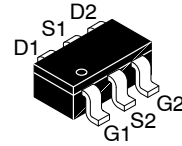


# Field Effect Transistor - Dual, N & P-Channel, Enhancement Mode

## NDC7001C



TSOT23 6-Lead  
SUPERSOT-6  
CASE 419BL

### General Description

These dual N & P-Channel Enhancement Mode Field Effect Transistors are produced using onsemi's proprietary, high cell density, DMOS technology. This very high density process has been designed to minimize on-state resistance, provide rugged and reliable performance and fast switching. These device is particularly suited for low voltage, low current, switching, and power supply application.

### Features

- Q1 0.51 A, 60 V  
 $R_{DS(ON)} = 2 \Omega @ V_{GS} = 10 V$   
 $R_{DS(ON)} = 4 \Omega @ V_{GS} = 4.5 V$
- Q2 -0.34 A, 60 V  
 $R_{DS(ON)} = 5 \Omega @ V_{GS} = -10 V$   
 $R_{DS(ON)} = 7.5 \Omega @ V_{GS} = -4.5 V$
- High Saturation Current
- High Density Cell Design for Low  $R_{DS(ON)}$
- Proprietary SUPERSOT™ -6 Package Design Using Copper Lead Frame for Superior Thermal and Electrical Capabilities
- This is a Pb-Free Device

### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

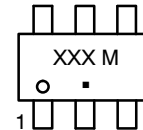
Symbol	Parameter	Q1	Q2	Unit	
V <sub>DSS</sub>	Drain-Source Voltage	60	-60	V	
V <sub>GSS</sub>	Gate-Source Voltage	±20	±20	V	
I <sub>D</sub>	Drain Current	- Continuous (Note 1a)	0.51	-0.34	A
		- Pulsed	1.5	-1	A
P <sub>D</sub>	Power Dissipation for Single Operation	(Note 1a)	0.96	W	
		(Note 1b)	0.9	W	
		(Note 1c)	0.7	W	
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-55 to +150		°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.

### THERMAL CHARACTERISTICS

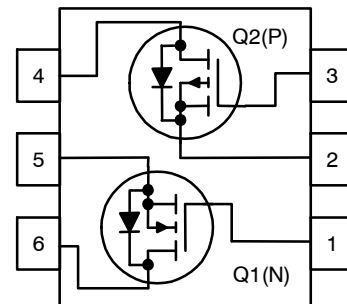
Symbol	Parameter	Ratings	Unit
R <sub>θJA</sub>	Thermal Resistance, Junction to Ambient (Note 1a)	130	°C/W
R <sub>θJC</sub>	Thermal Resistance, Junction to Case (Note 1)	60	°C/W

### MARKING DIAGRAM



XXX = Specific Device Code  
M = Date Code  
■ = Pb-Free Package

### PINOUT



### ORDERING INFORMATION

See detailed ordering and shipping information on page 8 of this data sheet.

# NDC7001C

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

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

BV <sub>DSS</sub>	Drain–Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA V <sub>GS</sub> = 0 V, I <sub>D</sub> = –250 μA	Q1 Q2	60 –60	– –	– –	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I <sub>D</sub> = 250 μA, Ref. to 25°C I <sub>D</sub> = –250 μA, Ref. to 25°C	Q1 Q2	– –	67 –57	– –	mV/°C
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 48 V, V <sub>GS</sub> = 0 V V <sub>DS</sub> = –48 V, V <sub>GS</sub> = 0 V	Q1 Q2	– –	– –	1 –1	μA
I <sub>GSSF</sub>	Gate–Body Leakage, Forward	V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0 V	All	–	–	100	nA
I <sub>GSSR</sub>	Gate–Body Leakage, Reverse	V <sub>GS</sub> = –20 V, V <sub>DS</sub> = 0 V	All	–	–	–100	nA

### ON CHARACTERISTICS (Note 2)

V <sub>GS(th)</sub>	Gate Threshold Voltage	Q1	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1	2.1	2.5	V
		Q2	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = –250 μA	–1	–1.9	–3.5	
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	Q1	I <sub>D</sub> = 250 μA, Referenced to 25°C	–	–3.8	–	mV/°C
		Q2	I <sub>D</sub> = –250 μA, Ref. to 25°C	–	3.2	–	
R <sub>DS(on)</sub>	Static Drain–Source On–Resistance	Q1	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.51 A V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.35 A V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.51 A, T <sub>J</sub> = 125°C	– – –	1 2 1.7	2 4 3.5	Ω
		Q2	V <sub>GS</sub> = –10 V, I <sub>D</sub> = –0.34 A V <sub>GS</sub> = –4.5 V, I <sub>D</sub> = –0.25 A V <sub>GS</sub> = –10 V, I <sub>D</sub> = –0.34 A, T <sub>J</sub> = 125°C	– – –	1.2 1.5 1.9	5 7.5 10	
I <sub>D(on)</sub>	On–State Drain Current	Q1	V <sub>GS</sub> = 10 V, V <sub>DS</sub> = 10 V	1.5	–	–	A
		Q2	V <sub>GS</sub> = –10 V, V <sub>DS</sub> = –10 V	–1	–	–	
g <sub>FS</sub>	Forward Transconductance	Q1	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.51 A	–	380	–	mS

### DYNAMIC CHARACTERISTICS

C <sub>iss</sub>	Input Capacitance	Q1	For Q1: V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V f = 1.0 MHz	–	20	–	pF
		Q2		–	66	–	
C <sub>oss</sub>	Output Capacitance	Q1	For Q2: V <sub>DS</sub> = –25 V, V <sub>GS</sub> = 0 V f = 1.0 MHz	–	11	–	pF
		Q2		–	13	–	
C <sub>rss</sub>	Reverse Transfer Capacitance	Q1		–	4.3	–	pF
		Q2		–	6	–	
R <sub>G</sub>	Gate Resistance	Q1	V <sub>GS</sub> = 15 mV, f = 1.0 MHz	–	11.2	–	Ω
		Q2		–	11.2	–	

### SWITCHING CHARACTERISTICS (Note 2)

t <sub>d(on)</sub>	Turn–On Delay Time	Q1	For Q1: V <sub>DS</sub> = 25 V, I <sub>DS</sub> = 1 A V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω	–	2.8	5.6	ns
		Q2		–	3.2	6.4	
t <sub>r</sub>	Turn–On Rise Time	Q1	For Q2: V <sub>DS</sub> = –25 V, I <sub>DS</sub> = –1 A V <sub>GS</sub> = –10 V, R <sub>GEN</sub> = 6 Ω	–	8	16	ns
		Q2		–	10	20	
t <sub>d(off)</sub>	Turn–Off Delay Time	Q1		–	14	26	ns
		Q2		–	8	16	
t <sub>f</sub>	Turn–Off Fall Time	Q1		–	4	8	ns
		Q2		–	1	2	
Q <sub>g</sub>	Total Gate Charge	Q1	For Q1: V <sub>DS</sub> = 25 V, I <sub>DS</sub> = 0.51 A V <sub>GS</sub> = 10 V, R <sub>GEN</sub> = 6 Ω	–	1.1	1.5	nC
		Q2		–	1.6	2.2	
Q <sub>gs</sub>	Gate–Source Charge	Q1	For Q2: V <sub>DS</sub> = –25 V, I <sub>DS</sub> = –0.35 A V <sub>GS</sub> = –10 V, R <sub>GEN</sub> = 6 Ω	–	0.2	–	nC
		Q2		–	0.3	–	
Q <sub>gd</sub>	Gate–Drain Charge	Q1		–	0.4	–	nC

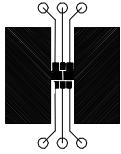
# NDC7001C

## ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted) (continued)

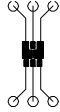
Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit	
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>							
$I_S$	Maximum Continuous Drain-Source Diode Forward Current	Q1	-	-	0.51	A	
		Q2	-	-	-0.34		
$V_{SD}$	Drain-Source Diode Forward Voltage	Q1	$V_{GS} = 0\text{ V}, I_S = 0.51\text{ A}$ (Note 2)		-	0.8	V
		Q2	$V_{GS} = 0\text{ V}, I_S = -0.34\text{ A}$ (Note 2)		-	-0.8	
$t_{rr}$	Diode Reverse Recovery Time	Q1	$I_F = 0.51\text{ A}, d_{IF}/d_t = 100\text{ A}/\mu\text{s}$		-	18	nS
		Q2	$I_F = -0.34\text{ A}, d_{IF}/d_t = 100\text{ A}/\mu\text{s}$		-	16	
$Q_{rr}$	Diode Reverse Recovery Charge	Q1	$I_F = 0.51\text{ A}, d_{IF}/d_t = 100\text{ A}/\mu\text{s}$		-	16	nC
		Q2	$I_F = -0.34\text{ A}, d_{IF}/d_t = 100\text{ A}/\mu\text{s}$		-	11	

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.

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a.  $130^\circ\text{C}/\text{W}$  when mounted on a  $0.125\text{ in}^2$  pad of 2 oz. copper.



b.  $140^\circ\text{C}/\text{W}$  when mounted on a  $.005\text{ in}^2$  pad of 2 oz. copper.



c.  $180^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

Scale 1:1 on letter size paper

- Pulse Test: Pulse Width  $< 300\ \mu\text{s}$ , Duty cycle  $< 2.0\%$ .

TYPICAL CHARACTERISTICS: N-CHANNEL

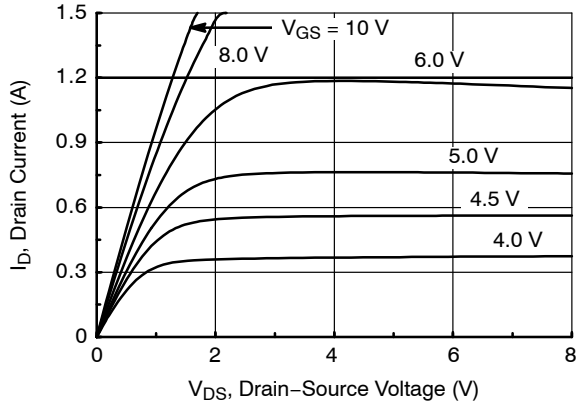


Figure 1. On-Region Characteristics

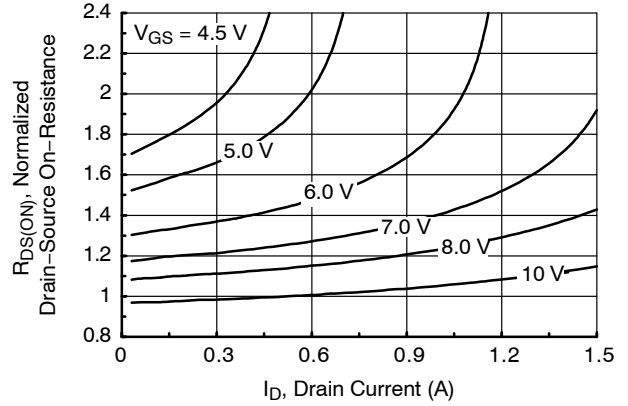


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

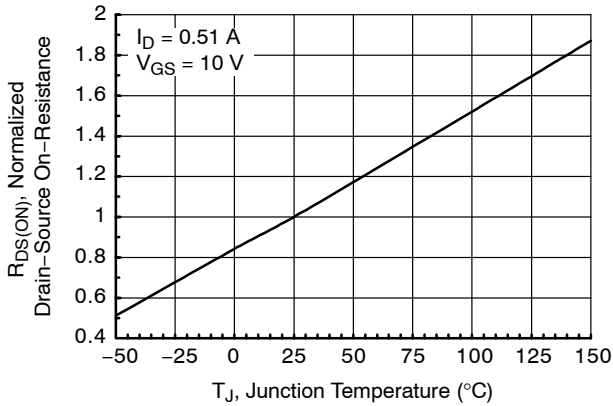


Figure 3. On-Resistance Variation with Temperature

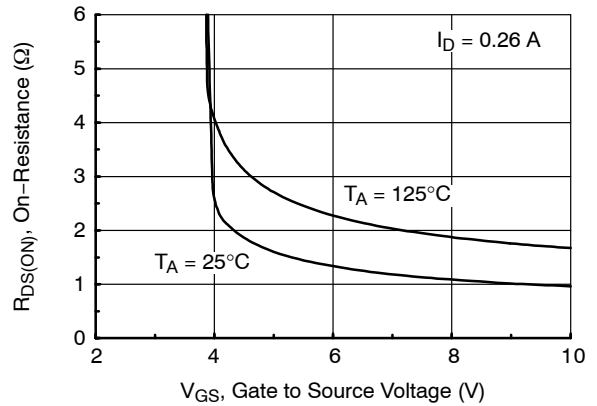


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

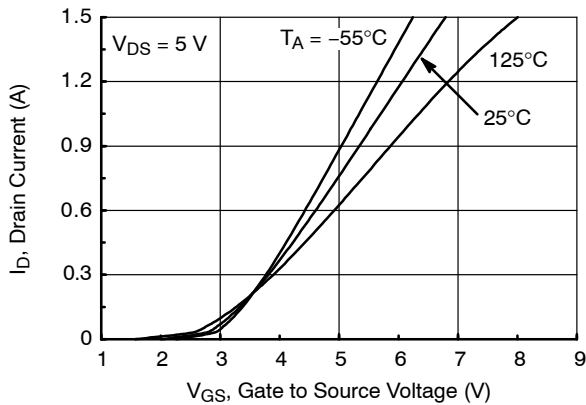


Figure 5. Transfer Characteristics

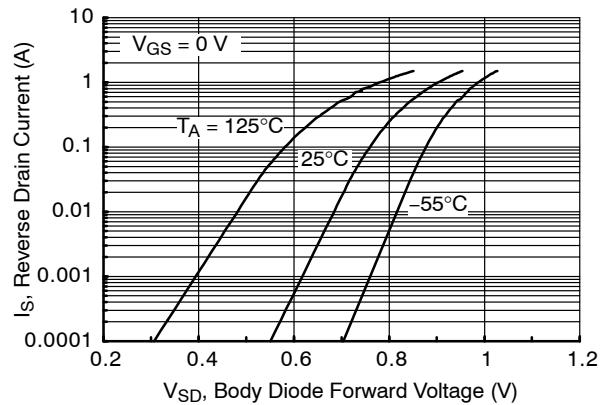
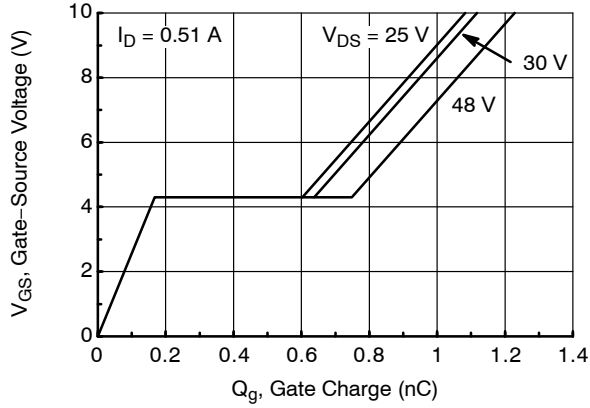


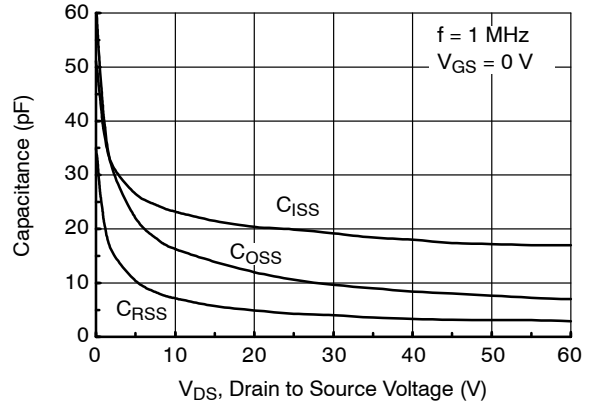
Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

# NDC7001C

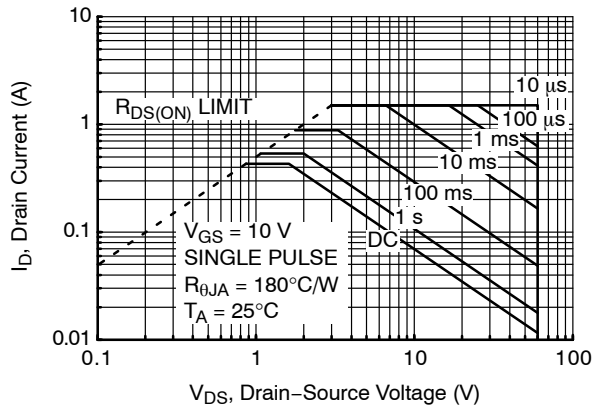
## TYPICAL CHARACTERISTICS: N-CHANNEL (continued)



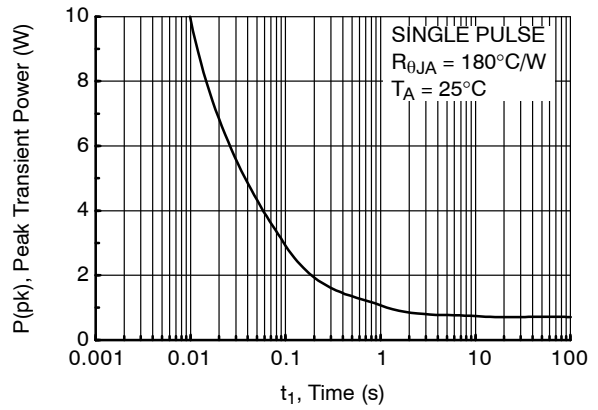
**Figure 7. Gate Charge Characteristics**



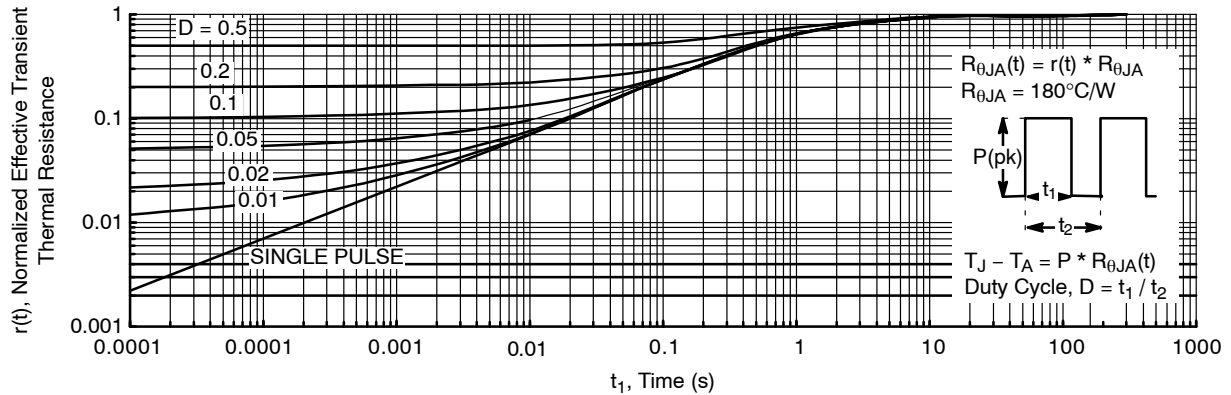
**Figure 8. Capacitance Characteristics**



**Figure 9. Maximum Safe Operating Area**



**Figure 10. Single Pulse Maximum Power Dissipation**



**Figure 11. Transient Thermal Response Curve**

(Note: Thermal characterization performed using the conditions described in Note 1c. Transient thermal response will change depending on the circuit board design.)

TYPICAL CHARACTERISTICS: P-CHANNEL

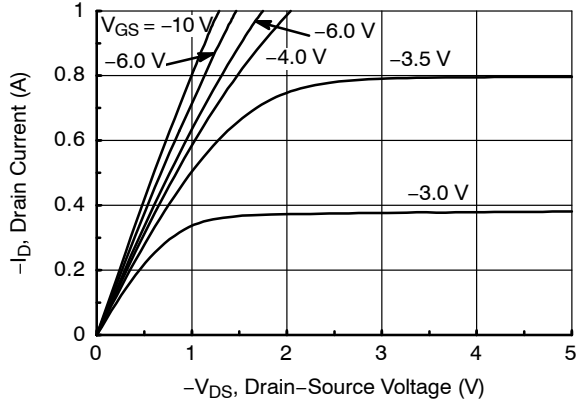


Figure 12. On-Region Characteristics

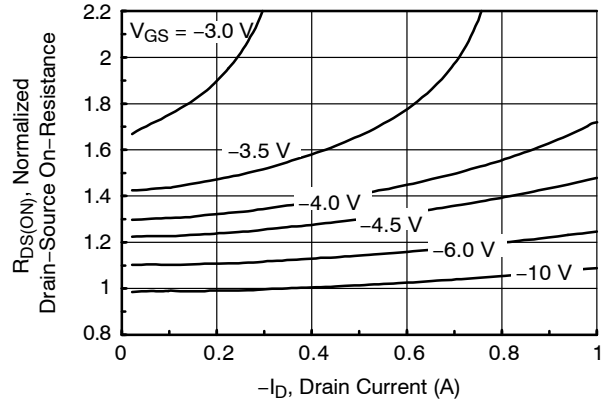


Figure 13. On-Resistance Variation with Drain Current and Gate Voltage

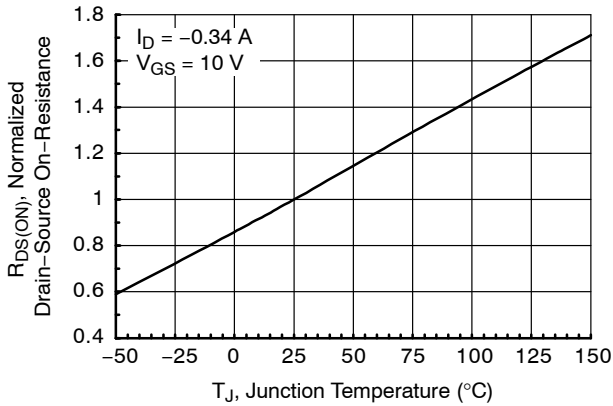


Figure 14. On-Resistance Variation with Temperature

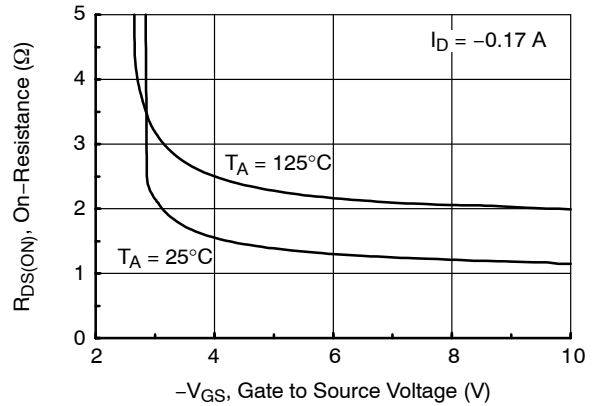


Figure 15. On-Resistance Variation with Gate-to-Source Voltage

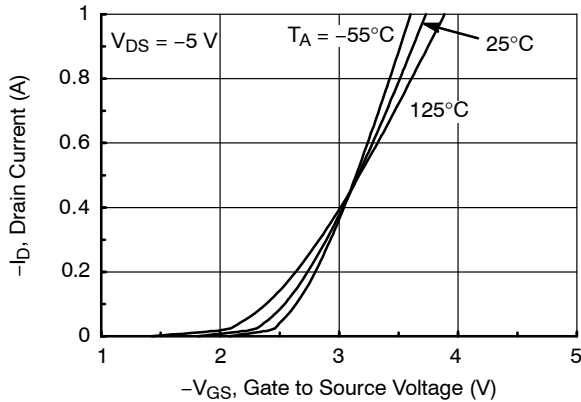


Figure 16. Transfer Characteristics

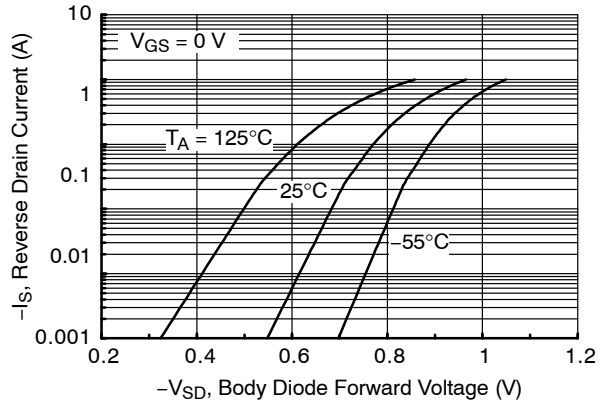


Figure 17. Body Diode Forward Voltage Variation with Current and Temperature

# NDC7001C

## TYPICAL CHARACTERISTICS: P-CHANNEL (continued)

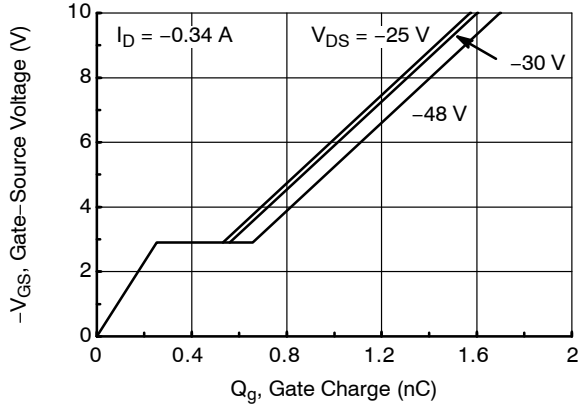


Figure 18. Gate Charge Characteristics

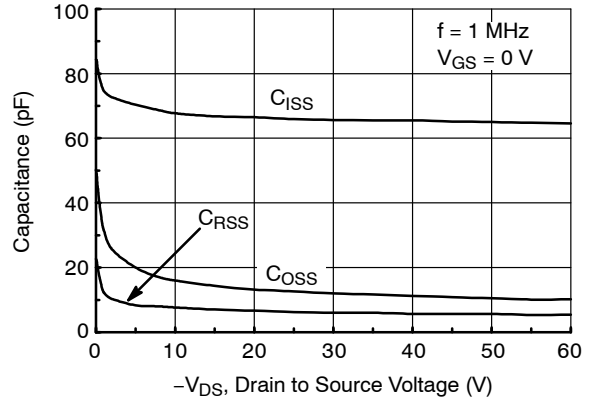


Figure 19. Capacitance Characteristics

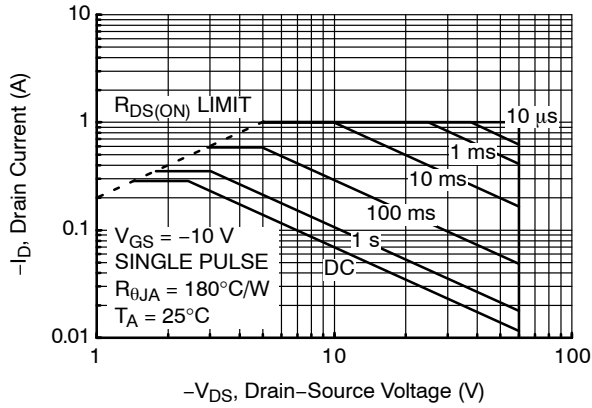


Figure 20. Maximum Safe Operating Area

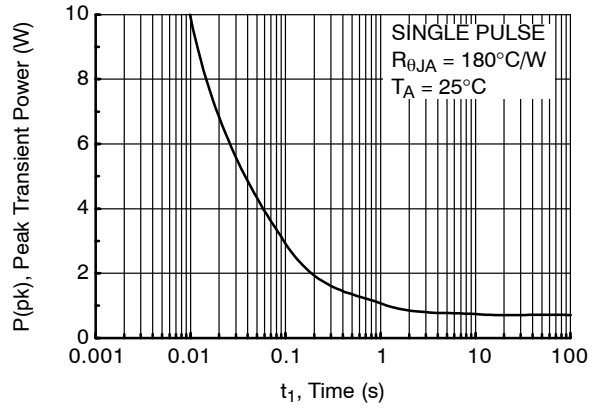


Figure 21. Single Pulse Maximum Power Dissipation

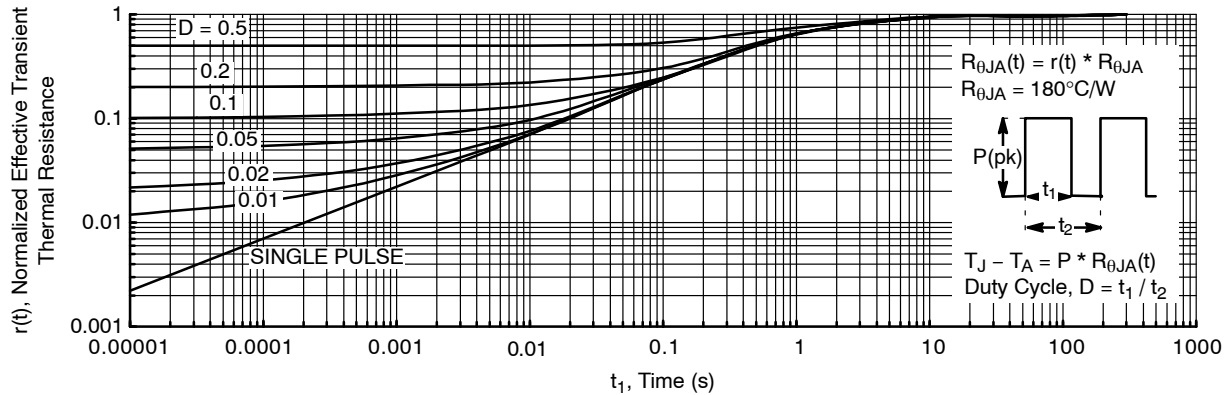


Figure 22. Transient Thermal Response Curve

(Note: Thermal characterization performed using the conditions described in Note 1c. Transient thermal response will change depending on the circuit board design.)

# NDC7001C

## ORDERING INFORMATION

Device	Device Marking	Package Type	Reel Size	Tape Width	Shipping <sup>†</sup>
NDC7001C	.01	TSOT-23-6 (Pb-free)	7"	8 mm	3000 / 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.

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

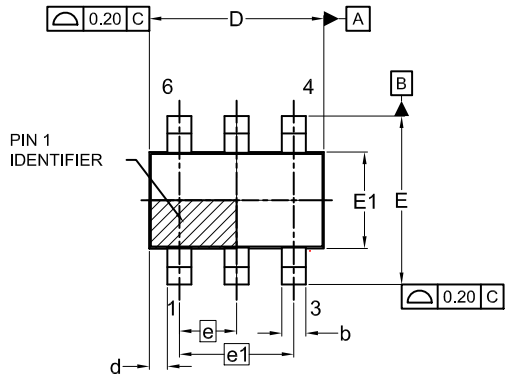
ON Semiconductor®



SCALE 2:1

### TSOT23 6-Lead CASE 419BL ISSUE A

DATE 31 AUG 2020



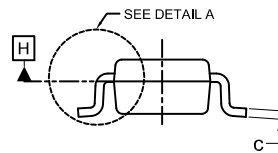
TOP VIEW



FRONT VIEW

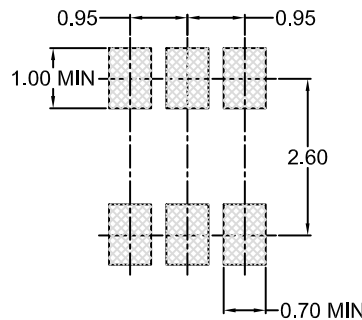


DETAIL A



SIDE VIEW

SYMM  
⌀



LAND PATTERN  
RECOMMENDATION

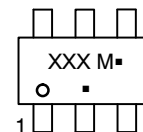
\*FOR ADDITIONAL INFORMATION ON OUR Pb-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2009.
2. CONTROLLING DIMENSION: MILLIMETERS
3. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.25MM PER END. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
4. SEATING PLANE IS DEFINED BY THE TERMINALS. "A1" IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	0.05	0.10
A2	0.70	0.85	1.00
A3	0.25 BSC		
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.80	2.95	3.10
d	0.30 REF		
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e	0.95 BSC		
e1	1.90 BSC		
L1	0.60 REF		
L2	0.20	0.40	0.60
⌀	0°	--	10°

#### GENERIC MARKING DIAGRAM\*



XXX = Specific Device Code  
M = Date Code  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*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.

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<b>DESCRIPTION:</b>	<b>TSOT23 6-Lead</b>	<b>PAGE 1 OF 1</b>

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**onsemi Website:** [www.onsemi.com](http://www.onsemi.com)

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**North American Technical Support:**

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