MOSFET - Power, Single N-Channel, SO-8FL

30 V, 78 A

NTMFS4C05N

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

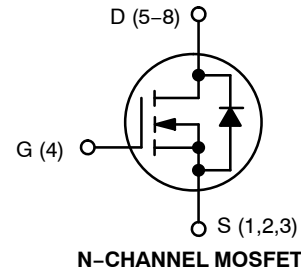- CPU Power Delivery
- DC−DC Converters

$V_{(BR)DSS}$	$R_{DS(ON)}$ MAX	I_D MAX
30 V	3.4 mΩ @ 10 V	78 A
	5.0 mΩ @ 4.5 V	

D (5−8)

G (4)

S (1,2,3)

N−CHANNEL MOSFET

MARKING DIAGRAMS

SO−8 FLAT LEAD CASE 488AA STYLE 1

S — D
S — 4C05N — D
S — AYWZZ — D
G — D
D

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

ORDERING INFORMATION

Device	Package	Shipping[†]
NTMFS4C05NT1G	SO−8 FL (Pb−Free)	1500 / Tape & Reel
NTMFS4C05NT3G	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 Specifications Brochure, BRD8011/D.

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

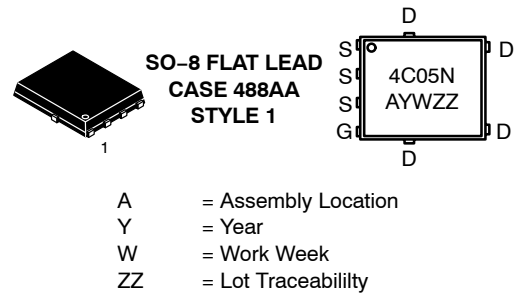| Parameter			Symbol	Value	Unit
Drain−to−Source Voltage			V_{DSS}	30	V
Gate−to−Source Voltage			V_{GS}	±20	V
Continuous Drain Current $R_{θJA}$ (Note 1)	Steady State	T_A = 25°C	I_D	21.7	A
		T_A = 80°C		16.3	
Power Dissipation $R_{θJA}$ (Note 1)		T_A = 25°C	P_D	2.57	W
Continuous Drain Current $R_{θJA}$ ≤ 10 s (Note 1)		T_A = 25°C	I_D	34.8	A
		T_A = 80°C		26.0	
Power Dissipation $R_{θJA}$ ≤ 10 s (Note 1)		T_A = 25°C	P_D	6.6	W
Continuous Drain Current $R_{θJA}$ (Note 2)		T_A = 25°C	I_D	11.9	A
		T_A = 80°C		8.9	
Power Dissipation $R_{θJA}$ (Note 2)		T_A = 25°C	P_D	0.77	W
Continuous Drain Current $R_{θJC}$ (Note 1)		T_C = 25°C	I_D	78	A
		T_C = 80°C		58	
Power Dissipation $R_{θJC}$ (Note 1)		T_C = 25°C	P_D	33	W
Pulsed Drain Current	T_A = 25°C, t_p = 10 μs		I_{DM}	174	A
Current Limited by Package	T_A = 25°C		I_{Dmax}	80	A
Operating Junction and Storage Temperature Range			T_J, T_{STG}	−55 to +150	°C
Source Current (Body Diode)			I_S	30	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} = 20 V, I_L = 41 A_{pk}, L = 0.1 mH, R_{GS} = 25 Ω) (Note 3)			E_{AS}	84	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. This is the absolute maximum ratings. Parts are 100% tested at T_J = 25°C, V_{GS} = 20 V, I_L = 29 A, E_{AS} = 42 mJ.

THERMAL RESISTANCE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Junction−to−Case (Drain)	$R_{\theta JC}$	3.8	°C/W
Junction−to−Ambient − Steady State (Note 4)	$R_{\theta JA}$	48.6	
Junction−to−Ambient − Steady State (Note 5)	$R_{\theta JA}$	161.7	
Junction−to−Ambient − (t ≤ 10 s) (Note 4)	$R_{\theta JA}$	19	

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, $I_{D(aval)}$ = 12.6 A, T_{case} = 25°C, $t_{transient}$ = 100 ns		34			V
Drain−to−Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$				12		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		2.2	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$				5.1		mV/°C
Drain−to−Source On Resistance	$R_{DS(on)}$	V_{GS} = 10 V	I_D = 30 A		2.7	3.4	mΩ
		V_{GS} = 4.5 V	I_D = 30 A		4.0	5.0	
Forward Transconductance	g_{FS}	V_{DS} = 1.5 V, I_D = 15 A			68		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			1972		pF
Output Capacitance	C_{OSS}				1215		
Reverse Transfer Capacitance	C_{RSS}				59		
Capacitance Ratio	C_{RSS}/C_{ISS}	V_{GS} = 0 V, V_{DS} = 15 V, f = 1 MHz			0.030		
Total Gate Charge	$Q_{G(TOT)}$	V_{GS} = 4.5 V, V_{DS} = 15 V; I_D = 30 A			14		nC
Threshold Gate Charge	$Q_{G(TH)}$				3.3		
Gate−to−Source Charge	Q_{GS}				6.0		
Gate−to−Drain Charge	Q_{GD}				5.0		
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			30		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			11		ns
Rise Time	t_r				32		
Turn−Off Delay Time	$t_{d(OFF)}$				21		
Fall Time	t_f				7.0		

NTMFS4C05N

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			8.0		ns
Rise Time	t_r				26		
Turn−Off Delay Time	$t_{d(OFF)}$				26		
Fall Time	t_f				5.0		
DRAIN−SOURCE DIODE CHARACTERISTICS							
Forward Diode Voltage	V_{SD}	V_{GS} = 0 V, I_S = 10 A	T_J = 25°C		0.77	1.1	V
			T_J = 125°C		0.62		
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, dI_S/dt = 100 A/μs, I_S = 30 A			40.2		ns
Charge Time	t_a				20.3		
Discharge Time	t_b				19.9		
Reverse Recovery Charge	Q_{RR}				30.2		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 ≤ 300 μs, duty cycle ≤ 2%.
7. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS
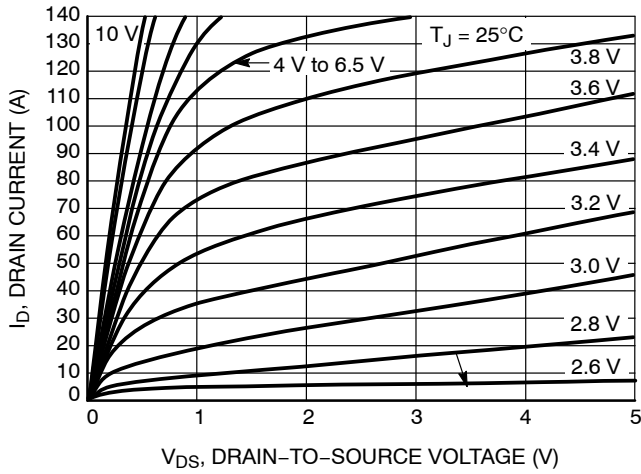
Figure 1. On−Region Characteristics
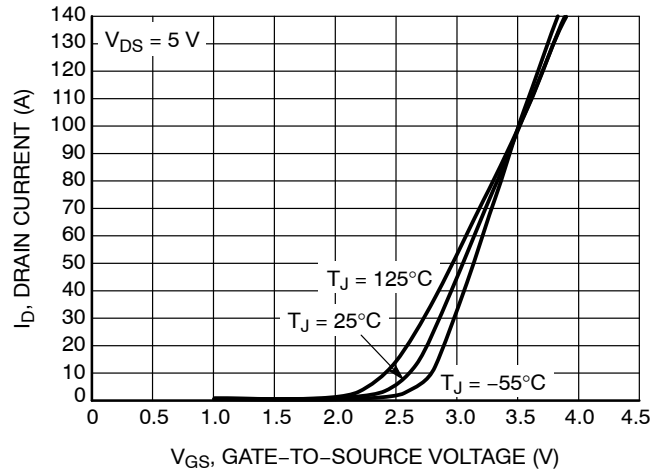
Figure 2. Transfer Characteristics
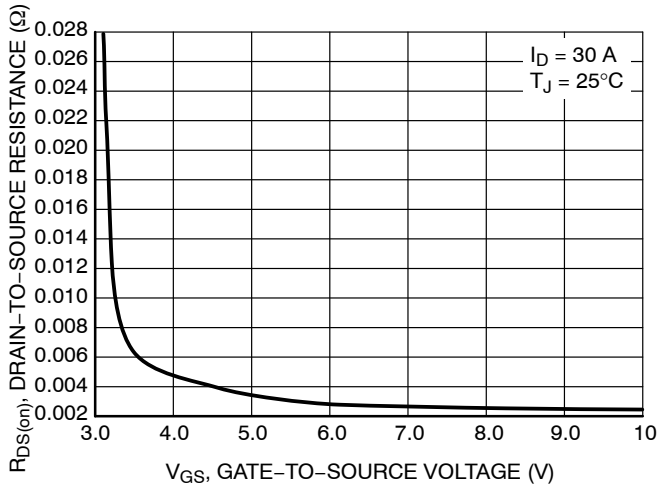
Figure 3. On−Resistance vs. V_{GS}
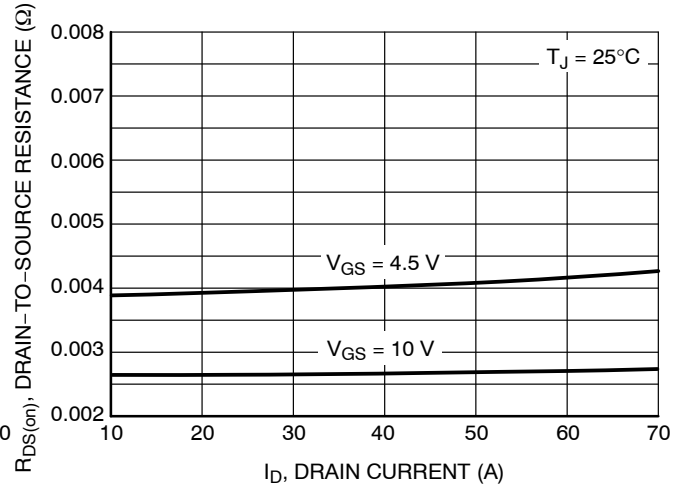
Figure 4. On−Resistance vs. Drain Current and Gate Voltage
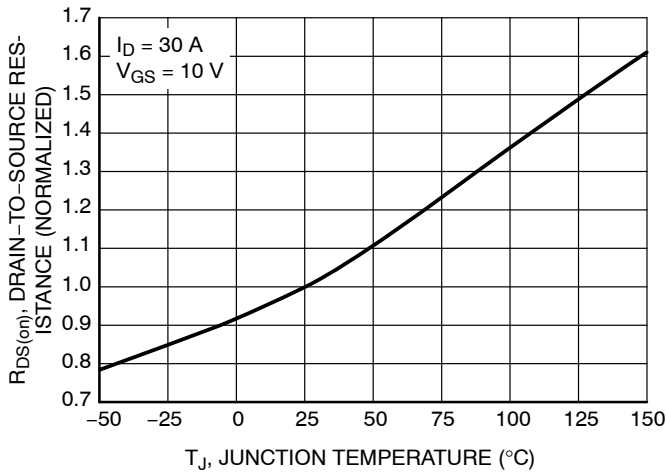
Figure 5. On−Resistance Variation with Temperature
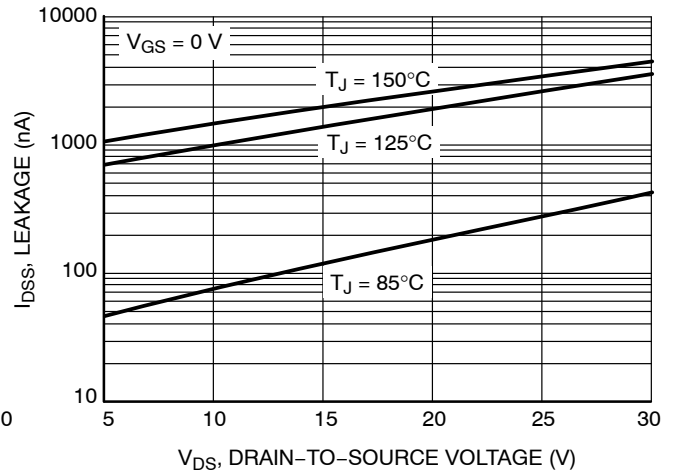
Figure 6. Drain−to−Source Leakage Current vs. Voltage

NTMFS4C05N

TYPICAL CHARACTERISTICS
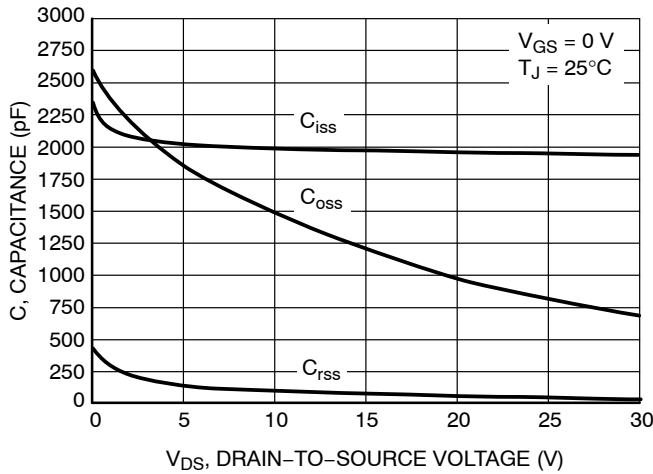
Figure 7. Capacitance Variation
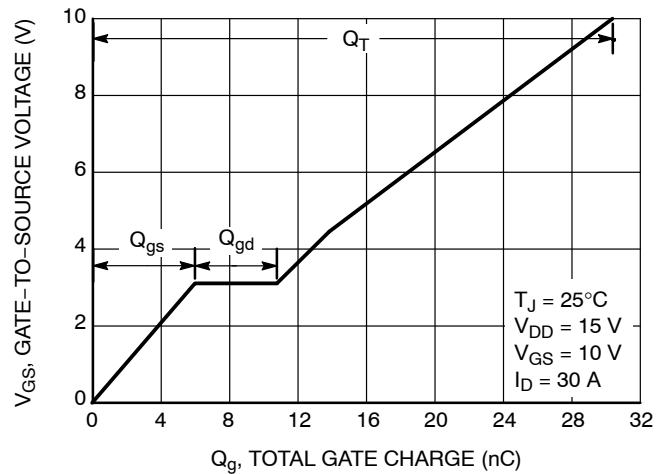
Figure 8. Gate−to−Source and
Drain−to−Source Voltage vs. Total Charge
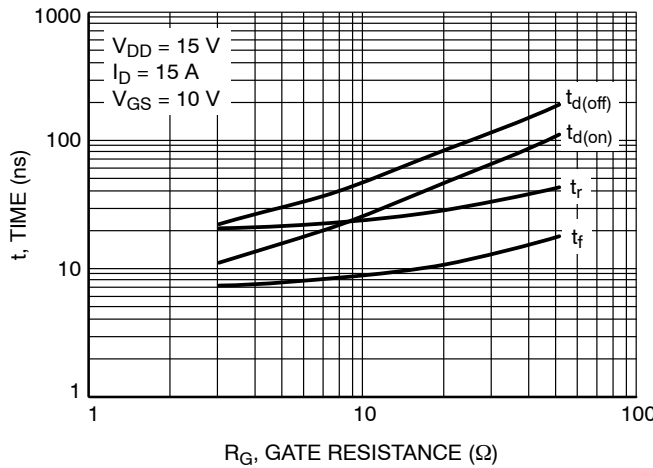
Figure 9. Resistive Switching Time Variation
vs. Gate Resistance
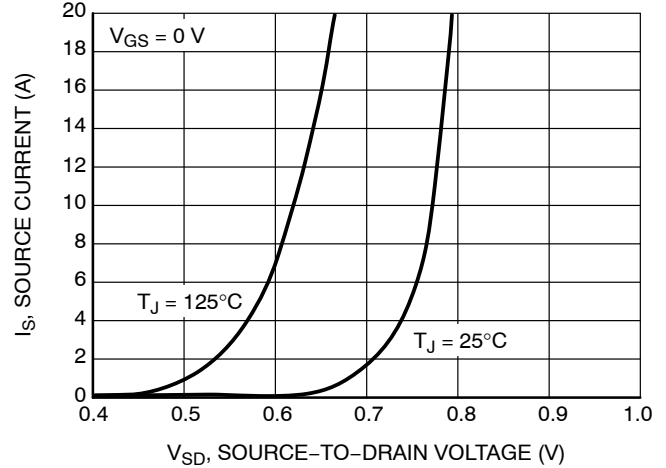
Figure 10. Diode Forward Voltage vs. Current
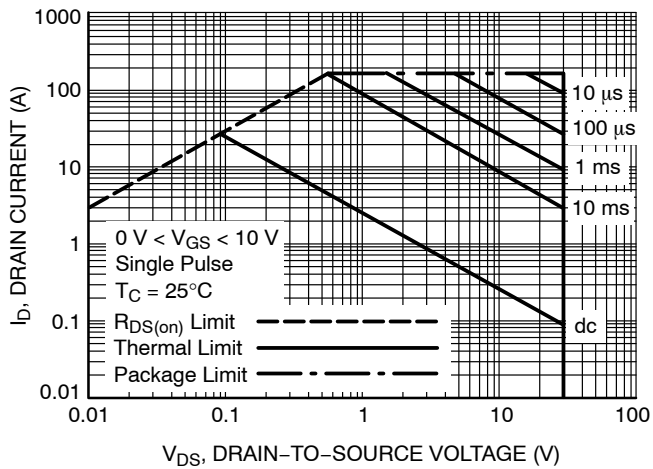
Figure 11. Maximum Rated Forward Biased
Safe Operating Area
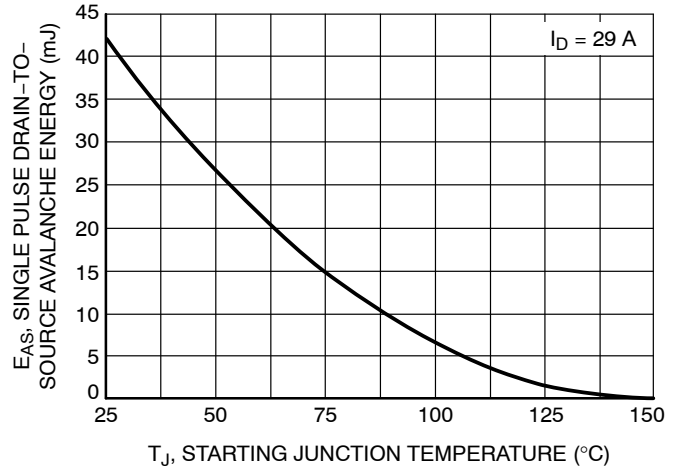
Figure 12. Maximum Avalanche Energy vs.
Starting Junction Temperature

TYPICAL CHARACTERISTICS
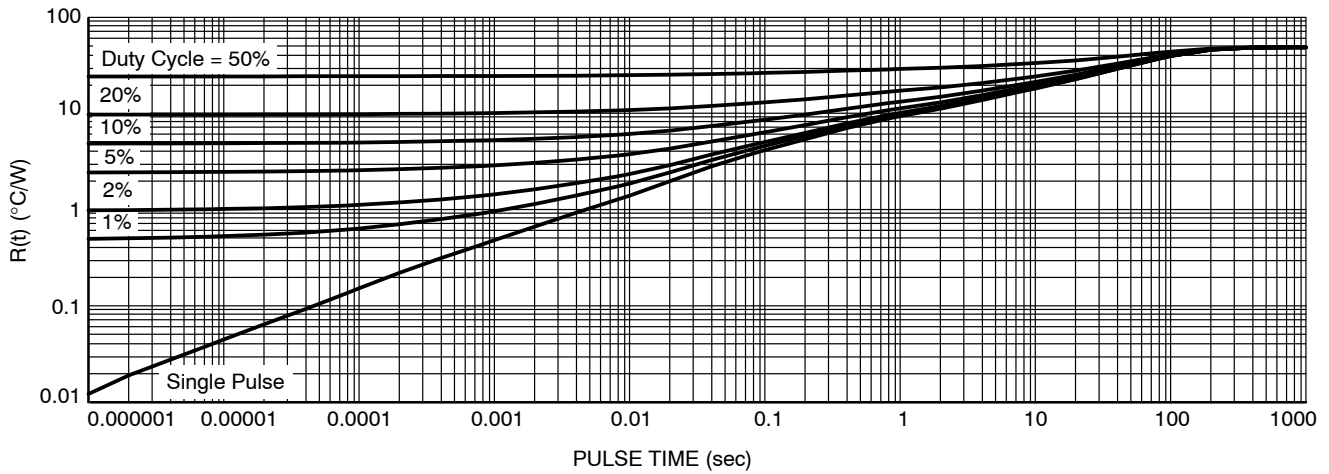
Figure 13. Thermal Response
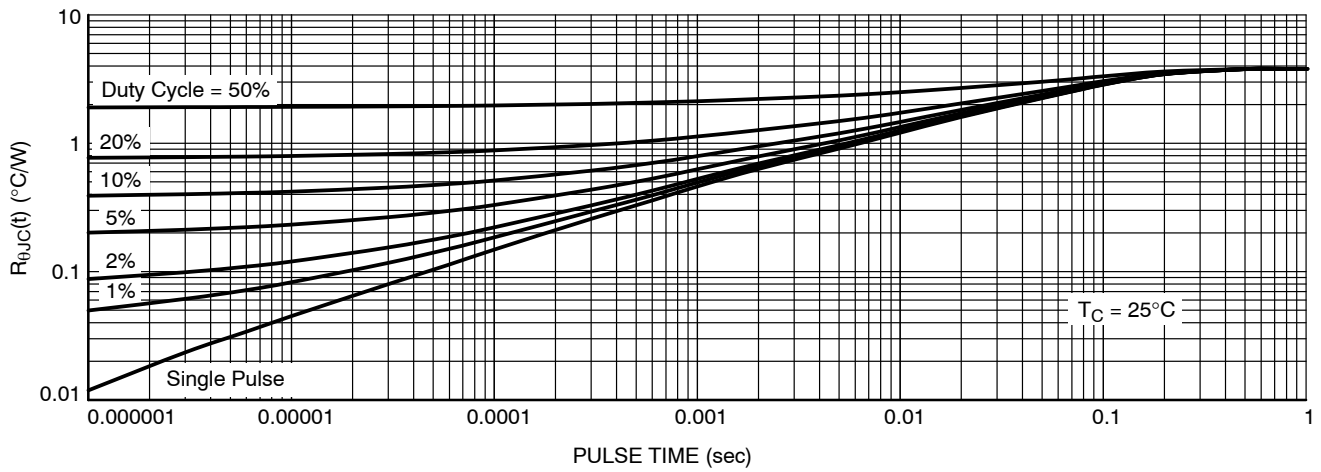
Figure 14. Thermal Response
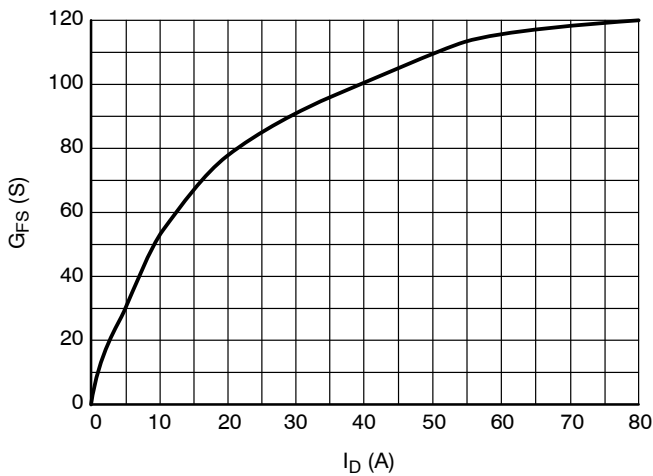
Figure 15. G$_{FS}$ vs. I$_D$
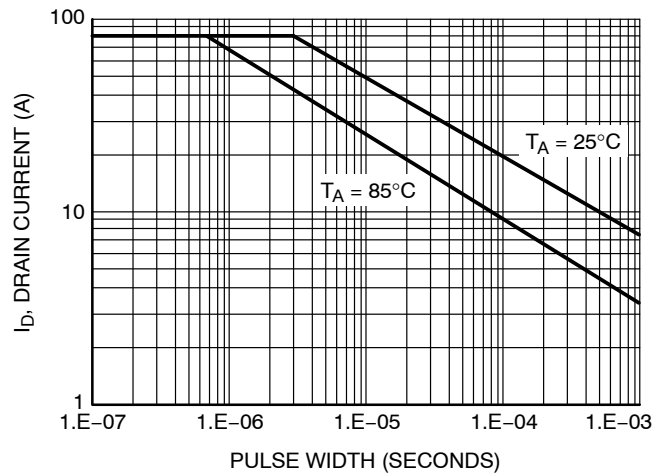
Figure 16. Avalanche Characteristics

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

SCALE 2:1

DATE 25 JUN 2018

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 °

TOP VIEW

DETAIL A

SEATING PLANE

SIDE VIEW

DETAIL A

GENERIC
MARKING DIAGRAM*
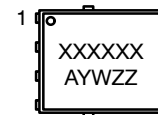
XXXXXX
AYWZZ

XXXXXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
ZZ = Lot Traceability

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot " ▪", may or may not be present. Some products may not follow the Generic Marking.

PIN 5
(EXPOSED PAD)

BOTTOM VIEW

RECOMMENDED
SOLDERING FOOTPRINT*

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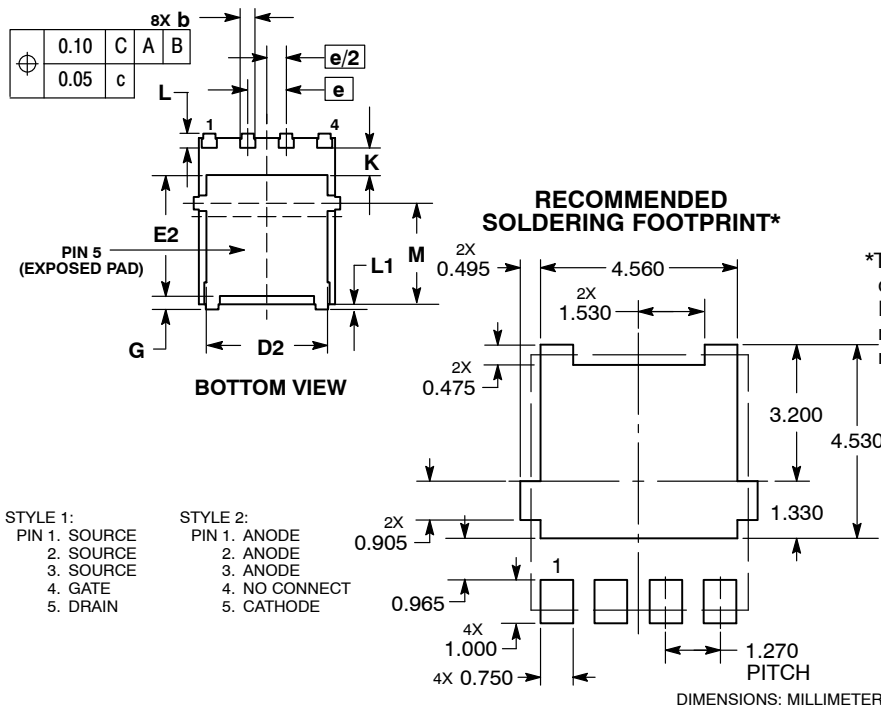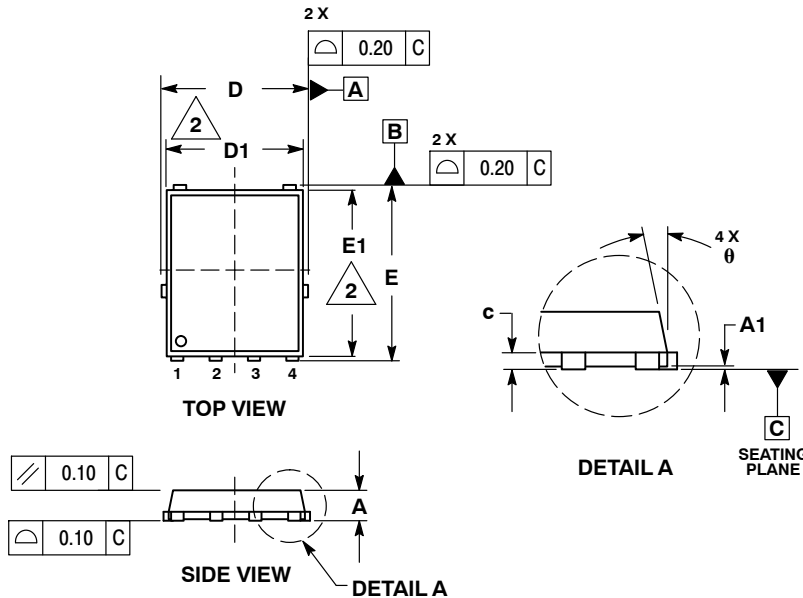
STYLE 1:
PIN 1. SOURCE
2. SOURCE
3. SOURCE
4. GATE
5. DRAIN

STYLE 2:
PIN 1. ANODE
2. ANODE
3. ANODE
4. NO CONNECT
5. CATHODE

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

DOCUMENT NUMBER:	98AON14036D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	**DFN5 5x6, 1.27P (SO−8FL)**		**PAGE 1 OF 1**

ADDITIONAL INFORMATION

◊