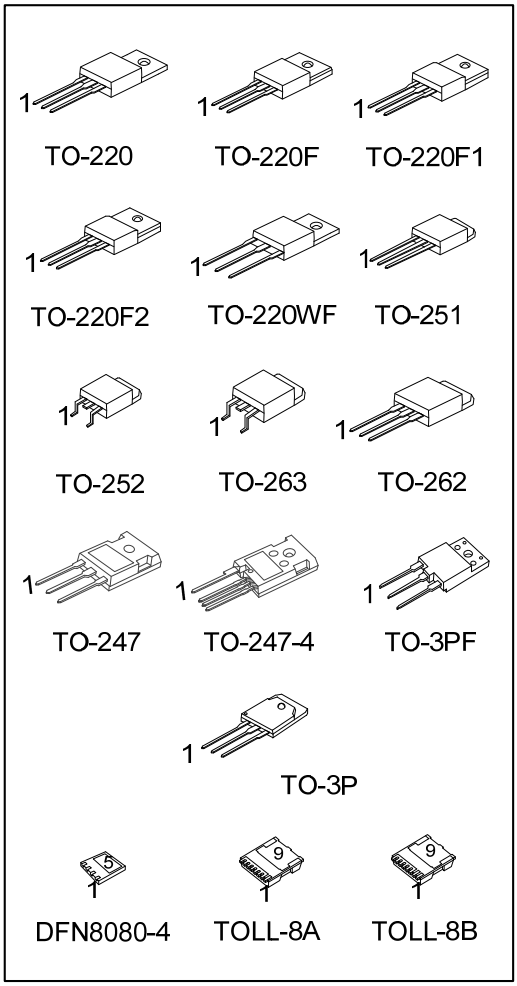
20NM60G2

POWER MOSFET

20A, 600V N-CHANNEL SUPER-JUNCTION MOSFET



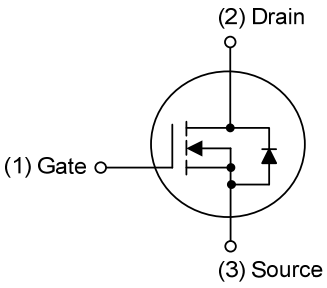
■ DESCRIPTION

The UTC **20NM60G2** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

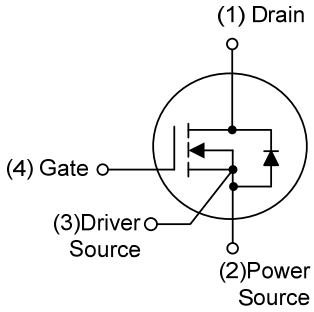
■ FEATURES

* $R_{DS(ON)} \leq 0.22\ \Omega$ @ V_{GS}=10V, I_D=4.5A
* Fast Switching Capability
* Avalanche Energy Specified
* Improved dv/dt Capability, High Ruggedness

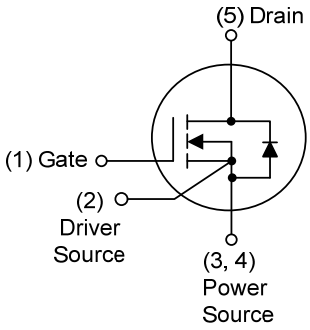
■ SYMBOL



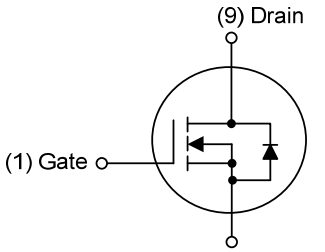
TO-220 / TO-220F / TO-220F1 / TO-220F2
TO-220WF / TO-251 / TO-252 / TO-3P
TO-3PF / TO-247 /TO-247-4 / TO-262 / TO-263



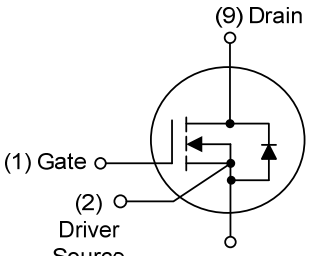
TO-247-4



DFN8080-4



TOLL-8A

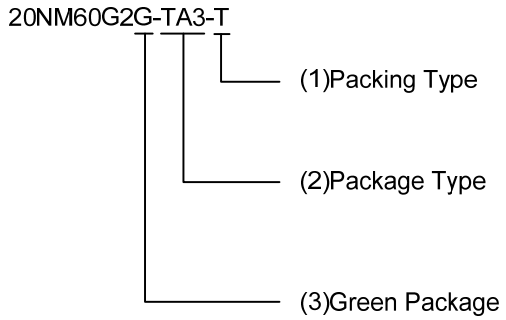


TOLL-8B

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment									Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
20NM60G2L-TA3-T	20NM60G2G-TA3-T	TO-220	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TF1-T	20NM60G2G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TF2-T	20NM60G2G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TF3-T	20NM60G2G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TW1-T	20NM60G2G-TW1-T	TO-220WF	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TM3-T	20NM60G2G-TM3-T	TO-251	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TN3-R	20NM60G2G-TN3-R	TO-252	G	D	S	-	-	-	-	-	-	Tape Reel
20NM60G2L-T2Q-T	20NM60G2G-T2Q-T	TO-262	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TQ2-T	20NM60G2G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-TQ2-R	20NM60G2G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	-	Tape Reel
20NM60G2L-T3P-T	20NM60G2G-T3P-T	TO-3P	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-T3F-T	20NM60G2G-T3F-T	TO-3PF	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-T47-T	20NM60G2G-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube
20NM60G2L-T474-T	20NM60G2G-T474-T	TO-247-4	D	S	S	G	-	-	-	-	-	Tube
20NM60G2L-K04-8080-R	20NM60G2G-K04-8080-R	DFN8080-4	G	S	S	S	D	-	-	-	-	Tape Reel
20NM60G2L-T8A-R	20NM60G2G-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	D	Tape Reel
20NM60G2L-T8B-R	20NM60G2G-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel

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

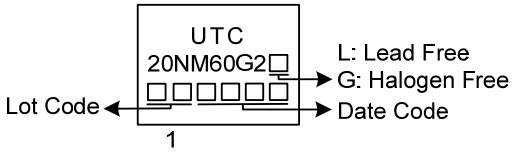
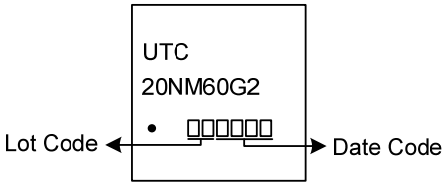
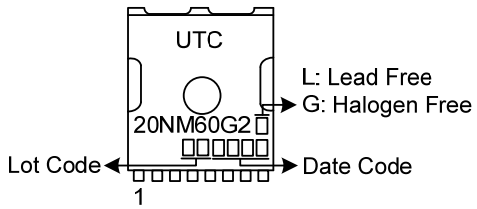


(1) T: Tube, R: Tape Reel

(2) TA3: TO-220, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F, TW1: TO-220WF, TM3: TO-251, TN3: TO-252, T2Q: TO-262, TQ2: TO-263, T3P: TO-3P, T3F: TO-3PF, T47: TO-247, T474: TO-247-4, K04-8080: DFN8080-4, T8A: TOLL-8A, T8B: TOLL-8B

(3) G: Halogen Free and Lead Free L: Lead Free

■ MARKING

TO-220 / TO-220F / TO-220F1 / TO-220F2 TO-220WF / TO-251 / TO-252 / TO-3P TO-3PF / TO-247 /TO-247-4 / TO-262 / TO-263	DFN8080-4
	
TOLL-8A / TOLL-8B	-
	-

■ 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	T_C=25°C	I_D	18	A
		T_C=100°C		11.4	A
	Pulsed (Note 2)		I_{DM}	54	A
Avalanche Current (Note 2)			I_{AR}	2.9	A
Avalanche Energy	Single Pulsed (Note 3)		E_{AS}	560	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	6.0	V/ns
Power Dissipation	TO-220/TO-262 TO-263		P_D	104	W
	TO-220F/TO-220F1 TO-220F2/TO-220WF			33	W
	TO-3P			130	W
	TO-3PF			55	W
	TO-247/TO-247-4			120	W
	TO-251/TO-252			64	W
	DFN8080-4			60	W
	TOLL-8A/TOLL-8B			195	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 = 133 mH, I_{AS} = 2.9A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤18A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220WF/TO-262 TO-263	$θ_{JA}$	62.5	°C/W
	TO-3P		30	°C/W
	TO-3PF		30	°C/W
	TO-247/TO-247-4		40	°C/W
	TO-251/TO-252		110	°C/W
	DFN8080-4		35	°C/W
	TOLL-8A/TOLL-8B		35	°C/W
Junction to Case	TO-220/TO-262 TO-263	$θ_{JC}$	1.2	°C/W
	TO-220F/TO-220F1 TO-220F2/TO-220WF		3.78	°C/W
	TO-3P		0.96	°C/W
	TO-3PF		2.27	°C/W
	TO-247/TO-247-4		1.04	°C/W
	TO-252		1.95 (Note)	°C/W
	DFN8080-4		2.08 (Note)	°C/W
	TOLL-8A/TOLL-8B		0.64 (Note)	°C/W

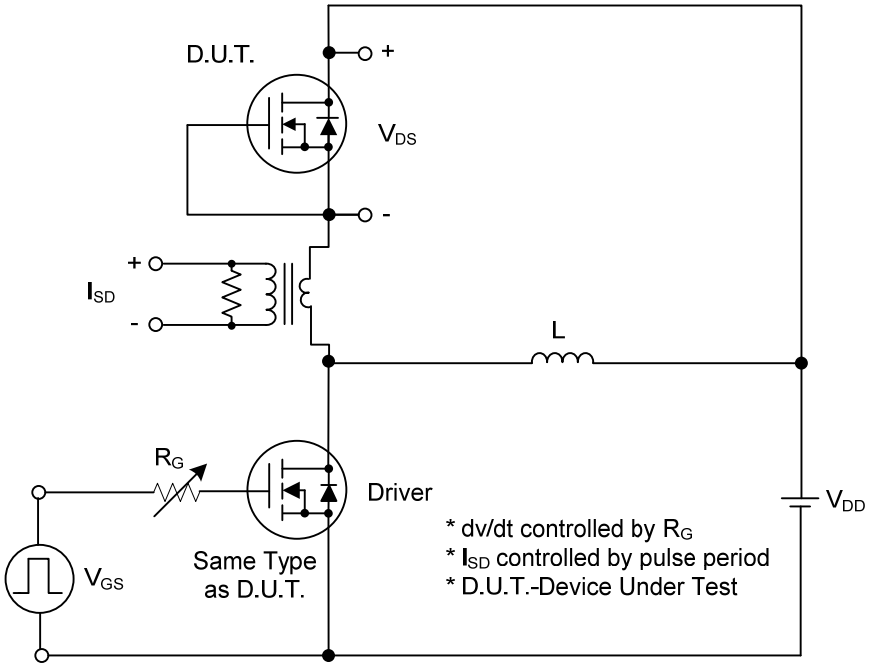
Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

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

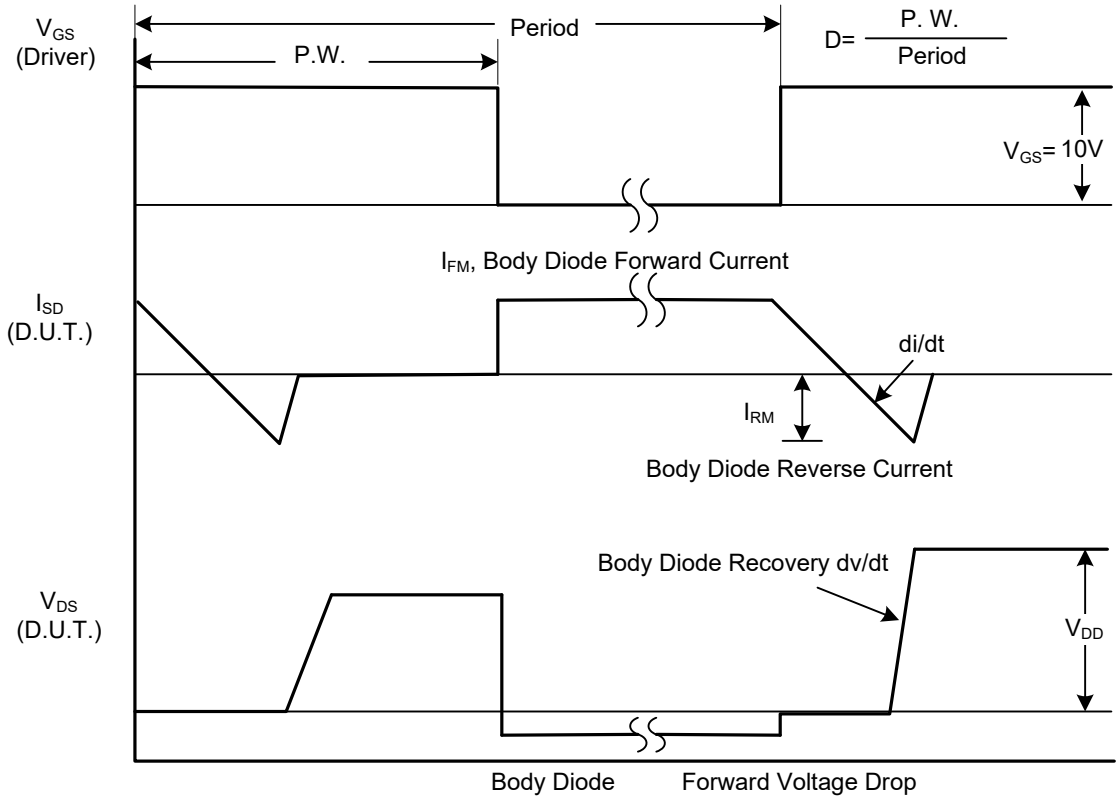
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS}=0V, I_D=250μA	600			V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	μA
Gate-Body Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=±30V			±100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	2.5		4.5	V
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=4.5A		0.18	0.22	Ω
DYNAMIC PARAMETERS						
Input Capacitance	C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1MHz		1100		pF
Output Capacitance	C_{OSS}			750		pF
Reverse Transfer Capacitance	C_{RSS}			65		pF
Gate Resistance	R_G	V_{GS}=0V, V_{DS}=0V, f=1MHz		1.5		Ω
SWITCHING PARAMETERS						
Total Gate Charge (Note 1)	Q_G	V_{DS}=100V, I_D=18A, V_{GS}=10V I_G=1mA (Note 1, 2)		38		nC
Gate to Source Charge	Q_{GS}			10		nC
Gate to Drain Charge	Q_{GD}			16		nC
Turn-ON Delay Time (Note 1)	$t_{D(ON)}$	V_{DD}=100V, V_{GS}=10V, I_D=18A, R_G=25Ω (Note 1, 2)		20		ns
Rise Time	t_R			26		ns
Turn-OFF Delay Time	$t_{D(OFF)}$			116		ns
Fall-Time	t_F			45		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I_S				18	A
Maximum Body-Diode Pulsed Current	I_{SM}				54	A
Drain-Source Diode Forward Voltage (Note 1)	V_{SD}	I_S=18A, V_{GS}=0V			1.5	V
Body Diode Reverse Recovery Time (Note 1)	t_{rr}	I_S=18A, V_{GS}=0V, dI_F/dt=100A/μs		420		ns
Body Diode Reverse Recovery Charge	Q_{rr}			7		μC

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

■ TEST CIRCUITS AND WAVEFORMS

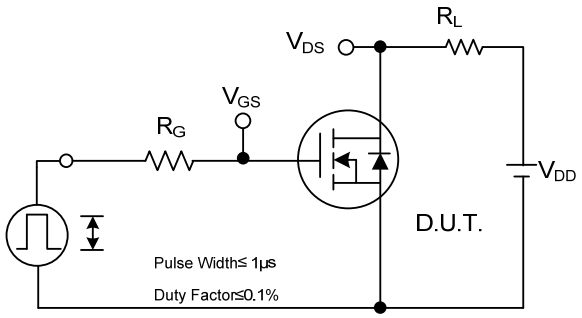


Peak Diode Recovery dv/dt Test Circuit

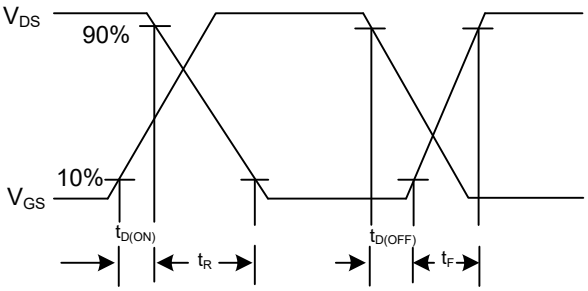


Peak Diode Recovery dv/dt Waveforms

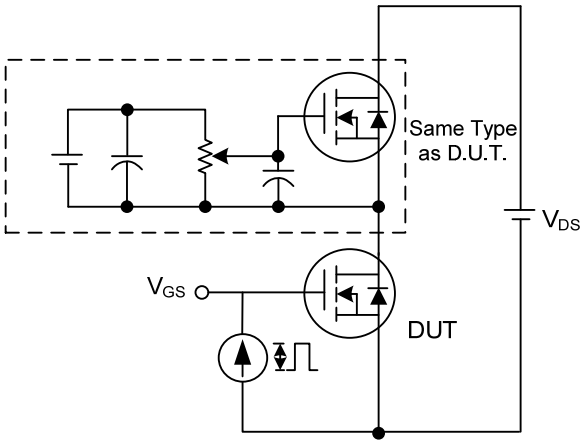
■ TEST CIRCUITS AND WAVEFORMS



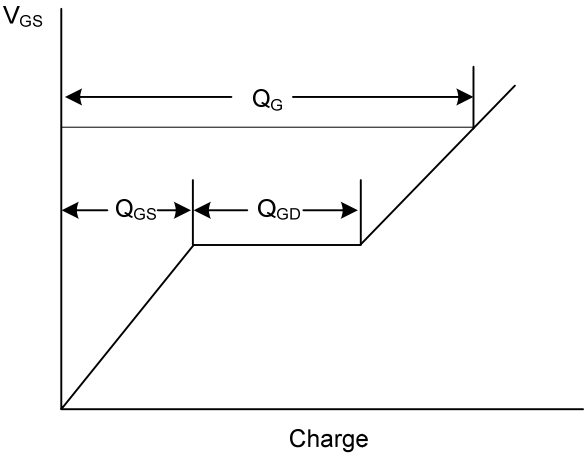
Switching Test Circuit



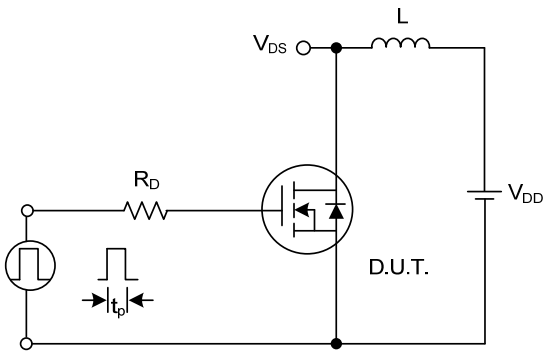
Switching Waveforms



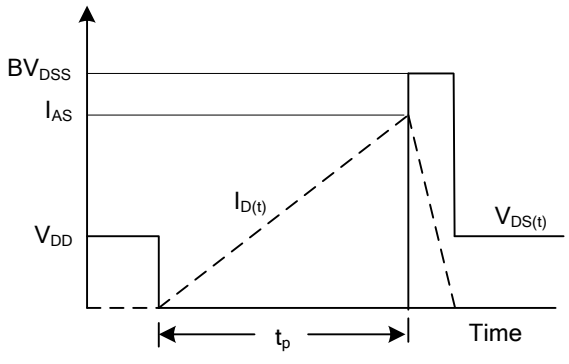
Gate Charge Test Circuit



Gate Charge Waveform



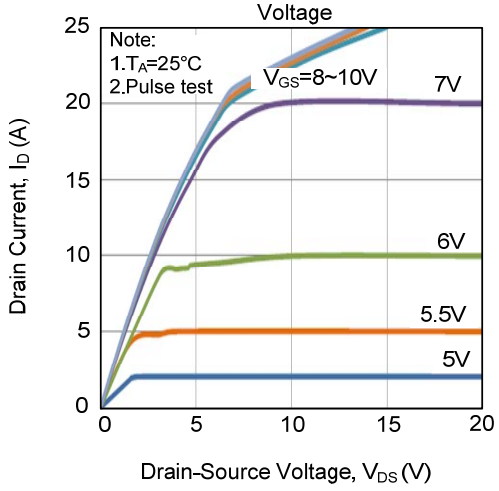
Unclamped Inductive Switching Test Circuit



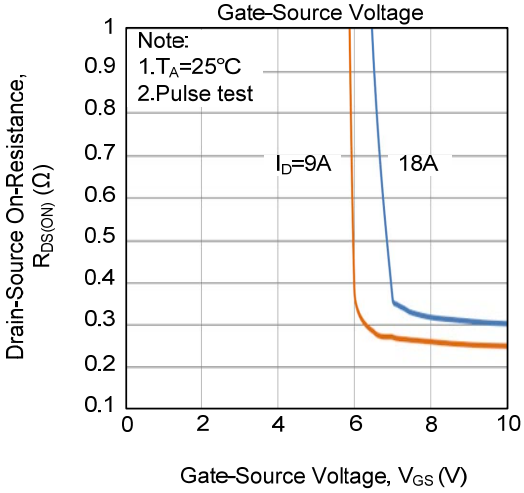
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

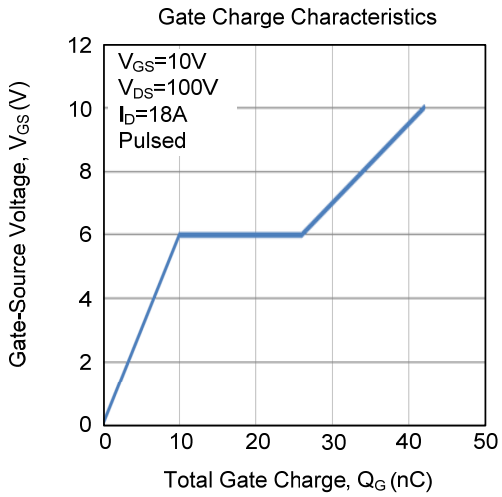
Drain Current vs. Drain-Source Voltage



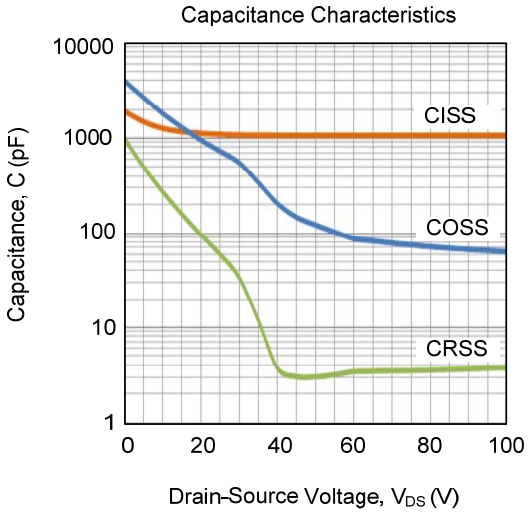
Drain-Source On-Resistance vs. Gate-Source Voltage



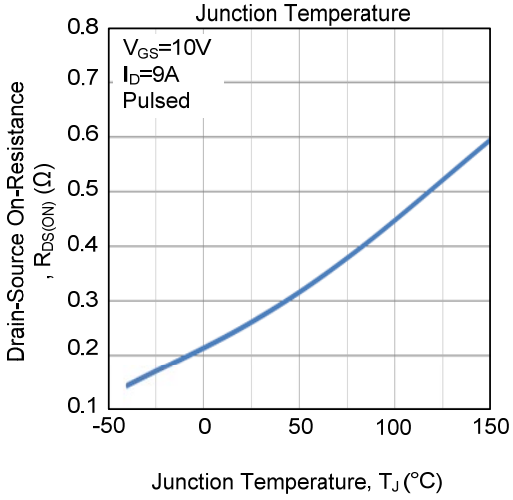
Gate Charge Characteristics



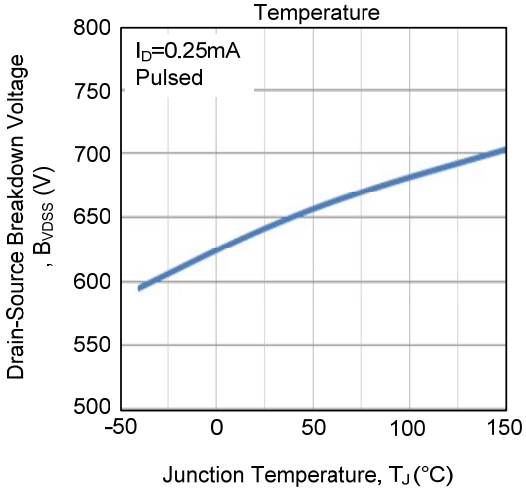
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

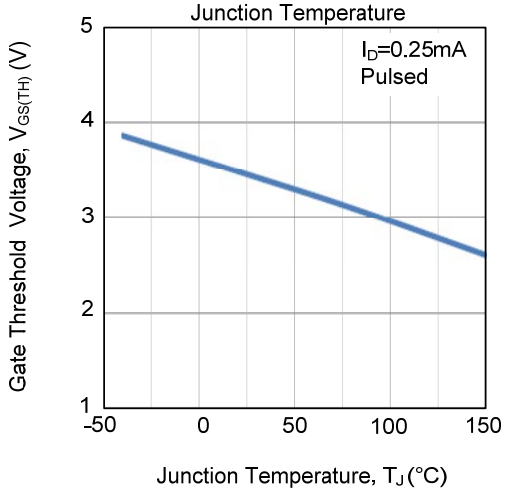


Breakdown Voltage vs. Junction Temperature

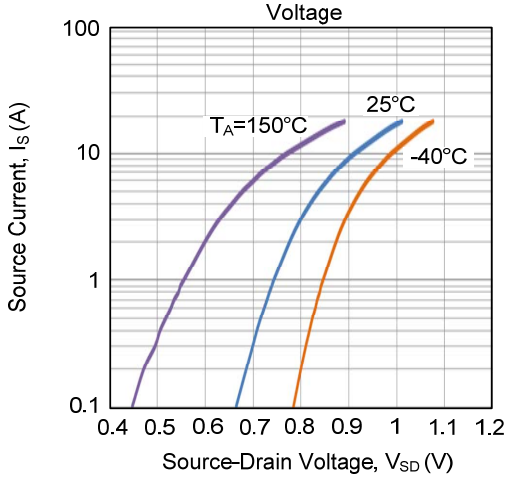


■ TYPICAL CHARACTERISTICS (Cont.)

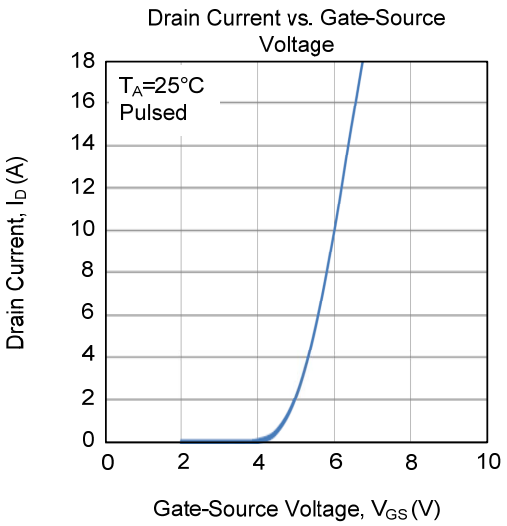
Gate Threshold Voltage vs. Junction Temperature



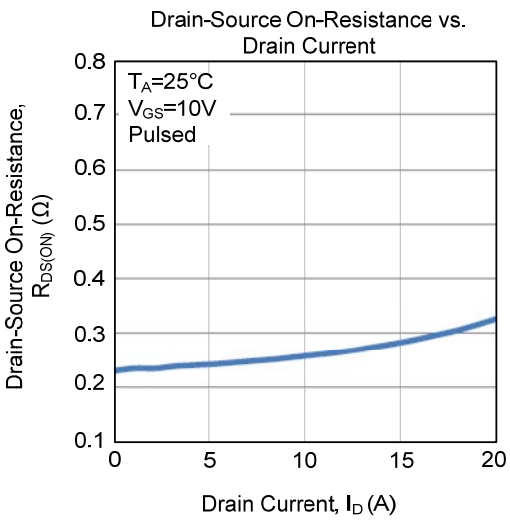
Source Current vs. Source-Drain Voltage



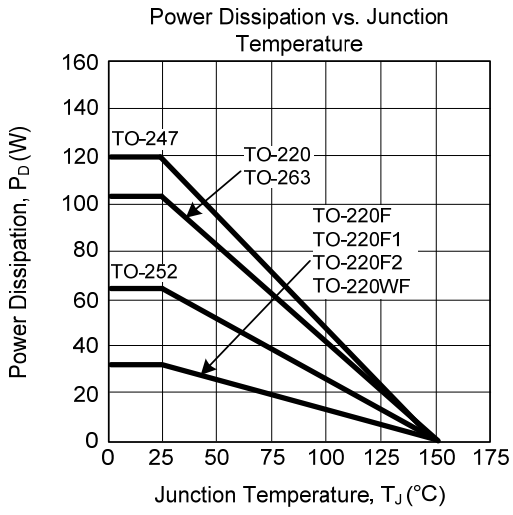
Drain Current vs. Gate-Source Voltage



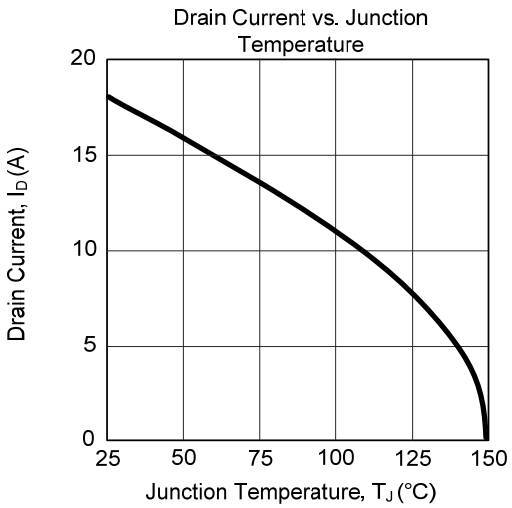
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)