MFC8020A
MFC8021A
MFC8022A

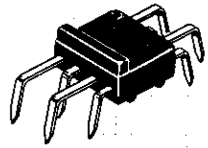
DEVICES DISCONTINUED – CONSULT FACTORY

CLASS B AUDIO DRIVERS

. . . designed as preamplifiers and driver circuits for complementary output transistors.

- Driver for Auto Radios – and up to 20-Watt Amplifiers
- High Gain – 7.0 mV for 1.0 Watt, R_L = 3.2 Ohms
- High Input Impedance – 500-Kilohm Capability
- Output Biasing Diodes Included
- No Special h_{FE} Matching of Outputs Required

CLASS B AUDIO DRIVERS
SILICON MONOLITHIC
FUNCTIONAL CIRCUITS



CASE 644A
PLASTIC PACKAGE

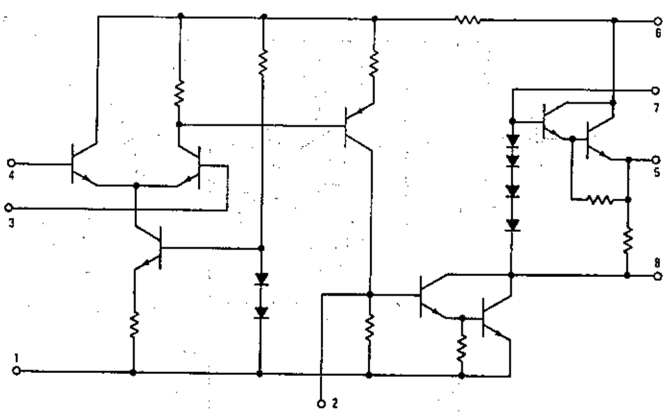
MAXIMUM RATINGS (T_A = +25°C unless otherwise noted.)

Rating	Value			Unit
	MFC8020A	MFC8021A	MFC8022A	
Power Supply Voltage	35	20	45	Vdc
Power Dissipation Derate above T_A = +25°C	1.0 10	1.0 10	1.0 10	Watt mW/°C
Peak Output Current (pins 5 & 8)	150	150	150	mA
Operating Temperature Range	-10 to +75	-10 to +75	-10 to +75	°C
Storage Temperature Range	-55 to +125	-55 to +125	-55 to +125	°C

THERMAL CHARACTERISTICS

Characteristic	Value	Unit
Thermal Resistance	100	°C/W
Junction Temperature	125	°C

FIGURE 1 – CIRCUIT SCHEMATIC

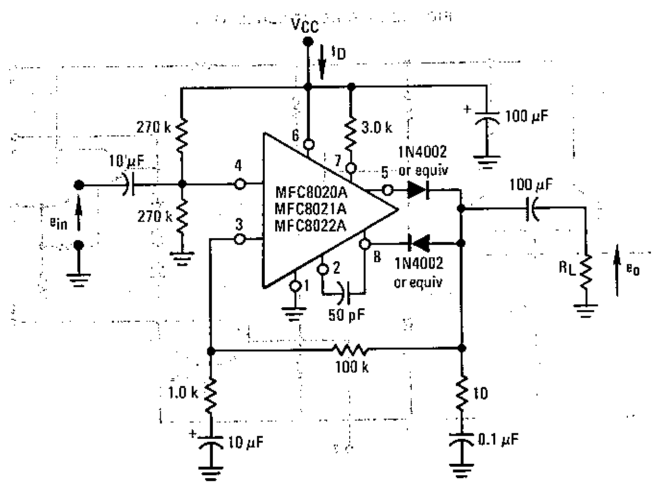


See Packaging Information Section for outline dimensions.

ELECTRICAL CHARACTERISTICS (T_A = +25°C unless otherwise noted) (See Figure 2)

Characteristic		Min	Typ	Max	Unit
Drain Current (e_{in} = 0)					mA
V_{CC} = 30 Vdc	MFC8020A	—	10	30	
V_{CC} = 14 Vdc	MFC8021A	—	7.0	30	
V_{CC} = 40 Vdc	MFC8022A	—	12	30	
Sensitivity (P_O = 1.0 Watt, f = 1.0 kHz)					mV
e_o = 8.95 V(RMS), R_L = 165 Ω	MFC8020A	—	89	112	
e_o = 3.2 V(RMS), R_L = 65 Ω	MFC8021A	—	32	40	
e_o = 12.65 V(RMS), R_L = 165 Ω	MFC8022A	—	126	160	
Total Harmonic Distortion (f = 1.0 kHz)					%
V_{CC} = 30 V, e_o = 8.95 V(RMS), R_L = 165 Ω	MFC8020A	—	0.7	5.0	
V_{CC} = 14 V, e_o = 3.2 V(RMS), R_L = 65 Ω	MFC8021A	—	1.0	5.0	
V_{CC} = 40 V, e_o = 12.65 V(RMS), R_L = 165 Ω	MFC8022A	—	1.5	5.0	
Open-Loop Gain					dB
V_{CC} = 30 V, R_L = 165 Ω	MFC8020A	—	89	—	
V_{CC} = 14 V, R_L = 65 Ω	MFC8021A	—	87	—	
V_{CC} = 40 V, R_L = 165 Ω	MFC8022A	—	90	—	
Ripple Rejection f = 60 Hz, A_v = 100, e_{in} = 0, Power Supply Ripple = 1.0 V(RMS)		—	27	—	dB
Equivalent Input Noise e_{in} = 0, R_S = 1.0 k Ω, BW = 100 Hz – 10 kHz		—	18	—	µV
Quiescent Output Voltage (e_{in} = 0)					Vdc
V_{CC} = 30 V	MFC8020A	—	15	—	
V_{CC} = 14 V	MFC8021A	—	7.0	—	
V_{CC} = 40 V	MFC8022A	—	20	—	

FIGURE 2 — TEST CIRCUIT



TYPICAL AUTO RADIO AUDIO APPLICATION and CHARACTERISTICS

(T_A = +25°C unless otherwise noted.)

FIGURE 3 – APPLICATION CIRCUIT FOR MFC8021A

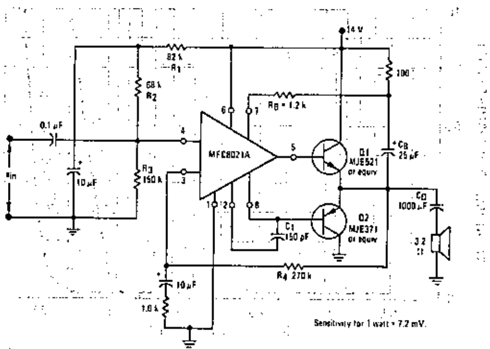


FIGURE 4 – TOTAL HARMONIC DISTORTION versus OUTPUT POWER

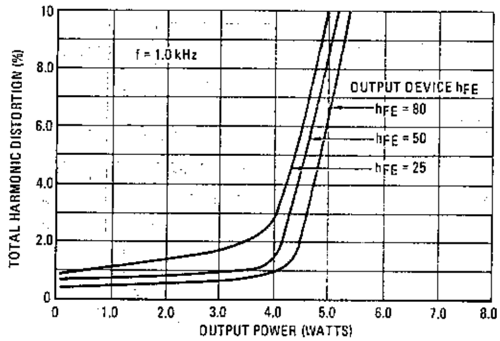


FIGURE 5 – TOTAL HARMONIC DISTORTION versus FREQUENCY

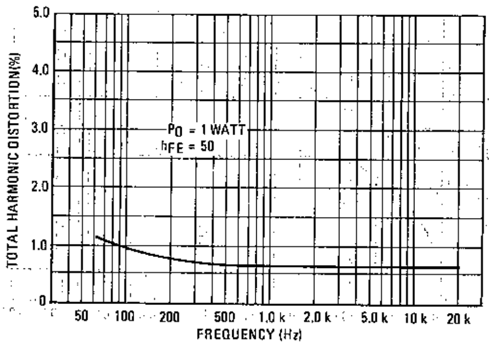
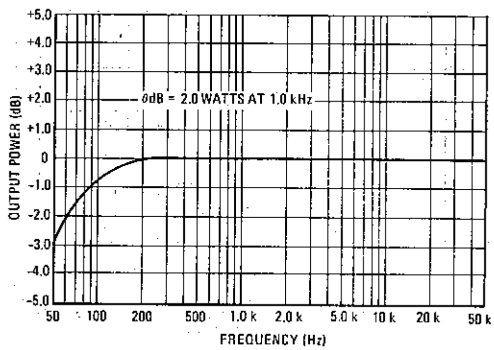


FIGURE 6 – FREQUENCY RESPONSE

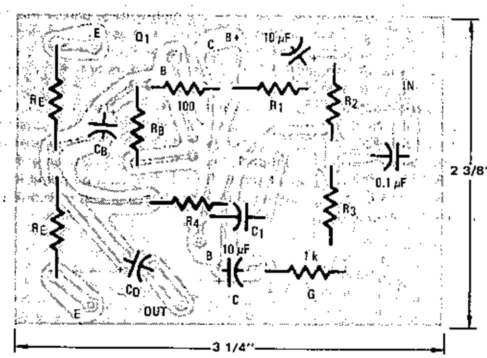


APPLICATIONS INFORMATION for MFC8021A (AUTO RADIO AUDIO)

The MFC8021A combines all the voltage gain required for an automotive radio audio amplifier into one package reducing the circuit-board area requirement. The circuit shown in Figure 3 has an input sensitivity of approximately 7.2 millivolts for a one-watt output. Sensitivity can be adjusted by changing the value of R_4. The circuit performance is a function of the output device h_{FE}, as shown in Figure 4. Figure 4 can be used to determine the minimum h_{FE} of the output transistors. The bandwidth of the amplifier is determined by the capacitor, C_1. If C_1 is increased to 390 pF the high frequency 3.0 dB point is typically 20 kHz.

An illustration of the copper side of the printed-circuit board layout is shown in Figure 7. The output transistors are mounted on the heatsink which for auto radio audio applications should have a maximum thermal resistance of 18°C/W for each device or 9.0°C/W when both output transistors are mounted on the same heatsink.

FIGURE 7 – PRINTED CIRCUIT BOARD for AUTOMOTIVE RADIO AUDIO 10-and-20 WATT AMPLIFIERS (COPPER SIDE)



8

TYPICAL 10-and-20 WATT AMPLIFIER APPLICATION AND CHARACTERISTICS

(T_A = +25°C unless otherwise noted.)

FIGURE 8 – APPLICATION CIRCUIT for MFC8020A/and MFC8022A

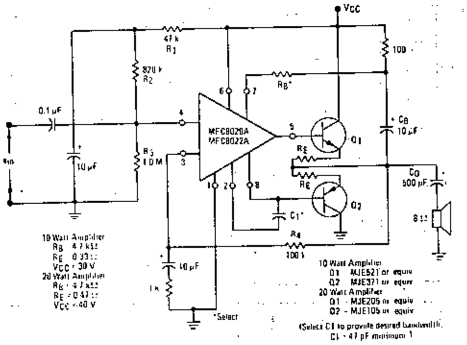


FIGURE 9 – TOTAL HARMONIC DISTORTION versus OUTPUT POWER

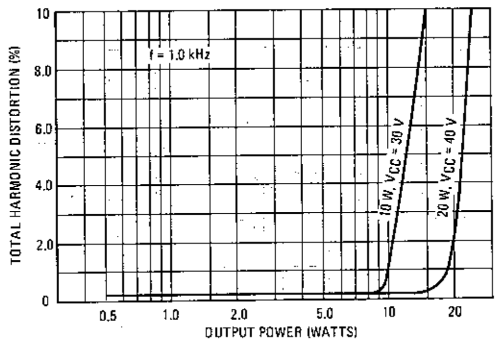


FIGURE 10 – TOTAL HARMONIC DISTORTION versus FREQUENCY

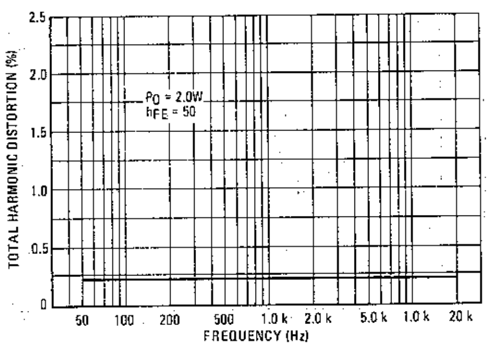
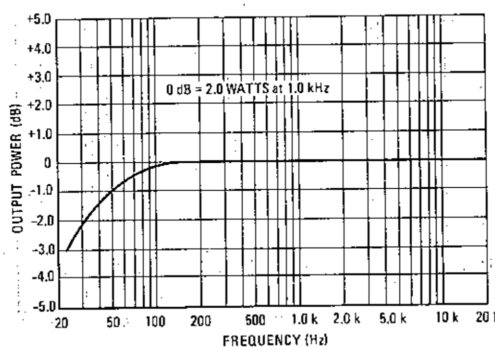


FIGURE 11 – FREQUENCY RESPONSE



APPLICATIONS INFORMATION for MFC8020A and MFC8022A
(10-Watt and 20-Watt Amplifiers)

The MFC8020A and MFC8022A are high-voltage parts capable of driving 10-to-20 watt audio amplifiers. The gain of the circuit shown in Figure 8 changes when the value of R_4 is varied and the bandwidth is determined by C_1. Emitter resistors are required at the higher voltages used for 10-to-20 watt audio amplifiers to provide thermal stability. The value of R_E is a function of the heatsink thermal resistance and supply voltage. The heatsink requirements for operation at +65°C (with both devices mounted on the same heatsink) is about 14°C/W for the 10-watt amplifier and 8.0°C/W for the 20-watt amplifier. If the maximum ambient operating temperature is reduced then the heatsink can be reduced in size as calculated by

$$\theta_{SA} = \frac{T_J - (\theta_{JS}) P_D - T_A}{P_D}$$

where

θ_{SA} = Heatsink thermal resistance

T_J = Maximum junction operating temperature

θ_{JS} = Junction to heatsink thermal resistance (includes all surface interface components for thermal resistance such as the insulating washer)

P_D = Maximum power dissipation of transistors (This occurs at about 60% of maximum output power) 6.0 W for 10 W, 7.2 W for 12 W

T_A = Maximum ambient temperature

The printed circuit board layout is shown in Figure 7.

8

MFC8030

PACKAGE DISCONTINUED – AVAILABLE IN CASE 626
CONSULT FACTORY

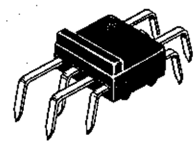
DIFFERENTIAL/CASCODE AMPLIFIER

. . . designed for applications requiring differential or cascode amplifiers.

- Extremely Flexible Amplifier
- Diode Available for Biasing
- Economical 8-Staggered Lead Package

DIFFERENTIAL/CASCODE AMPLIFIER

Silicon Monolithic Functional Circuit

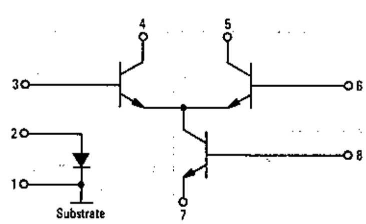


CASE 644A
PLASTIC PACKAGE

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

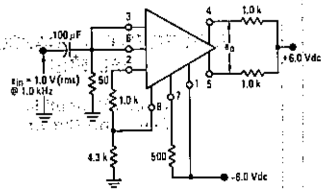
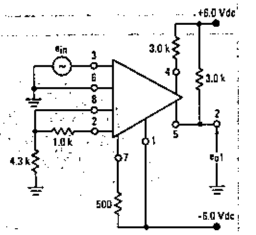
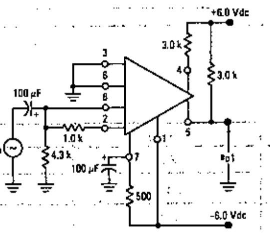
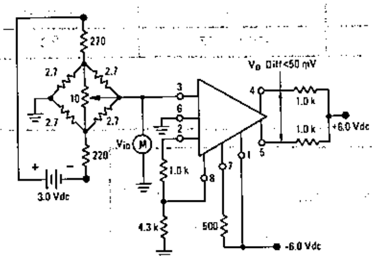
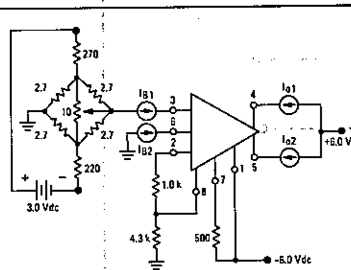
Rating	Symbol	Value	Unit
Power Supply Voltage	V^+	20	Vdc
Differential Input Voltage	V_{in}	±5.0	Vdc
Power Dissipation @ T_A = 25°C (Package Limitation)	P_D	1.0	Watt
Derate above 25°C	$1/\theta_{JA}$	10	mW/°C
Operating Temperature Range	T_A	-10 to +75	°C

FIGURE 1 – CIRCUIT SCHEMATIC



See Packaging Information Section for outline dimensions.

ELECTRICAL CHARACTERISTICS ($T_A = 25^{\circ}C$ unless otherwise noted)

Circuit	Characteristic	Symbol	Min	Typ	Max	Unit
	AC Common-Mode Rejection $e_{4\text{-}5} = e_o$ $CMR = 20 \log \frac{(e_{in})}{(e_o)}$	CMR_{AC}	–	35	–	dB
	Differential-Mode Voltage Gain $A_V\ Diff = 20 \log \frac{(e_{o1})}{(e_{in})}$ (e_{in} = 1.0 kHz, 1.0 mV(rms)) (e_{in} = 10 MHz, 1.0 mV(rms)) (e_{in} = 50 MHz, 1.0 mV(rms))	$A_{V(dif)}$	 – – –	 32 26 10	 – – 	dB
	Cascode-Mode Voltage Gain $A_V\ Cascode = 20 \log \frac{(e_{o1})}{(e_{in})}$ (e_{in} = 1.0 kHz, 1.0 mV(rms)) (e_{in} = 10 MHz, 1.0 mV(rms)) (e_{in} = 50 MHz, 1.0 mV(rms))	$A_{V(cscd)}$	 – – 	 36 31.5 15	 – – –	dB
	Input Offset Voltage	V_{io}	–	5.0	10	mV
	DC Current Gain Match ($I_{O1} = I_{O2}$)	$\frac{h_{FE1}}{h_{FE2}}$	0.8	–	1.1	–

MFC8040

DEVICE DISCONTINUED – CONSULT FACTORY

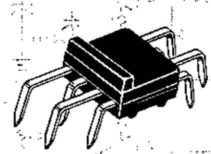
LOW NOISE AUDIO PREAMPLIFIER

. . . designed for high-gain, low-noise applications.

- Special Monolithic "State-of-the-Art" Process to Insure Low Noise – 1.0 μV (Typ)
- Can be Externally Equalized for NAB, RIAA
- Low Distortion – 0.1% (Typ) @ A_V = 100
- Large Dynamic Range – 7.0 V(rms) Out
- Low Output Impedance – 100 Ohms (Max)

LOW NOISE AUDIO PREAMPLIFIER

Silicon Monolithic Functional Circuit

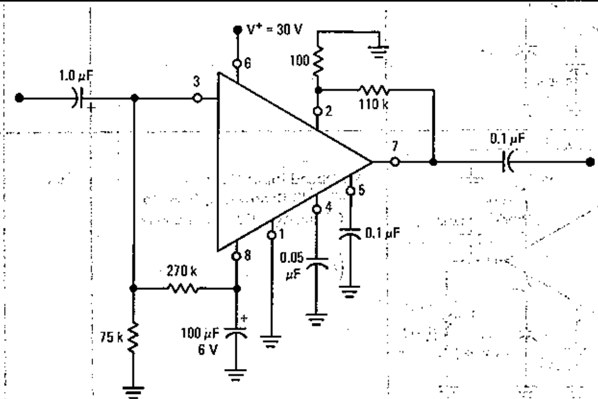


CASE 644A
PLASTIC PACKAGE

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+	33	Vdc
Power Dissipation @ T_A = 25°C (Package Limitation)	P_D	1.0	Watt
Derate above T_A = 25°C	$1/\theta_{JA}$	10	mW/°C
Operating Temperature Range	T_A	–10 to +75	°C

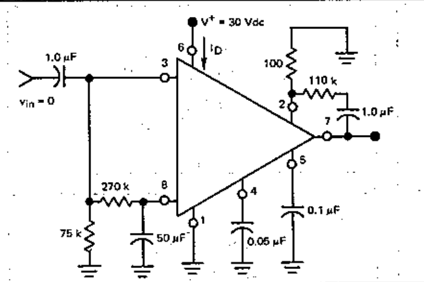
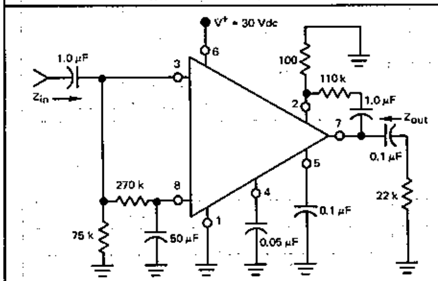
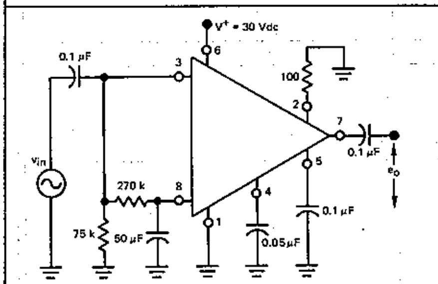
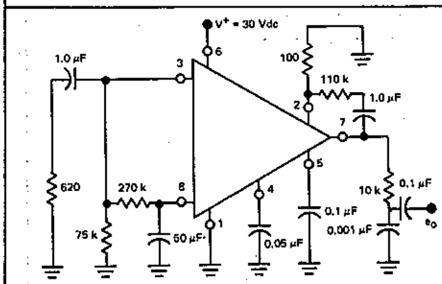
FIGURE 1 – TYPICAL WIDEBAND AMPLIFIER CIRCUIT (A_V = 60 dB)



See Packaging Information Section for outline dimensions.

8

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

<table>
<tr><th>Circuit</th><th>Characteristic</th><th>Symbol</th><th>Min</th><th>Typ</th><th>Max</th><th>Unit</th></tr>
<tr><td>
</td><td>Drain Current</td><td>I_D</td><td>–</td><td>8.0</td><td>12</td><td>mA</td></tr>
<tr><td rowspan="3">
</td><td>Total Harmonic Distortion
(v_o = 1.0 V, f = 1.0 kHz)</td><td>THD</td><td>–</td><td><0.1</td><td>0.25</td><td>%</td></tr>
<tr><td>Input Impedance</td><td>Z_{in}</td><td>–</td><td>75</td><td>–</td><td>k ohms</td></tr>
<tr><td>Output Impedance</td><td>Z_{out}</td><td>–</td><td>100</td><td>–</td><td>ohms</td></tr>
<tr><td>
</td><td>Open Loop Voltage Gain
(v_{in} = 100 µV(rms) @ f = 1.0 kHz)</td><td>A_{VOL}</td><td>80</td><td>–</td><td>–</td><td>dB</td></tr>
<tr><td>
</td><td>Wideband Input Noise
(–3.0 dB Bandwidth, 10 Hz to 16 kHz, A_V = 60 dB @ 1.0 kHz,
$\left(e_n = \frac{e_o}{A_V}\right)$</td><td>$e_n$</td><td>–</td><td>1.0</td><td>3.0</td><td>µV (rms)</td></tr>
</table>

8

FIGURE 2 – CIRCUIT SCHEMATIC

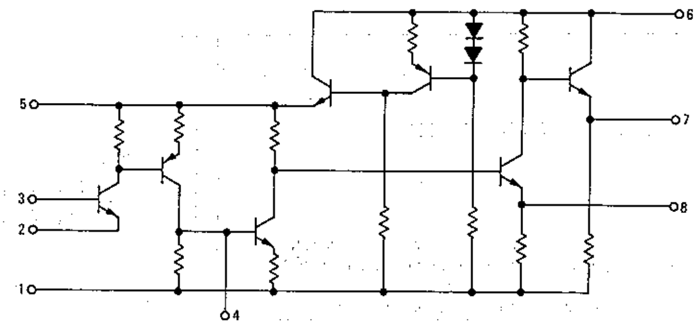


FIGURE 3 – INPUT NOISE

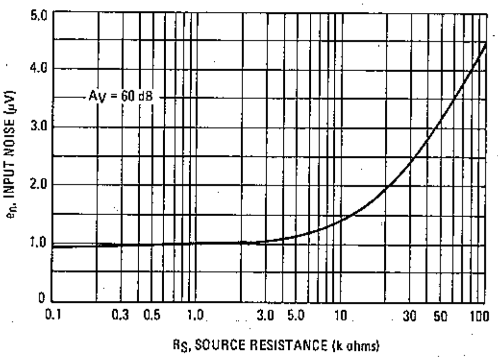


FIGURE 4 – OPEN LOOP TOTAL HARMONIC DISTORTION

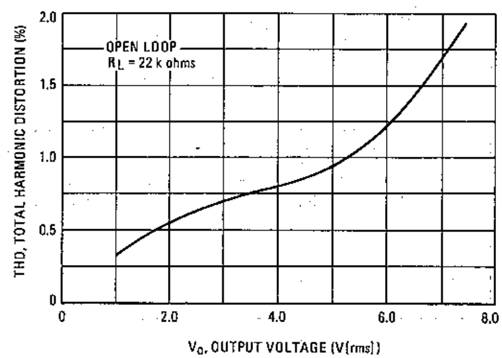
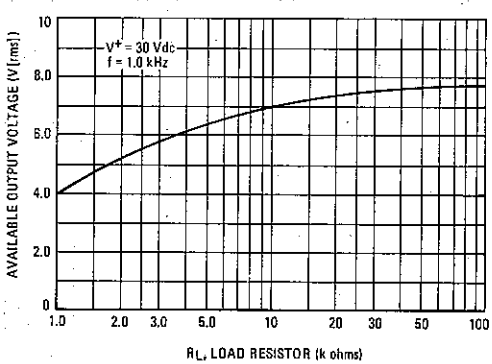


FIGURE 5 – AVAILABLE OUTPUT VOLTAGE



8

MFC8070

PACKAGE DISCONTINUED – AVAILABLE IN CASE 626 CONSULT FACTORY

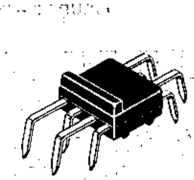
ZERO VOLTAGE SWITCH

. . . designed for use in ac power switching applications with output drive capable of triggering triacs. Other operational features include; (1) a built-in voltage regulator that allows direct ac line operation, (2) a differential input with dual sensor inputs capable of testing the condition of two external sensors and controlling the gate pulse to a triac accordingly; (hysteresis or proportional control to this section may be added if desired) (3) sensor input "open and short" protection; this insures that the triac will never be turned "on" if either of the inputs are shorted or opened (4) a zero crossing detector that synchronizes the triac gate pulses with the zero crossing of the ac line voltage. This eliminates radio frequency interference (RFI) when used with resistive loads.

- Heater Controls
- Photo Controls
- Threshold Detector
- Lamp Driver
- Valve Control
- On-Off Power Controls
- Relay Driver
- Flasher Control

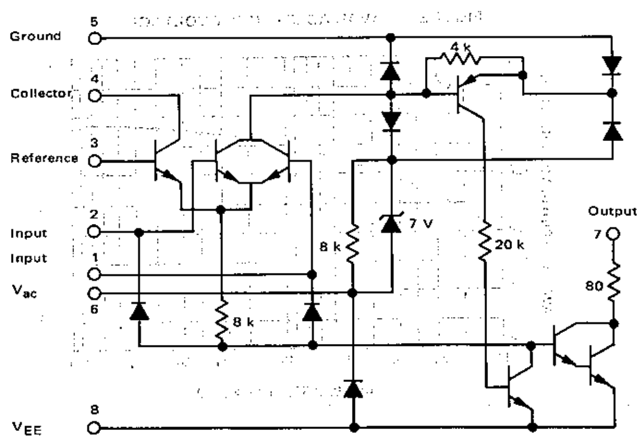
ZERO VOLTAGE SWITCH

SILICON MONOLITHIC FUNCTIONAL CIRCUIT



CASE 644A
PLASTIC PACKAGE

FIGURE 1 – CIRCUIT SCHEMATIC

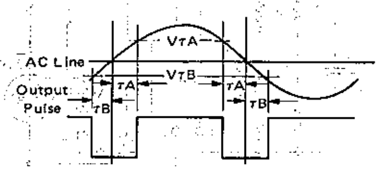


See Packaging Information Section for outline dimensions.

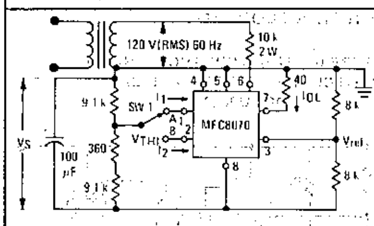
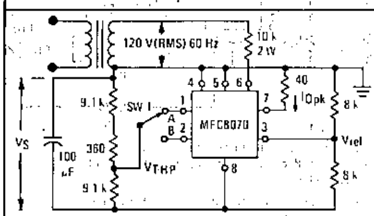
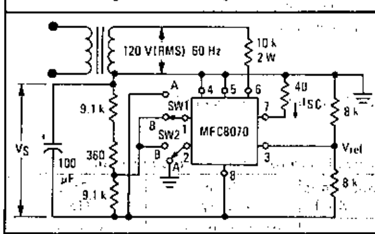
MAXIMUM RATINGS (T_A = +25°C unless otherwise noted.)

Rating	Symbol	Value	Unit
DC Voltage	$V_{5\text{-}8}$	15	Vdc
DC Voltage	$V_{4\text{-}8}$	15	Vdc
DC Voltage	$V_{7\text{-}8}$	15	Vdc
Peak Supply Current	I_6	35	mA
Power Dissipation Derate above T_A = +25°C	P_D $1/\theta_{JA}$	1.0 10	Watt mW/°C
Operating Temperature Range	T_A	−10 to +75	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C

FIGURE 2 — OUTPUT PULSE DEFINITION



ELECTRICAL CHARACTERISTICS (T_A = +25°C unless otherwise noted.)

Characteristic Definitions	Characteristic	Symbol	Min	Typ	Max	Unit
	V_S with Inhibit Output (Sw 1: A or B)	V_{SIO}	–	9.0	11	Vdc
	Output Leakage Current (Sw 1: A or B)	I_{OL}	–	5.0	100	µA
	Input Current 1 (Sw 1: A)	I_1	–	5.0	15	µA
	Input Current 2 (Sw 1: B)	I_2	–	5.0	15	µA
	Inhibit Threshold Voltage (Sw 1: A or B)	V_{THI}	V_{ref} +100 mV	V_{ref} +10 mV	–	Vdc
	V_S with Pulse Output (Sw 1: A or B)	V_{SPO}	6.0	8.5	–	Vdc
	Peak Output Current (Sw 1: A or B)	I_{Opk}	50	80	–	mA
	Pulse Threshold Voltage (Sw 1: A or B)	V_{THP}	–	V_{ref} -10 mV	V_{ref} -100 mV	Vdc
	Output Pulse Width (Sw 1: A or B, See Figure 2)	τA, τB VτA, VτB	–	70 ±4.5	– –	µs V
	Output Current With Input Short (Sw 1: B; Sw 2: A) (Sw 1: A; Sw 2: B)	I_{SC}	– –	5.0 5.0	100 100	µA

TEST CIRCUIT AND TYPICAL CHARACTERISTICS

FIGURE 3 – CIRCUIT WITH INCREASED PULSE WIDTH AND TRIAC DRIVER TO CONTROL HIGH-CURRENT SCR's

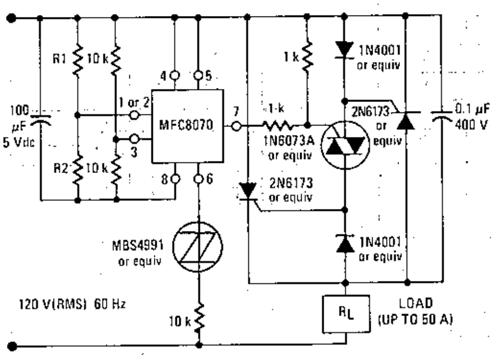
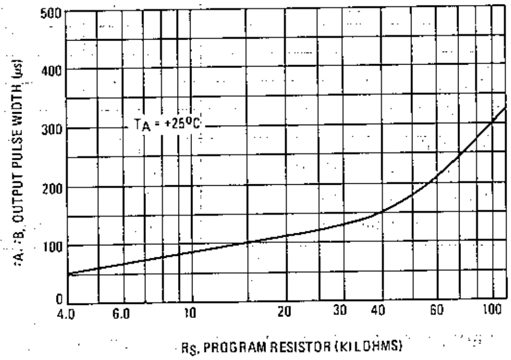
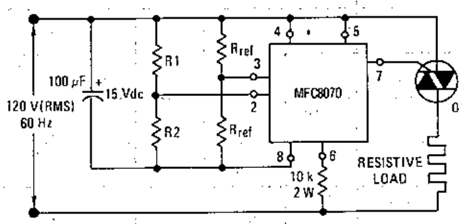


FIGURE 4 – OUTPUT PULSE WIDTH versus SOURCE RESISTANCE (See Figure 6.)



TYPICAL ZERO VOLTAGE SWITCH APPLICATIONS FOR TRIAC CONTROL

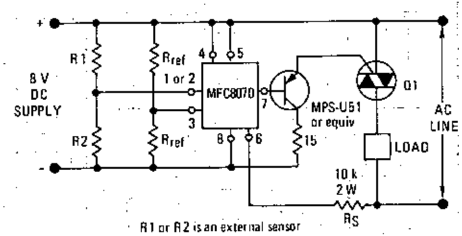
FIGURE 5 – TRIAC CONTROL CIRCUIT



R1 or R2 is an external sensor

Basic triac trigger circuit utilizing the zero crossing detector and the input comparator to control triacs with gate current requirements to 500 mA.

FIGURE 6 – TRIAC CONTROL CIRCUIT WITH CURRENT BOOST UTILIZING DC SUPPLY



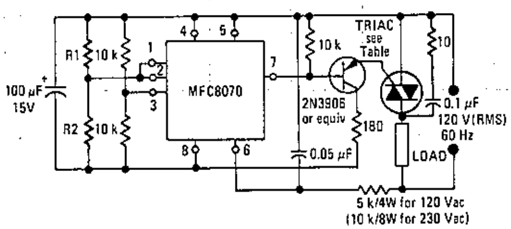
R1 or R2 is an external sensor

Basic dc trigger application using the input comparator to control a PNP capable of furnishing gate drive of approximately 0.5 A.

Suggested circuit to vary output pulse width by value of RS (See Figure 4).

R2 must be the external sensor for the internal short and open protection to be operative.

FIGURE 7 – TRIAC CONTROL CIRCUIT WITH CURRENT BOOST UTILIZING AC SUPPLY

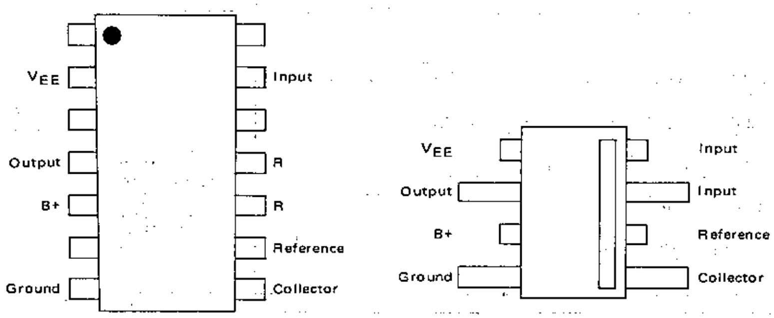


Zero crossing triac control circuit for gate current requirements to 100 mA.

Recommended Motorola triacs for use in circuit.

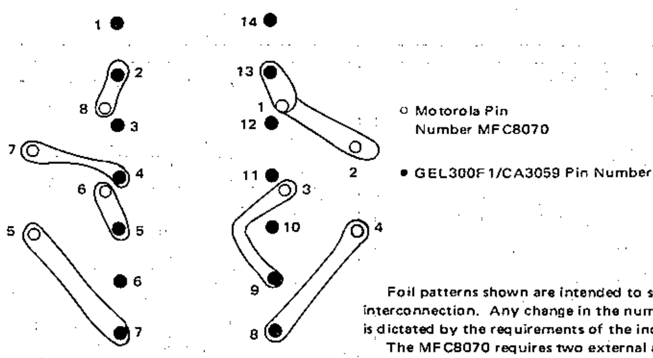
Maximum Continuous Current (A [RMS])	Triac Family	Case No.
10	2N6151/2N6153 2N6346A/2N6349A	90 (Plastic) 221-024 (Plastic)
10	2N6139/2N6144	86, 250
25	2N6157/2N6165	174, 175, 235
40	2N5441/2N5446	237, 238, 239

PIN COMPARISON OF MFC8070 AND GEL300F1 (PA424/CA3059)



GEL300F1/CA3059 MFC8070

COMPATIBLE PRINTED CIRCUIT FOIL PATTERN FOR MFC8070, GEL300F1 (PA424) AND CA3059



Foil patterns shown are intended to show pin-for-pin interconnection. Any change in the number of components is dictated by the requirements of the individual design.

The MFC8070 requires two external reference resistors; one resistor between pin 3 and pin 5 and the other between pin 3 and pin 8.

8