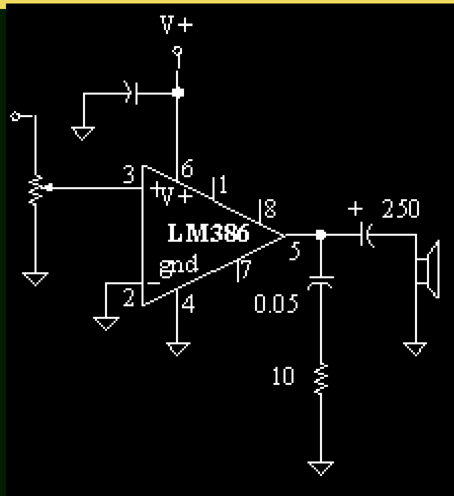
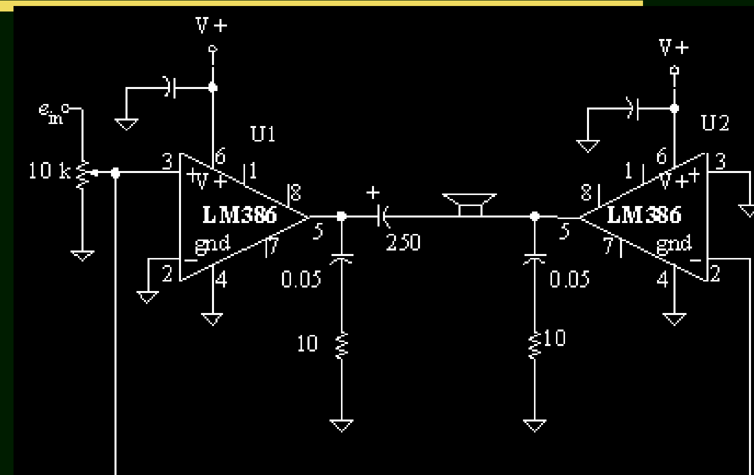
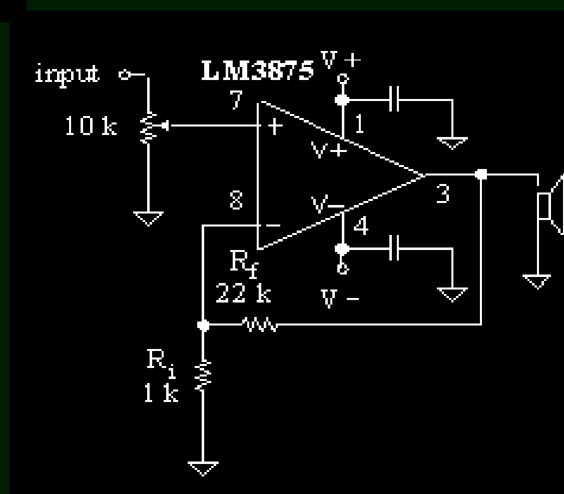
Audio ICs





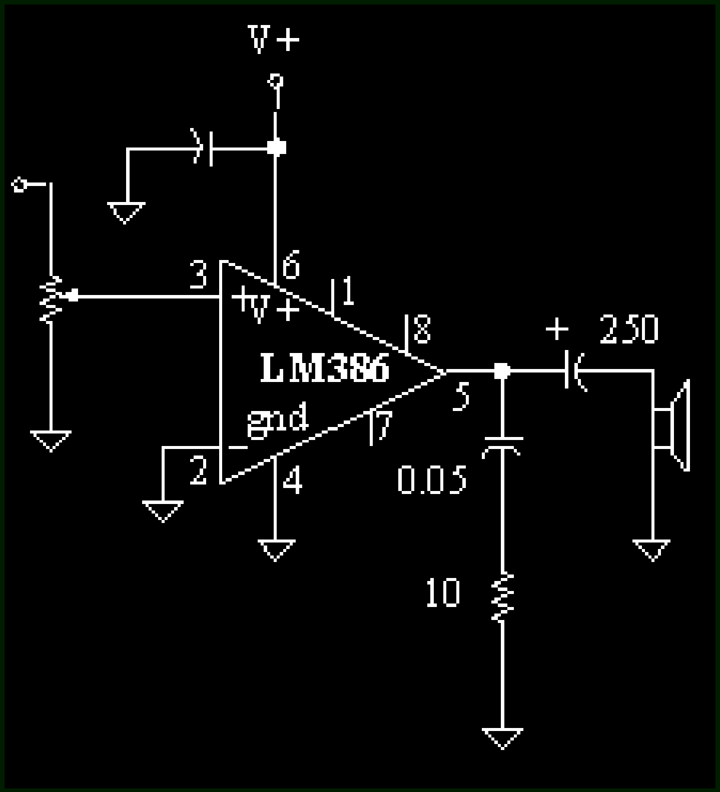


Power Electronics: Principles & Applications – Figure 4-19 - 22

Overview

- Low Power IC (1 W)   LM386
  - Schematic
  - Characteristics
  - Calculations
- High Power IC (50W)   LM3875
  - Schematic
  - Characteristics
  - Calculations

LM386 - characteristics

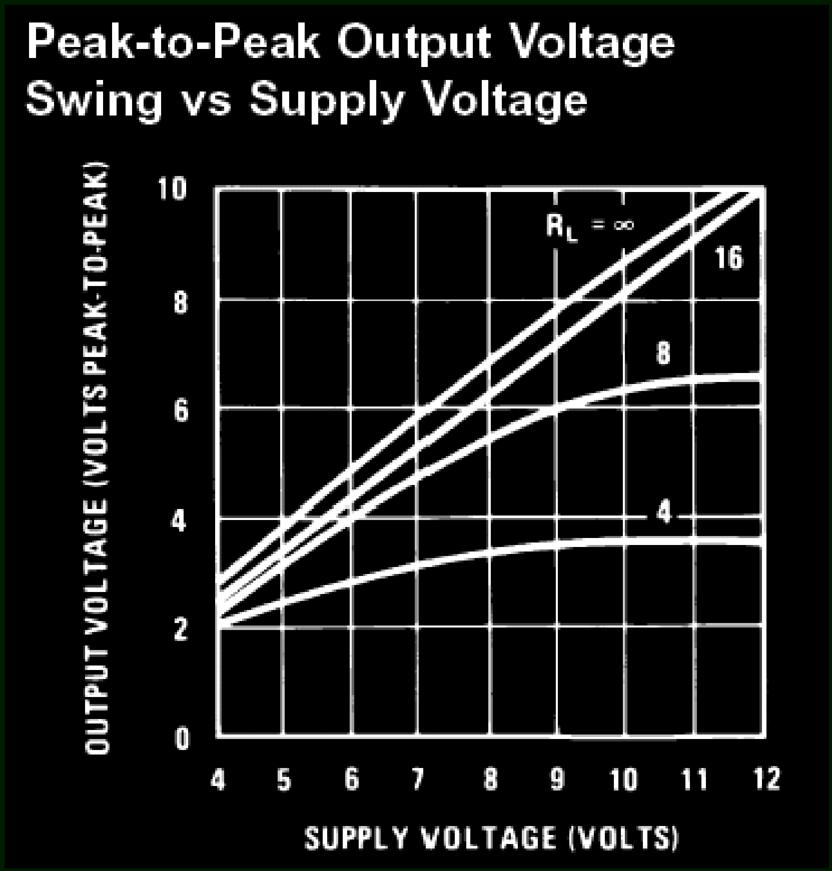


Power Electronics: Principles & Applications – Figure 4-19

- Single supply:
  - +4 V to +18 V
  - Output automatically adjusted to ½ V+
  - No RC *input* coupling needed
  - RC *output* coupling required

$f_{-3dB} = 1/(2\pi R_{load}\ C_{out})$

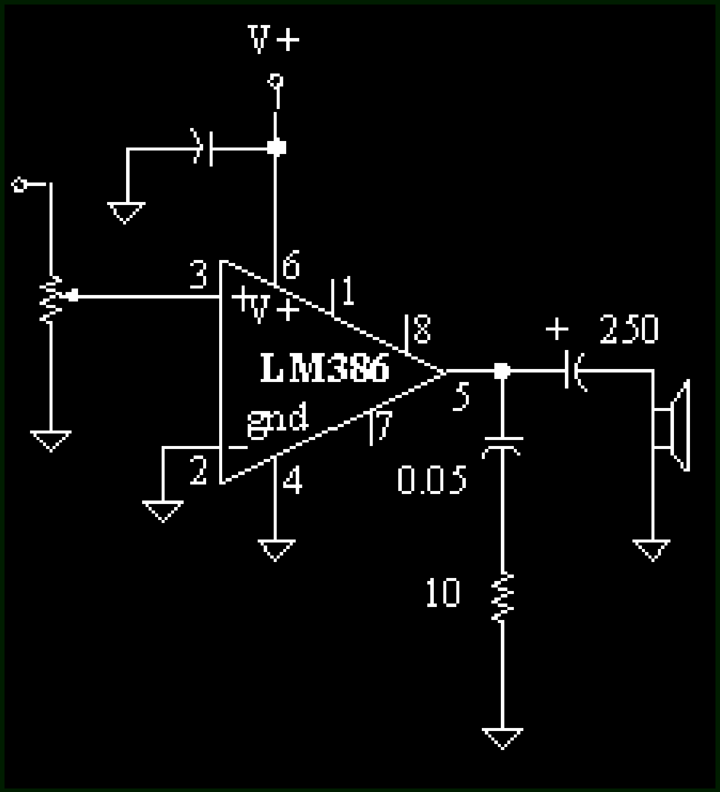
LM386 - characteristics



http://cache.national.com/ds/LM/LM386.pdf

- Rails (8 Ω load):
  - V+ = 4V ⇒ V_{sat} = ± 1V
  - V+ = 12 V ⇒ V_{sat} = ± 2.5 V

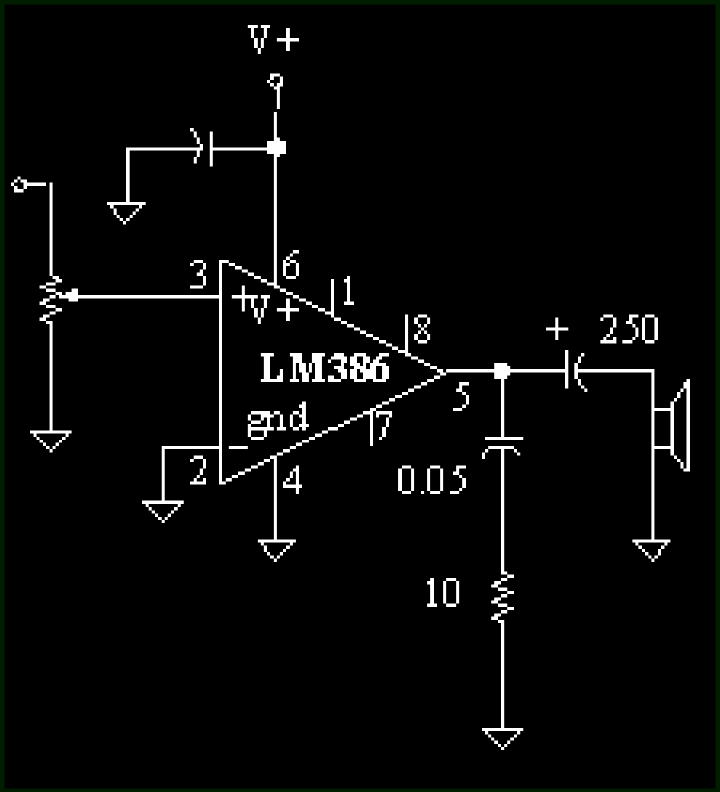
LM386 - characteristics



Power Electronics: Principles & Applications – Figure 4-19

- - feedback is *internal:*
  - $A_v \approx \pm 20$
  - NI: drive pin 3, ground pin 2
  - INV: drive pin 2, ground pin 3
  - Leave *neither* open
  - R_{in} = 50 kΩ
  - R_{input} < 10 kΩ : drive straight from signal generator
  - e_{in} < ________V_p : V+ = 12 V_{dc}

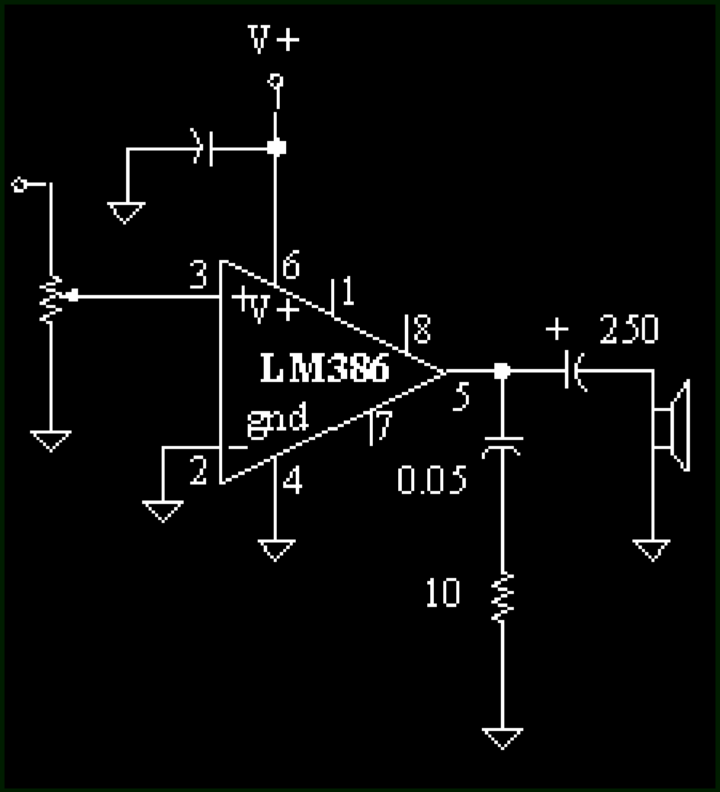
LM386 – max out calculations



Power Electronics: Principles & Applications – Figure 4-19

- V+ = 12 V, R_{load} = 8 Ω, 98 $dB_{spl@ 1W @ 1 m}$
- $V_{out\ dc}$ = __________
- $V_{out\ p\ max}$ = __________
- $V_{load\ p\ max}$ = __________
- $P_{load\ max}$ = __________
- dBW_{max} = __________
- $dB_{spl\ @\ 1\ m}$ = __________
- $dB_{spl\ @\ 3\ m}$ = __________

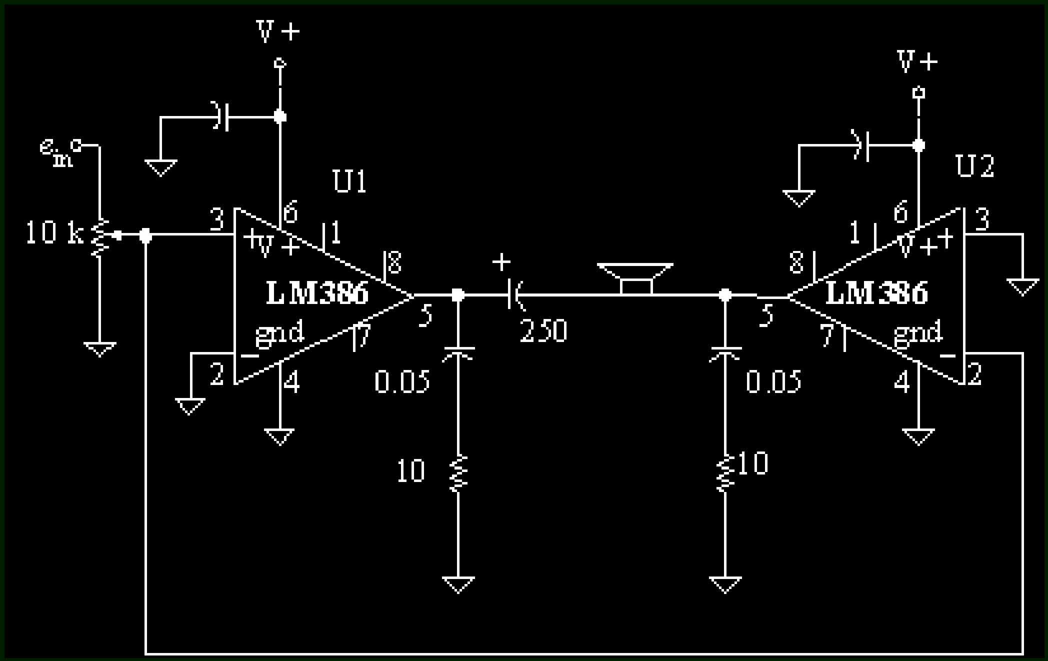
LM386 – max out calculations



- V+ = 12 V, R_{load} = 8 Ω, 98 $dB_{spl@\ 1W\ @\ 1\ m}$
- $V_{out\ dc} = 6\ V_{dc}$
- $V_{out\ p\ max} = 9.25\ V_{p\ max}$
- $V_{load\ p\ max} = 3.5\ V_p$
- $P_{load\ max}$ = 660 mW
- dBW_{max} = -1.8 dBW
- $dB_{spl\ @\ 1\ m} = 96.2\ dB_{spl}$
- $dB_{spl\ @\ 3\ m} = 86.7\ dB_{spl}$

Power Electronics: Principles & Applications – Figure 4-19

LM386 – bridged amp



Power Electronics: Principles & Applications – Figure 4-21

- V_{load} ↑ x 2
- $P_{load} = (V_{load\ rms})^2 / R_{load}$
- P_{load} ↑ x ____
- *Beware*!
  $I_{out\ p\ max}$ ~ 400 mA_p may be the limiting factor.

Overview

- Low Power IC (1 W) LM386
  - Schematic
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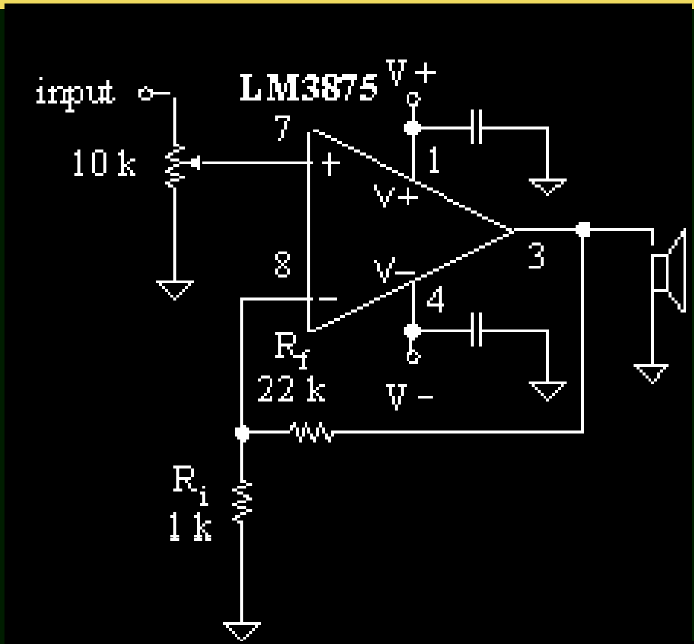
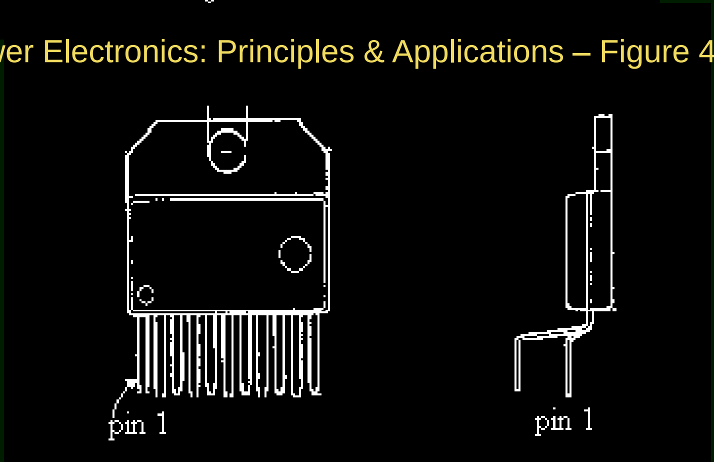
- High Power IC (50W) LM3875
  - Schematic
  - Characteristics
  - Calculations

LM3875 - characteristics



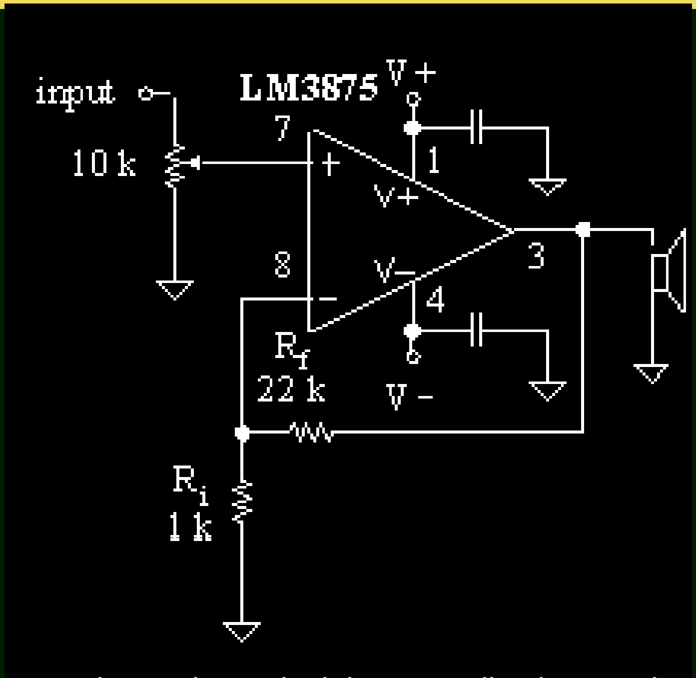
Power Electronics: Principles & Applications – Figure 4-22



Power Electronics: Principles & Applications – Figure 4-23

- $P_{load} \leq 56$ W into 8 Ω
- $T_{J\,max}$ internally limited 165 ºC
- $\Theta_{JC} = 1$ ºC/W
- $I_{p\,max} \leq 4\ A_p$
- V^+ to V^-: 20 V to 84 V
- V_{sat} : ± 5 V
- Use it like an op amp
  - R_f and R_i
  - GBW and slew rate concerns
- Layout is a *big* deal

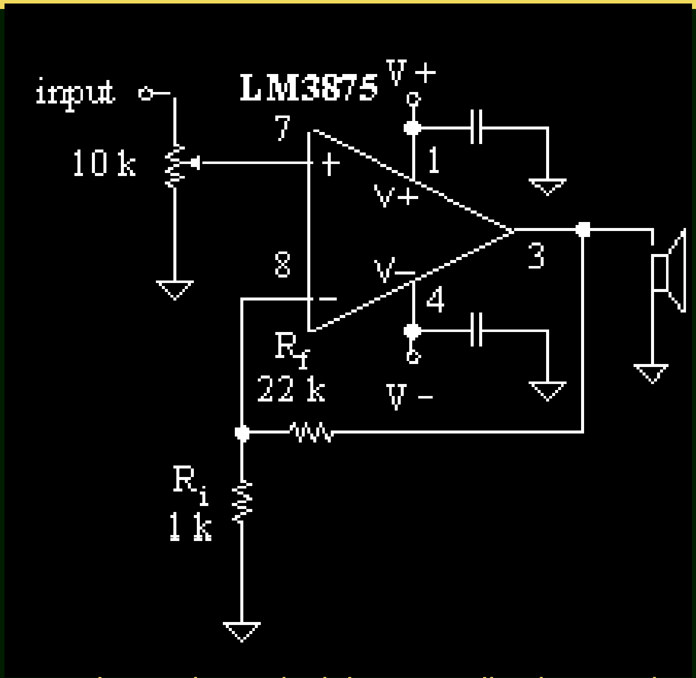
LM3875 – design - @ max output



Power Electronics: Principles & Applications – Figure 4-22

- $P_{load} \le 30$ W into 8 Ω, e_{in} = 300 mV$_{rms}$
- E_{supply} = ______________
- $I_{supply\ max}$ = ______________
- A_o = _______________
- R_f = ______________
- GBW = ______________ ok ?
- Slew rate = ______________ ok ?

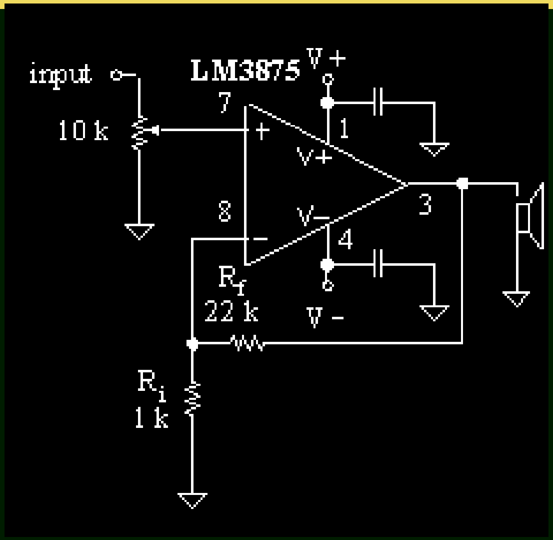
LM3875 – design - @ max output



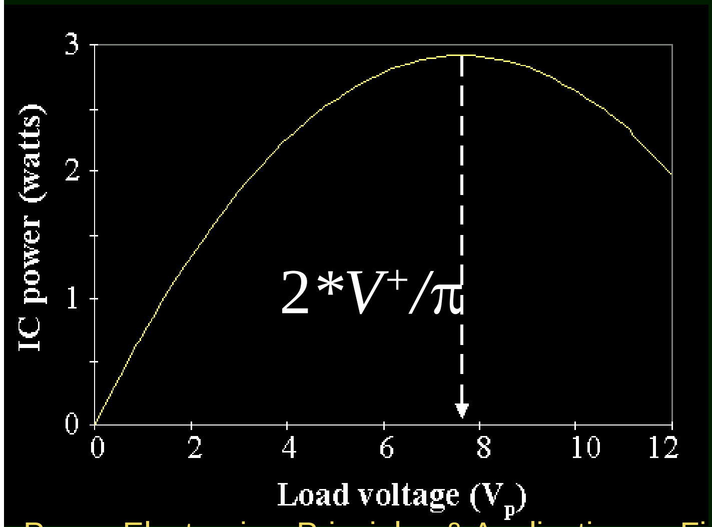
Power Electronics: Principles & Applications – Figure 4-22

- $P_{load} \leq 30$ W into 8 Ω, e_{in} = 300 mV_{rms}
- E_{supply} = +/- 28 V_{dc}
- $I_{supply\ max}$ = 2.75 A
- A_o = 51.7
- R_f = 50.7 kΩ
- GBW = 1.03 MHz
- Slew rate = 2.76 V/μs

LM3875 – design - @ IC worst case



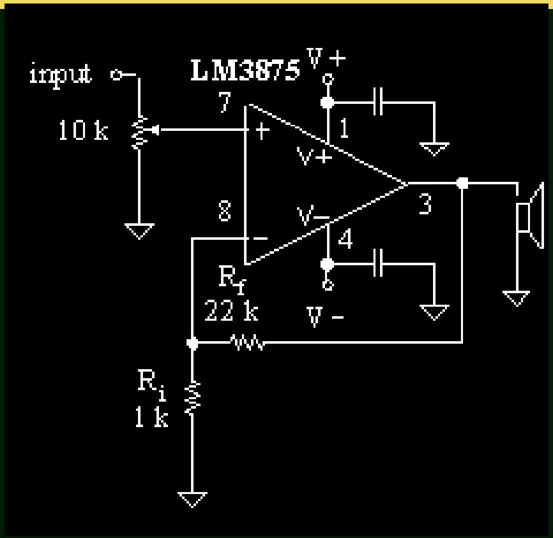
Power Electronics: Principles & Applications – Figure 4-22



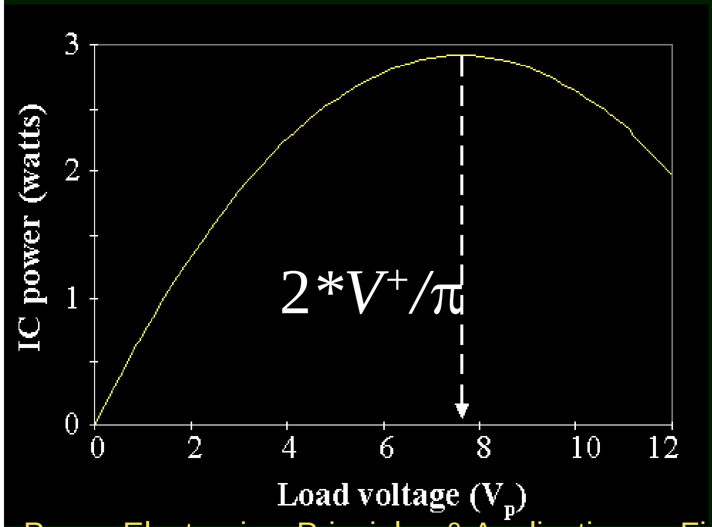
Power Electronics: Principles & Applications – Figure 4-12

- $P_{load} \leq 30$ W into 8 Ω, e_{in} = 300 mV_{rms}
- $V_{load\ p\ w.c.}$ = ____________
- $I_{load\ p\ w.c.}$ = ____________
- $P_{supply\ w.c.}$ = ___________
- $P_{load\ w.c.}$ = ____________
- $P_{IC\ w.c.}$ = ____________
- $\Theta_{JA\ w.c.}$ = ___________
- Heat sink ? ____________

LM3875 – design - @ IC worst case



Power Electronics: Principles & Applications – Figure 4-22



Power Electronics: Principles & Applications – Figure 4-12

- $P_{load} \leq$ 30 W into 8 Ω, e_{in} = 300 mV$_{rms}$
- $V_{load\ p\ w.c.}$ = 17.8 V_p
- $I_{load\ p\ w.c.}$ = _2.2 A_p
- $P_{supply\ w.c.}$ = 39.2 W
- $P_{load\ w.c.}$ = 19.8 W
- $P_{IC\ w.c.}$ = 19.5 W
- $\Theta_{JA\ w.c.}$ =5.2 deg C/W
- Heat sink : 4 deg C/W