

# SCSI Active Terminator

## FEATURES

- Complies with SCSI, SCSI-2 Standards
- 10pF Channel Capacitance During Disconnect
- Active Termination for 18 Lines
- Logic Command Disconnects all Termination Lines
- Low Supply Current in Disconnect Mode
- Trimmed Regulator for Accurate Termination Current
- Current Limit and Thermal Shutdown Protection
- 110 Ohm Termination
- Meets SCSI Hot Plugging

## DESCRIPTION

The UC5602 is a pin compatible version of its predecessor, the UC5601, and is targeted for high volume applications which require active termination, but not the high performance of the UC5601. The major differences are relaxed output current and termination tolerances, and the absence of low side clamps.

The UC5602 provides 18 lines of active termination for a SCSI (Small Computer Systems Interface) parallel bus. The SCSI-2 standard recommends active termination at both ends of the cable segment, and SCSI-3 will make it a requirement.

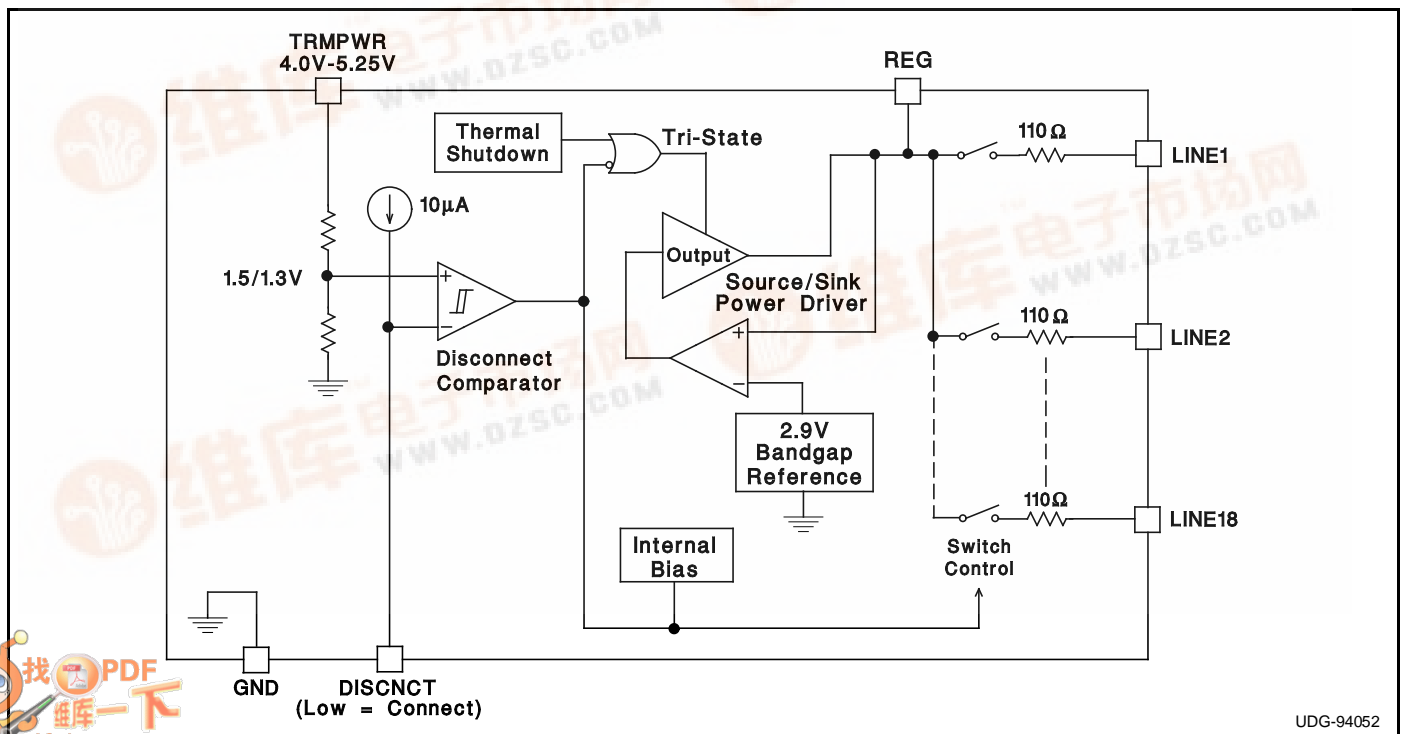
The UC5602 provides a disconnect feature which, when opened or driven high, will disconnect all terminating resistors, and disables the regulator; greatly reducing standby power. The output channels remain high impedance even without Tempwr applied.

Internal circuit trimming is utilized, first to trim the impedance to a 7% tolerance; and then most importantly, to trim the output current 7% tolerance, as close to the max SCSI as possible, which maximizes noise margin in fast SCSI operation.

Other features include thermal shutdown, current limit, and 40mA of active negation sink current capability.

This device is offered in low thermal resistance versions of the industry standard 28 pin wide body SOIC and PLCC, as well as a 24 pin DIL plastic package.

## BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS**

Tempwr Voltage .....	+7V
Signal Line Voltage .....	0V to +7V
Regulator Output Current .....	0.5A
Storage Temperature .....	-65°C to +150°C
Operating Temperature .....	-55°C to +150°C
Lead Temperature (Soldering, 10 Sec.) .....	+300°C

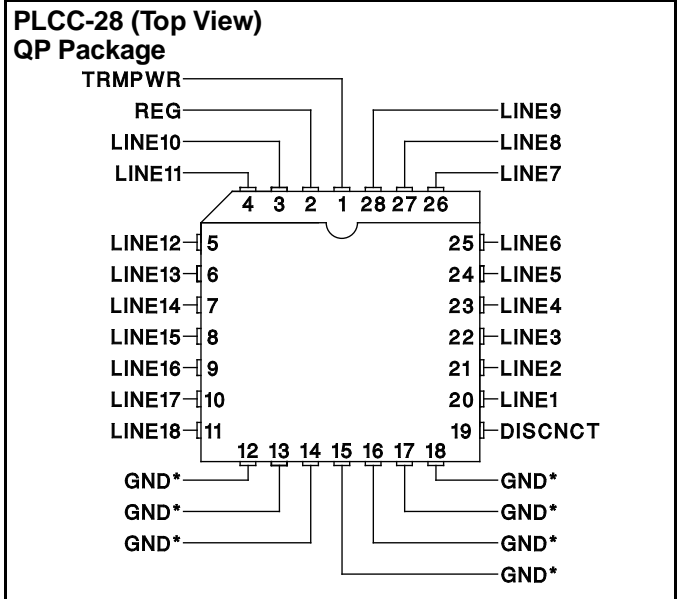
Unless otherwise specified all voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.

Consult Packaging Section of Unitrode Integrated Circuits databook for thermal limitations and considerations of packages.

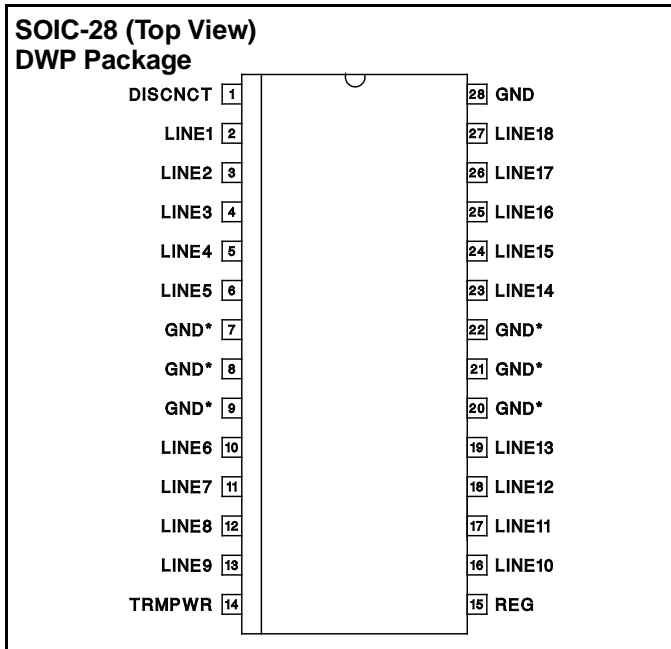
**RECOMMENDED OPERATING CONDITIONS**

Tempwr Voltage .....	4.0V to 5.25V
Signal Line Voltage .....	0V to +3V
Disconnect Input Voltage .....	0V to Tempwr

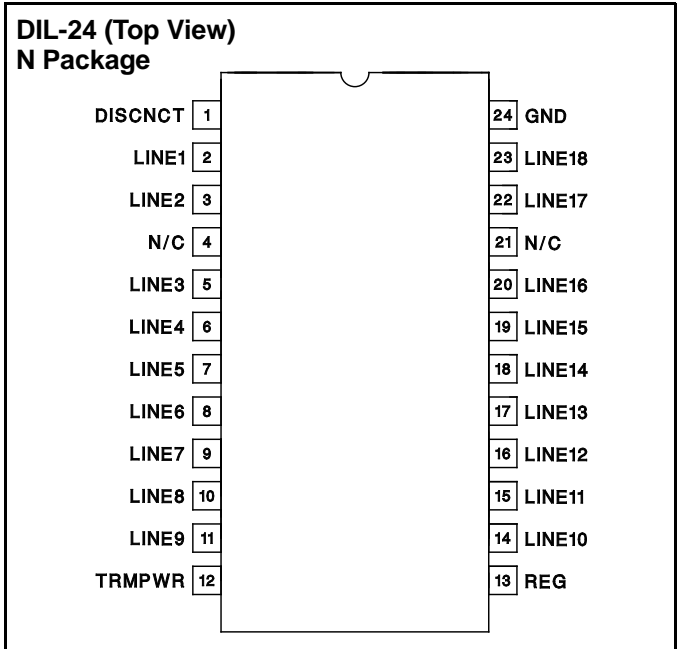
**CONNECTION DIAGRAMS**



\* QP package pins 12 - 18 serve as both heatsink and signal ground.



\* DWP package pin 28 serves as signal ground; pins 7, 8, 9, 20, 21, 22 serve as heatsink/ground.



Note: Drawings are not to scale.

**ELECTRICAL CHARACTERISTICS** Unless otherwise stated, these specifications apply for  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$ .  
 TRMPWR = 4.75V, DISCNCT = 0V.  $T_A = T_J$ .

PARAMETER	TEST CONDITIONS		MIN	TYP	MAX	UNITS	
<b>Supply Current Section</b>							
Termpwr Supply Current	All termination lines = Open			20	29	mA	
	All termination lines = 0.5V			400	435	mA	
Power Down Mode	DISCNCT = Open			100	150	$\mu\text{A}$	
<b>Output Section (Termination Lines)</b>							
Termination Impedance	$\Delta\text{LINE} = -5\text{mA}$ to $-15\text{mA}$		$T_J = 25^\circ\text{C}$	102	110	118	$\Omega$
			$0^\circ\text{C} < T_J < 70^\circ\text{C}$	97		129	$\Omega$
Output High Voltage	$V_{\text{TRMPWR}} = 4\text{V}$ (Note 1)		$T_J = 25^\circ\text{C}$	2.6	2.9	3.1	V
			$0^\circ\text{C} < T_J < 70^\circ\text{C}$	2.55		3.2	V
Max Output Current	$V_{\text{LINE}} = 0.5\text{V}$		$T_J = 25^\circ\text{C}$	-19.5	-21.4	-22.4	mA
			$0^\circ\text{C} < T_J < 70^\circ\text{C}$	-18.5		-22.4	mA
Max Output Current	$V_{\text{LINE}} = 0.5\text{V}$ , $V_{\text{TRMPWR}} = 4\text{V}$ (Note 1)		$T_J = 25^\circ\text{C}$	-18.0	-21.5	-22.4	mA
			$0^\circ\text{C} < T_J < 70^\circ\text{C}$	-17.0		-22.4	mA
Output Leakage	DISCNCT = 4V	$V_{\text{TRMPWR}} = 0\text{V}$ to $5.25\text{V}$ $V_{\text{REG}} = 0\text{V}$	$V_{\text{LINE}} = 0$ to $4\text{V}$		10	400	nA
			$V_{\text{LINE}} = 5.25\text{V}$			100	$\mu\text{A}$
		$V_{\text{TRMPWR}} = 0\text{V}$ to $5.25\text{V}$ , $V_{\text{REG}} = \text{Open}$ $V_{\text{LINE}} = 0\text{V}$ to $5.25\text{V}$			10	400	nA
Output Capacitance	DISCNCT = Open (Note 2)			10	13	pF	
<b>Regulator Section</b>							
Regulator Output Voltage			$T_J = 25^\circ\text{C}$	2.7	2.9	3.1	V
			$0^\circ\text{C} < T_J < 70^\circ\text{C}$	2.55		3.2	V
Line Regulation	$V_{\text{TRMPWR}} = 4\text{V}$ to $6\text{V}$			10	20	mV	
Load Regulation	$I_{\text{REG}} = 0$ to $-400\text{mA}$			20	50	mV	
Drop Out Voltage	All Termination Lines = 0.5V			1.0	1.2	V	
Short Circuit Current	$V_{\text{REG}} = 0\text{V}$		-450	-650	-850	mA	
Sinking Current Capability	$V_{\text{REG}} = 3.5\text{V}$		20	40		mA	
Thermal Shutdown				170		$^\circ\text{C}$	
<b>Disconnect Section</b>							
Disconnect Threshold			1.1	1.4	1.7	V	
Threshold Hysteresis				100		mV	
Input Current	DISCNCT = 0V			150	200	$\mu\text{A}$	

Note 1: Measuring each termination line while other 17 are low (0.5V).

Note 2: Guaranteed by design. Not 100% tested in production.

## THERMAL DATA

DWP package: (see packaging section of UICC data book for more details on thermal performance)

Thermal Resistance Junction to Leads,  $\theta_{jL}$  ..... 18 $^\circ\text{C}/\text{W}$

Thermal Resistance Junction to Ambient,  $\theta_{jA}$  ..... 33 $^\circ\text{C}/\text{W}$ –43 $^\circ\text{C}/\text{W}$

N package:

Thermal Resistance Junction to Leads,  $\theta_{jL}$  ..... 50 $^\circ\text{C}/\text{W}$

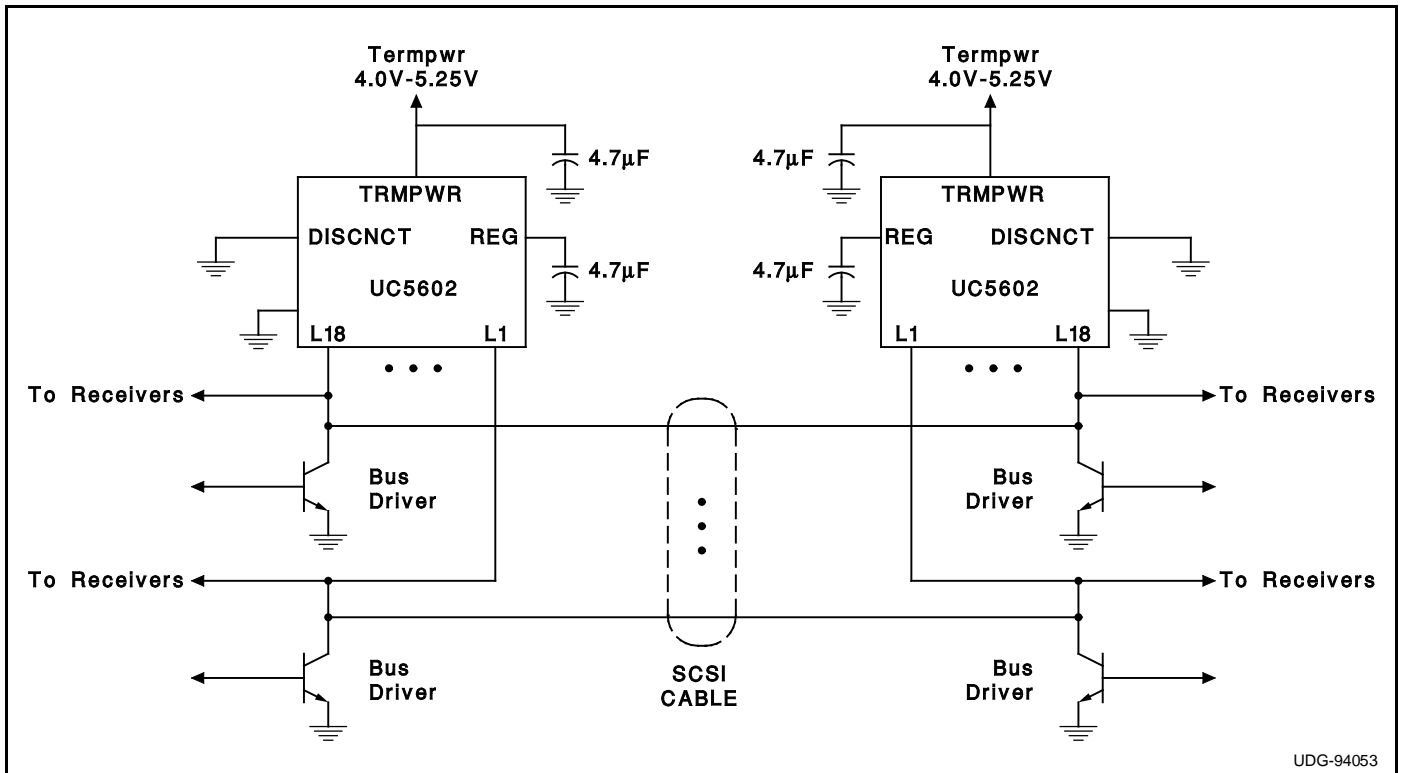
Thermal Resistance Junction to Ambient,  $\theta_{jA}$  ..... 95 $^\circ\text{C}/\text{W}$ –105 $^\circ\text{C}/\text{W}$

QP package:

Thermal Resistance Junction to Leads,  $\theta_{jL}$  ..... 15 $^\circ\text{C}/\text{W}$

Thermal Resistance Junction to Ambient,  $\theta_{jA}$  ..... 30 $^\circ\text{C}/\text{W}$ –40 $^\circ\text{C}/\text{W}$

Note: The above numbers for  $\theta_{jL}$  are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The  $\theta_{jA}$  numbers are meant to be guidelines for the thermal performance of the device/pc-board system. All of the above numbers assume no ambient airflow.



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Typical SCSI Bus Configuration Using the UC5602

**A Look at the Response of a SCSI-2 Cable**

Figure 1 shows a single line of a SCSI cable. The driver is an open collector type which when asserted pulls low, and when negated the termination resistance serves as the pull-up.

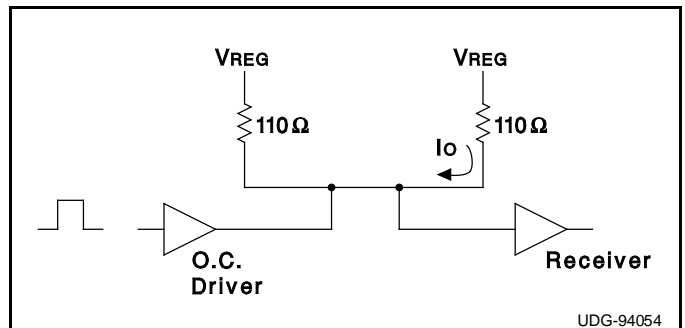
Figure 2 shows a worst case scenario of mid cable deassertion with a close proximity receiver. The voltage  $V_{STEP}$  is defined as:

$$V_{STEP} = V_{OL} + I_O Z_0$$

- $V_{OL}$  = Driver Output Low Voltage
- $I_O$  = Current from Receiving Terminator
- $Z_0$  = Cable Characteristic Impedance

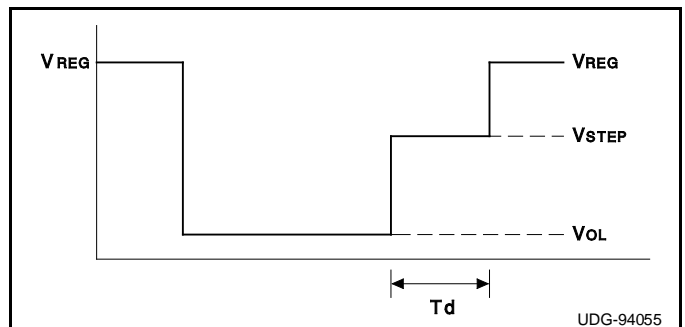
$$I_O = \frac{V_{REG} - V_{OL}}{110}$$

In the pursuit of higher data rates, sampling could occur during this step portion, therefore it is important to ensure that the step is as high as possible to get the most noise margin. For this reason the UC5602 is trimmed so that the output current ( $I_O$ ) is as close as possible to the SCSI max current spec of 22.4mA. The Termination impedance is initially trimmed on the IC to 110 ohms typical, then the regulator voltage is trimmed for the highest output current to within 22.4mA.



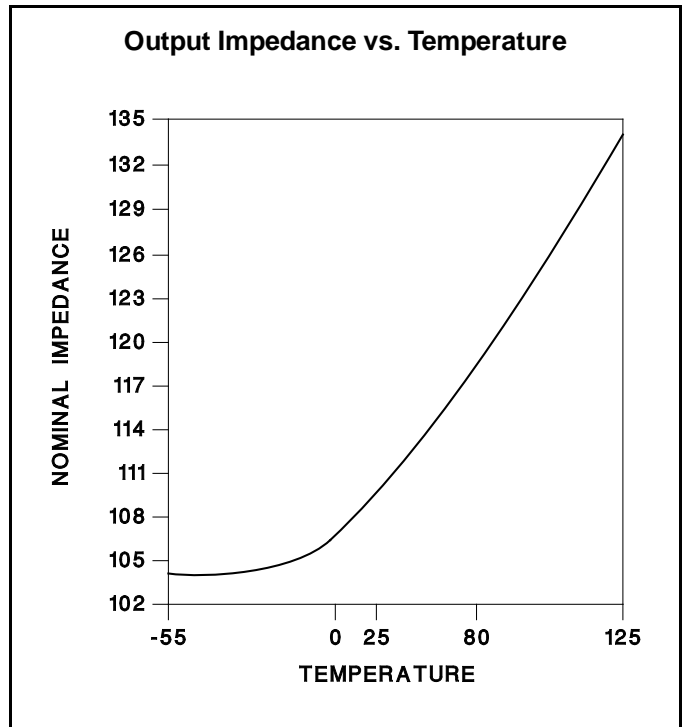
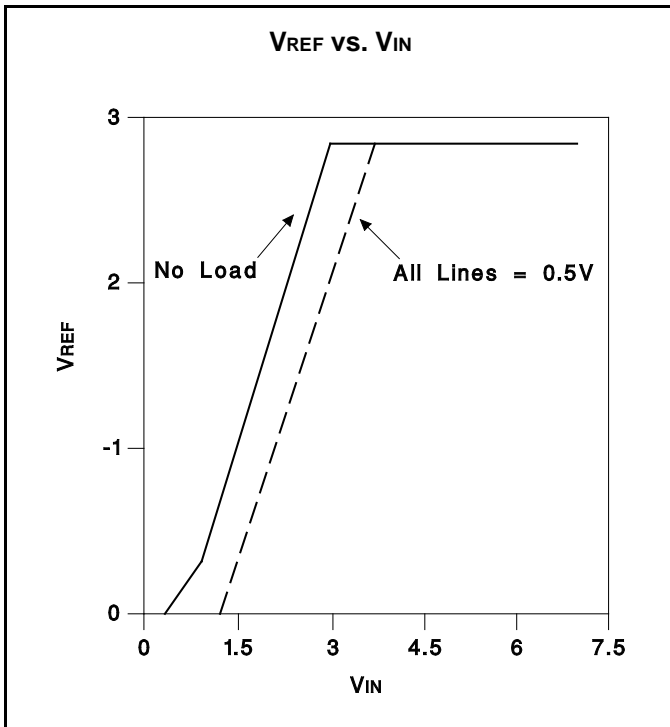
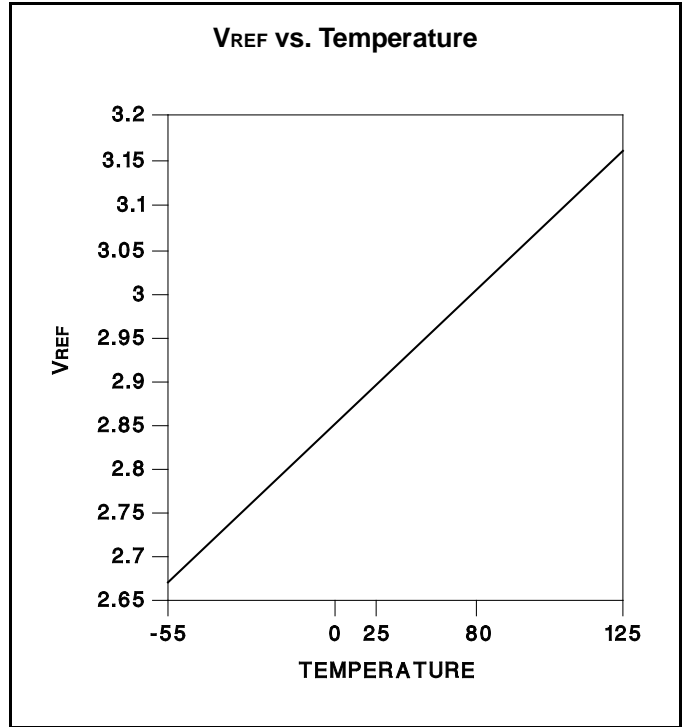
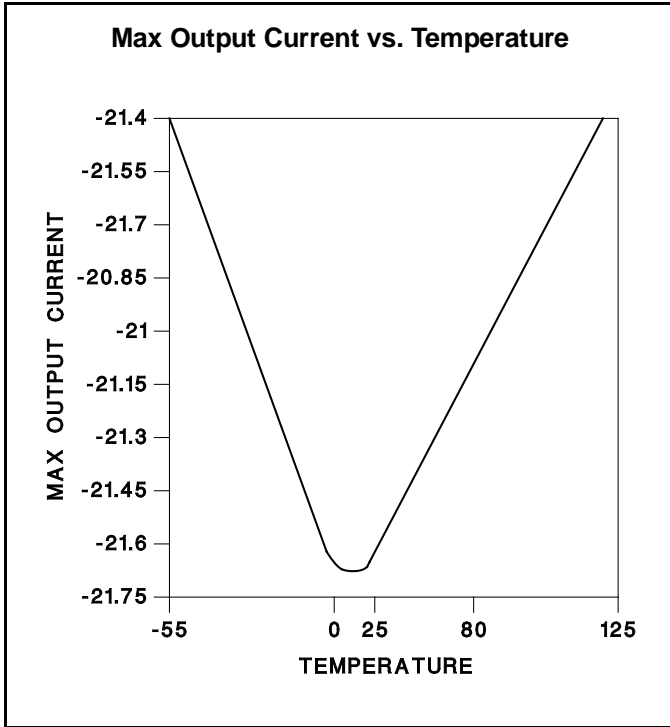
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Figure 1. A Single Line of a SCSI Cable



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Figure 2. A Typical Response of a SCSI Cable



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