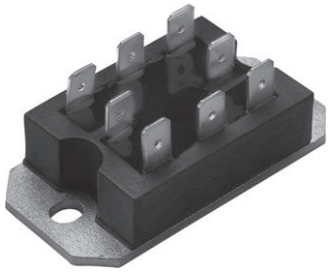
Power Modules, Passivated Assembled Circuit Elements, 40 A



PACE-PAK (D-19)

FEATURES

- Glass passivated junctions for greater reliability
- Electrically isolated base plate
- Available up to 1200 V_{RRM}/V_{DRM}
- High dynamic characteristics
- Wide choice of circuit configurations
- Simplified mechanical design and assembly
- UL E78996 approved
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

PRIMARY CHARACTERISTICS	
I_O	40 A
Type	Modules - thyristor, standard
Package	PACE-PAK (D-19)

DESCRIPTION

The VS-P400 series of integrated power circuits consists of power thyristors and power diodes configured in a single package. With its isolating base plate, mechanical designs are greatly simplified giving advantages of cost reduction and reduced size.

Applications include power supplies, control circuits and battery chargers.

MAJOR RATINGS AND CHARACTERISTICS			
SYMBOL	CHARACTERISTICS	VALUES	UNITS
I_O	80 °C	40	A
I_{TSM}, I_{FSM}	50 Hz	385	A
	60 Hz	400	
I^2t	50 Hz	745	A^2s
	60 Hz	680	
$I^2\sqrt{t}$		7450	$A^2\sqrt{s}$
V_{RRM}	Range	400 to 1200	V
V_{ISOL}		2500	V
T_J		-40 to +125	°C
T_{Stg}			

ELECTRICAL SPECIFICATIONS

VOLTAGE RATINGS			
TYPE NUMBER	V_{RRM}/V_{DRM}, MAXIMUM REPETITIVE PEAK REVERSE AND PEAK OFF-STATE VOLTAGE V	V_{RSM}, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	I_{RRM} MAXIMUM AT T_J MAXIMUM mA
VS-P401, VS-P421, VS-P431	400	500	10
VS-P402, VS-P422, VS-P432	600	700	
VS-P403, VS-P423, VS-P433	800	900	
VS-P404, VS-P424, VS-P434	1000	1100	
VS-P405, VS-P425, VS-P435	1200	1300	

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ON-STATE CONDUCTION						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**			**VALUES**	**UNITS**
Maximum DC output current at case temperature	I_O	Full bridge circuits			40	A
					80	°C
Maximum peak, one-cycle non-repetitive on-state or forward current	I_{TSM}, I_{FSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	385	A
		t = 8.3 ms			400	
		t = 10 ms	100 % V_{RRM} reapplied		325	
		t = 8.3 ms			340	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		745	A^2s
		t = 8.3 ms			680	
		t = 10 ms	100 % V_{RRM} reapplied		530	
		t = 8.3 ms			480	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 ms to 10 ms, no voltage reapplied I^2t for time tx = $I^2\sqrt{t} \cdot \sqrt{tx}$			7450	$A^2\sqrt{s}$
Low level value of threshold voltage	$V_{T(TO)1}$	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.83	V
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			1.03	
Low level value of on-state slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			9.61	mΩ
High level value of on-state slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			7.01	
Maximum on-state voltage drop	V_{TM}	I_{TM} = π x $I_{T(AV)}$		T_J = 25 °C	1.4	V
Maximum forward voltage drop	V_{FM}	I_{FM} = π x $I_{F(AV)}$		T_J = 25 °C	1.4	V
Maximum non-repetitive rate of rise of turned-on current	dI/dt	T_J = 125 °C from 0.67 V_{DRM} I_{TM} = π x $I_{T(AV)}$, I_g = 500 mA, t_r < 0.5 µs, t_p > 6 µs			200	A/µs
Maximum holding current	I_H	T_J = 25 °C anode supply = 6 V, resistive load			130	mA
Maximum latching current	I_L				250	

BLOCKING				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum critical rate of rise of off-state voltage	dV/dt	T_J = 125 °C, exponential to 0.67 V_{DRM} gate open	200	V/µs
Maximum peak reverse and off-state leakage current at V_{RRM}, V_{DRM}	I_{RRM}, I_{DRM}	T_J = 125 °C, gate open circuit	10	mA
Maximum peak reverse leakage current	I_{RRM}	T_J = 25 °C	100	µA
RMS isolation voltage	V_{ISOL}	50 Hz, circuit to base, all terminals shorted, T_J = 25 °C, t = 1 s	2500	V

TRIGGERING					
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**VALUES**	**UNITS**
Maximum peak gate power	P_{GM}			8	W
Maximum average gate power	$P_{G(AV)}$			2	
Maximum peak gate current	I_{GM}			2	A
Maximum peak negative gate voltage	$-V_{GM}$			10	V
Maximum gate voltage required to trigger	V_{GT}	T_J = - 40 °C	Anode supply = 6 V resistive load	3	V
		T_J = 25 °C		2	
		T_J = 125 °C		1	
Maximum gate current required to trigger	I_{GT}	T_J = - 40 °C		90	mA
		T_J = 25 °C		60	
		T_J = 125 °C		35	
Maximum gate voltage that will not trigger	V_{GD}	T_J = 125 °C, rated V_{DRM} applied		0.2	V
Maximum gate current that will not trigger	I_{GD}			2	mA

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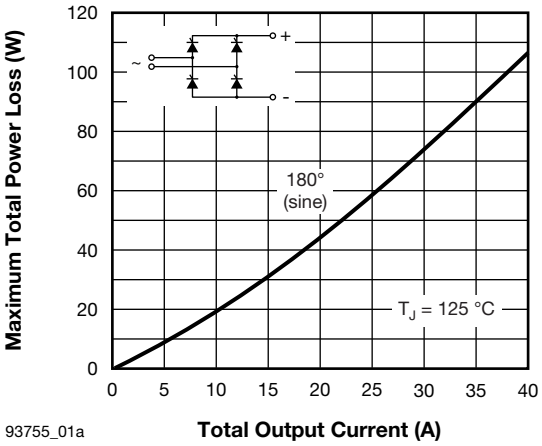
THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**VALUES**	**UNITS**
Maximum junction operating and storage temperature range	T_J, T_{Stg}		-40 to +125	°C
Maximum thermal resistance, junction to case per junction	R_{thJC}	DC operation	1.05	K/W
Maximum thermal resistance, case to heatsink	R_{thCS}	Mounting surface, smooth and greased	0.10	
Mounting torque, base to heatsink (1)			4	Nm
Approximate weight			58	g
			2.0	oz.
Case style			PACE-PAK (D-19)	

Note

(1) A mounting compound is recommended and the torque should be checked after a period of 3 hours to allow for the spread of the compound



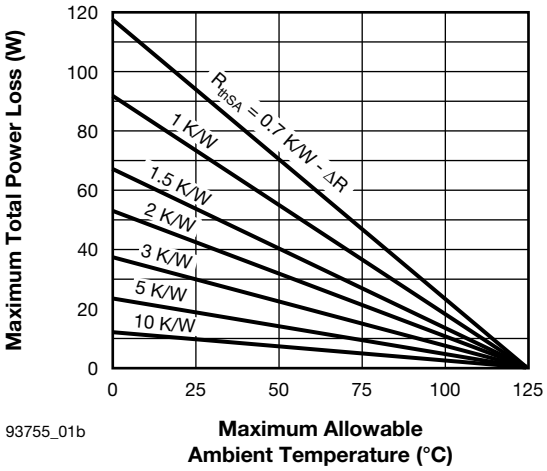


Fig. 1 - Current Ratings Nomogram (1 Module Per Heatsink)

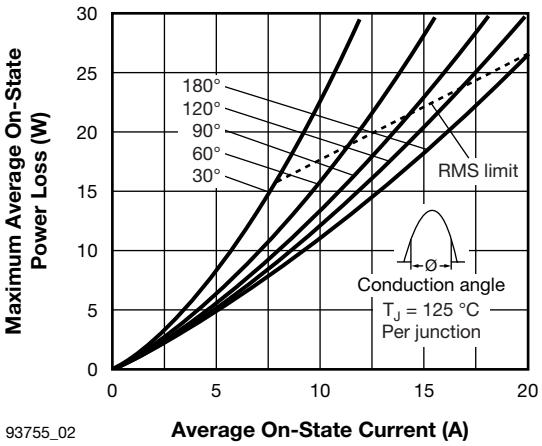


Fig. 2 - On-State Power Loss Characteristics

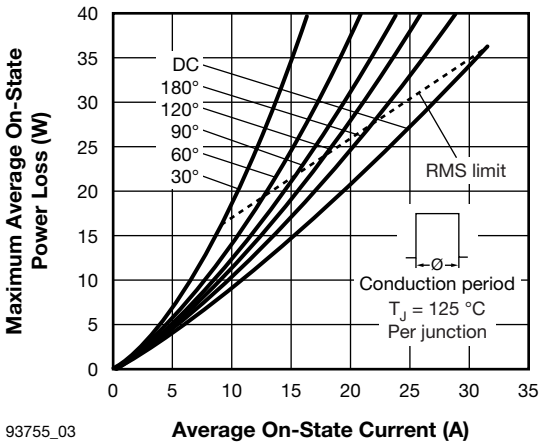


Fig. 3 - On-State Power Loss Characteristics

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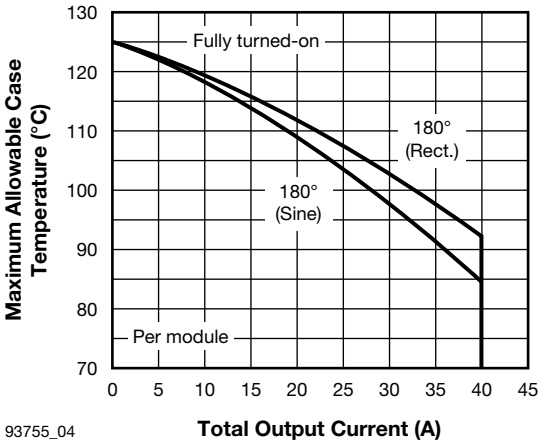

Fig. 4 - Current Ratings Characteristics

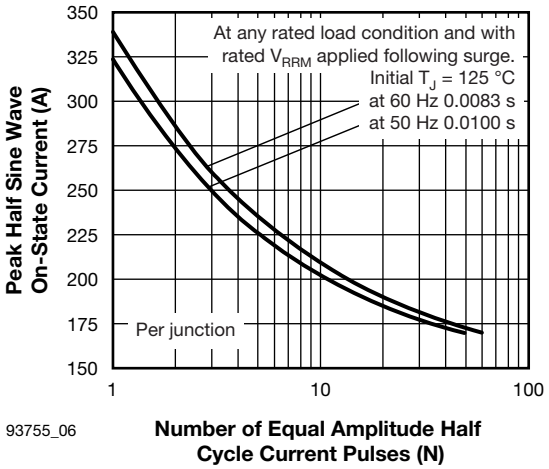

Fig. 6 - Maximum Non-Repetitive Surge Current

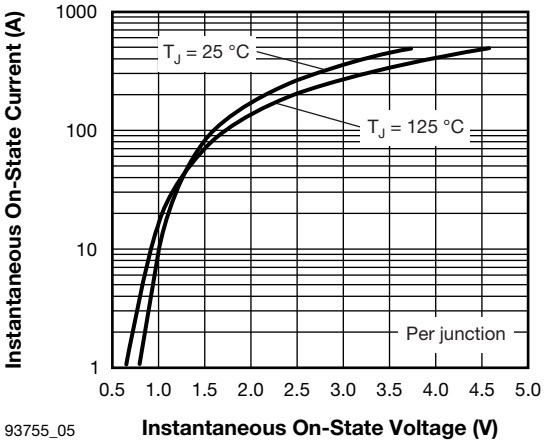

Fig. 5 - On-State Voltage Drop Characteristics

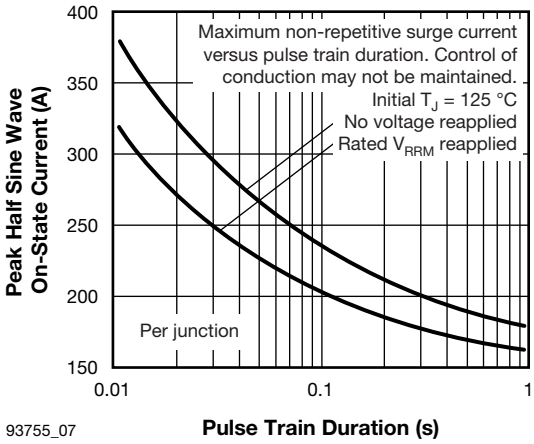

Fig. 7 - Maximum Non-Repetitive Surge Current

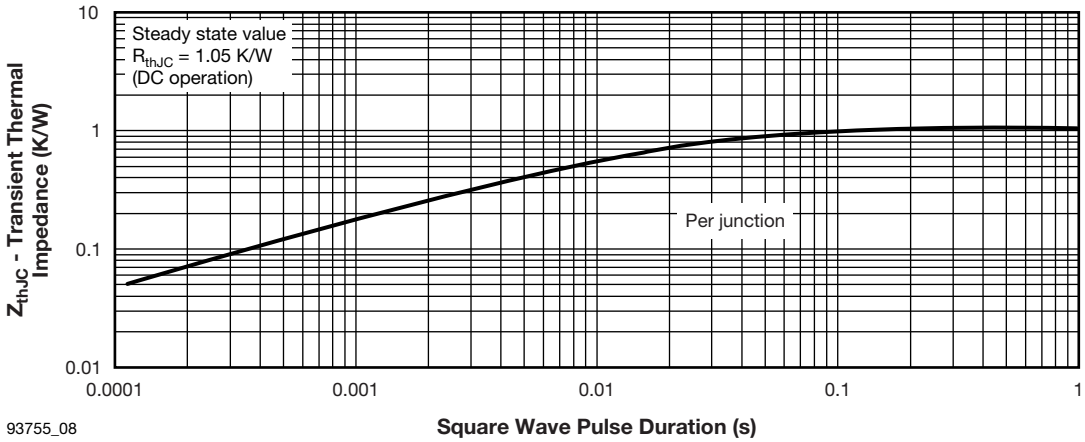

Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

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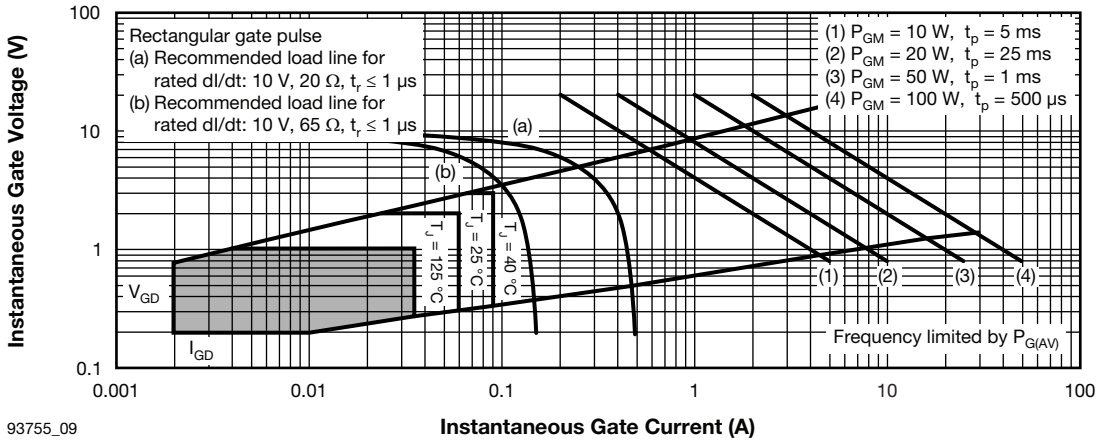

Fig. 9 - Gate Characteristics

ORDERING INFORMATION TABLE

Device code	VS-	P	4	0	2	K	W
	1	2	3	4	5	6	7

1 - Vishay Semiconductors product

2 - Module type

3 - Current rating
1 = 25 A DC (P100 series)
4 = 40 A DC (P400 series)

4 - Circuit configuration
0 = single phase, hybrid bridge common cathode
2 = single phase, hybrid bridge doubler connection
3 = single phase, all SCR bridge

5 - Voltage code
1 = 400 V
2 = 600 V
3 = 800 V
4 = 1000 V
5 = 1200 V

6 - K = optional voltage suppression

7 - W = optional freewheeling diode

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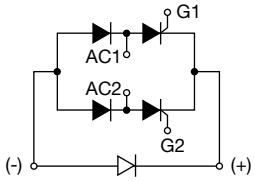
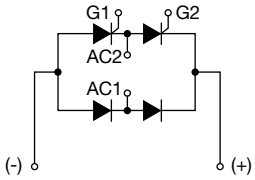
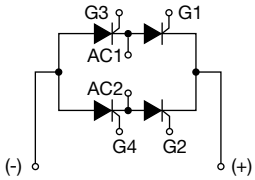
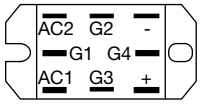
CIRCUIT CONFIGURATION			
CIRCUIT DESCRIPTION	**CIRCUIT CONFIGURATION CODE**	**SCHEMATIC DIAGRAM**	**TERMINAL POSITIONS**
Single phase, hybrid bridge common cathode	0		
Single phase, hybrid bridge doubler connection	2		
Single phase, all SCR bridge	3		

CODING [1]					
CIRCUIT DESCRIPTION	**CIRCUIT CONFIGURATION CODE**	**BASIC SERIES**	**WITH VOLTAGE SUPPRESSION**	**WITH FREEWHEELING DIODE**	**WITH BOTH VOLTAGE SUPPRESSION AND FREEWHEELING DIODE**
Single phase, hybrid bridge common cathode	0	P40.	P40.K	P40.W	P40.KW
Single phase, hybrid bridge doubler connection	2	P42.	P42.K	-	-
Single phase, all SCR bridge	3	P43.	P43.K	-	-

Note

(1) To complete code refer to Voltage Ratings table, i.e.: for 600 V P40.W complete code is P402W

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95335

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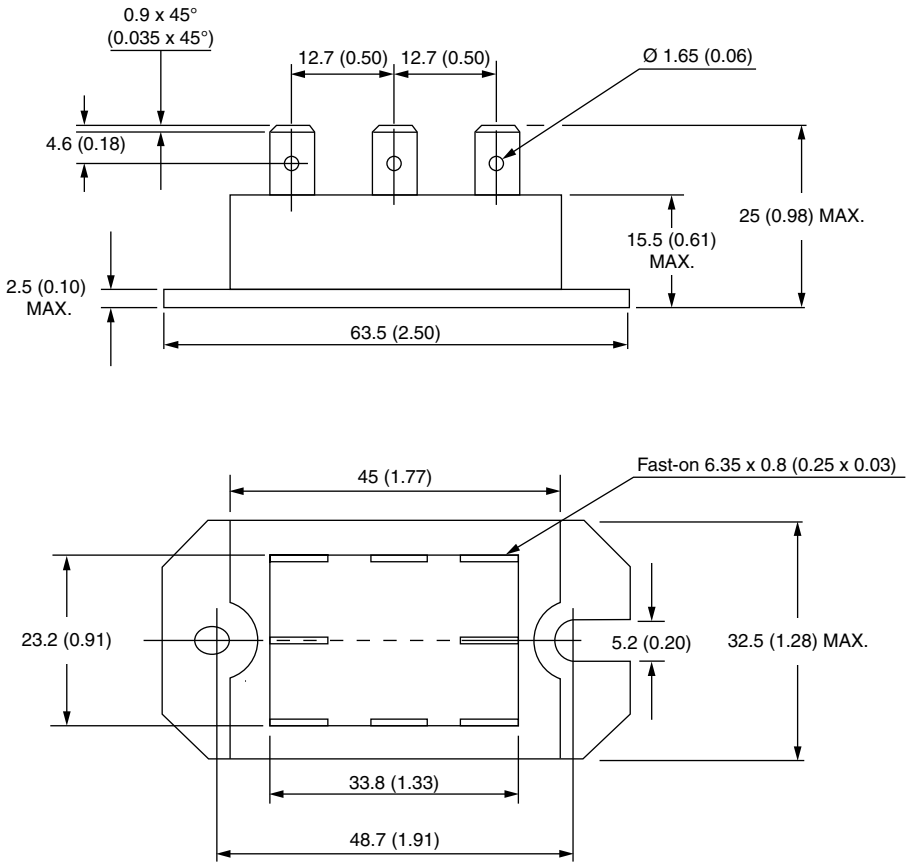
D-19 PACE-PAK

DIMENSIONS in millimeters (inches)



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