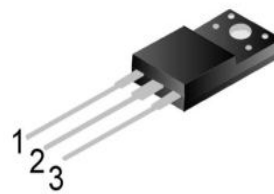
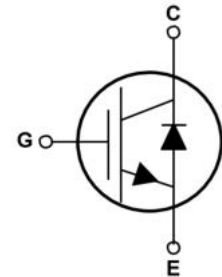


Main Product Characteristics:

$V_{(BR)CES}$	600V
$V_{CE(sat)}$	1.65V(Typ.)
I_C	20A@100°C



TO-220F



Schematic Diagram

Features and Benefits

- Grand Turbo Trench Field stop technology.
- Optimized the cell structure.
- Low EMI and low gate charge.
- Featuring low switching and conductive losses.
- Fast switching and reverse body recovery.
- High ruggedness and robustness.



Description

The GT series products utilizes Norsem's outstanding Grand turbo Trench Field stop technology to achieve low EMI and low gate charge and to provide the industry's best-in-class performance.

These features make this series products extremely efficient, temperature characteristics and reliable for use in UPS, PFC, Inverter, SMPS, etc.

Absolute Maximum Ratings (T_J=25°C unless otherwise specified)

Parameter	Symbol	Parameter.	Unit
Collector-Emitter Voltage	V_{CE}	600	V
Gate-to-Emitter Voltage	V_{GE}	±20	V
Continuous Collector Current	$I_C @ T_C=25^{\circ}C$	40	A
	$I_C @ T_C=100^{\circ}C$	20	A
Pulsed Collector Current	I_{CM}	60	A
Power Dissipation	$P_D @ T_C=25^{\circ}C$	46	W
		0.37	W/°C
Short Circuit withstand Time ¹	T_{SC}	10	uS
Diode Forward Current	$I_F @ T_C=25^{\circ}C$	16	A
	$I_F @ T_C=100^{\circ}C$	8	A
Junction-to-Ambient (PCB Mounted, Steady-State)	$R_{\theta JA}$	62	°C/W
Junction-to-Case(IGBT)	$R_{\theta JC}$	2.7	°C/W
Junction-to-Case(FRD)	$R_{\theta JC}$	3.8	°C/W
Operating Junction and Storage Temperature Range	T_J/T_{STG}	-55 to + 150	°C
Soldering temperature	T_{sold}	260	°C

Electrical Characteristics ($T_J=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Collector-to-Emitter Breakdown Voltage	$V_{(BR)CES}$	$V_{GE}=0V, I_C=250\mu A$	600	-	-	V
Collector-to-Emitter Leakage Current	I_{CES}	$V_{CE}=600V, V_{GE}=0V, T_C=25^{\circ}\text{C}$	-	-	200	μA
		$V_{CE}=600V, V_{GE}=0V, T_C=125^{\circ}\text{C}$	-	1000	-	μA
Gate-to-Source Forward Leakage	I_{GES}	$V_{CE}=0V, V_{GE}=20V$	-	-	400	nA
		$V_{CE}=0V, V_{GE}=-20V$	-	-	-400	
Collector-to-Emitter Saturation Voltage	$V_{CE(sat)}$	$V_{GE}=15V, I_C=20A$	-	1.65	2.4	V
		$V_{GE}=15V, I_C=20A, T_C=125^{\circ}\text{C}$	-	1.9	-	
Gate-Emitter Threshold Voltage	$V_{GE(th)}$	$V_{CE}=V_{GE}, I_C=250\mu A$	4.0	5.0	6.5	V
Input Capacitance	C_{ies}	$V_{GE}=0V, V_{CE}=130V, f=1\text{MHz}$	-	1100	-	pF
Output Capacitance	C_{oes}		-	55	-	
Reverse transfer capacitance	C_{res}		-	22	-	
Total Gate Charge	Q_g	$I_C=20A, V_{CE}=400V, V_{GE}=15V$	-	52	-	nC
Gate-to-Emitter Charge	Q_{ge}		-	15	-	
Gate-to-Collector("Miller") Charge	Q_{gc}		-	22	-	
Turn-on Delay Time	$t_{d(on)}$	$V_{CE}=400V, V_{GE}=15V, R_G=10\Omega, I_C=20A, \text{Inductive load}$	-	19	-	nS
Rise Time	t_r		-	55	-	
Turn-Off Delay Time	$t_{d(off)}$		-	48	-	
Fall Time	t_f		-	115	-	
Turn-on Energy	E_{on}		-	1	-	mJ
Turn-off Energy	E_{off}		-	0.3	-	
Switching Energy	E_{st}		-	1.3	-	

Source-Drain Ratings and Characteristics

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Diode Forward Voltage	V_{FM}	$I_F=8A, T_C=25^{\circ}\text{C}$	-	1.7	2.4	V
		$I_F=8A, T_C=125^{\circ}\text{C}$	-	1.4	-	
Reverse Recovery Time	t_{rr}	$I_F=8A, V_{GE}=0V, dI_F/dt=200A/\mu s$	-	22	-	nS
Reverse Recovery Charge	Q_{rr}		-	36	-	nC

Notes:

1. $V_{GE}=15V, V_{CC}=300V$.

Typical Electrical and Thermal Characteristic Curves

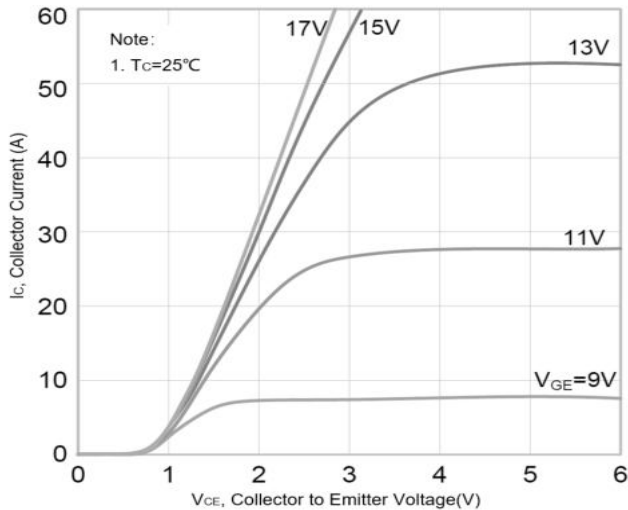


Figure1. Typical Output Characteristics

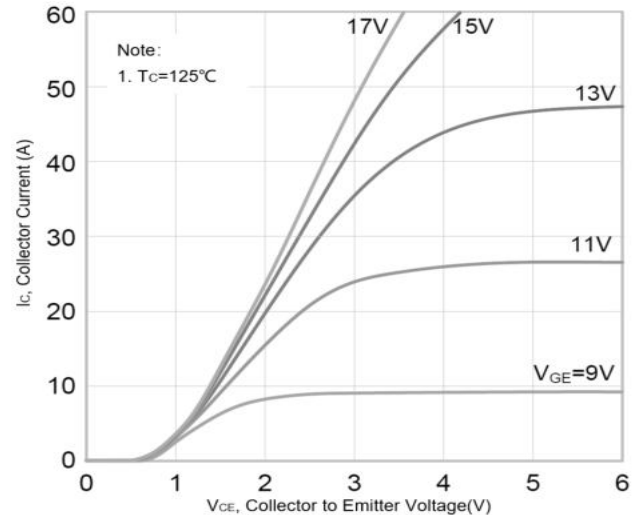


Figure2. Typical Output Characteristics

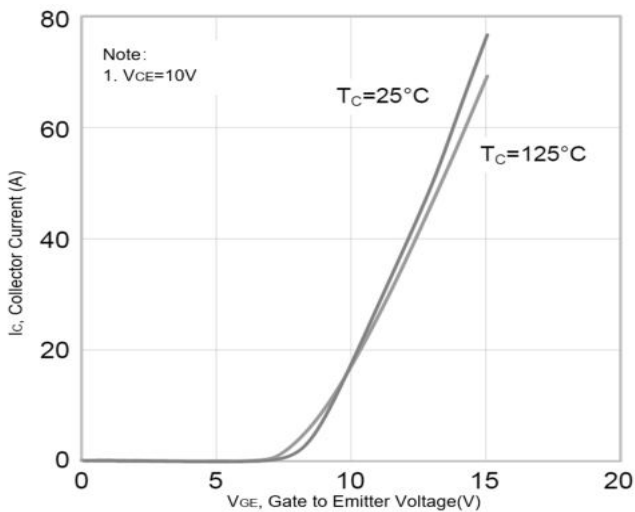


Figure3. Transfer Characteristics

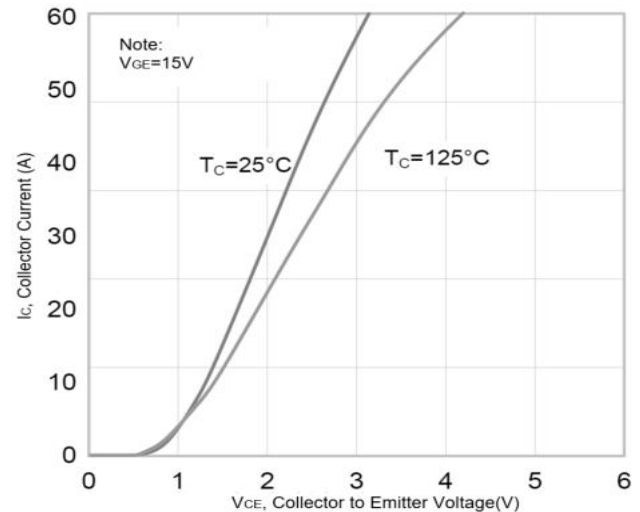


Figure4. Typical Saturation Voltage Curve

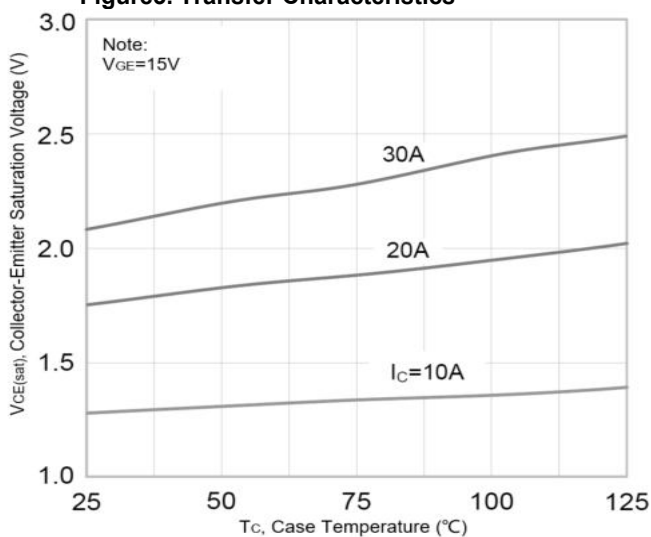


Figure5. $V_{CE(sat)}$ vs. Case Temperature

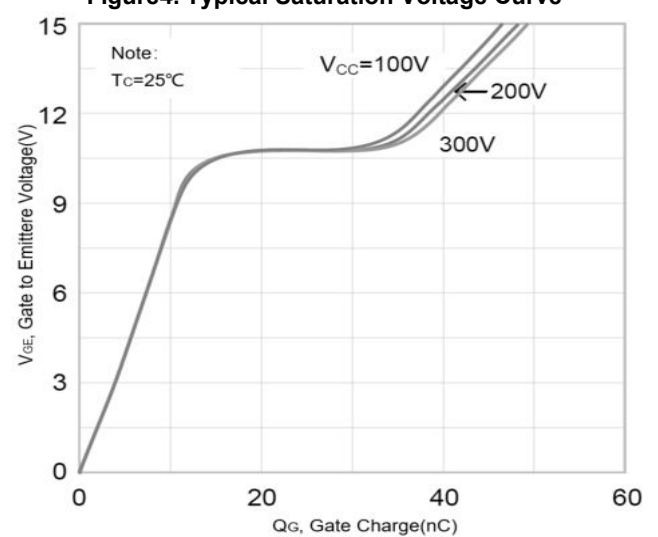


Figure6. Gate Charge Characteristic

Typical Electrical and Thermal Characteristic Curves

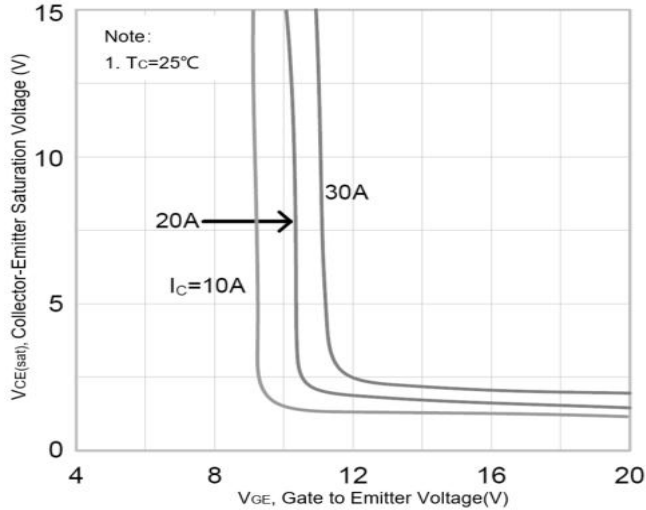


Figure 7. $V_{CE(sat)}$ vs. V_{GE} Curve ($T_C=25^\circ\text{C}$)

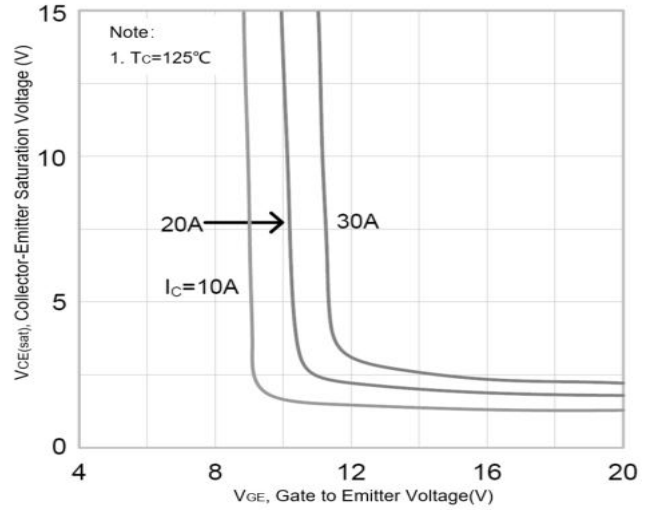


Figure 8. $V_{CE(sat)}$ vs. V_{GE} Curve ($T_C=125^\circ\text{C}$)

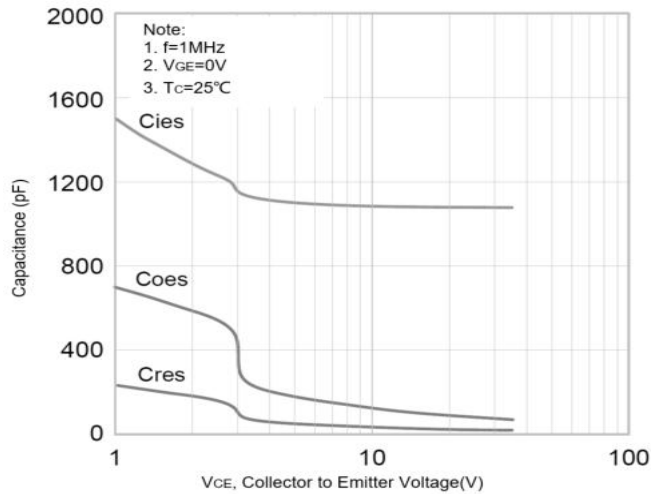


Figure 9. Capacitance Characteristic

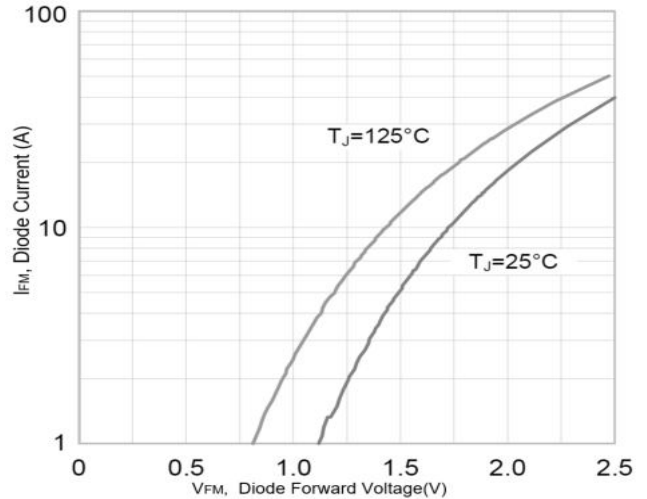


Figure 10. Diode Forward Characteristics

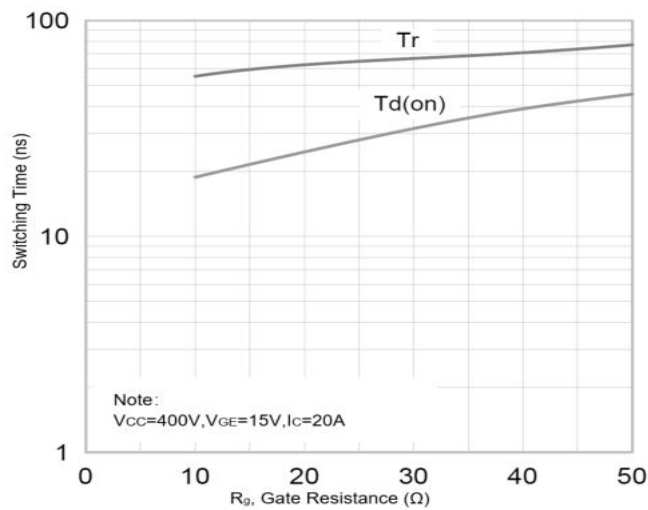


Figure 11. Switching Time vs. R_g (turn on)

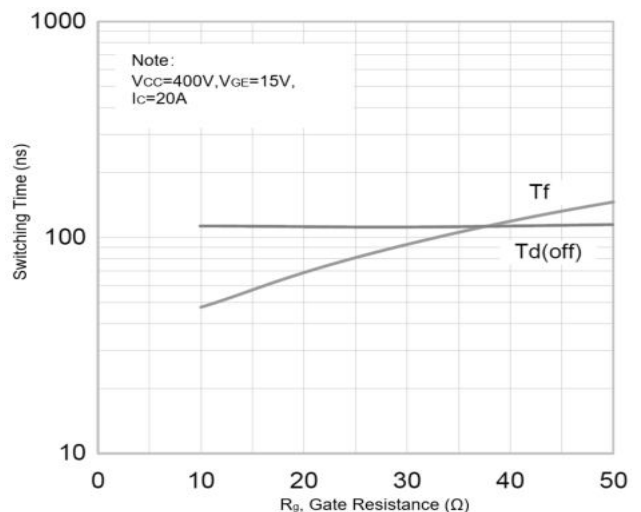


Figure 12. Switching Time vs. R_g (turn off)

Typical Electrical and Thermal Characteristic Curves

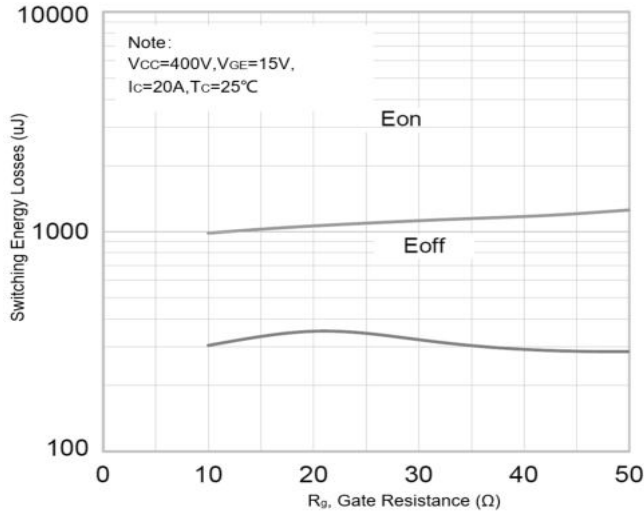


Figure13. Switching Energy Losses vs. R_g

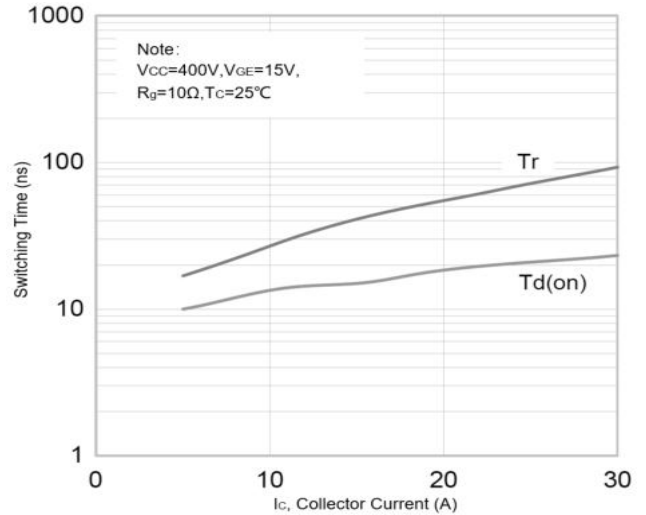


Figure14. Switching Time vs. I_C (turn on)

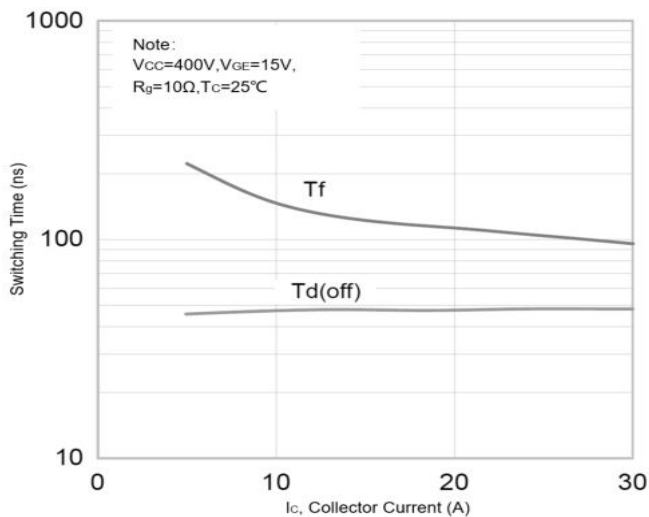


Figure15. Switching Time vs. I_C (turn off)

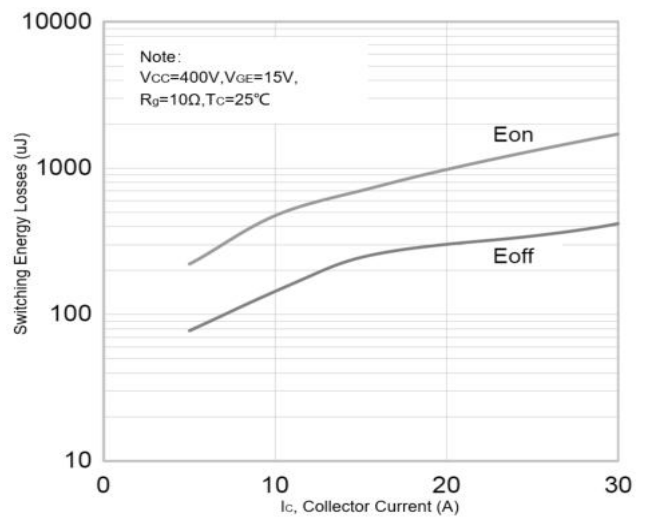


Figure16. Switching Energy Losses vs. I_C

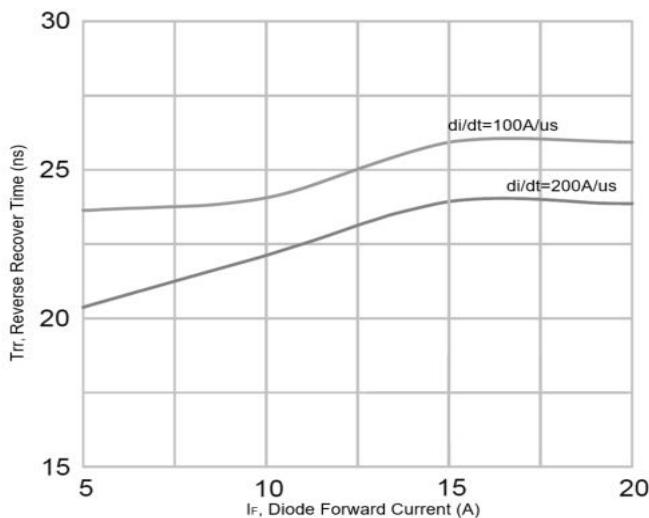


Figure17. Reverse Recover Time vs. I_F

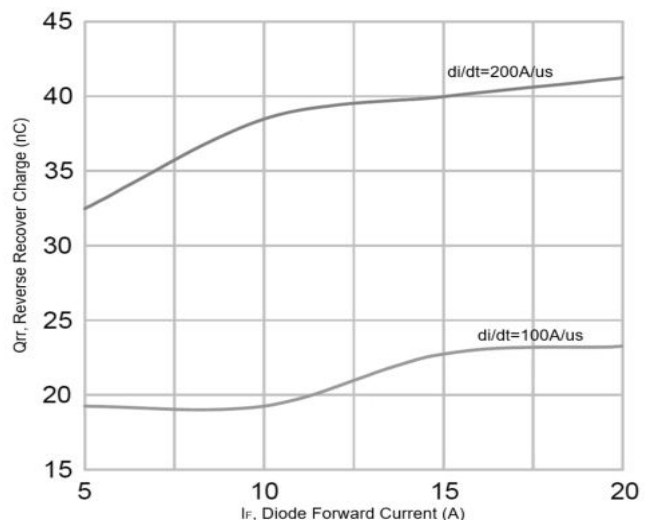


Figure18. Reverse Recover Charge vs. I_F

Typical Electrical and Thermal Characteristic Curves

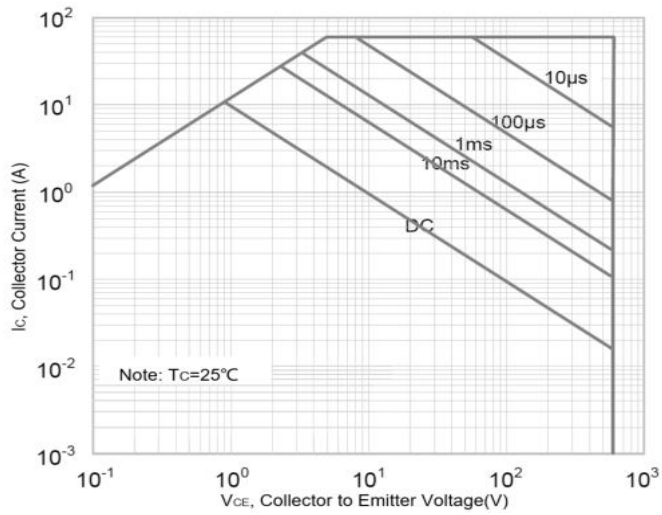


Figure19. Safe Operation Area

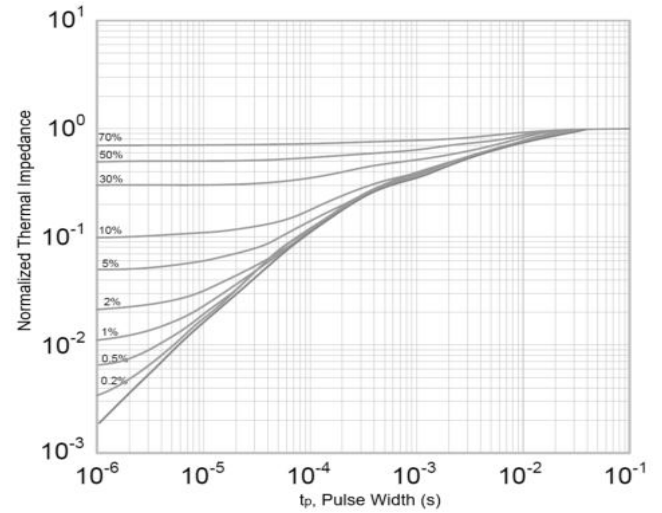
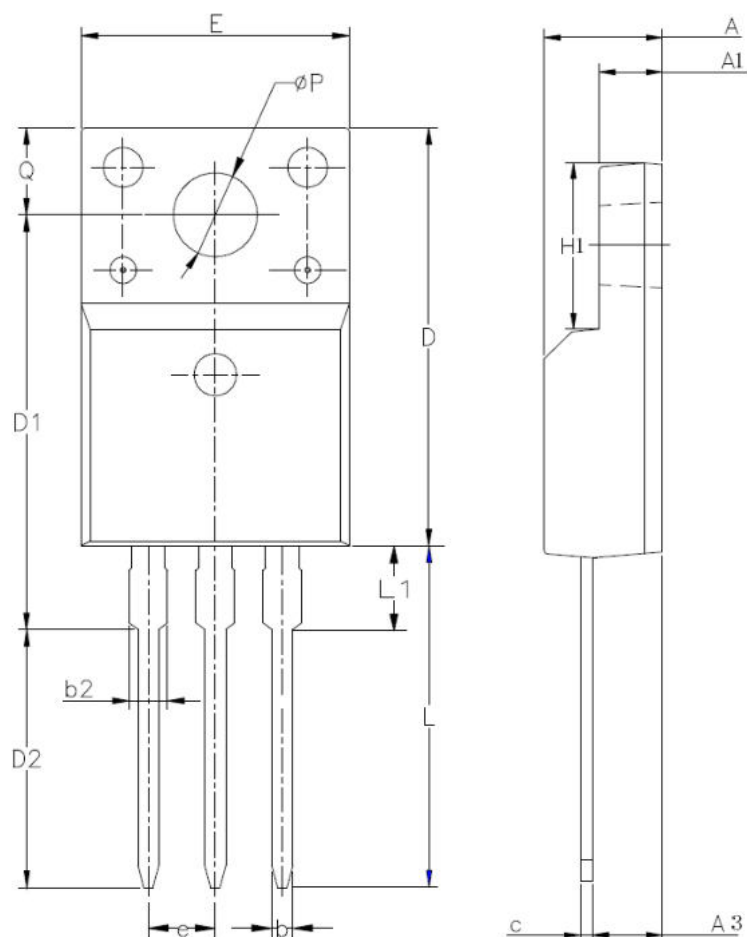


Figure20. Transient thermal impedance vs. t_p

Package Outline Dimensions

TO-220F



SYMBOL	MIN	NOM	MAX
A	4.42	4.70	5.02
A1	2.30	2.54	2.80
A3	2.50	2.76	3.10
b	0.55	0.70	0.85
b2	—	—	1.29
c	0.35	0.50	0.65
D	15.25	15.87	16.25
D1	13.97	14.47	14.97
D2	10.58	11.08	11.58
E	9.73	10.16	10.36
e	2.54BCS		
H1	6.40	6.68	7.00
L	12.48	12.98	13.48
L1	—	—	2.00
ϕP	3.00	3.18	3.40
Q	3.05	3.30	3.55