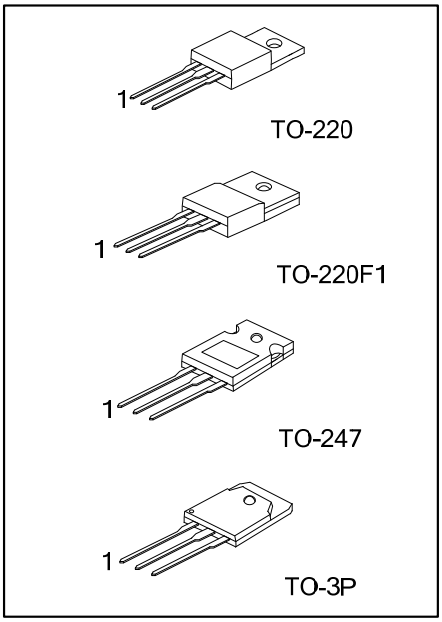
9N90-Q

Power MOSFET

9A, 900V N-CHANNEL POWER MOSFET



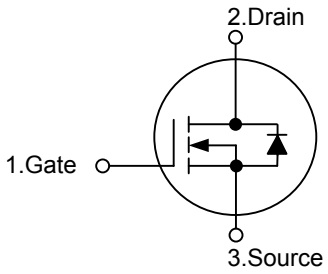
■ DESCRIPTION

The UTC **9N90-Q** uses UTC's advanced proprietary, planar stripe, DMOS technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with low gate voltages. This device is suitable for use as a load switch or in PWM applications.

■ FEATURES

* $R_{DS(ON)} \leq 1.4\ \Omega$ @ V_{GS} = 10V, I_D = 4.5A
* Fast Switching Capability
* Avalanche Energy Specified
* Improved dv/dt Capability, High Ruggedness

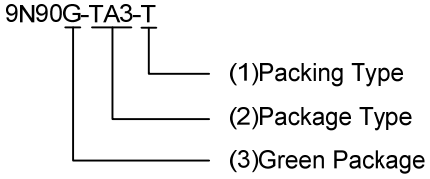
■ SYMBOL



■ ORDERING INFORMATION

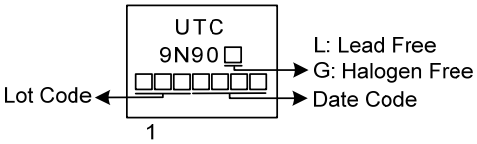
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
9N90L-TA3-T	9N90G-TA3-T	TO-220	G	D	S	Tube
9N90L-TF1-T	9N90G-TF1-T	TO-220F1	G	D	S	Tube
9N90L-T3P-T	9N90G-T3P-T	TO-3P	G	D	S	Tube
9N90L-T47-T	9N90G-T47-T	TO-247	G	D	S	Tube

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



(1) T: Tube
(2) TA3: TO-220, TF1: TO-220F1, T3P: TO-3P
T47: TO-247
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	900	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current (T_C = 25°C)		I_D	9.0	A
Pulsed Drain Current (Note 2)		I_{DM}	36	A
Avalanche Current (Note 2)		I_{AR}	9.0	A
Avalanche Energy	Single Pulsed(Note 3)	E_{AS}	890	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.8	V/ns
Power Dissipation	TO-220	P_D	170	W
	TO-220F1		45	W
	TO-3P		300	W
	TO-247		290	W
Junction Temperature		T_J	150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°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 = 30mH, I_{AS} = 7.7A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
4. I_{SD} ≤ 9.0A, di/dt ≤ 200A/μs, V_{DD}≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F1	θ_{JA}	62.5	°C/W
	TO-247/TO-3P		40	°C/W
Junction to Case	TO-220	θ_{JC}	0.73	°C/W
	TO-220F1		2.77	°C/W
	TO-3P		0.41	°C/W
	TO-247		0.43	°C/W

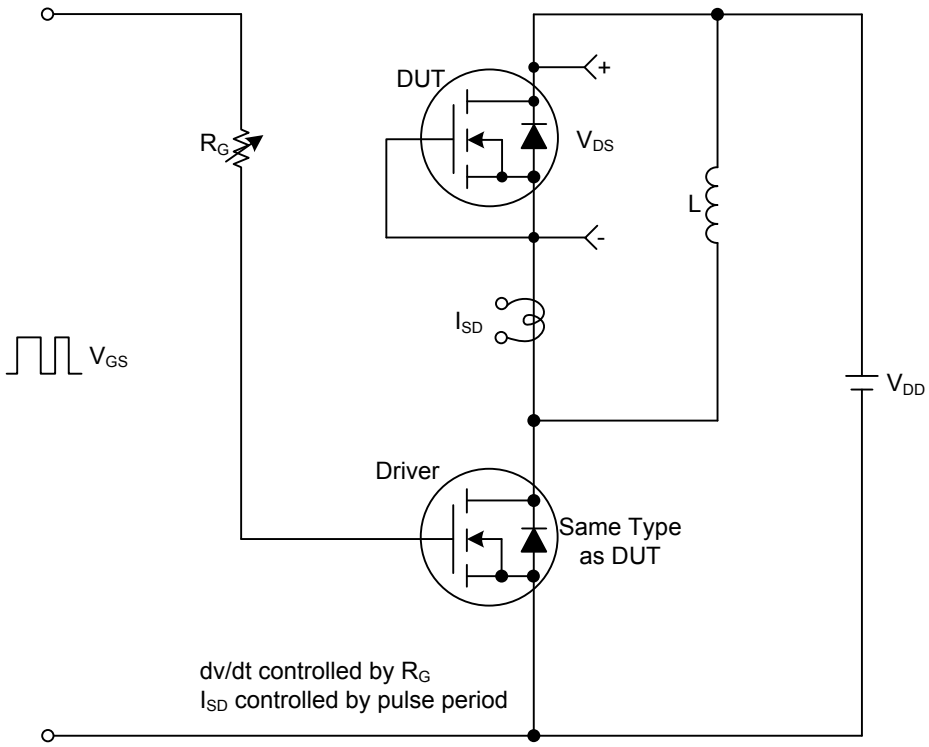
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

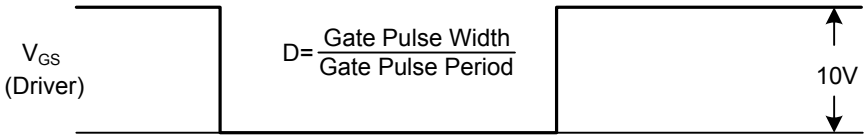
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250μA	900			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=900V, V_{GS}=0V			10	μA
Gate-Body Leakage Current	Forward	I_{GSSF}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse	I_{GSSR}	V_{GS}=-30V, V_{DS}=0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	3.0		5.0	V
Static Drain-Source On-Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=4.5A			1.4	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{DS}=25V,V_{GS}=0V, f=1.0MHz		1980		pF
Output Capacitance		C_{OSS}			180		pF
Reverse Transfer Capacitance		C_{RSS}			22		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	V_{DS}=720V, V_{GS}=10V, I_D=9.0A, I_G=1mA (Note 1, 2)		55		nC
Gate-Source Charge		Q_{GS}			18		nC
Gate-Drain Charge		Q_{GD}			20		nC
Turn-On Delay Time		$t_{D(ON)}$	V_{DD}=100V, V_{GS}=10V, I_D=9.0A, R_G=25Ω (Note 1, 2)		30		ns
Turn-On Rise Time		t_R			22		ns
Turn-Off Delay Time		$t_{D(OFF)}$			125		ns
Turn-Off Fall Time		t_F			50		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				9.0	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				36	A
Drain-Source Diode Forward Voltage		V_{SD}	I_S=9.0A, V_{GS}=0V			1.4	V
Reverse Recovery Time		t_{rr}	I_S=9.0A, V_{GS}=0V		650		ns
Reverse Recovery Charge		Q_{rr}	dI_F/dt=100A/μs(Note1)		23		μC

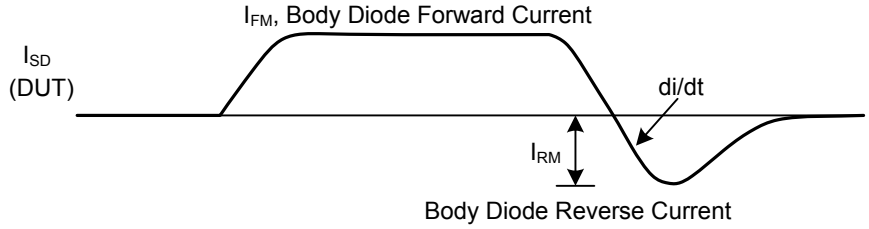
Notes: 1. Pulse Test : Pulse width≤300μs, Duty cycle≤2%
2. Essentially independent of operating temperature

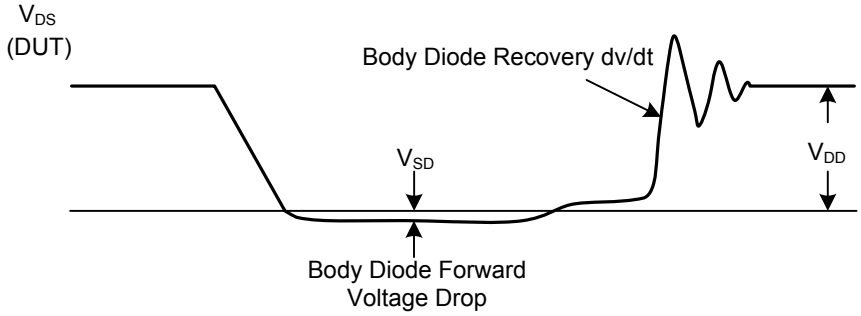
■ TEST CIRCUITS AND WAVEFORMS

Peak Diode Recovery dv/dt Test Circuit & Waveforms

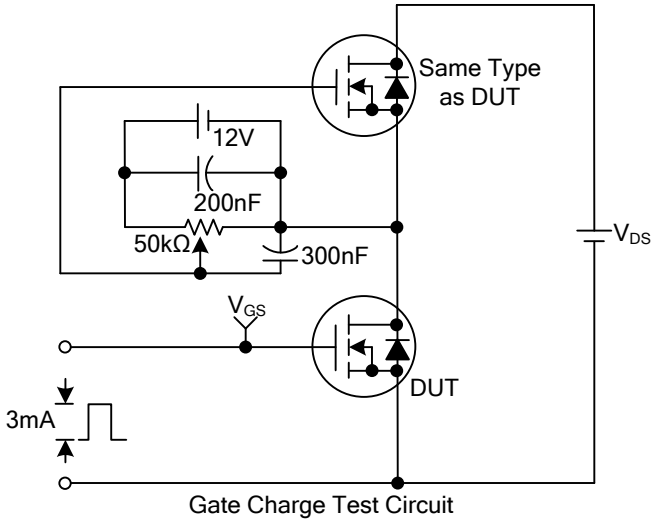




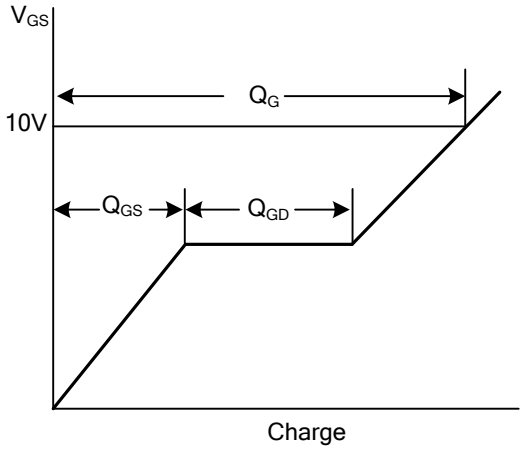




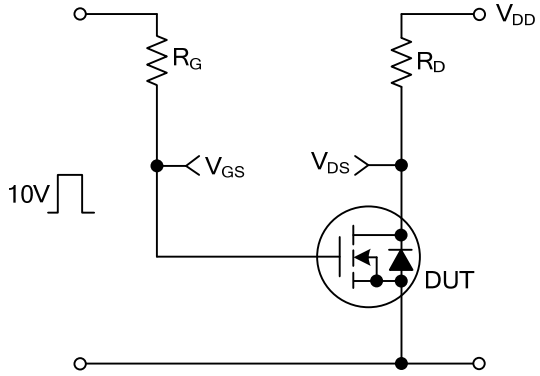
■ TEST CIRCUITS AND WAVEFORMS



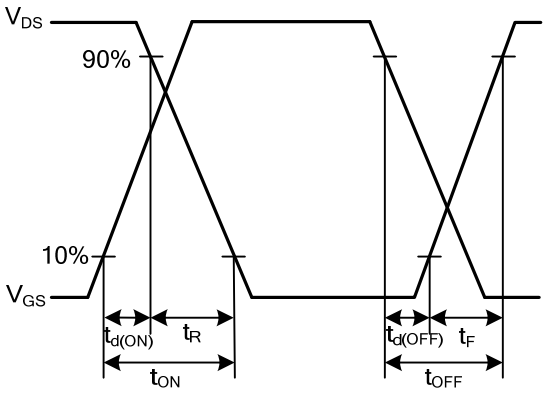
Gate Charge Test Circuit



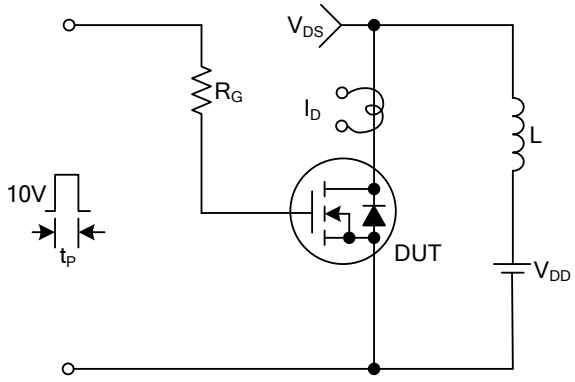
Gate Charge Waveforms



Resistive Switching Test Circuit

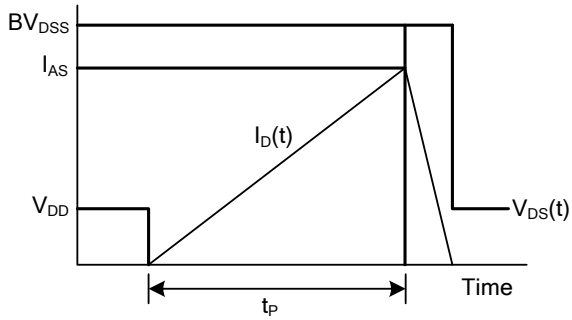


Resistive Switching Waveforms



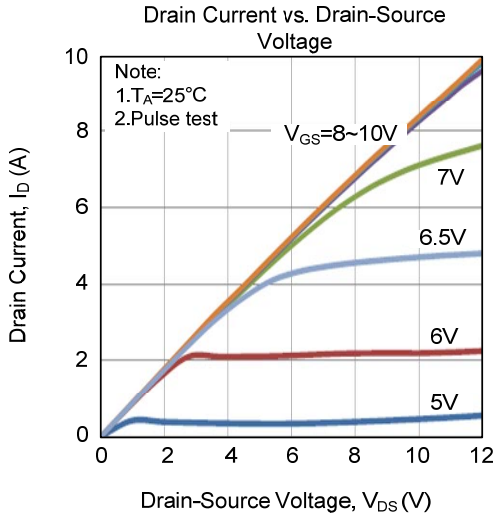
Unclamped Inductive Switching Test Circuit

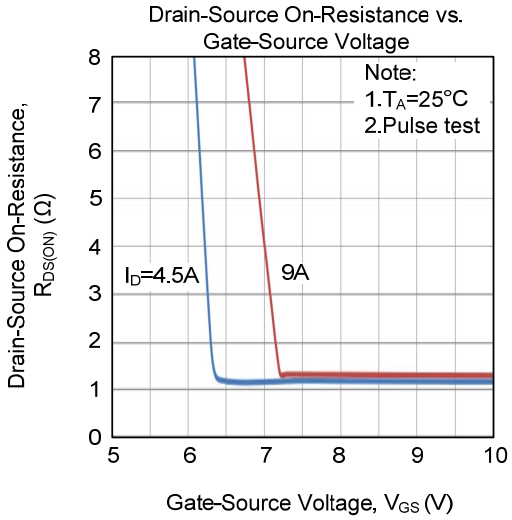
$$E_{AS}=\frac{1}{2}LI_{AS}^{2}\frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$

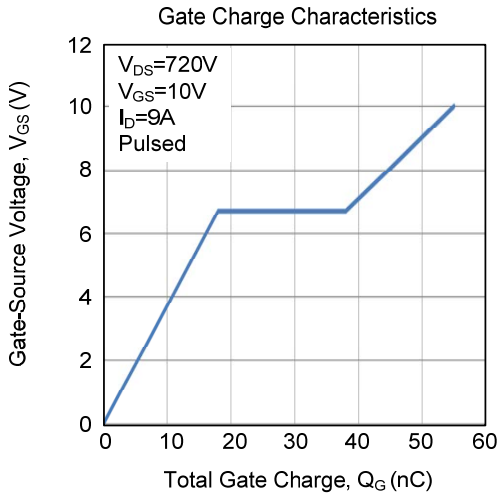


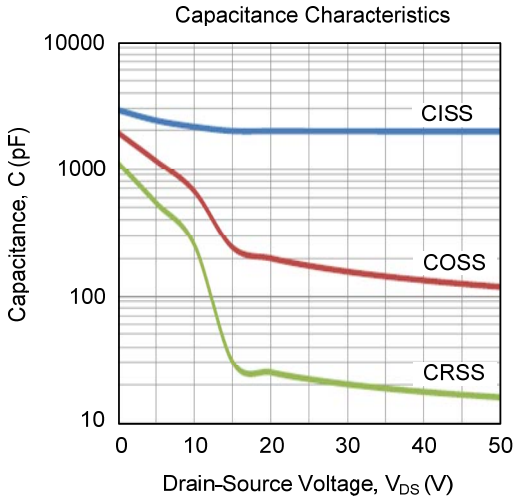
Unclamped Inductive Switching Waveforms

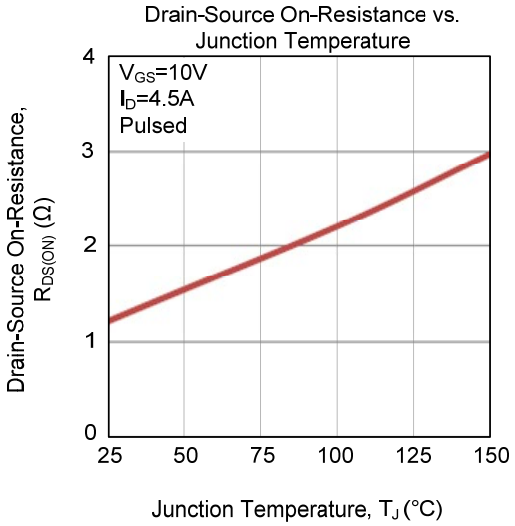
■ TYPICAL CHARACTERISTICS

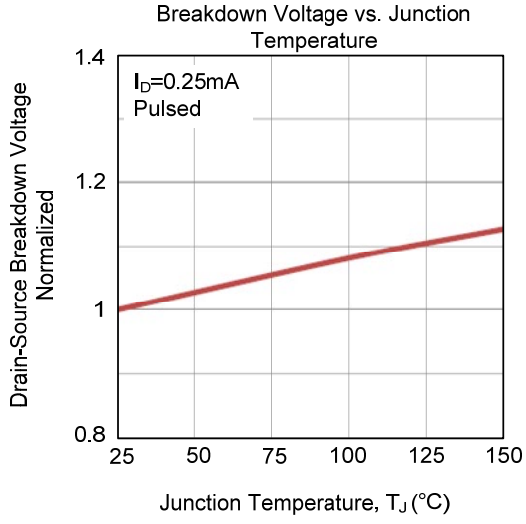






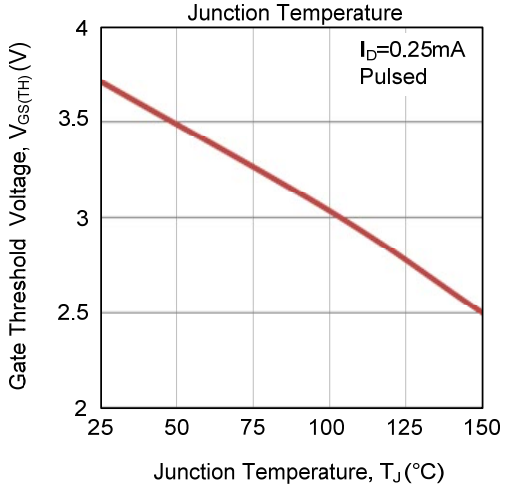




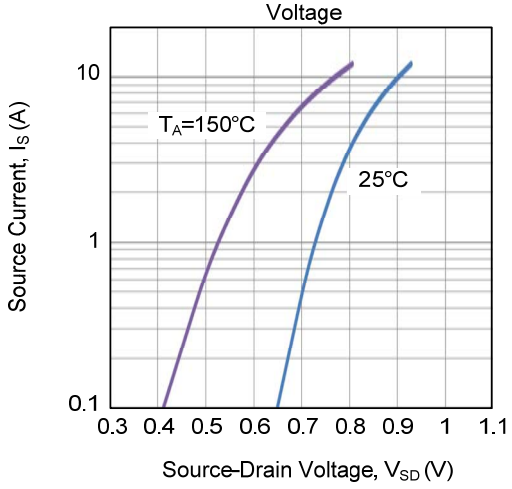


■ TYPICAL CHARACTERISTICS (Cont.)

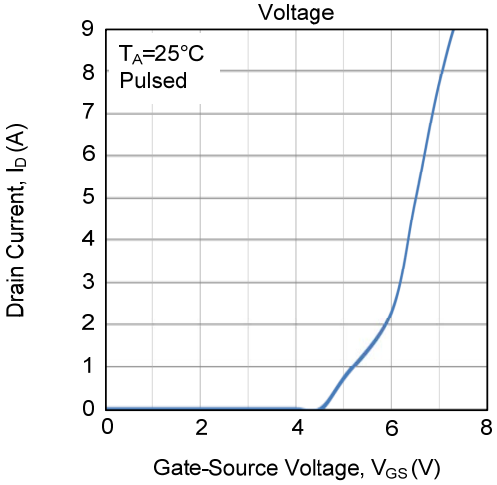
Gate Threshold Voltage vs. Junction Temperature



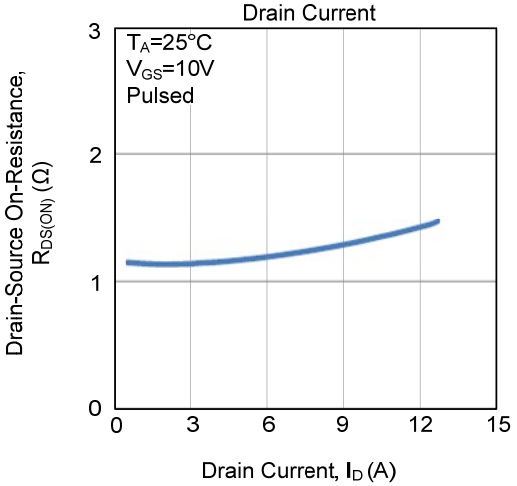
Source Current vs. Source-Drain Voltage



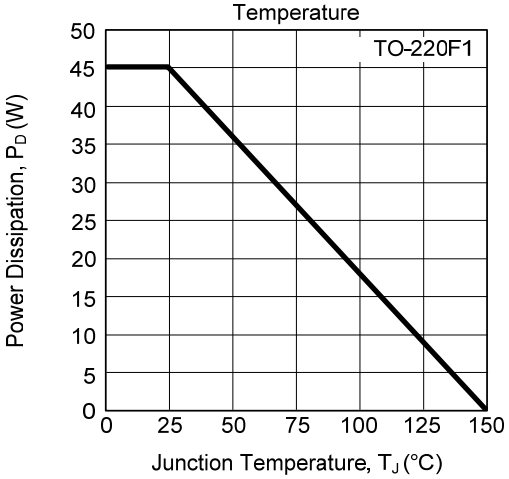
Drain Current vs. Gate-Source Voltage



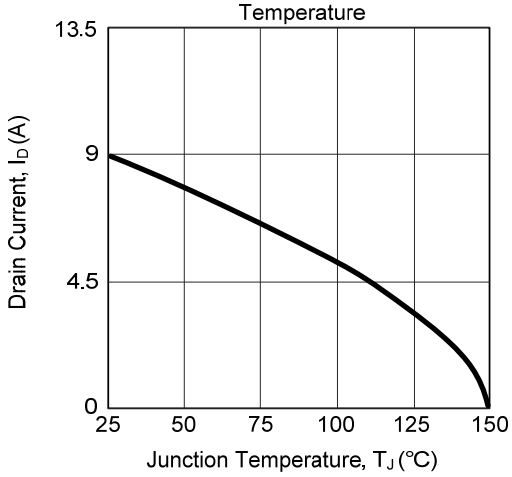
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)