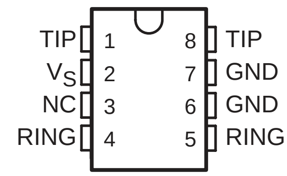
- **Meet or Exceed Bell Standard LSSGR Requirements**
- **Externally-Controlled Negative Firing Voltage . . . −70 V Max**
- **Accurately Controlled, Wide Negative Firing Voltage Range . . . −5 V to −65 V**
- **Surge Current (see Note 1):**

	TCM1030	TCM1060
10/1000	**16 A**	**30 A**
10/160	**25 A**	**45 A**
2/10	**35 A**	**50 A**

- **High Holding Current**
  - **− TCM1030 . . . 100 mA Min**
  - **− TCM1060 . . . 150 mA Min**

D OR P PACKAGE
(TOP VIEW)



NC − No internal connection
The D package is available taped and reeled. Add R suffix (i.e., TCM1030DR).

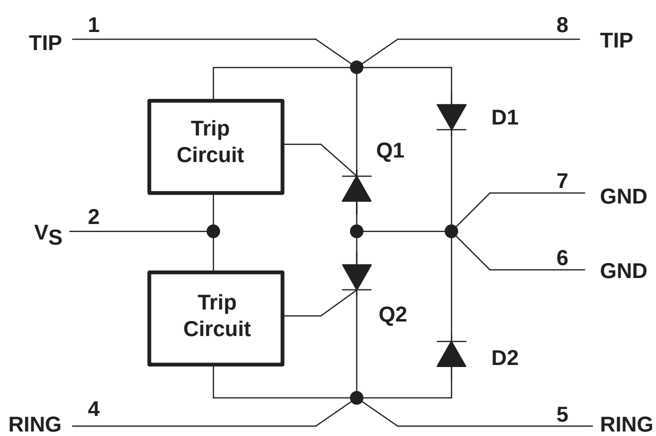
description

The TCM1030 and TCM1060 dual transient-voltage suppressors are designed specifically for telephone line-card protection against lightning and transients (voltage transients) induced by ac lines. One of the TIP terminals (pin 1 or 8) and one of the RING terminals (pin 4 or 5) are connected to the tip and ring circuits of a SLIC (subscriber-line interface circuit). The battery feed connections between the SLIC and the subscriber line are from the remaining TIP (pin 1 or 8) and RING (pin 4 or 5) through the TCM1030 or the TCM1060 to the tip and ring lines. Transients are suppressed between tip and ground, and ring and ground.

Positive transients are clamped by diodes D1 and D2. Negative transients that are more negative than V_S cause the SCRs, Q1 and Q2, to crowbar. The high holding current of the SCRs prevent dc latchup as the transient subsides.

The TCM1030 and TCM1060 are characterized for operation from −40°C to 85°C.

functional block diagram



NOTE 1: The notation 10/1000 refers to a waveshape having t_r = 10 µs and t_w = 1000 µs ending at 50% of the peak value. The notation 10/160 is t_r = 10 µs and t_w = 160 µs. The notation 2/10 is t_r = 2 µs and t_w = 10 µs.

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

TCM1030 nonrepetitive peak surge current (see Note 1): 10/1000 . . . ±16 A
10/160 . . . ±25 A
2/10 . . . ±35 A
TCM1060 nonrepetitive peak surge current (see Note 1): 10/1000 . . . ±30 A
10/160 . . . ±45 A
2/10 . . . ±50 A
Nonrepetitive peak surge current, t_W = 10 ms, half sinewave (see Note 2) . . . 5 A
Continuous 60-Hz sinewave at 1 A . . . 2 s
Continuous total power dissipation . . . See Dissipation Rating Table
Operating free-air temperature range, T_A . . . −40°C to 85°C
Storage temperature range, T_{stg} . . . −40°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package . . . 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.

NOTES: 1 The notation 10/1000 refers to a waveshape having t_r = 10 µs and t_W = 1000 µs ending at 50% of the peak value. The notation 10/160 is t_r = 10 µs and t_W = 160 µs. The notation 2/10 is t_r = 2 µs and t_W = 10 µs.
2. This value applies when the case temperature is at or below 85°C. The surge current may be repeated after the device has returned to thermal equilibrium.

DISSIPATION RATING TABLE

PACKAGE	$T_A \leq 25°C$ POWER RATING	OPERATING FACTOR ABOVE T_A = 25°C	T_A = 85°C POWER RATING
D	725 mW	5.8 mW/°C	377 mW
P	1000 mW	8.0 mW/°C	520 mW

electrical characteristics over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS	TCM1030			TCM1060			UNIT
			MIN	TYP†	MAX	MIN	TYP†	MAX	
V_{CF}	Forward clamping voltage (diode forward voltage) (see Note 3)	I_{FM} = 1-A transient		1.2	2		1.2	2	V
		I_{FM} = 10-A transient		2.5	4		2	4	
		I_{FM} = 16-A transient		4	5		2.5	5	
		I_{FM} = 30-A transient					3.1	5	
$V_{C(R)}$	Reverse clamping voltage (SCR on-state voltage) (see Note 3)	I_{TM} = 1-A transient		1.2	2		1.2	2	V
		I_{TM} = 10-A transient		2.5	4		2.5	4	
		I_{TM} = 16-A transient		4	5		3	5	
		I_{TM} = 30-A transient					4.8	7	
$I_{I(trip)}$	Trip current (see Note 4)	V_S = −50 V	−100		−325	−100		−325	mA
I_H	Holding current	V_S = −50 V	−100			−150			mA
$V_{I(trip)}$	Trip voltage	V_S = −50 V, I = trip current	−50		−55	−50		−55	V
		V_S = −65 V, I = trip current	−65		−70	−65		−70	
$I_{I(stby)}$	Standby current	TIP and RING at −85 V or GND, V_S = −85 V			±5			±5	μA
	Transient overshoot voltage	V_S = −50 V, t_r = 10 ns		2.5			2.5		V
C_{off}	Off-state (high impedance) capacitance	TIP and RING at −50 V		25			25		pF
		TIP and RING at GND		50			50		
dv/dt	Critical rate of rise of off-state voltage (see Note 5)	V_S open, V_S = −50 V		−1			−1		kV/μs

† All typical values are at T_A = 25°C.

NOTES: 3. The current flows through one TIP (or RING) terminal and one of the GND terminals. The voltage is measured between the other TIP (or RING) terminal and the other GND terminal. Measurement time ≤ 1 ms.

4. The negative value of trip current refers to the current flowing out of TIP or RING on the line side that is sufficient in magnitude to trigger the SCRs. Measurement time ≤ 1 ns.

5. The critical dv/dt is measured using a linear rate of rise with the maximum voltage limited to −50 V with V_S connected to TIP or RING being measured.

TYPICAL CHARACTERISTICS

TIP OR RING CURRENT
vs
TIP OR RING TO GND VOLTAGE

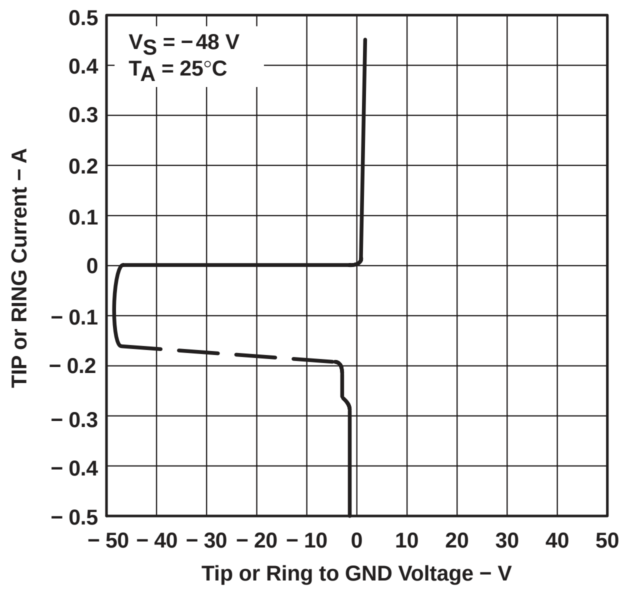


Figure 1

APPLICATION INFORMATION

The trip voltage represents the most negative level of stress applied to the system. Positive transients are clamped by diodes D1 and D2. When a negative transient is applied, current flows from V_S to TIP or RING where the transient voltage is applied. When the current through TIP or RING reaches the pulse-trip current, the SCR turns on and shorts TIP or RING to GND. The majority of the transient energy is dissipated in the external resistor (nominally 100 Ω for the TCM1030 and 50 Ω for the TCM1060). Current into V_S ceases when the SCR turns on. When the energy of the transient has been dissipated so that the current into TIP or RING due to the transient plus the battery feed supply is less than the holding current, the SCR turns off.

To help ensure reliability and consistency in the firing voltage, it is recommended that two capacitors be connected between V_S and GND, as close to the device terminals as possible. One capacitor should be a 0.1 µF, 100 V ceramic unit and the other, a 0.47 µF, 100 V stacked-film (not wound) metalized plastic capacitor. If inductance is present in the line to V_S, these capacitors help prevent overshoot in the firing voltage during fast rise-time transients.

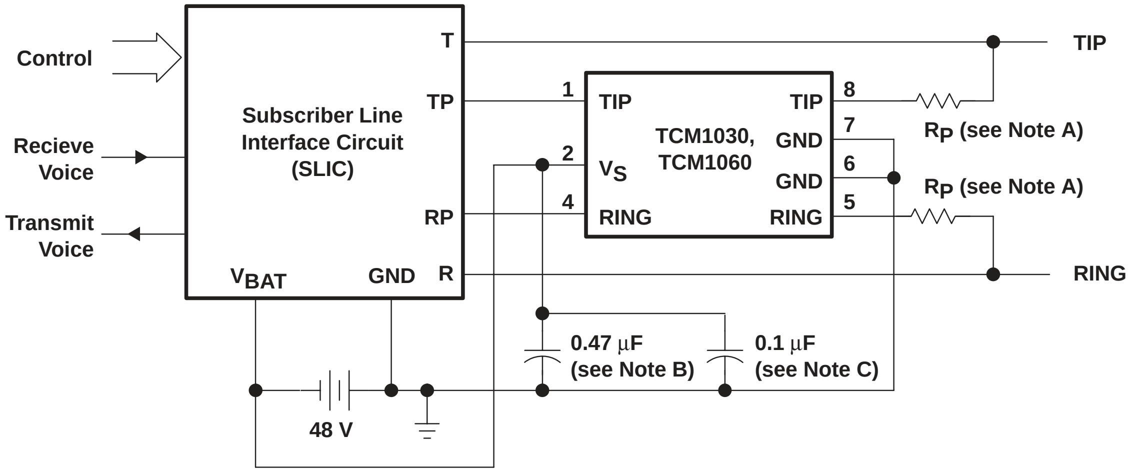
To avoid dc latchup after the SCR has fired, the current must be less than the holding current, I_H. To prevent this from happening, the line feed current must be limited to the following conditions:

$$\frac{V_{TP} - V_{RP}}{R_{line} + 2R_p} < I_H$$

where V_{TP} and V_{RP} are the voltages on TIP and RING, respectively, of the TCM1030 or TCM1060. Induced ac currents into TIP or RING (e.g., power-line inductive coupling) must be less than the trip current to prevent the SCR from firing.

APPLICATION INFORMATION

Line short-circuits to external power sources can damage the suppressor due to excessive power dissipation. Conventional protection techniques, such as fuses or PTC (positive temperature coefficient) thermistors, should be used to eliminate or reduce the fault current.



NOTES: A. R_P is 100 Ω minimum for TCM1030 and 50 Ω minimum for TCM1060.
B. 0.47 µF, 100 V stacked film metalized plastic capacitor
C. 0.1 µF, 100 V ceramic capacitor

Figure 2. Typical Line-Card Application Circuit

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
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