

6367254 MOTOROLA SC (XSTRS/R F)

96D-80721 D

T-33-13

**MOTOROLA SEMICONDUCTOR TECHNICAL DATA**

**BUS47  
BUS47A**

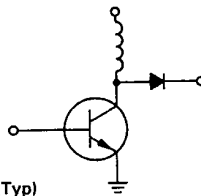
**SWITCHMODE II<sup>Δ</sup> SERIES  
NPN SILICON POWER TRANSISTORS**

The BUS 47 and BUS 47A 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 switch-mode applications such as:

- Switching Regulators
- Inverters
- Solenoid and Relay Drivers
- Motor Controls
- Deflection Circuits

Fast Turn-Off Times

60 ns Inductive Fall Time—25°C (Typ)  
120 ns Inductive Crossover Time—25°C (Typ)



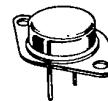
Operating Temperature Range - 65 to +200°C  
100°C Performance Specified for:  
Reverse-Biased SOA with Inductive Loads  
Switching Times with Inductive Loads  
Saturation Voltages  
Leakage Currents (125°C)

**9 AMPERES  
NPN SILICON  
POWER TRANSISTORS**

**400 AND 450 VOLTS (BVCEO)  
150 WATTS  
850 - 1000 V (BVCEES)**

**Designer's Data for  
"Worst Case" Conditions**

The Designer's Data Sheet permits the design of most circuits entirely from the information presented. Limit data - representing device characteristics boundaries - are given to facilitate "worst case" design.



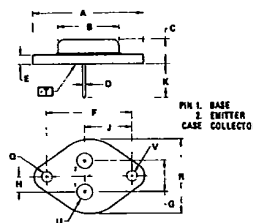
**MAXIMUM RATINGS**

Rating	Symbol	BUS 47	BUS 47A	Unit
Collector-Emitter Voltage	V <sub>CEO(sus)</sub>	450	450	Vdc
Collector-Emitter Voltage	V <sub>CEV</sub>	850	1000	Vdc
Emitter Base Voltage	V <sub>EB</sub>	7		Vdc
Collector Current - Continuous	I <sub>C</sub>	9		Adc
Collector Current - Peak (1)	I <sub>CM</sub>	18		Adc
Collector Current - Overload	I <sub>OL</sub>	36		Adc
Base Current - Continuous	I <sub>B</sub>	5		Adc
Base Current - Peak (1)	I <sub>BM</sub>	10		Adc
Total Power Dissipation - T <sub>C</sub> = 25°C	P <sub>D</sub>	150		Watts
Derate above 25°C		85.5		W/°C
Derate above 25°C		0.86		W/°C
Operating and Storage Junction Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to +200		°C

**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	1.17	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8" from Case for 5 Seconds	T <sub>L</sub>	275	°C

(1) Pulse Test: Pulse Width = 5 ms, Duty Cycle ≤ 10%.



- NOTES  
1 DIMENSIONS Q AND V ARE DATUMS  
2 IS SEATING PLANE AND DATUM  
3 POSITIONAL TOLERANCE FOR MOUNTING HOLE Ø  
4 DIMENSIONS AND TOLERANCES PER ANSI Y14.5, 1973

MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN
A	19.27	19.27	0.759
B	21.04	21.04	0.830
C	0.33	0.47	0.013
D	0.97	1.01	0.038
E	1.52	1.78	0.059
F	0.13 BSC	0.13 BSC	0.005 BSC
G	10.92 BSC	10.92 BSC	0.430 BSC
H	4.48 BSC	4.48 BSC	0.176 BSC
J	16.83 BSC	16.83 BSC	0.663 BSC
K	11.18	11.18	0.440
L	3.81	4.13	0.150
M	26.67	26.67	1.050
N	4.83	5.13	0.190
U	3.81	4.13	0.150
V	3.81	4.13	0.150

CASE 1-05 TO-3 TYPE

6367254 MOTOROLA SC (XSTRS/R F)

96D 80722 D

BUS47, BUS47A

T-33-13

ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS (1)</b>					
Collector-Emitter Sustaining Voltage (Table 1) (I <sub>C</sub> = 200 mA, I <sub>B</sub> = 0) L = 25 mH	BUS47 BUS47A	V <sub>CEO(sus)</sub>	400 450	-	Vdc
Collector Cutoff Current (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc) (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 125°C)		I <sub>CEV</sub>	-	0.15 1.5	mAdc
Collector Cutoff Current (V <sub>CE</sub> = Rated V <sub>CEV</sub> , R <sub>BE</sub> = 10 Ω)	T <sub>C</sub> = 25°C T <sub>C</sub> = 125°C	I <sub>CER</sub>	-	0.4 3.0	mAdc
Emitter Cutoff Current (V <sub>EB</sub> = 5 Vdc, I <sub>C</sub> = 0)		I <sub>EBO</sub>	-	0.1	mAdc
Emitter-base breakdown Voltage (I <sub>E</sub> = 50 mA - I <sub>C</sub> = 0)		B <sub>VEBO</sub>	7.0	-	Vdc

SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased	I <sub>S/b</sub>	See Figure 12
Clamped Inductive SOA with Base Reverse Biased	R <sub>B</sub> SOA	See Figure 13

ON CHARACTERISTICS (1)

DC Current Gain (I <sub>C</sub> = 6 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 5 Adc, V <sub>CE</sub> = 5 V)	BUS47 BUS47A	h <sub>FE</sub>	7	-	-
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 6 Adc, I <sub>B</sub> = 1.2 Adc) (I <sub>C</sub> = 9 Adc, I <sub>B</sub> = 1.8 Adc) (I <sub>C</sub> = 6 Adc, I <sub>B</sub> = 1.2 Adc, T <sub>C</sub> = 100°C) (I <sub>C</sub> = 5 Adc, I <sub>B</sub> = 1 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 1.6 Adc) (I <sub>C</sub> = 5 Adc, I <sub>B</sub> = 1 Adc, T <sub>C</sub> = 100°C)	BUS47 BUS47A	V <sub>CE(sat)</sub>	-	-	1.5 5.0 2.5 1.5 5.0 2.5
Base-Emitter Saturation Voltage (I <sub>C</sub> = 6 Adc, I <sub>B</sub> = 1.2 Adc) (I <sub>C</sub> = 6 Adc, I <sub>B</sub> = 1.2 Adc, T <sub>C</sub> = 100°C) (I <sub>C</sub> = 5 Adc, I <sub>B</sub> = 1 Adc) (I <sub>C</sub> = 5 Adc, I <sub>B</sub> = 1 Adc, T <sub>C</sub> = 100°C)	BUS47 BUS47A	V <sub>BE(sat)</sub>	-	-	1.6 1.6 1.6 1.6

DYNAMIC CHARACTERISTICS

Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f <sub>test</sub> = 100 KHz)	C <sub>ob</sub>	-	-	300	pF
---	-----------------	---	---	-----	----

SWITCHING CHARACTERISTICS

Resistive Load (Table 1)

Delay Time	(V <sub>CC</sub> = 250 Vdc, I <sub>C</sub> = 6 A, I <sub>B1</sub> = 1.2 A, t <sub>p</sub> = 30 μs, Duty Cycle 2, V <sub>BE(off)</sub> = 5 V)	t <sub>d</sub>	-	0.05	0.2	μs
Rise Time		t <sub>r</sub>	-	0.5	0.8	
Storage Time		t <sub>s</sub>	-	1	2.0	
Fall Time		t <sub>f</sub>	-	0.2	0.4	

Inductive Load, Clamped (Table 1)

Storage Time	I <sub>C(pk)</sub> = 6 A, I <sub>B1</sub> = 1.2 A, V <sub>BE(off)</sub> = 5 V, V <sub>CE(c1)</sub> = 250 V)	BUS47	(T <sub>C</sub> = 25°C)	t <sub>sv</sub>	-	0.9	-	μs
Fall Time				t <sub>fi</sub>	-	0.06	-	
Storage Time	I <sub>C(pk)</sub> = 5 A, I <sub>B1</sub> = 1 A	BUS47A	(T <sub>C</sub> = 100°C)	t <sub>sv</sub>	-	1.0	2.5	
Crossover Time				t <sub>c</sub>	-	0.2	0.5	
Fall Time				t <sub>fi</sub>	-	0.1	0.3	

(1) Pulse Test: PW = 300 μs, Duty Cycle ≤ 2%.