MAC97A6

4Q Triac

Rev.02 - 19 October 2021 Product data sheet

1. General description

Planar passivated very sensitive gate four quadrant triac in a TO92 plastic package intended to be interfaced directly to microcontrollers, logic integrated circuits and other low power gate trigger circuits.

2. Features and benefits

- Direct interfacing to logic level ICs
- Direct interfacing to low power gate drivers and microcontrollers
- High blocking voltage capability
- Planar passivated for voltage ruggedness and reliability
- Triggering in all four quadrants
- Very sensitive gate

3. Applications

- General purpose low power phase control
- General purpose low power switching
- Solid-state relay

4. Quick reference data

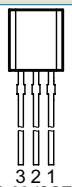
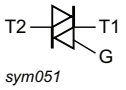
Table 1. Quick reference data

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Absolute maximum rating							
V_{DRM}	repetitive peak off-state voltage			-	-	400	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{lead} \leq 50$ °C; Fig. 1; Fig. 2; Fig. 3		-	-	0.6	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25$ °C; $t_p = 20$ ms; Fig. 4; Fig. 5		-	-	8	A
		full sine wave; $T_{j(init)} = 25$ °C; $t_p = 16.7$ ms		-	-	8.8	A
T_j	junction temperature			-	-	125	°C
Static characteristics							
I_{GT}	gate trigger current	$V_D = 12$ V; $I_T = 0.1$ A; T2+ G+; $T_j = 25$ °C; Fig. 7		-	1	5	mA
		$V_D = 12$ V; $I_T = 0.1$ A; T2+ G-; $T_j = 25$ °C; Fig. 7		-	2	5	mA
		$V_D = 12$ V; $I_T = 0.1$ A; T2- G-; $T_j = 25$ °C; Fig. 7		-	2	5	mA
		$V_D = 12$ V; $I_T = 0.1$ A; T2- G+; $T_j = 25$ °C; Fig. 7		-	4	7	mA
I_H	holding current	$V_D = 12$ V; $T_j = 25$ °C; Fig. 9		-	1	10	mA
V_T	on-state voltage	$I_T = 0.85$ A; $T_j = 25$ °C; Fig. 10		-	1.4	1.9	V

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 268 V; T_j = 110 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit; Fig. 12		30	45	-	V/µs
dV_{com}/dt	rate of change of commutating voltage	V_D = 400 V; T_j = 50 °C; dI_{com}/dt = 0.3 A/ms; I_T = 0.84 A; gate open circuit		-	5	-	V/µs

5. Pinning information

Table 2. Pinning information

Pin	Symbol	Description	Simplified outline	Graphic symbol
1	T2	main terminal 2	 TO-92 (SOT54)	 *sym051*
2	G	gate		
3	T1	main terminal 1		

6. Ordering information

Table 3. Ordering information

Type number	Package Name	Orderable part number	Packing method	Small packing quantity	Package version	Package issue date
MAC97A6	TO92	MAC97A6,412	Bulk	1000	SOT54	14-Nov-2013
MAC97A6	TO92	MAC97A6,116	Reel	2000	SOT54 wide pitch	14-Nov-2013

7. Marking

Table 4. Marking codes

Type number	Marking codes
MAC97A6	MAC97A6

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{DRM}	repetitive peak off-state voltage			-	400	V
$I_{T(RMS)}$	RMS on-state current	full sine wave; $T_{lead} \leq 50$ °C; Fig 1; Fig 2; Fig 3		-	0.6	A
I_{TSM}	non-repetitive peak on-state current	full sine wave; $T_{j(init)} = 25$ °C; $t_p = 20$ ms; Fig 4; Fig 5		-	8	A
		full sine wave; $T_{j(init)} = 25$ °C; $t_p = 16.7$ ms		-	8.8	A
I^2t	I^2t for fusing	$t_p = 10$ ms; sine-wave pulse		-	0.32	A^2s
dI_T/dt	rate of rise of on-state current	$I_G = 20$ mA; T2+ G+		-	50	A/µs
		$I_G = 20$ mA; T2+ G-		-	50	A/µs
		$I_G = 20$ mA; T2- G-		-	50	A/µs
		$I_G = 20$ mA; T2- G+		-	10	A/µs
I_{GM}	peak gate current			-	1	A
P_{GM}	peak gate power			-	5	W
$P_{G(AV)}$	average gate power	over any 20 ms period		-	0.1	W
T_{stg}	storage temperature			-40	150	°C
T_j	junction temperature			-	125	°C

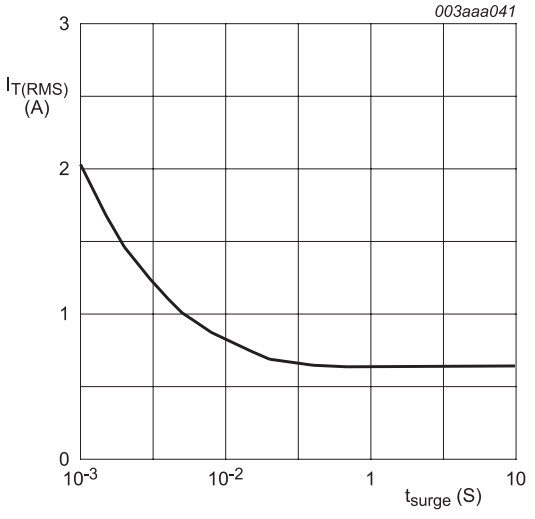


Fig. 1. RMS on-state current as a function of surge duration; maximum values

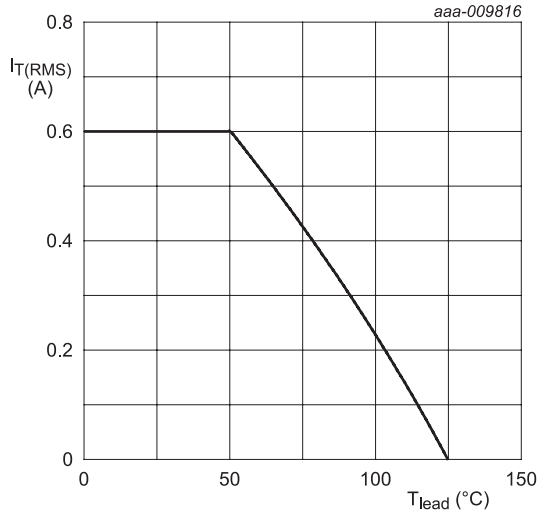
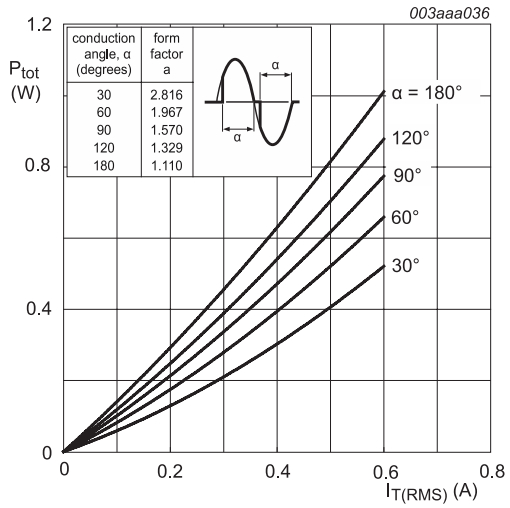


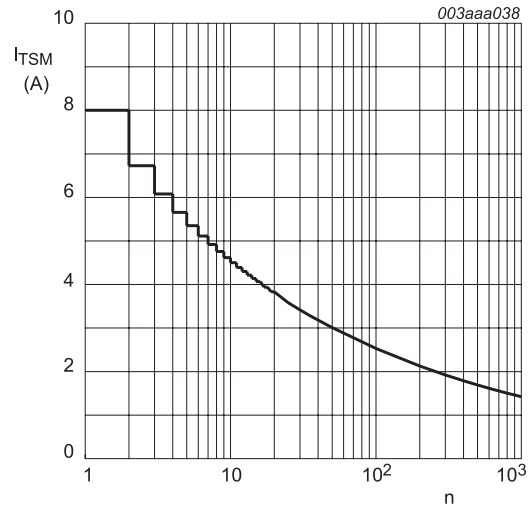
Fig. 2. RMS on-state current as a function of lead temperature; maximum values



α = conduction angle

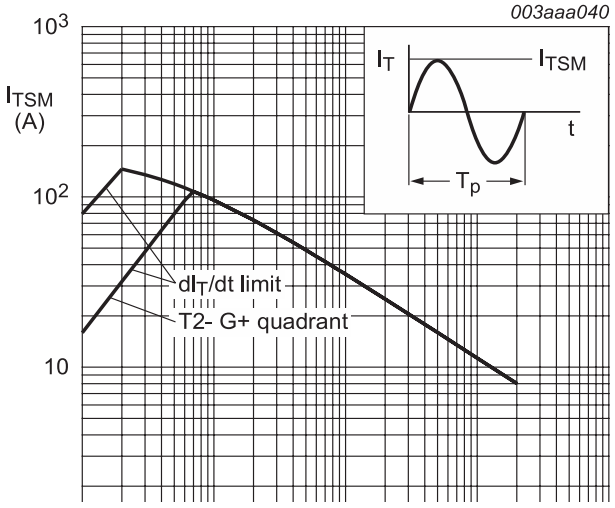
a = form factor = $I_{T(RMS)}$ / $I_{T(AV)}$

Fig. 3. Total power dissipation as a function of RMS on-state current; maximum values



f = 50 Hz

Fig. 4. Non-repetitive peak on-state current as a function of the number of sinusoidal current cycles; maximum values



$t_p \leq 20$ ms

Fig. 5. Non-repetitive peak on-state current as a function of pulse width; maximum values

9. Thermal characteristics

Table 6. Thermal characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
$R_{th(j\text{-}lead)}$	thermal resistance from junction to lead	full cycle; Fig 6		-	-	60	K/W
		half cycle		-	-	80	K/W
$R_{th(j\text{-}a)}$	thermal resistance from junction to ambient free air	printed circuit board mounted: lead length = 4 mm		-	150	-	K/W

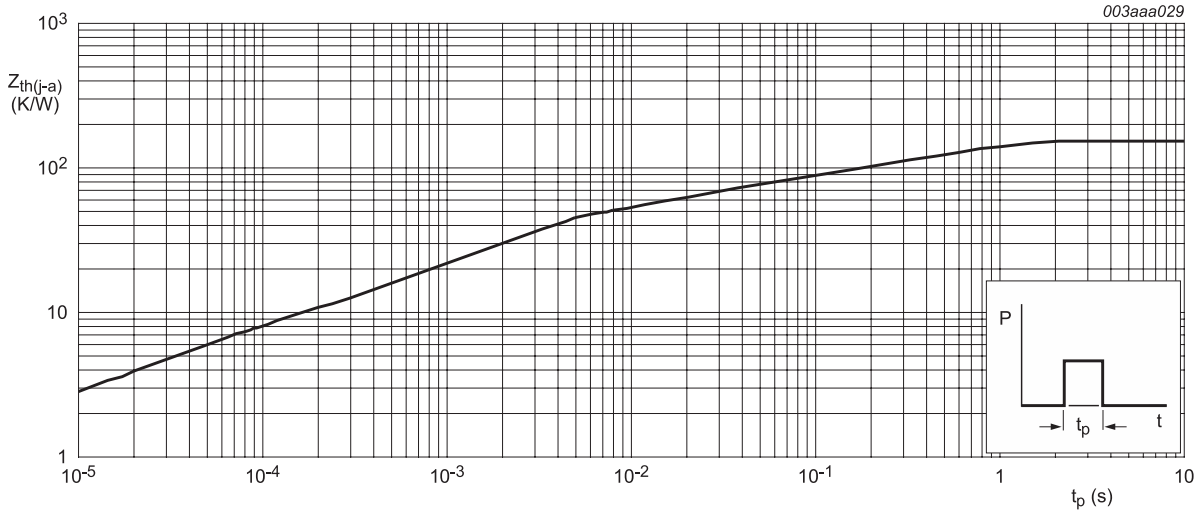
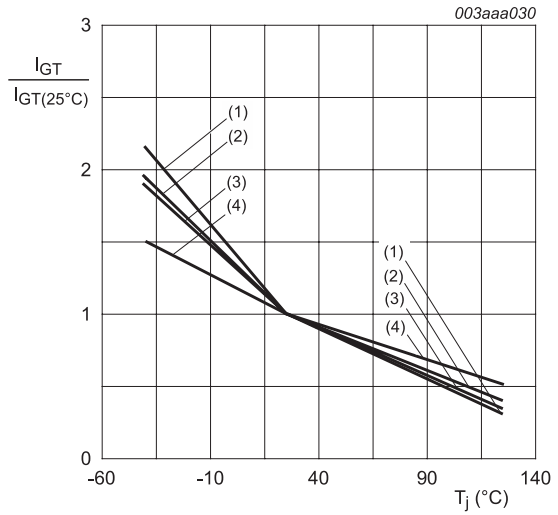


Fig. 6. Transient thermal impedance from junction to ambient as a function of pulse width

10. Characteristics

Table 7. Characteristics

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
Static characteristics							
I_{GT}	gate trigger current	V_D = 12 V; I_T = 0.1 A; T2+ G+; T_j = 25 °C; Fig. 7		-	1	5	mA
		V_D = 12 V; I_T = 0.1 A; T2+ G-; T_j = 25 °C; Fig. 7		-	2	5	mA
		V_D = 12 V; I_T = 0.1 A; T2- G-; T_j = 25 °C; Fig. 7		-	2	5	mA
		V_D = 12 V; I_T = 0.1 A; T2- G+; T_j = 25 °C; Fig. 7		-	4	7	mA
I_L	latching current	V_D = 12 V; I_G = 0.1 A; T2+ G+; T_j = 25 °C; Fig. 8		-	1	10	mA
		V_D = 12 V; I_G = 0.1 A; T2+ G-; T_j = 25 °C; Fig. 8		-	5	10	mA
		V_D = 12 V; I_G = 0.1 A; T2- G-; T_j = 25 °C; Fig. 8		-	1	10	mA
		V_D = 12 V; I_G = 0.1 A; T2- G+; T_j = 25 °C; Fig. 8		-	2	10	mA
I_H	holding current	V_D = 12 V; T_j = 25 °C; Fig. 9		-	1	10	mA
V_T	on-state voltage	I_T = 0.85 A; T_j = 25 °C; Fig. 10		-	1.4	1.9	V
V_{GT}	gate trigger voltage	V_D = 12 V; I_T = 0.1 A; T_j = 25 °C; Fig. 11		-	0.9	1.5	V
		V_D = 400 V; I_T = 0.1 A; T_j = 110 °C		0.1	0.7	-	V
I_D	off-state current	V_D = 400 V; T_j = 110 °C		-	3	100	µA
Dynamic characteristics							
dV_D/dt	rate of rise of off-state voltage	V_{DM} = 268 V; T_j = 110 °C; (V_{DM} = 67% of V_{DRM}); exponential waveform; gate open circuit; Fig. 12		30	45	-	V/µs
dV_{com}/dt	rate of change of commutating voltage	V_D = 400 V; T_j = 50 °C; dI_{com}/dt = 0.3 A/ms; I_T = 0.84 A; gate open circuit		-	5	-	V/µs
t_{gt}	gate-controlled turn-on time	I_{TM} = 1 A; V_D = 400 V; I_G = 25 mA; dI_G/dt = 5 A/µs		-	2	-	µs



(1) T2- G+
(2) T2- G-
(3) T2+ G-
(4) T2+ G+

Fig. 7. Normalized gate trigger current as a function of junction temperature

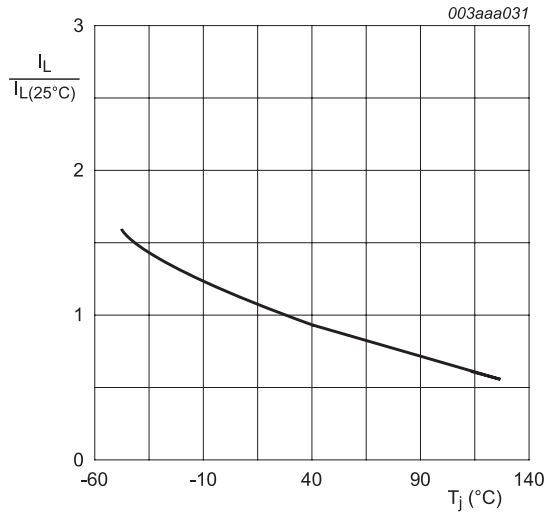


Fig. 8. Normalized latching current as a function of junction temperature

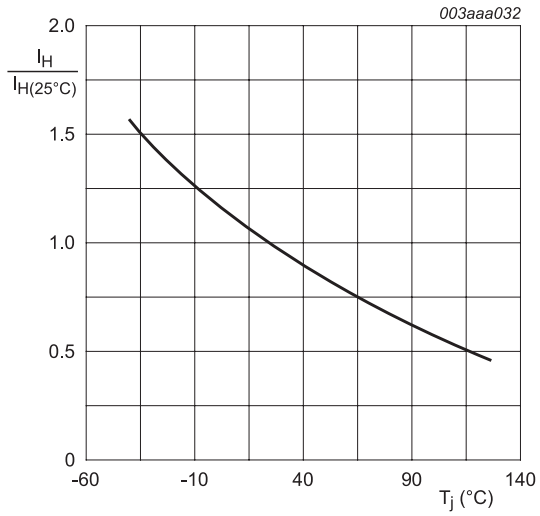
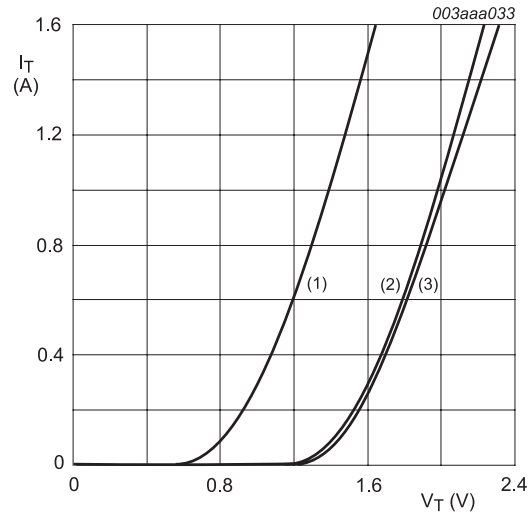


Fig. 9. Normalized holding current as a function of junction temperature



V_o = 1.45 V; R_s = 0.1875 Ω
(1) T_j = 125 °C; typical values
(2) T_j = 125 °C; maximum values
(3) T_j = 25 °C; maximum values

Fig. 10. On-state current as a function of on-state voltage

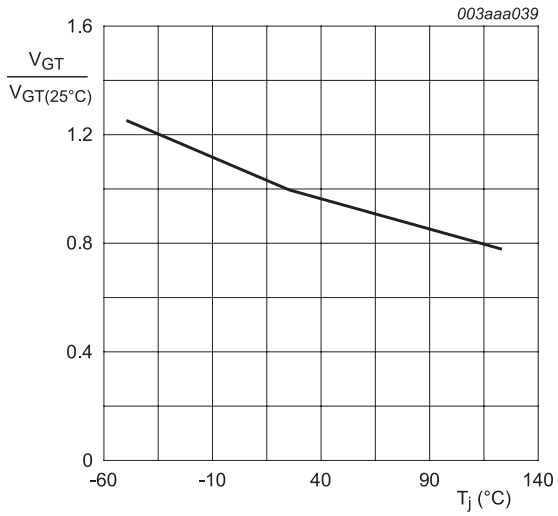


Fig. 11. Normalized gate trigger voltage as a function of junction temperature

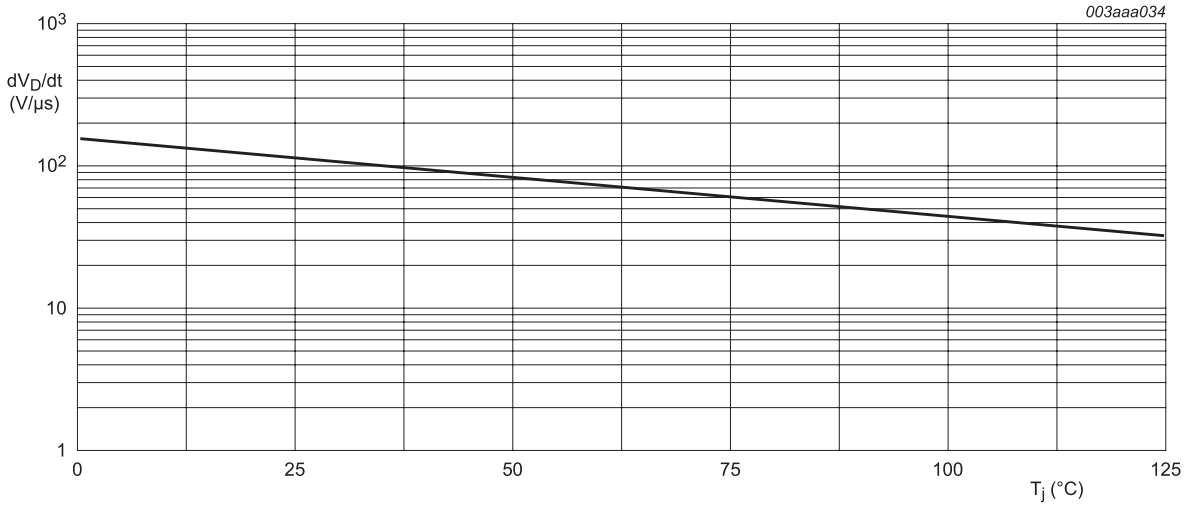
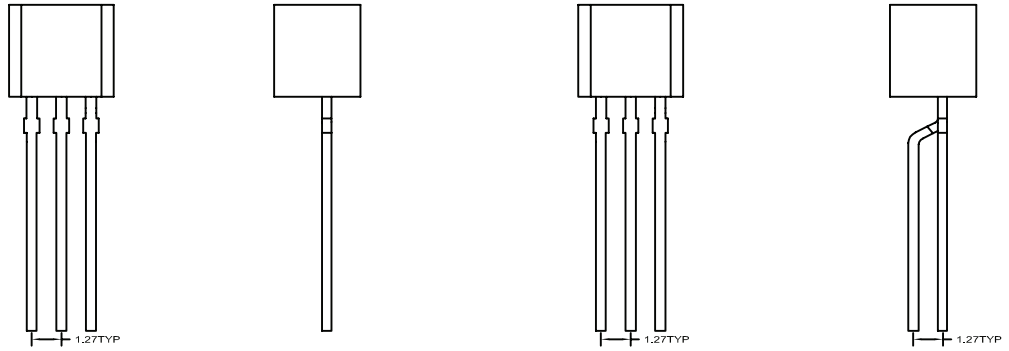


Fig. 12. Critical rate of rise of off-state voltage as a function of junction temperature; typical values

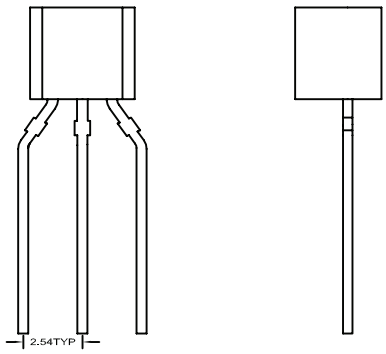
11. Package outline

SOT54 PACKAGE OUTLINE

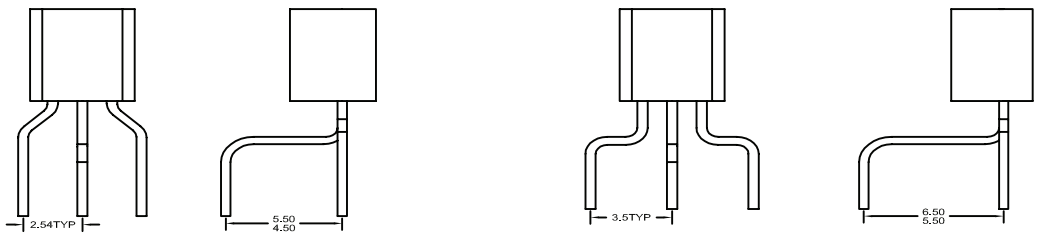


SOT54
Bulk Pack - 412

SOT54 LEADS ON CIRCLE
Bulk Pack - 112



SOT54 WIDE PITCH
Tape/ Reel Pack - 116
Ammo Pack - 126

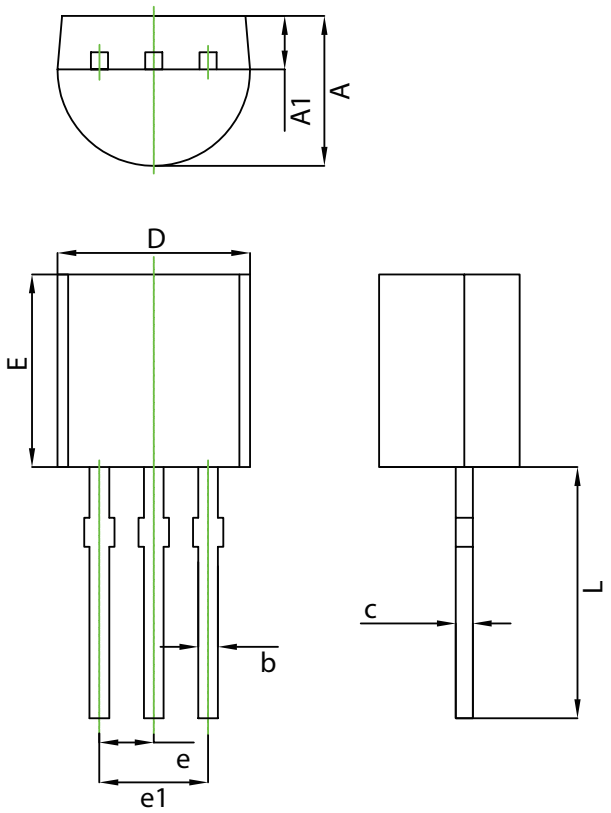


SOT54 LEAD BEND L01
Bulk Pack - 412

SOT54 LEAD BEND L02
Bulk Pack - 412

Remark: Detailed dimensions refer to POD drawing.

Plastic single-ended leaded(through hole) package; 3 leads TO92



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.300	3.700	0.130	0.146
A1	1.100	1.400	0.043	0.055
b	0.380	0.550	0.015	0.022
c	0.360	0.510	0.014	0.020
D	4.300	4.700	0.169	0.185
E	4.300	4.700	0.169	0.185
e	1.270 TYP.		0.050 TYP.	
e1	2.440	2.640	0.096	0.104
L	14.100	14.500	0.555	0.571

12. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

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[2] The term 'short data sheet' is explained in section "Definitions".
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13. Contents

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Date of release: 19 October 2021