

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

30 V, 78 A

## NTMFS4C024N

### 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

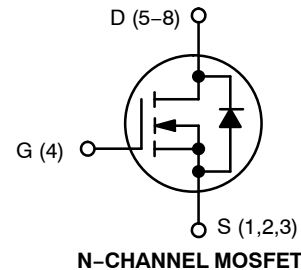
### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			$V_{DSS}$	30	V
Gate-to-Source Voltage			$V_{GS}$	$\pm 20$	V
Continuous Drain Current $R_{\theta JA}$ (Note 1)	Steady State	$T_A = 25^{\circ}\text{C}$	$I_D$	21.7	A
		$T_A = 80^{\circ}\text{C}$		16.3	
Power Dissipation $R_{\theta JA}$ (Note 1)		$T_A = 25^{\circ}\text{C}$	$P_D$	2.57	W
Continuous Drain Current $R_{\theta JA} \leq 10$ s (Note 1)		$T_A = 25^{\circ}\text{C}$	$I_D$	34.8	A
		$T_A = 80^{\circ}\text{C}$		26.0	
Power Dissipation $R_{\theta JA} \leq 10$ s (Note 1)		$T_A = 25^{\circ}\text{C}$	$P_D$	6.6	W
Continuous Drain Current $R_{\theta JA}$ (Note 2)		$T_A = 25^{\circ}\text{C}$	$I_D$	11.9	A
		$T_A = 80^{\circ}\text{C}$		8.9	
Power Dissipation $R_{\theta JA}$ (Note 2)		$T_A = 25^{\circ}\text{C}$	$P_D$	0.77	W
Continuous Drain Current $R_{\theta JC}$ (Note 1)		$T_C = 25^{\circ}\text{C}$	$I_D$	78	A
		$T_C = 80^{\circ}\text{C}$		58	
Power Dissipation $R_{\theta JC}$ (Note 1)		$T_C = 25^{\circ}\text{C}$	$P_D$	33	W
Pulsed Drain Current	$T_A = 25^{\circ}\text{C}$ , $t_p = 10\text{ }\mu\text{s}$		$I_{DM}$	174	A
Current Limited by Package		$T_A = 25^{\circ}\text{C}$	$I_{Dmax}$	80	A
Operating Junction and Storage Temperature Range			$T_J$ , $T_{STG}$	-55 to +150	$^{\circ}\text{C}$
Source Current (Body Diode)			$I_S$	30	A
Drain to Source $dV/dt$			$dV/dt$	7.0	V/ns
Single Pulse Drain-to-Source Avalanche Energy ( $T_J = 25^{\circ}\text{C}$ , $V_{GS} = 20\text{ V}$ , $I_L = 41\text{ A}_{pk}$ , $L = 0.1\text{ mH}$ , $R_{GS} = 25\text{ }\Omega$ ) (Note 3)			$E_{AS}$	84	mJ
Lead Temperature for Soldering Purposes (1/8" from case for 10 s)			$T_L$	260	$^{\circ}\text{C}$

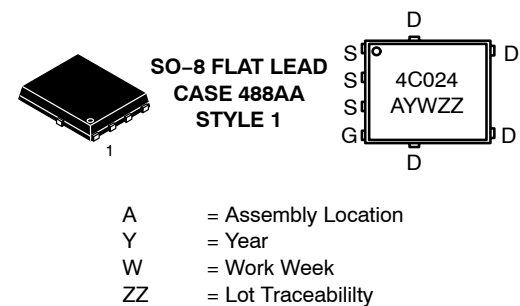
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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 ratings. Parts are 100% tested at  $T_J = 25^\circ\text{C}$ ,  $V_{GS} = 20$  V,  $I_L = 29$  A,  $E_{AS} = 42$  mJ.

$V_{(BR)DS}$	$R_{DS(ON)}$ MAX	$I_D$ MAX
30 V	2.8 m $\Omega$ @ 10 V	78 A
	4.0 m $\Omega$ @ 4.5 V	



### MARKING DIAGRAM



### ORDERING INFORMATION

Device	Package	Shipping <sup>†</sup>
NTMFS4C024NT1G	SO-8 FL (Pb-Free)	1500 / Tape & Reel
NTMFS4C024NT3G	SO-8 FL (Pb-Free)	5000 / Tape & Reel

<sup>†</sup>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.

# NTMFS4C024N

## 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 – ( $t \leq 10$ 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 ( $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
Drain-to-Source Breakdown Voltage (transient)	$V_{(BR)DSS(t)}$	$V_{GS} = 0\text{ V}, I_{D(aval)} = 12.6\text{ A}, T_{case} = 25^\circ\text{C}, t_{transient} = 100\text{ ns}$	34			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$			12		mV/°C
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = 24\text{ V}$	$T_J = 25^\circ\text{C}$		1.0	$\mu\text{A}$
			$T_J = 125^\circ\text{C}$		10	
Gate-to-Source Leakage Current	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA

### ON CHARACTERISTICS (Note 6)

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 250\text{ }\mu\text{A}$	1.3		2.2	V
Negative Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5.1		mV/°C
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 30\text{ A}$		2.3	2.8	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 30\text{ A}$		3.3	4.0	
Forward Transconductance	$g_{FS}$	$V_{DS} = 1.5\text{ V}, I_D = 15\text{ A}$		68		S
Gate Resistance	$R_G$	$T_A = 25^\circ\text{C}$	0.3	1.0	2.0	$\Omega$

### CHARGES AND CAPACITANCES

Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 15\text{ V}$		1972		pF
Output Capacitance	$C_{OSS}$			1215		
Reverse Transfer Capacitance	$C_{RSS}$			59		
Capacitance Ratio	$C_{RSS}/C_{ISS}$	$V_{GS} = 0\text{ V}, V_{DS} = 15\text{ V}, f = 1\text{ MHz}$		0.030		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		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		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V}; I_D = 30\text{ A}$		30		nC

### SWITCHING CHARACTERISTICS (Note 7)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 4.5\text{ V}, V_{DS} = 15\text{ V}, I_D = 15\text{ A}, R_G = 3.0\text{ }\Omega$		11		ns
Rise Time	$t_r$			32		
Turn-Off Delay Time	$t_{d(OFF)}$			21		
Fall Time	$t_f$			7.0		

# NTMFS4C024N

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

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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### SWITCHING CHARACTERISTICS (Note 7)

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = 10\text{ V}, V_{DS} = 15\text{ V},$ $I_D = 15\text{ A}, R_G = 3.0\ \Omega$		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	$V_{SD}$	$V_{GS} = 0\text{ V},$ $I_S = 10\text{ A}$	$T_J = 25^\circ\text{C}$		0.77	1.1	V
			$T_J = 125^\circ\text{C}$		0.62		
Reverse Recovery Time	$t_{RR}$	$V_{GS} = 0\text{ V}, dI_S/dt = 100\text{ A}/\mu\text{s},$ $I_S = 30\text{ A}$			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  $\leq 300\ \mu\text{s}$ , duty cycle  $\leq 2\%$ .

7. Switching characteristics are independent of operating junction temperatures.

TYPICAL CHARACTERISTICS

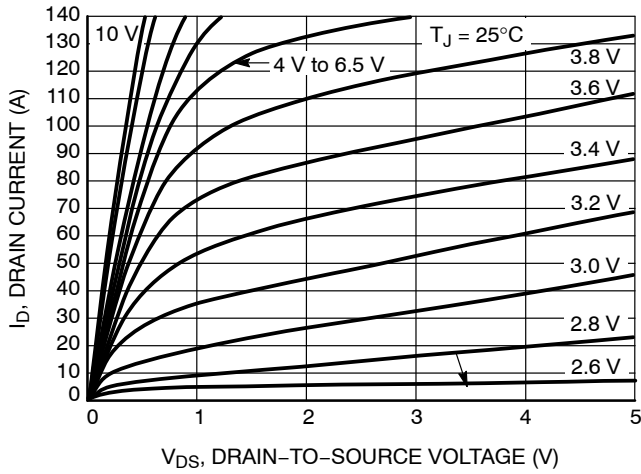


Figure 1. On-Region Characteristics

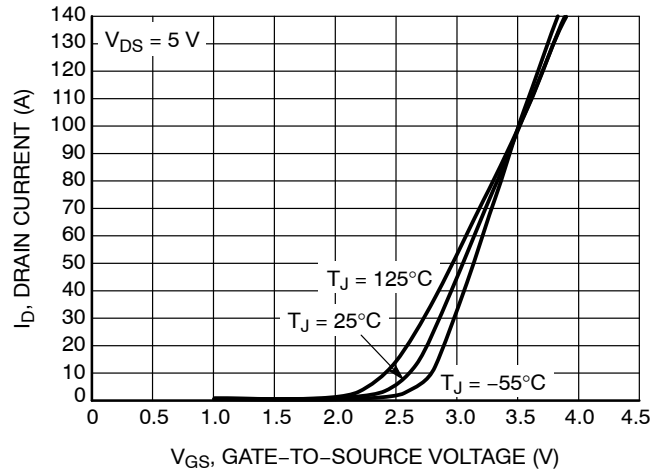


Figure 2. Transfer Characteristics

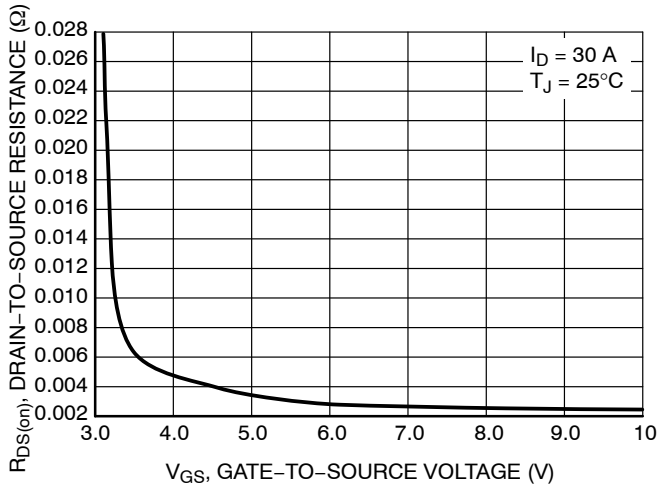


Figure 3. On-Resistance vs.  $V_{GS}$

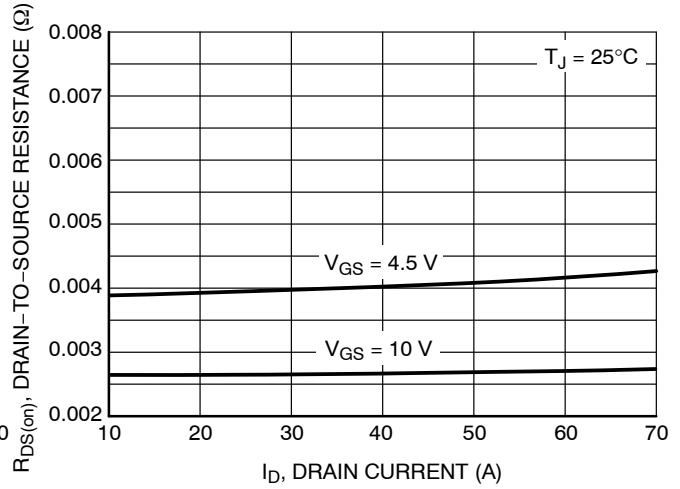


Figure 4. On-Resistance vs. Drain Current and Gate Voltage

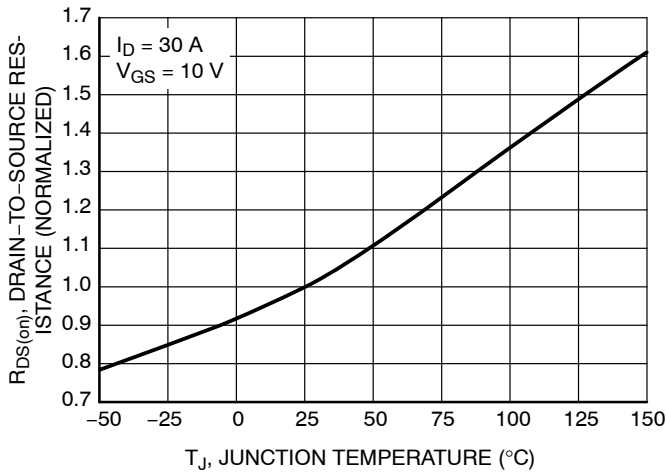


Figure 5. On-Resistance Variation with Temperature

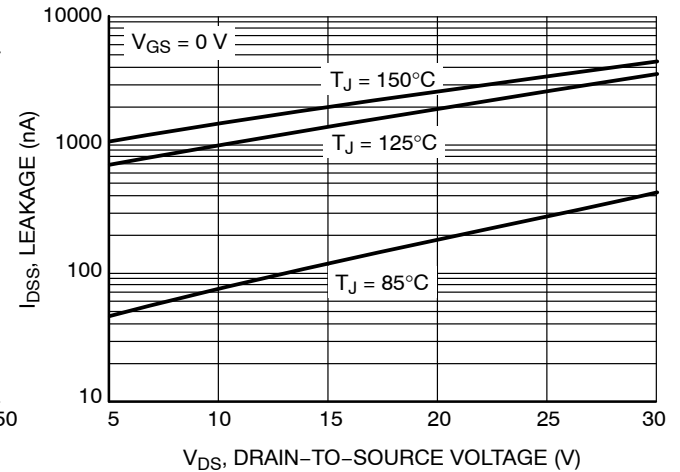


Figure 6. Drain-to-Source Leakage Current vs. Voltage

TYPICAL CHARACTERISTICS

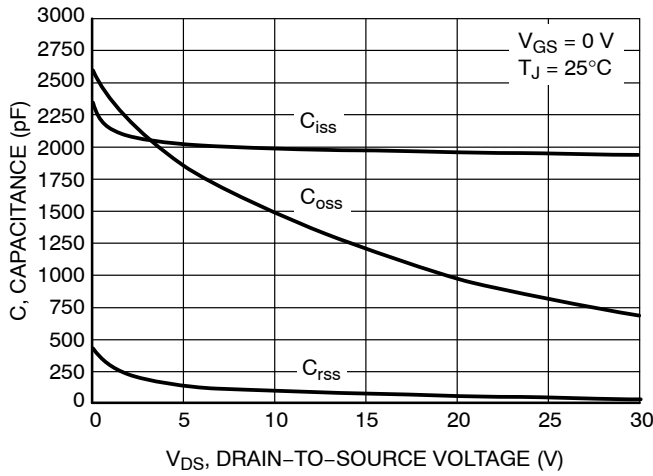


Figure 7. Capacitance Variation

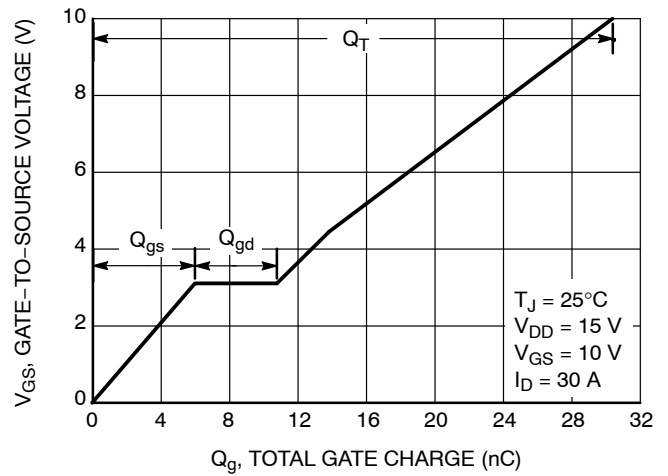


Figure 8. Gate-to-Source and Drain-to-Source Voltage vs. Total Charge

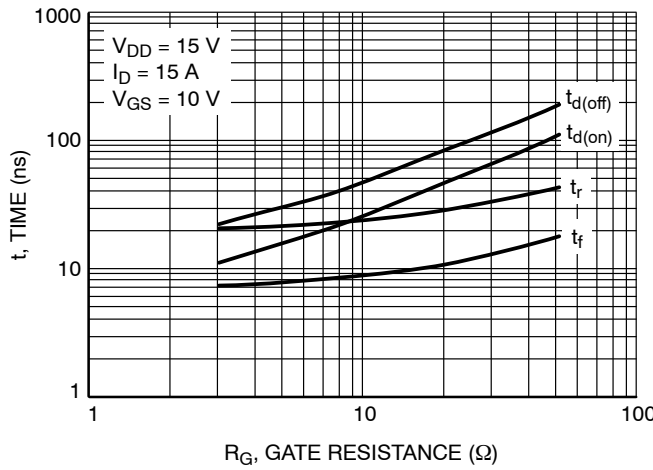


Figure 9. Resistive Switching Time Variation vs. Gate Resistance

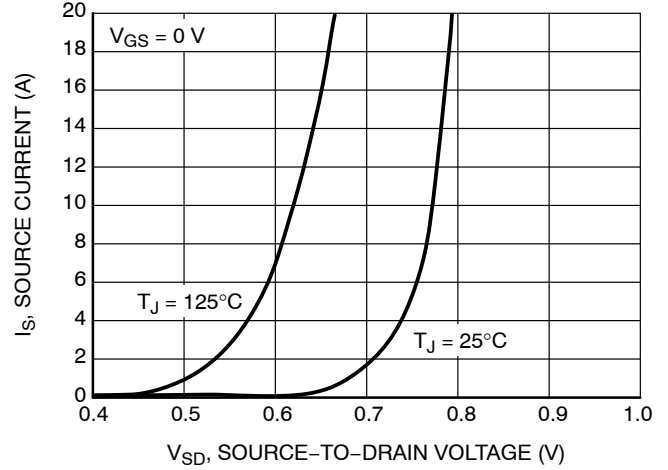


Figure 10. Diode Forward Voltage vs. Current

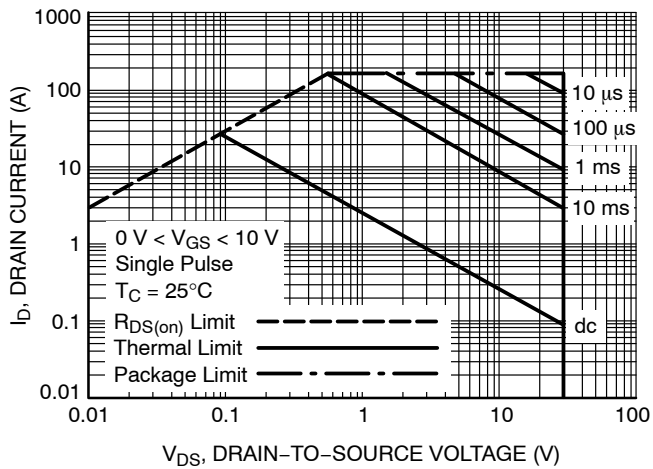


Figure 11. Maximum Rated Forward Biased Safe Operating Area

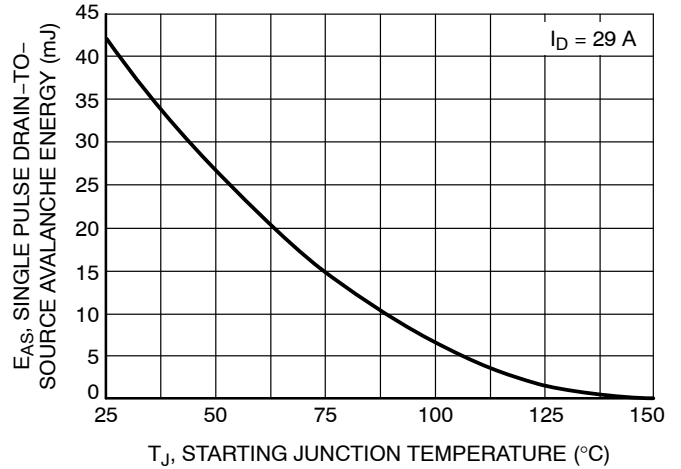


Figure 12. Maximum Avalanche Energy vs. Starting Junction Temperature

TYPICAL CHARACTERISTICS

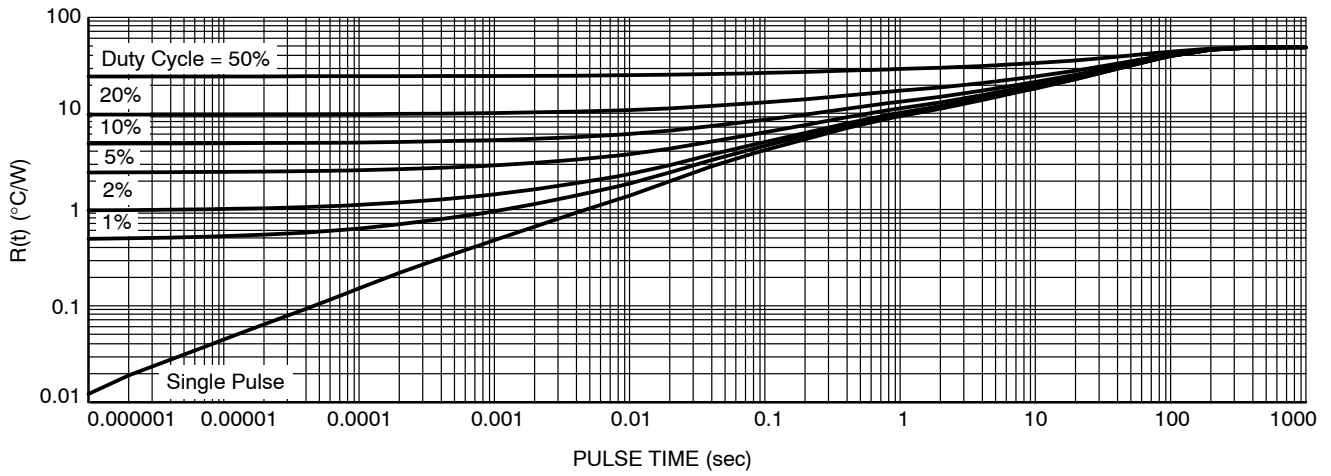


Figure 13. Thermal Response

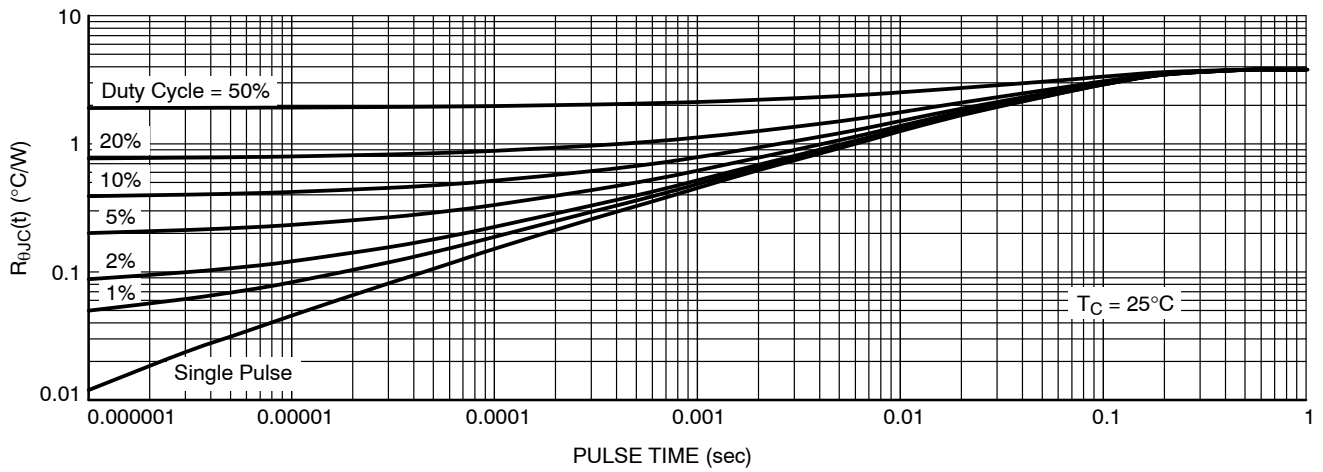


Figure 14. Thermal Response

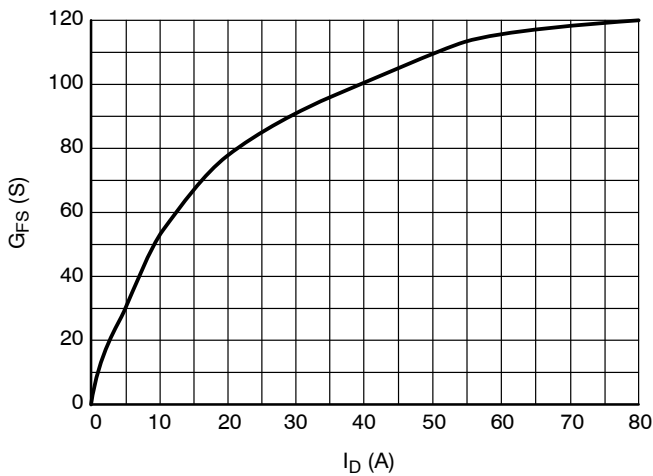


Figure 15.  $G_{FS}$  vs.  $I_D$

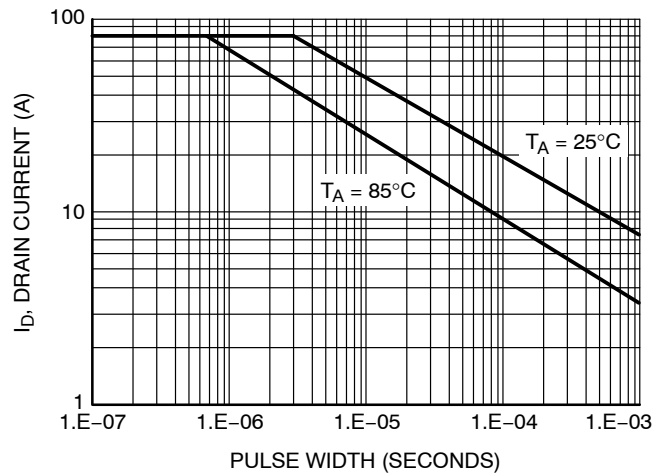


Figure 16. Avalanche Characteristics

# MECHANICAL CASE OUTLINE

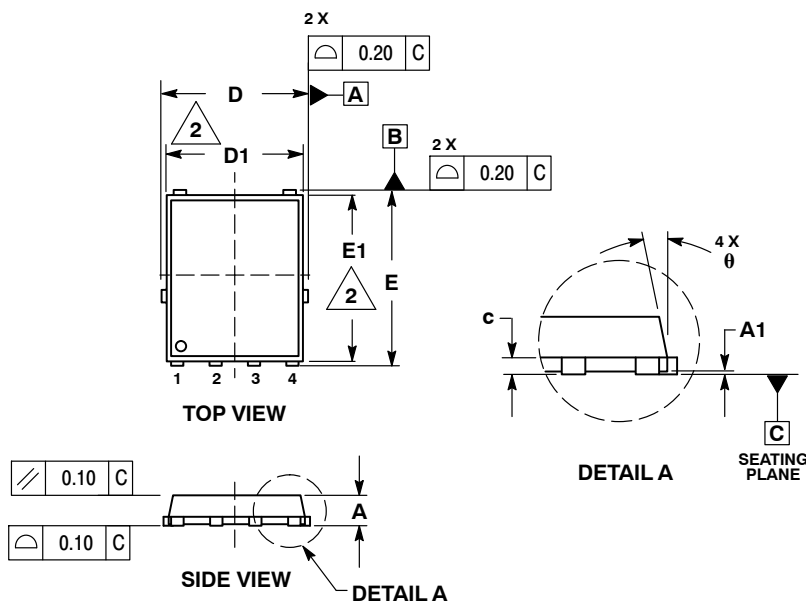
## PACKAGE DIMENSIONS



SCALE 2:1

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

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.

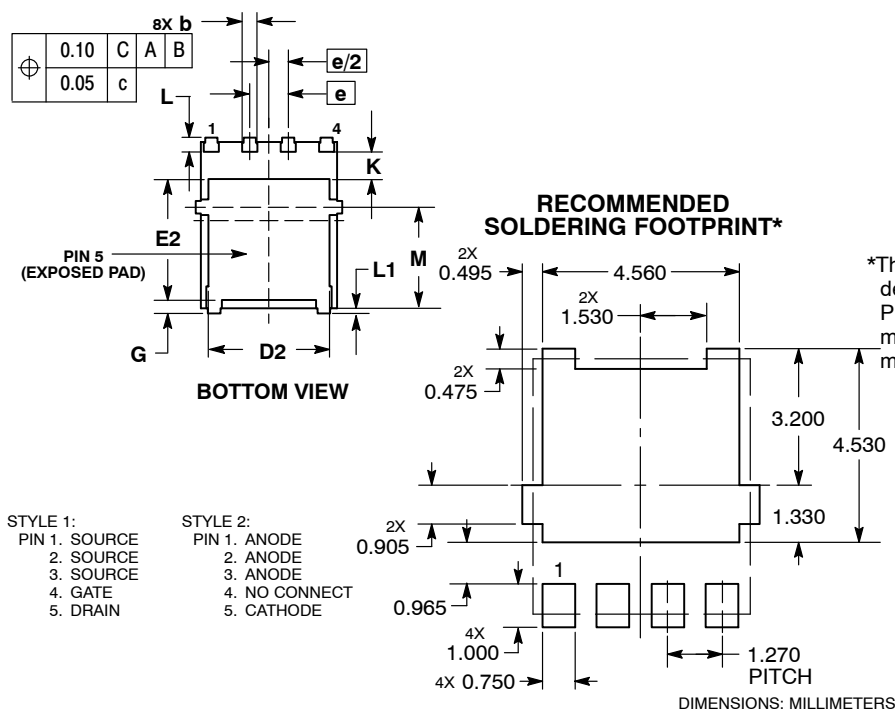
DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.00	---	0.05
b	0.33	0.41	0.51
c	0.23	0.28	0.33
D	5.00	5.15	5.30
D1	4.70	4.90	5.10
D2	3.80	4.00	4.20
E	6.00	6.15	6.30
E1	5.70	5.90	6.10
E2	3.45	3.65	3.85
e	1.27 BSC		
G	0.51	0.575	0.71
K	1.20	1.35	1.50
L	0.51	0.575	0.71
L1	0.125 REF		
M	3.00	3.40	3.80
θ	0°	---	12°

### GENERIC MARKING DIAGRAM\*



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.



\*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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