VS-ETY020P120F

Vishay Semiconductors

EMIPAK 2B PressFit Full Bridge Inverter Silicon Carbide MOSFET Power Modules



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EMIPAK 2B (package example)

PRIMARY CHARACTERISTICS				
FULL BRIDGE INVERT	ER - Q1 to Q6 MOSFET			
V _{DSS}	1200 V			
$R_{DS(on)}$ typical at $I_D = 20$ A	71 mΩ			
I _D at T _C = 80 °C	26 A			
Туре	Modules - MOSFET			
Package	EMIPAK 2B			
Circuit configuration	Full bridge			

FEATURES

• Silicon carbide power MOSFET



- Very tight variation of on-resistance vs. **RoHS** COMPLIANT
- Slight variation of switching losses with temperature
- · Very fast body diode
- PressFit pins technology
- Exposed Al₂O₃ substrate with low thermal resistance
- Low input capacitance
- Low internal inductance
- Easy to drive
- Material categorization: for definitions of compliance please see <u>www.vishay.com/doc?99912</u>

DESCRIPTION

The EMIPAK 2B package is easy to use thanks to the PressFit pins. The exposed substrate provides improved thermal performance.

The optimized layout also helps to minimize stray parameters, allowing for better EMI performance.

TYPICAL APPLICATIONS

• Solar inverter

ABSOLUTE MAXIMUM RATINGS							
PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS			
Operating junction temperature	TJ		175	°C			
Storage temperature range	T _{Stg}		-40 to +150	C			
RMS isolation voltage	V _{ISOL}	$T_J = 25$ °C, all terminals shorted, f = 50 Hz, t = 1 s	3500	V			
Q1 to Q6 - MOSFET			•				
Drain to source voltage	V _{DSS}		1200	V			
Gate to source voltage	V _{GSS}		-10 / +25	v			
Pulsed drain current	I _{DM} ⁽¹⁾		90	А			
		T _C = 25 °C	32				
Continuous drain current	I _D	T _C = 80 °C	26	A			
		T _{SINK} = 80 °C	22				
Devues discipation	PD	T _C = 25 °C	143	W			
Power dissipation		T _C = 80 °C	90	vv			
Pulsed source current (body diode)	I _{SM}		90	А			

Note

⁽¹⁾ Pulse width limited by safe operating area

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ELECTRICAL SPECIFICATIONS ($T_J = 25$ °C unless otherwise noted)							
PARAMETER	SYMBOL	SYMBOL TEST CONDITIONS MIN. TYP. MAX.				UNITS	
Q1 to Q6 - MOSFET							
		$V_{GS} = 20 \text{ V}, \text{ I}_{D} = 20 \text{ A}$	-	71	105		
Drain to source on resistance	R _{DS(on)}	$V_{GS} = 20 \text{ V}, \text{ I}_{D} = 20 \text{ A}, \text{ T}_{J} = 150 ^{\circ}\text{C}$	-	79	-	mΩ	
		V_{GS} = 20 V, I_{D} = 20 A, T_{J} = 175 °C	-	81	-		
Gate threshold voltage	V _{GS(th)}	$V_{DS} = V_{GS}$, $I_D = 1.0$ mA	1.6	3.6	6.5	V	
Temperature coefficient of threshold voltage	$\Delta V_{GS(th)} / \Delta T_J$	V_{DS} = V_{GS} , I_D = 1.0 mA (25 °C to 125 °C)	-	-8.3	-	mV/°C	
Forward transconductance	g fs	$V_{DS} = 20 \text{ V}, \text{ I}_{D} = 20 \text{ A}$	-	9.5	-	S	
Transfer characteristics	V _{GS}	$V_{DS} = 20 \text{ V}, \text{ I}_{D} = 20 \text{ A}$	-	12	-	V	
Zere gete veltage drein eurrent		$V_{GS} = 0 V, V_{DD} = 1200 V$	-	25	230		
Zero gate voltage drain current	I _{DSS}	$V_{GS} = 0 \text{ V}, \text{ V}_{DD} = 1200 \text{ V}, \text{ T}_{J} = 150 ^{\circ}\text{C}$	-	50	-	μA	
Gate to source leakage current	I _{GSS}	V_{GS} = +20 V / -10 V, V_{DS} = 0 V	-	-	150	nA	
Q1 to Q6 - BODY DIODE						-	
Forward voltage drop	V _{SD}	$I_{SD} = 10 \text{ A}; V_{GS} = 0$	-	3.2	-	V	

SWITCHING CHARACTERISTICS ($T_J = 25 \text{ °C}$ unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Q1 to Q6 - MOSFET			-			
Total gate charge (turn-on)	Qg	I _D = 20 A	-	105	-	
Gate to source charge (turn-on)	Q _{gs}	V _{DD} = 800 V	-	16	-	nC
Gate to drain charge (turn-on)	Q _{gd}	V _{GS} = 20 V	-	40	-	
Turn-on delay time	t _{d(on)}	$I_{\rm D} = 20 {\rm A}$	-	41	-	
Rise time	t _r	V _{DD} = 600 V V _{GS} = +20 V/-2 V	-	29	-	
Turn-off delay time	t _{d(off)}		-	79	-	ns
Fall time	t _f	R _g = 4.7 Ω, L = 500 μH	-	62	-	
Turn-on delay time	t _{d(on)}	I _D = 20 A	-	41	-	
Rise time	t _r	$V_{DD} = 600 \text{ V}$	-	30	-	
Turn-off delay time	t _{d(off)}	V _{GS} = +20 V/-2 V	-	91	-	ns
Fall time	t _f	R_g = 4.7 Ω, L = 500 μH, T _J = 150 °C	-	75	-	
Input capacitance	C _{iss}	V _{GS} = 0 V	-	1700	-	
Output capacitance	C _{oss}	V _{DS} = 400 V	-	130	-	pF
Reverse transfer capacitance	C _{rss}	f = 1 MHz	-	25	-	
Q1 to Q6 - BODY DIODE						
Diode reverse recovery time	t _{rr}	V _B = 400 V, T _J = 25 °C	-	140	-	ns
Diode reverse recovery current	Irr	$I_{\rm S} = 20$ A	-	3.1	-	A
Diode reverse recovery charge	Q _{rr}	dl/dt = 100 A/µs	-	220	-	nC

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INTERNAL NTC - THERMISTOR SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUE	UNITS	
Resistance	R ₂₅	$T_J = 25 \ ^{\circ}C$	$22\ 000\pm 5\ \%$	Ω	
nesistance	R ₁₅₀	T _J = 150 °C	483.86 ± 5 %	52	
B constant	B _{25/85}		3800 ± 1 %	К	
Operating temperature range at zero power			-40 to +150	°C	
Maximum dissipation at 25 °C			210	mW	
Dissipation factor	D		3.5	mW/K	
Thermal time constant	τ		≈ 10	S	

INTERNAL C1 / C3 DC LINK CAPACITOR - ELECTRICAL SPECIFICATIONS					
PARAMETER	SYMBOL	TEST CONDITIONS	VALUE	UNITS	
Capacitance	С		0.047 ± 10 %	μF	
Voltage			1000	V	

THERMAL AND MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNITS	
Q1 to Q6 - MOSFET - Junction to case thermal resistance (per switch)	R _{thJC}	-	-	1.05	°C/W	
Q1 to Q6 - MOSFET - Case to sink thermal resistance (per switch)	R _{thCS}	-	0.55	-	0/10	
Mounting torque (M4) ⁽¹⁾		2	-	3	Nm	
Weight		-	45	-	g	

Note

⁽¹⁾ See application note for further suggestion on mounting operation: <u>www.vishay.com/doc?95580</u>.

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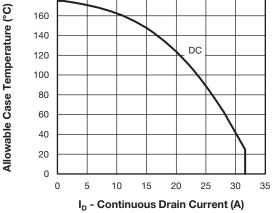


Fig. 1 - Maximum Continuous Drain Current vs. Case Temperature

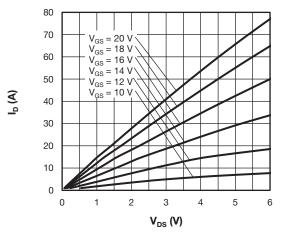


Fig. 2 - Typical Drain-to-Source Current Output Characteristics at T_J = 25 $^\circ\text{C}$

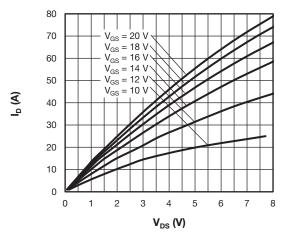


Fig. 3 - Typical Drain-to-Source Current Output Characteristics at $T_J = 150\ ^\circ C$

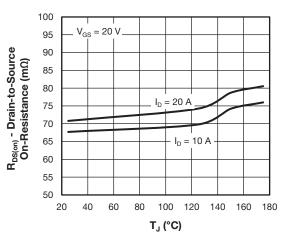
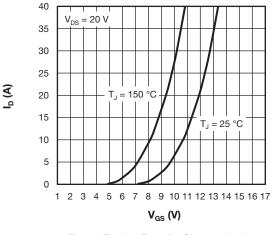
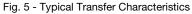


Fig. 4 - Typical Drain-to-Source On-Resistance vs. Temperature





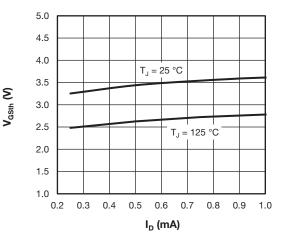


Fig. 6 - Typical Gate Threshold Voltage Characteristics

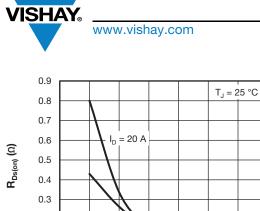
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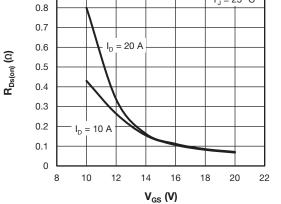


Fig. 7 - Typical Drain-State Resistance vs. Gate-to-Source Voltage

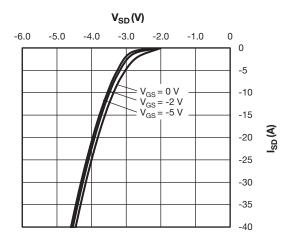


Fig. 8 - Typical Body Diode Source-to-Drain Current Characteristics at T_J = 25 °C

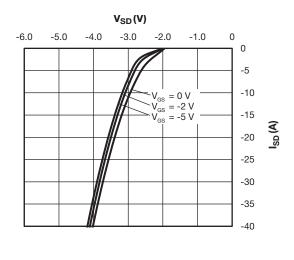


Fig. 9 - Typical Body Diode Source-to-Drain Current Characteristics at T_{.1} = 150 °C

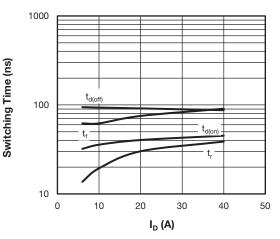


Fig. 10 - Typical Switching Time vs. I_D T_J = 150 °C, V_{DD} = 600 V, R_g = 4.7 $\Omega,$ V_{GS} = +20 V/-2 V, L = 500 μH

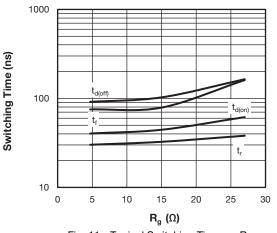


Fig. 11 - Typical Switching Time vs. R_g T_J = 150 °C, V_{DD} = 600 V, I_D = 20 A, V_{GS} = +20 V / -2 V, L = 500 μH

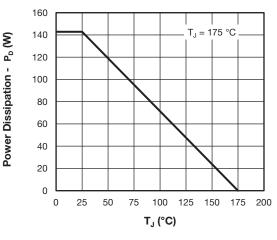


Fig. 12 - Power Dissipation Curve

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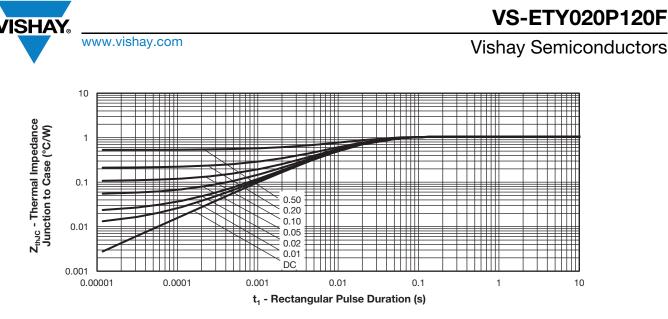


Fig. 13 - Maximum Thermal Impedance Junction-to-Case Characteristics

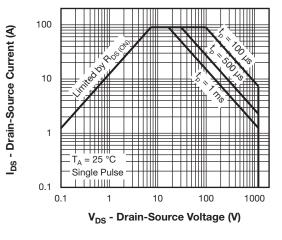
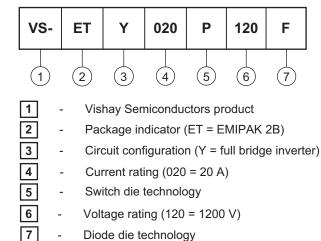


Fig. 14 - Safe Operating Area

ORDERING INFORMATION TABLE

Device code



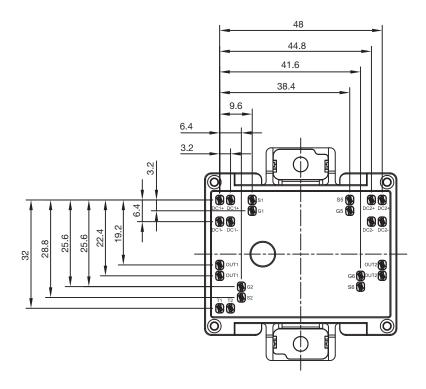


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CIRCUIT CONFIGU	CIRCUIT CONFIGURATION					
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING				
Full bridge inverter	Y	DC1+ \bigcirc \bigcirc DC2+ \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc \bigcirc				

PACKAGE



Dimensions www.visbay.com/doc?95559	LINKS TO RELATED DOCUMENTS				
	Dimensions	www.vishay.com/doc?95559			

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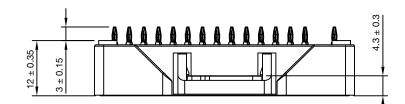
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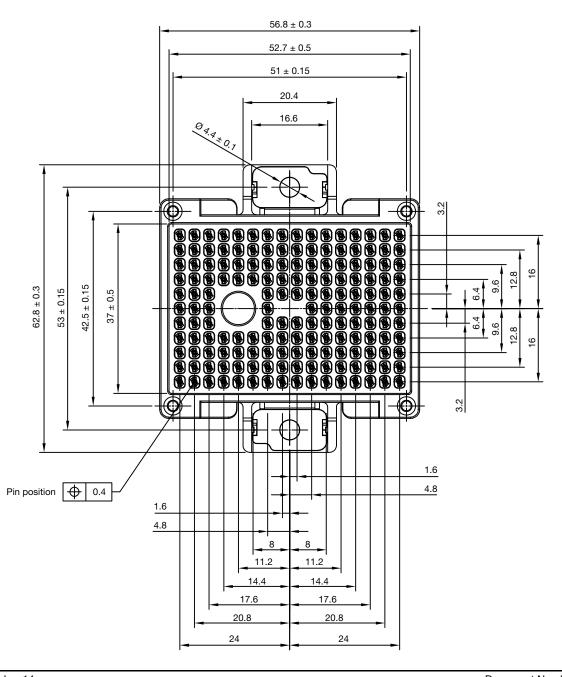




EMIPAK-2B PressFit

DIMENSIONS in millimeters





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