



S30EF SERIES
1600-1400 VOLTS RANGE
STANDARD TURN-OFF TIME 30 μ s
750 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
	$T_J = 0^\circ$ to $125^\circ C$	$T_J = -40^\circ$ to $0^\circ C$	$T_J = 25^\circ$ to $125^\circ C$	
18	1800	1520	1700	Gate open
14	1400	1330	1500	

MAXIMUM ALLOWABLE RATINGS

PARAMETER	VALUE	UNITS	NOTES
T_J Junction temperature	-40 to 125	$^\circ C$	
T_{stg} Storage temperature	-40 to 150	$^\circ C$	
$I_T(AV)$ Max. av. current	480	A	180 $^\circ$ half sine wave
• Max. T_C	70	$^\circ C$	
$I_T(RMS)$ Max. RMS current	750	A	
I_{TSM} Max. peak non-repetitive surge current	7350	A	50Hz half cycle sine wave Initial $T_J = 125^\circ C$, rated V_{RRM} applied after surge.
	7700		60Hz half cycle sine wave
	8750		50Hz half cycle sine wave Initial $T_J = 125^\circ C$, no voltage applied after surge.
	9150		60Hz half cycle sine wave
I^2t Max. I^2t capability	270	kA^2s	$t = 10ms$ Initial $T_J = 125^\circ C$, rated V_{RRM} applied after surge.
	245		$t = 8.3ms$
	385		$t = 10ms$ Initial $T_J = 125^\circ C$, no voltage applied after surge.
	350		$t = 8.3ms$
$I^2\sqrt{t}$ Max. $I^2\sqrt{t}$ capability	3850	$kA^2\sqrt{s}$	Initial $T_J = 125^\circ C$, no voltage applied after surge. I^2t for time $t_x = I^2\sqrt{t} = \sqrt{t_x}$. $0.1 \leq t_x \leq 10ms$.
di/dt Max. non-repetitive rate-of-rise of current	800	A/ μs	$T_J = 125^\circ C$, $V_D = V_{DRM}$, $I_{TM} = 1800A$. Gate pulses: 20V, 200, 10 μs , 0.5 μs rise time. Max. repetitive di/dt is approximately 40% of non-repetitive value.
P_{GM} Max. peak gate power	10	W	$t_p \leq 5ms$
$P_G(AV)$ Max. av. gate power	2	W	
$+I_{GM}$ Max. peak gate current	3	A	$t_p \leq 5ms$
$-V_{GM}$ Max. peak negative gate voltage	15	V	
F Mounting force	8900(2000) \pm 10%	N(lbf)	

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

S30EF SERIES 1600-1400 VOLTS RANGE

CHARACTERISTICS

PARAMETER	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{TM} Peak on-state voltage	—	2.35	2.43	V	Initial $T_J = 25^\circ\text{C}$, 50-60Hz half sine, $I_{peak} = 1500\text{A}$.	
$V_{T(TO)1}$ Low-level threshold	—	—	1.31	V	$T_J = 125^\circ\text{C}$ Av. power = $V_{T(TO)} \cdot I_{T(AV)} + r_T \cdot [I_{T(RMS)}]^2$ Use low level values for $I_{TM} \leq \pi$ rated $I_{T(AV)}$	
$V_{T(TO)2}$ High-level threshold	—	—	1.56			
r_{T1} Low-level resistance	—	—	0.80	m Ω		
r_{T2} High-level resistance	—	—	0.86			
I_L Latching current	—	300	—	mA	$T_C = 25^\circ\text{C}$, 12V anode. Gate pulse: 10V, 20 Ω , 100 μs .	
I_H Holding current	—	100	500	mA	$T_C = 25^\circ\text{C}$, 12V anode. Initial $I_T = 10\text{A}$.	
t_d Delay time	—	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					$T_J = 125^\circ\text{C}$. $I_{TM} = 500\text{A}$, $di/dt = 25\text{A}/\mu\text{s}$, $V_R = 50\text{V}$, $dv/dt = 200\text{V}/\mu\text{s}$ lin. to 80% rated V_{DRM} . Gate: 0V, 100 Ω .	
	"A" suffix	—	—	30		μs
	"B" suffix	—	—	40		μs
$t_q(\text{diode})$ Turn-off time with feedback diode					$T_J = 125^\circ\text{C}$. $I_{TM} = 500\text{A}$, $di/dt = 25\text{A}/\mu\text{s}$, $V_R = 1\text{V}$, $dv/dt = 800\text{V}/\mu\text{s}$ lin. to 40% V_{DRM} . Gate: 0V, 100 Ω .	
	"A" suffix	—	—	40		μs
	"B" suffix	—	—	50		μs
$I_{RM(REC)}$ Recovery current	—	80	—	A	$T_J = 125^\circ\text{C}$, $I_{TM} = 500\text{A}$, $di/dt = 50\text{A}/\mu\text{s}$.	
Q_{RR} Recovered charge	—	125	—	μC		
dv/dt Critical rate-of-rise of off-state voltage	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 87% V_{DRM} , gate open.	
I_{RM} , I_{DM} Peak reverse and off-state current	—	20	40	mA	$T_J = 125^\circ\text{C}$. Rated V_{RRM} and V_{DRM} , gate open.	
I_{GT} DC gate current to trigger	—	—	300	mA	$T_C = -40^\circ\text{C}$ +12V anode-to-cathode. For recommended gate drive see "Gate Characteristics" figure.	
	50	70	150		$T_C = 25^\circ\text{C}$	
V_{GT} DC gate voltage to trigger	—	—	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	—	—	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	—	—	0.040	$^\circ\text{C}/\text{W}$	DC operation, double side cooled.	
	—	—	0.051	$^\circ\text{C}/\text{W}$	180 $^\circ$ sine wave, double side cooled.	
	—	—	0.053	$^\circ\text{C}/\text{W}$	120 $^\circ$ rectangular wave, double side cooled.	
R_{thCS} Thermal resistance, case-to-sink	—	—	0.040	$^\circ\text{C}/\text{W}$	Mtg. surface smooth, flat and greased. Single side cooled. For double side, divide value by 2.	
wt Weight	—	85(3.0)	—	g(oz.)		
Case Style	IR A-29					

S30EF SERIES
1600-1400 VOLTS RANGE

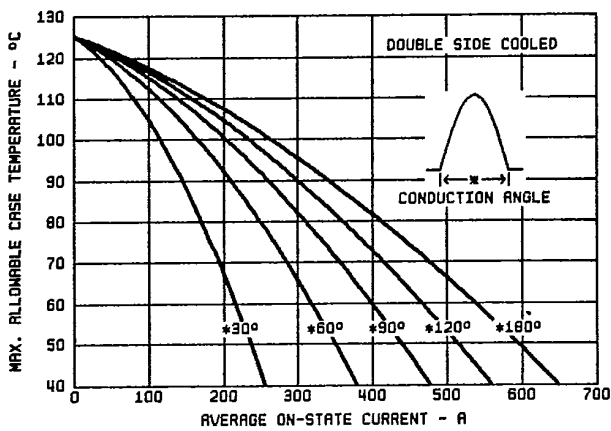


Fig. 1 — Case Temperature Ratings
— Sinusoidal Waveforms, 50 to 400 Hz

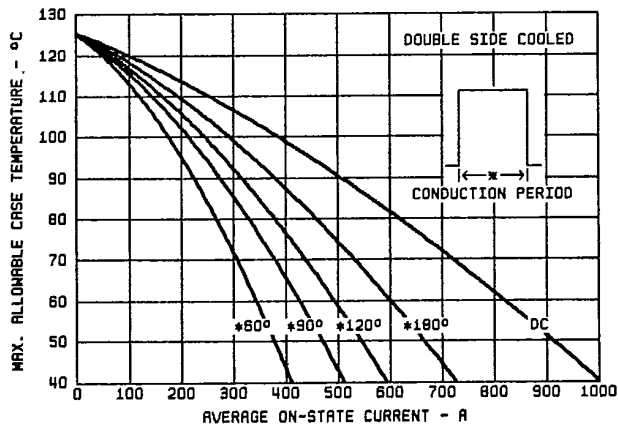


Fig. 2 — Case Temperature Ratings
— Rectangular Waveforms, 50 to 400 Hz

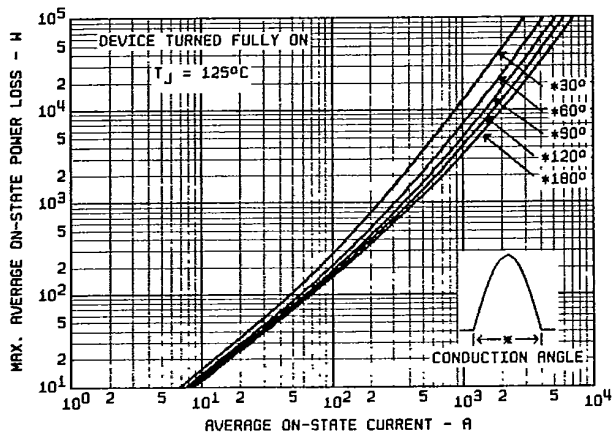


Fig. 3 — Power Loss Characteristics
— Sinusoidal Waveforms

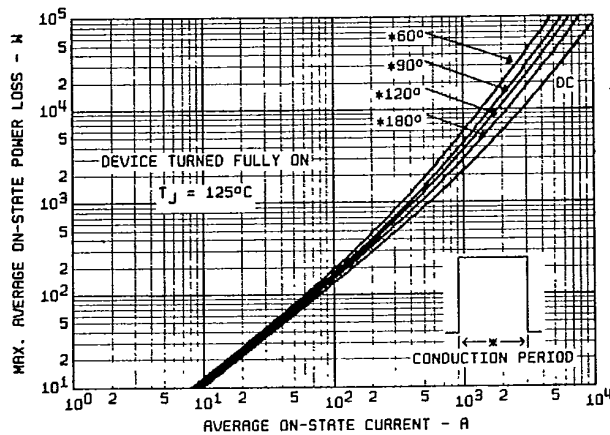


Fig. 4 — Power Loss Characteristics
— Rectangular Waveforms

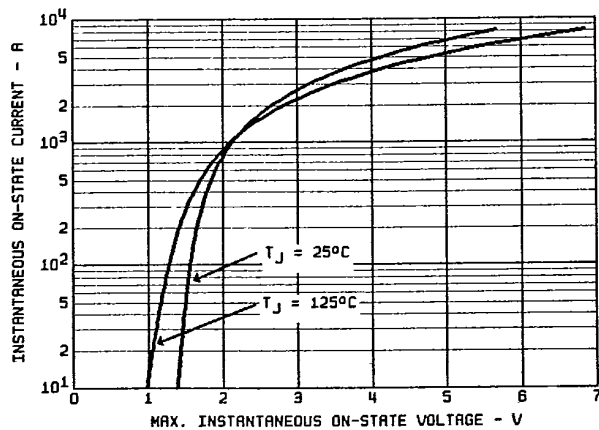


Fig. 5 — On-State Characteristics

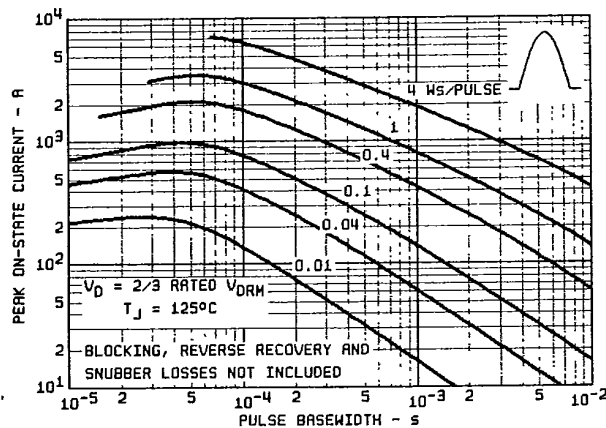


Fig. 6 — Max. Energy Loss per Pulse
— Sinusoidal Waveforms

S30EF SERIES
1600-1400 VOLTS RANGE

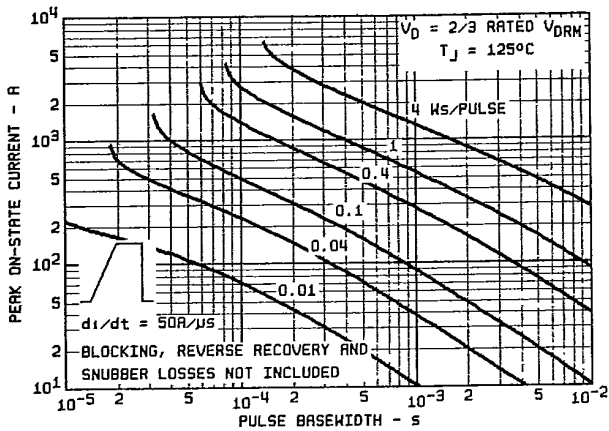


Fig. 7 — Max. Energy Loss per Pulse
— Trapezoidal Waveforms, $di/dt = 50 \text{ A}/\mu\text{s}$

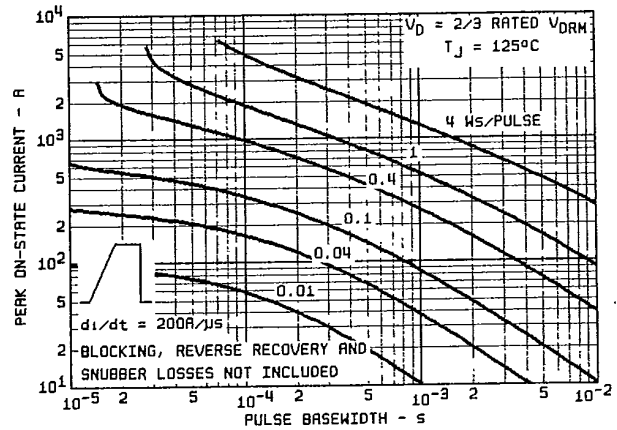


Fig. 8 — Max. Energy Loss per Pulse
— Trapezoidal Waveforms, $di/dt = 200 \text{ A}/\mu\text{s}$

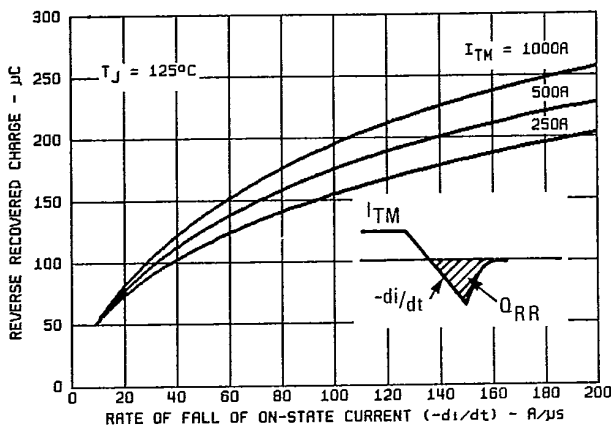


Fig. 9 — Typical Recovered Charge

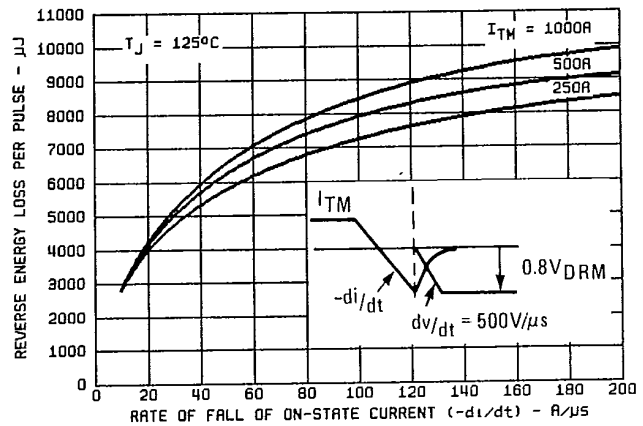


Fig. 10 — Typical Reverse Energy Losses

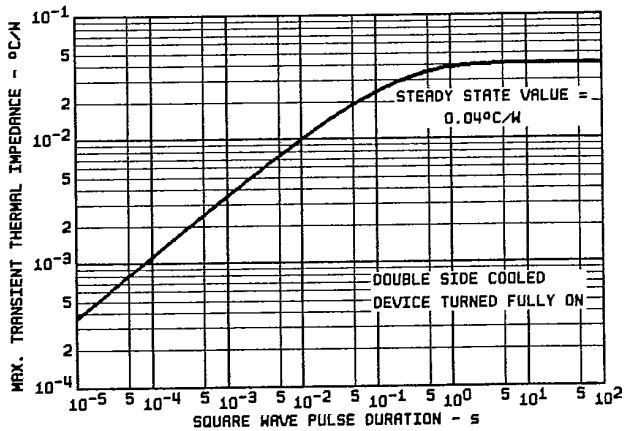


Fig. 11 — Transient Thermal Impedance, Junction-to-Case

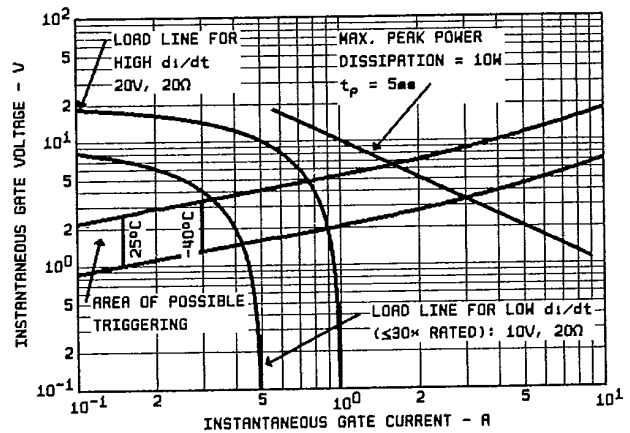


Fig. 12 — Gate Characteristics

S30EF SERIES 1600-1400 VOLTS RANGE

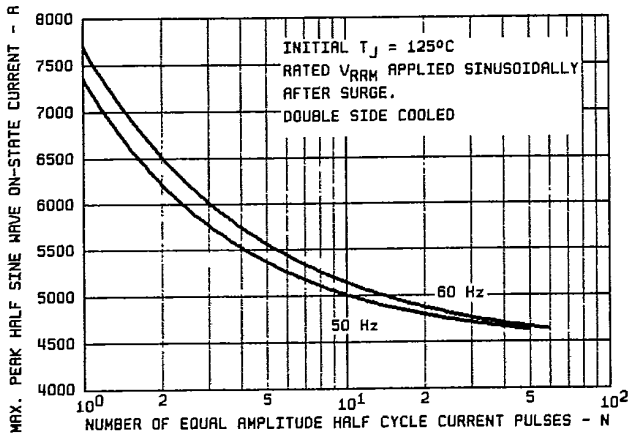


Fig. 13 — Non-Repetitive Surge Current Ratings

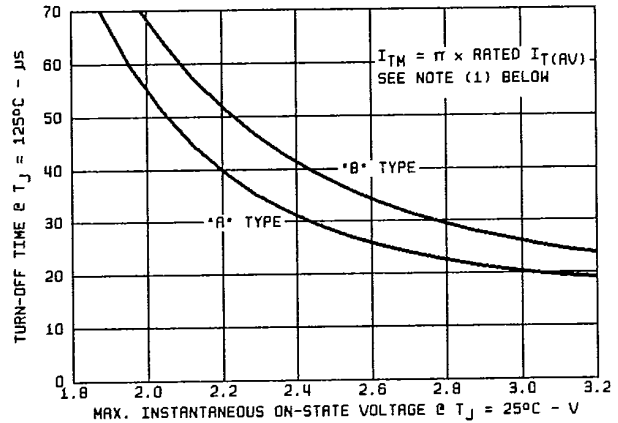


Fig. 14 — Trend for Turn-Off Time vs. On-State Voltage

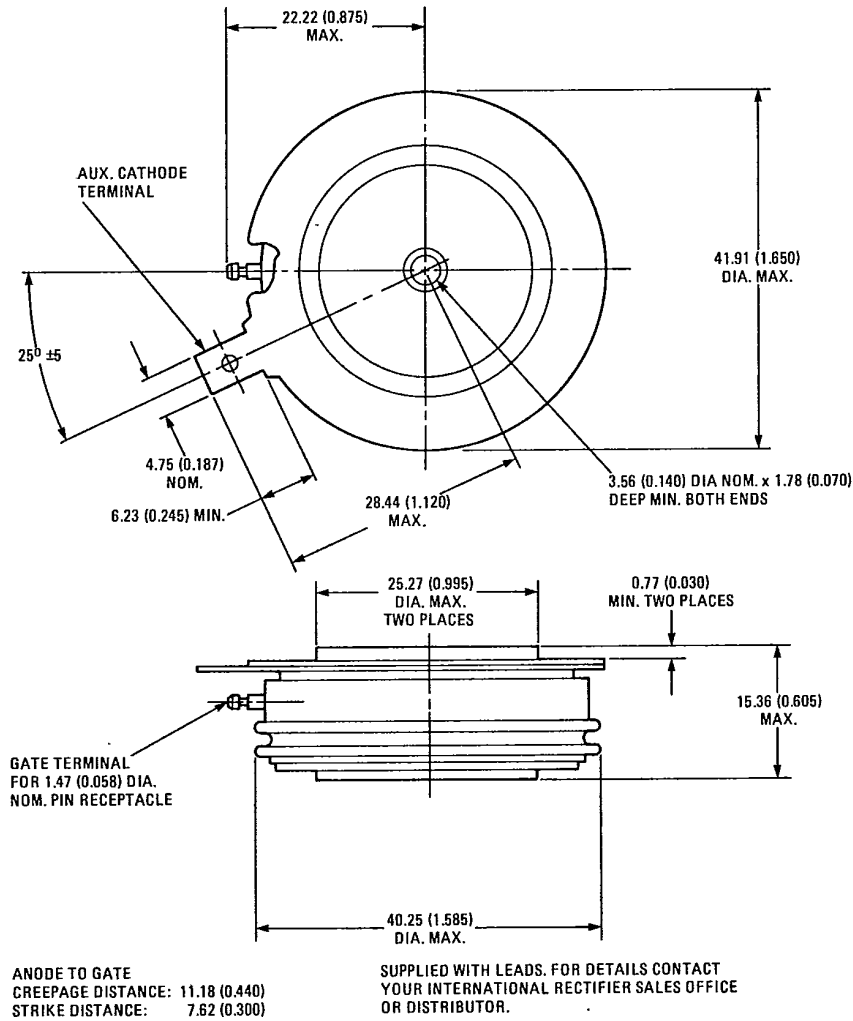
(1) These curves are intended as a guideline. To specify non-standard t_q/V_{TM} contact factory.

ORDERING INFORMATION

TYPE	TEMPERATURE		VOLTAGE		TURN-OFF	
	CODE	MAX. T_J	CODE	V_{DRM}	CODE	MAX. t_q
S30EF	—	125°C	16	1600V	A	30µs
			14	1400V	B	40µs

For example, for a device with max. $T_J = 125^\circ\text{C}$, $V_{DRM} = 1400\text{V}$, max. $t_q = 30\mu\text{s}$, order as: S30EF14A.

**S30EF SERIES
1600-1400 VOLTS RANGE**



IR Case Style A-29
Dimensions in Millimeters and (Inches)



S30EF SERIES
1200-1000 VOLTS RANGE
STANDARD TURN-OFF TIME 16 μ s
740 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 $125^\circ C$	$T_J = 25^\circ$ to $125^\circ C$	
12	1200	1300	Gate open
10	1000	1100	

MAXIMUM ALLOWABLE RATINGS

PARAMETER	VALUE	UNITS	NOTES
T_J Junction temperature	-40 to 125	$^\circ C$	
T_{stg} Storage temperature	-40 to 150	$^\circ C$	
$I_T(AV)$ Max. av. current	470	A	180 $^\circ$ half sine wave
ϕ Max. T_C	70	$^\circ C$	
$I_T(RMS)$ Nom. RMS current	740	A	
I_{TM} Max. peak non-repetitive surge current	7350	A	50Hz half cycle sine wave Initial $T_J = 125^\circ C$, rated V_{RRM} applied after surge.
	7700		60Hz half cycle sine wave
	8750		50Hz half cycle sine wave Initial $T_J = 125^\circ C$, no voltage applied after surge.
	9150		60Hz half cycle sine wave
$I^2 t$ Max. $I^2 t$ capability	270	$kA^2 s$	$t = 10ms$ Initial $T_J = 125^\circ C$, rated V_{RRM} applied after surge.
	245		$t = 8.3ms$
	385		$t = 10ms$ Initial $T_J = 125^\circ C$, no voltage applied after surge.
	350		$t = 8.3ms$
$I^2 \sqrt{t}$ Max. $I^2 \sqrt{t}$ capability	3850	$kA^2 \sqrt{s}$	Initial $T_J = 125^\circ C$, no voltage applied after surge. $I^2 t$ 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	800	A/ μs	$T_J = 125^\circ C$, $V_D = V_{DRM}$, $I_{TM} = 1600A$. Gate pulse: 20V, 20 μs , 10 μs , 0.5 μs rise time. Max. repetitive di/dt is approximately 40% of non-repetitive value.
P_{GM} Max. peak gate power	10	W	$t_p \leq 5ms$
$P_G(AV)$ Max. av. gate power	2	W	
$+I_{GM}$ Max. peak gate current	3	A	$t_p \leq 5ms$
$-V_{GM}$ Max. peak negative gate voltage	15	V	
F Mounting force	8900(2000) \pm 10%	N(lbf)	

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

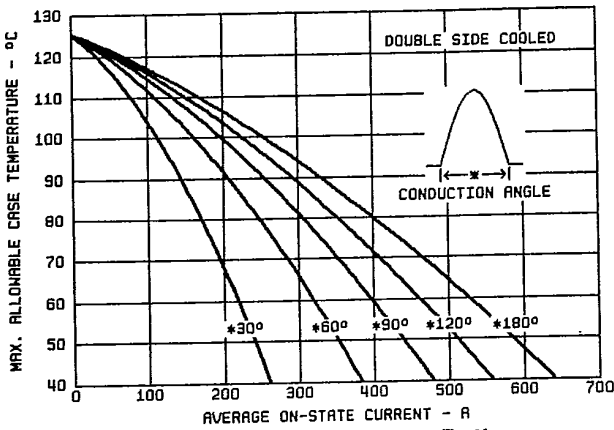


S30EF SERIES 1200-1000 VOLTS RANGE

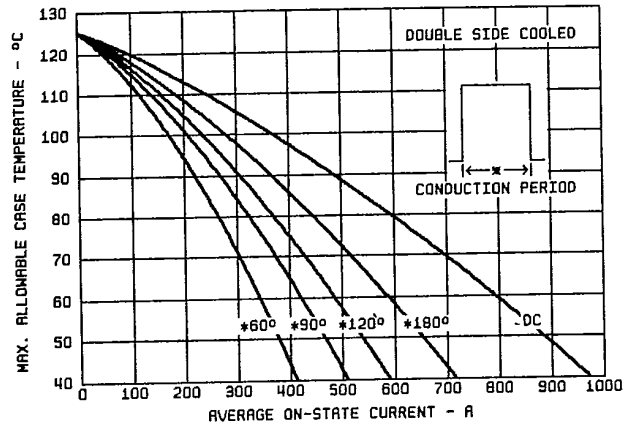
CHARACTERISTICS

PARAMETER	MIN.	TYP.	MAX.	UNITS	TEST CONDITIONS	
V_{TH} Peak on-state voltage	—	2.35	2.45	V	Initial $T_J = 25^\circ\text{C}$, 50-60Hz half sine, $I_{peak} = 1480\text{A}$.	
$V_{T(TO)1}$ Low-level threshold	—	—	1.40	V	$T_J = 125^\circ\text{C}$ Av. power = $V_{T(TO)} \cdot I_{T(AV)} + r_T \cdot (I_{T(RMS)})^2$ Use low level values for $I_{TH} \leq \pi$ rated $I_{T(AV)}$	
$V_{T(TO)2}$ High-level threshold	—	—	1.79			
r_{T1} Low-level resistance	—	—	0.78	m Ω		
r_{T2} High-level resistance	—	—	0.58			
I_L Latching current	—	300	—	mA	$T_C = 25^\circ\text{C}$, 12V anode. Gate pulses: 10V, 20 Ω , 100 μs .	
I_H Holding current	—	100	500	mA	$T_C = 25^\circ\text{C}$, 12V anode. Initial $I_T = 10\text{A}$.	
t_d Delay time	—	0.5	1.5	μs	$T_C = 25^\circ\text{C}$, $V_D =$ rated V_{DRM} , 50A resistive load. Gate pulses: 10V, 20 Ω , 10 μs , 1 μs rise time.	
t_q Turn-off time					$T_J = 125^\circ\text{C}$. $I_{TH} = 500\text{A}$, $di_p/dt = 25\text{A}/\mu\text{s}$, $V_R = 50\text{V}$, $dv/dt = 200\text{V}/\mu\text{s}$ lin. to 80% rated V_{DRM} . Gate: 0V, 100 Ω .	
	"A" suffix	—	—	16		μs
	"B" suffix	—	—	20		
$t_{q(\text{diode})}$ Turn-off time with feedback diode					$T_J = 125^\circ\text{C}$, $I_{TH} = 500\text{A}$, $di_p/dt = 25\text{A}/\mu\text{s}$, $V_R = 1\text{V}$, $dv/dt = 600\text{V}/\mu\text{s}$ lin. to 40% V_{DRM} . Gate: 0V, 100 Ω .	
	"A" suffix	—	—	20		μs
	"B" suffix	—	—	25		
$I_{RM(REC)}$ Recovery current	—	67	—	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	—	77	—	μC		
dv/dt Critical rate-of-rise of off-state voltage	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	—	15	40	mA	$T_J = 125^\circ\text{C}$. Rated V_{RRM} and V_{DRM} , gate open.	
I_{GT} DC gate current to trigger	—	—	300	mA	$T_C = -40^\circ\text{C}$ +12V anode-to-cathode. For recommended gate drive see "Gate Characteristics" figure.	
	50	70	150		$T_C = 25^\circ\text{C}$	
V_{GT} DC gate voltage to trigger	—	—	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	—	—	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	—	—	0.040	$^\circ\text{C}/\text{W}$	DC operation, double side cooled.	
	—	—	0.050	$^\circ\text{C}/\text{W}$	180 $^\circ$ sine wave, double side cooled.	
	—	—	0.053	$^\circ\text{C}/\text{W}$	120 $^\circ$ rectangular wave, double side cooled.	
R_{thCS} Thermal resistance, case-to-sink	—	—	0.040	$^\circ\text{C}/\text{W}$	Mtg. surface smooth, flat and greased. Single side cooled. For double side, divide value by 2.	
wt Weight	—	85(3.0)	—	g(oz.)		
Case Style	IR A-29					

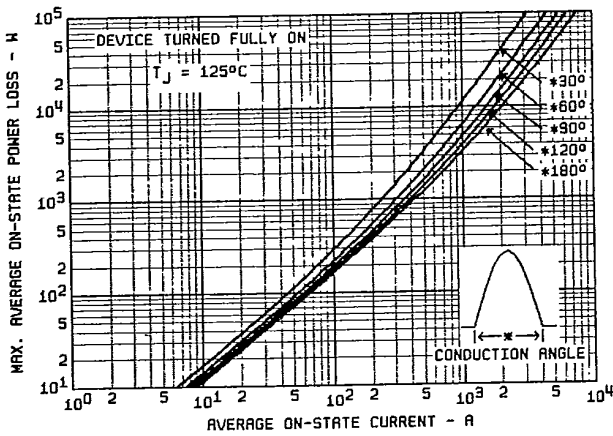
S30EF SERIES 1200-1000 VOLTS RANGE



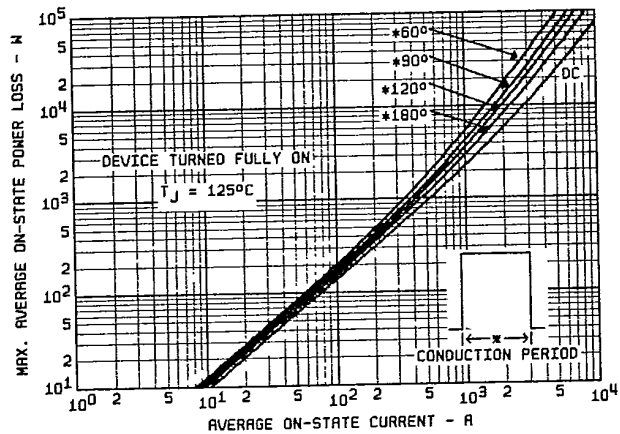
**Fig. 1 — Case Temperature Ratings
— Sinusoidal Waveforms, 50 to 400 Hz**



**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**

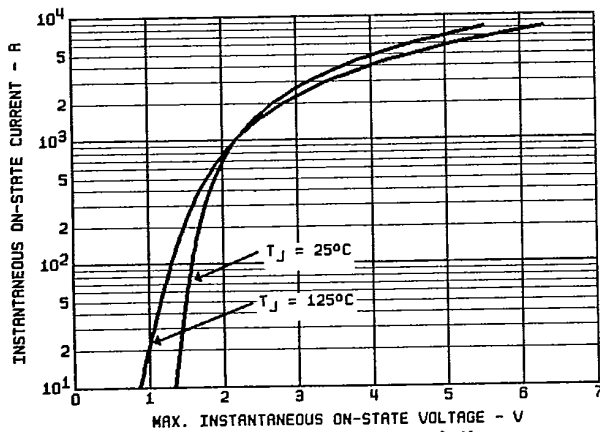
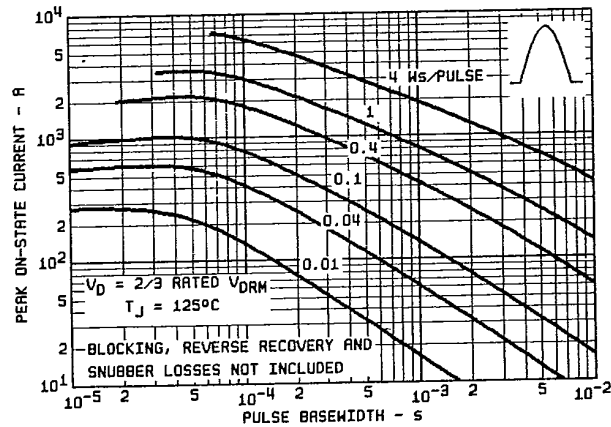


Fig. 5 — On-State Characteristics



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



S30EF SERIES 1200-1000 VOLTS RANGE

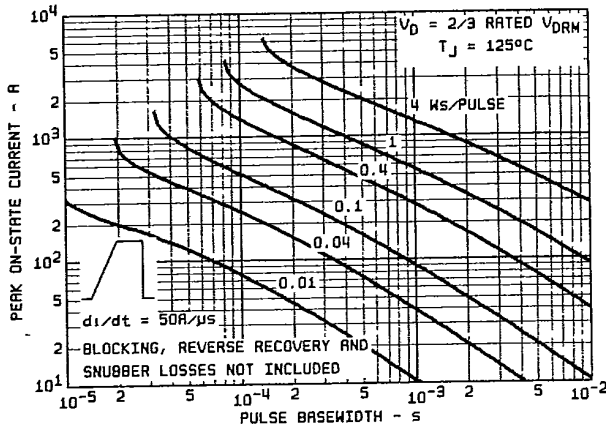


Fig. 7 — Max. Energy Loss per Pulse
— Trapezoidal Waveforms, $di/dt = 50 \text{ A}/\mu\text{s}$

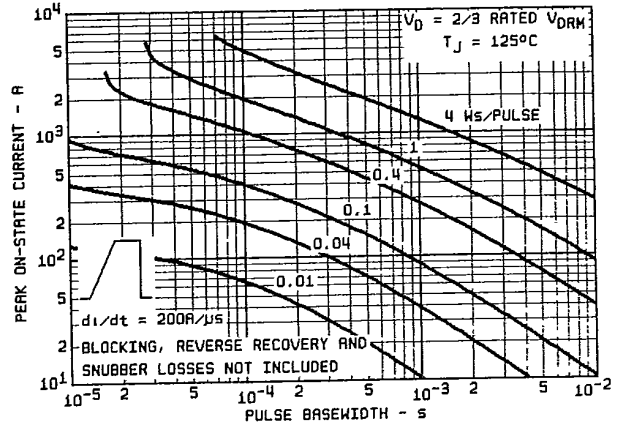


Fig. 8 — Max. Energy Loss per Pulse
— Trapezoidal Waveforms, $di/dt = 200 \text{ A}/\mu\text{s}$

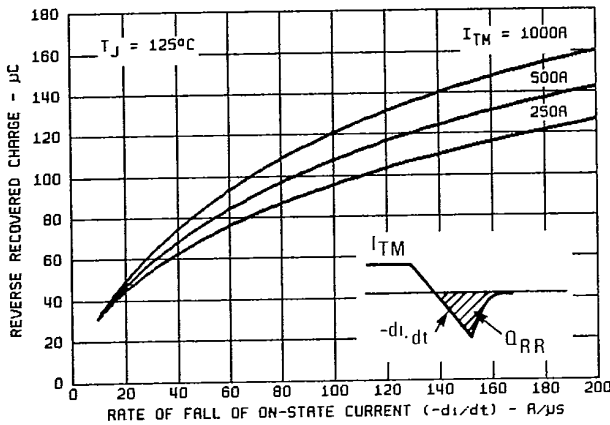


Fig. 9 — Typical Recovered Charge

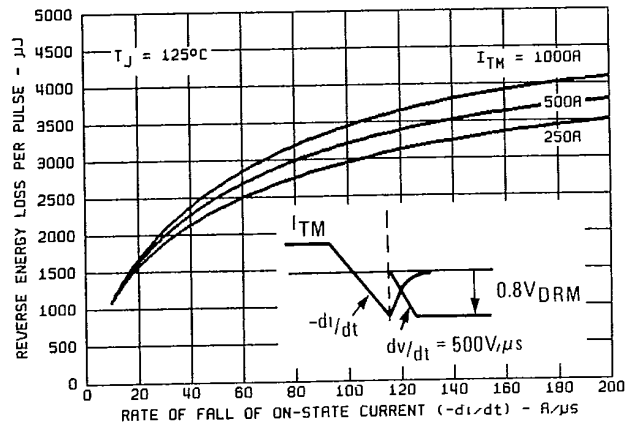


Fig. 10 — Typical Reverse Energy Losses

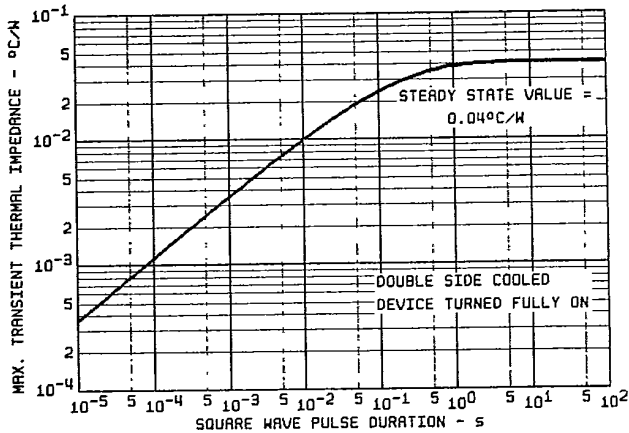


Fig. 11 — Transient Thermal Impedance,
Junction-to-Case

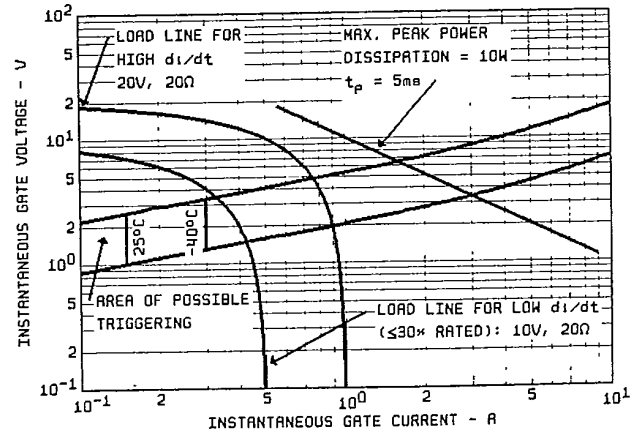


Fig. 12 — Gate Characteristics

S30EF SERIES 1200-1000 VOLTS RANGE

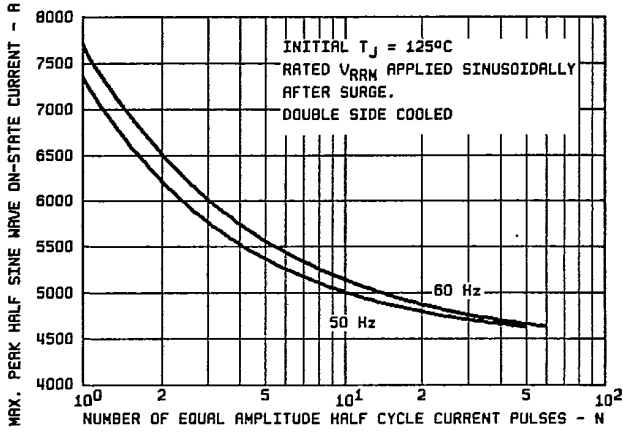


Fig. 13 — Non-Repetitive Surge Current Ratings

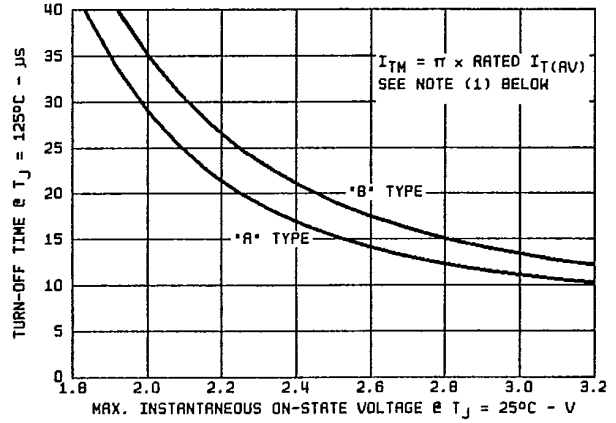


Fig. 14 — Trend for Turn-Off Time vs. On-State Voltage

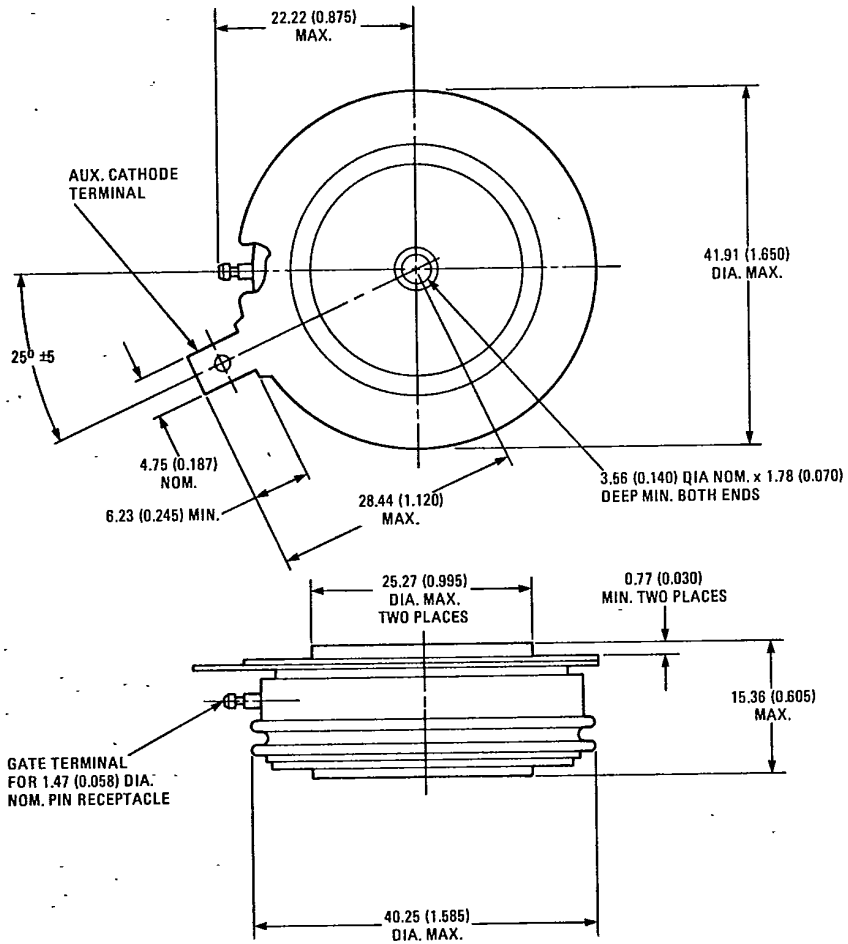
(1) These curves are intended as a guideline. To specify non-standard t_q/V_{TM} contact factory.

ORDERING INFORMATION

TYPE	TEMPERATURE		VOLTAGE		TURN-OFF	
	CODE	MAX. T_J	CODE	V_{DRM}	CODE	MAX. t_q
S30EF	—	125°C	12	1200V	A	16µs
			10	1000V	B	20µs

For example, for a device with max. $T_J = 125^\circ\text{C}$, $V_{DRM} = 1200\text{V}$, max. $t_q = 16\mu\text{s}$, order as: S30EF12A.

**S30EF SERIES
1200-1000 VOLTS RANGE**



ANODE TO GATE
CREEPAGE DISTANCE: 11.18 (0.440)
STRIKE DISTANCE: 7.62 (0.300)

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

IR Case Style A-29
Dimensions in Millimeters and (Inches)