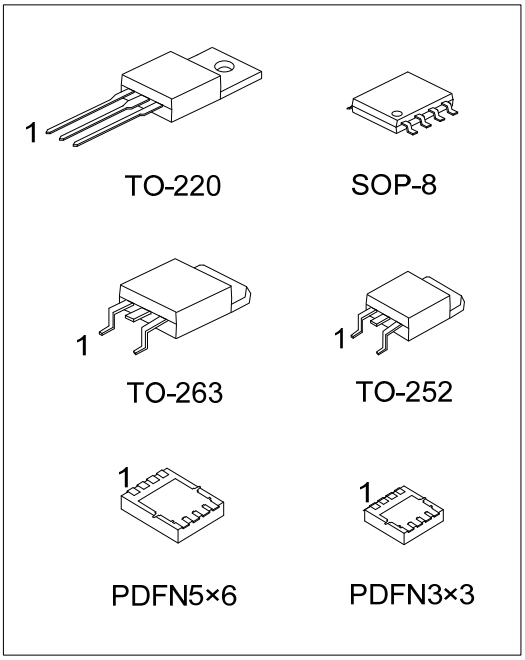
50A, 40V N-CHANNEL POWER MOSFET



■ DESCRIPTION

The UTC **UT50N04** is a N-channel enhancement MOSFET using UTC's advanced technology to provide the customers with perfect $R_{DS(ON)}$ and high switching speed.

■ FEATURES

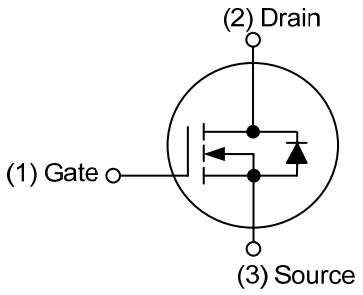
TO-220/TO-252/TO-263

* $R_{DS(ON)} \leq 7.0\ m\Omega$ @ V_{GS}=10V, I_D=25A
* $R_{DS(ON)} \leq 10\ m\Omega$ @ V_{GS}=4.5V, I_D=20A

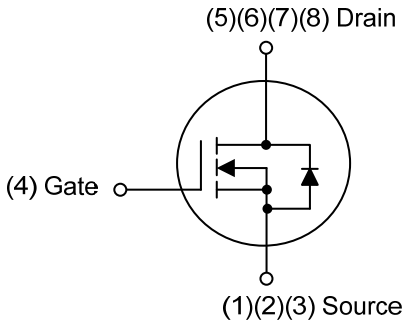
PDFN3x3/PDFN5x6/SOP-8

* $R_{DS(ON)} \leq 6.5\ m\Omega$ @ V_{GS}=10 V, I_D=25A
* $R_{DS(ON)} \leq 8.0\ m\Omega$ @ V_{GS}=4.5V, I_D=25A
* High Switching Speed

■ SYMBOL



TO-220 / TO-252 / TO-263

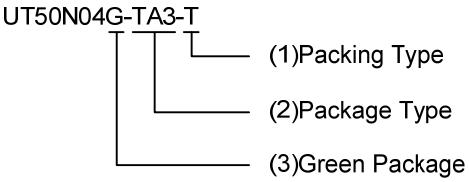


SOP-8/PDFN3×3/PDFN5×6

■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
UT50N04L-TA3-T	UT50N04G-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
UT50N04L-TN3-R	UT50N04G-TN3-R	TO-252	G	D	S	-	-	-	-	-	Tape Reel
UT50N04L-TQ2-T	UT50N04G-TQ2-T	TO-263	G	D	S	-	-	-	-	-	Tube
UT50N04L-TQ2-R	UT50N04G-TQ2-R	TO-263	G	D	S	-	-	-	-	-	Tape Reel
UT50N04L-S08-R	UT50N04G-S08-R	SOP-8	S	S	S	G	D	D	D	D	Tape Reel
UT50N04L-P3030-R	UT50N04G-P3030-R	PDFN3×3	S	S	S	G	D	D	D	D	Tape Reel
UT50N04L-P5060-R	UT50N04G-P5060-R	PDFN5×6	S	S	S	G	D	D	D	D	Tape Reel

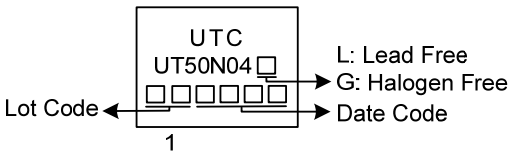
Note: Pin Assignment: G: Gate D: Drain S: Source



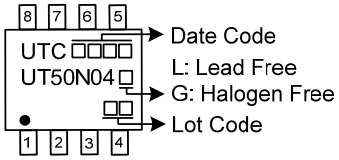
(1) T: Tube, R: Tape Reel
(2) TA3: TO-220, TN3: TO-252, TQ2: TO-263
S08: SOP-8, P3030: PDFN3×3, P5060: PDFN5×6
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

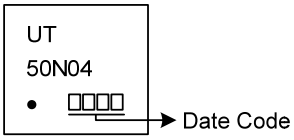
TO-220 / TO-252 / TO-263



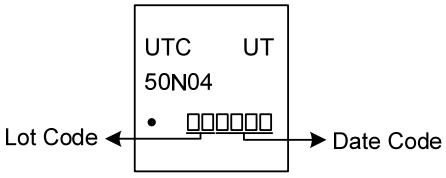
SOP-8



PDFN3×3



PDFN5×6



■ ABSOLUTE MAXIMUM RATINGS

PARAMETER			SYMBOL	RATINGS	UNIT
Drain-Source Voltage			V_{DSS}	40	V
Gate-Source Voltage			V_{GSS}	±20	V
Drain Current	Continuous (V_{GS}=10V)	Other	I_D	50	A
		SOP-8		20	A
	Pulsed (Note 2)	Other	I_{DM}	100	A
		SOP-8		50	A
Avalanche Energy	Single Pulsed (Note 3)		E_{AS}	93	mJ
Peak Diode Recovery dv/dt (Note 4)			dv/dt	0.79	V/ns
Power Dissipation	TO-220/TO-263		P_D	160	W
	TO-252			52	W
	SOP-8			5.2	W
	PDFN3×3			32	W
	PDFN5×6			41	W
Junction Temperature			T_J	+150	°C
Storage Temperature			T_{STG}	-55 ~ +175	°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 = 0.1mH, I_{AS} = 43.13A, V_{DD} = 25V, 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	RATINGS	UNIT
Junction to Ambient	TO-220/TO-263	θ_{JA}	62.5	°C/W
	TO-252		110	°C/W
	SOP-8		125 (Note)	°C/W
	PDFN3×3		75 (Note)	°C/W
	PDFN5×6		65 (Note)	°C/W
Junction to Case	TO-220/TO-263	θ_{JC}	0.78	°C/W
	TO-252		2.4 (Note)	°C/W
	SOP-8		24 (Note)	°C/W
	PDFN3×3		3.9 (Note)	°C/W
	PDFN5×6		3.04 (Note)	°C/W

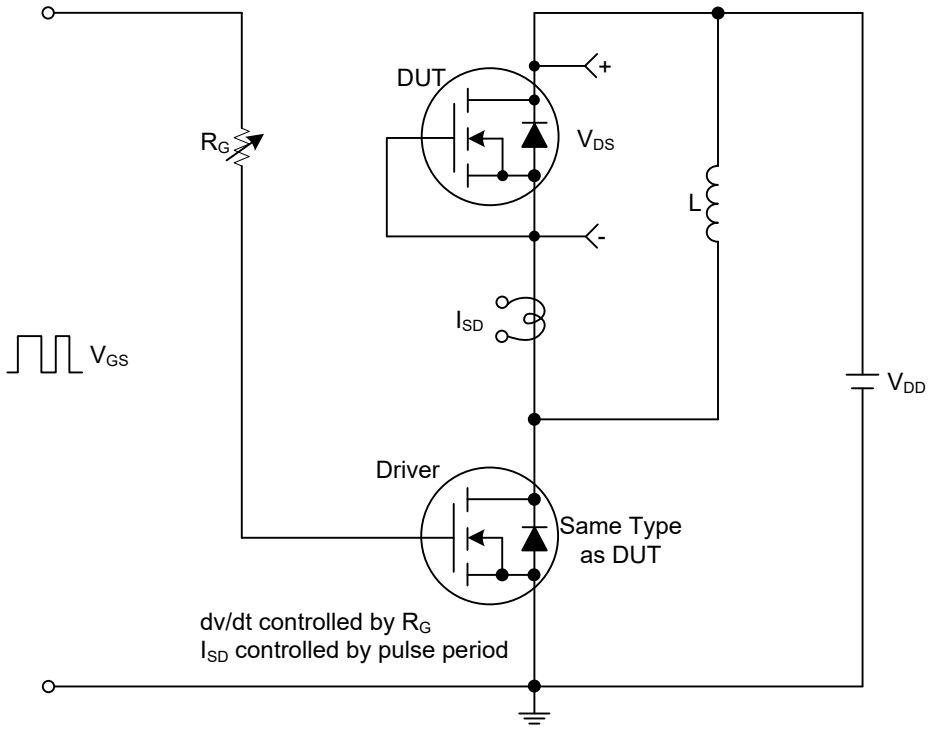
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

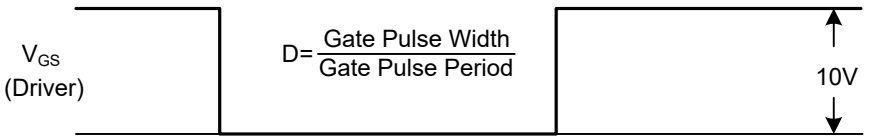
■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

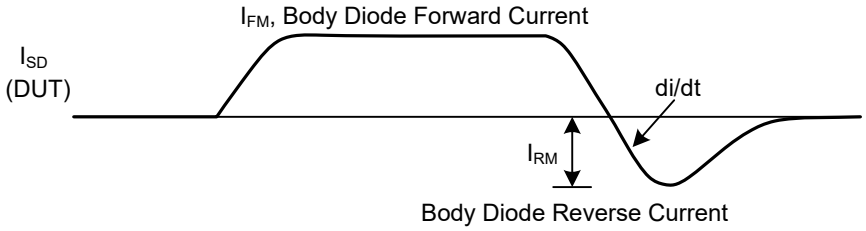
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS}=0V, I_D=250μA	40			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=40V, V_{GS}=0V			1	μA
Gate- Source Leakage Current	Forward	I_{GSS}	V_{GS}=+20V, V_{DS}=0V			+100	nA
	Reverse		V_{GS}=-20V, V_{DS}=0V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS}=V_{GS}, I_D=250μA	1.0		3.0	V
Static Drain-Source On-State Resistance	TO-220 TO-252 TO-263	$R_{DS(ON)}$	V_{GS}=10V, I_D=25A			7.0	mΩ
			V_{GS}=4.5V, I_D=25A			10	mΩ
	PDFN3×3 PDFN5×6 SOP-8		V_{GS}=10V, I_D=25A			6.5	mΩ
			V_{GS}=4.5V, I_D=25A			8.0	mΩ
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1.0MHz		2718		pF
Output Capacitance		C_{OSS}			260		pF
Reverse Transfer Capacitance		C_{RSS}			234		pF
SWITCHING PARAMETERS							
Total Gate Charge		Q_G	V_{DS}=32V, V_{GS}=10V, I_D=50A (Note 1, 2)		91.4		nC
Gate to Source Charge		Q_{GS}			7.6		nC
Gate to Drain Charge		Q_{GD}			38		nC
Turn-ON Delay Time		$t_{D(ON)}$	V_{DD}=20V, V_{GS}=10V, I_D=50A, R_G=3.3Ω (Note 1, 2)		9.5		ns
Rise Time		t_R			18		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			72		ns
Fall-Time		t_F			33		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}				100	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_F=30A,V_{GS}=0V, di/dt=100A/μs		38		ns
Body Diode Reverse Recovery Charge		Q_{rr}			28		nC

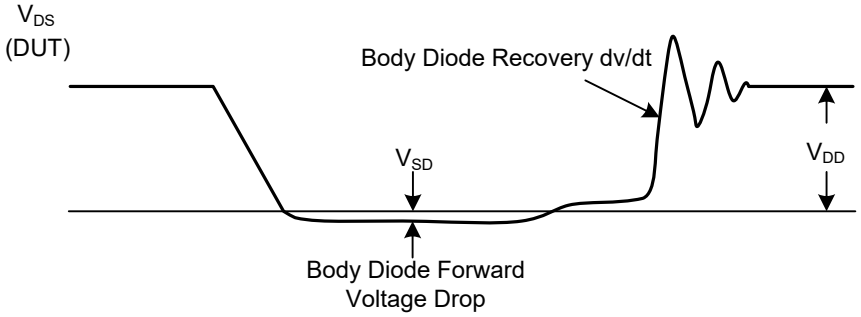
Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle ≤ 2%.
2. Essentially independent of operating ambient temperature.

■ TEST CIRCUITS AND WAVEFORMS



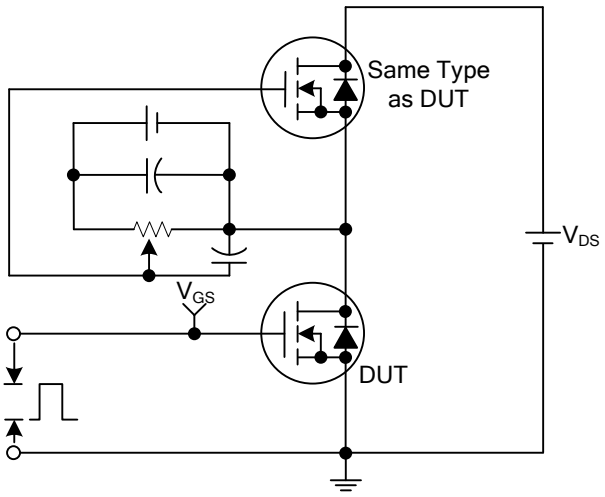




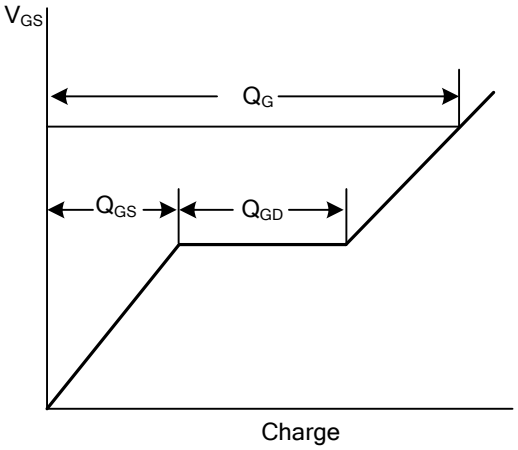


Peak Diode Recovery dv/dt Test Circuit and Waveforms

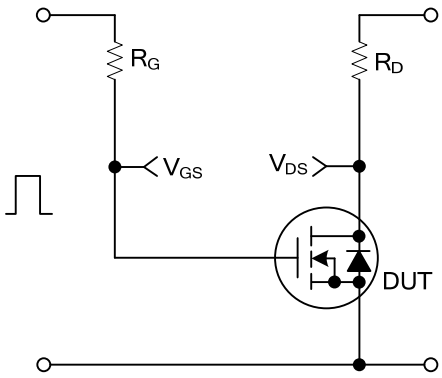
■ TEST CIRCUITS AND WAVEFORMS



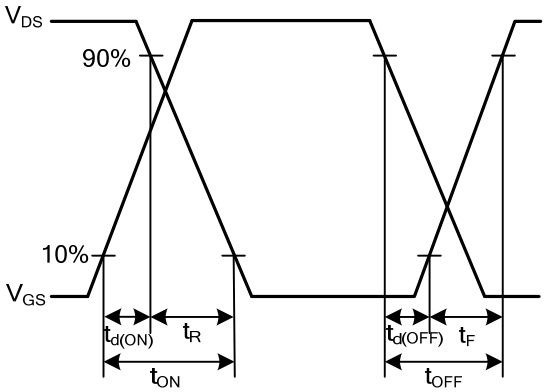
Gate Charge Test Circuit



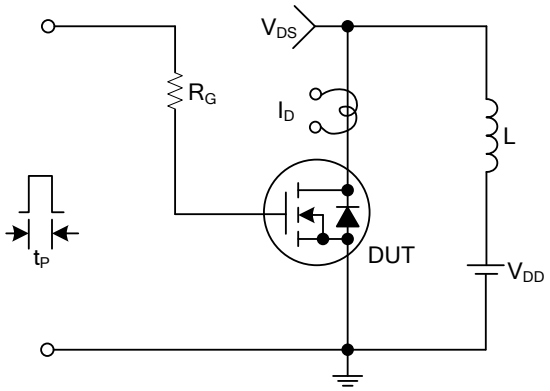
Gate Charge Waveforms



Resistive Switching Test Circuit

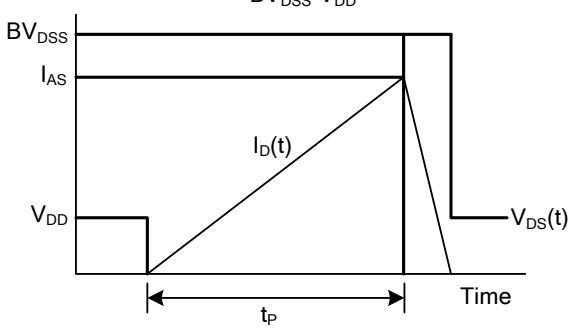


Resistive Switching Waveforms



Unclamped Inductive Switching Test Circuit

$$E_{AS}=\frac{1}{2}LI_{AS}^2\frac{BV_{DSS}}{BV_{DSS}-V_{DD}}$$



Unclamped Inductive Switching Waveforms