

EE 3113

INTRODUCTION INTO RF

CIRCUIT DESIGN

Lecture Notes for A-term 1999

LECTURE 18

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RF diodes

- Key equation: Schottky diode equation

$$I = I_0 \left(e^{\frac{V_A}{nV_T}} - 1 \right)$$

- diode analysis involves typically three models:
 - DC model
 - small signal ac model
 - small signal RF model

- Small signal ac model

$$V_A = V_Q + v_d$$

$$I = I_Q + i_d$$

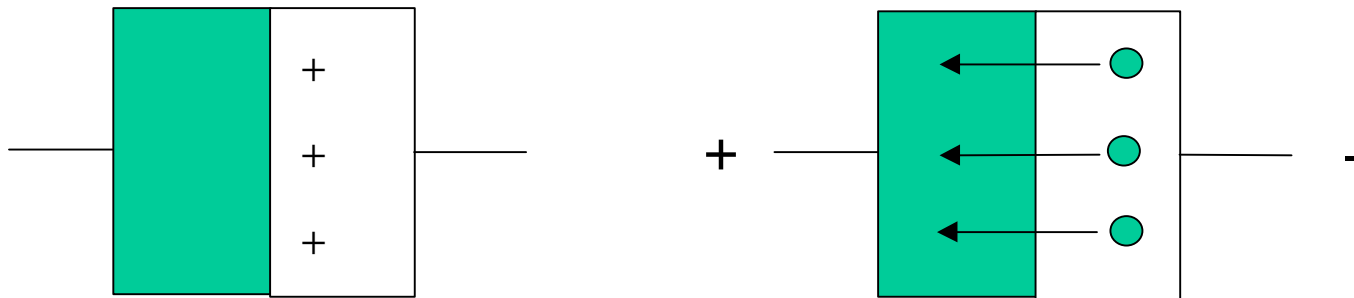
- Dynamic resistance (junction resistance)

$$R_j = \frac{nV_T}{I_Q + I_0}$$

Note: dynamic resistance depends on bias
and is strongly temperature dependent

Small signal RF model

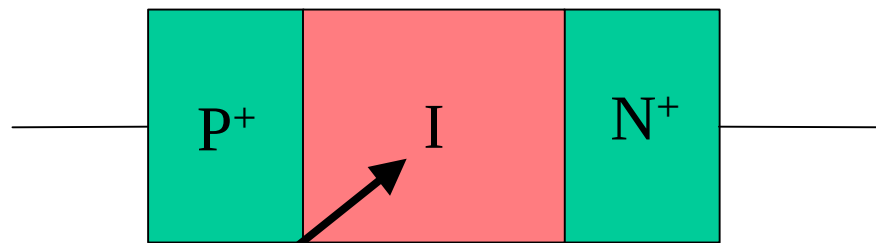
- Schottky diode
 - metal-n semiconductor
 - majority carrier only



Applications: mixers, detectors, rectifiers

- PIN diode

Major property: Variable resistance behavior



Intrinsic (low doped) n, p, or
pn layer

Forward bias:

Isolation state

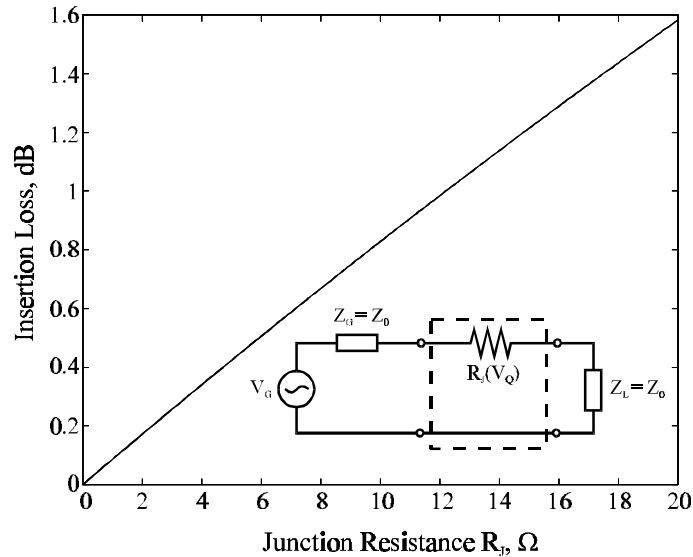
Zero bias:

Insertion loss state

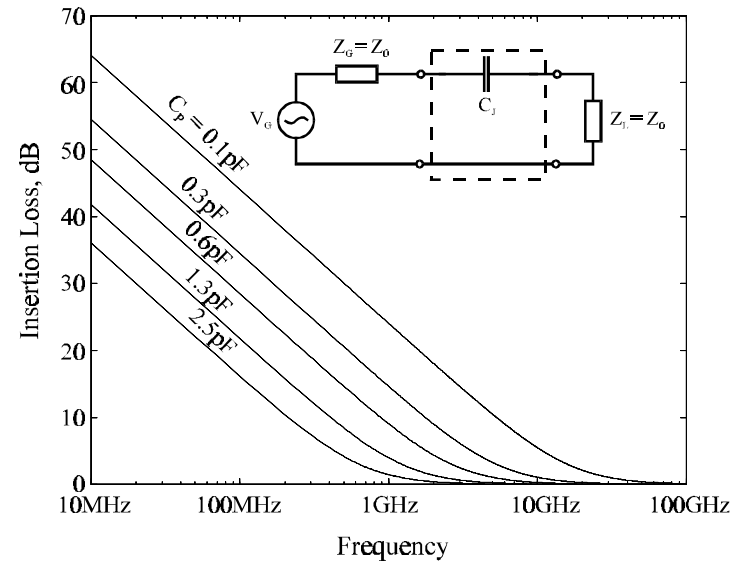
Applications: attenuating, switching, modulating, limiting,
and phase shifting.

Electric behavior of PIN diode

Forward bias (low resistance)



Reverse bias (capacitance)



Circuit application

