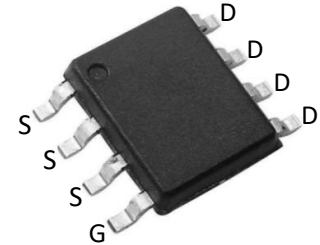


## N and P-Channel Enhancement Mode Power MOSFET

### Description:

This N+P Channel MOSFET uses advanced trench technology and design to provide excellent  $R_{DS(on)}$  with low gate charge. It can be used in a wide variety of applications.

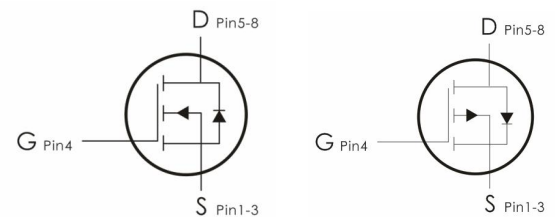


### Features:

N-Channel:  $V_{DS}=40V, I_D=-10A, R_{DS(ON)} < 22m\Omega @ V_{GS}=-10V$

P-Channel:  $V_{DS}=-40V, I_D=-8A, R_{DS(ON)} < 53m\Omega @ V_{GS}=-10V$

- 1)
- 2) Low gate charge.
- 3) Green device available.
- 4) Advanced high cell density trench technology for ultra low  $R_{DS(ON)}$ .
- 5) Excellent package for good heat dissipation.



### Absolute Maximum Ratings: ( $T_A=25^\circ C$ unless otherwise noted)

Symbol	Parameter	N-Channel	P-Channel	Units
$V_{DS}$	Drain-Source Voltage	40	-40	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D$	Continuous Drain Current- $T_A=25^\circ C$	10	-8	A
	Continuous Drain Current- $T_A=100^\circ C$	6.5	-5.0	
$I_{DM}$	Pulsed Drain Current <sup>note1</sup>	35	-28	A
$E_{AS}$	Single Pulsed Avalanche Energy <sup>note2</sup>	13	17.6	mJ
$P_D$	Power Dissipation - $T_A=25^\circ C$	2.0	3.2	W
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150		$^\circ C$

### Thermal Characteristics:

Symbol	Parameter	N-CH	P-CH	Units
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	62.5	39	$^\circ C/W$

**N-Channel Electrical Characteristics:** ( $T_J=25^\circ\text{C}$  unless otherwise noted)

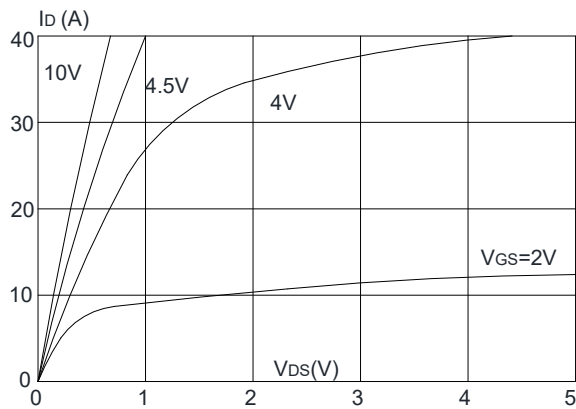
Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
<b>BV<sub>DSS</sub></b>	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\ \mu\text{A}$	40	---	---	V
<b>I<sub>DSS</sub></b>	Zero Gate Voltage Drain Current	$V_{GS}=0V, V_{DS}=40V$	---	---	1	$\mu\text{A}$
<b>I<sub>GSS</sub></b>	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0A$	---	---	$\pm 100$	nA
<b>On Characteristics<sup>3</sup></b>						
<b>V<sub>GS(th)</sub></b>	GATE-Source Threshold Voltage	$V_{GS}=V_{DS}, I_D=250\ \mu\text{A}$	1	1.5	2.5	V
<b>R<sub>DS(on)</sub></b>	Drain-Source On Resistance <sup>note3</sup>	$V_{GS}=10V, I_D=10A$	---	17	22	m $\Omega$
		$V_{GS}=4.5V, I_D=6.5A$	---	25	35	
<b>Dynamic Characteristics<sup>4</sup></b>						
<b>C<sub>iss</sub></b>	Input Capacitance	$V_{DS}=20V, V_{GS}=0V, f=1\text{MHz}$	---	620	---	pF
<b>C<sub>oss</sub></b>	Output Capacitance		---	65	---	
<b>C<sub>rss</sub></b>	Reverse Transfer Capacitance		---	55	---	
<b>Q<sub>g</sub></b>	Gate Charge	$V_{GS}=8V, V_{DS}=20V$ $I_D=10A$	---	12	---	nC
<b>Q<sub>gs</sub></b>	Gate-Source Charge		---	3.2	---	
<b>Q<sub>gd</sub></b>	Gate-Drain Charge		---	3.1	---	
<b>Switching Characteristics<sup>4</sup></b>						
<b>t<sub>d(on)</sub></b>	Turn-On Delay Time	$V_{DS}=20V, R_L=2.5\ \Omega,$ $R_{REN}=3\ \Omega, V_{GS}=10V$	---	4	---	ns
<b>t<sub>r</sub></b>	Rise Time		---	3	---	ns
<b>t<sub>d(off)</sub></b>	Turn-Off Delay Time		---	15	---	ns
<b>t<sub>f</sub></b>	Fall Time		---	2	---	ns
<b>Drain-Source Diode Characteristics</b>						
<b>I<sub>S</sub></b>	Continuous Drain to Source Diode	---	---	---	10	A
<b>I<sub>SM</sub></b>	Pulsed Drain to Source Diode	---	---	---	35	A

$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS}=0V, I_S=8A$	---	---	1.2	V
----------	------------------------------------	---------------------	-----	-----	-----	---

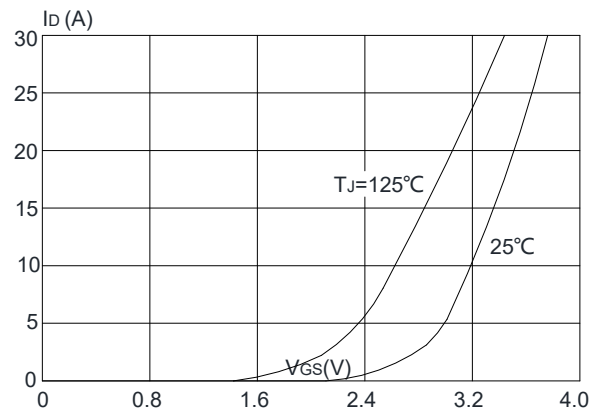
### Notes:

1. Repetitive Rating: Pulse Width Limited by Maximum Junction Temperature
2. EAS condition :  $T_J=25^\circ C, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega, I_{AS}=7.2A$   
 $T_J=25^\circ C, V_{DD}=-20V, V_G=-10V, L=0.5mH, R_g=25\Omega, I_{AS}=-8.4A$
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$

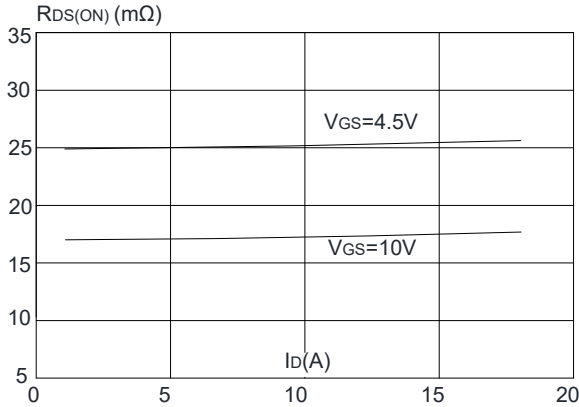
## Typical Performance Characteristics-N



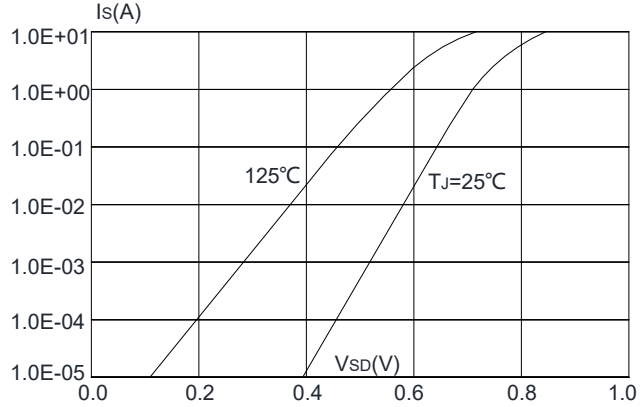
**Figure 1:** Output Characteristics



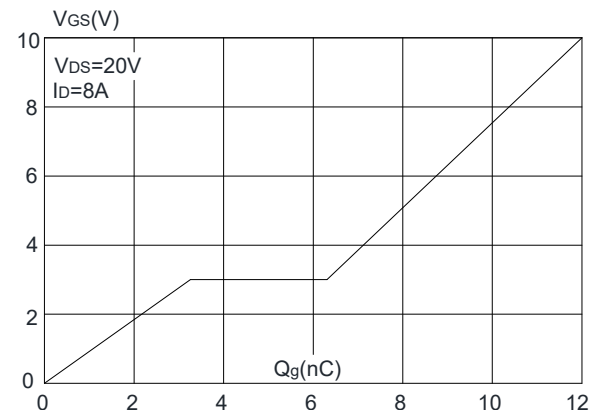
**Figure 2:** Typical Transfer Characteristics



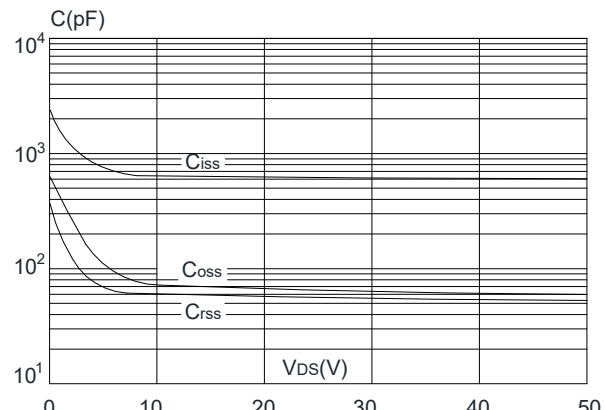
**Figure 3:** On-resistance vs. Drain Current



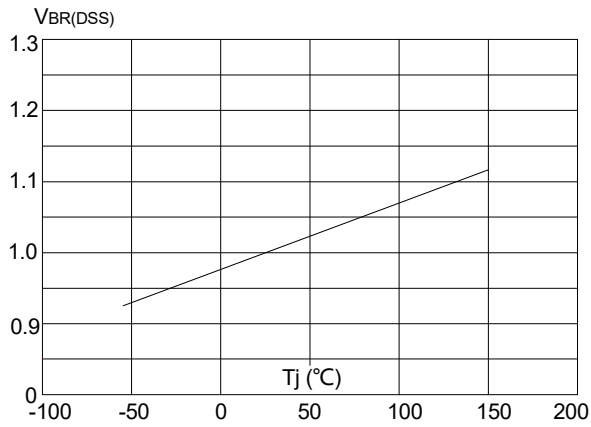
**Figure 4:** Body Diode Characteristics



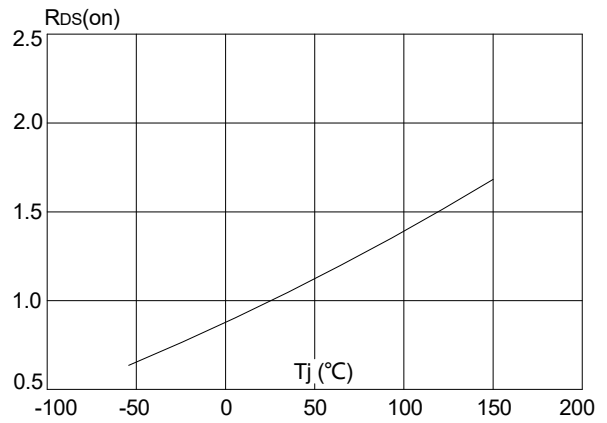
**Figure 5:** Gate Charge Characteristics



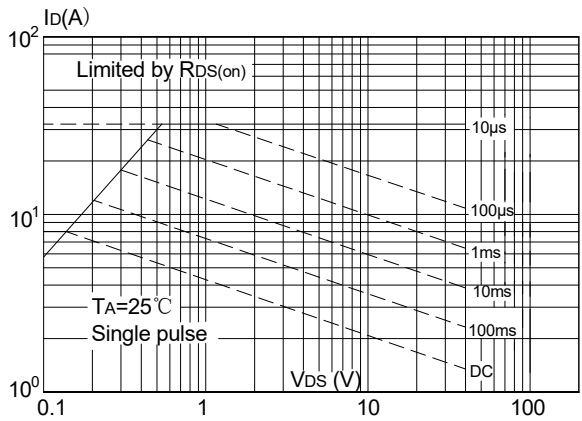
**Figure 6:** Capacitance Characteristics



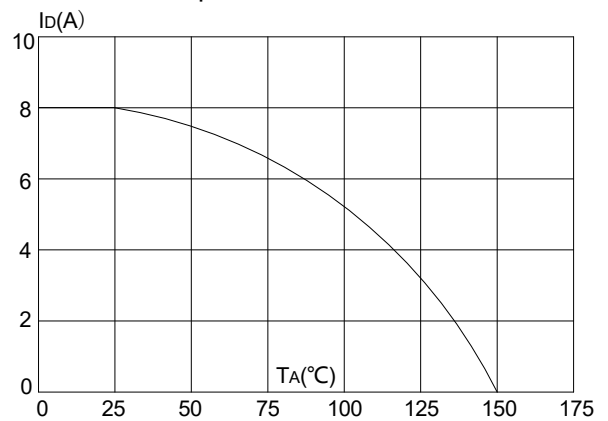
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



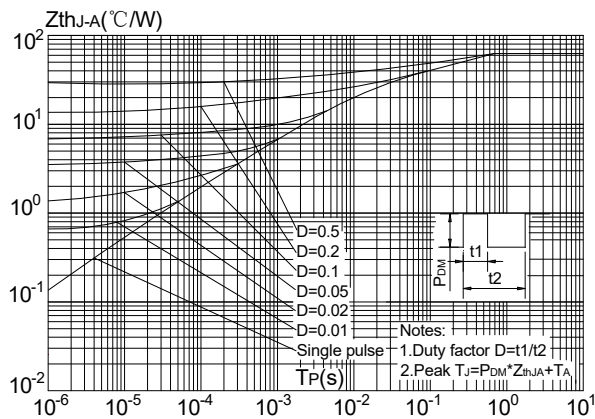
**Figure 8:** Normalized on Resistance vs. Junction Temperature



**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

**P-Channel Electrical Characteristics:** ( $T_J=25^\circ\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250 \mu A$	-40	---	---	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{GS}=0V, V_{DS}=-40V$	---	---	-1	$\mu A$
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0A$	---	---	$\pm 100$	nA
<b>On Characteristics<sup>3</sup></b>						
$V_{GS(th)}$	GATE-Source Threshold Voltage	$V_{GS}=V_{DS}, I_D=250 \mu A$	-1	-1.6	-2.5	V
$R_{DS(on)}$	Drain-Source On Resistance <sup>note3</sup>	$V_{GS}=-10V, I_D=-8A$	---	41	53	m $\Omega$
		$V_{GS}=-4.5V, I_D=-5A$	---	58	81	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS}=-20V, V_{GS}=0V, f=1MHz$	---	850	---	pF
$C_{oss}$	Output Capacitance		---	85	---	
$C_{rss}$	Reverse Transfer Capacitance		---	68	---	
<b>Switching Characteristics<sup>4</sup></b>						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD}=-20V, R_L=2.3 \Omega$ $V_{GS}=-10V, R_{GEN}=6 \Omega$	---	7.5	---	ns
$t_r$	Rise Time		---	5.5	---	ns
$t_{d(off)}$	Turn-Off Delay Time		---	19	---	ns
$t_f$	Fall Time		---	7	---	ns
$Q_g$	Total Gate Charge	$V_{GS}=-10V, V_{DS}=-20V, I_D=-6A$	---	13	---	nC
$Q_{gs}$	Gate-Source Charge		---	3.8	---	nC
$Q_{gd}$	Gate-Drain "Miller" Charge		---	3.1	---	nC
<b>Drain-Source Diode Characteristics</b>						
$I_S$	Continuous Drain to Source Diode	---	---	---	-8	A
$I_{SM}$	Pulsed Drain to Source Diode	---	---	---	-24	---
$V_{SD}$	Source-Drain Diode Forward Voltage	$V_{GS}=0V, I_S=-6A$	---	---	-1.2	V

Typical Performance Characteristics-P

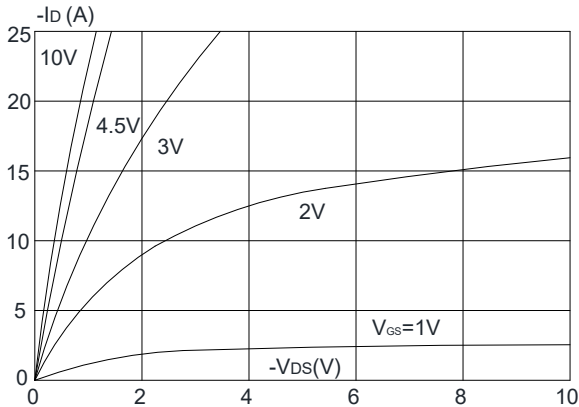


Figure 1: Output Characteristics

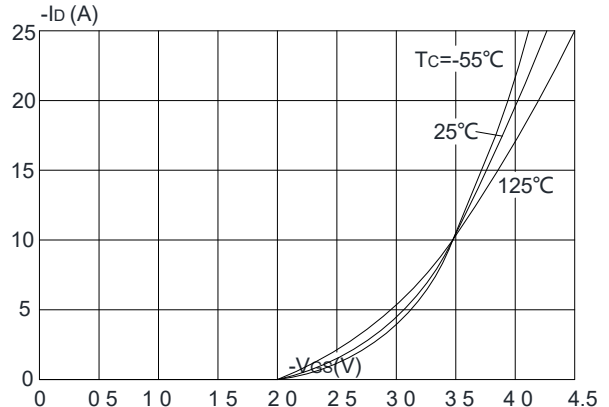


Figure 2: Typical Transfer Characteristics

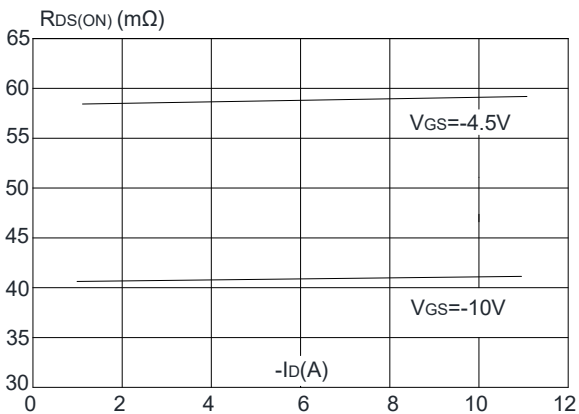


Figure 3: On-resistance vs. Drain Current

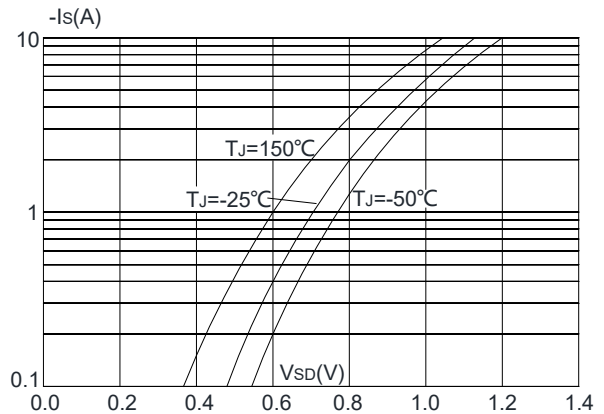


Figure 4: Body Diode Characteristics

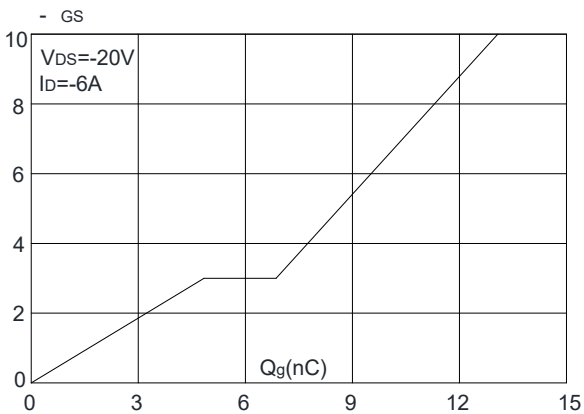


Figure 5: Gate Charge Characteristics

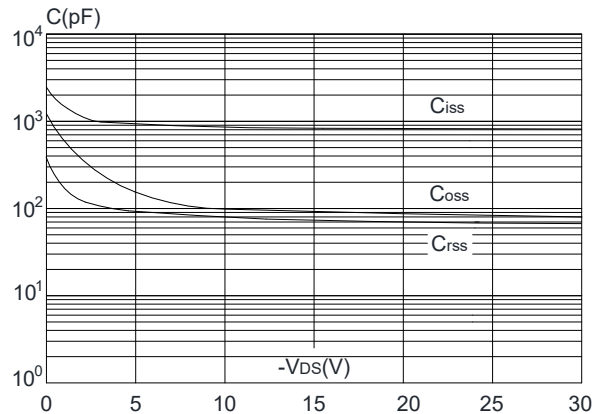
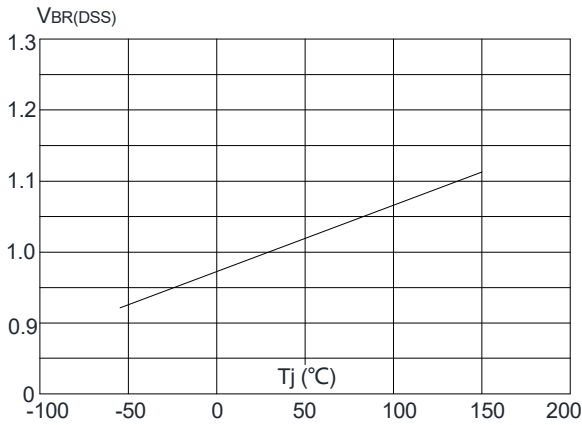
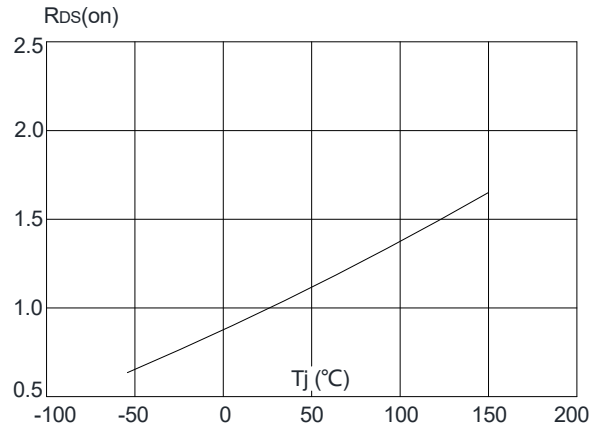


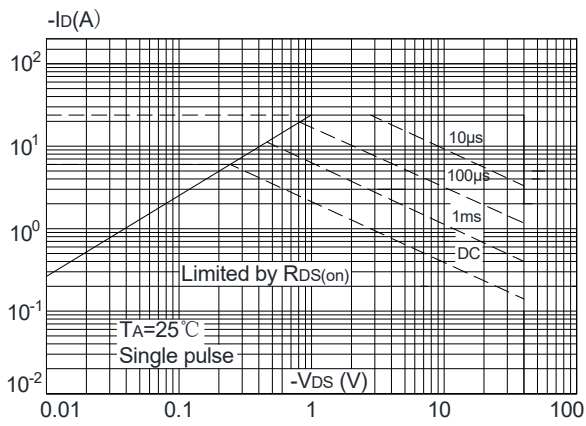
Figure 6: Capacitance Characteristics



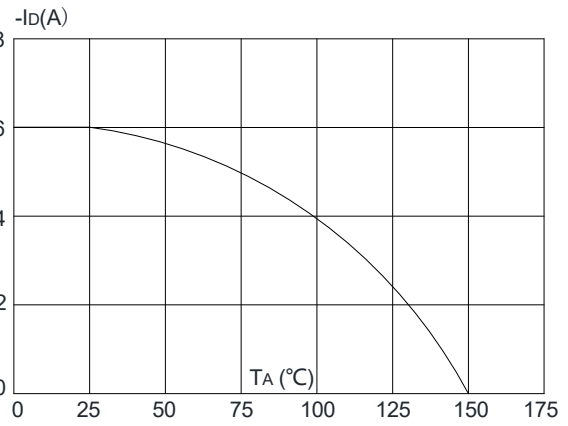
**Figure 7:** Normalized Breakdown Voltage vs. Junction Temperature



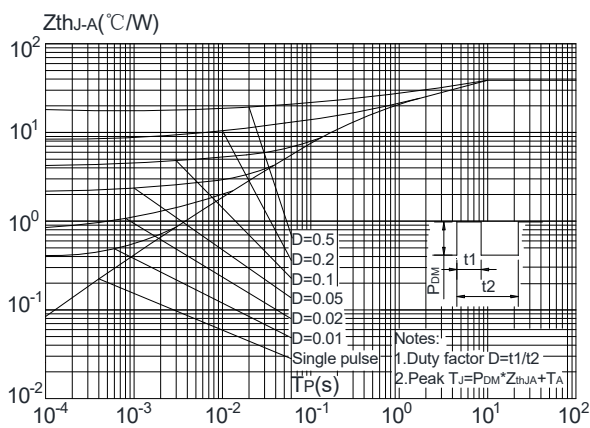
**Figure 8:** Normalized on Resistance vs. Junction Temperature



**Figure 9:** Maximum Safe Operating Area

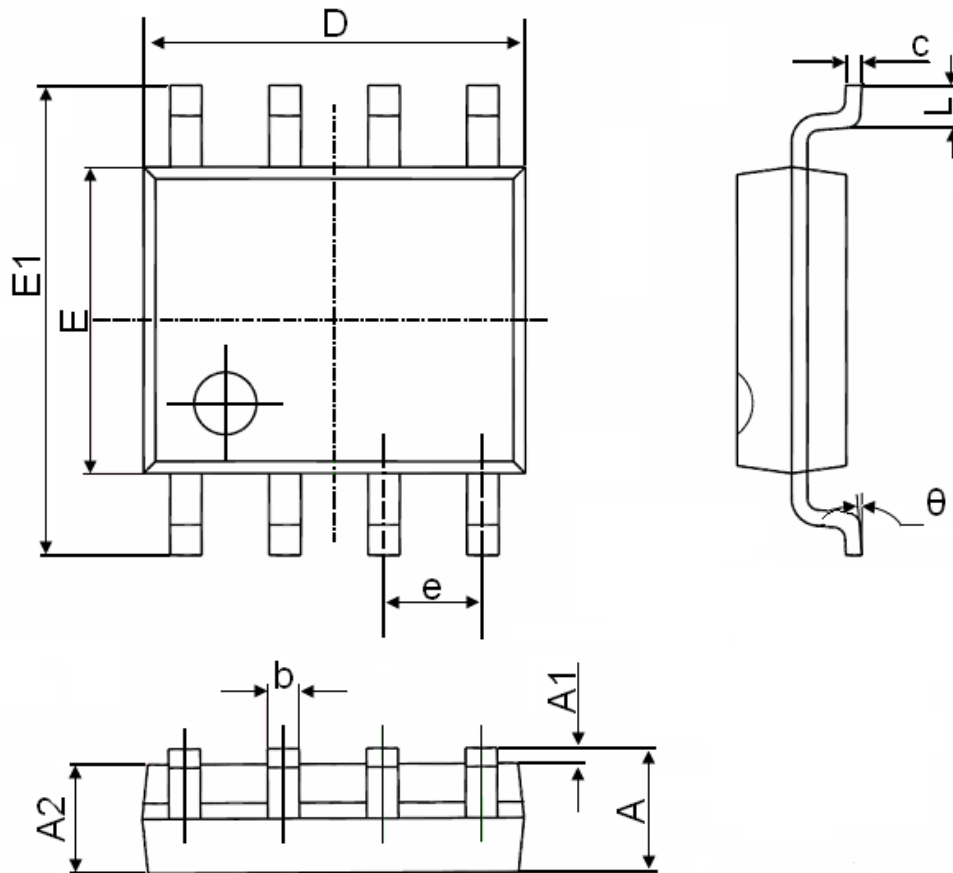


**Figure 10:** Maximum Continuous Drain Current vs. Ambient Temperature



**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

SOP-8 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
theta	0°	8°	0°	8°



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