



## XDSL LINE DRIVER

PRELIMINARY DATA

- LOW NOISE :  $4\text{nV}/\sqrt{\text{Hz}}$
- HIGH PEAK OUTPUT CURRENT: 500 mA
- HIGH SPEED
  - 140MHz Gain Bandwidth
  - 30MHz Gain Flatness
  - 400 V/us Slew Rate
- LOW POWER OPERATION
  - $\pm 5\text{V}$  to  $\pm 15\text{V}$  Voltage Supply
  - 12.5 mA/Amp (typ) Supply current
  - Power reduced Current
- LOW SINGLE TONE DISTORTION
- THERMAL AND OVERLOAD PROTECTION
- HTSSOP28 PACKAGE
- -40 TO +85°C OPERATING RANGE

### DESCRIPTION

The STLC60133 is a dual amplifier featuring a high slew rate and a large bandwidth, optimized for XDSL applications. The device is available in a HTSSOP 28 pin package (4x9 mm) with an exposed leadframe.

Thanks to its small package this line driver is suitable for high density XDSL line card.



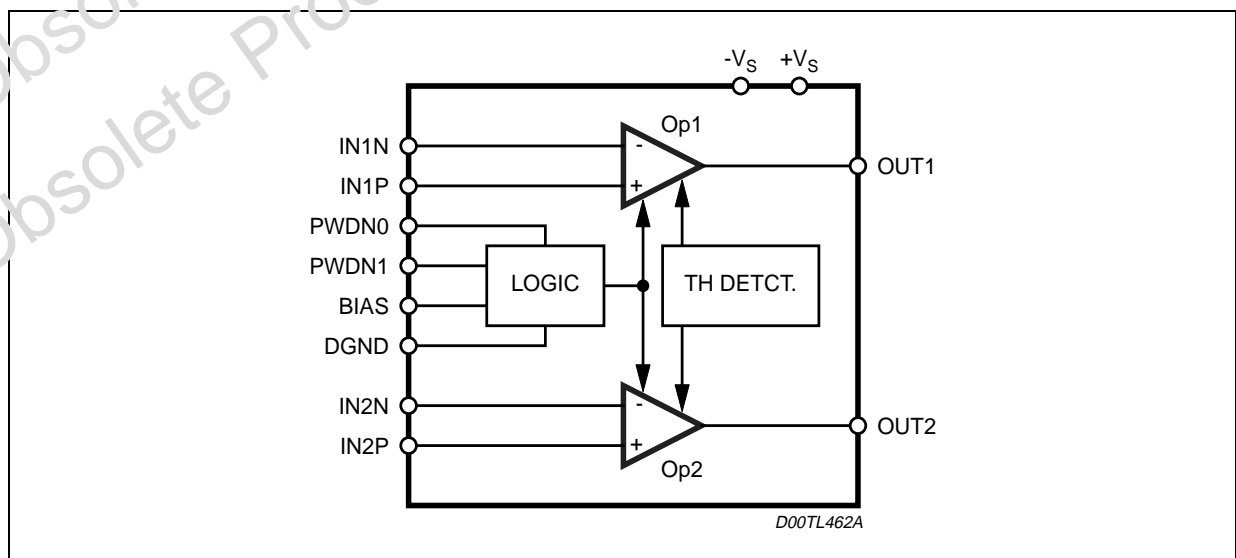
Two digital pins (PWDN0 and PWDN1) allow the driver to work in full performance mode, in low-power mode or two intermediate bias states.

The low-power mode biases the output stage in order to provide a low impedance at the amplifier outputs for back termination.

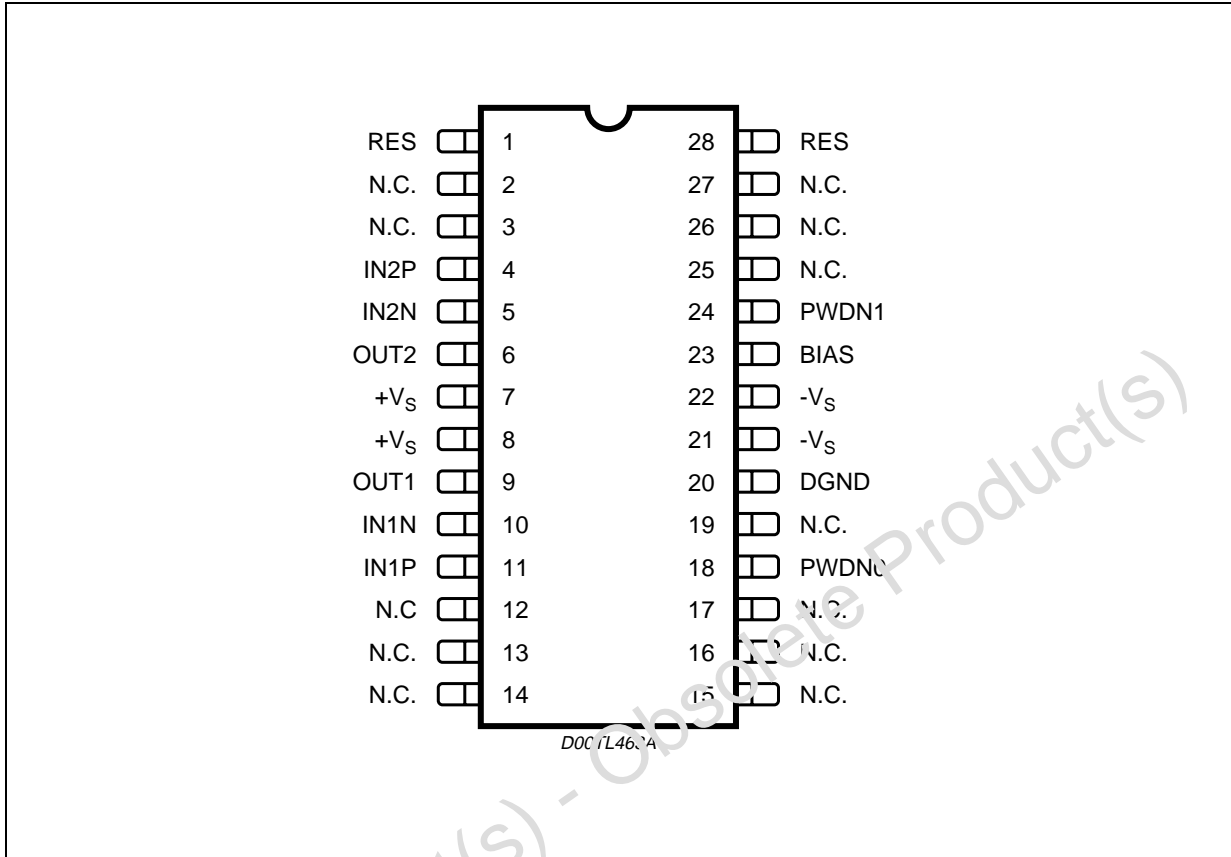
The STLC60133 is designed optimizing bandwidth and distortion performances. For proper device operating it is necessary to work with a gain level greater than 15.6dB.

Typical differential gain is normally +27dB, while typical common mode gain is 15.6dB

Figure 1. BLOCK DIAGRAM



**PIN CONNECTION**



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Positive Supply voltage (note1)	+16.5	V
$V_{SS}$	Negative Supply voltage (note1)	-16.5	V
$V_{id}$	Differential Input Voltage (note2)	$\pm 5$	V
$V_{i,c}$	Common mode Input Voltage	$\pm 1$	V
$T_{op}$	Operating Free Air Temperature Range	-40 to +85	$^{\circ}C$
$T_{stg}$	Storage temperature	-65 to +150	$^{\circ}C$
$T_j$	Junction temperature	150	$^{\circ}C$

**THERMAL DATA**

Symbol	Parameter	Value	Unit
$R_{thj-amb}$	Thermal resistance junction to ambient (note 3)	29	$^{\circ}C/W$

**OPERATING RANGE**

Symbol	Parameter	Value	Unit
T <sub>op</sub>	Operating Temperature Range	-40 to 85	°C
V <sub>CC</sub>	Positive Supply voltage (note1)	+5 to +15	V
V <sub>SS</sub>	Negative Supply voltage (note1)	-5 to -15	V
V <sub>DGND</sub>	Digital Ground level	V <sub>SS</sub> +5<V <sub>DGND</sub> <V <sub>CC</sub> -5	V
V <sub>icm</sub>	Common Mode Input Voltage Range	±1	V

**Notes**

- 1) All voltages values , except differential voltage , are with respect to network ground terminal .
- 2) Differential voltages are non-inverting input terminal with respect to the inverting input terminal
- 3) Specification is for device on a 4 layer board within 10 square inches of oz. copper at +85°C and 200m/s air velocity. With 0m/s air velocity the parameter increases up to 33°C/W

**PIN DESCRIPTION**

N°	Pin	Description
2, 3, 12, 13, 14, 15, 16, 17, 19, 25, 26, 27	NC	Not Connected
4	IN2P	Non Inverting Input of Op. Amplifier 2
5	IN2N	Inverting Input of Op. Amplifier 2
6	OUT2	Ouput of Op. Amplifier 2
7, 8	+Vs	Positive Supply Voltage
9	OUT1	Ouput of Op. Amplifier 1
10	IN1N	Inverting Input of Op. Amplifier 1
11	IN1P	Non Inverting Input of Op. Amplifier 1
14	PWDN1	Power Down 1 logic input
18	PWDN0	Power Down 0 logic input
21, 22	-Vs	Negative Supply Voltage
23	BIAS	Bias Control pin
1, 28	RES	To be left not connected

**Power Down Management**

The STLC60133 provides several quiescent bias levels from full performance, to reduced bias (in three steps through PWDN0/1 pins) or to full OFF operation (through BIAS pin). According to the different XDSL application (both site CO and CPE), different bias levels can be chosen maintaining good MTPR performances. In the following table are shown the bias levels versus the PWDN values.

PWDN1	PWDN0	Bias Level
1	1	100%
1	0	60%
0	1	40%
0	0	25% (low Zout but not OFF)
X	X	Full OFF (High Zout via 250uA pulled out of BIAS pin)



**ELECTRICAL CHARACTERISTICS**

Test Conditions: ( $V_{CC} = \pm 12V$ ,  $T_{amb} = 0$  to  $70^{\circ}C$ , Single amplifier in normal condition ( $PWDN0 = 1$ ,  $PWDN1 = 1$ ), unless otherwise specified). The limits listed below are guaranteed in the above temperature range ( $0-70^{\circ}C$ ) by specific testing at different temperature or by product characterisation.

**TRANSMISSION PATH**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
SR	Slew Rate	$G = 6$ , $V_{out} = 2V_{pp}$		400		V/us
GBW	Gain Bandwidth	$G = 6$ , $V_{out} = 2V_{pp}$ , $f = 5MHz$	90	140		MHz
THD	Single ended Distortion	$G = 6$ , $f = 1MHz$ , $V_{out} = 12V_{pp}$ , $R_I = 16.5\Omega$ $R_I = 100\Omega$	-40 -45	-47 -52		dBc
DTHD	Differential THD <sup>(2)</sup>	$G = 6$ , $f = 1MHz$ , $V_{out} = 24V_{pp}$ , $R_I = 33\Omega$ $R_I = 100\Omega$	-50 -55			dBc
IMD	Single ended IMD	$G = 6$ , $V_{out} = 3V_p$ each tone, $f = 500KHz$ , $\Delta f = 10KHz$ $R_I = 16.5\Omega$ $R_I = 100\Omega$	-50 -60	-70 -75		dBc
DIMD	Differential IMD <sup>(2)</sup>	$G = 6$ , $V_{out} = 6V_p$ each tone, $f = 500KHz$ , $\Delta f = 10KHz$ $R_I = 33\Omega$ $R_I = 100\Omega$	-66 -72			dBc
IB	Input Biasing			5		$\mu A$
OZ	Output Impedance	$PWDN0 = PWDN1 = 0$ ; $f = 1MHz$			2	$\Omega$
VN	Voltage Noise (RTI)	$f = 30KHz$		4	10	$nV/\sqrt{Hz}$
IOV	Input Offset Voltage				6	mV
ICMR	Input Common Mode Voltage Range	$f = 1 MHz$	-1		+1	V
CMRR	Common Mode Rejection Ratio	$f = 1 MHz$ , $V_{in} = 100mV$		40		dB
OVS	Output Voltage Swing	Single ended, $R_I = 100\Omega$ , $G = 6$	-10.8		+10.8	V
LOCC	Linear Output Current	Single ended, $R_I = 10\Omega$ , $G = 6$	400	600		mA
SCC	Short Circuit Current <sup>(1)</sup>	Single ended		1000	1400	mA
QC	Quiescent Current	$PWDN1, PWDN0 = 1,1$ $PWDN1, PWDN0 = 1,0$ $PWDN1, PWDN0 = 0,1$ $PWDN1, PWDN0 = 0,0$		12 8 5 4	16.2 10.7 7.5 5.3	mA/Amp
SC	Shutdown Current	250 $\mu A$ out of Bias pin		1.5	2.0	mA/Amp
PSRR	Power Supply Rejection ratio	$f = 500kHz$ , $V = 100mV$	30			dB
BIASV	Bias Pin Voltage		10	10.5		V
DCG	DC Gain			80		dB

Notes: 1. The output stage of the STLC60133 is designed for maximum load current capability. As a result, shorting the output to common can cause the STLC60133 to source or sink 1.4A.

2. Guaranteed by product characterization.

**ELECTRICAL CHARACTERISTICS**

Test conditions ( $V_{CC} = \pm 6V$ ,  $T_{amb} = 0$  to  $70^{\circ}C$ , Single amplifier in normal condition ( $PWDN0 = 1$ ,  $PWDN1 = 1$ ), unless otherwise specified.) The limits listed below are guaranteed in the above temperature range by (0-70°C) specific testing at different temperature or by product characterisation.

**TRANSMISSION PATH**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
SR	Slew Rate	$G = 6$ , $V_{out} = 2V_{pp}$		400		V/us
GBW	Gain Bandwidth	$G = 6$ , $V_{out} = 2V_{pp}$ , $f = 5MHz$	90	140		MHz
THD	Single Ended Distortion	$G = 6$ , $f = 1MHz$ , $V_{out} = 6V_{pp}$ , $R_I = 25\Omega$ $R_I = 100\Omega$	-40 -45	-46 -51		dBc
DTHD	Differential THD <sup>(2)</sup>	$G = 6$ , $f = 1MHz$ , $V_{out} = 12V_{pp}$ , $R_I = 25\Omega$ $R_I = 100\Omega$	-50 -55			dBc
IMD	Single Ended IMD	$G = 6$ , $V_{out} = 1.5V_p$ each tone, $f = 500KHz$ , $\Delta f = 10KHz$ $R_I = 25\Omega$ $R_I = 100\Omega$	-65 -70	-76 -81		dBc
DIMD	Differential IMD <sup>(2)</sup>	$G = 6$ , $V_{out} = 3V_p$ each tone, $f = 500KHz$ , $\Delta f = 10KHz$ $R_I = 25\Omega$ $R_I = 100\Omega$	-77 -82			dBc
IB	Input Biasing			5		$\mu A$
VN	Voltage Noise (RTI)	$f = 30KHz$		4	10	$nV/\sqrt{Hz}$
IOV	Input Offset Voltage				6	mV
ICMR	Input Common Mode Voltage Range	$f = 1 MHz$	-1		+1	V
CMRR	Common Mode Rejection Ratio	$f = 1 MHz$ , $V_{in} = 100mV$		40		dB
OVS	Output Voltage Swing	Single ended, $R_I = 100\Omega$ , $G = 6$	-5		+5	V
LOC	Linear Output Current	Single ended, $R_I = 10\Omega$ , $G = 6$	300	420		mA
SCC	Short Circuit Current <sup>(1)</sup>	Single ended,		1000	1400	mA
QC	Quiescent Current	$PWDN1, PWDN0 = 1,1$ $PWDN1, PWDN0 = 1,0$ $PWDN1, PWDN0 = 0,1$ $PWDN1, PWDN0 = 0,0$		10 7 5 3.5	13.7 9 6.5 4.5	mA/Amp
SC	Shutdown Current	250 $\mu A$ out of Bias pin		1.5	2.0	mA/Amp
PSRR	Power Supply Rejection ratio	$f = 500kHz$ , $V = 100mV$	30	40		dB
BIASV	Bias Pin Voltage		4	4.5		V
DCG	DC Gain			80		dB

Notes: 1. The output stage of the STLC60133 is designed for maximum load current capability. As a result, shorting the output to common can cause the STLC60133 to source or sink 1.4A.  
2. Guaranteed by product characterization.



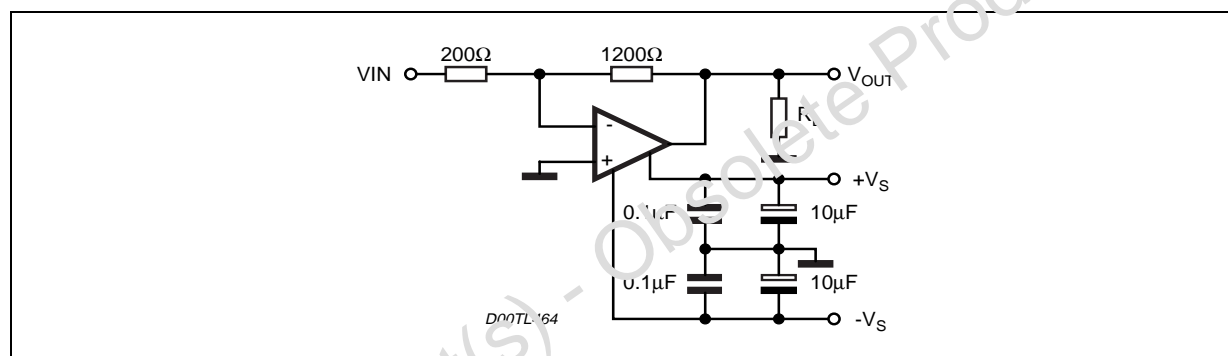
**DIGITAL INTERFACE (PWDN0, PWDN1, Vcc = ±12 V or ±6 V)**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V <sub>il</sub>	Input low voltage		0		0.8	V
V <sub>ih</sub>	Input high voltage		2.2		5.5	V

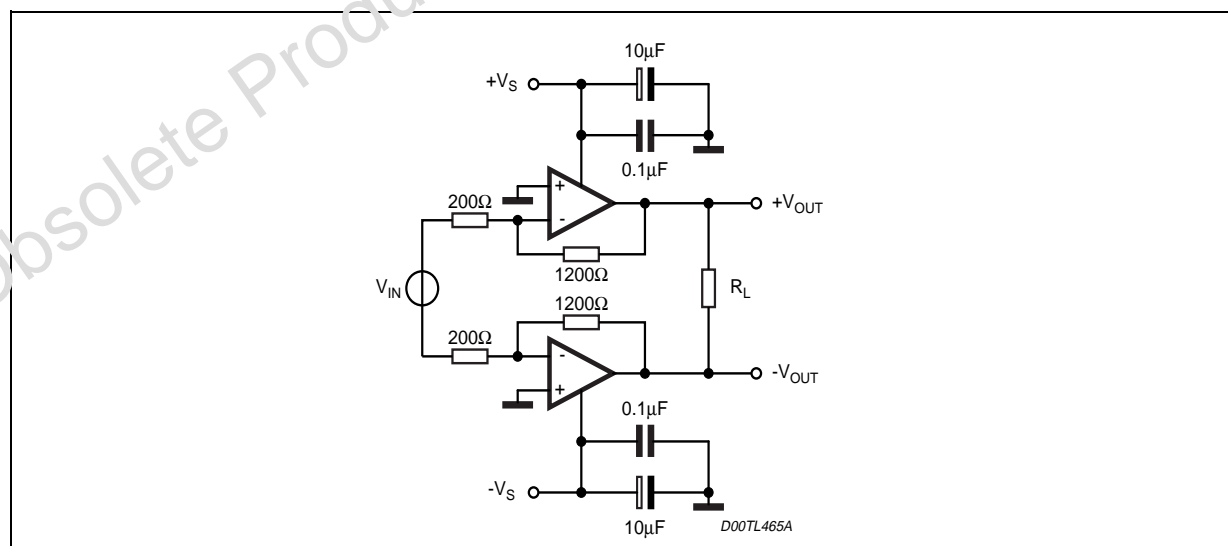
**THERMAL PROTECTION**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
T <sub>hsd</sub>	Thermal shut down threshold			160		°C
T <sub>hist</sub>	Thermal detector histeresys			15		°C

**Figure 4. Single ended Test Circuit G = 6**



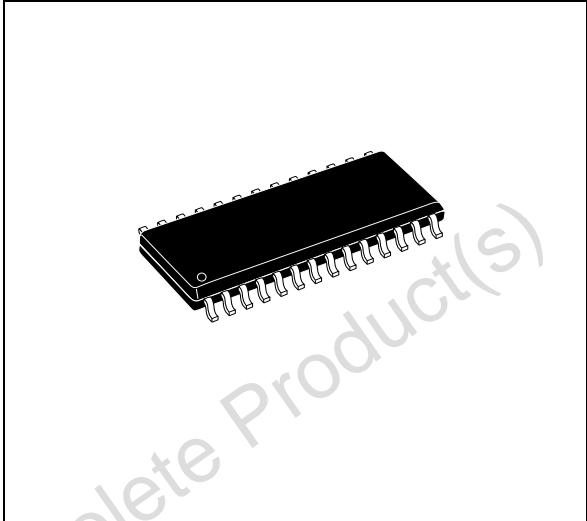
**Figure 5. Differential Test Circuit G = 6**



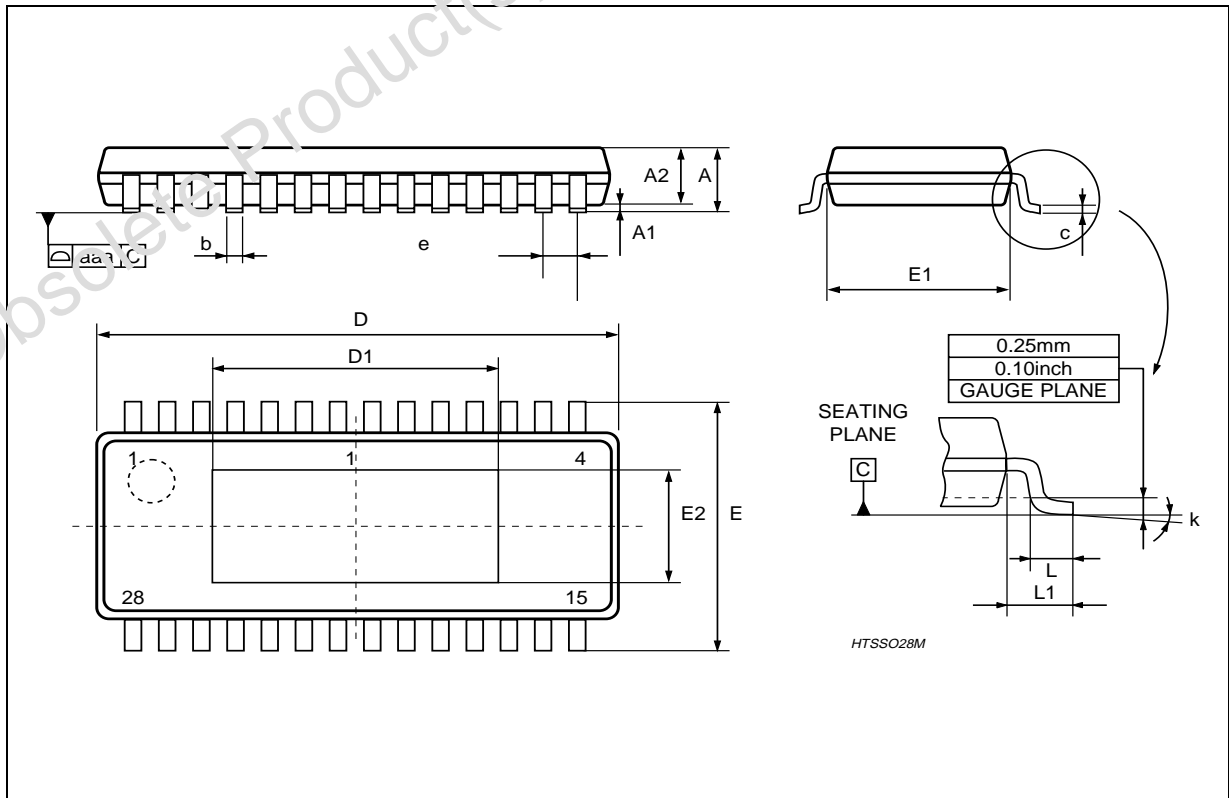
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.2			0.0
A1			0.15			0.006
A2	0.8	1.0	1.05	0.031	0.039	0.041
b	0.19		0.3	0.007		0.012
c	0.09		0.2	0.003		0.008
D (*)	9.6	9.7	9.8	0.377	0.382	0.385
D1		5.5			0.216	
E	6.2	6.4	6.6	0.244	0.252	0.260
E1 (*)	4.3	4.4	4.5	0.169	0.173	0.177
E2		3.0			0.118	
e		0.65			0.026	
L	0.45	0.6	0.75	0.018	0.024	0.029
L1		1.0			0.039	
k	0° (min), 8° (max)					
aaa		0.1			0.004	

(\*) Dimensions D and E1 does not include mold flash or protusions. Mold flash or protusions shall not exceed 0.15mm per side.

**OUTLINE AND MECHANICAL DATA**



**HTSSOP28 (Exposed Pad)**





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