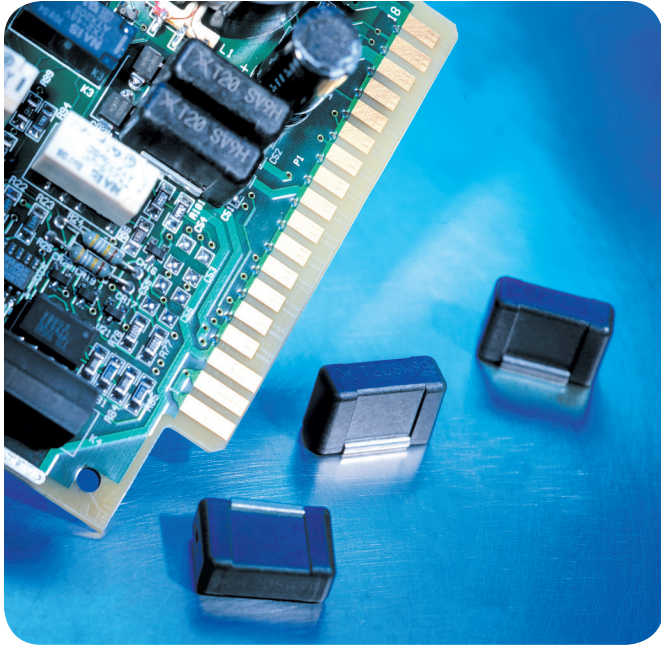


## Analog Linecards



### Problem and Solution

Analog linecards are subject to overcurrent and overvoltage hazards from AC power cross, power induction, and lightning surges which may enter the central office via the copper wire infrastructure. Equipment damage and injury present safety concerns in case linecards are left unprotected from these hazards. PolySwitch resettable devices and thyristors can help provide matched resettable protection solutions against equipment damage and personnel injury.

### Typical Protection Requirements

Typically, analog linecards have -45 to -65VDC battery feeds and ringing signals ranging from 70-100VAC, 20Hz superimposed on the line. Ringing may be integrated directly on the Subscriber Line Interface Circuit (SLIC) or may be provided by an external ring generator. Typically currents of 20-70mA are expected on the linecard. Most linecards are grounded and therefore both longitudinal and metallic protection is required.

PolySwitch resettable devices in series with the tip-and-ring conductors serve to open the line under power cross and power induction conditions. Parallel overvoltage devices help protect the card from damage due to excess voltage buildup such as that induced by lightning or high-voltage power cross. On-hook (secondary) overvoltage protection design should account for both DC battery voltage and ringing voltages. Off-hook (tertiary) protection should be designed specifically for the ringing configuration used.

Figure 1 provides the recommended protection circuitry for an analog linecard with an external ring generator.

Figure 2 provides recommended protection circuitry for an analog linecard with an integrated ring generator.

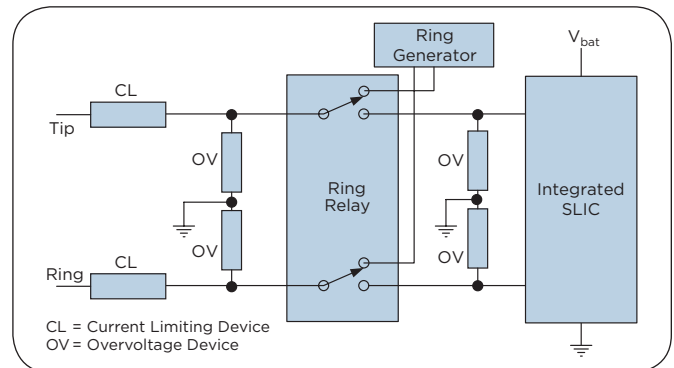


Figure 1. Analog Linecard with External Ring Generator

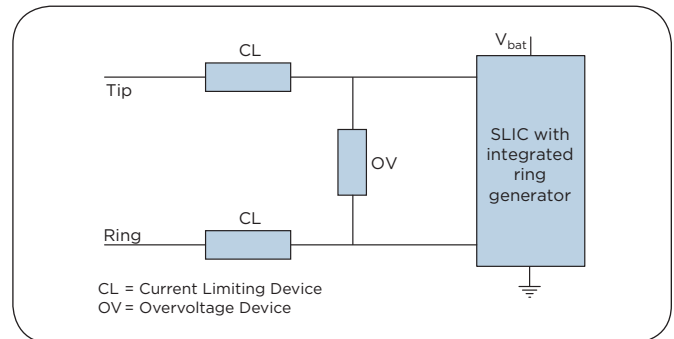


Figure 2. Analog Linecard with Integrated Ring Generator

## Analog Linecards

### Device Selection

Protection for network linecards is typically designed to meet the requirements of Telcordia GR-1089 for North American use and of ITU-T K.20 for rest of world use.

PolySwitch devices should be selected with voltage ratings based on the regulatory standards for which the equipment is being designed. Surface-mount TS600, TSM600, and radial leaded TRF600 devices are applicable for North American GR-1089 standards and for UL60950 standards, while surface-mount TS250, TSV250 and radial-leaded TRF250 devices are applicable for ITU-T K.20 standard and Telcordia GR-1089

intrabuilding/short-haul protection requirements. The surface-mount TSL250-080F device is also applicable for GR-1089 intrabuilding applications.

Overvoltage devices should be selected with surge current ratings based on the regulatory standards for which the equipment is being designed and with off-state voltage ratings based on normal system operation. Overvoltage devices with off-state voltage ratings of 270V or more are applicable for on-hook protection for equipment with maximum ringing voltages up to 270V peak. For systems with lower expected voltages (when no ringing voltage is present), designers may consider devices with lower voltage ratings.

**Table 1. Recommended Circuit Protection Devices**

Regulatory Standard	Overcurrent Protection Devices		Overvoltage Protection Devices	
	Thru-hole	Surface-mount	Thru-hole	Surface-mount
GR-1089 Port Type 1*	TRF600-160	TS600-170F	GTCRxx-xxxx-xxx	GTCSxx-xxxx-xxx
	TRF600-400	TS600-200F	GTCAXx-xxxx-xxx	
		TS600-400F		
		TSM600-250F		
			TSM600-400F	
ITU-T K.20	TRF250-120	TS250-130F	GTCRxx-xxxx-xxx	GTCSxx-xxxx-xxx
	TRF250-120T	TSV250-130F	GTCAXx-xxxx-xxx	
	TRF250-145	TSV250-184F		
	TRF250-183			
	TRF250-184			

\* May require additional impedance or coordination with primary protector.

### Notice:

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