

N-Channel Enhancement Mode MOSFET

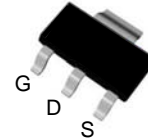
Features

- 200V/1.9A,
 $R_{DS(ON)} = 400m\Omega(\text{max.}) @ V_{GS} = 10V$
- Reliable and Rugged
- Lead Free and Green Devices Available
(RoHS Compliant)

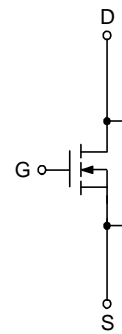
Applications

- Power Management in TV Inverter.

Pin Description



Top View SOT- 223



N- Channel MOSFET

DEVICE MARKING AND ORDERING INFORMATION

Device	Marking	Shipping
FTK2A04NS	SM2A04N	2500/Tape&Reel



FTK2A04NS

Absolute Maximum Ratings (T_A = 25°C Unless Otherwise Noted)

Symbol	Parameter	Rating	Unit	
Common Ratings				
V _{DSS}	Drain-Source Voltage	200	V	
V _{GSS}	Gate-Source Voltage	±25		
T _J	Maximum Junction Temperature	150	°C	
T _{STG}	Storage Temperature Range	-55 to 150		
I _S ^a	Diode Continuous Forward Current	1.2	A	
I _{DP} ^a	300us Pulse Drain Current Tested	T _C =25°C		8
		T _C =100°C		5
I _D ^a	Continuous Drain Current	T _C =25°C		1.9
		T _C =100°C		1.2
P _D ^a	Maximum Power Dissipation	T _C =25°C	2.5	
		T _C =100°C	1	
R _{θJA} ^{a,b}	Thermal Resistance-Junction to Ambient	50	°C/W	

Notes a: Surface Mounted on 1in2 pad area, t ≤ 10sec.

Notes b: Maximum under Steady State conditions is 75 °C/W.



FTK2A04NS

Electrical Characteristics (T_A = 25°C Unless Otherwise Noted)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
Static Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _{DS} =250μA	200	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =160V, V _{GS} =0V	-	-	1	μA
		T _J =85°C	-	-	30	
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _{DS} =250μA	2	3	4	V
I _{GSS}	Gate Leakage Current	V _{GS} =±25V, V _{DS} =0V	-	-	±100	nA
R _{DS(ON)} ^c	Drain-Source On-state Resistance	V _{GS} =10V, I _{DS} =1.9A	-	320	400	mΩ
Diode Characteristics						
V _{SD} ^c	Diode Forward Voltage	I _{SD} =1.2A, V _{GS} =0V	-	0.8	1.3	V
t _{rr} ^d	Reverse Recovery Time	I _{SD} =1.9A, dI _{SD} /dt=100A/μs	-	67	-	ns
Q _{rr} ^d	Reverse Recovery Charge		-	114	-	nC
Dynamic Characteristics^d						
R _G	Gate Resistance	V _{GS} =0V, V _{DS} =0V, F=1MHz	-	3	-	Ω
C _{iss}	Input Capacitance	V _{GS} =0V, V _{DS} =30V, Frequency=1.0MHz	-	500	-	pF
C _{oss}	Output Capacitance		-	41	-	
C _{rss}	Reverse Transfer Capacitance		-	16	-	
t _{d(ON)}	Turn-on Delay Time	V _{DD} =30V, R _L =30Ω, I _{DS} =1A, V _{GEN} =10V, R _G =6Ω	-	9	16	ns
t _r	Turn-on Rise Time		-	8	15	
t _{d(OFF)}	Turn-off Delay Time		-	18	33	
t _f	Turn-off Fall Time		-	3	6	
Gate Charge Characteristics^d						
Q _g	Total Gate Charge	V _{DS} =100V, V _{GS} =10V, I _{DS} =1.9A	-	10	14	nC
Q _{gs}	Gate-Source Charge		-	2.6	-	
Q _{gd}	Gate-Drain Charge		-	2.5	-	

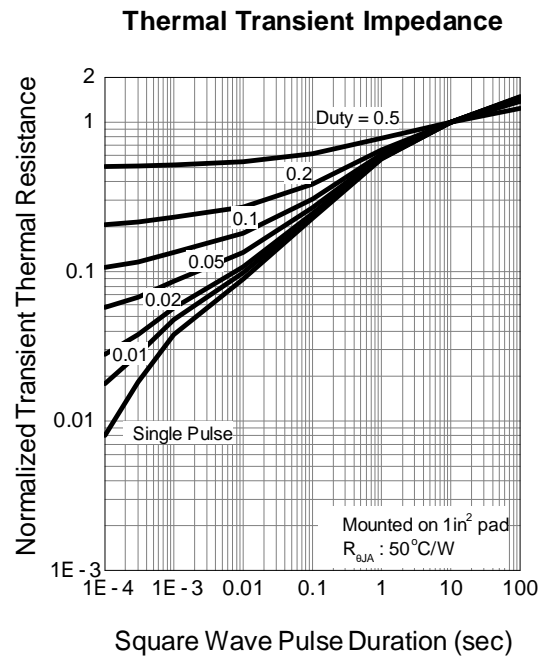
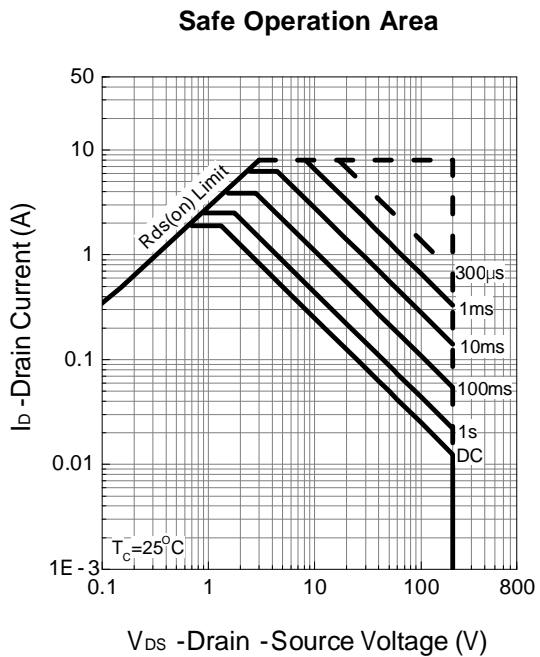
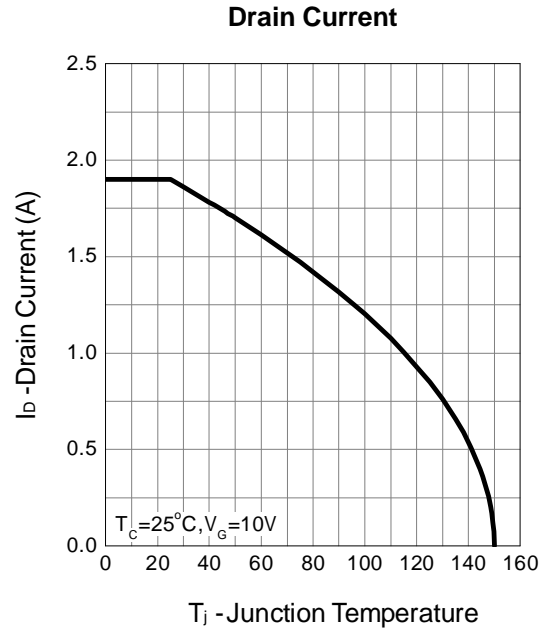
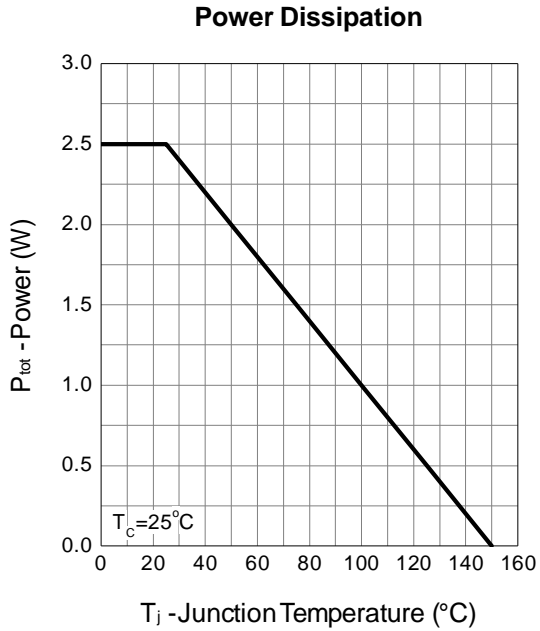
Note c : Pulse test ; pulse width ≤ 300 μs, duty cycle ≤ 2%.

Note d : Guaranteed by design, not subject to production testing.



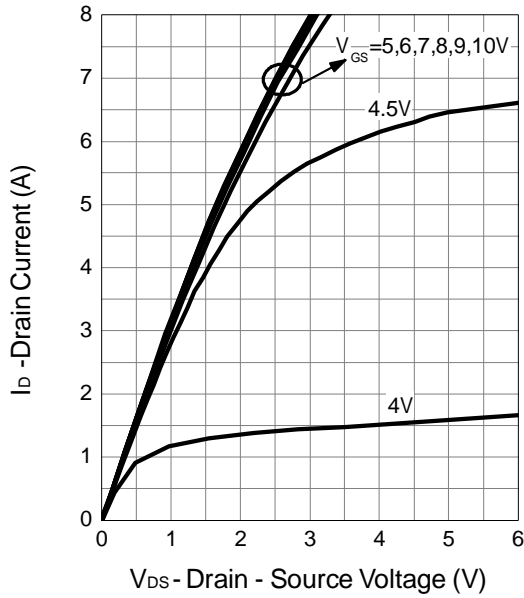
FTK2A04NS

Typical Operating Characteristics

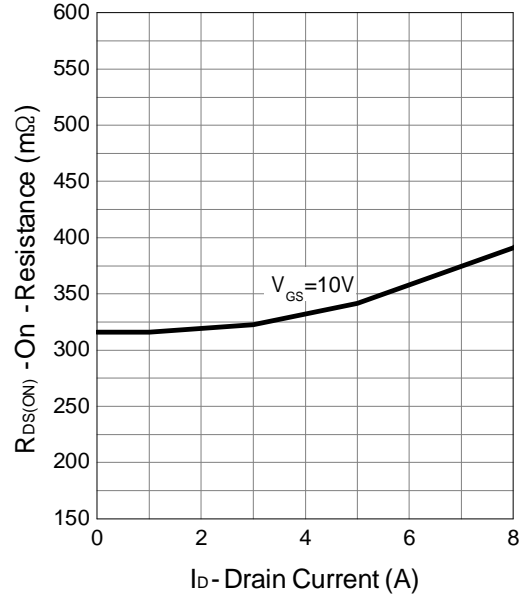


Typical Operating Characteristics (Cont.)

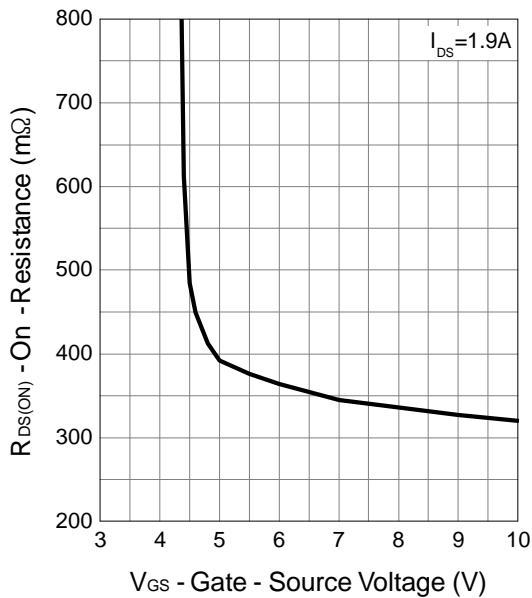
Output Characteristics



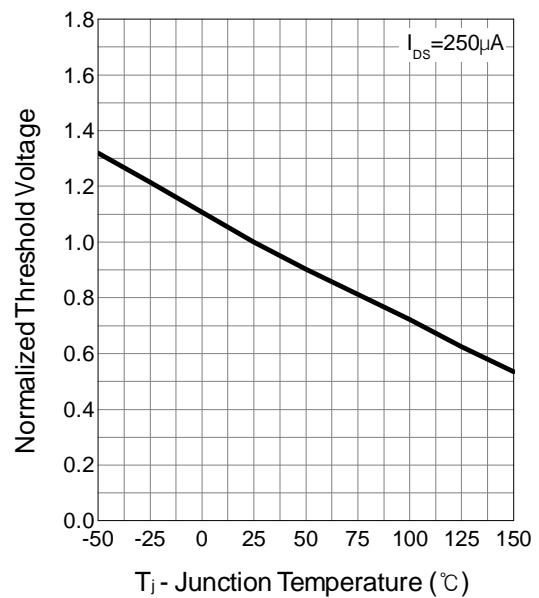
Drain-Source On Resistance



Gate-Source On Resistance



Gate Threshold Voltage

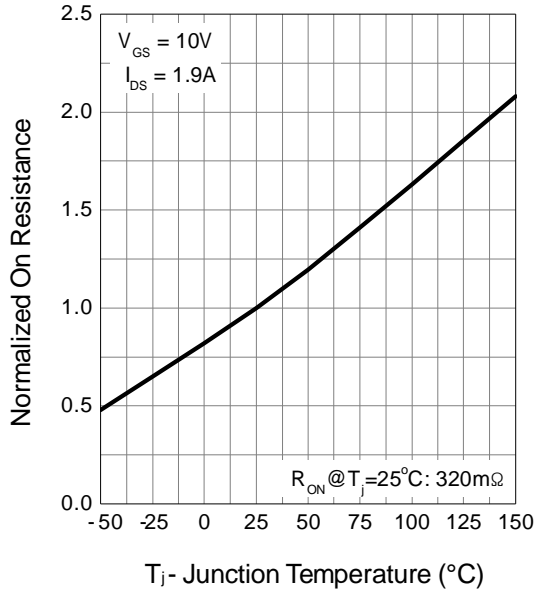




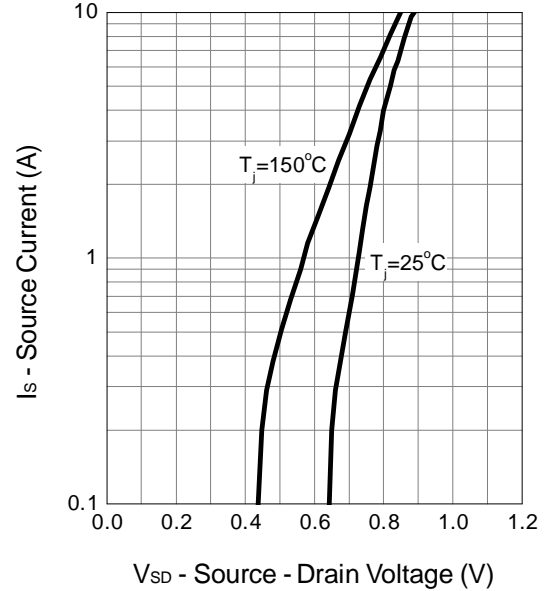
FTK2A04NS

Typical Operating Characteristics (Cont.)

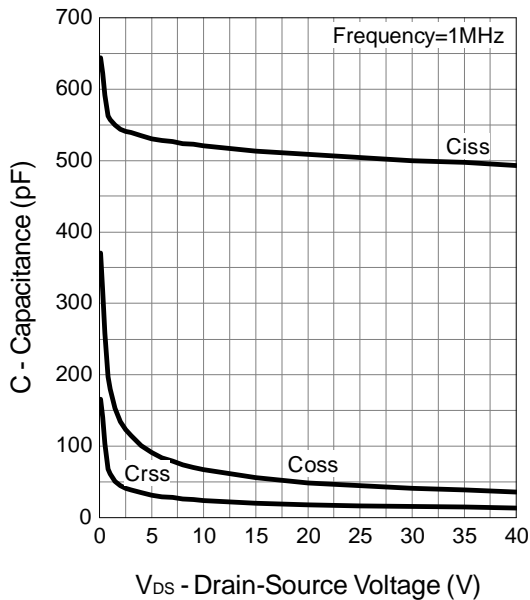
Drain-Source On Resistance



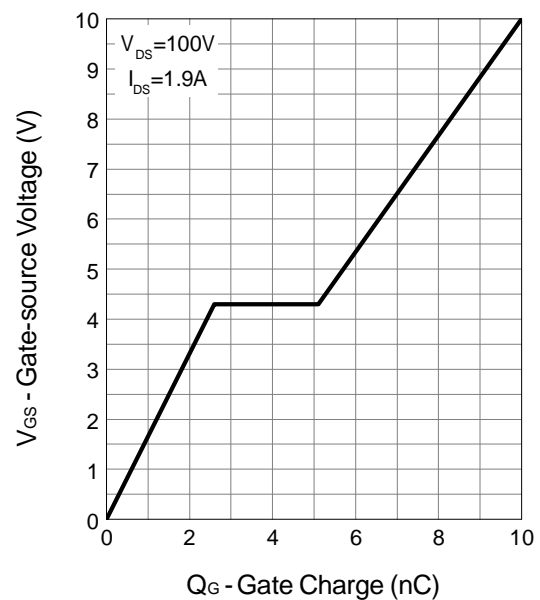
Source-Drain Diode Forward



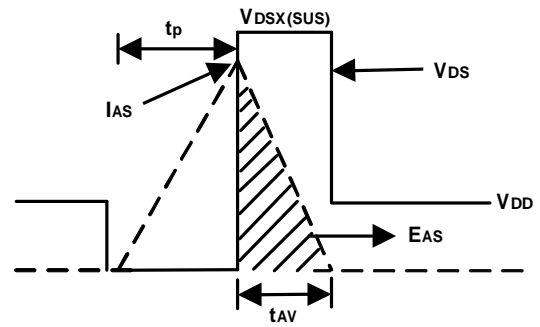
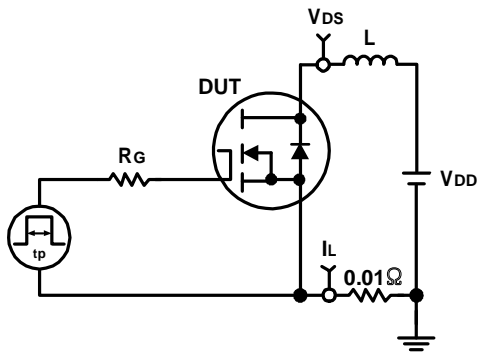
Capacitance



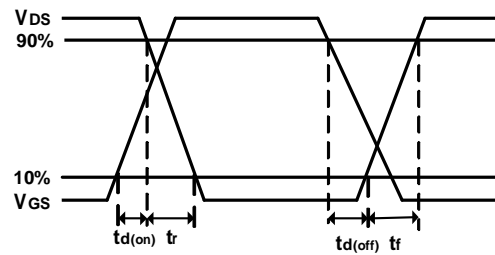
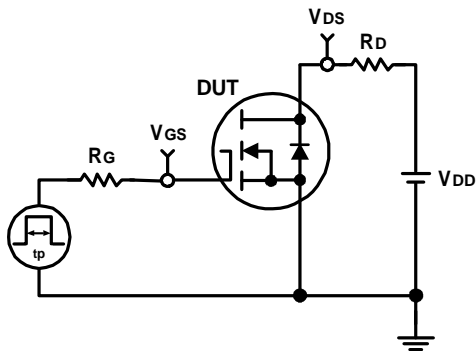
Gate Charge



Avalanche Test Circuit and Waveforms

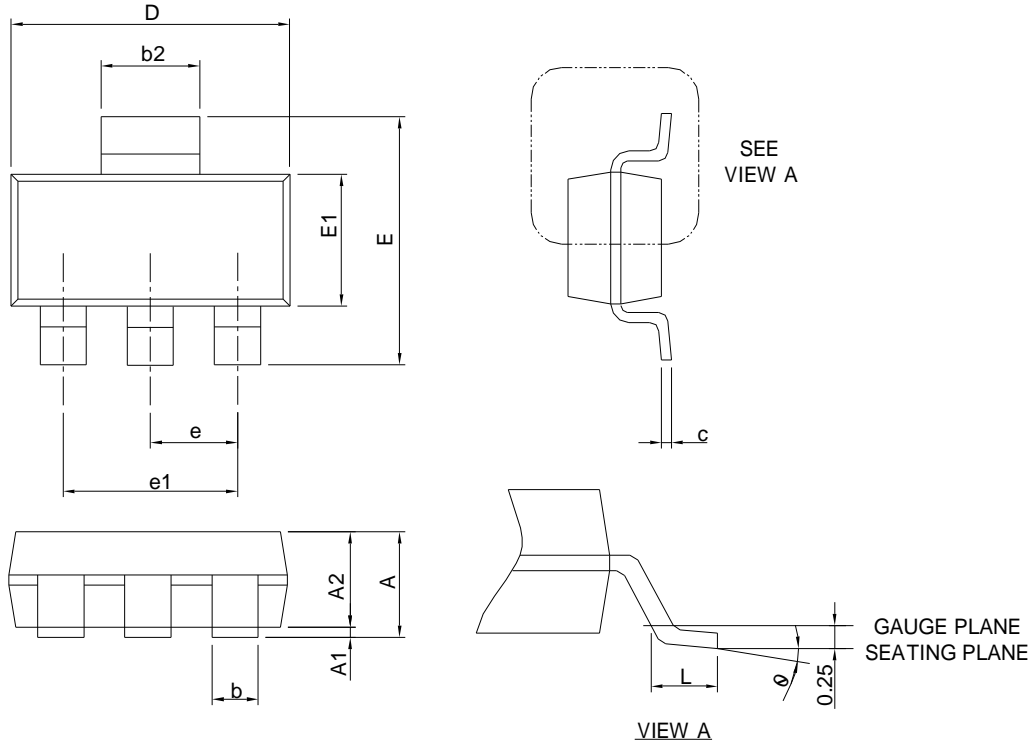


Switching Time Test Circuit and Waveforms



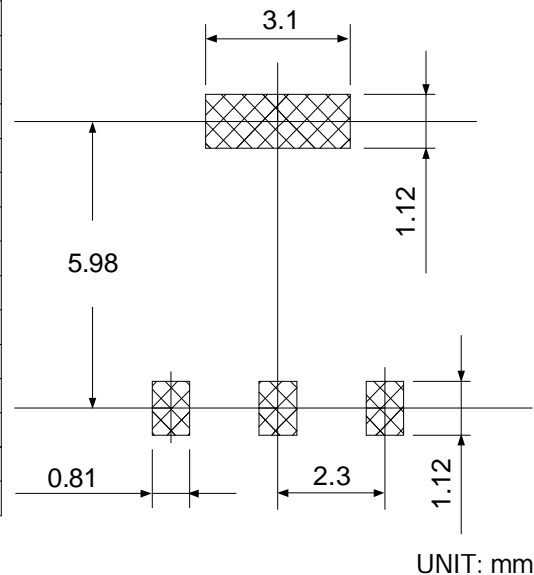
Package Information

SOT-223



SYM BOL	SOT-223			
	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A		1.80		0.071
A1	0.02	0.10	0.001	0.004
A2	1.50	1.70	0.059	0.067
b	0.66	0.84	0.026	0.033
b2	2.90	3.10	0.114	0.122
c	0.23	0.33	0.009	0.013
D	6.30	6.70	0.248	0.264
E	6.70	7.30	0.264	0.287
E1	3.30	3.70	0.130	0.146
e	2.30 BSC		0.091 BSC	
e1	4.60 BSC		0.181 BSC	
L	0.75		0.030	
θ	0°	10°	0°	10°

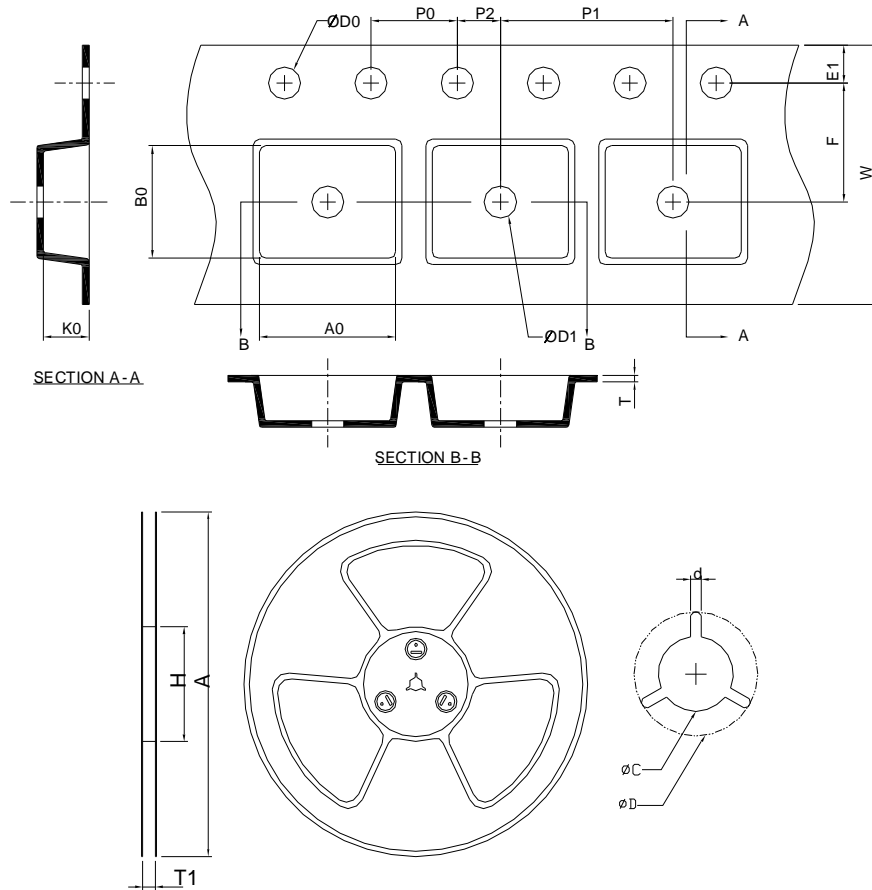
RECOMMENDED LAND PATTERN



Note : 1. Follow from JEDEC TO-261 AA.

2. Dimension D and E1 are determined at the outermost extremes of the plastic exclusive of mold flash, tie bar burrs, gate burrs, and interlead flash, but including any mismatch between the top and bottom of the plastic body.

Carrier Tape & Reel Dimensions

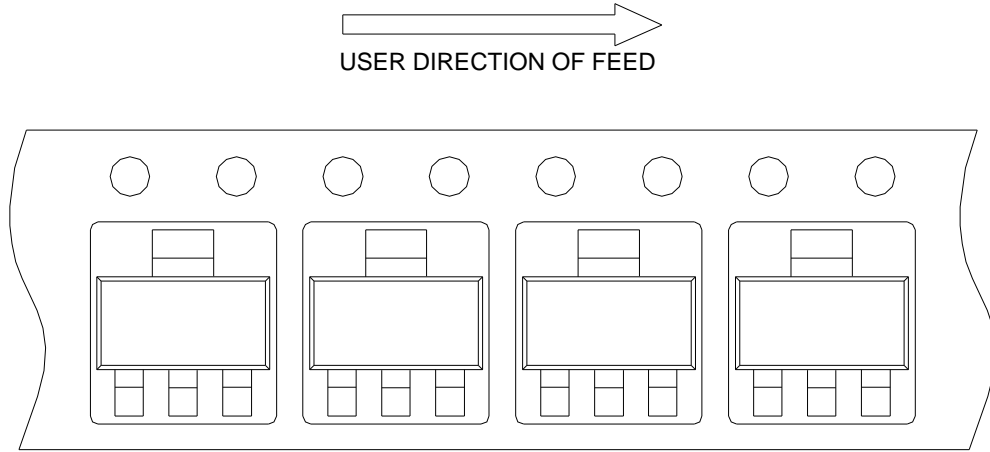


Application	A	H	T1	C	d	D	W	E1	F
SOT-223	320.0±2.00	50 MIN.	12.4+2.00 -0.00	13.0+0.50 -0.20	1.5 MIN.	20.2 MIN.	12.00±0.30	1.75±0.10	5.50±0.05
	P0	P1	P2	D0	D1	T	A0	B0	K0
	4.00±0.10	8.00±0.10	2.00±0.50	1.5+0.10 -0.00	1.5 MIN.	0.6+0.00 -0.40	6.90±0.20	7.50±0.20	2.10±0.20

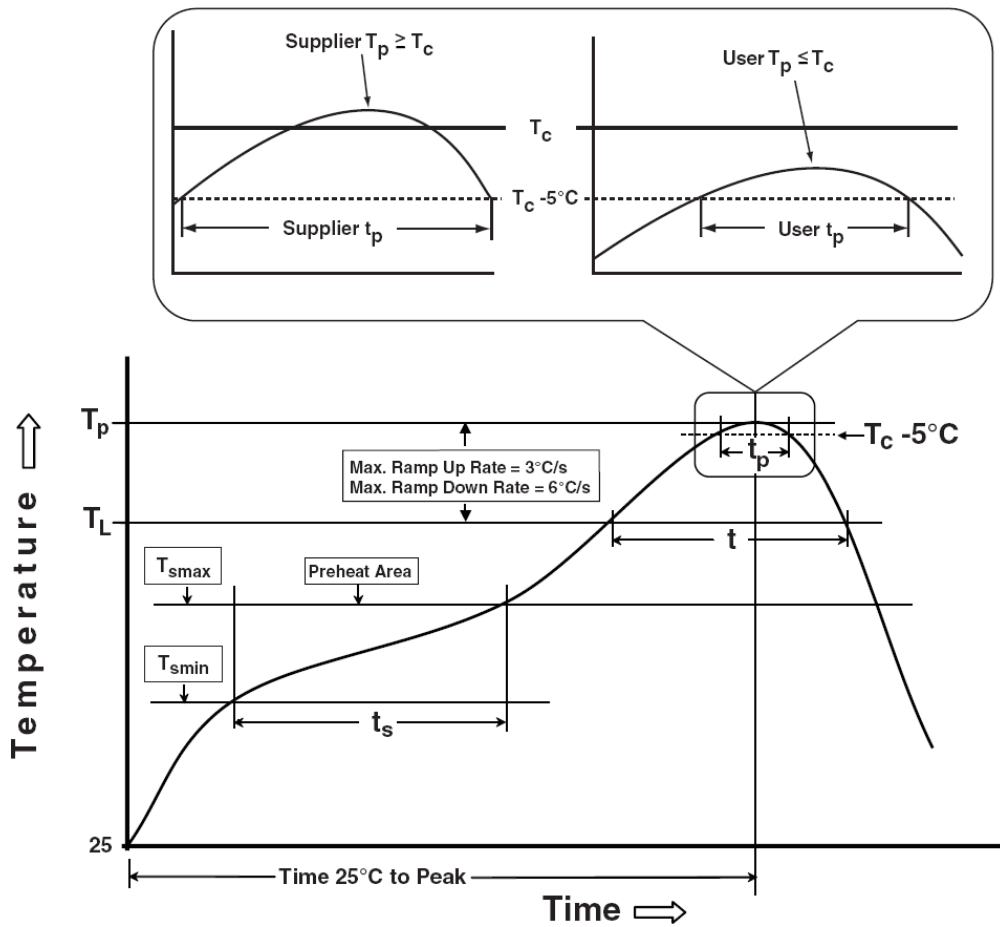
(mm)

Taping Direction Information

SOT-223



Classification Profile





FTK2A04NS

Classification Reflow Profiles

Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat & Soak Temperature min (T_{smin}) Temperature max (T_{smax}) Time (T_{smin} to T_{smax}) (t_s)	100 °C 150 °C 60-120 seconds	150 °C 200 °C 60-120 seconds
Average ramp-up rate (T_{smax} to T_P)	3 °C /second max.	3 °C /second max.
Liquidous temperature (T_L) Time at liquidous (t_L)	183 °C 60-150 seconds	217 °C 60-150 seconds
Peak package body Temperature (T_P)*	See Classification Temp in table 1	See Classification Temp in table 2
Time (t_p)** within 5 °C of the specified classification temperature (T_c)	20** seconds	30** seconds
Average ramp-down rate (T_P to T_{smax})	6 °C /second max.	6 °C /second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.
* Tolerance for peak profile Temperature (T_P) is defined as a supplier minimum and a user maximum. ** Tolerance for time at peak profile temperature (t_p) is defined as a supplier minimum and a user maximum.		

Table 1. SnPb Eutectic Process – Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ ≥350
<2.5 mm	235 °C	220 °C
≥2.5 mm	220 °C	220 °C

Table 2. Pb-free Process – Classification Temperatures (T_c)

Package Thickness	Volume mm ³ <350	Volume mm ³ 350-2000	Volume mm ³ >2000
<1.6 mm	260 °C	260 °C	260 °C
1.6 mm – 2.5 mm	260 °C	250 °C	245 °C
≥2.5 mm	250 °C	245 °C	245 °C

Reliability Test Program

Test item	Method	Description
SOLDERABILITY	JESD-22, B102	5 Sec, 245 °C
HTRB	JESD-22, A108	1000 Hrs, 80% of VDS max @ T_{jmax}
HTGB	JESD-22, A108	1000 Hrs, 100% of VGS max @ T_{jmax}
PCT	JESD-22, A102	168 Hrs, 100%RH, 2atm, 121 °C
TCT	JESD-22, A104	500 Cycles, -65 °C ~150 °C