Single-Ended Bus Transceiver

DESCRIPTION

The Si9243AEY is a monolithic bus transceiver designed to provide bidirectional serial communication in automotive diagnostic applications.

The device incorporates protection against overvoltages and short circuits to V_{BAT}. The transceiver pin is protected and can be driven beyond the V_{BAT} voltage.

The RX output is capable of driving CMOS or 1 x LSTTL load.

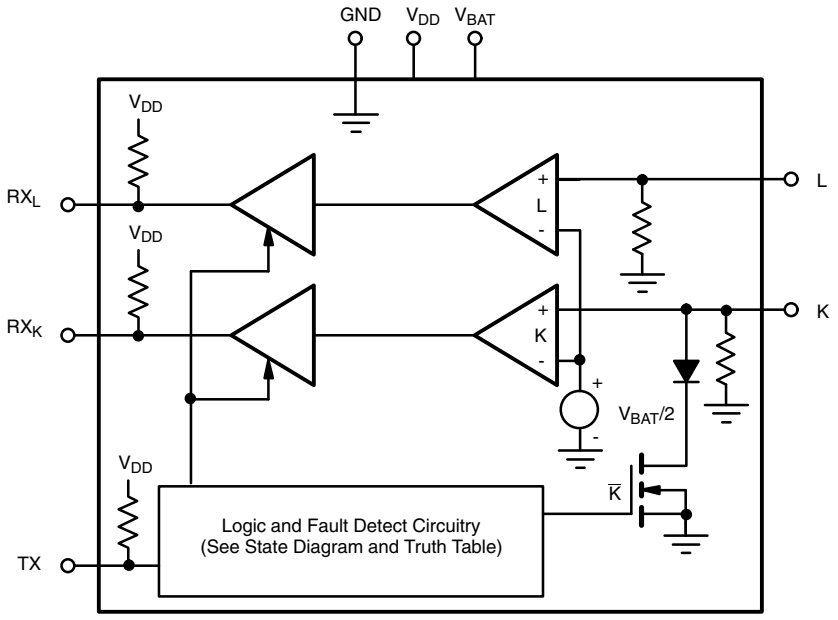
The Si9243AEY is built on the Vishay Siliconix BiC/DMOS process. This process supports bipolar transistors, CMOS, and DMOS. An epitaxial layer prevents latchup.

The Si9243AEY is available in a 8-pin SO package and operates over the automotive temperature range (- 40 °C to 125 °C). The Si9243AEY is available in both standard and lead (Pb)-free packages.

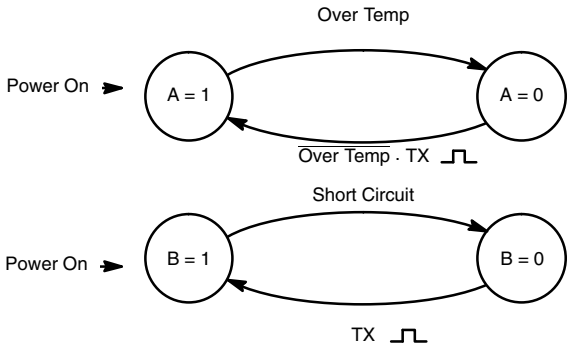
FEATURES

- Operating Power Supply Range
  $6\ V \leq V_{BAT} \leq 36\ V$
- Reverse Battery Protection Down to $V_{BAT} \geq -24\ V$
- Standby Mode With Very Low Current Consumption
  $I_{BAT(SB)} = 1\ \mu A$ at $V_{DD} = 0.5\ V$
- Low Quiescent Current in OFF Condition
  $I_{BAT} = 120\ \mu A$ and $I_{DD} \leq 10\ A$
- ISO 9141 Compatible
- Overtemperature Shutdown Function For K Output
- Defined K Output OFF for Open GND
- Defined Receive Output Status for Open K Input
- Defined K Output OFF for TX Input Open
- Open Drain Fault Output
- 2 kV ESD
- Typical Transmit Speeds of 200 kBaud

PIN CONFIGURATION AND FUNCTIONAL BLOCK DIAGRAM



OUTPUT TABLE AND STATE DIAGRAMS



Note: Over Temp is an internal condition, not meant to be a logic signal.

INPUTS		STATE VARIABLE		OUTPUT TABLE			
TX	L	A	B	K	RX_K	RX_L	Comments
0	0	1	1	0	0	0	
1	1	1	1	1	1	1	
0	1	1	1	0	0	1	
1	0	1	1	1	1	0	
X	L	0	1	HiZ	K	L	Over Temp
0	L	1	0	HiZ	K	L	Short Circuit
1	1	1	1	1	1	1	Receive Mode
1	0	1	1	0	0	0	

X = "1" or "0"
HiZ = High Impedance State

ABSOLUTE MAXIMUM RATINGS

Parameter	Limit	Unit
Voltages Referenced to Ground		
Voltage On V_{BAT}	- 24 to 45	V
Voltage K, L	- 16 to (V_{BAT} + 1)	
Voltage Difference $V_{(VBAT, K, L)}$	55	
Voltage On Any Pin (Except V_{BAT} , K, L) or Max. Current	- 0.3 V to (V_{DD} + 0.3 V) or 10	mA
Voltage on V_{DD}	7	V
K Pin Only, Short Circuit Duration (to V_{BAT} or GND)	Continuous	
Operating Temperature (T_A)	- 40 to 125	°C
Junction and Storage Temperature	- 55 to 150	
Thermal Impedance (Θ_{JA})	125	°C/W

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

RECOMMENDED OPERATING RANGE

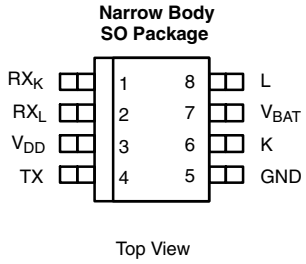
Parameter	Limit	Unit
Voltages Referenced to Ground		
V_{DD}	4.5 to 5.5	V
V_{BAT}	6 to 36	
K, L	6 to 36	
Digital Inputs	0 to V_{DD}	

SPECIFICATIONS

Parameter	Symbol	Test Conditions Unless Specified V_{DD} = 4.5 V to 5.5 V V_{BAT} = 6 V to 36 V		Temp.[a]	Limits - 40 to 125 °C Min.[b]	Typ.[c]	Max.[b]	Unit
Transmitter and Logic Levels								
TX Input Low Voltage	V_{ILT}			Full			1.5	V
TX Input High Voltage	V_{IHT}			Full	3.5			
TX Input Capacitance[d]	C_{INT}			Full			10	pF
TX Input Pull-up Resistance	R_{TX}	V_{DD} = 5.5 V, TX = 1.5 V, 3.5 V		Full	10	20	40	kΩ
K Transmit								
K Output Low Voltage	V_{OLK}	R_L = 510 Ω ± 5 %, V_{BAT} = 6 to 18		Full			0.2 V_{BAT}	V
		R_L = 1 kΩ ± 5 %, V_{BAT} = 16 to 36		Full			0.2 V_{BAT}	
		R_L = 510 Ω ± 5 %, V_{BAT} = 4.5		Full			1.2	
K Output High Voltage	V_{OHK}	R_L = 510 Ω ± 5 %, V_{BAT} = 4.5 to 18		Full	0.95 V_{BAT}			
		R_L = 1 kΩ ± 5 %, V_{BAT} = 16 to 36		Full	0.95 V_{BAT}			
K Rise, Fall Times	t_r, t_f	See Test Circuit		Full			9.6	µs
K Output Sink Resistance	Rsi	TX = 0 V		Full			110	Ω
K Output Capacitance[d]	C_O			Full			20	pF
Receiver								
L and K Input High Voltage	V_{IH}			Full	0.65 V_{BAT}			V
L and K Input Hysteresis[c, d]	V_{HYS}			Full		0.05 V_{BAT}		
L and K Input Currents	I_{IH}	TX = 4	V_{IH}= V_{BAT}	Full			20	µA
RX_L and RX_K Output Low Voltage	V_{OLR}	TX = 4	V_{ILK}, V_{ILL} = 0.35 V_{BAT} I_{OLR} = 1 mA	Full			0.4	V
RX_L and RX_K Pull-up Resistance	R_{RX}			Full	5		20	kΩ
RX_K Turn On Delay	$t_{d(on)}$	R_L = 510 Ω ± 5 %, V_{BAT} = 6 V to 18 V C_L = 10 nF, See Test Circuit		Full		3	10	µs
		R_L = 1 kΩ ± 5 %, V_{BAT} = 16 V to 36 V C_L = 4.7 nF, See Test Circuit		Full		3	10	
RX_K Turn Off Delay	$t_{d(off)}$	R_L = 510 Ω ± 5 %, V_{BAT} = 6 V to 18 V C_L = 10 nF, See Test Circuit		Full		3	10	
		R_L = 1 kΩ ± 5 %, V_{BAT} = 16 V to 36 V C_L = 4.7 nF, See Test Circuit		Full		3	10	
Supplies								
Bat Supply Current On	$I_{BAT(on)}$	TX = 0 V, V_{BAT} ≤ 16 V		Full		1.2	3	mA
Bat Supply Current Off	$I_{BAT(off)}$	V_{IHT} ≤ V_{TX}, V_{IHK} ≤ V_K, V_{IHL} ≤ V_L V_{BAT} ≤ 12 V		Full		120	220	µA
Bat Supply Current Standby	$I_{BAT(SB)}$	V_{DD} ≤ 0.5 V, V_{BAT} ≤ 12 V		Full		< 1	10	
Logic Supply Current On	$I_{DD(on)}$	V_{DD} ≤ 5.5 V, TX = 0 V		Full		1.4	2.3	mA
Logic Supply Current Off	$I_{DD(off)}$	V_{IHT} ≤ V_{TX}, V_{IHK} ≤ V_K, V_{IHL} ≤ V_L V_{BAT} ≤ 12 V		Full			10	µA
Miscellaneous								
TX Transmit Baud Rate	BR_T	R_L = 510 Ω, C_L = 10 nF		Full	10.4			kBaud
RX_L and RX_K Receive Baud Rate[c]	BR_R	6 V < V_{BAT} < 16 V, C_{RX} = 20 pF		Full		200		
Transmission Frequency	$f_{K\text{-}RXK}$	6 V < V_{BAT} < 16 V, R_K = 510 Ω, C_K ≤ 1.3 nF		Full	50	200		kHz
TX Minimum Pulse Width[d, e]	t_{TX}			Full	1			µs
Over Temperature Shutdown[d]	T_{SHUT}	Temperature Rising			160	180		°C
Temperature Shutdown Hysteresis[c]	T_{HYST}					30		

Notes:
a. Room = 25 °C, Cold and Hot = as determined by the operating temperature suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
d. Guaranteed by design, not subject to production test.
e. Minimum pulse width to reset a fault condition.

PIN CONFIGURATION



Top View

ORDERING INFORMATION	
Part Number	**Temperature Range**
Si9243AEY-T1	- 40 to 125 °C
Si9243AEY-T1-E3 (Lead (Pb)-free)	

PIN DESCRIPTION		
Pin Number	**Symbol**	**Description**
1	RX_K	K Receiver, Output
2	RX_L	L Receiver, Output
3	V_{DD}	Positive Power Supply
4	TX	Transmit, Input
5	GND	Ground Connection
6	K	K Transmit/Receive, Bidirectional
7	V_{BAT}	Battery Power Supply
8	L	L Transmit, Input

FUNCTIONAL DESCRIPTION

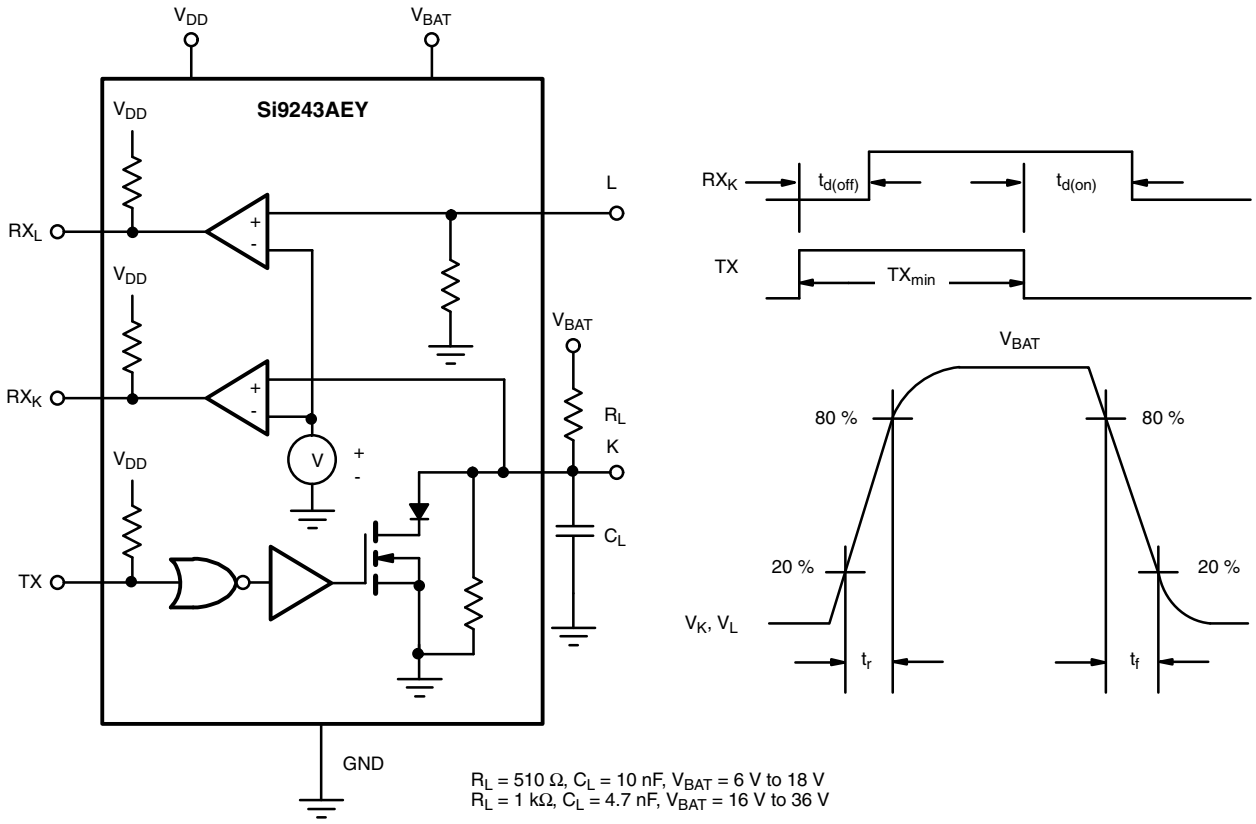
The Si9243AEY can be either in transmit or receive mode and it contains over temperature, and short circuit V_{BAT} fault detection circuits.

The voltage on the K and L pins are internally compared to $V_{BAT/2}$. If the voltage on the K or L pin is less than $V_{BAT/2}$ then RX_K or RX_L output will be "low". If the voltage on the K or L pin is greater than $V_{BAT/2}$ then RX_K or RX_L output will be "high".

In order to be in transmit mode, TX must be set "low". The TX signal is then internally inverted and turns the MOSFET on, causing the K pin to be "low". In transmit mode, the processor monitors the RX_K and TX. When the two mirror each other there is no fault. In the event of over temperature, or short circuit to V_{BAT}, the Si9243AEY will turn off the K output to protect the IC. The K pin will stay in high impedance and RX_K will follow the K pin. The fault will be reset when TX is toggled high. RX_K, RX_L and TX pins have internal pull up resistor to V_{DD} while K and L pins have internal pull down resistors. When any one of the TX, V_{BAT} or GND pins is open the K output is off.

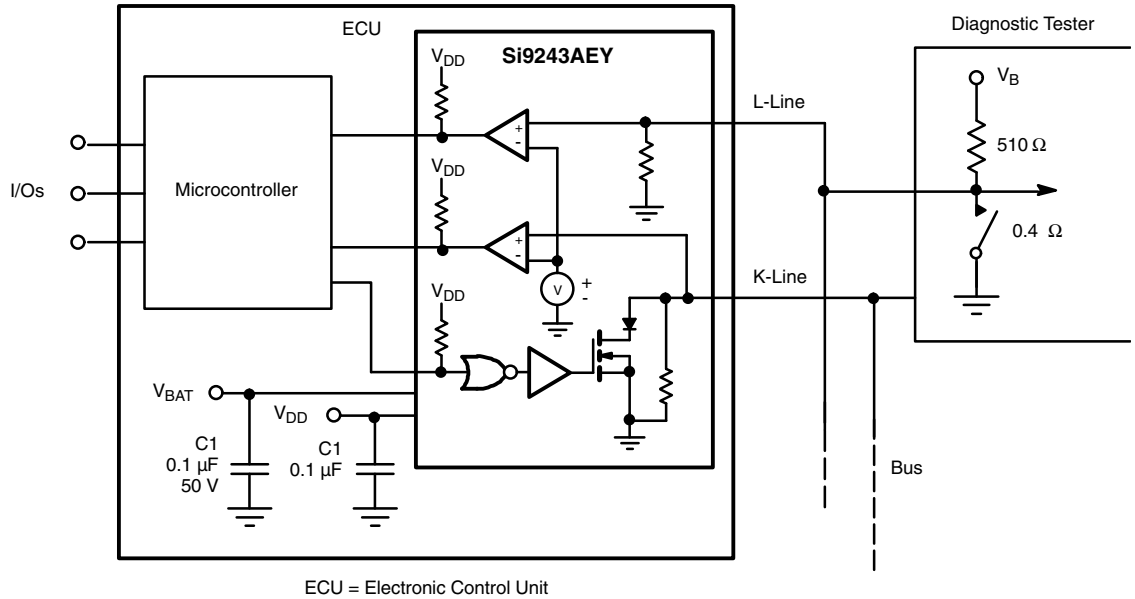
When the TX pin is set "high" the Si9243AEY is in receive mode and the internal MOSFET is turned off. RX_L and RX_K outputs will follow L and K inputs respectively.

TEST CIRCUIT AND TIMING DIAGRAMS (TRANSMIT ONLY)



R_L = 510 Ω, C_L = 10 nF, V_{BAT} = 6 V to 18 V
R_L = 1 kΩ, C_L = 4.7 nF, V_{BAT} = 16 V to 36 V

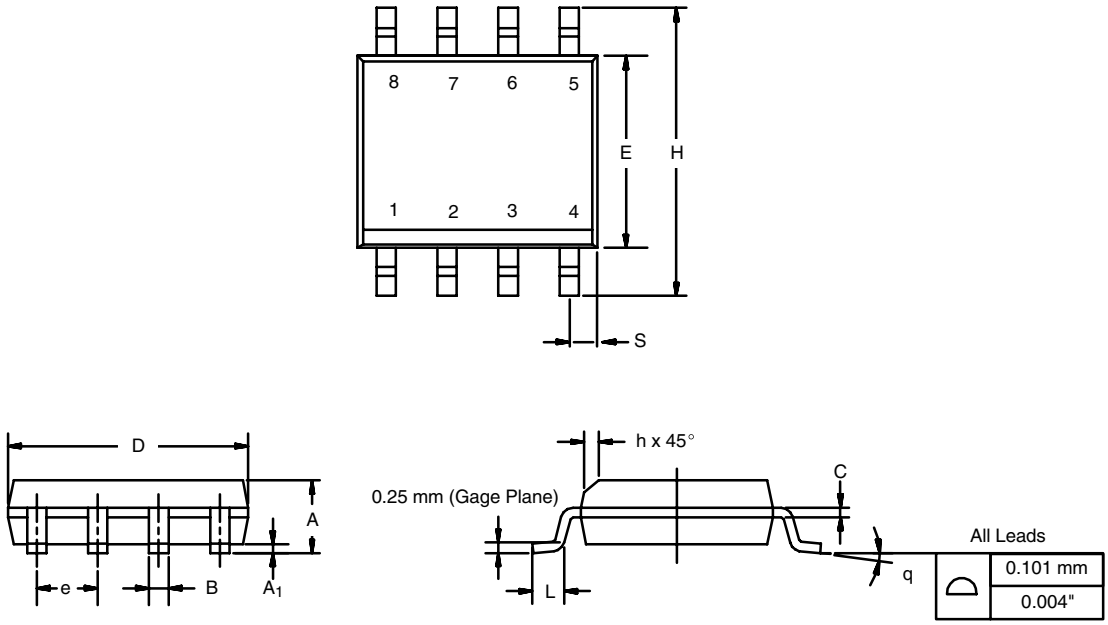
APPLICATIONS CIRCUIT



ECU = Electronic Control Unit

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?70788.

SOIC (NARROW): 8-LEAD
JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A_1	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°	8°	0°	8°
S	0.44	0.64	0.018	0.026
ECN: C-06527-Rev. I, 11-Sep-06 DWG: 5498				

Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.

Material Category Policy

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.

Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.

Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.