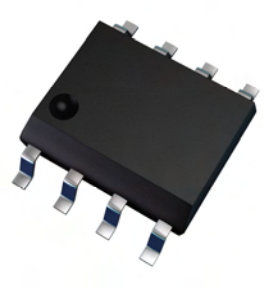
ZXMHC3F381N8

30V SO8 Complementary enhancement mode MOSFET H-Bridge

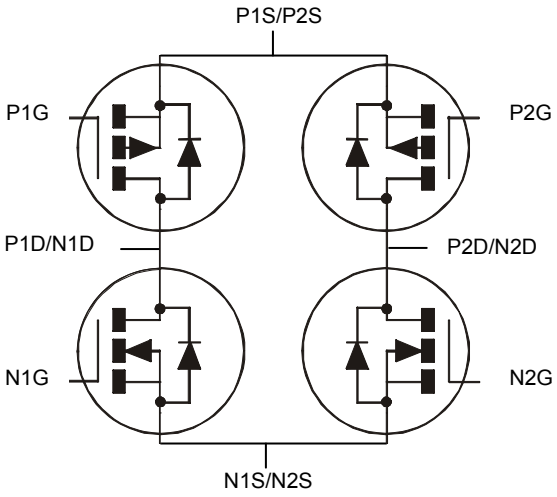
Summary

Device	$V_{(BR)DSS}$	Q_G	$R_{DS(on)}$	I_D T_A= 25°C
N-CH	30V	9.0nC	33mΩ @ V_{GS}= 10V	5.0A
			60mΩ @ V_{GS}= 4.5V	3.9A
P-CH	-30V	12.7nC	55mΩ @ V_{GS}= -10V	-4.1A
			80mΩ @ V_{GS}= -4.5V	-3.3A



Description

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



Features

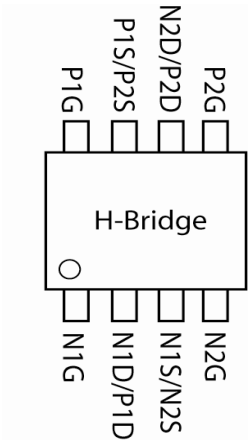
- 2 x N + 2 x P channels in a SOIC package
- Low voltage (V_{GS} = 4.5 V) gate drive

Applications

- DC Motor control
- DC-AC Inverters

Ordering information

Device	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXMHC3F381N8TC	13	12	2,500



Device marking

ZXMHC
3F381

Absolute maximum ratings

Parameter	Symbol	N-channel	P-channel	Unit
Drain-Source voltage	V_{DSS}	30	-30	V
Gate-Source voltage	V_{GS}	±20	±20	V
Continuous Drain current @ V_{GS}= 10V; T_A=25°C (b)	I_D	4.98	-4.13	A
@ V_{GS}= 10V; T_A=70°C (b)		3.98	-3.31	
@ V_{GS}= 10V; T_A=25°C (a)		3.98	-3.36	
@ V_{GS}= 10V; T_L=25°C (f)		4.17	-3.51	
Pulsed Drain current @ V_{GS}= 10V; T_A=25°C (c)	I_{DM}	22.9	-19.6	A
Continuous Source current (Body diode) at T_A =25°C (b)	I_S	2.0	-2.0	A
Pulsed Source current (Body diode) at T_A =25°C (c)	I_{SM}	22.9	-19.6	A
Power dissipation at T_A =25°C (a)	P_D	0.87		W
Linear derating factor		6.94		mW/°C
Power dissipation at T_A =25°C (b)	P_D	1.35		W
Linear derating factor		10.9		mW/°C
Power dissipation at T_L =25°C (f)	P_D	0.95	0.98	W
Linear derating factor		7.63	7.81	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)	$R_{\theta JA}$	144		°C/W
Junction to ambient (b)	$R_{\theta JA}$	92		°C/W
Junction to ambient (d)	$R_{\theta JA}$	106		°C/W
Junction to ambient (e)	$R_{\theta JA}$	254		°C/W
Junction to lead (f)	$R_{\theta JL}$	131	128	°C/W

NOTES:

(a) 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.

(b) Same as note (a), except the device is measured at t ≤ 10 sec.

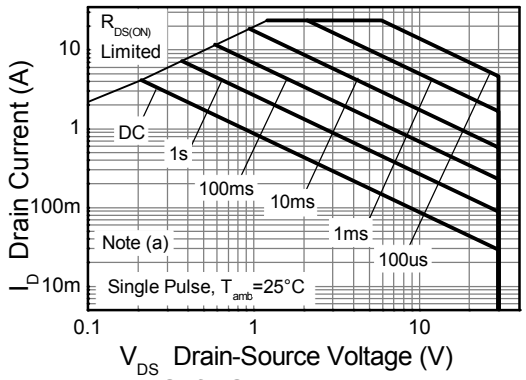
(c) Same as note (a), except the device is pulsed with D= 0.02 and pulse width 300 µs. The pulse current is limited by the maximum junction temperature.

(d) 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.

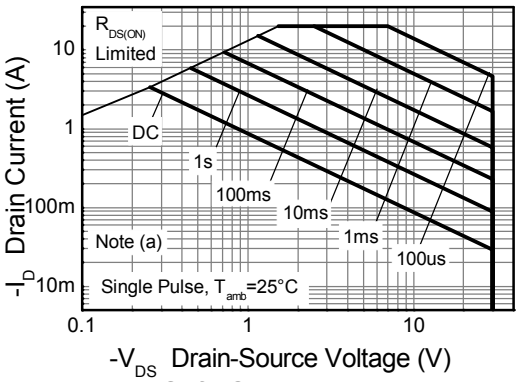
(e) For a device surface mounted on minimum copper 1.6mm FR4 PCB, in still air conditions; the device is measured when operating in a steady-state condition with one active die.

(f) 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.

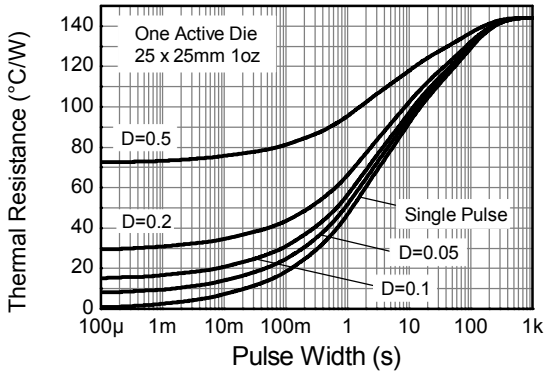
Thermal characteristics



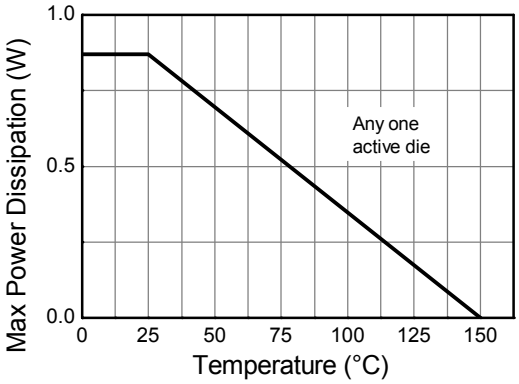
N-channel Safe Operating Area



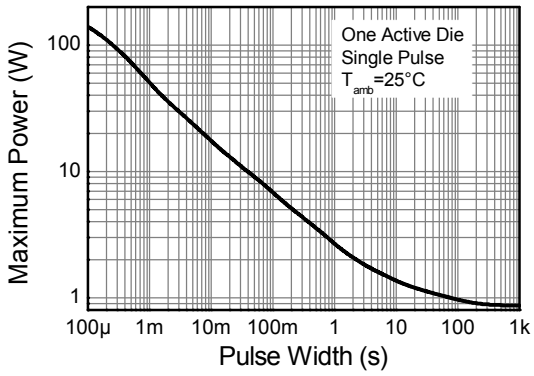
P-channel Safe Operating Area



Transient Thermal Impedance



Derating Curve



Pulse Power Dissipation

N-channel electrical characteristics (at T_{amb} = 25°C unless otherwise stated)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Static						
Drain-Source breakdown voltage	$V_{(BR)DSS}$	30			V	I_D = 250μA, V_{GS}= 0V
Zero Gate voltage Drain current	I_{DSS}			0.5	μA	V_{DS}= 30V, V_{GS}= 0V
Gate-Body leakage	I_{GSS}			±100	nA	V_{GS}= ±20V, V_{DS}= 0V
Gate-Source threshold voltage	$V_{GS(th)}$	1.0		3.0	V	I_D= 250μA, V_{DS}= V_{GS}
Static Drain-Source on-state resistance (a)	$R_{DS(on)}$			0.033 0.060	Ω	V_{GS}= 10V, I_D= 5A V_{GS}= 4.5V, I_D= 4A
Forward Transconductance (a) (c)	g_{fs}		11.8		S	V_{DS}= 15V, I_D= 5A
Dynamic						
Capacitance (c)						
Input capacitance	C_{iss}		430		pF	V_{DS}= 15V, V_{GS}= 0V f= 1MHz
Output capacitance	C_{oss}		101		pF	
Reverse transfer capacitance	C_{rss}		56		pF	
Switching (b) (c)						
Turn-on-delay time	$t_{d(on)}$		2.5		ns	V_{DD}= 15V, V_{GS}= 10V I_D= 1A $R_G \cong 6\Omega$,
Rise time	t_r		3.3		ns	
Turn-off delay time	$t_{d(off)}$		11.5		ns	
Fall time	t_f		6.3		ns	
Gate charge (c)						
Total Gate charge	Q_g		9.0		nC	V_{DS}=15V, V_{GS}= 10V I_D= 5A
Gate-Source charge	Q_{gs}		1.7		nC	
Gate-Drain charge	Q_{gd}		2.0		nC	
Source–Drain diode						
Diode forward voltage (a)	V_{SD}		0.82	1.2	V	I_S= 1.7A, V_{GS}= 0V
Reverse recovery time (c)	t_{rr}		12		ns	I_S= 2.1A, di/dt= 100A/μs
Reverse recovery charge (c)	Q_{rr}		4.9		nC	

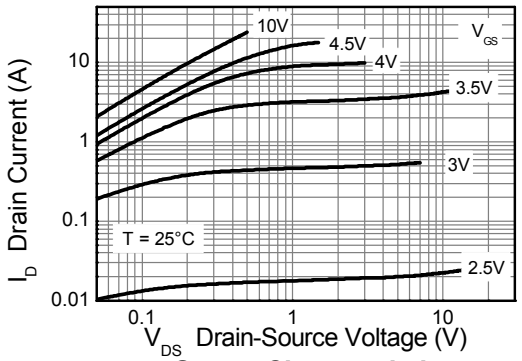
NOTES:

(a) Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%.

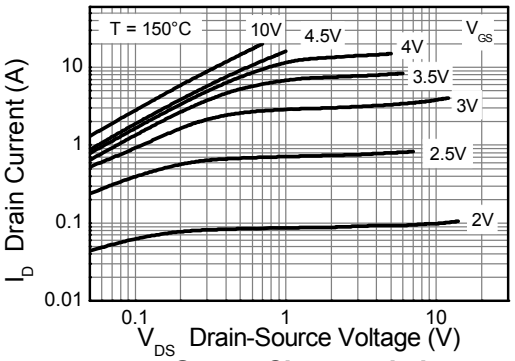
(b) Switching characteristics are independent of operating junction temperature.

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

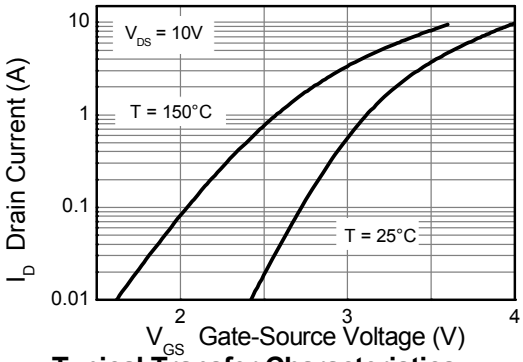
N-channel typical characteristics



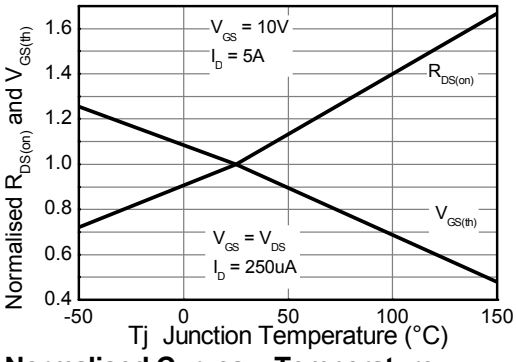
Output Characteristics



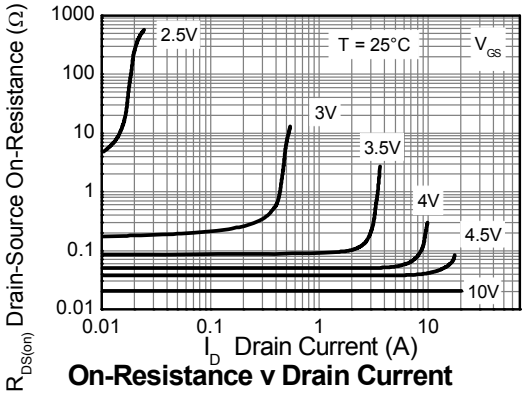
Output Characteristics



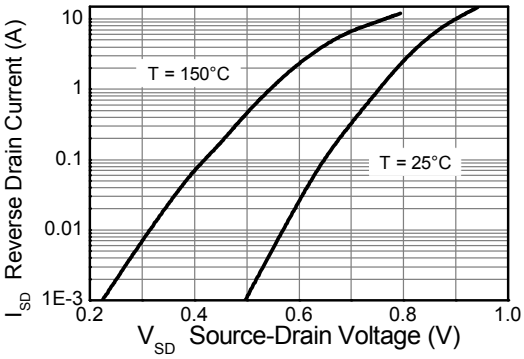
Typical Transfer Characteristics



Normalised Curves v Temperature

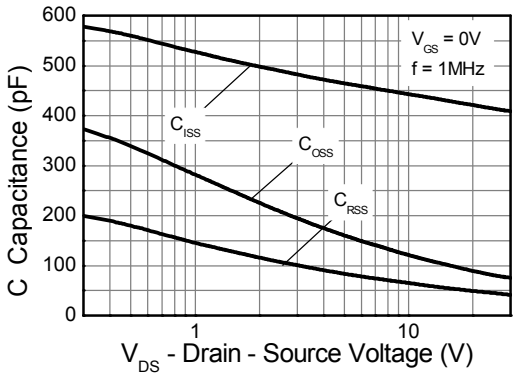


On-Resistance v Drain Current

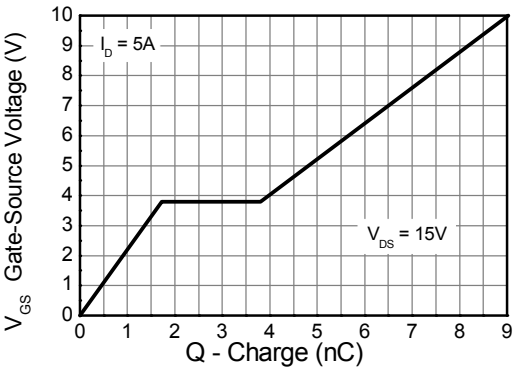


Source-Drain Diode Forward Voltage

N-channel typical characteristics –continued

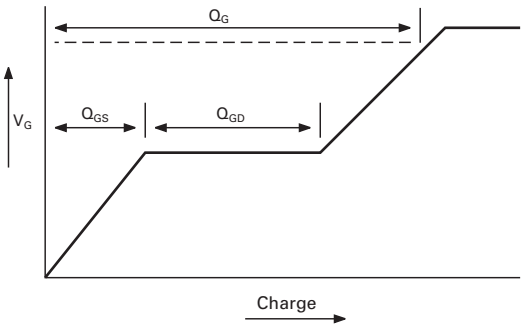


Capacitance v Drain-Source Voltage

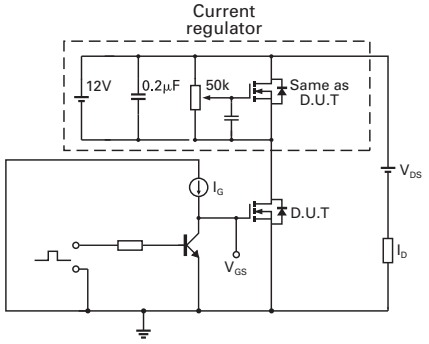


Gate-Source Voltage v Gate Charge

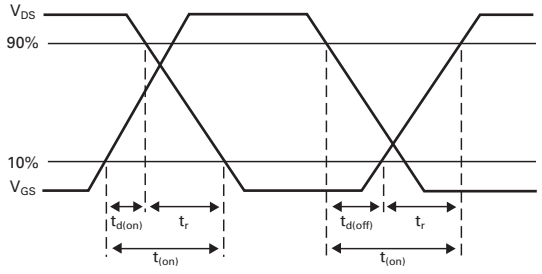
Test circuits



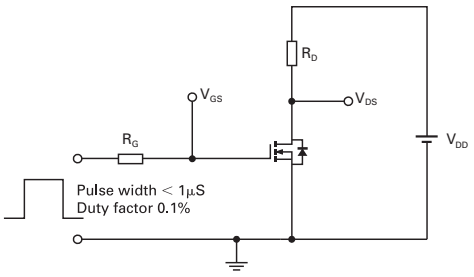
Basic gate charge waveform



Gate charge test circuit



Switching time waveforms



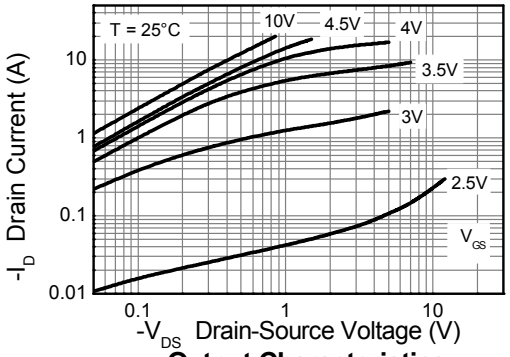
Switching time test circuit

P-channel electrical characteristics (at T_{amb} = 25°C unless otherwise stated)

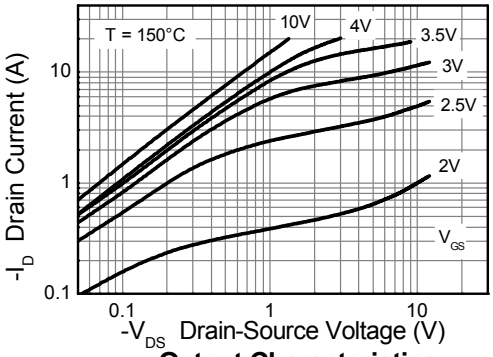
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Static						
Drain-Source breakdown voltage	$V_{(BR)DSS}$	-30			V	I_D = -250μA, V_{GS}= 0V
Zero Gate voltage Drain current	I_{DSS}			-0.5	μA	V_{DS}= -30V, V_{GS}= 0V
Gate-Body leakage	I_{GSS}			±100	nA	V_{GS}= ±20V, V_{DS}= 0V
Gate-Source threshold voltage	$V_{GS(th)}$	-1.0		-3.0	V	I_D= -250μA, V_{DS}= V_{GS}
Static Drain-Source on-state resistance (a)	$R_{DS(on)}$			0.055 0.080	Ω	V_{GS}= -10V, I_D= -5A V_{GS}= -4.5V, I_D= -4A
Forward Transconductance (a) (c)	g_{fs}		14		S	V_{DS}= -15V, I_D= -5A
Dynamic						
Capacitance (c)						
Input capacitance	C_{iss}		670		pF	V_{DS}= -15V, V_{GS}= 0V f= 1MHz
Output capacitance	C_{oss}		126		pF	
Reverse transfer capacitance	C_{rss}		70		pF	
Switching (b) (c)						
Turn-on-delay time	$t_{d(on)}$		1.9		ns	V_{DD}= -15V, V_{GS}= -10V I_D= -1A $R_G \cong 6\Omega$
Rise time	t_r		3.0		ns	
Turn-off delay time	$t_{d(off)}$		30		ns	
Fall time	t_f		21		ns	
Gate charge (c)						
Total Gate charge	Q_g		12.7		nC	V_{DS}= -15V, V_{GS}= -10V I_D= -5A
Gate-Source charge	Q_{gs}		2.0		nC	
Gate-Drain charge	Q_{gd}		2.4		nC	
Source–Drain diode						
Diode forward voltage (a)	V_{SD}		-0.82	-1.2	V	I_S= -1.7A, V_{GS}= 0V
Reverse recovery time (c)	t_{rr}		16.5		ns	I_S= -2.1A, di/dt= 100A/μs
Reverse recovery charge(c)	Q_{rr}		11.5		nC	

NOTES:
(a) Measured under pulsed conditions. Pulse width ≤ 300μs; duty cycle ≤ 2%.
(b) Switching characteristics are independent of operating junction temperature.
(c) For design aid only, not subject to production testing

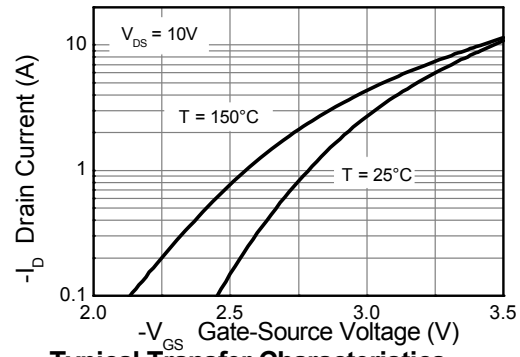
P-channel typical characteristics



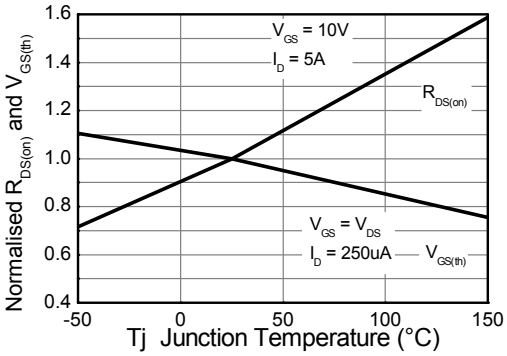
Output Characteristics



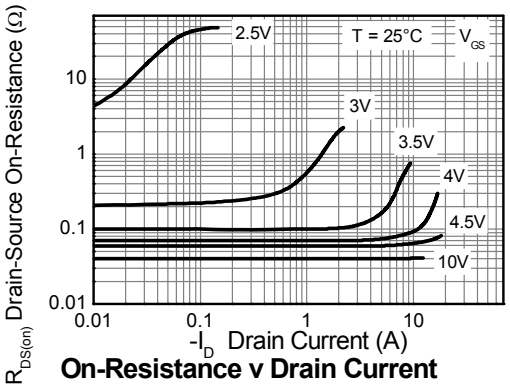
Output Characteristics



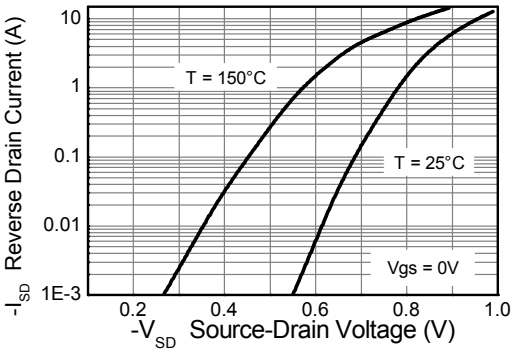
Typical Transfer Characteristics



Normalised Curves v Temperature

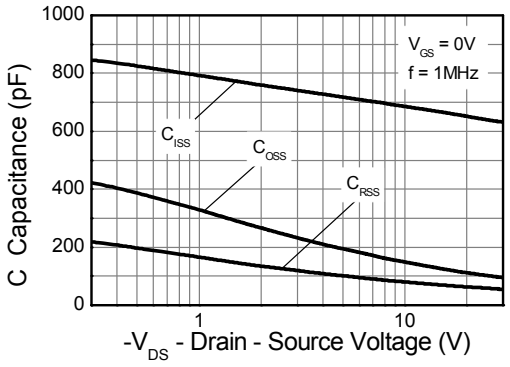


On-Resistance v Drain Current

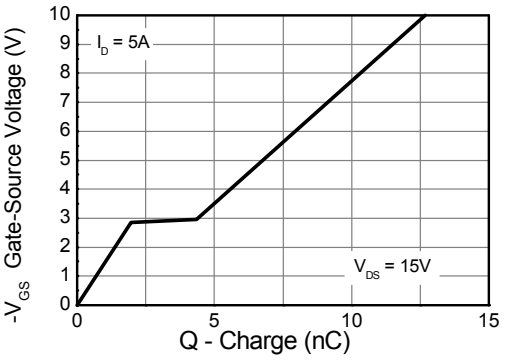


Source-Drain Diode Forward Voltage

P-channel typical characteristics –continued

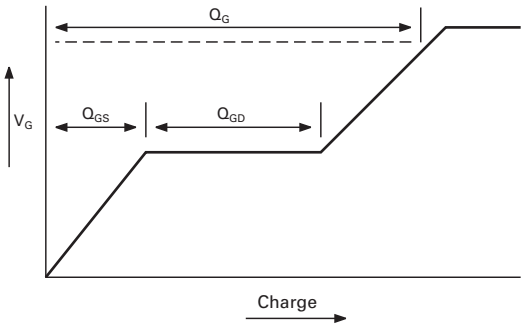


Capacitance v Drain-Source Voltage

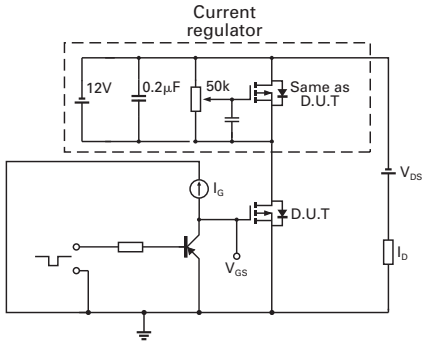


Gate-Source Voltage v Gate Charge

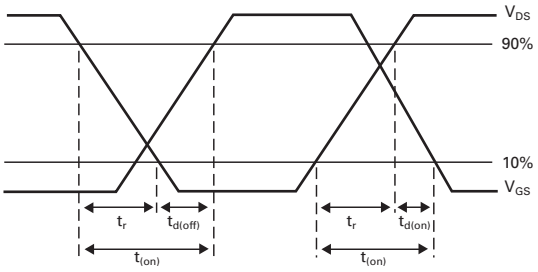
Test circuits



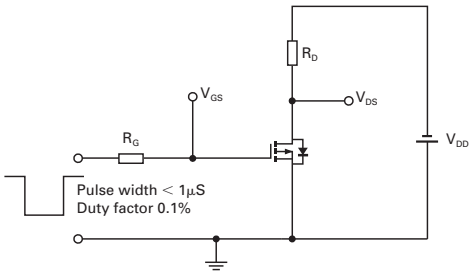
Basic gate charge waveform



Gate charge test circuit

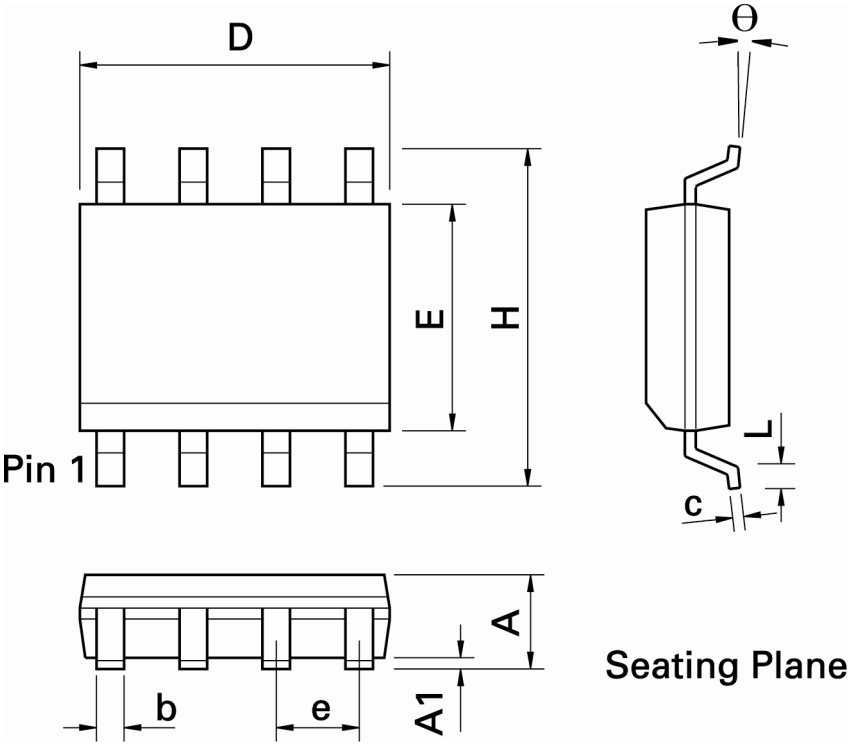


Switching time waveforms



Switching time test circuit

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	θ	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

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2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

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