



MMDT4413

COMPLEMENTARY NPN/PNP SMALL SIGNAL SURFACE MOUNT TRANSISTOR

VOLTAGE 40 Volt **POWER** 225 mWatt

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
- Lead free in compliance with EU RoHS 2011/65/EU directive
- Green molding compound as per IEC61249 Std. . (Halogen Free)

MECHANICAL DATA

- Case: SOT-363, Plastic
- Terminals: Solderable per MIL-STD-750, Method 2026
- Approx. Weight: 0.0002 ounces, 0.006 grams.
- Marking: M6A

SOT-363 Unit : inch(mm)

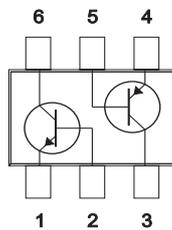
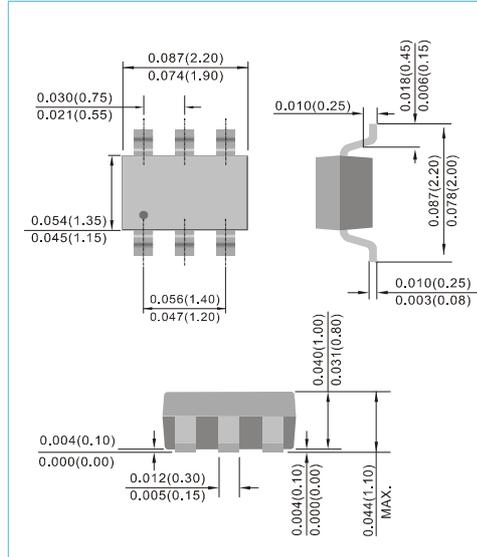


Fig.55

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	$R_{\theta JA}$	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

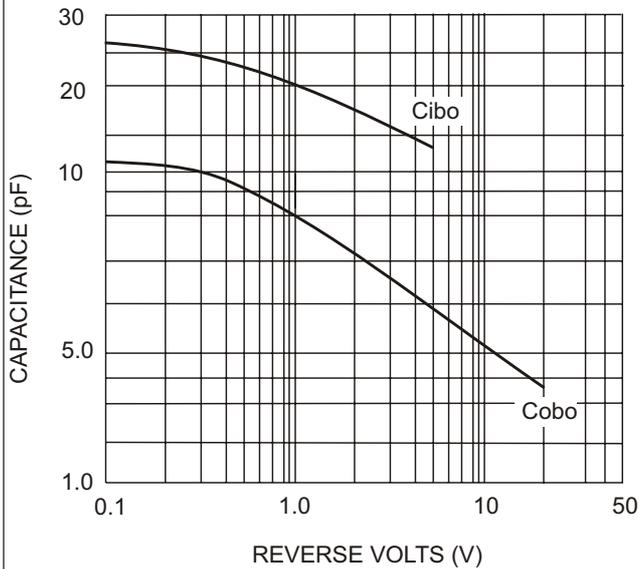


Fig. 1 Typical Capacitance (4401)

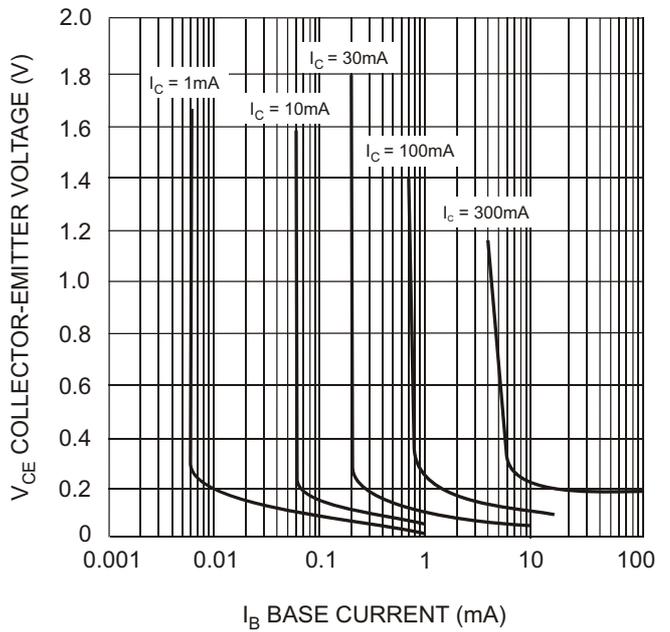


Fig. 2 Typical Collector Saturation Region (4401)

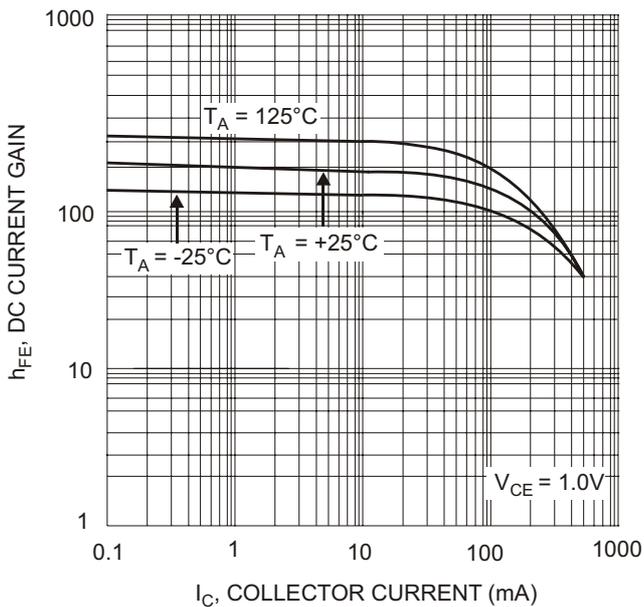


Fig. 3 Typical DC Current Gain vs. Collector Current (4401)

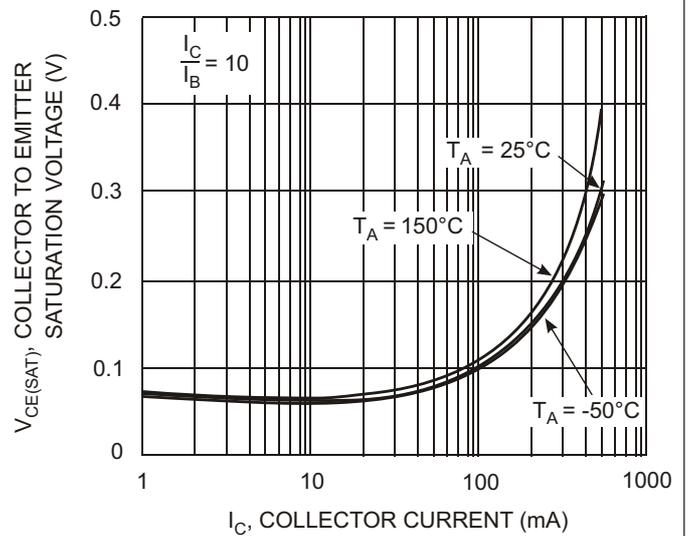


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current (4401)



MMDT4413

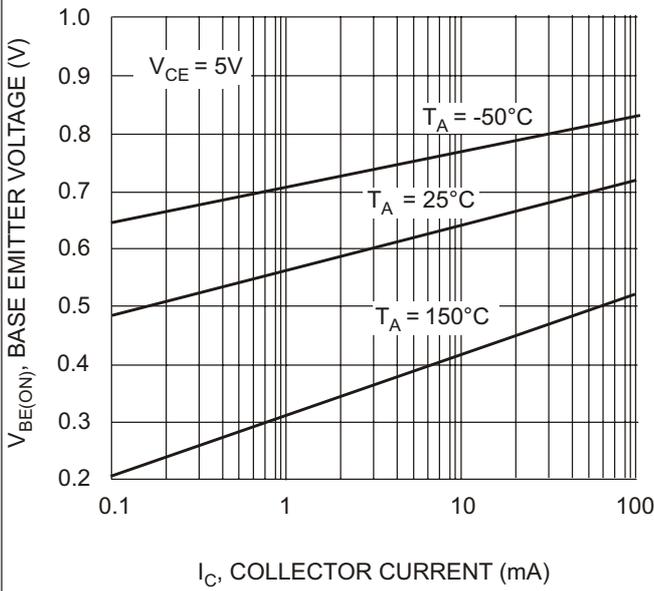


Fig. 5 Base Emitter Voltage vs. Collector Current (4401)

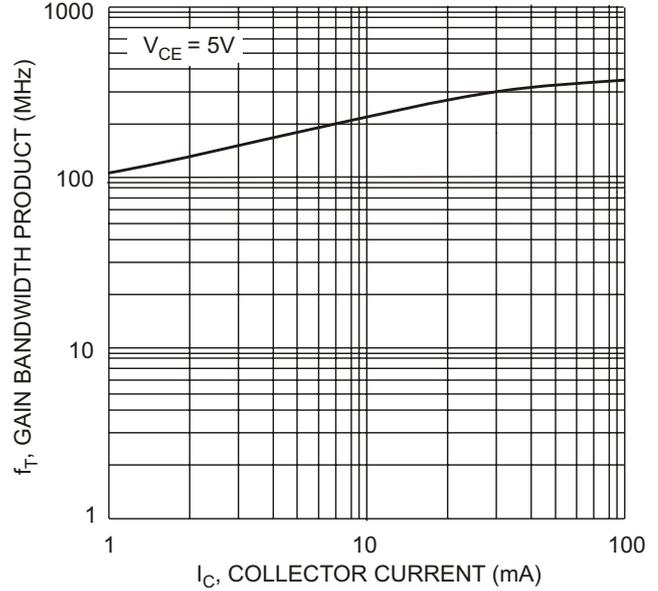


Fig. 6 Gain Bandwidth Product vs. Collector Current (4401)

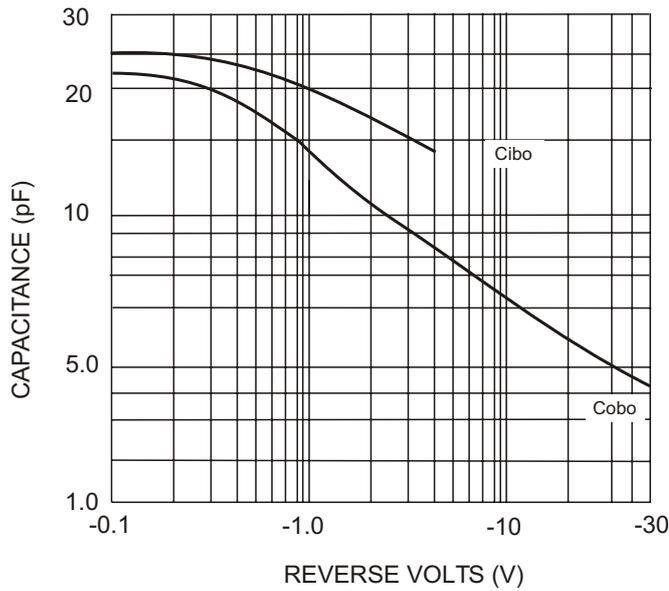


Fig. 7 Typical Capacitance (4403)



MMDT4413

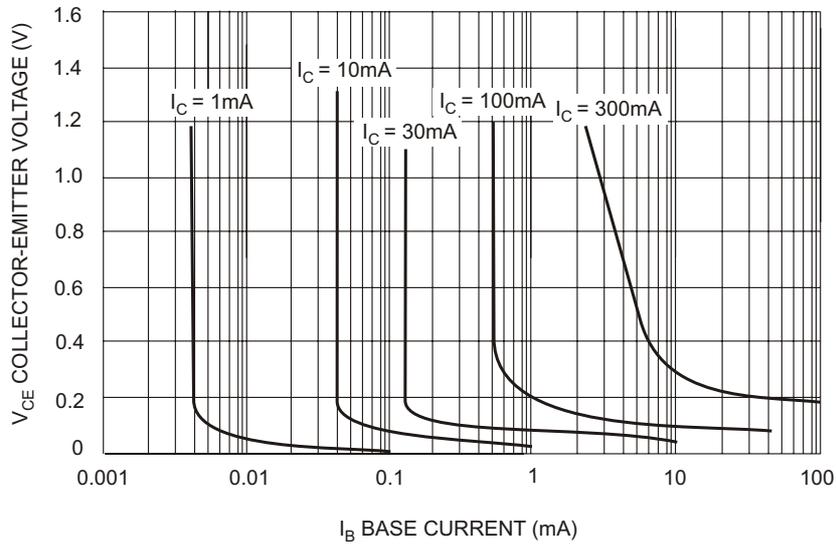


Fig. 8 Typical Collector Saturation Region (4403)

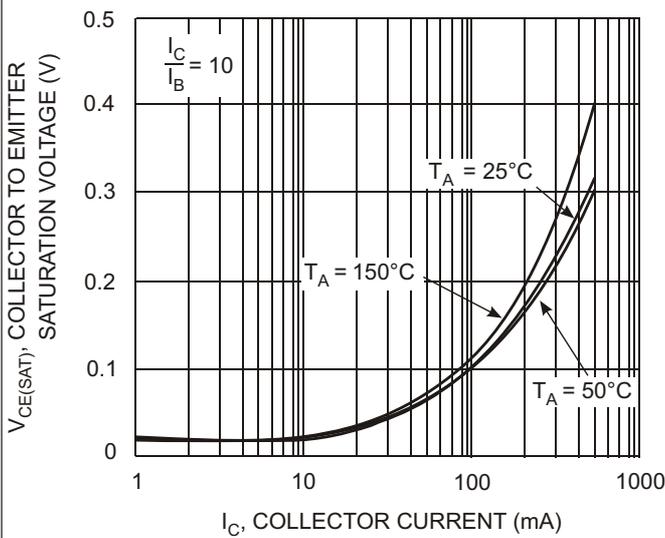


Fig. 9 Collector Emitter Saturation Voltage vs. Collector Current (4403)

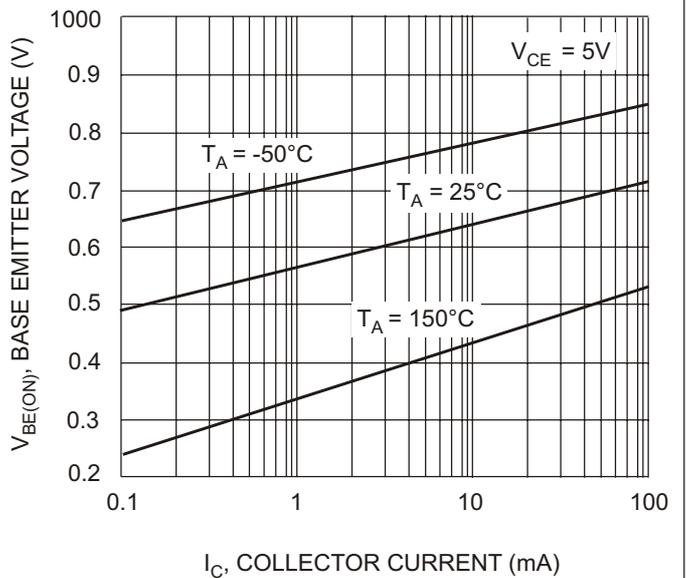


Fig. 10 Base-Emitter Voltage vs. Collector Current (4403)



MMDT4413

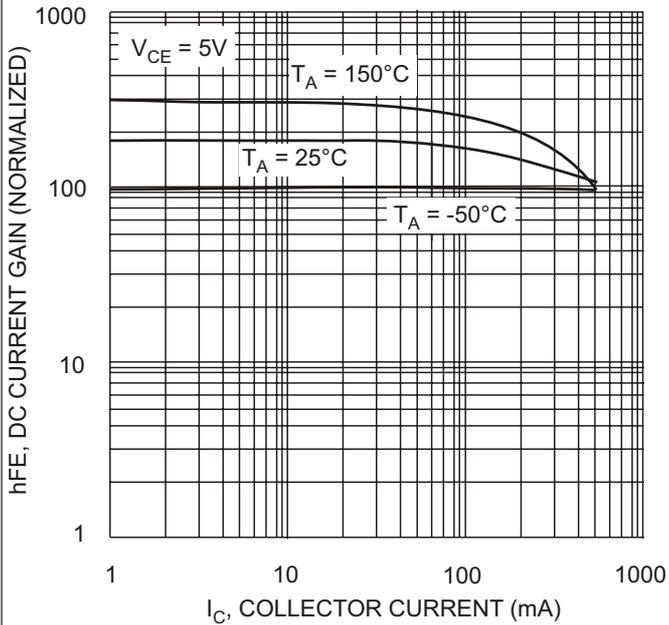


Fig. 11 DC Current Gain vs. Collector Current (4403)

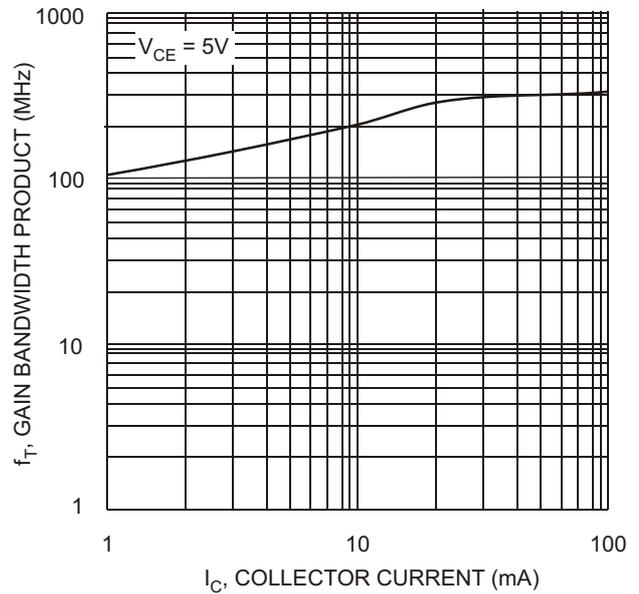


Fig. 12 Gain Bandwidth Product vs. Collector Current (4403)

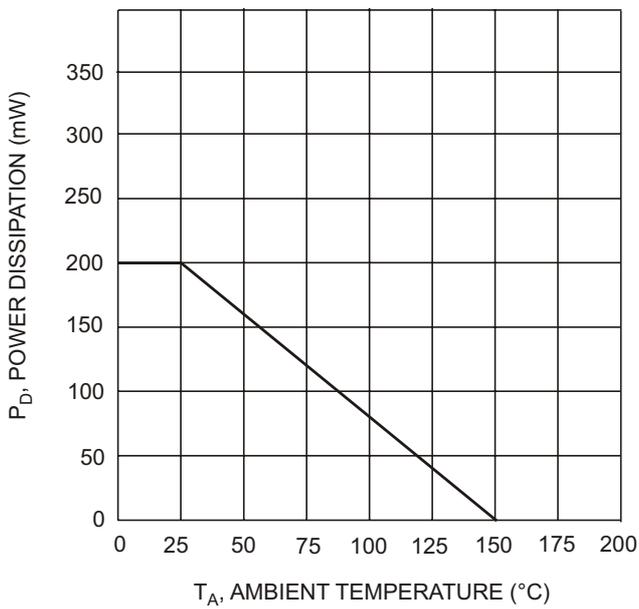


Fig. 13, Max Power Dissipation vs Ambient Temperature (4403)

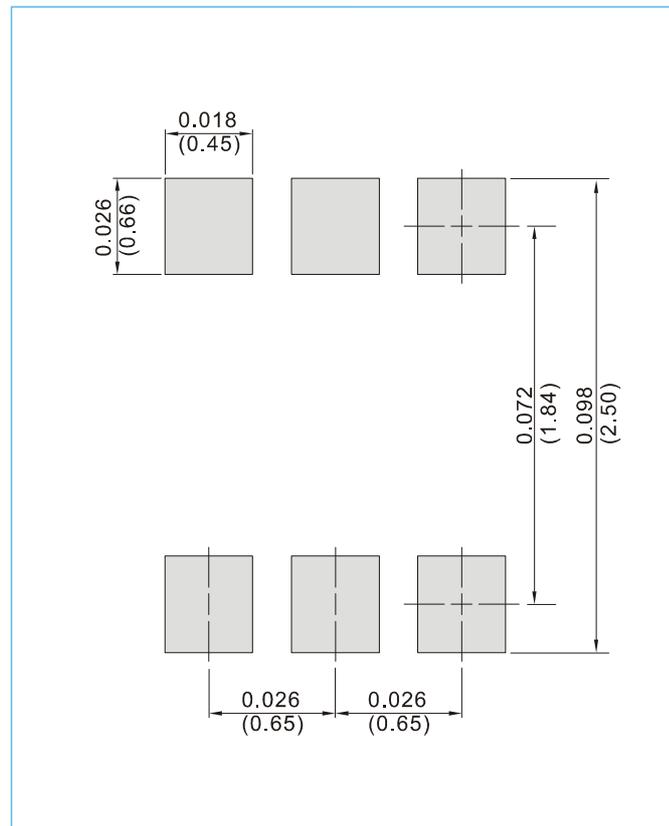


MMDT4413

MOUNTING PAD LAYOUT

SOT-363

Unit : inch(mm)



ORDER INFORMATION

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



MMDT4413

Part No_packing code_Version

MMDT4413_R1_00001

MMDT4413_R2_00001

For example :

RB500V-40_R2_00001



Packing Code XX				Version Code XXXXX		
Packing type	1 st Code	Packing size code	2 nd Code	HF or RoHS	1 st Code	2 nd ~5 th Code
Tape and Ammunition Box (T/B)	A	N/A	0	HF	0	serial number
Tape and Reel (T/R)	R	7"	1	RoHS	1	serial number
Bulk Packing (B/P)	B	13"	2			
Tube Packing (T/P)	T	26mm	X			
Tape and Reel (Right Oriented) (TRR)	S	52mm	Y			
Tape and Reel (Left Oriented) (TRL)	L	PANASERT T/B CATHODE UP (PBCU)	U			
FORMING	F	PANASERT T/B CATHODE DOWN (PBCD)	D			



MMDT4413

Disclaimer

- Reproducing and modifying information of the document is prohibited without permission from Panjit International Inc..
- Panjit International Inc. reserves the rights to make changes of the content herein the document anytime without notification. Please refer to our website for the latest document.
- Panjit International Inc. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.
- Panjit International Inc. does not assume any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.
- Applications shown on the herein document are examples of standard use and operation. Customers are responsible in comprehending the suitable use in particular applications. Panjit International Inc. makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.
- The products shown herein are not designed and authorized for equipments requiring high level of reliability or relating to human life and for any applications concerning life-saving or life-sustaining, such as medical instruments, transportation equipment, aerospace machinery et cetera. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Panjit International Inc. for any damages resulting from such improper use or sale.
- Since Panjit uses lot number as the tracking base, please provide the lot number for tracking when complaining.