

S23AF & S23AFH SERIES
800-600 VOLTS RANGE
STANDARD TURN-OFF TIME 12 μ s
430 AMP RMS, RING AMPLIFYING GATE
INVERTER TYPE HOCKEY PUK SCRs

VOLTAGE RATINGS

VOLTAGE CODE (1)	$V_{RRM}, V_{DRM} - (V)$ Max. rep. peak reverse and off-state voltage	$V_{RSM} - (V)$ Max. non-rep. peak reverse voltage $t_p \leq 5ms$	NOTES
	$T_J = -40^\circ$ to max. rated	$T_J = 25^\circ$ to max. rated	
8	800	900	Gate open
6	600	700	

MAXIMUM ALLOWABLE RATINGS

PARAMETER	SERIES	VALUE	UNITS	NOTES
T_J Junction temperature	S23AF	-40 to 125	$^\circ C$	
	S23AFH	-40 to 140		
T_{stg} Storage temperature	ALL	-40 to 150	$^\circ C$	
$I_T(AV)$ Max. av. current @ Max. T_C	ALL	275	A	180° half sine wave
	S23AF	70	$^\circ C$	
	S23AFH	85		
$I_T(RMS)$ Nom. RMS current	ALL	430	A	
I_{TSM} Max. peak non-repetitive surge current	ALL	4400	A	50Hz half cycle sine wave Initial $T_J = 125^\circ C$, rated V_{RRM} applied after surge.
		4600		60Hz half cycle sine wave
		5250		50Hz half cycle sine wave Initial $T_J = 125^\circ C$, no voltage applied after surge.
		5450		60Hz half cycle sine wave
I^2t Max. I^2t capability	ALL	96	kA^2s	$t = 10ms$ Initial $T_J = 125^\circ C$, rated V_{RRM} applied after surge.
		88		$t = 8.3ms$
		135		$t = 10ms$ Initial $T_J = 125^\circ C$, no voltage applied after surge.
		125		$t = 8.3ms$
$I^2\sqrt{t}$ Max. $I^2\sqrt{t}$ capability	ALL	1350	$kA^2\sqrt{s}$	Initial $T_J = 125^\circ C$, no voltage applied after surge. I^2t for time $t_x = I^2\sqrt{t} \cdot \sqrt{t_x}$, $0.1 \leq t_x \leq 10ms$.
di/dt Max. non-repetitive rate-of-rise of current	ALL	800	A/ μs	$T_J = 125^\circ C$, $V_D = V_{DRM}$, $I_{TM} = 1600A$. Gate pulse: 20V, 20 Ω , 10 μs , 0.5 μs rise time. Max. repetitive di/dt is approximately 40% of non-repetitive value.
P_{GM} Max. peak gate power	ALL	10	W	$t_p \leq 5ms$
$P_{G(AV)}$ Max. av. gate power	ALL	2	W	
$+I_{GM}$ Max. peak gate current	ALL	3	A	$t_p \leq 5ms$
$-V_{GM}$ Max. peak negative gate voltage	ALL	15	V	
F Mounting force	ALL	4450(1000) \pm 10%	N(lbf)	

(1) To complete the part number, refer to the Ordering Information table.

S23AF & S23AFH SERIES 800-600 VOLTS RANGE

CHARACTERISTICS

PARAMETER	SERIES	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{TH} Peak on-state voltage	ALL	—	2.05	2.14	V	Initial $T_J = 25^\circ\text{C}$, 50-60Hz half sine, $I_{peak} = 850\text{A}$.	
$V_{T(TO)1}$ Low-level threshold	ALL	—	—	1.25	V	$T_J = \text{max. rated}$ $\text{Av. power} = V_{T(TO)} \cdot I_{T(AV)} + r_T \cdot [I_{T(RMS)}]^2$ Use low level values for $I_{TH} \leq \pi \text{ rated } I_{T(AV)}$	
$V_{T(TO)2}$ High-level threshold		—	—	1.57			
r_{T1} Low-level resistance	ALL	—	—	0.99	m Ω		
r_{T2} High-level resistance		—	—	0.67			
I_L Latching current	ALL	—	270	—	mA	$T_C = 25^\circ\text{C}$, 12V anode. Gate pulse: 10V, 20 Ω , 100 μs .	
I_H Holding current	ALL	—	90	500	mA	$T_C = 25^\circ\text{C}$, 12V anode. Initial $I_T = 5\text{A}$.	
t_d Delay time	ALL	—	0.5	1.5	μs	$T_C = 25^\circ\text{C}$, $V_D = \text{rated } V_{DRM}$, 50A resistive load. Gate pulse: 10V, 20 Ω , 10 μs , 1 μs rise time.	
t_q Turn-off time							
	"A" suffix	S23AF	—	—	12	μs	$T_J = \text{max. rated}$. $I_{TH} = 300\text{A}$, $di_p/dt = 15\text{A}/\mu\text{s}$, $V_R = 50\text{V}$, $dv/dt = 200\text{V}/\mu\text{s}$ lin. to 80% rated V_{DRM} . Gate: 0V, 100 Ω .
	"B" suffix	S23AF/H	—	—	15		
$t_{q(\text{diode})}$ Turn-off time with feedback diode							
	"A" suffix	S23AF	—	—	15	μs	$T_J = \text{max. rated}$. $I_{TH} = 300\text{A}$, $di_p/dt = 15\text{A}/\mu\text{s}$, $V_R = 1\text{V}$, $dv/dt = 600\text{V}/\mu\text{s}$ lin. to 40% V_{DRM} . Gate: 0V, 100 Ω .
	"B" suffix	S23AF/H	—	—	20		
$I_{RM(REC)}$ Recovery current	ALL	—	43	—	A	$T_J = 125^\circ\text{C}$, $I_{TH} = 500\text{A}$, $di_p/dt = 50\text{A}/\mu\text{s}$.	
Q_{RR} Recovered charge	ALL	—	41	—	μC		
dv/dt Critical rate-of-rise of off-state voltage	ALL	500	700	—	V/ μs	$T_J = 125^\circ\text{C}$. Exp. to 100% or lin. Higher dv/dt values to 80% V_{DRM} , gate open. available.	
		1000	—	—		$T_J = 125^\circ\text{C}$. Exp. to 67% V_{DRM} , gate open.	
I_{RM} , I_{DM} Peak reverse and off-state current	S23AF	—	10	30	mA	$T_J = \text{max rated}$. Rated V_{RRM} and V_{DRM} , gate open.	
	S23AFH	—	15	45			
I_{GT} DC gate current to trigger	ALL	—	—	300	mA	$T_C = -40^\circ\text{C}$ +12V anode-to-cathode. For recommended gate drive see "Gate Characteristics" figure.	
		40	60	150		$T_C = 25^\circ\text{C}$	
V_{GT} DC gate voltage to trigger	ALL	—	—	3.3	V	$T_C = -40^\circ\text{C}$	
		—	1.2	2.5		$T_C = 25^\circ\text{C}$	
V_{GD} DC gate voltage not to trigger	ALL	—	—	0.3	V	$T_C = 125^\circ\text{C}$. Max. value which will not trigger with rated V_{DRM} anode-to-cathode.	
R_{thJC} Thermal resistance, junction-to-case	ALL	—	—	0.085	$^\circ\text{C}/\text{W}$	DC operation, double side cooled.	
		—	—	0.104	$^\circ\text{C}/\text{W}$	180 $^\circ$ sine wave, double side cooled.	
		—	—	0.109	$^\circ\text{C}/\text{W}$	120 $^\circ$ rectangular wave, double side cooled.	
R_{thCS} Thermal resistance, case-to-sink	ALL	—	—	0.060	$^\circ\text{C}/\text{W}$	Mtg. surface smooth, flat and greased. Single side cooled. For double side, divide value by 2.	
wt Weight	ALL	—	57(2)	—	g(oz.)		
Case Style	ALL	TO-200AB			JEDEC		

S23AF & S23AFH SERIES 800-600 VOLTS RANGE

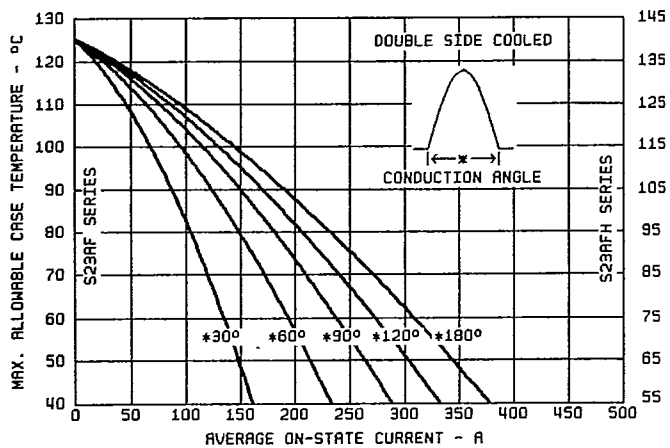


Fig. 1 — Case Temperature Ratings
— Sinusoidal Waveforms, 50 to 400 Hz

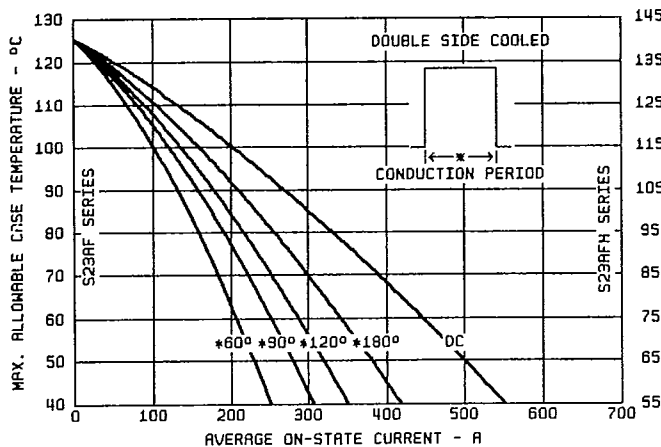


Fig. 2 — Case Temperature Ratings
— Rectangular Waveforms, 50 to 400 Hz

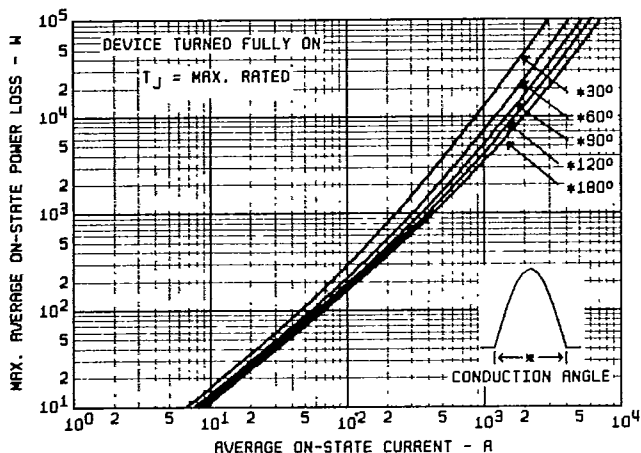


Fig. 3 — Power Loss Characteristics
— Sinusoidal Waveforms

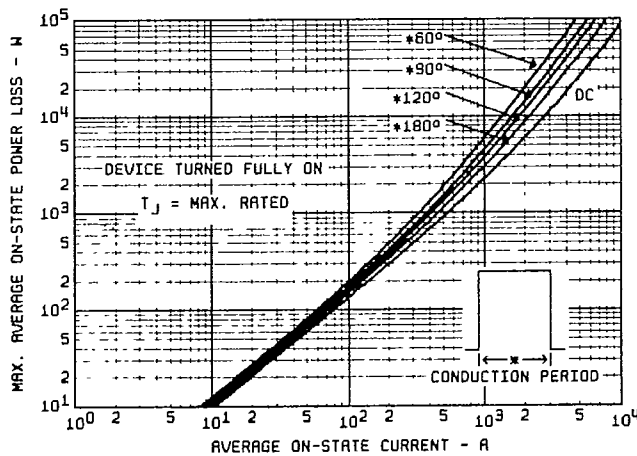


Fig. 4 — Power Loss Characteristics
— Rectangular Waveforms

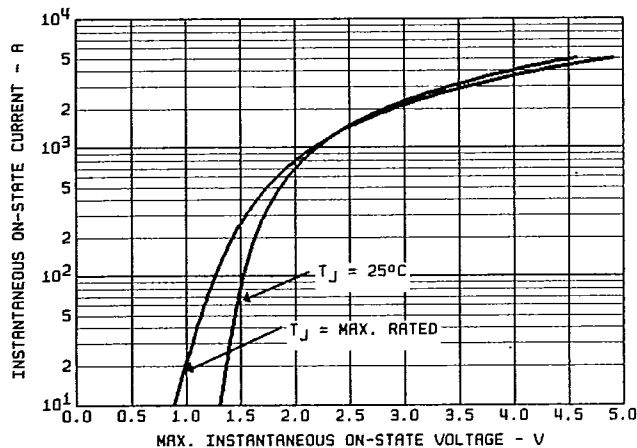


Fig. 5 — On-State Characteristics

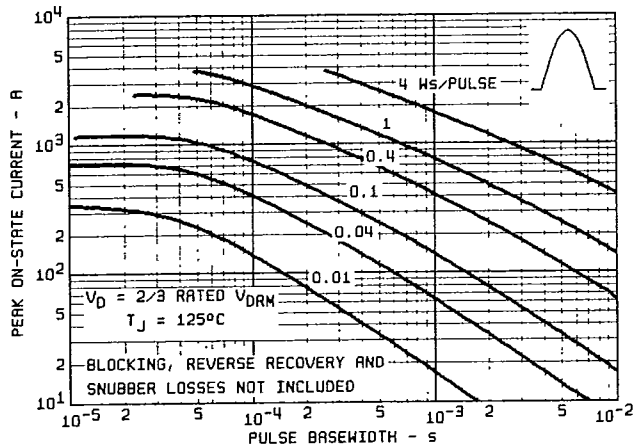


Fig. 6 — Max. Energy Loss per Pulse
— Sinusoidal Waveforms

S23AF & S23AFH SERIES 800-600 VOLTS RANGE

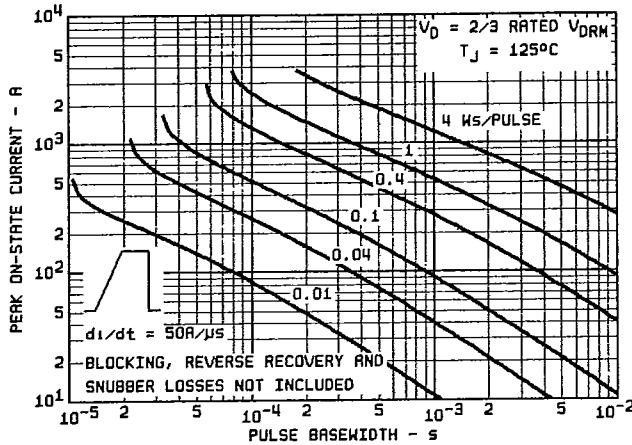


Fig. 7 — Max. Energy Loss per Pulse — Trapezoidal Waveforms, $di/dt = 50 \text{ A}/\mu\text{s}$

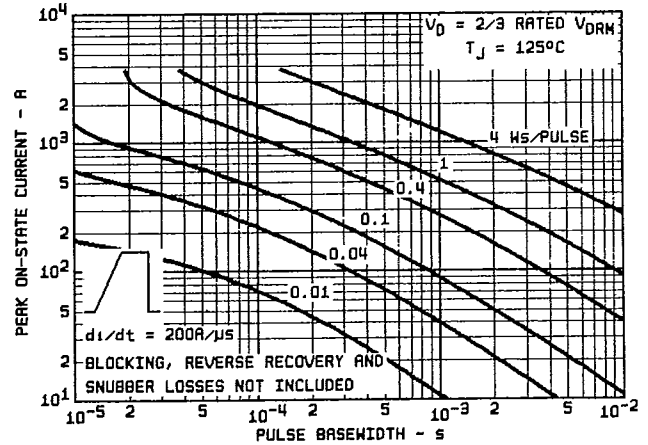


Fig. 8 — Max. Energy Loss per Pulse — Trapezoidal Waveforms, $di/dt = 200 \text{ A}/\mu\text{s}$

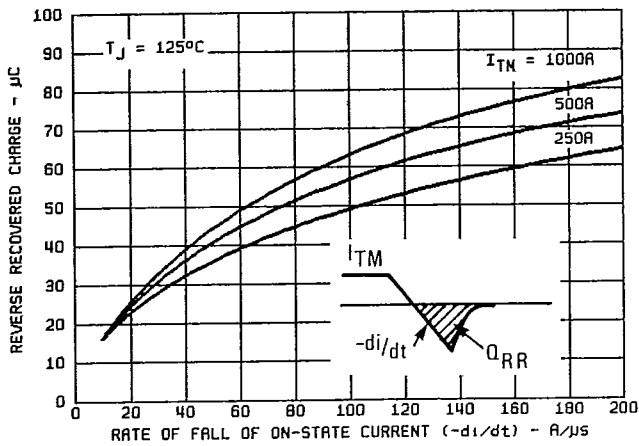


Fig. 9 — Typical Recovered Charge

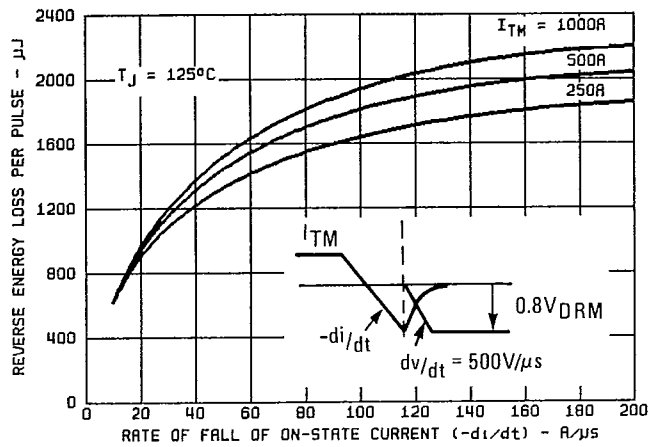


Fig. 10 — Typical Reverse Energy Losses

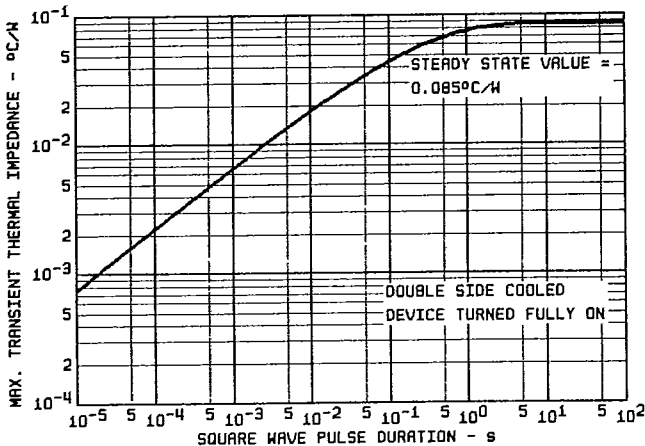


Fig. 11 — Transient Thermal Impedance, Junction-to-Case

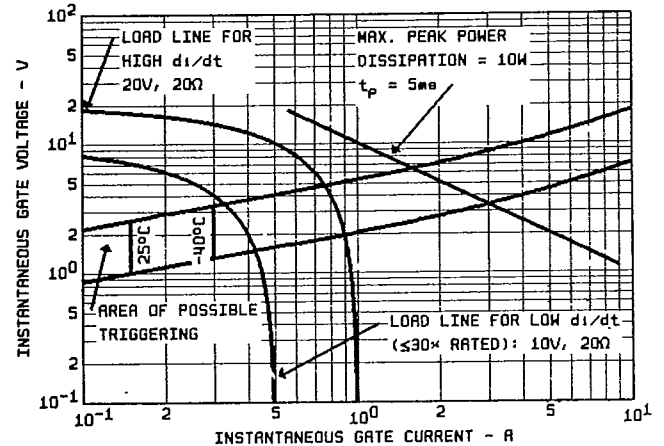


Fig. 12 — Gate Characteristics

S23AF & S23AFH SERIES 800-600 VOLTS RANGE

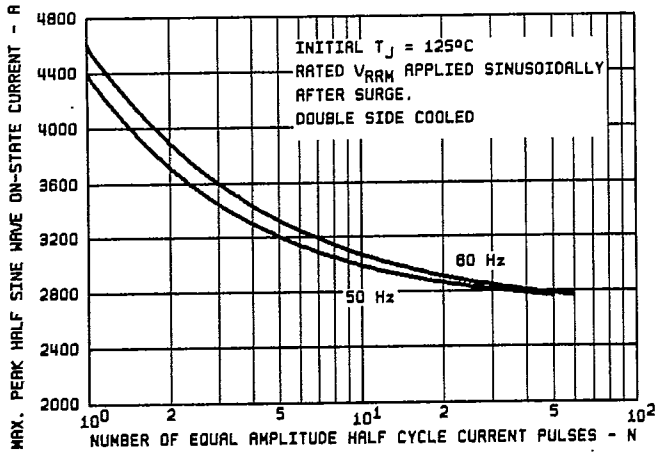


Fig. 13 — Non-Repetitive Surge Current Ratings

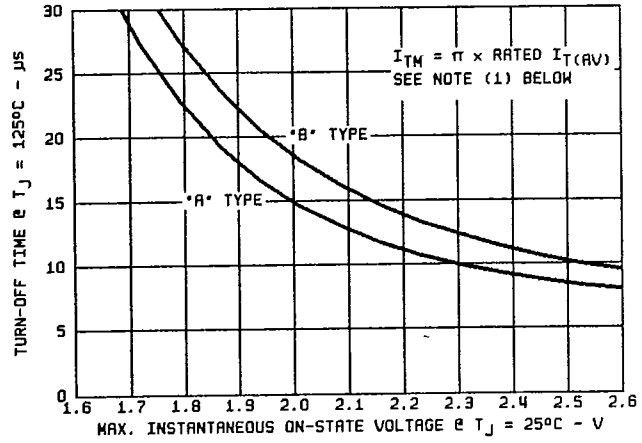


Fig. 14 — Trend for Turn-Off Time vs. On-State Voltage

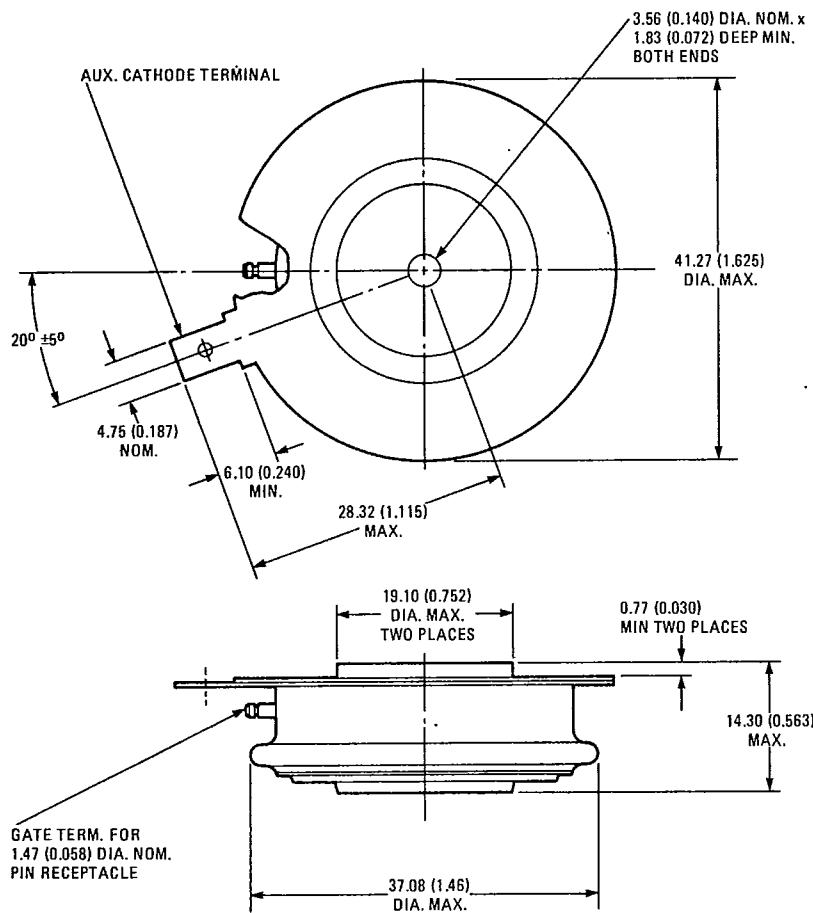
(1) These curves are intended as a guideline. To specify non-standard t_q/V_{TM} contact factory.

ORDERING INFORMATION

TYPE	TEMPERATURE		VOLTAGE		TURN-OFF	
	CODE	MAX. T_J	CODE	V_{DRM}	CODE	MAX. t_q
S23AF	—	125°C	8	800V	A	12µs
	H	140°C	6	600V	B	15µs

For example, for a device with max. $T_J = 125^\circ\text{C}$, $V_{DRM} = 800\text{V}$, max. $t_q = 12\mu\text{s}$, order as: S23AF6A.

S23AF & S23AFH SERIES 800-600 VOLTS RANGE



ANODE TO GATE
CREEPAGE DISTANCE: 7.62 (0.300) MIN.
STRIKE DISTANCE: 7.12 (0.280) MIN.

SUPPLIED WITH LEADS. FOR DETAILS CONTACT
YOUR INTERNATIONAL RECTIFIER SALES OFFICE
OR DISTRIBUTOR.

Conforms to JEDEC Outline TO-200AB

Dimensions in Millimeters and (Inches)