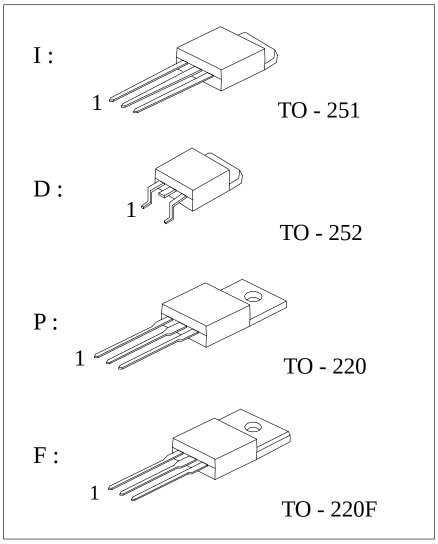
SEMICONDUCTOR
TECHNICAL DATA

FTK4N60P / F / D / I

Power MOSFET

4 Amps, 600 Volt
N-CHANNEL POWER MOSFET



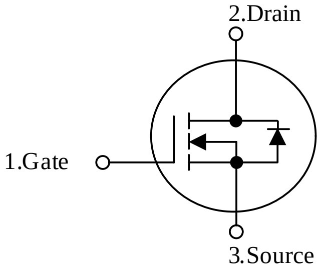
■ DESCRIPTION

The FTK 4N60 is a high voltage MOSFET 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

* $R_{DS(ON)} = 2.5\Omega @ V_{GS} = 10V$
* Ultra low gate charge (typical 10 nC)
* Low reverse transfer Capacitance (C_{RSS} = typical 7.5 pF)
* Fast switching capability
* Avalanche energy Specified
* Improved dv/dt capability, high ruggedness

■ SYMBOL



■ ORDERING INFORMATION

Ordering Number	Package	Pin Assignment			Packing
		1	2	3	
FTK4N60P	TO-220	G	D	S	Tube
FTK4N60F	TO-220F	G	D	S	Tube
FTK4N60I	TO-251	G	D	S	Tube
FTK4N60D	TO-252	G	D	S	Tape Reel

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

■ ABSOLUTE MAXIMUM RATINGS (T$_C$ = 25˚C, unless otherwise specified)

PARAMET		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	600	V
Gate-Source Voltage		V_{GSS}	±30	V
Avalanche Current (Note 1)		I_{AR}	4.4	A
Continuous Drain Current	T_C = 25°C	I_D	4.0	A
	T_C = 100°C		2.2	
Pulsed Drain Current (Note 1)		I_{DM}	16	A
Avalanche Energy	Single Pulse(Note 2)	E_{AS}	150	mJ
	Repetitive Limited by $T_{J(MAX)}$	E_{AR}	7.0	mJ
Peak Diode Recovery dv/dt (Note 3)		dv/dt	4.5	V/ns
Power Dissipation		P_D	106	W
Junction Temperature		T_J	+150	˚C
Operating Temperature		T_{OPR}	-55 ~ +150	˚C
Storage Temperature		T_{STG}	-55 ~ +150	˚C

Note: 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.

■ 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} = 0V, I_D = 250μA	600			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 600V, V_{GS} = 0V			1	μA
			V_{DS} = 480V, T_C = 125°C			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
Breakdown Voltage Temperature Coefficient		$\Delta BV_{DSS} / \Delta T_J$	I_D = 250μA, Referenced to 25°C		0.7		V / ˚C
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250μA	2.0		4.0	V
Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS} = 10V, I_D = 2.2A			2.5	Ω
Forward Transconductance		g_{FS}	V_{DS} = 50V, I_D = 2.2A (Note 4)		1.9		S
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz		520		pF
Output Capacitance		C_{OSS}			35		pF
Reverse Transfer Capacitance		C_{RSS}			7.5		pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	V_{DD} = 300V, I_D = 4A, R_G = 25Ω (Note 4,5)		10		ns
Turn-On Rise Time		t_R			42		ns
Turn-Off Delay Time		$t_{D(OFF)}$			38		ns
Turn-Off Fall Time		t_F			46		ns
Total Gate Charge		Q_G	V_{DS} = 480V, I_D = 4A, V_{GS} = 10V (Note 4,5)		15		nC
Gate-Source Charge		Q_{GS}			2.8		nC
Gate-Drain Charge		Q_{GD}			5.5		nC

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS						
Drain-Source Diode Forward Voltage	V_{SD}	V_{GS} = 0 V, I_S = 4.0 A			1.4	V
Maximum Continuous Drain-Source Diode Forward Current	I_S				4.0	A
Maximum Pulsed Drain-Source Diode Forward Current	I_{SM}				16	A
Reverse Recovery Time	t_{RR}	V_{GS} = 0 V, I_S = 4.0A, dI_F/dt =100 A/μs (Note 4)		310		ns
Reverse Recovery Charge	Q_{RR}			2.26		μC

Note:

1. Repetitive Rating : Pulse width limited by maximum junction temperature
2. L = 17mH, I_{AS} = 4A, V_{DD} = 50V, R_G = 25 Ω, Starting T_J = 25°C
3. $I_{SD} \leq$ 4A, di/dt $\leq$ 300A/μs, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test: Pulse width $\leq$ 300μs, Duty cycle $\leq$ 2%
5. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

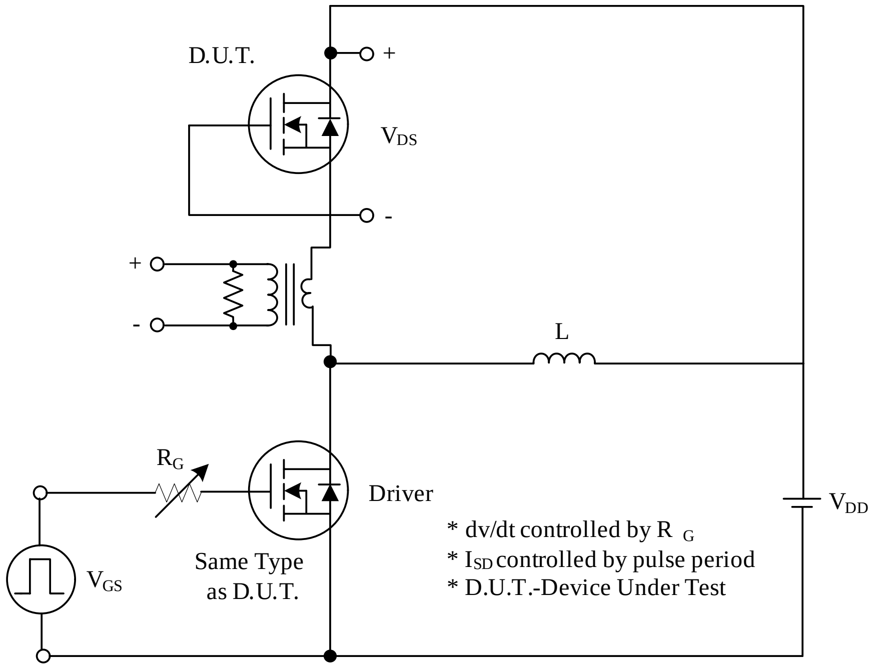


Fig. 1A Peak Diode Recovery dv/dt Test Circuit

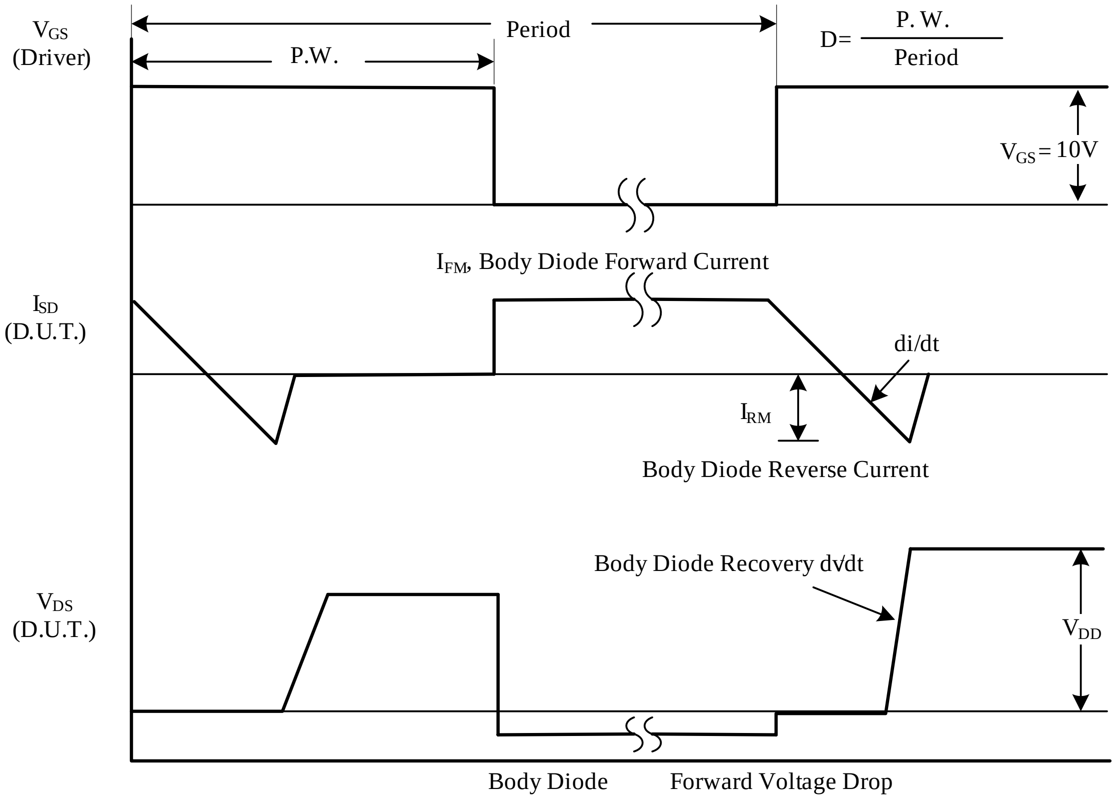


Fig. 1B Peak Diode Recovery dv/dt Waveforms

■ TEST CIRCUITS AND WAVEFORMS (Cont.)

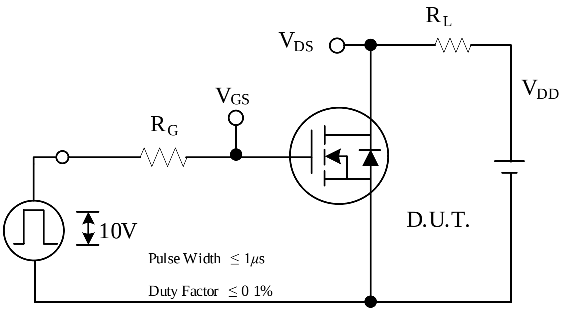


Fig. 2A Switching Test Circuit

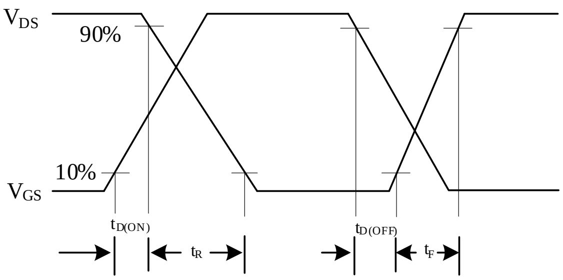


Fig. 2B Switching Waveforms

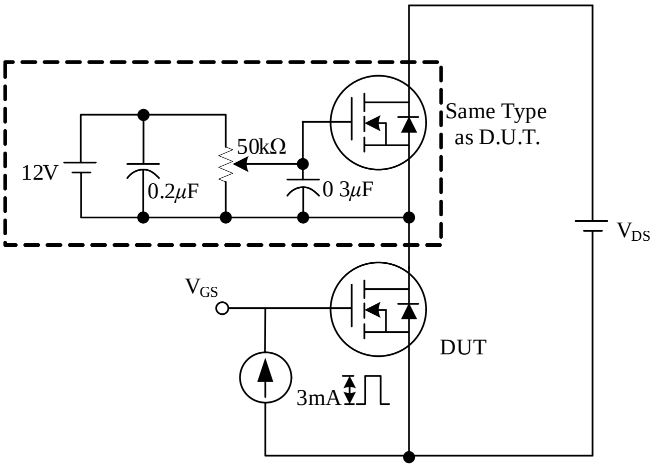


Fig. 3A Gate Charge Test Circuit

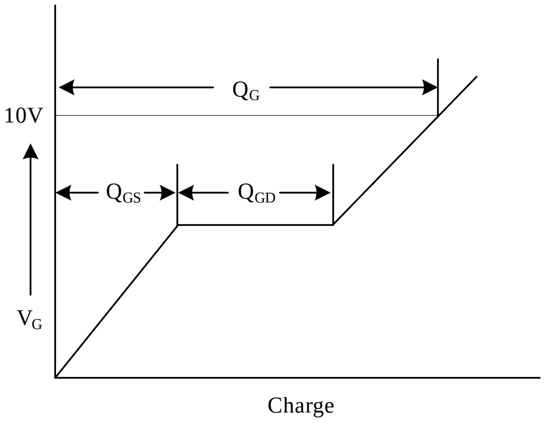


Fig. 3B Gate Charge Waveform

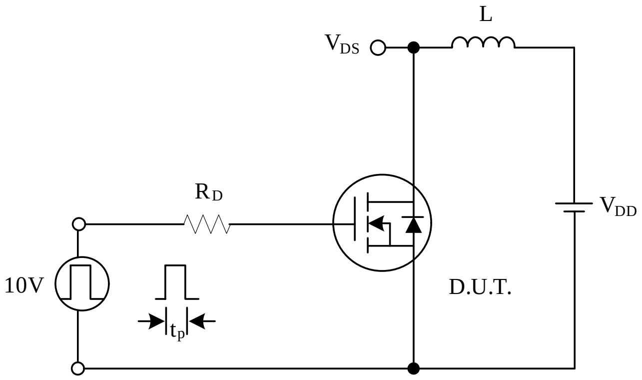


Fig. 4A Unclamped Inductive Switching Test Circuit

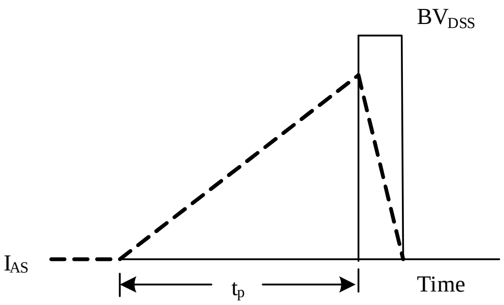
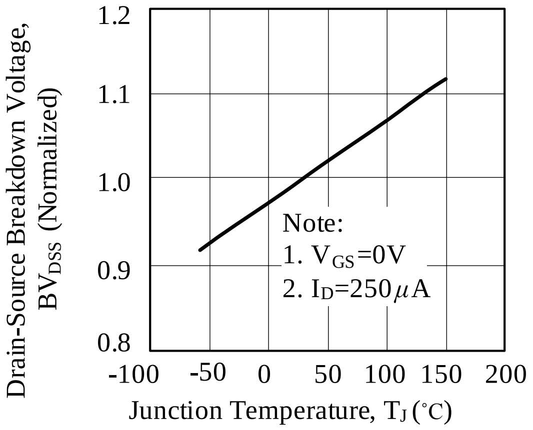


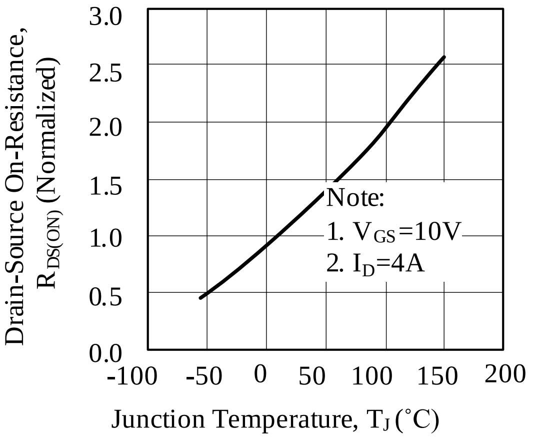
Fig. 4B Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

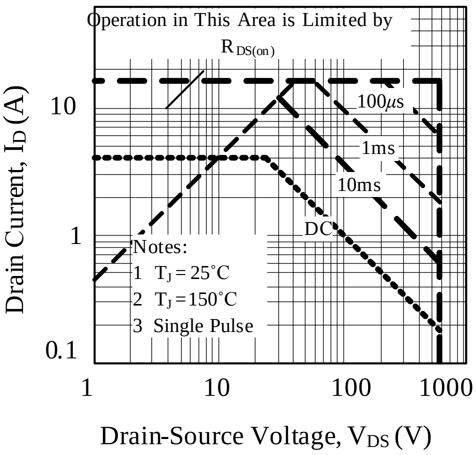
Breakdown Voltage Variation vs. Temperature



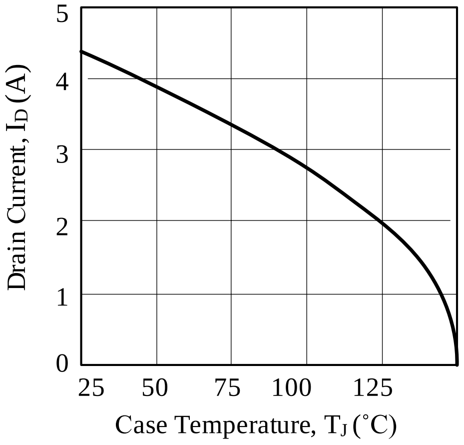
On-Resistance Junction Temperature



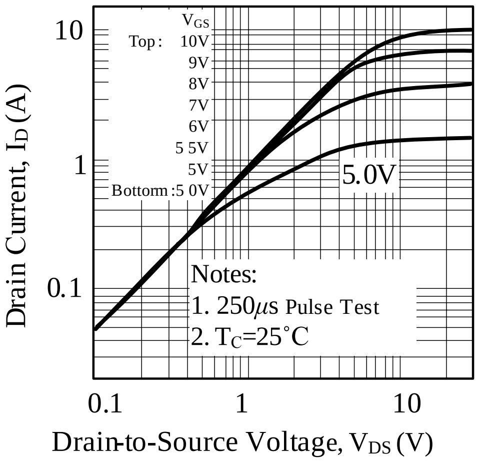
Maximum Safe Operating Area



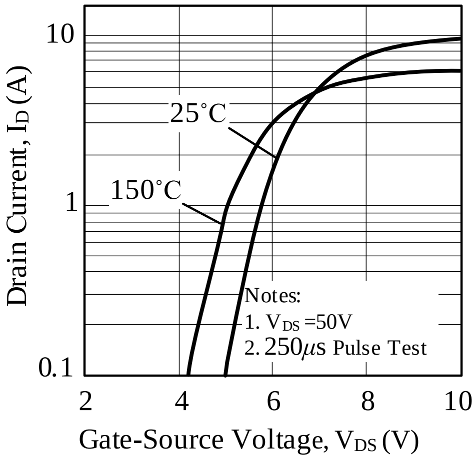
Maximum Drain Current vs. Case Temperature



On-State Characteristics

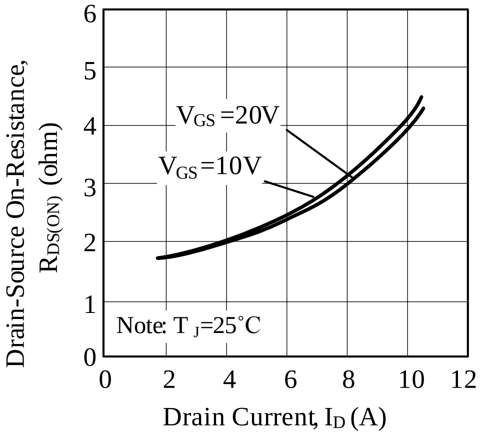


Transfer Characteristics

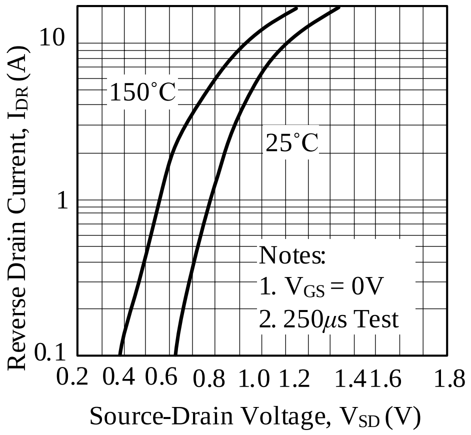


■ TYPICAL CHARACTERISTICS(Cont.)

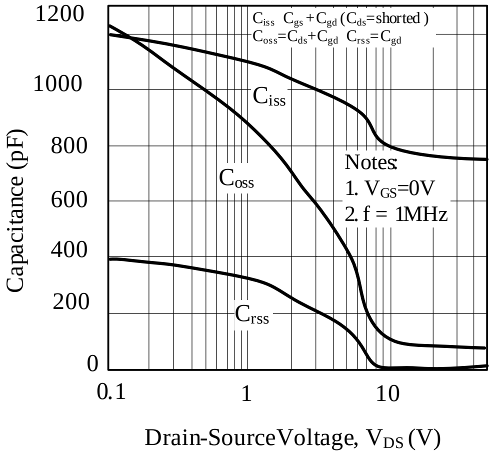
On-Resistance Variation vs. Drain Current and Gate Voltage



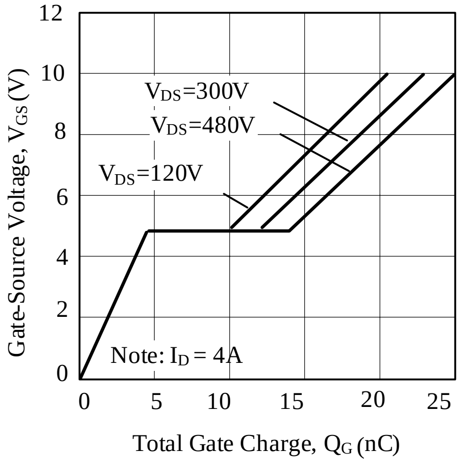
On State Current vs. Allowable Case Temperature



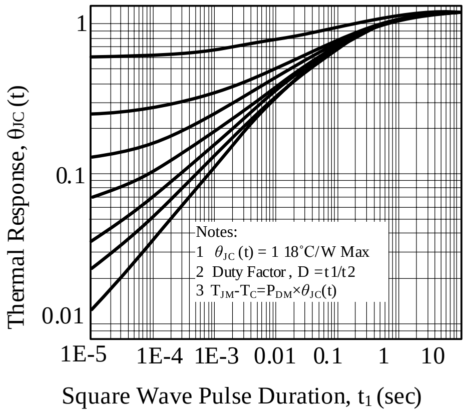
Capacitance Characteristics (Non-Repetitive)



Gate Charge Characteristics



Transient Thermal Response Curve



Power Dissipation