



STU/D2040PL

P-Channel Enhancement Mode MOSFET

PRODUCT SUMMARY

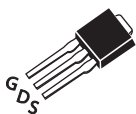
V _{DS}	I _D	R _{DS(ON)} (m Ω) Max
-40V	-20A	45 @ V _{GS} = -10V
		60 @ V _{GS} = -4.5V

FEATURES

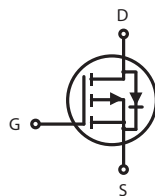
- Super high dense cell design for low R_{DS(ON)}.
- Rugged and reliable.
- TO-252 and TO-251 Package.



STU SERIES
TO-252AA(D-PAK)



STD SERIES
TO-251(I-PAK)



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

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		V _{DS}	-40	V
Gate-Source Voltage		V _{GS}	±20	V
Drain Current-Continuous ^a @ T _a	25°C	I _D	-20	A
	70°C		-16.7	A
-Pulsed ^b		I _{DM}	-84	A
Drain-Source Diode Forward Current ^a		I _S	-20	A
Maximum Power Dissipation ^a	T _a = 25°C	P _D	50	W
	T _a =70°C		35	
Operating Junction and Storage Temperature Range		T _J , T _{STG}	-55 to 175	°C

THERMAL CHARACTERISTICS

Thermal Resistance, Junction-to-Case	R θ JC	3	°C/W
Thermal Resistance, Junction-to-Ambient	R θ JA	50	°C/W

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

Parameter	Symbol	Condition	Min	Typ ^c	Max	Unit
OFF CHARACTERISTICS						
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	μA
Gate-Body Leakage	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$			± 100	nA
ON CHARACTERISTICS ^b						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.8	-1.5	-2.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-16A$		35	45	m ohm
		$V_{GS}=-4.5V, I_D=-10A$		46	60	m ohm
On-State Drain Current	$I_{D(ON)}$	$V_{DS}=-5V, V_{GS}=-10V$	50			A
Forward Transconductance	g_{FS}	$V_{DS}=-10V, I_D=-15A$		15		S
DYNAMIC CHARACTERISTICS ^c						
Input Capacitance	C_{ISS}	$V_{DS}=-10V, V_{GS}=0V$ $f=1.0MHz$		1115	1250	pF
Output Capacitance	C_{OSS}			200	225	pF
Reverse Transfer Capacitance	C_{RSS}			125	140	pF
Gate resistance	R_g	$V_{GS}=0V, V_{DS}=0V, f=1.0MHz$		3		ohm
SWITCHING CHARACTERISTICS ^c						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=-24V$ $I_D=-16A$ $V_{GS}=-10V$ $R_{GEN}=4.7\text{ ohm}$		11.5	13	ns
Rise Time	t_r			7.3	8.5	ns
Turn-Off Delay Time	$t_{D(OFF)}$			53.1	62	ns
Fall Time	t_f			31.8	37	ns
Total Gate Charge	Q_g	$V_{DS}=-24V, I_D=-16A, V_{GS}=-10V$		19.5	22	nC
		$V_{DS}=-24V, I_D=-16A, V_{GS}=-4.5V$		9.4	11	nC
Gate-Source Charge	Q_{gs}	$V_{DS}=-24V, I_D=-16A$ $V_{GS}=-10V$		4.1	4.8	nC
Gate-Drain Charge	Q_{gd}			2.8	3.2	nC

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ELECTRICAL CHARACTERISTICS (T_c=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
DRAIN-SOURCE DIODE CHARACTERISTICS ^a						
Diode Forward Voltage	V _{SD}	V _{GS} = 0V, I _s = -20A		-1.02	-1.3	V

Notes

- a. Pulse Test: Pulse Width ≤ 300us, Duty Cycle ≤ 2%.
- b. Guaranteed by design, not subject to production testing.

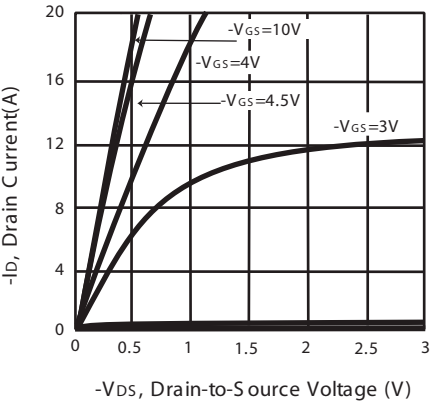


Figure 1. Output Characteristics

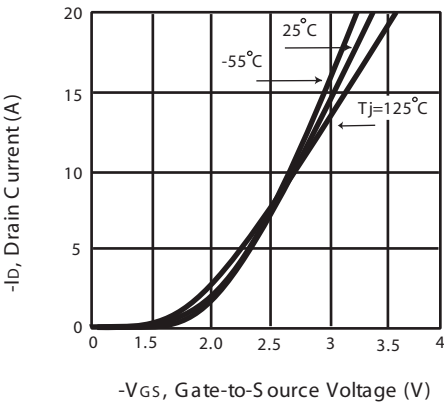


Figure 2. Transfer Characteristics

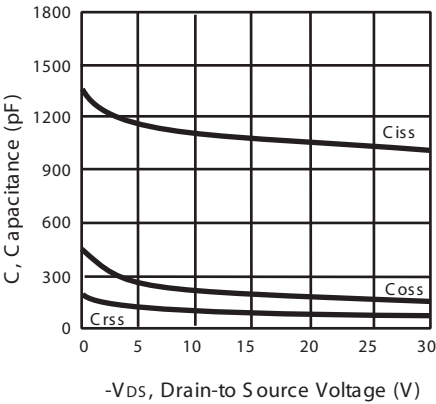


Figure 3. Capacitance

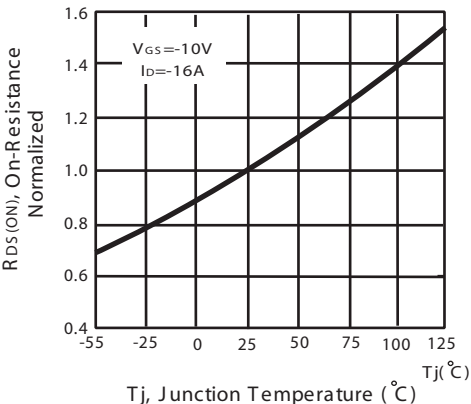


Figure 4. On-Resistance Variation with Drain Current and Temperature

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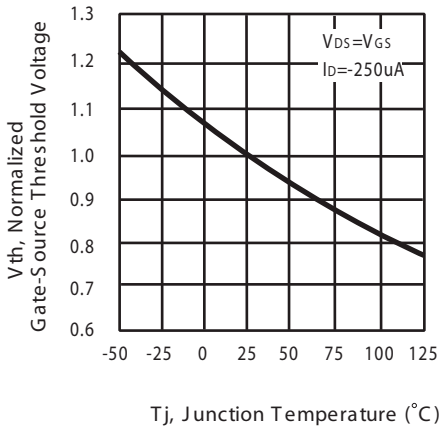


Figure 5. Gate Threshold Variation with Temperature

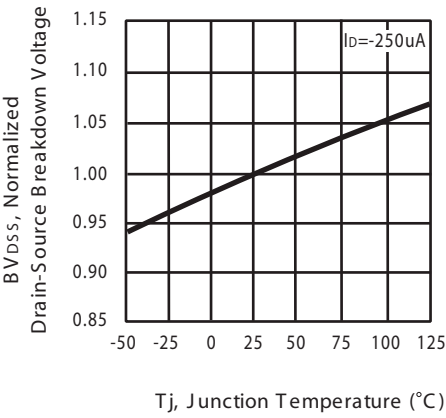


Figure 6. Breakdown Voltage Variation with Temperature

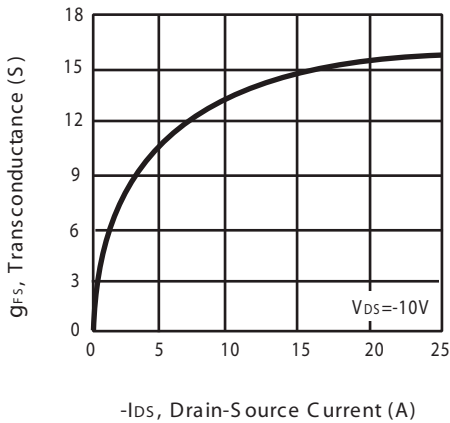


Figure 7. Transconductance Variation with Drain Current

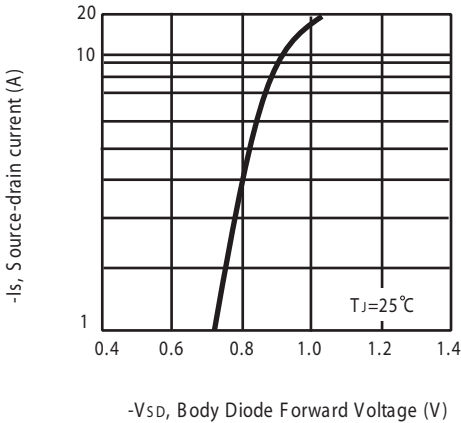


Figure 8. Body Diode Forward Voltage Variation with Source Current

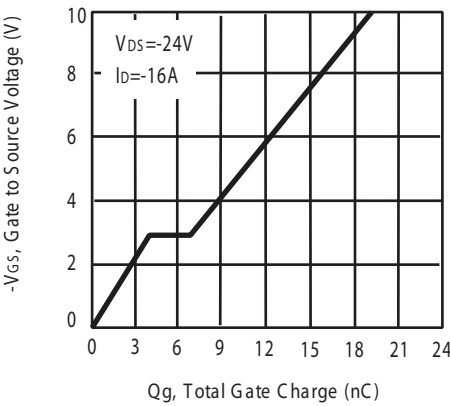


Figure 9. Gate Charge

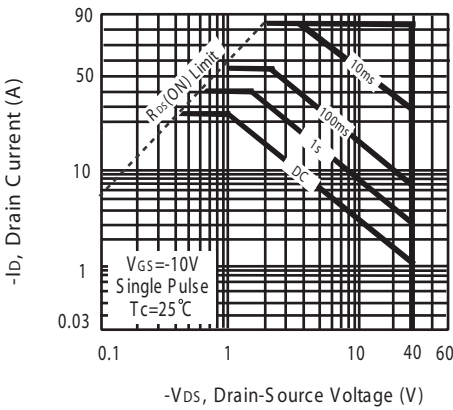


Figure 10. Maximum Safe Operating Area

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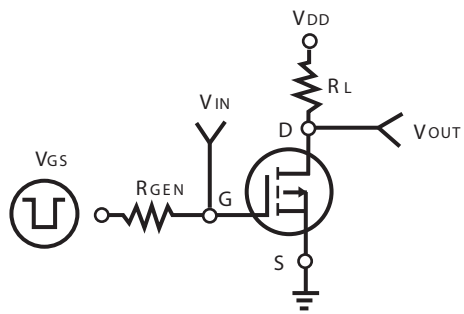


Figure 11. S switching Test Circuit

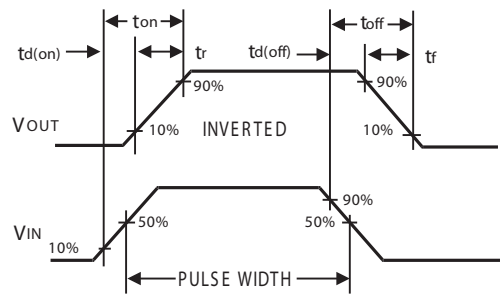
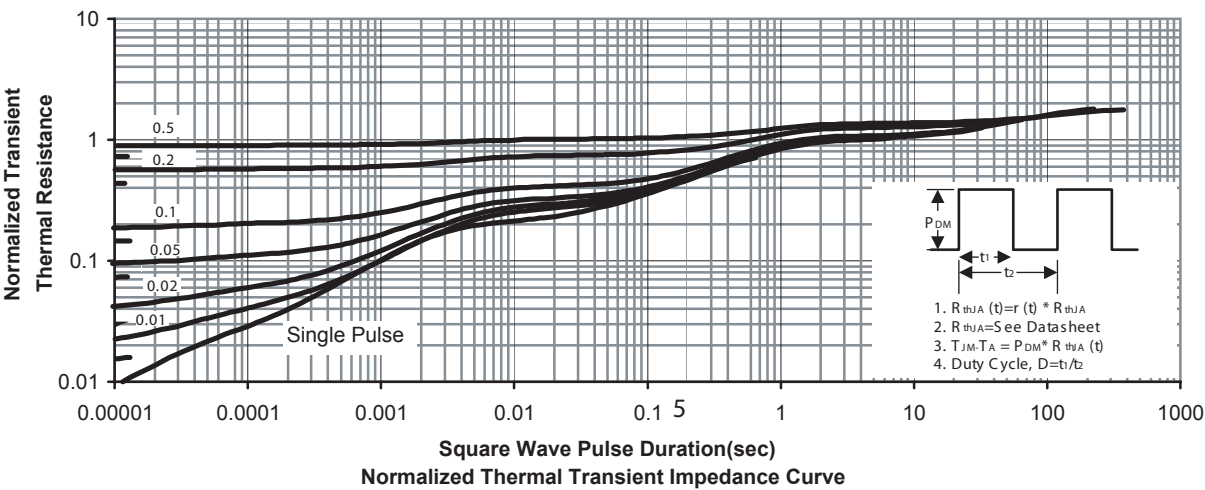


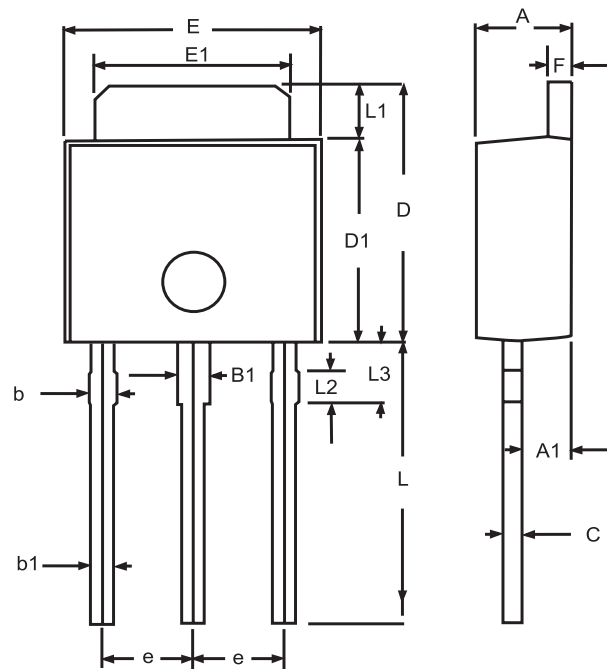
Figure 12. S switching Waveforms



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PACKAGE OUTLINE DIMENSIONS

TO-251

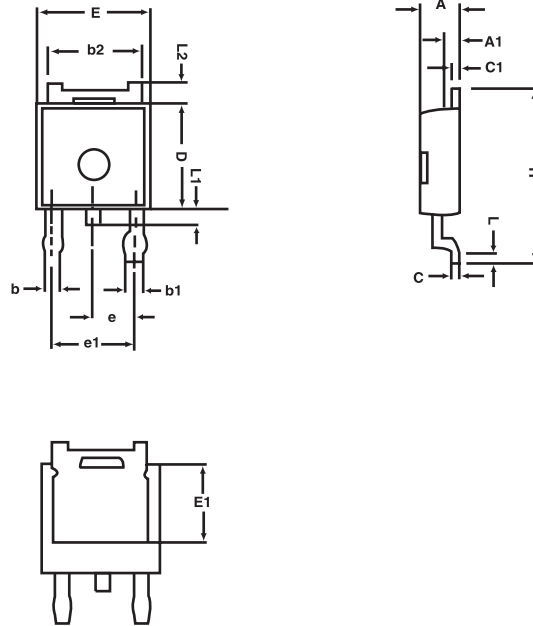


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.20	2.40	0.087	0.095
A1	1.100	1.300	0.043	0.051
B1	0.650	1.050	0.026	0.041
b	0.500	0.900	0.020	0.035
b1	0.400	0.800	0.016	0.32
C	0.400	0.600	0.016	0.024
D	6.700	7.300	0.264	0.287
D1	5.400	5.650	0.213	0.222
E	6.40	6.650	0.252	0.262
e	2.100	2.500	0.083	0.098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

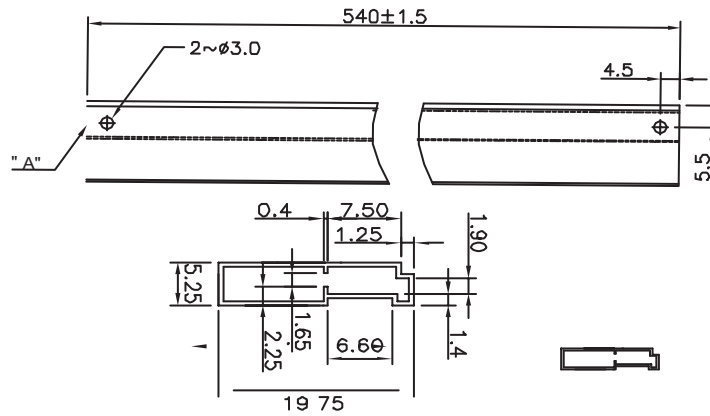


SYMBOLS	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.25	2.35	0.089	0.093
A1	0.95	1.05	0.037	0.041
b	0.77	0.85	0.030	0.033
b1	0.84	0.94	0.033	0.037
b2	5.30	5.45	0.209	0.215
C	0.49	0.53	0.019	0.021
D	6.00	6.20	0.236	0.244
E	6.40	6.60	0.252	0.260
E1	3.18	3.67	0.125	0.145
e	2.29	BSC	0.090	BSC
H	9.70	10.10	0.382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

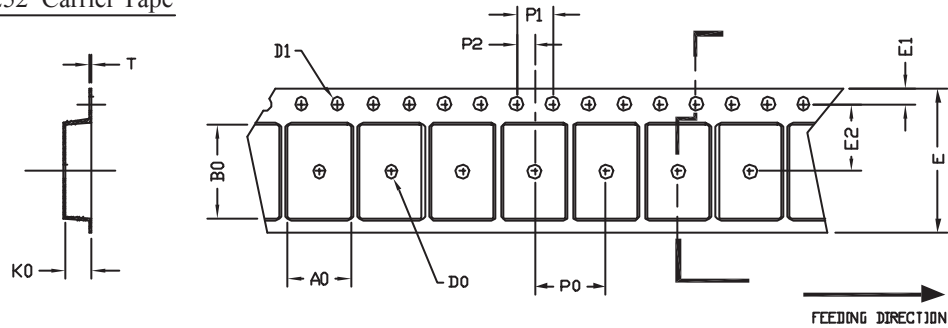
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TO251 Tube/TO-252 Tape and Reel Data

TO-251 Tube



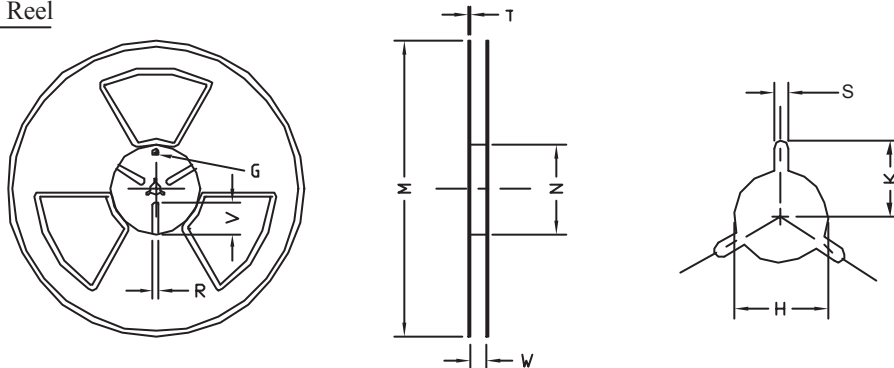
TO-252 Carrier Tape



UNIT:mm

PACKAGE	A0	B0	K0	D0	D1	E	E1	E2	P0	P1	P2	T
TO-252 (16 mm)	6.80 ± 0.1	10.3 ± 0.1	2.50 ± 0.1	$\phi 2$	$\phi 1.5$ $+ 0.1$ $- 0$	16.0 $0.3 \pm$	1.75 $0.1 \pm$	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	$\phi 330$	$\phi 330$ ± 0.5	$\phi 97$ ± 1.0	17.0 $+ 1.5$ $- 0$	2.2	$\phi 13.0$ $+ 0.5$ $- 0.2$	10.6	2.0 ± 0.5	---	---	---