

PowerMOS transistor Logic level TOPFET

BUK102-50GL

DESCRIPTION

Monolithic temperature and overload protected logic level power MOSFET in a 3 pin plastic envelope, intended as a general purpose switch for automotive systems and other applications.

APPLICATIONS

General controller for driving

- lamps
- motors
- solenoids
- heaters

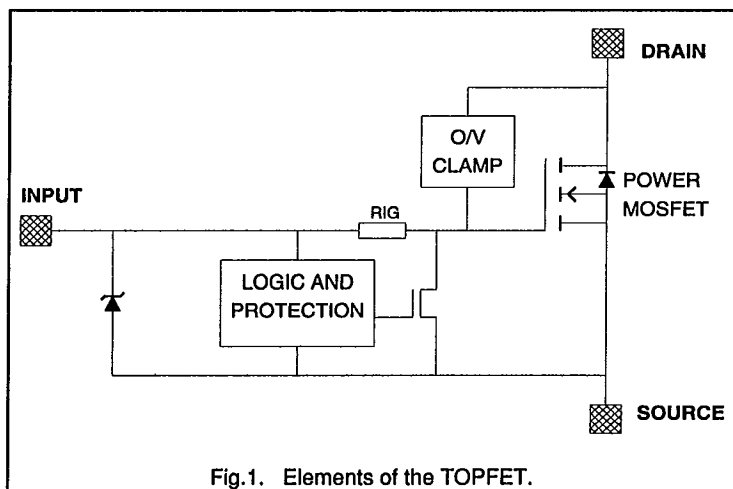
FEATURES

- Vertical power DMOS output stage
- Low on-state resistance
- Overload protection against over temperature
- Overload protection against short circuit load
- Latched overload protection reset by input
- 5 V input level
- Low threshold voltage also allows 5 V control
- Control of power MOSFET and supply of overload protection circuits derived from input
- ESD protection on input pin
- Overvoltage clamping for turn off of inductive loads

QUICK REFERENCE DATA

SYMBOL	PARAMETER	MAX.	UNIT
V_{DS}	Continuous drain source voltage	50	V
I_D	Continuous drain current	45	A
P_D	Total power dissipation	125	W
T_J	Continuous junction temperature	150	°C
$R_{DS(ON)}$	Drain-source on-state resistance $V_{IS} = 5\text{ V}$	35	mΩ

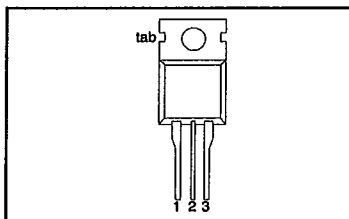
FUNCTIONAL BLOCK DIAGRAM



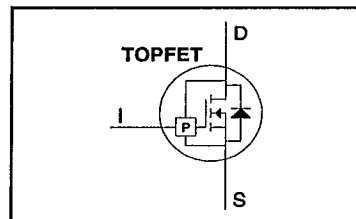
PINNING - TO220AB

PIN	DESCRIPTION
1	input
2	drain
3	source
tab	drain

PIN CONFIGURATION



SYMBOL



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BUK102-50GL**LIMITING VALUES**

Limiting values in accordance with the Absolute Maximum System (IEC 134)

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{DSS}	Continuous off-state drain source voltage ¹	$V_{IS} = 0 \text{ V}$	-	50	V
V_{IS}	Continuous input voltage	-	0	6	V
I_D	Continuous drain current	$T_{mb} \leq 25 \text{ }^\circ\text{C}; V_{IS} = 5 \text{ V}$	-	45	A
I_D	Continuous drain current	$T_{mb} \leq 100 \text{ }^\circ\text{C}; V_{IS} = 5 \text{ V}$	-	28	A
I_{DRM}	Repetitive peak on-state drain current	$T_{mb} \leq 25 \text{ }^\circ\text{C}; V_{IS} = 5 \text{ V}$	-	180	A
P_D	Total power dissipation	$T_{mb} \leq 25 \text{ }^\circ\text{C}$	-	125	W
T_{slg}	Storage temperature	-	-55	150	$^\circ\text{C}$
T_j	Continuous junction temperature ²	normal operation	-	150	$^\circ\text{C}$
T_{soid}	Lead temperature	during soldering	-	250	$^\circ\text{C}$

OVERLOAD PROTECTION LIMITING VALUES

With the protection supply provided via the input pin, TOPFET can protect itself from two types of overload.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_{ISP}	Protection supply voltage ³	for valid protection	4	-	V
Over temperature protection					
$V_{DDP(T)}$	Protected drain source supply voltage	$V_{IS} = 5 \text{ V}$	-	50	V
Short circuit load protection					
$V_{DDP(P)}$	Protected drain source supply voltage ⁴	$V_{IS} = 5 \text{ V}$	-	24	V
P_{DSM}	Instantaneous overload dissipation	$T_{mb} = 25 \text{ }^\circ\text{C}$	-	2.1	kW

OVERVOLTAGE CLAMPING LIMITING VALUES

At a drain source voltage above 50 V the power MOSFET is actively turned on to clamp overvoltage transients.

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_{DROM}	Repetitive peak clamping current	$V_{IS} = 0 \text{ V}$	-	45	A
E_{DSM}	Non-repetitive clamping energy	$T_{mb} \leq 25 \text{ }^\circ\text{C}; I_{DM} = 25 \text{ A};$ $V_{DD} \leq 25 \text{ V};$ inductive load	-	1	J
E_{DRM}	Repetitive clamping energy	$T_{mb} \leq 85 \text{ }^\circ\text{C}; I_{DM} = 16 \text{ A};$ $V_{DD} \leq 20 \text{ V}; f = 250 \text{ Hz}$	-	80	mJ

ESD LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
V_C	Electrostatic discharge capacitor voltage	Human body model; $C = 250 \text{ pF}; R = 1.5 \text{ k}\Omega$	-	2	kV

¹ Prior to the onset of overvoltage clamping. For voltages above this value, safe operation is limited by the overvoltage clamping energy.

² A higher T_j is allowed as an overload condition but at the threshold $T_{j(TOT)}$ the over temperature trip operates to protect the switch.

³ The input voltage for which the overload protection circuits are functional.

⁴ The device is able to self-protect against a short circuit load providing the drain-source supply voltage does not exceed $V_{DDP(P)}$ maximum. For further information, refer to OVERLOAD PROTECTION CHARACTERISTICS.

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THERMAL CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$R_{th\ j-mb}$	Thermal resistance Junction to mounting base	-	-	0.8	1.0	K/W
$R_{th\ j-a}$	Junction to ambient	in free air	-	60	-	K/W

STATIC CHARACTERISTICS

 $T_{mb} = 25\ ^\circ\text{C}$ unless otherwise specified

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{(CL)DSS}$	Drain-source clamping voltage	$V_{IS} = 0\text{ V}; I_D = 10\text{ mA}$	50	-	-	V
$V_{(CL)DSS}$	Drain-source clamping voltage	$V_{IS} = 0\text{ V}; I_{DM} = 2\text{ A}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.01$	-	-	70	V
I_{DSS}	Zero input voltage drain current	$V_{DS} = 12\text{ V}; V_{IS} = 0\text{ V}$	-	0.5	10	μA
I_{DSS}	Zero input voltage drain current	$V_{DS} = 50\text{ V}; V_{IS} = 0\text{ V}$	-	1	20	μA
I_{DSS}	Zero input voltage drain current	$V_{DS} = 40\text{ V}; V_{IS} = 0\text{ V}; T_J = 125\ ^\circ\text{C}$	-	10	100	μA
$R_{DS(ON)}$	Drain-source on-state resistance	$I_{DM} = 25\text{ A}; V_{IS} = 5\text{ V}; t_p \leq 300\ \mu\text{s}; \delta \leq 0.01$	-	30	35	m Ω

OVERLOAD PROTECTION CHARACTERISTICS

TOPFET switches off when one of the overload thresholds is reached. It remains latched off until reset by the input.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$E_{DS(TO)}$	Short circuit load protection ¹ Overload threshold energy	$T_{mb} = 25\ ^\circ\text{C}; L \leq 10\ \mu\text{H}$ $V_{DD} = 13\text{ V}; V_{IS} = 5\text{ V}$	-	1.1	-	J
t_{dco}	Response time	$V_{DD} = 13\text{ V}; V_{IS} = 5\text{ V}$	-	0.8	-	ms
$T_{K(TO)}$	Over temperature protection Threshold junction temperature	$V_{IS} = 5\text{ V}; \text{from } I_D \geq 2\text{ A}^2$	150	-	-	$^\circ\text{C}$

INPUT CHARACTERISTICS

 $T_{mb} = 25\ ^\circ\text{C}$ unless otherwise specified. The supply for the logic and overload protection is taken from the input.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
$V_{IS(TO)}$	Input threshold voltage	$V_{DS} = 5\text{ V}; I_D = 1\text{ mA}$	1.0	1.5	2.0	V
I_{IS}	Input supply current	$V_{IS} = 5\text{ V}; \text{normal operation}$	-	0.2	0.35	mA
V_{ISR}	Protection reset voltage ³		2.0	2.6	3.5	V
V_{ISR}	Protection reset voltage	$T_J = 150\ ^\circ\text{C}$	1.0	-	-	
I_{ISL}	Input supply current	$V_{IS} = 5\text{ V}; \text{protection latched}$	2	3.8	10	mA
$V_{(BR)IS}$	Input clamp voltage	$I_I = 10\text{ mA}$	6	-	-	V
R_{IG}	Input series resistance	to gate of power MOSFET	-	1.5	-	k Ω

¹ The short circuit load protection is able to save the device providing the instantaneous on-state dissipation is less than the limiting value for P_{DSM} , which is always the case when V_{DS} is less than V_{DSF} maximum. Refer to OVERLOAD PROTECTION LIMITING VALUES.

² The over temperature protection feature requires a minimum on-state drain source voltage for correct operation. The specified minimum I_D ensures this condition.

³ The input voltage below which the overload protection circuits will be reset.

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TRANSFER CHARACTERISTICS

 $T_{mb} = 25\text{ }^{\circ}\text{C}$

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
g_{fs}	Forward transconductance	$V_{DS} = 10\text{ V}; I_{DM} = 25\text{ A}; t_p \leq 300\text{ }\mu\text{s}; \delta \leq 0.01$	17	28	-	S
$I_{D(SC)}$	Drain current ¹	$V_{DS} = 13\text{ V}; V_{IS} = 5\text{ V}$	-	60	-	A

SWITCHING CHARACTERISTICS

 $T_{mb} = 25\text{ }^{\circ}\text{C}$. $R_L = 50\text{ }\Omega$. Refer to waveform figures and test circuits.

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
t_{don}	Turn-on delay time	$V_{DD} = 13\text{ V}; V_{IS} = 5\text{ V}$ resistive load $R_L = 1.1\text{ }\Omega$	-	2	-	μs
t_r	Rise time		-	8	-	μs
t_{doff}	Turn-off delay time	$V_{DD} = 13\text{ V}; V_{IS} = 0\text{ V}$ resistive load $R_L = 1.1\text{ }\Omega$	-	8	-	μs
t_f	Fall time		-	8	-	μs
t_{don}	Turn-on delay time	$V_{DD} = 13\text{ V}; V_{IS} = 5\text{ V}$ inductive load $I_{DM} = 11\text{ A}$	-	3.7	-	μs
t_r	Rise time		-	3.7	-	μs
t_{doff}	Turn-off delay time	$V_{DD} = 13\text{ V}; V_{IS} = 0\text{ V}$ inductive load $I_{DM} = 11\text{ A}$	-	13	-	μs
t_f	Fall time		-	1.4	-	μs

REVERSE DIODE LIMITING VALUE

SYMBOL	PARAMETER	CONDITIONS	MIN.	MAX.	UNIT
I_S	Continuous forward current	$T_{mb} \leq 25\text{ }^{\circ}\text{C}; V_{IS} = 0\text{ V}$	-	50	A

REVERSE DIODE CHARACTERISTICS

 $T_{mb} = 25\text{ }^{\circ}\text{C}$

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
V_{SDS}	Forward voltage	$I_S = 50\text{ A}; V_{IS} = 0\text{ V}; t_p = 300\text{ }\mu\text{s}$	-	1.0	1.5	V
t_{rr}	Reverse recovery time	not applicable ²	-	-	-	-

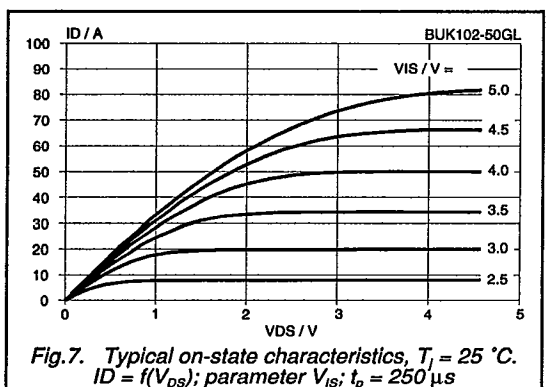
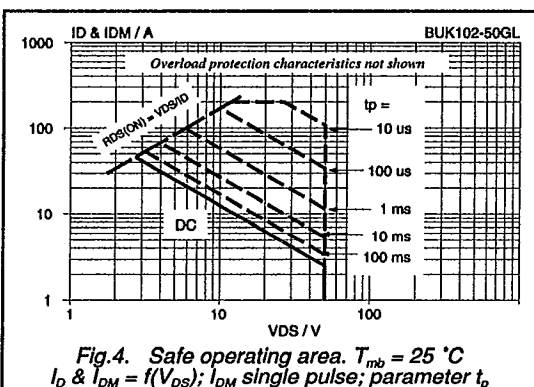
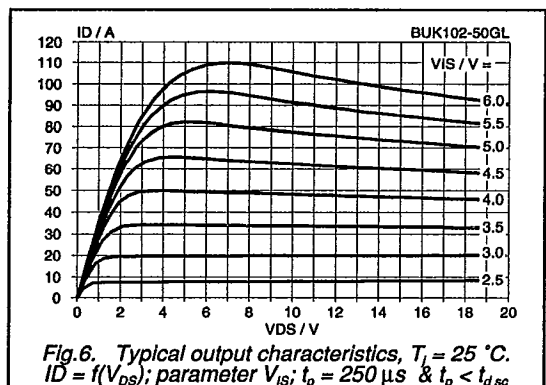
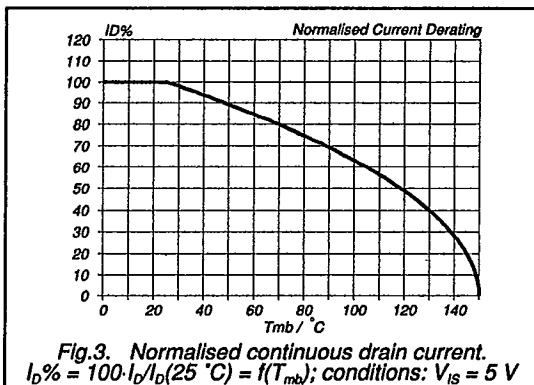
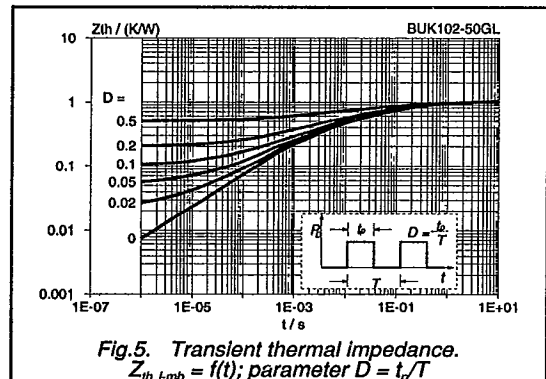
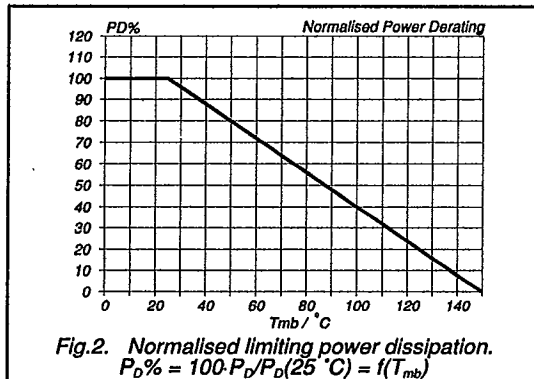
ENVELOPE CHARACTERISTICS

SYMBOL	PARAMETER	CONDITIONS	MIN.	TYP.	MAX.	UNIT
L_d	Internal drain inductance	Measured from contact screw on tab to centre of die	-	3.5	-	nH
L_d	Internal drain inductance	Measured from drain lead 6 mm from package to centre of die	-	4.5	-	nH
L_s	Internal source inductance	Measured from source lead 6 mm from package to source bond pad	-	7.5	-	nH

¹ During overload before short circuit load protection operates.² The reverse diode of this type is not intended for applications requiring fast reverse recovery.

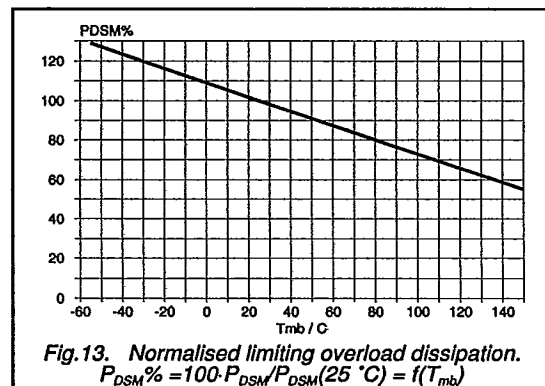
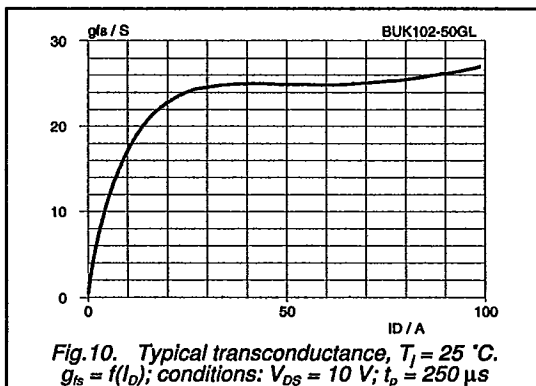
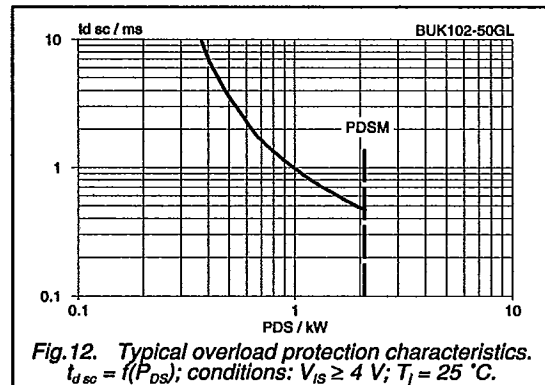
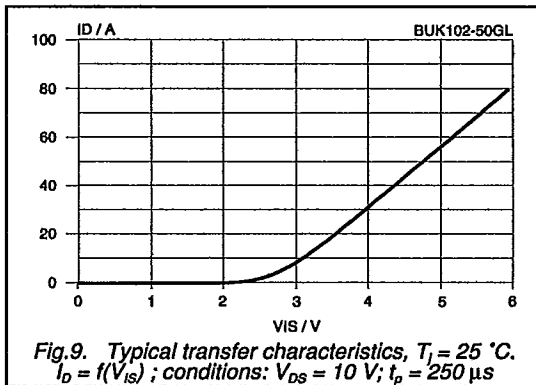
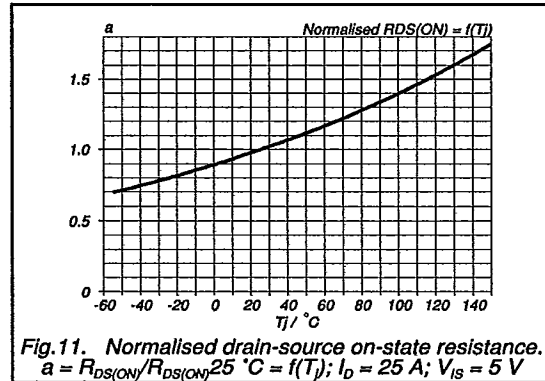
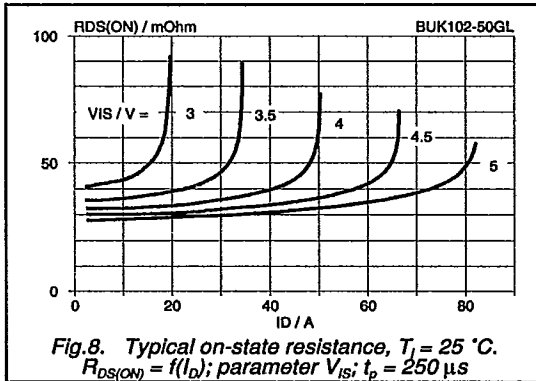
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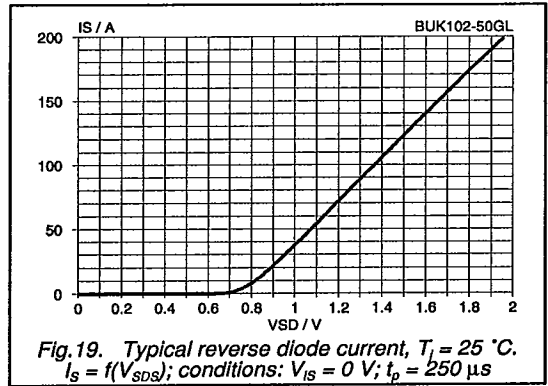
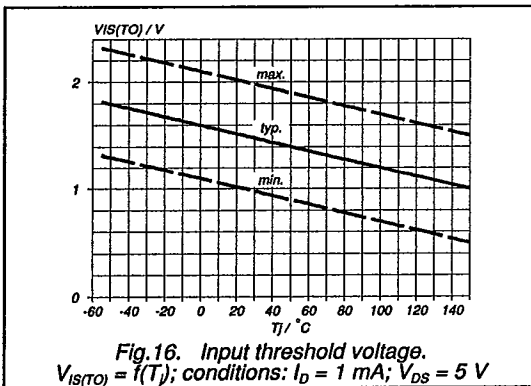
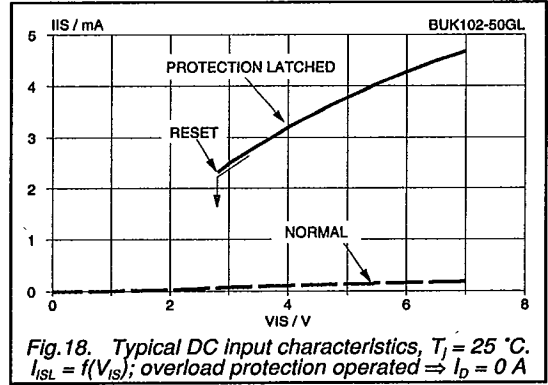
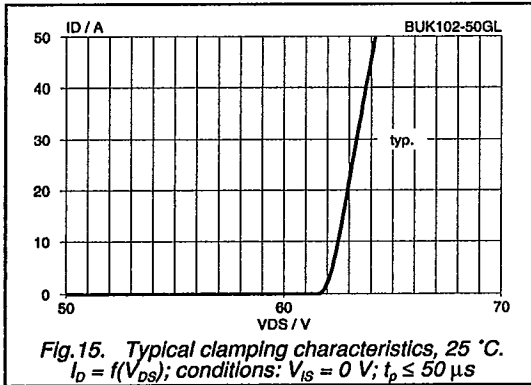
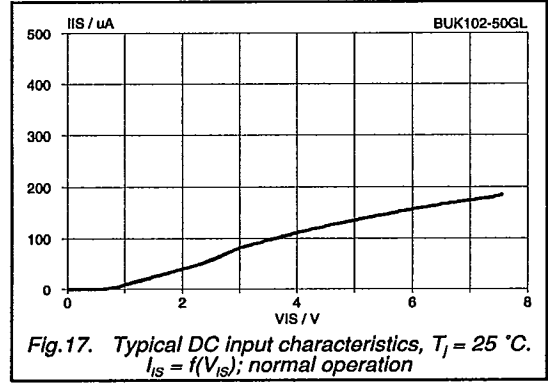
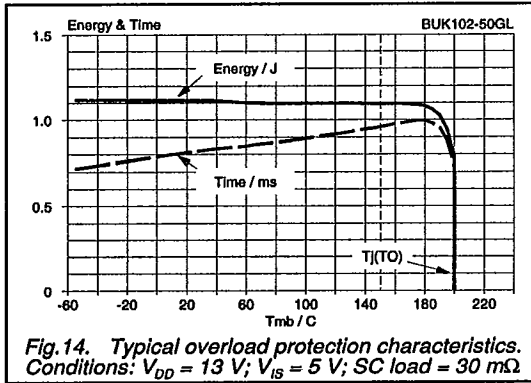
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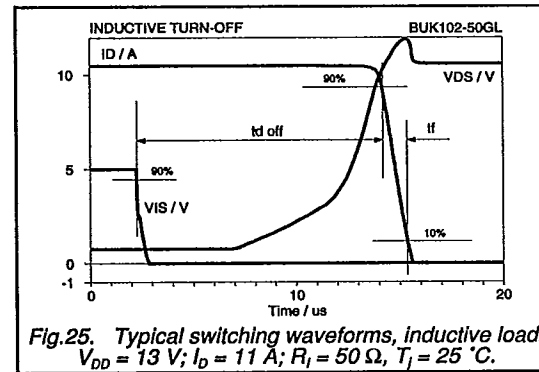
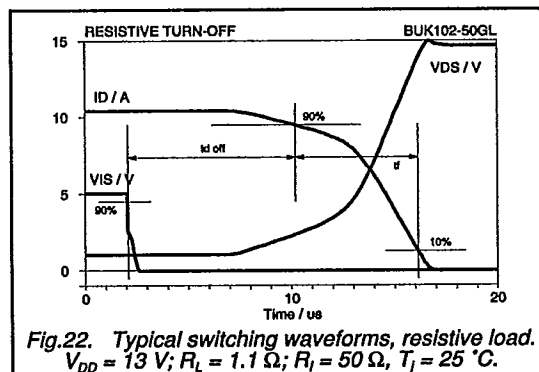
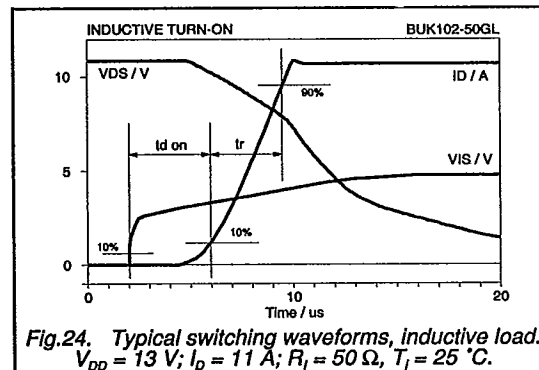
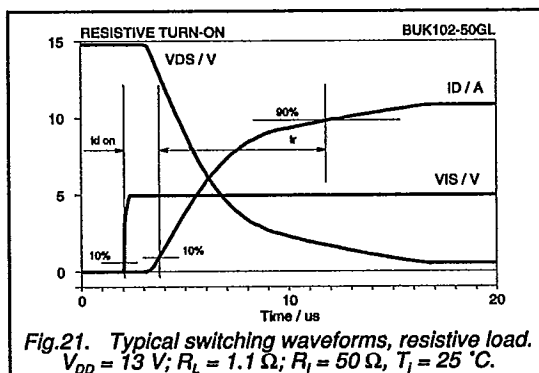
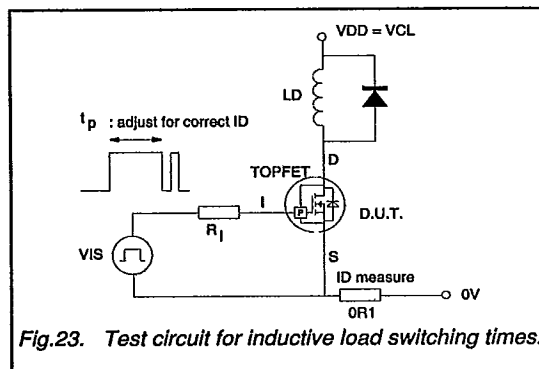
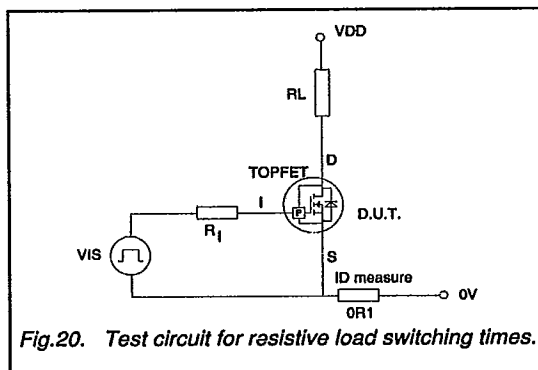
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