

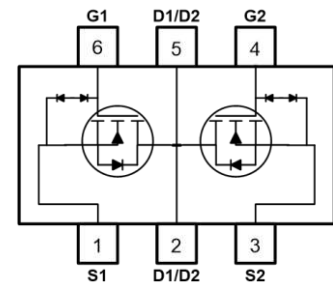
### ➤ General Description

This PAN20E28C Dual N-Channel enhancement mode power field effect transistor is the high density trench technology and this advanced technology can provide excellent  $R_{ds(On)}$  performance and efficiency for power switching and load switching application., this device also comply with the RoHS and Green Product requirement with full function reliability approved.

### ➤ Feature

- Super Low Gate Charge
- Green Device Available
- Excellent  $CdV/dt$  effect decline
- ESD Protected
- Advanced high cell density Trench technology
- TSOP-6 package design

### ➤ TSOP-6



### ➤ Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Continuous Drain Current <sup>1</sup>	$I_D@T_A=25^\circ C$	6	A
Continuous Drain Current <sup>1</sup>	$I_D@T_A=70^\circ C$	4.5	A
Pulsed Drain Current <sup>2</sup>	$I_{DM}$	22	A
Total Power Dissipation <sup>3</sup>	$P_D@T_A=25^\circ C$	1.25	W
Storage Temperature Range	$T_{STG}$	-55 to 150	$^\circ C$
Operating Junction Temperature Range	$T_J$	-55 to 150	$^\circ C$
Thermal Resistance Junction-ambient <sup>1</sup>	$R_{\theta JA}$	100	$^\circ C/W$

### ➤ Electrical Characteristics ( $T_J=25^\circ C$ Unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	20	---	---	V
Static Drain-Source On-Resistance <sup>2</sup>	$R_{DS(ON)}$	$V_{GS}=4.5V, I_D=3A$	16.5	20.5	24.5	m $\Omega$
		$V_{GS}=4.0V, I_D=3A$	17	21	25.5	
		$V_{GS}=3.7V, I_D=3A$	17.5	22	27.5	
		$V_{GS}=3.1V, I_D=3A$	19	23	30	
		$V_{GS}=2.5V, I_D=3A$	22.5	26	33	
Gate Threshold Voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	0.5	0.7	1.2	V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS}=16V, V_{GS}=0V, T_J=25^\circ C$	---	---	1	uA
		$V_{DS}=16V, V_{GS}=0V, T_J=55^\circ C$	---	---	5	
Gate-Source Leakage Current	$I_{GSS}$	$V_{GS}=\pm 8V, V_{DS}=0V$	---	---	$\pm 10$	uA
Forward Transconductance	$g_{fs}$	$V_{DS}=5V, I_D=3A$	---	17	---	S
Total Gate Charge	$Q_g$	$V_{DS}=15V, V_{GS}=4.5V, I_D=6A$	---	11.4	---	nC
Gate-Source Charge	$Q_{gs}$		---	1.4	---	
Gate-Drain Charge	$Q_{gd}$		---	2.8	---	
Turn-On Delay Time	$T_{d(on)}$	$V_{DD}=10V, V_{GS}=4.5V, R_G=3.3\Omega$ $I_D=3A$	---	3.6	---	ns
Rise Time	$T_r$		---	10.0	---	
Turn-Off Delay Time	$T_{d(off)}$		---	33	---	
Fall Time	$T_f$		---	3.9	---	
Input Capacitance	$C_{iss}$	$V_{DS}=15V, V_{GS}=0V, f=1MHz$	---	638	---	pF
Output Capacitance	$C_{oss}$		---	69	---	
Reverse Transfer Capacitance	$C_{rss}$		---	66	---	

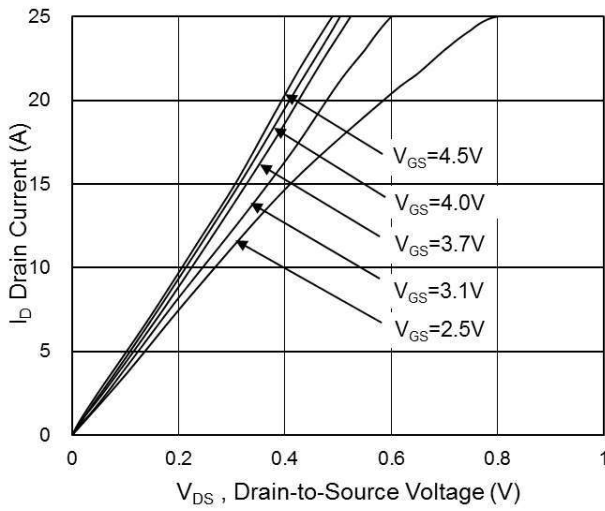
### ➤ Diode Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Continuous Source Current <sup>1,4</sup>	$I_S$	$V_G=V_D=0V$ , Force Current	---	---	5.5	A
Diode Forward Voltage <sup>2</sup>	$V_{SD}$	$V_{GS}=0V, I_S=1A, T_J=25^\circ C$	---	0.75	1.2	V

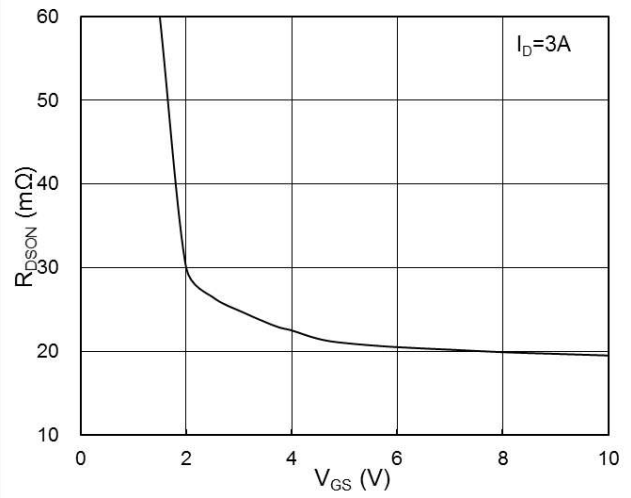
Note :

1. Pulse width limited by maximum junction temperature.
2. The data tested by pulsed, pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$
3. Ensure that the channel temperature does not exceed  $150^\circ C$ .
4. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

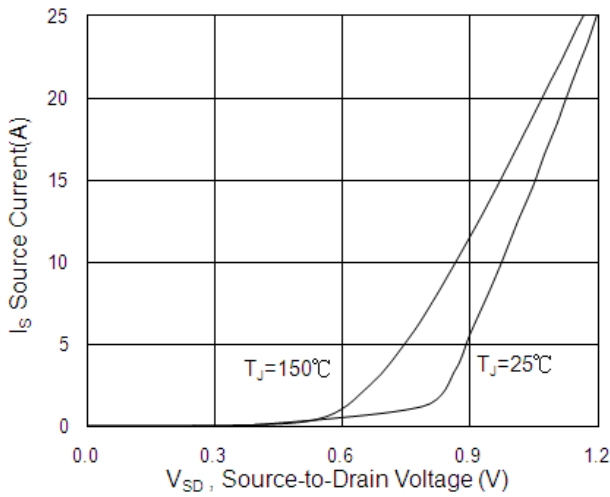
### ➤ Typical Characteristics



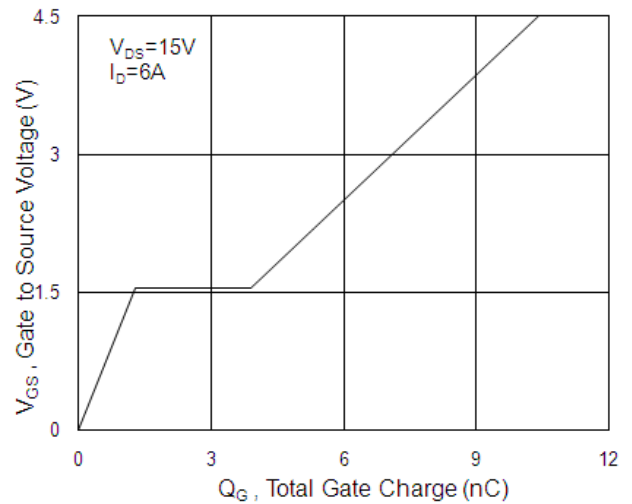
**Fig.1 Typical Output Characteristics**



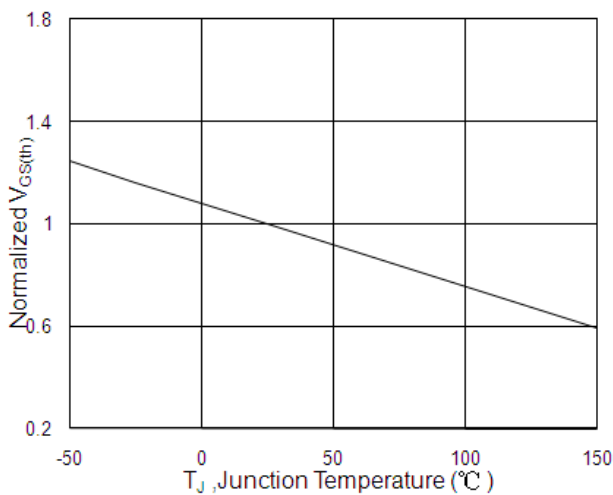
**Fig.2 On-Resistance vs. G-S voltage**



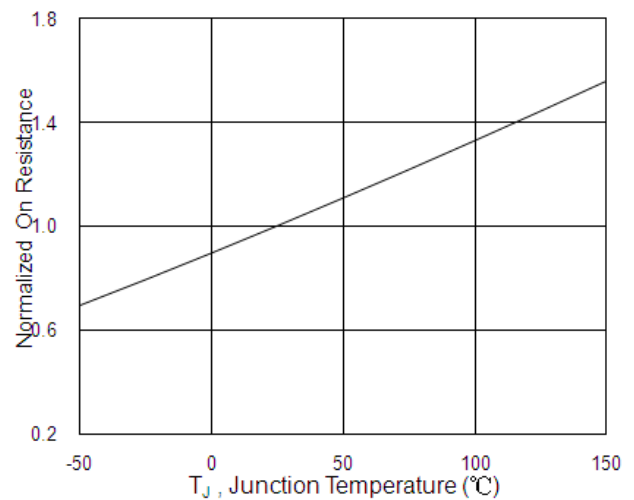
**Fig.3 Source Drain Forward Characteristics**



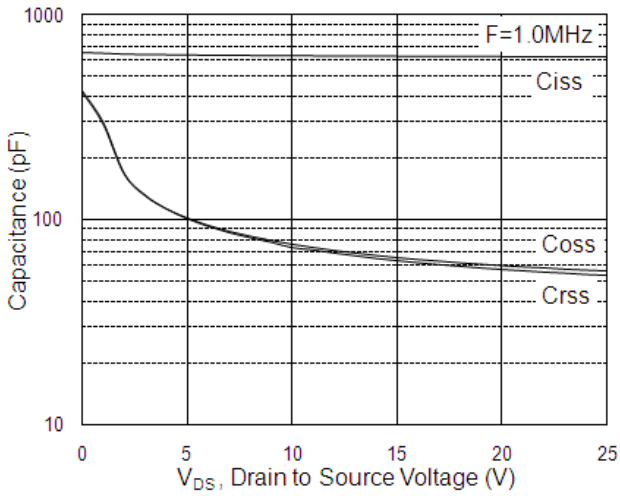
**Fig.4 Gate-Charge Characteristics**



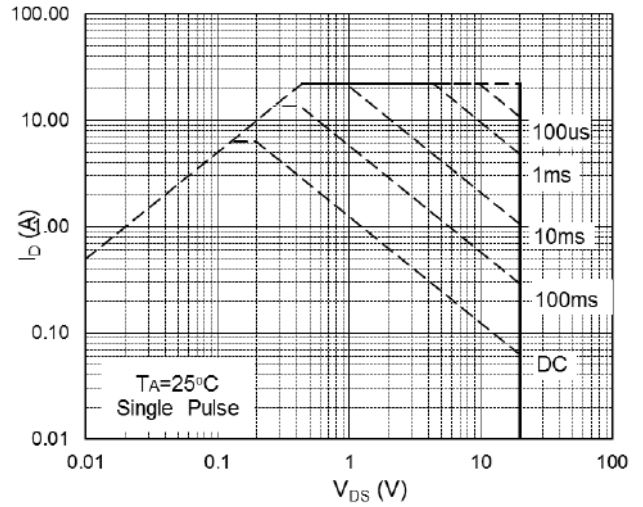
**Fig.5 Normalized  $V_{GS(th)}$  vs.  $T_J$**



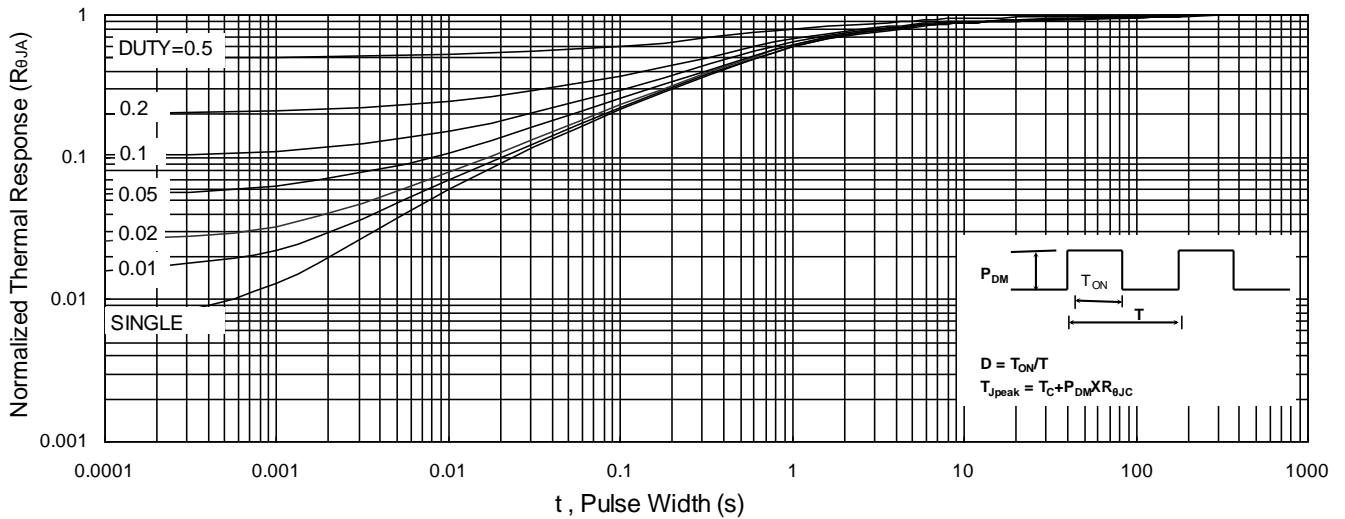
**Fig.6 Normalized  $R_{DS(on)}$  vs.  $T_J$**



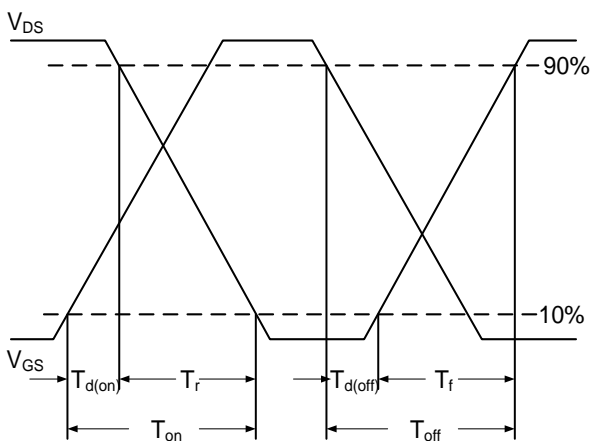
**Fig.7 Capacitance**



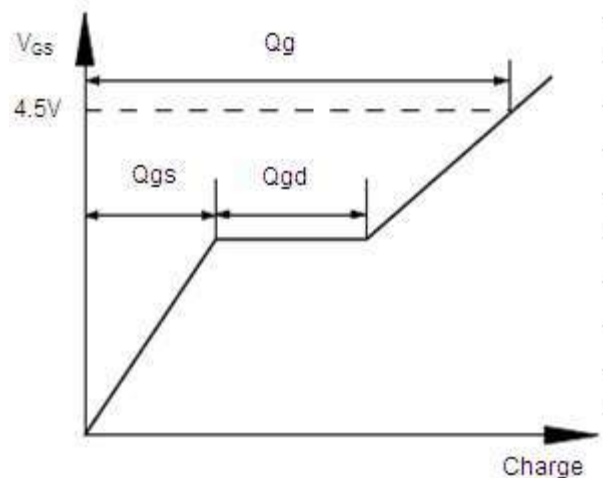
**Fig.8 Safe Operating Area**



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



**Fig.10 Switching Time Waveform**



**Fig.11 Gate Charge Waveform**

### ➤ Recommend IR Reflow Soldering Thermal Profile

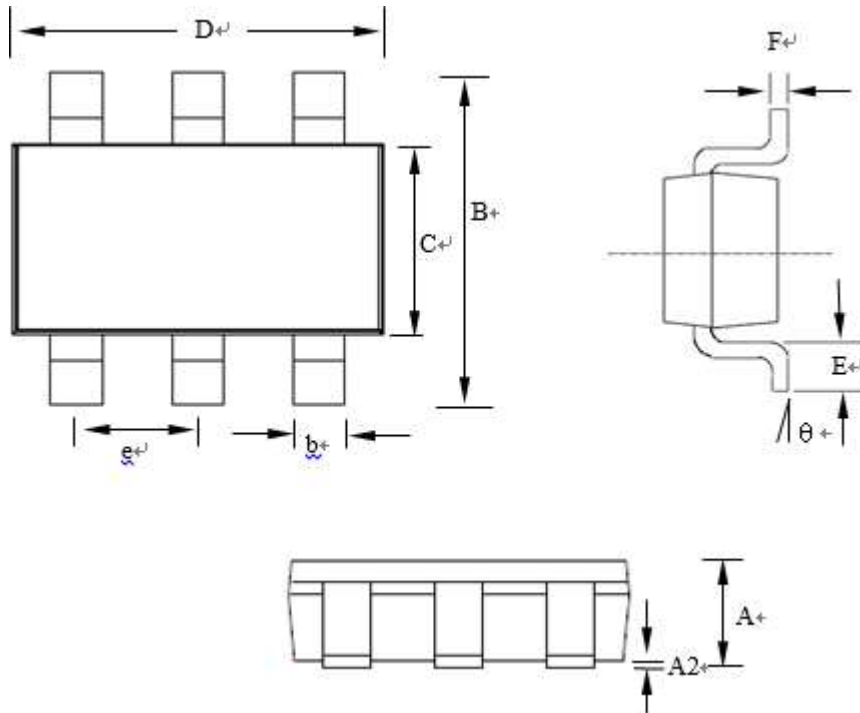


Profile Feature	Pb-Free Assembly Profile
Temperature Min. (T <sub>smin</sub> )	150°C
Temperature Max. (T <sub>smax</sub> )	200°C
Time (t <sub>s</sub> ) from (T <sub>smin</sub> to T <sub>smax</sub> )	60-120 seconds
Average Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )	3°C/second max.
Liquidous Temperature (T <sub>L</sub> )	217°C
Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )	60 – 150 seconds
Peak Temperature	260°C +0°C / -5°C
Time (t <sub>P</sub> ) within 5°C of actual Peak Temperature	30 seconds
Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )	6°C/second max
Time 25°C to Peak Temperature	8 minutes max.

### ➤ Ordering Information

Part Number	Description	Quantity
PAN20E28C	TSOP-6 Reel	3000 pcs

### ➤ Package Information (TSOP-6)



SYMBOLS	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	--	0.9	0.028	--	0.035
A2	0.00	--	0.10	0.000	--	0.004
B	2.60	2.80	3.00	0.102	0.110	0.118
C	1.40	1.60	1.80	0.055	0.063	0.071
D	2.70	2.90	3.10	0.106	0.114	0.122
E	0.30	0.40	0.60	0.012	0.016	0.024
F	0.07	0.127	0.20	0.003	0.005	0.008
b	0.30	0.40	0.50	0.012	0.016	0.020
e	--	0.95	--	--	0.037	--
θ	0°	5°	10°	0°	5°	10°

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