

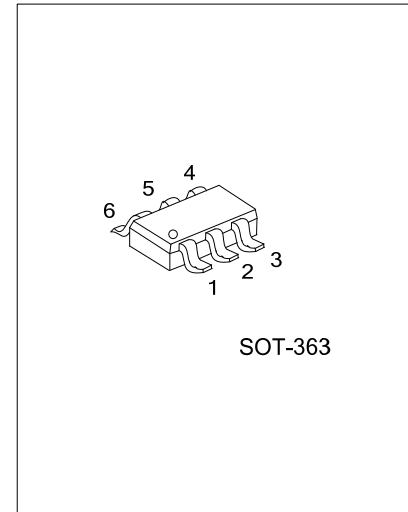


MMDT3946

Preliminary

DUAL TRANSISTOR

COMPLEMENTARY NPN/PNP
SMALL SIGNAL SURFACE
MOUNT TRANSISTOR



DESCRIPTION

The UTC **MMDT3946** is a complementary NPN/PNP small signal surface mount transistor. It's suitable for low power amplification and switch.

FEATURES

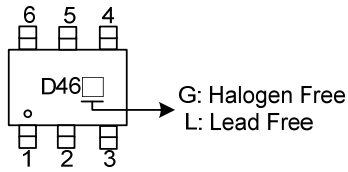
- * Epitaxial Planar Die Construction
- * Extremely-Small Surface Mount Package

ORDERING INFORMATION

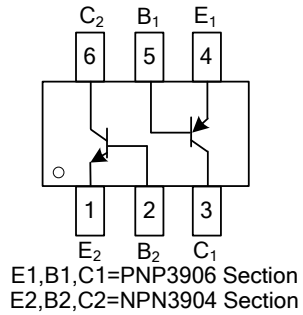
Ordering Number		Package	Packing
Lead Free	Halogen Free		
MMDT3946L-AL6-R	MMDT3946G-AL6-R	SOT-363	Tape Reel

MMDT3946L-AL6-R	(1)Packing Type (2)Package Type (3)Lead Free	(1) R: Tape Reel (2) AL6: SOT-363 (3) G: Halogen Free, L: Lead Free
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■ MARKING



■ PIN CONFIGURATION



■ ABSOLUTE MAXIMUM RATINGS ($T_A=25^{\circ}\text{C}$, unless otherwise specified.)

TR1(PNP)

PARAMETER	SYMBOL	RATINGS	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	I_C	-200	mA
Power Dissipation	P_D	200	mW
Junction Temperature	T_J	+150	$^{\circ}\text{C}$
Storage Temperature	T_{STG}	-55~+150	$^{\circ}\text{C}$

Note: Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

TR2(NPN)

PARAMETER	SYMBOL	RATINGS	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	I_C	200	mA
Power Dissipation	P_D	200	mW
Junction Temperature	T_J	+150	$^{\circ}\text{C}$
Storage Temperature	T_{STG}	-55~+150	$^{\circ}\text{C}$

■ THERMAL DATA ($T_A=25^{\circ}\text{C}$, unless otherwise specified.)

PARAMETER	SYMBOL	RATINGS	UNIT
Junction to Ambient	θ_{JA}	625	$^{\circ}\text{C}/\text{W}$

■ ELECTRICAL CHARACTERISTICS (T_A=25°C, unless otherwise specified.)

TR1(PNP)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS (Note 1)						
Collector-Base Breakdown Voltage	V _{(BR)CBO}	I _C =-10μA, I _E =0	-40			V
Collector-Emitter Breakdown Voltage	V _{(BR)CEO}	I _C =-1.0mA, I _B =0	-40			V
Emitter-Base Breakdown Voltage	V _{(BR)EBO}	I _E =-10μA, I _C =0	-5.0			V
Collector Cutoff Current	I _{CEX}	V _{CE} =-30V, V _{EB(OFF)} =-3.0V			-50	nA
Base Cutoff Current	I _{BL}	V _{CE} =-30V, V _{EB(OFF)} =-3.0V			-50	nA
ON CHARACTERISTICS (Note 1)						
DC Current Gain	h _{EF}	I _C =-100μA, V _{CE} =-1.0V	60			
		I _C =-1.0mA, V _{CE} =-1.0V	80			
		I _C =-10mA, V _{CE} =-1.0V	100		300	
		I _C =-50mA, V _{CE} =-1.0V	60			
		I _C =-100mA, V _{CE} =-1.0V	30			
Collector-Emitter Saturation Voltage	V _{CE(SAT)}	I _C =-10mA, I _B =-1.0mA			-0.25	V
		I _C =-50mA, I _B =-5.0mA			-0.40	
Base-Emitter Saturation Voltage	V _{BE(SAT)}	I _C =-10mA, I _B =-1.0mA	-0.65		-0.85	V
		I _C =-50mA, I _B =-5.0mA			-0.95	
SMALL SIGNAL CHARACTERISTICS						
Output Capacitance	C _{OBO}	V _{CB} =-5.0V, f=1.0MHz, I _E =0			4.5	pF
Input Capacitance	C _{IBO}	V _{EB} =-0.5V, f=1.0MHz, I _C =0			10	pF
Input Impedance	h _{IE}	V _{CE} =10V, I _C =1.0mA, f=1.0kHz	2.0		12	kΩ
Voltage Feedback Ratio	h _{RE}		0.1		10	×10 ⁻⁴
Small Signal Current Gain	h _{FE}		100		400	
Output Admittance	h _{OE}		3.0		60	μS
Current Gain-Bandwidth Product	f _T		V _{CE} =-20V, I _C =-10mA, f=100MHz	250		
Noise Figure	NF	V _{CE} =-5.0V, I _C =-100μA, R _S =1.0kΩ, f=1.0kHz			4.0	dB
SWITCHING CHARACTERISTICS						
Delay Time	t _D	V _{CC} =-3.0V, I _C =-10mA,			35	ns
Rise Time	t _R	V _{BE(OFF)} =0.5V, I _{B1} =-1.0mA			35	ns
Storage Time	t _S	V _{CC} =-3.0V, I _C =-10mA,			225	ns
Fall Time	t _F	I _{B1} =I _{B2} =-1.0mA			75	ns

Note: 1. Short duration pulse test used to minimize self-heating effect.

■ ELECTRICAL CHARACTERISTICS(Cont.)($T_A=25^\circ\text{C}$, unless otherwise specified.)

TR2(NPN)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS (Note 1)						
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C=10\mu\text{A}$, $I_E=0$	60			V
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C=1.0\text{mA}$, $I_B=0$	40			V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E=10\mu\text{A}$, $I_C=0$	5.0		6.0	V
Collector Cutoff Current	I_{CEX}	$V_{CE}=30\text{V}$, $V_{EB(OFF)}=3.0\text{V}$			50	nA
Base Cutoff Current	I_{BL}	$V_{CE}=30\text{V}$, $V_{EB(OFF)}=3.0\text{V}$			50	nA
ON CHARACTERISTICS (Note 1)						
DC Current Gain	h_{FE}	$I_C=100\mu\text{A}$, $V_{CE}=1.0\text{V}$	40			
		$I_C=1.0\text{mA}$, $V_{CE}=1.0\text{V}$	70			
		$I_C=10\text{mA}$, $V_{CE}=1.0\text{V}$	100		300	
		$I_C=50\text{mA}$, $V_{CE}=1.0\text{V}$	60			
		$I_C=100\text{mA}$, $V_{CE}=1.0\text{V}$	30			
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C=10\text{mA}$, $I_B=1.0\text{mA}$			0.20	V
		$I_C=50\text{mA}$, $I_B=5.0\text{mA}$			0.30	
Base-Emitter Saturation Voltage	$V_{BE(SAT)}$	$I_C=10\text{mA}$, $I_B=1.0\text{mA}$	0.65		0.85	V
		$I_C=50\text{mA}$, $I_B=5.0\text{mA}$			0.95	
SMALL SIGNAL CHARACTERISTICS						
Output Capacitance	C_{OBO}	$V_{CB}=5.0\text{V}$, $f=1.0\text{MHz}$, $I_E=0$			4.0	pF
Input Capacitance	C_{IBO}	$V_{EB}=0.5\text{V}$, $f=1.0\text{MHz}$, $I_C=0$			8.0	pF
Input Impedance	h_{iE}	$V_{CE}=10\text{V}$, $I_C=1.0\text{mA}$, $f=1.0\text{kHz}$	1.0		10	k Ω
Voltage Feedback Ratio	h_{rE}		0.5		8.0	$\times 10^{-4}$
Small Signal Current Gain	h_{FE}		100		400	
Output Admittance	h_{oE}		1.0		40	μS
Current Gain-Bandwidth Product	f_T		$V_{CE}=20\text{V}$, $I_C=20\text{mA}$, $f=100\text{MHz}$	300		
Noise Figure	NF	$V_{CE}=5.0\text{V}$, $I_C=100\mu\text{A}$, $R_S=1.0\text{k}\Omega$, $f=1.0\text{kHz}$			5.0	dB
SWITCHING CHARACTERISTICS						
Delay Time	t_D	$V_{CC}=3.0\text{V}$, $I_C=10\text{mA}$,			35	ns
Rise Time	t_R	$V_{BE(OFF)}=-0.5\text{V}$, $I_{B1}=1.0\text{mA}$			35	ns
Storage Time	t_S	$V_{CC}=3.0\text{V}$, $I_C=10\text{mA}$,			200	ns
Fall Time	t_F	$I_{B1}=I_{B2}=1.0\text{mA}$			50	ns

Note: 1. Short duration pulse test used to minimize self-heating effect.

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