

## -20V P-Channel Mosfet

### FEATURES

- $V_{DS} = -20V$ ,  $I_D = -60A$   
 $R_{DS(ON)} < 8.5m\Omega @ V_{GS} = -4.5V$   
 $R_{DS(ON)} < 12m\Omega @ V_{GS} = -2.5V$
- High Power and Current Handling Capability
- Lead Free Product is Acquired
- Surface Mount Package

### TO-252

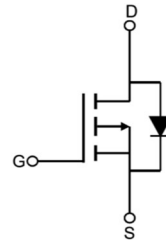


1. Gate
2. Source
3. Drain

### APPLICATIONS

- Motor Control and Drive
- Uninterruptible Power Supply (UPS)
- Battery Management

### P-CHANNEL MOSFET



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

Symbol	Parameter	Max.	Units
$V_{DSS}$	Drain-Source Voltage	-20	V
$V_{GSS}$	Gate-Source Voltage	$\pm 12$	V
$I_D$	Continuous Drain Current	$T_C = 25^\circ C$	-60
		$T_C = 100^\circ C$	-39
$I_{DM}$	Pulsed Drain Current <sup>note1</sup>	-240	A
$P_D$	Power Dissipation	$T_C = 25^\circ C$	70
$R_{\theta JC}$	Thermal Resistance, Junction to Ambient	2.1	$^\circ C / W$
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to +175	$^\circ C$

**MOSFET ELECTRICAL CHARACTERISTICS  $T_J=25\text{ }^\circ\text{C}$  unless otherwise specified**

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units
<b>Off Characteristic</b>						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D = -250\mu A$	-20	-	-	V
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -20V, V_{GS} = 0V,$	-	-	-1	$\mu A$
$I_{GSS}$	Gate to Body Leakage Current	$V_{DS} = 0V, V_{GS} = \pm 12V$	-	-	$\pm 100$	nA
<b>On Characteristics</b>						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = -250\mu A$	-0.35	-0.65	-1.0	V
$R_{DS(on)}$	Static Drain-Source on-Resistance <small>note3</small>	$V_{GS} = -4.5V, I_D = -15A$	-	6.6	8.5	m $\Omega$
		$V_{GS} = -2.5V, I_D = -12A$	-	8	12	
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input Capacitance	$V_{DS} = -10V, V_{GS} = 0V, f = 1.0MHz$	-	4590	-	pF
$C_{oss}$	Output Capacitance		-	505	-	pF
$C_{rss}$	Reverse Transfer Capacitance		-	440	-	pF
$Q_g$	Total Gate Charge	$V_{DS} = -10V, I_D = -15A, V_{GS} = -4.5V$	-	46	-	nC
$Q_{gs}$	Gate-Source Charge		-	7.3	-	nC
$Q_{gd}$	Gate-Drain("Miller") Charge		-	10	-	nC
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = -10V, I_D = -14A, R_{GEN} = 2.7\Omega, V_{GS} = -10V$	-	8	-	ns
$t_r$	Turn-on Rise Time		-	59	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	111	-	ns
$t_f$	Turn-off Fall Time		-	43	-	ns
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain to Source Diode Forward Current		-	-	-60	A
$I_{SM}$	Maximum Pulsed Drain to Source Diode Forward Current		-	-	-240	A
$V_{SD}$	Drain to Source Diode Forward Voltage	$V_{GS} = 0V, I_S = -20A$	-	-	-1.2	V
$t_{rr}$	Reverse Recovery Time	$T_J = 25^\circ C, I_{SD} = -15A, V_{GS} = 0V$	-	18	-	ns
$Q_{rr}$	Reverse Recovery Charge	$di/dt = -100A/\mu s$	-	7.7	-	nC

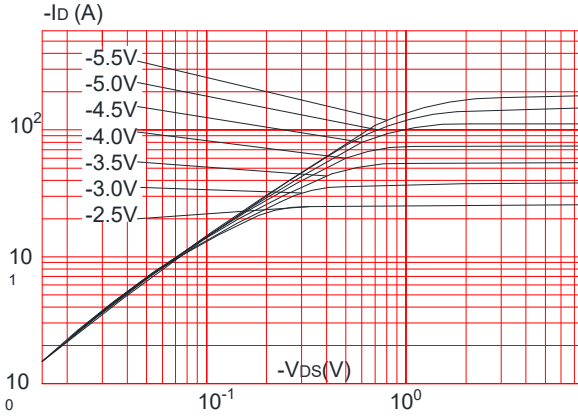
Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature

2. EAS condition:  $T_J = 25^\circ C, V_{DD} = -10V, V_G = -10V, R_G = 5.9\Omega, L = 0.5mh, I_{AS} = -13.2A$

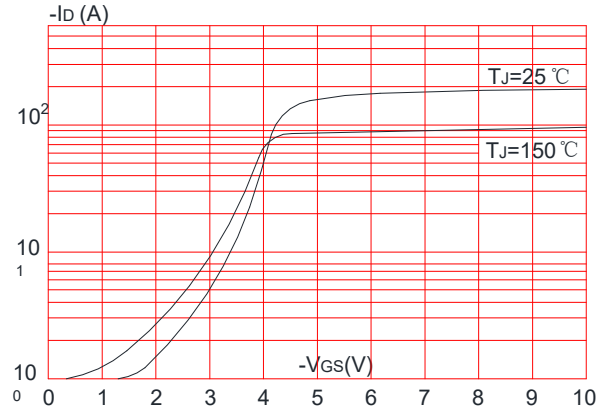
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 0.5\%$

## TYPICAL PERFORMANCE CHARACTERISTICS

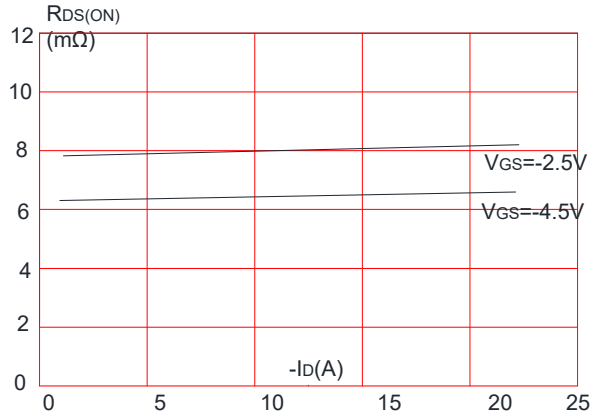
**Figure 1: Output Characteristics**



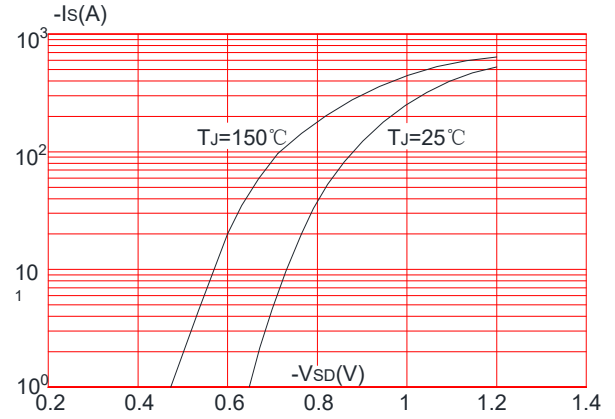
**Figure 2: Typical Transfer Characteristics**



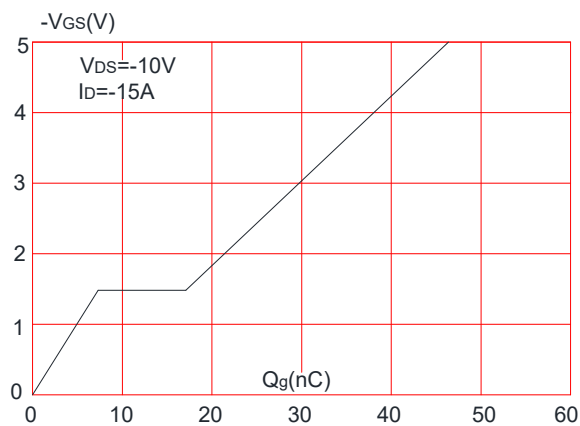
**Figure 3: On-resistance vs. Drain Current**



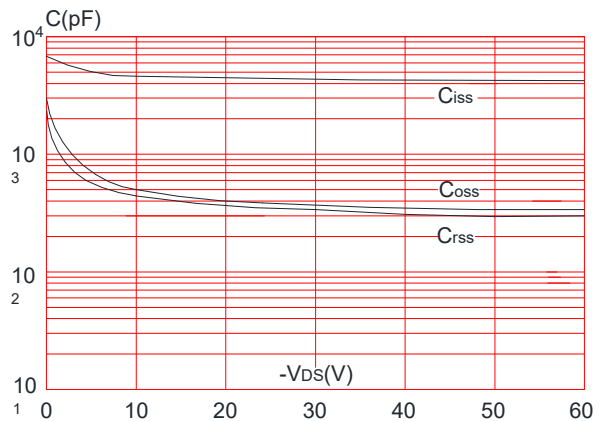
**Figure 4: Body Diode Characteristics**



**Figure 5: Gate Charge Characteristics**

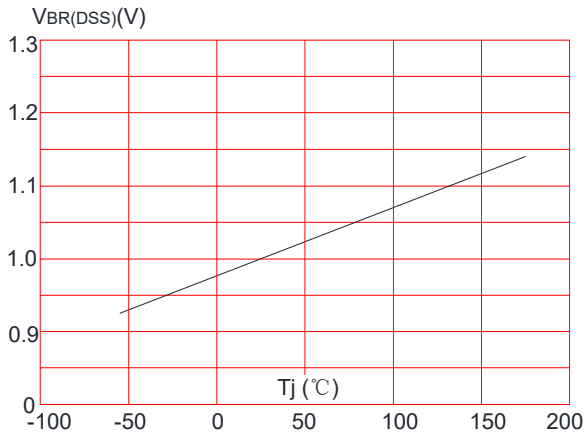


**Figure 6: Capacitance Characteristics**

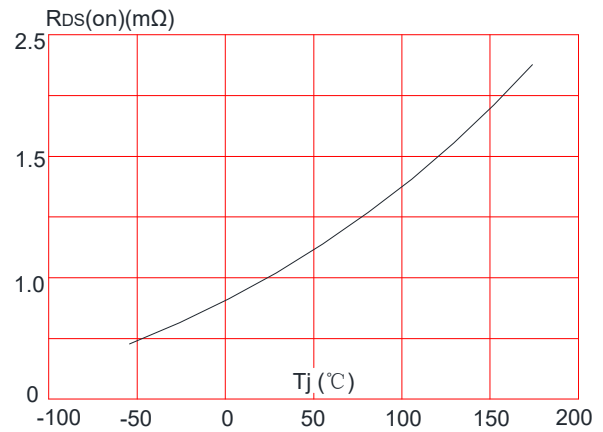


TYPICAL PERFORMANCE CHARACTERISTICS (cont.)

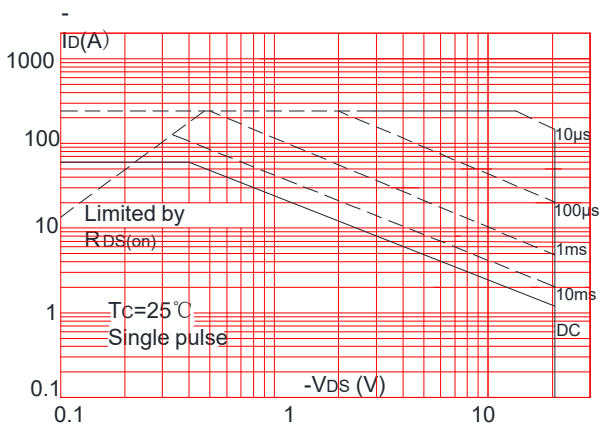
**Figure 7:** Normalized Breakdown Voltage vs.=Junction Temperature



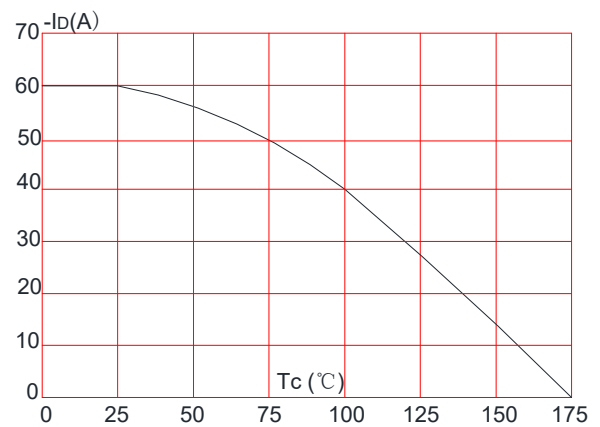
**Figure 8:** Normalized on Resistance vs.=Junction Temperature



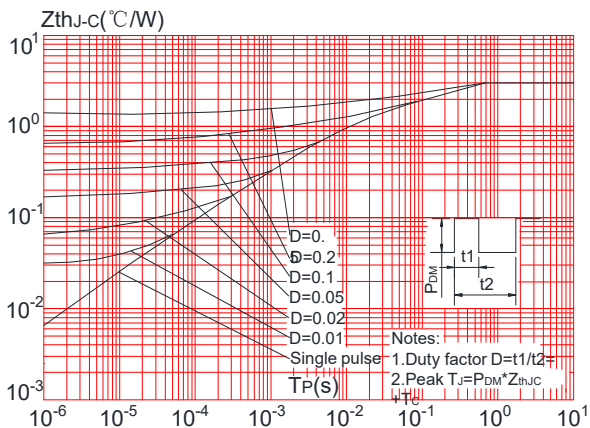
**Figure 9:** Maximum Safe Operating Area



**Figure 10:** Maximum Continuous Drain Current vs.= Case Temperature

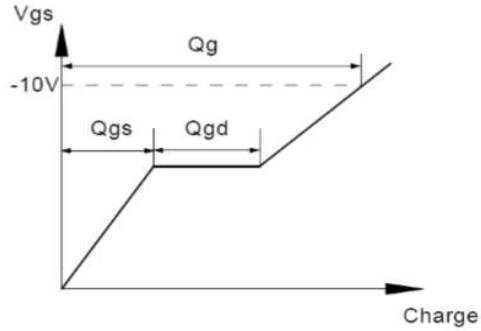
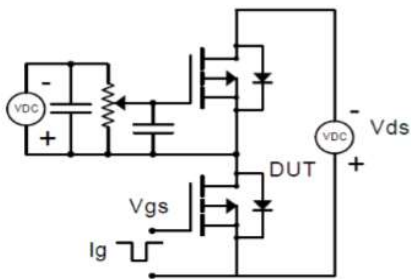


**Figure.11:** Maximum Effective Transient Thermal Impedance, Junction-to-Case

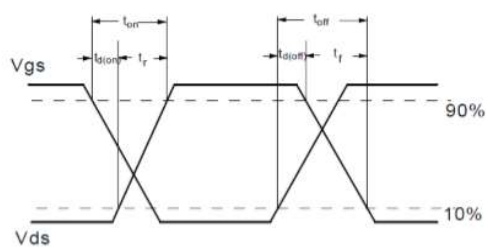
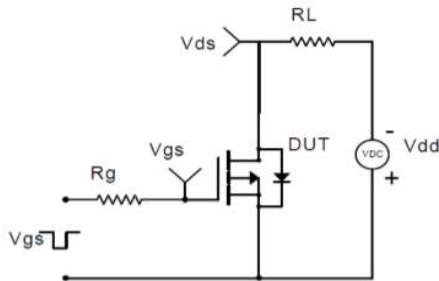


## Test Circuit

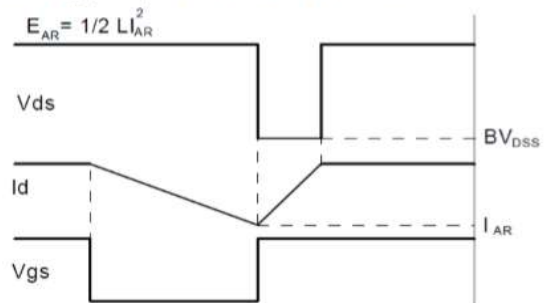
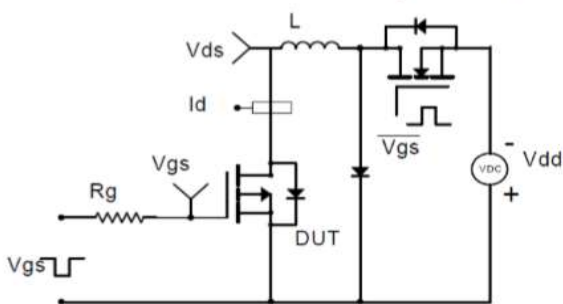
Gate Charge Test Circuit & Waveform



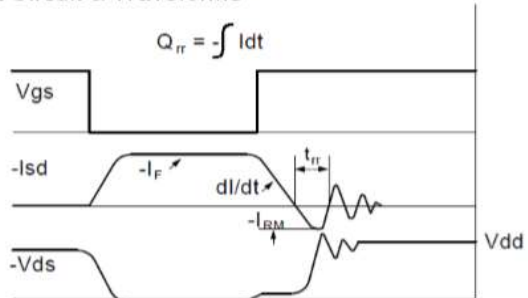
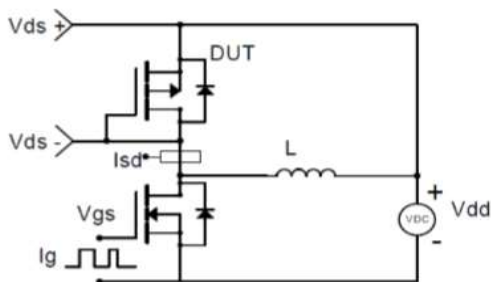
Resistive Switching Test Circuit & Waveforms



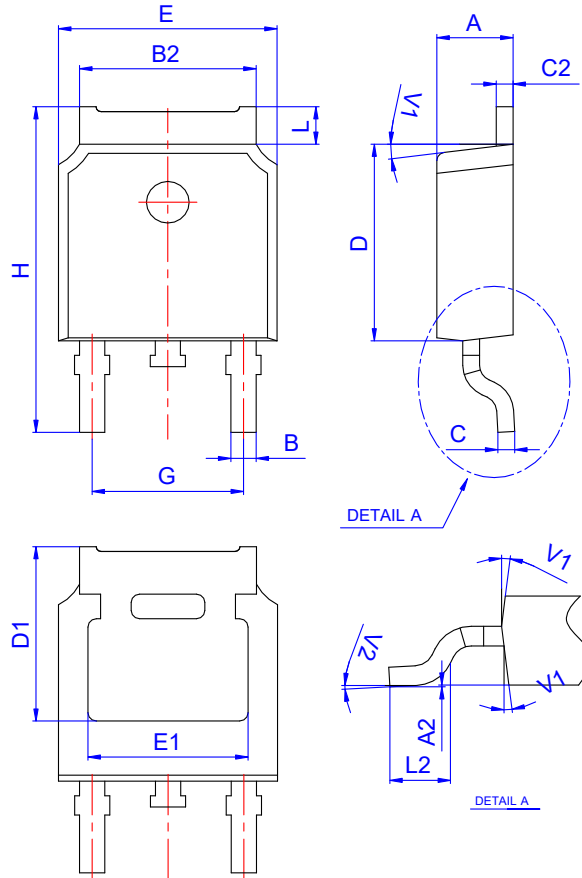
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms



## TO-252 PACKAGE OUTLINE DRAWING



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°