device on-resistance resistance of the lightly-doped n-region, reducing the charge causes conductivity modulation of the stored minority

Under forward-biased conditions, the stored minority depletion region and change in the charge within the reverse-bias $I-V$ curve, because of change in the stored charge the current deviates substantially from the equilibrium

During the turn-on and turn-off switching transients, conditions relationship that can be violated during transient

The familiar $I-V$ curve of the diode is an equilibrium

Discussion
Charge-control in the diode:
PIN Diode Dynamics

V_{on} \approx 0.7 V

DC

I_{off} \mu A

Transient

Off to on Voltage

On to off Current

What about \{on-off \} \{off-on\} \{Volts\} \{mAs\}?
Turn-on transient

Region

On-resistance of $r_n$
Charge to reduce current
Support the on-state
Charge needed to depletion region
Voltage across charge to increase

Current supplied: Converter circuit. This determined by the current $i(t)$ is

Diode is forward-biased, supply minority charge to n-region to reduce on-resistance

Diode conducts with low on-resistance

On-state current determined by converter circuit

Charge depletion region

$V(t)$

$\tau(t)$
Removal of stored minority charge $q$

Turn-off transient

Flip polarity
Diode turn-off transient

continued

Charge depletion region

Diode is reverse-biased.

Remove stored charge in n⁺ region

Diode remains forward-biased.

Shunt through chip

Big B! Why?
Typical diode switching waveforms

All together