

4N65

Power MOSFET

4A, 650V N-CHANNEL POWER MOSFET

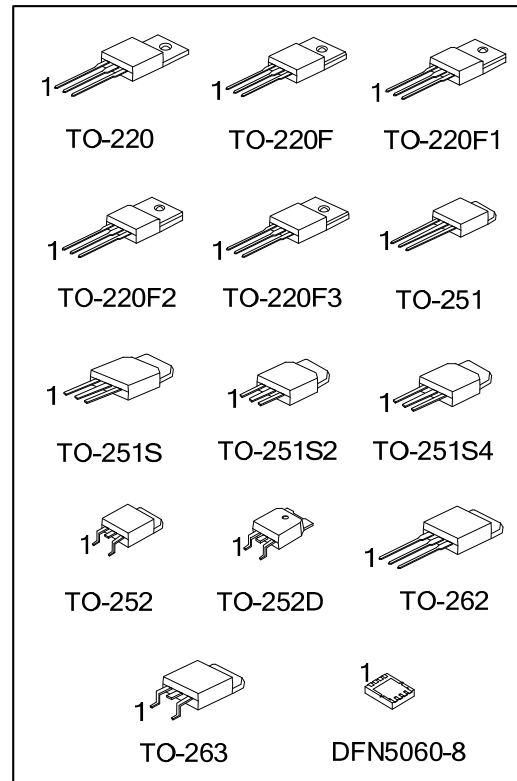
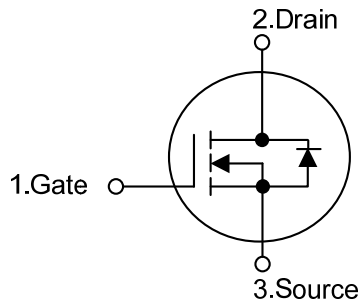
DESCRIPTION

The **4N65** is a high voltage power MOSFET designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristic. This power MOSFET is usually used in high speed switching applications including power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

FEATURES

- * $R_{DS(ON)} < 2.5\Omega$ @ $V_{GS} = 10V$, $I_D = 2.2A$
- * 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	4	5	6	7	8	
4N65L-TA3-T	4N65G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
4N65L-TF1-T	4N65G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
4N65L-TF2-T	4N65G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	Tube
4N65L-TF3-T	4N65G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
4N65L-TF3T-T	4N65G-TF3T-T	TO-220F3	G	D	S	-	-	-	-	-	Tube
4N65L-TM3-T	4N65G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
4N65L-TMS-T	4N65G-TMS-T	TO-251S	G	D	S	-	-	-	-	-	Tube
4N65L-TMS2-T	4N65G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	Tube
4N65L-TMS4-T	4N65G-TMS4-T	TO-251S4	G	D	S	-	-	-	-	-	Tube
4N65L-TN3-R	4N65G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
4N65L-TND-R	4N65G-TND-R	TO-252D	G	D	S	-	-	-	-	-	Tape Reel
4N65L-T2Q-T	4N65G-T2Q-T	TO-262	G	D	S	-	-	-	-	-	Tube
4N65L-TQ2-R	4N65G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	Tape Reel
4N65L-TQ2-T	4N65G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	Tube
4N65G-K08-5060-R	4N65G-K08-5060-R	DFN5060-8	S	S	S	G	D	D	D	D	Tape Reel

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

4N65G-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, TF3T: TO-220F3, TM3: TO-251, TMS: TO-251S, TMS2: TO-251S2, TN3: TO-252, TMS4: TO-251S4, TND: TO-252D, T2Q: TO-262, TQ2: TO-263, K08-5060: DFN5060-8 (3) G: Halogen Free and Lead Free, L: Lead Free
---	---

MARKING

PACKAGE		MARKING
TO-220 TO-220F TO-220F1 TO-220F2 TO-220F3 TO-251 TO-251S	TO-251S2 TO-251S4 TO-252 TO-252D TO-262 TO-263	Lot Code ← 4N65 □ → Data Code 1 L: Lead Free G: Halogen Free
DFN5060-8		Lot Code ← 4N65 □ → Date Code

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DS}	650	V
Gate-Source Voltage		V_{GS}	± 30	V
Avalanche Current (Note2)		I_{AR}	4.4	A
Drain Current	Continuous	I_D	4.0	A
	Pulsed (Note2)	I_{DM}	16	A
Avalanche Energy	Single Pulsed (Note3)	E_{AS}	260	mJ
	Repetitive (Note2)	E_{AR}	10.6	mJ
Peak Diode Recovery dv/dt (Note4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220/TO-262/TO-263	P_D	106	W
	TO-220F/TO-220F1 TO-220F3		35	W
	TO-220F2		36	W
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		50	W
	DFN5060-8		30	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Operating Temperature		T_{OPR}	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

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. Repetitive Rating: Pulse width limited by maximum junction temperature.

3. $L = 30\text{mH}$, $I_{AS} = 4\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 4.4\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER	PACKAGE	SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-262/TO-263 TO-220F/TO-220F1 TO-220F2/TO-220F3	θ_{JA}	62.5	$^\circ\text{C/W}$
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		110	$^\circ\text{C/W}$
	DFN5060-8		75	$^\circ\text{C/W}$
Junction to Case	TO-220/TO-262/TO-263	θ_{JC}	1.18	$^\circ\text{C/W}$
	TO-220F/TO-220F1 TO-220F3		3.5	$^\circ\text{C/W}$
	TO-220F2		3.4	$^\circ\text{C/W}$
	TO-251/ TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.5	$^\circ\text{C/W}$
	DFN5060-8		4.17	$^\circ\text{C/W}$

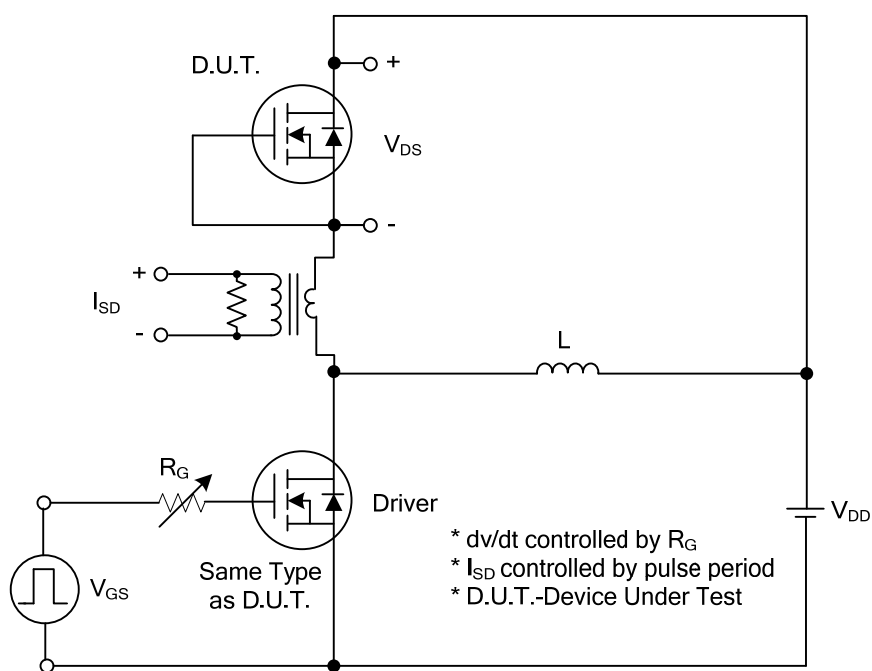
■ **ELECTRICAL CHARACTERISTICS** ($T_C = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{GS} = 0\text{ V}, I_D = 250\mu\text{A}$	650			V
Drain-Source Leakage Current		I_{DSS}	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$			10	μA
			$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$			100	μA
Gate-Source Leakage Current	Forward	I_{GSS}	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$			100	nA
	Reverse		$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$			-100	nA
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	$I_D = 250\mu\text{A}$, Referenced to 25°C		0.6		$\text{V}/^\circ\text{C}$
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		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.2\text{A}$		2.4	2.5	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{V},$ $f = 1\text{MHz}$		670	750	pF
Output Capacitance		C_{OSS}			70	90	pF
Reverse Transfer Capacitance		C_{RSS}			23	26	pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	$V_{DS} = 520\text{V}, I_D = 4.0\text{A},$ $V_{GS} = 10\text{V}$ (Note 1, 2)		100	120	nC
Gate-Source Charge		Q_{GS}			17	19	nC
Gate-Drain Charge		Q_{GD}			20	26	nC
Turn-On Delay Time		$t_{D(ON)}$	$V_{DS} = 325\text{V}, I_D = 4.0\text{A},$ $R_G = 25\Omega$ (Note 1, 2)		45	85	ns
Turn-On Rise Time		t_R			100	140	ns
Turn-Off Delay Time		$t_{D(OFF)}$			200	240	ns
Turn-Off Fall Time		t_F			130	150	ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				17.6	A
Drain-Source Diode Forward Voltage		V_{SD}	$V_{GS} = 0\text{ V}, I_S = 4.4\text{A}$			1.4	V
Reverse Recovery Time		t_{rr}	$V_{GS} = 0\text{V}, I_S = 4.4\text{A},$		250		ns
Reverse Recovery Charge		Q_{rr}	$di_F/dt = 100\text{ A}/\mu\text{s}$ (Note 1)		1.5		μC

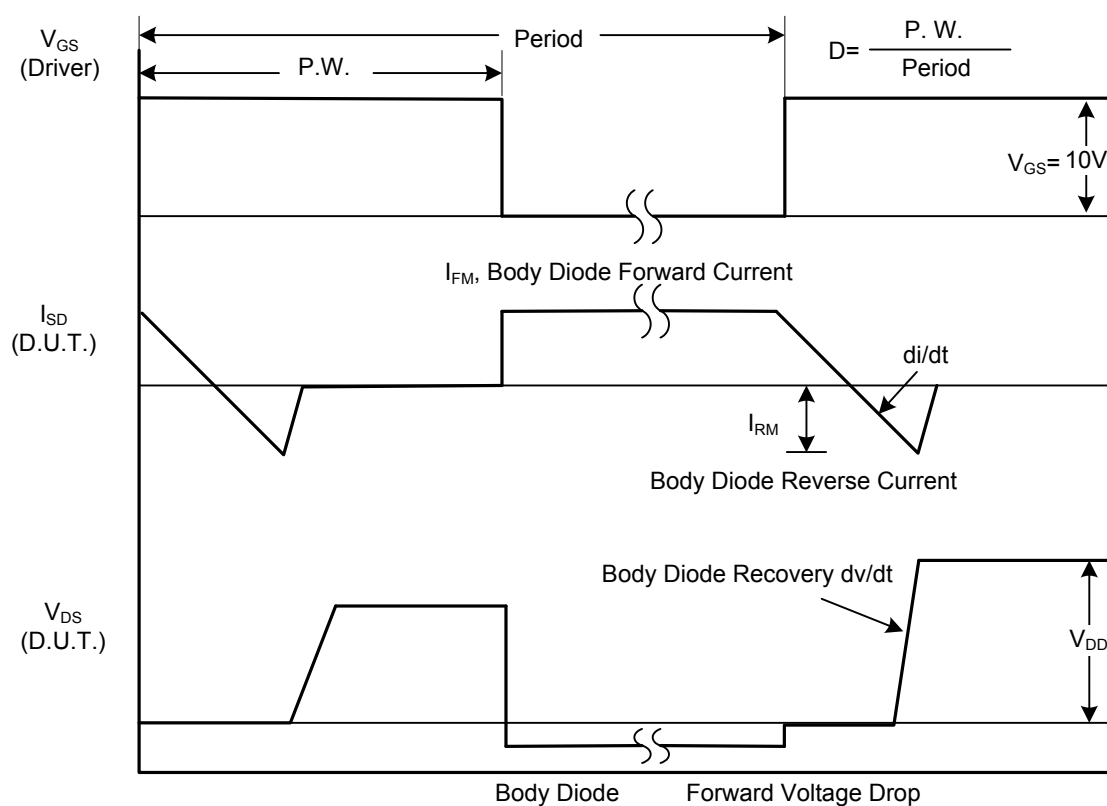
Note: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating temperature.

■ TEST CIRCUITS AND WAVEFORMS

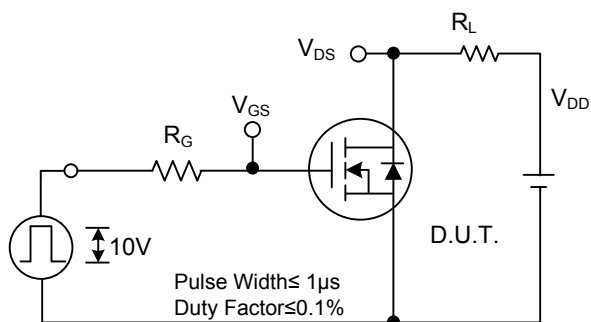


Peak Diode Recovery dv/dt Test Circuit

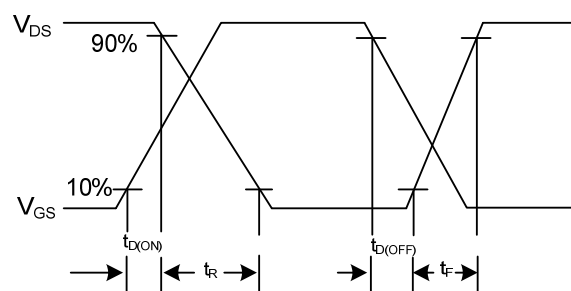


Peak Diode Recovery dv/dt Waveforms

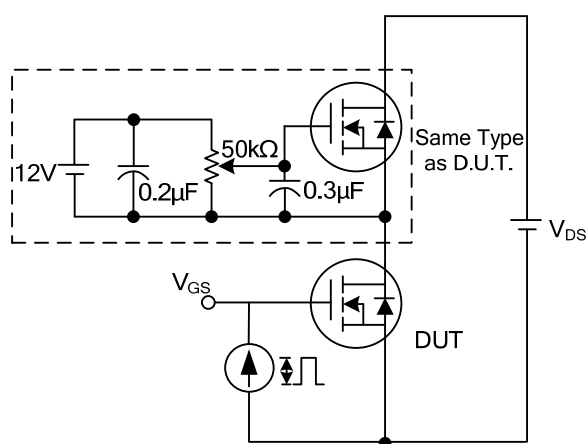
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



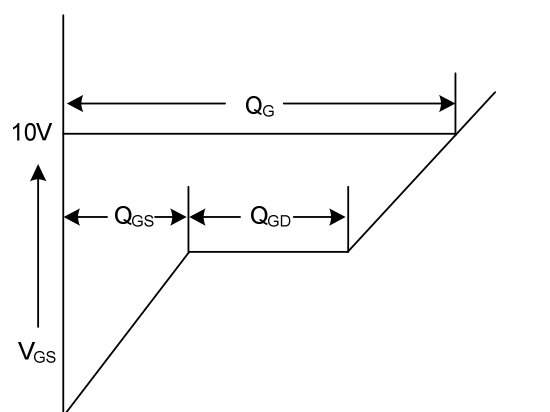
Switching Test Circuit



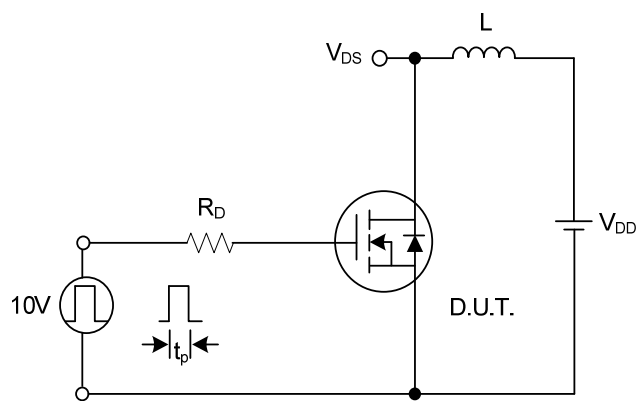
Switching Waveforms



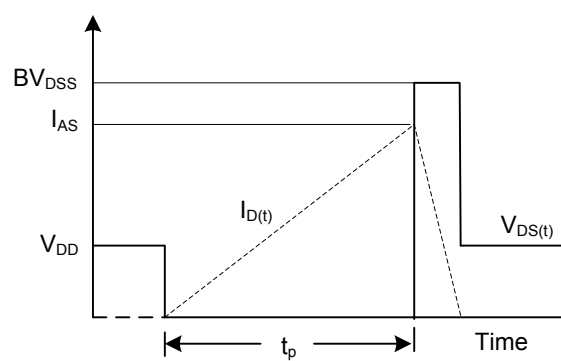
Gate Charge Test Circuit



Gate Charge Waveform

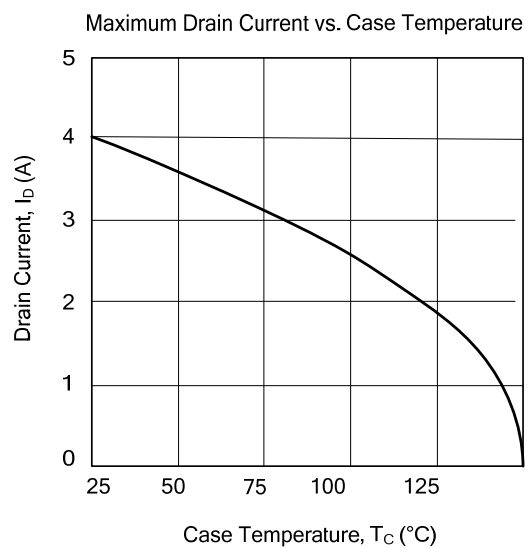
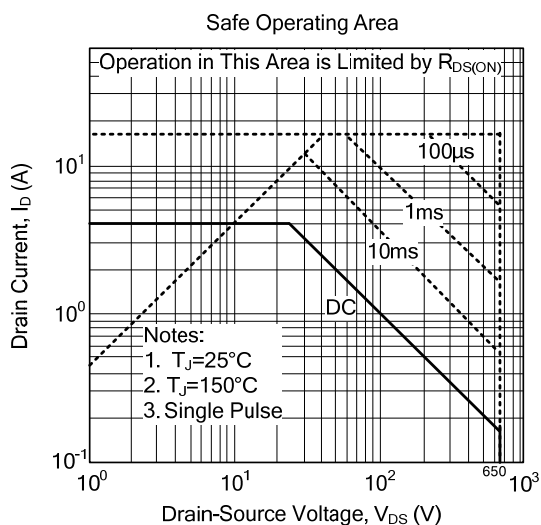
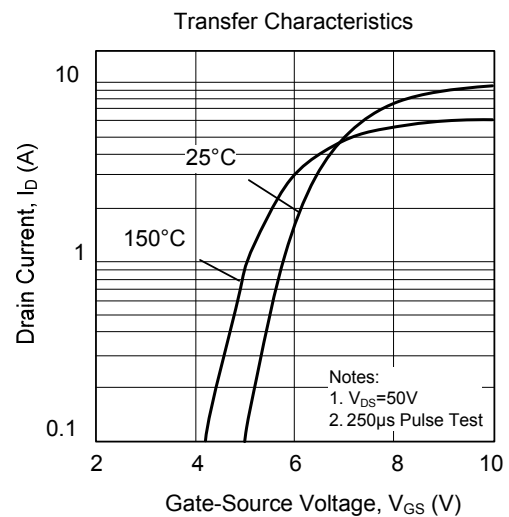
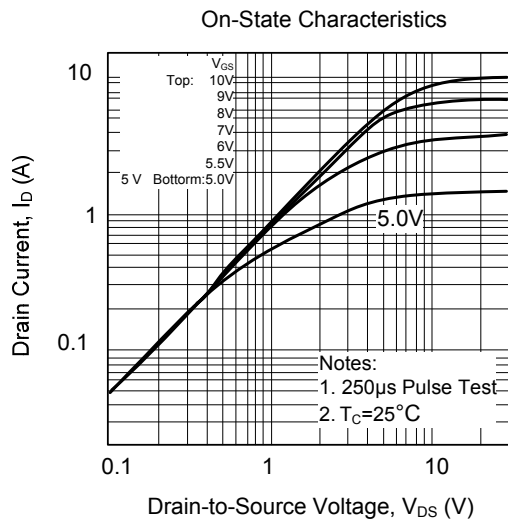
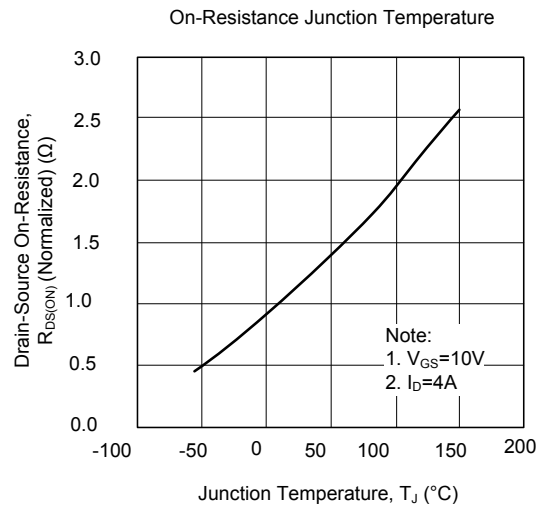
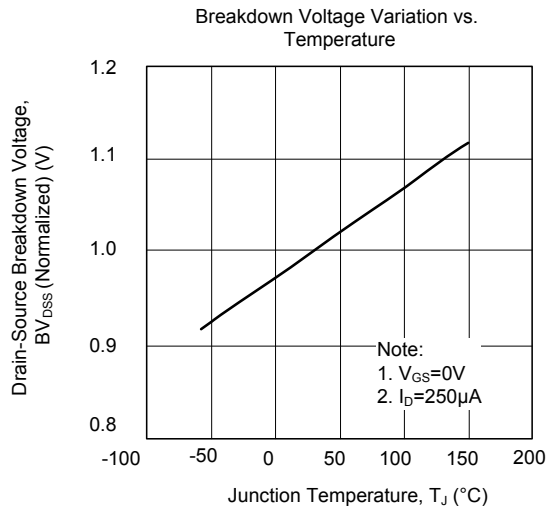


Unclamped Inductive Switching Test Circuit

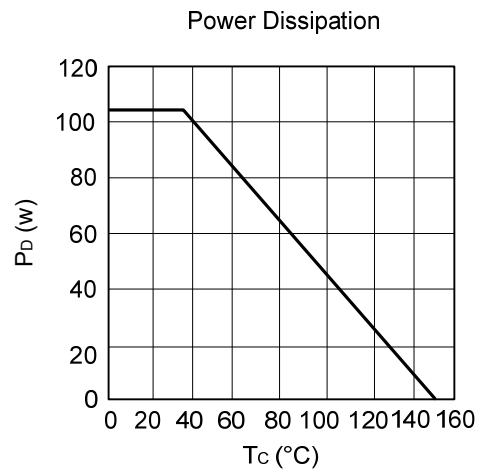
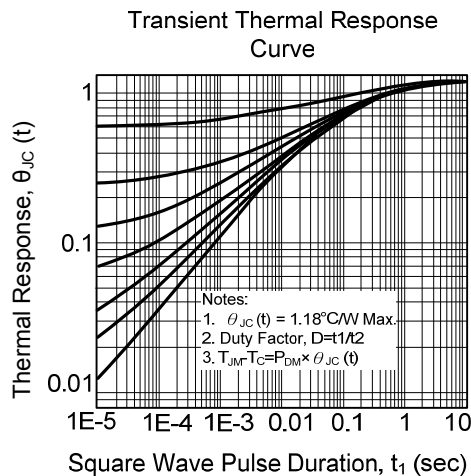
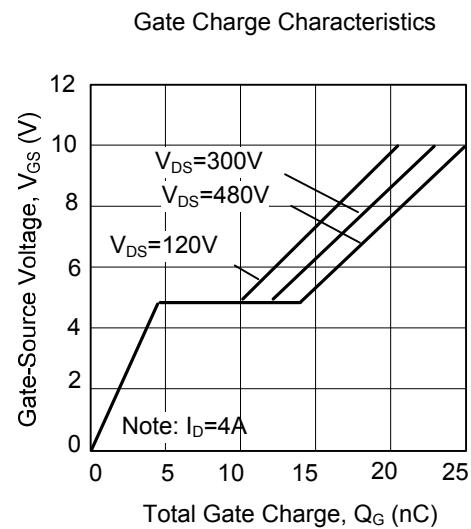
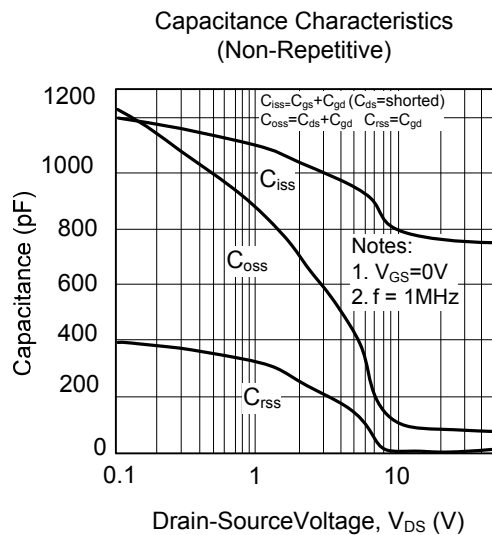
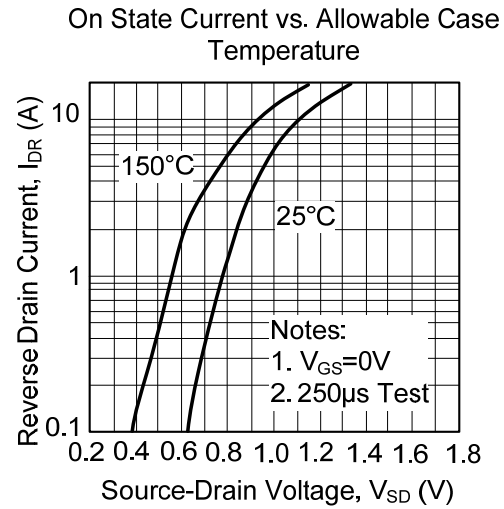
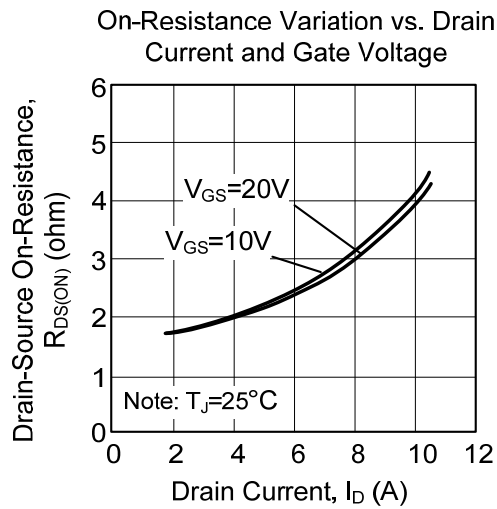


Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



TYPICAL CHARACTERISTICS(Cont.)



Yixin assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all Yixin products described or contained herein. Yixin products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.