

### General Description

The WSD3023DN56 is the highest performance trench N-Ch and P-Channel MOSFETs with extreme high cell density, which provide excellent  $R_{DS(ON)}$  and gate charge for most of the synchronous buck converter applications.

The WSD3023DN56 meet the RoHS and Green Product requirement 100%  $E_{AS}$  guaranteed with full function reliability approved.

### Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100%  $E_{AS}$  Guaranteed
- Green Device Available

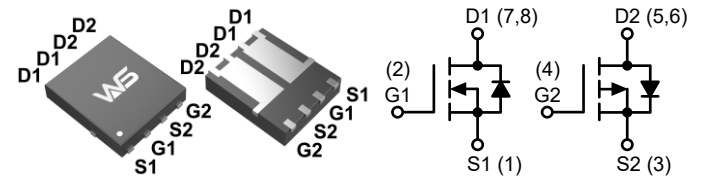
### Product Summary

$BV_{DSS}$	$R_{DS(ON)}$	$I_D$
30V	14m $\Omega$	14A
-30V	23m $\Omega$	-12A

### Applications

- High Frequency Point-of-Load Synchronous Buck Converter for MB/NB/UMPC/VGA
- Networking DC-DC Power System
- CCFL Back-light Inverter

### DFN5X6-8L Pin Configuration



### Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
$V_{DS}$	Drain-Source Voltage	30	-30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	
$I_D$	Continuous Drain Current, $V_{GS(NP)} = 10V$ , $T_A = 25^\circ C$	14*	-12	A
	Continuous Drain Current, $V_{GS(NP)} = 10V$ , $T_A = 70^\circ C$	7.6	-9.7	
$I_{DP}^1$	Pulse Drain Current Tested, $V_{GS(NP)} = 10V$	48.8	-48	
$E_{AS}^3$	Avalanche Energy, Single pulse, $L = 0.5mH$	20	20	mJ
$I_{AS}^3$	Avalanche Current, Single pulse, $L = 0.5mH$	9	-9	A
$P_D$	Total Power Dissipation, $T_A = 25^\circ C$	5.25	5.25	W
$T_{STG}$	Storage Temperature Range	-55 to 175	-55 to 175	$^\circ C$
$T_J$	Operating Junction Temperature Range	175	175	
$R_{\theta JA}^2$	Thermal Resistance-Junction to Ambient, Steady State	60	60	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance-Junction to Case, Steady State	6.25	6.25	

**N-Channel Electrical Characteristics ( $T_J=25^{\circ}\text{C}$ , Unless Otherwise Noted)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	30	---	---	V
$R_{DS(ON)}^4$	Static Drain-Source On-Resistance	$V_{GS}=10V, I_D=8A$	---	14	18.5	m $\Omega$
		$V_{GS}=4.5V, I_D=5A$	---	17	25	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.3	1.8	2.3	V
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=20V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	---	---	1.0	$\mu A$
		$V_{DS}=20V, V_{GS}=0V, T_J=85^{\circ}\text{C}$	---	---	30	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1.0\text{MHz}$	---	1.7	3.4	$\Omega$
$Q_g^5$	Total Gate Charge	$V_{DS}=15V, V_{GS}=4.5V, I_D=8A$	---	5.2	---	nC
$Q_{gs}^5$	Gate-Source Charge		---	1.0	---	
$Q_{gd}^5$	Gate-Drain Charge		---	2.8	---	
$T_{d(on)}^5$	Turn-On Delay Time	$V_{DD}=15V, R_L=15\Omega, I_{DS}=1A, V_{GEN}=10V, R_G=6\Omega$	---	6	---	ns
$T_r^5$	Rise Time		---	8.6	---	
$T_{d(off)}^5$	Turn-Off Delay Time		---	16	---	
$T_f^5$	Fall Time		---	3.6	---	
$C_{iss}^5$	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1.0\text{MHz}$	---	545	---	pF
$C_{oss}^5$	Output Capacitance		---	95	---	
$C_{rss}^5$	Reverse Transfer Capacitance		---	55	---	

**Diode Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
$I_S$	Continuous Source Current	$V_G=V_D=0V$ , Force Current	---	---	12	A
$V_{SD}^4$	Diode Forward Voltage	$V_{GS}=0V, I_S=1A, T_J=25^{\circ}\text{C}$	---	---	1.2	V

Note:

\*. Max. current is limited by bonding wire.

1. Pulse width limited by max. junction temperature.

2.  $R_{\theta JA}$  steady state  $t=999s$ .  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup>, FR-4 board with 2oz. Copper.

3. UIS tested and pulse width limited by maximum junction temperature 175 $^{\circ}\text{C}$ (initial temperature  $T_J=25^{\circ}\text{C}$ ).

4. Pulse test ; pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .

5. Guaranteed by design, not subject to production testing.

**P-Channel Electrical Characteristics (T<sub>J</sub>=25°C, Unless Otherwise Noted)**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-30	---	---	V
R <sub>DS(ON)</sub> <sup>4</sup>	Static Drain-Source On-Resistance	V <sub>GS</sub> =-10V, I <sub>D</sub> =-12A	---	23	32.5	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A	---	32	42	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250μA	-1.3	-1.8	-2.3	V
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	-1.0	μA
		V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, T <sub>J</sub> =85°C	---	---	-30	
I <sub>GSS</sub>	Gate-Source Leakage Current	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	---	---	±100	nA
Q <sub>g</sub> <sup>5</sup>	Total Gate Charge	V <sub>DS</sub> =-15V, V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-12A	---	13	---	nC
Q <sub>gs</sub> <sup>5</sup>	Gate-Source Charge		---	1.0	---	
Q <sub>gd</sub> <sup>5</sup>	Gate-Drain Charge		---	4.0	---	
T <sub>d(on)</sub> <sup>5</sup>	Turn-On Delay Time	V <sub>DD</sub> =-15V, V <sub>GS</sub> =-10V, R <sub>G</sub> =6Ω, I <sub>D</sub> =-1A, R <sub>L</sub> =15Ω	---	8.7	---	ns
T <sub>r</sub> <sup>5</sup>	Rise Time		---	10	---	
T <sub>d(off)</sub> <sup>5</sup>	Turn-Off Delay Time		---	22	---	
T <sub>f</sub> <sup>5</sup>	Fall Time		---	9.0	---	
C <sub>iss</sub> <sup>5</sup>	Input Capacitance	V <sub>DS</sub> =-15V, V <sub>GS</sub> =0V, f=1.0MHz	---	580	---	pF
C <sub>oss</sub> <sup>5</sup>	Output Capacitance		---	105	---	
C <sub>rss</sub> <sup>5</sup>	Reverse Transfer Capacitance		---	72	---	

**Diode Characteristics**

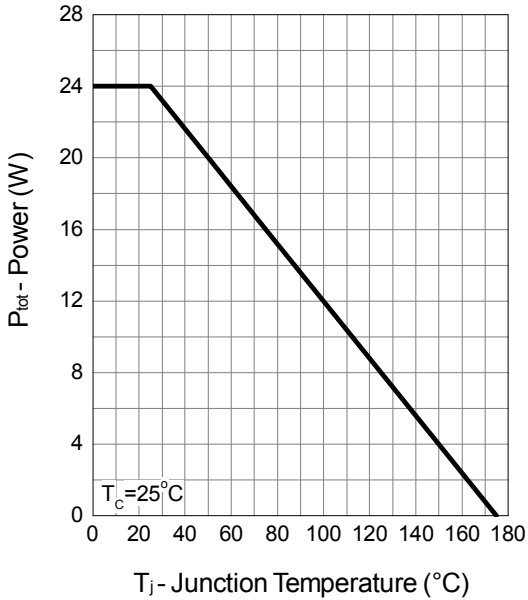
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
I <sub>S</sub>	Continuous Source Current	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-10	A
V <sub>SD</sub> <sup>5</sup>	Diode Forward Voltage	V <sub>GS</sub> =0V, I <sub>S</sub> =-1A, T <sub>J</sub> =25°C	---	---	-1.2	V

Note:

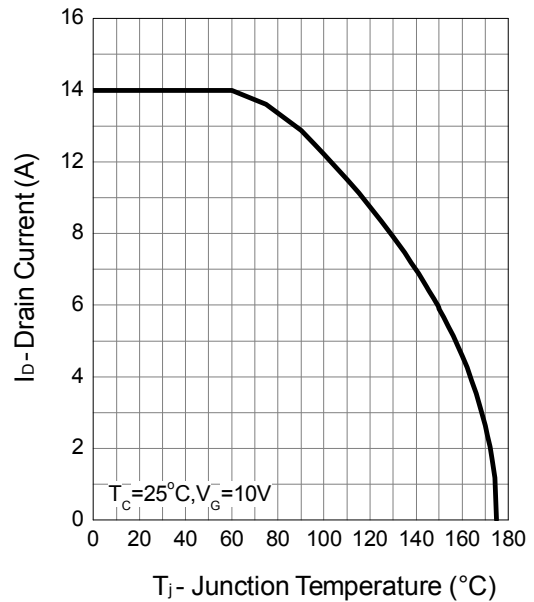
- \*. Max. current is limited by bonding wire.
- 1. Pulse width limited by max. junction temperature.
- 2. R<sub>θJA</sub> steady state t=999s. R<sub>θJA</sub> is measured with the device mounted on 1in<sup>2</sup>, FR-4 board with 2oz. Copper.
- 3. UIS tested and pulse width limited by maximum junction temperature 175°C(initial temperature T<sub>J</sub>=25°C).
- 4. Pulse test ; pulse width ≤ 300μs, duty cycle ≤ 2%.
- 5. Guaranteed by design, not subject to production testing.

**N-Channel Typical Characteristics**

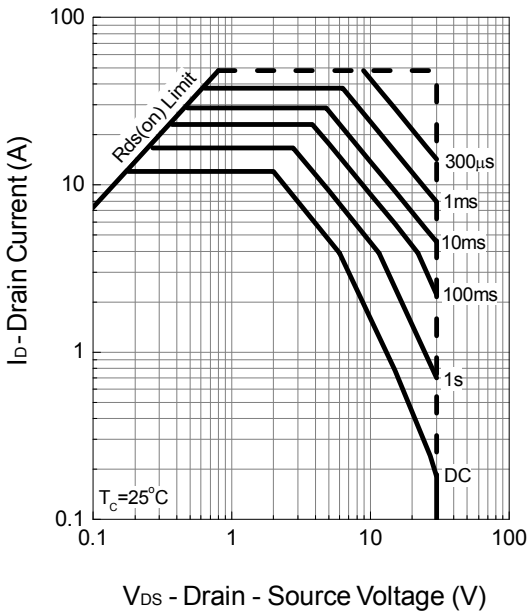
**Power Dissipation**



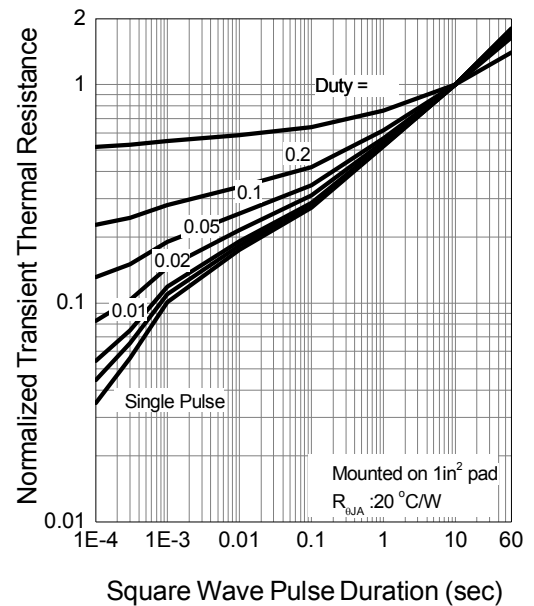
**Drain Current**



**Safe Operation Area**

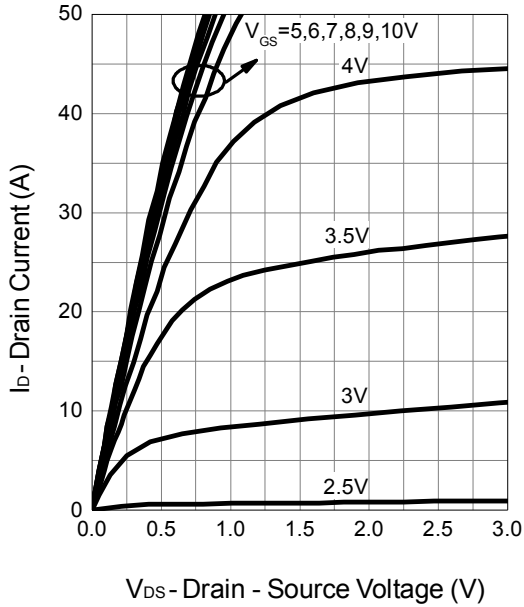


**Thermal Transient Impedance**

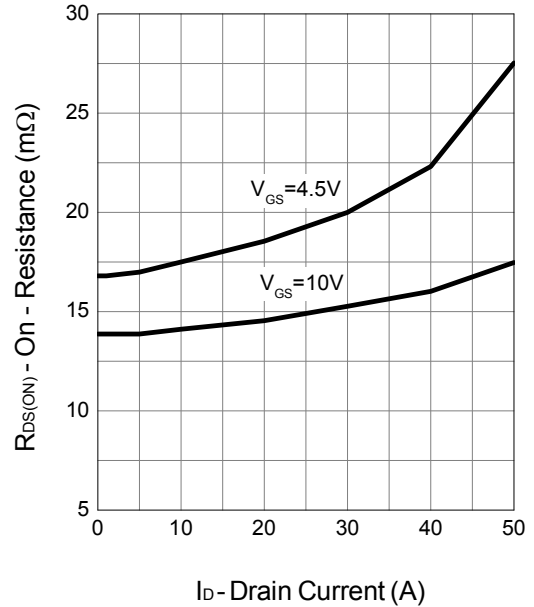


**N-Channel Typical Characteristics (Cont.)**

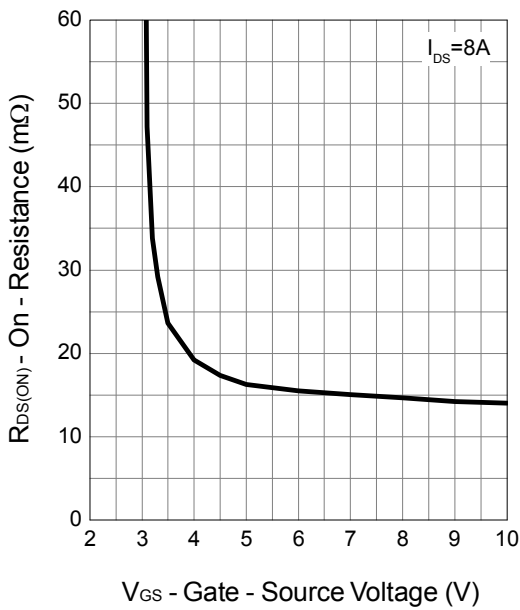
**Output Characteristics**



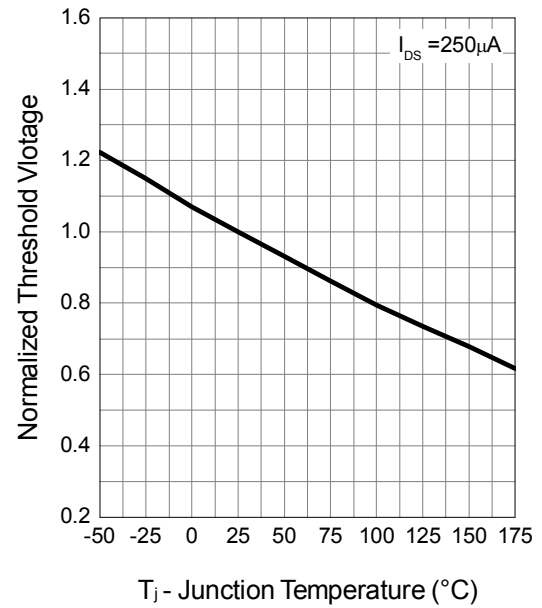
**Drain-Source On Resistance**



**Gate-Source On Resistance**

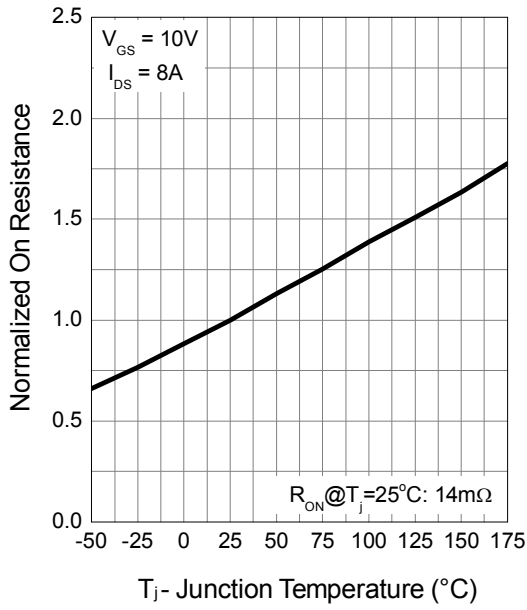


**Gate Threshold Voltage**

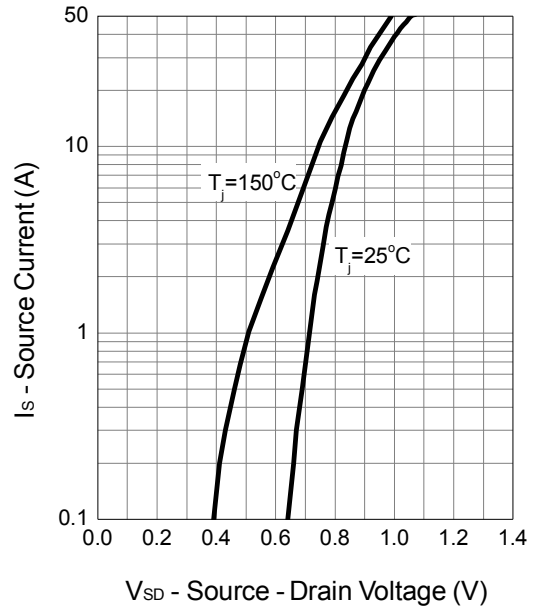


**N-Channel Typical Characteristics (Cont.)**

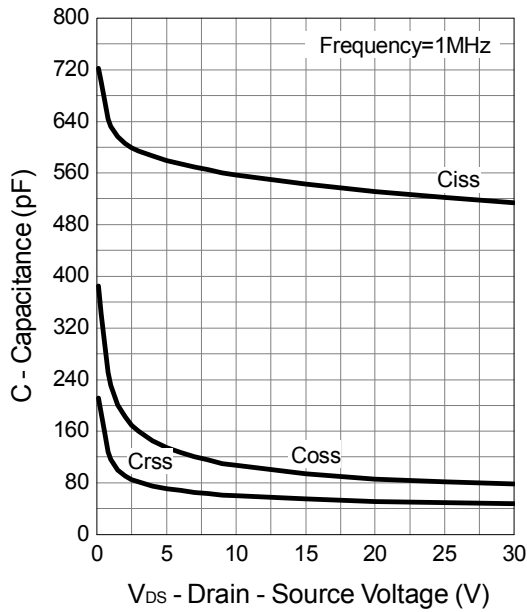
**Drain-Source On Resistance**



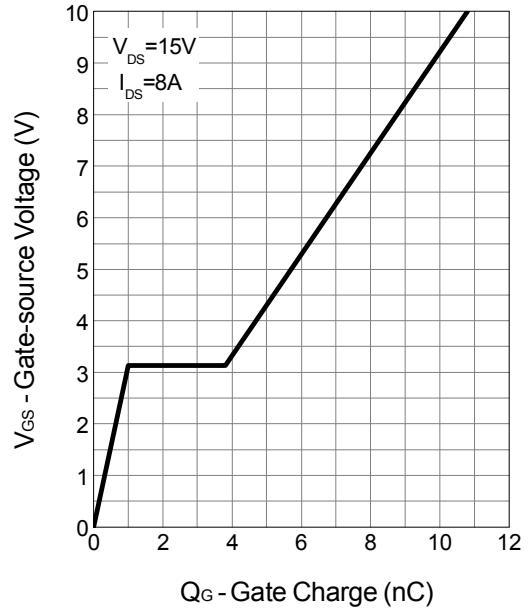
**Source-Drain Diode Forward**



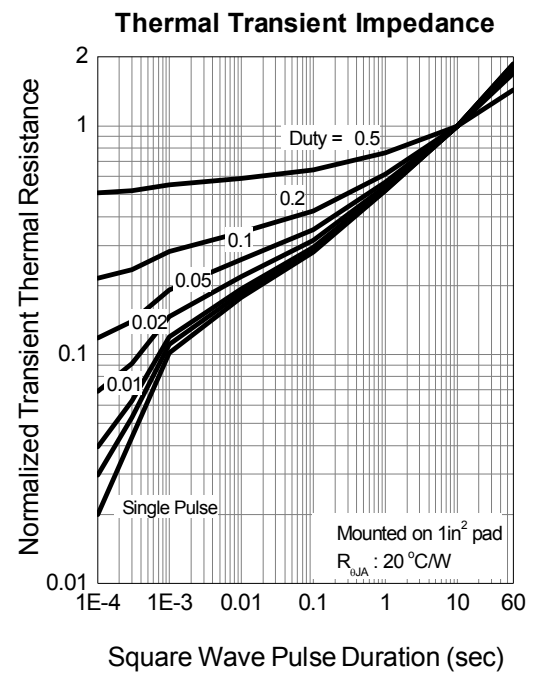
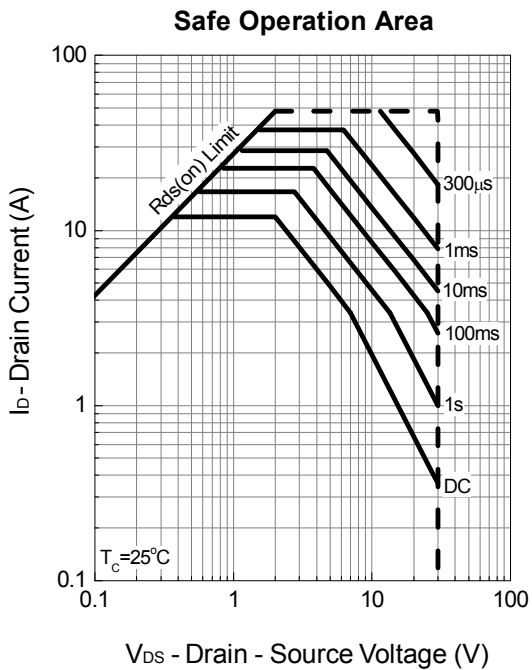
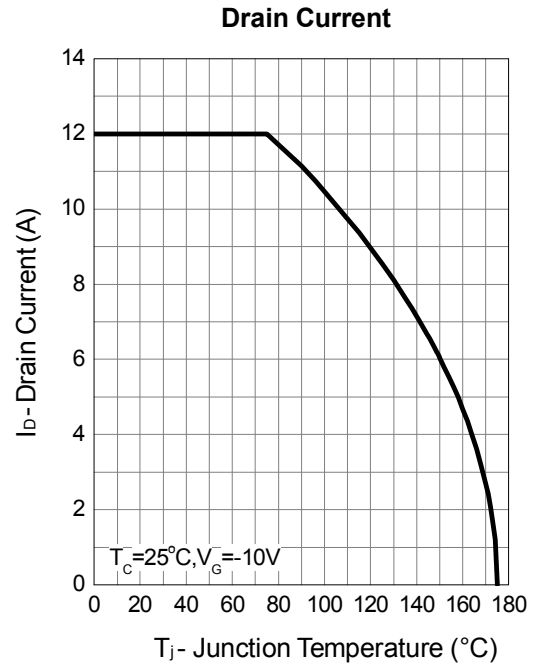
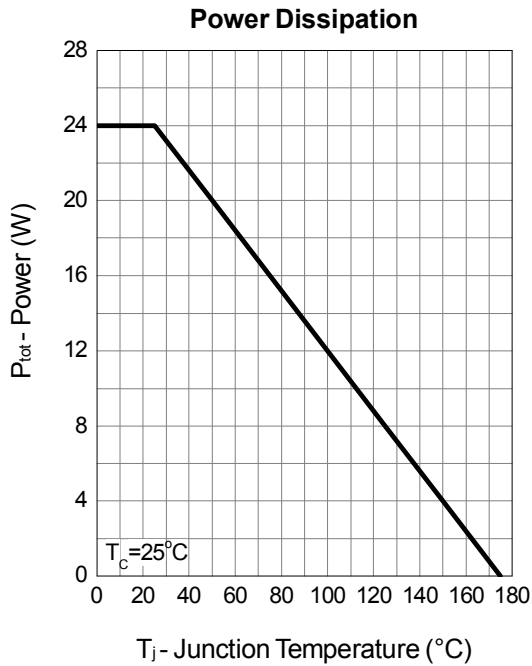
**Capacitance**



**Gate Charge**

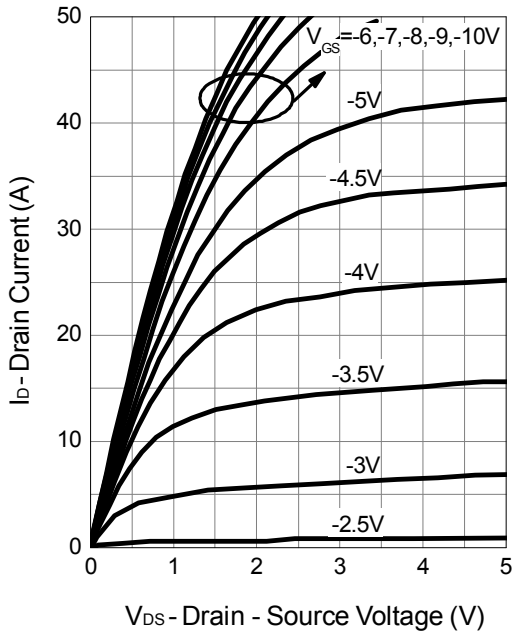


**P-Channel Typical Characteristics**

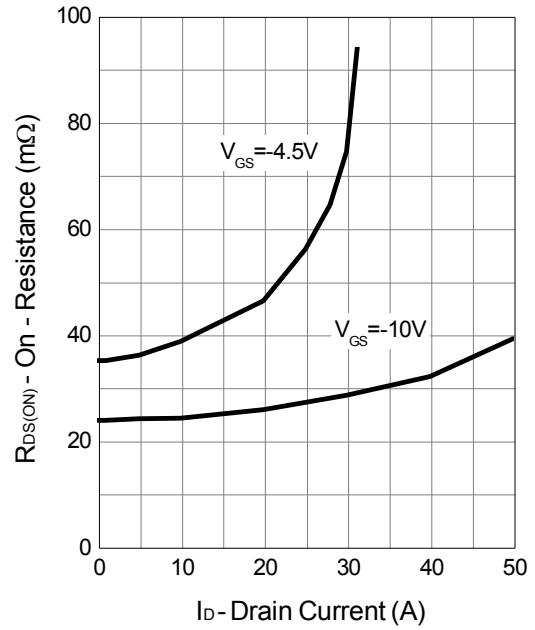


**P-Channel Typical Characteristics (Cont.)**

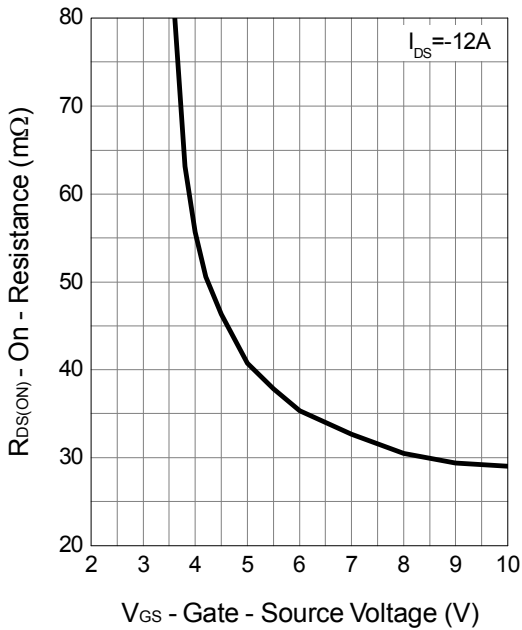
**Output Characteristics**



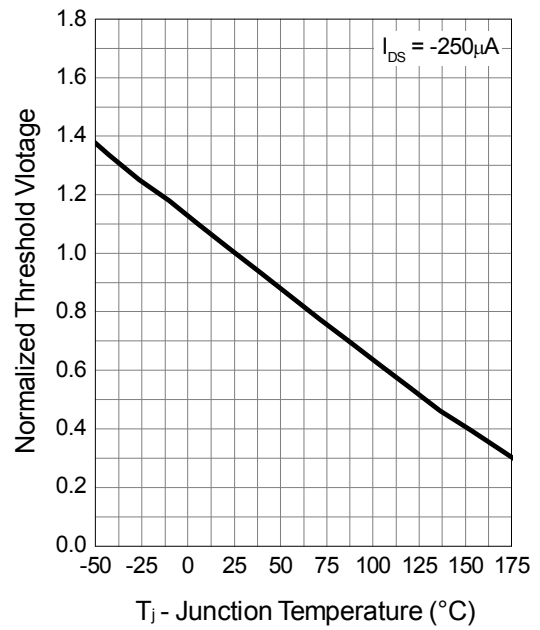
**Drain-Source On Resistance**



**Gate-Source On Resistance**



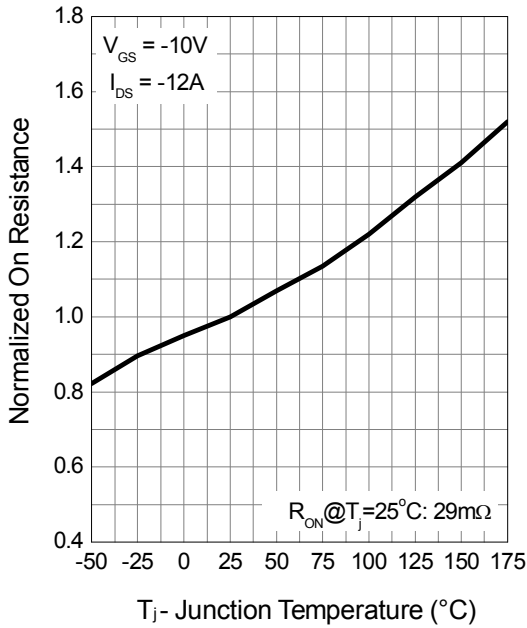
**Gate Threshold Voltage**



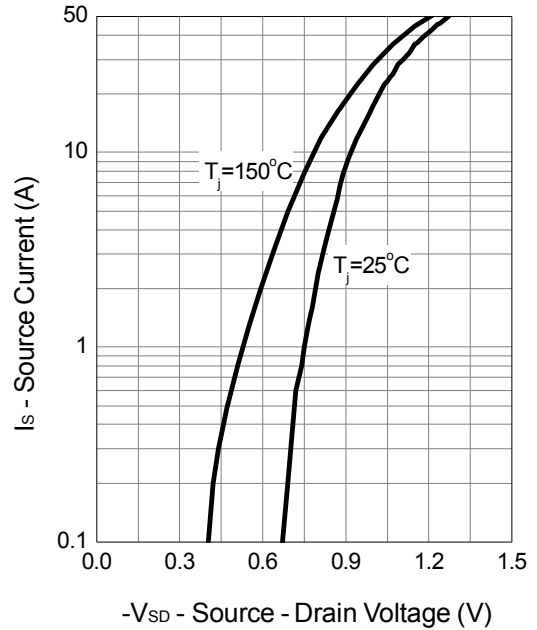


**P-Channel Typical Characteristics (Cont.)**

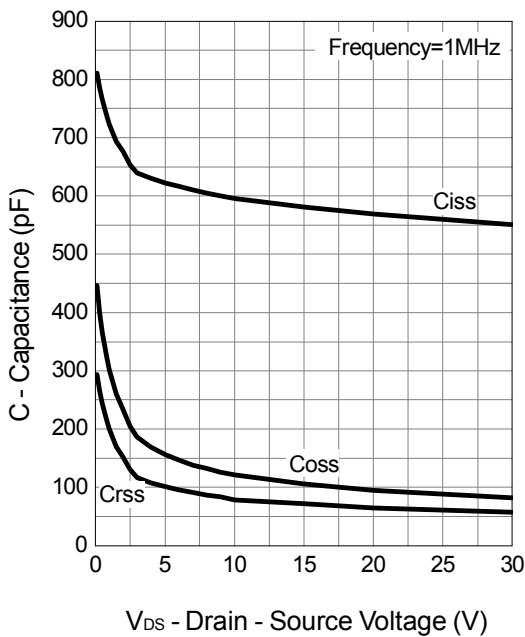
**Drain-Source On Resistance**



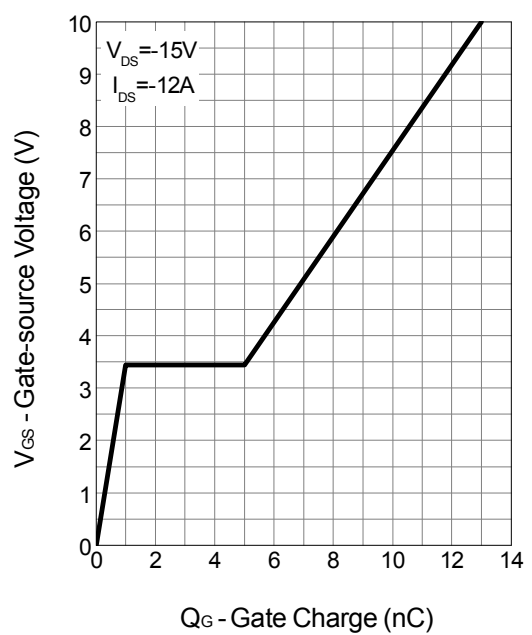
**Source-Drain Diode Forward**

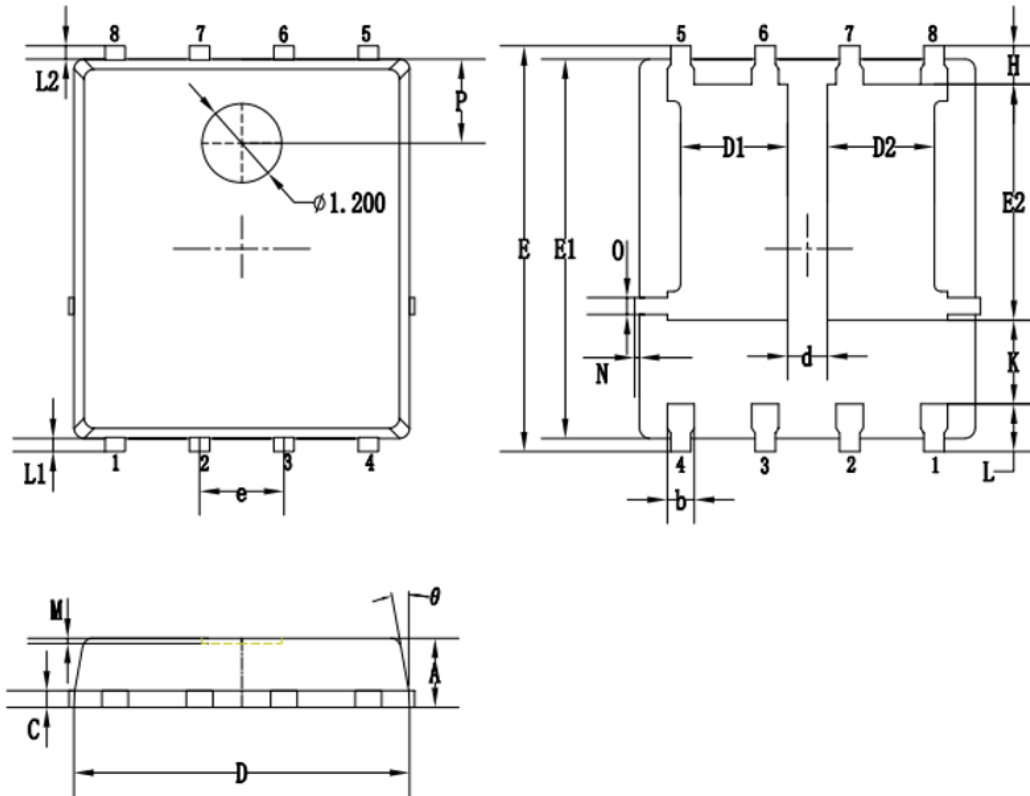


**Capacitance**



**Gate Charge**



**Packaging information**


SYMBOLS	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.05	1.20
b	0.35	0.40	0.50
C	0.20	0.25	0.35
D	4.90	5.05	5.20
D1/D2	1.51	1.61	1.71
d	0.50	0.60	0.70
E	6.00	6.15	6.30
E1	5.60	5.75	5.90
E2	3.47	3.57	3.67
e	1.27 BSC.		
H	0.48	0.58	0.68
K	1.17	1.27	1.37
L	0.64	0.74	0.84
L1/L2	0.20 REF.		
$\theta$	8°	10°	12°
M	0.08 REF.		
N	0	-	0.15
O	0.25 REF.		
P	1.28 REF.		

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