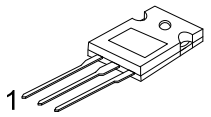
50NM60-U3

Power MOSFET

50A, 600V N-CHANNEL SUPER-JUNCTION MOSFET



TO-247

TOLL-8B

DFN8080-4

■ DESCRIPTION

The **UTC 50NM60-U3** 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

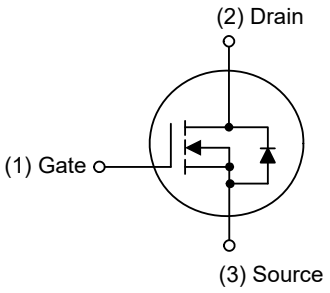
TO-247/TOLL-8B

* $R_{DS(ON)} \leq 63\ m\Omega$ @ V_{GS}=10V, I_D=25A

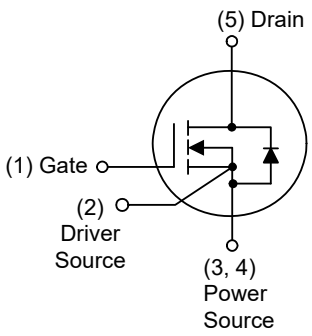
DFN8080-4

* $R_{DS(ON)} \leq 70\ m\Omega$ @ V_{GS}=10V, I_D=25A
* Fast switching capability
* Avalanche energy tested
* Improved dv/dt capability, high ruggedness

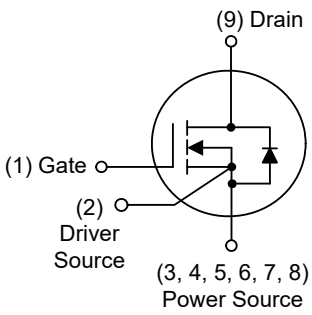
■ SYMBOL



TO-247



DFN8080-4

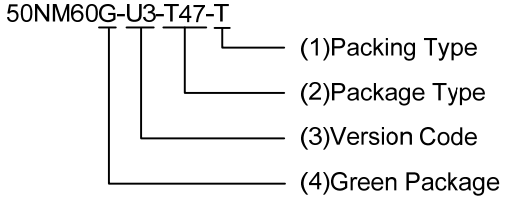


TOLL-8B

■ ORDERING INFORMATION

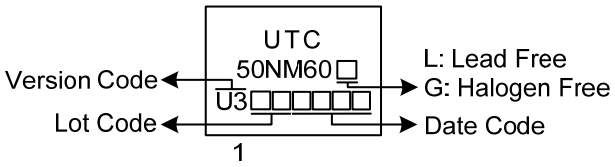
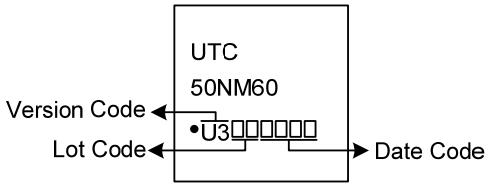
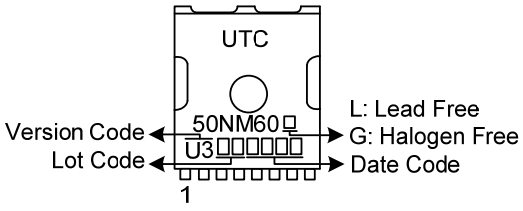
Ordering Number		Package	Pin Assignment									Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	9	
50NM60L-U3-T47-T	50NM60G-U3-T47-T	TO-247	G	D	S	-	-	-	-	-	-	Tube
50NM60L-U3-T8B-R	50NM60G-U3-T8B-R	TOLL-8B	G	S	S	S	S	S	S	S	D	Tape Reel
50NM60L-U3-K04-8080-R	50NM60G-U3-K04-8080-R	DFN8080-4	G	S	S	S	D	-	-	-	-	Tape Reel

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



(1) T: Tube, R: Tape Reel
(2) T47: TO-247, T8B: TOLL-8B,
K04-8080: DFN8080-4
(3) Version U3
(4) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

PACKAGE	MARKING
TO-247	
DFN8080-4	
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	50	A
		T_C=100°C		32.5	A
	Pulsed (Note 2)		I_{DM}	150	A
Avalanche Energy	Single Pulsed (Note 3)		E_{AS}	612	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	5.9	V/ns
Power Dissipation	TO-247		P_D	220	W
	TOLL-8B			300	W
	DFN8080-4			120	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} = 3.5A, V_{DD} = 90V, R_G = 25Ω, Starting T_J = 25°C
4. I_{SD} ≤ 30A, di/dt ≤ 200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-247/TOLL-8B	θ_{JA}	50	°C/W
	DFN8080-4		35	°C/W
Junction to Case	TO-247	θ_{JC}	0.56	°C/W
	TOLL-8B		0.41	°C/W
	DFN8080-4		1.04	°C/W

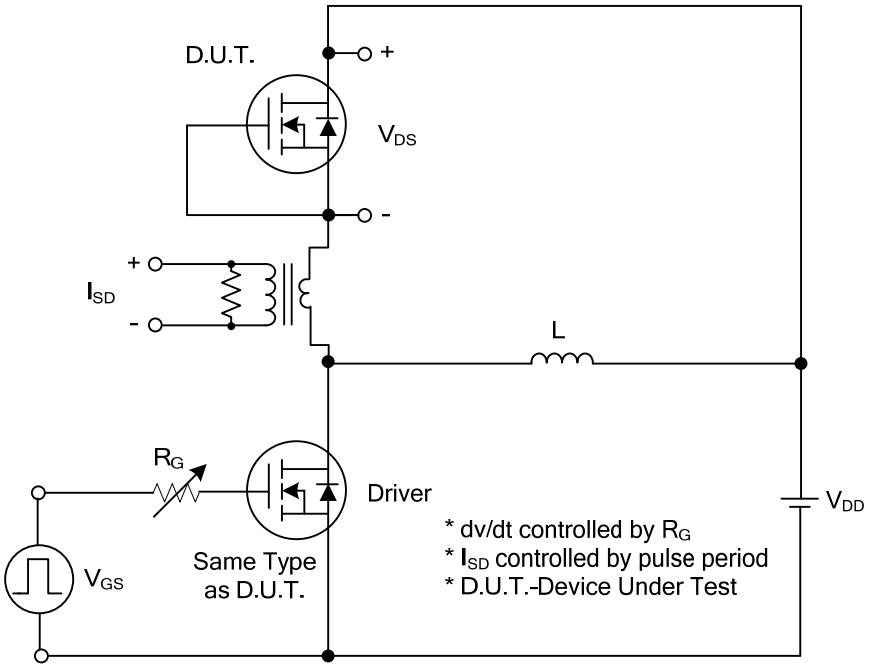
Note: Device mounted on FR-4 substrate P_C board, 2oz copper, with 1inch square copper plate.

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

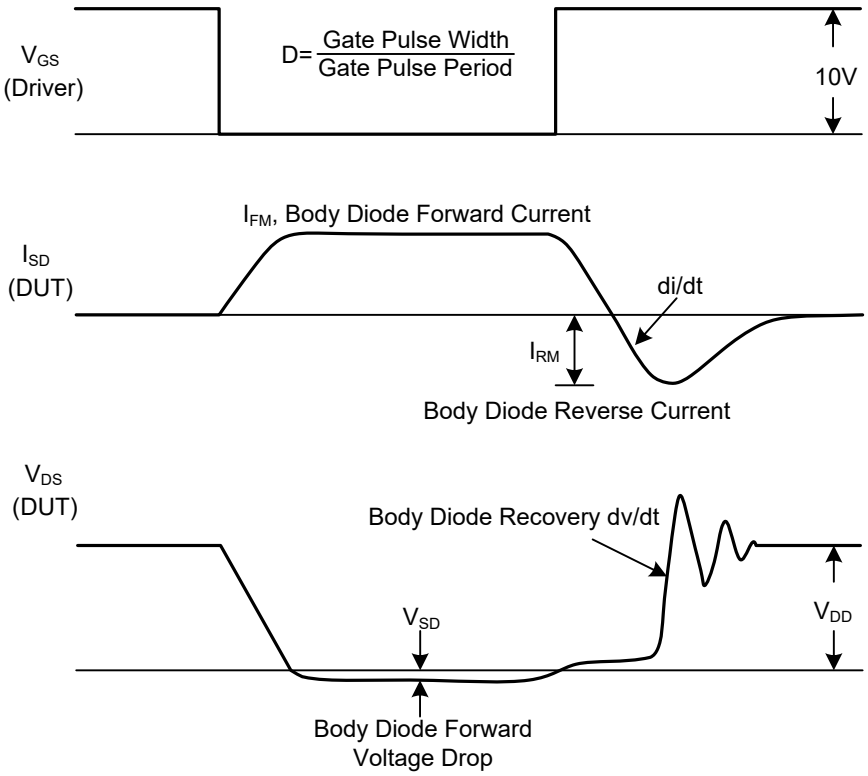
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250μA	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	μA
Gate-Source Leakage Current		I_{GSS}	V_{GS}=±30V, V_{DS}=0V			±100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	2.5		4.5	V
Static Drain-Source On-State Resistance	TO-247 TOLL-8B	$R_{DS(ON)}$	V_{GS}=10V, I_D=25A		52	63	mΩ
	DFN8080-4				58	70	mΩ
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=50V, f=1MHz		3450		pF
Output Capacitance		C_{OSS}			1075		pF
Reverse Transfer Capacitance		C_{RSS}			44		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	V_{DS}=480V, V_{GS}=10V, I_D=50A (Note 1, 2)		145		nC
Gate-Source Charge		Q_{GS}			25		nC
Gate-Drain Charge		Q_{DD}			70		nC
Turn-On Delay Time		$t_{D(ON)}$	V_{DD}=100V, V_{GS}=10V, I_D =50A, R_G =3.3Ω (Note 1, 2)		21		ns
Turn-On Rise Time		t_R			28		ns
Turn-Off Delay Time		$t_{D(OFF)}$			122		ns
Turn-Off Fall Time		t_F			30		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				50	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				150	A
Drain-Source Diode Forward Voltage		V_{SD}	I_S=50A, V_{GS}=0V			1.4	V
Body Diode Reverse Recovery Time		t_{rr}	I_S=30A, V_{GS}=0V, dI_F/dt=100A/μs		607		nS
Body Diode Reverse Recovery Charge		Q_{rr}			12.6		μC

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

■ TEST CIRCUITS AND WAVEFORMS

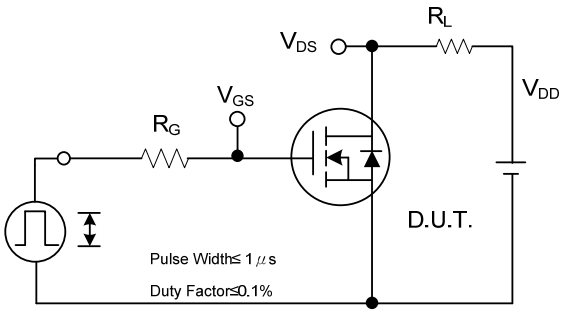


Peak Diode Recovery dv/dt Test Circuit

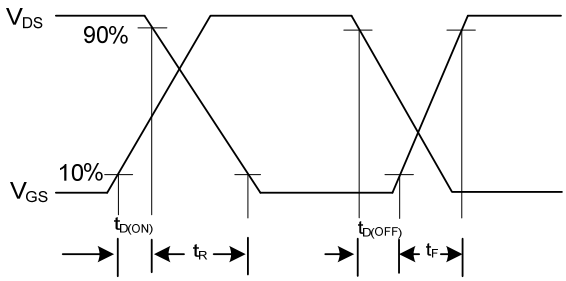


Peak Diode Recovery dv/dt Waveforms

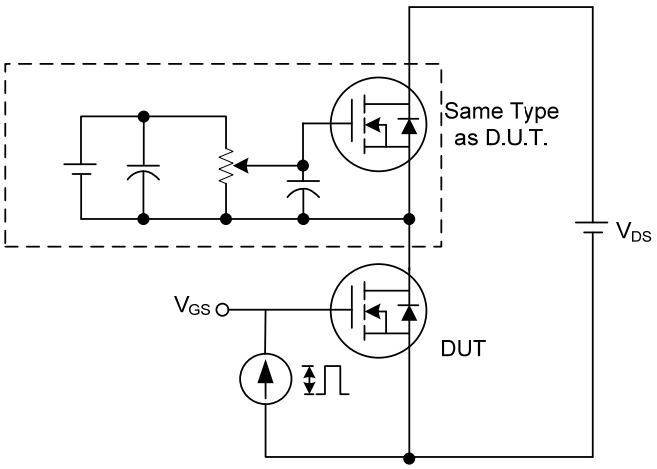
■ TEST CIRCUITS AND WAVEFORMS



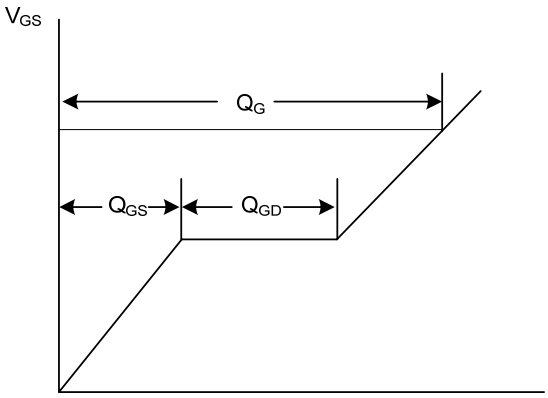
Switching Test Circuit



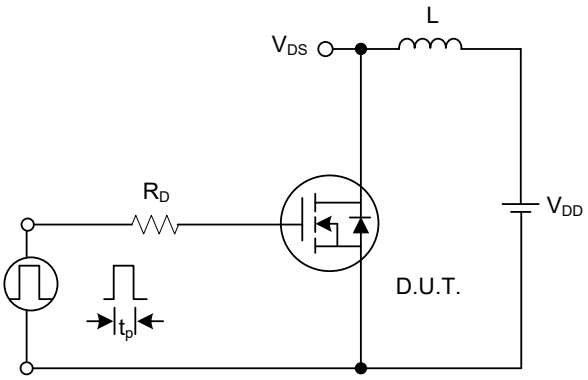
Switching Waveforms



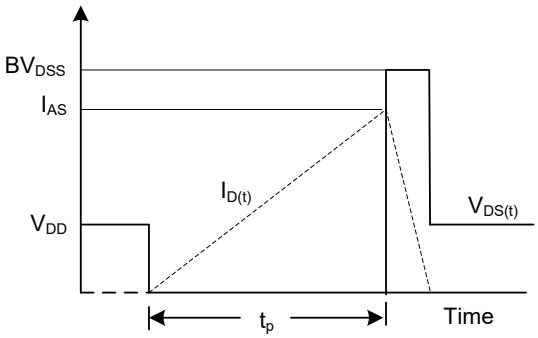
Gate Charge Test Circuit



Gate Charge Waveform



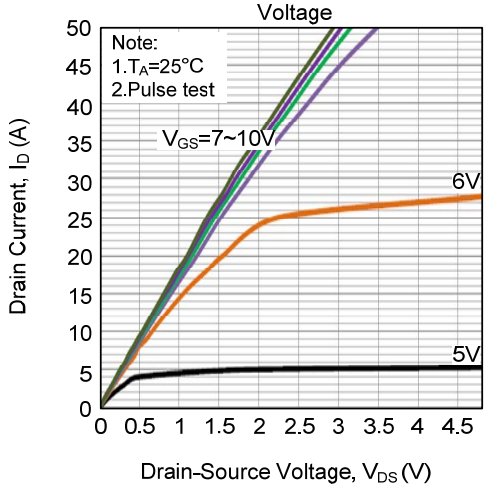
Unclamped Inductive Switching Test Circuit



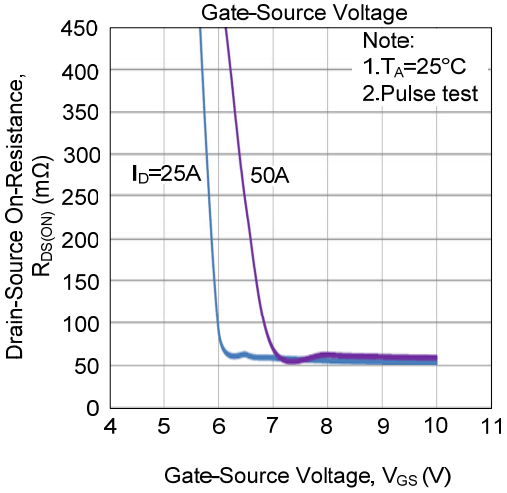
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

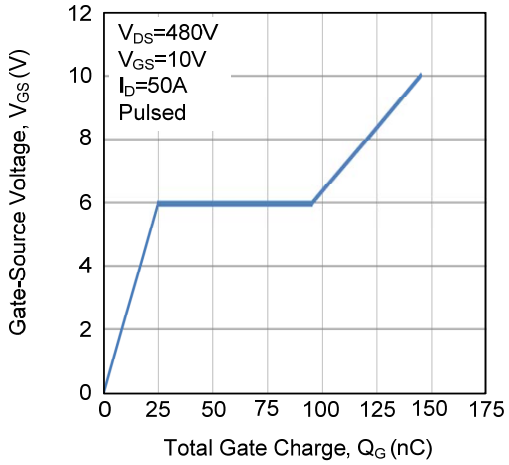
Drain Current vs. Drain-Source Voltage



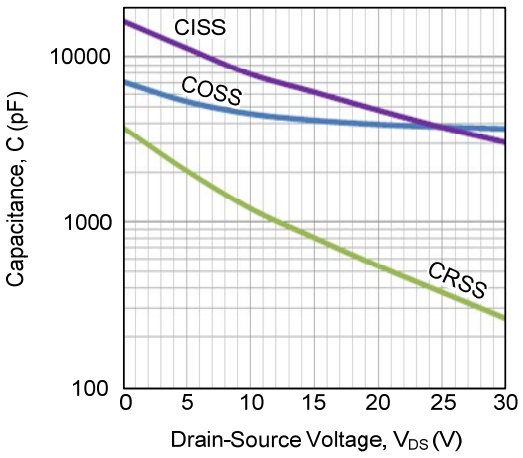
Drain-Source On-Resistance vs. Gate-Source Voltage



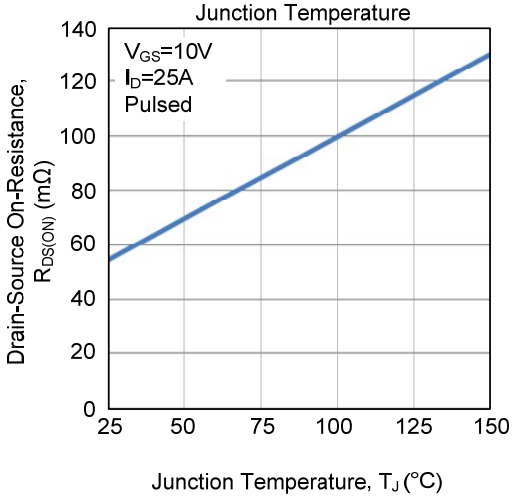
Gate Charge Characteristics



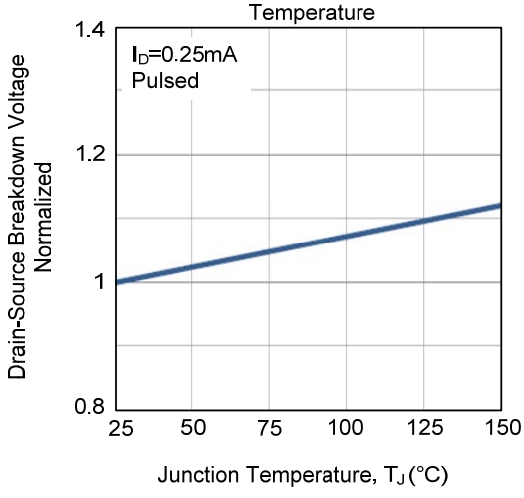
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

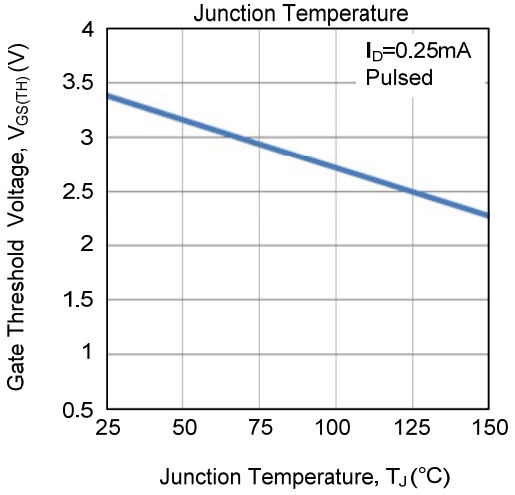


Breakdown Voltage vs. Junction Temperature

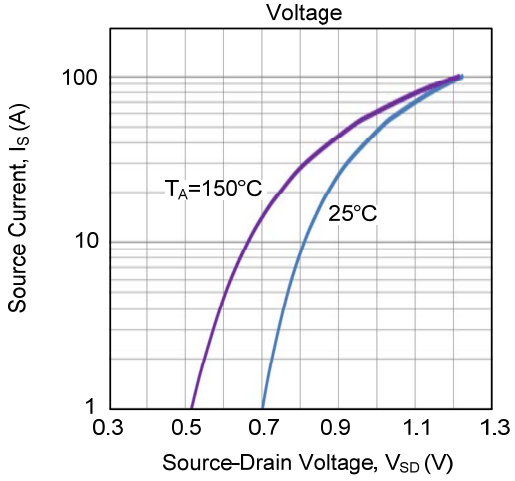


■ TYPICAL CHARACTERISTICS (Cont.)

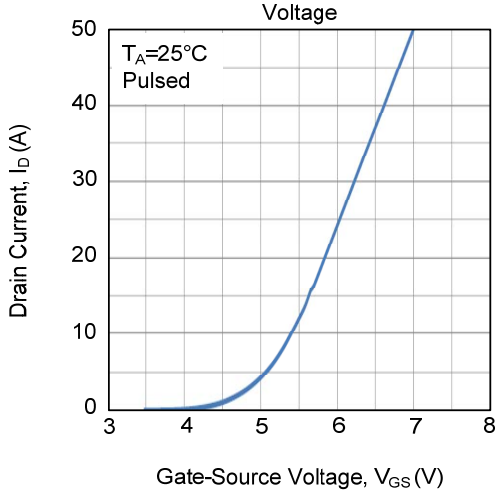
Gate Threshold Voltage vs. Junction Temperature



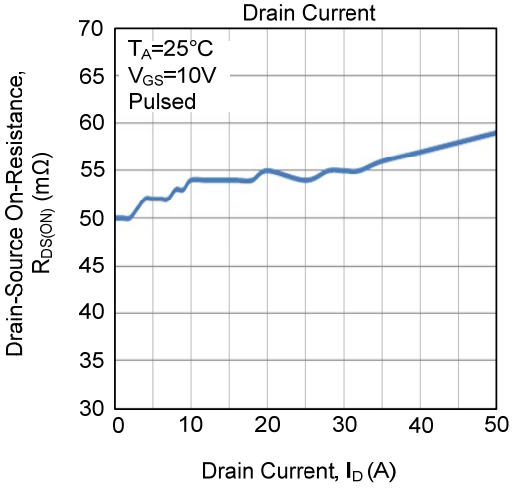
Source Current vs. Source-Drain Voltage



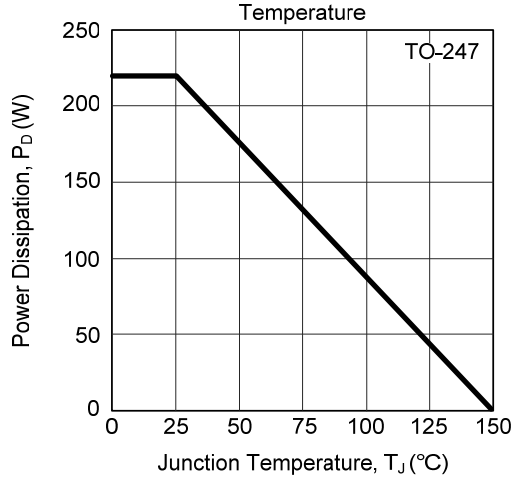
Drain Current vs. Gate-Source Voltage



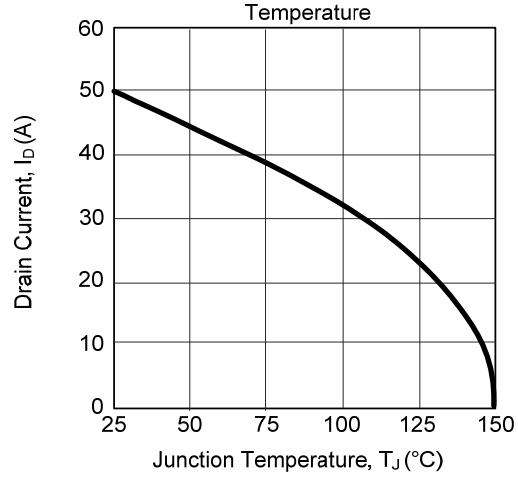
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature

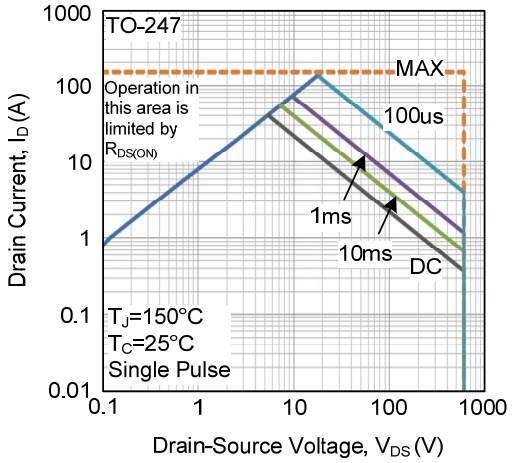


Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)

Safe Operating Area



Maximum Effective Transient Thermal Impedance, Junction to Case