NTMFS4120N

Power MOSFET

30 V, 31 A, Single N−Channel, SO−8 Flat Lead

Features

- Low $R_{DS(on)}$
- Optimized Gate Charge
- Low Inductance SO−8 Package
- These are Pb−Free Devices*

Applications

- Notebooks, Graphics Cards
- DC−DC Converters
- Synchronous Rectification

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current (Note 1)	Steady State	T_A = 25°C	I_D	18	A
		T_A = 85°C		13	
	t ≤ 10 s	T_A = 25°C		31	
Power Dissipation (Note 1)	Steady State	T_A = 25°C	P_D	2.2	W
	t ≤ 10 s			6.9	
Continuous Drain Current (Note 2)	Steady State	T_A = 25°C	I_D	11	A
		T_A = 85°C		8.0	
Power Dissipation (Note 2)		T_A = 25°C	P_D	0.9	W
Pulsed Drain Current	t_p = 10 μs		I_{DM}	94	A
Operating Junction and Storage Temperature			T_J, T_{stg}	−55 to 150	°C
Source Current (Body Diode)			I_S	7.0	A
Single Pulse Drain−to−Source Avalanche Energy (V_{DD} = 30 V, V_{GS} = 10 V, I_{PK} = 30 A, L = 1 mH, R_G = 25 Ω)			E_{AS}	450	mJ
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°C

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Ambient − Steady State (Note 1)	$R_{\theta JA}$	55.8	°C/W
Junction−to−Ambient − t ≤ 10 s (Note 1)	$R_{\theta JA}$	18	
Junction−to−Ambient − Steady State (Note 2)	$R_{\theta JA}$	139.1	

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

1. Surface mounted on FR4 board using 1 in sq pad size (Cu area = 1.127 in sq [1 oz] including traces).
2. Surface mounted on FR4 board using the minimum recommended pad size (Cu area = 1.0 in sq).

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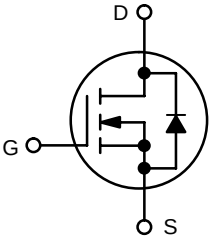
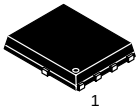
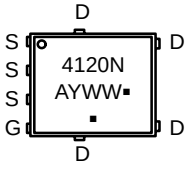
$V_{(BR)DSS}$	$R_{DS(on)}$ TYP	I_D MAX (Note 1)
30 V	3.5 mΩ @ 10 V	31 A
	4.2 mΩ @ 4.5 V	





SO−8 FLAT LEAD
CASE 488AA
STYLE 1

MARKING DIAGRAM



4120N = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package
(Note: Microdot may be in either location)

ORDERING INFORMATION

Device	Package	Shipping†
NTMFS4120NT1G	SO−8 FL (Pb−Free)	1500 Tape & Reel
NTMFS4120NT3G	SO−8 FL (Pb−Free)	5000 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

ELECTRICAL CHARACTERISTICS (T_J = 25°C unless otherwise noted)

Characteristic	Symbol	Test Condition		Min	Typ	Max	Unit
OFF CHARACTERISTICS							
Drain−to−Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 μA		30			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				21		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	V_{GS} = 0 V, V_{DS} = 24 V	T_J = 25°C			1.0	μA
			T_J = 125°C			10	
Gate−to−Source Leakage Current	I_{GSS}	V_{DS} = 0 V, V_{GS} = 20 V				100	nA
ON CHARACTERISTICS (Note 3)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.0		2.5	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				7.4		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 26 A			3.5	4.5	mΩ
		V_{GS} = 4.5 V, I_D = 24 A			4.2	5.5	
Forward Transconductance	g_{FS}	V_{DS} = 15 V, I_D = 26 A			35		S
CHARGES, CAPACITANCES AND GATE RESISTANCE							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1.0 MHz, V_{DS} = 24 V			3600		pF
Output Capacitance	C_{OSS}				640		
Reverse Transfer Capacitance	C_{RSS}				380		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 24 A			33	50	nC
Threshold Gate Charge	$Q_{G(TH)}$				4.4		
Gate−to−Source Charge	Q_{GS}				13		
Gate−to−Drain Charge	Q_{GD}				14		
Gate Resistance	R_G				1.0		Ω
SWITCHING CHARACTERISTICS (Note 4)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 1.0 A, R_G = 3.0 Ω			24		ns
Rise Time	t_r				32		
Turn−Off Delay Time	$t_{d(OFF)}$				27		
Fall Time	t_f				31		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 6.0 A	T_J = 25°C		0.74	1.0	V
			T_J = 125°C		0.6		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = 6.0 A			36		ns
Charge Time	t_a				18		
Discharge Time	t_b				18		
Reverse Recovery Charge	Q_{RR}				34		nC

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
4. Switching characteristics are independent of operating junction temperatures.

TYPICAL PERFORMANCE CURVES

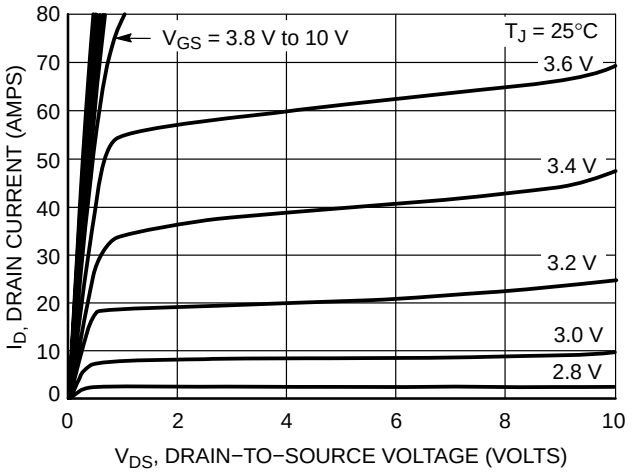


Figure 1. On−Region Characteristics

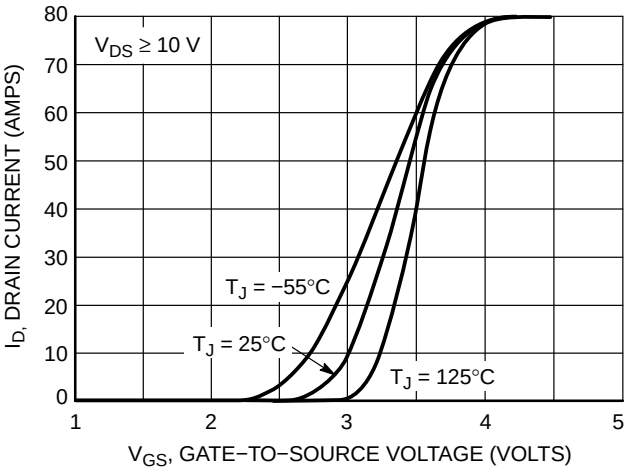


Figure 2. Transfer Characteristics

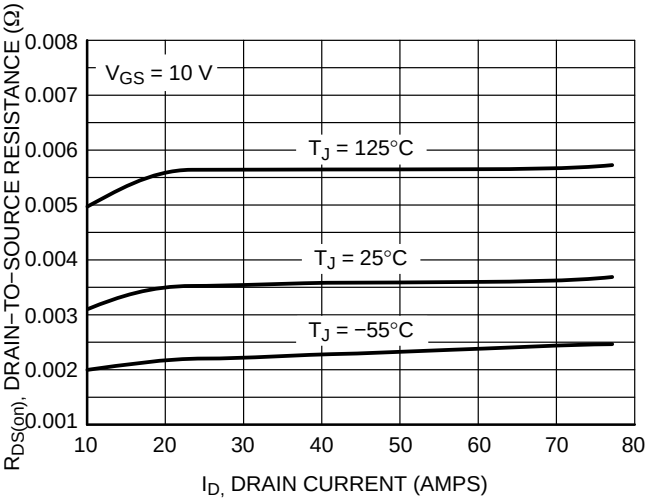


Figure 3. On−Resistance vs. Drain Current and Temperature

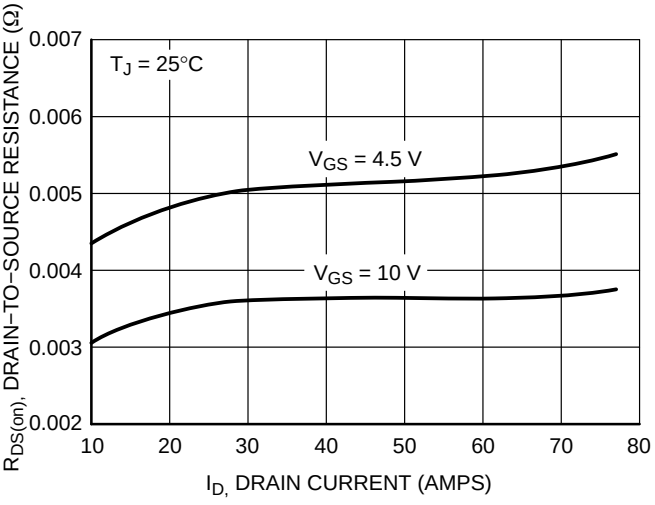


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

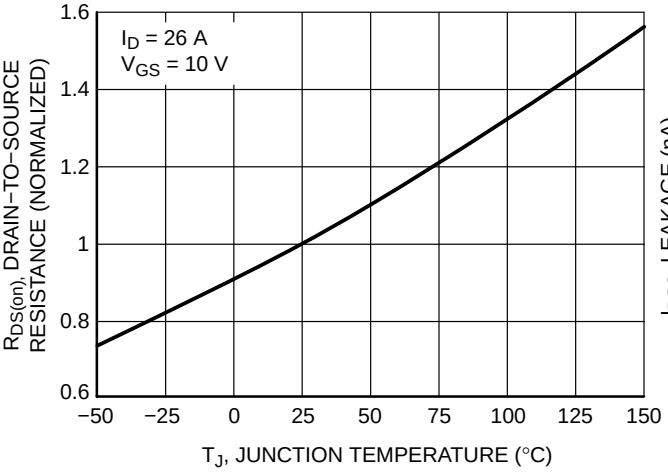


Figure 5. On−Resistance Variation with Temperature

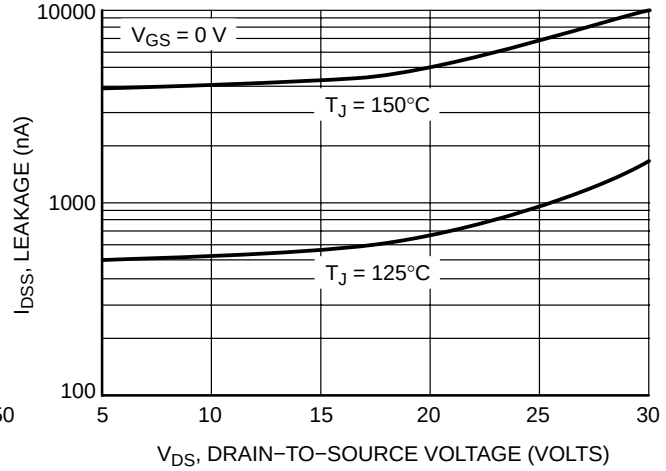


Figure 6. Drain−to−Source Leakage Current vs. Voltage

TYPICAL PERFORMANCE CURVES

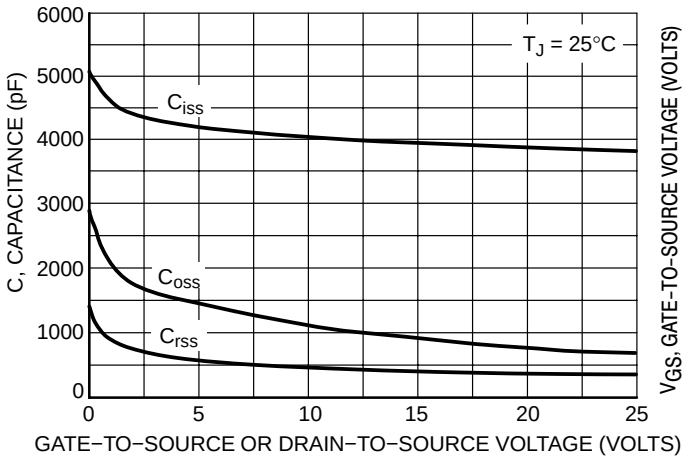


Figure 7. Capacitance Variation

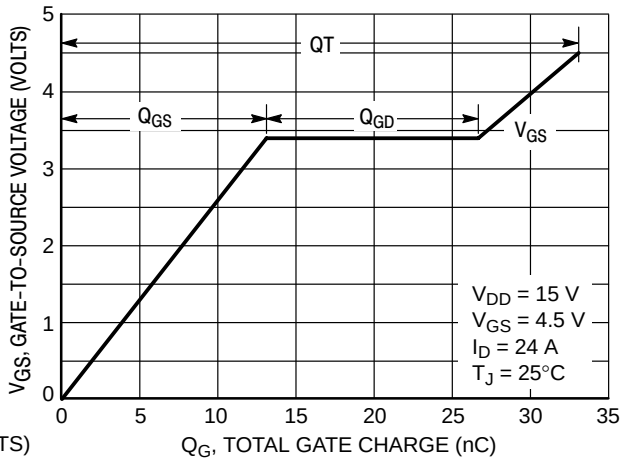


Figure 8. Gate−To−Source and Drain−To−Source Voltage vs. Total Charge

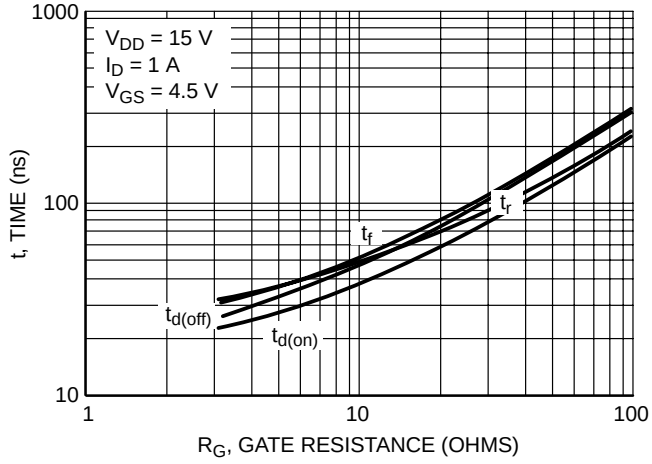


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

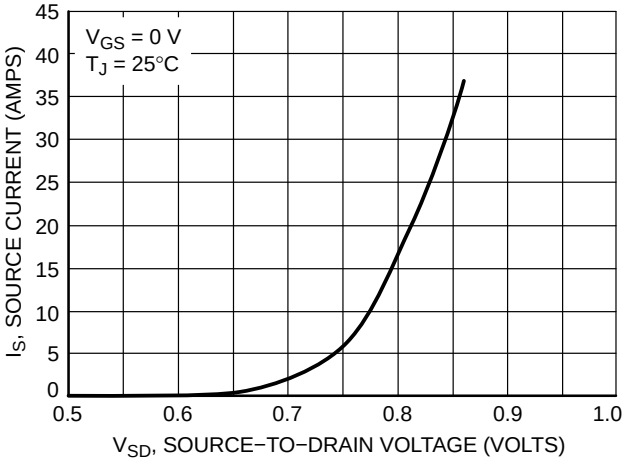


Figure 10. Diode Forward Voltage vs. Current

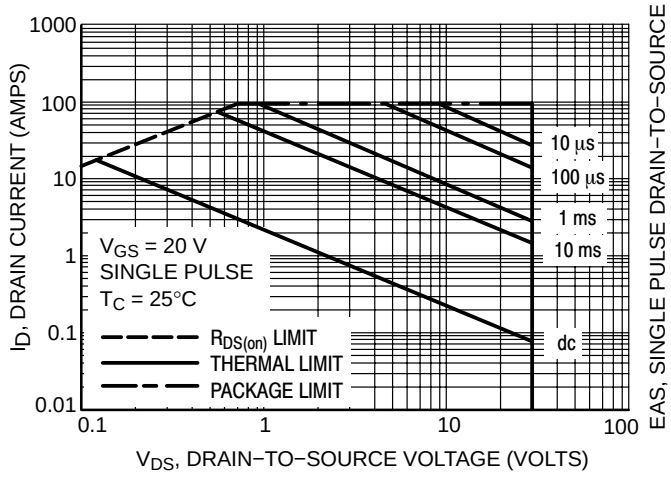


Figure 11. Maximum Rated Forward Biased Safe Operating Area

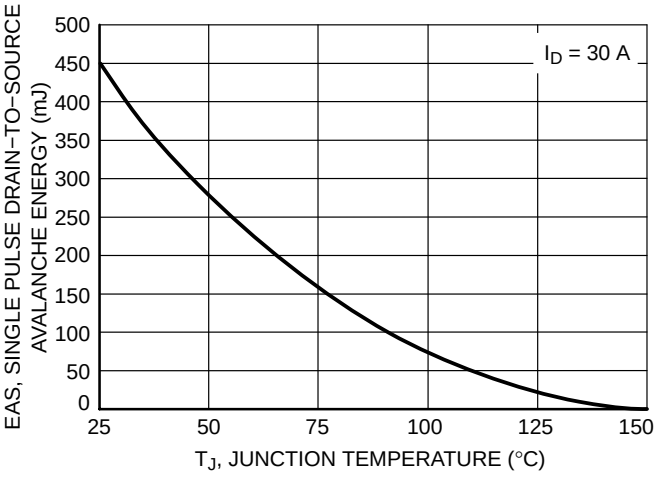


Figure 12. Maximum Avalanche Energy vs Starting Junction Temperature

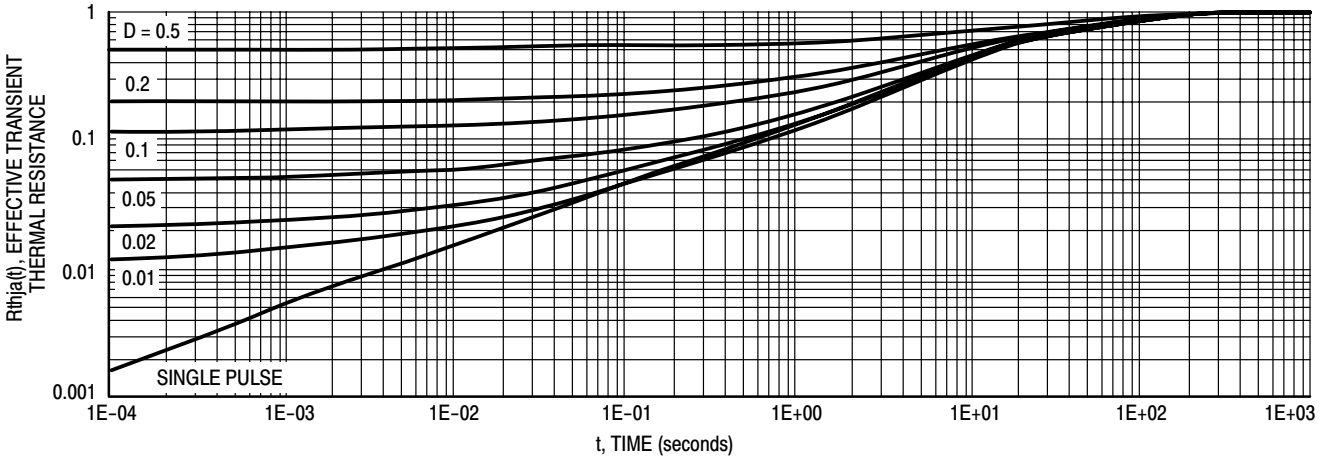
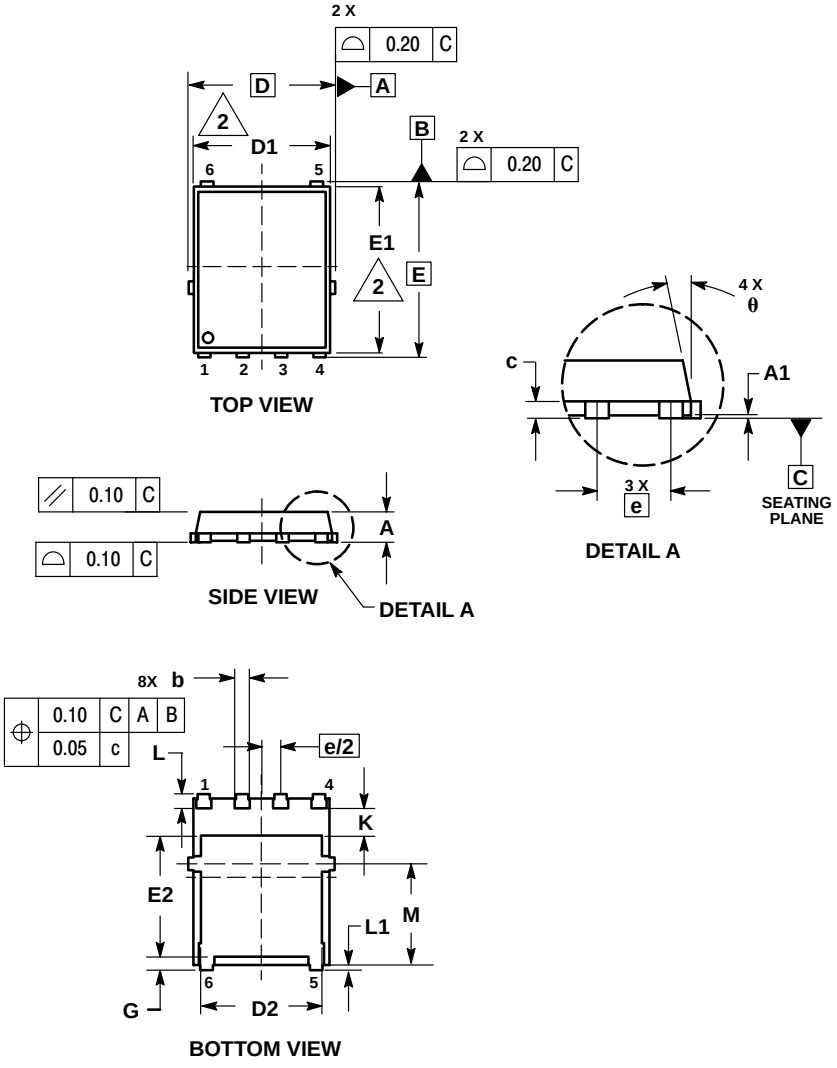


Figure 13. Thermal Response

PACKAGE DIMENSIONS

SO−8 FLAT LEAD
CASE 488AA−01
ISSUE A



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION D1 AND E1 DO NOT INCLUDE MOLD FLASH PROTRUSIONS OR GATE BURRS.

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.90	0.99	1.20
A1	0.00	−−−	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D		5.15 BSC	
D1	4.50	4.90	5.10
D2	3.50	−−−	4.22
E		6.15 BSC	
E1	5.50	5.80	6.10
E2	3.45	−−−	4.30
e		1.27 BSC	
G	0.51	0.61	0.71
K	0.51	−−−	−−−
L	0.51	0.61	0.71
L1	0.05	0.17	0.20
M	3.00	3.40	3.80
θ	0 °	−−−	12 °

STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN
6. DRAIN

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