



SamHop Microelectronics Corp.

# STU/D413S

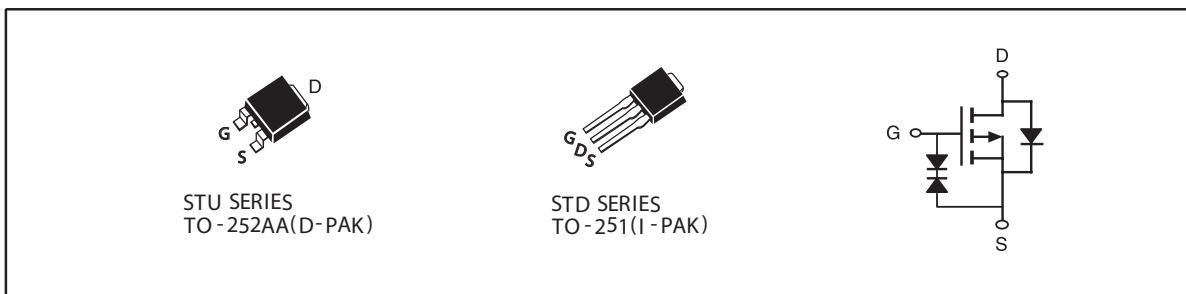
Ver 1.0

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

PRODUCT SUMMARY		
V <sub>DSS</sub>	I <sub>D</sub>	R <sub>DSON</sub> (mΩ) Max
-40V	-19A	48 @ V <sub>GS</sub> =10V
		78 @ V <sub>GS</sub> =4.5V

### FEATURES

- Super high dense cell design for low R<sub>DSON</sub>.
- Rugged and reliable.
- Surface Mount Package.
- ESD Protected.



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=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	-19	A
		T <sub>C</sub> =70°C	-15	A
I <sub>DM</sub>	-Pulsed <sup>b</sup>	-58	A	
E <sub>AS</sub>	Single Pulse Avalanche Energy <sup>d</sup>	16	mJ	
P <sub>D</sub>	Maximum Power Dissipation <sup>a</sup>	T <sub>C</sub> =25°C	32	W
		T <sub>C</sub> =70°C	20	W
T <sub>J</sub> , T <sub>STG</sub>	Operating Junction and Storage Temperature Range	-55 to 150	°C	

### THERMAL CHARACTERISTICS

R <sub>θ</sub> JC	Thermal Resistance, Junction-to-Case <sup>a</sup>	4	°C/W
R <sub>θ</sub> JA	Thermal Resistance, Junction-to-Ambient <sup>a</sup>	50	°C/W

Details are subject to change without notice.

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## ELECTRICAL CHARACTERISTICS ( $T_A=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-40			V
$I_{DSs}$	Zero Gate Voltage Drain Current	$V_{DS}=-32V, V_{GS}=0V$		1		$\mu A$
$I_{GSS}$	Gate-Body Leakage Current	$V_{GS} = \pm 20V, V_{DS}=0V$			$\pm 10$	$\mu A$
<b>ON CHARACTERISTICS</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1	-1.8	-3	V
$R_{DS(ON)}$	Drain-Source On-State Resistance	$V_{GS}=-10V, I_D=-9.5A$		38	48	m ohm
		$V_{GS}=-4.5V, I_D=-7.5A$		58	78	m ohm
$g_{FS}$	Forward Transconductance	$V_{DS}=-10V, I_D=-9.5A$		10		S
<b>DYNAMIC CHARACTERISTICS <sup>c</sup></b>						
$C_{iss}$	Input Capacitance	$V_{DS}=-20V, V_{GS}=0V$ $f=1.0MHz$		895		pF
$C_{oss}$	Output Capacitance			138		pF
$C_{rss}$	Reverse Transfer Capacitance			67		pF
<b>SWITCHING CHARACTERISTICS <sup>c</sup></b>						
$t_{D(ON)}$	Turn-On Delay Time	$V_{DD}=-20V$ $I_D=-1.0A$ $V_{GS}=-10V$ $R_{GEN}=3.3\text{ ohm}$		14		ns
$t_r$	Rise Time			14		ns
$t_{D(OFF)}$	Turn-Off Delay Time			54		ns
$t_f$	Fall Time			10		ns
$Q_g$	Total Gate Charge	$V_{DS}=-20V, I_D=-9.5A, V_{GS}=-10V$		14.5		nC
		$V_{DS}=-20V, I_D=-9.5A, V_{GS}=-4.5V$		7		nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=-20V, I_D=-9.5A,$ $V_{GS}=-10V$		2.1		nC
$Q_{gd}$	Gate-Drain Charge			3.4		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
$I_s$	Maximum Continuous Drain-Source Forward Current				-2.0	A
$V_{SD}$	Diode Forward Voltage <sup>b</sup>	$V_{GS}=0V, I_s = -2.0A$		-0.77	-1.3	V
Notes						
a.Surface Mounted on FR4 Board, $t \leq 10\text{sec}$ .						
b.Pulse Test: Pulse Width $\leq 300\mu s$ , Duty Cycle $\leq 2\%$ .						
c.Guaranteed by design, not subject to production testing.						
d.Starting $T_J=25^\circ C, L=0.5\text{mH}, V_{DD} = 20V$ . (See Figure 13)						

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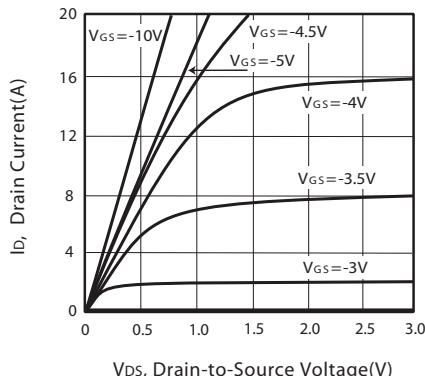


Figure 1. Output Characteristics

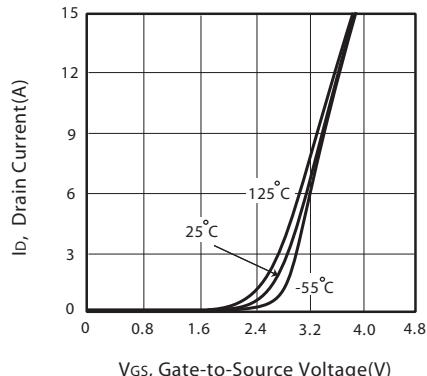


Figure 2. Transfer Characteristics

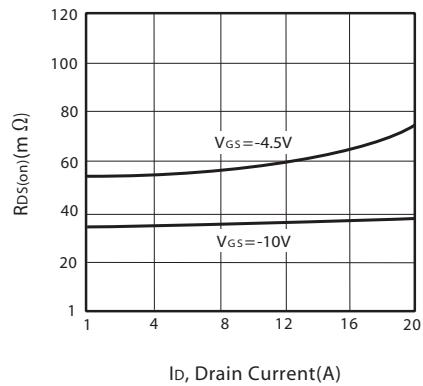


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

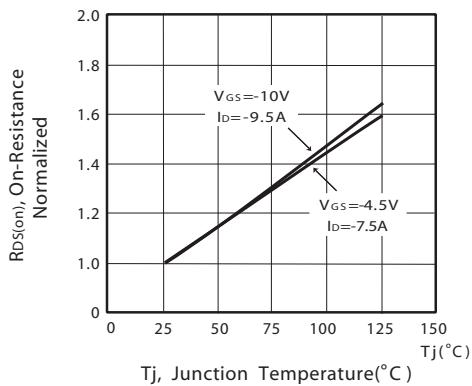


Figure 4. On-Resistance Variation with Drain Current and Temperature

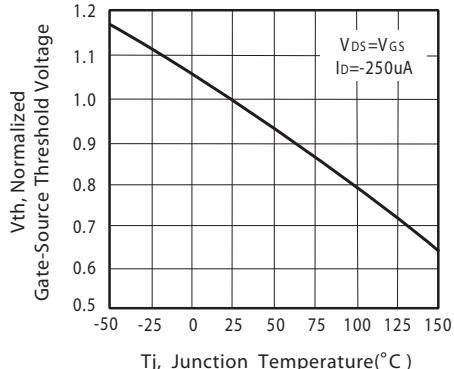


Figure 5. Gate Threshold Variation with Temperature

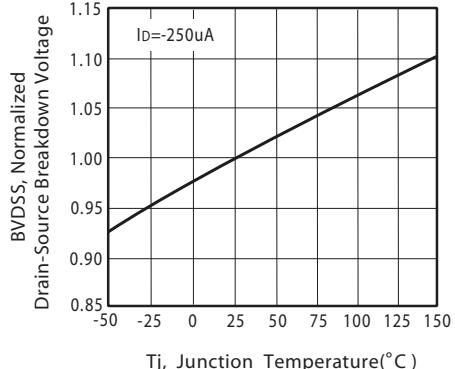


Figure 6. Breakdown Voltage Variation with Temperature

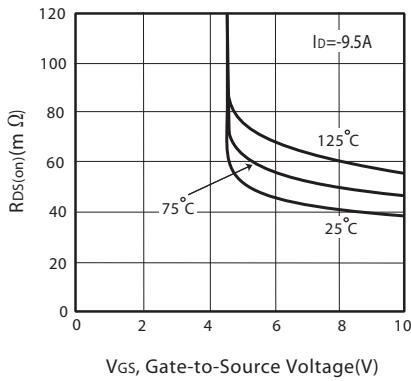


Figure 7. On-Resistance vs.  
Gate-Source Voltage

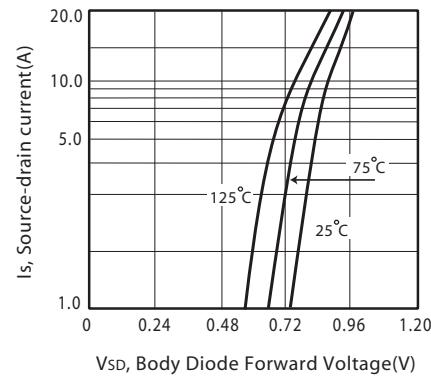


Figure 8. Body Diode Forward Voltage  
Variation with Source Current

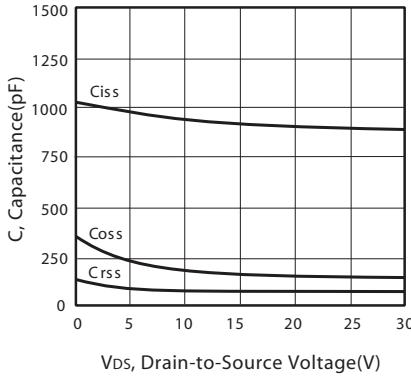


Figure 9. Capacitance

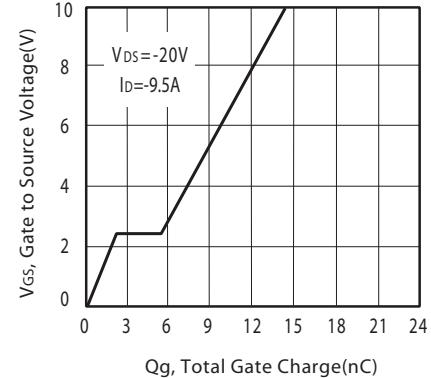


Figure 10. Gate Charge

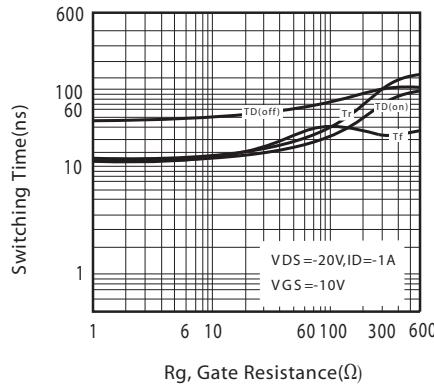


Figure 11. switching characteristics

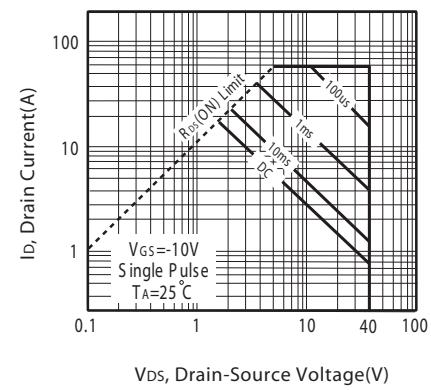
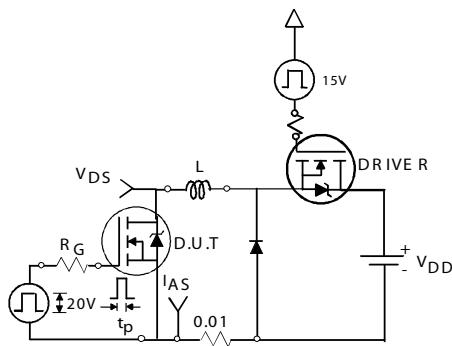
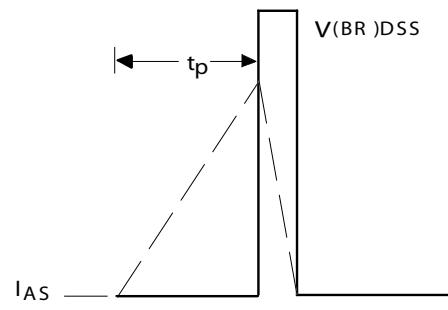


Figure 12. Maximum Safe Operating Area



Unclamped Inductive Test Circuit

Figure 13a.



Unclamped Inductive Waveforms

Figure 13b.

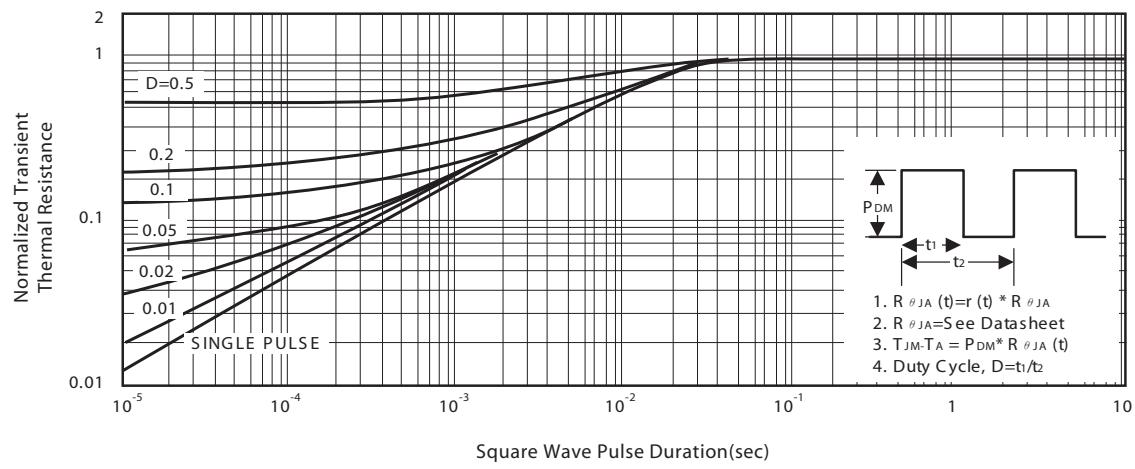
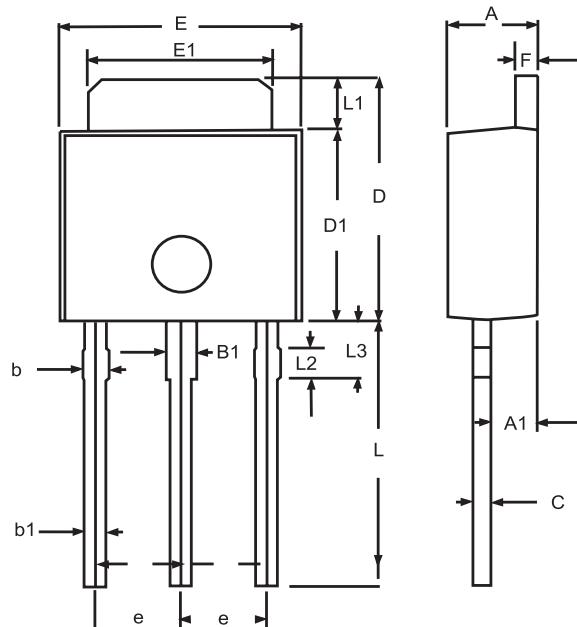


Figure 14. Normalized Thermal Transient Impedance Curve

## PACKAGE OUTLINE DIMENSIONS

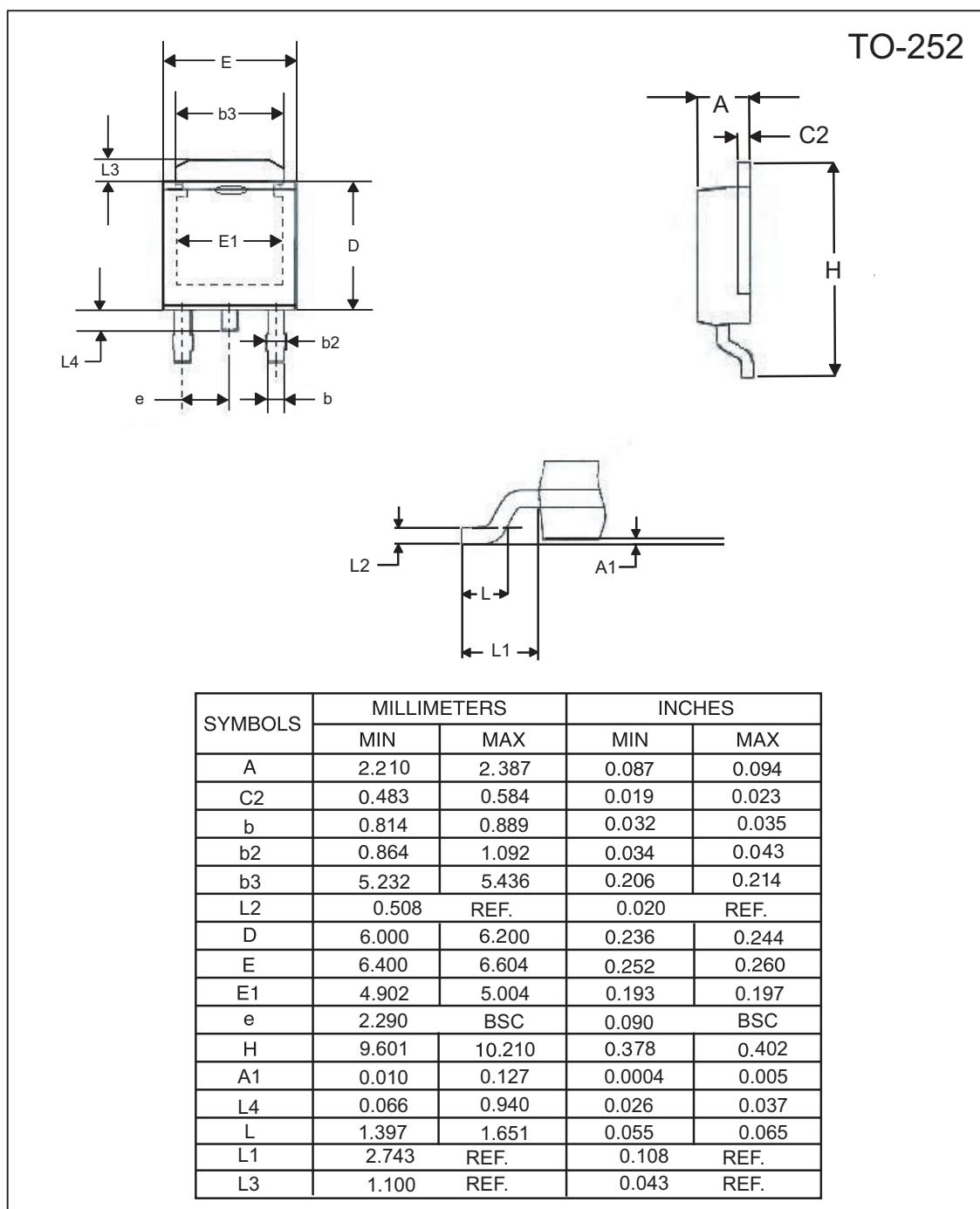
TO-251



SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.20	2.40	0.087	0.095
A1	1.100	1.300	0.043	0.051
B1	0.650	1.050	0.026	0.041
b	0.500	0.900	0.020	0.035
b1	0.400	0.800	0.016	0.32
C	0.400	0.600	0.016	0.024
D	6.700	7.300	0.264	0.287
D1	5.400	5.650	0.213	0.222
E	6.40	6.650	0.252	0.262
e	2.100	2.500	0.083	0.098
F	0.400	0.600	0.016	0.024
L	7.000	8.000	0.276	0.315
L1	1.300	1.700	0.051	0.067
L2	0.700	0.900	0.028	0.035
L3	1.400	1.800	0.055	0.071

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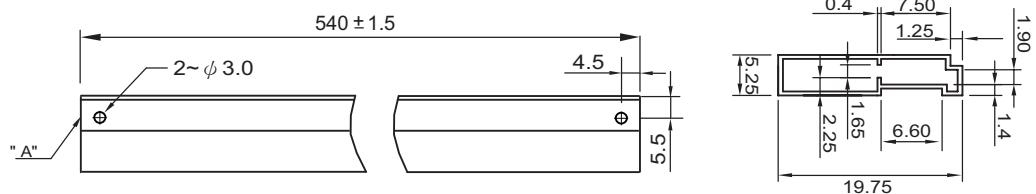
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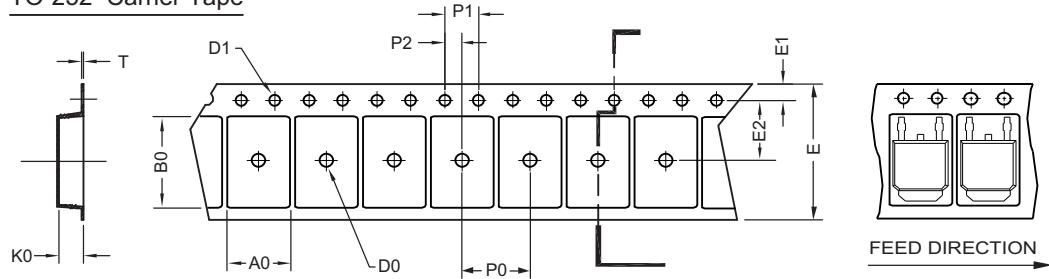
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## TO251 Tube/TO-252 Tape and Reel Data

### TO-251 Tube



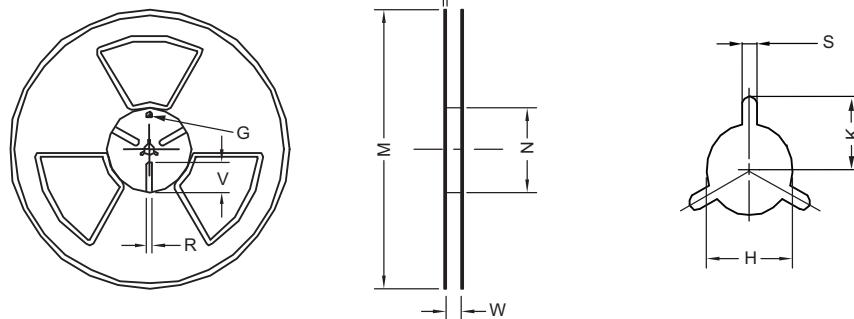
### TO-252 Carrier Tape



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	φ2	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	---	---	---

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