



ST3243E

$\pm 15\text{KV}$ ESD PROTECTED 3 TO 5.5V, 400KBPS, RS-232 TRANSCEIVER WITH AUTO-POWERDOWN

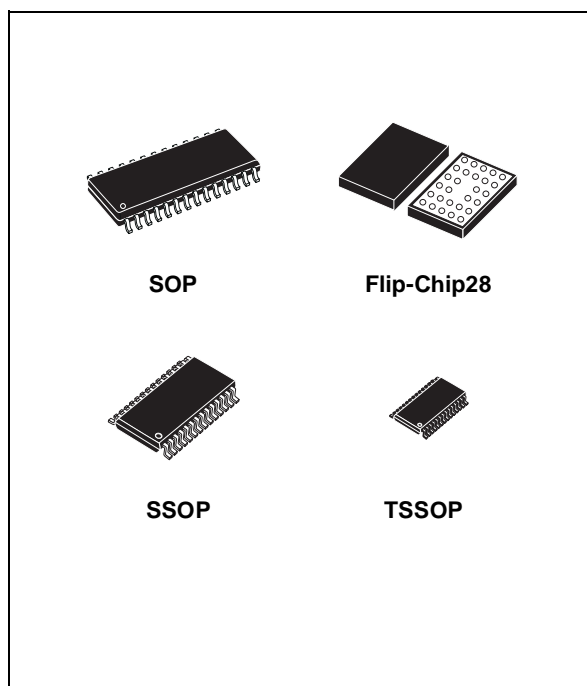
- ESD PROTECTION FOR RS-232 I/O PINS:
 $\pm 8\text{KV}$ IEC 1000-4-2 CONTACT DISCHARGE
 $\pm 15\text{KV}$ HUMAN BODY MODEL
- $1\mu\text{A}$ SUPPLY CURRENT ACHIEVED WHEN
IN AUTO-POWERDOWN
- 250Kbps MINIMUM GUARANTEED DATA
RATE
- GUARANTEED $6\text{V}/\mu\text{s}$ SLEW RATE RANGE
- GUARANTEED MOUSE DRIVEABILITY
- $0.1\mu\text{F}$ EXTERNAL CAPACITORS
- MEET EIA/TIA-232 SPECIFICATIONS DOWN
TO 3V
- AVAILABLE IN SO-28, SSOP-28, TSSOP28
AND FLIP-CHIP28 PACKAGES

DESCRIPTION

The ST3243E device consists of 3 drivers, 5 receivers and a dual charge-pump circuit. The device meets the requirements of EIA/TIA and V.28/V.24 communication standards providing high data rate capability and enhanced electrostatic discharge (ESD) protection. All transmitter outputs and receiver input are protected to $\pm 8\text{KV}$ USING IEC 1000-4-2 contact discharge and $\pm 15\text{KV}$ using the Human Body Model. The receiver R2 is always active to implement a wake-up feature for serial port.

The ST3243E has a proprietary low-dropout transmitter output stage enabling true RS-232 performance from a 3.0V to 5.5V supply with a dual charge pump. The device is guaranteed to run at data rates of 250kbps while maintaining RS-232 output levels.

The Auto-powerdown feature functions when FORCEON is low and $\overline{\text{FORCEOFF}}$ is high. During this mode of operation, if the device does not sense a valid RS-232 signal, the driver outputs are



disabled. If $\overline{\text{FORCEOFF}}$ is set low, both drivers and receivers (except R2B) are shut off, and supply current is reduced to $1\mu\text{A}$. Disconnecting the serial port or turning off the peripheral drives causes the auto-powerdown condition to occur.

Auto-powerdown can be disabled when FORCEON and $\overline{\text{FORCEOFF}}$ are high, and should be done when driving a serial mouse. With Auto-powerdown enabled, the device is activated automatically when a valid signal is applied to any receiver input.

Typical application are in notebook, subnotebook, palmtop computers, battery-powered equipment, hand-held equipment, peripherals and printers.

ORDERING CODES

Type	Temperature Range	Package	Comments
ST3243ECD	0 to 70 °C	SO-28 (Tube)	27parts per tube / 12tube per box
ST3243EBD	-40 to 85 °C	SO-28 (Tube)	27parts per tube / 12tube per box
ST3243ECDR	0 to 70 °C	SO-28 (Tape & Reel)	1000 parts per reel
ST3243EBDR	-40 to 85 °C	SO-28 (Tape & Reel)	1000 parts per reel
ST3243ECPR	0 to 70 °C	SSOP-28 (Tape & Reel)	1350 parts per reel
ST3243EBPR	-40 to 85 °C	SSOP-28 (Tape & Reel)	1350 parts per reel
ST3243ECTR	0 to 70 °C	TSSOP28 (Tape & Reel)	2500 parts per reel
ST3243EBTR	-40 to 85 °C	TSSOP28 (Tape & Reel)	2500 parts per reel
ST3243ECJ	0 to 70 °C	FLIP-CHIP28	coming soon
ST3243EBJ	-40 to 85 °C	FLIP-CHIP28	coming soon

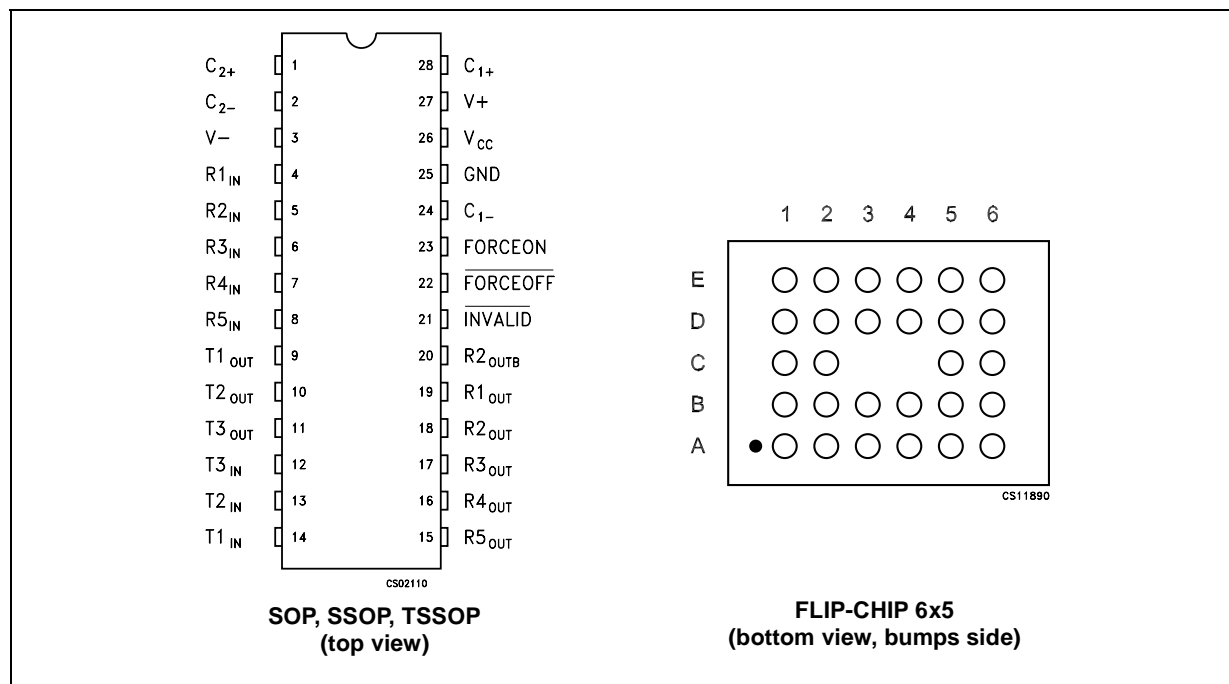
PIN DESCRIPTION

PIN N°	SYMBOL	NAME AND FUNCTION
1	C ₂ ⁺	Positive Terminal of Inverting Charge Pump Capacitor
2	C ₂ ⁻	Negative Terminal of Inverting Charge Pump Capacitor
3	V ⁻	-5.5V Generated by the Charge Pump
4	R ₁ IN	First Receiver Input Voltage
5	R ₂ IN	Second Receiver Input Voltage
6	R ₃ IN	Third Receiver Input Voltage
7	R ₄ IN	Fourth Receiver Input Voltage
8	R ₅ IN	Fifth Receiver Input Voltage
9	T ₁ OUT	First Transmitter Output Voltage
10	T ₂ OUT	Second Transmitter Output Voltage
11	T ₃ OUT	Third Transmitter Output Voltage
12	T ₃ IN	Third Transmitter Input Voltage
13	T ₂ IN	Second Transmitter Input Voltage
14	T ₁ IN	First Transmitter Input Voltage
15	R ₅ OUT	Fifth Receiver Output Voltage
16	R ₄ OUT	Fourth Receiver Output Voltage
17	R ₃ OUT	Third Receiver Output Voltage
18	R ₂ OUT	Second Receiver Output Voltage
19	R ₁ OUT	First Receiver Output Voltage
20	R ₂ OUTB	Non-inverting Complementary Receiver Output, always active for wake-up
21	INVALID	Output of the valid signal detector. Indicates if a valid RS-232 level is present on receiver inputs logic "1"
22	FORCEOFF	Drive low to shut down transmitters and on-board power supply. This over-rides all automatic circuitry and FORCEON
23	FORCEON	Drive high to override automatic circuitry keeping transmitters on (FORCEOFF must be high)
24	C ₁ ⁻	Negative Terminal of Voltage- Charge Pump Capacitor
25	GND	Ground
26	V _{CC}	Supply Voltage
27	V ⁺	5.5V Generated by the Charge Pump
28	C ₁ ⁺	Positive Terminal of Voltage- Charge Pump Capacitor

PIN DESCRIPTION

PIN N°	SYMBOL	NAME AND FUNCTION
A1	R2 _{IN}	Second Receiver Input Voltage
A2	R3 _{IN}	Third Receiver Input Voltage
A3	R4 _{IN}	Fourth Receiver Input Voltage
A4	R5 _{IN}	Fifth Receiver Input Voltage
A5	T1 _{OUT}	First Transmitter Output Voltage
A6	T2 _{OUT}	Second Transmitter Output Voltage
B1	V-	-5.5V Generated by the Charge Pump
B2	R1 _{IN}	First Receiver Input Voltage
B3	T3 _{OUT}	Third Transmitter Output Voltage
B4	T3 _{IN}	Third Transmitter Input Voltage
B5	T1 _{IN}	First Transmitter Input Voltage
B6	T2 _{IN}	Second Transmitter Input Voltage
C1	C ₂ ⁺	Positive Terminal of Inverting Charge Pump Capacitor
C2	C ₂ ⁻	Negative Terminal of Inverting Charge Pump Capacitor
C5	R4 _{OUT}	Fourth Receiver Output Voltage
C6	R5 _{OUT}	Fifth Receiver Output Voltage
D1	C ₁ ⁺	Positive Terminal of Voltage- Charge Pump Capacitor
D2	V+	5.5V Generated by the Charge Pump
D3	V _{CC}	Supply Voltage
D4	FORCEON	Drive high to override automatic circuitry keeping transmitters on (FORCEOFF must be high)
D5	R1 _{OUT}	First Receiver Output Voltage
D6	R3 _{OUT}	Third Receiver Output Voltage
E1	GND	Ground
E2	C ₁ ⁻	Negative Terminal of Voltage- Charge Pump Capacitor
E3	FORCEOFF	Drive low to shut down transmitters and on-board power supply. This over-rides all automatic circuitry and FORCEON
E4	INVALID	Output of the valid signal detector. Indicates if a valid RS-232 level is present on receiver inputs logic "1"
E5	R2 _{OUTB}	Non-inverting Complementary Receiver Output, always active for wake-up
E6	R2 _{OUT}	Second Receiver Output Voltage

PIN CONFIGURATION



INVALID TRUTH TABLE

RS-232 SIGNAL PRESENT AT ANY RECEIVER INPUT	INVALID OUTPUT
YES	H
NO	L

OUTPUT CONTROL TRUTH TABLE

FORCE ON	FORCE OFF	VALID RECEIVER LEVEL	OPERATION STATUS	T _{OUT}	R _{OUT}	R _{2OUTB}
X	0	X	Shutdown (Force OFF)	HIGH Z	HIGH Z	ACTIVE
1	1	X	Normal Operating (Force ON)	ACTIVE	ACTIVE	ACTIVE
0	1	YES	Normal Operating (Auto-powerdown)	ACTIVE	ACTIVE	ACTIVE
0	1	NO	Shutdown (Auto-powerdown)	HIGH Z	ACTIVE	ACTIVE

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	-0.3 to 6	V
V+	Doubled Voltage Terminal	($V_{CC} - 0.3$) to 7	V
V-	Inverted Voltage Terminal	0.3 to -7	V
$V+ + V- $		13	V
FORCEON, FORCEOFF, T_{IN}	Input Voltage	-0.3 to 6	V
R_{IN}	Receiver Input Voltage Range	± 25	V
T_{OUT}	Transmitter Output Voltage Range	± 13.2	V
R_{OUT} R_{OUTB} INVALID	Receiver Output Voltage Range	-0.3 to ($V_{CC} + 0.3$)	V
t_{SHORT}	Short Circuit Duration on T_{OUT} (one at a time)	Continuous	
T_{stg}	Storage Temperature Range	-65 to 150	°C

Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

ESD PERFORMANCE: TRANSMITTER OUTPUTS, RECEIVER INPUTS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
ESD	ESD Protection Voltage	Human Body Model	± 15			KV
ESD	ESD Protection Voltage	IEC 1000-4-2 (Contact Discharge)	± 8			KV

ELECTRICAL CHARACTERISTICS

($C_1 - C_4 = 0.1\mu F$, $V_{CC} = 3V$ to $5.5V$, $T_A = -40$ to $85^\circ C$, unless otherwise specified.

Typical values are referred to $T_A = 25^\circ C$)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{ASHDN}	Supply Current Auto-powerdown	FORCEOFF = GND FORCEON = V_{CC} All R_{IN} open or grounded		1	10	μA
I_{SUPPLY}	Supply Current	FORCEON = FORCEOFF = V_{CC}		0.3	1	mA
I_{SHDN}	Shutdown Supply Current	FORCEOFF = GND		1	10	μA

LOGIC INPUT ELECTRICAL CHARACTERISTICS

($C_1 - C_4 = 0.1\mu F$, $V_{CC} = 3V$ to $5.5V$, $T_A = -40$ to $85^\circ C$, unless otherwise specified.

Typical values are referred to $T_A = 25^\circ C$)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_{TIL}	Input Logic Threshold Low	T-IN, FORCEON, FORCEOFF			0.8	V
V_{TIH}	Input Logic Threshold High	T-IN, FORCEON, FORCEOFF $V_{CC} = 3.3V$ $V_{CC} = 5V$	2 2.4			V V
V_{THYS}	Transmitter Input Hysteresis			0.5		V
I_{IL}	Input Leakage Current	T-IN, FORCEON, FORCEOFF		± 0.01	± 1.0	μA
I_{OL}	Output Leakage Current	Receiver Disabled		± 0.05	± 10	μA
V_{OL}	Output Voltage Low	$I_{OUT} = 1.6mA$			0.4	V
V_{OH}	Output Voltage High	$I_{OUT} = -1mA$	$V_{CC}-0.6$	$V_{CC}-0.1$		V

AUTO-POWERDOWN ELECTRICAL CHARACTERISTICS(C₁ - C₄ = 0.1μF, V_{CC} = 3V to 5.5V, T_A = -40 to 85°C, unless otherwise specified.Typical values are referred to T_A = 25°C, FORCEON = GND, FORCEOFF = V_{CC})

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{RITE}	Receiver Input Threshold to INVALID Output Voltage HIGH (Fig. 1)	Positive Threshold			2.7	V
		Negative Threshold	2.7			V
V _{RITD}	Receiver Input Threshold to INVALID Output Voltage LOW (Fig. 1)		-0.3		0.3	V
V _{IOL}	INVALID Output Voltage LOW	I _{OUT} = 1.6mA			0.4	V
V _{IOH}	INVALID Output Voltage HIGH	I _{OUT} = -1mA	V _{CC} -0.6			V
t _{WU}	Receiver or Transmitter Edge Transmitter Enabled (Fig. 1)			100		μs
t _{invh}	Receiver Positive or Negative Threshold to INVALID HIGH (Fig. 1)			0.2		μs
t _{invL}	Receiver Positive or Negative Threshold to INVALID LOW (Fig. 1)			30		μs

TRANSMITTER ELECTRICAL CHARACTERISTICS(C₁ - C₄ = 0.1μF, V_{CC} = 3V to 5.5V, T_A = -40 to 85°C, unless otherwise specified.Typical values are referred to T_A = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{TOUT}	Output Voltage Swing	All Transmitter outputs are loaded with 3KΩ to GND	± 5	± 5.4		V
R _{OUT}	Output Resistance	V _{CC} = V+ = V- = 0V V _{OUT} = ± 2V	300	10M		Ω
I _{SC}	Output Short Circuit Current	V _{CC} = 3.3V		± 40	± 60	mA
I _L	Output Leakage Current	V _{CC} = 0 to 5.5V, trasmitter output = ± 12V, trasmitter disabled			± 25	mA
V _{OT}	Transmitter Output Voltage	T1IN = T2IN = GND, T3IN = V _{CC} T3OUT loaded with 3KΩ to GND T1OUT and T2OUT loaded with 2.5mA each	± 5			V

RECEIVER ELECTRICAL CHARACTERISTICS(C₁ - C₄ = 0.1μF, V_{CC} = 3V to 5.5V, T_A = -40 to 85°C, unless otherwise specified.Typical values are referred to T_A = 25°C)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V _{RIN}	Receiver Input Voltage Operating Range		-25		25	V
V _{RIL}	RS-232 Input Threshold Low	T _A = 25°C V _{CC} = 3.3V T _A = 25°C V _{CC} = 5.0V	0.6 0.8	1.1 1.4		V
V _{RIH}	RS-232 Input Threshold High	T _A = 25°C V _{CC} = 3.3V T _A = 25°C V _{CC} = 5.0V		1.6 1.9	2.4 2.4	V
V _{RIHYS}	Input Hysteresis			0.5		V
R _{RIN}	Input Resistance	T _A = 25°C	3	5	7	KΩ

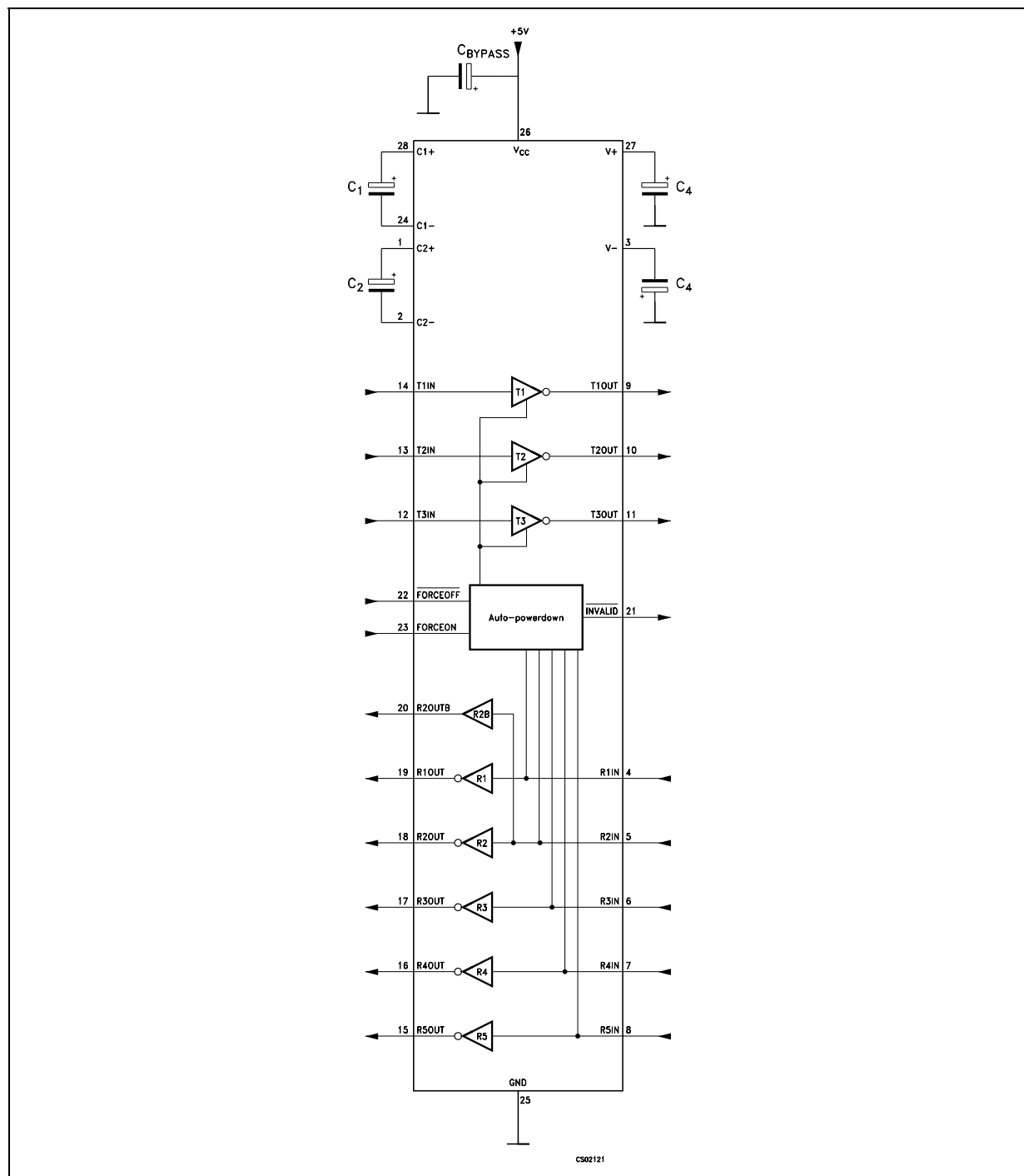
TIMING CHARACTERISTICS

($C_1 - C_4 = 0.1\mu\text{F}$, $V_{CC} = 3\text{V}$ to 5.5V , $T_A = -40$ to 85°C , unless otherwise specified.

Typical values are referred to $T_A = 25^\circ\text{C}$)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
D_R	Maximum Data Rate	$R_L = 3\text{K}\Omega$ $C_L = 1000\text{pF}$ one trasmitter switching	250	400		Kbps
t_{PHL} t_{PLH}	Receiver Propagation Delay	R_{IN} to R_{OUT} $C_L = 150\text{pF}$		0.15		μs
t_{T_SKEW}	Transmitter Skew			150		ns
t_{R_SKEW}	Receiver Skew			70		ns
S_{RT}	Transition Slew Rate	$T_A = 25^\circ\text{C}$ $R_L = 3\text{K}$ to $7\text{K}\Omega$ $V_{CC} = 3.3\text{V}$ measured from $+3\text{V}$ to -3V or -3V to $+3\text{V}$ $C_L = 150\text{pF}$ to 1000pF $C_L = 150\text{pF}$ to 2500pF	6 4		30 30	$\text{V}/\mu\text{s}$ $\text{V}/\mu\text{s}$

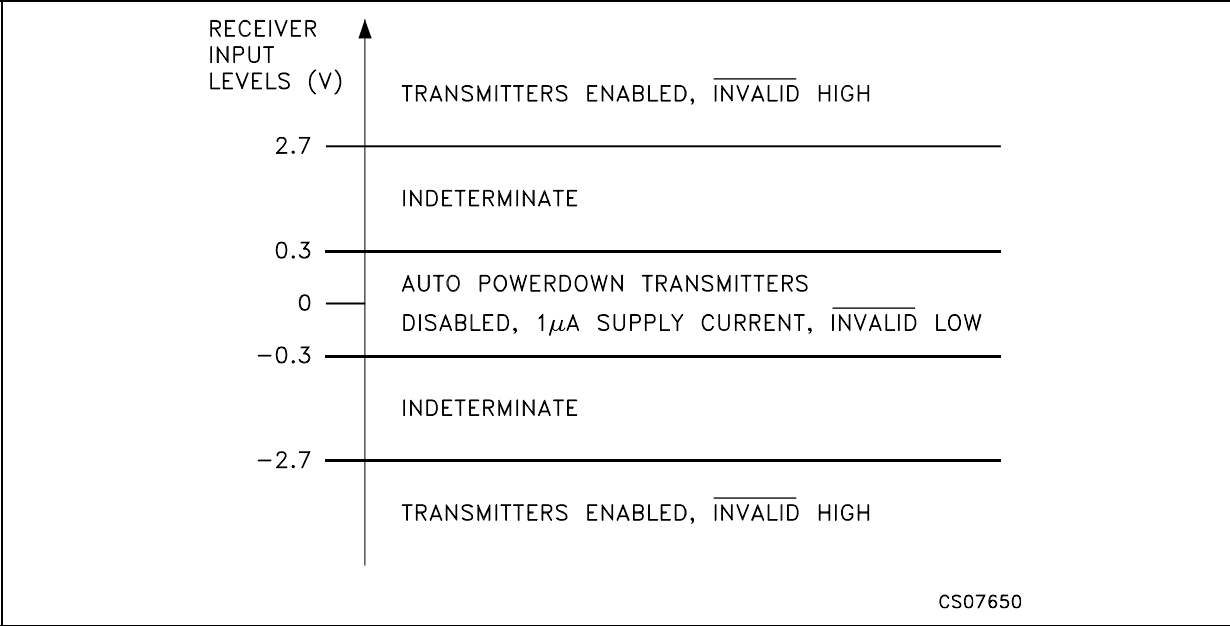
APPLICATION CIRCUITS



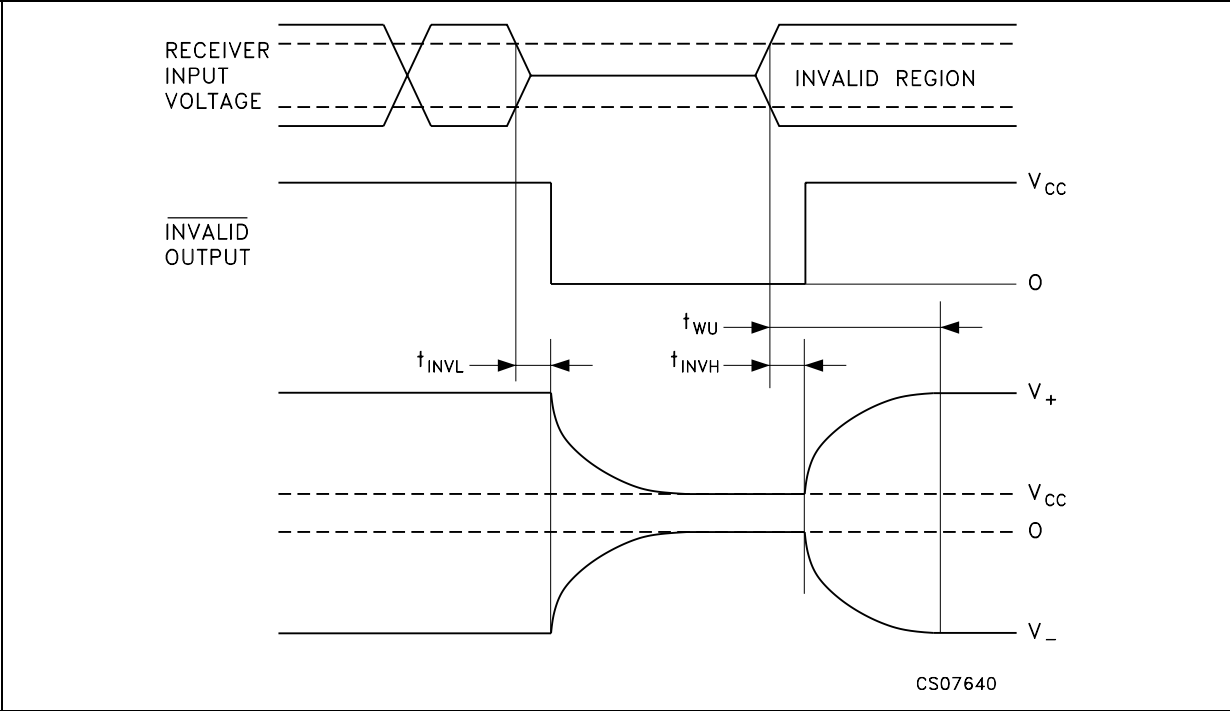
REQUIRED MINIMUM CAPACITANCE VALUE (μF)

V _{CC} (V)	C ₁	C ₂ , C ₃ , C ₄ , C _{BYPASS}
3 to 3.6	0.1	0.1
4.5 to 5.5	0.047	0.33

AUTOPOWERDOWN INPUT LEVELS

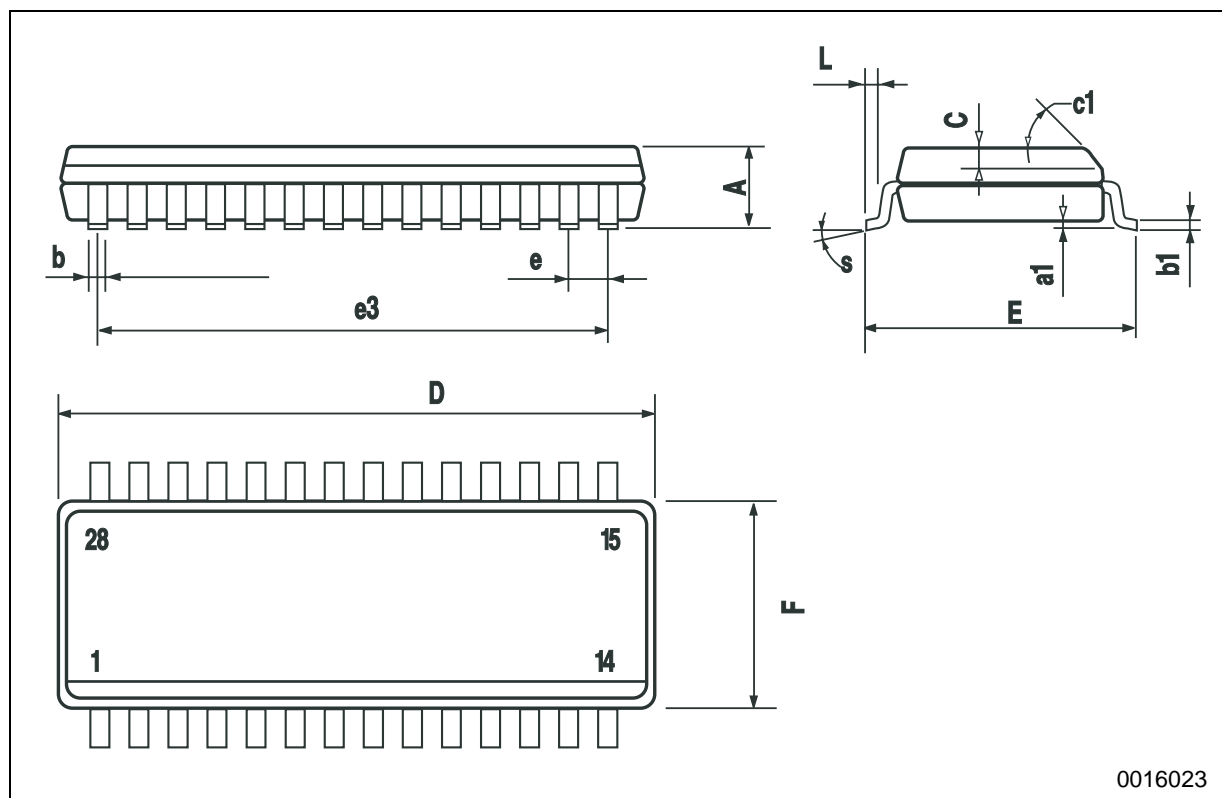


AUTOPOWERDOWN INPUT TIMING



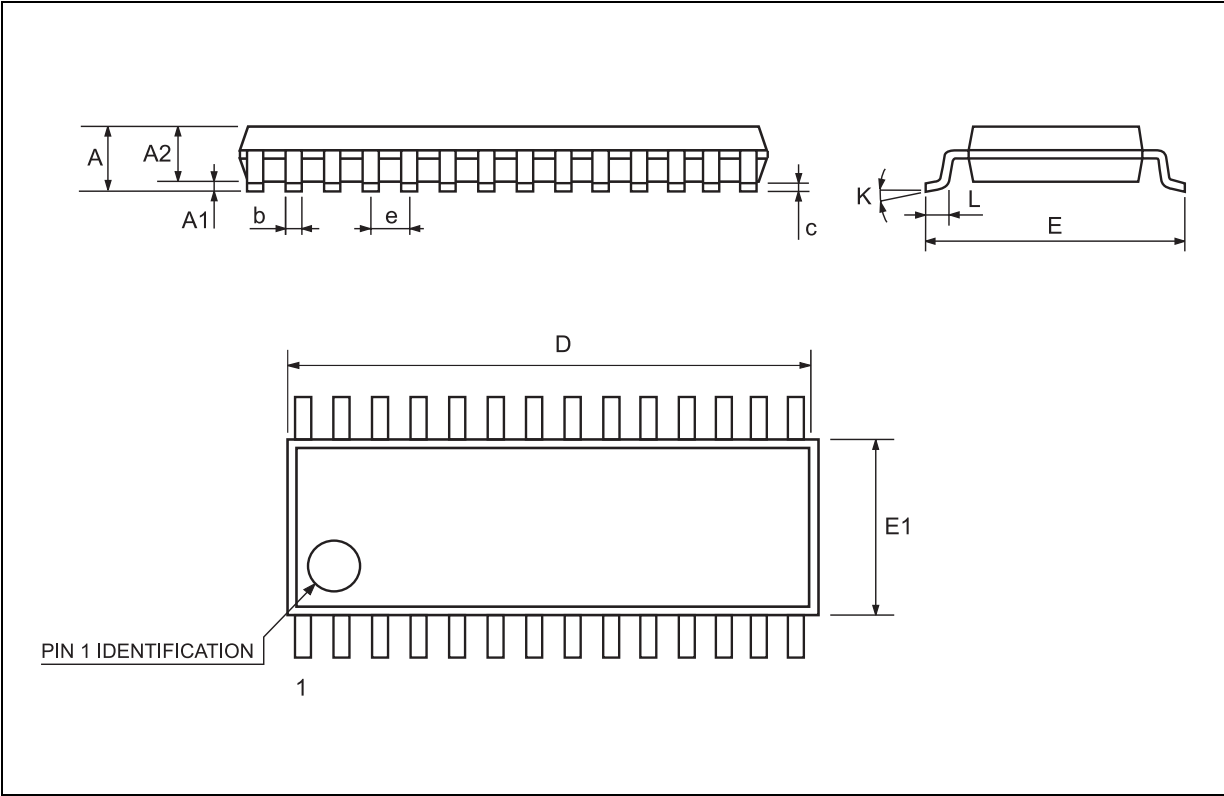
SO-28 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2.65			0.104
a1	0.1		0.3	0.004		0.012
b	0.35		0.49	0.014		0.019
b1	0.23		0.32	0.009		0.012
C		0.5			0.020	
c1	45° (typ.)					
D	17.70		18.10	0.697		0.713
E	10.00		10.65	0.393		0.419
e		1.27			0.050	
e3		16.51			0.650	
F	7.40		7.60	0.291		0.300
L	0.50		1.27	0.020		0.050
S	8° (max.)					



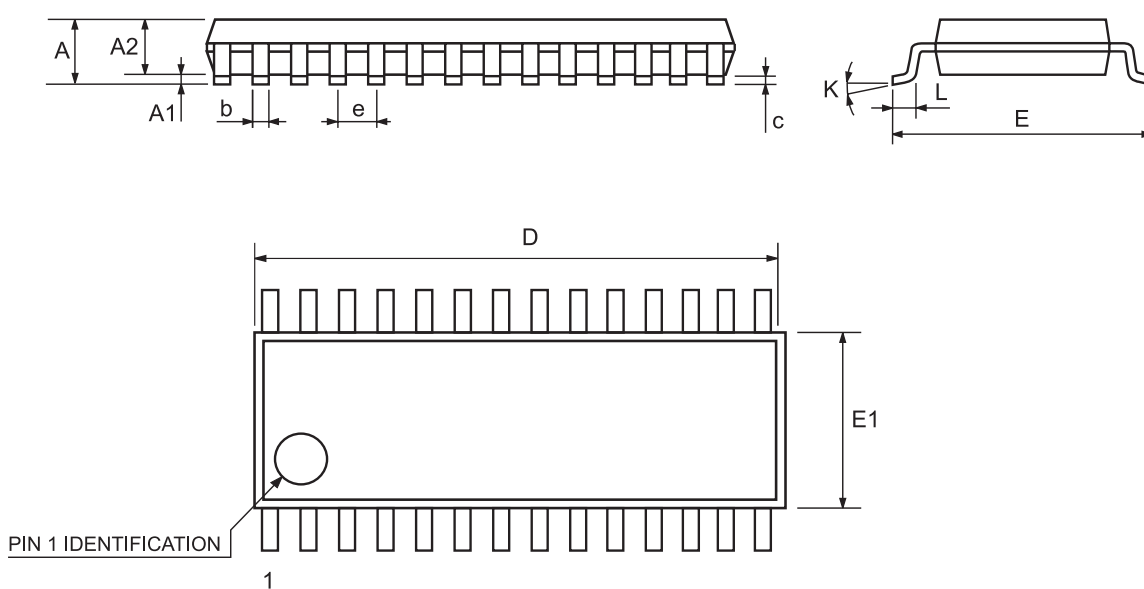
SSOP28 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			2			0.079
A1	0.050			0.002		
A2	1.65	1.75	1.85	0.065	0.069	0.073
b	0.22		0.38	0.009		0.015
c	0.09		0.25	0.004		0.010
D	9.9	10.2	10.5	0.390	0.402	0.413
E	7.4	7.8	8.2	0.291	0.307	0.323
E1	5	5.3	5.6	0.197	0.209	0.220
e		0.65 BSC			0.0256 BSC	
K	0°		10°	0°		10°
L	0.55	0.75	0.95	0.022	0.030	0.037



TSSOP28 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A			1.2			0.047
A1	0.05		0.15	0.002	0.004	0.006
A2	0.8	1	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.0079
D	9.6	9.7	9.8	0.378	0.382	0.386
E	6.2	6.4	6.6	0.244	0.252	0.260
E1	4.3	4.4	4.48	0.169	0.173	0.176
e		0.65 BSC			0.0256 BSC	
K	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030

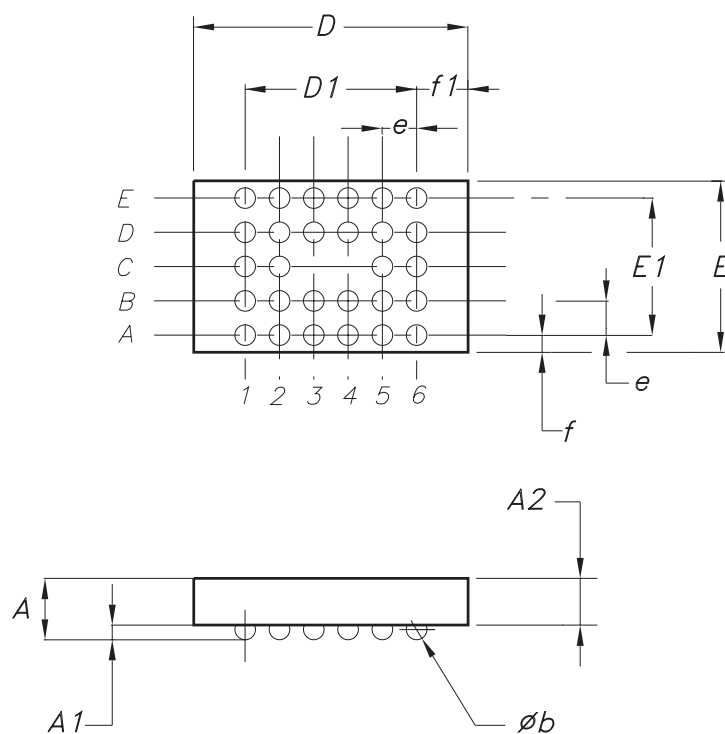


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Flip-Chip28 MECHANICAL DATA

DIM.	mm.			mils		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	0.58		0.95	22.8		37.4
A1		0.24			9.4	
A2		0.65			25.6	
b	0.25	0.30	0.35	9.8	11.8	13.8
D	3.97		4.17	156.3		164.2
D1		2.5			98.4	
E	2.47		2.67	97.2		105.1
E1		2			78.7	
e	0.45		0.55	17.7		21.7
f	0.23		0.34	9.1		13.4
f1	0.80		0.91	31.5		31.8

BOTTOM VIEW (BUMPS SIDE)



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