UNISONIC TECHNOLOGIES CO., LTD

10N70

10A, 700V N-CHANNEL POWER MOSFET

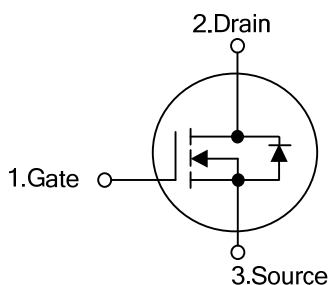TO-220F TO-220F1

TO-263 TO-220F2

■ DESCRIPTION

The **UTC 10N70** is a high voltage and high current power MOSFET, designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

* $R_{DS(ON)}$ ≤ 1.2Ω @ V_{GS}=10V, I_D=5.0A
* Fast switching
* 100% avalanche tested
* Improved dv/dt capability

■ SYMBOL
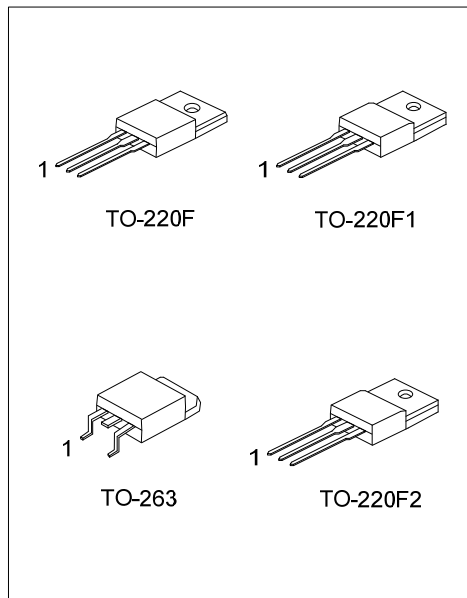

2.Drain

1.Gate

3.Source

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
10N70L-TF1-T	10N70G-TF1-T	TO-220F1	G	D	S	Tube
10N70L-TF2-T	10N70G-TF2-T	TO-220F2	G	D	S	Tube
10N70L-TF3-T	10N70G-TF3-T	TO-220F	G	D	S	Tube
10N70L-TQ2-T	10N70G-TQ2-T	TO-263	G	D	S	Tube
10N70L-TQ2-R	10N70G-TQ2-R	TO-263	G	D	S	Tape Reel

Note: Pin Assignment: G: Gate   D: Drain   S: Source

10N70G-TF1-T

(1)Packing Type

(2)Package Type

(3)Green Package

(1) T: Tube, R: Tape Reel

(2) TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F
    TQ2: TO-263

(3) G: Halogen Free and Lead Free, L: Lead Free

QW-R502-572.G

■ **MARKING**

UTC
10N70 □
L: Lead Free
G: Halogen Free
Lot Code
Date Code
1
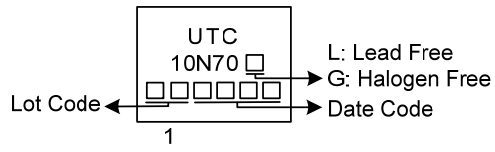
■ **ABSOLUTE MAXIMUM RATINGS** (T_C = 25°C unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	700	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 2)		I_{AR}	10	A
Drain Current	Continuous	I_D	10	A
	Pulsed (Note 2)	I_{DM}	40	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	600	mJ
	Repetitive (Note 2)	E_{AR}	15.6	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.5	V/ns
Power Dissipation	TO-220F/TO-220F1 TO-220F2	P_D	50	W
	TO-263		162	W
Junction Temperature		T_J	+150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating: Pulse width limited by maximum junction temperature

3. L = 12mH, I_{AS} = 10A, V_{DD} = 50V, R_G = 25 Ω Starting T_J = 25°C

4. I_{SD} ≤ 10A, di/dt ≤200A/μs, V_{DD} ≤BV_{DSS}, Starting T_J = 25°C

■ **THERMAL CHARACTERISTICS**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		$θ_{JA}$	62.5	°C/W
Junction to Case	TO-220F/TO-220F1 TO-220F2	$θ_{JC}$	2.5	°C/W
	TO-263		0.77 (Note)	

Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

■ **ELECTRICAL CHARACTERISTICS**(T_C=25°C, unless otherwise specified)

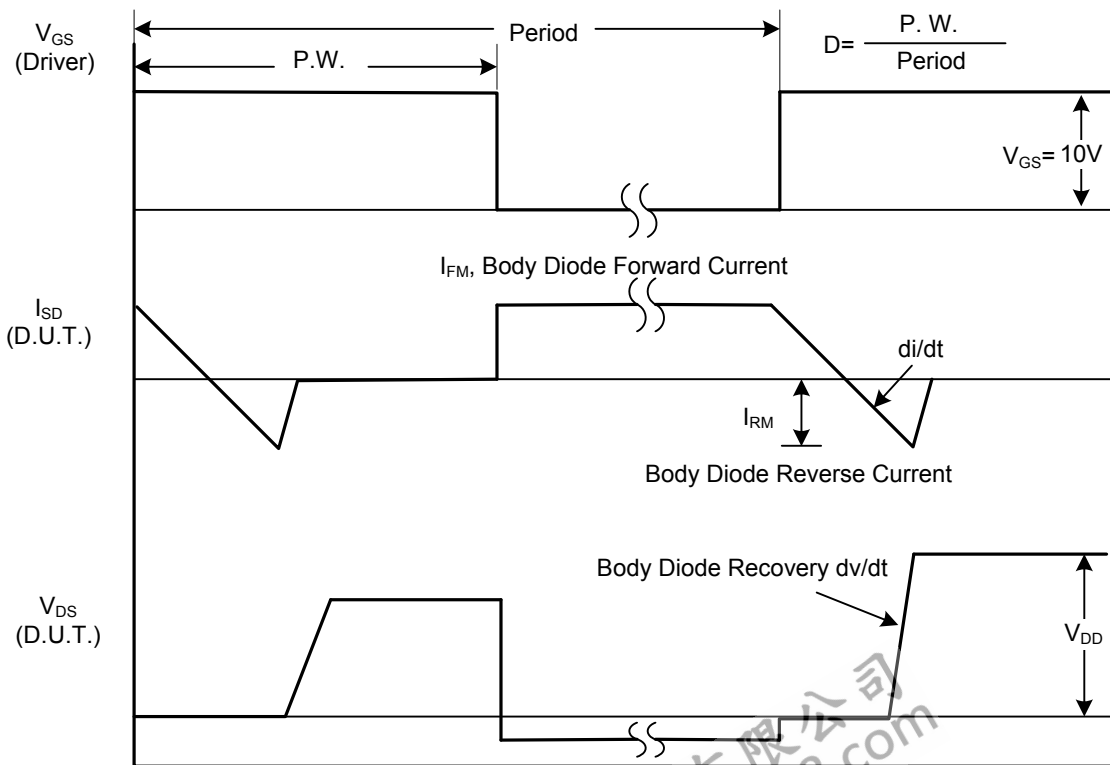| PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250µA	700			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=700V, V_{GS}=0V			10	µA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse		V_{GS}=-30V, V_{DS}=0V			-100	nA
Breakdown Voltage Temperature Coefficient		$\Delta BV_{DSS}/\Delta T_J$	I_D=250µA, Referencedto25°C		0.7		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250µA	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=5A			1.2	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS}=25V, V_{GS}=0V, f=1.0 MHz		1700		pF
Output Capacitance		C_{OSS}			163		pF
Reverse Transfer Capacitance		C_{RSS}			30		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	V_{DS}=100V, I_D=10A, V_{GS}=10V I_G=1mA (Note1,2)		51		nC
Gate-Source Charge		Q_{GS}			8		nC
Gate-Drain Charge		Q_{GD}			19		nC
Turn-On Delay Time		$t_{D(ON)}$	V_{DD}=100V, I_D=10A, R_G=25Ω (Note1,2)		22		ns
Turn-On Rise Time		t_R			24		ns
Turn-Off Delay Time		$t_{D(OFF)}$			184		ns
Turn-Off Fall Time		t_F			63		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				10	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				40	A
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} = 0 V, I_S =10A			1.4	V
Reverse Recovery Time		t_{rr}	V_{GS} = 0 V, I_S = 10A, dI_F / dt = 100 A/µs (Note 1)		400		ns
Reverse Recovery Charge		Q_{rr}			5.7		µC

Notes: 1. Pulse Test : Pulse width ≤ 300µs, Duty cycle ≤ 2%
 2. Essentially independent of operating temperature.

■ **TEST CIRCUITS AND WAVEFORMS**
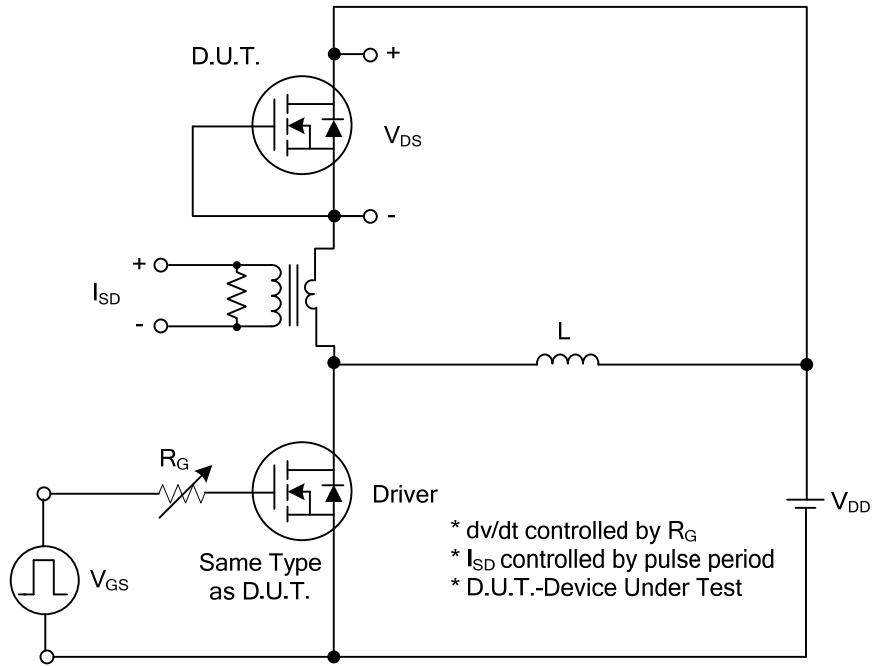
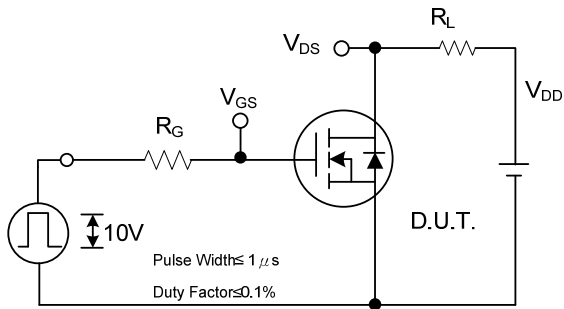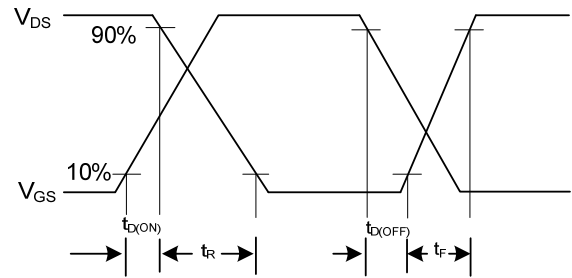**Peak Diode Recovery dv/dt Test Circuit**

* dv/dt controlled by R_G
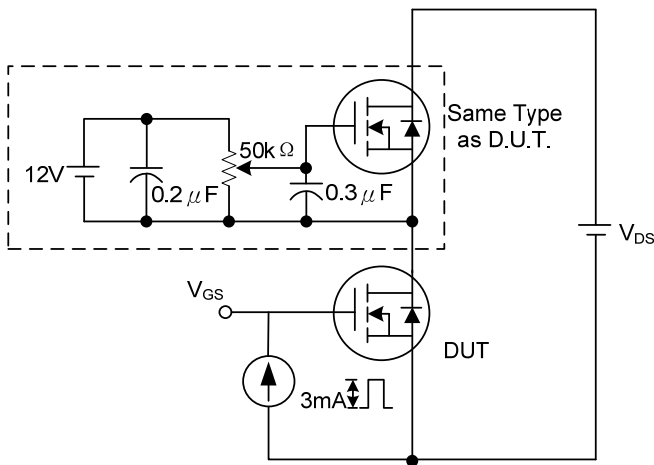* I_{SD} controlled by pulse period
* D.U.T.-Device Under Test

$$D = \frac{P.\,W.}{Period}$$

$V_{GS} = 10V$

I_{FM}, Body Diode Forward Current

I_{RM}

di/dt

Body Diode Reverse Current

Body Diode Recovery dv/dt

V_{DD}

Body Diode Forward Voltage Drop

Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS

Switching Test Circuit
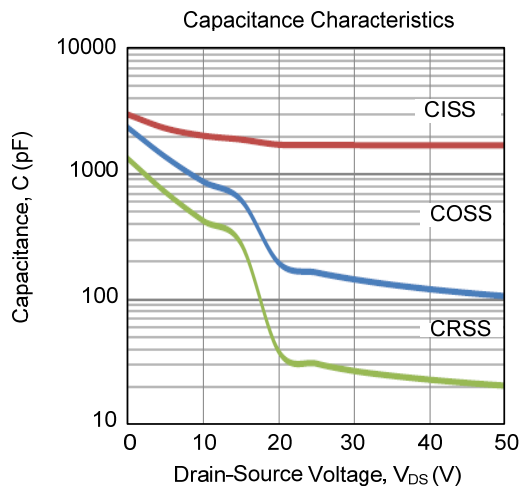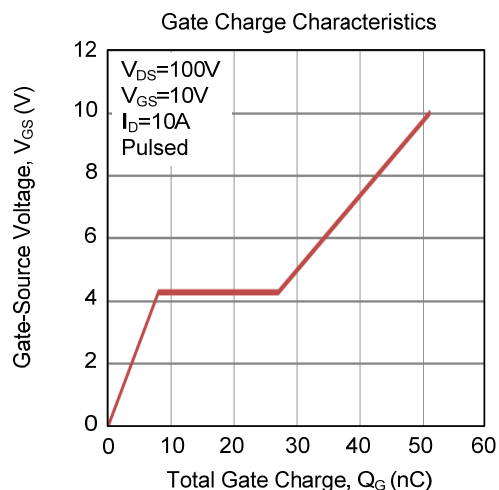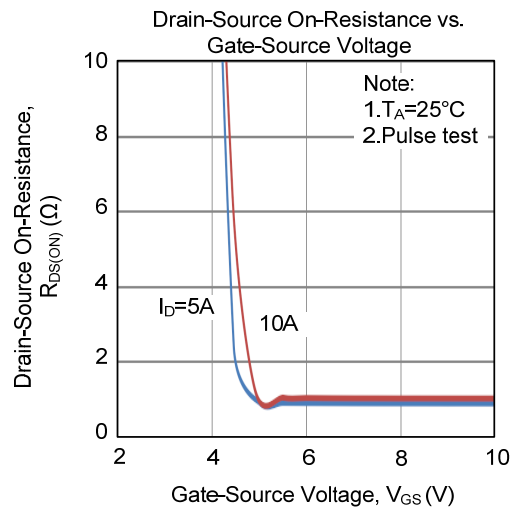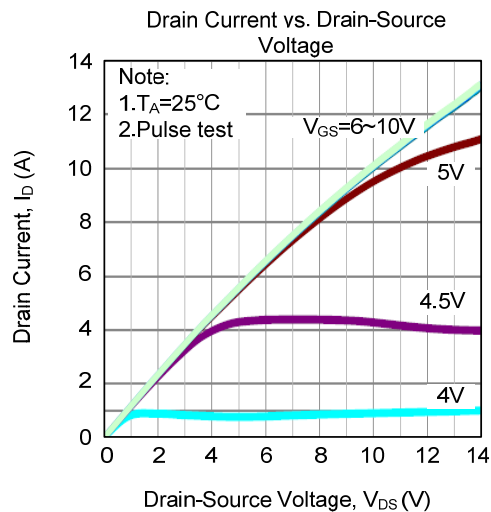
Switching Waveforms

Gate Charge Test Circuit
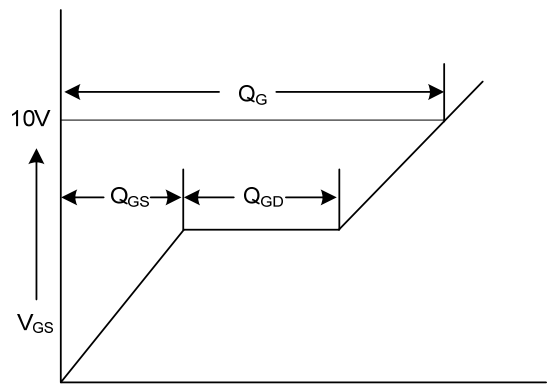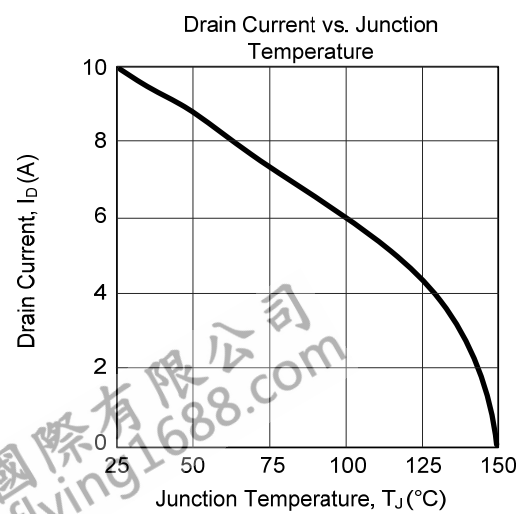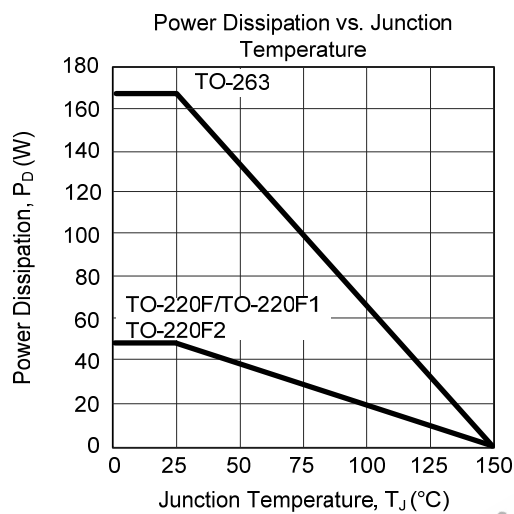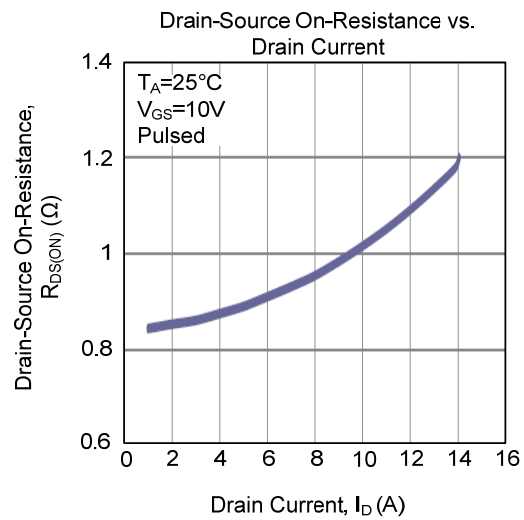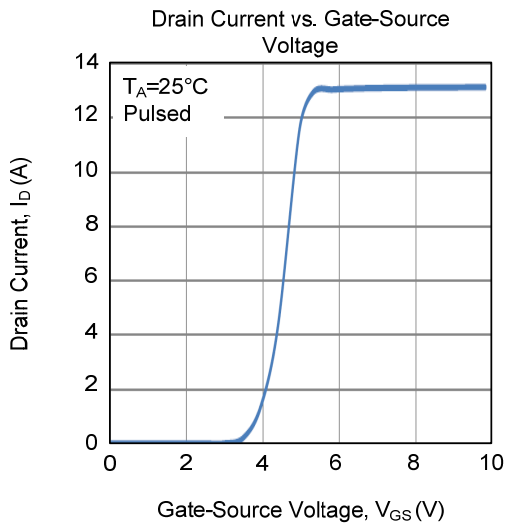
Gate Charge Waveform
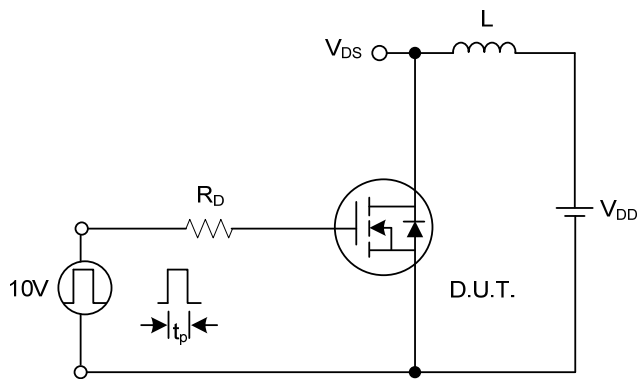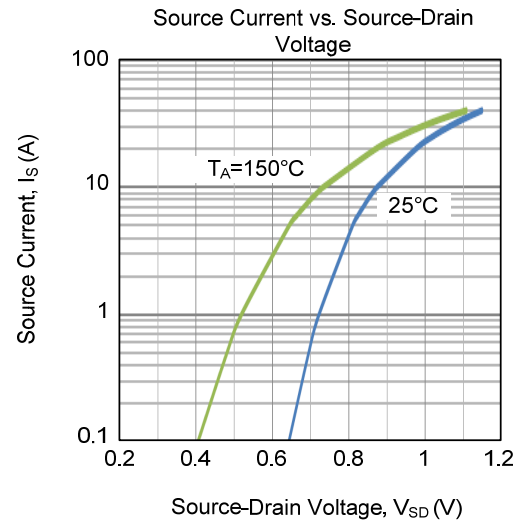
Unclamped Inductive Switching Test Circuit
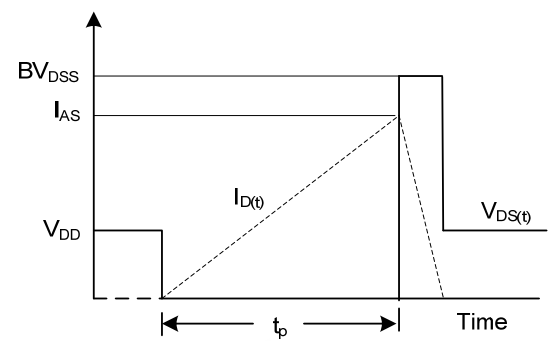
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

Drain Current vs. Drain-Source Voltage

Note:
1. $T_A=25°C$
2. Pulse test

$V_{GS}=6\sim10V$
5V
4.5V
4V

Drain Current, I_D (A) vs. Drain-Source Voltage, V_{DS} (V)

Drain-Source On-Resistance vs. Gate-Source Voltage

Note:
1. $T_A=25°C$
2. Pulse test

$I_D=5A$ 10A

Drain-Source On-Resistance, $R_{DS(ON)}$ (Ω) vs. Gate-Source Voltage, V_{GS} (V)

Gate Charge Characteristics

$V_{DS}=100V$
$V_{GS}=10V$
$I_D=10A$
Pulsed

Gate-Source Voltage, V_{GS} (V) vs. Total Gate Charge, Q_G (nC)

Capacitance Characteristics

CISS
COSS
CRSS

Capacitance, C (pF) vs. Drain-Source Voltage, V_{DS} (V)

Drain-Source On-Resistance vs. Junction Temperature

$V_{GS}=10V$
$I_D=5A$
Pulsed

Drain-Source On-Resistance Normalized vs. Junction Temperature, T_J (°C)

Breakdown Voltage vs. Junction Temperature

$I_D=0.25mA$
Pulsed

Drain-Source Breakdown Voltage Normalized vs. Junction Temperature, T_J (°C)

■ TYPICAL CHARACTERISTICS (Cont.)

Gate Threshold Voltage vs. Junction Temperature

I_D=0.25mA
Pulsed

Gate Threshold Voltage Normalized vs. Junction Temperature, T_J (°C)

Source Current vs. Source–Drain Voltage

T_A=150°C
25°C

Source Current, I_S (A) vs. Source–Drain Voltage, V_{SD} (V)

Drain Current vs. Gate–Source Voltage

T_A=25°C
Pulsed

Drain Current, I_D (A) vs. Gate-Source Voltage, V_{GS} (V)

Drain-Source On-Resistance vs. Drain Current

T_A=25°C
V_{GS}=10V
Pulsed

Drain-Source On-Resistance, $R_{DS(ON)}$ (Ω) vs. Drain Current, I_D (A)

Power Dissipation vs. Junction Temperature

TO-263

TO-220F/TO-220F1
TO-220F2

Power Dissipation, P_D (W) vs. Junction Temperature, T_J (°C)

Drain Current vs. Junction Temperature

Drain Current, I_D (A) vs. Junction Temperature, T_J (°C)

■ **TYPICAL CHARACTERISTICS (Cont.)**

Safe Operating Area

Safe Operating Area