



# 10N60K-MT

**Power MOSFET**

## 10A, 600V N-CHANNEL POWER MOSFET

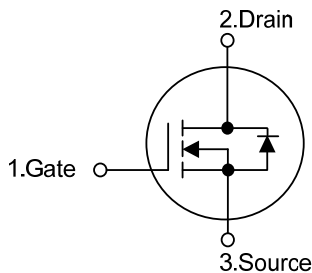
■ DESCRIPTION

The **UTC 10N60K-MT** 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 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

- \*  $R_{DS(ON)} < 0.75\Omega @ V_{GS} = 10V, I_D = 5.0A$
- \* Low  $C_{rss}$  ( typical 7 pF)
- \* Fast switching
- \* 100% avalanche tested
- \* Improved dv/dt capability

■ SYMBOL

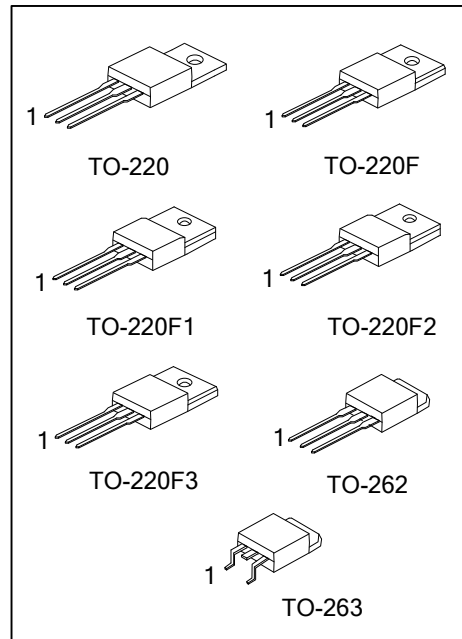


■ ORDERING INFORMATION

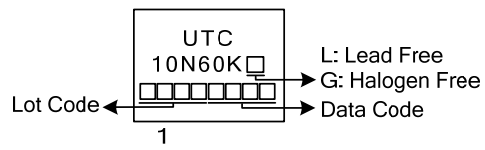
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
10N60KL-TA3-T	10N60KG-TA3-T	TO-220	G	D	S	Tube
10N60KL-TF3-T	10N60KG-TF3-T	TO-220F	G	D	S	Tube
10N60KL-TF1-T	10N60KG-TF1-T	TO-220F1	G	D	S	Tube
10N60KL-TF2-T	10N60KG-TF2-T	TO-220F2	G	D	S	Tube
10N60KL-TF3T-T	10N60KG-TF3T-T	TO-220F3	G	D	S	Tube
10N60KL-T2Q-T	10N60KG-T2Q-T	TO-262	G	D	S	Tube
10N60KL-TQ2-T	10N60KG-TQ2-T	TO-263	G	D	S	Tube
10N60KL-TQ2-R	10N60KG-TQ2-R	TO-263	G	D	S	Tape Reel

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

<p>10N60KG-TA3-T</p> <p>(1)Packing Type (2)Package Type (3)Green Package</p>	<p>(1) T: Tube (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1 TF2: TO-220F2, TF3T: TO-220F3, T2Q: TO-262, TQ2: TO-263 (3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		$V_{DSS}$	600	V
Gate-Source Voltage		$V_{GSS}$	$\pm 30$	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)	$E_{AS}$	200	mJ
	Repetitive (Note 2)	$E_{AR}$	12	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262	$P_D$	156	W
	TO-263			
	TO-220F/TO-220F1		52	W
	TO-220F2/TO-220F3			
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Operating Temperature		$T_{OPR}$	-55 ~ +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.  $L = 4\text{mH}$ ,  $I_{AS} = 10\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\ \Omega$  Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 9.5\text{A}$ ,  $di/dt \leq 200\text{A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		$\theta_{JA}$	62.5	$^\circ\text{C}/\text{W}$
Junction to Case	TO-220/TO-262	$\theta_{JC}$	0.8	$^\circ\text{C}/\text{W}$
	TO-263			
	TO-220F/TO-220F1		2.4	$^\circ\text{C}/\text{W}$
	TO-220F2/TO-220F3			

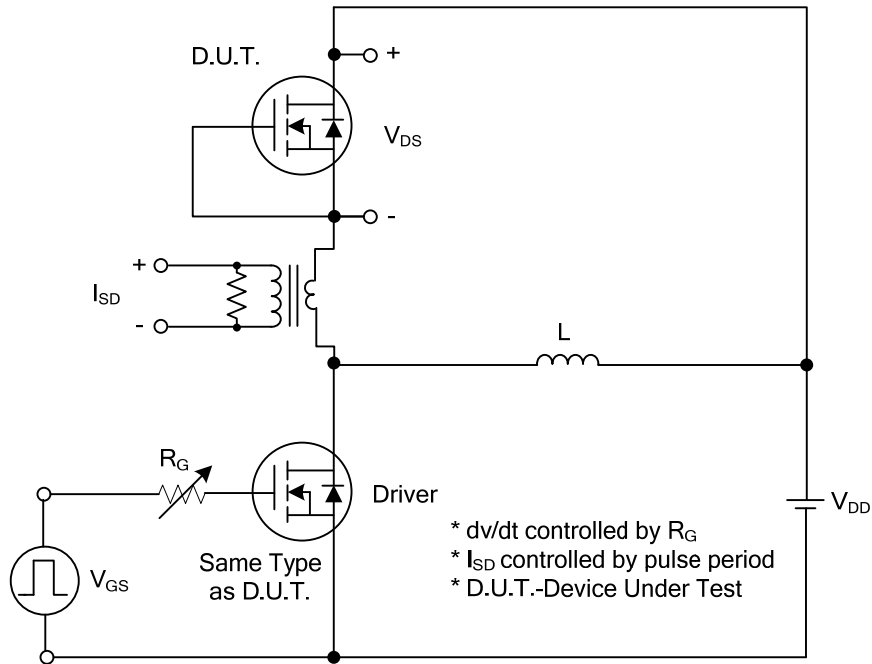
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C, unless otherwise specified)

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	600			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> =600V, V <sub>GS</sub> =0V			1	μA
Gate-Source Leakage Current	Forward	I <sub>GSS</sub> V <sub>GS</sub> =30V, V <sub>DS</sub> =0V			100	nA
	Reverse		V <sub>GS</sub> =-30V, V <sub>DS</sub> =0V			-100
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> =250 μA, Referenced to 25°C		0.7		V/°C
<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> =5.0A		0.63	0.75	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> =25V, V <sub>GS</sub> =0V, f=1.0 MHz		1330	1995	pF
Output Capacitance	C <sub>OSS</sub>			150	225	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			7	11	pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> =50V, I <sub>D</sub> =1.3A, V <sub>GS</sub> =10V I <sub>G</sub> =100μA (Note1, 2)		96	115	nC
Gate-Source Charge	Q <sub>GS</sub>			9		nC
Gate-Drain Charge	Q <sub>GD</sub>			11.4		nC
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> =30V, I <sub>D</sub> =0.5A, R <sub>G</sub> =25Ω, V <sub>GS</sub> =0V (Note1, 2)		56	67	ns
Turn-On Rise Time	t <sub>R</sub>			68	82	ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			300	360	ns
Turn-Off Fall Time	t <sub>F</sub>			84	101	ns
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				10	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				38	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =10A			1.4	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =10A, di <sub>F</sub> /dt=100A/μs (Note1)		420		ns
Reverse Recovery Charge	Q <sub>rr</sub>				4.2	

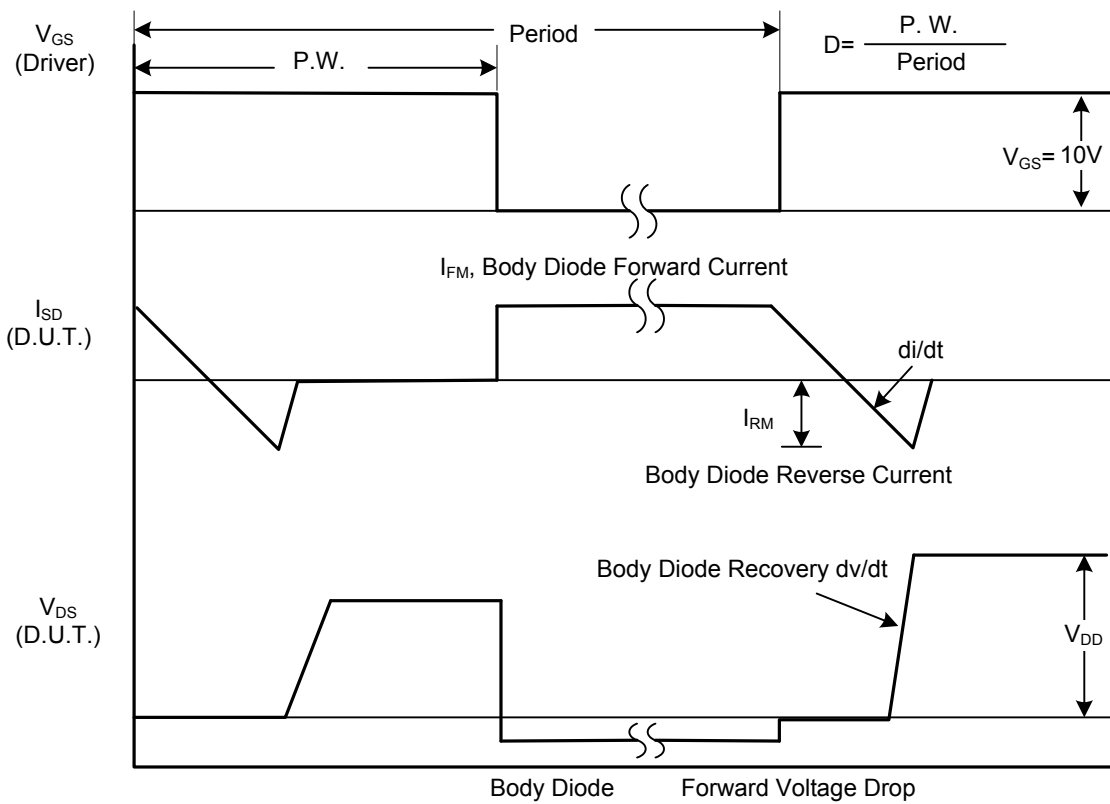
Notes: 1. Pulse Test : Pulse width ≤300μs, Duty cycle ≤2%

2. Essentially independent of operating temperature

## TEST CIRCUITS AND WAVEFORMS

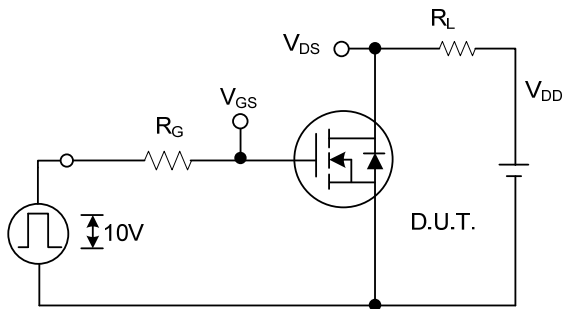


**Peak Diode Recovery  $dv/dt$  Test Circuit**

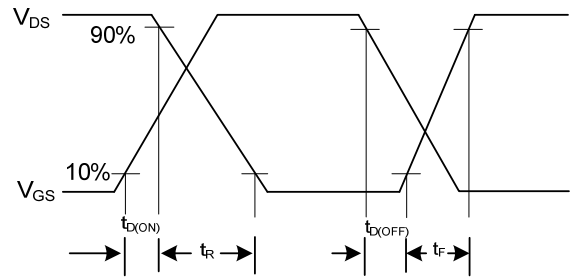


**Peak Diode Recovery  $dv/dt$  Waveforms**

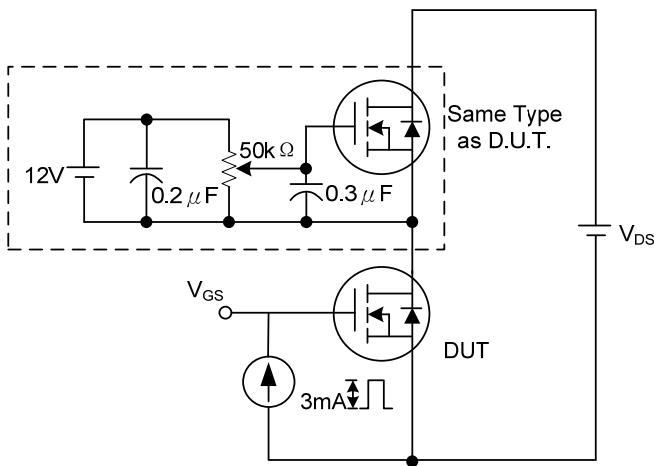
### TEST CIRCUITS AND WAVEFORMS (Cont.)



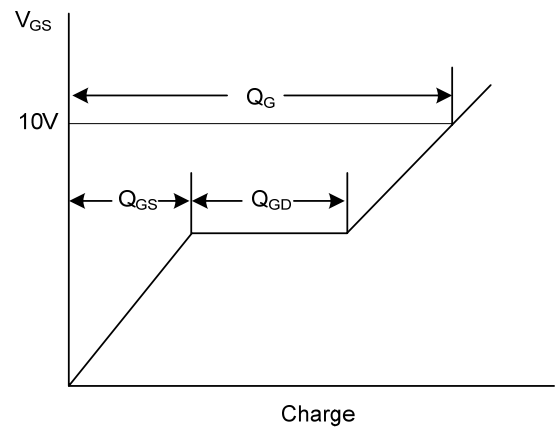
Switching Test Circuit



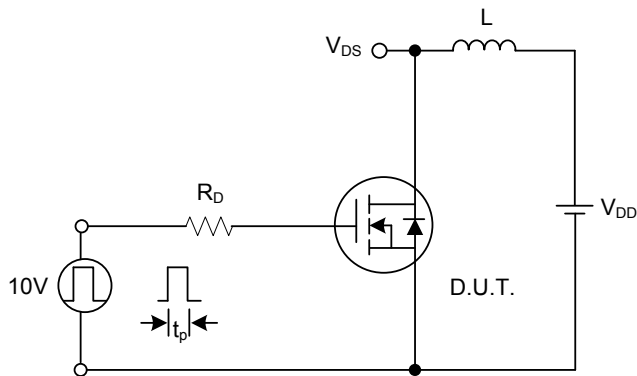
Switching Waveforms



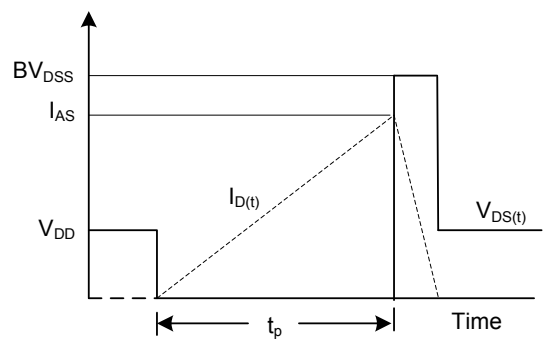
Gate Charge Test Circuit



Gate Charge Waveform

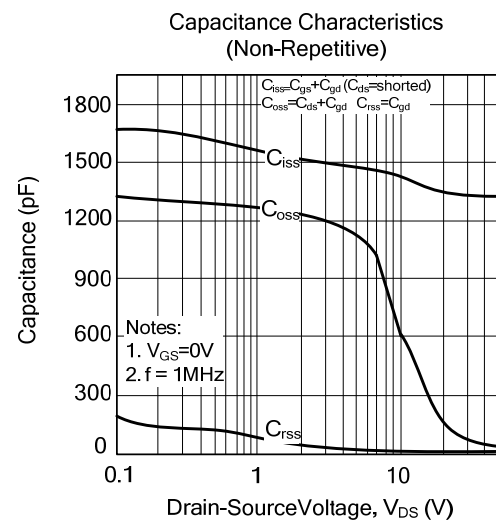
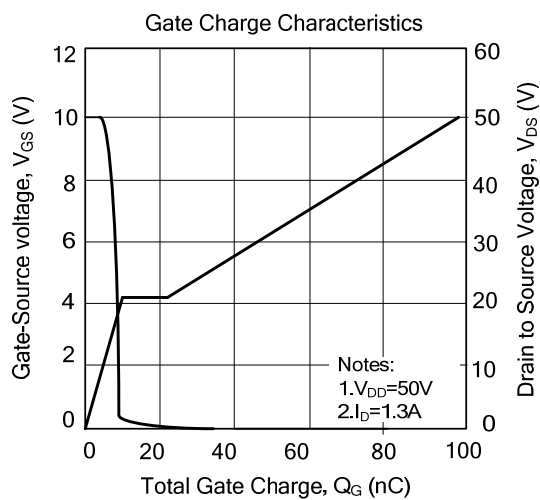
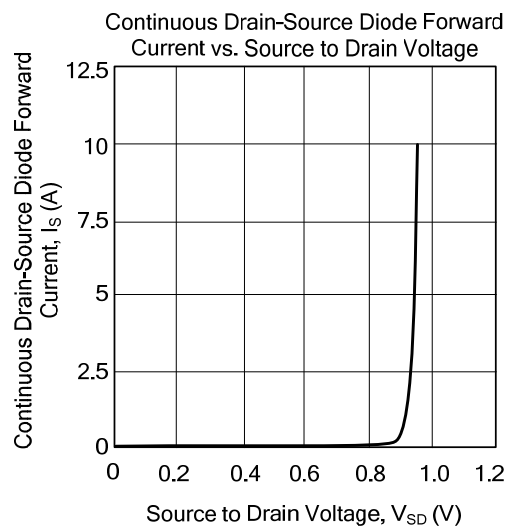
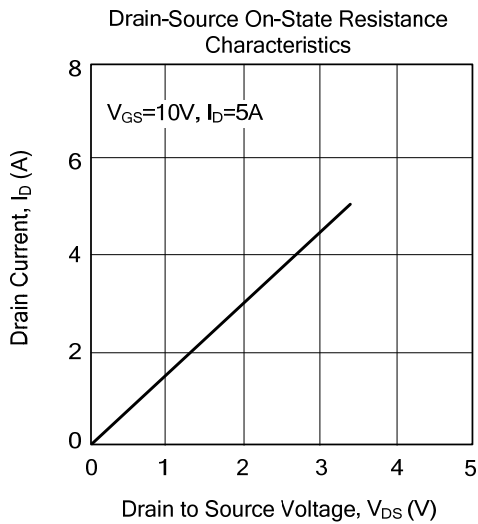
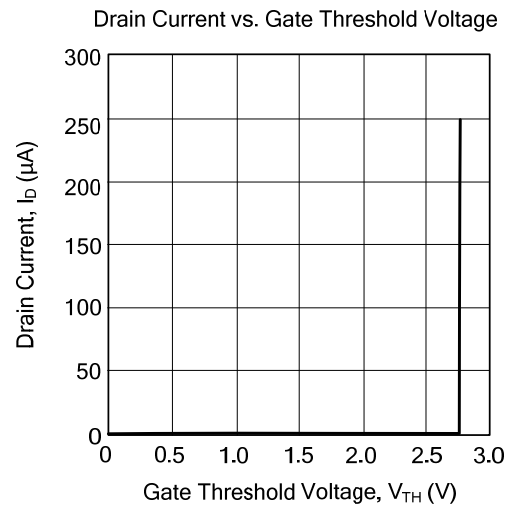
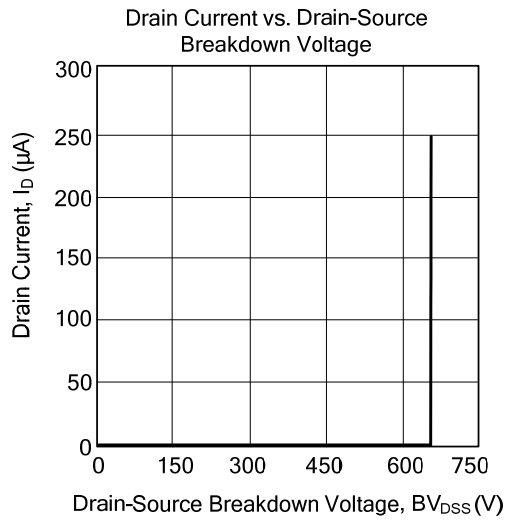


Unclamped Inductive Switching Test Circuit

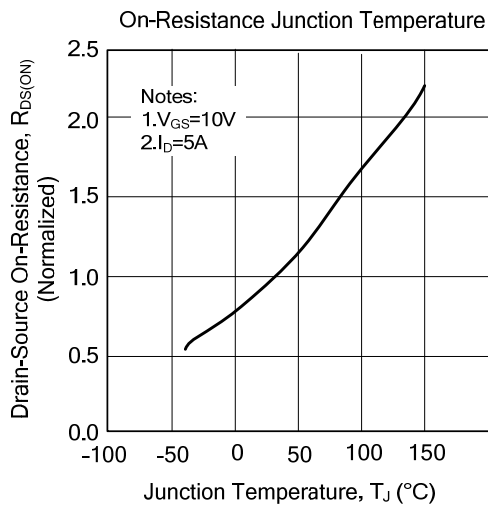


Unclamped Inductive Switching Waveforms

### TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS (Cont.)



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