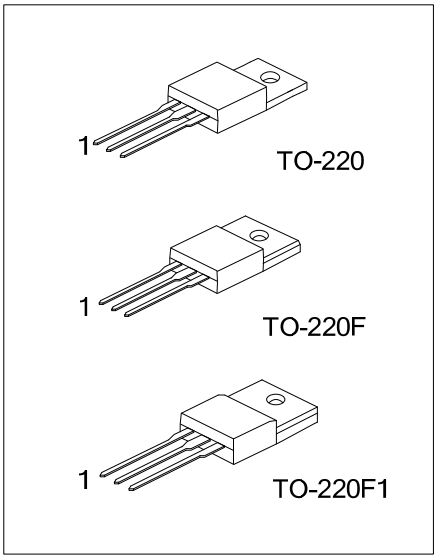
12N60-TC

Power MOSFET

12A, 600V N-CHANNEL POWER MOSFET



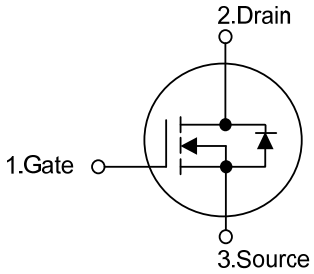
■ DESCRIPTION

The **UTC 12N60-TC** is a high voltage and high current power MOSFET, designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and 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

* $R_{DS(ON)}$ < 0.7Ω @ V_{GS} =10V, I_D = 6.0A
* Fast switching
* Improved dv/dt capability

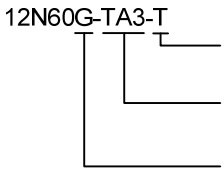
■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
12N60L-TA3-T	12N60G-TA3-T	TO-220	G	D	S	Tube
12N60L-TF1-T	12N60G-TF1-T	TO-220F1	G	D	S	Tube
12N60L-TF3-T	12N60G-TF3-T	TO-220F	G	D	S	Tube

Note: Pin Assignment: G: Gate C: Collector E: Emitter

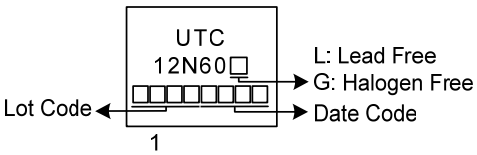


(1) T: Tube

(2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F

(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}	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Drain Current	Continuous	I_D	12	A
	Pulsed (Note 2)	I_{DM}	24	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	304	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	3.1	V/ns
Power Dissipation	TO-220	P_D	150	W
	TO-220F/TO-220F1		36	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} = 7.8A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤ 12A, di/dt ≤200A/s, V_{DD} ≤BV_{DSS} Starting T_J = 25°C

■ THERMAL DATA

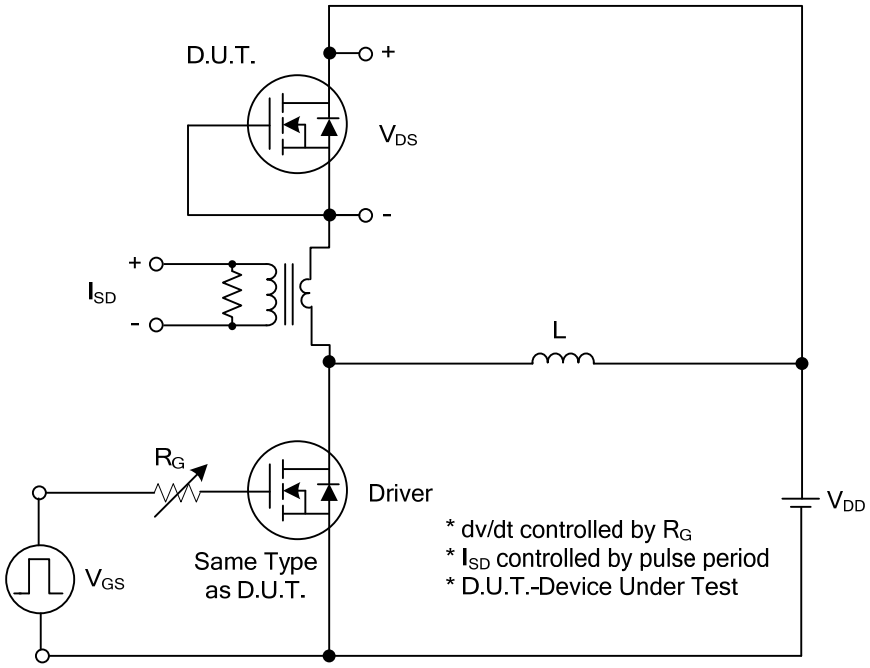
PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient		θ_{JA}	62.5	°C/W
Junction to Case	TO-220	θ_{JC}	0.83	°C/W
	TO-220F/TO-220F1		3.47	°C/W

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

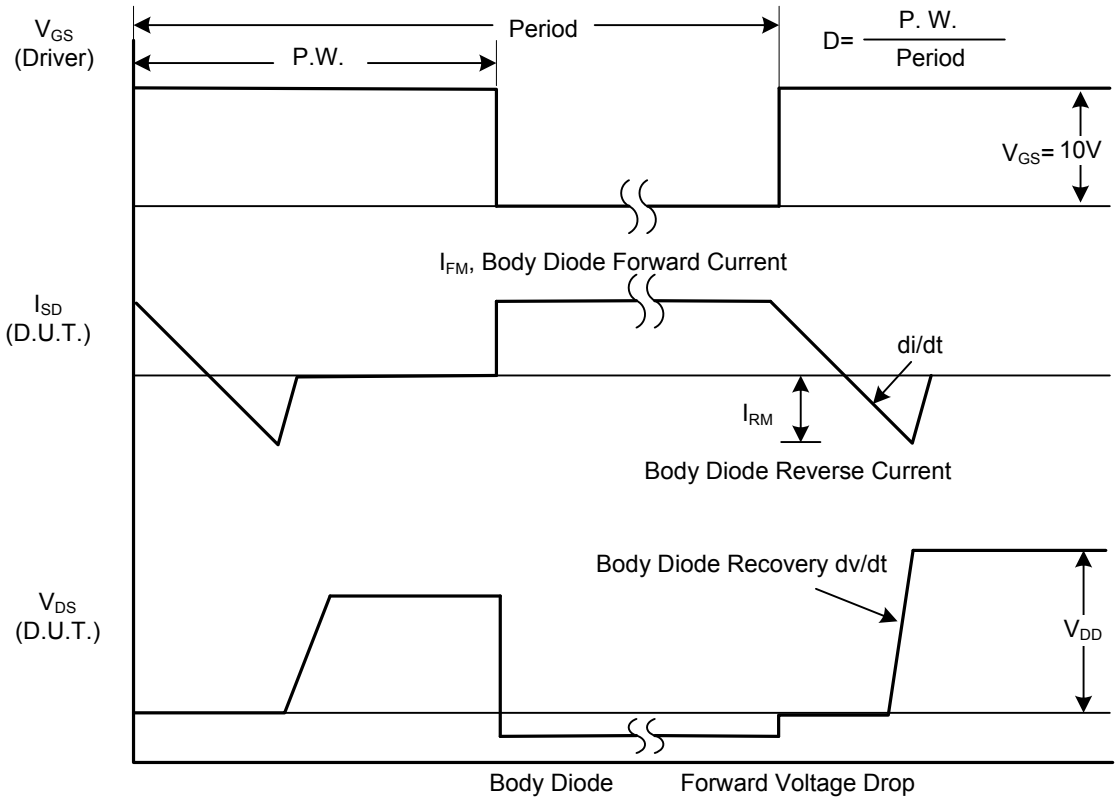
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	600			V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	μA
Gate-Source Leakage Current	I_{GSS}	V_{GS}=±30V, V_{DS}=0V			±100	nA
ON CHARACTERISTICS						
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=6.0A			0.7	Ω
DYNAMIC CHARACTERISTICS						
Input Capacitance	C_{ISS}	V_{DS}=25V, V_{GS}=0V, f=1MHz		1820		pF
Output Capacitance	C_{OSS}			166		pF
Reverse Transfer Capacitance	C_{RSS}			5		pF
SWITCHING CHARACTERISTICS						
Total Gate Charge	Q_G	V_{DS}=100V, I_D=12A, V_{GS}=10V I_G=1mA (Note1,2)		33		nC
Gate-Source Charge	Q_{GS}			13		nC
Gate-Drain Charge	Q_{GD}			7		nC
Turn-On Delay Time	$t_{D(ON)}$	V_{DD}=100V, I_D=12A, R_G=25Ω (Note1,2)		26		ns
Turn-On Rise Time	t_R			21		ns
Turn-Off Delay Time	$t_{D(OFF)}$			83		ns
Turn-Off Fall Time	t_F			29		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I_S				12	A
Maximum Body-Diode Pulsed Current	I_{SM}				24	A
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS}=0V, I_S=12A			1.4	V
Reverse Recovery Time	t_{rr}	V_{GS}=0V, I_S=12A, di/dt=100A/μs		380		ns
Reverse Recovery Charge	Q_{rr}			5.3		μC

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

■ TEST CIRCUITS AND WAVEFORMS

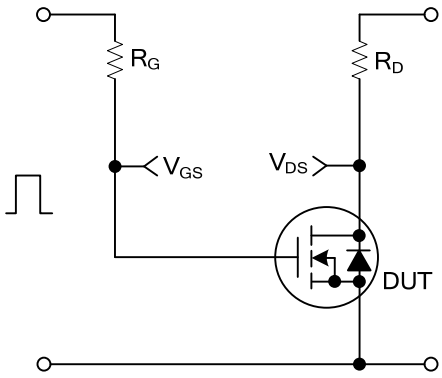


Peak Diode Recovery dv/dt Test Circuit

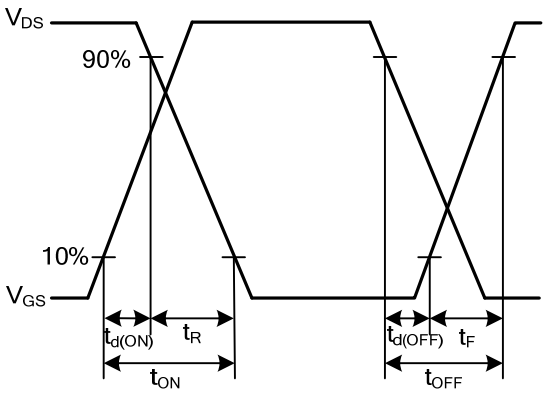


Peak Diode Recovery dv/dt Waveforms

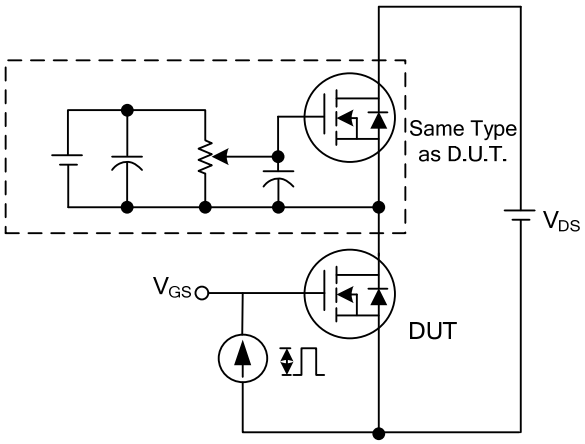
■ TEST CIRCUITS AND WAVEFORMS



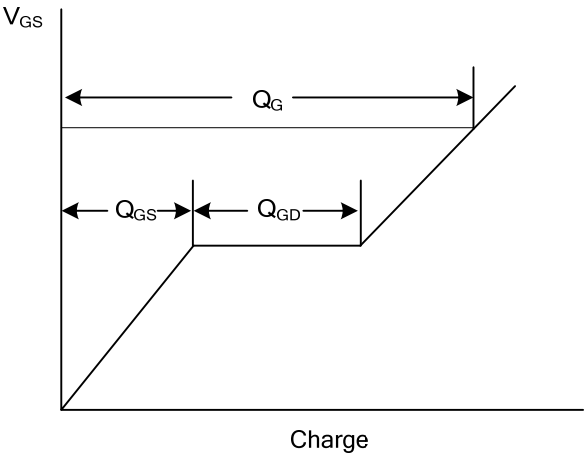
itching Test Circuit



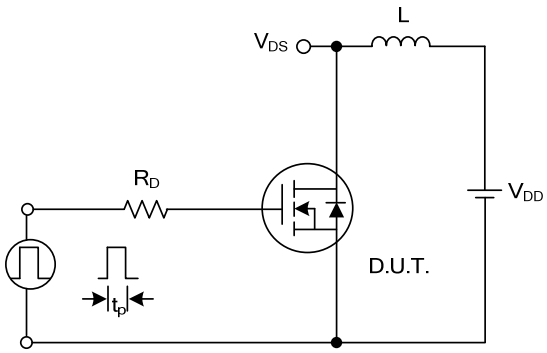
Switching Waveforms



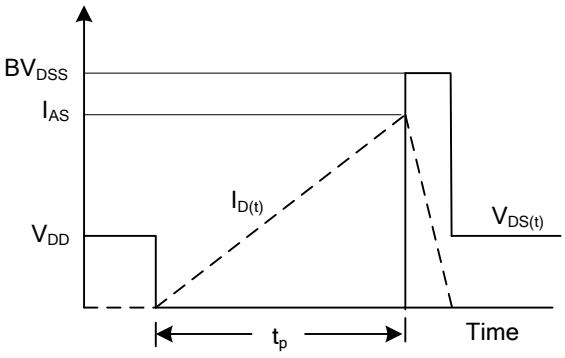
Gate Charge Test Circuit



Gate Charge Waveform



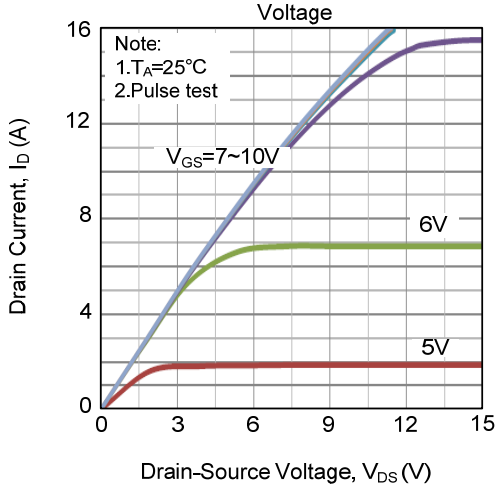
Unclamped Inductive Switching Test Circuit



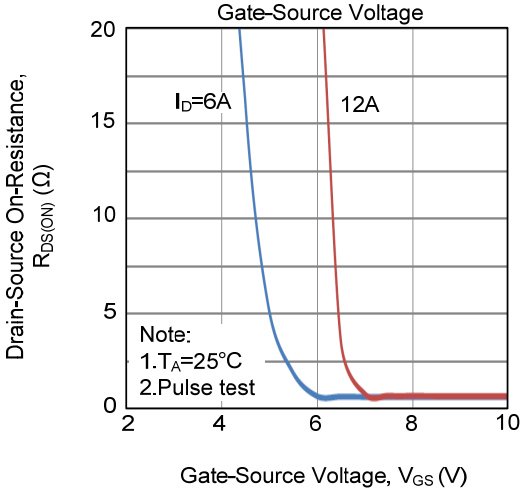
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

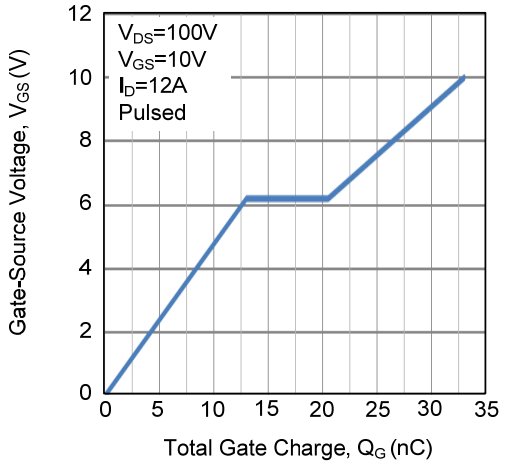
Drain Current vs. Drain-Source Voltage



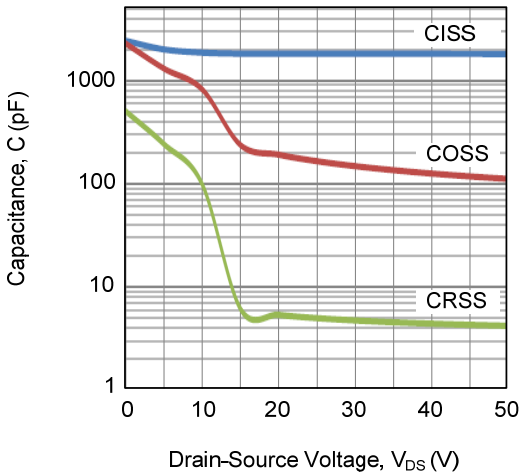
Drain-Source On-Resistance vs. Gate-Source Voltage



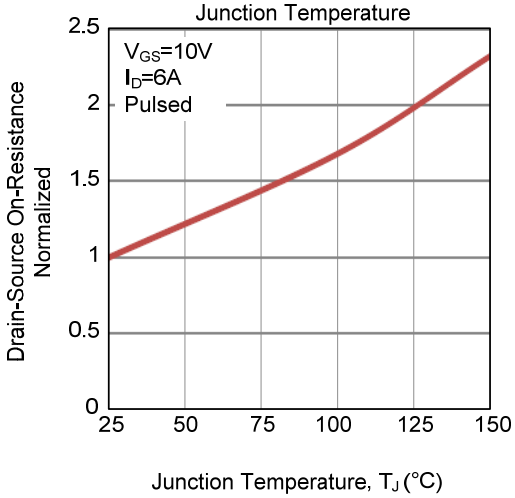
Gate Charge Characteristics



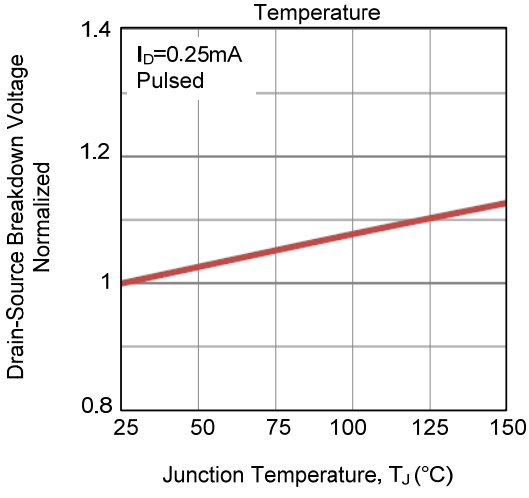
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

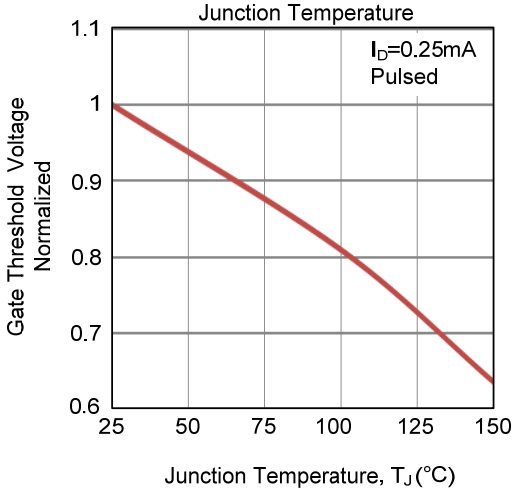


Breakdown Voltage vs. Junction Temperature

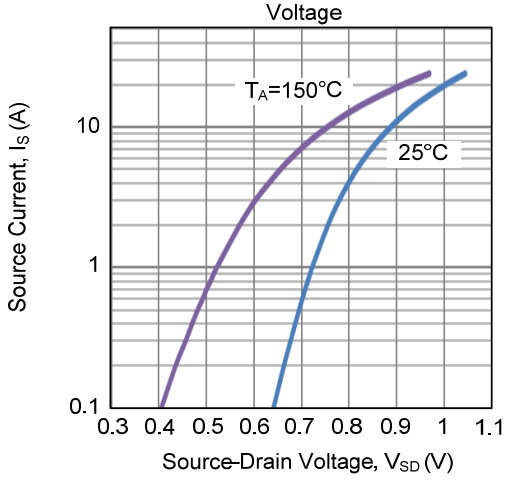


■ TYPICAL CHARACTERISTICS (Cont.)

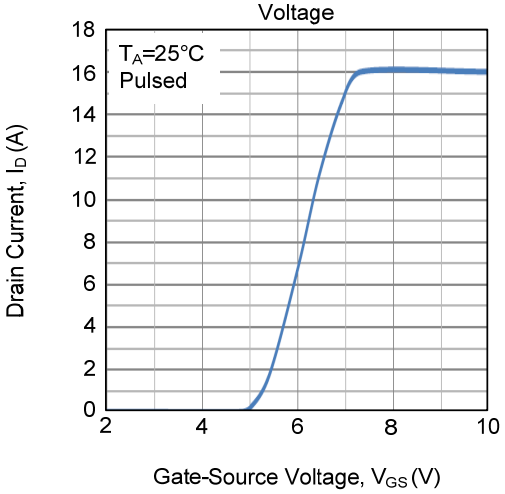
Gate Threshold Voltage vs. Junction Temperature



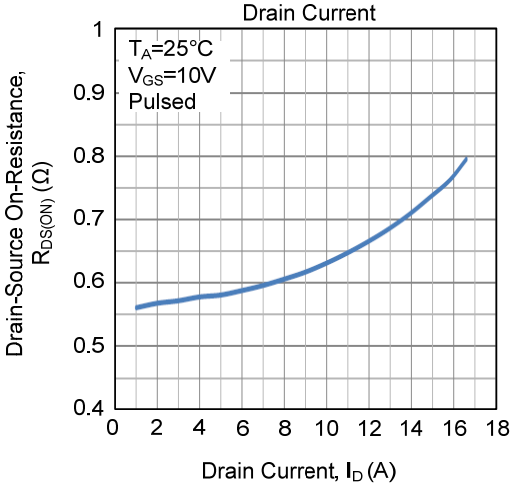
Source Current vs. Source-Drain Voltage



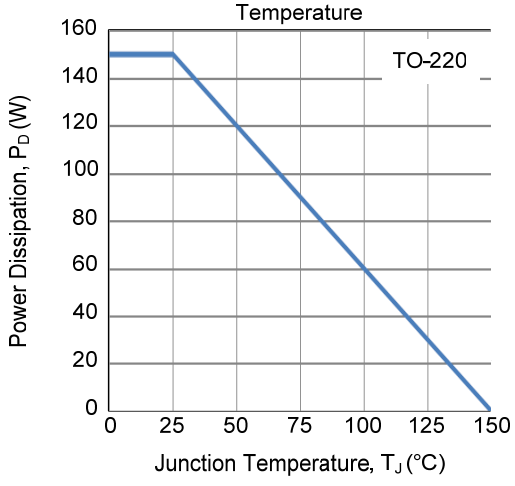
Drain Current vs. Gate-Source Voltage



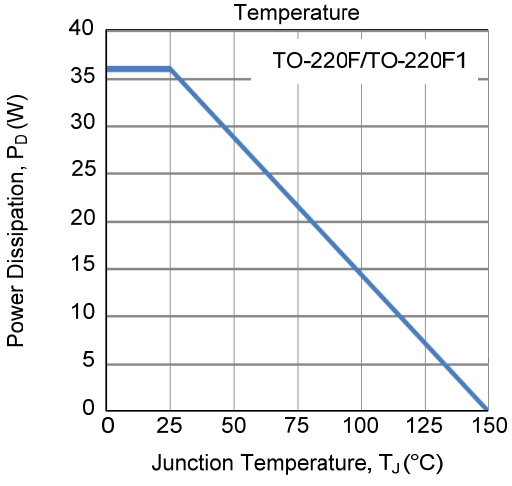
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature



Power Dissipation vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)