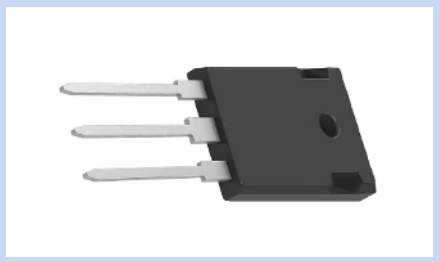
Insulated Gate Bipolar Transistor
650V 133A 366W TO-247

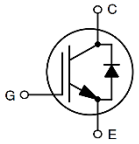
MIG65N133T247

MERITEK

FEATURE

- Superior High-Speed Switching
- Low $V_{CE(sat)}$ at T_J=25°C
- Positive $V_{CE(sat)}$ Coefficient
- Co-Packed with Low Qrr and Soft Recovery Diode
- Application: Uninterruptible Power Supplies, PV Inverter, Welding Machine, and EV Charger





RoHS

MECHANICAL DATA

- Case: TO-247 Package
- Terminals: Solderable per MIL-STD-750, Method 2026

MAXIMUM RATINGS

Parameter		Symbol	Value	Unit
Collector-to-Emitter Breakdown Voltage		V_{CES}	650	V
Gate-to-Emitter Voltage		V_{GE}	±20	V
Collector Current – Continuous	T_C=25°C	I_C	133	A
	T_C=100°C		80	
Collector Current – Pulsed	t_p limited by T_{jmax}	I_{CM}	225	A
Diode Forward Current – Continuous	T_C=25°C	I_F	75	A
	T_C=100°C		37.5	
Diode Forward Current – Pulsed		I_{FM}	225	A
IGBT Max. Power Dissipation	T_C=25°C	P_D	366	W
FWD Max. Power Dissipation	T_C=100°C		183	W
Thermal Resistance Junction to Ambient		$R_{\theta JA}$	40	°C/W
Thermal Resistance Junction to Case for IGBT		$R_{\theta JC}$	0.41	°C/W
Thermal Resistance Junction to Case for Diode			0.60	
Operating Junction Temperature Range		T_J	-40 to 175	°C
Storage Temperature Range		T_{STG}	-55 to 150	°C
Soldering Temperature,1/8" from case for 5s		T_{STD}	260	°C

TYPICAL RATINGS

Parameter		Symbol	Value	Unit
Non−Repetitive Forward Surge Current	Half−Sine Pulse, tp=8.3 ms, T_C=25°C	I_{FSM}	420	A
	Half−Sine Pulse, tp=8.3 ms, T_C=150°C		380	
Internal emitter inductance measured 5mm(0.197 inch) from case		L_E	13	nH

ELECTRICAL CHARACTERISTICS

Static Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Collector-Emitter Breakdown Voltage	V_{GE}=0V, I_C=0.5mA	BV_{CES}	650	--	--	V
Zero Gate Voltage Collector Current	V_{CE}=650V, V_{GE}=0V	I_{CES}	--	--	150	μA
Gate-Body Leakage Current	V_{GE}=20V, V_{CE}=0V	I_{GES}	--	--	200	nA
Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=75A, T_J=25°C	$V_{CE(SAT)}$	--	1.65	2.25	V
	V_{GE}=15V, I_C=75A, T_J=125°C		--	1.85	--	
	V_{GE}=15V, I_C=75A, T_J=175°C		--	2.0	--	
Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=75mA	$V_{GE(th)}$	3.0	4.5	6.0	V
Transconductance	V_{CE}=20V, I_C=75A	g_{FS}	--	36	--	S
Dynamic Characteristics	**Conditions**	**Symbol**	**Min**	**Typ.**	**Max**	**Unit**
Total Gate Charge	V_{CE}=520V, V_{GE}=15V, I_C=75A	Q_g	--	108	--	nC
Input Capacitance	V_{CE}=25V, V_{GE}=0V, F=1MHz	C_{ies}	--	3400	--	pF
Output Capacitance		C_{oes}	--	220	--	
Reverse Transfer Capacitance		C_{res}	--	28	--	
Switching Characteristics	**Conditions**	**Symbol**	**Min**	**Typ.**	**Max**	**Unit**
Turn-On Delay Time	V_{CC}=400V, V_{GE}=0/15V, R_G=10Ω I_C=37.5A, T_C=25°C	$T_{d(on)}$	--	25	--	ns
Rise Time		T_r	--	33	--	
Turn-Off Delay Time		$T_{d(off)}$	--	148	--	
Fall Time		T_f	--	20	--	
Turn-On Switching Loss		E_{on}	--	0.86	--	mJ
Turn-Off Switching Loss		E_{off}	--	0.31	--	
Total Switching Loss		E_{ts}	--	1.17	--	
Turn-On Delay Time	V_{CC}=400V, V_{GE}=0/15V, R_G=10Ω I_C=75A, T_C=25°C	$T_{d(on)}$	--	30	--	ns
Rise Time		T_r	--	73	--	
Turn-Off Delay Time		$T_{d(off)}$	--	137	--	
Fall Time		T_f	--	68	--	
Turn-On Switching Loss		E_{on}	--	2.47	--	mJ
Turn-Off Switching Loss		E_{off}	--	1.27	--	
Total Switching Loss		E_{ts}	--	3.74	--	
Turn-On Delay Time	V_{CC}=400V, V_{GE}=0/15V, R_G=10Ω I_C=37.5A, T_C=175°C	$T_{d(on)}$	--	23	--	ns
Rise Time		T_r	--	34	--	
Turn-Off Delay Time		$T_{d(off)}$	--	171	--	
Fall Time		T_f	--	20	--	
Turn-On Switching Loss		E_{on}	--	1.13	--	mJ
Turn-Off Switching Loss		E_{off}	--	0.43	--	
Total Switching Loss		E_{ts}	--	1.56	--	
Turn-On Delay Time	V_{CC}=400V, V_{GE}=0/15V, R_G=10Ω I_C=75A, T_C=175°C	$T_{d(on)}$	--	29	--	ns
Rise Time		T_r	--	75	--	
Turn-Off Delay Time		$T_{d(off)}$	--	151	--	
Fall Time		T_f	--	71	--	
Turn-On Switching Loss		E_{on}	--	3.15	--	mJ
Turn-Off Switching Loss		E_{off}	--	1.41	--	
Total Switching Loss		E_{ts}	--	4.56	--	

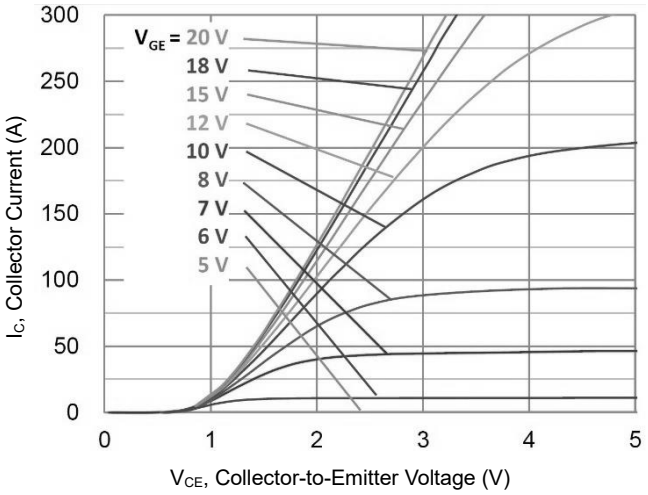
ELECTRICAL CHARACTERISTICS (CONT.)

Diode Characteristics	Conditions	Symbol	Min	Typ.	Max	Unit
Collector-Emitter Breakdown Voltage	V_{GE}=0V, I_C=0.5mA	**BV_{CES}**	650	--	--	V
Zero Gate Voltage Collector Current	V_{CE}=650V, V_{GE}=0V	**I_{CES}**	--	--	150	μA
Gate-Body Leakage Current	V_{GE}=20V, V_{CE}=0V	**I_{GES}**	--	--	200	nA
Collector-Emitter Saturation Voltage	V_{GE}=15V, I_C=75A, T_J=25°C	**$V_{CE(SAT)}$**	--	1.65	2.25	V
	V_{GE}=15V, I_C=75A, T_J=125°C		--	1.85	--	
	V_{GE}=15V, I_C=75A, T_J=175°C		--	2.0	--	
Gate Threshold Voltage	V_{GE}=V_{CE}, I_C=75mA	**$V_{GE(th)}$**	3.0	4.5	6.0	V
Diode Froward Voltage	V_{GE}=0V, I_F=37.5A, T_J=25°C	**V_F**	--	1.74	--	V
	V_{GE}=0V, I_F=37.5A, T_J=125°C		--	1.44	--	
	V_{GE}=0V, I_F=37.5A, T_J=175°C		--	1.29	--	
Reverse Recovery Time	I_F =37.5A, V_R=400V, di/dt = 1000A/μs, T_J=25°C	**t_{rr}**	--	57	--	ns
Reverse Recovery Charge		**Q_{rr}**	--	568	--	nC
Peak Reverse Recovery Current		**I_{rr}**	--	17	--	A
Peak Reverse Recovery Energy		**E_{rec}**	--	85	--	μJ
Diode peak rate of fall of reverse recovery current		**di_{rr}/dt**	--	586	--	A/μs
Reverse Recovery Time	I_F =37.5A, V_R=400V, di/dt = 1000A/μs, T_J=175°C	**t_{rr}**	--	84	--	ns
Reverse Recovery Charge		**Q_{rr}**	--	1129	--	nC
Peak Reverse Recovery Current		**I_{rr}**	--	23	--	A
Peak Reverse Recovery Energy		**E_{rec}**	--	205	--	μJ
Diode peak rate of fall of reverse recovery current		**di_{rr}/dt**	--	602	--	A/μs

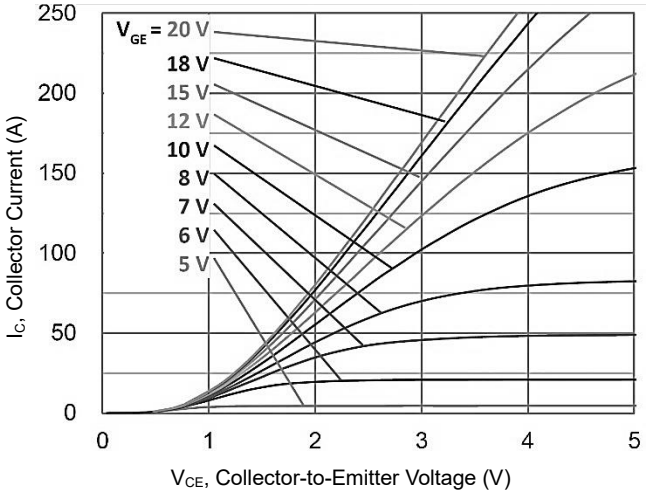
Note:
1. T_J = 25 °C unless otherwise specified

CHARACTERISTIC CURVES

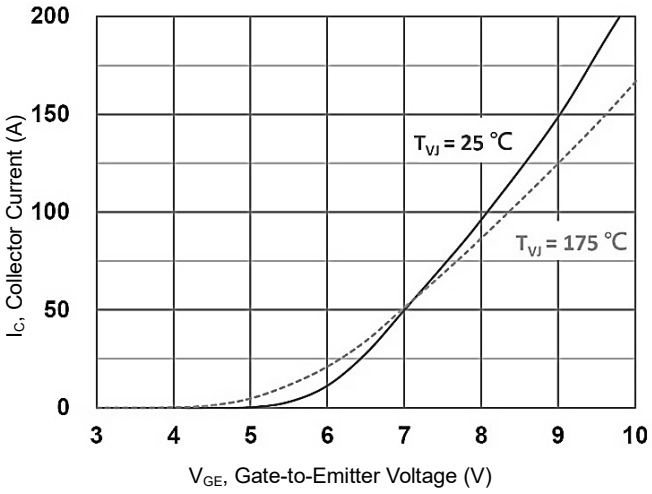
Output Characteristics



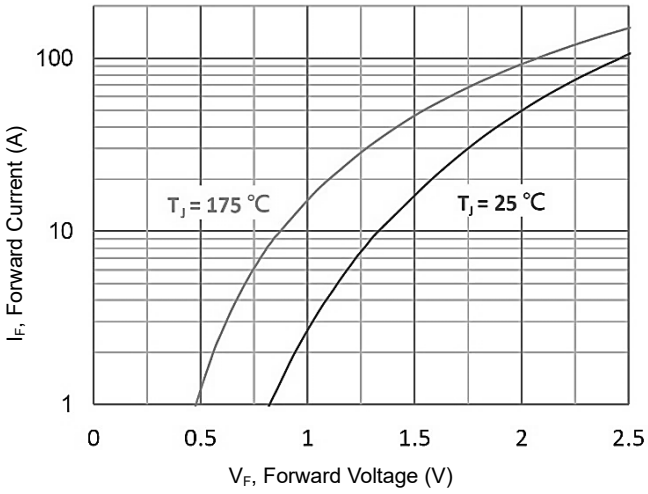
Output Characteristics



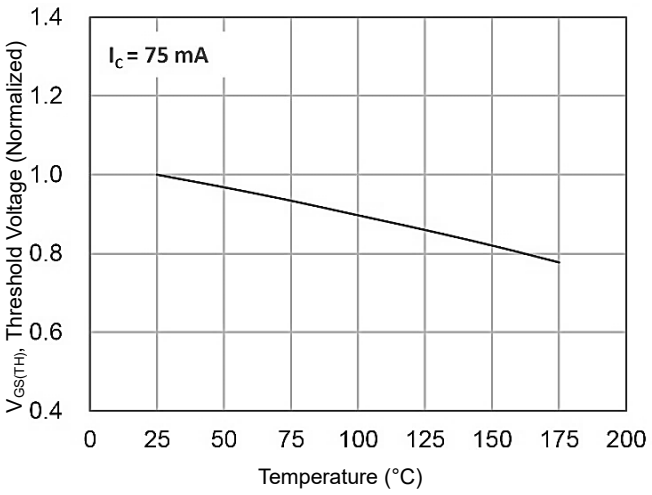
Transfer Characteristics



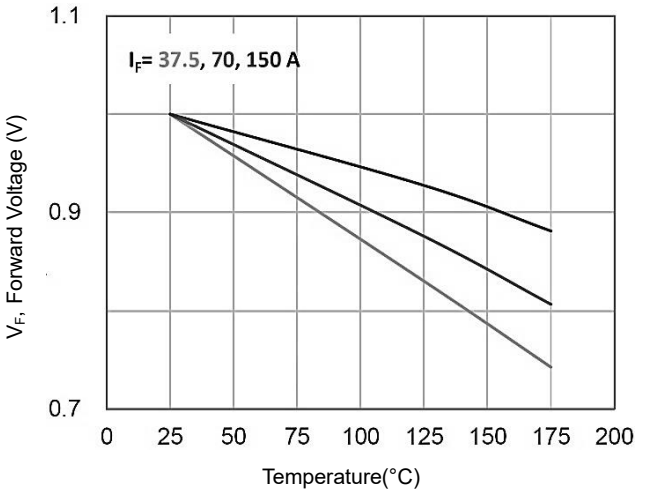
Diode Forward Characteristics



Threshold Voltage Variance

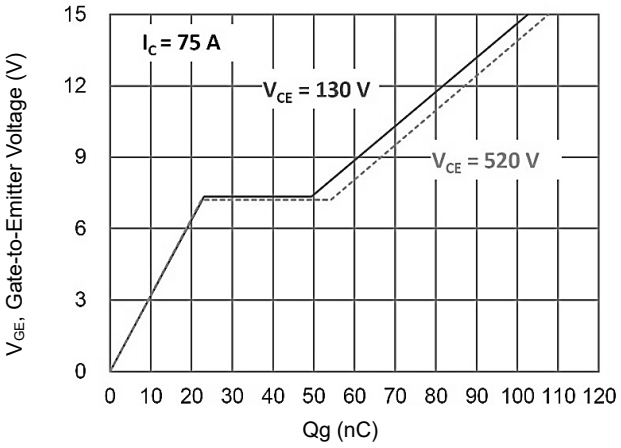


Diode Forward Voltage vs Temperature

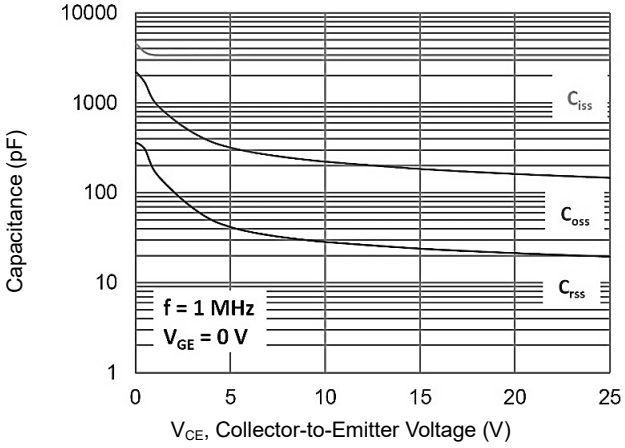


CHARACTERISTIC CURVES

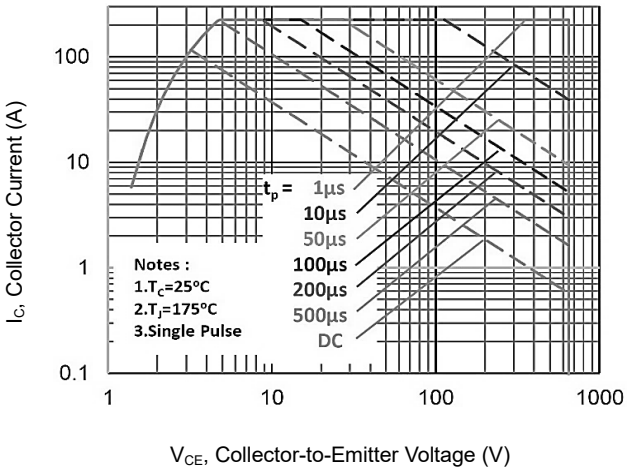
Gate-Charge Characteristics



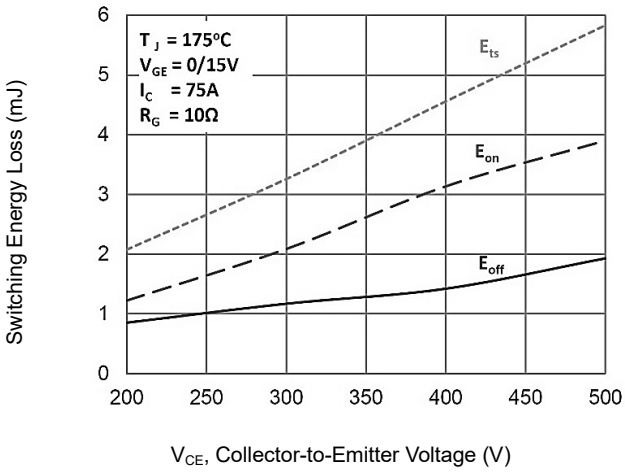
Capacitance Characteristics



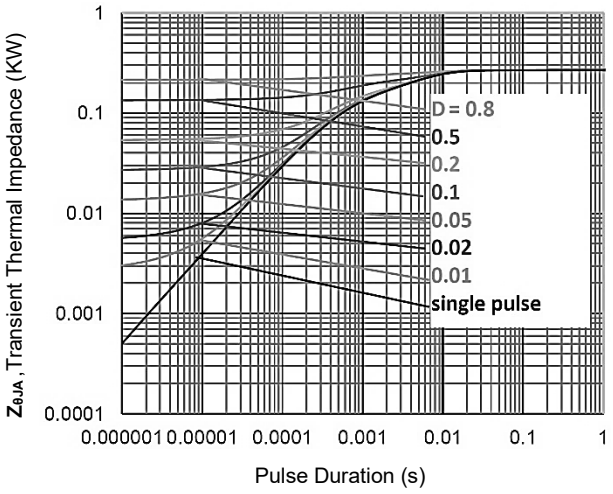
Safe Operating Area



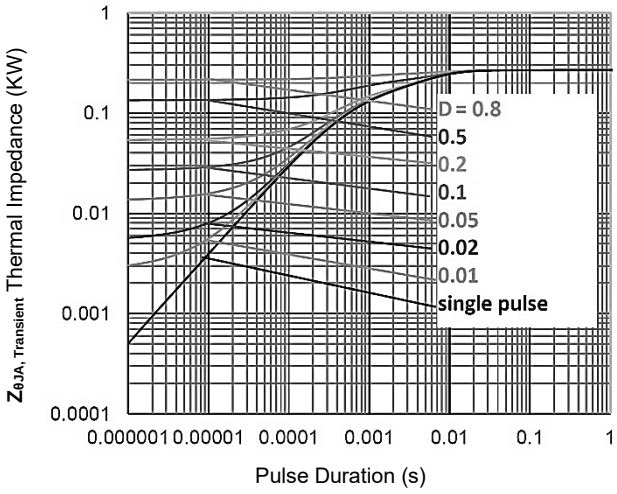
Switching Energy Loss vs Collector-to-Emitter Voltage



Transient Thermal Impedance Curves-IGBT

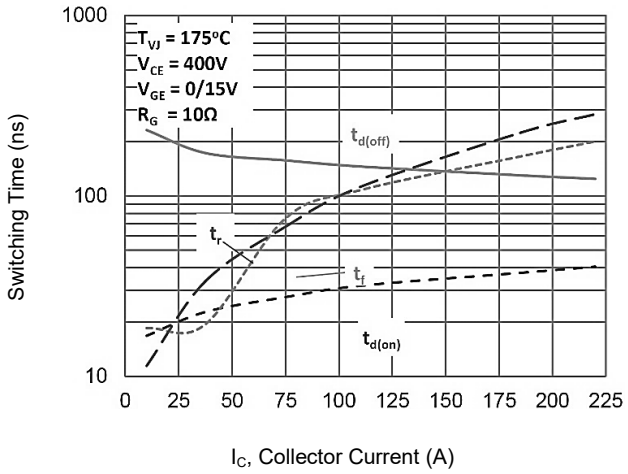


Transient Thermal Impedance Curves-Diode

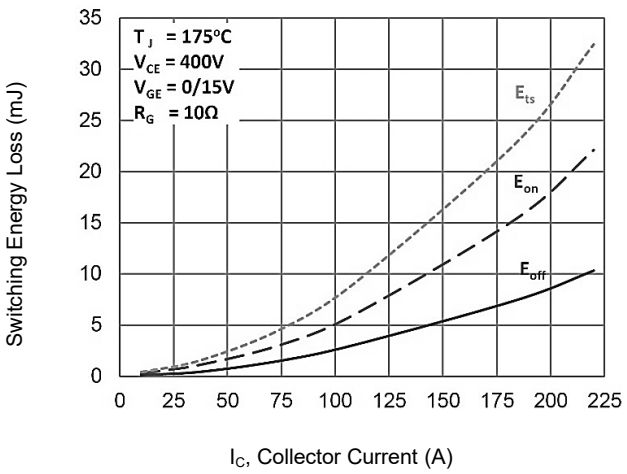


CHARACTERISTIC CURVES

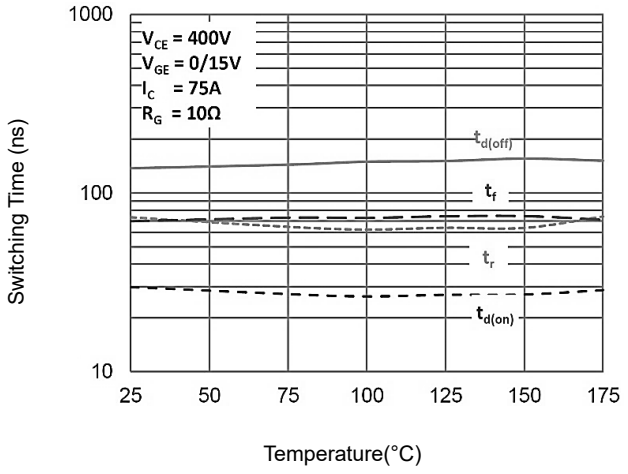
Switching Time vs Collector Current



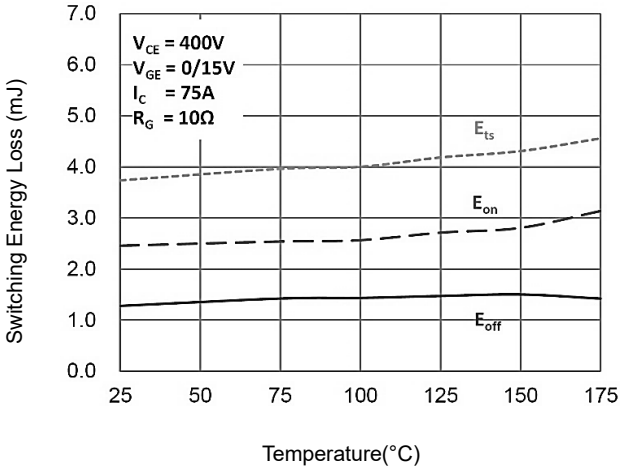
Switching Energy Loss vs Collector Current



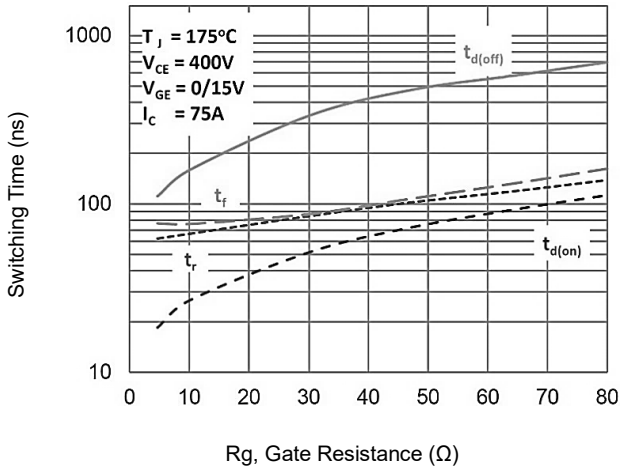
Switching Time vs Temperature



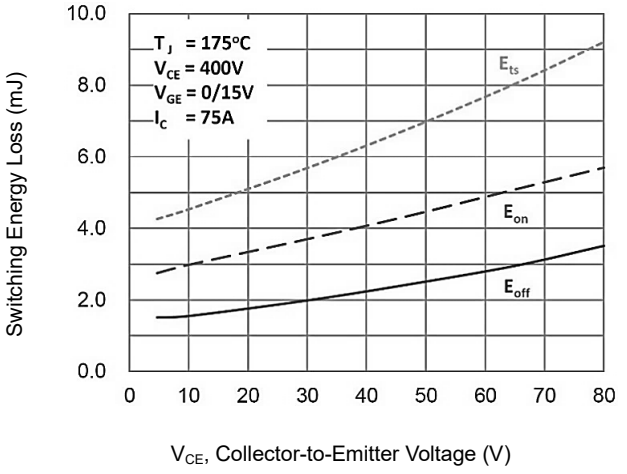
Switching Energy Loss vs Temperature



Switching Time vs Gate Resistances

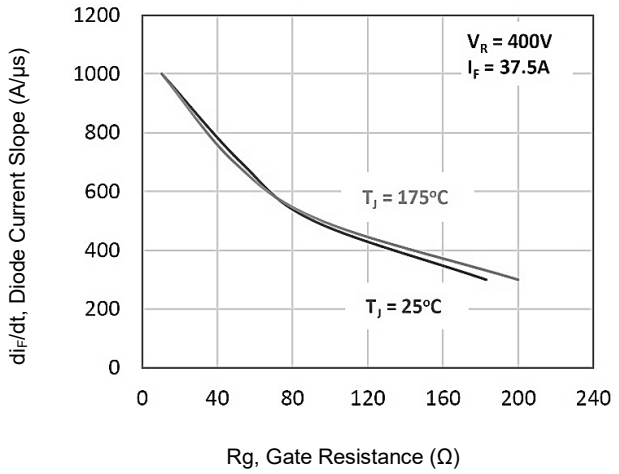


Switching Energy Loss vs Gate Resistances

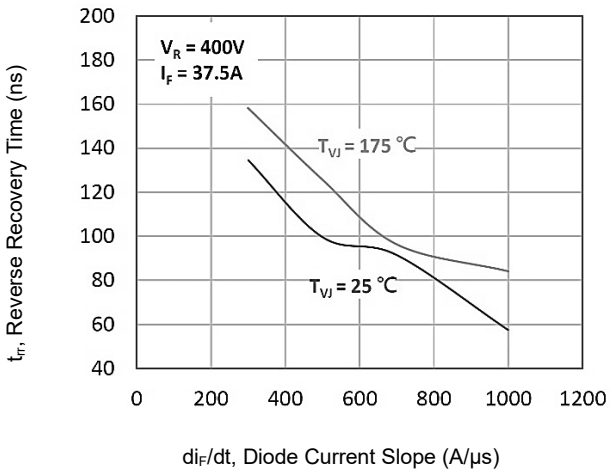


CHARACTERISTIC CURVES

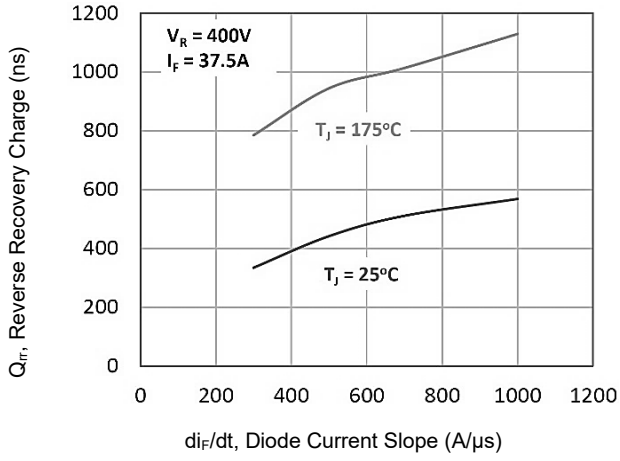
Typical Diode Current Slope vs Gate Resistance



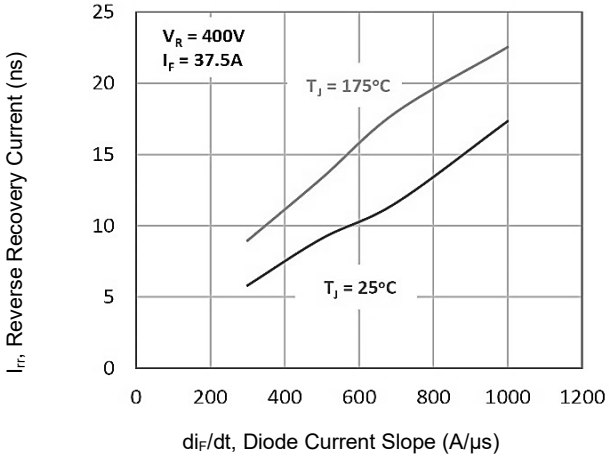
Typical Reverse Recovery Time vs di_F/dt



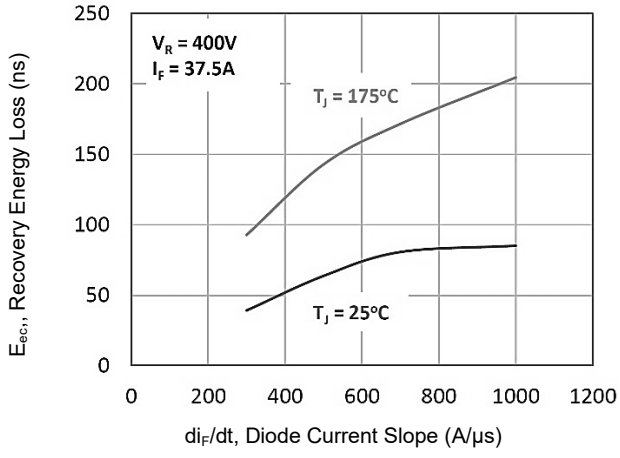
Typical Reverse Recovery Charge vs di_F/dt



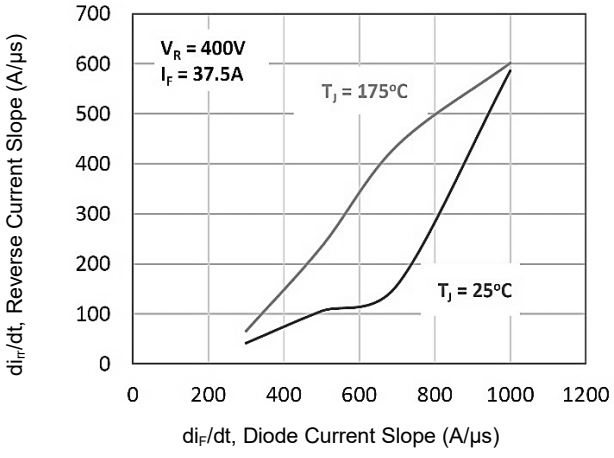
Typical Reverse Recovery Current vs di_F/dt



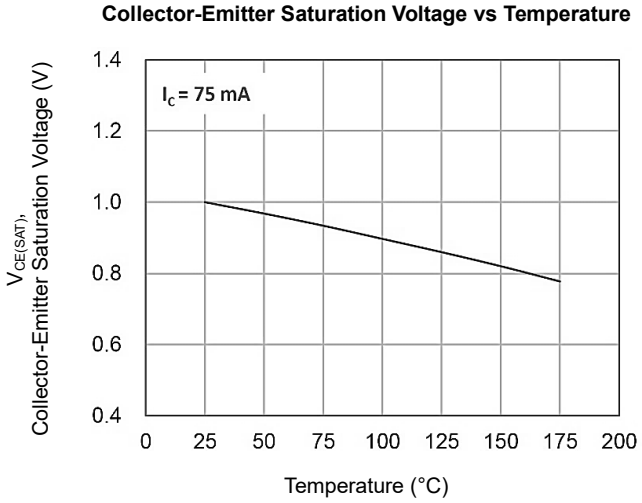
Typical Reverse Energy Loss vs di_F/dt



di_{rr}/dt vs di_F/dt



CHARACTERISTIC CURVES



DIMENSIONS

Item	Min (mm)	Max (mm)
A	4.83	5.21
A1	1.91	2.16
A2	2.29	2.54
b	1.07	1.37
b1	2.87	3.38
b2	1.91	2.41
c	0.55	0.68
D	20.80	21.10
D1	3.68	5.10
E	15.75	16.13
e	5.44	
e1	10.88	
L	19.81	20.32
L1	4.10	4.40
P	3.51	3.65
Q	6.04	6.30