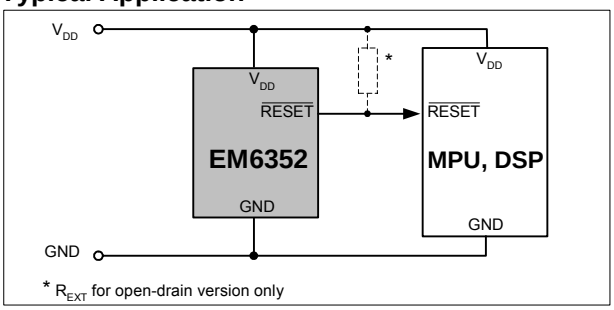
Voltage Detector, High-Precision

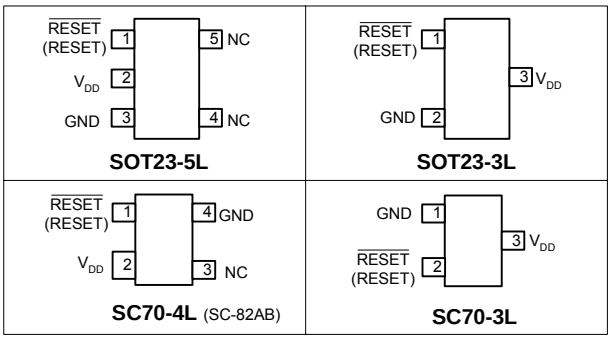
Description

The EM6352 is an ultra-low current voltage detector available in a large variety of configurations and very small packages for maximum flexibility in all end-applications up to 125°C and using power supplies between 1.5V and 5.5V.
This circuit monitors the supply voltage of any electronic system, and generates the appropriate reset signal without a delay time. The threshold defines the minimum allowed voltage which guarantees the good functionality of the system. As long as V_{DD} stays above the threshold voltage, the output stays inactive. If V_{DD} drops below V_{TH}, the output goes active. The output is guaranteed to be in the correct state for V_{DD} down to 0.8V. There are 12 reset threshold voltages starting as low as 1.31V and up to 4.63V. The EM6352 features three output types: active-low push-pull, active-low open-drain and active-high push-pull.
Small SC70 and SOT23 packages as well as ultra-low supply current of 2.7µA make the EM6352 an ideal choice for portable and battery-operated devices.

Typical Application



Pin Configuration (top view)



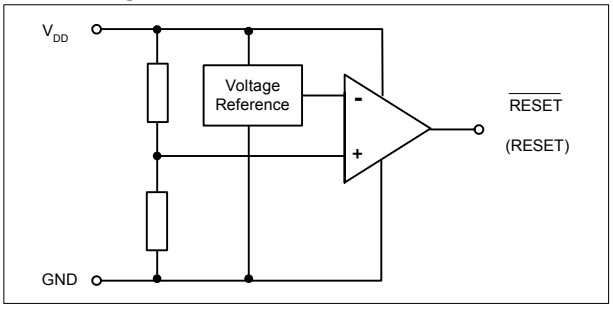
Features

- Ultra-low supply current of 2.7µA (V_{DD}=3.3V)
- Operating temperature range: -40°C to +125°C
- ±1.5% reset threshold accuracy
- 12 reset threshold voltages V_{TH}: 4.63V, 4.4V, 3.08V, 2.93V, 2.63V, 2.26V, 2.2V, 1.8V, 1.66V, 1.57V, 1.38V, 1.31V
- 3 reset output options:
  - Active-low $\overline{\text{RESET}}$ push-pull
  - Active-low $\overline{\text{RESET}}$ open-drain
  - Active-high RESET push-pull
- No external components
- Immune to short negative V_{DD} transients
- Guaranteed Reset valid down to 0.8V
- Threshold hysteresis: 2.1% of V_{TH}
- Very small SOT23-5L, SOT23-3L, SC70-3L and SC70-4L (SC-82AB) packages

Applications

- Mobile and cordless phones
- Modems
- Printers
- TV, VCR, Video sets
- GPS
- Toys
- Basestations
- NiCd cell battery
- Automotive systems

Block Diagram



Pin Description

Pin				Name	Function
SOT23-5L	SOT23-3L	SC70-4L	SC70-3L		
1	1	1	2	$\overline{\text{RESET}}$	Active-low $\overline{\text{RESET}}$ output. $\overline{\text{RESET}}$ remains low while V_{DD} is below the reset threshold voltage.
				RESET	Active-high RESET output. RESET remains high while V_{DD} is below the reset threshold voltage.
2	3	2	3	V_{DD}	Supply Voltage (5.5V max.)
3	2	4	1	GND	Ground
4, 5	-	3	-	N.C.	Not connected. Not internally connected

Ordering Information

EM6352 X SP3B - 2.9 +

Reset Output Type:
X = Active-low /RES push-pull
Y = Active-low /RES open-drain
Z = Active-high RES push-pull

Package:
SP3B = SOT23-3, Tape&Reel 3000 pcs
SP5B = SOT23-5, Tape&Reel 3000 pcs
SC3B = SC70-3, Tape&Reel 3000 pcs
SC4B = SC70-4, Tape&Reel 3000 pcs

RoHS Compliance:
+ = lead-free/green mold compliant
[blank] = leaded

Reset Threshold Voltage (V_{TH}):

1.3 = 1.31V	2.26 = 2.26V
1.4 = 1.38V	2.6 = 2.63V
1.6 = 1.57V	2.9 = 2.93V
1.7 = 1.66V	3.1 = 3.08V
1.8 = 1.80V	4.4 = 4.40V
2.2 = 2.20V	4.6 = 4.63V

Note: subject to availability (see standard versions list below). Please give complete Part Number when ordering.

Standard Versions, Samples & Top Marking

Top Marking

Part Number	Top Marking
EM6352X__-1.3	AKAA
EM6352X__-1.4	AKAB
EM6352X__-1.6	AKAC
EM6352X__-1.7	AKAD
EM6352X__-1.8	AKAE
EM6352X__-2.2	AKAF
EM6352X__-2.26	AKAY
EM6352X__-2.6	AKAG
EM6352X__-2.9	AKAH
EM6352X__-3.1	AKAJ
EM6352X__-4.4	AKAK
EM6352X__-4.6	AKAL
EM6352Y__-1.3	AKAM
EM6352Y__-1.4	AKAN
EM6352Y__-1.6	AKAP
EM6352Y__-1.7	AKAQ
EM6352Y__-1.8	AKAR
EM6352Y__-2.2	AKAS
EM6352Y__-2.6	AKAT
EM6352Y__-2.9	AKAU
EM6352Y__-3.1	AKAV
EM6352Y__-4.4	AKAW
EM6352Y__-4.6	AKAX
EM6352Z__-1.3	AKAY
EM6352Z__-1.4	AKAZ
EM6352Z__-1.6	AKA1
EM6352Z__-1.7	AKA2
EM6352Z__-1.8	AKA3
EM6352Z__-2.2	AKA4
EM6352Z__-2.6	AKA5
EM6352Z__-2.9	AKA6
EM6352Z__-3.1	AKA7
EM6352Z__-4.4	AKA8
EM6352Z__-4.6	AKA9

Package top marking above is for most parts in leaded package (first letter is “A”). For lead-free/green mold (RoHS) parts, the first letter of top marking begins with letter “B” instead of letter “A”.

The underscore "__" refers to the four-letter code for the package (eg. SP3B, SC4B, …).

Standard Versions (samples)

Part Number
EM6352XSC3B-2.2
EM6352XSC3B-2.9
EM6352XSP3B-1.3
EM6352XSP3B-1.8
EM6352XSP3B-2.2
EM6352XSP3B-2.26
EM6352XSP3B-2.6
EM6352XSP3B-2.9
EM6352XSP3B-4.6
EM6352XSP5B-1.3
EM6352XSP5B-1.8
EM6352XSP5B-2.6
EM6352XSP5B-2.9
EM6352XSP5B-4.6
EM6352YSC3B-2.6
EM6352YSC3B-4.6
EM6352YSC4B-1.3
EM6352YSC4B-3.1
EM6352YSC4B-2.2
EM6352YSP3B-2.6
EM6352YSP3B-2.9

Sample stock is generally held on **standard versions** only. Non standard versions have a 30,000 pieces minimum order quantity. Please contact factory for other versions not shown here and for availability of non standard versions.

Absolute Maximum Ratings

Parameter	Symbol	Conditions
Voltage at V_{DD} to GND	V_{DD}	-0.3V to +6V
Minimum voltage at any signal pin	V_{MIN}	GND - 0.3V
Maximum voltage at any signal pin	V_{MAX}	V_{DD} + 0.3V
Electrostatic discharge max. to MIL-STD-883C method 3015.7 with ref. to V_{SS}	V_{ESD}	2000V
Max. soldering conditions	T_{MAX}	250°C x 10s
Storage Temperature Range	T_{STG}	-65°C to +150°C

Stresses above these listed maximum ratings may cause permanent damages to the device. Exposure beyond specified operating conditions may affect device reliability or cause malfunction.

Handling Procedures

This device has built-in protection against high static voltages or electric fields; however, anti-static precautions must be taken as for any other CMOS component. Unless otherwise specified, proper operation can only occur when all terminal voltages are kept within the voltage range. Unused inputs must always be tied to a defined logic voltage level.

Operating Conditions

Parameter	Symbol	Min	Max	Unit
Supply voltage (note 1)	V_{DD}	0.8	5.5	V
Operating Temperature	T_A	-40	+125	°C

Electrical Characteristics

Unless otherwise specified: V_{DD}= 0.8V to 5.5V, T_A=+25°C (note 1).

Parameter	Symbol	Conditions		Min	Typ	Max	Unit
Supply current (note 2)	I_{DD}	V_{DD}=1.5V	+25°C	-	2.1	4.5	µA
			-40°C to +125°C	-		7	
		V_{DD}=3.3V	+25°C	-	2.7	5.4	
			-40°C to +125°C	-		8.3	
		V_{DD}=5.0V	+25°C	-	3.2	6.3	
			-40°C to +125°C	-		9.6	
Threshold voltage (note 3)	V_{TH}	EM6352 – 1.3		1.290	1.31	1.330	V
		EM6352 – 1.4		1.359	1.38	1.401	
		EM6352 – 1.6		1.546	1.57	1.594	
		EM6352 – 1.7		1.635	1.66	1.685	
		EM6352 – 1.8		1.773	1.80	1.827	
		EM6352 – 2.2		2.167	2.20	2.233	
		EM6352 – 2.26		2.226	2.26	2.294	
		EM6352 – 2.6		2.591	2.63	2.669	
		EM6352 – 2.9		2.886	2.93	2.974	
		EM6352 – 3.1		3.034	3.08	3.126	
		EM6352 – 4.4		4.334	4.40	4.466	
		EM6352 – 4.6		4.561	4.63	4.699	
Threshold voltage temperature coefficient (note 4)	$\frac{\Delta V_{TH}}{\Delta T_A}$	T_A = -40°C to +125°C		-	±50	-	ppm/°C
Threshold hysteresis	V_{HYS}			-	2.1%•V_{TH}	-	V

Note 1: Production tested at +25°C only. Over temperature limits are guaranteed by design, not production tested. V_{DD} min=0.9V for active-high versions (EM6352Z).

Note 2: $\overline{\text{RESET}}$ (RESET) open.

Note 3: Threshold voltage is specified for V_{DD} falling.

Note 4: Typical variation ΔV_{TH} of V_{TH} at a given temperature T_A is calculated as follows:

$$\Delta V_{TH}(T = T_A) = \frac{\Delta V_{TH}}{\Delta T_A} \times V_{TH} \times \left| T_A - 25°C \right|$$

Example:
for version V_{TH}=2.93V, variation at T_A=70°C is equal to $\Delta V_{TH}(70°C)=\pm 50 \cdot 10^{-6}$ x 2.93 x (70-25)=±6.59mV

Electrical Characteristics (continued)

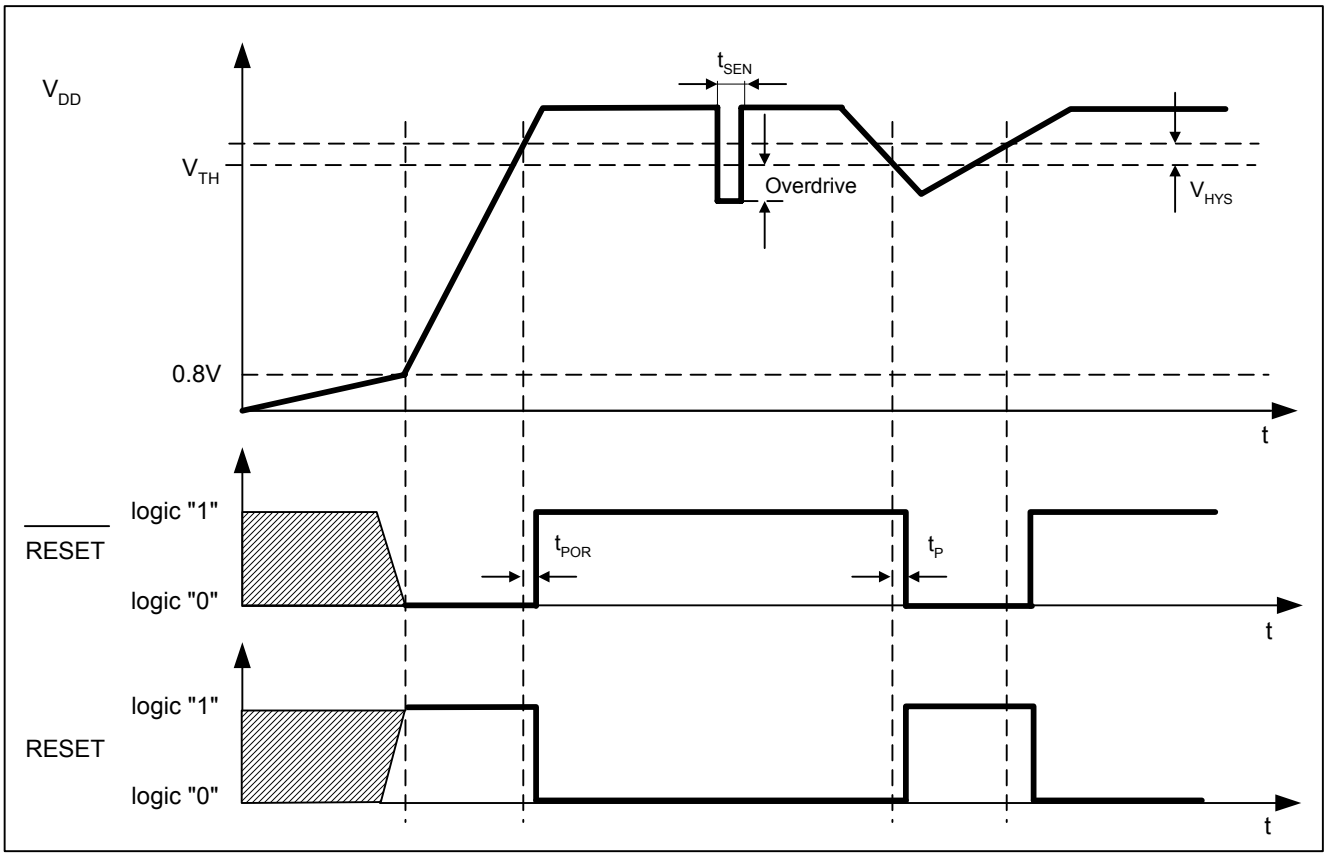
Unless otherwise specified: V_{DD}= 0.8V to 5.5V, T_A=+25° C (note 1).

Parameter	Symbol	Conditions			Min	Typ	Max	Unit
Reset timeout period	t_{POR}	V_{DD} from 0V to $V_{TH\ (typ)}$+15% (note 2)			9	500	1090	µs
Propagation delay time V_{DD} to $\overline{RESET}$ (RESET) delay	t_P	V_{DD} drops from $V_{TH\ (typ)}$+0.2V to $V_{TH\ (typ)}$-0.2V (note 2)			2	130	255	µs
Open-drain $\overline{RESET}$ output Voltage	V_{OL}	-40°C to +125°C	V_{DD}>1V	I_{OL}=100µA	-	-	0.3	V
			V_{DD}>2.5V	I_{OL}=1.5mA	-	-	0.3	
			V_{DD}>5V	I_{OL}=3mA	-	-	0.3	
Push-pull RESET / $\overline{RESET}$ Output voltage	V_{OL}	-40°C to +125°C	V_{DD}>1V	I_{OL}=100µA	-	-	0.3	V
			V_{DD}>2.5V	I_{OL}=1.5mA	-	-	0.3	
			V_{DD}>5V	I_{OL}=3mA	-	-	0.3	
	V_{OH}	-40°C to +125°C	V_{DD}>1V	I_{OH}=-30µA	0.8	-	-	
			V_{DD}>2.5V	I_{OH}=-1.5mA	2	-	-	
			V_{DD}>5V	I_{OH}=-3mA	4	-	-	
Output leakage current	I_{LEAK}	-40°C to +125°C, only for EM6352Y (open-drain)			-	-	0.5	µA

Note 1: Production tested at +25°C only. Over temperature limits are guaranteed by design, not production tested. V_{DD} min=0.9V for active-high version (EM6352Z).

Note 2: $\overline{RESET}$ (RESET) open.

Timing Waveforms

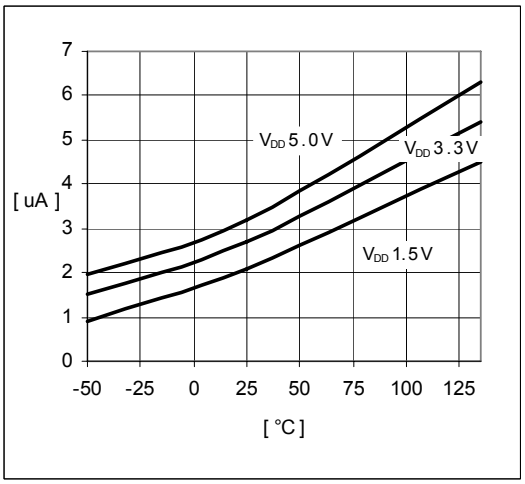


Note 5: t_{SEN} = Maximum Transient Duration. Please refer to figure on next page.

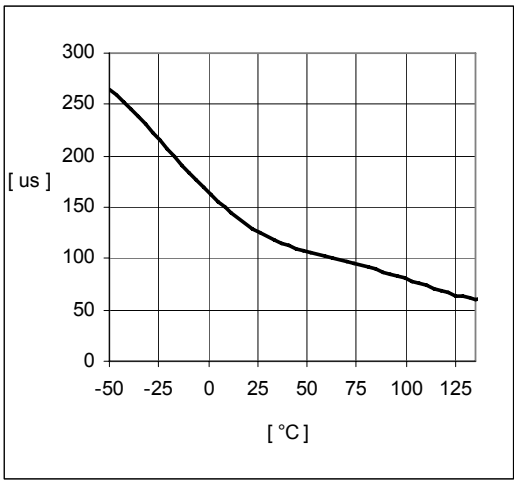
Note 6: Overdrive = V_{TH-} -V_{DD}. Please refer to figure on next page.

Typical Operating Characteristics

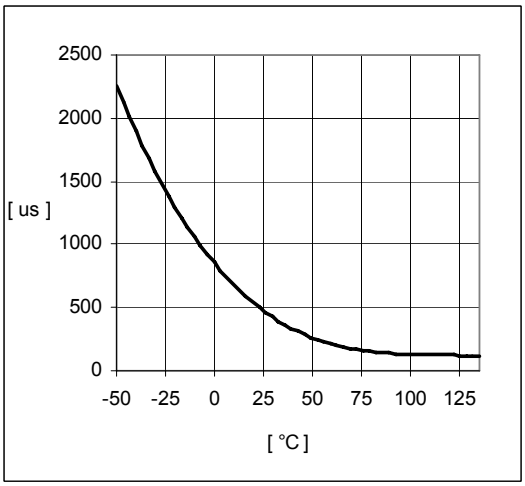
(Typical values are at T_A=+25°C unless otherwise noted, $\overline{\text{RESET}}$ or RESET open.)



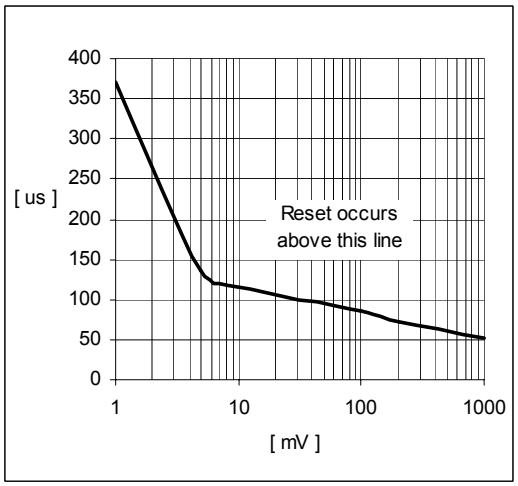
I_{DD} vs. Temperature



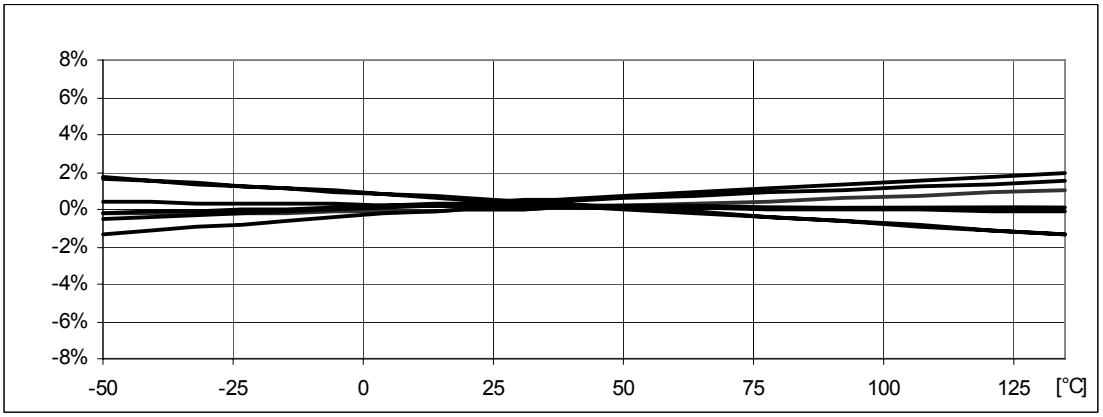
Propagation Time t_P vs. Temperature



Reset Timeout Period t_{POR} vs. Temperature



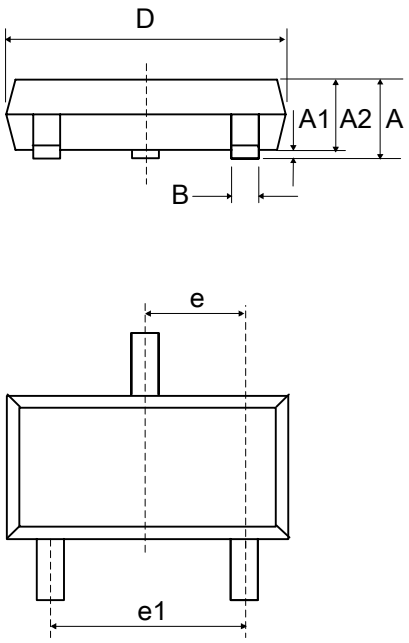
Maximum Transient Duration t_{SEN} vs. Overdrive V_{TH}-V_{DD}



Threshold Voltage Variation vs. Temperature (normalized)

Package Information

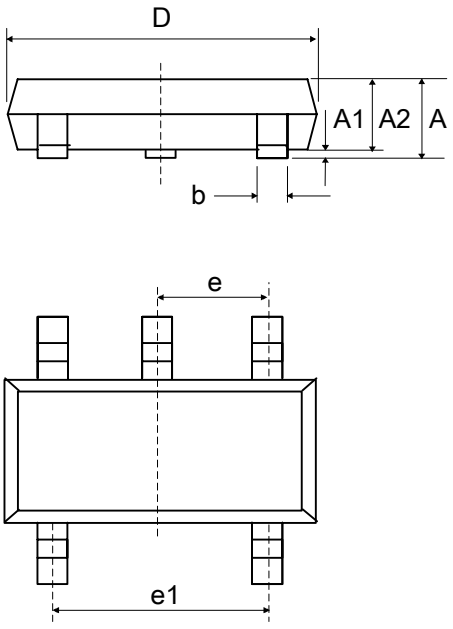
SOT23-3L



SYMBOL	MIN	TYP	MAX
A	0.89	1.04	1.12
A1	0.013		0.10
A2	0.95	0.97	1.00
B	0.37		0.51
C	0.085	0.12	0.18
D	2.80	2.95	3.04
E	1.20	1.32	1.40
e		0.95	
e1	1.78	1.90	2.05
H	2.10	2.40	2.64
L		0.55	

Dimensions are in mm

SOT23-5L

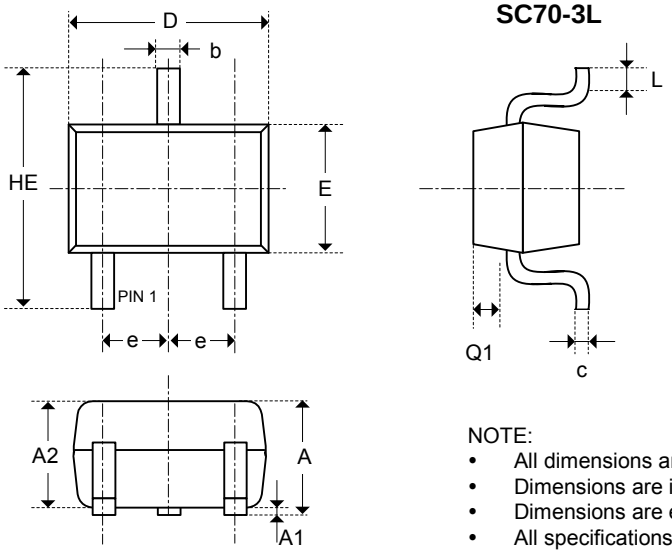


SYMBOL	MIN	TYP	MAX
A	0.90	1.30	1.45
A1	0.05	0.08	0.15
A2	0.90	1.15	1.30
b	0.35		0.50
C	0.08		0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50		1.75
e		0.95	
e1		1.90	
L		0.45	

Dimensions are in mm

Package Information (continued)

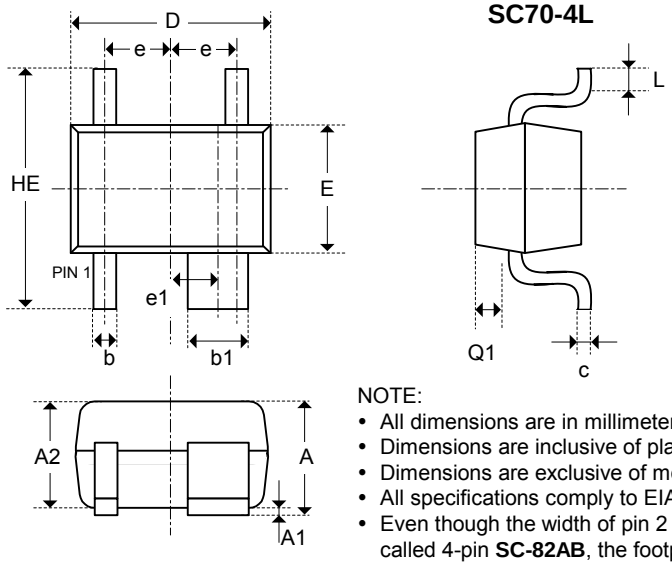
SC70-3L



SYMBOL	MIN	MAX
e	0.65 BSC	
D	1.80	2.20
b	0.25	0.40
E	1.15	1.35
HE	1.80	2.40
Q1	0.10	0.40
A2	0.80	1.00
A1	0.00	0.10
A	0.80	1.10
c	0.10	0.18
L	0.10	0.30

NOTE:
- All dimensions are in millimeters
- Dimensions are inclusive of plating
- Dimensions are exclusive of mold flash & metal burr
- All specifications comply to EIAJ SC70

SC70-4L



SYMBOL	MIN	MAX
e	0.65 BSC	
e1	0.5 BSC	
D	1.80	2.20
b	0.15	0.30
b1	0.575	0.70
E	1.15	1.35
HE	1.80	2.40
Q1	0.10	0.40
A2	0.80	1.00
A1	0.00	0.10
A	0.80	1.10
c	0.10	0.18
L	0.10	0.30

NOTE:
- All dimensions are in millimeters
- Dimensions are inclusive of plating
- Dimensions are exclusive of mold flash & metal burr
- All specifications comply to EIAJ SC70
- Even though the width of pin 2 on SC70-4L is slightly larger than on so-called 4-pin **SC-82AB**, the footprint of SC70-4L package is **compatible** with the footprint of **SC-82AB** package from other suppliers, and thus suitable for pin-to-pin replacement. Please check footprint on PCB.

Traceability for small packages

Due to the limited space on the package surface, the bottom marking contains a limited number of characters that provide only partial information for lot traceability. Full information for complete traceability is however provided on the packing labels of the product at delivery from EM. It is highly recommended that the customer insures full lot traceability of EM product in his final product.