

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

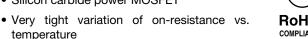


EMIPAK 2B (package example)

PRIMARY CHARACTERISTICS					
FULL BRIDGE INVERTER - 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



- · 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	Α			
		T _{SINK} = 80 °C	22				
Dower dissination	В	T _C = 25 °C	143	W			
Power dissipation	P _D	T _C = 80 °C	90	VV			
Pulsed source current (body diode)	I _{SM}		90	А			

Note

⁽¹⁾ Pulse width limited by safe operating area





ELECTRICAL SPECIFICATIONS (T _J = 25 °C unless otherwise noted)							
PARAMETER	SYMBOL TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS	
Q1 to Q6 - MOSFET	Q1 to Q6 - MOSFET						
		$V_{GS} = 20 \text{ V}, I_D = 20 \text{ A}$	-	71	105		
Drain to source on resistance	R _{DS(on)}	$V_{GS} = 20 \text{ V}, I_D = 20 \text{ A}, T_J = 150 ^{\circ}\text{C}$	-	79	-	mΩ	
		$V_{GS} = 20 \text{ V}, I_D = 20 \text{ A}, T_J = 175 ^{\circ}\text{C}$	-	81	-		
Gate threshold voltage	V _{GS(th)}	$V_{DS} = V_{GS}$, $I_D = 1.0 \text{ mA}$	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	9 _{fs}	V _{DS} = 20 V, I _D = 20 A	-	9.5	-	S	
Transfer characteristics	V _{GS}	V _{DS} = 20 V, I _D = 20 A	-	12	-	V	
Zava gata valtaga drain avvent	I _{DSS}	V _{GS} = 0 V, V _{DD} = 1200 V	-	25	230		
Zero gate voltage drain current		V _{GS} = 0 V, V _{DD} = 1200 V, T _J = 150 °C	-	50	-	μA	
Gate to source leakage current	nt I_{GSS} $V_{GS} = +20 \text{ V} / -10 \text{ V}, V_{DS} = 0 \text{ V}$		-	-	150	nA	
Q1 to Q6 - BODY DIODE	Q1 to Q6 - BODY DIODE						
Forward voltage drop	V _{SD}	I _{SD} = 10 A; V _{GS} = 0	-	3.2	-	V	

SWITCHING CHARACTERISTICS (T _J = 25 °C unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS	
Q1 to Q6 - MOSFET	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 _D = 20 A	-	41	-		
Rise time	t _r	V _{DD} = 600 V	-	29	-		
Turn-off delay time	t _{d(off)}	V _{GS} = +20 V/-2 V	-	79	-	ns	
Fall time	t _f	$R_g = 4.7 \Omega, L = 500 \mu H$		62	-		
Turn-on delay time	t _{d(on)}	I_D = 20 A V_{DD} = 600 V V_{GS} = +20 V/-2 V R_g = 4.7 Ω, L = 500 μH, T_J = 150 °C	-	41	-		
Rise time	t _r		-	30	-		
Turn-off delay time	t _{d(off)}		-	91	-	ns	
Fall time	t _f		-	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	I _{rr}	I _S = 20 A	=	3.1	-	Α	
Diode reverse recovery charge	Q _{rr}	Q _{rr} dl/dt = 100 A/μs		220	-	nC	





INTERNAL NTC - THERMISTOR SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	VALUE	UNITS		
Resistance	R ₂₅	T _J = 25 °C	22 000 ± 5 %	Ω		
nesistarice	R ₁₅₀	T _J = 150 °C	483.86 ± 5 %	7.2		
B constant	B _{25/85}		3800 ± 1 %	K		
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	-	C/VV	
Mounting torque (M4) (1)		2	-	3	Nm	
Weight		-	45	-	g	

Note

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



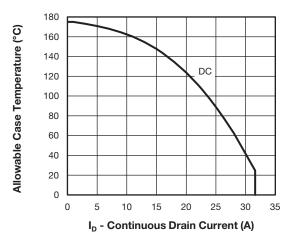


Fig. 1 - Maximum Continuous Drain Current vs. Case Temperature

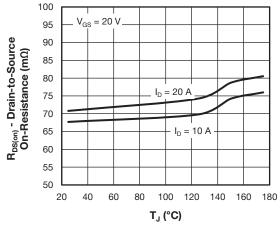


Fig. 4 - Typical Drain-to-Source On-Resistance vs. Temperature

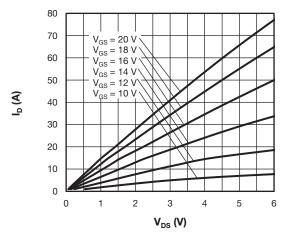


Fig. 2 - Typical Drain-to-Source Current Output Characteristics at $T_{J}=25\ ^{\circ}\text{C}$

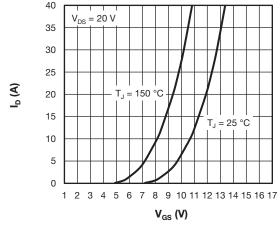


Fig. 5 - Typical Transfer Characteristics

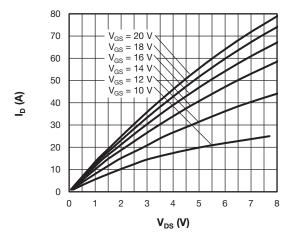


Fig. 3 - Typical Drain-to-Source Current Output Characteristics at $T_{J} = 150\ ^{\circ}\text{C}$

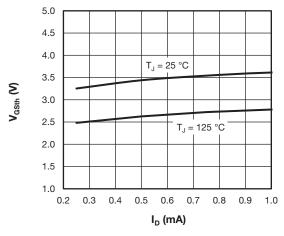


Fig. 6 - Typical Gate Threshold Voltage Characteristics

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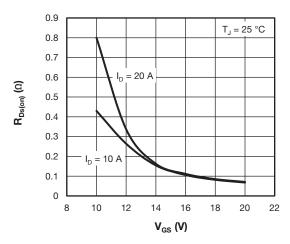


Fig. 7 - Typical Drain-State Resistance vs. Gate-to-Source Voltage

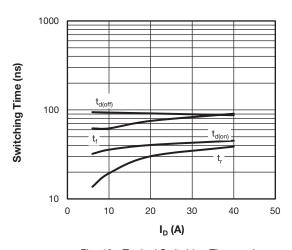


Fig. 10 - Typical Switching Time vs. I_D T_J = 150 °C, V_{DD} = 600 V, R_g = 4.7 $\Omega,$ V_{GS} = +20 V/-2 V, L = 500 μH

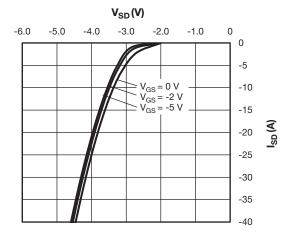


Fig. 8 - Typical Body Diode Source-to-Drain Current Characteristics at $T_J = 25~^{\circ}\text{C}$

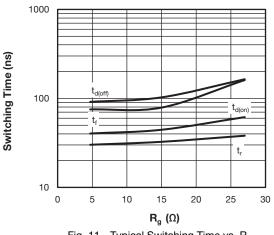


Fig. 11 - Typical Switching Time vs. R_g T_J = 150 °C, V_{DD} = 600 V, I_D = 20 A, V_{GS} = +20 V / -2 V, L = 500 μH

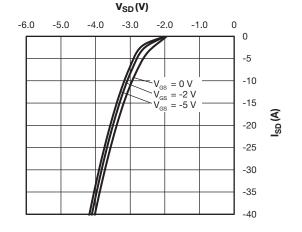


Fig. 9 - Typical Body Diode Source-to-Drain Current Characteristics at $T_{\rm J}$ = 150 °C

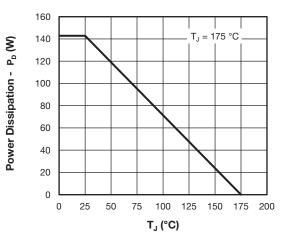


Fig. 12 - Power Dissipation Curve

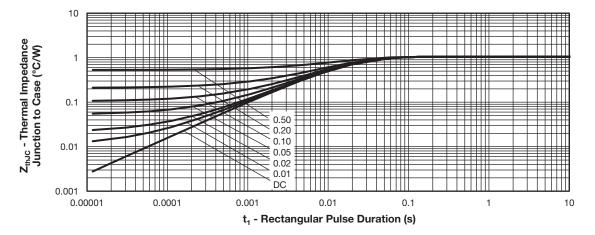


Fig. 13 - Maximum Thermal Impedance Junction-to-Case Characteristics

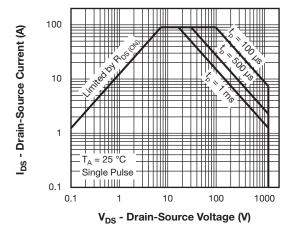


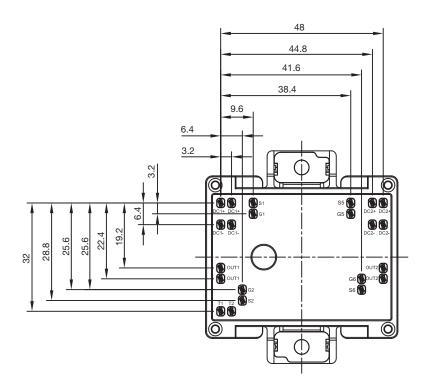
Fig. 14 - Safe Operating Area

ORDERING INFORMATION TABLE

- 1 Vishay Semiconductors product
- 2 Package indicator (ET = EMIPAK 2B)
- 3 Circuit configuration (Y = full bridge inverter)
- 4 Current rating (020 = 20 A)
- 5 Switch die technology
- 6 Voltage rating (120 = 1200 V)
- 7 Diode die technology

CIRCUIT CONFIGURATION				
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING		
Full bridge inverter	Y	DC1+ Q1 Q5 DC2+ OUT1 Q2 Q6 C3 OUT2 DC1- Ntc DC2- T1 T2		

PACKAGE

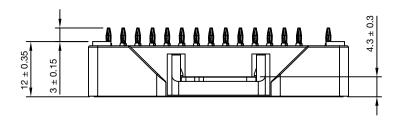


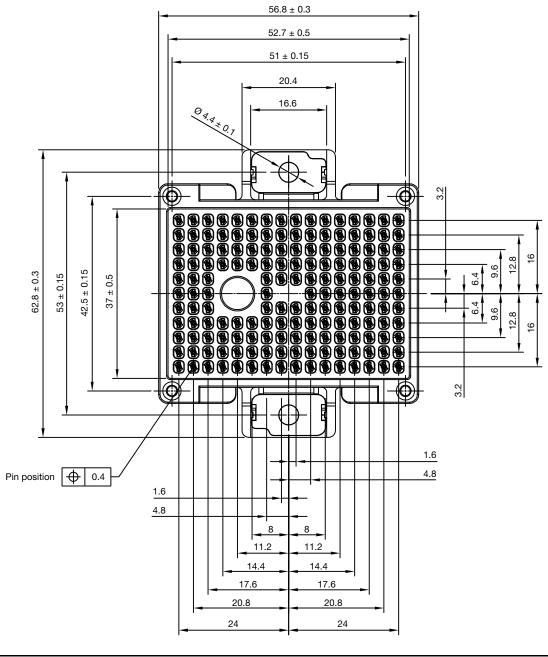
LINKS TO RELATED DOCUMENTS			
Dimensions	www.vishay.com/doc?95559		



EMIPAK-2B PressFit

DIMENSIONS in millimeters







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