

1.Description

This Power MOSFET utilizes the latest processing techniques to achieve extremely low on-resistance per silicon area. Additional features of this design are a 150°C junction operating temperature, fast switching speed and improved repetitive avalanche rating.

2.2Features

- Advanced Process Technology
- Ultra Low On-Resistance

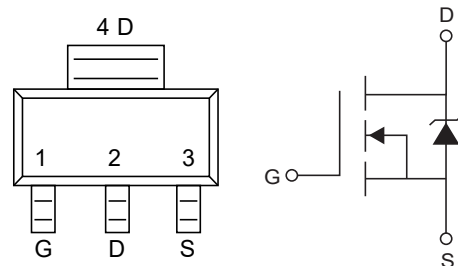
2.1Features

- $V_{DS(V)}=55V$
- $I_D=5.1A(V_{GS}=10V)$
- $R_{DS(ON)}\leq 57.5m\Omega(V_{GS}=10V)$

3.Pinning information

Pin	Symbol	Description
1	G	GATE
2,4	D	DRAIN
3	S	SOURCE

SOT-223
top view



4.Absolute Maximum Ratings

Parameter		Symbol	Max.	Units
Continuous Drain Current, V_{GS} @ 10V(Silicon Limited) ⑦	$T_A=25^{\circ}C$	I_D	5.1	A
Continuous Drain Current, V_{GS} @ 10V ⑦	$T_A=70^{\circ}C$		4.1	A
Pulsed Drain Current ①		I_{DM}	41	A
Power Dissipation ⑦	$T_A=25^{\circ}C$	P_D	2.8	
Power Dissipation ⑧	$T_A=25^{\circ}C$		1	W
Linear Derating Factor ⑦			0.02	W/°C
Gate-to-Source Voltage		V_{GS}	±20	V
Single Pulse Avalanche Energy ②		E_{AS} (Thermally limited)	13	mJ
Single Pulse Avalanche Energy Tested Value ⑥		E_{AS} (Tested)	32	mJ



Avalanche Current ①	I_{AR}	See Fig.16a, 16b, 13, 15	A
Repetitive Avalanche Energy ⑤	E_{AR}		mJ
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 to 150	°C

5. Thermal resistance rating

Parameter	Symbol	Typ	Max	Units
Junction-to-Ambient (PCB mount, steady state) ⑦	R_{thJA}		45	°C/W
Junction-to-Ambient (PCB Mount, steady state) ⑧	R_{thJA}		120	°C/W



6. Electrical Characteristic ($T_J=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D=250\mu\text{A}$, $V_{GS}=0\text{V}$	55			V
Breakdown Voltage Temp. Coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	Reference to 25°C , $I_D=1\text{mA}$		0.053		$\text{V}/^{\circ}\text{C}$
Static Drain-to-Source On-Resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=3.1\text{A}$ ③		46.2	57.5	$\text{m}\Omega$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$, $I_D=250\mu\text{A}$	2		4	V
Forward Transconductance	g_{FS}	$V_{DS}=25\text{V}$, $I_D=3.1\text{A}$	6.2			S
Drain-to-Source Leakage Current	I_{DSS}	$V_{DS}=55\text{V}$, $V_{GS}=0\text{V}$			20	μA
		$V_{DS}=55\text{V}$, $V_{GS}=0\text{V}$, $T_J=125^{\circ}\text{C}$			250	μA
Gate-to-Source Forward Leakage	I_{GSS}	$V_{GS}=20\text{V}$			200	nA
Gate-to-Source Reverse Leakage		$V_{GS}=-20\text{V}$			-200	nA
Total Gate Charge	Q_g	$I_D=3.1\text{A}$, $V_{DS}=44\text{V}$, $V_{GS}=10\text{V}$ ③		9.1	14	nC
Gate-to-Source Charge	Q_{gs}			1.9		nC
Gate-to-Drain ("Miller") Charge	Q_{gd}			3.9		nC
Turn-On Delay Time	$t_{D(on)}$	$V_{DD}=28\text{V}$, $I_D=3.1\text{A}$ $R_G=53\Omega$, $V_{GS}=10\text{V}$ ③		7.8		ns
Rise Time	t_r			21		ns
Turn-Off Delay Time	$t_{D(off)}$			30		ns
Fall Time	t_f			23		ns
Input Capacitance	C_{iss}	$V_{GS}=0\text{V}$, $V_{DS}=25\text{V}$, $f=1\text{MHz}$		340		pF
Output Capacitance	C_{oss}			68		pF
Reverse Transfer Capacitance	C_{rss}			39		pF
Output Capacitance	C_{oss}	$V_{GS}=0\text{V}$, $V_{DS}=1\text{V}$, $f=1\text{MHz}$		210		pF
Output Capacitance	C_{oss}	$V_{GS}=0\text{V}$, $V_{DS}=44\text{V}$, $f=1\text{MHz}$		55		pF
Effective Output Capacitance	$C_{oss\text{eff.}}$	$V_{GS}=0\text{V}$, $V_{DS}=0\text{V to }44\text{V}$ ④		93		pF



Diode Characteristics						
Continuous Source Current (Body Diode)	I_S	MOSFET symbol showing the integral reverse p-n junction diode.			5.1	A
Pulsed Source Current (Body Diode) ①	I_{SM}				41	A
Diode Forward Voltage	V_{SD}	$T_J=25^{\circ}\text{C}, I_S=3.1\text{A}, V_{GS}=0\text{V}$ ③			1.3	V
Reverse Recovery Time	t_{rr}	$T_J=25^{\circ}\text{C}, I_F=3.1\text{A}, V_{DD}=28\text{V}$		15	23	ns
Reverse Recovery Charge	Q_{rr}	$di/dt=100\text{A}/\mu\text{s}$ ③		9.8	15	nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature(See fig. 14).
- ② Limited by T_{Jmax} , starting $T_J=25^{\circ}\text{C}$, $L=2.8\text{mH}$, $R_G=25\Omega$, $I_{AS}=3.1\text{A}$, $V_{GS}=10\text{V}$. Part not recommended for use above this value.
- ③ Pulse width $\leq 1\text{ms}$; duty cycle $\leq 2\%$.
- ④ C_{oss} eff. is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 80% V_{DSS} .
- ⑤ Limited by T_{Jmax} , see Fig.16a, 16b, 13, 15 for typical repetitive avalanche performance.
- ⑥ This value determined from sample failure population. 100% tested to this value in production.
- ⑦ When mounted on 1 inch square copper board.
- ⑧ When mounted on FR-4 board using minimum recommended footprint.



7.1 Typical Characteristics

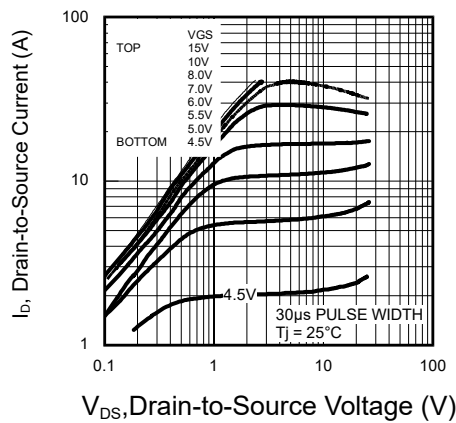


Figure 1: Typical On-Resistance vs. Gate Voltage

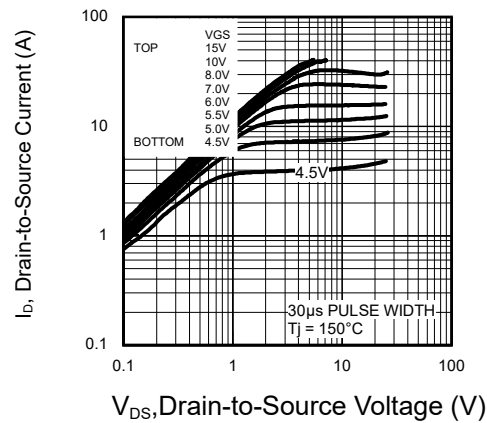


Figure 2: Typical Output Characteristics

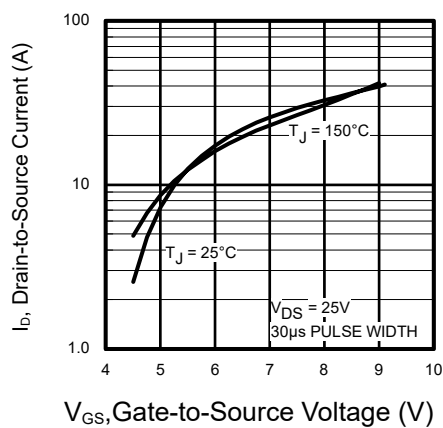


Figure 3: Typical Output Characteristics

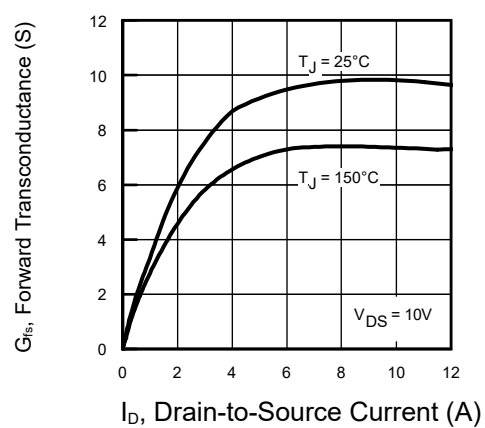


Figure 4: Typical Forward Transconductance Vs. Drain Current

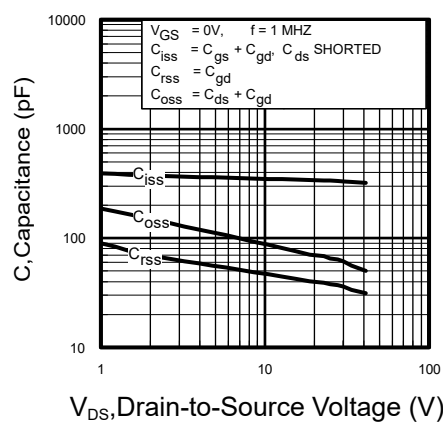


Figure 5: Typical Capacitance vs. Drain-to-Source Voltage

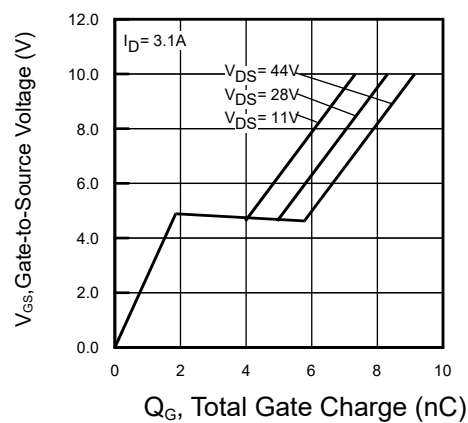


Figure 6: Typical Gate Charge Vs. Gate-to-Source Voltage



7.2 Typical Characteristics

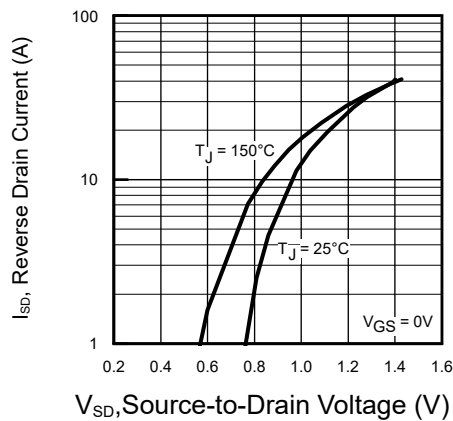


Figure 7: Typical Capacitance vs. Drain-to-Source Voltage

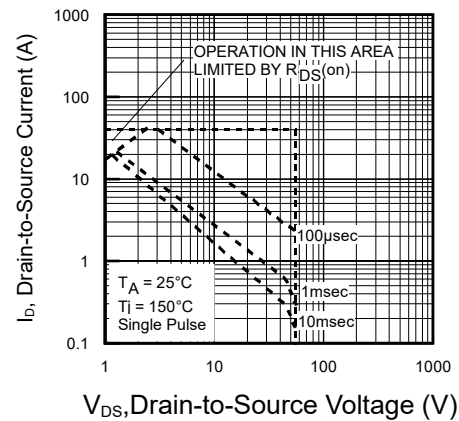


Figure 8: Maximum Safe Operating Area

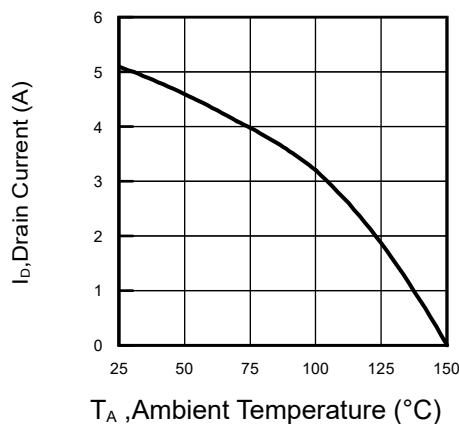


Figure 9: Maximum Drain Current Vs. Ambient Temperature

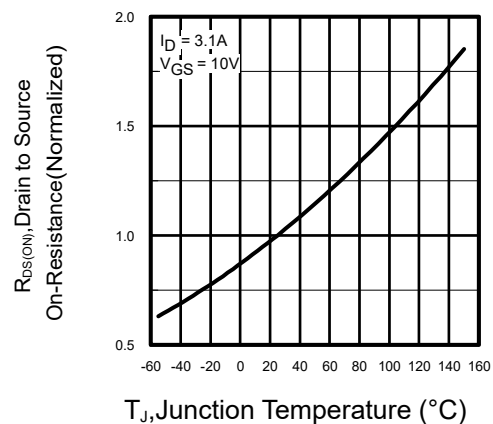


Figure 10: Normalized On-Resistance Vs. Temperature

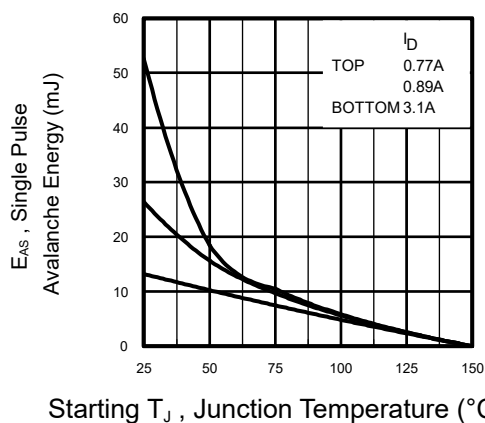


Figure 11: Typical On-Resistance vs. Drain Current

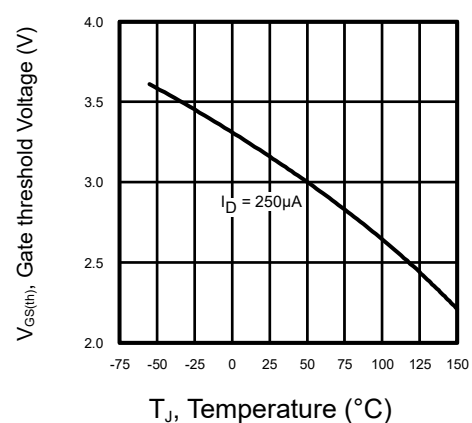
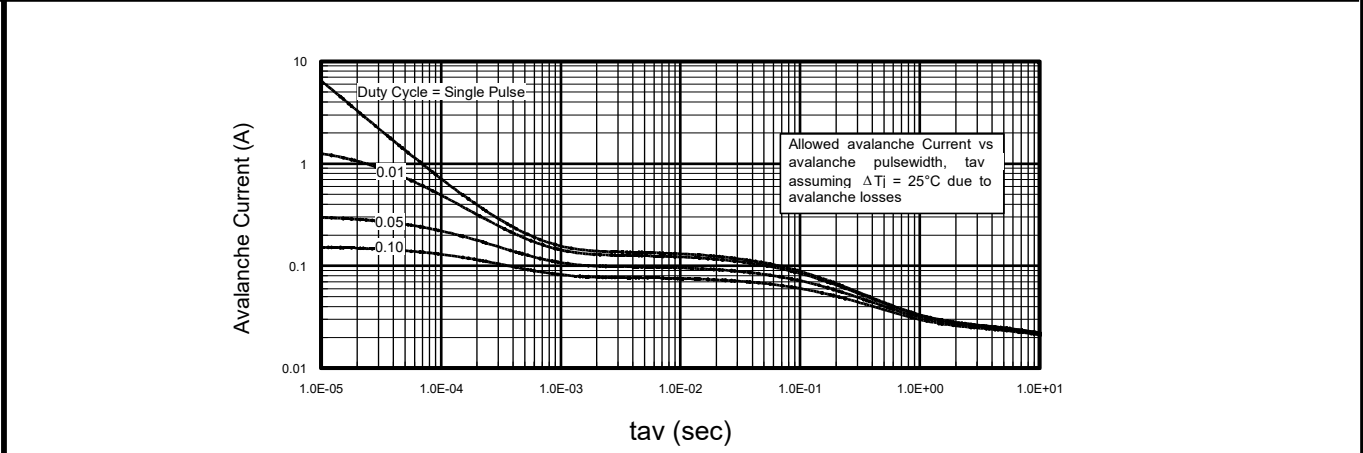
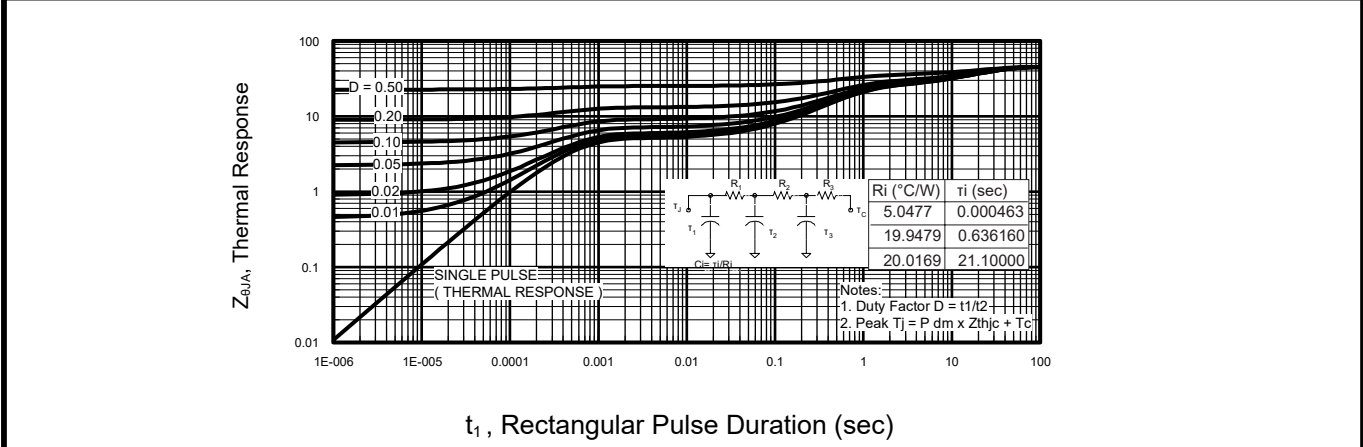
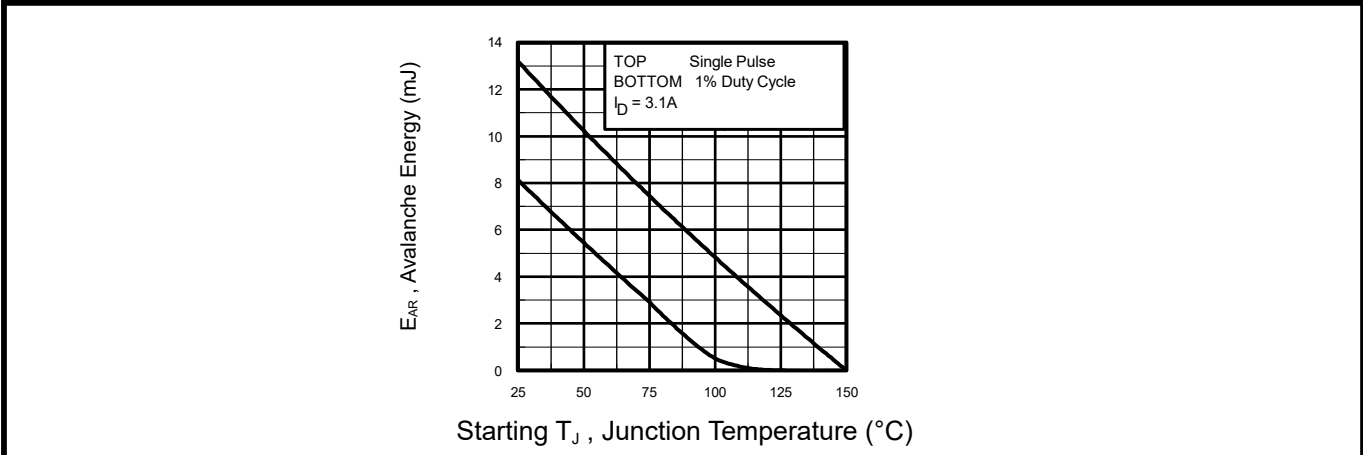


Figure 12: Threshold Voltage Vs. Temperature



7.3Typical Characterisitics





7.4 Typical Characteristics

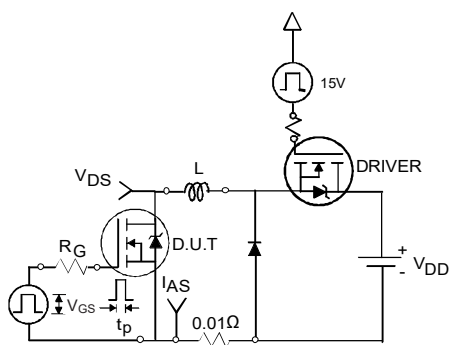


Figure 16a: Unclamped Inductive Test Circuit

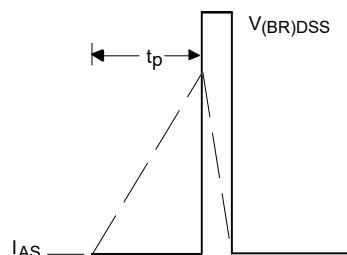


Figure 16b: Unclamped Inductive Waveforms

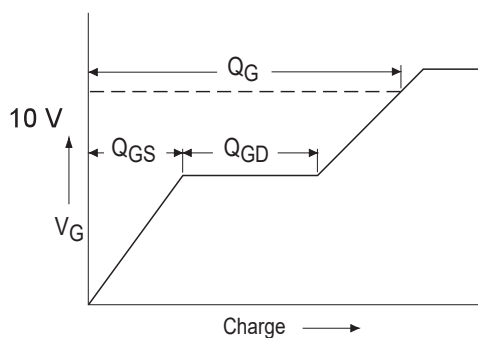


Figure 17a: Gate Charge Test Circuit

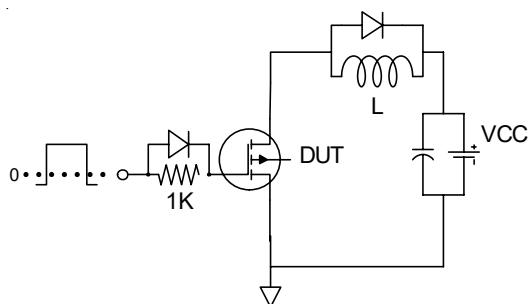
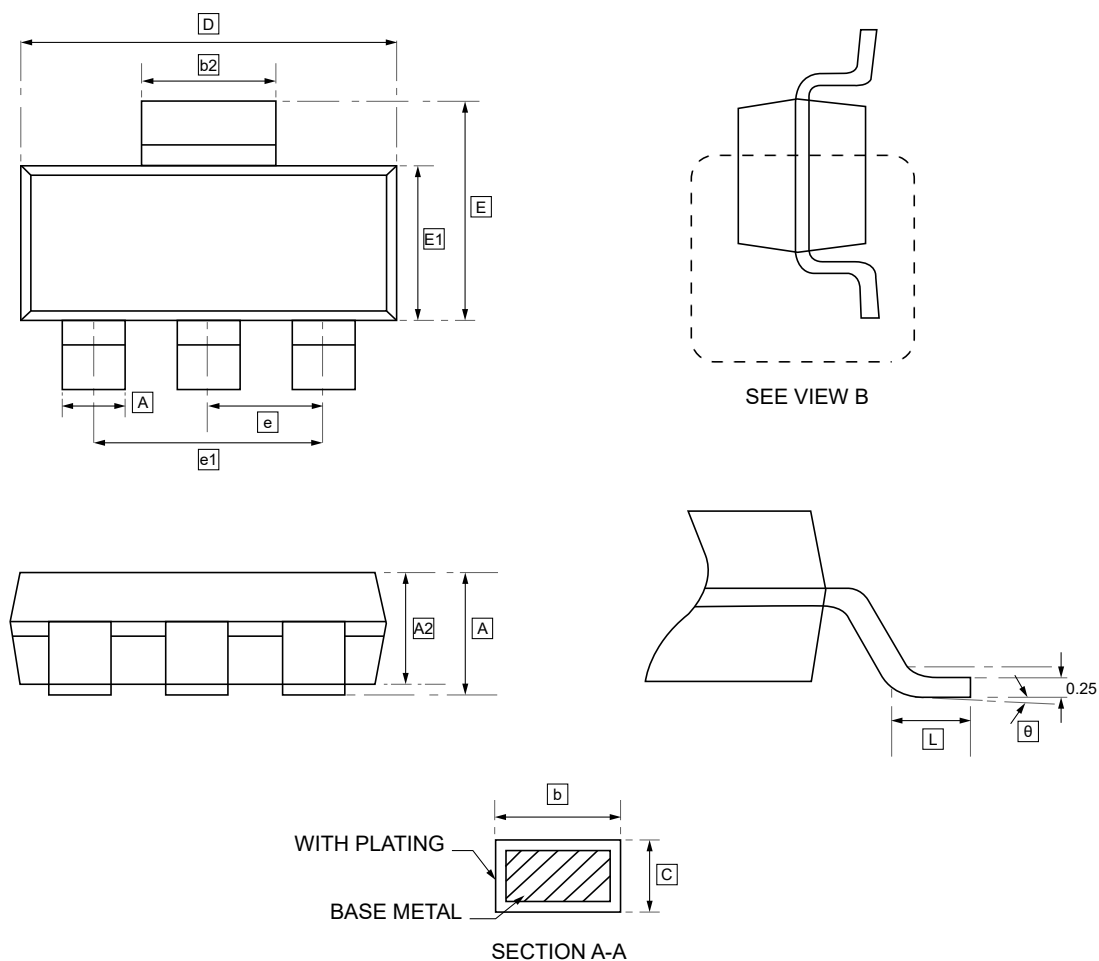


Figure 17b: Threshold Voltage Vs. Temperature



8.SOT-223 Package Outline Dimensions

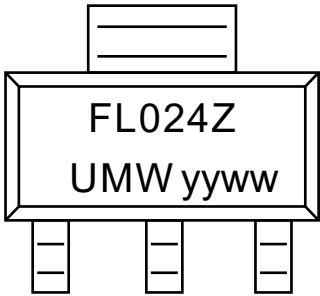


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	b2	c	D	E	E1	e	e1	L	θ
Min		0.02	1.55	0.66	2.90	0.23	6.30	6.70	3.30	2.30	4.60	0.90	0°
Max	1.80	0.10	1.65	0.84	3.10	0.33	6.70	7.30	3.70	BSC	BSC		8°



9.Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW IRFL024ZTR	SOT-223	2500	Tape and reel



10.Disclaimer

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