

**N-Channel Enhancement Mode MOSFET**

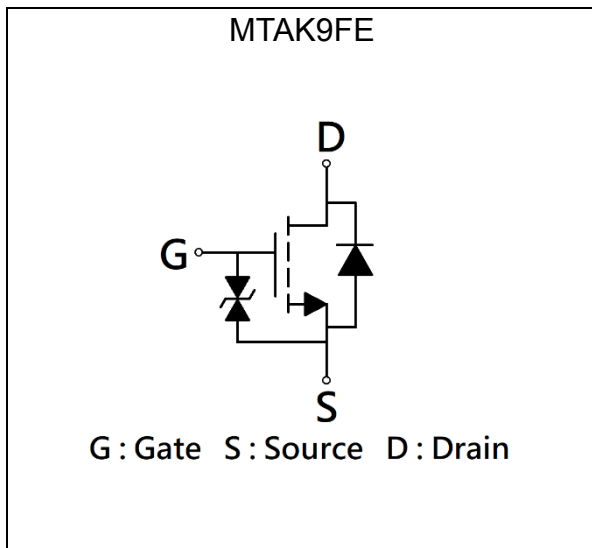
# MTAK9FE

**Features**

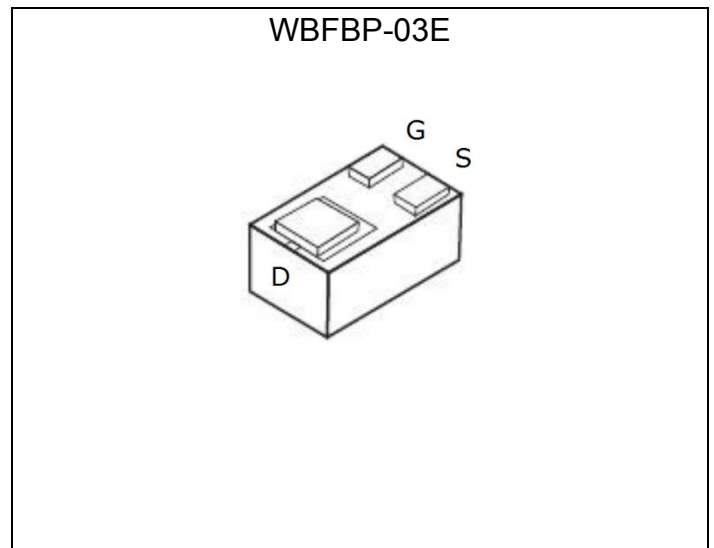
- ESD protected gate, typical 3kV (HBM)
- High speed switching
- Easily designed drive circuits
- Low-voltage drive
- Easy to use in parallel
- RoHS compliant package

$BV_{DSS}$	20V
$I_D @ V_{GS}=4.5V, T_C=25^\circ C$	1.4A
$I_D @ V_{GS}=4.5V, T_A=25^\circ C$	1.1A
$R_{DS(ON) \text{ typ.}} @ V_{GS}=4.5V, I_D=0.5A$	0.3 $\Omega$
$R_{DS(ON) \text{ typ.}} @ V_{GS}=2.5V, I_D=0.3A$	0.4 $\Omega$
$R_{DS(ON) \text{ typ.}} @ V_{GS}=1.8V, I_D=0.3A$	0.8 $\Omega$

**Equivalent Circuit**

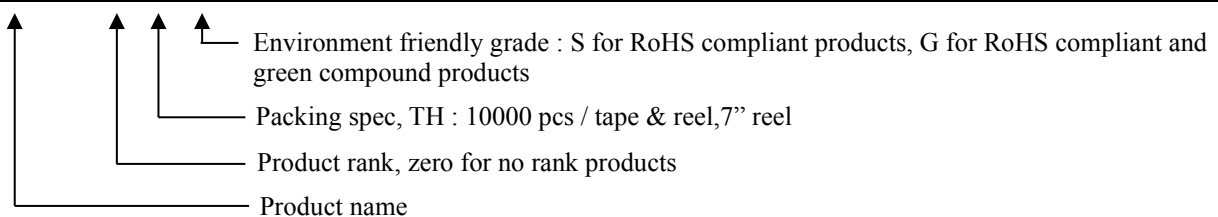


**Outline**



**Ordering Information**

Device	Package	Shipping
MTAK9FE-0-TH-G	WBFBP-03E (Pb-free lead plating and halogen-free package)	10000 pcs / Tape & Reel



**Absolute Maximum Ratings (T<sub>A</sub>=25°C)**

Parameter	Symbol	Limits	Unit	
Drain-Source Voltage	V <sub>DS</sub>	20	V	
Gate-Source Voltage	V <sub>GS</sub>	±8		
Continuous Drain Current @ V <sub>GS</sub> =4.5V, T <sub>C</sub> =25°C	I <sub>D</sub>	1.4	A	
Continuous Drain Current @ V <sub>GS</sub> =4.5V, T <sub>C</sub> =100°C		0.9		
Continuous Drain Current @ V <sub>GS</sub> =4.5V, T <sub>A</sub> =25°C		1.1		
Continuous Drain Current @ V <sub>GS</sub> =4.5V, T <sub>A</sub> =70°C		0.9		
Pulsed Drain Current *a	I <sub>DM</sub>	5.6		
Continuous Body Diode Forward Current @ T <sub>A</sub> =25°C	I <sub>S</sub>	1		
ESD susceptibility *b	V <sub>ESD</sub>	3000	V	
Total Power Dissipation	P <sub>D</sub>	T <sub>C</sub> =25°C	1.4	W
		T <sub>C</sub> =100°C	0.6	
		T <sub>A</sub> =25°C	0.9	
		T <sub>A</sub> =70°C	0.6	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-55~+150	°C	

**Thermal Data**

Parameter	Symbol	Steady State	Unit
Thermal Resistance, Junction-to-case	R <sub>θJC</sub>	90	°C/W
Thermal Resistance, Junction-to-ambient	R <sub>θJA</sub>	136	

Note:

- \*a. The power dissipation P<sub>D</sub> is based on T<sub>J(MAX)</sub>=150°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.
- \*b. The value of R<sub>θJA</sub> is measured with the device mounted on 1 in<sup>2</sup> FR-4 board with 2 oz. copper, in a still air environment with T<sub>A</sub>=25°C. The power dissipation P<sub>D</sub> is based on R<sub>θJA</sub> and the maximum allowed junction temperature of 150°C. The value in any given application depends on the user's specific board design.
- \*c. Repetitive rating, pulse width limited by junction temperature T<sub>J(MAX)</sub>=150°C. Ratings are based on low frequency and low duty cycles to keep initial T<sub>J</sub>=25°C.



**Electrical Characteristics (T<sub>A</sub>=25°C, unless otherwise specified)**

Symbol	Min.	Typ.	Max.	Unit	Test Conditions
<b>Static</b>					
BV <sub>DSS</sub>	20	-	-	V	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA
V <sub>GS(th)</sub>	0.3	-	1.2		V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA
G <sub>FS</sub>	-	1.2	-	S	V <sub>DS</sub> =5V, I <sub>D</sub> =0.3A
I <sub>GSS</sub>	-	-	±10	μA	V <sub>GS</sub> =±8V, V <sub>DS</sub> =0V
I <sub>DSS</sub>	-	-	1		V <sub>DS</sub> =16V, V <sub>GS</sub> =0V
R <sub>DS(ON)</sub>	-	0.3	0.4	Ω	V <sub>GS</sub> =4.5V, I <sub>D</sub> =0.5A
	-	0.4	0.6		V <sub>GS</sub> =2.5V, I <sub>D</sub> =0.3A
	-	0.8	1.2		V <sub>GS</sub> =1.8V, I <sub>D</sub> =0.3A
<b>Dynamic</b>					
C <sub>iss</sub>	-	32	-	pF	V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, f=1MHz
C <sub>oss</sub>	-	19	-		
C <sub>rss</sub>	-	17	-		
Q <sub>g</sub> *1, 2	-	0.8	-	nC	V <sub>DS</sub> =10V, I <sub>D</sub> =0.3A, V <sub>GS</sub> =4.5V
Q <sub>gs</sub> *1, 2	-	0.2	-		
Q <sub>gd</sub> *1, 2	-	0.15	-		
t <sub>d(ON)</sub> *1, 2	-	4.8	-	ns	V <sub>DS</sub> =10V, I <sub>D</sub> =0.3A, V <sub>GS</sub> =4.5V, R <sub>GS</sub> =10Ω
t <sub>r</sub> *1, 2	-	16	-		
t <sub>d(OFF)</sub> *1, 2	-	20	-		
t <sub>f</sub> *1, 2	-	15.6	-		
<b>Source-Drain Diode</b>					
V <sub>SD</sub> *1	-	0.83	1.2	V	I <sub>S</sub> =0.3A, V <sub>GS</sub> =0V
t <sub>rr</sub>	-	7	-	ns	I <sub>F</sub> =0.3A, dI <sub>F</sub> /dt=100A/μs
Q <sub>rr</sub>	-	1	-	nC	

Note:

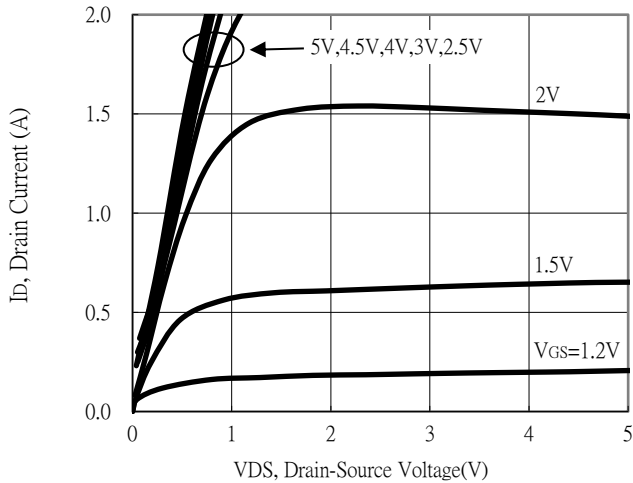
\*1. Pulse Test : Pulse Width ≤300μs, Duty Cycle≤2%

\*2. Independent of operating temperature

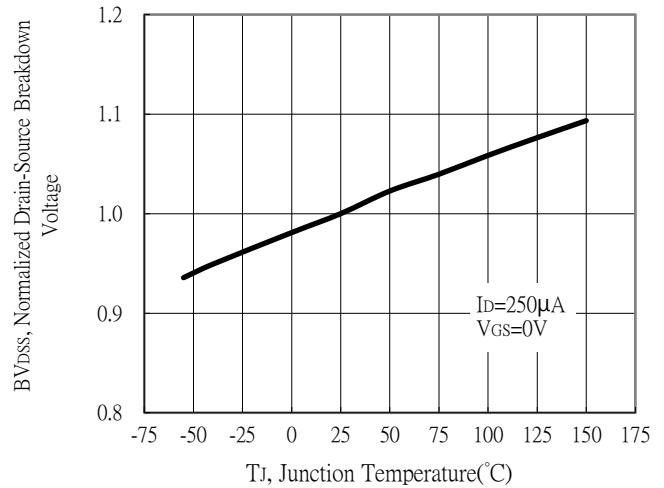


## Typical Characteristics

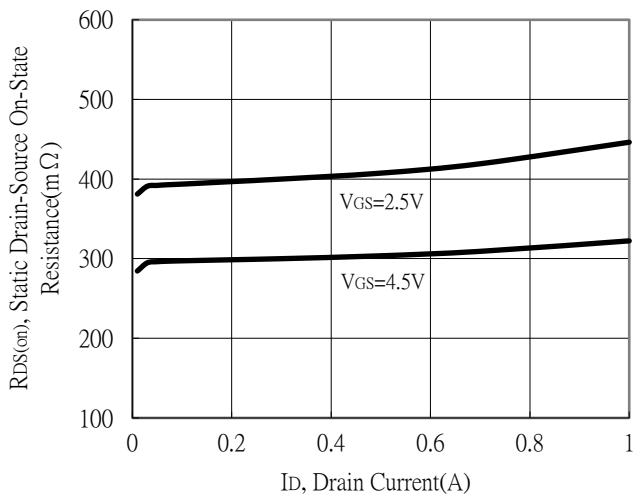
Typical Output Characteristics



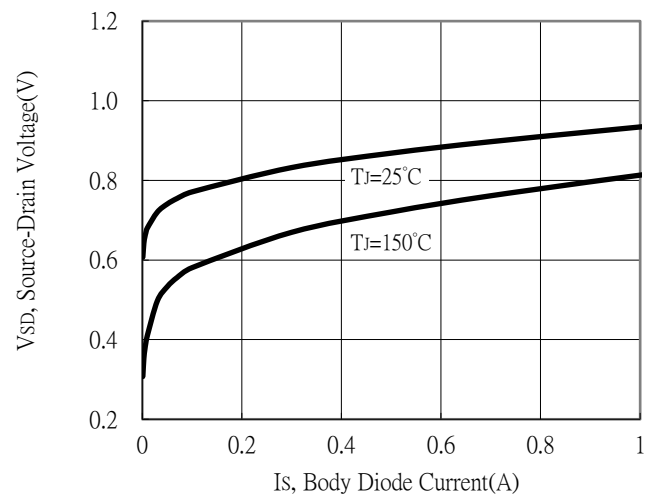
Breakdown Voltage vs Junction Temperature



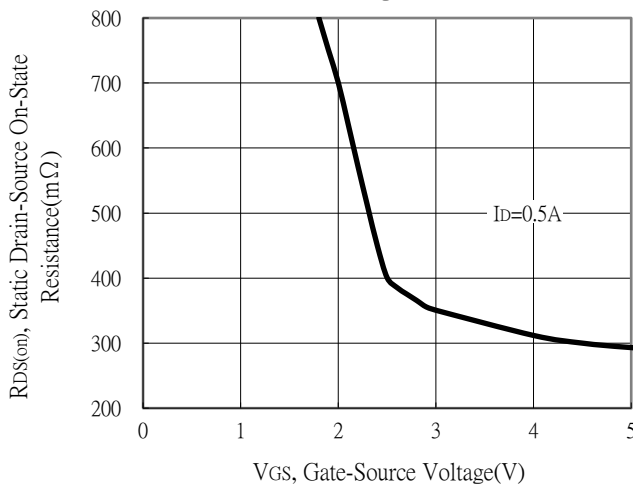
Static Drain-Source On-State resistance vs Drain Current



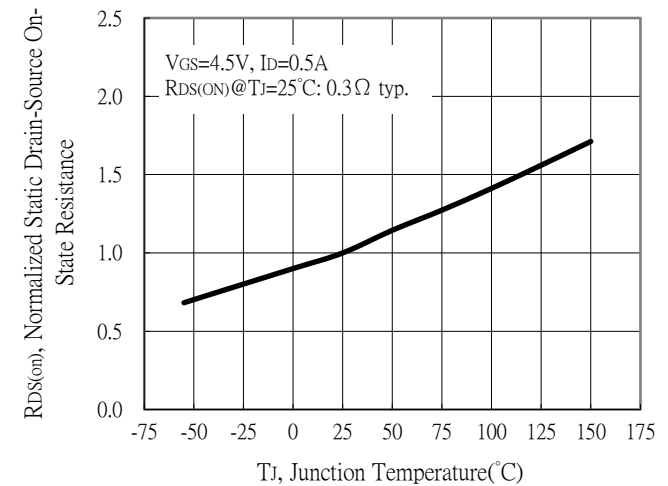
Body Diode Current vs Source-Drain Voltage



Static Drain-Source On-State Resistance vs Gate-Source Voltage



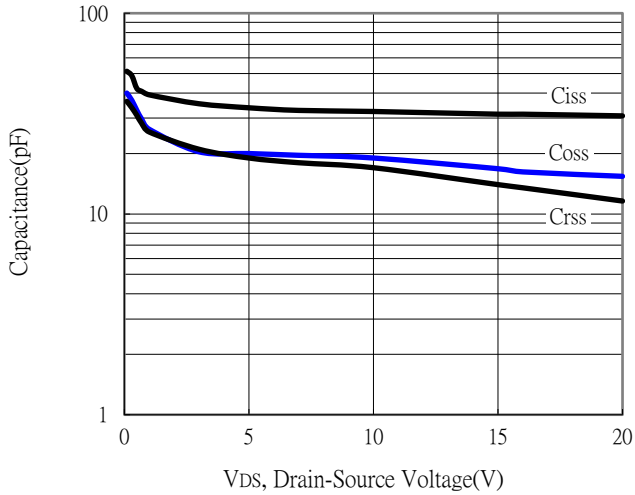
Drain-Source On-State Resistance vs Junction Temperature



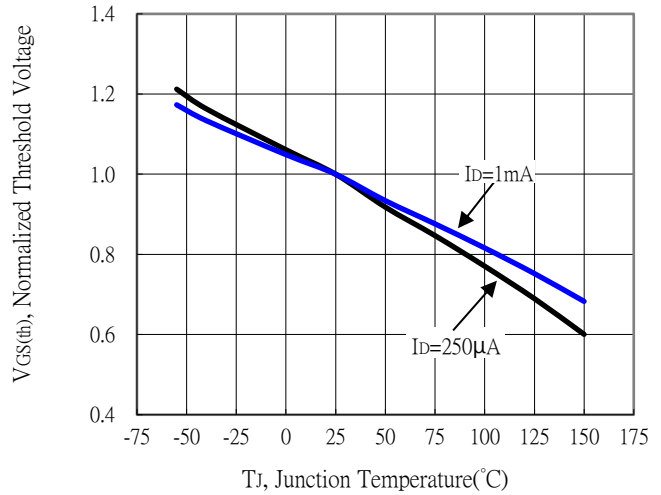


**Typical Characteristics (Cont.)**

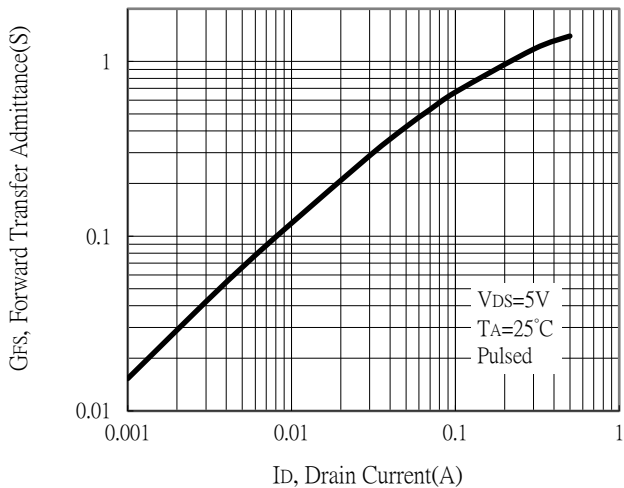
Capacitance vs Drain-to-Source Voltage



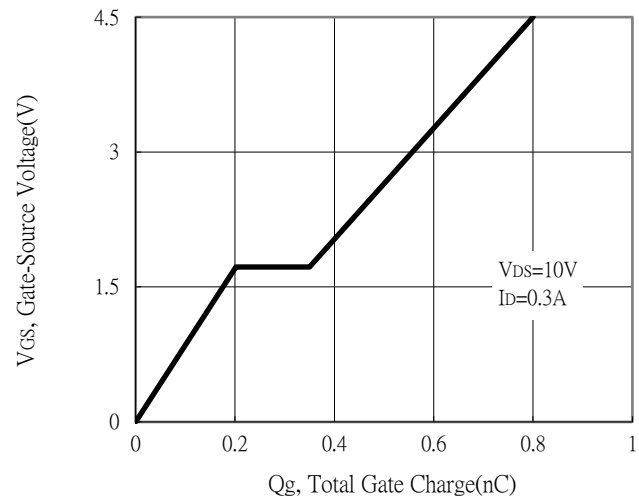
Threshold Voltage vs Junction Temperature



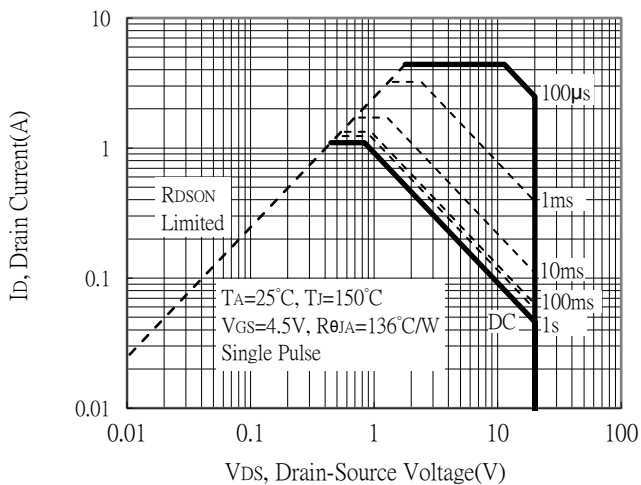
Forward Transfer Admittance vs Drain Current



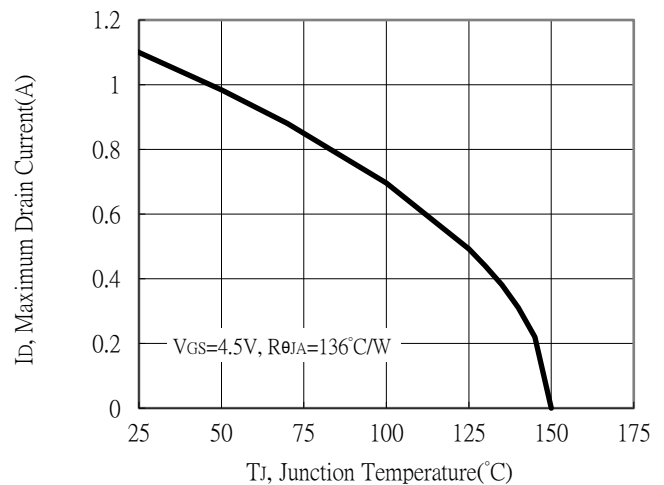
Gate Charge Characteristics



Maximum Safe Operating Area

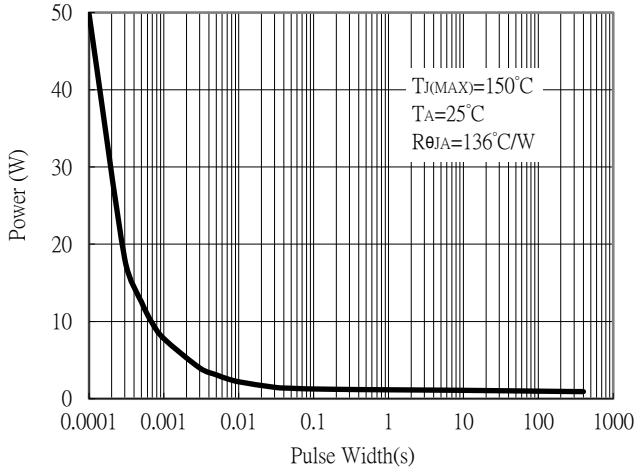


Maximum Drain Current vs Junction Temperature

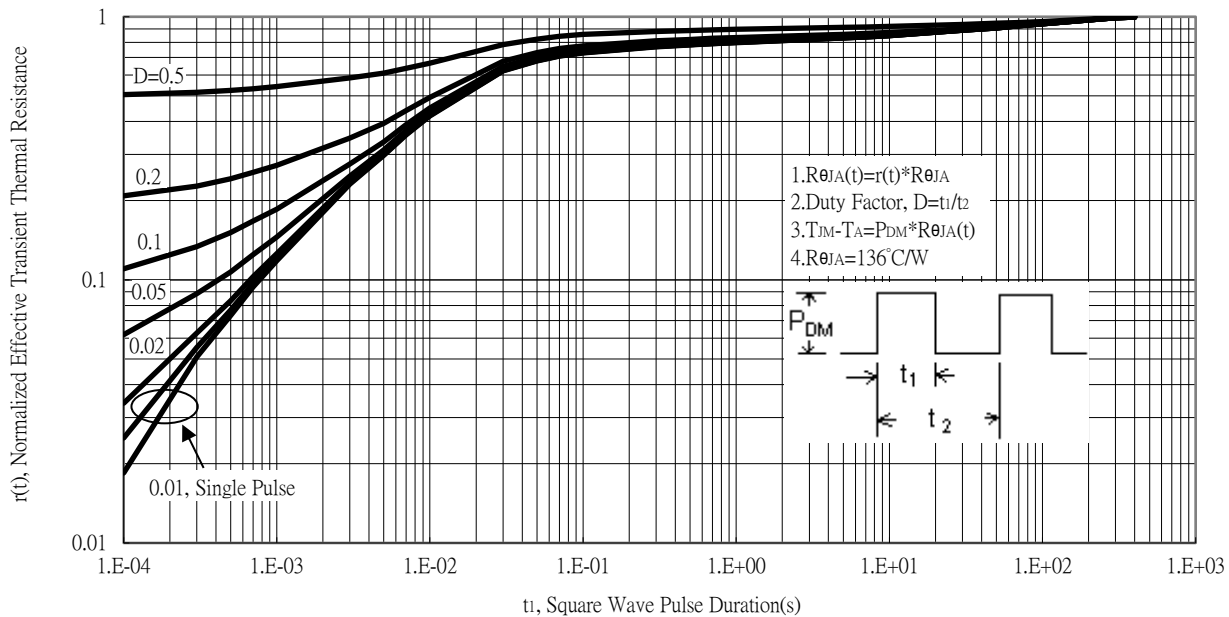


**Typical Characteristics (Cont.)**

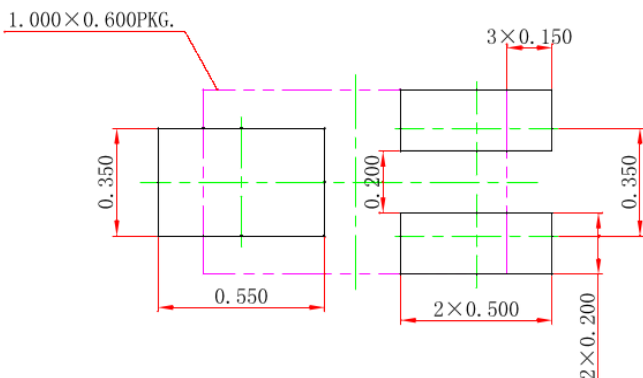
Single Pulse Power Rating, Junction to Ambient



Transient Thermal Response Curves



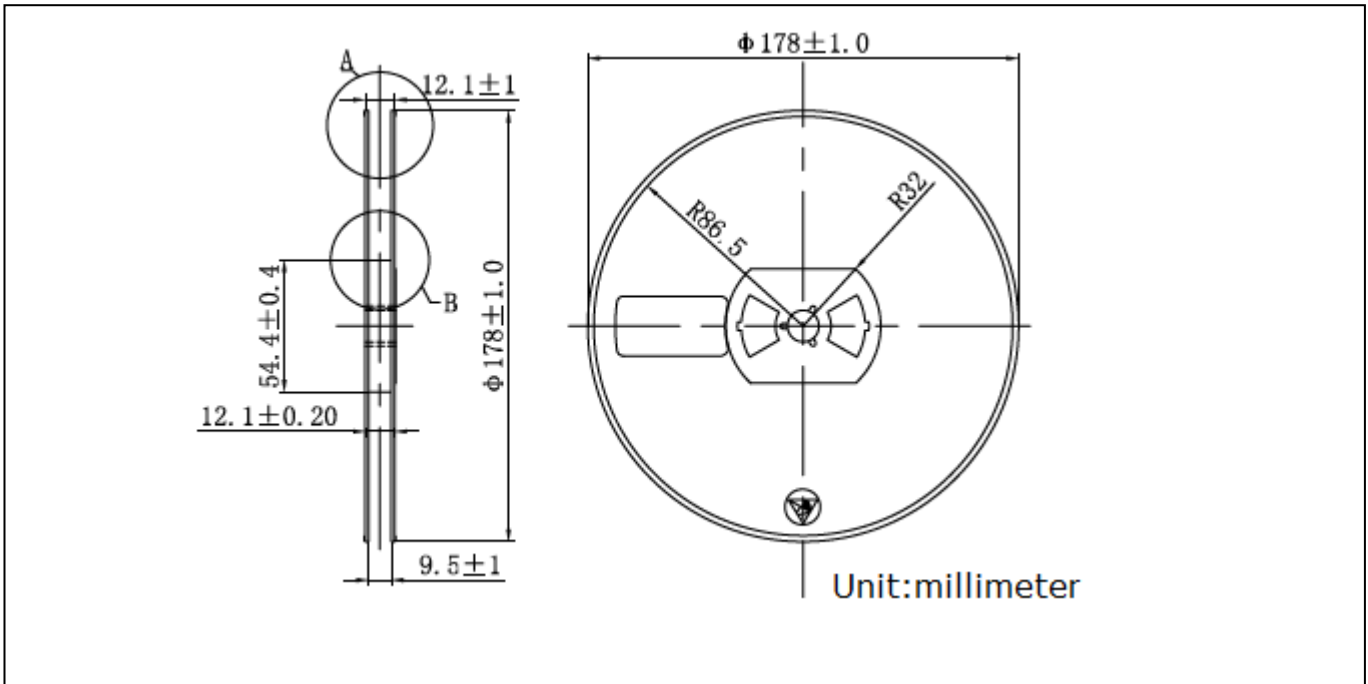
**Recommended Soldering Footprint**



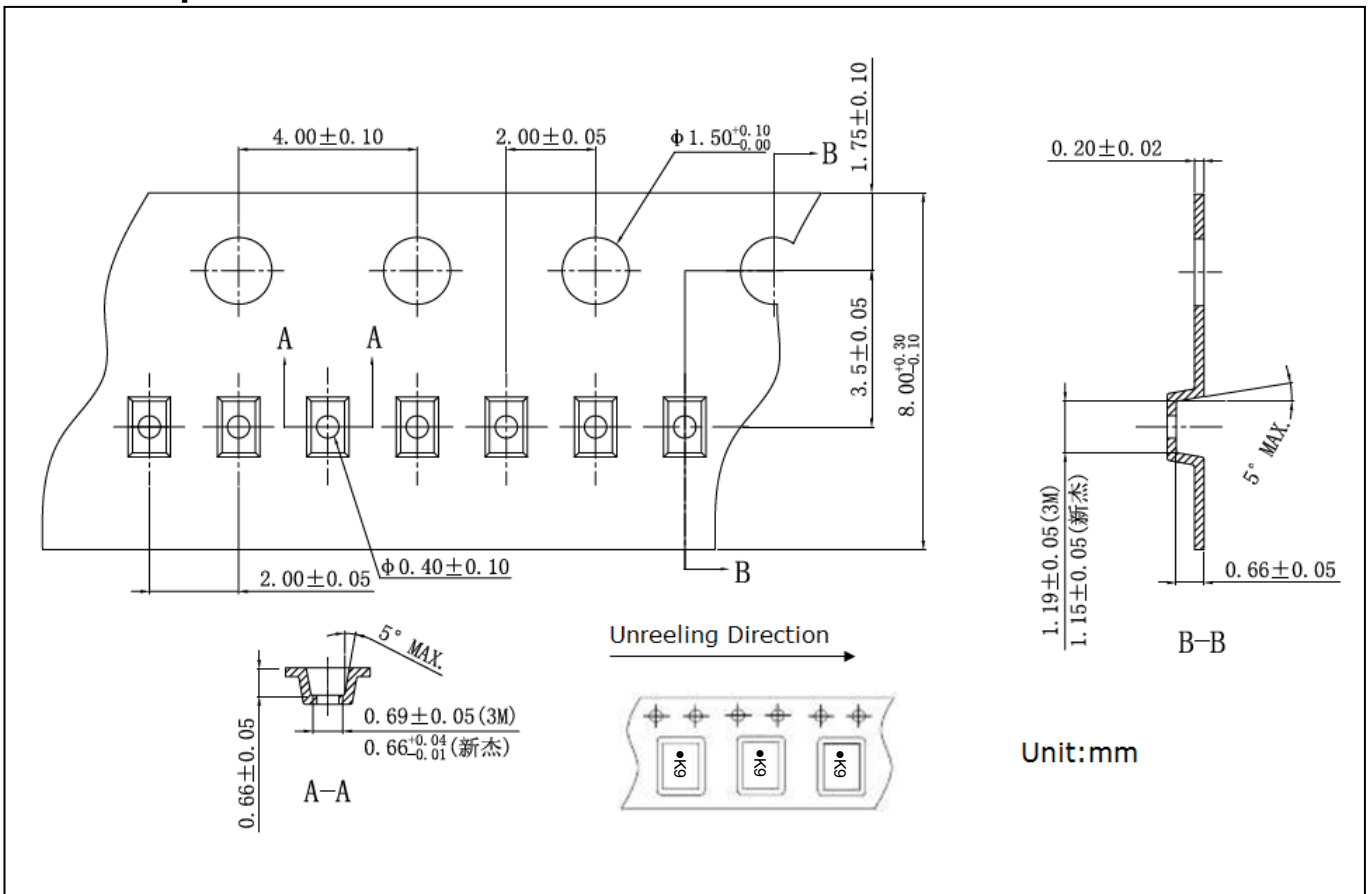
**Note:**

1. Controlling dimension: in millimeters.
2. General tolerance:  $\pm 0.050$ mm.
3. The pad layout is for reference purposes only.

**Reel Dimension**



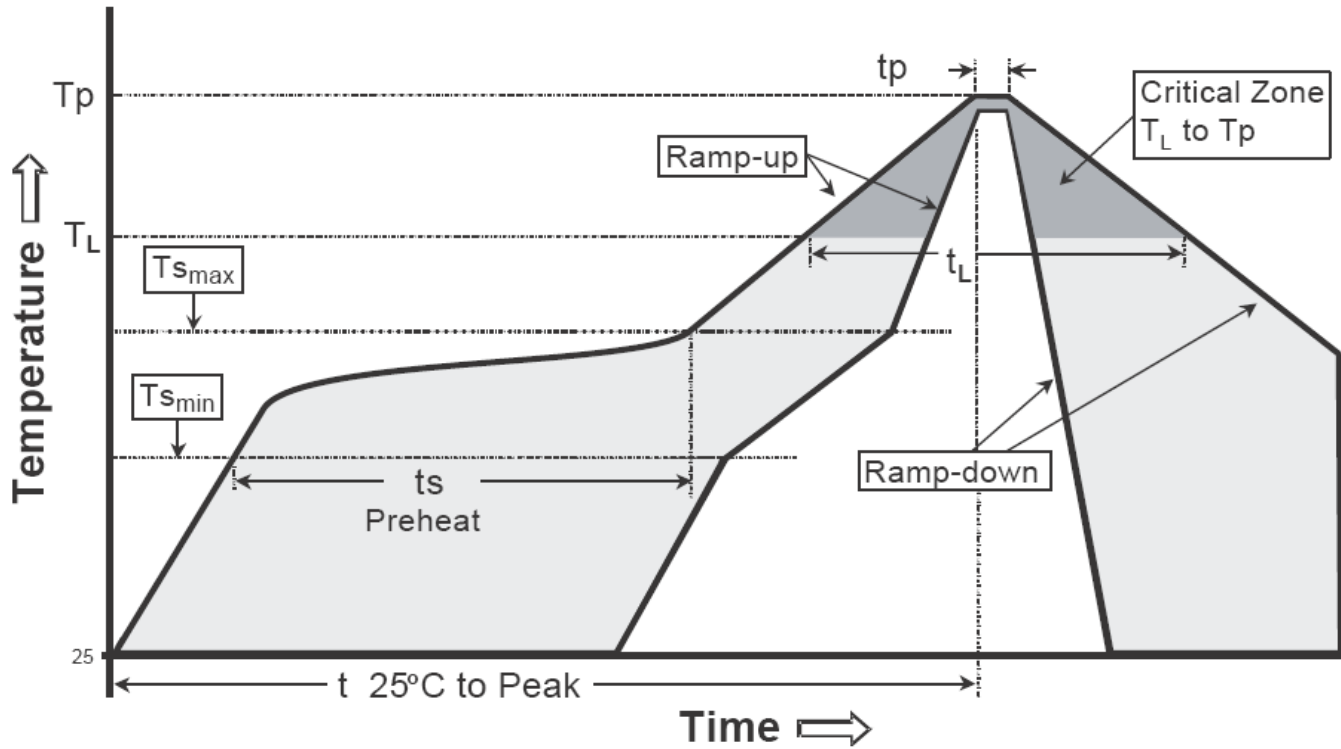
**Carrier Tape Dimension**



**Recommended wave soldering condition**

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

**Recommended temperature profile for IR reflow**

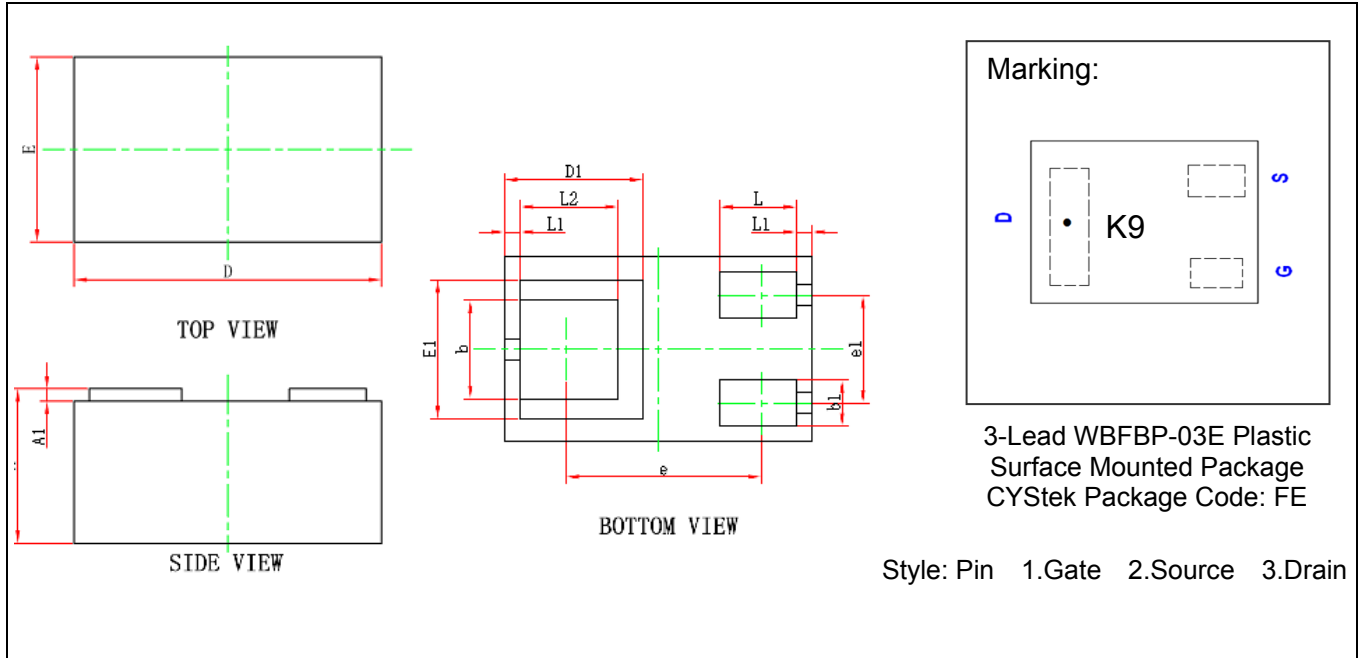


Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (Tl)	183°C	217°C
- Time (tl)	60-150 seconds	60-150 seconds
Peak Temperature(Tp)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.



**WBFBP-03E Dimension**



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.018	0.022	0.450	0.550	b1	0.004	0.008	0.100	0.200
A1	0.000	0.004	0.010	0.100	e	0.025 REF		0.635 REF	
D	0.037	0.041	0.950	1.050	e1	0.012	0.016	0.300	0.400
E	0.022	0.026	0.550	0.650	L	0.008	0.012	0.200	0.300
D1	0.018 REF		0.450 REF		L1	0.002 REF		0.050 REF	
E1	0.018 REF		0.450 REF		L2	0.011	0.015	0.270	0.370
b	0.011	0.015	0.270	0.370					

**Notes:** 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYStek sales office.

**Material:**

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

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