

MAACPAK PressFit Power Module Full Bridge Inverter Silicon Carbide MOSFET, 38 mΩ



MAACPAK
(package example)

PRIMARY CHARACTERISTICS

V_{DSS}	1200 V
$R_{DS(on)}$ at $I_D = 40$ A	33 mΩ
I_D at $T_{sink} = 80$ °C	35 A
Type	Modules - SiC MOSFET
Package	MAACPAK
Circuit configuration	Full bridge inverter

DESCRIPTION

This is an high performance silicon carbide MOSFET. The high blocking voltage with low on-resistance, high speed switching with low capacitance make this MOSFET ideal for high frequency switching application including solar inverters and EV chargers.

FEATURES

- Silicon carbide power MOSFET
- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- Maximum 175 °C junction temperature
- PressFit pins locking technology
- UL pending
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

TYPICAL APPLICATIONS

- EV chargers
- Server and telecom PSU
- UPS
- Solar inverters
- SMPS
- DC/DC converters

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
MOSFET				
Drain to source voltage	V_{DSS}		1200	V
Continuous drain current, V_{GS} at 15 V	I_D	$T_{sink} = 25$ °C	43	A
		$T_{sink} = 80$ °C	35	
Pulsed drain current	$I_{DM}^{(1)}$		180	
Power dissipation	P_D	$T_{sink} = 80$ °C	93	W
Gate to source voltage	V_{GS}		-8 / +19	V
MODULE				
Maximum junction temperature range	T_J max.	Instantaneous event	-55 to +175	°C
Operating junction temperature range	T_{JOP}	Continuous operation under switching	-40 to +150	°C
Operating storage temperature range	T_{Stg}		-40 to +150	
Insulation voltage (RMS)	V_{ISOL}	Any terminal to case, $t = 1$ min	3500	V

Note

⁽¹⁾ Limited at max. junction temperature

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	RATING	UNITS
Recommended operating gate - source voltage	$V_{GS(op)}$	-4 / +15	V



ELECTRICAL CHARACTERISTICS (T _J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Drain to source breakdown voltage	V _{(BR)DSS}	V _{GS} = 0 V, I _D = 200 μA	1200	-	-	V
Static drain to source on-resistance	R _{DS(on)}	V _{GS} = 15 V, I _D = 40 A	-	33	49.8	mΩ
		V _{GS} = 15 V, I _D = 40 A, T _J = 175 °C	-	63	-	
Gate threshold voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 10 mA	1.6	2.7	3.8	V
		V _{DS} = V _{GS} , I _D = 10 mA, T _J = 175 °C	-	2.08	-	
Temperature coefficient of threshold voltage	ΔV _{GS(th)} /ΔT _J	V _{DS} = V _{GS} , I _D = 10 mA (25 °C to 125 °C)	-	-5.9	-	mV/°C
Forward transconductance	g _{fs}	V _{DS} = 20 V, I _D = 40 A	-	27.3	-	S
Drain to source leakage current	I _{DSS}	V _{DS} = 1200 V, V _{GS} = 0 V	-	0.01	120	μA
		V _{DS} = 1200 V, V _{GS} = 0 V, T _J = 150 °C	-	0.25	-	
Gate to source leakage	I _{GSS}	V _{GS} = ± 15 V	-	-	± 250	nA
Total gate charge	Q _g	V _{DD} = 800 V, I _D = 40 A, V _{GS} = -4 V / +15 V	-	100	-	nC
Gate to source charge	Q _{gs}		-	33	-	
Gate to drain ("Miller") charge	Q _{gd}		-	27	-	
Turn-on switching energy	E _{on}	V _{DD} = 800 V, I _D = 40 A, R _g = 1.0 Ω, V _{GS} = -4 V / +15 V	-	0.379	-	mJ
Turn-off switching energy	E _{off}		-	0.152	-	
Turn-on delay time	t _{d(on)}		-	15	-	ns
Rise time	t _r		-	13	-	
Turn-off delay time	t _{d(off)}		-	40	-	
Fall time	t _f		-	10	-	
Turn-on switching energy	E _{on}	V _{DD} = 800 V, I _D = 40 A, R _g = 1.0 Ω, V _{GS} = -4 V / +15 V, T _J = 125 °C	-	0.508	-	mJ
Turn-off switching energy	E _{off}		-	0.141	-	
Turn-on delay time	t _{d(on)}		-	15	-	ns
Rise time	t _r		-	14	-	
Turn-off delay time	t _{d(off)}		-	44	-	
Fall time	t _f		-	11	-	
Input capacitance	C _{iss}	V _{GS} = 0 V, V _{DS} = 1000 V, f = 100 kHz	-	2979	-	pF
Output capacitance	C _{oss}		-	91	-	
Reverse transfer capacitance	C _{rss}		-	8.9	-	

SOURCE-DRAIN RATINGS AND CHARACTERISTICS (T _J = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Pulsed source current (body diode)	I _{SM}	T _C = 25 °C, V _{GS} = 0 V, T _p = 6 ms	-	-	189	A
Diode forward voltage	V _{SD}	I _S = 40 A, V _{GS} = -4 V	-	5.96	-	V
Reverse recovery time	t _{rr}	T _J = 25 °C, I _F = I _S = 40 A, dI/dt = 5100 A/μs, V _R = 800 V	-	15	-	ns
Reverse recovery charge	Q _{rr}		-	346	-	nC
Reverse recovery current	I _{RRM}		-	38.3	-	A

**THERMAL AND MECHANICAL SPECIFICATIONS**

PARAMETER		SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Thermal resistance junction to sink each ⁽¹⁾	MOSFET	R_{thJS}		-	0.9	-	°C/W
Thermal resistance case to sink ⁽¹⁾	Module	R_{thCS}	Flat, greased surface	-	0.1	-	
Mounting torque (M3)				0.7	1.2	1.7	Nm
Weight				-	16	-	g
Case style				MAACPAK			

Note

⁽¹⁾ Mounting surface flat, smooth, and greased $\lambda_{grease} = 2.9 \text{ W/mK}$

INTERNAL NTC - THERMISTOR SPECIFICATIONS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUE	UNITS
Resistance	R_{25}	$T_J = 25^\circ\text{C}$	10 000	Ω
B constant	$B_{25/85}$	$R_2 = R_{25} \exp. (B_{25/85} (1/T_1 - 1/(298.15 \text{ K})))$	$3430 \pm 3 \%$	K
Operating temperature range at zero power			-40 to +150	°C
Dissipation factor	D		3.5	mW/K
Thermal time constant	τ		≈ 10	s

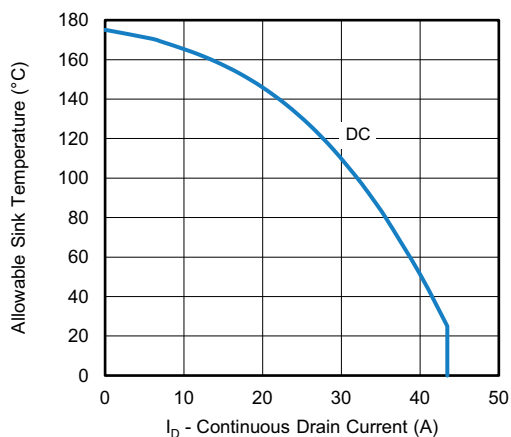
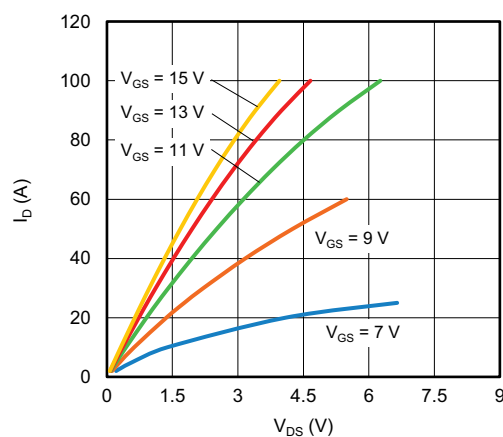


Fig. 1 - Max. Continuous Drain Current vs. Sink Temperature

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

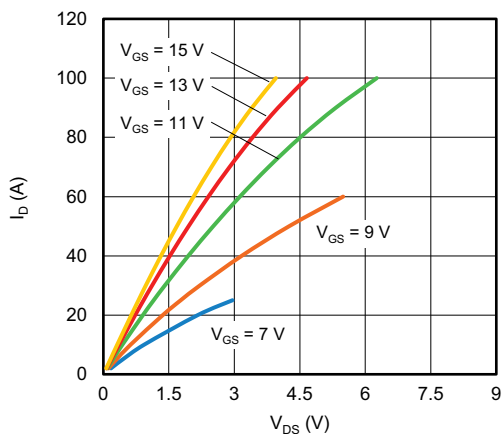


Fig. 3 - Typical Drain to Source Current Output Characteristics at $T_J = 150\text{ }^{\circ}\text{C}$

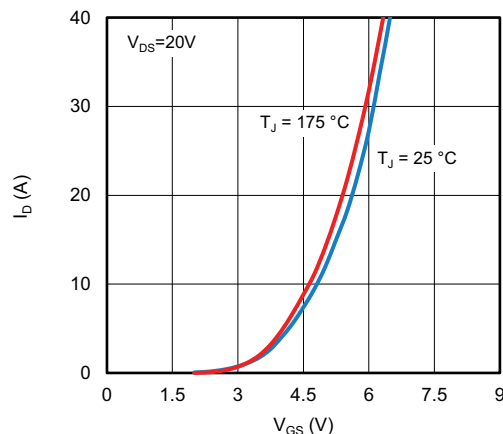


Fig. 6 - Typical Transfer Characteristics

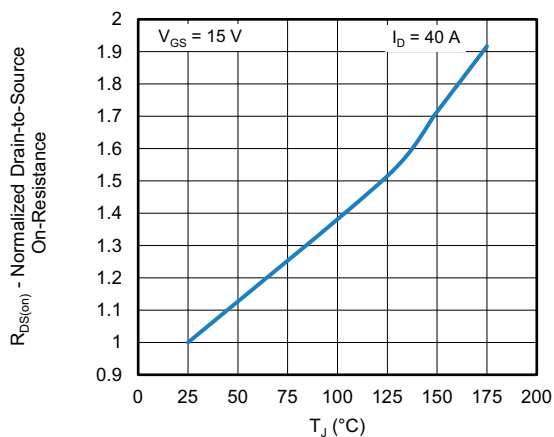


Fig. 4 - Normalized Drain-to-Source On-Resistance vs. Temperature

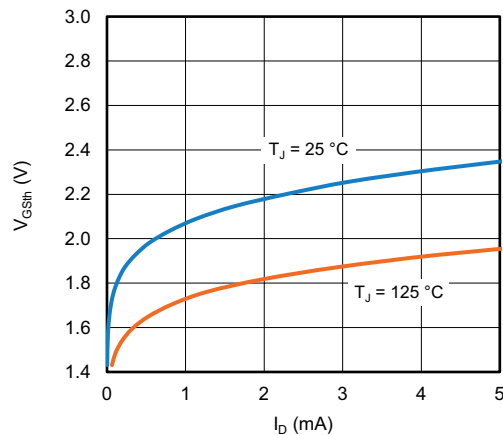


Fig. 7 - Typical Gate Threshold Voltage Characteristics

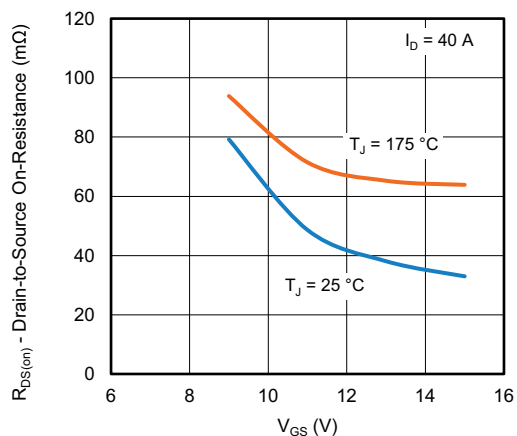


Fig. 5 - Typical Drain-to-Source On-Resistance vs. Gate to Source Voltage

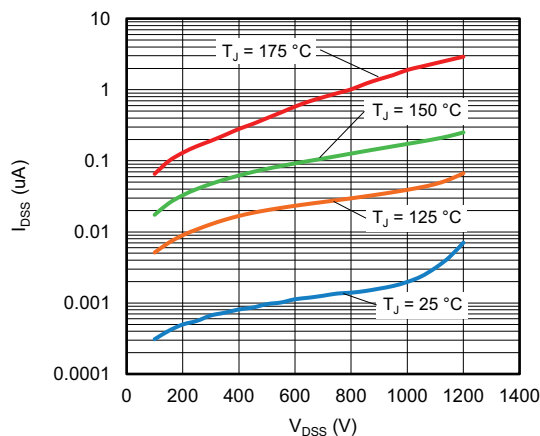


Fig. 8 - Typical Zero Gate Voltage Drain Current

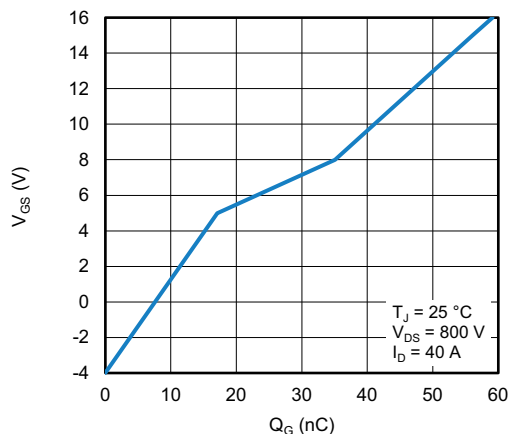
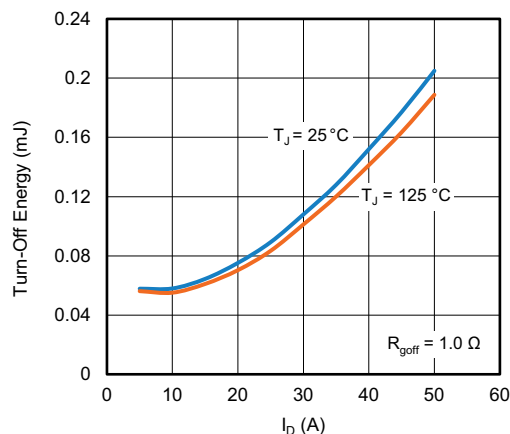
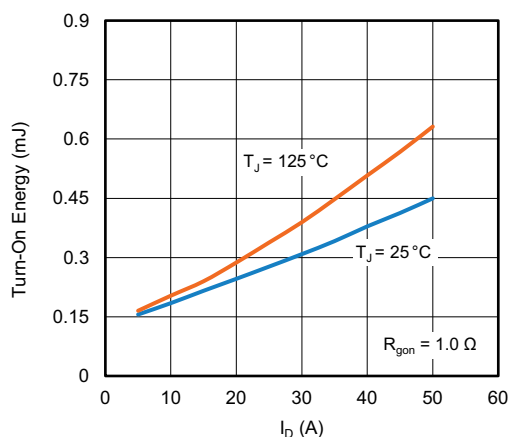
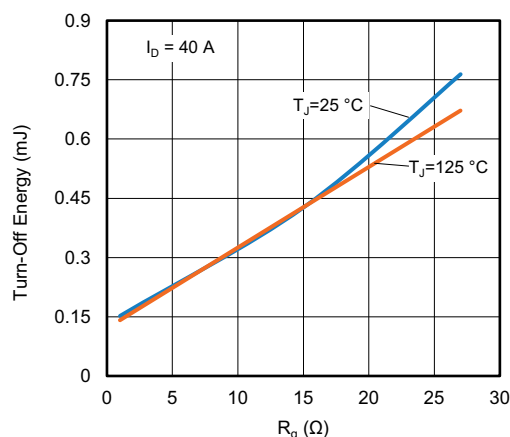
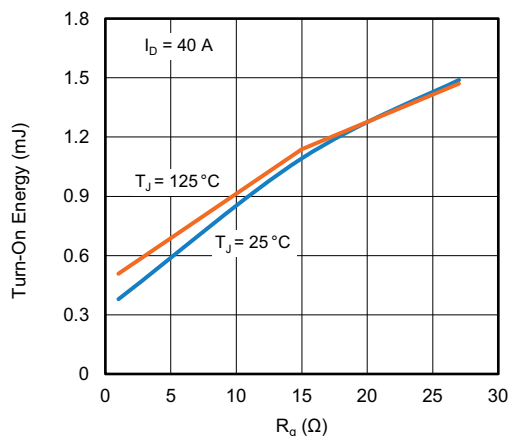
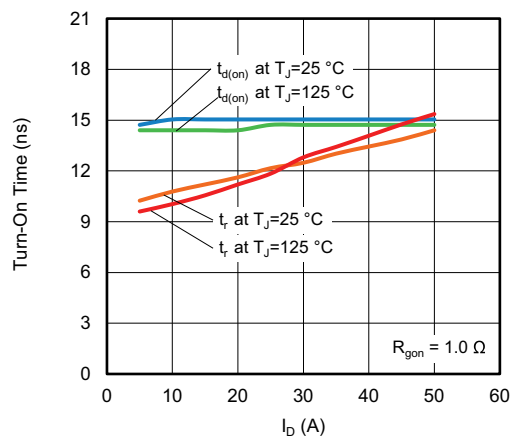


Fig. 9 - Typical Gate Charge vs. Gate to Source Voltage


Fig. 12 - Typical Turn-Off Energy Loss vs. I_D

Fig. 10 - Typical Turn-On Energy Loss vs. I_D

Fig. 13 - Typical Turn-Off Energy Loss vs. R_g

Fig. 11 - Typical Turn-On Energy Loss vs. R_g

Fig. 14 - Typical Turn-On Switching Time vs. I_D

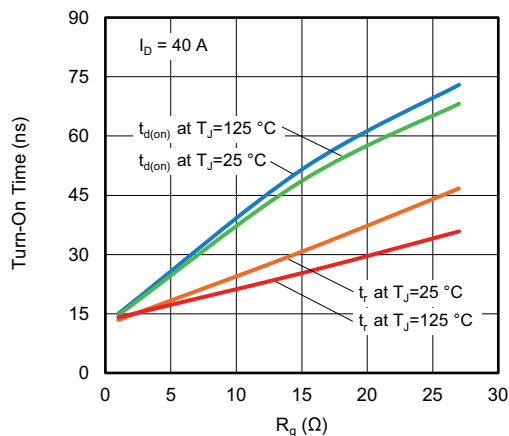


Fig. 15 - Typical Turn-On Switching Time vs. R_g

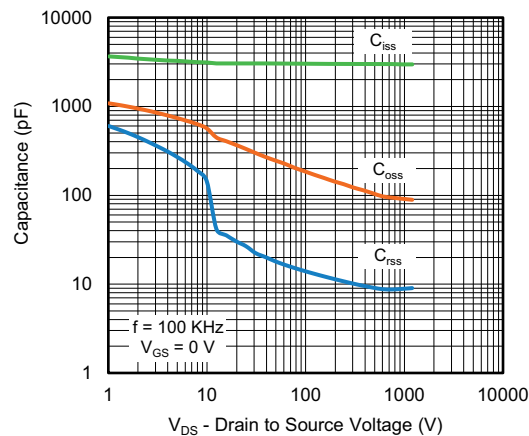


Fig. 18 - Typical Capacitance vs. Drain-to-Source Voltage

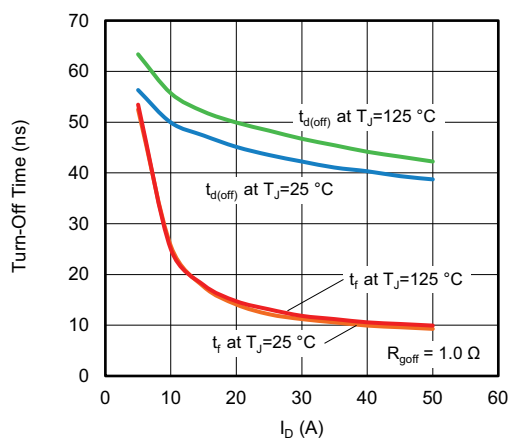


Fig. 16 - Typical Turn-Off Switching Time vs. I_D

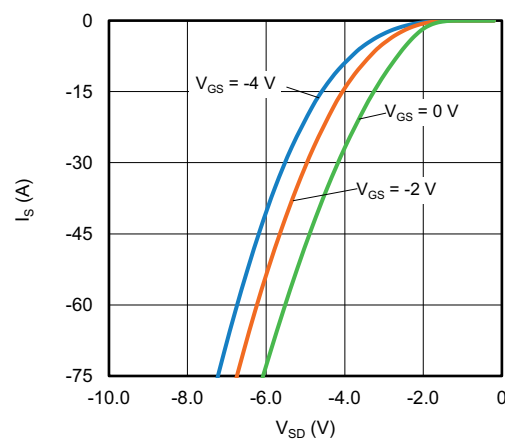


Fig. 19 - Typical Body Diode Source-to-Drain Current Characteristics $T_J = 25\text{ }^{\circ}\text{C}$

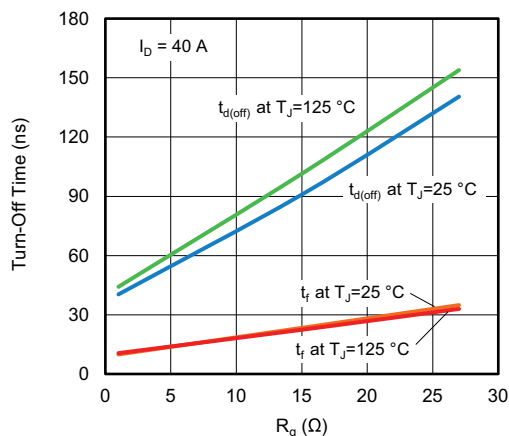


Fig. 17 - Typical Turn-Off Switching Time vs. R_g

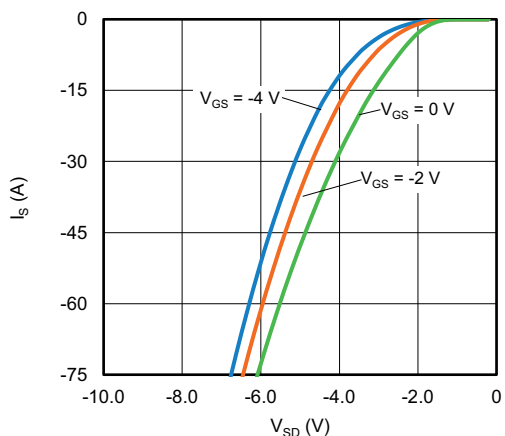


Fig. 20 - Typical Body Diode Source-to-Drain Current Characteristics $T_J = 125\text{ }^{\circ}\text{C}$

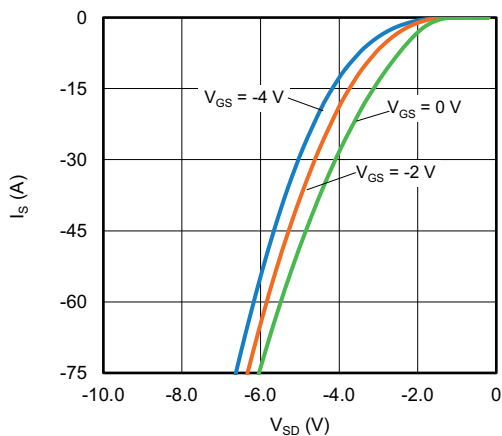


Fig. 21 - Typical Body Diode Source-to-Drain Current Characteristics $T_J = 150^\circ\text{C}$

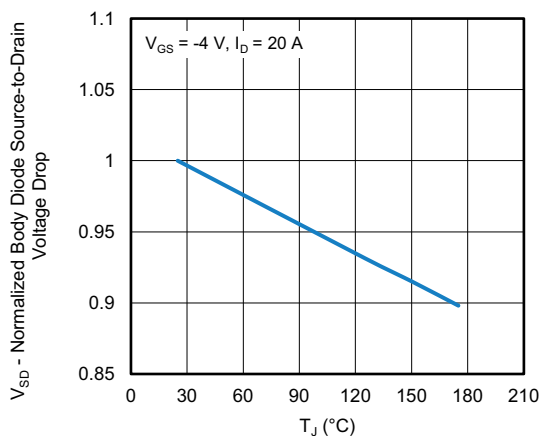


Fig. 22 - Normalized Body Diode Source-to-Drain Voltage Drop vs. Temperature

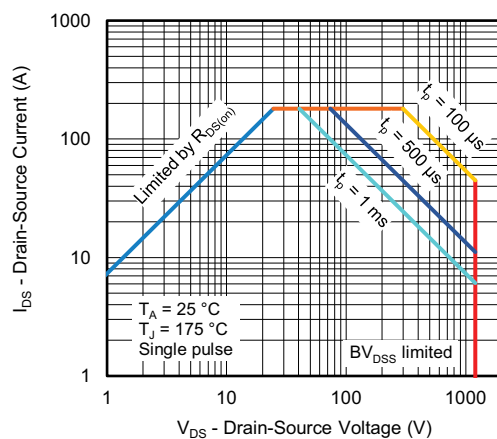


Fig. 23 - Safe Operating Area

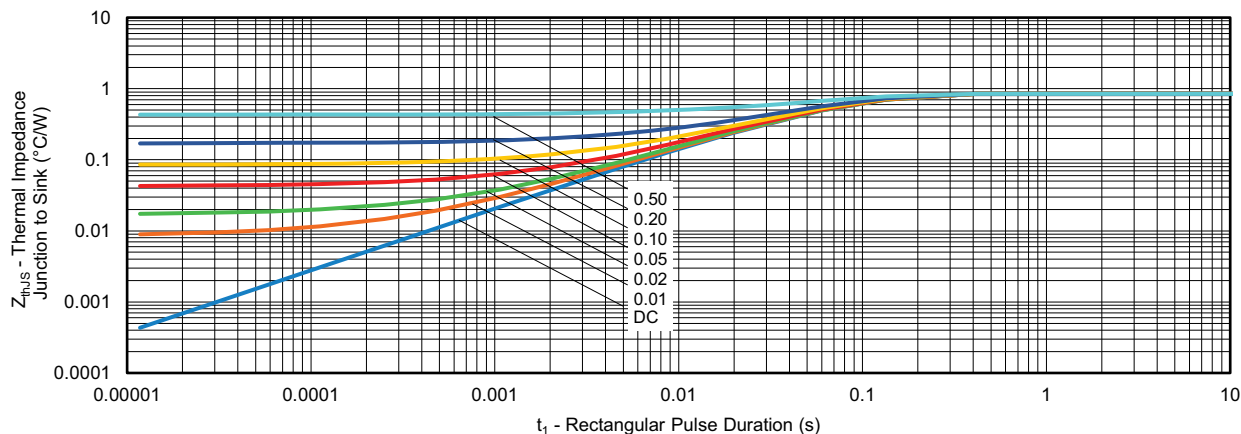


Fig. 24 - Typical Thermal Impedance Z_{thJS} Characteristics

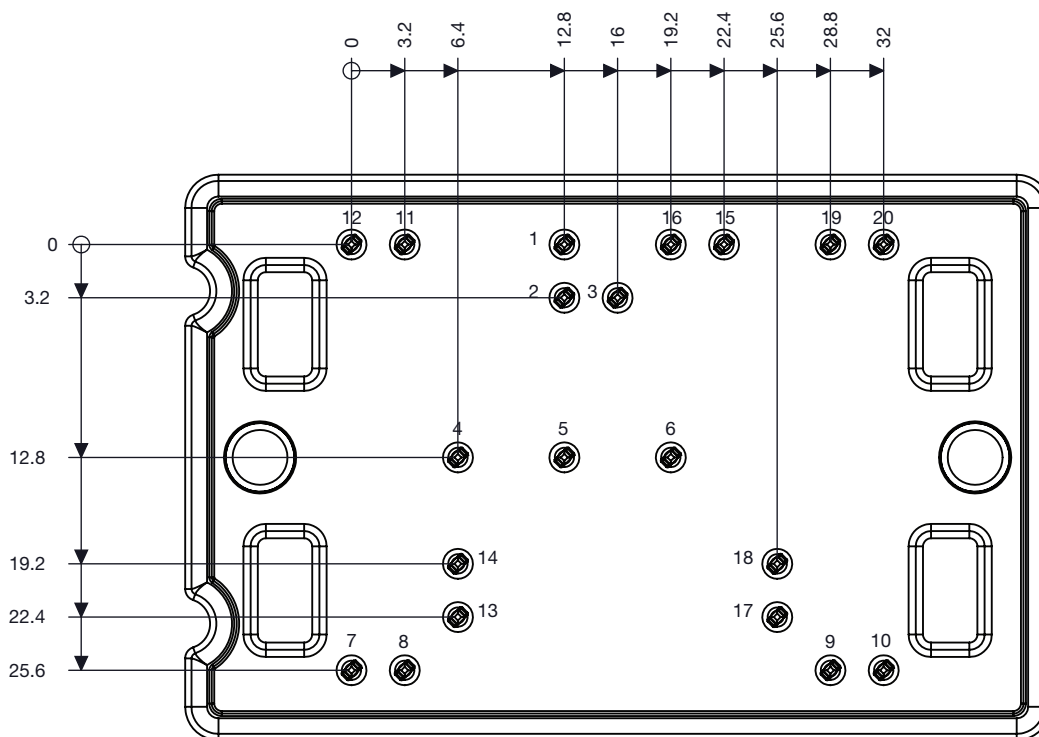


ORDERING INFORMATION TABLE

Device code	VS-	MP	Y	038	P	120
	1	2	3	4	5	6

- | | |
|---|---|
| 1 | - Vishay Semiconductors product |
| 2 | - Package indicator (MP = MAACPAK) |
| 3 | - Circuit configuration (Y = full bridge inverter topology) |
| 4 | - $R_{DS(on)}$ in m Ω (038 = 38 m Ω) |
| 5 | - Die technology (P = SiC MOSFET) |
| 6 | - Voltage rating (120 = 1200 V) |

CIRCUIT CONFIGURATION		
CIRCUIT	CIRCUIT CONFIGURATION CODE	CIRCUIT DRAWING
Full bridge inverter	Y	

PACKAGE

LINKS TO RELATED DOCUMENTS

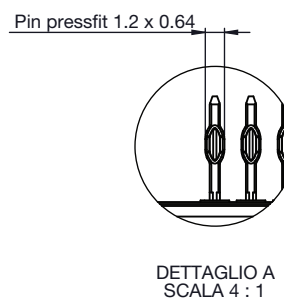
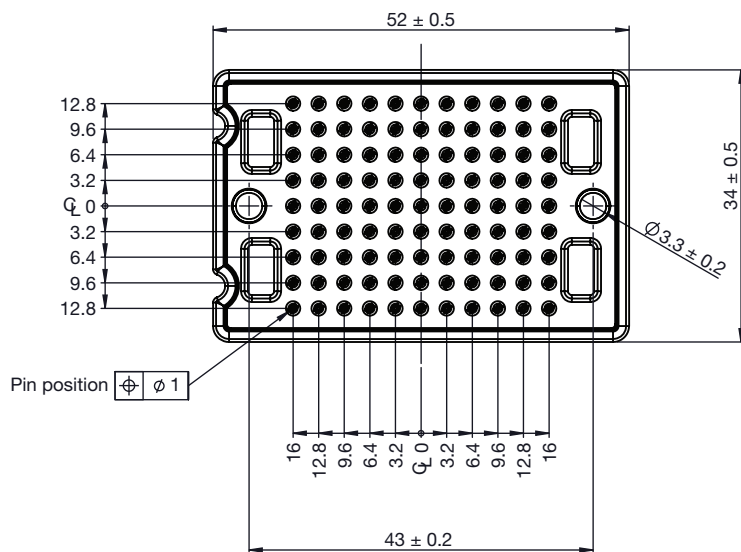
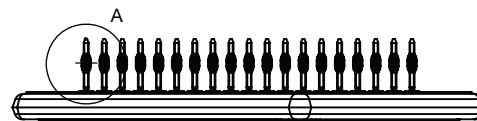
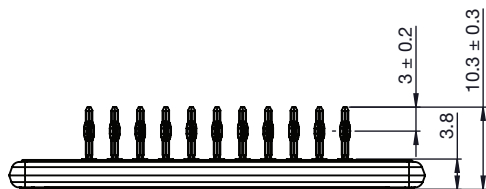
Dimensions

www.vishay.com/doc?97293



MAACPAK PressFit

DIMENSIONS in inches (millimeters)



Notes

- Tolerances (unless otherwise stated):
 - x = ± 0.3
 - x.x = ± 0.1
 - x.xx = ± 0.03



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