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TECHNICAL DATA

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9-Bit Switchable SCSI Passive Bus Terminator (220 Ω and 330 Ω)

MCCS142233

The MCCS142233 is a precision 9-bit switchable SCSI bus terminator with a Local-V_{CC} (LV_{CC}) low voltage sense circuit to latch the Enable state. When the switch is enabled according to the truth table the device provides a 220 Ω resistance to Terminator Power (TERMPWR) and 330 Ω resistance to Ground for SCSI termination of 9 bits. When the switch is disabled according to the truth table, the device is in a High Impedance State on all 9 bits.

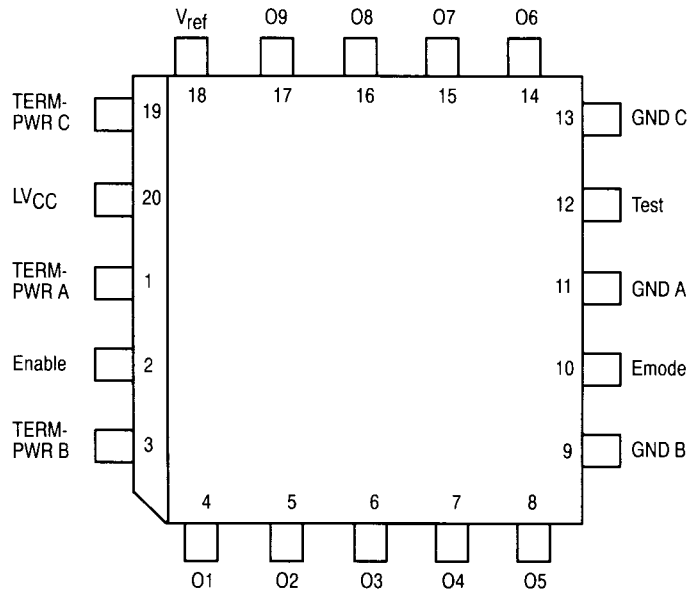
The low voltage sense circuit gives the device the ability to latch the current output state when power is removed from the LV_{CC} pin. When powering down a SCSI peripheral containing this device as long as Terminator Power remains there is no interruption to the SCSI bus.

- 9 Switchable 220 Ω/330 Ω Terminating Resistor Pairs
- Operating Temperature Range: 0°C to 70°C
- Operating Voltage Range: 4.25 to 5.25 V
- Resistor Tolerance ± 7.5% (Over Temperature And Supply Voltage Ranges)
- Resistor Ratio: R220/R330 = 220 Ω/330 Ω ± 2%
- Local-V_{CC} (LV_{CC}) Low Voltage Sense Circuit
- Active High or Active Low Enable Input

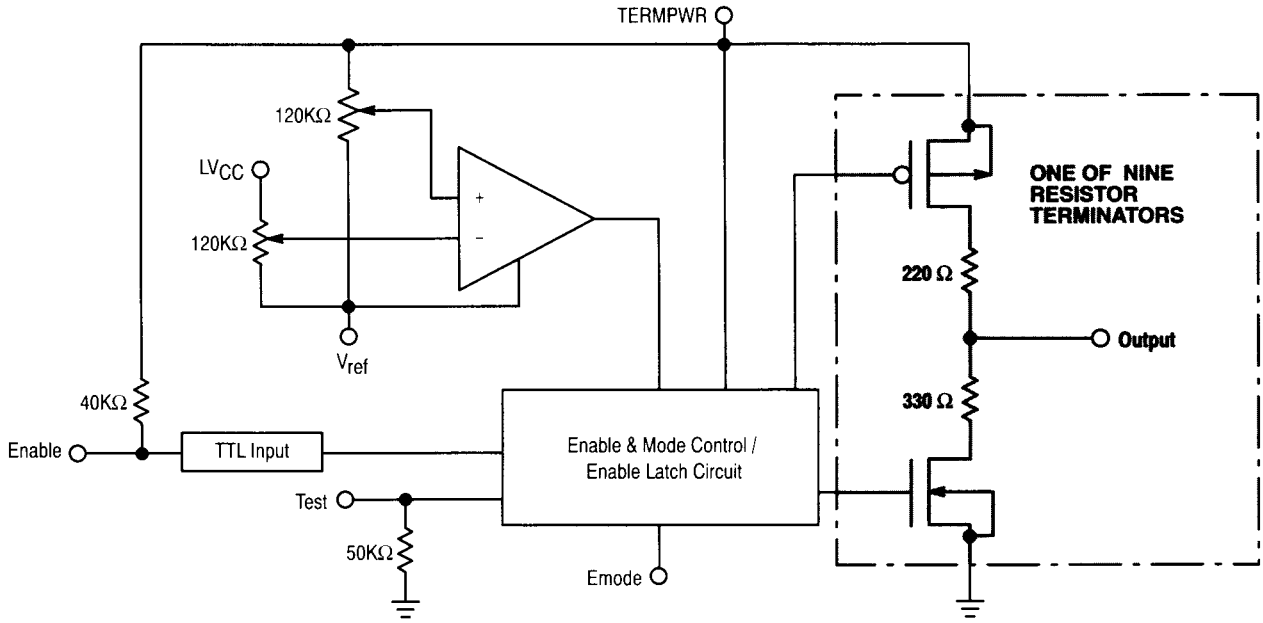
Truth Table

	Test	Emode	Enable	Output		Test	Emode	Enable	Output
	0	0	0	Terminated		1	0	0	330 Ω to GND
Active	0	0	1	Z	Test	1	0	1	220 Ω to TERMPWR
Mode	0	1	0	Z	Mode	1	1	0	220 Ω to TERMPWR
	0	1	1	Terminated		1	1	1	330 Ω to GND

PIN ASSIGNMENT



NOTE: All three TERMPWR pins must be connected externally.
All three V_{GND} pins must be connected externally.



MAXIMUM RATINGS*

Symbol	Parameter	Value	Units
TERMPWR	DC Terminator Power Voltage (Referenced to GND)	– 0.5 to + 6.0	V
V_{in}	DC Input Voltage (Referenced to GND) for Emode/Test pins	– 0.5 to TERMPWR + 0.5	V
V_{in}	DC Input Voltage (Referenced to GND) for LV_{CC}/Enable pins	– 0.5 to + 6.0	V
V_{out}	DC Output Voltage (Referenced to GND)	– 0.5 to TERMPWR +0.5	V
I_{in}	DC Input Current, per pin	± 20	mA
I_{out}	DC Output Current, per pin	± 35	mA
I_{CC}	DC Supply Current, TERMPWR and GND pins	± 250	mA
T_{stg}	Storage Temperature	– 65 to + 150	°C
T_L	Lead Temperature, 1mm from case for 10 seconds	260	°C

* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Units
TERMPWR	DC Terminator Power Voltage (Referenced to GND)	4.25	5.25	V
V_{in}, V_{out}	DC Input Voltage	0	TERMPWR	V
T_A	Operating Temperature	0	70	°C
t_r, t_f	Input Rise and Fall Time (All inputs but LV_{CC})	0	500	ns
t_r, t_f	Input Rise and Fall Time (LV_{CC})	0	no limit	ns

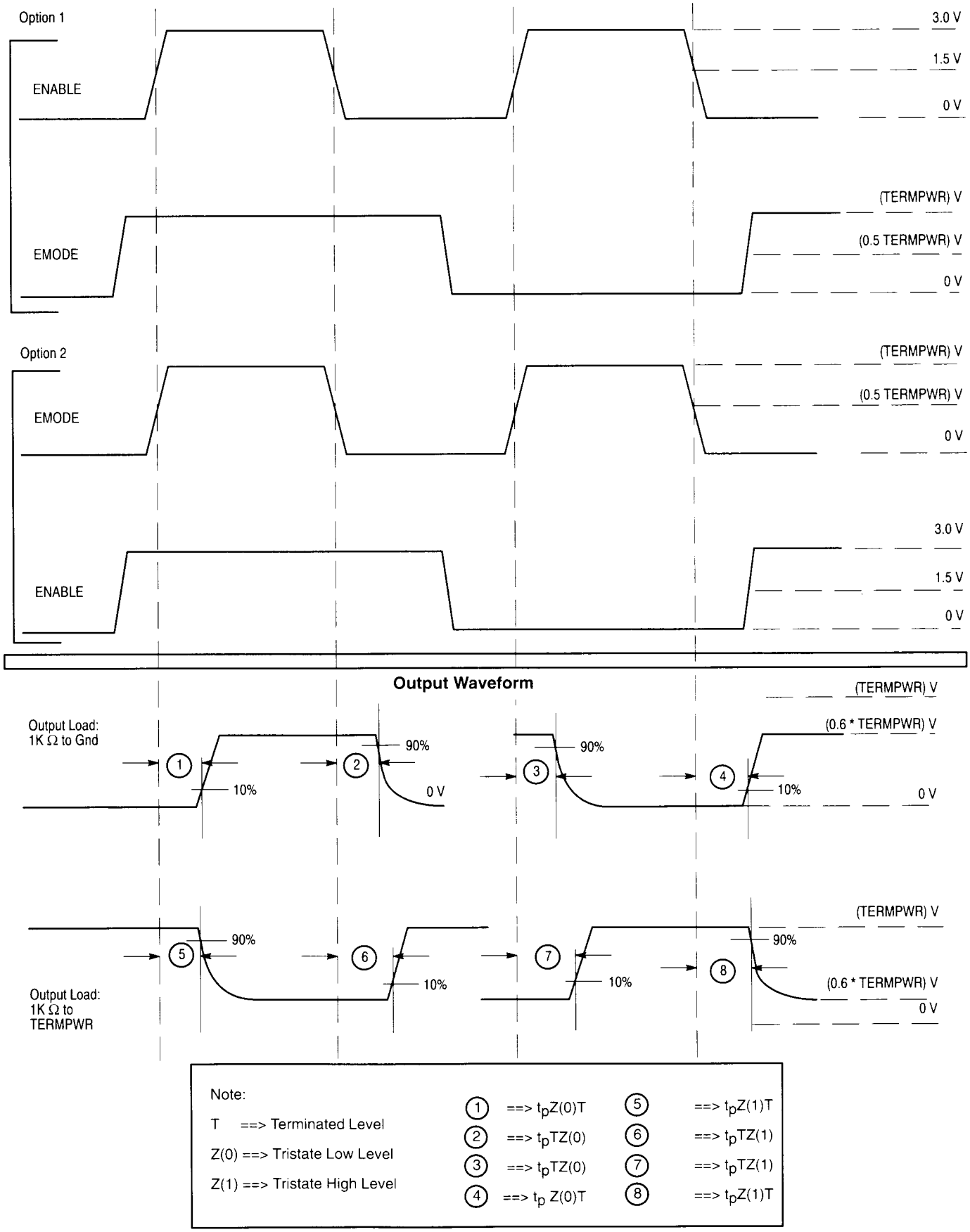
DC CHARACTERISTICS

Symbol	Parameters	TERMPWR (V)	25°C		0°C to + 70°C		Unit	Condition
			Min	Max	Min	Max		
V_{IH}	Min High-Level Input Voltage (Emode & Test — HC Inputs)	4.25 5.25	2.98 3.68		2.98 3.68		V	Per Truth Table
	Min High-Level Input Voltage (Enable — HCT Input)	4.25 5.25	2.0 2.0		2.0 2.0		V	Per Truth Table
V_{IL}	Max Low-Level Input Voltage (Emode & Test — HC Inputs)	4.25 5.25		1.27 1.57		1.27 1.57	V	Per Truth Table
	Max Low-Level Input Voltage (Enable — HCT Inputs)	4.25 5.25		0.8 0.8		0.8 0.8	V	Per Truth Table
V_{out}	Output Voltage When Terminated	4.25 5.25	0.6 * TERMPWR ±2%				V	V_{in} = V_{IH} or V_{IL} |IOUT| = 0 µA
I_{in}	Max Input Leakage Current (Emode & LV_{CC} Inputs)	5.25		±0.10		±1.0	µA	V_{in} = TERMPWR or GND V_{ref} = TERMPWR
	Max Input Leakage Current (Enable Input)	5.25		±0.10		±1.0	µA	V_{in} = TERMPWR
	Max Input Leakage Current (Test Input)	5.25		±0.10		±1.0	µA	V_{in} = GND
I_{OZ}	Max Output Leakage Current	5.25		±0.50		±5.0	µA	Per Truth Table
I_{CC}	Max Quiescent Supply Current (Enable Active Low)	5.25		300		300	µA	Emode/V_{ref}/LV_{CC} = TERMPWR Enable/Test = GND
	Max Quiescent Supply Current (Comparator Active)	5.25		500		800	µA	Enable/LV_{CC} = TERMPWR Emode/V_{ref}/Test = GND
R220	Output Pull-Up Resistor Value [1]	4.25 to 5.25	218	222	203	237	Ω	Enable/Test/LV_{CC} = TERMPWR Emode/V_{ref}/ = GND
R330	Output Pull-Down Resistor Value [1]	4.25 to 5.25	327	333	305	355	Ω	Test/LV_{CC} = TERMPWR Enable/Emode/V_{ref}/ = GND

[1] Resistor Values are compensated for a 30°C ambient to junction temperature delta. See "Thermal Considerations" section for a detailed explanation and formula. See Figures 3 & 4 for "Temperature Characteristics of Resistor Values".

Symbol	Parameter	TERMPWR (V)	Typical @ +25°C	Unit	Condition
V_{T-}	Max Latch Voltage (LV_{CC} Input)	4.25 4.75 5.25	3.50 3.90 4.25	V	Per Truth Table
V_{T+}	Min Unlatch Voltage (LV_{CC} Input)	4.25 4.75 5.25	4.00 4.40 4.75	V	Per Truth Table

Figure 1. AC Characteristics Input Waveform Options



AC CHARACTERISTICS (TERMPWR = 4.75 ±0.5 V, C_L = 50 pF, $t_r = t_f$ = 6 ns)

Symbol	Parameters	25°C		0°C to + 70°C		Unit	Condition
		Min	Max	Min	Max		
$t_{pTZ(0)}$	Max Propagation Delay,	–	150	–	200	ns	1 KΩ to GND (See Fig. 1)
$t_{pTZ(1)}$	Enable or Emode to Outputs	–	100	–	150		1 KΩ to TERMPWR (See Fig. 1)
$t_{pZ(0)T}$	Max Propagation Delay,	–	150	–	200	ns	1 KΩ to GND (See Fig. 1)
$t_{pZ(1)T}$	Enable or Emode to Outputs	–	100	–	150		1 KΩ to TERMPWR (See Fig. 1)

TIMING REQUIREMENTS (TERMPWR = 4.75 ±0.5 V, C_L = 50 pF, $t_r = t_f$ = 6 ns)

Symbol	Parameters	25°C		0°C to + 70°C		Unit	Condition
		Min	Max	Min	Max		
$t_{(Enable)}$	Min Setup Time, LV_{CC} to Enable	200	–	500	–	ns	See Fig. 2
$t_{(Latch)}$	Min Hold Time, LV_{CC} to Enable	50	–	100	–		

Figure 2. Timing Requirements

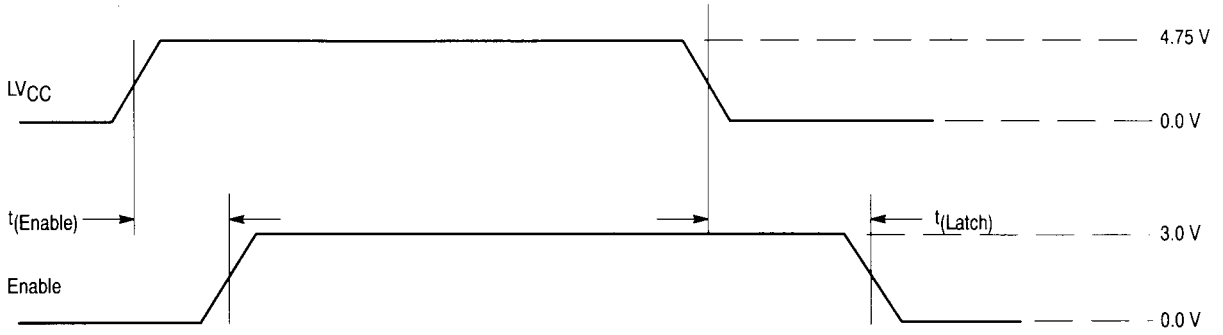
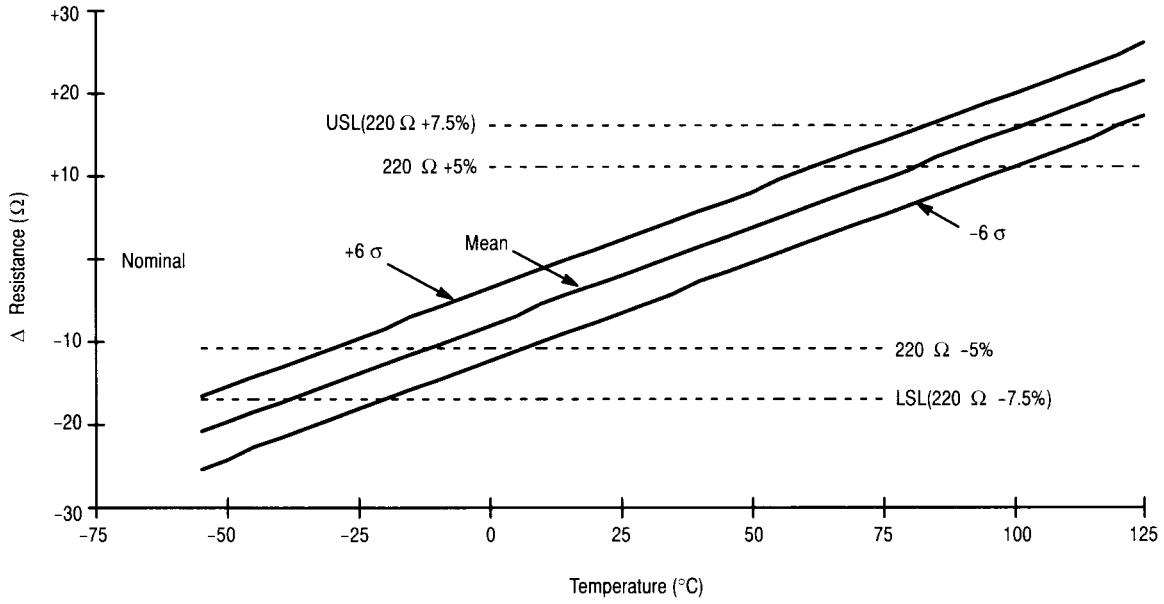
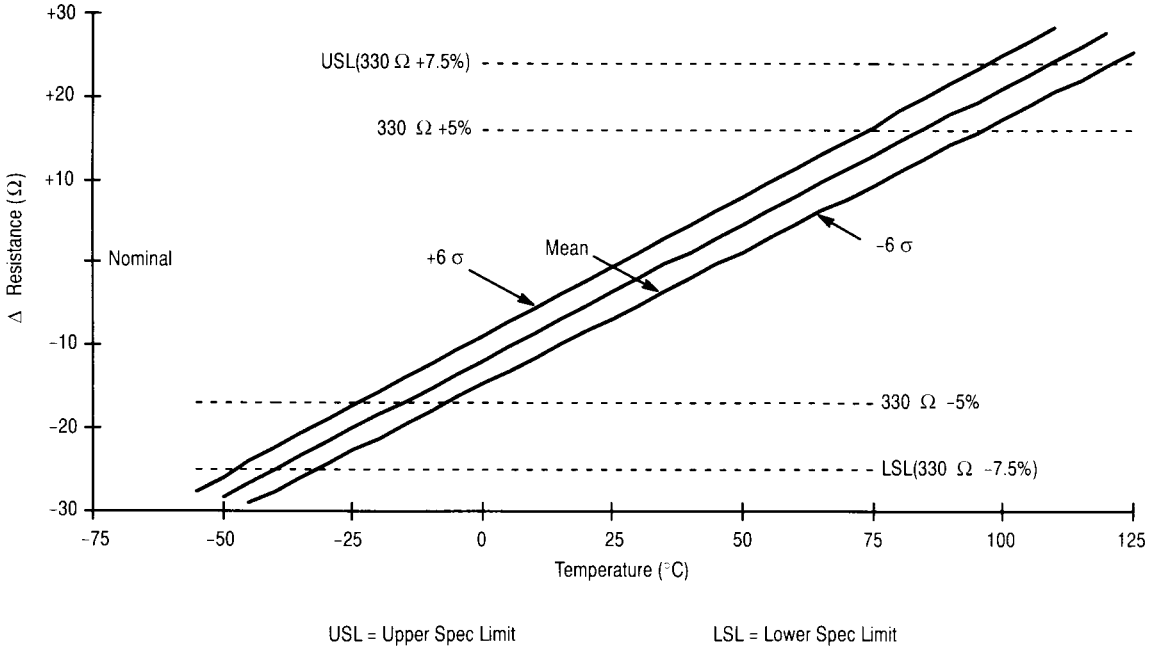


Figure 3. Temperature Characteristic of 220 Ω Resistor



USL = Upper Spec Limit LSL = Lower Spec Limit

Figure 4. Temperature Characteristic of 330 Ω Resistor



USL = Upper Spec Limit LSL = Lower Spec Limit

THERMAL CONSIDERATIONS

The following formula can be used to determine the operating junction temperature of the MCCS142233FN, 20 lead PLCC device:

$$T_J = ((28)(P_{diss})) + ((0.34)(T_C)) + ((0.66)(T_L))$$

T_J = junction temperature
T_C = case temperature(measured top center)
T_L = lead temperature
$P_{diss} = (TERMPWR)^2((\#\ bus\ lines\ low/R220) + (\#\ bus\ lines\ high/(R220 + R330)))$

Minimum power dissipation, (0.45 watts) is achieved when all 9 bus lines are high. If all 9 bus lines are low, maximum power, (1.3 watts) is dissipated. The following section details the device reliability as a function of junction temperature.

Optimizing the Long Term Reliability of Plastic Packages

Todays plastic integrated circuit packages are as reliable as ceramic packages under most environmental conditions. However when the ultimate in system reliability is required, thermal management must be considered as a prime system design goal.

Modern plastic package assembly technology utilizes gold wire bonded to aluminum bonding pads throughout the electronics industry. When exposed to high temperatures for protracted periods of time, an intermetallic compound can form in the bond area resulting in high impedance contacts and degradation of device performance. Since the formation of intermetallic compounds is directly related to device junction temperature, it is incumbent on the designer to determine that the device junction temperatures are consistent with system reliability goals.

Predicting Bond Failure Time:

Based on the results of almost ten (10) years of +125°C operating life testing, a special arrhenius equation has been developed to show the relationship between junction temperature and reliability. Table I shows the relationship between junction temperature, and continuous operating time to 0.1% wire bond failure, (1 failure per 1000 bonds).

Table I. Device Junction Temperature Vs. Time to 0.1% Bond Failures.

Junction Temperature °C	Time (Hours)	Time (Years)
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

MCCS142233 Applications Information

Enable & Emode:

The Enable and Emode input pins work together to determine the state of the termination resistors; either terminated(Enabled) or high impedance(Disabled). Enable and Emode allow the user to select the polarity of the enable signal to match the system logic signal used to drive the Enable input. If Emode is tied "high" (to TERMPWR), the enable input becomes active "high". Conversely, with Emode tied "low" (to GND), the Enable input becomes active low. This eliminates the need to add external inversion to the Enable signal regardless of the polarity of the system signal provided to the MCCS142233.

Emode can be used instead of Enable to select the state of the termination resistors. Emode has CMOS input levels, while Enable has TTL-compatible input levels.

LV_{CC} & V_{ref}:

LVcc (Local-V_{CC}) and V_{ref} pins provide a means for latching the proper termination state when the Enable input is driven by local logic. With Enable under local system logic control, the possibility exists for the peripheral containing the MCCS142233 to be powered down. The termination circuitry will still be powered from TERMPWR, but the Enable signal supplied to the chip by local logic will be lost. With the LV_{CC} input tied to the peripheral's internal power supply, the MCCS142233 will sense the loss of local power prior to loss of a valid Enable input signal, and will latch the Enable state which is present prior to local power loss.

The V_{ref} pin is the analog ground for the Local-V_{CC} comparator and reference circuitry. For proper use of this feature, V_{ref} must be tied to GND. Series resistance supplied by the user between V_{ref} and GND will alter the data sheet latch threshold of LV_{CC}. Thus the LV_{CC} threshold may be tailored to the user's specific requirements.

Note: The input ESD structures on the Enable and LV_{CC} inputs do not incorporate a diode to TERMPWR. Loss of TERMPWR will not result in the local power supply attempting to source TERMPWR to the system. Likewise, if the local supply (5.5 V maximum) exceeds TERMPWR (4.25 V minimum) current will not be drawn from the local power supply to TERMPWR through the MCCS142233.

Use of the Local-V_{CC} sensing feature is only appropriate when the Enable input is driven by system logic. If the MCCS142233 is to be enabled using a wire jumper or throw switch, the user can disable the Local-V_{CC} sensing circuitry by hardwiring the LV_{CC} and V_{ref} pins to TERMPWR. This will eliminate the power consumed by the comparator and reference circuitry to attain the lowest standby power condition possible.

Test:

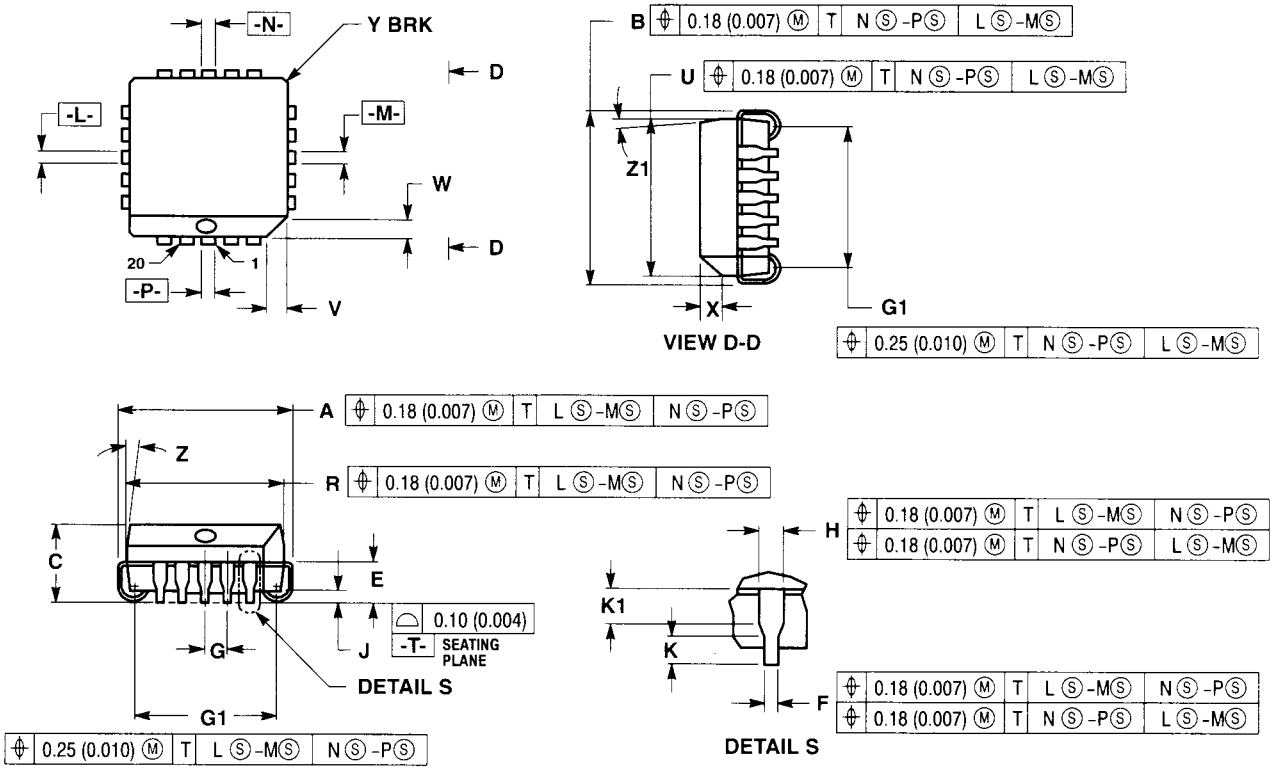
The Test pin is used to open circuit one resistor branch of each terminator pair ("Test Mode") to facilitate measurement of the resistor value in production. It is held low internally through a pulldown resistor to operate the device in the "Active Mode" per the truth table. The Test mode may be of use in system debug once the MCCS142233 is on the PC board. It is recommended to leave the Test pin either unconnected (pulled low internally) or grounded depending on whether the "Test Mode" offers any utility to the user in the system configuration.

MCCS142233 Applications Information

Enable Input Application	Result
A. No Connection to Enable	Enable input will be pulled "high" internally. Termination state will depend upon the polarity of the Emode input. Emode should be hardwired "high" or the termination will be permanently disabled.
B. Single Pole Switch to GND	Enable input will be pulled "high" internally when the switch is open. Enable input will be held "low" when the switch is closed. Termination state will depend upon the polarity of the Emode input.
C. Double Pole Switch to Both TERMPWR and GND	This is a more expensive way to accomplish application B. above. It is more economical to allow the internal pullup to provide the "high" input level.
D. Hardwired "High"	With Emode also hardwired "high", the MCCS142233 will be permanently enabled and provide termination on all outputs. With Emode hardwired "low", the chip will be permanently disabled.
E. Hardwired "Low"	With Emode also hardwired "low", the MCCS142233 will be permanently enabled and provide termination on all outputs. With Emode hardwired "high" the chip will be permanently disabled. Application D. above is preferred over E. since D. does not draw current through the Enable input pull-up resistor.
F. External Logic Driven	With LV_{CC} input connected to the local power supply and V_{ref} connected to GND, the Local-V_{CC} sensing and Enable latching feature will be active. If this feature is not desired, hardwire LV_{CC} and V_{ref} to TERMPWR.

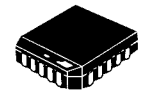
OUTLINE DIMENSIONS

FN SUFFIX
PLASTIC PACKAGE
CASE 775-02



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	9.78	10.03	0.385	0.395
B	9.78	10.03	0.385	0.395
C	4.20	4.57	0.165	0.180
E	2.29	2.79	0.090	0.110
F	0.33	0.48	0.013	0.019
G	1.27 BSC		0.050 BSC	
H	0.66	0.81	0.026	0.032
J	0.51	—	0.020	—
K	0.64	—	0.025	—
R	8.89	9.04	0.350	0.356
U	8.89	9.04	0.350	0.356
V	1.07	1.21	0.042	0.048
W	1.07	1.21	0.042	0.048
X	1.07	1.42	0.042	0.056
Y	—	0.50	—	0.020
Z	2°	10°	2°	10°
G1	7.88	8.38	0.310	0.330
K1	1.02	—	0.040	—
Z1	2°	10°	2°	10°

NOTES:
1. DATUMS -L-, -M-, -N-, AND -P- DETERMINED WHERE TOP OF LEAD SHOULDER EXIT PLASTIC BODY AT MOLD PARTING LINE.
2. DIM GI, TRUE POSITION TO BE MEASURED AT DATUM -T-, SEATING PLANE.
3. DIM R AND U DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.25 (0.010) PER SIDE.
4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
5. CONTROLLING DIMENSION: INCH.
6. 775-01 IS OBSOLETE. NEW STANDARD 775-02.



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