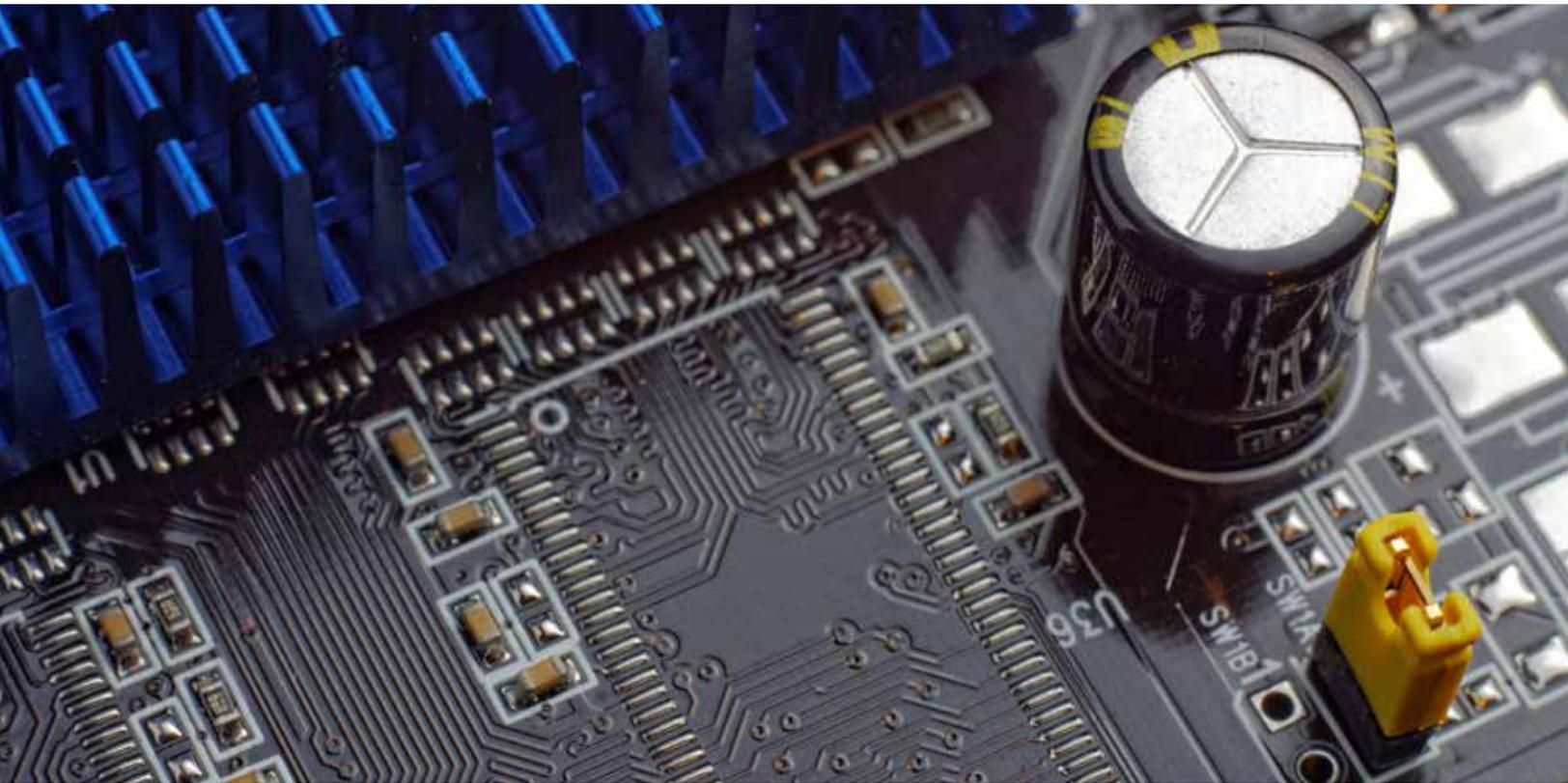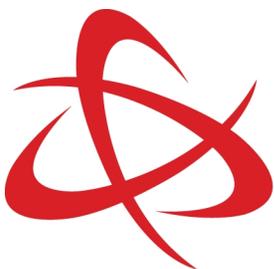# CFAA COURSE 4
LIFE SAFETY SYSTEMS ELECTRONICS

ERRATUM

HEALTH and **SAFETY**
management college

ERRATUM

CFAA, Course 4, Life Safety Systems Electronics
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Cover
- See Figure 2 for corrections to the schematic shown on the cover.

Chapter 1: Diodes, Rectifiers and Regulators
Module 1.1: Conductors, Insulators and Semi-Conductors

Refer to Page 1-4, Section 1.1.1, <u>Conductors</u>
In the first paragraph, modify the following statement as shown:

"These materials readily conduct electrical current because their atomic structure contains relatively few (one or two) ~~large and heavy~~ valence (outer shell) electrons that can be relatively easily removed."

Modify the following statement as shown:
- "contain valence electrons that ~~are large and heavy and~~ are easily released, and"

Refer to Page 1-4, Section 1.1.2, <u>Insulators</u>
Delete the third point under "Insulators generally:"
- "contain atoms with valence electrons that are small and light"

Refer to Page 1-6, Section 1.1.4, <u>The Diode (or the P-N Junction)</u>
Delete the last two points under "Semi-conductors:"
- "P-type material (negative terminal) is called the "cathode"."
- "N-type material (positive terminal) is called the "anode"."
Replace them with the following statements:
- "N-type material (negative terminal) is called the "cathode"."
- "P-type material (positive terminal) is called the "anode"."

Refer to Page 1-7, Section 1.1.5, <u>Operation of a Diode</u>

Refer to the diagram. If it is assumed that the diode is silicon, then the voltage drop across the diode would be 0.7 V. That means that the voltage across the resistor would be 1.3 V. Hence the meter should indicate 13 mA.

Refer to Page 1-8, Section 1.1.6, <u>Diode Characteristics</u>
- In the paragraph below the diagram:
  - Horizontal axis voltage values should be designated as V_D, not VD.
  - Vertical axis current values should be designated as I_D, not ID.

Refer to Page 1-9, Section 1.1.6, <u>Diode Characteristics</u>

- In the paragraph at the top of the page, VF should be corrected to read V_F

- In the second paragraph, VR should be corrected to read V_R

Refer to Page 1-8, Section 1.1.6, <u>Diode Characteristics</u> Refer to the diagram

- The definition of I_D: I_D should be defined as simply "Current Flow" since there is current flow both at forward bias and at reverse breakdown as shown on the left hand side of the graph.

- Refer to the second point in the definition of VR. When Maximum Reverse Voltage has been exceeded current will not "flow in either direction": it will flow in the reverse direction only. A better definition of Maximum Reverse Voltage would be "That value of reverse voltage beyond which there is a significant increase in reverse current."

Refer to the final sentence in the final paragraph in the section. Again, at the point of Maximum

Reverse Voltage, current will not flow in both directions: it will flow in the reverse direction only.

Refer to Page 1-9, Section 1.1.7, <u>Testing a Diode</u>

The instructions should tell the person to use the resistance scale which exhibits the diode symbol in order to obtain a higher testing voltage. This will ensure that the meter applies a voltage that is adequate to overcome the barrier voltage of the junction.

Module.2: Rectifiers and Filters
Refer to Page 1-13, Section 1.2.2, <u>Full-Wave, Centre-Tapped Rectifiers</u>
Refer to the paragraph above the diagram: D1 and D2 should be referred to as D_1 and D2

Refer to the diagram: the legend should refer to T_R and R_L.

Refer to Page 1-14, Section 1.2.3, <u>Full-Wave Bridge Rectifier</u>

- Refer to the third paragraph, D1, D2 and RL should be referred to as D_1, D_2 and R_L

- Refer to the fifth paragraph, D3 and D$ should be referred to as D_3 and D_4

Module 1.3: <u>Voltage Regulators</u>
Refer to Page 1-17, Section 1.3.2, <u>Zener Diode</u>
Replace the schematic shown at the bottom of page 1-17 with the schematic shown in Figure 1.

Delete the following paragraph:
"A 20-volt peak-to-peak voltage applied to an 8.2 volt Zener diode will deliver an 8.2 volt positive reading with a negative 10 volt reading on an oscilloscope"

Add the following paragraph:
"A rectified half wave with a 10-volt peak applied to the circuit will deliver to the load, a rectified half wave with its peak shaved to 8.2 volts."

Refer to Page 1-18, Section 1.3.3, <u>Dual Zener Diodes</u>

Remove the plus and minus signs from the left hand side of the schematic.

Refer to Page 1-19, Section 1.3.3, <u>Dual Zener Diodes</u>
Refer to the second paragraph: change R1 to read R_1

Refer to Page 1-18, Section 1.3.5, <u>Inductive-Load Commutation Protection</u>

Delete the final sentence in the section which says:
"This helps protect the circuit against high current values created by collapsing fields."

Replace it with a sentence that says:
"This helps protect the circuit against voltage spikes created by the collapsing fields."

Refer to Page 1-20, Chapter Summary Delete the following
statements:

1. "Some materials are good electrical conductors because their atoms contain very few valence electrons in their outer shells.

2. Other materials are good insulators because their atoms contain several valence electrons in their outer shells."

Replace them with the following statements:

3. "Some materials are good electrical conductors because their atoms contain 1,2 or 3 valence electrons in their outer shells.

4. Other materials are good insulators because their atoms contain 5 or more valence electrons in their outer shells."

Refer to Page 1-21, Review Questions

Replace Question 1 with the following:

1. In a diode, electrons will flow from the negative terminal through the positive terminal. Which of the following best describes the electron flow?
    a. Electrons will flow from the anode to the cathode
    b. Electrons will flow from the cathode to the junction
    c. Electrons will flow from the cathode to the anode
    d. Electrons will flow to the semiconductor reverse biased diode

Delete the following statement:

5. "What is the name for the condition when current flows from a negative terminal through the positive terminal across the P-N junction of a diode?"

Replace it with the following statement:

5. "What is the name for the condition that occurs when electrons flow from a negative

    terminal through the positive terminal across the PN junction of a diode?"

Refer to Page 1-23, Review Questions

Replace Question 15 with the following:

15. With regard to the "Single Zener Diode Regulator" circuit example, a rectified half wave with a 10-volt peak applied to the circuit will deliver to the load, a rectified half wave with its peak shaved to 8.2 volts.
    e. True
    f. False

Chapter 2: Bipolar Transistors

Language Defined

carrier   an electron in the conduction band or a hole in the valence band of a semiconductor that is free to carry an electric charge, and hence, can contribute to the semiconductor conductivity

Module 2.1: Transistor Basics
Refer to Page 2-5, Section 2.1.7, <u>Current Flow</u>
Refer to the last paragraph on the page: VCE and VBE should be show as V_{CE} and V_{BE}.

Refer to Page 2-6, Section 2.1.7, <u>Current Flow</u>
Refer to the last paragraph on the page: VEE should be shown as V_{EE}

Refer to Page 2-7, Section 2.1.7, <u>Current Flow</u>
The arrows in the diagram at the top of the page show electron flow not current flow as suggested by the text. Conventional current flow would be in the opposite direction.

Refer to Page 2-8, Section 2.1.8, <u>Transistor Operating Regions</u>
Refer to the first paragraph: HFE should be show as H_{FE}

Refer to Page 2-10, Module 2.3: Common-Emitter Transistor
Refer to the second last paragraph on the page: RB and RC should be shown as R_B and R_c

Refer to Page 2-11, Module 2.3: Common-Emitter Transistor
The upper diagram should be referred to as the emitter-follower circuit and the lower schematic should be designated as the common-emitter circuit.

Refer to Page 2-12, Module 2.5: Testing Transistors
The diagram and the instructions should tell the person to use the resistance scale which exhibits the diode symbol in order to obtain a higher testing voltage. This will ensure that the meter applies a voltage that is adequate to overcome the barrier voltage of the junction.

Refer to Page 2-16, Chapter Summary
Revise point 5 as follows:

   5. In the active region, one junction is forward biased and one junction is reverse biased.

Refer to Page 2-19, Review Questions
In Question 14, change RB and RC to read as R_B and R_c.

In Question 15, change —VEE and RE to read as $-V_{EE}$ and R_E.

Refer to Page 2-20, Review Questions
In Question 17, change R1and R2 to read as R_1 and R_2

Chapter 3: Field Effect Transistors

Refer to Page 3-2, Language Defined
Modify the following definition as shown:

MOSFET (metal oxide semiconductor field effect transistor   a field effect transistor that has ~~sliding contact~~ no electrical connection between the gate and the current channel

Refer to Page 3-3, Language Defined
Replace the operational amplifier definition with the following definition:

Operational amplifier   a DC-coupled high-gain amplifier with a differential voltage input and, a single voltage output

Refer to Page 3-6, <u>Drain Curves</u>
Refer to the `JFET Drain Curves" diagram.
Add the following items to the Legend:

I_D	drain current
L_{DSS}	drain current for zero bias which is the maximum current that flows through a JFET
V_{DS}	voltage between the drain and source
V_{GS}	voltage between the gate and source
V_P	pinch-off voltage
V_{BR}	breakdown voltage
Ohmic Region	region where the ohmic value of the channel can be varied by varying the Gate bias

Refer to Page 3-6, <u>Drain Curves</u>
Delete the following sentence in the last paragraph:

"An advantage to the JFET is that it is usually operated with the voltage connected to the base, and with the gate junction reverse-biased."

And replace it with the following sentence:

"An advantage of the JFET is that it is usually operated with its gate commoned through resistors with its source and always with its gate junction reverse-biased."

Refer to Page 3-7, <u>JFET Biasing</u>
Refer to the three schematics shown in this section.
Add the following items to the Legend:

V_{DD}	drain voltage source
V_{ss}	source voltage source
$-V_{GG}$	gate voltage source
R_G	gate resistor
R_D	drain resistor
Rs	source resistor
R_1	gate bias resistor
R_2	gate bias resistor

Refer to Page 3-8, <u>JFET Amplifiers</u>
Refer to the three schematics shown in this section.
Add the following items to the Legend:

V_{DD}	drain voltage source
R_D	drain resistor
R_S	source resistor
R_1	gate bias resistor
R_2	gate bias resistor
R_L	load resistor

Refer to Page 3-10, Section 3.2.2, <u>Structure of MOSFET's: Enhancement — Depletion Type</u> The description presented in this section is **NOT** comprehensible: a complete rewrite is required.

Refer to Page 3-10, Section 3.2.3, <u>Structure of MOSFET's: Depletion Type</u> When Section 3.2.2 is rewritten, this section should be rewritten at the same time.

Refer to Page 3-11, Section 3.2.4, <u>Biasing for JFETs and MOSFETs</u>
Refer to the second last paragraph.
VGS should be written as V_{GS}

Refer to Page 3-11, Section 3.2.4, <u>Biasing for JFETs and MOSFETs</u> Refer to the diagram. The following terms should be added to the Legend:

R_D drain resistor

RG   gate resistor

Chapter 4: Power Supplies

Refer to Page 4-4, Section 4.1.2, <u>Unregulated Power Supplies</u>
Refer to the second complete paragraph on the page.
Replace the sentence that says:

"The plug-in low power transformer converts the 120 volts AC to some value of low voltage AC (depending upon the specific need) and the very basic in-line filter rectifies the DC."

With the following sentence:

"The plug-in low voltage power transformer converts the 120 volts AC to some value of low voltage AC (depending upon the specific need) and the very basic in-line rectifier converts the AC to DC."

Refer to Page 4-15, Review Questions
Refer to Question 8.

In answer a., R1, R2 and V2 should be shown as R_1, R_2 and V_2.

In answer b., VZ and V2 should be shown as V_z and V_2.
         The bipolar transistor referred to as Q_2.

In answer c., Q1 and Q2 should be shown as Q_1 and Q_2.

Chapter 5: Operational Amplifier

Refer to Page 5-4, Section 5.1.1, <u>Introduction</u>
In the diagram on this page V_{1in} and V2in should be shown as V_{1in} and V_{2in}.
In the third paragraph in this section, V2in should be shown as V_{2in}

Refer to Page 5-10, Section 5.4.5, <u>Comparators</u>
Refer to the legend of the diagram in this section.
V1 and V2 should be shown as V_1 and V_2.

Refer to Page 5-10, Section 5.4.5, <u>Regulators</u>
Refer to the legend of the diagram in this section.
Pi and PiD should be shown as P_i and P_{id}.

Refer to Page 5-11, Section 5.4.8, <u>Oscillators</u>
Replace the diagram with the diagram shown in Fig. 2. Without the resistor added in Fig. 2, the oscillator will not oscillate.

Referring to the Legend and to the first two paragraphs, Wien is the correct spelling of the family name mentioned.

Refer to Page 5-12, Section 5.4.9, <u>Audio Amplifiers</u>
Refer to the legend of the diagram in this section.
Define LSS as Life Safety System.

Chapter 6: Analog Electronics Applications

Module 6.1: Diode Applications

Refer to Page 6-3, Section 6.1.1, <u>Supervisory Condition</u>
Replace the following sentence appearing the second paragraph:

"The resistor acts as an over-voltage protection device for the diodes in the bells"

With a sentence saying:

"The end-of-line resistor acts as a biasing resistor for a transistor back in the control unit"

Refer to Page 6-9, Review Questions
Referring to question 2., modify answer d. to read as follows:

    2. "Functions as a biasing resistor for a transistor located in the control panel."
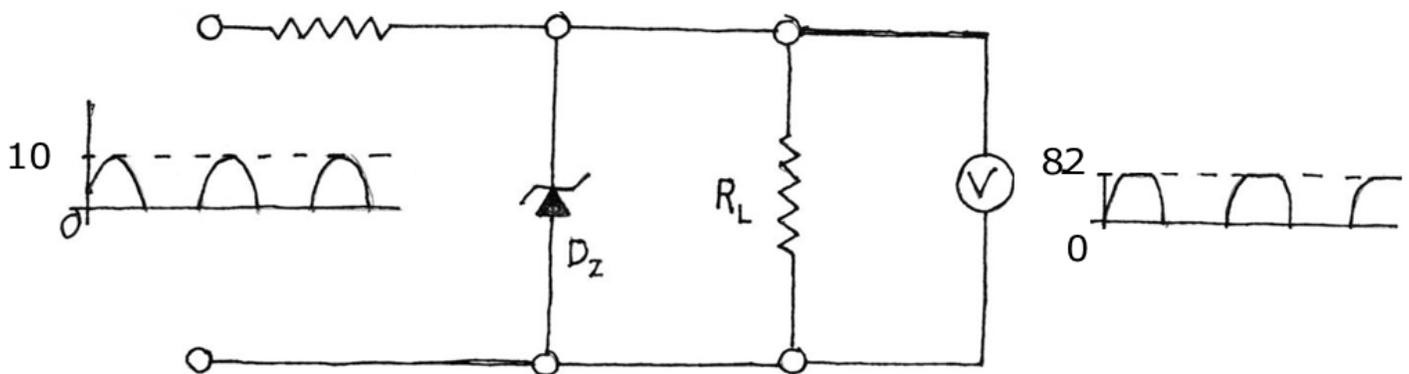

Chapter 7 Numbering Systems

Module 7.1: Binary Numbers

Refer to Page 7-7, Section 7.1.6, <u>The Hexidecimal Method</u>
Refer to the example at the bottom of the page.

It should read as follows:

$$3BE2 = (3)16^3 + (11)16^2 + (14)16^1 + (2)16^\circ$$

$$=12{,}288 + 2{,}816 + 224 + 2$$

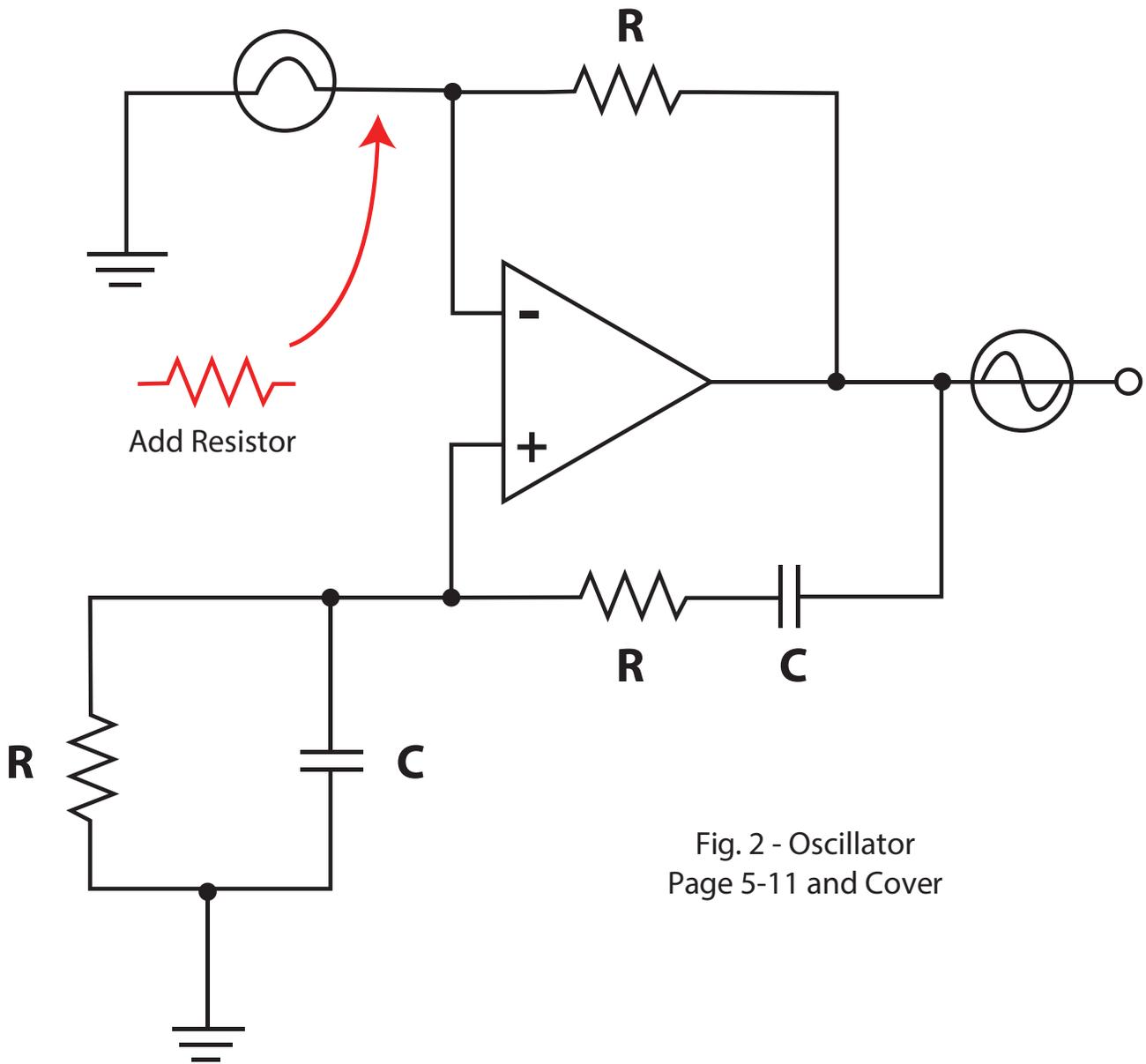$$=15{,}330$$

Fig. 1 — Application of Zener Diode

Add Resistor

R

R   C

R   C

Fig. 2 - Oscillator
Page 5-11 and Cover