



12N60

Power MOSFET

12 Amps, 600/650 Volts N-CHANNEL MOSFET

DESCRIPTION

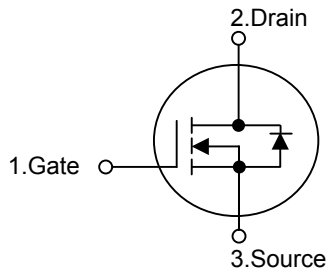
The UTC **12N60** are N-Channel enhancement mode power field effect transistors (MOSFET) which are produced using UTC's proprietary, planar stripe, DMOS technology.

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

- * $R_{DS(ON)} = 0.8\Omega @ V_{GS} = 10V$
- * 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

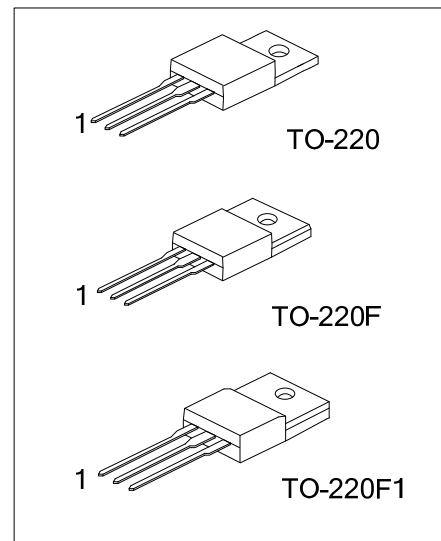


ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
12N60L-x-TA3-T	12N60G-x-TA3-T	TO-220	G	D	S	Tube
12N60L-x-TF1-T	12N60G-x-TF1-T	TO-220F1	G	D	S	Tube
12N60L-x-TF3-T	12N60G-x-TF3-T	TO-220F	G	D	S	Tube

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

<p>12N60L-x-TA3-T</p>	<p>(1) Packing Type (2) Package Type (3) Drain-Source Voltage (4) Lead Free</p> <p>(1) T: Tube (2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F (3) A: 600V, B: 650V (4) G: Halogen Free, L: Lead Free</p>
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Lead-free: 12N60L

Halogen-free: 12N60G

■ ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, 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 2)		I_{AR}	12	A
Drain Current	Continuous	I_D	12	A
	Pulsed (Note 2)	I_{DM}	48	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	790	mJ
	Repetitive (Note 2)	E_{AR}	24	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	P_D	225	$^\circ\text{C/W}$
	TO-220F/TO-220F1		51	$^\circ\text{C/W}$
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 = 10mH, $I_{AS} = 12\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$

$I_{SD} \leq 12\text{A}$, $di/dt \leq 200\text{A/s}$, $V_{DD} \leq BV_{DSS}$ Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		θ_{JA}	62.5	$^\circ\text{C/W}$
Junction to Case	TO-220	θ_{JC}	0.56	$^\circ\text{C/W}$
	TO-220F/TO-220F1		2.43	$^\circ\text{C/W}$

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

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage	12N60-A	BV_{DSS}	$V_{GS} = 0\text{V}$, $I_D = 250\mu\text{A}$	600			V
	12N60-B			650			V
Drain-Source Leakage Current		I_{DSS}	$V_{DS} = 600\text{V}$, $V_{GS} = 0\text{V}$			1	μA
Gate-Source Leakage Current		I_{GSS}	$V_{GS} = \pm 30\text{V}$, $V_{DS} = 0\text{V}$			± 100	nA
Breakdown Voltage Temperature Coefficient		$\Delta BV_{DSS}/\Delta T_J$	$I_D = 250\mu\text{A}$, Referenced to 25°C		0.7		$\text{V}/^\circ\text{C}$
ON CHARACTERISTICS							
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		$R_{DS(ON)}$	$V_{GS} = 10\text{V}$, $I_D = 6.0\text{A}$		0.55	0.8	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	$V_{DS} = 25\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$		1480	1900	pF
Output Capacitance		C_{OSS}			200	270	pF
Reverse Transfer Capacitance		C_{RSS}			25	35	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	$V_{DD} = 300\text{V}$, $I_D = 12\text{A}$, $R_G = 25\Omega$ (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			42	54	nC
Gate-Source Charge		Q_{GS}	$V_{DS} = 480\text{V}$, $I_D = 12\text{A}$, $V_{GS} = 10\text{V}$ (Note 4, 5)		8.6		nC
Gate-Drain Charge		Q_{GD}			21		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	$V_{GS} = 0\text{ V}, I_S = 12\text{ A}$			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}	$V_{GS} = 0\text{ V}, I_S = 12\text{ A},$		380		ns
Reverse Recovery Charge	Q_{RR}	$di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 4)		3.5		μC

Notes: 1. Pulse Test : Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

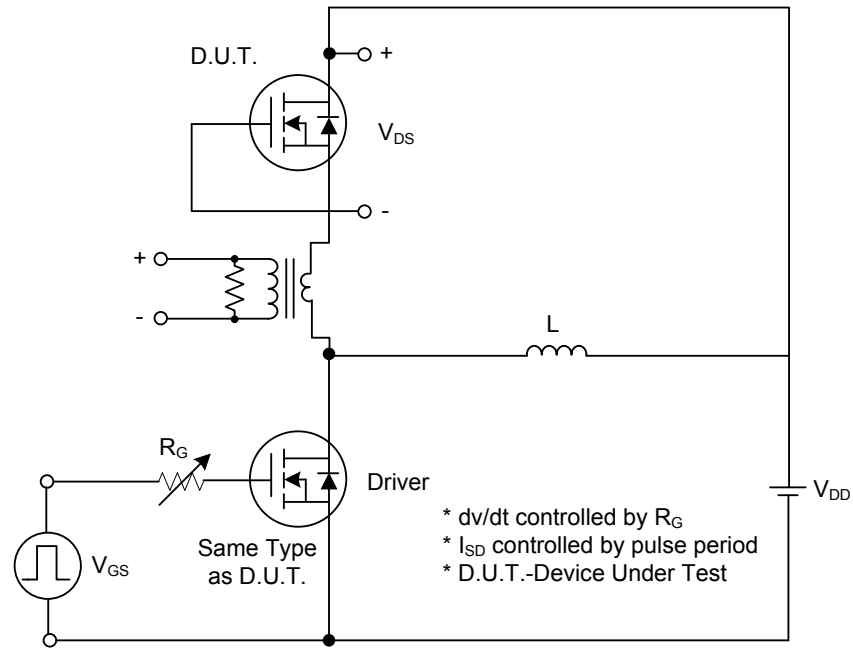


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

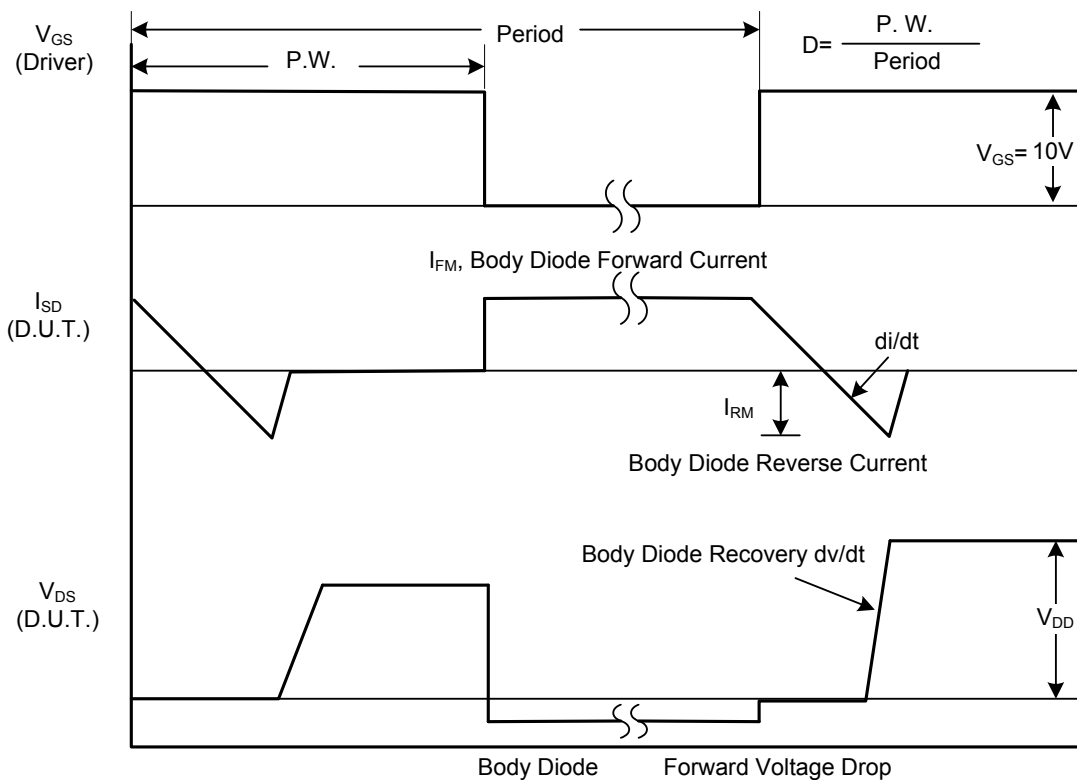


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

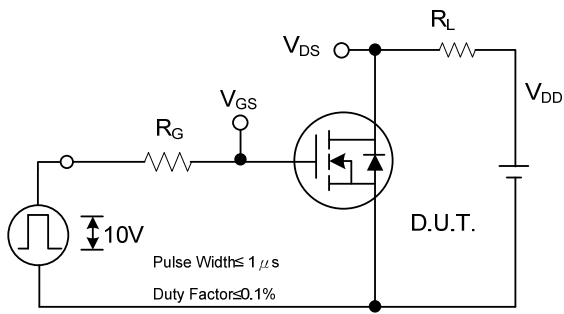


Fig. 2A Switching Test Circuit

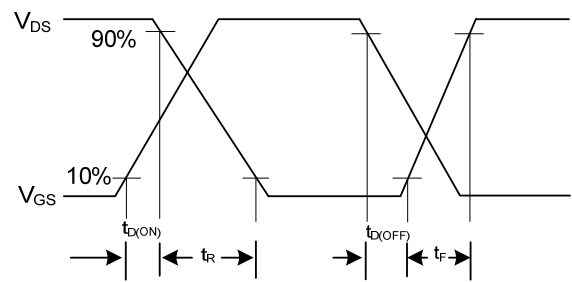


Fig. 2B Switching Waveforms

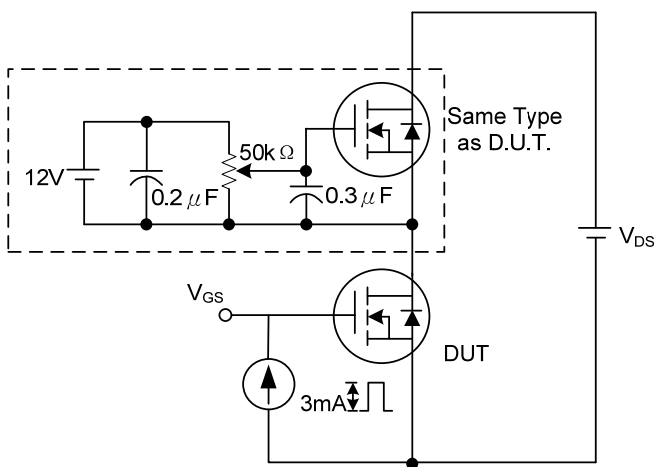


Fig. 3A Gate Charge Test Circuit

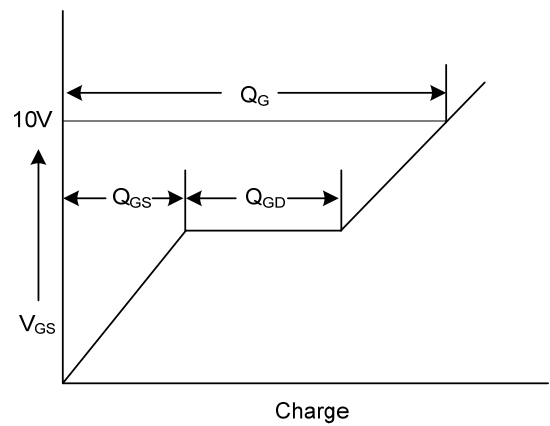


Fig. 3B Gate Charge Waveform

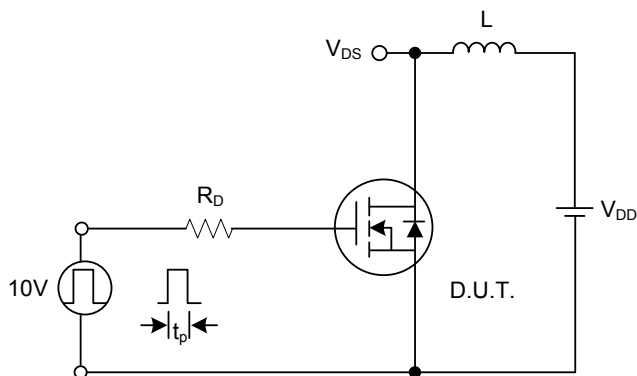


Fig. 4A Unclamped Inductive Switching Test Circuit

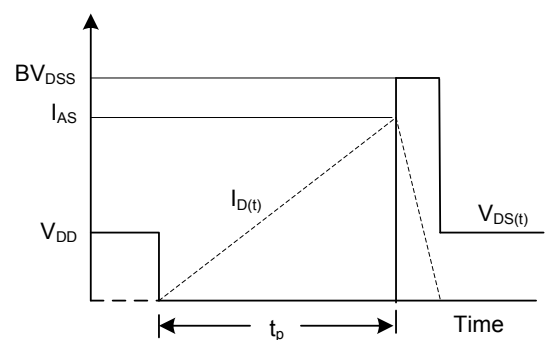
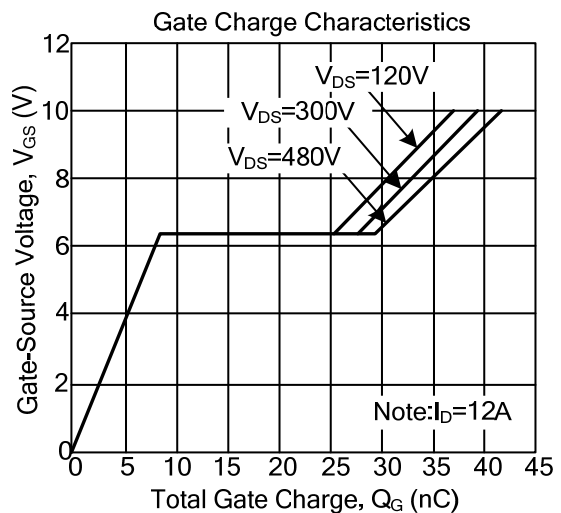
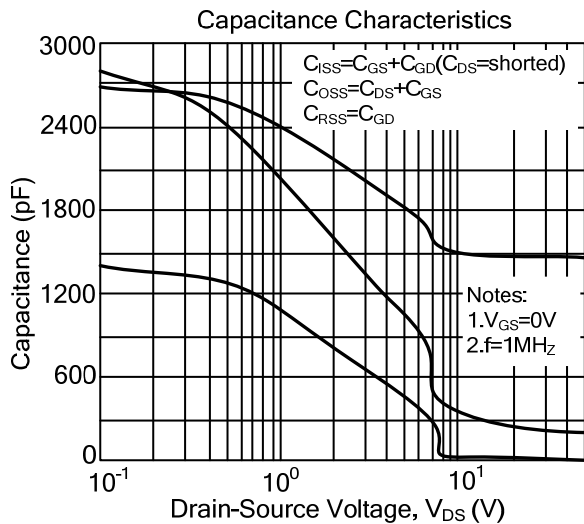
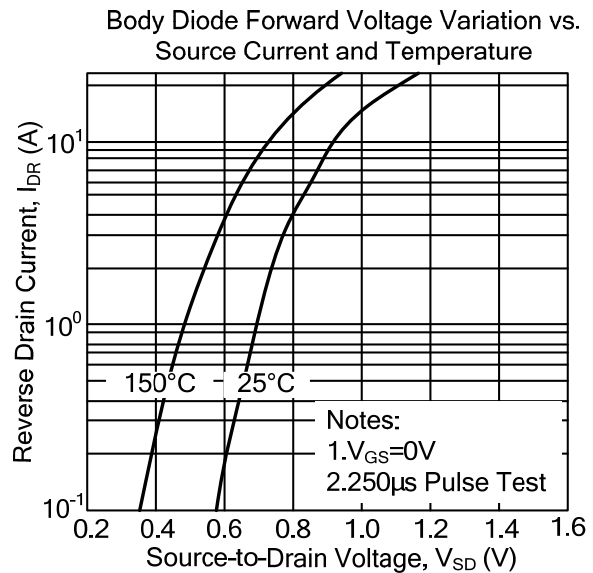
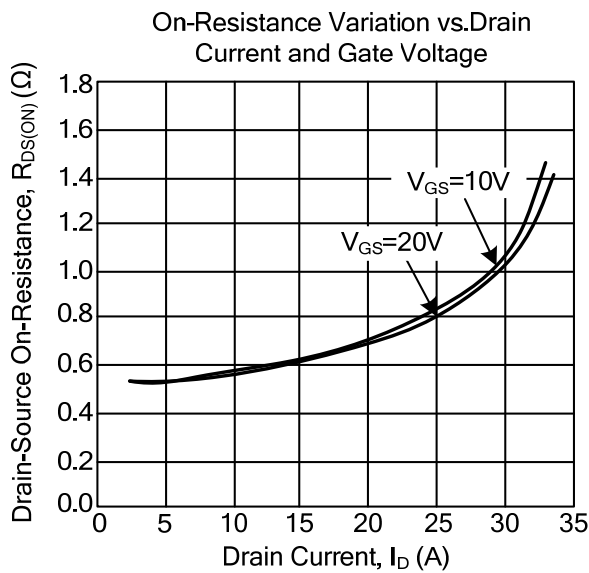
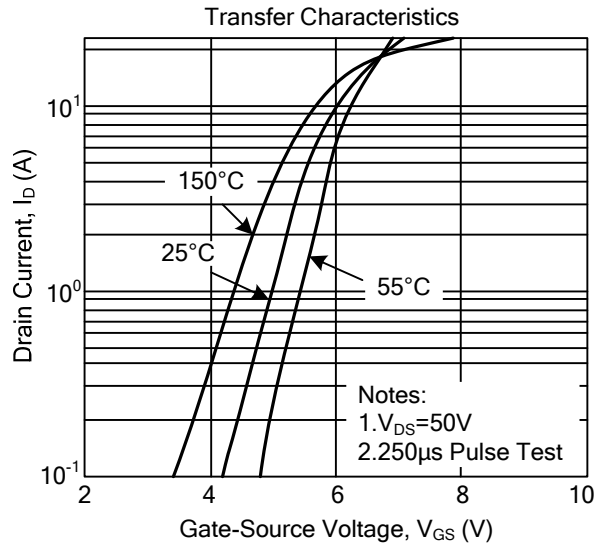
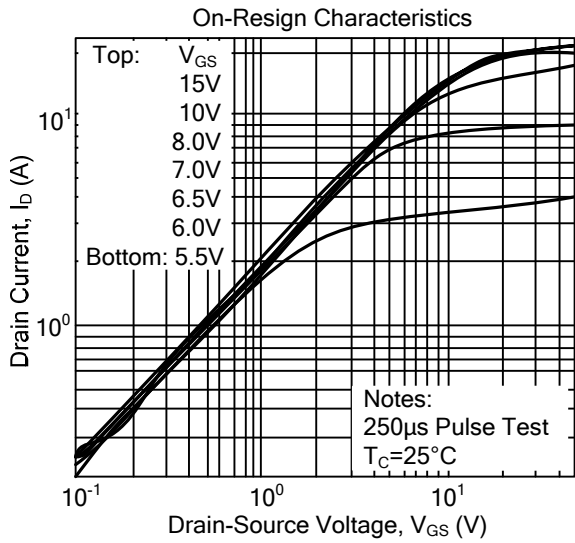
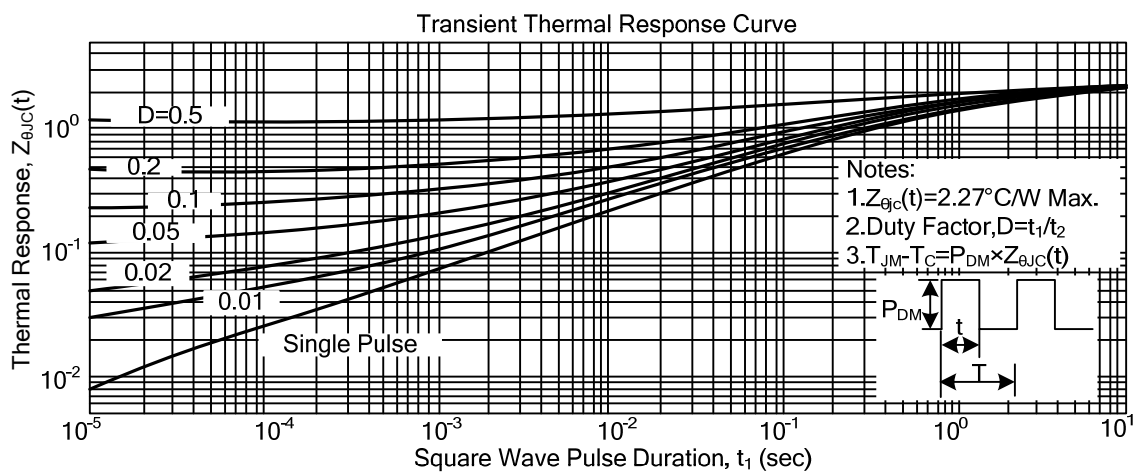
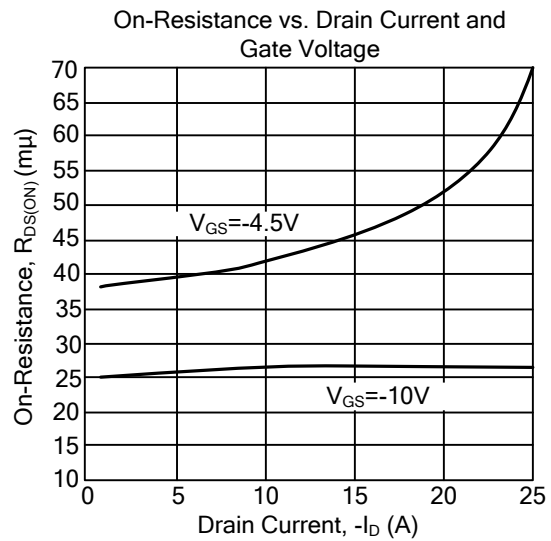
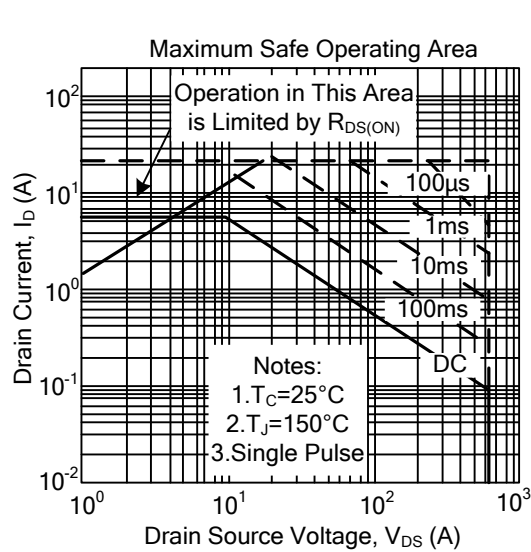


Fig. 4B Unclamped Inductive Switching Waveforms

TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS



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