

NPN SILICON HIGH SPEED  
SWITCHING TRANSISTORS

2N3009, 2N3013, 2N3014 types are Silicon NPN switching Transistors designed for high speed, medium power saturated switching applications.

MAXIMUM RATINGS ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)

	SYMBOL	2N3009	2N3013	2N3014	UNIT
Collector-Base Voltage	$V_{CB0}$	40	40	40	V
Collector-Emitter Voltage	$V_{CES}$	40	40	40	V
Collector-Emitter Voltage	$V_{CEO}$	15	15	20	V
Emitter-Base Voltage	$V_{EBO}$	4.0	5.0	5.0	V
Collector Current	$I_C$	200	200	200	mA
Collector Current Peak (10 $\mu$ s pulse)	$I_C$	500	500	500	mA
Power Dissipation	$P_D$	360	360	300	mW
Power Dissipation ( $T_C=25^{\circ}\text{C}$ )	$P_D$	1.2	1.2	1.2	$\frac{\text{W}}{^{\circ}\text{C}}$
Oper. and Storage Junction Temp.	$T_J, T_{stg}$		-65 TO	+200	$^{\circ}\text{C}$

ELECTRICAL CHARACTERISTICS ( $T_A=25^{\circ}\text{C}$ )

SYMBOL	TEST CONDITIONS	2N3009		2N3013		2N3014		UNIT
		MIN	MAX	MIN	MAX	MIN	MAX	
$I_{CES}$	$V_{CE}=20\text{V}$		0.5		0.3		0.3	$\mu\text{A}$
$I_B$	$V_{CE}=20\text{V}, V_{BE}=0$		0.5		0.3		0.3	$\mu\text{A}$
$BV_{CB0}$	$I_C=100\mu\text{A}$	40		40		40		V
$BV_{CES}$	$I_C=100\mu\text{A}$	40		40		40		V
$BV_{CEO}$	$I_C=10\text{mA}$	15		15		20		V
$BV_{EBO}$	$I_E=100\mu\text{A}$	4.0		5.0		5.0		V
$V_{CE}(\text{SAT})$	$I_C=30\text{mA}, I_B=3.0\text{mA}$		0.18		0.18		0.18	V
$V_{CE}(\text{SAT})$	$I_C=100\text{mA}, I_B=10\text{mA}$		0.28		0.28		0.35	V
$V_{CE}(\text{SAT})$	$I_C=300\text{mA}, I_B=30\text{mA}$		0.5		0.5		-	V
$V_{CE}(\text{SAT})$	$I_C=10\text{mA}, I_B=1.0\text{mA}$		-		-		0.18	V
$V_{BE}(\text{SAT})$	$I_C=30\text{mA}, I_B=3.0\text{mA}$	0.75	0.95	0.75	0.95	0.75	0.95	V
$V_{BE}(\text{SAT})$	$I_C=100\text{mA}, I_B=10\text{mA}$		1.2		1.2		1.2	V
$V_{BE}(\text{SAT})$	$I_C=300\text{mA}, I_B=30\text{mA}$		1.7		1.7		-	V
$V_{BE}(\text{SAT})$	$I_C=10\text{mA}, I_B=1.0\text{mA}$	-	-	-	-	0.7	0.8	V
$h_{FE}$	$V_{CE}=0.4\text{V}, I_C=30\text{mA}$	30	120	30	120	30	120	
$h_{FE}$	$V_{CE}=0.4\text{V}, I_C=10\text{mA}$	-	-	-	-	25	-	
$h_{FE}$	$V_{CE}=0.5\text{V}, I_C=100\text{mA}$	25	-	25	-	-	-	
$h_{FE}$	$V_{CE}=1.0\text{V}, I_C=100\text{mA}$	-	-	-	-	25	-	
$h_{FE}$	$V_{CE}=1.0\text{V}, I_C=300\text{mA}$	15	-	15	-	-	-	
$f_T$	$V_{CE}=10\text{V}, I_C=30\mu\text{A}, f=100\text{MHz}$	350	-	350	-	350	-	MHz
$C_{ob}$	$V_{CB}=5.0\text{V}, I_E=0, f=140\text{kHz}$		5.0		5.0		5.0	pF
$C_{ib}$	$V_{BE}=0.5, I_C=0, f=140\text{kHz}$		8.0		8.0		8.0	pF
$t_{on}$	$V_{CC}=15\text{V}, I_C=300\text{mA}, I_{B1}=30\text{mA}$		15		15		-	ns
$t_{on}$	$V_{CC}=2.0\text{V}, I_C=30\text{mA}, I_{B1}=3.0\text{mA}$		-		-		16	ns
$t_{off}$	$V_{CC}=15\text{V}, I_C=300\text{mA}, I_{B1}=I_{B2}=30\text{mA}$		25		25		-	ns
$t_{off}$	$V_{CC}=2.0\text{V}, I_C=30\text{mA}, I_{B1}=I_{B2}=3.0\text{mA}$		-		-		25	ns
$\tau_s$	$I_C=I_{B1}=I_{B2}=10\text{mA}$		18		18		18	ns

