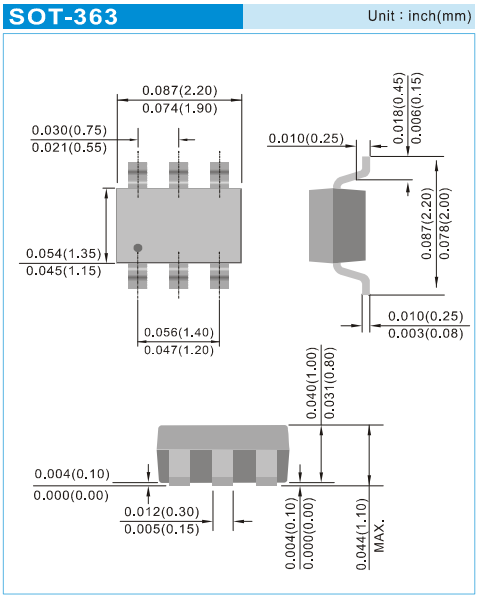
MMDT4413

COMPLEMENTARY NPN/PNP SMALL SIGNAL SURGACE 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

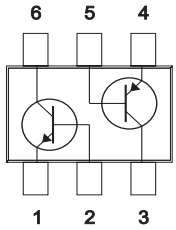


Fig.55

MAXIMUM RATINGS,TOTAL DEVICE@T_A=25°C UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	Value	Unit
Power Dissipation	Pd	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	°C

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MAXIMUM RATINGS,NPN 4401 SECTION@T_A=25°C UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	NPN4401	Unit
Collector-Base Voltage	V_{CBO}	60	V
Collector-Emitter Voltage	V_{CEO}	40	V
Emitter-Base Volage	V_{EBO}	6.0	V
Collector Current-Continuous	I c	600	mA

MAXIMUM RATINGS,NPN 4403 SECTION@T_A=25°C UNLESS OTHERWISE SPECIFIED

Characteristic	Symbol	PNP4403	Unit
Collector-Base Voltage	V_{CBO}	-40	V
Collector-Emitter Voltage	V_{CEO}	-40	V
Emitter-Base Volage	V_{EBO}	-5.0	V
Collector Current-Continuous	I c	-600	mA

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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∝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∝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∝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}=1.0V I_C=500mA, V_{CE}=2.0V	20 40 80 100 40	- - - 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 1.20	V
SMALL SIGNAL CHARACTERISTICS					
Output Capacitance	Ccb	V_{CB}=5V, I_E=0, f=1.0MHz	-	6.5	pF
Input Capacitance	Ceb	V_{EB}=0.5V, I_C=0, f=1MHz	-	30	pF
Input Impedance	hie	V_{CE}=10V, I_C=1.0mA, f=1.0KHz	1.0	15	kΩ
Voltage Feedback Ratio	hre		0.1	8.0	X 10^{-4}
Small Signal Current Gain	hfe		40	500	-
Output Admittance	hoe		1.0	30	∝S
Current Gain - Bandwidth Product	f_T	V_{CE}=10V, I_C=20mA, f=100MHz	250	-	MHz
SWITCHING CHARACTERISTICS					
Delay Time	td	V_{CC}=30V,$V_{BE(OFF)}$=2.0V, I_C=150mA,I_{B1}=15mA	-	15	ns
Rise Time	tr		-	20	ns
Storage Time	ts	V_{CC}=30V,I_C=150mA I_{B1}=I_{B2}=15mA	-	225	ns
Fall Time	tf		-	30	ns

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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∝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∝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∝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	Ccb	V_{CB}=-10V, I_E=0, f=1.0MHz	-	8.5	pF
Input Capacitance	Ceb	V_{EB}=-0.5V, I_C=0, f=1MHz	-	30	pF
Input Impedance	hie	V_{CE}=-10V, I_C=-1.0mA, f=1.0KHz	1.5	15	kΩ
Voltage Feedback Ratio	hre		0.1	8.0	X 10^{-4}
Small Signal Current Gain	hfe		60	500	-
Output Admittance	hoe		1.0	100	∝S
Current Gain - Bandwidth Product	f_T	V_{CE}=-10V, I_C=-20mA, f=100MHz	200	-	MHz
SWITCHING CHARACTERISTICS					
Delay Time	td	V_{CC}=-30V,$V_{BE(OFF)}$=-2.0V, I_C=-150mA,I_{B1}=-15mA	-	15	ns
Rise Time	tr		-	20	ns
Storage Time	ts	V_{CC}=-30V,I_C=-150mA I_{B1}=I_{B2}=-15mA	-	225	ns
Fall Time	tf		-	30	ns

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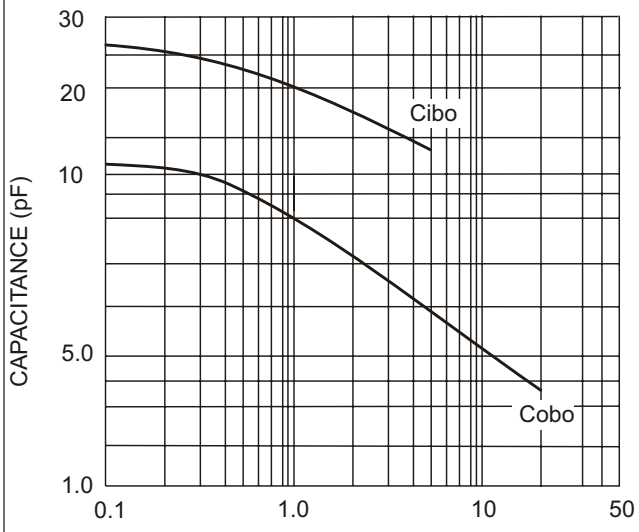

Fig. 1 Typical Capacitance (4401)

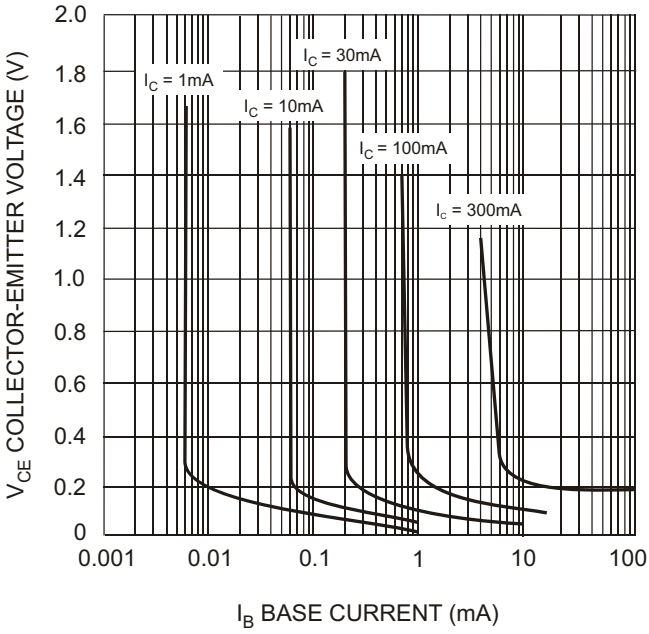

Fig. 2 Typical Collector Saturation Region (4401)

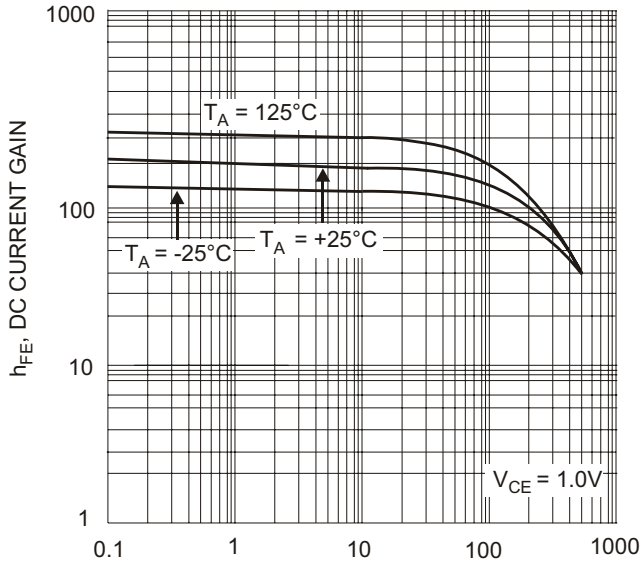

Fig. 3 Typical DC Current Gain vs Collector Current (4401)

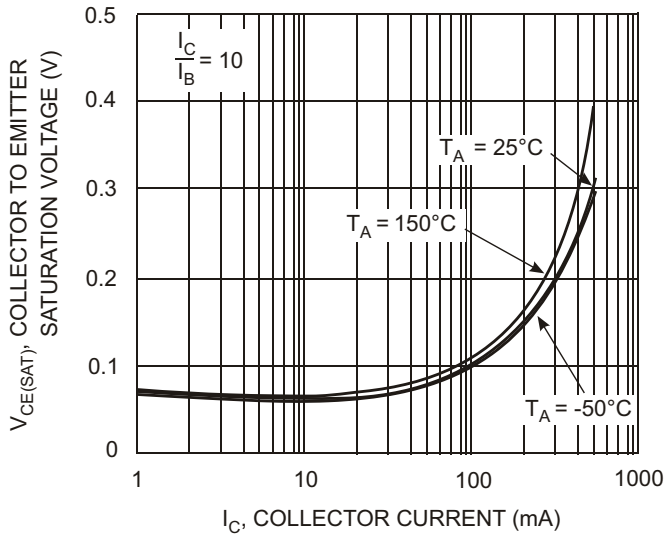

Fig. 4 Collector Emitter Saturation Voltage vs. Collector Current (4401)

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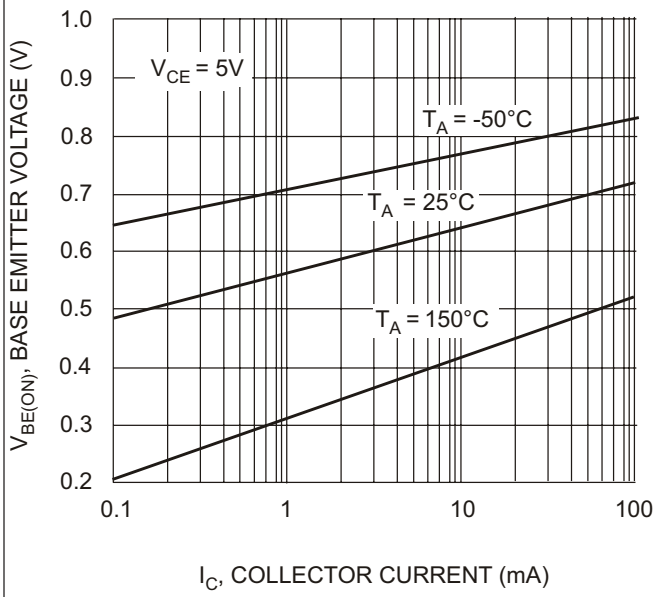

Fig. 5 Base Emitter Voltage vs. Collector Current (4401)

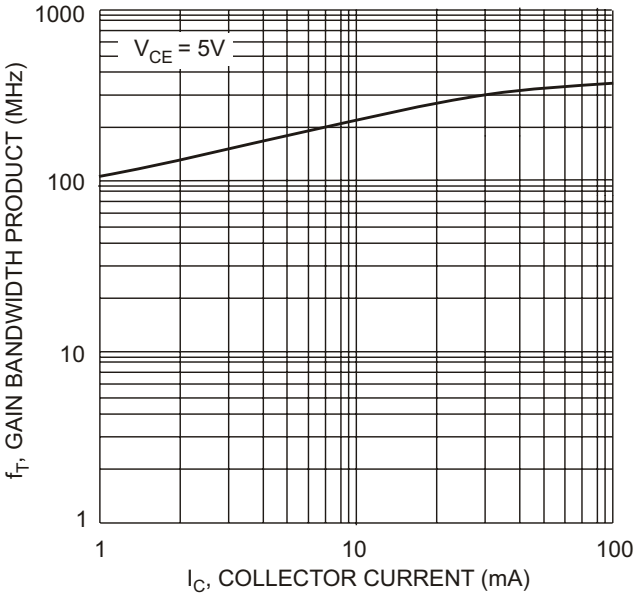

Fig. 6 Gain Bandwidth Product vs. Collector Current (4401)

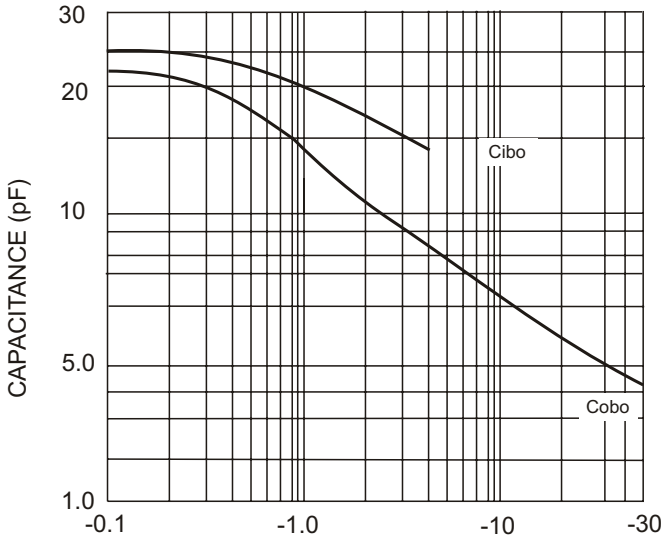

Fig. 7 Typical Capacitance (4403)

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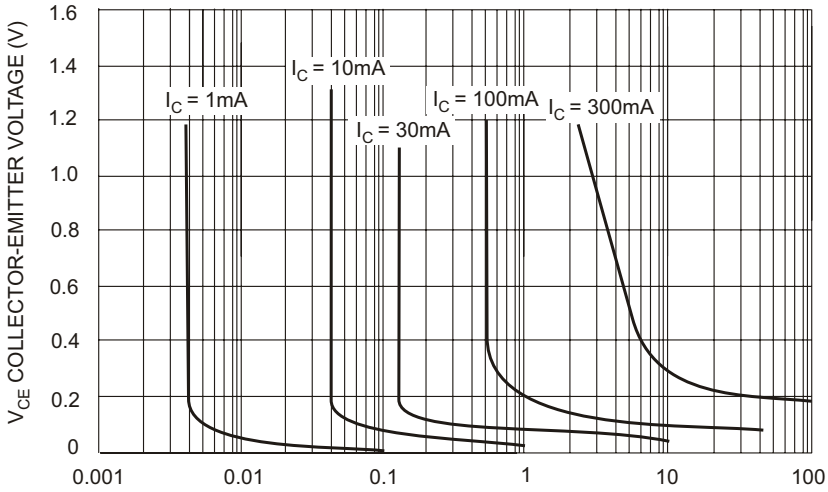

Fig. 8 Typical Collector Saturation Region (4403)

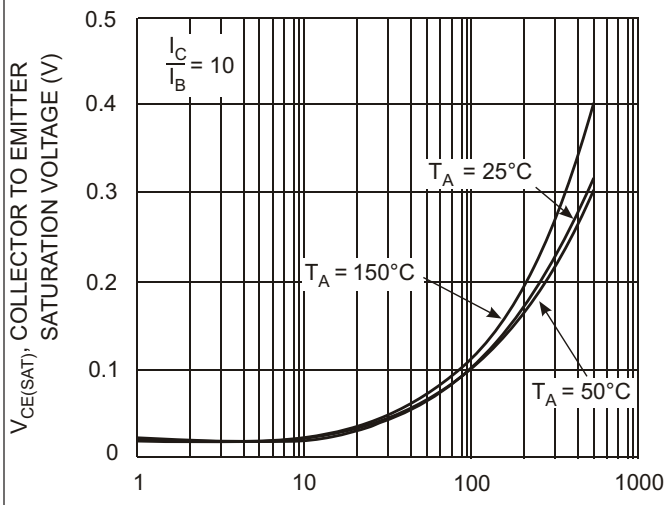

Fig. 9 Collector Emitter Saturation Voltage vs. Collector Current (4403)

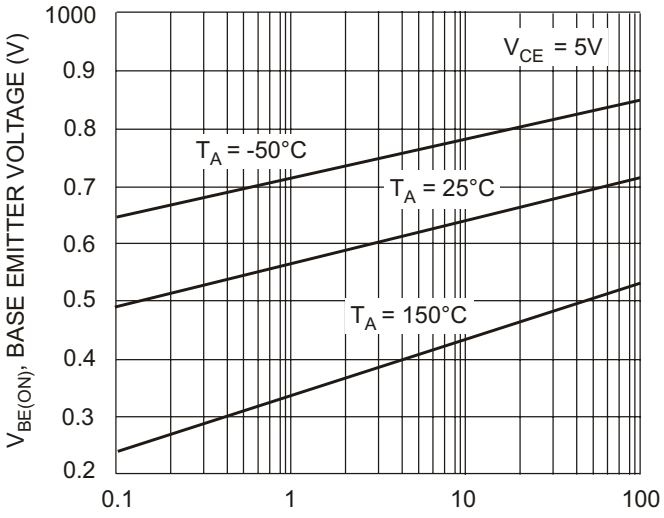

Fig. 10 Base-Emitter Voltage vs. Collector Current (4403)

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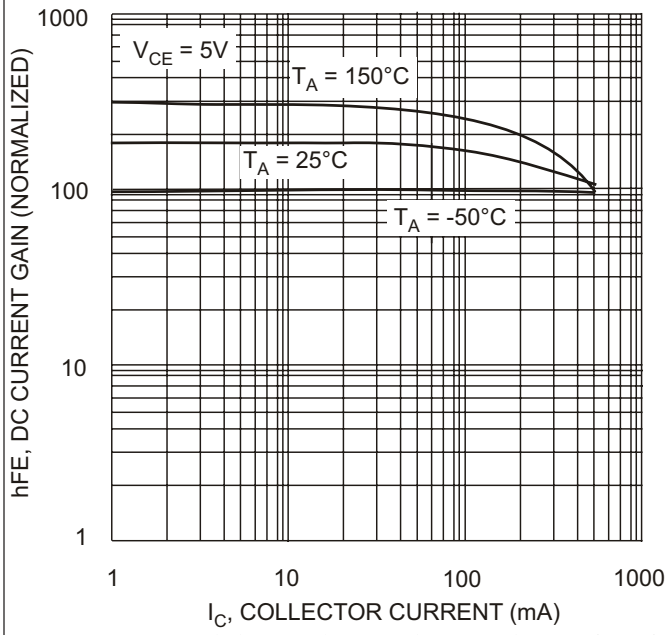

Fig. 11 DC Current Gain vs. Collector Current (4403)

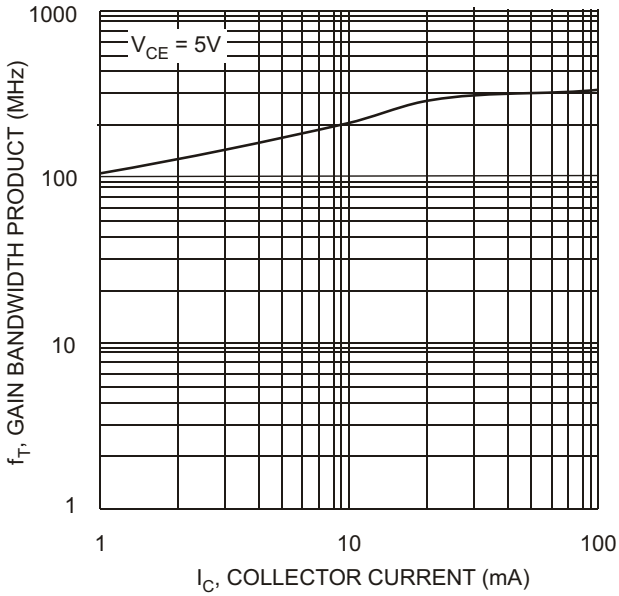

Fig. 12 Gain Bandwidth Product vs. Collector Current (4403)

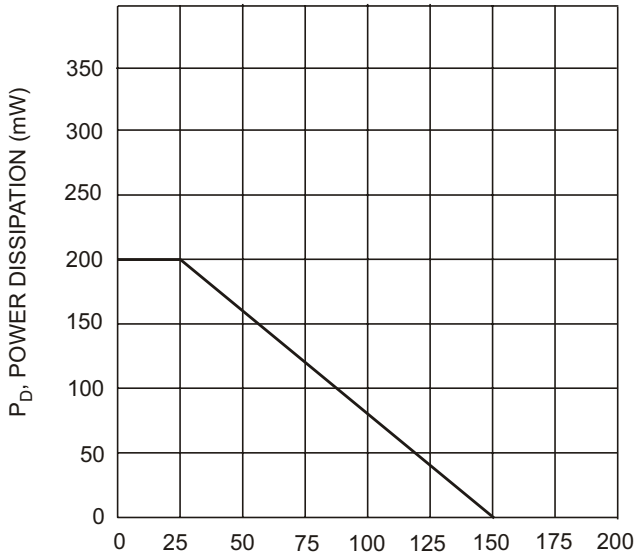

Fig. 13, Max Power Dissipation vs Ambient Temperature (4403)

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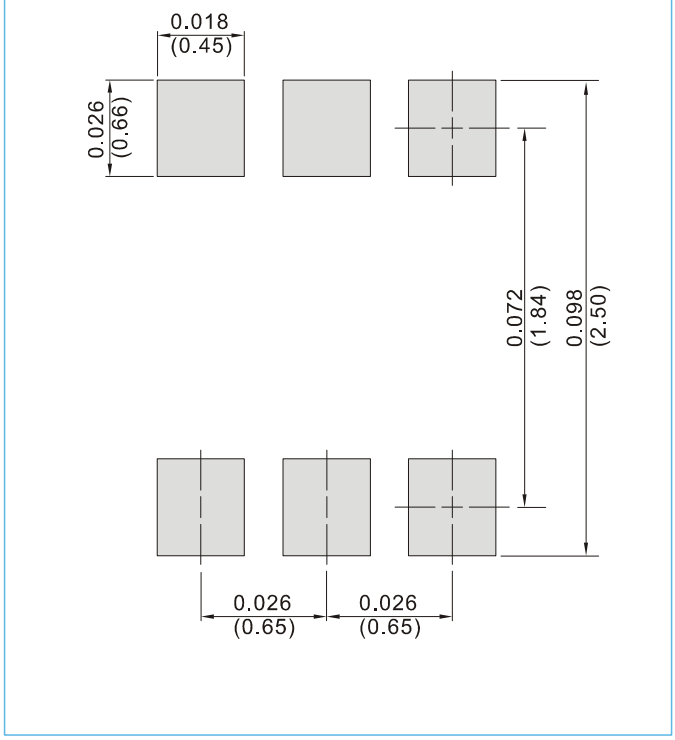
MOUNTING PAD LAYOUT

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

- Part No.
- Packing type means T/R
- Packing size code means 13"
- Version code means HF
- Serial number

Packing Code XX				Version Code XXXXX		
Packing type	1st Code	Packing size code	2nd Code	HF or RoHS	1st Code	2nd~5th 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			

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