



## UPGE5N65FQ

*Insulated Gate Bipolar Transistor*

### 650V, SMPS N-CHANNEL IGBT

#### DESCRIPTION

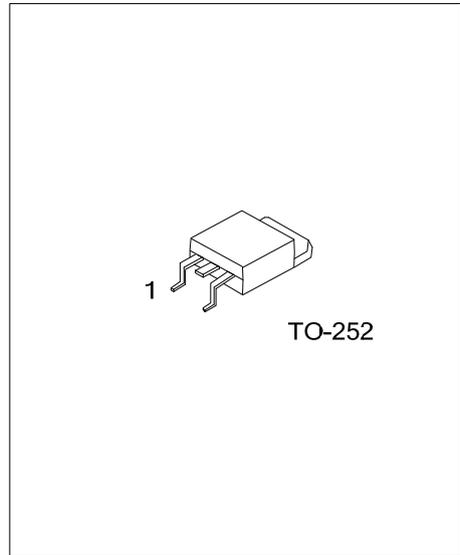
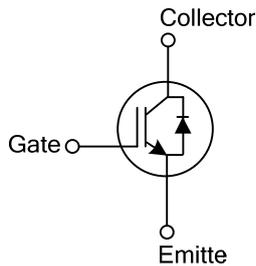
The UTC **UPGE5N65FQ** is a N-channel IGBT. it uses UTC's advanced technology to provide customers with high input impedance, high switching speed and low conduction loss, etc.

The UTC **UPGE5N65FQ** is suitable for high voltage switching, high frequency switch mode power supplies.

#### FEATURES

- \* High switching speed
- \* High avalanche ruggedness
- \* Low saturation voltage:  $V_{CE(SAT),Typ.}=1.76V @ I_C=5.0A, V_{GE}=15V (T_C = 25^{\circ}C)$

#### SYMBOL



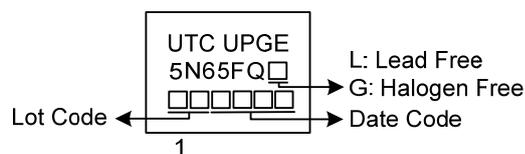
#### ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
UPGE5N65FQL-TN3-R	UPGE5N65FQG-TN3-R	TO-252	G	C	E	Tape Reel

Note: Pin Assignment: G: Gate C: Collector E: Emitter

<p>UPGE5N65FQG-TN3-R</p>	<p>(1) R: Tape Reel</p> <p>(2) TN3: TO-252</p> <p>(3) G: Halogen Free and Lead Free L: Lead Free</p>
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#### MARKING



# UPGE5N65FQ

## Insulated Gate Bipolar Transistor

### ■ ABSOLUTE MAXIMUM RATINGS ( $T_A=25^{\circ}\text{C}$ , unless otherwise noted)

PARAMETER	SYMBOL	RATINGS	UNIT
Collector-Emitter Voltage	$V_{CES}$	650	V
Gate-Emitter Voltage	$V_{GES}$	$\pm 20$	V
Transient Gate-emitter voltage ( $t_P < 5 \text{ ms}$ )		$\pm 25$	V
Continuous Collector Current	$I_C$	$T_C=25^{\circ}\text{C}$	A
		$T_C=100^{\circ}\text{C}$	A
Collector Current Pulsed (Note 1)	$I_{CM}$	20	A
Diode Forward Current	$I_F$	$T_C=25^{\circ}\text{C}$	A
		$T_C=100^{\circ}\text{C}$	A
Short Circuit Withstand Time $V_{GE} = 15\text{V}$ , $V_{CC} \leq 200\text{V}$ Allowed number of short circuits < 1000 Time between short circuits: $\geq 1.0\text{s}$ $T_{VJ} = 25^{\circ}\text{C}$	$t_{SC}$	10	$\mu\text{s}$
Power Dissipation ( $T_C=25^{\circ}\text{C}$ )	$P_D$	36	W
Operating Junction Temperature	$T_J$	-40 ~ +150	$^{\circ}\text{C}$
Storage Temperature Range	$T_{STG}$	-55 ~ +150	$^{\circ}\text{C}$

Notes: 1. Absolute maximum ratings are stress ratings only and functional device operation is not implied.  
Absolute maximum ratings are those values beyond which the device could be permanently damaged.  
2. Pulse width limited by maximum junction temperature.

### ■ THERMAL DATA

PARAMETER	SYMBOL	RATING	UNIT
Junction to Case	$\theta_{JC}$	3.47	$^{\circ}\text{C/W}$

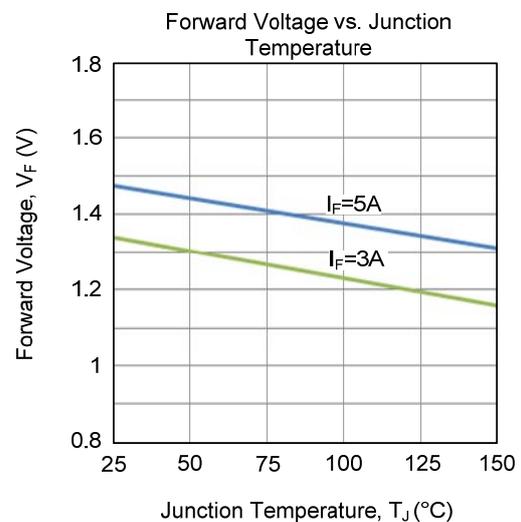
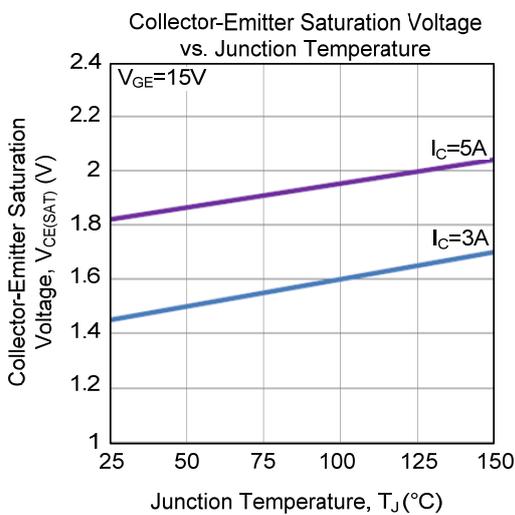
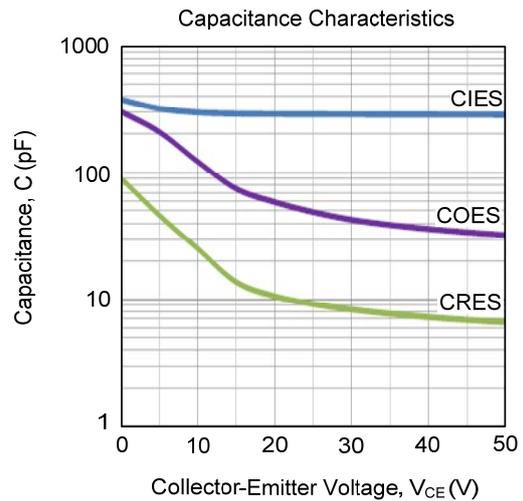
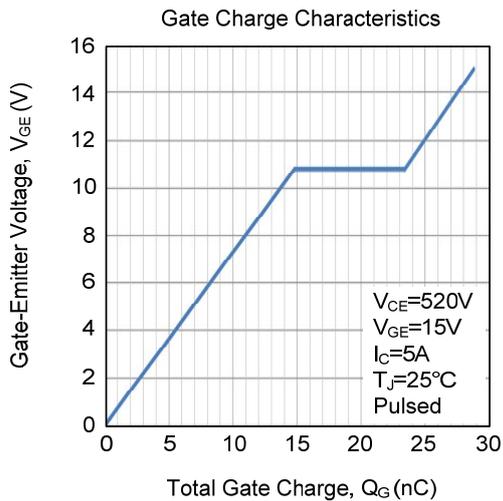
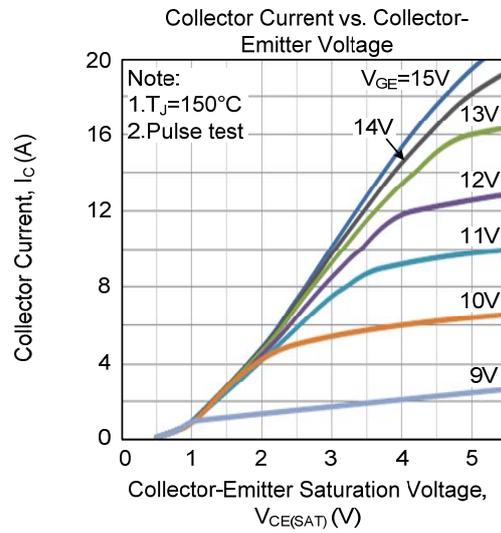
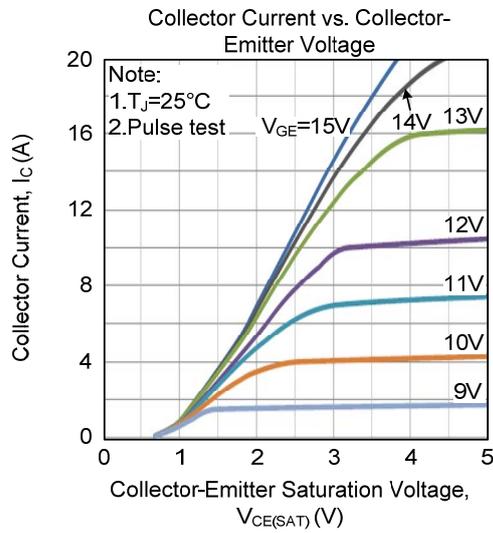
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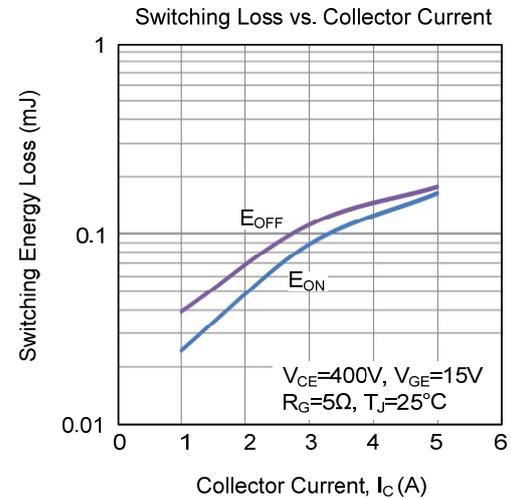
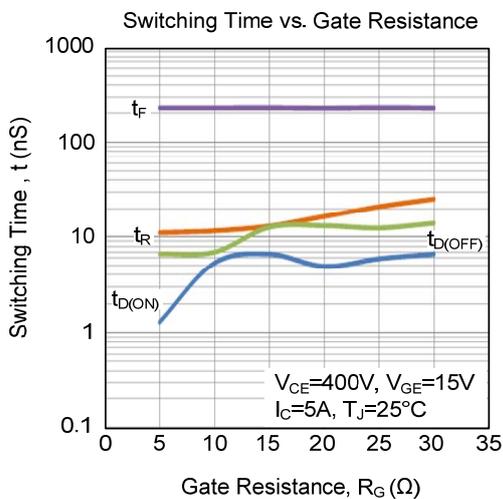
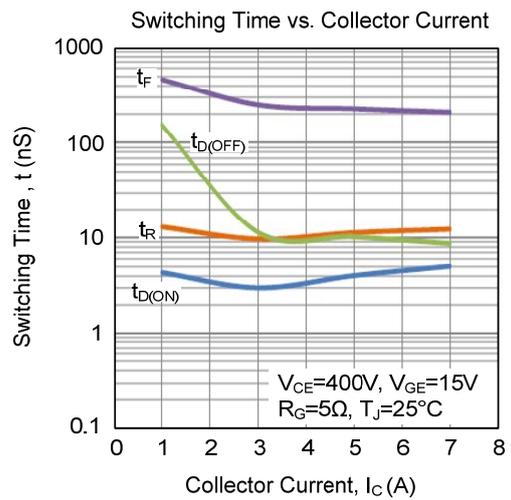
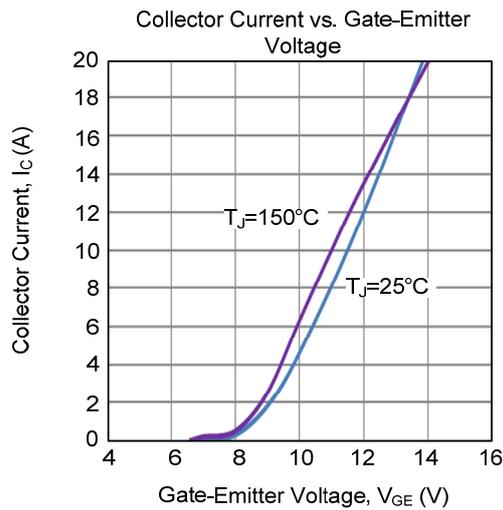
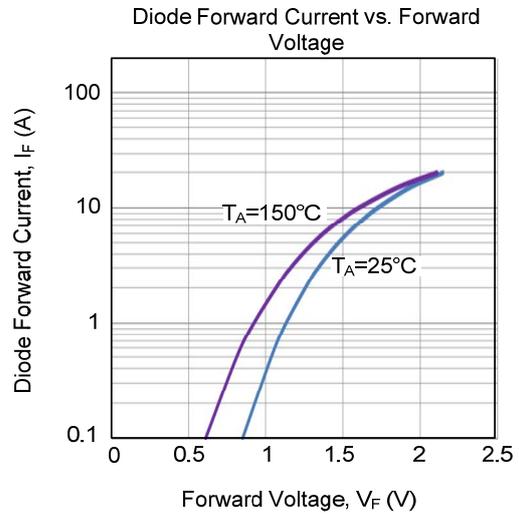
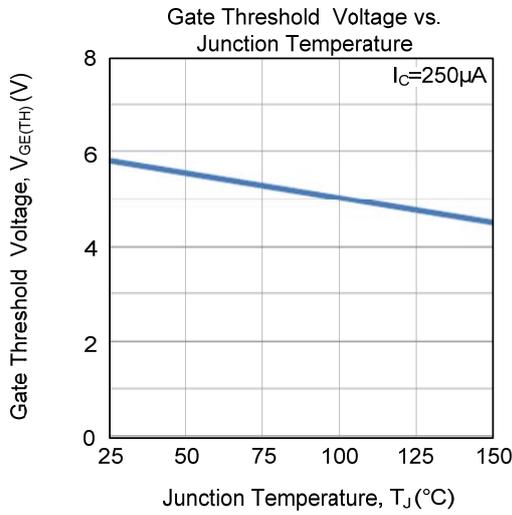
■ ELECTRICAL CHARACTERISTICS (T<sub>C</sub>=25°C, unless otherwise noted)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
<b>Off Characteristics</b>						
Collector-Emitter Breakdown Voltage	BV <sub>CES</sub>	I <sub>C</sub> =250μA, V <sub>GE</sub> =0V	650			V
Collector Cut-Off Current	I <sub>CES</sub>	V <sub>CE</sub> =650V, V <sub>GE</sub> =0V			10	μA
G-E Leakage Current	I <sub>GES</sub>	V <sub>CE</sub> =0V, V <sub>GE</sub> =±20V			±400	nA
<b>On Characteristics</b>						
Gate to Emitter Threshold Voltage	V <sub>GE(TH)</sub>	I <sub>C</sub> =250μA, V <sub>CE</sub> =V <sub>GE</sub>	4.5		7.5	V
Collector to Emitter Saturation Voltage	V <sub>CE(SAT)</sub>	I <sub>C</sub> =5.0A, V <sub>GE</sub> =15V	T <sub>C</sub> =25°C	1.76	2.1	V
			T <sub>C</sub> =125°C	2.1		V
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>IES</sub>	V <sub>CE</sub> =25V, V <sub>GE</sub> =0V, f=1MHz		274		pF
Output Capacitance	C <sub>OES</sub>			38.8		pF
Reverse Transfer Capacitance	C <sub>RES</sub>			6		pF
<b>Switching Characteristics</b>						
Total Gate Charge	Q <sub>G</sub>	V <sub>CE</sub> =400V, I <sub>C</sub> =5.0A, V <sub>GE</sub> =15V		28.8		nC
Gate-Emitter Charge	Q <sub>GE</sub>			14.8		nC
Gate-Collector Charge	Q <sub>GC</sub>			8.6		nC
Turn-On Delay Time	t <sub>DON)</sub>	V <sub>CC</sub> =400V, I <sub>C</sub> =5.0A, R <sub>G</sub> =25Ω, V <sub>GE</sub> =0~15V, L=500μH		14.7		ns
Rise Time	t <sub>R</sub>			22		ns
Turn-Off Delay Time	t <sub>DOFF)</sub>			19.2		ns
Fall Time	t <sub>F</sub>			218		ns
Turn-On Switching Loss	E <sub>ON</sub>			0.184		mJ
Turn-Off Switching Loss	E <sub>OFF</sub>			0.168		mJ
<b>SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS</b>						
Forward Voltage Drop	V <sub>F</sub>	I <sub>F</sub> =3A			2.0	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> =3.0A, di/dt=100A/μS, V <sub>CC</sub> =400V		49.2		ns
Reverse Recovery Charge	Q <sub>rr</sub>				109	

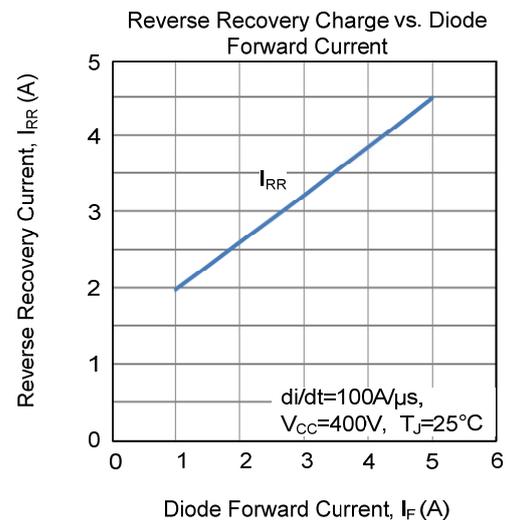
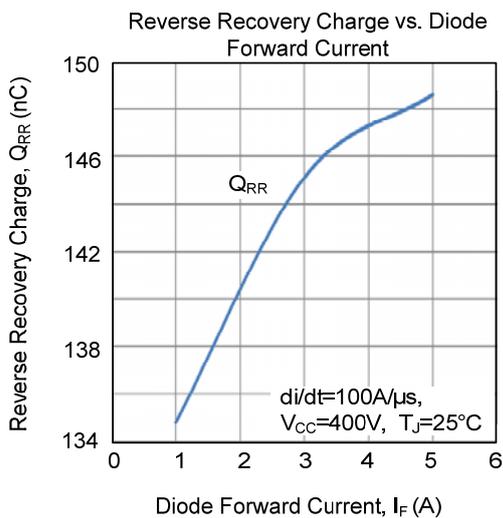
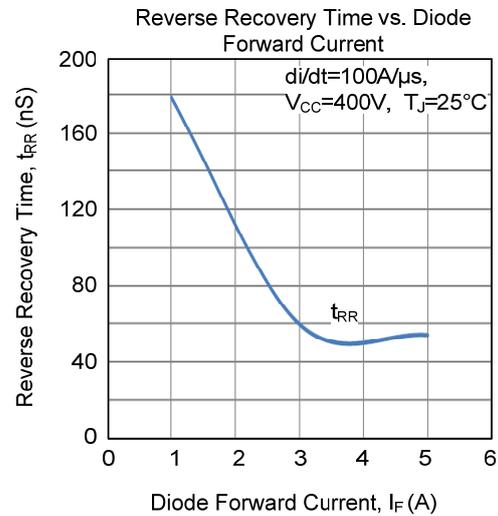
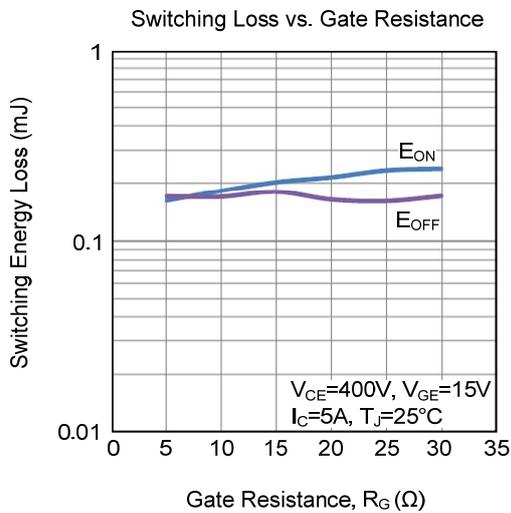
### TYPICAL CHARACTERISTICS



### TYPICAL CHARACTERISTICS (Cont.)



### ■ TYPICAL CHARACTERISTICS (Cont.)



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