Digital FET, Dual N & P Channel

FDG6320C

General Description

These dual N & P-Channel logic level enhancement mode field effect transistors are produced using ON Semiconductor's proprietary, high cell density, DMOS technology, this very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for bipolar digital transistors and small signal MOSFETS. Since bias resistors are not required, this dual digital FET can replace several different digital transistors, with different bias resistor values.

Features

- N-Ch 0.22 A, 0.25 V
 - $R_{DS(ON)} = 4.0 \Omega @ V_{GS} = 4.5 V$
 - $R_{DS(ON)} = 5.0 \Omega @ V_{GS} = 2.7 V$
- P-Ch -0.14 A, -25 V
 - $R_{DS(ON)} = 10 \Omega @ V_{GS} = -4.5 V$
 - $R_{DS(ON)} = 13 \Omega @ V_{GS} = -2.7 V$
- Very Small Package Outline SC70–6
- Very Low Level Gate Drive Requirements Allowing Direct Operation in 3 V Circuits (V_{GS(th)} < 1.5 V)
- Gate-Source Zener for ESD Ruggedness (>6 kV Human Body Model)
- These Devices are Pb-Free and are RoHS Compliant

Aboolotil MAXIMOM HATINGO (1A = 20 0 dilless otherwise hoted)								
Symbol	Parameter		N-Channel	P-Channel	Units			
V _{DSS}	Drain-Source V	/oltage	25	-25	V			
V _{GSS}	Gate-Source V	oltage	8	-8	V			
I _D	Drain Current Continuous		0.22	-0.14	А			
		Pulsed	0.65	-0.4				
P _D	Maximum Power Dissipation (Note 1)		0	W				
T _J , T _{STG}	Operating and Storage Temperature Range		–55 to 150		°C			
ESD	Electrostatic Dis Rating MIL–STI Human Body M 1500 Ω)	D-883D	6		kV			

ABSOLUTE MAXIMUM RATINGS ($T_A = 25^{\circ}C$ unless otherwise noted)

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.



ON Semiconductor®

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SC-88/SC70-6/SOT-363 CASE 419B-02





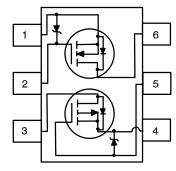
= Specific Device Code

20

М

= Assembly Operation Month

PIN CONNECTIONS



ORDERING INFORMATION

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

THERMAL CHARACTERISTICS

Symbol	Parameter	Ratings	Unit
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	415	°C/W

 R_{θJA} 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_{θJC} is guaranteed by design while R_{θCA} is determined by the user's board design. R_{θJA} = 415°C/W on minimum pad mounting on FR-4 board in still air.

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

Symbol	Parameter	Conditions	Туре	Min	Тур	Max	Unit	
OFF CHARACTERISTICS								
BV _{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 250 μ A	N-Ch	25	-	-	V	
		V_{GS} = 0 V, I_D = –250 μ A	P-Ch	-25	-	-		
$\Delta \text{BV}_{\text{DSS}} / \Delta \text{T}_{\text{J}}$	Breakdown Voltage Temperature	$I_D = 250 \ \mu\text{A}$, Referenced to 25°C	N-Ch	-	25	-	mV/°C	
Coe	Coefficient	$I_D = -250 \ \mu\text{A}$, Referenced to 25°C	P-Ch	-	-19	-		
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 20 \text{ V}, V_{GS} = 0 \text{ V}$	N-Ch	-	-	1	μA	
		V_{DS} = 20 V, V_{GS} = 0 V, T_{J} = 55 $^{\circ}C$		-	-	10		
I _{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -20 \text{ V}, \text{ V}_{GS} = 0 \text{ V}$	P-Ch	-	-	-1	μA	
		V_{DS} = –20 V, V_{GS} = 0 V, T_{J} = 55 $^{\circ}C$		-	-	-10		
I _{GSS}	Gate-Body Leakage Current	V_{GS} = 8 V, V_{DS} = 0 V	N-Ch	-	-	100	nA	
		$V_{GS} = -8 V, V_{DS} = 0 V$	P-Ch	-	-	-100	1	

ON CHARACTERISTICS (Note 2)

V _{GS(th)}	Gate Threshold Voltage	$V_{DS}=V_{GS},\ I_{D}=250\ \mu A$	N-Ch	0.65	0.85	1.5	V
		$V_{DS}=V_{GS},\ I_{D}=-250\ \mu A$	P-Ch	-0.65	-0.82	-1.5	
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage	$I_D = 250 \ \mu A$, Referenced to $25^{\circ}C$	N-Ch	-	-2.1	-	mV/°C
	Temperature Coefficient	$I_D = -250 \ \mu\text{A}$, Referenced to 25°C	P-Ch	-	2.1	-	1
R _{DS(ON)}	Static Drain-Source	V_{GS} = 4.5 V, I _D = 0.22 A	N-Ch	-	2.6	4	Ω
	On-Resistance	V_{GS} = 4.5 V, I _D = 0.22 A, T _J = 125°C		-	5.3	7	
		V_{GS} = 2.7 V, I _D = 0.19 A		-	3.7	5	
		$V_{GS} = -4.5 \text{ V}, \text{ I}_{D} = -0.14 \text{ A}$	P-Ch	-	7.3	10	
		$V_{GS} = -4.5 \text{ V}, \text{ I}_D = -0.14 \text{ A}, \ T_J = 125^{\circ}\text{C}$		-	11	17	
		$V_{GS} = -2.7 \text{ V}, \text{ I}_{D} = -0.05 \text{ A}$		-	10.4	13	
I _{D(ON)}	On-State Drain Current	V_{GS} = 4.5 V, V_{DS} = 5 V	N-Ch	0.22	-	-	А
		V_{GS} = -4.5 V, V_{DS} = -5 V	P-Ch	-0.14	-	-	
9 FS	Forward Transconductance	$V_{DS} = 5 \text{ V}, \text{ I}_{D} = 0.22 \text{ A}$	N-Ch	-	0.2	-	S
		$V_{DS} = -5 \text{ V}, \text{ I}_{D} = -0.14 \text{ A}$	P-Ch	-	0.12	-]

DYNAMIC CHARACTERISTICS

C _{iss}	Input Capacitance	N–Channel V _{DS} = 10 V, V _{GS} = 0 V, f = 1.0 MHz	N-Ch	-	9.5	-	pF
			P-Ch	-	12	-	
C _{oss}	Output Capacitance	P–Channel V _{DS} = −10 V, V _{GS} = 0 V,	N-Ch	-	6	_	
		f = 1.0 MHz	P-Ch	-	7	-	
C _{rss}	Reverse Transfer Capacitance		N-Ch	-	1.3	-	
			P-Ch	-	1.5	-	

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

Symbol	Parameter	Conditions	Туре	Min	Тур	Max	Unit				
SWITCHING C	WITCHING CHARACTERISTICS (Note 2)										
t _{D(on)}	Turn-On Delay Time	N-Channel	N-Ch	-	5	12	ns				
		V_{DD} = 5 V, I _D = 0.5 A, V _{GS} = 4.5 V, R _{GEN} = 50 Ω	P-Ch	-	5	12					
t _r	Turn-On Rise Time	P-Channel	N-Ch	-	4.5	10	ns				
		$V_{DD} = -5 \text{ V}, \text{ I}_D = -0.5 \text{ A},$ $V_{GS} = -4.5 \text{ V}, \text{ R}_{GEN} = 50 \Omega$	P-Ch	-	8	16					
t _{D(off)}	Turn-Off Delay Time	$V_{GS} = -4.5 \text{ V}, \text{h}_{GEN} = 50.52$	N-Ch	-	4	8	ns				
			P-Ch	-	9	18					
t _f	Turn-Off Fall Time		N-Ch	-	3.2	7	ns				
			P-Ch	-	5	12					
Qg	Total Gate Charge	N-Channel	N-Ch	-	0.29	0.4	nC				
		$V_{DS} = 5 V, I_D = 0.22 A, V_{GS} = 4.5 V$	P-Ch	-	0.22	0.31					
Q _{gs}	Gate-Source Charge	P-Channel	N-Ch	-	0.12	-	nC				
		$V_{DS} = -5 \text{ V}, \text{ I}_D = -0.14 \text{ A},$ $V_{GS} = -4.5 \text{ V}$	P-Ch	-	0.12	-					
Q _{gd}	Gate-Drain Charge	VGS4.5 V	N-Ch	-	0.03	-	nC				
			P-Ch	-	0.05	-	1				

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Source Current		N-Ch	-	-	0.25	А
			P-Ch	-	-	-0.25	
V _{SD}	Drain-Source Diode Forward	V_{GS} = 0 V, I_S = 0.5 A (Note 2)	N-Ch	-	0.8	1.2	V
	Voltage	V_{GS} = 0 V, I_S = –0.5 A (Note 2)	P-Ch	-	-0.8	-1.2	

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. 2. Pulse Test: Pulse Width \leq 300 μ s, Duty Cycle \leq 2.0%

TYPICAL PERFORMANCE CHARACTERISTICS: N-CHANNEL

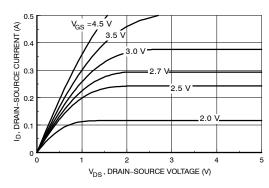


Figure 1. On-Region Characteristics

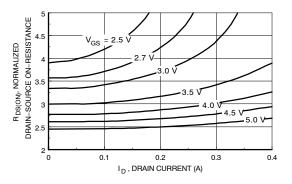


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

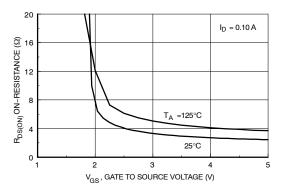


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

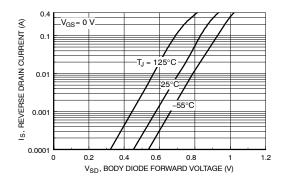


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

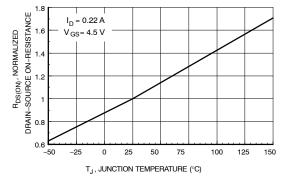


Figure 3. On–Resistance Variation with Temperature

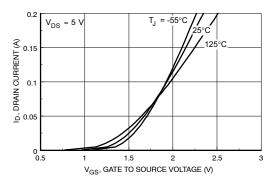


Figure 5. Transfer Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS: N-CHANNEL (continued)

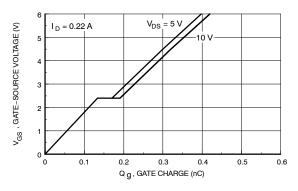


Figure 7. Gate Charge Characteristics

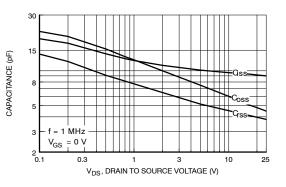


Figure 8. Capacitance Characteristics

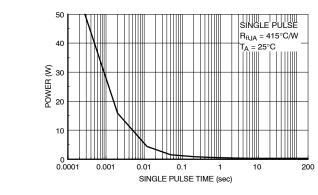


Figure 10. Single Pulse Maximum Power Dissipation

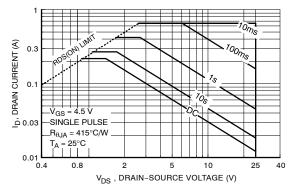


Figure 9. Maximum Safe Operating Area

TYPICAL PERFORMANCE CHARACTERISTICS: P-CHANNEL

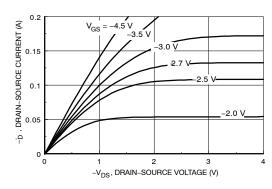


Figure 11. On-Region Characteristics

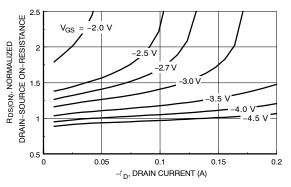


Figure 12. On–Resistance Variation with Drain Current and Gate Voltage

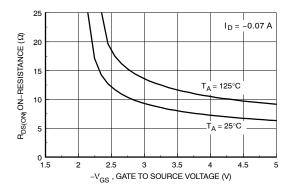


Figure 14. On–Resistance Variation with Gate–to–Source Voltage

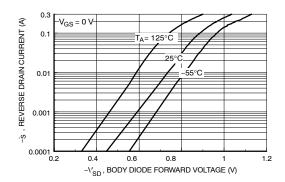


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature

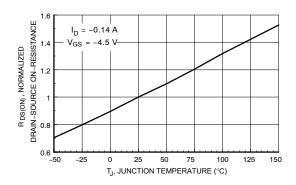


Figure 13. On–Resistance Variation with Temperature

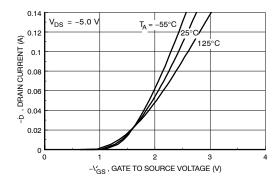


Figure 15. Transfer Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS: P-CHANNEL (continued)

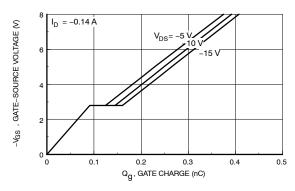


Figure 17. Gate Charge Characteristics

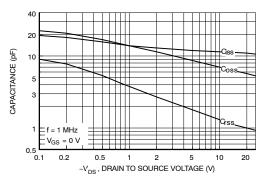


Figure 18. Capacitance Characteristics

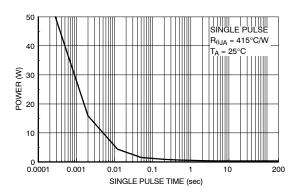


Figure 20. Single Pulse Maximum Power Dissipation

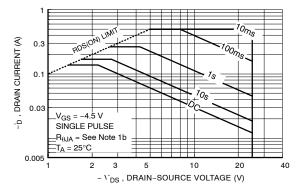
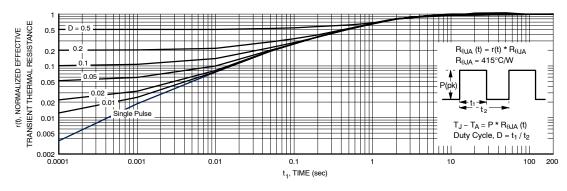


Figure 19. Maximum Safe Operating Area

TYPICAL PERFORMANCE CHARACTERISTICS: N & P-CHANNEL



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

Figure 21. Transient Thermal Response Curve

ORDERING INFORMATION

Device Order Number	Device Marking	Package Type	Shipping [†]
FDG6320C	20	SC-88/SC70-6/SOT-363 (Pb-Free)	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.

0.043

0.004





- XXX = Specific Device Code

(Note: Microdot may be in either location)

*Date Code orientation and/or position may vary depending upon manufacturing 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.



DIMENSIONS: MILLIMETERS

*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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SC-88/SC70-6/SOT-363 CASE 419B-02 ISSUE Y

DATE 11 DEC 2012

STYLE 1: PIN 1. EMITTER 2 2. BASE 2 3. COLLECTOR 1 4. EMITTER 1 5. BASE 1 6. COLLECTOR 2	STYLE 2: CANCELLED	STYLE 3: CANCELLED	STYLE 4: PIN 1. CATHODE 2. CATHODE 3. COLLECTOR 4. EMITTER 5. BASE 6. ANODE	STYLE 5: PIN 1. ANODE 2. ANODE 3. COLLECTOR 4. EMITTER 5. BASE 6. CATHODE	STYLE 6: PIN 1. ANODE 2 2. N/C 3. CATHODE 1 4. ANODE 1 5. N/C 6. CATHODE 2
STYLE 7: PIN 1. SOURCE 2 2. DRAIN 2 3. GATE 1 4. SOURCE 1 5. DRAIN 1 6. GATE 2	STYLE 8: CANCELLED	STYLE 9: PIN 1. EMITTER 2 2. EMITTER 1 3. COLLECTOR 1 4. BASE 1 5. BASE 2 6. COLLECTOR 2	STYLE 10: PIN 1. SOURCE 2 2. SOURCE 1 3. GATE 1 4. DRAIN 1 5. DRAIN 2 6. GATE 2	STYLE 11: PIN 1. CATHODE 2 2. CATHODE 2 3. ANODE 1 4. CATHODE 1 5. CATHODE 1 6. ANODE 2	STYLE 12: PIN 1. ANODE 2 2. ANODE 2 3. CATHODE 1 4. ANODE 1 5. ANODE 1 6. CATHODE 2
STYLE 13:	STYLE 14:	STYLE 15:	STYLE 16:	STYLE 17:	STYLE 18:
PIN 1. ANODE	PIN 1. VREF	PIN 1. ANODE 1	PIN 1. BASE 1	PIN 1. BASE 1	PIN 1. VIN1
2. N/C	2. GND	2. ANODE 2	2. EMITTER 2	2. EMITTER 1	2. VCC
3. COLLECTOR	3. GND	3. ANODE 3	3. COLLECTOR 2	3. COLLECTOR 2	3. VOUT2
4. EMITTER	4. IOUT	4. CATHODE 3	4. BASE 2	4. BASE 2	4. VIN2
5. BASE	5. VEN	5. CATHODE 2	5. EMITTER 1	5. EMITTER 2	5. GND
6. CATHODE	6. VCC	6. CATHODE 1	6. COLLECTOR 1	6. COLLECTOR 1	6. VOUT1
STYLE 19:	STYLE 20:	STYLE 21:	STYLE 22:	STYLE 23:	STYLE 24:
PIN 1. I OUT	PIN 1. COLLECTOR	PIN 1. ANODE 1	PIN 1. D1 (i)	PIN 1. Vn	PIN 1. CATHODE
2. GND	2. COLLECTOR	2. N/C	2. GND	2. CH1	2. ANODE
3. GND	3. BASE	3. ANODE 2	3. D2 (i)	3. Vp	3. CATHODE
4. V CC	4. EMITTER	4. CATHODE 2	4. D2 (c)	4. N/C	4. CATHODE
5. V EN	5. COLLECTOR	5. N/C	5. VBUS	5. CH2	5. CATHODE
6. V REF	6. COLLECTOR	6. CATHODE 1	6. D1 (c)	6. N/C	6. CATHODE
STYLE 25:	STYLE 26:	STYLE 27:	STYLE 28:	STYLE 29:	STYLE 30:
PIN 1. BASE 1	PIN 1. SOURCE 1	PIN 1. BASE 2	PIN 1. DRAIN	PIN 1. ANODE	PIN 1. SOURCE 1
2. CATHODE	2. GATE 1	2. BASE 1	2. DRAIN	2. ANODE	2. DRAIN 2
3. COLLECTOR 2	3. DRAIN 2	3. COLLECTOR 1	3. GATE	3. COLLECTOR	3. DRAIN 2
4. BASE 2	4. SOURCE 2	4. EMITTER 1	4. SOURCE	4. EMITTER	4. SOURCE 2
5. EMITTER	5. GATE 2	5. EMITTER 2	5. DRAIN	5. BASE/ANODE	5. GATE 1
6. COLLECTOR 1	6. DRAIN 1	6. COLLECTOR 2	6. DRAIN	6. CATHODE	6. DRAIN 1

Note: Please refer to datasheet for style callout. If style type is not called out in the datasheet refer to the device datasheet pinout or pin assignment.

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