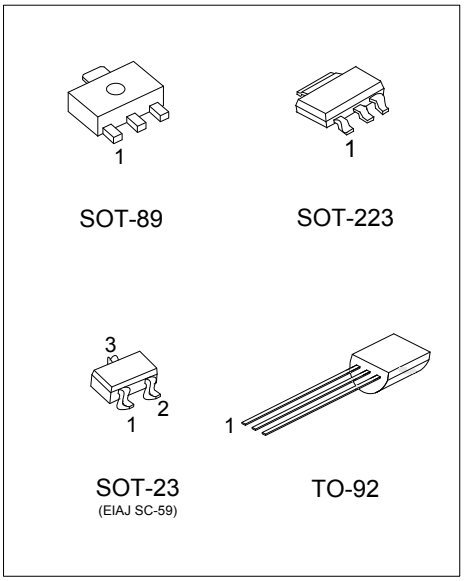
0.5A, 600V N-CHANNEL SUPER-JUNCTION MOSFET



■ DESCRIPTION

The UTC **05NM60** is an Super Junction MOSFET Structure and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and have a high rugged avalanche characteristics. This power MOSFET is usually used at high speed switching applications in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

* $R_{DS(on)} \leq 8.8\ \Omega$ @ V_{GS}=10V, I_D=0.25A
* High breakdown voltage

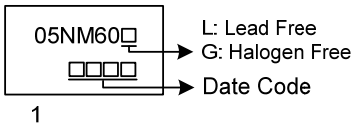
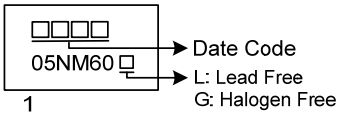
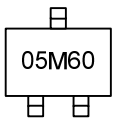
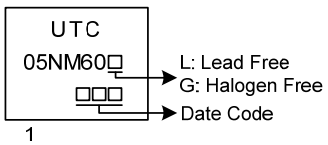
■ ORDERING INFORMATION

Order Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
05NM60L-AA3-R	05NM60G-AA3-R	SOT-223	G	D	S	Tape Reel
05NM60L-AB3-R	05NM60G-AB3-R	SOT-89	G	D	S	Tape Reel
05NM60L-AE3-R	05NM60G-AE3-R	SOT-23	G	S	D	Tape Reel
05NM60L-T92-B	05NM60G-T92-B	TO-92	G	D	S	Tape Box
05NM60L-T92-K	05NM60G-T92-K	TO-92	G	D	S	Bulk

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

(1) R: Tape Reel, B: Tape Box, K: Bulk
(2) AA3: SOT-223, AB3: SOT-89, AE3: SOT-23
T92: TO-92
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

SOT-223	SOT-89
	
SOT-23	TO-92
	

■ 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	0.5	A
	Pulsed (Note 2)	I_{DM}	2.0	A
Power Dissipation	SOT-223	P_D	3.5	W
	SOT-89		1.8	W
	SOT-23		1.4	W
	TO-92		2.8	W
Junction Temperature		T_J	+150	°C
Storage Temperature Range		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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	θ_{JA}	150	°C/W
	SOT-89		180	
	SOT-23		325	
	TO-92		160	
Junction to Case	SOT-223	θ_{JC}	35.7	°C/W
	SOT-89		69	
	SOT-23		89	
	TO-92		44.6	

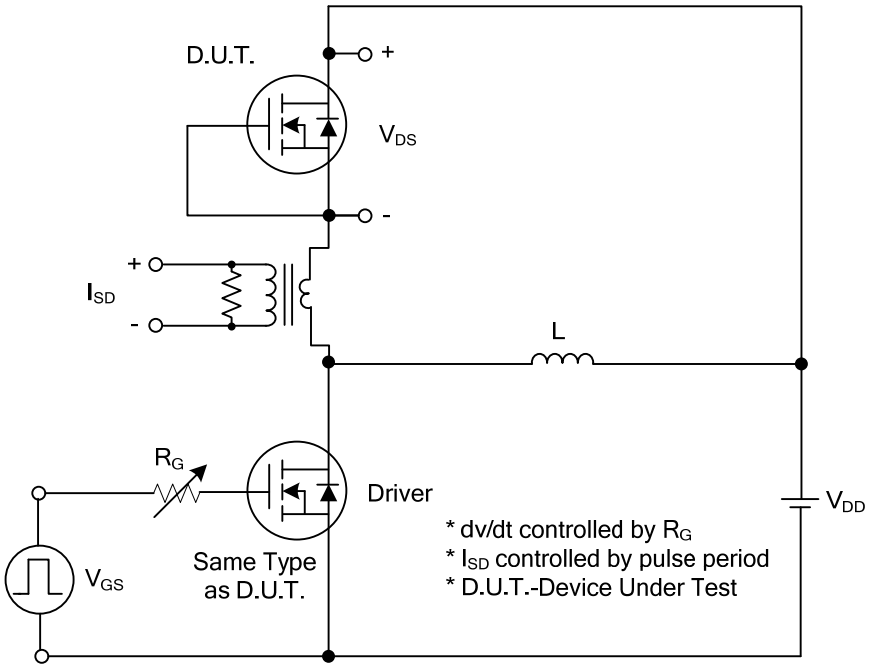
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

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

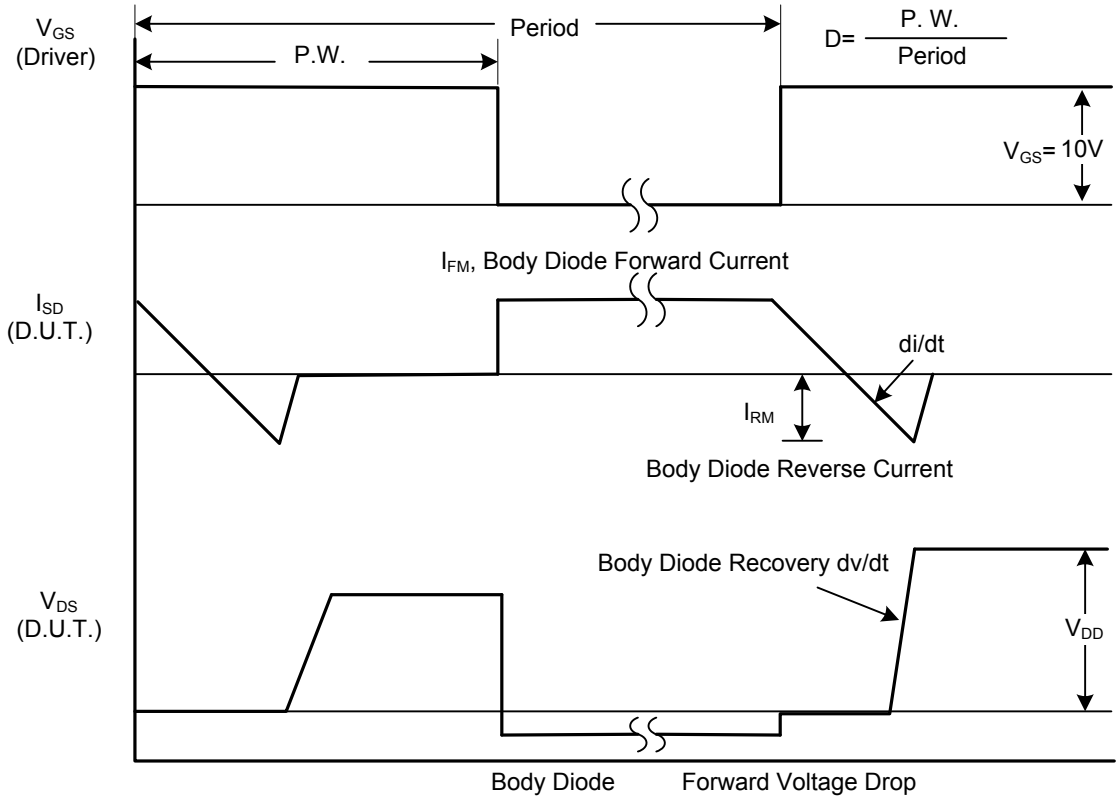
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	I_D=250μA, V_{GS}=0V	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS}=600V, V_{GS}=0V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS}=+30V, V_{DS}=0V			+100	nA
	Reverse		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		$R_{DS(ON)}$	V_{GS}=10V, I_D=0.25A			8.8	Ω
DYNAMIC PARAMETERS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=50V, f=1.0MHz		36		pF
Output Capacitance		C_{OSS}			17		pF
Reverse Transfer Capacitance		C_{RSS}			3.7		pF
SWITCHING PARAMETERS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=480V, V_{GS}=10V, I_D=0.5A, (Note 1, 2)		10		nC
Gate to Source Charge		Q_{GS}			5		nC
Gate to Drain Charge		Q_{GD}			2		nC
Turn-ON Delay Time (Note 1)		$t_{D(ON)}$	V_{DS}=100V, V_{GS}=10V, I_D=0.5A, R_G=25Ω (Note 1, 2)		4		ns
Rise Time		t_R			18		ns
Turn-OFF Delay Time		$t_{D(OFF)}$			8		ns
Fall-Time		t_F			10		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Body-Diode Continuous Current		I_S				0.5	A
Maximum Body-Diode Pulsed Current		I_{SM}				2.0	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_S=0.5A, V_{GS}=0V			1.4	V
Reverse Recovery Time (Note 1)		t_{rr}	I_S=0.5A , V_{GS}=0V di/dt=100A/μs		120		ns
Reverse Recovery Charge		Q_{rr}			200		nC

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

■ TEST CIRCUITS AND WAVEFORMS

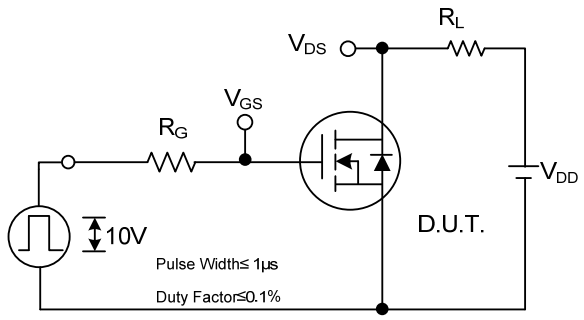


Peak Diode Recovery dv/dt Test Circuit

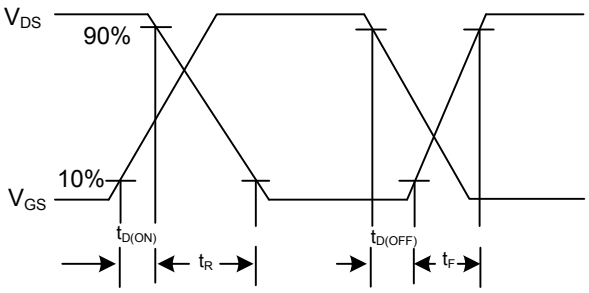


Peak Diode Recovery dv/dt Waveforms

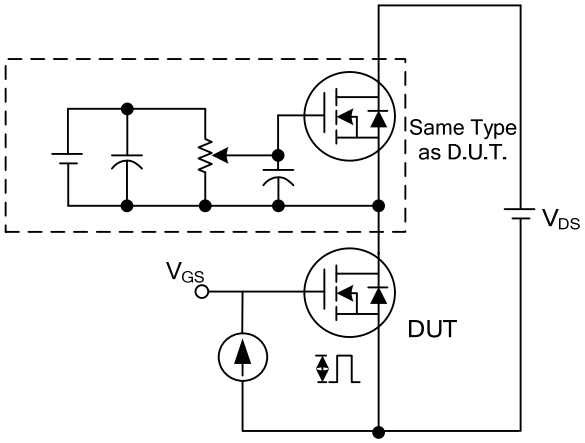
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



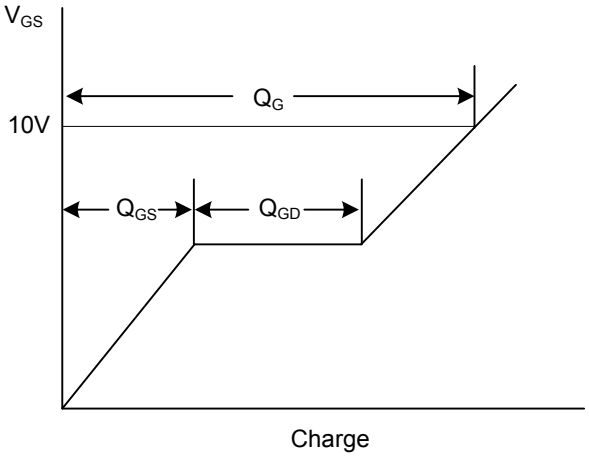
Switching Test Circuit



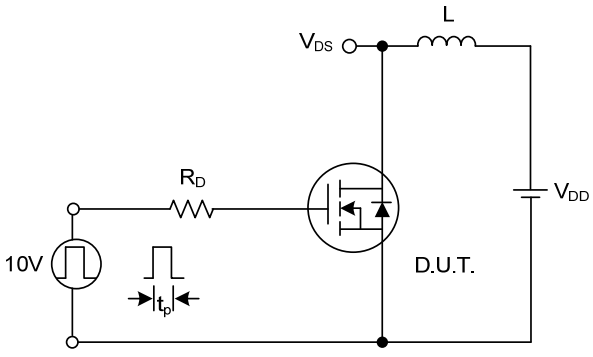
Switching Waveforms



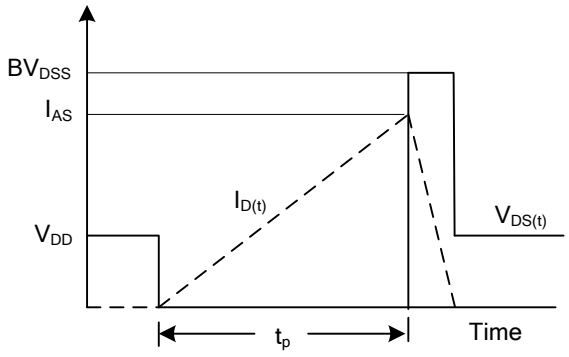
Gate Charge Test Circuit



Gate Charge Waveform



Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms