

## DYNAMIC SPEAKER DRIVE AMPLIFIER

### FEATURES

- Very Wide Operating Voltage ( $V_{CC} = 1.8$  to  $5.5$  V)
- Very Low Supply Current
- Very Low Standby Current
- Miniature Package (SOT23L-6)
- Adjustable Voltage Gain ( $V_{G1} = 0$  to  $40$  dB)
- Needs No Output Coupling Capacitor

### APPLICATIONS

- Speaker Driver for Portable Equipment
- Headphone Driver
- Toys

### DESCRIPTION

The TK10416M is a very low operating voltage and current audio power amplifier to drive dynamic speakers.

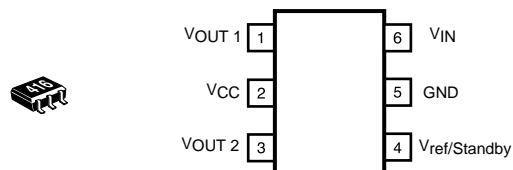
The TK10416M drives the speaker directly, because the device has a differential output that does not need an output coupling capacitor.

The voltage gain is adjustable by two external resistors.

The TK10416M is available in the very small SOT23L-6 surface mount package.

The small package in conjunction with few external components save printed circuit board space.

TK10416M



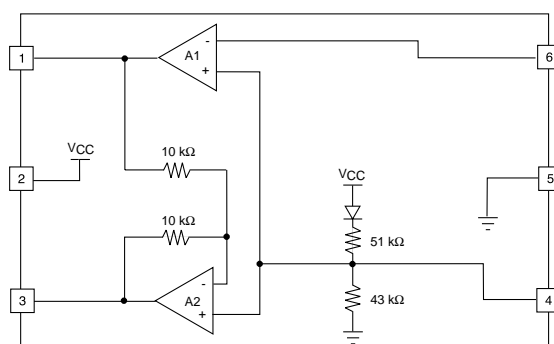
### ORDERING INFORMATION

TK10416M □□

Tape/Reel Code

TAPE/REEL CODE  
TL: Tape Left

BLOCK DIAGRAM



# TK10416

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... 6 V  
Operating Voltage ..... 1.8 to 5.5 V  
Power Dissipation (Notes 1 and 2) ..... 400 mW

Storage Temperature Range ..... -55 to +150 °C  
Operating Temperature Range ..... -20 to +70 °C

## TK10416 ELECTRICAL CHARACTERISTICS

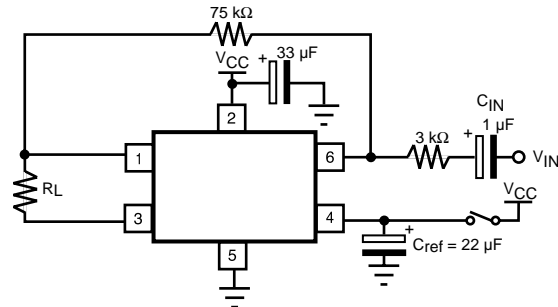
Test Conditions:  $V_{CC} = 3.6\text{ V}$ ,  $f = 1.0\text{ kHz}$ ,  $R_L = 32\ \Omega$ ,  $T_A = 25\text{ °C}$ , unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
$I_{CC}$	Supply Current	$V_{CC} = 3.6\text{ V}$ , $R_L = \infty$		2.7	4.0	mA
		$V_{CC} = 5.0\text{ V}$ , $R_L = \infty$		2.8	4.2	mA
$I_{CC(STBY)}$	Standby Supply Current	$V_{CC} = 3.6\text{ V} = \text{Pin 4}$ , $R_L = \infty$		0.0	2.0	$\mu\text{A}$
$I_{CONT}$	Control Terminal Current	Pin 4 Sink Current, $V_{Pin4} = V_{CC}$		90	140	$\mu\text{A}$
$V_{THS}$	Standby Threshold Voltage	Pin 4	$V_{CC} - 0.4$			V
$G_{VO}$	Open Circuit Voltage Gain	AMP1		71.0		dB
$G_V$	Voltage Gain	AMP1	25.0	28.0	30.0	dB
		AMP2	-3.0	0.0	+3.0	dB
		AMP1 + AMP2	31.0	34.0	36.0	dB
THD	Total Harmonic Distortion	$V_{CC} = 3.6\text{ V}$ , $P_{OUT} = 60\text{ mW}$		0.5	1.0	%
		$V_{CC} = 5.0\text{ V}$ , $P_{OUT} = 120\text{ mW}$		0.5	1.0	%
$P_{OUT(MAX)}$	Maximum Output Power	$V_{CC} = 3.6\text{ V}$ , $THD \leq 10\%$	80	120		mW
		$V_{CC} = 5.0\text{ V}$ , $THD \leq 10\%$	170	280		mW
RR	Ripple Rejection Ratio	$C_{ref} = 22\ \mu\text{F}$		42.5		dB
$V_{OUT(DC)}$	DC Voltage at Output Terminal	$V_{OUT1}$	1.20	1.40	1.60	V
		$V_{OUT2}$	1.20	1.40	1.60	V
$V_{OUT(OS)}$	Output Offset Voltage	$V_{OUT2} + V_{OUT1}$	-30.0	0.0	+30.0	mV
$R_L$	Load Resistance		8	32		$\Omega$

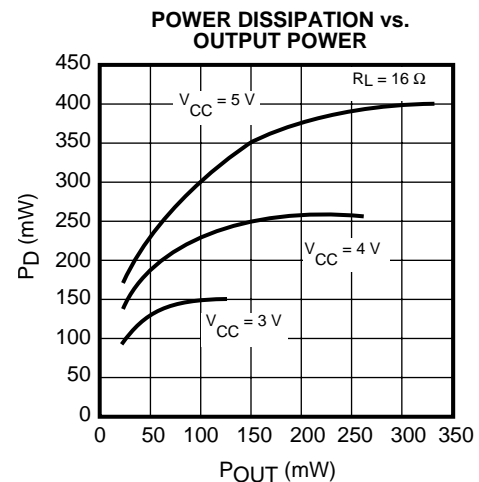
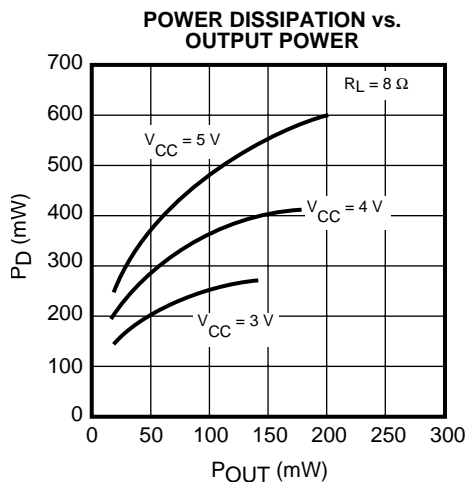
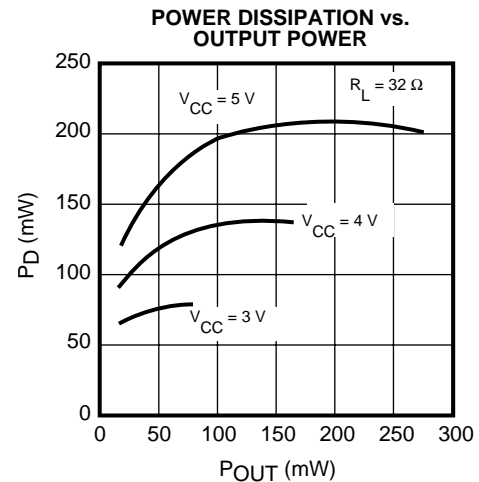
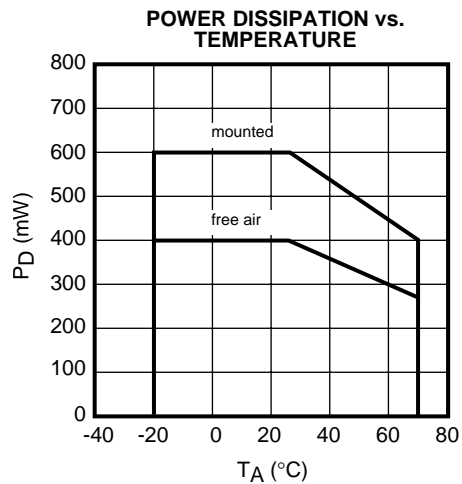
Note 1: Power dissipation is 400 mW in free air. Derate at 3.2 mW/°C for operation above 25 °C.

Note 2: Power dissipation is 600 mW when mounted. Derate at 4.8 mW/°C for operation above 25 °C.

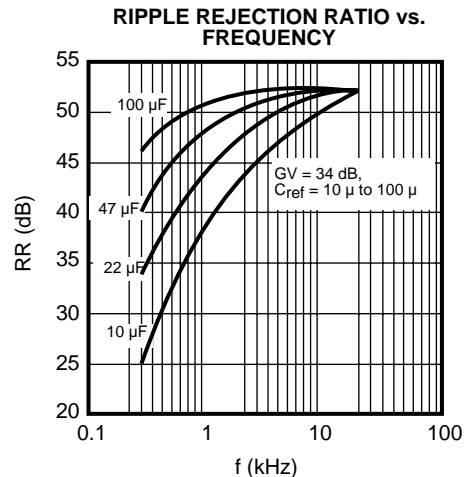
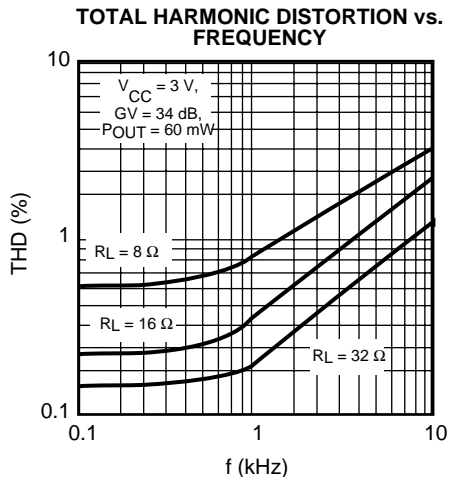
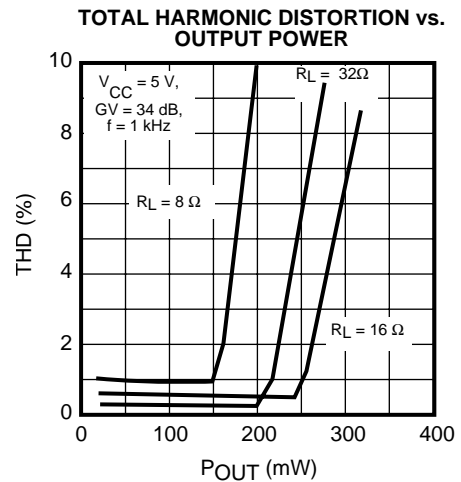
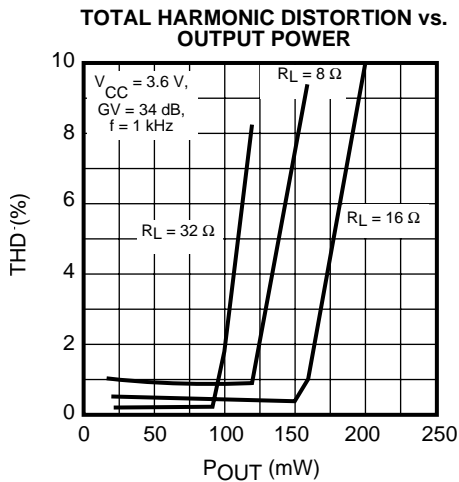
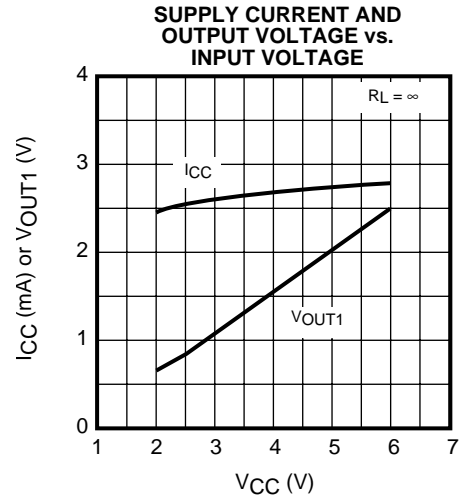
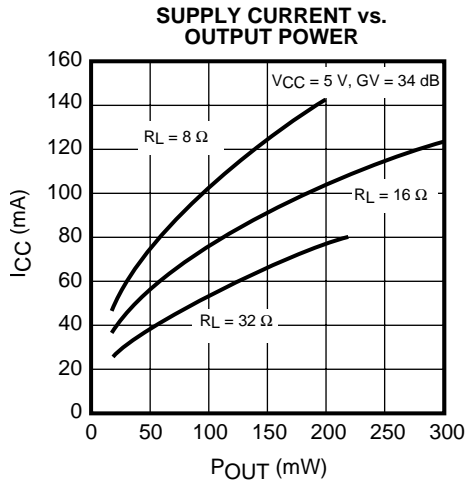
## TEST CIRCUIT



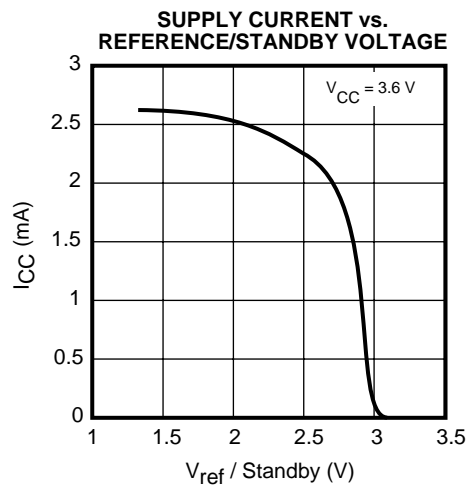
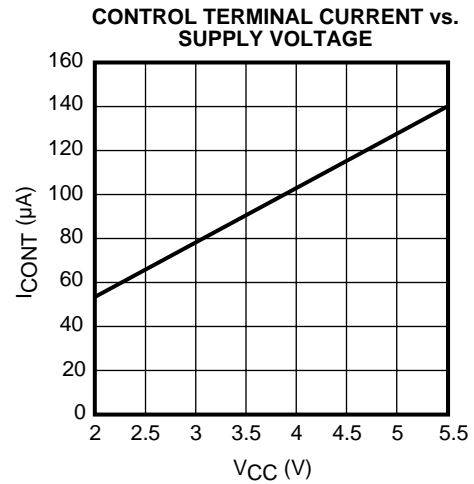
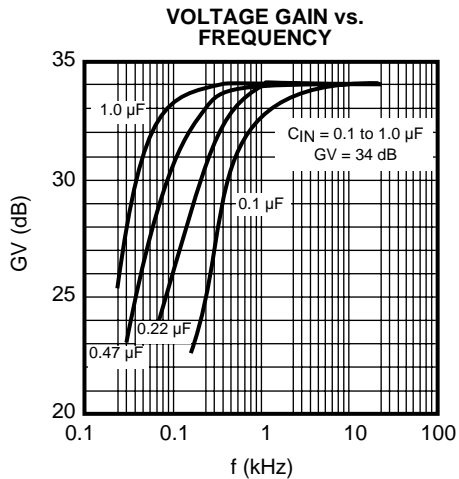
## TYPICAL PERFORMANCE CHARACTERISTICS



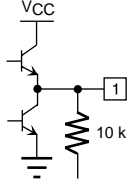
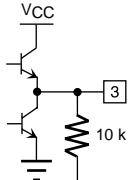
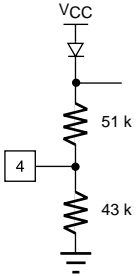
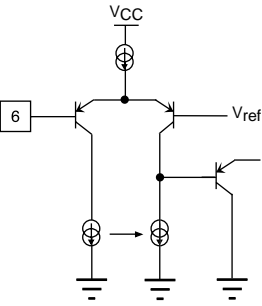
## TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)



## TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)



PIN FUNCTION DESCRIPTION

PIN NO.	SYMBOL	TERMINAL VOLTAGE (V)	INTERNAL EQUIVALENT CIRCUIT	DESCRIPTION
1	$V_{OUT1}$	$V_{OUT}$ (Note 1)		A1 amplifier output terminal
2	$V_{CC}$	$V_{CC}$		Supply input terminal
3	$V_{OUT2}$	$V_{OUT}$ (Note 1)		A2 amplifier output terminal
4	$V_{ref}/$ Standby	$V_{OUT}$ (Note 1)		Reference voltage terminal. When this terminal is $V_{CC}$ , the device is in the standby mode and the supply current is down to under 0.1 $\mu A$ .
5	GND	0 V		Ground terminal
6	$V_{IN}$	$V_{OUT}$ (Note 1)		A1 amplifier input terminal

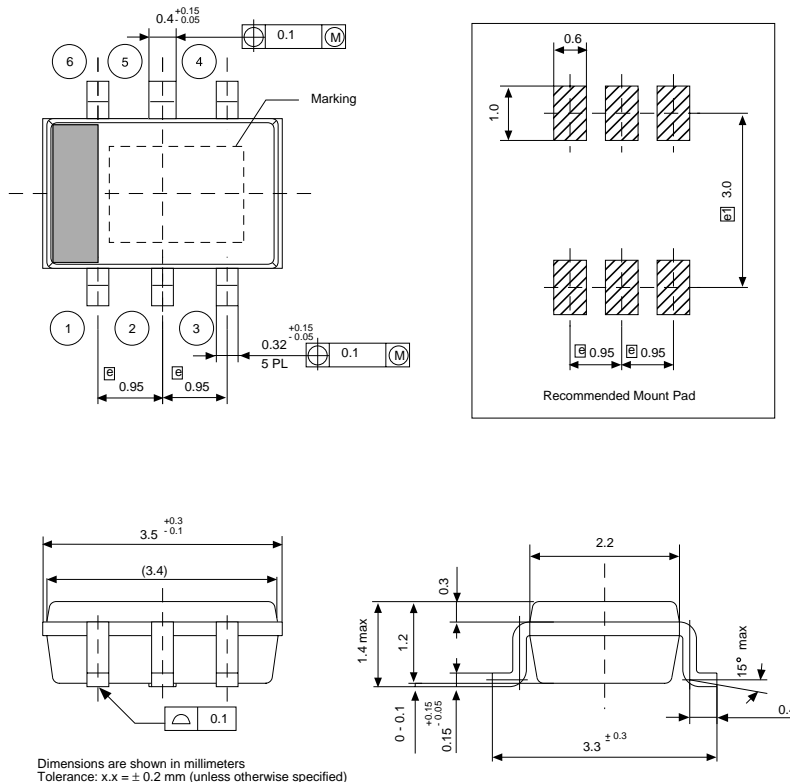
Note 1: Terminal voltage with no input signal is calculated by the following equation:

$$V_{OUT} = (V_{CC} - 0.56) \times \frac{43\text{ k}}{43\text{ k} + 51\text{ k}}$$

**NOTES**

## PACKAGE OUTLINE

## SOT23L-6



## Marking Information

TK10416

Marking  
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Toko America, Inc. Headquarters  
1250 Feehanville Drive, Mount Prospect, Illinois 60056  
Tel: (847) 297-0070 Fax: (847) 699-7864

## TOKO AMERICA REGIONAL OFFICES

Midwest Regional Office  
Toko America, Inc.  
1250 Feehanville Drive  
Mount Prospect, IL 60056  
Tel: (847) 297-0070  
Fax: (847) 699-7864

Western Regional Office  
Toko America, Inc.  
2480 North First Street, Suite 260  
San Jose, CA 95131  
Tel: (408) 432-8281  
Fax: (408) 943-9790

Eastern Regional Office  
Toko America, Inc.  
107 Mill Plain Road  
Danbury, CT 06811  
Tel: (203) 748-6871  
Fax: (203) 797-1223

Semiconductor Technical Support  
Toko Design Center  
4755 Forge Road  
Colorado Springs, CO 80907  
Tel: (719) 528-2200  
Fax: (719) 528-2375

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