



YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

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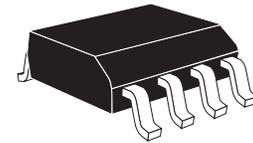
SUMMARY

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.



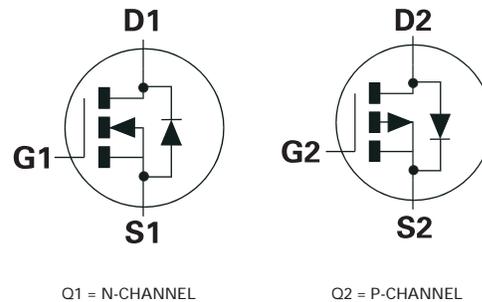
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FEATURES

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

APPLICATIONS

- Motor drive
- LCD backlighting



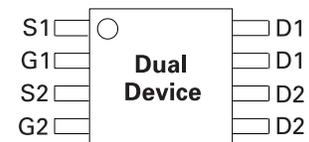
ORDERING INFORMATION

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

DEVICE MARKING

NK-ZXMC
6A09

PINOUT



Top view

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	N-Channel	P-Channel	UNIT
Drain-Source Voltage	V_{DSS}	60	-60	V
Gate-Source Voltage	V_{GS}	± 20	± 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

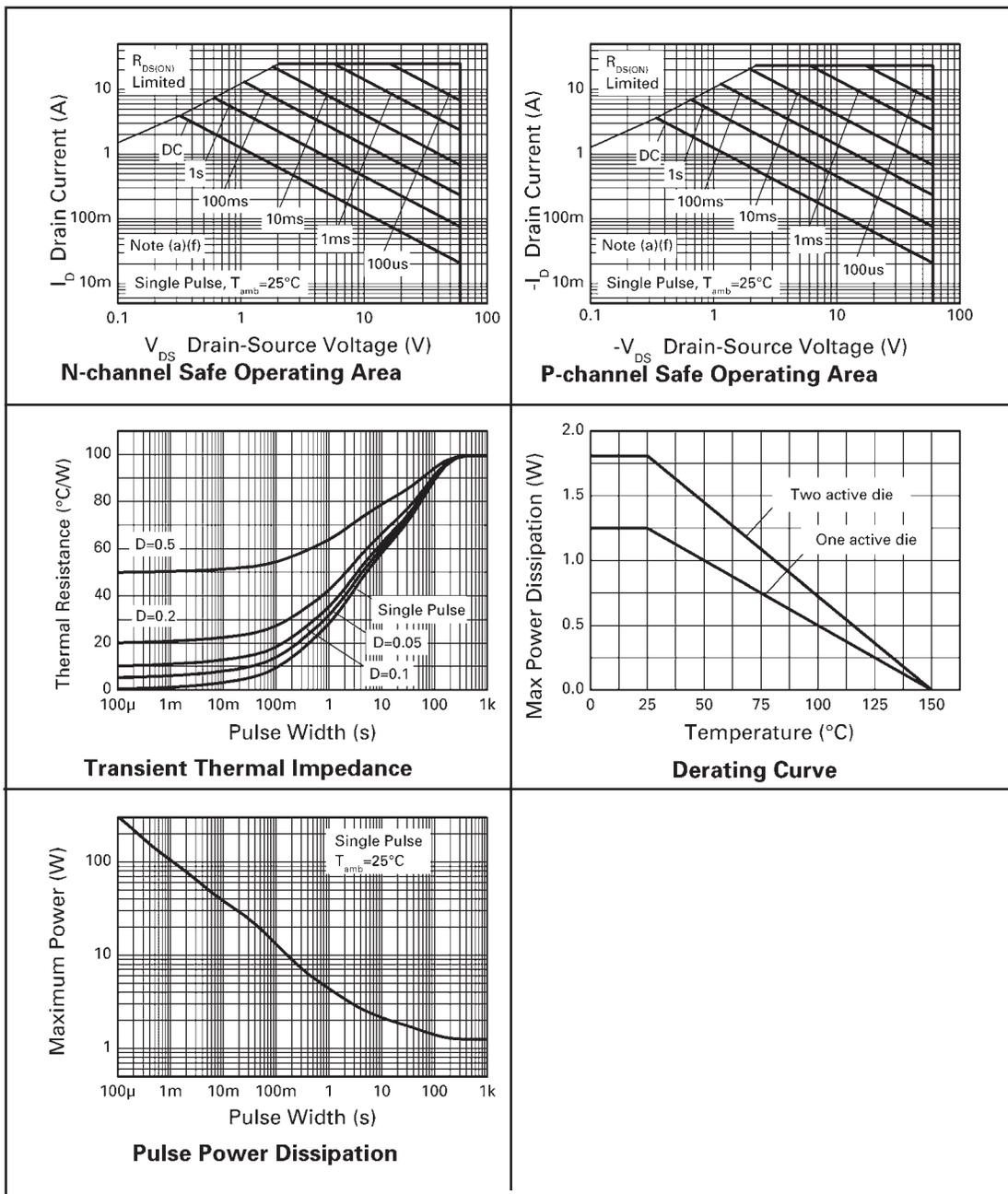
THERMAL RESISTANCE

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 μ 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.

CHARACTERISTICS



N-CHANNEL ELECTRICAL CHARACTERISTICS

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

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
STATIC						
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	μA	$V_{DS}=60\text{V}, V_{GS}=0\text{V}$
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 ⁽¹⁾	$R_{DS(on)}$			0.045 0.070	Ω Ω	$V_{GS}=10\text{V}, I_D=8.2\text{A}$ $V_{GS}=4.5\text{V}, I_D=7.4\text{A}$
Forward Transconductance ⁽¹⁾⁽³⁾	g_{fs}		15		S	$V_{DS}=15\text{V}, I_D=8.2\text{A}$
DYNAMIC ⁽³⁾						
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	
SWITCHING ^{(2) (3)}						
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	
SOURCE-DRAIN DIODE						
Diode Forward Voltage ⁽¹⁾	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 ⁽³⁾	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 ⁽³⁾	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.

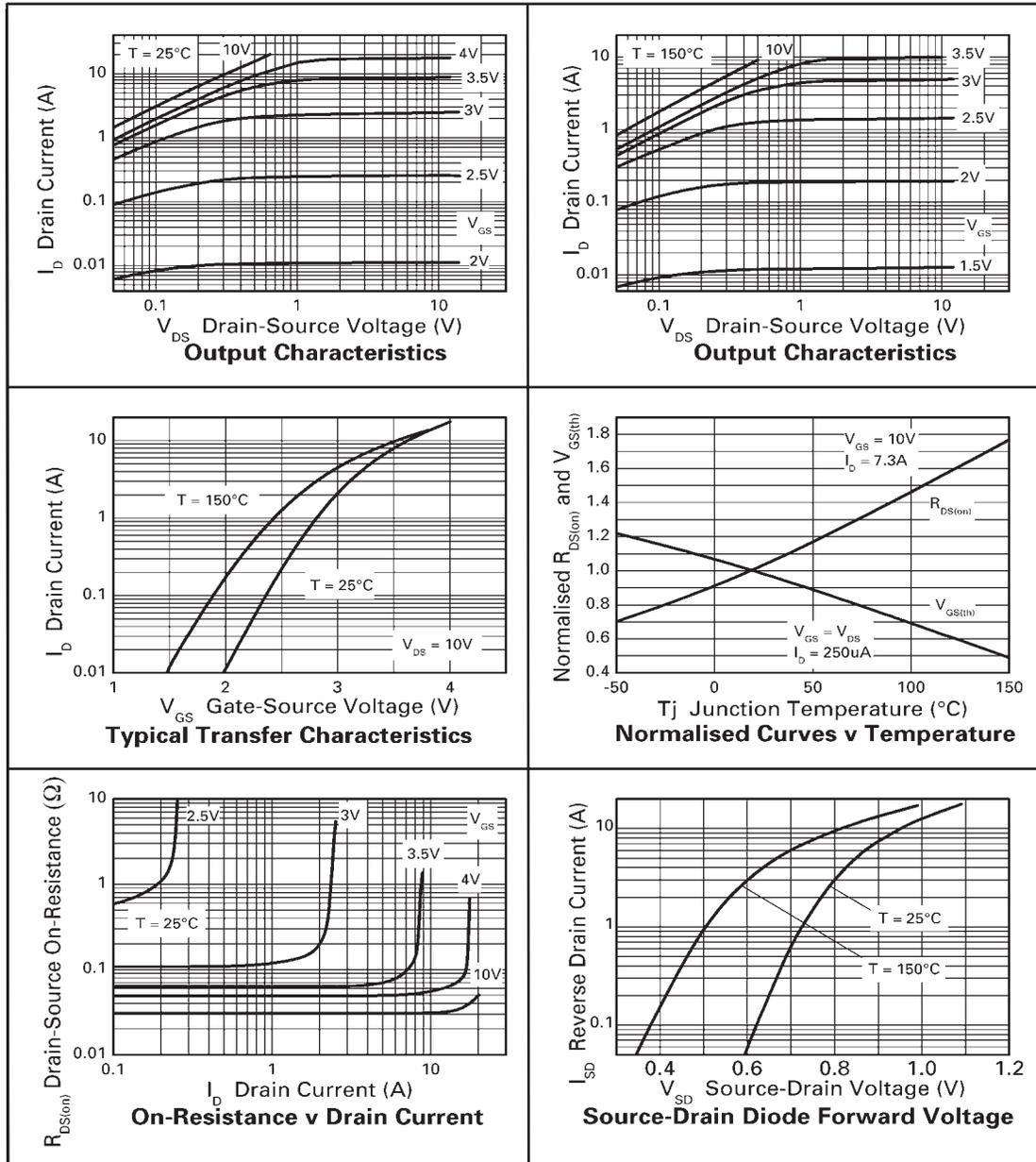
P-CHANNEL ELECTRICAL CHARACTERISTICS (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
STATIC						
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	μA	$V_{DS} = -60\text{V}, V_{GS} = 0\text{V}$
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 ⁽¹⁾	$R_{DS(on)}$			0.055 0.080	Ω Ω	$V_{GS} = -10\text{V}, I_D = -3.5\text{A}$ $V_{GS} = -4.5\text{V}, I_D = -2.9\text{A}$
Forward Transconductance ⁽¹⁾⁽³⁾	g_{fs}		8.7		S	$V_{DS} = -15\text{V}, I_D = -3.5\text{A}$
DYNAMIC ⁽³⁾						
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	
SWITCHING ^{(2) (3)}						
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	
SOURCE-DRAIN DIODE						
Diode Forward Voltage ⁽¹⁾	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 ⁽³⁾	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 ⁽³⁾	Q_{rr}		56		nC	

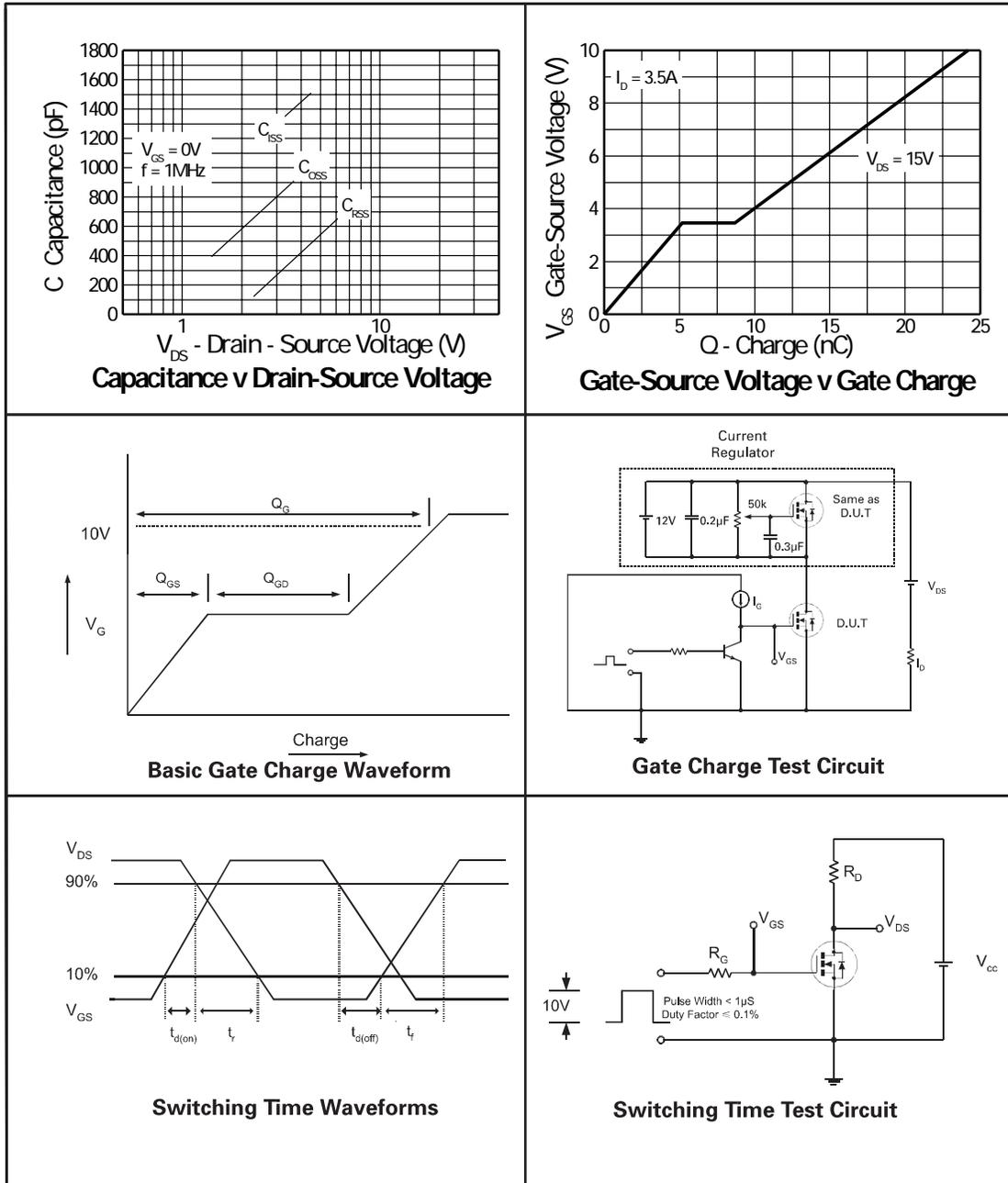
NOTES

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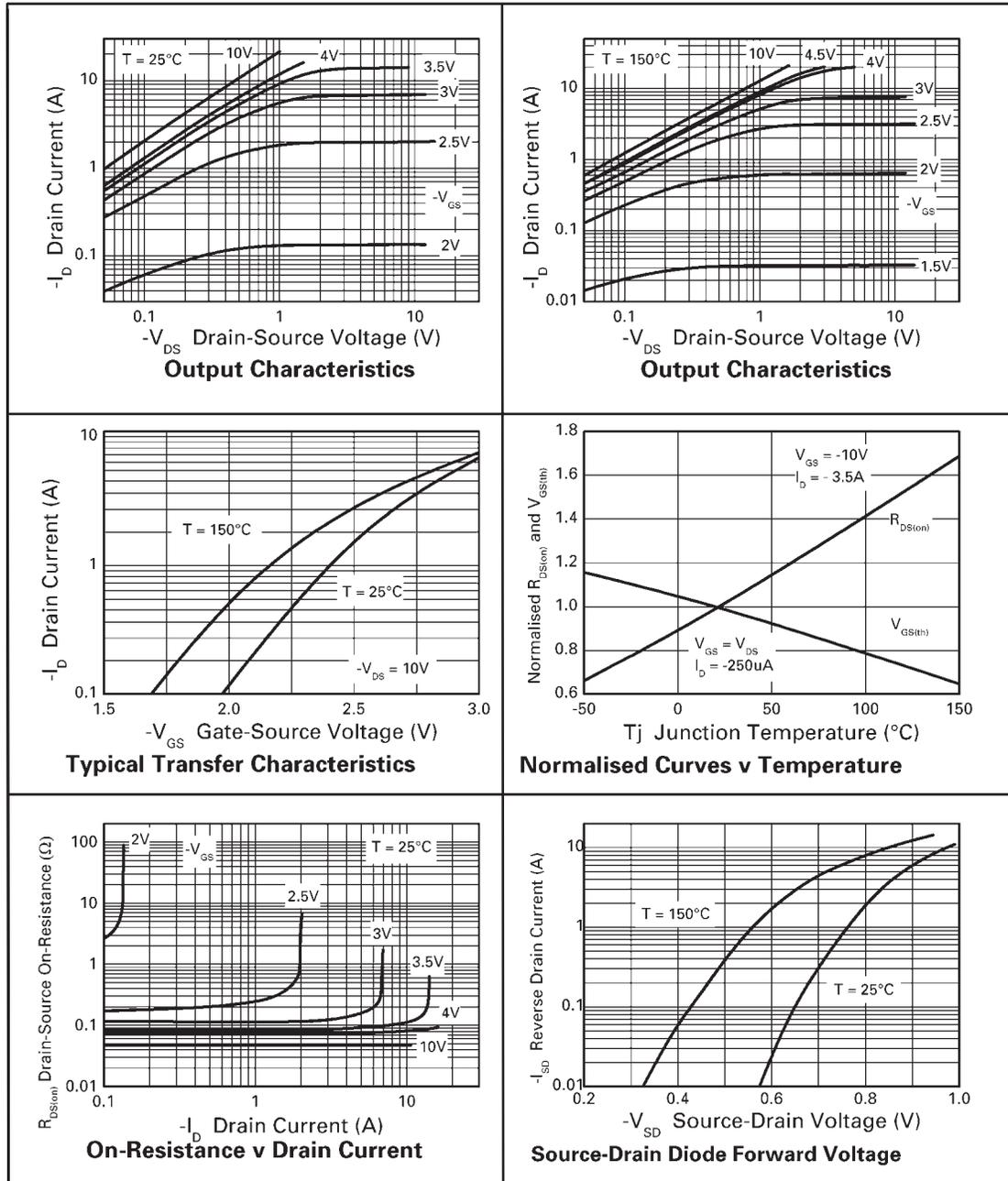
N-CHANNEL TYPICAL CHARACTERISTICS



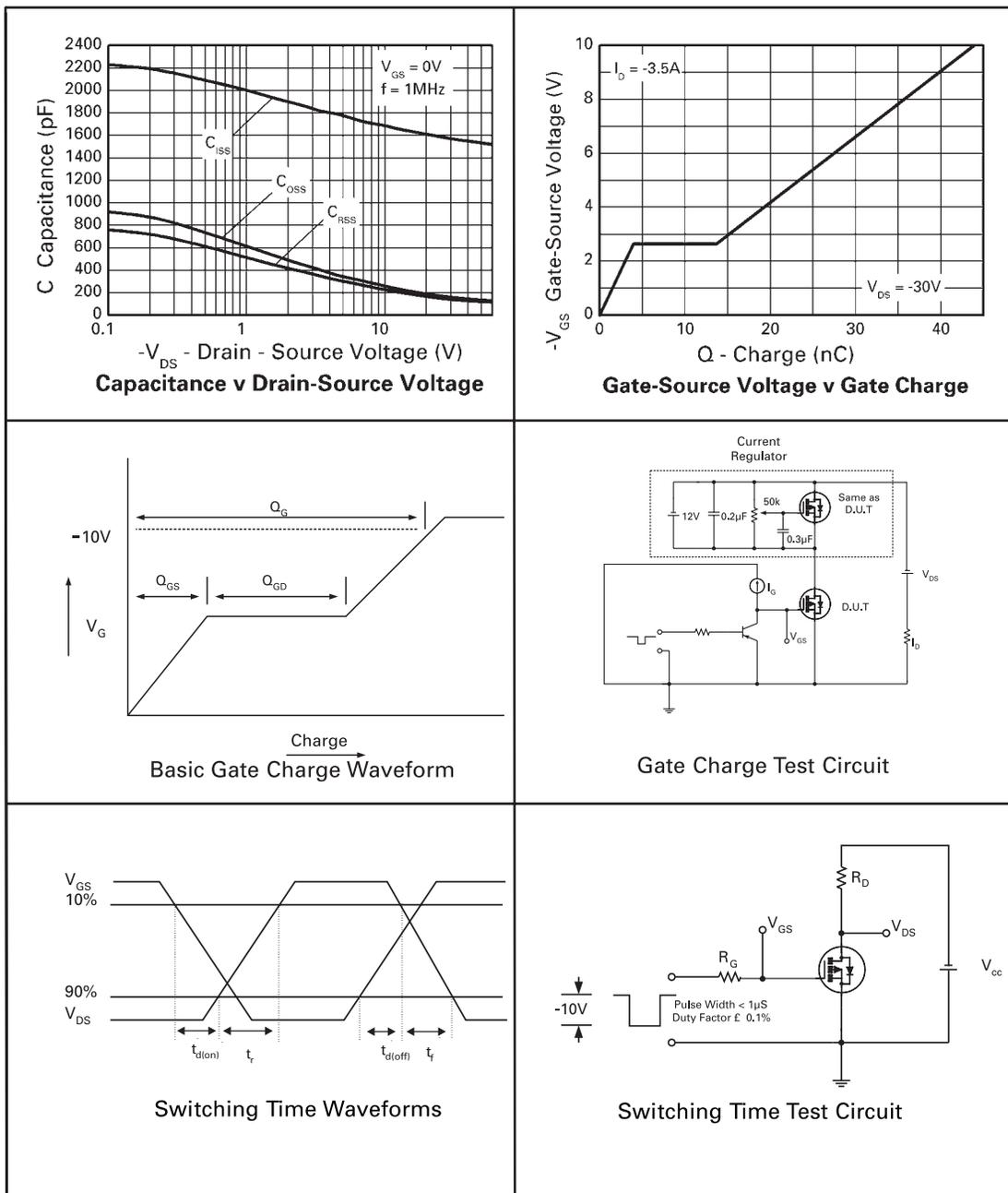
N-CHANNEL TYPICAL CHARACTERISTICS



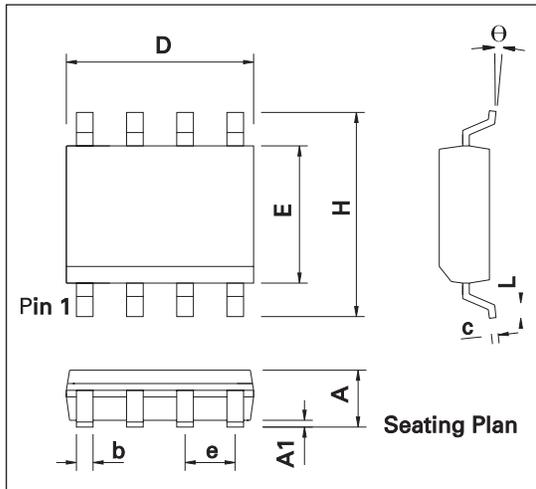
P-CHANNEL TYPICAL CHARACTERISTICS



P-CHANNEL TYPICAL CHARACTERISTICS



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	-	-	-	-	-