aptek technologies

AMS 3089-3
12 kHz/16kHz
METERING PULSE DETECTOR

DESCRIPTION

The AMS 3089-3 is an integrated telephone pulse metering tone detector. Designed to work from a single 5V supply, its operation is guaranteed down to 3V, making it ideally suitable for both PABX and subscriber set applications. It is fabricated in 3µ double-poly silicon gate CMOS technology and implemented using switched-capacitor techniques to provide accurate and reliable operation under the control of an inexpensive colorburst (3.579545 MHz) crystal.

Specified sensitivity levels have been carefully selected to satisfy the requirements of most users, however, detection levels are adjustable for design flexibility.

FEATURES

- 3µ CMOS double-poly technology
- 5V single supply operation, guaranteed down to 3V
- Low operating power dissipation
  - 1.8 mW @ VDD = 3V, typical
  - 6.0 mW @ VDD = 5V, typical
- 14-lead dual-in-line , plastic or 16-lead plastic SO-16 packages
- Selectable 12kHz/16kHz operation
- Meets most countries specifications with minimum number of external components
- Both fully qualified and tone follower outputs available

PIN CONFIGURATIONS

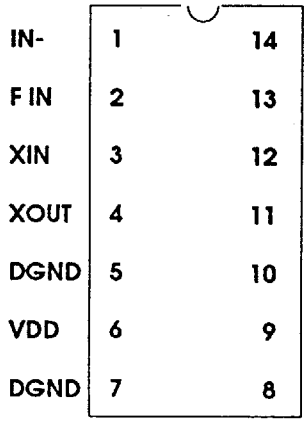


Figure 1. 14 DUAL-IN-LINE PACKAGE

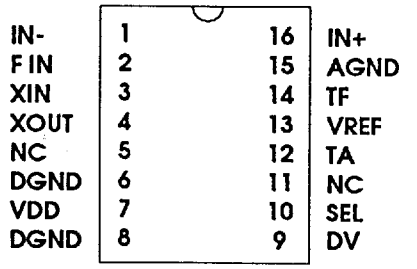
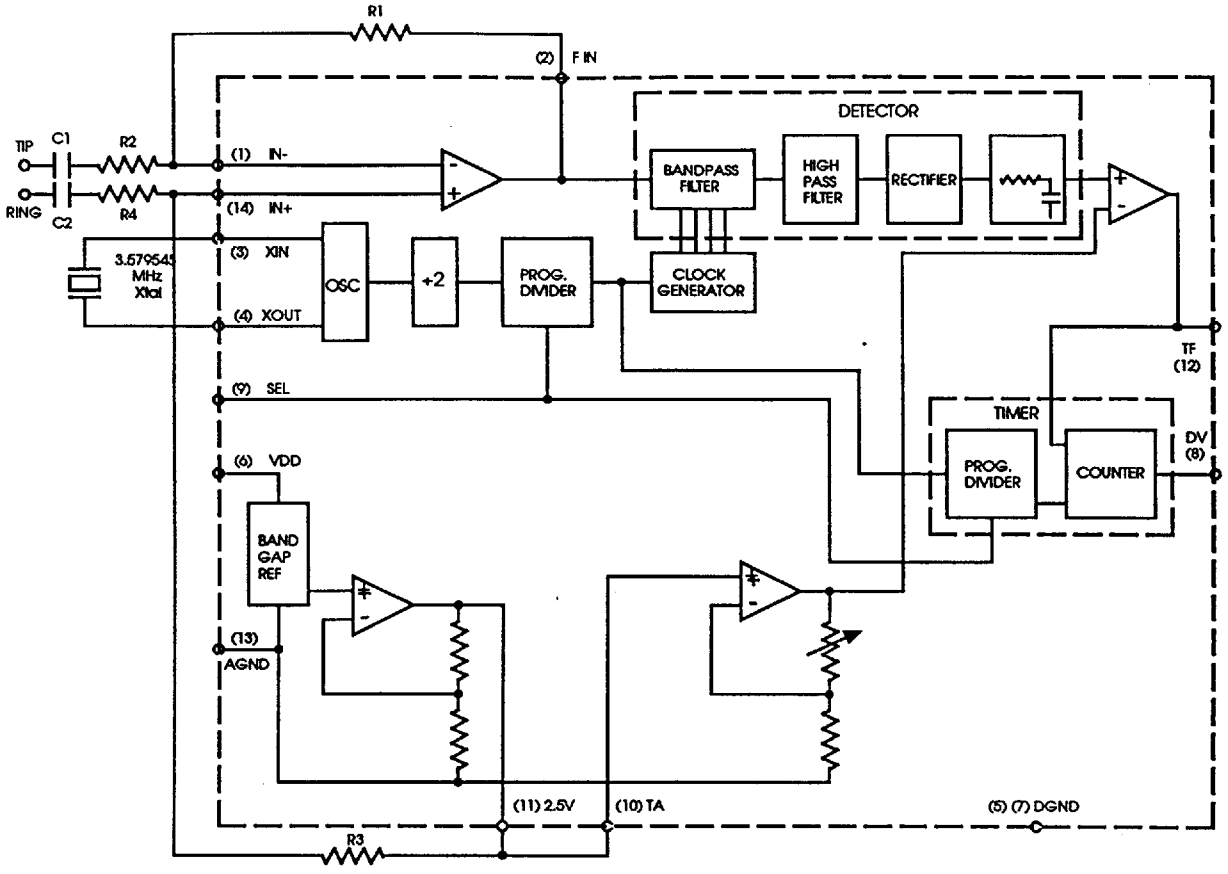


Figure 2. 16- LEAD SO-16 PACKAGE

BLOCK DIAGRAM



Note: Pin numbers shown for 14 pin dual-in-line package.

PIN NAMES

IN-	Analog input. Op amp inverting input	SEL	Select input
FIN	Analog output. Op amp output; input to filter	TA	Threshold adjust
XIN	Input to crystal oscillator	VREF	Internal reference voltage
XOUT	Output of crystal oscillator	TF	Tone follower output
DGND	Digital ground	AGND	Most negative supply
VDD	Power supply	IN+	Analog input. Op amp non-inverting input
DV	Data valid output		

FUNCTIONAL DESCRIPTION

The AMS 3089-3 is an integrated tone detector for use in PABX and telephone pulse metering applications. An op amp is provided at the input for setting the detector sensitivity and interfacing to the line. The incoming tones are fed to the level detector that provides accurate level and frequency discrimination. It consists of:

- An eighth-order switched-capacitor bandpass filter synthesized from a doubly-terminated passive RLC prototype to minimize the effect of component variation on filter performance.
- A high pass filter that provides additional gain and desensitizes the detector to internal offsets.
- A full-wave rectifier and smoothing circuit that produces a DC voltage proportional to the level of the incoming tones.
- A threshold voltage derived from a bandgap reference that contains sensitivity information.
- A comparator that decides on the validity of the frequency and level of the tone.

The output of the level detector passes to the timer. Its function is to determine whether the incoming tone is of the right duration or if a valid pause has occurred. It consists of an up-down counter which is clocked by a programmable divider and enabled by the level detector. The output of the timer at DV provides a high logic level when a tone burst has met all the level and timing requirements. The output of the level detector is available at TF. Selecting this pin as the output bypasses the internal timer and enables the detector to operate in the tone follower mode, for applications where timing is not required or is to be microprocessor controlled.

The circuit operation is controlled from an inexpensive colorburst crystal (3.579545 MHz). Operating mode is set by the SEL pin. A high level at this pin (VDD) sets the detector to 12 kHz operation, while grounding it switches the mode to 16 kHz.

PIN DESCRIPTION

PIN		SYMBOL	FUNCTION
14 DIP	SO16		
1	1	IN-	Pins for input op amp. Used for setting detector sensitivity and interfacing to the line. See Applications Section.
2	2	F IN	
14	16	IN+	
3	3	XIN	Input and output for crystal oscillator. The crystal should be placed across these pins.
4	4	XOUT	
5, 7	6, 8	DGND	Digital ground. Both pins must be connected.
6	7	VDD	Power supply. The most positive voltage in circuit.
8	9	DV	Data valid output.
9	10	SEL	Select pin. VDD selects 12 kHz; GND selects 16 kHz.
10	12	TA	Threshold adjust. Used for setting sensitivity. See Applications Section. Normally shorted to 2.5 V
11	13	VREF	Internal reference.
12	14	TF	Tone follower output. Output prior to timer.
13	15	AGND	Most negative supply. Normally ground.

ELECTRICAL CHARACTERISTICS

ABSOLUTE MAXIMUM RATINGS

Supply voltage	-0.3 to 7.0 V
Input voltage at any pin	-0.3 to (VDD + 0.3 V)
Maximum power dissipation	800 mW
Operating temperature range	-30°C to 70°C
Storage temperature range	-40°C to 85°C
Note: Exceeding MAX ratings may cause permanent damage to the device and may affect device reliability. Functional operation under these conditions is not guaranteed.	

D. C. CHARACTERISTICS

(T_A = 25° C, V_{DD} = +3 - 5% V to +5 +5% V, AGND = 0V, DGND = 0V)

PARAMETER	SYMBOL	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	CONDITION
Supply current V_{DD} = 5V	I_{DD}		1.3	1.6	mA	
Supply current V_{DD} = 3V	I_{DD}		610	800	µA	
Low level output voltage	V_{OL}		0.1	0.4	V	Data Valid Output I_{OL} = 1.0 mA
High level output voltage	V_{OH}	V_{DD}-0.5	V_{DD}-0.2		V	Data Valid Output I_{OH} = -1.0 mA
Low level output voltage	V_{OL}		0.1	0.4	V	Tone Follower Output I_{OL} = 5µA*
High level output voltage	V_{OH}	V_{DD}-0.5	V_{DD}-0.2		V	Tone Follower Output I_{OH} = 5µA*
Reference voltage	V_{REF}	1.5		1.9	V	

*This output should only be used for driving CMOS loads (20pF max)

12 kHz DETECTOR

(DV Output; V_{DD} = 3.0V, AGND = 0V, DGND = 0V)

PARAMETER	SYMBOL	FREQUENCY	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	CONDITIONS
Must detect sensitivity	S_D	12 kHz ± 1%	-19.3		22.2	dBm	
Must not detect sensitivity	$\overline{S_D}$	12 kHz ± 6%			-24.3	dBm	Input amplifier gain at -30.44 dB 0dBm = 775 mV_{RMS}
		≤11280			-10.74		
		≥12720			-10.74		
		≤10800			-3.5		
		≥13200			-3.5		
		≤10500			22.2		
		≥13500			22.2		

16 kHz DETECTOR

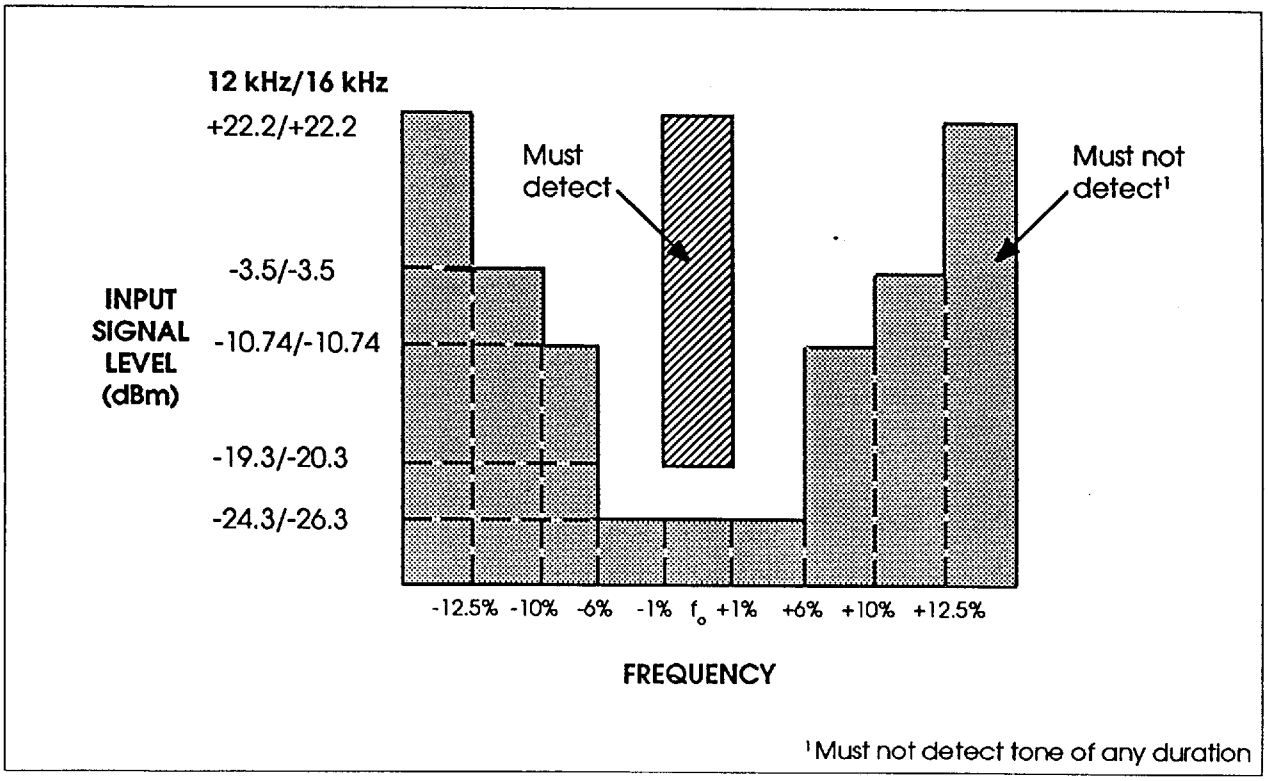
(DV Ouput; V_{DD} =3.0 V, AGND = 0V, DGND = 0V)

PARAMETER	SYMBOL	FREQUENCY	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	CONDITIONS
Must detect sensitivity	S_D	16 kHz ± 1%	-20.3		+22.2	dBm	
Must not detect sensitivity	$\overline{S_D}$	16 kHz ± 1%			-26.3	dBm	Input amplifier Gain at -30.44dB 0dBm = 775 mVRMS
		≤15040			-10.74		
		≥16960			-10.74		
		≤14400			-3.5		
		≥17600			-3.5		
		≤14000			+22.2		
		≥18000			+22.2		

A. C. CHARACTERISTICS

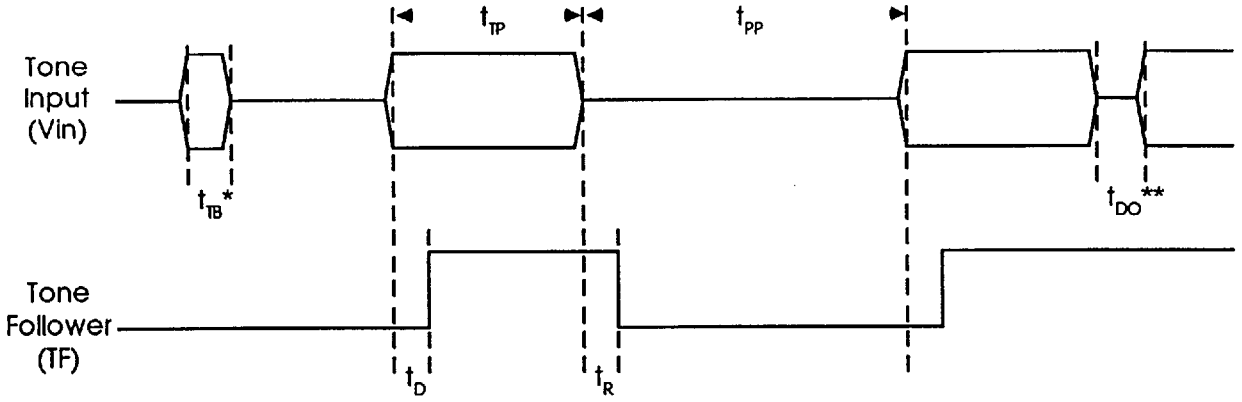
(DV Output; f_O = 12 kHz or 16 kHz)

PARAMETER	SYMBOL	FREQUENCY	LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS	COMMENTS
Must detect pulse	tpwd	f_o ±1%	50	45		msec	Must detect pulses ≥ 50ms
Must not detect pulse	$\overline{tpwd}$	f_o ±1%		43	40	msec	Must not detect pulses ≤ 40ms
Must detect pause	tpd	f_o ±1%	75	45		msec	Must detect pauses ≥ 75ms
Must not detect pause	$\overline{tpd}$	f_o ±1%		45	30	msec	Must not detect pauses ≤ 30ms



[1]Must not detect tone of any duration

TONE FOLLOWER OUTPUT CHARACTERISTICS



* t_{TB} = Tone Bursts of less than t_D (Detect Time) are not detected.

** t_{DO} = Tone Drop Outs of less than t_R (Release Time) are not detected.

TIMING DIAGRAM

TIMING CHARACTERISTICS

T_A =25° C, V_{DD} = +3V - 5% to +5 + 5%, AGND = 0V, DGND = 0V, For signals from minimum detect sensitivity to +8dbm

PARAMETER	CONDITION	MIN	MAX	UNITS
t_D Detect Time	12kHz		5.0	ms
	16kHz		5.0	ms
t_R Release Time	12kHz		12.0	ms
	16kHz		14.0	ms
t_{TP} Valid Tone Period	12kHz	5.0		ms
	16kHz	5.0		ms
t_{PP} Valid Pause Period	12kHz	12.0		ms
	16kHz	14.0		ms

TYPICAL CHARACTERISTICS

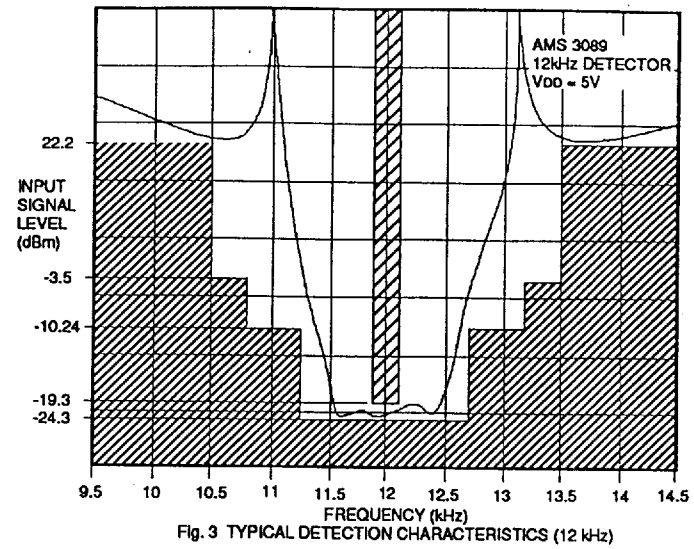


Fig. 3 TYPICAL DETECTION CHARACTERISTICS (12 kHz)

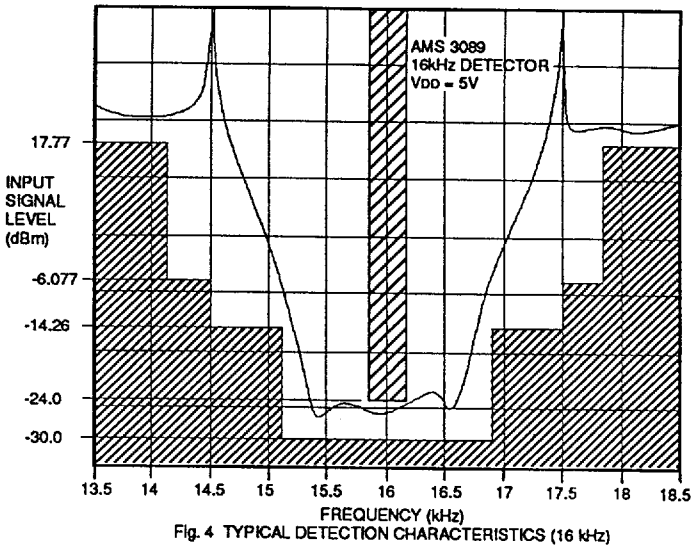


Fig. 4 TYPICAL DETECTION CHARACTERISTICS (16 kHz)

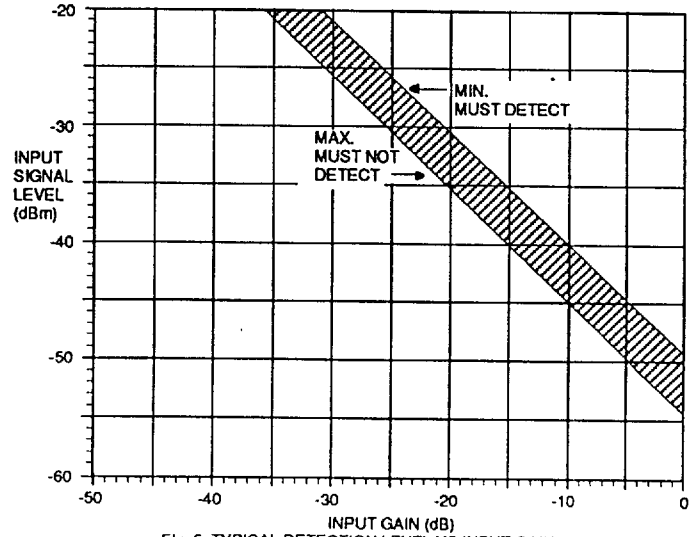


Fig. 5 TYPICAL DETECTION LEVEL VS INPUT GAIN (12 kHz)

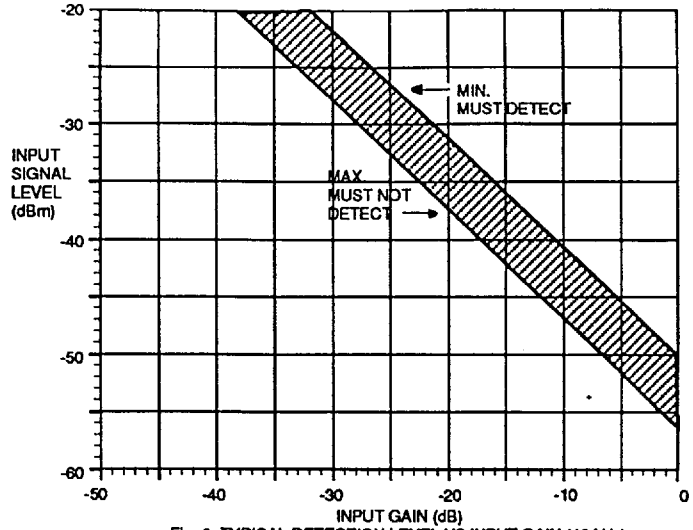


Fig. 6 TYPICAL DETECTION LEVEL VS INPUT GAIN (16 kHz)

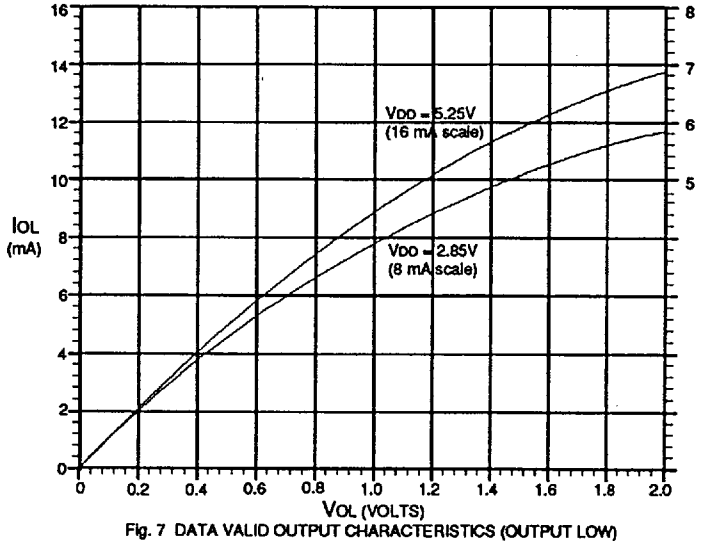


Fig. 7 DATA VALID OUTPUT CHARACTERISTICS (OUTPUT LOW)

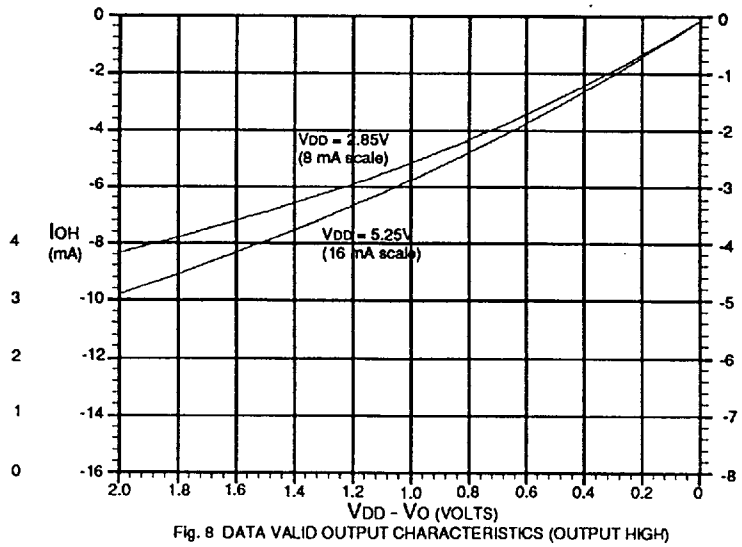


Fig. 8 DATA VALID OUTPUT CHARACTERISTICS (OUTPUT HIGH)

APPLICATIONS

INPUT CONFIGURATIONS

Recommended input connections for the AMS 3089-3 are shown in Figures 9 and 10.

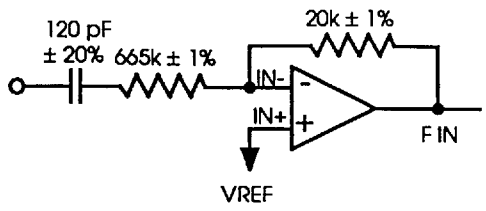


Figure 9. **12 kHz/16 kHz Detector Single Ended Configuration**

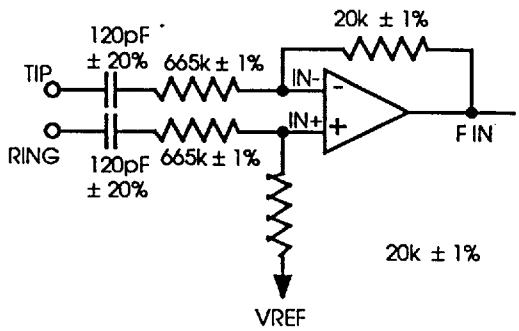
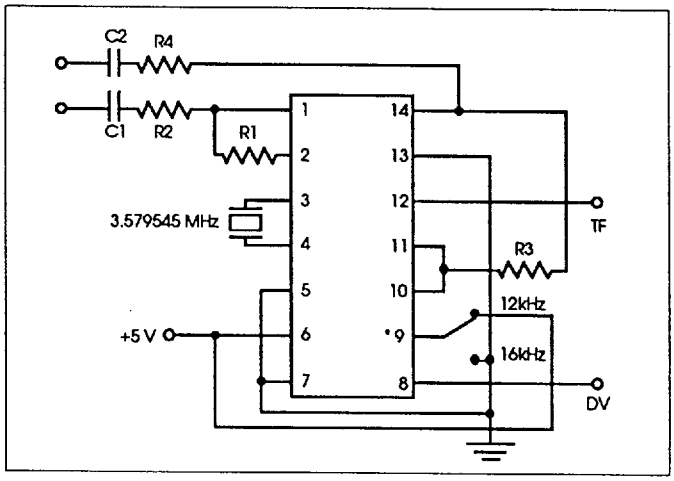


Figure 10. **12 kHz/16 kHz Detector Differential Configuration**

ALIASING CONSIDERATIONS

The AMS 3089-3 detector has been designed using switched-capacitor techniques and as all sampled-data systems is susceptible to aliasing distortion. In most systems this will not be a problem. However, if high frequency signals (above 200 kHz) exists at the input, the device should be bandlimited. This can be accomplished by placing a capacitor in parallel with the 20kΩ feedback resistors. The value of the capacitor should be 390pF ± 10% for the 12kHz detector and 270pF ± 10% for the 16kHz detector. Under worst case conditions these capacitors will introduce an additional 1.4dB loss in the detection band. The gain of the input amplifier should be adjusted by an equal amount in order to maintain the same detection levels.

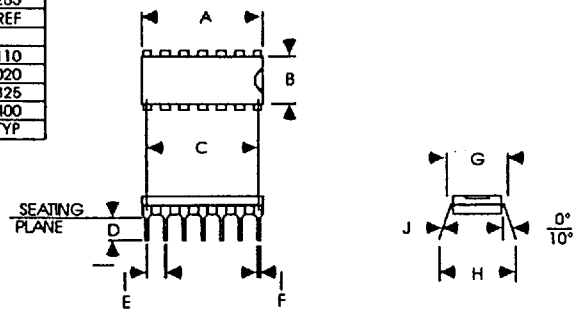
TYPICAL CONNECTION DIAGRAM



* Shown for 12kHz operation. Pin 9 must be connected to GND for 16kHz operation.
Note: Pin numbers shown for 14 pin dual-in-line package.

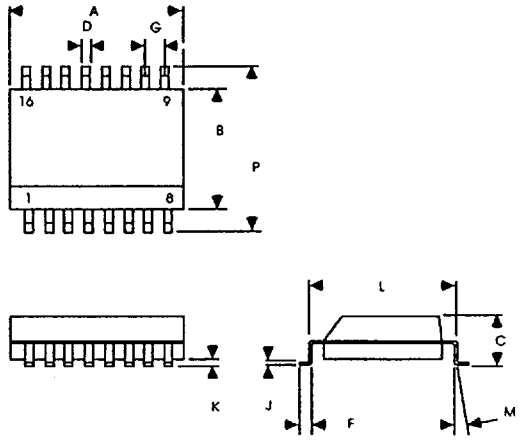
PACKAGE OUTLINE DRAWINGS

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	16.89	16.891	.655	.665
B	6.223	6.477	.245	.255
C	15.24	REF	.600	REF
D	3.175		.125	
E	2.286	2.794	.090	.110
F	0.406	0.508	.016	.020
G		8.225		.325
H		10.16		.400
J	0.254	TYP	.010	TYP



14-Pin DIP Package

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	10.16	10.43	.400	.411
B	7.39	7.69	.291	.299
C	2.36	2.64	.093	.104
D	.36	.48	.014	.019
F	.61	.88	.020	.036
G	1.27	BSC	.050	BSC
J	.20	.30	.010	.012
K	.25	.30	.010	.012
L	8.50	8.90	.335	.351
M	0°	7°	0°	7°
P	10.08	10.64	.397	.415



16-Lead SO Plastic Package

ORDERING INFORMATION: DIP Package = 3089-3 (no suffix)
SO Package = 3089-3DW

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