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**10N65**

**650V N-Channel MOSFET.**

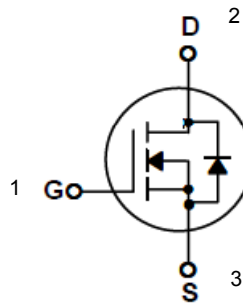
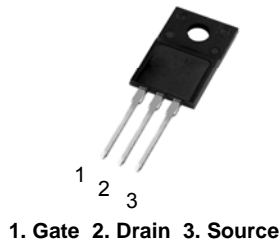
**Features**

- 10A, 650V,  $R_{DS(on)}=0.63\Omega @V_{GS}=10\text{ V}$
- Low gate charge ( typical 45 nC)
- Low Crss ( typical 12pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

**General Description**

This Power MOSFET is produced by HSDQ using its own advanced planar stripe DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency switched mode power supplies, active power factor correction based on half bridge topology.

**TO-220F Package**



Symbol	Parameter	Value	Units
$V_{DSS}$	Drain-Source Voltage	650	V
$I_D$	Drain Current - Continuous ( $T_C=25^\circ\text{C}$ ) - Continuous ( $T_C=100^\circ\text{C}$ )	10	A
		6.3*	A
$I_{DM}$	Drain Current - Pulsed (Note 1)	40*	A
$V_{GSS}$	Gate-Source Voltage	$\pm 30$	V
$E_{AS}$	Single Pulsed Avalanche Energy (Note 2)	606	mJ
$I_{AR}$	Avalanche Current (Note 1)	10	A
$E_{AR}$	Repetitive Avalanche Energy (Note 1)	55	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)	5	V/ns
$P_D$	Power Dissipation ( $T_C=25^\circ\text{C}$ ) - Derate above $25^\circ\text{C}$	27.5	W
		0.22	W/ $^\circ\text{C}$
$T_i, T_{stg}$	Operating and Storage Temperature Range	-55 to +150	$^\circ\text{C}$
$T_L$	Maximum lead temperature for soldering purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

\* Drain current limited by maximum junction temperature

**Thermal Characteristics**

Symbol	Parameter	Value	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	4.54	$^\circ\text{C/W}$
$R_{\theta JS}$	Thermal Resistance, Case-to-Sink Typ.	--	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	42.2	$^\circ\text{C/W}$

## Electrical Characteristics $T_C=25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
<b>Off Characteristics</b>						
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{ V}, I_D=250\ \mu\text{A}$	650			V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D=250\ \mu\text{A}$ , Referenced to $25^\circ\text{C}$		0.64		$\text{V}/^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS}=650\text{ V}, V_{GS}=0\text{ V}$			1	$\mu\text{A}$
		$V_{DS}=520\text{ V}, T_C=125^\circ\text{C}$			10	$\mu\text{A}$
$I_{GSSF}$	Gate-Body Leakage Current, Forward	$V_{GS}=30\text{ V}, V_{DS}=0\text{ V}$			100	nA
$I_{GSSR}$	Gate-Body Leakage Current, Reverse	$V_{GS}=-30\text{ V}, V_{DS}=0\text{ V}$			-100	nA
<b>On Characteristics</b>						
$V_{GS(TH)}$	Gate Threshold voltage	$V_{DS}=V_{GS}, I_D=250\ \mu\text{A}$	2.0		4.0	V
$R_{DS(on)}$	Drain-Source on-state resistance	$V_{GS}=10\text{ V}, I_D=5\text{ A}, T_J=25^\circ\text{C}$		0.63	0.81	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS}=40\text{ V}, I_D=5\text{ A}$ (Note 4)		10.5		S
<b>Dynamic Characteristics</b>						
$C_{iss}$	Input capacitance	$V_{DS}=25\text{ V}, V_{GS}=0\text{ V}, f=1.0\text{ MHz}$		1998		pF
$C_{oss}$	Output capacitance			174		pF
$C_{rss}$	Reverse transfer capacitance			12		pF
<b>Switching Characteristics</b>						
$t_{d(on)}$	Turn On Delay Time	$V_{DD}=325\text{ V}, I_D=10\text{ A}, R_G=25\ \Omega$ (Note 4, 5)		24		ns
$t_r$	Rising Time			37		ns
$t_{d(off)}$	Turn Off Delay Time			114		ns
$t_f$	Fall Time			43		ns
$Q_g$	Total Gate Charge	$V_{DS}=520\text{ V}, I_D=10\text{ A}, V_{GS}=10\text{ V}$ (Note 4, 5)		45		nC
$Q_{gs}$	Gate-Source Charge			11		nC
$Q_{gd}$	Gate-Drain Charge			17		nC
<b>Drain-Source Diode Characteristics and Maximum Ratings</b>						
$I_S$	Maximum Continuous Drain-Source Diode Forward Current				10	A
$I_{SM}$	Maximum Pulsed Drain-Source Diode Forward Current				40	A
$V_{SD}$	Diode Forward Voltage	$V_{GS}=0\text{ V}, I_S=10\text{ A}$			1.2	V
$t_{rr}$	Reverse Recovery Time	$V_{GS}=0\text{ V}, I_S=10\text{ A}, di_F / dt=100\text{ A}/\mu\text{s}$ (Note 4)		520		ns
$Q_{rr}$	Reverse Recovery Charge			4.3		$\mu\text{C}$
<b>Notes:</b>						
1. Repetitive Rating : Pulse width limited by maximum junction temperature						
2. $L=12.1\text{ mH}, I_{AS}=10\text{ A}, V_{DD}=50\text{ V}, R_G=25\ \Omega$ , Starting $T_J=25^\circ\text{C}$						
3. $I_{SD} \leq 10\text{ A}, di/dt \leq 200\text{ A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$ , Starting $T_J=25^\circ\text{C}$						
4. Pulse Test : Pulse width $\leq 300\ \mu\text{s}$ , Duty cycle $\leq 2\%$						
5. Essentially independent of operating temperature						

# Typical Characteristics

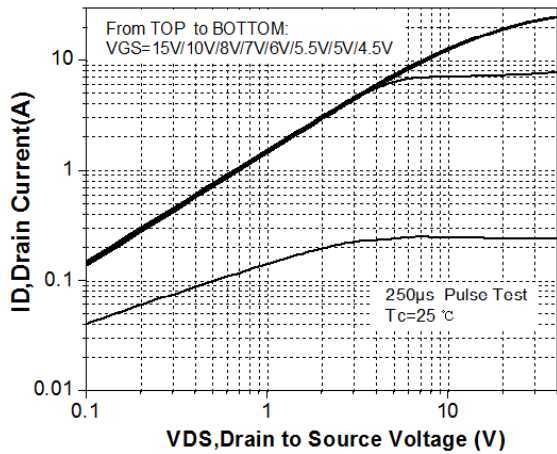


Figure 1. On-Region Characteristics

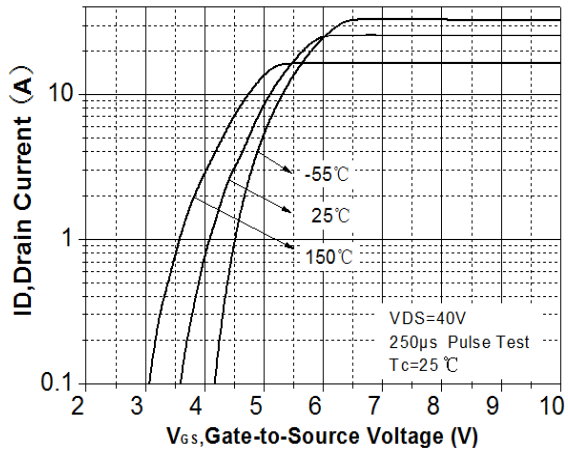


Figure 2. Transfer Characteristics

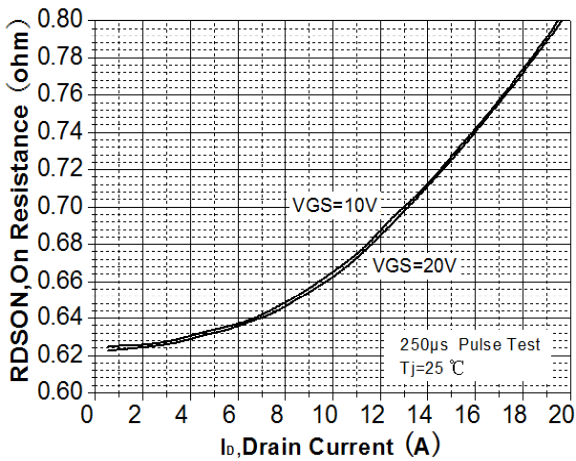


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

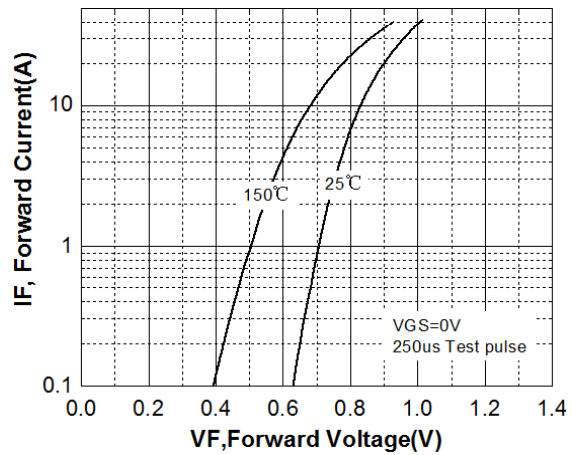


Figure 4. Body Diode Forward Voltage Variation with Source Current and Temperature

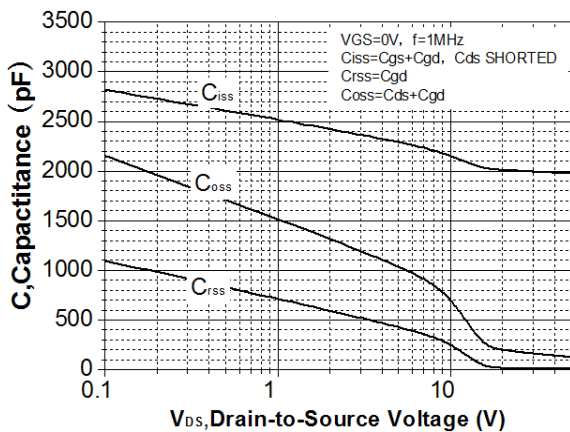


Figure 5. Capacitance Characteristics

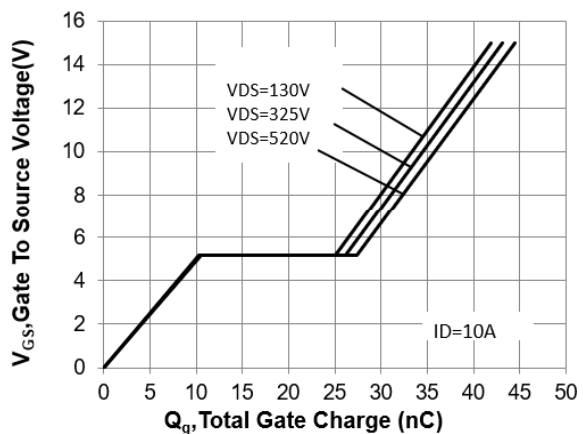


Figure 6. Gate Charge Characteristics

### Typical Characteristics (Continued)

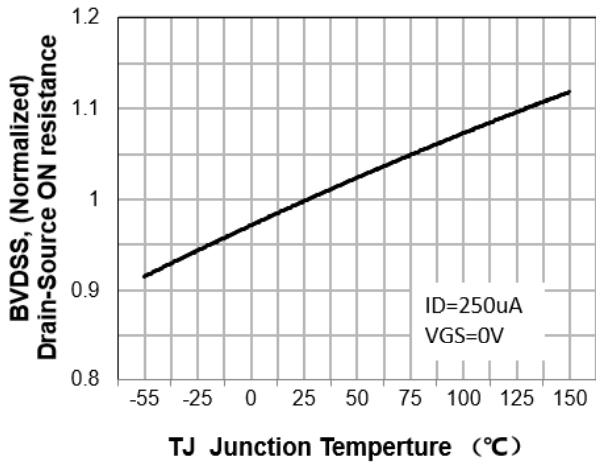


Figure 7. Breakdown Voltage Variation vs Temperature

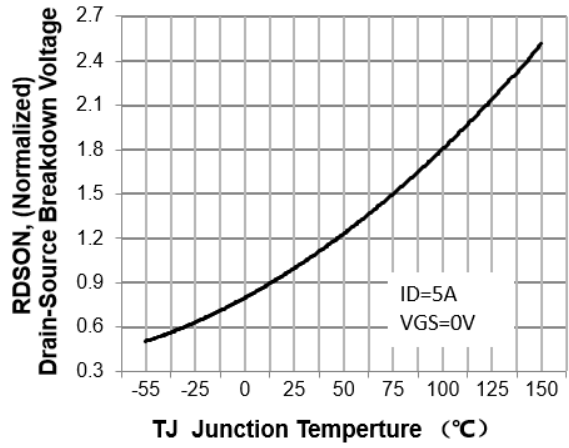


Figure 8. On-Resistance Variation vs Temperature

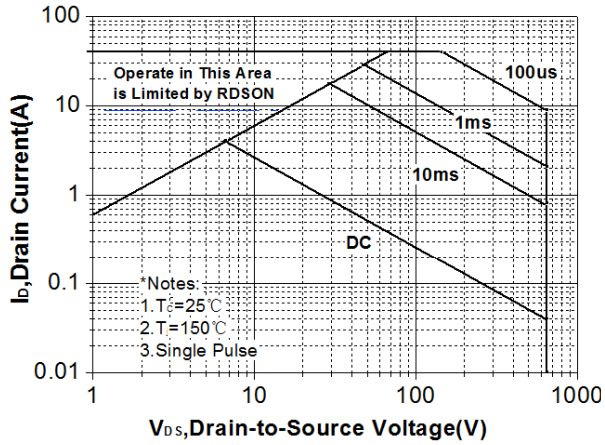


Figure 9. Maximum Safe Operating Area

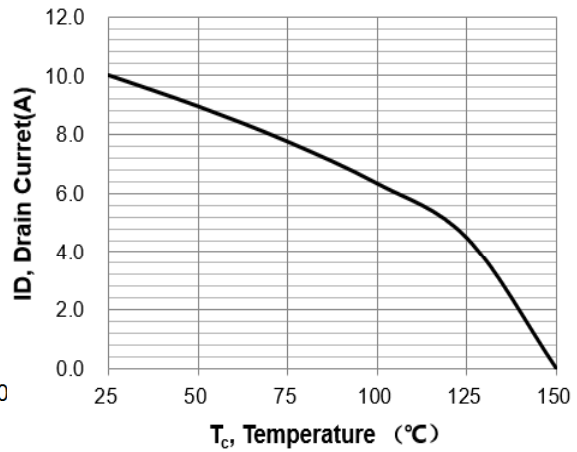


Figure 10. Maximum Drain Current vs Case Temperature

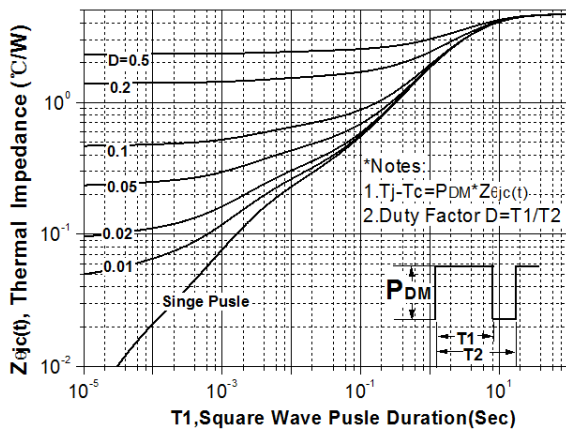
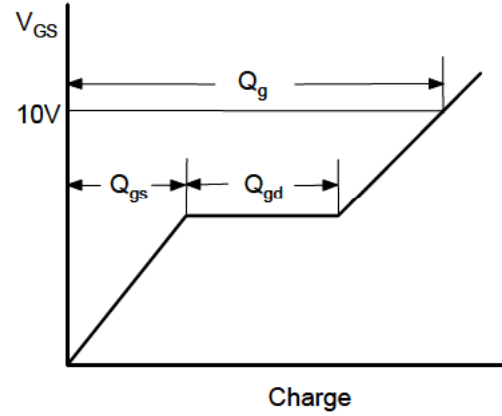
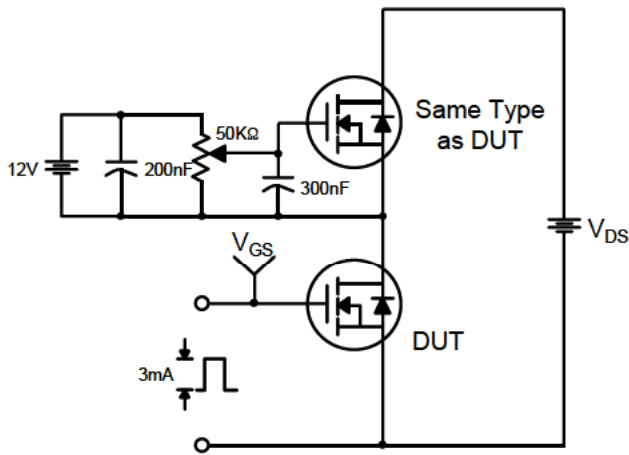
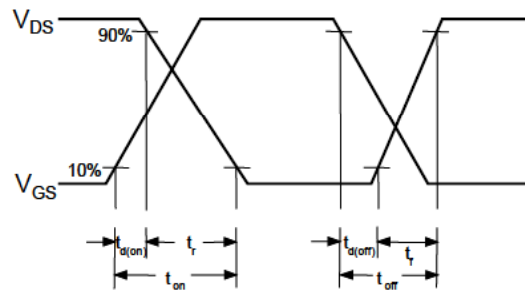
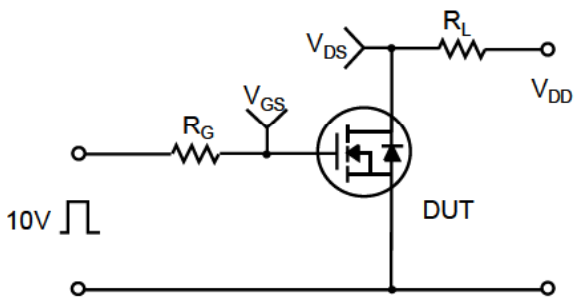


Figure 11. Transient Thermal Response Curve

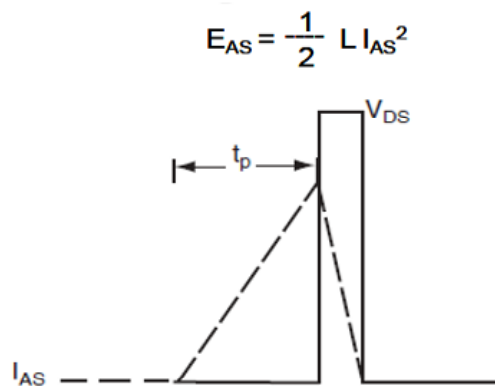
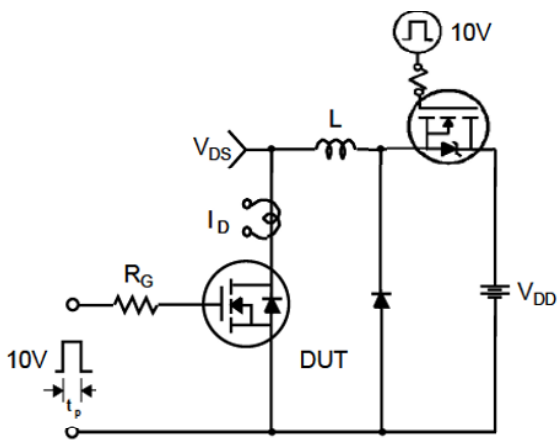
### Gate Charge Test Circuit & Waveform



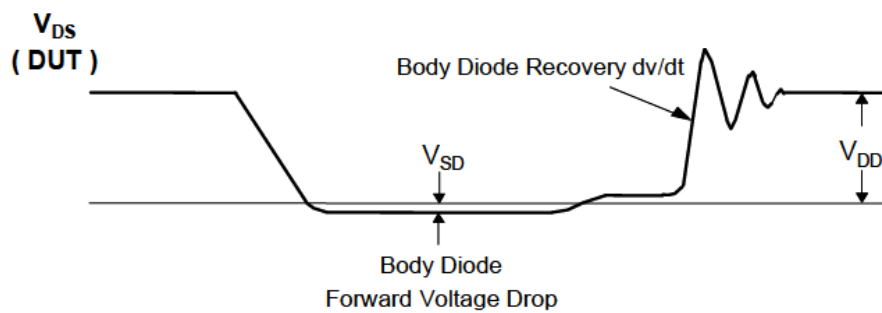
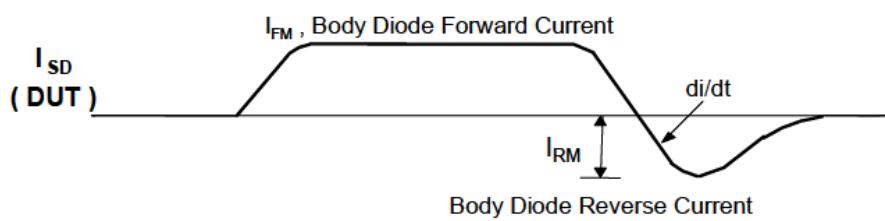
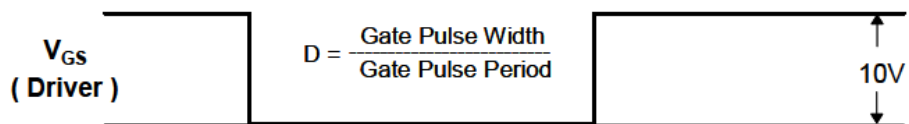
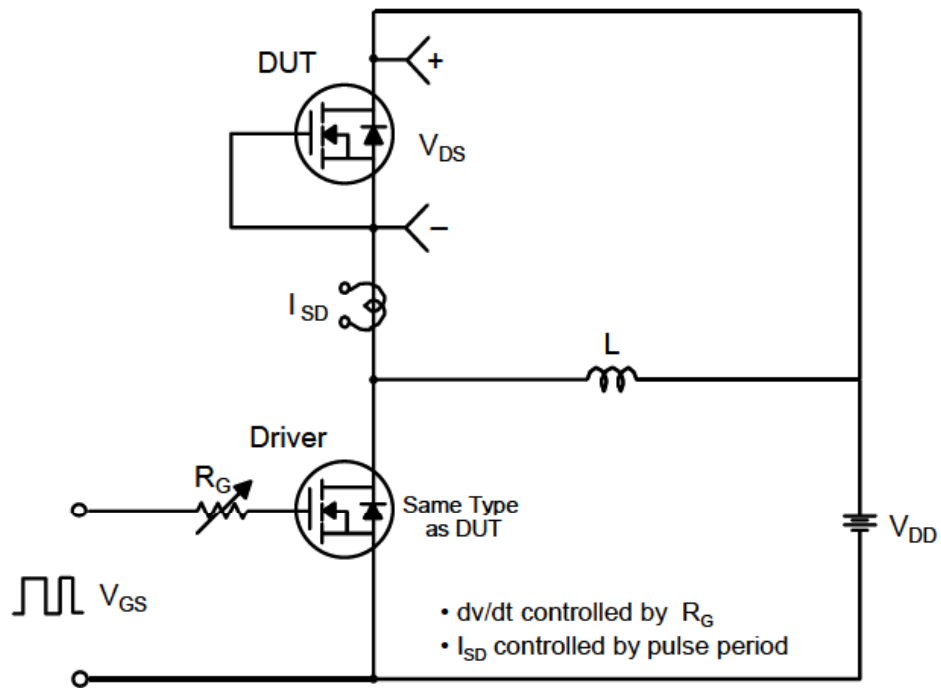
### Resistive Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



### Peak Diode Recovery dv/dt Test Circuit & Waveforms



# Package Dimensions

## TO220F

