



## N-Channel Enhancement Mode Power MOSFET **MX4408**

### DESCRIPTION

The MX4408 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a wide variety of applications.

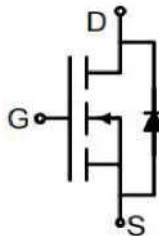
### GENERAL FEATURES

- $V_{DS}=30V$ ,  $I_D=13A$   
 $R_{DS(ON)}(Typ.)=10m\Omega$  @  $V_{GS}=4.5V$   
 $R_{DS(ON)}(Typ.)=7m\Omega$  @  $V_{GS}=10V$
- High density cell design for ultra low  $R_{dson}$
- Lead free product is acquired

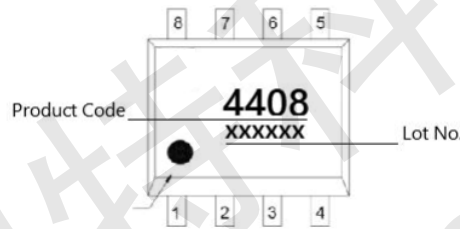
### APPLICATION

- Battery protection
- Load switch
- Power management

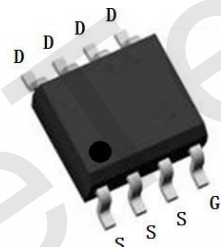
### PINOUT



Schematic diagram



Marking and pin Assignment



SOP-8 top view

### ORDERING INFORMATION

Part Number	Marking	Storage Temperature	Package	Devices Per Reel
MX4408	4408	-55°C to 150°C	SOP-8	3000

### ABSOLUTE MAXIMUM RATINGS ( $T_A=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage ( $V_{GS}=0V$ )	$V_{DS}$	30	V
Gate-Source Voltage ( $V_{DS}=0V$ )	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous ( $T_C=25^\circ C$ ) <sup>(Note1)</sup>	$I_D$	13	A
Drain Current-Continuous ( $T_C=100^\circ C$ )	$I_D$	7	A
Drain Current-Continuous@ Current-Pulsed <sup>(Note2)</sup>	$I_{DM(pluse)}$	44	A
Maximum Power Dissipation	$P_D$	3	W
Avalanche Energy <sup>(Note 3)</sup>	$E_{AS}$	90	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ C$

### THERMAL RESISTANCE

Parameter	Symbol	Max.	Unit
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	42	$^\circ C/W$

Notes 1.The maximum current rating is package limited.

Notes 2.Repetitive Rating: Pulse width limited by maximum junction temperature

Notes 3.EAS condition:  $T_J=25^\circ C, V_{DD}=30V, V_G=10V, R_G=25\Omega$ ,



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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
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**On/Off Characteristics**

Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	30	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=30V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1.0	1.5	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=4.5V, I_D=6A$	-	10	12	m $\Omega$
		$V_{GS}=10V, I_D=11A$	-	7	9	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=5V, I_D=11A$	-	12	-	S

**Dynamic Characteristics**

Gate resistance	$R_g$	$V_{DS}=0V, V_{GS}=0V, F=1.0\text{MHz}$	-	1.2	-	$\Omega$
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V, F=1.0\text{MHz}$	-	1050	-	pF
Output Capacitance	$C_{oss}$		-	214	-	pF
Reverse Transfer Capacitance	$C_{rss}$		-	148	-	pF
Total Gate Charge	$Q_g$	$V_{DS}=25V, I_D=11A, V_{GS}=10V$	-	25	-	nC
Gate-Source Charge	$Q_{gs}$		-	2.5	-	nC
Gate-Drain Charge	$Q_{gd}$		-	9	-	nC

**Switching Characteristics**

Turn-on Delay Time	$t_{d(on)}$	$V_{DS}=15V, R_L=0.75\Omega, V_{GS}=10V, R_{GEN}=3\Omega$	-	5	-	nS
Turn-on Rise Time	$t_r$		-	10	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	18	-	nS
Turn-Off Fall Time	$t_f$		-	6	-	nS

**Source-Drain Diode Characteristics**

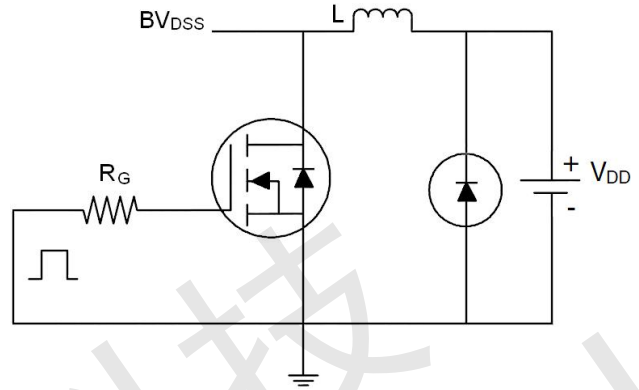
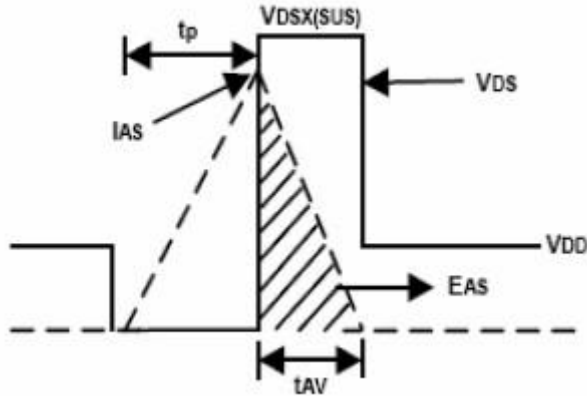
Forward On Voltage	$V_{SD}$	$V_{GS}=0V, I_S=11A$	-	-	1.2	V
Source-Drain Current(Body Diode)	$I_{SD}$		-	-	13	A



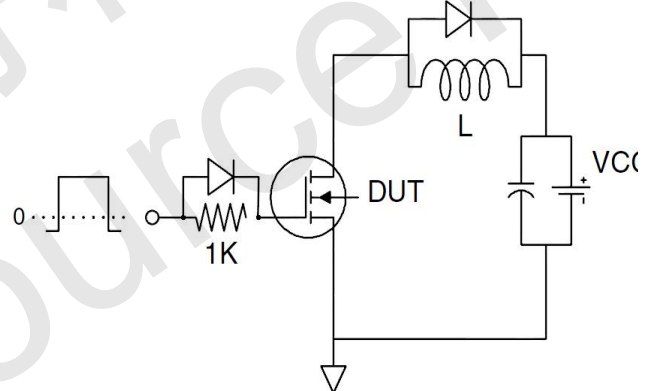
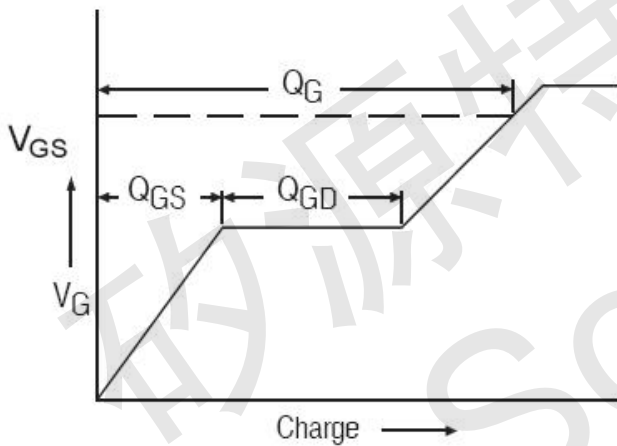
N-Channel Enhancement Mode Power MOSFET **MX4408**

**TYPICAL PERFORMANCE CHARACTERISTICS**

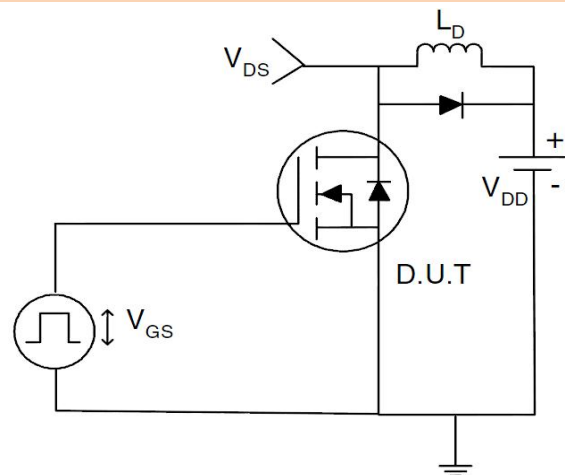
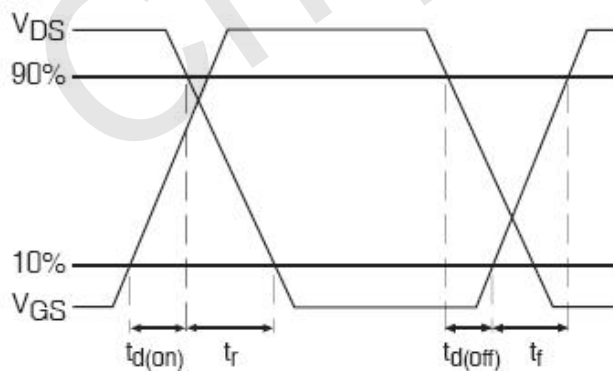
**1) EAS Test Circuits**



**2) Gate Charge Test Circuit:**



**3) Switch Time Test Circuit:**

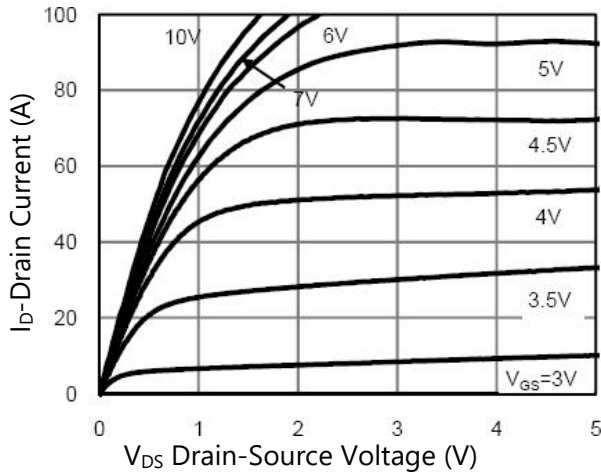




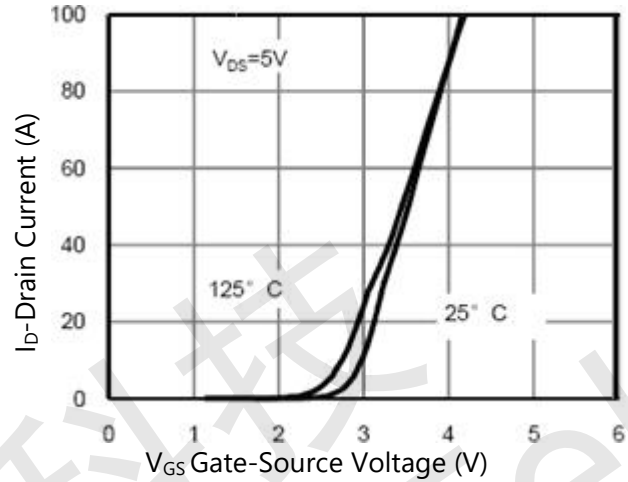
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**TYPICAL PERFORMANCE CHARACTERISTICS**

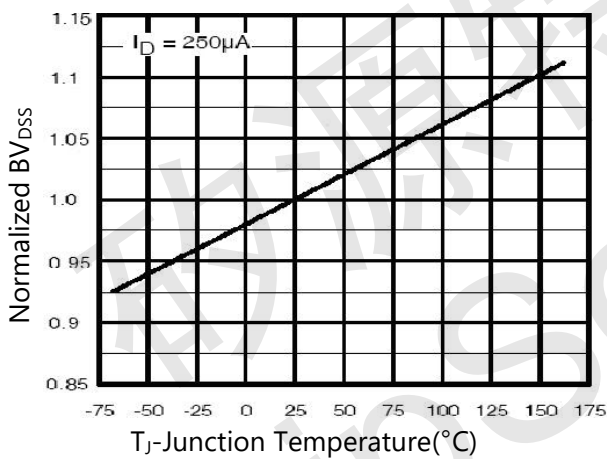
**Figure1. Output Characteristics**



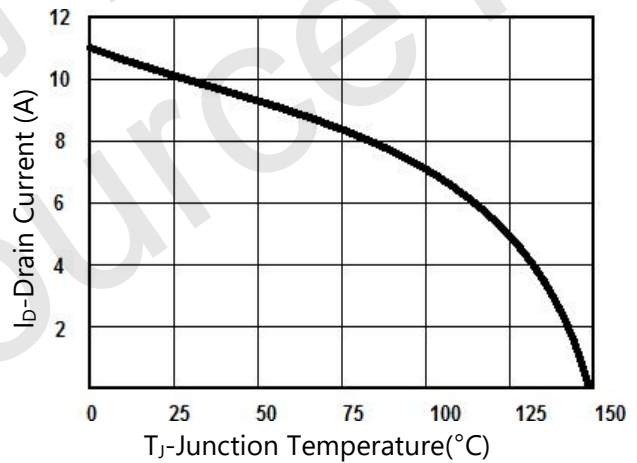
**Figure2. Transfer Characteristics**



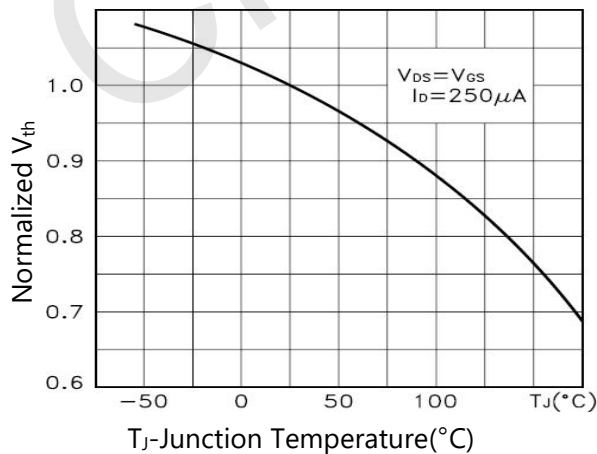
**Figure3. BV<sub>DSS</sub> vs Junction Temperature**



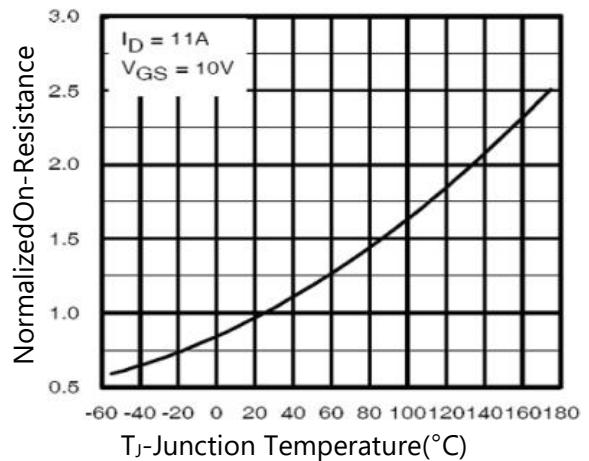
**Figure4. Drain Current**



**Figure5. V<sub>GS(th)</sub> vs Junction Temperature**



**Figure6. R<sub>dson</sub> Vs Junction Temperature**

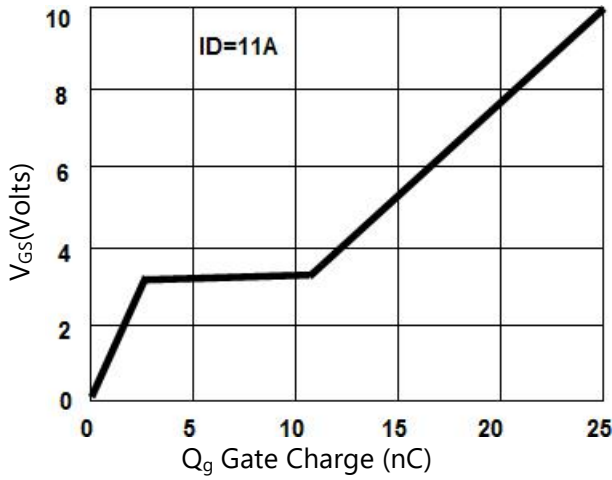




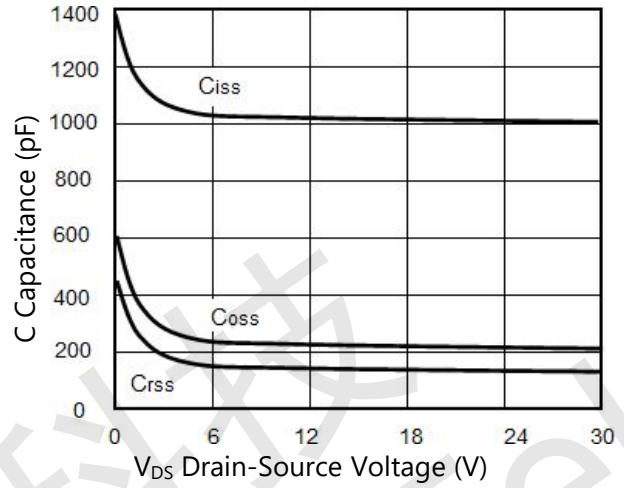
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### TYPICAL PERFORMANCE CHARACTERISTICS

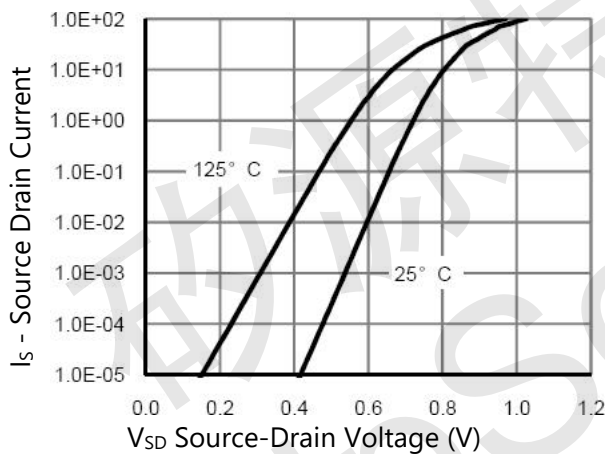
**Figure7. Gate Charge**



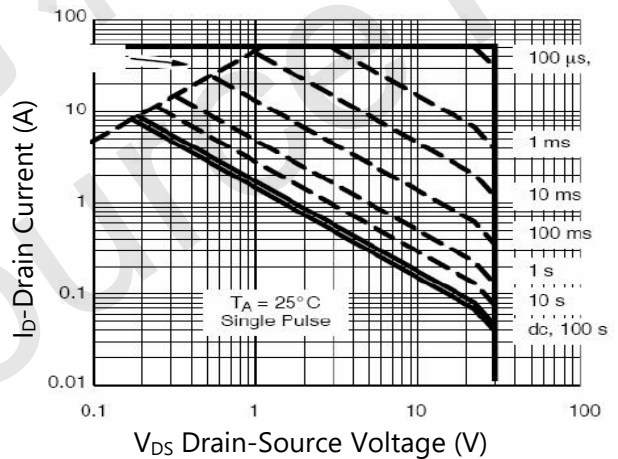
**Figure8. Capacitance**



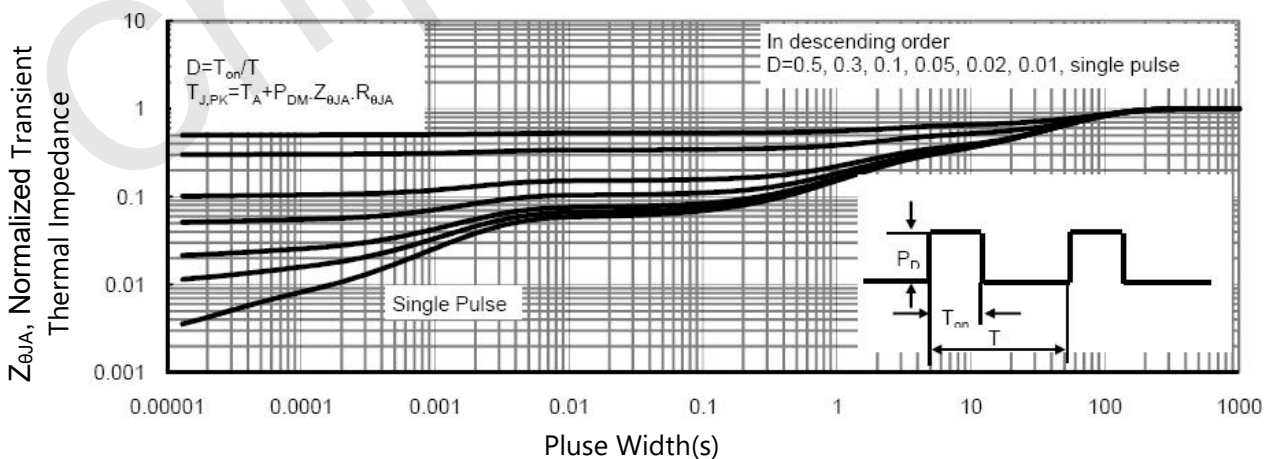
**Figure9. Body-Diode Characteristics**



**Figure10. Safe Operation Area**



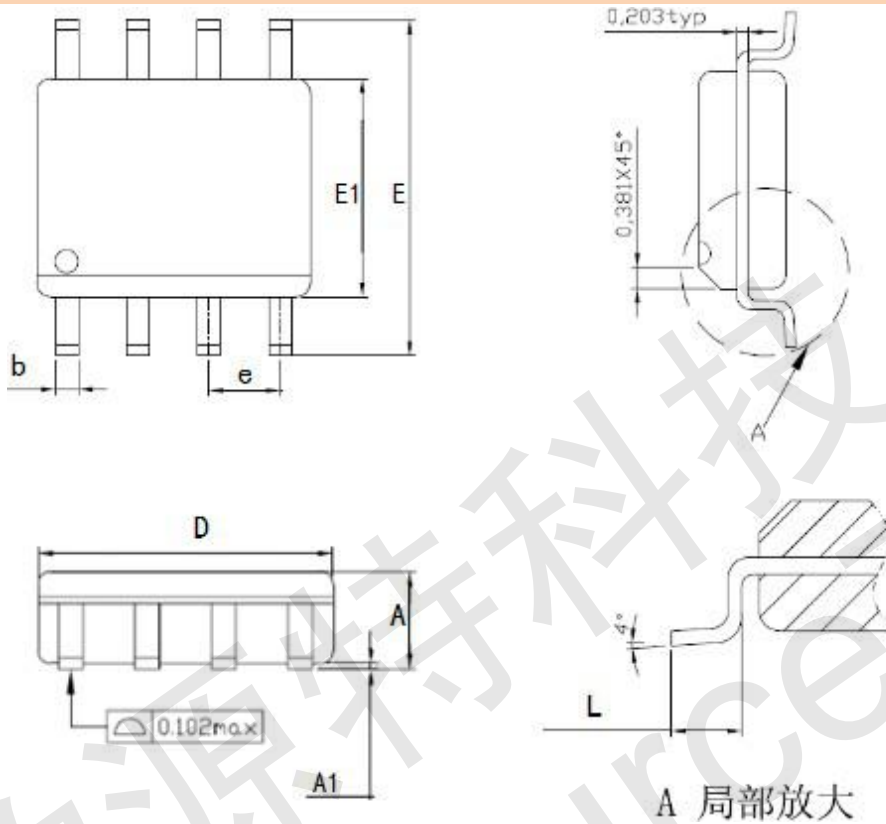
**Figure11. Normalized Maximum Transient Thermal Impedance**





 **PACKAGE INFORMATION**

SOP-8



Symbol	Dimensions In Millimeters		
	Min.	Nom.	Max.
A	1.35	1.55	1.75
A1	0.1	0.15	0.2
b	0.346	0.406	0.466
D	4.8	4.89	4.98
E	5.75	6.00	6.25
E1	3.81	3.90	3.99
e	1.27 TYP		
L	0.106	0.838	1.27