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TRANSYS ELECTRONICS LIMITED

MMDT3946

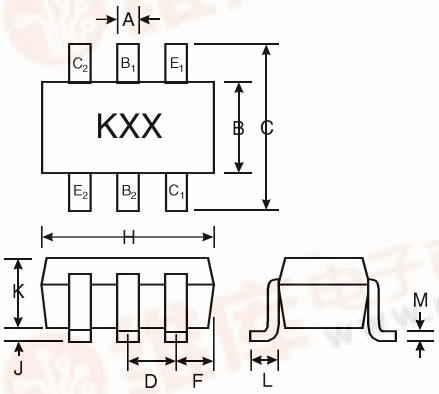
COMPLEMENTARY NPN / PNP
SMALL SIGNAL SURFACE MOUNT TRANSISTOR

Features

- Complementary Pair
- One 3904-Type NPN, One 3906-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching
- Ultra-Small Surface Mount Package

Mechanical Data

- Case: SOT-363, Molded Plastic
- Terminals: Solderable per MIL-STD-202, Method 208
- Terminal Connections: See Diagram
- Marking: K46
- Weight: 0.006 grams (approx.)



E_1, B_1, C_1 = PNP3906 Section
E_2, B_2, C_2 = NPN3904 Section

SOT-363		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 Nominal	
F	0.30	0.40
H	1.80	2.20
J		0.10
K	0.90	1.00
L	0.25	0.40
M	0.10	0.25
All Dimensions in mm		

Maximum Ratings, NPN 3904 Section

@ T_A = 25 C unless otherwise specified

Characteristic	Symbol		Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage	V_{EBO}	6.0	V
Collector Current - Continuous (Note 1)	I_C	200	mA
Power Dissipation (Note 1)	P_d	200	mW
Thermal Resistance, Junction to Ambient (Note 1)	R_{JA}	625	K/W

Maximum Ratings, PNP 3906 Section

@ T_A = 25 C unless otherwise specified

Characteristic	Symbol	PNP 3906 Section	Unit
Collector-Base Voltage	V_{CBO}	-40	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Voltage	V_{EBO}	-5.0	V
Collector Current - Continuous (Note 1)	I_C	-200	mA
Power Dissipation (Note 1)	P_d	200	mW
Thermal Resistance, Junction to Ambient (Note 1)	R_{JA}	625	K/W

Notes: 1. Valid provided that terminals are kept at ambient temperature. Total device dissipation.

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Electrical Characteristics, NPN 3904 Section

@ T_A = 25 C unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 1)					
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	60		V	I_C = 10 A, I_E = 0
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	40		V	I_C = 1.0mA, I_B = 0
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	5.0	6.0	V	I_E = 10 A, I_C = 0
Collector Cutoff Current	I_{CEX}		50	nA	V_{CE} = 30V, $V_{EB(OFF)}$ = 3.0V
Base Cutoff Current	I_{BL}		50	nA	V_{CE} = 30V, $V_{EB(OFF)}$ = 3.0V
ON CHARACTERISTICS (Note 1)					
DC Current Gain	h_{FE}	40 70 100 60 30	300		I_C = 100µA, V_{CE} = 1.0V I_C = 1.0mA, V_{CE} = 1.0V I_C = 10mA, V_{CE} = 1.0V I_C = 50mA, V_{CE} = 1.0V I_C = 100mA, V_{CE} = 1.0V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$		0.20 0.30	V	I_C = 10mA, I_B = 1.0mA I_C = 50mA, I_B = 5.0mA
Base- Emitter Saturation Voltage	$V_{BE(SAT)}$	0.65	0.85 0.95	V	I_C = 10mA, I_B = 1.0mA I_C = 50mA, I_B = 5.0mA
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{obo}		4.0	pF	V_{CB} = 5.0V, f = 1.0MHz, I_E = 0
Input Capacitance	C_{ibo}		8.0	pF	V_{EB} = 0.5V, f = 1.0MHz, I_C = 0
Input Impedance	h_{ie}	1.0	10	k	V_{CE} = 10V, I_C = 1.0mA, f = 1.0kHz
Voltage Feedback Ratio	h_{re}	0.5	8.0	x 10^{-4}	
Small Signal Current Gain	h_{fe}	100	400		
Output Admittance	h_{oe}	1.0	40	S	
Current Gain-Bandwidth Product	f_T	300		MHz	V_{CE} = 20V, I_C = 20mA, f = 100MHz
Noise Figure	NF		5.0	dB	V_{CE} = 5.0V, I_C = 100 A, R_S = 1.0k f = 1.0kHz
SWITCHING CHARACTERISTICS					
Delay Time	t_d		35	ns	V_{CC} = 3.0V, I_C = 10mA, $V_{BE(off)}$ = - 0.5V, I_{B1} = 1.0mA
Rise Time	t_r		35	ns	
Storage Time	t_s		200	ns	V_{CC} = 3.0V, I_C = 10mA, I_{B1} = I_{B2} = 1.0mA
Fall Time	t_f		50	ns	

Notes: 1. Pulse test: Pulse width 300 s, duty cycle 2%.

Electrical Characteristics, PNP 3906 Section

@ T_A = 25 C unless otherwise specified

Characteristic	Symbol	Min	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 1)					
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	-40		V	I_C = -10 A, I_E = 0
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	-40		V	I_C = -1.0mA, I_B = 0
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	-5.0		V	I_E = -10 A, I_C = 0
Collector Cutoff Current	I_{CEX}		-50	nA	V_{CE} = -30V, $V_{EB(OFF)}$ = -3.0V
Base Cutoff Current	I_{BL}		-50	nA	V_{CE} = -30V, $V_{EB(OFF)}$ = -3.0V
ON CHARACTERISTICS (Note 1)					
DC Current Gain	h_{FE}	60 80 100 60 30	300		I_C = -100µA, V_{CE} = -1.0V I_C = -1.0mA, V_{CE} = -1.0V I_C = -10mA, V_{CE} = -1.0V I_C = -50mA, V_{CE} = -1.0V I_C = -100mA, V_{CE} = -1.0V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$		-0.25 -0.40	V	I_C = -10mA, I_B = -1.0mA I_C = -50mA, I_B = -5.0mA
Base- Emitter Saturation Voltage	$V_{BE(SAT)}$	-0.65	-0.85 -0.95	V	I_C = -10mA, I_B = -1.0mA I_C = -50mA, I_B = -5.0mA
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{obo}		4.5	pF	V_{CB} = -5.0V, f = 1.0MHz, I_E = 0
Input Capacitance	C_{ibo}		10	pF	V_{EB} = -0.5V, f = 1.0MHz, I_C = 0
Input Impedance	h_{ie}	2.0	12	k	V_{CE} = 10V, I_C = 1.0mA, f = 1.0kHz
Voltage Feedback Ratio	h_{re}	0.1	10	x 10^{-4}	
Small Signal Current Gain	h_{fe}	100	400		
Output Admittance	h_{oe}	3.0	60	S	
Current Gain-Bandwidth Product	f_T	250		MHz	V_{CE} = -20V, I_C = -10mA, f = 100MHz
Noise Figure	NF		4.0	dB	V_{CE} = -5.0V, I_C = -100 A, R_S = 1.0k f = 1.0kHz
SWITCHING CHARACTERISTICS					
Delay Time	t_d		35	ns	V_{CC} = -3.0V, I_C = -10mA, $V_{BE(off)}$ = 0.5V, I_{B1} = -1.0mA
Rise Time	t_r		35	ns	
Storage Time	t_s		225	ns	V_{CC} = -3.0V, I_C = -10mA, I_{B1} = I_{B2} = -1.0mA
Fall Time	t_f		75	ns	

Note: 1. Pulse test: Pulse width 300 s, duty cycle 2%.