



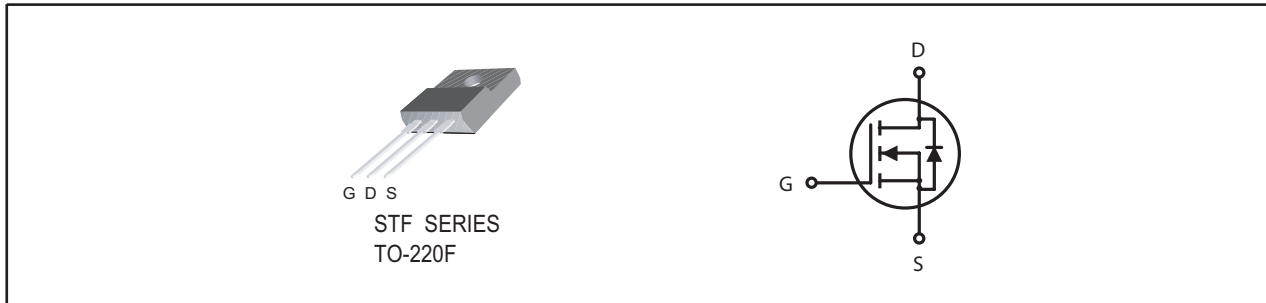
## N-Channel Enhancement Mode Field Effect Transistor

### PRODUCT SUMMARY

V <sub>DSS</sub>	I <sub>D</sub>	R <sub>DS(ON)</sub> (mΩ) Max
60V	22A	19 @ V <sub>GS</sub> =10V
		29 @ V <sub>GS</sub> =4.5V

### FEATURES

- Super high dense cell design for low R<sub>DS(ON)</sub>.
- Rugged and reliable.
- TO-220F Package.



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

Symbol	Parameter	Limit	Units
V <sub>DS</sub>	Drain-Source Voltage	60	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	22
		T <sub>C</sub> =70°C	17.7
I <sub>DM</sub>	-Pulsed <sup>b</sup>	66	A
E <sub>AS</sub>	Avalanche Energy <sup>d</sup>	182	mJ
P <sub>D</sub>	Maximum Power Dissipation <sup>a</sup>	T <sub>C</sub> =25°C	21
		T <sub>C</sub> =70°C	13.3
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>	6	°C/W
R <sub>θJA</sub>	Thermal Resistance, Junction-to-Ambient <sup>a</sup>	65	°C/W

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## ELECTRICAL CHARACTERISTICS (T<sub>A</sub>=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	60			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =48V , V <sub>GS</sub> =0V			1	uA
I <sub>GSS</sub>	Gate-Body Leakage Current	V <sub>GS</sub> = ±20V , V <sub>DS</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	1.8	3	V
R <sub>DS(ON)</sub>	Drain-Source On-State Resistance	V <sub>GS</sub> =10V , I <sub>D</sub> =11A		15	19	m ohm
		V <sub>GS</sub> =4.5V , I <sub>D</sub> =9A		21	29	m ohm
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> =20V , I <sub>D</sub> =11A		31		S
<b>DYNAMIC CHARACTERISTICS °</b>						
C <sub>ISS</sub>	Input Capacitance	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V f=1.0MHz		2180		pF
C <sub>OSS</sub>	Output Capacitance			196		pF
C <sub>RSS</sub>	Reverse Transfer Capacitance			132		pF
<b>SWITCHING CHARACTERISTICS °</b>						
t <sub>D(ON)</sub>	Turn-On Delay Time	V <sub>DD</sub> =30V I <sub>D</sub> =1A V <sub>GS</sub> =10V R <sub>GEN</sub> = 6 ohm		40		ns
t <sub>r</sub>	Rise Time			47		ns
t <sub>D(OFF)</sub>	Turn-Off Delay Time			65		ns
t <sub>f</sub>	Fall Time			37		ns
Q <sub>g</sub>	Total Gate Charge	V <sub>DS</sub> =30V, I <sub>D</sub> =11A, V <sub>GS</sub> =10V		34		nC
		V <sub>DS</sub> =30V, I <sub>D</sub> =11A, V <sub>GS</sub> =4.5V		17		nC
Q <sub>gs</sub>	Gate-Source Charge	V <sub>DS</sub> =30V, I <sub>D</sub> =11A, V <sub>GS</sub> =10V		4		nC
Q <sub>gd</sub>	Gate-Drain Charge			9		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		0.76	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> = 30V. (See Figure13)

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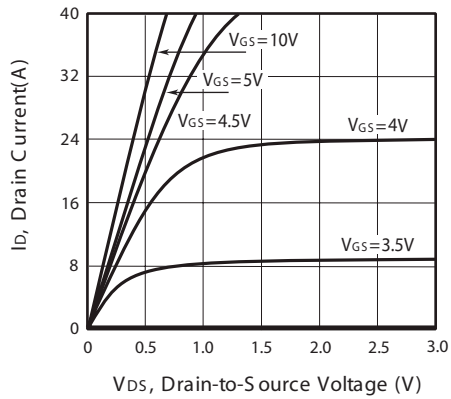


Figure 1. Output Characteristics

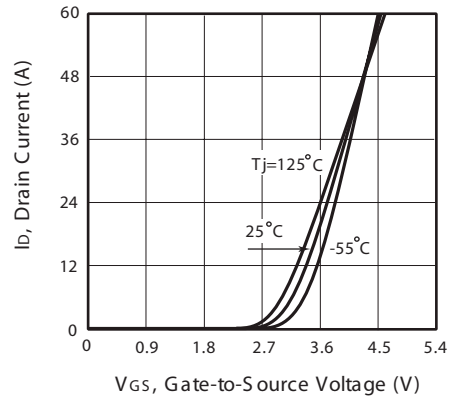


Figure 2. Transfer Characteristics

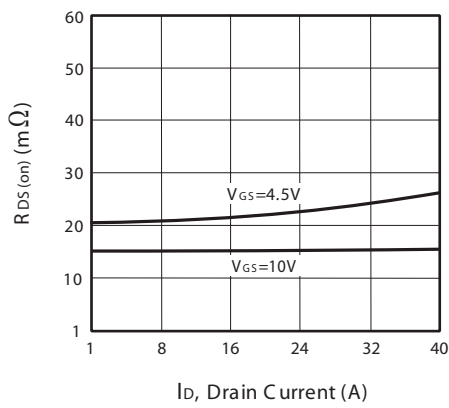


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

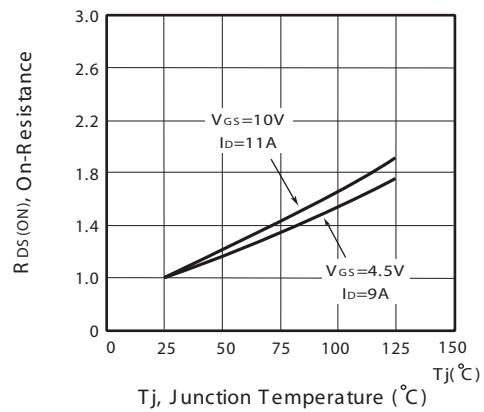


Figure 4. On-Resistance Variation with Drain Current and Temperature

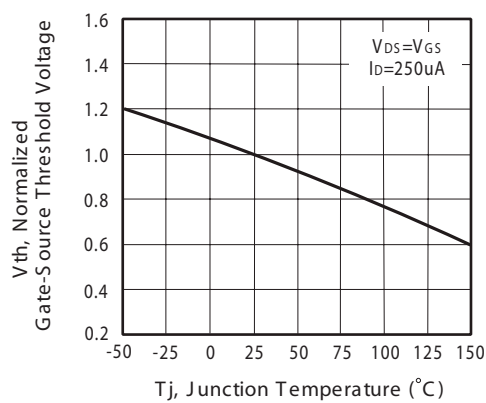


Figure 5. Gate Threshold Variation with Temperature

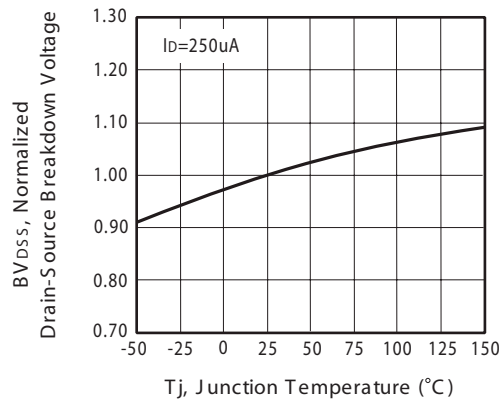


Figure 6. Breakdown Voltage Variation with Temperature

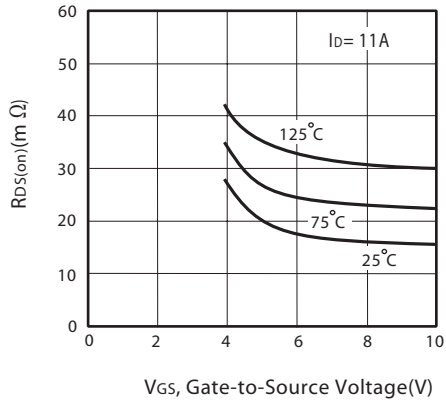


Figure 7. On-Resistance vs. Gate-Source Voltage

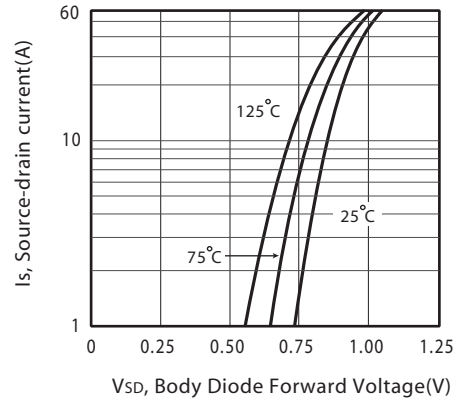


Figure 8. Body Diode Forward Voltage Variation with Source Current

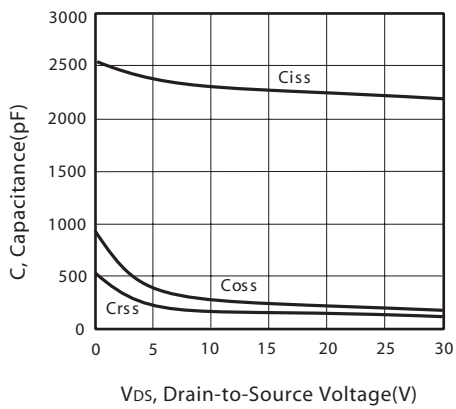


Figure 9. Capacitance

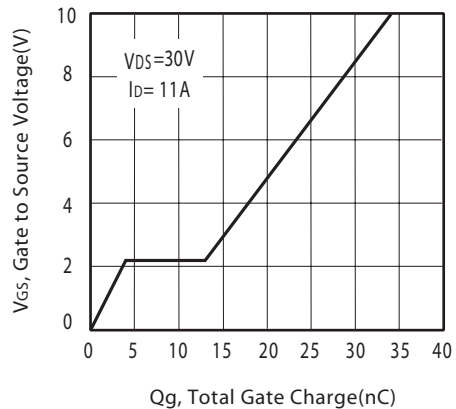


Figure 10. Gate Charge

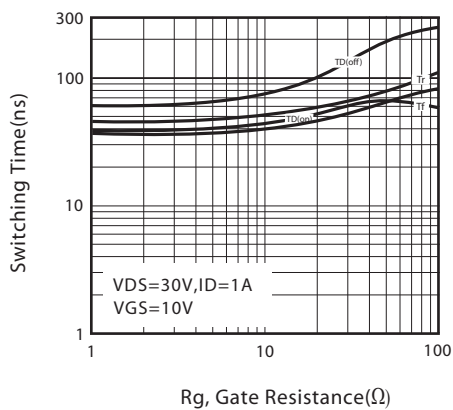


Figure 11. switching characteristics

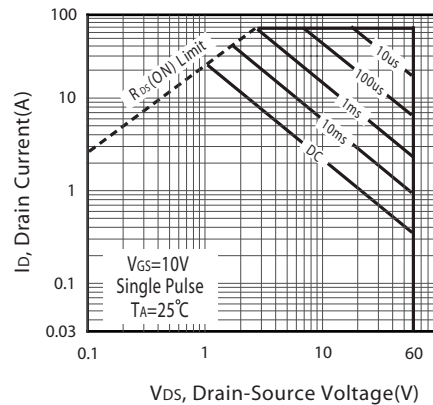
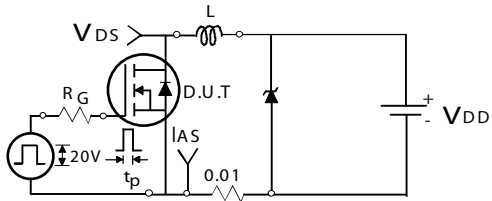
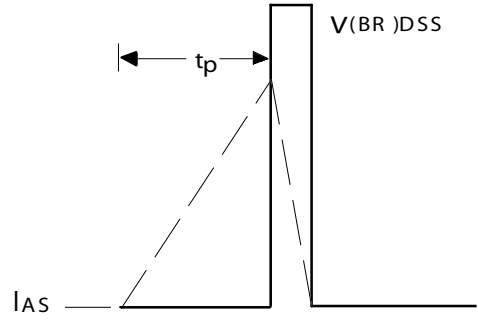


Figure 12. Maximum Safe Operating Area



Unclamped Inductive Test Circuit

Figure 13a.



Unclamped Inductive Waveforms

Figure 13b.

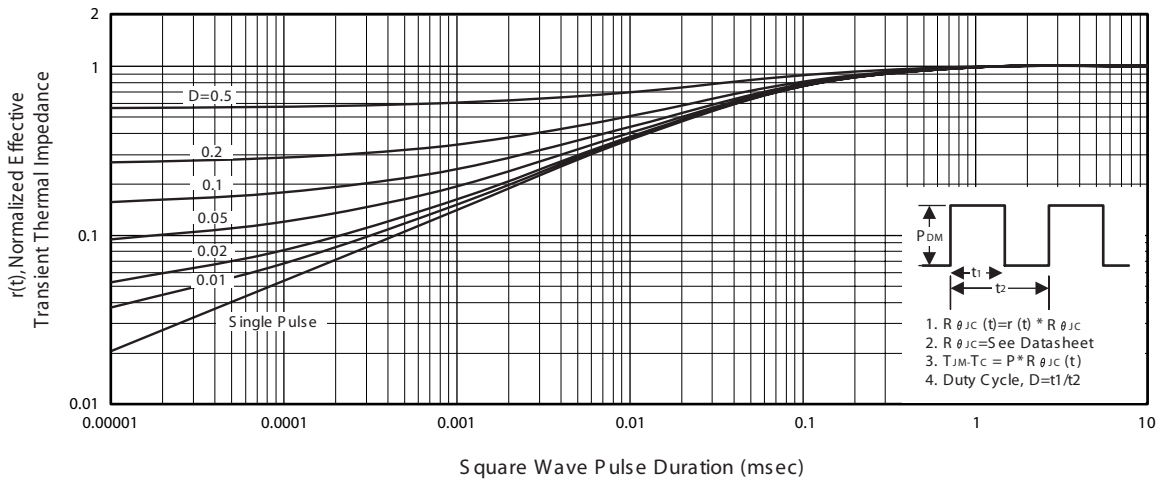
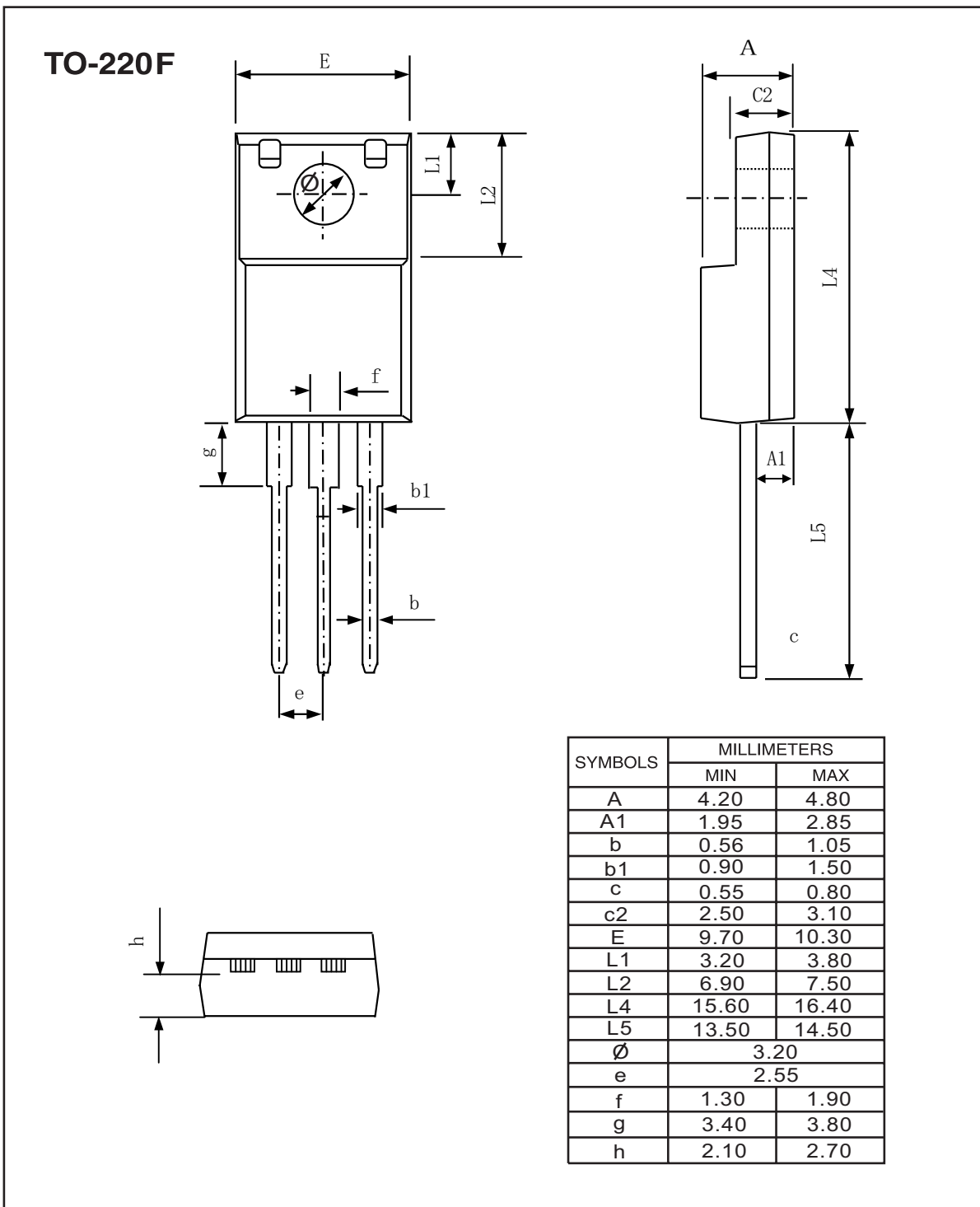


Figure 14. Normalized Thermal Transient Impedance Curve

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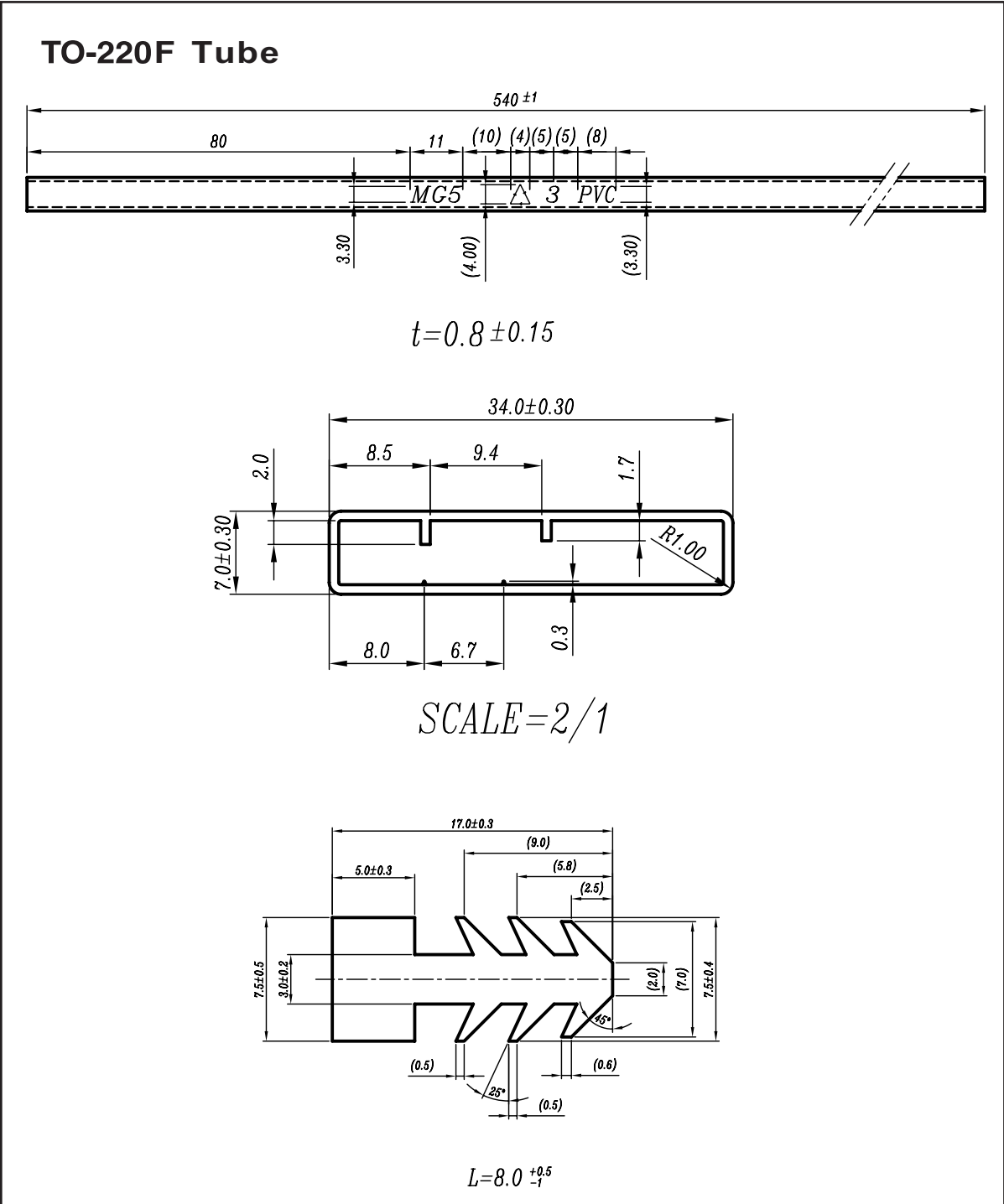
## PACKAGE OUTLINE DIMENSIONS



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