




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

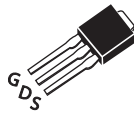
PRODUCT SUMMARY		
V <sub>DSS</sub>	I <sub>D</sub>	R <sub>DS(ON)</sub> (mΩ) Max
-40V	-10A	45 @ V <sub>GS</sub> = -10V
		60 @ V <sub>GS</sub> = -4.5V

### FEATURES

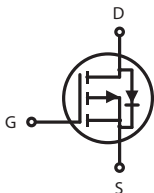
- Super high dense cell design for low R<sub>DS(ON)</sub>.
- Rugged and reliable.
- TO-252 and TO-251 Package.



STU SERIES  
TO-252AA(D-PAK)



STD SERIES  
TO-251(I-PAK)



### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub>=25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	V <sub>DS</sub>	-40	V	
Gate-Source Voltage	V <sub>GS</sub>	±20	V	
Drain Current-Continuous <sup>a</sup> @ T <sub>a</sub>	I <sub>D</sub>	25°C	-10	A
		70°C	-8.3	A
-Pulsed <sup>b</sup>	I <sub>DM</sub>	-50	A	
Drain-Source Diode Forward Current <sup>a</sup>	I <sub>S</sub>	-10	A	
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>a</sub> =25°C	50	W
		T <sub>a</sub> =70°C	35	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to 175	°C	

### THERMAL CHARACTERISTICS

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

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P-Channel ELECTRICAL CHARACTERISTICS ( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ <sup>c</sup>	Max	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0V, I_D = -250\mu A$	-40			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -32V, V_{GS} = 0V$			1	$\mu A$
Gate-Body Leakage	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			$\pm 100$	nA
<b>ON CHARACTERISTICS<sup>b</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\mu A$	-1.0	-1.7	-3.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = -10V, I_D = -10A$		34	45	m ohm
		$V_{GS} = -4.5V, I_D = -6A$		47	60	m ohm
On-State Drain Current	$I_{D(ON)}$	$V_{DS} = -5V, V_{GS} = -10V$	30			A
Forward Transconductance	$g_{FS}$	$V_{DS} = -10V, I_D = -10A$		11		S
<b>DYNAMIC CHARACTERISTICS<sup>c</sup></b>						
Input Capacitance	$C_{ISS}$	$V_{DS} = -20V, V_{GS} = 0V$ $f = 1.0MHz$		900		pF
Output Capacitance	$C_{OSS}$			135		pF
Reverse Transfer Capacitance	$C_{RSS}$			85		pF
Gate resistance	$R_g$	$V_{GS} = 0V, V_{DS} = 0V, f = 1.0MHz$		3.5		ohm
<b>SWITCHING CHARACTERISTICS<sup>c</sup></b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD} = -24V$ $I_D = -10A$ $V_{GS} = -10V$ $R_{GEN} = 3.3\text{ ohm}$		12		ns
Rise Time	$t_r$			15		ns
Turn-Off Delay Time	$t_{D(OFF)}$			45		ns
Fall Time	$t_f$			26		ns
Total Gate Charge	$Q_g$	$V_{DS} = -24V, I_D = -10A, V_{GS} = -10V$		17		nC
		$V_{DS} = -24V, I_D = -10A, V_{GS} = -4.5V$		8		nC
Gate-Source Charge	$Q_{gs}$	$V_{DS} = -24V, I_D = -16A$		1.8		nC
Gate-Drain Charge	$Q_{gd}$	$V_{GS} = -10V$		5		nC

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>DRAIN-SOURCE DIODE CHARACTERISTICS <sup>a</sup></b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0V, I_s = -10A$		-0.91	-1.3	V

### Notes

- a. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
- b. Guaranteed by design, not subject to production testing.

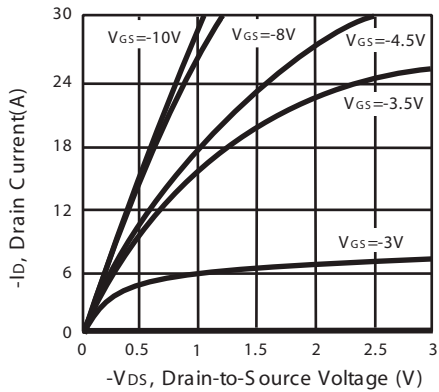


Figure 1. Output Characteristics

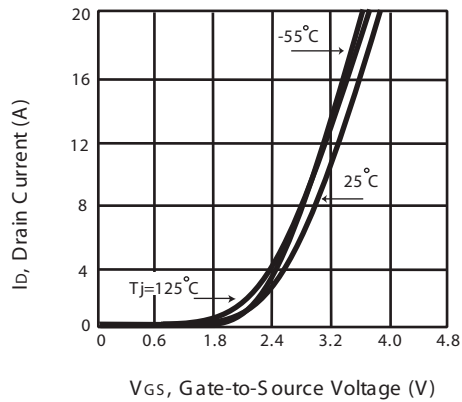


Figure 2. Transfer Characteristics

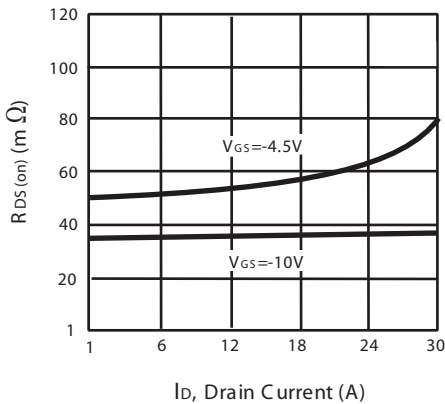


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

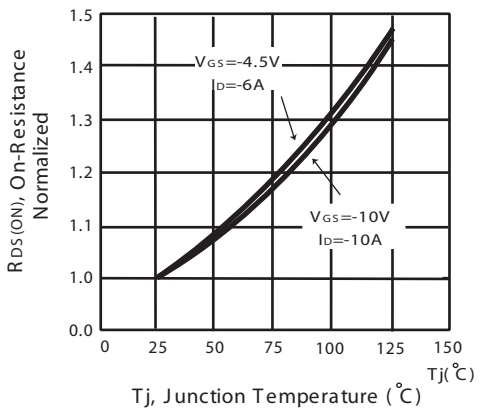


Figure 4. On-Resistance Variation with Drain Current and Temperature

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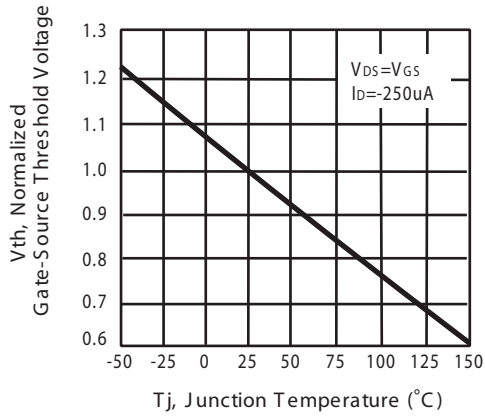


Figure 5. Gate Threshold Variation with Temperature

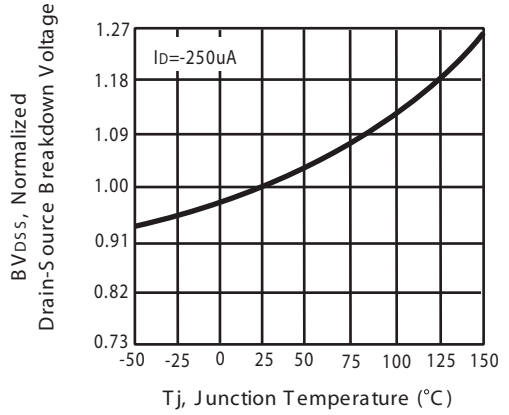


Figure 6. Breakdown Voltage Variation with Temperature

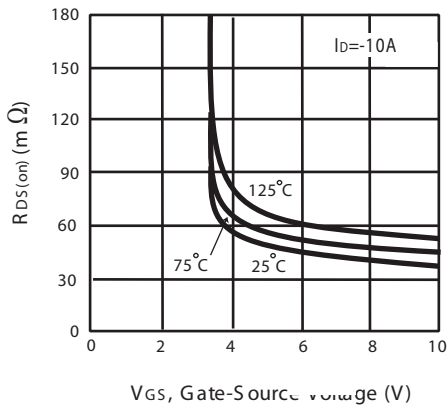


Figure 7. On-Resistance vs. Gate-Source Voltage

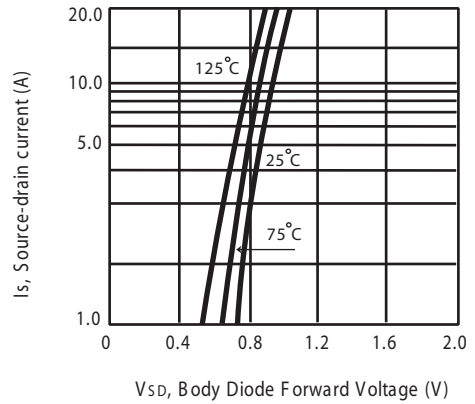
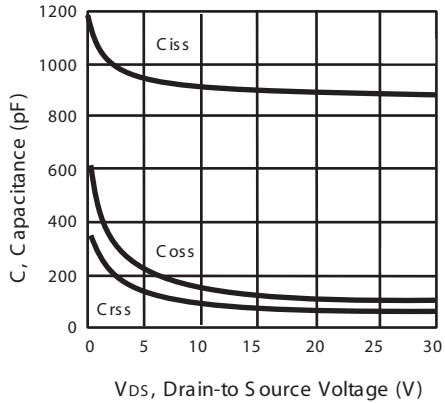


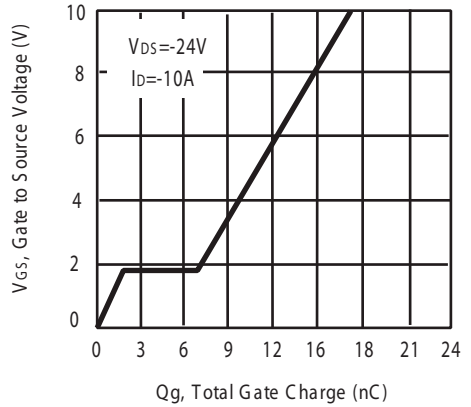
Figure 8. Body Diode Forward Voltage Variation with Source Current

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$V_{DS}$ , Drain-to Source Voltage (V)

Figure 9. Capacitance



$Q_g$ , Total Gate Charge (nC)

Figure 10. Gate Charge

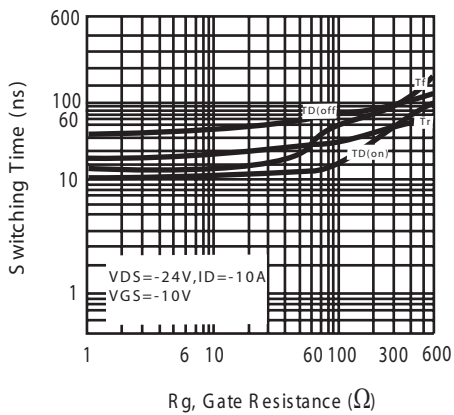


Figure 11. switching characteristics

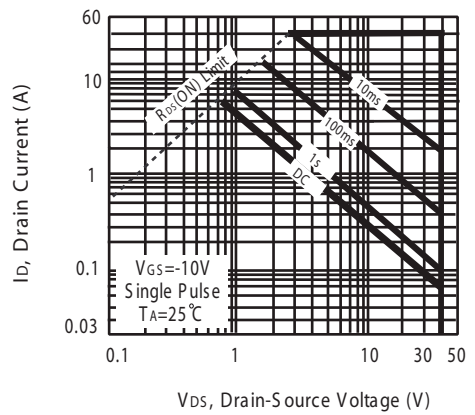


Figure 12. Maximum Safe Operating Area

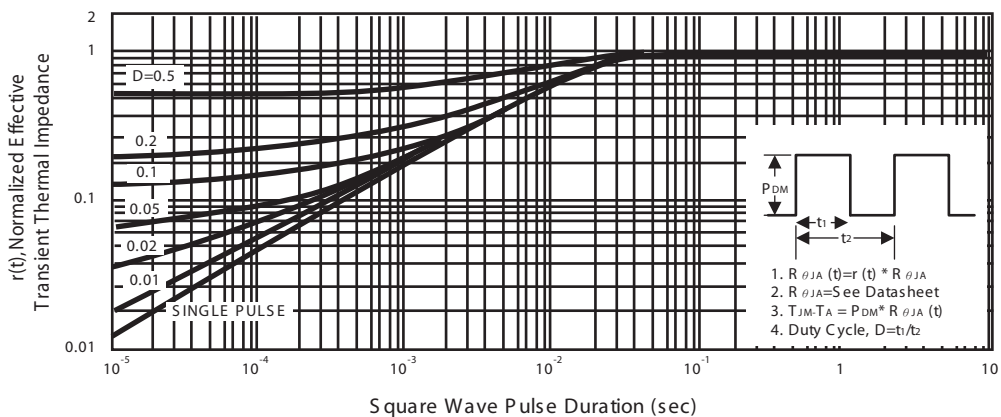
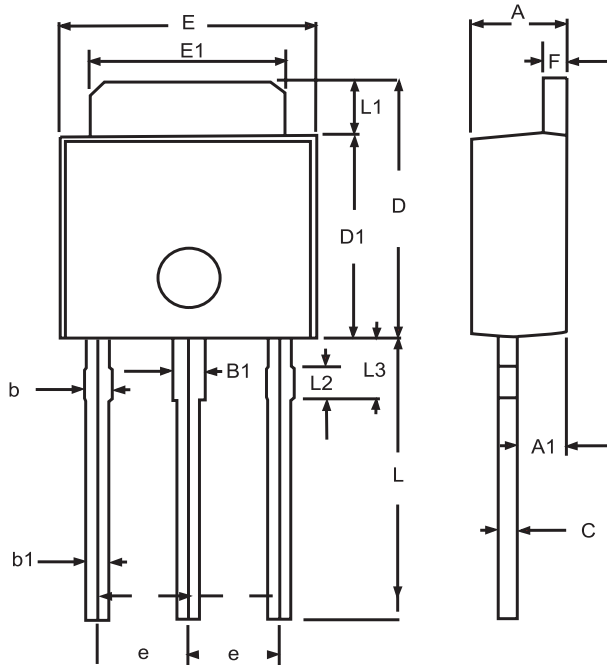


Figure 13. Normalized Thermal Transient Impedance Curve

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## PACKAGE OUTLINE DIMENSIONS

TO-251

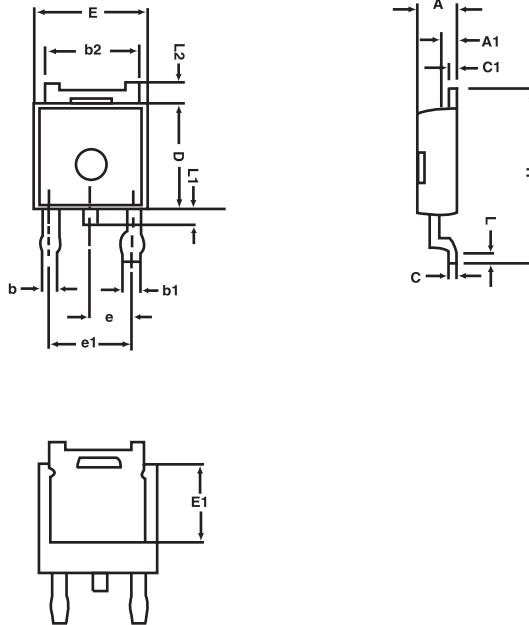


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.20	2.40	0.087	0.095
A1	1.100	1.300	0.043	0.051
B1	0.650	1.050	0.026	0.041
b	0.500	0.900	0.020	0.035
b1	0.400	0.800	0.016	0.32
C	0.400	0.600	0.016	0.024
D	6.700	7.300	0.264	0.287
D1	5.400	5.650	0.213	0.222
E	6.40	6.650	0.252	0.262
e	2.100	2.500	0.083	0.098
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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## PACKAGE OUTLINE DIMENSIONS

TO-252

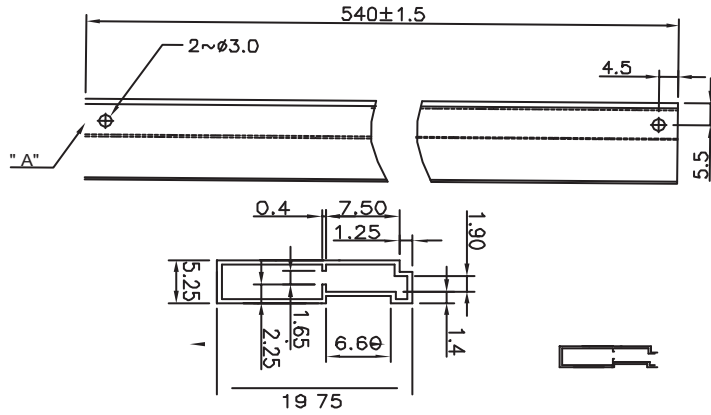


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.25	2.35	0.089	0.093
A1	0.95	1.05	0.037	0.041
b	0.77	0.85	0.030	0.033
b1	0.84	0.94	0.033	0.037
b2	5.30	5.45	0.209	0.215
C	0.49	0.53	0.019	0.021
D	6.00	6.20	0.236	0.244
E	6.40	6.60	0.252	0.260
E1	3.18	3.67	0.125	0.145
e	2.29	BSC	0.090	BSC
H	9.70	10.10	0.382	0.398
L	1.425	1.625	0.056	0.064
L1	0.650	0.850	0.026	0.033
L2	0.600	REF.	0.024	REF.

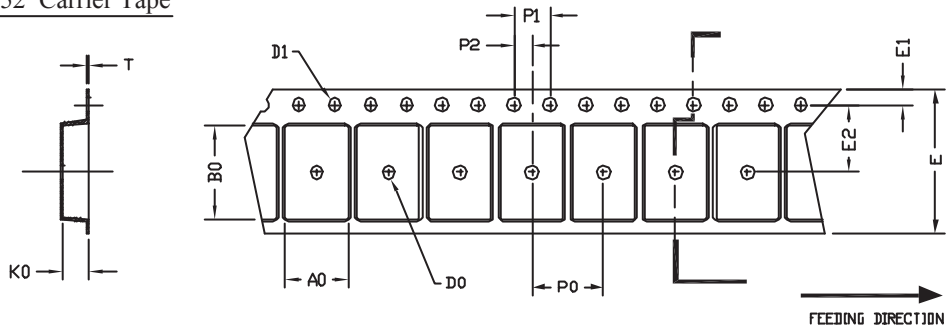
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## TO251 Tube/TO-252 Tape and Reel Data

### TO-251 Tube



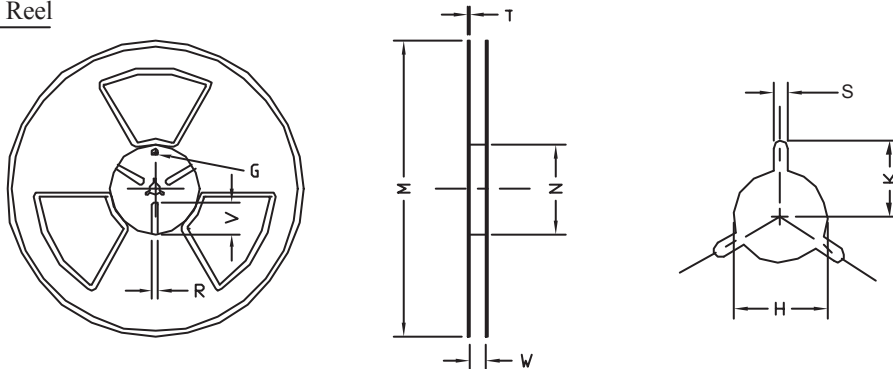
### TO-252 Carrier Tape



UNIT:mm

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
TO-252 (16 mm)	6.80 $\pm 0.1$	10.3 $\pm 0.1$	2.50 $\pm 0.1$	$\phi 2$	$\phi 1.5$ $+ 0.1$ $- 0$	16.0 $0.3 \pm$	1.75 $0.1 \pm$	7.5 $\pm 0.15$	8.0 $\pm 0.1$	4.0 $\pm 0.1$	2.0 $\pm 0.15$	0.3 $\pm 0.05$

### TO-252 Reel



UNIT:mm

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