

### Product Summary

$V_{(BR)DSS}$	$R_{DS(on)MAX}$	$I_D$	$V_{(BR)DSS}$	$R_{DS(on)MAX}$	$I_D$
30V	13.5mΩ@10V	10A	-30V	20mΩ@-10V	-9.1A
	20mΩ@4.5V			35mΩ@4.5V	

### Feature

- Advanced trench process technology
- High Density Cell Design For Ultra Low On-Resistance
- Surface mount package
- Suffix “-Q1” for AEC-Q101

### Application

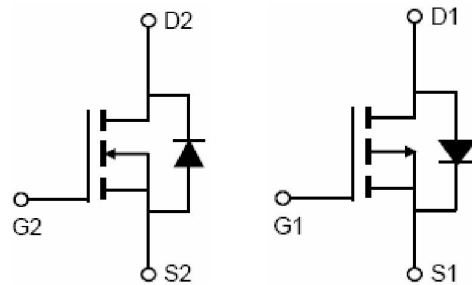
- Battery protection
- Load switch
- Power management

### Package

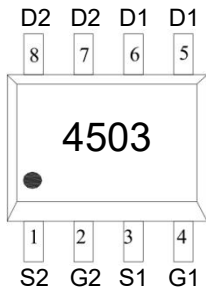


SOP-8

### Circuit diagram



### Marking



### Absolute maximum ratings (Ta=25°C unless otherwise noted)

Parameter	Symbol	N-Channel	p-Channel	Unit
Drain-Source Voltage	$V_{DS}$	30	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	$\pm 20$	V
Continuous Drain Current	$I_D$	10	-9.1	A
Pulsed Drain Current	$I_{DM}$	30	-30	A
Power Dissipation	$P_D$	2.5	2.5	W
Junction Temperature	$T_J$	150	150	°C
Thermal Resistance, Junction-to-Ambient <sup>1)</sup>	$R_{\theta JA}$	50	50	°C/W
Storage Temperature	$T_{STG}$	-55 ~ +150	-55 ~ +150	°C

### N-CH Electrical characteristics (TA=25 °C, unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
<b>Static Characteristics</b>						
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0V, I_D = 250\mu A$	30			V
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 30V, V_{GS} = 0V$			1	$\mu A$
Gate-body leakage current	$I_{GSS}$	$V_{GS} = \pm 20V, V_{DS} = 0V$			$\pm 100$	nA
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\mu A$	1.0		3.0	V
Drain-source on-resistance <sup>2)</sup>	$R_{DS(on)}$	$V_{GS} = 10V, I_D = 10A$			13.5	m $\Omega$
		$V_{GS} = 4.5V, I_D = 5A$			20	m $\Omega$
<b>Dynamic characteristics<sup>3)</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 15V, V_{GS} = 0V, f = 1MHz$		1550		pF
Output Capacitance	$C_{oss}$			300		
Reverse Transfer Capacitance	$C_{rss}$			180		
Total Gate Charge	$Q_g$	$V_{DS} = 15V, V_{GS} = 4.5V, I_D = 10A$		13		nC
Gate-Source Charge	$Q_{gs}$			5.5		
Gate-Drain Charge	$Q_{gd}$			3.5		
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 25V, V_{GS} = 10V, I_D = 1A, R_{GEN} = 6\Omega$		30		nS
Turn-on rise time	$t_r$			20		
Turn-off delay time	$t_{d(off)}$			100		
Turn-off fall time	$t_f$			80		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage	$V_{DS}$	$V_{GS} = 0V, I_S = 6A$			1.2	V

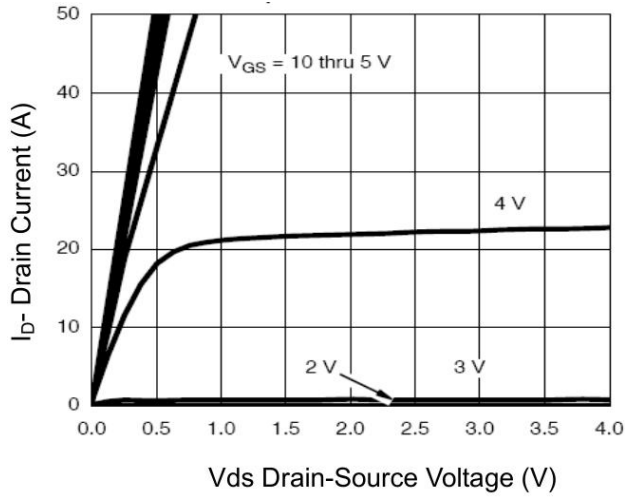
### P-CH Electrical characteristics (T<sub>A</sub>=25 °C, unless otherwise noted)

Parameter	Symbol	Test Condition	Min.	Typ.	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	-30			V
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = -30V, 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	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA	-1.0		-3.0	V
Drain-source on-resistance <sup>2)</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = -10V, I <sub>D</sub> = -9.1A			20	mΩ
		V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -5A			35	mΩ
<b>Dynamic characteristics<sup>3)</sup></b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V, f = 1MHz		1600		pF
Output Capacitance	C <sub>oss</sub>			350		
Reverse Transfer Capacitance	C <sub>rss</sub>			300		
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = -15V, V <sub>GS</sub> = -10V, I <sub>D</sub> = -9.1A		30		nC
Gate-Source Charge	Q <sub>gs</sub>			5.5		
Gate-Drain Charge	Q <sub>gd</sub>			8		
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = -15V, V <sub>GS</sub> = -10V, I <sub>D</sub> = -1A, R <sub>GEN</sub> = 6Ω		10		nS
Turn-on rise time	t <sub>r</sub>			15		
Turn-off delay time	t <sub>d(off)</sub>			110		
Turn-off fall time	t <sub>f</sub>			70		
<b>Source-Drain Diode characteristics</b>						
Diode Forward voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = -6A			-1.2	V

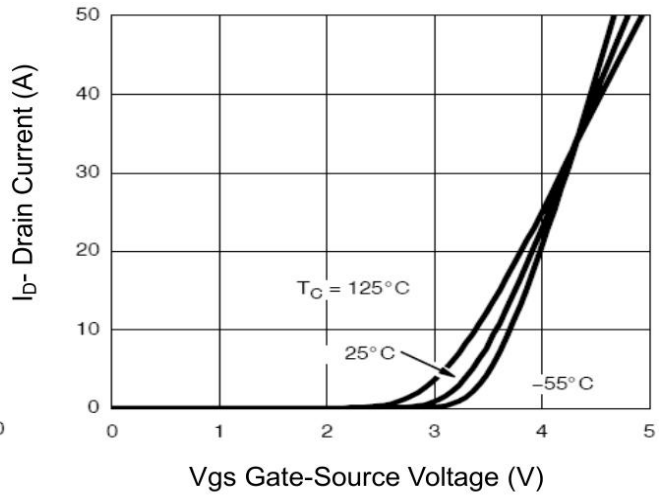
Notes:

- 1) Surface Mounted on FR4 Board, t<sub>s</sub> ≤ 10 sec.
- 2) Pulse Test: Pulse Width < 300μs, Duty Cycle ≤ 2%.
- 3) Guaranteed by design, not subject to production testing.

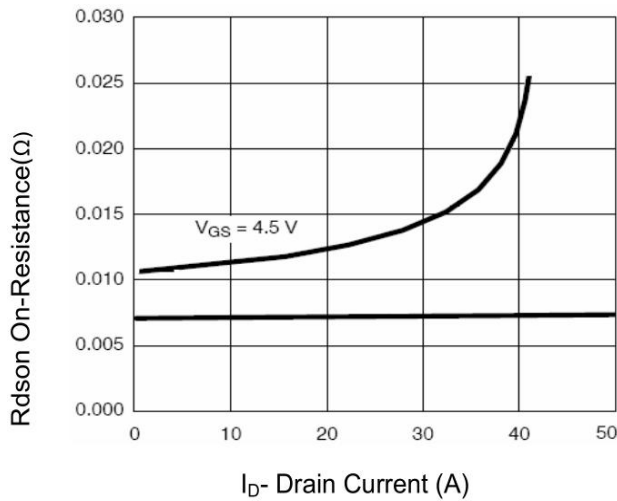
## N- Channel Typical Characteristics



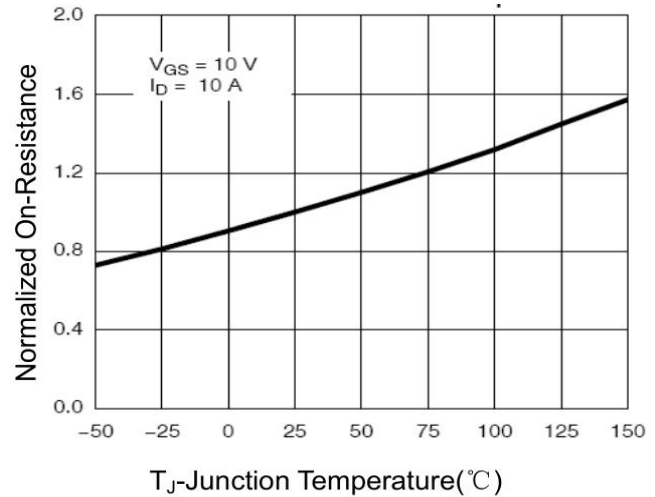
**Figure 1 Output Characteristics**



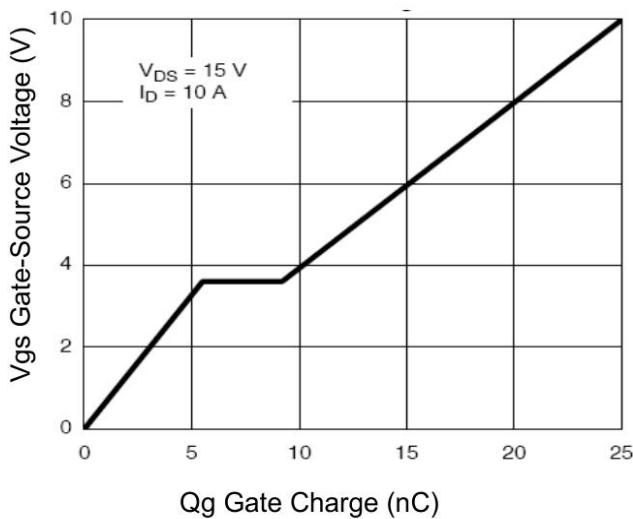
**Figure 2 Transfer Characteristics**



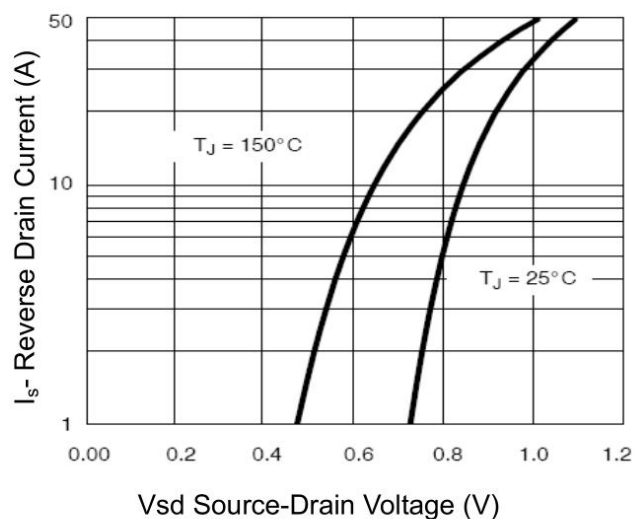
**Figure 3 Rdson- Drain Current**



**Figure 4 Rdson- Junction Temperature**



**Figure 5 Gate Charge**



**Figure 6 Source- Drain Diode Forward**

## N- Channel Typical Characteristics

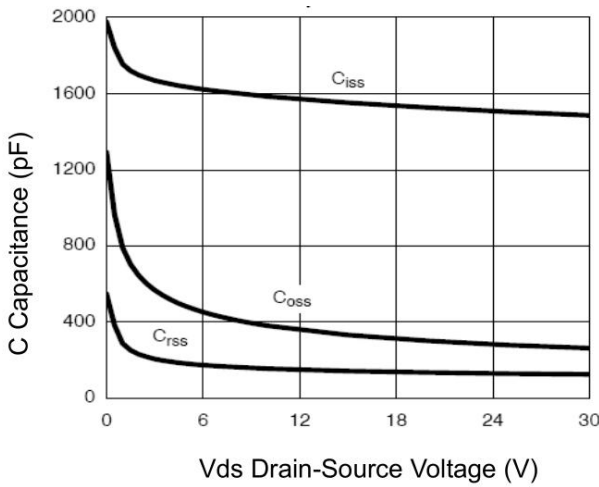


Figure 7 Capacitance vs Vds

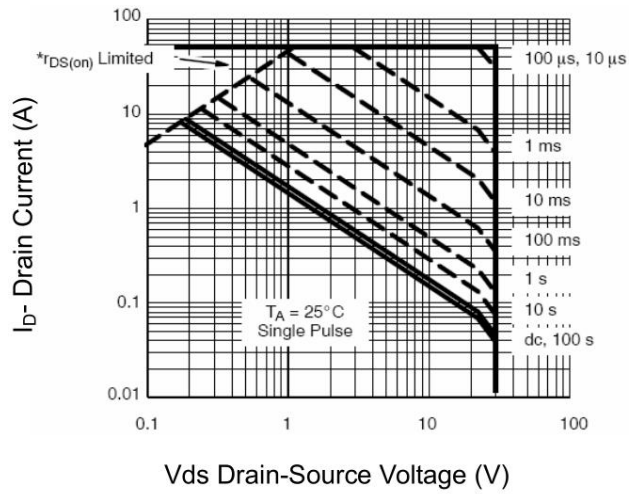


Figure 8 Safe Operation Area

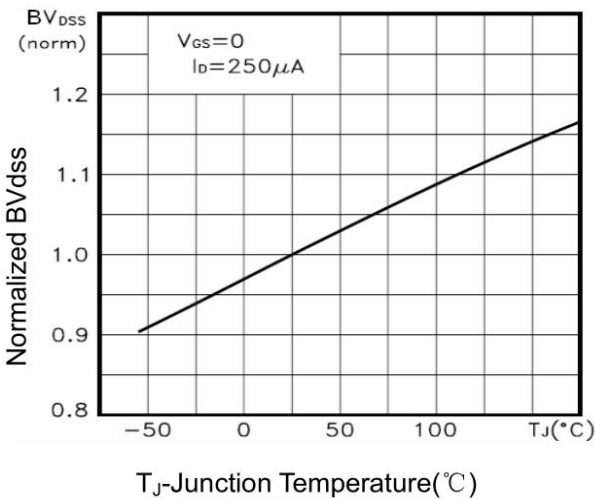


Figure 9 BV<sub>DSS</sub> vs Junction Temperature

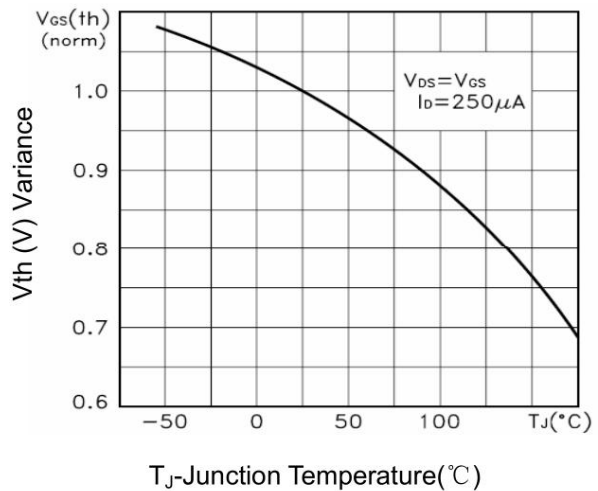


Figure 10 V<sub>GS(th)</sub> vs Junction Temperature

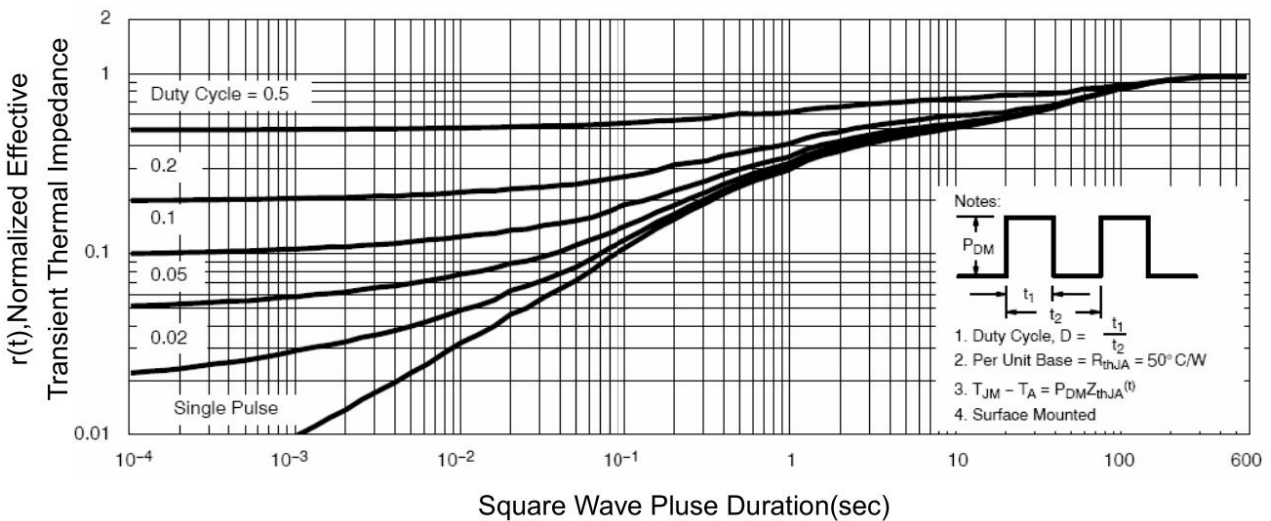
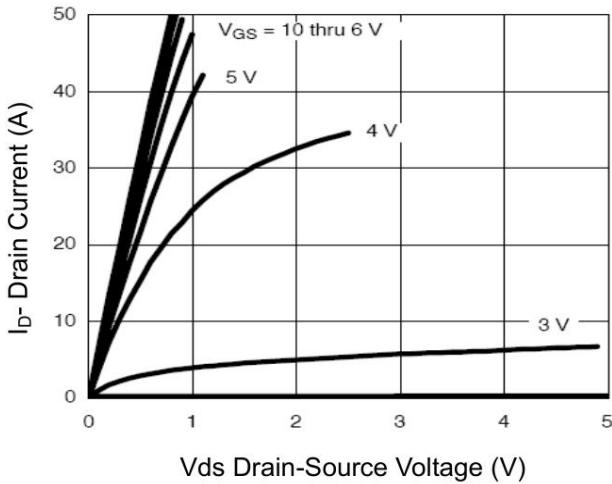
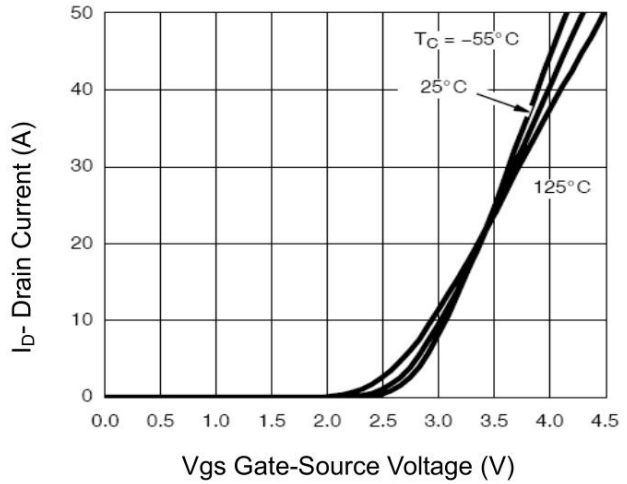


Figure 11 Normalized Maximum Transient Thermal Impedance

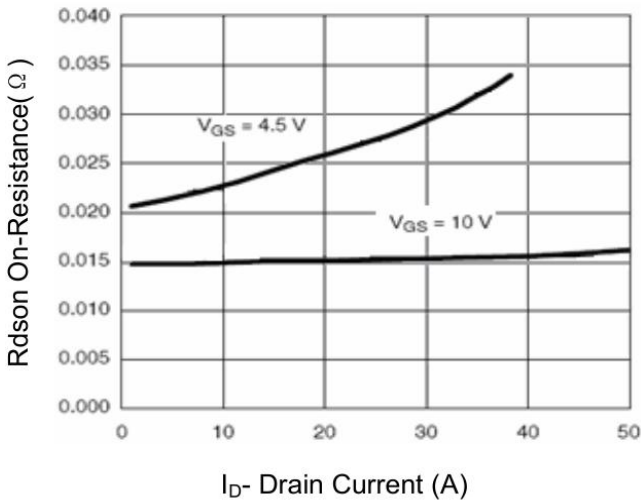
## P- Channel Typical Characteristics



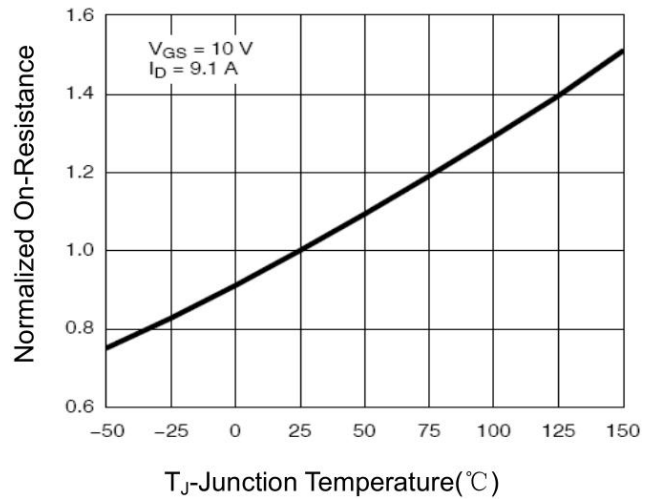
**Figure 1 Output Characteristics**



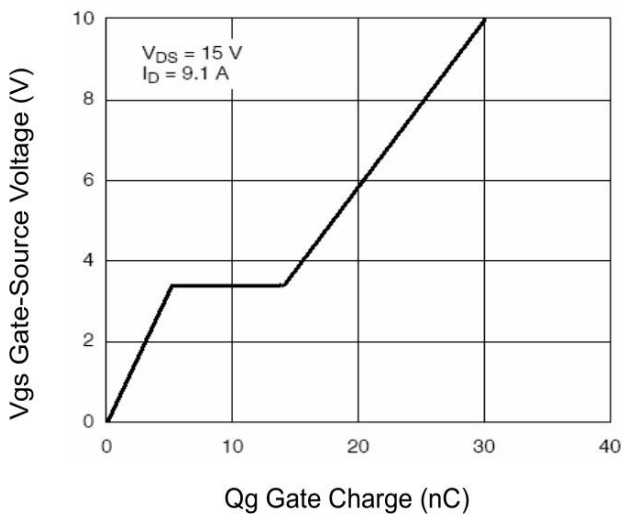
**Figure 2 Transfer Characteristics**



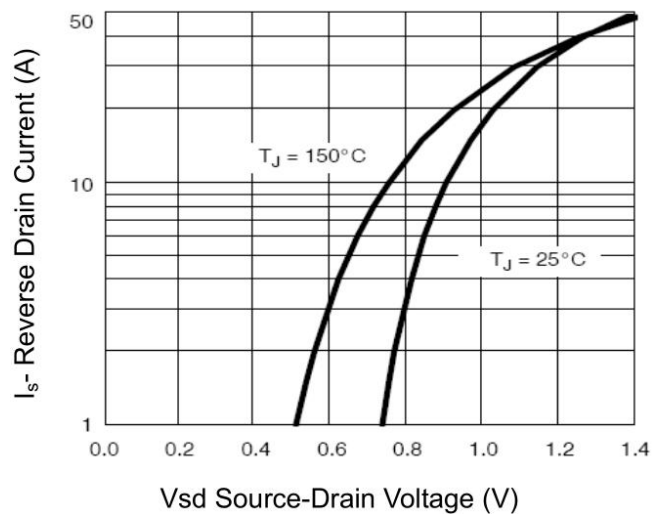
**Figure 3 Drain-Source On-Resistance**



**Figure 4 Drain-Source On-Resistance**

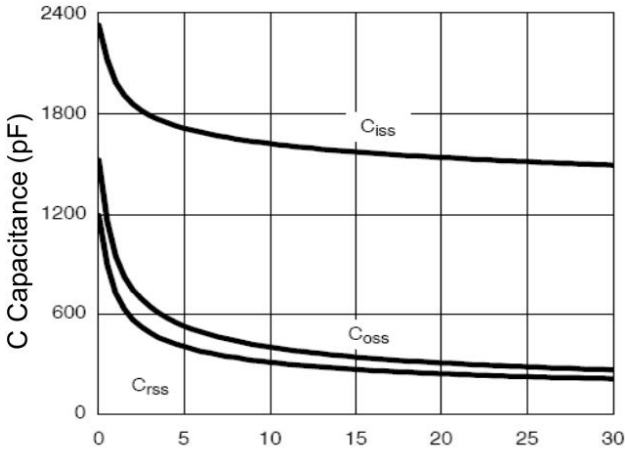


**Figure 5 Gate Charge**

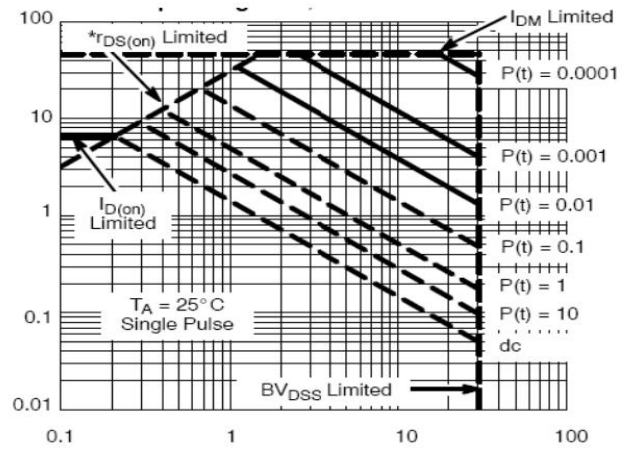


**Figure 6 Source- Drain Diode Forward**

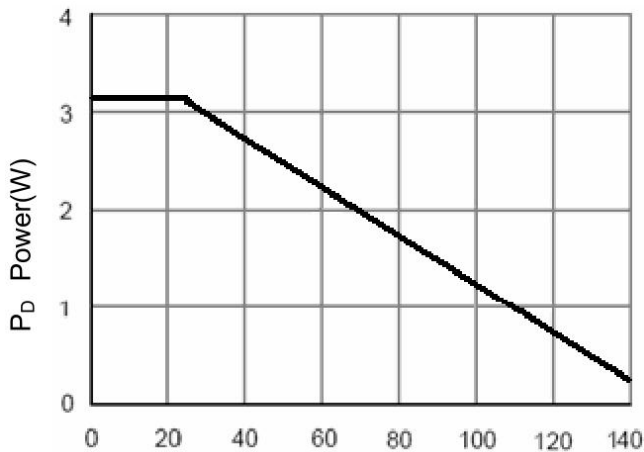
## P- Channel Typical Characteristics



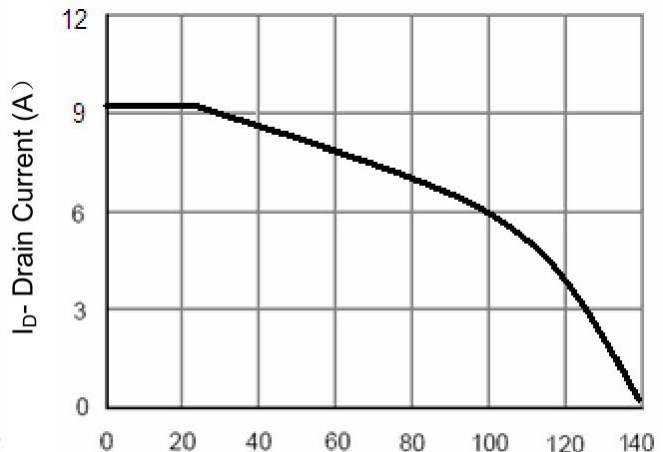
Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



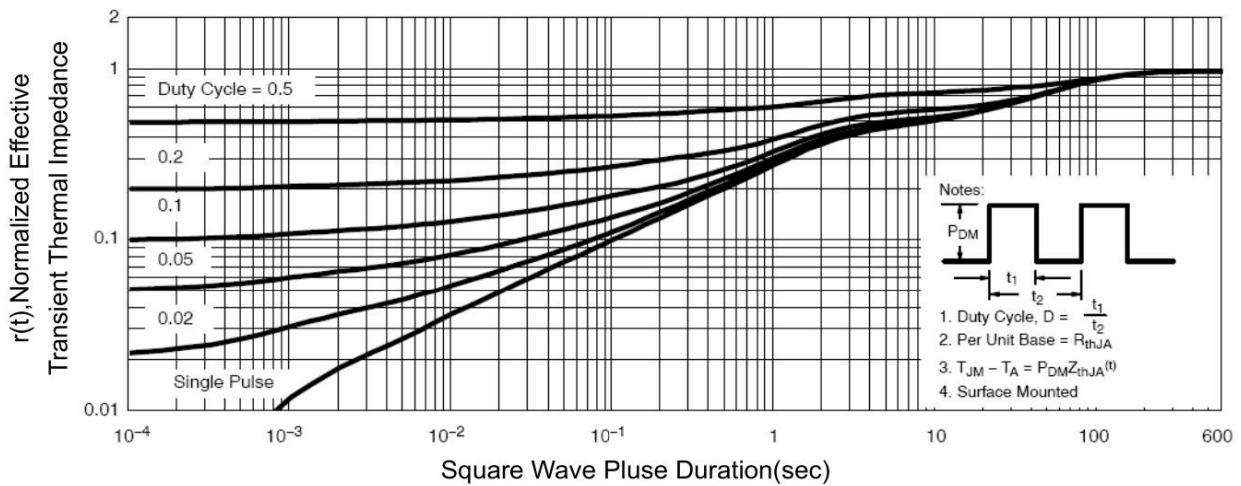
Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**



T<sub>J</sub>-Junction Temperature(°C)  
**Figure 9 Power Dissipation**

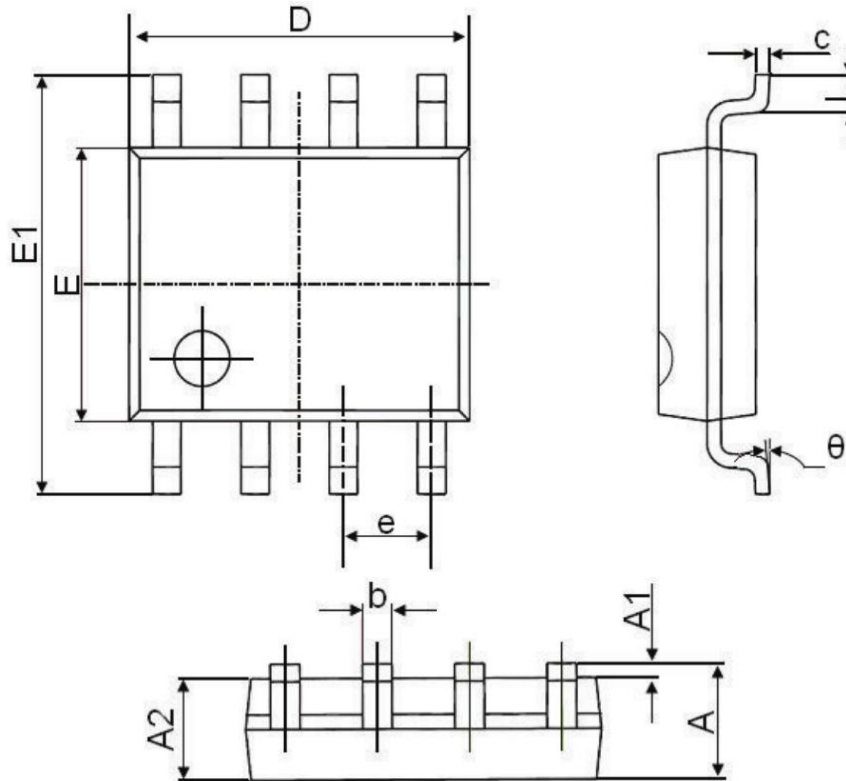


T<sub>J</sub>-Junction Temperature(°C)  
**Figure 10 Drain Current**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

### 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°