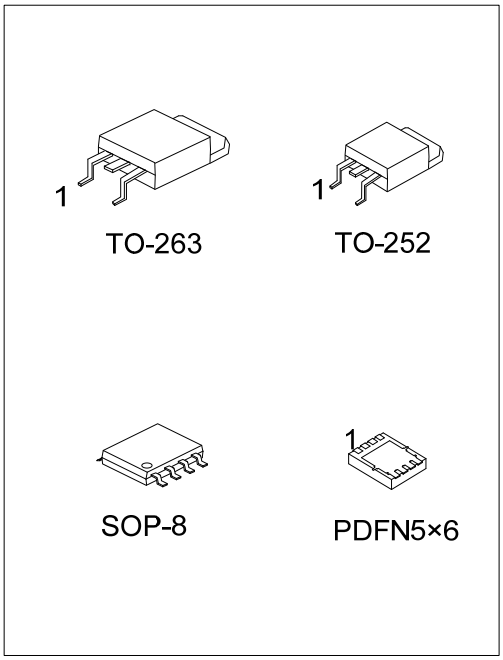
USG60N10

POWER MOSFET

60A, 100V N-CHANNEL ENHANCEMENT MODE TRENCH POWER MOSFET



■ DESCRIPTION

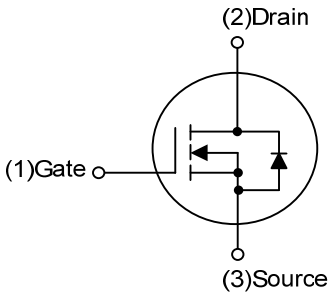
The UTC **USG60N10** is a N-channel Power MOSFET, it uses UTC's advanced technology to provide the customers with low $R_{DS(ON)}$ characteristic by high cell density trench technology.

The UTC **USG60N10** is suitable for high efficiency synchronous rectification in SMPS, UPS, hard switched and high frequency circuits.

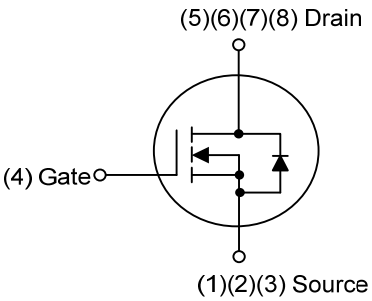
■ FEATURES

* $R_{DS(ON)} \leq 10.5\ m\Omega$ @ V_{GS}=10V, I_D=30A
  $R_{DS(ON)} \leq 15\ m\Omega$ @ V_{GS}=4.5V, I_D=20A
* Optimized for high speed switching, Logic level
* Enhanced Body diode dv/dt capability
* Enhanced Avalanche Ruggednessy

■ SYMBOL



TO-252/TO-263



SOP-8/PDFN5×6

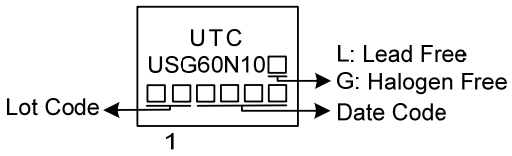
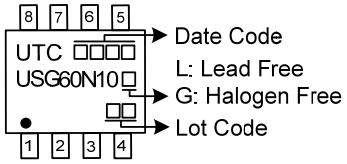
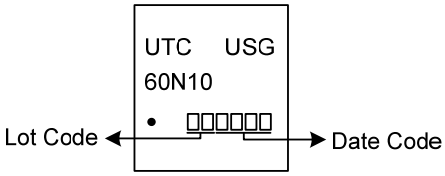
■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
USG60N10L-TN3-R	USG60N10G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
USG60N10L-TQ2-T	USG60N10G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	Tube
USG60N10L-TQ2-R	USG60N10G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	Tape Reel
USG60N10L-S08-R	USG60N10G-S08-R	SOP-8	S	S	S	G	D	D	D	D	Tape Reel
USG60N10L-P5060-R	USG60N10G-P5060-R	PDFN5×6	S	S	S	G	D	D	D	D	Tape Reel

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

USG60N10G-TN3-R (1)Packing Type (2)Package Type (3)Green Package	(1) R: Tape Reel, T: Tube (2) TN3: TO-252, TQ2: TO-263, S08: SOP-8, P5060: PDFN5×6 (3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

Package	Marking
TO-252 TO-263	
SOP-8	
PDFN5×6	

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	100	V
Gate-Source Voltage		V_{GSS}	±20	V
Drain Current	Continuous	I_D	60	A
	Pulsed (Note 2)	I_{DM}	100	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	3.7	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.83	V/ns
Power Dissipation	TO-252	P_D	65	W
	TO-263		80	W
	SOP-8		6	W
	PDFN5×6		58	W
Junction Temperature		T_J	+150	°C
Storage Temperature Range		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 = 0.1mH, I_{AS} =8.6A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C.
4. I_{SD} ≤ 30A, di/dt ≤ 200A/μs, V_{DD} ≤ $V_{(BR)DSS}$, T_J = 25°C.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-252	θ_{JA}	110	°C/W
	TO-263		62.5	°C/W
	SOP-8		90 (Note)	°C/W
	PDFN5×6		65 (Note)	°C/W
Junction to Case	TO-252	θ_{JC}	1.92 (Note)	°C/W
	TO-263		1.56	°C/W
	SOP-8		20.8 (Note)	°C/W
	PDFN5×6		2.15 (Note)	°C/W

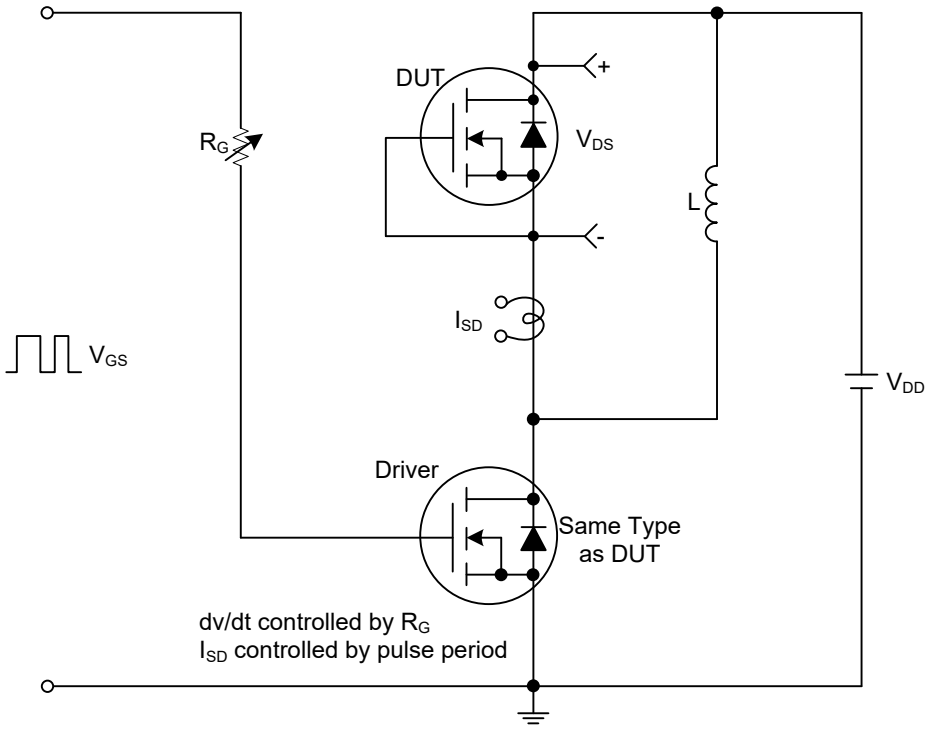
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

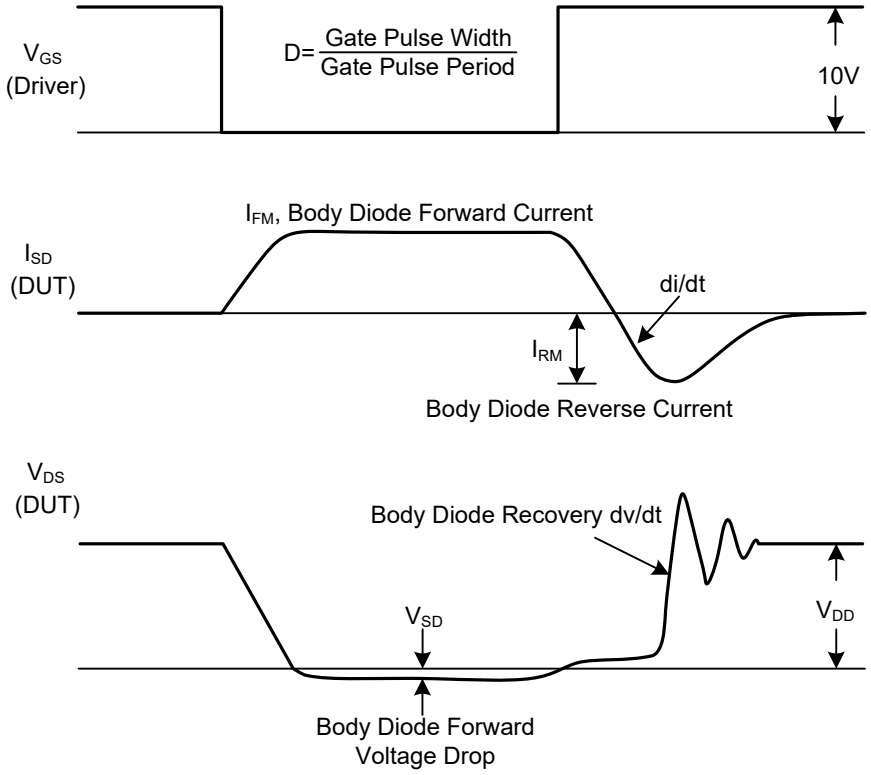
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	I_D=250μA, V_{GS}=0V	100			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=100V, V_{GS}=0V			1	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS}=+20V, V_{DS}=0V			+100	nA
	Reverse		V_{GS}=-20V, 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=30A			10.5	mΩ
			V_{GS}=4.5V, I_D=20A			15	mΩ
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		2048		pF
Output Capacitance		C_{OSS}			944		pF
Reverse Transfer Capacitance		C_{RSS}			95		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=80V, V_{GS}=10V, I_D=60A, I_G=1mA (Note 1, 2)		44		nC
Gate to Source Charge		Q_{GS}			9		nC
Gate to Drain Charge		Q_{GD}			12		nC
Turn-on Delay Time (Note 1)		$t_{D(ON)}$	V_{DD}=50V, V_{GS}=10V, I_D=60A, R_G =3.3Ω (Note 1, 2)		10		ns
Rise Time		t_R			16		ns
Turn-off Delay Time		$t_{D(OFF)}$			30		ns
Fall-Time		t_F			20		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				60	A
Maximum Body-Diode Pulsed Current		I_{SM}				120	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_S=60A, V_{GS}=0V			1.2	V
Reverse Recovery Time (Note 1)		t_{rr}	I_S=30A, V_{GS}=0V, dI_F/dt =100A/μs		60		nS
Reverse Recovery Charge		Q_{rr}			225		nC

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

■ TEST CIRCUITS AND WAVEFORMS



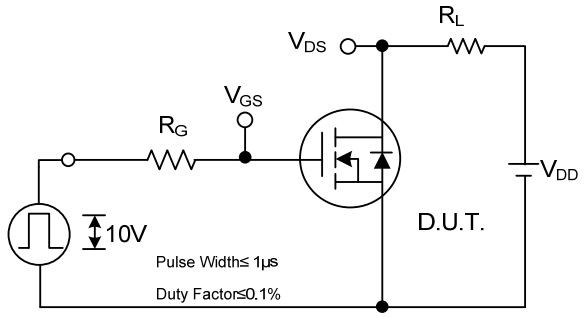
Peak Diode Recovery dv/dt Test Circuit



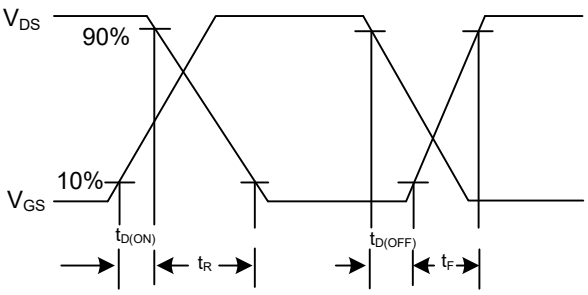
Peak Diode Recovery dv/dt Test Circuit and Waveforms

Peak Diode Recovery dv/dt Waveforms

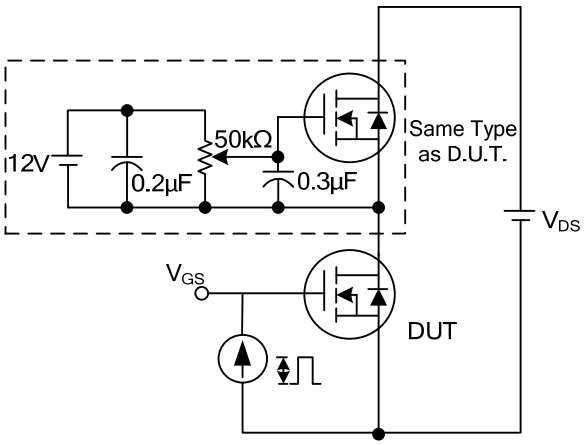
■ TEST CIRCUITS AND WAVEFORMS



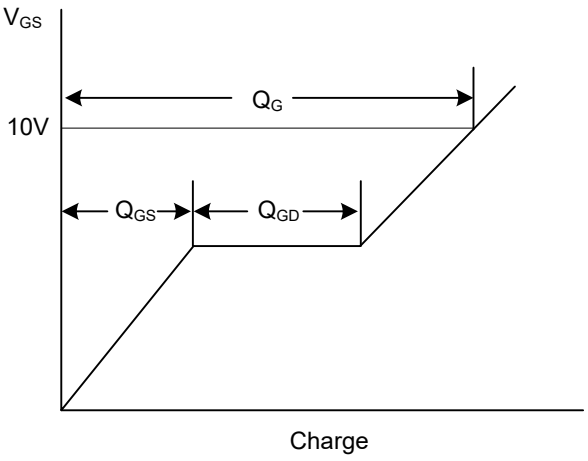
Switching Test Circuit



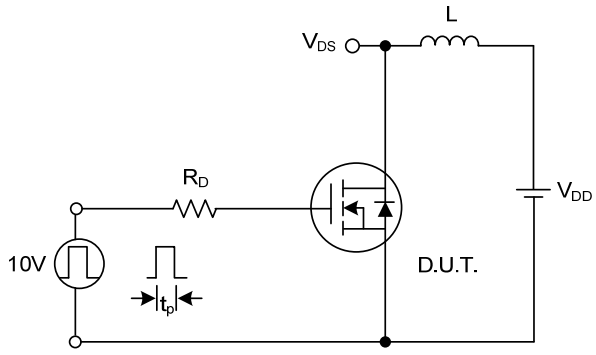
Switching Waveforms



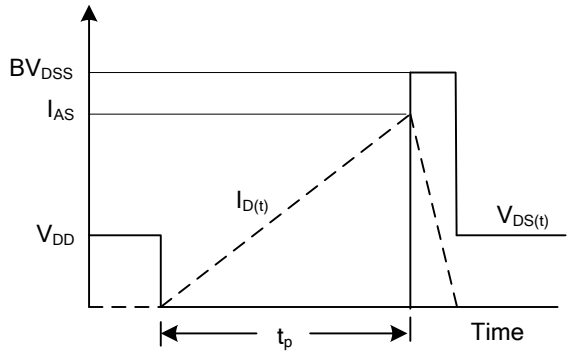
Gate Charge Test Circuit



Gate Charge Waveform



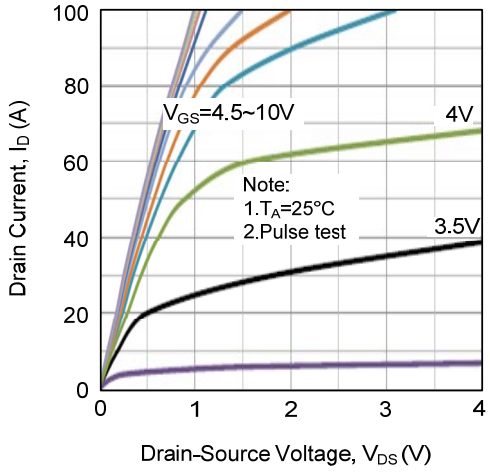
Unclamped Inductive Switching Test Circuit



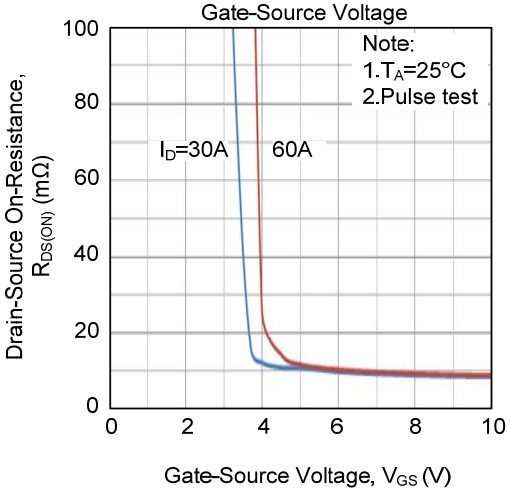
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

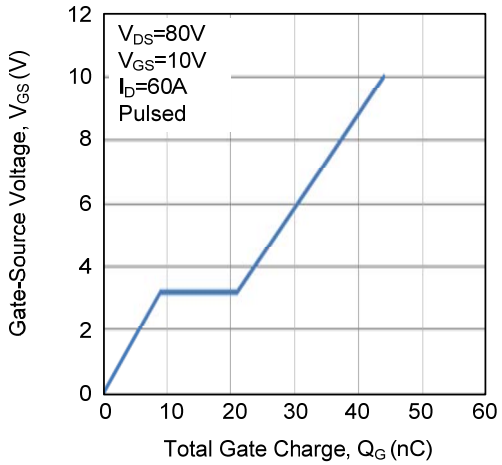
Drain Current vs. Drain-Source Voltage



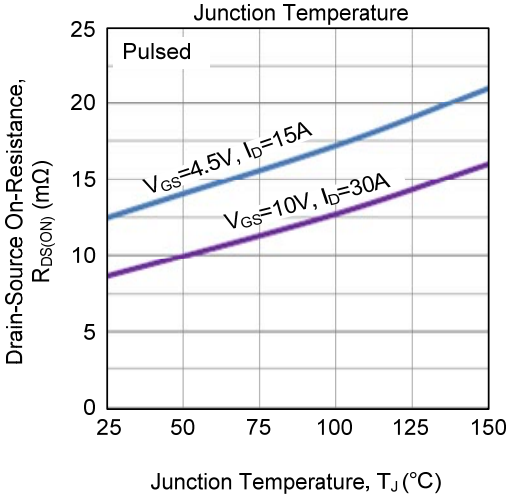
Drain-Source On-Resistance vs. Gate-Source Voltage



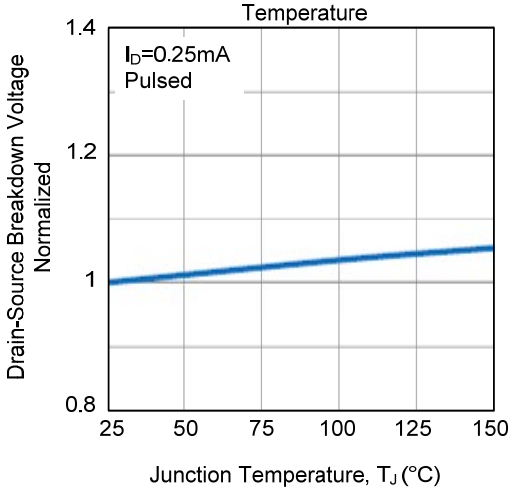
Gate Charge Characteristics



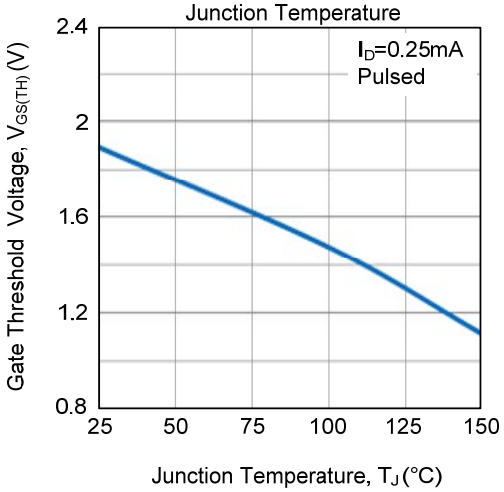
Drain-Source On-Resistance vs. Junction Temperature



Breakdown Voltage vs. Junction Temperature

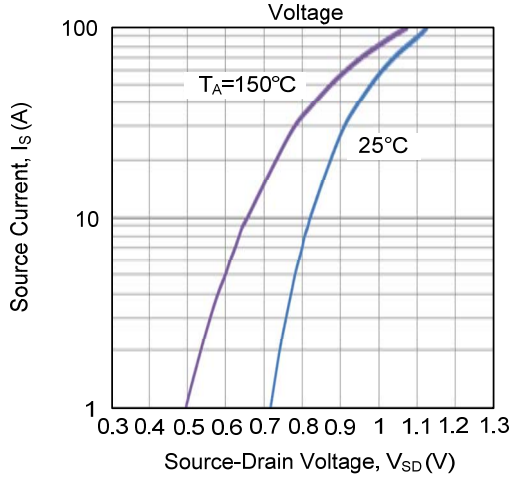


Gate Threshold Voltage vs. Junction Temperature

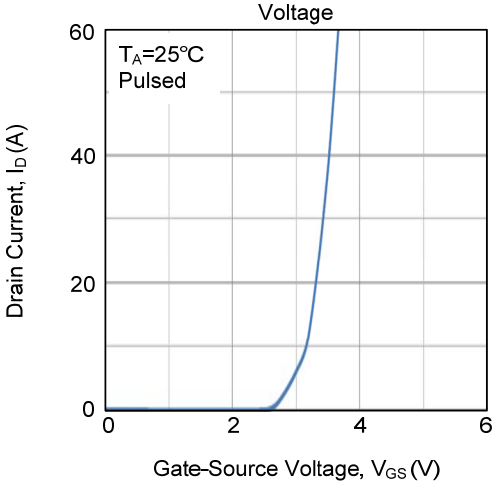


■ TYPICAL CHARACTERISTICS (Cont.)

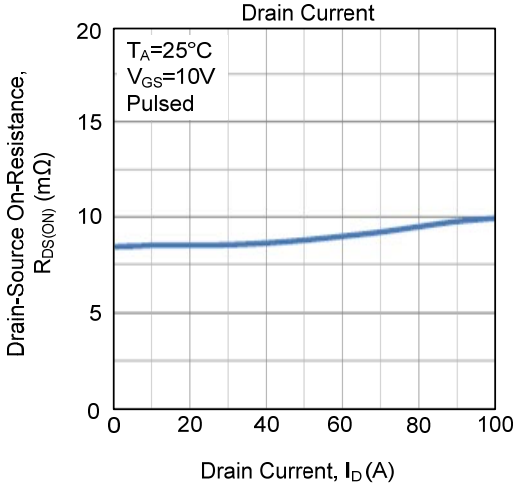
Source Current vs. Source-Drain Voltage



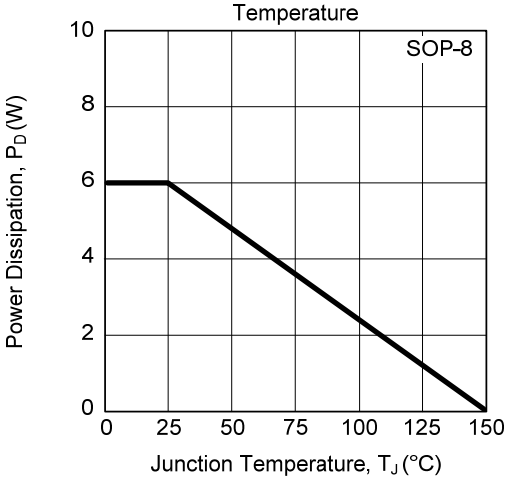
Drain Current vs. Gate-Source Voltage



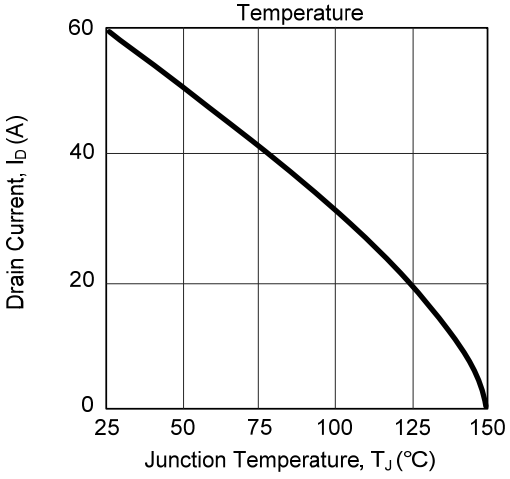
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



Safe Operating Area