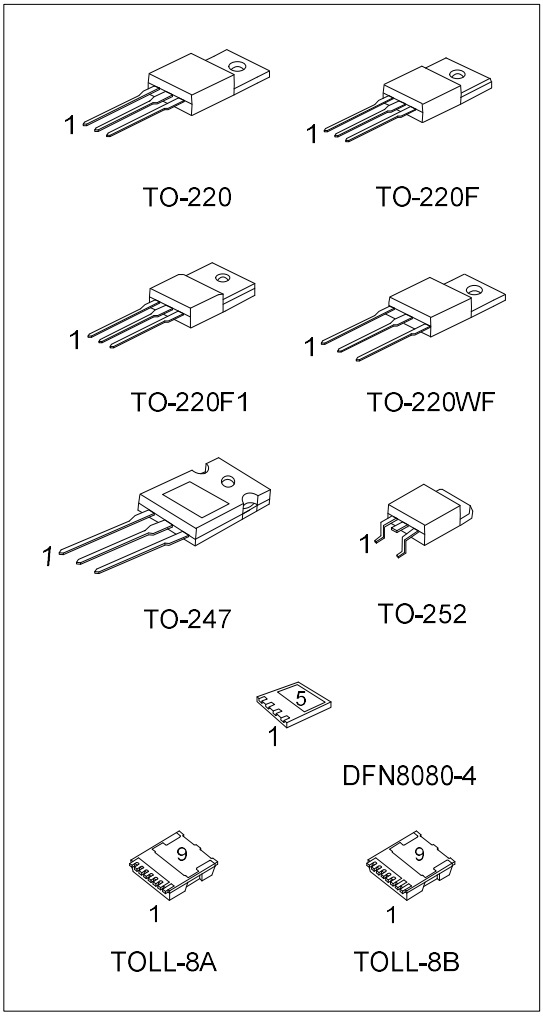
USJ60R190Z

Power MOSFET

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



■ DESCRIPTION

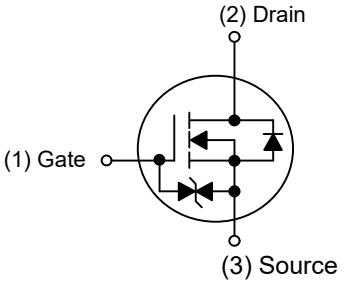
The **UTC USJ60R190Z** is a Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and a high rugged avalanche characteristics. This power MOSFET is usually used at AC-DC converters for power applications.

■ FEATURES

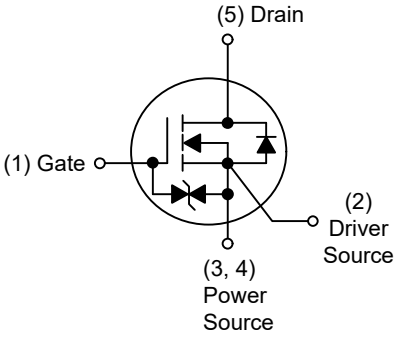
* $R_{DS(ON)} \leq 0.19\ \Omega$ @ V_{GS} = 10V, I_D = 5.0A
* Fast switching capability
* Avalanche energy tested
* Improved dv/dt capability, high ruggedness
* With ESD protection

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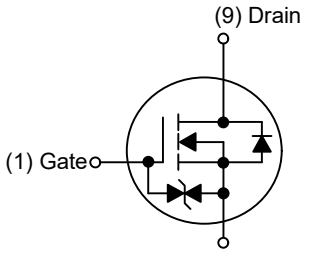
■ SYMBOL



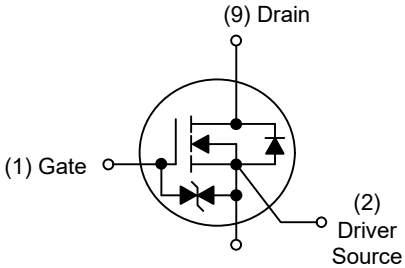
TO-220 / TO-220F / TO-220F1
TO-220WF / TO-247 / TO-252



DFN8080-4



TOLL-8A

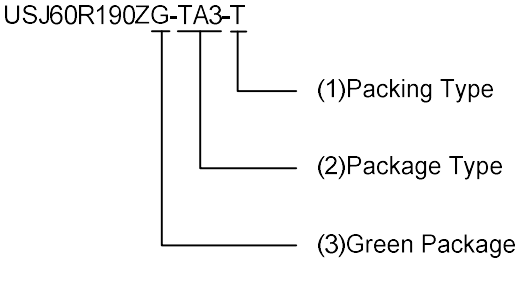


TOLL-8B

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment									Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
USJ60R190ZL-TA3-T	USJ60R190ZG-TA3-T	TO-220	G	D	S	-	-	-	-	-	-	Tube
USJ60R190ZL-TF1-T	USJ60R190ZG-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	-	Tube
USJ60R190ZL-TF3-T	USJ60R190ZG-TF3-T	TO-220F	G	D	S	-	-	-	-	-	-	Tube
USJ60R190ZL-TW1-T	USJ60R190ZG-TW1-T	TO-220WF	G	D	S	-	-	-	-	-	-	Tube
USJ60R190ZL-TN3-R	USJ60R190ZG-TN3-R	TO-252	G	D	S	-	-	-	-	-	-	Tape Reel
USJ60R190ZL-T47-T	USJ60R190ZG-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube
USJ60R190ZL-K04-8080-R	USJ60R190ZG-K04-8080-R	DFN8080-4	G	S	S	S	D	-	-	-	-	Tape Reel
USJ60R190ZL-T8A-R	USJ60R190ZG-T8A-R	TOLL-8A	G	S	S	S	S	S	S	S	D	Tape Reel
USJ60R190ZL-T8B-R	USJ60R190ZG-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel

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

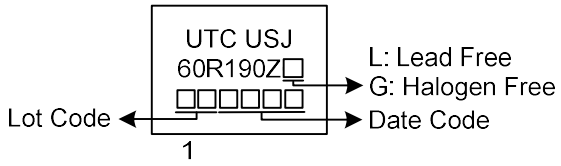
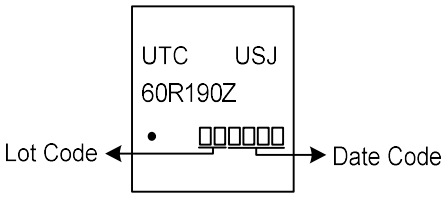
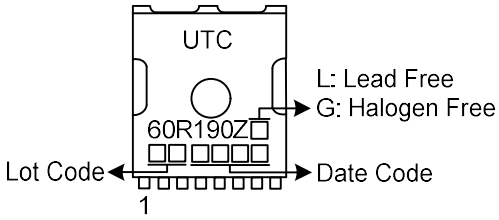


(1) T: Tube, R: Tape Reel

(2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F, TW1: TO-220WF, TN3: TO-252, T47: TO-247, K04-8080: DFN8080-4, T8A: TOLL-8A TB8: TOLL-8B

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

■ MARKING

TO-220 / TO-220F / TO-220F1 TO-220WF / TO-252 / TO-247	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	I_D	20	A
	Pulsed (Note 2)	I_{DM}	60	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	181	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.3	V/ns
Power Dissipation	TO-220	P_D	92	W
	TO-220F/TO-220F1 TO-220WF		29	W
	TO-252		64	W
	TO-247		125	W
	DFN8080-4		62	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 = 100mH, I_{AS} = 1.9A, V_{DD} = 50V, R_G = 25 Ω Starting T_J = 25°C
4. I_{SD} ≤ 20A, 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-220WF	θ_{JA}	62.5	°C/W
	TO-252		110	°C/W
	TO-247		40	°C/W
	DFN8080-4 TOLL-8A/TOLL-8B		35 (Note)	°C/W
Junction to Case	TO-220	θ_{JC}	1.35	°C/W
	TO-220F/TO-220F1 TO-220WF		4.31	°C/W
	TO-252		1.95 (Note)	°C/W
	TO-247		1	°C/W
	DFN8080-4		2.01 (Note)	°C/W
	TOLL-8A/TOLL-8B		0.64 (Note)	°C/W

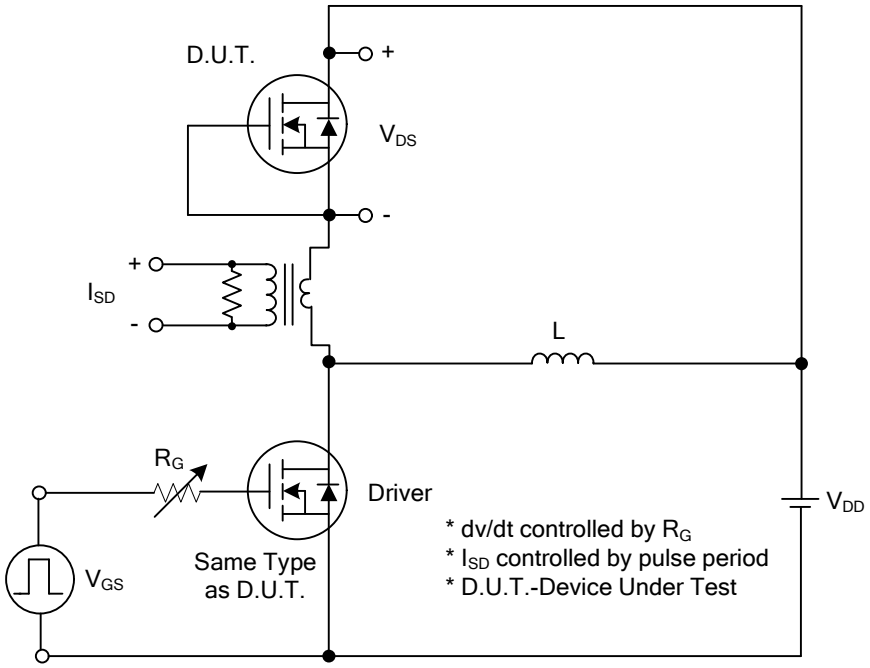
Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

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

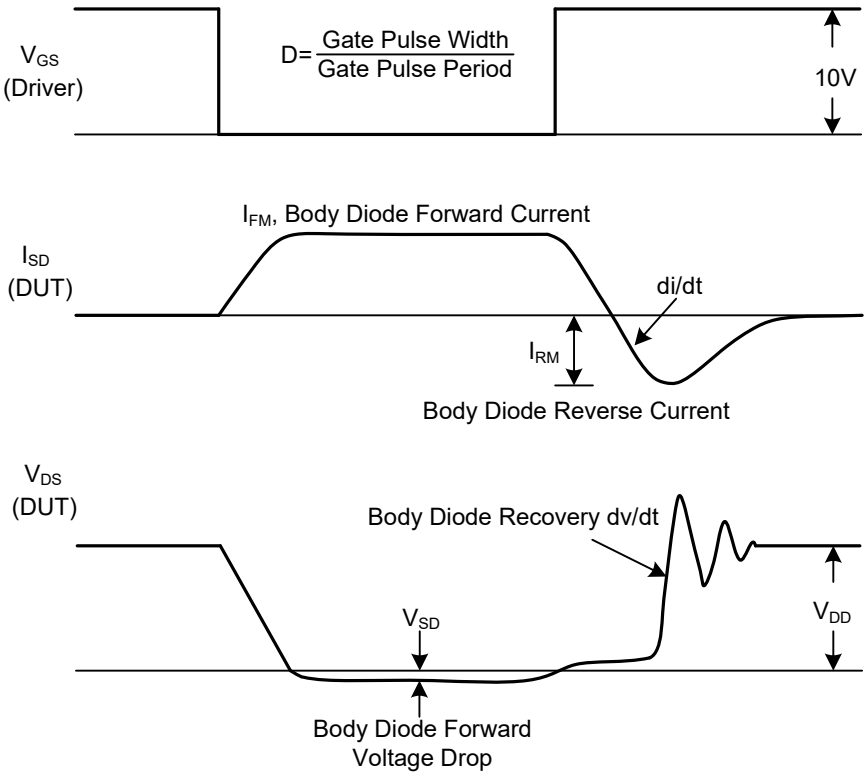
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250μA	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{DS}=0V ,V_{GS}=25V			10	μA
	Reverse		V_{DS}=0V ,V_{GS}=-20V			-10	μA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	2.5		4.5	V
Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS}=10V, I_D=5.0A			0.19	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=50V, f=1.0MHz		1150		pF
Output Capacitance		C_{OSS}			542		pF
Reverse Transfer Capacitance		C_{RSS}			42		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=480V, V_{GS}=10V, I_D=20A (Note 1, 2)		59		nC
Gate to Source Charge		Q_{GS}			12		nC
Gate to Drain Charge		Q_{GD}			28		nC
Internal Gate Input Resistance		R_G	V_{GS}=0V, f=1MHz		3.2		Ω
Turn-ON Delay Time (Note 1)		$t_{D(ON)}$	V_{DD}=100V, V_{GS}=10V, I_D=20A, R_G=25Ω (Note 1, 2)		26		ns
Rise Time		t_R			57		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			166		ns
Fall-Time		t_F			78		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				20	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_S=20A, V_{GS}=0V			1.4	V
Body Diode Reverse Recovery Time(Note 1)		t_{rr}	I_S =20A, V_{GS}=0V, dI_F/dt=100A/μs		404		ns
Body Diode Reverse Recovery Charge		Q_{rr}			6.3		μC

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

■ TEST CIRCUITS AND WAVEFORMS

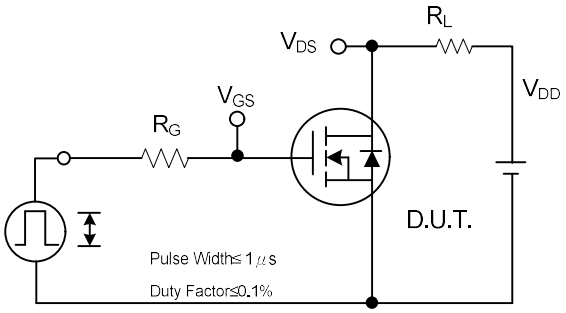


Peak Diode Recovery dv/dt Test Circuit

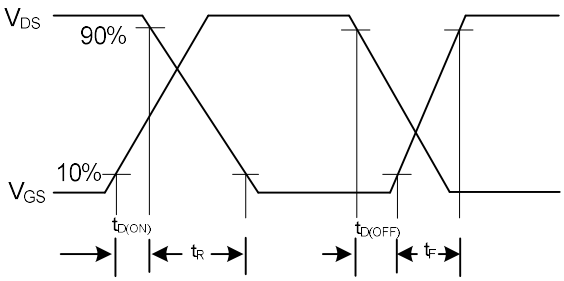


Peak Diode Recovery dv/dt Waveforms

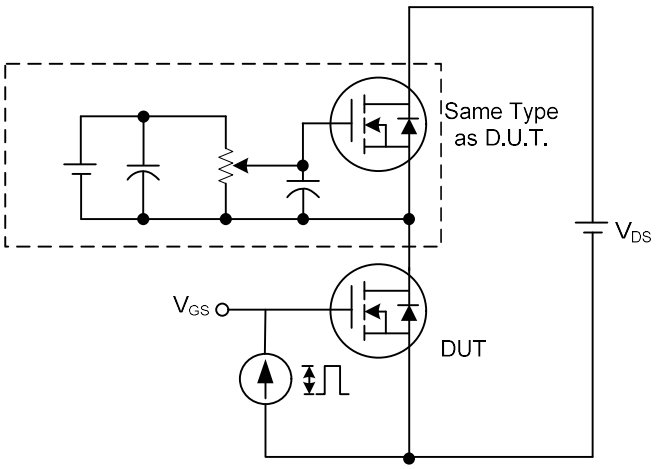
■ TEST CIRCUITS AND WAVEFORMS



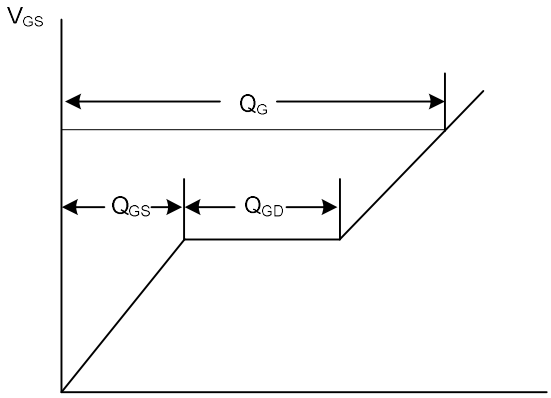
Switching Test Circuit



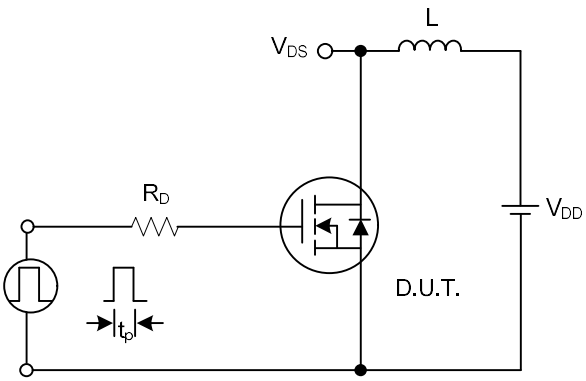
Switching Waveforms



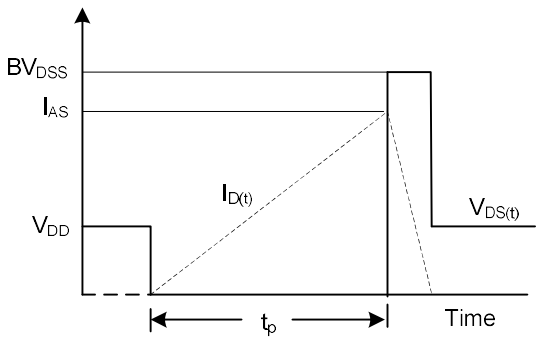
Gate Charge Test Circuit



Gate Charge Waveform



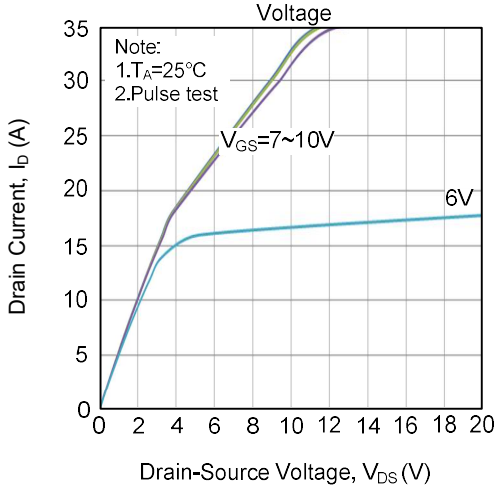
Unclamped Inductive Switching Test Circuit



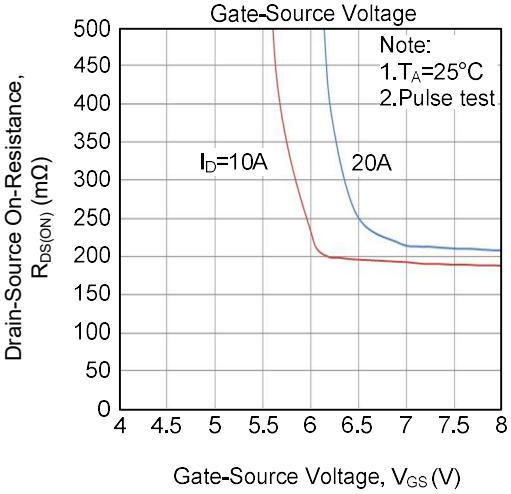
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

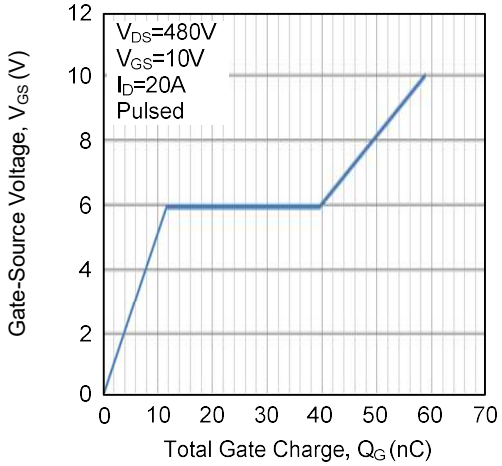
Drain Current vs. Drain-Source Voltage



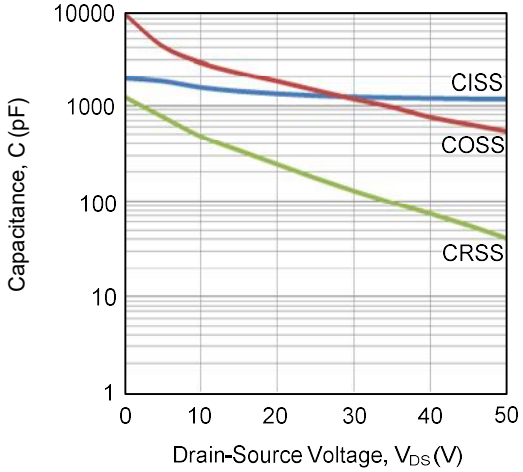
Drain-Source On-Resistance vs. Gate-Source Voltage



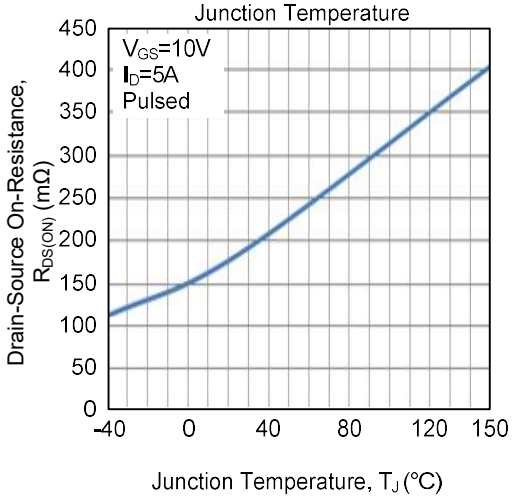
Gate Charge Characteristics



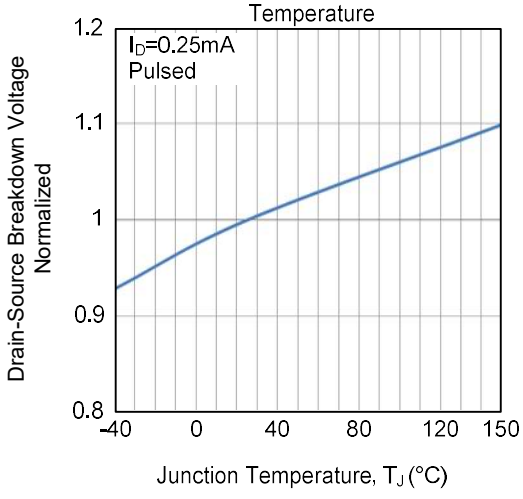
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

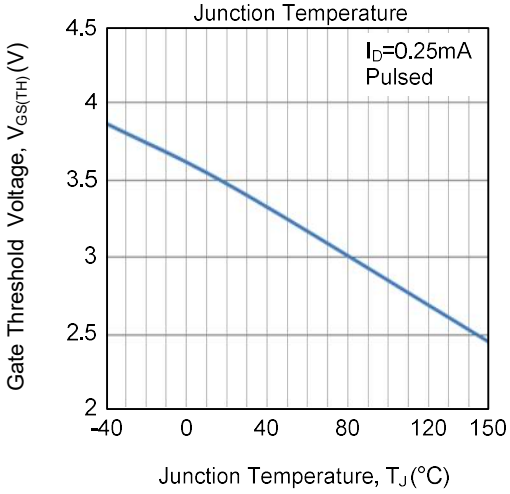


Breakdown Voltage vs. Junction Temperature

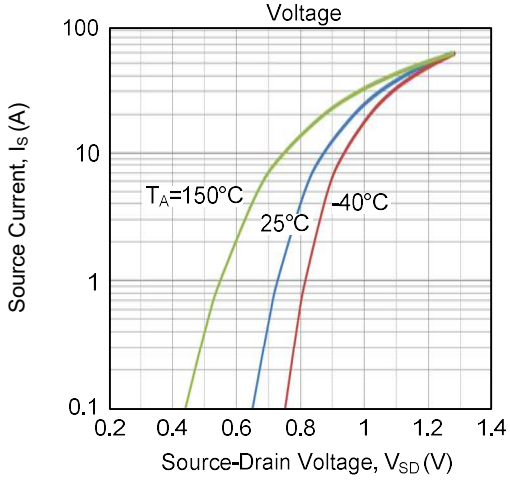


■ TYPICAL CHARACTERISTICS (Cont.)

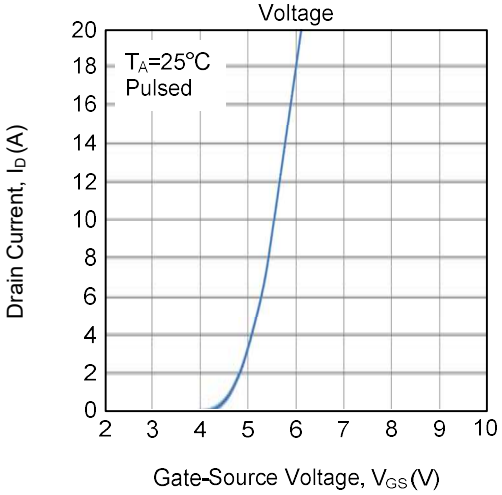
Gate Threshold Voltage vs. Junction Temperature



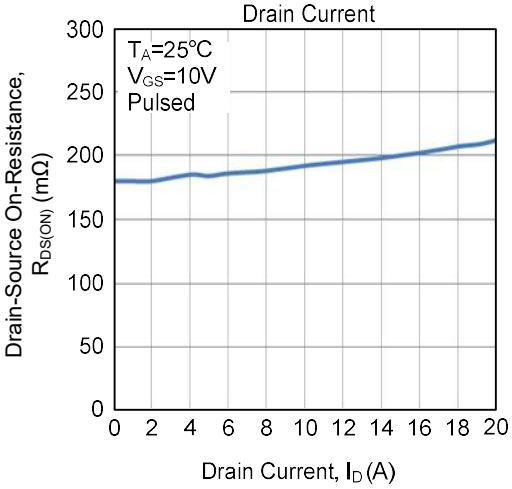
Source Current vs. Source-Drain Voltage



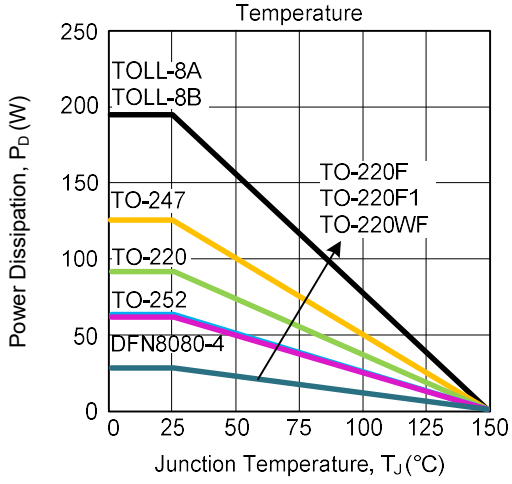
Drain Current vs. Gate-Source Voltage



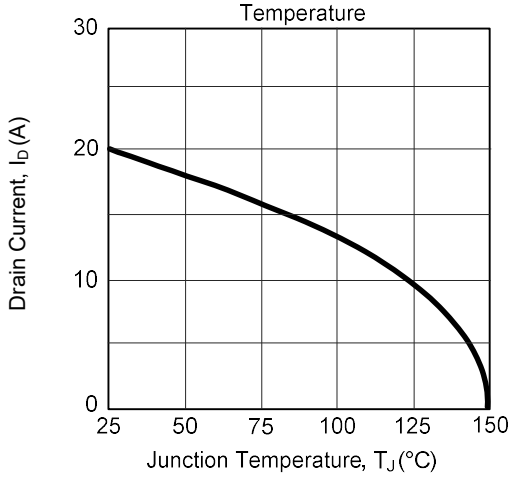
Drain-Source On-Resistance vs. Drain Current



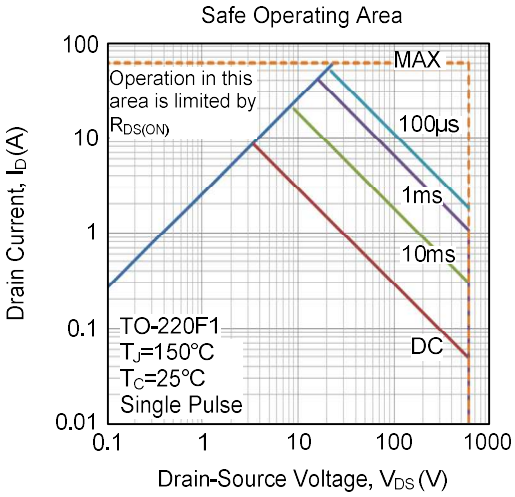
Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)



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