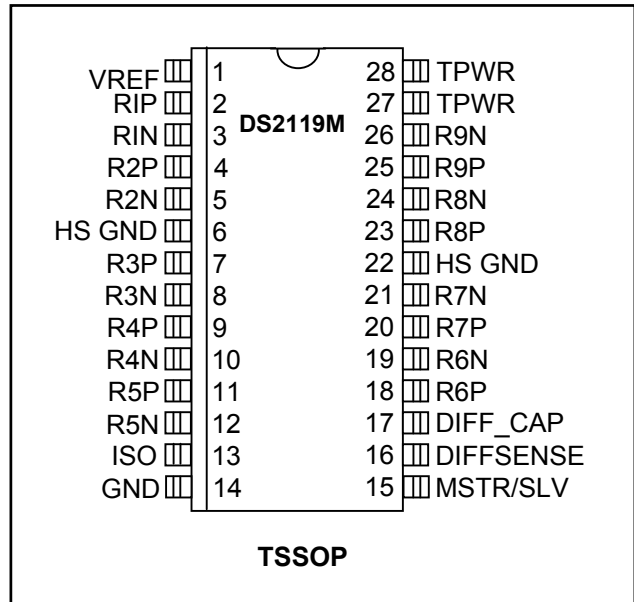# DS2119M
Ultra3 LVD/SE SCSI Terminator

FEATURES

- Fully Compliant with SCSI SPI-2, SPI-3, SPI-4, Ultra160, and Ultra320
- Provides Multimode Low-Voltage Differential/Single-Ended (LVD/SE) Termination for Nine Signal Line Pairs
- Autoselection of LVD or SE Termination
- 5% Tolerance on SE and LVD Termination Resistance
- Low Power-Down Capacitance of 3pF
- On-Board Thermal Shutdown Circuitry
- SCSI Bus Hot Plug Compatible
- Fully Supports Actively Negated SE SCSI Signals

PIN CONFIGURATION

	DS2119M	
VREF	1	28 TPWR
RIP	2	27 TPWR
RIN	3	26 R9N
R2P	4	25 R9P
R2N	5	24 R8N
HS GND	6	23 R8P
R3P	7	22 HS GND
R3N	8	21 R7N
R4P	9	20 R7P
R4N	10	19 R6N
R5P	11	18 R6P
R5N	12	17 DIFF_CAP
ISO	13	16 DIFFSENSE
GND	14	15 MSTR/SLV

TSSOP

ORDERING INFORMATION

PART	VOLTAGE (V)	TEMP RANGE	PIN-PACKAGE	TOP MARK*
DS2119ME	5	0°C to +70°C	28 TSSOP (0.173")	DS2119M
DS2119ME+	5	0°C to +70°C	28 TSSOP (0.173")	DS2119M
DS2119ME/T&R	5	0°C to +70°C	28 TSSOP (0.173")/Tape and Reel	DS2119M
DS2119ME+T&R	5	0°C to +70°C	28 TSSOP (0.173")/Tape and Reel	DS2119M

+ *Denotes a lead-free/RoHS-compliant package.*
* *The top mark includes a "+" on lead-free packages.*

DETAILED DESCRIPTION

The DS2119M Ultra3 LVD/SE SCSI terminator is both a low-voltage differential (LVD) and single-ended (SE) terminator. The multimode operation enables the designer to implement LVD in current products while allowing the end-user SE-backward compatibility with legacy devices. If the device is connected in an LVD-only bus, the DS2119M will use LVD termination. If any SE devices are connected to the bus, the DS2119M will use SE termination. This is accomplished automatically inside the part by sensing the voltage on the SCSI bus DIFFSENS line.

For the LVD termination, the DS2119M integrates two current sources with nine precision resistor strings. For the SE termination, one regulator and nine precision 110Ω resistors are used. Three DS2119M terminators are needed for a wide SCSI bus.

REV: 010406

REFERENCE DOCUMENTS
Small Computer Systems Interface (SCSI-3)   SCSI Parallel Interface (SPI)   Project: 0855-M, 1995
Small Computer Systems Interface (SCSI-3)   SCSI Parallel Interface 2 (SPI-2) Project: 1142-M, 1998
Small Computer Systems Interface (SCSI-3)   SCSI Parallel Interface 3 (SPI-3) Project: 1302-D, 1999
Small Computer Systems Interface (SCSI-3)   SCSI Parallel Interface 4 (SPI-4) Project: 1365-D, 200x

Available From:
American National Standards Institute (ANSI)   Phone: (212) 642-4900
Global Engineering Documents 15 Inverness Way East; Englewood, CO 80112   Phone: (800) 854-7179

FUNCTIONAL DESCRIPTION
The DS2119 combines LVD and SE termination with DIFFSENS sourcing and detection.

A bandgap reference is fed into two amplifiers, which creates a 1.25V reference voltage and a 2.85V reference voltage. The control logic determines which of these references will be applied to the termination resistors. If the SCSI bus is in LVD mode, then the 1.25V reference will be used. If the SCSI bus is in SE mode, then the 2.85V reference will be used. That same control logic will switch in/out parallel resistors to change the total termination resistance accordingly. Finally, in SE mode, the Rp pins will be switched to ground.

The DIFFSENSE circuitry decodes trinary logic. There will be one of three voltages on the SCSI control line called DIFFSENS. Two comparators and a NAND gate determine if the voltage is below 0.6V, above 2.15V, or in between. That indicates the mode of the bus to be SE, HVD, or LVD, respectively.

The DS2119M's DIFF_CAP pin monitors the DIFFSENS line to determine the proper operating mode of the device. The DIFFSENSE pin can also drive the SCSI DIFFSENS line (when MSTR/SLV = 1) to determine the SCSI bus-operating mode. The DS2119M switches to the termination mode that is appropriate for the bus based on the value of the DIFFSENS voltage. These modes are:

- **LVD Mode:** LVD termination is provided by a precision laser-trimmed resistor string with two current sources. This configuration yields a 105Ω differential and 150Ω common-mode impedance. A fail-safe bias of 112mV is maintained when no drivers are connected to the SCSI bus.

- **SE Mode:** When the external driver for a given signal line turns off, the active terminator will pull that signal line to 2.85V (quiescent state). When used with an active negation driver, the power amp can sink 22mA per line and the reference voltage will move less than 100mV. The terminating resistors maintain their 110Ω value.

- **HVD Isolation Mode:** The DS2119M identifies that there is an HVD (high-voltage differential) device on the SCSI bus and isolates the termination pins from the bus.

When ISO = 1, the termination pins are isolated from the SCSI bus, V_{REF} remains active. During thermal shutdown, the termination pins are isolated from the SCSI bus and V_{REF} becomes high impedance. The DIFFSENSE driver is shut down during either of these two events.

To ensure proper operation, the TPWR pin should be connected to the SCSI bus TERMPWR line. As with all analog circuitry, the TERMPWR and V_{DD} lines should be bypassed locally. A 2.2μF capacitor and a 0.01μF high-frequency capacitor are recommended between TPWR and ground and placed as close

as possible to the DS2119M. The DS2119M should be placed as close as possible to the SCSI connector to minimize signal and power-trace length, thereby resulting in less input capacitance and reflections, which can degrade the bus signals.

To maintain the specified regulation, a 4.7μF capacitor is required between the V_{REF} pin (VREF) and ground of each DS2119M. A high frequency cap (0.1μF ceramic recommended) can also be placed on the V_{REF} pin in applications that use fast rise/fall time drivers. A typical SCSI bus configuration is shown in Figure 2.

- **DIFFSENS Noise Filtering:** The DS2119M incorporates a digital filter to remove high-frequency transients on the DIFFSENS control line, thereby eliminating erroneous switching between modes. This filter eliminates the need for the external capacitor and resistor, which heretofore performed this function.

NOTES:
1) DIFFSENS. Refers to the SCSI bus signal.
2) DIFFSENSE. Refers to the Dallas Semiconductor pin name and internal circuitry relating the DIFFSENS driver.
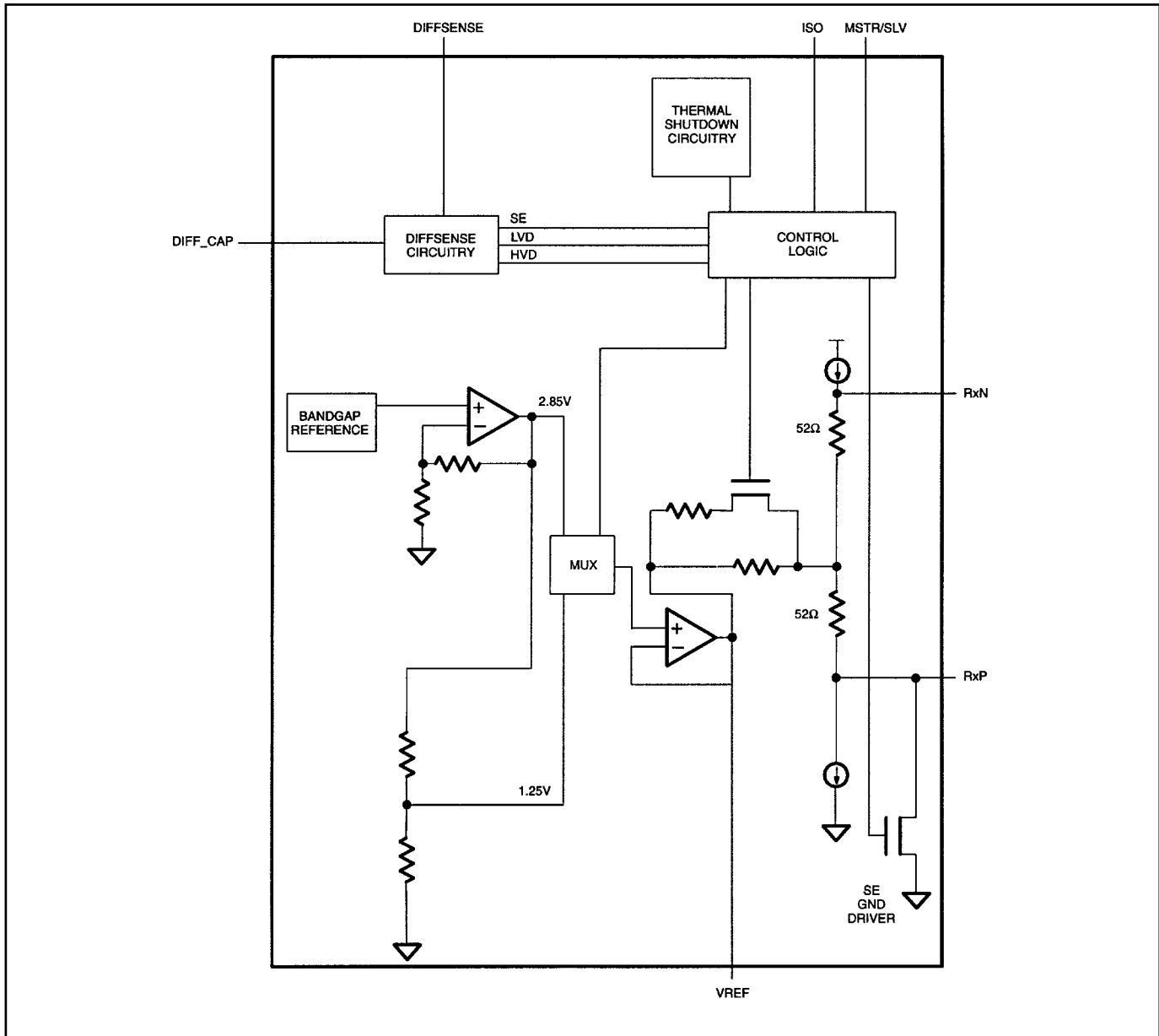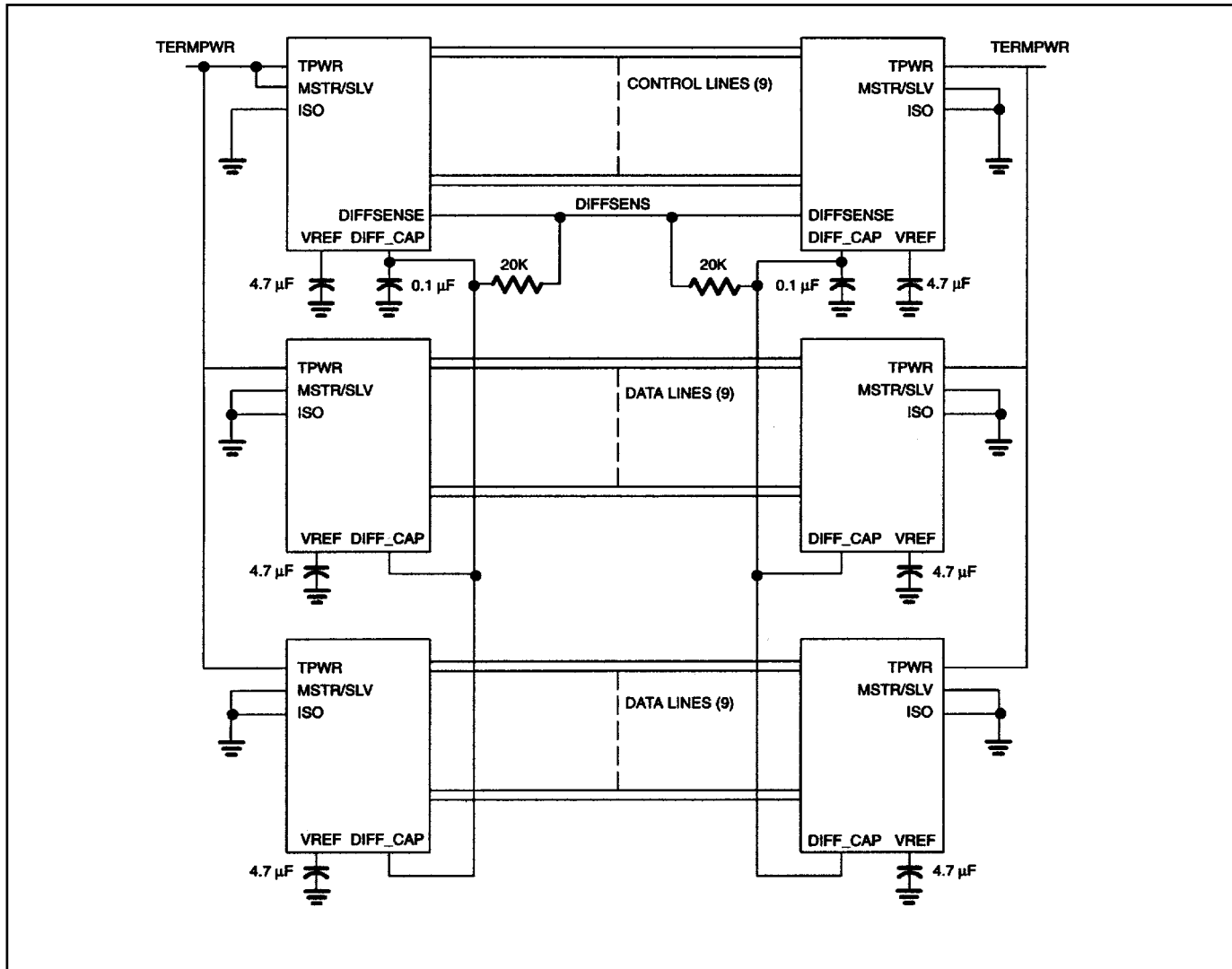
Figure 1. DS2119M Block Diagram

Figure 2. SCSI Bus Configuration

PIN DESCRIPTION

PIN	NAME	FUNCTION
1	VREF	**Reference Voltage.** 2.85V reference in SE mode and 1.25V reference in LVD mode; must be decoupled with a 4.7µF cap.
2–5, 7–12, 18–21, 23–26	RxP, RxN	**Signal Termination.** Connect to SCSI bus signal lines.
6, 22	HS GND	**Heat Sink Ground.** Internally connected to the mounting pad. Should be grounded.
13	ISO	**Isolation.** When pulled high, the DS2119M isolates its bus pins (RxP, RxN) from the SCSI bus.
14	GND	**Ground.** Signal ground; 0V.
15	MSTR/SLV	**Master/Slave.** Mode-select for the noncontrolling terminator. When pulled high, MSTR enables the DIFFSENSE driver.
16	DIFFSENSE	**DIFFSENSE.** Output to drive the SCSI bus DIFFSENS line.
17	DIFF_CAP	**DIFFSENSE Capacitor.** Connect a 0.1µF capacitor for DIFFSENSE filter. Input to detect the type of device (differential or single-ended) on the SCSI bus.
27, 28	TPWR	**Termination Power.** Connect to the SCSI TERMPWR line and decouple with a 2.2µF capacitor.

RECOMMENDED OPERATING CONDITIONS

PARAMETER		SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Termpower Voltage	SE Mode	$V_{TPWR(SE)}$	4.0		5.5	V	
	LVD Mode	$V_{TPWR(LVD)}$	2.7		5.5	V	
Logic 0		V_{IL}	-0.3		+0.8	V	
Logic 1		V_{IH}	2.0		$V_{TPWR} + 0.3$	V	
Operating Temperature		V_{AMB}	0		70	°C	

SINGLE-ENDED CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
SE Termination Resistance	R_{SE}	104.5	110	115.5	Ω	1
SE Voltage Reference	V_{REF}	2.7	2.85	3.0	V	
SE Output Current	I_{OSE}			25.4	mA	2
Output Capacitance	C_{OUT}			3	pF	3

LOW-VOLTAGE DIFFERENTIAL CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Differential Mode Termination Resistance	R_{DM}	100		110	Ω	
Common Mode Termination Resistance	R_{CM}	110		190	Ω	
Differential Mode Bias	V_{DM}	100		125	mV	4
Common Mode Bias	V_{CM}	1.125		1.375	V	

DC CHARACTERISTICS

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Termpower Current	I_{TPMR}		12		mA	4
Input Leakage High	I_{IH}	-1.0			µA	
Input Leakage Low	I_{IL}			1.0	µA	
Output Current High	I_{OH}	-1.0			mA	5, 7
Output Current Low	I_{OL}	4.0			mA	6, 7
DIFFSENS SE Operating Range	V_{SEOR}	-0.3		0.5	V	
DIFFSENS LVD Operating Range	V_{LVDOR}	0.7		1.9	V	
DIFFSENS HVD Operating Range	V_{HVDOR}	2.4		V_{TPWR} + 0.3	V	
DIFFSENSE Driver Output Voltage	V_{DSO}	1.2		1.4	V	8, 9
DIFFSENSE Driver Source Current	I_{DSH}	5		15	mA	8, 10, 12
DIFFSENSE Driver Sink Current	I_{DSL}	20		200	µA	8, 11
Thermal Shutdown			150		ºC	3

REGULATOR CHARACTERISTICS

(T_A = 0°C to +70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Line Regulation	LI_{REG}		1.0	2.5	%	
Load Regulation	LO_{REG}		1.3	3.5	%	
Current Limit	I_{LIM}		550		mA	
Sink Current	I_{SINK}	200			mA	

NOTES:

1) V_{LINE} = 0V to 3V.

2) V_{LINE} = 0.2V.

3) Guaranteed by design.

4) All lines open.

5) V_{OUT} = 2.4V.

6) V_{OUT} = 0.4V.

7) SE/LVD/HVD pins only.

8) MSTR/SLV = 1.

9) I_{DS} = 0mA to 5mA.

10) V_{DSO} = 0V.

11) V_{DSO} = 2.75V.

12) TPWR = 5.5V.

PACKAGE INFORMATION

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information, go to **www.maxim-ic.com/DallasPackInfo**.)

| REVISIONS				
LTR	DESCRIPTION		DATE	APPROVED
A	NEW DRAWING			
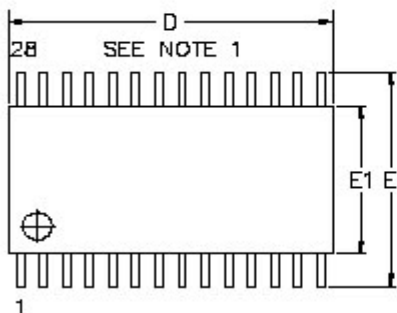
NOTES:

1. DIMENSION "D" DOES NOT INCLUDE MOLD MISSMATCH, FLASH OR PROTRUSIONS. MOLD MISSMATCH, FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.15 PER SIDE.

2. DIMENSION "B" DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT.

SEE DETAIL A
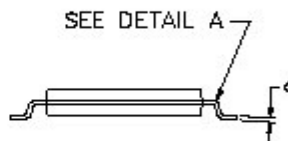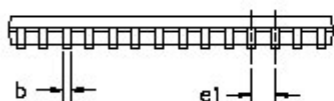
DETAIL A

DIM	MIN	MAX
A	–	1.10
A1	0.05	–
A2	0.75	1.05
c	0.09	0.20
L	0.50	0.75
e1	0.65 BSC	
b	0.18	0.30
D	9.60	9.80
E1	4.40 BSC	
E	6.20	6.60
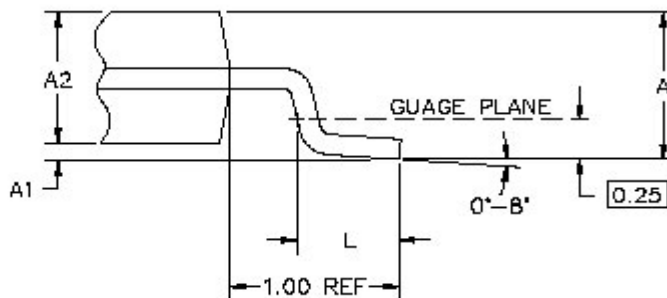
DIMENSIONS ARE IN MILLIMETERS

SIGNATURE		DATE	DALLAS SEMICONDUCTOR MAXIM				
DOC. CONTROL:							
ENGR. MGR:			TITLE				
MFG. ENGR:			MARKETING OUTLINE, 28 LD. TSSOP, 4.4 MM BODY				
CHECKED BY:			SIZE	FSCM NO	PART NO.		REV
DRAWN BY:	R.W.E.	8/97	A		56–G2020–001		A
DO NOT SCALE DWG.			SCALE N/A			SHEET 1 OF 1	

Maxim Integrated Products, 120 San Gabriel Drive, Sunnyvale, CA 94086 408-737-7600