



## 13N65-Q

Power MOSFET

### 13A, 650V N-CHANNEL POWER MOSFET

#### DESCRIPTION

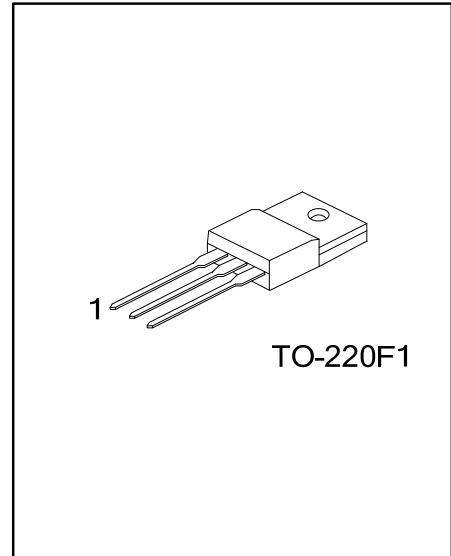
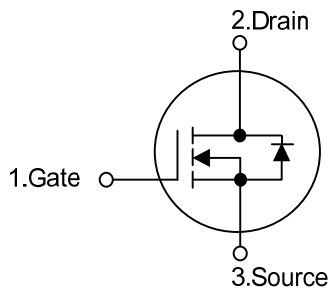
The UTC **13N65-Q** are N-Channel enhancement mode power field effect transistors (MOSFET) which are produced by using UTC's proprietary, planar stripe and DMOS technology.

These devices are suited for high efficiency switch mode power supply. To minimize on-state resistance, provide superior switching performance and withstand high energy pulse in the avalanche and commutation mode, the advanced technology has been especially tailored.

#### FEATURES

- \*  $R_{DS(ON)} < 0.85\Omega$  @  $V_{GS} = 10V, I_D = 6.5A$
- \* Ultra low gate charge ( typical 42 nC )
- \* Low reverse transfer capacitance (  $C_{RSS} =$  typical 25 pF )
- \* Fast switching capability
- \* Avalanche energy specified
- \* Improved dv/dt capability, high ruggedness

#### SYMBOL



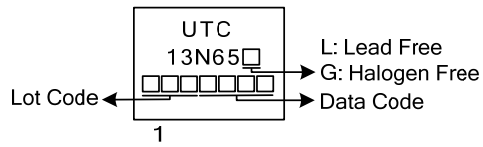
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen-Free		1	2	3	
13N65L-TF1-T	13N65G-TF1-T	TO-220F1	G	D	S	Tube

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

<p>13N65G-TF1-T</p>	<p>(1) T: Tube</p> <p>(2) TF1: TO-220F1</p> <p>(3) G: Halogen Free and Lead Free, L: Lead Free</p>
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■ MARKING



■ ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$ , unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Drain-Source Voltage	$V_{DSS}$	650	V
Gate-Source Voltage	$V_{GSS}$	$\pm 30$	V
Avalanche Current (Note 2)	$I_{AR}$	13	A
Drain Current	Continuous	$I_D$	13
	Pulsed (Note 2)	$I_{DM}$	52
Avalanche Energy	Single Pulsed (Note 3)	$E_{AS}$	790
	Repetitive (Note 2)	$E_{AR}$	24
Peak Diode Recovery dv/dt (Note 4)	dv/dt	4.5	V/ns
Power Dissipation	$P_D$	51	W
Junction Temperature	$T_J$	+150	$^\circ\text{C}$
Operating Temperature	$T_{OPR}$	-55 ~ +150	$^\circ\text{C}$
Storage Temperature	$T_{STG}$	-55 ~ +150	$^\circ\text{C}$

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.  $L = 10\text{mH}$ ,  $I_{AS} = 13\text{A}$ ,  $V_{DD} = 50\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$

4.  $I_{SD} \leq 13\text{A}$ ,  $di/dt \leq 200\text{A/s}$ ,  $V_{DD} \leq BV_{DSS}$  Starting  $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Ambient	$\theta_{JA}$	62.5	$^\circ\text{C/W}$
Junction to Case	$\theta_{JC}$	2.43	$^\circ\text{C/W}$

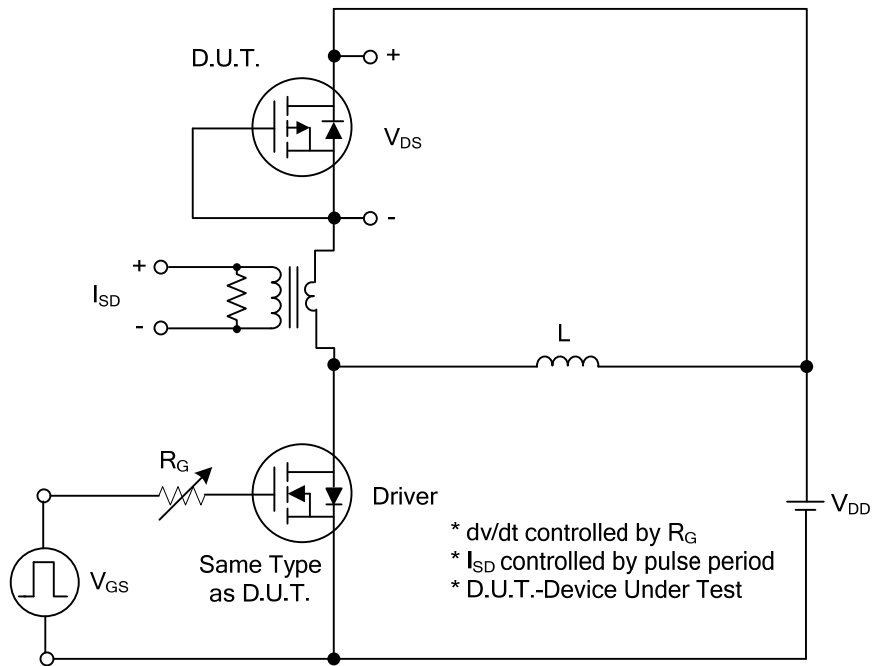
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	650			V
Drain-Source Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 650 V, V <sub>GS</sub> = 0 V			1	μA
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V			±100	nA
Breakdown Voltage Temperature Coefficient	ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	I <sub>D</sub> = 250 μA, Referenced to 25°C		0.7		V/°C
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	2.0		4.0	V
Static Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 6.0A		0.65	0.85	Ω
<b>DYNAMIC CHARACTERISTICS</b>						
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V, f = 1MHz		1480	1900	pF
Output Capacitance	C <sub>OSS</sub>			200	270	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			25	35	pF
<b>SWITCHING CHARACTERISTICS</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>DS</sub> = 520V, I <sub>D</sub> = 13A, V <sub>GS</sub> = 10 V (Note 1, 2)		42	54	nC
Gate-Source Charge	Q <sub>GS</sub>			8.6		nC
Gate-Drain Charge	Q <sub>GD</sub>			21		nC
Turn-On Delay Time	t <sub>D(ON)</sub>	V <sub>DD</sub> = 325V, I <sub>D</sub> = 13A, R <sub>G</sub> = 25Ω (Note 1, 2)		30	70	ns
Turn-On Rise Time	t <sub>R</sub>			115	240	ns
Turn-Off Delay Time	t <sub>D(OFF)</sub>			95	200	ns
Turn-Off Fall Time	t <sub>F</sub>			85	180	ns
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				13	A
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				52	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 13A			1.4	V
Reverse Recovery Time	t <sub>rr</sub>	V <sub>GS</sub> = 0 V, I <sub>S</sub> = 13A, dI <sub>F</sub> /dt = 100 A/μs (Note 1)		380		ns
Reverse Recovery Charge	Q <sub>rr</sub>				3.5	

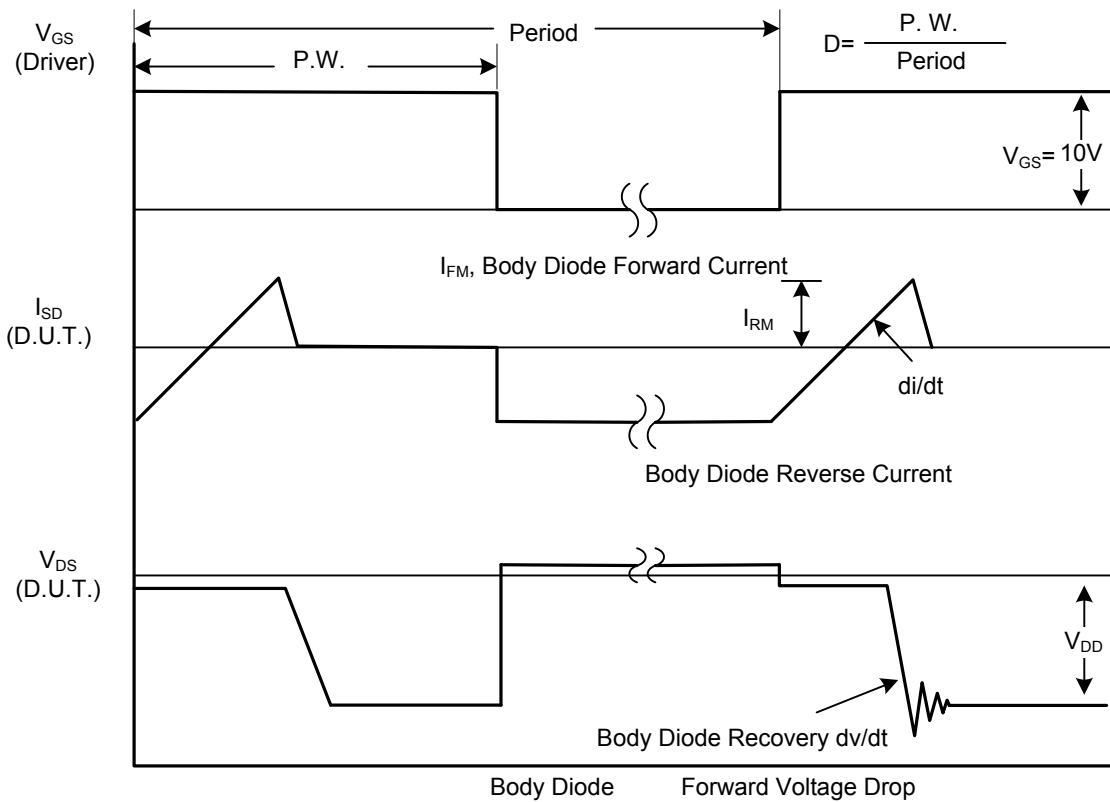
Notes: 1. Pulse Test : Pulse width ≤ 300 μs, Duty cycle ≤ 2%

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

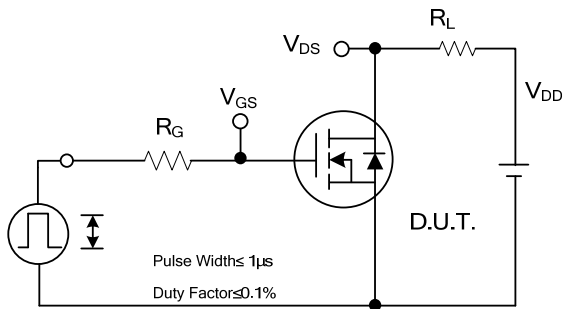


Peak Diode Recovery  $dv/dt$  Test Circuit

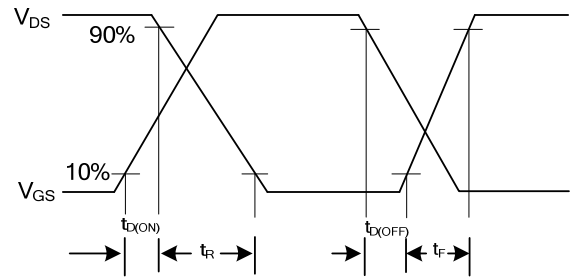


Peak Diode Recovery  $dv/dt$  Waveforms

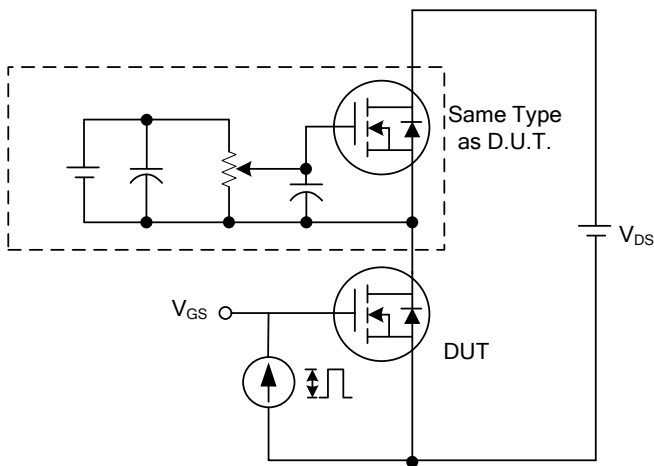
## TEST CIRCUITS AND WAVEFORMS (Cont.)



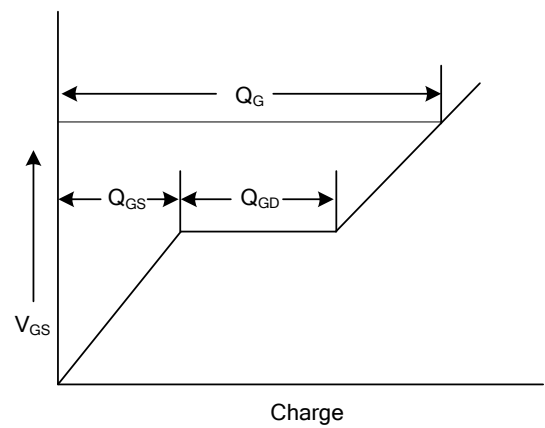
**Switching Test Circuit**



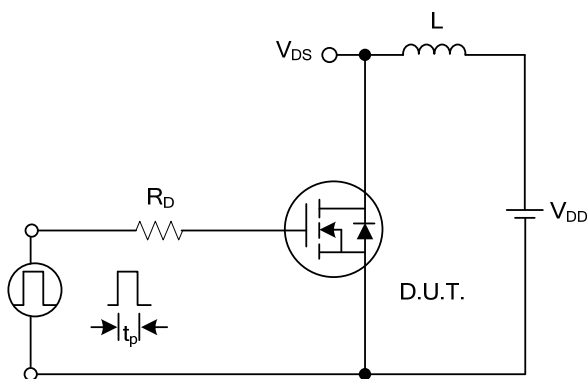
**Switching Waveforms**



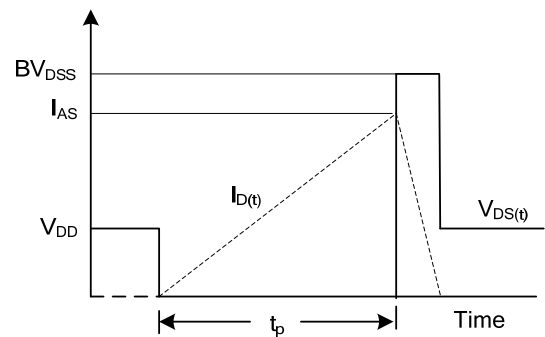
**Gate Charge Test Circuit**



**Gate Charge Waveform**

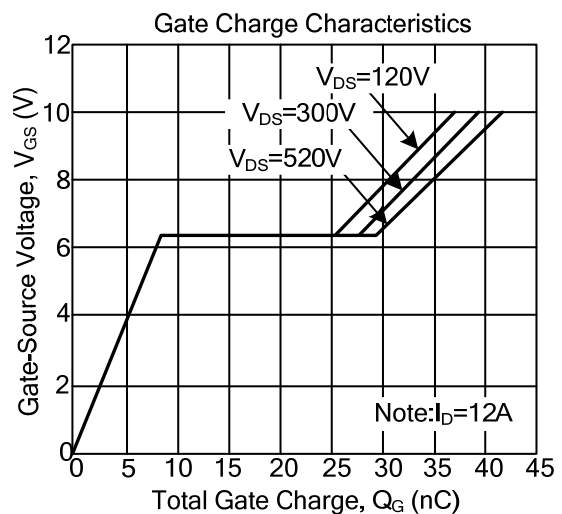
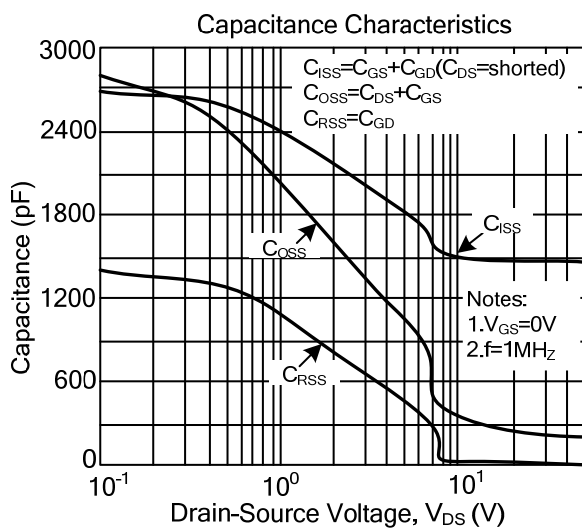
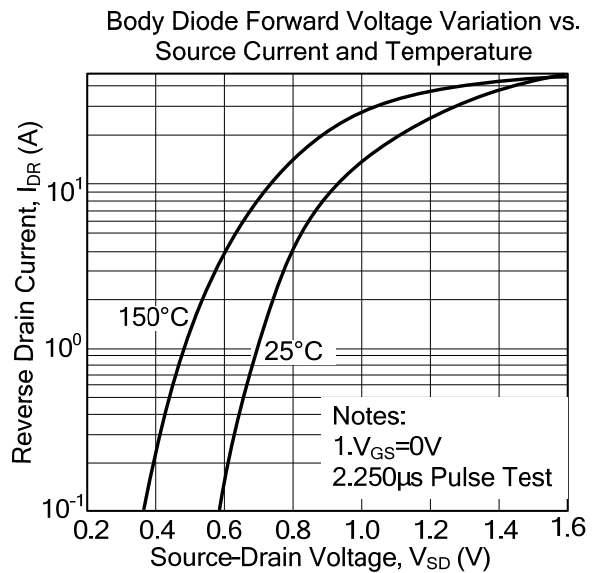
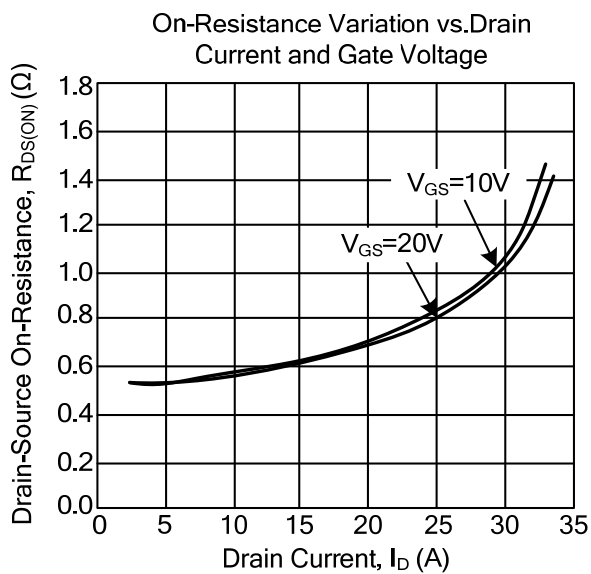
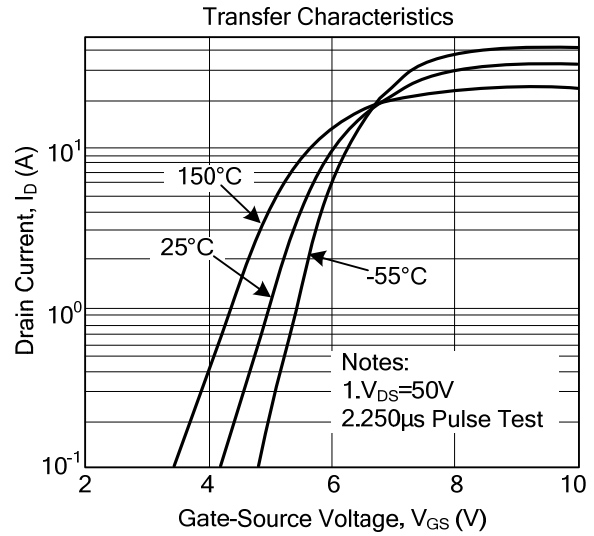
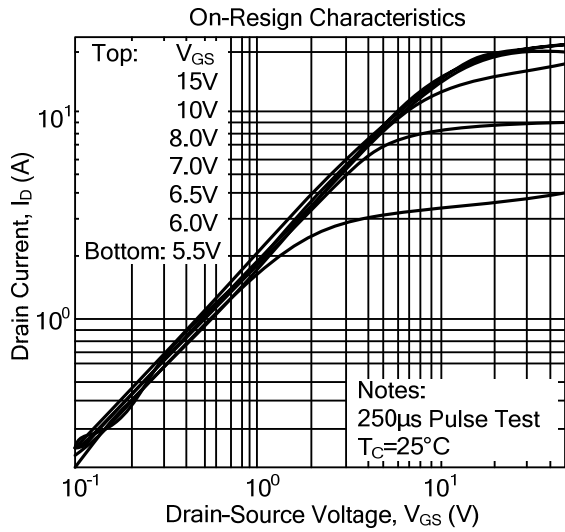


**Unclamped Inductive Switching Test Circuit**

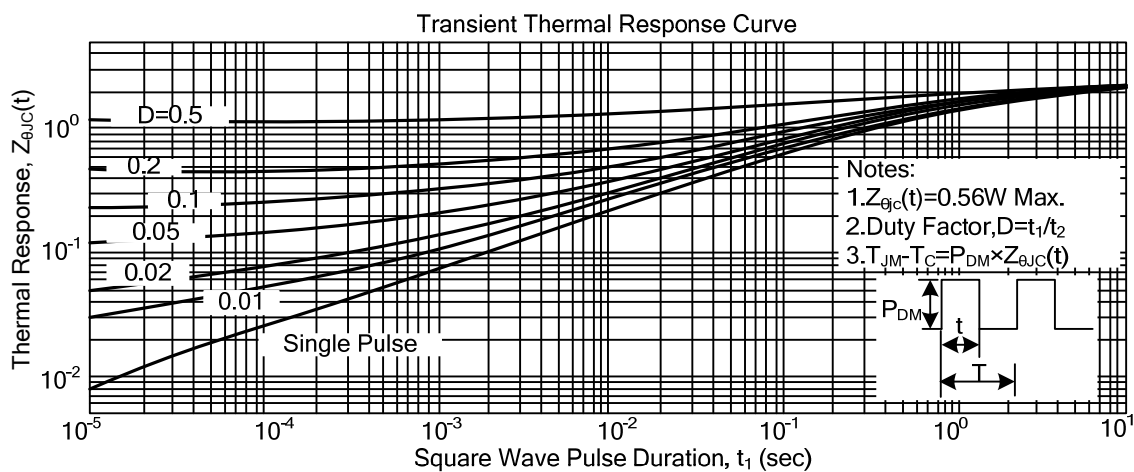
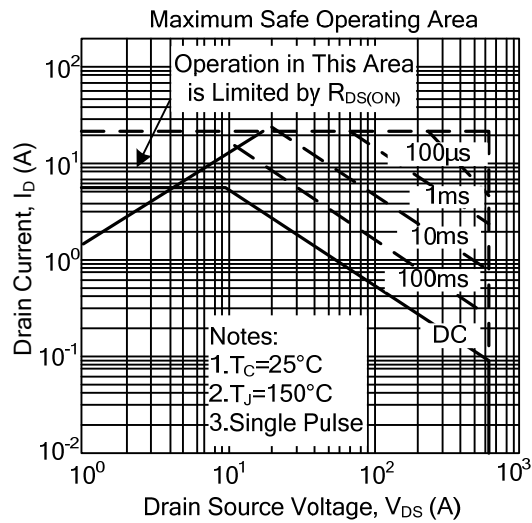


**Unclamped Inductive Switching Waveforms**

## TYPICAL CHARACTERISTICS



## ■ TYPICAL CHARACTERISTICS



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