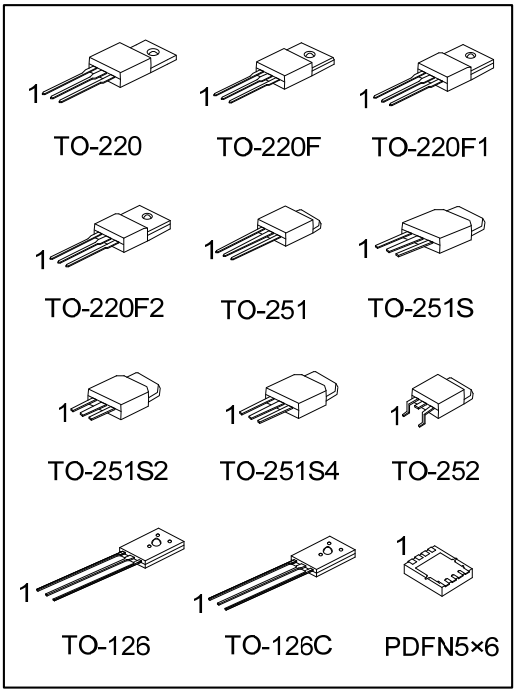
3.0A, 650V N-CHANNEL POWER MOSFET



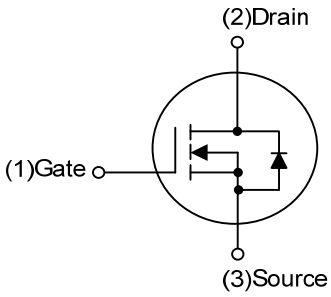
■ DESCRIPTION

The UTC **3N65** 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 high rugged avalanche characteristics. This power MOSFET is usually used in high speed switching applications at power supplies, PWM motor controls, high efficient AC to DC converters and bridge circuits.

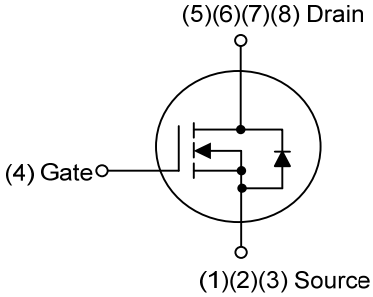
■ FEATURES

* $R_{DS(ON)} \leq 3.8\ \Omega$ @ V_{GS}=10V, I_D=1.5A
* Fast switching capability
* Avalanche energy specified
* Improved dv/dt capability, high ruggedness

■ SYMBOL



TO-220/TO-220F/TO-220F1/TO-220F2
TO-220F3/TO-251/TO-251L/TO-251S
TO-251S2/TO-251S4/TO-252/TO-52D
TO-262/TO-126/TO-126C/TO-126S

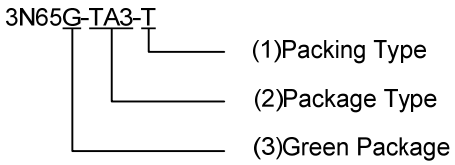


PDFN5×6

■ ORDERING INFORMATION

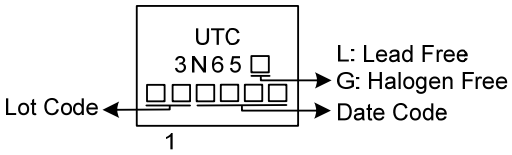
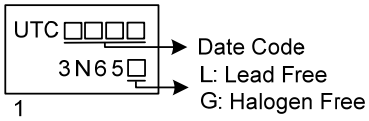
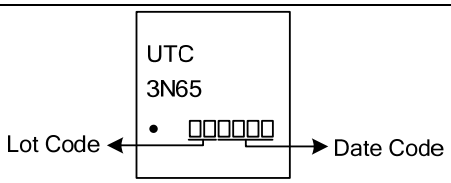
Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
3N65L-TA3-T	3N65G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
3N65L-TF1-T	3N65G-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
3N65L-TF2-T	3N65G-TF2-T	TO-220F2	G	D	S	-	-	-	-	-	Tube
3N65L-TF3-T	3N65G-TF3-T	TO-220F	G	D	S	-	-	-	-	-	Tube
3N65L-TM3-T	3N65G-TM3-T	TO-251	G	D	S	-	-	-	-	-	Tube
3N65L-TMS-T	3N65G-TMS-T	TO-251S	G	D	S	-	-	-	-	-	Tube
3N65L-TMS2-T	3N65G-TMS2-T	TO-251S2	G	D	S	-	-	-	-	-	Tube
3N65L-TMS4-T	3N65G-TMS4-T	TO-251S4	G	D	S	-	-	-	-	-	Tube
3N65L-TN3-R	3N65G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
3N65L-T60-K	3N65G-T60-K	TO-126	G	D	S	-	-	-	-	-	Bulk
3N65L-T6C-K	3N65G-T6C-K	TO-126C	G	D	S	-	-	-	-	-	Bulk
3N65L-P5060-R	3N65G-P5060-R	PDFN5×6	S	S	S	G	D	D	D	D	Tape Reel

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



(1) R: Tape Reel, T: Tube, K: Bulk
(2) TA3: TO-220, TF1: TO-220F1, TF3: TO-220F2, TF3: TO-220F, TM3: TO-251, TMS: TO-251S TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252, T60: TO-126, T6C: TO-126C, P5060: PDFN5×6
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

Package		MARKING
TO-220 TO-220F TO-220F1 TO-220F2 TO-251	TO-251S TO-251S2 TO-251S4 TO-252	
TO-126 TO-126C		
PDFN5×6		

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 2)		I_{AR}	3.0	A
Continuous Drain Current		I_D	3.0	A
Pulsed Drain Current (Note 2)		I_{DM}	12	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	200	mJ
	Repetitive (Note 2)	E_{AR}	7.5	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Power Dissipation	TO-220	P_D	75	W
	TO-220F/TO-220F1		34	
	TO-251/TO-252/TO-251S TO-251S2/TO-251S4		50	
	TO-126/TO-126C		17	
	PDFN5×6		25	
Junction Temperature		T_J	+150	°C
Operating Temperature		T_{OPR}	-55 ~ +150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

Note: 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 = 64mH, I_{AS} = 2.4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
4. I_{SD} ≤ 3.0A, di/dt ≤200A/μs, V_{DD} ≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/ TO-220F2	θ_{JA}	62.5	°C/W
	TO-251/TO-252/TO-251S TO-251S2/TO-251S4		110	
	TO-126/TO-126C		132	
	PDFN5×6		75 (Note)	
Junction to Case	TO-220	θ_{JC}	1.67	°C/W
	TO-220F/TO-220F1		3.68	
	TO-251/TO-252/TO-251S TO-251S2/TO-251S4		2.5	
	TO-126/TO-126C		7.36	
	PDFN5×6		5 (Note)	

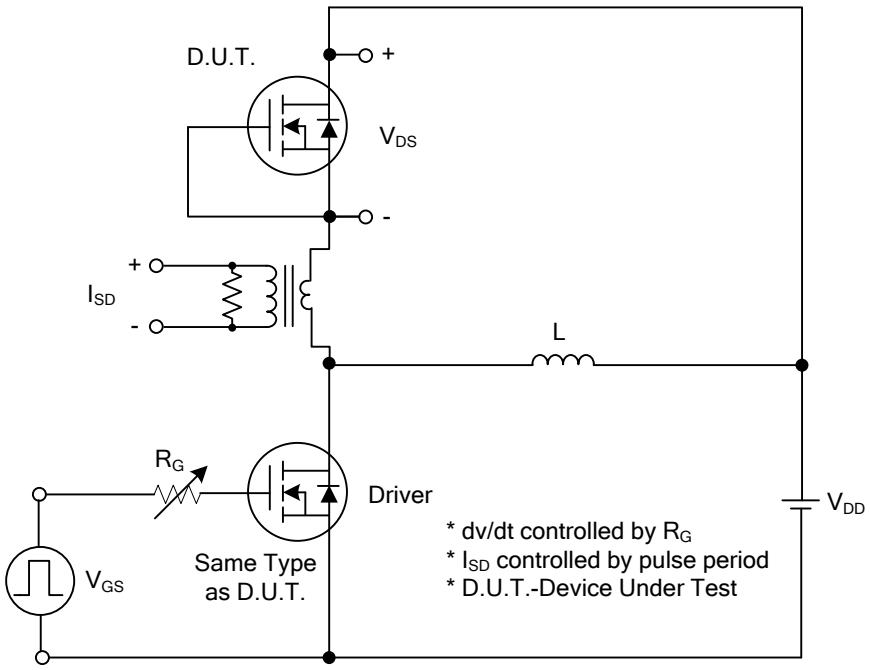
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

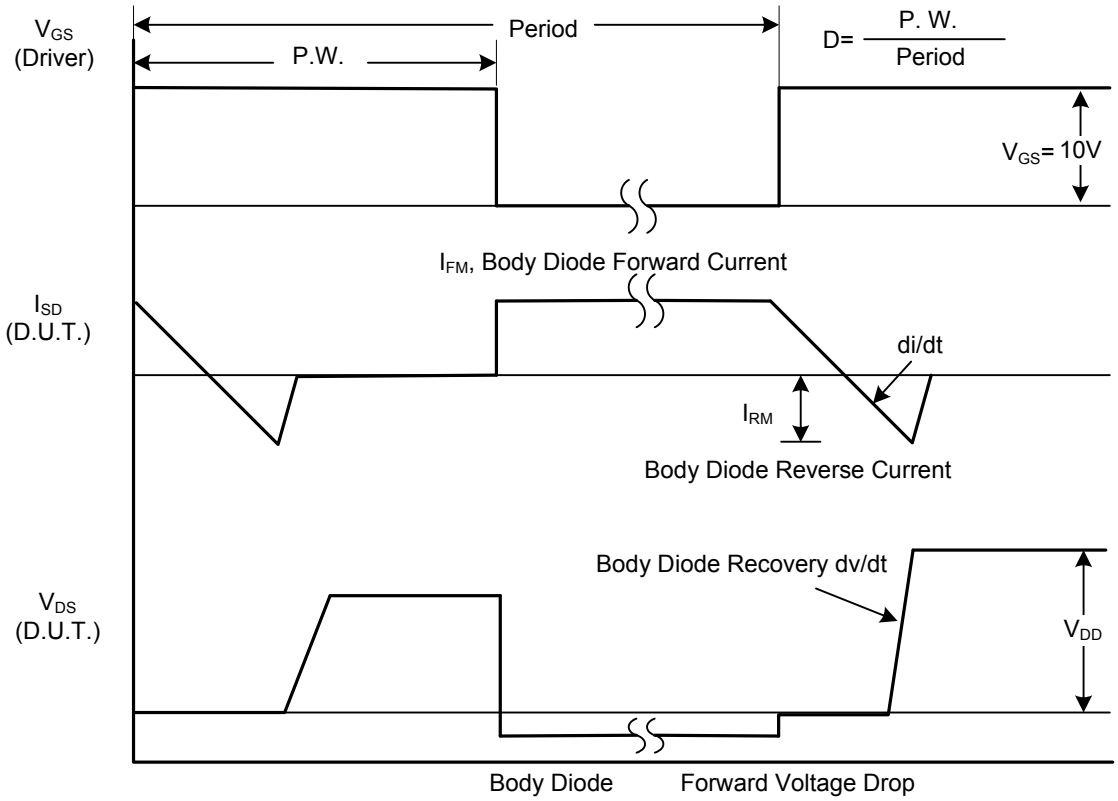
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0 V, I_D = 250 μA	650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 650 V, V_{GS} = 0 V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30 V, V_{DS} = 0 V			100	nA
	Reverse		V_{GS} = -30 V, V_{DS} = 0 V			-100	nA
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	I_D=250μA,Referenced to 25°C		0.6		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250 μA	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS} = 10V, I_D = 1.5A		2.8	3.8	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} = 25V, V_{GS} = 0V, f = 1MHz		430	500	pF
Output Capacitance		C_{OSS}			50	65	pF
Reverse Transfer Capacitance		C_{RSS}			11	20	pF
SWITCHING CHARACTERISTICS							
Total Gate Charge		Q_G	V_{DS}= 50V, I_D=1.3A, V_{GS}= 10 V (Note 1, 2)		51	70	nC
Gate-Source Charge		Q_{GS}			13		nC
Gate-Drain Charge		Q_{GD}			11		nC
Turn-On Delay Time		$t_{D(ON)}$	V_{DD} = 30V, I_D = 0.5A, R_G = 25Ω (Note 1, 2)		32	45	ns
Turn-On Rise Time		t_R			64	80	ns
Turn-Off Delay Time		$t_{D(OFF)}$			115	140	ns
Turn-Off Fall Time		t_F			60	75	ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				3.0	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				12	A
Drain-Source Diode Forward Voltage		V_{SD}	V_{GS} = 0 V, I_S = 3.0 A			1.4	V

Notes: 1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 64mH, I_{AS} = 2.4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C

■ TEST CIRCUITS AND WAVEFORMS

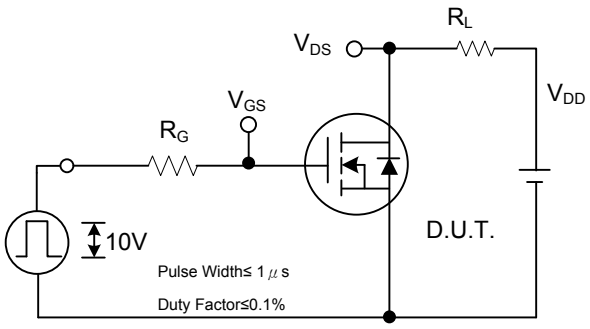


Peak Diode Recovery dv/dt Test Circuit

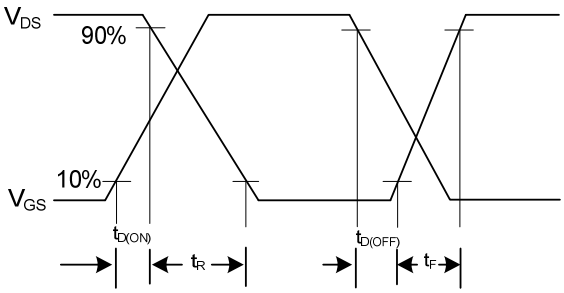


Peak Diode Recovery dv/dt Waveforms

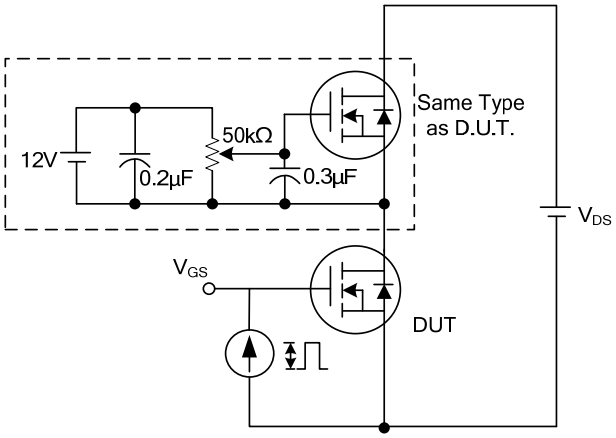
■ TEST CIRCUITS AND WAVEFORMS



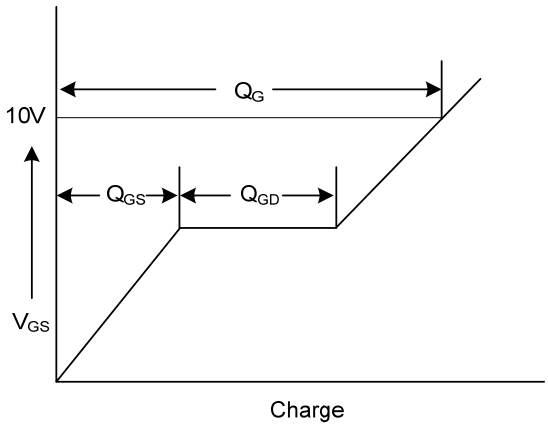
Switching Test Circuit



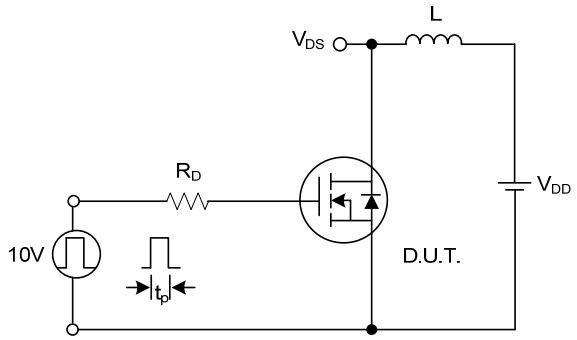
Switching Waveforms



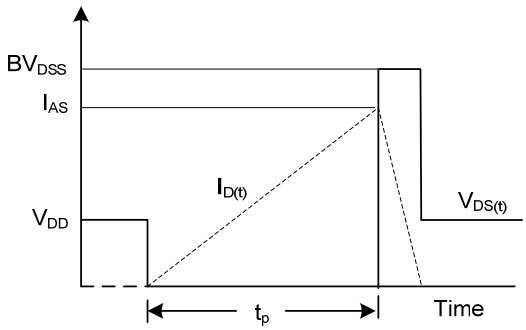
Gate Charge Test Circuit



Gate Charge Waveform



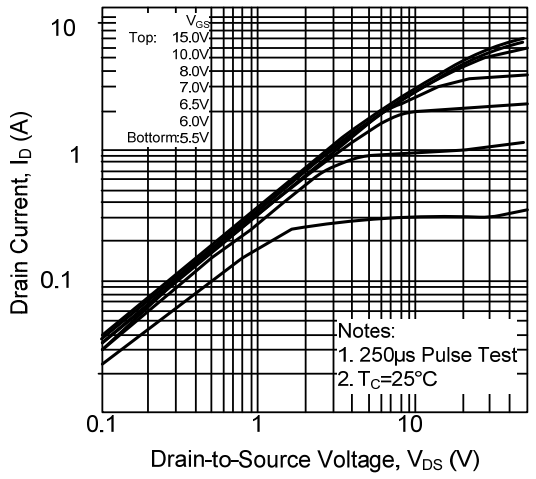
Unclamped Inductive Switching Test Circuit



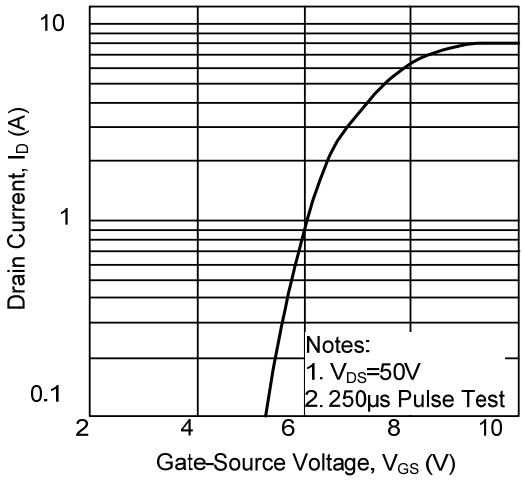
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

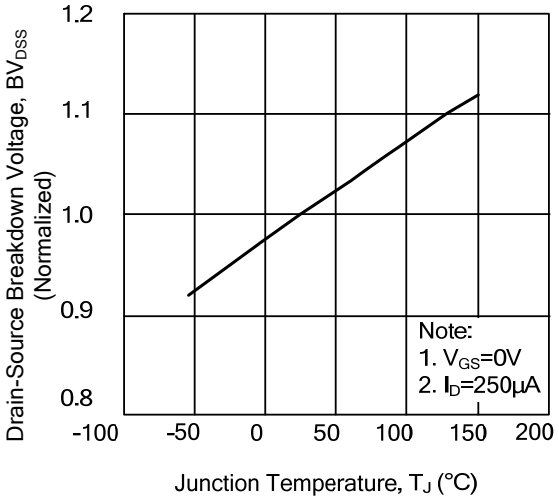
On-State Characteristics



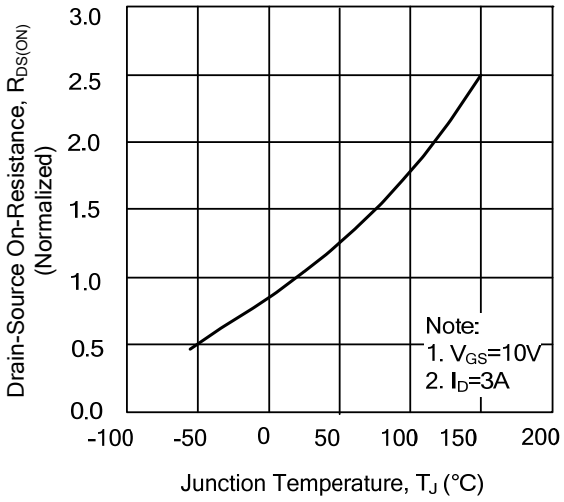
Transfer Characteristics



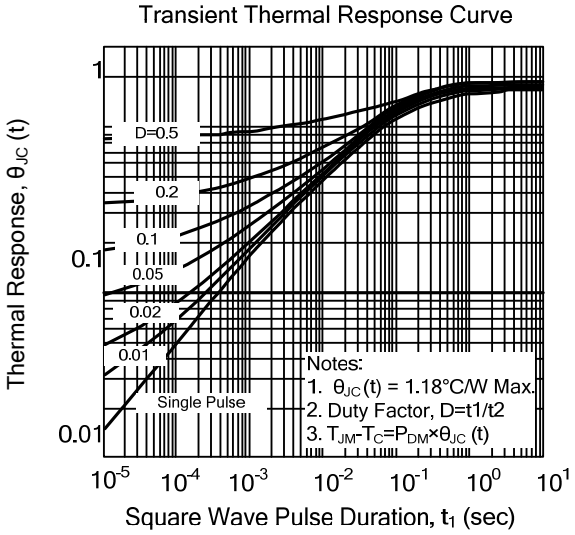
Breakdown Voltage Variation vs. Junction Temperature



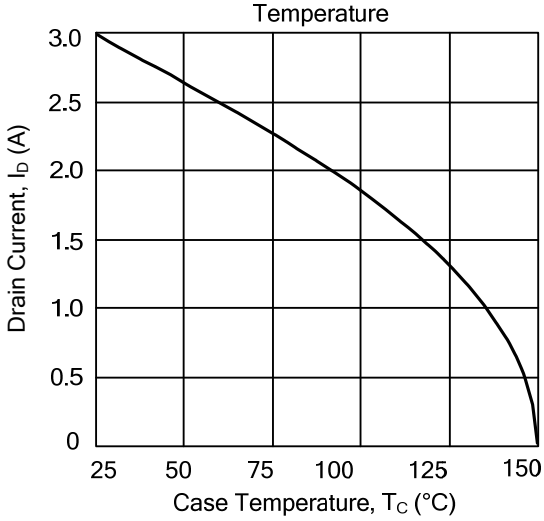
On-Resistance Variation vs. Junction Temperature



Transient Thermal Response Curve

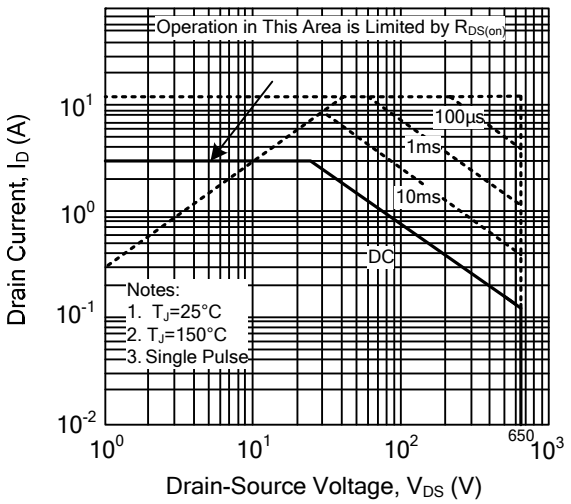


Maximum Drain Current vs. Case Temperature



■ TYPICAL CHARACTERISTICS (Cont.)

Safe Operating Area



On State Current vs.
Allowable Case Temperature