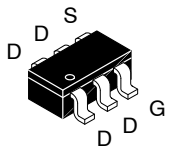
N-Channel Enhancement Mode Field Effect Transistor

FDC653N

V_{DSS}	$R_{DS(ON)}$ MAX	I_D MAX
30 V	0.035 Ω @ 10 V	5.0 A
	0.055 Ω @ 4.5 V	



TSOT23 6−Lead
SUPERSOT™−6
CASE 419BL

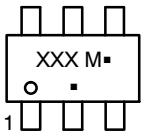
General Description

This N−Channel enhancement mode power field effect transistor is produced using **onsemi**'s proprietary, high cell density, DMOS technology. This very high density process is tailored to minimize on−state resistance. These devices are particularly suited for low voltage applications in notebook computers, portable phones, PCMICA cards, and other battery powered circuits where fast switching, and low in−line power loss are needed in a very small outline surface mount package.

Features

- 5.0 A, 30 V
  $R_{DS(ON)}$ = 0.035 Ω @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 0.055 Ω @ V_{GS} = 4.5 V
- Proprietary SUPERSOT™−6 Package Design Using Copper Lead Frame for Superior Thermal and Electrical Capabilities.
- High Density Cell Design for Extremely Low $R_{DS(ON)}$.
- Exceptional On−Resistance and Maximum DC Current Capability.
- This Device is Pb−Free and Halogen Free

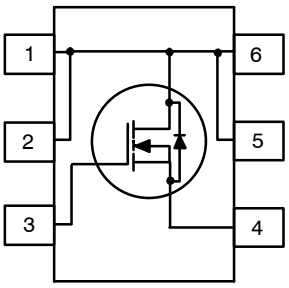
MARKING DIAGRAM



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

(Note: Microdot may be in either location)

PINOUT



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Symbol	Parameter		Ratings	Unit
V_{DSS}	Drain−Source Voltage		30	V
V_{GSS}	Gate−Source Voltage − Continuous		±20	V
I_D	Drain Current	− Continuous (Note 1a)	5	A
		− Pulsed	15	
P_D	Maximum Power Dissipation	(Note 1a)	1.6	W
		(Note 1b)	0.8	
T_J, T_{STG}	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
$R_{\theta JA}$	Thermal Resistance, Junction−to−Ambient (Note 1a)	78	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction−to−Case (Note 1)	30	°C/W

ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
BV_{DSS}	Drain–Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μA	30	–	–	V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 250 μA,Referenced to 25°C	–	31	–	mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V T_J = 55°C	– –	– –	1 10	μA
I_{GSSF}	Gate–Body Leakage, Forward	V_{GS} = 20 V, V_{DS} = 0 V	–	–	100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	V_{GS} = –20 V, V_{DS} = 0 V	–	–	–100	nA
ON CHARACTERISTICS (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250 μA	1	1.7	2	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 250 μA, Referenced to 25°C	–	–4.2	–	mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	V_{GS} = 10 V, I_D = 5 A T_J = 125°C V_{GS} = 4.5 V, I_D = 4.2 A	– – –	0.027 0.042 0.046	0.035 0.056 0.055	Ω
$I_{D(on)}$	On–State Drain Current	V_{GS} = 10 V, V_{DS} = 5 V	8	–	–	A
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 5 A	–	6.2	–	S
DYNAMIC CHARACTERISTICS						
C_{iss}	Input Capacitance	V_{DS} = 15 V, V_{GS} = 0 V, f = 1.0 MHz	–	350	–	pF
C_{oss}	Output Capacitance		–	220	–	pF
C_{rss}	Reverse Transfer Capacitance		–	80	–	pF
SWITCHING CHARACTERISTICS (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	V_{DD} = 10 V, I_D = 1 A, V_{GS} = 4.5 V, R_{GEN} = 6 Ω	–	7.5	15	ns
t_r	Turn–On Rise Time		–	12	25	ns
$t_{d(off)}$	Turn–Off Delay Time		–	13	25	ns
t_f	Turn–Off Fall Time		–	6	15	ns
Q_g	Total Gate Charge	V_{DS} = 15 V, I_D = 5 A, V_{GS} = 10 V	–	12	17	nC
Q_{gs}	Gate–Source Charge		–	2.1	–	nC
Q_{gd}	Gate–Drain Charge		–	2.6	–	nC
DRAIN–SOURCE DIODE CHARACTERISTICS						
I_S	Continuous Source Diode Current		–	–	1.3	A
V_{SD}	Drain–Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 1.3 A (Note 2) T_J = 125°C	–	0.75 0.6	1.2 1.0	V

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.

1. $R_{\theta JA}$ 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.78°C/W when mounted on a minimum on 1 in^2 pad of 2oz Cu in FR–4 board.
   b.156°C/W when mounted on a minimum pad of 2oz Cu in FR–4 board.
2. Pulse Test: Pulse Width ≤300 μs, Duty cycle ≤2.0 %.

TYPICAL CHARACTERISTICS

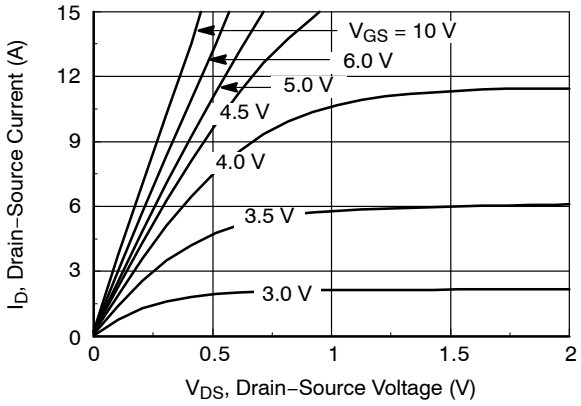


Figure 1. On−Region Characteristics

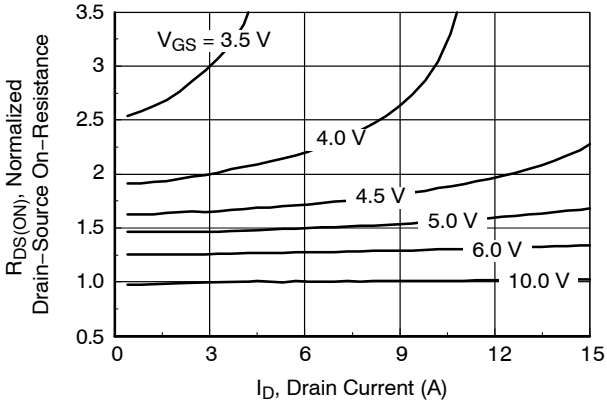


Figure 2. On−Resistance Variation with Drain Current and Gate Voltage

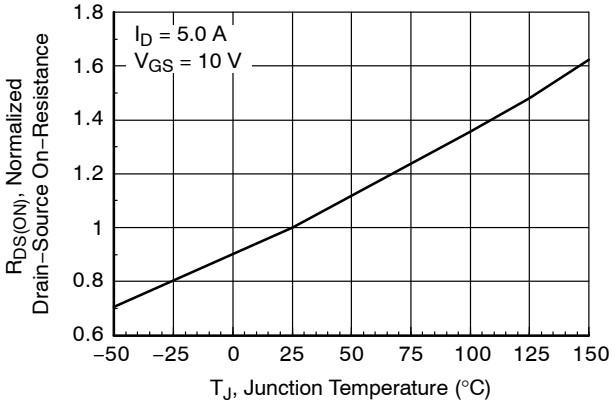


Figure 3. On−Resistance Variation with Temperature

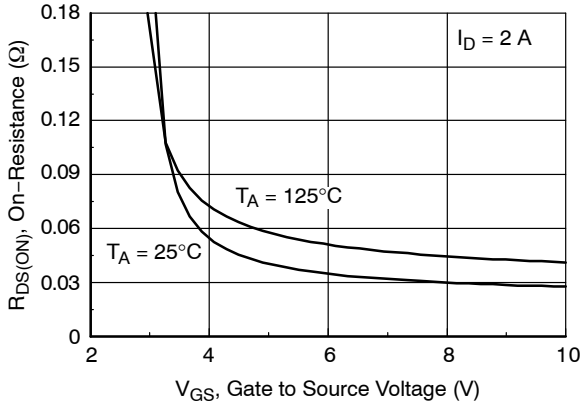


Figure 4. On−Resistance Variation with Gate−to−Source Voltage

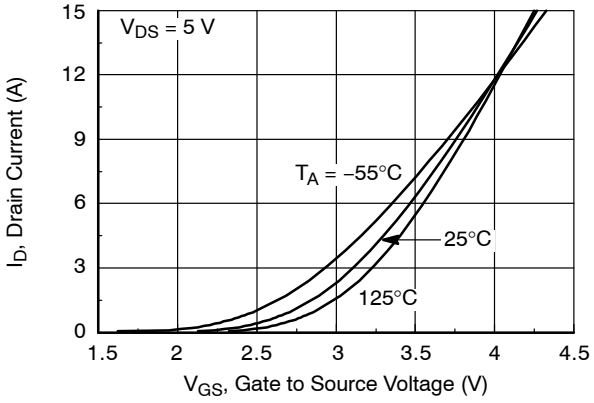


Figure 5. Transfer Characteristics

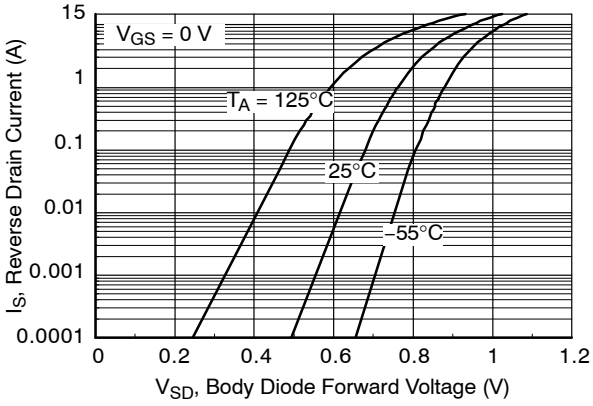


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

TYPICAL ELECTRICAL CHARACTERISTICS (continued)

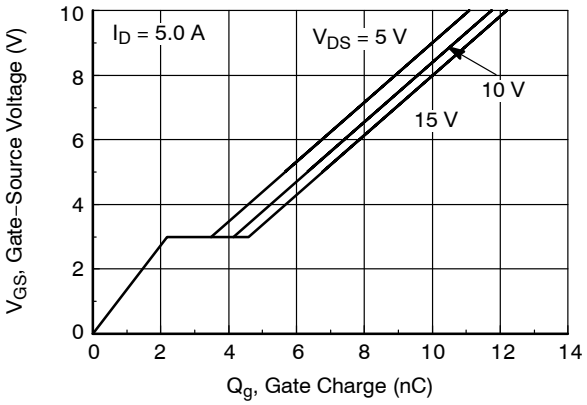


Figure 7. Gate Charge Characteristics

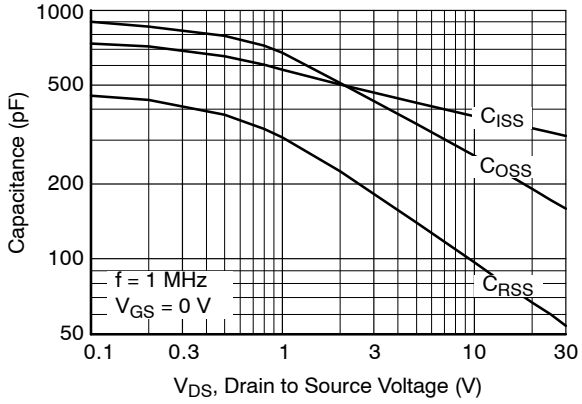


Figure 8. Capacitance Characteristics

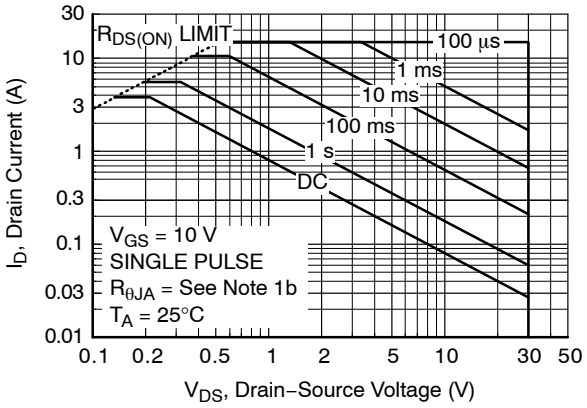


Figure 9. Maximum Safe Operating Area

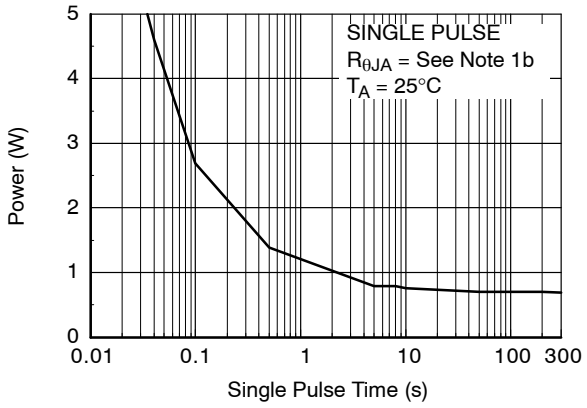


Figure 10. Single Pulse Maximum Power Dissipation

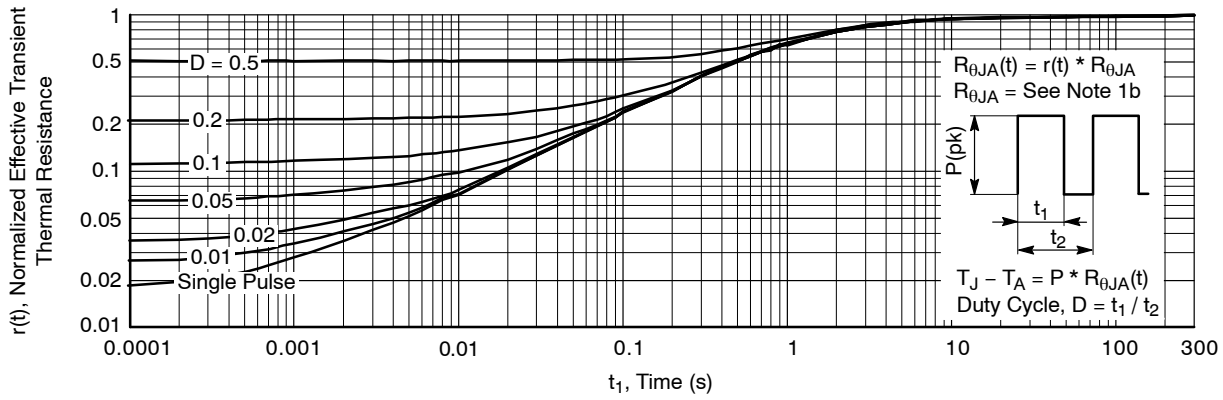


Figure 11. Transient Thermal Response Curve

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

ORDERING INFORMATION

Device	Device Marking	Package Type	Reel Size	Tape Width	Shipping†
FDC653N	.653	TSOT23 6−Lead (Pb−free)	7”	8 mm	3000 / 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.

MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

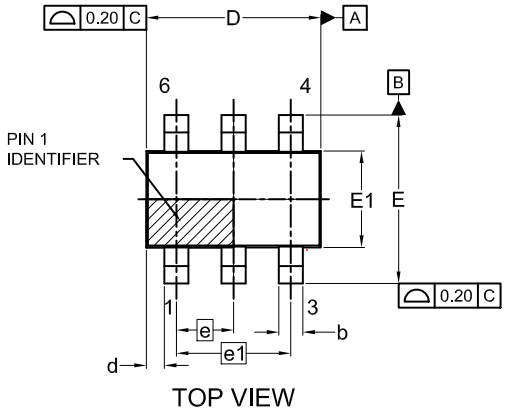
ON Semiconductor®

1

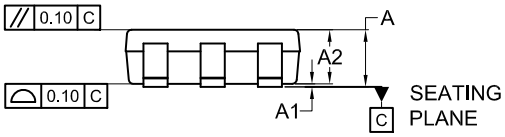
SCALE 2:1

TSOT23 6−Lead
CASE 419BL
ISSUE A

DATE 31 AUG 2020

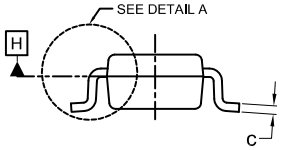


TOP VIEW

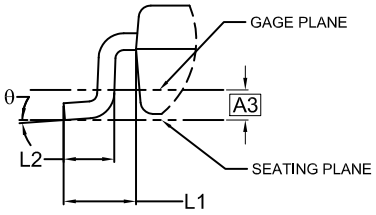


FRONT VIEW

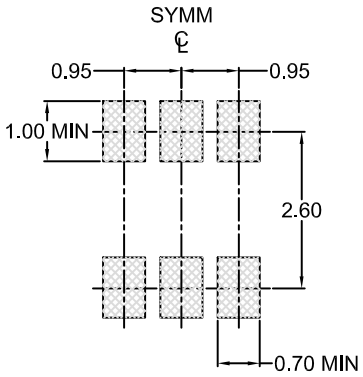
NOTE 4



SIDE VIEW



DETAIL A



LAND PATTERN
RECOMMENDATION

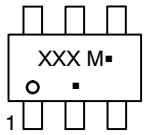
*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ON SEMICONDUCTOR SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

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
θ	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.

DOCUMENT NUMBER:	**98AON83292G**	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red.
DESCRIPTION:	**TSOT23 6−Lead**	**PAGE 1 OF 1**

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Email Requests to: orderlit@onsemi.com

onsemi Website: www.onsemi.com

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Phone: 011 421 33 790 2910

Europe, Middle East and Africa Technical Support:
Phone: 00421 33 790 2910
For additional information, please contact your local Sales Representative

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