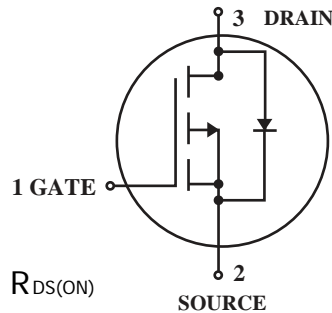


**Surface Mount P-Channel Enhancement  
Mode POWER MOSFET**

**(Pb)** Lead(Pb)-Free

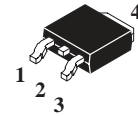


**DRAIN CURRENT**  
**-20 AMPERES**

**DRAIN SOURCE VOLTAGE**  
**-30 VOLTAGE**

**Features:**

- \*Super High Dense Cell Design For Low  $R_{DS(ON)}$   
 $R_{DS(ON)} < 50m \Omega @ V_{GS} = -10V$
- \*Simple Drive Requirement
- \*Lower On-resistance
- \*Fast Switching Characteristic
- \*TO-252 Package



1. GATE  
2.4 DRAIN  
3. SOURCE

**D-PAK / (TO-252)**

**Maximum Ratings** ( $T_a = 25^\circ C$  Unless Otherwise Specified)

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	-30	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current, ( $V_{GS} @ 10V, T_C = 25^\circ C$ ) , ( $V_{GS} @ 10V, T_C = 100^\circ C$ )	$I_D$	-20 -13	A
Pulsed Drain Current <sup>1</sup>	$I_{DM}$	-72	
Total Power Dissipation ( $T_C = 25^\circ C$ )	$P_D$	31	W
Thermal Resistance Junction-case	$R_{\theta JC}$	4.0	$^\circ C/W$
Thermal Resistance Junction-ambient	$R_{\theta JA}$	110	$^\circ C/W$
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-55~+150	$^\circ C$

## Electrical Characteristics (T<sub>j</sub> = 25°C Unless otherwise specified)

Characteristic	Symbol	Min	Typ	Max	Unit
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### Static

Drain-Source Breakdown Voltage I <sub>D</sub> =-250μA, V <sub>GS</sub> =0	BV <sub>DSS</sub>	-30	-	-	V
Gate-Source Threshold Voltage I <sub>D</sub> =-250μA, V <sub>DS</sub> =V <sub>GS</sub>	V <sub>GS(Th)</sub>	-1.0	-	3.0	
Gate-Source Leakage current V <sub>GS</sub> =±20V	I <sub>GSS</sub>	-	-	±100	nA
Drain-Source Leakage Current (T <sub>j</sub> =25°C) V <sub>DS</sub> =-30V, V <sub>GS</sub> =0	I <sub>DSS</sub>	-	-	-1	μA
Drain-Source Leakage Current (T <sub>j</sub> =70°C) V <sub>DS</sub> =-24V, V <sub>GS</sub> =0		-	-	-25	
Static Drain-Source On-Resistance <sup>2</sup> I <sub>D</sub> =-10A, V <sub>GS</sub> =-10V I <sub>D</sub> =-5A, V <sub>GS</sub> =-4.5V	R <sub>DS(on)</sub>	-	-	50 90	mΩ
Forward Transconductance I <sub>D</sub> =-10A, V <sub>DS</sub> =-10V	g <sub>fs</sub>	-	9.6	-	S

### Dynamic

Input Capacitance V <sub>GS</sub> =0V, V <sub>DS</sub> =-25V, f=1.0MHz	C <sub>iss</sub>	-	463	740	pF
Output Capacitance V <sub>GS</sub> =0V, V <sub>DS</sub> =-25V, f=1.0MHz	C <sub>oss</sub>	-	187	-	
Reverse Transfer Capacitance V <sub>GS</sub> =0V, V <sub>DS</sub> =-25V, f=1.0MHz	C <sub>rss</sub>	-	140	-	

## Switching

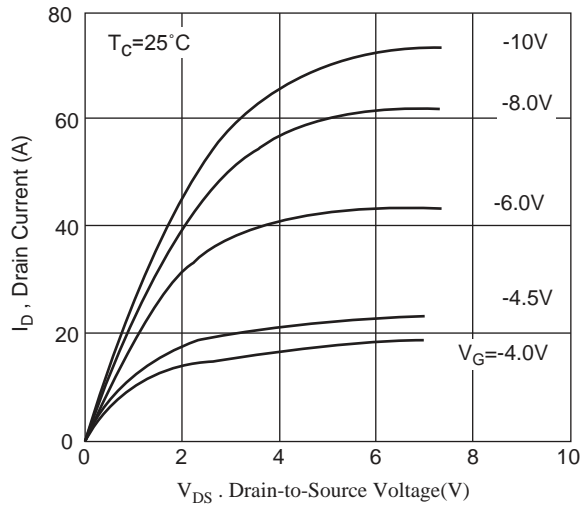
Turn-on Delay Time <sup>2</sup> $I_D=-10A, V_{DS}=-15V, V_{GS}=-10V, R_G=3.3\Omega, R_D=1.5\Omega$	$T_{d(on)}$	-	9.6	-	ns
Rise Time $I_D=-10A, V_{DS}=-15V, V_{GS}=-10V, R_G=3.3\Omega, R_D=1.5\Omega$	$T_r$	-	18	-	
Turn-off Delay Time $I_D=-10A, V_{DS}=-15V, V_{GS}=-10V, R_G=3.3\Omega, R_D=1.5\Omega$	$T_{d(off)}$	-	19	-	
Fall Time $I_D=-10A, V_{DS}=-15V, V_{GS}=-10V, R_G=3.3\Omega, R_D=1.5\Omega$	$T_f$	-	14	-	
Total Gate CHarge <sup>2</sup> $I_D=-10A, V_{DS}=-24V, V_{GS}=-4.5V$	$Q_g$	-	10	-	nC
Gate-Source Charge $I_D=-10A, V_{DS}=-24V, V_{GS}=-4.5V$	$Q_{gs}$	-	3	-	
Gate-Drain ("Miller") Charge $I_D=-10A, V_{DS}=-24V, V_{GS}=-4.5V$	$Q_{gd}$	-	5	-	

## Source-Drain Diode Characteristics

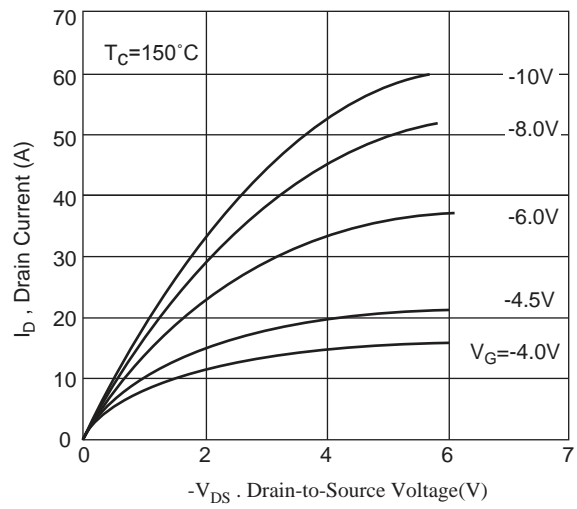
Forward On Voltage <sup>2</sup> $I_S=-10A, V_{GS}=0V$	$V_{SD}$	-	-	-1.2	V
Reverse Recovery Time $I_S=-10A, V_{GS}=0V \quad di/dt=100A/\mu s$	$T_{rr}$	-	34	-	ns
Reverse Recovery Charge $I_S=-10A, V_{GS}=0V \quad di/dt=100A/\mu s$	$Q_{rr}$	-	30	-	nc

Note: 1. Pulse width limited by safe operating area.  
2. Pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .

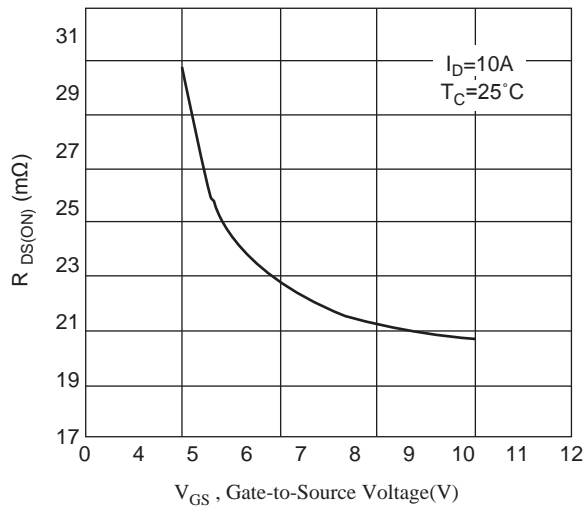
## Characteristics Curve



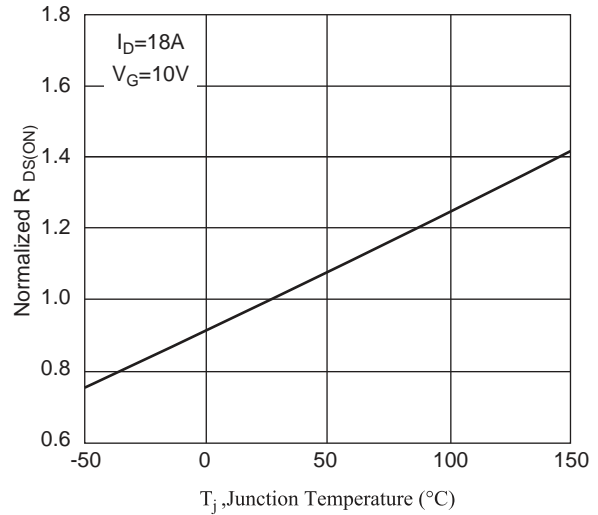
**Fig.1 Typical Output Characteristics**



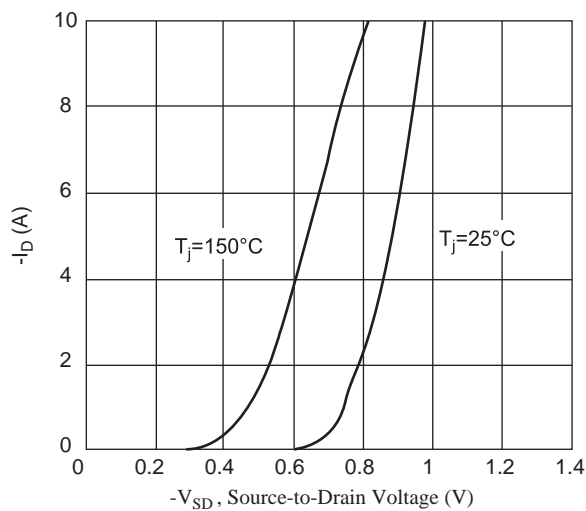
**Fig.2 Typical Output Characteristics**



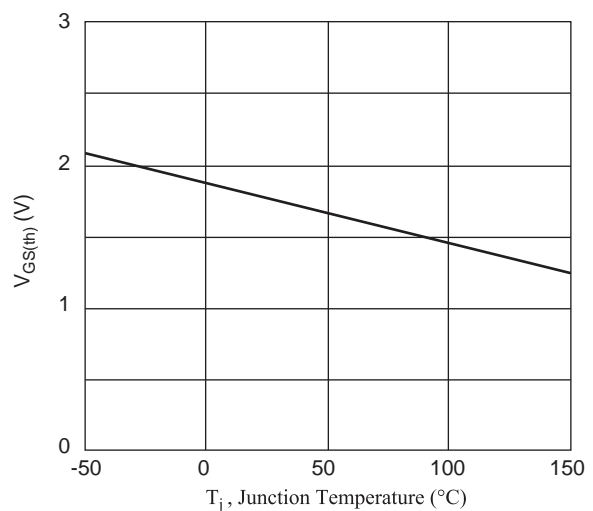
**Fig.3 On-Resistance v.s. Gate Voltage**



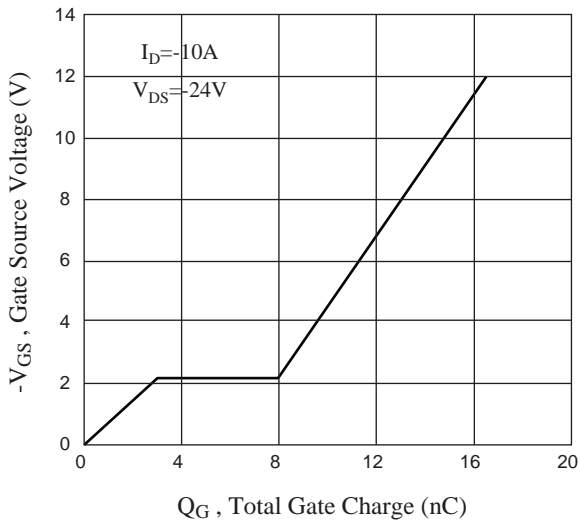
**Fig.4 Normalized OnResistance**



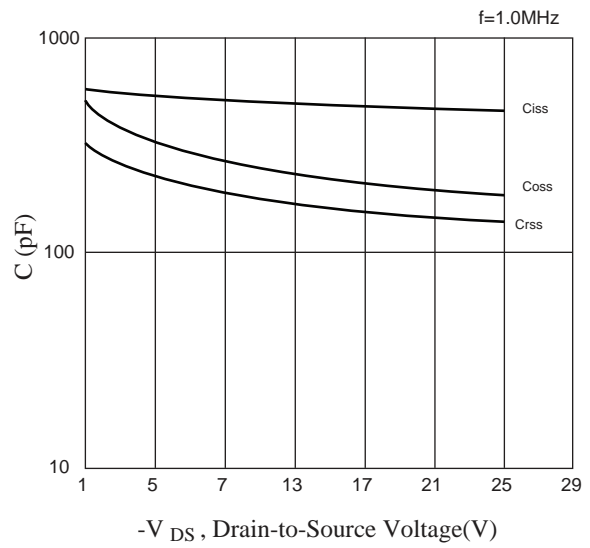
**Fig.5 Forward Characteristic of Reverse Diode**



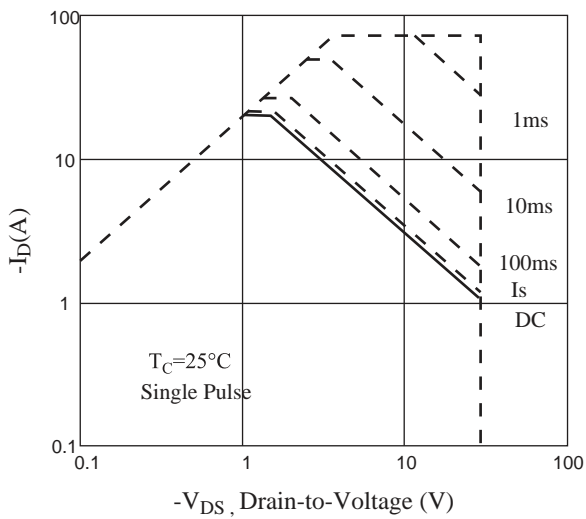
**Fig.6 Gate Threshold Voltage v.s. Junction Temperature**



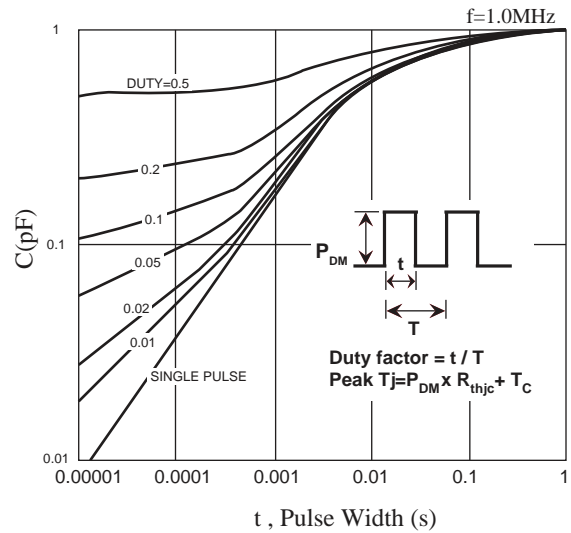
**Fig 7. Gate Charge Characteristics**



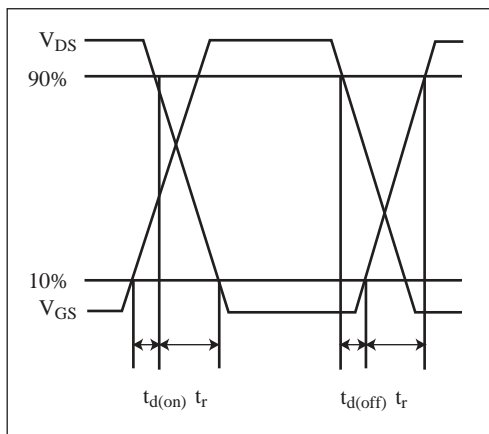
**Fig 8. Effective Transient Thermal Impedance**



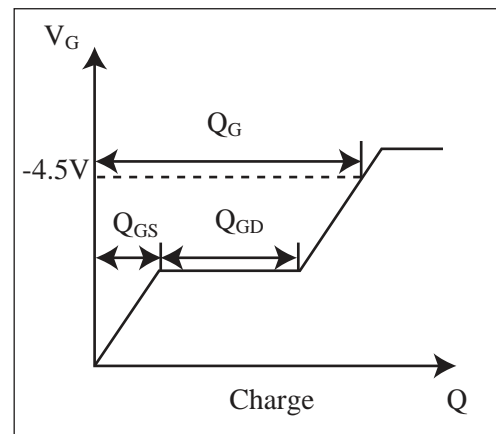
**Fig 9. Maximum Safe Operating Area**



**Fig 10. Effective Transient Thermal Impedance**



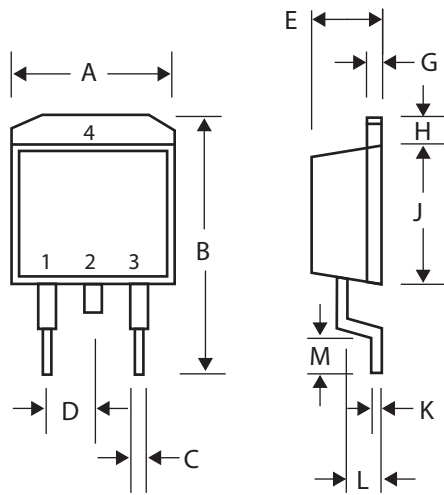
**Fig 11. Switching Time Waveform**



**Fig 12. Gate Charge Waveform**

**D-PAK / (TO-252) Outline Dimension**

Unit:mm



<b>D-PAK</b>		
<b>Dim</b>	<b>Min</b>	<b>Max</b>
<b>A</b>	6.40	6.80
<b>B</b>	9.00	10.00
<b>C</b>	0.50	0.80
<b>D</b>	-	2.30
<b>E</b>	2.20	2.50
<b>G</b>	0.45	0.55
<b>H</b>	1.00	1.60
<b>J</b>	5.40	5.80
<b>K</b>	0.30	0.64
<b>L</b>	0.70	1.70
<b>M</b>	0.90	1.50