

**Features**

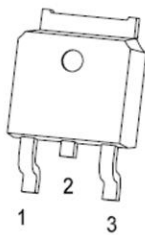
- $V_{DS} = -60V, I_D = -14A$   
 $R_{DS(ON)} = 88m\Omega @ V_{GS} = -10V (Typ)$   
 $R_{DS(ON)} = 120m\Omega @ V_{GS} = -4.5V (Typ)$

**Application**

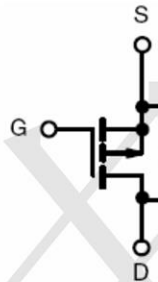
- Load/Power Switching
- Interfacing Switching
- Battery Management for Ultra Small Portable Electronics
- Logic Level Shift

**Package and Pin Configuration**

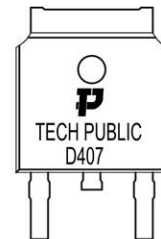
TO-252



1. GATE
2. DRAIN
3. SOURCE



**Marking:**



**Absolute Maximum Ratings ( $T_A = 25^\circ C$  unless otherwise noted)**

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D$	-14	A
Drain Current-Continuous( $T_C = 100^\circ C$ )	$I_D(100^\circ C)$	-8.5	A
Pulsed Drain Current	$I_{DM}$	-30	A
Maximum Power Dissipation	$P_D$	60	W
Derating factor		0.4	W/ $^\circ C$
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	50	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	$^\circ C$

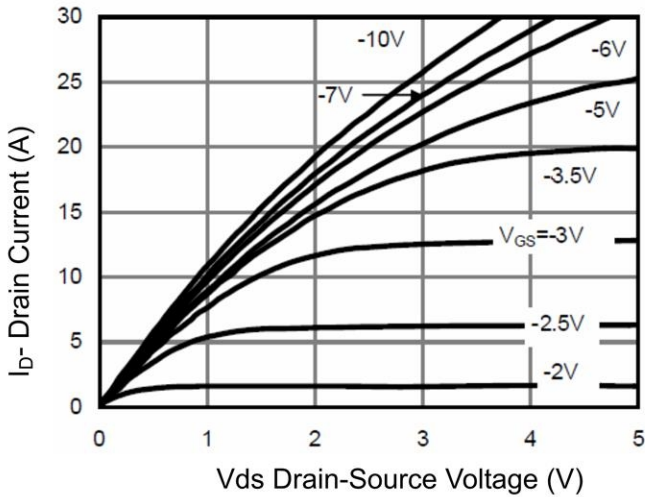
**Thermal Characteristic**

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	2.5	$^\circ C/W$
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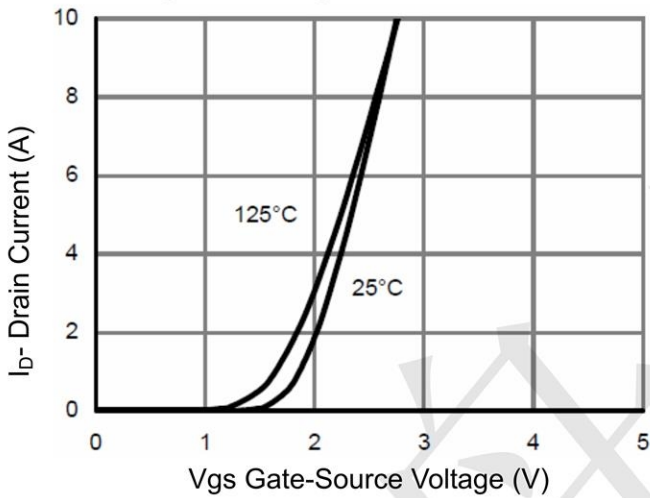
**Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =-250μA	-60	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-60V, 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
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	1.0	1.7	3.0	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-12A	-	88	98	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-8A	-	120	140	Ω
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-12A	-	10	-	S
<b>Dynamic Characteristics</b> (Note 4)						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-30V, V <sub>GS</sub> =0V, F=1.0MHz	-	1630.7	-	PF
Output Capacitance	C <sub>oss</sub>		-	90.6	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	77.3	-	PF
<b>Switching Characteristics</b> (Note 4)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-30V, R <sub>L</sub> =1.5Ω, V <sub>GS</sub> =-10V, R <sub>G</sub> =3Ω	-	11	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	14	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	33	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	13	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-30, I <sub>D</sub> =-13A, V <sub>GS</sub> =-10V	-	37.6	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	4.3	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	7.2	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-12A	-	-	-1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>				-14	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = - 12A di/dt = -100A/μs (Note3)	-	35	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	38	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

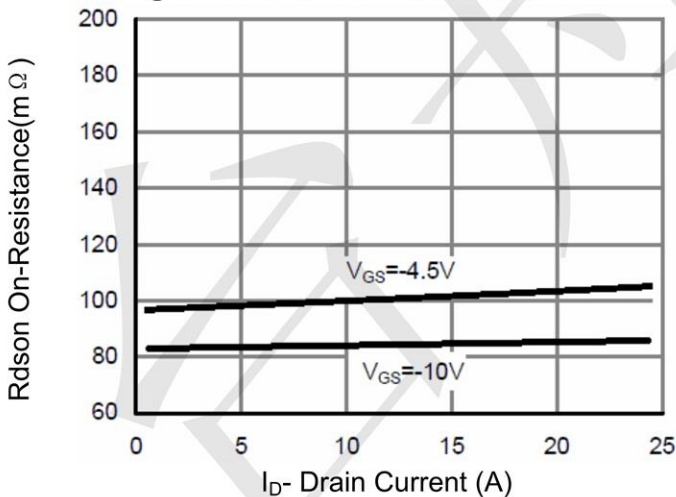
## Typical Characteristics



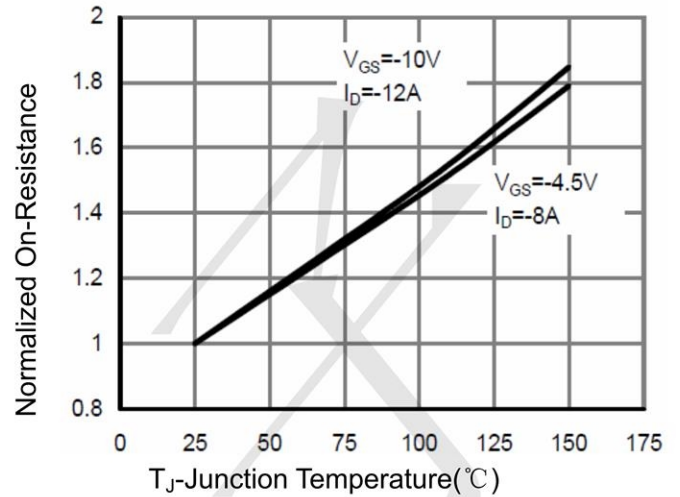
**Figure 1 Output Characteristics**



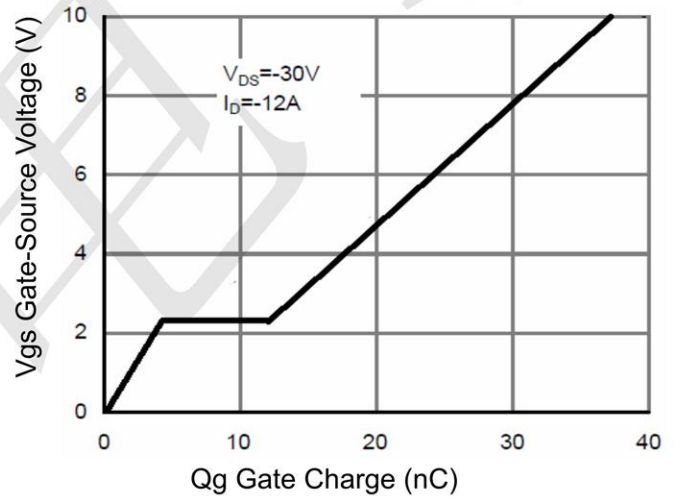
**Figure 2 Transfer Characteristics**



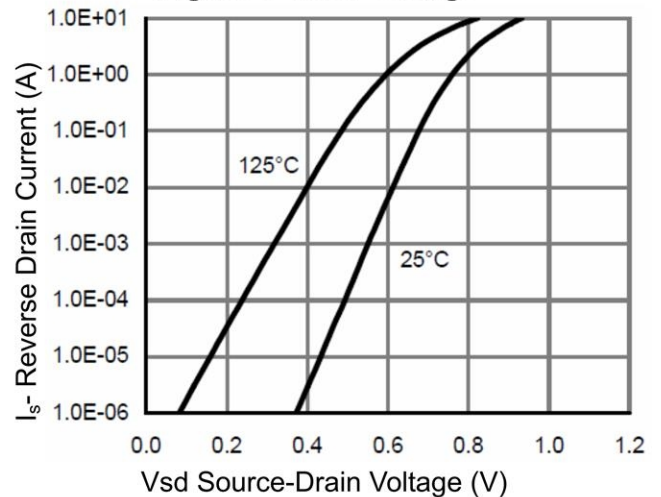
**Figure 3  $R_{ds(on)}$ - Drain Current**



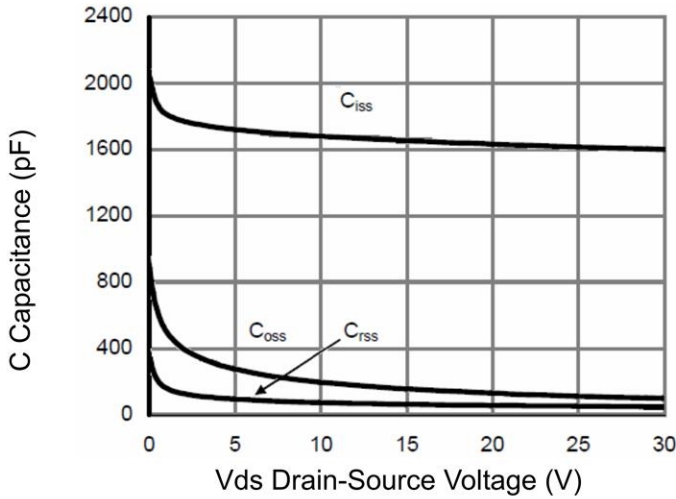
**Figure 4  $R_{ds(on)}$ -Junction Temperature**



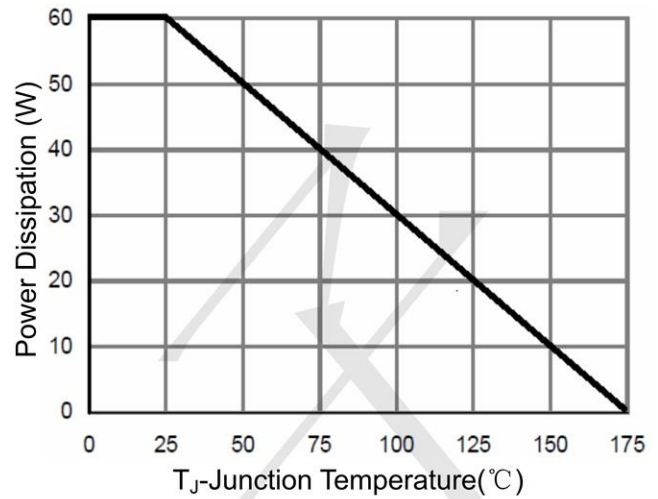
**Figure 5 Gate Charge**



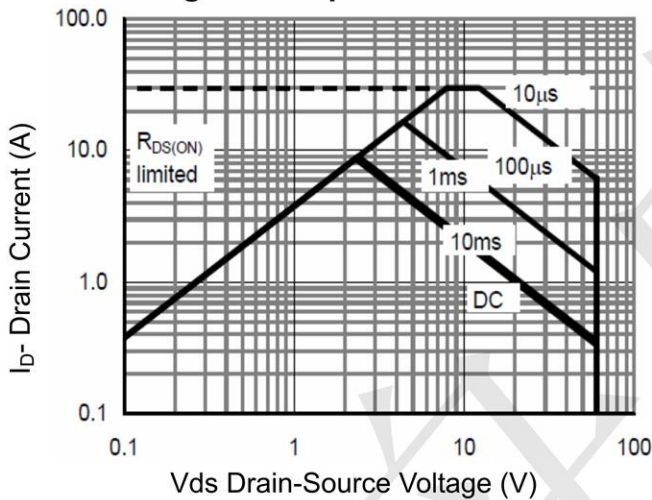
**Figure 6 Source- Drain Diode Forward**



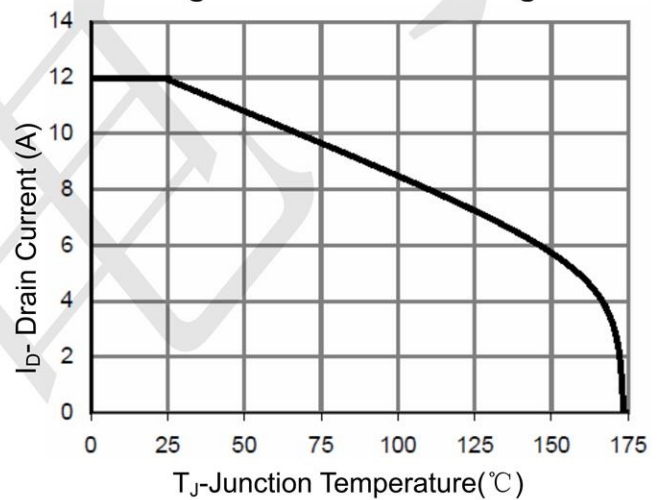
**Figure 7 Capacitance vs Vds**



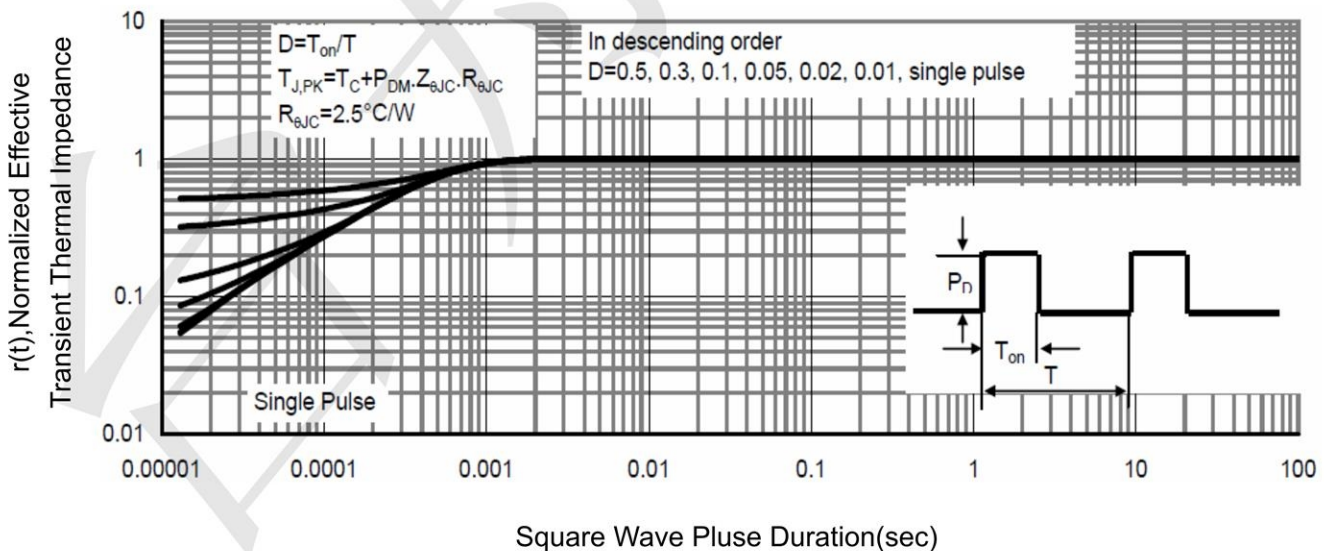
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area**

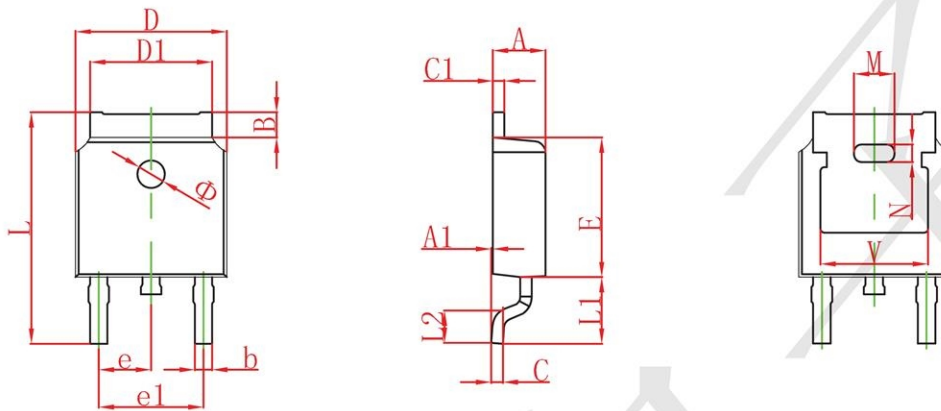


**Figure 10 ID Current De-rating**



**Figure 11 Normalized Maximum Transient Thermal Impedance**

**TO252 Package Information**



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.380	0.087	0.094
A1	0.000	0.100	0.000	0.004
B	0.800	1.400	0.031	0.055
b	0.710	0.810	0.028	0.032
c	0.460	0.560	0.018	0.022
c1	0.460	0.560	0.018	0.022
D	6.500	6.700	0.256	0.264
D1	5.130	5.460	0.202	0.215
E	6.000	6.200	0.236	0.244
e	2.286 TYP.		0.090 TYP.	
e1	4.327	4.727	0.170	0.186
M	1.778REF.		0.070REF.	
N	0.762REF.		0.018REF.	
L	9.800	10.400	0.386	0.409
L1	2.9REF.		0.114REF.	
L2	1.400	1.700	0.055	0.067
V	4.830 REF.		0.190 REF.	
Φ	1.100	1.300	0.043	0.051