



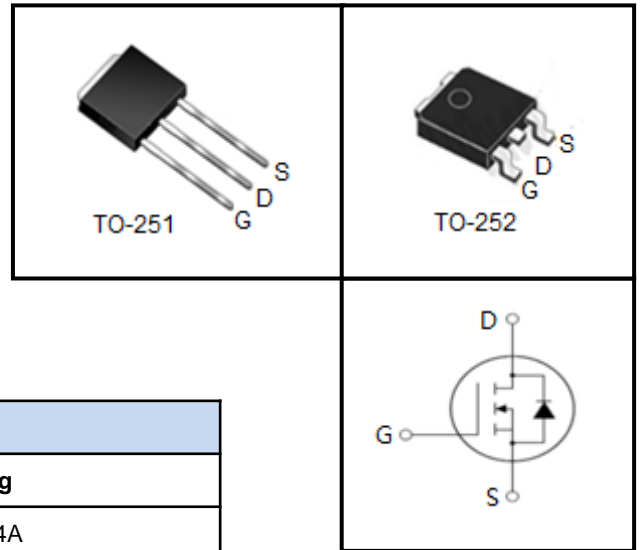
600V Super-Junction Power MOSFET

FEATURES

- Very low FOM $R_{DS(on)} \times Q_g$
- 100% avalanche tested
- RoHS compliant

APPLICATIONS

- Switch Mode Power Supply (SMPS)
- Uninterruptible Power Supply (UPS)
- Power Factor Correction (PFC)



Device Marking and Package Information		
Device	Package	Marking
TPU60R1K4A	TO-251	60R1K4A
TPD60R1K4A	TO-252	60R1K4A

Absolute Maximum Ratings $T_C = 25^\circ\text{C}$, unless otherwise noted				
Parameter	Symbol	Value		Unit
		TO-251	TO-252	
Drain-Source Voltage ($V_{GS} = 0\text{V}$)	V_{DSS}	600		V
Continuous Drain Current	I_D	3.2		A
Pulsed Drain Current (note1)	I_{DM}	9.6		A
Gate-Source Voltage	V_{GSS}	± 30		V
Single Pulse Avalanche Energy (note2)	E_{AS}	12		mJ
Avalanche Current (note1)	I_{AR}	3.2		A
Repetitive Avalanche Energy (note1)	E_{AR}	0.1		mJ
Power Dissipation ($T_C = 25^\circ\text{C}$)	P_D	37		W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	-55~+150		$^\circ\text{C}$

Thermal Resistance				
Parameter	Symbol	Value		Unit
		TO-251	TO-252	
Thermal Resistance, Junction-to-Case	R_{thJC}	3.3		K/W
Thermal Resistance, Junction-to-Ambient	R_{thJA}	75		



Specifications $T_J = 25^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Value			Unit
			Min.	Typ.	Max.	
Static						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	600	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 600V, V_{GS} = 0V, T_J = 25^\circ\text{C}$	--	--	1	μA
		$V_{DS} = 600V, V_{GS} = 0V, T_J = 150^\circ\text{C}$	--	--	100	
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 30V$	--	--	± 100	nA
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	2.5	--	3.5	V
Drain-Source On-Resistance (Note3)	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 1A$	--	1.24	1.39	Ω
Forward Transconductance (Note3)	g_{fs}	$V_{DS} = 10V, I_D = 1A$	--	3	--	S
Dynamic						
Input Capacitance	C_{iss}	$V_{GS} = 0V,$ $V_{DS} = 50V,$ $f = 1.0MHz$	--	418	--	pF
Output Capacitance	C_{oss}		--	124	--	
Reverse Transfer Capacitance	C_{rss}		--	4	--	
Total Gate Charge	Q_g	$V_{DD} = 480V, I_D = 3A,$ $V_{GS} = 10V$	--	9	--	nC
Gate-Source Charge	Q_{gs}		--	1.5	--	
Gate-Drain Charge	Q_{gd}		--	4.5	--	
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 300V, I_D = 3A,$ $R_G = 25\Omega$	--	12	30	ns
Turn-on Rise Time	t_r		--	32	71	
Turn-off Delay Time	$t_{d(off)}$		--	25	60	
Turn-off Fall Time	t_f		--	21	50	
Drain-Source Body Diode Characteristics						
Continuous Body Diode Current	I_S	$T_C = 25^\circ\text{C}$	--	--	3.2	A
Pulsed Diode Forward Current	I_{SM}		--	--	9.6	
Body Diode Voltage	V_{SD}	$T_J = 25^\circ\text{C}, I_{SD} = 3A, V_{GS} = 0V$	--	0.95	1.2	V
Reverse Recovery Time	t_{rr}	$V_R = 480V, I_F = I_S,$ $di_F/dt = 100A/\mu s$	--	250	--	ns
Reverse Recovery Charge	Q_{rr}		--	1.2	--	μC
Peak Reverse Recovery Current	I_{rrm}		--	11	--	A

Notes

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $I_{AS} = 1.5A, V_{DD} = 50V, R_G = 25\Omega, \text{Starting } T_J = 25^\circ\text{C}$
3. Pulse Test: Pulse width $\leq 300\mu s, \text{Duty Cycle } \leq 1\%$



Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 1. Output Characteristics ($T_J = 25^\circ\text{C}$)

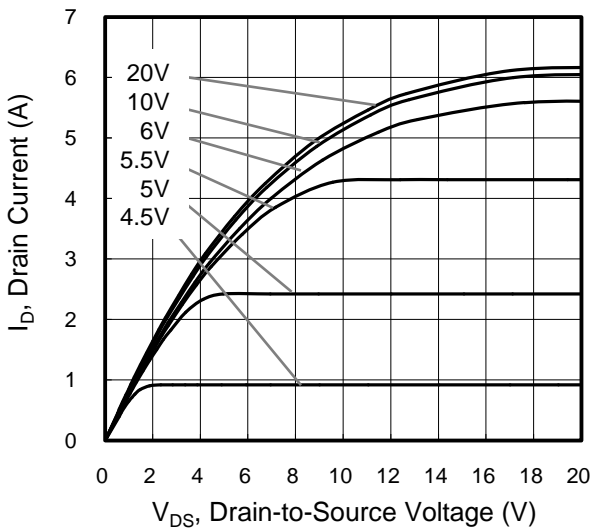


Figure 2. Output Characteristics ($T_J = 150^\circ\text{C}$)

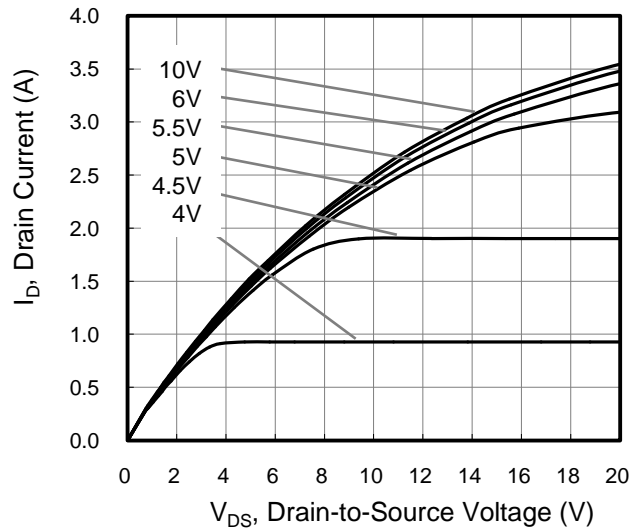


Figure 3. On-Resistance vs. Drain Current

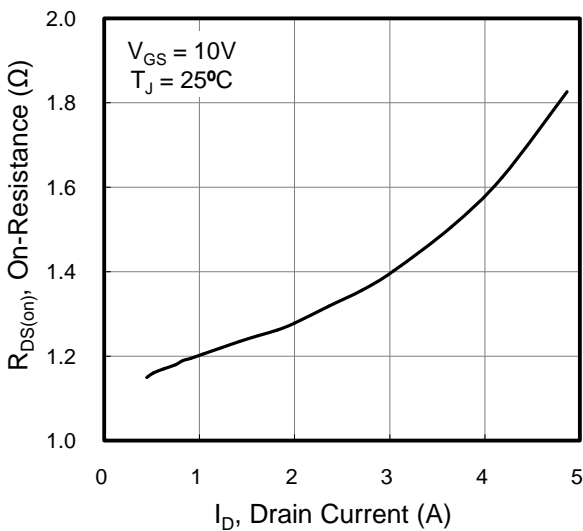


Figure 4. On-Resistance vs. Temperature

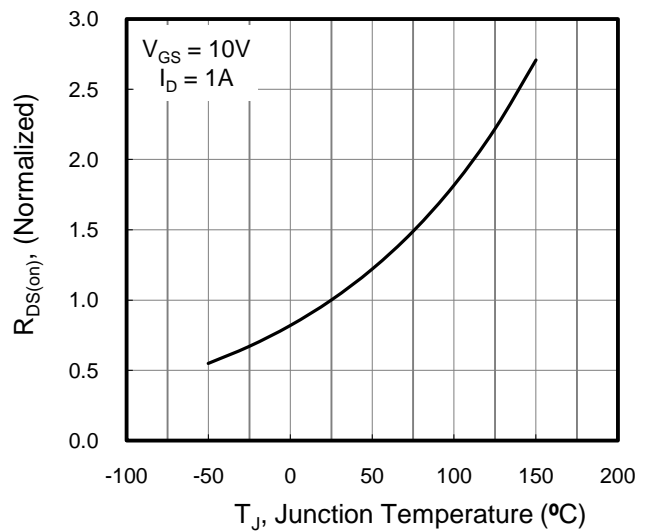


Figure 5. Transfer Characteristics

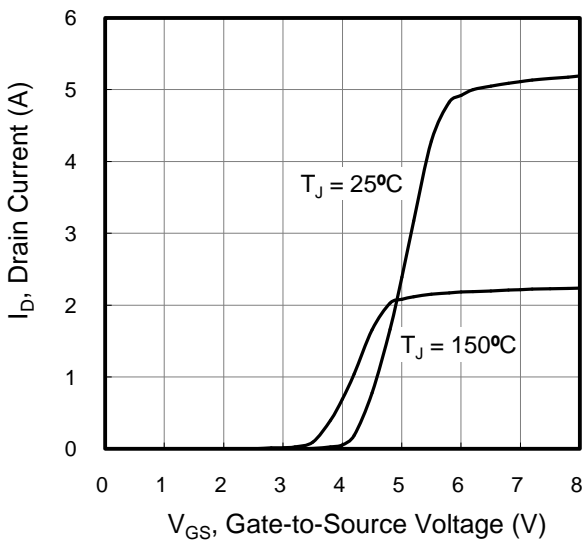
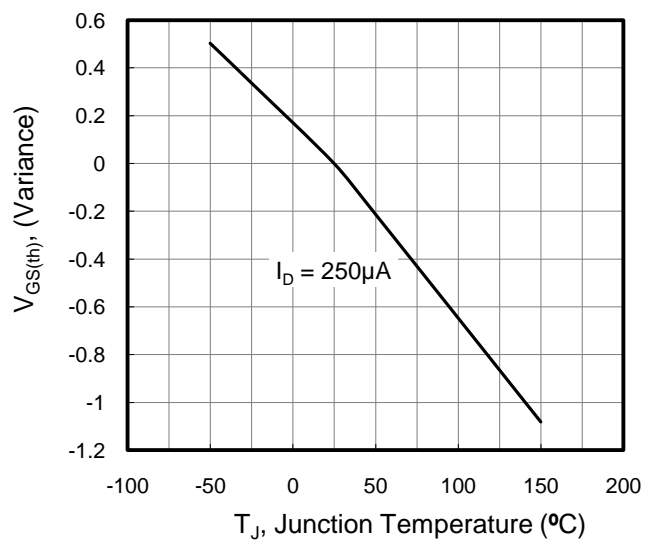


Figure 6. Threshold Voltage vs. Temperature





Typical Characteristics $T_J = 25^\circ\text{C}$, unless otherwise noted

Figure 7. Capacitance

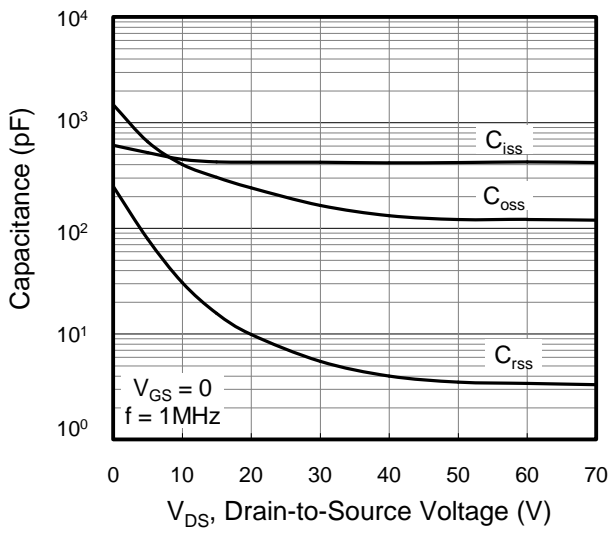


Figure 8. Gate Charge

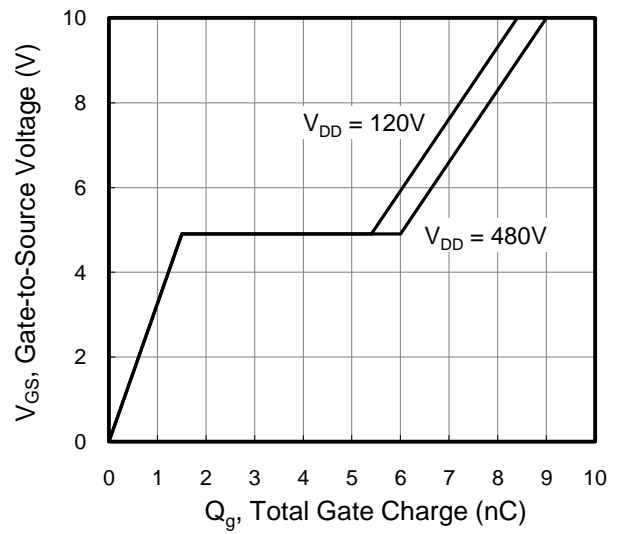


Figure 9. Body Diode Forward Voltage

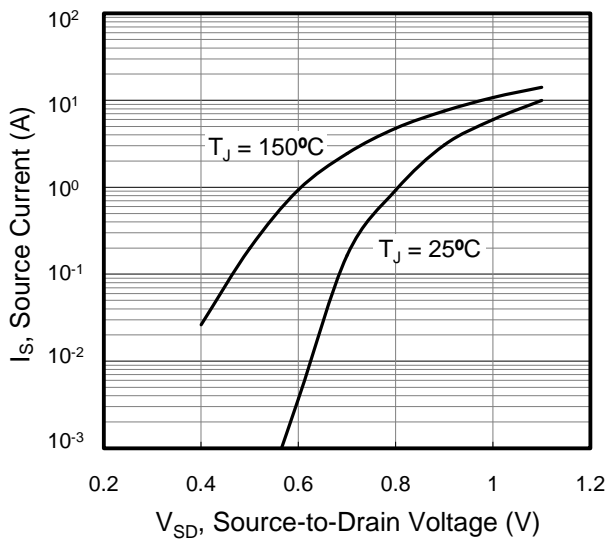


Figure 10. Transient Thermal Impedance

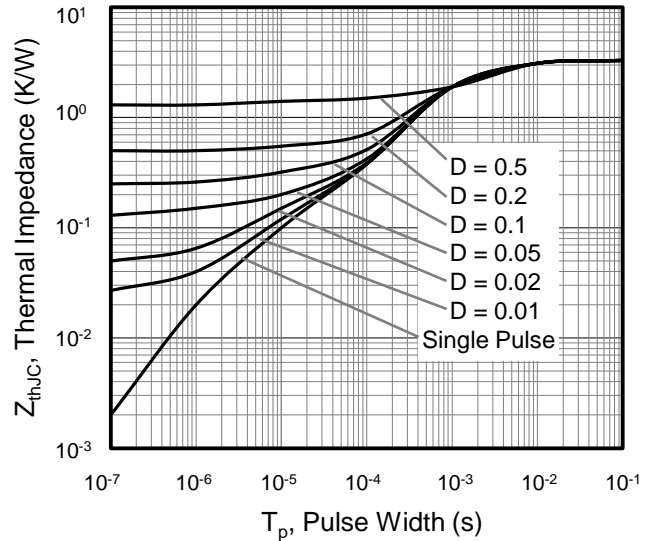




Figure A: Gate Charge Test Circuit and Waveform



Figure B: Resistive Switching Test Circuit and Waveform

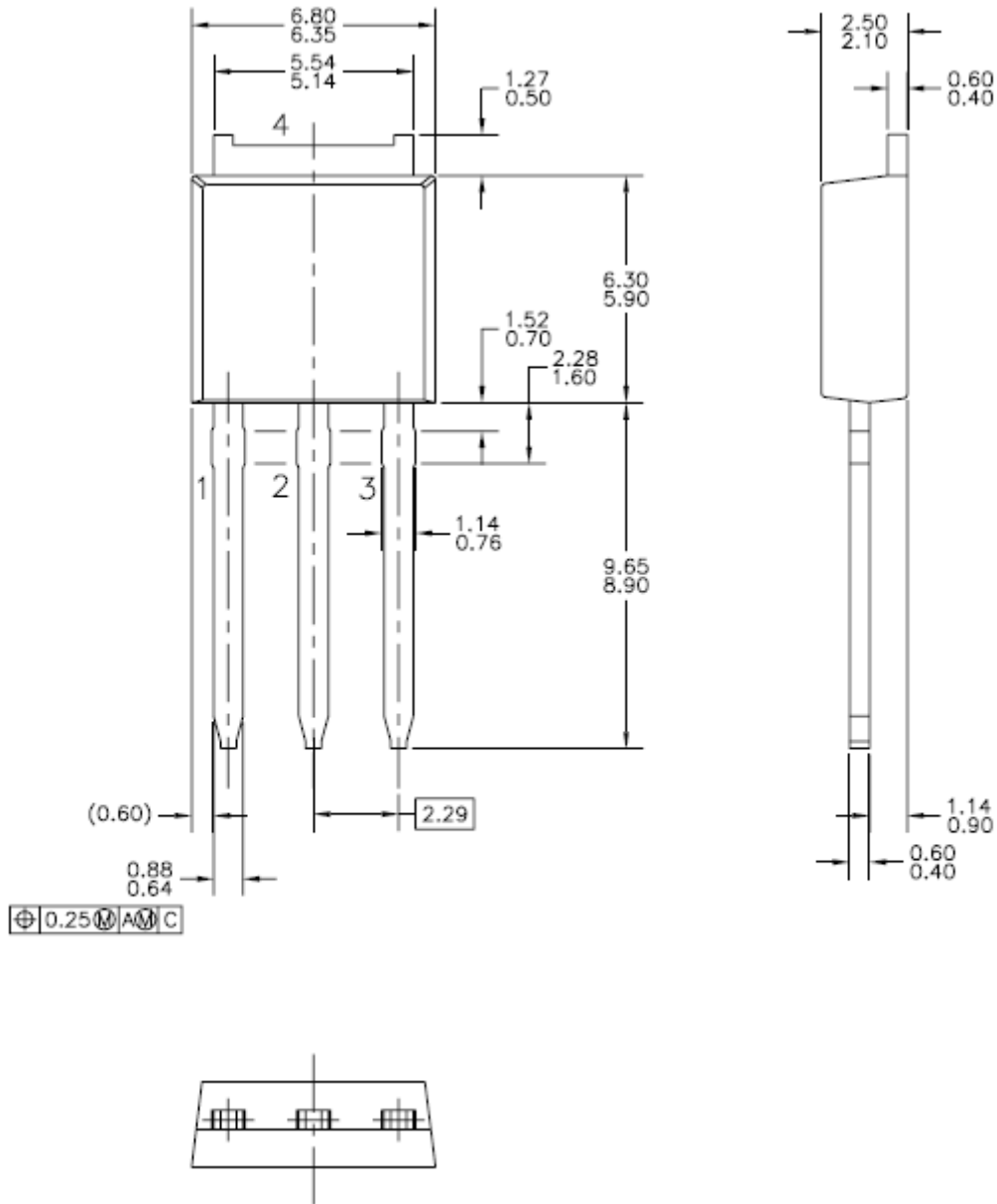


Figure C: Unclamped Inductive Switching Test Circuit and Waveform



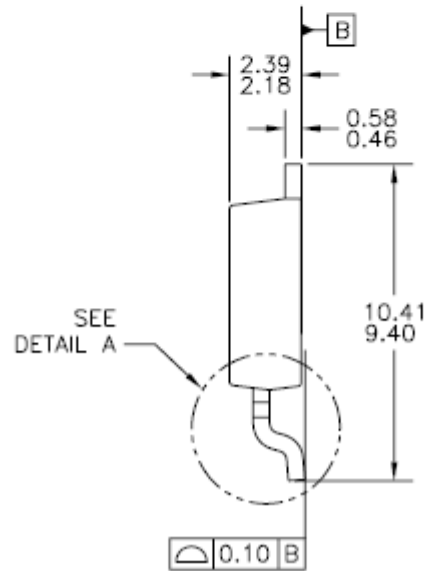
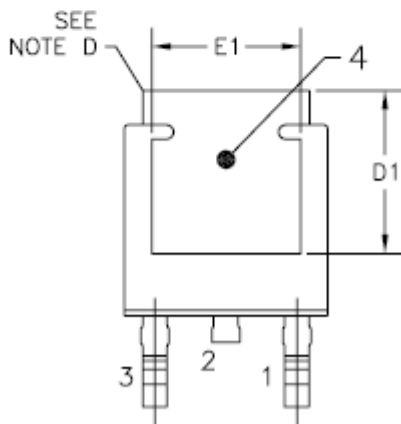
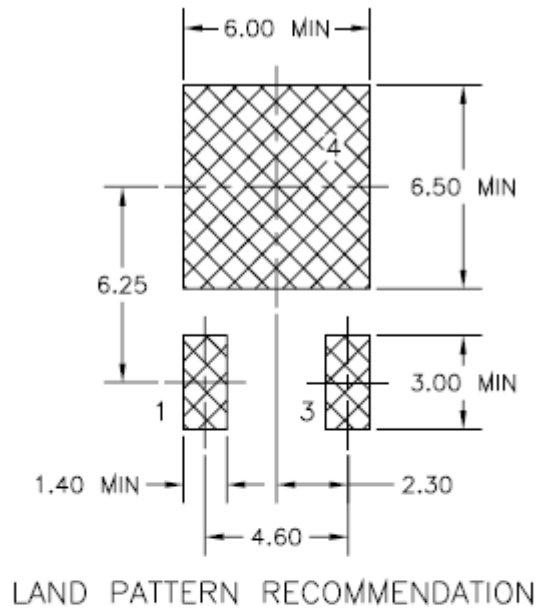
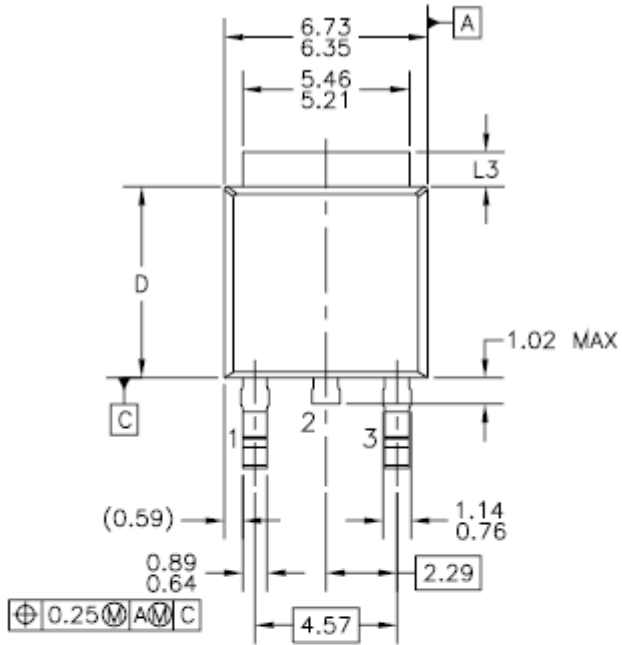


TO-251





TO-252





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