

- On-Chip 150-V Bridge Diode Configuration
- Reliable B<sup>†</sup>IDFET Technology
- High Standby Impedance . . . 1 MΩ Typ
- Efficient High-Voltage Operation
- Output Compatible With TTL, NMOS, and CMOS
- Built-In 5-V Series Regulator
- Built-In Lightning and Transient Protection

## description

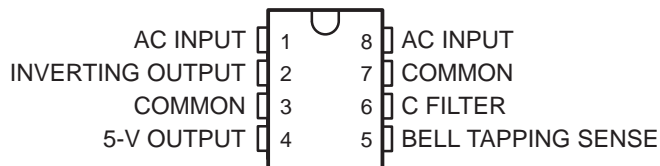
The TCM1520A is a monolithic ring-detection integrated circuit designed for use in isolated or nonisolated telephone applications. The device uses a modified form of the Texas Instruments B<sup>†</sup>IDFET technology to combine low-voltage CMOS and high-voltage bipolar input/output circuitry. It features efficient high-voltage (40 V to 150 V) operation with a typical current drain of 1 mA.

During standby, the input impedance is approximately 1 MΩ or greater, which prevents any interference with parallel off-hook telephones transmitting DTMF or voice frequencies. The device achieves this high input impedance with an on-chip series zener diode that does not conduct until the voltage across AC INPUT (pins 1 and 8) exceeds 8 V. When the voltage across pins 1 and 8 exceeds 18 V, the internal switch is closed, which bypasses the 6.8-V zener diode series resistor. This allows more efficient power transfer to the load when the device is in the operating mode. In the operating mode, the impedance of the device varies from 30 kΩ to 7 kΩ over the ring signal of 40 V at 16 Hz to 150 V at 68 Hz and is reasonably independent of the output load.

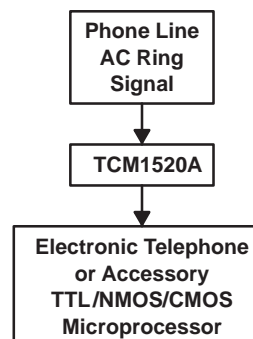
In typical telephone applications, the TCM1520A is activated through the telephone line by a ring voltage of 40 V at 16 Hz to 150 V at 68 Hz. The TCM1520A generates a signal suitable to drive an optocoupler or TTL, NMOS, or CMOS logic. The 5-V OUTPUT can be used as a supply source for optocouplers or low-power logic. This output is noninverting and is at a high level during ringing.

The TCM1520A incorporates lightning and transient protection that is designed to withstand lightning strikes of 1.5-kV amplitude and 200-μs duration and also features built-in circuitry to avoid tapping or false triggering due to transients.

## D OR P PACKAGE (TOP VIEW)



## TCM1520A APPLICATION



## AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGE	
	SMALL OUTLINE (D) <sup>‡</sup>	PLASTIC DIP (P)
–40°C to 85°C	TCM1520AD	TCM1520AP

<sup>‡</sup> The D package is available taped and reeled with suffix R added to the device type (i.e., TCM1520ADR).



Caution. These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

<sup>†</sup> B<sup>†</sup>IDFET – Bipolar, double-diffused, N-channel and P-channel MOS transistors on same chip. This is a patented process.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



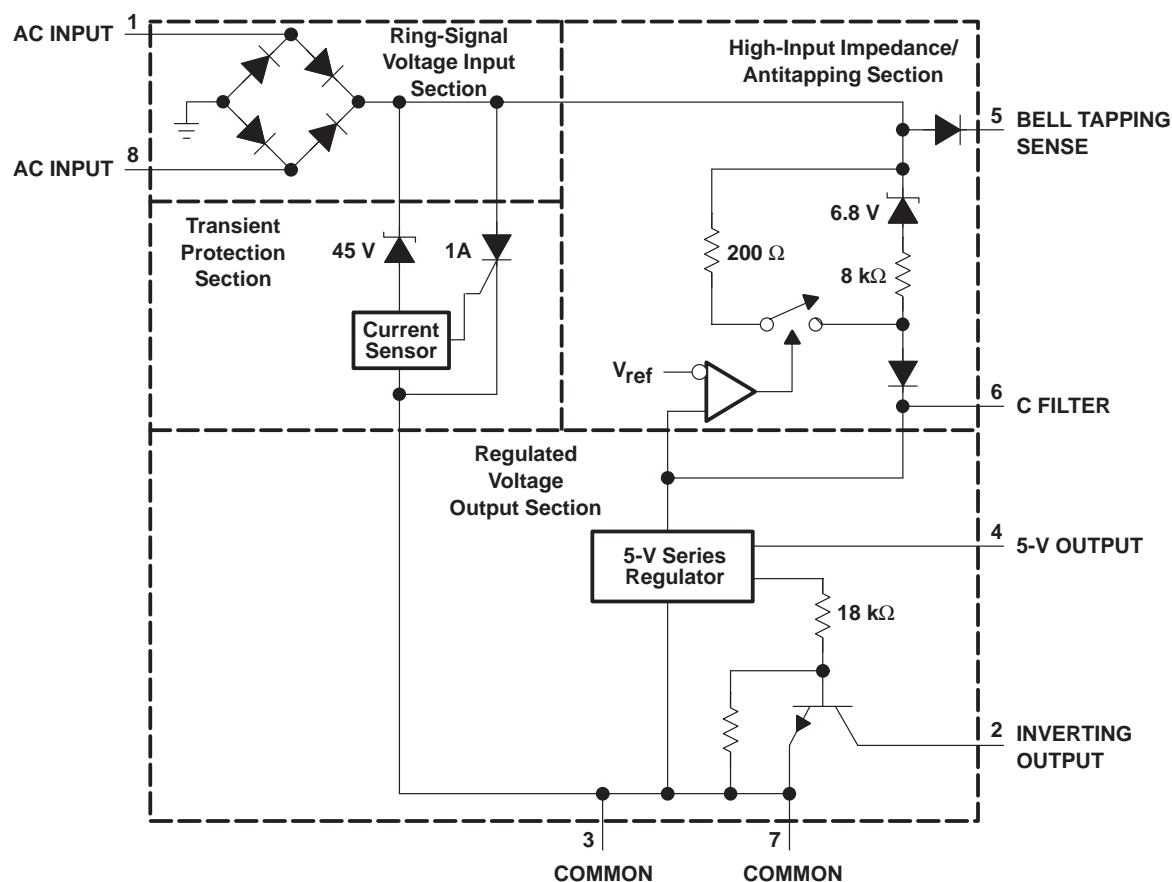
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265  
POST OFFICE BOX 1443 • HOUSTON, TEXAS 77251-1443

Copyright © 1990, Texas Instruments Incorporated

# TCM1520A DUAL DIFFERENTIAL COMPARATORS

SCTS005B – OCTOBER 1984 – REVISED DECEMBER 1990

## functional block diagram



## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

Continuous supply voltage at C FILTER (see Note 1)	40 V
Continuous differential input voltage, $V_{ID}$ (AC INPUT)	40 V
Continuous output current at 5-V OUTPUT, $I_O$	12 mA
Continuous SCR on-state input current	200 mA
SCR on-state input current, $I_{I(on)}$ (duration $\leq 200 \mu s$ )	900 mA
Continuous total dissipation	See Dissipation Rating Table
Operating free-air temperature range, $T_A$	$-40^\circ C$ to $105^\circ C$
Storage temperature range	$-40^\circ C$ to $125^\circ C$
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds	$260^\circ C$

<sup>†</sup> Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values, unless otherwise noted, are with respect to COMMON (pin 7).

DISSIPATION RATING TABLE

PACKAGE	$T_A = 25^\circ C$ POWER RATING	OPERATING FACTOR ABOVE $T_A = 25^\circ C$	$T_A = 85^\circ C$ POWER RATING
D	950 mW	7.6 mW/ $^\circ C$	494 mW
P	1000 mW	8.0 mW/ $^\circ C$	520 mW

## recommended operating conditions

	MIN	MAX	UNIT
Input voltage, $V_{Irms}$ ( $f = 15.3 \text{ Hz}$ to $68 \text{ Hz}$ ) (see Note 2)	40	150	V
Operating free-air temperature, $T_A$	-40	85	°C

NOTE 2: Input voltage is applied to AC INPUT (pins 1 and 8) through a series  $2.2\text{-k}\Omega \pm 10\%$  resistor and a  $0.47\text{-}\mu\text{F} \pm 10\%$  capacitor. (see Figures 1, 4, and 5.)

## electrical characteristics over recommended operating free-air temperature range, $R_L = \text{open}$ , $C_{(fltr)} = 10 \mu\text{F}$ (unless otherwise noted)

### detector section

PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
$V_{(BR) CEX}$ Collector-emitter output breakdown voltage, INVERTING OUTPUT	$V_{ID} \leq 5 \text{ Vrms}$ , $I_O = 5 \mu\text{A}$	45			V
$V_{OL}$ Low-level output voltage, INVERTING OUTPUT	$V_{ID} = 25 \text{ Vrms}$ , $I_O = 1.6 \text{ mA}$			1	V
$V_{IT+}$ Positive-going input threshold voltage			18	25	V
$V_{IT-}$ Negative-going input threshold voltage		6	7		V
$V_{hys}$ Hysteresis ( $V_{IT+} - V_{IT-}$ )			11		V
Shunt voltage, C FILTER	$I_{ID} = 10 \text{ mA}$	38		50	V
$V_{I(on)}$ On-state input current, SCR	See Note 3	50		100	V
$V_O$ Output voltage, 5-V OUTPUT	$V_{ID} = 40 \text{ V}$ , $R_L = 10 \text{ k}\Omega$	4.25		5.75	V
$Z_{I(off)}$ Standby input impedance	$V_{Irms} = 3 \text{ V}$ , $f \leq 20 \text{ kHz}$		1		M $\Omega$
Impedance when ringing	$V_{Irms} = 40 \text{ V}$ , $f = 16 \text{ Hz}$		30		k $\Omega$
	$V_{Irms} = 130 \text{ V}$ , $f = 20 \text{ Hz}$		20		
$I_{I(on)}$ On-state input current, SCR (see Note 4)	See Note 3	55		110	mA
$I_{I(hold)}$ Input holding current, SCR	See Note 3	100			$\mu\text{A}$
Operating current	$V_{ID} = 40 \text{ V}$ , Output open		1	1.6	mA

† All characteristics are measured with a  $2.2\text{-k}\Omega$  resistor and a  $0.47\text{-}\mu\text{F}$  capacitor connected at AC INPUT (pin 1) in series with the input signal, unless otherwise noted.

‡ All typical values are at  $T_A = 25^\circ\text{C}$ .

NOTES: 3. These parameters are measured using pulse techniques ( $t_w \leq 200 \mu\text{s}$ , duty cycle  $\leq 5\%$ ) with C FILTER grounded.

4. This is the input current required to turn on the SCR.

## switching characteristics at $25^\circ\text{C}$ operating free-air temperature, $f = 20 \text{ Hz}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{on}$ Turn-on time	$V_{Irms} = 40 \text{ V}$		100		ms
$t_{(off)}$ Turn-off time	$V_{Irms} = 40 \text{ V}$		175		ms
	$V_{Irms} = 60 \text{ V}$ to $150 \text{ V}$		300		

## PARAMETER MEASUREMENT INFORMATION

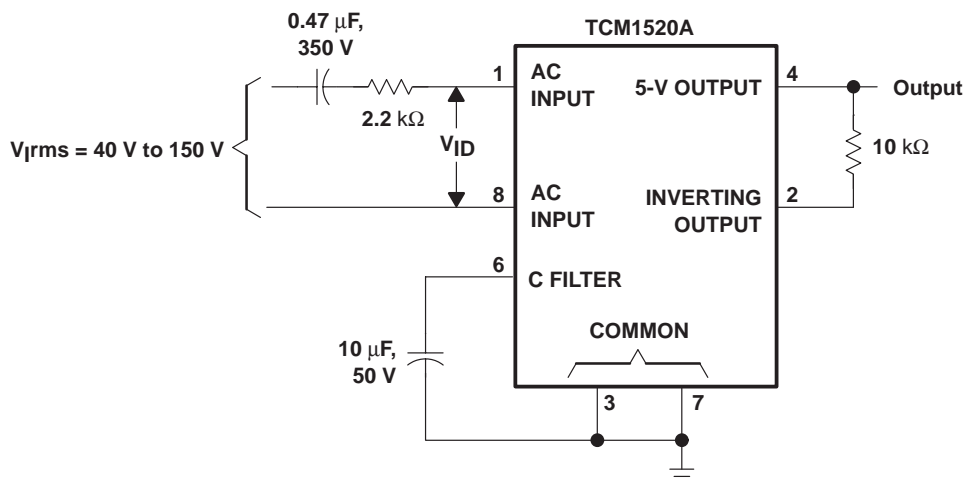


Figure 1. Switching Test Circuit

## TYPICAL CHARACTERISTICS

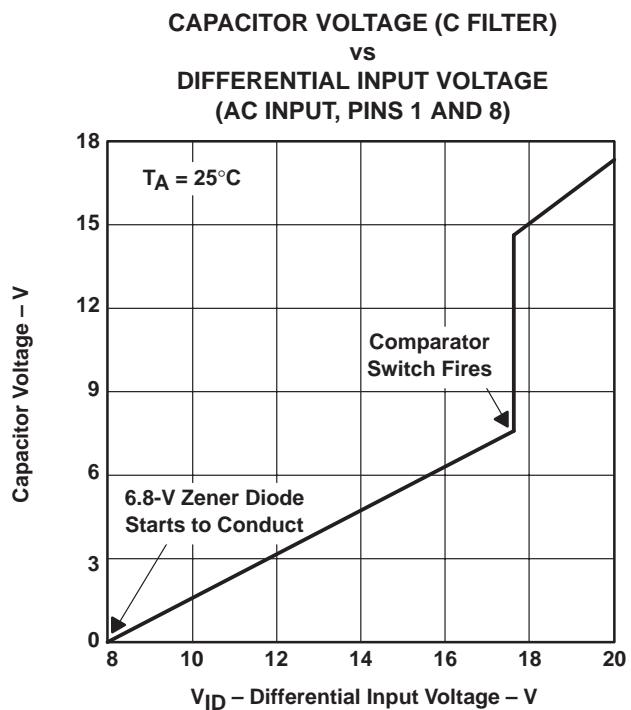


Figure 2

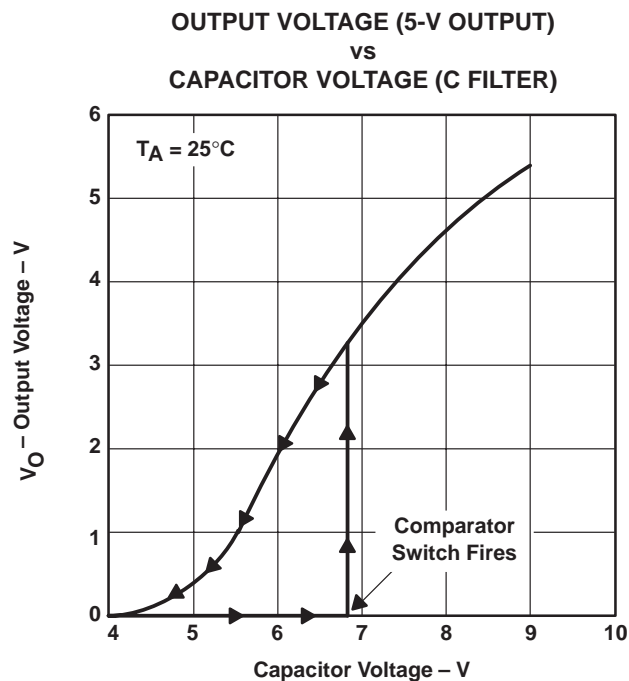


Figure 3

## APPLICATION INFORMATION

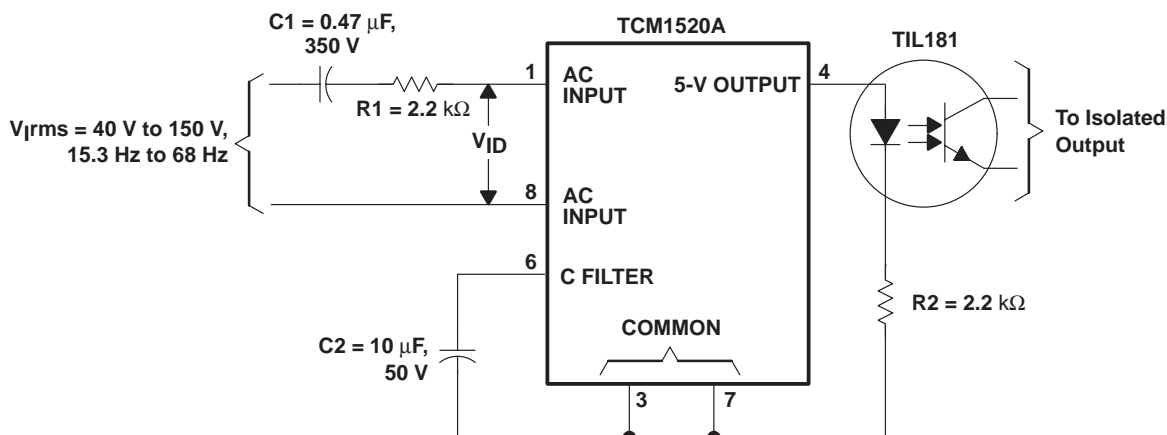


Figure 4. Isolated Configuration

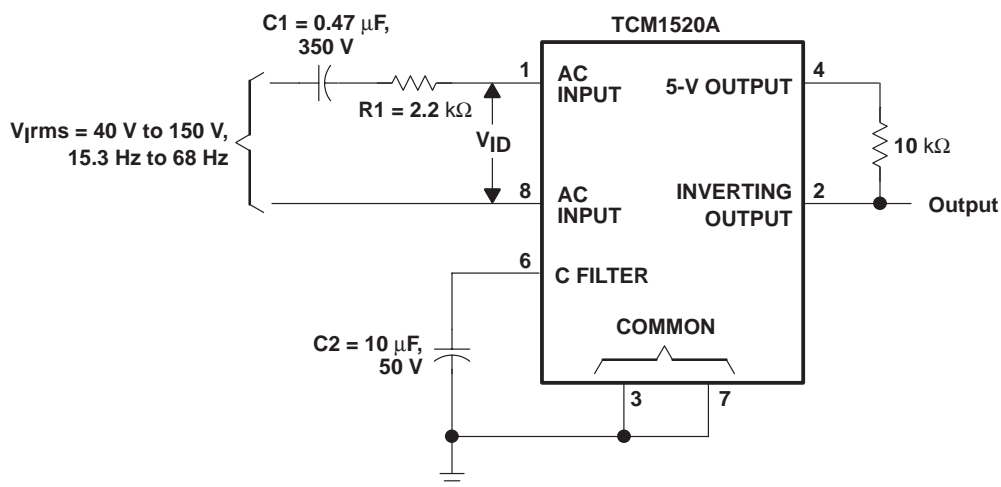


Figure 5. Nonisolated Configuration

NOTE: See Table 1 for component functions.

TABLE 1. COMPONENT FUNCTIONS

COMPONENT	FUNCTION
R1	Limits current into SCR during high-voltage transients and aids in dial-pulse rejection.
R2	Limits current into light-emitting diode.
C1	Blocks dc-battery voltage in standby and aids in filtering dial pulses. Smaller values of C1 improve tapping immunity.
C2	Stores energy from the ring signal to power the 5-V regulator.
Optocoupler	Provides ground and transient isolation between the host system and the telephone line.



## **IMPORTANT NOTICE**

Texas Instruments and its subsidiaries (TI) reserve the right to make changes to their products or to discontinue any product or service without notice, and advise customers to obtain the latest version of relevant information to verify, before placing orders, that information being relied on is current and complete. All products are sold subject to the terms and conditions of sale supplied at the time of order acknowledgement, including those pertaining to warranty, patent infringement, and limitation of liability.

TI warrants performance of its semiconductor products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are utilized to the extent TI deems necessary to support this warranty. Specific testing of all parameters of each device is not necessarily performed, except those mandated by government requirements.

CERTAIN APPLICATIONS USING SEMICONDUCTOR PRODUCTS MAY INVOLVE POTENTIAL RISKS OF DEATH, PERSONAL INJURY, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE ("CRITICAL APPLICATIONS"). TI SEMICONDUCTOR PRODUCTS ARE NOT DESIGNED, AUTHORIZED, OR WARRANTED TO BE SUITABLE FOR USE IN LIFE-SUPPORT DEVICES OR SYSTEMS OR OTHER CRITICAL APPLICATIONS. INCLUSION OF TI PRODUCTS IN SUCH APPLICATIONS IS UNDERSTOOD TO BE FULLY AT THE CUSTOMER'S RISK.

In order to minimize risks associated with the customer's applications, adequate design and operating safeguards must be provided by the customer to minimize inherent or procedural hazards.

TI assumes no liability for applications assistance or customer product design. TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right of TI covering or relating to any combination, machine, or process in which such semiconductor products or services might be or are used. TI's publication of information regarding any third party's products or services does not constitute TI's approval, warranty or endorsement thereof.