- **On-Chip 150-V Bridge Diode Configuration**
- **Reliable BIDFET† 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**

D OR P PACKAGE
(TOP VIEW)

AC INPUT	1	8	AC INPUT
INVERTING OUTPUT	2	7	COMMON
COMMON	3	6	C FILTER
5-V OUTPUT	4	5	BELL TAPPING SENSE

TCM1520A APPLICATION

Phone Line AC Ring Signal

↓

TCM1520A

↓

Electronic Telephone or Accessory TTL/NMOS/CMOS Microprocessor

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 BIDFET† 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.
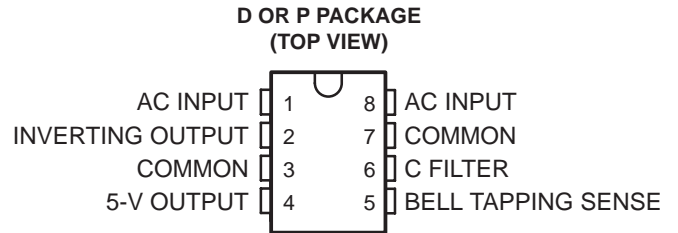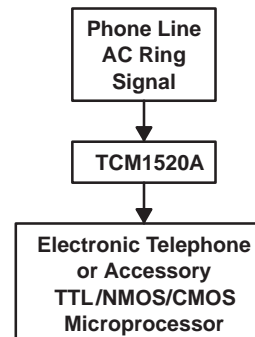
AVAILABLE OPTIONS

T_A	PACKAGE	
	SMALL OUTLINE (D)‡	PLASTIC DIP (P)
−40°C to 85°C	TCM1520AD	TCM1520AP

‡ 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.

† BIDFET – Bipolar, double-diffused, N-channel and P-channel MOS transistors on same chip. This is a patented process.

TEXAS INSTRUMENTS

TCM1520A
DUAL DIFFERENTIAL COMPARATORS

functional block diagram
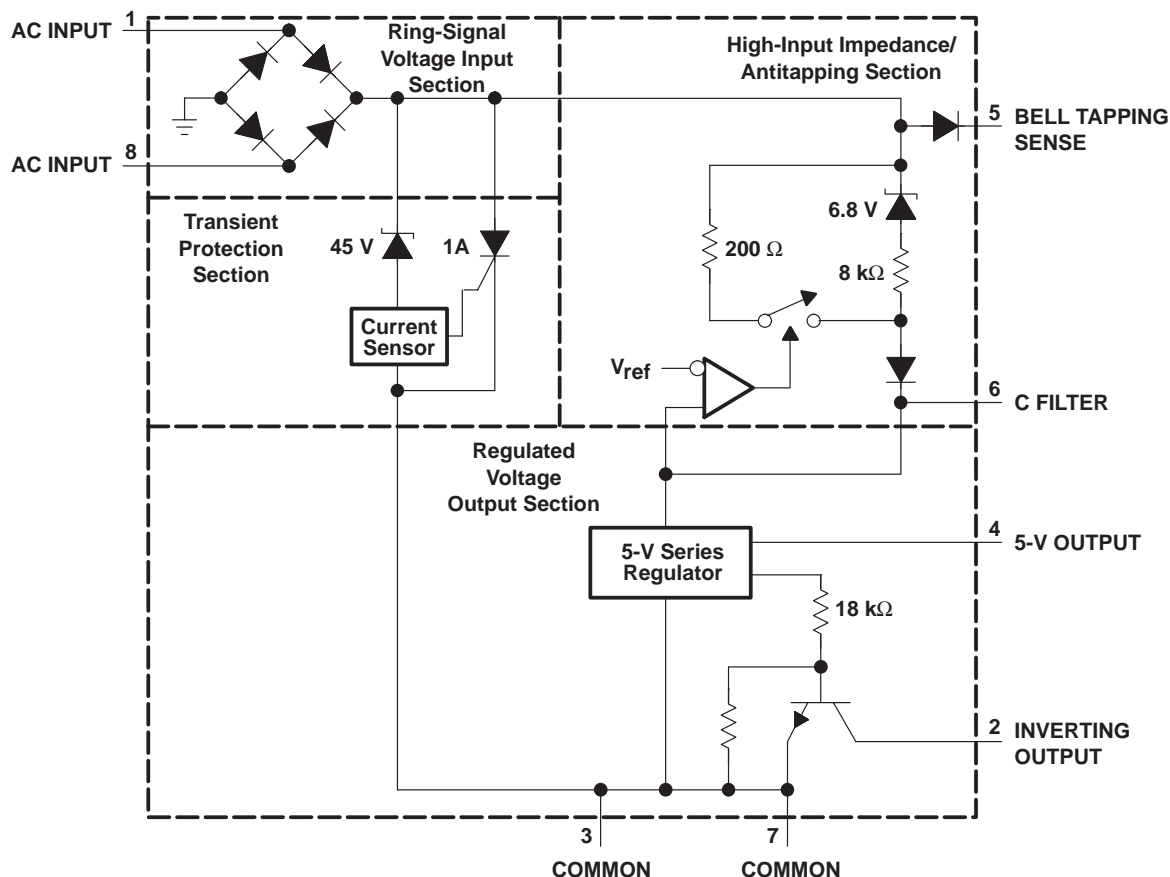
absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

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 ≤200 μs) . . . . 900 mA
Continuous total dissipation . . . . See Dissipation Rating Table
Operating free-air temperature range, T_A . . . . −40°C to 105°C
Storage temperature range . . . . −40°C to 125°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . 260°C

† 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°C POWER RATING	OPERATING FACTOR ABOVE T_A = 25°C	T_A = 85°C POWER RATING
D	950 mW	7.6 mW/°C	494 mW
P	1000 mW	8.0 mW/°C	520 mW

TEXAS
INSTRUMENTS

recommended operating conditions

	MIN	MAX	UNIT
Input voltage, $V_I$rms (f = 15.3 Hz to 68 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-kΩ ±10% resistor and a 0.47-µF ±10% capacitor. (see Figures 1, 4, and 5.)

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

detector section

	PARAMETER	TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
$V_{(BR)CEX}$	Collector-emitter output breakdown voltage, INVERTING OUTPUT	V_{ID} ≤ 5 Vrms, I_O = 5 µA	45			V
V_{OL}	Low-level output voltage, INVERTING OUTPUT	V_{ID} = 25 Vrms, I_O = 1.6 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 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 V, R_L = 10 kΩ	4.25		5.75	V
$Z_{I(off)}$	Standby input impedance	$V_I$rms = 3 V, f ≤ 20 kHz		1		MΩ
	Impedance when ringing	$V_I$rms = 40 V, f = 16 Hz		30		kΩ
		$V_I$rms = 130 V, f = 20 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			µA
	Operating current	V_{ID} = 40 V, Output open		1	1.6	mA

† All characteristics are measured with a 2.2-kΩ resistor and a 0.47-µF capacitor connected at AC INPUT (pin 1) in series with the input signal, unless otherwise noted.
‡ All typical values are at T_A = 25°C.
NOTES: 3. These parameters are measured using pulse techniques (t_W ≤ 200 µs, duty cycle ≤ 5%) with C FILTER grounded.
        4. This is the input current required to turn on the SCR.

switching characteristics at 25°C operating free-air temperature, f = 20 Hz (unless otherwise noted)

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

PARAMETER MEASUREMENT INFORMATION
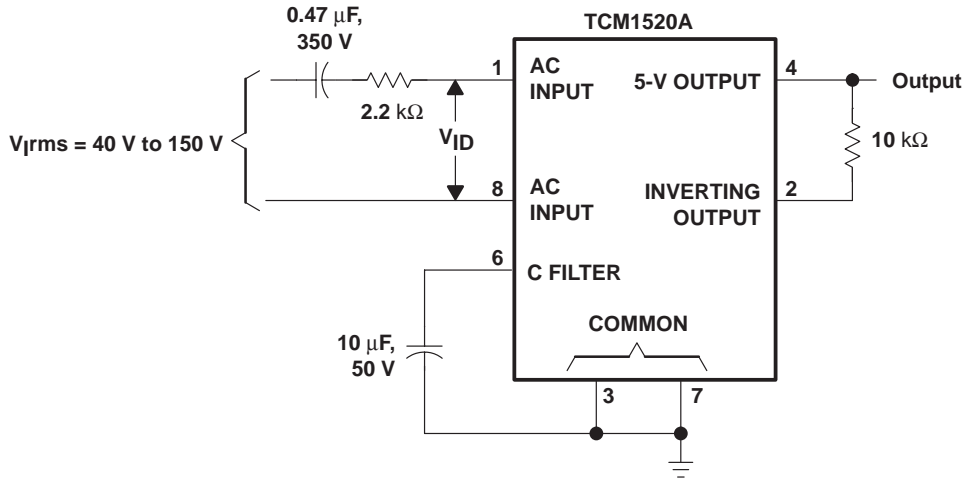
Figure 1. Switching Test Circuit

TYPICAL CHARACTERISTICS

CAPACITOR VOLTAGE (C FILTER)
vs
DIFFERENTIAL INPUT VOLTAGE
(AC INPUT, PINS 1 AND 8)

Figure 2

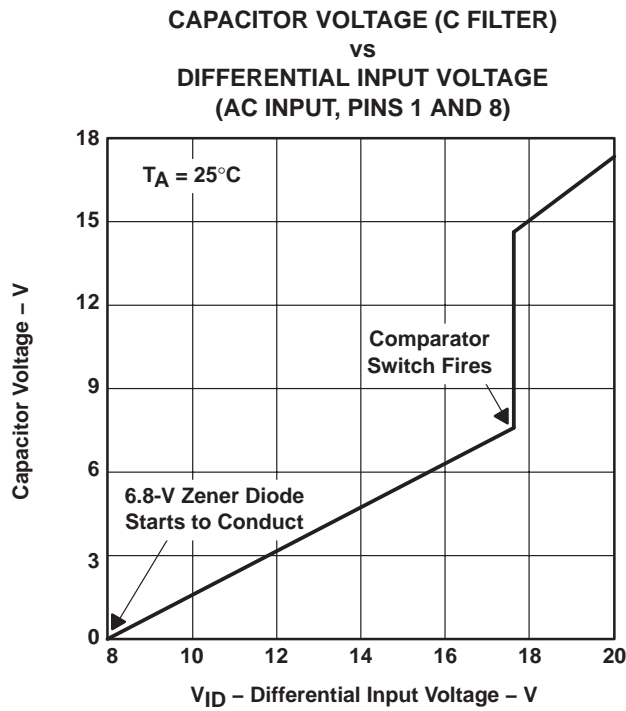OUTPUT VOLTAGE (5-V OUTPUT)
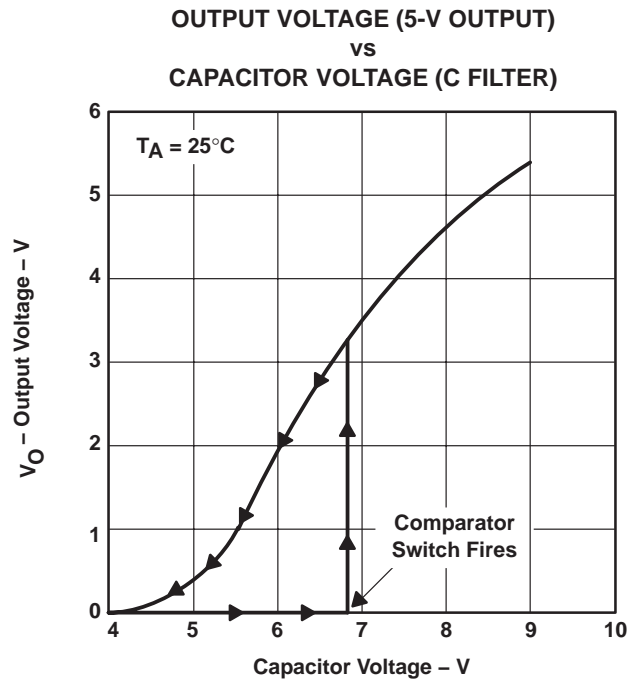vs
CAPACITOR VOLTAGE (C FILTER)
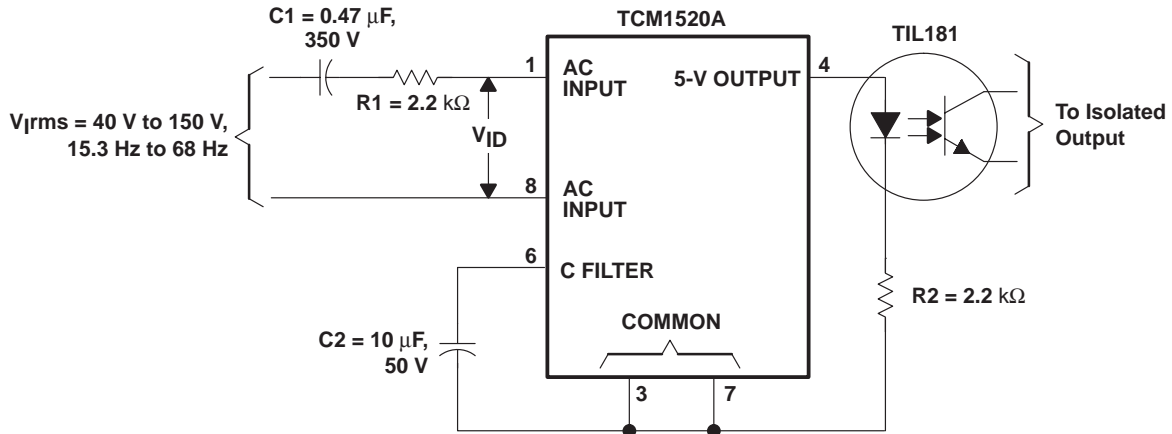

Figure 3

APPLICATION INFORMATION

Figure 4. Isolated Configuration
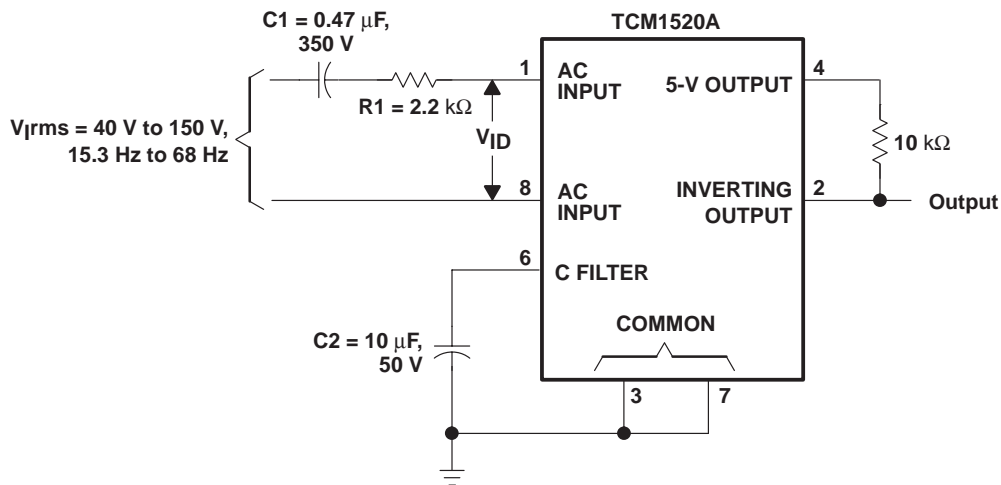
Figure 5. Nonisolated Configuration

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.

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