



# 60N06

**Power MOSFET**

## 60A, 60V N-CHANNEL POWER MOSFET

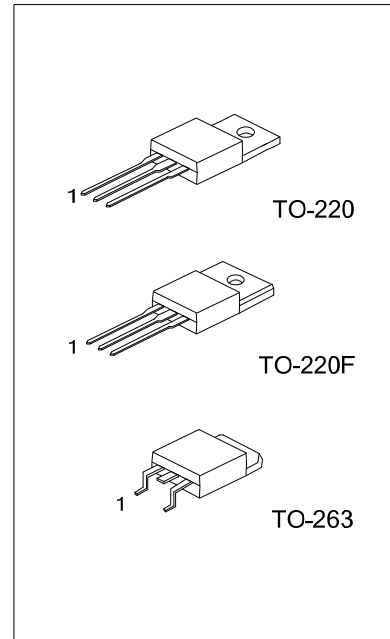
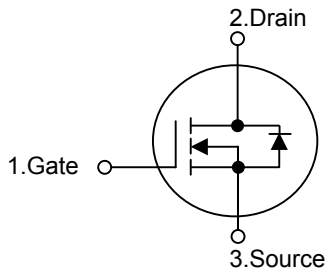
■ DESCRIPTION

The UTC **60N06** is N-channel enhancement mode power field effect transistors with stable off-state characteristics, fast switching speed, low thermal resistance, usually used at telecom and computer application.

■ FEATURES

- \*  $R_{DS(ON)} = 18m\Omega @ V_{GS} = 10V$
- \* Ultra low gate charge ( typical 39nC )
- \* Fast switching capability
- \* Low reverse transfer Capacitance ( $C_{RSS} =$  typical 115pF )
- \* Avalanche energy Specified
- \* Improved dv/dt capability, high ruggedness

■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
60N06L-TA3-T	60N06G-TA3-T	TO-220	G	D	S	Tube
60N06L-TF3-T	60N06G-TF3-T	TO-220F	G	D	S	Tube
60N06L-TQ2-R	60N06G-TQ2-R	TO-263	G	D	S	Tape Reel
60N06L-TQ2-T	60N06G-TQ2-T	TO-263	G	D	S	Tube

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

<p>60N06L-TA3-T</p>	<p>(1) T: Tube (2) TA3: TO-220, TF3: TO-220F, TQ2: TO-263 (3) G: Halogen Free, L: Lead Free</p>
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### ■ ABSOLUTE MAXIMUM RATINGS

PARAMETER		SYMBOL	RATINGS	UNIT
Drain to Source Voltage		$V_{DSS}$	60	V
Gate to Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$T_C = 25^\circ\text{C}$	$I_D$	60	A
	$T_C = 100^\circ\text{C}$		39	A
Drain Current Pulsed (Note 2)		$I_{DM}$	120	A
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	1000	mJ
	Repetitive (Note 2)	$E_{AR}$	180	mJ
Power Dissipation ( $T_C=25^\circ\text{C}$ )	TO-220	$P_D$	100	W
	TO-220F		70.62	
	TO-263		54	
Junction Temperature		$T_J$	+150	$^\circ\text{C}$
Storage Temperature		$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

Note: 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. Repeatability rating: pulse width limited by junction temperature  
 3.  $L=0.61\text{mH}$ ,  $I_{AS}=60\text{A}$ ,  $R_G=20\Omega$ , Starting  $T_J=25^\circ\text{C}$

### ■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F	$\theta_{JA}$	62.5	$^\circ\text{C/W}$
	TO-263		110	
Junction to Case	TO-220	$\theta_{JC}$	1.25	$^\circ\text{C/W}$
	TO-220F		1.77	
	TO-263		2.31	

### ■ ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

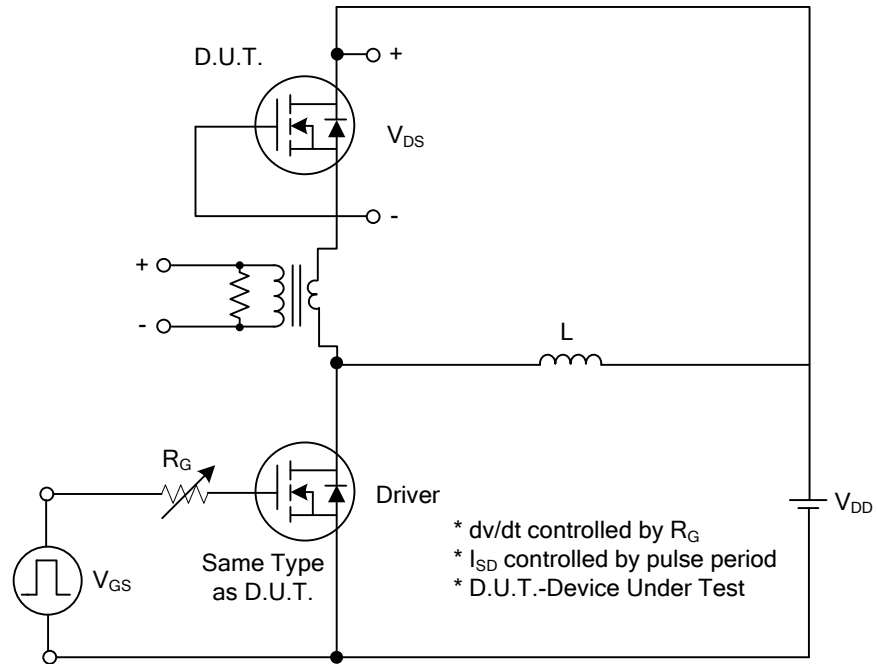
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS} = 0\text{ V}$ , $I_D = 250\mu\text{A}$	60			V
Drain-Source Leakage Current	$I_{DSS}$	$V_{DS} = 60\text{ V}$ , $V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
Gate-Source Leakage Current	Forward	$I_{GSS}$			100	nA
	Reverse				-100	nA
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS} = 10\text{ V}$ , $I_D = 30\text{A}$		14	18	m $\Omega$
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	$C_{ISS}$	$V_{GS} = 0\text{ V}$ , $V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$		2000		pF
Output Capacitance	$C_{OSS}$			400		pF
Reverse Transfer Capacitance	$C_{RSS}$			115		pF
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{D(ON)}$	$V_{DD} = 30\text{ V}$ , $I_D = 60\text{ A}$ , $R_L = 0.5\Omega$ , $V_{GS} = 10\text{ V}$ (Note 2, 3)		12	30	ns
Rise Time	$t_R$			11	30	ns
Turn-Off Delay Time	$t_{D(OFF)}$			25	50	ns
Fall Time	$t_F$			15	30	ns
Total Gate Charge	$Q_G$	$V_{DS} = 30\text{ V}$ , $V_{GS} = 10\text{ V}$ $I_D = 60\text{ A}$ (Note 2, 3)		39	60	nC
Gate-Source Charge	$Q_{GS}$			12		nC
Gate-Drain Charge (Miller Charge)	$Q_{GD}$			10		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

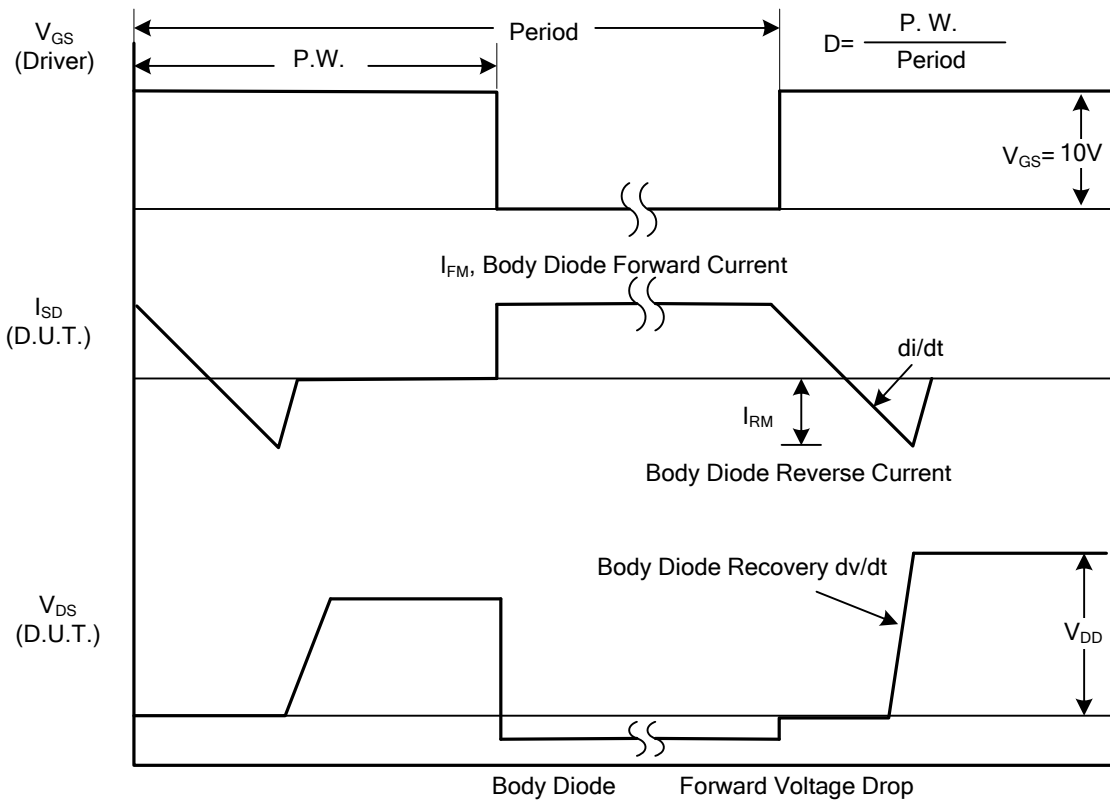
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Diode Forward Voltage	$V_{SD}$	$V_{GS} = 0\text{ V}, I_S = 60\text{ A}$			1.6	V
Continuous Source Current	$I_S$				60	A
Pulsed Source Current	$I_{SM}$				120	
Reverse Recovery Time	$t_{rr}$	$I_S=60\text{ A}, V_{GS}=0\text{ V}, di_F/dt=100\text{ A}/\mu\text{s}$		60		ns
Reverse Recovery Charge	$Q_{RR}$			3.4		$\mu\text{C}$

- Note: 1.  $I_{SD} \leq 60\text{ A}$ ,  $di/dt \leq 300\text{ A}/\mu\text{s}$ ,  $V_{DD} \leq BV_{DSS}$ , Starting  $T_J = 25^\circ\text{C}$   
 2. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$   
 3. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

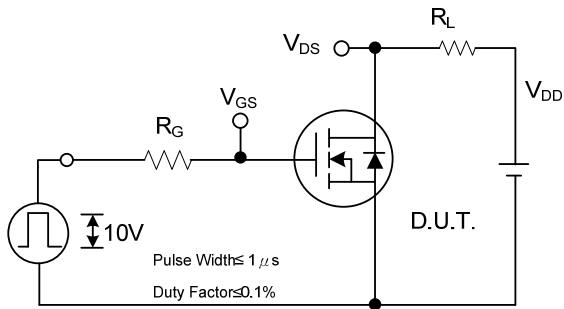


Peak Diode Recovery dv/dt Test Circuit

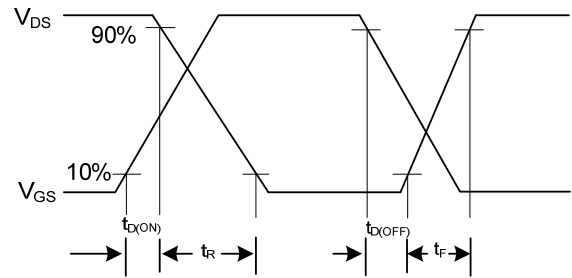


Peak Diode Recovery dv/dt Waveforms

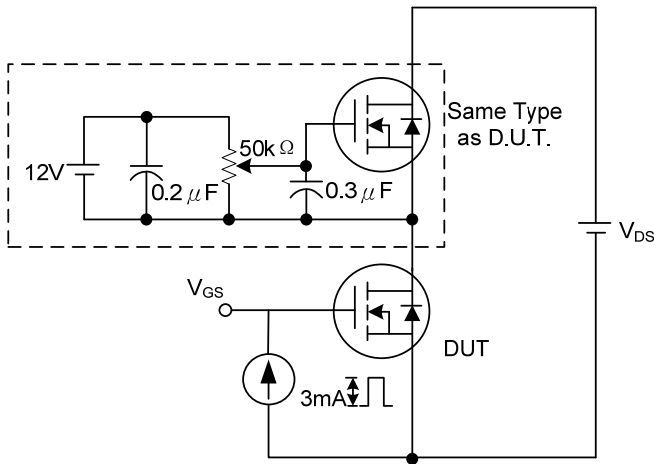
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



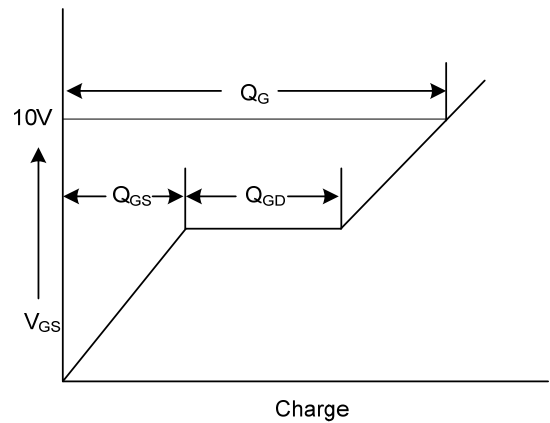
Switching Test Circuit



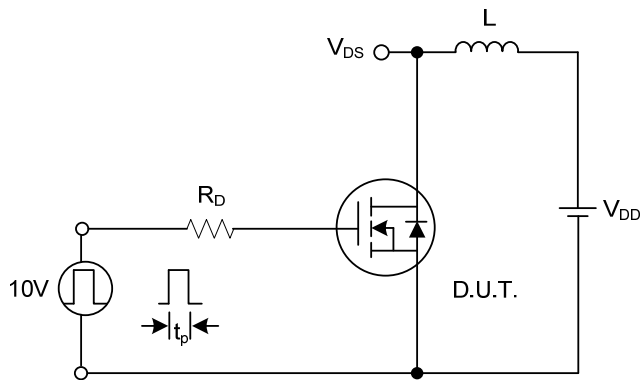
Switching Waveforms



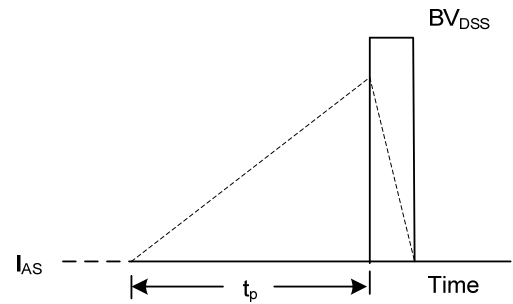
Gate Charge Test Circuit



Gate Charge Waveform

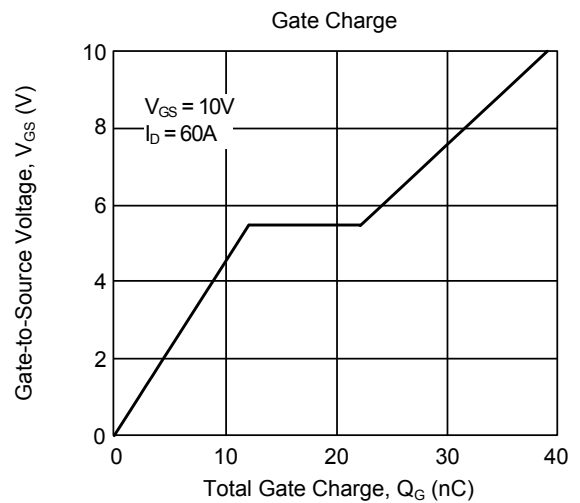
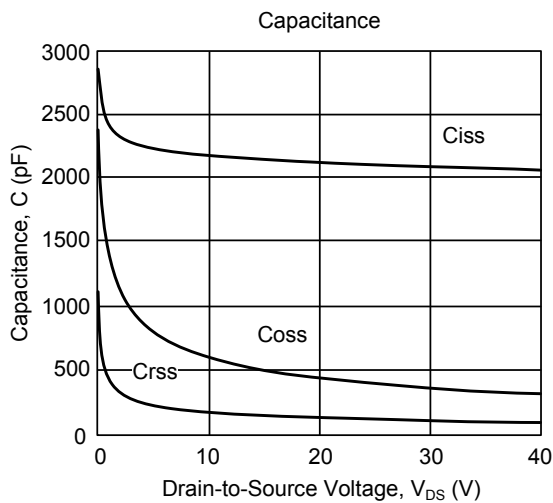
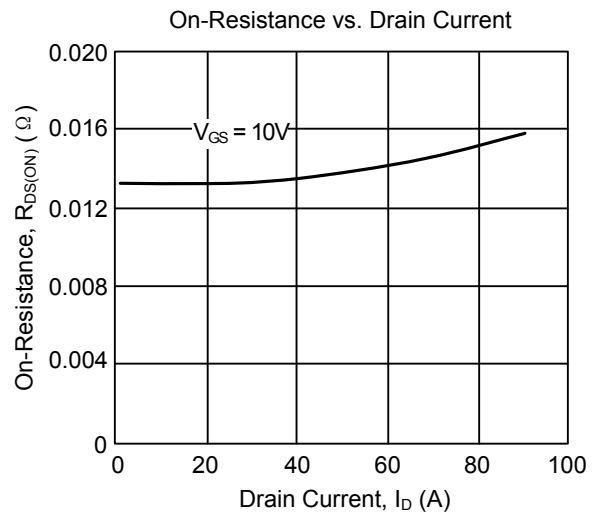
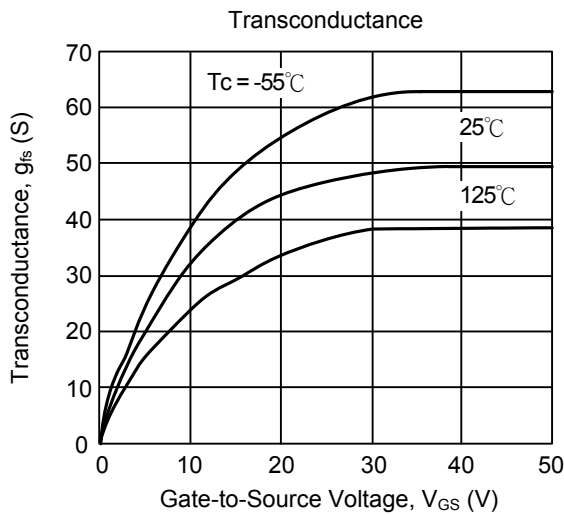
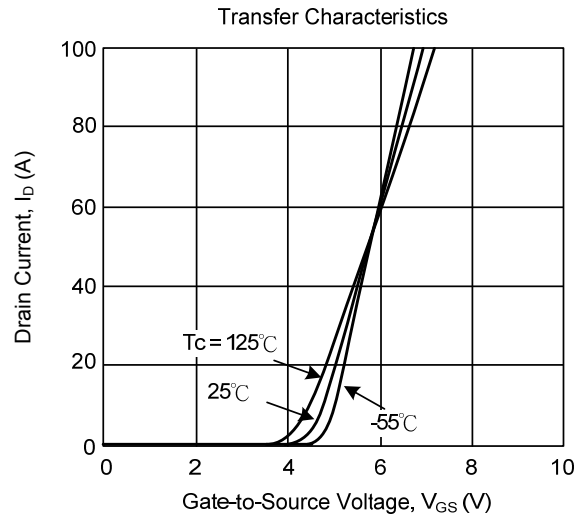
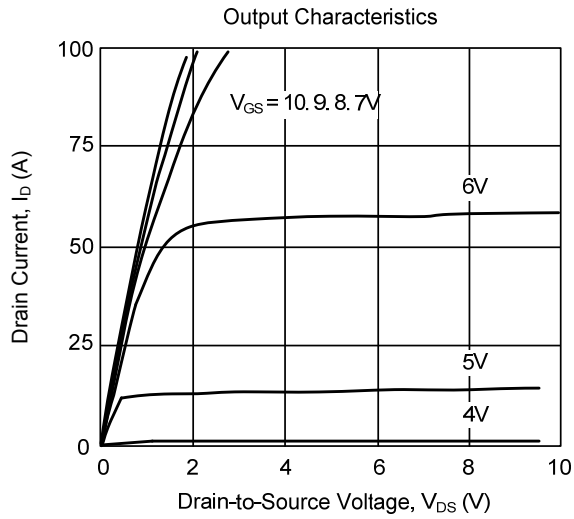


Unclamped Inductive Switching Test Circuit

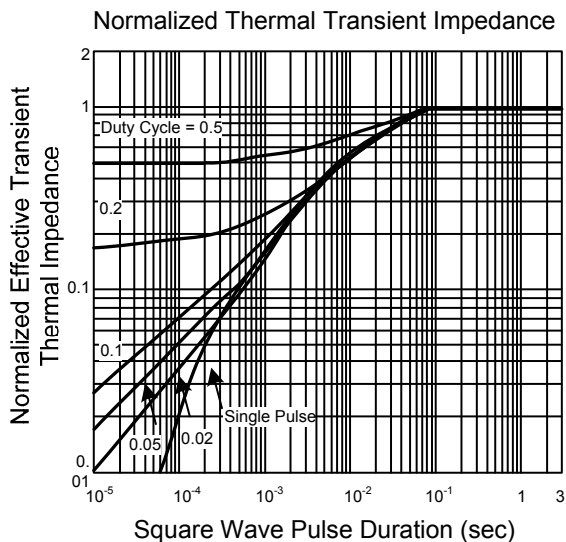
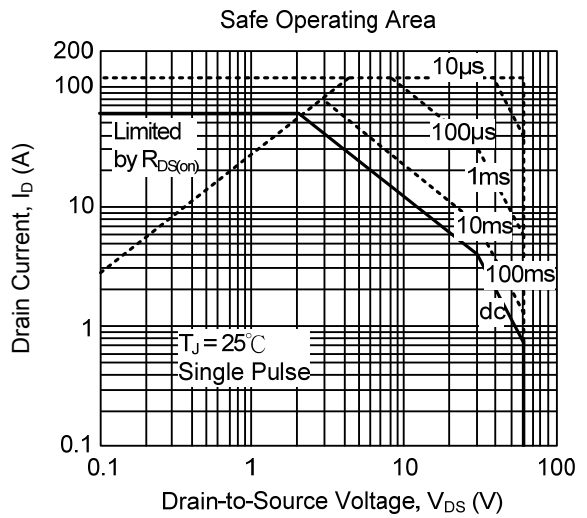
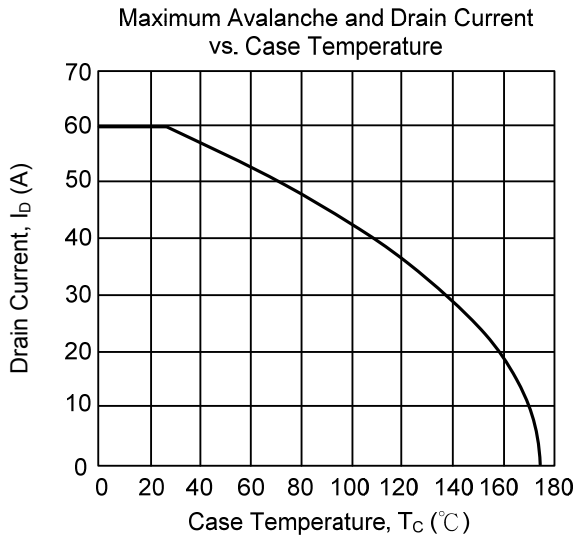
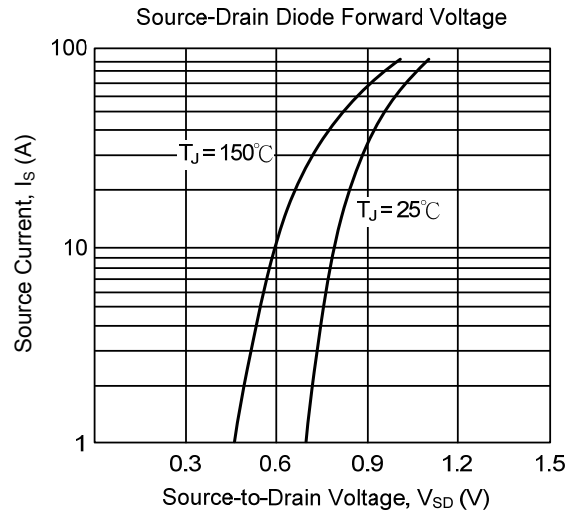
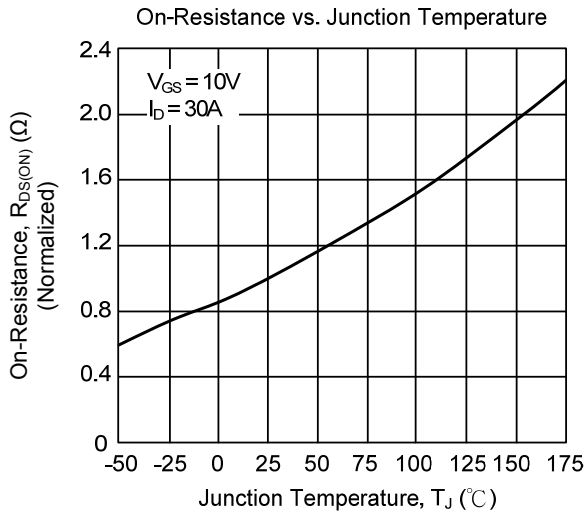


Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS(Cont.)



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