INTEGRATED
CIRCUITS
UNITRODE

UC5602

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.

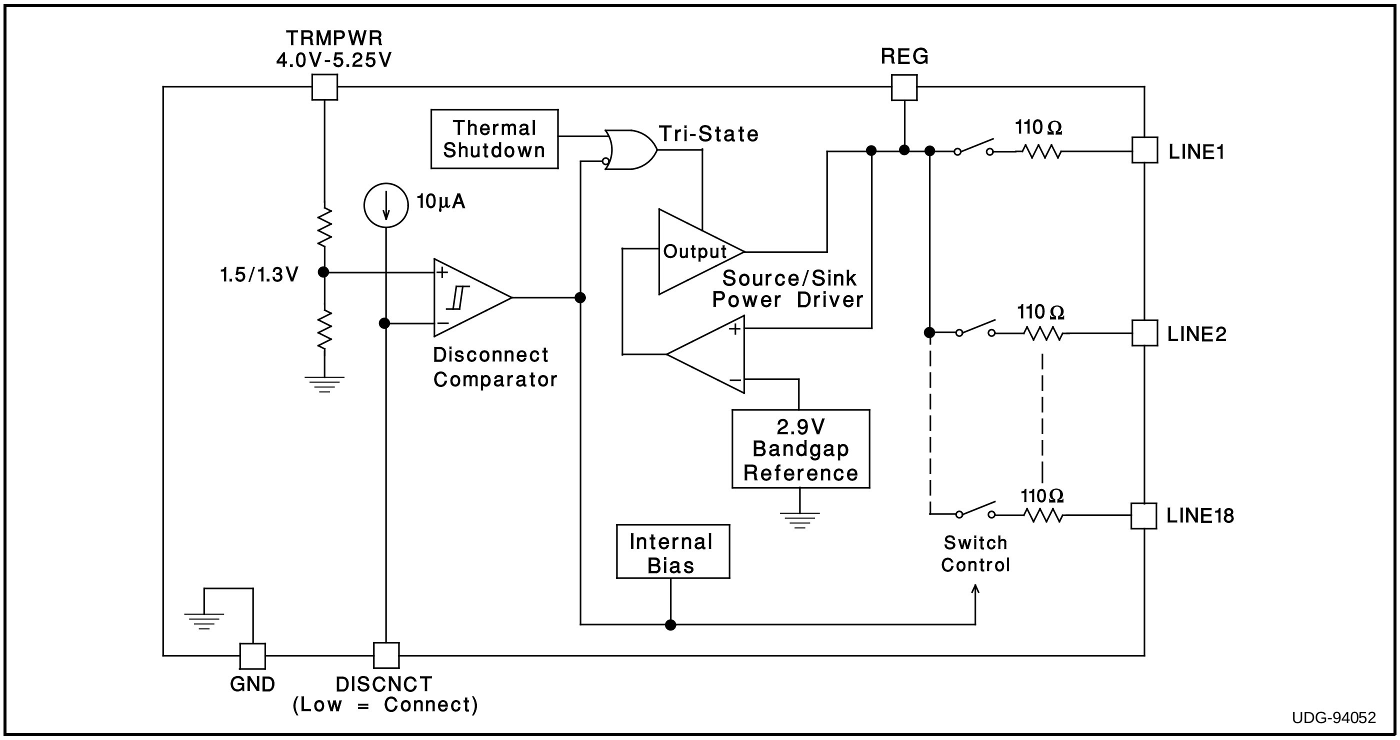
The UC5602 provides a disconnect feature which, when opened or driven high, will disconnect all terminating resistors, and disables the regulator; greatly reducing standby power. The output channels remain high impedance even without Termpwr applied.

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



Circuit Design Patented

ABSOLUTE MAXIMUM RATINGS

Termpwr 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

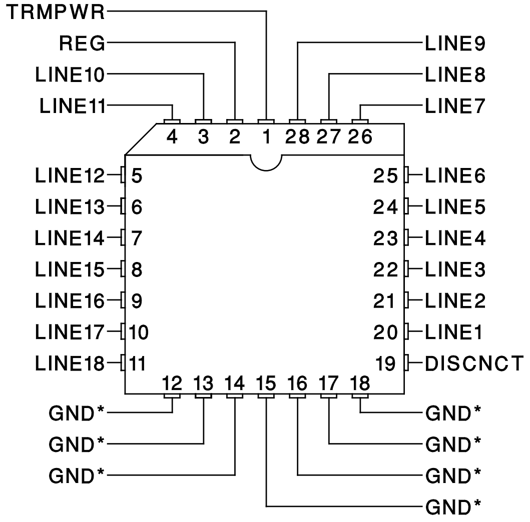
Unless otherwise specified all voltages are with respect to Ground. Currents are positive into, negative out of the specified terminal.
Consult Packaging Section of Unitrode Integrated Circuits databook for thermal limitations and considerations of packages.

RECOMMENDED OPERATING CONDITIONS

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

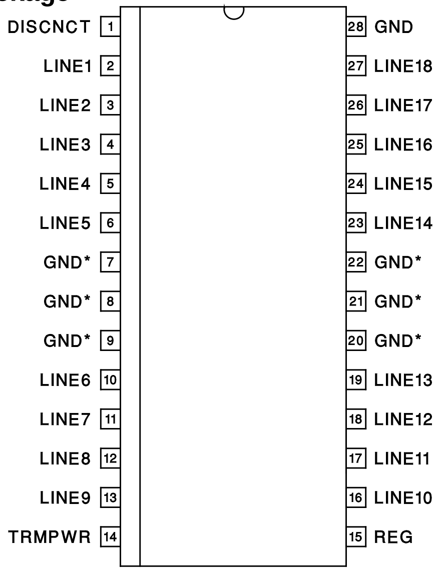
CONNECTION DIAGRAMS

PLCC-28 (Top View)
QP Package



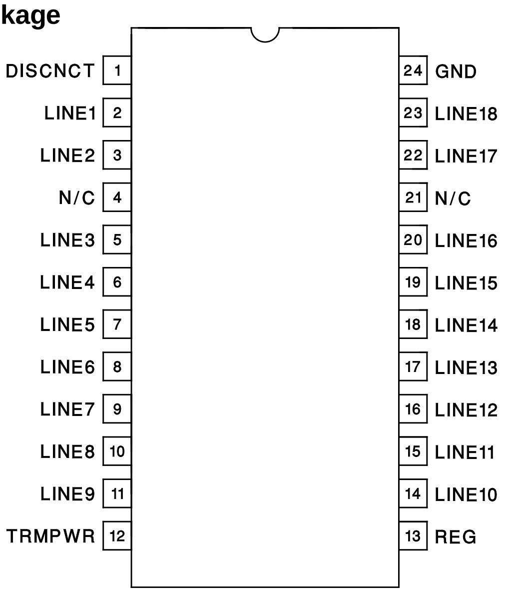
** QP package pins 12 - 18 serve as both heatsink and signal ground.*

SOIC-28 (Top View)
DWP Package



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

DIL-24 (Top View)
N Package



Note: Drawings are not to scale.

ELECTRICAL CHARACTERISTICS Unless otherwise stated, these specifications apply for T_A = 0°C to 70°C. TRMPWR = 4.75V, DISCNCT = 0V. $T_A = T_J$.

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

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, θjL . . . . 18°C/W
Thermal Resistance Junction to Ambient, θja . . . . 33°-43°C/W

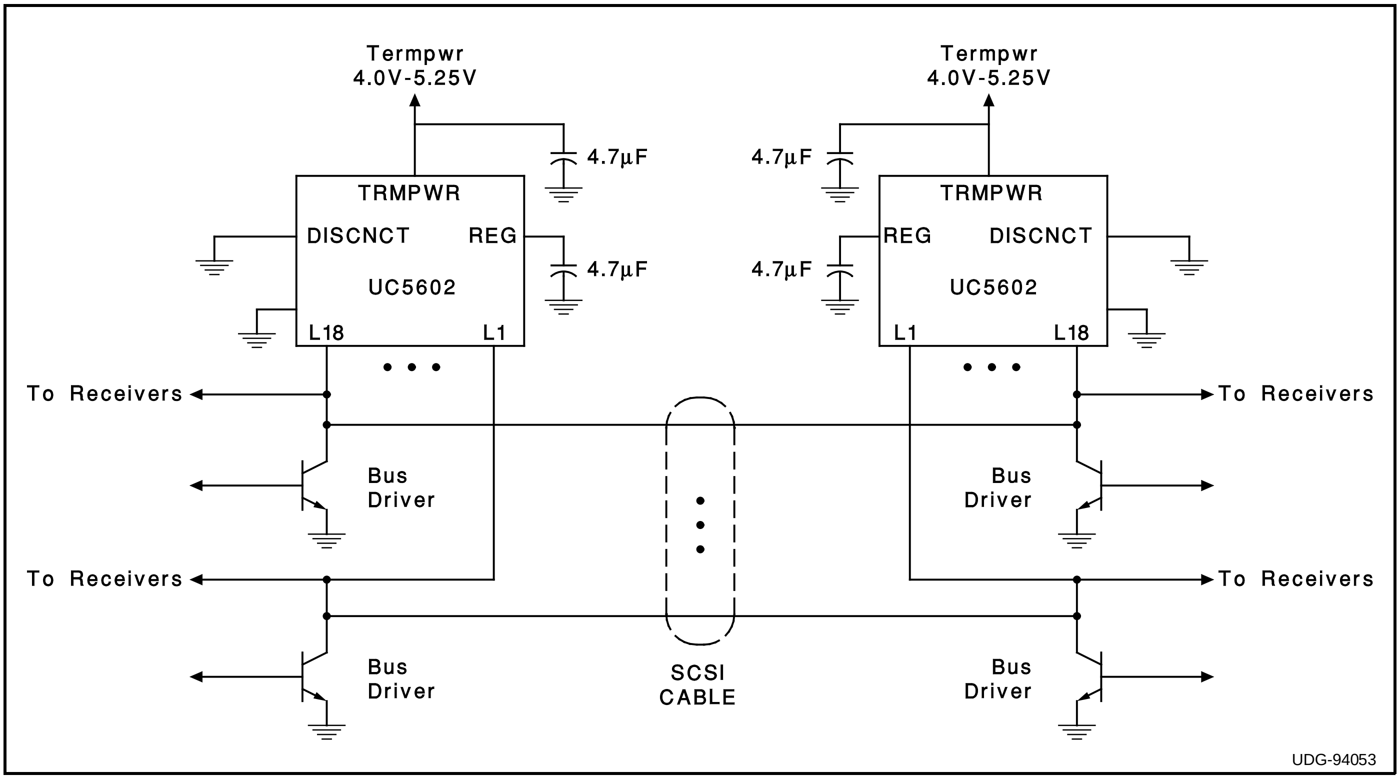
N package:

Thermal Resistance Junction to Leads, θjL . . . . 50°C/W
Thermal Resistance Junction to Ambient, θja . . . . 95°-105°C/W

QP package:

Thermal Resistance Junction to Leads, θjL . . . . 15°C/W
Thermal Resistance Junction to Ambient, θja . . . . 30°-40°C/W

Note: The above numbers for θjL are maximums for the limiting thermal resistance of the package in a standard mounting configuration. The θja 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.



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 colletor 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 de-assertion 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.

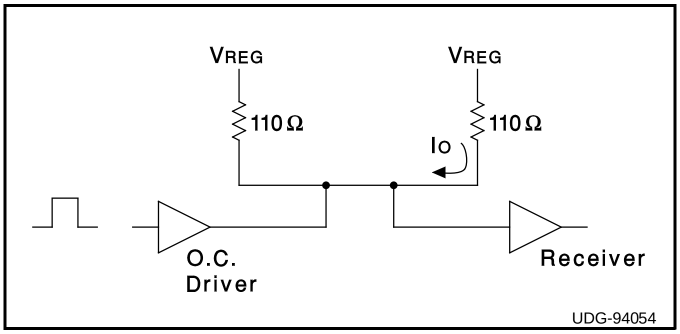


Figure 1. A Single Line of a SCSI Cable

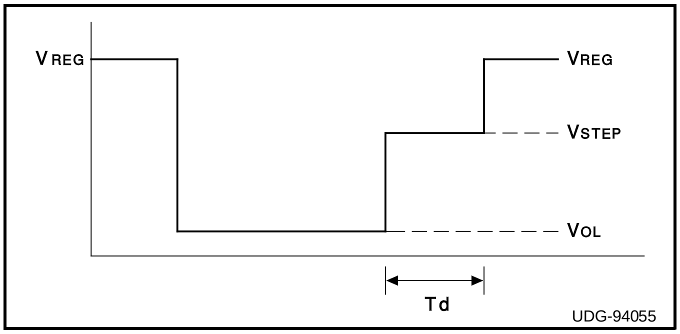
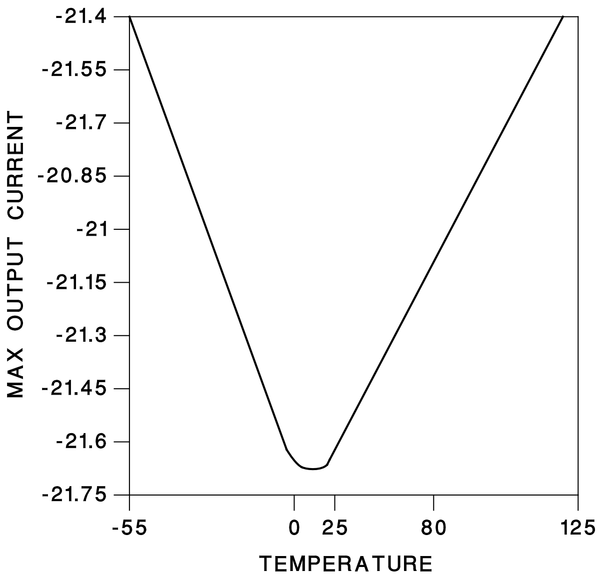
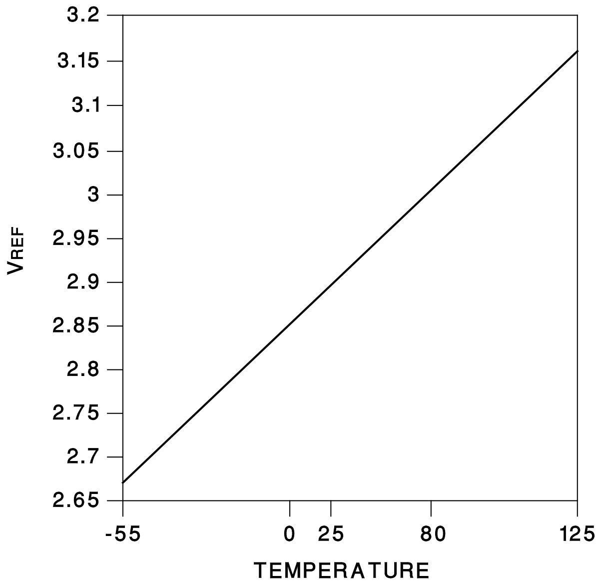


Figure 2. A Typical Response of a SCSI Cable

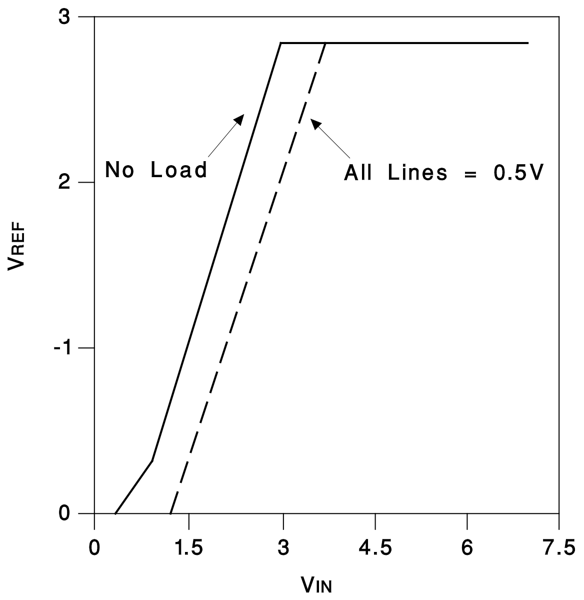
Max Output Current vs. Temperature



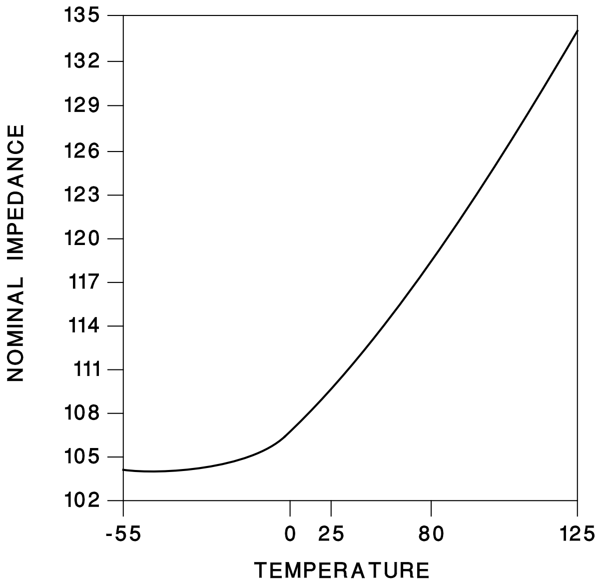
V_{REF} vs. Temperature



V_{REF} vs. V_{IN}



Output Impedance vs. Temperature



PACKAGE OPTION ADDENDUM

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
UC5602DWP	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI
UC5602DWPTR	OBSOLETE	SOIC	DW	28		TBD	Call TI	Call TI
UC5602QP	OBSOLETE	PLCC	FN	28		TBD	Call TI	Call TI
UC5602QPTR	OBSOLETE	PLCC	FN	28		TBD	Call TI	Call TI

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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