NTMFS4C09N

Power MOSFET

30 V, 52 A, Single N−Channel, SO−8 FL

Features

- Low $R_{DS(on)}$ to Minimize Conduction Losses
- Low Capacitance to Minimize Driver Losses
- Optimized Gate Charge to Minimize Switching Losses
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Applications

- CPU Power Delivery
- DC−DC Converters

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

Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current $R_{\theta JA}$ (Note 1)	Steady State	T_A = 25°C	I_D	16.4	A
		T_A = 80°C		12.3	
Power Dissipation $R_{\theta JA}$ (Note 1)		T_A = 25°C	P_D	2.51	W
Continuous Drain Current $R_{\theta JA} \le 10$ s (Note 1)		T_A = 25°C	I_D	25.3	A
		T_A = 80°C		19.0	
Power Dissipation $R_{\theta JA} \le 10$ s (Note 1)		T_A = 25°C	P_D	6.0	W
Continuous Drain Current $R_{\theta JA}$ (Note 2)		T_A = 25°C	I_D	9.0	A
		T_A = 80°C		6.8	
Power Dissipation $R_{\theta JA}$ (Note 2)		T_A = 25°C	P_D	0.76	W
Continuous Drain Current $R_{\theta JC}$ (Note 1)		T_C = 25°C	I_D	52	A
		T_C =80°C		39	
Power Dissipation $R_{\theta JC}$ (Note 1)		T_C = 25°C	P_D	25.5	W
Pulsed Drain Current	T_A = 25°C, t_p = 10 μs		I_{DM}	146	A
Current Limited by Package		T_A = 25°C	I_{Dmax}	80	A
Operating Junction and Storage Temperature			T_J, T_{STG}	−55 to +150	°C
Source Current (Body Diode)			I_S	23	A
Drain to Source dV/dt			dV/d_t	7.0	V/ns
Single Pulse Drain−to−Source Avalanche Energy (T_J = 25°C, V_{GS} = 10 V, I_L = 29 A_{pk}, L = 0.1 mH, R_{GS} = 25 Ω) (Note 3)			E_{AS}	42	mJ
Lead Temperature for Soldering Purposes (1/8″ from case for 10 s)			T_L	260	°C

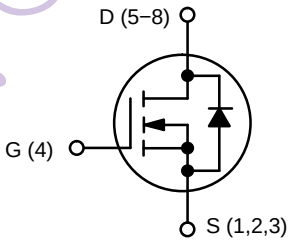
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Surface−mounted on FR4 board using 1 sq−in pad, 1 oz Cu.
2. Surface−mounted on FR4 board using the minimum recommended pad size.
3. Parts are 100% tested at T_J = 25°C, V_{GS} = 10 V, I_L = 20 A_{pk}, EAS = 20 mJ.

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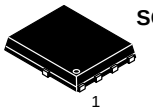
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$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
30 V	5.8 mΩ @ 10 V	52 A
	8.5 mΩ @ 4.5 V	

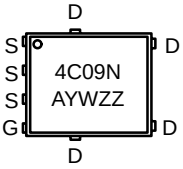


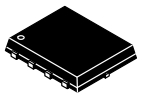
N−CHANNEL MOSFET

MARKING DIAGRAMS

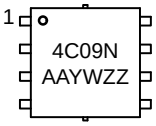


SO−8 FLAT LEAD CASE 488AA STYLE 1





DFN5 5x6 (SO−8 FLAT LEAD) CASE 506CX



A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceabililty

ORDERING INFORMATION

Device	Package	Shipping†
NTMFS4C09NT1G	SO−8 FL (Pb−Free)	1500 / Tape & Reel
NTMFS4C09NT3G	SO−8 FL (Pb−Free)	5000 / Tape & Reel
NTMFS4C09NT1G−001	SO−8 FL (Pb−Free)	1500 / Tape & Reel

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

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THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	4.9	°C/W
Junction−to−Ambient – Steady State (Note 4)	$R_{\theta JA}$	49.8	
Junction−to−Ambient – Steady State (Note 5)	$R_{\theta JA}$	164.6	
Junction−to−Ambient – (t ≤ 10 s) (Note 4)	$R_{\theta JA}$	21.0	

4. Surface−mounted on FR4 board using 1 sq−in pad, 1 oz Cu.
5. Surface−mounted on FR4 board using the minimum recommended pad size.

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

Parameter	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 (transient)	$V_{(BR)DSSt}$	V_{GS} = 0 V, $I_{D(aval)}$ = 8.4 A, T_{case} = 25°C, $t_{transient}$ = 100 ns		34			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}$/T_J				14.4		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 6)							
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} = V_{DS}, I_D = 250 μA		1.3		2.1	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}$/T_J				4.8		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 30 A		4.6	5.8	mΩ
		V_{GS} = 4.5 V	I_D = 18 A		6.8	8.5	
Forward Transconductance	g_{FS}	V_{DS} = 1.5 V, I_D = 15 A			50		S
Gate Resistance	R_G	T_A = 25°C		0.3	1.0	2.0	Ω
CHARGES AND CAPACITANCES							
Input Capacitance	C_{ISS}	V_{GS} = 0 V, f = 1 MHz, V_{DS} = 15 V			1252		pF
Output Capacitance	C_{OSS}				610		
Reverse Transfer Capacitance	C_{RSS}				126		
Capacitance Ratio	C_{RSS}/C_{ISS}	V_{GS} = 0 V, V_{DS} = 15 V, f = 1 MHz			0.101		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 15 V; I_D = 30 A			10.9		nC
Threshold Gate Charge	$Q_{G(TH)}$				1.9		
Gate−to−Source Charge	Q_{GS}				3.4		
Gate−to−Drain Charge	Q_{GD}				5.4		
Gate Plateau Voltage	V_{GP}				3.1		V
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 10 V, V_{DS} = 15 V; I_D = 30 A			22.2		nC
SWITCHING CHARACTERISTICS (Note 7)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 4.5 V, V_{DS} = 15 V, I_D = 15 A, R_G = 3.0 Ω			10		ns
Rise Time	t_r				32		
Turn−Off Delay Time	$t_{d(OFF)}$				16		
Fall Time	t_f				6.0		

6. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

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

Parameter	Symbol	Test Condition		Min	Typ	Max	Unit
SWITCHING CHARACTERISTICS (Note 7)							
Turn−On Delay Time	$t_{d(ON)}$	V_{GS} = 10 V, V_{DS} = 15 V, I_D = 15 A, R_G = 3.0 Ω			7.0		ns
Rise Time	t_r				28		
Turn−Off Delay Time	$t_{d(OFF)}$				20		
Fall Time	t_f				4.0		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 10 A	T_J = 25°C		0.79	1.1	V
			T_J = 125°C		0.65		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dIS/dt = 100 A/μs, I_S = 30 A			31		ns
Charge Time	t_a				15		
Discharge Time	t_b				16		
Reverse Recovery Charge	Q_{RR}				15		nC

6. Pulse Test: pulse width ≤ 300 μs, duty cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

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TYPICAL CHARACTERISTICS

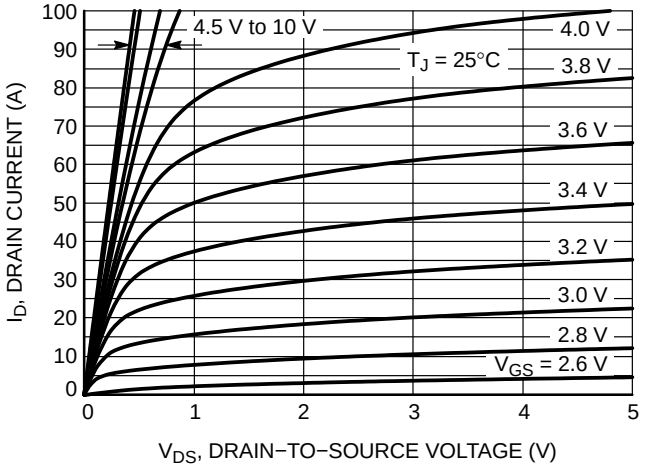


Figure 1. On−Region Characteristics

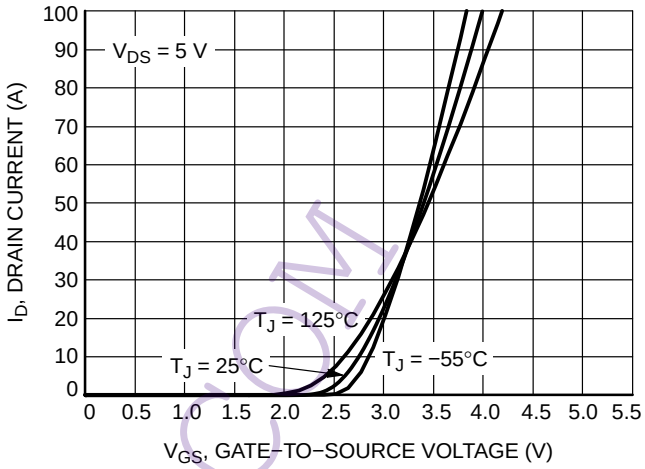


Figure 2. Transfer Characteristics

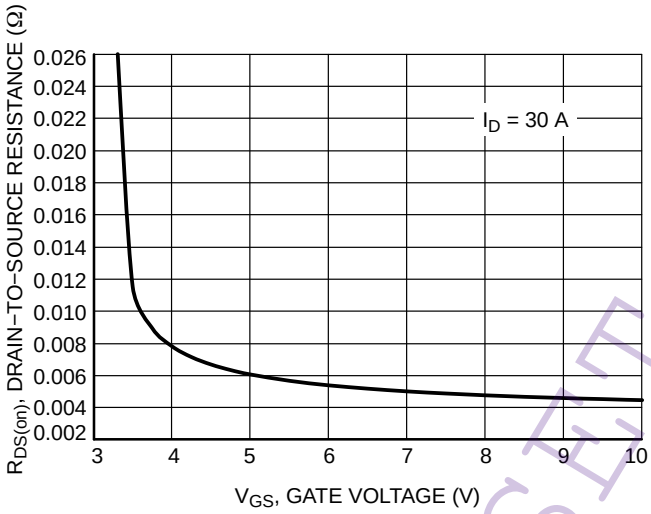


Figure 3. On−Resistance vs. Gate−to−Source Voltage

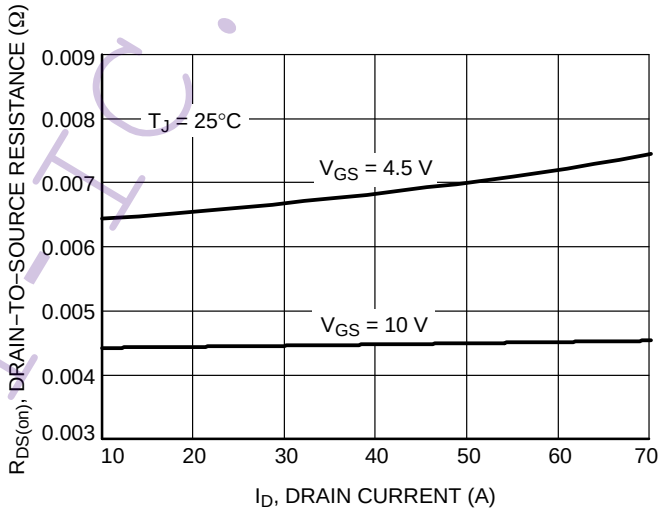


Figure 4. On−Resistance vs. Drain Current and Gate Voltage

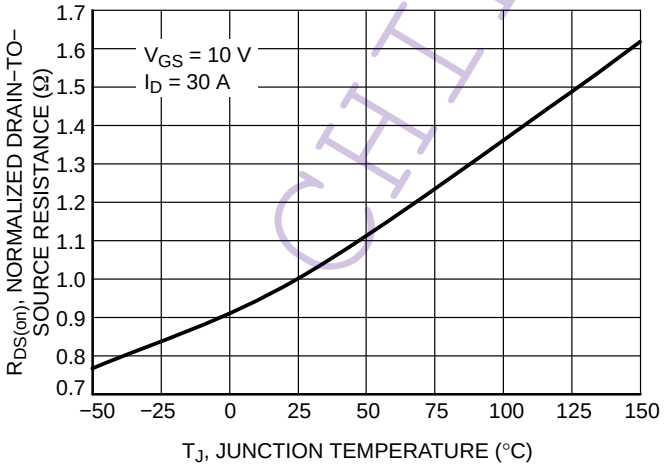


Figure 5. On−Resistance Variation with Temperature

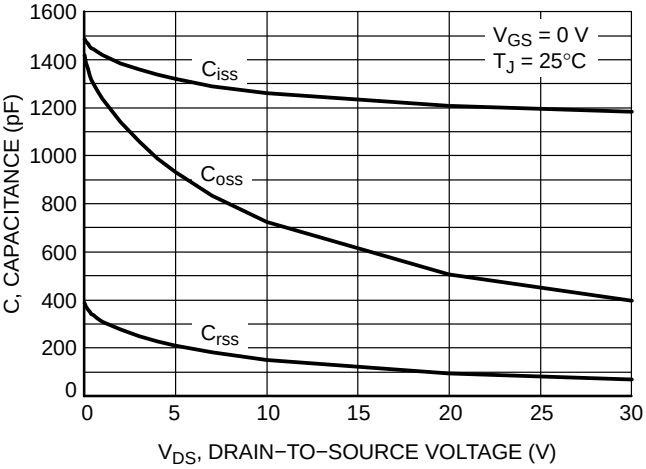


Figure 6. Capacitance Variation

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TYPICAL CHARACTERISTICS

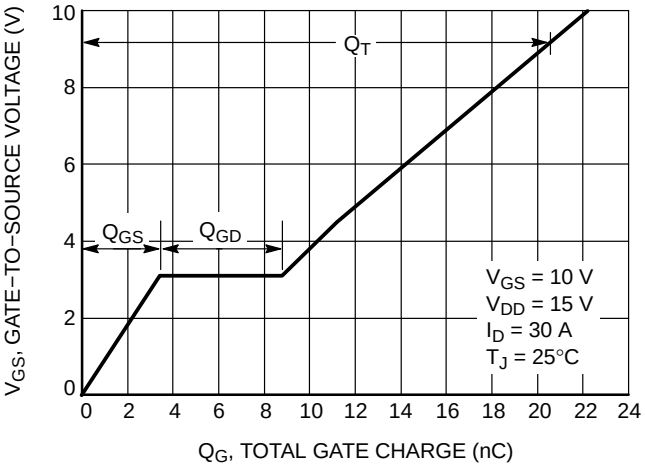


Figure 7. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

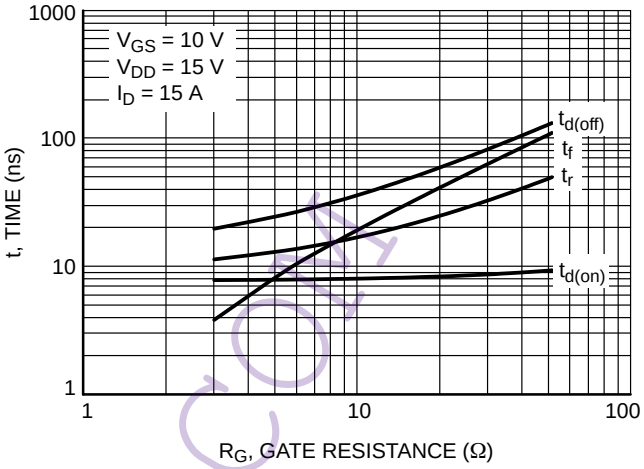


Figure 8. Resistive Switching Time Variation vs. Gate Resistance

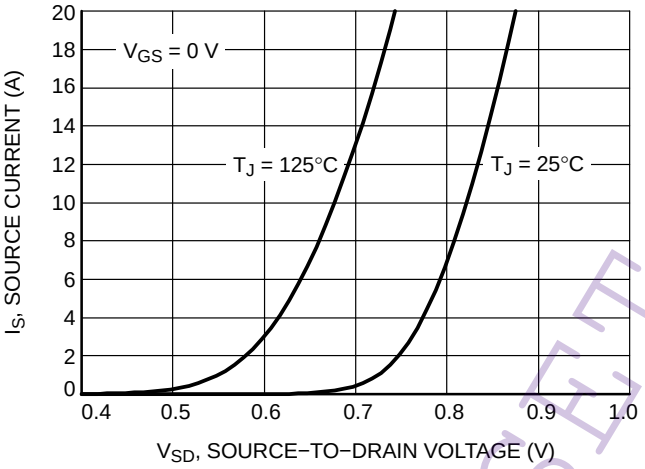


Figure 9. Diode Forward Voltage vs. Current

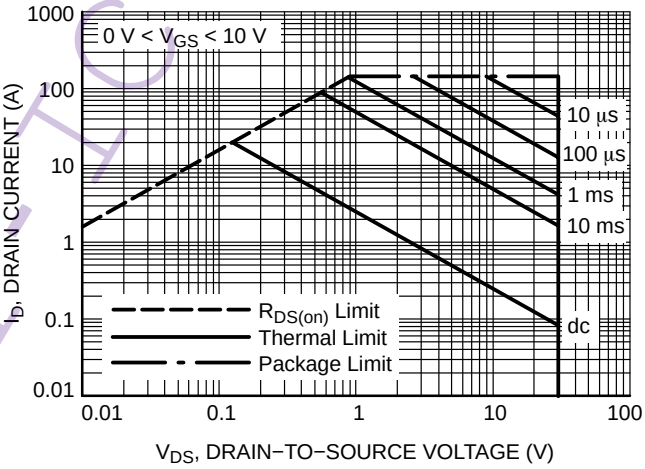


Figure 10. Maximum Rated Forward Biased Safe Operating Area

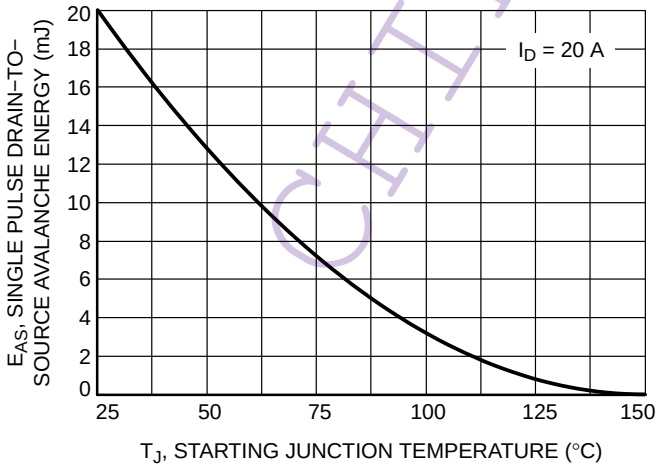


Figure 11. Maximum Avalanche Energy vs. Starting Junction Temperature

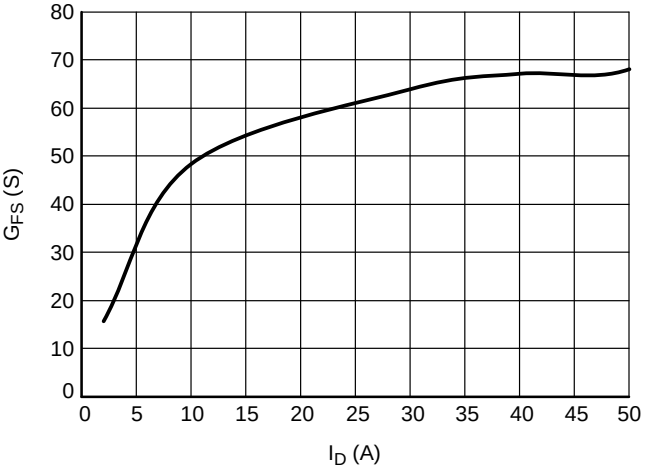


Figure 12. G_{FS} vs. I_D

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TYPICAL CHARACTERISTICS

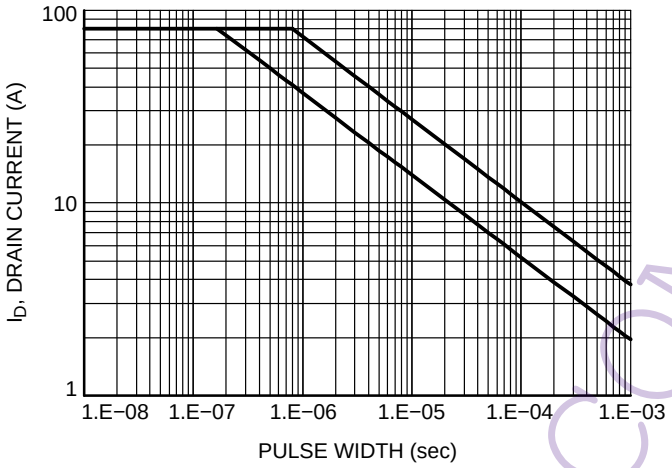


Figure 13. Avalanche Characteristics

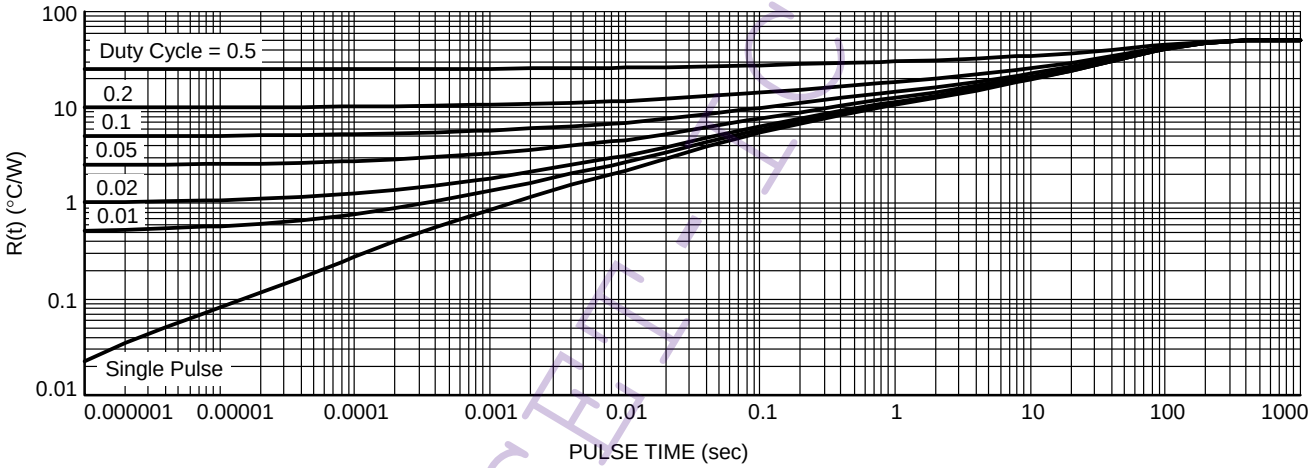
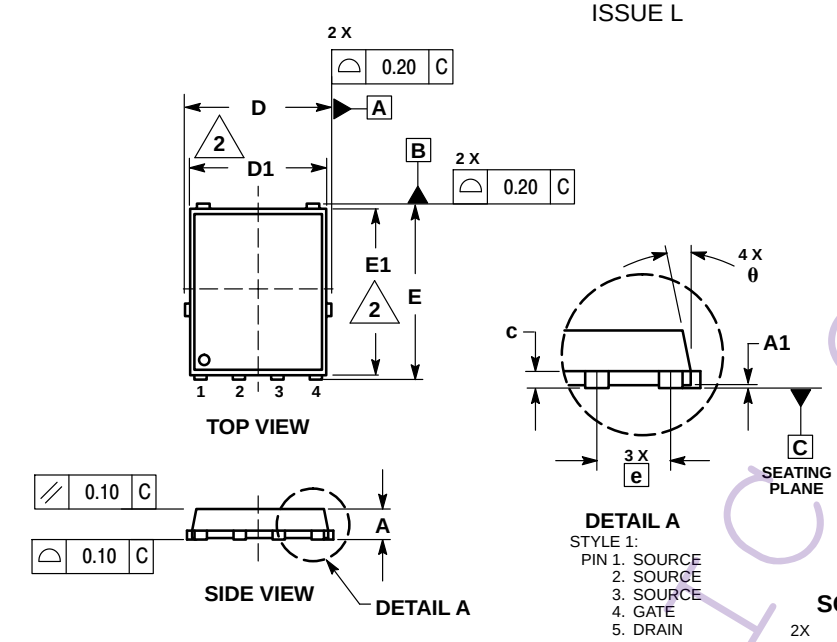


Figure 14. Thermal Response

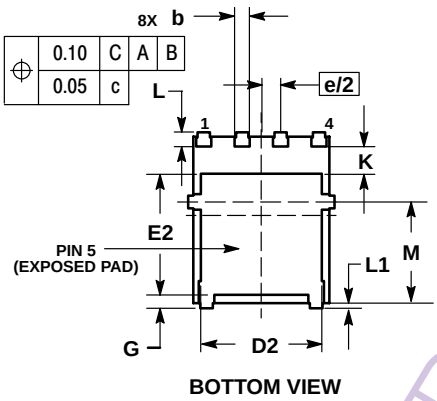
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PACKAGE DIMENSIONS

DFN5 5x6, 1.27P
(SO−8FL)
CASE 488AA
ISSUE L



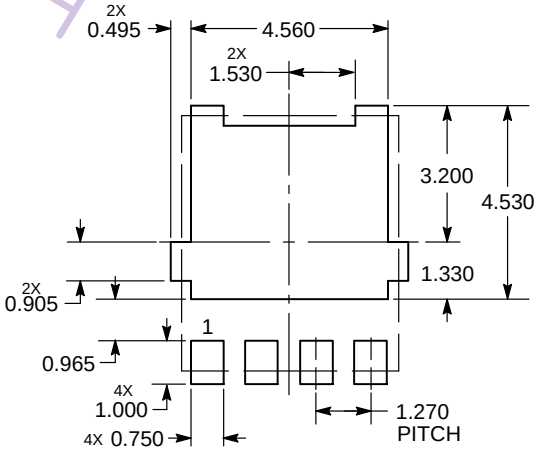
STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN



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	1.00	1.10
A1	0.00	–––	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.61	0.71
K	1.20	1.35	1.50
L	0.51	0.61	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0 °	–––	12 °

RECOMMENDED SOLDERING FOOTPRINT*



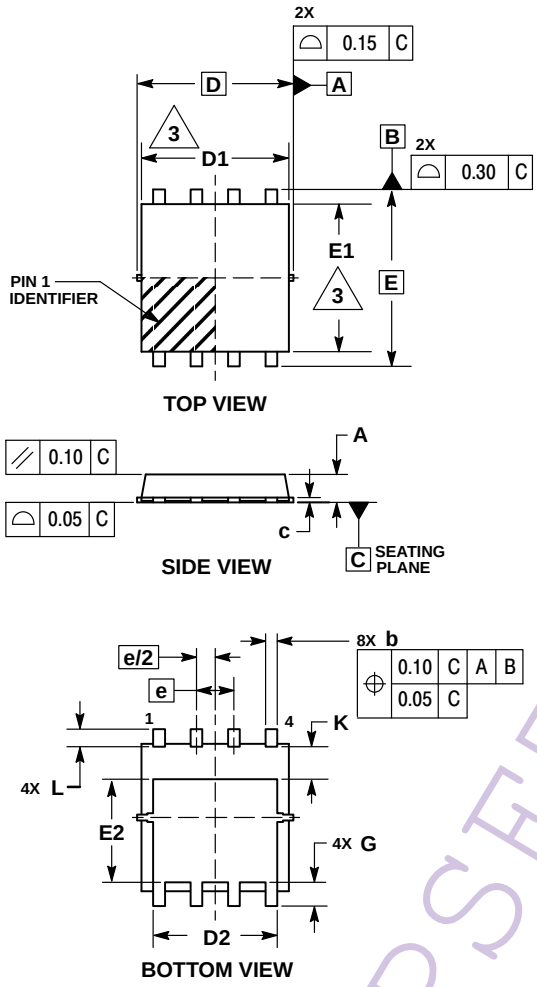
DIMENSIONS: MILLIMETERS

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

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PACKAGE DIMENSIONS

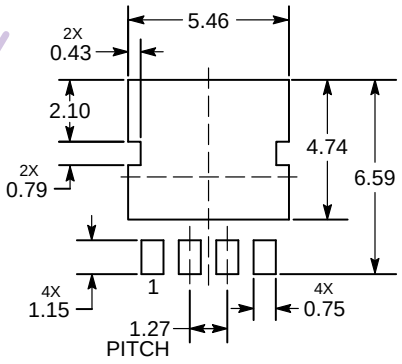
DFN5 5x6, 1.27P
(SO−8FL)
CASE 506CX
ISSUE O



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

	MILLIMETERS	
DIM	MIN	MAX
A	0.90	1.00
b	0.30	0.50
c	0.11	0.22
D	5.30 BSC	
D1	4.80	5.20
D2	4.05	4.45
E	6.00 BSC	
E1	4.80	5.20
E2	3.30	3.70
e	1.27 BSC	
G	0.70	0.90
K	0.90	1.30
L	0.50	0.70

SOLDERING FOOTPRINT*



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