

## N-Channel 600V (D-S) Super Junction Power MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V) at $T_J$ max.	600	
$R_{DS(on)}$ max. at 25 °C ( $\Omega$ )	$V_{GS} = 10$ V	0.28
$Q_g$ max. (nC)	43	
$Q_{gs}$ (nC)	5	
$Q_{gd}$ (nC)	22	
Configuration	Single	

### FEATURES

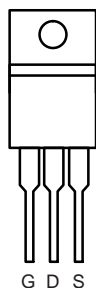
- Low figure-of-merit (FOM)  $R_{on} \times Q_g$
- Low input capacitance ( $C_{iss}$ )
- Reduced switching and conduction losses
- Ultra low gate charge ( $Q_g$ )
- Avalanche energy rated (UIS)



### APPLICATIONS

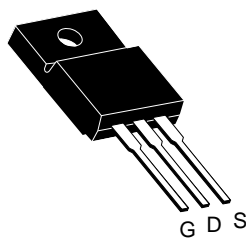
- Server and telecom power supplies
- Switch mode power supplies (SMPS)
- Power factor correction power supplies (PFC)
- Lighting
  - High-intensity discharge (HID)
  - Fluorescent ballast lighting
- Industrial

TO-220AB



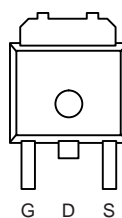
Top View

TO-220 FULLPAK

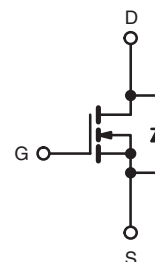


Top View

TO-252



Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>C</sub> = 25 °C, unless otherwise noted)					
PARAMETER			SYMBOL	LIMIT	UNIT
Drain-Source Voltage			V <sub>DS</sub>	600	V
Gate-Source Voltage			V <sub>GS</sub>	± 30	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	V <sub>GS</sub> at 10 V	T <sub>C</sub> = 25 °C	I <sub>D</sub>	15	A
		T <sub>C</sub> = 100 °C		9.4	
Pulsed Drain Current <sup>a</sup>			I <sub>DM</sub>	45	
Linear Derating Factor				3.6	W/°C
Single Pulse Avalanche Energy <sup>b</sup>			E <sub>AS</sub>	9	mJ
Maximum Power Dissipation			P <sub>D</sub>	156/34	W
Operating Junction and Storage Temperature Range			T <sub>J</sub> , T <sub>stg</sub>	-55 to +150	°C
Drain-Source Voltage Slope	T <sub>J</sub> = 125 °C		dV/dt	15	V/ns
Reverse Diode dV/dt <sup>d</sup>				4.1	
Soldering Recommendations (Peak Temperature) <sup>c</sup>	for 10 s			300	°C


#### Notes

- Repetitive rating; pulse width limited by maximum junction temperature.
- $V_{DS} = 50$  V, starting  $T_J = 25$  °C,  $L = 28.2$  mH,  $R_g = 25$   $\Omega$ ,  $I_{AS} = 4.5$  A.
- 1.6 mm from case.
- $I_{SD} \leq I_D$ ,  $dI/dt = 100$  A/ $\mu$ s, starting  $T_J = 25$  °C.

**THERMAL RESISTANCE RATINGS**

PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	$R_{thJA}$	-	60	°C/W
Maximum Junction-to-Case (Drain)	$R_{thJC}$	-	0.8	

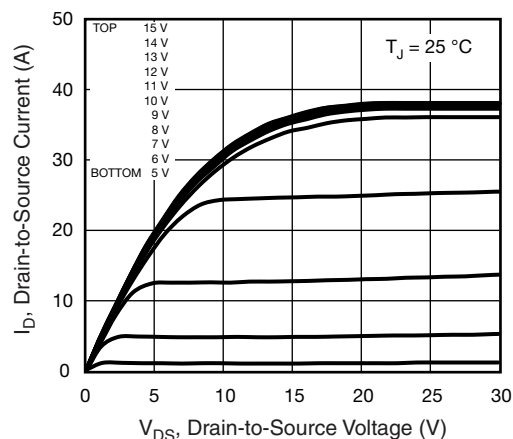
**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\text{ }\mu\text{A}$	600	-	-	V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ °C}$ , $I_D = 1\text{ mA}$	-	0.75	-	V/°C
Gate-Source Threshold Voltage (N)	$V_{GS(th)}$	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$	2	-	4	V
Gate-Source Leakage	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA
		$V_{GS} = \pm 30\text{ V}$	-	-	$\pm 1$	$\mu\text{A}$
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 650\text{ V}$ , $V_{GS} = 0\text{ V}$	-	-	1	$\mu\text{A}$
		$V_{DS} = 520\text{ V}$ , $V_{GS} = 0\text{ V}$ , $T_J = 125\text{ °C}$	-	-	10	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$ , $I_D = 8\text{ A}$	-	0.28	-	$\Omega$
Forward Transconductance	$g_{fs}$	$V_{DS} = 30\text{ V}$ , $I_D = 8\text{ A}$	-	16	-	S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 100\text{ V}$ , $f = 1\text{ MHz}$	-	800	-	pF
Output Capacitance	$C_{oss}$		-	70	-	
Reverse Transfer Capacitance	$C_{rss}$		-	8	-	
Effective Output Capacitance, Energy Related <sup>a</sup>	$C_{o(er)}$	$V_{DS} = 0\text{ V to } 520\text{ V}$ , $V_{GS} = 0\text{ V}$	-	63	-	
Effective Output Capacitance, Time Related <sup>b</sup>	$C_{o(tr)}$		-	213	-	
Total Gate Charge	$Q_g$	$V_{GS} = 10\text{ V}$ , $I_D = 8\text{ A}$ , $V_{DS} = 520\text{ V}$	-	48	96	nC
Gate-Source Charge	$Q_{gs}$		-	11	-	
Gate-Drain Charge	$Q_{gd}$		-	21	-	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 520\text{ V}$ , $I_D = 8\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_g = 9.1\text{ }\Omega$	-	13	25	ns
Rise Time	$t_r$		-	11	35	
Turn-Off Delay Time	$t_{d(off)}$		-	81	90	
Fall Time	$t_f$		-	25	40	
Gate Input Resistance	$R_g$	$f = 1\text{ MHz}$ , open drain	-	3.5	-	$\Omega$
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	MOSFET symbol showing the integral reverse p - n junction diode 	-	-	15	A
Pulsed Diode Forward Current	$I_{SM}$		-	-	40	
Diode Forward Voltage	$V_{SD}$	$T_J = 25\text{ °C}$ , $I_S = 8\text{ A}$ , $V_{GS} = 0\text{ V}$	-	-	1.5	V
Reverse Recovery Time	$t_{rr}$	$T_J = 25\text{ °C}$ , $I_F = I_S = 8\text{ A}$ , $dI/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 400\text{ V}$	-	345	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	4.5	-	$\mu\text{C}$
Reverse Recovery Current	$I_{RRM}$		-	35	-	A

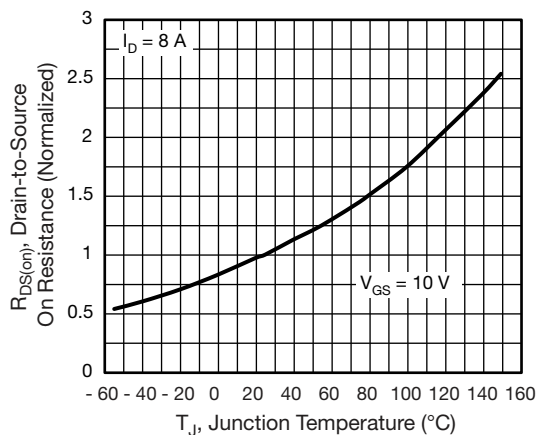
**Notes**

- a.  $C_{oss(er)}$  is a fixed capacitance that gives the same energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .  
 b.  $C_{oss(tr)}$  is a fixed capacitance that gives the same charging time as  $C_{oss}$  while  $V_{DS}$  is rising from 0 % to 80 %  $V_{DSS}$ .

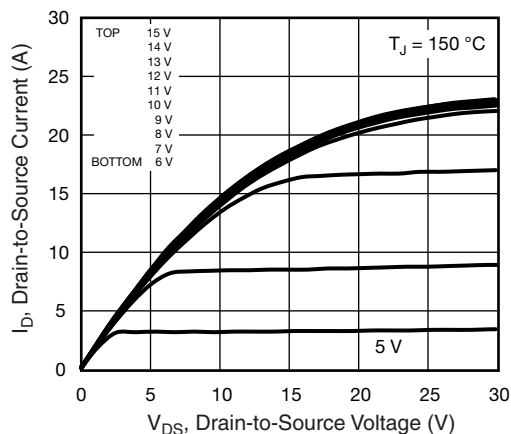
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



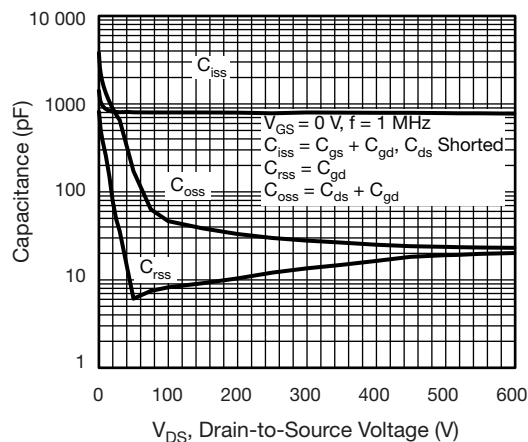
**Fig. 1 - Typical Output Characteristics**



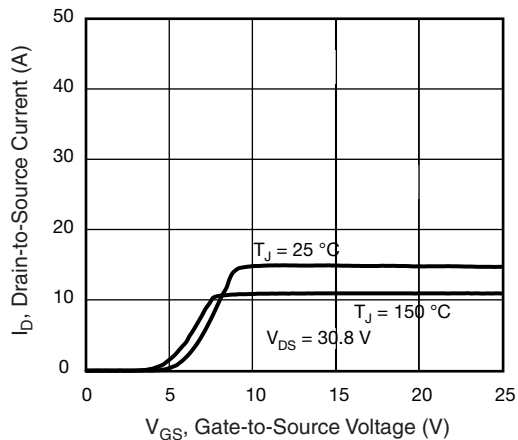
**Fig. 4 - Normalized On-Resistance vs. Temperature**



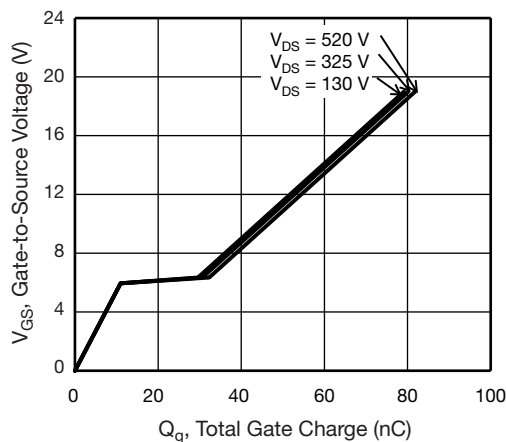
**Fig. 2 - Typical Output Characteristics**



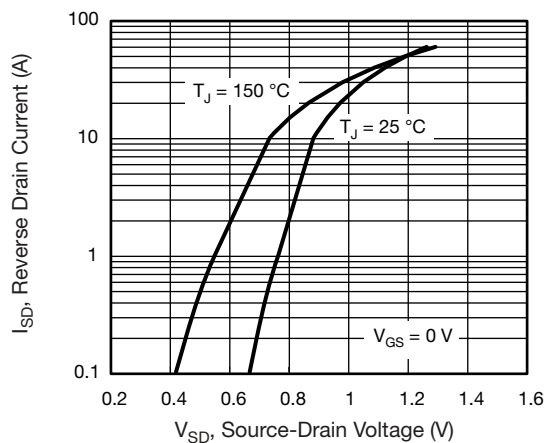
**Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage**



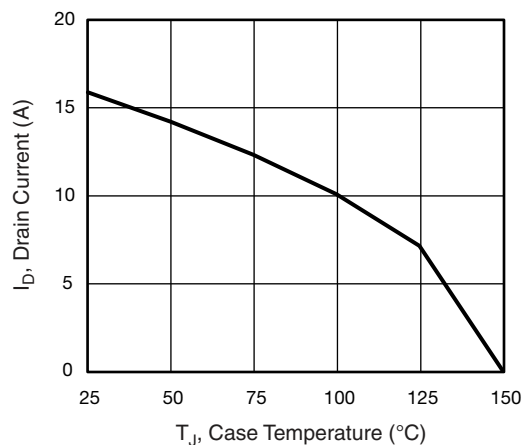
**Fig. 3 - Typical Transfer Characteristics**



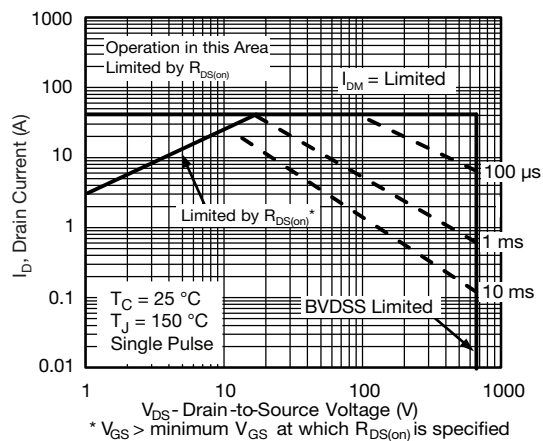
**Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage**



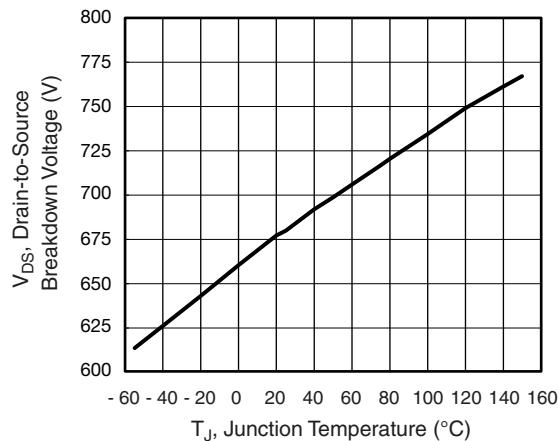
**Fig. 7 - Typical Source-Drain Diode Forward Voltage**



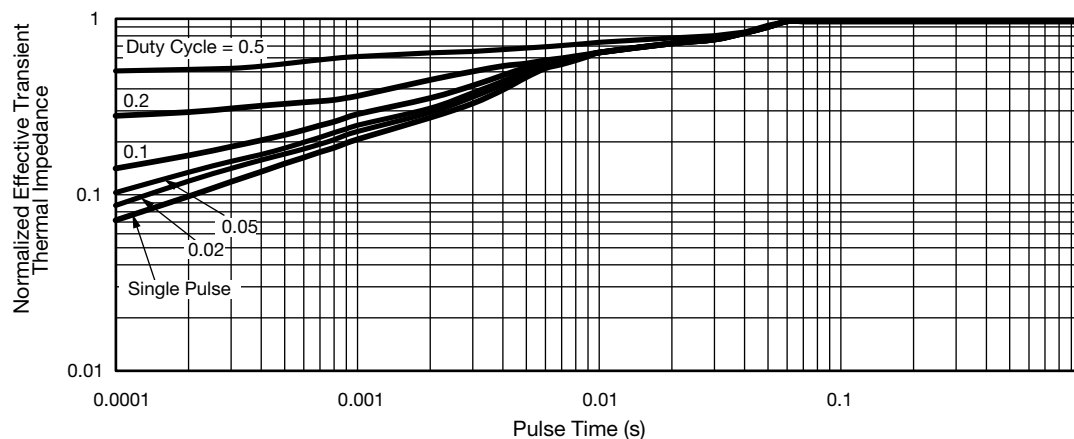
**Fig. 9 - Maximum Drain Current vs. Case Temperature**



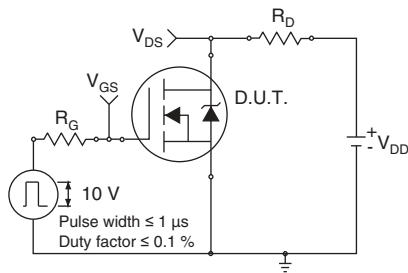
**Fig. 8 - Maximum Safe Operating Area**



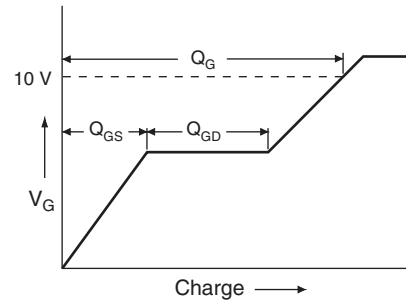
**Fig. 10 - Temperature vs. Drain-to-Source Voltage**



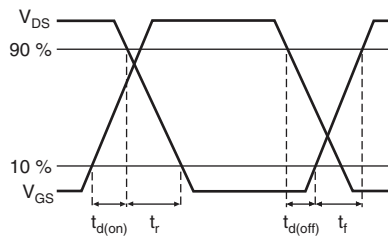
**Fig. 11 - Normalized Thermal Transient Impedance, Junction-to-Case**



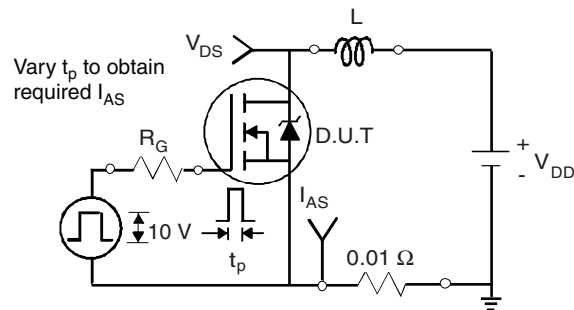
**Fig. 12 - Switching Time Test Circuit**



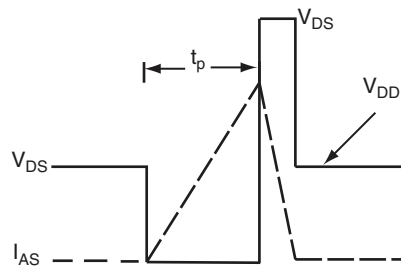
**Fig. 16 - Basic Gate Charge Waveform**



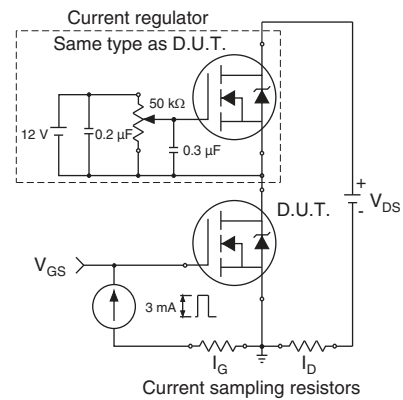
**Fig. 13 - Switching Time Waveforms**



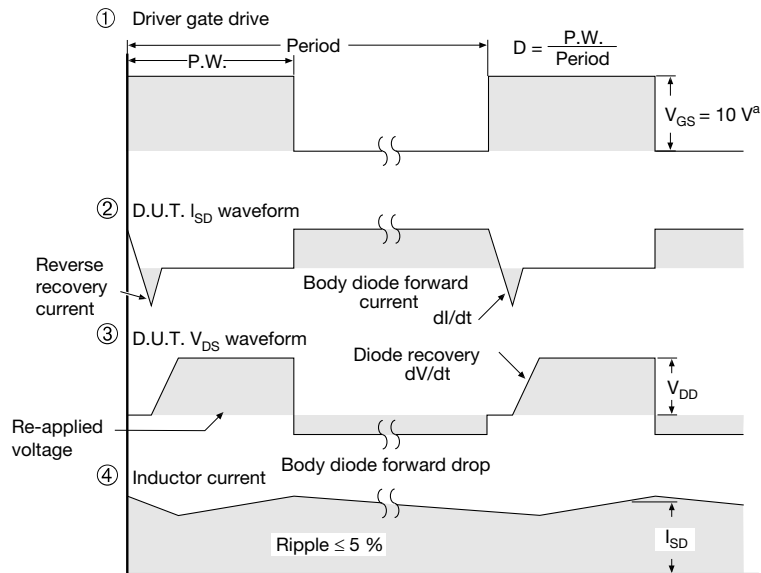
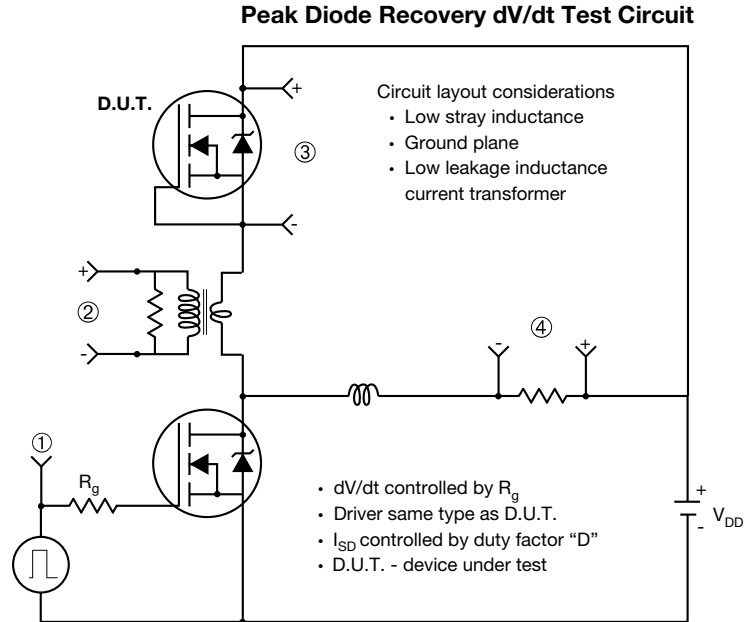
**Fig. 14 - Unclamped Inductive Test Circuit**



**Fig. 15 - Unclamped Inductive Waveforms**



**Fig. 17 - Gate Charge Test Circuit**



**Note**

a.  $V_{GS} = 5 V$  for logic level devices

**Fig. 18 - For N-Channel**

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