TCM1030, TCM1060
DUAL TRANSIENT-VOLTAGE SUPPRESSORS

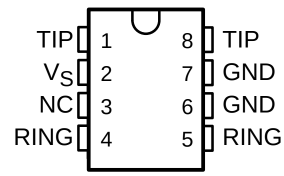
SCTS040 – D3273, JUNE 1989–REVISED DECEMBER 1990

- **Meets or Exceeds Bell Standard LSSGR Requirements**
- **Externally Controlled Negative Firing Voltage . . . −70 V Max**
- **Wide, Accurately Controlled, 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
(T0P VIEW)



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

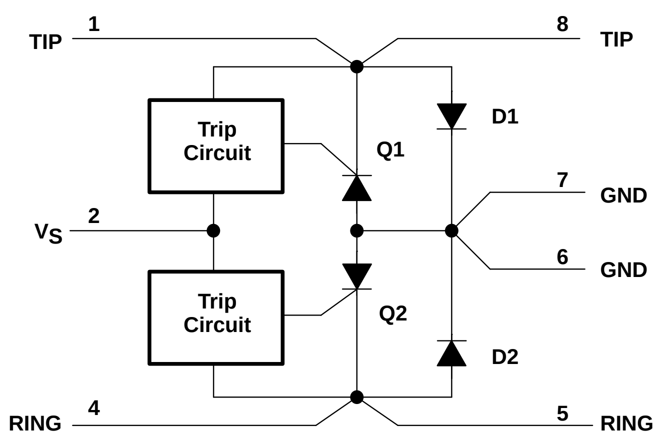
description

The TCM1030 and TCM1060 dual transient-voltage suppressors are designed specifically for telephone line card protection against lightning and transients 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 subscriber line interface circuit (SLIC). 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 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 SCR's Q1 and Q2 to crowbar. The high holding current prevents 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 dissipation		See Dissipation Rating Table
Operating free-air temperature range		–40°C to 85°C
Storage temperature range		–40°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds: D or P package		260°C

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	$T_A \le 25°C$ 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	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_{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_{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_D	Standby current	TIP and RING at –85 V or GND, V_S = –85 V			±5			±5	µA
V_{OS}	Transient overshoot voltage	V_S = –50 V, t_r = 10 ns		2.5			2.5		V
C_{off}	Off-state 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		–1			–1		kV/µs
		V_S = –50 V		–1			–1		

† 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 the V_S pin connected to the TIP or RING pin being measured.

TYPICAL CHARACTERISTICS

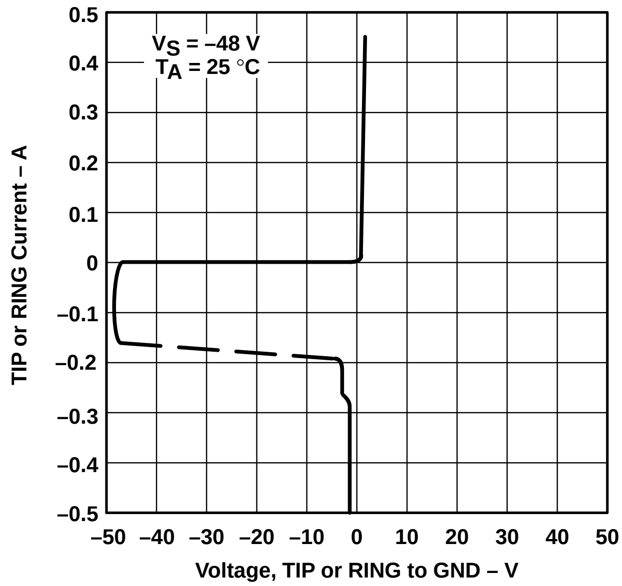


Figure 1. Voltage-Current Characteristics (TIP and RING to GND)

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 the V_S input to the TIP or RING terminals where the transient is applied. When the current through TIP or RING reaches the pulse-trip current, the SCR turns on and shorts the TIP or RING terminal to the GND terminal. The majority of the transient energy is dissipated in the external resistor (nominally 100 Ω and 50 Ω for TCM1030 and TCM1060, respectively). Current into the V_S terminal ceases when the SCR turns on. When the energy of the transient has been dissipated so that the current into the TIP or RING terminal due to the transient plus the battery feed supply is less then the holding current, the SCR resets.

If the lead to the V_S terminal is inductive, it may be necessary to connect a capacitor between V_S and GND. The capacitor must be placed as close as possible to the V_S terminal to avoid overshoot in the firing voltage caused by fast rise-time transients.

To avoid dc latchup after the SCR has been 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:

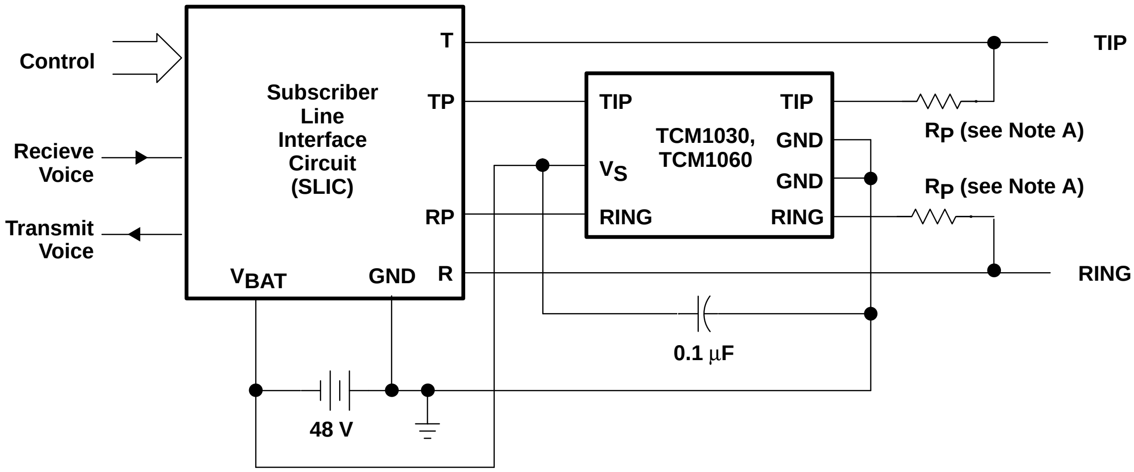
$$\frac{V_{TP} - V_{RP}}{R_{line} + 2R_p} < I_H$$

where V_{TP} and V_{RP} are the voltages on the TIP and RING terminals, 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.

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

APPLICATION INFORMATION



NOTE A: R_P is 100 Ω minimum for TCM1030 and 50 Ω minimum for TCM1060.

Figure 2. Typical Line-Card Application Circuit