

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

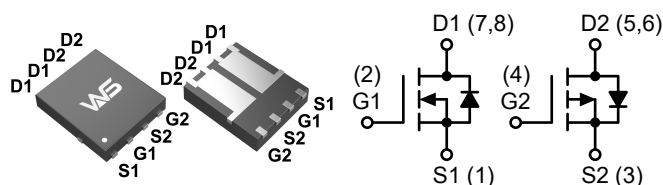
Product Summary

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	$^\circ C$
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 ¹	---	75	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case ¹	---	6	$^\circ C/W$

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
$R_{DS(ON)}$	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	$m\Omega$
		$V_{GS}=-4.5V, I_D=-4A$	---	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

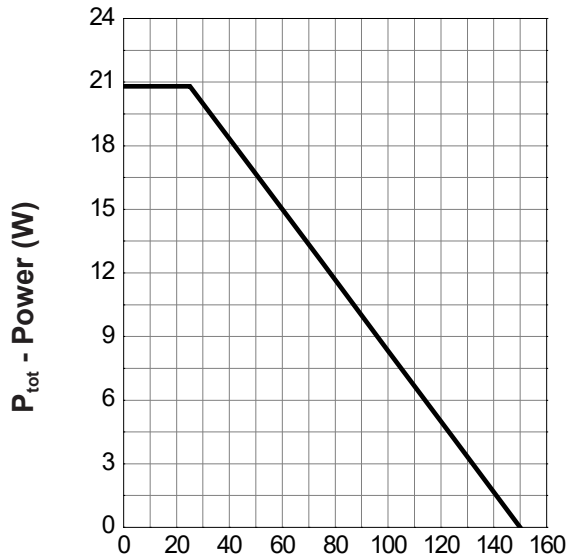
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_S	Continuous Source Current ^{1,6}	$V_G=V_D=0V$, Force Current	---	---	-18	A
V_{SD}	Diode Forward Voltage ²	$V_{GS}=0V, I_S=-4A, T_J=25^\circ\text{C}$	---	-0.8	-1.1	V
t_{rr}	Reverse Recovery Time	$I_F=-7A, dI/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	27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

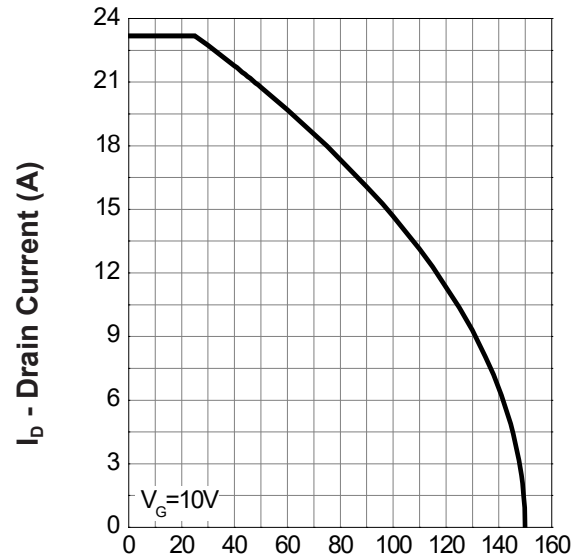
N-Channel Typical Characteristics

Power Dissipation



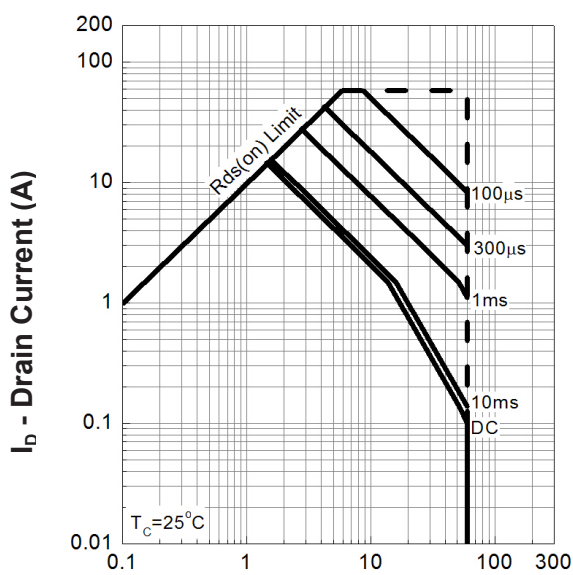
T_c - Case Temperature ($^{\circ}C$)

Drain Current



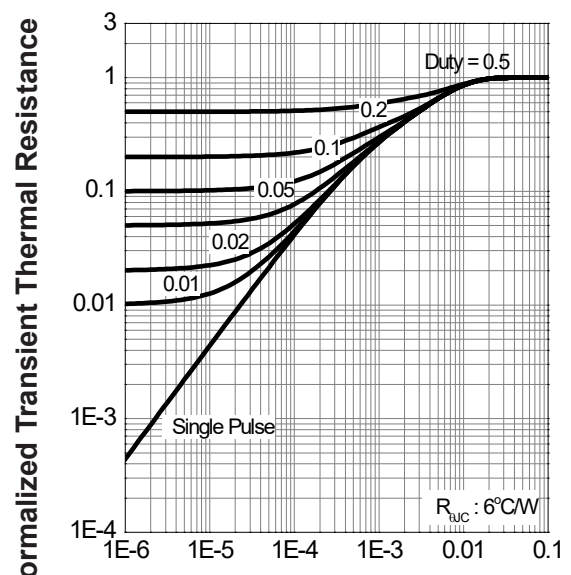
T_c - Case Temperature ($^{\circ}C$)

Safe Operation Area



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

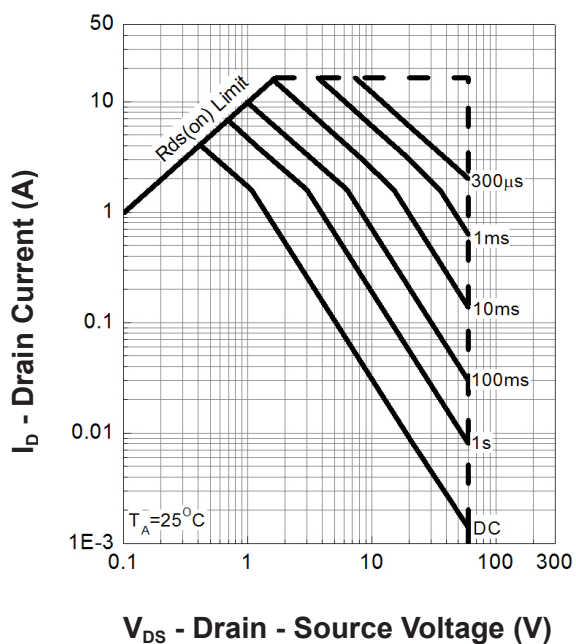
Thermal Transient Impedance



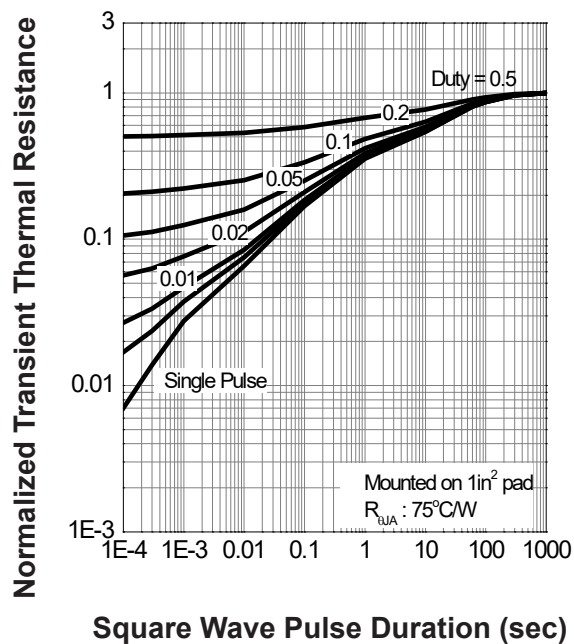
Square Wave Pulse Duration (sec)

N-Channel Typical Characteristics(Cont.)

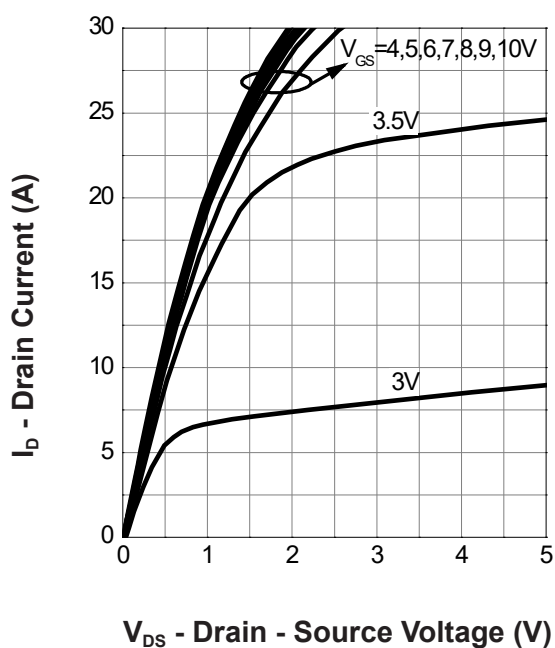
Safe Operation Area



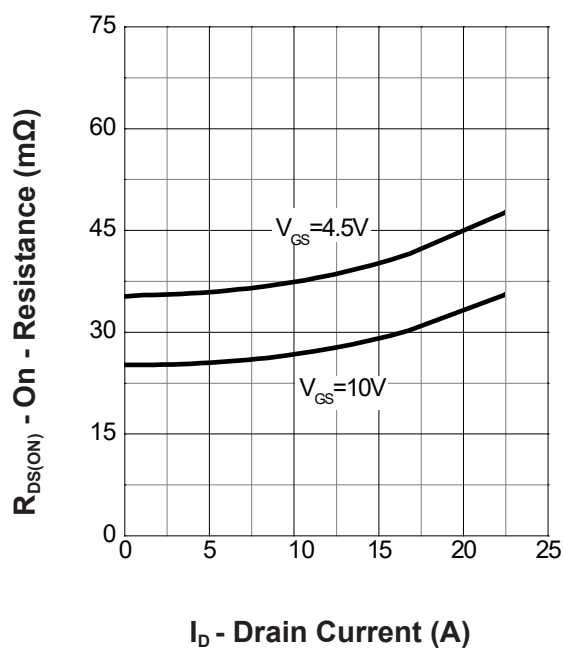
Thermal Transient Impedance



Output Characteristics

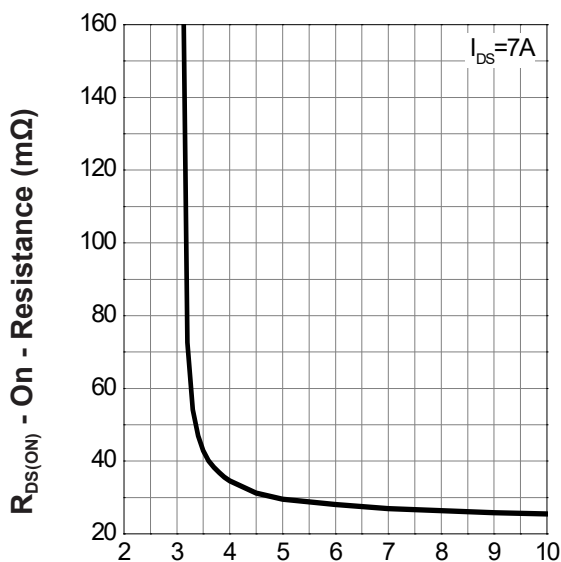


Drain-Source On Resistance



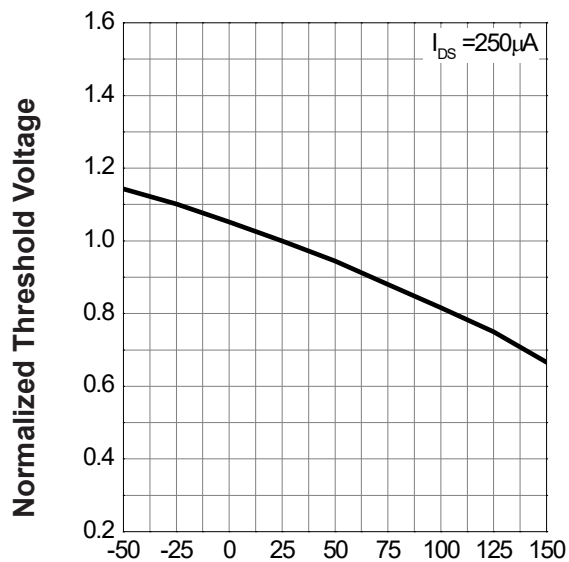
N-Channel Typical Characteristics(Cont.)

Gate-Source On Resistance



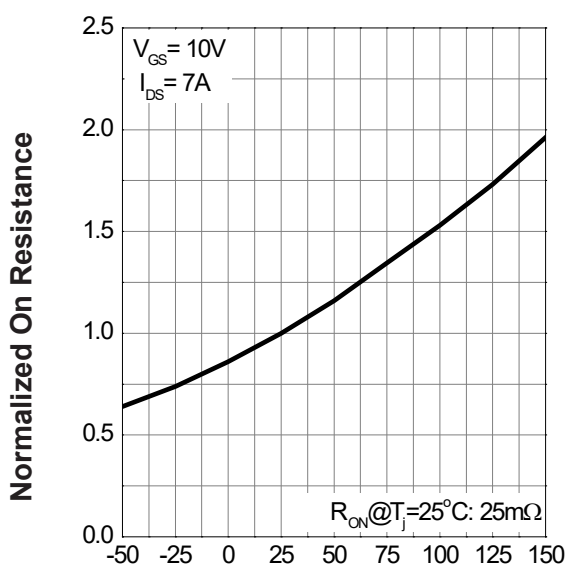
V_{GS} - Gate - Source Voltage (V)

Gate Threshold Voltage



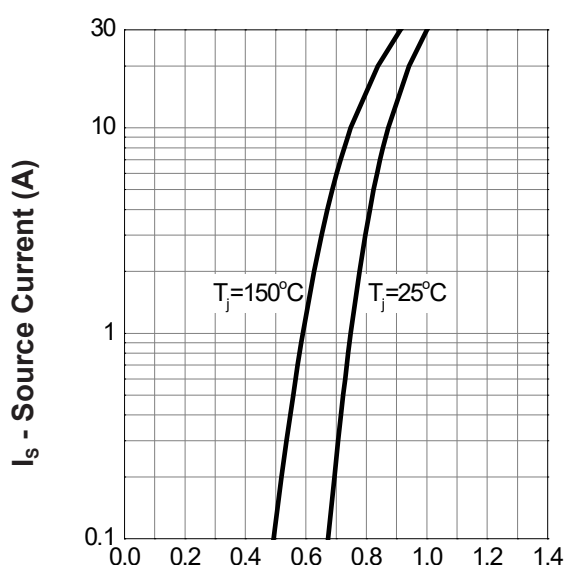
T_J - Junction Temperature (°C)

Drain-Source On Resistance



T_J - Junction Temperature (°C)

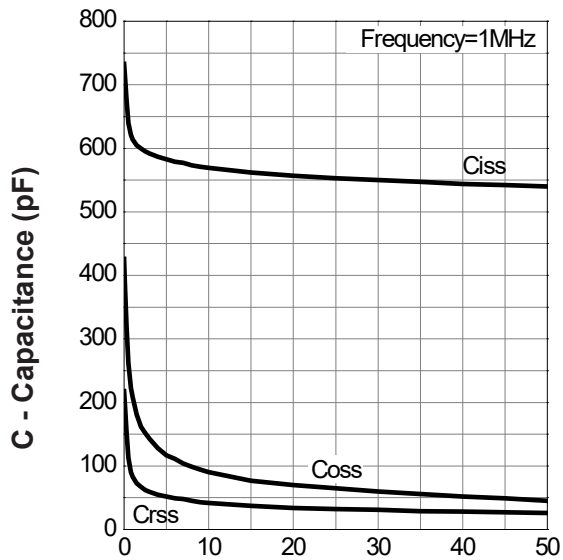
Source-Drain Diode Forward



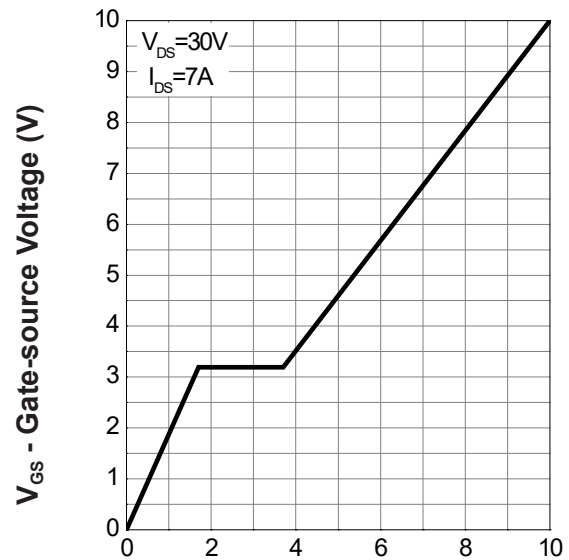
V_{SD} - Source - Drain Voltage (V)

N-Channel Typical Characteristics(Cont.)

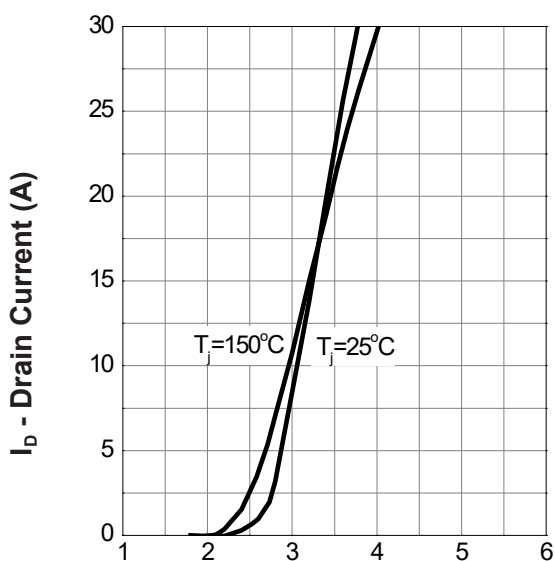
Capacitance



Gate Charge

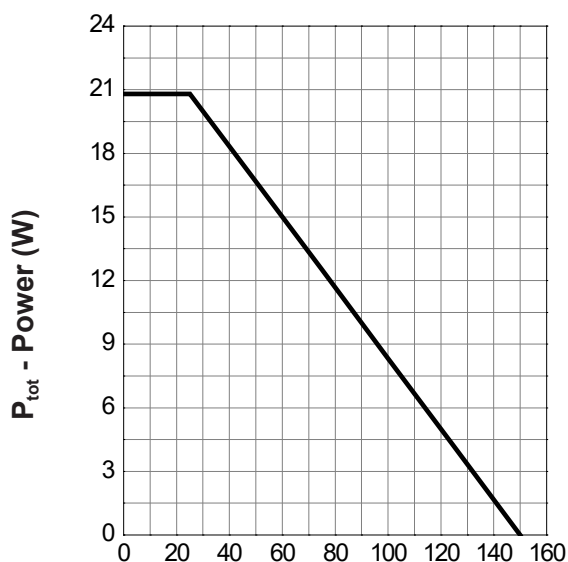


Transfer Characteristics



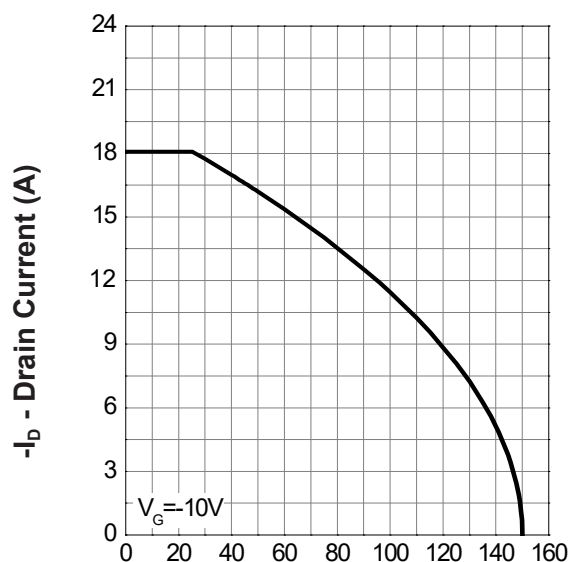
P-Channel Typical Characteristics

Power Dissipation



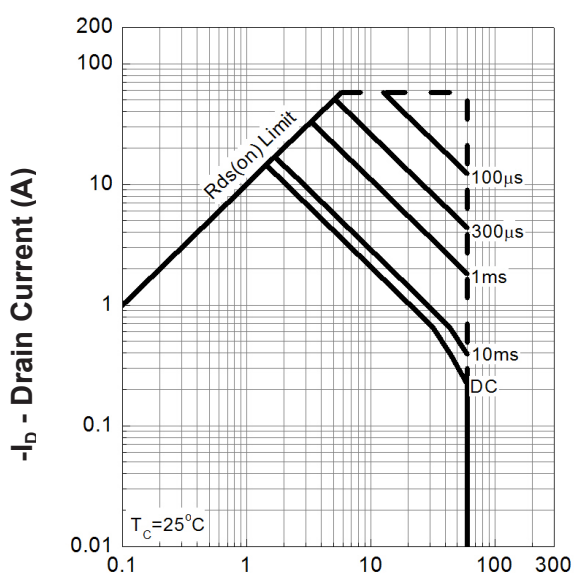
T_c - Case Temperature (°C)

Drain Current



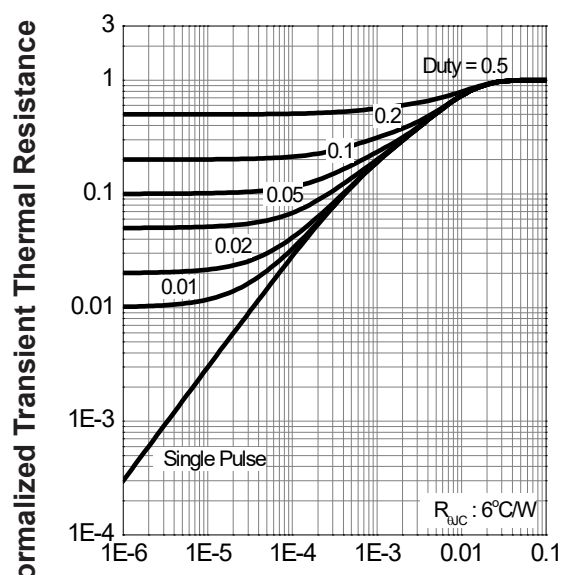
T_c - Case Temperature (°C)

Safe Operation Area



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

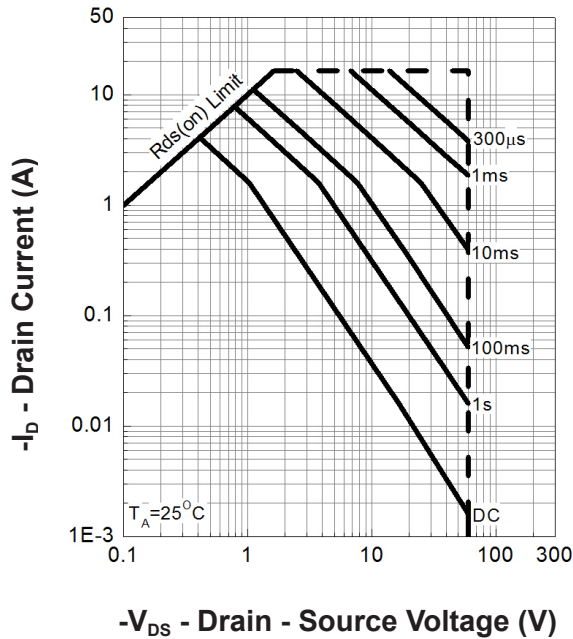
Thermal Transient Impedance



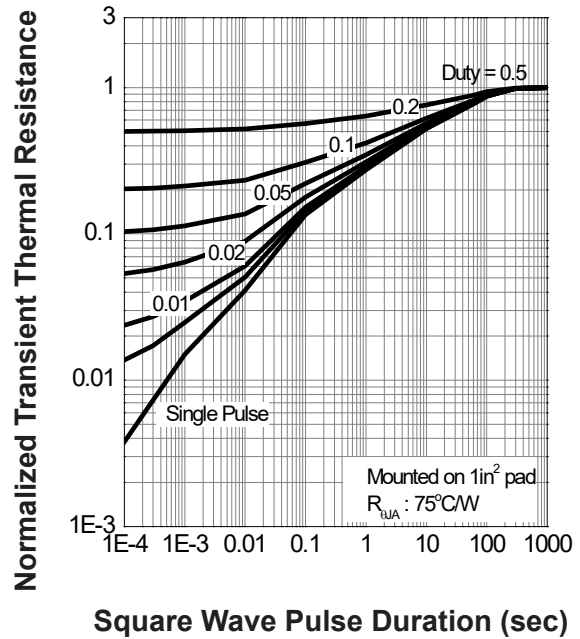
Square Wave Pulse Duration (sec)

P-Channel Typical Characteristics(Cont.)

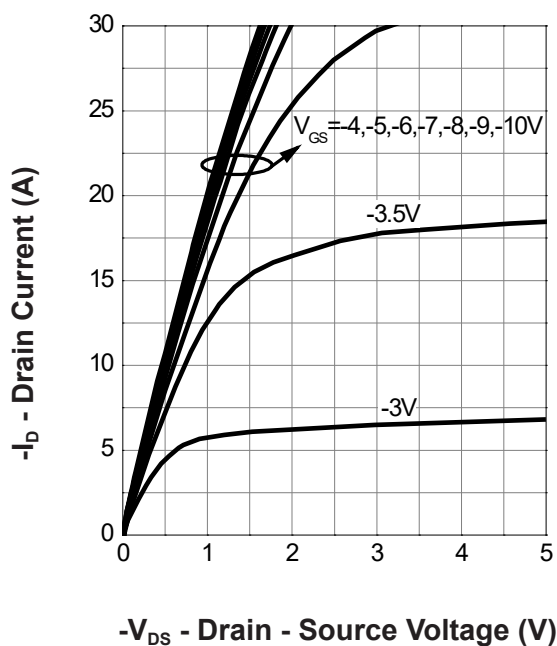
Safe Operation Area



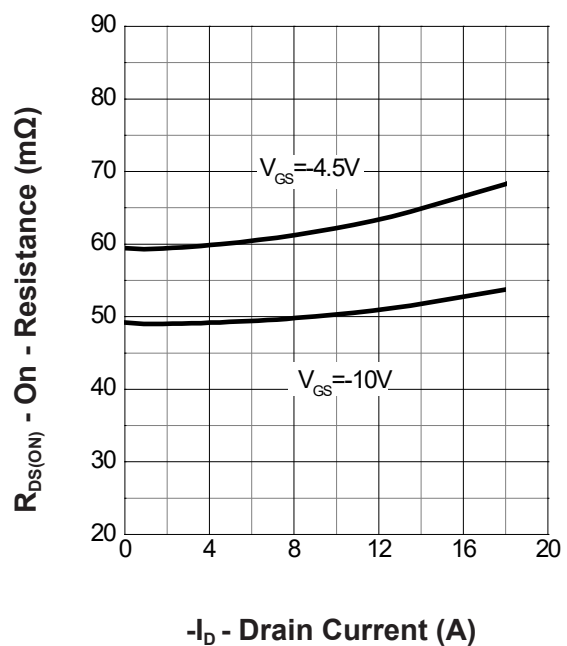
Thermal Transient Impedance



Output Characteristics

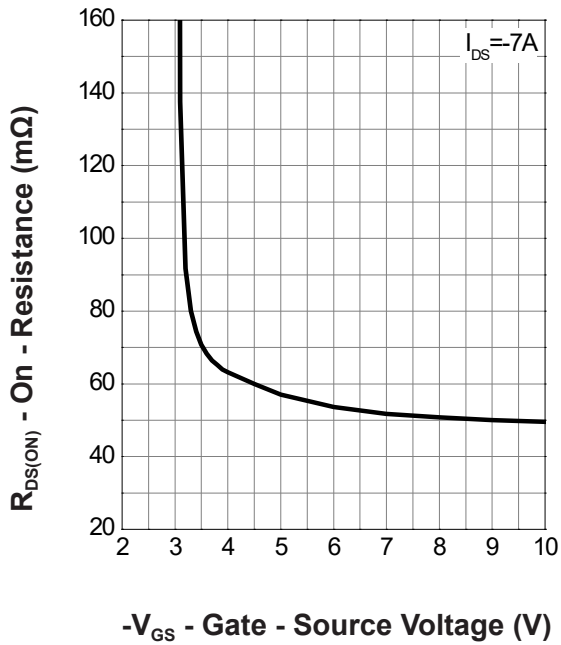


Drain-Source On Resistance

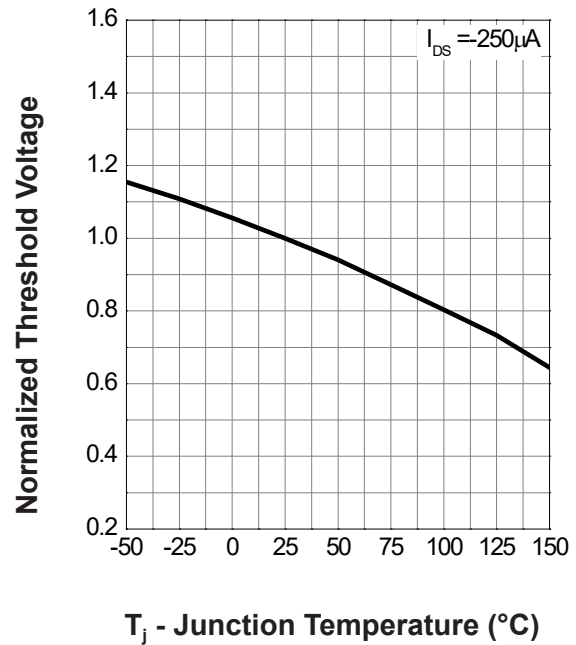


P-Channel Typical Characteristics(Cont.)

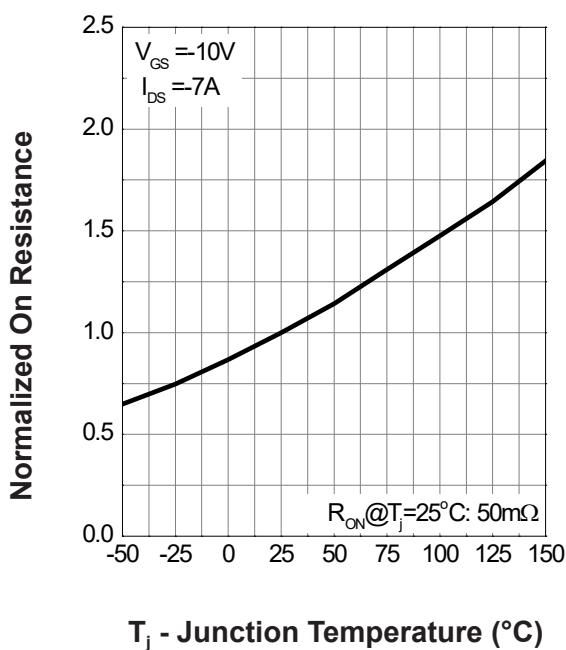
Gate-Source On Resistance



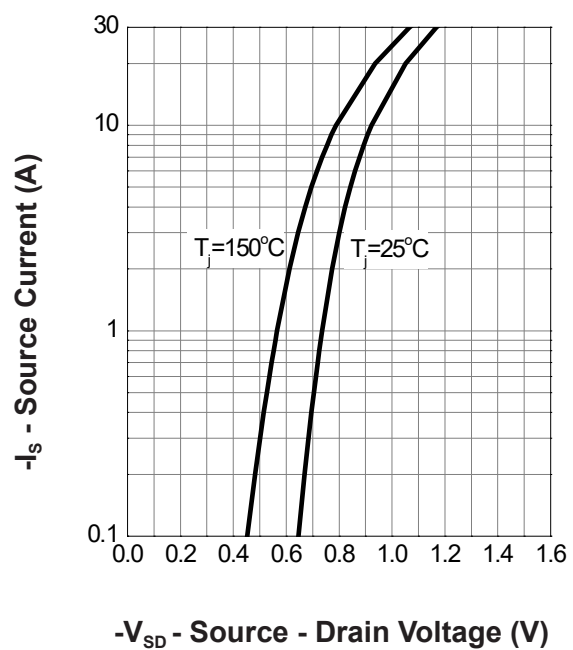
Gate Threshold Voltage



Drain-Source On Resistance

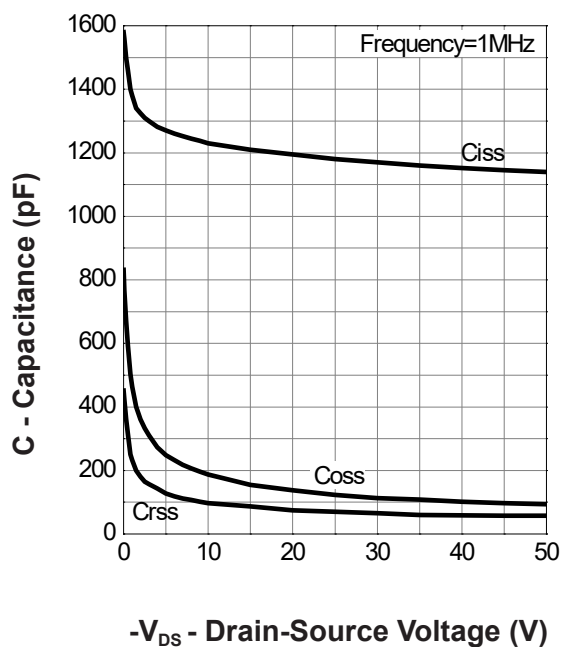


Source-Drain Diode Forward

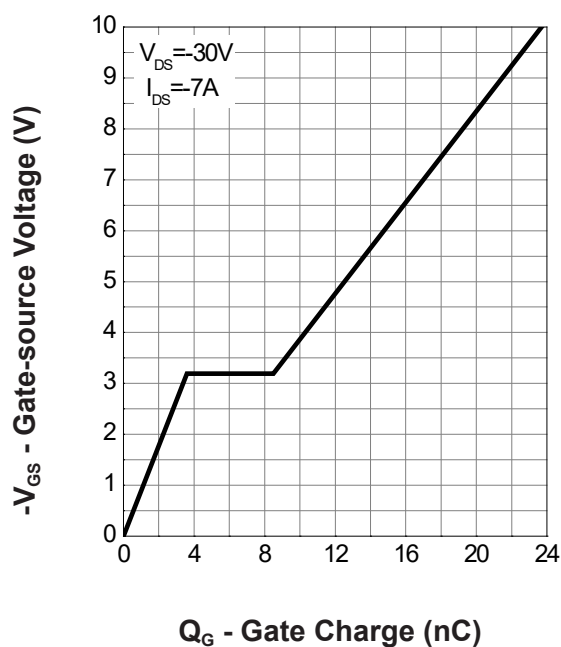


P-Channel Typical Characteristics(Cont.)

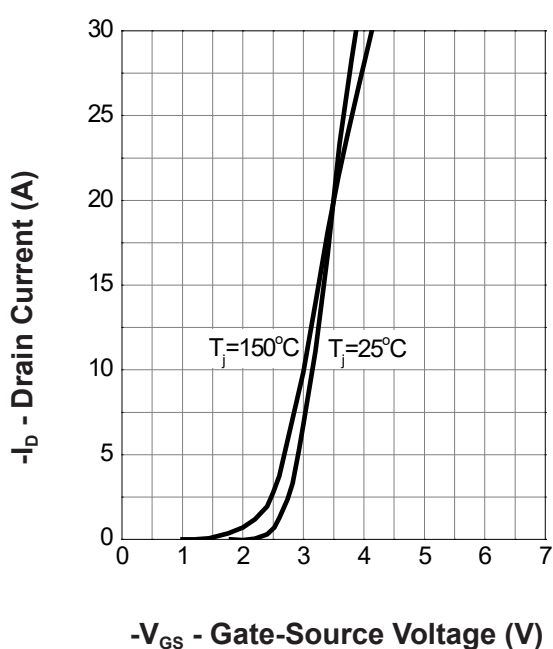
Capacitance

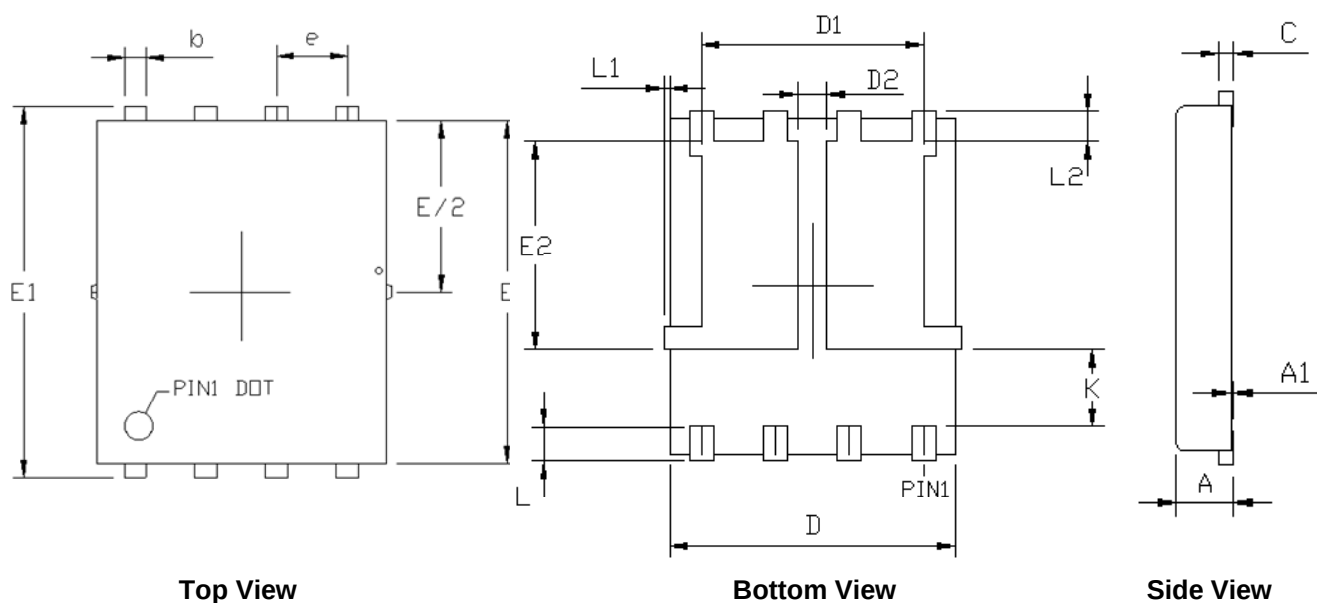


Gate Charge

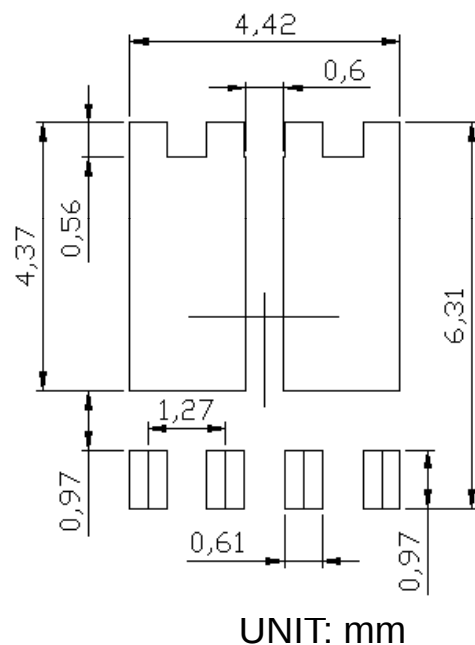


Transfer Characteristics



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





Attention

- 1, Any and all Winsok power products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your Winsok power representative nearest you before using any Winsok power products described or contained herein in such applications.
- 2, Winsok power assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all Winsok power products described or contained herein.
- 3, Specifications of any and all Winsok power products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- 4, Winsok power Semiconductor CO., LTD. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- 5, In the event that any or all Winsok power products (including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- 6, No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of Winsok power Semiconductor CO., LTD.
- 7, Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. Winsok power believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.
- 8, Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the Winsok power product that you intend to use.
- 9, this catalog provides information as of Sep. 2014. Specifications and information herein are subject to change without notice.