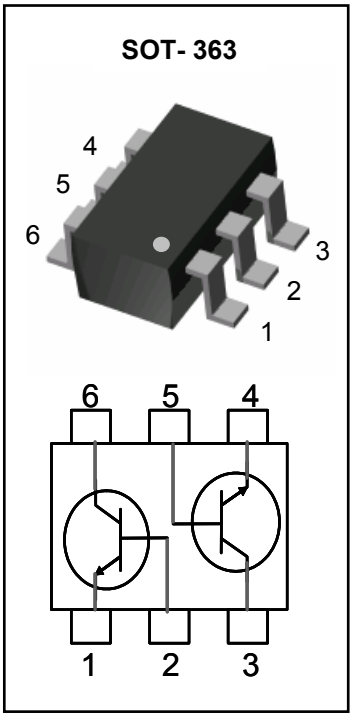
MMDT3904

DUAL SURFACE MOUNT NPN TRANSISTORS

This device contains two electrically-isolated 2N3904 NPN transistors. The two transistors have well matched hFE and are encapsulated in an ultra-small SOT-363 (SC70-6L) package. This device is ideal for portable applications where board space is at a premium.



FEATURES

- **Electrically Isolated Dual NPN Switching Transistor**
- **Lead-Free Plating (100% matte tin finish)**

APPLICATIONS

- **General Purpose Amplifier Applications**
- **Hand-Held Computers, PDAs**

Device Marking Code: S1A

MAXIMUM RATINGS

T_J = 25°C Unless otherwise noted

Rating	Symbol	Value	Units
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Voltage Voltage	V_{EB}	6.0	V
Collector Current	I_C	200	mA
Total Power Dissipation (Note 1)	P_D	200	mW
Operating Junction Temperature Range	T_J	-55 to +150	°C
Storage Temperature Range	T_{stg}	-55 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Value	Units
Thermal Resistance, Junction to Ambient (Note 1)	R_{thja}	625	°C/W

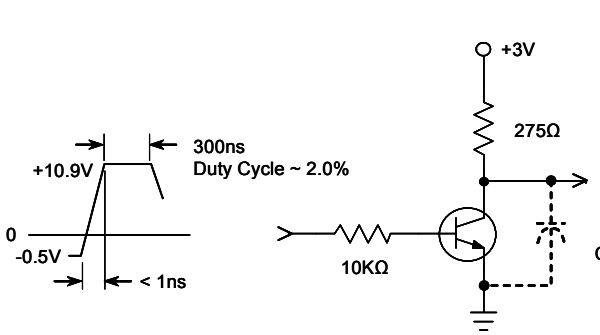
Note 1. FR-5 board 1.0 x 0.75 x 0.062 inch with minimum recommended pad layout

ELECTRICAL CHARACTERISTICS (Each Transistor) T_J = 25°C Unless otherwise noted

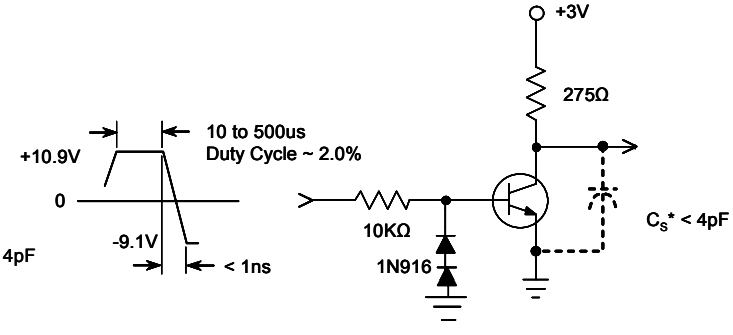
Parameter	Symbol	Conditions	Min	Typ	Max	Units
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	I_C = 1.0mA	40	-	-	V
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	I_C = 10uA	60	-	-	V
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	I_E = 10uA	6.0	-	-	V
Collector Cutoff Current	I_{CEX}	V_{CE}= 30V, V_{EB}= 3.0V	-	-	50	nA
Base Cutoff Current	I_{BL}	V_{CE}= 30V, V_{EB}= 3.0V	-	-	50	nA
DC Current Gain (Note 2)	h_{FE}	I_C= 0.1mA, V_{CE}= 1.0V	40	-	-	-
		I_C= 1.0mA, V_{CE}= 1.0V	70	-	-	
		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 (Note 2)	$V_{CE(SAT)}$	I_C= 10mA, I_B= 1.0mA	-	-	0.2	V
		I_C= 50mA, I_B= 5.0mA	-	-	0.3	V
Base-Emitter Saturation Voltage (Note 2)	$V_{BE(SAT)}$	I_C= 10mA, I_B= 1.0mA	0.65	-	0.85	V
		I_C= 50mA, I_B= 5.0mA	-	-	0.95	
Gain-Bandwidth Product	f_T	V_{CE}= 20V, I_C= 10mA f = 100MHz	300	-	-	MHz
Collector-Base Capacitance	C_{CBO}	V_{CB}= 5.0V, f =1.0MHz	-	-	4.0	pF
Emitter-Base Capacitance	C_{EBO}	V_{EB}= 0.5V, f =1.0MHz	-	-	8.0	pF
Delay Time	t_d	V_{CC}= 3.0V, I_C= 10mA V_{BE}(off) = -0.5V, I_{B1}= -1.0mA	-	-	35	ns
Rise Time	t_r		-	-	35	ns
Storage Time	t_s	V_{CC}= 3.0V, I_C= 10mA I_{B1}= I_{B2}= 1.0mA	-	-	200	ns
Fall Time	t_f		-	-	50	ns

Note 2. Short duration test pulse used to minimize self-heating

SWITCHING TIME EQUIVALENT TEST CIRCUITS



Delay and Rise Time Equivalent Test Circuit



Storage and Fall Time Equivalent Test Circuit

CHARACTERISTICS CURVES (Each Transistor) T_J = 25°C Unless otherwise noted

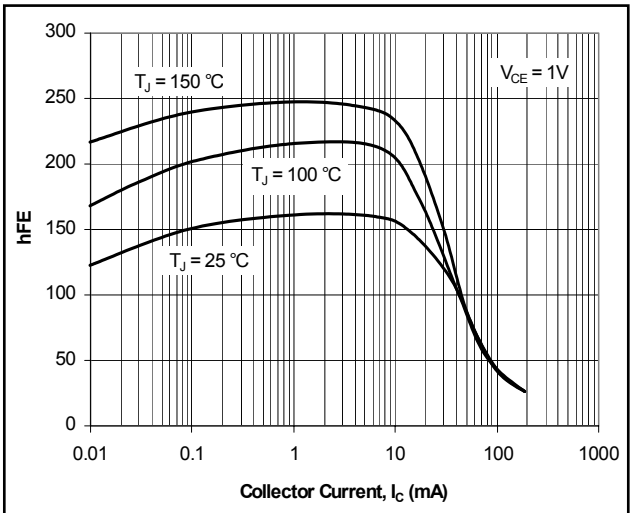


Fig. 1. hFE vs. Ic

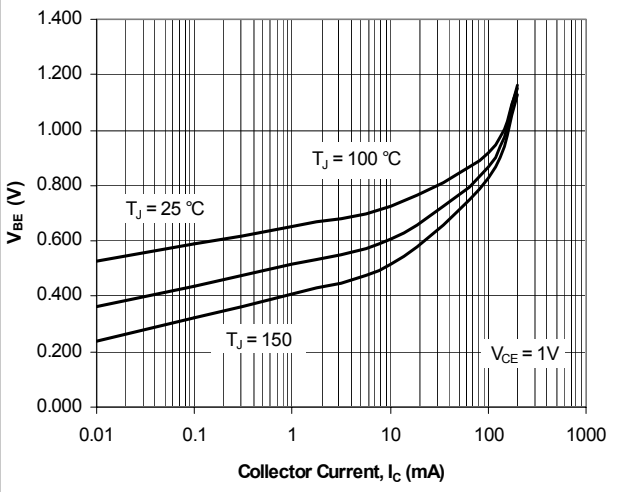


Fig. 2. VBE vs. Ic

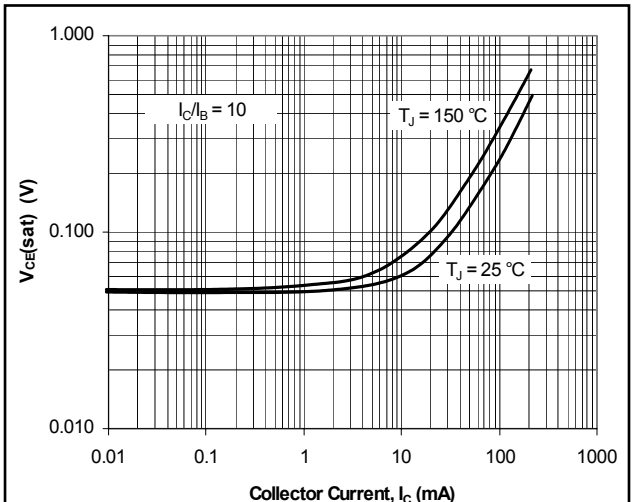


Fig. 3. VCE(sat) vs. Ic

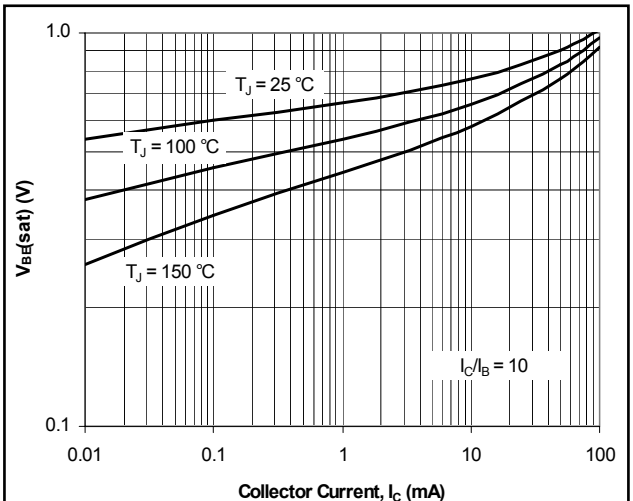


Fig. 4. VBE(sat) vs. Ic

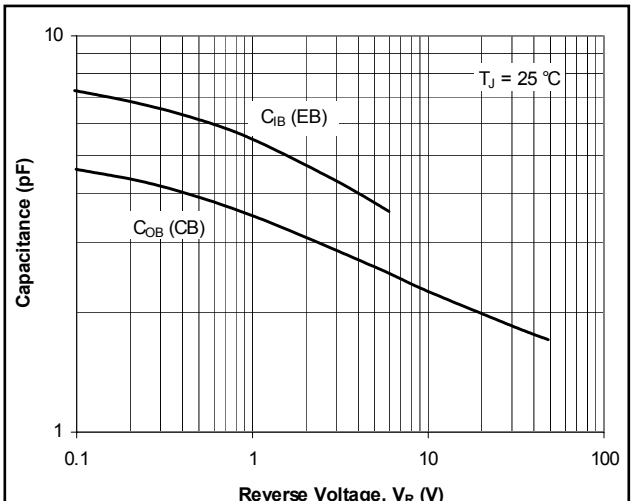
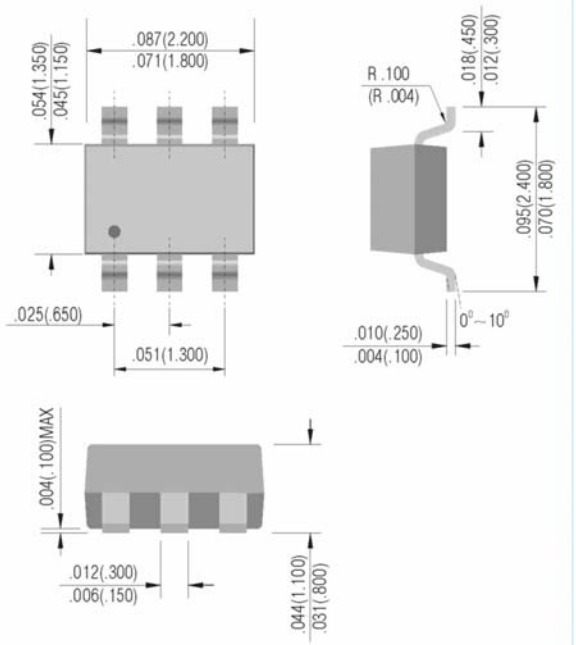


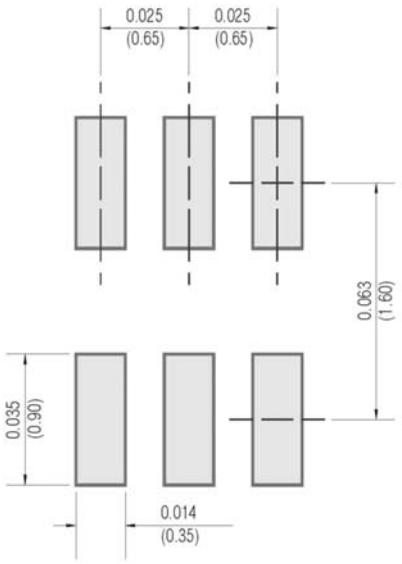
Fig. 5. Capacitances

PACKAGE LAYOUT AND SUGGESTED PAD DIMENSIONS

SOT-363 Unit: inch (mm)



SOT-363 Unit: inch (mm)



ORDERING INFORMATION

MMDT3904 T/R7 - 3,000 units per 7 inch reel

MMDT3904 T/R13 -10,000 units per 13 inch reel