



MMDT4413

COMPLEMENTARY NPN/PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

VOLTAGE 40 Volts **POWER** 225 mWatts

SOT-363 Unit: inch (mm)

FEATURES

- Complementary Pair
- One 4401-Type NPN
- One 4403-Type PNP
- Epitaxial Planar Die Construction
- Ideal for Low Power Amplification and Switching
- Ultra-Small Surface Mount Package
- Also Available in Lead Free Version
- In compliance with EU RoHS 2002/95/EC directives

MECHANICAL DATA

- Case: SOT-363, Plastic
- Terminals: Solderable per MIL-STD-750, Method 2026
- Approx. Weight: 0.006 gram
- Marking: M6A

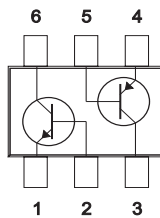
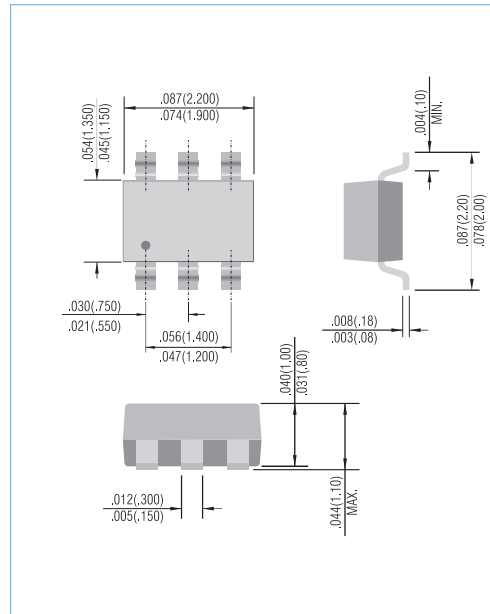


Fig.55

MAXIMUM RATINGS, TOTAL DEVICE @ $T_A = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	Value	Unit
Power Dissipation	P_d	225	mW
Thermal Resistance , Junction to Ambient	$R_{\theta A}$	625	K/W
Operating and Storage and Junction Range	T_J, T_{STG}	-55 to 150	$^\circ\text{C}$



MMDT4413

MAXIMUM RATINGS,NPN 4401 SECTION @ $T_A=25^{\circ}\text{C}$ UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	NPN4401	Unit
Collector-Base Voltage	V_{CB0}	60	V
Collector-Emitter Voltage	V_{CE0}	40	V
Emitter-Base Voltage	V_{EB0}	6.0	V
Collector Current-Continuous	I_c	600	mA

MAXIMUM RATINGS,NPN 4403 SECTION @ $T_A=25^{\circ}\text{C}$ UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	PNP4403	Unit
Collector-Base Voltage	V_{CB0}	-40	V
Collector-Emitter Voltage	V_{CE0}	-40	V
Emitter-Base Voltage	V_{EB0}	-5.0	V
Collector Current-Continuous	I_c	-600	mA



MMDT4413

ELECTRICAL CHARACTERISTICS, NPN 4401 SECTION @ TA=25°C UNLESS OTHERWISE SPECIFIED

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	MAX	UNIT
OFF CHARACTERISTIC					
Collector - Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C=100\mu A, I_E=0$	60	-	V
Collector - Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C=1.0mA, I_B=0$	40	-	V
Emitter - Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E=100\mu A, I_C=0$	6.0	-	V
Collector Cutoff Current	I_{cEX}	$V_{CE}=35V, V_{EB(OFF)}=0.4V$	-	100	nA
Base Cutoff Current	I_{BL}	$V_{CE}=35V, V_{EB(OFF)}=0.4V$	-	100	nA
ON CHARACTERISTICS					
DC Current Gain (Note 2)	h_{FE}	$I_C=100\mu A, V_{CE}=1.0V$	20	-	-
		$I_C=1.0mA, V_{CE}=1.0V$	40	-	
		$I_C=10mA, V_{CE}=1.0V$	80	-	
		$I_C=150mA, V_{CE}=1.0V$	100	300	
		$I_C=500mA, V_{CE}=2.0V$	40	-	
Collector - Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C=150mA, I_B=15mA$ $I_C=500mA, I_B=50mA$	-	0.40 0.75	V
Base - Emitter Saturation Voltage	$V_{BE(SAT)}$	$I_C=150mA, I_B=15mA$ $I_C=500mA, I_B=50mA$	0.75 -	0.95 1.20	V
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{cb}	$V_{CB}=5V, I_E=0, f=1.0MHz$	-	6.5	pF
Input Capacitance	C_{eb}	$V_{EB}=0.5V, I_C=0, f=1MHz$	-	30	pF
Input Impedance	h_{ie}	$V_{CE}=10V, I_C=1.0mA, f=1.0KHz$	1.0	15	k Ω
Voltage Feedback Ratio	h_{re}		0.1	8.0	$\times 10^{-4}$
Small Signal Current Gain	h_{fe}		40	500	-
Output Admittance	h_{oe}		1.0	30	μS
Current Gain - Bandwidth Product	f_T		$V_{CE}=10V, I_C=20mA, f=100MHz$	250	-
SWITCHING CHARACTERISTICS					
Delay Time	t_d	$V_{CC}=30V, V_{BE(OFF)}=2.0V,$ $I_C=150mA, I_{B1}=15mA$	-	15	ns
Rise Time	t_r		-	20	ns
Storage Time	t_s	$V_{CC}=30V, I_C=150mA$ $I_{B1}=I_{B2}=15mA$	-	225	ns
Fall Time	t_f		-	30	ns



MMDT4413

ELECTRICAL CHARACTERISTICS, NPN 4403 SECTION @ TA=25°C UNLESS OTHERWISE SPECIFIED

CHARACTERISTIC	SYMBOL	TEST CONDITION	MIN	MAX	UNIT
OFF CHARACTERISTIC					
Collector - Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = -100\mu A, I_E = 0$	-40	-	V
Collector - Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = -1.0mA, I_B = 0$	-40	-	V
Emitter - Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = -100\mu A, I_C = 0$	-5.0	-	V
Collector Cutoff Current	I_{CEX}	$V_{CE} = -35V, V_{EB(OFF)} = -0.4V$	-	-100	nA
Base Cutoff Current	I_{BL}	$V_{CE} = -35V, V_{EB(OFF)} = -0.4V$	-	-100	nA
ON CHARACTERISTICS					
DC Current Gain (Note 2)	h_{FE}	$I_C = -100\mu A, V_{CE} = -1.0V$ $I_C = -1.0mA, V_{CE} = -1.0V$ $I_C = -10mA, V_{CE} = -1.0V$ $I_C = -150mA, V_{CE} = -2.0V$ $I_C = -500mA, V_{CE} = -2.0V$	30 60 100 100 20	- - - 300 -	-
Collector - Emitter Saturation Voltage	$V_{CE(SAT)}$	$I_C = -150mA, I_B = -15mA$ $I_C = -500mA, I_B = -50mA$	-	-0.40 -0.75	V
Base - Emitter Saturation Voltage	$V_{BE(SAT)}$	$I_C = -150mA, I_B = -15mA$ $I_C = -500mA, I_B = -50mA$	-0.75 -	-0.95 -1.30	V
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	C_{cb}	$V_{CB} = -10V, I_E = 0, f = 1.0MHz$	-	8.5	pF
Input Capacitance	C_{eb}	$V_{EB} = -0.5V, I_C = 0, f = 1MHz$	-	30	pF
Input Impedance	h_{ie}	$V_{CE} = -10V, I_C = -1.0mA, f = 1.0KHz$	1.5	15	k Ω
Voltage Feedback Ratio	h_{re}		0.1	8.0	$\times 10^{-4}$
Small Signal Current Gain	h_{fe}		60	500	-
Output Admittance	h_{oe}		1.0	100	μS
Current Gain - Bandwidth Product	f_T		$V_{CE} = -10V, I_C = -20mA, f = 100MHz$	200	-
SWITCHING CHARACTERISTICS					
Delay Time	t_d	$V_{CC} = -30V, V_{BE(OFF)} = -2.0V,$ $I_C = -150mA, I_{B1} = -15mA$	-	15	ns
Rise Time	t_r		-	20	ns
Storage Time	t_s	$V_{CC} = -30V, I_C = -150mA$ $I_{B1} = I_{B2} = -15mA$	-	225	ns
Fall Time	t_f		-	30	ns



MMDT4413

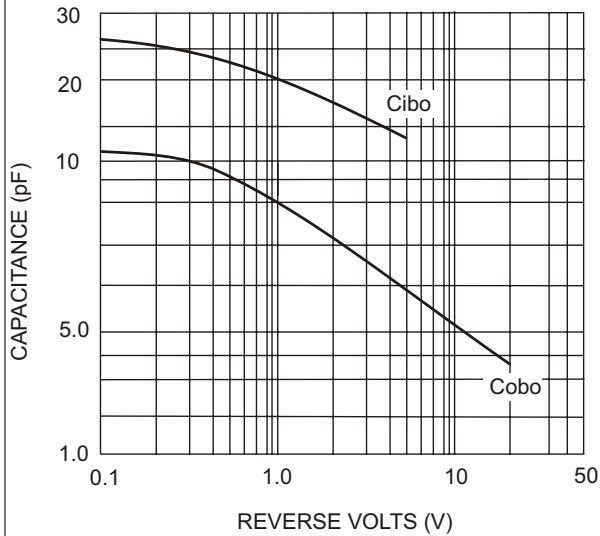


Fig. 1 Typical Capacitance (4401)

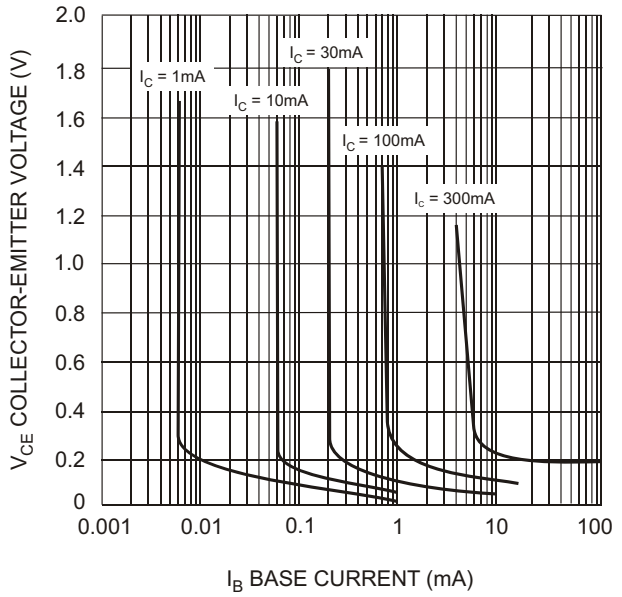


Fig. 2 Typical Collector Saturation Region (4401)

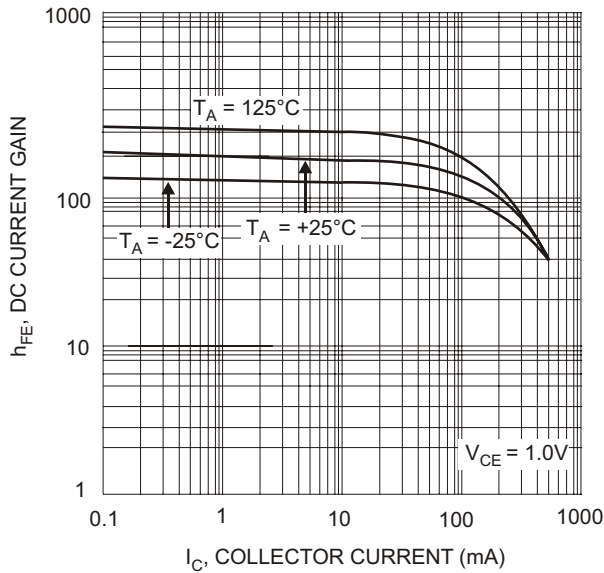


Fig. 3 Typical DC Current Gain vs. Collector Current (4401)

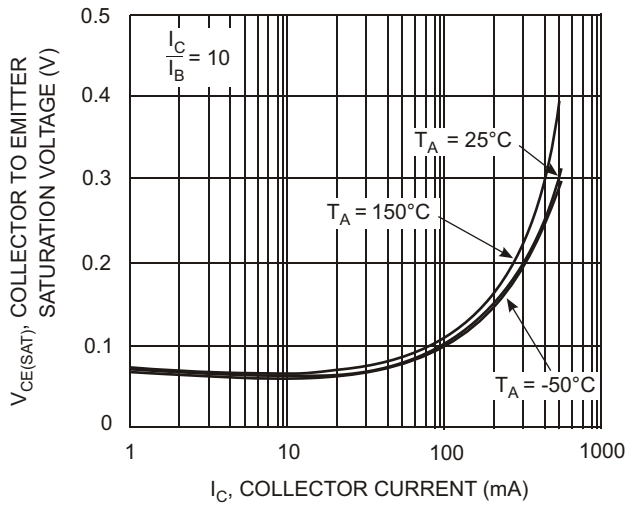


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current (4401)



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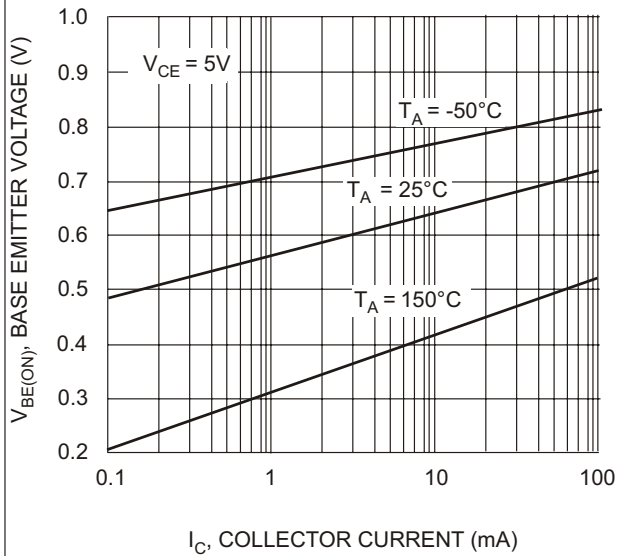


Fig. 5 Base Emitter Voltage vs. Collector Current (4401)

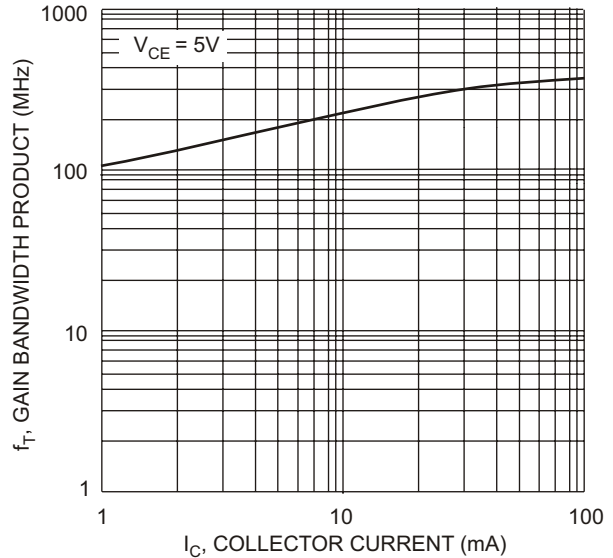


Fig. 6 Gain Bandwidth Product vs. Collector Current (4401)

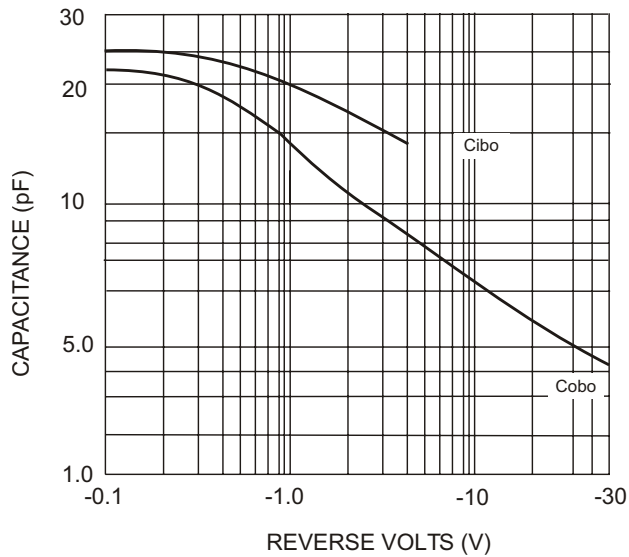


Fig. 7 Typical Capacitance (4403)



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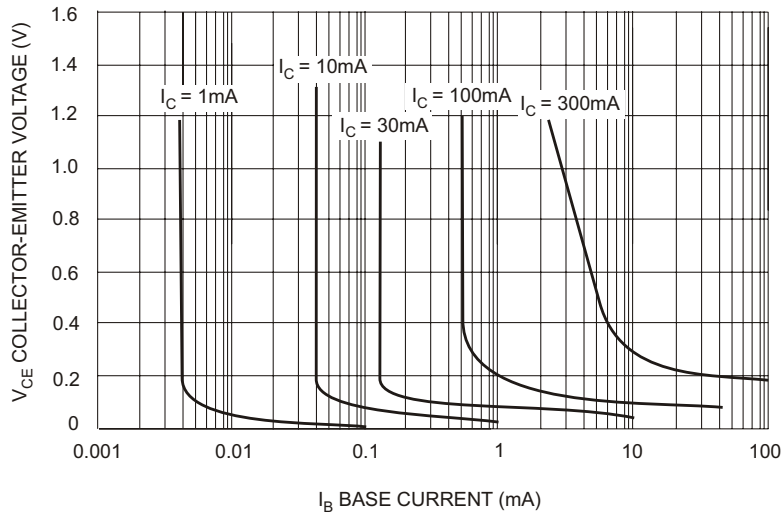


Fig. 8 Typical Collector Saturation Region (4403)

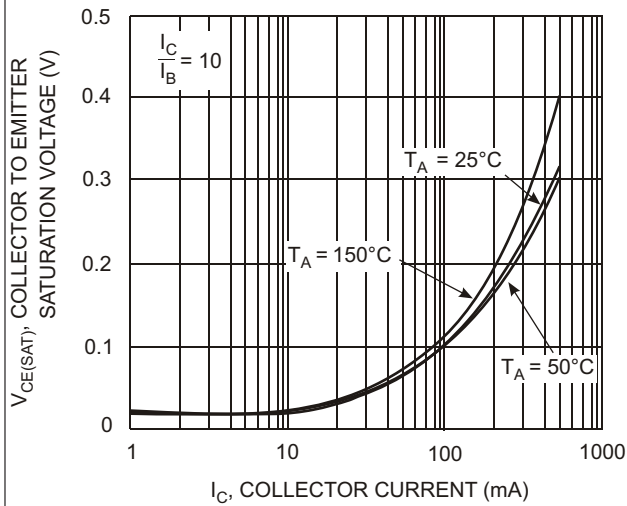


Fig. 9 Collector Emitter Saturation Voltage vs. Collector Current (4403)

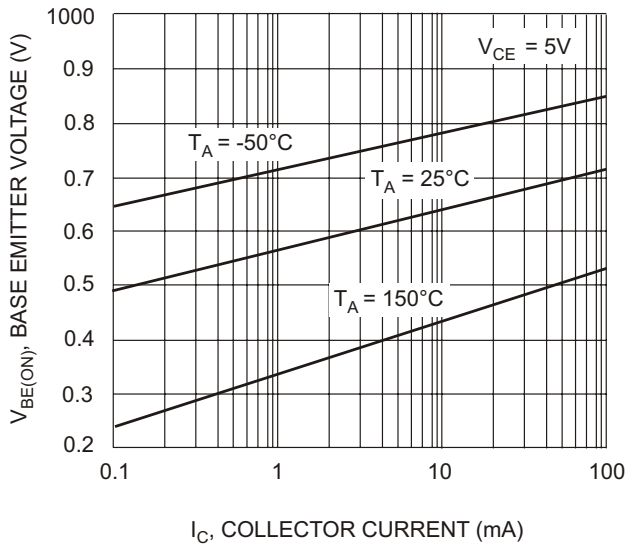


Fig. 10 Base-Emitter Voltage vs. Collector Current (4403)



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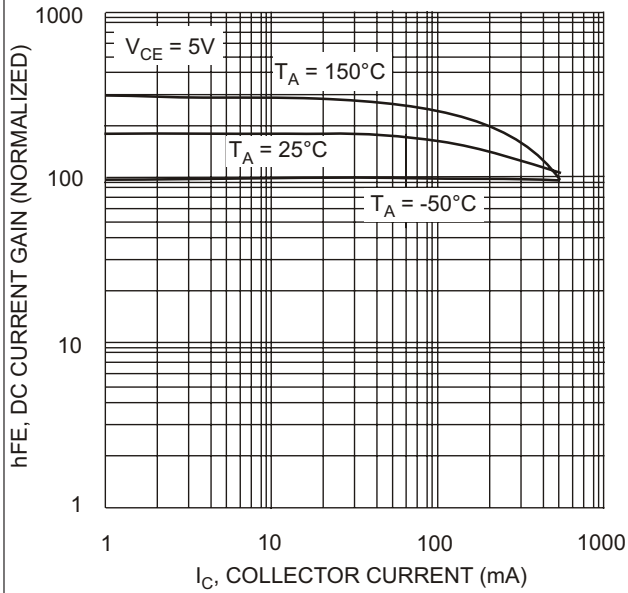


Fig. 11 DC Current Gain vs. Collector Current (4403)

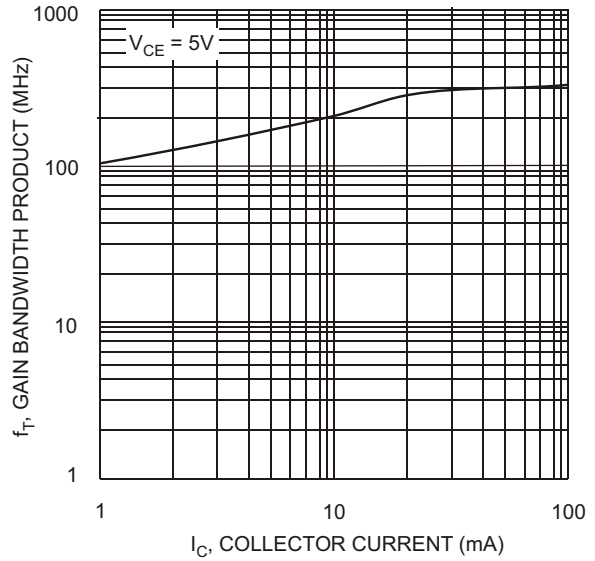


Fig. 12 Gain Bandwidth Product vs. Collector Current (4403)

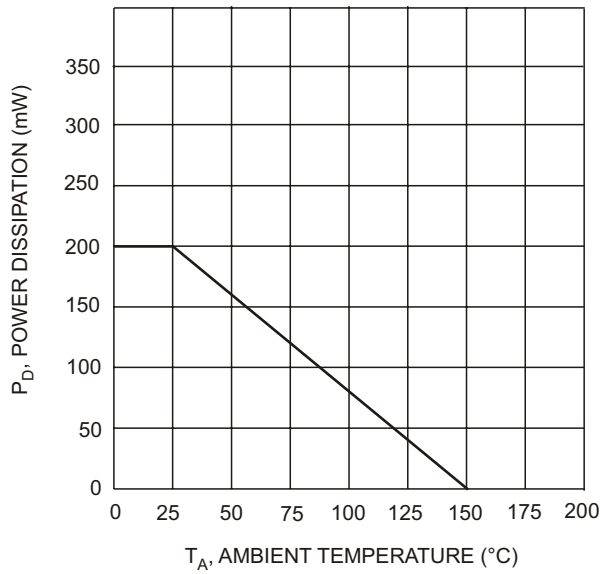
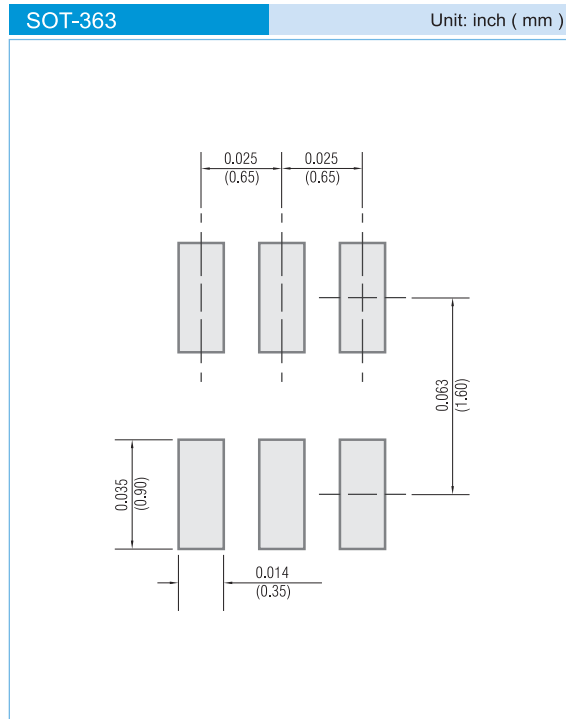


Fig. 13, Max Power Dissipation vs Ambient Temperature (4403)



MMDT4413

MOUNTING PAD LAYOUT



ORDER INFORMATION

- Packing information
 - T/R - 10K per 13" plastic Reel
 - T/R - 3K per 7" plastic Reel

LEGAL STATEMENT

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