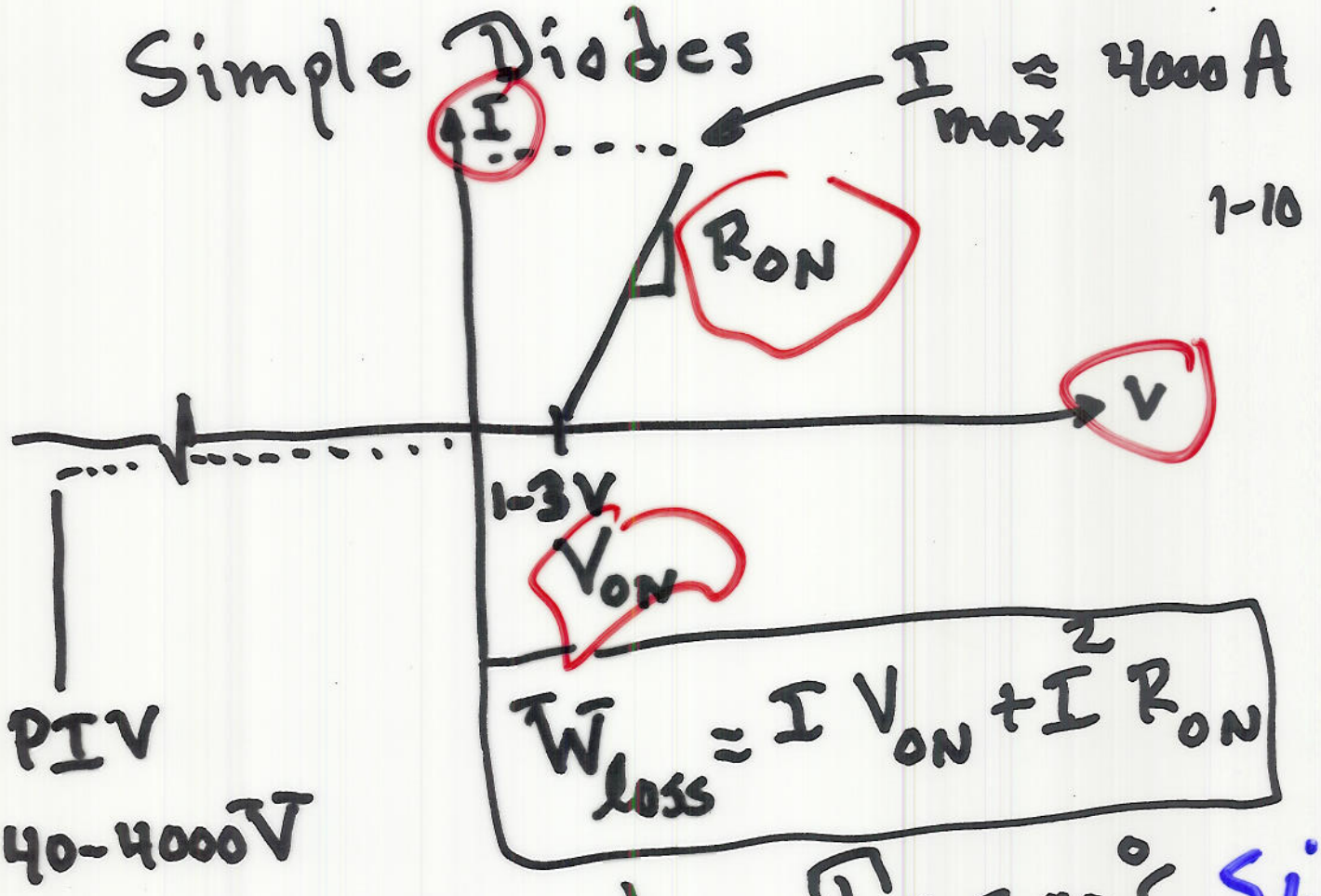
Simple Diodes



$$W_{loss} \approx I V_{ON} + I^2 R_{ON}$$

Very Max Junction $T \approx 200^\circ C$ Si

$$T_j - T_A = R_{Th}\left(\frac{^\circ C}{W}\right) W_{loss}$$

$$\frac{125 - 25}{100 \text{ good design}} \Rightarrow$$

Required R_{th}

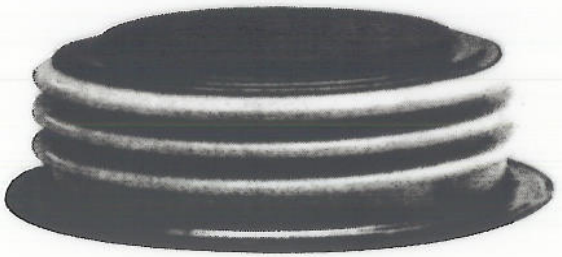
R_{th}		Acceptable W_{loss}
0.1	$^\circ C/W$	1KW
1	$^\circ C/W$	100W
10	$^\circ C/W$	10W

GaN, SiC } $400^\circ C$ ok

Figure 21-10 a. Average current: 4 A; PIV: 400 V; body length: 10 mm; diameter: 5.6 mm. b. Average current: 15 A; PIV: 500 V; stud type; length less thread: 25 mm; diameter: 17 mm. c. Average current: 500 A; PIV: 2000 V; length less thread: 244 mm; diameter: 40 mm. d. Average current: 2600 A; PIV: 2500 V; Hockey Puk; distance between pole-faces: 35 mm; diameter: 98 mm. *(Photos courtesy of International Rectifier)*

$P \sim I_{ON} V_{off}$

10kW diode



MW diode

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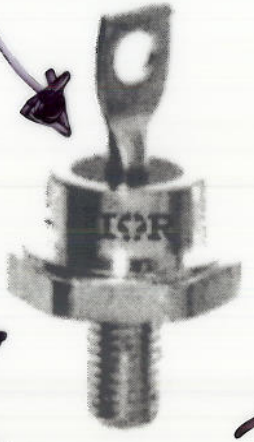
Electrical Machines, Drives, and Power Systems, 5e

① 4A, 75A ② 500V ③ 500A 2KV ④ 2600A 2500V

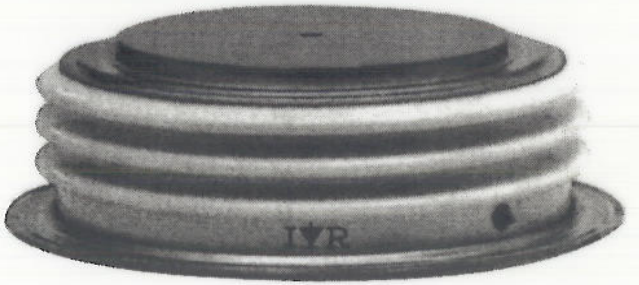
① Figure 27.10 pg 477

① I_{AV} = ?



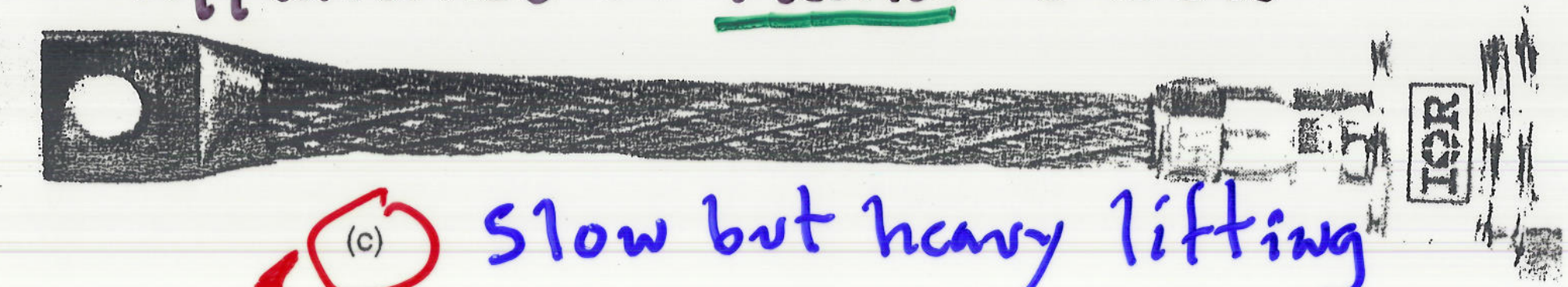
② PIV = ?

③ I_{AV} = ? PIV = ?



④ PIV = ?
I_{AV}

Appearance of Mains Diodes



(c) Slow but heavy lifting

Fig 21.16
Pg 477

1-100 KW & typical industrial load

Voff Ion

a. Average current: 4 A; PIV: 400 V; body length: 10 mm; diameter: 5.6 mm.
b. Average current: 15 A; PIV: 500 V; stud type; length less thread: 25 mm; diameter: 17 mm.
c. Average current: 500 A; PIV: 2000 V; length less thread: 244 mm; diameter: 40 mm.
d. Average current: 2600 A; PIV: 2500 V; Hockey Puk; distance between pole-faces: 35 mm; diameter:
(*Photos courtesy of International Rectifier*)

Megawatts Voff Ion } SW regal power!

Table 21.a
pg 477

limited V range to stand-off

PROPERTIES OF SOME TYPICAL DIODES

Relative power	I_0 [A]	E_0 [V]	I_{cr} [A]	E_2 [V]	I_2 [mA]	T_J[°C]	d [r
low	1	0.8	30	1000	0.05	175	:
medium	12	0.6	240	1000	0.6	200	1
high	100	0.6	1 600	1000	4.5	200	2:
very high	1000	1.1	10 000	2000	50	200	4'

I_0 – average dc current
E_0 – voltage drop corresponding to I_0
I_{cr} – peak value of surge current for one cycle
E_2 – peak inverse voltage
I_2 – reverse leakage current corresponding to E_2
T_J – maximum junction temperature (inside the diode)
d – diameter
l – length

R_{ON} = mΩ effective
best case
KA * mΩ = ?

T_{max}

Shut-off of Diode is Not simple