



# MMDT3946

## COMPLEMENTARY NPN/PNP GENERAL PURPOSE SWITCHING TRANSISTOR

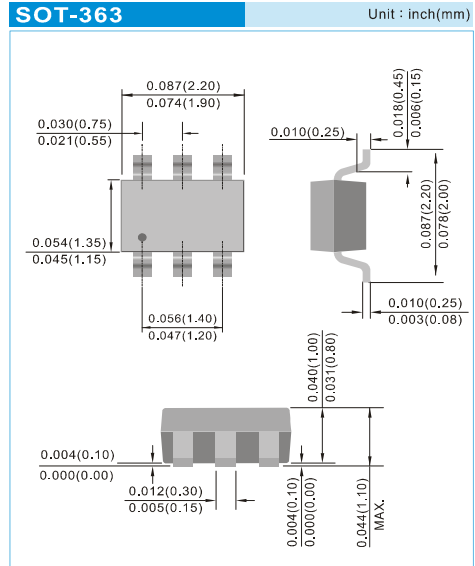
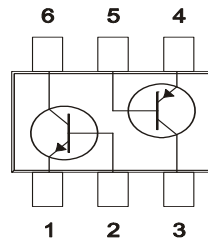
<b>VOLTAGE</b>	<b>40 Volt</b>	<b>POWER</b>	<b>225 mWatt</b>
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### FEATURES

- Epitaxial silicon, planar design
- Collector-emitter voltage  $V_{CE} = 40V$
- Collector current  $I_c = 200mA$
- Transition Frequency  $> 300MHz$   $f_T @ I_c=10mA, V_{CE}=20V, f=100MHz$
- 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: S3A



### ABSOLUTE RATINGS

ABSOLUTE RATING		NPN 3904 SECTION	PNP 3906 SECTION	-
PARAMETER	SYMBOL	VALUE	VALUE	UNITS
Collector - Emitter Voltage	$V_{CEO}$	40	-40	V
Collector - Base Voltage	$V_{CBO}$	60	-40	V
Emitter - Base Voltage	$V_{EBO}$	6	-5	V
Collector Current - Continuous	$I_c$	200	-200	mA

### THERMAL CHARACTERISTICS

PARAMETER	SYMBOL	VALUE	UNITS
Max Power Dissipation (Note 1)	$P_{TOT}$	225	mW
Thermal Resistance , Junction to Ambient	$R_{\theta JA}$	625	$^{\circ}C/W$
Junction Temperature	$T_J$	-55 to 150	$^{\circ}C$
Storage Temperature	$T_{STG}$	-55 to 150	$^{\circ}C$

Note 1: Transistor mounted on FR-5 board 1 x 0.75 x 0.062 in.



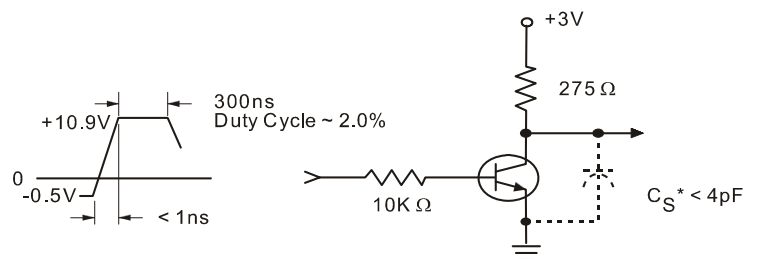
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## ELECTRICAL CHARACTERISTICS NPN SECTION

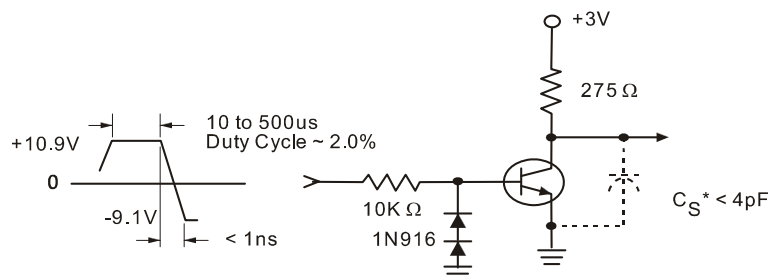
PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNITS
Collector - Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C=1.0mA, I_B=0$	40	-	-	V
Collector - Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C=10\mu A, I_E=0$	60	-	-	V
Emitter - Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E=10\mu A, I_C=0$	6.0	-	-	V
Base Cutoff Current	$I_{BI}$	$V_{CE}=30V, V_{EB}=3.0V$	-	-	50	nA
Collector Cutoff Current	$I_{CEX}$	$V_{CE}=30V, V_{EB}=3.0V$	-	-	50	nA
DC Current Gain (Note 2)	$h_{FE}$	$I_C=0.1mA, V_{CE}=1.0V$ $I_C=1.0mA, V_{CE}=1.0V$ $I_C=10mA, V_{CE}=1.0V$ $I_C=50mA, V_{CE}=1.0V$ $I_C=100mA, V_{CE}=1.0V$	40 70 100 60 30	- - - - -	- - 300 - -	-
Collector - Emitter Saturation Voltage (Note 2)	$V_{CE(SAT)}$	$I_C=10mA, I_B=1.0mA$ $I_C=50mA, I_B=5.0mA$	-	-	0.2 0.3	V
Base - Emitter Saturation Voltage (Note 2)	$V_{BE(SAT)}$	$I_C=10mA, I_B=1.0mA$ $I_C=50mA, I_B=5.0mA$	0.65 -	- -	0.85 0.95	V
Collector - Base Capacitance	$C_{CBO}$	$V_{CB}=5V, I_E=0, f=1MHz$	-	-	4.0	pF
Emitter - Base Capacitance	$C_{EBO}$	$V_{CB}=0.5V, I_C=0, f=1MHz$	-	-	8.0	pF
Delay Time	$t_d$	$V_{CC}=3V, V_{BE}=-0.5V,$ $I_C=10mA, I_B=1.0mA$	-	-	35	ns
Rise Time	$t_r$	$V_{CC}=3V, V_{BE}=-0.5V,$ $I_C=10mA, I_B=1.0mA$	-	-	35	ns
Storage Time	$t_s$	$V_{CC}=3V, I_C=10mA$ $I_{B1}=I_{B2}=1.0mA$	-	-	200	ns
Fall Time	$t_f$	$V_{CC}=3V, I_C=10mA$ $I_{B1}=I_{B2}=1.0mA$	-	-	50	ns

Note 2: Pulse Test: Pulse Width < 300 us, Duty Cycle < 2.0%.

### SWITCHING TIME EQUIVALENT TEST CIRCUITS



Delay and Rise Time Equivalent Test Circuit



Storage and Fall Time Equivalent Test Circuit

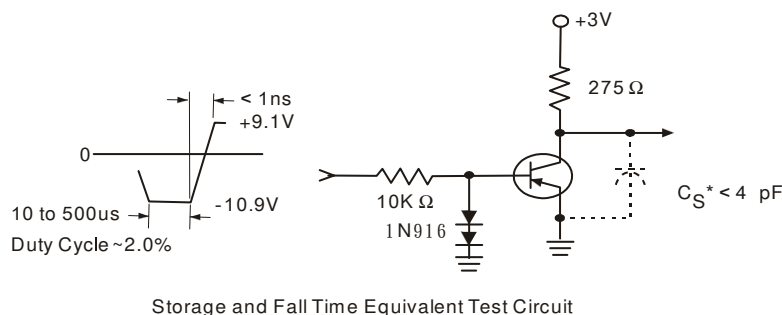
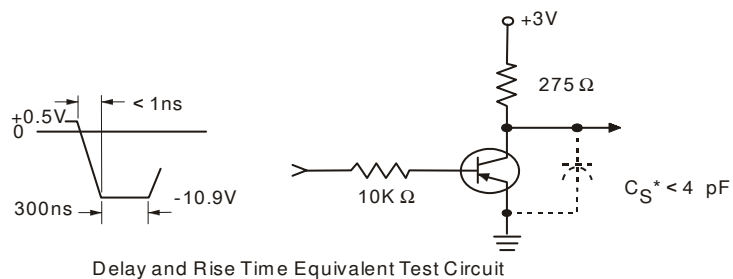


# MMDT3946

## ELECTRICAL CHARACTERISTICS PNP SECTION

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNITS
Collector - Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = -1.0\text{mA}, I_B = 0$	-40	-	-	V
Collector - Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = -10\mu\text{A}, I_E = 0$	-40	-	-	V
Emitter - Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = -10\mu\text{A}, I_C = 0$	-5.0	-	-	V
Base Cutoff Current	$I_{BI}$	$V_{CE} = -30\text{V}, V_{EB} = -3.0\text{V}$	-	-	-50	nA
Collector Cutoff Current	$I_{CEX}$	$V_{CE} = -30\text{V}, V_{EB} = -3.0\text{V}$	-	-	-50	nA
DC Current Gain (Note 2)	$h_{FE}$	$I_C = -0.1\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -1.0\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -10\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -50\text{mA}, V_{CE} = -1.0\text{V}$ $I_C = -100\text{mA}, V_{CE} = -1.0\text{V}$	60 80 100 60 30	- - - - -	- - 300 - -	-
Collector - Emitter Saturation Voltage (Note 2)	$V_{CE(SAT)}$	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$	-	-	-0.25 -0.4	V
Base - Emitter Saturation Voltage (Note 2)	$V_{BE(SAT)}$	$I_C = -10\text{mA}, I_B = -1.0\text{mA}$ $I_C = -50\text{mA}, I_B = -5.0\text{mA}$	-0.65 -	- -	-0.85 -0.95	V
Collector - Base Capacitance	$C_{CBO}$	$V_{CB} = -5\text{V}, I_E = 0, f = 1\text{MHz}$	-	-	4.0	pF
Emitter - Base Capacitance	$C_{EBO}$	$V_{CB} = -0.5\text{V}, I_C = 0, f = 1\text{MHz}$	-	-	10	pF
Delay Time	$t_d$	$V_{CC} = -3\text{V}, V_{BE} = -0.5\text{V},$ $I_C = -10\text{mA}, I_B = -1.0\text{mA}$	-	-	35	ns
Rise Time	$t_r$	$V_{CC} = -3\text{V}, V_{BE} = -0.5\text{V},$ $I_C = -10\text{mA}, I_B = -1.0\text{mA}$	-	-	35	ns
Storage Time	$t_s$	$V_{CC} = -3\text{V}, I_C = -10\text{mA}$ $I_{B1} = I_{B2} = -1.0\text{mA}$	-	-	225	ns
Fall Time	$t_f$	$V_{CC} = -3\text{V}, I_C = -10\text{mA}$ $I_{B1} = I_{B2} = 1.0\text{mA}$	-	-	75	ns

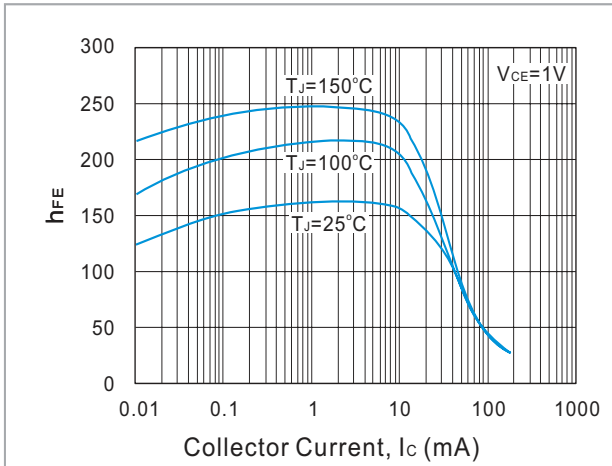
### SWITCHING TIME EQUIVALENT TEST CIRCUITS



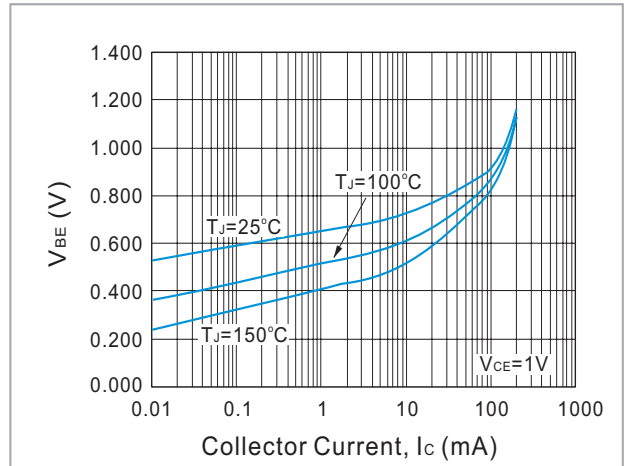


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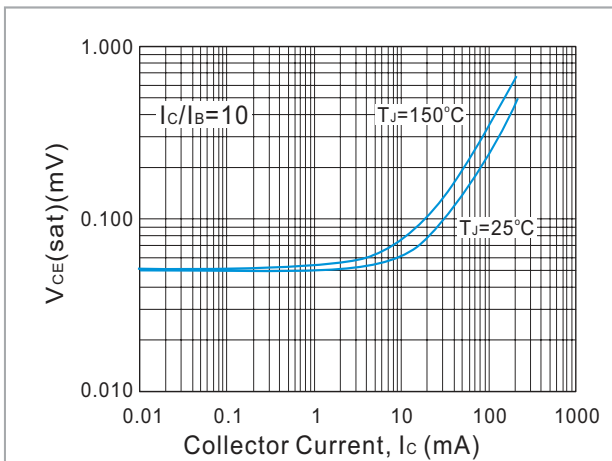
## ELECTRICAL CHARACTERISTICS CURVE NPN SECTION



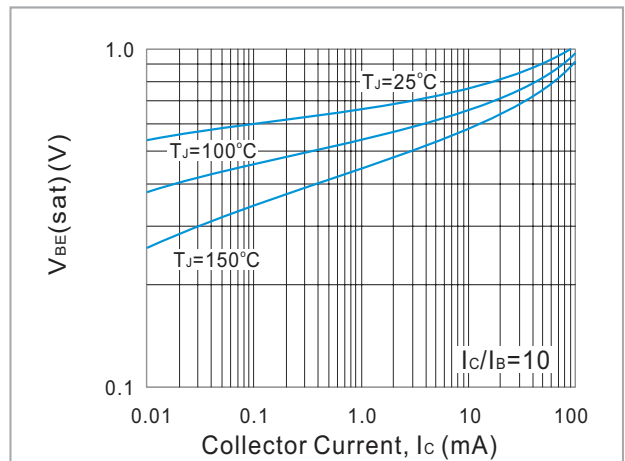
**Fig. 1. Typical  $h_{FE}$  vs. Collector Current**



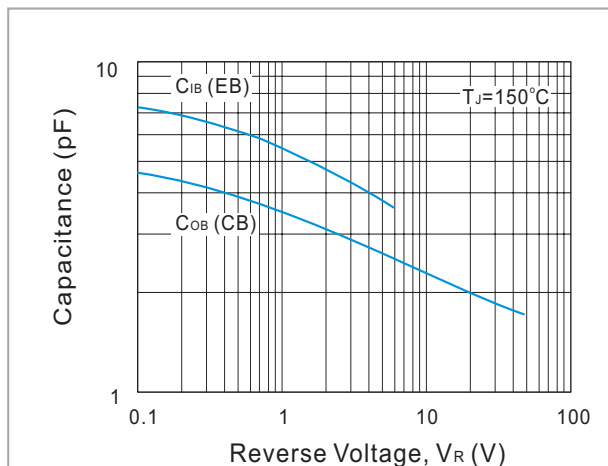
**Fig. 2. Typical  $V_{BE}$  vs. Collector Current**



**Fig. 3. Typical  $V_{CE(sat)}$  vs. Collector Current**



**Fig. 4. Typical  $V_{BE(sat)}$  vs Collector Current**

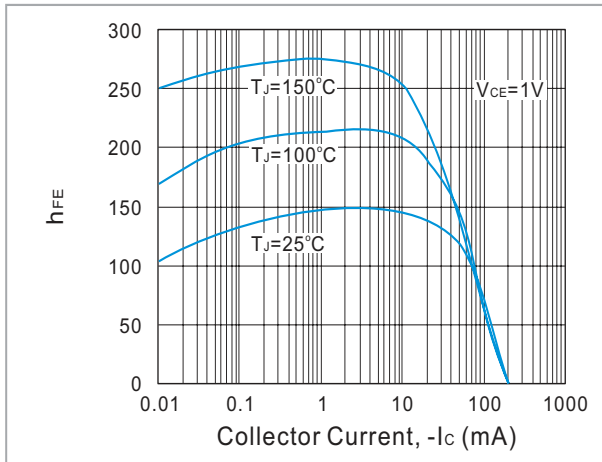


**Fig. 5. Typical Capacitances vs. Reverse Voltage**

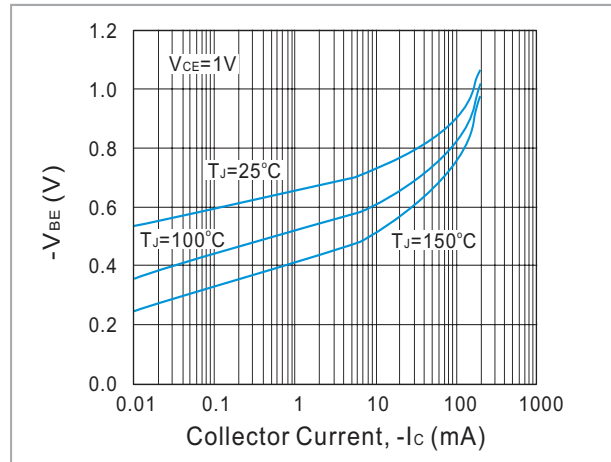


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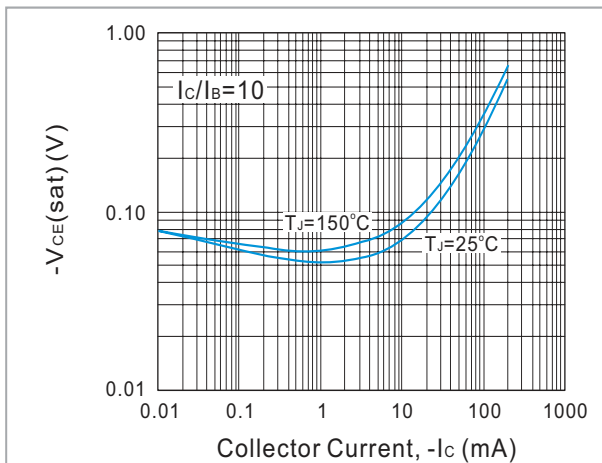
## ELECTRICAL CHARACTERISTICS CURVE PNP SECTION



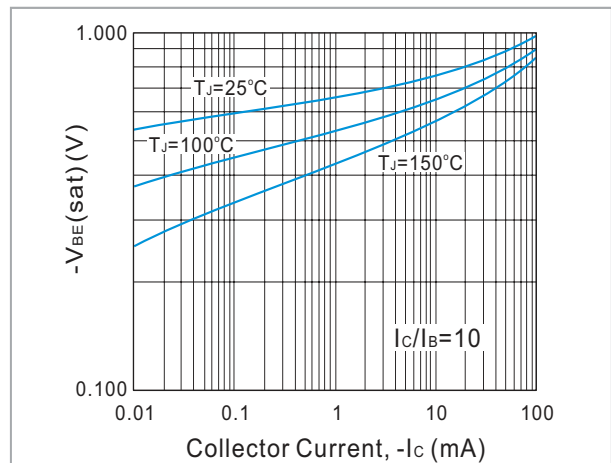
**Fig. 1. Typical  $h_{FE}$  vs Collector Current**



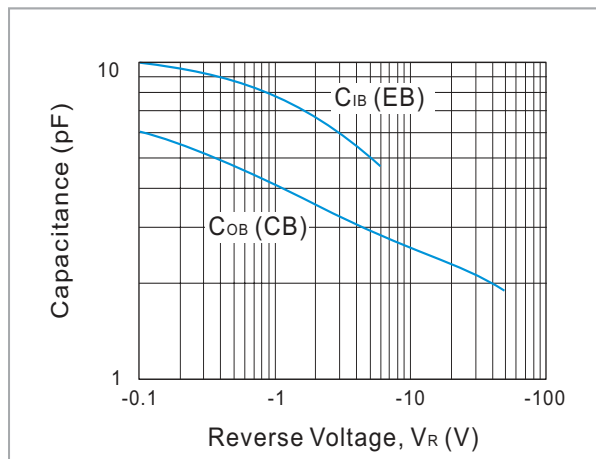
**Fig. 2. Typical  $V_{BE}$  vs Collector Current**



**Fig. 3. Typical  $V_{CE(sat)}$  vs Collector Current**



**Fig. 4. Typical  $V_{BE(sat)}$  vs Collector Current**



**Fig. 5. Typical Capacitances vs Reverse Voltage**

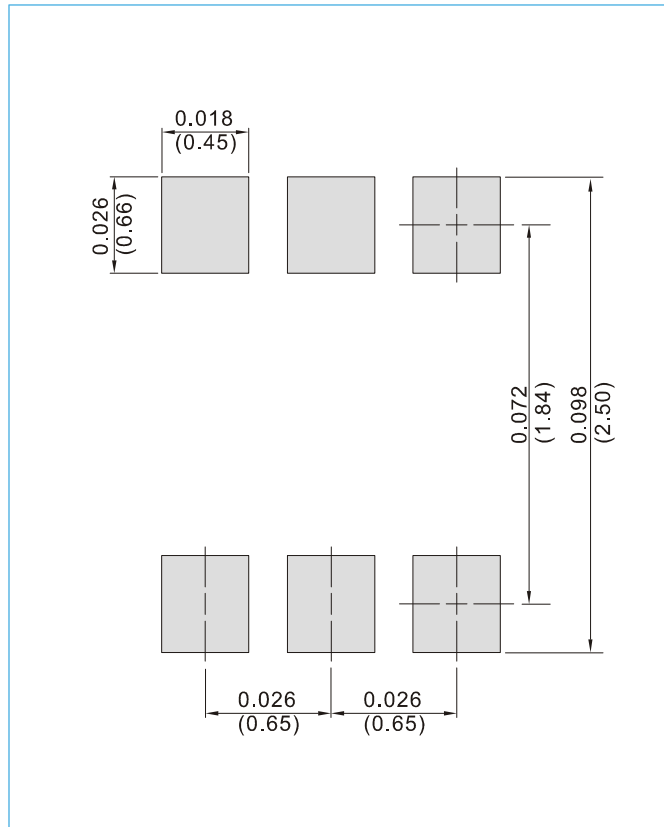


# MMDT3946

## 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



# MMDT3946

## Part No\_packing code\_Version

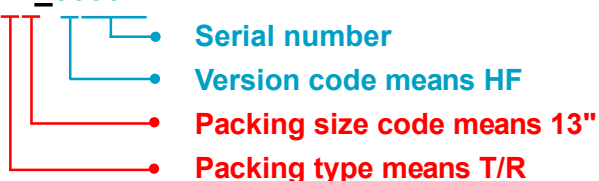
MMDT3946\_R1\_00001

MMDT3946\_R2\_00001

For example :

**RB500V-40\_R2\_00001**

Part No.



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>	HF	<b>0</b>	serial number
Tape and Reel (T/R)	<b>R</b>	7"	<b>1</b>	RoHS	<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>			



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