



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

Device	$V_{(BR)DSS}$	$Q_G$	$R_{DS(on)}$	$I_D$ $T_A = 25^\circ C$
N-CH	100V	2.9nC	0.70Ω @ $V_{GS} = 10V$	1.0A
			0.90Ω @ $V_{GS} = 6.0V$	0.9A
P-CH	-100V	3.5nC	1.00Ω @ $V_{GS} = -10V$	-0.9A
			1.45Ω @ $V_{GS} = -6.0V$	-0.7A



### Description

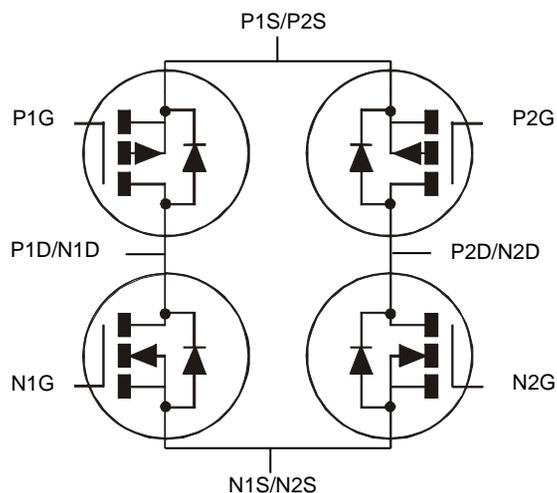
This new generation complementary MOSFET H-Bridge features low on-resistance achievable with low gate drive.

### Features

- 2 x N + 2 x P channels in a SOIC package

### Applications

- DC Motor control
- DC-AC Inverters

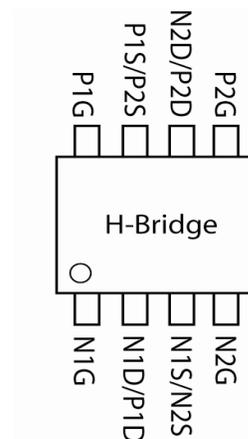


### Ordering information

Device	Reel size (inches)	Tape width (mm)	Quantity per reel
NK-ZXMHC10A07N8TC	13	12	2,500

### Device marking

NK-ZXMHC  
10A07



### Absolute maximum ratings

Parameter	Symbol	N-channel	P-channel	Unit
Drain-Source voltage	$V_{DSS}$	100	-100	V
Gate-Source voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain current @ $V_{GS}=10V$ ; $T_A=25^\circ C$ <sup>(b)</sup> @ $V_{GS}=10V$ ; $T_A=70^\circ C$ <sup>(b)</sup> @ $V_{GS}=10V$ ; $T_A=25^\circ C$ <sup>(a)</sup> @ $V_{GS}=10V$ ; $T_L=25^\circ C$ <sup>(f)</sup>	$I_D$	1.00 0.80 0.80 0.81	-0.85 -0.68 -0.68 -0.69	A
Pulsed Drain current @ $V_{GS}=10V$ ; $T_A=25^\circ C$ <sup>(c)</sup>	$I_{DM}$	4.30	-3.64	A
Continuous Source current (Body diode) at $T_A=25^\circ C$ <sup>(b)</sup>	$I_S$	0.70	-0.60	A
Pulsed Source current (Body diode) at $T_A=25^\circ C$ <sup>(c)</sup>	$I_{SM}$	4.30	-3.64	A
Power dissipation at $T_A=25^\circ C$ <sup>(a)</sup> Linear derating factor	$P_D$	0.87 6.94		W mW/°C
Power dissipation at $T_A=25^\circ C$ <sup>(b)</sup> Linear derating factor	$P_D$	1.36 10.9		W mW/°C
Power dissipation at $T_L=25^\circ C$ <sup>(f)</sup> Linear derating factor	$P_D$	0.90 7.19		W mW/°C
Operating and storage temperature range	$T_j, T_{stg}$	-55 to 150		°C

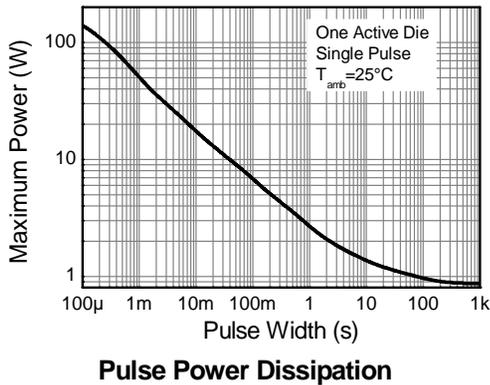
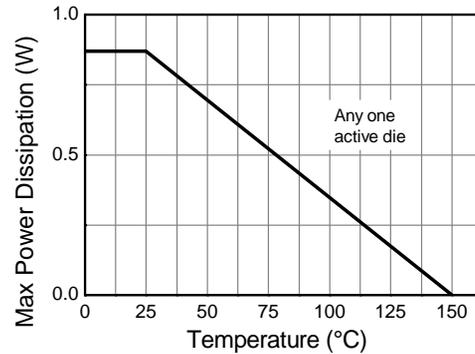
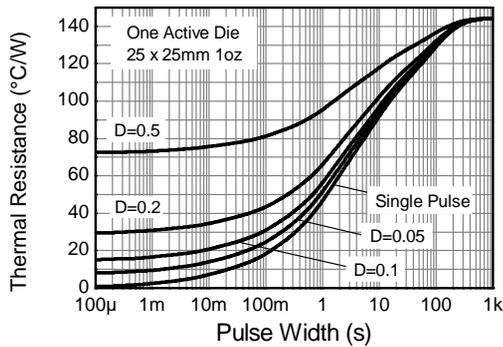
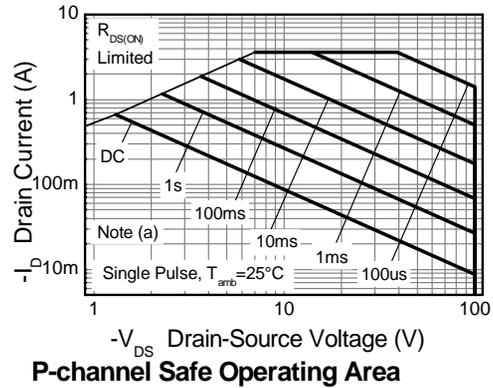
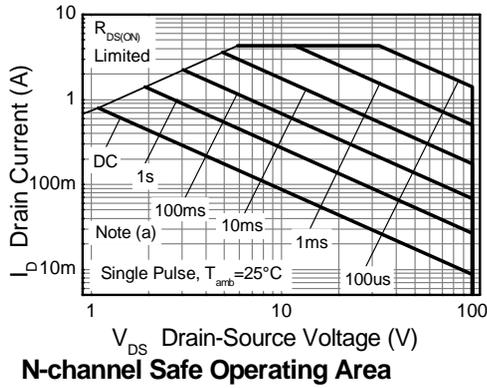
### Thermal resistance

Parameter	Symbol	Value	Unit
Junction to ambient <sup>(a)</sup>	$R_{\theta JA}$	144	°C/W
Junction to ambient <sup>(b)</sup>	$R_{\theta JA}$	92	°C/W
Junction to ambient <sup>(d)</sup>	$R_{\theta JA}$	106	°C/W
Junction to ambient <sup>(e)</sup>	$R_{\theta JA}$	254	°C/W
Junction to lead <sup>(f)</sup>	$R_{\theta JL}$	139	°C/W

#### NOTES:

- For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions with the heat-sink split into two equal areas (one for each drain connection); the device is measured when operating in a steady-state condition with one active die.
- Same as note (a), except the device is measured at  $t \leq 10$  sec.
- Same as note (a), except the device is pulsed with  $D=0.02$  and pulse width 300  $\mu s$ . The pulse current is limited by the maximum junction temperature.
- For a device surface mounted on 50mm x 50mm x 1.6mm FR4 PCB with high coverage of single sided 2oz copper, in still air conditions with the heat-sink split into two equal areas (one for each drain connection); the device is measured when operating in a steady-state condition with one active die.
- For a device surface mounted on minimum copper 1.6mm FR4 PCB, in still air conditions; the device is measured when operating in a steady-state condition with one active die.
- Thermal resistance from junction to solder-point (at the end of the drain lead); the device is operating in a steady-state condition with one active die.

**Thermal characteristics**



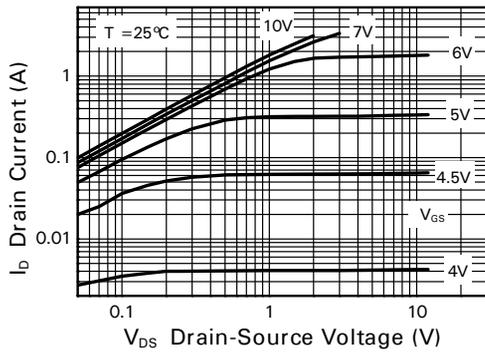
**N-channel electrical characteristics (at  $T_{amb} = 25^{\circ}\text{C}$  unless otherwise stated)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
<b>Static</b>						
Drain-Source breakdown voltage	$V_{(BR)DSS}$	100			V	$I_D = 250\mu\text{A}$ , $V_{GS} = 0\text{V}$
Zero Gate voltage Drain current	$I_{DSS}$			0.5	$\mu\text{A}$	$V_{DS} = 100\text{V}$ , $V_{GS} = 0\text{V}$
Gate-Body leakage	$I_{GSS}$			$\pm 100$	nA	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$
Gate-Source threshold voltage	$V_{GS(th)}$	2.0		4.0	V	$I_D = 250\mu\text{A}$ , $V_{DS} = V_{GS}$
Static Drain-Source on-state resistance <sup>(a)</sup>	$R_{DS(on)}$			0.7 0.9	$\Omega$	$V_{GS} = 10\text{V}$ , $I_D = 1.5\text{A}$ $V_{GS} = 6.0\text{V}$ , $I_D = 1.0\text{A}$
Forward Transconductance <sup>(a) (c)</sup>	$g_{fs}$		1.6		S	$V_{DS} = 15\text{V}$ , $I_D = 1.0\text{A}$
<b>Dynamic</b>						
<b>Capacitance <sup>(c)</sup></b>						
Input capacitance	$C_{iss}$		138		pF	$V_{DS} = 60\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output capacitance	$C_{oss}$		12		pF	
Reverse transfer capacitance	$C_{rss}$		6		pF	
<b>Switching <sup>(b) (c)</sup></b>						
Turn-on-delay time	$t_{d(on)}$		1.8		ns	$V_{DD} = 50\text{V}$ , $V_{GS} = 10\text{V}$ $I_D = 1.0\text{A}$ $R_G \cong 6.0\Omega$ ,
Rise time	$t_r$		1.5		ns	
Turn-off delay time	$t_{d(off)}$		4.1		ns	
Fall time	$t_f$		2.1		ns	
<b>Gate charge <sup>(c)</sup></b>						
Total Gate charge	$Q_g$		2.9		nC	$V_{DS} = 50\text{V}$ , $V_{GS} = 10\text{V}$ $I_D = 1.0\text{A}$
Gate-Source charge	$Q_{gs}$		0.7		nC	
Gate-Drain charge	$Q_{gd}$		1.0		nC	
<b>Source-Drain diode</b>						
Diode forward voltage <sup>(a)</sup>	$V_{SD}$			0.95	V	$I_S = 1.5\text{A}$ , $V_{GS} = 0\text{V}$
Reverse recovery time <sup>(c)</sup>	$t_{rr}$		27		ns	$I_S = 1.8\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$
Reverse recovery charge <sup>(c)</sup>	$Q_{rr}$		12		nC	

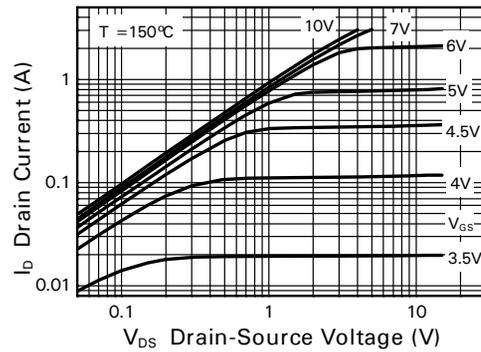
**NOTES:**

- (a) Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .  
(b) Switching characteristics are independent of operating junction temperature.  
(c) For design aid only, not subject to production testing

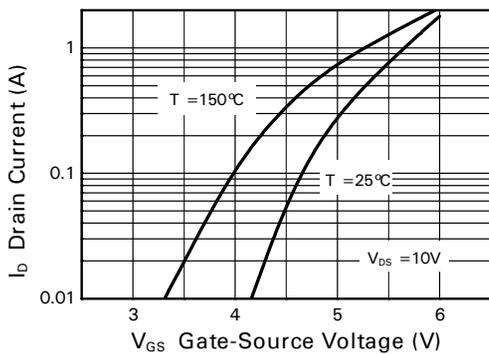
N-channel typical characteristics



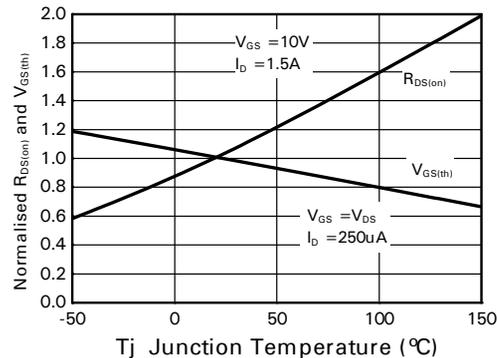
Output Characteristics



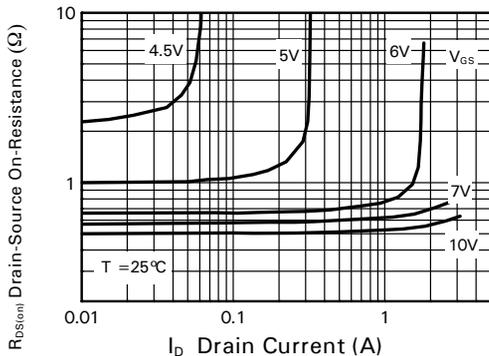
Output Characteristics



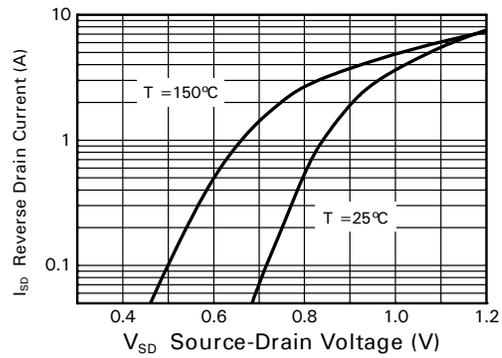
Typical Transfer Characteristics



Normalised Curves v Temperature

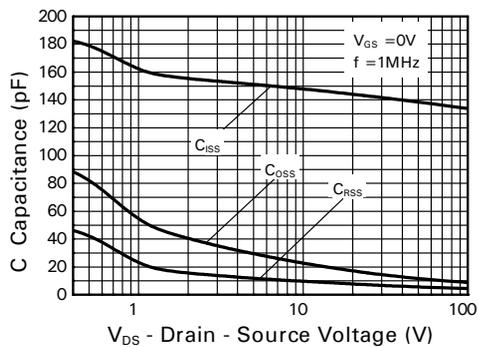


On-Resistance v Drain Current

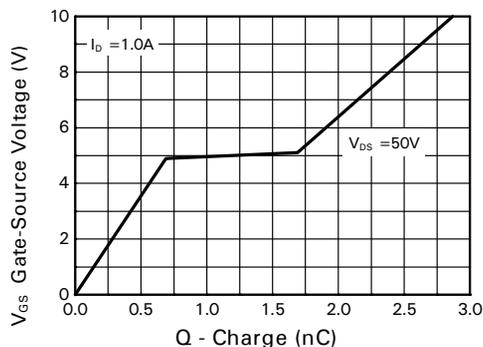


Source-Drain Diode Forward Voltage

**N-channel typical characteristics –continued**

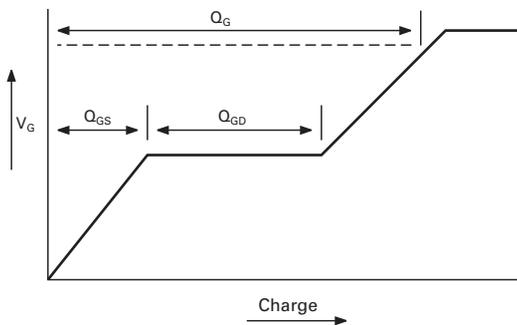


**Capacitance v Drain-Source Voltage**

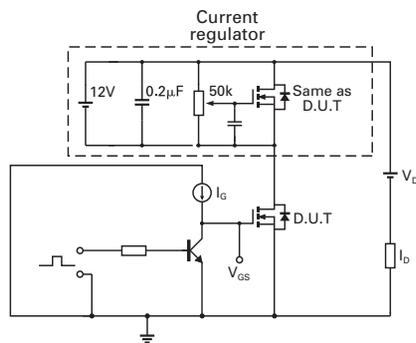


**Gate-Source Voltage v Gate Charge**

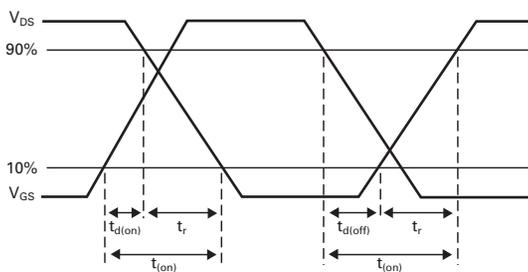
**Test circuits**



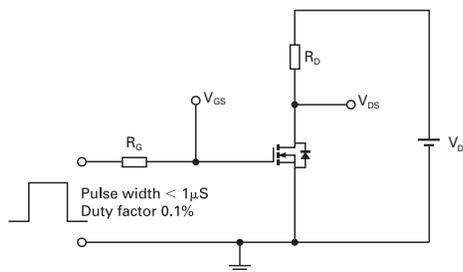
**Basic gate charge waveform**



**Gate charge test circuit**



**Switching time waveforms**



**Switching time test circuit**

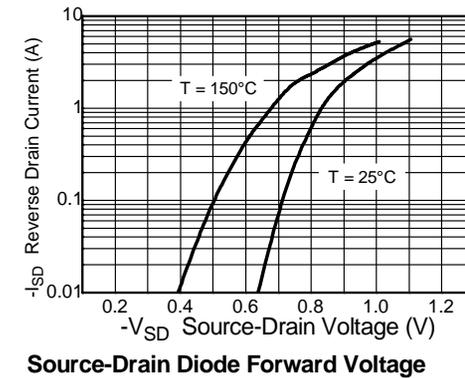
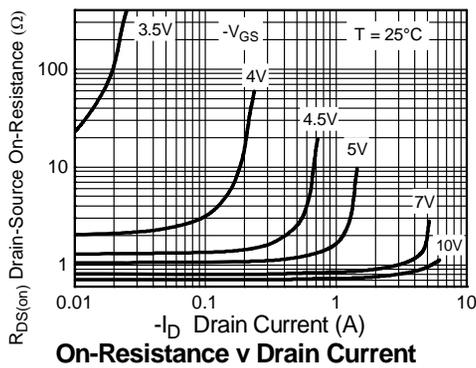
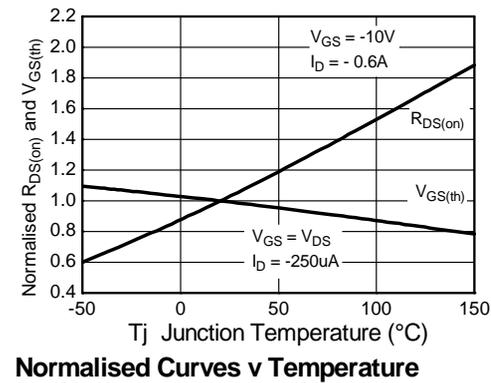
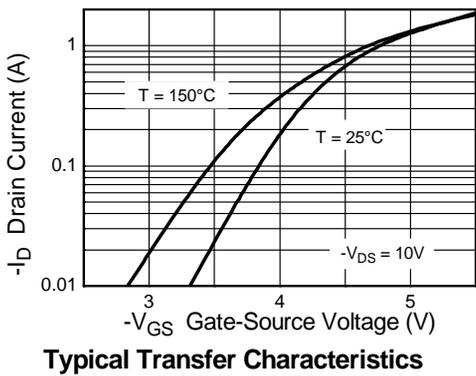
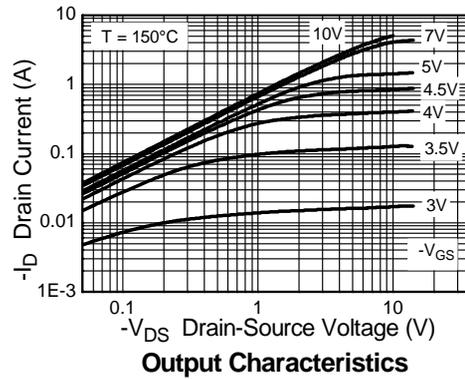
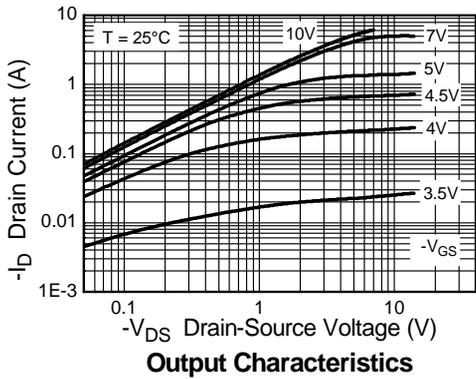
**P-channel electrical characteristics (at  $T_{amb} = 25^{\circ}\text{C}$  unless otherwise stated)**

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
<b>Static</b>						
Drain-Source breakdown voltage	$V_{(BR)DSS}$	-100			V	$I_D = -250\mu\text{A}$ , $V_{GS} = 0\text{V}$
Zero Gate voltage Drain current	$I_{DSS}$			-0.5	$\mu\text{A}$	$V_{DS} = -100\text{V}$ , $V_{GS} = 0\text{V}$
Gate-Body leakage	$I_{GSS}$			$\pm 100$	nA	$V_{GS} = \pm 20\text{V}$ , $V_{DS} = 0\text{V}$
Gate-Source threshold voltage	$V_{GS(th)}$	-2.0		-4.0	V	$I_D = -250\mu\text{A}$ , $V_{DS} = V_{GS}$
Static Drain-Source on-state resistance <sup>(a)</sup>	$R_{DS(on)}$			1.0 1.45	$\Omega$	$V_{GS} = -10\text{V}$ , $I_D = -0.6\text{A}$ $V_{GS} = -6.0\text{V}$ , $I_D = -0.5\text{A}$
Forward Transconductance <sup>(a) (c)</sup>	$g_{fs}$		1.2		S	$V_{DS} = -15\text{V}$ , $I_D = -0.6\text{A}$
<b>Dynamic</b>						
<b>Capacitance <sup>(c)</sup></b>						
Input capacitance	$C_{iss}$		141		pF	$V_{DS} = -50\text{V}$ , $V_{GS} = 0\text{V}$ $f = 1\text{MHz}$
Output capacitance	$C_{oss}$		13.1		pF	
Reverse transfer capacitance	$C_{rss}$		10.8		pF	
<b>Switching <sup>(b) (c)</sup></b>						
Turn-on-delay time	$t_{d(on)}$		1.6		ns	$V_{DD} = -50\text{V}$ , $V_{GS} = -10\text{V}$ $I_D = -1.0\text{A}$ $R_G \cong 6.0\Omega$
Rise time	$t_r$		2.1		ns	
Turn-off delay time	$t_{d(off)}$		5.9		ns	
Fall time	$t_f$		3.3		ns	
<b>Gate charge <sup>(c)</sup></b>						
Total Gate charge	$Q_g$		3.5		nC	$V_{DS} = -50\text{V}$ , $V_{GS} = -10\text{V}$ $I_D = -0.6\text{A}$
Gate-Source charge	$Q_{gs}$		0.6		nC	
Gate-Drain charge	$Q_{gd}$		1.6		nC	
<b>Source-Drain diode</b>						
Diode forward voltage <sup>(a)</sup>	$V_{SD}$		-0.85	-0.95	V	$I_S = -0.7\text{A}$ , $V_{GS} = 0\text{V}$
Reverse recovery time <sup>(c)</sup>	$t_{rr}$		29		ns	$I_S = -0.9\text{A}$ , $di/dt = 100\text{A}/\mu\text{s}$
Reverse recovery charge <sup>(c)</sup>	$Q_{rr}$		31		nC	

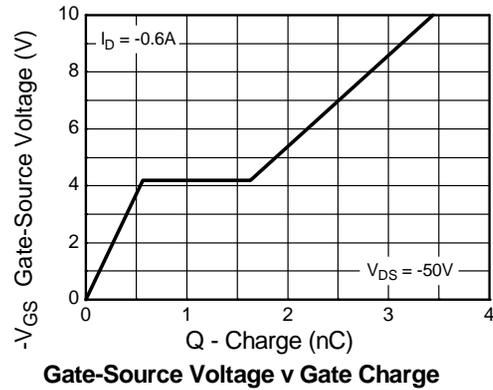
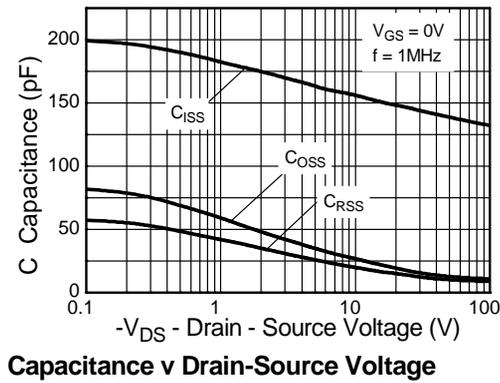
**NOTES:**

- (a) Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .  
(b) Switching characteristics are independent of operating junction temperature.  
(c) For design aid only, not subject to production testing

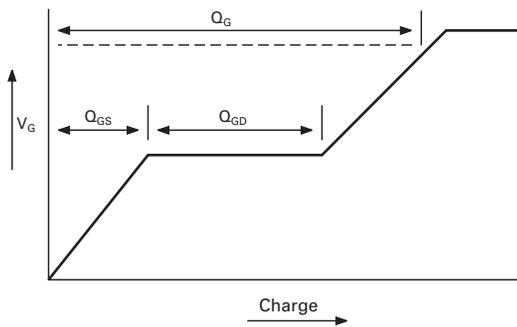
P-channel typical characteristics



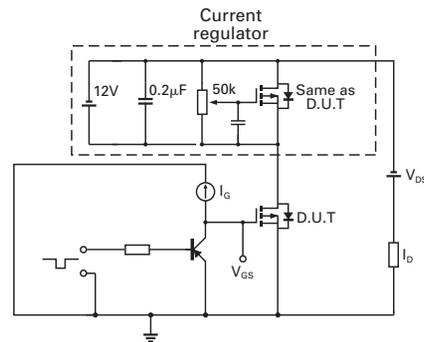
**P-channel typical characteristics –continued**



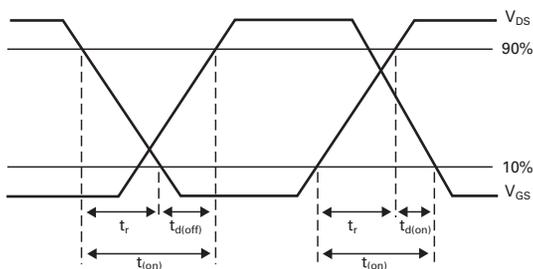
**Test circuits**



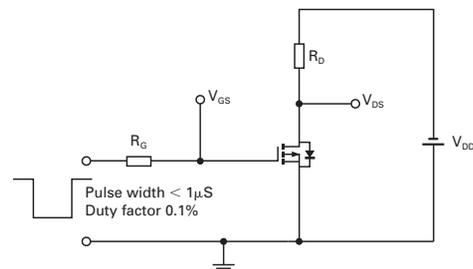
**Basic gate charge waveform**



**Gate charge test circuit**

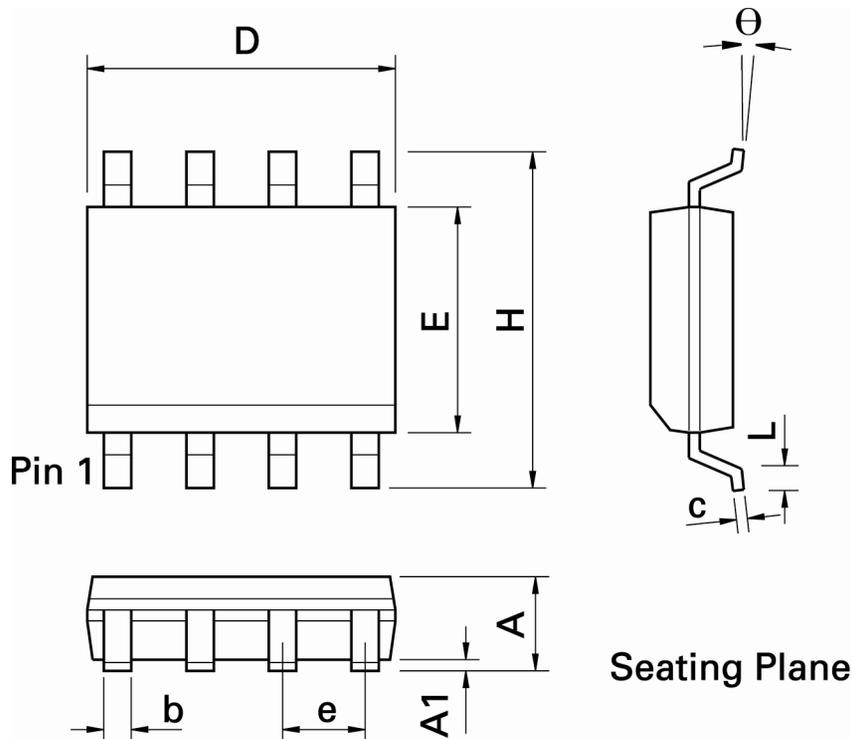


**Switching time waveforms**



**Switching time test circuit**

Packaging details - SO8



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

**Note:** Controlling dimensions are in inches. Approximate dimensions are provided in millimeters