



## MMDT3946

DUAL TRANSISTOR

### COMPLEMENTARY NPN/PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

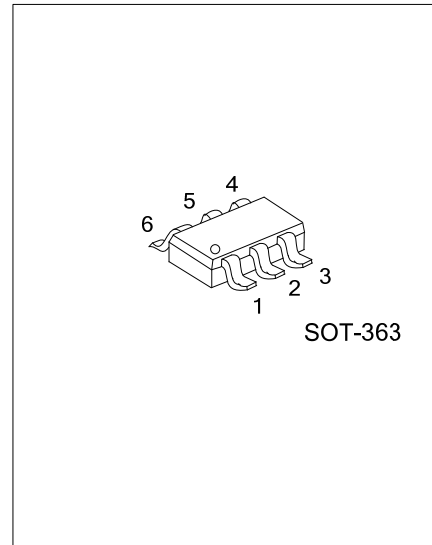
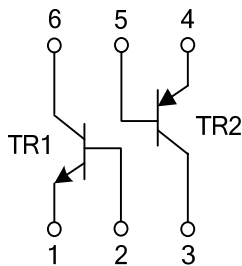
#### DESCRIPTION

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

#### EQUIVALENT CIRCUIT

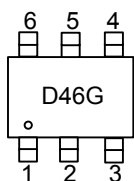


#### ORDERING INFORMATION

Ordering Number	Package	Pin Assignment						Packing
		1	2	3	4	5	6	
MMDT3946G-AL6-R	SOT-363	E1	B1	C2	E2	B2	C1	Tape Reel

<p>MMDT3946G-AL6-R</p> <ul style="list-style-type: none"> <li>(1) Packing Type</li> <li>(2) Package Type</li> <li>(3) Green Package</li> </ul>	<ul style="list-style-type: none"> <li>(1) R: Tape Reel</li> <li>(2) AL6: SOT-363</li> <li>(3) G: Halogen Free and Lead Free</li> </ul>
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#### MARKING



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

## TR1

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	$^\circ\text{C}$

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

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	$^\circ\text{C}$

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

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

■ ELECTRICAL CHARACTERISTICS (T<sub>A</sub>=25°C, unless otherwise specified.)

**TR1**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS (Note)</b>						
Collector-Base Breakdown Voltage	V <sub>CBO</sub>	I <sub>C</sub> =10μA, I <sub>E</sub> =0	60			V
Collector-Emitter Breakdown Voltage	V <sub>CEO</sub>	I <sub>C</sub> =1mA, I <sub>B</sub> =0 (Note)	40			V
Emitter-Base Breakdown Voltage	V <sub>EBO</sub>	I <sub>E</sub> =10μA, I <sub>C</sub> =0	6			V
Collector Cutoff Current	I <sub>CEX</sub>	V <sub>CE</sub> =30V, V <sub>EB</sub> =3V			50	nA
Base Cutoff Current	I <sub>BL</sub>	V <sub>CE</sub> =30V, V <sub>EB</sub> =3V			50	nA
<b>ON CHARACTERISTICS (Note)</b>						
DC Current Gain	h <sub>FE1</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =0.1mA	40			
	h <sub>FE2</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =1mA	70			
	h <sub>FE3</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =10mA	100		300	
	h <sub>FE4</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =50mA	60			
	h <sub>FE5</sub>	V <sub>CE</sub> =1V, I <sub>C</sub> =100mA	30			
Collector-Emitter Saturation Voltage (Note)	V <sub>CE(SAT)1</sub>	I <sub>C</sub> =10mA, I <sub>B</sub> =1mA			0.2	V
	V <sub>CE(SAT)2</sub>	I <sub>C</sub> =50mA, I <sub>B</sub> =5mA			0.3	
Base-Emitter Saturation Voltage (Note)	V <sub>BE(SAT)1</sub>	I <sub>C</sub> =10mA, I <sub>B</sub> =1mA	0.65		0.85	V
	V <sub>BE(SAT)2</sub>	I <sub>C</sub> =50mA, I <sub>B</sub> =5mA			0.95	
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Output Capacitance	C <sub>OB</sub>	V <sub>CB</sub> =5V, I <sub>E</sub> =0, f=1MHz			4	pF
Current Gain-Bandwidth Product	f <sub>T</sub>	V <sub>CE</sub> =20V, I <sub>C</sub> =10mA, f=100MHz	300			MHz
<b>SWITCHING CHARACTERISTICS</b>						
Turn On Time	t <sub>ON</sub>	V <sub>CC</sub> =3V, V <sub>BE</sub> =0.5V, I <sub>C</sub> =10mA, I <sub>B1</sub> =1mA			70	ns
Turn Off Time	t <sub>OFF</sub>	I <sub>B1</sub> =1B2=1mA			250	ns

Note: Pulse test: P<sub>W</sub> ≤ 300μs, Duty Cycle ≤ 2.0%

**TR2**

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS (Note 1)</b>						
Collector-Base Breakdown Voltage	V <sub>CBO</sub>	I <sub>C</sub> =-10μA, I <sub>E</sub> =0	-40			V
Collector-Emitter Breakdown Voltage	V <sub>CEO</sub>	I <sub>C</sub> =-1mA, I <sub>B</sub> =0	-40			V
Emitter-Base Breakdown Voltage	V <sub>EBO</sub>	I <sub>E</sub> =-10μA, I <sub>C</sub> =0	-5			V
Collector Cutoff Current	I <sub>CEX</sub>	V <sub>CE</sub> =-30V, V <sub>EB</sub> =-3V			-50	nA
Base Cutoff Current	I <sub>BL</sub>	V <sub>CE</sub> =-30V, V <sub>EB</sub> =-3V			-50	nA
<b>ON CHARACTERISTICS (Note 1)</b>						
DC Current Gain	h <sub>FE1</sub>	V <sub>CE</sub> =-1V, I <sub>C</sub> =-0.1mA	60			
	h <sub>FE2</sub>	V <sub>CE</sub> =-1V, I <sub>C</sub> =-1mA	80			
	h <sub>FE3</sub>	V <sub>CE</sub> =-1V, I <sub>C</sub> =-10mA	100		300	
	h <sub>FE4</sub>	V <sub>CE</sub> =-1V, I <sub>C</sub> =-50mA	60			
	h <sub>FE5</sub>	V <sub>CE</sub> =-1V, I <sub>C</sub> =-100mA	30			
Collector-Emitter Saturation Voltage (Note)	V <sub>CE(SAT)1</sub>	I <sub>C</sub> =-10mA, I <sub>B</sub> =-1mA			-0.25	V
	V <sub>CE(SAT)2</sub>	I <sub>C</sub> =-50mA, I <sub>B</sub> =-5mA			-0.4	
Base-Emitter Saturation Voltage	V <sub>BE(SAT)1</sub>	I <sub>C</sub> =-10mA, I <sub>B</sub> =-1mA	-0.65		-0.85	V
	V <sub>BE(SAT)2</sub>	I <sub>C</sub> =-50mA, I <sub>B</sub> =-5mA			-0.95	
<b>SMALL SIGNAL CHARACTERISTICS</b>						
Output Capacitance	C <sub>ob</sub>	V <sub>CB</sub> =-5V, I <sub>E</sub> =0, f=1MHz			4.5	pF
Transition Voltage	f <sub>T</sub>	V <sub>CE</sub> =-20V, I <sub>C</sub> =-10mA, f=100MHz	250			MHz
<b>SWITCHING CHARACTERISTICS</b>						
Turn on Time	t <sub>ON</sub>	V <sub>CC</sub> =-3V, V <sub>BE</sub> =-0.5V, I <sub>C</sub> =-10mA, I <sub>B1</sub> =-1mA			70	ns
Turn off Time	t <sub>OFF</sub>	I <sub>B1</sub> =1B2=-1mA			300	ns

Note: Pulse test: P<sub>W</sub> ≤ 300μs, Duty Cycle ≤ 2.0%

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