



## N-Channel Logic Level Enhancement Mode Field Effect Transistor

### PRODUCT SUMMARY

VDSS	ID	RDS(ON) (mΩ) Max
40V	30A	23 @ VGS=10V
		36 @ VGS=4.5V

### FEATURES

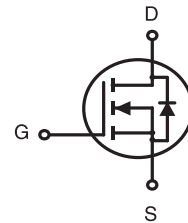
- Super high dense cell design for low RDS(ON).
- Rugged and reliable.
- TO-252 and TO-251 Package.



STU SERIES  
TO-252AA(D-PAK)



STD SERIES  
TO-251S(I-PAK)



### ABSOLUTE MAXIMUM RATINGS (TA=25°C unless otherwise noted)

Symbol	Parameter	Limit	Units
V <sub>DS</sub>	Drain-Source Voltage	40	V
V <sub>GS</sub>	Gate-Source Voltage	±20	V
I <sub>D</sub>	Drain Current-Continuous <sup>a</sup>	T <sub>C</sub> =25°C	30
		T <sub>C</sub> =70°C	24
I <sub>DM</sub>	-Pulsed <sup>b</sup>	88	A
E <sub>AS</sub>	Single Pulse Avalanche Energy <sup>d</sup>	30	mJ
P <sub>D</sub>	Maximum Power Dissipation <sup>a</sup>	T <sub>C</sub> =25°C	42
		T <sub>C</sub> =70°C	27
T <sub>J</sub> , T <sub>STG</sub>	Operating Junction and Storage Temperature Range	-55 to 150	°C

### THERMAL CHARACTERISTICS

R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case <sup>a</sup>	3	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient <sup>a</sup>	50	°C/W

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## ELECTRICAL CHARACTERISTICS (TA=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>						
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V , I <sub>D</sub> =250uA	40			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =32V , V <sub>GS</sub> =0V			1	uA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> = ±20V , V <sub>BS</sub> =0V			±100	nA
<b>ON CHARACTERISTICS</b>						
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250uA	1	1.9	3	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> =10V , I <sub>D</sub> =15A		18.5	23	m ohm
		V <sub>GS</sub> =4.5V , I <sub>D</sub> =12A		26.5	36	m ohm
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =10V , I <sub>D</sub> =15A		32		S
<b>DYNAMIC CHARACTERISTICS <sup>c</sup></b>						
C <sub>ISS</sub>	Input Capacitance	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V f=1.0MHz		540		pF
C <sub>OSS</sub>	Output Capacitance			87		pF
C <sub>RSS</sub>	Reverse Transfer Capacitance			70		pF
<b>SWITCHING CHARACTERISTICS <sup>c</sup></b>						
t <sub>D(ON)</sub>	Turn-On Delay Time	V <sub>DD</sub> =20V I <sub>D</sub> =1A V <sub>GS</sub> =10V R <sub>GEN</sub> = 6 ohm		12		ns
t <sub>r</sub>	Rise Time			12.5		ns
t <sub>D(OFF)</sub>	Turn-Off Delay Time			18.5		ns
t <sub>f</sub>	Fall Time			17		ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =20V, I <sub>D</sub> =15A, V <sub>GS</sub> =10V		11.5		nC
		V <sub>DS</sub> =20V, I <sub>D</sub> =15A, V <sub>GS</sub> =4.5V		6		nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>DS</sub> =20V, I <sub>D</sub> =15A, V <sub>GS</sub> =10V		1.5		nC
Q <sub>gd</sub>	Gate-Drain Charge			3.8		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
V <sub>SD</sub>	Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =2A		0.785	1.3	V

### Notes

- Surface Mounted on FR4 Board, t ≤ 10sec.
- Pulse Test: Pulse Width ≤ 300us, Duty Cycle ≤ 2%.
- Guaranteed by design, not subject to production testing.
- Starting T<sub>J</sub>=25°C, L=0.5mH, V<sub>DD</sub> = 20V. (See Figure 13)

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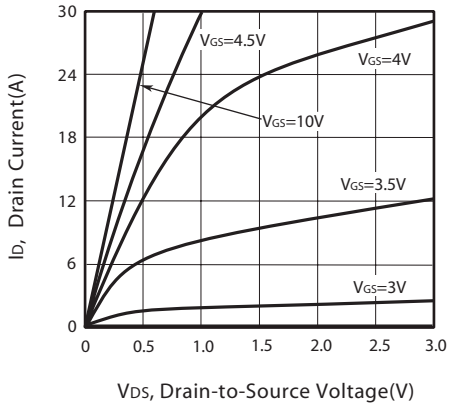


Figure 1. Output Characteristics

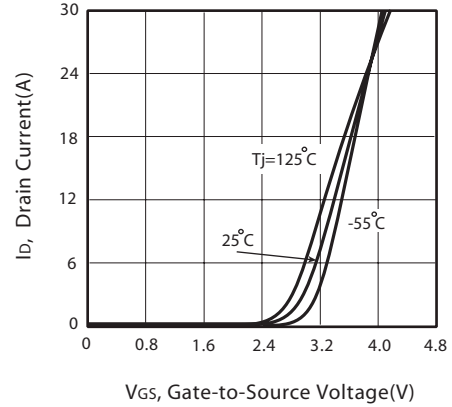


Figure 2. Transfer Characteristics

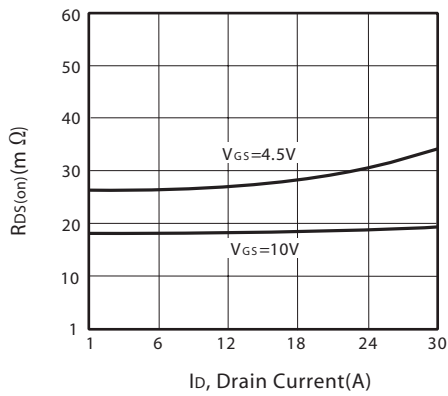


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

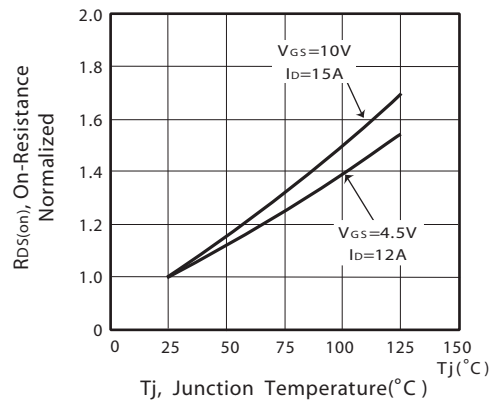


Figure 4. On-Resistance Variation with Drain Current and Temperature

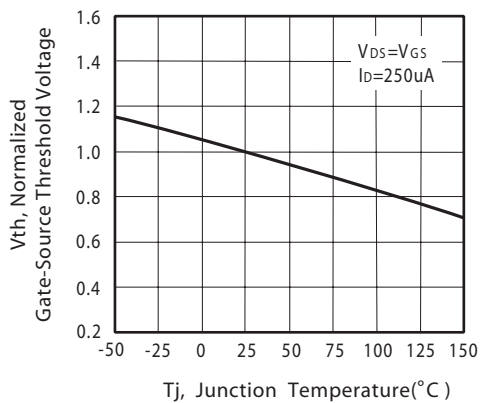


Figure 5. Gate Threshold Variation with Temperature

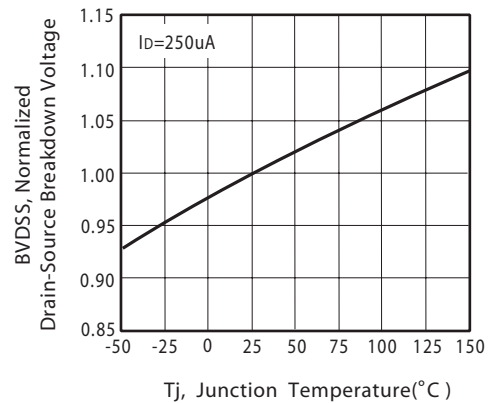


Figure 6. Breakdown Voltage Variation with Temperature

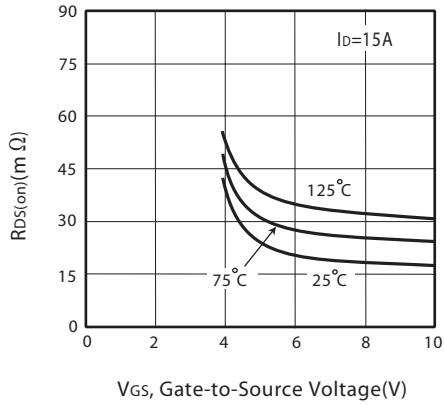


Figure 7. On-Resistance vs. Gate-Source Voltage

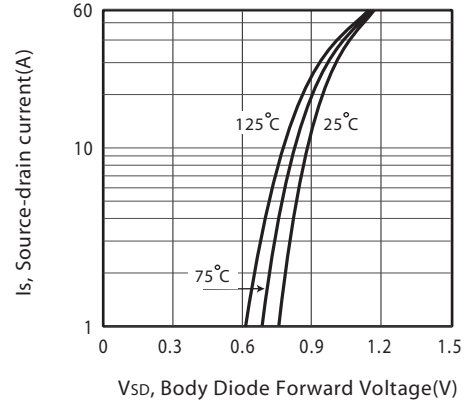


Figure 8. Body Diode Forward Voltage Variation with Source Current

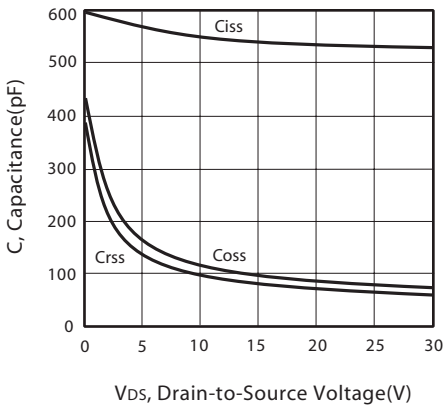


Figure 9. Capacitance

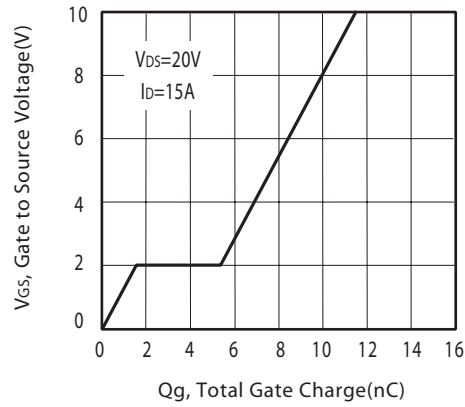


Figure 10. Gate Charge

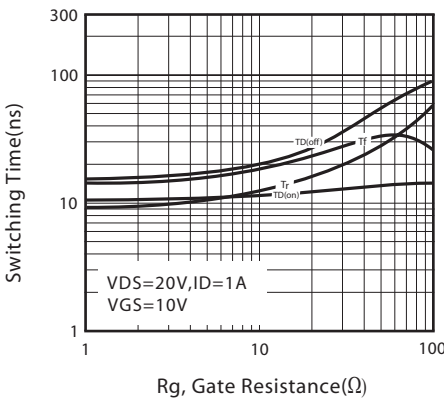


Figure 11. switching characteristics

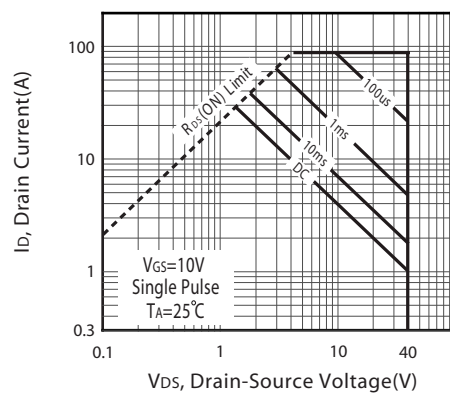
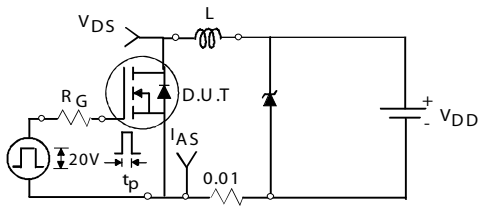
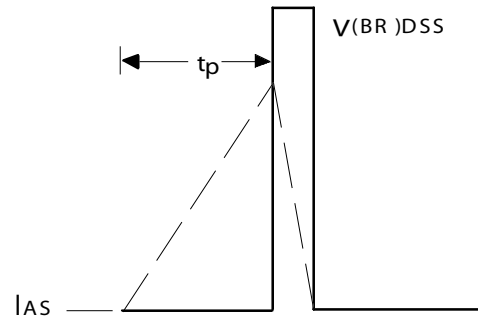


Figure 12. Maximum Safe Operating Area



Unclamped Inductive Test Circuit

Figure 13a.



Unclamped Inductive Waveforms

Figure 13b.

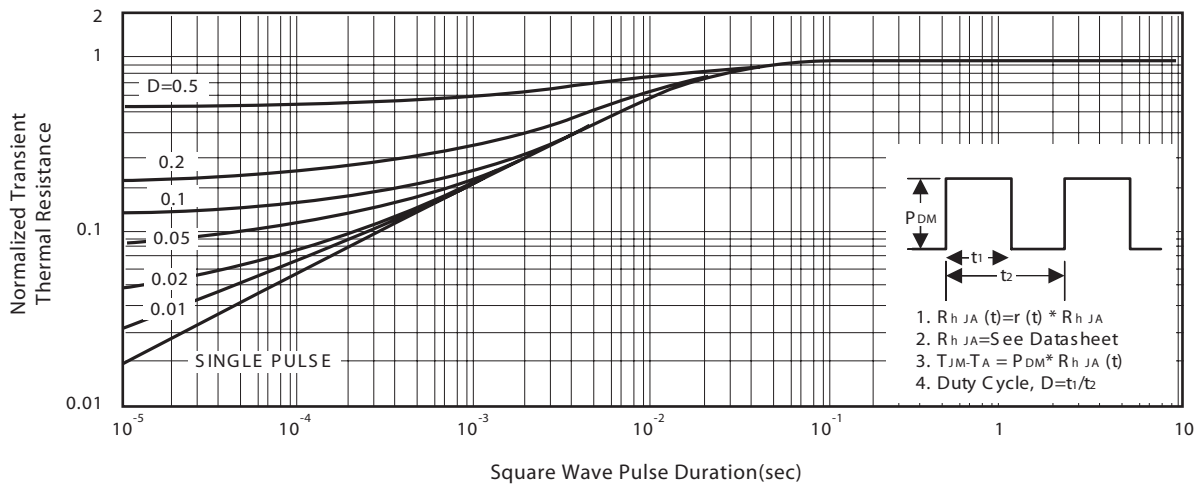
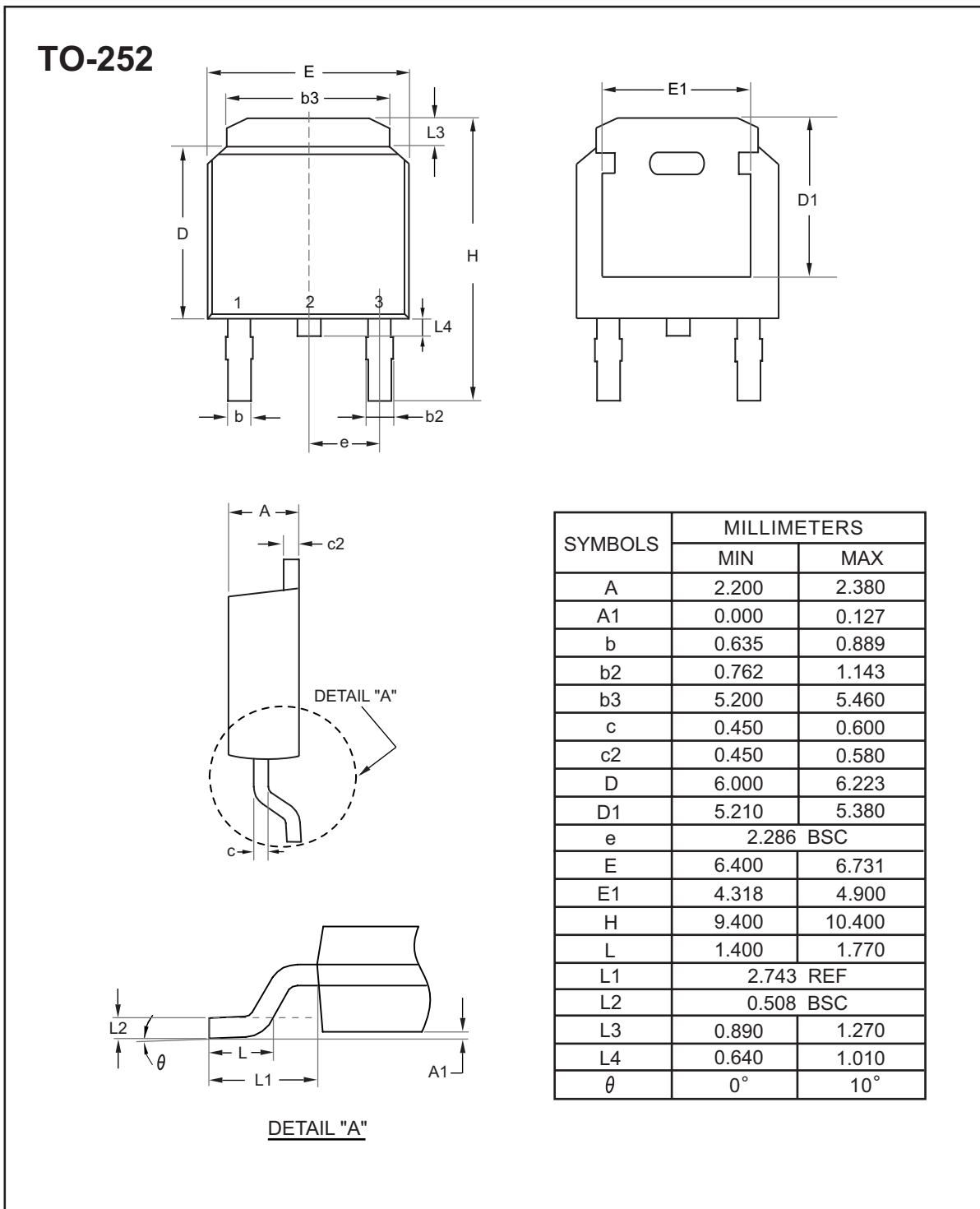


Figure 14. Normalized Thermal Transient Impedance Curve

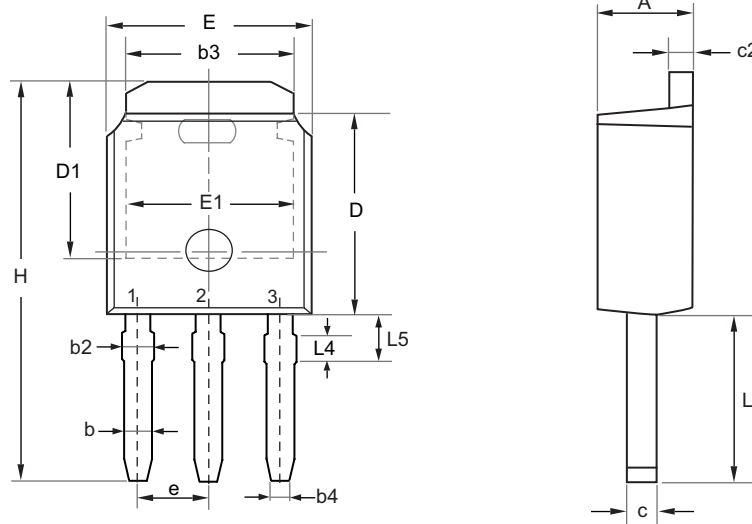
## PACKAGE OUTLINE DIMENSIONS



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## TO-251



SYMBOL	MILLIMETERS	
	MIN	MAX
E	6.350	6.731
L	3.700	4.400
L4	0.698 REF	
L5	0.972	1.226
D	5.970	6.223
H	9.670	11.450
b	0.630	0.850
b2	0.760	1.140
b3	4.950	5.460
b4	0.450	0.550
e	2.286 BSC	
A	2.180	2.390
c	0.400	0.610
c2	0.400	0.610
D1	5.100	---
E1	4.318	---

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## TO-251 Tube/TO-252 Tape and Reel Data

### TO-251 Tube



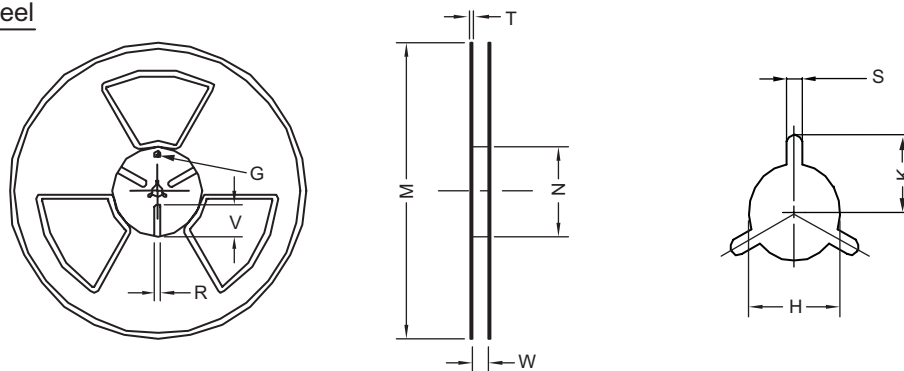
### TO-252 Carrier Tape



UNIT:mm

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
TO-252 (16 mm)	6.96 ±0.1	10.49 ±0.1	2.79 ±0.1	φ 2	φ 1.5 + 0.1 - 0	16.0 ±0.3	1.75 ±0.1	7.5 ±0.15	8.0 ±0.1	4.0 ±0.1	2.0 ±0.15	0.3 ±0.05

### TO-252 Reel

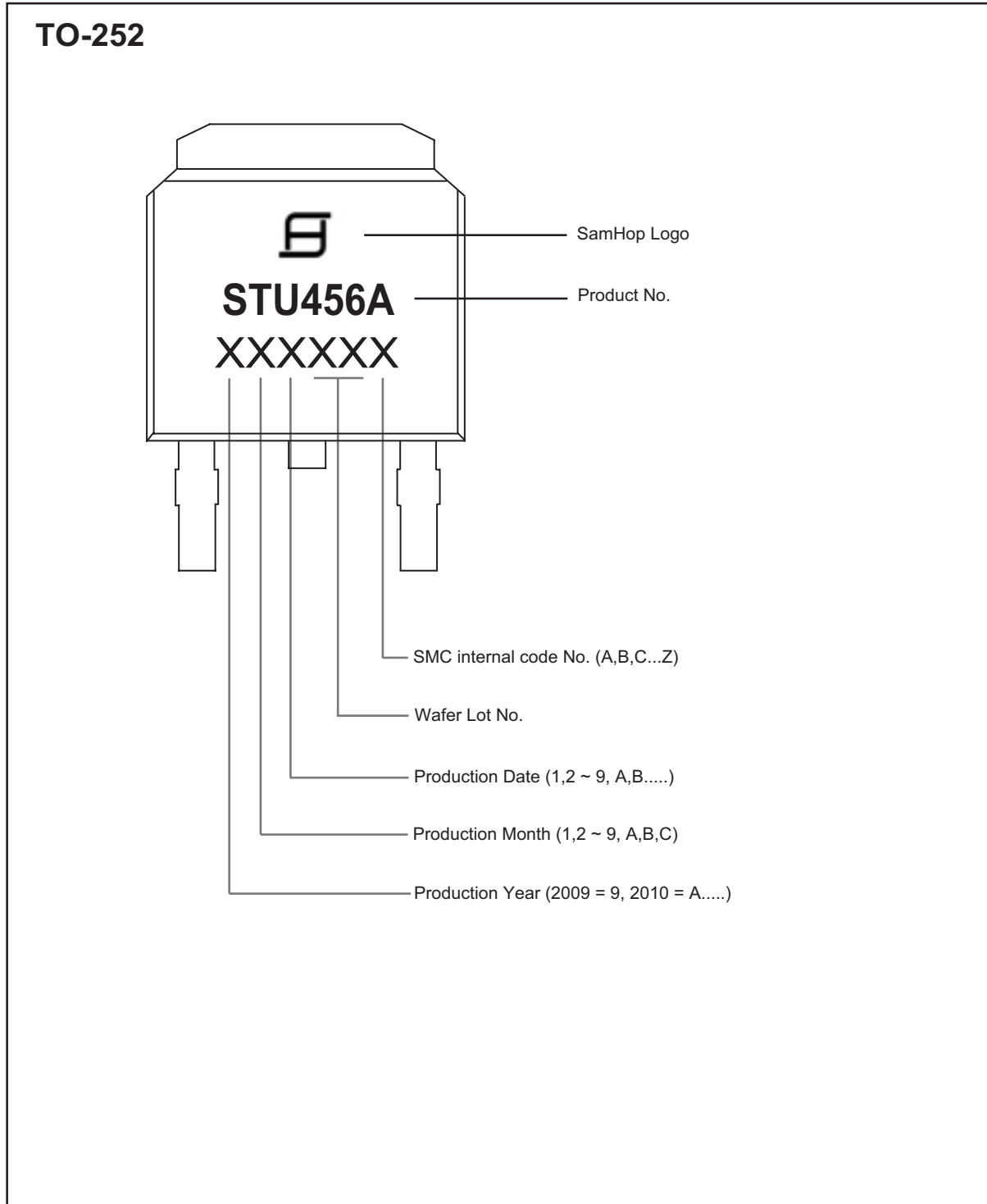


UNIT:mm

TAPE SIZE	REEL SIZE	M	N	W	T	H	K	S	G	R	V
16 mm	φ 330	φ 330 ± 0.5	φ 97 ± 1.0	17.0 + 1.5 - 0	2.2	φ 13.0 + 0.5 - 0.2	10.6	2.0 ±0.5	---	---	---



## TOP MARKING DEFINITION



TOP MARKING DEFINITION

