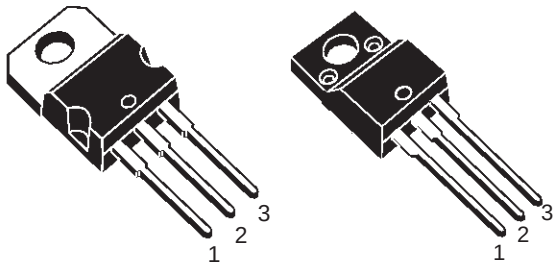
BUF405A
BUF405AFP

HIGH VOLTAGE FAST-SWITCHING NPN POWER TRANSISTORS

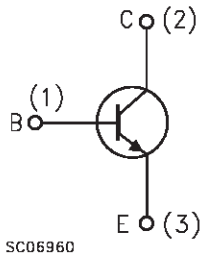
- HIGH SWITCHING SPEED NPN POWER TRANSISTORS
- EASY TO DRIVE
- HIGH VOLTAGE FOR OFF-LINE APPLICATIONS
- 100 KHz SWITCHING SPEED
- LOW COST DRIVE CIRCUITS
- LOW DYNAMIC SATURATION

APPLICATIONS:
- SWITCH MODE POWER SUPPLIES
- MOTOR DRIVERS



TO-220 **TO-220FP**

INTERNAL SCHEMATIC DIAGRAM



DESCRIPTION

These Easy-to-Drive FASTSWITCH NPN power transistors are specially designed for high reliability industrial and professional power driving applications such us motor drives and off-line switching power supplies. ETD transistors will operate using easy drive circuits at up to 100KHz; this helps to simplify designs and improve reliability. The superior switching performance and low crossover losses reduce dissipation and consequently lowers the equipment operating temperature.

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		BUF405A	BUF405AFP	
V_{CEV}	Collector-Emitter Voltage (V_{BE} = -1.5 V)	1000		V
V_{CEO}	Collector-Emitter Voltage (I_B = 0)	450		V
V_{EBO}	Emitter-Base Voltage (I_C = 0)	7		V
I_C	Collector Current	7.5		A
I_{CM}	Collector Peak Current (t_p < 5 ms)	15		A
I_B	Base Current	3		A
I_{BM}	Base Peak Current (t_p < 5 ms)	4.5		A
P_{tot}	Total Dissipation at T_c = 25 °C	80	39	W
T_{stg}	Storage Temperature	-65 to 150		°C
T_j	Max Operation Junction Temperature	150		°C

THERMAL DATA

		TO-220	TO-220FP	
$R_{thj\text{-}case}$	Thermal Resistance Junction-Case Max	1.56	3.2	°C/W

ELECTRICAL CHARACTERISTICS (T_{case} = 25 °C unless otherwise specified)

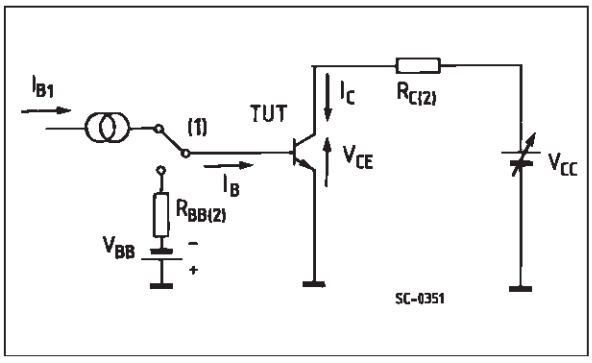
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CER}	Collector Cut-off Current (R_{BE} = 5 Ω)	V_{CE} = V_{CEV} V_{CE} = V_{CEV} T_c = 100 °C			0.1 0.5	mA mA
I_{CEV}	Collector Cut-off Current (I_B = 0)	V_{CE} = V_{CEV} V_{BE} = -1.5 V V_{CE} = V_{CEV} V_{BE} = -1.5 V T_c =100°C			0.1 0.5	mA mA
I_{EBO}	Emitter Cut-off Current (I_C = 0)	V_{BE} = 5 V			1	mA
$V_{CEO(sus)}$*	Collector-Emitter Sustaining Voltage	I_C = 200 mA L = 25 mH	450			V
V_{EBO}	Emitter Base Voltage (I_C = 0)	I_E = 50 mA	7			V
$V_{CE(sat)}$*	Collector-Emitter Saturation Voltage	I_C = 2.5 A I_B = 0.25 A I_C = 2.5 A I_B = 0.25 A T_c =100°C I_C = 5 A I_B = 1 A I_C = 5 A I_B = 1 A T_c =100°C		0.8 0.5 	 2.8 2	V V V V
$V_{BE(sat)}$*	Base-Emitter Saturation Voltage	I_C = 2.5 A I_B = 0.25 A I_C = 2.5 A I_B = 0.25 A T_c =100°C I_C = 5 A I_B = 1 A I_C = 5 A I_B = 1 A T_c =100°C		0.9 1.1 	 1.5 1.5	V V V V
di_c/dt	Rate of rise on-state Collector Current	V_{CC} = 300 V R_C = 0 t_p= 3 µs I_{B1} = 0.375 A T_j =25°C I_{B1} = 0.375 A T_j =100°C I_{B1} = 1.5 A T_j =100°C	 30 60	 40 	 	 A/µs A/µs A/µs
V_{CE}(3µs)	Collector-Emitter Dynamic Voltage	V_{CC} = 300 V R_C = 120 Ω I_{B1} = 0.375 A T_j =25°C T_j =100°C		 2.1 	 8	 V V
V_{CE}(5µs)	Collector-Emitter Dynamic Voltage	V_{CC} = 300 V R_C = 120 Ω I_{B1} = 0.375 A T_j =25°C T_j =100°C		 1.1 	 4	 V V
 t_s t_f t_c	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	I_C = 2.5 A V_{CC} = 50 V V_{BB} = - 5 V R_{BB} = 2.4 Ω V_{clamp} = 400 V I_{B1} = 0.25 A L = 1 mH		 0.8 0.05 0.08	 	 µs µs µs
 t_s t_f t_c	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	I_C = 2.5 A V_{CC} = 50 V V_{BB} = - 5 V R_{BB} = 2.4 Ω V_{clamp} = 400 V I_{B1} = 0.25 A L = 1 mH T_j =100°C		 	 1.8 0.1 0.18	 µs µs µs
V_{CEW}	Maximum Collector Emitter Voltage without Snubber	IC = 2.5 A V_{CC} = 50 V V_{BB} = - 5 V R_{BB} = 2.4 Ω V_{clamp} = 400 V I_{B1} = 0.25 A L = 1 mH T_j =125°C	500	 	 	V
 t_s t_f t_c	INDUCTIVE LOAD Storage Time Fall Time Cross Over Time	I_C = 2.5 A V_{CC} = 50 V V_{BB} = 0 R_{BB} = 0.6 Ω V_{clamp} = 400 V I_{B1} = 0.25 A L = 1 mH		 1.5 0.04 0.07	 	 µs µs µs

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions		Min.	Typ.	Max.	Unit
	INDUCTIVE LOAD	I_C = 2.5 A	V_{CC} = 50 V				
t_s	Storage Time	V_{BB} = 0	R_{BB} = 0.6 Ω			3	µs
t_f	Fall Time	V_{clamp} = 400 V	I_{B1} = 0.25 A			0.15	µs
t_c	Cross Over Time	L = 1 mH	T_j =100°C			0.25	µs
V_{CEW}	Maximum Collector Emitter Voltage without Snubber	IC = 2.5 A V_{BB} = 0 V_{clamp} = 400 V L = 1 mH	V_{CC} = 50 V R_{BB} = 0.6 Ω I_{B1} = 0.25 A T_j =125°C	500			V
	INDUCTIVE LOAD	I_C = 5 A	V_{CC} = 50 V				
t_s	Storage Time	V_{BB} = -5 V	R_{BB} = 2.4 Ω		1.9		µs
t_f	Fall Time	V_{clamp} = 400 V	I_{B1} = 1 A		0.06		µs
t_c	Cross Over Time	L = 0.5 mH			0.12		µs
	INDUCTIVE LOAD	I_C = 5 A	V_{CC} = 50 V				
t_s	Storage Time	V_{BB} = - 5 V	R_{BB} =2.4 Ω			3.2	µs
t_f	Fall Time	V_{clamp} = 400 V	I_{B1} = 1 A			0.12	µs
t_c	Cross Over Time	L = 0.5 mH	T_j =100°C			0.3	µs
V_{CEW}	Maximum Collector Emitter Voltage without Snubber	ICWoff = 7.5 A V_{BB} = - 5 V L = 0.33 mH T_j =125°C	V_{CC} = 50 V R_{BB} = 2.4 Ω I_{B1} = 1.5 A	400			V

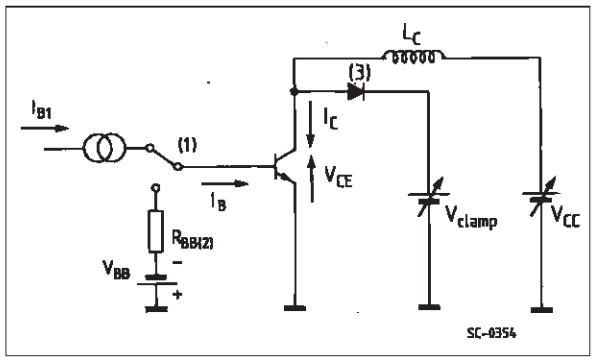
∗ Pulsed: Pulse duration = 300 µs, duty cycle < 1.5 %

Turn-on Switching Test Circuit



1 Fast electronic switch 2 Non-inductive Resistor

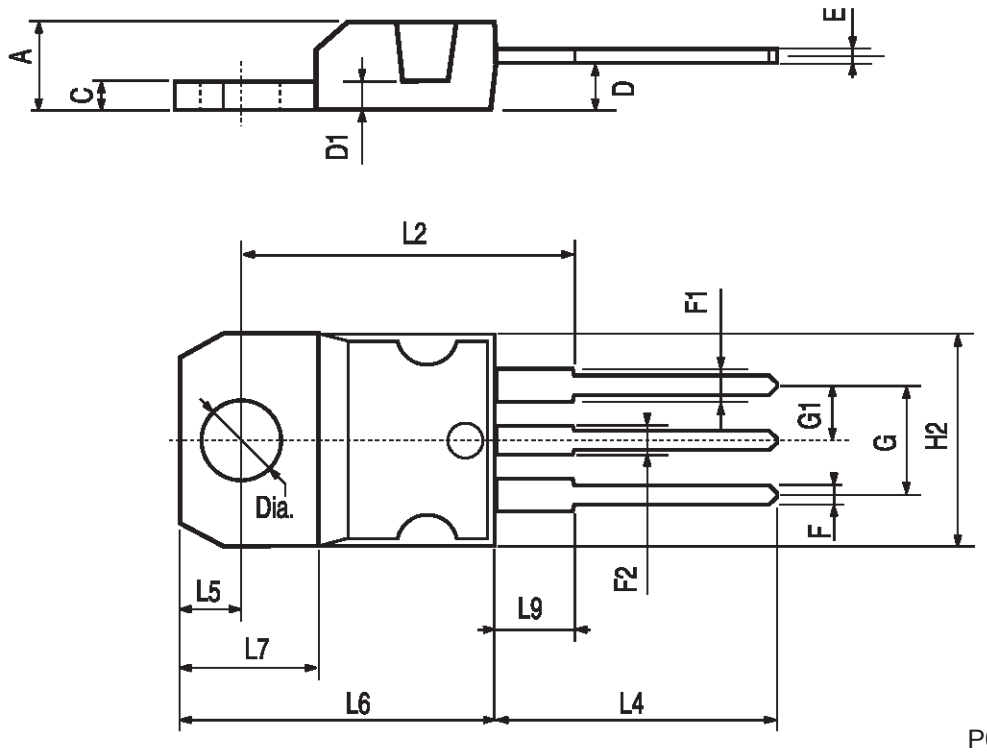
Turn-off Switching Test Circuit



1 Fast electronic switch 2 Non-inductive Resistor
3 Fast recovery rectifier

TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151



P011C

TO-220FP MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126