

# AP2716SD

## N and P-Channel Enhancement Mosfet

### Feature

- **N-Channel**

$V_{DD}=40V, I_D=10A$

$R_{DS(on)} < 22m\Omega @ V_{GS}=10V$  TYP=17 mΩ

$R_{DS(on)} < 30m\Omega @ V_{GS}=4.5V$  TYP=22 mΩ

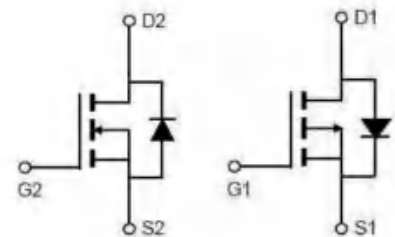
- **P-Channel**

$V_{DD}=-40V, I_D=-10A$

$R_{DS(on)} < 54m\Omega @ V_{GS}=-10V$  TYP=44 mΩ

$R_{DS(on)} < 70m\Omega @ V_{GS}=-4.5V$  TYP=55 mΩ

- Lead free product is acquired
- High power and current handling capability
- Surface mount package



N-channel P-channel

Schematic diagram



Marking and pin assignment

### Application

- PWM applications
- Load Switch
- Power management

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity (PCS)
2716SD	AP2716SD	SOP-8	13 inch	-	4000

### ABSOLUTE MAXIMUM RATINGS ( $T_a=25^\circ C$ unless otherwise noted)

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	$V_{DS}$	40	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current ( $T_a = 25^\circ C$ )	$I_D$	10	-10	A
Continuous Drain Current ( $T_a = 100^\circ C$ )	$I_D$	6.5	-6.5	A
Pulsed Drain Current <sup>(1)</sup>	$I_{DM}$	40	-40	A
Power Dissipation	$P_D$	4.0	7.5	W
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	31.3	16.7	$^\circ C/W$
Junction Temperature	$T_J$	150	150	$^\circ C$
Storage Temperature	$T_{STG}$	-55~ +150	-55~ +150	$^\circ C$

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## N-CH ELECTRICAL CHARACTERISTICS(T<sub>a</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	40			V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 40V, V <sub>GS</sub> = 0V			1	μA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V			±100	nA
Gate threshold voltage <sup>(2)</sup>	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	1	1.6	2.5	V
Drain-source on-resistance <sup>(2)</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 10A		17	22	mΩ
		V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 6A		22	30	
<b>Dynamic characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V, f = 1MHz		1050		pF
Output Capacitance	C <sub>oss</sub>			84		
Reverse Transfer Capacitance	C <sub>rss</sub>			72		
<b>Switching characteristics</b>						
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 20V, I <sub>D</sub> = 5A, R <sub>L</sub> = 6Ω V <sub>GS</sub> = 10V, R <sub>G</sub> = 1Ω		11		ns
Turn-on rise time	t <sub>r</sub>			13		
Turn-off delay time	t <sub>d(off)</sub>			36		
Turn-off fall time	t <sub>f</sub>			9		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 20V, I <sub>D</sub> = 5A, V <sub>GS</sub> = 10V		11		nC
Gate-Source Charge	Q <sub>gs</sub>			1.9		
Gate-Drain Charge	Q <sub>gd</sub>			2.2		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(2)</sup>	V <sub>DS</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 10A			1.2	V
Diode Forward current <sup>(3)</sup>	I <sub>S</sub>		-	-	10	A

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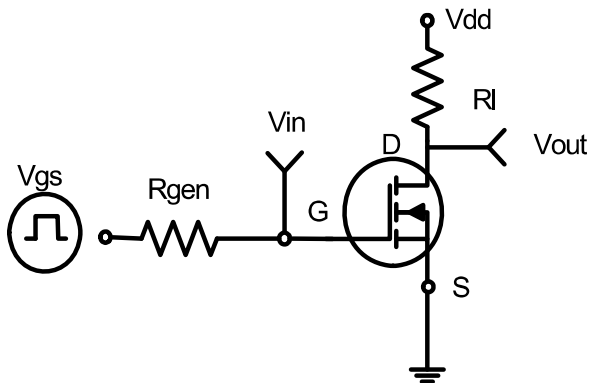
## P-CH ELECTRICAL CHARACTERISTICS(T<sub>a</sub>=25°C unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Type	Max	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA	-40			V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -40V, V <sub>GS</sub> = 0V			1	μA
Gate-body leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V			±100	nA
Gate threshold voltage <sup>(2)</sup>	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1	-1.6	-2.5	V
Drain-source on-resistance <sup>(2)</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10V, I <sub>D</sub> = -10A		44	54	mΩ
		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -6A		55	70	
<b>Dynamic characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -20V, V <sub>GS</sub> = 0V, f = 1MHz		1160		pF
Output Capacitance	C <sub>oss</sub>			155		
Reverse Transfer Capacitance	C <sub>rss</sub>			98		
<b>Switching characteristics</b>						
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = -20V, I <sub>D</sub> = -5A, R <sub>L</sub> = 6Ω V <sub>GS</sub> = -10V, R <sub>G</sub> = 1Ω		8		ns
Turn-on rise time	t <sub>r</sub>			15		
Turn-off delay time	t <sub>d(off)</sub>			23		
Turn-off fall time	t <sub>f</sub>			9		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = -20V, I <sub>D</sub> = -5A, V <sub>GS</sub> = -10V		20		nC
Gate-Source Charge	Q <sub>gs</sub>			3.5		
Gate-Drain Charge	Q <sub>gd</sub>			4.2		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage <sup>(2)</sup>	V <sub>DS</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = -10A			1.2	V
Diode Forward current <sup>(3)</sup>	I <sub>S</sub>		-	-	-10	A

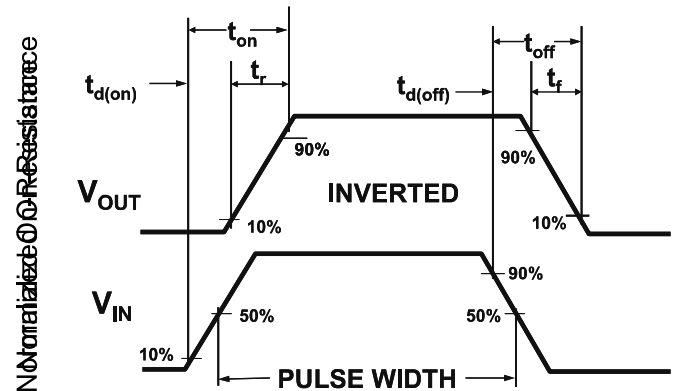
### Notes:

1. Repetitive Rating: pulse width limited by maximum junction temperature
2. Pulse Test: pulse width ≤ 300μs, duty cycle ≤ 2%
3. Surface Mounted on FR4 Board, t ≤ 10 sec

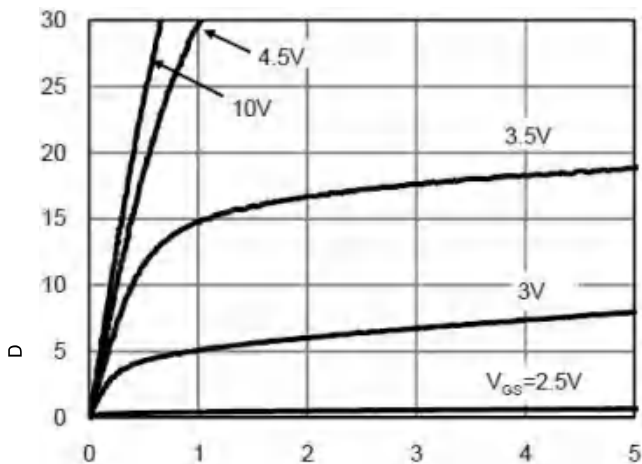
N-Channel



**Figure 1: Switching Test Circuit**

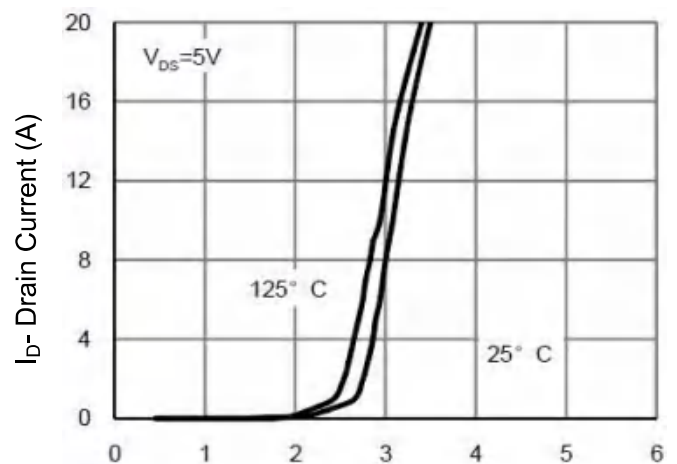


**Figure 2: Switching Waveforms**



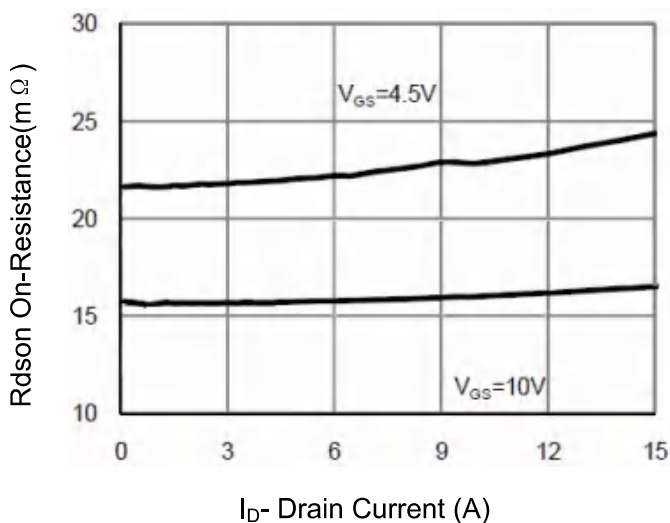
Vds Drain-Source Voltage (V)

**Figure 3 Output Characteristics**



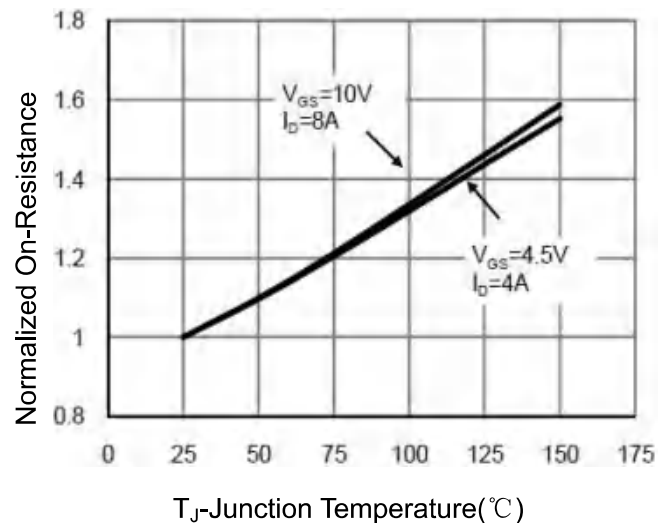
Vgs Gate-Source Voltage (V)

**Figure 4 Transfer Characteristics**



ID- Drain Current (A)

**Figure 5 Drain-Source On-Resistance**

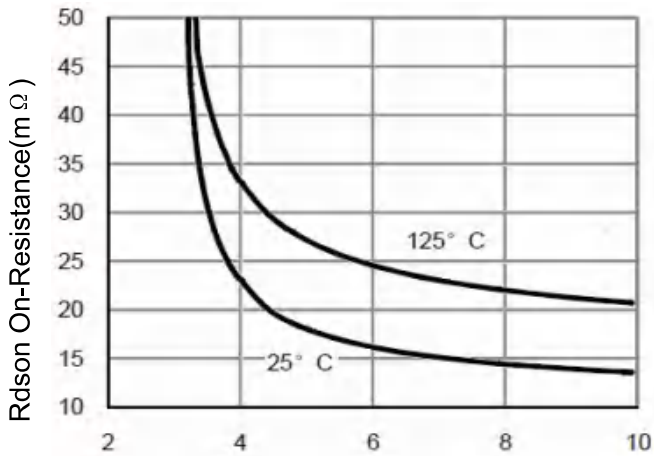


Tj-Junction Temperature(°C)

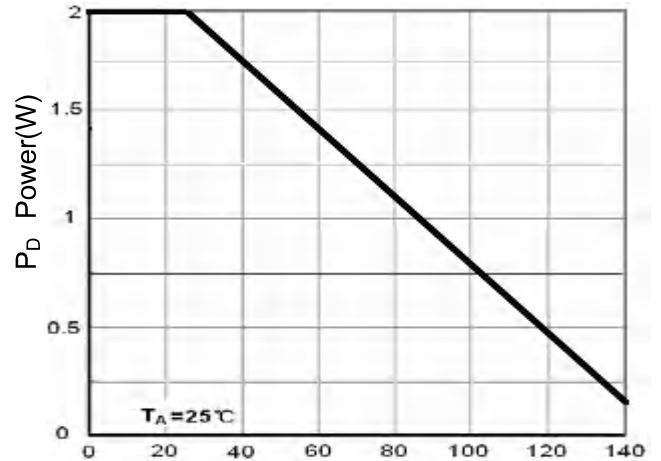
**Figure 6 Drain-Source On-Resistance**

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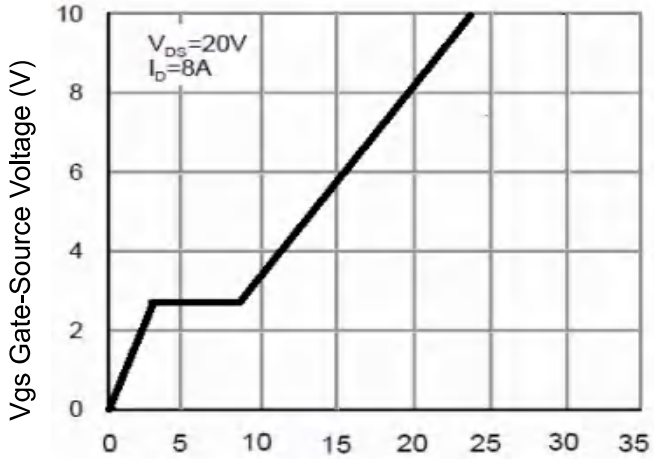
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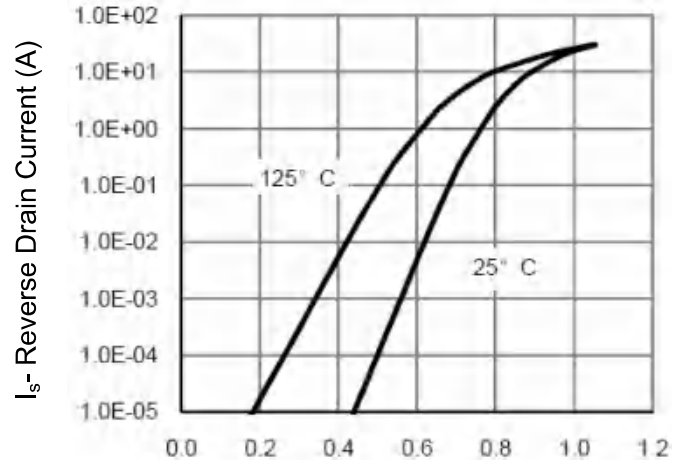
Vgs Gate-Source Voltage (V)  
**Figure 7 Rdson vs Vgs**



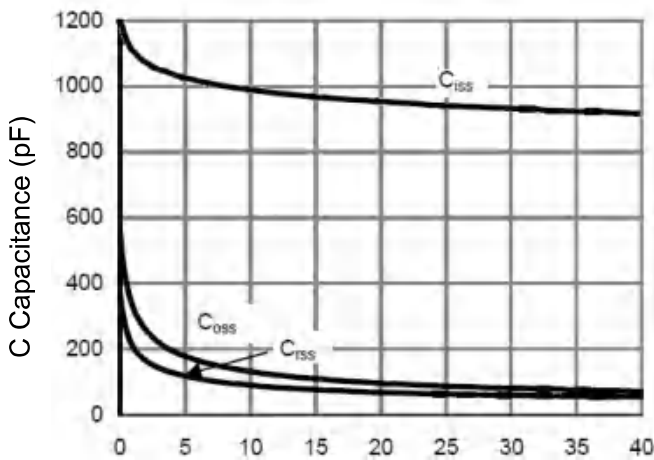
Tj Junction Temperature (°C)  
**Figure 8 Power Dissipation**



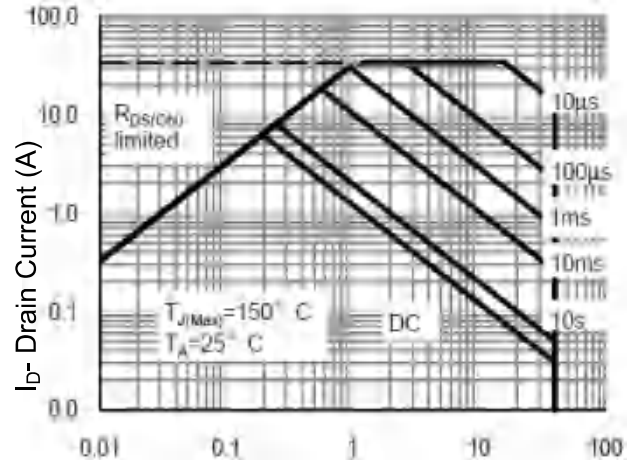
Qg Gate Charge (nC)  
**Figure 9 Gate Charge**



Vds Drain-Source Voltage (V)  
**Figure 10 Source-Drain Diode Forward**

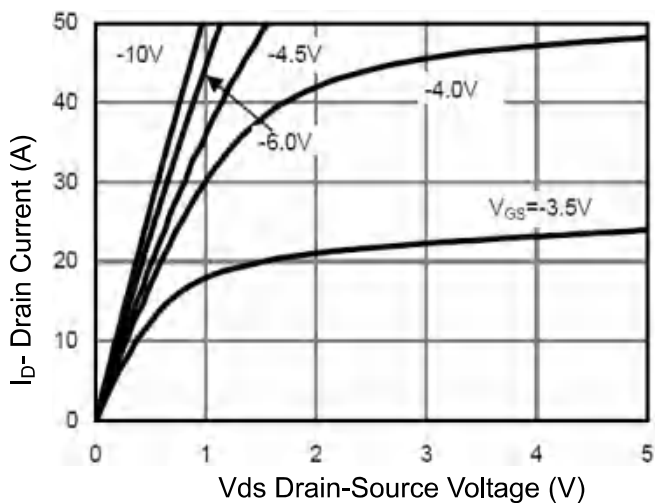


Vds Drain-Source Voltage (V)  
**Figure 11 Capacitance vs Vds**

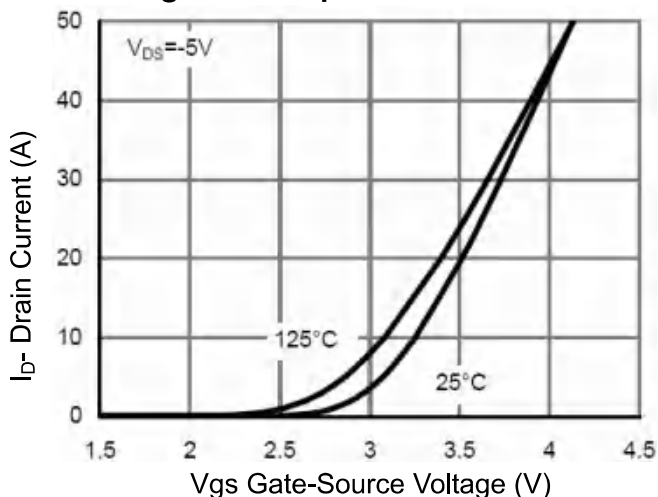


Vds Drain-Source Voltage (V)  
**Figure 12 Safe Operation Area**

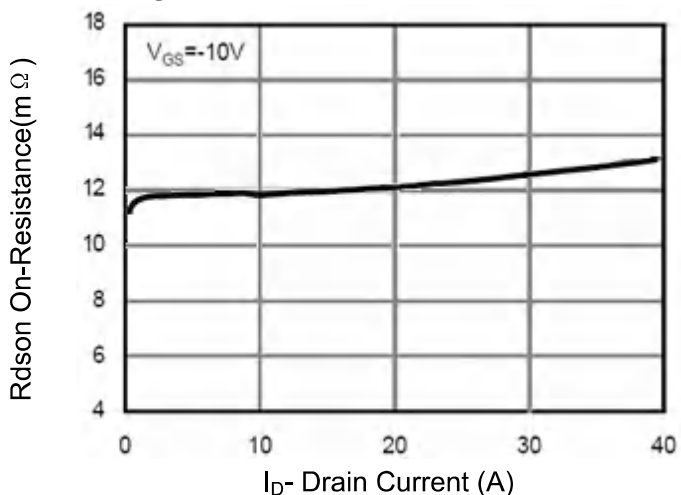
P-Channel



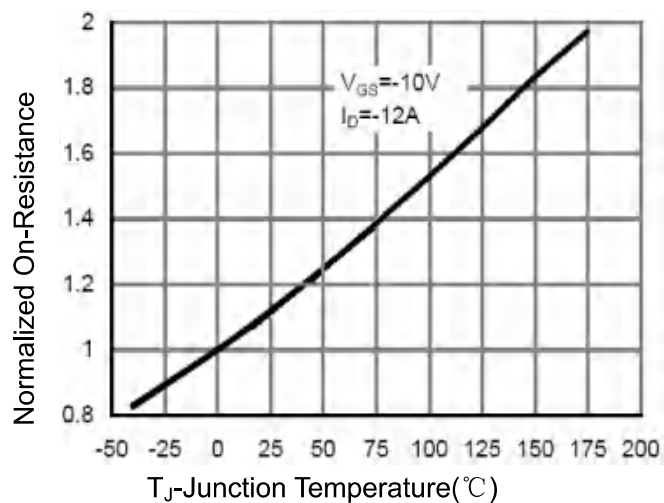
**Figure 1 Output Characteristics**



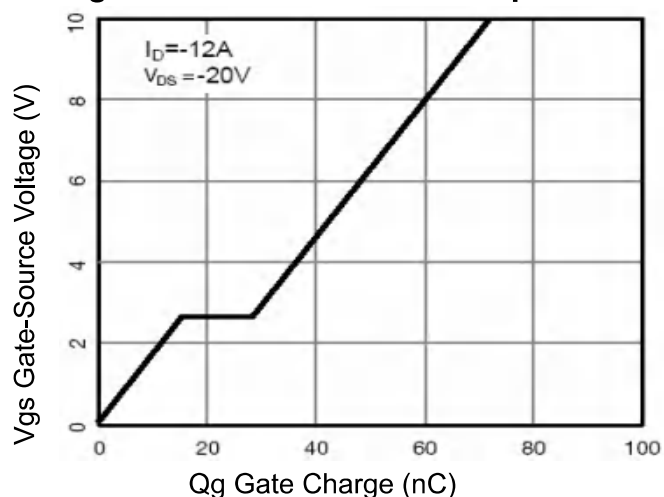
**Figure 2 Transfer Characteristics**



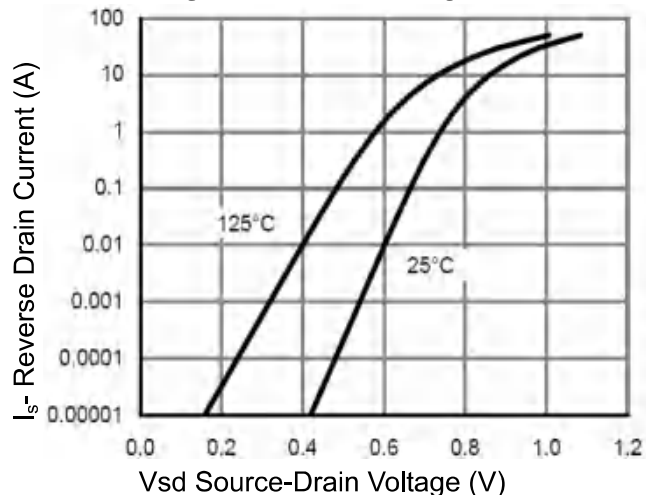
**Figure 3 Rdson- Drain Current**



**Figure 4 Rdson-Junction Temperature**

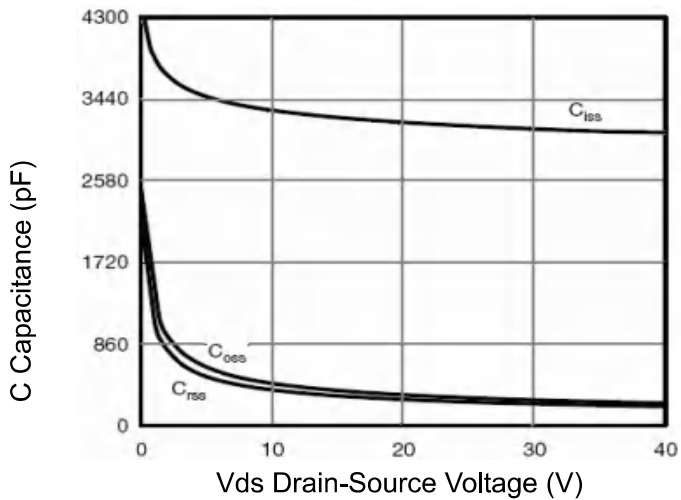


**Figure 5 Gate Charge**

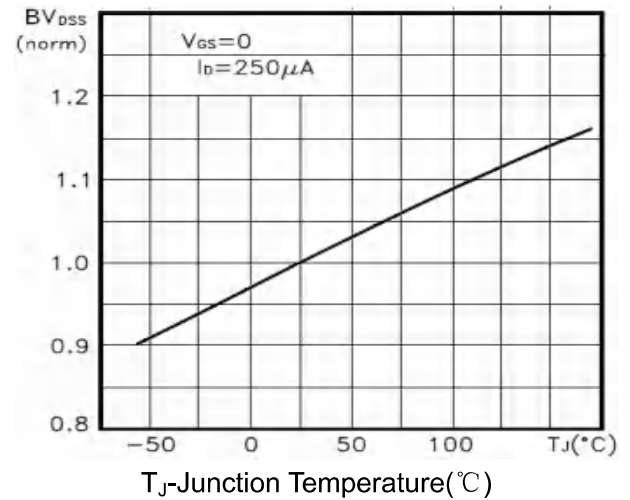


**Figure 6 Source- Drain Diode Forward**

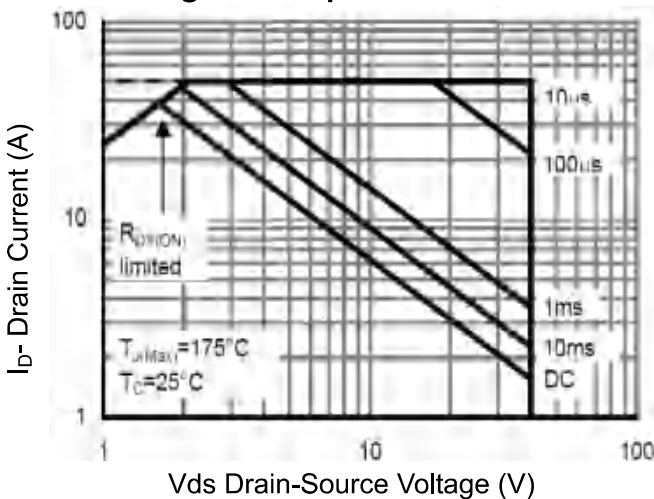




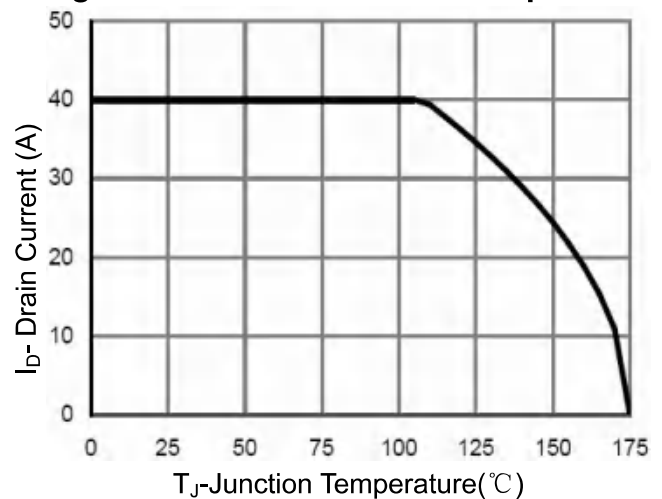
**Figure 7 Capacitance vs Vds**



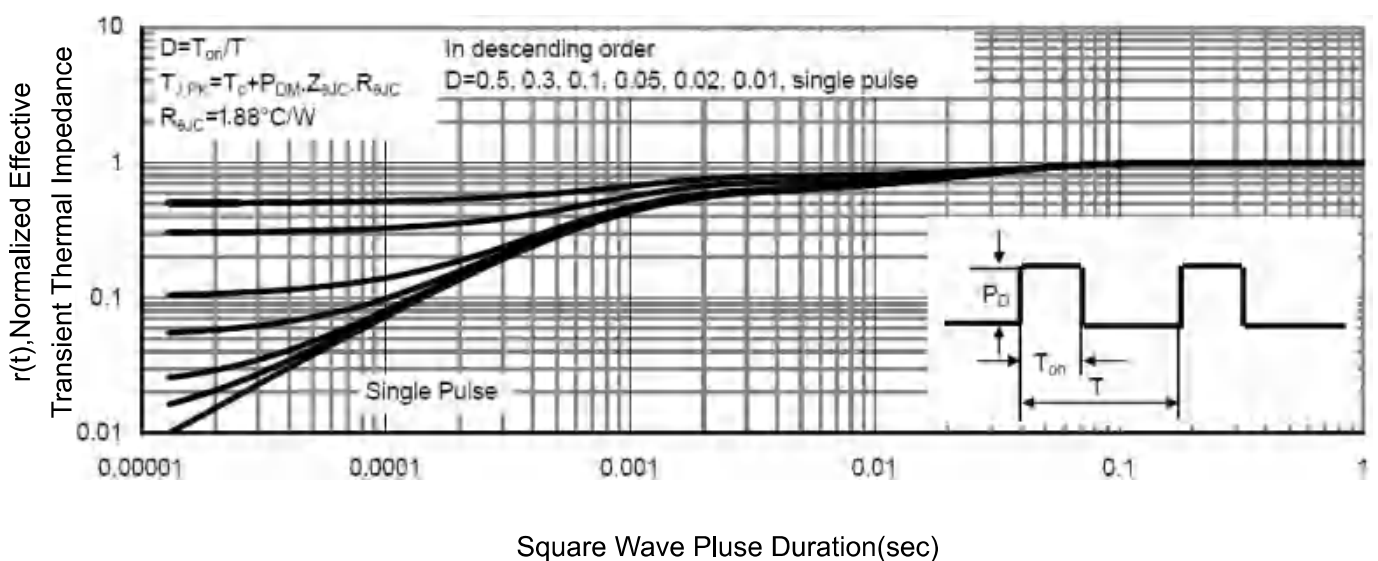
**Figure 9 BV<sub>DSS</sub> vs Junction Temperature**



**Figure 8 Safe Operation Area**



**Figure 10 ID Current Derating vs Junction Temperature**

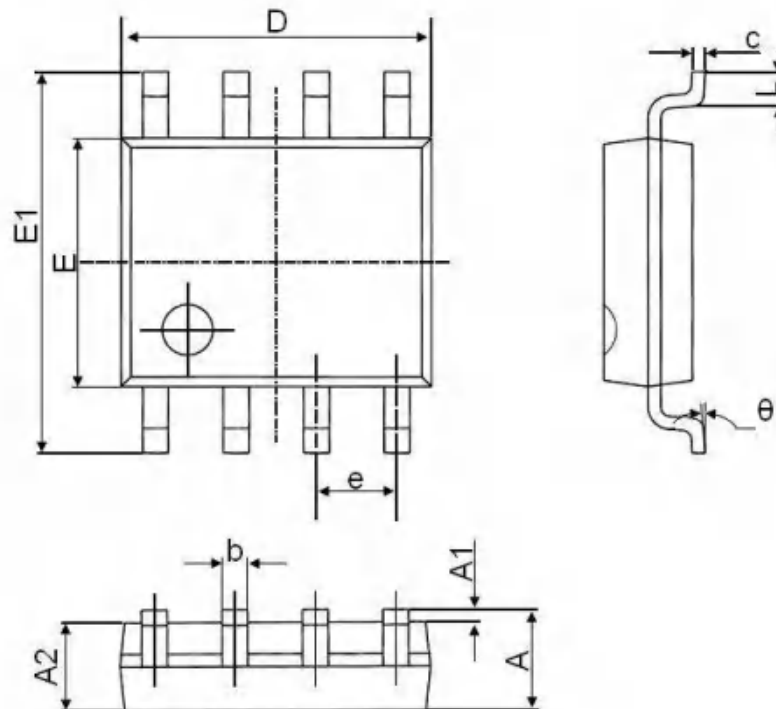


**Figure 11 Normalized Maximum Transient Thermal Impedance**

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## 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
θ	0°	8°	0°	8°