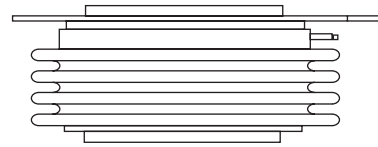


## Distributed Gate Thyristors (Hockey PUK Version), 1460A

### FEATURES

- Distributed center amplifying gate
- Metal case with ceramic insulator
- International standard case TO-200AC (K-PUK), Nell's D-type Capsule
- Compliant to RoHS
- Low on-state and switching losses
- Fast turn-on time,  $t_{gt} \leq 3\mu s$
- $di/dt > 1500 A/\mu s$



TO-200AC(K-PUK)  
(Nell's D-type Capsule)

### TYPICAL APPLICATIONS

- DC and AC motor controls
- Controlled DC power supplies
- AC controllers
- Ideal for Impulse Magnetizer

### PRODUCT SUMMARY

$I_{T(AV)}$	1460A
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### MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNIT
$I_{T(AV)}$	Double side cooled, single phase, 50Hz, 180° half-sine wave	1460	A
	$T_{hs}$	55	°C
$I_{T(RMS)}$		2900	A
	$T_{hs}$	25	°C
$I_{TSM}$	50 HZ	20	kA
	60 HZ	21	
$I^2t$	50 HZ	2000	kA <sup>2</sup> s
	60 HZ	1830	
$V_{DRM}/V_{RRM}$		1600 to 3200	V
$t_{gt}$	Typical	2.0	$\mu s$
$T_q$	Maximum	250	
$T_J$		-40 to 125	°C

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

TYPE NUMBER	VOLTAGE CODE	$V_{DRM}/V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V	$V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V	$I_{DRM}/I_{RRM}$ , MAXIMUM AT $T_J = T_J$ MAXIMUM mA
1460PTGxxD0	16	1600	1700	100
	18	1800	1900	
	20	2000	2100	
	24	2400	2500	
	26	2600	2700	
	30	3000	3100	
	32	3200	3300	

FORWARD CONDUCTION					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNIT
Maximum average current at heatsink temperature	$I_{T(AV)}$	180° conduction, half sine wave double side (single side) cooled		1460(630)	A
				55/(85)	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25°C heatsink temperature double side cooled		2900	A
Maximum peak, one cycle non-repetitive surge current	$I_{TSM}$	t = 10ms	No voltage reapplied	20	A
		t = 8.3ms		21	
		t = 10ms	100% $V_{RRM}$ reapplied	16.8	
		t = 8.3ms		17.6	
Maximum $I^2t$ for fusing	$I^2t$	t = 10ms	No voltage reapplied	2000	kA <sup>2</sup> s
		t = 8.3ms		1830	
		t = 10ms	100% $V_{RRM}$ reapplied	1411	
		t = 8.3ms		1286	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reapplied		20000	kA <sup>2</sup> √s
Low level value of threshold voltage	$V_{T(TO)1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		1.25	V
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		1.50	
Low level value on-state slope resistance	$r_{t1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.48	mΩ
High level value on-state slope resistance	$r_{t2}$	$(I > \pi \times I_{T(AV)})$ , $T_J = T_J$ maximum		0.44	
Maximum on-state voltage	$V_{TM}$	$I_{pk} = 3000A$ , $T_J = T_J$ maximum, $t_p = 10$ ms sine pulse		2.90	V
Maximum holding current	$I_H$	$T_J = 25^\circ C$ , anode supply 12V resistive load		1000	mA
Typical latching current	$I_L$			1500	

SWITCHING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNIT
Minimum non-repetitive rate of rise of turned-on current	$di/dt$	$V_D = 67\% V_{DRM}$ , $I_{FG} = 2A$ , $T_{case} = 125^\circ C$		1500	A/μs
Typical turn-off time	$t_q$	$I_{TM} = 1000A$ , $T_J = T_J$ maximum, $di/dt = 60A/\mu s$ . $V_R = 50V$ , $dV/dt = 20 V/\mu s$ , $V_{DR} = 33\% V_{DRM}$ , $t_p = 1000\mu s$		200	μs
Maximum gate controlled turn-on delay time	$t_d$	$V_D = 67\%$ , $V_{DRM}$ , $I_{TM} = 1000A$ , $di/dt = 60A/\mu s$ . $I_{FG} = 2A$ , $t_r = 0.5\mu s$ , $T_J = 25^\circ C$		1.6	
Maximum turn-on time	$t_{gt}$			3.0	
Typical reverse recovery time	$t_{rr}$			9.5	
Typical recovered charge	$Q_{rr}$	$I_{TM} = 1000A$ , $t_p = 1000\mu s$ , $di/dt = 60A/\mu s$ .		3500	μC
Typical reverse recovery current	$I_{rm}$	$V_R = 50V$		315	A

BLOCKING					
PARAMETER	SYMBOL	TEST CONDITIONS		VALUES	UNIT
Minimum critical rate of rise of off-state voltage	$dV/dt$	$T_J = T_J$ maximum, linear to 80% rated $V_{DRM}$		200	V/μs
Maximum peak reverse and off-state leakage current	$I_{RRM}$ , $I_{DRM}$	$T_J = T_J$ maximum, rated $V_{DRM}/V_{RRM}$ applied		100	mA

TRIGGERING						
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES		UNIT	
			TYP.	MAX.		
Maximum peak gate power	$P_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms	30		W	
Maximum average gate power	$P_{G(AV)}$	$T_J = T_J$ maximum, $f = 50$ Hz, $d\% = 50$	5			
Maximum peak positive gate current	$I_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms	3		A	
Maximum peak positive gate voltage	$+V_{GM}$	$T_J = T_J$ maximum, $t_p \leq 5$ ms	20		V	
Maximum peak negative gate voltage	$-V_{GM}$		5			
DC gate current required to trigger	$I_{GT}$	$T_J = -40^\circ\text{C}$	100	-	mA	
		$T_J = 25^\circ\text{C}$	50	300		
		$T_J = 125^\circ\text{C}$	25	-		
DC gate voltage required to trigger	$V_{GT}$	$T_J = -40^\circ\text{C}$	1.3	-	V	
		$T_J = 25^\circ\text{C}$	1.0	3.0		
		$T_J = 125^\circ\text{C}$	0.8	-		
DC gate current not to trigger	$I_{GD}$	$T_J = T_J$ maximum	Maximum gate current/voltage not to trigger is the maximum value which will not trigger any unit with rated $V_{DRM}$ anode to cathode applied		10	mA
DC gate voltage not to trigger	$V_{GD}$		0.25	V		

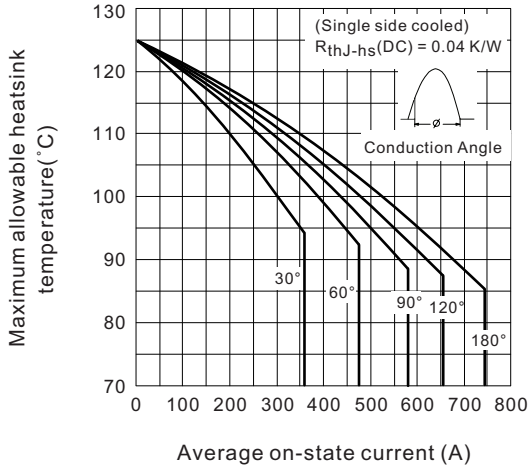
THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNIT
Maximum operating junction temperature range	$T_J$		-40 to 125	$^\circ\text{C}$
Maximum storage temperature range	$T_{stg}$		-40 to 150	
Maximum thermal resistance, junction to heatsink	$R_{th(J-hs)}$	DC operation single side cooled	0.040	K/W
		DC operation double side cooled	0.020	
Maximum thermal resistance, case to heatsink	$R_{th(C-hs)}$	DC operation single side cooled	0.006	
		DC operation double side cooled	0.003	
Mounting force, $\pm 10\%$			24500 (2500)	N (kg)
Approximate weight			440	g
Case style		TO-200AC (K-PUK), Nell's D-type Capsule)		

$\Delta R_{thJC}$ CONDUCTION						
CONDUCTION ANGEL	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDUCTIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.003	0.003	0.002	0.002	$T_J = T_J$ maximum	K/W
120°	0.004	0.004	0.004	0.004		
90°	0.005	0.005	0.005	0.005		
60°	0.007	0.007	0.007	0.007		
30°	0.012	0.012	0.012	0.012		

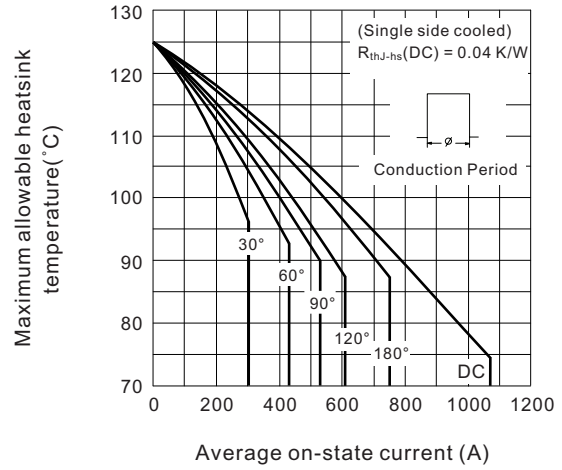
**Note**

• The table above shows the increment of thermal resistance  $R_{thJ-hs}$  when devices operate at different conduction angles than DC

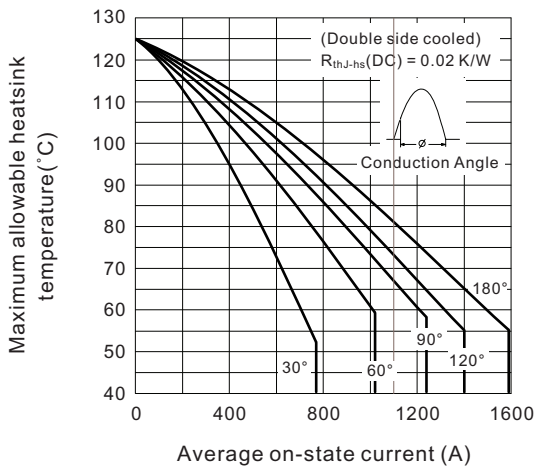
**Fig.1 Current ratings characteristics**



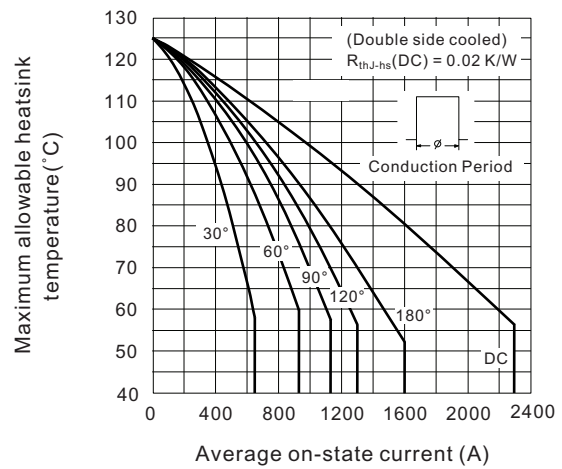
**Fig.2 Current ratings characteristics**



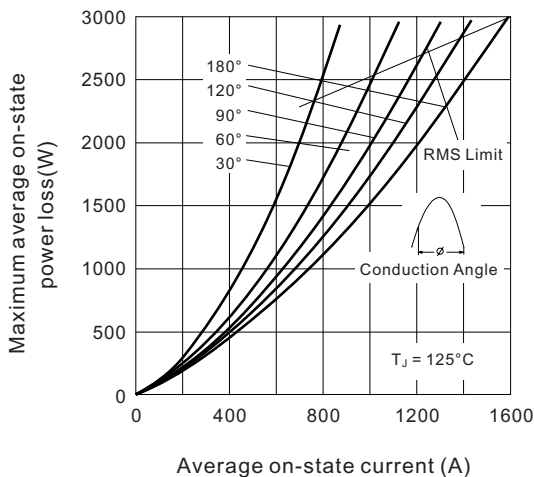
**Fig.3 Current ratings characteristics**



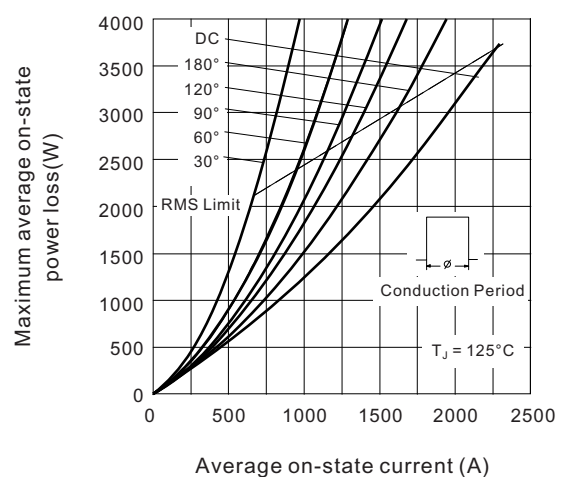
**Fig.4 Current ratings characteristics**



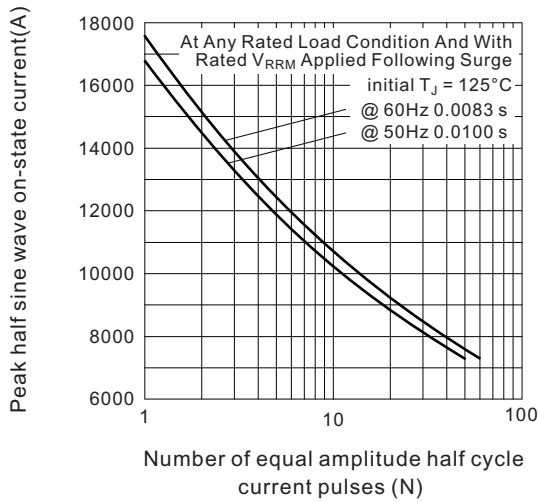
**Fig.5 On-state power loss characteristics**



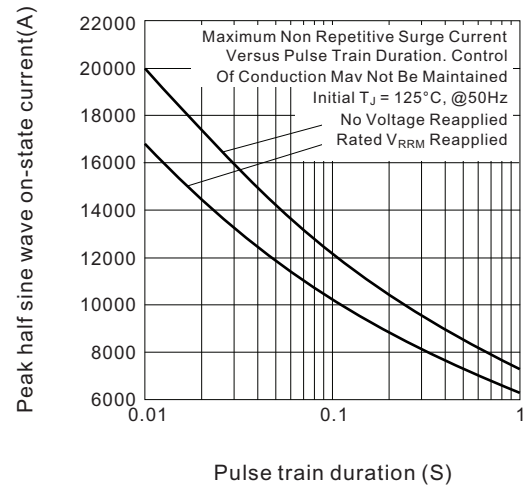
**Fig.6 On-state power loss characteristics**



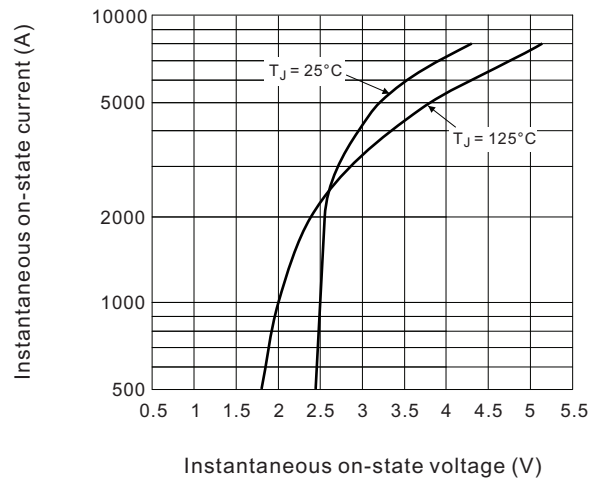
**Fig.7 Maximum non-repetitive surge current single and double side cooled**



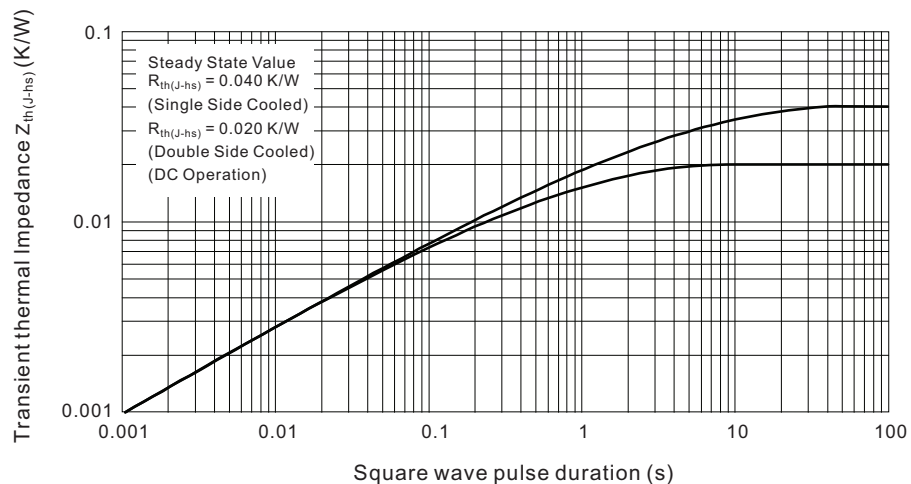
**Fig.8 Maximum non-repetitive surge current single and double side cooled**



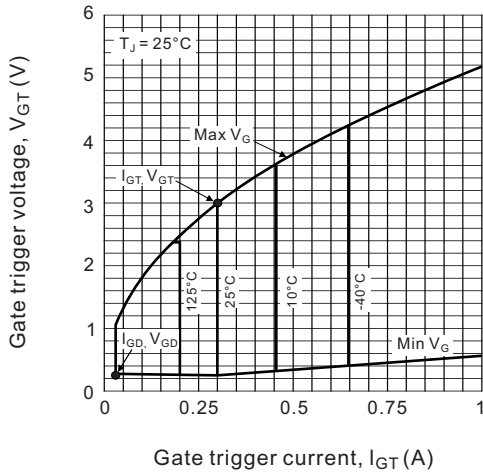
**Fig.9 Maximum on-state voltage drop characteristics**



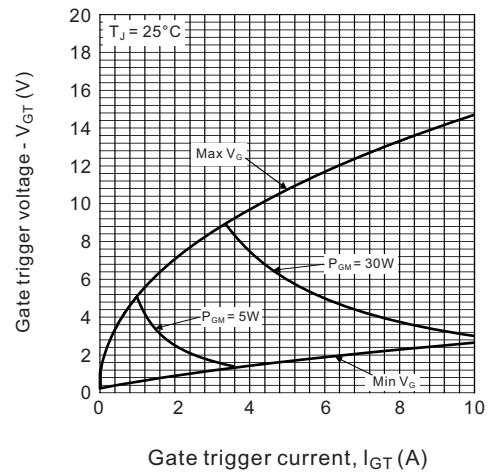
**Fig.10 Thermal Impedance  $Z_{th(J-hs)}$  characteristics**



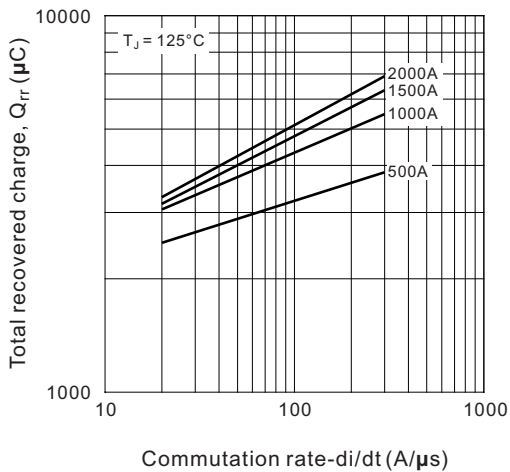
**Fig.11 Gate characteristics - Trigger limits**



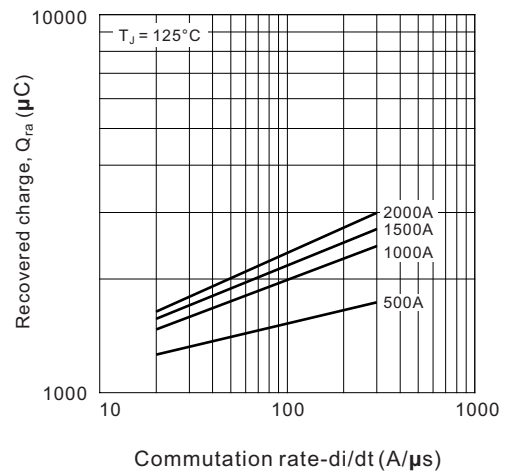
**Fig.12 Gate characteristics - Power curves**



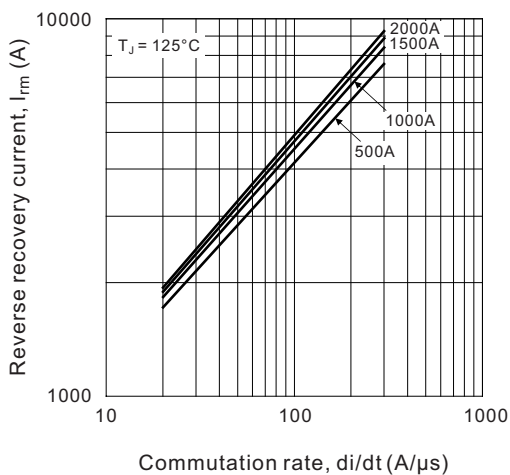
**Fig.13 Total recovered charge,  $Q_{rr}$**



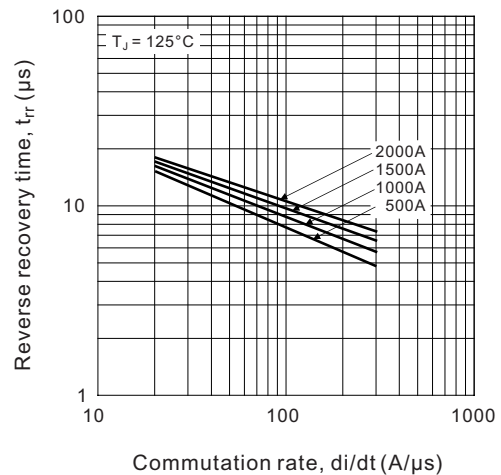
**Fig.14 Recovered charge,  $Q_{ra}$  (50% chord)**



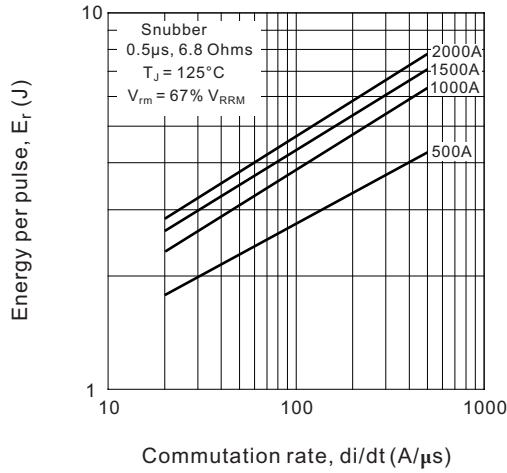
**Fig.15 Peak reverse recovery current,  $I_{rm}$**



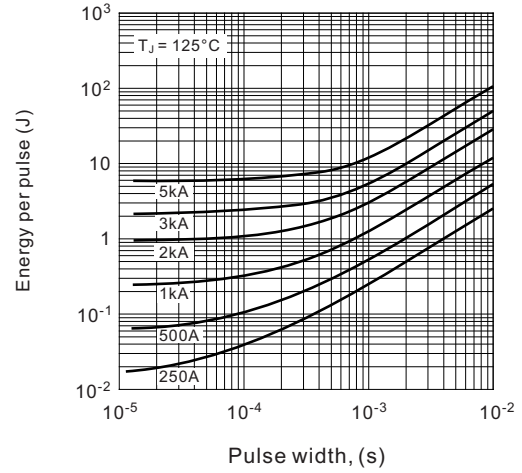
**Fig.16 Maximum recovery time,  $t_{rr}$  (50% chord)**



**Fig.17 Reverse recovery energy per pulse**



**Fig.18 Sine wave energy per pulse**



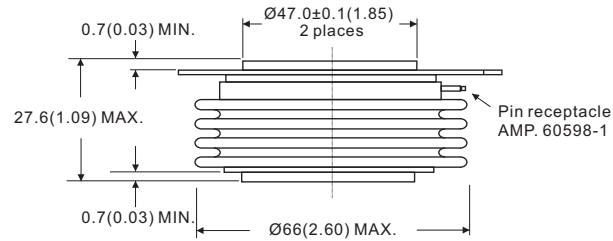
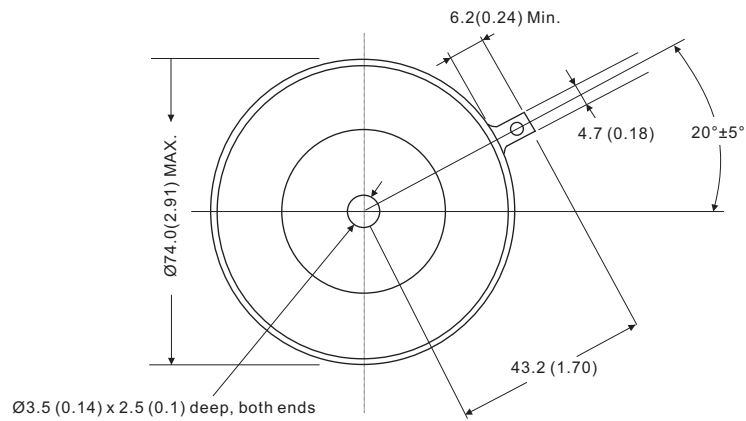
### ORDERING INFORMATION TABLE

Device code	<b>1460</b>	<b>PTG</b>	<b>30</b>	<b>D</b>	<b>0</b>
	①	②	③	④	⑤

- 1** - Maximum average on-state current  $I_{T(AV)}$ , 1460 for 1460A
- 2** - PTG = Distribute gate thyristor
- 3** - Voltage code, cold  $\times 100 = V_{RRM}/V_{RRM}$
- 4** - D = PUK case TO-200AC (K-PUK), Nell's D-type Capsule
- 5** - Terminal type, "0" for eyelet

**TO-200AC (K-PUK)**

Creepage distance: 28.88(1.137) minimum  
Strike distance: 18.0(0.708) minimum



All dimensions in millimeters (inches)

