

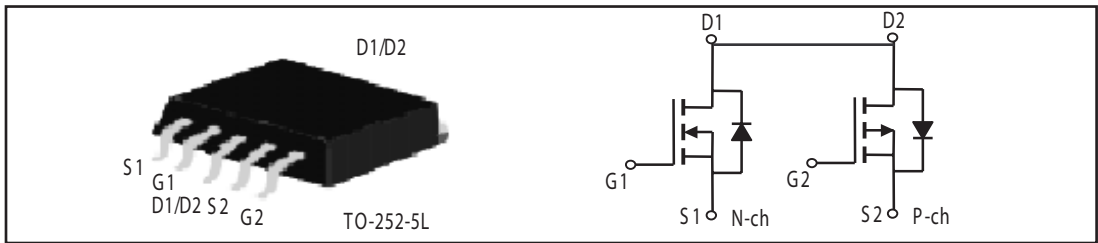


# STU405D

## Dual Enhancement Mode Field Effect Transistor ( N and P Channel)

PRODUCT SUMMARY (N-Channel)		
V <sub>DSS</sub>	I <sub>D</sub>	R <sub>DS(ON)</sub> ( mΩ ) Max
40V	16A	30 @ V <sub>GS</sub> = 10V
		40 @ V <sub>GS</sub> = 4.5V

PRODUCT SUMMARY (P-Channel)		
V <sub>DSS</sub>	I <sub>D</sub>	R <sub>DS(ON)</sub> ( mΩ ) Max
-40V	-12A	48 @ V <sub>GS</sub> = -10V
		65 @ V <sub>GS</sub> = -4.5V



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

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V <sub>DS</sub>	40	-40	V
Gate-Source Voltage		V <sub>GS</sub>	±20	±20	V
Drain Current-Continuous @ T <sub>c</sub>	25°C	I <sub>D</sub>	16	-12	A
	70°C		13.8	-10	A
-Pulsed <sup>a</sup>		I <sub>DM</sub>	50	-50	A
Drain-Source Diode Forward Current		I <sub>S</sub>	8	-6	A
Maximum Power Dissipation	T <sub>c</sub> = 25°C	P <sub>D</sub>	11		W
	T <sub>c</sub> = 70°C		7.7		
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>	13.6	°C/W
Thermal Resistance, Junction-to-Ambient	R <sub>θJA</sub>	120	°C/W

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N-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>a</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1	1.8	3	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V, I_D=8A$		22	30	m ohm
		$V_{GS}=4.5V, I_D=6A$		30	40	m ohm
On-State Drain Current	$I_{D(ON)}$	$V_{DS}=5V, V_{GS}=4.5V$	20			A
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=8A$		20		S
<b>DYNAMIC CHARACTERISTICS<sup>b</sup></b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=25V, V_{GS}=0V$ $f=1.0MHz$		885	1050	pF
Output Capacitance	$C_{OSS}$			105		pF
Reverse Transfer Capacitance	$C_{RSS}$			65		pF
Gate resistance	$R_g$	$V_{GS}=0V, V_{DS}=0V, f=1.0MHz$		0.32		ohm
<b>SWITCHING CHARACTERISTICS<sup>b</sup></b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=20V$ $I_D=1A$ $V_{GS}=10V$ $R_{GEN}=3.3\text{ ohm}$		16		ns
Rise Time	$t_r$			12		ns
Turn-Off Delay Time	$t_{D(OFF)}$			28		ns
Fall Time	$t_f$			7		ns
Total Gate Charge	$Q_g$	$V_{DS}=28V, I_D=8A, V_{GS}=10V$		17		nC
		$V_{DS}=28V, I_D=8A, V_{GS}=4.5V$		8.6		nC
Gate-Source Charge	$Q_{gs}$	$V_{DS}=28V, I_D=8A$		2.2		nC
Gate-Drain Charge	$Q_{gd}$	$V_{GS}=10V$		4.8		nC

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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>a</sup></b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-1	-1.6	-3	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-10V, I_D=-6A$		40	48	m ohm
		$V_{GS}=-4.5V, I_D=-4A$		50	65	m ohm
On-State Drain Current	$I_{D(ON)}$	$V_{DS}=-5V, V_{GS}=-10V$	-20			A
Forward Transconductance	$g_{FS}$	$V_{DS}=-10V, I_D=-6A$		12		S
<b>DYNAMIC CHARACTERISTICS<sup>b</sup></b>						
Input Capacitance	$C_{ISS}$	$V_{DS}=-25V, V_{GS}=0V$ $f=1.0MHz$		980	1150	pF
Output Capacitance	$C_{OSS}$			135		pF
Reverse Transfer Capacitance	$C_{RSS}$			90		pF
Gate resistance	$R_g$	$V_{GS}=0V, V_{DS}=0V, f=1.0MHz$		2.2		ohm
<b>SWITCHING CHARACTERISTICS<sup>b</sup></b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD}=-20V$ $I_D=-1A$ $V_{GS}=-10V$ $R_{GEN}=3.3\text{ ohm}$		12		ns
Rise Time	$t_r$			17		ns
Turn-Off Delay Time	$t_{D(OFF)}$			82		ns
Fall Time	$t_f$			35		ns
Total Gate Charge	$Q_g$	$V_{DS}=-28V, I_D=-6A, V_{GS}=-10V$		20.7		nC
		$V_{DS}=-28V, I_D=-6A, V_{GS}=-4.5V$		11		nC
Gate-Source Charge	$Q_{gs}$	$V_{DS}=-28V, I_D=-6A$		1.5		nC
Gate-Drain Charge	$Q_{gd}$	$V_{GS}=-10V$		6.2		nC

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

Parameter	Symbol	Condition	Min	Typ <sup>c</sup>	Max	Unit
<b>DRAIN-SOURCE DIODE CHARACTERISTICS<sup>b</sup></b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0\text{V}, I_S = 8\text{A}$	N-Ch	0.98	1.2	V
		$V_{GS} = 0\text{V}, I_S = -6\text{A}$	P-Ch	-0.9	-1.2	

Notes

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

N-Channel

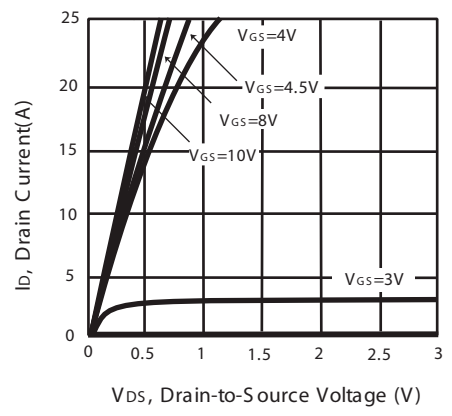


Figure 1. Output Characteristics

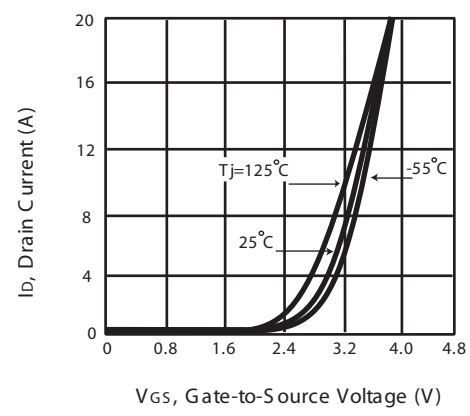


Figure 2. Transfer Characteristics

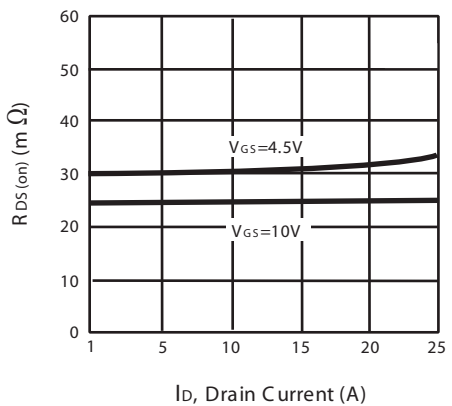


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

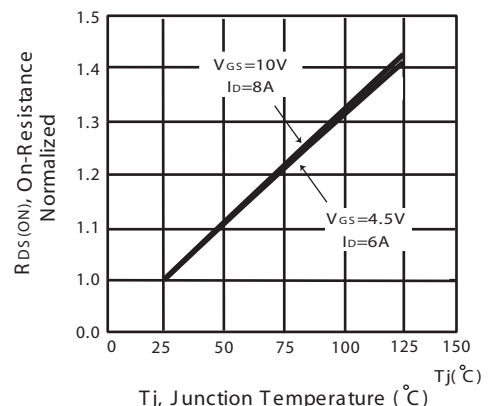


Figure 4. On-Resistance Variation with Drain Current and Temperature

# STU405D

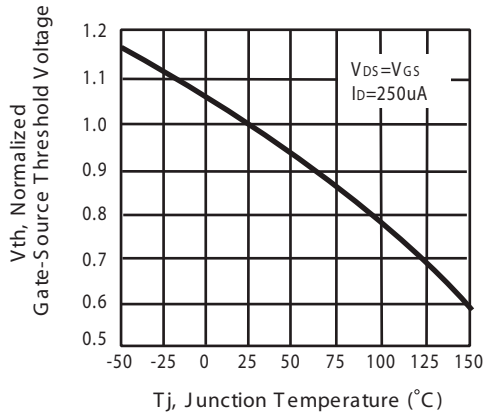


Figure 5. Gate Threshold Variation with Temperature

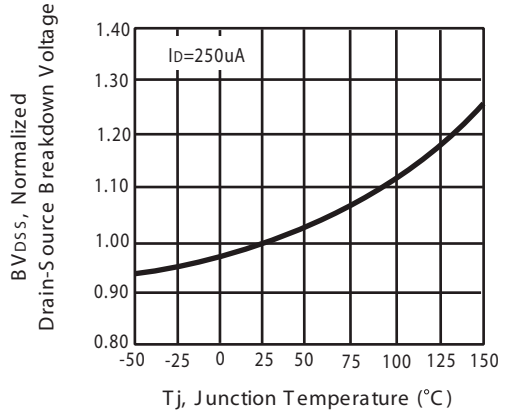


Figure 6. Breakdown Voltage Variation with Temperature

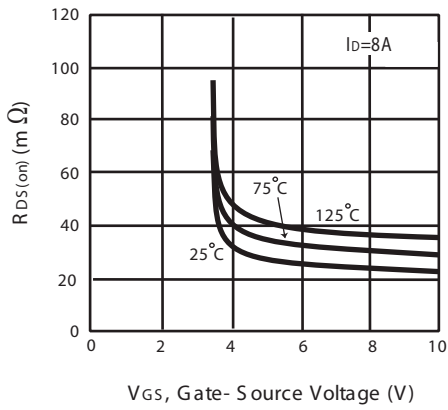


Figure 7. On-Resistance vs. Gate-Source Voltage

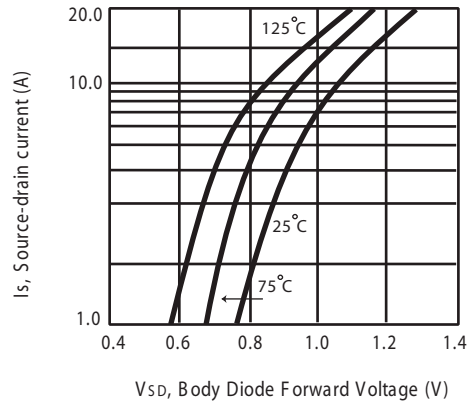


Figure 8. Body Diode Forward Voltage Variation with Source Current

# STU405D

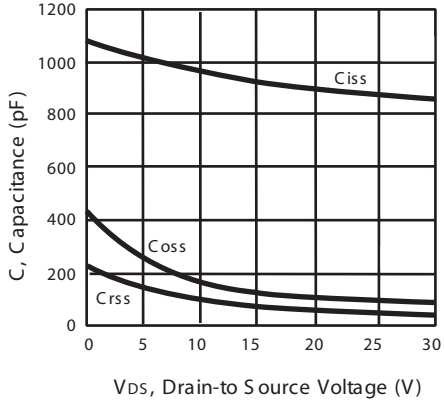


Figure 9. Capacitance

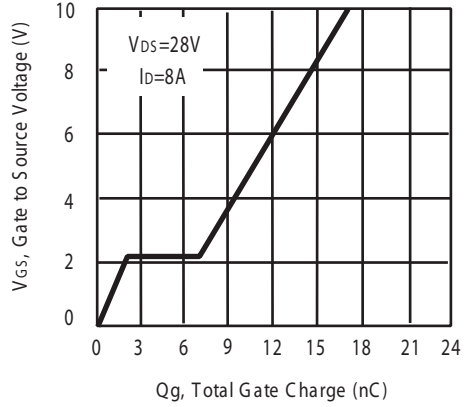


Figure 10. Gate Charge

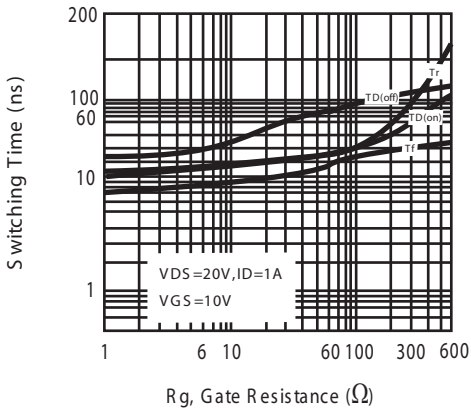


Figure 11. switching characteristics

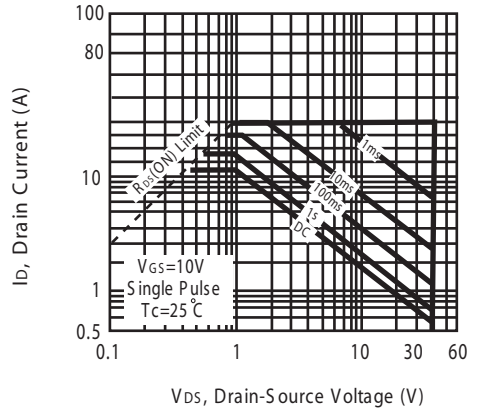


Figure 12. Maximum Safe Operating Area

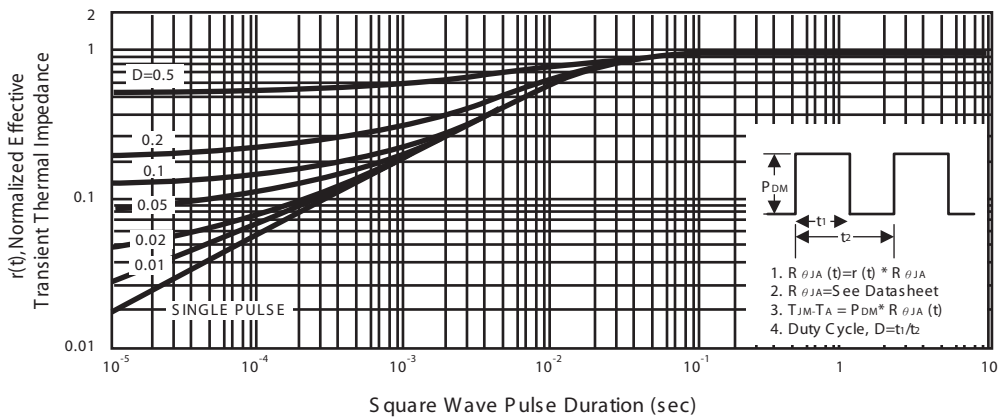


Figure 13. Normalized Thermal Transient Impedance Curve

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## P-Channel

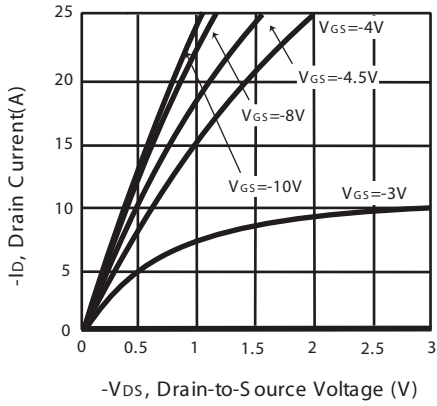


Figure 1. Output Characteristics

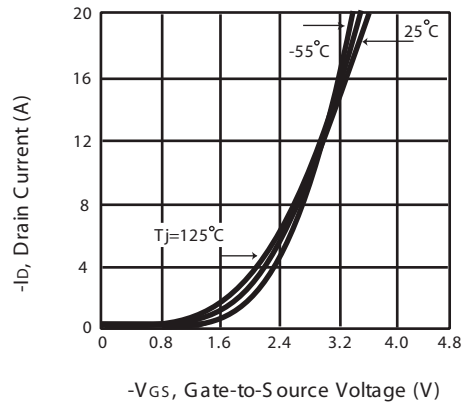


Figure 2. Transfer Characteristics

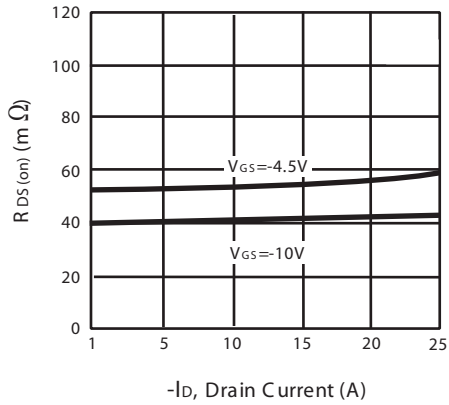


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

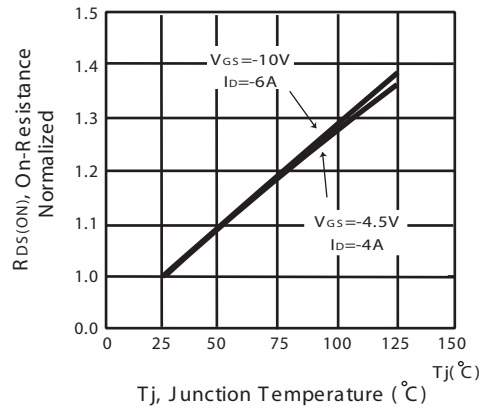


Figure 4. On-Resistance Variation with Drain Current and Temperature

# STU405D

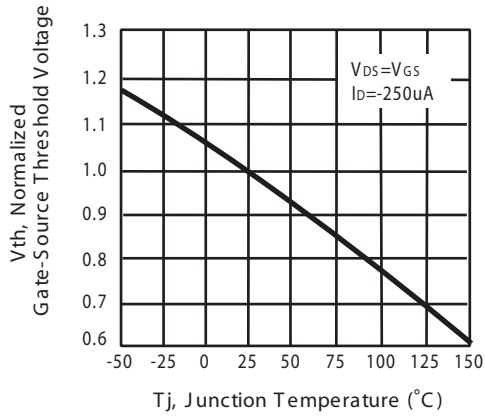


Figure 5. Gate Threshold Variation with Temperature

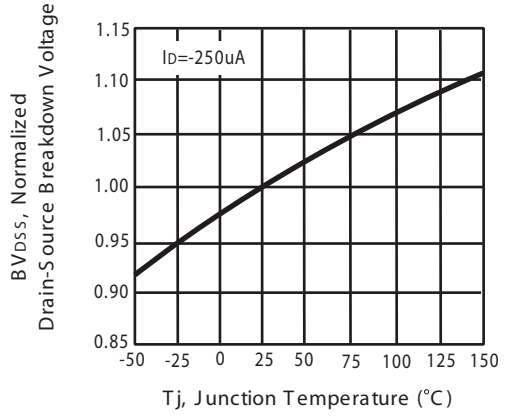


Figure 6. Breakdown Voltage Variation with Temperature

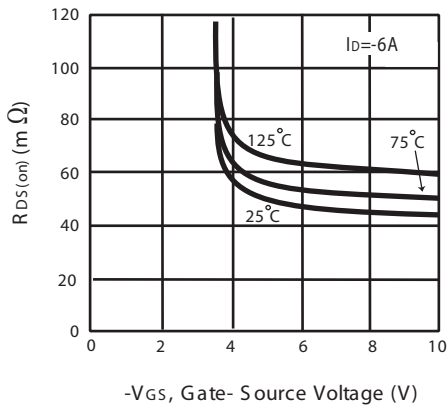


Figure 7. On-Resistance vs. Gate-Source Voltage

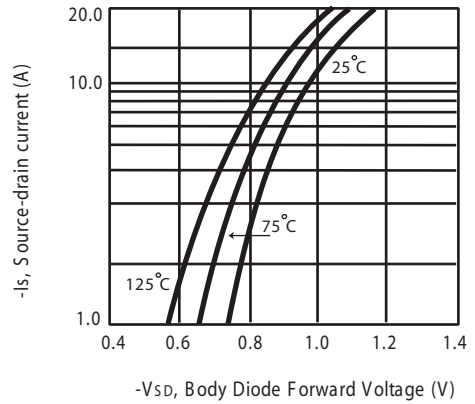


Figure 8. Body Diode Forward Voltage Variation with Source Current



# STU405D

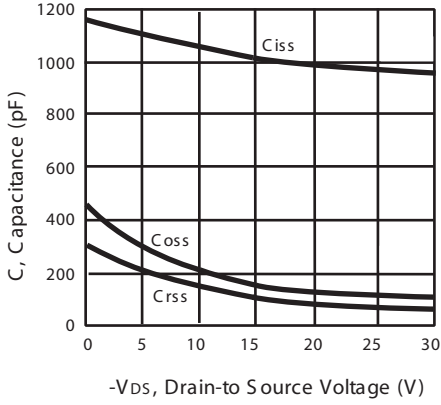


Figure 9. Capacitance

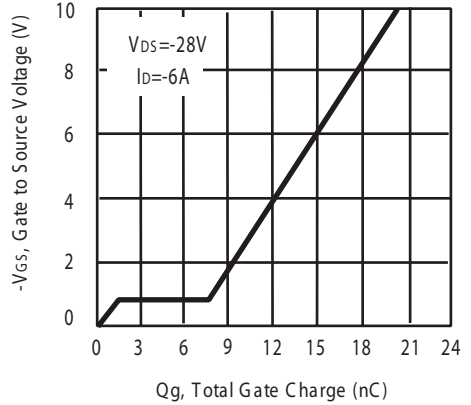


Figure 10. Gate Charge

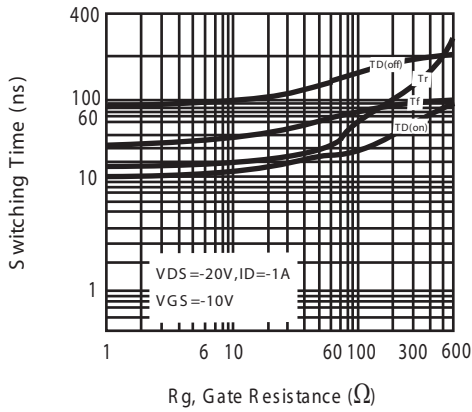


Figure 11. switching characteristics

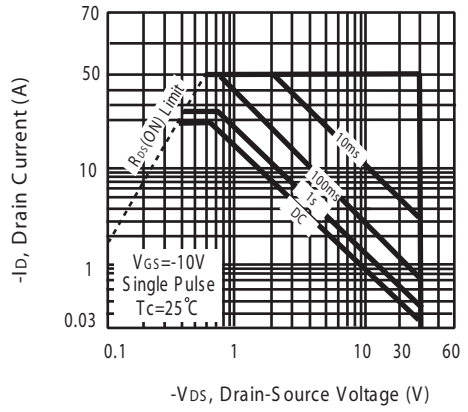


Figure 12. Maximum Safe Operating Area

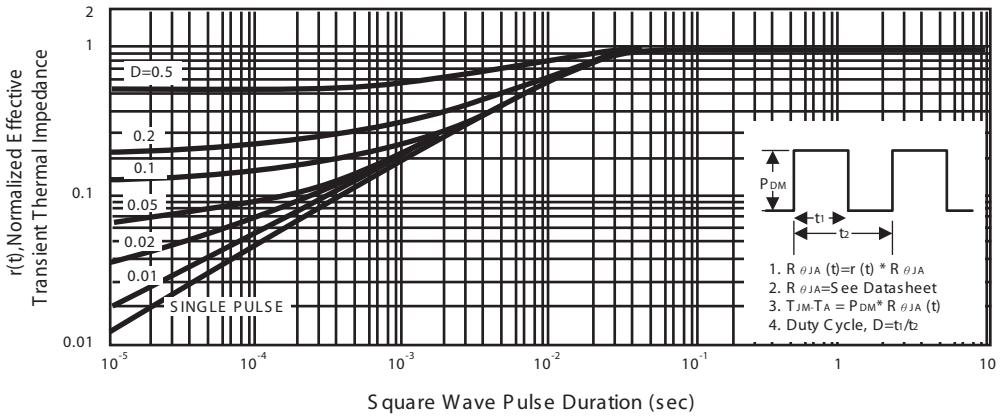
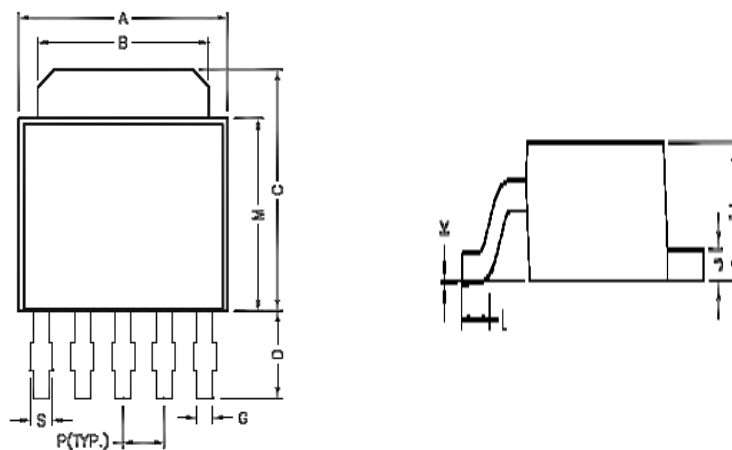


Figure 13. Normalized Thermal Transient Impedance Curve

# STU405D

## PACKAGE OUTLINE DIMENSIONS

TO-252-5L

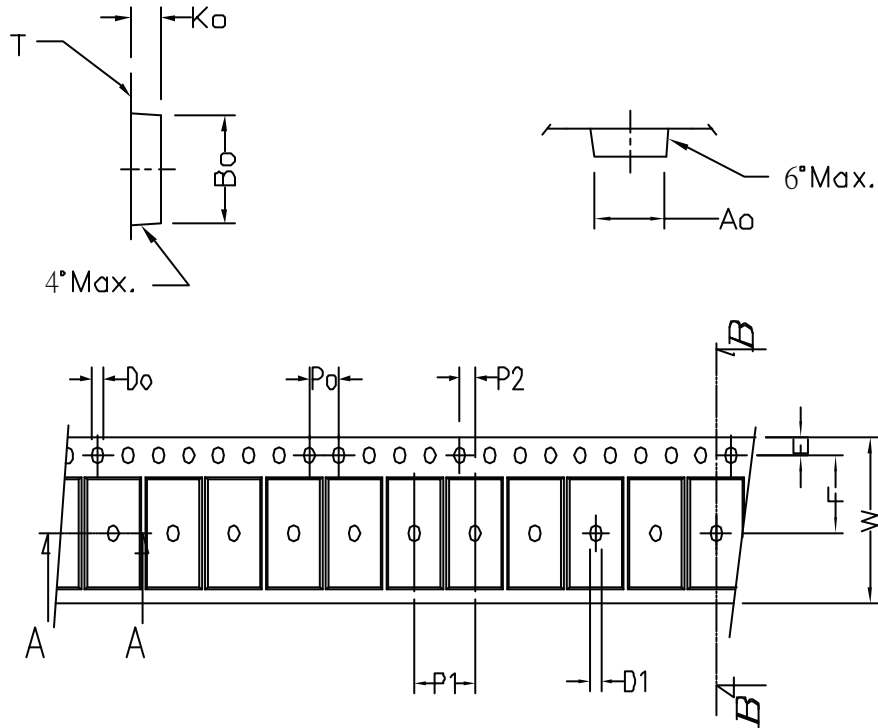


REF .	Millimeters		REF .	Millimeters	
	MIN	MAX		MIN	MAX
A	6.40	6.80	G	0.40	0.60
B	5.20	5.50	H	2.2	2.40
C	6.80	7.20	J	0.45	0.55
D	2.20	2.80	K	0	0.15
P	1.27 REF.		L	0.90	1.50
S	0.50	0.80	M	5.40	5.80

# STU405D

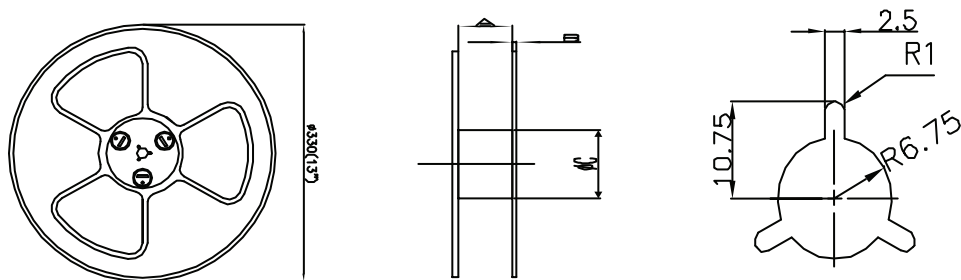
## TO-252-5L Tape and Reel Data

### TO-252-5L Carrier Tape



symbol	$A_0$	$B_0$	$K_0$	$P_0$	$P_1$	$P_2$	$T$
Spec	$6.96 \pm 0.1$	$10.49 \pm 0.1$	$2.79 \pm 0.1$	$4.0 \pm 0.1$	$8.0 \pm 0.10$	$2.0 \pm 0.05$	$0.33 \pm 0.013$
symbol	$E$	$F$	$D_0$	$D_1$	$W$	$10P_0$	
Spec	$1.75 \pm 0.1$	$7.5 \pm 0.05$	$1.55 \pm 0.05$	$1.5 \pm 0.25$	$16.0 \pm 0.3$	$40.0 \pm 0.2$	

### TO-252-5L Reel



UNIT:mm

Width of carrier tape	8	12	16	24	32	44	56
$A \pm 0.1$	9.4	13.4	17.4	25.4	33.4	45.4	57.4
$B$	2.3	2.3	2.3	2.3	2.3	2.3	2.3
$\phi C$	100	100	100	100	100	100	100