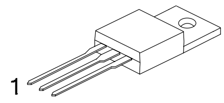
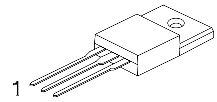
12 Amps, 600/650 Volts
N-CHANNEL MOSFET



TO-220



TO-220F

*Pb-free plating product number:12N60L

■ DESCRIPTION

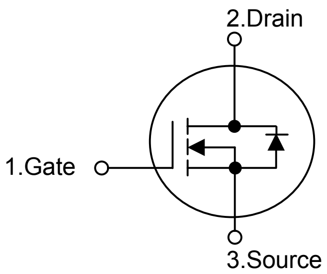
The UTC **12N60** are N-Channel enhancement mode power field effect transistors (MOSFET) which are produced using UTC's proprietary, planar stripe, DMOS technology.

These devices are suited for high efficiency switch mode power supply. To minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode the advanced technology has been especially tailored.

■ FEATURES

* $R_{DS(ON)}$ = 0.7Ω @V_{GS} = 10 V
* Ultra low gate charge (typical 42 nC)
* Low reverse transfer capacitance (C_{RSS} = typical 25 pF)
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Normal	Lead Free Plating		1	2	3	
12N60-x-TA3-T	12N60L-x-TA3-T	TO-220	G	D	S	Tube
12N60-x-TF3-T	12N60L-x-TF3-T	TO-220F	G	D	S	Tube

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

12N60L-x-TA3-T	
(1)Packing Type	(1) T: Tube
(2)Package Type	(2) TA3: TO-220, TF3: TO-220F
(3)Drain-Source Voltage	(3) A: 600V, B: 650V
(4)Lead Plating	(4) L: Lead Free Plating, Blank: Pb/Sn

■ ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage	12N60-A	V_{DSS}	600	V
	12N60-B		650	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 1)		I_{AR}	12	A
Continuous Drain Current		I_D	12	A
Pulsed Drain Current (Note 1)		I_{DM}	48	A
Avalanche Energy	Single Pulsed (Note 2)	E_{AS}	790	mJ
	Repetitive (Note 1)	E_{AR}	24	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Junction Temperature		T_J	+150	℃
Operating Temperature		T_{OPR}	-55 ~ +150	℃
Storage Temperature		T_{STG}	-55 ~ +150	℃

Note: 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.

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

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	12N60-A	BV_{DSS}	V_{GS} = 0 V, I_D = 250 μA	600			V
	12N60-B			650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 600 V, V_{GS} = 0 V			10	μA
Gate-Source Leakage Current		I_{GSS}	V_{GS} = ±30 V, V_{DS} = 0 V			±100	nA
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	I_D = 250 μA, Referenced to 25°C		0.7		V/℃
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 = 6.0A		0.55	0.7	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} = 25 V, V_{GS} = 0 V, f = 1MHz		1480	1900	pF
Output Capacitance		C_{OSS}			200	270	pF
Reverse Transfer Capacitance		C_{RSS}			25	35	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	V_{DD} = 300V, I_D = 12A, R_G = 25Ω (Note 4, 5)		30	70	ns
Turn-On Rise Time		t_R			115	240	ns
Turn-Off Delay Time		$t_{D(OFF)}$			95	200	ns
Turn-Off Fall Time		t_F			85	180	ns
Total Gate Charge		Q_G	V_{DS}= 480V, I_D= 12A, V_{GS}= 10 V (Note 4, 5)		42	54	nC
Gate-Source Charge		Q_{GS}			8.6		nC
Gate-Drain Charge		Q_{GD}			21		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} = 0 V, I_S = 12A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I_S				12	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				48	A
Reverse Recovery Time		t_{RR}	V_{GS} = 0 V, I_S = 12A, dI_F/dt = 100 A/μs (Note 4)		380		ns
Reverse Recovery Charge		Q_{RR}			3.5		μC

Notes:1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 10mH, I_{AS} = 12A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. I_{SD} ≤ 12A, di/dt ≤200A/s, V_{DD} ≤BV_{DSS} Starting T_J = 25°C
4. Pulse Test : Pulse width ≤300μs, Duty cycle ≤ 2%
5. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

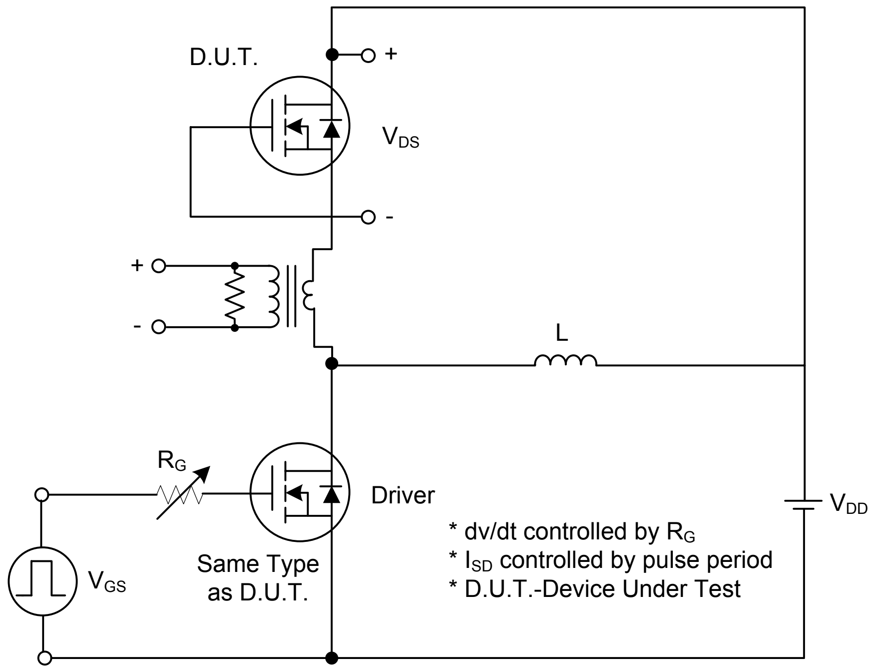


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

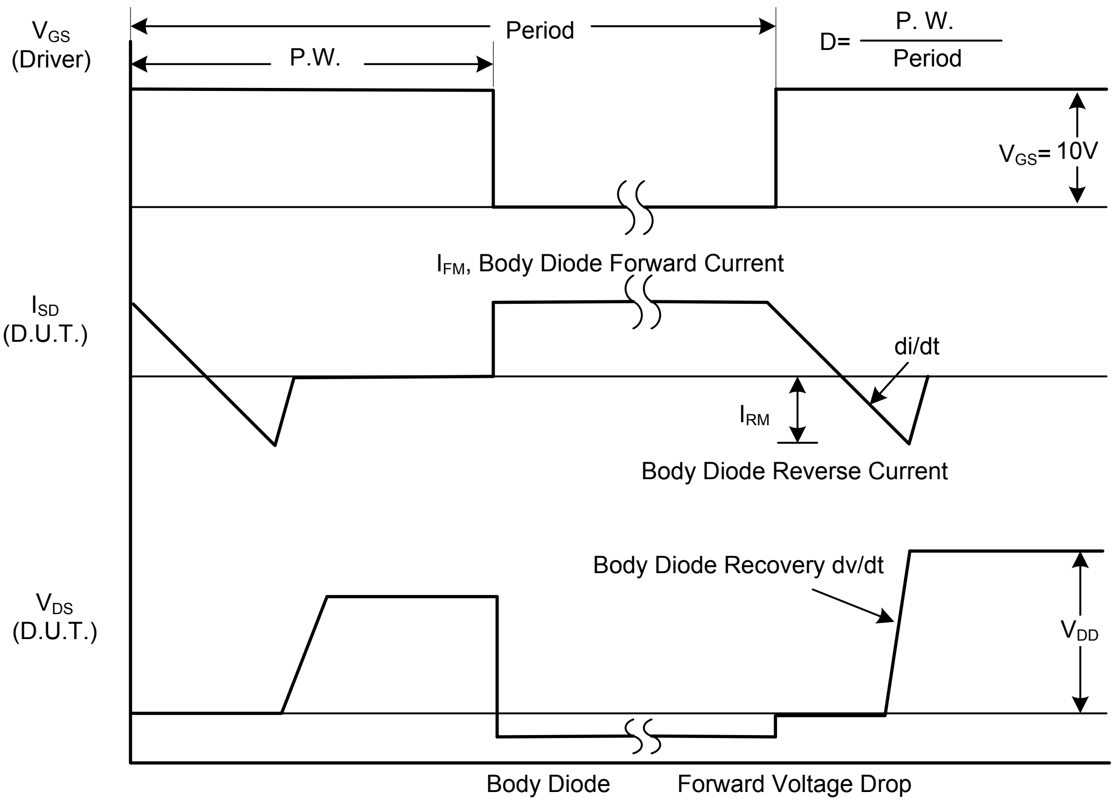


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

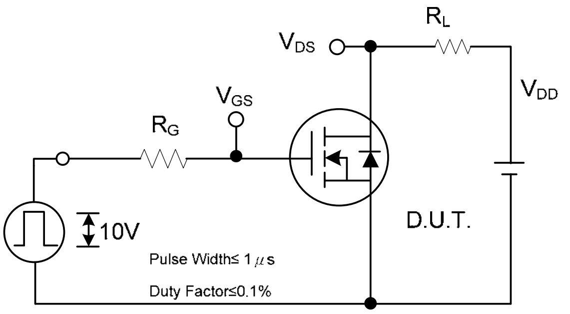


Fig. 2A Switching Test Circuit

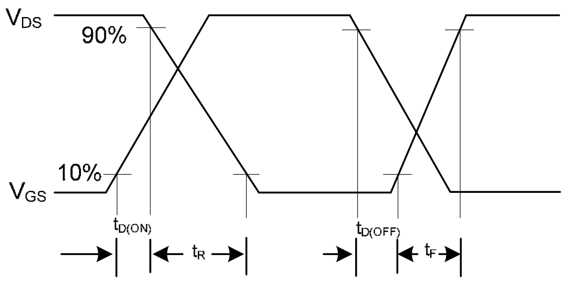


Fig. 2B Switching Waveforms

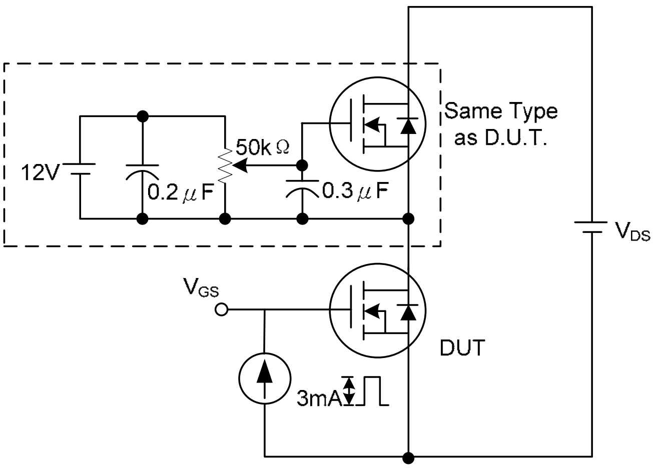


Fig. 3A Gate Charge Test Circuit

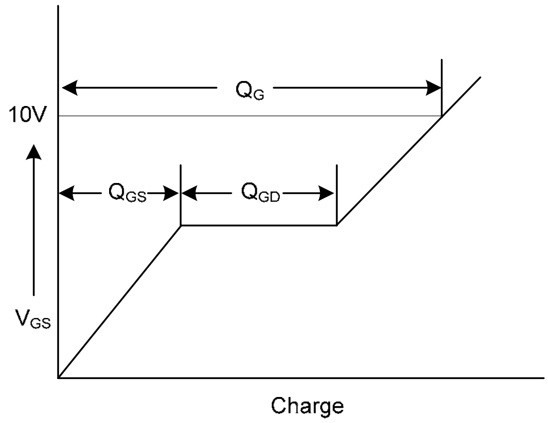


Fig. 3B Gate Charge Waveform

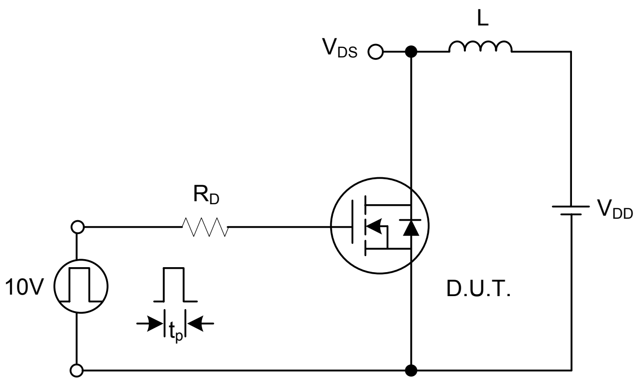


Fig. 4A Unclamped Inductive Switching Test Circuit

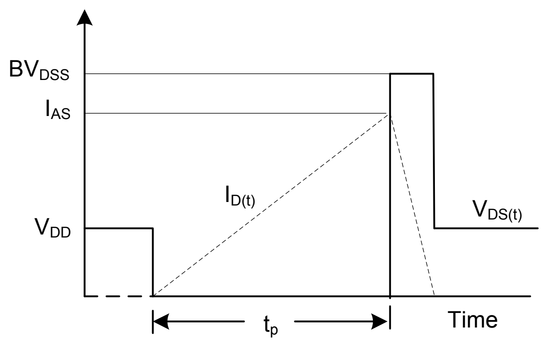
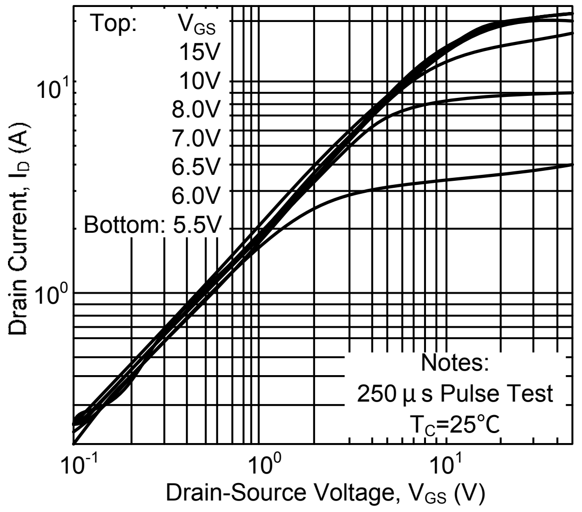


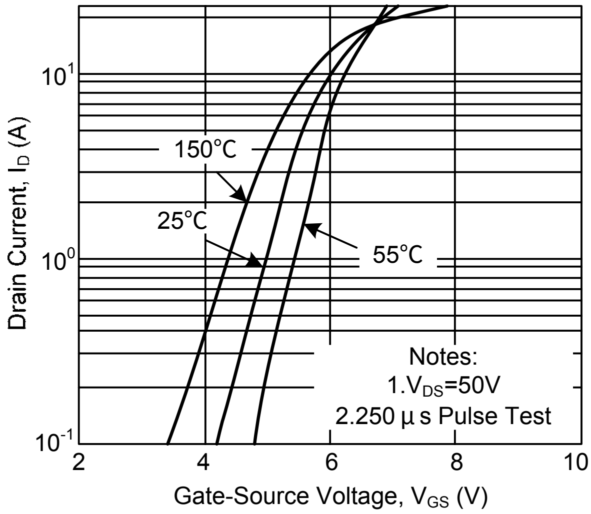
Fig. 4B Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

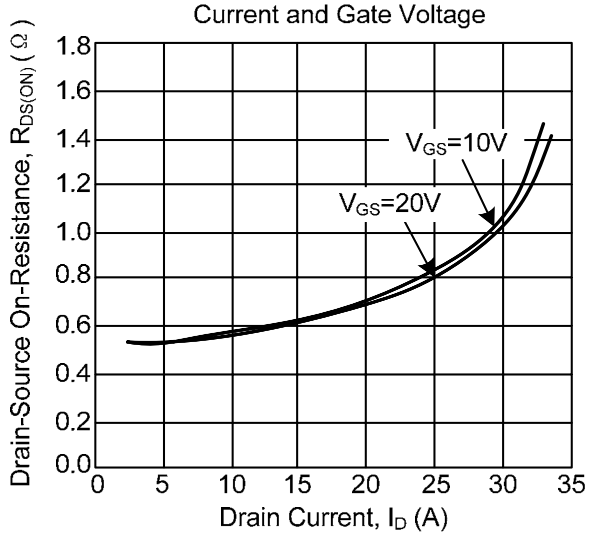
On-Resign Characteristics



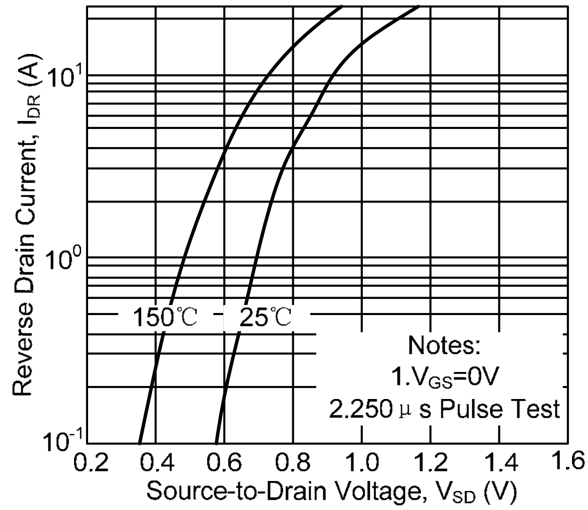
Transfer Characteristics



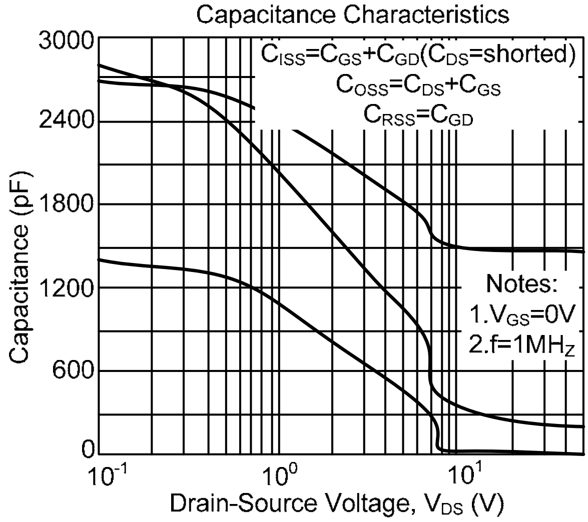
On-Resistance Variation vs.Drain Current and Gate Voltage



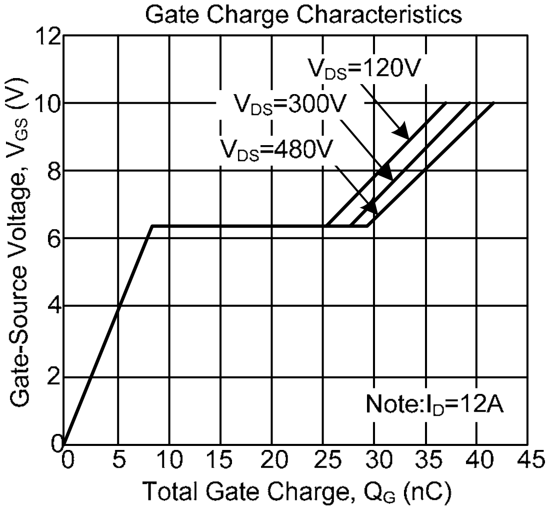
Body Diode Forward Voltage Variation vs. Source Current and Temperature



Capacitance Characteristics

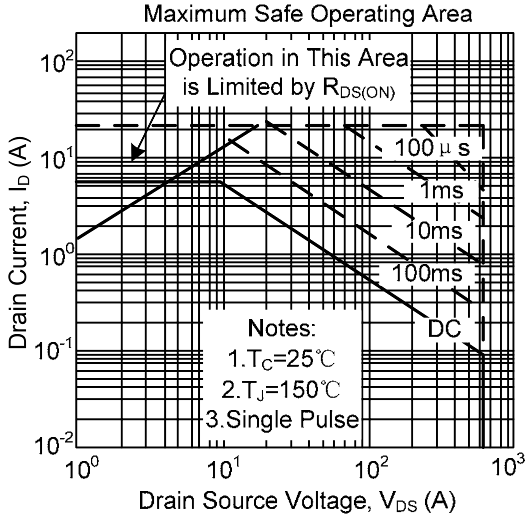


Gate Charge Characteristics

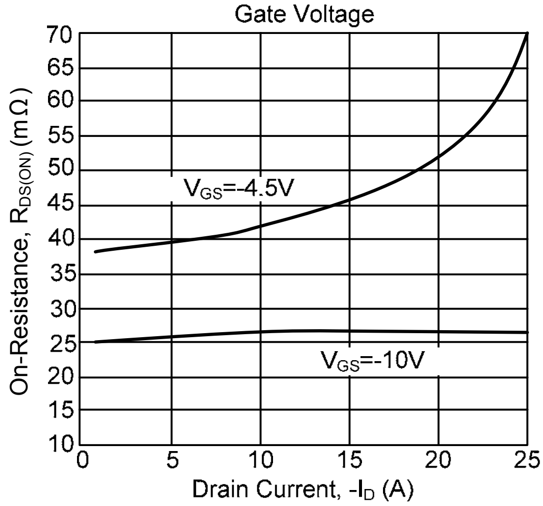


■ TYPICAL CHARACTERISTICS

Maximum Safe Operating Area



On-Resistance vs. Drain Current and Gate Voltage



Transient Thermal Response Curve