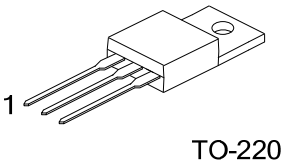
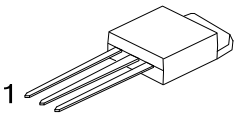
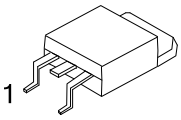
-4.0A, -500V P-CHANNEL POWER MOSFET



TO-220



TO-251



TO-252

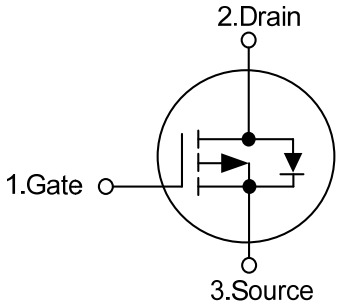
■ DESCRIPTION

The **4P50** uses 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 to be used in low voltage applications such as audio amplifier, high efficiency switching AC/DC converters, and DC motor control.

■ FEATURES

* $R_{DS(ON)} \leq 4.3\ \Omega$ @ V_{GS}=-10V, I_D=-2.0A
* Low capacitance
* Low gate charge
* Fast switching capability
* Avalanche energy specified

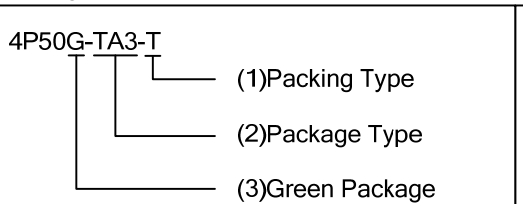
■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4P50L-TA3-T	4P50G-TA3-T	TO-220	G	D	S	Tube
4P50L-TM3-T	4P50G-TM3-T	TO-251	G	D	S	Tube
4P50L-TN3-R	4P50G-TN3-R	TO-252	G	D	S	Tape Reel

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

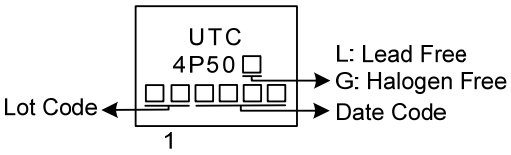


(1) T: Tube, R: Tape Reel

(2) TA3: TO-220, TM3: TO-251, TN3: TO-252

(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}	-500	V
Gate-Source Voltage		V_{GSS}	±30	V
Continuous Drain Current	Continuous	I_D	-4	A
Pulsed Drain Current	Pulsed (Note 2)	I_{DM}	-12	A
Single Pulsed Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	144	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.66	V/ns
Power Dissipation	TO-220	P_D	73	W
	TO-251/TO-252		40	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} = -3.1A, V_{DD} = -50V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤ -4.0A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220	θ_{JA}	62.5	°C/W
	TO-251/TO-252		110	°C/W
Junction to Case	TO-220	θ_{JC}	1.71	°C/W
	TO-251/TO-252		3.12(Note)	°C/W

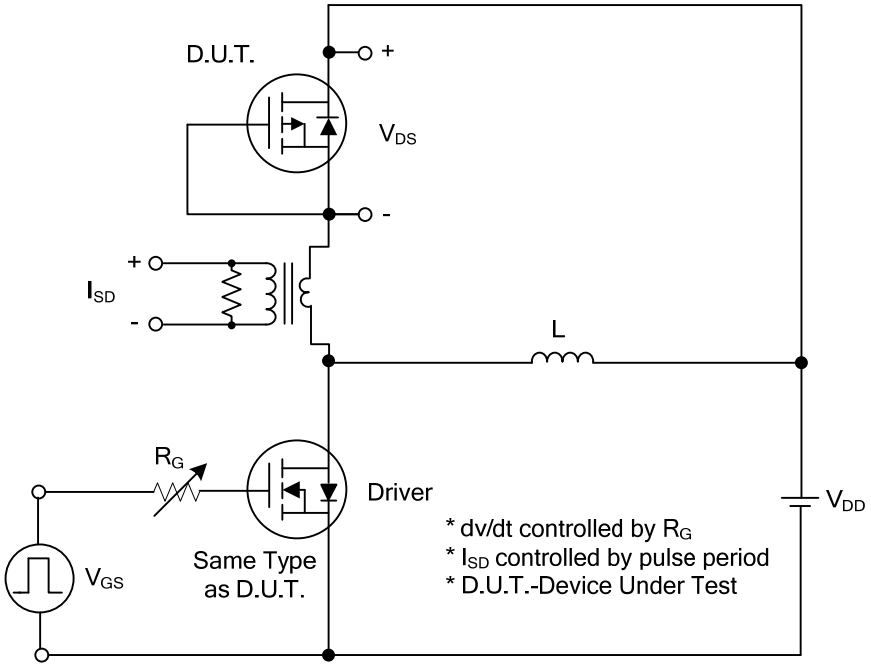
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

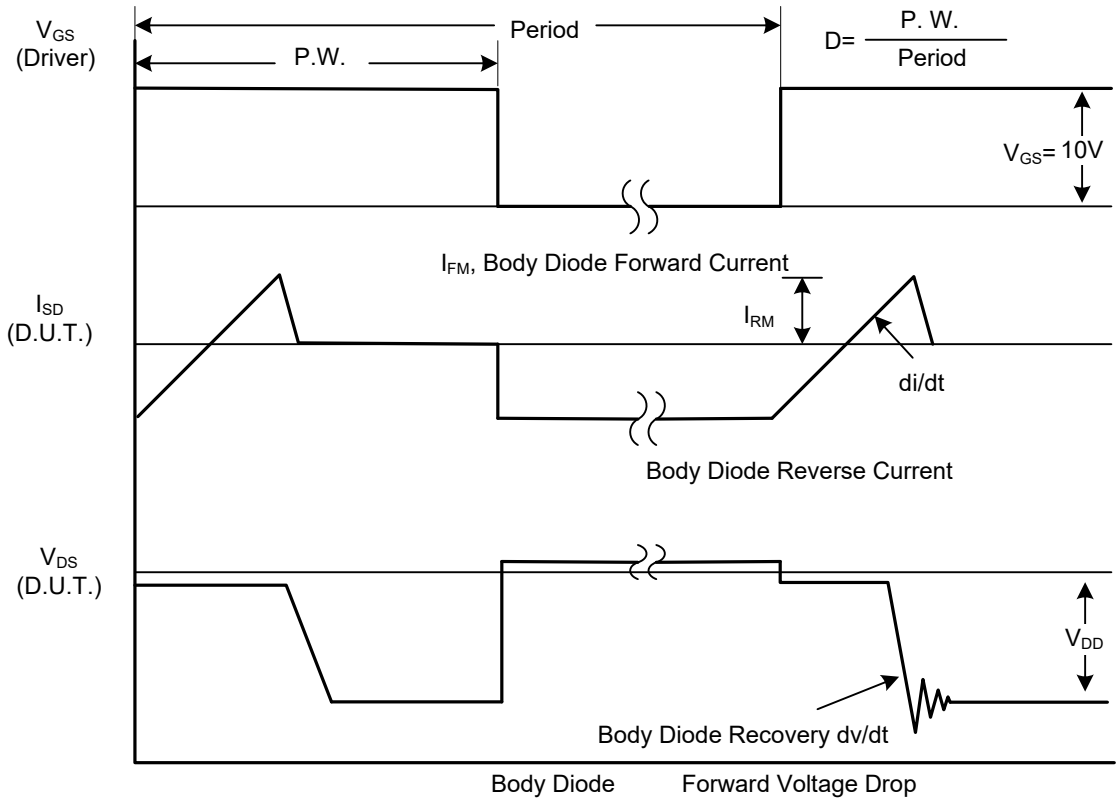
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0 V, I_D=-250μA	-500			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=-500V, V_{GS}=0V			-1	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{DS}=0V, V_{GS}=+30V			100	nA
	Reverse		V_{DS}=0V, V_{GS}=-30V			-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-Resistance		$R_{DS(ON)}$	V_{GS}=-10V, I_D=-2.0A			4.3	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{DS}=-25V, V_{GS}=0V, f=1.0MHz		560		pF
Output Capacitance		C_{OSS}			85		pF
Reverse Transfer Capacitance		C_{RSS}			12		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=-400V, V_{GS}=-10V, I_D=-4.0A I_G=-1mA (Note 1, 2)		18.5		nC
Gate Source Charge		Q_{GS}			7		nC
Gate Drain Charge		Q_{GD}			5.2		nC
Turn-ON Delay Time (Note 1)		$t_{D(ON)}$	V_{DD}=-30V, V_{GS}=-10V, I_D=-0.5A, R_G=25Ω (Note 1, 2)		85		ns
Turn-ON Rise Time		t_R			42		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			176		ns
Turn-OFF Fall-Time		t_F			80		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				-4	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				-12	A
Diode Forward Voltage (Note 1)		V_{SD}	I_S=-2.0A, V_{GS}=0V			-3.5	V
Body Diode Reverse Recovery Time(Note 1)		t_{rr}	I_S=-4.0A, V_{GS}=0V, dI_F/dt=100A/μs		320		ns
Body Diode Reverse Recovery Charge		Q_{rr}			4.1		μC

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

■ TEST CIRCUITS AND WAVEFORMS

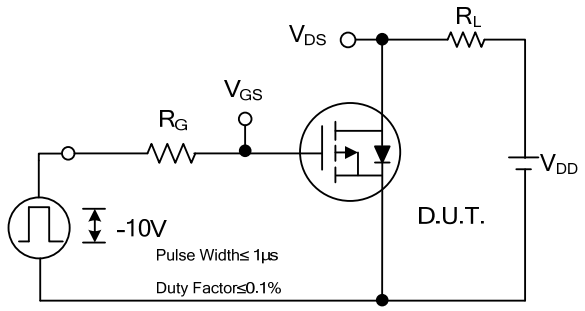


Peak Diode Recovery dv/dt Test Circuit

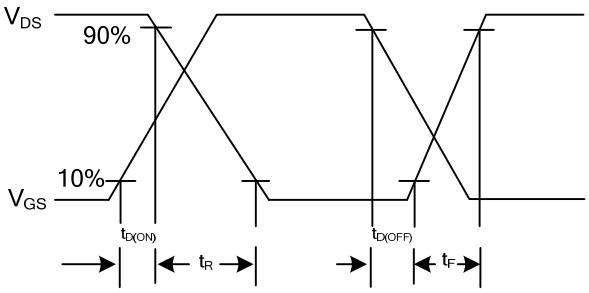


Peak Diode Recovery dv/dt Waveforms

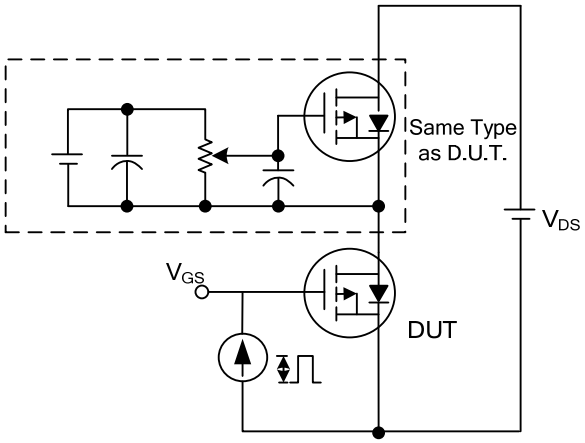
■ TEST CIRCUITS AND WAVEFORMS



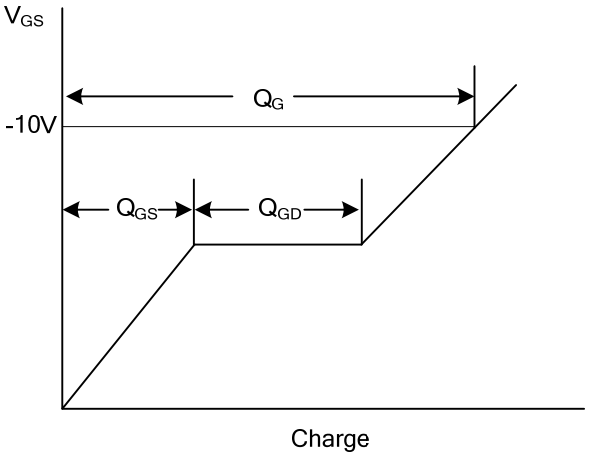
Switching Test Circuit



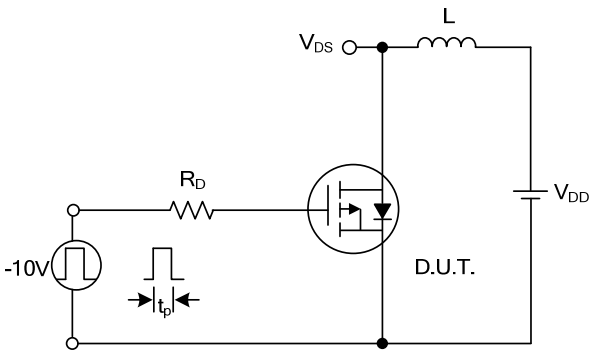
Switching Waveforms



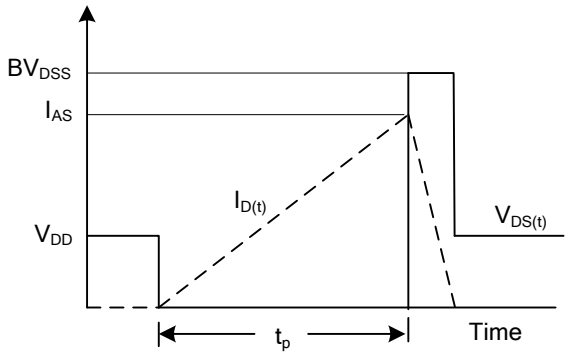
Gate Charge Test Circuit



Gate Charge Waveform



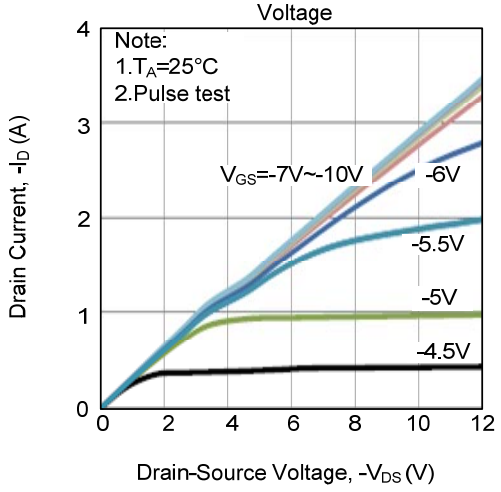
Unclamped Inductive Switching Test Circuit



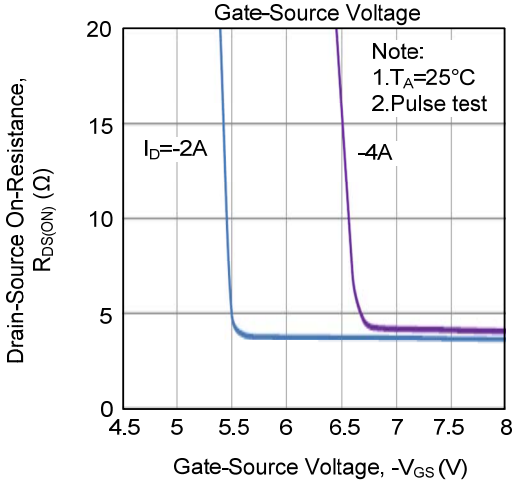
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

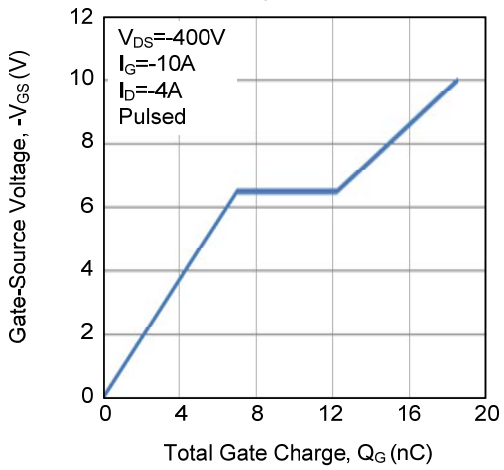
Drain Current vs. Drain-Source Voltage



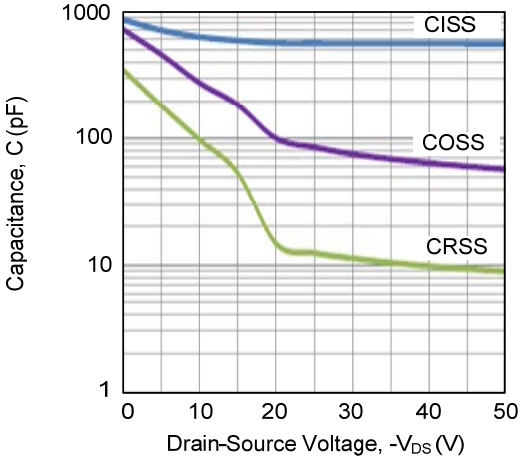
Drain-Source On-Resistance vs. Gate-Source Voltage



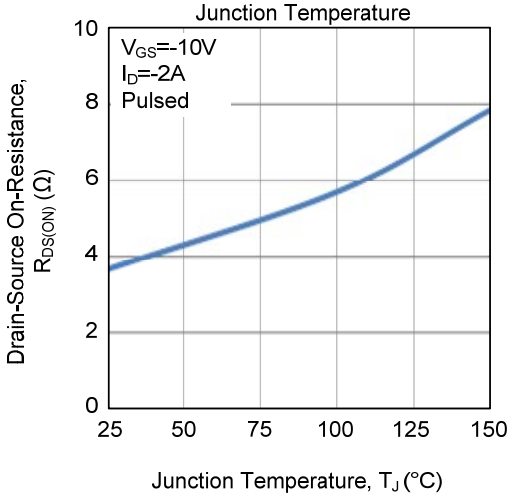
Gate Charge Characteristics



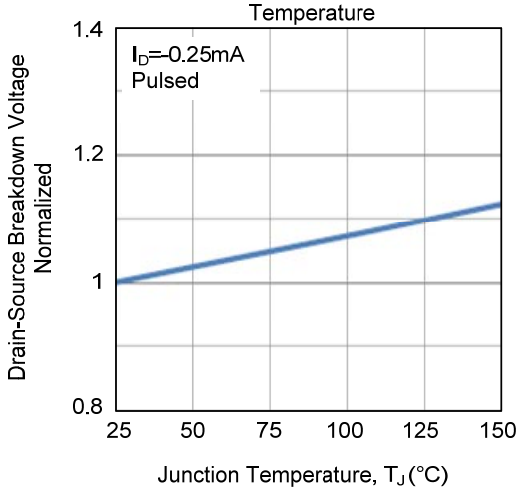
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

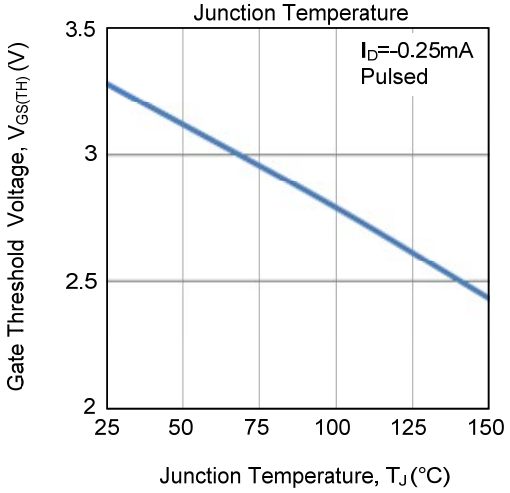


Breakdown Voltage vs. Junction Temperature

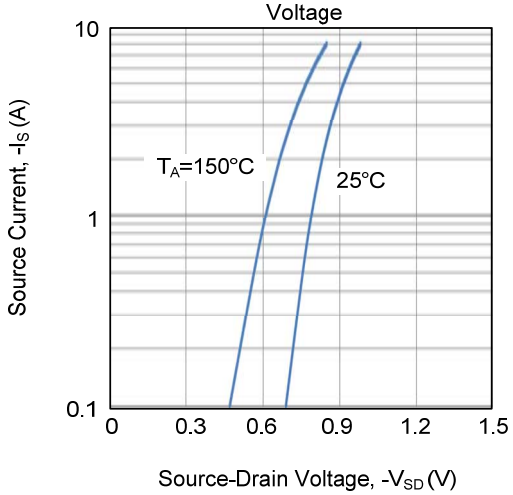


■ TYPICAL CHARACTERISTICS (Cont.)

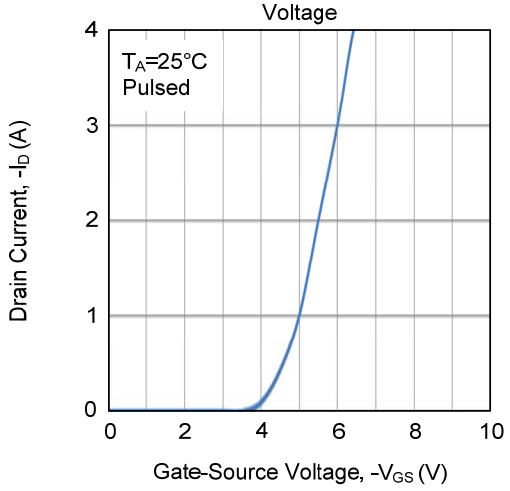
Gate Threshold Voltage vs. Junction Temperature



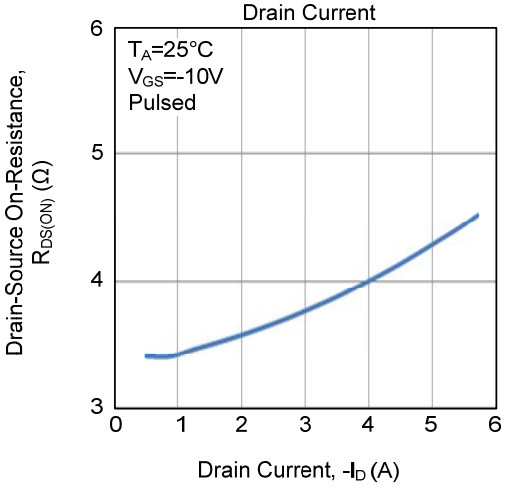
Source Current vs. Source-Drain Voltage



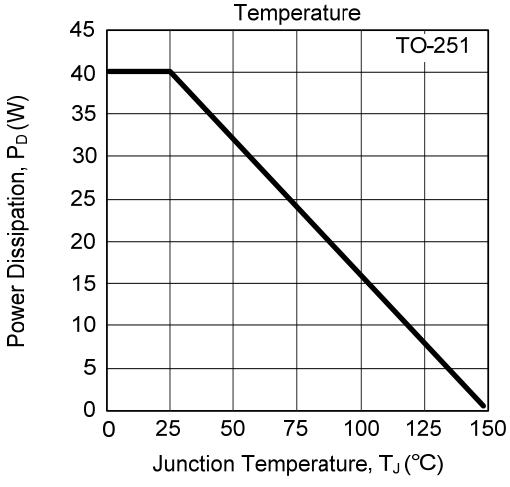
Drain Current vs. Gate-Source Voltage



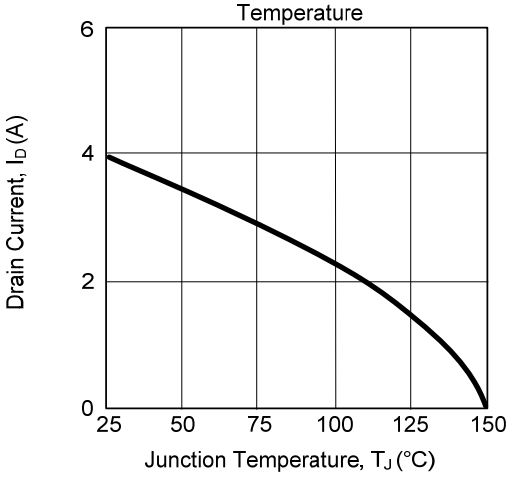
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature

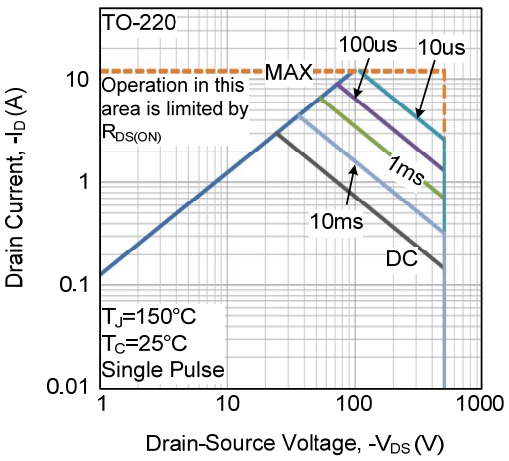


Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)

Safe Operating Area



Safe Operating Area