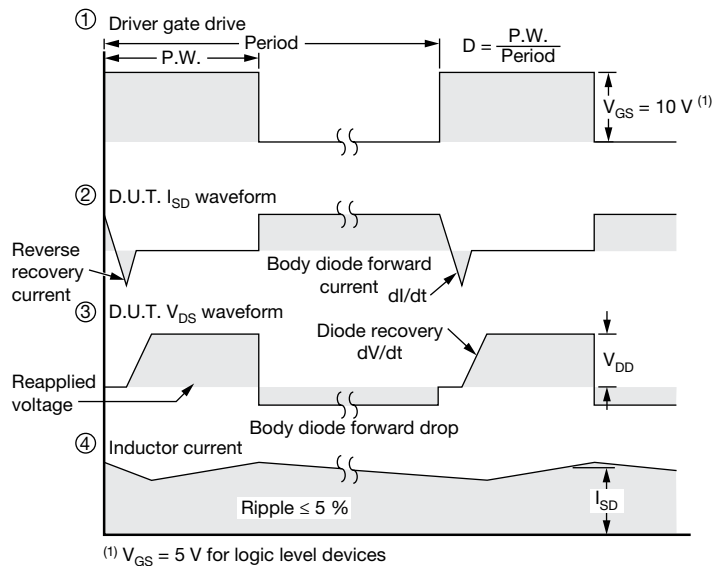


Fig. 15 - For N-Channel Power MOSFETs

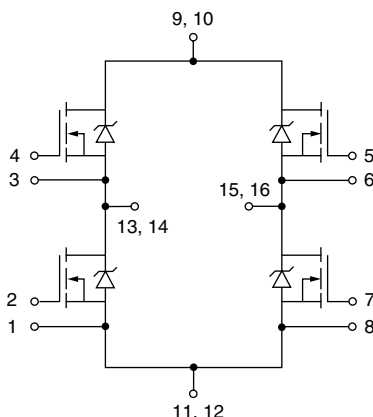


Fig. 16 - Electrical diagram

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





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