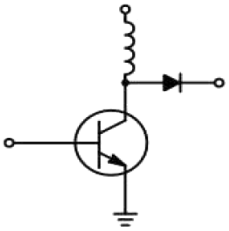
NPN Silicon Power Transistor

V_{CEO} 450V, I_C 15A, 175W, TO-3

multicomp PRO

RoHS Compliant



Features

The transistors are designed for high-voltage, high-speed, power switching in inductive circuits where fall time is critical. They are particularly suited for line-operated circuits.
Fast Turn-Off Times
60 ns Inductive Fall Time- 25°C (Typ)
120 ns Inductive Crossover Time- 25°C (Typ)
Operating Temperature Range -65°C to +200°C
100° C Performance Specified for:
Reverse-Biased SOA with Inductive Loads
Switching Times with Inductive Loads
Saturation Voltage
Leakage Currents (125°C)

Applications

1. Switching Regulators
2. Inverters
3. Solenoid and Relay Drivers
4. Motor Controls
5. Deflection Circuits

Absolute Maximum Ratings (T_a = 25 °C)

Rating	Symbol	BUX48A	Units
Collector - Emitter Voltage	$V_{CEO(SUS)}$	450	V DC
Collector - Emitter Voltage (V_{BE}=-1.5V)	V_{CEX}	1000	V DC
Emitter Base Voltage	V_{EB}	7	V DC
Collector Current - Continuous Peak Overloaded	I_C I_{CM} I_{OI}	15 30 60	A_{DC}
Base Current - Continuous Peak	I_B I_{BM}	5 20	A_{DC}
Total Power Dissipation @ TC = 25°C Derate above 25°C	P_D	175 100 1	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65°C to +200°C	°C

Thermal Characteristics

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to case	R_{JC}	1	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8 from Case for 5 Seconds	T_L	275	°C

(1) Pulse Test: Pulse Width = 5 ms, Duty Cycle10%.

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Electrical Characteristics at T_a = 25°C unless otherwise specified)

Characteristic		Symbol	Min	Typ	Max	Units
Off Characteristics (1)						
Collector Emitter Sustaining Voltage (Table1) (I_C = 200mA, I_B = 0) L = 25 mH BUX48A		$V_{CEO(sus)}$	400 450	- -	- -	V DC
Collector Cut Off Current (V_{CEX} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc) (V_{CEX} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc, Tc = 125°C		I_{CEX}	- -	- -	0.2 2	mA DC
Collector Cut Off Current (V_{CE} = Rated V_{CEX}), R_{BE} = 10) TC = 25°C TC = 25°C		I_{CER}	-		0.5 3	mA DC
Emitter Cut Off Current (V_{EB} = 5V DC, I_C = 0)		I_{EBO}	-		0.1	mA DC
Emitter-Base Breakdown Voltage (I_E = 50 mA - I_C = 0)		$V_{(BR)EBO}$	7	-	-	V DC
Second Breakdown						
Second Breakdown Collector Current with Base Forward Biased		$I_{S/b}$	See Figure 12			
Clamped Inductive SOA with Base Reverse Biased		RBSOA	See Figure 13			
On Characteristics (1)						
DC Current Gain (1) (I_C = 15A DC, V_{CE} = 5 V_{DC}) (I_C = 8A DC, V_{CE} = 5 V_{DC}) BUX48A		h_{FE}	8 8		- -	-
Collector Emitter Saturation Voltage (I_C = 10A DC, I_B = 2 A_{DC}) (I_C = 15A DC, I_B = 3 A_{DC}) (I_C = 10A DC, I_B = 2 A_{DC}, T_C = 100°C) (I_C = 8A DC, I_B = 1.6 A_{DC}) (I_C = 12A DC, I_B = 2.4 A_{DC}) (I_C = 8A DC, I_B = 1.6 A_{DC}, T_C = 100°C) BUX48A		$V_{CE(sat)}$	- - - - - -	- - - - - -	1.5 5 2 1.5 5 2	V DC
Collector Emitter Saturation Voltage (I_C = 10A DC, V_{CE} = 2 A_{DC}) (I_C = 10A DC, I_B = 2 A_{DC}, T_C = 100°C) (I_C = 8A DC, V_{CE} = 1.6 A_{DC}) (I_C = 8A DC, I_B = 1.6 A_{DC}, T_C = 100°C) BUX48A		$V_{BE(sat)}$	- - - -	- - - -	1.6 1.6 1.6 1.6	V DC
***Dynamic Characteristics**						
Output Capacitance (V_{CB} = 10 Vdc, I_E= 0, f_{test} = 1 MHz)		C_{ob}	-	-	350	pF
Switching Characteristics Resistive Load (Table 1)						
Delay Time	I_C = 10 A, I_B = 2 A I_C = 8 A, I_B = 1.6 A BUX48A Duty Cycle = 2%, $V_{BE(off)}$ = 5 V T_P = 30 s, V_{CC} = 300 V	t_d	-	0.1	0.2	s
Rise Time		t_r	-	0.4	0.7	
Storage Time		t_s	-	1.3	2	
Fall Time		t_f	-	0.2	0.4	

Characteristic			Symbol	Min	Typ	Max	Units
Inductive Load, Clamped (Table 1)							
Storage Time	I_C = 8A I_{B1} = 1.6A	BUX48A	t_{sv}	-	1.3	-	s
Fall Time			t_{fi}		0.06	-	
Storage Time			t_{sv}		1.5	2.5	
Crossover Time			t_c		0.3	0.6	
Fall Time			t_{fi}		0.17	0.35	

(1) Pulse Test: Pulse Width = 300s, Duty Cycle ≤12%
V_{CI} = 300V, $V_{BE(off)}$ = 5V, L_C = 180 H

Table 1. Test Conditions for Dynamic Performance

	$V_{CEO(sus)}$	RBSOA AND INDUCTIVE SWITCHING	RESISTIVE SWITCHING
INPUT CONDITIONS	+10 V, 20, 1, 0, 2 PW Varied to Attain I_C = 200 mA	33 2 W, D1, 22 F, 2N6438, +10 V, 160, 220, 100, MM3735, MR854, 680 pF, 22, I_{b1} ADJUST, D1 D2 D3 D4 1N4934, 0.1 F, I_{b2} ADJUST, dT_b ADJUST, PULSES = 3%, 680 pF, 2N3763, 100, MR854, D4, D3, 0.22 F, 2N6339, V_{CC}	TURN–ON TIME I_{B1} adjusted to obtain the forced h_{FE} desired TURN–OFF TIME Use inductive switching driver as the input to the resistive test circuit.
CIRCUIT VALUES	L_{coil} = 25 mH, V_{CC} = 10 V R_{coil} = 0.7	L_{coil} = 180 H R_{coil} = 0.05 V_{CC} = 20 V V_{clamp} = 300 V R_B ADJUSTED TO ATTAIN DESIRED I_{B1}	V_{CC} = 300 V R_L = 83 Pulse Width = 10 s
TEST CIRCUITS	INDUCTIVE TEST CIRCUIT TUT, 1, INPUT, 2, SEE ABOVE FOR DETAILED CONDITIONS, 1N4937 OR EQUIVALENT, R_{coil}, L_{coil}, V_{clamp}, V_{CC}, RS = 0.1	OUTPUT WAVEFORMS I_C, $I_{C(pk)}$, t_f Clamped, t, t_1, t_f, V_{CE}, V_{CE} or V_{clamp}, TIME, t_2 t_1 Adjusted to Obtain I_C $t_1 \simeq \frac{L_{coil}(I_{C_{pk}})}{V_{CC}}$ $t_2 \simeq \frac{L_{coil}(I_{C_{pk}})}{V_{Clamp}}$ Test Equipment Scope — Tektronix 475 or Equivalent	RESISTIVE TEST CIRCUIT TUT, 1, 2, R_L, V_{CC}

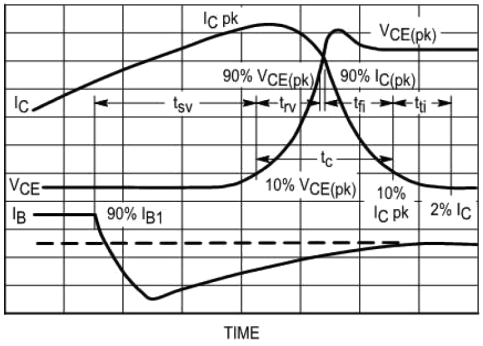

Figure 7. Inductive Switching Measurements

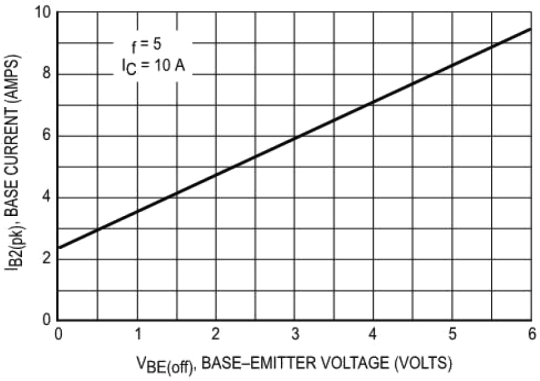

Figure 8. Peak–Reverse Current

INDUCTIVE SWITCHING

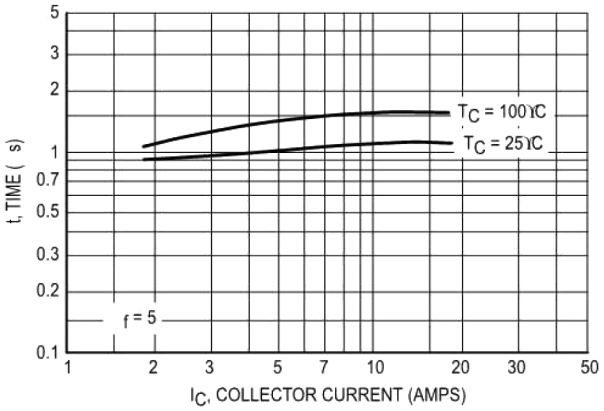

Figure 9. Storage Time, t_{sv}

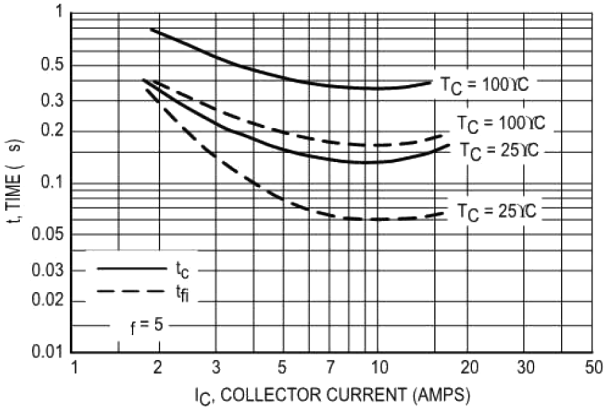

Figure 10. Crossover and Fall Times

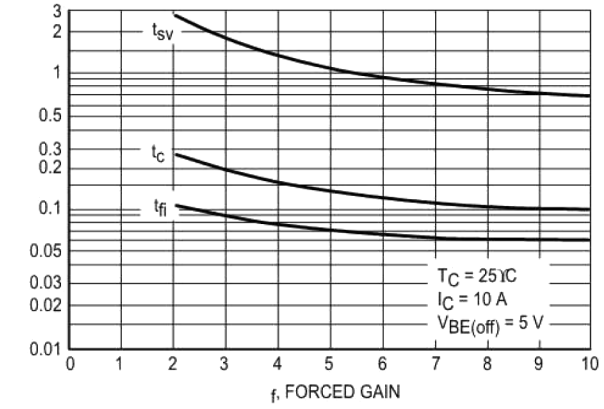

Figure 11a. Turn–Off Times versus Forced Gain

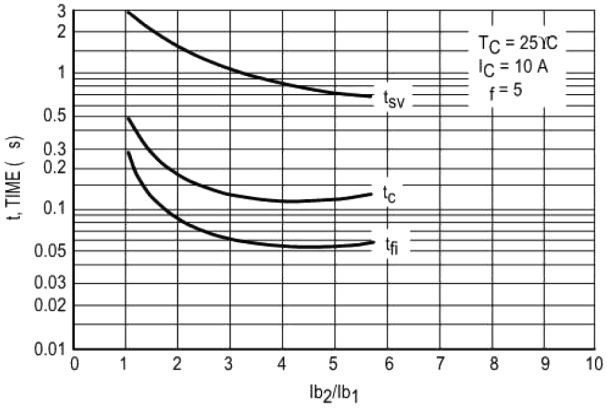

Figure 11b. Turn–Off Times versus Ib_2/Ib_1

Typical Characteristic Curves

The Safe Operating Area figures shown in Figures 12 and 13 are specified for these devices under the test conditions shown.

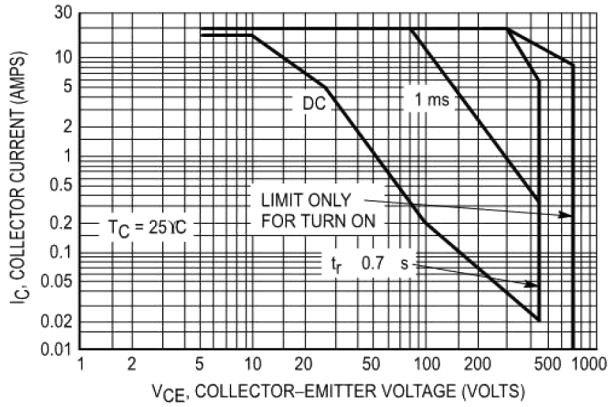

Figure 12. Forward Bias Safe Operating Area

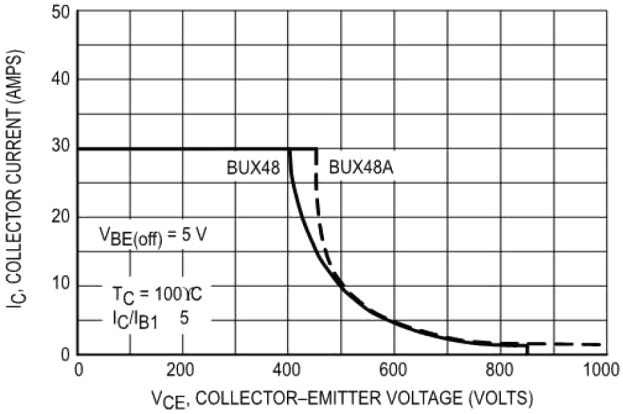

FIgure 13. Reverse Bias Safe Operating Area

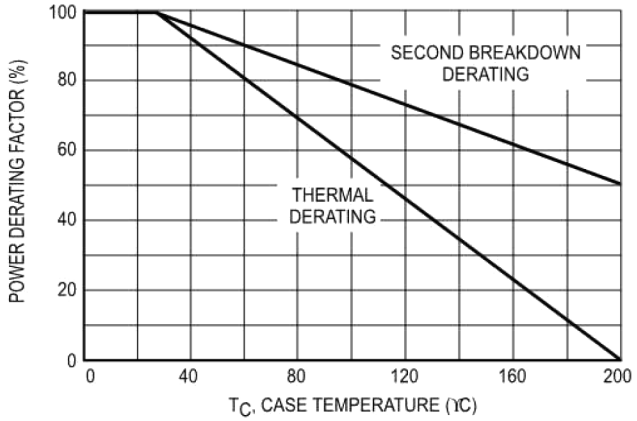

Figure 14. Power Derating

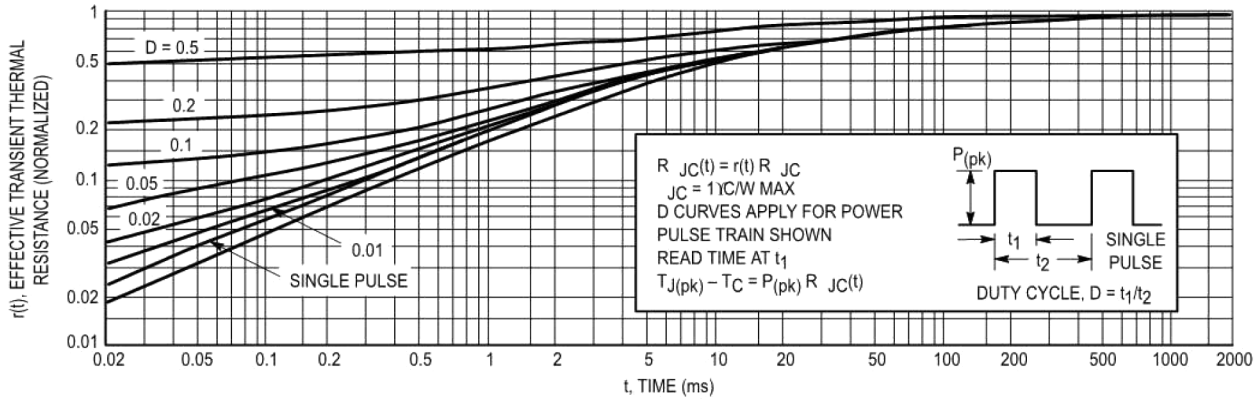

Figure 15. Thermal Response

Typical Characteristic Curves

OVERLOAD CHARACTERISTICS

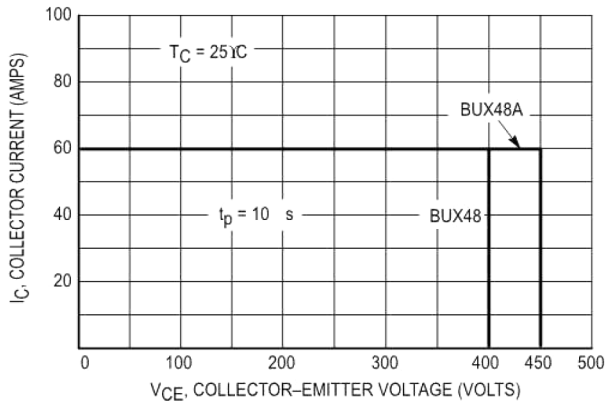

Figure 16. Rated Overload Safe Operating Area (OLSOA)

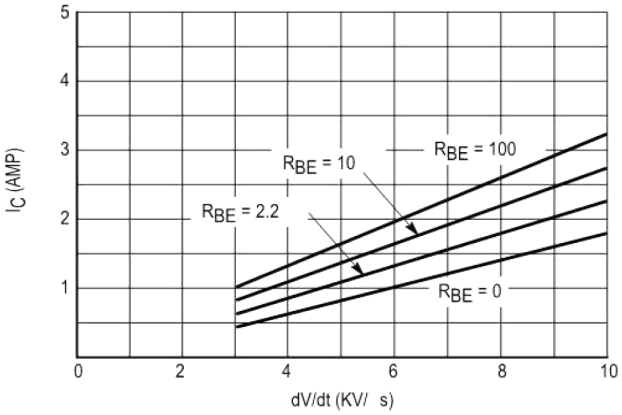

Figure 17. I_C = f(dV/dt)

Notes:

- $V_{CE} = V_{CC} + V_{BE}$
- Adjust pulsed current source for desired I_C, t_p

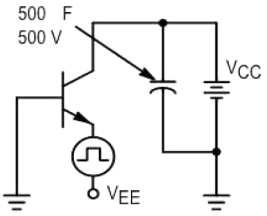

Figure 18. Overload SOA Test Circuit

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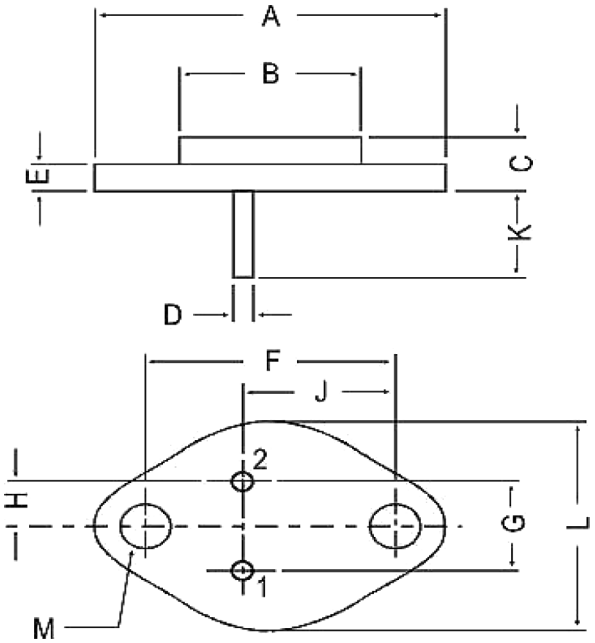
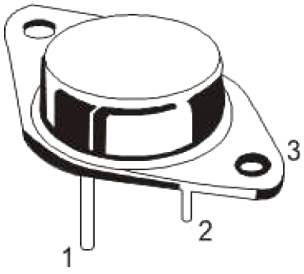
Package Details



Dimensions : Millimetres



PIN CONFIGURATION
1. BASE
2. EMITTER
3. COLLECTOR

Dim	Min.	Max.
A	-	39.37
B	-	22.22
C	6.35	8.5
D	0.96	1.09
E	-	1.77
F	29.9	30.4
G	10.69	11.18
H	5.2	5.72
J	16.64	17.15
K	11.15	12.25
L	-	26.67
M	3.84	4.19

Part Number Table

Description	Part Number
Silicon High Power Transistor, NPN, 450V, 15A, TO-3	BUX48A

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