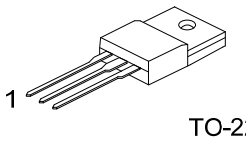
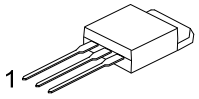
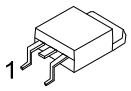
4A, 700V N-CHANNEL POWER MOSFET



TO-220F1



TO-262



TO-252

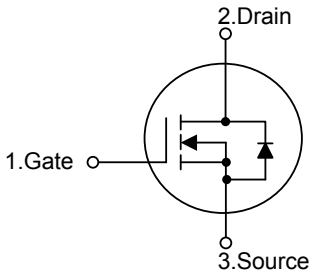
■ DESCRIPTION

The UTC **4N70-TC3** is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

* $R_{DS(ON)} \leq 3.3\Omega$ @ V_{GS}=10V, I_D=2.0A
* High Switching Speed

■ SYMBOL



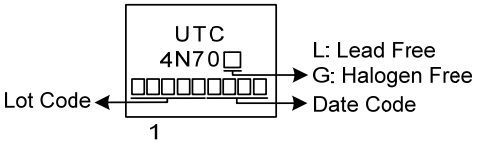
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N70L-TF1-T	4N70G-TF1-T	TO-220F1	G	D	S	Tube
4N70L-TN3-R	4N70G-TN3-R	TO-252	G	D	S	Tape Reel
4N70L-T2Q-T	4N70G-T2Q-T	TO-262	G	D	S	Tube

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

4N70G-TF1-T (1)Packing Type (2)Package Type (3)Green Package	(1) T: Tube, R: Tape Reel (2) TF1: TO-220F1, TN3: TO-252, T2Q: TO-262 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING



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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	700	V
Gate-Source Voltage		V_{GSS}	± 30	V
Drain Current	Continuous	I_D	4	A
	Pulsed (Note 2)	I_{DM}	8	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	80	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4	V/ns
Power Dissipation	TO-220F1	P_D	36	W
	TO-252		49	W
	TO-262		106	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 = 10mH, I_{AS} = 4.0A, V_{DD} = 50V, R_G = 25 Ω Starting T_J = 25°C
4. I_{SD} ≤ 2.0A, di/dt ≤200A/μs, V_{DD} ≤BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

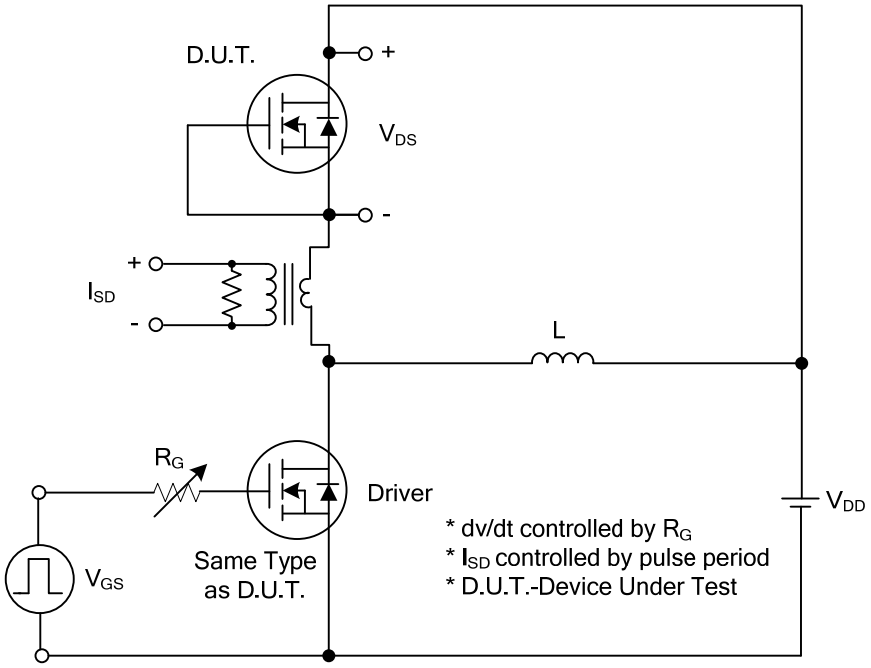
PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220F1/TO-262	$θ_{JA}$	62.5	°C/W
	TO-252		110	°C/W
Junction to Case	TO-220F1	$θ_{JC}$	3.47	°C/W
	TO-252		2.55	°C/W
	TO-262		1.18	°C/W

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

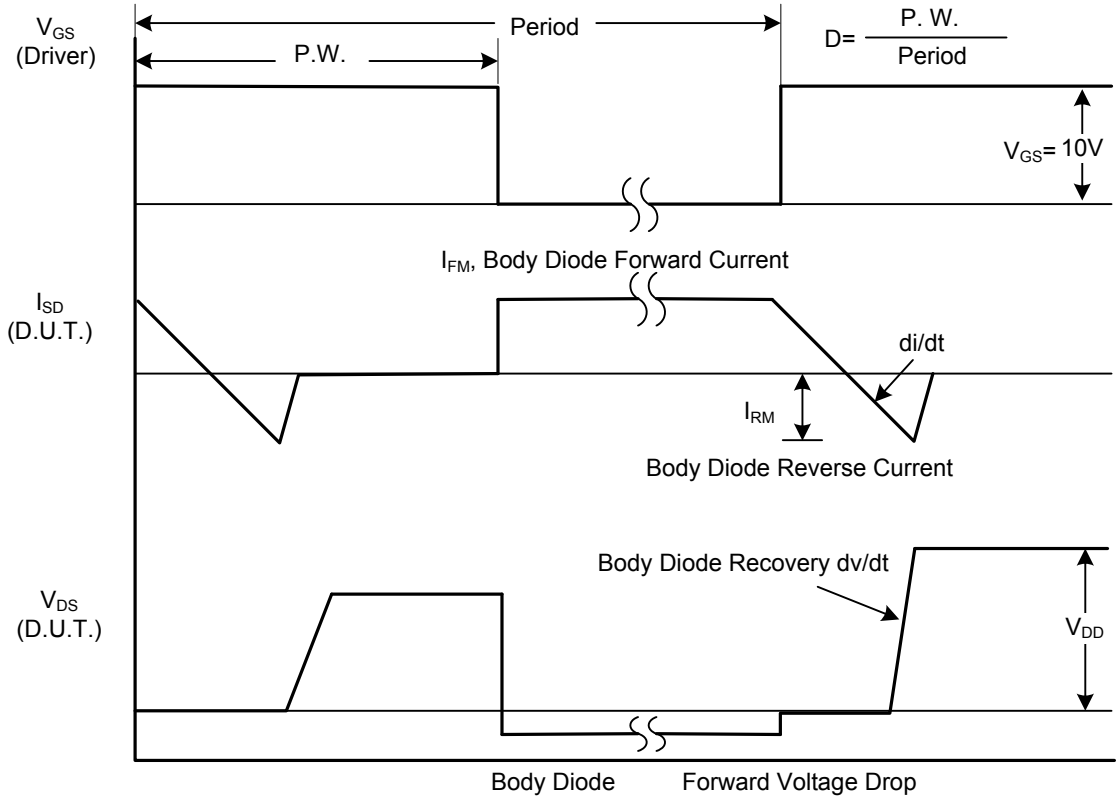
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D= 250μA	700			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=700V, V_{GS}=0V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS}=30V, V_{DS}=0V			100	nA
	Reverse		V_{GS}=-30V, V_{DS}=0V			-100	nA
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=2.0A			3.3	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0 MHz		470		pF
Output Capacitance		C_{OSS}			50		pF
Reverse Transfer Capacitance		C_{RSS}			3.2		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=50V, V_{GS}=10V, I_D=1.3A I_G=100μA (Note 1, 2)		20		nC
Gateource Charge		Q_{GS}			2.8		nC
Gate-Drain Charge		Q_{GD}			6.6		nC
Turn-on Delay Time (Note 1)		$t_{D(ON)}$	V_{DS}=350V, V_{GS}=10V, I_D=4.0A, R_G=25Ω (Note 1, 2)		6.4		ns
Rise Time		t_R			14		ns
Turn-off Delay Time		$t_{D(OFF)}$			28		ns
Fall-Time		t_F			22		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				4	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				16	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	V_{GS}=0V, I_S=4.0A			1.4	V
Reverse Recovery Time (Note 1)		t_{rr}	V_{GS}=0V, I_S=4.0A, dI_F/dt=100A/μs (Note1)		224		ns
Reverse Recovery Charge		Q_{rr}			1.8		μC

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

■ TEST CIRCUITS AND WAVEFORMS

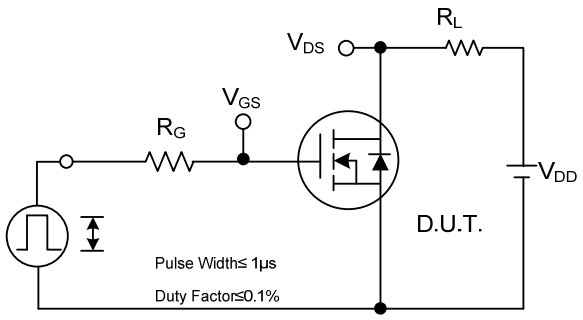


Peak Diode Recovery dv/dt Test Circuit

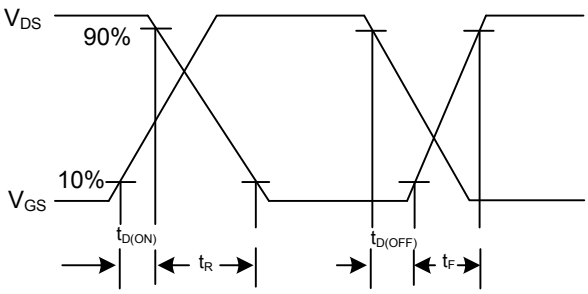


Peak Diode Recovery dv/dt Waveforms

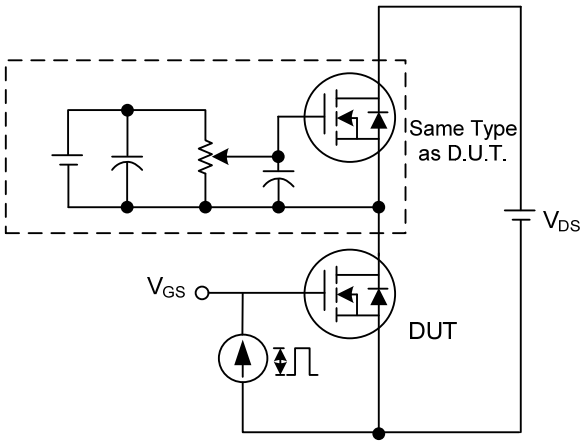
■ TEST CIRCUITS AND WAVEFORMS



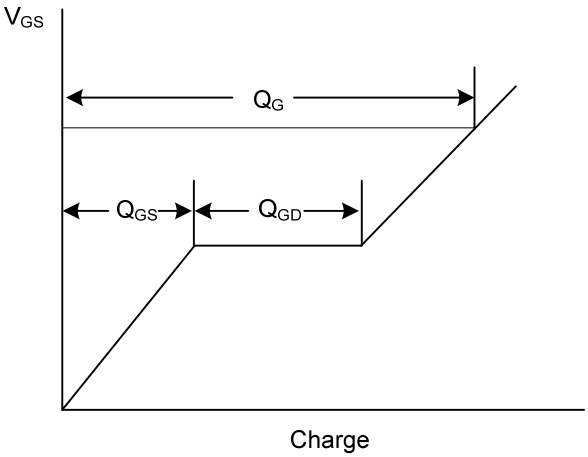
Switching Test Circuit



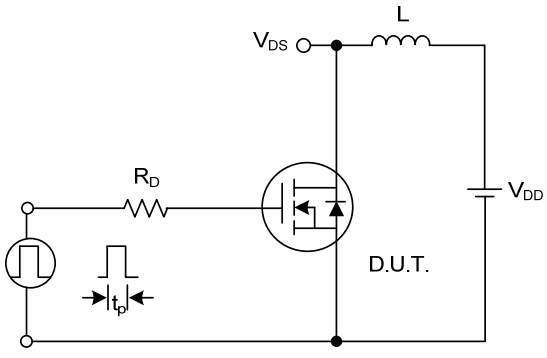
Switching Waveforms



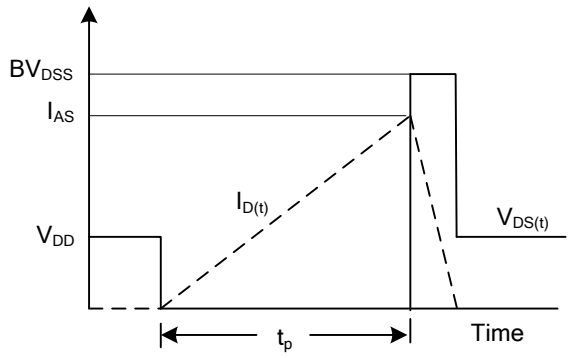
Gate Charge Test Circuit



Gate Charge Waveform



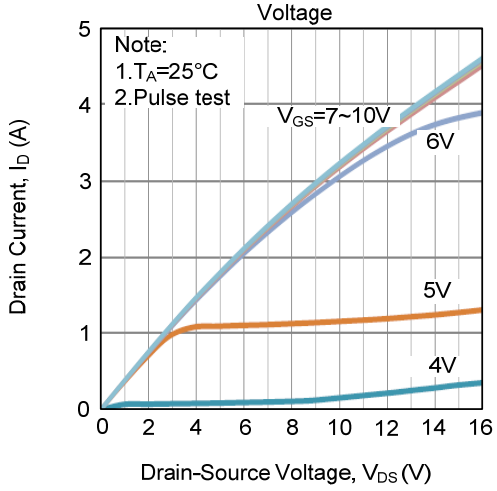
Unclamped Inductive Switching Test Circuit



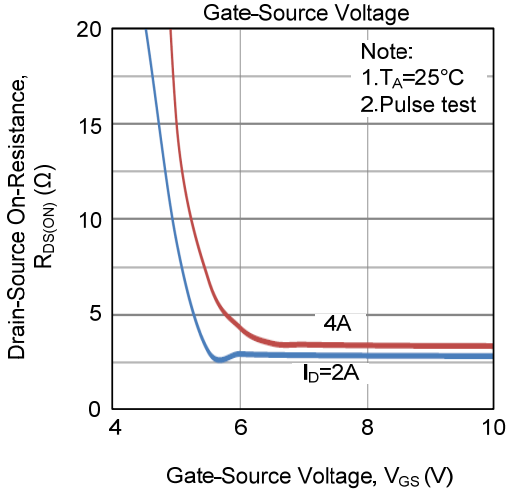
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

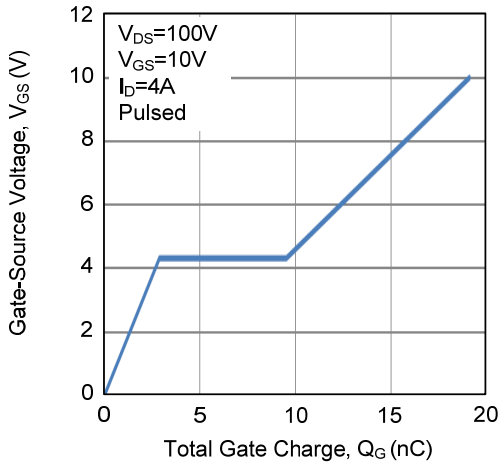
Drain Current vs. Drain-Source Voltage



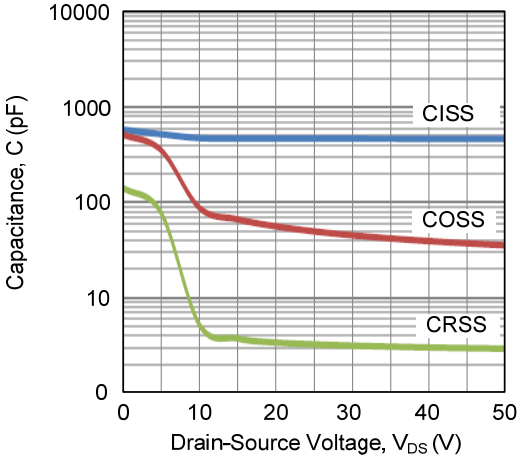
Drain-Source On-Resistance vs. Gate-Source Voltage



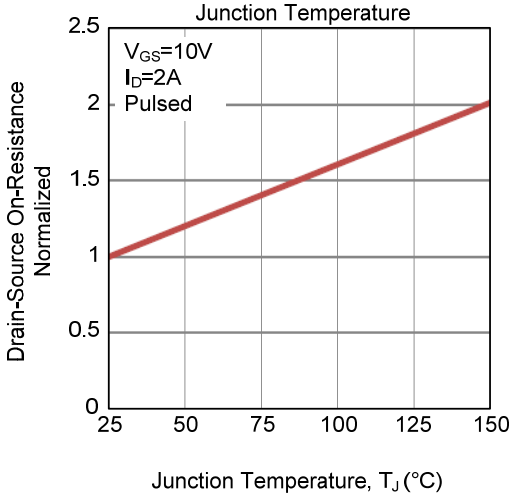
Gate Charge Characteristics



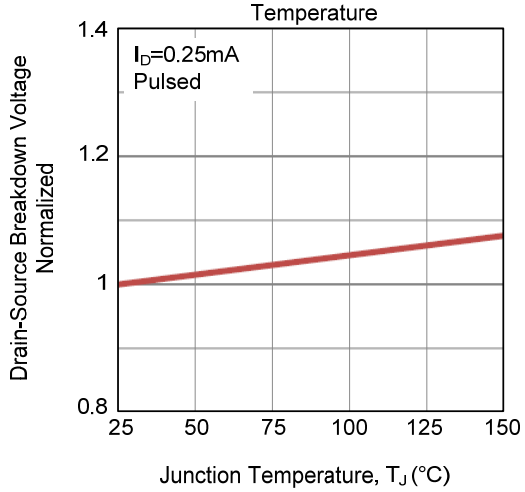
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

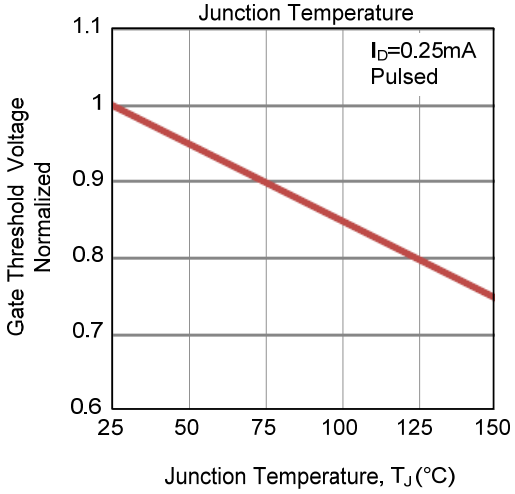


Breakdown Voltage vs. Junction Temperature

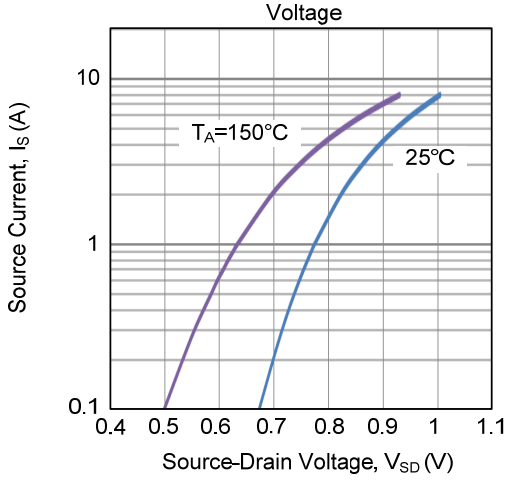


■ TYPICAL CHARACTERISTICS (Cont.)

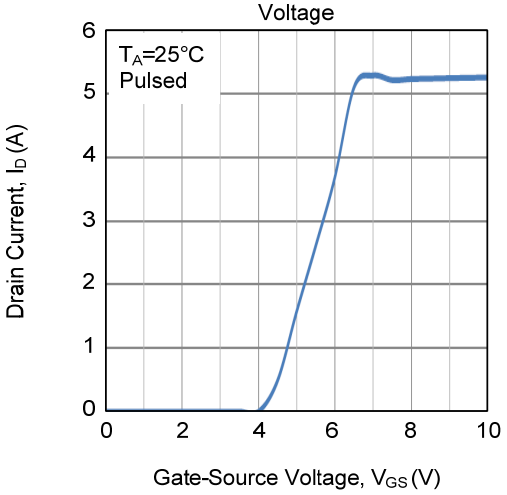
Gate Threshold Voltage vs. Junction Temperature



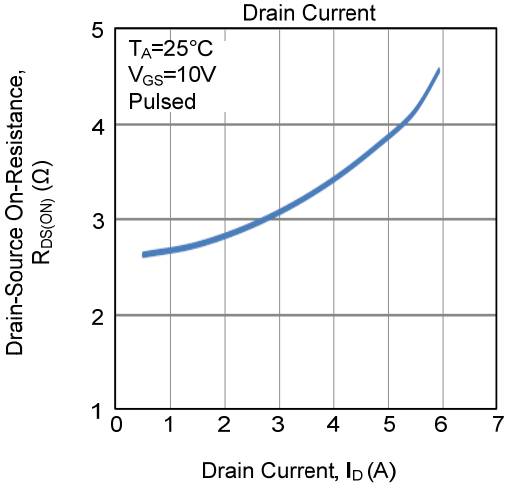
Source Current vs. Source-Drain Voltage



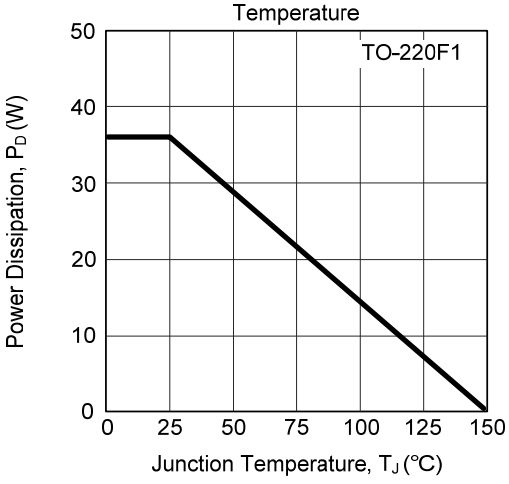
Drain Current vs. Gate-Source Voltage



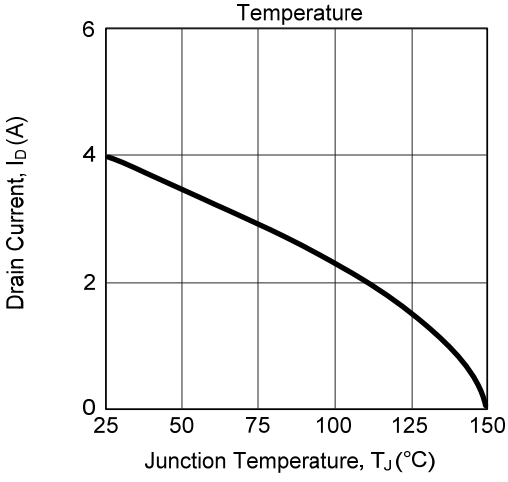
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)