

## 13N50

Power MOSFET

### 13A, 500V N-CHANNEL POWER MOSFET

#### DESCRIPTION

The UTC **13N50** is a N-Channel enhancement mode power MOSFET. The device adopts planar stripe and uses DMOS technology to minimize and provide lower on-state resistance and faster switching speed. It can also withstand high energy pulse under the avalanche and commutation mode conditions.

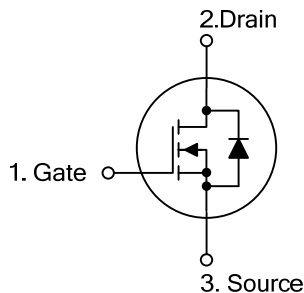
The UTC **13N50** is ideally suitable for high efficiency switch mode power supply, power factor correction, electronic lamp ballast based on half bridge topology.

#### FEATURES

\*  $R_{DS(ON)} < 0.48\Omega$  @  $V_{GS} = 10V, I_D = 6.5A$

\* Avalanche energy tested

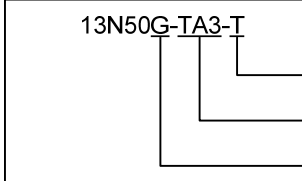
#### SYMBOL

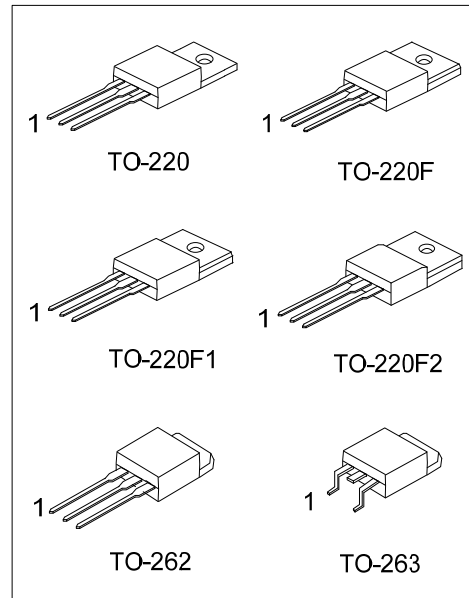


#### ORDERING INFORMATION

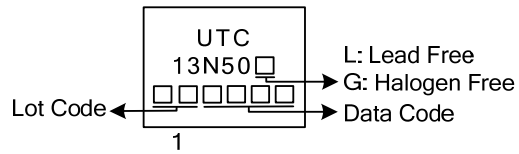
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
13N50L-TA3-T	13N50G-TA3-T	TO-220	G	D	S	Tube
13N50L-TF3-T	13N50G-TF3-T	TO-220F	G	D	S	Tube
13N50L-TF1-T	13N50G-TF1-T	TO-220F1	G	D	S	Tube
13N50L-TF2-T	13N50G-TF2-T	TO-220F2	G	D	S	Tube
13N50L-T2Q-T	13N50G-T2Q-T	TO-262	G	D	S	Tube
13N50L-TQ2-T	13N50G-TQ2-T	TO-263	G	D	S	Tube
13N50L-TQ2-R	13N50G-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>13N50G-TA3-T</p>  <p>(1) Packing Type (2) Package Type (3) Green Package</p>	<p>(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, T2Q: TO-262, TQ2: TO-263 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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## MARKING



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■ ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	500	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	V
Drain Current	Continuous	$I_D$	13	A
	Pulsed (Note 2)	$I_{DM}$	52	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	972	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	2.1	V/ns
Power Dissipation	TO-220/TO-262	$P_D$	168	W
	TO-263			
	TO-220F/TO-220F1		35	W
	TO-220F2			
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Storage Temperature		$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

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.  $L=11.5\text{mH}$ ,  $I_{AS}=13\text{A}$ ,  $V_{DD}=50\text{V}$ ,  $R_G=25\ \Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD}\leq 13\text{A}$ ,  $di/dt\leq 200\text{A}/\mu\text{s}$ ,  $V_{DD}\leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220/TO-262	$\theta_{JC}$	0.74	$^\circ\text{C}/\text{W}$
	TO-263			
	TO-220F/TO-220F1		3.57	
	TO-220F2			

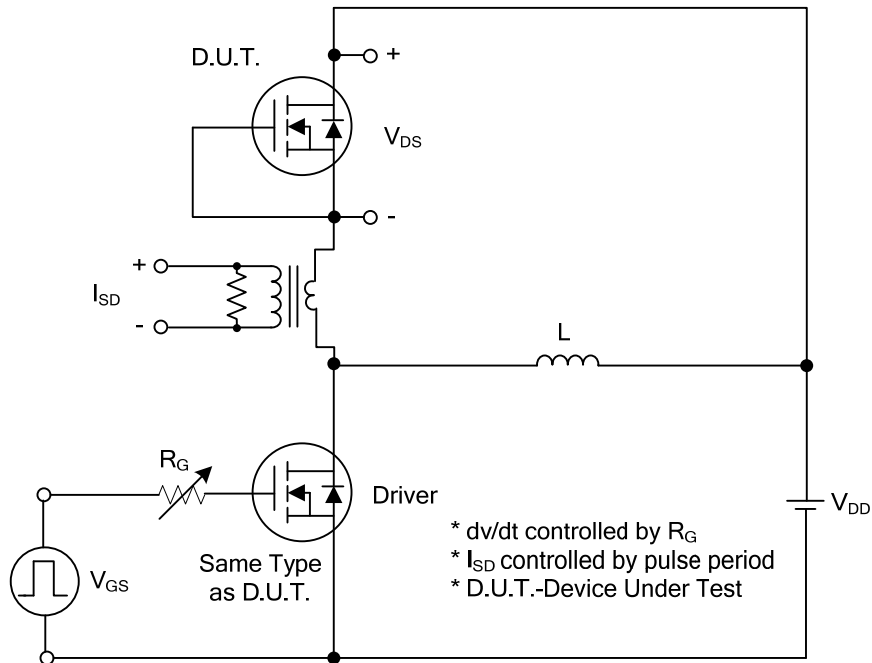
■ ELECTRICAL CHARACTERISTICS (T<sub>J</sub>=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA	500			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 500V, V <sub>GS</sub> = 0V			1	μA
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = 30V, V <sub>DS</sub> = 0V			100	nA
		V <sub>GS</sub> = -30V, V <sub>DS</sub> = 0V			-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	2.0		4.0	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 6.5A			0.48	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =25V, f=1.0MHz		1920		pF
Output Capacitance	C <sub>OSS</sub>			235		pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			36		pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge (Note 1)	Q <sub>G</sub>	V <sub>DS</sub> =400V, V <sub>GS</sub> =10V, I <sub>D</sub> =13A, I <sub>D</sub> =1mA (Note 1, 2)		60		nC
Gate to Source Charge	Q <sub>GS</sub>			16		nC
Gate to Drain Charge	Q <sub>GD</sub>			24		nC
Turn-ON Delay Time (Note 1)	t <sub>D(ON)</sub>	V <sub>DS</sub> =250V, V <sub>GS</sub> =10V, I <sub>D</sub> =13A, R <sub>G</sub> =25Ω (Note 1, 2)		27		nS
Rise Time	t <sub>R</sub>			25		nS
Turn-OFF Delay Time	t <sub>D(OFF)</sub>			140		nS
Fall-Time	t <sub>F</sub>			35		nS
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Body-Diode Continuous Current	I <sub>S</sub>				13	A
Maximum Body-Diode Pulsed Current	I <sub>SM</sub>				52	A
Drain-Source Diode Forward Voltage (Note 1)	V <sub>SD</sub>	I <sub>S</sub> =13A, V <sub>GS</sub> =0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)	t <sub>rr</sub>	I <sub>S</sub> =13A, V <sub>GS</sub> =0V, dI <sub>F</sub> /dt=100A/μs		380		nS
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>				5.5	

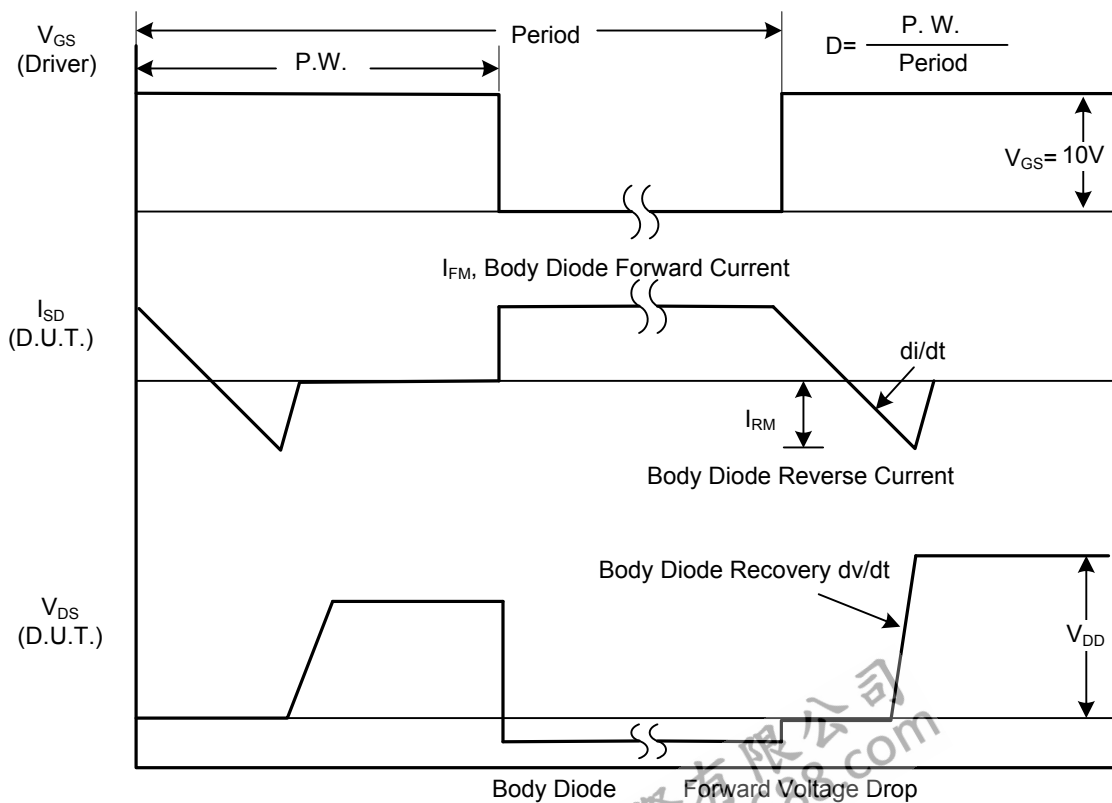
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.

2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS

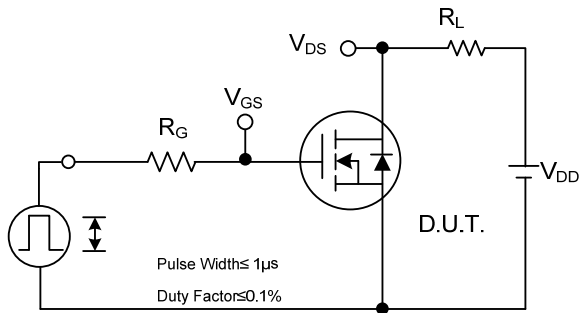


Peak Diode Recovery dv/dt Test Circuit

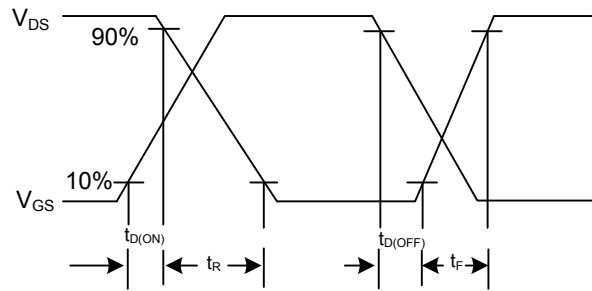


Peak Diode Recovery dv/dt Waveforms

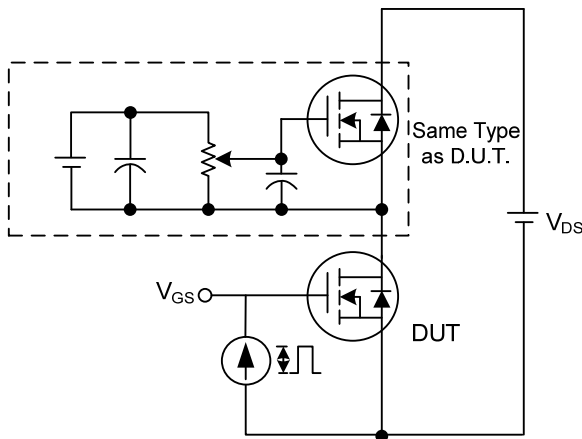
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



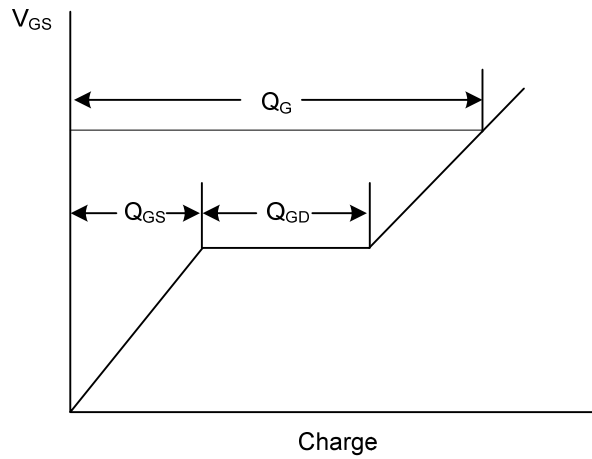
Switching Test Circuit



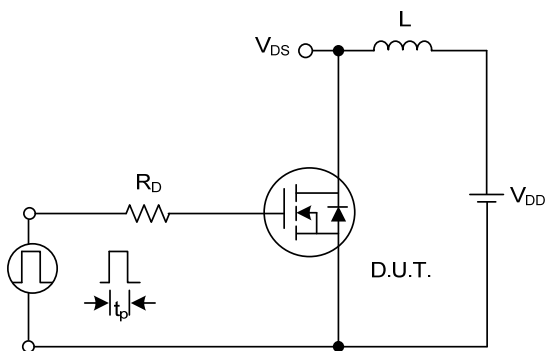
Switching Waveforms



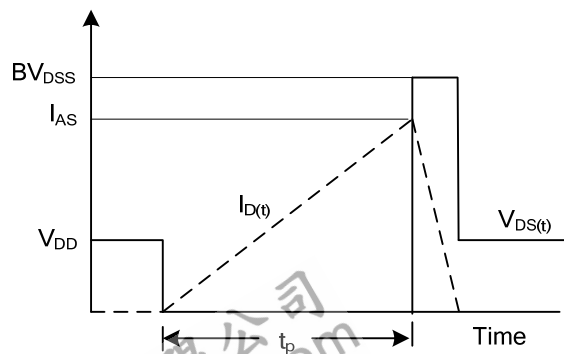
Gate Charge Test Circuit



Gate Charge Waveform

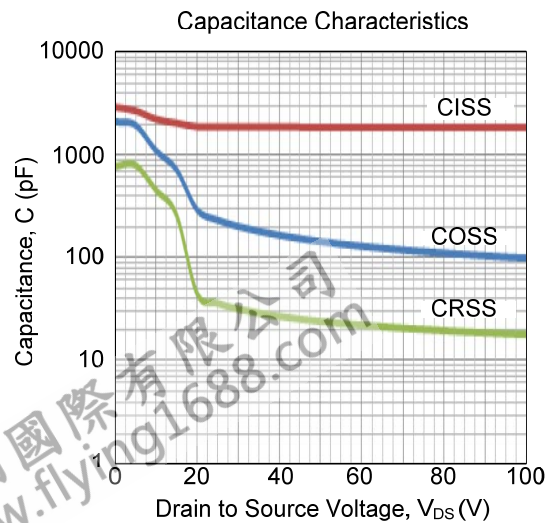
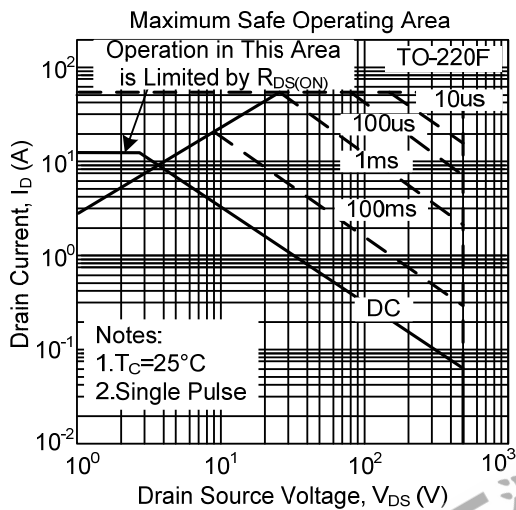
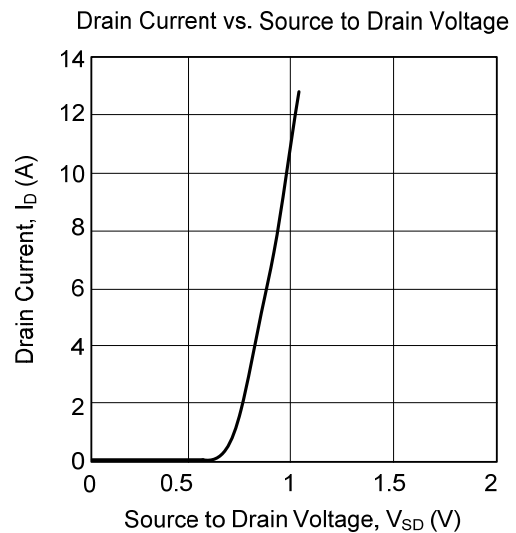
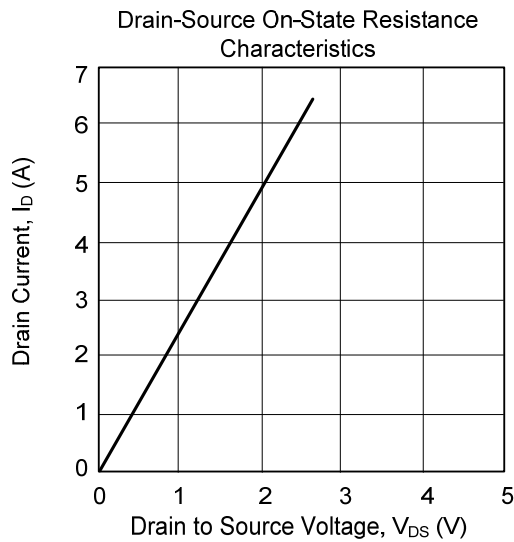
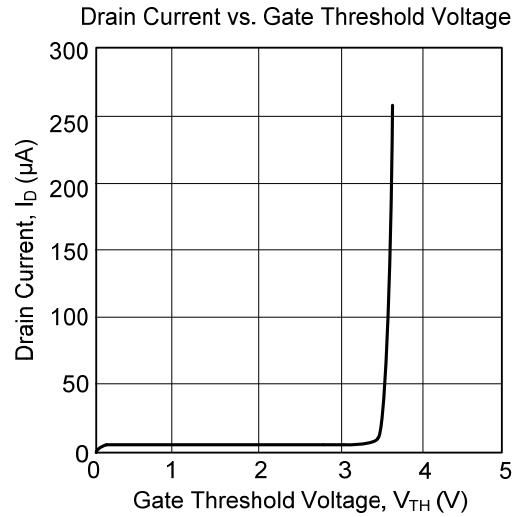
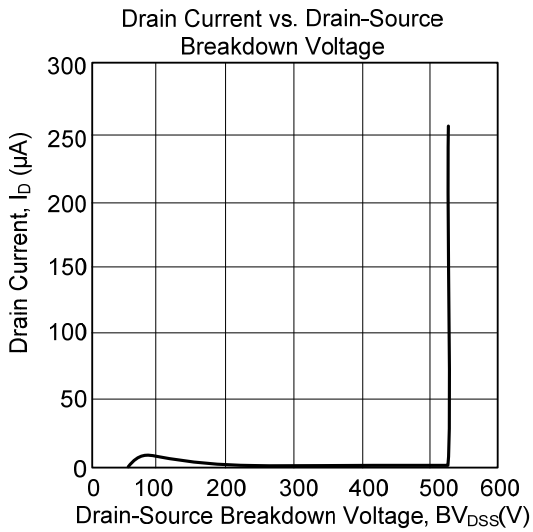


Unclamped Inductive Switching Test Circuit

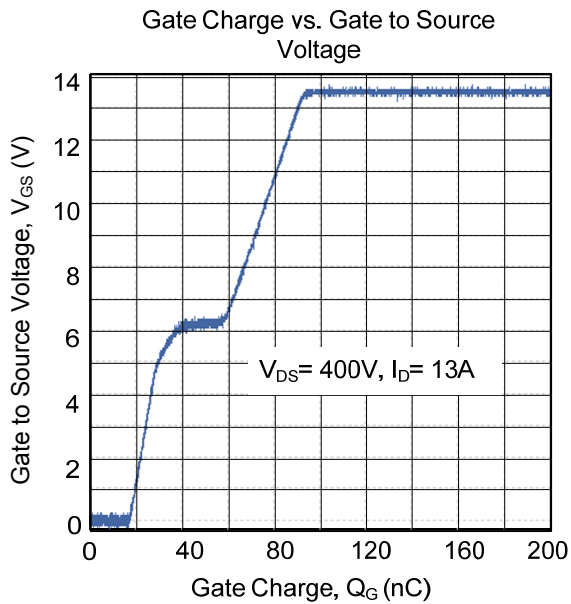


Unclamped Inductive Switching Waveforms

## ■ TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS



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