

General Description

The WSD6023DN56 is the highest performance trench N-ch and P-ch MOSFET with extreme high cell density, which provide excellent RDSON and gate charge for most of the synchronous buck converter applications.

The WSD6023DN56 meet the RoHS and Green Product requirement 100% EAS guaranteed with full function reliability approved.

Features

- Reliable and Rugged
- Lead Free and Green Devices Available (RoHS Compliant)
- Moisture Sensitivity Level MSL1

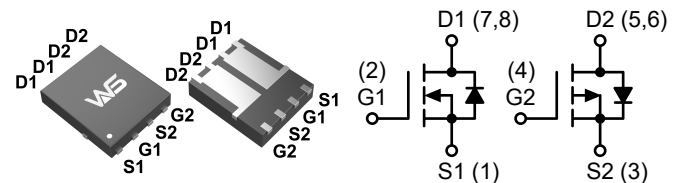
Product Summary

BV_{DSS}	$R_{DS(ON)}$	I_D
60V	25mΩ	23A
-60V	50mΩ	-18A

Applications

- Power Management in Notebook Computer, Portable Equipment and Battery Powered Systems.

DFN5X6C-8-EP2 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	±20	±20	V
$I_D@T_C=25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	23	-18	A
$I_D@T_C=100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	9	-7	A
I_{DM}	Pulsed Drain Current ²	60	-45	A
EAS	Single Pulse Avalanche Energy ³	16	56	mJ
I_{AS}	Avalanche Current	8	-15	A
$P_D@T_C=25^\circ C$	Total Power Dissipation ⁴	20.8	20.8	W
T_{STG}	Storage Temperature Range	-55 to 150	-55 to 150	°C
T_J	Operating Junction Temperature Range	-55 to 150	-55 to 150	°C

Thermal Data

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JA}$	Thermal Resistance Junction-Ambient ¹	---	75	°C/W
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	6	°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
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=10V, I_D=7A$	---	25	30	$m\Omega$
		$V_{GS}=4.5V, I_D=4A$	---	35	40	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\mu A$	1.0	1.8	2.5	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=48V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	μA
		$V_{DS}=48V, V_{GS}=0V, T_J=85^\circ\text{C}$	---	---	30	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	± 100	nA
R_G	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	2.8	---	Ω
Q_g	Total Gate Charge (4.5V)	$V_{DS}=30V, V_{GS}=10V, I_D=7A$	---	4.9	---	nC
Q_{gs}	Gate-Source Charge		---	1.7	---	
Q_{gd}	Gate-Drain Charge		---	2	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=30V, R_L=30\Omega, I_{DS}=1A, V_{GEN}=10V, R_G=6\Omega$	---	6	11	ns
T_r	Rise Time		---	10	18	
$T_{d(off)}$	Turn-Off Delay Time		---	5.3	10	
T_f	Fall Time		---	21	38	
C_{iss}	Input Capacitance	$V_{DS}=30V, V_{GS}=0V, f=1\text{MHz}$	---	550	715	pF
C_{oss}	Output Capacitance		---	60	---	
C_{rss}	Reverse Transfer Capacitance		---	31	---	

Diode Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V$, Force Current	---	---	23	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=4A, T_J=25^\circ\text{C}$	---	0.8	1.1	V
t_{rr}	Reverse Recovery Time	$I_F=7A, dI/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	21	---	nS
Q_{rr}	Reverse Recovery Charge		---	20	---	nC

Note :

1. The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
2. The data tested by pulsed, pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
3. The EAS data shows Max. rating. The test condition is $V_{DD}=25V, V_{GS}=10V, L=0.5mH, I_{AS}=8A$
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_D and I_{DM} , in real applications, should be limited by total power dissipation.

P-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
$R_{DS(ON)}$	Static Drain-Source On-Resistance ²	$V_{GS}=-10V, I_D=-7A$	---	50	55	m Ω
		$V_{GS}=-4.5V, I_D=-4A$	---	60	65	
$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.0	-1.8	-2.5	V
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-48V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	-1	μA
		$V_{DS}=-48V, V_{GS}=0V, T_J=85^\circ\text{C}$	---	---	-30	
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	-	± 100	nA
R_G	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	3	---	Ω
Q_g	Total Gate Charge (-4.5V)	$V_{DS}=-30V, V_{GS}=-10V, I_D=-7A$	---	11.4	---	nC
Q_{gs}	Gate-Source Charge		---	3.6	---	
Q_{gd}	Gate-Drain Charge		---	4.9	---	
$T_{d(on)}$	Turn-On Delay Time	$V_{DD}=-30V, R_L=30\Omega, I_{DS}=-1A, V_{GEN}=-10V, R_G=6\Omega$	---	8	14	ns
T_r	Rise Time		---	12	22	
$T_{d(off)}$	Turn-Off Delay Time		---	12	22	
T_f	Fall Time		---	40	72	
C_{iss}	Input Capacitance	$V_{DS}=-30V, V_{GS}=0V, f=1\text{MHz}$	---	1170	1520	pF
C_{oss}	Output Capacitance		---	113	---	
C_{rss}	Reverse Transfer Capacitance		---	66	---	

Diode Characteristics

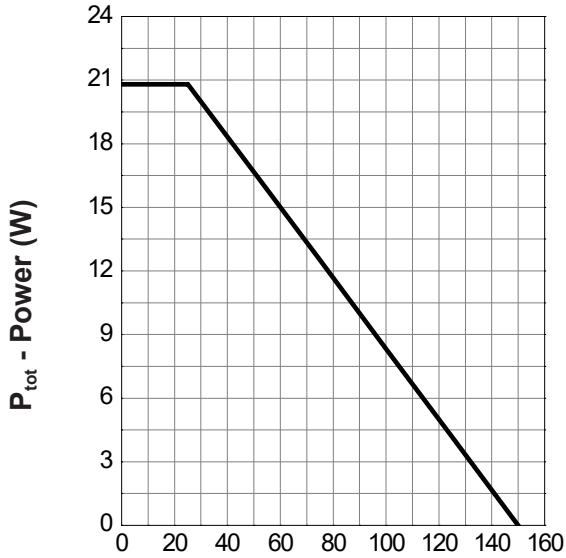
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V$, Force Current	---	---	-18	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-4A, T_J=25^\circ\text{C}$	---	-0.8	-1.1	V
t_{rr}	Reverse Recovery Time	$I_F=-7A, di/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	27	---	nS
Q_{rr}	Reverse Recovery Charge		---	32	---	nC

Note :

1. The data tested by surface mounted on a 1 inch² FR-4 board with 20Z copper.
2. The data tested by pulsed, pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$
3. The EAS data shows Max. rating. The test condition is $V_{DD}=-25V, V_{GS}=-10V, L=0.5mH, I_{AS}=-15A$
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.

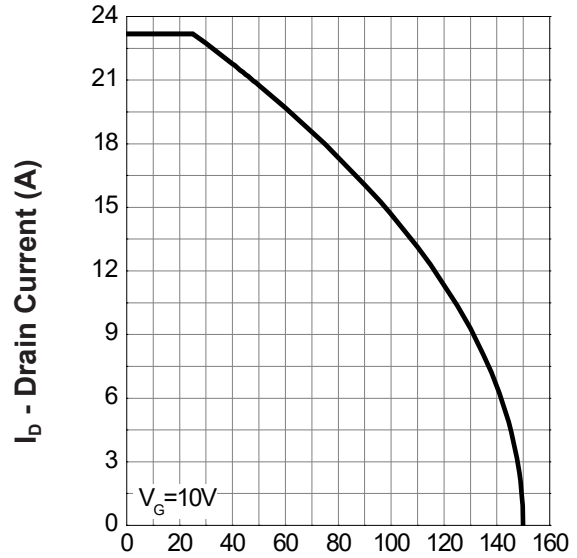
N-Channel Typical Characteristics

Power Dissipation



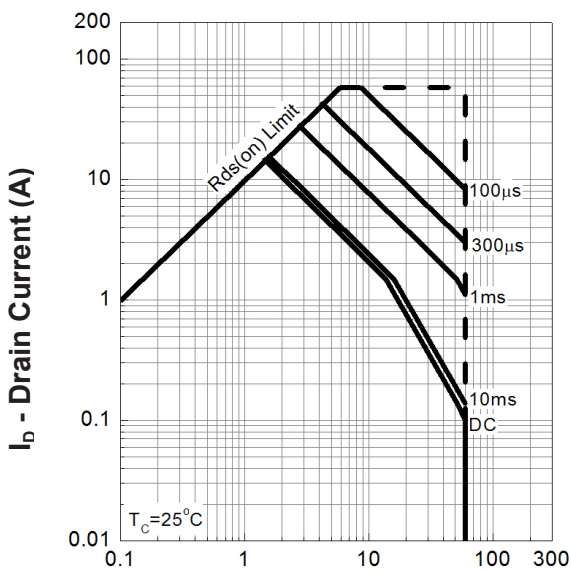
T_c - Case Temperature (°C)

Drain Current



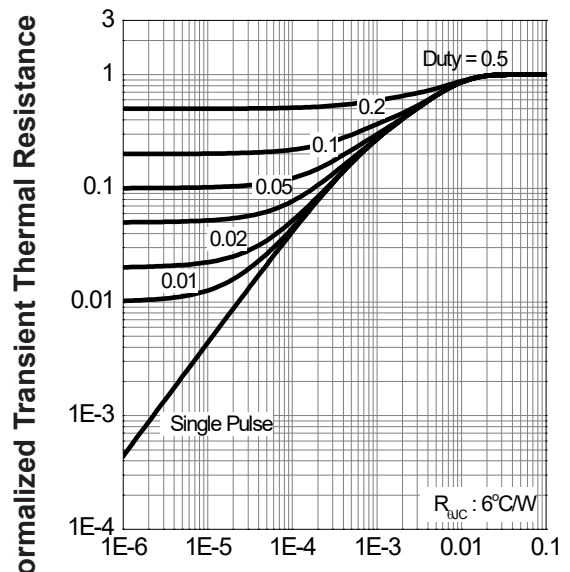
T_c - Case Temperature (°C)

Safe Operation Area



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

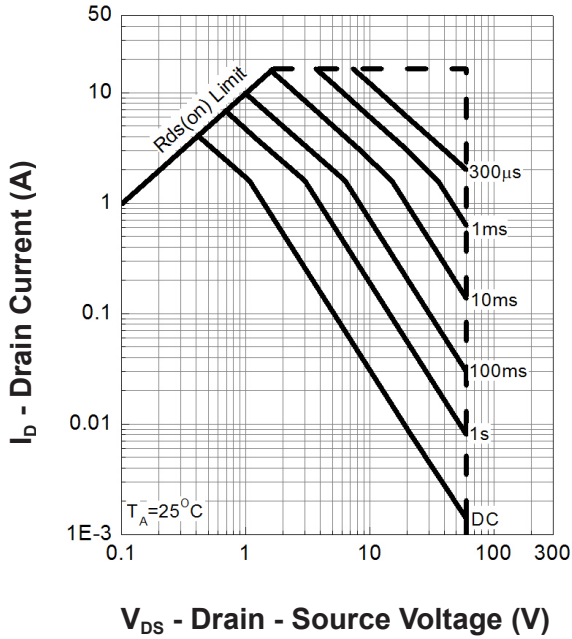
Thermal Transient Impedance



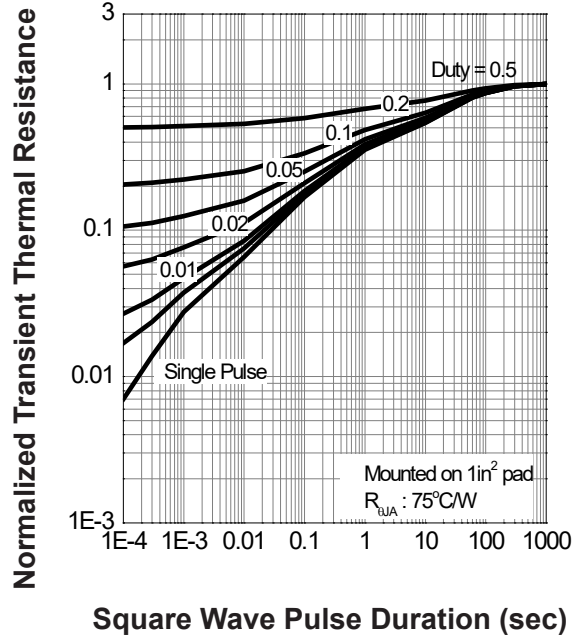
Square Wave Pulse Duration (sec)

N-Channel Typical Characteristics(Cont.)

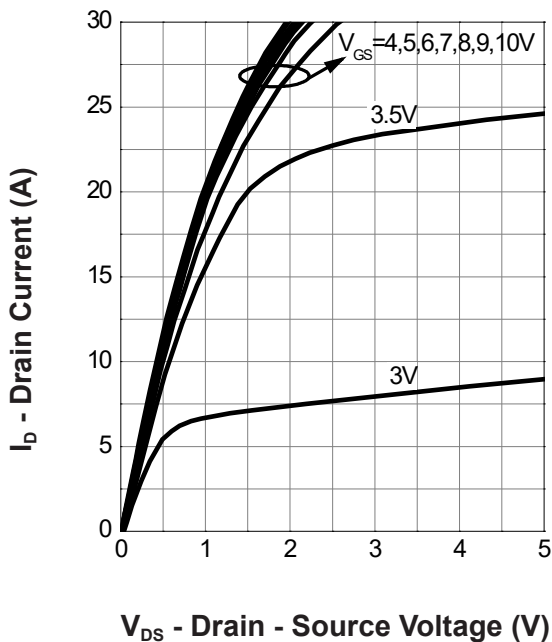
Safe Operation Area



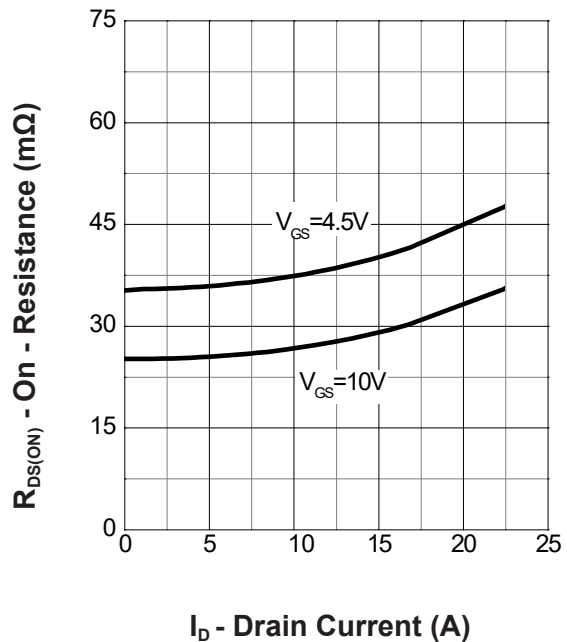
Thermal Transient Impedance



Output Characteristics

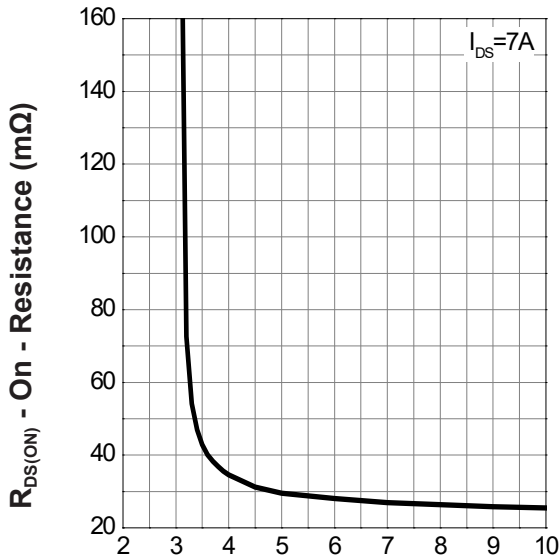


Drain-Source On Resistance



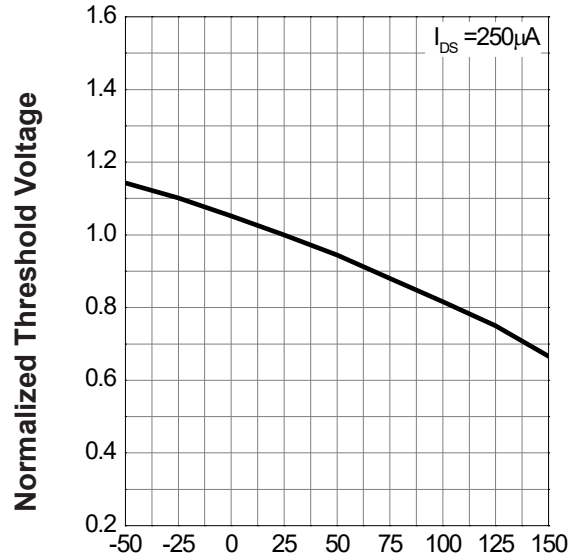
N-Channel Typical Characteristics(Cont.)

Gate-Source On Resistance



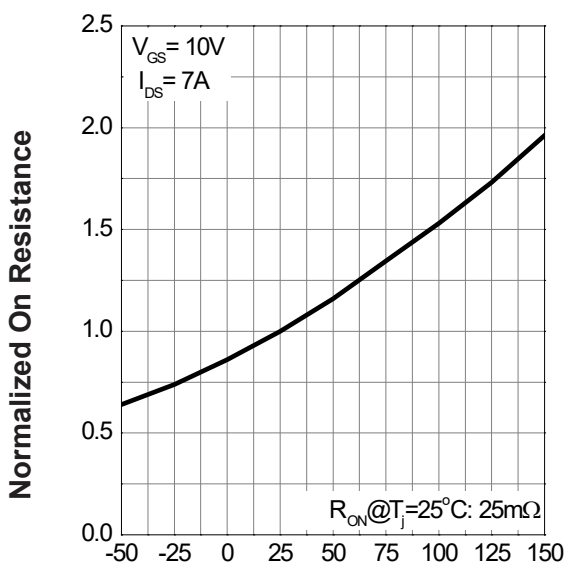
V_{GS} - Gate - Source Voltage (V)

Gate Threshold Voltage



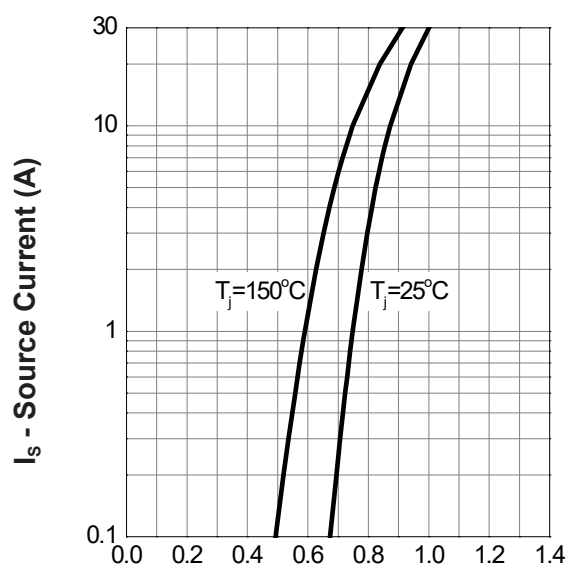
T_j - Junction Temperature (°C)

Drain-Source On Resistance



T_j - Junction Temperature (°C)

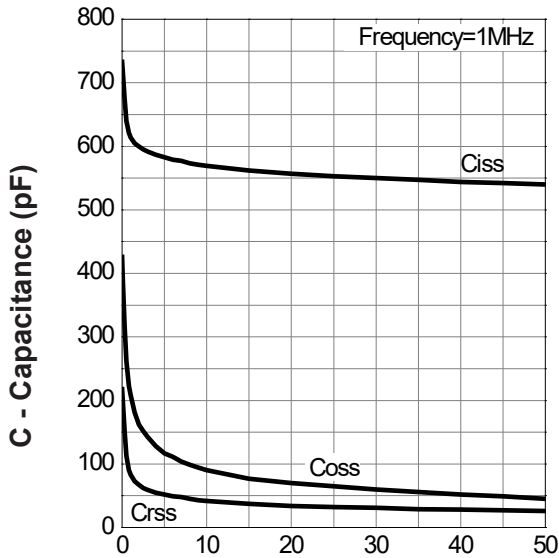
Source-Drain Diode Forward



V_{SD} - Source - Drain Voltage (V)

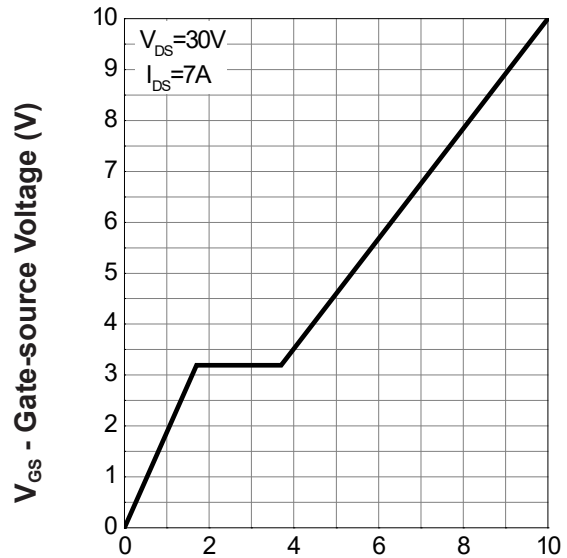
N-Channel Typical Characteristics(Cont.)

Capacitance



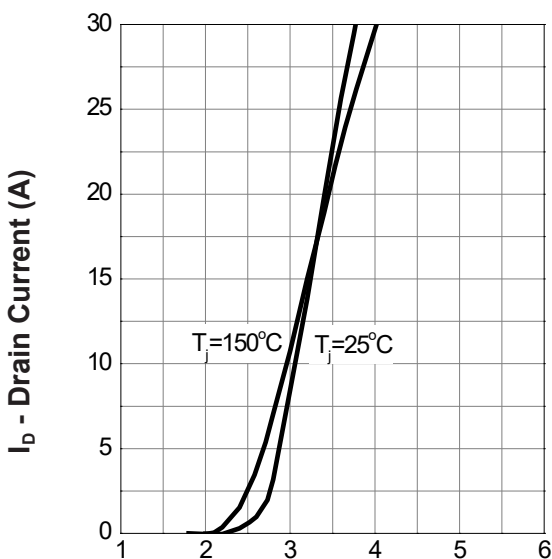
V_{DS} - Drain-Source Voltage (V)

Gate Charge



Q_G - Gate Charge (nC)

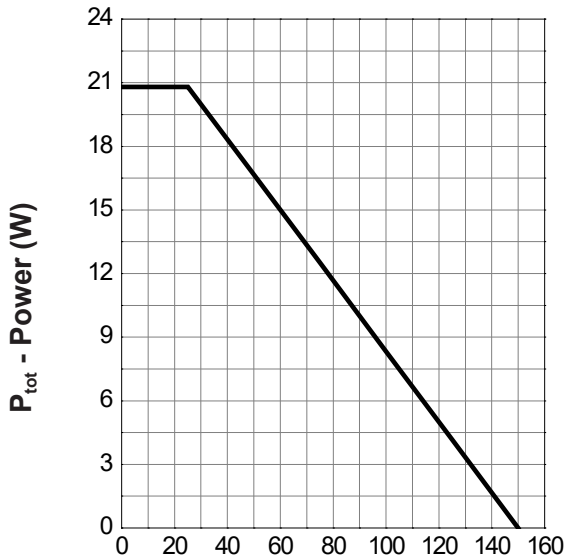
Transfer Characteristics



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

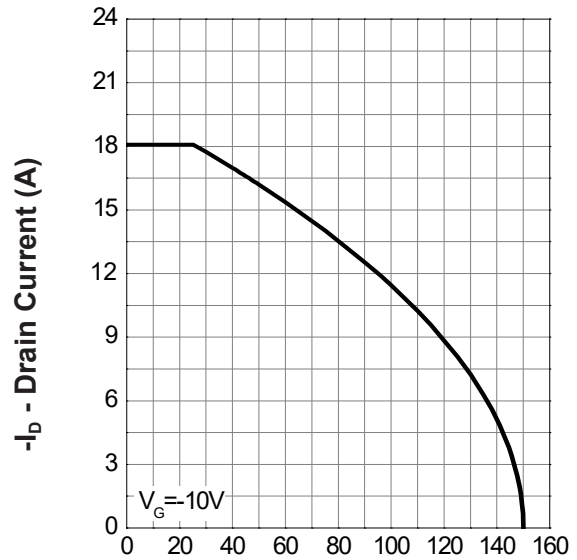
P-Channel Typical Characteristics

Power Dissipation



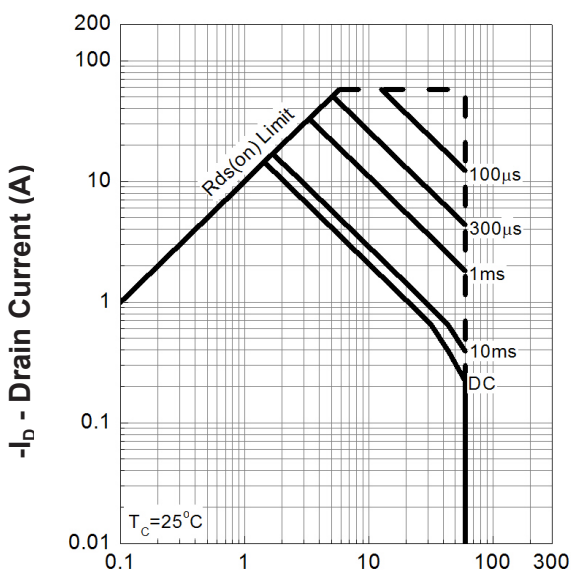
T_c - Case Temperature (°C)

Drain Current



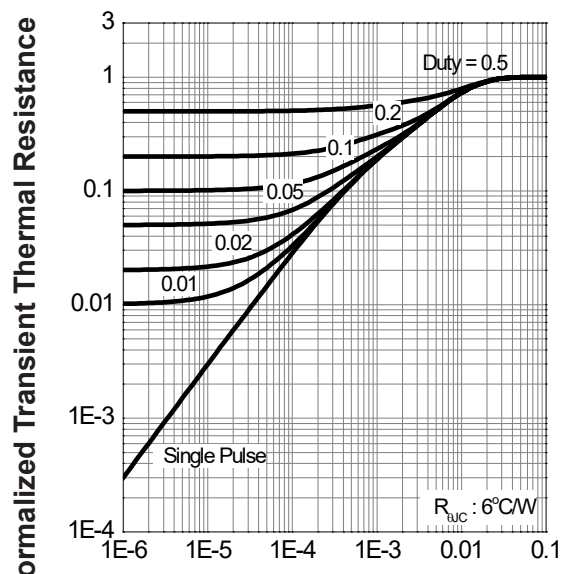
T_c - Case Temperature (°C)

Safe Operation Area



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

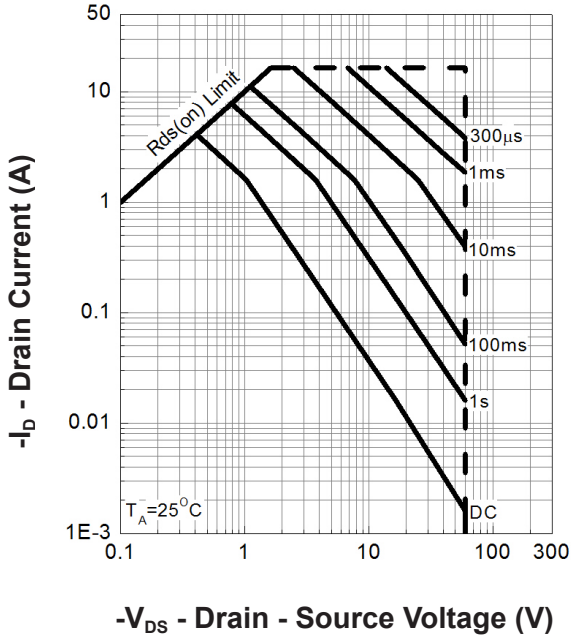
Thermal Transient Impedance



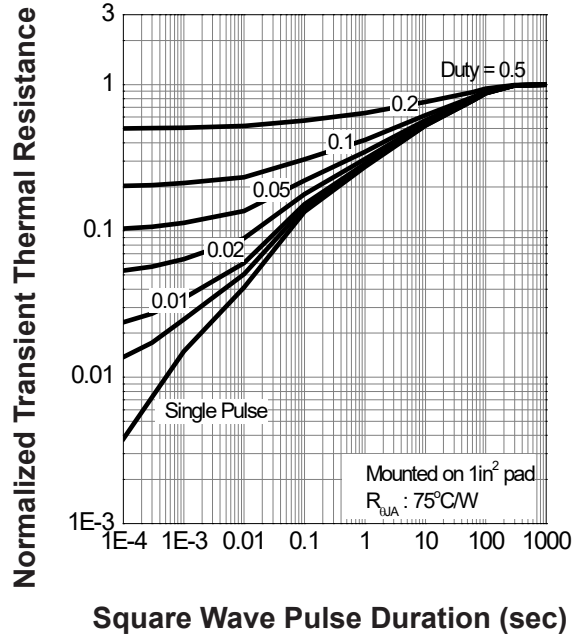
Square Wave Pulse Duration (sec)

P-Channel Typical Characteristics(Cont.)

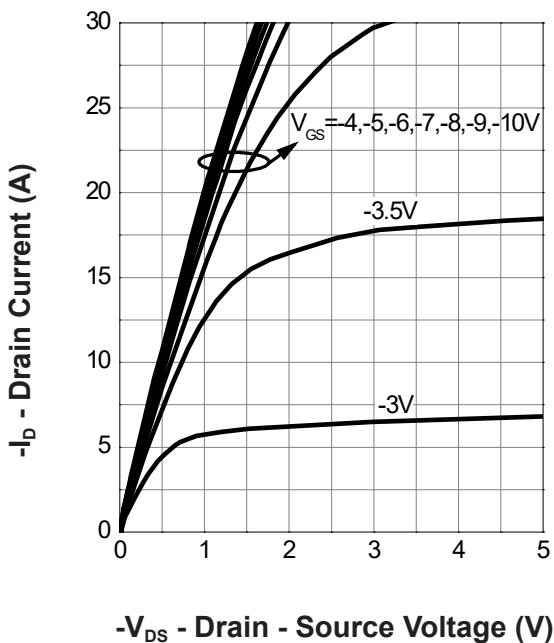
Safe Operation Area



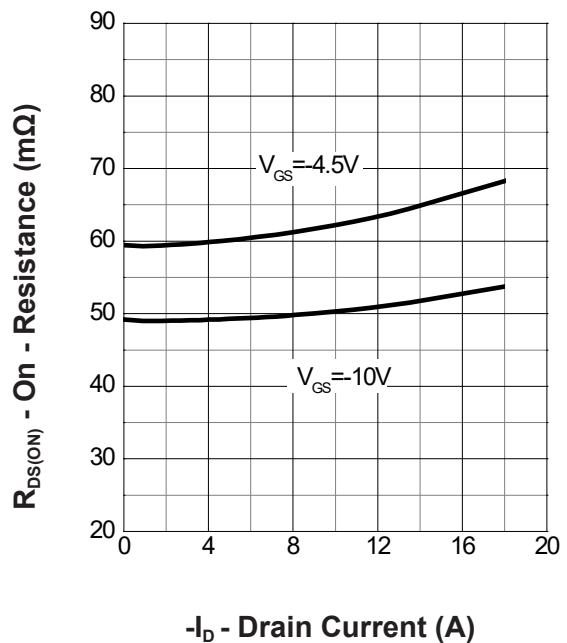
Thermal Transient Impedance



Output Characteristics

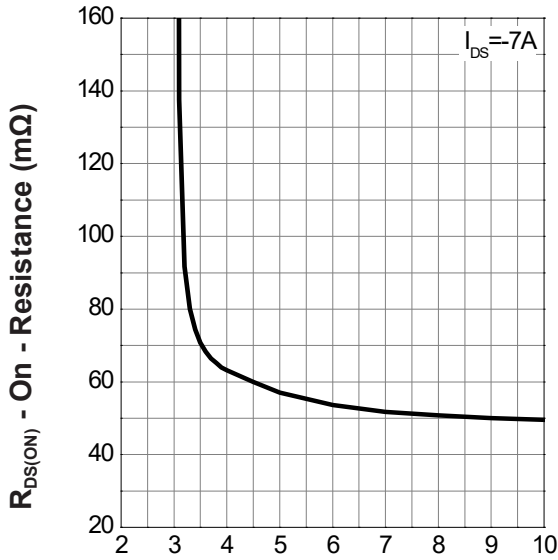


Drain-Source On Resistance



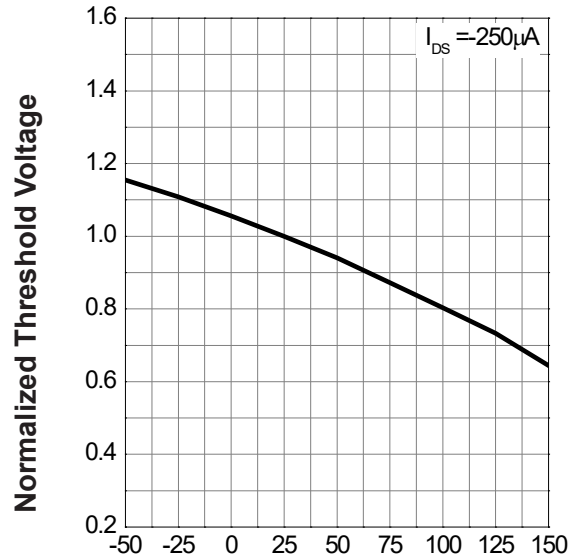
P-Channel Typical Characteristics(Cont.)

Gate-Source On Resistance



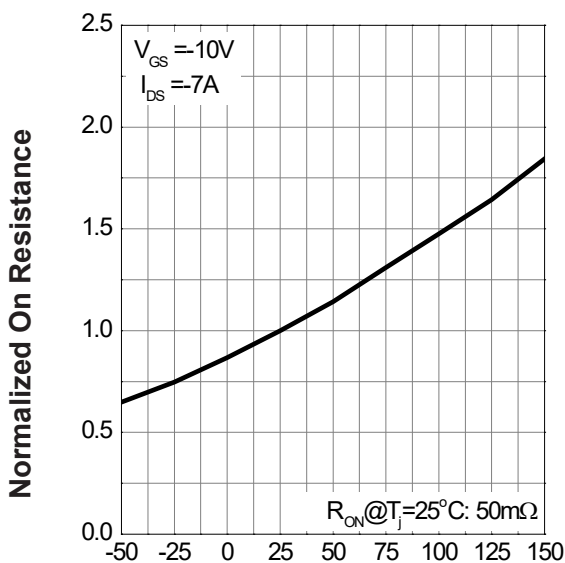
$-V_{GS}$ - Gate - Source Voltage (V)

Gate Threshold Voltage



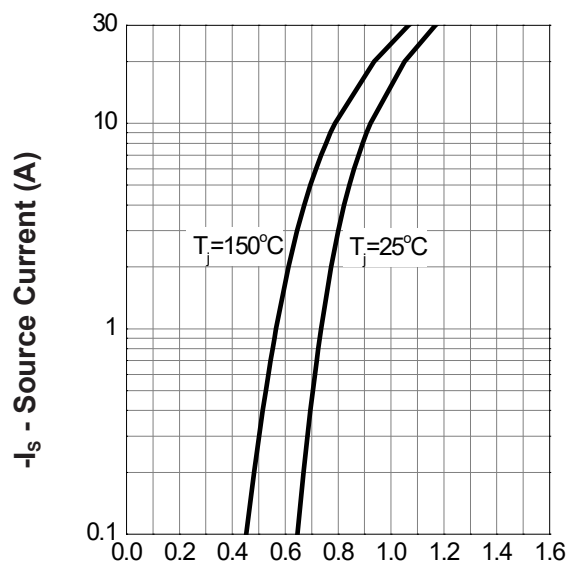
T_j - Junction Temperature (°C)

Drain-Source On Resistance



T_j - Junction Temperature (°C)

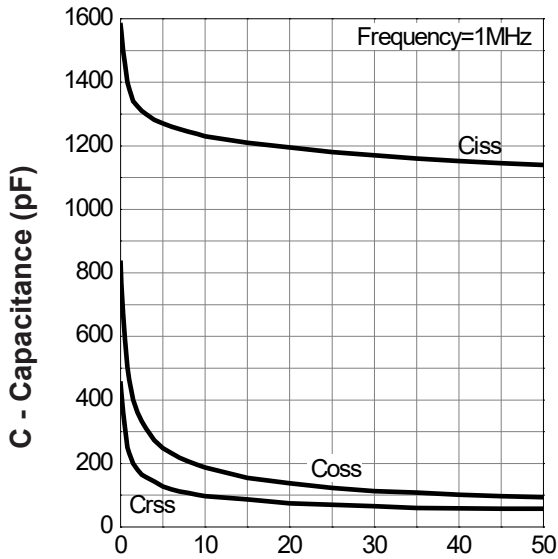
Source-Drain Diode Forward



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

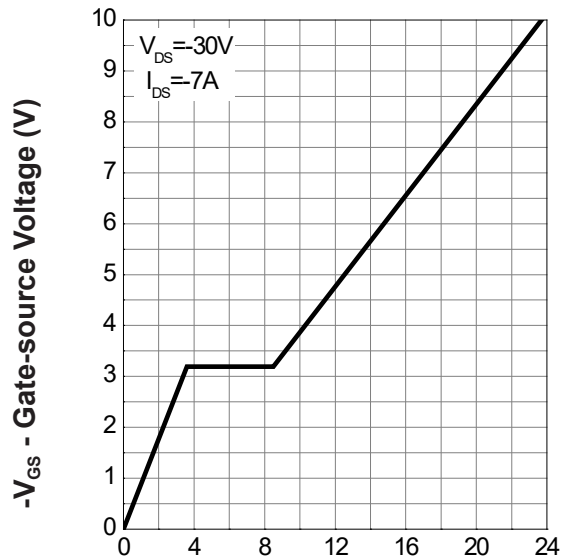
P-Channel Typical Characteristics(Cont.)

Capacitance



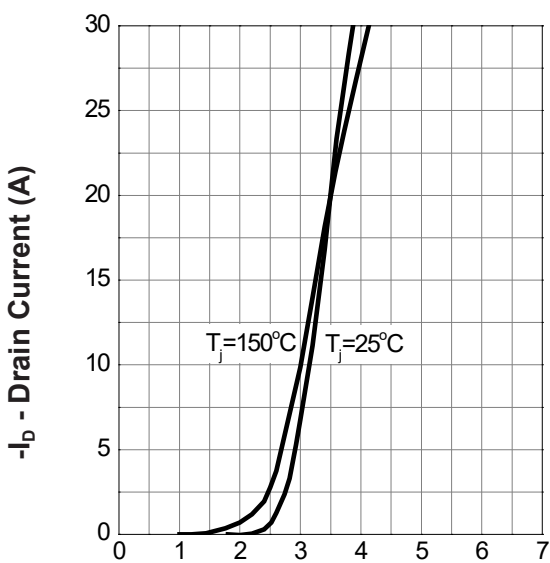
$-V_{DS}$ - Drain-Source Voltage (V)

Gate Charge

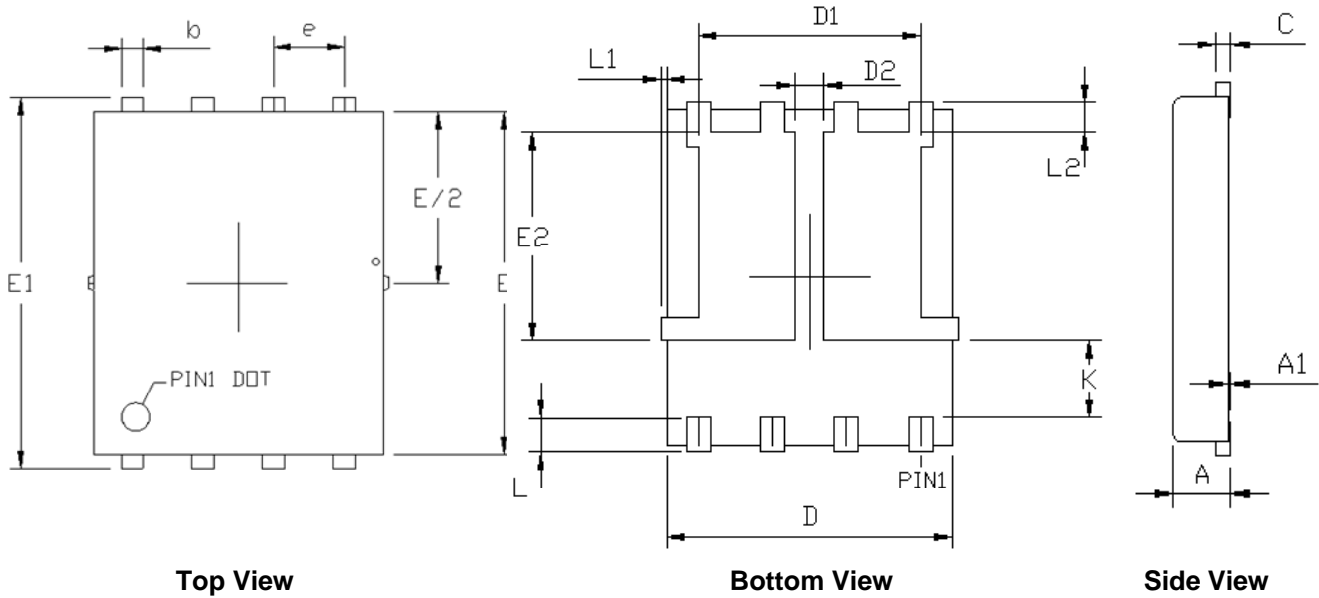


Q_G - Gate Charge (nC)

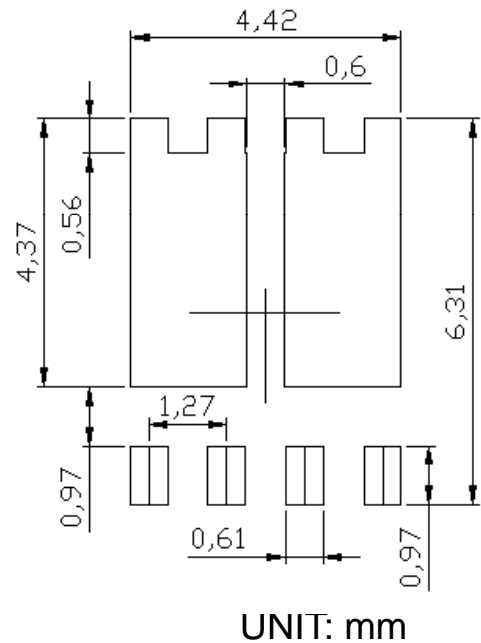
Transfer Characteristics



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

Packaging information

RECOMMENDED LAND PATTERN

SYMBOLS	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	0.900	1.200	0.035	0.047
A1	0.000	0.050	0.000	0.002
b	0.300	0.500	0.012	0.020
c	0.150	0.300	0.006	0.012
D	4.800	5.000	0.189	0.197
D1	3.550	4.550	0.140	0.179
D2	0.500	0.910	0.020	0.036
E	5.650	5.850	0.222	0.230
E1	5.900	6.200	0.232	0.244
E2	3.200	3.780	0.126	0.149
e	1.27 BSC		0.050 BSC	
K	1.100	-	0.043	-
L	0.500	0.800	0.020	0.031
L1	0.000	0.150	0.000	0.006
L2	0.325	0.610	0.013	0.024



UNIT: mm



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[TK16J60W,S1VQ\(O](#) [2SK2614\(TE16L1,Q\)](#) [DMN1017UCP3-7](#) [DMN1053UCP4-7](#) [SQJ469EP-T1-GE3](#) [NTE2384](#) [DMC2700UDMQ-7](#)
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