

## CERAMIC SPEAKER DRIVE AMPLIFIER

### FEATURES

- Wide Operating Voltage Range ( $V_{CC} = 1.8$  to  $5.5$  V)
- Very Low Supply Current ( $I_{CC} = 1.8$  mA @  $V_{CC} = 2.4$  V)
- Very Low Standby Current ( $I_{STBY} = 0.1$   $\mu$ A)
- Miniature Package (SOT23L-6)
- Very Large Output Voltage ( $V_{OUT(MAX)} = 1.7$  Vrms @  $V_{CC} = 2.4$  V,  $R_L = 620$   $\Omega$ )
- Very Small Total Harmonic Distortion (THD = 0.1 % @  $V_{OUT} = 0.8$  Vrms)
- Needs No Output Coupling Capacitor

### APPLICATIONS

- Speaker Driver for Portable Equipment
- Headphone Driver
- Toys and Games

### DESCRIPTION

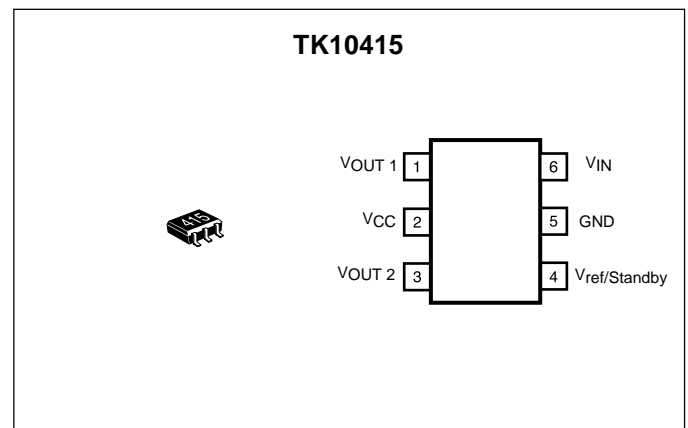
The TK10415M is a very low operating voltage and current audio power amplifier to drive ceramic speakers.

The TK10415M 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 TK10415M is available in the very small SOT23L-6 surface mount package.

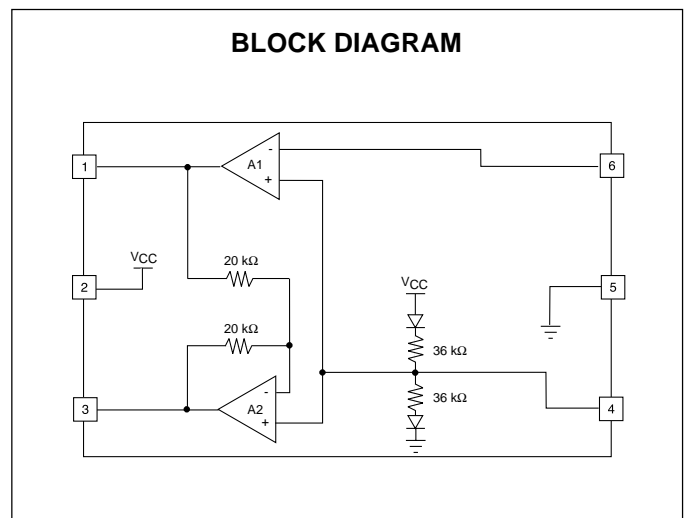
The small package in conjunction with few external components saves printed circuit board space.



**ORDERING INFORMATION**

TK10415M Tape/Reel Code

TAPE/REEL CODE  
TL: Tape Left



# TK10415

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage .....	6 V	Storage Temperature Range .....	-55 to +150 °C
Operating Voltage .....	1.8 to 5.5 V	Operating Temperature Range .....	-20 to +70 °C
Power Dissipation (Notes 1 and 2).....	400 mW		

## TK10415 ELECTRICAL CHARACTERISTICS

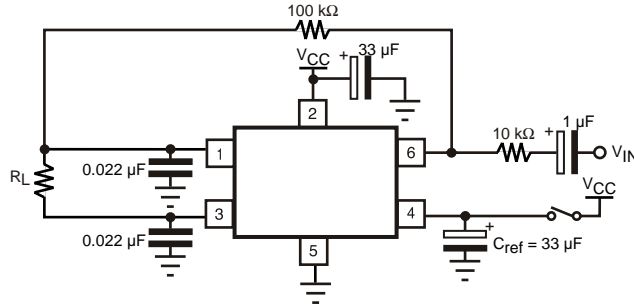
Test Conditions:  $V_{CC} = 2.4\text{ V}$ ,  $f = 1.0\text{ kHz}$ ,  $R_L = 620\ \Omega$ ,  $T_A = 25\text{ °C}$ , unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNITS
$I_{CC}$	Supply Current	$V_{CC} = 2.4\text{ V}$ , $R_L = \infty$		1.8	3.0	mA
		$V_{CC} = 5.0\text{ V}$ , $R_L = \infty$		2.2	3.5	mA
$I_{STBY}$	Standby Supply Current	$V_{CC} = 2.4\text{ V} = \text{Pin 4}$ , $R_L = \infty$		0.0	2.0	$\mu\text{A}$
$I_{CONT}$	Control Terminal Current	Pin 4 Sink Current, $V_{\text{Pin4}} = V_{CC}$		53.0	90.0	$\mu\text{A}$
$V_{THS}$	Standby Threshold Voltage	Pin 4	$V_{CC} - 0.4$			V
$G_{VO}$	Open Circuit Voltage Gain	AMP1		60.0		dB
$G_V$	Voltage Gain	AMP1	17.0	20.0	23.0	dB
		AMP2	-3.0	0.0	3.0	dB
		AMP1 + AMP2	23.0	26.0	29.0	dB
THD	Total Harmonic Distortion	$V_{CC} = 2.4\text{ V}$ , $V_{OUT} = 0.8\text{ V}_{rms}$		0.1	1.0	%
		$V_{CC} = 5.0\text{ V}$ , $V_{OUT} = 2.0\text{ V}_{rms}$		0.1	1.0	%
$V_{OUT(MAX)}$	Maximum Output Voltage	$V_{CC} = 2.4\text{ V}$ , THD $\leq 10\%$	1.2	1.7		$V_{rms}$
		$V_{CC} = 5.0\text{ V}$ , THD $\leq 10\%$	2.6	3.7		$V_{rms}$
RR	Ripple Rejection Ratio	$C_{ref} = 33\ \mu\text{F}$		38.0		dB
$V_{OUT(DC)}$	DC Voltage at Output Terminal	$V_{OUT1}$	1.00	1.20	1.40	V
		$V_{OUT2}$	1.00	1.20	1.40	V
$V_{OUT(OS)}$	Output Offset Voltage	$V_{OUT2} - V_{OUT1}$	-30.0	0.0	30.0	mV
$R_L$	Load Resistance		100	620		$\Omega$

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.

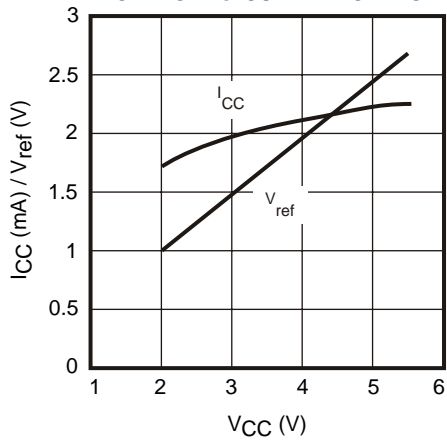
TEST CIRCUIT



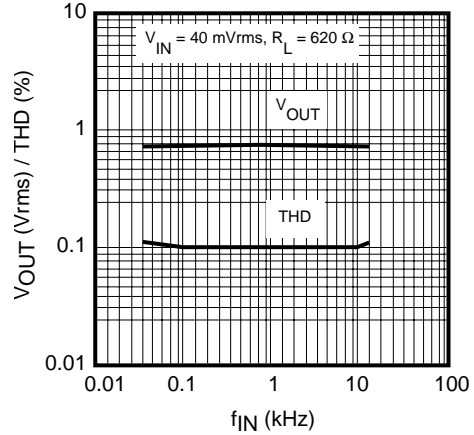
TYPICAL PERFORMANCE CHARACTERISTICS

$V_{CC} = 5\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified.

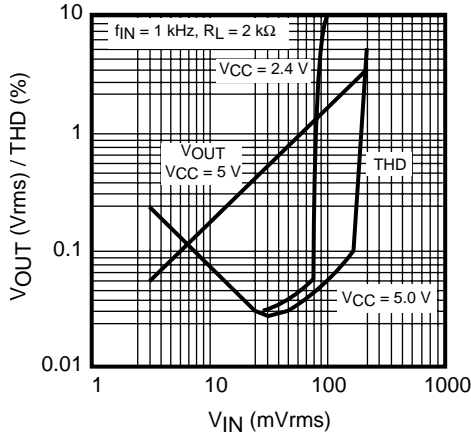
SUPPLY CURRENT and REFERENCE VOLTAGE vs. SUPPLY VOLTAGE



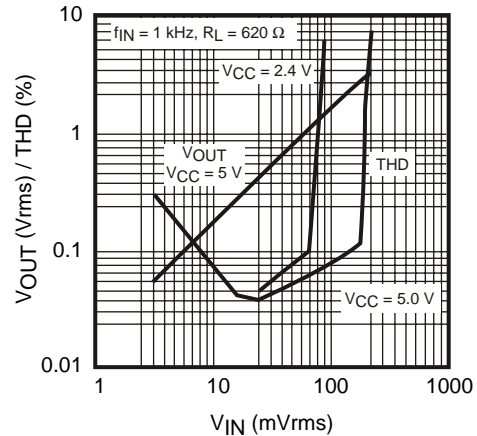
OUTPUT VOLTAGE AND DISTORTION vs. FREQUENCY



OUTPUT VOLTAGE AND DISTORTION vs. INPUT VOLTAGE 1

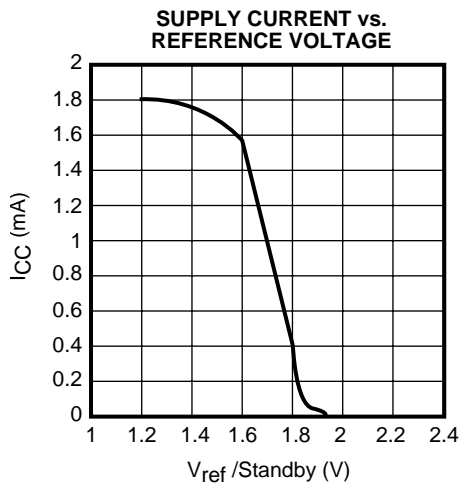
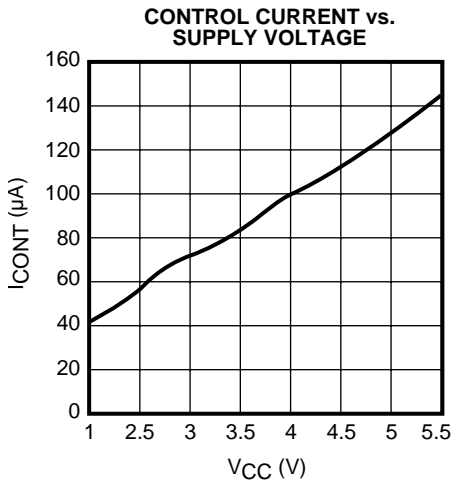
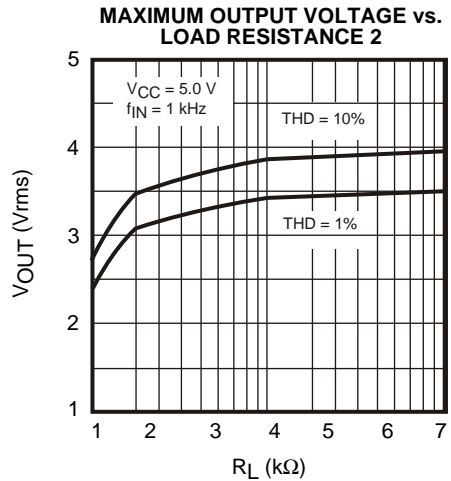
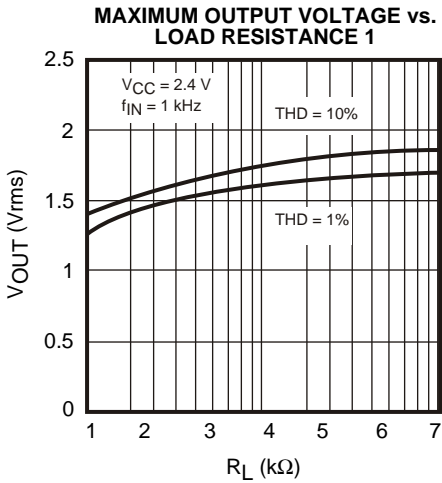
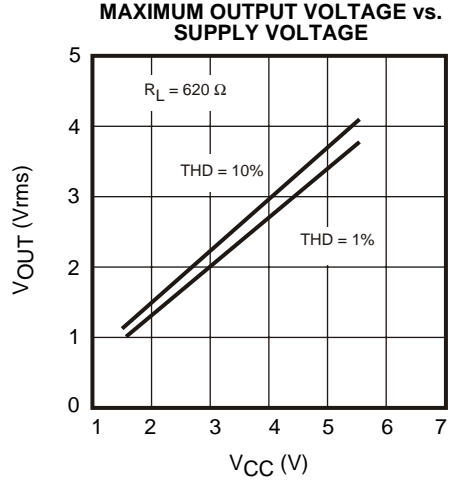
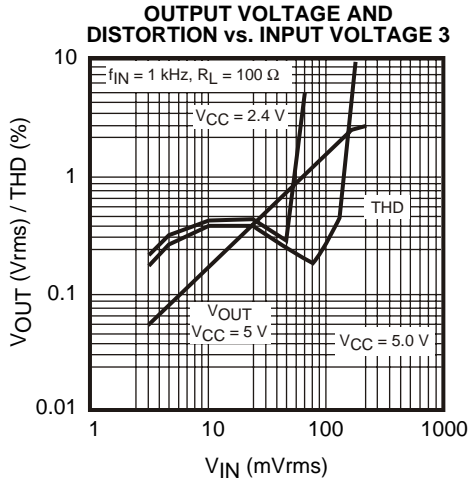


OUTPUT VOLTAGE AND DISTORTION vs. INPUT VOLTAGE 2

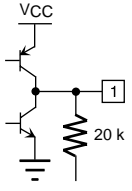
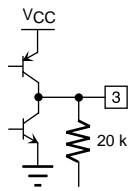
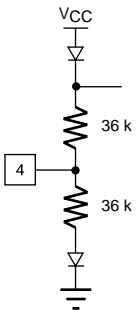
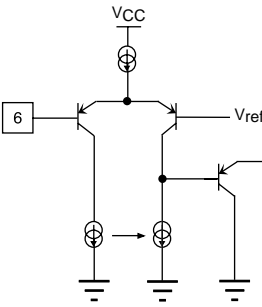


**TYPICAL PERFORMANCE CHARACTERISTICS (CONT.)**

$V_{CC} = 5\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified.



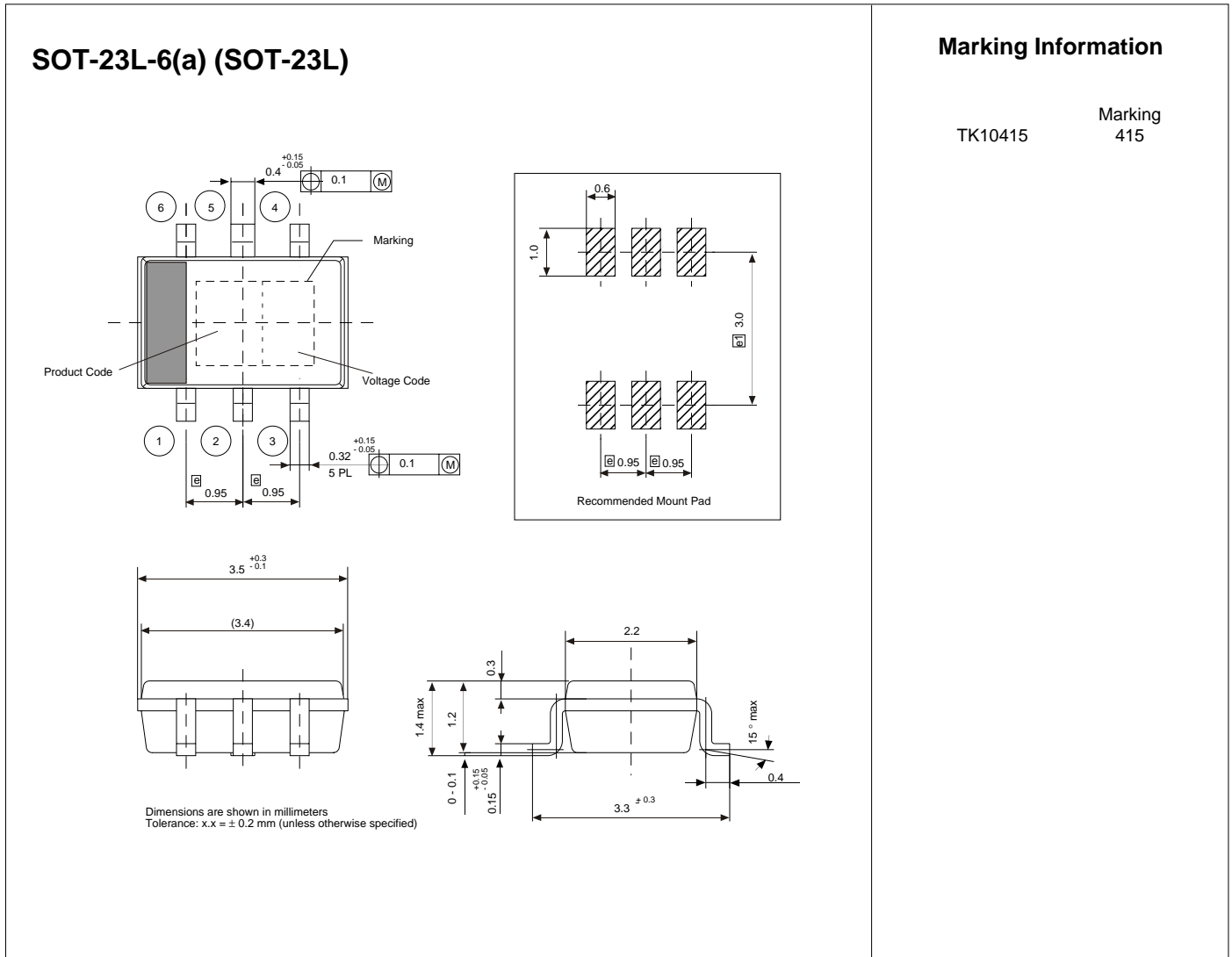
## PIN FUNCTION DESCRIPTIONS

PIN NO.	SYMBOL	TERMINAL VOLTAGE (V)	INTERNAL EQUIVALENT CIRCUIT	DESCRIPTION
1	$V_{OUT1}$	$1/2 V_{CC}$		A1 amplifier output terminal
2	$V_{CC}$	$V_{CC}$	—	Supply input terminal
3	$V_{OUT2}$	$1/2 V_{CC}$		A2 amplifier output terminal
4	$V_{ref}$	$1/2 V_{CC}$		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	$V_{IN}$	$1/2 V_{CC}$		A1 amplifier input terminal.

NOTES

**NOTES**

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