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## 2N5038 & 2N5039 Silicon NPN Transistor Power Amp, Switch TO-3 Type Package

**Description:**

The 2N5038 and 2N5039 are silicon NPN transistors in a TO-3 type package that have fast switching speeds and high current capacity that ideally suit these devices for use in switching regulators, inverters, wide-band amplifiers and power oscillators in industrial and commercial applications.

**Features:**

- High Speed:  $t_f = 0.5\mu s$  Max.
- High Current:  $I_C(max) = 30A$
- Low Collector-Emmitter Saturation Voltage:  $V_{CE(sat)} = 2.5V$  max @  $I_C = 20A$

**Absolute Maximum Ratings:**

Collector-Base Voltage, $V_{CBO}$		
2N5038	.....	150V
2N5039	.....	120V
Collector-Emmitter Voltage, $V_{CEV}$		
2N5038	.....	150V
2N5039	.....	120V
Emitter-Base Voltage, $V_{EBO}$		7V
Collector Current, $I_C$		
Continuous	.....	20A
Peak (Note 1)	.....	30A
Continuous Base Current, $I_B$		5A
Total Device Dissipation ( $T_C = +25^\circ C$ ), $P_D$		140W
Derate Above $25^\circ C$		0.8W/ $^\circ C$
Operating Junction Temperature Range, $T_J$		$-65^\circ$ to $+200^\circ C$
Storage Temperature Range, $T_{stg}$		$-65^\circ$ to $+200^\circ C$
Maximum Thermal Resistance, Junction-to-Case, $R_{thJC}$		1.25 $^\circ C/W$

Note 1. Pulse Test: Pulse Width  $\leq 10ms$ , Duty Cycle  $\leq 50\%$ .

**Electrical Characteristics:** ( $T_C = +25^\circ C$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
<b>OFF Characteristics</b>							
Collector-Emmitter Sustaining Voltage 2N5038	$V_{CEO(sus)}$	$I_C = 200mA, I_B = 0, \text{Note 2}$	90	-	-	V	
			75	-	-	V	
Collector Cutoff Current 2N5038	$I_{CEX}$	$V_{CE} = 140V$	$V_{EB(off)} = 1.5V$	-	-	50	mA
				$V_{CE} = 110V$	-	-	50
		$V_{CE} = 100V$	$V_{EB(off)} = 1.5V,$ $T_C = +150^\circ C$	-	-	10	mA
				$V_{CE} = 85V$	-	-	10

Note 2. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .

**Electrical Characteristics (Cont'd):** ( $T_C = +25^\circ\text{C}$  unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
Emitter Cutoff Current 2N5038	$I_{EBO}$	$V_{BE} = 5V, I_C = 0$	-	-	5	mA	
2N5039			-	-	15	mA	
Both		$V_{BE} = 7V, I_C = 0$	-	-	50	mA	
<b>ON Characteristics (Note 2)</b>							
DC Current Gain 2N5038	$h_{FE}$	$V_{CE} = 5V$	$I_C = 12A$	20	-	100	
2N5039				$I_C = 10A$	20	-	100
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 20A, I_B = 5A$	-	-	2.5	V	
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 20A, I_B = 5A$	-	-	3.3	V	
<b>Dynamic Characteristics</b>							
Magnitude of Common-Emitter Small-Signal Short-Circuit Forward Current Transfer Ratio	$ h_{fe} $	$V_{CE} = 10V, I_C = 2A, f = 5\text{MHz}$	12	-	-		
<b>Switching Characteristics (Resistive Load)</b>							
2N5038 Rise Time	$t_r$	$V_{CC} = 30V, I_C = 12A, I_{B1} = I_{B2} = 1.2A$	-	-	0.5	$\mu\text{s}$	
Storage Time	$t_s$		-	-	1.5	$\mu\text{s}$	
Fall Time	$t_f$		-	-	0.5	$\mu\text{s}$	
2N5039 Rise Time	$t_r$	$V_{CC} = 30V, I_C = 10A, I_{B1} = I_{B2} = 1A$	-	-	0.5	$\mu\text{s}$	
Storage Time	$t_s$		-	-	1.5	$\mu\text{s}$	
Fall Time	$t_f$		-	-	0.5	$\mu\text{s}$	

Note 2. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

