

## General Description

The WSD6034DN33 is the highest performance trench N-Ch and P-Channel MOSFET with extreme high cell density, which provide excellent  $R_{DS(ON)}$  and gate charge for most of the synchronous buck converter applications .

The WSD6034DN33 meet the RoHS and Green Product requirement, 100% E<sub>AS</sub> guaranteed with full function reliability approved.

## Features

- Advanced high cell density Trench technology
- Super Low Gate Charge
- Excellent CdV/dt effect decline
- 100% EAS Guaranteed
- Green Device Available

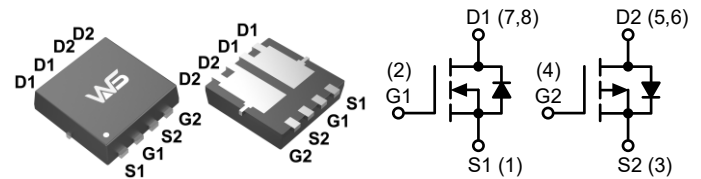
## Product Summary

$BV_{DSS}$	$R_{DS(ON)}$	$I_D$
60V	35mΩ	15A
-60V	80mΩ	-10A

## Applications

- High Frequency Point-of-Load Synchronous Buck Converter.
- Networking DC-DC Power System
- Load Switch

## DFN3X3-8L Pin Configuration



## Absolute Maximum Ratings

Symbol	Parameter	Rating		Units
		N-Channel	P-Channel	
$V_{DS}$	Drain-Source Voltage	60	-60	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	15	-10	A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	6	-4	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	45	-30	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	16	18	mJ
$I_{AS}$	Avalanche Current	8	-9	A
$P_D@T_C=25^\circ C$	Total Power Dissipation <sup>4</sup>	13.3	13.3	W
$T_{STG}$	Storage Temperature Range	-55 to 150	-55 to 150	$^\circ C$
$T_J$	Operating Junction Temperature Range	-55 to 150	-55 to 150	$^\circ C$

## Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	---	85	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	50	$^\circ C/W$

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	60	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	$BV_{DSS}$ Temperature Coefficient	Reference to $25^{\circ}\text{C}$ , $I_D=1\text{mA}$	---	0.063	---	$\text{V}/^{\circ}\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=10V, I_D=5A$	---	35	40	$\text{m}\Omega$
		$V_{GS}=4.5V, I_D=3A$	---	40	48	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.0	2.0	3.0	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient		---	-5.24	---	$\text{mV}/^{\circ}\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=48V, V_{GS}=0V, T_J=25^{\circ}\text{C}$	---	---	1	$\mu\text{A}$
		$V_{DS}=48V, V_{GS}=0V, T_J=85^{\circ}\text{C}$	---	---	30	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
$g_{fs}$	Forward Transconductance	$V_{DS}=5V, I_D=5A$	---	21	---	S
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	3.0	---	$\Omega$
$Q_g$	Total Gate Charge (4.5V)	$V_{DS}=30V, V_{GS}=10V, I_D=5A$	---	4.3	---	$\text{nC}$
$Q_{gs}$	Gate-Source Charge		---	1.6	---	
$Q_{gd}$	Gate-Drain Charge		---	1.5	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=30V, V_{GS}=10V, R_G=6\Omega, I_D=1A$	---	7	13	ns
$T_r$	Rise Time		---	7	13	
$T_{d(off)}$	Turn-Off Delay Time		---	5	9	
$T_f$	Fall Time		---	18	33	
$C_{iss}$	Input Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	---	400	520	$\text{pF}$
$C_{oss}$	Output Capacitance		---	43	---	
$C_{rss}$	Reverse Transfer Capacitance		---	24	---	

**Diode Characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$I_S$	Continuous Source Current <sup>1,6</sup>	$V_G=V_D=0V$ , Force Current	---	---	15	A
$I_{SM}$	Pulsed Source Current <sup>2,6</sup>		---	---	45	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=1.7A, T_J=25^{\circ}\text{C}$	---	0.8	1.3	V

Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper,  $t < 10\text{sec}$ .
- 2.The data tested by pulsed , pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is  $V_{DD}=25V, V_{GS}=10V, L=0.5\text{mH}, I_{AS}=8A$
- 4.The power dissipation is limited by  $150^{\circ}\text{C}$  junction temperature
- 5.The Min. value is 100% EAS tested guarantee.
- 6.The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

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

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> =0V, I <sub>D</sub> =-250uA	-60	---	---	V
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	BV <sub>DSS</sub> Temperature Coefficient	Reference to 25°C, I <sub>D</sub> =-1mA	---	-0.03	---	V/°C
R <sub>DS(ON)</sub>	Static Drain-Source On-Resistance <sup>2</sup>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-3.5A	---	80	93	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-2.1A	---	100	128	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =-250uA	-1.0	-2.0	-3.0	V
ΔV <sub>GS(th)</sub>	V <sub>GS(th)</sub> Temperature Coefficient		---	4.56	---	mV/°C
I <sub>DSS</sub>	Drain-Source Leakage Current	V <sub>DS</sub> =-48V, V <sub>GS</sub> =0V, T <sub>J</sub> =25°C	---	---	-1	uA
		V <sub>DS</sub> =-48V, 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
g <sub>fs</sub>	Forward Transconductance	V <sub>DS</sub> =-5V, I <sub>D</sub> =-4.5A	---	15	---	S
R <sub>g</sub>	Gate Resistance	V <sub>DS</sub> =0V, V <sub>GS</sub> =0V, f=1MHz	---	11	---	Ω
Q <sub>g</sub>	Total Gate Charge (-4.5V)	V <sub>DS</sub> =-30V, V <sub>GS</sub> =-10V, I <sub>D</sub> =-3.5A	---	5.2	---	nC
Q <sub>gs</sub>	Gate-Source Charge		---	1.9	---	
Q <sub>gd</sub>	Gate-Drain Charge		---	2.1	---	
T <sub>d(on)</sub>	Turn-On Delay Time	V <sub>DD</sub> =-30V, V <sub>GS</sub> =-10V, R <sub>G</sub> =6Ω, I <sub>D</sub> =-1A,	---	4	7	ns
T <sub>r</sub>	Rise Time		---	8	14	
T <sub>d(off)</sub>	Turn-Off Delay Time		---	22	40	
T <sub>f</sub>	Fall Time		---	39	70	
C <sub>iss</sub>	Input Capacitance	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, f=1MHz	---	455	592	pF
C <sub>oss</sub>	Output Capacitance		---	51	---	
C <sub>rss</sub>	Reverse Transfer Capacitance		---	32	---	

**Diode Characteristics**

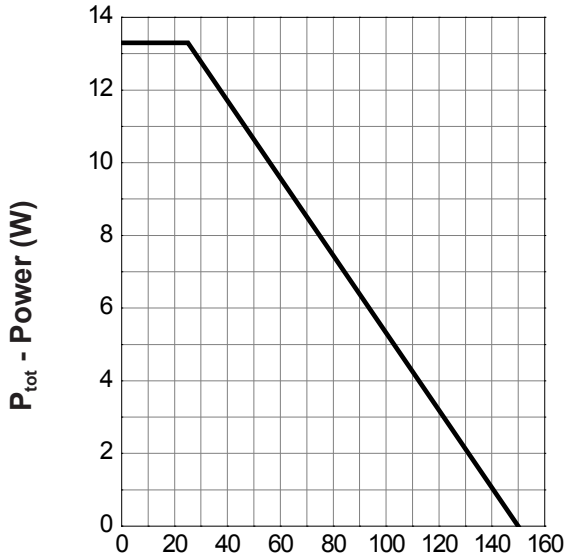
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I <sub>S</sub>	Continuous Source Current <sup>1,6</sup>	V <sub>G</sub> =V <sub>D</sub> =0V, Force Current	---	---	-15	A
I <sub>SM</sub>	Pulsed Source Current <sup>2,6</sup>		---	---	-50	A
V <sub>SD</sub>	Diode Forward Voltage <sup>2</sup>	V <sub>GS</sub> =0V, I <sub>S</sub> =-1.5A, T <sub>J</sub> =25°C	---	-0.8	-1.0	V

Note :

- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper, t<10sec.
- 2.The data tested by pulsed, pulse width ≤ 300us, duty cycle ≤ 2%
- 3.The EAS data shows Max. rating. The test condition is V<sub>DD</sub>=-25V, V<sub>GS</sub>=-10V, L=0.5mH, I<sub>AS</sub>=-9A
- 4.The power dissipation is limited by 150°C junction temperature
- 5.The Min. value is 100% EAS tested guarantee.
- 6.The data is theoretically the same as I<sub>D</sub> and I<sub>DM</sub>, in real applications, should be limited by total power dissipation.

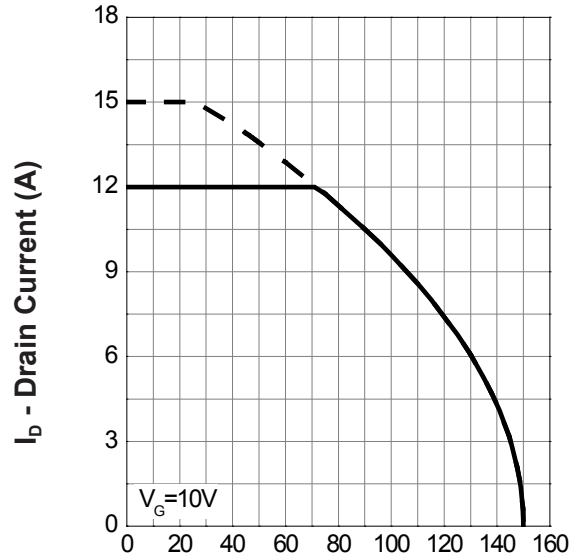
**N-Channel Typical Characteristics**

**Power Dissipation**



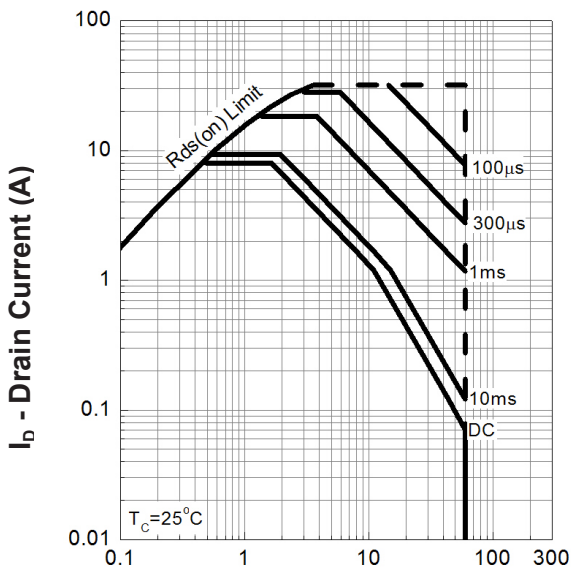
**T<sub>c</sub> - Case Temperature (°C)**

**Drain Current**



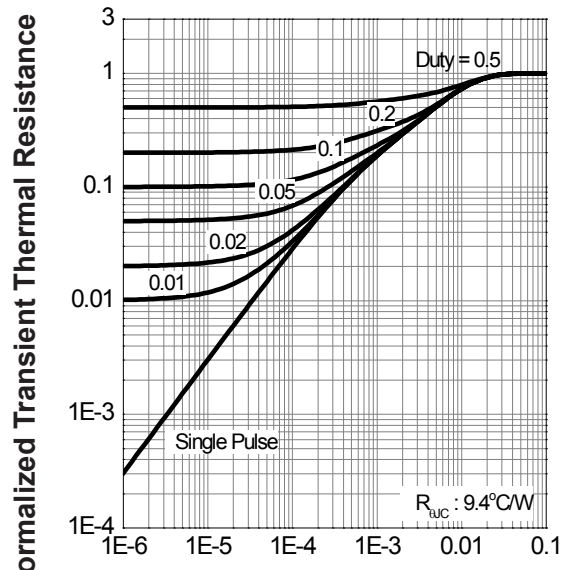
**T<sub>c</sub> - Case Temperature (°C)**

**Safe Operation Area**



**V<sub>DS</sub> - Drain - Source Voltage (V)**

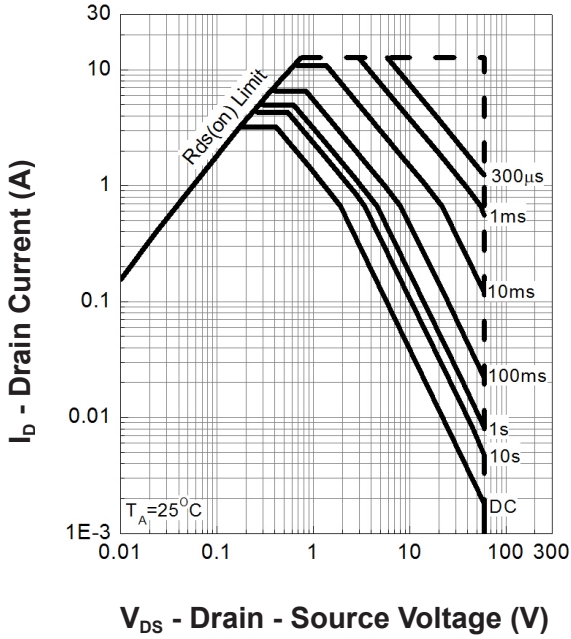
**Thermal Transient Impedance**



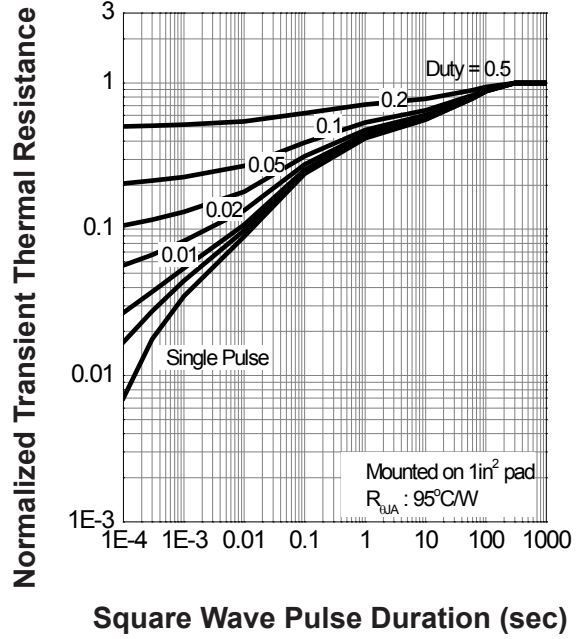
**Square Wave Pulse Duration (sec)**

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

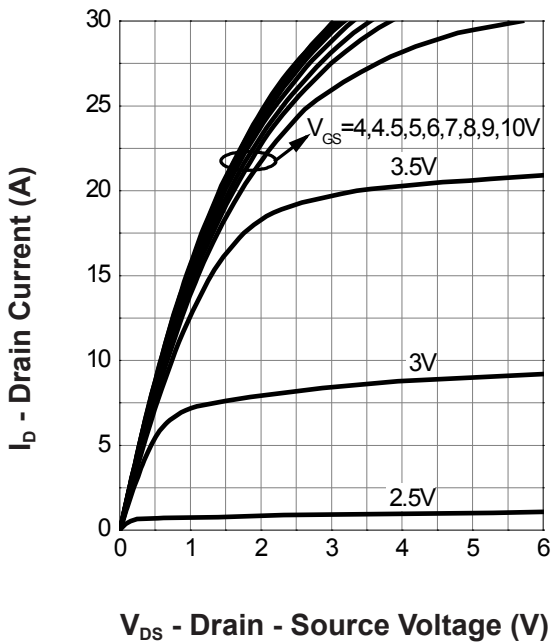
**Safe Operation Area**



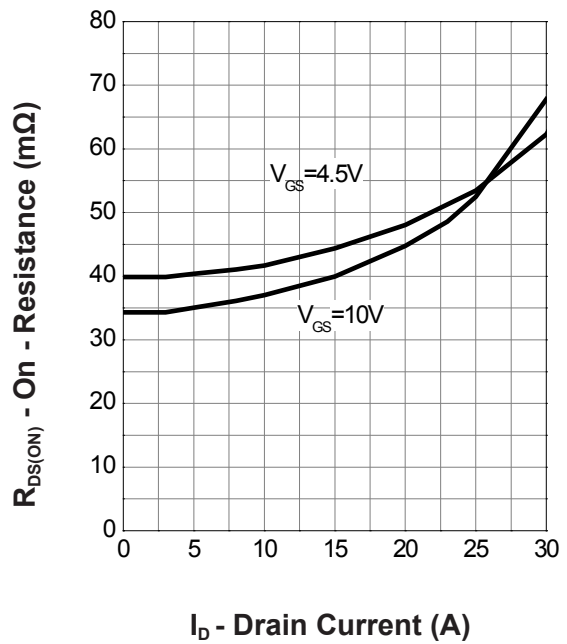
**Thermal Transient Impedance**



**Output Characteristics**

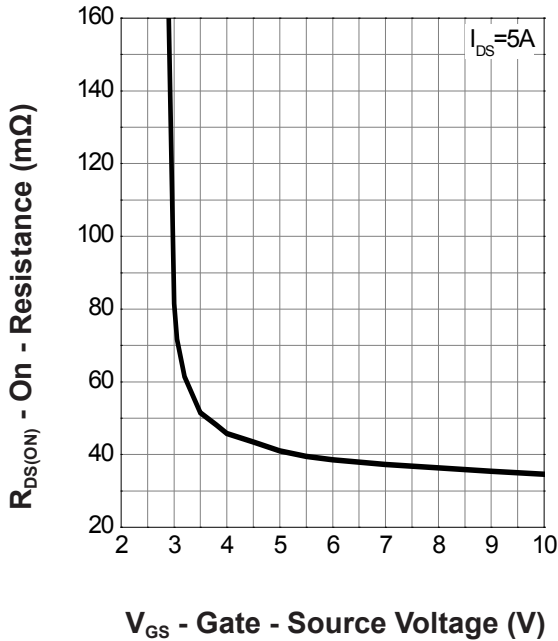


**Drain-Source On Resistance**

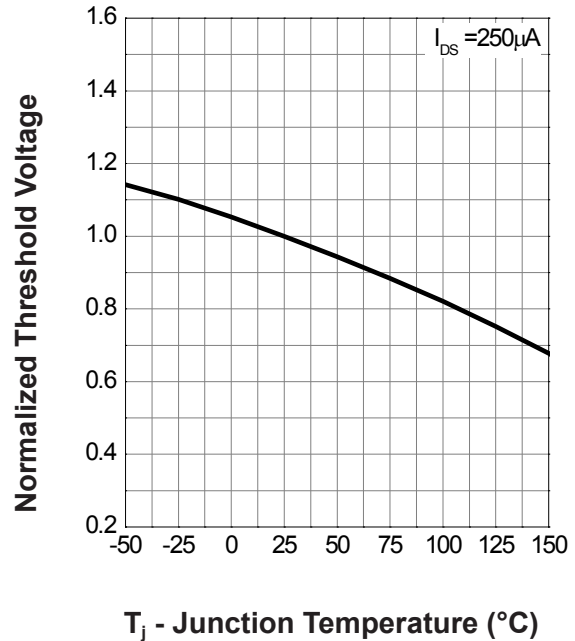


**N-Channel Typical Characteristics (Cont.)**

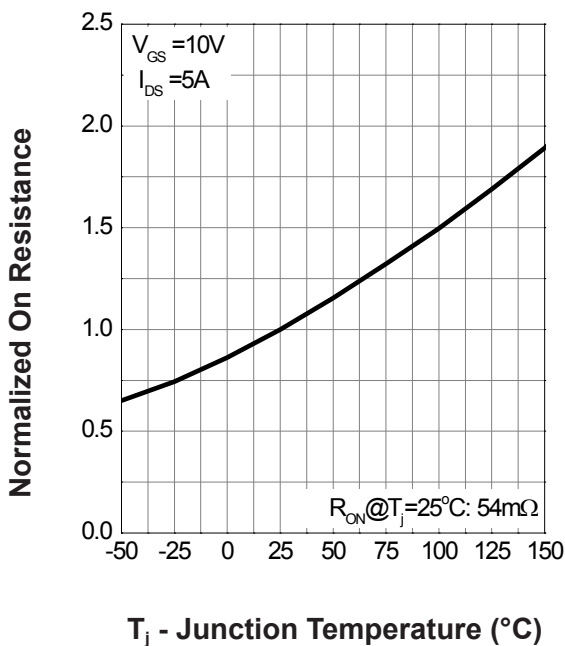
**Gate-Source On Resistance**



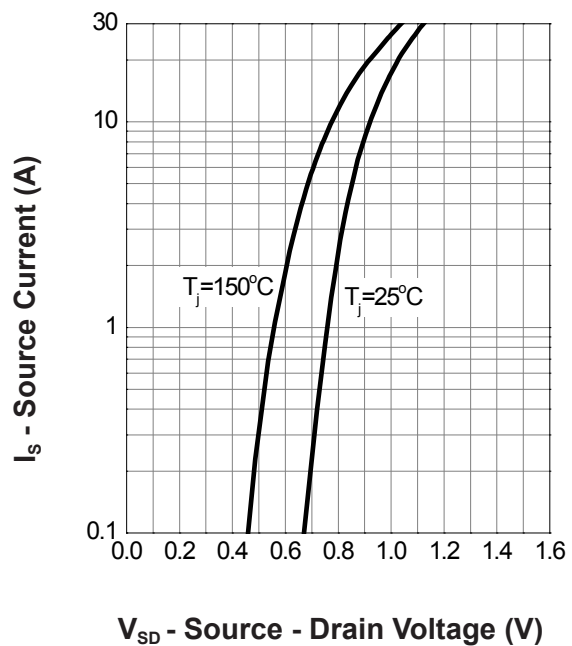
**Gate Threshold Voltage**



**Drain-Source On Resistance**

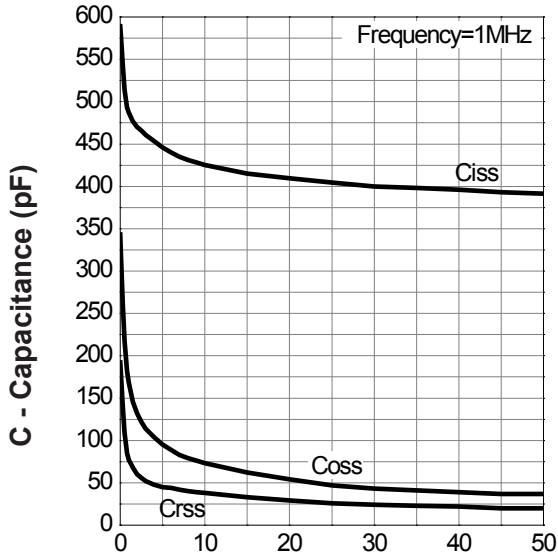


**Source-Drain Diode Forward**



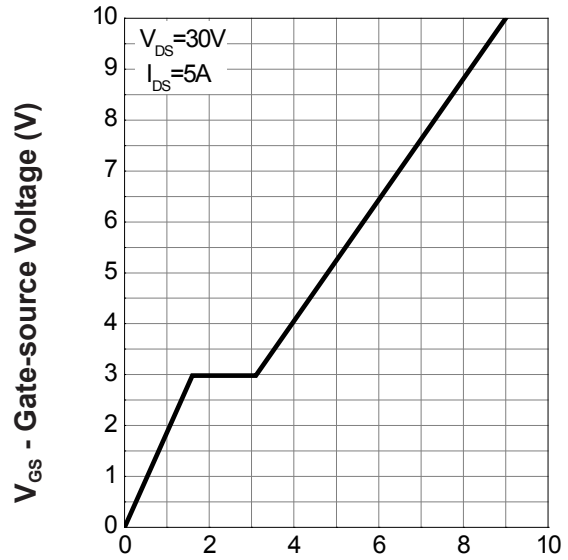
**N-Channel Typical Characteristics (Cont.)**

**Capacitance**



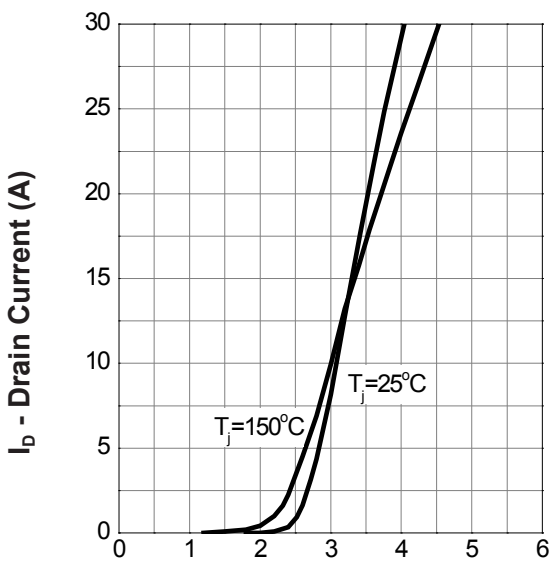
$V_{DS}$  - Drain-Source Voltage (V)

**Gate Charge**



$Q_G$  - Gate Charge (nC)

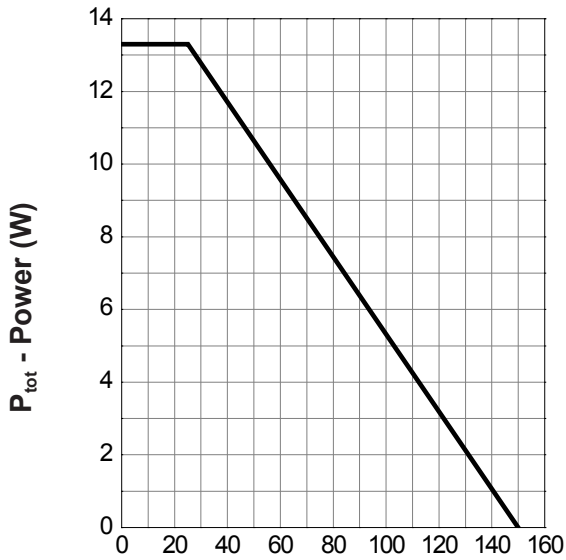
**Transfer Characteristics**



$V_{GS}$  - Gate-Source Voltage (V)

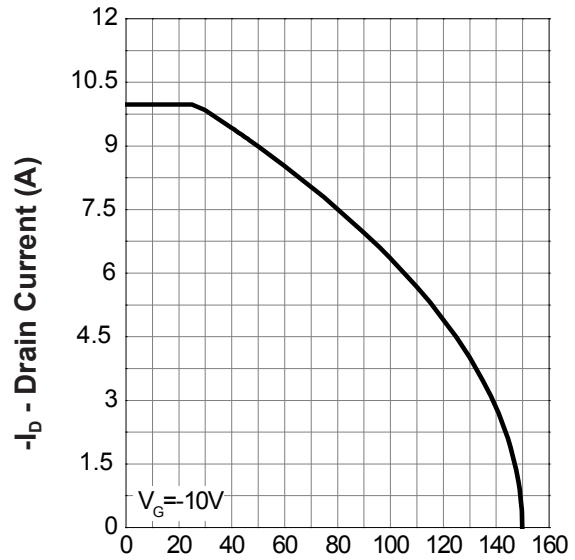
**P-Channel Typical Characteristics**

**Power Dissipation**



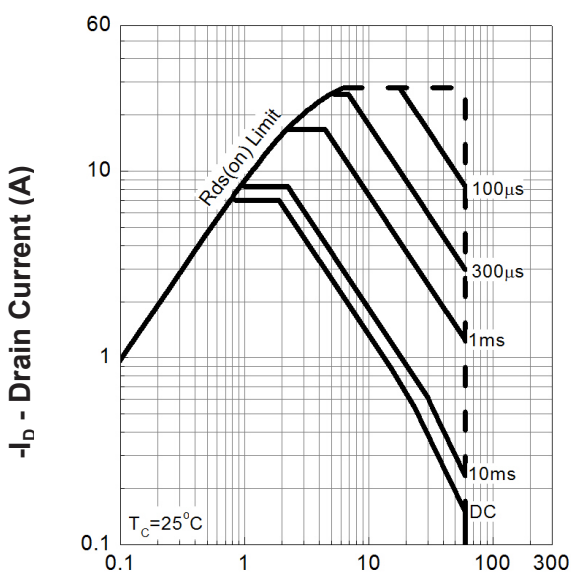
$T_c$  - Case Temperature (°C)

**Drain Current**



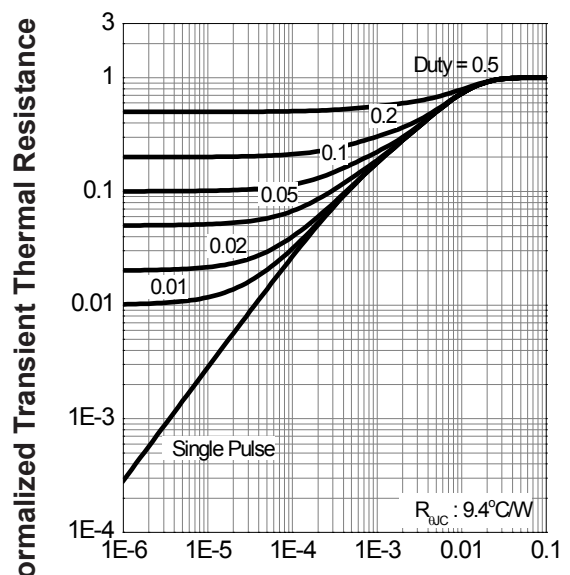
$T_c$  - Case Temperature (°C)

**Safe Operation Area**



$-V_{DS}$  - Drain - Source Voltage (V)

**Thermal Transient Impedance**

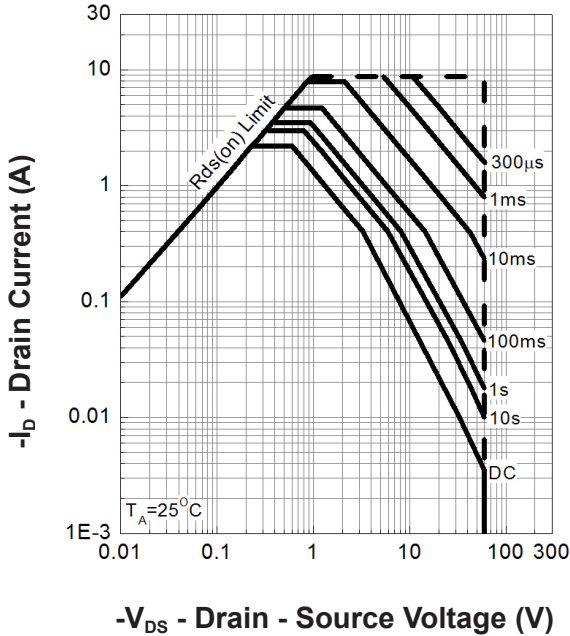


Square Wave Pulse Duration (sec)

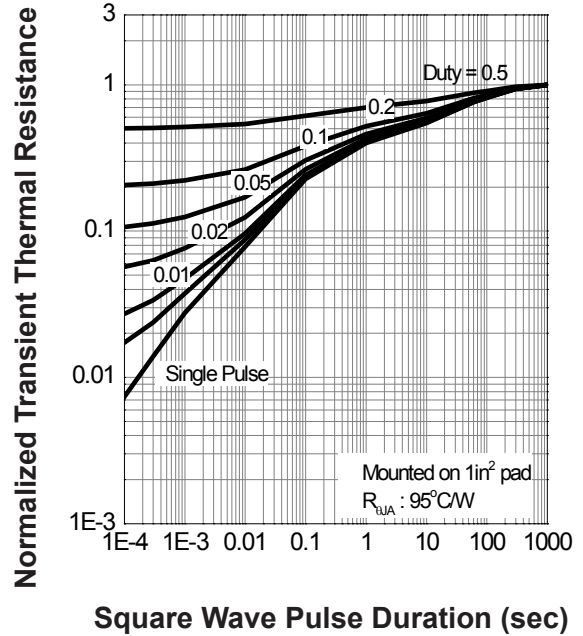


**P-Channel Typical Characteristics (Cont.)**

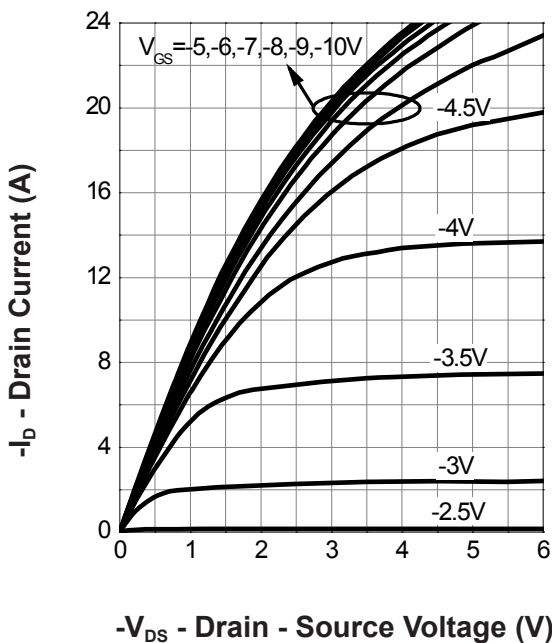
**Safe Operation Area**



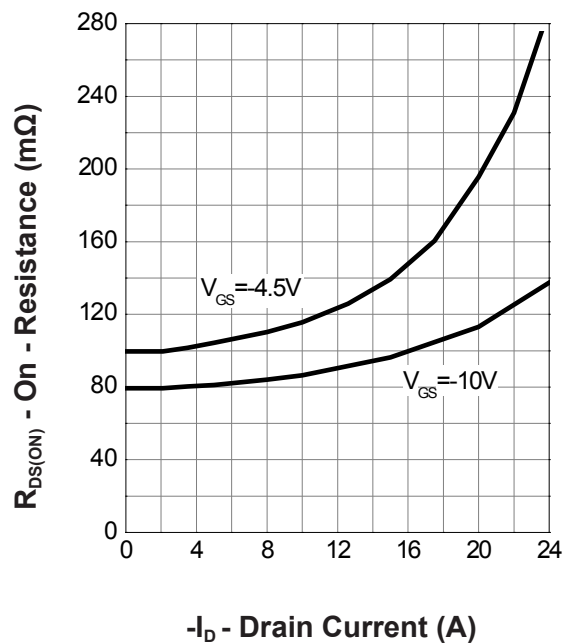
**Thermal Transient Impedance**



**Output Characteristics**

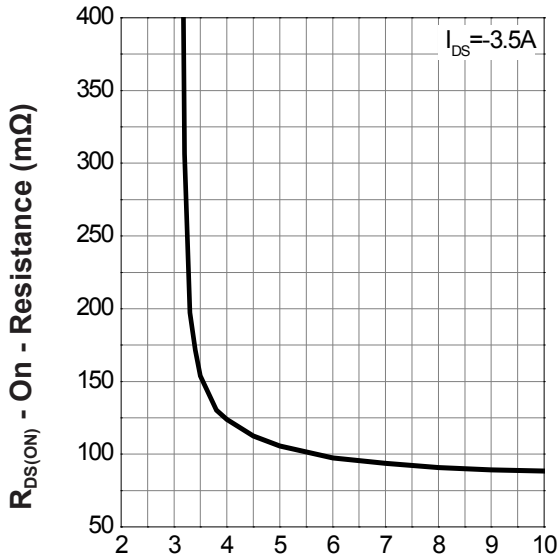


**Drain-Source On Resistance**



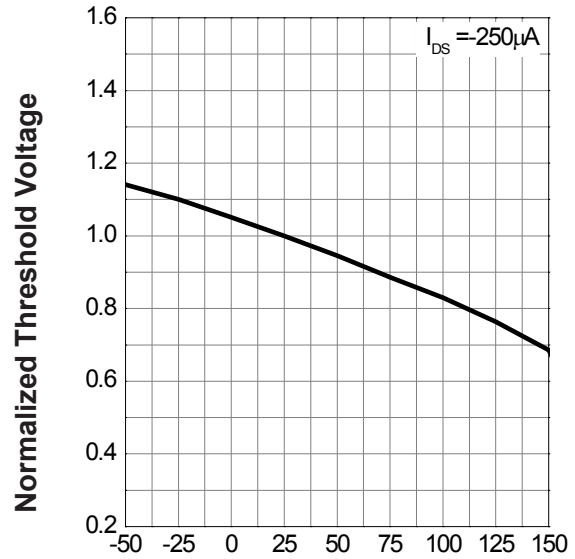
**P-Channel Typical Characteristics (Cont.)**

**Gate-Source On Resistance**



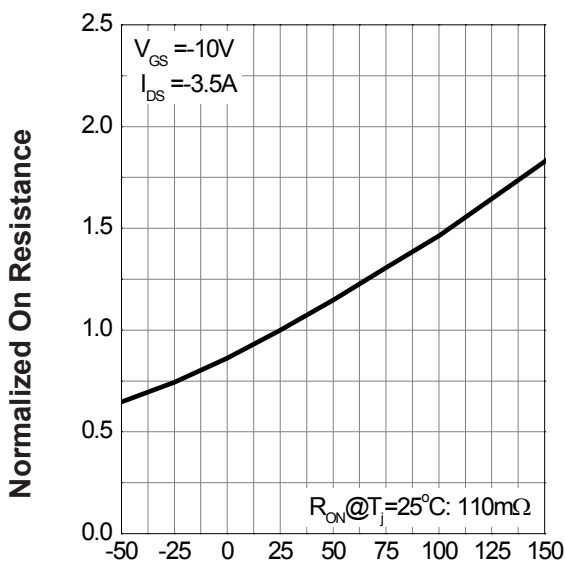
-V<sub>GS</sub> - Gate - Source Voltage (V)

**Gate Threshold Voltage**



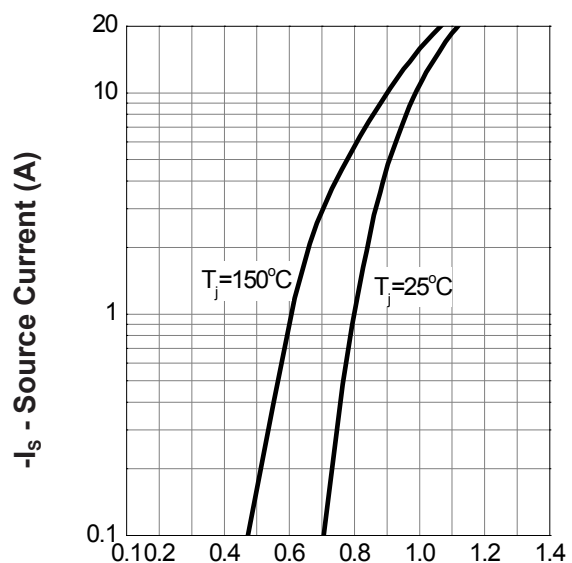
T<sub>J</sub> - Junction Temperature (°C)

**Drain-Source On Resistance**



T<sub>J</sub> - Junction Temperature (°C)

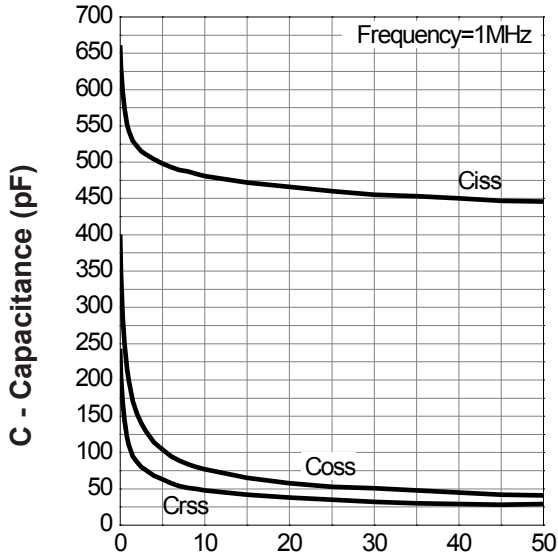
**Source-Drain Diode Forward**



-V<sub>SD</sub> - Source - Drain Voltage (V)

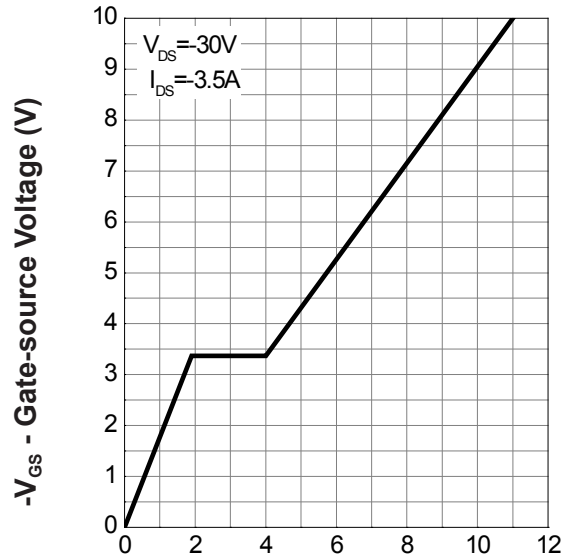
**P-Channel Typical Characteristics (Cont.)**

**Capacitance**



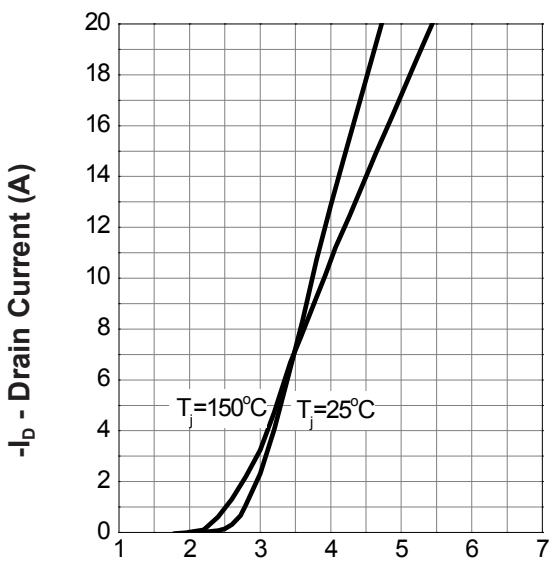
-V<sub>DS</sub> - Drain-Source Voltage (V)

**Gate Charge**

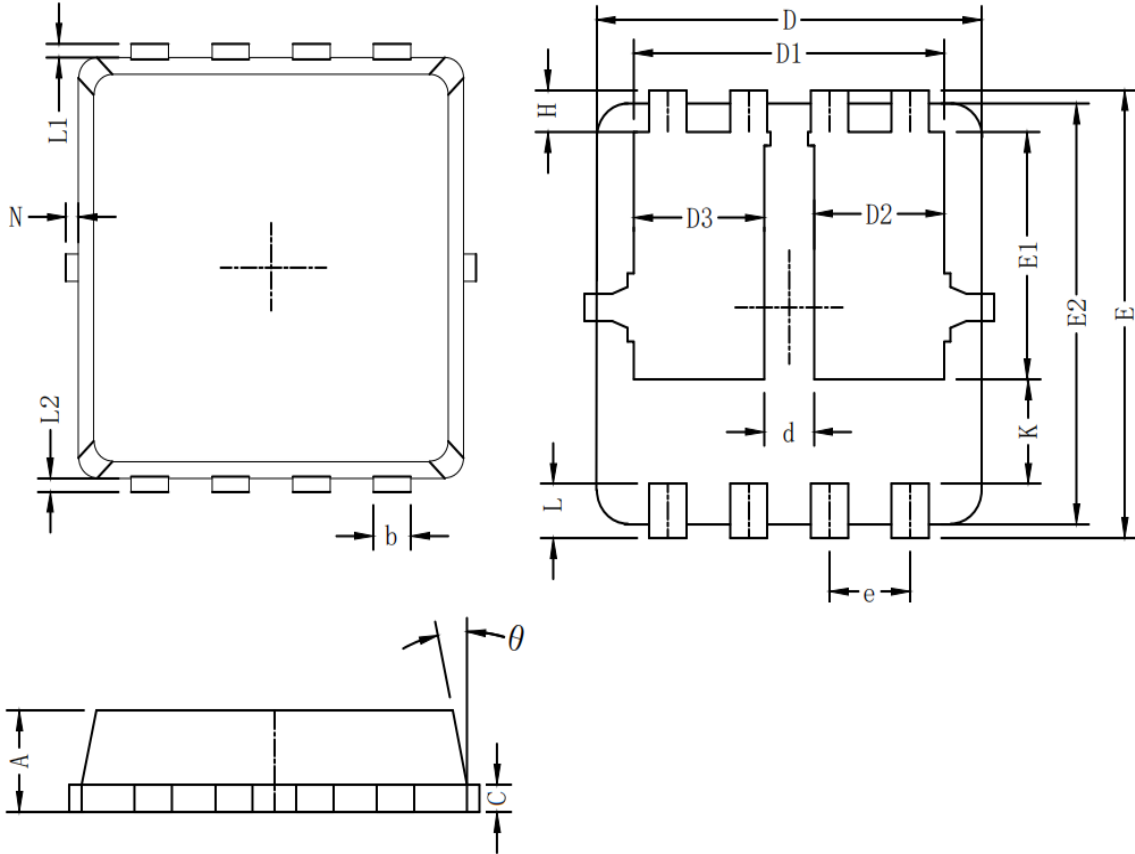


Q<sub>G</sub> - Gate Charge (nC)

**Transfer Characteristics**



-V<sub>GS</sub> - Gate-Source Voltage (V)

**Packaging information**


Symbol	Dim in mm		
	min	typ	max
A	0.6	0.75	0.9
b	0.2	0.3	0.4
C	0.15	0.2	0.25
D	3	3.1	3.2
D1	2.3	2.45	2.6
D2/D3	0.8	1	1.2
E	3.15	3.3	3.45
E1	1.43	1.73	1.93
E2	2.9	3.05	3.2
e	0.65BSC		
H	0.2	0.35	0.5
K	0.57	0.77	0.87
L	0.3	0.4	0.5
L1/L2	0.1REF		
$\theta$	8°	10°	13°
N	0		0.15
d	0.3	0.4	0.5



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