

USG10R050M-T

POWER MOSFET

**130A, 100V N-CHANNEL
POWER MOSFET**

■ DESCRIPTION

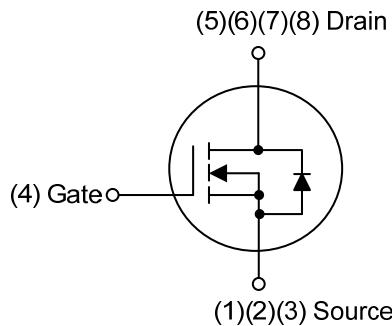
The UTC **USG10R050M-T** is a N-channel Power MOSFET, it uses UTC's advanced technology to provide the customers with low $R_{DS(ON)}$ characteristic by high cell density trench technology.

The UTC **USG10R050M-T** is suitable for high efficiency synchronous rectification in SMPS, UPS, hard switched and high frequency circuits.

■ FEATURES

- * $R_{DS(ON)} \leq 5.0 \text{ m}\Omega @ V_{GS}=10\text{V}, I_D=30\text{A}$
- * High Switching Speed

■ SYMBOL



■ ORDERING INFORMATION

Ordering Number		Package	Pin Assignment								Packing
Lead Free	Halogen Free		1	2	3	4	5	6	7	8	
USG10R050ML-TA3-T	USG10R050MG-TA3-T	TO-220	G	D	S	-	-	-	-	-	Tube
USG10R050ML-TF1-T	USG10R050MG-TF1-T	TO-220F1	G	D	S	-	-	-	-	-	Tube
USG10R050ML-P5060-R	USG10R050MG-P5060-R	PDFN5x6	S	S	S	G	D	D	D	D	Tape Reel

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

USG10R050MG-TA3-T <ul style="list-style-type: none"> (1)Packing Type (2)Package Type (3)Green Package 	<ul style="list-style-type: none"> (1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF1: TO-220F1, P5060: PDFN5x6 (3) G: Halogen Free and Lead Free, L: Lead Free
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■ MARKING

TO-220 / TO-220F1	PDFN5×6
<p>Diagram illustrating marking for TO-220 and TO-220F1 packages. The marking consists of: - Top row: UTC (top left), USG10R050M (center), and a square symbol (top right). - Middle row: A series of seven small squares. - Bottom row: A single square (leftmost) followed by a series of six squares. Annotations indicate: - "L: Lead Free" points to the top-right square. - "G: Halogen Free" points to the bottom-left square. - "Date Code" points to the bottom-right series of squares. - "Lot Code" points to the bottom-left square. - "1" is located at the bottom center of the marking area.</p>	<p>Diagram illustrating marking for PDFN5×6 package. The marking consists of: - Top row: UTC (top left), USG (top center), and 10R050M (top right). - Middle row: A single dot symbol (leftmost) followed by a series of seven squares. - Bottom row: A series of seven small squares. Annotations indicate: - "Lot Code" points to the bottom-left square. - "Date Code" points to the bottom-right series of squares.</p>

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

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	100	V
Gate-Source Voltage		V_{GSS}	± 20	V
Drain Current	Continuous	I_D	130	A
	Pulsed (Note 2)	I_{DM}	260	A
Single Pulsed Avalanche Energy (Note 3)		E_{AS}	238	mJ
Peak Diode Recovery dv/dt (Note 4)		dv/dt	1.8	V/ns
Power Dissipation	TO-220	P_D	133	W
	TO-220F1		42	W
	PDFN5x6		58	W
Junction Temperature		T_J	+150	$^\circ\text{C}$
Storage Temperature Range		T_{STG}	-20 ~ +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. $L = 0.1\text{mH}$, $I_{AS} = 69\text{A}$, $V_{DD} = 50\text{V}$, $R_G = 25 \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 30\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220	θ_{JA}	62.5	$^\circ\text{C/W}$
	TO-220F1		62.5	$^\circ\text{C/W}$
	PDFN5x6		65	$^\circ\text{C/W}$
Junction to Case	TO-220	θ_{JC}	0.94	$^\circ\text{C/W}$
	TO-220F1		2.98	$^\circ\text{C/W}$
	PDFN5x6		2.16 (Note)	$^\circ\text{C/W}$

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

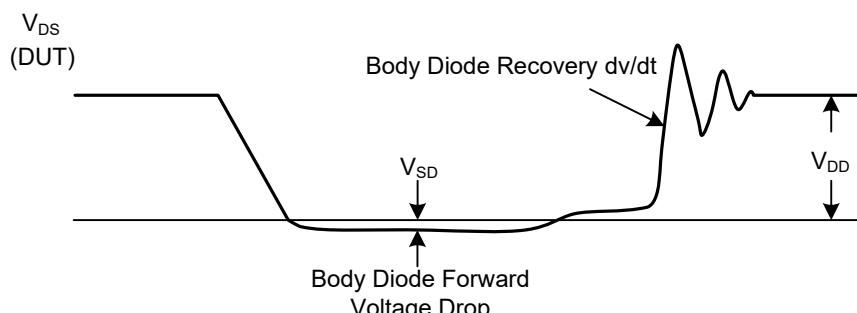
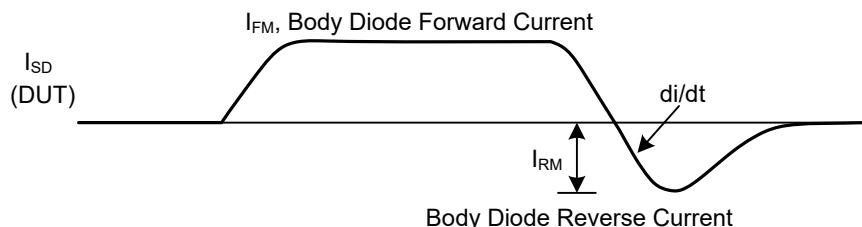
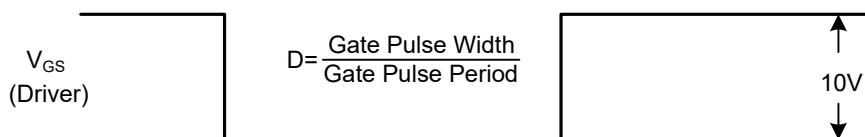
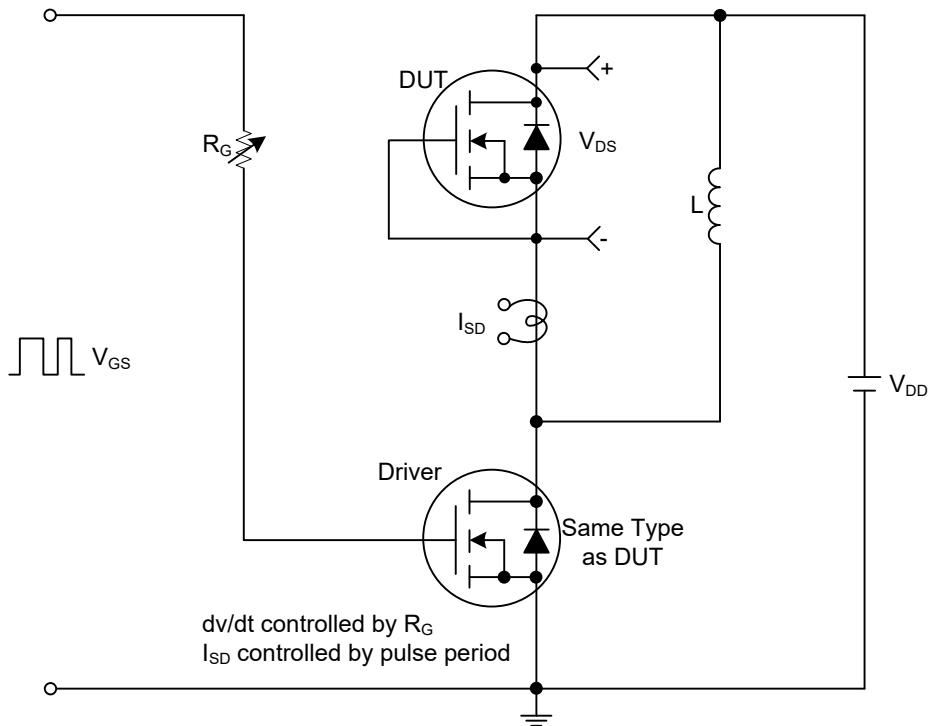
■ ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS						
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D=250\mu\text{A}, V_{GS}=0\text{V}$	100			V
Drain-Source Leakage Current	I_{DSS}	$V_{DS}=80\text{V}, V_{GS}=0\text{V}$			1	μA
Gate-Source Leakage Current	Forward	$V_{GS}=+20\text{V}, V_{DS}=0\text{V}$			+100	nA
	Reverse				-100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(\text{TH})}$	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance	$R_{DS(\text{ON})}$	$V_{GS}=10\text{V}, I_D=30\text{A}$		3.7	5.0	$\text{m}\Omega$
DYNAMIC PARAMETERS						
Input Capacitance	C_{ISS}	$V_{GS}=0\text{V}, V_{DS}=25\text{V}, f=1.0\text{MHz}$		6028		pF
Output Capacitance	C_{OSS}			2140		pF
Reverse Transfer Capacitance	C_{RSS}			255		pF
SWITCHING PARAMETERS						
Total Gate Charge (Note 1)	Q_G	$V_{DS}=80\text{V}, V_{GS}=10\text{V}, I_D=130\text{A},$ (Note 1, 2)		155		nC
Gate to Source Charge	Q_{GS}			21		nC
Gate to Drain Charge	Q_{GD}			45		nC
Turn-on Delay Time (Note 1)	$t_{D(\text{ON})}$	$V_{DD}=50\text{V}, V_{GS}=10\text{V}, I_D=130\text{A},$ $R_G=3.3\Omega$ (Note 1, 2)		18		ns
Rise Time	t_R			26		ns
Turn-off Delay Time	$t_{D(\text{OFF})}$			85		ns
Fall-Time	t_F			36		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS						
Maximum Body-Diode Continuous Current	I_S				130	A
Maximum Body-Diode Pulsed Current	I_{SM}				260	A
Drain-Source Diode Forward Voltage (Note 1)	V_{SD}	$I_S=130\text{A}, V_{GS}=0\text{V}$			1.4	V
Reverse Recovery Time (Note 1)	t_{rr}	$I_S=30\text{A}, V_{GS}=0\text{V},$ $dI_F/dt = 100\text{A}/\mu\text{s}$		66		nS
Reverse Recovery Charge	Q_{rr}			135		nC

Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$.

2. Essentially independent of operating ambient temperature.

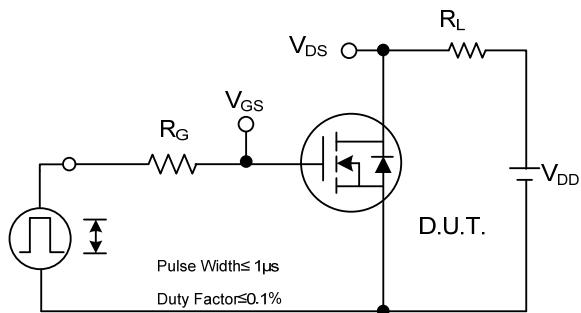
■ TEST CIRCUITS AND WAVEFORMS



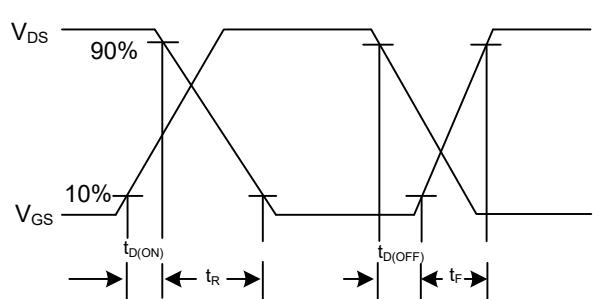
Peak Diode Recovery dv/dt Test Circuit and Waveforms

Peak Diode Recovery dv/dt Waveforms

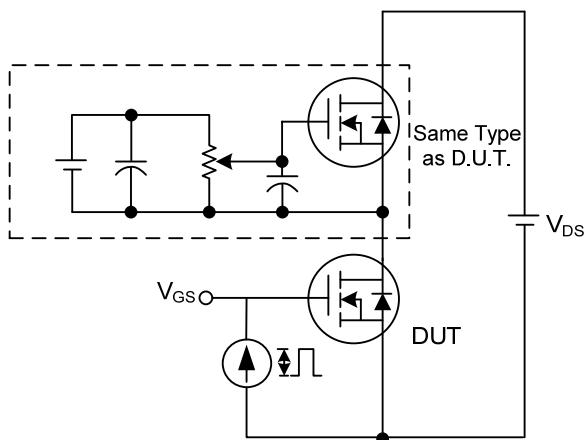
■ TEST CIRCUITS AND WAVEFORMS



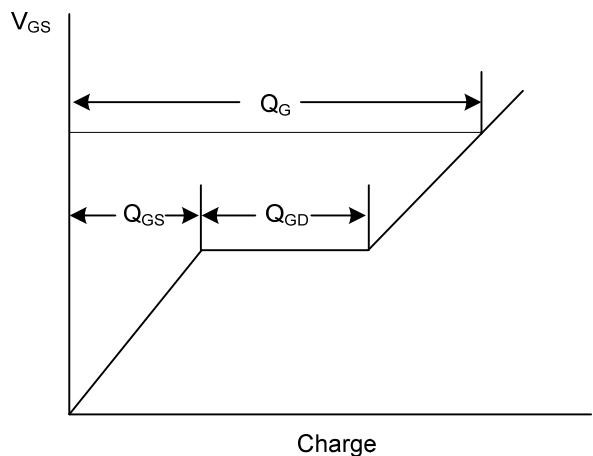
Switching Test Circuit



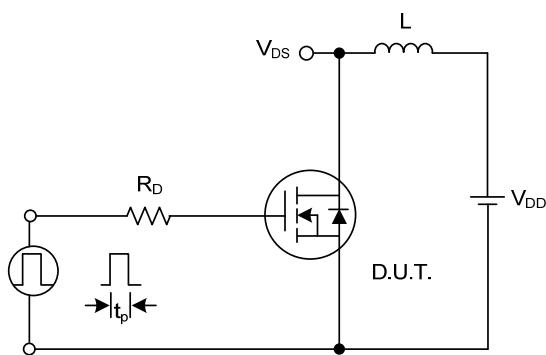
Switching Waveforms



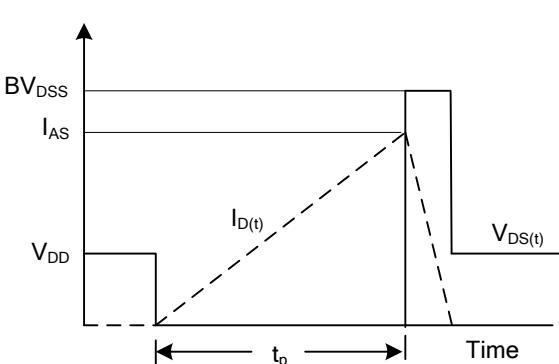
Gate Charge Test Circuit



Gate Charge Waveform

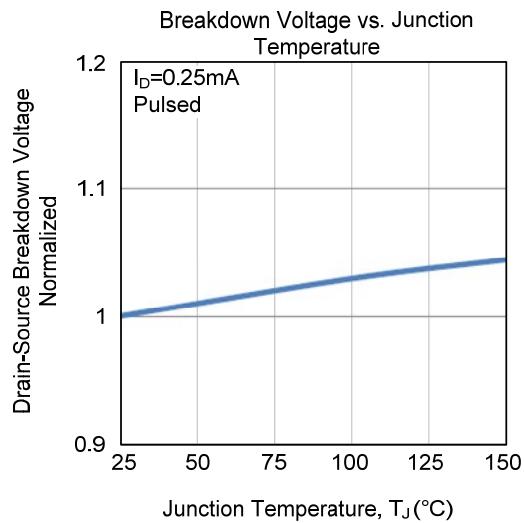
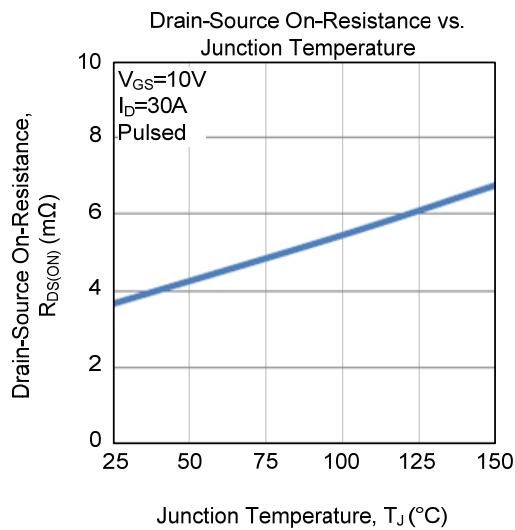
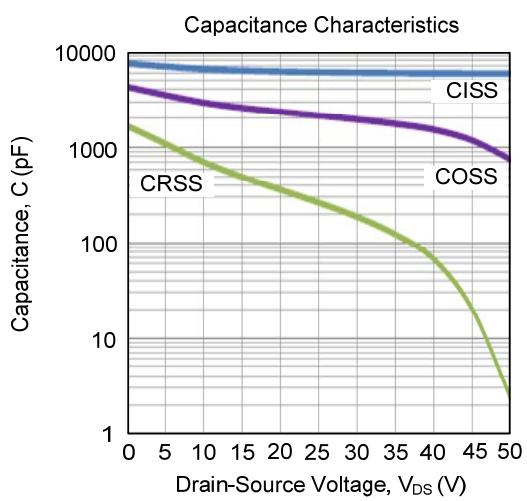
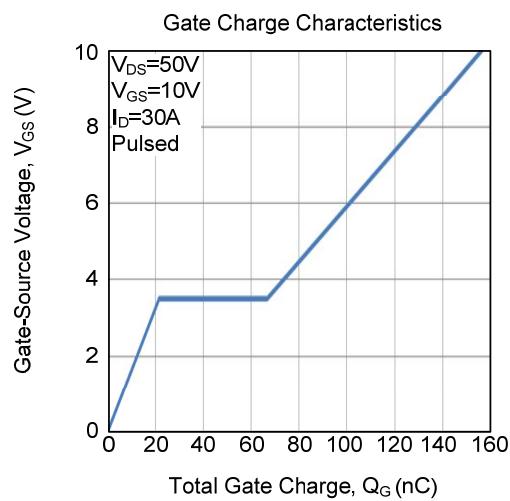
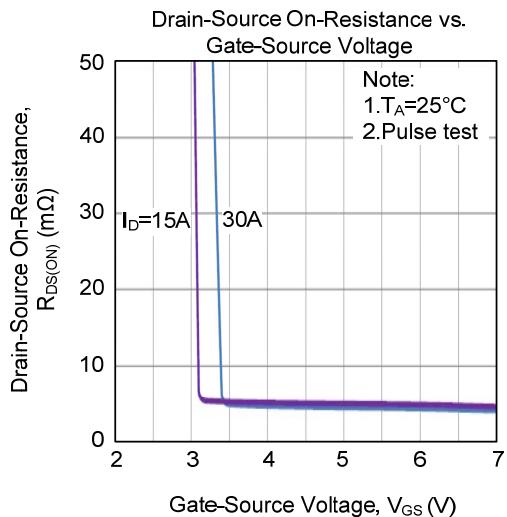
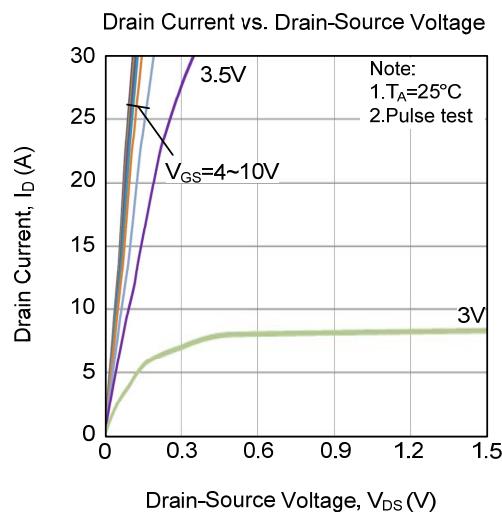


Unclamped Inductive Switching Test Circuit

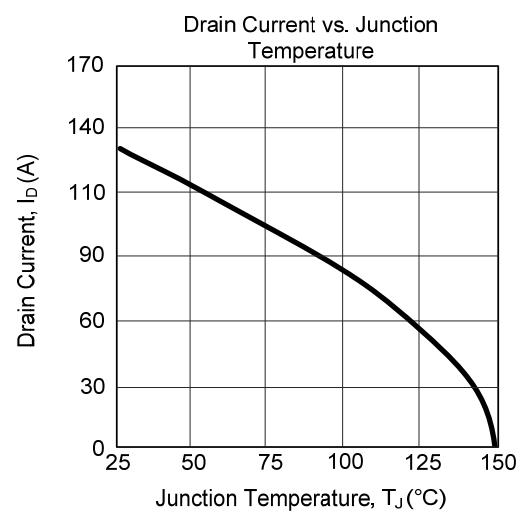
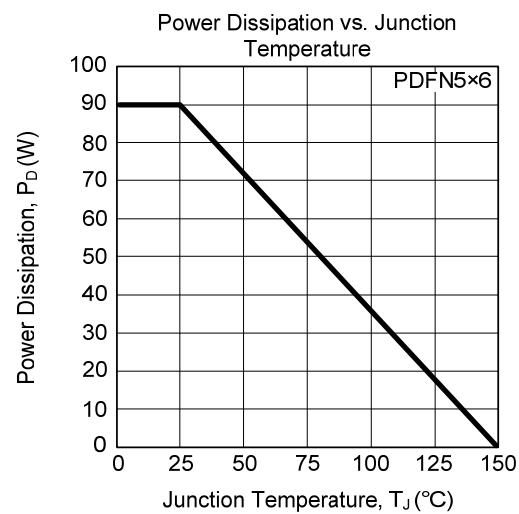
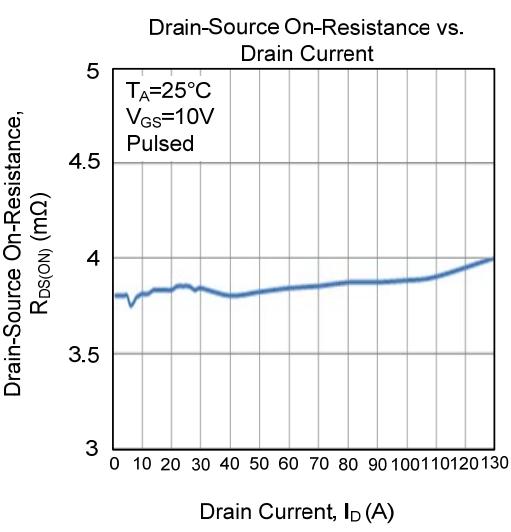
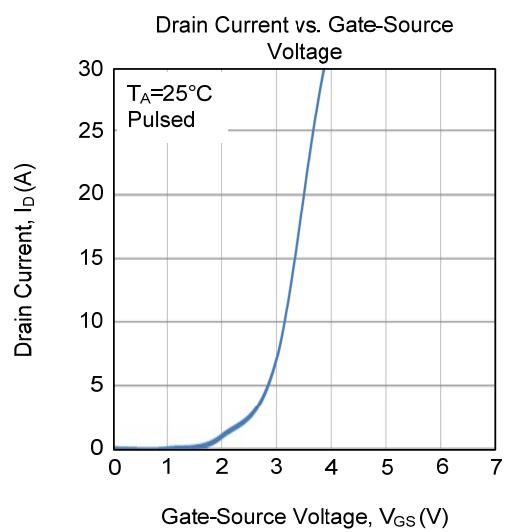
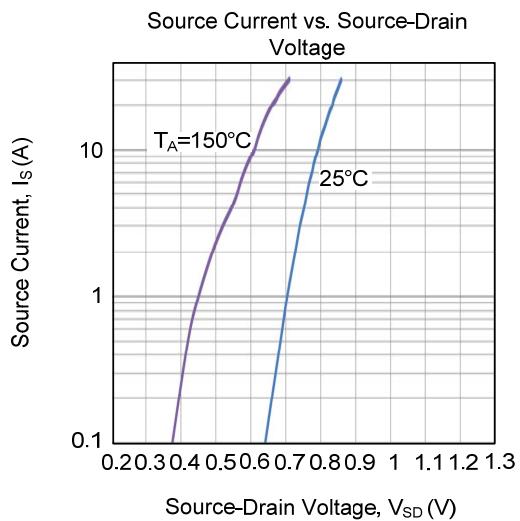
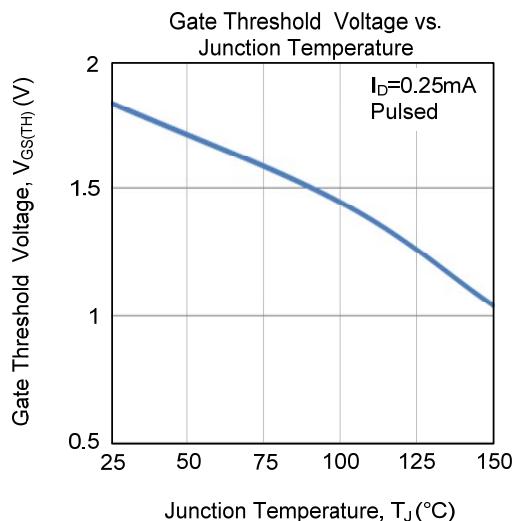


Unclamped Inductive Switching Waveforms

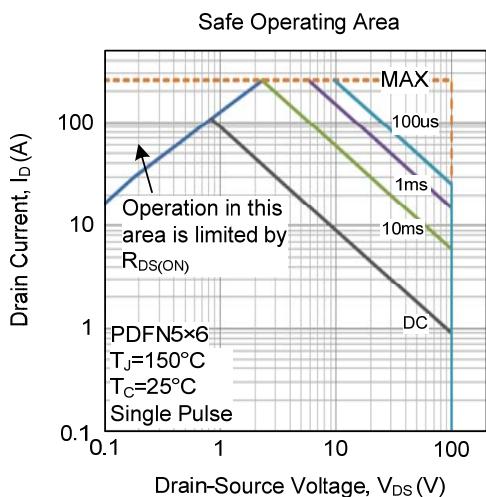
■ TYPICAL CHARACTERISTICS



■ TYPICAL CHARACTERISTICS (Cont.)



- TYPICAL CHARACTERISTICS (Cont.)



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