

# ZXMC6A09DN8

## COMPLEMENTARY 60V ENHANCEMENT MODE MOSFET

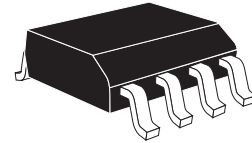
### SUMMARY

N-Channel  $V_{(BR)DSS} = 60V$ ;  $R_{DS(ON)} = 0.045\Omega$ ;  $I_D = 5.1A$

P-Channel  $V_{(BR)DSS} = -60V$ ;  $R_{DS(ON)} = 0.055\Omega$ ;  $I_D = -4.8A$

### DESCRIPTION

This new generation of trench MOSFETs from Zetex utilizes a unique structure that combines the benefits of low on-resistance with fast switching speed. This makes them ideal for high efficiency, low voltage, power management applications.



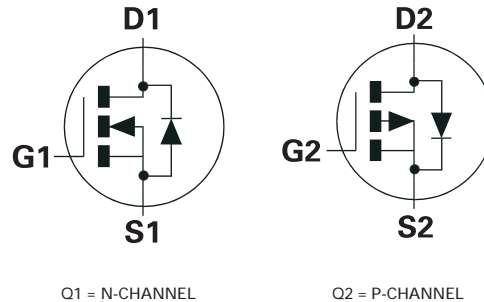
SO8

### FEATURES

- Low on-resistance
- Fast switching speed
- Low threshold
- Low gate drive
- Low profile SOIC package

### APPLICATIONS

- Motor drive
- LCD backlighting



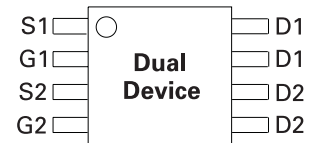
### ORDERING INFORMATION

DEVICE	REEL	TAPE WIDTH	QUANTITY PER REEL
ZXMC6A09DN8TA	7"	12mm	500 units
ZXMC6A09DN8TC	13"	12mm	2500 units

### DEVICE MARKING

ZXMC  
6A09

### PINOUT



Top view

# ZXMC6A09DN8

## ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	N-Channel	P-Channel	UNIT
Drain-Source Voltage	$V_{DSS}$	60	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current @ $V_{GS}=10V$ ; $T_A=25^\circ C$ (b)(d) @ $V_{GS}=10V$ ; $T_A=25^\circ C$ (b)(d) @ $V_{GS}=10V$ ; $T_A=25^\circ C$ (a)(d)	$I_D$	5.1 4.1 3.9	-4.8 -3.8 -3.7	A A A
Pulsed Drain Current (c)	$I_{DM}$	25	-23	A
Continuous Source Current (Body Diode)(b)	$I_S$	3.5	-3.3	A
Pulsed Source Current (Body Diode)(c)	$I_{SM}$	25.4	-23.8	A
Power Dissipation at $T_A=25^\circ C$ (a)(d) Linear Derating Factor	$P_D$	1.25 10		W mW/°C
Power Dissipation at $T_A=25^\circ C$ (a)(e) Linear Derating Factor	$P_D$	1.8 14		W mW/°C
Power Dissipation at $T_A=25^\circ C$ (b)(d) Linear Derating Factor	$P_D$	2.1 17		W mW/°C
Operating and Storage Temperature Range	$T_J:T_{stg}$	-55 to +150		°C

## THERMAL RESISTANCE

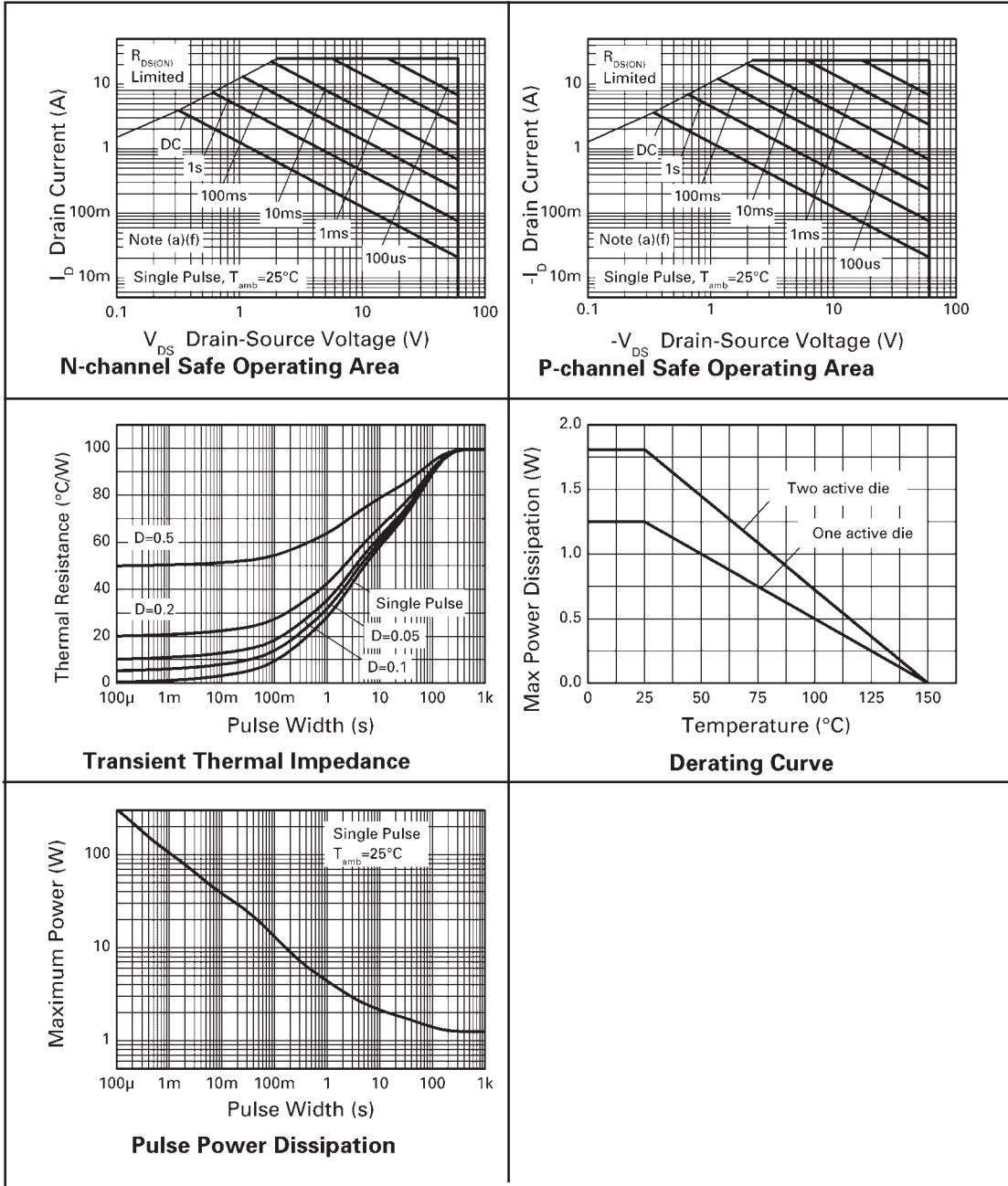
PARAMETER	SYMBOL	VALUE	UNIT
Junction to Ambient (a)(d)	$R_{\theta JA}$	100	°C/W
Junction to Ambient (b)(e)	$R_{\theta JA}$	69	°C/W
Junction to Ambient (b)(d)	$R_{\theta JA}$	58	°C/W

### Notes:

- (a) For a dual device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper in still air conditions.
- (b) For a dual device surface mounted on FR4 PCB measured at  $t \leq 10$  sec.
- (c) Repetitive rating 25mm x 25mm FR4 PCB,  $D=0.02$ , pulse width=300 $\mu$ s - pulse width limited by maximum junction temperature.
- (d) For a dual device with one active die.
- (e) For a device with two active die running at equal power.

# ZXMC6A09DN8

## CHARACTERISTICS



# ZXMC6A09DN8

## N-CHANNEL

### ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
<b>STATIC</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	60			V	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$
Zero Gate Voltage Drain Current	$I_{DSS}$			1.0	$\mu\text{A}$	$V_{DS}=60\text{V}, V_{GS}=0\text{V}$
Gate-Body Leakage	$I_{GSS}$			100	nA	$V_{GS}=\pm 20\text{V}, V_{DS}=0\text{V}$
Gate-Source Threshold Voltage	$V_{GS(th)}$	1.0			V	$I_D=250\mu\text{A}, V_{DS}=V_{GS}$
Static Drain-Source On-State Resistance <sup>(1)</sup>	$R_{DS(on)}$			0.045 0.070	$\Omega$ $\Omega$	$V_{GS}=10\text{V}, I_D=8.2\text{A}$ $V_{GS}=4.5\text{V}, I_D=7.4\text{A}$
Forward Transconductance <sup>(1)(3)</sup>	$g_{fs}$		15		S	$V_{DS}=15\text{V}, I_D=8.2\text{A}$
<b>DYNAMIC</b> <sup>(3)</sup>						
Input Capacitance	$C_{iss}$		1407		pF	$V_{DS}=40\text{V}, V_{GS}=0\text{V},$ $f=1\text{MHz}$
Output Capacitance	$C_{oss}$		121		pF	
Reverse Transfer Capacitance	$C_{rss}$		59		pF	
<b>SWITCHING</b> <sup>(2) (3)</sup>						
Turn-On Delay Time	$t_{d(on)}$		4.9		ns	$V_{DD}=30\text{V}, I_D=1.0\text{A}$ $R_G=6.0\Omega, V_{GS}=10\text{V}$
Rise Time	$t_r$		3.3		ns	
Turn-Off Delay Time	$t_{d(off)}$		28.5		ns	
Fall Time	$t_f$		11.0		ns	
Gate Charge	$Q_g$		12.4		nC	$V_{DS}=15\text{V}, V_{GS}=5\text{V},$ $I_D=3.5\text{A}$
Total Gate Charge	$Q_g$		24.2		nC	$V_{DS}=15\text{V}, V_{GS}=10\text{V},$ $I_D=3.5\text{A}$
Gate-Source Charge	$Q_{gs}$		5.2		nC	
Gate-Drain Charge	$Q_{gd}$		3.5		nC	
<b>SOURCE-DRAIN DIODE</b>						
Diode Forward Voltage <sup>(1)</sup>	$V_{SD}$		0.85	0.95	V	$T_J=25^{\circ}\text{C}, I_S=6.6\text{A},$ $V_{GS}=0\text{V}$
Reverse Recovery Time <sup>(3)</sup>	$t_{rr}$		26.3		ns	$T_J=25^{\circ}\text{C}, I_F=3.5\text{A},$ $di/dt=100\text{A}/\mu\text{s}$
Reverse Recovery Charge <sup>(3)</sup>	$Q_{rr}$		26.6		nC	

#### NOTES

(1) Measured under pulsed conditions. Width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$ .

(2) Switching characteristics are independent of operating junction temperature.

(3) For design aid only, not subject to production testing.

# ZXMC6A09DN8

## P-CHANNEL

ELECTRICAL CHARACTERISTICS (at  $T_{amb} = 25^{\circ}\text{C}$  unless otherwise stated)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
<b>STATIC</b>						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	-60			V	$I_D = -250\mu\text{A}$ , $V_{GS} = 0\text{V}$
Zero Gate Voltage Drain Current	$I_{DSS}$			-1.0	$\mu\text{A}$	$V_{DS} = -60\text{V}$ , $V_{GS} = 0\text{V}$
Gate-Body Leakage	$I_{GSS}$			100	nA	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$
Gate-Source Threshold Voltage	$V_{GS(th)}$	-1.0			V	$I_D = -250\mu\text{A}$ , $V_{DS} = V_{GS}$
Static Drain-Source On-State Resistance <sup>(1)</sup>	$R_{DS(on)}$			0.055 0.080	$\Omega$ $\Omega$	$V_{GS} = -10\text{V}$ , $I_D = -3.5\text{A}$ $V_{GS} = -4.5\text{V}$ , $I_D = -2.9\text{A}$
Forward Transconductance <sup>(1)(3)</sup>	$g_{fs}$		8.7		S	$V_{DS} = -15\text{V}$ , $I_D = -3.5\text{A}$
<b>DYNAMIC</b> <sup>(3)</sup>						
Input Capacitance	$C_{iss}$		1580		pF	$V_{DS} = -30\text{V}$ , $V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$
Output Capacitance	$C_{oss}$		160		pF	
Reverse Transfer Capacitance	$C_{rss}$		140		pF	
<b>SWITCHING</b> <sup>(2) (3)</sup>						
Turn-On Delay Time	$t_{d(on)}$		4.6		ns	$V_{DD} = -30\text{V}$ , $I_D = -1\text{A}$ $R_G = 6.0\Omega$ , $V_{GS} = -10\text{V}$
Rise Time	$t_r$		5.8		ns	
Turn-Off Delay Time	$t_{d(off)}$		55		ns	
Fall Time	$t_f$		23		ns	
Gate Charge	$Q_g$		23		nC	$V_{DS} = -30\text{V}$ , $V_{GS} = -5\text{V}$ , $I_D = -3.5\text{A}$
Total Gate Charge	$Q_g$		44		nC	$V_{DS} = -30\text{V}$ , $V_{GS} = -10\text{V}$ , $I_D = -3.5\text{A}$
Gate-Source Charge	$Q_{gs}$		3.9		nC	
Gate-Drain Charge	$Q_{gd}$		9.8		nC	
<b>SOURCE-DRAIN DIODE</b>						
Diode Forward Voltage <sup>(1)</sup>	$V_{SD}$		-0.85	-0.95	V	$T_J = 25^{\circ}\text{C}$ , $I_S = -4.2\text{A}$ , $V_{GS} = 0\text{V}$
Reverse Recovery Time <sup>(3)</sup>	$t_{rr}$		37		ns	$T_J = 25^{\circ}\text{C}$ , $I_F = -2.1\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$
Reverse Recovery Charge <sup>(3)</sup>	$Q_{rr}$		56		nC	

### NOTES

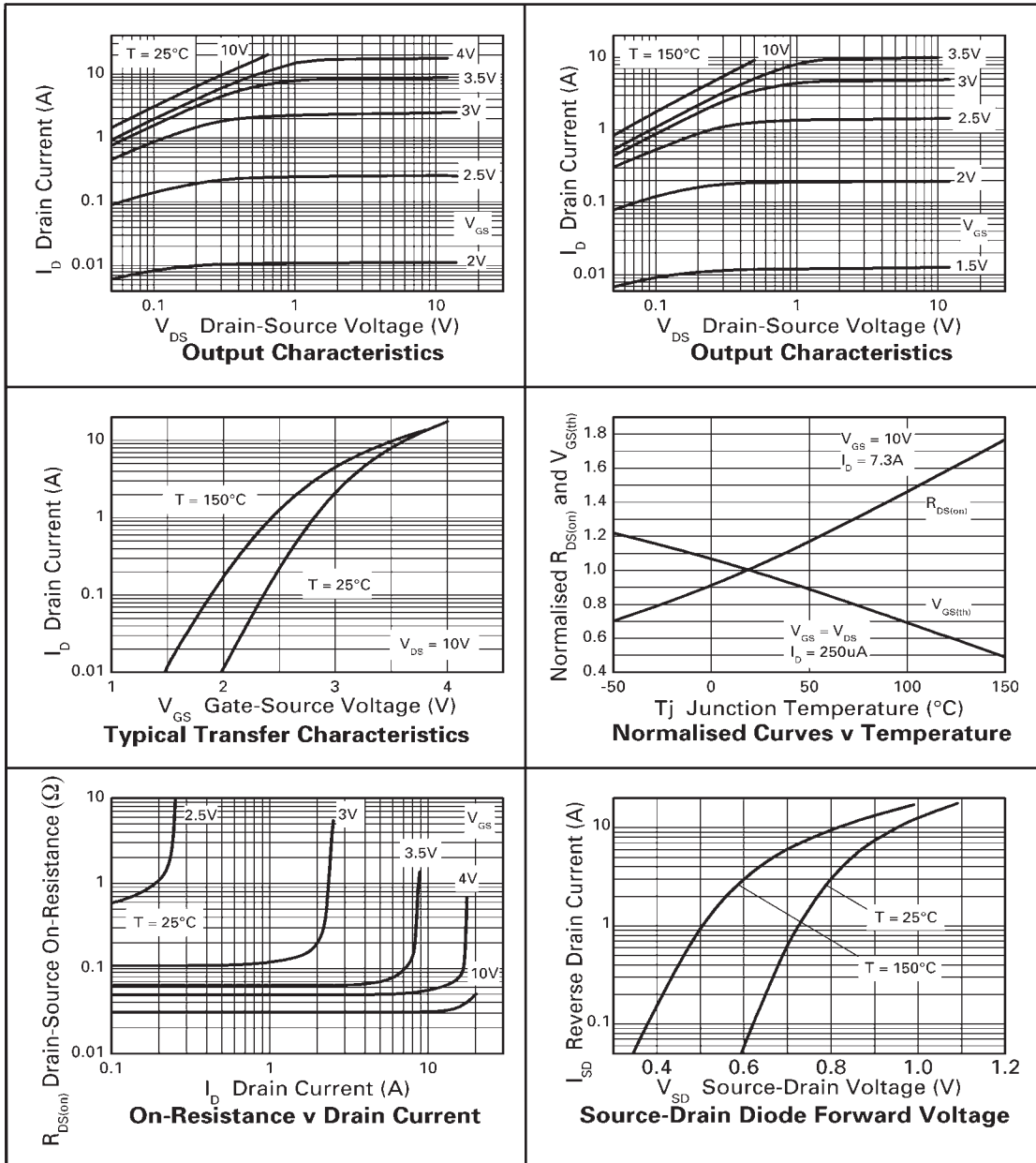
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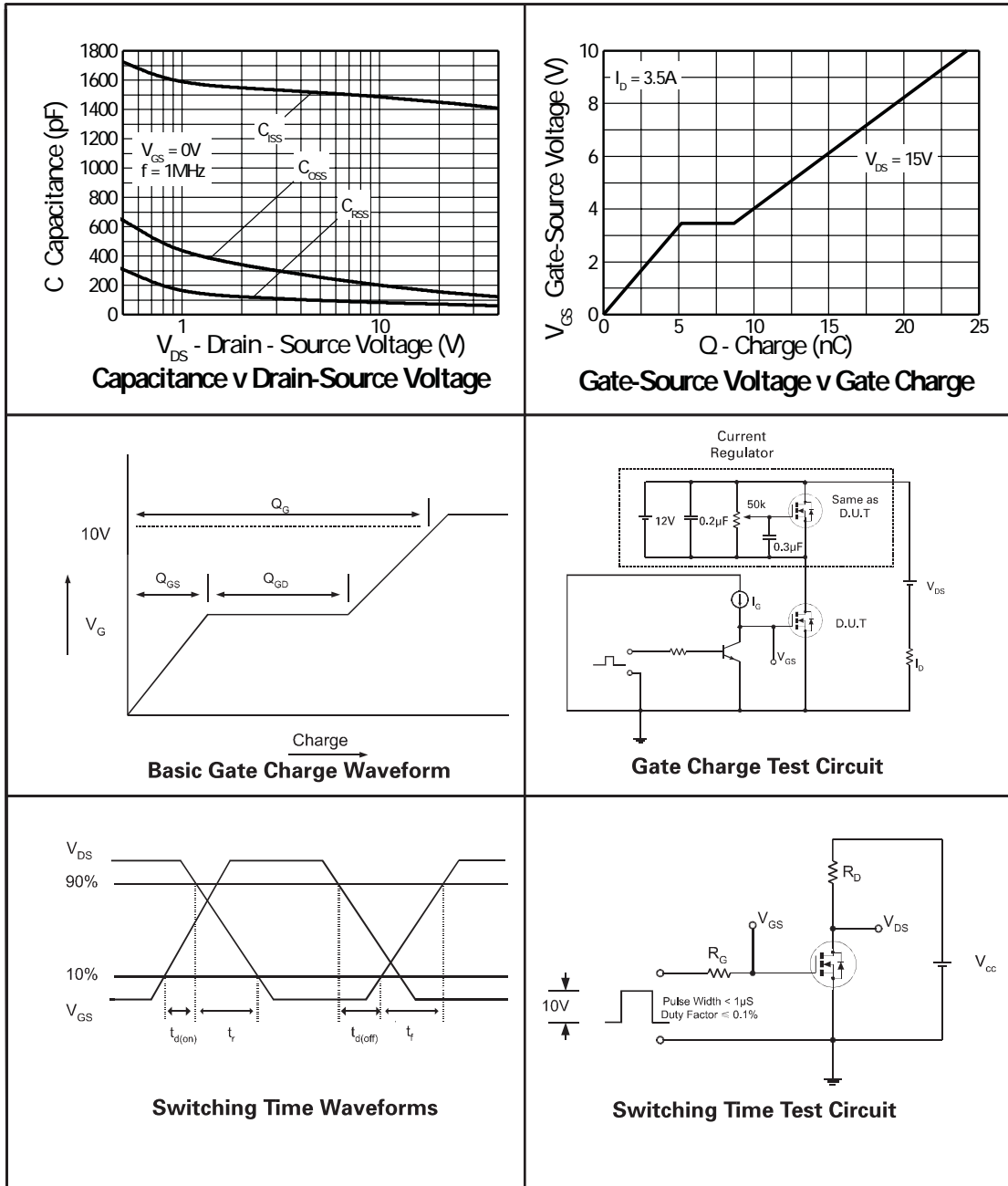
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## N-CHANNEL TYPICAL CHARACTERISTICS



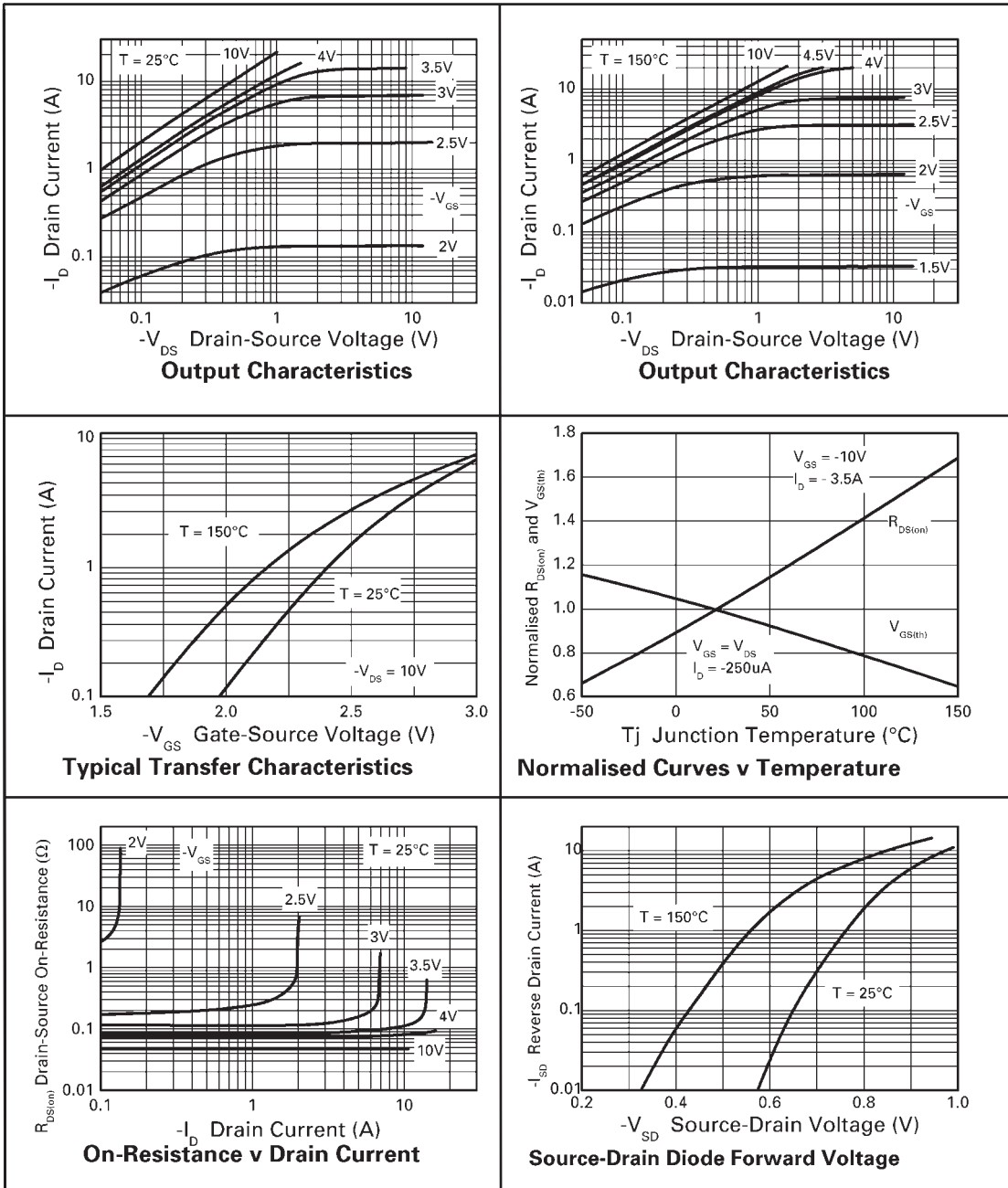
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## N-CHANNEL TYPICAL CHARACTERISTICS



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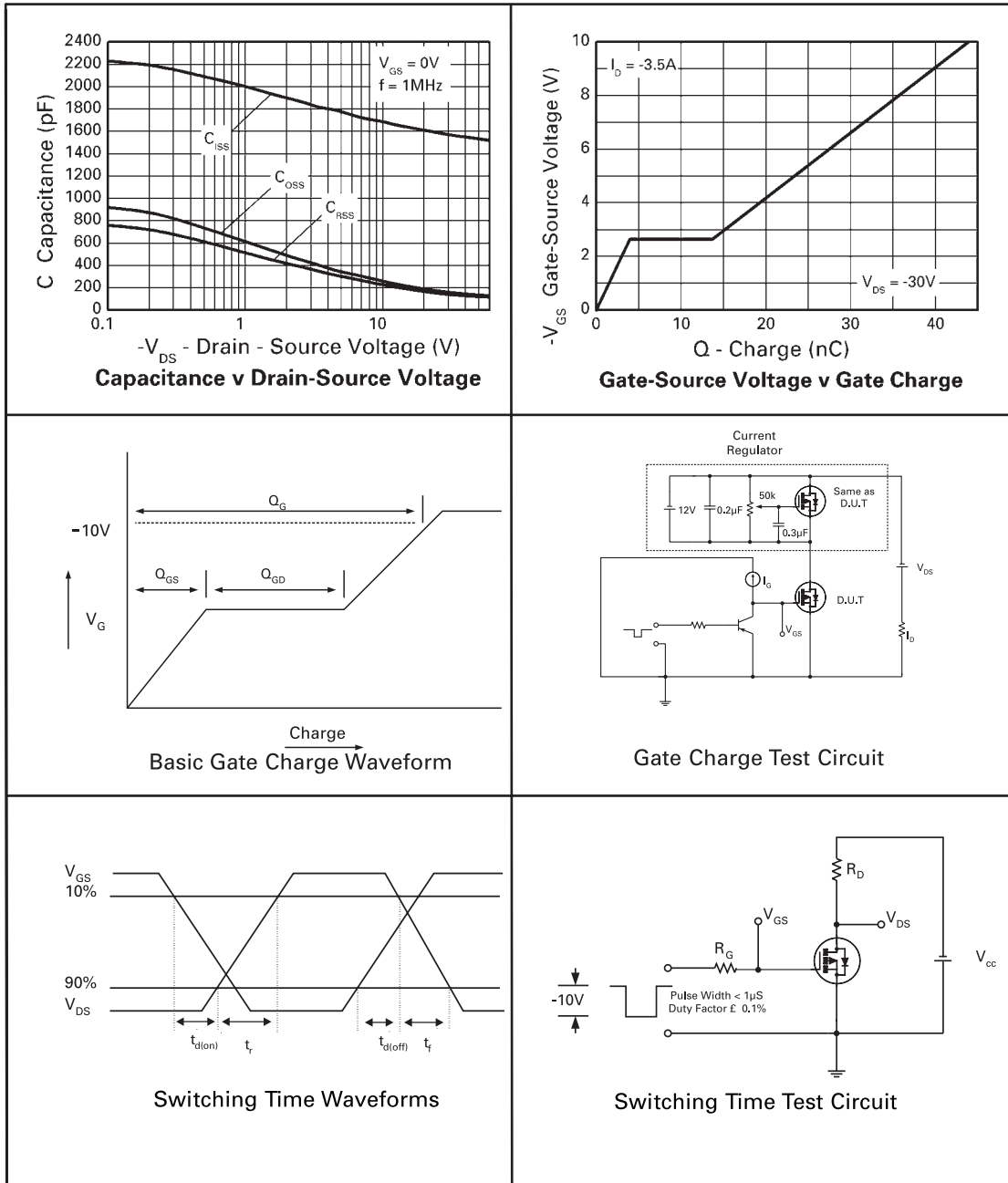
## P-CHANNEL TYPICAL CHARACTERISTICS





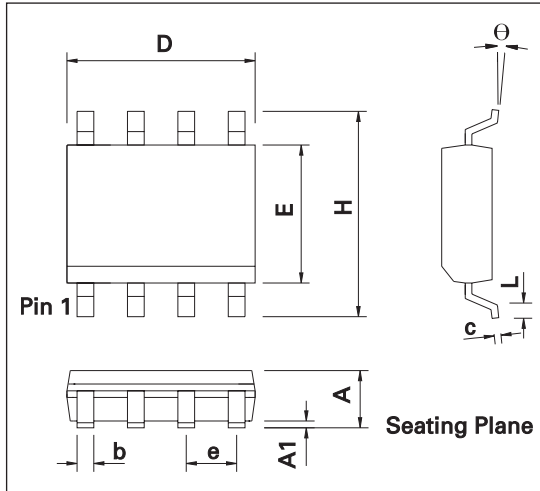
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## P-CHANNEL TYPICAL CHARACTERISTICS



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## PACKAGE OUTLINE



CONTROLLING DIMENSIONS ARE IN INCHES  
APPROX IN MILLIMETERS

## PACKAGE DIMENSIONS

DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min	Max	Min	Max		Min	Max	Min	Max
A	1.35	1.75	0.053	0.069	e	1.27 BSC		0.050 BSC	
A1	0.10	0.25	0.004	0.010	b	0.33	0.51	0.013	0.020
D	4.80	5.00	0.189	0.197	c	0.19	0.25	0.008	0.010
H	5.80	6.20	0.228	0.244	Θ	0°	8°	0°	8°
E	3.80	4.00	0.150	0.157	h	0.25	0.50	0.010	0.020
L	0.40	1.27	0.016	0.050	-	-	-	-	-

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