

NTMFS4C10N

Power MOSFET

30 V, 46 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 ($T_J = 25^\circ\text{C}$ 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)	$T_A = 25^\circ\text{C}$	I_D	15.0	A
	$T_A = 80^\circ\text{C}$		11.2	
Power Dissipation $R_{\theta JA}$ (Note 1)	$T_A = 25^\circ\text{C}$	P_D	2.49	W
	$T_A = 80^\circ\text{C}$		16.8	
Continuous Drain Current $R_{\theta JA} \leq 10 \text{ s}$ (Note 1)	$T_A = 25^\circ\text{C}$	I_D	22.5	A
	$T_A = 80^\circ\text{C}$		16.8	
Power Dissipation $R_{\theta JA} \leq 10 \text{ s}$ (Note 1)	$T_A = 25^\circ\text{C}$	P_D	5.6	W
	$T_A = 80^\circ\text{C}$		6.2	
Continuous Drain Current $R_{\theta JA}$ (Note 2)	$T_A = 25^\circ\text{C}$	I_D	8.2	A
	$T_A = 80^\circ\text{C}$		6.2	
Power Dissipation $R_{\theta JA}$ (Note 2)	$T_A = 25^\circ\text{C}$	P_D	0.75	W
	$T_A = 80^\circ\text{C}$		0.75	
Continuous Drain Current $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$	I_D	46	A
	$T_C = 80^\circ\text{C}$		34	
Power Dissipation $R_{\theta JC}$ (Note 1)	$T_C = 25^\circ\text{C}$	P_D	23.6	W
Pulsed Drain Current	$T_A = 25^\circ\text{C}$, $t_p = 10 \mu\text{s}$	I_{DM}	132	A
Current Limited by Package	$T_A = 25^\circ\text{C}$	I_{Dmax}	80	A
Operating Junction and Storage Temperature		T_J , T_{STG}	-55 to +150	$^\circ\text{C}$
Source Current (Body Diode)		I_S	21	A
Drain to Source dV/dt		dV/dt	7.0	V/ns
Single Pulse Drain-to-Source Avalanche Energy ($T_J = 25^\circ\text{C}$, $V_{GS} = 10 \text{ V}$, $I_L = 25 \text{ A}_{pk}$, $L = 0.1 \text{ mH}$, $R_{GS} = 25 \Omega$) (Note 3)		E_{AS}	31	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)		T_L	260	$^\circ\text{C}$

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.

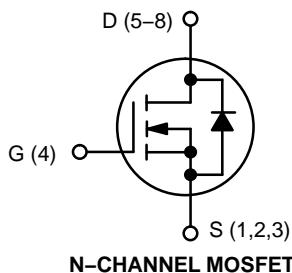
1. Surface-mounted on FR4 board using 1 sq-in pad, 1 oz Cu.
2. Surface-mounted on FR4 board using the minimum recommended pad size.
3. This is the absolute maximum rating. Parts are 100% tested at $T_J = 25^\circ\text{C}$, $V_{GS} = 10 \text{ V}$, $I_L = 17 \text{ A}_{pk}$, $E_{AS} = 14 \text{ mJ}$.



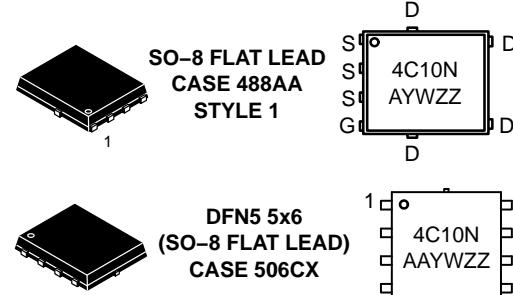
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$V_{(BR)DSS}$	$R_{DS(ON) \text{ MAX}}$	$I_D \text{ MAX}$
30 V	6.95 m Ω @ 10 V	46 A
	10.8 m Ω @ 4.5 V	



MARKING DIAGRAMS



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

ORDERING INFORMATION

Device	Package	Shipping [†]
NTMFS4C10NT1G	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)	$R_{\theta JC}$	5.3	$^{\circ}\text{C}/\text{W}$
Junction-to-Ambient – Steady State (Note 4)	$R_{\theta JA}$	50.3	
Junction-to-Ambient – Steady State (Note 5)	$R_{\theta JA}$	165.9	
Junction-to-Ambient – (t \leq 10 s) (Note 4)	$R_{\theta JA}$	22.2	

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 ($T_J = 25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(\text{BR})\text{DSS}}$	$V_{\text{GS}} = 0 \text{ V}$, $I_D = 250 \mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage (transient)	$V_{(\text{BR})\text{DSSt}}$	$V_{\text{GS}} = 0 \text{ V}$, $I_{\text{D(aval)}} = 7.1 \text{ A}$, $T_{\text{case}} = 25^{\circ}\text{C}$, $t_{\text{transient}} = 100 \text{ ns}$	34			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(\text{BR})\text{DSS}}/T_J$			14.5		$\text{mV}/^{\circ}\text{C}$
Zero Gate Voltage Drain Current	I_{DSS}	$V_{\text{GS}} = 0 \text{ V}$, $V_{\text{DS}} = 24 \text{ V}$	$T_J = 25^{\circ}\text{C}$		1.0	μA
			$T_J = 125^{\circ}\text{C}$		10	
Gate-to-Source Leakage Current	I_{GSS}	$V_{\text{DS}} = 0 \text{ V}$, $V_{\text{GS}} = \pm 20 \text{ V}$			± 100	nA

ON CHARACTERISTICS (Note 6)

Gate Threshold Voltage	$V_{\text{GS(TH)}}$	$V_{\text{GS}} = V_{\text{DS}}$, $I_D = 250 \mu\text{A}$	1.3		2.2	V
Negative Threshold Temperature Coefficient	$V_{\text{GS(TH)}}/T_J$			4.7		$\text{mV}/^{\circ}\text{C}$
Drain-to-Source On Resistance	$R_{\text{DS(on)}}$	$V_{\text{GS}} = 10 \text{ V}$	$I_D = 30 \text{ A}$		5.8	6.95
		$V_{\text{GS}} = 4.5 \text{ V}$	$I_D = 15 \text{ A}$		8.9	10.8
Forward Transconductance	g_{FS}	$V_{\text{DS}} = 1.5 \text{ V}$	$I_D = 15 \text{ A}$		43	
Gate Resistance	R_G	$T_A = 25^{\circ}\text{C}$		0.3	1.0	2.0
						Ω

CHARGES AND CAPACITANCES

Input Capacitance	C_{ISS}	$V_{\text{GS}} = 0 \text{ V}$, $f = 1 \text{ MHz}$, $V_{\text{DS}} = 15 \text{ V}$	987		pF
Output Capacitance	C_{OSS}		574		
Reverse Transfer Capacitance	C_{RSS}		162		
Capacitance Ratio	$C_{\text{RSS}}/C_{\text{ISS}}$	$V_{\text{GS}} = 0 \text{ V}$, $V_{\text{DS}} = 15 \text{ V}$, $f = 1 \text{ MHz}$	0.165		
Total Gate Charge	$Q_{\text{G(TOT)}}$	$V_{\text{GS}} = 4.5 \text{ V}$, $V_{\text{DS}} = 15 \text{ V}$, $I_D = 30 \text{ A}$	9.7		nC
Threshold Gate Charge	$Q_{\text{G(TH)}}$		1.5		
Gate-to-Source Charge	Q_{GS}		2.8		
Gate-to-Drain Charge	Q_{GD}		4.8		
Gate Plateau Voltage	V_{GP}		3.2		
Total Gate Charge	$Q_{\text{G(TOT)}}$	$V_{\text{GS}} = 10 \text{ V}$, $V_{\text{DS}} = 15 \text{ V}$, $I_D = 30 \text{ A}$	18.6		nC

SWITCHING CHARACTERISTICS (Note 7)

Turn-On Delay Time	$t_{\text{d(ON)}}$	$V_{\text{GS}} = 4.5 \text{ V}$, $V_{\text{DS}} = 15 \text{ V}$, $I_D = 15 \text{ A}$, $R_G = 3.0 \Omega$	9.0		ns
Rise Time	t_r		34		
Turn-Off Delay Time	$t_{\text{d(OFF)}}$		14		
Fall Time	t_f		7.0		

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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			26		
Turn-Off Delay Time	t _{d(OFF)}			18		
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		0.80	1.1	V
			T _J = 125°C		0.67		
Reverse Recovery Time	t _{RR}	V _{GS} = 0 V, dI _S /dt = 100 A/μs, I _S = 30 A			26.7		ns
Charge Time	t _a				14.1		
Discharge Time	t _b				12.6		
Reverse Recovery Charge	Q _{RR}				13.7		nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

TYPICAL CHARACTERISTICS

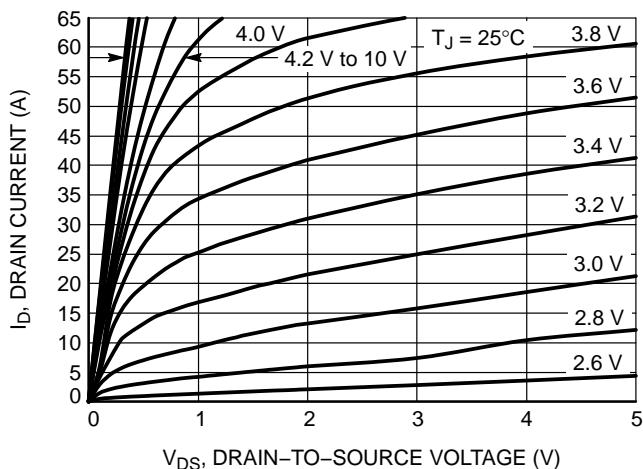


Figure 1. On-Region Characteristics

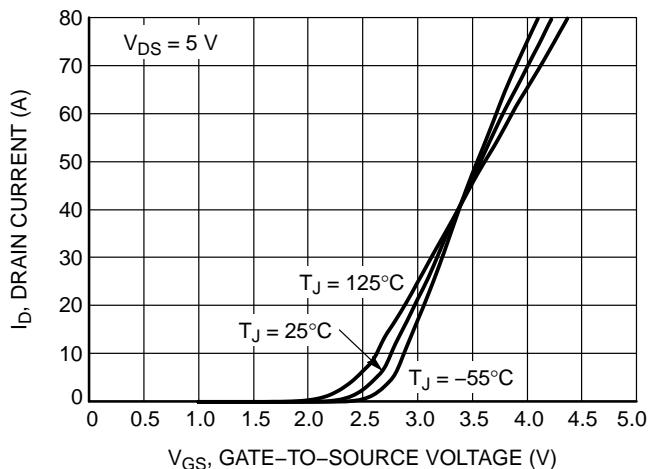


Figure 2. Transfer Characteristics

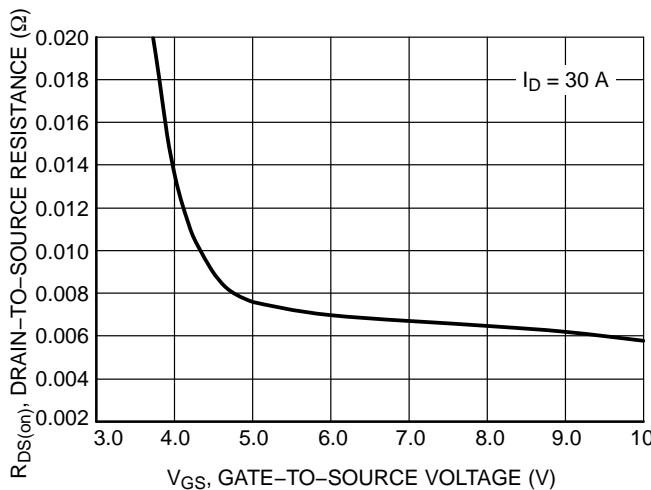


Figure 3. On-Resistance vs. V_{GS}

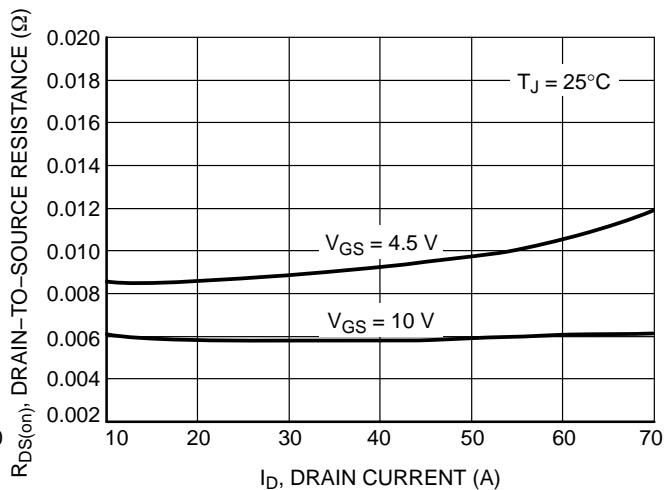


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

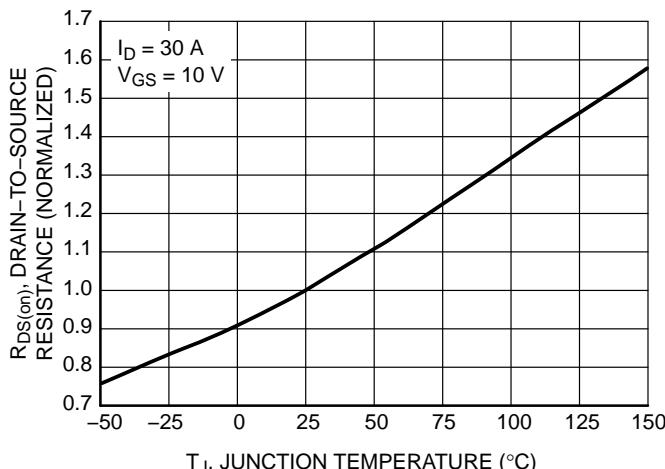


Figure 5. On-Resistance Variation with Temperature

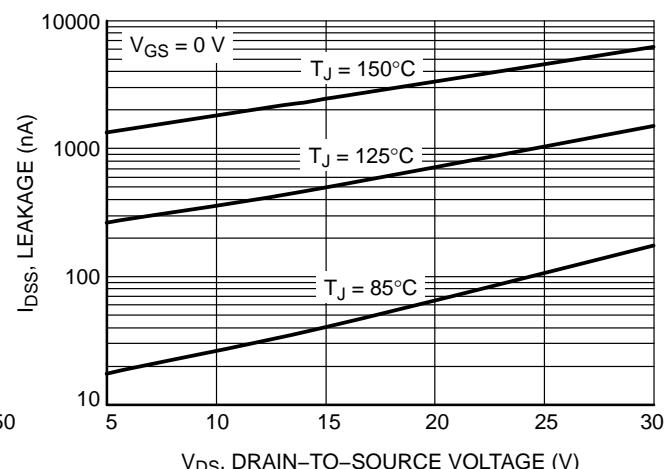


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

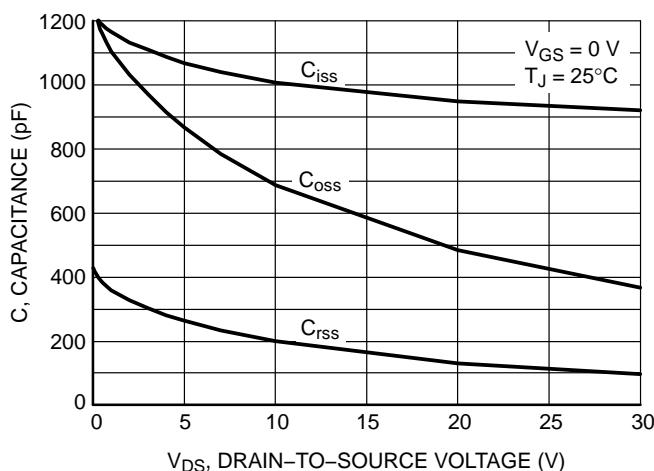


Figure 7. Capacitance Variation

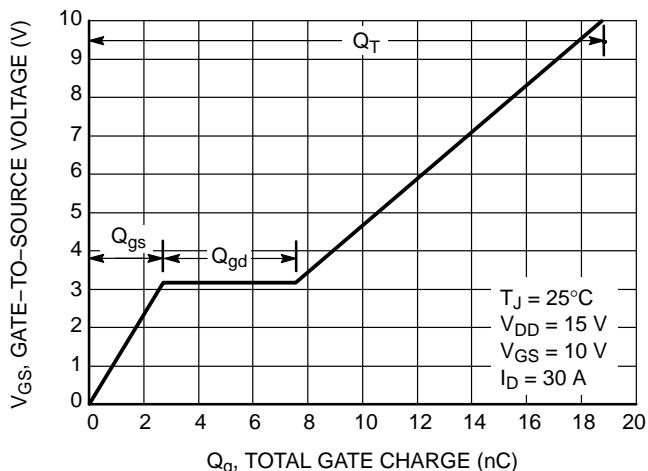


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

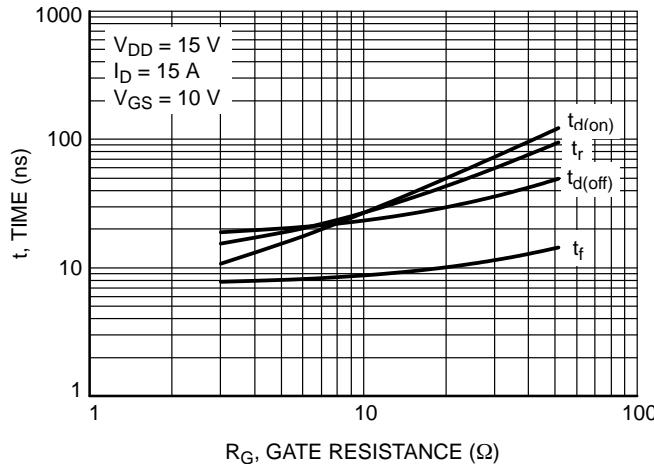


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

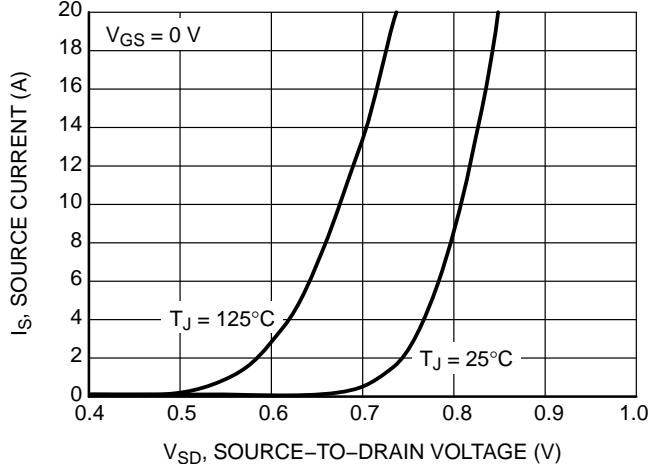


Figure 10. Diode Forward Voltage vs. Current

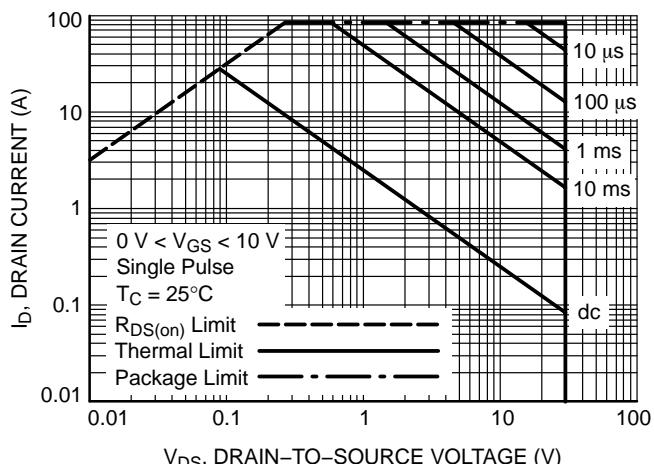


Figure 11. Maximum Rated Forward Biased Safe Operating Area

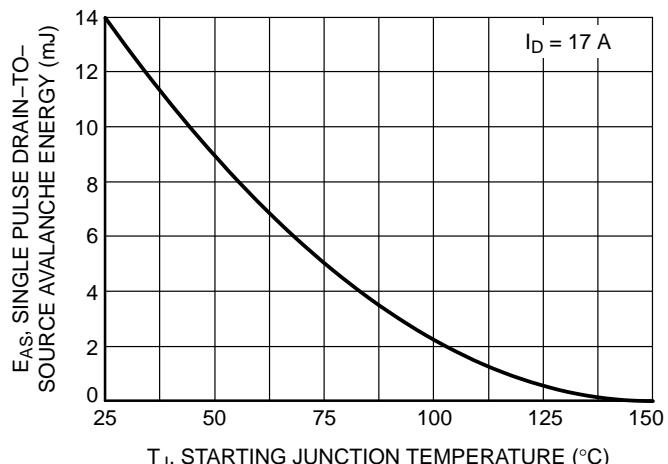


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL CHARACTERISTICS

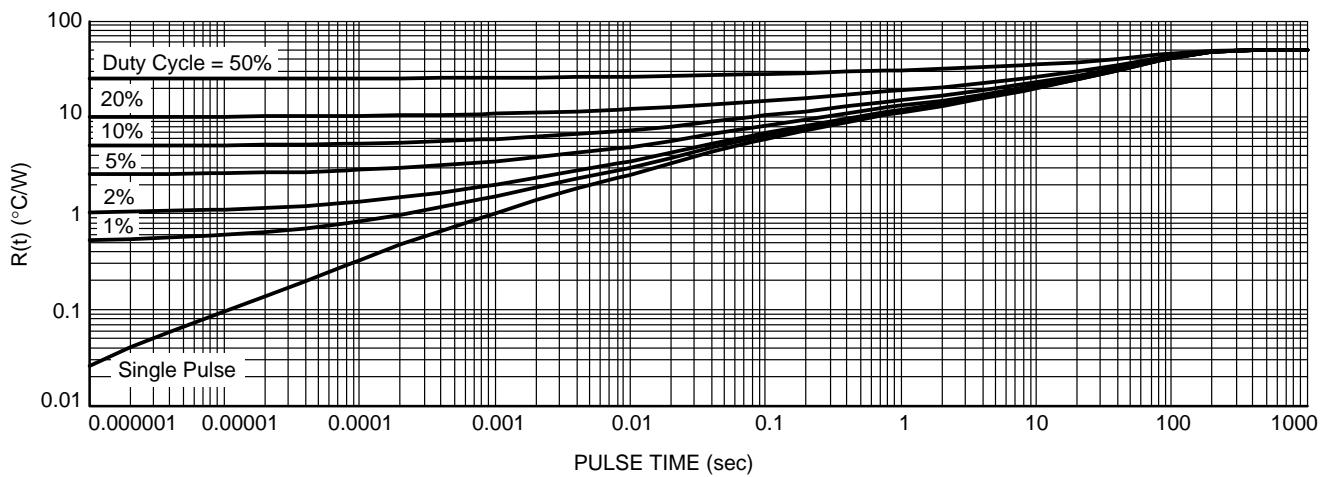


Figure 13. Thermal Response

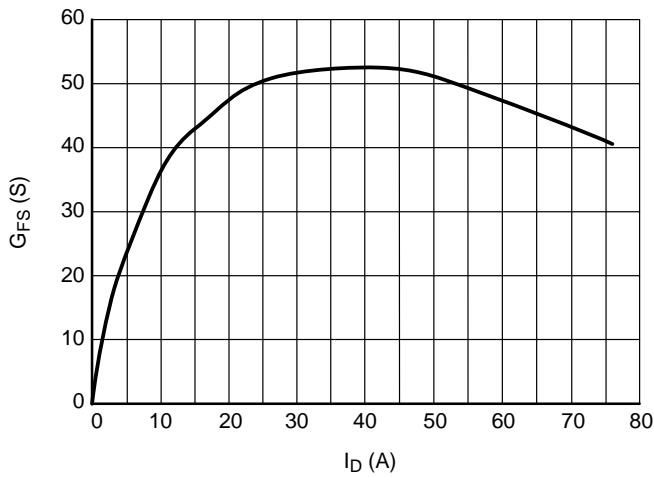


Figure 14. G_{FS} vs. I_D

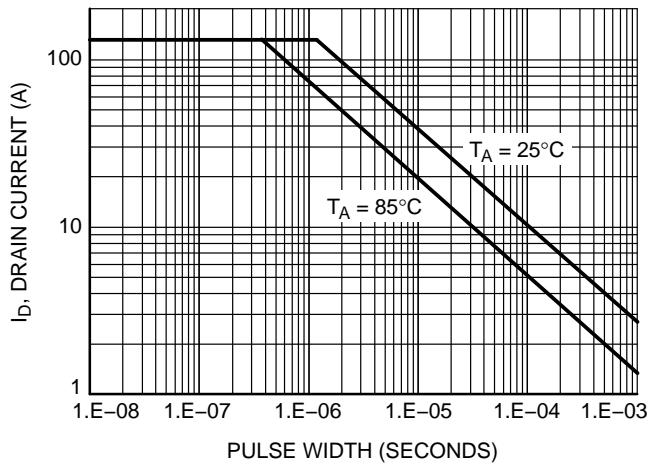
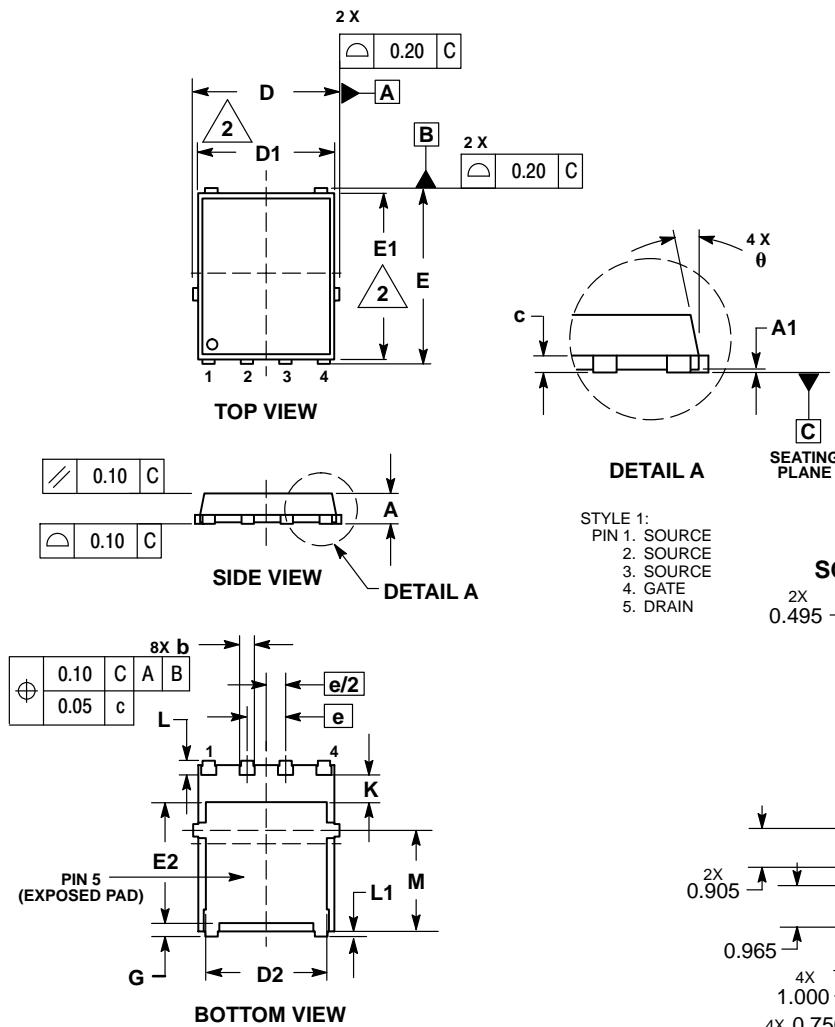


Figure 15. Avalanche Characteristics

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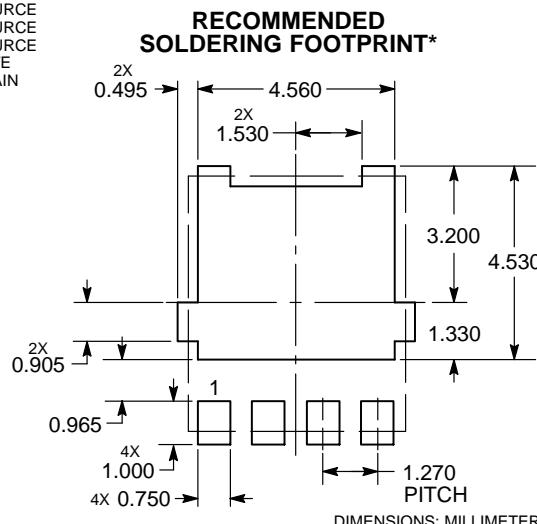
PACKAGE DIMENSIONS

DFN5 5x6, 1.27P (SO-8FL) CASE 488AA ISSUE M



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.

DIM	MILLIMETERS		
	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	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0°	—	12°

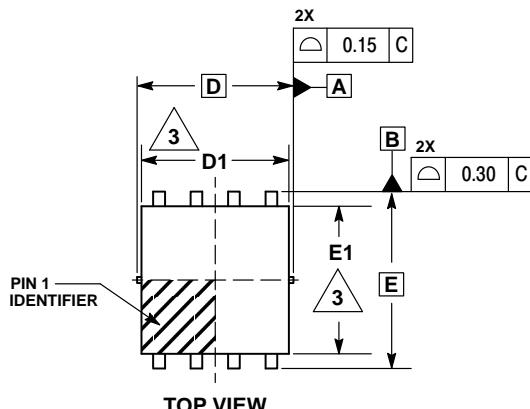


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

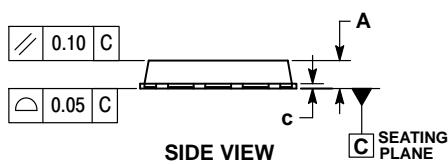
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PACKAGE DIMENSIONS

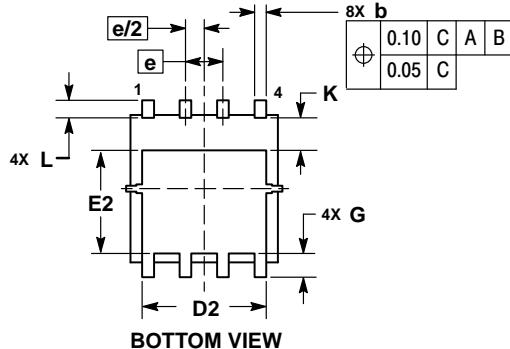
**DFN5 5x6, 1.27P
(SO-8FL)
CASE 506CX
ISSUE O**



TOP VIEW



SIDE VIEW

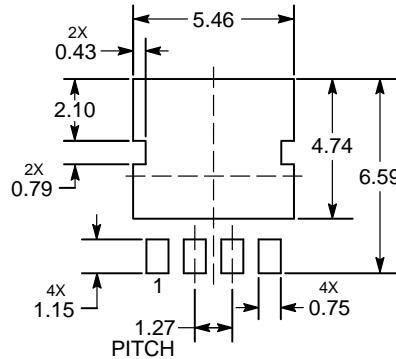


BOTTOM VIEW

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.

DIM	MILLIMETERS	
	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*



*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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