

**Multi-mode LVD/SE SCSI Terminator****Features**

- Auto-selectable multi-mode Single-Ended or LVD Termination
- Meets SCSI-1, SCSI-2, SCSI-3 SPI Ultra (Fast-20), Ultra 2(SPI-2 LVD), Ultra160 standards.
- Supports active negation
- Current limit and thermal protection
- Hot-Swap compatible (Single-Ended)
- 5% tolerance on SE and LVD termination resistance
- 28 and 36 pin SSOP package
- 28 Pin SSOP: Pin Compatible with DS2119
- 36 Pin SSOP: Pin Compatible with DS2118, LX5241 and UCC5630

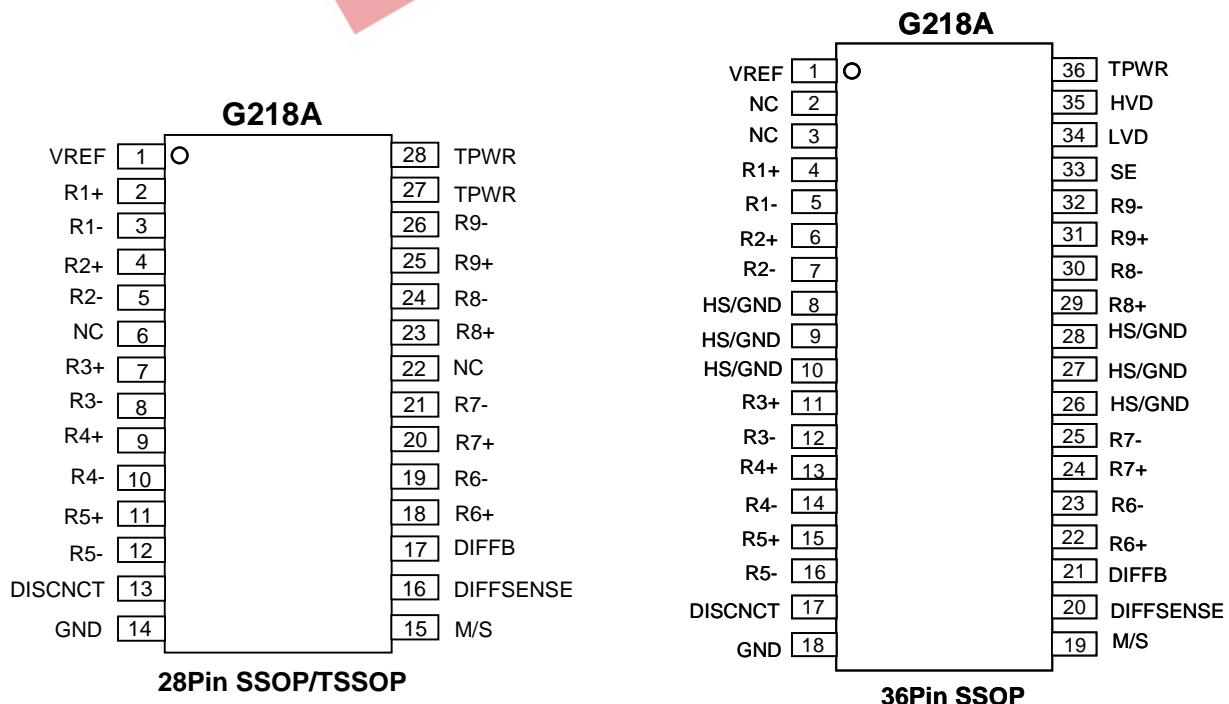
**Applications**

- Server and workstation
- High-end PC
- Industrial PC
- Disk Array (RAID)
- SCSI cable

**General Description**

The G218A Multi-mode LVD/SE SCSI terminator provides a smooth transition into the next generation of the SCSI Parallel Interface (SPI-2). It automatically senses the bus, via DIFFSENS, and switches the termination to either single-ended (SE) or low voltage differential (LVD) SCSI, dependent on which type of devices are connected to the bus. If the G218A detects a HVD SCSI device, it switches to a high impedance state. For a 16-bit Wide SCSI bus to be operational, three G218A terminators are needed.

The Multi-mode terminator contains all functions required to terminate and auto detect and switch modes for SCSI parallel Interface (SPI-2) bus architectures. For the SE termination, one regulator and nine precision 110ohm resistors are used. For the LVD termination, the G218A integrates two regulated supplies with nine precision resistor strings.

**Pin Configuration  
(Top View)**

## Ordering Information

PART NUMBER	TEMP. RANGE	PIN-PACKAGE	FEATURE
G218AT-S4	0°C-70°C	SSOP-28 pin / Tube	DISCNCT does not disable VREF
G218AR-S4	0°C-70°C	SSOP-28 pin / Tape & Reel	DISCNCT does not disable VREF
G218AT-S5	0°C-70°C	SSOP-36 pin / Tube	DISCNCT does not disable VREF
G218AR-S5	0°C-70°C	SSOP-36 pin / Tape & Reel	DISCNCT does not disable VREF
G218AT-D3	0°C-70°C	TSSOP-28 pin / Tube	DISCNCT does not disable VREF
G218AR-D3	0°C-70°C	TSSOP-28 pin / Tape & Reel	DISCNCT does not disable VREF

## Functional Description

The G218A combines LVD and SE termination with DIFFSENS sourcing and detection. The LVD termination section consists of two source/sink amplifiers (VTOP, VBOT), biasing circuitry and nine precision resistor strings (RTOP, RMID, RBOT). The SE termination section consists of a 2.85V source/sink regulator with 9 precision 110ohm resistor. The DIFFSENSE section consists of a 1.3V, 5mA driver and a sensing circuit (Figure 1)

DIFFSENSE is used by multi-mode transceiver (LVD/SE) to determine if the device is connected to a single-ended, LVD or HVD SCSI bus. If the voltage on DIFFSENSE is between 0-0.5V the bus is single-ended; if it is between 0.7-1.9V the bus is LVD; and if it is greater than 2.4V, the bus is HVD.

The G218A DIFFB pin monitors the DIFFSENS line to determine the proper operating mode of the device; this mode is indicated by the SE/LVD/HVD outputs.

**HVD Isolation Mode** The G218A identifies that there is an HVD (high voltage differential) device on the SCSI bus and isolates the termination pins from the bus.

When DISCNCT=1, the termination pins are isolated from the SCSI bus, and the bus mode indicators (SE/LVD/HVD) as well as VREF remains active. During thermal shutdown, the termination pins are isolated from the SCSI bus and VREF 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 VDD lines should be bypassed locally. A 2.2μF capacitor and a 0.01μF high frequency capacitor is recommended between TPWR and ground and placed as close as possible to the G218A. The G218A should be placed as close as possible to the SCSI connector to minimize signal and

The DIFFSENSE pin can also drive the SCSI DIFFSENS line (when M/S=1) to determine the SCSI bus operating mode. The G218A 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 resistor string with two amplifiers. 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 2.85 volts (quiescent state). When used with an active negation driver, the power amp can sink 22mA per line.

while keeping the voltage reference in regulation. The terminating resistors maintain their 110Ω value.

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 VREF pin and ground of each G218A. A high frequency cap (0.1μF ceramic recommended) can also be placed on the VREF pin in applications that use fast rise/fall time drivers. A typical SCSI bus configuration is shown in Figure2.

An internal pull down resistor assures that the G218A will be terminating the bus if the DISCNCT pin is left floating.

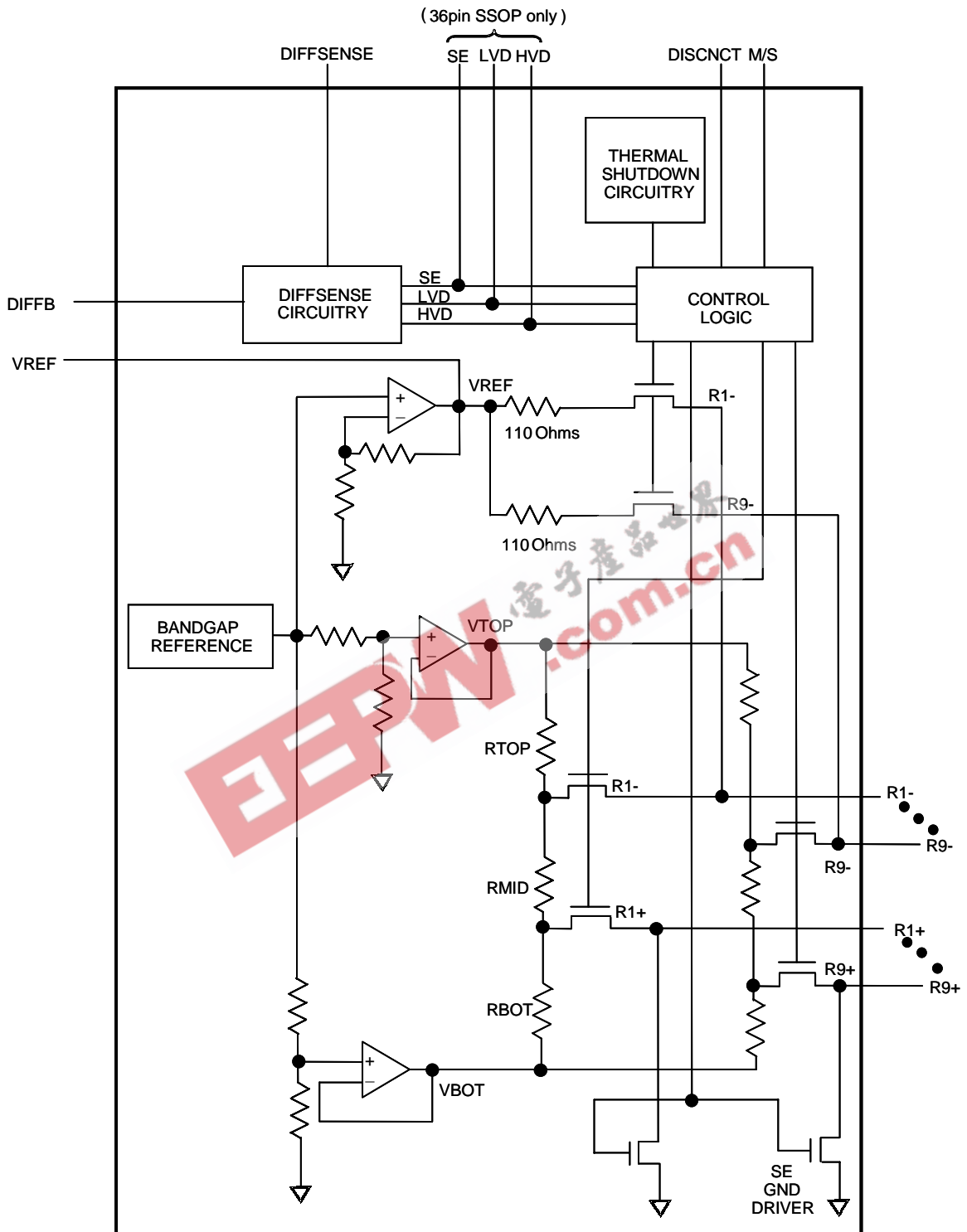
### Note:

DIFFSENS—Refers to the SCSI bus signal.

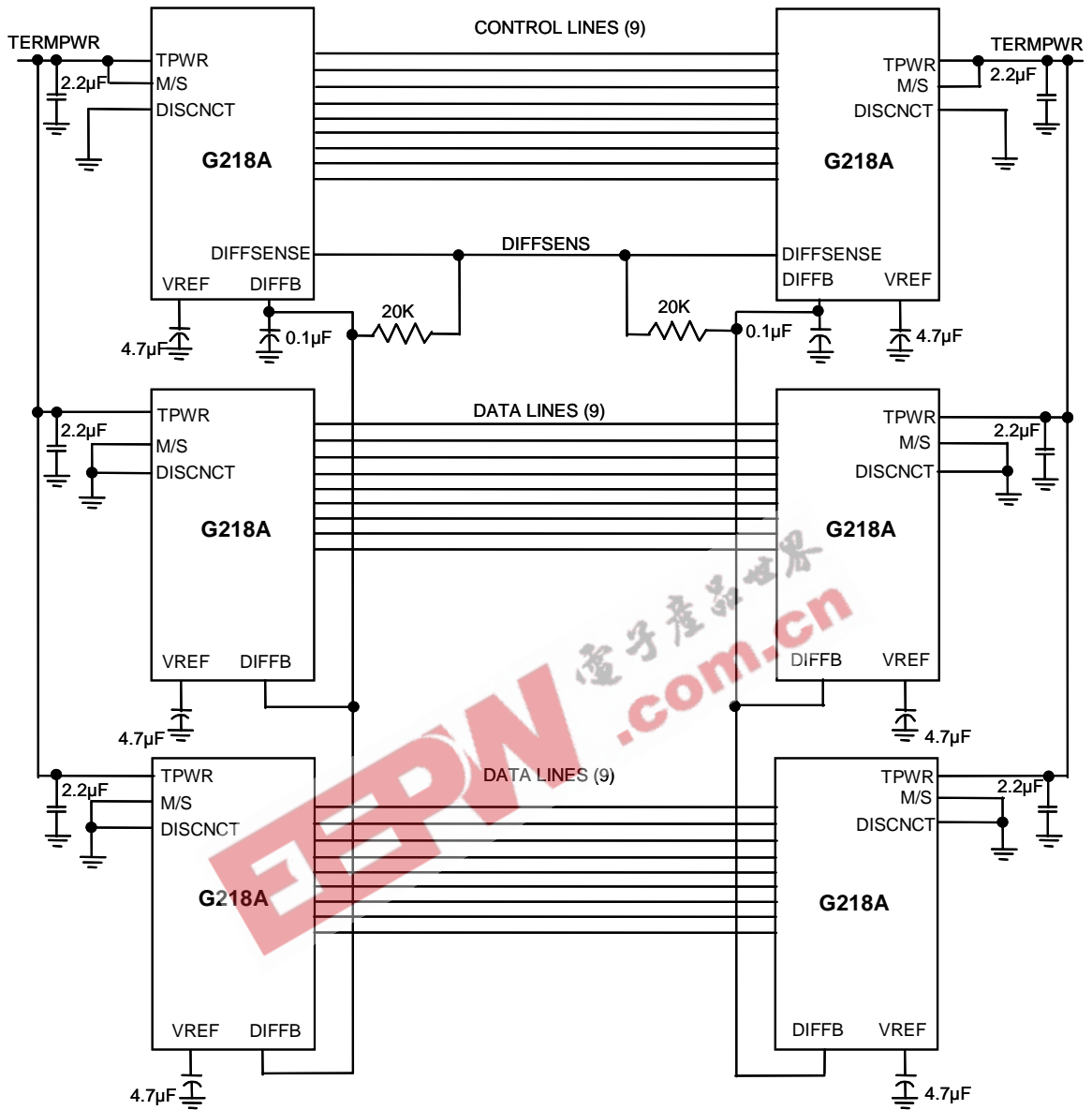
DIFFSENSE—Refers to the G218A pin name and internal circuitry relating to differential sensing.

DIFFB—Refers to the G218A pin name and internal circuitry relating to monitoring the DIFFSENS line.

G218A Block Diagram (Figure 1)



SCSI Bus Configuration (Figure 2)





## Pin Description (for 28pin SSOP)

PIN	SYMBOL	DESCRIPTION
1	VREF*	<b>Reference Voltage.</b> 2.85-volt reference; a regulator bypass, must be connected to a 4.7 $\mu$ F capacitor.
2-5,7-12, 18-21, 23-26	Rx+, Rx-	<b>Signal Termination.</b> (X=1,2,3,.....9) Rx+: Ground line for single-ended or positive line for differential applications for the SCSI bus. Rx-: Signal line/active line for single-ended or negative line in differential applications for the SCSI bus.
6,22	NC	<b>No Connect.</b> Do not connect these pins.
13	DISCNCT	<b>Disconnect.</b> When pulled high, the G218 isolates its bus pins (Rx+, Rx-) from the SCSI bus.
14	GND	<b>Ground.</b> Terminator ground pin. Connected to ground.
15	M/S	<b>Master/slave.</b> Used to select which terminator is the controlling device. M/S pin high enables the DIFFSENSE driver.
16	DIFFSENSE	Output to drive the SCSI bus DIFFSENS line.
17	DIFFB	DIFFB pin should be connected to a 0.1 $\mu$ F capacitor to GND and 20k resistor to SCSI/Bus DIFFSENS line. An input pin to detect the type of device (differential or single-ended) on the SCSI bus.
27,28	TPWR	<b>Terminator Power.</b> Connect to the SCSI TERMPWR line and de-couple with a 2.2 $\mu$ F capacitor.

\*The VREF keeps the level at 2.85 volt, despite the DISCNCT pin is asserted or not; even the termination mode is changed.

## (36pin SSOP)

PIN	SYMBOL	DESCRIPTION
1	VREF*	<b>Reference Voltage.</b> 2.85-volt reference; a regulator bypass, must be connected to a 4.7 $\mu$ F capacitor.
2,3	NC	<b>No Connect.</b> Do not connect these pins.
4-7,11-16, 22-25, 29-32	Rx+ Rx-	<b>Signal Termination.</b> (X=1,2,3,.....9) Rx+: Ground line for single-ended or positive line for differential applications for the SCSI bus. Rx-: Signal line/active line for single-ended or negative line in differential applications for the SCSI bus.
8, 9,10,26, 27,28	HS/GND	<b>Heat Sink Ground.</b> Connect to large area PC board traces to increase power dissipation capability.
17	DISCNCT	<b>Disconnect.</b> When pulled high, the G218 isolates its bus pins (Rx+, Rx-) from the SCSI bus.
18	GND	<b>Ground.</b> Terminator ground pin. Connected to ground.
19	M/S	<b>Master/slave.</b> Mode select for the non controlling terminator. MSTR enables the DIFFSENSE driver.
20	DIFFSENSE	Output to drive the SCSI bus DIFFSENS line.
21	DIFFB	DIFFB pin should be connected to a 0.1 $\mu$ F capacitor to GND and 20k resistor to SCSI/Bus DIFFSENS line. An input pin to detect the type of device (differential or single-ended) on the SCSI bus.
33	SE	<b>Single ended mode indicator.</b> It is HIGH when terminator is operating in SE mode.
34	LVD	<b>Low Voltage Differential mode indicator.</b> It is HIGH when terminator is operating in LVD mode.
35	HVD	<b>High Voltage Differential mode indicator.</b> It is HIGH when terminator is operating in HVD mode or thermal shutdown.
36	TPWR	<b>Terminator Power.</b> Connect to SCSI bus TERMPWR line and decouple with 2.2 $\mu$ F capacitor.

\*The VREF keeps the level at 2.85 volt, despite the DISCNCT pin is asserted or not; even the termination mode is changed.

**Recommended Operating Conditions**

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Termpower Voltage	$V_{tpwr}$	4.5	5	5.50	V	
Logic 0	$V_{il}$	-0.3		+0.8	V	
Logic 1	$V_{ih}$	2.0		$V_{tpwr}+0.3$	V	
Operating Temperature	$T_{amb}$	0		70	°C	

**Single Ended Characteristics**

(0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
SE Termination Resistance	Rse	104.5	110	115.5	Ohms	Vline = 0-3.0 volts
SE Voltage Reference	Vref	2.79	2.85	2.93	Volts	
SE output Current	Iose			25.4	mA	Vline = 0.2 volts

**Low Voltage Differential Characteristics**

(0°C to 70°C)

PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Differential Mode Termination Resistance	Rdm	100	105	110	Ohms	
Common Mode Termination Resistance	Rcm	110	150	190	Ohms	
Differential Mode Bias	Vdm	100	112	125	mV	All lines Open
Common Mode Bias	Vcm	1.125	1.25	1.375	V	

**DC Characteristics**

(0°C to 70°C)

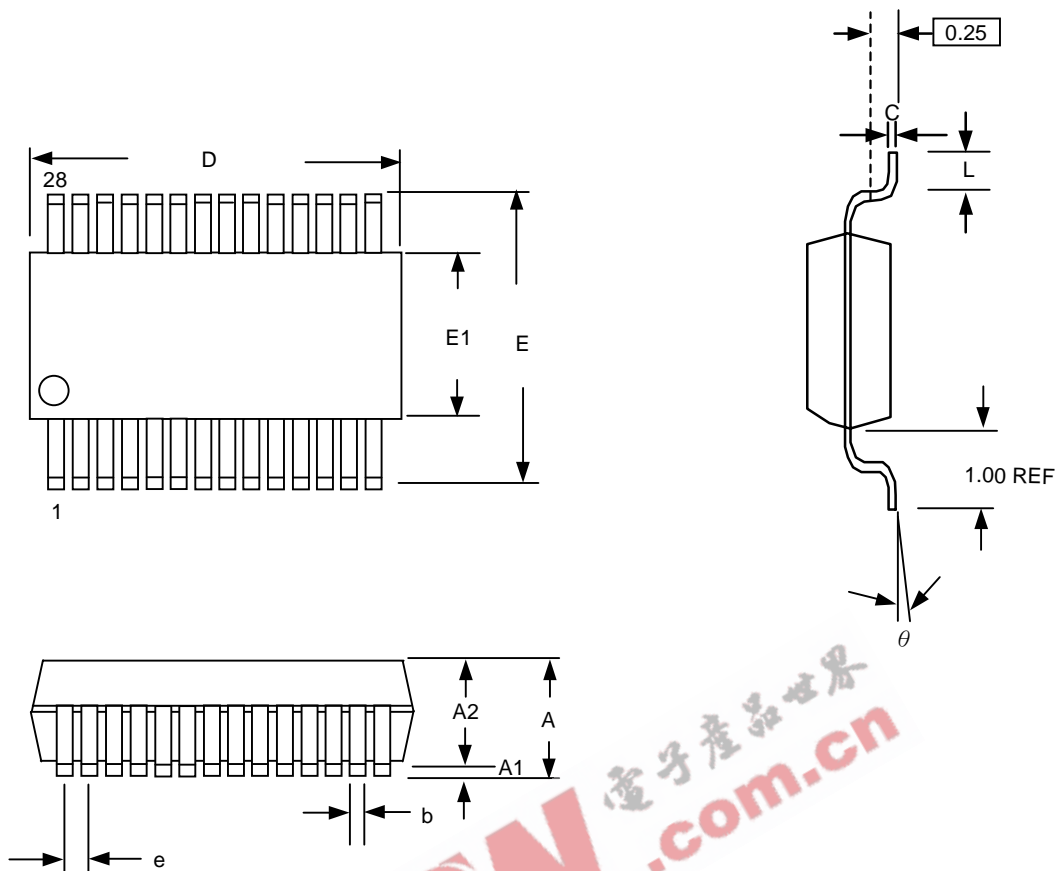
PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Termpower Current	$I_{tpmr}$		35		mA	All lines Open
Input Leakage High	$I_{ih}$	-1.0			μA	
Input Leakage Low	$I_{il}$			1.0	μA	
Output Current High	$I_{oh}$	-1.0			mA	$V_{out} = 2.4$ volts; SE/LVD/HVD Pins only
Output Current Low	$I_{ol}$	4.0			mA	$V_{out}=0.4$ volts; SE/LVD/HVD Pins only
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	
DIFFSENS Driver Output Voltage	$V_{dso}$	1.2		1.4	V	M/S=1; $I_{ds} = 0-5$ mA
DIFFSENSE Driver Source Current	$I_{dsh}$		5	15	mA	M/S = 1; $V_{dso}=0$ V
DIFFSENSE Driver Sink Current	$I_{dsl}$	20		200	μA	M/S=1; $V_{dso}=2.75$ V

**Regulator Characteristics**

(0°C to 70°C)

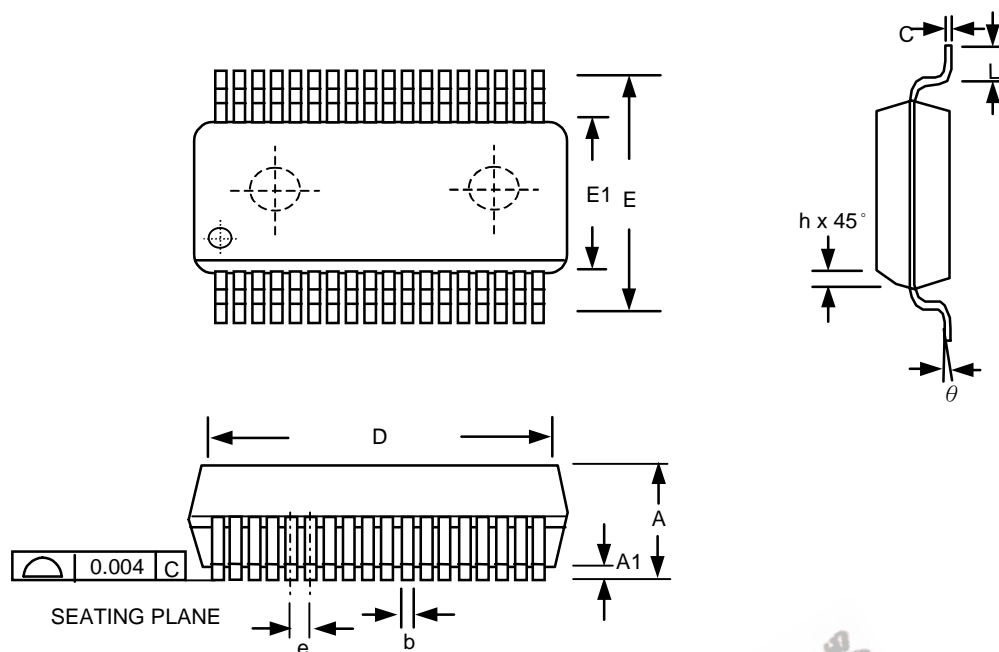
PARAMETER	SYMBOL	MIN	TYP	MAX	UNITS	NOTES
Line Regulation	$L_{REG}$		1.0	2.0	%	
Load Regulation	$LO_{REG}$		1.3	3.0	%	
Current Limit	$I_{LIM}$		350		mA	
Sink Current	$I_{SINK}$	200			mA	

## Package Information (28 pin SSOP)



Symbol	Dimension in mm			Dimension in inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	1.35	1.60	1.75	0.053	0.064	0.069
A1	0.10	-----	0.25	0.004	-----	0.010
A2	-----	1.45	-----	-----	0.057	-----
b	0.20	0.25	0.30	0.008	0.010	0.012
C	0.19	-----	0.25	0.007	-----	0.010
D	9.80	-----	10.00	0.386	-----	0.394
E	5.80	-----	6.20	0.228	-----	0.244
E1	3.80	-----	4.00	0.150	-----	0.157
e	-----	0.64	-----	-----	0.025	-----
L	0.40	-----	1.27	0.016	-----	0.050
y	-----	-----	0.10	-----	-----	0.004
$\theta$	0°	-----	8°	0°	-----	8°

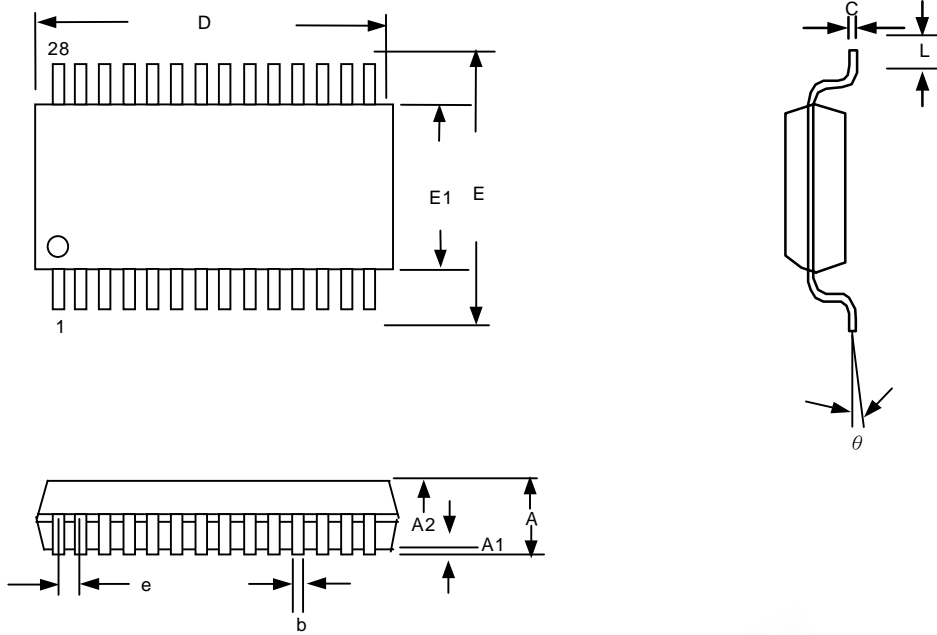
36 pin SSOP



Symbol	Dimension in mm			Dimension in inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.413	2.591	2.794	0.095	0.102	0.110
A1	0.203	0.305	0.406	0.008	0.012	0.016
b	0.300		0.450			0.018
c	0.127		0.254	0.005		0.010
D	15.748	15.875	16.002	0.620	0.625	0.630
e	0.800 BASIC			0.032 BASIC		
E	10.033		10.668	0.395		0.420
E1	7.391	7.493	7.595	0.291	0.295	0.289
h	0.381		0.635	0.015		0.025
L	0.508		1.016	0.020		0.040
theta	0		8	0		8



**28 pin TSSOP**



**Note:**

1. Package body sizes exclude mold flash protrusions or gate burrs
2. Tolerance  $\pm 0.1\text{mm}$  unless otherwise specified
3. Coplanarity : 0.1mm
4. Controlling dimension is millimeter converted inch dimensions are not necessarily exact.
5. Followed from JEDEC MO-153

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	----	----	1.20	----	----	0.048
A1	0.05	----	0.15	0.002	----	0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	----	0.30	0.007	----	0.012
C	0.09	----	0.20	0.004	----	0.008
D	9.60	9.70	9.80	0.378	0.382	0.386
E	----	6.40	----	----	0.252	----
E1	4.30	4.40	4.50	0.169	0.173	0.177
e	----	0.65	----	----	0.026	----
L	0.45	0.60	0.75	0.018	0.024	0.030
y	----	----	0.10	----	----	0.004
$\theta$	0°	----	8°	0°	----	8°

**Taping Specification**

