

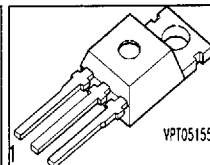
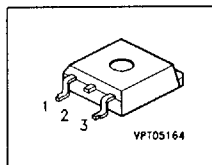
SIPMOS® Power Transistor

Features

- N channel
- Enhancement mode
- Avalanche rated
- dv/dt rated
- 175 °C operating temperature

Product Summary

Drain source voltage	V_{DS}	55	V
Drain-Source on-state resistance	$R_{DS(on)}$	0.08	Ω
Continuous drain current	I_D	13.5	A



Type	Package	Ordering Code	Packaging
BUZ104S	P-TO220-3-1	Q67040-S4007-A2	Tube
BUZ104S E3045A	P-TO263-3-2	Q67040-S4007-A6	Tape and Reel
BUZ104S E3045	P-TO263-3-2	Q67040-S4007-A5	Tube

Pin 1	Pin 2	Pin 3
G	D	S

Maximum Ratings, at $T_j = 25\text{ °C}$, unless otherwise specified

Parameter	Symbol	Value	Unit
Continuous drain current $T_C = 25\text{ °C}$ $T_C = 100\text{ °C}$	I_D	13.5 9.6	A
Pulsed drain current $T_C = 25\text{ °C}$	I_{Dpulse}	54	
Avalanche energy, single pulse $I_D = 13.5\text{ A}$, $V_{DD} = 25\text{ V}$, $R_{GS} = 25\text{ }\Omega$	E_{AS}	52	mJ
Avalanche energy, periodic limited by T_{jmax}	E_{AR}	3.5	
Reverse diode dv/dt $I_S = 13.5\text{ A}$, $V_{DS} = 40\text{ V}$, $di/dt = 200\text{ A}/\mu\text{s}$, $T_{jmax} = 175\text{ °C}$	dv/dt	6	kV/ μs
Gate source voltage	V_{GS}	± 20	V
Power dissipation $T_C = 25\text{ °C}$	P_{tot}	35	W
Operating and storage temperature	T_j , T_{stg}	-55... +175	°C
IEC climatic category; DIN IEC 68-1		55/175/56	

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Thermal Characteristics

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Characteristics					
Thermal resistance, junction - case	R_{thJC}	-	-	4.3	K/W
Thermal resistance, junction - ambient, leded	R_{thJA}	-	-	62	
SMD version, device on PCB:	R_{thJA}				
@ min. footprint		-	-	62	
@ 6 cm ² cooling area ¹⁾		-	-	40	

Electrical Characteristics, at $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Static Characteristics					
Drain- source breakdown voltage $V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$	$V_{(BR)DSS}$	55	-	-	V
Gate threshold voltage, $V_{GS} = V_{DS}$ $I_D = 20\text{ }\mu\text{A}$	$V_{GS(th)}$	2.1	3	4	
Zero gate voltage drain current $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 25\text{ }^{\circ}\text{C}$ $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $T_j = 150\text{ }^{\circ}\text{C}$	I_{DSS}	-	0.1	1	μA
		-	-	100	
Gate-source leakage current $V_{GS} = 20\text{ V}$, $V_{DS} = 0\text{ V}$	I_{GSS}	-	10	100	nA
Drain-Source on-state resistance $V_{GS} = 10\text{ V}$, $I_D = 9.6\text{ A}$	$R_{DS(on)}$	-	0.074	0.08	Ω

¹ Device on 40mm*40mm*1.5mm epoxy PCB FR4 with 6 cm² (one layer, 70 μm thick) copper area for drain connection. PCB is vertical without blown air.

Electrical Characteristics, at $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Transconductance $V_{DS} \geq 2 \cdot I_D \cdot R_{DS(on)max}$, $I_D = 9.6\text{ A}$	g_{fs}	4	5.8	-	S
Input capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{iss}	-	270	340	pF
Output capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{oss}	-	95	120	
Reverse transfer capacitance $V_{GS} = 0\text{ V}$, $V_{DS} = 25\text{ V}$, $f = 1\text{ MHz}$	C_{rss}	-	50	65	
Turn-on delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 13.5\text{ A}$, $R_G = 33\text{ }\Omega$	$t_{d(on)}$	-	9	15	ns
Rise time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 13.5\text{ A}$, $R_G = 33\text{ }\Omega$	t_r	-	22	35	
Turn-off delay time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 13.5\text{ A}$, $R_G = 33\text{ }\Omega$	$t_{d(off)}$	-	18	30	
Fall time $V_{DD} = 30\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 13.5\text{ A}$, $R_G = 33\text{ }\Omega$	t_f	-	17	25	

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Electrical Characteristics, at $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
Dynamic Characteristics					
Gate to source charge $V_{DD} = 40\text{ V}$, $I_D = 13.5\text{ A}$	Q_{gs}	-	2.5	3.75	nC
Gate to drain charge $V_{DD} = 40\text{ V}$, $I_D = 13.5\text{ A}$	Q_{gd}	-	3.8	5.7	
Gate charge total $V_{DD} = 40\text{ V}$, $I_D = 13.5\text{ A}$, $V_{GS} = 0\text{ to }10\text{ V}$	Q_g	-	9.5	14	
Gate plateau voltage $V_{DD} = 40\text{ V}$, $I_D = 13.5\text{ A}$	$V_{(\text{plateau})}$	-	5.9	-	V

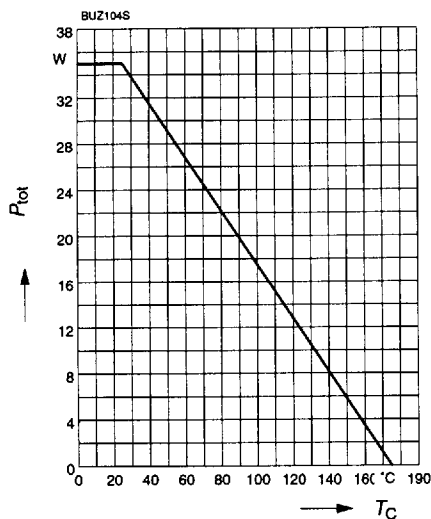
Reverse Diode

Inverse diode continuous forward current $T_C = 25\text{ }^{\circ}\text{C}$	I_S	-	-	13.5	A
Inverse diode direct current, pulsed $T_C = 25\text{ }^{\circ}\text{C}$	I_{SM}	-	-	54	
Inverse diode forward voltage $V_{GS} = 0\text{ V}$, $I_F = 27\text{ A}$	V_{SD}	-	1.17	1.8	V
Reverse recovery time $V_R = 30\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	t_{rr}	-	50	75	ns
Reverse recovery charge $V_R = 30\text{ V}$, $I_F = I_S$, $di_F/dt = 100\text{ A}/\mu\text{s}$	Q_{rr}	-	0.1	0.15	μC

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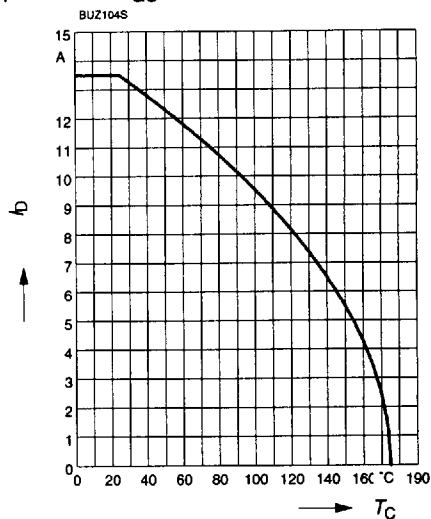
Power Dissipation

$$P_{\text{tot}} = f(T_C)$$


Drain current

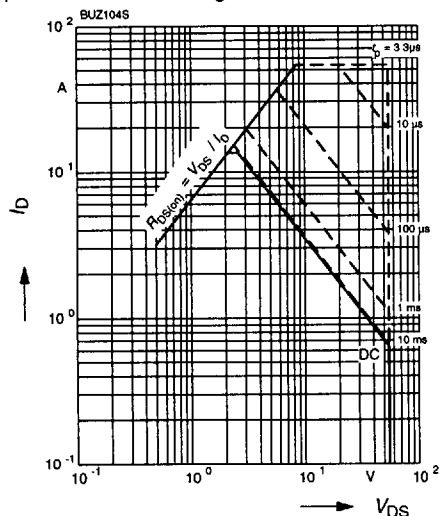
$$I_D = f(T_C)$$

parameter: $V_{\text{GS}} \geq 10 \text{ V}$


Safe operating area

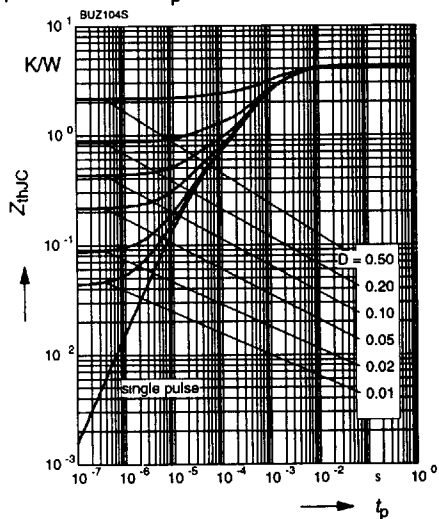
$$I_D = f(V_{\text{DS}})$$

parameter: $D = 0$, $T_C = 25^{\circ}\text{C}$


Transient thermal impedance

$$Z_{\text{thJC}} = f(t_p)$$

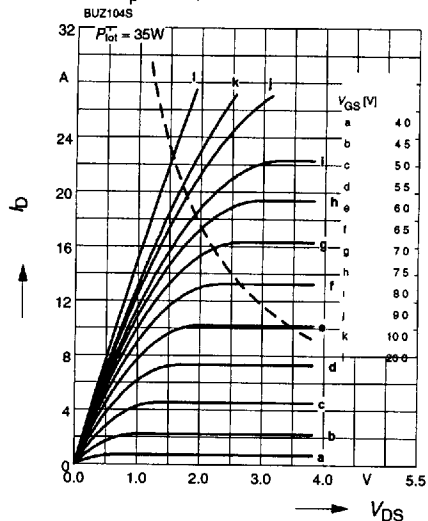
parameter: $D = t_p / T$



Typ. output characteristics

$$I_D = f(V_{DS})$$

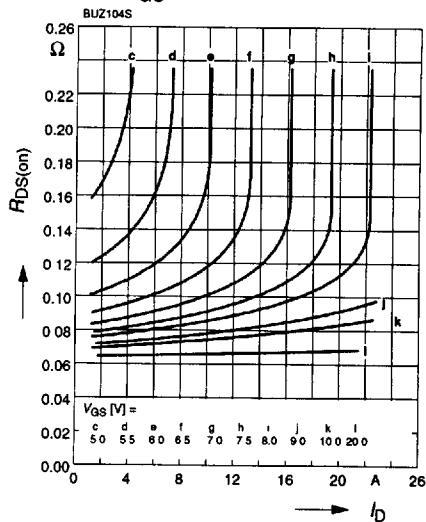
parameter: $t_p = 80 \mu s$



Typ. drain-source-on-resistance

$$R_{DS(on)} = f(I_D)$$

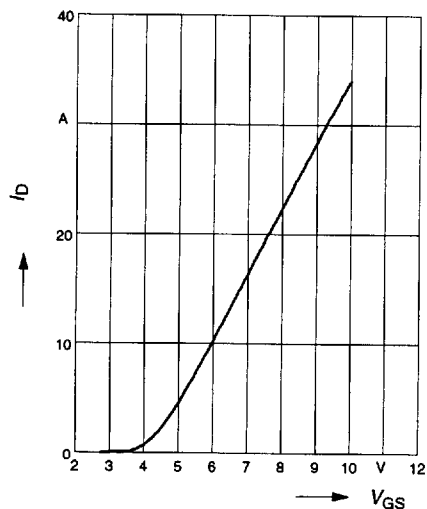
parameter: V_{GS}



Typ. transfer characteristics $I_D = f(V_{GS})$

parameter: $t_p = 80 \mu s$

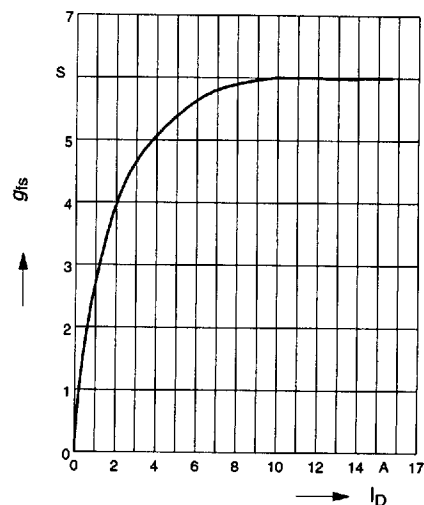
$$V_{DS} \geq 2 \times I_D \times R_{DS(on) \max}$$



Typ. forward transconductance

$$g_{fs} = f(I_D); T_j = 25^\circ C$$

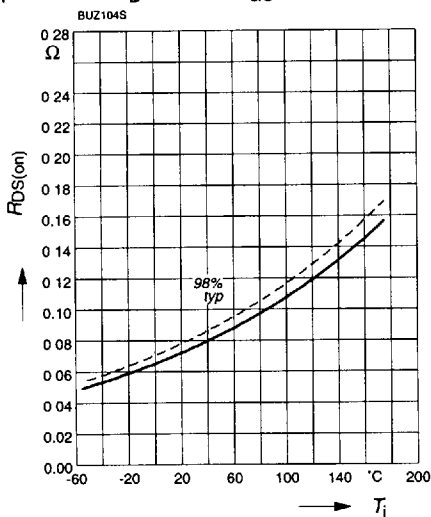
parameter: g_{fs}



Drain-source on-resistance

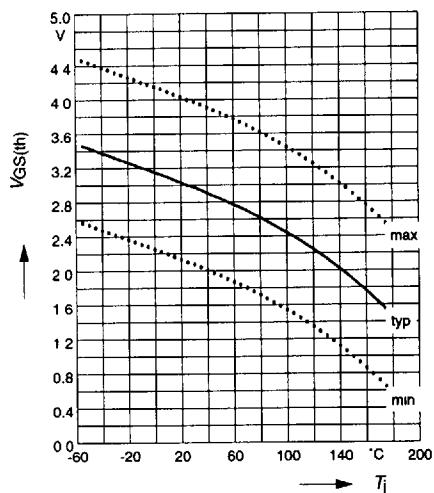
$$R_{DS(on)} = f(T_j)$$

parameter : $I_D = 9.6 \text{ A}$, $V_{GS} = 10 \text{ V}$


Gate threshold voltage

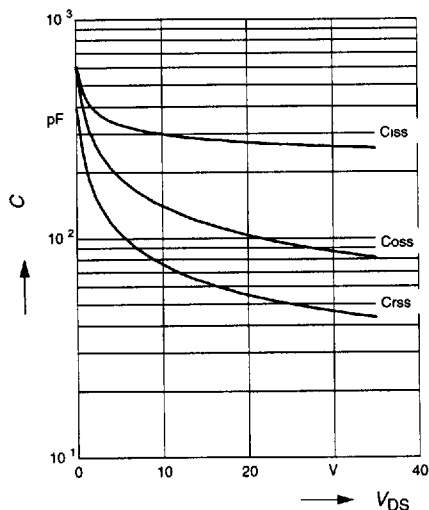
$$V_{GS(th)} = f(T_j)$$

parameter : $V_{GS} = V_{DS}$, $I_D = 20 \mu\text{A}$


Typ. capacitances

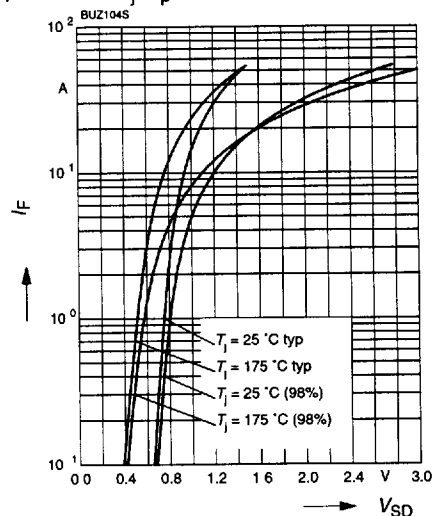
$$C = f(V_{DS})$$

parameter: $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$


Forward characteristics of reverse diode

$$I_F = f(V_{SD})$$

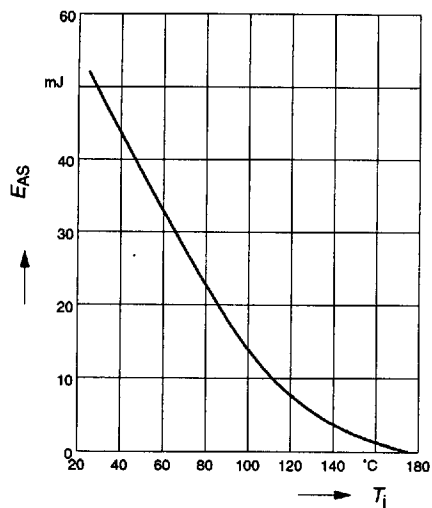
parameter: T_j , $t_p = 80 \mu\text{s}$



Avalanche Energy $E_{AS} = f(T_j)$

parameter: $I_D = 13.5 \text{ A}$, $V_{DD} = 25 \text{ V}$

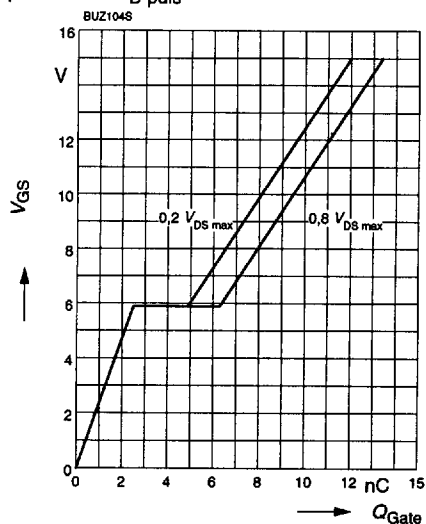
$R_{GS} = 25 \Omega$



Typ. gate charge

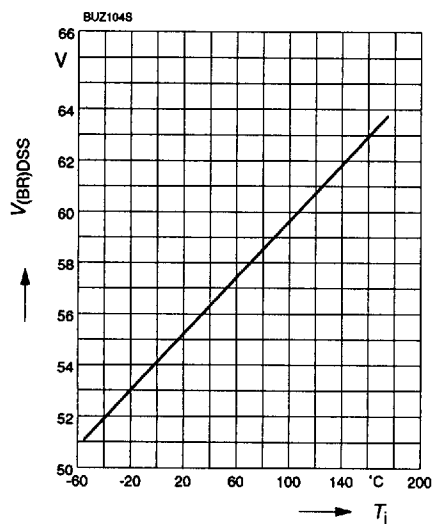
$V_{GS} = f(Q_{Gate})$

parameter: $I_D \text{ puls} = 13.5 \text{ A}$



Drain-source breakdown voltage

$V_{(BR)DSS} = f(T_j)$



Gehäusemaßbilder

(Maße in mm, wenn nicht anders angegeben)

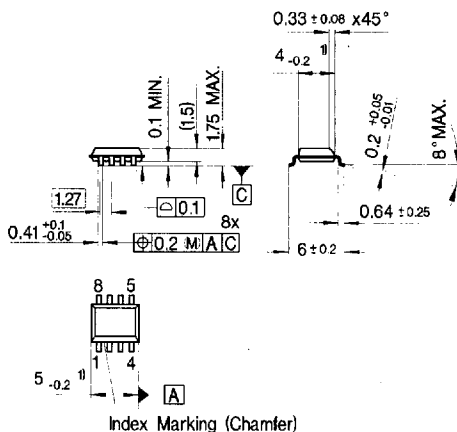
Package Outlines

(Dimensions in mm, unless otherwise specified)

P-DSO-8-6/-7

Gewicht etwa 0.15 g

Approx. weight 0.15 g



1) Does not include plastic or metal protrusion of 0.15 max. per side

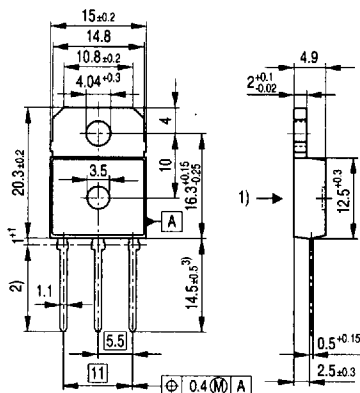
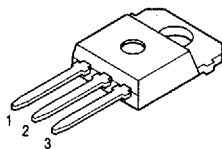
Bild 16

Figure 16

P-T0218-AA (P-T0218-2-1)

Gewicht etwa 4.9 g

Approx. weight 4.9 g



- 1) Punch direction, burr max. 0.04
- 2) Dip tinning
- 3) Max. 15.5 by dip tinning
press burr max. 0.05
radii not dimensioned max. 0.2

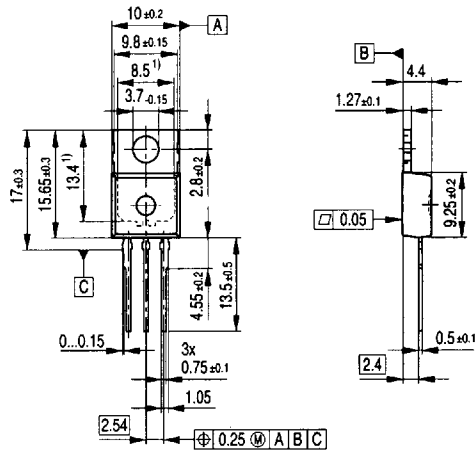
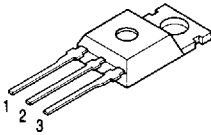
GPT05156

Bild 17

Figure 17

P-TO220-3-1

Gewicht etwa 1.8 g
Approx. weight 1.8 g



¹⁾ Typical

All metal surfaces tin plated, except area of cut.

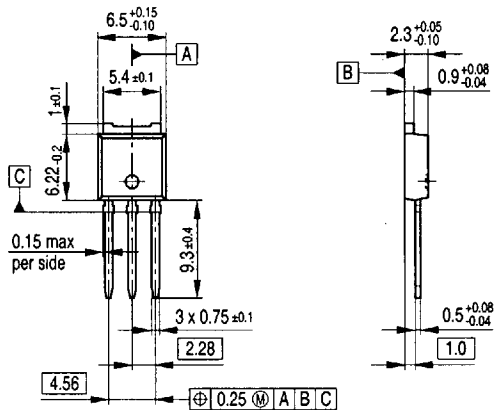
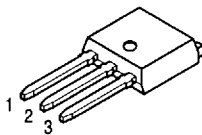
GPT05155

Bild 18

Figure 18

P-TO251-3-1

Gewicht etwa 2.0 g
Approx. weight 2.0 g



All metal surfaces tin plated, except area of cut.

GPT09060

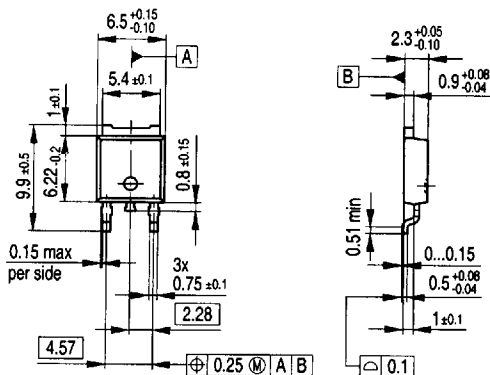
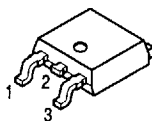
Bild 19

Figure 19

P-TO252-3-1

Gewicht etwa 0.38 g

Approx. weight 0.38 g



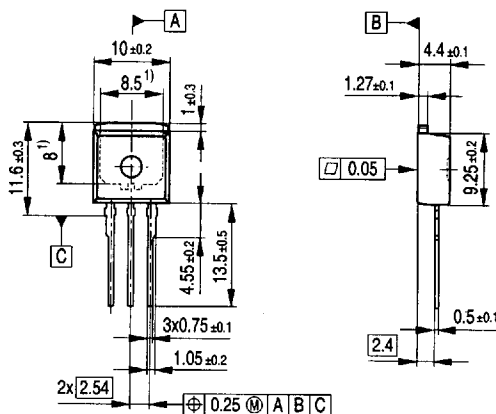
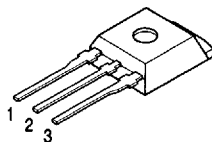
All metal surfaces tin plated, except area of cut.

GPT09051

Bild 20

Figure 20

P-TO262-3-1/I²PAK



¹⁾ Typical

Metal surface min. X = 7.25, Y = 7.35

All metal surfaces tin plated, except area of cut.

GPT09244

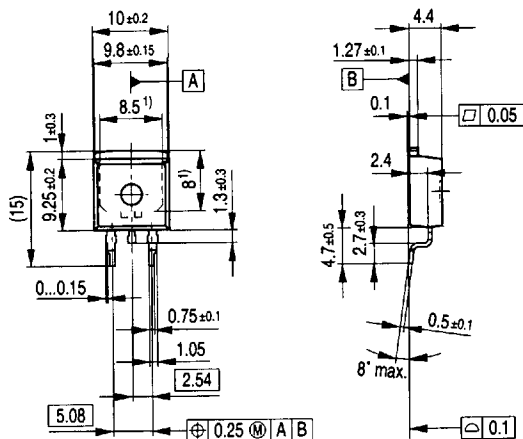
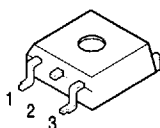
Bild 21

Figure 21

P-TO263-3-2/D²PAK

Gewicht etwa 1.38 g

Approx. weight 1.38 g



¹⁾ Typical

All metal surfaces tin plated, except area of cut.

GPT09085

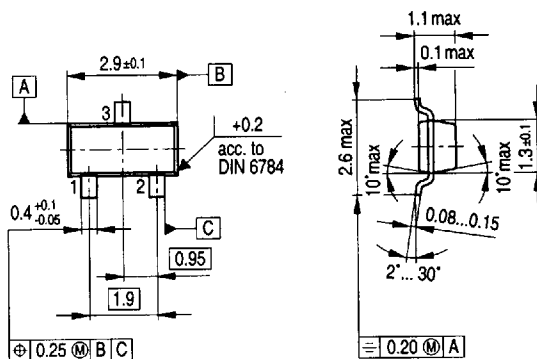
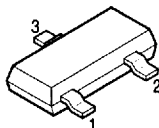
Bild 22

Figure 22

SOT-23 (P-SOT23-3-1)

Gewicht etwa 0.01 g

Approx. weight 0.01 g



GPS05557

Bild 23

Figure 23

SOT-89

Gewicht etwa 0.01 g
Approx. weight 0.01 g

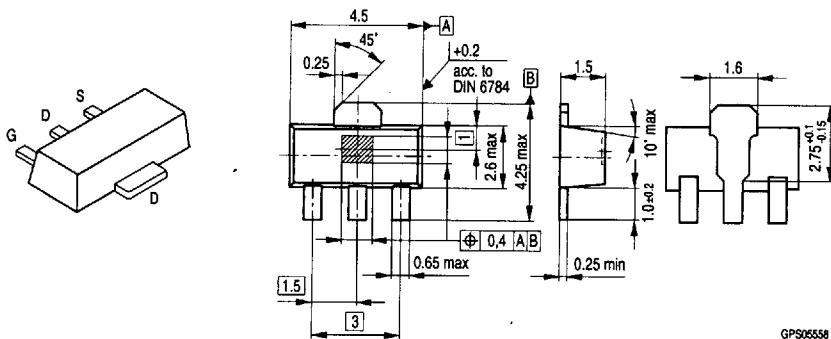


Bild 24

Figure 24

SOT-223 (P-SOT223-4-1)

Gewicht etwa 0.15 g
Approx. weight 0.15 g

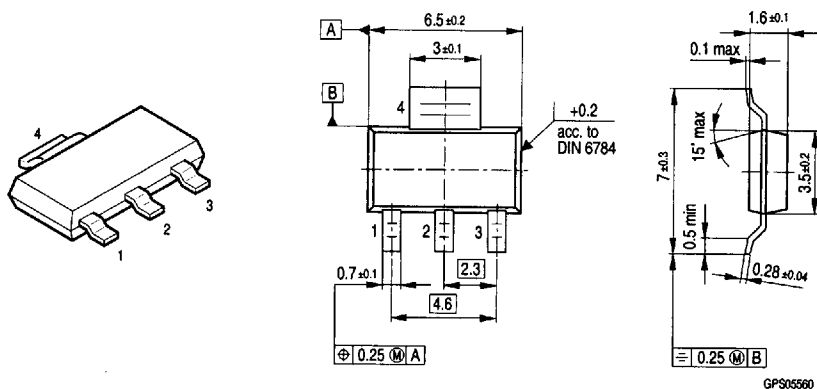


Bild 25

Figure 25

TO-92

Gewicht etwa 0.23 g

Approx. weight 0.23 g

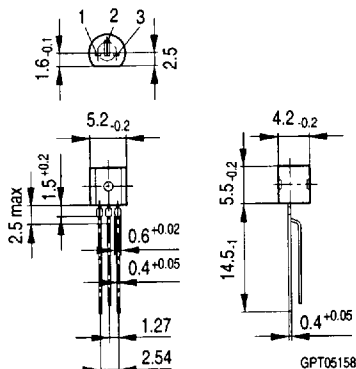
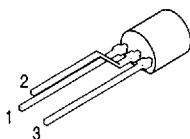


Bild 26

Figure 26

TO-92-E6288

Gewicht etwa 0.23 g

Approx. weight 0.23 g

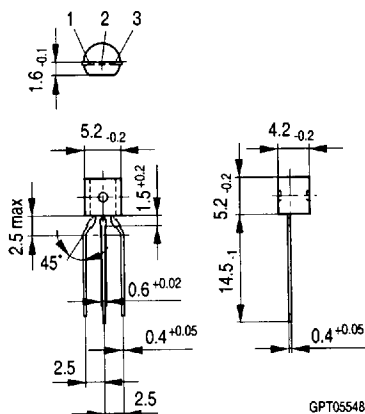
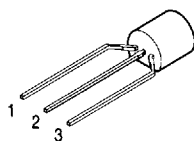


Bild 27

Figure 27

Sorts of Packing

Package outlines for tubes, trays etc. are contained in our Data Book "Package Information".

SMD = Surface Mounted Device