



# 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)

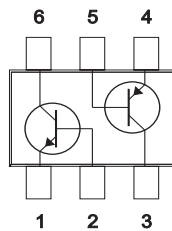
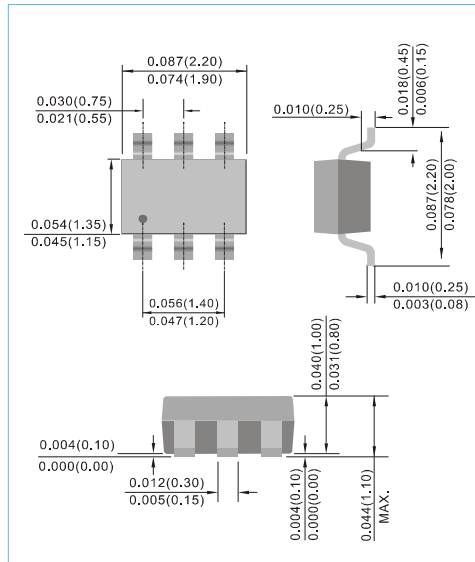


Fig.55

### MAXIMUM RATINGS, TOTAL DEVICE @ T<sub>A</sub>=25°C UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	Value	Unit
Power Dissipation	P <sub>d</sub>	225	mW
Thermal Resistance , Junction to Ambient	R <sub>θJA</sub>	625	K/W
Operating and Storage and Junction Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to 150	°C



# MMDT4413

## MAXIMUM RATINGS,NPN 4401 SECTION@T<sub>A</sub>=25°C UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	NPN4401	Unit
Collector-Base Voltage	V <sub>CB0</sub>	60	V
Collector-Emitter Voltage	V <sub>CE0</sub>	40	V
Emitter-Base Voltage	V <sub>EB0</sub>	6.0	V
Collector Current-Continuous	I <sub>c</sub>	600	mA

## MAXIMUM RATINGS,NPN 4403 SECTION@T<sub>A</sub>=25°C UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	PNP4403	Unit
Collector-Base Voltage	V <sub>CB0</sub>	-40	V
Collector-Emitter Voltage	V <sub>CE0</sub>	-40	V
Emitter-Base Voltage	V <sub>EB0</sub>	-5.0	V
Collector Current-Continuous	I <sub>c</sub>	-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 $\Omega$
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	$\mu S$
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
<b>OFF CHARACTERISTIC</b>					
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
<b>ON CHARACTERISTICS</b>					
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
<b>SMALL SIGNAL CHARACTERISTICS</b>					
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 $\Omega$
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	$\mu S$
Current Gain - Bandwidth Product	$f_T$		$V_{CE} = -10V, I_C = -20mA, f = 100MHz$	200	-
<b>SWITCHING CHARACTERISTICS</b>					
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

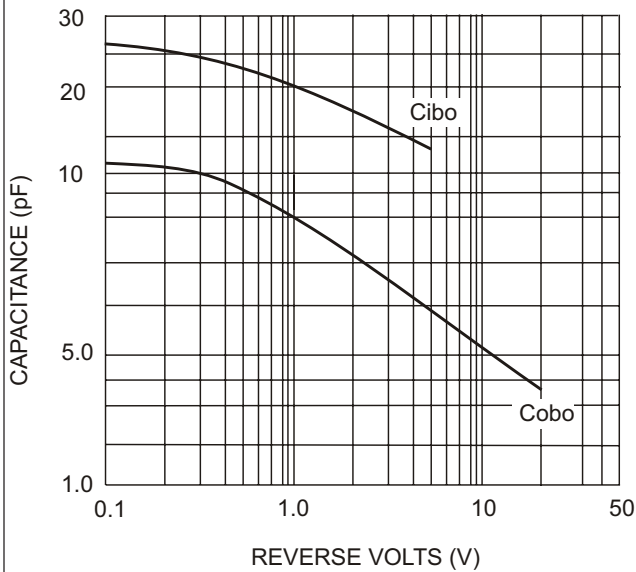


Fig. 1 Typical Capacitance (4401)

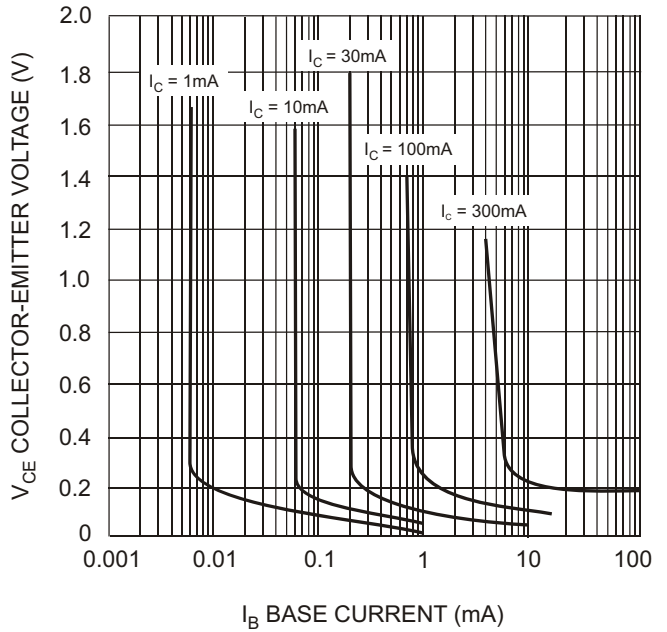


Fig. 2 Typical Collector Saturation Region (4401)

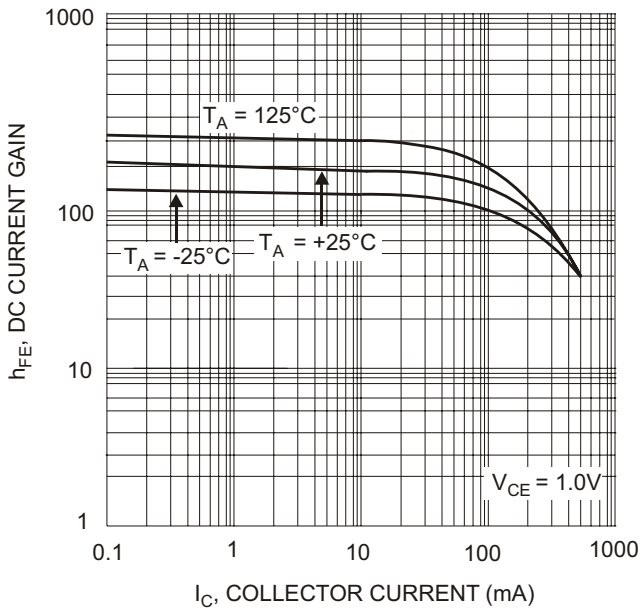


Fig. 3 Typical DC Current Gain vs Collector Current (4401)

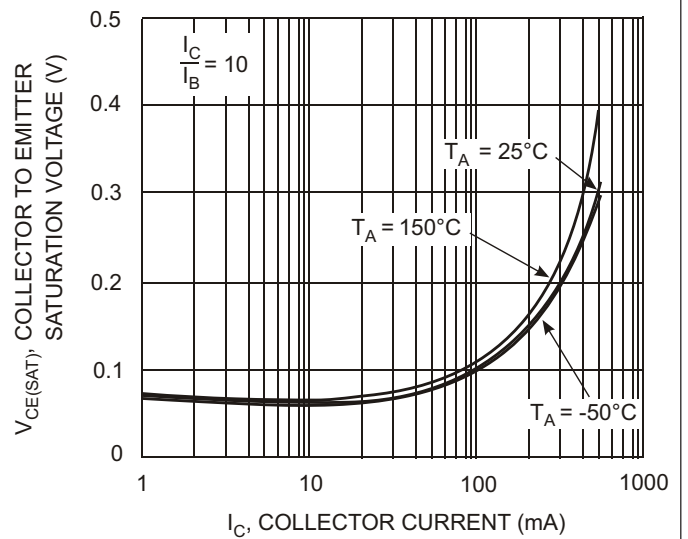


Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current (4401)



# MMDT4413

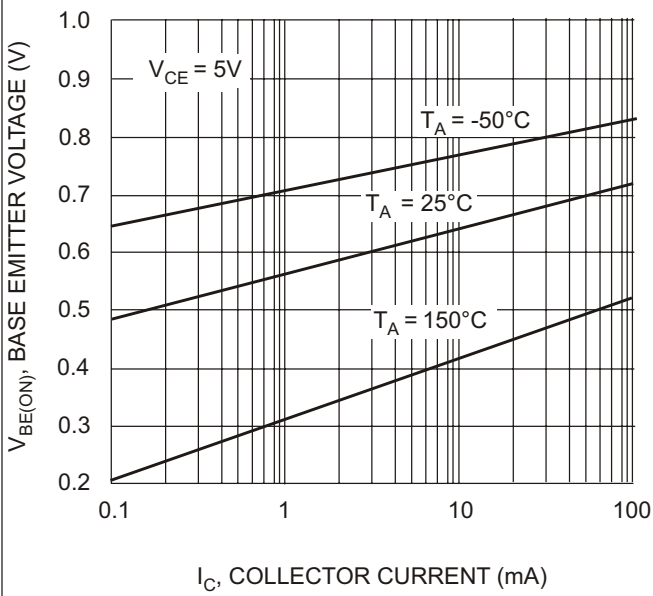


Fig. 5 Base Emitter Voltage vs. Collector Current (4401)

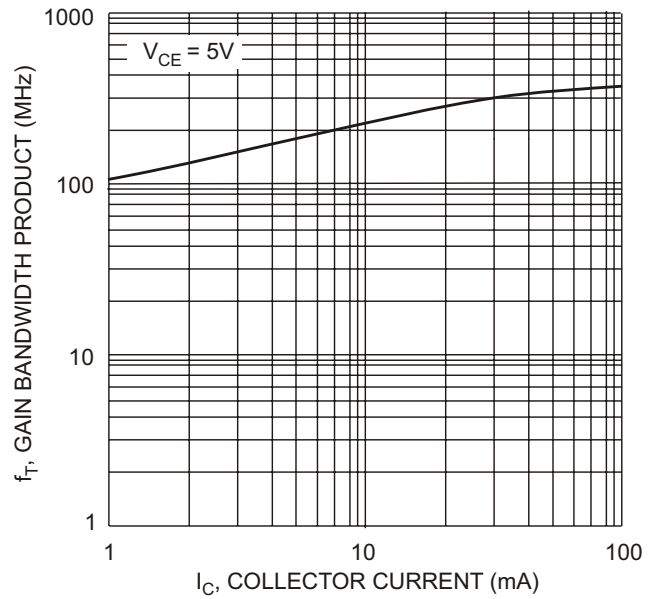


Fig. 6 Gain Bandwidth Product vs. Collector Current (4401)

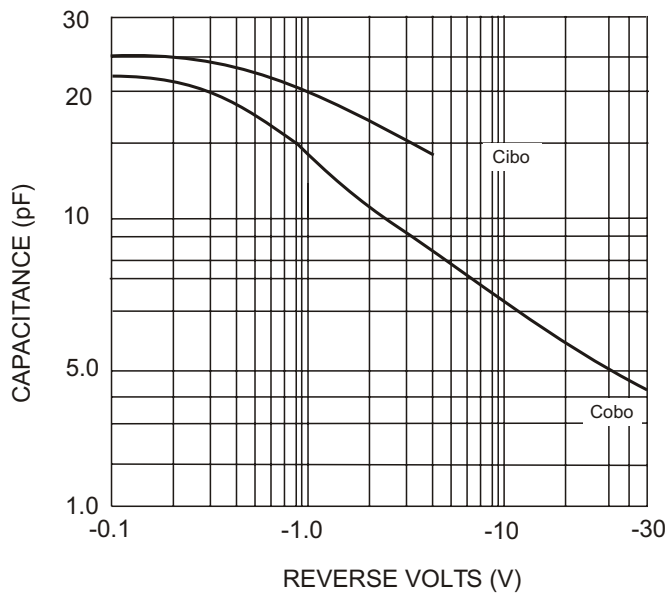


Fig. 7 Typical Capacitance (4403)



# MMDT4413

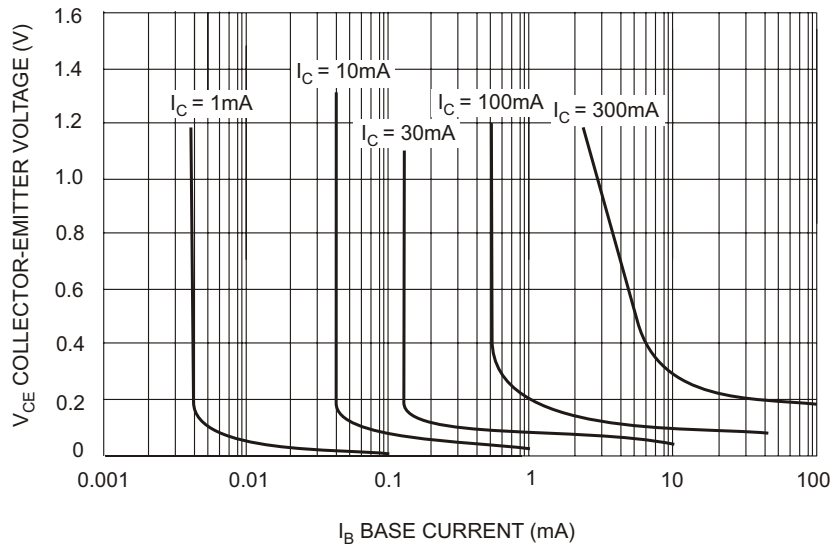


Fig. 8 Typical Collector Saturation Region (4403)

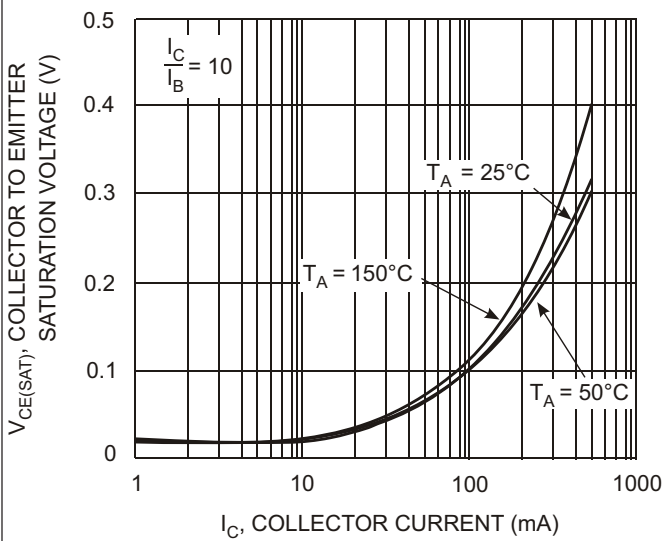


Fig. 9 Collector Emitter Saturation Voltage vs. Collector Current (4403)

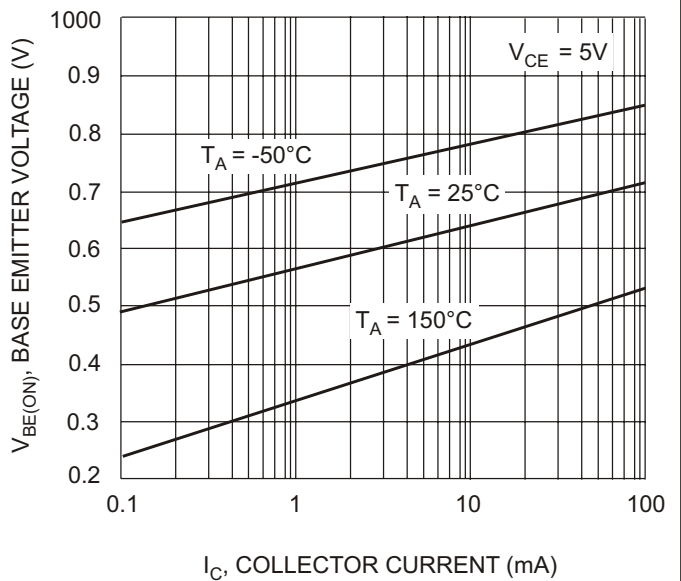


Fig. 10 Base-Emitter Voltage vs. Collector Current (4403)



# MMDT4413

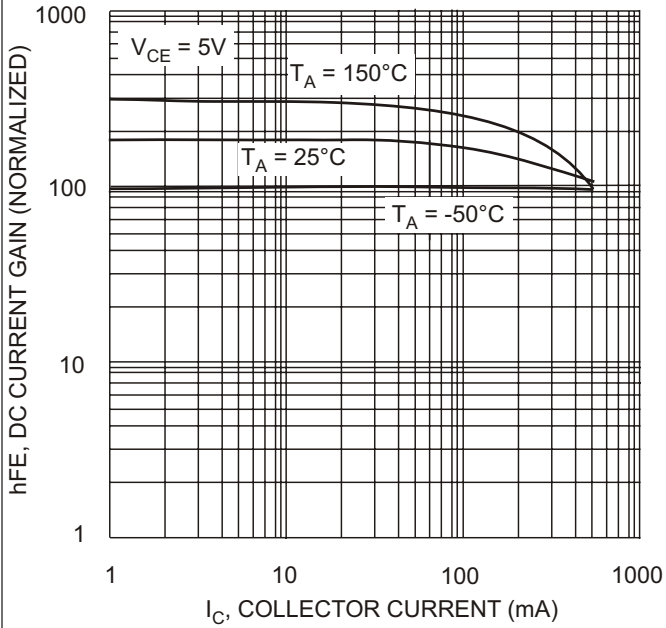


Fig. 11 DC Current Gain vs. Collector Current (4403)

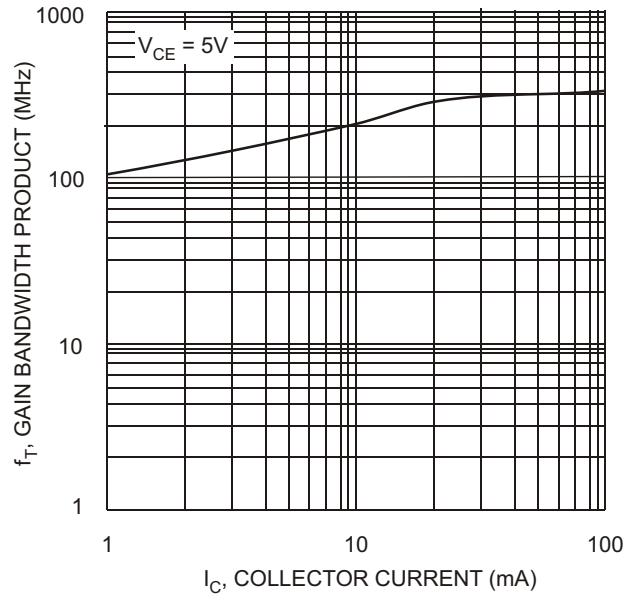


Fig. 12 Gain Bandwidth Product vs. Collector Current (4403)

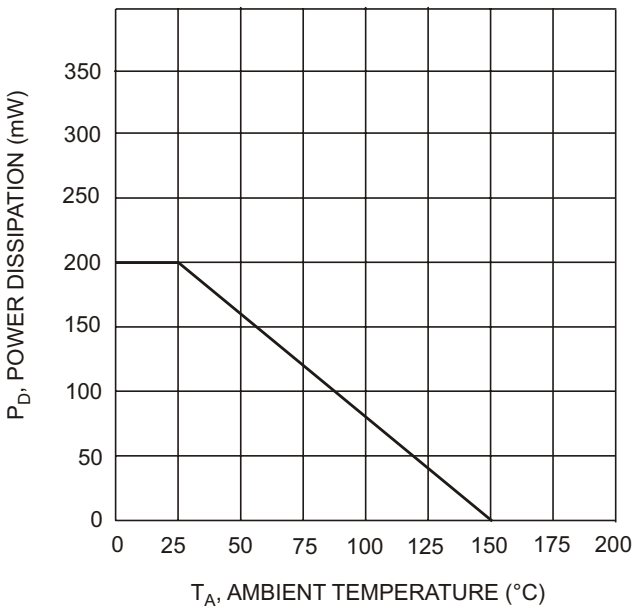


Fig. 13, Max Power Dissipation vs Ambient Temperature (4403)



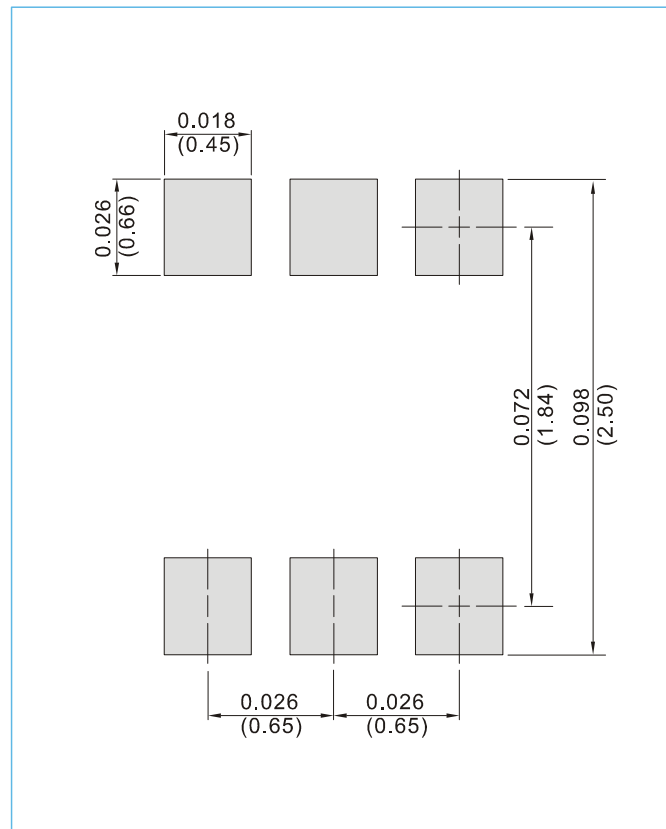


# MMDT4413

## 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

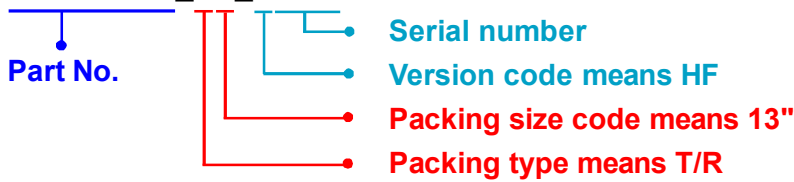
## Part No\_packing code\_Version

MMDT4413\_R1\_00001

MMDT4413\_R2\_00001

For example :

**RB500V-40\_R2\_00001**



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



## 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.