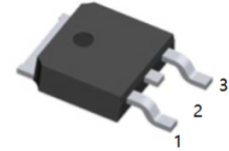


### Applications

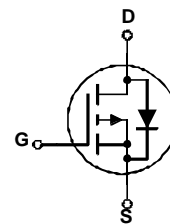
- Inverter
- Power Supplies

### Features

- $V_{DSS} = -30V$
- $R_{DS(ON)} = 11.6m\Omega (V_{GS} = -10 V)$
- $R_{DS(ON)} = 18m\Omega (V_{GS} = -4.5 V)$
- High performance trench technology for extremely low  $R_{DS(ON)}$
- RoHS Compliant



1.G 2.D 3.S  
TO-252(DPAK) top view



### Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{DSS}$	Drain-Source Voltage	-30	V
$V_{DS(Avalanche)}$	Drain-Source Avalanche Voltage (maximum) (Note 4)	-40	V
$V_{GSS}$	Gate-Source Voltage	$\pm 25$	V
$I_D$	Continuous Drain Current @ $T_C=25^\circ C$ (Note 3)	@ $T_A=25^\circ C$ (Note 1a)	-55
		Pulsed (Note 1a)	-13
			-100
$P_D$	Power Dissipation @ $T_C=25^\circ C$ (Note 3)	@ $T_A=25^\circ C$ (Note 1a)	57
		@ $T_A=25^\circ C$ (Note 1b)	3.1
			1.3
$T_J, T_{STG}$	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ C$

### Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	2.2	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	40	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1b)	96	

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$E_{AS}$	Drain-Source Avalanche Energy (Single Pulse)	$V_{DD} = -35\text{ V}$ , $I_D = -11\text{ A}$ , $L=1\text{mH}$		61		mJ
$I_{AS}$	Drain-Source Avalanche Current			-14		A
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$ , $I_D = -250\ \mu\text{A}$	-30			V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -28\text{ V}$ , $V_{GS} = 0\text{ V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate-Body Leakage	$V_{GS} = \pm 25\text{ V}$ , $V_{DS} = 0\text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = -250\ \mu\text{A}$	-1	-1.6	-3	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = -10\text{ V}$ , $I_D = -14\text{ A}$ $V_{GS} = -4.5\text{ V}$ , $I_D = -11\text{ A}$		9.7 14.4	11.6 18	$\text{m}\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{ V}$ , $I_D = -14\text{ A}$		35		S
$C_{iss}$	Input Capacitance	$V_{DS} = -20\text{ V}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$		2370		pF
$C_{oss}$	Output Capacitance			470		pF
$C_{riss}$	Reverse Transfer Capacitance			250		pF
$R_G$	Gate Resistance	$f = 1.0\text{ MHz}$		3.6		$\Omega$
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -20\text{ V}$ , $I_D = -1\text{ A}$ , $V_{GS} = -10\text{ V}$ , $R_{GEN} = 6\ \Omega$		18	32	ns
$t_r$	Turn-On Rise Time			10	20	ns
$t_{d(off)}$	Turn-Off Delay Time			62	100	ns
$t_f$	Turn-Off Fall Time			36	58	ns
$Q_g$	Total Gate Charge, $V_{GS} = -10\text{V}$	$V_{DS} = -20\text{ V}$ , $I_D = -14\text{ A}$		45	63	nC
$Q_g$	Total Gate Charge, $V_{GS} = -5\text{V}$			25	35	nC
$Q_{gs}$	Gate-Source Charge			7		nC
$Q_{gd}$	Gate-Drain Charge			10		nC

**Electrical Characteristics**  $T_A = 25^\circ\text{C}$  unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = -14\text{ A}$ (Note 2)		-0.8	-1.2	V
$t_{rr}$	Diode Reverse Recovery Time	$I_F = -14\text{ A}$ , $diF/dt = 100\text{ A}/\mu\text{s}$		28		ns
$Q_{rr}$	Diode Reverse Recovery Charge			15		nC

**Notes:**

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $R_{\theta JA} = 40^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $R_{\theta JA} = 96^\circ\text{C}/\text{W}$  when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width <  $300\mu\text{s}$ , Duty Cycle < 2.0%

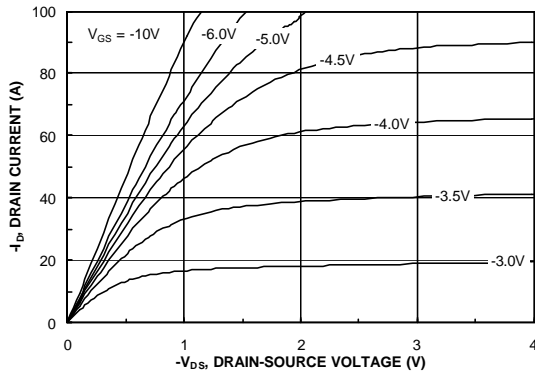
- Maximum current is calculated as:

$$\sqrt{\frac{P_D}{R_{DS(ON)}}}$$

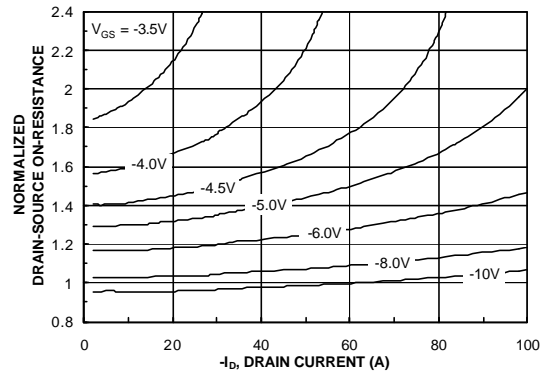
where  $P_D$  is maximum power dissipation at  $T_C = 25^\circ\text{C}$  and  $R_{DS(on)}$  is at  $T_{J(max)}$  and  $V_{GS} = 10\text{V}$ . Package current limitation is 21A

- BV(avalanche) Single-Pulse rating is guaranteed if device is operated within the UIS SOA boundary of the device.

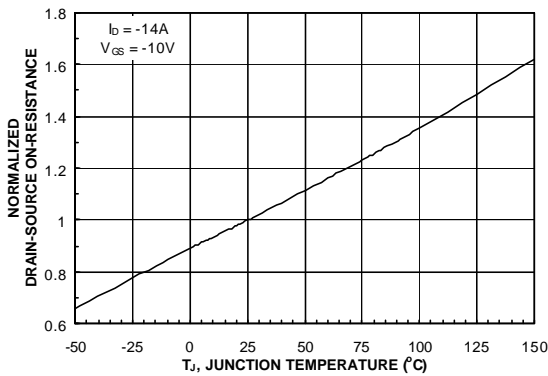
**Typical Characteristics**



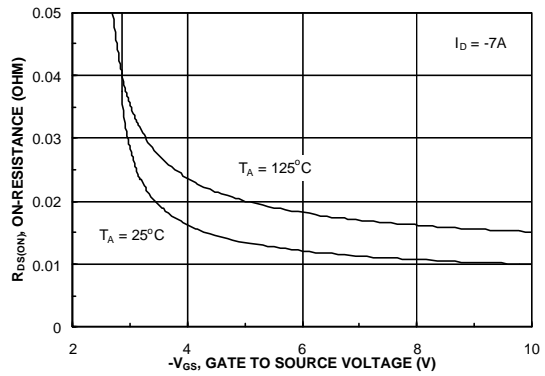
**Figure 1. On-Region Characteristics**



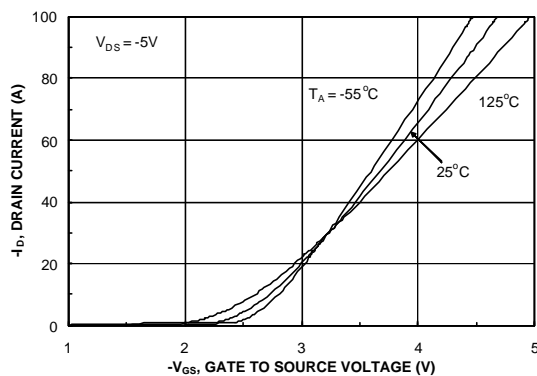
**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage**



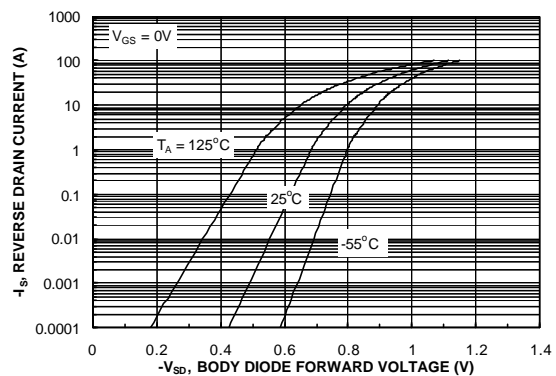
**Figure 3. On-Resistance Variation with Temperature**



**Figure 4. On-Resistance Variation with Gate-to-Source Voltage**

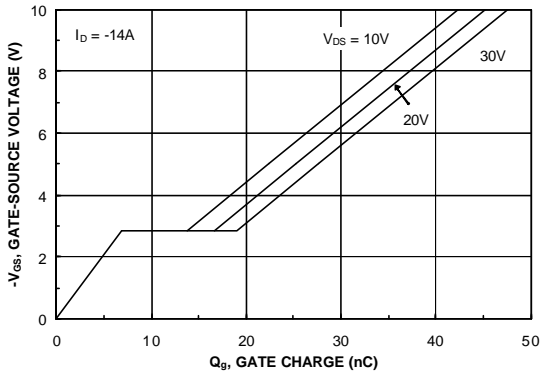


**Figure 5. Transfer Characteristics**

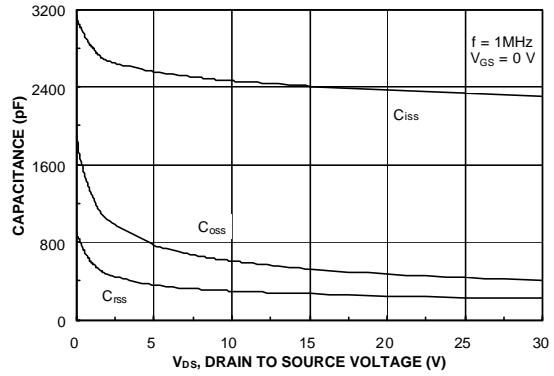


**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature**

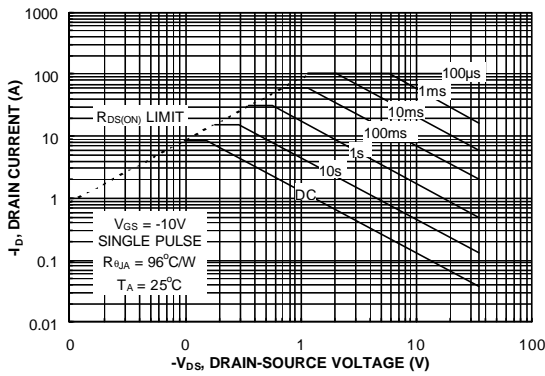
**Typical Characteristics**



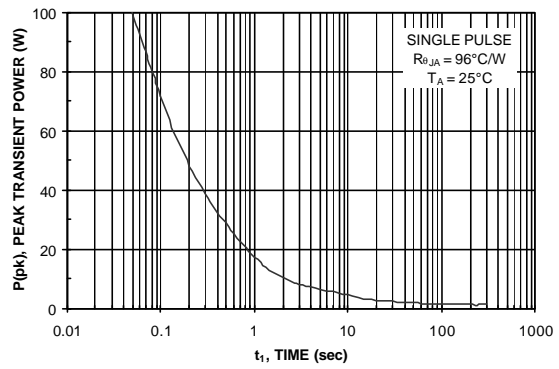
**Figure 7. Gate Charge Characteristics**



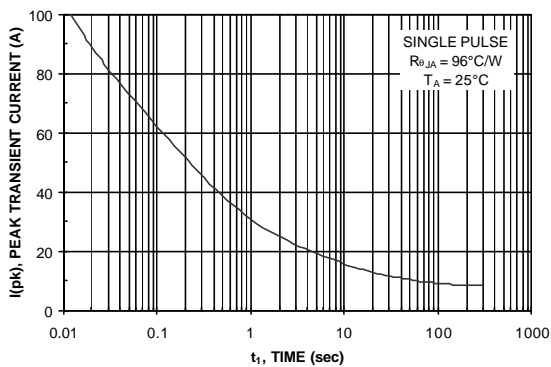
**Figure 8. Capacitance Characteristics**



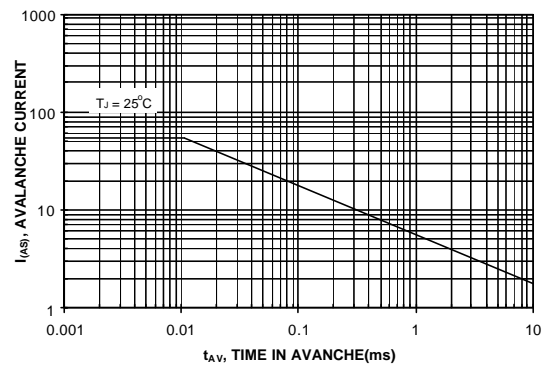
**Figure 9. Maximum Safe Operating Area**



**Figure 10. Single Pulse Maximum Power Dissipation**

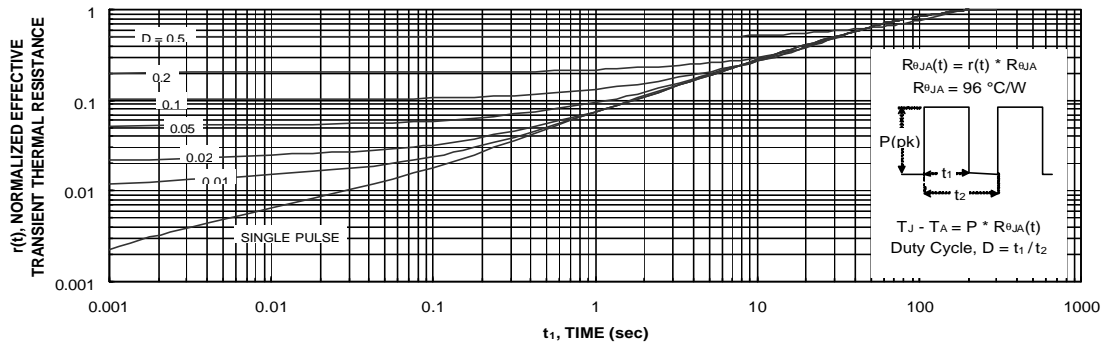


**Figure 11. Single Pulse Maximum Peak Current**



**Figure 12. Unclamped Inductive Switching Capability**

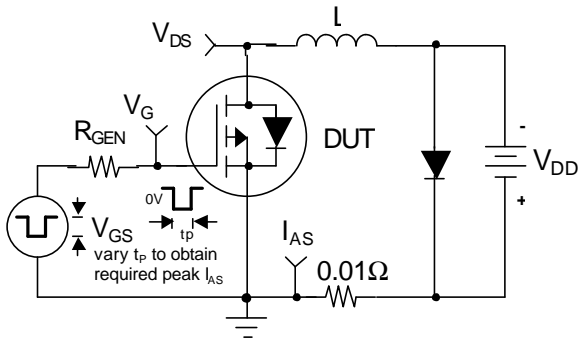
**Typical Characteristics**



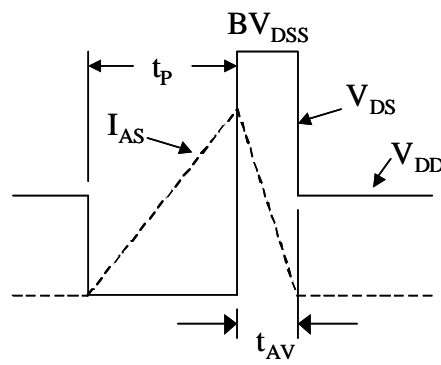
**Figure 13. Transient Thermal Response Curve**

Thermal characterization performed using the conditions described in Note 1b.  
Transient thermal response will change depending on the circuit board design.

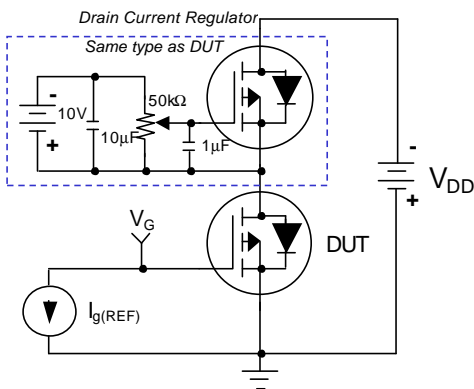
**Test Circuits and Waveforms**



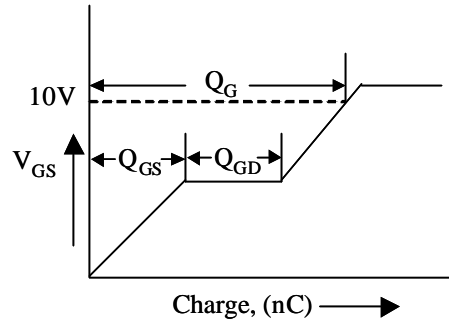
**Figure 14. Unclamped Inductive Load Test Circuit**



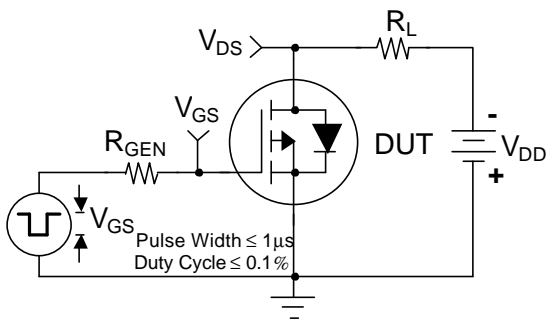
**Figure 15. Unclamped Inductive Waveforms**



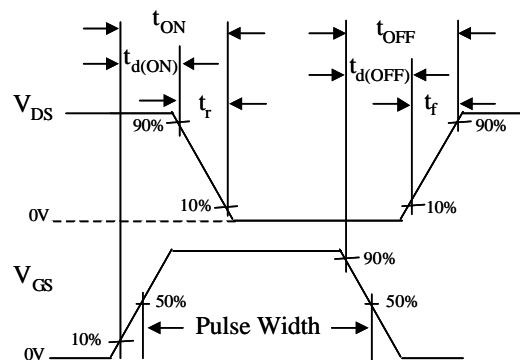
**Figure 16. Gate Charge Test Circuit**



**Figure 17. Gate Charge Waveform**

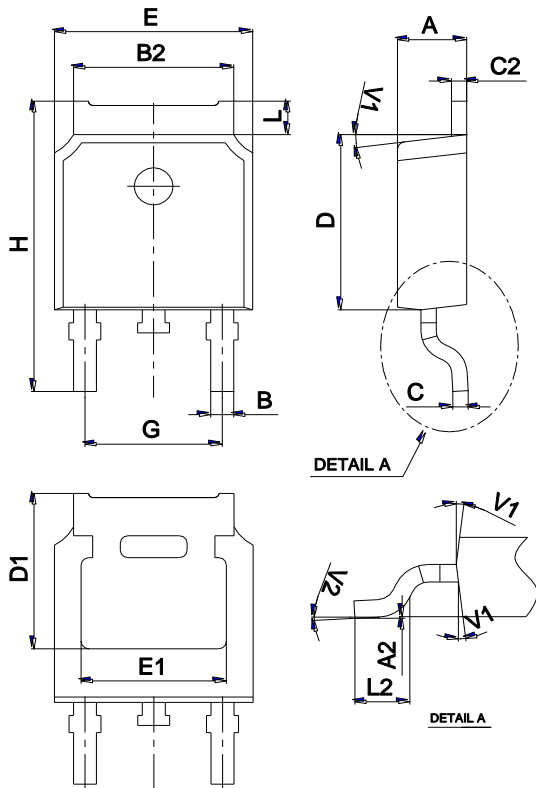


**Figure 18. Switching Time Test Circuit**



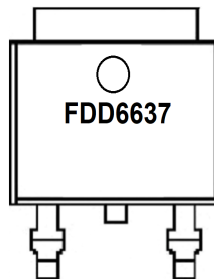
**Figure 19. Switching Time Waveforms**

**Package Mechanical Data TO-252**



Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.10		2.50	0.083		0.098
A2	0		0.10	0		0.004
B	0.66		0.86	0.026		0.034
B2	5.18		5.48	0.202		0.216
C	0.40		0.60	0.016		0.024
C2	0.44		0.58	0.017		0.023
D	5.90		6.30	0.232		0.248
D1	5.30REF			0.209REF		
E	6.40		6.80	0.252		0.268
E1	4.63			0.182		
G	4.47		4.67	0.176		0.184
H	9.50		10.70	0.374		0.421
L	1.09		1.21	0.043		0.048
L2	1.35		1.65	0.053		0.065
V1		7°			7°	
V2	0°		6°	0°		6°

**Marking**



**Ordering information**

Order code	Package	Baseqty	Deliverymode
FDD6637	TO-252	2500	Tape and reel