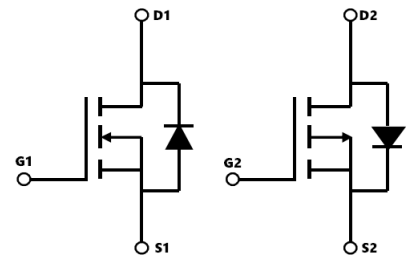


## 30V N+P-Channel Enhancement Mode MOSFET

### Description

The AP20G03GD uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.



### General Features

$V_{DS} = 30V$   $I_D = 30A$

$R_{DS(ON)} < 22m\Omega$  @  $V_{GS} = 10V$

$V_{DS} = -30V$   $I_D = -24A$

$R_{DS(ON)} < 35m\Omega$  @  $V_{GS} = 10V$

### Application

- Battery protection
- Load switch
- Uninterruptible power supply

### Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
AP20G03GD	TO-252-4L	AP20G03GD XXX YYYY	2500

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

Symbol	Parameter	Rating		Units
		N-Ch	P-Ch	
$V_{DS}$	Drain-Source Voltage	30	-30	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	$\pm 20$	V
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	30	-24	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V^1$	18	-19	A
$I_{DM}$	Pulsed Drain Current <sup>2</sup>	60	-50	A
EAS	Single Pulse Avalanche Energy <sup>3</sup>	22	45	mJ
$I_{AS}$	Avalanche Current	21	-30	A
$P_D @ T_C = 25^\circ C$	Total Power Dissipation <sup>4</sup>	25	25	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	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction-Ambient <sup>1</sup>	---	62	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance Junction-Case <sup>1</sup>	---	5	$^\circ C/W$

## 30V N+P-Channel Enhancement Mode MOSFET

### Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)

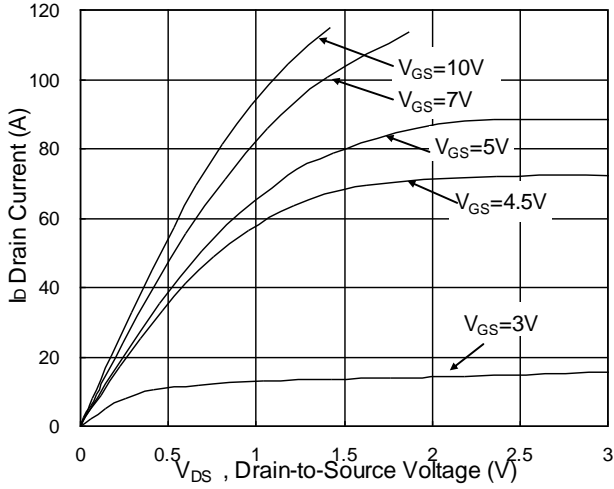
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	30	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	BVDSS Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=1\text{mA}$	---	0.0193	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=10V, I_D=30A$	---	15	22	m $\Omega$
		$V_{GS}=4.5V, I_D=15A$	---	26	36	
$V_{GS(th)}$	Gate Threshold Voltage		1.2	---	2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient	$V_{GS}=V_{DS}, I_D=250\mu A$	---	-3.97	---	mV/ $^\circ\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=24V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	uA
		$V_{DS}=24V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
$g_{fs}$	Forward Transconductance	$V_{DS}=5V, I_D=30A$	---	34	---	S
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$	---	1.8	---	$\Omega$
$Q_g$	Total Gate Charge (4.5V)		---	9.8	---	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=15V, V_{GS}=4.5V, I_D=15A$	---	4.2	---	
$Q_{gd}$	Gate-Drain Charge		---	3.6	---	
$T_{d(on)}$	Turn-On Delay Time		---	4	---	ns
$T_r$	Rise Time	$V_{DD}=15V, V_{GS}=10V, R_g=3.3$	---	8	---	
$T_{d(off)}$	Turn-Off Delay Time	$I_D=15A$	---	31	---	
$T_f$	Fall Time		---	4	---	
$C_{iss}$	Input Capacitance		---	940	---	pF
$C_{oss}$	Output Capacitance	$V_{DS}=15V, V_{GS}=0V, f=1\text{MHz}$	---	131	---	
$C_{rss}$	Reverse Transfer Capacitance		---	109	---	
$I_S$	Continuous Source Current <sup>1,5</sup>		---	---	43	A
$I_{SM}$	Pulsed Source Current <sup>2,5</sup>	$V_G=V_D=0V$ , Force Current	---	---	112	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=1A, T_J=25^\circ\text{C}$	---	---	1	V
$t_{rr}$	Reverse Recovery Time		---	8.5	---	nS
$Q_{rr}$	Reverse Recovery Charge	$I_F=30A, di/dt=100A/\mu s, T_J=25^\circ\text{C}$	---	2.2	---	nC

Note :

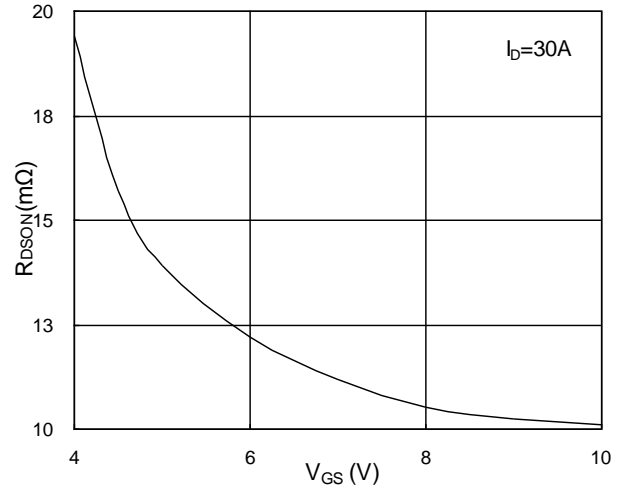
- 1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
- 2.The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$
- 3.The EAS data shows Max. rating . The test condition is  $V_{DD}=25V, V_{GS}=10V, L=0.1\text{mH}, I_{AS}=21A$
- 4 .The power dissipation is limited by  $150^\circ\text{C}$  junction temperature 5.The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

**30V N+P-Channel Enhancement Mode MOSFET**

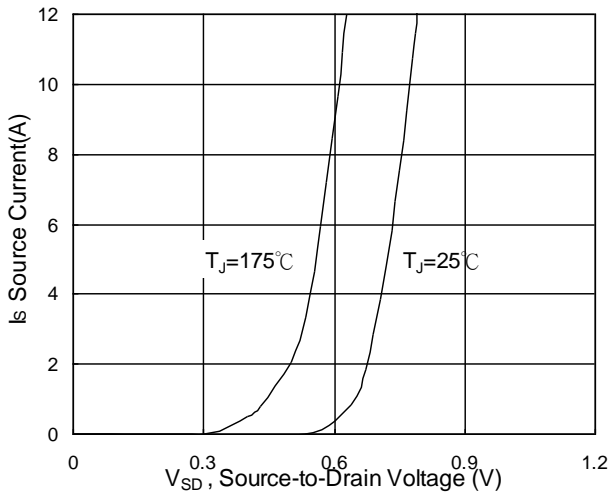
**N-Channel Typical Characteristics**



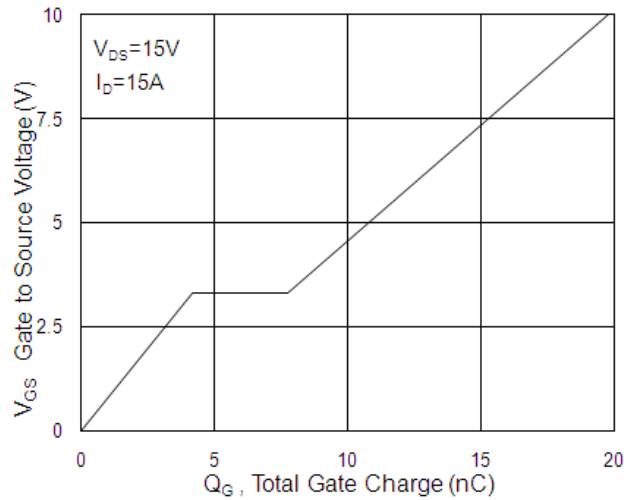
**Fig.1 Typical Output Characteristics**



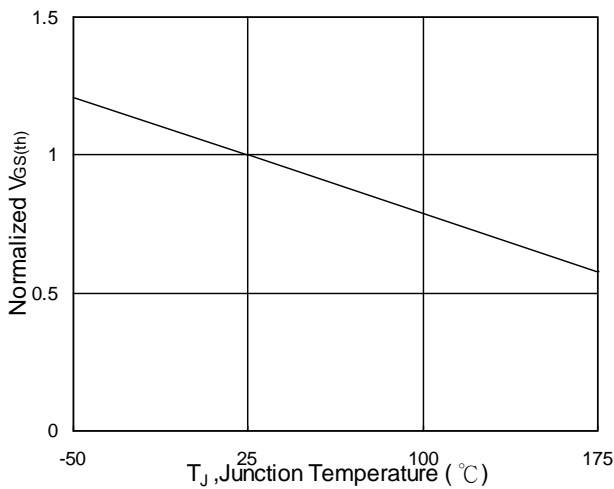
**Fig.2 On-Resistance vs. G-S Voltage**



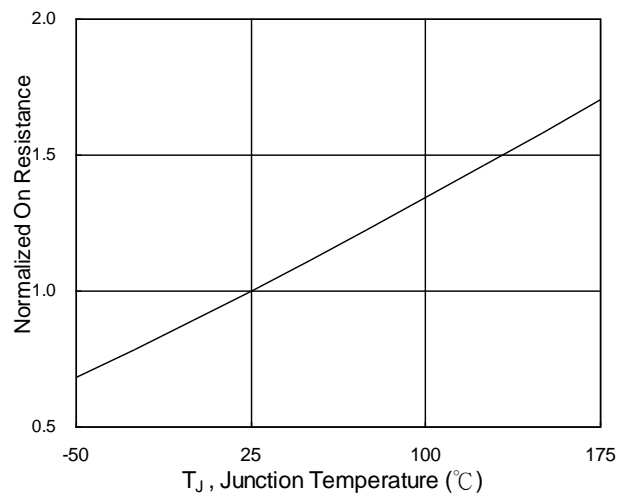
**Fig.3 Forward Characteristics of Reverse**



**Fig.4 Gate-Charge Characteristics**



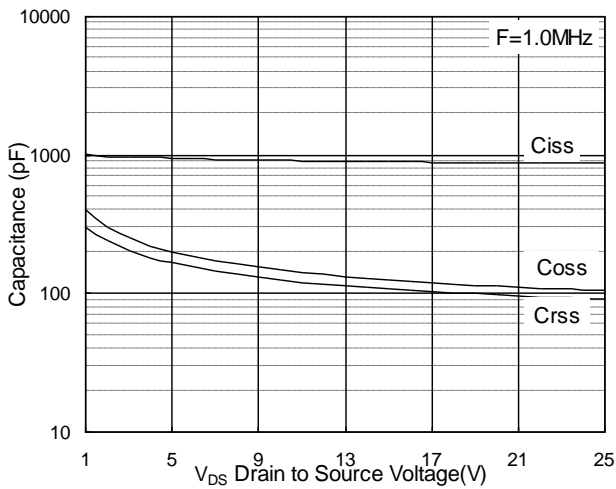
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



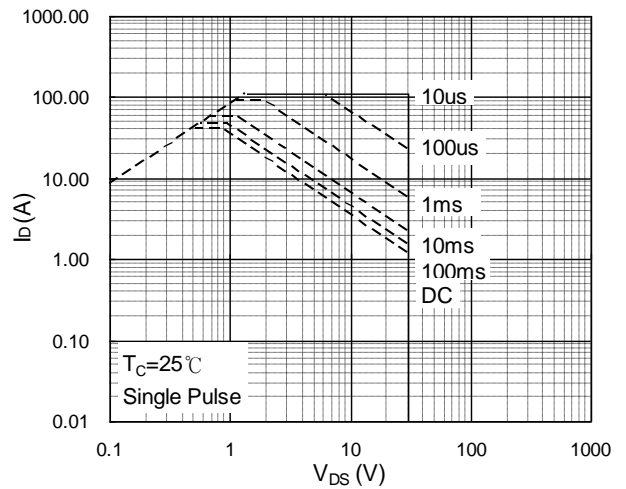
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



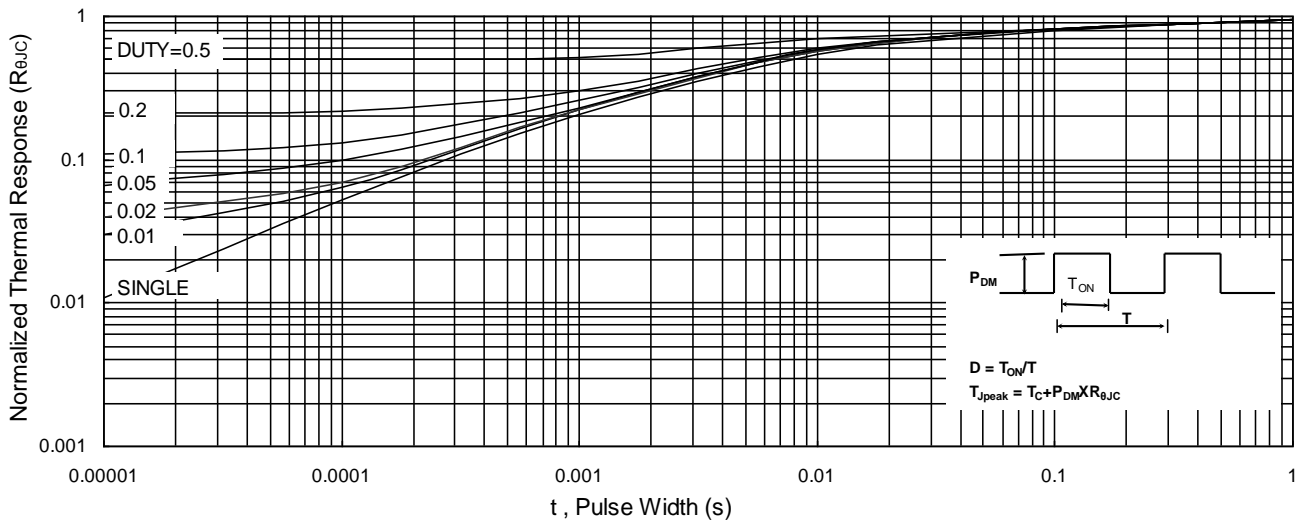
## 30V N+P-Channel Enhancement Mode MOSFET



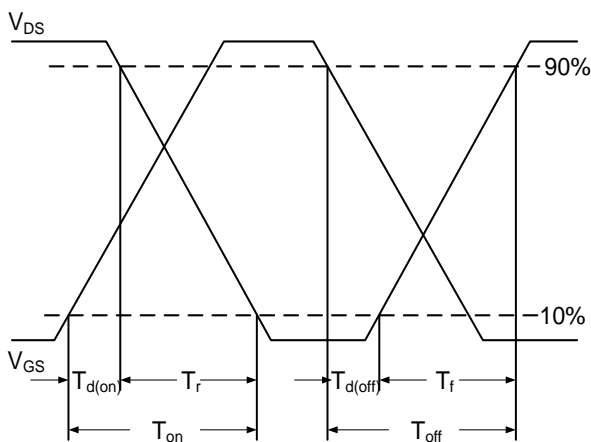
**Fig.7 Capacitance**



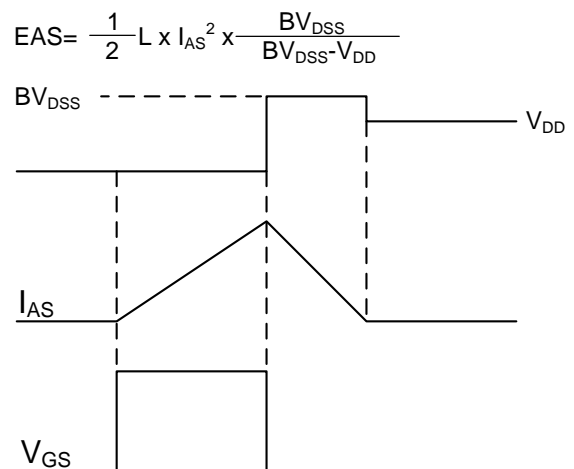
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Switching Waveform**

## 30V N+P-Channel Enhancement Mode MOSFET

Electrical Characteristics ( $T_J=25^\circ\text{C}$ , unless otherwise noted)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-30	---	---	V
$\Delta BV_{DSS}/\Delta T_J$	$BV_{DSS}$ Temperature Coefficient	Reference to $25^\circ\text{C}$ , $I_D=-1\text{mA}$	---	-0.021	---	$V/^\circ\text{C}$
$R_{DS(ON)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=-10V, I_D=-12A$	---	30	45	m $\Omega$
		$V_{GS}=-4.5V, I_D=-6A$	---	38	55	
$V_{GS(th)}$	Gate Threshold Voltage		-1.0	-1.5	-2.5	V
$\Delta V_{GS(th)}$	$V_{GS(th)}$ Temperature Coefficient	$V_{GS}=V_{DS}, I_D=-250\mu A$	---	-4.2	---	mV/ $^\circ\text{C}$
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=-24V, V_{GS}=0V, T_J=25^\circ\text{C}$	---	---	1	uA
		$V_{DS}=-24V, V_{GS}=0V, T_J=55^\circ\text{C}$	---	---	5	
$I_{GSS}$	Gate-Source Leakage Current	$V_{GS}=\pm 20V, V_{DS}=0V$	---	---	$\pm 100$	nA
$g_{fs}$	Forward Transconductance	$V_{DS}=-5V, I_D=-12A$	---	15	---	S
$R_g$	Gate Resistance	$V_{DS}=0V, V_{GS}=0V, f=1\text{MHz}$		15	30	
$Q_g$	Total Gate Charge (-4.5V)		---	9.8	---	nC
$Q_{gs}$	Gate-Source Charge	$V_{DS}=-20V, V_{GS}=-4.5V, I_D=-12A$	---	2.2	---	
$Q_{gd}$	Gate-Drain Charge		---	3.4	---	
$T_{d(on)}$	Turn-On Delay Time		---	16.4	---	ns
$T_r$	Rise Time	$V_{DD}=-24V, V_{GS}=-10V, R_G=3.3\Omega, I_D=-1A$	---	20.2	---	
$T_{d(off)}$	Turn-Off Delay Time		---	55	---	
$T_f$	Fall Time		---	10	---	
$C_{iss}$	Input Capacitance		---	930	---	pF
$C_{oss}$	Output Capacitance	$V_{DS}=-15V, V_{GS}=0V, f=1\text{MHz}$	---	148	---	
$C_{rss}$	Reverse Transfer Capacitance		---	115	---	
$I_S$	Continuous Source Current <sup>1,5</sup>		---	---	-24	A
$I_{SM}$	Pulsed Source Current <sup>2,5</sup>	$V_G=V_D=0V, \text{Force Current}$	---	---	-50	A
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$V_{GS}=0V, I_S=-1A, T_J=25^\circ\text{C}$	---	---	-1.2	V

Note :

1.The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 20Z copper.

2. The data tested by pulsed , pulse width  $\leq 300\mu s$  , duty cycle  $\leq 2\%$

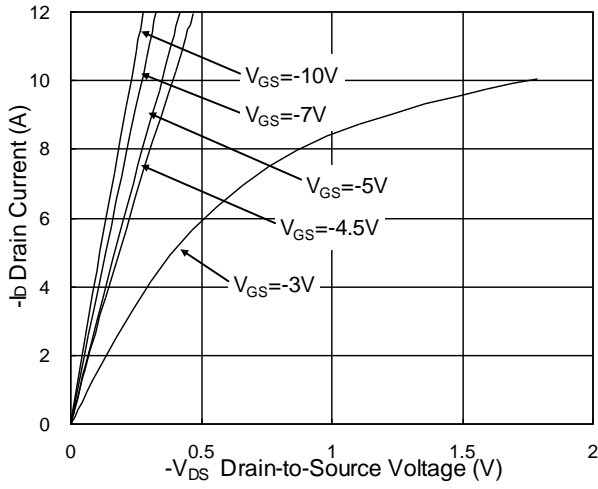
3.The EAS data shows Max. rat.The power dissipation is limited by ing . The test condition is  $V_{DD}=-25V, V_{GS}=-10V, L=0.1\text{mH}, I_{AS}=-30A$

4

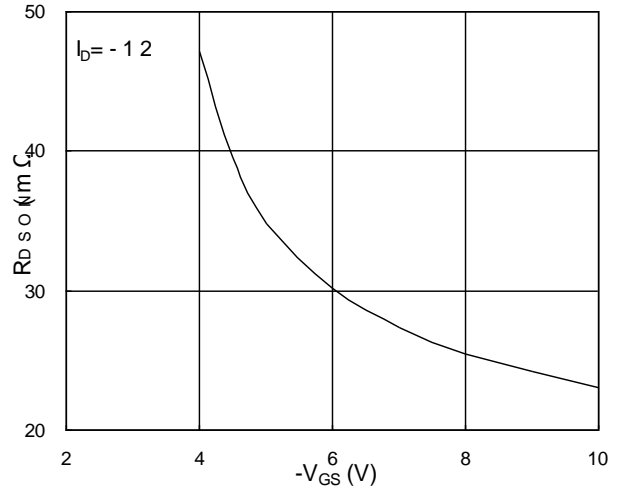
5 .The data is theoretically the same as  $I_D$  and  $I_{DM}$  , in real applications , should be limited by total power dissipation.

**30V N+P-Channel Enhancement Mode MOSFET**

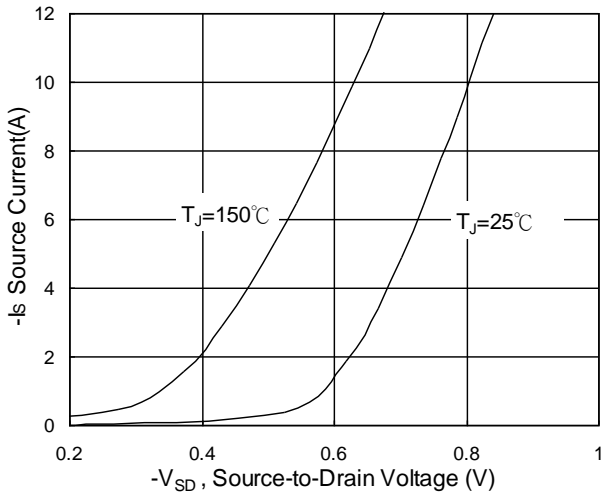
**P-Channel Typical Characteristics**



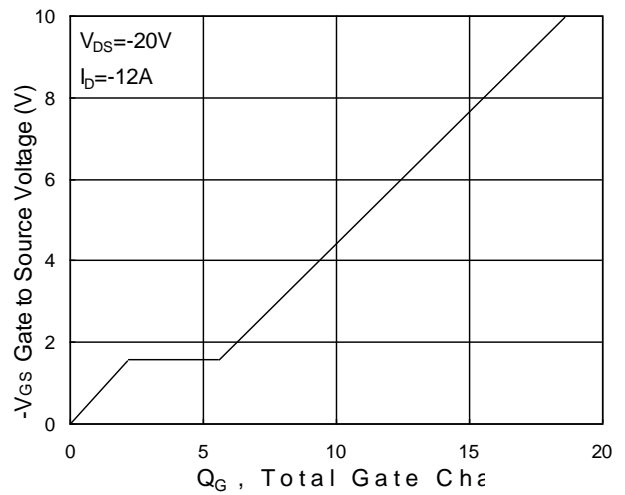
**Fig.1 Typical Output Characteristics**



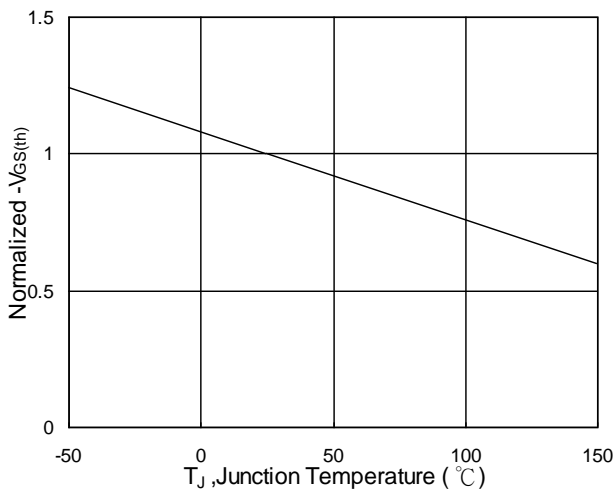
**Fig.2 On-Resistance v.s Gate-Source**



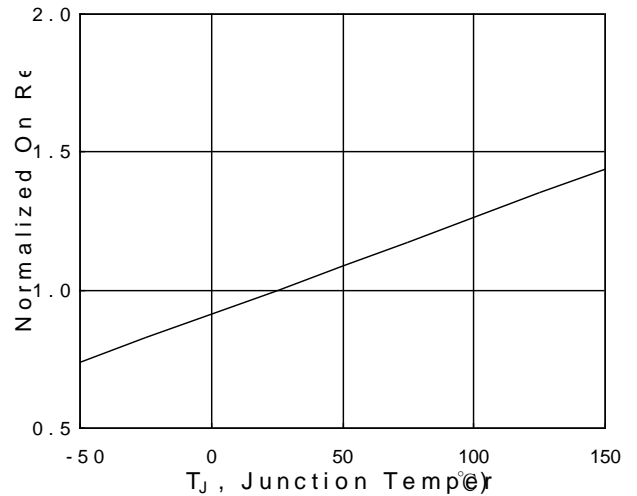
**Fig.3 Forward Characteristics Of Reverse**



**Fig.4 Gate-Charge Characteristics**



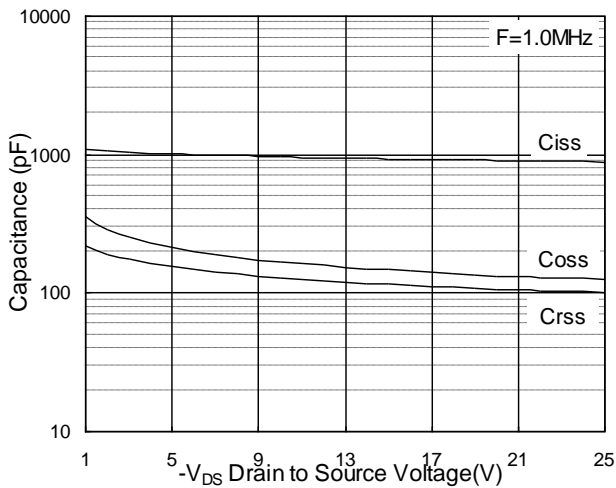
**Fig.5 Normalized  $V_{GS(th)}$  v.s  $T_J$**



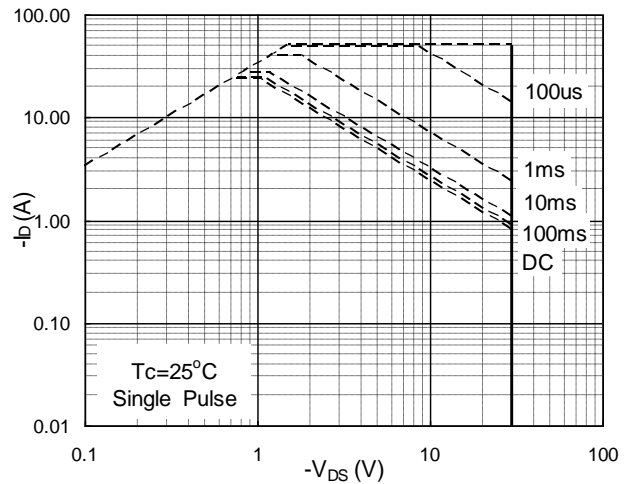
**Fig.6 Normalized  $R_{DS(on)}$  v.s  $T_J$**



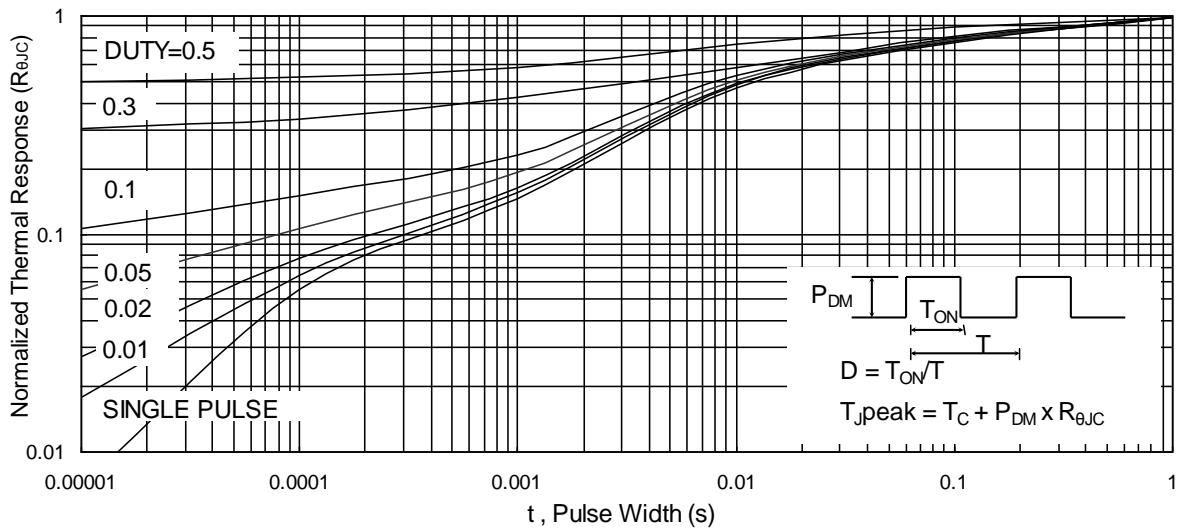
## 30V N+P-Channel Enhancement Mode MOSFET



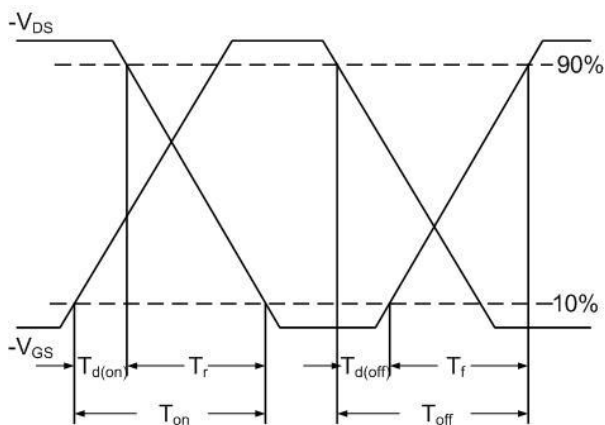
**Fig.7 Capacitance**



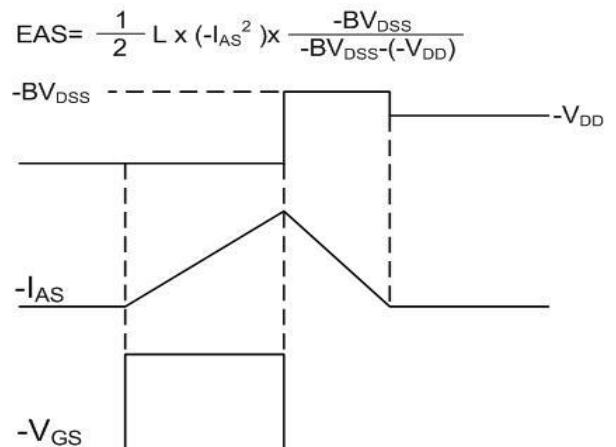
**Fig.8 Safe Operating Area**



**Fig.9 Normalized Maximum Transient Thermal Impedance**



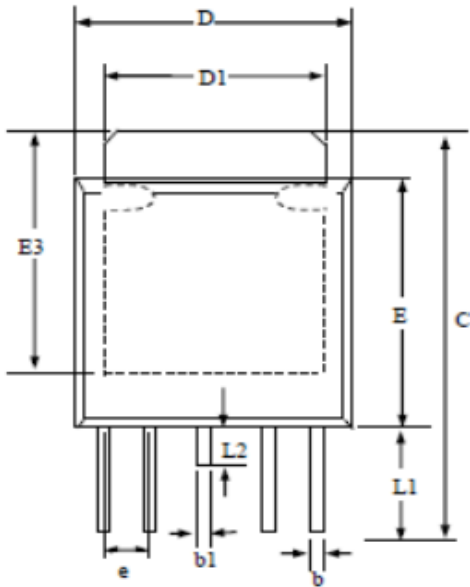
**Fig.10 Switching Time Waveform**



**Fig.11 Unclamped Inductive Waveform**

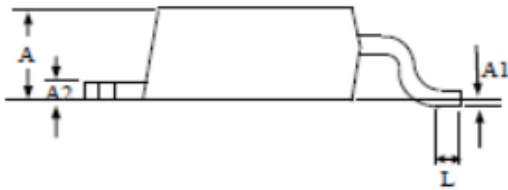


### Package Mechanical Data

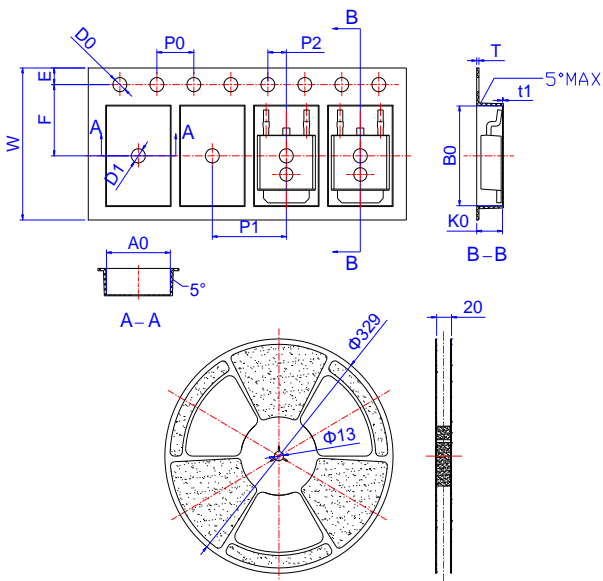


SYMBOLS	Millimeters		
	MIN	NOM	MAX
D	6.30	6.55	6.80
D1	4.80	5.35	5.90
C	9.30	9.75	10.20
E	5.30	5.80	6.30
E3	4.50	5.15	5.80
L	0.90	1.35	1.80
L1	2.00	2.53	3.05
L2	0.50	0.85	1.20
b	0.30	0.50	0.70
b1	0.40	0.60	0.80
A	2.10	2.30	2.50
A2	0.40	0.53	0.65
A1	0.00	0.10	0.20
e	1.20	1.30	1.40

1. All Dimensions Are in Millimeters.
2. Dimension Does Not Include Mold Protrusions.



### Reel Specification-TO-252-4



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
W	15.90	16.00	16.10	0.626	0.630	0.634
E	1.65	1.75	1.85	0.065	0.069	0.073
F	7.40	7.50	7.60	0.291	0.295	0.299
D0	1.40	1.50	1.60	0.055	0.059	0.063
D1	1.40	1.50	1.60	0.055	0.059	0.063
P0	3.90	4.00	4.10	0.154	0.157	0.161
P1	7.90	8.00	8.10	0.311	0.315	0.319
P2	1.90	2.00	2.10	0.075	0.079	0.083
A0	6.85	6.90	7.00	0.270	0.271	0.276
B0	10.45	10.50	10.60	0.411	0.413	0.417
K0	2.68	2.78	2.88	0.105	0.109	0.113
T	0.24		0.27	0.009		0.011
t1	0.10			0.004		
10P0	39.80	40.00	40.20	1.567	1.575	1.583



**30V N+P-Channel Enhancement Mode MOSFET****Attention**

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