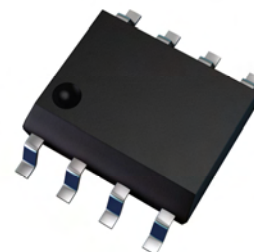


ZXMHC3F381N8

30V SO8 Complementary enhancement mode MOSFET H-Bridge

Summary

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



Description

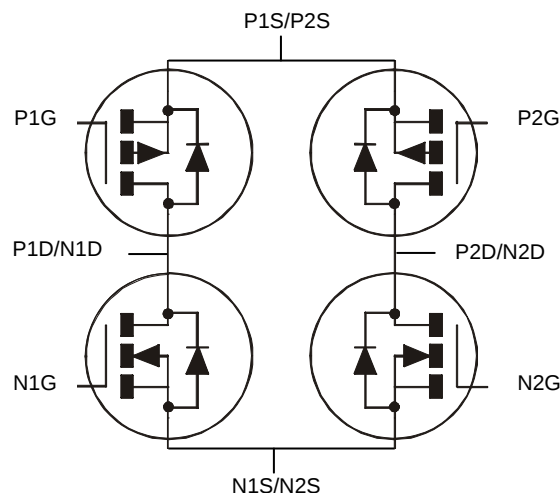
This new generation complementary MOSFET H-Bridge features low on-resistance achievable with low gate drive.

Features

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

Applications

- DC Motor control
- DC-AC Inverters

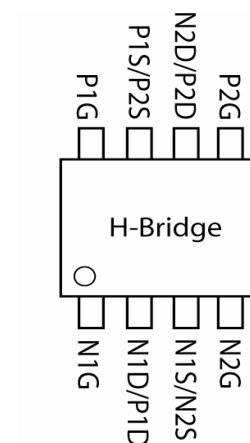


Ordering information

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 @ $V_{GS} = 10V$; $T_A = 25^\circ C$ ^(b) @ $V_{GS} = 10V$; $T_A = 70^\circ C$ ^(b) @ $V_{GS} = 10V$; $T_A = 25^\circ C$ ^(a) @ $V_{GS} = 10V$; $T_L = 25^\circ C$ ^(f)	I_D	4.98 3.98 3.98 4.17	-4.13 -3.31 -3.36 -3.51	A
Pulsed Drain current @ $V_{GS} = 10V$; $T_A = 25^\circ C$ ^(c)	I_{DM}	22.9	-19.6	A
Continuous Source current (Body diode) at $T_A = 25^\circ C$ ^(b)	I_S	2.0	-2.0	A
Pulsed Source current (Body diode) at $T_A = 25^\circ C$ ^(c)	I_{SM}	22.9	-19.6	A
Power dissipation at $T_A = 25^\circ C$ ^(a) Linear derating factor	P_D	0.87 6.94		W mW/ $^\circ C$
Power dissipation at $T_A = 25^\circ C$ ^(b) Linear derating factor	P_D	1.35 10.9		W mW/ $^\circ C$
Power dissipation at $T_L = 25^\circ C$ ^(f) Linear derating factor	P_D	0.95 7.63	0.98 7.81	W mW/ $^\circ C$
Operating and storage temperature range	T_j, T_{stg}	-55 to 150		$^\circ C$

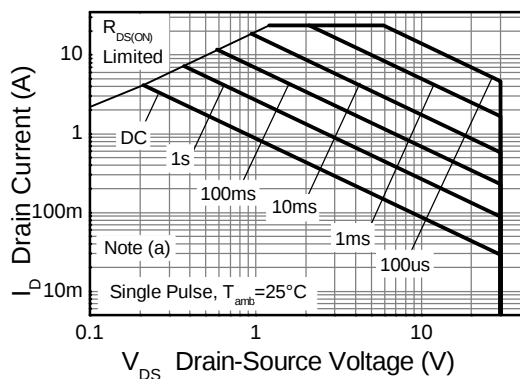
Thermal resistance

Parameter	Symbol	Value		Unit
Junction to ambient ^(a)	$R_{\theta JA}$	144		$^\circ C/W$
Junction to ambient ^(b)	$R_{\theta JA}$	92		$^\circ C/W$
Junction to ambient ^(d)	$R_{\theta JA}$	106		$^\circ C/W$
Junction to ambient ^(e)	$R_{\theta JA}$	254		$^\circ C/W$
Junction to lead ^(f)	$R_{\theta JL}$	131	128	$^\circ C/W$

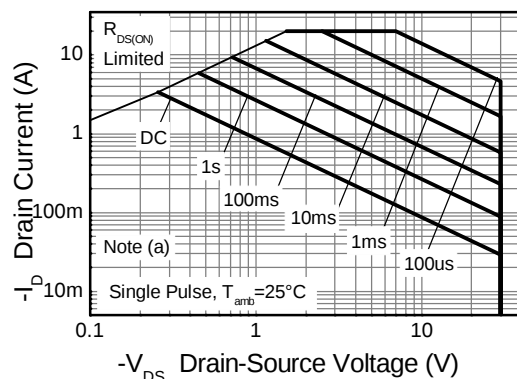
NOTES:

- (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 $t \leq 10$ 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.

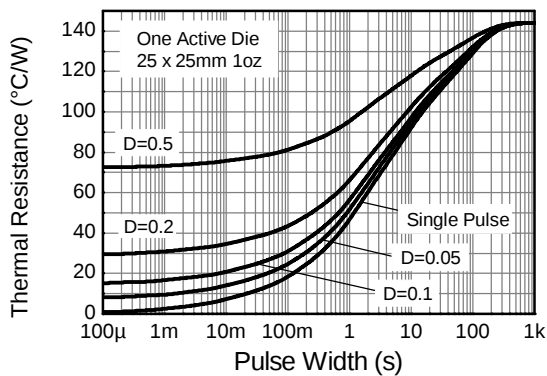
Thermal characteristics



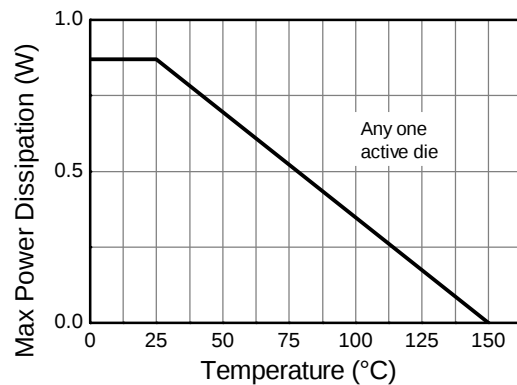
N-channel Safe Operating Area



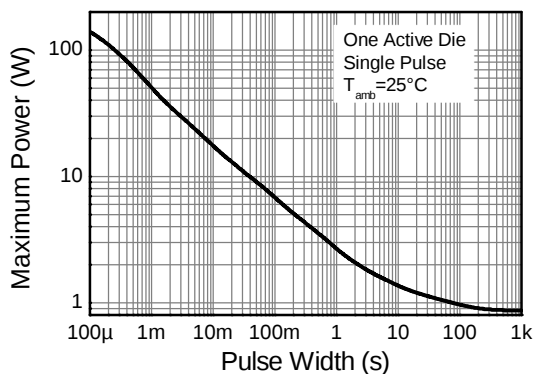
P-channel Safe Operating Area



Transient Thermal Impedance



Derating Curve



Pulse Power Dissipation

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

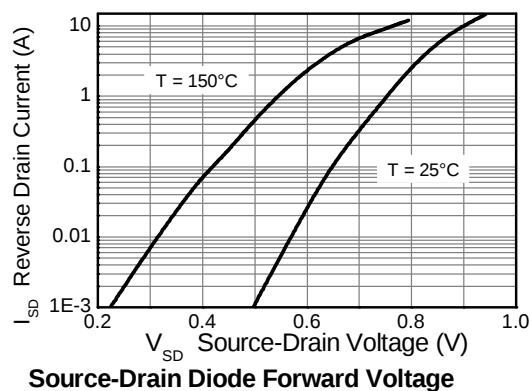
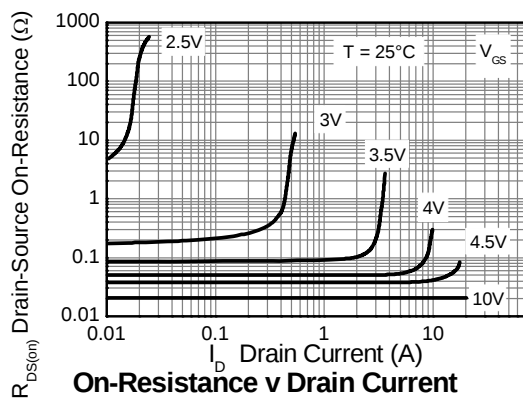
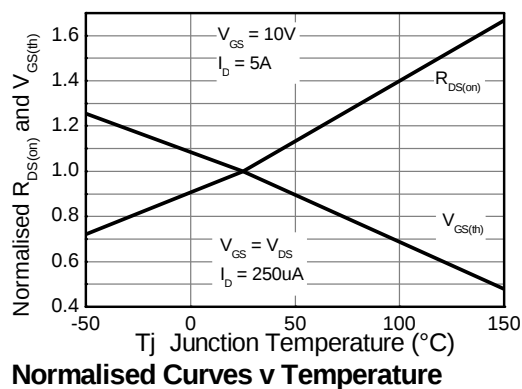
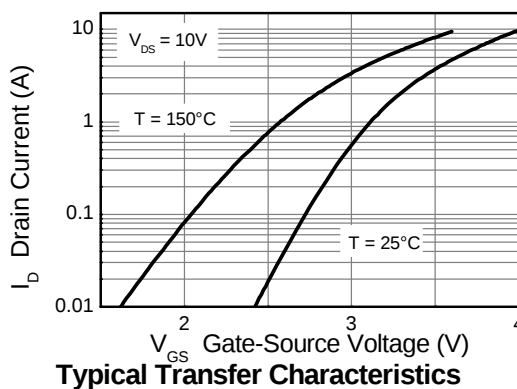
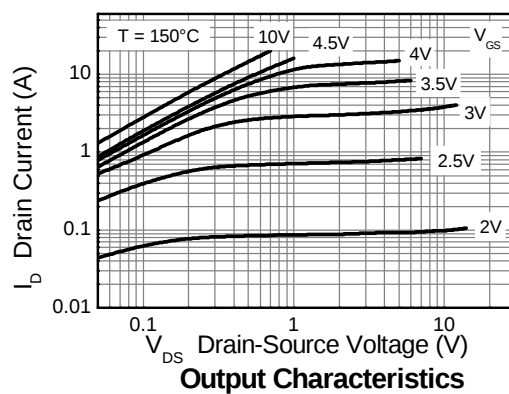
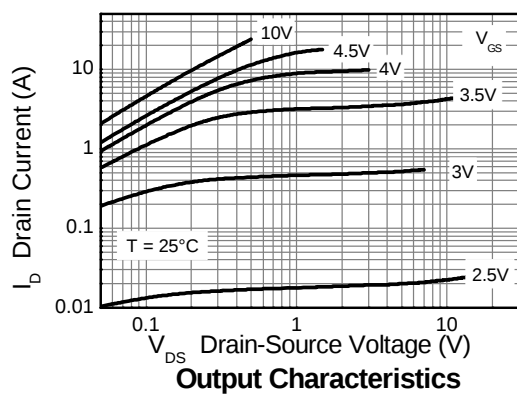
Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Static						
Drain-Source breakdown voltage	V _{(BR)DSS}	30			V	I _D = 250μA, V _{GS} = 0V
Zero Gate voltage Drain current	I _{DSS}			0.5	μA	V _{DS} = 30V, V _{GS} = 0V
Gate-Body leakage	I _{GSS}			±100	nA	V _{GS} = ±20V, V _{DS} = 0V
Gate-Source threshold 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 ≅ 6Ω,
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	

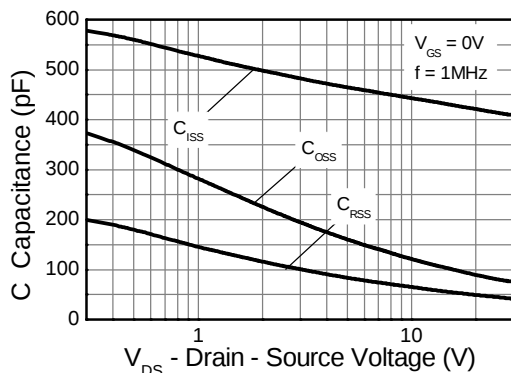
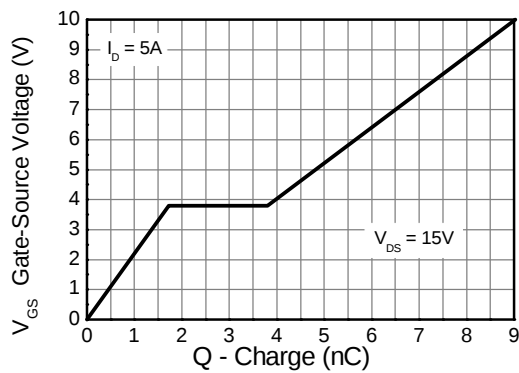
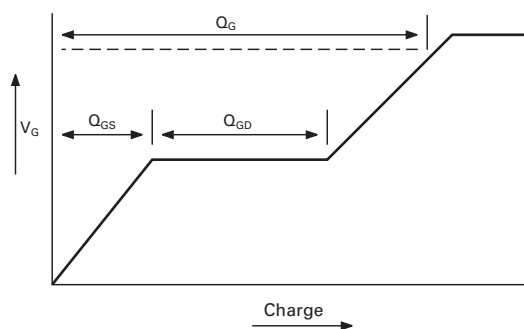
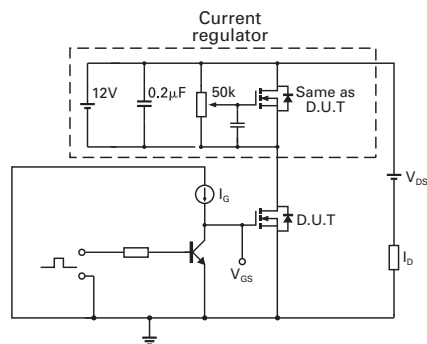
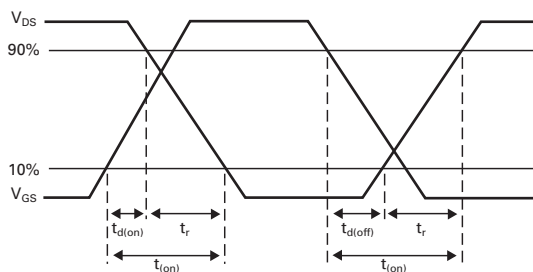
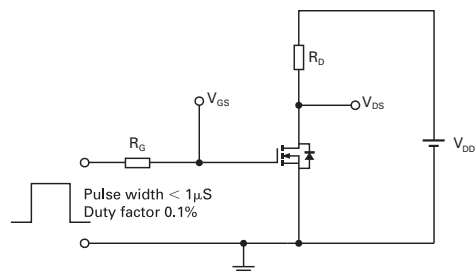
NOTES:(a) Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$; duty cycle $\leq 2\%$.

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

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

N-channel typical characteristics



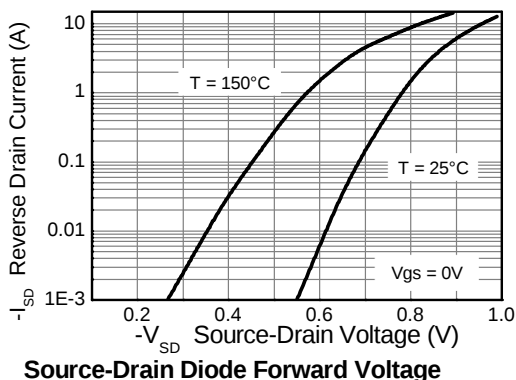
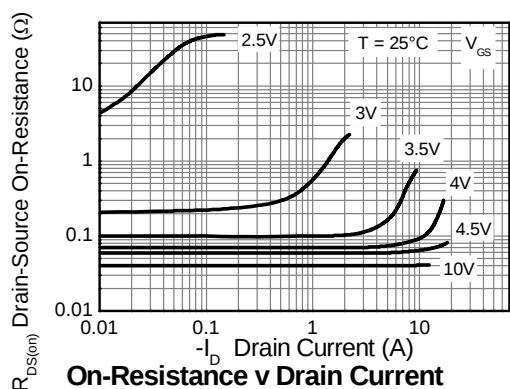
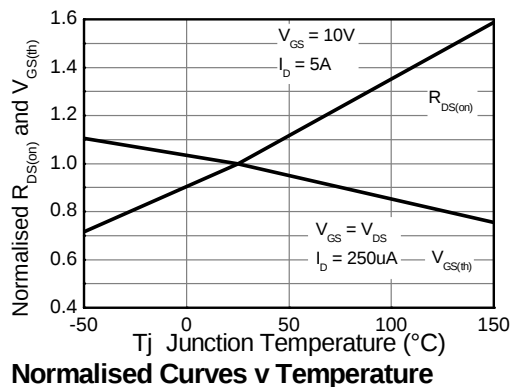
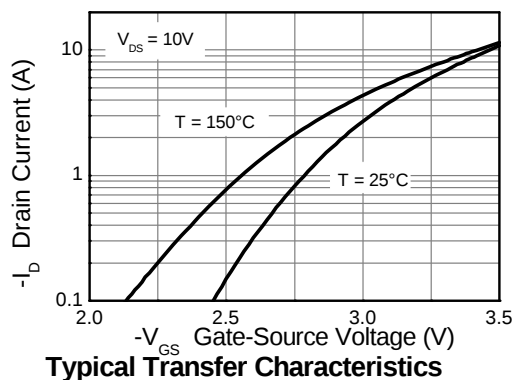
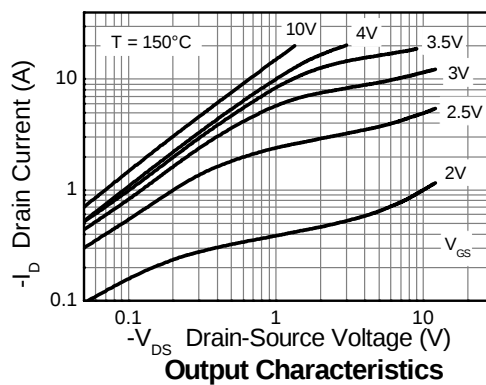
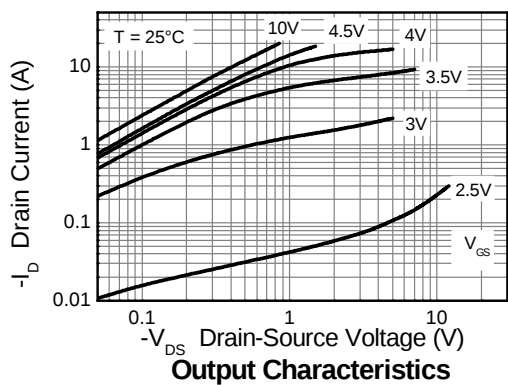
N-channel typical characteristics –continued**Capacitance v Drain-Source Voltage****Gate-Source Voltage v Gate Charge****Test circuits****Basic gate charge waveform****Gate charge test circuit****Switching time waveforms****Switching time test circuit**

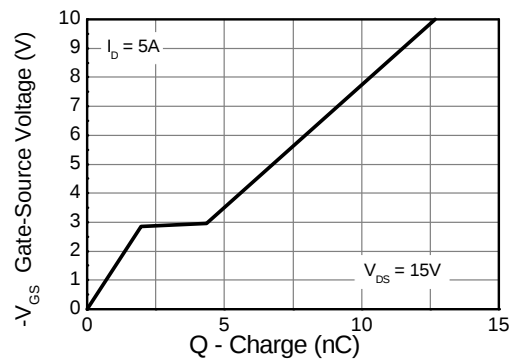
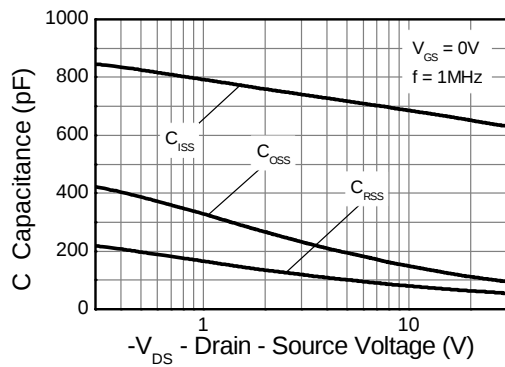
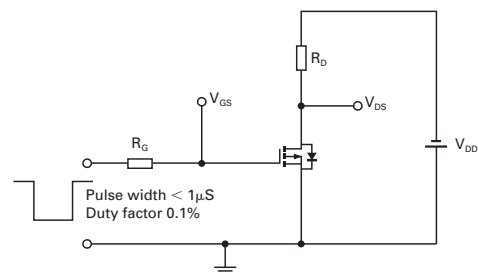
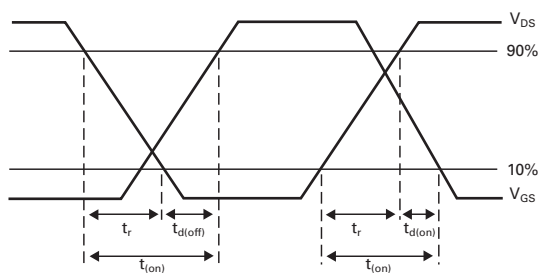
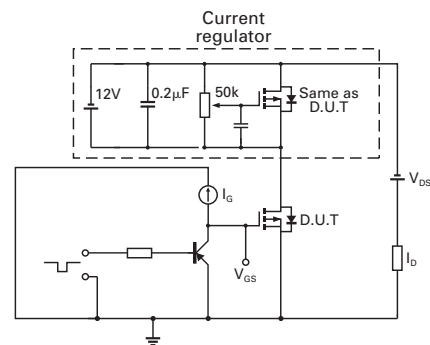
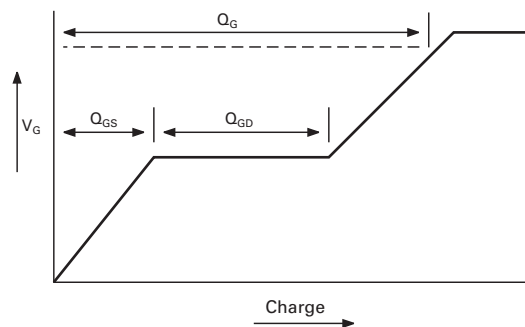
P-channel electrical characteristics (at $T_{amb} = 25^{\circ}\text{C}$ unless otherwise stated)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
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 ≅ 6Ω
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	

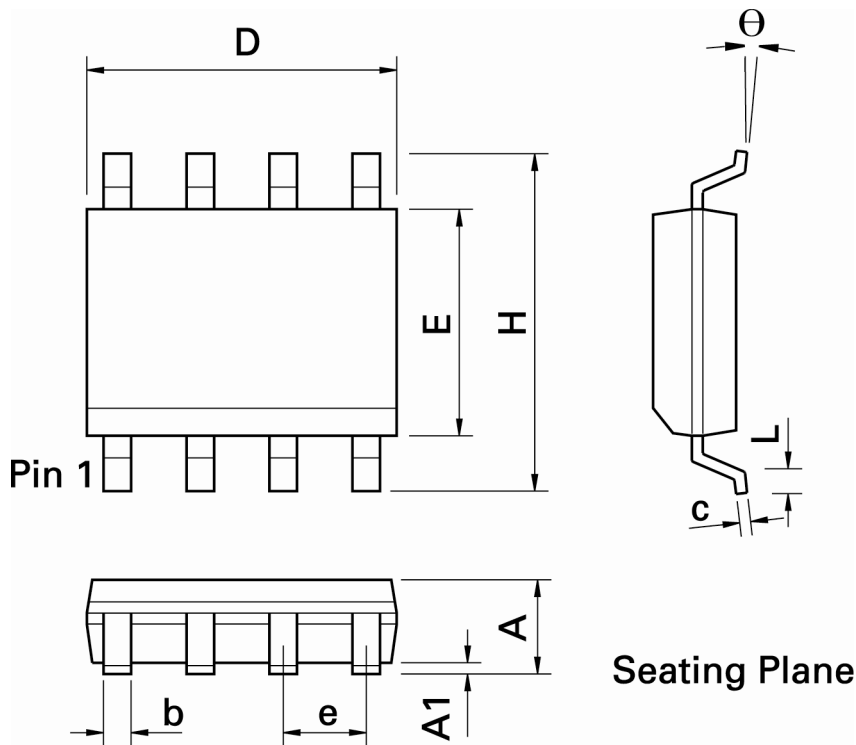
NOTES:

- (a) Measured under pulsed conditions. Pulse width $\leq 300\mu\text{s}$; 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**

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

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