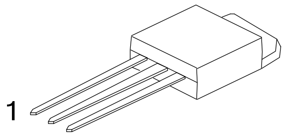
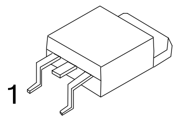
2.0A, 400V N-CHANNEL POWER MOSFET



TO-251



TO-252

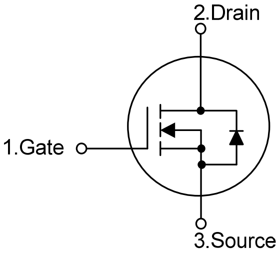
■ DESCRIPTION

The UTC **2N40-V** 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 switching power supplies and adaptors.

■ FEATURES

- * $R_{DS(ON)} \le 8.0\ \Omega$ @ V_{GS}=10V, I_D=1.25A
- * Fast switching capability
- * Avalanche energy tested
- * Improved dv/dt capability, high ruggedness

■ SYMBOL



■ ORDERING INFORMATION

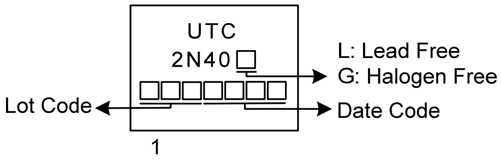
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
2N40L-TM3-T	2N40G-TM3-T	TO-251	G	D	S	Tube
2N40L-TN3-R	2N40G-TN3-R	TO-252	G	D	S	Tape Reel

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

2N40G-TM3-T

(1)Packing Type	(1) T: Tube, R: Tape Reel
(2)Package Type	(2) TM3: TO-251, TN3: TO-252
(3)Green Package	(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}	400	V
Gate-Source Voltage		V_{GSS}	±30	V
Drain Current	Continuous	I_D	2	A
	Pulsed (Note 2)	I_{DM}	4	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	7.2	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.1	V/ns
Power Dissipation		P_D	22	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} = 1.2A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C

4. $I_{SD} \leq 2.0A$, di/dt ≤ 200A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	θ_{JA}	110	°C/W
Junction to Case	θ_{JC}	5.68 (Note)	°C/W

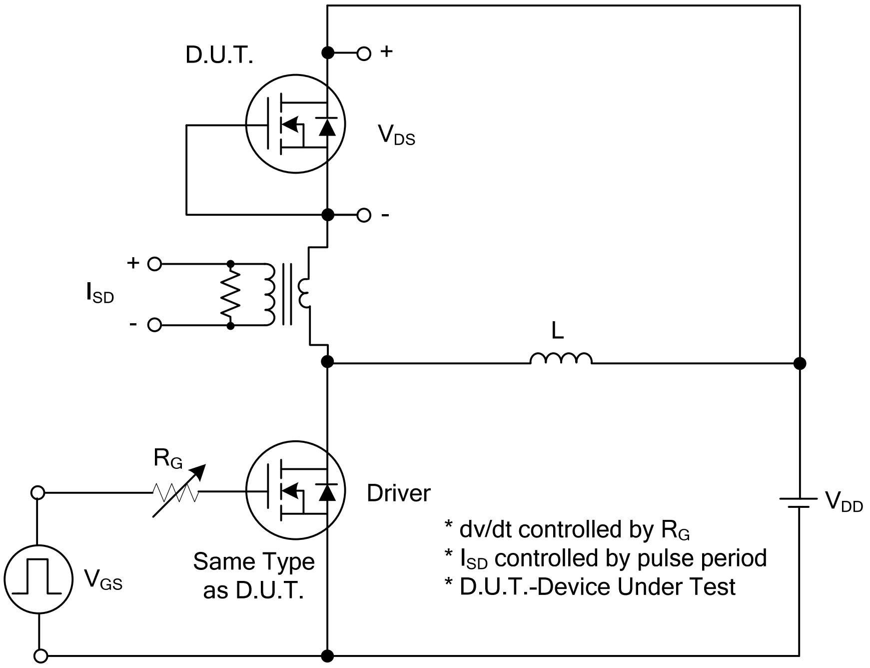
Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

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

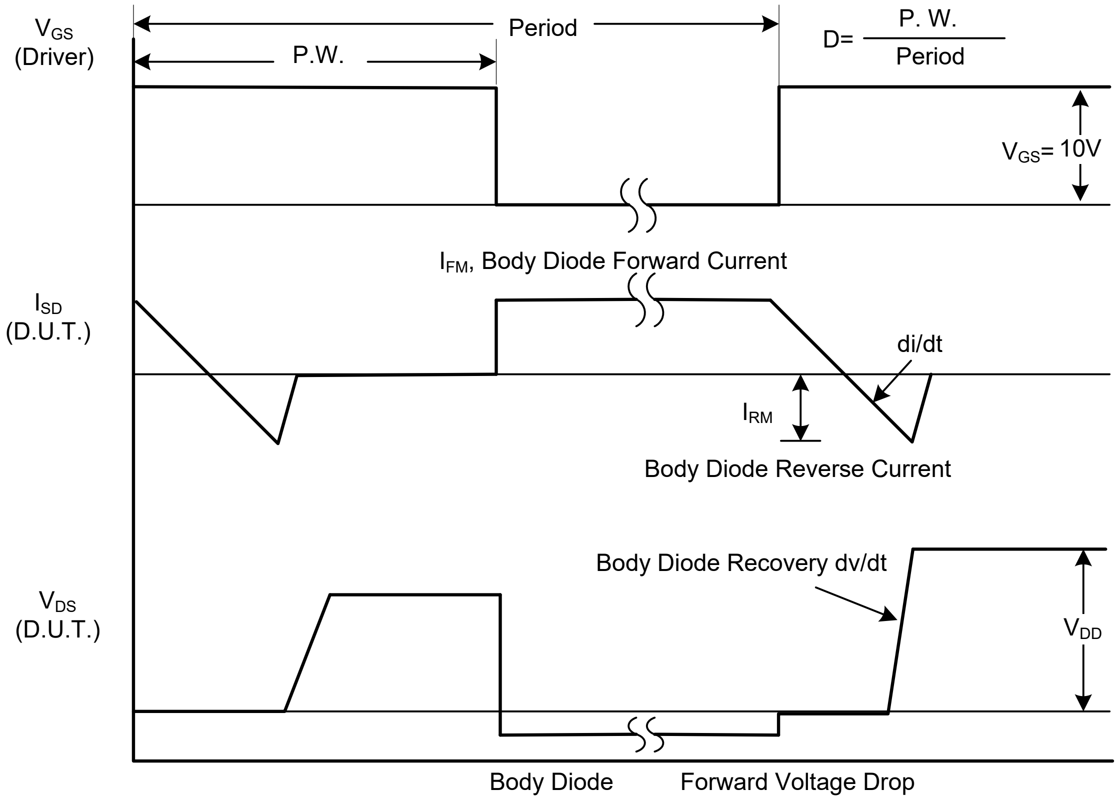
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250μA	400			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=400V, V_{GS}=0V			10	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30V, V_{DS} = 0V			100	nA
	Reverse		V_{GS} = -30V, V_{DS} = 0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	1.0		3.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=1.25A			8.0	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS}=25V, V_{GS}=0V, f=1.0MHz		135		pF
Output Capacitance		C_{OSS}			18		pF
Reverse Transfer Capacitance		C_{RSS}			2		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	V_{DS}=100V, V_{GS}=10V, I_D=1.0A, (Note1,2)		3.4		nC
Gate-Source Charge		Q_{GS}			1.1		nC
Gate-Drain Charge		Q_{GD}			0.1		nC
Turn-On Delay Time		$t_{D(ON)}$	V_{DS}=100V, V_{GS}=10V, I_D=1.0A R_G=6Ω (Note1,2)		2.4		ns
Turn-On Rise Time		t_R			16		ns
Turn-Off Delay Time		$t_{D(OFF)}$			14		ns
Turn-Off Fall Time		t_F			22		ns
DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				2	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				4	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	V_{GS}=0V, I_S=2.0A			1.4	V
Reverse Recovery Time (Note 1)		t_{rr}	V_{GS}=0V, I_S=2.0A, dI_F/dt=100A/μs(Note1)		220		ns
Reverse Recovery Charge		Q_{rr}			0.46		μC

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

■ TEST CIRCUITS AND WAVEFORMS

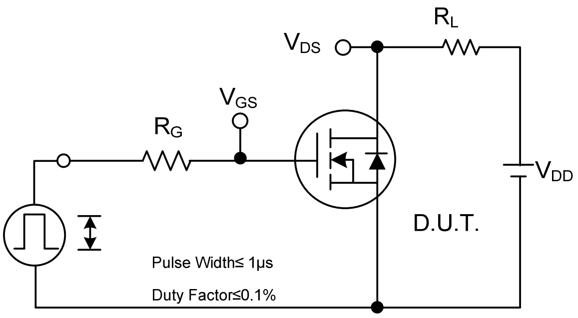


Peak Diode Recovery dv/dt Test Circuit

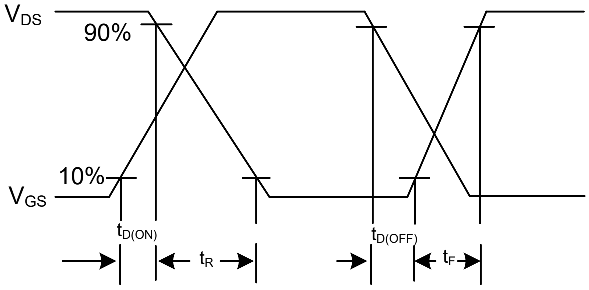


Peak Diode Recovery dv/dt Waveforms

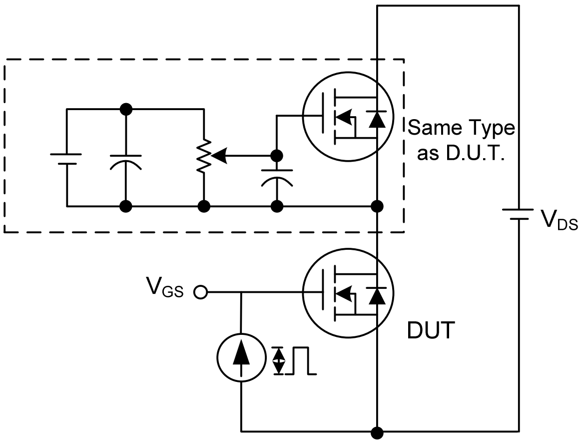
■ TEST CIRCUITS AND WAVEFORMS



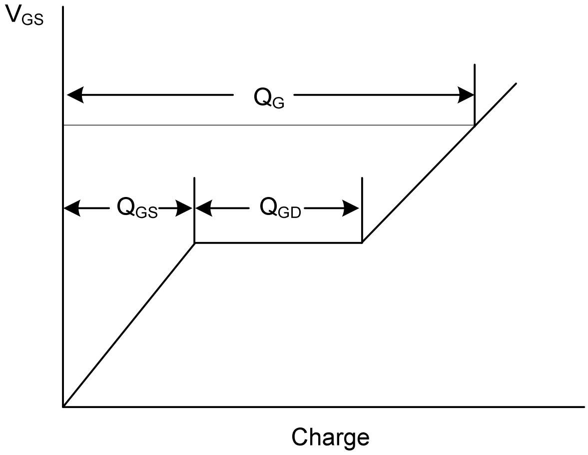
Switching Test Circuit



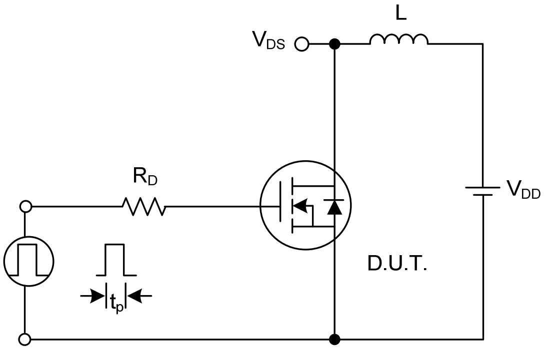
Switching Waveforms



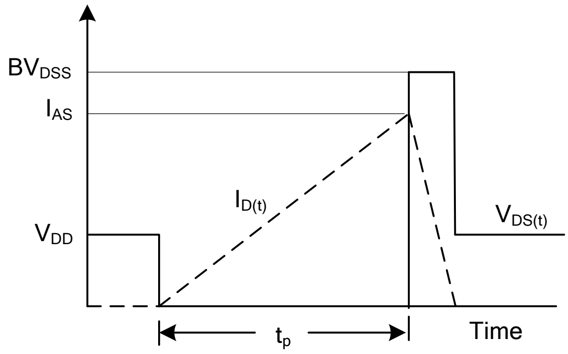
Gate Charge Test Circuit



Gate Charge Waveform

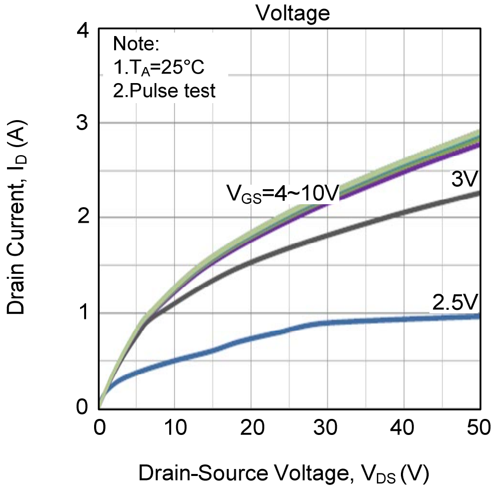


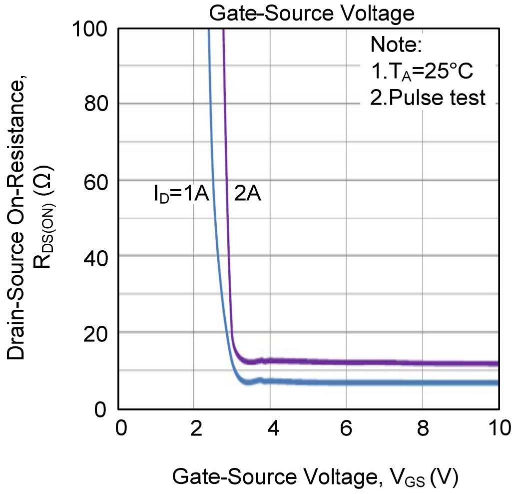
Unclamped Inductive Switching Test Circuit

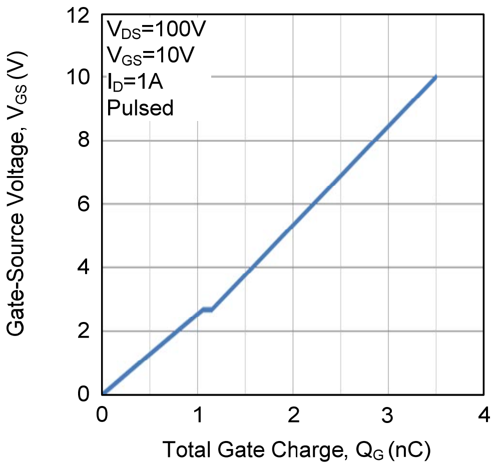


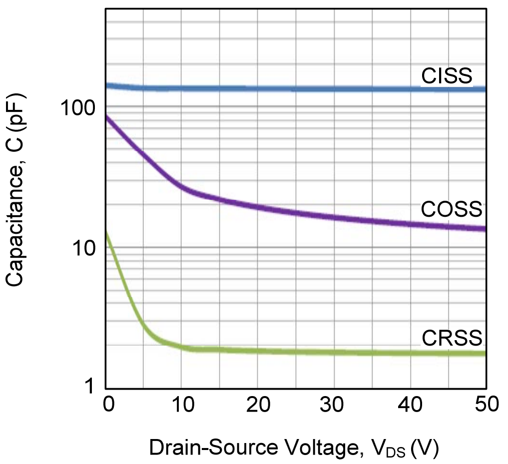
Unclamped Inductive Switching Waveforms

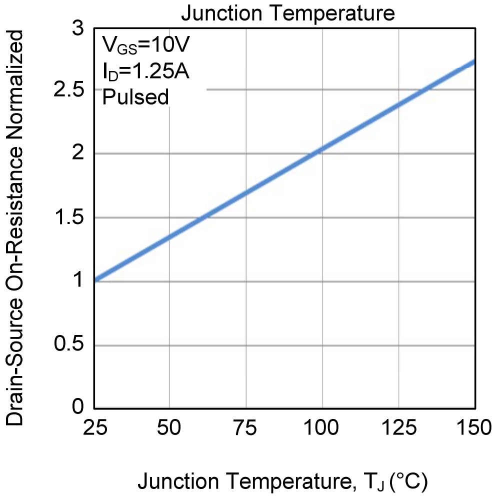
■ TYPICAL CHARACTERISTICS

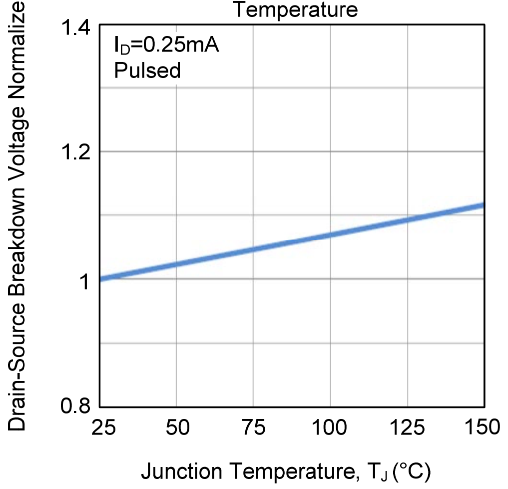

Drain Current vs. Drain-Source Voltage


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


Gate Charge Characteristics

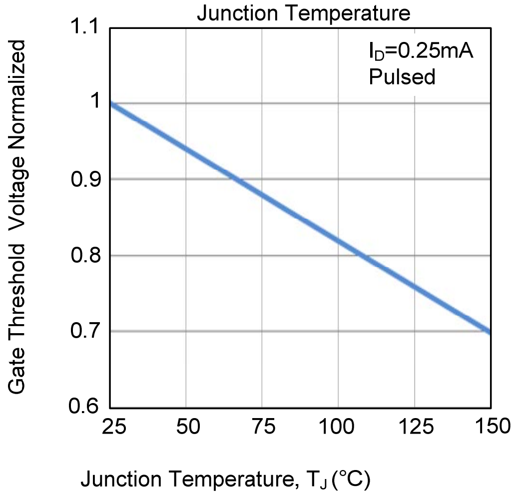

Capacitance Characteristics


Drain-Source On-Resistance vs. Junction Temperature

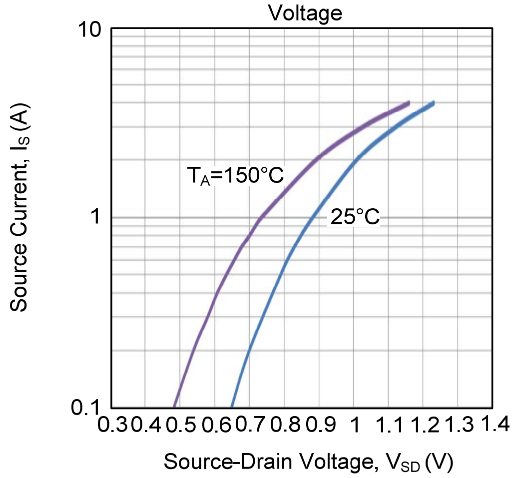

Breakdown Voltage vs. Junction Temperature

■ TYPICAL CHARACTERISTICS (Cont.)

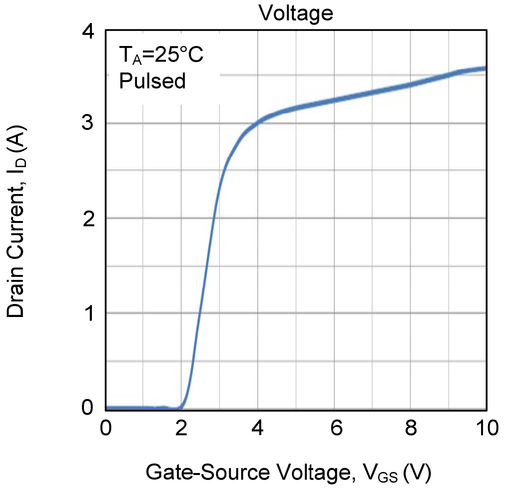
Gate Threshold Voltage vs. Junction Temperature



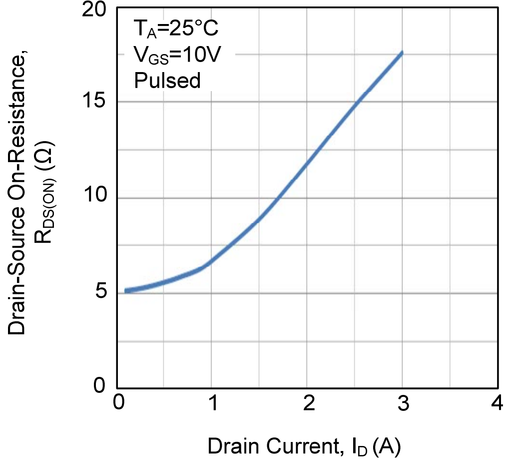
Source Current vs. Source-Drain Voltage



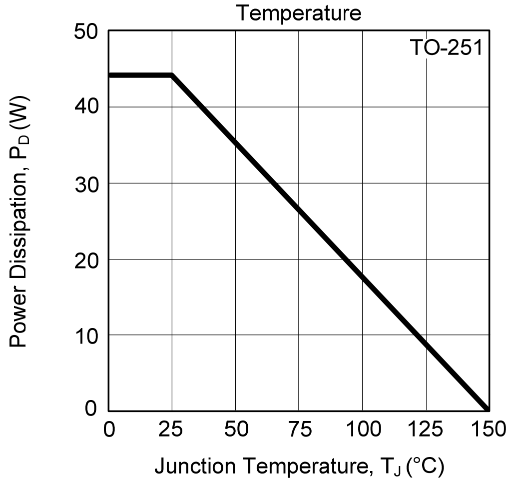
Drain Current vs. Gate-Source Voltage



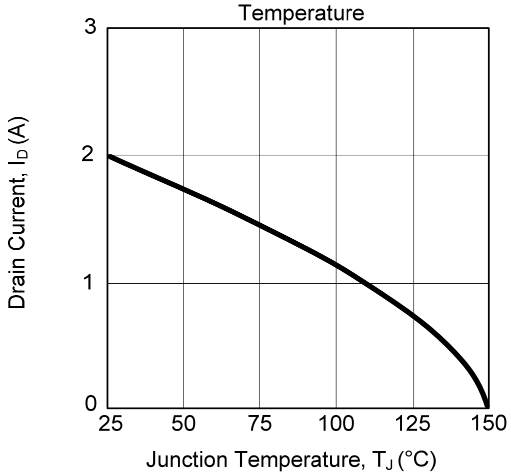
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)